November 26, 2019

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Federal Highway Administration – Indiana Division
Division Administrator
575 North Pennsylvania Street, Room 254
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RE: Request for Closure of I-65 and I-70 at the North Split Interchange, Downtown Indianapolis (INDOT Contract B-36910)

Pursuant to Section §658.1 1(d) of the Code of Federal Regulation, the Indiana Department of Transportation (INDOT) hereby requests approval of its plan to close both directions of Interstate I-65 and I-70 at the North Split interchange on the near northeast side of downtown Indianapolis, Marion County Indiana. In accordance with this requirement and in order to support this request, this application includes analysis of safety problems, analysis of impacts on interstate commerce, analysis and recommendations of alternative routes to safely accommodate commercial vehicles, evidence of consultation with local governments affected by the Project. The application also includes an analysis of maintenance of traffic (MOT) alternatives, traffic operations and safety analysis, mitigation strategies and public outreach in addition to other supporting information.

The scope of work for the Project includes complete reconstruction of the North Split interchange including significant portions of the east, west and south legs approaching the interchange. The limits of the Project are shown on Attachment A, Project Map. Existing deficiencies will be corrected. The existing substandard weaving areas within the south and west legs of the interchange will be corrected. The Project includes removal, rehabilitation and/or replacement of 48 bridges, new concrete pavement, retaining walls, new drainage infrastructure, aesthetic features, utility relocations, traffic signage, lighting, ITS, signals and other improvements. The bridge complexity includes long-span, curved steel girders, straddle bents and two three level structures requiring bridges to be built at separate times. The road approaches to the third level bridges are to be built on over 45 feet of fill.

This Project is being procured by INDOT through a Design-Build Best Value (DBBV) procurement process. In June 2019, INDOT announced that three Design-Build (DB) teams were shortlisted as a part of the Request for Qualifications (RFQ) process. The Project has now entered the Request for Proposal (RFP) stage. INDOT has prepared the Draft Public, Private Agreement (PPA), Technical Provisions (TP) and preliminary plans. A concept maintenance of traffic (MOT) plan has been developed and provided to the DB teams for this Project (see Attachment C, Concept MOT Plans). At the end of

the RFP stage, each DB team will submit their bid price, schedule, MOT plan and project approach based on the scope of work identified on the preliminary plans and the requirements defined in the TPs. The scoring and selection criteria for the Project will include a schedule component that will require the DB teams to submit their proposed interstate and ramp closure durations. INDOT will define the maximum closure durations for each of the closed movements in the PPA and TP's. The DB contractor will be subject to liquidated damage penalties if they fail to reopen the closed movements within the duration they committed to in their bid proposal. The movements and maximum closure durations as currently proposed in the Draft PPA and TP's are noted in Attachment G, Closure Durations.

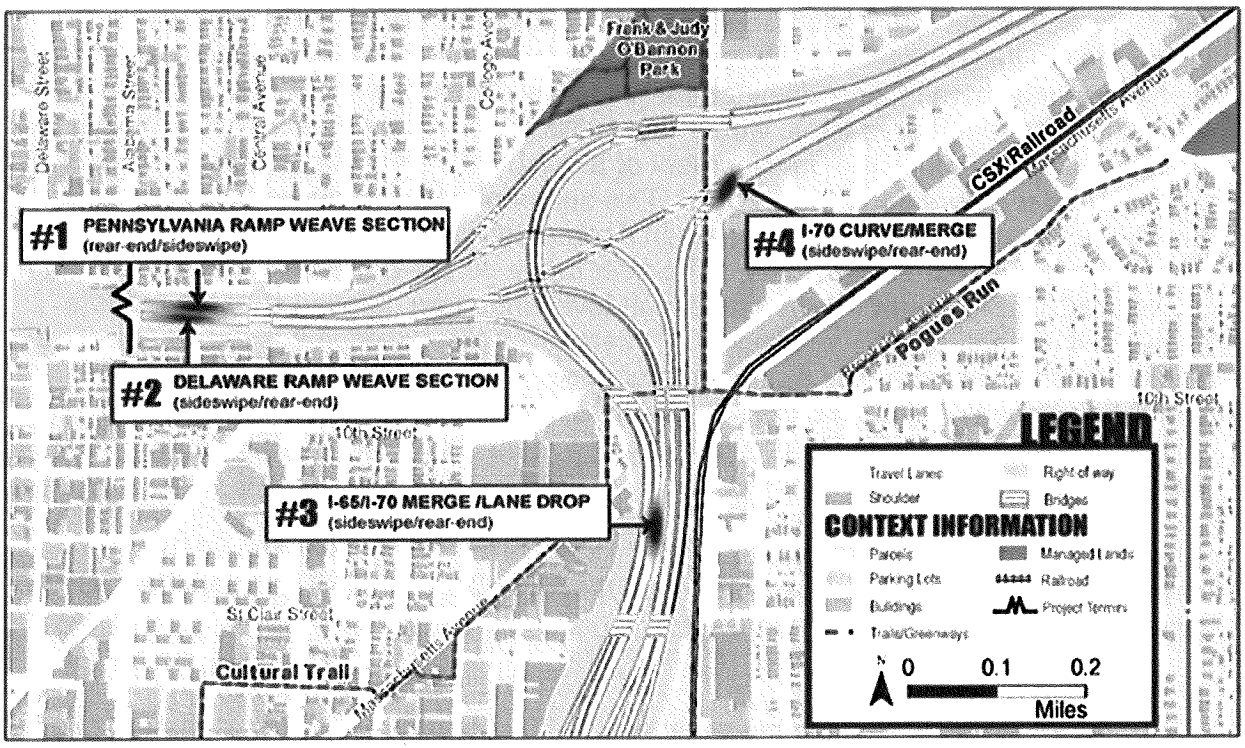
INDOT will select a DB team to finish the design and construct the Project based on the best value determination considering price, schedule and technical approach to the Project. Each DB team will prepare their own maintenance of traffic plans, phasing and schedule that will be compliant with the PPA and TP's. INDOT's goal is to have this Project completed within two years and open to traffic by the end of 2022 while maintaining mobility and access into and out of downtown Indianapolis during construction. This is an aggressive construction schedule considering the size and complexity of the Project. It is anticipated that the winning team will be under contract in the summer of 2020 with construction starting at the end of 2020 and extending through the end of 2022.

TRAFFIC OPERATIONS AND SAFETY ANALYSIS

Safety Analysis

An Interstate Access Document (IAD) was developed as part of the Interstate Access Request (IAR) process during the National Environmental Policy Act (NEPA) Environmental Assessment (EA) process. As a part of this process, the project team analyzed 2012 to 2016 crash data from the Automated Reporting Information Exchange (ARIES) system for the project area. The crash rates per 100 million vehicle miles traveled (100 MVMT) were presented in the IAD. See below for excerpt Figure 3-5 from the IAD displaying the top four identified hot spots where the majority of crashes are occurring.

Figure 3-5: Top 4 Crash Locations in North Split Project Area



Source: NEPA Alternatives Screening Report

The IAD provides sufficient responses to the FHWA Interstate Access Policy Points and received a Determination of Engineering, Operational and Safety Acceptability on August 12, 2019. The preliminary preferred alternative (current proposal) will improve safety by eliminating weaving and lane drop sections, improve traffic operations, and is cost effective.

INDOT believes one of the best ways to ensure the safety of the construction workers and the motoring public is to eliminate or minimize the amount of vehicular traffic within work zones. Closure of the Interstate is being requested for this Project. Closing the interstate to through traffic will reduce lengthy queues and delays that would be caused by restricting the number of travel lanes available. Reducing queues and delays on the interstate will reduce the exposure to high speed rear end, typically severe crashes at the back of queues. Closure of the interstate will all but eliminate crashes within the active work zone and provide a safer working environment for the construction workers.

Traffic Operations Analysis

As part of the development of the IAD for the Project, traffic modeling was performed for the AM and PM 4-hour peak periods for the no build and the various build alternatives. High-level TransCAD modeling used the Indianapolis Metropolitan Planning

Organization's (MPO's) regional travel demand model, encompassing all of the Indianapolis area including I-465. One of the items established during the high-level modeling is that the majority of the traffic on I-70 and I-65 during the peak periods, within the North Split interchange, is not long-distance through traffic; but rather, traffic that either originates in, or is destined for, a location within the I-465 loop. This means that much of the detoured traffic would likely utilize local routes instead of the official I-465 detour. Also during the development of the IAD, a TransModeler subarea model was created for more detailed analysis. This subarea model is focused on a 6-mile by 6-mile area roughly bordered by Emerson Avenue to the east, Raymond Street to the south, White River to the west and 38th Street to the north. While the IAD does not contain MOT traffic analysis, the same high-level and more detailed subarea models were used to analyze the preferred MOT alternatives discussed in this document. The North Split is a very complex system interchange. Typical INDOT queuing analysis spreadsheets may not be the most appropriate tool for this project. The TransCAD and TransModeler model analysis provides a better estimation of traffic operations during construction.

Attachment H graphically summarizes the high-level modeling using the 2016 Indianapolis MPO's regional travel demand model in TransCAD. The three North Split closure scenarios modeled include:

1. Full closure,
2. Full closure but keeping the westbound I-70 to northbound I-65 movement open,
3. Full closure but keeping the southbound collector-distributor (CD) open.

While these modeling scenarios do not precisely match the four MOT alternatives (discussed in detail below), they do provide useful information regarding anticipated traffic operations for each alternative. AM peak, PM peak, and daily traffic summary graphics are included for each scenario. Numbers in red indicate the anticipated increase in traffic compared to the no build and numbers in blue represent a decrease in traffic compared to the no build. The first graphic in each set of scenarios estimates the anticipated change in traffic for various I-465 segments, while the second and third graphics illustrates the resulting anticipated change in level of service (LOS). The fourth graphic in each set of scenarios captures the overall anticipated change in traffic for the north-south local road corridors crossing the west leg of the North Split and east-west local road corridors crossing the south leg of the North Split. Taken together, these graphics provide a feel for the anticipated impacts to the "official" I-465 detour and the "unofficial" local road detours, resulting from full and partial closure of the North Split during construction.

The high-level modeling predicts that full closure of the North Split would divert more traffic onto the southern half of I-465 than the northern half of I-465. Daily volumes on the southern half could increase by 26% (24,000 vehicles) and by 11% to 22% (2,700 vehicles) in the peak. For context, a typical urban freeway can handle approximately 2,000 vehicles per hour per lane. The high-level modeling also predicts that full closure

of the North Split could increase the overall daily traffic on the local roads entering and departing downtown, by 33% (30,200 vehicles) on the north south local roads and by 100% (49,000 vehicles) on the east-west local roads. The graphical summary sets for the 2nd and 3rd model scenarios contained in Attachment H reinforce the importance of keeping the westbound I-70 to northbound I-65 connection open and keeping the southbound CD access to downtown open, as much as possible. When compared to a full closure of the North Split, keeping the westbound I-70 to northbound I-65 open and keeping the I-65/I-70 southbound CD open each reduce the amount of additional traffic that would be diverted to I-465 and to the north-south and east-west local roads, in an even higher percentage. While not specifically modelled, it is clear that keeping the two primary outbound movements, the on-ramp from Pine Street to eastbound I-70 and southbound I-65 to eastbound I-70, open as much as possible during construction is important. The two key movements inbound and the two key movements outbound will provide the primary access into and out of downtown Indianapolis during construction.

Additional detailed subarea TransModeler modeling was performed for MOT Alternative 3 (preferred). Attachment I provides a graphical summary of the anticipated AM peak and PM peak traffic redistribution patterns. Due to the large amount of congestion, encountered with any MOT scenario in the urban environmental, dynamic traffic assignment (DTA) methodology was used for this analysis. Similar to the high-level analysis previously discussed, red on the graphic indicates an increase in traffic compared to the no build and blue indicates a decrease in traffic compared to the no build. The width of the segment indicates the magnitude of the volume change for that particular roadway segment. Because this is a subarea analysis, it does not include I-465. The graphical summaries in Attachment I indicate that traffic is anticipated to increase on most all local roads, and in particular Binford Boulevard/Fall Creek Parkway, West Street, and Washington Street.

Specific modeling was not performed for MOT Alternative 2; however, the inside-out construction approach would require closing some, but not all, interstate mainline lanes through the North Split. Impacts to traffic operations for MOT Alternative 2 can be anticipated by looking at Highway Capacity Software (HCS) capacity analysis results mapping contained in Chapter 6 of the IAD, focusing on the mainline interstate segments on the west, east, and south legs of the North Split interchange. The year 2017 existing (no build) capacity analysis results contained in the IAD are summarized in the table below.

Interchange Leg	Segment	# of Lanes	Peak Hour	Approx. Volume	LOS
West	NB I-65	4	AM	6500	E
	SB I-65	4	PM	5700	D
East	WB I-70	5	AM	8900	E
	EB I-70	5	PM	8400	D
South	NB I-65/I-70	4	AM	5350	D
	SB I-65/I-70	3	AM	4450	D

Queuing during the AM and PM peak periods is common on these segments today, with no construction activity occurring. With any inside-out construction, the minimum lane restriction would eliminate the use of at least one lane, which would result in the loss of anywhere from 20% to 33% of available capacity, depending on the segment. It would also reduce capacity due to the "work zone". In reality, inside out construction would likely eliminate the use of more than one lane at any given time, due to constructability and schedule concerns. MOT Alternative 2 would result in significant congestion and queuing.

The North Split is heavily-travelled and congested. Any construction activity, and any MOT plan, will increase congestion and queuing. INDOT intends to work with local partners to pursue strategies to reduce peak period demand during construction. Strategies could include working with employers to provide flexible work hours for employees, park and ride facilities, promotion of transit options, etc. These items are difficult to incorporate into MOT traffic operations analysis and they have not been accounted for in any of the analysis summarized in the subject document. Implementation of any of these strategies would only have a net positive effect on traffic operations during construction.

MOT ALTERNATE ANALYSIS

Our MOT Task Group includes members of INDOT, FHWA, City of Indianapolis, our design consultant and many others with expertise in design, construction, traffic, safety and mobility. We have investigated many different construction phasing alternatives for this Project. The North Split interchange is a complex, multi-level system interchange. The proposed three level interchange replaces the existing three level interchange within basically the same, but more complex and confined footprint. Reconstructing a new three level interchange within the same footprint of an existing three level interchange while trying to maintain traffic has proven to be very challenging especially for some of the key, high volume traffic movements.

Four different MOT alternatives were investigated for this Project. The overall goals of the MOT alternatives focus on safety (worker and driver), schedule, quality and mobility. The following are the four alternates that were investigated:

- Alternate 1: Completely close I-65, I-70 and all movements within the North Split interchange.
- Alternate 2: Inside-outside construction on the approach legs and reconstruction of the interchange while maintaining traffic and all movements.
- Alternate 3: (Preferred MOT Alternative) Closure of I-65 and I-70 through movements with four key ramp movements into and out of downtown Indianapolis kept open to traffic. Short term closure of I-65 SB to I-70 EB.

- Alternate 4:. Closure of I-65 and I-70 through movements with four key movements into and out of downtown Indianapolis kept open to traffic. No closure of I-65 SB to I-70 EB

See below for MOT Alternative Comparisons summarizing the traffic, safety, quality, cost and environmental impacts associated with the alternates that were investigated. INDOT has studied the traffic mobility implications of the interstate closures. Similar to other recent interstate closures on this section of I-65 and I-70 between the north and south split interchanges, through traffic on I-65 and I-70 heading into Indianapolis will be directed and detoured around I-465. See Attachment E Closure Signing Maps for proposed I-465 detour routes for through traffic on I-65 and I-70.

Alternate 1 – Complete Closure of North Split Interchange

Complete closure of the interchange, ramps and portions of the interstate legs approaching the interchange would allow the contractor complete access to the Project without having to work around and maintain any existing traffic movements. Initially, the goal and viability of this alternative was based on the ability for the Project to be completed in one construction season, rather than two or three construction seasons. Complete closure of the interstate within the Project limits would severely impact the traveling public and commerce entering the City. Delays and traffic on the local streets would be excessive. This Alternate would be more viable if the duration could be minimized to one construction season or less. Our MOT Task Group determined that due to the size and complexity of this Project, it could not be constructed in a one year construction season. There are 48 bridges that require removal, rehabilitation and/or replacement. The bridge complexity includes long-span, curved steel girders, straddle bents and two three level structures requiring bridges to be built at separate times. The road approaches to the third level bridges are to be built on over 45 feet of fill with a large amount of retaining walls. Even with the full closure, this Alternate would require two construction seasons to build.

There are 15 local roadways that cross under I-65 and I-70 within the Project limits. All these local roadways cannot be closed at the same time because access into and out of downtown Indianapolis is required on the local street network. Phased construction involving alternating closure of adjacent roadways is required thereby requiring a longer, multiple season construction period to reconstruct them all. This concept of alternating local roadway closures and local roadway detours was discussed with and approved by both INDOT and the City of Indianapolis. See Attachment D Local Detour Concept Maps and below for further discussion of local roadway closures and local roadway detours.

- **Queue Length** With the full closure alternative, it is anticipated that I-65 and I-70 service interchanges, adjacent to but outside the project limits of the North Split, will have certain ramps that remain open to be used to get traffic to and from the City roadway network and into and out of downtown. The I-65/I-70 half

interchange at Washington Street would remain open. The westbound I-70 exit ramp to Keystone Avenue and the eastbound I-70 entrance ramp from Rural Street would remain open. The southbound I-65 exit ramp to Meridian Street and the northbound I-65 entrance ramp from Meridian Street would remain open. Modeling shows that full closure will result in queuing on I-65 and I-70 well outside of the I-465 loop , generally to at least the Marion County line in each direction. Queuing would also occur in multiple locations along I-465 that currently do not experience queuing, on the typical day, during the AM or PM peak periods.

- **Driver Comprehension** With full closure, drivers should be able to easily comprehend the MOT scheme because it would be constant throughout the life of the project. Traffic operations would be poor, with lengthy queuing and delays on the interstates and the local roadway network; however, motorists would experience this on a consistent daily basis.

- **Worker Safety** This Alternate provides maximum worker safety by completely closing the interchange, all legs of the interstate approaching the interchange and local roadways under the proposed construction.

- **Construction Quality** Because the interstate and interchange will be closed to traffic, the ability for the contractor to construct a quality product should be maximized.

- **Environmental Impacts** Full closure represents the MOT alternative that would have the most potential to negatively impact surrounding neighborhoods; therefore, full closure has been incorporated into the Section 106 process during the development of the Environmental Assessment (EA). The methodology for determining if increased traffic on the local roadway network, resulting from the full closure alternative, will potentially have an adverse effect on historic properties has been developed and approved by INDOT Cultural Resources Office (CRO) and FHWA, in coordination with the State Historic Preservation Officer (SHPO) and consulting parties. The methodology focused on heavy trucks, and their potential to diminish the physical features of the local roadway network. Results have been shared with consulting parties and will be included in the effect finding for the Project. Preliminary indications are that the full closure during construction will not create a Section 106 adverse effect. A similar effort is underway with neighborhood representatives as part of the environmental justice analysis for the EA. Modeling shows that traffic that will reroute to the local roadway network, as a result of full closure, in an even manner, typically utilize arterials more because they have better traffic progression capability. At this time, it does not appear that EJ communities would be unfairly impacted.

- **Cost** Because the interchange and the interstate will be closed to traffic for this Alternate, the contractor's means and methods to construct the project should produce efficiencies resulting in a reduced construction bid price. The estimated construction bid price savings compared to Alternate 3 is about $10 Million with a total estimated bid price of this MOT Alternate 1 to be about $290 million.

- **Detour Signing** See Attachment E Interstate Closure Signage Maps for temporary closure signing on the surrounding interstates and alternate routes for detoured traffic. Existing overhead signage on the detour routes will be modified to assist drivers in navigating the detour routes. Existing ITS and new ITS devices supplemented with PCMS's will be utilized to communicate upcoming closures and detour routes.

- **Other Project Impacts** Full closure, especially the closure of the southbound collector distributor (CD) and the west side of I-65/I-70, eliminates the ability to get a large amount of commuter traffic directly into and out of downtown. Full closure also removes the highest capacity grade separation with the CSX rail line that parallels I-65/I-70 to the east. The only east-west local road corridors that have grade separation with the rail are Washington Street, Market Street, and 10th Street. INDOT cannot control rail activity, which is likely to continue to occur during AM and PM peak periods.

- **Summary** This Alternate involving complete closure of the interstate, interchange and ramps was discarded. The Project cannot be constructed in one construction season, all of the traffic getting into and out of downtown Indianapolis would have to detour onto local streets. Traffic delays and congestion would be excessive.

Alternate 2 – Inside-Outside Phase Construction, Maintain Interstate Through Movements

To keep the through movements on I-65 and I-70 open to traffic would require a multi-phase construction approach taking into considering both traffic movements, available construction work space and phasing. To maintain traffic on the interstate and on the ramps during construction would require an inside-outside construction phasing concept on the legs approaching the interchange and many temporary ramps, temporary bridges and temporary bridge widenings within the interchange. Building the inside lanes while maintaining traffic on the outside and then moving traffic on the newly constructed inside lanes and building the outside lanes would require interstate mainline lane reductions (from the current three lanes to two or possibly one) in addition to requiring the contractor to work in a very confined, potentially unsafe workspace. This Alternate would require a three year construction period, require minimum lane and shoulder widths for traffic during construction, require additional lane closures on the interstate, be more expensive than other alternatives, and create safety problems and concerns for both the workers and traveling public.

- **Queue Length** Based on the daily queuing observed during the AM and PM peak for the current no construction activity period, and based on the capacity analysis results for the no build condition as contained in the IAD, inside-out construction would require lane closures, create a reduced capacity work zone, and would result in significant daily queuing for all legs of the North Split interchange, to at least the subarea boundary limit (Emerson Avenue to the east, Raymond Street to the south, White River to the west, and 38th Street to the north), and possibly more, in each direction.

- **Driver Comprehension** This Alternate would be the most difficult of the four alternatives for drivers to comprehend. The MOT phasing would be constantly changing as differing lanes are being reconstructed and as ramps are closed at varying times. This would be difficult for motorists to anticipate and would require driver attention to messaging boards and signage, potentially distracting motorists.

- **Worker Safety** This Alternate would require the contractor to work in very tight, confined spaces utilizing and inside-out construction technique and phasing. Minimum 11 ft. travel lanes with one ft. or two ft. shoulders would be required. Workers and the traveling public would in close proximity to each other. This Project will require extensive amount of materials, bridge beams, earthmoving equipment, etc. to be brought onto the site. Providing a safe, working environment for both the contractor and the traveling public for this Alternate will be challenging.

- **Construction Quality** Because of the inside-out phase construction, there will be extensive partial width construction for this Alternate that will lead to additional bridge and pavement joints. Maintaining high construction quality will be challenging for this Alternate.

- **Environmental Impacts** Since the full closure alternative, being incorporated into the Section 106 and EJ analysis in the EA, represents the worst case for potential impacts to surrounding neighborhoods, MOT Alternate 2 is covered from a NEPA standpoint.

- **Cost** Due to the longer construction period, phase construction, confined work space and other issues, the estimated construction bid cost for this Alternate 2 would be about $325 million.

- **Detour Signing** This Alternate would not require closure of any interstate movements. Short term closure of several ramps and the local roadways would be required.

- **Other Project Impacts** This alternate maintains all traffic movements during construction. A three year construction season is required with numerous MOT construction phases, traffic shifts, temporary pavements and temporary bridges.

- **Summary** This Alternate requires a three year construction season with numerous MOT construction phases, traffic shifts, temporary pavements and temporary bridges. INDOT has determined that this Alternate does not meet the MOT goals of the Project and was therefore discarded.

Alternate 3 (Preferred MOT) – Close I-65 and I-70 Through Movements, Provide Access for Key Movements Into and Out of Downtown Indy. Short Term Closure of I-65SB to I-70EB

This Alternate closes the through traffic movements on I-65 or I-70. Through traffic on I-65 or I-70 approaching Indianapolis will be detoured around on I-465 as noted on Attachment E, Interstate Closure Signage Maps. While through movements on the same interstate are detoured, errant freight traffic will not be required to detour onto a local route as the I-70 westbound to I-65 northbound, I-70 eastbound to I-65 southbound and I-65 northbound to I-70 westbound movements are maintained. The I-65 southbound to I-70 eastbound movement can be closed for no more than 45 days. During the closure of I-65 and I-70, in order to maintain mobility and access into and out of downtown Indianapolis, our traffic analysis determined that it is essential to maintain four key interstate movements at the North Split interchange. See Attachment B, Interstate and Ramp Closure Map for additional information. The four key movements to be kept open to traffic are:

- On-ramp from Pine St. to eastbound I-70
- Southbound I-65 to eastbound I-70 (may be closed up to a maximum of 45 days)
- Westbound I-70 to northbound I-65
- Westbound I-70 to the off ramps at both Ohio St. and Michigan St.

This Alternate does allow traffic along the northside of the interchange from I-65 SB to travel to I-70 EB and traffic from I-70 WB to travel to I-65 NB. In addition, this Alternate does allow traffic access the Ohio St. and Michigan St. offramps into downtown Indianapolis on the south side of the interchange from I-70 WB in addition to allowing traffic from downtown on the south leg of the interchange access via the Pine St. onramp to I-70 EB. Basically, two key movements are provided for inbound traffic and two key movements are provided for outbound traffic. Due to complex construction phasing, the I-65 southbound to I-70 eastbound ramp movement will be allowed to incur a short term closure (up to a maximum of 45 days) to remove the existing bridges and pavement while the new ramp pavement is constructed. It is possible that the successful design build contractor will determine a method to significantly reduce or eliminate this maximum 45 day closure.

In accordance with the PPA and TPs, the DB contractor will be required to maintain two lanes of traffic on these four key ramp movements at all times. The one exception as noted above will allow the contractor to close the I-65 southbound to I-70 eastbound ramp movement for a short duration. The DB teams will be required to submit their proposed closure duration. The PPA will specify a maximum closure duration of no more than 45 days.

INDOT has prepared a concept level MOT construction phasing plan for this preferred MOT Alternate. The MOT plan is contained in Attachments C1 through C4. These concept MOT plans and proposed phasing were developed in coordination with our design consultant, INDOT construction and traffic staff, Indianapolis DPW and others. The construction and maximum closure durations defined in the TP's and PPA are based on this concept plan. These concept MOT plans have been provided to the DB teams. They are not obligated to use them or the concept, but they have to abide by the terms of the PPA and TP's.

As noted above, there are 15 local roadways that cross under I-65 and I-70 within the Project limits. These roadways consist of major arterials such as College Ave., Michigan St., Ohio St. and 10th St. These major roadways provide access into and out of downtown Indianapolis as well as connections for the neighborhoods and businesses in the Project vicinity. All these local roadways cannot be closed at the same time. Phase construction involving alternating closure of adjacent roadways is required. This concept of alternating local roadway closures and local roadway detours was discussed with and approved by both INDOT and the City of Indianapolis. See Attachment D Local Detour Concept Maps.

The movements and maximum closure durations as currently proposed in the Draft TP Section Maintenance of Traffic are noted in Attachment G, Closure Durations. The TP defines the maximum closure durations for each of the movements. The contractor will be subject to liquidated damages if closures exceed the amount of time that is bid, which in all cases will be less than or equal to the TP requirements.

- **Queue Length** Modeling shows that MOT Alternative 3 will result in queuing on I-65 and I-70 in all directions, beyond the subarea boundary, but within the I-465 loop.

- **Driver Comprehension** With MOT Alternative 3, partial closures will be large enough, and for a significant enough period of time, that drivers should be able to easily comprehend the MOT scheme because it would be constant throughout a construction season. Traffic operations would be poor, with lengthy queuing and delays on the interstates and the local roadway network; however, motorists would experience this on a consistent daily basis.

- **Worker Safety** Alternate 3 involves closure of the I-65 and I-70 through movements while maintaining access into and out of downtown Indianapolis on

the four noted key movements. This will allow the DB contractor to expeditiously construct the Project without having to implement multiple phases. With this Alternate, the critical weaving and lane drop movements where the majority of the crashes are occurring are eliminated.

- **Construction Quality** Because the southern leg of the interchange and a majority of the interchange will be closed to traffic, the ability for the contractor to construct a quality product should be maximized. Inside-out phase construction is required on the east and west legs of the interchange. Because the through movements have been closed, there is ample width available on both legs for the contractor to safely work in while maintaining traffic on the key movements. Maintaining high construction quality should be viable with this Alternate.

- **Environmental Impacts** Since the full closure alternative, being incorporated into the Section 106 and EJ analysis in the EA, represents the worst case for potential impacts to surrounding neighborhoods, this MOT alternative is covered from a NEPA standpoint.

- **Cost** Because a major portion of the interchange and the southern leg of the interstate will be closed to traffic for this Alternate 3, the contractor's means and methods to construct the project should produce efficiencies resulting in a reduced construction bid price. The estimated construction bid price for this Alternate is about $300 million.

- **Other Project Impacts** A majority of the movements into and out of downtown are maintained, albeit some movements require access via different interchanges. It is anticipated that no more than two seasons of movement closures would be required. Proposer teams will be asked to bid actual days of movement closures and it is anticipated these days will be below required maximum closure durations.

- **Summary** This MOT Alternate was chosen as the preferred alternate. This Alternate meets INDOT's MOT goals of building the project within two construction seasons while maximizing mobility and access into and out of downtown Indianapolis.

Alternate 4 – Close I-65 and I-70 Through Movements, Provide Access for Key Movements Into and Out of Downtown Indy. No Short Term Closures

This Alternate is very similar to Alternate 3 except this Alternate does not require the short term closure of the I-65 SB to I-70 EB movement. To maintain this movement will require the I-70 WB bridge to be constructed first and temporary ramps be built to the new bridge. I-70 EB traffic will then be detoured onto the newly constructed I-70 WB bridge. Once I-70 EB traffic is detoured onto the I-70 WB bridge, the I-70 EB roadway and demolition of the existing bridges can be constructed. One of the four key

movements that has to be kept open to traffic is the I-70 WB ramp (CD Road) to the Ohio St. and Michigan St. off ramps. The new I-70 WB roadway crosses over this ramp. To keep access to the Ohio St. and Michigan St. offramps open to traffic, the I-70 WB roadway would have to be eliminated and a new bridge constructed over it instead. Due to the close proximity of this crossing of I-70 WB over this Ohio St./Michigan St. ramp, the proposed 510 ft. long I-70 WB bridge would have to be lengthened another 560 ft. for a total length of about 1170 ft. This complex bridge is a long span curved steel girder bridge with straddle bents at two of the piers. Lengthening this bridge further complicates this bridge in addition to requiring new bridge construction over an active ramp.

- **Queue Length** Queuing is anticipated to be similar to MOT Alternative 3.

- **Driver Comprehension** Driver comprehension is expected to be similar to MOT Alternative 3.

- **Worker Safety** Worker safety is expected to be similar to MOT Alternative 3.

- **Construction Quality** Similar to Alternate 3, because the southern leg of the interchange and a majority of the interchange will be closed to traffic, the ability for the contractor to construct a quality product should be maximized. Inside-out phase construction is required on the east and west legs of the interchange. Because the through movements have been closed, there is ample width available on both legs for the contractor to safely work in while maintaining traffic on the key movements. Maintaining high construction quality should be viable with this Alternate.

- **Environmental Impacts** Since the full closure alternative, being incorporated into the Section 106 and EJ analysis in the EA, represents the worst case for potential impacts to surrounding neighborhoods, this MOT alternative is covered from a NEPA standpoint.

- **Cost** The cost of this Alternate is significantly higher than Alternate 3 due to the added complexity and cost of having to lengthen the I-70 WB bridge, construct temporary ramps, temporary retaining walls and an additional MOT traffic phase. The estimated additional construction cost compared to Alternate 3 is about $25 million with a total estimated bid price of about $325 million.

- **Other Project Impacts** Other project impacts are expected to be similar to MOT Alternative 3 other than a short term movement closure.

- **Summary** This alternative would require two seasons of construction. INDOT has determined that this Alternate may be more costly than Alternative 3, but was discarded due to the possible additional cost of the I-70 WB bridge and related

construction costs, while most other portions of the alternative were similar to Alternative 3.

MITIGATION STRATEGIES

We have analyzed the traffic modeling results from the MPO Travel Demand Model which shows the diverted traffic flows associated with the proposed I-65 and I-70 interstate through route closures. This model along with actual observations in the field will allow INDOT's Traffic Management staff the opportunity to work with the City of Indianapolis to adjust traffic signal timing or make other traffic engineering adjustments on the local diversion routes that we anticipate will be most impacted. Our Traffic Management staff utilized this effort in 2018 and 2019 with the interstate closures during these years. INDOT is committed to bringing in statewide resources to assist in this effort again with this Project, however given the potential long term nature of the duration of the closures, we will be working with our project team, selected Design Build Contractor and the City of Indianapolis to determine the improvements and modifications that can have the most effective benefits during the extended closures.

INDOT has funds for additional police patrols by the Indiana State Police and plans to use additional police patrols as needed. We also anticipate working with the Indianapolis Metropolitan Police Department to consider utilizing these additional police resources. Our Traffic Management Division has been and will be actively involved in the coordination of this Project and has committed to utilize all of those available resources. An objective and commitment defined in INDOT's Policies, Processes and Procedures for Work Zone Safety Manual is "reducing the frequency and severity of crashes and the overall amount of congestion in all highway work zones." The MOT Alternates considered for this Project take into account this commitment. INDOT is currently evaluating enhancements to our tool box to address back of queue incidents and by the time this project begins, we will have implementation recommendations related to more widespread use of queue trucks and queue management systems. The project team, along with the selected design build contractor, will make recommendations for deployment as the design is completed.

It is anticipated that a Mobility Management Plan (MMP) will be developed for this project. Numerous task forces are in the process of being identified. As this organizational structure and specific activities are still in the draft stage, we don't have specifics to share, but it is anticipated that FHWA will be asked to be a member on many of the teams. Teams will likely be developed to address functional areas such as Traffic Control/MOT, Transportation Demand Management, Traffic Impacts and Communications and Public Outreach. Team members will be selected and be coordinated with the DB team members as they come on board. Specific recommendations from these teams are anticipated to be part of the mitigation and communication plans and will be shared as they are identified. A wide range of strategies to reduce demand (transit, remote work, etc.) and increase capacity (signal

optimization, spot improvements, etc.) on alternate routes will be covered with these teams.

WORK ZONES ON DETOUR ROUTES

I-465 will be utilized as the official detour route for I-65 and I-70 through traffic. INDOT is committed to having no lane closures or interstate closures on these routes during the closure period. The work on this project will overlap with the construction of I-69, Section 6 on a portion of I-465 on the southwest side of Indianapolis. We are working closely with the I-69 team to insure the MOT plan for that project will not include lane closures on I-465 during 2021 and 2022. Short lengths of shoulder closure (1000 feet or less) will be allowed but this will have a minimal impact on capacity. Between the two projects, queue mitigation alternatives will be deployed on the I-465 detour route and any routes that will see impacts. Our Clear Path Project on I-465/I-69 on the northeast side may begin work in 2022, but no restrictions to traffic on I-465 are expected until 2023.

PUBLIC OUTREACH

The PPA and TP's will require the DB team to develop a robust public outreach and public involvement plan (PIP) for this Project. An integral part of this Plan will require the DB teams to work with INDOT to supply advanced, clear communication with the public and stakeholders during construction. INDOT will be the point of contact with the public, but the DB team will work closely with INDOT team members to ensure enhanced public awareness and thorough engagement of stakeholders. The selected DB team will assist INDOT in identifying and implementing ways of informing the public, individual property owners, stakeholders, media and other broader communities about design and construction activities that directly affect them. The PIP program includes activities shared between INDOT and the DB team including community involvement coordination and meetings, communications with local agencies and the public, public notices, media relations, development of Transportation Management Plan (TMP), public information meetings. The PIP will engage a broad range of groups and agencies, including the following: INDOT, Indianapolis Department of Public Works (DPW), media, local, state, and federal Governmental Entities, including regulatory and law enforcement agencies, schools and emergency services general public residing or working within the general vicinity of the Project, or traveling within or across the limits of the Project, business owners or business groups within the Project corridor, utilities, railroads, IndyGo, airports, neighborhood associations, community groups, and other organizations with special interest in the Project. Subgroups are committed to be devoted to each of these areas and recommendations for implementation will be developed that will be supportive of the needs of the design as it is developed.

We plan on using existing ITS devices and new ITS devices supplemented by Portable Changeable Message Signs (PCMS) to communicate detour routes to motorists. Significant advanced communication plans will be developed to communicate the plan

to the public on a regular basis. Extra emphasis will be placed on phase changes or when access to ramps and local roadways are altered. Special events in the downtown area will be monitored to allow for additional coordination to be provided when short term travel patterns are changed.

§658.11 d.2.ii ANALYSIS OF IMPACT ON INTERSTATE COMMERCE

The temporary closure of I-65 and I-70 through movements is anticipated to have a negligible impact to Interstate commerce. Through traffic on I-65 and I-70 will be detoured using I-465. INDOT plans on utilizing permanent and temporary ITS signage and other devices to inform motorists throughout the duration of this Project. For local traffic, route marker assemblies and PCMSs will be utilized at numerous locations to direct traffic back to the original routes. Permanent dynamic message signs will also be utilized to inform and direct motorists. Oversize and Overweight trucks and trucks with hazardous cargo are currently not permitted within I-465 so this project will not have an effect on these specific groups of trucks.

§658.11 d.2.iii ANALYSIS OF RECOMMENDATIONS OF ALTERNATIVE ROUTES FOR COMMERCIAL VEHICLES

Commercial motor vehicles will use the Interstate detour routes mentioned above. The detour routes will have no lane restrictions during the times of the detours. INDOT will utilize the Hoosier Helper workforce (the state's freeway service patrols) along the detour routes to help address incident response and minimize any incident impacts as the detour route is a regular route of the Hoosier Helpers. INDOT will issue formal press releases as the Project passes major milestone points and final closure dates become finalized. INDOT will also post the closures in the Condition Acquisition and Reporting System (CARS 511) which is part of the INDOT traveler information website "Trafficwise". With respect to oversize and overweight permits requests, INDOT will work with the Indiana Department of Revenue to ensure permits will direct permitted vehicles along an acceptable alternate route if a permit load would otherwise be dependent on the closed route. INDOT will inform the Indiana Motor Truck Association of the overall project plans and anticipate that they will communicate with their members as occurred during the 2018 and 2019 Interstate closures. INDOT will also work very closely with the Indiana State Police to provide current information relative to the closure periods.

§658.11 d.2.iv EVIDENCE OF CONSULTATION WITH LOCAL GOVERNMENTS DIRECTLY AFFECTED

The Project is contained entirely within the City of Indianapolis. We have met and consulted extensively with representatives from the City of Indianapolis Department of Public Works (DPW), Mayor's office, Indygo, Indianapolis Parks Department, local utilities, and others. See Attachment F DPW Correspondence containing coordination

meeting minutes with DPW. DPW is in support of the Project. We have considered their input and suggestions in regard to the local road closures, local detours, impacts to trail system and other impacts. See Attachment D for local roadway closures and detour mapping. We have made changes to the MOT Conceptual Plan, road closures and detours based on their input. The project team has had regular meetings with the DPW staff to share the importance of minimizing local road projects that could have a cumulative impact on traffic patterns on the local streets that will likely be affected by roadway and ramp closures. Outreach was also undertaken with other groups (IndyGo and other local businesses) to understand other projects that may have impact interactions with the NorthSplit project. On-going dialog will occur as these other projects are developed and the final design and schedule for the NorthSplit closures becomes clearer.

This Project will include a comprehensive Traffic Management Plan (TMP). The Technical Provisions will require the DB contractor to prepare the TMP, hold public meetings, meet with neighborhood groups, DPW, utilities, emergency responders and others. INDOT has initiated outreach to some of these groups. Over the next three months, INDOT will continue to develop the Preliminary TMP that will then be handed over the DB contractor.

MONITORING DURING CONSTRUCTION

The DB team will identify a MOT Manager and a Certified Worksite Traffic Supervisor (CWTS). The CWTS will be responsible to monitor all daily MOT activities including observing existing traffic movements, delays, queueing and identifying potential traffic problems. The CWTS, the MOT Manager and INDOT will constantly monitor traffic conditions during construction. The DB team will be required to prepare, implement, and maintain a TMP throughout the construction period. The TMP will include a Traffic Operations Plan, MOT Plans, a Traffic Incident Management Plan, and a coordination process with the PIP. The TMP will be developed in coordination with emergency service providers, school transportation officials, and all affected local public agencies and other stakeholders. The TMP will include procedures to monitor and communicate all MOT phase installations and changes with INDOT and these affected groups and stakeholders. If changes to the MOT plan are required based on observed conditions, INDOT will direct those changes through terms of the PPA contract.

AFTER ACTION ASSESSMENT

INDOT will constantly observe the operations and safety to the traveling public and construction workers during the interstate closure period. The effectiveness of the TMP, warning and detour signage, public outreach and communications will be constantly evaluated including identification for improvements to the process. At the end of the closure period, INDOT will conduct a meeting with the FHWA, DB team and others to review the observed operations and safety and identify improvements to the process for any future potential Interstate closures. INDOT will consider how best to utilize Purdue

University and the JTRP program to assist in evaluation of the project. We currently have access to a large amount of data from Purdue faculty and will utilize as needed during the project. During our upcoming call for new research projects (for FY 2021), we will develop recommendations to consider how best to utilize that resource in the overall after action assessment.

SUMMARY

The justification for the overall request Is based on the provision found under Title 23 of the Code of Federal Regulation Section §658.11 (additions, deletions, exceptions, and restriction) with subcategories d.2.i, ii, iii, and iv.

INDOT has carefully evaluated MOT alternatives to construct this Project. Due to the complexity of the interchange, proposed changes in ramp alignments, profile grades, construction completion date and desirable interstate and ramp closures durations, we determined the best alternative to build this Project cost effectively, safely and expeditiously is to allow closure of the through movements on I-65 and I-70 through the interchange. The preferred Alternate is the best alternate to ensure the safety of the motoring public and the construction workers with the least amount of impact to interstate commerce. INDOT specifically requests the Federal Highway Administration grant approval of this request for the temporary closure of Interstates I-65 and I-70. INDOT will continue to work with the Federal highway Administration Indiana Division Office on the details of this Project as it progress through the RFP stage and eventually into the award, contract and construction phases.

If you have any questions regarding this request or if you desire more specific dialog on specific details of the overall plan, please feel free to contact INDOT Senior Director of Engineering and Research, Jim Poturalski, at 317-234-0410 or via e-mail at jpoturalski@indot.in.gov

Respectfully submitted,

Roland Fegan
Deputy Commissioner of Construction

FHWA Indiana Divisions Approval:

JAY DUMONTELLE

PROJECT DELIVERY TEAM LEADER — Title

DEC. 4, 2019 — Date

Additional FHWA comments or conditions to approval above:

Attachments:

- A: Project Map
- B: Interstate and Ramp Closures Map
- C: Concept MOT Plans
- D: Local Detour Concept Maps
- E: Interstate Closure Signage Maps
- F: Indianapolis DPW Coordination Meeting Minutes
- G: Closure Movements and Durations
- H: MOT Alternates Traffic Diversions Analysis
- I: MOT Alternates Preliminary Modeling Analysis
-

Cc: Runfa Shi, INDOT PM
Eryn Fletcher, FHWA Indiana Division
Karen Stippich, FHWA Indiana Division
Kevin Jasinski, INDOT
Jim Poturalski, INDOT Senior Director of Engineering Research
Seth Schickel, HNTB Corporation
Dave Cleveland, Corradino Group

Before or After North Split Interchange Closure

Minimum Number of Lanes Open

	West Leg (I-65 at Meridian)														East Leg (I-70 at Roosevelt)													
	Southbound (3-Lane)							Northbound (3-Lane)							Westbound (5-Lane)							Eastbound (5-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
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1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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22:00 - 23:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	2	1	2	2	2	2	2	2	1
23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	2	1	1

	South Leg																																		
	I-65/I-70 at Michigan																					I-65/I-70 at Virginia													
	SB, CD (2-Lane)							SB, ML (3-Lane)							Northbound (4-lane)							Southbound (4-Lane)							Northbound (4-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
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1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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2021 During North Split Interchange Closure

Minimum Number of Lanes Open

	West Leg (I-65 at Meridian)													
	Southbound (3-Lane)							Northbound (3-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5:00 - 6:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6:00 - 7:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7:00 - 8:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8:00 - 9:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
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23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	East Leg (I-70 at Roosevelt)													
	Westbound (5-Lane)							Eastbound (5-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
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8:00 - 9:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
9:00 - 10:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10:00 - 11:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
11:00 - 12:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
12:00 - 13:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
13:00 - 14:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
14:00 - 15:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
15:00 - 16:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
16:00 - 17:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
17:00 - 18:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
18:00 - 19:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
19:00 - 20:00	2	2	2	2	2	2	2	3	3	3	3	3	3	2
20:00 - 21:00	2	2	2	2	2	2	1	2	2	2	2	2	2	2
21:00 - 22:00	1	1	1	1	2	1	1	2	2	2	2	2	2	2
22:00 - 23:00	1	1	1	1	1	1	1	1	1	1	1	2	2	1
23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	2	1	1

	South Leg (I-65/I-70 at Virginia)													
	Southbound (4-Lane)							Northbound (4-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	2	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	2	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	2	1	1
5:00 - 6:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6:00 - 7:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
7:00 - 8:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
8:00 - 9:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9:00 - 10:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
10:00 - 11:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
11:00 - 12:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
12:00 - 13:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
13:00 - 14:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
14:00 - 15:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
15:00 - 16:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
16:00 - 17:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
17:00 - 18:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
18:00 - 19:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
19:00 - 20:00	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20:00 - 21:00	2	2	2	2	2	2	1	2	2	2	2	2	2	2
21:00 - 22:00	1	1	1	2	2	2	1	2	2	2	2	2	2	2
22:00 - 23:00	1	1	1	1	2	1	1	2	2	2	2	2	2	1
23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	2	2	1

2022 During North Split Interchange Closure

Minimum Number of Lanes Open

	West Leg (I-65 at Meridian)													
	Southbound (3-Lane)							Northbound (3-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5:00 - 6:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
6:00 - 7:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
7:00 - 8:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
8:00 - 9:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
9:00 - 10:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
10:00 - 11:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
11:00 - 12:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
12:00 - 13:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
13:00 - 14:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
14:00 - 15:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
15:00 - 16:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
16:00 - 17:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
17:00 - 18:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
18:00 - 19:00	3	3	3	3	3	3	3	3	3	3	3	3	3	3
19:00 - 20:00	2	2	2	2	2	2	1	1	1	1	1	2	2	1
20:00 - 21:00	1	1	1	1	2	2	1	1	1	1	1	2	2	1
21:00 - 22:00	1	1	1	1	2	2	1	1	1	1	1	2	2	1
22:00 - 23:00	1	1	1	1	2	1	1	1	1	1	1	1	1	1
23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	East Leg (I-70 at Roosevelt)													
	Westbound (5-Lane)							Eastbound (5-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5:00 - 6:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
6:00 - 7:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
7:00 - 8:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
8:00 - 9:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
9:00 - 10:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
10:00 - 11:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
11:00 - 12:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
12:00 - 13:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
13:00 - 14:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
14:00 - 15:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
15:00 - 16:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
16:00 - 17:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
17:00 - 18:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
18:00 - 19:00	5	5	5	5	5	5	5	5	5	5	5	5	5	5
19:00 - 20:00	2	2	2	2	2	2	2	2	2	2	2	3	2	2
20:00 - 21:00	2	2	2	2	2	2	1	2	2	2	2	2	2	2
21:00 - 22:00	1	1	1	1	2	1	1	2	2	2	2	2	2	1
22:00 - 23:00	1	1	1	1	1	1	1	1	1	1	1	2	2	1
23:00 - 0:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1

	South Leg (I-65/I-70 at Virginia)													
	Southbound (4-Lane)							Northbound (4-Lane)						
Time	M	Tu	W	Th	F	Sa	Su	M	Tu	W	Th	F	Sa	Su
0:00 - 1:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
1:00 - 2:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
2:00 - 3:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
3:00 - 4:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
4:00 - 5:00	1	1	1	1	1	1	1	1	1	1	1	1	1	1
5:00 - 6:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
6:00 - 7:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
7:00 - 8:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
8:00 - 9:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
9:00 - 10:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
10:00 - 11:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
11:00 - 12:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
12:00 - 13:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
13:00 - 14:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
14:00 - 15:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
15:00 - 16:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
16:00 - 17:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
17:00 - 18:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
18:00 - 19:00	4	4	4	4	4	4	4	4	4	4	4	4	4	4
19:00 - 20:00	2	2	2	2	2	2	2	2	2	2	2	2	2	2
20:00 - 21:00	2	2	2	2	2	2	1	2	2	2	2	2	2	2
21:00 - 22:00	2	2	2	2	2	2	1	2	2	2	2	2	2	2
22:00 - 23:00	1	1	1	1	2	2	1	2	2	2	2	2	2	1
23:00 - 0:00	1	1	1	1	2	1	1	1	1	1	2	2	2	1

ATTACHMENT 12-4: Local Event Days

		Restrictions Effective	
Event	**Date**	**From**	**To**
NBA All Star Game	February 14, 2021 Sunday	Saturday, February 13 at 7 am EST	Monday, February 15 at 5 am EST
NCAA Final Four	April 3-5, 2021	Friday, April 2 at 10am EST	Tuesday, April 6 at 5am EST
OneAmerica 500 Festival Mini Marathon	May 8, 2021	Friday, May 7 at 11pm EST	Saturday, May 8 at 11 pm EST
Indianapolis 500	May 30, 2021	Saturday, May 29 at 11 pm EST	Monday, May 31 at 5am EST
Big Ten Football Championship	December 4, 2021	Friday, December 3 at 10am EST	Sunday, December 5 at 5am EST
College Football Championship	January 10, 2022	Saturday, January 8 at 12 pm EST	Tuesday, January 11 at 5am EST
NCAA Men's Basketball First and Second Round	March 17-19, 2022	Wednesday, March 16 at 10am EST	Sunday, March 20 at 5am EST
OneAmerica 500 Festival Mini Marathon	May 7, 2022	Friday, May 6 at 11 pm	Saturday, May 7 at 5am EST
Indianapolis 500	May 29, 2022	Saturday, May 28 at 11 pm EST	Monday, May 30 at 5am EST

ATTACHMENT 13-1

Reinforced Soil Slopes

Description

This Work shall consist of preparing the design, furnishing the materials, and constructing the reinforced soil slope, RSS, to the lines, grades and dimensions shown in the Design Documents, this special provision, any additional requirements specified by the RSS system supplier in the approved shop drawings and as directed by INDOT.

General Requirements

The RSS system shall consist of reinforced fill, soil reinforcement, a facing treatment, and incidental materials designed to provide adequate stability of slopes with inclines of up to 70 degrees which are resistant to erosion and requiring little or no long-term maintenance. Tiered vegetated facing treatment shall be used, unless otherwise specified in the Design Documents.

Reference Standards

American Society for Testing and Materials (ASTM)

1. ASTM D 422 Particle Size Analysis
2. ASTM D 4318 Liquid Limit, Plastic Limit and Plasticity Index of Soils
3. ASTM D 698 Laboratory Compaction Characteristics of Soil –Standard Effort
4. ASTM D 1238 Melt Flow (HDPE and PP)
5. ASTM D 1248 Molding and Extrusion (HDPE)
6. ASTM D 1505 Specific Gravity (HDPE)
7. ASTM D 4218 Carbon Black Content (HDPE)
8. ASTM D 2455 Carboxyl End Group (PET)
9. ASTM D 4603 Intrinsic Viscosity (PET)
10. ASTM D 4595 Tensile Properties of Geotextiles - Wide Width Strip
11. ASTM D 5262 Unconfined Tension Creep Behavior of Geosynthetics
12. ASTM D 6637 Tensile Properties of Geogrids by Single or Multi-Rib Tensile Method
13. ASTM D 4884 Strength of Sewn or bonded Seams of geotextiles
14. ASTM D 6706 Geosynthetic Pullout Resistance in Soil
15. ASTM D 5321 Shear Strength of Soil-Geosynthetic and Geosynthetic-Geosynthetic Interfaces by Direct Shear
16. ASTM D 4355 Deterioration of Geotextiles by Exposure to Light, Moisture and Heat in a Xenon Arc Type Apparatus
17. ASTM D 7737 Individual Geogrid Junction Strength

Geosynthetic Research Institute (GRI)

1. GRI:GG4(a) Long Term Design Strength of Geogrid
2. GRI:GG4(b) Long-Term Design Strength of Flexible Grid

American Association of State Highway and Transportation Officials (AASHTO) and Federal Highway Administration (FHWA) Documents

1. AASHTO LRFD Bridge Design, 8th Edition, 2017.
2. AASHTO LRFD Bridge Construction Specifications, 4th Edition, 2017
3. FHWA/NHI-10-024 and 025, GEC 11 Design and Construction of Mechanically Stabilized Earth Walls and Reinforced Soil Slopes Volumes 1 and 2.

Design Requirements

The design shall be completed in accordance with the reference standards utilizing AASHTO load, resistance, and stability design criteria. The bottom of the RSS shall be established no less than 3 ft below the finished grade at the face of the RSS. No less than a 4-ft wide horizontal bench shall be provided in front of an RSS founded on slopes. Design submittals not in accordance with these reference standards and design criteria or technical/administrative criteria specified will be rejected in their entirety until compliance is achieved.

The RSS supplier shall be responsible for all internal and external stability aspects of the slope at all stages of construction. The design shall provide the required factors of safety/resistance factors using the soil reinforcement long-term nominal tensile strength (T_{al}) and Pullout Resistance for the reinforced fill proposed.

The soil reinforcement coefficient of interaction and mechanical interlock with the proposed reinforced fill material shall be selected and documented with appropriate test data. The soil reinforcement shall be dimensionally stable and able to retain its geometry under construction stresses and have high resistance to damage during installation considering ultraviolet degradation and all forms of chemical and biological degradation encountered in the reinforced fill. Soil reinforcement coverage ratios must be maintained at no less than 50 percent, and the maximum vertical spacing between primary reinforcement layers is 1.5 feet.

The appropriate test data documenting the connection design capacity with minimal elongation will be required as part of the submittal package for approval. Lap splices in the primary direction of the soil reinforcement will not be allowed.

The design computations shall indicate the factor of safety for the temporary construction and permanent slopes, considering both internal stability and external stability.

External loads, such as those applied through structure foundations, light and sign foundations, from traffic or railroads, and slope surcharge, shall be accounted for in the stability design. The presence of all appurtenances behind, in front of, or passing through the reinforced fill such as drainage structures, utilities, structure foundation elements or other items shall be accounted for in the stability design. The design shall address hydrostatic and erosive forces. Minimum live loads of 250 psf shall be used.

Design-Build Contractor shall avoid placement of utilities within the reinforced fill. Where placement of utilities within reinforced fill is unavoidable, Design-Build Contractor shall provide for access to the utility such that the integrity of the RSS is maintained in the event access to the utility is required in the future.

The design of the soil reinforcement shall account for the strength reduction due to long-term creep, chemical and biological degradation, stage construction issues, and installation damage and shall insure stress levels are below the allowable at the end of a 75-year design life. All components of the RSS, including elements used to form the facing treatment, shall be designed for a 75-yr design life.

Submittals

A minimum of 45 days prior to the Stage 3 Plans for the RSS, the Design-Build Contractor shall submit complete design calculations and shop drawings to INDOT for review and approval. All submittals shall be sealed by a Registered Professional Engineer and shall contain all details, dimensions, quantities and cross sections necessary to construct the RSS and in accordance with Section 105 of Standard Specifications and, as a minimum, include the following:

1. Plan, Elevation and Cross section sheet(s) as shown in the Design Documents:
   i) Plan view showing the horizontal alignment and offset from the CL of the roadway to the toe and top of the RSS. Beginning and end stations for the RSS system and transition areas shall be shown. These views shall be developed from the plan view begin and end stations of the RSS System.
   ii) Elevation view indicating stations and elevations at the top and bottom of the RSS system. The stations and elevations of the final ground line along the length of the wall shall also be indicated. These views shall be developed from the elevation view top and bottom lines of the RSS system.
   iii) Location, length, size, coverage ratio, and type of soil reinforcement shall be shown. The stations or elevations where changes in soil reinforcement occur shall be clearly indicated.
   iv) Typical cross section(s) showing the elements and limits of the RSS system. These views shall include the reinforced fill, soil reinforcement, facing treatment, and their relationship to the right-of-way limits, excavation cut slopes, retained embankment, existing ground conditions and the finished grade line.
   v) Facing treatment details indicating type, elements and all dimensions necessary to construct the facing system. The details shall include facing interaction with the soil reinforcement and reinforced fill. The specifications for installation and establishment of vegetated facings shall be provided and shall be in accordance with the details on the plans. The selected facing shall provide a stable and erosion and sloughing resistant surface layer that will permit compaction against and near the face of the slope.
   vi) Locations of signs, lighting, guardrail posts, future locations of piles, and other infrastructure within the reinforced fill shall be indicated. Details for placing soil reinforcement around such elements shall also be provided.
   vii) Any general notes required for construction.
2. Design Computations: The shop drawings shall be supported by detailed computations for each design section indicating the design criteria specified have been met.
3. Manufacturer’s Certification: The Design-Build Contractor shall include manufacturer’s certifications and test results indicating that the proposed soil reinforcement, reinforced fill and facing treatment are in accordance with the design parameters used and the materials portion of this specification. INDOT reserves the right to obtain random samples of materials for testing by INDOT to confirm the certification values. No Work or ordering of materials for the structure shall commence until the submittal has been approved by INDOT.
4. Design-Build Contractor’s certification:
   i) The specific RSS system proposed for use on this project shall have been successfully used on a minimum of five similar projects and been successfully installed on a minimum of 1,000,000 square feet of

elevation view.

ii) The Design-Build Contractor shall have a minimum of 20,000 square feet of experience with the proposed RSS system. Contact names and telephone numbers shall be listed for projects used to document the 20,000 square feet.

Delivery, Storage and Handling

The Design-Build Contractor shall check all materials upon delivery to ensure that the proper type, grade, color and material certification have been received. The Design-Build Contractor shall protect materials from damage due to jobsite conditions and in accordance with the manufacturer's recommendations. Damaged materials shall not be incorporated into the Work.

Materials

Definitions

1. Soil Reinforcement - geosynthetic formed by a regular network of integrally connected tensile elements with apertures of sufficient size to allow interlocking with surrounding soil, rock or earth and function as ground reinforcement.
2. Reinforced Fill - compacted fill that is within the reinforced soil volume as shown on the plans.
3. Foundation Soil – soil beneath entire RSS.
4. Retained Soil – soil behind reinforced fill of the RSS.
5. Facing Treatment – the elements used at the face of the slope to provide a stable condition and to promote a vegetated condition with little to no maintenance required.

Soil Reinforcement

Geosynthetic Reinforcement - shall be evaluated in accordance with FHWA GEC 011.

Reinforced Fill

Reinforced fill shall consist of soil meeting the requirements presented in Table 3-1 of GEC 011 except as modified below.

1. Less than 10 percent passing the No. 200 sieve in accordance with AASHTO T-88 with a maximum size of 3/4 inches.
2. The effective internal friction angle used for design shall be verified by appropriate testing and submitted to INDOT for review. The maximum friction angle shall be 34 degrees.
3. Less than 0.5% organic material.

Facing Treatment

The facing treatment shall be vegetated unless otherwise specified in the Design Documents.

The vegetated facing treatment materials shall include any top soil, compost, seeding, sod, erosion controls, watering provisions, or other vegetative systems complying with Section 621 of the Standard Specifications. R S S shall be constructed such that the vegetated portion of the slope is completed prior to the latest seeding dates shown in Section 621.12 of the Standard Specifications.

The tiered facing shall be established using cellular confinement or permanent welded wire forms.

Construction Requirements

General

The Design-Build Contractor shall obtain technical assistance from the supplier during slope erection to demonstrate proper construction procedures and shall include any costs related to this technical assistance in this item.

The foundation soils supporting the RSS shall be graded for a width equal to the length of the lowest soil reinforcement length. Cut slope surfaces shall be benched to allow the RSS to be keyed into existing retained embankment. Prior to soil reinforcement placement, the foundation soils shall be compacted.

Foundation soils found to be unsuitable shall be removed and replaced as directed by the Design-Build Contractor's geotechnical engineer. Water shall be diverted from the area where soil reinforcement is being placed and soil is being compacted.

At each soil reinforcement level, the reinforced fill shall be roughly leveled and compacted before placing the soil reinforcement. Reinforcement placement shall be installed in accordance with the manufacturer's recommendations and as shown on the approved shop drawings.

Place only that amount of reinforcement required for immediately pending Work to prevent undue damage. After a layer of soil reinforcement has been placed, the next succeeding layer of reinforced fill shall be placed and compacted. After the required facing treatment is installed and a series of reinforced fill lifts are placed to the next level of soil reinforcement, the next soil reinforcement layer shall be installed, and the process shall be repeated until the RSS height is completed. Soil reinforcement layers shall be laid flat, pulled tight prior to backfilling, and held in place with pins or other methods. Each soil reinforcement layer shall be placed to within 3 inches vertically of that shown on the shop drawings.

Where future foundations, such as light and sign foundations, are planned to be installed through the reinforced soil fill, temporary casing or other means of providing future construction access shall be provided. Excavation, including drilling, through the reinforced fill is not permitted.

Reinforced fill shall be placed and compacted in accordance with the contract requirements. Reinforced fill shall not be placed under freezing conditions. Reinforced fill shall be placed, spread, and compacted in such a manner to avoid the development of wrinkles and/or displacement of the soil reinforcement. Where retained embankment is to be placed behind the RSS, embankment placement shall closely follow placement of the reinforced fill. Reinforced fill and retained embankment shall be graded away from the slope crest and rolled at the end of each work day to prevent ponding of water on surface of the reinforced soil mass.

A minimum fill thickness of 6 inches is required prior to operation of tracked vehicles over the soil reinforcement and turning of tracked vehicles shall be kept to a minimum to prevent displacing the soil reinforcement. If approved by INDOT, rubber-tired equipment may pass over the reinforcement at speeds of less than 5 mph. Sudden braking and sharp turning shall be avoided. No rubber-tired wheel traffic will be allowed in direct contact with coated

geosynthetic geogrid, as damage to the coating could result.

Compaction adjacent to the backside of the facing treatment shall be achieved by use of light weight mechanical tampers, rollers, vibratory system or other methods to provide short- and long-term erosion and facing stability.

For the vegetated facing treatment, the construction of any top soil, compost, seeding, sod, mulching, erosion controls, watering, shall be in accordance with the Standard Specifications unless otherwise specified in the approved shop drawings.

Construction and construction tolerances shall be in accordance with AASHTO Bridge Construction Specifications Section 7 with the following additions or clarifications:

1. A minimum of 1 cubic foot of unit drainage fill shall be used for each square foot of slope face and shall be placed between and behind the facing units and shall extend back from the face of the wall a minimum of 2 feet. Geotextile is not an acceptable substitute for unit drainage fill unless the entire reinforced fill zone is in accordance with Section 7.3.6.3 and connection strength requirements can be met without unit drainage fill.
2. Soil reinforcement shall be staked at the corners and on 12-foot centers along the roll edges to prevent wrinkling or other distortion of the reinforcement during backfill placement.

Basis of Item

The RSS shall be quantified in square feet of vertical projected slope face area. The RSS will be quantified from the top of the RSS to the bottom of the RSS for the length of the slope as shown in the Design Documents. Any additional face area below or above the top or bottom of plan lines to satisfy the design stability requirements or stepping of the facing will be not be measured but considered included in the measured area defined above.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
203-11340	Reinforced Soil Slope.....	SFT

The following shall be considered incidental to this item:

Design, supply, and installation of the RSS including any excavation, base leveling pad, foundation soil preparation, soil reinforcement and placement of soil reinforcement, compaction, unit drainage fill, reinforced backfill, retained backfill, facing elements and facing treatment, subdrain, and other items specified on the approved shop drawings, equipment, materials and labor necessary to construct the RSS.

ATTACHMENT 13-2

This section replaces 203.23 of the Standard Specifications

203.23 Embankment other than Rock, with Strength or Density Control

Compaction will be determined by dynamic cone penetrometer, DCP, testing in accordance with ITM 509 and the moisture content in accordance with ITM 506.

A test strip shall be constructed for density verification. Density verification for each test strip will be in accordance with AASHTO 310 in direct transmission mode for each type of material. This test strip procedure shall be used to estimate the number of DCP blow counts to represent 95% percent compaction requirements in accordance with AASHTO T 180.

The test section shall be approximately 225 ft long and 24 ft wide and consist of no less than two lifts and be made where embankment fill is being constructed. The natural ground surface shall be proof rolled in accordance with 203.26 prior to construction of the test section lift. The soil in the test section shall meet the requirements of 203.09 and 203 23. The DCP and moisture acceptance tests on each underlying lift will meet the specification requirements. The moisture acceptance tests on the top lift will meet the specification requirements.

The roller shall be checked to assure that the equipment complies with the specification requirements. The speed of the roller and the frequency of vibratory rollers shall be consistent throughout the test section. There shall be no stopping or turning within the established test section.

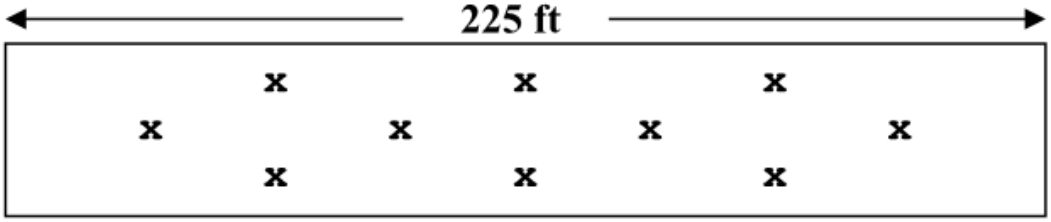
PROCEDURE – NUMBER OF ROLLER PASSES

Initially roll the top lift of the test section with four to six applications of the compaction roller.

Note 1: A roller application is defined as one pass of the roller over the entire test section.

Note 2: The roller that is used for normal production compaction shall be used for the test section.

Following the initial applications with the compaction roller, obtain 10 random DCP tests for 12 in. in accordance with 203.23 and 10 density tests in accordance with AASHTO 310 with a 12-in. depth and conducted in direct transmission mode. Tests shall be spaced uniformly throughout the test section at the following locations. Each location shall be marked with paint.



Average the 10 DCP test values and the AASHTO T 310 density test values. When the average of the 10 AASHTO T 310 density tests meet the 95% compaction requirements of AASHTO T 180, the number of roller passes that was used and the corresponding average DCP blow count is reported. The test section is complete.

Additional rolling is required when the average AASHTO T 310 density test values do not meet the 95% compaction requirements of AASHTO T 180. After the additional roller passes are complete, test the same 10 random locations 1 ft from each original test site with the DCP and density test.

The information recorded from the test section shall include the date, location, number of passes to achieve the target density value, average DCP blow count to meet target density and the DCP test data for the initial passes and each additional pass of the roller, and the type of roller used to compact the test section shall be reported.

The moisture compaction range for all soil types shall be as follows:

Soil Type	Moisture Compaction Range
Clay (< 105 lb/cu ft)	-2 to +2% of optimum moisture content
Clay (105 - 114 lb/cu ft)	-2 to +1% of optimum moisture content
Silty and Sandy (> 114 lb/cu ft)	-3% to optimum moisture content
Granular	5 to 8%

DCP testing and verification testing, AASHTO T 310 in direct transmission mode, will be performed in accordance with the Frequency Manual at random locations determined in accordance with ITM 802.

Moisture testing will be performed in accordance with the Frequency Manual.

If the embankment material is too wet or too dry, either the material shall be aerated to remove excess moisture or watered and disked to increase the moisture content, until in either case the moisture content is within the specified range. Sufficient moisture tests will be made to ensure that this range is maintained throughout the embankment.

The embankment material shall be placed in uniform level layers, left properly shaped as set out above, and compacted with approved compacting equipment. Compacting equipment shall include at least one 3-wheel roller or other approved compacting equipment capable of providing a smooth and even surface on the embankment as directed.

Each lift shall be disked or treated by some other mechanical means which shall ensure the breaking up of any existing lumps and clods.

The loose depth of each lift shall be such that the required compaction can be obtained, but in no case shall it exceed 8 in. Where a tamping roller is used, the loose depth of lift shall not exceed the length of the tamper feet. The surface area of the end of each foot of the tamping roller shall be no less than 5 1/2 sq in.

ATTACHMENT 13-3

This section replaces 203.24 of the Standard Specifications

203. 24 Method of Making Strength, Stiffness and Density Tests

The strength of chemically modified or compacted soils will be determined by DCP in accordance with ITM 509. The stiffness of chemically modified soils or aggregates will be determined by the LWD, in accordance with ITM 508. The density of soils and aggregates, as a percent of compaction, will be based on the maximum dry densities unless otherwise specified or directed. DCP field compaction tests will be performed in accordance with this section. The required compaction shall be obtained before additional material is placed.

(a) Laboratory

The DCP criteria will be established on representative soils by performing ASTM D 1140, AASHTO T 88, AASHTO T 89, AASHTO T 90, and AASHTO T 180 using Method A for soils and Method D for granular materials.

The optimum moisture content, maximum dry density, and gradation of aggregates will be determined by performing AASHTO T 180 Method D, AASHTO T 11 and AASHTO T 27 on representative sample of aggregates.

(b) Field

The soil strength of compacted soils or compacted chemically modified soils will be determined by DCP in accordance with ITM 509 and the stiffness of chemically modified soils or aggregates will be determined by LWD in accordance with ITM 508. The moisture content will be determined in accordance with ITM 506 or AASHTO T 255.

At the discretion of INDOT, verification of in situ field density and associated DCP values may be performed in accordance with AASHTO T 310 in direct transmission mode to a depth of 12 in. This testing criteria will govern in the event of a discrepancy in the acceptance.

Acceptance testing of chemically modified soils and coarse aggregates will be determined by LWD testing in accordance with ITM 508. The allowable deflection will be determined from a test section or will be specified. Test sections shall be constructed in accordance with ITM 514 in the presence of a representative of the INDOT Geotechnical Services Division for other materials not included in the Tables to determine the allowable deflection. The compaction procedures shall be in accordance with 203.23, 215, 301, 302, and 303. Proofrolling of compacted aggregate shall be performed in accordance with 203.26

The allowable average deflection and maximum deflection for chemically modified soils, aggregate over chemically modified and untreated soils shall be in accordance with the following:

Table 1. Allowable Average Deflection and Maximum Deflection for Chemically Modified Soils and Aggregate over Chemically Modified Soils

Material Type	Maximum Allowable *Average* Deflection (mm)	*Maximum Deflection at a Single Test Location (mm)*
Lime Modified Soil	*≤ 0.30*	*0.35*
Cement Modified Soil	*≤ 0.27*	*0.31*
Aggregate over Lime Modified Soil	*≤ 0.30*	*0.35*
Aggregate over Cement Modified Soil	*≤ 0.27*	*0.31*

Table 2. Aggregate over Untreated Soils: Where Proofrolling Can Be Performed

Material Thickness	*Allowable Average Deflection (mm)*	*Maximum Deflection at a Single Test Location (mm)*
6 in. Thick Coarse Aggregate No. 53	*≤ 0.51*	*0.57**
12 in. Thick Coarse Aggregate No. 53	*≤ 0.34*	*0.40***
18 in. Thick Coarse Aggregate No. 53	*≤ 0.31*	*0.35***

** When deflection exceeds this value, the area shall be recompacted or undercut as directed. The failed area will be delineated prior to excavation. Deflection will be measured based on the top 6 in. thick coarse aggregate No. 53 material placed for undercut.*

*** The Contractor shall recompact the coarse aggregate No. 53 in accordance with 301.06.*

Table 3. Aggregate over Untreated Soils: Where Proofrolling Cannot be Performed

Material Thickness	*Allowable Average Deflection (mm)*	*Maximum Deflection at a Single Test Location (mm)*
6 in. Thick Coarse Aggregate No. 53	*≤ 0.60*	*0.65**
12 in. Thick Coarse Aggregate No. 53	*≤ 0.47*	*0.52***
18 in. Thick Coarse Aggregate No. 53	*≤ 0.44*	*0.49***

** When deflection exceeds this value, the area shall be recompacted or undercut as directed. The failed area will be delineated prior to excavation. Deflection will be measured based on the top 6 in. thick coarse aggregate No 53 material placed for undercut.*

*** The Contractor shall recompact the coarse aggregate No. 53 in accordance with 301.06.*

Note:

The Engineer will perform the moisture test on in-situ soils prior to placement of coarse aggregate. If the result of the moisture test is > 13%, the Engineer will contact the Geotechnical Section.

Acceptance of the compaction of chemically modified soils or aggregate will be determined by averaging three LWD tests obtained at a random station determined in accordance with ITM 802, for each 1,500 ft length of chemically modified soil for each two-lane pavement section, or for each 800 t of compacted aggregate. Where the construction area is 8 ft wide or more, the location of the three tests will be at 2 ft from each edge of the construction area and at 1/2 of the width of the construction area. Where the construction area is less than 8 ft wide, the location of the three LWD tests will be spaced at 1/2 of the width of the construction area and spaced 5 ft apart in the longitudinal direction. The average deflection shall be equal to or less than the maximum deflection determined by the test section.

If the average deflection is not equal to or less than the maximum deflection for aggregates, a sample of the aggregate shall be obtained in accordance with AASHTO T 2 and a moisture content test shall be performed in accordance with AASHTO T 255 or ITM 506 to determine if the moisture content is within the acceptable limits. If the moisture content is not within the acceptable limits, additional LWD tests may be taken at the same locations after 24 h if the moisture content is within the acceptable limits at the time of testing. The aggregate will be accepted if the LWD tests are equal to or less than the maximum deflection.

ATTACHMENT 14-1

UNIQUE SPECIAL PROVISIONS

STRUCTURES

BRIDGE INSPECTION COORDINATION

The following routine, fracture critical, underwater or special bridge inspections are due to be performed by the INDOT's Bridge Inspection Office, or its authorized representative, on each bridge within the construction limits of the Project.

Structure Number	NBI Number	Location	Inspection Type	Last Inspection Date (MM/DD/YY)	Frequency (Mos.)	First Scheduled Inspection (MM/YY)	Second Scheduled Inspection (MM/YY)
I70-082-05751 DWBL	042370	I-70 WB, Ramp, CD over Proposed Ramp	Routine	11/22/2019	24	11/2021	11/2023
I65-112-05750 B	036640	I-65 Ramp over Proposed Ramp	Routine	11/22/2019	24	11/2021	11/2023
I65-112-05749 A	036630	I-70 WB – I-65 NB over College Ave	Routine Special	11/18/2019	24	11/2021	11/2023
I65-112-05748 ANBL	036620	I-65 NB over College Ave	Routine Special	11/18/2019	24	11/2021	11/2023
I65-112-05747 CNBL	036590	I-65 NB over I-75 WB, Ramp	Routine	11/08/2019	24	11/2021	11/2023
I65-112-05746 A	036610	I-65 SB CD Ramp over College Ave	Routine Special	11/18/2019	24	11/2021	11/2023
I65-112-05745 A	036600	I-65 SB & I-70 EB Ramp over College Ave	Routine Special	11/15/2019	24	11/2021	11/2023
I65-112-05744 BSBL	036580	I-65 SB over I-70 WB, I-65 Ramp	Routine	11/08/2019	24	11/2021	11/2023
I65-112-05743 B	036570	Ramp I-65 SB – I-70 EB over I-70 WB & CD	Routine	11/08/2019	24	11/2021	11/2023
I65-112-05742 BNBL	036560	I-65 NB over Proposed Ramp	Routine	11/06/2019	24	11/2021	11/2023
(I70)I65-112-05741 BEBL	042350	I-70 EB over I-65 NB	Routine	11/06/2019	24	11/2021	11/2023
I70-083-	042340	I-70 WB	Routine	11/14/2019	24	11/2021	11/2023

05739 BWBL		over East 10th Street	Special				
I65-112-05738 BSBL	036550	I-65 SB over East 10th street	Routine	11/14/2019	24	11/2021	11/2023
(I65)I70-079-05737 ANBL	042330	I-65 NB, I-70 EB over East 10th Street	Routine Special	11/14/2019	24	11/2021	11/2023
I65-111-05736 ASBL	036540	I-65 SB, I-70 WB over St Clair Street	Routine	11/25/2019	24	11/2021	11/2023
I65-111-05735 ANBL	036530	I-65 NB, I-70 EB over St Clair Street	Routine	11/25/2019	24	11/2021	11/2023
I65-111-05734 ANBL	036520	I-65 NB over I-65 Ramp NB	Routine	11/25/2019	24	11/2021	11/2023
I65-111-05733 ASBL	036510	I-65 SB, CD over Michigan Street	Routine	11/25/2019	24	11/2021	11/2023
I65-111-05732 BNBL	036500	I-65 NB over Michigan Street	Routine	11/25/2019	24	11/2021	11/2023
I65-111-05731 B	036490	I-65, CD over Vermont Street	Routine Special	11/25/2019	24	11/2021	11/2023
I65-111-05730 B	036480	I-65, CD over New York Street	Routine Special	11/20/2019	24	11/2021	11/2023
I65-111-05728 A	036460	I-65, CD over Market Street	Routine	11/19/2019	24	11/2021	11/2023
I65-111-05725 A	036430	I-65, Ramp 5W-S over Washington St/Old US 40	Routine Special	11/19/2019	24	11/2021	11/2023
I65-112-05666 A	036650	I-65 over Central Ave	Routine	11/15/2019	24	11/2021	11/2023
I70-083-02434 CWBL	042380	I-70 WB, Ramp & CD over Lewis st & Monon	Routine	11/19/2019	24	11/2021	11/2023

		Trail					
I70-083-02432 CEBL	042345	I-70 EB over Lewis St, Monon Trail	Routine	11/19/2019	24	11/2021	11/2023
I65-111-02431 A	036470	I-65, CD over CSX RR, Ohio st	Routine Special	11/20/2019	24	11/2021	11/2023
I70-084-05702 DEBL	042430	I-70 EB over Valley Ave	Routine	04/05/2018	24	05/2020	05/2022
I70-084-05702 CWBL	042440	I-70 WB over Valley Ave	Routine	04/05/2018	24	05/2020	05/2022
I70-083-05701 DWBL	042420	I-70 WB over Roosevelt Ave @ Comm Ave	Routine	04/05/2018	24	05/2020	05/2022
I70-083-05701 DEBL	042410	I-70 EB over Roosevelt Ave @ Comm Ave	Routine	04/05/2018	24	05/2020	05/2022
I65-112-02419 C	036660	I-65 over 7 Sts, Access Rd, Monorail	Routine Special	03/19/2018	24	03/2020	03/2023

Each bridge inspection shall be identified in the schedule of Work in accordance with 108.04 and in accordance with the Technical Provisions. Portions of each bridge replaced, reconstructed, or repaired and subsequently used for maintenance of traffic will be inspected prior to being opened to traffic. Design-Build Contractor shall notify INDOT a minimum of two weeks prior to the construction completion of a bridge and prior to being opened to traffic for INDOT to perform its initial inspection.

Notice from INDOT will be given no less than seven days prior to each bridge inspection. Access, coordination and cooperation for the required bridge inspections shall be provided by the Design-Build Contractor.

TERMINAL JOINT RETROFIT, POLYMER MODIFIED ASPHALT

Description

This Work shall consist of constructing a terminal joint with a 3 in. polymer modified asphalt product topping in accordance with 105.03.

Materials

Polymer modified asphalt shall consist of polymer modified asphalt binder and manufacturer-specific aggregate. The product shall be one of the following:

FibreJoint by Fibrecrete Preservation Technologies
131 St. James Way
Mount Airy, NC 27030
www.fibrecretept.com

Matrix 501 or Matrix 502 by Crafco, Inc.
420 N. Roosevelt Ave.
Chandler, AZ 85226
www.crafco.com

RP 6297 or 6297 W/AGG by Right Pointe
234 Harvestore Drive
Dekalb, IL 60115
www.rightpointe.com

Thorma-Joint by Dynamic Surface Applications
373 Village Road
Pennsdale, PA 17756
www.dsa-ltd.com

Wabo Expandex by Watson Bowman Acme Corp.
95 Pineview Drive
Amherst, NY 14228
www.wbacorp.com

The backer rod and steel plate components of the above products shall be omitted. The binder and aggregate may be pre-blended or blended on site. The product shall be in accordance with ASTM D 6297, Standard Specification for Asphaltic Plug Joints for Bridges. A Type C certification shall be submitted and shall include the product trade name and manufacturer.

Construction Requirements

The Design-Build Contractor shall construct the sleeper slab, polyethylene bond breaker, and HMA intermediate mixtures in accordance with 503.03. The intermediate HMA layers shall end 3 in. below the surface of the adjacent pavement to place the required thickness of polymer modified asphalt. The total thickness of the polymer modified joint material shall not exceed 4 in. HMA Surface, Type B shall be omitted.

The manufacturer's instructions for the polymer modified asphalt product shall be provided to INDOT at least one week prior to placement. Instructions shall cover the 3 in. surface placement and all product modifications required for patching a depth in excess of 3 in.

The existing terminal joint asphalt material shall be removed to the top of the existing sleeper slab. Removal shall be by milling in accordance with

306 or as directed by INDOT. The exposed vertical faces of the adjacent concrete shall be clean, free of asphalt or other contaminants, and dry prior to polymer modified asphalt placement. Damage to adjacent concrete surfaces during removal shall be repaired as directed by INDOT.

The polymer modified asphalt shall be prepared in accordance with the manufacturer's instructions. Each lift shall be allowed to cool for a minimum of 15 minutes prior to placing successive lifts. The binder and aggregate shall be mixed and placed in lifts not to exceed 2.5 in. The top lift shall be between ½ in. and 1.0 in. The completed joint surface shall match the grade of the adjacent pavement.

The completed joint shall be allowed to cool to a surface temperature less than 150°F and shall not be tacky prior to being opened to traffic.

Basis of Item

The polymer modified asphalt terminal joint shall be quantified by the square foot. Asphalt removal and surface preparation shall not be quantified.

The items list shall include the following:

Item No.	Item Description	Pay Unit Symbol
503-12480	Terminal Joint, Retrofit Polymer Modified Asphalt	SFT

The following shall be considered incidental to this item:

Removing existing asphalt joint material, surface preparation, repairing sleeper slabs and adjacent pavement, and all incidental labor, equipment, and materials required to complete this Work.

SECTION 503, BEGIN LINE 9, DELETE AND INSERT AS FOLLOWS:

503.02 Materials

Materials shall be in accordance with the following:

Chemical Anchor System.....901.05
Dowel Bars.....910.01(b)10
Epoxy Coated Reinforcing Bars.....910.01(b)9
Joint Filler.....906.01
Joint Materials.....906
PCC Sealer/Healers.....901.06
Reinforcing Bars.....910.01
Concrete, Class A.....702
Support Devices.....910.01(b)9
Threaded Tie Bar Assembly.....910.01(b)2
Curing Materials.....912.01

For Jointed Reinforced Concrete Pavement, materials for the concrete shall be in accordance with 502.03 and the concrete mix criteria shall be in accordance with 502.04.

SECTION 503, BEGIN LINE 114, DELETE AND INSERT AS FOLLOWS:

(e) Terminal Joints

~~Terminal joints shall consist of a sleeper slab, polyethylene bond breaker, and HMA mixtures. The polyethylene bond breaker shall be an approved polyethylene sheeting having a thickness of 6 mils or greater. HMA mixtures shall consist of type B surface and intermediate mixtures in accordance with 402.04. A MAF in accordance with 402.05 will not apply. Aggregate requirements of 904.03(d) do not apply. The portion of the sleeper slab on which the polyethylene bond breaker is to be placed shall be finished to a smooth trowel finish.~~

A terminal joint of the type specified shall be constructed at the locations as shown on the Design Documents. The embankment shall be shaped to the required grade and section, free from all ruts, corrugations, or other irregularities, and uniformly compacted and approved in accordance with 203. The embankment shall be furnished within a tolerance of ½ in. from the grade as shown on the Design Documents. The subgrade shall be prepared as shown on the Design Documents and in accordance with 207. The sleeper slab shall be placed on top of the prepared subgrade.

1. Terminal Joint, Type CRCP

Terminal joint, type CRCP shall consist of sleeper slabs, polyethylene bond breaker, pre-compressed foam joint, and CRCP transition slab. The polyethylene bond breaker shall be an approved polyethylene sheeting having a thickness of 10 mils or greater. The portion of the sleeper slab on which the polyethylene bond breaker is to be placed shall be finished to a smooth trowel finish. The pre-compressed foam joint shall be in accordance with the Recurring Special Provision titled "Pre-Compressed Foam Joint" and as shown on the Design Documents. The CRCP transition slab shall be in accordance with the Special Provision titled "Continuously Reinforced Concrete Pavement" and as shown on

the Design Documents.

2. Terminal Joint, Type PCCP

Terminal joint, type PCCP shall consist of a sleeper slab, polyethylene bond breaker, pre-compressed foam joint, and jointed reinforced concrete pavement, JRCP, transition slabs. The polyethylene bond breaker shall be an approved polyethylene sheeting having a thickness of 6 mils or greater. The portion of the sleeper slab on which the polyethylene bond breaker is to be placed shall be finished to a smooth trowel finish. The pre-compressed foam joint shall be in accordance with the Recurring Special Provision titled "Pre-Compressed Foam Joint" and as shown on the Design Documents. The longitudinal and transverse joints of the jointed reinforced concrete pavement transition slabs shall be in accordance with 503 and as shown on the Design Documents. The concrete delivery and placement of concrete for JRCP shall be in accordance with 502 and as shown on the Design Documents. Steel reinforcement shall be epoxy coated and placed in accordance with 703. The metal chairs, spacers, clips, wire, or other mechanical means used for fastening or holding reinforcement in place shall be epoxy coated.

SECTION 503, AFTER LINE 151, INSERT AS FOLLOWS:

(h) *Expansion Joint with Load Transfer*

Expansion joints with load transfer shall be constructed at the locations shown on the Design Documents. The joint shall be an assembly of dowel bars, expansion caps, and joint filler components as shown on the Design Documents. The components shall be supported by an approved welded wire assembly which holds the components rigid and in proper alignment during placement of the concrete.

Damaged or repaired joint filler shall not be used. The joint filler shall be held in a position which is normal to the surface and secured in place. The bottom of the joint filler shall be set firmly in place on top of the subgrade. The top of the joint filler shall be parallel to the pavement surface and be the full width of the pavement. The expansion joint assembly shall be held in place in accordance with 503.04(g). Finished joints shall deviate no more than ¼ in. in the horizontal alignment from a straight line. There shall be no offsets between adjacent sections when the joint filler consists of more than one section. No plugs or leakage of concrete shall be allowed to occur through the joint filler or into the air gap of expansion caps.

The expansion joint opening shall be sealed with hot pour joint sealant in accordance with 906.02(a)2.

SECTION 503, DELETE LINES 239 THROUGH 250.

SECTION 503, LINE 239, INSERT AS FOLLOWS:

503.07 Basis of Item

D-1 contraction joints, expansion joint with load transfer, pre-compressed foam joints, and terminal joints shall be quantified by the linear foot as measured along the centerline of the joint. The sleeper slabs, reinforcing bars, bond breaker, sealants shall not be quantified. When required, removing an existing terminal joint or sleeper slab shall not be quantified.

Jointed reinforced concrete pavement shall be quantified by the square yard.

Subgrade treatment, type IC shall be quantified in accordance with 207.

Retrofitted tie bars shall be quantified by the number of units installed.

The items list shall include the following:

Item No.	***Item Description***	***Unit Symbol***
503-05240	*D-1 Contraction Joint*	*LFT*
503-03489	*Retrofitted Tie Bars*	*EACH*
503-12476	*Jointed Reinforced Concrete Pavement, 13 in.*	*SYS*
503-12478	*Terminal Joint, Type PCCP*	*LFT*
503-05310	*Terminal Joint, Type CRCP*	*LFT*
503-12479	*Expansion Joint with Load Transfer*	*LFT*
724-12103	*Pre-Compressed Foam Joint*	*LFT*

The following shall be considered incidental to these items:

Furnishing and placing all materials.

Dowels, dowel bar assemblies, expansion caps, joint filler, and joint sealants.

Sleeper slab, reinforcing bars, bond breaker, sealants, JRCP and CRCP transition panels, and removing an existing joint and sleeper slab.

Retrofitted tie bars or CRCP replacement used to repair damaged CRCP due to fault or negligence, remediation of random cracking, or the replacement of broken deformed bars.

SECTION 503, DELETE LINES 245 THROUGH 271.

METALLIZED STRUCTURAL STEEL

Description

This Work shall consist of applying a thermal sprayed, metallized, coating system to new structural steel and includes requirements for surface preparation, application of metallic coating by wire arc spray, sealer, and topcoat in accordance with SSPC-CS 23.00/AWS C2.23M/NACE No. 12, 105.03, the Design Documents, and as described herein.

Materials

Materials furnished shall be marked by the manufacturer with a batch number or marking to identify each batch to be used. The coating materials shall be in accordance with the specifications of the material manufacturer and the requirements of this specification. The Design-Build Contractor shall provide manufacturer's product data sheets and manufacturer's data with respect to procedures and material specifications for the coating wire, sealer, topcoat, or any other materials used in this process and manufacturer's material safety data sheets in accordance with 29 CFR 1910.1200 for all hazardous materials to be used at the job site prior to beginning any Work outlined in this specification.

Abrasive

Abrasives shall be hard and sharp to produce an angular surface profile on the steel substrate as described in the Surface Preparation section below. The blast cleaning abrasive shall be angular aluminum oxide, chilled iron grit, steel grit, or garnet. Steel grit hardness shall be Rockwell C of 51 or greater. Garnet abrasive shall conform to the requirements of SSPC-AB 1, Type 1, Class A, and shall be an appropriate grade to produce the specified blast profile. Aluminum oxide abrasives shall be commercially pure materials of the appropriate gradation to produce the specified blast profile.

Shot or other abrasives producing a round surface profile shall not be used. Coal slag shall not be used.

Mineral and slag abrasives

Mineral and slag abrasives and non-metallic abrasives shall be selected and evaluated per SSPC-AB 1. The results of the tests specified in section 4.1 thru 4.4 of SSPC-AB 1 and documented in accordance with section 5.4 of SSPC-AB 1 shall be provided on the Type A certification.

Recycled Abrasives

The abrasive shall be cleaned of paint, chips, rust, mill scale, and other foreign material after each use and before each reuse according to SSPC-AB 2. The Design-Build Contractor shall use equipment specifically designed for cleaning the abrasive. The abrasive shall be checked for oil content and water-soluble contamination according to SSPC-AB 2 at the frequency defined in the Surface Preparation section.

Metallic Abrasive

Recycled ferrous metallic abrasives shall be in accordance with the chemical and physical properties of SSPC-AB 2.

Non-metallic Abrasive

Recycled non-metallic abrasive shall meet all requirements of SSPC-AB 1 each time that it is placed in the blast pot.

Metallic Abrasive

New and remanufactured steel grit shall be selected and evaluated per

SSPC-AB 3. The results of the tests specified in Section 4.1.3 and section 5 of SSPC-AB 3 shall be provided on the Type A certification.

Metallizing Wire

The metallizing wire shall be in accordance with AWS C.25 or ASTM B833. The zinc wire shall be 99.99% Zinc – UNS (Z13005). The following shall be provided to INDOT in the Type A certification for the metallizing wire:

- a manufacturer's certification that the raw material used to manufacture the wire meets the requirements of this provision
- a copy of all the chemical composition test results
- wire diameter measurements

The chemical composition analysis and wire diameter measurements shall be tested at the frequency defined in ASTM B833.

Sealers and Topcoats

The sealer shall be compatible with the topcoat and with the metallized substrate. The sealer and topcoat shall be provided by a single manufacturer. The cured film of the sealer and topcoat shall not contain any contaminants in concentrations which exceed the regulatory levels of 40 CFR 261.24, table 1, when tested in accordance with EPA TCLP, or contain any other material which will require characterization as a hazardous waste for the disposal of the dried film.

Sealer

The sealer shall be a low viscosity acrylic, epoxy, phenolic, silicone, or polyurethane, and shall be colored white. The sealer shall be formulated to penetrate and fill the pores in the metallized coating. The sealer shall have a minimum fineness of grind of 5 Hegman when determined in accordance with ASTM D1210. The information specified in section 10 of ASTM D1210 shall be provided on the Type A certification.

Topcoat

The topcoat shall be a two-component polyester or acrylic aliphatic polyurethane suitable for use as a topcoat over metallizing sealers. The general requirements as specified in 909.01 shall apply.

The mixed paint shall be in accordance with the following requirements.

Volatile organic compounds, ASTM D3960, Max.....336 g/L
Volume solids, ASTM D2697, Min.....60%
Set-to-touch, ASTM D1640, 5 mils wet film thickness, 25 ± 1°C,
50 ± 10% relative humidity, Min.....30 min
Total solids ASTM D2369, Min.....70%
Specular gloss, 60°, ASTM D 523, Max.....50
Viscosity, ASTM D562, Kreb Units, Max.....100
Contrast ratio, ASTM D2805, 5 ± 0.5 mils wet film thickness,
dried 24 h @ 25 ± 2°C on Leneta Form 2A or 2C, Min.....0.95
Dry hard, ASTM D1640, 5 mils wet film thickness, 25 ± 1°C,
50 ± 10% relative humidity, Max.....24 h

The color of the dried paint film shall match color number 26270, medium-gray, of Aerospace Material Specification Standard 595A.

Inaccessible Areas

Areas inaccessible to the metal spraying equipment as determined by INDOT shall use the structural steel paint system in accordance with 619.09(a) with

the exception that the topcoat shall be in accordance with the Topcoat section of this provision.

Construction Requirements

The Design-Build Contractor performing the Work shall be SSPC-QP2 certified in accordance with 619.03. The area to be coated includes all steel surfaces including, but not limited to, inside box sections and bearings. If exposed, the top of the top flange of the girders or beams shall not be coated.

Reference Standards

Listed below are the industry standards which shall apply to this Work. At least one copy of each of these referenced standards, manufacturer's product data sheets for application of sealer, or sealer and topcoat and manufacturer's material safety data sheets for each hazardous material shall be provided to INDOT.

ASTM

ASTM B833	Standard Specification for Zinc Wire for Thermal Spraying (Metallizing)
ASTM C633	Test Method for Adhesive/Cohesive Strength of Flame Sprayed Coatings
ASTM D1200	Standard Test Method for Viscosity by Ford Viscosity Cup
ASTM D3276	Standard Guide for Painting Inspectors (Metal Substrates)
ASTM D3925	Sampling Liquid Paints and Related Pigmented Coatings
ASTM D4285	Method for Indicating Oil or Water in Compressed Air
ASTM D4417	Test Method for Field Measurement of Surface Profile of Blasted Steel
ASTM D4541	Test Method for Pull-Off Strength of Coating Using Portable Adhesion Testers
ASTM E337	Standard Test Method for Measuring Humidity with a Psychrometer (the Measurement of Wet- and Dry-Bulb Temperatures)

AWS

AWS C2.16/C2.16M	Guide for Thermal-Spray Operator Qualification
ANSI/AWS C2.18-93	Guide for the Protection of Steel with Thermal Spray Coatings of Aluminum, Zinc, and their Alloys and Composites
AWS C2.23M/C2.23	Specification for the Application of Thermal Spray Coatings of Aluminum, Zinc, and their Alloys and Composites for the Corrosion Protection of Steel
AWS C.25/C2.25M	Specification for Thermal Spray Feedstock – Solid and Composite Wire and Ceramic Rods
AWS TS 1	Recommended Safety Practices for Thermal Spraying, 1973

2.3 ISO

ISO 8502-3	Preparation of Steel Substrates Before Application of Paint and Related Products – Tests for the Assessment of Surface Cleanliness – Part Assessment of Dust on Steel Surfaces Prepared for Painting (Pressure-Sensitive Tape Method)

NACE

NACE Std RP0287	Field Measurement of Surface Profile of Abrasive Blast Cleaned Steel Surfaces Using a Replica Tape

SSPC

SSPC Publication	The Inspection of Coatings and Linings: A Handbook of Basic Practice for Inspectors, Owners, and Specifiers
SSPC-AB 1	Mineral and Slag Abrasives
SSPC-AB 2	Cleanliness of Recycled Ferrous Metallic Abrasives
SSPC-AB 3	Newly Manufactured or Re-Manufactured Steel Abrasives
SSPC-PA 1	Shop, Field, and Maintenance Painting
SSPC-PA 2	Measurement of Dry Paint Thickness with Magnetic Gages
SSPC-PA Guide 3	A Guide to Safety in Paint Application
SSPC-QP 2	Standard Procedure for the Qualification of Painting Contractors (Field Removal of Hazardous Coatings from Complex Structures)
SSPC Guide 6	Guide for Containing Debris Generated During Paint Removal Operations
SSPC Guide 7	Guide for the Disposal of Lead-Containing Surface Preparation Debris
SSPC-SP COM	Surface Preparation Commentary
SSPC-SP 1	Solvent Cleaning
SSPC-SP 5/ NACE No. 1	White Metal Blast Cleaning
SSPC-SP 7	Brush-Off Blast Cleaning
SSPC-SP 10/ NACE No. 2	Near-White Blast Cleaning
SSPC-TR 3	Dehumidification and Temperature Control During Surface Preparation, Application, and Curing for Coatings/Linings of Steel Tanks, Vessels, and Other Enclosed Spaces
SSPC-VIS 1	Guide and Reference Photographs for Steel Surfaces Prepared by Dry Abrasive Blast Cleaning

Design-Build Contractor Submittals

Quality Control Plan, QCP

A QCP in accordance with Section 8.0 of Indiana Test Methods, ITM, 803 shall be submitted at the preconstruction conference. The following revisions are made to Section 8.5.2 of ITM 803:

(k) Metallizing application and recoatability;
(l) Seal coat application and recoatability;
(m) Topcoat application and cure;

In addition to the requirements above, the QCP shall also include quality control procedures for training and qualification requirements for blast cleaning, thermal spray operation, and quality control inspection. The thermal spray operation procedure shall also be in accordance with the arc spray equipment supplier's recommended procedures. The Design-Build Contractor shall also include the detailed procedures that will be used to meet the requirements of this specification for surface preparation, metallizing, applying the sealer and topcoat and quality control. The procedures shall detail application process, in-process quality control, and job control record to be used for the contract Work as well as the Design-Build Contractor's safety plan, inspection standards, inspector qualifications and tools, test procedures, pollution control system, safety plan, and inspection/test logs. The information shall also include the in-process quality control checkpoints and procedure for repairing the metallized coating.

No Work described in this specification may begin until written notice has been received that the QCP has been accepted by INDOT.

Equipment List

The Design-Build Contractor shall provide a list to INDOT of the equipment to be used for surface preparation, thermal spraying, sealing and topcoating, and in-process quality control.

Qualifications of Key Personnel and Thermal Spray Operators

The Design-Build Contractor shall submit evidence for each individual that is in direct charge of the thermal spray operators has successfully performed the surface preparation and application of metallized coatings on a minimum of three steel structures similar in scope and complexity to the project covered by this specification. The Design-Build Contractor shall list information by individual and include the following:

1. Name of individual and proposed position for this Work
2. Information about each previous assignment including:
    a. Position or responsibility
    b. Employer, if other than the current Design-Build Contractor
    c. Name and location of the facility owner
    d. Dates Work was carried out
    e. A brief description of structure
    f. Description of Work carried out on structure by the individual

Operator Testing

Each thermal spray operator shall be evaluated according to AWS C2.16/C2.16M:2017 (Sections JK-1, and AS-1), and pass the relevant tests prior to performing any thermal spray Work. The quality control inspector, as described in the Quality Control Inspector, QCI, section shall witness and certify in writing that each thermal spray operator has been tested and passed the relevant tests prior to performing any thermal spray Work. Unless waived

by INDOT in writing, the operator tests shall be performed in the presence of INDOT. At the discretion of INDOT or QCI, any operator may be required to be retested at any time. The Design-Build Contractor shall provide all materials and equipment necessary for these tests at no additional cost to INDOT.

Job Reference Standard, JRS

The Job Reference Standard, JRS, shall be representative of the whole job or major sections of the job. The JRS shall be prepared by the Design-Build Contractor performing the metallizing under the supervision of the quality control inspector and shall be the pass/fail sample for all Work including blast cleaning, metallizing, sealing, and topcoating.

The JRS is made with the actual field equipment, the process parameters and procedures for surface preparation; thermal spraying; sealing and topcoating and in process QC check points that will be used for the contracted Work. The JRS is made on a steel plate approximately 18 in. by 18 in. by 1/4 in. that has any sharp edges ground smooth. The JRS shall be blast cleaned, metallized, sealed and topcoated in accordance with this specification and AWS C2.23M/C2.23:2018. Two JRSs are required. One will remain the property of INDOT. The other will become the property of INDOT Central Office – Office of Materials Management and is deliverable after acceptance by INDOT.

The JRS shall be processed to illustrate the four coating steps: blast cleaning, metallizing, sealing and topcoating each in equal parts. The entire coupon is blast cleaned; one quarter remains blast cleaned only; one quarter is blast cleaned/metallized; one quarter is blast cleaned/ metallized/sealed; one quarter is blast cleaned/metallized/sealed/ topcoated.

The QCI shall make thickness and tensile bond measurements of the unsealed metallized coating as required in the Quality Control and Assurance section of this specification. This plate, when accepted by INDOT, will be used as the visual standard to determine the acceptability of the thermal sprayed coating system.

Quality Control and Assurance

Quality Control Inspector, QCI

The Design-Build Contractor shall provide a quality control inspector, QCI. The QCI shall have documented training in the applicable test procedures of ASTM D3276 and SSPC-CS 23.00 and shall have a minimum of two years of verifiable experience in the inspection of metallizing bridges or similar structures. The QCI shall be employed by a company possessing a valid SSPC-QP 5 certification and a copy of the QP 5 certification shall be provided with the QCP. The QCI shall be either a NACE Certified Coatings Inspector or have an SSPC Protective Coating Specialist Certification. The QCI shall be available for inspection and not delay coating operations.

Compressed Air Quality

Blast cleaning and metallizing compressed air shall be tested daily in accordance with ASTM D4285, Standard Test Method for Indicating Oil or Water in Compressed Air. If the cloth or blotter retains oil or other contaminants, the QCI shall suspend abrasive blasting operations until retests verify that the problem is corrected.

Visual Inspection Requirements

Prior to sealing, the thermal sprayed coating shall have a uniform appearance, in accordance with the Spray Pattern specifications. If the coating is inferior to the JRS, the Design-Build Contractor shall correct the coating

by an acceptable repair method, as defined in the QCP.

Metal Thickness Conformance

The QCI shall inspect the Work for thickness conformance as necessary to ensure a uniform coating of the specified thickness. The QCI's thickness inspection procedure shall be as specified in the QCP.

Coating thickness shall be measured in accordance with SSPC-PA 2, using a mutually approved magnetic thickness and eddy current gauge with a digital readout and a probe. Such gauge shall be furnished to INDOT but shall remain the property of the Design-Build Contractor. The gauge shall be:

PosiTector 6000 FRS3 with separate probe by DeFelsko Corporation.

The gauge shall be calibrated according to SSPC-PA 2.

The metallized coating thickness shall be measured according to AWS C2.23M/C2.23. One measurement line or spot measurement shall be taken every 100 to 200 sq ft of applied metallized coating. The Design-Build Contractor shall use a measurement line for flat surfaces. The Design-Build Contractor shall take the average value of five readings taken in a line at 1 in. intervals. The Design-Build Contractor shall use a measurement spot for complex geometries and geometry transitions. The spot measurement should be approximately 1 to 2 sq in. A gauge reading that is unusually high or low shall be discarded provided it is not consistently repeated. No single spot measurement shall be less than 80% of the specified minimum thickness or greater than 25 mils.

Thickness Less Than Contract Specification

If upon inspection and prior to sealer application, the metallized coating thickness is less than the contract requirement, the Design-Build Contractor shall apply, within the same work day, additional coating to meet the minimum thickness requirement.

Bend Test

The bend test is used as a qualitative test for proper surface preparation, equipment setup, and spray parameters. The bend test coupons shall be low carbon steel, 0.050 in. thick, 2 in. wide by 4 in. to 8 in. long. These coupons shall be blast cleaned and arc sprayed according to the requirements of this specification. The bend test is a pass/fail test. Once sprayed, the coupons shall be bent 180 degrees around a 1/2 in. diameter mandrel. The bend test passes if on the bend radius there is no cracking or spalling or only minor cracking that cannot be lifted from the substrate with a knife blade. The bend test fails if the coating cracks with lifting from the substrate. Every operator is subject to a complete re-test at the sole discretion of INDOT.

Tensile Bond, Adhesion, and Measurement Schedule

The metallized coating's tensile bond strength shall be measured according to ASTM D4541 using a self-aligning adhesion tester and the results shall be documented. One portable tensile-bond measurement shall be made every 500 sq ft at a location randomly selected by INDOT. The adhesion test shall be performed in the presence of INDOT. The minimum tensile bond strength for the metallized zinc coating shall be 500 psi.

If the tensile bond is less than the contract specification, the degraded metallized coating shall be removed and reapplied. The tensile bond strength of the metallized coating shall be measured before the application of the sealer. Damage to the coated surface shall be repaired as directed in the specifications.

Sealer and Topcoat Conformance

Each coat of the sealer and topcoat shall be inspected for compliance with the manufacturer's requirements and the JRS. Acceptance of each coat is required prior to application of the next coat.

Repair of Defective Areas

All coated areas which have been rejected or damaged shall be repaired according to the Design-Build Contractor's written repair procedure and shall meet the requirements of this specification. Any touch-up of rejected or damaged areas shall be completed by the Design-Build Contractor prior to final acceptance of the Work.

Pre-Construction Meeting

A pre-construction meeting shall be held prior to beginning any Work described in this specification. At a minimum, specific items addressed for metallizing shall include the Design-Build Contractor's work plan, safety plan, inspection standards, inspector qualifications and tools, test procedures, pollution control system, safety plan, and inspection/test logs. All of the above-mentioned items shall also be included in the Design-Build Contractor's QCP.

Equipment

Equipment and Techniques

The metal spraying equipment shall be of electric arc spray type. Flame spray is not permitted. The equipment shall be portable and capable of spraying 3/16 in. diameter maximum wire of zinc at a controllable rate. The wire shall be automatically dispensed to the spray gun. The spray gun shall be equipped with an arc shorting control device. The spray gun shall operate with oil-free and dry compressed air at 90 psi minimum. The air quality shall be in accordance with ASTM D4285. The spray equipment shall be capable of the following:

1) Spray for 3 minutes without sputtering or shutdown.
2) Produce test specimens that are acceptable for visual standards, the bend test, minimum three repetitions, and the tensile bond strength specified in the Visual Inspection Requirements, Bend Test, and Tensile Bond, Adhesion, and Measurement Schedule sections.
3) Start and stop spraying test consisting of eight "10-second spray, 5-second off" sequences without fusing or sputtering that could cause discontinuities or clumps of improperly melted sprayed metal on the work surface. This proof of equipment function shall be demonstrated by spraying the feedstock material specified in this specification.

The equipment shall be operated in accordance with the manufacturer's latest written instructions including, but not limited to, air pressure, gun to work piece standoff distance, and gun angle relative to the work surface.

Stages of Work

Thermal spray safety procedures in AWS TS 1 shall be followed when thermal spraying. The safety precautions recommended for thermal spray applicators are generally the same as those for welders. At a minimum, the applicator shall be concerned with eye, respiratory, and noise protection. In addition to following procedures described in the equipment manufacturer's operating manual, the precautions set forth in the spray material manufacturer's Material Safety Data Sheets shall be observed. The Design-Build Contractor shall provide a detailed safety program to INDOT for acceptance prior to commencing Work. Any safety devices such as respirators deemed necessary by INDOT shall be provided to INDOT personnel. Additional safety information is available in AWS C2.16/C2.16M, Annex A. The Design-Build Contractor shall not use open combustion in the

enclosure.

Pollution, environmental, control and hazardous waste disposal shall be in accordance with 619.07, SSPC Guide 6 – Class 2A or better with method A, level 0 emission containment, and SSPC Guide 7, as well as all current regulations and laws as may apply. The Design-Build Contractor shall be responsible for all containment and disposal, and as such, bears the entire liability if the Indiana Department of Environmental Management, IDEM, Indiana Department of Natural Resources, IDNR, or any other jurisdictional agency finds pollution of the ground or water resulting from improper or poor containment and disposal practices.

When the QCI believes a section of Work is ready for acceptance, the QCI shall contact INDOT and arrange for inspection of the Work to proceed to the next quality control checkpoint.

Precleaning

The structure shall be precleaned in accordance with 619.08(a) and (b) prior to any blast cleaning. The pressure washing shall remove only the contaminants, oils, greases, asphalt cement, diesel fuel deposits, and other petroleum products that interfere with coating adhesion or reduce coating life and not remove large amounts of paint.

Removal of Surface Defects

Surface irregularities interfering with the performance of the coating, such as sharp edges or carburized edges, shall be removed by grinding before any blast cleaning is performed.

Surface Preparation

The surface shall be abrasive blast cleaned to an SSPC-SP 5/NACE No. 1 white metal blast. The abrasive type, size, and hardness shall be selected to produce an angular surface profile of 2.5 to 5.0 mils. Shot blasting or peening is not acceptable. The abrasive shall be checked at the beginning of each shift and at 4 hour intervals for oil content and water-soluble contamination according to SSPC-AB 2.

The surface profile shall be measured in accordance with ASTM D4417, Method B or C. Surface profile readings shall be taken at least one per every 200 sq ft of blasted surface. Profile readings shall be taken at random locations including, but not limited to, flanges, webs, and cross frames.

The level of soluble salts on the blast cleaned steel substrate shall be measured in accordance with SSPC-TU 4, class A cell retrieval method. Soluble salt concentration levels shall be taken at least once per every 200 sq ft of blasted surface. The maximum allowable concentration will be 5 µg/cm2. For areas where the level of soluble salt concentration exceeds 5 µg/cm2, corrective action shall be proposed and submitted in writing. Corrective action measures shall not begin until written notice has been received that the corrective action is accepted by INDOT.

The blast cleaned surface shall be inspected for surface profile, oil contamination, dust, blasting residue, and soluble salts, and accepted prior to the application of the metallized coating.

The Design-Build Contractor performing the metallizing Work shall also perform the abrasive blast operation in preparation for all metallized coatings. This responsibility shall not be passed to any other contractor or sub-contractor.

Waste Residue Sampling

After the first day of existing coating removal operations, the Design-Build Contractor, under the supervision of the QCI and in the presence of INDOT, shall collect two 4 ounce random samples of blast/paint residue. One of these samples will be shipped for testing within 24 h in a manner described in the QCP. INDOT will retain custody of each waste residue sample until it is shipped. The other waste residue sample will be retained by INDOT. The samples shall be analyzed for full Toxicity Characteristic Leaching Procedure, TCLP. Waste residue shall be placed in an approved container. The containers shall be labeled and maintained to comply with 40 CFR 264. On bridges with hazardous-based coatings, the waste residue generated shall be treated at a facility rendering it to a non-hazardous state and disposed of in accordance with all applicable federal, state, and local regulations.

Holding Period and Flash Coat

The holding period, or time between the completion of the final anchor-tooth blasting, or final brush blasting, and completing the thermal spraying, shall be no greater than 6 h or before flash rusting occurs. In high-humidity and damp environments, shorter holding periods may be used. If rust bloom occurs, the Design-Build Contractor shall blast clean the surface to meet the requirements of the blast cleaning/surface finish requirements in the Waste Residue Sampling section of this specification. Rust bloom shall be the overriding consideration. In low-humidity environments or in enclosed spaces, it may be possible to retard the oxidation of the steel and hold the surface finish for more than six h using industrial dehumidification equipment. The Design-Build Contractor shall validate the temperature-humidity envelope for the work enclosure by spraying and analyzing bend coupons, by tensile-bond test, or both. For small and movable parts, if more than 15 minutes is expected to elapse between completion of surface preparation and the start of thermal spraying, or if the part is moved to another location, the prepared surface shall be protected from moisture, contamination, and finger/hand marks. Wrapping with clean print-free paper is normally adequate.

A flash coat of at least 2 mils of metallized coating shall be applied within 6 h of blasting or before flash rusting occurs, whichever is sooner. This single layer shall cover the peaks of the surface profile. This thin coating is intended to temporarily preserve the surface preparation. Before applying additional sprayed metal to the specified thickness, the first layer of coating shall be visually inspected to verify that the coating surface has not become contaminated. Any contamination between coats shall be removed in accordance with the Design-Build Contractor’s written procedures before any additional material is applied. The coating shall be sprayed to achieve the specified thickness as soon as possible and within 36 h after initial coating.

The flash coat, holding period, and final metallized coating will be acceptable provided the final coating meets the quality requirements of the Application of Metallized Coating section below.

Application of Metallized Coating

Steel Surface

The steel surface to be thermal sprayed shall be inspected and meet the requirements of the Waste Residue Sampling section prior to applying metallic coating.

Environmental Conditions

Metallizing shall not be performed when the steel surface temperature is

32°F or lower. The temperatures shall be monitored using a recording thermometer. The Design-Build Contractor may use a heated enclosure in accordance with SSPC-TR3/NACE -6A192 that uniformly and continuously heats the enclosure to maintain the minimum required steel surface temperature during all blasting, metallizing, sealing, and topcoating operations.

If the Design-Build Contractor elects to use industrial dehumidification equipment within an enclosure, the steel surface temperature shall be maintained at a temperature above 32°F and at least 15°F above the dew point and the maximum relative humidity within the enclosure shall not exceed 54%.

Metallizing shall not be applied to a surface which shows any sign of surface moisture. Metallizing or abrasive blasting shall not be performed when the steel temperature is less than 5°F above the dew point; if the steel surface is wet, damp, frosted, or ice-coated; during periods of rain, fog, or mist unless the above moisture criteria is met; or if the relative humidity is 85% or greater.

Surfaces to be metallized shall be dust free.

Spray Pattern

The metallized coating shall be applied in multiple, overlapping passes to ensure uniform coverage. Each layer or pass shall be applied at right angles to the previous layer. Spraying shall be performed in a block pattern, typically 2 ft square. The metallized coating shall not exceed 4 mils in thickness in a single layer.

Metallized Coating Thickness

The applied metallized coating thickness shall be between 10 mils and 12 mils.

Metallized Coating Properties

The coating shall be firmly adherent, free of spots, lumps, blisters, chips, or loosely adhering particles. The metallized coating shall be inspected and accepted according to all the requirements of this section before application of the sealer.

Application of Sealers and Topcoats

The sealer and topcoat shall be applied according to manufacturer's recommendations.

Sealer

Sealer shall be applied at a rate to obtain a nominal dry film thickness of 2.0 mils and shall be applied the same day as the metallized coating. If the sealer cannot be applied within 8 h of the completion of metallizing, the metallized coating shall be visually inspected to verify that the metallized coating has not been contaminated. The metallized coating shall be inspected to ensure that it is dust free by using the clear cellophane tape test method ISO 8502-3 before applying the sealer. The sealed metallized coating shall be inspected and accepted prior to application of the topcoat.

Topcoat

The topcoat shall be applied over the sealed metallized coating according to the manufacturer's recommended procedures for use of the product with a thermal sprayed coating system and SSPC-PA1. The topcoat shall be applied within one to five calendar days of application of the sealer, but in no instance shall the topcoat be applied before the sealer has cured according to temperature and moisture considerations as furnished by the sealer manufacturer. The topcoat

shall be applied at a rate to obtain a nominal dry film thickness of 4.0 mils or the dry film thickness as recommended by the manufacturer for use with a thermal sprayed coating system.

Stencil Information

After the topcoat has been approved, project identification information shall be painted with a stencil in 2 in. black capital letters onto the outside of both fascia beams or girders, at the right end of the beam or girder and near the end bent, which reads as follows:

_____
Bridge Number

_____
Contract Number

METALLIZED-Zn_____
Date

Final Acceptance

INDOT will base final acceptance upon the results of the adhesion tests and dry film thickness measurements obtained during the Work. The Design-Build Contractor shall supply a report certified in writing by the QCI that documents and contains the raw field data demonstrating compliance to all aspects of this specification. INDOT will review this report, progressive project documentation, and progressive field measurements to determine the final acceptability of the metallized coating.

Basis of Item

Pollution control, surface preparation, metallizing, seal coating, topcoating, and the structural steel paint system shall not be quantified.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
619-03778	Metallizing.....	LS

The following shall be considered incidental to this item:

Maintaining traffic including furnishing, placing, moving, removal, remobilization/demobilizing of all temporary traffic control devices, and maintenance of all temporary traffic control devices.

Pollution control including devices and equipment required when cleaning and coating the structure, labor and material necessary to provide this item, including class 2A or better method A level 0 emission containment and disposal of spent materials.

Sampling, testing, grinding, repair of test areas, performing corrective actions.

QCI, tests, testing equipment, the JRS.

Removing the existing coating and obtaining the specified surface profile.

Using the structural steel paint system in areas deemed inaccessible to the metal spraying equipment.

SOUND BARRIER FIRE HYDRANT ACCESS DOOR FEATURES

Description

This Work shall consist of designing, furnishing and installing doors, handles, signs, and raised pavement markers (RPM), in accordance with 105.03.

Materials

The door shall have no locks. The handle shall be of the lever type. Signs and RPMs shall meet the requirements of 919.01 and 921.02, respectively. The door shall have a plunging type deadbolt that is controlled by the highway side lever handle with no key or locking mechanism. An exterior grade closing mechanism shall be included to cause the door to close automatically.

Construction Requirements

One handle shall be placed on the highway side of the fire hydrant access door to make it accessible from the highway side only. The right-of-way side shall not have a handle. The gap between the door's threshold and the bottom of the door shall have enough clearance to accommodate vegetation growth, snow and ice, or any other potential obstructions.

There shall be three signs for each door, mounted on the highway side. The first sign above the door frame shall state, "Fire Hydrant Access". The legend of the second sign, mounted just below the first sign, shall be the street name or highway number of the roadway the hydrant is accessed from. The third sign shall be positioned on the door itself and shall indicate the perpendicular distance in feet between the nearest point on the highway edge line to the fire hydrant.

A blue RPM shall be installed in the shoulder edge line at the nearest point perpendicular to the door.

Basis of Item

Access doors shall not be quantified. Furnishing access doors and all materials, equipment, and labor necessary to install access doors shall be considered incidental to the quantity of pay items in accordance with Recurring Special Provision 620-R-483.

PILE SLEEVES FOR MECHANICALLY STABILIZED EARTH RETAINING WALLS

Description

This Work shall consist of installing 24 in. diameter, Type 3 Pipe as pile sleeves through mechanically stabilized earth retaining wall fill in accordance with 105.03 and at the locations shown on the Design Documents.

Materials

Materials shall be in accordance with 701.02 and the following:

Ribbed Polyethylene Pipe.....907.20
Smooth Wall Polyethylene Pipe.....907.21
Profile Wall Polyvinyl Chloride Pipe.....907.22
Smooth Wall Polyvinyl Chloride Pipe.....907.23
Corrugated Aluminum Alloy Pipe.....908.04

The minimum thickness of 2 5/8 in. by 1/2 in. corrugated aluminum alloy pipe, lock seam, shall be 1/16 in. The minimum thickness of 2 5/8 in. by 1/2 in. corrugated aluminum alloy pipe, riveted, shall be 1/16 in. The dimension ratio for smooth wall polyethylene pipe shall be 26.

Bentonite Grout.....913.06

The piles shall be backfilled with uncrushed gravel, class D or higher, in accordance with 904 and the following gradation requirements.

Sieve Size	% Passing
1/2 in.	100
No. 50	0-5
No. 100	0-2

#11 or #12 gravel or pea gravel from an INDOT approved CAPP source will meet these gradation requirements.

Construction

The piles shall be driven and sleeved in accordance with the applicable portions of 701 prior to the construction of the mechanically stabilized earth retaining walls.

The pile sleeves shall extend from the base of the excavation for the mechanically stabilized earth retaining walls to 2 in. below the bottom of the bridge end bents. The pile sleeves shall be placed within 1 in. of the plan location and shall be sufficiently braced so that the sleeves shall remain within 2 in. of the plan location after placing the embankment material. The area between the pile and the pile sleeves shall be backfilled with uncrushed gravel. The top of the pile sleeves shall be sealed with bentonite grout to prevent concrete and structural backfill from entering the annular space between the pile and the pile sleeve. The bottom of the bridge bent shall be isolated from the top of the pile sleeve by expanded polystyrene.

Basis of Item

Pile sleeves shall be quantified per each.

The items list shall include the following:

Item No.	**Item Description**	**Pay Unit Symbol**
701-08253	Pile Sleeve.....	EACH

The following shall be considered incidental to this item:

Maintaining pile sleeve placement during construction of mechanically stabilized earth retaining walls, backfilling pile sleeves with uncrushed gravel, sealing and isolating the top of the pile sleeves and all miscellaneous materials, equipment, and other necessary incidentals.

PILE DRIVING VIBRATION MONITORING

Description

This Work shall consist of seismograph monitoring during pile driving of all piles at all substructures in accordance with 105.03, the Design Documents, and as described herein.

Definitions

Geophone or vibration transducer: A sensor used to monitor ground vibrations, particle velocity components.

Peak particle velocity: The maximum of any one of the three mutually perpendicular ground motion velocity components of a vibration measured in directions vertical, radial, and perpendicular to the vibration source in inches per second, in./sec.

Seismograph: An instrument used to record the magnitude and frequency of ground vibrations sensed by a geophone.

Quality Assurance

The Design-Build Contractor shall engage the service of a qualified, independent Registered Professional Engineer in the State of Indiana, acceptable to INDOT to conduct the vibration monitoring.

Prior to starting pile driving, the Design-Build Contractor, INDOT, and the Registered Professional Engineer shall jointly conduct a pre-construction survey of the existing site.

Monitoring shall be performed by personnel trained in the use of a seismograph, records shall be analyzed and results reported by personnel familiar with analyzing and reporting the frequency content of a seismograph record.

Prior to pile driving, the data collector shall obtain baseline readings of ambient vibrations. The vibration during the pile driving shall be measured with the seismograph sensor placed at a location closest to the piles being driven. The vibration during pile driving shall be limited to a peak particle velocity of not more than 0.5 in./sec. Vibration shall be monitored during driving of all piles at all substructures and throughout all pile driving if peak particle velocity measurements exceed 0.3 in./sec.

The Design-Build Contractor shall be responsible for all damages resulting from the pile driving operations and shall take whatever measures are necessary to maintain peak particle velocity within the specified limits.

Basis of Item

Vibration monitoring shall be quantified as a lump sum.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
701-05787	Instrumentation, Integrity Testing and Data Collection, Vibration Monitoring	LS

ALTERNATE CLASS C CONCRETE

SECTION 702, BEGIN LINE 11, DELETE AND INSERT AS FOLLOWS:

Concrete in superstructure, integral *and semi-integral* bents ~~-~~ *diaphragms*, *approach slabs*, and railings shall be *alternate* class C. Concrete in bent caps, unless poured integrally with the superstructure; pier caps; abutment caps; pier stems; abutment walls; mudwalls; columns; crashwalls; collision walls; and wingwalls, unless poured with integral end bents, shall be class A. Concrete in footings shall be class B.

SECTION 702, LINE 37, INSERT AS FOLLOWS:

Silica Fume 901.04

SECTION 709, BEGIN LINE 80, DELETE AND INSERT AS FOLLOWS:

In lieu of concrete surface sealing for concrete barrier wall, bridge decks, reinforced concrete bridge approaches, ~~pier and bent caps,~~ bridge railing, and bridge railing transitions, an alternate concrete mix design ~~may~~ *shall* be used. *In lieu of concrete surface sealing for pier and bent caps an alternate concrete mix design may be used.*

The concrete mix design shall be as specified, except either 3% silica fume by weight of cementitious material shall be added to the mix design or 30% ground granulated blast furnace slag substitution based on the required cement content shall be incorporated into the mix. The substitution of ground granulated blast furnace slag shall be in accordance with 702.05. A water-reducing admixture or a water-reducing retarding admixture shall be used in the mix design, and the amount of water added shall be adjusted accordingly. The use of these admixtures shall be in accordance with
702.05.

~~When one of these alternate concrete mix designs are used in lieu of a concrete surface sealer, a~~ *A* finish in accordance with 702.21 ~~will~~ *shall* be required.

STRUCTURAL MASS POUR CONCRETE

Description

This Work shall consist of furnishing and placing a concrete structural element, of large cross section, that is free of cracks resulting from thermal gradients created by the heat of hydration during the curing process in accordance with 105.03 and as described herein.

This shall be accomplished through appropriate mix design and management of the concrete temperature and temperature differential. Structural mass pour concrete is defined as any Class A or Class C concrete placements with a least dimension greater than 4 ft and as shown on the Design Documents. This specification shall not apply to concrete placed in drilled shafts.

Materials

The mass pour concrete structural element shall utilize Class A or Class C concrete in accordance with 702.02 and 702.03, except as follows:

1. The coarse aggregate shall be size No. 5 or No. 8. An AASHTO M 43 size coarse aggregate meeting the gradation requirements of #467, #4 or #357 may be used if approved by INDOT. In addition, the minimum clearance between reinforcing bars shall be at least 1.5 times the nominal maximum size of the coarse aggregate.

2. The maximum slag cement substitution is 60% based on the required cement content. Increased slag cement percentage may be considered but is subject to INDOT review and approval.

3. Cooling of materials prior to addition to the mixer will be allowed to reduce the temperature of the concrete in its plastic state. The normal practices as identified in ACI 207.4R – 05 are considered acceptable for pre-cooling materials prior to and at the time of concrete batching.

4. Other acceptable methods that are developed by the Design-Build Contractor and approved by INDOT in writing may be used.

Thermal Control

The maximum concrete temperature at time of placement shall not exceed 70°F and shall not be less than 40°F. The maximum concrete temperature during the period of heat dissipation shall not exceed 150°F. The temperature differential between the interior of the section and the outside surface of the section shall not exceed the limits specified in the following table:

Hours After Placement Hours	Maximum Temperature Differential °F
0-24	20
24-48	30
48-72	40
>72	50

Thermal control of each placement shall be maintained until the temperature of the interior is within 50°F of the average outside air temperature. The average outside air temperature shall be determined by

averaging the daily high and low temperature of the preceding seven calendar days.

Thermal Control Plan

A thermal control plan shall be written to describe the procedures used during the period of heat dissipation following concrete placement. The thermal control plan shall describe the procedures used to ensure that the maximum temperature and temperature differential between the interior of the section and the outside surface of the section do not exceed the restrictions specified. The thermal control plan shall be submitted to INDOT at least 30 days before the first intended structural mass pour concrete placement. Compliance with this specification may result in long cooling times. Therefore, consideration shall be given to options that control heat of hydration which are compatible with the desired construction schedule and erection procedures.

Mass pour concrete shall not be placed until the thermal control plan has been approved by INDOT, and the equipment and materials necessary to facilitate the plan are on site and ready for use.

For mass pour concrete placements, the thermal control plan shall be developed by a Registered Professional Engineer in the State of Indiana who is competent in the modeling, design, and temperature control of mass pour concrete in structural elements. The Registered Professional Engineer shall be known as the Thermal Control Engineer, TCE. The TCE shall be knowledgeable of Section 207.02R-95 of the ACI Manual of Concrete Practice entitled "Effect of Restraint, Volume Change and Reinforcement on Cracking of Mass Concrete". The TCE shall follow the guidelines outlined in Section 207.4R-05 of the ACI Manual of Concrete Practice entitled "Cooling and Insulating Systems for Mass Concrete" to formulate, implement, administer, and monitor a thermal control plan.

The TCE shall have administered at least three mass pour concrete projects of similar dimension and thermal control requirements to those shown on the Design Documents and the projects shall have been completed within the past three years. The TCE shall be responsible for making adjustments as necessary to ensure compliance with these specifications.

The thermal control plan shall include, but is not limited to, the following:

1. The mix design for the mass pour concrete.

2. The adiabatic heat generation for the mix design being used. This shall be determined by laboratory testing in accordance with ASTM C186.

3. Identification of any modeling software used to predict maximum temperature and temperature differential resulting from the heat of hydration generated in mass pour concrete.

4. Methods to monitor and control the maximum temperature and the temperature differential temperature within the concrete to prevent thermal cracking. Methods of curing and a remedial action plan shall be defined.

5. List at least three mass pour concrete projects of similar dimension and thermal control requirements to those shown on the Design Documents. The projects shall have been administered by the TCE and shall have been completed within the past three years. The list of

projects shall include the names and phone numbers of the owner's representative who can verify the TCE's participation on those projects.

6. Qualifications of all technicians employed to inspect or monitor mass pour concrete placements.

7. If necessary, design of a post-cooling system consisting of non-corrosive piping to be embedded in the structural mass. Details of the grouting operations shall be provided. The grout shall be a pre-packaged material and shall be identified on the Design Documents.

8. Provide information on the temperature sensing and recording equipment to be used and the details of the installation and location of the temperature probes for each planned mass pour concrete placement.

9. Details of mass pour concrete placement to ensure prevention of cold joints during placement.

Temperature Sensing and Recording

For each placement of structural mass pour concrete, two temperature sensors shall be installed at each of the following five locations, for a total of 10 temperature sensors. Additional sensors may be installed at other locations within the concrete placement, as required and detailed in the thermal control plan.

- Center of the placement.
- Midpoint of the side which is the shortest distance from the center, having 2 to 3 in. of cover.
- Midpoint of the top surface, having 2 to 3 in. of cover.
- Corner of the placement which is furthest distance from the center, having 2 to 3 in. of cover.
- Air temperature.

The purpose of the two sensors at each location is to provide a primary sensor and secondary back up sensor. A back-up readout device for the sensors shall also be provided. The back-up system is intended to be used to complete the monitoring of a placement should the primary system fail.

Temperatures shall be electronically recorded automatically by an approved recorder furnished by the Design-Build Contractor. The equipment shall be capable of continuously recording at least one reading every 30 minutes for the duration of the mass concrete temperature monitoring period. The sensors and recorder shall be accurate to within ± 2°F in the temperature range of the 32°F to 212°F.

Production

The TCE, or qualified technician employed by the TCE, shall personally inspect and approve the installation of monitoring devices and verify that the process for recording temperature data is effective for the first placement of each size and type of concrete component. Recording of temperature data shall begin when the concrete placement is complete and shall continue past the maximum temperature differential, not maximum temperature, and a decreasing temperature differential is confirmed for compliance with these

specifications. For placements other than the first, a qualified technician may inspect and monitor the temperature sensing and recording system for the purpose of:

1. Reviewing temperature data.

2. Being in contact with the TCE during mass pour concrete placement should adjustments be made as a result of the temperature differential being exceeded.

3. Implement adjustments to temperature control measure for mass pour concrete as directed by the TCE.

4. If conditions change, such as a drop in the ambient temperature or a change in insulation resulting in an increase in the temperature differential, the recording of the temperature data shall be resumed. A copy of all recorded temperature data shall be furnished to INDOT as they are determined.

The TCE or qualified technician shall report temperature data at intervals not exceeding four hours. The TCE shall furnish INDOT a final report within three days of completing monitoring of each structural element. The report shall include all recorded temperature data and pertinent information and actions taken to implement the thermal control plan.

If the maximum concrete temperature or differential temperature within the structural mass pour concrete placement exceeds the specified limits, immediate corrective action as directed by the Design-Build Contractor or the TCE shall be taken. Future placement of structural mass pour concrete shall be suspended and a revised thermal control plan shall be submitted to INDOT for approval. Further placement of mass pour concrete shall not occur without written approval from INDOT.

Acceptance

Application of loads and acceptance of mass pour concrete shall be in accordance with 702.24, except that sulfate resistant concrete will be tested for compliance based on flexural strength of beam specimens. ITM 402 may be used as an alternate method to determine flexural strength.

If the maximum temperature of the mass pour concrete after placement exceeds 150°F, but is less than 160°F, the concrete will be accepted if no cracking or other unacceptable defects are identified. If cracking or unacceptable defects are identified, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03. If the maximum concrete temperature equals or exceeds 160°F, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03.

If a temperature differential between the internal center of concrete placement and the concrete 2 to 3 in. from the exposed surface exceeds the specified amount, the mass pour concrete will be accepted if no cracking or other unacceptable defects are identified. If cracking or unacceptable defects are identified, the mass pour concrete will be adjudicated as a failed material in accordance with 105.03.

The mass pour concrete shall be inspected for cracks after the temperature monitoring is discontinued. The Design-Build Contractor shall provide access for inspection. The Design-Build Contractor shall be responsible for repair of cracks identified. A clear concrete sealer shall be applied in accordance with 709 to a crack that is less than 0.007 in. in width. A crack that is 0.007

in. or greater in width shall be repaired by epoxy injection in accordance with 727.

Basis of Item

Class A and Class C structural mass pour concrete shall be quantified by the cubic yard in accordance with the neat lines and quantities shown on the Design Documents, or as directed by INDOT. No deductions shall be made for the volume of embedded reinforcement, encased piles, temperature sensors or mechanical cooling ducts.

The items list shall include the following:

Item No.	Item Description	Unit Symbol
702-51005	Concrete, A, Substructure, Modified.....	CYS
702-92857	Concrete, C, Substructure, Modified.....	CYS

The following shall be considered incidental to this item:

Material, forms, falsework, falsework piling, placement, curing, finishing and necessary incidentals.

Thermal control plan; temperature sensing and recording of structural mass pour concrete; monitoring and implementation of thermal control; installation, operation and grouting of post-cooling system; and any incidentals.

FORMLINER FOR PIERS AND MSE WALLS

Description

This Work shall consist of constructing fluted rib recesses or simulated natural textured surfaces on all areas designated on the Design Documents for piers and MSE walls in accordance with 105.03, 702, the Design Documents, and as described herein.

Formed Textured Surfaces

Where formliner is designated, concrete surfaces shall be formed using a form lining system made of high-strength urethane elastomer materials capable of withstanding anticipated concrete pour pressures without leakage or causing physical defects. Formliners shall attach easily to forms and be removable without causing concrete surface damage. The formliners shall be designed to form surfaces conforming to the design intent including the shape, lines and dimensions described herein, Attachment 6-1 (North Split Aesthetic Design Guidelines), and on the Design Documents.

Formliners shall produce a highly realistic finish. Textured surfaces shall exhibit rough and natural finishes. Simulated textured surfaces having a smooth, slick or shiny surface will be rejected. Recesses and texture shall be formed with crisp, sharp edges and a natural relief to the shape and dimensions described herein and shown on the approved Working Drawings.

Formliner for the octagonally shaped pier columns shall be as follows:

- Fluted rib
- 8 inch deep rib, 1 foot-6 inch center to center, 4 inch wide valley, 9 inch wide peak

Formliner for the textured portions of the pier caps shall be as follows:

- Medium fractured granite finish with a maximum 5/16 inch surface relief
- Formliner panels shall be sized to allow for full size texturing without simulated grout lines within the pattern. Simulated grout lines along the perimeter of the pattern is acceptable.

Formliner for the inner rectangular textured finish of the MSE wall panels shall be as follows based on an assumed panel size, exposed panel dimensions, of 10 ft long by 5 ft high:

- Medium fractured granite finish with a maximum 5/16 inch surface relief
- Panels shall be sized to allow for full size texturing without simulated grout lines around the perimeter of the panel or within the pattern.

If snap ties are to be used, the ties shall be made of non-corrosive materials when the portion permanently embedded in the concrete is less than 1 1/2 in. from the finished surface.

Form release agents shall be fully compatible with the formliner material and the modified surface seal finish to be applied to the textured surfaces.

Submittals

Within 60 calendar days of execution and approval of the commencement of construction, the Design-Build Contractor shall submit the following to INDOT for approval:

1. Product data including the manufacturer's technical information and use instructions for formliner placement and release.

2. Actual samples of formliners to be used.

3. Qualification data for firms and the person specified below under Quality Assurance to demonstrate their capabilities and experience. Design-Build Contractor shall include a list of completed projects with project names, addresses, names of architects, engineers and owners, plus any other pertinent information.

4. Working Drawings indicating formliner layout and termination details. Design-Build Contractor shall indicate backup, rustication, reveal, and chamfer strip locations. Include jointing, form tie location, pattern placement, pattern match details, and end, edge and other special conditions. Design-Build Contractor shall indicate tolerances and procedure of installation and separation.

After INDOT approves the Working Drawings and prior to commencement of production or construction of the piers and MSE wall panels, the Design-Build Contractor shall submit the following to INDOT for approval:

1. Test Panel Mock-ups and Concrete Test Panels as specified below under Quality Assurance.

Quality Assurance

1. Manufacturer's Qualifications: The formliner manufacturer shall have five years minimum experience making liners used to create formed concrete surfaces matching natural stone shapes and textures.

2. Installer Qualifications: The formliner installer shall have had a minimum of five consecutive years of experience in textured formed concrete construction.

3. Test Panel Mock-ups and Test Panels, Split-Face block Patterns Only: Design-Build Contractor shall construct test panel mock-ups of textured and formed surfaces to be used for the pier caps, pier columns, and MSE wall panels for quality control comparison of surface texture and pattern characteristics between the approved sample mock-ups and the actual Work as it is installed. The test panel mock-ups shall be constructed using urethane foam or other suitable lightweight material to produce a surface that simulates that produced when casting concrete. The test panel mock-ups shall be a minimum of 3 in. thick, 5 ft wide, and 5 ft high. The test panel mock-ups shall be provided near the Project Site or field office and INDOT shall be notified at least one week in advance.

Upon approval of the test panel mock-up, three concrete test panels shall also be constructed and shall be provided near the Project Site or field office. At a minimum, the concrete test panel for the pier column shall be 2.5 ft thick by 5 ft tall by 10 ft long providing a half-section of the column including the recess on the sides. At a minimum, the concrete test panel for the pier cap shall be 6 in. thick by 5 ft tall by 10 ft long. At a minimum, the concrete test panel for the MSE walls shall be 6 in. thick by 5 ft tall by 10 ft long. Materials used in constructing the concrete test panels shall comply with the

applicable requirements of 702 for formwork and concrete. Concrete mix for the concrete test panels shall be Class A. The formliner used for the concrete test panels shall produce the same pattern that is intended for use on the structures. Modified surface seal, of the color specified on the Design Documents, shall also be applied to the test panels. Additional concrete test panels will be required if results of the initial test panel do not meet the requirements of these special provisions. INDOT shall be notified at least one week in advance.

Following completion of the structure, the Design-Build Contractor shall remove and dispose of the test panels in accordance with 202.

Test panels shall be considered incidental to the Work.

Construction Requirements

Design-Build Contractor shall match pattern features at formliner joints to make the formed concrete surface appear uniform and continuous without grout leakage at the joints. When concrete vertical and horizontal construction joints are required, the Design-Build Contractor shall place formliner joints in the valley of the grooves, or as approved by INDOT. Following removal of forms, the Design-Build Contractor shall finish improperly formed joints to achieve a smooth and uniform cast concrete surface. No visible vertical and horizontal seams or conspicuous form marks created by butt-joining formliners will be allowed. Where it is not possible to locate a vertical or horizontal groove at a construction joint, the concrete surface shall be finished to reduce visibility of the construction joints.

Formwork shall be stripped in accordance with the formliner manufacturer's recommendations to avoid concrete surface deterioration or weakness planes in the substrate. Form tie holes shall be finished in accordance with 702 using approved patching materials.

Surfaces of formliners to be re-used shall be cleaned and repaired. Split, frayed, delaminated or otherwise damaged formliner material will not be acceptable for exposed surfaces. Formliners shall be cleaned and free of concrete buildup prior to each pour. Design-Build Contractor shall not use "patched" forms for exposed concrete surfaces unless approved by INDOT.

Basis of Item

Formliner for piers and MSE wall panels shall not be quantified. Formliner for piers and MSE wall panels shall be considered incidental and shall be included in the quantity of Concrete, A, Substructure, and Face Panels, Concrete in accordance with 702.28 and 731.13.

ULTRA-HIGH PERFORMANCE CONCRETE

Description

This Work shall consist of furnishing and placing Ultra High Performance Concrete, UHPC, in accordance with 105.03, the Design Documents, and as described herein.

Materials

Materials shall be in accordance with 702.03 and the following:

Admixtures for Concrete*.....912.03
Portland Cement .....901.01(b)
Water 913.01
*Admixtures shall be in accordance with Manufacturer's requirements.

UHPC material shall meet the following requirements at 28 days, unless noted otherwise:

1. Minimum compressive strength (ASTM C39)
   - Heat-treated* ≥ 25 ksi
   - Not heat-treated** ≥ 21 ksi
   - Not heat-treated 4 day** ≥ 12 ksi
   - Heat-treated 2 day* ≥ 10 ksi
2. Minimum flexural strength (ASTM C78)
   - Heat-treated 2 day* ≥ 5 ksi
3. Prism flexural tensile toughness (ASTM C1018; 10 in. span) $I_{30} \geq 48$
4. Long-term shrinkage (ASTM C157; initial reading after set) ≤ 766 microstrain
5. Chloride ion penetrability (ASTM C1202) ≤ 250 coulombs
6. Chloride ion penetrability (AASHTO T259; 1/5 in. depth) ≤ 0.07 oz/cu ft
7. Scaling resistance (ASTM C672) y < 3
8. Abrasion resistance (ASTM C944 2x weight; ground surf.) < 0.025 oz. lost
9. Freeze-thaw resistance (ASTM C666A; 600 cycles) RDM > 96%
10. Alkali-silica reaction (ASTM C1260; tested for 28 days) Innocuous

*Heat treated according to Manufacturer's recommendation; temperature not to exceed 250°F.
**Not heat-treated-cured at a temperature of 60°F ± 3°F.

Fine aggregates shall be crushed quartz with 100% passing the No. 30 sieve and a maximum of 3% passing the No. 200 sieve.

Steel fibers are required for use in UHPC. Steel fibers shall be ASTM A 820, Type 1, cold drawn high-carbon steel with a minimum tensile strength of 360 ksi, length of 12mm to 13mm, and diameter of 0.220 to 0.225mm. Minimum steel fiber content will be 3.25% of the mix's dry volume.

Construction Requirements

Submittals

The submittals requiring written approval from INDOT are as follows:

1. **UHPC Placement Plan**

a. Submit the UHPC placement plan for approval 30 days before casting concrete that includes a joint surface abutting UHPC for the superstructure to substructure connection, such as abutment footing concrete.
b. The UHPC placement plan shall include, but not necessarily be limited to, the following:
   - Proposed methods of joint surface preparation to achieve the required concrete surface profile texture.
   - Proposed forming methods.
   - Proposed batching sequence. The batching sequence shall include the order and time of introduction of the materials and the mixing time.
   - Proposed sequence and schedule for UHPC placement operations.
   - Details of all equipment to be used to batch and place UHPC materials, including mixers, pumps, and concrete buggies.
   - Curing procedures, including minimum cure time and minimum strength requirements prior to loading.
   - Testing procedures.
   - Quality control / quality assurance procedures for verification of mix uniformity.

2. **UHPC Mix Design**
   The Design-Build Contractor shall submit UHPC mix design and results of the material testing conducted by an AASHTO accredited testing lab to INDOT 60 days prior to first placement of UHPC. INDOT may waive the tests of the UHPC mix if these tests have been previously performed for material supplied by the manufacturer.

3. **List of Similar Bridge Projects**
   The Design-Build Contractor shall provide a list of bridge projects in which the proposed UHPC material has been used as joint fill between cast-in-place and/or precast concrete elements, within or outside the USA, 60 days prior to first placement of UHPC. INDOT reserves the right to reject proposed UHPC material which lacks a proven track record for precast concrete joint filling in bridge applications.

Pre-Pour Meeting

Prior to the initial placement of UHPC, the Design-Build Contractor shall arrange for an onsite meeting with the UHPC representative and INDOT. The Design-Build Contractor's staff shall attend the site meeting. The objective of the meeting will be to clearly outline the procedures for mixing, transporting, finishing and curing of the UHPC material. The Design-Build Contractor shall arrange for a representative of the UHPC supplier to be on site during the placement of all UHPC connections.

The UHPC representative shall be knowledgeable in the supply, mixing, delivery, placement, and curing of the UHPC material.

Storage

The Design-Build Contractor shall assure the proper storage of the UHPC premix fibers and additives as required by the UHPC supplier’s specifications to protect materials against loss of physical and mechanical properties.

Forming, Batching, Placement, and Curing.

The Design-Build Contractor shall work with the UHPC manufacturer to ensure appropriate initial strength gains to meet the desired project schedule. The bridge may be opened to traffic when strength of 15 ksi has been achieved, unless otherwise recommended by the UHPC manufacturer.

Forming, batching, placing, and curing shall be in accordance with the procedures as submitted to and accepted by INDOT. The design and fabrication of forms shall follow 702.14 and the recommendations of the UHPC manufacturer.

The Design-Build Contractor shall follow the batching sequence as specified by the UHPC manufacturer and as approved by INDOT.

The UHPC joint shall be cast using one continuous placement. No cold joints will be allowed.

The concrete in the form shall be cured according to the UHPC manufacturer's recommendations at minimum temperature of 60˚F to attain the design strength.

Material Testing

The Design Build Contractor shall cast four sets of compressive test cylinders for each day of UHPC placement. Each set shall consist of three 3 in. by 6 in. cylinders. An additional three 12 in. diameter by 7 ½ in. deep cylinders with one 32 in. long No. 4 stainless steel reinforcing bar embedded 3 in. deep in the center of the circular face shall be cast for pullout testing. The axis of the bar shall be perpendicular to the formed surface. All sets shall be cured using the same method of curing proposed to be used in the field. The temperature during curing shall be within 18˚F of the low end of the proposed temperature range for curing in the field.

Compressive tests shall be performed in accordance with ASTM C39. Three specimens shall be tested to validate achievement of the 10 ksi compressive strength required prior to grinding UHPC overfill. Three specimens shall be tested to validate achievement of 15 ksi compressive strength prior to opening the bridge to traffic. Three specimens shall be tested at 28 days to validate the required 21 ksi final strength. The remaining three specimens shall be treated as reserves.

Pullout testing shall be in accordance with ASTM E488. The cylinders shall be kept wet for four days prior to delivery to the testing lab. The test shall be performed as soon as practical after corresponding compressive test samples reach 12 ksi compressive strength. Pullout test samples pass if the bars yield without the UHPC failing and without the bars pulling out of the UHPC.

Slump will be measured in accordance with 505 and shall be no less than 7 in. and no more than 10 in.

Basis of Item

Ultra High Performance Concrete, UHPC, shall be quantified per square yard.

The items list shall include the following:

Item No.	Item Description	Unit Symbol

702-12611 Ultra High Performance Concrete.....SY

If the UHPC does not meet the minimal material properties described herein, the UHPC shall be removed and replaced or remediated to the satisfaction of INDOT.

The following shall be considered incidental to this item:

Surface preparation, supplying, mixing, transporting, placing, finishing, curing, grinding, grooving, and furnishing all equipment, tools, and labor required to complete the Work.

Additional quantity of material used in the determination of material properties and for acceptance testing.

EMBEDDED GALVANIC ANODES

Description

This Work shall consist of furnishing and placing discrete embedded galvanic anodes in accordance with 105.03.

Materials

The galvanic anodes shall be supplied by one of the following:

BASF Construction Chemicals, LLC
889 Valley Park Drive
Shakopee, MN 55379
(800) 443-9517

The Euclid Chemical Company
19218 Redwood Road
Cleveland, OH 44110
(800) 321-7628

Sika Corporation
201 Polito Avenue
Lyndhurst, NJ 07071
(800) 933-7452

Vector Corrosion Technologies, Inc.
8413 Laurel Fair Circle, Ste 200A
Tampa, FL 33610
(813) 830-7566

The galvanic anodes shall conform to the requirements of ASTM B418, Type II and shall contain no less than 100 grams of zinc per anode. A Type C Certification in accordance with 916, including the vendor name, product names, and a statement certifying the compatibility of the galvanic anode and the patching material, shall be furnished for the galvanic anodes.

Construction Requirements

The galvanic anode manufacturer shall prepare and submit Working Drawings in accordance with 105.02. The Working Drawing shall include calculations for the manufacturer's recommended spacing, calculations showing the provided zinc content meets or exceeds the minimum required zinc content, manufacturer's installation instructions and details, and certification by the manufacturer that the proposed patching materials are compatible with the galvanic anodes.

A qualified representative of the galvanic anode manufacturer shall be present at the beginning of the Work to ensure adequate workmanship and inspection of the anode installation.

Galvanic anodes shall be kept dry and stored in their original unopened box at temperatures less than 100 °F.

Discrete galvanic anodes shall be installed within partial and full depth cavities, new portions of bridge deck, and along the perimeter of the cavity interface with existing concrete as shown on the Design Documents. The spacing of the anodes shall be as per the manufacturer's recommendations, but shall not exceed 28 in. The minimum required zinc content in each direction shall be calculated as follows:

$$\text{Zinc} = 1.7 \times \gamma_{\text{Steel}} + 4.0$$

where:

Zinc = minimum required zinc content, grams/inch

γ_{Steel} = steel density ratio defined as the ratio of the total surface area of all of the reinforcing bars within or below the patch to the surface area of the patch that could be exposed to chlorides. In locations where two or more layers of reinforcing bars have more than 12 in. of space between them, and the lower layer of reinforcing is located below the depth of the patch, only the reinforcing bar layer closest to the surface is required to be included in the calculation. The surface area of each bar = 3.14 x bar diameter x length of bar within the patch. At locations where the existing concrete is being widened, the steel density ratio shall be calculated based on a one-foot tributary width of the existing concrete section.

The anodes shall be placed at the required spacing in each direction for partial depth patches and at the required spacing around the perimeter of full depth patches. At locations where existing concrete structures are being widened, the anodes shall be placed at the required spacing along the interface of the existing and new concrete. Anodes shall be attached to the layer of reinforcing steel closest to the surface that could be exposed to chlorides.

Existing concrete shall be removed in accordance with the applicable sections of 202, 710, and 722. Any reinforcement that has lost 50% or more of its original cross-sectional area or any reinforcement that has been damaged during concrete removal shall be removed and replaced in accordance with the applicable sections of 202, 710, and 722. After all loose or unsound concrete has been removed in the areas to be repaired and as shown on the Design Documents and as directly by INDOT, the continuity of the existing reinforcing bars within the repair area shall be tested. The DC resistivity between all reinforcing bars, as measured with a multi-meter, shall be less than 1.0 ohms. Continuity between bars shall be restored at locations where the resistivity is greater than 1.0 ohms by use of uncoated tie wires.

The discrete galvanic anodes shall be positioned no further than 4 in. and no less than 1 in. from the edge of the patch. The surface of the reinforcing bars in the areas to be connected to the anodes shall be prepared by removing all concrete and cleaning to a near-white surface condition. The anodes shall be firmly and securely attached to the reinforcing bars by tightly wrapping the wire ties around the exposed uncoated and cleaned reinforcing bars at least one full turn in opposite directions, and in accordance with the manufacturer's recommendations. Attachment shall be made immediately after reinforcing bar surface preparation, and the anodes should be positioned in the plane of the reinforcing with a minimum cover of 1 in. to the surface of the patch. Anodes shall have a minimum of 1 in. clearance to the bottom of the patch and shall allow the patching material to completely encase the anode. Where sufficient space is available, the anode may be positioned below the reinforcing bars. The DC resistivity between the anodes and the reinforcing bars, as measured with a multi-meter, shall be less than 1.0 ohms.

The anodes shall be pre-wet to a saturated surface dry condition immediately prior to installing the patching material in order to minimize moisture loss of the anode mortar and to improve adhesion.

Basis of Item

Embedded galvanic anodes shall be quantified per each, complete in place.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
703-08247	Embedded Galvanic Anode	EACH

The cost material, labor, equipment, incidental work to establish continuity of reinforcement, shall be included in the cost of embedded galvanic anode.

The cost of removing portions of existing concrete structures shall be included in present structure remove portion pay item.

The cost of material, labor, equipment, and incidental work for patching existing concrete piers, end bents, abutments, wingwalls, retaining walls, concrete structure surfaces other than bridge decks, and patching concrete drainage structures shall be included in patching concrete structures pay item.

The cost of material, labor, equipment, and incidental work for patching existing bridge decks shall be included in the bride deck overlay or bridge deck patching pay item.

STAINLESS STEEL REINFORCING BARS

Description

This Work shall consist of furnishing all labor, materials, equipment, and incidentals necessary for placing stainless steel reinforcing bars, lap splices, mechanical connectors, chairs and supports, inserts, dowels, and tie wire in accordance with 105.03, 703, the Design Documents, and as specified herein.

Materials

Materials for this Work shall be in accordance with the following:

Reinforcing bars shall be deformed and shall meet the requirements of ASTM A955 except for Section 6, Chemical Composition and Section 15, Finish. Acceptable alloys are listed by Uniform Numbering System for Metals and Alloys (UNS) designation in Table 1. Surfaces shall be finished in accordance with Table 1 and the requirements of ASTM A380.

Table 1
Stainless Steel Alloys for Reinforcing Bars and Dowels

UNS Designation	S31653		S31803		S20910		S24100		S32304	
AISI Type	316LN		2205		XM-19		XM-28		2304	
Common or Trade Name	Type 316 Low Carbon Nitrogen Added		Type 2205 Duplex		Nitronic 50		Nitronic 32 Enduramet 32 18-Cr-2Ni-12Mn		Type 2304 Duplex SAF 2304 Fe-23Cr-4Ni-0.1N	
Required Condition	As rolled		As rolled		As rolled		As rolled		As rolled	
Required Finish	Descaled and white pickled		Descaled and white pickled		Descaled and white pickled		Descaled and white pickled		Descaled and white pickled	
Grade	60	75	60	75	60	75	60	75	60	75
Minimum Tensile Strength (ksi)	90	95	90	95	90	95	90	95	90	95
Minimum Yield Strength (ksi)	60	75	60	75	60	75	60	75	60	75
Minimum Elongation in 2 inches (%)	25	20	25	20	25	20	25	20	25	20

Mechanical connectors for reinforcing bars are defined as systems which connect the bars without raising their temperature above 1,300°F.

Mechanical connectors shall be provided which develop at least 150% of the specified minimum ultimate strength of the reinforcing bars in compression and in tension. Where bars of different sizes or strengths are connected, the

Design-Build Contractor shall match the strength of the smaller or weaker bar.

Spliced reinforcing bars that slip more than 0.040 in. when measured between guage points clear of the splice sleeve shall not be allowed when the reinforcing bars are loaded in tension to 67% of the specified minimum yield strength of the reinforcing bar.

The splice sleeve and connection hardware shall be fabricated from an alloy listed in Table 1. The surface shall be finished in accordance with Table 1 and the requirements of ASTM A380.

Chairs and continuous supports shall be fabricated from an alloy listed in Table 1. The surface shall be finished in accordance with Table 1 and the requirements of ASTM A380.

Concrete inserts shall be fabricated from an alloy listed in Table 1. The surface shall be finished in accordance with Table 1 and the requirements of ASTM A380. Concrete inserts with closed-back ferrule threaded to receive UNC threaded bolts or rods shall be provided in the size shown. Concrete inserts shall be provided with the following minimum lengths and safe working loads:

Bolt or Rod Diameter (Inches)	**Insert Length (Inches)**	**Safe Working Load in Shear or Tension (Pounds)**
3/4	4 1/2	4,000
1	5 1/2	6,000
1 1/4	7 1/2	10,000
1 1/2	9 1/2	16,000

Dowels shall be provided meeting the requirements of ASTM A955 except for Section 6, Chemical Composition and Section 15, Finish. Acceptable alloys are listed by Uniform Numbering System for Metals and Alloys, UNS, designation in Table 1. The surface shall be finished in accordance with Table 1 and the requirements of ASTM A380.

Tie wire shall be 16-gauge and shall meet the requirements of ASTM A555 and shall be fabricated from an alloy listed in Table 1, in dead soft annealed condition and passivated according to ASTM A380.

Where stainless steel inserts are specified, inserts shall be provided that meet the requirements as described herein.

For stainless steel reinforcing bars, splice samples shall be provided that meet the requirements as described herein.

Tie wires shall be provided meeting the requirements as described herein for blocks supporting stainless steel reinforcing bars.

Stainless steel reinforcing bars shall only be tied with stainless steel tie wire meeting the requirements as described herein.

Stainless steel reinforcing bars shall be supported with stainless steel metal chairs and continuous supports meeting the requirements as described herein.

Stainless steel reinforcing bars shall not be tied to plain or epoxy-coated steel reinforcing bars. Direct contact is not acceptable. When stainless steel reinforcing bars or dowels must be near plain or epoxy-coated reinforcing

bars, nylon or polyethylene spacers shall be used to maintain a minimum 1 in. clearance between the two metals and bind them with nylon cable ties. Where insufficient space exists to maintain this minimum, either bar may be sleeved with a continuous polyethylene or nylon tube extending at least 1 in. in each direction past the point of closest contact between the two dissimilar bars.

Construction

Construction for this Work shall meet the following requirements:

Placing and Fastening

Prior to placing reinforcing bars, all grease, dirt, mortar and other foreign substances shall be removed.

Reinforcing bars shall be placed in the position indicated and within the allowable tolerances specified. Before concrete is placed, all reinforcing bars shall be securely fastened and supported with chairs or other devices.

Inspection

Concrete shall not be placed until the reinforcing bar is inspected and permission for placing concrete has been granted by INDOT. All concrete placed in violation of this provision will be rejected and shall be removed.

Bar Splices

Bar splices will be allowed only where shown on the Design Documents. Splices shall not be allowed unless a minimum of 2 in. can be provided between the spliced bar and the nearest adjacent bar.

Splices for bar sizes No. 11, or smaller, shall be made by means of a mechanical connector or by placing the bars in contact and wiring them together for the full length of a lap splice.

Splices for bars larger than No. 11 shall be made by use of a mechanical connector.

Splices made with mechanical connectors shall be installed in accordance with the manufacturer's written requirements.

Placement in Structural Slabs

Placing and fastening shall be in accordance with 703.06.

Basis of Item

Stainless steel reinforcing bars shall be quantified per pound, complete in place.

The items list shall include the following:

Item No.	Item Description	Unit Symbol
703-06028	Reinforcing Bars, Stainless Steel.....	LBS

The following shall be considered incidental to this item:

Furnishing all materials, equipment, labor, installation, metal chairs, spacers, clips, wire, or other mechanical means used for fastening or holding reinforcement in place, laps, and all incidentals necessary to complete this Work.

PRECAST PRESTRESSED HIGH STRENGTH CONCRETE

Description

This Work shall consist of fabricating, furnishing, and installing precast prestressed high strength concrete structural members having a design 28 day concrete compressive strength, f'c, as specified herein, in accordance with 105.03, 707, and the Design Documents.

Materials

Materials shall be in accordance with 702.03 and the following:

Admixtures and Admixture Systems.....912.03
Coarse Aggregates, Class A or Higher, Size No. 91.....904
Concrete Curing Materials.....912
Concrete Sealers.....909.09, 909.10
Elastomeric Bearings.....915.04
Fine Aggregates, Size No. 23.....904
Portland Cement, Types I, II, or III.....901.01
Reinforcing Bars.....910.01
Silica Fume.....901.04
Uncoated 7 Wire Strand.....910.01(b)7
Water.....913.01

Prestressing strands used in high strength concrete shall be uncoated 7 wire, low-relaxation, Grade 270 strands.

Structural steel for steel intermediate diaphragms shall be in accordance with 910.02(a) and shall be galvanized in accordance with ASTM A123 after cutting, bending, and welding. Bolts for steel intermediate diaphragms shall be 7/8 in. and in accordance with 910.02(f), except they shall be Type 1. All bolts, nuts, washers, and similar threaded fasteners shall be galvanized in accordance with ASTM A123 or may be mechanically zinc coated in accordance with ASTM B695, Class 50.

All high strength concrete structural members shall be manufactured in an INDOT approved plant in accordance with ITM 814.

High Strength Concrete Mix Design

The high strength concrete mix design shall be in accordance with the mix criteria stated herein. The mix design shall be submitted a minimum of 14 days prior to the trial batch and shall include the following:

(a) A list of all ingredients
(b) The source of all materials
(c) The gradation of the aggregates
(d) The absorption of the aggregates
(e) The SSD bulk specific gravity of the aggregates
(f) The specific gravity of silica fume
(g) The batch weights
(h) The names of all admixtures
(i) The range of admixture dosage rates as recommended by the manufacturer

Mix Design Criteria

The mix design shall be air entrained and shall produce concrete having the following properties:

Concrete Properties Requirements:
Maximum cementitious content .....800 lbs/cu yd

Silica fume content .....5.0%-6.5% of cementitious by weight
Air content .....6.5%±1.5%
Maximum water cementitious ratio 0.340
Maximum Concrete Temperature .....78°F
Minimum release strength .....8,000 psi
Minimum 28 day strength .....10,000 psi
Slump .....4 in. to 8 in.
Relative Yield .....1.000 ± 0.020

Air entraining cement will not be permitted.

Chemical admixture types F or G shall be used in combination with an air entraining admixture. High range water reducing, HRWR, and high range water reducing retarding, HRWRR, admixture systems may be used.

Chemical admixture types B, C, and E will be allowed only with INDOT's written permission.

The amount of water present in the chemical admixtures shall be included when determining the water cementitious ratio.

Concrete temperature requirement is after delivery to the casting site, but prior to placement in the structural members.

Trial Batch

A trial batch shall be produced at least four weeks prior to beam fabrication. The concrete will be tested to verify that the mix design meets the concrete mix criteria. A minimum of 3 cu yds of concrete shall be batched at the plant facility to accurately represent the mix design and provide an amount of concrete to perform all tests from the same batch. The concrete shall be batched and mixed in accordance with the applicable requirements of 702.06 and 702.07. To ensure adequate dispersion of the silica fume, the batching sequence shall be reviewed for concurrence prior to batching of the concrete.

The Design-Build Contractor will test the trial batch and submit results to INDOT. Trial batch concrete shall not be used for more than one test, except the concrete used for the unit weight may be used to conduct the air content test.

Four 6 in. diameter by 12 inch cylinders shall be cast. Two cylinders shall be tested for compressive strength at 3 days and averaged for a result. Two cylinders shall be tested for compressive strength at 28 days and averaged for a result.

All facilities and materials necessary to prepare and initially cure cast specimens shall be provided.

Following the trial batch demonstration all required test results and final mix design shall be submitted to INDOT.

Except for adjustments to compensate for routine aggregate moisture fluctuations, changes in aggregate, SSD, batch weights shall be documented and submitted to the DMTE for approval, prior to use. Changes to the dosage amounts of admixtures will be allowed. A new mix design shall be prepared and successfully demonstrated for changes in the source of a material, the amounts of cementitious materials, increase in target water cementitious ratio, or the addition or deletion of admixtures.

Test Methods and Procedures

The following test methods and procedures shall apply for the Design-Build Contractor's process control and acceptance, with exceptions as listed below.

Air Content (a).....AASHTO T 152
Compressive Strength .....AASHTO T 22
Making and Curing Specimens .....AASHTO T 23
Moisture Content, Aggregate .....AASHTO T 255
Relative Yield .....AASHTO T 121
Sampling Fresh Concrete (b).....AASHTO T 141
Sampling Stockpiles Aggregates .....ITM 207
Sieve Analysis of Aggregates (c).....AASHTO T 27
Slump .....AASHTO T 119
Specific Gravity and Absorption, Coarse Aggregate (d) .AASHTO T 84
Specific Gravity and Absorption, Fine Aggregate (d)....AASHTO T 85
Temperature of Concrete .....AASHTO T 309
Water Cementitious Ratio .....ITM 403

(a) The exceptions for determining the air content shall be as follows:

1. The aggregate correction factor shall be determined in accordance with 6.4.3 except that the volume of water shall not be removed from the assembled and filled apparatus.

2. The aggregate correction factor test shall be rerun for confirmation if the test results for gravel are greater than 0.4% or if the test results for crushed stone are greater than 0.6%.

(b) The exception for sampling fresh concrete in the field shall be that the entire sample may be obtained from one portion of the load after at least 0.25 cu yds of concrete has been discharged.

(c) The exceptions for conducting a sieve analysis on aggregates are in accordance with 904.06.

(d) The exceptions for determining SSD bulk specific gravity and absorption for fine and coarse aggregate shall be that bulk specific gravity will be reported to the nearest 0.001 and the absorption reported to the nearest 0.01% point.

CONSTRUCTION REQUIREMENTS

General Requirements

Production of high strength concrete structural members shall not begin until the compression strength test results from the 28 day trial batch cylinders are acceptable to INDOT.

Dimensions and design requirements for structural members shall be as shown on the Design Documents. Lengths and dimension tolerances shall be as shown on the Design Documents or as otherwise specified by INDOT. A beam which is to include a field attached curb shall have curb reinforcement located longitudinally within 3/4 in. of the locations shown on the Design Documents. If detailed drawings are not included in the Design Documents, Working Drawings shall be submitted for approval in accordance with 105.02. Certified mill test

reports shall be furnished for all uncoated 7 wire strands.

Where temperature requirements are specified herein, the Design-Build Contractor shall provide INDOT with written verification that the temperature requirements have been met.

Prior to the beginning of fabrication, a prefabrication meeting shall be held at the fabrication facility or another agreed upon location. The meeting shall be conducted by the Design-Build Contractor and attended by the fabricator's production supervisor and quality control inspector, and INDOT. The Design-Build Contractor shall take notes of the meeting and distribute copies to all attending parties within five days of the date of the meeting. Items to be discussed at the meeting shall include a minimum of: fabrication and shipping schedule including hours of operation; line of communication between Design-Build Contractor and INDOT; material test reports; Working Drawings; special fabrication methods; fabrication hold points for inspection; final inspection and acceptance of materials; method of shipment.

Structural steel diaphragms shall be fabricated and erected in accordance with 711. Steel diaphragms shall include all connection angles, plates, and associated hardware required for a complete installation. The Design-Build Contractor shall replace, re-galvanize, or repair all damaged galvanized material.

Steel and Concrete Requirements

(a) Reinforcing Bars

A tight coat of concrete grout extending 1/2 in. maximum from the top of high strength concrete structural members will be allowed to remain on reinforcing bars extending from high strength concrete structural members. All loose and flaky material on these reinforcing bars shall be removed. Lap splices shall be in accordance with 703.06.

(b) Prestressing Strands

The splicing of straight prestressing strands is acceptable provided that the location of the splice does not occur within a concrete structural member. Splicing of draped strands is not allowed. Spliced prestressing strands shall have the same twist or lap. For single strand tensioning, slippage of the splices should be considered in computing the elongation. For multiple strand tensioning, either all of the strands shall be spliced or not more than 10% of the strands shall be spliced. If all of the strands are spliced the average splice slippage shall be considered in computing the elongation. If 10% or less of the strands are spliced, no slippage allowance will be required.

Wire breaks will be allowed to remain on the prestressed concrete casting bed as follows:

Number of Strands in Bed	Wire Breaks
19 or fewer	0
20 through 39	1
40 through 59	2
60 or more	3

The ends of each allowed wire break shall be tied to the strand. If more than the permissible number of wire breaks appears in a particular strand pattern, or if more than one broken wire appears in an individual strand, such strands shall be removed and replaced.

The tolerance for the center of gravity for a prestressing strand group shall be ± 1/4 in. The tolerance for the longitudinal position of handling devices shall be ± 6 in.

(c) Concrete

The amount of time from mixing to placement and consolidation shall be a maximum of 30 minutes. The concrete shall not be retempered with additional amounts of chemical admixture types F or G after the initial mixing has been completed.

1. Cold Weather Concrete

Cold weather concrete shall be in accordance with 702.11, except the maximum concrete temperature shall be as specified herein.

2. Hot Weather Concrete

When it is necessary to fabricate high strength concrete structural members during times of hot weather the mix water may be chilled or an appropriate amount of ice may be added to the concrete mix to produce concrete of the temperature specified herein.

3. Acceptance Testing

Acceptance of high strength concrete structural members will be based on tests for slump, air content, and compressive strength. All slump, air content, and compressive strength tests shall be performed in the presence of INDOT. Slump and air content measurements shall be obtained each time cylinders are made. Compressive strengths of the structural members shall be determined from cylinder sets described herein. The 28 day compressive strength shall be equal to or greater than the specified concrete compressive strength. The compressive strength of the concrete for each structural member will be determined from the average strength of the cylinder set representing that member. No individual compressive strength within a cylinder set representing a structural member shall be less than 90% of the specified concrete compressive strength.

All molds, facilities, labor, and materials necessary to prepare, cure, and test the cylinder sets shall be furnished.

a. Cylinder Set

A cylinder set shall consist of at least three cylinders obtained from three separate batches or loads of concrete used in casting a structural member. The batches or loads to be sampled may be as directed by INDOT. All cylinders for acceptance shall be 6 in. diameter by 12 in., molded and field cured in accordance with ASTM C31. The Design-Build Contractor may make additional cylinder sets for use in acceptance testing.

All cylinders shall be identified by use of INDOT-marked cylinder identification tags which are inserted a maximum of 3/8 in. into the top of each freshly molded cylinder. The cylinder number, a unique structural member identification number, temperature, air content, and slump of the concrete represented by each cylinder shall be referenced to the numbers on these cylinder identification tags and provided to INDOT by the end of each day in which cylinders are cast.

Cylinders shall be stored as near as possible to the point of deposit of the concrete represented. All surfaces of the cylinders shall be protected from the elements in the same manner as the formed structural members. Cylinders shall be cured at the same temperature and moisture environment as the structural members.

Cylinders shall be in the moisture condition resulting from the selected curing treatment prior to testing. To meet these conditions, the cylinders shall be removed from the molds at the time the structural member is removed from the form Work. Cylinders shall be tested in accordance with ASTM C39. The Design-Build Contractor shall have on file a certificate of calibration for the testing machine. All cylinders in a cylinder set, for a given age, shall be broken within the time tolerances shown in ASTM C39. INDOT will remove cylinder identification tags prior to the Design-Build Contractor testing the cylinders.

b. High Strength Concrete Structural Members

A minimum of two cylinder sets shall be made for each structural member cast. One cylinder set shall be tested and used to determine when the high strength concrete structural member has met or exceeded the required strength for detensioning the prestressing bed. If an additional cylinder set has been made, the Design-Build Contractor may test this set to determine if the required strength for detensioning of the prestressing bed has been met or exceeded, or if the required 28 day compressive strength has been met or exceeded prior to an age of 28 days. INDOT will accept the results from compression testing of the additional cylinder set, in place of either the detensioning strength test results, or the 28 day compressive strength test results, if the results equal or exceed the respective compressive strength requirements. If an additional cylinder set was not made, or if the additional cylinder set does not meet or exceed the 28 day compressive strength requirement, the remaining cylinder set shall be tested at 28 days of age to determine the acceptability of the structural members.

Coring of high strength concrete structural members shall not be performed. High strength concrete structural members that have been cored will not be accepted. Compressive strength results for cylinders that exceed 28 days in age or results from cylinders that do not have the marked cylinder identification tag intact will result in the high strength concrete structural members not being accepted.

(d) Other Requirements

Inspection of the high strength concrete structural member during manufacture and checking and testing aggregates, cement, concrete, and steel specimens shall be performed. Inspection, checking, and testing performed will not relieve the Design-Build Contractor or the fabricator from performing their own quality control inspection, testing, and checking as necessary to maintain quality control over the manufacturing, handling, and curing procedure. A permanent record of the force applied to and measured elongation obtained for each prestressing strand and the identification of the strand and high strength concrete structural member to which the record applies shall be provided. This record shall be certified that it accurately represents the force applied and measured elongation by the fabricator’s production supervisor and provided to INDOT prior to shipment.

Forms

High strength concrete structural members shall be manufactured in steel forms which are unyielding, smooth, mortar-tight, and of sufficient rigidity to prevent distortion due to pressure of the concrete. They shall be designed so that the finished concrete is in accordance with the required dimensions and contours. The design of the forms shall take into account the effect of vibration of the concrete as it is placed. Forms shall be chamfered 3/4 in. in accordance with 702.13(a). Exposed edges of curbs shall be beveled or edged. Forms shall be set and maintained true to the lines designated until the concrete is sufficiently hardened or for periods hereinafter specified. Interiors of forms

shall be treated with an approved formulated form coating which allows them to be released without adhering, discoloring, or otherwise damaging the concrete. Form coating materials shall not come in contact with either reinforcing bars or prestressing strands.

Placing and Finishing Cement Concrete

The temperature of the prestressing strands and forms shall be monitored between the time of the application of prestressing force and the placing the concrete. During hot weather, approved means shall be undertaken to cool the forms immediately prior to placing the concrete.

When abutment anchorage set-ups where prestressing strands are anchored to abutments that are independent from the form, thermal adjustments shall be made if the temperature of the prestressing strands at the time of tensioning differs by more than 25˚F from the temperature of the concrete mixture during placement. This requirement will not apply to self-stressing beds.

Void boxes, inserts, and attachments shall be securely fastened to maintain the proper position during concrete placement and consolidation. All voids shall have weep holes or otherwise be vented during beam production until after the initial concrete set, then sealed before the beams are shipped.

Concrete, during and immediately after depositing, shall be consolidated with vibrators and suitable spading tools. Vibration shall be applied at the point of deposit and in the area of freshly deposited concrete. The vibrators used may be internal, external, or a combination of both. Internal vibration shall be of sufficient duration and intensity to consolidate thoroughly but shall not be continued so as to cause segregation. Vibration shall not be continued at any one point so that localized areas of grout are formed.

The entire operation of depositing and consolidating the concrete shall be conducted so that the concrete will be smooth, dense, and free from any honeycomb or pockets of segregated aggregates. The concrete in each HSHPC structural member shall be placed in one continuous operation. The outside vertical faces of fascia high strength concrete structural members and the exposed face and top of the curb section, if applicable, shall be finished in accordance with 702.21. The tops of all beams and the outside faces and bottom flanges of the fascia beams shall be sealed in accordance with 709.

Removal of Forms and Curing

Curing shall be in a suitable enclosure to minimize heat and moisture loss and insulated blankets may be used. The concrete in the form shall be maintained at a minimum temperature of 50˚F during the entire curing cycle. Curing for high strength concrete structural members shall be done by wet curing without supplemental heat or by accelerated curing. During the period of initial set of the high strength concrete structural member and during the accelerated curing by radiant heat, the concrete shall be kept wet by the method outlined below for wet curing without supplemental heat. Side forms may be removed when no distortion, slump, or misalignment of the concrete will result.

Approval shall be obtained before curing is done by any means other than those outlined below.

(a) Wet Curing without Supplemental Heat

When wet curing without supplemental heat is used, the exposed surfaces of the high strength concrete structural members shall be covered by two layers of wet burlap and the burlap shall be kept wet to ensure that free water is present at all times. In lieu of using wet burlap, the Design-Build Contractor

may propose an alternate method which provides a moist environment with free water being present at all times. The Design-Build Contractor shall receive written approval from INDOT prior to using the proposed alternate method. Additional curing of high strength concrete structural members will not be required provided the minimum specified ultimate strength can be obtained.

In high strength concrete structural members, wet curing without supplemental heat shall continue until such time as the compressive strength of the concrete reaches or exceeds the strength specified for transfer of prestress or detensioning. At this point wet curing is considered to have concluded. Detensioning shall be performed after wet curing has concluded, provided the compressive strength of the concrete in the high strength concrete structural member has met or exceeded the required strength for detensioning.

(b) Accelerated Curing

When accelerated curing of the concrete is used, it shall be done by low pressure steam or radiant heat curing. Radiant heat may be applied by means of pipes circulating steam, hot oil or hot water, or by electric heating elements. When steam is used, the jets shall be positioned so that they do not discharge directly on the concrete, forms, or cylinders. The steam shall be at 100% relative humidity to prevent loss of moisture and to provide moisture for proper hydration of the cement.

Except to maintain a minimum concrete temperature of 50°F, heat shall not be applied until the concrete has attained initial set. The time of initial set may be determined by ASTM C403. Once the penetration resistance, as performed in accordance with ASTM C403, equals or exceeds 500 psi accelerated curing may begin. When the initial set is not determined by ASTM C403, the initial application of heat shall be a minimum of 4 h after final concrete placement. When retarders are used and the initial set is not determined by ASTM C403, this time shall be increased to a minimum of 6 h after final concrete placement. Heat shall always be applied at a controlled rate following the initial set of the concrete, and an effective method of retaining the heat and moisture in the concrete shall be used during the entire curing cycle.

During the initial application of radiant heat or live steam, the temperature measured in the concrete shall increase at an average rate not exceeding 36°F/h. The maximum concrete temperature shall not exceed 158°F. A minimum of three time and temperature recording devices capable of recording temperatures in degrees Fahrenheit at intervals not exceeding 15 minutes shall be provided throughout a contiguous form group and common heat source. The time and temperature recording devices shall be located at the portions of the contiguous form group likely to experience the maximum temperatures during curing.

The curing temperature shall be sustained until the concrete has reached the minimum required strength for detensioning the high strength concrete structural members.

As the application of heat is discontinued, the concrete temperature shall decrease at a rate not to exceed 50°F/h. When the concrete temperature has reached 40°F or less above the ambient temperature outside the curing enclosure, accelerated curing is considered to have concluded. Detensioning shall be performed after accelerated curing has concluded, provided the compressive strength of the concrete in the high strength concrete structural member has met or exceeded the required strength for detensioning. A thermometer shall be provided to monitor ambient air temperatures. This thermometer does not need to have recording capabilities.

The time and temperature recording devices shall be used to verify compliance with the heating and cooling rates contained herein.

When multiple high strength concrete structural members are cast in the same bed, all members shall meet or exceed the specified release strength prior to detensioning. Additional curing of high strength concrete structural members will not be required provided the minimum specified ultimate strength can be obtained.

A grinder or other methods that induce minimal amounts of heat into the prestressing strand shall be used to cut off prestressing strands. The ends of the concrete high strength concrete structural member where prestressing strands have been cut to be flush with the end of the member shall be coated with bituminous mastic sealant in accordance with 907.11. All prestressing strands that are exposed and protrude from the end of the beam shall be protected from rusting by use of a spray, brush, or roller-applied rust-inhibiting paint or other material that is not considered detrimental to bonding with concrete.

Handling and Shipping

High strength concrete structural members shall not be subjected to excessive abuse which produces crushing or undue marring of the concrete. All high strength concrete structural members damaged during handling, storing, transporting, or erecting shall be replaced. Unless otherwise approved, high strength concrete structural members shall be handled with a suitable hoisting device provided with a spreader sling. The spreader shall be of sufficient length to prevent horizontal forces being produced in the structural member due to lifting and shall be equipped with leads and hooks at each end. The high strength concrete structural members shall be lifted by the devices shown on the Design Documents. Proposed alternate lifting devices and procedures shall be approved prior to use and shown on the Working Drawings. If any other method of handling is used, it shall be shown on the Working Drawings and approved prior to use. If the method produces horizontal forces in the structural member, sufficient reinforcement shall be added to compensate for them.

The high strength concrete structural members shall remain in an upright position at all times and shall be supported as indicated herein when in storage and during transportation to the construction site.

In storage, all high strength concrete structural members shall be fully supported across their width on battens not less than 4 in. wide with one being placed at each end at the centerline of the bearing. The supports of the structural members while in storage shall be maintained in a level position so no twisting occurs.

During transportation, the high strength concrete structural members shall be supported with truck bolsters or battens no less than 4 in. wide which are padded with no less than 1/2 in. of rubber. The ends of I-beams, U-beams, and bulb-T beams shall extend no more than the depth of the beam and not more than 3.5 ft beyond the supports. The ends of box-beams shall extend no more than 1 1/2 times their depth and not more than 3 feet beyond the supports. The ends of slabs shall extend no more than the depth of the beam beyond the supports. Supports of cantilever beams shall be as shown on the Design Documents. Trucks with double bolsters will be allowed, provided the beams are fully seated on the outer bolsters and the inner bolsters are no more than 8 ft from the ends of the beams. Wood blocks or other suitable material shall be placed under the tie chains to prevent chipping the concrete.

Placing High Strength Concrete Structural Members

Erection of high strength concrete structural members shall commence at the centerline and proceed out to the curb, one member at a time. As each structural member is placed, the transverse tie bars, if shown on the Design Documents, shall be inserted and secured. Any shifting of the structural members shall be done while they are held free of the supports by the hoisting device. The use of a steel pinch bar will not be allowed. High strength concrete structural members shall be set to proper line and grade with uniform bearing on bridge seats, mortar joints, or bearing pads as required on the Design Documents. When required, high strength concrete structural members shall be secured to the pier or bent with dowel rods. Holes for dowels shall be filled with mortar at fixed ends and with crack or joint filler at expansion ends. Longitudinal keyway joints shall be cleaned. A coat of cement mortar shall be scrubbed on the surface. The joint shall be filled with a non-shrinking grout composed of one part portland cement, two parts No. 23 fine aggregate, and an approved non-shrinking additive or a non-shrink, non-metallic cementation grout in accordance with ASTM C1107. All bolts or drains shown on the Design Documents as necessary or desirable to be placed in the concrete shall be placed by the methods and at the locations shown on the Design Documents. Necessary tie rods, tie bolts, and hardware for tying high strength concrete structural members together shall be furnished.

Dowel holes shall not be grouted nor concrete or the forming thereof, be placed in floor slabs, diaphragms, or shear keys prior to receipt of complete documentation of the acceptability of the high strength concrete structural members and bearing pads, including the satisfactory laboratory reports and certifications in accordance with 915.04(e). Neither the high strength concrete structural members, nor the bearings will be considered incorporated into the Work, and neither will be paid for until this documentation is accomplished satisfactorily.

Railing, when required, shall be of the type shown on the Design Documents. The component parts shall be in accordance with 706, unless otherwise indicated on the Design Documents. Other high strength concrete structural members shall be placed in the structure in accordance with the Design Documents and the specifications or special provisions indicated for the type of structure being built.

Cranes or other heavy erection equipment may be operated on the high strength concrete structural members only if approved in writing and if a proposed operating procedure is submitted showing loading, distribution of loads, resulting stresses, and that the design of the high strength concrete structural members is satisfactory to allow. However, such approval shall not relieve the Design-Build Contractor of any damage from this operation.

Basis of Item

Precast prestressed high strength structural members shall be quantified per linear foot for structural member, concrete, of the type and size specified. Structural steel for intermediate diaphragms shall not be quantified.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
707-XXXXX	Structural Member, Concrete, ____, ____ (type, size)	LFT

The following shall be considered incidental to this item:

Conducting a trial batch, high strength concrete, reinforcing bars, elastomeric bearing pads, modifications to bearing pads, bearing beams or bearing assemblies, bearing plates, expanded polystyrene, threaded reinforcing bars, threaded inserts in fascia beams, hex bolts, sealer on the outside face and bottom flange of fascia beams and on the tops of all beams, and other necessary incidentals.

Providing all molds, cylinder identification tags, facilities, labor, and materials necessary to prepare and cure the test specimens.

Removing and replacing prestressing strands due to excessive wire breakage and replacing high strength concrete structural members damaged during handling, storing, transporting or erecting.

All materials, including galvanizing, labor, and equipment necessary for furnishing and installing steel intermediate diaphragms.

Time and temperature recording devices and their monitoring.

Field office and providing the field office items listed herein.

FULL DEPTH PRECAST CONCRETE DECK PANELS

Description

This Work shall consist of furnishing all labor, materials, equipment, and incidentals necessary to fabricate, furnish, erect, and install full-depth, precast concrete deck panels in accordance with 105.03, 707, the Design Documents, and as described herein.

Materials

Materials shall be in accordance with 702.03 and the following:

A. Concrete
   1. Structural concrete for reinforced precast concrete deck panels shall be Alternate Class C with a minimum 28 day f'c = 4,000 psi in accordance with 702 and the Unique Special Provision titled "Alternate Class C Concrete".
   2. Prestressed precast concrete panels shall have a minimum 28 day f'c = 5,000 psi in accordance with 707.
   3. Structural concrete for closure pours shall match the applicable precast elements.

B. Reinforcing bars shall be stainless steel in accordance with the Special Provision titled "Stainless Steel Reinforcing Bars".

C. Vertical Adjusting Hardware
   1. Steel vertical adjusting hardware shall include high strength leveling bolts, steel plates, and heavy hex nuts in accordance with 711.02 and 711.65. Alternate devices may be substituted with approval from INDOT.

D. Embedded Blind Pocket Blockouts
   1. Cold formed rectangular steel tubing shall be in accordance with ASTM A500 Grade B.
   2. Steel top plates shall be in accordance with AASHTO M 270 Grade 36. Higher strength grades of steel may be substituted with approval from INDOT.
   3. The steel assembly shall be fabricated from an alloy listed in Table 1 of the Special Provision titled "Stainless Steel Reinforcing Bars". The surface shall be finished in accordance with the requirements of ASTM A380.
   4. Plastic pipe shall be used for grout ports and vents. Grout ports shall be at least 2 inch diameter and vents shall be at least 0.75 inch diameter.
   5. Optional blockout details may be substituted with approval from INDOT.

E. Lifting Devices
   1. Lifting devices shall be used that can support the required vertical and horizontal forces with the applicable safety factors as specified in the Component Handling and Erection Bracing requirements in the PCI Design Handbook.
   2. Devices used shall have 2.75 inch top cover and 1 inch bottom cover after installation. Partial removal of the device may be required after installation.

F. Structural non-shrink grout shall be used for girder camber strips, shear stud blockouts, keyway blockouts, and other blockouts.
   1. Gray non-shrink grout concrete shall contain no calcium chloride or admixture containing calcium chloride or other

ingredient in sufficient quantity to cause corrosion to reinforcing bars.

2. Quick-setting, rapid strength gain, non-shrink, and high-bond strength grout shall be used in accordance with 702.03.
3. All the requirements of AASHTO T 160 shall be met, with the exception that the Design-Build Contractor-supplied cube molds will remain intact with a top firmly attached throughout the curing period.
4. Further requirements for structural non-shrink grout shall be in accordance with Table 1.

Table 1

Structural Non-Shrink Grout			
***Properties**	**Requirements**	**ASTM**	**AASHTO**
Accelerated Weathering Tested Medium Accepted Weight Loss	<3% White Indiana Road Salt <15% @ 300 Cycles		T161
Compressive Strength	>3,000 psi @ 24 hours >5,000 psi @ 7 days		T106
Accepted Bond Strengths	>1,000 psi @ 24 Hours	C882 as modified by C928 8.5	
Length Change	No expansion after 7 days		T160

* Certified test results from an AASHTO accredited testing laboratory will suffice for acceptance.

G. Prestressing strands shall be in accordance with 707.02 and all post-tensioning hardware, including ducts, anchorage assemblies, grouting ducts, local zone reinforcing bars, all documentation of the operation, and testing shall be in accordance with the Special Provision titled “Post-Tensioning Works”.

H. Shear Connectors
1. Headed anchor studs used for shear connectors shall be in accordance with dimensions shown on the Design Documents or as determined by the Design-Build Contractor using field measurements to provide a minimum 2 in. embedment beyond bottom of panel.
2. Steel used shall be in accordance with AASHTO M 169.
3. Low carbon grade steel suitable for welding shall be used in accordance with ASTM A109 for the caps if steel flux-retaining caps are used.

I. T-Headed reinforcing bars shall consist of deformed rebar with steel plates friction welded to one end of the rebar. The Design-Build Contractor shall use deformed rebar according to ASTM A706, Grade 60. The Design-Build Contractor shall ensure friction welding conforms to the quality control manual and AWS C6.2, Friction Welding of Metals. Headed bars that meet the requirements of ASTM A970 may be substituted. Plate heads for T-headed bars shall be cut from flats of hot-rolled steel according to ASTM A108. An approved chemical anchor system shall be used to develop minimum pullout strength in T-Headed bar anchorage as shown on the Design Documents.

J. Chemical anchor systems for doweled anchors shall be in accordance with 901.05.

K. All miscellaneous steel items permanently cast into structural concrete elements shall be fabricated from an alloy listed in Table 1 of the Special Provision titled "Stainless Steel Reinforcing Bars". The surface shall be finished in accordance with the requirements of ASTM A380.

Submittals

Working Drawings shall be produced by the Design-Build Contractor that supplement the Design Documents to provide information not included in the contract documents and that are required to fabricate, erect, transport, or temporarily support the structure or structural elements in the completion of the Work. If there is a conflict between the Working Drawings and the Design Documents, the Design Documents control.

Detailed shop drawings shall be provided of all fabricated materials.

a. The following shall be included:
   1) Locations and details of all lifting inserts, hardware, or devices.
   2) Type and amount of any additional reinforcing required for lifting.
   3) Locations and details of vertical adjusting hardware. Bolts shall be designed for twice the tributary dead load.
   4) Type and size of longitudinal post-tensioning anchorage assembly, ducts, and local zone reinforcement.
   5) Minimum compressive strength attained before handling the precast elements.
b. Supporting engineering calculations shall be included in accordance with 105.02. Precast panels shall be designed in accordance with the Project Standards. Empirical deck design shall not apply to full depth deck panels.
c. Drawings and calculations shall be sealed by a Registered Professional Engineer in the State of Indiana.

Erection drawings shall be provided for all precast concrete members.

a. The following shall be included:
   1) Crane charts
   2) Crane and pick locations
   3) Cables and lifting equipment
   4) Load distribution
   5) Panel erection and sequence
   6) Sequence used to level panel
   7) Method, equipment, and sequence for forming the camber strips and installing the structural non-shrink grout.
   8) Method of forming closure pours at joints between precast panels.
b. Supporting engineering calculations shall be included.
c. Drawings and calculations shall be sealed by a Registered Professional Engineer in the State of Indiana. Bridge temporary Works shall be designed in accordance with the Project Standards.

Additional calculations shall be provided that include:

a. Local zone reinforcing designed for post-tensioning assembly.
b. Tensile stresses that show both faces do not exceed the modulus of rupture during the handling, fabrication, shipping, and erection of

the panel.

c. Engineering calculations shall be certified as having been checked according to the Design-Build Contractor Quality Management Plan.

Drawing Preparation

a. The Design-Build Contractor shall submit drawings. The following information shall be placed in the title block of each sheet:
   1) INDOT/State Project Designation
   2) INDOT/State Project Name
   3) INDOT/State Structure Number
   4) Design-Build Contractor, Fabricator, or Erector Name
   5) Design-Build Contractor, Fabricator, or Erector Drawing Number
   6) Design-Build Contractor, Fabricator, or Erector Sheet Number
b. Drawings shall be signed and sealed by a Registered Professional Engineer in the State of Indiana.
c. Drawings shall be certified as having been checked according to the Design-Build Contractor Quality Management Plan.

Engineering Calculation Preparation

a. The Design-Build Contractor shall submit calculations. The following information shall be placed in the title block of each sheet:
   1) INDOT/State Project Designation
   2) INDOT/State Project Name
   3) INDOT/State Structure Number
   4) Design-Build Contractor, Fabricator, or Erector Name
   5) Design-Build Contractor, Fabricator, or Erector Drawing Number
   6) Design-Build Contractor, Fabricator, or Erector Sheet Number
b. Calculations shall be signed and sealed by a Registered Professional Engineer in the State of Indiana. The seal shall be placed on the calculation cover sheet.
c. Engineering calculations shall be certified as having been checked according to the Design-Build Contractor Quality Management Plan.

The Design-Build Contractor shall assume the responsibility for faulty detailing or fabrication.

Material Submittals

Structural Non-Shrink Grout

a. A Certificate of Compliance shall be submitted to INDOT in accordance with ITM 804.
b. The proposed method, sequence, and equipment for forming grout voids and installing the structural non-shrink grout shall be submitted to INDOT before beginning installation of structural non-shrink grout.

Concrete testing and submittals shall be in accordance with 702, 704, and 707.

A written plan for handling and storage of precast elements shall be submitted to INDOT as described below for Quality Assurance. Written procedures for repair to defects and breakage of precast elements shall be submitted to INDOT as described below for Quality Assurance.

Fabrication

The Design-Build Contractor shall use a concrete precaster on INDOT's

list of Certified Precast Concrete Producers in accordance with ITM 813.

Concrete shall not be placed in the forms until the placement of all materials in the deck panels has been inspected.

Panels shall be constructed to tolerances as shown below.

Table 2

Variable	**Description**	Tolerance (inch)
A	Length Measured From Control Line	± 3/16
B	Width (Overall)	± 1/4
C	Depth (Overall)	± 3/16
D	Variation From Specified Plan End Squareness or Skew	± 1/4
E	Location of Leveling Bolts	± 1
F	Sweep over Member Length	± 3/8
G	Location of Projecting Reinforcing Measured From a Common Reference Point	± 1/2
H	Local Smoothness of Any Surface	± 1/8 in 10 Feet
I	Location of Blockout for Shear Connectors	± 1/2
J	Location of Post-Tensioning Duct Measured From a Common Reference Point	± 1/8
K	Location of Post-Tensioning Duct Measured From Bottom of Panel at Edge of Panel	± 1/8
L	Erection Elevation Tolerance	± 1/8

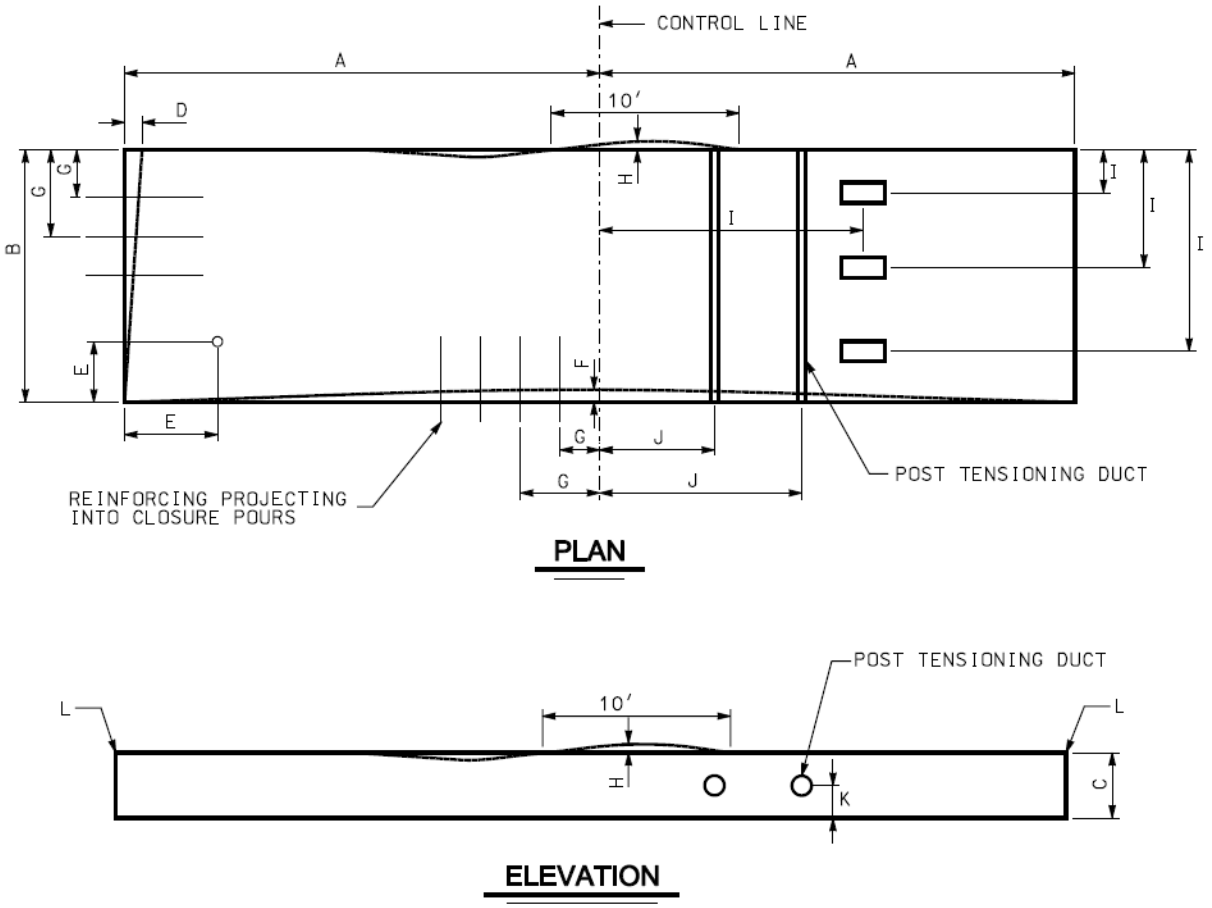


Figure 1

Prestressing shall be performed in accordance with 707. Prestressing strands shall project 2 in. from the end of the panel over beam centerline. During panel erection any individual strand which conflicts with beam stirrups may be mechanically cut the minimal amount sufficient to provide clearance. Only those strands which interfere with panel placement may be cut.

Reinforcing bars and strands in the panel shall have a minimum of 1 in. concrete cover on the bottom of the panel and a minimum of 2 3/4 in. concrete cover on the top of the panel.

The Design-Build Contractor shall be responsible for designing and determining the required number and location of lifting devices. Lifting devices shall be designed and detailed in accordance with the applicable Project Standards.

Finishing and texturing of the precast concrete deck panels shall be in accordance with 702.21, 704.05, and 707.06.

All exposed corners shall be chamfered ¾ in. in accordance with 702.13(a). Precast panels adjacent to closure pours or other panels will not be considered exposed corners.

Each precast unit shall be permanently marked with the date of casting and supplier identification. Markings shall be stamped in fresh concrete.

A minimum compressive strength of 500 psi, or as specified in the shop drawings, shall be maintained before stripping the form.

The deck panels shall be wet cured for 14 consecutive days before placing on the superstructure. Cure shall begin immediately after performing the final finish. The Design-Build Contractor shall wet cure panels by covering all exposed surfaces with wet burlap, cotton mats, or both and plastic sheets. The Design-Build Contractor shall keep the burlap and cotton saturated throughout the wet cure. The precast panels shall have a minimum cure of 28 days prior to placement on the superstructure.

Quality Assurance

Precast Deck Panels

1. Cracking or damage shall be prevented during handling and storage of precast units.
2. Storage and handling shall be designed and detailed in accordance with the applicable Project Standards. The Design-Build Contractor shall be responsible for the handling and storage of panels in such a manner that does not cause undue stress on the panels.
3. Defects and Breakage of Prestressed and Non-stressed Elements
    a. Elements that sustain damage or surface defects during fabrication, handling, storage, hauling, or erection shall be subject to review and rejection.
    b. Proposed repair procedures shall be provided in writing and approval obtained before performing repairs.
    c. Repair work shall reestablish the element's structural integrity, durability, and aesthetics to the satisfaction of INDOT.
    d. The cause of any damage shall be determined, and corrective action shall be taken.
    e. Failure to take corrective action leading to similar repetitive damage shall be cause for rejection of the damaged elements.
    f. Cracks that extend to the nearest reinforcing plane and fine surface cracks that do not extend to the nearest reinforcing plane but are numerous or extensive shall be subject to review and rejection.
    g. Full depth cracking and breakage greater than 12 in. long shall be cause for rejection.
4. All test results shall be documented. The quality control file shall contain at least the following information:
    a. Element identification
    b. Date and time of cast
    c. Concrete cylinder test results
    d. Quantity of used concrete and the batch printout
    e. Form-stripping date and repairs if applicable
    f. Location/number of blockouts and lifting inserts
    g. Temperature and moisture of curing period
    h. Lifting device details, requirements, and inserts

Construction Requirements

Welded Shear Connectors Installation

Welded shear connectors shall be installed at the locations shown on the Design Documents on existing steel girders, new steel girders, and new concrete beams. The Design-Build Contractor may elect to use embedded plates in

prestressed precast concrete structural beams in lieu of stirrups cast and fabricated with the beams.

Shear studs shall be welded to steel girders or plates embedded in prestressed concrete in accordance with AASHTO/AWS D1.5. Studs shall be adjusted as necessary to provide clearance for bolts in existing and new bolted splices. The Design-Build Contractor shall use methods and equipment recommended by the manufacturer of the studs and submitted to INDOT. Studs shall be field welded in accordance with 711.32. Equipment shall be used with adequate capacity for the size of stud welded.

Chemical Epoxy Dowel Anchor Installation

Field drill holes in the top flange of existing concrete and pre-stressed precast concrete beams shall be in accordance with 702.25. The Design-Build Contractor shall locate all internal beam reinforcing before drilling holes and shall avoid drilling through reinforcing bars or prestressing stands.

Anchors shall be installed in accordance with the manufacturer's recommendations.

Precast Concrete Deck Panels Placement

Concrete beams or steel girders shall be fully braced before placing panels.

The precast concrete deck panels shall be placed as shown on the Design Documents. Panels shall not be considered as lateral bracing of supporting structural members.

The grade of the deck panels shall be checked after all deck panels are placed and adjusted to provide the elevations shown on the Design Documents. The grade shall be checked before any post-tensioning of the deck panels, if applicable.

Leveling devices shall be adjusted in the sequence defined in the erection plan to bring panels to the elevations shown on the Design Documents. The Design-Build Contractor shall be responsible for the design of the leveling device based on the weight of the panels and the number of devices.

Shifting of the precast concrete deck panels shall be prevented during the joining of all the deck panels after the proper grade is achieved.

Longitudinal Post-Tensioning

Precast panels shall be cured 28 days before tensioning any post-installed cables or rods, unless otherwise noted on the Design Documents.

All post-tensioning hardware and blockouts required by the Design-Build Contractor’s design shall be designed and shown on the Working Drawings.

All debris shall be cleaned and removed from blockouts.

Shear keyway between panels shall be grouted.

Stressing operations shall not begin until the concrete reaches the strength and age designated on the Design Documents. Strands shall be stressed within 72 hours of transverse joint grouting.

Post-tensioning shall not begin until the shear key grout has attained a compressive strength of 1,000 psi in accordance with the manufacturer’s data.

Strands shall be installed as shown on the Design Documents.

Strand shall be fully tensioned and all ducts shall be grouted in accordance with the Special Provision titled "Post-Tensioning Works". Post-tensioning shall be completed before grouting girder camber strips and shear connector grout pockets.

Installation of T-Headed Reinforcing Bars and Anchors

Installation of T-Headed reinforcing bars and anchors shall be in accordance with 703.

Preparation and Installation of Structural Non-Shrink Grout

All debris from the camber strips and blockouts shall be cleaned and removed before placing the structural non-shrink grout.

Bonding surfaces shall be kept free from laitence, dirt, dust, paint, grease, oil, rust, or any contaminant other than water.

The girder camber strips shall be formed as shown on the Working Drawings after installing shear connectors at the locations shown on the Design Documents.

Grout material installation shall be pre-tested under field conditions in a grout pocket and camber strip mock-up to determine grout flowability and whether subsequent cracking will occur. The mock-up shall include at least two shear connector pockets and a camber strip that is the same configuration as the actual bridge. Once completed INDOT will determine if any corrective action is required. The grouting process shall only proceed at INDOT's direction.

All surfaces receiving structural non-shrink grout shall be saturate surface dry, SSD.

Grout materials shall be mixed and placed in accordance with the manufacturer's recommendations for preparation and installation. Structural non-shrink grout shall be mixed just before use in accordance with the manufacturer's instructions.

The girder camber strips shall be grouted using structural non-shrink grout. Structural non-shrink grout shall be placed in the girder camber strips in a continuous operation within a panel.

The shear stud blockouts shall be grouted using structural non-shrink grout. Structural non-shrink grout in the shear stud blockouts may be placed as part of the placement of the structural non-shrink grout in the girder camber strips.

Voids shall not be allowed in the grout for the girder camber strips and shear stud blockouts.

Construction loads, superimposed dead loads, or live loads shall not be applied to the precast concrete deck panels until the structural non-shrink grout in the shear stud blockouts and the girder camber strips have reached a strength of 1,000 psi based on the manufacturer's published data.

All surface voids shall be filled with non-shrink grout including lifting device blockouts and grout ports.

The top surface of all grouted blockouts and voids shall be textured in accordance with 704 for bridge decks with an overlay.

Structural non-shrink grout shall be cured in accordance with the manufacturer's recommendation. The Design-Build Contractor shall follow the manufacturer's written recommendations on limiting the heat of hydration to levels acceptable by the manufacturer.

Grout shall be finished flush or a maximum of 0.125 in. above adjacent panels. Blockout and void profiles shall be corrected in excess of 0.125 in. higher than the adjacent panel through surface grinding. Blockout and void profiles shall be corrected below the top of the adjacent panels through removing and replacing of the blockout or void at no cost to INDOT.

Deck Grinding

The deck shall be profile ground in accordance with 508.08(c) and 704.05 after all panels are in place, grouting and closure pours are complete, and design strength is achieved. The precast panels shall have a 0.25 in. concrete grinding allowance for correcting uneven roadway surfaces at joints between precast concrete deck panels and end of bridge deck or edge of adjacent phase(s). The deck thickness shown on the Design Documents shall be the nominal or final thickness after grinding. The Design-Build Contractor shall account for the load of the 0.25 in. grinding allowance.

Overlay

An LMC-VE overlay shall then be placed on the completed bridge deck in accordance with 722 and the Design Documents.

Basis of Item

Full Depth Precast Concrete Deck Panels shall be quantified per square foot. Reinforcing bars shall be quantified in accordance with the Special Provision titled "Stainless Steel Reinforcing Bars".

The Items List shall include the following:

Item No.	Item Description	Unit Symbol
704-12408	Precast Concrete Deck Panels.....	SFT

The following shall be considered incidental to this item:

Vertical adjusting hardware, embedded blind pocket blockouts, lifting devices, structural non-shrink grout, prestressing strands, shear connectors, and other necessary incidentals.

POST-TENSIONING WORKS

Description

This Work shall consist of post-tensioning precast or cast-in-place concrete by furnishing, placing, tensioning, and grouting prestressing steel in accordance with details shown on the Design Documents, in accordance with 105.03, 707, and as described herein. It includes prestressing by either the pretensioning or post-tensioning methods or by a combination of these methods.

This Work shall include furnishing and installing any appurtenant items necessary for the particular post-tensioning system to be used, including ducts, anchorage assemblies, post-tensioning strands, grouting ducts, local zone reinforcing bars, all documentation of the operation, and testing.

Materials

Ducts

Duct material shall be corrugated plastic and made from either polyethylene or polypropylene. Ducts shall be embedded in concrete. The minimum acceptable radius of curvature shall be established by the duct supplier according to standard methods. The duct shall have a thickness as shown in Table 1. Ducts shall have a white coating on the outside or shall be of white material with ultraviolet stabilizers added.

Polyethylene duct shall be fabricated from resins meeting or exceeding the requirements of ASTM D3350 with a cell classification of 345464A.

Polypropylene duct shall be fabricated from resins meeting or exceeding the requirements of ASTM D4101 with a cell classification range of PP0340B14541 to PP0340B67884. Resin containing antioxidants with a minimum oxidation induction time, in accordance with ASTM D3895 of not less than 20 minutes shall be used.

Rigid smooth black polyethylene ducts for use where the tendon is not embedded in concrete shall be rigid pipe manufactured from 100% virgin polyethylene resin meeting the requirements of ASTM D3350 with a minimum cell class of 344464C. A resin containing antioxidants with a minimum OIT according to ASTM D3895 of not less than 40 minutes shall be used. The duct shall be manufactured with a dimensional ratio, DR, of 17.0 as established by either ASTM D3350 or ASTM F714 as appropriate for the manufacturing process used.

The duct areas shall be in accordance with Article 5.4.6.2 of the AASHTO LRFD Bridge Design Specifications.

Table 1

Duct Shape	Duct Diameter (inch)	Duct Thickness (inch)
Flat	Any size	0.08
Round	I.D. < 2.375	0.08
Round	2.375 < I.D. < 4.0	0.10
Round	I.D. > 4.0	0.12

A type C certification in accordance with 916 shall be provided for the duct.

Duct Fittings

Coupling and transition fittings for ducts formed by sheathing shall be

polyethylene or polypropylene and shall be air and watertight and of sufficient strength to prevent distortion or displacement of the ducts during concrete placement and tendon grouting.

A type C certification in accordance with 916 shall be provided for the duct fittings.

Inlets, Outlets, Valves and Plugs

Grout inlets, outlets, and threaded plugs shall be made of either ASTM A240 Type 316 stainless steel, nylon, or polyolefin materials. Products made of nylon shall have a cell class of either S-PAO141, weather resistant, S-PA0231, or S-PA0401, with an ultimate strength not less than 10,000 psi with UV stabilizer added, in accordance with ASTM D5989. Products made of polyolefin shall contain antioxidants with a minimum oxidation induction time of not less than 20 minutes in accordance with ASTM D3895.

Inlets, outlets, valves, and plugs shall be designed and tested to resist a minimum pressure of 150 psi. Inlets and outlets shall have a minimum inside diameter of 3/4 in. for multi-strand tendons and 3/8 in. for single-bar or four-strand tendons.

A type C certification in accordance with 916 shall be provided for the inlets, outlets, valves, and plugs.

Permanent Grout Caps

Permanent grout caps shall be made from polymer or ASTM A240 Type 316L stainless steel. The resins used in the polymer shall be nylon, Acrylonitrite Butadiene Styrene (ABS) or polyester. For products made from nylon, the cell class of the nylon according to ASTM D5989 shall be S-PA0141, weather resistant, S-PA0231 or S-PA0401, with an ultimate strength not less than 10,000 psi with UV stabilizer added. The cap shall be sealed with "O" ring seals or precision fitted flat gaskets placed against the bearing plate. A grout vent shall be placed on the top of the cap. Grout caps shall be rated for a minimum pressure rating of 150 psi. ASTM A240 Type 316L stainless steel bolts shall be used to attach the cap to the anchorage.

A type C certification in accordance with 916 shall be provided for the permanent grout caps.

Grout

Grout shall be a cement-based, thixotropic, prebagged grout supplied by a grout manufacturer. The grout shall be prebagged in plastic lined or coated containers, stamped with the date of manufacturer, lot number, and mixing instructions. Materials with a total time from manufacturer to usage shall not exceed six months, and on-site storage shall be limited to one month. Grout materials shall be stored in a weatherproof location, and any grout exposed to excessive moisture which contain clumps shall be rejected. Storage in the open may be allowed by INDOT, in which case a raised platform and adequate waterproof covering shall be provided.

The grout shall be mixed in accordance with the manufacturer's recommendations. The water used in the grout shall be potable, clean, and free of injurious quantities of substances known to be harmful to portland cement or prestressing steel.

Grouts shall achieve a non-bleeding characteristic. Grout shall contain no aluminum powder or gas generating system that produces hydrogen, carbon dioxide, or oxygen. Cementitious grout shall meet or exceed the specified

physical properties stated in 10.9.3 of the AASHTO LRFD Bridge Construction Specifications.

A type B certification in accordance with 916 shall be provided for the prebagged grout. The limits of the physical properties stated in the AASHTO LRFD Bridge Construction Specifications shall be shown on the certification.

Epoxy Grout for Anchorage Protection

The epoxy grout used for encapsulation and protection of post-tensioning anchorages shall be a three component epoxy grout consisting of resin, hardener, and aggregate, with all components supplied by the epoxy grout manufacturer. No additional fillers shall be added. Products shall be delivered in original containers with manufacturer's name, date of manufacture, product identification label and batch numbers. Materials shall be used within the manufacturer's recommended shelf life and shall be stored in full compliance with manufacturer's recommendations. The epoxy grout shall be mixed and installed in accordance with the manufacturer's recommendations.

The epoxy grout system shall meet the following requirements.

Physical Test	Specification	Requirement
Compressive Strength Cubes 7 Day Cure at 77°F	ASTM C 579B	>10,000 psi
Tensile Strength at 7 days	ASTM C 307	>2,100 psi
Flexural Strength at 7 Day Cure at 77°F	ASTM C 580	>3,600 psi
Modulus of Elasticity 7 day Cure at 77°F	ASTM C 580	< 2,100,000 psi
Coefficient of Thermal Expansion at 74 to 210°F	ASTM C 531	< 20 x 10 - 6 in/in/°F
Peak Exotherm, Specimen 12 x 12 x 3 in.	ASTM D 2471	< 150°F
Slant Shear at 7 days (Bond Strength to Concrete)	ASTM C 882	> 3000 psi
Thermal Compatibility	ASTM C 884	5 Cycles Passed
Linear Shrinkage at 7 days	ASTM C 531	0.025%
Flowability and Bearing Area	ASTM C 1339	90% Contact area
Gel Time, Specimen 12 x 12 x 3 in.	ASTM D 2471	< 4 h

A type B certification in accordance with 916 shall be provided for the epoxy grout. The limits of the physical tests shown above shall be shown on the certification.

Elastomeric Coating System

An elastomeric coating system shall be used to provide a waterproof barrier over post-tensioning anchorages or other areas shown on the Design Documents. The components of the coating system shall be supplied by a single manufacturer and sold as a waterproof coating system. The surface preparation and application of the coating system shall be applied in accordance with the manufacturer's specifications.

Upon curing, all coatings and/or coating systems shall produce an adherent coating that is visually uniform and capable of performing according to its designated purpose for a service life greater than 20 years. The composition of the coating shall be at the discretion of the manufacturer, but the finished product shall meet all requirements of this specification. All coatings shall be designed for a marine, coastal environment and shall be self-curing. Coatings that are multi-component shall be prepackaged in required ratios for ease of mixing.

A type C certification in accordance with 916 shall be provided for the elastomeric coating system.

Tendons

Tendons shall be uncoated 7 wire stand and shall be in accordance with 910.01(b) 7.

Anchorage Assemblies and Couplers

Post-tensioning anchorages shall be designed and tested to resist at least 95% of the actual ultimate tensile strength of the prestressing steel, when tested in an unbonded state, without exceeding the anticipated anchor set. Tendon couplers shall not be used unless shown on the Design Documents or approved by INDOT. All embedded portions of the anchorage assembly shall be galvanized in accordance with ASTM A123. All local zone reinforcing required by the design calculations provided in accordance with the Working Drawings shall be epoxy coated and in accordance with section 910.01.

A type C certification in accordance with 916 shall be provided for the anchorage assemblies and couplers.

Material Traceability

Stored and installed post-tensioning system shall be fully traceable to production lots and installation records. The post-tensioning system supplier shall maintain a complete list of all traceability numbers and documentation for materials supplied to the Project. Records kept by Design-Build Contractor shall maintain traceability of stored and installed post-tensioning system materials to specific tendon numbers. Traceability documentation and records shall be formally transferred to INDOT.

Traceability shall be provided for all load-bearing or load-transfer components of the post-tensioning system. Specifically included are the following components/materials: strand, bar, bearing plates, wedge plates, wedges, nuts, couplers, duct, duct couplers, pipe, trumpets, grout tubes, and permanent grout caps. Traceability for miscellaneous installation aids not permanently incorporated in the structure is not required.

Construction Requirements

Personnel Qualifications

The Foremen of each installation and stressing crew shall have a minimum of five years of bridge construction experience with a minimum of two years of

experience in post-tensioning related operations and a minimum of one year as the foreman in responsible charge of post-tensioning related operations. The Foremen shall be certified as PTI Level 1 and 2 Multistrand and Grouted PT Specialist. At least one other member of each installation and stressing crew shall be certified as PTI Level 1 Multistrand and Grouted PT Specialist.

The Foremen of each grouting crew shall have a minimum of five years of bridge construction experience with a minimum of two years of experience in post-tensioning related operations and a minimum of one year as the foreman in responsible charge of post-tensioning related operations. The Foremen and the person operating the grouting and pumping equipment shall each be certified as ASBI Certified Grouting Technicians. At least one other member of each grouting crew shall be certified as having completed the ASBI Grouting Training program.

Working Drawings and Grout Plan

The Design-Build Contractor shall prepare and submit to INDOT Working Drawings and Grout Plan, in accordance with 105.02, for the post-tensioning system proposed for use. Preparation of the post-tensioning Working Drawings and grout plan shall be completed by a Registered Professional Engineer in the State of Indiana with a minimum of five years' experience in post-tensioned concrete. Fabrication or installation of post-tensioning material shall not begin until INDOT has approved the drawings.

The Working Drawings and Grout Plan of the post-tensioning system shall show complete details and substantiating calculations of the method, materials, and equipment the Design-Build Contractor proposes to use in the post-tensioning operations.

The Working Drawings, including stressing calculations, shall be in accordance with section 5.0 of PTI/ASBI M50.3-12 Guide Specification for Grouted Post-Tensioning.

The grouting procedures shall be devised to ensure that the ducts shall be properly filled by grout. These procedures shall cover in detail, the following:

(a) Type, quantity and brand of materials used in grouting, including all certifications required;
(b) Type of equipment needed, including capacity in relation to demand and Working condition, as well as provisions for back-up equipment and spare parts;
(c) Types and locations of inlets and outlets;
(d) Types and sizes of grout hoses and connections;
(e) Duct cleaning methods prior to grouting;
(f) Mixing and pumping procedures;
(g) Direction of grouting;
(h) Sequence of use of the inlets and outlets;
(i) Procedures for handling blockages; and
(j) The names of the persons in charge and the other personnel who will perform the grouting operation, including their relevant experience and skill.

The Design-Build Contractor shall record the progress of the gouting operations for each duct in accordance with section 5.6.7 of PTI M55.1-12 and submit a written report to INDOT within 72 h of grouting.

Working Drawings and Grout Plan shall be submitted in accordance with 105.02.

Construction Hold Points

A hold point is a mandatory verification point that requires the Design-Build Contractor to notify or submit the identified items to INDOT beyond which work shall not proceed until approval is given by INDOT. The following hold points shall apply:

(a) Prior to placement of concrete around the ducts, inspection and approval of the PT ducts, inlets and outlets, anchorage, reinforcing steel, and pre-concreting duct pressure test;
(b) Prior to beginning the installation of PT strand, inspection and approval of the strands, PT duct proving and post-concreting duct pressure testing;
(c) Prior to commencement of grouting operations, inspection and approval of the grouting apparatus and set up, and approval of the stressing records;
(d) Prior to commencement of the preparation and encapsulation of the anchor heads, inspection and approval of grouting.

Duct Placement

Ducts shall be rigidly supported at the proper locations in the forms by ties to reinforcing bars which are adequate to prevent displacement during the concrete placement. Supplementary support bars shall be used where needed to maintain proper alignment of the duct. Hold-down ties to the forms shall be used when the buoyancy of the ducts in the fluid concrete would lift the reinforcing bars. Duct for longitudinal or transverse post-tensioning in the flanges shall be supported at intervals not to exceed ft. Ducts in webs for longitudinal post-tensioning shall be tied to stirrups at intervals not to exceed 2 ft and shall be supported on each side of a duct joint.

Joints between sections of duct shall be coupled with positive connections which do not result in angle changes at the joints and will prevent the intrusion of cement paste.

After placing ducts, reinforcement and forming is complete, an inspection shall be made to locate possible duct damage. All unintentional holes or openings in the duct shall be repaired prior to concrete placing.

Grout openings and vents shall be securely anchored to the duct and to either the forms or to reinforcing bars to prevent displacement during concrete-placing operations. After installation in the forms, the ends of ducts shall at all times be sealed to prevent the entry of water or debris.

Duct Position Tolerances

Tolerances	Vertical Position (inch)	Lateral Position (inch)
Horizontal tendons in slabs or in slab regions of larger members	± 1/4	± 1/2
Longitudinal draped superstructure tendons in webs. Tendon over supports or in middle third of span.	± 1/4	± 1/4
Tendon in middle half of web depth	± 1/2	± 1/4
Longitudinal, generally horizontal, superstructure tendons usually in top or bottom of member	± 1/4	± 1/4
Horizontal tendons in substructure and foundations	± 1/2	± 1/2

	Longitudinal position (inch)	Transverse position (inch)
Vertical tendons in webs	± 1	± 1/4
Vertical tendons in pier shafts	± 1/2	± 1/2

Additionally, the following shall apply:

1. In all other cases, locate tendons within ± 1/4 in. in any direction.
2. Entrance and exit angles of tendon paths at anchorages or at faces of concrete shall be within ±3° of desired angle measured in any direction and any deviations in the alignment are accomplished with smooth transitions without any kinks.
3. Angle changes at duct joints shall not be greater than ±3° in any direction and shall be accomplished with smooth transitions without any kinks.
4. Locate anchorages within ±1/4 in. of desired position laterally and ±1 in. along the tendon except that minimum cover requirements shall be maintained.
5. Position anchorage confinement reinforcing in the form of spirals, multiple U-shaped bars or links, to be properly centered around the duct and to start within 0.5 in. of the back of the main anchor plate.
6. If conflicts exist between the reinforcement and post-tensioning duct, the Design-Build Contractor shall adjust the reinforcing.

Inlets and outlets shall be at least ¾ in. diameter. Connection to ducts shall be made with metallic or plastic structural fasteners. The inlets and outlets shall be mortar tight, taped as necessary, and constructed with either mechanical or shrink wrap connections. Inlets and outlets shall provide means for injection of grout through the vents and for sealing to prevent leakage of grout. Low-point inlets and outlets shall remain open until grouting is started.

All ducts shall be supplied with inlets and outlets at the following locations:

(a) At the anchorage area of the tendon;
(b) At the high points of the duct, when the vertical distance between the highest and lowest point is more than 20 in.;
(c) Where outlets are placed at the high points, at a distance not to exceed 39 in. in both directions from the high-point outlets;
(d) An inlet shall be placed at or near the lowest point of a tendon;
(e) Outlets shall be placed at all low points, and shall be free draining;
(f) At major changes in the cross section of the duct, such as couplers and anchorages; and
(g) At other locations shown on the Design Documents.

After the ducts have been placed, the openings at the ends of the ducts shall be sealed to prevent the entry of moisture.

Pre-Concreting Duct Pressure Test

Prior to testing, inlets, outlets, and drains shall either be capped or have their shut-off valves closed. The Design-Build Contractor shall pressurize the completed duct assembly to an air pressure of 5 psi and lock off the outside air source and inspect for leaks. The Design-Build Contractor shall monitor and measure the pressure maintained within the closed assembly. Locations of leakage shall be identified, repaired, or reconstructed, and the repaired

reassembled duct system retested. The cycle of testing, repair, and retesting of each completed duct assembly shall continue until the completed duct assembly completes a one minute test with a maximum pressure loss of 2 psi.

Proving of Post-Tensioning Ducts

Upon completion of concrete placement, the Design-Build Contractor shall prove that the post-tensioning ducts are free and clear of any obstructions or damage and are able to accept the post-tensioning tendons by passing a torpedo through the ducts. The torpedo shall have the same cross-sectional shape as the duct, and be 1/4 in. smaller all around than the clear nominal dimensions of the duct. For straight ducts, a torpedo at least 2 ft long shall be used. For curved ducts, the length shall be determined so that when both ends touch the outermost wall of the duct, the torpedo is ¼ in. clear of the innermost wall. If the torpedo will not travel completely through the duct, the member shall be rejected unless a workable repair is approved by INDOT.

Post-Concreting Duct Pressure Test

Before placing the strands, install all grout caps, inlets and outlets and test the tendon with compressed air to determine if duct connections require repair. In the presence of INDOT, pressure the tendon to 50 psi and lock-off the outside air source. Record the pressure loss for 1 minute. A pressure loss of up to and including 25 psi is acceptable for tendons having a length of equal to or less than 150 ft and a pressure loss of up to and including 15 psi is acceptable for tendons longer than 150 ft. If the pressure loss exceeds the allowable, repair the leaking connections using methods approved by INDOT and retest.

Placement of PT Strands

Post-tensioning steel shall not be removed from its protective packaging until immediately prior to installation in the forms and placement of concrete. Openings in the packaging shall be resealed as necessary to protect the unused steel.

The Design-Build Contractor shall demonstrate to the satisfaction of INDOT that the ducts are free of water and debris immediately prior to installation of the steel.

Anchorage devices or block-out templates for anchorages shall be set so that their axis coincides with the axis of the tendon and anchor plates are normal in all directions to the tendon.

After tendons are placed in ducts, the openings at the ends of the ducts shall be sealed to prevent the entry of moisture.

Tendons shall be grouted within 15 days of placement.

In Place Friction Test

A minimum of one tendon in each tendon group type shall tested for in place friction. Tendon group types include cantilever tendons, continuity tendons, draped external tendons, or continuous profiled tendons passing through one or more spans. The selected tendon shall represent the size and length of the group of tendons being tested. The in-place friction test is not required for straight tendons used in flat slabs.

The test procedure shall consist of stressing the tendon at an anchor assembly with a load cell or a second certified jack at the dead end. The test specimen shall be stressed to 80% of ultimate tendon strength in eight equal

increments. For each increment, the gauge pressure, elongations and load cell force shall be recorded. The test shall account for any wedge seating in both the live end (i.e., back of jack) and the dead end (i.e., back of load cell) and any friction within the anchorages, wedge plates and jack as a result of slight deviations of the strands through these assemblies. For long tendons requiring multiple jack pulls with intermediate temporary anchoring, an accurate account of the elongation at the jacking end allowing for intermediate wedge seating and slip of the jack's wedges shall be kept.

If the elongation's fall outside a ± 5% range compared to the anticipated elongations based on expected friction coefficients, the reason shall be investigated and detailed calculations confirming the final tendon forces are in agreement with the requirements of the released-for-construction drawings shall be submitted to INDOT.

Significant shortfall in elongations may indicate poor duct alignment and/or obstructions. Such elongations shall be corrected or compensated for in a manner acceptable to INDOT.

One successful friction test for each tendon group in each structure will be required.

If there are irreconcilable differences between forces and elongations, or other difficulties during the course of routine stressing operations, INDOT may require additional in place friction tests.

The apparatus and methods used to perform the test shall be submitted to INDOT.

Tensioning

Tendons shall be tensioned by hydraulic jacks to produce the forces shown on the Design Documents or on the approved Working Drawings with appropriate allowances for all losses. Losses to be provided for shall be as specified in Articles 5.9.3 of the AASHTO LRFD Bridge Design Specifications, 8th Edition. The losses shall also include the anchor set loss appropriate for the anchorage system employed.

The strand stress prior to seating and immediately following shall not exceed the values allowed in Article 5.9.2 of the AASHTO LRFD Bridge Design Specifications, 8th Edition.

Prior to tensioning any member, the Design-Build Contractor shall demonstrate to the satisfaction of INDOT that the tendons are free and unbonded in the duct.

All strands in each tendon, except for those in flat ducts with not more than four strands, shall be stressed simultaneously with a multi-strand jack.

Except as provided herein or when specified on the Design Documents or on the approved Working Drawings, tendons in continuous post-tensioned members shall be tensioned by jacking at each end of the tendon.

Individual wire failures may be accepted by INDOT, provided not more than one wire in a strand is broken and the area of the broken wires does not exceed 2% of the total area of the post-tensioning steel in the member.

Prestressing Equipment

Hydraulic jacks used to stress tendons shall be capable of providing and

sustaining the necessary forces and shall be equipped with either a pressure gage or a load cell for determining the jacking stress. The jacking shall provide an independent means by which the tendon elongation can be measured. The pressure gauge shall have an accurately reading dial at least 6 in. in diameter or a digital display, and each jack and its gage shall be calibrated as a unit with the cylinder extension in the approximate position that it will be at final jacking force, and shall be accompanied by a certified calibration chart or curve. The load cell shall be calibrated and shall be provided with an indicator by means of which the prestressing force in the tendon may be determined. The range of the load cell shall be such that the lower 10% of the manufacturer's rated capacity will not be used in determining the jacking stress. When approved by INDOT, calibrated proving rings may be used in lieu of load cells.

Recalibration of gages shall be done at least annually and whenever gage pressure and elongations indicate materially different stresses. Certified calibration charts and curved shall be submitted to INDOT prior to stressing.

Measurement of Stress

A record of gauge pressures and tendon elongations for each tendon shall be provided by the Design-Build Contractor to INDOT. Elongations shall be measured to an accuracy of 0.0625 inch. Stressing tails of post-tensioned tendons shall not be cut off until the stressing records have been approved.

The stress in tendons during tensioning shall be determined by the gage or load-cell readings and shall be verified with the measured elongations. Calculations of anticipated elongations shall utilize the modulus of elasticity, based on nominal area, as furnished by the manufacturer for the lot of steel being tensioned.

All tendons shall be tensioned to a preliminary force as necessary to eliminate any take-up in the tensioning system before elongation readings are started. This preliminary force shall be between 5% and 25% of the final jacking force. The initial force shall be measured by a dynamometer or by other approved method, so that its amount can be used as a check against elongation as computed and as measured. Each strand shall be marked prior to final stressing to allow measurement of elongation and to ensure that all anchor wedges are set properly.

It is anticipated that there may be discrepancy in indicated stress between jack gauge pressure and elongation. When a discrepancy between gauge pressure and elongation is greater than 5% in tendons greater than 50 ft long or 7% in tendons 50 ft or less, the source of the error shall be determined and corrected before proceeding.

Record of Stressing Operation

A record of the following post-tensioning operations shall be kept for each tendon installed:

1. Project contract number, structure number, and beam line identification,
2. Design-Build Contractor and foreman names,
3. Tendon location, size, and type,
4. Date and time of initial installation,
5. Complete strand identification and data,
6. Assumed and actual cross-sectional area;
7. Assumed and actual modulus of elasticity,
8. Date and time stressing completed,
9. Jack and gage numbers per end of tendon,
10. Required jacking force,
11. Gage pressures at 20%, 40%, 60%, and 100% of the jacking force,

12. Charting of anticipated and actual elongations at 20%, 40%, 60%, and 100% of the jacking force,
13. Anticipated and actual anchor sets,
14. Stressing sequence,
15. Stressing mode indicating which end or ends of the tendon were stressed,
16. Witnesses, crew and inspector names,
17. Date grouted, days from stressing to grouting, grouting pressure applied, and injection locations, and
18. Record of any relevant information including problems encountered and resolution, pourback and bitumastic dates.

INDOT shall be provided with a complete copy of all stressing operations and the jack calibration forms.

Within 4 h after stressing and prior to grouting, tendons shall be protected against corrosion or harmful effects of debris by temporarily plugging or sealing all openings and vents.

Grouting Equipment

The pump shall be a positive displacement type and be able to produce an outlet pressure of at least 0.150 ksi. The pump shall have seals adequate to prevent introduction of oil, air, or other foreign substances into the grout, and to prevent loss of grout or water.

A pressure gauge having a full-scale reading of no greater than 0.300 ksi shall be placed at some point in the grout line between the pump outlet and duct inlet.

The grouting equipment shall contain a screen having clear opening of 1/8 in. maximum size to screen the grout prior to its introduction into the grout pump.

The grouting equipment shall utilize gravity feed to the pump inlet from a hopper attached to and directly over it. The hopper shall be kept at least partially full of grout at all times during the pumping operation to prevent air from being drawn into the post-tensioning duct.

The grouting equipment shall be capable of continuously grouting the largest tendon in the Project in no more than 20 minutes.

The group machinery shall have a mixing tank with a high-speed shear colloidal mixer, a holding tank with an agitator, and a circulation system allowing the grout from the holding tank to be moved back to the mixing tank. The placing pump shall have exact pressure control capabilities and shall be fed by gravity from the holding tank.

Mixing of Grout

A chloride ion test shall be performed prior to adding water.

Water shall be added to the mixer first followed by cement grout. Grout shall be mixed in accordance with the manufacturer’s instructions using a colloidal mixer to obtain a homogeneous mixture. The accuracy of the batching shall be ±1% for the mixing water. A fluidity test shall be performed on the mixed grout prior to beginning the injection process. Target flow rates as a function of mixer type used and ambient temperature shall be obtained from the grout manufacturer. The grouting process shall not be started until proper grout properties have been obtained.

The grout shall be used within 30 minutes of the first addition of water. Water shall not be added to increase flowability which has been decreased by delayed use of the grout.

Grout Testing

1. Chloride Ion Test. One test per 40,000 lb of material before the addition of water shall be completed. A minimum of one test on mixed grout per project shall be completed. The test shall be in accordance with AASHTO LRFD Bridge Construction Specifications, 4th Edition, table 10.9.3-2.
2. Pressure Bleeding Test. One test per day shall be completed. The sample shall be taken at the mixer. The test shall be in accordance with AASHTO LRFD Bridge Construction Specifications, 4th Edition, table 10.9.3-2.
3. Mud balance tests. A minimum of two tests per day shall be completed. Additional tests shall be completed when there is a visual or apparent change in the characteristics of the grout at the mixer and the grout at the duct outlet. The test shall be in accordance with ANSI/API Mud Balance Test, Section 4.4.8. The acceptable range of wet density shall be established for the optimized grout using the minimum and maximum water dosage per this specification and the grout manufacturer's recommendations.
4. Strength test. A minimum of one test per day shall be completed. The test shall be in accordance with AASHTO LRFD Bridge Construction Specifications, 4th Edition, table 10.9.3-2.
5. Fluidity Tests. One test at the mixer and one test at the duct outlet shall be performed every 2 h of grouting operations for each duct. The test shall be in accordance with AASHTO LRFD Bridge Construction Specifications, 4th Edition, table 10.9.3-2. In addition to the requirements given in the aforementioned table, the efflux time shall be within 5 seconds of the values established during laboratory testing.

Grout tests performed by the Design-Build Contractor will be monitored by INDOT.

Injection of Grout

All grout vents shall be opened before grouting starts. Injection and ejection vents with positive shut-offs shall be provided. Grout shall be injected from near the lowest end of the tendons in an uphill direction while maintaining a continuous one-way flow. Grout shall be allowed to flow from the first injection vent until any entrapped air has been removed prior to closing that vent. Remaining vents shall be closed in sequence in the same manner. A continuous flow of grout at a rate between 17 and 50 ft of duct per minute shall be maintained. The flow rate of grout shall be slow enough to avoid air entrapment and segregation of the grout and ensure complete filling of the duct.

The method of injecting grout shall ensure complete filling of the ducts and complete surrounding of the tendon or bar with grout. Grout shall be pumped through the duct and flow continuously at the first outlet after the inlet, until no visible slugs water or air are ejected and consistency of the grout is equivalent to that of the grout injected, at which time the outlet shall be closed.

All outlets shall be closed in a similar manner one after another in the direction of the flow except that at intermediate crests; outlets placed a short distance downstream of the crest shall be closed before their associated crest outlet.

The pumping pressure at the injection vent shall not exceed 150 psi.

Normal operations shall be performed at approximately 75 psi. If the actual grouting pressure exceeds the maximum allowed, the injection vent shall be closed and the grout shall be injected at the next vent that has been, or is ready to be closed, as long as a one-way flow is maintained. Grout shall not be injected into a succeeding vent from which grout has not yet flowed.

Grout shall be pumped through the duct and continuously wasted at the ejection vent until no visible signs of bleed water or air are ejected. A fluidity test shall be performed on each tendon.

The inlets shall be sealed off under pressure once the post tensioning duct is completely filled and all outlets have been closed. All vent, inlet and outlet tubes shall be elevated above the level of the tendon to where they are connected until the grout has hardened to help capture any entrapped air or bleed water.

The duct shall not be flushed with water under any circumstance such as, but not limited to, the removal of corrosion inhibitor and the clearing of a blockage.

Temperature

The temperature of the grout shall be 40°F or higher for three consecutive days from the time of grouting or until job-cured 2 in. cubes of grout reach a minimum compressive strength of 800 psi. Grouting shall only be performed when the ambient temperature is 40°F or higher and is not to fall below 40°F for the following three days. Grout shall not be above 90° during mixing or pumping.

Post-Grouting Inspection

All inspections shall be performed in the presence of INDOT. Valves, caps and pipes at inlets and outlets shall not be removed or opened until the grout has set and cured for a minimum of 24 h. Also, the filled ducts shall not be subject to shock or vibration, nor shall any falsework be removed, within 24 h of grouting. Within 72 h of grouting, all inlets and outlets shall be opened to facilitate inspection. Inspection of the gout shall be performed within 1 h of opening the inlets and outlets.

All inlets, outlets, and anchorages shall be inspected to ensure complete filling with grout. Drilling equipment shall be capable of automatic shut-off when steel is encountered. All inlets and outlets shall be capped and sealed within 1 h of the completion of inspection.

Vacuum-grouting, when necessary, shall be completed within 120 h of inspection.

Frequency of Inspection

For longitudinal superstructure post tensioning ducts:

1. All inlets and outlets at anchors and post tensioning duct high points shall be inspected by drilling and probing with an endoscope to detect defects.
2. For bridges with more than 20 post tensioning ducts but where no duct is longer than 150 ft, all inlets and outlets at anchors and post tensioning duct high points shall be inspected by drilling and probing with an endoscope or probe until no defects are found in 20 consecutive post tensioning ducts. Thereafter, inspection may be reduced by 50%. If a defect is found, then the last five post tensioning ducts grouted shall be inspected and the next 20 consecutive post tensioning ducts shall be inspected before once again reducing frequency of inspection

to 50% if no voids are found. This cycle shall continue throughout all post tensioning duct grouting operations.

Drilled inspection holes that do not encounter voids shall be filled with grout or epoxy using an injection tube extending to the bottom of the drilled hole.

Incomplete Grouting

When any post tensioning duct grouting operation has been prematurely terminated before the ducts could be completely filled with grout, the post tensioning ducts shall be drilled into and explored for voided areas using an endoscope to determine the extent and volume of voids. Grout inlets and outlets shall be installed and the voids filled using volumetric measuring vacuum grouting equipment.

Vacuum grouting equipment shall include a device for measuring the volume of the voids so that the amount of grout injected can be checked against the anticipated amounts in order to give some assurance that the voids have been filled.

Unless otherwise approved by INDOT, grout for vacuum grouting shall be the same as that used to grout the post tensioning ducts.

Grouting Report

A report on post tensioning duct grouting, inspection, vacuum grouting and sealing shall be provided from the Design-Build Contractor to INDOT within 72 h of completing sealing. The post tensioning duct grouting report shall include the following:

1. Project contract number and structure number;
2. Identification of the post tensioning duct;
3. Date tendon was stressed;
4. Date grouted, including start and completion times;
5. Grout manufacturer name, lot number and bag number;
6. Number of days from stressing to grouting;
7. Type of grout;
8. Post tensioning ducts grouted in same grouting operation;
9. Injection end;
10. Applied grouting pressure;
11. Ratio of actual to theoretical quantity of grout;
12. Summary of any problems with grouting and corrective action taken;
13. Date of filling voids by vacuum grouting;
14. Estimated volume of voids measured during vacuum grouting process;
15. Quantity of grout injected by vacuum grouting;
16. Summary of any problems with vacuum grouting and corrective action taken;
17. Confirmation and date of sealing of inlets and outlets; and
18. Type of epoxy used to fill recesses containing sealed inlets and outlets.

Protection of Anchorages

The anchorages of post-tensioning bars and tendons shall be protected within seven days of the completion of grouting, and in accordance with section 14.0 of PTI/ASBI M50.3-12 Guide Specification for Grouted Post-Tensioning. All blockouts shall be filled with epoxy grout with material properties in accordance with this specification. The application of the elastomeric coating may be delayed by up to 45 days if approved by INDOT. Substrate pulloff testing in accordance with ASTM C1583/C1583M shall be performed prior to installation of the epoxy grout. The test will be considered passing if the bond is capable of resisting at least 175 psi.

Basis of Item

The completed and accepted post-tensioned tendons shall be quantified by the lump sum.

The items list shall include the following:

Item No.	Item Description	Unit Symbol
707-01065	Post-Tensioning	LS

The following shall be considered incidental to this item:

Furnishing and stressing all temporary and permanent tendons, anchorage assemblies not embedded in the concrete, ducts and ducts supports not embedded in the concrete, steel deviation pipes, grouting, reinforcing bars required to resist local stresses imposed in the concrete by anchorage devices, anchorage protection, furnishing samples of materials and devices, testing of post-tensioning tendons, and for all labor, materials, tools, equipment and incidentals necessary for completing the Work in accordance with these Specifications.

Description

This Work shall consist of manufacturing, storing, transporting and assembling prefabricated substructure and superstructure elements and modular systems, specifically intended for accelerated bridge construction applications, including decked precast prestressed beams, decked steel girder modules, end bents and wings, pier columns and caps, and precast concrete bridge barriers herein referred to as elements or modular systems in accordance with 105.03, the Design Documents, and as described herein.

Materials

Materials used for prefabricated elements and modular systems, closure pours, and connections shall conform to the requirements of the Project Standards, the Technical Provisions, and as described herein.

1. Concrete
   Concrete shall be in accordance with 702 and 707. Structural concrete for precast deck elements shall be Alternate Class C in accordance with the Unique Special Provision titled "Alternate Class C Concrete".

2. Steel
   Reinforcing bars, prestressing strand, and structural steel shall be in accordance with 703, 707, 711, and the Technical Provisions. Design-Build Contractor shall galvanize all miscellaneous structural steel items permanently cast into structural concrete elements in accordance with AASHTO M111. Corrugated steel pipe shall conform to AASHTO M36 or AASHTO M245.

3. Closure Pours
   a. High early strength self-consolidating concrete, SCC: A unique special provision and mix designs for substructure closure pours and pile pockets, as shown on the Design Documents, shall be submitted for review and approval.
   b. High early strength ultra-high performance concrete, UHPC: A mix design for superstructure closure pours, as shown on Design Documents, shall be submitted in accordance with the unique special provision for Ultra-High Performance Concrete.

4. Grout
   A structural non-shrink grout shall be applied at all pier column joints to ensure uniform bearing, as shown on the Design Documents. Grout shall be high-performance structural non-shrink grout that has low-permeability, quick-setting, rapid strength gain, and high-bond strength. Design-Build Contractor shall mix grout just prior to use according to the manufacturer's instructions. Design-Build Contractor shall follow the manufacturer's recommendation for dosage of corrosion inhibitor admixture. Design-Build Contractor shall use structural non-shrink grout that meets a minimum compressive strength of 4,000 psi within 24 h when tested as specified in AASHTO T106. The grout shall be pre-packaged, commercially available, and approved by INDOT prior to use.

5. Couplers
   Where shown on the Design Documents, Design-Build Contractor shall use grouted splice couplers to join precast substructure elements or modular systems. Design-Build Contractor shall provide couplers using high strength cementitious grout placed inside a steel casting. Design-

Build Contractor shall use grouted splice couplers that can provide 100% of the specified minimum tensile strength of the connecting Grade 60 reinforcing bar. This equates to 90 ksi for reinforcing conforming to ASTM A615 and 80ksi for reinforcing conforming to ASTM A706. The following reinforcing splice couplers are acceptable for use provided the requirements of this specification are met:

NMB Splice Sleeve
Splice Sleeve North America, Inc.
192 Technology Drive, Suite J
Irvine, CA 92618-2409

Sleeve-Lock Grout Sleeve System
Dayton Superior
Corporate Headquarters
7777 Washington Village Drive, Suite 130
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6. Lifting Devices
Design-Build Contractor shall use lifting devices that can support the required vertical and horizontal forces with the applicable safety factors according to the Component Handling and Erection Bracing requirements in the PCI Design Handbook. In the approach slabs, the Contractor shall use a device that has 2¾ in. top cover and 1 in. bottom cover after installation. This may require partial removal of the device after installation.

Design Requirements

Design of the prefabricated bridge elements and modular systems shall consider the final in-service condition and construction loading, including the means of construction. Design consideration shall be given to loading due to construction conditions for transportation, support on blocking, and unique one-time demands during erection. Accelerated bridge construction details for construction methods such as suggested erection sequence and details to facilitate the anticipated construction methods such as lifting lugs or similar shall be included on the Design Documents and Working Drawings.

Construction Requirements

Design-Build Contractor shall design and construct temporary structures, falsework, or specialized equipment required to construct the bridge.

Design-Build Contractor shall construct the bridge in an undamaged condition with correct geometry accounting for built-in dead load stresses and erection stresses consistent with the design.

Design-Build Contractor shall perform all construction operations in accordance with the Project Standards.

Inspection

Two phases of inspection will be implemented by INDOT for accelerated bridge construction. Fabrication inspection will monitor the fabrication operations in the shop or at the site casting facility to verify the quality of the physical elements or modular systems to be used in the bridge construction.

Materials, quality of workmanship, shop operations and geometry will be addressed for the fabrication inspection process. Field inspection will verify the proposed erection methods are executed in the field and the final in-place bridge elements or modular systems are in accordance with the Design Documents, Project Standards, and Technical Provisions. Specific Design-Build Contractor means-and-methods will be reviewed to ensure the Design-Build Contractor's methodology conforms to the design requirements or addresses deviations from the design.

Fabrication

Fabrication shall be performed in accordance with 707.

The Design-Build Contractor shall use a concrete precaster on INDOT's list of Certified Precast Concrete Producers in accordance with ITM-813.
The prefabrication of prestressed concrete elements and modular systems shall be done at a precast concrete manufacturing plant. All precast products used in the bridge elements and modular systems shall be fabricated by the same precast plant, unless approved by INDOT. The prefabrication of non-prestressed concrete elements and modular systems may be done at a temporary site casting facility.

Design-Build Contractor shall not place concrete in the forms until INDOT has inspected the form and has approved all materials in the precast elements and the placement of the materials in the form.

Decked girder systems shall be supported at the bearing points during deck casting operations and storage. Shored construction is not allowed. Design Documents shall include a completed table of anticipated deflections. The deflection control shall be checked prior to pouring and monitored throughout the pouring process.

Prefabricated superstructure spans shall be pre-assembled to ensure proper match between modules to the satisfaction of INDOT before shipping to the Site. The procedure for leveling any differential camber shall be established during the pre-assembly and approved by INDOT. The modules shall be matched as closely as possible for camber and shall be match-marked. Dimensions shall be provided by the Design-Build Contactor for setting precast substructure elevations.

The modules shall be measured for sweep and the bearing anchor bolt locations reconfigured as needed. Anchor bolts may be cast into the precast pier cap or, at the Design-Build Contractor's option, the pier cap fabricated with preformed oversized holes and the anchor bolts grouted into the precast pier cap.

Fabrication tolerances shall be in accordance with standard precast practice. PCI MNL-116 Manual for Quality Control for Plants and Production of Precast and Prestressed Concrete Production or PCI MNL-135-00 Tolerance Manual for Precast and Prestressed Concrete Construction shall be used for more detailed tolerances for precast elements.

Design-Build Contractor shall construct modules to the following minimum tolerances unless noted otherwise:

- Deck surfaces shall meet a 1/8 in. in 10-ft straightedge requirement in longitudinal and transverse directions.
- Control of camber during fabrication shall be required to achieve ride quality. Differences in camber between adjacent modules shall not exceed ¼ in. at the time of erection. Design-Build Contractor

shall establish the differential camber by pre-assembling the modules as required herein.

- Design-Build Contractor shall ensure beam seat bearing areas are flat and perpendicular transversely to the vertical axis of the beam.

Yard Assembly

Design-Build Contractor shall ensure the prefabricated elements will fit-up and align properly before shipping from the precast facility. Each superstructure and substructure composed of prefabricated elements shall be assembled in the yard prior to shipping the elements to the Site to perform such verification. Design-Build Contractor shall use blocking to simulate the support of the elements and the spacing between the elements. Design-Build Contractor shall verify the construction of all element units in compliance with the Design Documents and Working Drawings. All connections shall be dry fit in the fabrication yard prior to installation of the elements at the Site.

Submittals

Working Drawings

Design-Build Contractor shall prepare and submit Working Drawings and all other necessary shop details for review and approval in accordance with 105.02 and the requirements of the PPA Documents. Working Drawings shall be signed and sealed by a Registered Professional Engineer. Design-Build Contractor shall submit the Working Drawings at least 60 days before fabrication. Fabrication shall not begin until written approval of the submitted Working Drawings has been received from INDOT. Deviations from the approved Working Drawings will not be allowed without written approval of INDOT.

Working Drawings shall include at least the following:

- Location and details of all lifting inserts, hardware, or devices including supporting calculations, type, and amount of any additional reinforcing bars required for lifting. Lifting devices shall be placed to avoid being visible once the prefabricated element is placed or should be detailed with recessed pockets that can be patched after installation.
- Description of method of curing, handling, storing, transporting and erecting the sections.
- Supporting calculations regarding transport and erection loads and stresses.
- Any leveling inserts in the deck and include the leveling procedure for modules.
- Details of vertical elevation adjusting hardware.
- Minimum compressive strength attained for all precast concrete prior to handling the modules.
- Details of structural steel, shear connectors and bearing assemblies as well as elastomeric bearing pads.
- Quantities for each section, concrete volume, reinforcing bar weight and total section weight.

Design-Build Contractor shall not order materials or begin Work until receiving final approval of the Working Drawings. INDOT may reject any element or module fabricated before receiving written approval or outside of specified tolerances. Design-Build Contractor shall be responsible for faulty detailing or fabrication.

Assembly Plan

Design-Build Contractor shall prepare an assembly plan that is prepared and signed and sealed by a Registered Professional Engineer. Design-Build Contractor shall submit for review and approval at least 60 days prior to fabrication.

The assembly plan shall include at least the following:

- A work area plan, depicting all utilities overhead and below the work area, drainage inlet structures, and protective measures.
- Details of all equipment that will be employed for the assembly of the superstructure, substructure and approach slabs.
- Details of all equipment to be used to lift modules including cranes, excavators, lifting slings, sling hooks, and jacks. Include crane locations, operation radii, and lifting calculations.
- Computations to indicate the magnitude of stress in the prefabricated components during erection are within allowable limits and to demonstrate that all of the erection equipment has adequate capacity for the Work to be performed.
- Detailed sequence of construction and a CPM schedule for all operations. Account for setting and cure time for any grouts and concrete closure pours, splice couplers and fill of pile pockets.
- Methods of providing temporary support of the elements. Include methods of adjusting, bracing and securing the element after placement.
- Procedures for controlling tolerance limits.
- Methods for leveling any differential camber between adjacent modules prior to placing closure pour.
- Methods of forming closure pours, fill concrete and sealing lifting holes.
- Methods for curing grout, closure pour, and lifting hole concrete.
- Implementation of the Next Generation Concrete Surface special provision to achieve deck profile and longitudinal grooving.
- A list of personnel that will be responsible for the grouting of the reinforcing splice couplers. Include proof of completion of two successful installations within the last two years. Training of new personnel within three months prior to installation by a manufacturer's technical representative is an acceptable substitution for this experience. In this case, provide proof of training.

Quality Assurance

When precast members are manufactured in established casting yards, Design-Build Contractor and manufacturer shall be responsible for the continuous monitoring of the quality of all materials and concrete strengths. Tests shall be performed in accordance with AASHTO or ASTM methods. INDOT shall be allowed to observe all sampling and testing and the results of all tests shall be made available to INDOT.

INDOT will inspect the fabrication of the members for quality assurance. This inspection will include the examination of materials, work procedures, and the final fabricated product. Design-Build Contractor shall provide Notice at least 14 days prior to the scheduled start of casting on any member or test section. Design-Build Contractor and fabricator shall fully cooperate with INDOT in the inspection of the Work in progress. Design-Build Contractor and fabricator shall allow INDOT unrestricted access to the necessary areas of the shop or site casting yard during work hours.

Design-Build Contractor shall permanently mark each module with date of fabrication, supplier identification and module identification. Design-Build Contractor shall stamp markings in fresh concrete.

Design-Build Contractor shall prevent cracking or damage of precast components during handling and storage.

Design-Build Contractor shall replace defects and breakage of precast concrete members according to the following:

- Modules that sustain concrete damage or surface defects during fabrication, handling, storage, hauling, or erection are subject to review or rejection.
- Obtain approval before performing concrete repairs.
- Concrete repair work shall reestablish the module's structural integrity, durability, and aesthetics to the satisfaction of INDOT.
- Determine the cause when damage occurs and take corrective action.
- Failure to take corrective action, leading to similar repetitive damage, can be cause for rejection of the damaged module.
- Cracks that extend to the nearest reinforcing bar plane and fine surface cracks that do not extend to the nearest reinforcing bar plane but are numerous or extensive are subject to review and rejection.
- Full depth cracking and breakage greater than 1 ft are cause for rejection.

Modules will be rejected for any of the following reasons:

- Fabrication not in conformance with the Design Documents and Working Drawings.
- Full depth cracking of concrete and concrete breakage that is not repairable to 100% conformance to the actual product.
- Camber that does not meet the requirements required by the Design Documents and Working Drawings.
- Honeycombed texture.
- Dimensions not within the allowable tolerances specified in the Design Documents, Working Drawings, and Project Standards.
- Defects that indicate concrete proportioning, mixing and molding not conforming to the Project Standards.
- Damaged ends, preventing satisfactory joint.
- Damage during transportation, erection, or construction determined to be significant by INDOT.

Design-Build Contractor shall document all test results for structural concrete. The quality control file shall contain at least the following information:

- Module identification
- Date and time of fabrication of concrete pour
- Concrete cylinder test results
- Quantity of used concrete and the batch printout
- Form-stripping date and repairs if applicable
- Location/number of blockouts and lifting inserts
- Temperature and moisture of curing period
- Lifting device details, requirements, and inserts

Handling, Storing, and Transportation

Handling, storing and transportation shall be performed in accordance with 707.08.

Design-Build Contractor shall be responsible for the safety and stability of prefabricated elements during all stages of handling, transportation and construction.

Design-Build Contractor shall follow Chapter 5 of the PCI Design Handbook for handling and erection bracing requirements.

Modules shall be lifted at the designated points by approved lifting devices properly attached to the module and proper hoisting procedures. Design-Build Contractor shall be responsible for handling stresses in the modules. Design-Build Contractor shall include all necessary precast element modifications to resist handling stresses on the Working Drawings. The locations of the lifting points shall be chosen so that the anticipated flexural tensile stress induced in the top of the structural concrete slab for the assumed support locations is no greater than the allowable stress.

Storage areas shall be smooth and well compacted to prevent damage due to differential settlement.

Precast elements shall be stored in such a manner that adequate support is provided to prevent cracking or creep induced deformation, sagging, during storage for long periods of time. Precast elements shall be checked at least once per month to ensure that creep-induced deformation does not occur.

Modules shall be protected from freezing temperatures for five days or until precast concrete attains design compressive strength detailed on the plans, whichever comes first. Design-Build Contractor shall not remove protection any time before the units attain the specified compressive strength when the surrounding air temperature is below 20°F.

The modules shall not be subject to damaging torsional, dynamic, or impact stresses.

A 48 h notice of the loading and shipping schedule shall be provided to INDOT.

Design-Build Contractor shall transport modules horizontal with beams on the bottom side for support. Design-Build Contractor shall support the modules at approximately the same points they will be supported when installed.

Material, quality and condition after shipment will be inspected after delivery to the construction site.

Geometry Control

General

Design-Build Contractor shall ensure proper fit-up of prefabricated elements and modular systems and construction geometry control for differential camber, skew, and cross-slopes.

Design-Build Contractor shall check the elevations and alignment of the structure at every stage of construction to assure proper erection of the structure to the final grade shown on the Design Documents. Design-Build Contractor shall use vertical adjustment devices to provide grade adjustment to meet the elevation tolerances shown on the substructure elevation Plans. Pier columns and pier cap elevations may be adjusted with shim stacks contained in

the grouted joints. Girder or beam seat elevations at the erected end bents and piers shall not deviate from the plan elevations by more than ± ¼ in. Corrections and adjustments for grade shall be done only when approved by INDOT.

Bridge cross slope up to 4° may be accommodated by tilting the superstructure modules with respect to plumb. The slope of the bridge seat shall conform to the bridge cross slope. Corrections for grade by shimming or neoprene pads shall be done only when approved by INDOT.

Camber and Deflection

Design-Build Contractor shall control camber during fabrication to achieve ride quality. Design-Build Contractor shall schedule fabrication so that camber differences between adjacent deck sections are minimized. Differences in camber between adjacent modules shall not exceed 1/8 in. at the time of erection. Design-Build Contractor shall establish the differential camber by pre-assembling the modules as required herein.

Equalizing Differential Camber

All aspects of the fabrication process shall be as uniform as possible for each girder or beam. Mix design and concrete batch quality shall be carefully monitored. Cure time shall not vary, which may inadvertently occur if only some of the girders or beams are allowed an extended curing period. Location of temporary supports for girders or beams in fabrication yard shall be uniform. Exposure to sunlight shall also be uniform.

Estimates of girder or beam camber shall be made with the recognition that girder or beam camber is inherently variable due to the many parameters that influence it. Allowances shall therefore be made in tolerances in the project to allow a reasonable level of deviation not exceeding ¼ in. of actual camber from predicted values.

For steel composite modular systems, dead load deflections for the steel beam or girders and diaphragms alone and for the weight of the deck, diaphragm, and barriers shall be shown on the Plans at every tenth points. Differences in camber between adjacent modules shall not exceed 1/8 in. at the time of erection. Design-Build Contractor shall establish the differential camber by pre-assembling the modules as required herein.

Design-Build Contractor shall equip all deck sections with leveling inserts for field adjustment or equalizing of differential camber. The inserts with threaded ferrules shall be cast in the deck and centered over the beam's or girder’s web. A minimum tension capacity of 5,500 lbs. shall be required for the inserts. After all adjustments are complete and the deck sections are in final position, the Design-Build Contractor shall fill all leveling insert holes with a non-shrink epoxy grout.

Design-Build Contractor shall have available a leveling beam and suitable jacking assemblies for attachment to the leveling inserts of adjacent beams. Design-Build Contractor shall adjust the deck sections to the tolerances required. More than one leveling beam may be necessary.

If the prescribed adjustment tolerance between deck sections cannot be attained by use of the approved leveling system, shimming the bearings of the deck sections may be necessary.

Finishing of Bridge Deck

Design-Build Contractor shall finish bridge decks in accordance with the Next Generation Concrete Surface special provision.

Connections

Requirements for UHPC Joints in the Deck

Ultra-High Performance Concrete, UHPC, shall be in accordance with the Ultra High Performance Concrete special provision.

Requirements for Mechanical Grouted Splices

A template for accurate mechanical splice placement during element fabrication and field cast conditions to ensure fit-up between joined elements shall be provided. Placement tolerances shall be as recommended by the manufacturer. The grouting process shall follow the manufacturer's recommendations for materials and equipment. All connections between precast elements shall be dry fit in the fabrication yard prior to installation of the elements at the Site.

Grouted Splice Couplers

Design-Build Contractor shall submit an independent test report confirming the compliance of the coupler, for each supplied coupler size, with the following requirements:

- Develop 100% of the specified minimum tensile strength of the attached Grade 60 reinforcing bar. This equates to 90 ksi bar stress for an ASTM A615 bar and 80 ksi bar stress for an ASTM A706 bar.
- Determine through testing, the amount of time required to provide 100% of the specified minimum yield strength of the attached reinforcing bar. Use this value to develop the assembly plan timing.
- Submit the specification requirements for the grout including required strength gain to develop the specified minimum yield strength of the connected reinforcing bar.

Post-Tensioned Connections

Post-tensioning, PT, shall be in accordance with the Post-Tensioning Works special provision.

Bolted Connections

Bolted connections shall be in accordance with the Project Standards for bolted connections between prefabricated steel elements and modules.

Erection Methods

Design-Build Contractor shall employ methods and equipment which will produce satisfactory Work under the Site conditions encountered and Project constraints.

Erection Procedures

General Requirements for Installation of Precast Elements and Systems

1. Design-Build Contractor shall dry fit adjacent precast elements in the yard prior to shipping to the Site.
2. Design-Build Contractor shall establish working points, working lines, and benchmark elevations prior to placement of all precast elements.
3. Design-Build Contractor shall place precast elements in the sequence and according to the methods outlined in the assembly plan. Design-Build Contractor shall adjust the height of each precast element by means of leveling devices or shims.
4. Design-Build Contractor shall use personnel familiar with installation and grouting of splice couplers that have completed at least two successful projects in the last two years. Training of new personnel within three months prior to installation by a manufacturer's technical representative is an acceptable substitution for this experience.

5. Design-Build Contractor shall keep bonding surfaces free from laitance, dirt, dust, paint, grease oil, or any contaminants other than water.
6. Design-Build Contractor shall follow the recommendations of the manufacturer for the installation and grouting of the couplers.

General Procedure for Superstructure Modules

1. Design-Build Contractor shall not place modules on precast substructure until the compressive test result of the cylinders for the precast substructure connection concrete has reached the specified minimum values.
2. Design-Build Contractor shall survey the top elevation of the precast concrete substructures and shall establish working points, working lines, and benchmark elevations prior to placement of all modules.
3. Design-Build Contractor shall clean bearing surface before modules are erected.
4. Design-Build Contractor shall lift and erect modules using lifting devices as shown on the Working Drawings in conformance with the assembly plans.
5. Design-Build Contractor shall set module in the proper location. Design-Build Contractor shall survey the top elevation of the modules. Design-Build Contractor shall check for proper alignment and grade within specified tolerances. Approved shims may be used between the bearing and the girder to compensate for minor differences in elevation between modules and approach elevations. Design-Build Contractor shall follow match-marks.
6. Design-Build Contractor shall temporarily support, anchor, and brace all erected modules as necessary for stability and to resist wind or other loads until they are permanently secured to the structure. Design-Build Contractor shall support, anchor, and brace all modules as detailed in the assembly plan.
7. Differences in camber between adjacent modules shipped to the site shall not exceed the prescribed limits. If there is a differential camber the Design-Build Contractor shall apply dead load to the high beam to bring it within the connection tolerance. A leveling beam can also be used to equalize camber. The leveling procedure shall be demonstrated during the pre-assembly process prior to shipping to the site. The assembly plan shall indicate the leveling process to be applied in the field. If a leveling beam is to be used, have available a leveling beam and suitable jacking assemblies for attachment to the leveling inserts of adjacent modules. Design-Build Contractor shall equip all modules with leveling inserts for field adjustment or equalizing of differential camber. The inserts with threaded ferrules shall be cast in the deck and centered over the beam's or girder's web. A minimum tension capacity of 5,500 lbs is required for the inserts.
8. Design-Build Contractor shall saturate surface dry, SSD, all closure pour surfaces prior to connecting the modules. Design-Build Contractor shall apply an epoxy bonding coat as required by the specifications.
9. Design-Build Contractor shall form closure pours and seal lifting holes as required by the approved assembly plan. The closure pour forms and the sealed lifting holes shall be free of any material such as oil, grease, or dirt that may prevent bonding of the joint. Apply epoxy bonding coat where required by Design Documents.
10. Design-Build Contractor shall cast UHPC closure pours and fill lifting holes with UHPC as shown on the Design Documents. Design-Build Contractor shall cure closure pours and lifting holes.

11. Remaining concrete defects and holes for inserts shall be repaired as required by INDOT.
12. Design-Build Contractor shall not apply superimposed dead loads or construction live loads to the prefabricated superstructure until the compressive test result of the cylinders for the UHPC closure pour concrete has reached the specified minimum compressive strength of 10 ksi.
13. Design-Build Contractor shall construct the very early strength LMC overlay in accordance with 722 and the Technical Provisions.

General Procedure for Pier Columns and Caps

1. Design-Build Contractor shall lift the precast element as shown on the assembly plan using lifting devices as shown on the Working Drawings.
2. Design-Build Contractor shall survey the elevation of the completed structure directly below the element. Design-Build Contractor shall provide shims to bring the bottom of the element to the required elevation.
3. Design-Build Contractor shall set the element in the proper horizontal location. Design-Build Contractor shall check for proper horizontal and vertical alignment within specified tolerances. Design-Build Contractor shall remove and adjust the shims and reset the element if it is not within tolerance.
4. Design-Build Contractor shall check the grouted splice couplers between adjacent elements that will support common precast elements in future stages of construction. Design-Build Contractor shall set the element and install the couplers once the connection geometry is established and checked.
5. Design-Build Contractor shall install temporary bracing if specified in the assembly plan.
6. Design-Build Contractor shall allow the grout in the coupler to cure until the coupler can resist 100% of the specified minimum yield strength of the bar prior to removal of bracing and proceeding with installation of elements above the element.

General Procedure for End Bent Stem and Wingwalls Supported on Piles

1. Design-Build Contractor shall lift end bent stem precast element or wingwall precast element as shown in the assembly plan using lifting devices as shown on the Working Drawings.
2. Design-Build Contractor shall set the precast element in the proper horizontal location. Design-Build Contractor shall check for proper alignment within specified tolerances.
3. Design-Build Contractor shall adjust the devices prior to full release from the crane if vertical leveling devices are used. This will reduce the amount of torque required to turn the bolts in the leveling devices. Design-Build Contractor shall check for proper grade within specified tolerances.
4. Design-Build Contractor shall place high early strength self-consolidating concrete around pile tops as shown on the Plans. Design-Build Contractor shall allow concrete to flow partially under the precast element. The entire underside of the precast element need not be filled with concrete.
5. Design-Build Contractor shall not remove the installation bolts, if used, or proceed with the installation of additional precast elements above until the compressive test result of the cylinders for the pile connection concrete has reached the specified minimum values.

Basis of Item

Structural concrete for precast bridge elements shall be quantified per

cubic yard of concrete, for the class and use specified in accordance with 702.28. Reinforcing bars and epoxy-coated reinforcing bars shall be quantified in accordance with 703.08. Stainless steel reinforcing bars shall be quantified in accordance with the unique special provision for Stainless Steel Reinforcing Bars.

The following shall be considered incidental to these items:

All materials, labor and equipment, including additional reinforcing bars for lifting and transport, lifting hardware, testing, transportation and installation, grinding, corrugated steel pipe, leveling devices, shims, grouted splice couplers and grout for bedding material or closure pours.

All materials, labor and equipment including additional reinforcing bars for lifting and transport, lifting hardware, testing, transportation, B Borrow for leveling, and installation for the terminal joint and sleeper slab.

ANTI-GRAFFITI COAT

Description

This Work shall consist of preparing surfaces and furnishing and applying anti-graffiti coating in accordance with 105.03 and as shown on the Design Documents.

Materials

The anti-graffiti coating shall be a sacrificial, wax-based emulsion type coating.

Construction Requirements

Prior to application, the Design-Build Contractor shall inspect all surfaces to be treated and correct all flaws in the substrate that would ultimately affect the performance or appearance of the anti-graffiti coating.

Surface preparation, method of application, application techniques, coating thickness, time of application, rate of application, temperature requirements for application and curing time for the anti-graffiti coating shall be in accordance with the written requirements of the manufacturer.

The Design-Build Contractor shall allow substrate to fully cure and newly coated surface to fully cure before application. Application shall be performed by an experienced applicator in accordance with the manufacturer's recommendations. The number of coats and coverage rates shall at no time be less than the manufacturers written requirements.

The Design-Build Contractor shall protect plants and vegetation from over-spray and adjoining surfaces that are not to have the anti-graffiti coating applied. The Design-Build Contractor shall protect the public in an area used by the public. The Design-Build Contractor shall comply with all federal, state, and local environmental restrictions.

The Design-Build Contractor shall apply the tinted and modified surface seal in accordance with the special provision for "MODIFIED SURFACE SEAL" prior to applying the anti-graffiti coating.

Basis of Item

Only those measurement necessary to verify application rates will be made; however, the Design Documents shall include the approximate square feet for information only.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
709-0773	Anti-Graffiti Coat	LS

MODIFIED SURFACE SEAL

Description

This Work shall consist of preparing surfaces and applying a combination concrete stain and sealer in accordance with 105.03 and as described herein.

Materials

Modified surface seal shall consist of a material that stains and seals the concrete. The material shall provide an opaque appearance and the specular gloss in accordance with ASTM D 523 shall range from 8 to 20 at 60°. The material used shall be a water-based all-acrylic stain with VOC less than 150 grams per liter and shall contain no toxic heavy metals.

Acceptable products shall allow moisture and vapor transmission, be formulated for exterior application with resistance to freeze/thaw, moisture, alkali, acid and mildew, mold or fungus, discoloration or degradation, and meet the following requirements:

Water Vapor Transmission, ASTM D1653, Method B, Wet Cup:
5 Perms, Minimum
Scaling Resistance, ASTM C672, 50 cycles:
No scaling
Chloride Ion Penetration Resistance, AASHTO T259/T260:
1/16 in. to 1/2 in. deep, 75% minimum reduction in chloride ion migration as compared to an untreated sample
1/2 in. to 1 in. deep, 85% minimum reduction in chloride ion migration as compared to an untreated sample
ASTM G 153, Cycle 1, 2500 hrs:
No cracking, crazing or adhesive loss

Only one material shall be used at an individual location. It shall be delivered to the project site in undamaged sealed containers bearing the manufacturer's original labels. The manufacturer's brand name, date of manufacture, batch number, and color shall be clearly marked on each container. All material shall be from the same lot or batch unless otherwise authorized. A copy of the manufacturer's printed instructions shall be made available to INDOT upon request.

The material shall be stored in airtight, upright containers. The containers shall be stored in a dry enclosure where the temperature is kept in a temperature range as recommended by the manufacturer. Material which has been subjected to freezing will be rejected.

The stain material shall have a shelf life of not less than 12 months. The color of the applied stain material shall be in accordance with Red-Green-Blue variations. Such color shall match the color identification number shown on the Design Documents or in other special provisions.

All materials shall be furnished, prepared, applied, cured, and stored according to the product manufacturer's directions and as specified herein. Special attention shall be given to the recommended temperature range for application.

(a) Material Testing

The testing shall be performed by a recognized laboratory in accordance with ITM 806.

The applied material shall be subjected to and shall satisfy the

requirements of the tests listed above, prior to use.

(b) Certification

Before the stain is applied, a type B certification in accordance with 916 shall be furnished attesting that the commercial product furnished is in accordance with the same formula as that previously subject to the tests specified above and approved. Copies of the test reports shall be attached to the certification. Reports for tests made more than four years prior to shipment to the contract will not be accepted.

A service record shall be supplied which shows that the material has a satisfactory service record on concrete surfaces for a period of not less than five years prior to the date of submission of the service record. The coating shall also have shown satisfactory service characteristics without peeling, chipping, flaking, or non-uniform change in texture or color. A specific structure for the specific product shall be named for the service record.

Construction Requirements

Surface Preparation

The surfaces which are to receive the material shall be given a finish in accordance with 702.21. Air pockets of up to 1/4 in. in width and depth will not require grouting prior to application of the stain. Air pockets larger than 1/4 in. in width and depth shall be filled with a grout mix composed of one-part portland cement, two parts screened and washed sand graded to pass the No. 16 sieve with not more than 5% retained on the No. 30 sieve, and sufficient water to produce a thick liquid mix. The grout shall be applied to fill the air pockets and voids by using burlap pads, float sponges or other acceptable methods. As soon as the grout has taken its initial set, the surface shall be brushed to remove all loose grout, leaving the surface smooth and free of air pockets and voids.

Minor defects shall be finished to blend with the balance of the textured surfaces. Visible vertical or horizontal seams or conspicuous form marks shall be repaired to the satisfaction of INDOT and at no additional cost to INDOT. Prior to applying the material, regardless of whether the concrete surface has been previously sealed, the surface to be coated shall be water-blasted to remove flaking coatings, dirt, oil and other substances which could be deleterious to the application of the material. Sandblasting will not be allowed for cleaning concrete surfaces. Pressure washing with water at a pressure of 3000 psi at a rate of 3 to 4 gallons per minute using a fan nozzle held perpendicular to the surface at a distance of 12 in. to 24 in. shall be used. Overblasting, exposing additional air pockets, or disfiguring the surface shall be prevented. Final cleaning shall be done with compressed air. The air compressor shall be equipped with suitable separators, traps, or filters which shall remove water, oil, grease, or other substances from the air line.

Prior to applying the material, the surfaces shall have been prepared in accordance with the manufacturer’s recommendations and shall be in a condition consistent with the manufacturer’s requirements.

Surface Color

The material shall stain the concrete and provide an opaque appearance as shown on the Design Documents or other special provisions.

Application

The application, including equipment used, shall be in accordance with

the manufacturer's recommendations. The material shall be applied by qualified personnel experienced in the Work.

Enough coats of the material shall be used to attain an opaque appearance. The application of the material shall follow the surface preparation operations and be by air or airless sprayer. Each coat shall be allowed to thoroughly dry before applying additional coats. The final coat shall be applied in a uniform manner, moving in one direction. The application rates used shall be in accordance with the manufacturer's recommendations.

The Design-Build Contractor shall use sufficient material to provide color uniformity but avoid buildups and runs. The material shall be applied only when the ambient air and surface temperatures, humidity and dew point during application are in the ranges recommended by the manufacture. The material shall not be applied onto frozen surfaces or if rain is imminent. If rain occurs on a freshly applied surface, recoating may be required, at INDOT's sole discretion, based on the extent of rain damage.

The material shall not be applied if dusty conditions exist in the vicinity of the surfaces to be coated. When dust conditions are beyond the control of the Design-Build Contractor, or are generated off-site, application shall not take place until more favorable conditions exist. The application of the modified surface seal shall be scheduled as one of the final finishing operations to minimize construction generated dust. A wet edge shall be maintained at all times to prevent lap marks. Stopping and starting in the middle of a section of concrete will not be allowed.

Finishing

The material shall be tightly bonded to the structure and walls to present a uniform color appearance accentuating the concrete texture. If necessary, additional coats shall be applied to produce the desired surface color uniformity. However, the additional coating thickness shall not diminish the appearance of the concrete texture.

The material shall be entirely removed from the structure and walls upon their failure to positively adhere without chipping, flaking or peeling, or attaining the desired surface color uniformity and concrete texture appearance. The material shall be reapplied after proper surface preparation until the desired finished product is achieved.

Appearance

The Design-Build Contractor shall apply the sealer and finish coat to a minimum 10 ft by 5 ft test area at the coverage rate recommended by the manufacturer. The test area shall include both horizontal and vertical surfaces and different concrete textures. The test areas shall demonstrate the coatings visual effects, including but not limited to, finish sheen, color and coverage rate.

Uniform appearance and the final color shall visually match the test section. Re-coating, removal, and re-application or other methods recommended by the manufacturer shall be performed to correct the final appearance.

Basis of Item

Only those measurements necessary to verify application rates will be made; however, the Design Documents shall include the approximate square feet for information only. This accepted quantities for this Work shall be in accordance with 709.08.

The following shall be considered incidental to this item:

Material, surface preparation, labor, and all other incidentals required for this Work shall be included in the lump sum of surface seal.

SUPERSTRUCTURE INSTALLATION, SPMT

Description

This Work shall consist of installing the superstructure onto the permanent substructure units in accordance with 105.03, the Design Documents, and as described herein. The superstructure shall be built in a temporary location and moved into its permanent position using a Self-Propelled Modular Transporter in accordance with these provisions.

Definitions

1. Self-Propelled Modular Transporter, SPMT: Specialized equipment used to move bridge superstructures, consisting of motorized load bearing multi-axle platforms with each axle having its own hydraulic lifting system to equalize loading pressures and maintain a level system and with turning capabilities that are linked and controlled through a computer.
2. Bridge Staging Area, BSA: The location of the temporary bridge supports where the bridge superstructure is constructed prior to transport to its final location.
3. Travel Path, TP: The route along which the SPMT carries the new bridge superstructures from the Bridge Staging Area to the final bridge location.
4. Temporary Supports: Any structure used to provide temporary support to a bridge or bridge superstructure which will be removed after the structure is removed.
5. Temporary Sheeting and Shoring: Any temporary system to support either a structural component or soil slope.
6. Monitoring: The act of measuring, recording and quantifying changes in the geometry and condition of bridge superstructures as a result of temporary support conditions and moving operations.
7. Heavy Lifter: The firm employed by the Design-Build Contractor to provide heavy lift equipment and operations including SPMTs and related shoring, bracing, and engineering.
8. Superstructure: Bridge elements above the bearings including, but not limited to, beams or girders, deck, and barriers.
9. Twist: The condition where a corner of a superstructure deflects up or down relative to the plane defined by the other three corners of the supported bridge span.
10. Deflection Change: The relative vertical movement of the ends of the bridge while the superstructure is supported at the temporary support points, either during superstructure installation or in the BSA. It shall be the average of the three measurements along each centerline of bearing compared to the average of the three measurements along the temporary support line and the three measurements along the midspan of the structure.

Design Data

Any temporary supports, falsework, sheeting or shoring required to perform the Work listed in this provision shall be in accordance with the following specifications:

1. AASHTO Guide Design Specifications for Bridge Temporary Works, 2nd Edition
2. AASHTO LRFD Bridge Construction Specifications, 4th Edition
3. AASHTO LRFD Bridge Design Specifications, 8th Edition

Qualifications

The Heavy Lifter shall have a minimum of five years of experience using SPMTs and shall have successfully completed a bridge installation using SPMTs within the United States in the past 10 years.

The Heavy Lifter's supervisor in charge of this Work shall have a minimum of five years of experience as a Heavy Lifter supervisor, which includes previous SPMT bridge installation experience.

The Heavy Lifter's SPMT operator shall have a minimum of five years of experience as a Heavy Lifter SPMT operator.

The Design-Build Contractor shall submit the following information and data for approval with the Working Drawings:

1. Proof that the Heavy Lifter qualifications have been met including a list of similar projects completed within the last 10 years with names and phone numbers of owner's representatives who can verify the Heavy Lifter's participation in those projects.
2. Name and experience record of the Heavy Lifter supervisor in charge of the bridge installation.
3. Name and experience record of the Heavy Lifter SPMT operator.

Submittals

Detailed Working Drawings of all equipment and material used for transporting and lowering the bridge superstructure shall be submitted for approval by INDOT. The Working Drawings shall be stamped by a registered professional engineer in the State of Indiana and shall include the following:

1. Working Drawings
   a. Working Drawings detailing dimensional, structural and other physical requirements of the permanent structure necessitated by the Design-Build Contractor's construction methods for the SPMT shall be provided.
   b. Supporting calculations that show the use of SPMT does not adversely impact the load carrying capacity of the structure shall be provided.
2. Details and Calculations of the Temporary Substructures and Other Temporary Works
   a. Detailed Working Drawings for items such as temporary support structures, falsework, cofferdams, shoring, and temporary bridges shall be included.
   b. Temporary supports for the superstructure shall be shown.
   c. Bents or ground beams and temporary piling shall be included.
   d. Elevations and dimensions of temporary bearings, as necessary, to match the relative positions of the final permanent bearings at the final location shall be shown.
   e. Design calculations and supporting data which verify the temporary works are adequate for the proposed loads and that settlement or elastic deflections of the bridge temporary works will not adversely affect the structure shall be included.
   f. Temporary works shall be designed according to the current edition of the documents in the design data.
   g. Basis of design criteria for all assumed loads, including wind and impact effects, limits for stability against overturning, combined stresses, deflection, and buckling shall be placed on the Working Drawings.
3. Lifting, Transporting and Placement Plan

a. Details of the BSA and travel path location, general layout surface grading, surfacing material, drainage, environmental protection, material storage area, concrete delivery methods, shelters, heavy lift travel paths, accesses, fences, gates, barriers, offices, and workshops shall be provided.
b. A plan view of the travel path identifying all obstacles requiring removal and replacement, all structures crossed, all utilities crossed, over and under, and intended access under the completed superstructure shall be provided. It shall include a plan view of the axles, average effective ground pressure under SPMT or similar units and maximum single wheel load and anticipated wheel contact patch size.
c. A geotechnical evaluation of the travel path shall be provided and areas requiring ground improvement shall be identified. Details of required improvements shall be provided.
d. Plating or bridging required at utilities shall be identified and provided.
e. Calculated superstructure weight for installation based on actual, known dimensions of components and known densities of materials shall be included.
f. QC/QA procedures to be followed during the superstructure installation shall be included.
g. The means of mitigating unacceptably high or concentrated loads along travel path shall be included.

4. Details of the Heavy Lift System
   a. Details of the heavy lift system including SPMT, components, mechanical devices, jacks, temporary blocking, and operational techniques shall be provided.
   b. The center of gravity of the structure shall be provided.
   c. The support locations shall be included.
   d. The maximum vertical load demands and capacities on the controlling axle line and on the controlling vertical jack shall be included.
   e. The number of wheels or axles in each hydraulic group and the geometry of the wheels or axle lines in each hydraulic group shall be included.
   f. The maximum stroke requirements shall be included.
   g. The stability limits including, but not limited to, the maximum longitudinal and transverse grades along the path and the maximum permitted longitudinal and transverse grades based on system properties shall be included.
   h. The Maximum allowed deviation of support columns from vertical and maximum anticipated deviation of support columns from vertical shall be included.
   i. Operational details for the control of the movement, including turning radius, lifting, and transportation shall be included. A system of check off items for the Operators and for safety purposes shall be included.
   j. An hour by hour schedule of the move shall be included.
5. Safety and Communication Plan
   a. A schedule of operations, organization of machinery, safety gear requirements and operational perimeters shall be included.
   b. Contact information for SPMT system supervisor, contractor supervisor, safety supervisor, and Design-Build Contractor engineer of record shall be included.
   c. The protection of public, spectators, and workers shall be ensured.
   d. Property during the movement of the superstructure shall be protected.
   e. Nighttime operations including lighting shall be addressed.

f. OSHA requirements shall be addressed.
g. A schedule of operations, organization of machinery and operational perimeters shall be included.

6. Monitoring Plan
   a. The monitoring plan shall be submitted in the form of Working Drawings or a manual.
   b. Details of a monitoring system shall be included. The monitoring system shall be capable of measuring:
      i. The change in bridge camber at initial lift
      ii. The relative twist between adjacent lines of supports at initial lift and during the installation
      iii. The relative change in elevation between adjacent lines of support at initial lift and during the bridge installation. This measurement is not required for bridges installed with two lines of support.
   c. Measuring equipment, procedures and locations of geometry control reference points on the superstructure and in the BSA shall be included.
   d. Longitudinal and lateral location reference points on the superstructure that correspond to, or can be referenced to, appropriate longitudinal and lateral reference points at the erection site, such as station and offsets shall be established.
   e. Warning levels and absolute limit levels shall be included.
      i. Displacement limits to avoid damage to the superstructure during the installation shall be established.
      ii. Displacement limits that are less than or equal to the limits defined in the Design Documents shall be established.
   f. Minimum detectable movements and system accuracy shall be included.
   g. Potential remedial actions that must be implemented when measurements exceed the warning levels shall be included.
   h. Measurements shall be taken and recorded at least as follows:
      i. Before beginning the move. The move monitoring system shall be set and the bridge monitored through a typical daily temperature cycle. Measurements shall be recorded just before dawn of each day and when the bridge reaches the approximate maximum temperature.
      ii. Immediately before initial lift. The initial measurements shall be recorded to establish the baseline for the system.
      iii. Immediately after the initial lift. Measurements shall be recorded and compared to the baseline condition. The deflection change shall be calculated as the difference between the condition just before to just after the initial lifting of the bridge.
      iv. The measurements shall be monitored continuously during the installation.
      v. When the bridge is aligned and ready for setting but is not in contact with the final supports.
      vi. After setting the bridge in its permanent location. A final set of monitoring system measurements shall be recorded. The measurements shall be verified to ensure they are within anticipated and allowable tolerance limits specified for permanent elevations.

7. Contingency Plan
   a. Discussion of potential equipment problems such as insufficient equipment or equipment breakdowns.
   b. Discussion of potential problems with inclement weather.
   c. Identification of individuals involved in the superstructure installation and their risks and responsibilities.

d. Identification of the use of manual overrides of electronic or hydraulic equipment.
e. Identification of additional equipment to have on hand such as SPMT controllers, spare tires or repair items for tires, demolition equipment, hydraulic jacks, blocking, columns or towers, stabilizing devices, strong-backs, and cross-frames and ties, shipping-containers, grillages, cribbing, shims and any other incidental components needed to support the superstructure atop the SPMT platforms.
f. Public notice of extended delays.
g. Identification of a detour route for extended closures.
h. Traffic shall not be allowed to pass beneath the superstructure supported by SPMTs until the source of the problem is found and corrected.
i. Corrective actions if problems occur.

8. Details of any temporary sheeting or shoring required to install or complete the installation of the superstructure. This includes any sheeting or shoring required to open the roadway to traffic prior to other permanent earth retaining being installed.
9. The Design-Build Contractor shall provide repair methodology and supporting calculations for procedures for repairing damage and injecting and sealing cracks.
10. Other items not covered above shall be submitted for approval by INDOT.
    a. Overall schedule of the timing and sequence of superstructure fabrication, erection, and installation shall be provided. An hour by hour schedule of the bridge installation shall be provided 21 calendar days prior to the scheduled installation date for review.

The Design-Build Contractor shall allow INDOT 14 calendar days to review and approve Working Drawings and supporting calculations. This review period applies each time the drawings and calculations are submitted.

The Design-Build Contractor shall not deviate from the approved drawings unless authorized in writing by the engineer of record and INDOT.

Faulty design or detailing shall be the Design-Build Contractor's responsibility.

Revisions to the concepts and to the detailed descriptions of materials, components, erection methods, and sequencing shown on the Design Documents shall be included on the Working Drawings. This includes, but is not limited to, changes to locations of permanent support conditions, cross section component sizes or connectivity, construction joints in any plane, and splice location, sizes, or types as required.

Construction Requirements

General Requirements

The Design-Build Contractor shall use methods and procedures to provide adequate safety to the general public from all construction activities, superstructure installation, and erection using heavy lift equipment and falsework placed over or adjacent to traveled roadways or any existing commercial, industrial or other facilities.

Meetings

The following meetings shall be held between the Design-Build Contactor, the Heavy Lifter, and INDOT.

1. Superstructure Installation Meeting

The meeting shall be held a minimum of two weeks prior to the superstructure installation. This meeting shall discuss pertinent items of the Working Drawings, including the contingency plan and safety plan.

2. Final Walk through Pre-installation Meeting

Immediately prior to installing the bridge, the Design-Build Contractor shall conduct a final walk through pre-installation meeting at the bridge site for the bridge installation. Verify all items identified in the Working Drawings have been completed. Walk the travel path to verify surfaces have been prepared adequately, all utility protection is in place, slopes have been adequately supported, and verify all Work has been completed for the installation.

Bridge Staging Area, BSA

The Design-Build Contractor shall be responsible for all Work items and materials necessary to prepare the bridge staging area including clearing and grubbing, excavation, drainage, drainage structures, fill, grades, and the soil support for all equipment, SPMTs, materials, and temporary supports. Prior to Substantial Completion of the project, all equipment and material, including components of the temporary substructure, shall be removed from the BSA. The BSA shall be regraded and seeded to closely match the ground surface prior to construction or as required for the proposed construction Work.

SPMT Lifting System

The Design-Build Contractor shall use a SPMT lifting system capable of lifting a bridge superstructure off the temporary supports, carrying it to its final location, and setting it down at its final location. The assembly shall function as one unit using one controller with capability to move forward, backward, transversely, at any angle, and pivot 360° in a carousel motion. The SPMT axles shall provide a minimum of a 24 in. vertical hydraulic stroke. SPMT axle loads shall be limited to 25 tons per axle, per single wide SPMT unit.

The SPMT lifting system shall include the SPMTs, their blocking which provides the interface between the SPMT platform and the bridge superstructure, and any other devices or apparatus used to tie the SPMTs together and to move the bridge superstructures.

The Design-Build Contractor shall design the SPMT lifting system to lift the superstructures at the support points shown on the Design Documents. Any variation in support point locations from the locations shown on the Design Documents shall require approval by the engineer of record and INDOT.

Temporary Supports

1. All temporary works shall be designed according to the applicable specifications listed in the design data.
2. Temporary support structures shall be verified that they are built according to approved Working Drawings.
3. Support surfaces shall be verified that they are built to required elevations and tolerances with sufficient clearances to accommodate the heavy lift system and the latter are independently verified by the heavy lift firm.
4. The railings shall be constructed prior to transporting the superstructure from the BSA to the final location unless clearance under another bridge restricts clearance.
5. Weekly elevation control surveys, including top of footing if exposed and temporary bearing seat elevations, shall be provided to monitor settlement.

Age at Installation

The Design-Build Contractor shall not lift or attempt to install the superstructure until it has attained a minimum age of 28 days since the last casting operation, unless otherwise approved by INDOT or the requirements of 702.24 are met. For the purpose of this provision, installation of the structure shall be considered a traffic load.

Preparation for Installation of Superstructure

1. The permanent substructure bridge seat elevations shall be verified to match the relative elevations of the bridge seats in the BSA. Any discrepancy shall be identified prior to transporting the structure. Proposed mitigation measures shall be submitted to INDOT for approval.
2. Adequate horizontal and vertical clearances shall be verified to exist to safely move the bridge.
3. The superstructure shall be jacked-up or jacked-down in an incremental or differential fashion using the insertion or removal of incremental cribbing, purpose-made steel grillages, blocks, prefabricated falsework sections or similar devices to facilitate raising or lowering the superstructure span by the amount necessary to install the bridge to the required elevation.
4. Heavy lift system shall be operated with care and within anticipated height change limitations, and stroke limits, of the jacking systems. The Design-Build Contractor shall follow limitations on Working Drawings or manuals for all incremental and differential jacking with due regard to corresponding stability conditions for the heavy lift system and falsework.
5. Proper considerations shall be made to ensure the support of the superstructure will not damage the superstructure beams.
6. QC/QA procedures shall be implemented prior to a transportation operation to ensure satisfactory completion.
7. Contingency plans shall be implemented in the event of a major breakdown or equipment malfunction.

Lift, Transportation and Placement of Superstructure

1. The intent during lifting, transportation and placement is to ensure the structure is delivered to INDOT, in its final location, with no damage or adverse loss of strength, loss of performance or loss of long-term durability. To this end, it is necessary to place certain limitations upon characteristics which can be quantified and observed or checked by careful observations or by using suitable detection methods during these operations.
2. The Design-Build Contractor shall exercise care and precaution when placing the spans into its final location on the bridge bearings and use observations to monitor and record conditions just before and just after setting the span in place.
3. The Design-Build Contractor shall follow the lifting, transporting, and placement plan.
4. The Design-Build Contractor shall monitor the bridge during lifting, transporting, and setting according to the approved monitoring plan.

Tolerances

1. Plan Alignment: Location and Clearances
   a. For the final condition of the span after placing the superstructure, the maximum deviation from alignment in both primary plan directions at each end of the span being set shall not exceed 1 in. or that required for the accommodation of manufactured bearings, whichever is less.

2. Bridge Bearings: Elevation and Location
   a. The elevation of individual bridge bearings for superstructure shall be kept within plus or minus 1/8 in. of required elevations, unless tighter tolerances are required according to the bearing manufacturer or as specified on the Working Drawings.
   b. The plan location of bridge bearings shall be kept within 1/8 in. and the alignment within plus or minus 1/8 in. across the bearing, unless tighter tolerances are required according to the bearing manufacturer or as specified on the Working Drawings.
   c. If tolerances are not met, the means to adjust elevations or to correct for or accommodate errors or unintended deviations from required tolerances shall be submitted to INDOT for approval. The use of shims, injection of high strength grout or other methods to accommodate differences from required tolerance shall be submitted to INDOT for approval.
3. During Lifting, Transportation and Placement, Installation:
   a. Deflection Change:
      i. Relative to the local tangent to the vertical profile grade at mid-span, keep the anticipated downward deflection of ends of superstructure when lifted at heavy lift support locations within plus or minus 20% of those given on the Design Documents or approved Working Drawings.
   b. Twist:
      i. Twist shall not exceed the lesser of W/200 or 2 3/8 in. when the four monitored points are over the centerlines of the permanent span support bearings. Twist shall not exceed the lesser of W/300 or 1 5/8 in. when the four monitored points are over the centerlines of the temporary supports during installation. W is defined as the perpendicular width in feet between the face of rails, clear roadway width.
      ii. When twist detected at both temporary support lines is in opposite directions, the sum of the twist on both temporary supports shall not exceed the lesser of W/300 or 1 5/8 in.
      iii. Twist shall remain within the above allowable limits or as otherwise predetermined and provided in the approved Working Drawings to incur no damage or cracks, even if cracks close after setting the bridge span in place.
   c. Change in Longitudinal Gradient, along the Railing and Centerline Bridge:
      i. The heavy lift firm is required to provide the maximum allowable change in longitudinal gradient.
      ii. The change in longitudinal gradient is defined as the change in slope experienced along the railing or centerline bridge from conditions just before first lifting to any time during installation.
      iii. The longitudinal gradient may be calculated from differences in elevations taken just before lifting to elevations taken at any time during installation.
   d. Change in Transverse Gradient, across the Beams of Span:
      i. The heavy lift firm is required to provide the maximum allowable change in transverse gradient.
      ii. The change in transverse gradient is defined as the change in slope experienced along the end diaphragms from conditions just before first lifting to any time during installation.
      iii. The change in transverse gradient may be calculated from differences in elevations taken just before lifting to elevations taken at any time during installation.

Superstructure Requirements

1. Uniform support for all beam or girder lines shall be provided and the temporary supports shall be ensured they do not damage the superstructure.
2. Shims may be used, if required, to correct discrepancies in the seat elevations at the substructures.
3. The Design-Build Contractor shall prepare a correction plan including material description and construction methods, to be submitted to INDOT for approval prior to making the repairs.

Corrections and Repairs

After installing the structure, the structure shall be inspected for cracking. Any cracks shall be repaired as follows:

1. Crack width less than 0.016 in. – Sealed with an epoxy penetrating sealer followed by an application of an approved sand. The sealing and sand application shall be repeated as needed to ensure that the voids remain completely filled.
2. Crack width greater than 0.016 in. – Epoxy injection in accordance with 727.

Basis of Item

Superstructure Installation, SPMT shall be quantified as a lump sum.

The items list shall include the following:

Item No.	Item Description	Unit Symbol
711-12147	Superstructure Installation, SPMT, Engineering	LS
711-12147	Superstructure Installation, SPMT, Temporary Substructure	LS
711-12147	Superstructure Installation, SPMT	LS

The following shall be considered incidental to this item:

All material, labor and incidentals related to the preparation of the Working Drawings, including any geotechnical analysis required for the TP and BSA, and designing of the temporary supports.

All material, labor and incidentals, including seed mixture, fertilizer and mulching material, related to the preparation and restoration of the BSA and construction and removal of the temporary supports.

All other material, labor and incidentals required to perform the Work described herein, including superstructure monitoring, preparation and restoration of the travel path, meetings, temporary sheeting and shoring, and superstructure repairs due to the installation.

SUPERSTRUCTURE INSTALLATION, SLIDE-IN

Description

This Work shall consist of installing the superstructure onto the permanent substructure units in accordance with 105.03, the Design Documents, and as described herein. The superstructure shall be built in a temporary location and moved into its permanent position using a Horizontal Jacking System in accordance with these specifications.

Definitions

1. Horizontal Jacking System: The system used to slide the superstructure from its temporary location to its permanent location. This system shall include, but not be limited to, the sliding surface, hydraulic actuators and pumps and the longitudinal restraining system which is used to keep the sliding superstructure centered over the supports.
2. Temporary Supports: Any structure used to provide temporary support to a bridge or bridge superstructure which shall be removed after the structure is removed.
3. Temporary Sheeting and Shoring: Any temporary system to support either a structural component or soil slope.
4. Monitoring: The act of measuring, recording and quantifying changes in the geometry and condition of bridge superstructures as a result of temporary support conditions and moving operations.
5. Superstructure: Bridge elements above the bearings including, but not limited to, girders or beams, deck, and barriers.
6. Twist: The condition where a corner of a superstructure deflects up or down relative to the plane defined by the other three corners of the supported bridge span due to uneven jacking.

Design Data

Any temporary supports, falsework, sheeting or shoring required to perform the Work listed in this provision shall be in accordance with the following specifications:

1. AASHTO Guide Design Specifications for Bridge Temporary Works, 2nd Edition
2. AASHTO LRFD Bridge Construction Specifications, 4th Edition
3. AASHTO LRFD Bridge Design Specifications, 8th Edition

Qualifications

The Horizontal Jacking System supervisor/foreman shall have experience with one or more projects within the last 10 years, of similar scope, in the area of heavy duty jacking, including both vertical and horizontal translation. Jacking experience can include work on bridges, buildings, ships or other sizeable structures.

The Design-Build Contractor shall submit proof that the Horizontal Jacking System supervisor/foreman's qualifications have been met including a list of similar projects completed within the last 10 years with names and phone numbers of owner's representatives who can verify the Horizontal Jacking System supervisor/foreman's participation in those projects with the Working Drawings.

Submittals

Detailed Working Drawings of all equipment and material used for sliding or jacking the bridge superstructure shall be submitted for approval by INDOT. The Working Drawings shall be stamped by a registered professional engineer in the State of Indiana and shall include the following:

1. Working Drawings

a. Working Drawings detailing dimensional, structural and other physical requirements of the permanent structure necessitated by the Design-Build Contractor's construction methods for the slide-in shall be provided.
b. Supporting calculations showing the use of a slide-in does not adversely impact the load carrying capacity of the structure shall be provided.

2. Details and Calculations of the Temporary Substructures and Other Temporary Works
   a. Detailed Working Drawings for items such as temporary support structures, falsework, cofferdams, shoring, and temporary bridges shall be included.
   b. Temporary supports for the superstructure shall be shown.
   c. Bents or ground beams and temporary piling shall be included.
   d. Elevations and dimensions of temporary bearings, as necessary, to match the relative positions of the final permanent bearings at the final location shall be shown.
   e. Design calculations and supporting data which verify the temporary works are adequate for the proposed loads and that settlement or elastic deflections of the bridge temporary works will not adversely affect the structure shall be included.
   f. Temporary works shall be designed according to the current edition of the documents in the design data.
   g. Basis of design criteria for all assumed loads, including wind and impact effects, limits for stability against overturning, combined stresses, deflection, and buckling shall be placed on the Working Drawings.
3. Lifting, Transporting and Placement Plan. The Design-Build Contractor shall provide details of travel path and planned movements. At least the following shall be included:
   a. Maximum permissible deviation from the exact slide plane to the constructed slide plane.
   b. Maximum possible load on a single slide bearing.
   c. Minimum possible load on a single slide bearing.
   d. Clearances to fixed obstacles.
   e. Plan for controlling and directing the location of the bridge during the slide.
   f. Maximum deflections along the slide path on the temporary support and permanent structure during the move.
4. Details of the Slide System.
   a. Details of the move equipment, including the heavy lift system, jacks, cranes, transport systems, slide pads, rollers or other systems used to laterally transport the structure shall be provided.
   b. At least the following information shall be included:
      i. Weight of the system being moved.
      ii. Minimum and maximum anticipated friction coefficients.
      iii. Minimum and maximum anticipated slide force.
      iv. Jack capacity.
      v. Maximum capacity over demand ratio of the weakest component along the lateral force system.
      vi. Stroke length and rate.
      vii. Method to reverse movement along the travel path.
      viii. Equipment used to control and direct the location of the bridge during the slide.
      ix. Details regarding how the hydraulic jacks at each jacking point will be regulated to ensure uniform movement.
   c. Step by step move procedures.

i. Operational details for the control of the lifting, transporting, and setting shall be included.
ii. Quality control steps shall be included. Quality control steps in this context are the steps operators take to assure the system is properly set up, and that the set up matches the submitted drawings.
iii. Steps to assure safety during the move shall be included.
iv. An hour by hour schedule of the move shall be included.

5. Safety and Communication Plan
   a. Schedule of operations, organization of machinery, safety gear requirements and operational perimeters shall be included.
   b. Contact information for slide system supervisor, contractor supervisor, safety supervisor, and Design-Build Contractor engineer of record shall be included.
   c. The protection of public, spectators, and workers shall be ensured.
   d. Property during the movement of the superstructure shall be protected.
   e. Nighttime operations including lighting shall be addressed.
   f. OSHA requirements shall be addressed.
   g. Schedule of operations, organization of machinery and operational perimeters shall be included.
6. Monitoring Plan. The Design-Build Contractor shall provide the following information, if applicable based on the jacking and slide system provided.
   a. The monitoring plan shall be submitted in the form of Working Drawings or a manual.
   b. Details of a monitoring system shall be included. Monitoring system shall be capable of measuring:
      i. The change in bridge camber at initial lift.
      ii. The relative twist between adjacent lines of supports at initial lift and during the installation.
      iii. The relative change in elevation between adjacent lines of support at initial lift and during the bridge installation. This measurement is not required for bridges installed with two lines of support.
   c. Measuring equipment, procedures and locations of geometry control reference points on the superstructure shall be included.
   d. Longitudinal and lateral location reference points shall be established on the superstructure that correspond to, or can be referenced to, appropriate longitudinal and lateral reference points at the erection site, such as station and offsets.
   e. Warning levels and absolute limit levels shall be included.
      i. Displacement limits shall be established to avoid damage to the superstructure during the installation.
      ii. Displacement limits that are less than or equal to the limits defined in the Design Documents shall be established.
   f. Minimum detectable movements and system accuracy shall be included.
   g. Potential remedial actions that must be implemented when measurements exceed the warning levels shall be included.
   h. Measurements shall be taken and recorded at least as follows:
      i. Before beginning the move. The move monitoring system shall be set and the bridge monitored through a typical daily temperature cycle. Measurements shall be recorded just before dawn of each day and when the bridge reaches the approximate maximum temperature.
      ii. Immediately before initial lift. The initial measurements shall be recorded to establish the baseline for the system.

iii. Immediately after the initial lift. Measurements shall be recorded and compared to the baseline condition. The deflection change shall be calculated as the difference between the condition just before to just after the initial lifting of the bridge.
iv. The measurements shall be monitored continuously during the installation.
v. When the bridge is aligned and ready for setting but is not in contact with the final supports.
vi. After setting the bridge in its permanent location. A final set of monitoring system measurements shall be recorded. The measurements shall be verified to ensure they are within anticipated and allowable tolerance limits specified for permanent elevations.

7. Contingency Plan
   a. Discussion of potential equipment problems such as insufficient equipment or equipment breakdowns.
   b. Discussion of potential problems with inclement weather.
   c. Identification of individuals involved in the superstructure installation and their risks and responsibilities.
   d. Identification of the use of manual overrides of electronic or hydraulic equipment.
   e. Identification of additional equipment to have available.
   f. Public notice of extended delays.
   g. Identification of a detour route for extended closures.
   h. Traffic shall not be allowed to pass beneath the superstructure until the source of the problem is found and corrected.
   i. Corrective actions if problems occur.
8. Details of any temporary sheeting or shoring required to install or complete the installation of the superstructure. This includes any sheeting or shoring required to open the roadway to traffic prior to other permanent earth retaining being installed.
9. The Design-Build Contractor shall provide repair methodology and supporting calculations for procedures for repairing damage and injecting and sealing cracks.
10. Other items not covered above shall be submitted for approval by INDOT.
11. Overall schedule of the timing and sequence of superstructure fabrication, erection, and installation shall be provided. An hour by hour schedule of the bridge installation shall be submitted 21 calendar days prior to the scheduled installation date for review.

The Design-Build Contractor shall allow INDOT 14 calendar days to review and approve Working Drawings and supporting calculations. This review period applies each time the drawings and calculations are submitted.

The Design-Build Contractor shall not deviate from the approved drawings unless authorized in writing by the engineer of record and INDOT.

Faulty design or detailing shall be the Design-Build Contractor's responsibility.

Within the Working Drawings, include revisions to the concepts and to the detailed descriptions of materials, components, erection methods, and sequencing shown on the Design Documents. This includes, but is not limited to, changes to locations of permanent support conditions, cross section component sizes or connectivity, construction joints in any plane, and splice location, sizes, or types as required.

Construction Requirements

General Requirements

The Design-Build Contractor shall use methods and procedures to provide adequate safety to the general public from all construction activities, superstructure installation, and falsework placed over or adjacent to traveled roadways or any existing commercial, industrial or other facilities.

Meetings

The following meetings shall be held between the Design-Build Contactor and INDOT.

1. Superstructure Installation Meeting
   The meeting shall be held a minimum of two weeks prior to the superstructure installation. This meeting shall discuss pertinent items of the Working Drawings, including the contingency plan and safety plan.
2. Final Walk through Pre-installation Meeting
   Immediately prior to installing the bridge, the Design-Build Contractor shall conduct a final walk through pre-installation meeting at the bridge site for the bridge installation and verify all items identified in the Working Drawings have been completed and verify all Work has been completed for the installation.

Horizontal Jacking System

Each jack shall be equipped with either a pressure gauge or a load cell for determining the jacking force. Pressure gauges shall have an accurate reading dial at least 6 in. in diameter. Each jack shall be calibrated by a private laboratory within six months prior to use and after each repair. Certification shall be provided to INDOT prior to its use. Each jack and its gauge shall be calibrated as a unit with the cylinder extension in the approximate position that it will be at final jacking force and shall be accompanied by a certified calibration chart. Load cells shall be calibrated and provided with an indicator by which the jacking force is determined.

The Horizontal Jacking System shall be able to push and pull the superstructure during installation to remedy any complication encountered during installation.

The Horizontal Jacking System shall also have a system in place to prevent longitudinal movement of the bridge during installation.

Age at Installation

The Design-Build Contractor shall not jack or attempt to install the superstructure until it has attained a minimum age of 28 days since the last casting operation, unless otherwise approved by INDOT or the requirements of 702.24 are met. For the purpose of this provision, installation of the structure shall be considered a "traffic load".

Preparation for Installation of Superstructure

1. The Design-Build Contractor shall verify the temporary and permanent bridge seats will accommodate the bridge installation based on their horizontal and vertical geometry. Any discrepancy shall be identified prior to sliding the structure. Proposed mitigation measures shall be submitted to INDOT for approval.
2. The Design-Build Contractor shall verify adequate horizontal and vertical clearances exist to safely move the bridge.

3. If required, the Design-Build Contractor shall carefully jack-up or jack-down the superstructure in an incremental or differential fashion as required by the amount necessary to install the superstructure to the required elevation.
4. The Design-Build Contractor shall operate the Horizontal Jacking System with care and within anticipated stroke limits of the jacking systems. The Design-Build Contractor shall follow limitations on Working Drawings or manuals for all incremental and differential jacking with due regard to corresponding stability conditions for the Horizontal Jacking System and falsework.
5. The Design-Build Contractor shall implement checking, QC/QA, procedures prior to an installation operation to ensure satisfactory completion.
6. The Design-Build Contractor shall implement contingency plans in the event of a major breakdown or equipment malfunction.

Lift, Transportation and Placement of Superstructure

1. The intent during installation is to ensure the structure is delivered to INDOT, in its final location, with no damage or adverse loss of strength, loss of performance or loss of long-term durability. To this end, it is necessary to place certain limitations upon characteristics which can be quantified and observed or checked by careful observations or by using suitable detection methods during these operations.
2. The Design-Build Contractor shall exercise care and precaution when placing the spans into its final location on the bridge bearings and use observations to monitor and record conditions just before and just after setting the span in place.
3. The Design-Build Contractor shall follow the lifting, transporting, and placement plan.
4. The Design-Build Contractor shall monitor the bridge during lifting, transporting, and setting according to the approved monitoring plan.

Tolerances

1. Plan Alignment: Location and Clearances
   a. For the final condition of the span after placement of the superstructure the maximum deviation from alignment in both primary plan directions at each end of the span being set shall not exceed 1 in. or that required for the accommodation of manufactured bearings, whichever is less.
2. Bridge Bearings: Elevation and Location
   a. The Design-Build Contractor shall keep the elevation of individual bridge bearings for superstructure within plus or minus 1/8 in. of required elevations, unless tighter tolerances are required according to the bearing manufacturer or as specified on the Working Drawings.
   b. The Design-Build Contractor shall keep the plan location of bridge bearings within 1/8 in. and the alignment within plus or minus 1/8 in. across the bearing, unless tighter tolerances are required according to the bearing manufacturer or as specified on the Working Drawings.
   c. If tolerances are not met, the Design-Build Contractor shall submit for approval of INDOT, means to adjust elevations or to correct for or accommodate errors or unintended deviations from required tolerances. The Design-Build Contractor shall submit proposals for approval by INDOT for the use of shims, injection of high strength grout or other methods to accommodate differences from required tolerance.
3. During Lifting, Transportation and Placement, Installation:

a. Deflection Change:
    i. Relative to the local tangent to the vertical profile grade at mid-span, the Design-Build Contractor shall keep the anticipated downward deflection of ends of superstructure when lifted at heavy lift support locations within plus or minus 20% of those given on the Design Documents or approved Working Drawings.

b. Twist:
    i. Twist shall not be allowed to exceed the lesser of W/200 or 3 in. when the four monitored points are over the centerlines of the permanent span support bearings. Twist is not allowed to exceed the lesser of W/300 or 2 in. when the four monitored points are over the centerlines of the temporary supports during installation. W is defined as the perpendicular width in feet between the face of rails, clear roadway width.
    ii. Twist shall remain within the above allowable limits or as otherwise predetermined and provided in the approved Working Drawings to incur no damage or cracks, even if cracks close after setting the bridge span in place.

c. Change in Longitudinal Gradient, Along the Railing and Centerline Bridge:
    i. The heavy lift firm is required to provide the maximum allowable change in longitudinal gradient.
    ii. The change in longitudinal gradient is defined as the change in slope experienced along the railing or centerline bridge from conditions just before first lifting to any time during installation.
    iii. The longitudinal gradient may be calculated from differences in elevations taken just before lifting to elevations taken at any time during installation.

d. Change in Transverse Gradient, Across the Beams of Span:
    i. The heavy lift firm is required to provide the maximum allowable change in transverse gradient.
    ii. The change in transverse gradient is defined as the change in slope experienced along the end diaphragms from conditions just before first lifting to any time during installation.
    iii. The change in transverse gradient may be calculated from differences in elevations taken just before lifting to elevations taken at any time during installation.

Corrections and Repairs

After installing the structure, the structure shall be inspected for cracking. Any cracks shall be repaired as follows:

1. Crack width less than 0.016 in. – Sealed with an epoxy penetrating sealer followed by an application of an approved sand. The sealing and sand application shall be repeated as needed to ensure that the voids remain completely filled.
2. Crack width greater than 0.016 in. – Epoxy injection in accordance with 727.

Basis of Item

Superstructure Installation, Slide-In shall be quantified as a lump sum.

The items list shall include the following:

Item No.	**Item Description**	**Unit Symbol**
711-12147	Superstructure Installation, Slide-In,	

Engineering ..... LS

711-12147 Superstructure Installation, Slide-In ..... LS

The following shall be considered incidental to this item:

All materials, labor and incidentals related to the preparation of the Working Drawings, including designing of the slide system.

All other materials, labor and incidentals required to perform the Work described herein, including superstructure monitoring meetings, temporary sheeting and shoring, and superstructure repairs due to the installation and installation and removal of any required temporary supports.

DISK BEARINGS

Description

This Work shall consist of designing, fabricating, and furnishing multi-rotational, high load disk bearings and installing disk bearing assemblies at the locations shown on the Design Documents in accordance with 105.03, the Indiana Design Manual, and the AASHTO LRFD Bridge Design and Construction Specifications, and as described herein.

Materials

Disk bearings shall consist of a polyether urethane structural element, disk, confined by upper and lower steel bearing plates. The bearing shall be equipped with a shear resisting mechanism, positive location device, or both, to prevent lateral movement of the disk. Bearings shall adequately provide for thermal expansion and contraction, rotation, camber changes, and creep and shrinkage of structural members, where applicable. Bearing assemblies shall include the bearing device, distribution plates, distribution pads, and connection hardware.

Disk bearings shall be supplied as fixed bearings; guided expansion bearings; non-guided expansion bearings; and uplift bearings as designated by the Design Documents. Disk bearings may be used as an alternate to a pot bearing.

All materials shall be new and unused, with no reclaimed material incorporated in the finished bearing.

The physical properties of the polyether urethane elements shall be in accordance with AASHTO LRFD Bridge Construction Specifications, Table 18.3.2.8-1.

All steel except stainless steel components of the bearing shall conform to the requirements of the type of steel designated on the contract Design Documents.

Stainless steel shall conform to the requirements of ASTM A240 – Type 304. Higher grades of stainless steel are permissible. Stainless steel in contact with the polytetrafluoroethylene, PTFE, Sheet shall be polished to a bright mirror finish, less than 20 micro-inches root mean square. The minimum thickness of the stainless steel shall be 0.063 in.

The PTFE sheet shall be manufactured from pure virgin, not reprocessed, PTFE resin. The PTFE sheet shall meet the applicable material requirements of AASHTO LRFD Bridge Construction Specifications, Section 18.8.2. The finished PTFE sheet shall be resistant to all acids, alkalis, and petroleum products, stable at temperatures from -360°F to +500°F, non-flammable, and non-absorbing of water. The minimum thickness of the PTFE sheet shall be 0.188 in.

The elastomeric rotational element shall be molded as a single piece. Separate layers are not allowed.

General Design Requirements

The Design-Build Contractor shall provide disk bearings for the loads and movements shown on the Design Documents. However, the Design-Build Contractor shall use the anchor rod size, length, spacing and masonry plate thickness as shown on the Design Documents and provide an overall height of the bearing assembly that is at least the height shown on the contract Design Documents,

but no more than 1/8 in. greater than this height. Otherwise, bearing seat elevations as shown on the Design Documents will need to be revised.

Qualification Requirements

Disk bearings and the bearing supplier shall be subject to the qualification requirements for acceptance listed below.

Disk bearings shall be designed and constructed in accordance with AASHTO LRFD Bridge Design Specifications 4th Edition, Section 14, and AASHTO LRFD Bridge Construction Specifications 2nd Edition, Section 18.

The supplier shall show previous history in the design and fabrication of disk bearings. Documentation showing a minimum of five years' experience and 10 bridge installations shall be provided to INDOT.

Sliding bearings shall be stiff in shear. Negligible shear displacements shall occur within the vertical load support element.

The vertical load support element, elastomeric disk shall be designed for rotational fatigue at the design vertical load. Rotational loading shall be static dead load rotation plus cyclic live load rotation. Unless otherwise specified, the minimum number of cyclic design rotations shall be 5 million. Bearings that rely upon lateral confinement of the elastomer to sustain the vertical load shall simultaneously include 1/2 the design horizontal load. In lieu of long term testing, accelerated rotational fatigue life testing may be performed with 15,000 complete cycles at +/- 0.02 radians on a minimum of 3 full size bearings. Rotational fatigue test results shall be provided to INDOT.

Submittals

The Design-Build Contractor shall submit eight copies of drawings and calculations to INDOT for review and shall have received acceptance prior to constructing the girder seats and fabrication of disk bearings. These drawings shall include, but not be limited to, the following information:

(1) Plan and elevation of each disk bearing size.
(2) Complete details and sections showing all materials, with ASTM or other designations, incorporated in the disk bearings.
(3) Vertical and horizontal load capacities.
(4) Bearing seat and all bearing connection details.

The Working Drawings and calculations shall be stamped by a Registered Professional Engineer from the State of Indiana and shall be employed by the bearing supplier with at least five years of documented history of disk bearing design experience.

Fabrication

The Design-Build Contractor shall provide INDOT with written notification 30 days prior to the start of bearing fabrication. The bearing fabricator shall be certified by the American Institute of Steel Construction, AISC, for Simple Steel Bridges Category.

All steel surfaces exposed to the atmosphere, except stainless steel surfaces and metal surfaces to be welded, shall be shop coated in accordance with the Design Documents. Prior to coating, the exposed steel surfaces shall be cleaned in accordance with the recommendations of the coating's manufacturer. Metal surfaces to be welded shall be given a coat of clear lacquer, or other protective coating approved by INDOT. The coating shall be removed at the time

of welding. No painting shall be done to these surfaces prior to completing welding.

Stainless steel sheet shall be attached to its steel substrate with a continuous seal weld.

All welding shall conform to, and all welders shall be qualified in accordance with, the requirements of the American Welding Society, AWS.

Except as noted, all bearing surfaces of steel plates shall be finished or machined flat within 0.010 in./ft. Out-of-flatness greater than 0.010 in./ft on any plate shall be cause for rejection. The bottom surfaces of lower bearing plates, masonry plates, designed to rest on bearing pads shall not exceed an out-of-flatness value of 0.0625 in./ft. Oxygen cut surfaces shall not exceed a surface roughness value of 1000 micro-inches as defined by ANSI B46.1.

Gross bearing dimensions shall have a tolerance of −0, + 1/8 in.

Every bearing shall have the project identification number, lot number, and individual bearing number indelibly marked with ink on a side that will be visible after erection.

After assembly, including sole plates and masonry plates, bearing components shall be held together with steel strapping or other means, to prevent disassembly until the time of installation. Packaging shall be adequate to prevent damage from impact as well as from dust and moisture contamination during shipping and storage.

Sampling and Testing

Production bearing sampling and testing shall be performed in accordance with AASHTO LRFD Bridge Construction Specifications, Section 18.3.4.

Each bearing shall be visually examined both during and after testing. Any resultant defects, such as bond failure, physical destruction or cold flow of PTFE to the point of debonding, shall be cause for rejection. Defects such as extruded or deformed elastomer or cracked steel shall also be cause for rejection.

Construction Requirements

Installation

Bearings delivered to the bridge site shall be stored under cover on a platform above the ground surface. Bearings shall be protected at all times from damage. When placed, bearings shall be dry, clean, and free from dirt, oil, grease, or other foreign substances.

Bearing devices shall not be disassembled unless otherwise allowed by INDOT or the manufacturer.

Bearings shall be installed in accordance with the alignment plan and installation scheme as shown on the Design Documents. Upon final installation of the bearings, INDOT, in the presence of the manufacturer’s representative if required, shall inspect the bearing components to assure that they are level and parallel to with ± 0.005 radians. Any deviations in excess of the allowed tolerances shall be corrected.

Bearings assemblies shall be handled by their bottom surfaces only and shall not lifted by their tops, sides or shipping bands.

Caution shall be taken to ensure that the steel temperature directly adjacent to the polyether urethane rotational element does not exceed 225°F. The polyether urethane disk shall not be exposed to direct flame or sparks.

Certificate of Compliance

In addition to records of test results, the Design-Build Contractor's disk bearing supplier shall submit Certificates of Compliance for the disk bearings indicating the materials, fabrication, testing, and installation are as specified herein.

Basis of Item

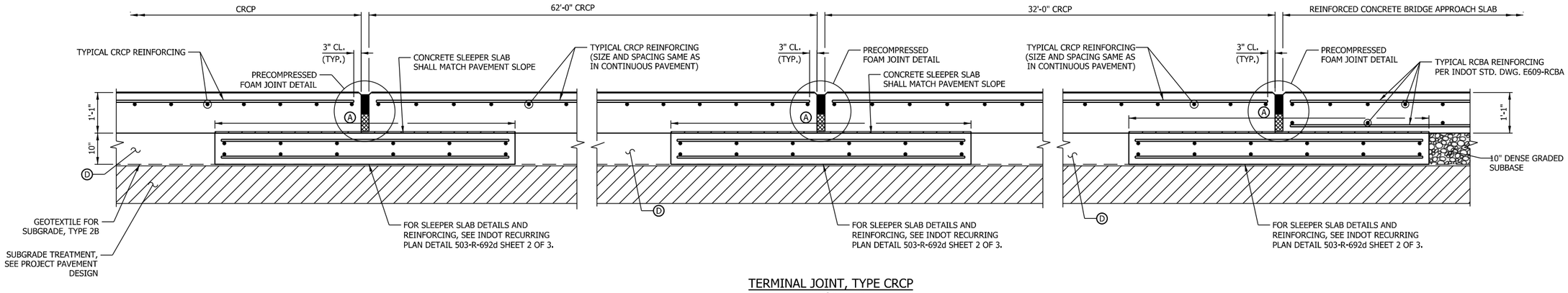
Disk Bearings fabricated and installed shall be quantified per each and shall be defined as one complete bearing assembly including anchor bolts, masonry plate, steel sole plate, bearing device, distribution plates, distribution pads, connection hardware and any incidental material needed to complete the Work.

The items list shall include the following:

Item No.	Item Description	Unit Symbol
707-10188	High Load Multi-Rotational Bearings, Guided	Each
707-10188	High Load Multi-Rotational Bearings, Fixed	Each
707-10188	High Load Multi-Rotational Bearings, Guided, Uplift	Each

The following shall be considered incidental to this item:

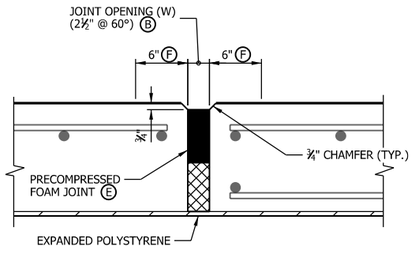
Furnishing all labor, materials, tools, equipment and incidentals required to complete the Work in accordance with the Standard Specifications, this Special Provision, the manufacturer's requirements and as directed by INDOT.



TERMINAL JOINT, TYPE CRCP

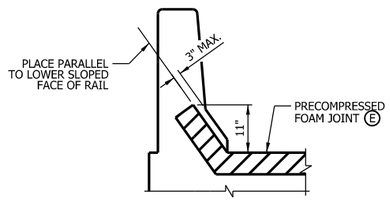
SCALE: 3/4" = 1'-0"

BILL OF MATERIALS	
CONCRETE	
CONCRETE, CLASS "A" (C)	XXX CYS
MISCELLANEOUS	
TERMINAL JOINT, TYPE CRCP	XX LFT
PRECOMPRESSED FOAM JOINT (C)	XX LFT



PRECOMPRESSED FOAM JOINT DETAIL

SCALE: 1½" = 1'-0"



PRECOMPRESSED FOAM JOINT DETAIL AT RAIL

SCALE: ¾" = 1'-0"

NOTES:

1. FOR ADDITIONAL INFORMATION ON TERMINAL JOINT, TYPE CRCP, SEE SPECIAL PROVISIONS.
2. ALL SLEEPER SLAB CONCRETE SHALL BE CLASS A.
3. ALL REINFORCING BARS SHALL BE EPOXY COATED.
4. MIN. LAP FOR #5 = 3'-6".
5. FOR ADDITIONAL REINFORCING BAR NOTES AND DETAILS, SEE STANDARD DRAWING E703-BRST-01.

LEGEND:

CRCP DENOTES CONTINUOUSLY REINFORCED CONCRETE PAVEMENT

(A) LIMITS OF POLYETHYLENE BOND BREAKER (MIN. THICKNESS 10 MILS)

(B) THE JOINT OPENING WIDTH SHALL BE CONSTRUCTED BASED ON THE ACTUAL AMBIENT TEMPERATURE AT THE TIME OF CONSTRUCTION, WITH THE MANUFACTURER'S JOINT SETTING TABLE. THE BRIDGE EXPANSION LENGTH SHALL BE AS SHOWN ON THE PLANS. THE MINIMUM AND MAXIMUM JOINT OPENING WIDTH SHALL BE AS SHOWN BELOW:
- EXPANSION LENGTH 250 FT. OR LESS
  - W (MIN.) = 1.3 IN.
  - W (MAX.) = 3.7 IN.
- EXPANSION LENGTH GREATER THAN 250 FT. AND LESS THAN 400 FT.
  - W (MIN.) = 1.0 IN.
  - W (MAX.) = 4.0 IN.

(C) FOR INFORMATION ONLY, INCLUDED IN THE COST OF "TERMINAL JOINT, TYPE CRCP".

(D) 440 LBS/SYS QC/QA-HMA, 3, 64, BASE, 19.0 MM, ON 6 IN. OF COMPACTED AGGREGATE, NO. 53, SEE PROJECT PAVEMENT DESIGN

(E) THE PRECOMPRESSED FOAM JOINT SHALL ACCOMMODATE BOTH THE MINIMUM AND MAXIMUM JOINT OPENING WIDTHS AS SHOWN HEREIN.

(F) NEXT GENERATION CONCRETE SURFACE SHALL BE TERMINATED 6 IN. BEFORE JOINT.

DRAFT
NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

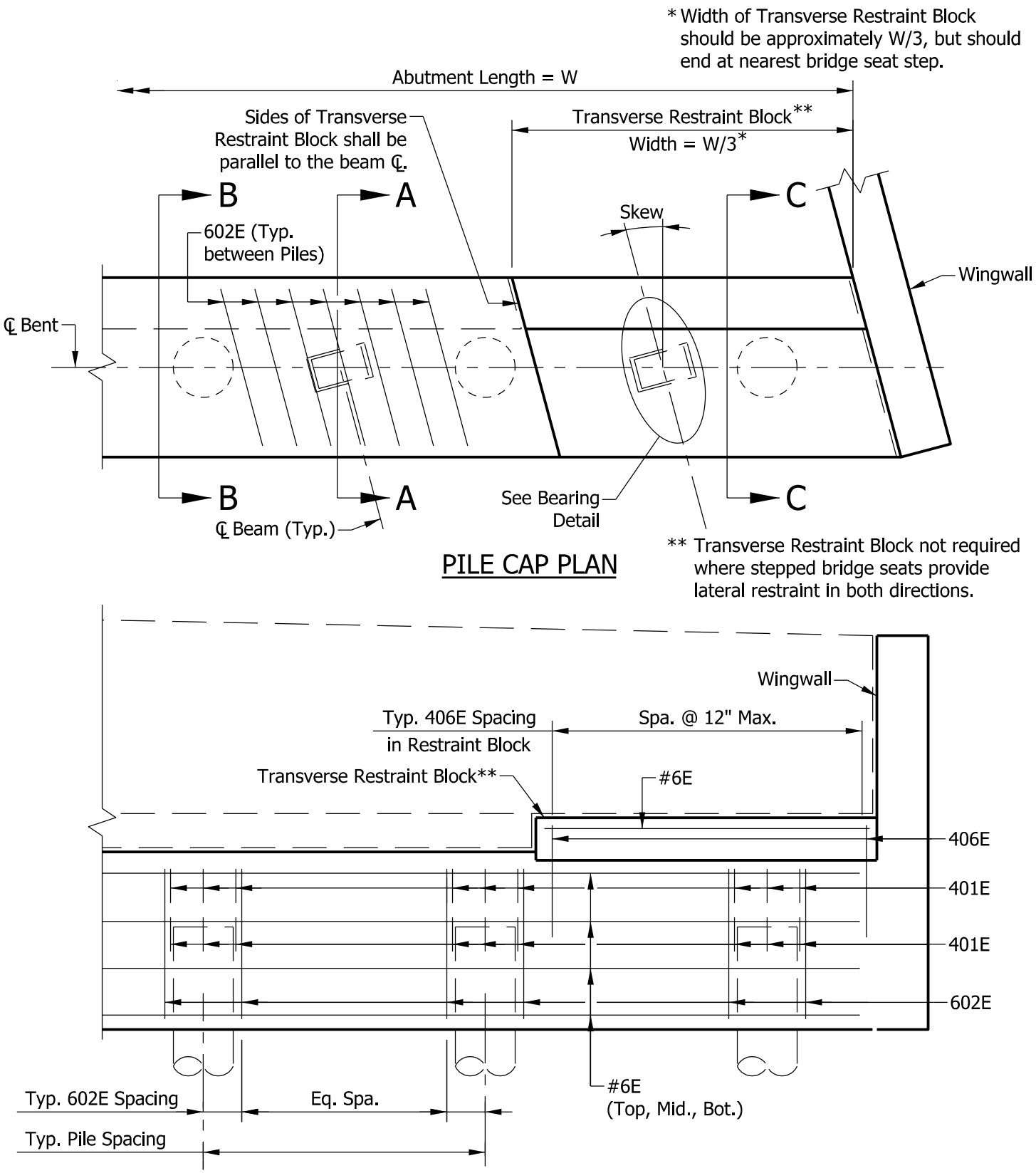
DESIGNED: JJO DRAWN: CLF

CHECKED: BDL CHECKED: JJO

INDIANA
DEPARTMENT OF TRANSPORTATION

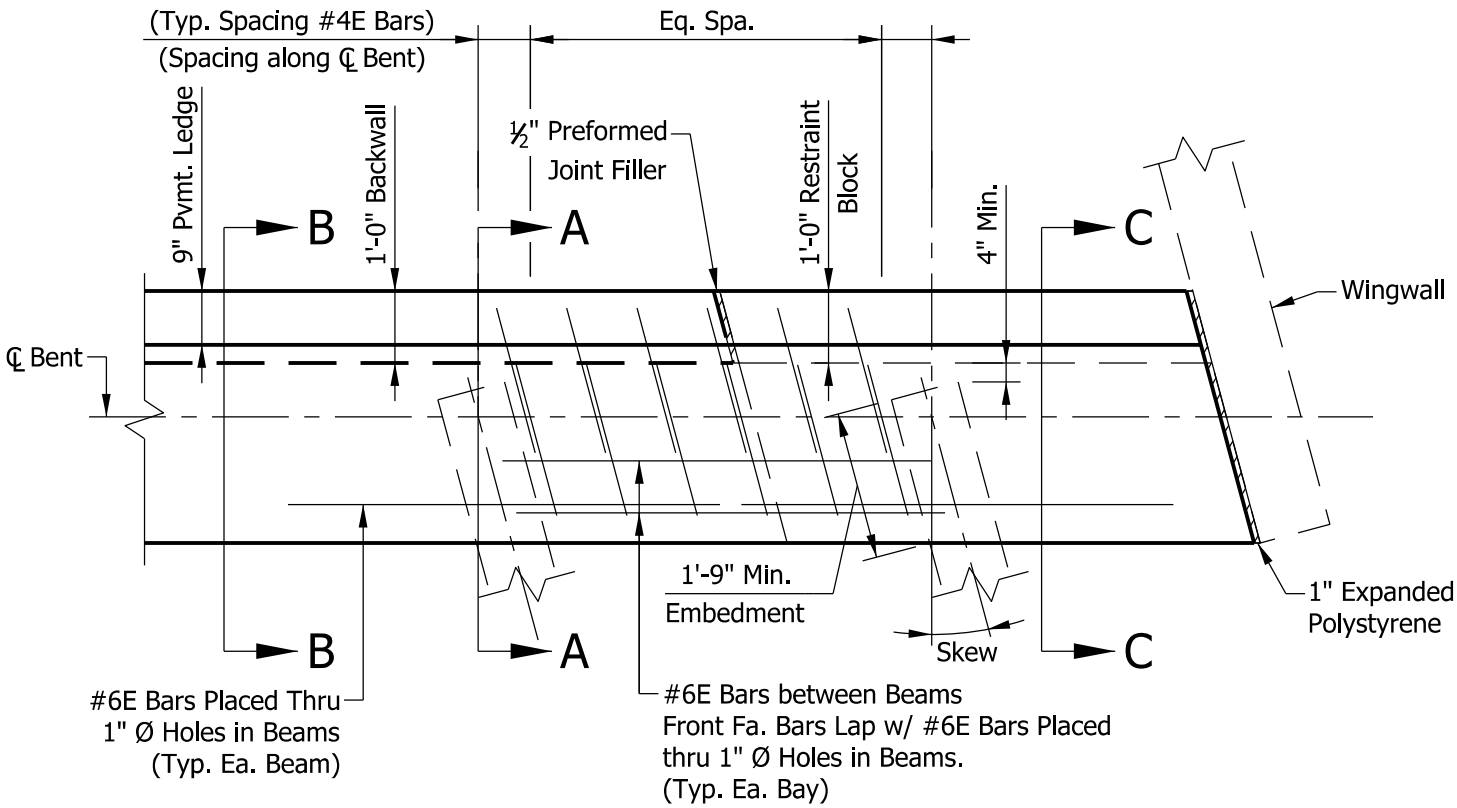
TERMINAL JOINT DETAILS: TYPE CRCP

HORIZONTAL SCALE	BRIDGE FILE
AS NOTED	TBD
VERTICAL SCALE	DESIGNATION
AS NOTED	TBD
SURVEY BOOK	SHEETS
ELECTRONIC	1 of 1
CONTRACT	PROJECT
B-36910	1600808

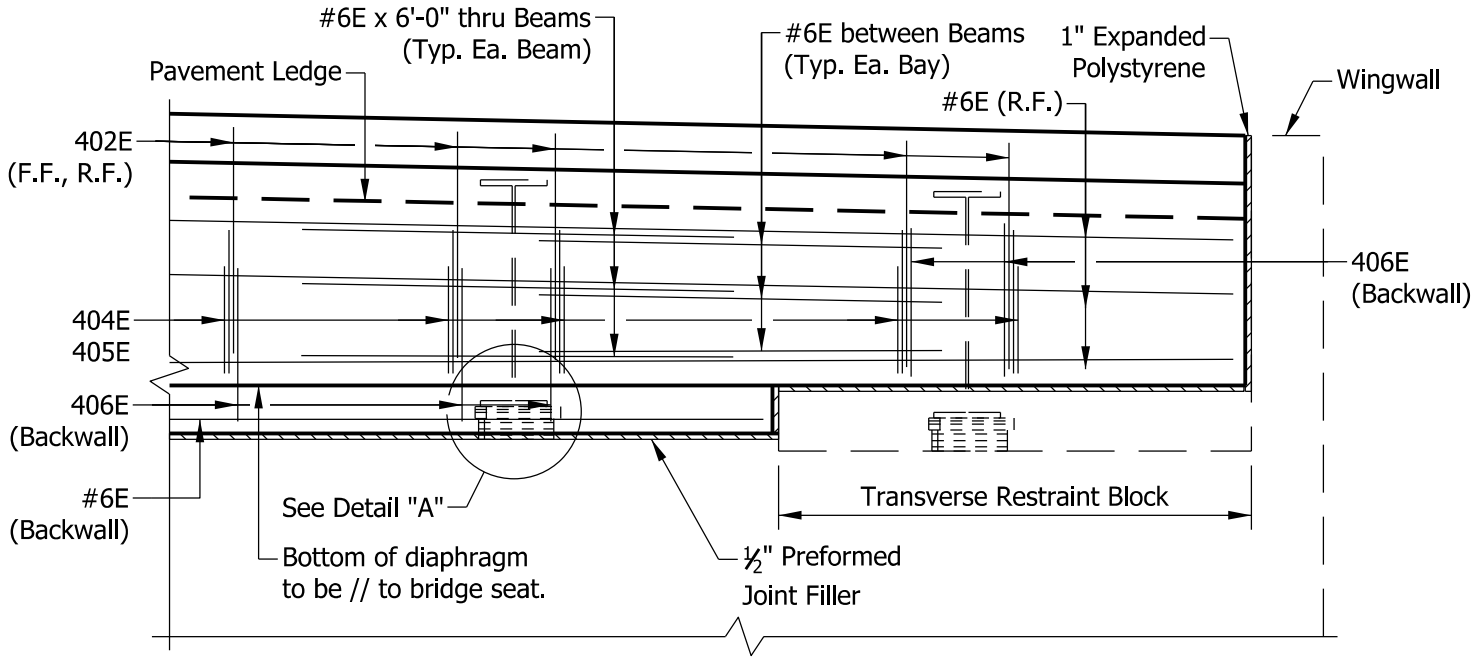


SEMI-INTEGRAL END BENT DETAILS

Figure 409-3A
(Sheet 1 of 7)



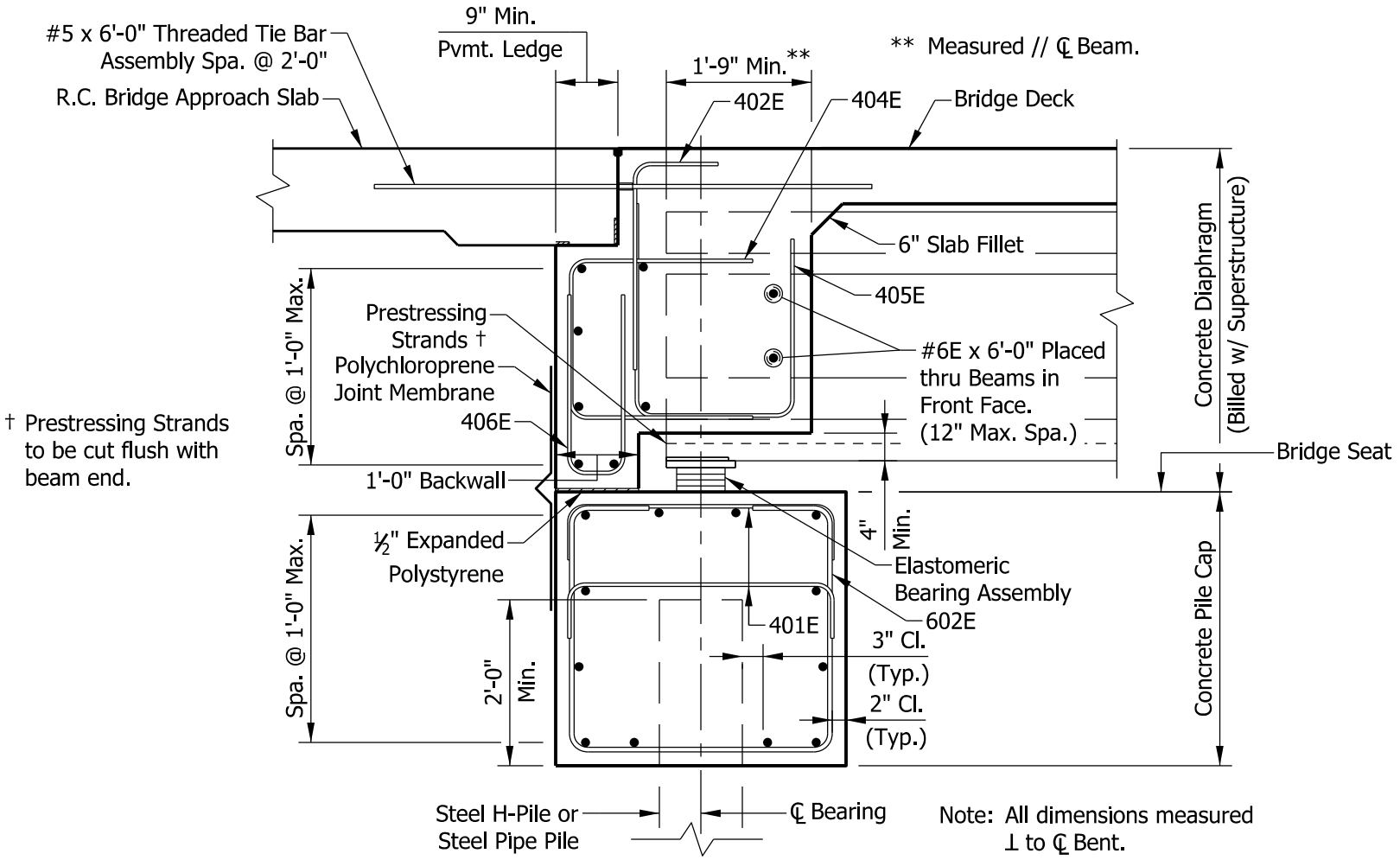
END DIAPHRAGM PLAN



END DIAPHRAGM ELEVATION

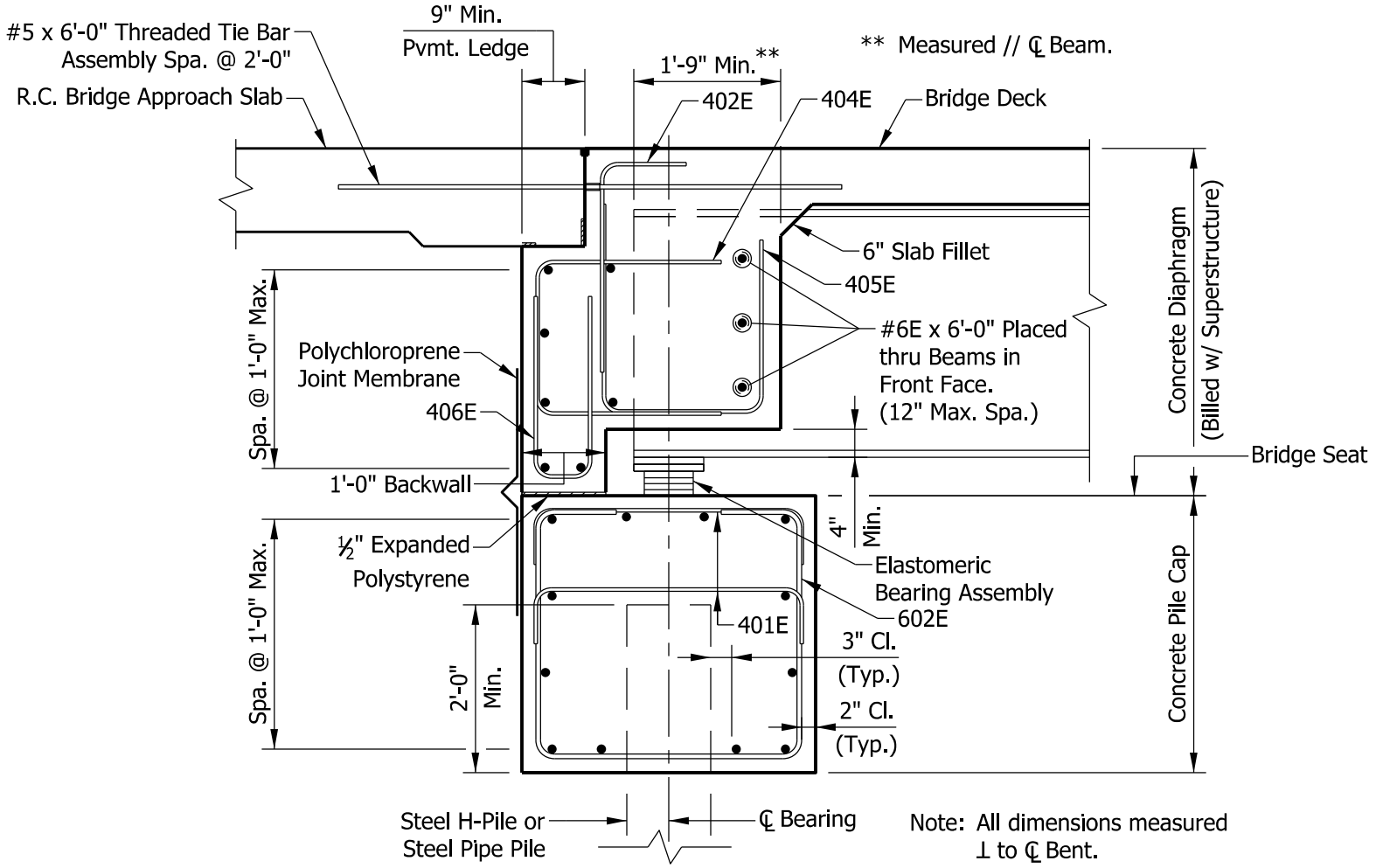
SEMI-INTEGRAL END BENT DETAILS

Figure 409-3A
(Sheet 2 of 7)



SECTION A-A THROUGH CONCRETE BEAM

SEMI-INTEGRAL END BENT DETAILS
Figure 409-3A
(Sheet 3 of 7)

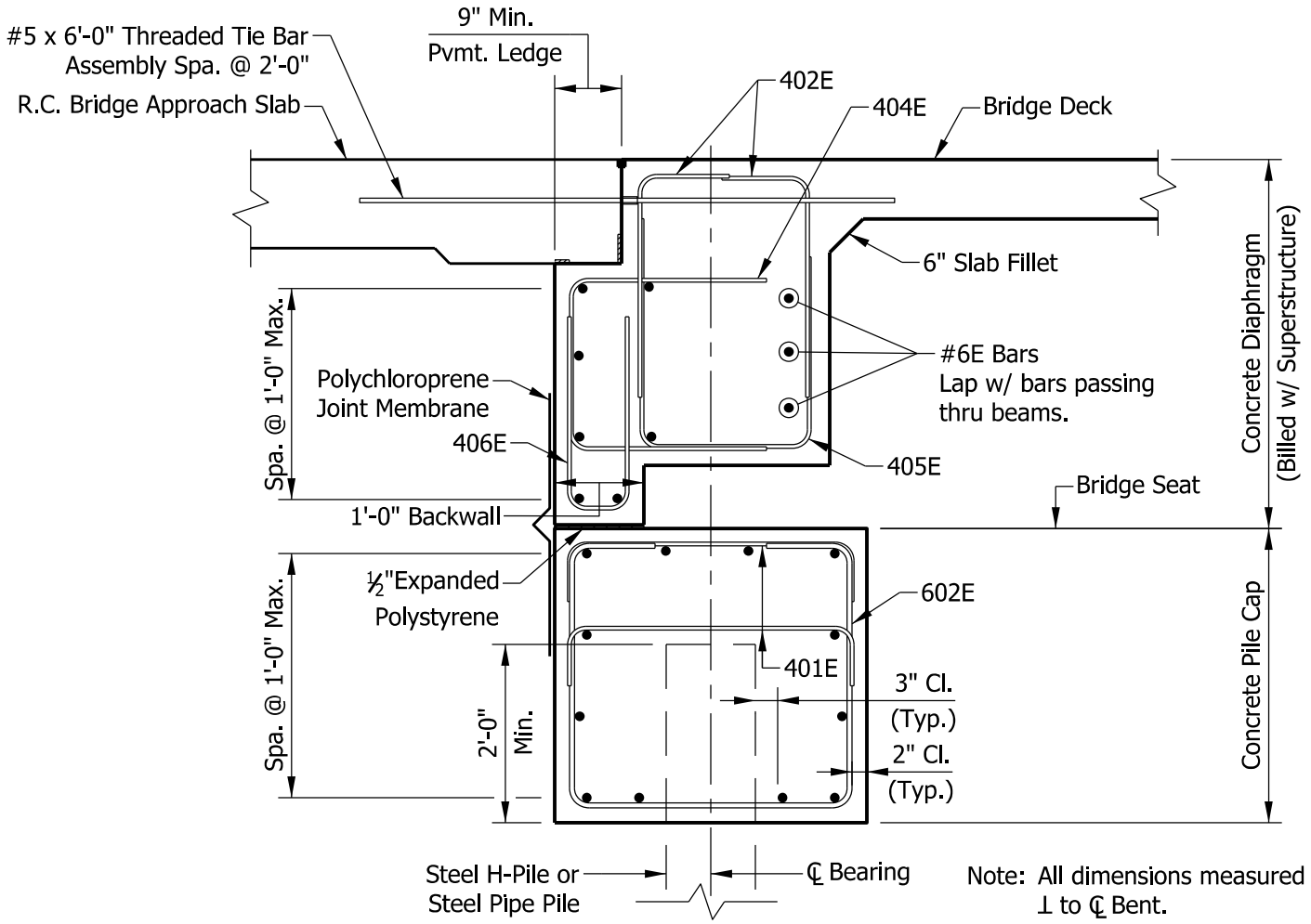


SECTION A-A THROUGH STEEL BEAM

SEMI-INTEGRAL END BENT DETAILS

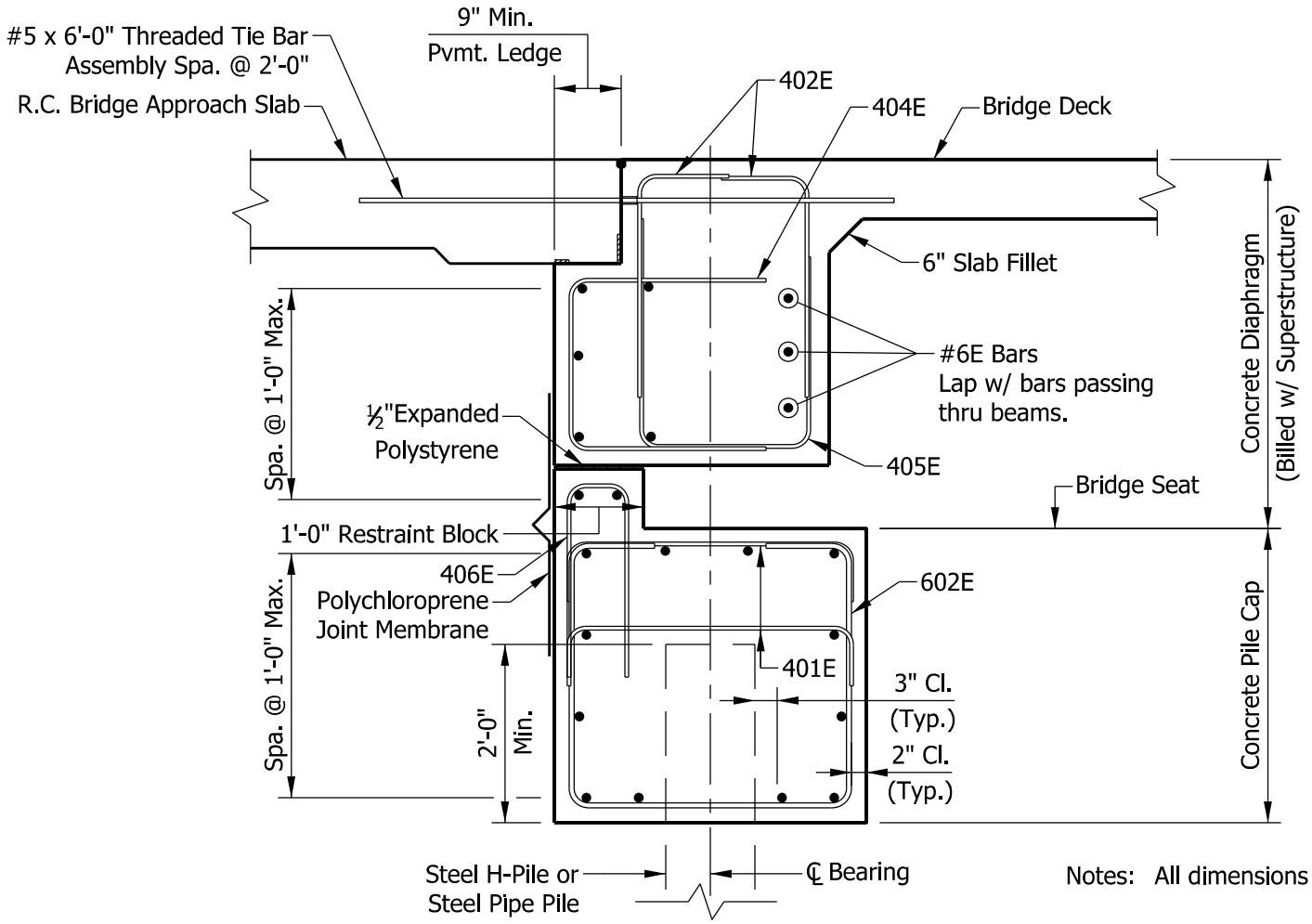
Figure 409-3A

(Sheet 4 of 7)



SECTION B-B BETWEEN BEAMS

SEMI-INTEGRAL END BENT DETAILS
Figure 409-3A
(Sheet 5 of 7)

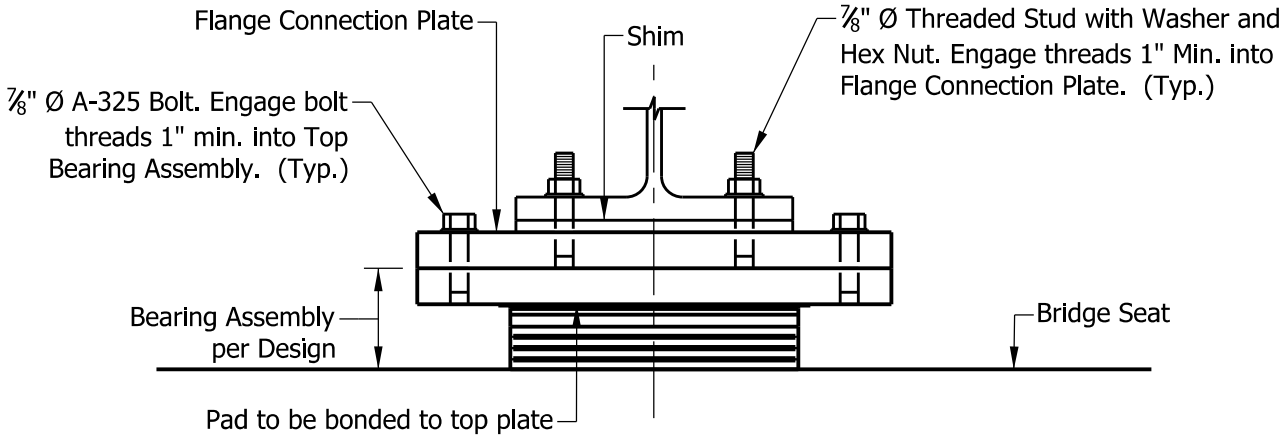


Notes: All dimensions measured ⊥ to ℄ Bent.

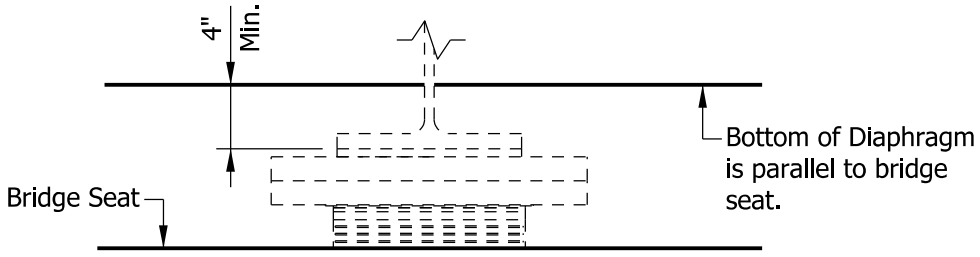
Transverse Restraint Block not required when stepped bridge seats provide lateral restraint in both directions.

SECTION C-C BETWEEN BEAMS
THROUGH TRANSVERSE RESTRAINT BLOCK

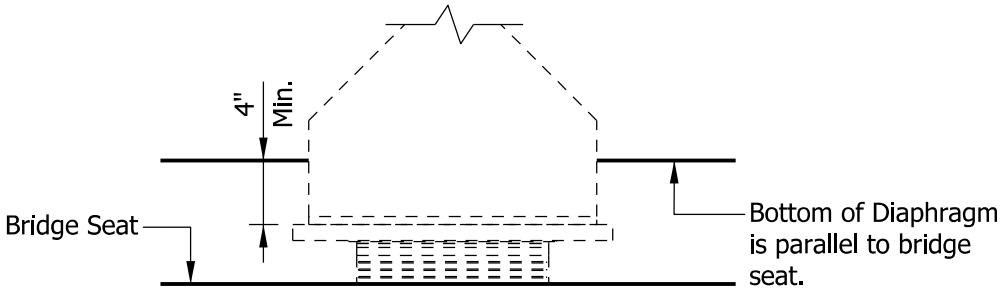
SEMI-INTEGRAL END BENT DETAILS
Figure 409-3A
(Sheet 6 of 7)



SECTION THROUGH STEEL BEAM



(STEEL BEAM)

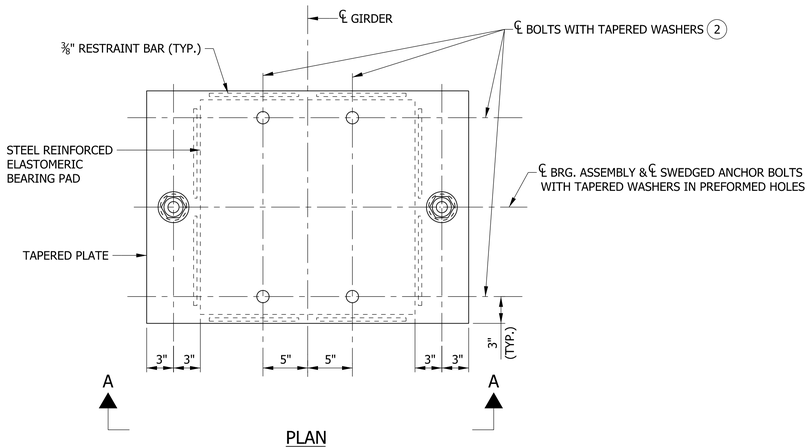


(CONCRETE BEAM)

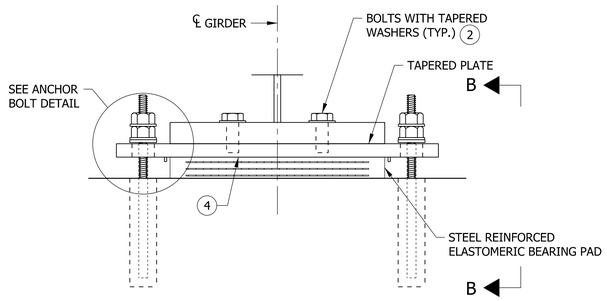
DETAIL "A"

SEMI-INTEGRAL END BENT DETAILS

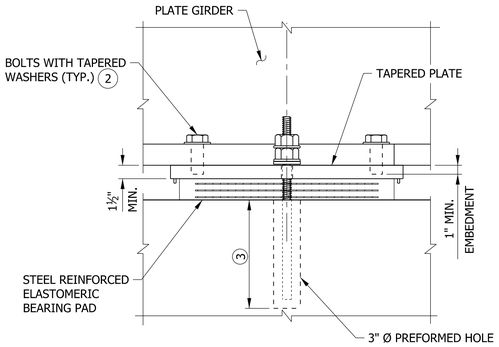
Figure 409-3A
(Sheet 7 of 7)



PLAN
(BOTTOM FLANGE NOT SHOWN FOR CLARITY)

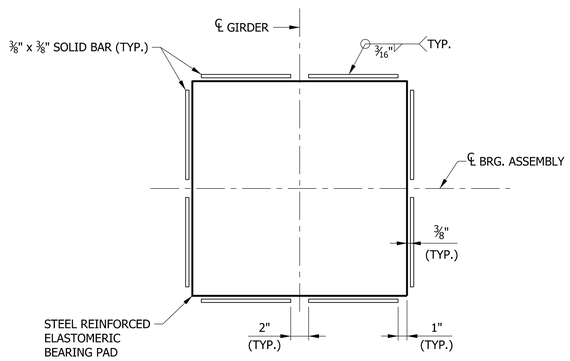


SECTION A-A

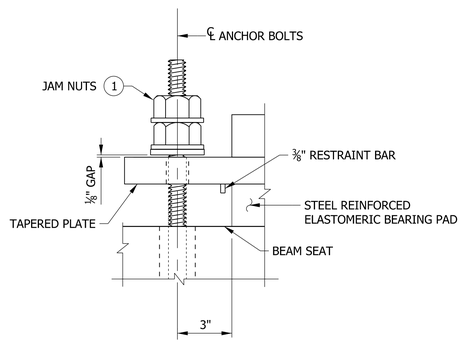


SECTION B-B

FIXED BEARING



RESTRAINT BAR PATTERN (5)



ANCHOR BOLT DETAIL

LEGEND

(1) INSTALL LOWER NUT IN CONTACT WITH TAPERED PLATE AND THEN BACK OFF ½ TURN. INSTALL UPPER NUT SNUG TIGHT TO PREVENT LOWER NUTS FROM LOOSENING.

(2) BOLTS SHALL BE DRILLED AND TAPPED TO A MINIMUM EMBEDMENT OF 1" INTO THE TAPERED PLATE.

(3) THE HOLES FOR THE ANCHOR BOLTS SHALL BE FORMED IN THE PIER CAP. HOLES SHALL NOT BE DRILLED. THE HOLE FORM MUST BE REMOVED PRIOR TO PLACING & GROUTING THE ANCHOR BOLTS. THE GROUT SHALL BE HIGH STRENGTH, NON-SHRINK, NON-METALLIC.

(4) ELASTOMERIC BEARING PAD SHALL BE VULCANIZED WITH THE BOTTOM OF THE TAPER PLATE . THE BOTTOM FACE OF THE TAPERED PLATE SHALL NOT BE METALLIZED.

(5) AS AN ALTERNATE TO THE RESTRAINT BARS, DESIGN-BUILD CONTRACTOR MAY USE A THICKER PLATE WITH A ⅜" MINIMUM RECESS IN THE BOTTOM OF THE TAPERED TOP PLATE.

NOTES:

1. ANCHOR BOLTS CONNECTING BOTTOM FLANGE TO TAPER PLATE SHALL BE ASTM F3125 GRADE A325 TYPE 1. SWEDGED ANCHOR BOLTS SHALL BE ASTM F1554 WITH GRADE AS DETERMINED BY FINAL DESIGN REQUIREMENTS.
2. ALL STEEL PLATES SHALL BE ASTM A709 GRADE 36 OR 50 AND METALLIZED. (SEE SPECIAL PROVISIONS)
3. TAPERED PLATE SHALL BE TAPERED AS NECESSARY TO ACCOMMODATE PROFILE GRADE AND MINIMIZE ROTATION.

NOTE TO DESIGN-BUILD CONTRACTOR

THESE DETAILS REPRESENT MINIMUM REQUIREMENTS. DESIGN-BUILD CONTRACTOR SHALL BE RESPONSIBLE FOR THE FINAL DESIGN AND DETAILING ENSURING THE DIMENSIONS AND SIZE OF ALL COMPONENTS SATISFY THE REQUIREMENTS OF THE PROJECT STANDARDS.

DRAFT
NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: _____ DRAWN: _____

CHECKED: _____ CHECKED: _____

INDIANA
DEPARTMENT OF TRANSPORTATION

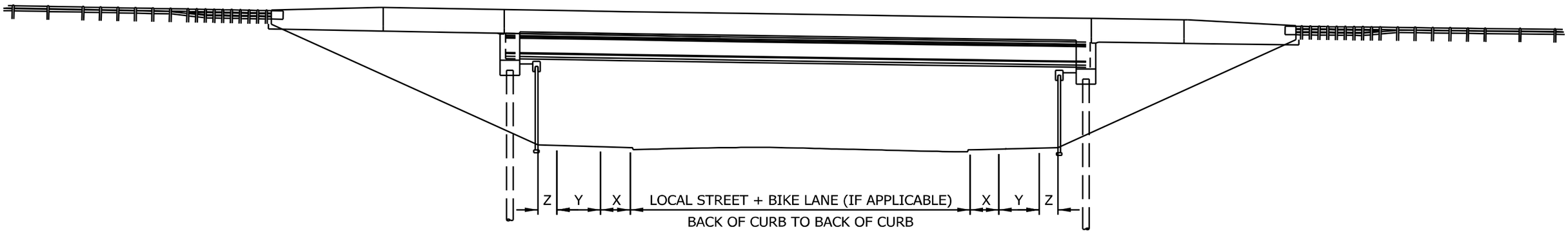
FIXED BEARING ASSEMBLY DETAILS

HORIZONTAL SCALE	BRIDGE FILE
NOT TO SCALE	
VERTICAL SCALE	DESIGNATION
NOT TO SCALE	
SURVEY BOOK	SHEETS
	of
CONTRACT	PROJECT

NORTH SPLIT UPGRADES DRIVING PROGRESS

MINIMUM LOCAL STREET REQUIREMENTS TO SET BRIDGE SPAN LENGTHS

Local Street	Buffer Width (X)	Sidewalk/Bike Path (Y)	Wall/Pier/Monument Offset (Z)
Washington Street	3 ft.	12 ft.	2 ft.
Market Street	3 ft.	10 ft.	2 ft.
New York Street	3 ft.	10 ft.	2 ft.
Vermont Street	3 ft.	10 ft.	2 ft.
Michigan Street	3 ft.	12 ft.	2 ft.
St. Clair Street	8 ft.	10 ft.	2 ft.
10th Street	8 ft.	12 ft.	2 ft.
Central Avenue	3 ft.	12 ft.	2 ft.
College Avenue	8 ft.	12 ft.	2 ft.



09-01-17

107-R-169 STATEMENTS ABOUT EXISTING CONDITIONS OF UTILITIES, ADDITIONAL RIGHT-OF-WAY, AND ENCROACHMENTS

(Revised 05-25-17)

The Standard Specifications are revised as follows:

SECTION 107, AFTER LINE 755, INSERT AS FOLLOWS:

107.26 Existing Conditions of Utilities, Additional Right-of-Way, and Encroachments

Such existing conditions are as described below.

(a) Utilities

The status of all utility companies and organizations potentially involved with the work to be performed are described below as known at the time this contract was prepared.

The facilities of AT&T – Distribution facilities exist within the project limits. Facilities are both buried and aerial on poles. Facilities with conflicts will be relocated as a Type 2 Utility Adjustment. . If questions arise, Zach Goodbar of the utility may be contacted at 317-610-5443.

The facilities of AT&T – Transmission facilities exist within the project limits but are not expected to be affected by the proposed construction. Their facilities consisted of buried fiber optic cables near the Monon Trail. If questions arise, Luke Dillow of the utility may be contacted at ldillow@jmceainc.com.

The facilities of Citizens Energy Group - Gas facilities exist within the project limits. Facilities with conflicts will be relocated as a Type 2 Utility Adjustment. If questions arise, Rich Miller of the utility may be contacted at 317-927-4684.

The facilities of Citizens Energy Group - Sanitary facilities exist within the project limits. Inlets & pipes currently serving roadway infrastructure may be affected. Facilities will coordinate with Design-Build Contractor and adjustments will be made as a part of construction. If questions arise, David Clark of the utility may be contacted at 317-429-3993.

The facilities of Citizens Energy Group - Water facilities exist within the project limits. Facilities with conflicts will be relocated as a Type 1 Utility Adjustment. If questions arise, David Clark of the utility may be contacted at 317-429-3993.

The facilities of Spectrum (Bright House, Time Warner) – Communications exist within the project limits on existing Indiana Power & Light poles. If questions arise, Jeff Farmer of the utility may be contacted at 317-710-2628.

The facilities of Comcast Cablevision exist within the project limits but are not expected to be affected by the proposed construction. If questions arise, William Morris of the utility may be contacted at 317-516-2237.

The facilities of Crown Castle Fiber – Communications exist within the project limits on existing Indiana Power & Light poles. If questions arise, Craig Brown of the utility may be contacted at 317-819-8648 craig.brown@crowncastle.com.

The facilities of Indianapolis Power and Light – Distribution exist within the project limits. Facilities on aerial poles near College Avenue and aerial poles near St. Clair will be replaced as a Type 1 Utility Adjustment with buried distribution facility within the limits of the project. Existing Facilities which are currently buried are not to be affected by proposed construction. It is anticipated that they will adjust their facilities for construction after Environmental Determination. If questions arise, Jim Duvall of the utility may be contacted at 317-261-8694.

The facilities of Indianapolis Power and Light – Transmission exist within the project limits. Facilities on aerial poles near 10th Street and aerial poles near St. Clair will be replaced as a Type 1 Utility Adjustment It is anticipated that they will adjust their facilities for construction after Environmental Determination. If questions arise, Dana Smith of the utility may be contacted at 317-261-8686.

The facilities of Zayo Bandwidth (Infinity Fiber) – Communications exist within the project limits on existing Indiana Power & Light poles. It is anticipated that they will adjust their facilities as a Type 2 Utility Adjustment after Environmental Determination. If questions arise, Waylon Higgins of the utility may be contacted at 765-341-1199 or Adam Lamb of EEG may be contacted at 317-697-2123.

The facilities of IUPUI exist within the project limits but are not expected to be affected by the proposed construction. If questions arise, Eric Mauser of the utility may be contacted at 317-274-5230.

The facilities of Century Link (Aka Level 3 Communications) – Communications exist within the project limits on existing Indiana Power & Light poles. It is anticipated that they will adjust their facilities after Environmental Determination as a Type 1 Utility Adjustment. If questions arise, Tim Hill of the utility may be contacted at 704-733-3204 or Andrew Purcell may be contacted at 317-289-9588.

The facilities of MCI/Verizon exist with the project limits but are not expected to be affected by the proposed construction. If questions arise, Ronald Kocienski of the utility may be contacted at 317-685-8050.

The facilities of Metro Fibernet, LLC exist with the project limits, but are not expected to be affected by the proposed construction. If questions arise, Korie Nellis of the utility may be contacted at 812-213-1378.

The facilities of Intelligent Fiber Network, LLC exist with the project limits, but are not expected to be affected by the proposed construction. If questions arise, Keith Hamm of the utility may be contacted at 317-777-7583 or Adam Lamb may be contacted at 317-697-2123.
The facilities of Windstream (Aka Paetec) – Communications exist within the project limits on existing Indiana Power & Light poles. It is anticipated that they will adjust their facilities after Environmental Determination as a Type 2 Utility Adjustment. If questions arise, Daniel Leskinen of the utility may be contacted at 812-455-9558.

The facilities of Purdue University Light Fiber - Communications exist with the project limits but are not expected to be affected by the proposed construction. If questions arise, George Huss of the utility may be contacted at 443-403-2023.

The facilities of Sprint/Nextel - Communications exist with the project limits but are not expected to be affected by the proposed construction. If questions arise, Steve Hughes of the utility may be contacted at 513-459-5796.

The facilities of US Signal. - exist with the project limits but are not expected to be affected by the proposed construction. If questions arise, John Lundell of the utility may be contacted at 616-443-9027.

(b) Right-of-Way

There is no involvement of additional right-of-way for the contract.

(c) Encroachments

All known encroachments within the project limits have been removed or have been cleared to remain, except as follows:

Encroachment	*Owner*	*Location*	*Estimated Clear Date*

(d) Other Noteworthy Conditions

There are no other noteworthy conditions which may affect the prosecution and progress of the contract.

(d) Other Noteworthy Conditions

The following condition exists which may affect the prosecution and progress of the contract.

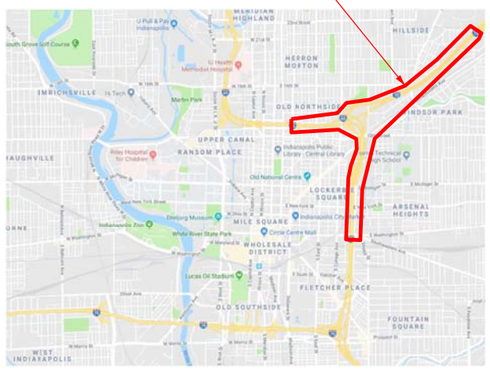
(e) Preconstruction Conference Notification

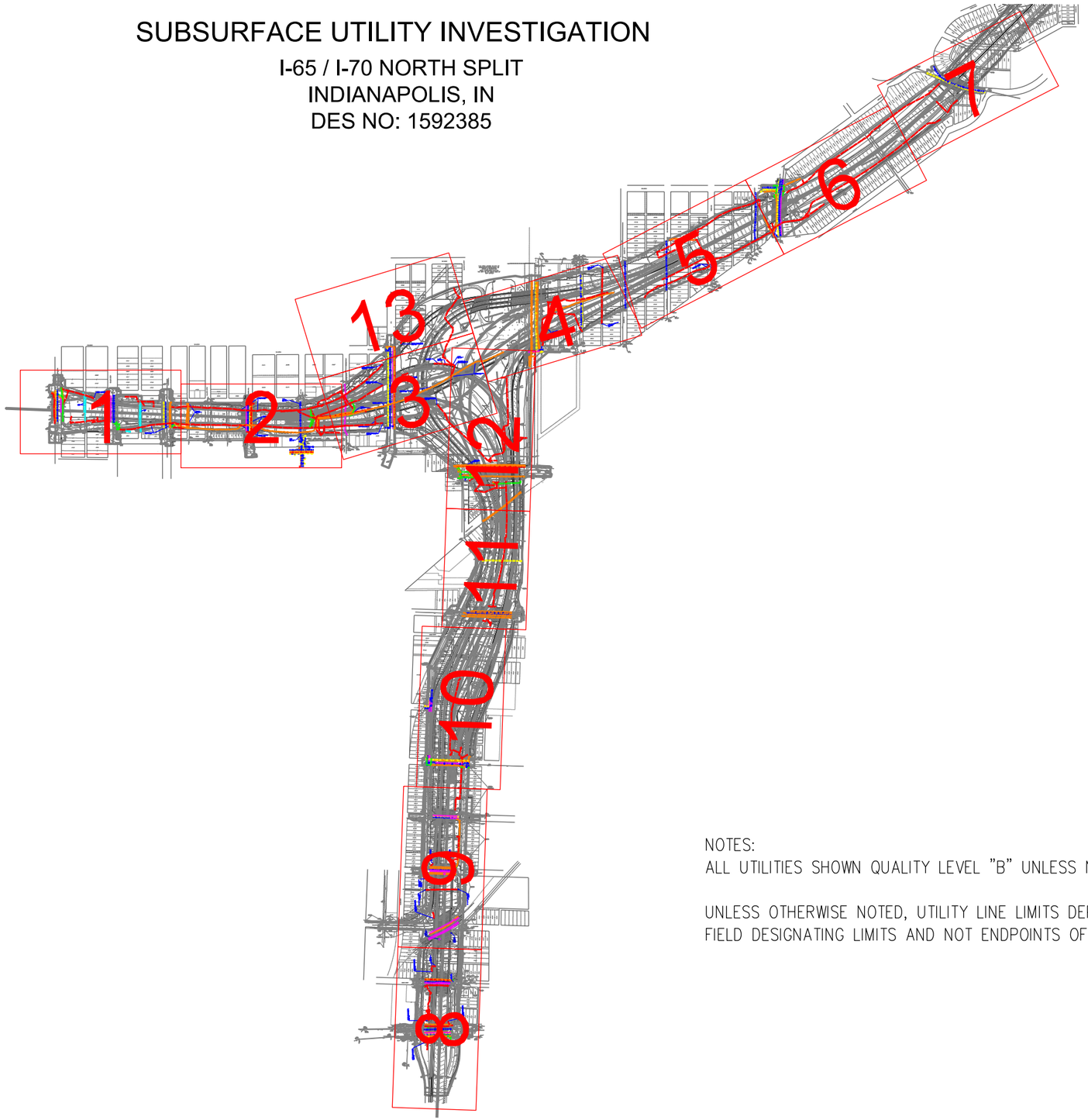
The Design-Build Contractor shall provide notification during the preconstruction conference about known corrections to or omissions of the information presented in 107.26(a) through 107.26(d) above. Otherwise, notification shall be provided as required in 105.06. Notifications regarding such corrections or omissions shall not alleviate the Design-Build Contractor's inquiry or interpretation obligations as contained in 105 IAC 11-3-7.

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN
DES NO: 1592385

LOCATION





NOTES:
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REVISIONS

7/8/19 ADDED TEST HOLE #1-2
7/22/19 ADDED TEST HOLE #3-6
7/22/19 ADDED ELECTRIC
8/28/19 PARK AVE. S-SIDE
10/16/19 ADDED TEST HOLE #7-8
2/17/20 ADDED GAS UTILITY
2/17/20 ADDED FIBER OPTIC UTILITY

LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- UC — CABLE TV
- G — GAS
- FO — FIBER OPTIC
- T — TELEPHONE
- CARDNO TEST HOLE
- (EOI) END OF INFORMATION

Utility Quality Level "A" : Visually Verified Test Hole
Utility Quality Level "B" : Designating
Utility Quality Level "C" : Research with Survey
Utility Quality Level "D" : Records Research

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF IND IANA PROFESSIONAL ENGINEER

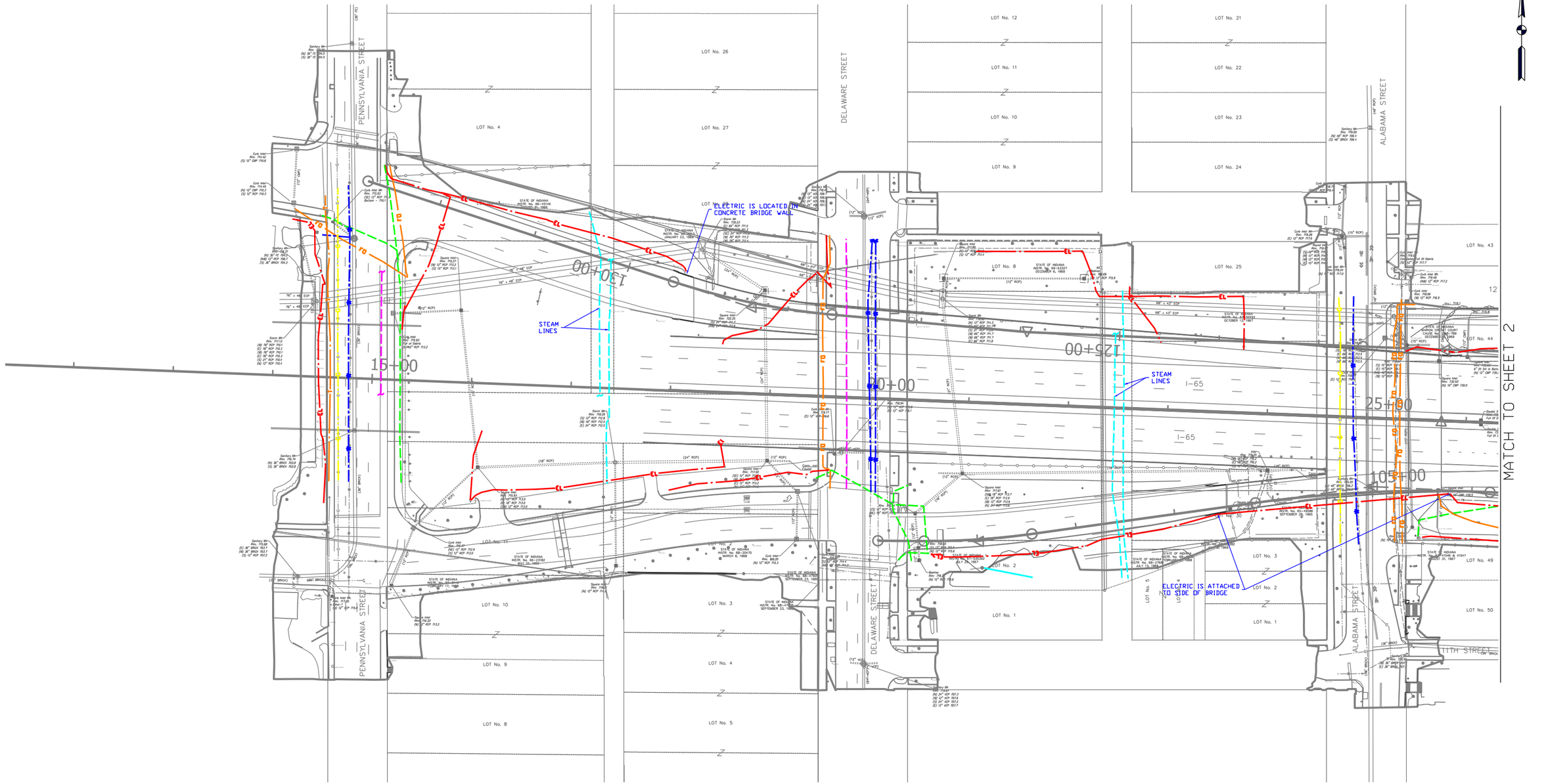
RECOMMENDED FOR APPROVAL Kenneth F. Slaninka Jr. 2-17-20
DESIGN ENGINEER DATE

DESIGNED: KFS DRAWN: KLC
CHECKED: CAA CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
N/A	DES NO: 1592385
	CONTRACT
	O180303a
	SHEET
	COVER



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- ELECTRIC (EL)
- CABLE TV (UC)
- GAS (G)
- FIBER OPTIC (FO)
- TELEPHONE (T)
- (EOI) END OF INFORMATION

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF INDIANA PROFESSIONAL ENGINEER

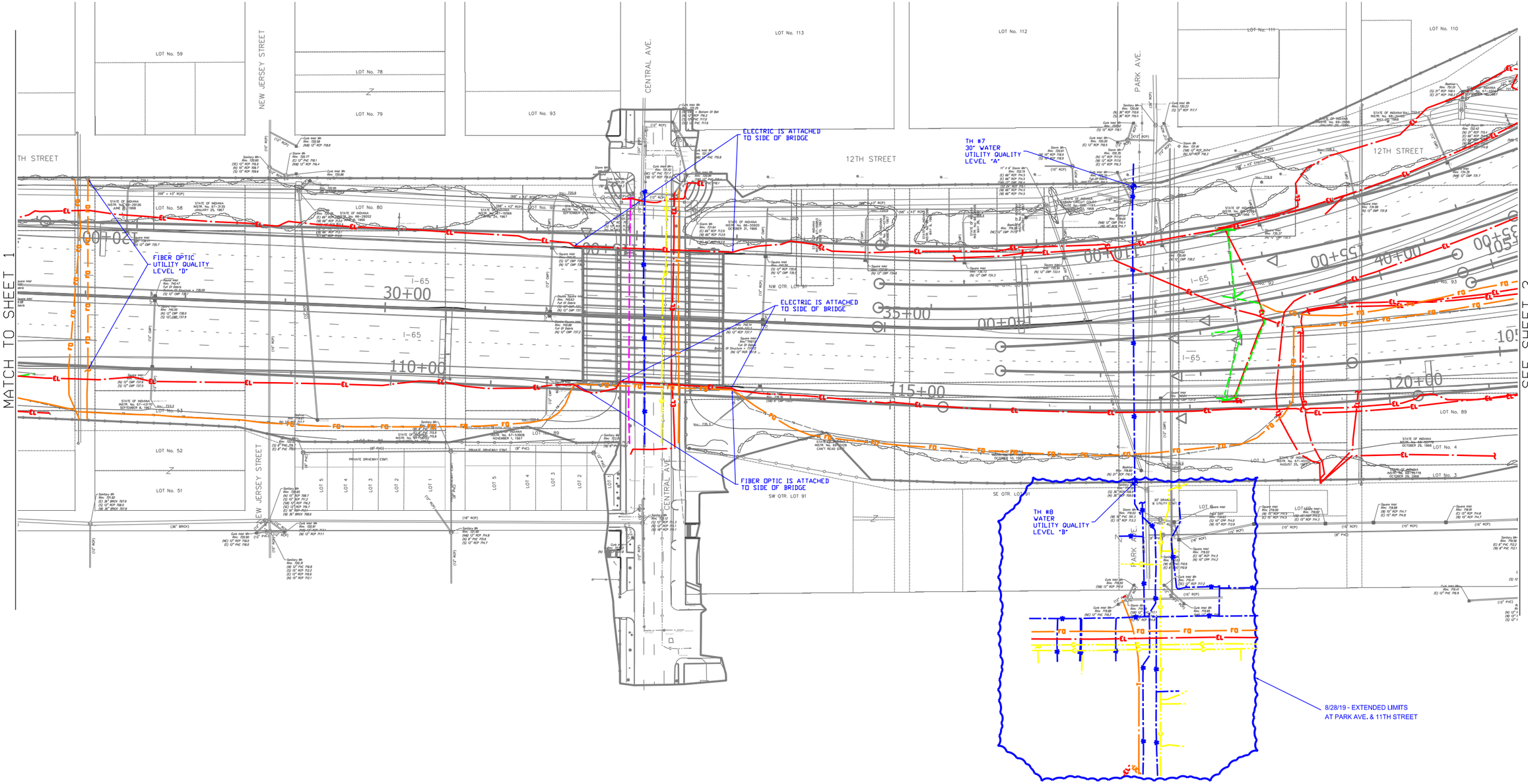
RECOMMENDED FOR APPROVAL: Kenneth F. Slaninka Jr. 6-04-19
DESIGN ENGINEER — DATE

DESIGNED: KFS	DRAWN: KLC
CHECKED: CAA	CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	1 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- UC — CABLE TV
- G — GAS
- FO — FIBER OPTIC
- T — TELEPHONE
- (EOI) END OF INFORMATION
- CARDNO TEST HOLE

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF IND IANA PROFESSIONAL ENGINEER

RECOMMENDED FOR APPROVAL: *Kenneth F. Slaninka Jr. 10-16-19*
DESIGN ENGINEER — DATE

DESIGNED: KFS — DRAWN: KLC
CHECKED: CAA — CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
	CONTRACT
	O180303a

REVISIONS
8/28/19 PARK AVE. S-SIDE
10/16/19 ADDED TEST HOLE #7-8

SHEETS
2 of 13

MATCH TO SHEET 13

SEE SHEET 2

MATCH SHEET 4 / SEE SHEET 12

SEE SHEET 12

ELECTRIC ATTACHED TO BRIDGE AND FEEDS LIGHTING GOING TO BRIDGE PIER

CUT ELECTRIC LINE INSIDE SIGN

ELECTRIC UTILITY QUALITY LEVEL "D"

CUT ELECTRIC LINE AT ABANDONED FIBERGLASS ELECTRIC HANDHOLE

FIBER OPTIC IS ATTACHED TO SIDE OF BRIDGE

7/22/19 ADDED ELECTRIC

BROADWAY STREET

12TH STREET

COLLEGE AVE

I-65

LOT No. 110

LOT No. 94

LOT No. 95

LOT No. 89

LOT No. 88

LOT No. 87

105+00

110+00

115+00

120+00

125+00

130+00

135+00

145+00

150+00

LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- CC — CABLE TV
- G — GAS
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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF IND IANA PROFESSIONAL ENGINEER

RECOMMENDED FOR APPROVAL: Kenneth F. Slaninka Jr. 6-04-19
DESIGN ENGINEER DATE

DESIGNED: KFS | DRAWN: KLC

CHECKED: CAA | CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
	CONTRACT
	O180303a
REVISIONS	
7/22/19 ADDED ELECTRIC	
	SHEETS
	3 of 13

MATCH TO SHEET 13

SEE SHEET 5

MATCH TO SHEET 3 / SEE SHEET 12

TH #3
27" ELECTRIC (CONCRETE CAP)
UTILITY QUALITY
LEVEL "A"

UNABLE TO TONE
CONDUIT BELIEVE IT
RUNS WITH FIBER

TH #6
30" ELECTRIC (CONCRETE CAP)
UTILITY QUALITY
LEVEL "B"

LEWIS STREET
YANCEY STREET
15TH STREET
13TH STREET
COLUMBIA AVE.
I-70

105+00
110+00
115+00
120+00
125+00
130+00
135+00
140+00
145+00
150+00

LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL ELECTRIC
- UC CABLE TV
- G GAS
- FO FIBER OPTIC
- T TELEPHONE
- (EOI) END OF INFORMATION
- CARDNO TEST HOLE

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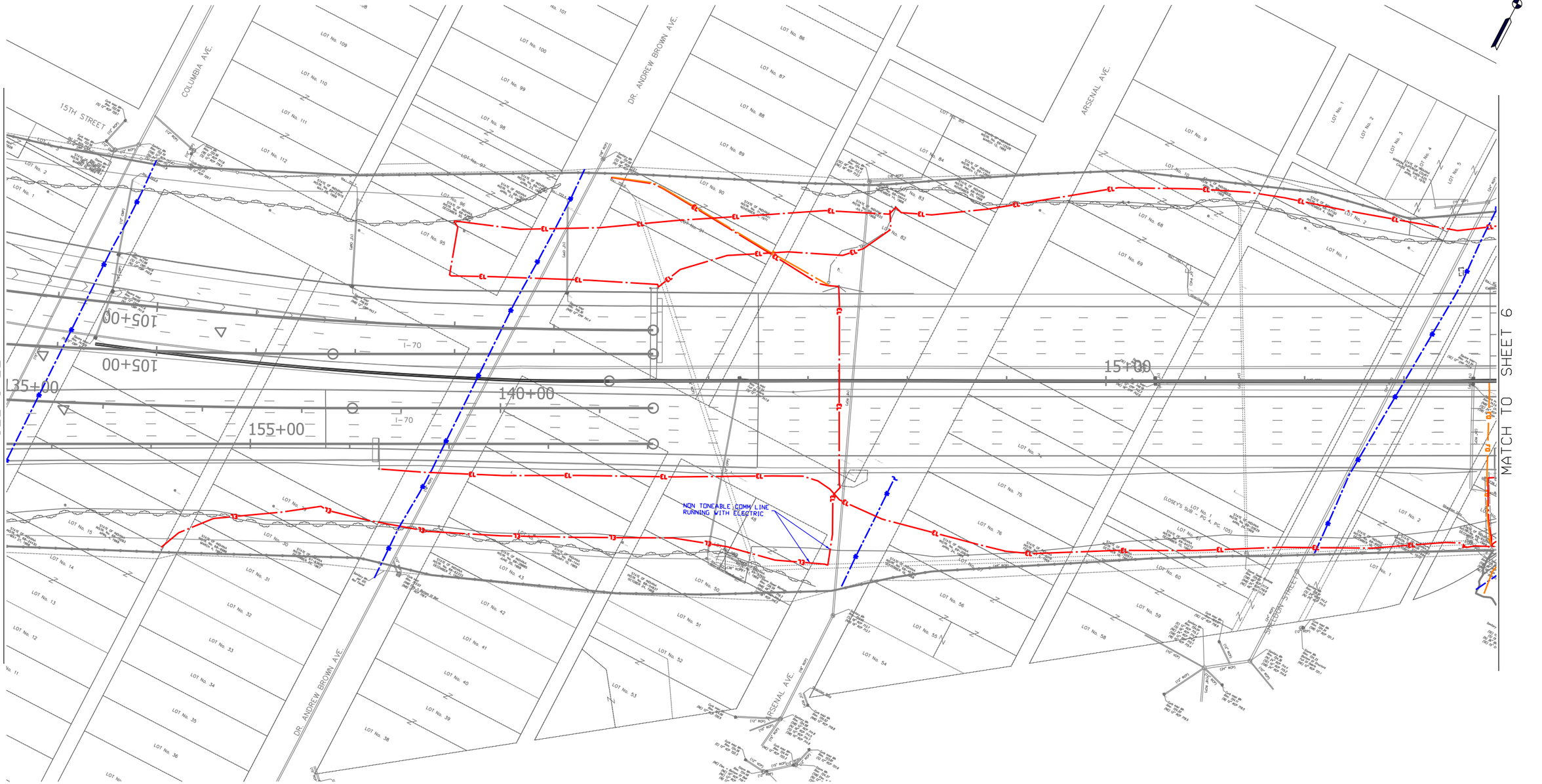
RECOMMENDED FOR APPROVAL Kenneth F. Slaninka Jr. 6-04-19
DESIGN ENGINEER DATE

DESIGNED: KFS DRAWN: KLC
CHECKED: CAA CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
	CONTRACT
	O180303a
REVISIONS	
7/22/19 ADDED TEST HOLE #3-6	
	SHEETS
	4 of 13



LEGEND

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF INDIANA PROFESSIONAL ENGINEER

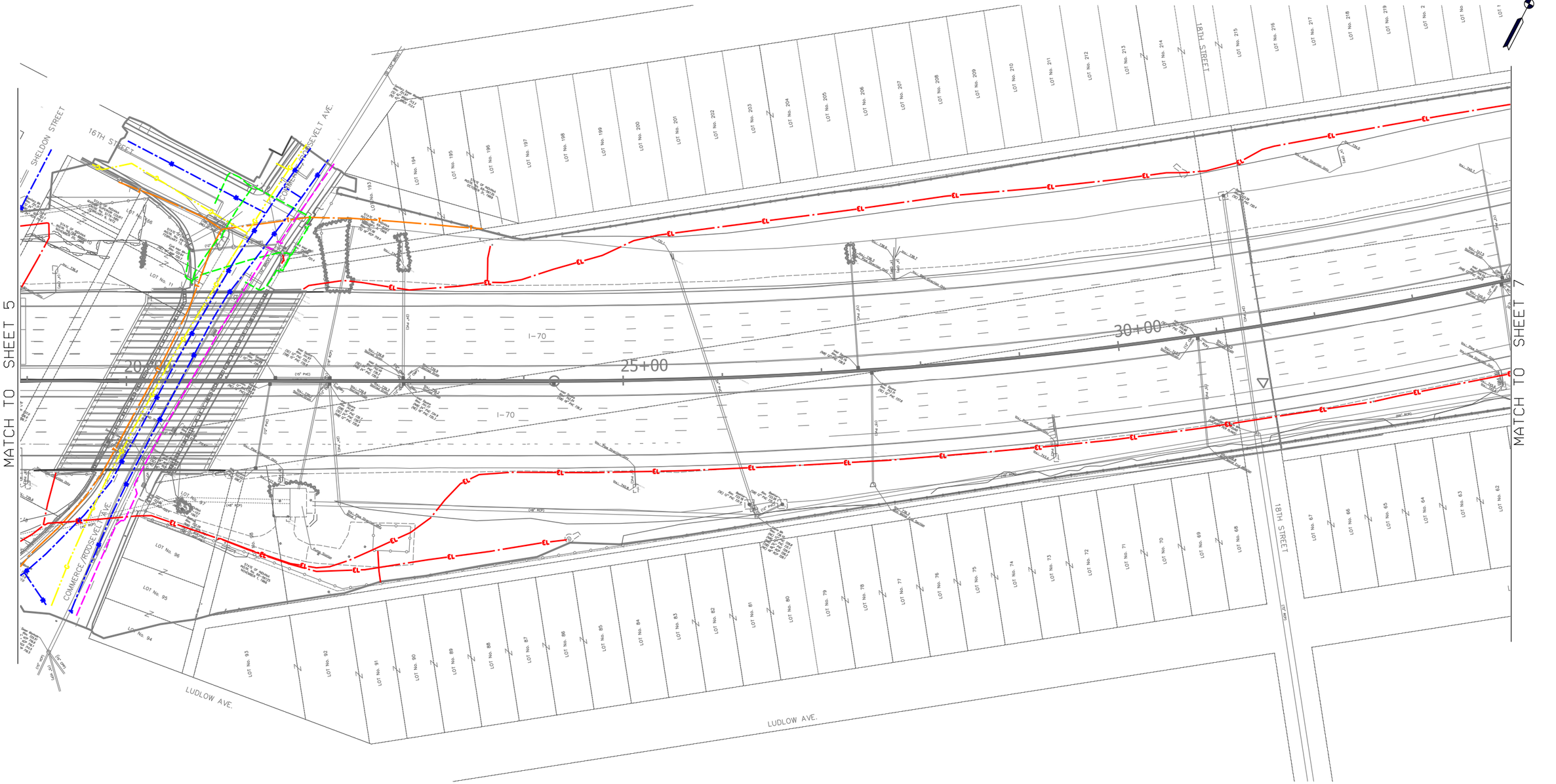
RECOMMENDED FOR APPROVAL: Kenneth F. Slaninka Jr. 6-04-19 (DESIGN ENGINEER / DATE)

DESIGNED: KFS | DRAWN: KLC
CHECKED: CAA | CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	5 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
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KENNETH F. SLANINKA JR. REGISTERED NO. PE19500370 STATE OF INDIANA PROFESSIONAL ENGINEER

RECOMMENDED FOR APPROVAL: *Kenneth F. Slaninka Jr.* 6-04-19
DESIGN ENGINEER — DATE

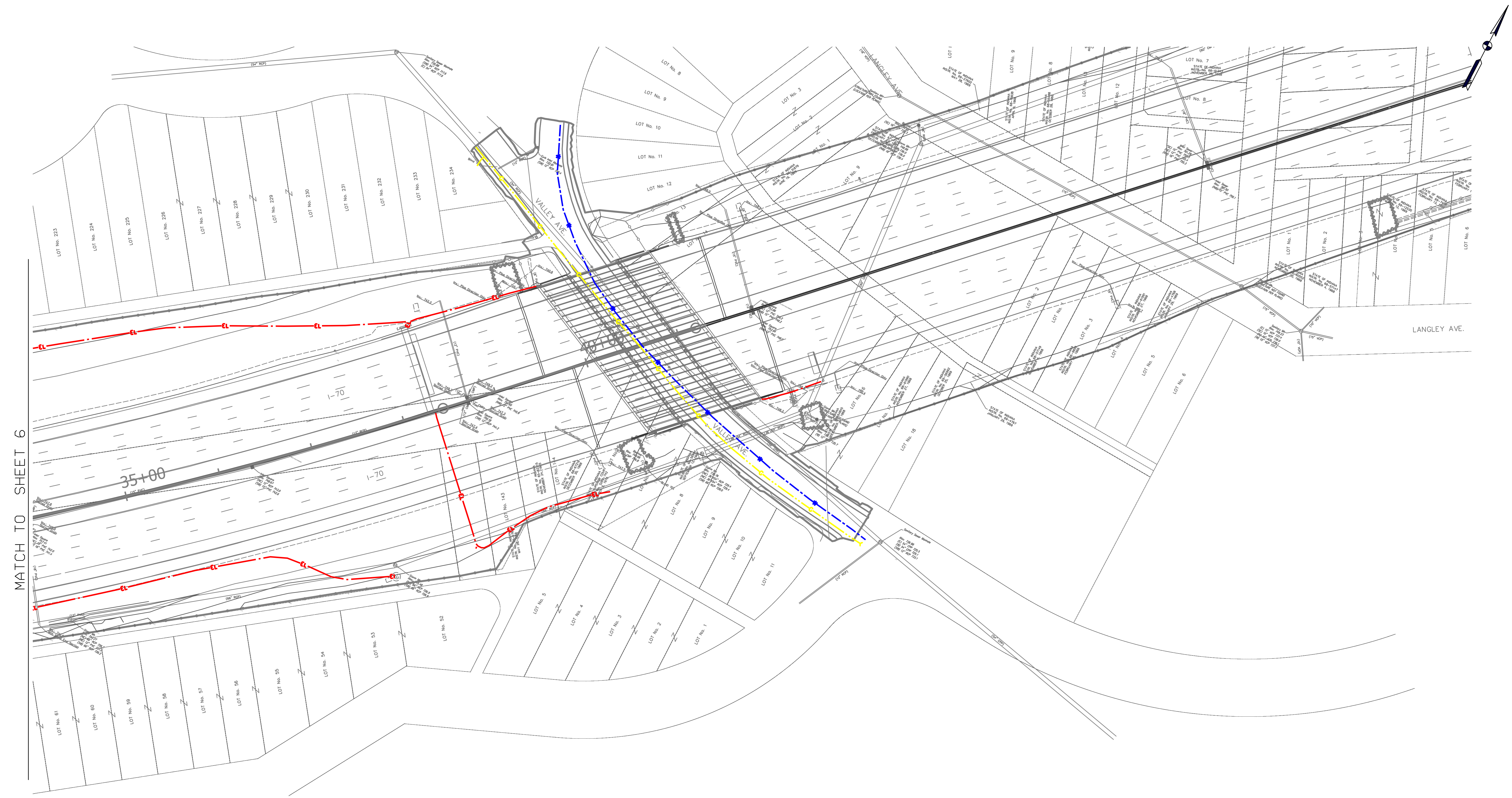
DESIGNED: KFS | DRAWN: KLC
CHECKED: CAA | CHECKED: KFS

Cardno

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	6 of 13



LEGEND

— — — —	TRAFFIC SIGNAL
— — — —	UNKNOWN
—·—W—·—	WATER
——EL——	ELECTRIC
·——UC——·	CABLE TV
—··—G—··—	GAS
— FO —— FO —	FIBER OPTIC
——T——	TELEPHONE
~	(EOI) END OF INFORMATION

NOTES:

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Utility Quality Level "C" : Research with Survey
Utility Quality Level "D" : Records Research

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF INDIANA PROFESSIONAL ENGINEER

RECOMMENDED FOR APPROVAL Kenneth F. Slaninka Jr. 6-04-19
DESIGN ENGINEER DATE

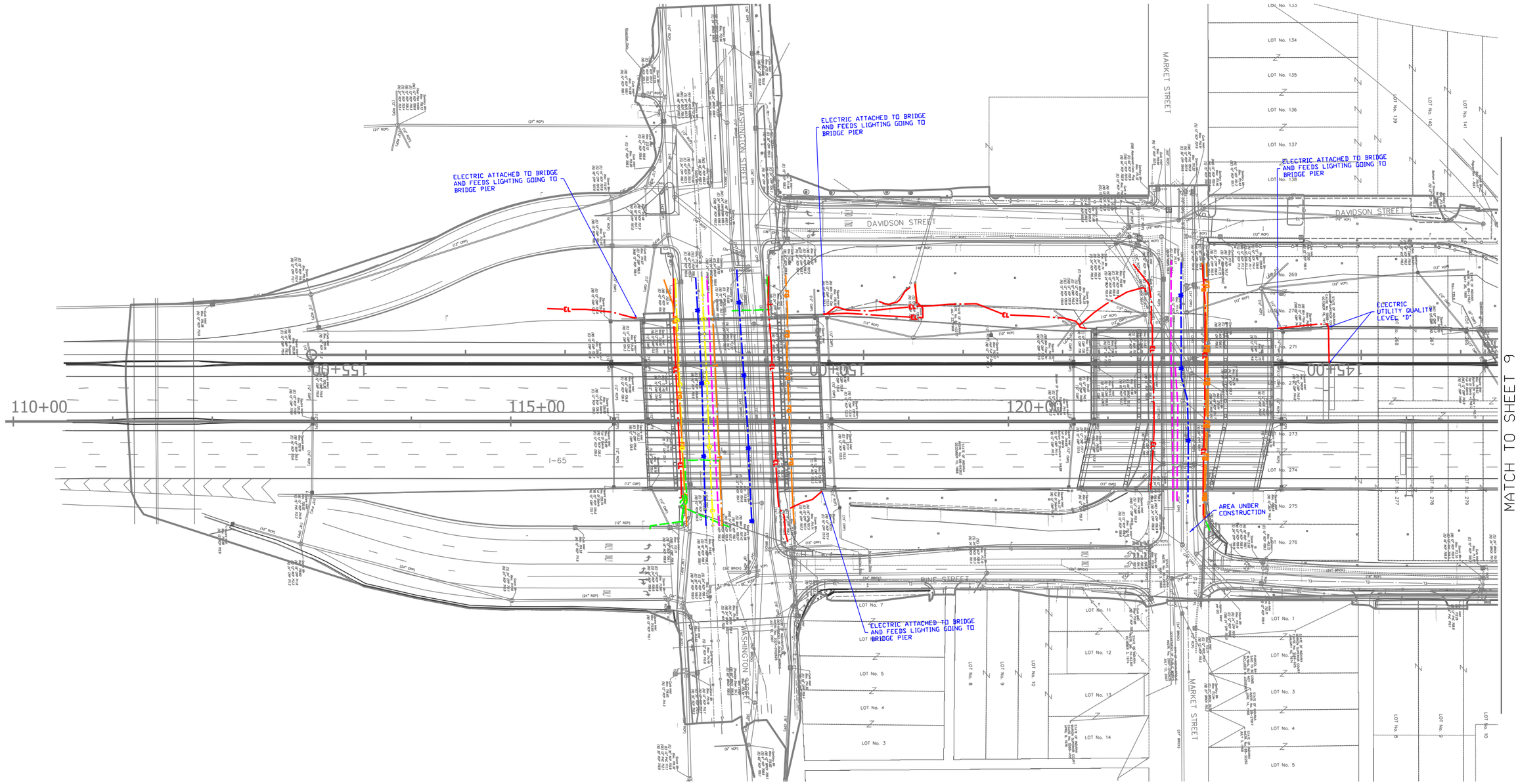
DESIGNED:	KFS	DRAWN:	KLC
CHECKED:	CAA	CHECKED:	KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

Cardno

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	7 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- ELECTRIC
- CABLE TV
- GAS
- FIBER OPTIC
- TELEPHONE
- (EOI) END OF INFORMATION

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RECOMMENDED FOR APPROVAL: Kenneth F. Slaninka Jr. 6-04-19 (DESIGN ENGINEER / DATE)

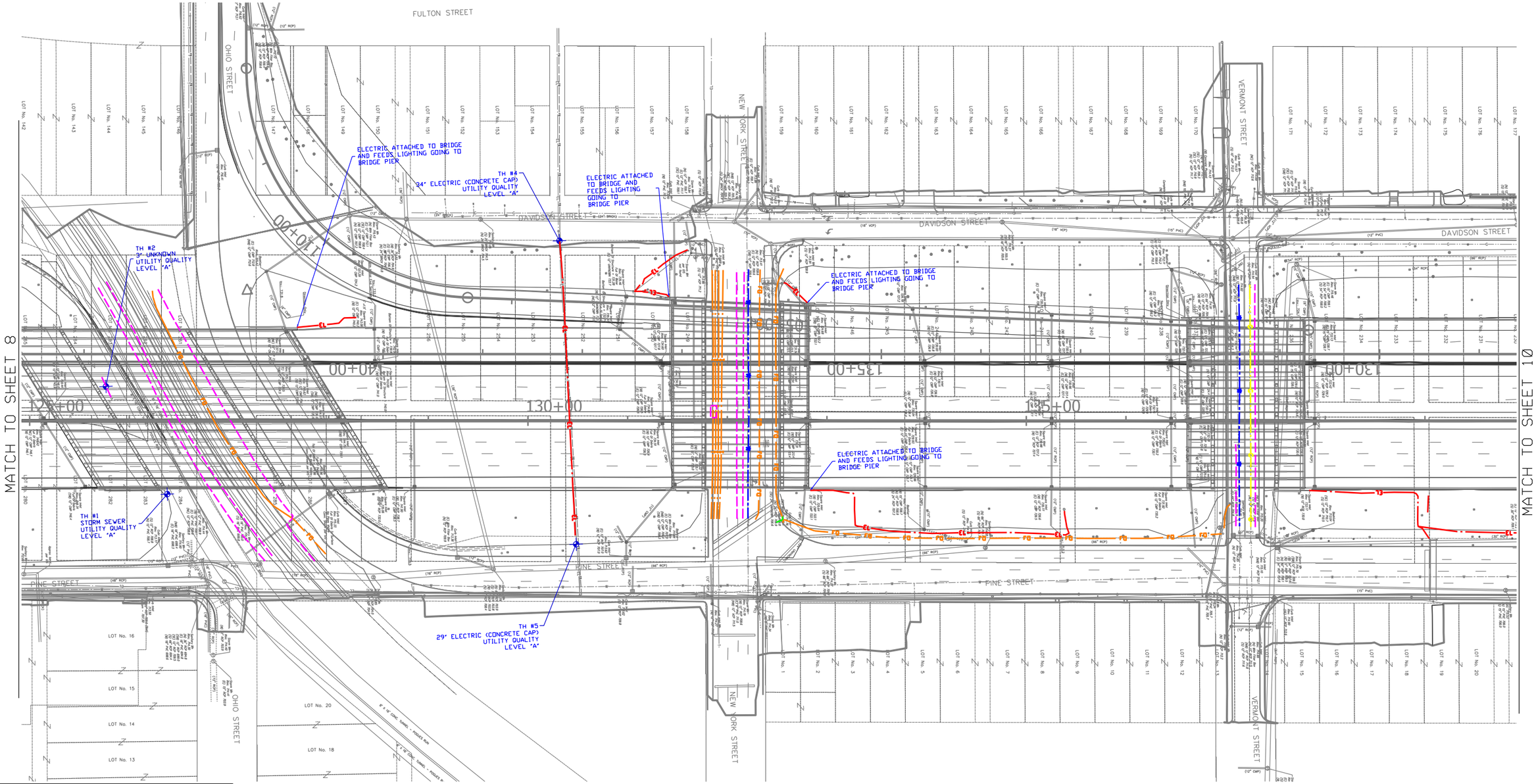
DESIGNED: KFS | DRAWN: KLC
CHECKED: CAA | CHECKED: KFS

Cardno

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	8 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- UC — CABLE TV
- G — GAS
- FO — FIBER OPTIC
- T — TELEPHONE
- (EOI) END OF INFORMATION
- CARDNO TEST HOLE

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF INDIANA PROFESSIONAL ENGINEER

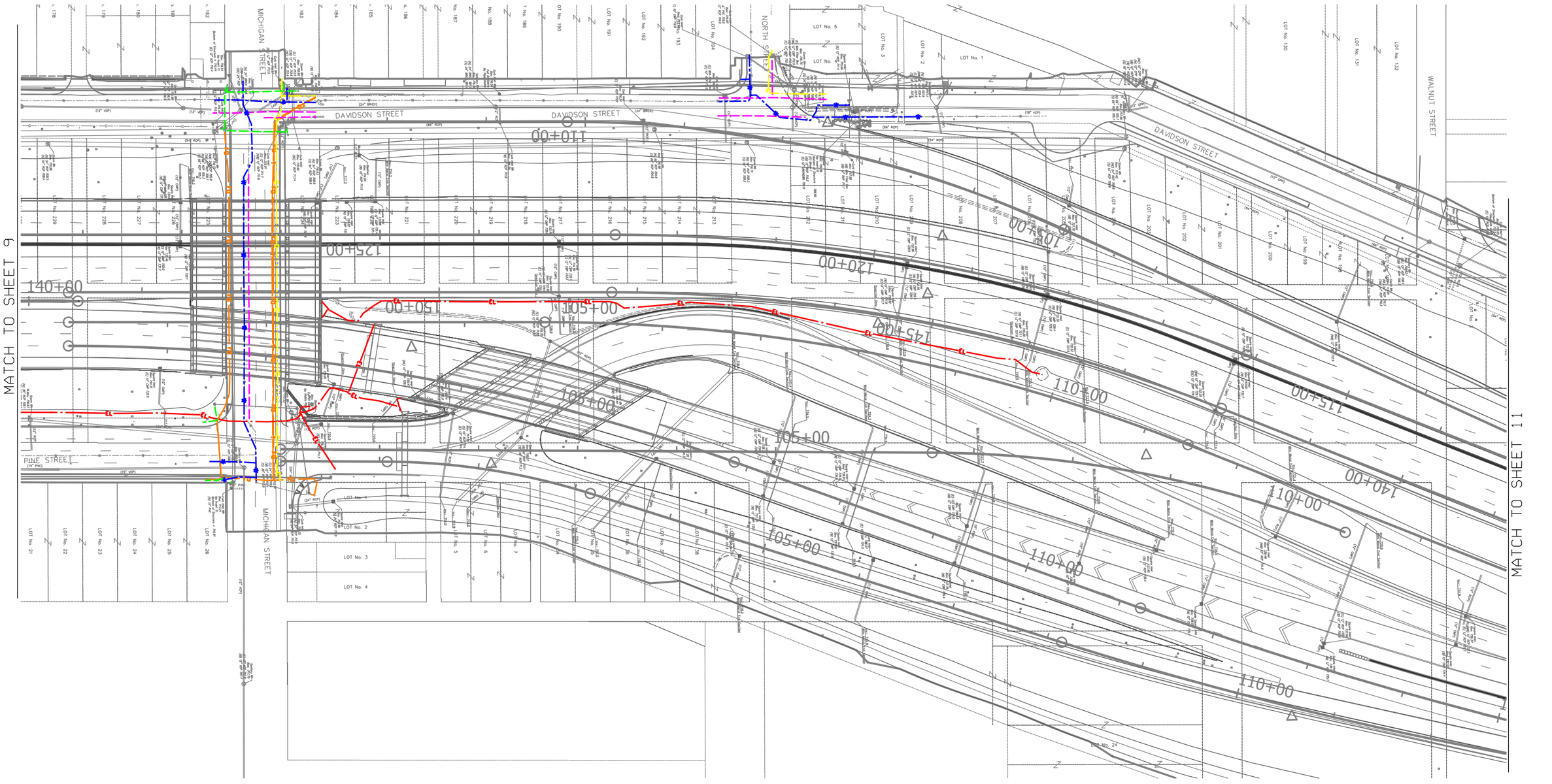
RECOMMENDED FOR APPROVAL: Kenneth F. Slaninka Jr. 6-04-19
DESIGN ENGINEER — DATE

DESIGNED: KFS	DRAWN: KLC
CHECKED: CAA	CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE: 1" = 100'	CARDNO PROJ # IN09501501
	DES NO: 1592385
	CONTRACT
	O180303a
REVISIONS	
7/8/19 ADDED TEST HOLE #1-2	
7/22/19 ADDED TEST HOLE #3-6	SHEETS
	9 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- UC — CABLE TV
- G — GAS
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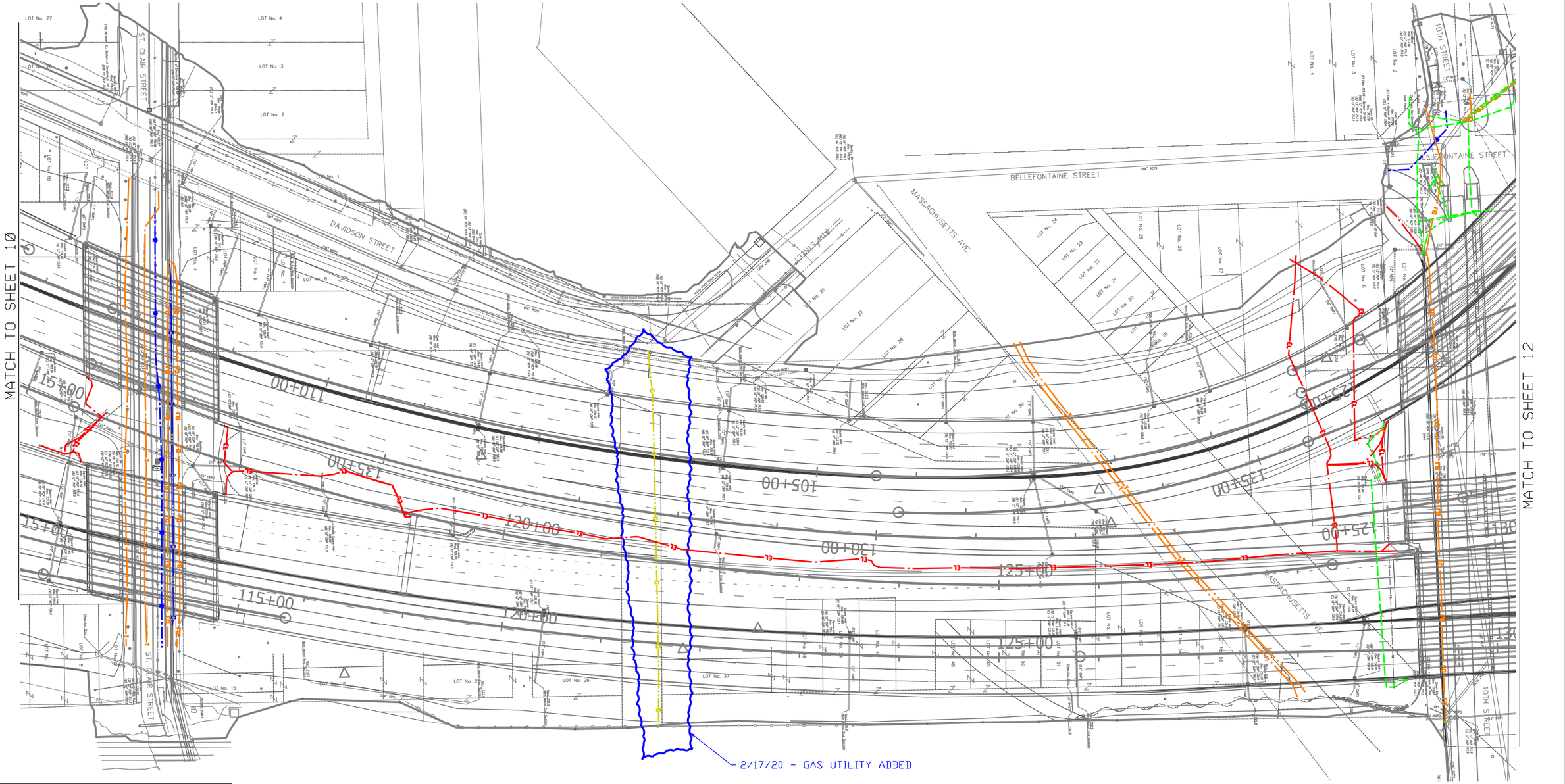
RECOMMENDED FOR APPROVAL *Kenneth F. Slaninka Jr.* 6-04-19
DESIGN ENGINEER DATE

DESIGNED: KFS DRAWN: KLC
CHECKED: CAA CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	10 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- CABLE TV
- G — GAS
- FO — FIBER OPTIC
- T — TELEPHONE
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- CARDNO TEST HOLE

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KENNETH F. SLANINKA JR. REGISTERED No. PE19500370 STATE OF IND IANA PROFESSIONAL ENGINEER

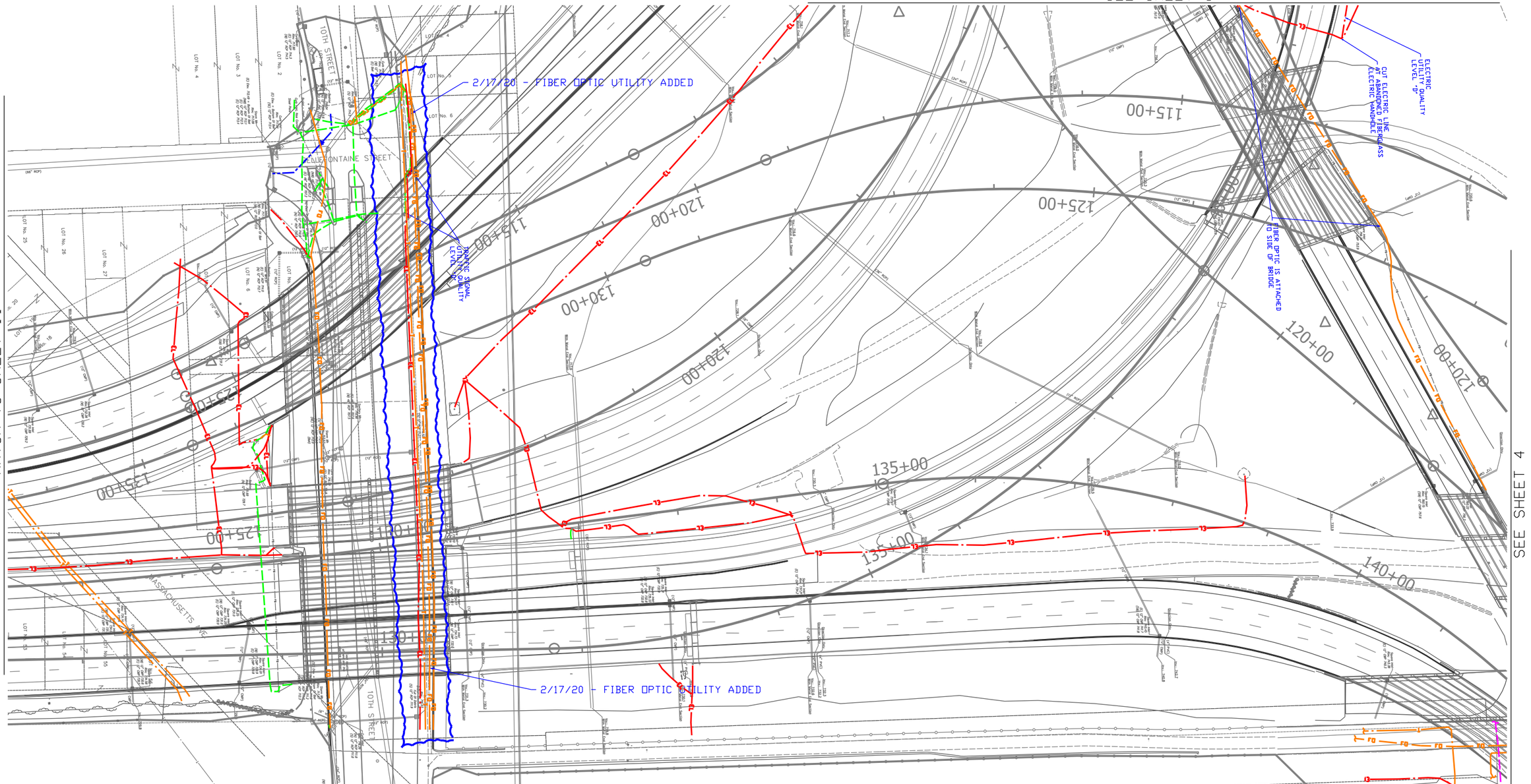
RECOMMENDED FOR APPROVAL: *Kenneth F. Slaninka Jr.* 2-17-20
DESIGN ENGINEER — DATE

DESIGNED: KFS | DRAWN: KLC
CHECKED: CAA | CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
	CONTRACT
	O180303a
REVISIONS	
2/17/20 ADDED GAS UTILITY	
	SHEETS
	11 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- WATER
- EL — ELECTRIC
- CATV — CABLE TV
- G — GAS
- FO — FO — FIBER OPTIC
- T — TELEPHONE
- (EOI) END OF INFORMATION
- CARDNO TEST HOLE

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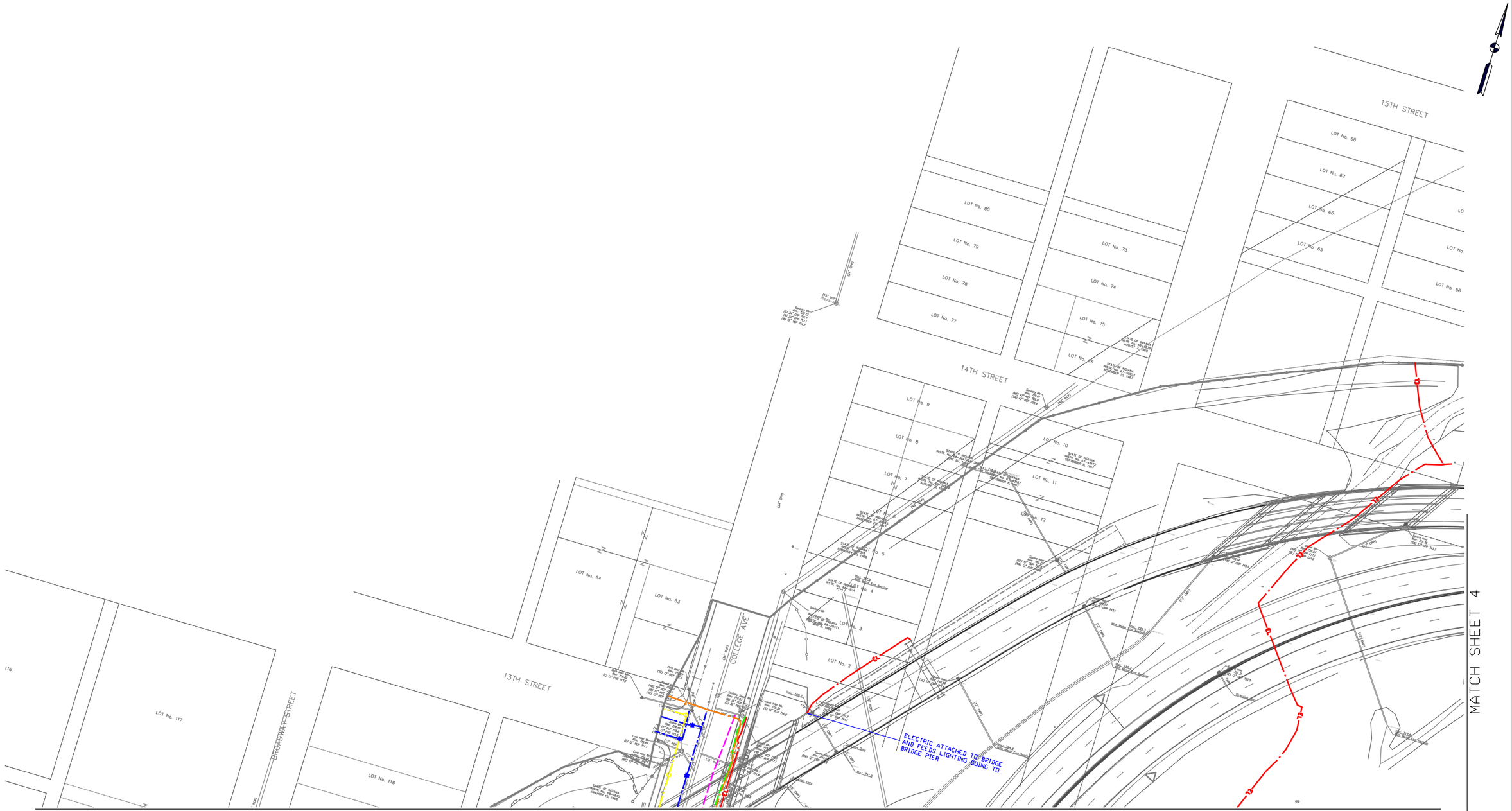
DESIGNED: KFS | DRAWN: KLC | CHECKED: CAA | CHECKED: KFS

Cardno

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
	CONTRACT
	O180303a
REVISIONS	
2/17/20 ADDED FIBER OPTIC UTILITY	
	SHEETS
	12 of 13



LEGEND

- TRAFFIC SIGNAL
- UNKNOWN
- W — WATER
- EL — ELECTRIC
- UC — CABLE TV
- G — GAS
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DESIGN ENGINEER — DATE

DESIGNED: KFS | DRAWN: KLC
CHECKED: CAA | CHECKED: KFS

SUBSURFACE UTILITY INVESTIGATION

I-65 / I-70 NORTH SPLIT
INDIANAPOLIS, IN

Cardno

HORIZONTAL SCALE	CARDNO PROJ # IN09501501
1" = 100'	DES NO: 1592385
CONTRACT	SHEETS
O180303a	13 of 13

Test Hole Number	Approximate Station	Date	Type of Utility	Utility Size (OD) (inches)	Material of Utility	Cross Section	Utility Direction	Approximate Offset	Survey Point ID Number	Northing	Easting	Existing Ground Elevation	Top of Utility Field Depth (Feet)	Elevation (Top of Utility)	Surface Type	Surface Thickness (Inches)	Quality Level	Notes
1	N/A	06-14-19	Storm Sewer	N/A	Concrete			85' Left of Centerline	2867	24348.74	10298.83	717.82'	4.35'	713.47'	Natural Ground	N/A	QL A	Offset measured from centerline of Pine St.
2	N/A	06-14-19	Unknown	7"	Concrete			----------	2866	24291.04	10188.64	718.57'	3.48'	715.09'	Asphalt	3"	QL A	Exposed 7" concrete pipe while looking for Pogues Run tunnel, believe to have found an old curb line 2.8' South of pipe near ground level, unable to find utility. Dug 10' trench with a depth of 6' across. Believe tunnel is heading at an angle towards the North after our information gathered on TH1. Offset measured from the north edge of trench to the bridge pier.
3	N/A	07-01-19	Electric	27"	Concrete Cap			102' Left of Back of Curb	30001	30562.94	11713.04	723.71'	4.46'	719.25'	Natural Ground	N/A	QL A	Exposed concrete cap.
4	N/A	07-01-19	Electric	34"	Concrete Cap			1.6' Right of Back of Curb	10002	24750.94	10058.63	713.92'	5.07'	708.85'	Natural Ground	N/A	QL A	Unable to expose edges of cap due to sand collapsing in hole; probed edges and saw top of cap before cave-ins. Offset measured from curb of Davidson St.
5	N/A	07-01-19	Electric	29"	Concrete Cap			12' Left of Back of Curb	10003	24757.03	10363.55	712.35'	6.18'	706.17'	Natural Ground	N/A	QL A	Unable to expose edges of cap due to sand collapsing in hole; probed edges and saw top of cap before cave-ins. Offset measured from curb of Pine St.
6	N/A	07-02-19	Electric	30"	Concrete Cap			135' Right of Edge of Pavement	30000	30039.49	11706.72	724.77'	5.06'	719.71'	Natural Ground	N/A	QL B	Due to location of test hole, unable to get truck in position. Due to soil conditions, we were unable to hand dig. Probed down to find edges of concrete cap and verify depth. Offset measured from centerline of 13th St.
7	N/A	10-07-19	Water	30"	Metallic			2.5' Right of Right of Way	1205	29289.78	8890.02	720.82'	8.75'	712.07'	Natural Ground	N/A	QL A	
8	N/A	10-07-19	Water	See Note	Unknown	See Note		0.5' Right of Right of Way	1202	28994.03	8891.21	720.71'	9.81'	710.90'	Natural Ground	N/A	QL B	Unable to visually verify utility due to depth. Tapped what we believe to be the utility with our airlance to verify shape.

Client: INDOT
Vac Truck/Trailer No.: 550420
SUE Crew: CC, DE
City / County: Indianapolis / Marion
I 65 & I 70 North Split

Prepared By: KC Date: 7/22/19
Checked By: KFS Date: 7/22/19

Revisions
Rev 1 - 10/16/19: Added TH #7-8

KENNETH F. SLAMINKA JR. REGISTERED PROFESSIONAL ENGINEER NO. PE19500370 STATE OF INDIANA

RECOMMENDED FOR APPROVAL: Kenneth F. Slaminka, Jr. 10/16/19
DESIGN ENGINEER DATE

Cardno
7217 E. 87th St
Indianapolis, Indiana 46256
PH 317 585 3540 - FAX

DES #: 1592385
CARDNO PROJECT No. - IN09501501

S.U.E. TEST HOLE DATA

I 65 & I 70 North Split
Indianapolis, IN

SHEET NO.
1 OF 1

EXISTING UTILITY MATRIX

INDOT DES.NO: 1600808
PROJECT: Reconstruction of I-65/I-70 (North Split) Interchange
Revised 2/25/20 Changes Highlighted in yellow

UTILITY			DESCRIPTION	POSSIBLE IMPACT LOCATIONS																	
COMPANY NAME	CONTACT	PHONE		Washington St.	Market St.	Ohio St.	New York St.	Vermont St.	Davidson St.	Michigan St.	North Street	Saint Clair St.	10th ST. / Mass Ave	Park St.	Myron St.	Lewis St.	Monon Trail	Pennsylvania St.	Delaware St.	Alabama St.	Central Ave	College Ave
Angies List	Karl Northern	317-213-7365		Type 2	Type 2																	
			Size & Material	Duct Bank	Duct Bank																	
			Type	Fiber	Fiber																	
			Aerial or UG	UG	Aerial & UG																	
			Location	East of Pine St.	East of Pine St.																	
AT&T Distribution	Zach Goodbar	317-610-5443		Type 2			Type 2	Type 2	Type 2	Type 2		Type 2	Type 2				Type 2	Type 2			Type 2	
			Size & Material	6-4" PVC Conduit				unknown	Multiple	copper and FO		unknown	Multiple								Plastic conduit concrete encased	
			Type	Telephone			Telephone	unknown	Multiple			unknown	Plastic Conduit				Telephone					
			Aerial or UG	UG			Aerial & UG	Aerial	Aerial & UG	UG		Aerial	UG				UG	UG			UG	
			Comment	Buried Telephone in EB lanes			Aerial along Davidson and Underground crossing on south side of New York St, and North side of New York	Attached to IPL poles runnning north to South on Davidson	Attached to IPL poles running north to South on Davidson	2 4" Plastic Ducts running East to West		Along Davidson attached to IPL	48 4" Ducts crossing diagonally				Conduits parallel and next to AT&T Transmission	16 4" Ducts running North to South			6 4" Ducts running North to South	
AT&T Transmission	Kenneth Colwell Luke Dillow	630-383-9249 ldillow@jmceainc.com					Type 2					Type 2	Type 2				Type 2					
			Size & Material				Concrete encased duct					FO in duct	FO under north sidewalk				Fiber Optic Cable					
			Type				FO					FO	FO				FO					
			Aerial or UG				UG					UG	UG				UG					
Citizens Energy Group (Gas)	Rich Miller	317-927-4684		Type 2				Type 2		Type 2			Type 2			Type 2		Type 2		Type 2	Type 2	Type 2
			Size & Material	4" PL & 24" WR				4" WR main		4" WR main			12" Steel Gas main (9th Street)			12" wr gas main		4" WR main		16" wr gas main	2" P.I. gas main inside 8" Pipe	2" P.I. gas main inside 8" Pipe
Citizens Energy Group (Sanitary)	David Clark	317-429-3993		CCTV and Structural lining to be completed under separate Type 1 Agreement																		
				Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2		Type 2		Type 2	Type 2	Type 2		Type 2
			Str. Type	M.H. 221900 & 71' of 48" RCP	M.H. 221946 & 146' of 48" PIP	M.H. 221038 & 58' 18" PVC	M.H. 220351 & 148' of 66" RCP	M.H. 221041 & 242' of 66" CON	M.H. 221761 & 230' of 18" VCP	M.H. 223689 & 235' of 66" VCP	M.H. 221772 & 146' of 18" VCP	M.H. 221776 & 172' OF 15" INV	Exist 48" to be protected in place per the work plan or Adbandoned & Replaced with 72" Std. Manholes & Prop 48"San. Sewer See Relocation Plan for more Detail	M.H. 220162 & 369' OF 26" C.I.P.		M.H. 232705 & 105' of 15" INV		M.H. 220414 & 150' of 36" BRK	M.H. 224556 & 447' of 24"VCP	M.H. 220560 & 159' of 34" BRK		Exist 48" to be protected in place per the work plan or Adbandoned & Replaced with 72" Std. Manholes & Prop 48"San. Sewer Relocation Plan for more Detail
			M.H. Location	S. of EB Washington I-	E. of Davidson, 42' S. Market	30' NW of Pine & Ohio	70' N. of New York	SE Cor Vermont/Pine	240' N. of New York St.	245' N. of Vermont St.	NW Cor. North St.	Center of Davidson St., 30'		115' N. of 11th St.		180' E. of Lewis St. on 13th St.		35' E. of Penn on 11th St.	120' S. of 11th St	Alabama/N. Edge of 11th		
			Pipe Direction	East to M.H. 221901	NE to M.H. 221429	N-NE to M.H. 223590	N. to Blind Tie 220312	W. to M.H. 221765	N. 221762	N. to M.H. 223688	N. to M.H. 221773	S. to M.H. 221775		N. to M.H. 223674		W. to M.H. 230172		W. then N. to M.H. 220415	N. to M.H. 224557	N. to M.H. 220070		
			Str. Type	M.H. 221901 & 73' of 48" RCP	M.H. 221429 186' of 48" RCP	M.H. 223590 & 15' 18" PVC		M.H. 221765 & 265' of 18" VCP	M.H. 221768 & 557' of 66" RCP	M.H. 221770 & 259' of 24" BRK	M.H. 221767 & 477' OF 66" RCP	M.H. 221769 & 273' of 66" RCP		M.H. 223674 & xx' of 36" RCP		M.H. 230172 & 105' of 15" INV		M.H. 220415 & 187' of 36" BRK		M.H. 220570 & 363' of 32" BRK		
			M.H. Location	S. of EB Washington,	WB Lanes, 125' E. of Davidson	W. of Pine, S. edge of Ohio		SE Cor Vermont/Davidso	530' S. of Saint Clair	Center of EB Lanes	90' S.W. of North/Davidson	E. Edge of Davidson/St. Clair		21' N. of 12th St.		83' E. of Lewis St. on 13th St.		115' N. of 11th St.		159' N. of 11th St.		
			Pipe Direction	NE to M.H. 221902	East to M.H. 223589	NE to M.H. 225761		N. to M.H. 221761	N. to M.H. 221769	N. to M.H. 221771	N. to M.H. 221768	N. to M.H. 221085				W. to M.H. 230210		N. to M.H. 220416		N. to M.H. 220071		
			Str. Type	M.H. 221902 & 122' of 36" Brick	M.H. 223589 & 503' 48" RCP	M.H. 225761 & 78"RCP overflow			M.H. 221773 & 194' of 18" VCP	M.H. 221766 & 523' OF 66" RCP		M.H. 221664 & 372' of 12" VCP				M.H. 230210 & 325' of 12" VCP		M.H. 220416 & 196' of 36" INB				
			M.H. Location	South Side of WB Lanes	NW Corner Pine	30' N. of Pine/Ohio			170' N. of North St.	10' S.W. of Michigan/Davidso		30' W. of Center/Davidson				Center of 13th St/Lewis St.		S. Edge of 13th/Pennsylvani				
			Pipe Direction	West to M.H. 221908	North to M.H. 223995	S. to CSO 152			N. to M.H. 221774	S. to M.H. 221765		W. to M.H. 221663				N. to 230211		N. to M.H. 221066				
			Str. Type	M.H. 221902 & 21' of 10" C.I.	M.H. 227985 & 53' of 18" CON	M.H. 225761 & 105' of 77" BRK			M.H. 221774 & 333' of 15" INV	M.H. 223688 & 218' of 12" INV						M.H. 230211 & 326' of 12" VCP						
			M.H. Location	South Side of WB Lanes	Davidson, 32' S. of Market	30' N. of Pine/Ohio			364' N. of North St.	SE Cor Michigan/Pine						310' N. of 13 Street						
			Pipe Direction	NE to M.H. 221912	N. to M.H. 221945	N. to M.H. 221037			N. to M.H. 221775	`						N. to 230212						
			Str. Type	M.H. 221912 & 48' of 66" BRK	M.H. 221945 & 27' of 18" CON	M.H. 221037 & 121' of 77" BRK			M.H. 221775 & 172' of 15" INV													
			M.H. Location	25' E. of Davidson, Center of WB	Center of Market/Davidson	135' N. of Pine/Ohio			206' S. of St. Clair													
			Pipe Direction	East to M.H. 221939	NW to M.H. 221949	N. to M.H. 223087			N. to M.H. 221776													
			Str. Type	M.H. 221939 & 180' of 66" BRK	M.H. 221949 & 276' of 15" VCP	M.H. 223087 & 363' of 36" CON																	
			M.H. Location	Center of WB Lanes	NW Cor Market/Davidson	215' S. of New York St.																	
			Pipe Direction	East to M.H. 221940	N. to M.H. 221942	N. to M.H. 221739																	
			Str. Type	M.H. 221940 & 201' of 66" BRK	M.H. 221947 & 265' of 65" CON	M.H. 221739 & 75' of 24" INB																	
			M.H. Location	Center of WB Lanes	SW cor market/Davidson	300' S. of New York, 55' W. of I-																	
			Pipe Direction	East to M.H. 228393	W. to CSO 133	N. to M.H. 221759																	

EXISTING UTILITY MATRIX

INDOT DES.NO: 1600808
PROJECT: Reconstruction of I-65/I-70 (North Split) Interchange
Revised 2/25/20 Changes Highlighted in yellow

UTILITY				POSSIBLE IMPACT LOCATIONS																	
COMPANY NAME	CONTACT	PHONE	DESCRIPTION	Washington St.	Market St.	Ohio St.	New York St.	Vermont St.	Davidson St.	Michigan St.	North Street	Saint Clair St.	10th ST. / Mass Ave	Park St.	Myron St.	Lewis St.	Monon Trail	Pennsylvania St.	Delaware St.	Alabama St.	Central Ave	College Ave
			Str. Type	M.H. 221940 & 341' of 36" BRK	M.H. 221947 & 108' of 65" RCP																	
			M.H. Location	Pine & Center of WB Lanes	SW cor market/Davidson																	
			Pipe Direction	West to M.H. 221901	East to M.H. 221948																	
			Str. Type		M.H. 221948 & 262'of 65" RCP																	
			M.H. Location		75' E. of Davidson																	
			Pipe Direction		E. to M.H. 221950 (Diversion)																	
			Str. Type		M.H. 221950 & 6' of 18" VCP																	
			M.H. Location		SE Cor Pine/Market																	
			Pipe Direction		N.W. to 36"BRK Main																	
Citizens Energy Group (Water)	David Clark	317-429-3993		Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2		Type 2		Type 2					Type 2	Type 2	Type 2	Type 2
			Pipe Direction	East to West in South lane 20"	East to West in North lane	North to South East lane	East to West in North lane	East to West in South Lane	North to South in West lane	East to West in South Lane		East to West in North lane		North to South West Lane					North to South in East lane	North to South in West lane	North to South in West lane	North to South in West lane
			Size & Material	20" CI Water Main 6" abandoned 12" water main	12" Water Main	6" Water Main Existing	6" Water Main	20" Water Main	6" Water Main Existing 8" Water Main Proposed	8" Water Main		20" Water Main		20" Water Main encased					24" Water Main 6" Water Main	6" Water Main	6" Water Main	6" Water Main
			Relocation Cost			$150,000 if necessary			$270,000 if necessary													
Centurylink (Level 3)	Tim Hill Andrew Purcell	317-966-3356		Type 2					Type 2			Type 1			Type 1	Type 2						
			Size & Material	Long Haul Line								144 F Fiber in conduit			144 F Fiber in conduit	144 F Fiber in conduit						
			Type																			
			Aerial or UG	UG					Aeiral			Aerial (Existing) UG (Proposed)			Aerial (Existing) UG (Proposed)	Aerial (Existing) UG (Proposed)						
			Comment	UG joint trench with Crown Castle under North Sope wall					IPL poles from Washington north along the Davidson			Moving to South side of Saint Clair St.			Moving to eastside of existing IPL Pole line.	Moving to eastside of existing IPL Pole line.						
Comcast Cablevision	William Morris	224-229-5863		Type 2					Type 2													
			Size & Material																			
			Type																			
			Aerial or UG	UG					Aerial													
			Comment	Parallel to Washington St.					Attached to IPL poles running north to South on Davidson													
Extenet NOC		866-892-5327		Type 2	Type 2	Type 2	Type 2	Type 2	Type 2	Type 2		Type 2	Type 2	Type 2	Type 2	Type 2		Type 2	Type 2	Type 2	Type 2	Type 2
			Size & Material																			
			Aerial or UG																			
			Comment																			
Crown Castle Fiber (aka Fibertech)	Craig Brown	317-819-8648		Type 2	Type 2				Type 2			Type 1								Type 2		
			Size & Material	4" Conduit	(2) 1.25" Ducts							unknown								4" Conduit		
			Type	Fiber Optic Cable	Fiber Optic Cable							telecom								Fiber Optic Cable		
			Aerial or UG	UG	UG / Aerial				Aerial			Aerial								UG		
			Comment	UG joint trench with Crown Castle under North Sope wall	Become aerial at NW quadrant of Market S. and Davidson				Attached to IPL poles on West side of Davidson St.			Pole 1028-SE Corner Davidson/St. Clair								Conduit leased by Zayo		
Indianapolis Power and Light	Janet Snodgrass	317-261-8617	*Type*	Type 2	Type 2	Type 2		Type 1	Type 2	Type 1		Type 1	Type 2		Type 1	Type 1		Type 2	Type 2	Type 2		
			Aerial or UG	UG	UG	Aerial		Aerial (Existing UG (Proposed)	Aerial	Aerial (Existing UG (Proposed)		Aerial (Existing UG (Proposed)	Existing Under ground line		Aerial (Existing UG (Proposed)	Aerial (Existing UG (Proposed)		Aerial	Aerial	Aerial		
			Description										Supervisory cable (FO)									

EXISTING UTILITY MATRIX

INDOT DES.NO: 1600808
PROJECT: Reconstruction of I-65/I-70 (North Split) Interchange
Revised 2/25/20 Changes Highlighted in yellow

UTILITY			DESCRIPTION	POSSIBLE IMPACT LOCATIONS																	
				Washington St.	Market St.	Ohio St.	New York St.	Vermont St.	Davidson St.	Michigan St.	North Street	Saint Clair St.	10th ST. / Mass Ave	Park St.	Myron St.	Lewis St.	Monon Trail	Pennsylvania St.	Delaware St.	Alabama St.	Central Ave	College Ave
COMPANY NAME	CONTACT	PHONE																			
(distribution)	Jim Duvall	317-261-8694	*Comment*	Burried East to West North of the WB lane	Burried East to West North of the WB lane	South side of Ohio		See Relocation Plan for more detail	Existing and Proposed poles along length of Davidson Pine St.	See Relocation Plan for more detail		See Relocation Plan for more detail	North of 10th street beneath sidewalk		See Relocation Plan for more detail	See Relocation Plan for more detail		Crossing North and South of Interstate	Crossing North of interstate	Two aerial interstate crossings of East and West of Alabama		
Indianapolis Power and Light (Transmission)	Ron Pollard Dana Smith	317-261-8514 317-261-8686										Type 1	Type 1	Type 2								
			Size & Material									138kV Electric	138kV Electric	138kV Electric								
			Aerial or UG									Aerial	Aerial	Aerial								
			Comment									Steel Poles	Steel Poles	Steel Poles								
Intelligent Fiber Network, LLC (IFN)	Keith Hamm Adam Lamb	317-777-7583 317-697-2123		Type 2																	
			Size & Material	FO																	
			Aerial or UG	UG																	
			Comment	Existing building in SW Quadrant of interchange and goes west.																	
IUPUI	Ben Cockrum	317-278-4620		Utility has stated they do not have facilities within the project area.																	
			Size & Material																		
			Aerial or UG																		
			Comment																		
MCI / Verizon Business	Rolland Craig	317-498-1242		Type 2		Type 2											Type 2	Type 2		Type 2		Type 2
			Size & Material														Empty Conduit	FO		(2) FO		
			Aerial or UG	UG		Aerial											UG	UG		UG		UG
			Comment	East Washington		Attached to IPL Poles along Davidson and going south across RR tracks											West of Lewis St.	East side of Pennsylvania St.		East of Alabama under sidewalk		on the East side of College under sidewalk
Metro Fibernet, LLC	Korie Nellis	812-213-1378		Utility has stated they do not have facilities within the project area.																	
			Size & Material																		
			Aerial or UG																		
			Comment																		
Purdue University I Light Fiber	George Huss	443-403-2023																			
			Size & Material																		
			Aerial or UG																		
			Comment																		
Spectrum (Brighthouse Timewarner)	Jeff Farmer	317-710-2628							Type 2			Type 1			Type 1						
			Size & Material									.875 coax 144 ct Fiber 288 ct Fiber			216 ct Fiber						
			Aerial or UG						UG			Aerial (Existing) UG (prop.)			Aerial (Existing) UG (prop.)						
			Comment						Running North and South												
Urban Systems		unknown																			
			Size & Material																		
			Aerial or UG																		
			Comment																		
				The Utility has determined to the best of their ability that they do not have facilities within the project area																	

EXISTING UTILITY MATRIX

INDOT DES.NO: 1600808
PROJECT: Reconstruction of I-65/I-70 (North Split) Interchange
Revised 2/25/20 Changes Highlighted in yellow

UTILITY			DESCRIPTION	POSSIBLE IMPACT LOCATIONS																	
				Washington St.	Market St.	Ohio St.	New York St.	Vermont St.	Davidson St.	Michigan St.	North Street	Saint Clair St.	10th ST. / Mass Ave	Park St.	Myron St.	Lewis St.	Monon Trail	Pennsylvania St.	Delaware St.	Alabama St.	Central Ave	College Ave
COMPANY NAME	CONTACT	PHONE																			
Sprint / Nextel	Steve Hughes	513-459-9558	*Size & Material*																		
			Aerial or UG																		
			Comment																		
US Signal (aka RVP Fiber Company, LLC)	John Lundell	616-443-9027		Type 2			Type 2		Type 2												
			Size & Material	Fiber Optic Cable			Fiber Optic Cable		Fiber Optic Cable												
			Aerial or UG	Aerial & UG			Aerial & UG		Aerial & UG												
			Comment	West of Davidson in South West quadrant, Aerial and Underground			Riser to first pole North of New York St. - Underground North Side of New York St. heading West		Riser to first pole North of New York St. (and Proceeds North)												
Windstream (aka Paetec Comm.)	Scott Builta	309-212-3870					Type 2	Type 2		Type 2		Type 2							Type 2			
			Size & Material				Fiber Optic	Fiber Optic		Fiber Optic		Fiber Optic							Fiber Optic			
			Aerial or UG				unknown	Aerial		Aerial		Aerial							Aerial to UG			
			Comment				W. of Davidson, N. of New York	Attached to IPL Poles on Davidson St.		Attached to IPL Poles on Pine St.		Attached to IPL Poles							300 count FO			
Zayo Bandwidth (aka Infinity Fiber Route / ALS)	Waylon Higgins Adam Lamb	317-697-2123				Type 2	Type 2	Type 2		Type 2		Type 2	Type 2			Type 2						Type 2
			Size & Material			Fiber Optic	Fiber Optic	Fiber Optic		Fiber Optic		Fiber Optic	FO			Fiber Optic						Fiber Optic
			Type																			
			Aerial or UG			Aerial	Aerial	Aerial		Aerial		UG	UG			UG						UG
			Comment			Attached to IPL poles	Attached to IPL Poles on Pine St.	Attached to IPL Poles on Pine St.		Attached to IPL Poles on Pine St.		Crossing	In AT&T Duct bank on Mass Ave.			Burried East side of Lewis						Burried East side of College
AT&T (TCA)	James Everett	770-335-9815		Type 2					Type 2			Type 2										
			Size & Material	FO					FO			FO										
			Aerial or UG	Aerial & UG					Aerial			Aerial										
			Comment	Attached to IPL poles West of Davidson, buried crossing 65/70 approx 200' south of Washington St.					Attached to IPL Poles West of Davidson			Attached to IPL Poles West of Davidson										

Date: Enter Date

Subject:

Utility Relocation Work Plan for:	Enter the Utility Name
Facility Type:	Enter Facility Type- gas, water, etc.

Section 1: General Information

A. INDOT/LPA Project Information

1.	DES NO.:	Enter the DES#
2.	Route Number:	Enter the Route Number
3.	Location:	Enter the Location Information
4.	Work Type:	Enter the Project Work Type
5.	Letting Date:	Enter the Letting Date
6.	Date Work Plan Needed	Enter the Date Work Plan Required
7.	Target Date for Utility to be out of conflict with INDOT Project	Enter Target Date
	Intermediate Phase	Enter Target Date
	Intermediate Phase	Enter Target Date

B. Utility Designated Contact – Information

1.	Designated Contact Name:	Enter Designated Contact Name
2.	Office telephone:	Enter Office Telephone
3.	Mobile telephone:	Enter Mobile Telephone
4.	Email address:	Enter Email Address
5.	Agency name	Enter Agency/Utility Name
6.	Address:	Enter Address
7.	City, State, Zip Code:	Enter City, State, Zip
8.	Construction Emergency Contact:	
	Name:	Enter Contact Name
	Number:	Enter Phone Number

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct

D. INDOT/LPA Utility Coordinator Contact Information

1.	Utility Coordinator Name:	Enter Coordinator Name
2.	Office Telephone:	Enter Office Telephone
3.	Mobile Telephone:	Enter Mobile Telephone
4.	Email Address:	Enter Email Address
5.	Agency Name:	Enter Agency Name
6.	Address:	Enter Address
7.	City, State, Zip Code	Enter City, State, Zip Code

Section 2: A narrative description of the facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.

B. Describe the location of existing active and inactive facilities.

C. Describe what will be done with existing active and inactive facilities.

D. Describe the details of the proposed new facilities.

E. Describe the proposed location of the new facilities.

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on <**Enter Date Received Plans**>

_____ _____

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]

Section 4: A statement whether the utility is or is not willing to allow the INDOT contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]

Section 5: From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	The expected lead time in calendar days to obtain required permits:	Enter Total Days
B.	The expected lead time in calendar days to obtain materials:	Enter Total Days
C.	The expected lead time in calendar days to schedule work crews:	Enter Total Days
D.	If the contractor is being selected by competitive bid what is the date of selection?	Enter Bid Date
E.	The expected lead time in calendar days to obtain new property interests:	Enter Days
F.	The earliest date when the utility could begin to implement the pre-construction activities of the work plan:	Enter Date
G.	The total number of calendar days for pre-construction activities: (accounting for concurrent activities)	Enter Total Days

Section 6: The Utility Construction Scheduling Information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]

   1. Utility A, with a description of the required work.

   2. Utility B, with a description of the required work.

   3. Utility C, with a description of the required work.

B. A statement whether the facility relocation is or is not dependent on work to be done by the department or the department's contractor with a description of that work. [IAC 13-3- 3(c)(2)(A)(ii)]

   1. Work item A

   2. Work item B

   3. Work item C

C. How many calendar days after the events identified in Sec 6 A and B are completed can the utility begin construction: Enter Total Days

D. The number of calendar days to complete the relocation work: Enter Total Relocation Days

Section 7: A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.

Section 8: For each work plan the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]

Section 9: For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]

Section 10: The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished)

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/LPA:	☐	☐
A relocation permit from INDOT/LPA:	☐	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

Signature of Utility Representative

Date

Utility Representative Name Printed

October 2019
Standard Agreement
Work in Contract

INDIANA DEPARTMENT OF TRANSPORTATION
HIGHWAY UTILITY AGREEMENT

Agreement Amount:_____ Des No:_____

Agreement Type:_____ Project No:_____

Work Description:_____ Road:_____

_____ County:_____

THIS AGREEMENT, made and entered into the _____day of _____, 20____, by and between

_____

_____

_____

(hereinafter referred to as the Utility), and the State of Indiana, through the INDIANA DEPARTMENT OF TRANSPORTATION, (hereinafter referred to as INDOT).

WITNESSETH:

WHEREAS, INDOT desires to _____ as referenced by the Des No. and Project No. given above (hereinafter referred to as the "project"); and

WHEREAS, due to the said highway construction certain adjustments, removals, alterations, and/or relocations of the existing facilities of the Utility will have to be made as shown on the plan marked Exhibit "A" attached hereto and incorporated by reference;

WHEREAS, INDOT will recommend approval of this project, if applicable, to the Federal Highway Administration for construction with funds apportioned to INDOT under Title 23, United States Code and Acts amendatory thereof and supplementary thereto;

WHEREAS, it is necessary for the parties hereto to comply with the applicable terms and provisions of the Federal-Aid Policy Guide (hereinafter called the Policy Guide and available at http://www.fhwa.dot.gov/legsregs/directives/cfr23toc.htm on the FHWA website) and 23 CFR 645 Subpart A, which is hereby incorporated by reference, in order to receive reimbursement;

NOW, THEREFORE, IN CONSIDERATION OF THE PREMISES AND THE MUTUAL AGREEMENTS AND COVENANTS HEREIN CONTAINED (THE ADEQUACY OF WHICH CONSIDERATIONS AS TO EACH OF THE PARTIES TO THIS AGREEMENT IS HEREBY

MUTUALLY ACKNOWLEDGED), AND OTHER GOOD AND VALUABLE CONSIDERATIONS, THE RECEIPT OF WHICH IS HEREBY ACKNOWLEDGED AND INTENDING TO BE LEGALLY BOUND, THE PARTIES HEREBY COVENANT AND AGREE AS FOLLOWS:

SECTION 1 – PREPARATION OF RELOCATION PLANS FOR INDOT'S CONSTRUCTION CONTRACT

The Utility shall prepare, or cause to be prepared, all plans, specifications and a preliminary itemized cost estimate, for relocation of the Utility's facilities that need to be relocated in order to construct INDOT's project. INDOT's construction contract will require the contractor, which is awarded the contract, to list the Utility as an additional named insured. In addition, INDOT's construction contract will provide that the Utility is a third-party beneficiary with respect to the relocation work. No changes to the plans or specifications for relocation of the Utility's facilities shall be made without the written approval of the Utility. INDOT will prepare the final engineer's estimate for the construction contract.

SECTION 2 – AWARDING OF CONSTRUCTION CONTRACT

INDOT will advertise one (1) contract for bids which includes the plans and specifications for relocation of the Utility's facilities and INDOT's plans and specifications for INDOT's project. Upon receipt of an acceptable bid in accordance with State law, INDOT will award a contract for construction of the work. The Utility agrees to have the contractor to whom INDOT awards the contract relocate the Utility's facilities.

SECTION 3 – CONSTRUCTION TESTING AND INSPECTION

INDOT will provide construction inspection and testing services to monitor the contractor's relocation of the Utility's facilities. The Utility may inspect, at its own cost, the relocation of the Utility's facilities. The Utility shall timely advise INDOT, in writing, of any deficiencies that are observed. Prior to INDOT's final acceptance of the construction contract, the Utility shall make an inspection of the Utility's relocation work and advise INDOT in writing of the Utility's acceptance thereof. Such acceptance shall not be unreasonably withheld.

SECTION 4 – SUBORDINATION OF RIGHTS

[Check the following that applies]

☐ The existing facilities are located on public right-of-way.

☐ The existing facilities are not located on public right-of-way

If such facilities are located on property, other than public right-of-way, and the Utility either has an easement thereon or a continuing right to maintain the facilities in that location, the Utility, for and in consideration of this Agreement, shall subordinate the Utility's rights herein to those of the INDOT in the highway right-of-way by executing a subordination Agreement.

SECTION 5 – REIMBURSEMENT

(a) _____% of the cost to design and prepare construction plans, specifications and preliminary itemized cost estimate for relocation of the Utility's facilities shall be borne by INDOT.

(b) _____% of the cost to provide testing and inspection services for relocation of the Utility's facilities shall be borne by INDOT.

(c) INDOT shall bear _____ % of the cost of relocating the Utility's facilities. (See exhibit "B")

The cost of relocation of the Utility's facilities (provided for in (c)) shall equal the amount paid by INDOT to the contractor (based upon the actual units of work performed at the unit prices set out in the contractor's itemized proposal or extra work agreement), selected in accordance with the procedure in Section 2.

The estimated cost of relocation is $_____(See Exhibit "B" for an itemized estimate of all anticipated costs, including but not limited to, materials, labor, and equipment costs.)

The estimated cost of non-reimbursable relocation work to the utility's facilities is $_____. The Utility has appropriated, duly made and entered of record, the sum of $_____to apply to the cost of the project. A copy of the Utility's official record wherein such appropriation was made is attached as Exhibit "C". If the amount to be contributed by the utility is zero then no Exhibit "C" is attached.

SECTION 6 – COMPLETION OF PROJECT

Upon final acceptance of the contractor's work (the construction contract) by INDOT, the Utility shall be responsible for maintenance, repair, and/or reconstruction of the Utility's facilities.

SECTION 7 – WAIVER

In consideration for INDOT's participation in this contract, the Utility waives any claim, demand, or expectation it may have in the future against INDOT based upon any negligent omission and/or commission by INDOT's contractor performing the relocation of the Utility's facilities.

SECTION 8 – PAYMENTS

Within forty-five (45) days after the contract is awarded, the Utility shall pay INDOT a sum equal to one hundred percent (100%) of the Utility's share of the bid price for construction as stated above in Section 5. If an Advice of Change Order (AC) is approved which increases the Utility's share of the project cost, the Utility shall pay INDOT within thirty (30) days a sum equal to one hundred percent (100%) of such increased cost. If the Utility's share is less than the amount the utility has contributed, then INDOT will refund the difference within thirty (30) days.

All payments shall be made in arrears in conformance with State fiscal policies and procedures and, as required by IC 4-13-2-14.8, by electronic funds transfer to the financial institution designated by the Utility in writing unless a specific waiver has been obtained from the Auditor of State. No payments will be made in advance of receipt of the goods or services that are the subject of this agreement except as permitted by IC 4-13-2-20

SECTION 9 – BINDING UPON SUCCESSORS OR ASSIGNS

This Agreement shall be binding upon the parties and their successors and assigns.

SECTION 10 – GENERAL LIABILITY PROVISIONS

The Utility for itself, its employees, agents and representatives, shall indemnify, protect and save harmless the Indiana Department of Transportation, and the State of Indiana from and against any and all legal liabilities and other expenses, claims, cost, losses, suits or judgments for damages, or injuries to or death of persons or damage to or destruction of property (hereafter "Claim"), arising out of intentional tortious acts or whether due in whole or in part to the negligent acts or omissions of the Utility, its employees or agents or contractors, in relation to or in connection with any work performed or to be performed pursuant to this agreement, provided however, that where the State has been found liable by a court, tribunal or governing body entitled to make such a determination for intentional tortious acts and/or negligence with respect to the occurrence or occurrences giving rise to the Claim, the Utility shall have no duty to indemnify, protect, or save harmless either the Department of Transportation or the State.

SECTION 11 – INCORPORATION OF THE UTILITY POLICY GUIDE

The Policy Guide forms an essential part of this Agreement, and the terms or provisions of this Agreement in no way abrogate or supersede the terms or provisions set forth in said Policy Guide.

SECTION 12 – PENALTIES/INTEREST/ATTORNEY'S FEES

INDOT will in good faith perform its required obligations hereunder and does not agree to pay any penalties, liquidated damages, interest, and/or attorney's fees, except as required by Indiana law.

SECTION 13 – COMPLIANCE WITH LAWS; APPLICABLE LAW

The UTILITY agrees to comply with all federal, state and local laws, rules, regulations, or ordinances that are applicable at the time the UTILITY's services pursuant to this agreement are rendered, and all provisions required thereby to be included herein are hereby incorporated by reference. The enactment of any Indiana or federal statute or the promulgation of regulations there under after execution of this agreement shall be reviewed by the Office of the Indiana Attorney General and the UTILITY to determine whether the provisions of this agreement require formal amendment.

This Agreement shall be construed in accordance with and governed by the laws of the State of Indiana and suit, if any, must be brought in the State of Indiana.

SECTION 14 – COMPLIANCE WITH TELEPHONE SOLICITATIONS ACT
As required by IC 5-22-3-7:

(1) the UTILITY and any principals of the UTILITY certify that
  (A) the UTILITY, except for de minimis and nonsystematic violations, has not violated the terms of
    (i) IC 24-4.7 [Telephone Solicitation Of Consumers],
    (ii) IC 24-5-12 [Telephone Solicitations] , or
    (iii) IC 24-5-14 [Regulation of Automatic Dialing Machines] in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and
  (B) the UTILITY will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

(2) The UTILITY and any principals of the UTILITY certify that an affiliate or principal of the UTILITY and any agent acting on behalf of the UTILITY or on behalf of an affiliate or principal of the UTILITY:
  (A) except for de minimis and nonsystematic violations, has not violated the terms of IC 24-4.7 in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and
  (B) will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

SECTION 15 – CONFLICT OF INTEREST

A. As used in this section:
  "Immediate family" means the spouse and the unemancipated children of an individual.
  "Interested party," means:
    1. The individual executing this Agreement;
    2. An individual who has an interest of three percent (3%) or more of the Utility, if the Utility is not an individual; or
    3. Any member of the immediate family of an individual specified under subdivision 1 or 2.
  "Commission" means the State Ethics Commission.

B. INDOT may cancel this Agreement without recourse by the Utilityif any interested party is an employee of the State of Indiana.

C. INDOT will not exercise its right of cancellation under section B, above, if the Utility gives INDOT an opinion by the Commission indicating that the existence of this Agreement and the employment by the State of Indiana of the interested party does not violate any statute or code relating to ethical conduct of INDOT employees. INDOT may take action, including cancellation of this Agreement, consistent with an opinion of the Commission obtained under this section.

D. The UTILITY has an affirmative obligation under this Agreement to disclose to INDOT when an interested party is or becomes an employee of the State of Indiana. The obligation under this section extends only to those facts that the Utility knows or reasonably could know.

SECTION 16 – DRUG-FREE WORKPLACE CERTIFICATION

The UTILITY hereby covenants and agrees to make a good faith effort to provide and maintain a drug-free workplace. The Utility will give written notice to INDOT and the Indiana Department of Administration within ten (10) days after receiving actual notice that the Utility or an employee of the UTILITY has been convicted of a criminal drug violation occurring in the UTILITY's workplace.

False certification or violation of the certification may result in sanctions including, but not limited to, suspension of agreement payments, termination of this Agreement and/or debarment of agreement opportunities with the State of Indiana for up to three (3) years.

In addition to the provisions of the above paragraphs, if the total agreement amount set forth in this Agreement is in excess of $25,000.00, the UTILITY hereby further agrees that this agreement is expressly subject to the terms, conditions, and representations of the following certification:

This certification is required by Executive Order No. 90-5, April 12, 1990, issued by the Governor of Indiana. Pursuant to its delegated authority, the Indiana Department of Administration is requiring the inclusion of this certification in all contracts and grants from the State of Indiana in excess of $25,000.00. No award of a contract shall be made, and no contract, purchase order or agreement, the total amount of which exceeds $25,000.00, shall be valid, unless and until this certification has been fully executed by the Utility and made a part of the contract or agreement as part of the contract documents.

The Utility certifies and agrees that it will provide a drug-free workplace by:

A. Publishing and providing to all of its employees a statement notifying employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the Utility's workplace, and specifying the actions that will be taken against employees for violations of such prohibition;

B. Establishing a drug-free awareness program to inform it's employees of (1) the dangers of drug abuse in the workplace; (2) the Utility's policy of maintaining a drug-free workplace; (3) any available drug counseling, rehabilitation, and employee assistance programs; and (4) the penalties that may be imposed upon an employee for drug abuse violations occurring in the workplace;

C. Notifying all employees in the statement required by subparagraph (A) above that as a condition of continued employment, the employee will (1) abide by the terms of the statement; and (2) notify the Utility of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction;

D. Notifying in writing INDOT within ten (10) days after receiving notice from an employee under subdivision (C)(2) above, or otherwise receiving actual notice of such conviction;

E. Within thirty (30) days after receiving notice under subdivision (C)(2) above of a conviction, imposing the following sanctions or remedial measures on any employee who is convicted of drug abuse violations occurring in the workplace: (1) taking appropriate personnel action against the employee, up to and including termination; or (2) requiring such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a federal, state or local health, law enforcement, or other appropriate agency; and

F. Making a good faith effort to maintain a drug-free workplace through the implementation of subparagraphs (A) through (E) above.

SECTION 17 – FUNDING CANCELLATION CLAUSE

When the Director of the State Budget Agency makes a written determination that funds are not appropriated or otherwise available to support continuation of performance of an agreement, the agreement shall be canceled. A determination by the Budget Director that funds are not appropriated or otherwise available to support continuation of performance shall be final and conclusive.

SECTION 18 – NON-DISCRIMINATION

A. Pursuant to I.C. 22-9-1-10, the Utility and its Contractor and subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this agreement, with respect to hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of race, color, religion, sex, disability, national origin or ancestry. Breach of this covenant may be regarded as a material breach of this agreement.

B. The UTILITY understands that INDOT is a recipient of federal funds. Pursuant to that understanding, the UTILITY and its Contractor and subcontractors, if any, agree that if the UTILITY employs fifty (50) or more employees and does at least $50,000.00 worth of business with INDOT and is not exempt, the UTILITY will comply with the affirmative action reporting requirements of 41 CFR 60-1.7. The UTILITY shall comply with Section 202 of executive order 11246, as amended, 41 CFR 60-250, and 41 CFR 60-741, as amended, which are incorporated herein by specific reference. Breach of this covenant may be regarded as a material breach of this agreement.

SECTION 19 – DEBARMENT AND SUSPENSION

The UTILITY certifies, by entering into this agreement, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from entering into this agreement by any federal agency or department agency or political subdivision of the State of Indiana. The term “principal” for the purposes of this agreement is defined as an officer, director, owner, partner, key employee, or other person with primary management or supervisory responsibilities, or a person who has a critical influence on or substantive control over the operations of the UTILITY.

SECTION 20 – CERTIFICATION FOR FEDERAL-AID CONTRACTS LOBBYING ACTIVITIES

The UTILITY certifies, by signing and submitting this Contract, to the best of its knowledge and belief, that the UTILITY has complied with Section 1352, Title 31, U.S. Code, and specifically, that:

A. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal Contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal Contract, grant, loan, or cooperative agreement.

B. If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this federal Contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

The UTILITY also agrees by signing this agreement that it shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000, and that all such subrecipients shall certify and disclose accordingly. Any person who fails to sign or file this required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each failure.

SECTION 21 – APPROVAL OF ATTORNEY-GENERAL

This Agreement shall not be effective unless and until it is approved by the Attorney General of Indiana or an authorized representative, as to form and legality.

SECTION 22 – ETHICS

The Utility and its agents shall abide by all ethical requirements that apply to persons who have a business relationship with the State, as set forth in Indiana Code § 4-2-6 et seq., the regulations promulgated hereunder, and Executive Order 05-12, dated January 12, 2005. If the Utility is not familiar with these ethical requirements, the Utility should refer any questions to the Indiana State Ethics Commission, or visit the Indiana State Ethics Commission website at <<<http://www.in.gov/ethics/>>>. If the Utility or its agents violate any applicable ethical standards, the State may, in its sole discretion, terminate this contract immediately upon notice to the Utility. In addition, the Utility may be subject to penalties under Indiana Code § 4-2-6-12.

SECTION 23 – NON-COLLUSION

The undersigned attests, subject to the penalties for perjury, that he/she is the Utility, or that he/she is the representative, agent, member or officer of the contracting party, that he/she has not, nor has any other member, employee, representative, agent or officer of the Utility, directly or indirectly, to the best of his/her knowledge, entered into or offered to enter into any combination,

collusion or agreement to receive or pay, and that he/she has not received or paid, any sum of money or other consideration for the execution of this Agreement other than that which appears upon the face of this Agreement.

THE REMAINDER OF THIS PAGE LEFT INTENTIONALLY BLANK

IN WITNESS HEREOF, the parties hereto separately and severally have caused this instrument to be executed in their respective names by and through their duly authorized officers.

THE UTILITY:

_____
(Utility Name)

_____ _____
(Signature of Officer) Date

_____
(Officer's Name, Printed or typed)

_____
(Officer's Position)

The State of Indiana
By the Indiana Department of Transportation

By:

_____ _____
Michael B. Jett Date
Statewide Director of Utilities and Railroads
Capital Program Management
For: Joseph McGuiness
Commissioner

APPROVED AS TO LEGALITY AND FORM:

_____ _____
Curtis T. Hill, Jr.
Attorney General of Indiana Date Approved

October 2019
Standard Agreement
Work by Utility
INDIANA DEPARTMENT OF TRANSPORTATION
HIGHWAY UTILITY AGREEMENT

Agreement Amount:_____ Des No:_____

Agreement Type:_____ Project No:_____

Work Description:_____ Road:_____

_____ County:_____

This Agreement, made and entered into this_____day of _____, 20____, by and between (include full entity name and address)

_____

_____

_____
(hereinafter referred to as the Utility,) and the State of Indiana, through the INDIANA DEPARTMENT OF TRANSPORTATION, (hereinafter referred to as INDOT or State), together referred to as the Parties.

WITNESSETH:

WHEREAS, INDOT desires to _____ as referenced by the Des No. and Project No. given above (hereinafter referred to as the "project"); and

WHEREAS, due to said highway construction certain adjustments, removals, alterations, and/or relocations of the existing facilities of the Utility will have to be made as shown on the plan marked Exhibit "A" attached hereto and incorporated by reference; and

WHEREAS, INDOT has determined the Utility to be eligible for reimbursement; and

WHEREAS, INDOT will recommend approval of this project, if applicable, to the Federal Highway Administration for construction with funds apportioned to INDOT under Title 23, United States Code and Acts amendatory thereof and supplementary thereto; and

WHEREAS, it is necessary for the parties hereto to comply with the applicable terms and provisions of the Federal-Aid Policy Guide (hereinafter called the Policy Guide and available at http://www.fhwa.dot.gov/legsregs/directives/cfr23toc.htm on the FHWA website) and 23 CFR 645 Subpart A, which is hereby incorporated by reference, in order to receive reimbursement; and

WHEREAS, it is in the best interest of the Utility and INDOT for the Utility to make the necessary adjustments, removals, alterations, and/or relocations of its existing facilities, as shown on said Exhibit "A" with the Utility's regular construction and maintenance forces, or by a contractor paid under a contract let by the Utility with the approval of INDOT as provided for under 23 CFR 645.115.

NOW, THEREFORE, in consideration of the premises and the mutual agreements and covenants herein contained and the adequacy of consideration as to each of the parties to this agreement is hereby mutually acknowledged, and other good and valuable considerations, the receipt is hereby acknowledged and intending to be legally bound the Parties hereby covenant and agree as follows:

SECTION 1 – DESCRIPTION OF WORK AND ITEMIZED COST ESTIMATE

The Utility shall: _____

The Utility shall: make the necessary adjustments, removals, alterations and/or relocations to its existing facilities as further shown in Exhibit "A", attached hereto and incorporated by reference in the following manner: **[Check the following that applies]**

☐With its regular construction or maintenance crew and personnel at its standard schedule of wages and working hours.

☐By an approved contractor, as set forth in 23 CFR 645.109 and/or 645.115.

The preliminary itemized cost estimate for this project is set forth in attached exhibit "B", incorporated by reference, and prepared in accordance with the Policy Guide.

Exhibit "B" shall include an itemized estimate of all anticipated cost, including, but not limited to, materials, labor, equipment cost, preliminary and construction engineering cost, administrative cost, eligible property cost, and/or contracted services. Each item shall be shown as a 'per unit' cost.

SECTION 2 – WORK COMMENCEMENT

The Utility shall not start work on the adjustments, removals, alterations and/or relocations covered by this Agreement until written authorization has been given the Utility by INDOT or until a satisfactory starting date has been established with the appropriate

District Utility Engineer.

SECTION 3 – SUBORDINATION OF RIGHTS

[Check the following that applies]

☐The existing facilities are located on public right-of-way.

☐The existing facilities are not located on public right-of-way

If such facilities are located on property, other than public right-of-way, and the Utility either has an easement thereon or a continuing right to maintain the facilities in that location, the Utility, for and in consideration of this Agreement, shall subordinate the Utility's rights herein to those of the INDOT in the highway right-of-way by executing a subordination Agreement.

SECTION 4 – MATERIAL ALTERATIONS DUE TO CHANGED AND UNFORESEEN CIRCUMSTANCES

The Utility shall modify its facilities in accordance with the plans, specifications, and estimates shown in Exhibits "A" and "B". No work shall be performed by the Utility beyond the scope contemplated by Exhibits "A" and "B" without prior written authorization by INDOT.

In the event there are changes in the scope of work, extra work, or major change in the planned work covered by the approved agreement, plans and estimate, the Utility shall inform INDOT as soon as practical upon discovery. The Utility shall also notify INDOT of any material alterations due to unforeseen circumstances as soon as practical upon discovery. Such notification shall consist of a letter, telephone call, or other electronic communication confirmed by letter to the following address:

Indiana Department of Transportation

_____

_____

_____

Said communication shall include sufficient information to indicate the nature of the changed or unforeseen circumstances, the location of the changed or unforeseen circumstances, and the impact of the changed or unforeseen circumstances upon the Utility's relocation efforts, cost of the relocation, the time necessary to complete the relocation, and the extent of relocation.

SECTION 5 – PAYMENTS

All payments shall be made in arrears in conformance with State fiscal policies and procedures and, as required by IC 4-13-2-14.8, by electronic funds transfer to the financial institution designated by the Utility in writing unless a specific waiver has been obtained from the Auditor of State. No payments will be made in advance of receipt of the goods or services that are the subject of this agreement except as permitted by IC 4-13-2-20.

SECTION 5 (A) – STANDARD PAYMENT METHOD

INDOT shall reimburse the Utility for any item of work or expense involved if performed at the written direction of the INDOT. The INDOT shall reimburse the Utility for actual cost of the work completed upon presentation of a valid invoice.

This Utility may submit one invoice per calendar month for work covered by this agreement. The Utility shall attach an itemization of cost incurred with each invoice. This itemization of cost shall appear in the same form and manner as the preliminary estimate as shown on Exhibit "B".

Within forty-five (45) days after receipt of a valid invoice from the Utility and the approval thereof by the INDOT, the INDOT will reimburse the Utility for its actual expenses. If the INDOT does not agree with the amount invoiced by the Utility, the INDOT will send the Utility a letter by regular mail and list the differences. The letter will be sent to the Utility's address as shown on page 1 of this agreement, or such subsequent address that the Utility may give to the INDOT's authorized representative.

Making a partial payment shall not abrogate the INDOT's right to dispute in good faith the Utility's claim for compensation. Such good faith disputes shall be resolved upon presentation of the Utility's final contract invoice and the resolution of any audit performed according to Section 8 of this agreement.

SECTION 5 (B) – LUMP SUM PAYMENT METHOD

The Utility may elect to petition INDOT for payment of relocation expenses by Lump Sum. Such petition shall include Exhibits "A" and "B" along with a detailed explanation requesting payment by lump sum and showing how all individuals will be best served by such payment method.

INDOT may make payment by lump sum if the total cost for relocation does not exceed $100,000.00. Lump sum payments in excess of $100,000.00 will be made only if in the best interest of the public in accordance with 23 CFR 645.113(f) and approved by the Federal Highway Administration.

If a lump sum payment is approved, the Utility shall submit one Contract Invoice no later than ninety (90) days after relocation work is completed. The INDOT shall issue reimbursement within forty-five (45) days after receipt of a valid Contract Invoice. No amount in excess of agreed amount in Exhibit "B" shall be reimbursed.

SECTION 6 – COST INCREASES

An invoice that increases the total invoiced project cost above the amount shown in Exhibit "B" shall not be approved until INDOT has issued another purchase order or an advice of

change (AC) order to cover the increased cost of relocation. If the invoice causes the total invoiced project cost to exceed the amount shown in Exhibit "B" by more than 10%, the invoice shall not be approved until the Utility submits a revised estimate and justification for the additional cost of relocation. The Utility acknowledges that until the above conditions are met INDOT may return any invoice submitted by the Utility which when totaled with previous invoices paid (or to be paid) by INDOT exceeds the amount shown in Exhibit "B" by more than 10%.

INDOT shall make every effort to expedite the payment of any approved cost increase above the amount originally agreed upon.

SECTION 7 – FINAL BILL

The utility shall present its final contract invoice accompanied by an itemized cumulative invoice within ninety (90) days of completion of its work. All documents required to substantiate any claims for payment shall be submitted with this final contract invoice. Such supporting documentation shall include, but shall not be limited to, copies of material invoices, time sheets, vendor and/or contractor invoices and other such documents as may be deemed necessary by INDOT to support such invoice.

SECTION 8 – RECORDS

The accounts and records of the Utility and any contractor or subcontractor involved in carrying out the proposed work shall be kept in such manner that they may be readily audited and actual cost determined, and such accounts shall be available for audit by auditors of INDOT, and the Federal Highway Administration for a period of not less than three (3) years from the date final payment has been received by the Utility in accordance with 23 CFR 645.117.

In the event of a dispute with regard to the allowable expenses or any other issue under this Agreement, the Utility shall thereafter continue to maintain the accounts and records until that dispute has been finally decided and the time for all available challenges or appeals of that decision has expired.

Upon completion of the Utility's work, the INDOT's Division of Accounting and Control may audit the Utility's records to determine the cost of relocation. Such audit shall be in accordance with generally accepted auditing standards and the appropriate cost principles as set forth in 48 CFR part 31.

Final payment shall be in accordance with INDOT's resolution of the final audit. If additional money is due the Utility, INDOT shall make payment to the Utility within forty-five (45) days after the audit resolution is approved by INDOT's Division of Accounting and Control. If the audit resolution shows that the Utility has been overpaid, INDOT shall bill the Utility for such overpayment and provide supporting documentation. The Utility shall pay INDOT within forty-five (45) days after receipt of such bill. If the Utility has not paid such bill within forty-five (45) days, INDOT may offset such amount against claims that the Utility has against INDOT.

SECTION 9 – BINDING UPON SUCCESSORS OR ASSIGNS

This agreement shall be binding upon the parties and their successors and assigns.

SECTION 10 – GENERAL LIABILITY PROVISIONS

The Utility for itself, its employees, agents and representatives, shall indemnify, protect and save harmless the Indiana Department of Transportation, and the State of Indiana from and against any and all legal liabilities and other expenses, claims, cost, losses, suits or judgments for damages, or injuries to or death of persons or damage to or destruction of property (hereafter "Claim"), arising out of intentional tortious acts or whether due in whole or in part to the negligent acts or omissions of the Utility, its employees or agents or contractors, in relation to or in connection with any work performed or to be performed pursuant to this agreement, provided however, that where the State has been found liable by a court, tribunal or governing body entitled to make such a determination for intentional tortious acts and/or negligence with respect to the occurrence or occurrences giving rise to the Claim, the Utility shall have no duty to indemnify, protect, or save harmless either the Indiana Department of Transportation or the State.

SECTION 11 – INCORPORATION OF THE UTILITY POLICY GUIDE

The Policy Guide forms an essential part of this agreement, and the terms or provisions of this agreement in no way abrogate or supersede the terms or provisions set forth in said Policy Guide.

SECTION 12 – PENALTIES / INTEREST / ATTORNEY'S FEES

INDOT will in good faith perform its required obligations hereunder and does not agree to pay any penalties, liquidated damages, interest, and/or attorney's fees, except as required by Indiana law.

SECTION 13 – COMPLIANCE WITH LAWS; APPLICABLE LAW

The UTILITY agrees to comply with all federal, state and local laws, rules, regulations, or ordinances that are applicable at the time the UTILITY's services pursuant to this Contract are rendered, and all provisions required thereby to be included herein are hereby incorporated by reference. The enactment of any Indiana or federal statute or the promulgation of regulations there under after execution of this Contract shall be reviewed by the Office of the Indiana Attorney General and the UTILITY to determine whether the provisions of this Contract require formal amendment.

This Contract shall be construed in accordance with and governed by the laws of the State of Indiana and suit, if any, must be brought in the State of Indiana.

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As required by IC 5-22-3-7:

(1) The UTILITY and any principals of the UTILITY certify that

(A) The UTILITY, except for de minimis and nonsystematic violations, has not violated the terms of
  (i) IC 24-4.7 [Telephone Solicitation of Consumers],
  (ii) IC 24-5-12 [Telephone Solicitations], or
  (iii) IC 24-5-14 [Regulation of Automatic Dialing Machines] in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and

(B) The UTILITY will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

(2) The UTILITY and any principals of the UTILITY certify that an affiliate or principal of the UTILITY and any agent acting on behalf of the UTILITY or on behalf of an affiliate or principal of the UTILITY:

(A) except for de minimis and nonsystematic violations, has not violated the terms of IC 24-4.7 in the previous three hundred sixty-five (365) days, even if IC 24-4.7 is preempted by federal law; and

(B) Will not violate the terms of IC 24-4.7 for the duration of the Contract, even if IC 24-4.7 is preempted by federal law.

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A. As used in this section:

"Immediate family" means the spouse and the unemancipated children of an individual.

"Interested party," means:

1. The individual executing the Contract;
2. An individual who has an interest of three percent (3%) or more of UTILITY, if UTILITY is not an individual; or
3. Any member of the immediate family of an individual specified under subdivision 1 or 2.

"Commission" means the State of Indiana Ethics Commission.

B. INDOT may cancel this Contract without recourse by UTILITY if any interested party is an employee of the State of Indiana.

C. INDOT will not exercise its right of cancellation under section B above if the UTILITY gives INDOT an opinion by the Commission indicating that the existence of this Contract and the employment by the State of Indiana of the interested party does not violate any statute or code relating to ethical conduct of INDOT employees. INDOT may take action, including cancellation of this Contract consistent with an opinion of the Commission obtained under this section.

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False certification or violation of the certification may result in sanctions including, but not limited to, suspension of Contract payments, termination of the Contract and/or debarment of contracting opportunities with the State of Indiana for up to three (3) years.

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This certification is required by Executive Order No. 90-5, April 12, 1990, issued by the Governor of Indiana. Pursuant to its delegated authority, the Indiana Department of Administration is requiring the inclusion of this certification in all contracts with and grants from the INDOT of Indiana in excess of $25,000.00. No award of a contract shall be made, and no contract, purchase order or agreement, the total amount of which exceeds $25,000.00, shall be valid, unless and until this certification has been fully executed by the UTILITY and made a part of the contract or agreement as part of the contract documents.

The UTILITY certifies and agrees that it will provide a drug-free workplace by:

A. Publishing and providing to all of its employees a statement notifying their employees that the unlawful manufacture, distribution, dispensing, possession or use of a controlled substance is prohibited in the UTILITY's workplace and specifying the actions that will be taken against employees for violations of such prohibition; and

B. Establishing a drug-free awareness program to inform their employees of (1) the dangers of drug abuse in the workplace; (2) the UTILITY's policy of maintaining a drug-free workplace; (3) any available drug counseling, rehabilitation, and employee assistance programs; and (4) the penalties that may be imposed upon an employee for drug abuse violations occurring in the workplace.

C. Notifying all employees in the statement required by subparagraph (a) above that as a condition of continued employment the employee will (1) abide by the terms of the statement; and (2) notify the UTILITY of any criminal drug statute conviction for a violation occurring in the workplace no later than five (5) days after such conviction;

D. Notifying in writing the INDOT within ten (10) days after receiving notice from an employee under subdivision (c)(2) above, or otherwise receiving actual notice of such conviction;

E. Within thirty (30) days after receiving notice under subdivision (c)(2) above of a conviction, imposing the following sanctions or remedial measures on any employee who is convicted of drug abuse violations occurring in the workplace: (1) take appropriate personnel action against the employee, up to and including termination; or (2) require such employee to satisfactorily participate in a drug abuse assistance or rehabilitation program approved for such purposes by a Federal, State or local health, law enforcement, or other appropriate agency; and

F. Making a good faith effort to maintain a drug-free workplace through the implementation of subparagraphs (a) through (e) above.

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When the Director of the State Budget Agency makes a written determination that funds are not appropriated or otherwise available to support continuation of performance of this Contract, the Contract shall be canceled. A determination by the Budget Director that funds are not appropriated or otherwise available to support continuation of performance shall be final and conclusive.

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C. Pursuant to I.C. 22-9-1-10, the Utility and its Contractor and subcontractors, if any, shall not discriminate against any employee or applicant for employment, to be employed in the performance of this Contract, with respect to hire, tenure, terms, conditions or privileges of employment or any matter directly or indirectly related to employment, because of race, color, religion, sex, disability, national origin or ancestry. Breach of this covenant may be regarded as a material breach of this Contract.

D. The UTILITY understands that INDOT is a recipient of federal funds. Pursuant to that understanding, the UTILITY and its Contractor and subcontractors, if any, agree that if the UTILITY employs fifty (50) or more employees and does at least $50,000.00 worth of business with INDOT and is not exempt, the UTILITY will comply with the affirmative action reporting requirements of 41 CFR 60-1.7. The UTILITY shall comply with Section 202 of executive order 11246, as amended, 41 CFR 60-250, and 41 CFR 60-741, as amended, which are incorporated herein by specific reference. Breach of this covenant may be regarded as a material breach of Contract.

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The UTILITY certifies, by entering into this agreement, that neither it nor its principals are presently debarred, suspended, proposed for debarment, declared ineligible, or voluntarily excluded from entering into this agreement by any federal agency or department agency or political subdivision of the State of Indiana. The term “principal” for the purposes of this

agreement is defined as an officer, director, owner, partner, key employee, or other person with primary management or supervisory responsibilities, or a person who has a critical influence on or substantive control over the operations of the UTILITY.

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The UTILITY certifies, by signing and submitting this Contract, to the best of its knowledge and belief that the UTILITY has complied with Section 1352, Title 31, U.S. Code, and specifically, that:

A. No federal appropriated funds have been paid or will be paid, by or on behalf of the undersigned, to any person for influencing or attempting to influence an officer or employee of any federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with the awarding of any federal Contract, the making of any federal grant, the making of any federal loan, the entering into of any cooperative agreement, and the extension, continuation, renewal, amendment, or modification of any federal Contract, grant, loan, or cooperative agreement.

C. If any funds other than federal appropriated funds have been paid or will be paid to any person for influencing or attempting to influence an officer or employee of any Federal agency, a Member of Congress, an officer or employee of Congress, or an employee of a Member of Congress in connection with this federal Contract, grant, loan, or cooperative agreement, the undersigned shall complete and submit Standard Form-LLL, "Disclosure Form to Report Lobbying," in accordance with its instructions.

The UTILITY also agrees by signing this Contract that it shall require that the language of this certification be included in all lower tier subcontracts, which exceed $100,000, and that all such subrecipients shall certify and disclose accordingly. Any person who fails to sign or file this required certification shall be subject to a civil penalty of not less than $10,000 and not more than $100,000 for each failure.

SECTION 21 - APPROVAL OF ATTORNEY-GENERAL

This Agreement shall not be effective unless and until it is approved by the Attorney General of Indiana or an authorized representative, as to form and legality.

SECTION 22 - ETHICS

The UTILITY and its agents shall abide by all ethical requirements that apply to persons who have a business relationship with the State, as set forth in Indiana Code § 4-2-6 et seq., the regulations promulgated thereunder, and Executive Order 04-08, dated April 27, 2004. If the UTILITY is not familiar with these ethical requirements, the UTILITY should refer any questions to the Indiana State Ethics Commission, or visit the Indiana State Ethics Commission website at

<<<http://www.in.gov/ethics/>>>. If the UTILITY or its agents violate any applicable ethical standards, the State may, in its sole discretion, terminate this contract immediately upon notice to the UTILITY. In addition, the contractor may be subject to penalties under Indiana Code § 4-2-6-12.

SECTION 23 – NON-COLLUSION

The undersigned attests, subject to the penalties for perjury, that he/she is the contract party, or that he/she is the representative, agent, member or officer of the UTILITY that he/she has not, nor has any other member, employee, representative, agent or officer of the firm, company, corporation or partnership represented by him/her, directly or indirectly, to the best of his/her knowledge, entered into or offered to enter into any combination, collusion or agreement to receive or pay, and that he/she has not received or paid, any sum of money or other consideration for the execution of this Contract other than that which appears upon the face of the Contract.

SECTION 24 - BUY AMERICA CERTIFICATION

The Utility agrees that all steel and cast iron materials and products to be used under this agreement will be produced and manufactured in the United States of America pursuant to the requirements of 23 CFR 635.410

----------Remainder of Page Intentionally Left Blank----------

IN WITNESS HEREOF, the parties hereto separately and severally have caused this instrument to be executed in their respective names by and through their duly authorized officers.

THE UTILITY:

_____
(Utility Name)

_____ _____
(Signature of Officer) Date

_____
(Officer's Name, Printed or typed)

_____
(Officer's Position)

The State of Indiana
By the Indiana Department of Transportation

By:

_____ _____
Michael B. Jett **Date**
Statewide Director of Utilities and Railroads
Capital Program Management
For: Joseph McGuiness
Commissioner

APPROVED AS TO FORM AND LEGALITY:

_____ _____
Curtis T. Hill, Jr. **Date Approved**
Attorney General of Indiana

Date: 11/8/2019

Subject: Utility Relocation Work Plan for: Indianapolis Power & Light Company
Facility Type: Electric Transmission

Section 1: General Information

A. DPW Project Information

(1) Des No.	**DES# 1600808**
(2) Route Number:	**I-65/I-70 (North Split) Interchange**
(3) Location:	**I-65 RP 111+0.16 to RP 112+0.94** **I-70 RP 81+0.72 to RP 83+0.67**
(4) Work Type:	**Interstate Road Reconstruction**
(5) Letting Date:	**N/A**
(6) Date Work Plan Needed	**October 18, 2019**
(7) Target Date for Utility to be out of conflict with INDOT Project	**XXXXXX XX, 2020**

B. Utility Designated Contact - Information

(1) Person name:	**Dana Smith**
(2) Office telephone:	**317-261-8686**
(3) Mobile telephone:	**317-997-7729**
(4) Email address:	**Dana.Smith@aes.com**
(5) Agency name:	**Indianapolis Power & Light Co.**
(6) Address:	**1230 W. Morris Street, Room 310E**
(7) City, State, Zip Code:	**Indianapolis, IN 46221**
(8) Construction Emergency Contact:	
Name:	**Dana Smith**
Number:	**317-261-8686**

As an informational course of action, the *contractor should notify* our Transmission Operations Center prior to beginning work in the area of the electric transmission lines. This will give the IPL Transmission Operations a 'heads up' that construction work is taking place, in case there is any unforeseen issues with the power lines. Notification number to call by the contractor is:

IPL Transmission Operations
317-261-8627

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative	Print Name	Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct

D. Utility Coordinator Contact Information

(1) Person name:	**Doug Garvin**
(2) Office telephone:	**317-917-5263**
(3) Mobile telephone:	**N/A**
(4) Email address:	**dgarvin@hntb.com**
(5) Agency name:	**HNTB Indiana**
(6) Address:	**111 Monument Circle, Suite 1200**
(7) City, State, Zip Code:	**Indianapolis, IN 46204**

Section 2: A narrative description of existing facilities within the project limits and any facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.
There are (3) transmission lines located within the limits of the roadway plans:

(a) An active aerial 138kV transmission line along the east side of Park Avenue that crosses the interstate west of the I-65/I-70 interchange.

(b) An active aerial 138kV transmission line along the north side of 10th Street that crosses the interstate south of the I-65/I-70 interchange.

(c) An active aerial 138kV transmission line along the north side of St. Clair Street that crosses the interstate south of the I-65/I-70 interchange.

B. Describe the location of existing active and inactive facilities.
(a) An active aerial 138kV transmission line runs along the east side of Park Avenue and crosses the interstate west of the I-65/I-70 interchange at line R_W70_N65 approximate station 138+50.

(b) An active aerial 138kV transmission line runs along the north side of 10th Street and crosses the interstate south of the I-65/I-70 interchange at line R_W70 approximate station 130+78.

(c) An active aerial 138kV transmission line runs along the north side of St. Clair Street and crosses the interstate south of the I-65/I-70 interchange at line R_S65 approximate station 135+89.

C. Describe what will be done with existing active and inactive facilities.

(a) The Park Avenue crossing has been deemed "no conflict" as the proposed increase in grade does not infringe on the necessary vertical wire clearances. No work will be performed at this location.

(b) The existing transmission facilities at the 10th Street crossing will be removed and relocated approximately 40' north for the proposed road/bridge construction.

(c) The existing transmission facilities at the St. Clair Street crossing will be removed and relocated approximately 125' north for the proposed road/bridge construction.

D. Describe the details of the proposed new facilities.

(a) No new facilities.

(b) The new facilities will generally be like for like replacements of existing facilities. (4) self-supporting steel poles ranging from 100' – 110' tall on concrete caissons will be required to carry the conductors over the interstate.

(c) Due to the nature of the relocation – like for like replacements are not feasible. (4) self-supporting steel poles ranging from 95' – 110' tall on concrete caissons will be required to carry the conductors over the interstate.

E. Describe the proposed location of the new facilities.

(a) No new facilities.

(b) The 138kV transmission line will generally move approximately 40' north of the existing facilities. Proposed #1 will be approximately 45' west and 40' north of existing 596/507-A inside of road right-of-way and outside of construction limits. Proposed #2 will be approximately 20' west and 40' north of existing 597/507-A inside of both road right-of-way and construction limits. Proposed #3 will be approximately 70' west and 40' north of existing 627/508-A inside of road right-of-way and outside of construction limits. Proposed #4 will be approximately 15' north of existing 627/508-A outside of road right-of-way.

(c) The 138kV transmission line will generally move approximately 125' north of the existing facilities. Proposed #1 will be approximately 20' east and 3' north of existing 1028/507-B inside of both road right-of-way and construction limits. Proposed #2 will be approximately 75' east and 125' north of existing 1028/507-B inside of road right-of-way and outside of construction limits.

Proposed #3 will be approximately 25' east and 125' north of existing 414/507-B inside of road right-of-way and outside of construction limits. Proposed #4 will be approximately 25' east and 30' north of existing 414/507-B inside of road right-of-way and outside of construction limits.

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on <Enter Date Received Plans>

Signature of Utility Representative **Print Name** **Date**

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]

No additional easements will need to be secured outside of the road right-of-way.

Section 4. A statement whether the utility is or is not willing to allow the INDOT Contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]

IPL will not allow INDOT's Contractor to do the work as part of the highway contract.

Section 5. From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	**The expected lead time in calendar days to obtain required permits:**	**120**
B.	**The expected lead time in calendar days to obtain materials:**	**180 (after order placed)**
C.	**The expected lead time in calendar days to schedule work crews:**	**90**
D.	**If the contractor is being selected by competitive bid what is the date of selection?**	**TBD**
E.	**The expected lead time in calendar days to obtain new property interests:**	**N/A**
F.	**The earliest date when the utility could begin to implement the pre-construction activities of the work plan:**	**20 days**

G.	**The total number of calendar days for pre-construction activities: (accounting for concurrent activities)**	**240**

Section 6. The Utility Construction Scheduling Information. [(IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]

1. Utility A, with a description of the required work.
   All telecommunications companies attached to IPL poles along St. Clair Street must remove their facilities before IPL can extract the obsolete poles.

2. Utility B, with a description of the required work.

3. Utility C, with a description of the required work.

B. A statement whether the facility relocation is or is not dependent on work to be done by the department's contractor with a description of that work. [IAC 13-3-3(c)(2)(A)(ii)]

1. Work item A.

2. Work item B.

3. Work item C.

C. How many calendar days after the events identified in Sec 6A and B are completed can the utility begin construction.
45

D. The number of calendar days to complete the relocation work: **60**

Section 7. A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.

See attached Exhibit A (3 sheets).

Section 8. For each work the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]

(a) 10th Street crossing $1,400,000
(b) St. Clair Street crossing $1,330,000

Section 9. For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]

Section 10. The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished).

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/HNTB:	☒	☐
A relocation permit from INDOT/HNTB:	☒	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

Dana Smith

Signature of Utility Representative

11/15/2019

Date

Dana Smith

Utility Representative Name Printed

INDOT/HNTB use only below this point----------INDOT/HNTB use only below this point

INDOT/HNTB use only below this point----------INDOT/HNTB use only below this point

The following sections to be used by INDOT personnel to review the utility relocation work plan.

Section 11. The Department shall review the work plan to ensure that it:

Description	Yes	N/A	Utility Coordinator Initials
(1.a) is compatible with department permit requirements	☐	☐	
(1.b) is compatible with the project plans	☐	☐	
(1.c) is compatible with the construction schedule	☐	☐	
(1.d) is compatible with other utility relocation work plans	☐	☐	
(2.a) has reasonable relocation scheme	☐	☐	
(2.b) has a reasonable cost for compensable work	☐	☐	

(Note: Double-click on box in Yes or NA to mark it with an "X")

Utility Coordinator Signature _____ Date _____

Utility Coordinator Name Printed _____

Section 12. Approved Work Plan. [IAC 13-3-3(f)]

I have reviewed the work plan and have been made aware of the schedule and budget.

Project Manager Signature (HNTB Project-ERC Signature) _____ Date _____

Project Manager Name Printed (HNTB Project-ERC Name Printed) _____

STRUCTURE	APPROXIMATE STATION	APPROXIMATE LINE R_W70 OFFSET
PROPOSED #1	131+00	58' LT
PROPOSED #2	129+50	312' RT

LEGEND

(A) Mainline Pavement (For Pavement Section, See Technical Provisions Section 9)
(1) Railing Concrete, FT
(2) Concrete Median Barrier, 45"
(4) Retaining Wall
(10) Guardrail, MGS W-Beam, 6 ft 3 in Spacing

DRAFT
NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: CAP DRAWN: JNII
CHECKED: CCR CHECKED: CCR

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN SHEET
LINE "R_W70"
I-70 WB to I-65/I-70 SB

HORIZONTAL SCALE	BRIDGE FILE
1"=50'	N/A
VERTICAL SCALE	DESIGNATION
N/A	1600808
SURVEY BOOK	SHEETS PLN-09
ELECTRONIC	69 of 649
CONTRACT	PROJECT
B-36910	1600808

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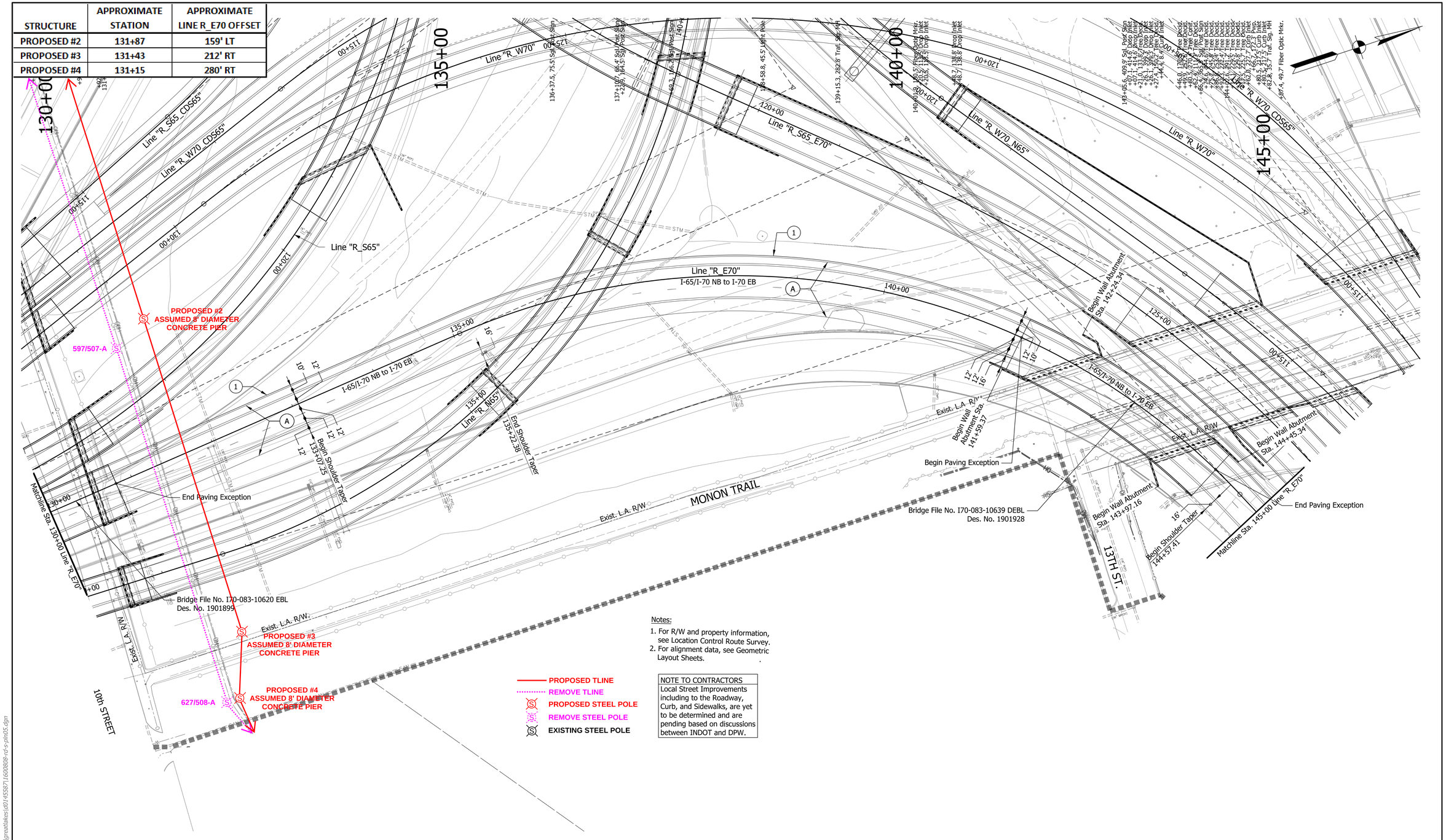
STRUCTURE	APPROXIMATE STATION	APPROXIMATE LINE R_E70 OFFSET
PROPOSED #2	131+87	159' LT
PROPOSED #3	131+43	212' RT
PROPOSED #4	131+15	280' RT



LEGEND

- (A) Mainline Pavement (For Pavement Section, See Technical Provisions Section 9)
- (1) Railing Concrete, FT
- (2) Concrete Median Barrier, 45"
- (4) Retaining Wall
- (10) Guardrail, MGS W-Beam, 6 ft 3 in Spacing

PROPOSED TLINE
REMOVE TLINE
PROPOSED STEEL POLE
REMOVE STEEL POLE
EXISTING STEEL POLE

Notes:

1. For R/W and property information, see Location Control Route Survey.
2. For alignment data, see Geometric Layout Sheets.

NOTE TO CONTRACTORS
Local Street Improvements including to the Roadway, Curb, and Sidewalks, are yet to be determined and are pending based on discussions between INDOT and DPW.

DRAFT
NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: CAP | DRAWN: JNII
CHECKED: CCR | CHECKED: CCR

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN SHEET
LINE "R_E70"
I-65/I-70 NB to I-70 EB

HORIZONTAL SCALE	BRIDGE FILE
1"=50'	N/A
VERTICAL SCALE	DESIGNATION
N/A	1600808
SURVEY BOOK	SHEETS PLN-12
ELECTRONIC	75 of 649
CONTRACT	PROJECT
B-36910	1600808

STRUCTURE	APPROXIMATE STATION	APPROXIMATE LINE R_S65 OFFSET
PROPOSED #1	137+90	181' RT
PROPOSED #2	136+43	175' RT
PROPOSED #3	135+23	255' LT
PROPOSED #4	136+02	282' LT

PROPOSED TLINE
REMOVE TLINE
PROPOSED STEEL POLE
REMOVE STEEL POLE
EXISTING STEEL POLE
PROPOSED WOOD POLE
REMOVE WOOD POLE
EXISTING WOOD POLE

NOTE TO CONTRACTORS
Local Street Improvements including to the Roadway, Curb, and Sidewalks, are yet to be determined and are pending based on discussions between INDOT and DPW.

PROPOSED #4 ASSUMED 8' DIAMETER CONCRETE PIER
PROPOSED #3 ASSUMED 8' DIAMETER CONCRETE PIER
PROPOSED #2 ASSUMED 8' DIAMETER CONCRETE PIER
PROPOSED #1 ASSUMED 8' DIAMETER CONCRETE PIER
650/507-B
414/507-B
649/507-B
1028/507-B

Notes:
1. For R/W and property information, see Location Control Route Survey.
2. For alignment data, see Geometric Layout Sheets.

LEGEND

(A) Mainline Pavement (For Pavement Section, See Technical Provisions Section 9)
(1) Railing Concrete, FT
(2) Concrete Median Barrier, 45"
(4) Retaining Wall
(10) Guardrail, MGS W-Beam, 6 ft 3 in Spacing

DRAFT
NOT FOR CONSTRUCTION

RECOMMENDED FOR APPROVAL _____ DESIGN ENGINEER DATE

DESIGNED: CAP DRAWN: JNII
CHECKED: CCR CHECKED: CCR

INDIANA
DEPARTMENT OF TRANSPORTATION

PLAN SHEET
LINE "R_S65"
I-65 SB to I-65/I-70 SB

HORIZONTAL SCALE	1"=50'
VERTICAL SCALE	N/A
BRIDGE FILE	N/A
DESIGNATION	1600808
SURVEY BOOK	
ELECTRONIC	91 of 649
CONTRACT	B-36910
SHEETS	PLN-20
PROJECT	1600808

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5330 East 65th Street | Indianapolis, IN 46220 | 800-391-3000

Date:10/15/2019

Subject:

Utility Relocation Work Plan for:	Comcast
Facility Type:	CATV/Communications

Section 1: General Information

A. INDOT/LPA Project Information

1.	DES NO.:	1600808
2.	Route Number:	I-65/I-70 (North Split) Interchange
3.	Location:	I-65 RP 111+0.16 to RP 112+0.94 I-70 RP 81+0.72 to RP 83+0.67
4.	Work Type:	Reconstruction
5.	Letting Date:	N/A
6.	Date Work Plan Needed	10/18/2019
7.	Target Date for Utility to be out of conflict with INDOT Project	
	Intermediate Phase	N/A
	Intermediate Phase	N/A

B. Utility Designated Contact – Information

1.	Designated Contact Name:	William Morris
2.	Office telephone:	317-516-2237
3.	Mobile telephone:	317-710-0602
4.	Email address:	William_morris@cable.comcast.com
5.	Agency name	Comcast
6.	Address:	5330 East 65th Street
7.	City, State, Zip Code:	Indianapolis, IN. 46220
8.	Construction Emergency Contact:	**For routine questions during regular business hours, please contact William Morris, section 1B; for emergency issues such as damaged facilities, contact 1-800-266-2278 (1-800-COMCAST)**
	Name:	William Morris
	Number:	800-266-2278

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative | Print Name | Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct

D. INDOT/LPA Utility Coordinator Contact Information

1.	Utility Coordinator Name:	Doug Garvin
2.	Office Telephone:	317-917-5263
3.	Mobile Telephone:	N/A
4.	Email Address:	dgarvin@hntb.com
5.	Agency Name:	HTNB Indiana, Inc.
6.	Address:	111 Monument Circle, Suite 1200
7.	City, State, Zip Code	Indianapolis, IN 46204

Section 2: A narrative description of existing facilities within the project limits and any facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.

Facilities consist of aerial fiber optic cables with associated electronics and support structures.
Facilities consist of underground fiber optic cables with associated electronics and support structures.

B. Describe the location of existing active and inactive facilities.

Facilities are attached to existing utility poles within the public Right of Way ,These poles are owned by others.
Facilities are Underground within the public Right of Way

Crossing are located at Washington Street and Davidson Street. (See RID 15.05 Data from Utilities)

C. Describe what will be done with existing active and inactive facilities.

NA

D. Describe the details of the proposed new facilities.

NA

E. Describe the proposed location of the new facilities.

NA

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on 10/15/2019

William Morris | William Morris | 10/15/2019
Signature of Utility Representative | Print Name | Date

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]

Section 4: A statement whether the utility is or is not willing to allow the INDOT contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]

Section 5: From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	The expected lead time in calendar days to obtain required permits:	Enter Total Days
B.	The expected lead time in calendar days to obtain materials:	Enter Total Days
C.	The expected lead time in calendar days to schedule work crews:	Enter Total Days
D.	If the contractor is being selected by competitive bid what is the date of selection?	Enter Bid Date
E.	The expected lead time in calendar days to obtain new property interests:	Enter Days
F.	The earliest date when the utility could begin to implement the pre-construction activities of the work plan:	Enter Date
G.	The total number of calendar days for pre-construction activities: (accounting for concurrent activities)	Enter Total Days

Section 6: The Utility Construction Scheduling Information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]

1. Utility A, with a description of the required work.

2. Utility B, with a description of the required work.

3. Utility C, with a description of the required work.

B. A statement whether the facility relocation is or is not dependent on work to be done by the department or the department's contractor with a description of that work. [IAC 13-3- 3(c)(2)(A)(ii)]

1. Work item A

2. Work item B

3. Work item C

C. How many calendar days after the events identified in Sec 6 A and B are completed can the utility begin construction: Enter Total Days

D. The number of calendar days to complete the relocation work: Enter Total Relocation Days

Section 7: A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.

Section 8: For each work plan the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]

Section 9: For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]

Section 10: The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished)

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/LPA:	☐	☐
A relocation permit from INDOT/LPA:	☐	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

Signature of Utility Representative _____ Date _____

Utility Representative Name Printed

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

The following sections are to be used by INDOT personnel to review the utility relocation work plan.

Section 11: The Department shall review the work plan to ensure that it: [IAC 13-3-3(e)]

Description	Yes	N/A	Utility Coordinator Initials
(1.a) is compatible with department permit requirements	☐	☐	
(1.b) is compatible with the project plans	☐	☐	
(1.c) is compatible with the construction schedule	☐	☐	
(1.d) is compatible with other utility relocation work plans	☐	☐	
(2.a) has reasonable relocation scheme	☐	☐	
(2.b) has a reasonable cost for compensable work	☐	☐	

(**Note**: Double-click on box under Yes or N/A to mark it with an "X")

Utility Coordinator Signature

Date

Utility Coordinator Name Printed

Section 12: Approved Work Plan. [IAC 13-3-3(f)]

I have reviewed the work plan and have been made aware of the schedule and budget.

Project Manager Signature (LPA Project – ERC Signature)

Date

Project Manager Name Printed (LPA Project – ERC Name Printed)

Date: February 20, 2020

Subject:

Utility Relocation Work Plan for:	Zayo
Facility Type:	Communications

Section 1: General Information

A. INDOT/LPA Project Information

1.	DES NO.:	1600808
2.	Route Number:	I-65/I-70 (North Split) Interchange
3.	Location:	I-65 RP 111+0.16 to RP 112+0.94 I-70 RP 81+0.72 to RP 83+0.67
4.	Work Type:	Reconstruction
5.	Letting Date:	N/A
6.	Date Work Plan Needed	10/18/2019
7.	Target Date for Utility to be out of conflict with INDOT Project	
	Intermediate Phase	N/A
	Intermediate Phase	N/A

B. Utility Designated Contact – Information

1.	Designated Contact Name:	Waylon Higgins
2.	Office telephone:	
3.	Mobile telephone:	765-341-1199
4.	Email address:	Waylon.Higgins@Zayo.com
5.	Agency name	Zayo Bandwidth
6.	Address:	9209 Castlegate Dr.
7.	City, State, Zip Code:	Indianapolis, IN, 46256
8.	Construction Emergency Contact:	
	Name:	
	Number:	

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

D. INDOT/LPA Utility Coordinator Contact Information

1.	Utility Coordinator Name:	Doug Garvin
2.	Office Telephone:	317-917-5263
3.	Mobile Telephone:	N/A
4.	Email Address:	dgarvin@hntb.com
5.	Agency Name:	HTNB Indiana, Inc.
6.	Address:	111 Monument Circle, Suite 1200
7.	City, State, Zip Code	Indianapolis, IN 46204

Section 2: A narrative description of existing facilities within the project limits and any facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.
Buried FO and plastic ducts and aerial FO

B. Describe the location of existing active and inactive facilities.
Aerial along the south side of Ohio St. west of the interstate;
Aerial along the east side of Pine St. between New York St. and Michigan St.;
Buried at the SE corner of Pine St. and New York St.
Buried along the east side of College Ave.
Buried along the east side of Lewis St.

Aerial line attached to IPL poles running North to South along Pine Street and turning East on 10th Street.

C. Describe what will be done with existing active and inactive facilities.
Remain active in place – no apparent conflict.

D. Describe the details of the proposed new facilities.
No new facilities proposed.

E. Describe the proposed location of the new facilities.
No new facilities proposed.

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on August, 19, 2019.

Signature of Utility Representative

Adam Lamb, PE — Print Name

February 20, 2020 — Date

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]

Section 4: A statement whether the utility is or is not willing to allow the INDOT contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]

Section 5: From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	The expected lead time in calendar days to obtain required permits:	Enter Total Days
B.	The expected lead time in calendar days to obtain materials:	Enter Total Days
C.	The expected lead time in calendar days to schedule work crews:	Enter Total Days
D.	If the contractor is being selected by competitive bid what is the date of selection?	Enter Bid Date
E.	The expected lead time in calendar days to obtain new property interests:	Enter Days
F.	The earliest date when the utility could begin to implement the pre-construction activities of the work plan:	Enter Date
G.	The total number of calendar days for pre-construction activities: (accounting for concurrent activities)	Enter Total Days

Section 6: The Utility Construction Scheduling Information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]

   1. Utility A, with a description of the required work.

B. A statement whether the facility relocation is or is not dependent on work to be done by the department or the department's contractor with a description of that work. [IAC 13-3- 3(c)(2)(A)(ii)]

   1. Work item A

C. How many calendar days after the events identified in Sec 6 A and B are completed can the utility begin construction: Enter Total Days

D. The number of calendar days to complete the relocation work: Enter Total Relocation Days

Section 7: A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.

Section 8: For each work plan the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]

Section 9: For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]

Section 10: The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished)

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/LPA:	☐	☐
A relocation permit from INDOT/LPA:	☐	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

Signature of Utility Representative _____ Date _____

Utility Representative Name Printed _____

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

The following sections are to be used by INDOT personnel to review the utility relocation work plan.

Section 11: The Department shall review the work plan to ensure that it: [IAC 13-3-3(e)]

Description	Yes	N/A	Utility Coordinator Initials
(1.a) is compatible with department permit requirements	☐	☐	
(1.b) is compatible with the project plans	☐	☐	
(1.c) is compatible with the construction schedule	☐	☐	
(1.d) is compatible with other utility relocation work plans	☐	☐	
(2.a) has reasonable relocation scheme	☐	☐	
(2.b) has a reasonable cost for compensable work	☐	☐	

(Note: Double-click on box under Yes or N/A to mark it with an "X")

Utility Coordinator Signature _____ Date _____

Utility Coordinator Name Printed _____

Section 12: Approved Work Plan. [IAC 13-3-3(f)]

I have reviewed the work plan and have been made aware of the schedule and budget.

Project Manager Signature (LPA Project – ERC Signature) _____ Date _____

Project Manager Name Printed (LPA Project – ERC Name Printed) _____

2150 Dr. Martin Luther King Jr. St. | Indianapolis, IN | 46202
CitizensEnergyGroup.com

Date: October 30, 2019
REVISED February 18, 2020

Subject:

Utility Relocation Work Plan for:	Citizens Energy Group
Facility Type:	Sanitary Sewers

Section 1: General Information

A. INDOT/LPA Project Information

1.	DES NO.:	1600808
2.	Route Number:	I-65/I-70 (North Split) Interchange
3.	Location:	I-65 RP 111+0.16 to RP 112+0.94 I-70 RP 81+0.72 to RP 83+0.67
4.	Work Type:	Reconstruction
5.	Letting Date:	N/A
6.	Date Work Plan Needed	10/18/2019
7.	Target Date for Utility to be out of conflict with INDOT Project	
	Intermediate Phase	N/A
	Intermediate Phase	N/A

B. Utility Designated Contact – Information

1.	Designated Contact Name:	David A. Clark, P.E.
2.	Office telephone:	317.429.3993
3.	Mobile telephone:	
4.	Email address:	dclark@citizensEnergyGroup.com
5.	Agency name	Citizens Energy Group – Sanitary (Citizens)
6.	Address:	2150 Dr. Martin Luther King Jr. Street
7.	City, State, Zip Code:	Indianapolis, IN 46202
8.	Construction Emergency Contact:	
	Name:	Citizens Energy Group Dispatch
	Number:	317.927.6000

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

D. INDOT/LPA Utility Coordinator Contact Information

1.	Utility Coordinator Name:	Doug Garvin
2.	Office Telephone:	317-917-5263
3.	Mobile Telephone:	N/A
4.	Email Address:	dgarvin@hntb.com
5.	Agency Name:	HTNB Indiana, Inc.
6.	Address:	111 Monument Circle, Suite 1200
7.	City, State, Zip Code	Indianapolis, IN 46204

Section 2: A narrative description of existing facilities within the project limits and any facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.
Active and abandoned Citizens Energy Group owned sanitary sewers are present within the project area. In addition, privately-owned sanitary sewer lateral connections are located within the project area.

B. Describe the location of existing active and inactive facilities.
The location of privately-owned sanitary sewer lateral connections within the project area shall be identified by the Contractor.
According to Citizens Energy Group's GIS data, active and abandoned sanitary sewers are located within the project area as described below, and as shown on the attached sanitary sewer utility GIS maps. The sanitary sewer utility GIS maps are attached in Exhibit A.
Washington Street to Market Street:

- Manhole (MH) 221433 is located at the West end of the Daly Street terminus, approximately 425' West of Shelby Street.
- A 30" Polyvinyl Chloride Pipe (PVC) extends 330' East from MH 221433 to MH 221432, which is located within the Daly Street and Shelby Street intersection, beyond the Southeastern project boundary.
- A 30" PVC extends 43' Southwest from MH 221433 to MH 223460, then extends 7' South to Node 220543.
- A 22" Brick Pipe (BRK) extends 336' South from Node 220543 to MH 223459, which is located beyond the Southeastern project boundary.
- MH 221900 is located along the South side of Eastbound Washington Street at the Southbound I-65/I-70 entrance ramp.
- A 21" Reinforced Concrete Pipe (RCP) extends 279' South from MH 221900 to MH 221930, which is located beyond the Southwestern project boundary.
- A 48" RCP extends 464' West from MH 221900 along the South side of the Eastbound Washington Street travel lanes. This line continues West beyond the project limits
- A 48" RCP extends 71' East from MH 221900 along the South side of the Eastbound Washington Street travel lanes to MH 221901.
- MH 221901 is located within the island between Eastbound Washington Street to I-65/I-70 Southbound Ramp and the Southbound Davidson Street to I-65/I-70 ramp.
- A 48" RCP extends 73' Northeast from MH 221901 to MH 221902.
- MH 221902 is located along the South side of the Westbound Washington Street travel lanes at the

Southbound Davidson Street intersection.

- A 36" BRK extends 122' East from MH221902 to MH221908, which is located along the south side of the Westbound Washington Street travel lanes at the Western project boundary.
- A 48" RCP extends 387' North from MH 221902 along the East side of Davidson Street to MH 221946, which is located approximately 42' South of Market Street.
- A 10" Cast Iron Pipe (CIP) extends 21' Northeast from MH 221902 to MH 221912.
- MH 221912 is located approximately 25' East of Davidson Street near the center of the Westbound Washington Street travel lanes.
- A 66" BRK extends 58' East along the Northern Westbound Washington Street travel lane from MH 221912 to MH 221939.
- A 66" BRK extends 180' East along the Northern Westbound Washington Street travel lane from MH 221939 to MH 221940.
- A 66" BRK extends 201' East along the Westbound Washington Street travel lanes from MH 221940 to MH 228393, which is located beyond the Eastern project boundary.
- A 72" RCP extends 278' West from MH 221912 to MH 221911, which is located near the center of the Westbound Washington Street travel lanes, beyond the Western project boundary.
- A 6" CIP extends 15' North-Northeast from MH 221902 to MH 221904. This line is abandoned.
- A 30" BRK extends 92' East from MH 221904 along the Westbound Washington Street travel lanes to MH 221905. This line and the manholes are abandoned.
- A 30" BRK extends 231' East from MH 221905 along the Westbound Washington Street travel lanes to MH 221906. This line and the manholes are abandoned.
- A 36" BRK extends 341' East from MH 221902 along the South side of the Westbound Washington Street travel lanes to MH 221040.
- Manhole 221040 is located within the center of the Westbound Washington Street and Pine Street intersection.
- A 36" BRK extends 229' North from MH 221040 along the center of the Pine Street to MH 223607, and a 36" BRK extends 515' North from MH 223607 to MH223608.
- Manhole 223608 is located within the center of Pine Street approximately 300' North of the Market Street intersection.

Market Street to Ohio Street:

- As noted above, MH 221946 is located along the East side of Davidson Street approximately 42' South of Market Street.
- A 48" Poured-In-Place Concrete Pipe (CON) extends 146' Northeast from MH 221946 to MH 221429.
- Manhole 221429 is located within the Westbound Market Street travel lane approximately 125' East of the Davidson Street intersection.
- A 48" RCP extends 186' East from MH 221429 to MH 223589.
- Manhole 223589 is located within the Northwest quadrant of the Market Street and Pine Street intersection.
- A 48" RCP bends to the north from MH 223589 extending 503' North along the Northbound Pine Street travel lanes to MH 223995.
- MH 223995 is located near the center of Pine Street at the Southern edge of the Ohio Street intersection.
- An 18" PVC extends 23' West-Southwest from MH 223995 to MH 223590.
- MH 223590 is located along the West side of Pine Street at the Southern edge of the Ohio Street intersection.
- An 18" PVC extends 58' North-Northeast from MH 223590 to MH 221038.
- Manhole 221038 is located approximately 30' Northwest of the Pine Street and Ohio Street

intersection.

- An 18" PVC extends 15' Northeast from MH 223590 to MH 225761, which is a divergence structure.
- Divergence structure MH 225761 is located approximately 30' North of the Pine Street and Ohio Street intersection.
- A 78" RCP overflow line extends 11' South from divergence structure MH 225761 to CSO 152.
- CSO 152 is located approximately 20' North of the Pine Street and Ohio Street intersection.
- An 18" RCP extends 19' Northwest from MH 221946 to MH 227985.
- MH 227985 is located near the center of Davidson Street approximately 32' South of Market Street.
- An 18" CON extends 53' North-Northwest from MH 227985 to MH 221945.
- MH 221945 is located within the Northwest quadrant of the Market Street / Davidson Street intersection (near the center).
- An 18" CON extends 27' North-Northwest from MH221945 to MH 221949.
- MH 221949 is located within the Northwest quadrant of the Market Street / Davidson Street intersection (within the sidewalk).
- An 18" CON extends 212' West along the North side of Market Street from MH221949 to MH 221942, which is located beyond the Western project boundary.
- A 15" Vitreous Clay Pipe (VCP) extends 276' North along the West side of Davidson Street from MH221949 to MH 221941, which is located at the Northern terminus of Davidson Street.
- MH 221947 is located within the near Southwest quadrant of the Market Street / Davidson Street intersection.
- A 65" CON overflow pipe extends 265' West along the Eastbound Market Street travel lane from MH 221947 to Combined Sewer Overflow (CSO) 133, which is located beyond the Western project boundary.
- A 65" RCP extends 276' East along the Eastbound Market Street travel lane from MH 221947 to MH 221948, which is located approximately 75' East of Davidson Street.
- A 65" RCP extends 262' East along the Eastbound Market Street travel lane from MH 221948 to MH 221950, which is a diversion structure.
- MH 221950 (diversion structure) is located within the Southeast quadrant of the Market Street and Pine Street intersection, near the center.
- An 18" VCP extends 6' West-Northwest from divergence structure MH 221950 to connect with the 36" BRK sanitary main located near the center of the Market Street and Pine Street intersection.
- A 36" Cast-In-Place Pipe Over Brick (INB) extends 37' East-Northeast from divergence structure MH 221950 to MH 221005.
- MH 221005 is located along the Westbound Market Street travel lanes at the East edge of the Pine Street intersection.
- A 30" INB extends 261' East from MH 221005 to MH 220483, which is located beyond the Eastern project boundary.
- A 52" RCP extends 439' East along the Eastbound Market Street travel lane from divergence structure MH 221950 to MH 220466, which is located at the Cruse Street intersection beyond the Eastern project boundary.
- As noted above, Manhole 223608 is located within the center of Pine Street approximately 300' North of the Market Street intersection. A 36" BRK extends East from MH 223608 to MH 223609, which is located near the Western edge of Herman Street beyond the Eastern project boundary.

Ohio Street to New York Street

- MH 221724 is located along the North side of the Westbound Ohio Street exit ramp, approximately 175' East of College Avenue.
- An 18" VCP extends 185' North from MH 221724 to MH 221725, which is located beyond the

Northern project boundary.

- An 18" VCP extends 204' West from MH 221724 to Blind Tie 227982, which is located near the center of College Avenue, beyond the Western project boundary.
- As noted above, divergence structure MH 225761 is located approximately 30' North of the Pine Street and Ohio Street intersection.
- A 77" RCP extends 105' North from MH 225761 to MH 221037.
- MH 221037 is located along the East side of the Ohio Street and Pine Street transition, approximately 330' South of the Pine Street and New York Street intersection.
- MH 221037 is located along the East side of the Ohio Street and Pine Street transition, approximately 135' North of the Pine Street and Ohio Street intersection
- A 77" BRK extends 121' North from MH 221037 to MH 223087.
- MH 223087 is located approximately along Pine St approximately 215' South of New York Street.
- A 66" RCP extends 338' North from MH223087 to MH 220351.
- MH 220351 is located along Pine Street approximately 70' North of New York Street.
- A 36" CON extends 363' West-Southwest from MH 223087 to MH 221739.
- MH 221739 is located along Davidson Street approximately 300' South of New York Street, and 55' West of the I-65/I-70 Ohio Street Exit Ramp.
- A 36" CON extends 193' West from MH 221739 to MH 221740, which is located beyond the Western project boundary.
- A 24" INB extends 75' North along Davidson Street from MH 221739 to MH 221759.
- MH 221759 is located along Davidson Street approximately 225' South of New York Street.
- A 24" BRK extends 259' North along Davidson Street from MH 221759 to MH 221760.
- MH 221760 is located near the center of the New York Street and Davidson Street intersection.

New York Street to Vermont Street:

- As noted above, MH 220351 is located along Pine Street approximately 70' North of New York Street.
- A 66" RCP extends 148' North along Pine Street from MH 220351 to Blind Tie 220312.
- A 10" VCP extends 188' East to MH 223690, which is located beyond the Eastern project boundary.
- A 66" RCP extends 9' North along Pine Street from Blind Tie 220312 to MH 220351.
- A 66" RCP extends 209' North along Pine Street from MH 220352 to Blind Tie 228938.
- Blind Tie 228938 is located along the West side of Pine Street approximately 30' South of Vermont Street.
- A 66" Unknown material pipe (UNK) extends 55' Northeast from Blind Tie 228938 to MH 221041.
- MH 221041 is located within the Southeast quadrant of the Vermont Street and Pine Street intersection.
- A 66" RCP extends 31' Northwest from Blind Tie 228938 to MH 221004.
- MH 221041 is located Southwest of the Vermont Street and Pine Street intersection, approximately 10' South of Vermont Street and 16' West of Pine Street.
- A 66" CON extends 242' West from MH 221004 to MH 221765.
- MH 221765 is located along the South side of Vermont Street approximately 45' East of Davidson Street.
- An 18" VCP extends 265' North along Davidson Street from MH 221760 to MH 221761.
- MH 221761 is located near the center of Davidson Street approximately 240' North of New York Street.
- An 18" Cast in Place Pipe over Vitreous Clay Pipe (INV) extends 230' North along Davidson Street from MH 221761 to MH 221762.
- MH 221762 is located near in the Southeast quadrant of the Vermont Street and Davidson Street intersection.

Vermont Street to Michigan Street:

- As noted above, MH 221762 is located within the Southeast quadrant of the Vermont Street and Davidson Street intersection.
- A 12" INV extends 286' North along Davidson Street from MH 221762 to MH 221763.
- MH 221763 is located along Davidson Street approximately 210' South of Michigan Street.
- A 12" INV extends 173' North along Davidson Street from MH 221763 to MH 221764.
- MH 221764 is located along Davidson Street approximately 30' South of Michigan Street.
- As noted above, MH 221765 is located along the South side of Vermont Street approximately 45' East of Davidson Street.
- A 66" RCP extends approximately 15' West from MH 221765 before bending to the North and extending 523' along the East side of Davidson Street to MH 221766.
- MH 221766 is located approximately 10' Southeast of the Michigan Street and Davidson Street intersection.
- A 24" RCP extends 25' Northwest from MH 221766 to MH 221770.
- MH 221770 is located near the center in the Southern half of the Michigan Street and Davidson Street intersection.
- As noted above, MH 221041 is located within the Southeast quadrant of the Vermont Street and Pine Street intersection.
- A 66" VCP extends 283' North from MH 221041 along the Eastern Pine Street travel lane to MH 223689.
- MH 223689 is located approximately 245' North of the Vermont Street and Pine Street intersection.
- A 66" VCP extends 235' North from MH 223689 along the Eastern Pine Street travel lane to MH 223688.
- MH 223688 is located within the Southeast quadrant of the Michigan Street and Pine Street intersection.

Michigan Street to College Avenue:

- As noted above, MH 221770 is located near the center in the Southern half of the Michigan Street and Davidson Street intersection.
- A 24" BRK extends 259' North along the center of Davidson Street from MH 221760 to MH 221771.
- MH 221771 is located within the center of Davidson Street approximately 245' South of North Street.
- A 24" BRK extends 298' North along the center of Davidson Street from MH 221771 to MH 221772.
- MH 221772 is located within the Northwest corner of the North Street and Davidson Street intersection.
- An 18" VCP extends 146' North along the center of Davidson Street from MH 221772 to MH 221773.
- An 18" VCP extends 194' North along the center of Davidson Street from MH 221773 to MH 221774.
- A 15" INV extends 333' North along the center of Davidson Street from MH 221774 to MH 221775.
- A 15" INV extends 172' North along the center of Davidson Street from MH 221775 to terminal MH 221776.
- Terminal MH 221776 is located within the center of Davidson Street approximately 30' South of the Saint Clair Street intersection.
- As noted above, MH 221766 is located approximately 10' Southeast of the Michigan Street and Davidson Street intersection.
- As noted above, a 66" RCP extends approximately 15' West from MH 221765 before bending to the North and extending 523' along the East side of Davidson Street to MH 221766.
- A 66" RCP extends 439' North along the East side of Davidson Street to MH 221767.
- MH 221767 is located along the East side of Davidson Street approximately 90' South of North Street.
- A 66" RCP extends 477' North along the East side of Davidson Street to MH 221768.

- MH 221768 is located along the East side of Davidson Street approximately 530' South of Saint Clair Street.
- A 66" RCP extends 557' North along the East side of Davidson Street to MH 221769.
- MH 221769 is located at the Eastern edge of the Saint Clair Street and Davidson Street intersection.
- A 66" RCP extends 273' North from MH 221769 along the East side of Davidson Street to MH 221085.
- A 66" RCP extends 275' North from MH 221085 along Davidson Street to MH 221084.
- A 66" RCP extends 249' Northwest from MH 221084 along Davidson Street to MH 221083.
- MH 221083 is located at the Davidson Street and Massachusetts Avenue intersection, beyond the Western project boundary.
- Terminal MH 221664 is located within the center of Saint Clair Street approximately 30' West of the Davidson Street intersection.
- A 12" VCP extends 372' West along the center of Saint Clair Street from MH 221664 to MH 221663, which is located beyond the Western project boundary.
- As noted above, MH 223688 is located within the Southeast quadrant of the Michigan Street and Pine Street intersection.
- A 12" INV extends East from MH 223688 between the Southern Michigan Street travel lanes to MH 223415, which is located beyond the Eastern project boundary.
- MH 230209 is located along the Westbound 10th Street travel lanes, East of the project boundary and approximately 135' West of the 10th Street and Dorman Street intersection.
- A 48" BRK extends 129' West-Southwest from MH 230209 to MH 238958, which is located along the south side of the Westbound 10th Street travel lanes approximately 265' West of Dorman Street.
- A 48" BRK extends 266' West-Southwest from MH 238958 to MH 230290, which is located along the Eastbound 10th Street travel lane approximately 280' East of Bellefontaine Street.
- A 48" BRK extends 300' West along the Eastbound 10th Street travel lane from MH 230290 to MH 230291.
- MH 230291 is located along the south side of the Eastbound 10th Street travel lane in the center of the Bellefontaine Street intersection.
- A 42" RCP extends 578' Northwest along the outside of the Western interstate highway right-of-way to MH 230289, which is located approximately 195' East of College Avenue.
- A 42" RCP extends 204' West-Northwest along the outside of the Western interstate highway right-of-way from MH 230289 to MH 230288.
- MH 230288 is located along the East side of College Avenue, approximately 170' North of 11th Street.
- A 42" RCP extends 475' North along the East side of College Avenue from MH 230288 to MH 230287.
- MH 230287 is located along the East side of College Avenue approximately 645' North of 11th Street.
- A 42" RCP extends 451' North along the East side of College Avenue MH 230271.
- MH 230271 is located along the East side of College Avenue, approximately 165' North of 13th Street beyond the Northern project boundary.
- MH 220157 is located within the Southbound College Avenue left turn lane, approximately 35' North of 11th Street, beyond the Southern project boundary.
- A 30" INB extends 454' North along the Southbound College Avenue travel lane from MH 220157 to MH 220158.
- MH 220158 is located within the center of Southbound College Avenue, approximately 490' North of 11th Street.
- A 30" INB extends 471' North along the center of College Avenue from MH 220158 to MH 220159.
- MH 220159 is located within the center of Southbound College Avenue, approximately 25' North of 13th Street.
- A 30" INB extends 421' North along the center of College Avenue travel lane from MH 220159 to MH

224502, which is located beyond the Northern project boundary.

Pennsylvania Street to College Avenue:

- MH 220414 is located within the center of Eastbound 11th Street, approximately 35‘ West of Pennsylvania Street.
- A 36” BRK extends 185’ West from MH 220414 along Eastbound 11th Street to MH 220413, which is located beyond the Western project boundary.
- A 36” BRK extends approximately 35’ East from MH 220414 before bending North and then extending along the center of Pennsylvania Street to MH 220415.
- MH 220415 is located along the center of Pennsylvania Street approximately 115’ North of 11th Street.
- A 36” BRK extends 187’ North from MH 220415 along the center of Pennsylvania Street to MH 220416.
- MH 220416 is located along the center of Pennsylvania Street at the Southern edge of the 13th Street intersection.
- A 36” INB extends 196’ North from MH 220416 along the center of Pennsylvania Street to MH 221066, which is located beyond the Norther project boundary.
- MH 224556 is located along the center of Delaware Street approximately 120’ South of the 11th Street entrance ramp, which is beyond the Southern project boundary.
- A 24” VCP extends 447’ North from MH 224556 along the center of Delaware Street to MH 224557.
- MH 224557 is located along the center of Delaware Street near the Northern edge of the 12th Street intersection, which is beyond the Northern project boundary.
- MH 220560 is located along the center of Alabama Street at the Northern edge of the 11th Street intersection, approximately 150’ South of the 11th Street entrance ramp. MH 220560 is located beyond the Southern project boundary.
- A 34” BRK extends 159’ North from MH 220560 along the center of Alabama Street to MH 220070.
- MH 220070 is located along the center of Delaware Street approximately 159’ North of 11th Street.
- A 32” BRK extends 363’ North from MH 220070 along the center of Alabama Street to MH 220071.
- MH 220071 is located along the center of Delaware Street approximately 75’ North of 12th Street, which is beyond the Northern project boundary.
- MH 224601 is located along the center of New Jersey Street approximately 75’ North of 11th Street, which is beyond the Southern project boundary.
- A 15” VCP extends 274’ North along the center of New Jersey Street from MH 224601 to MH 221081.
- MH 221081 is located along the center of New Jersey Street, near the center of the 12th Street intersection, which is beyond the Southern project boundary.
- MH 223672 is located along the West side of Central Avenue, near the center of the 11th Street intersection, which is beyond the Southern project boundary.
- A 15” VCP extends 126’ North along the West side of Central Avenue from MH 223672 to capped stub out 227439.
- Capped stub out 227439 is located along the West side of Central Avenue, approximately 115’ North of the 11th Street intersection.
- MH 225034 is located along the West side of Central Avenue, approximately 20’ South of the 12th Street intersection.
- An 18” VCP extends 261’ North along the West side of Central Avenue from MH 225034 to MH 225033, which is located beyond the Northern project boundary.
- MH 220162 is located along the center of Park Avenue, approximately 115’ North of the 11th Street intersection, which is just beyond the Southern project boundary.
- A 26” Cast in Place Pipe over Concrete Pipe (INC) extends North 369’ from MH 220162 to MH 223674,

which is located beyond the Northern project boundary.

- MH 220139 is located along the center of Broadway Street, approximately 115' North of 11th Street, which is just beyond the Southern project boundary.
- A 30" RCP extends 502' North along the center of Broadway Street to MH 220140.
- MH 220140 is located along the center of Broadway Street, approximately 285' South of 13th Street, which is just beyond the Northern project boundary.

13th Street and Lewis Street to 18th Street:

- MH 232705 is located along the center of 13th Street, approximately 180' East of Lewis Street, which is just beyond the Eastern project boundary.
- A 15" INV extends 105' West along the center of 13th Street from MH 232705 to MH 230172, and a 15" INV extends 90' West from MH 230172 to MH 230210.
- MH 230210 is located near the center of the 13th Street and Lewis Street intersection.
- A 12" VCP extends 325' North along the center of Lewis Street from MH 230210 to MH 230211.
- MH 230211 is located along Southbound Lewis Street, approximately 310' North of 13th Street.
- A 12" VCP extends 326' North along Southbound Lewis Street from MH 230211 to MH 230212.
- MH 230212 is located along Southbound Lewis Street, approximately 165' South of 15th Street, which is just beyond the Northern project boundary.
- MH 112675 is located at the Northern Columbia Avenue terminus, which is just beyond the Southern project boundary.
- A 15" INV extends 462' North along the Columbia Avenue alignment from MH 112675 to MH 112674, which is just beyond the Northern project boundary.
- MH 112680 is located at the Northern Dr. A. J. Brown Avenue terminus, which is just beyond the Southern project boundary.
- A 20" UNK extends 471' North along the Dr. A. J. Brown Avenue alignment to MH 112678, which is just beyond the Northern project boundary.
- MH 110139 is located at the Northern Arsenal Avenue terminus, which is just beyond the Southern project boundary.
- An 18" VCP extends 94' North-Northeast from MH 110139 to MH 112684.
- An 18" VCP extends 365' North-Northwest from MH 112684 to MH 112683, which is located approximately 105' Southwest of the Southern Arsenal Avenue terminus, beyond the Northern project boundary.
- MH 112692 is located at the Northern Sheldon Street terminus, which is just beyond the Southern project boundary.
- A 24" RCP extends 423' North along the Sheldon Street alignment from MH 112692 to MH 112691, which is located beyond the Northern project boundary.
- MH 112156 is located within the Commerce Avenue/Roosevelt Avenue and Ludlow Avenue intersection, which is just beyond the Southern project boundary.
- A 20" BRK extends 218' North along the center of Roosevelt Avenue from MH 112156 to MH 112155.
- MH 112155 is located along the center of Roosevelt Avenue, approximately 200' North of Ludlow Avenue.
- A 24" BRK extends 456' North along Roosevelt Avenue from MH 112155 to MH 112154, which is located beyond the Northern project boundary.

C. Describe what will be done with existing active and inactive facilities.

Connecting new storm drainage to the combined sewer system (combined sanitary and storm system) and/or modifying existing storm drainage requires approved evidence and documentation showing there will be no increase in runoff volume or peak flow entering the combined sewer system. Any

increase in peak flow or volume causes an increased risk of combined sewer overflow frequency and discharge. The Utility shall review all proposed new connections and modifications of existing drainage connecting to the combined sewer system. This review, along with submitted evidence and documentation, will be used to determine if such connections are permissible.

Where existing pavement is required to be removed within 10 (ten) feet vertical of exsiting sanitary sewers, the pavement shall be saw-cut and manually removed a minimum of 20 linear feet (centered above the Citizens Energy Group sanitary sewers) inclusive of the full width of the existing pavement at the sewer crossings. Vehicle mounted impact devices shall not be used to break up the pavement above the sanitary sewers.

If the project excavation work will occur within two (2) vertical feet of an existing Citizens Energy Group sanitary sewer line, timber mats, steel plates or another method subject to Citizens Energy Group approval shall be employed to protect the line.

If the project excavation work will occur within five (5) horizontal feet of an existing Citizens Energy Group sanitary sewer line, shoring, retention walls, steel plates or another method subject to Citizens Energy Group approval shall be employed to protect the sewer.

If piles will be driven within 10 horizontal feet of an existing sanitary sewer, an auger shall be employed to remove the soil to a minimum depth of 5 feet below the sanitary sewer. The full depth of the auger hole shall be encased/shored as necessary to prevent pipe bedding and soil loss around the sewer during pile driving activities.

Citizens Energy Group will clean and inspect approximately 18,000 LF of existing sanitary sewers within the project area via Closed Circuit Television (CCTV) prior to INDOT starting construction. The costs for the sewer cleaning and CCTV investigation are included within Exhibit B.

After completion of the of the cleaning and CCTV investigation by Citizens Energy Group will determine the requirement to structurally line approximately 18,000 LF of existing sanitary sewers within the project area. The Utility will determine if any adjustments (increase/decrease) to the footage of structural lining are required. In addition, the following segments require a 20 percent increase in thickness to account for additional protection due to nearby future structures:

College Avenue	10th Street
MH230271-MH230287	MH230209-MH238958
MH230287-MH230288	MH238958-MH230290
	MH230290-MH230291

On a case by case basis, the INDOT contractor may perform the required structural lining work per previous arrangements between INDOT and Citizens Energy Group related to this type of work. The structural lining will occur in areas where pipe deterioration exists (in accordance with the LDSR Technical Specifications, additional fill material such as embankment, riprap, barrier or retaining walls, etc., will be constructed, and in areas where the driving of bridge piles could potentially damage the sewers. Large Diameter Sewer Rehabilitation (LDSR) shall be in accordance with Citizens' LDSR Technical Specifications, as attached Exhibit C.

Citizens Energy Group shall reset the sanitary sewer manhole castings, and grade to fit around the manholes as required. On a case by case basis, the INDOT contractor may perform the required manhole casting adjustment work per previous arrangements between INDOT and Citizens Energy Group related to this type of work.

The location of privately-owned sanitary sewer laterals within the project area shall be identified. The

privately-owned sanitary sewer lateral connections to the Citizens-owned sanitary sewer system shall be maintained throughout construction.

For construction activity by the Contractor within Local Streets, the Contractor shall be responsible for obtaining Local Right-of-Way Permit through the City of Indianapolis, Department of Building and Neighborhood Services (DBNS).

For construction activity by the Contractor within the Ex. L.A. R/W, the Contractor shall be responsible for obtaining INDOT Right-of-Way Permits through the Indiana Department of Transportation.

D. Describe the details of the proposed new facilities.
The following Citizens Energy Group owned sanitary sewers will be relocated:

N/A

E. Describe the proposed location of the new facilities.

N/A

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on **August 27, 2019.**

Signature of Utility Representative | Print Name | Date

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]

The sanitary sewer facility work is not dependant upon the acquisition of additional property interests.

Section 4: A statement whether the utility is or is not willing to allow the INDOT contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]

On a case by case basis, Citizens will allow the INDOT contractor to do the required structural lining work with Citizens' Sanitary Capital Programs Contractors Granite Construction Company or SAK Construction, LLC in accordance with Citizens' Sanitary Standards Manual and inspection. On a case by case basis, the INDOT contractor may perform the required sewer manhole casting adjustment work per previous arrangements between INDOT and Citizens Energy Group related to this type of work. The web link to the Standards is: https://www.citizensenergygroup.com/Documents/Standards/SanitaryStandardsManual.

Section 5: From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	The expected lead time in calendar days to obtain required permits:	**5-7 days for Local R/W Permit to be obtained by the Contractor through the DBNS**
B.	The expected lead time in calendar days to obtain materials:	**30 Days – Structural Lining**
C.	The expected lead time in calendar days to schedule work crews:	**14 Days - Cleaning and CCTV work** **14 Days – Structural Lining Work**

		Citizens Energy Group requires five (5) business days minimum notice from the Contractor prior to the manhole casting adjustments. **The Contractor shall coordinate with Citizens Energy Group by contacting Courtney Hardy at (317) 927-1031 or (CHardy@citizensenergygroup.com).**
D.	If the contractor is being selected by competitive bid what is the date of selection?	**N/A**
E.	The expected lead time in calendar days to obtain new property interests:	**N/A**
F.	The earliest date when the utility could begin to implement the pre-construction activities of the work plan:	**Cleaning and CCTV – April 2020** **Structural Lining – October 2020**
G.	The total number of calendar days for pre-construction activities: (accounting for concurrent activities)	**14 Days – Cleaning and CCTV** **30 Days – Structural Lining**

Section 6: The Utility Construction Scheduling Information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]
   1. Utility A, with a description of the required work.
      The sanitary sewer facility cleaning, CCTV investigation, and structural lining work is not dependant upon work on or by any other utility.
   2. Utility B, with a description of the required work.
      N/A
   3. Utility C, with a description of the required work.
      N/A

B. A statement whether the facility relocation is or is not dependent on work to be done by the department or the department's contractor with a description of that work. [IAC 13-3- 3(c)(2)(A)(ii)]
   1. Work item A
      The structural lining and manhole casting adjustment work is dependent on work to be done by the department's contractor. The web link to the Standards is:
      https://www.citizensenergygroup.com/Documents/Standards/SanitaryStandardsManual
   2. Work item B
      For construction activity by the Contractor within Local Streets, the Contractor shall be responsible for obtaining Local Right-of-Way Permit through the City of Indianapolis, Department of Building and Neighborhood Services (DBNS).

      For construction activity by the Contractor within the Ex. L.A. R/W, the Contractor shall be responsible for obtaining INDOT Right-of-Way Permits through the Indiana Department of Transportation.

C. How many calendar days after the events identified in Sec 6 A and B are completed can the utility begin construction:
   N/A

D. The number of calendar days to complete the relocation work:
One (1) business day will be required to core around the manhole frame and cover (casting), and one (1) business day will be required to pour concrete around the casting. The adjusted castings will be protected from disturbance by plating or other method subject to Citizens Energy Group approval for one additional day.

90 Days will be required for sewer cleaning and CCTV investigation.

120 Days will be required for structural lining.

Section 7: A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.

N/A

Section 8: For each work plan the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]

The cost estimate for sewer cleaning, CCTV investigation, and structural lining work is attached as Exhibit B.

Section 9: For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]

N/A

Section 10: The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished)

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/LPA:	X	☐
A relocation permit from INDOT/LPA:	X	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

Signature of Utility Representative

2/18/20
Date

David A. Clark, P.E.
Utility Representative Name Printed

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CitizensEnergyGroup.com

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

The following sections are to be used by INDOT personnel to review the utility relocation work plan.

Section 11: The Department shall review the work plan to ensure that it: [IAC 13-3-3(e)]

Description	Yes	N/A	Utility Coordinator Initials
(1.a) is compatible with department permit requirements	☐	☐	
(1.b) is compatible with the project plans	☐	☐	
(1.c) is compatible with the construction schedule	☐	☐	
(1.d) is compatible with other utility relocation work plans	☐	☐	
(2.a) has reasonable relocation scheme	☐	☐	
(2.b) has a reasonable cost for compensable work	☐	☐	

(**Note**: Double-click on box under Yes or N/A to mark it with an "X")

Utility Coordinator Signature _____ Date _____

Utility Coordinator Name Printed _____

Section 12: Approved Work Plan. [IAC 13-3-3(f)]

I have reviewed the work plan and have been made aware of the schedule and budget.

Project Manager Signature (LPA Project – ERC Signature) _____ Date _____

Project Manager Name Printed (LPA Project – ERC Name Printed) _____

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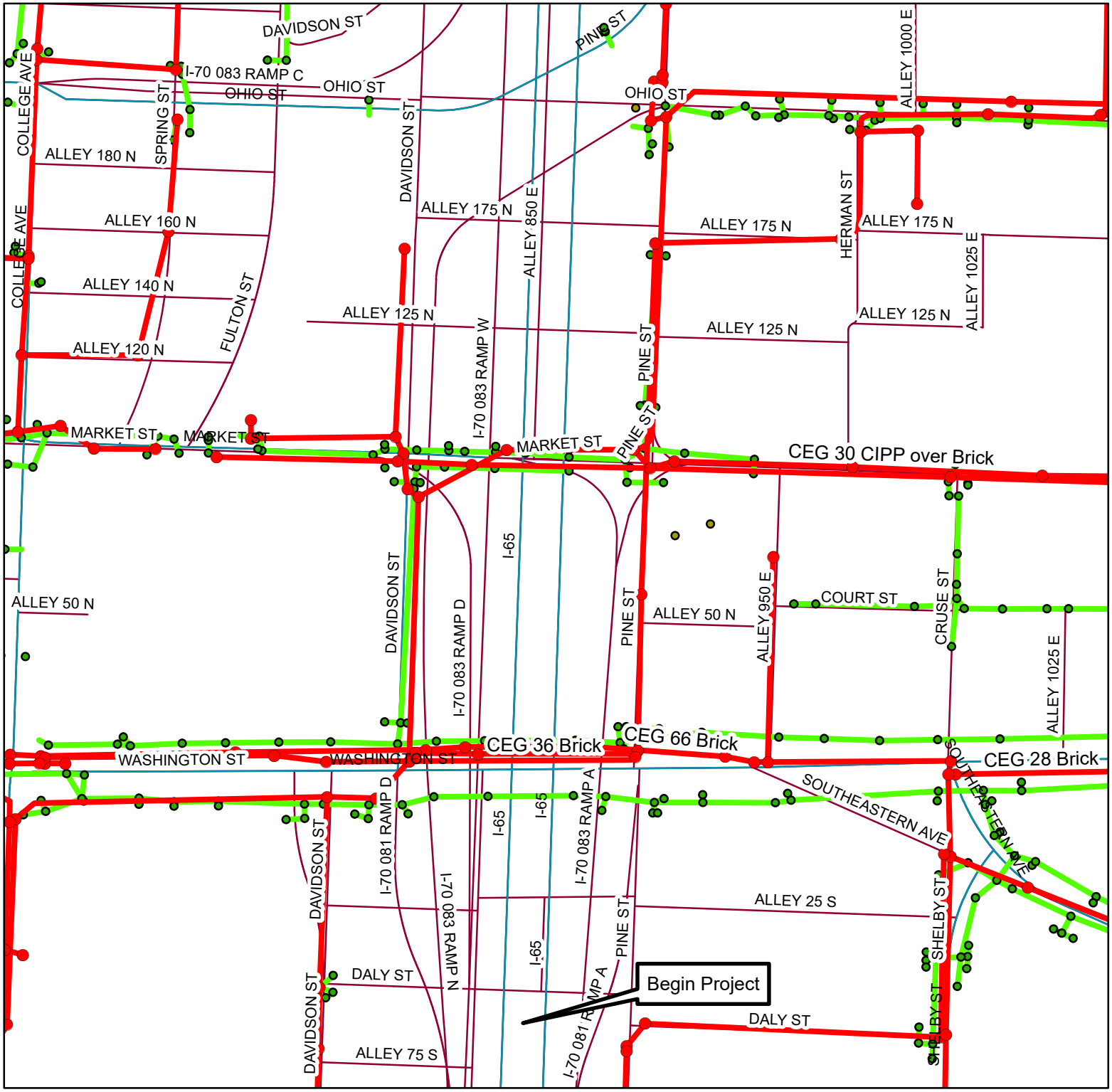
EXHIBIT A

Citizens Energy Group
Sanitary Sewer Work Plan
GIS Maps



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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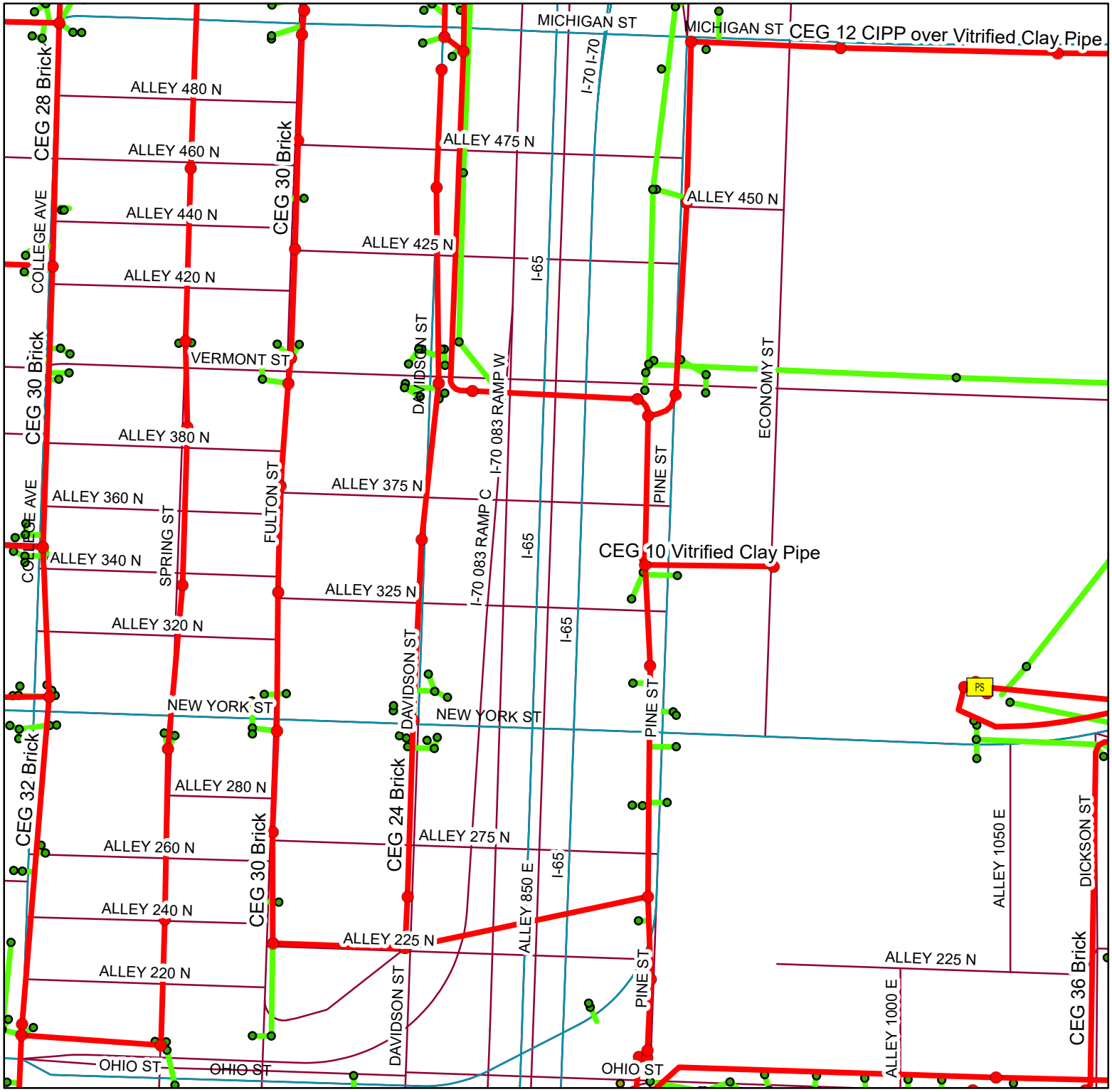
GIS Map 1

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP


MICHIGAN ST
MICHIGAN ST CEG 12 CIPP over Vitrified Clay Pipe
I-70 I-70
CEG 28 Brick
ALLEY 480 N
ALLEY 460 N
ALLEY 440 N
ALLEY 420 N
ALLEY 475 N
ALLEY 450 N
ALLEY 425 N
CEG 30 Brick
COLLEGE AVE
I-65
DAVIDSON ST
I-70 083 RAMP W
ECONOMY ST
VERMONT ST
ALLEY 380 N
ALLEY 360 N
ALLEY 340 N
ALLEY 375 N
SPRING ST
FULTON ST
I-70 083 RAMP C
PINE ST
CEG 10 Vitrified Clay Pipe
ALLEY 325 N
ALLEY 320 N
NEW YORK ST
CEG 32 Brick
CEG 24 Brick
ALLEY 280 N
ALLEY 260 N
ALLEY 275 N
ALLEY 850 E
ALLEY 1050 E
DICKSON ST
ALLEY 240 N
ALLEY 225 N
ALLEY 220 N
ALLEY 1000 E
CEG 36 Brick
OHIO ST
PS
Legend
SEWERLIFTSTATIONS
SANITARYSEWERSTRUCTURES
SANITARYSEWERS
Sewer_Capital_Structures
STORMSEWERSTRUCTURES
StormSewers
N
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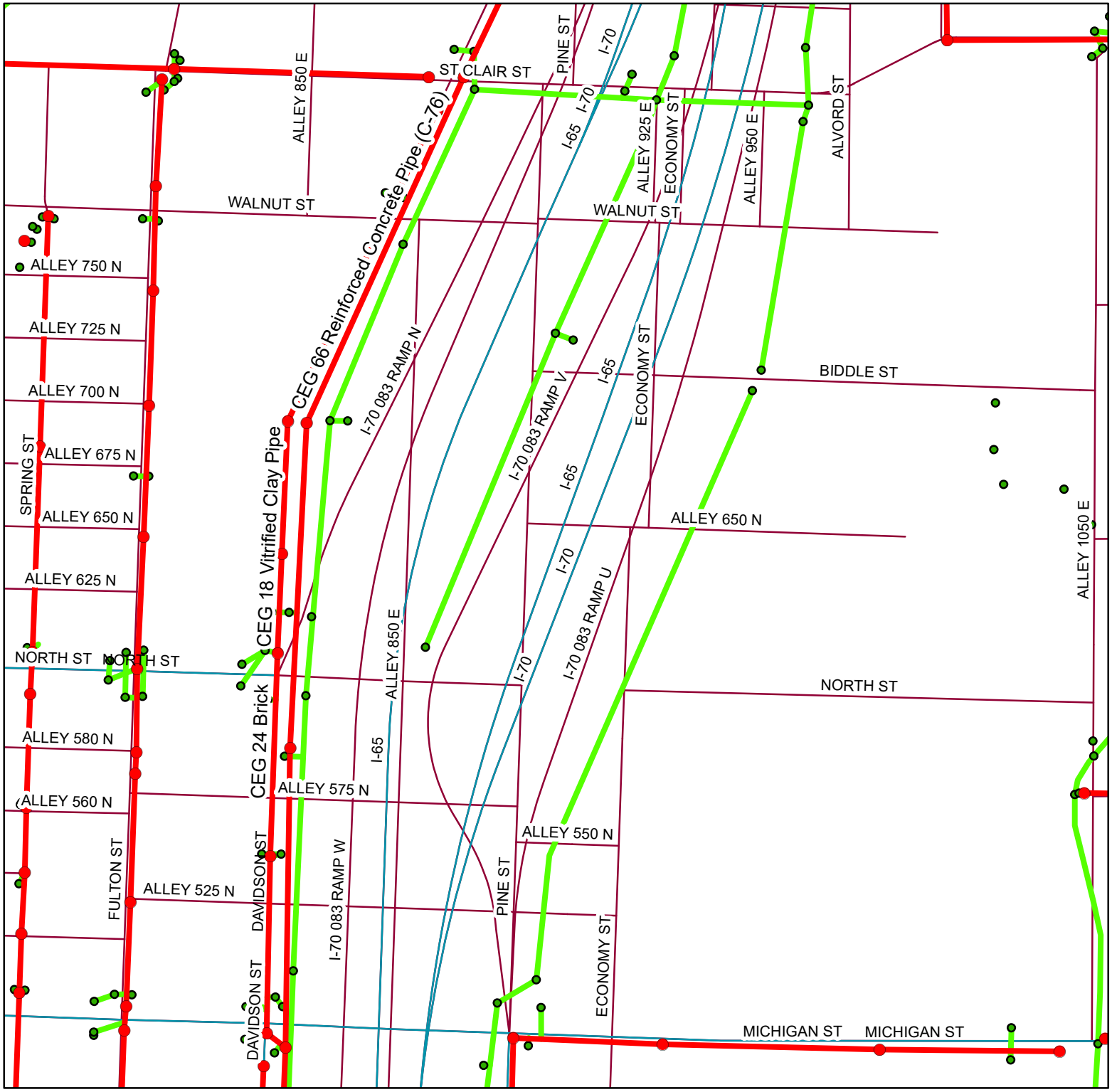
GIS Map 2
Des No 1600808
I-65 / I-70 North Split
SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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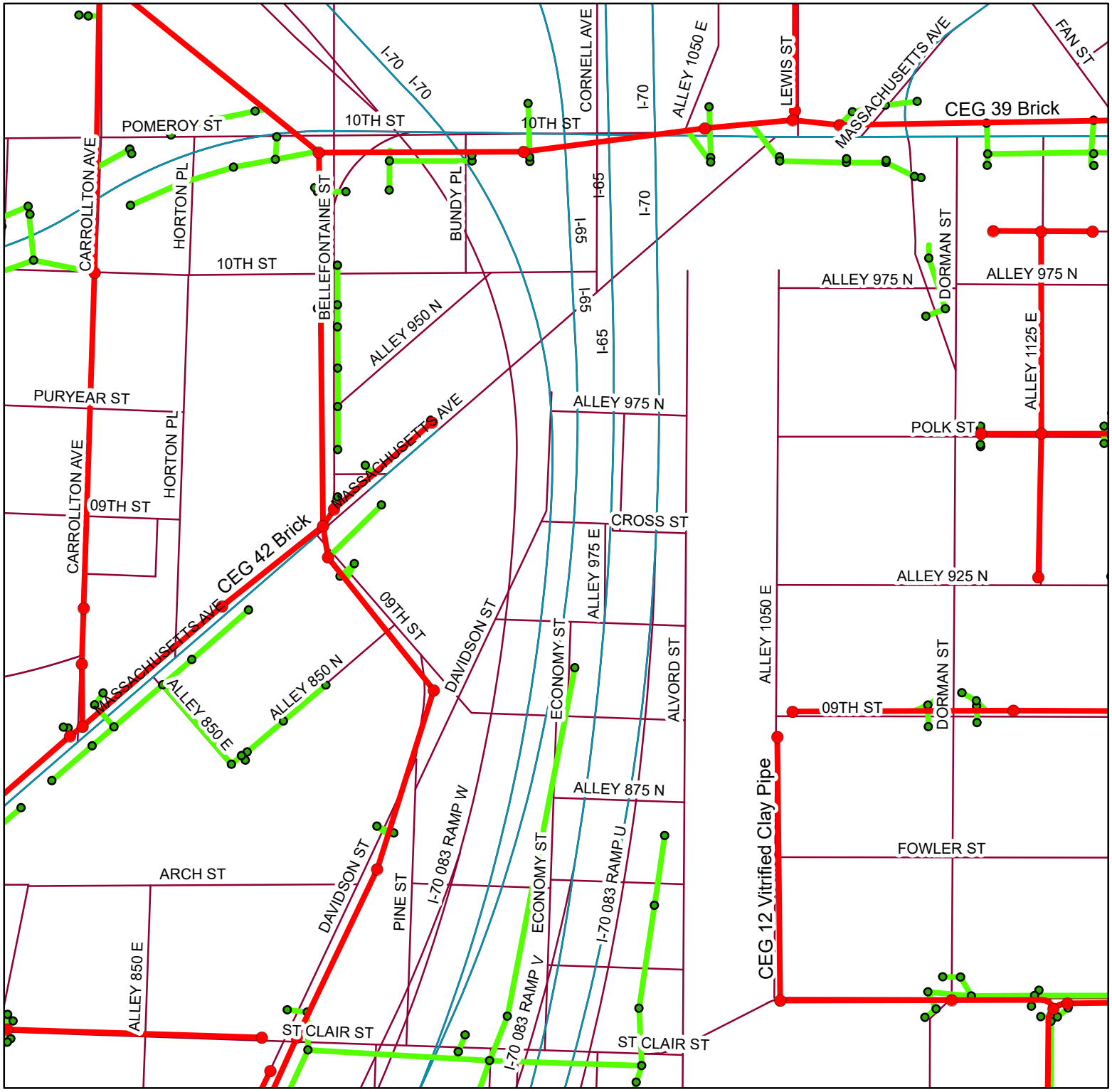
GIS Map 3

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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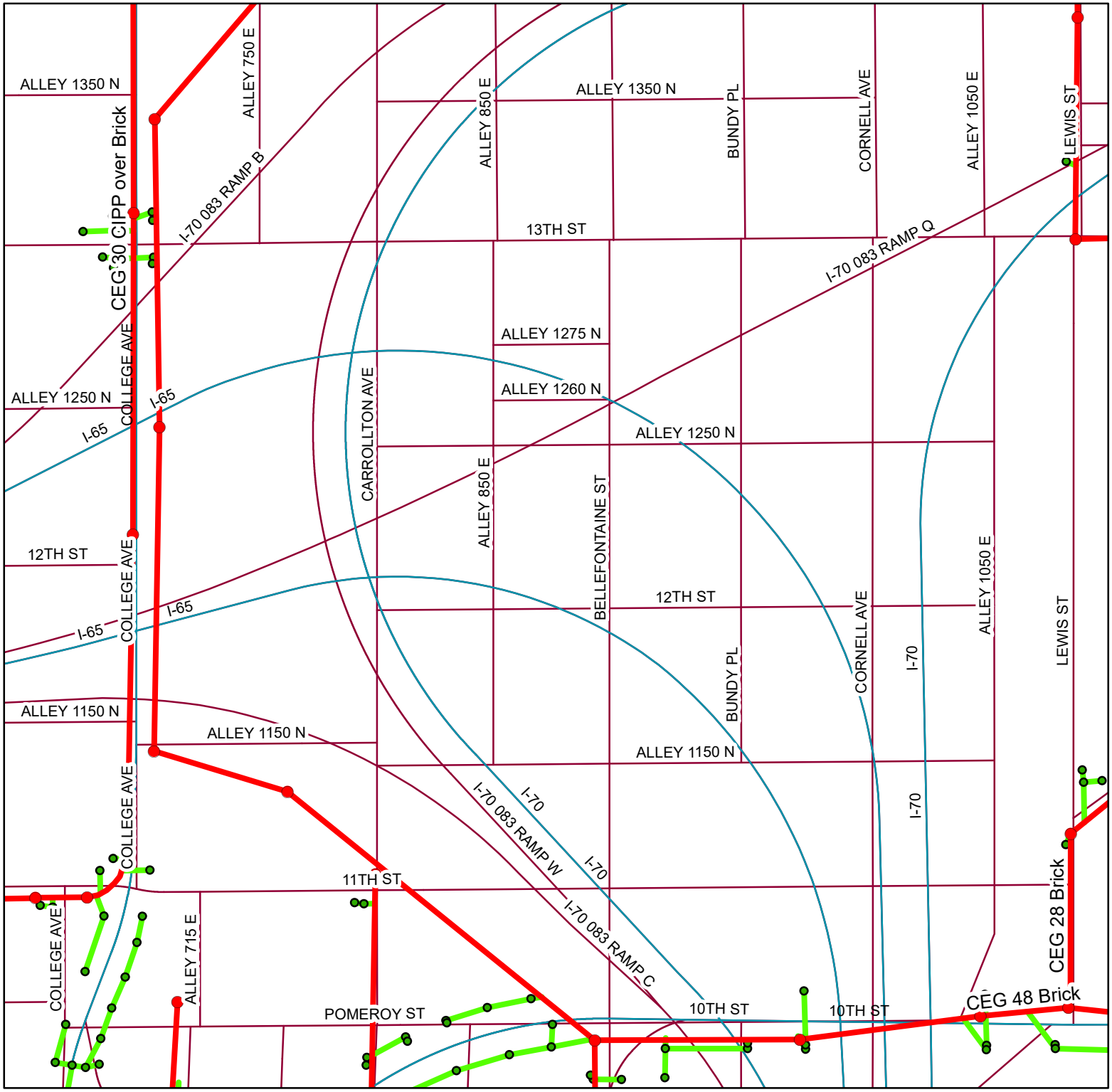
GIS Map 4

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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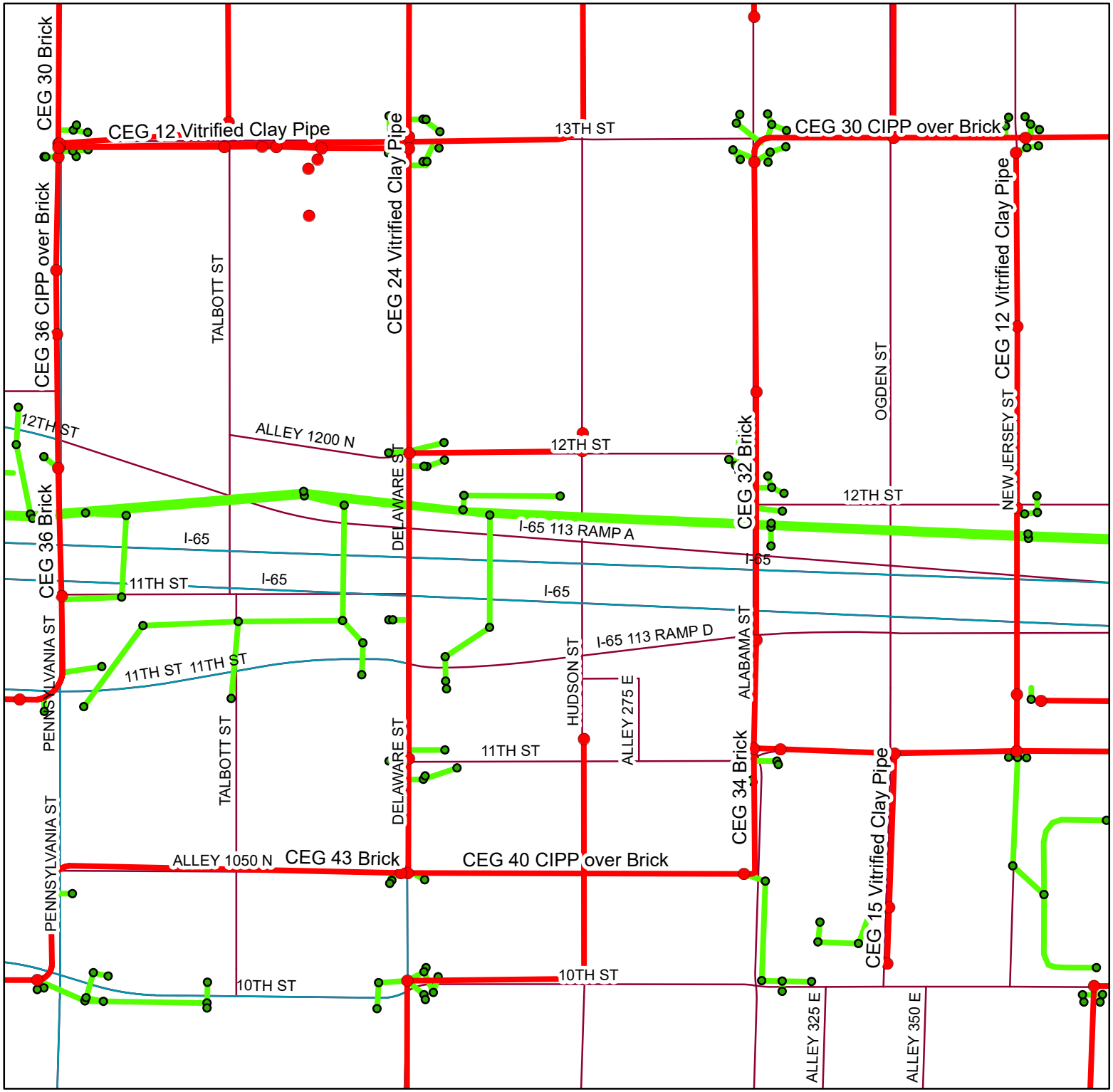
GIS Map 5

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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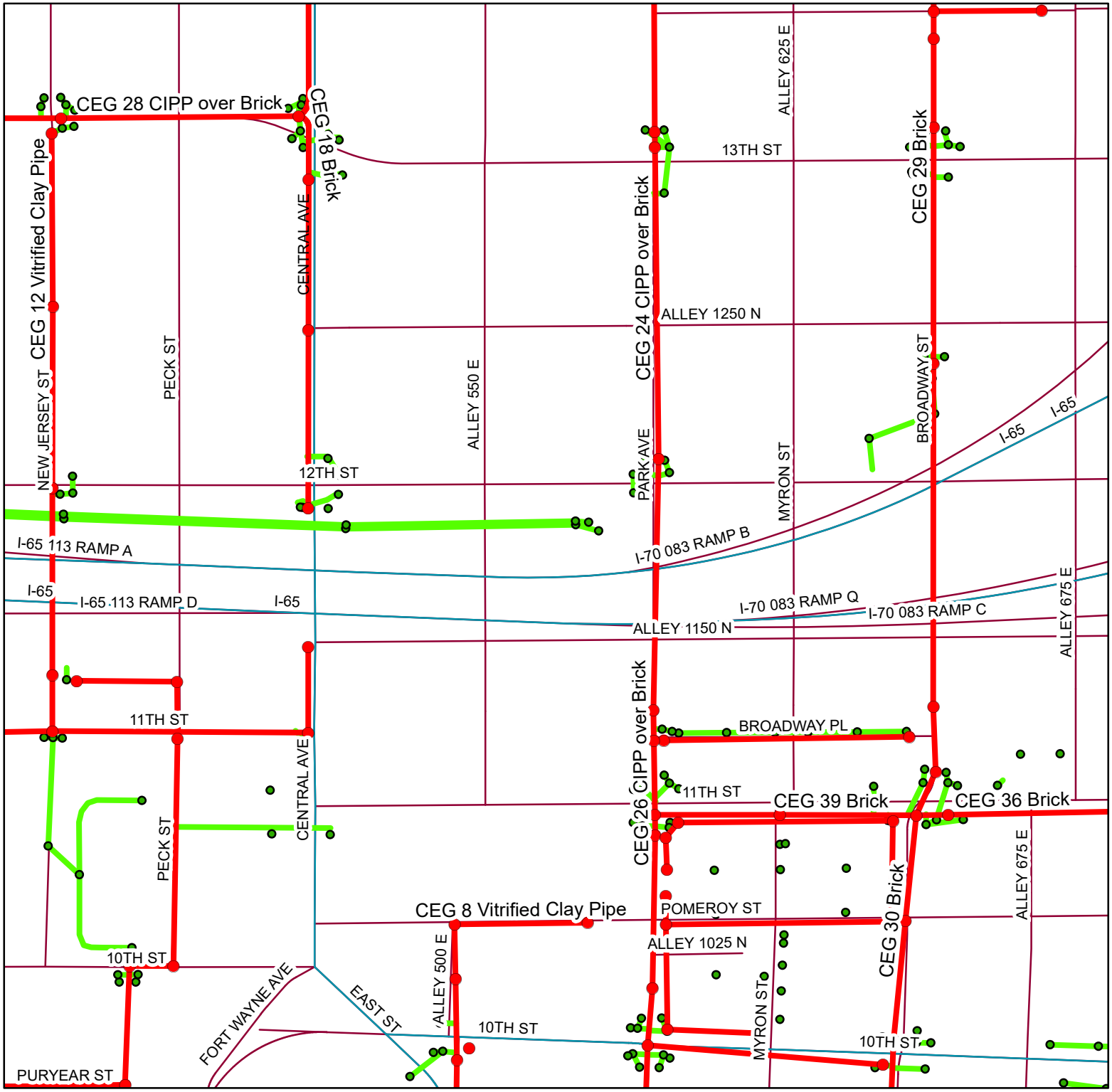
GIS Map 6

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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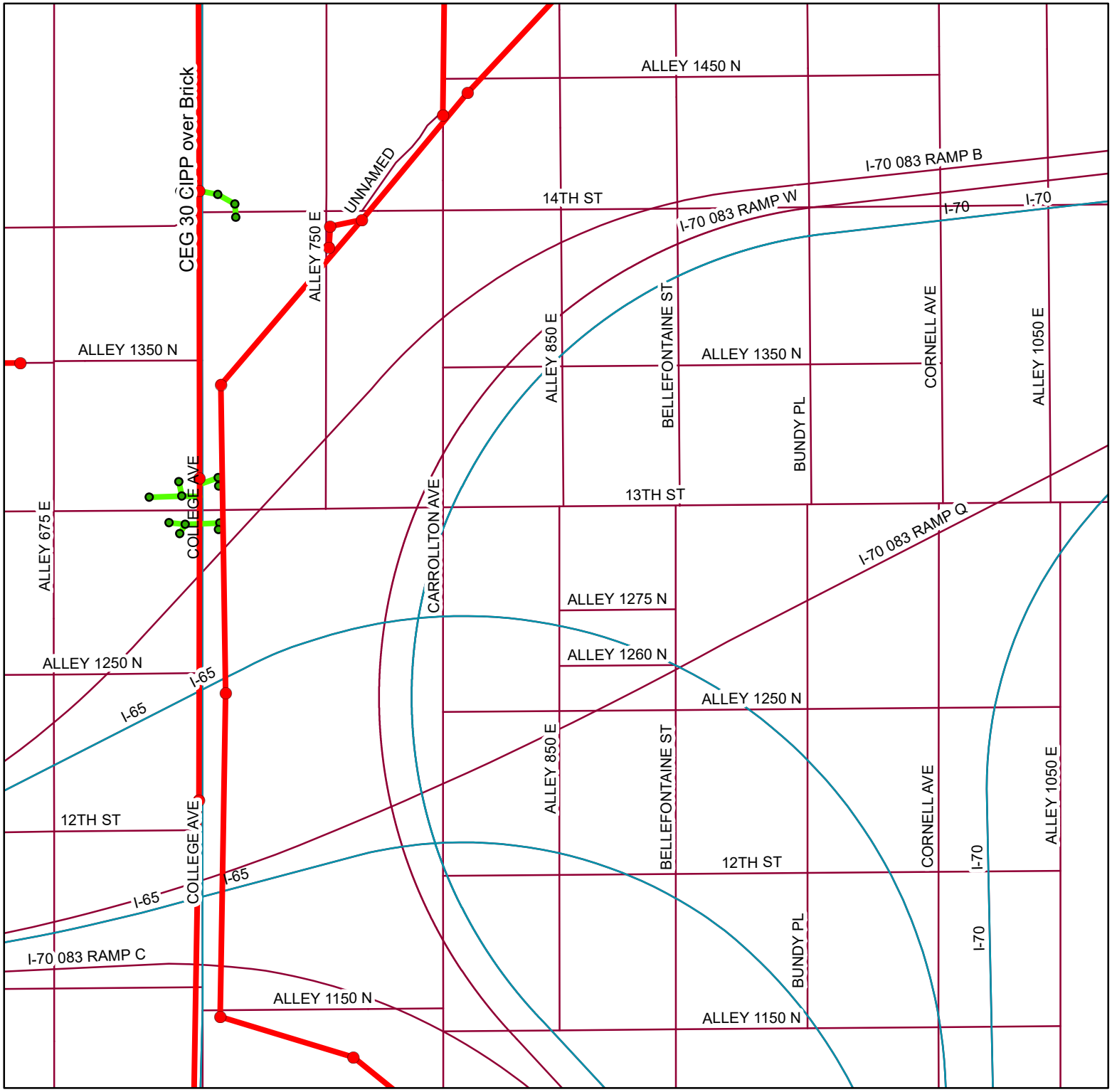
GIS Map 7

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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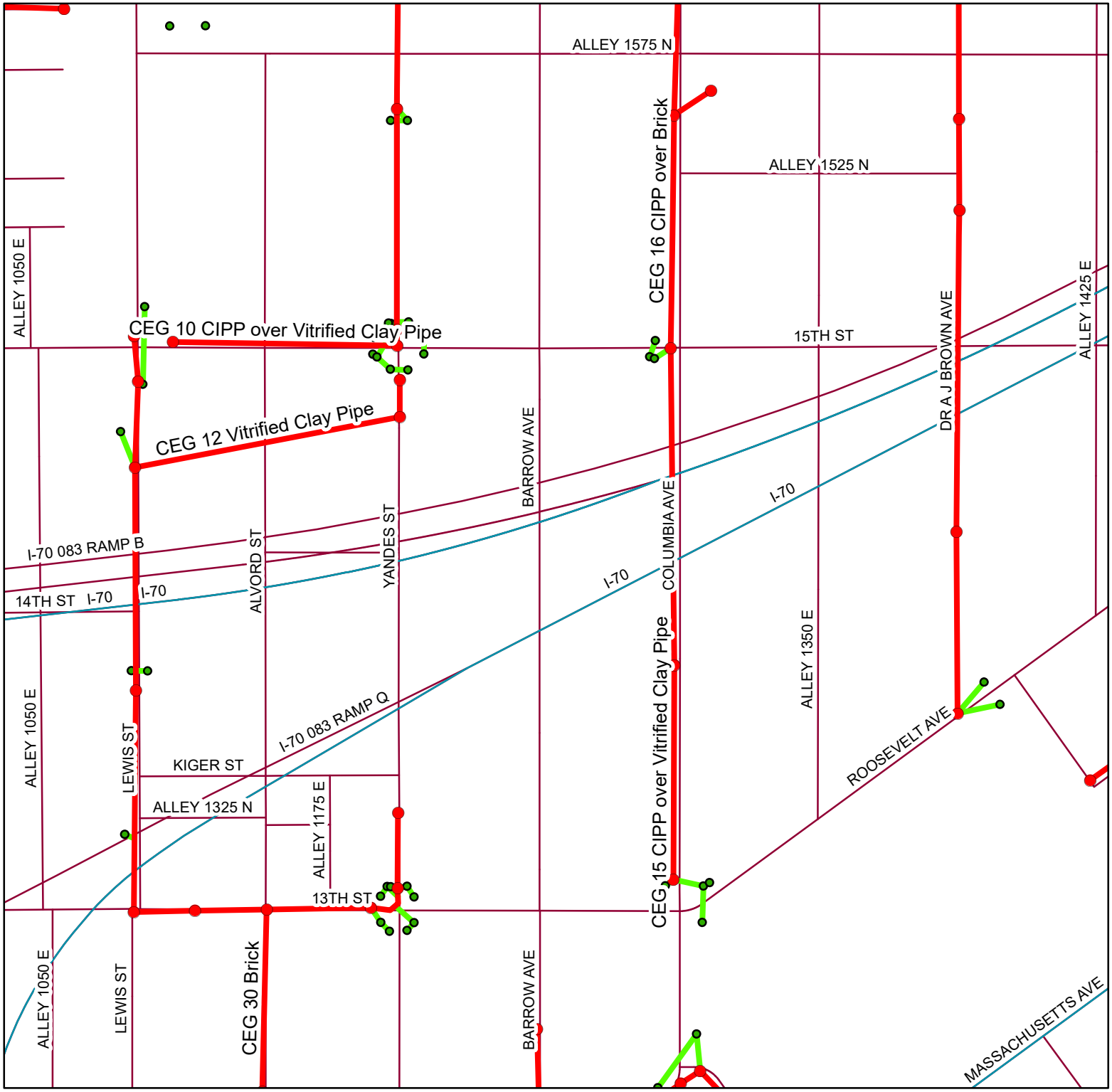
GIS Map 8

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS — SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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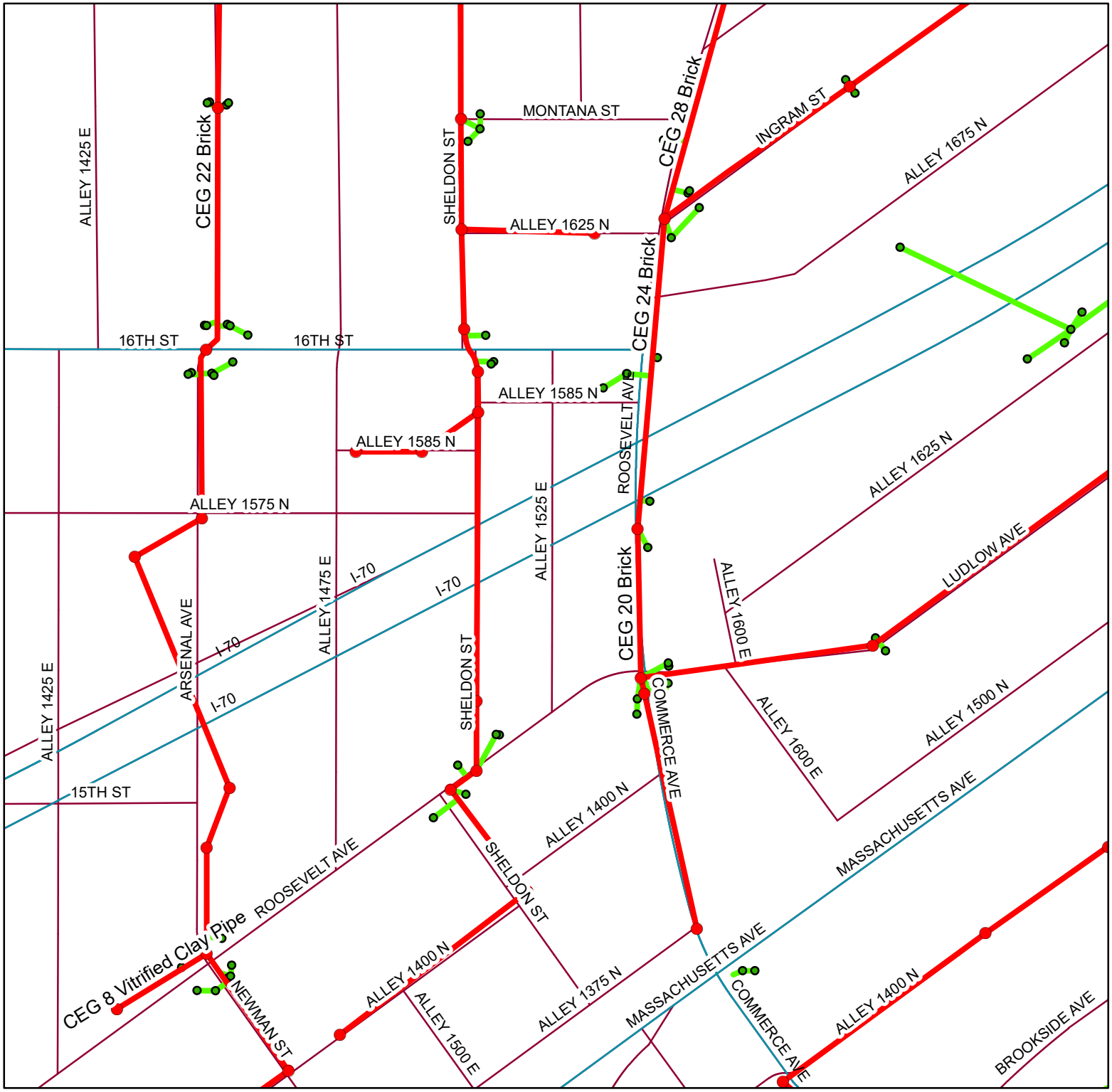
GIS Map 9

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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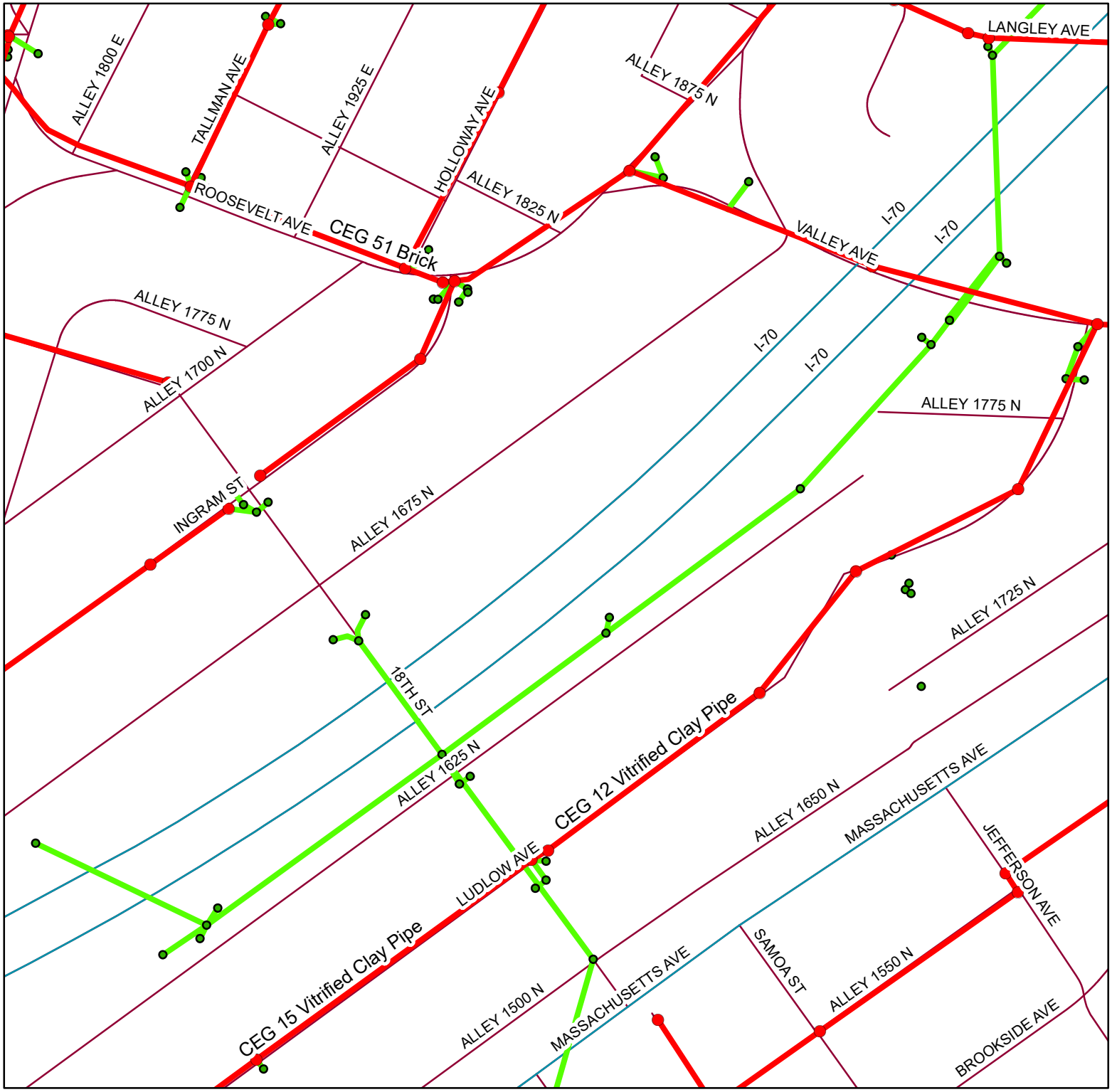
GIS Map 10

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP



Legend

- PS SEWERLIFTSTATIONS
- SANITARYSEWERSTRUCTURES
- SANITARYSEWERS
- Sewer_Capital_Structures
- STORMSEWERSTRUCTURES
- StormSewers

N

1 inch = 200 feet

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GIS Map 11

Des No 1600808
I-65 / I-70 North Split

SANITARY SEWER UTILITY MAP

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CitizensEnergyGroup.com

EXHIBIT B

Citizens Energy Group
Sanitary Sewer Work Plan
CCTV Investigation and Structural Lining Table and Costs

Des. 1600808 I-65/I-70 North Split Interchange
Citizens Energy Group - Sanitary Sewer Inspection

Dated: REVISED February 18, 2020

Cleaning and CCTV

Item	Cost
Citizens' Contractor Sewer Inspection	$ 107,000
Heavy Sewer Cleaning	$ 50,000
Citizens' Contactor Traffic Control	$ 70,000
Citizens Project Management	$ 39,000
Total	**$ 266,000**

Structural Lining and Inspection

Item	Cost
Citizens' Structural Lining	$ 16,233,000
Citizens' Construction Inspection	$ 812,000
Total	**$ 17,045,000**

Notes: Citizens Energy Group (Citizens)

USMH	DSMH	Street	Material Type	Diameter (in)	Height (in)	Length (ft)	USMH Approximate Depth (ft)[1]	DSMH Approximate Depth (ft)[1]	CCTV Cost	Non-Styrenated CIPP Cost	Total Cost
110139	112684	Arsenal Ave.	VCP	18	N/A	94.02	10	14	$517	$56,188	$56,705
112025	112024	Valley Ave.	INR	51	N/A	381.88	11	11	$0	$413,199	$413,199
112026	112025	Valley Ave.	RCP	51	N/A	339.66	12	11	$0	$389,909	$389,909
112155	112154	Roosevelt Ave.	BRK	24	36	456.31	13	9	$0	$130,495	$130,495
112156	112155	Roosevelt Ave.	BRK	20	30	218.33	10	13	$1,201	$81,684	$82,885
112675	112674	Columbia Ave.	INV	15	N/A	462.29	9	13	$0	$70,212	$70,212
112680	112678	Dr. A J Brown Ave.	UNK	20	N/A	470.88	8	10	$0	$133,483	$133,483
112684	112683	Arsenal Ave.	VCP	18	N/A	365.35	14	11	$2,009	$111,839	$113,848
112692	112691	Sheldon St.	RCP	24	N/A	423.17	10	10	$0	$123,696	$123,696
220070	220560*	Alabama St.	BRK	34	63	158.97	14	16	$1,033	$152,502	$153,535
220071	220070	Alabama St.	BRK	32	48	362.66	14	14	$2,357	$230,045	$232,402
220140	220139	Broadway St.	RCP	30	N/A	502.14	8	9	$3,264	$283,145	$286,409
220158	220157	College Ave.	INB	30	N/A	454.20	8	9	$2,952	$264,895	$267,847
220159	220158	College Ave.	INB	30	N/A	471.31	7	8	$3,064	$271,410	$274,474
220312*	220351	Pine St.	RCP	66	N/A	148.25	14	10	$964	$373,223	$374,187
220351	223087	Pine St.	RCP	66	N/A	338.12	10	9	$2,198	$591,036	$593,234
220352	220312*	Pine St.	RCP	66	N/A	8.93	10	14	$58	$213,390	$213,448
221004	228938*	Pine St.	RCP	66	N/A	31.41	11	10	$204	$239,180	$239,384
221037	225761	Pine St.	RCP	77	N/A	104.60	12	18	$680	$383,140	$383,820
221038	223590	Pine St.	PVC	18	N/A	57.98	16	16	$319	$48,796	$49,115
221041	228938*	Pine St.	UNK	66	N/A	55.43	10	10	$360	$266,731	$267,091
221081	224601	New Jersey St.	VCP	15	N/A	273.96	11	11	$1,507	$46,670	$48,177
221084	221085	Davidson St.	RCP	66	N/A	275.04	12	13	$1,788	$518,669	$520,457
221085	221769	Davidson St.	RCP	66	N/A	272.86	13	13	$1,774	$516,167	$517,941
221739	223087	Pine St.	CON	36	N/A	363.08	9	9	$0	$230,206	$230,206
221759	221239	Davidson St.	INB	24	N/A	75.22	9	9	$489	$52,333	$52,822
221760	221759	Davidson St.	BRK	24	N/A	258.89	9	9	$1,683	$90,004	$91,687
221761	221760	Davidson St.	VCP	18	N/A	264.91	9	9	$1,457	$91,238	$92,695
221762	221761	Davidson St.	INV	18	N/A	230.48	9	9	$1,268	$84,176	$85,444
221763	221762	Davidson St.	INV	12	N/A	286.34	9	9	$1,575	$48,217	$49,792
221764	221763	Davidson St.	INV	12	N/A	172.78	10	9	$950	$34,022	$34,972
221765	221004	Vermont St.	CON	66	N/A	241.52	9	11	$1,570	$480,215	$481,785
221766	221765	Davidson St.	RCP	66	N/A	522.51	11	9	$3,396	$802,575	$805,971
221767	221766	Davidson St.	RCP	66	N/A	438.72	12	11	$2,852	$706,451	$709,303
221768	221767	Davidson St.	RCP	66	N/A	476.67	12	12	$3,098	$749,977	$753,075
221769	221768	Davidson St.	RCP	66	N/A	556.50	13	12	$3,617	$841,567	$845,184
221770	221766	Michigan St.	RCP	24	N/A	34.88	11	11	$227	$44,100	$44,327
221771	221770	Davidson St.	BRK	24	N/A	259.35	10	11	$1,686	$90,097	$91,783
221772	221771	Davidson St.	BRK	24	N/A	297.66	11	10	$1,935	$97,955	$99,890
221773	221772	Davidson St.	VCP	18	N/A	145.77	11	11	$802	$66,802	$67,604
221776	221775	Davidson St.	INV	12	N/A	172.11	11	11	$947	$33,938	$34,885
223087	221037	Pine St.	BRK	77	N/A	121.00	9	12	$786	$401,956	$402,742
223415	223688	Michigan St.	INV	12	N/A	218.42	12	11	$1,201	$39,728	$40,929
223590	223995	Pine St.	PVC	18	N/A	23.14	16	20	$127	$41,650	$41,777
223674	220162	Park Ave.	INC	26	39	368.87	11	11	$2,398	$112,560	$114,958
223688	223689	Pine St.	VCP	66	N/A	235.08	11	10	$1,528	$472,835	$474,363
223689	221041	Pine St.	VCP	66	N/A	282.85	10	10	$1,839	$527,637	$529,476
223690	220312*	Pine St.	VCP	10	N/A	187.78	8	14	$1,033	$35,897	$36,930
224557	224556	Delaware St.	VCP	24	N/A	446.72	10	13	$2,457	$128,528	$130,985
224601	223671	New Jersey St.	VCP	18	N/A	82.52	11	12	$454	$53,830	$54,284
225034	225033	Central Ave.	VCP	18	N/A	260.51	10	12	$1,433	$90,335	$91,768
225761	CSO152	Pine St.	RCP	78	N/A	10.57	18	12	$69	$275,279	$275,348
225761	221038	Pine St.	PVC	18	N/A	15.41	18	16	$85	$40,066	$40,151
227439**	223672	Central Ave.	VCP	15	N/A	125.96	N/A	10	$693	$28,170	$28,863
228938*	220352	Pine St.	RCP	66	N/A	209.31	10	10	$1,361	$443,273	$444,634
229778	220222	Myron St.	PVC	8	N/A	83.70	5	9	$460	$22,888	$23,348
229779	229778	Broadway Pl.	PVC	8	N/A	147.00	N/A	5	$808	$30,800	$31,608
230172	232705	13th St.	INV	15	N/A	104.77	9	10	$576	$25,521	$26,097
230209	238958	10th St.	BRK	48	N/A	128.98	8	6	$838	$298,435	$299,273
230210	230172	13th St.	INV	15	N/A	89.61	10	9	$493	$23,626	$24,119
230211	230210	Lewis St.	VCP	12	N/A	324.76	9	10	$1,786	$53,021	$54,807
230212	230211	Lewis St.	VCP	12	N/A	326.50	10	9	$1,796	$53,237	$55,033
230271	230287	College Ave.	RCP	42	N/A	451.43	11	12	$2,934	$409,392	$412,326
230279	230271	College Ave.	RCP	42	N/A	317.55	11	11	$2,064	$267,310	$269,374
230287	230288	College Ave.	RCP	42	N/A	474.76	12	12	$3,086	$424,836	$427,922
230288	230289	College Ave.	RCP	42	N/A	203.98	12	14	$1,326	$204,066	$205,392
230289	230291	11th St.	RCP	42	N/A	578.24	14	11	$3,759	$411,109	$414,868
230290	230291	10th St.	RCP	48	N/A	299.99	8	11	$1,950	$411,632	$411,632
235077	230212	Lewis St.	VCP	12	N/A	394.34	8	10	$2,169	$61,717	$61,717
238958	230290	10th St.	RCP	48	N/A	266.44	6	8	$1,732	$389,424	$389,424
						18305.33			$107,000	$16,233,000	$16,340,000

[1] Sewer depth can vary significantly in between manholes due to elevation changes

* Blind Tee

** Capped Stub Out

2150 Dr. Martin Luther King Jr. St. | Indianapolis, IN | 46202
CitizensEnergyGroup.com

EXHIBIT C

Citizens Energy Group
Sanitary Sewer Work Plan
LDSR Technical
Specifications

SECTION 01025 - MEASUREMENT AND PAYMENT

PART 1 - GENERAL

1.1 DESCRIPTION

A. Payment for all work in compliance with the Contract Documents, inclusive of furnishing all manpower, equipment, materials, transportation, and performance of all operations relative to construction of this project, will be made under Contract Item Numbers listed on the Statement of Work and herein. Work for which there is not a Contract Item will be considered incidental to the Contract and no additional compensation will be allowed unless approved by OWNER.

B. OWNER reserves the right to alter the Contract Documents, modify incidental work as may be necessary, and increase or decrease quantities of work to be performed in accordance with such changes, including, but not necessarily limited to deduction or cancellation of any one or more of the Contract Items. Cancellation of or decrease in quantities shall not be cause for a claim by CONTRACTOR for lost overhead or profit.

C. CONTRACTOR shall take no advantage of any apparent error or omission in the Contract Documents and ENGINEER shall be permitted to make corrections and interpretations as may be deemed necessary for fulfillment of the intent of the Contract Documents.

D. Contract Items which are to be measured in terms of weight shall be weighed on scales which have been approved by CONSTRUCTION INSPECTOR prior to receipt of any weighed material. Approved weight tickets must be given to CONSTRUCTION INSPECTOR prior to the material being placed.

E. CONSTRUCTION INSPECTOR will make measurements and determinations as necessary to classify the work within Contract Items and determine the quantities for pay purposes.

F. CONTRACTOR shall include, as part of each Application for Payment, a current copy of the Schedule of Sewer Rehabilitation and Schedule of Manhole Rehabilitation, as well as a detailed record identifying the location and quantity of all other work completed for the Application Period.

1.2 SEWER CLEANING AND TELEVISING

A. Description: This work shall consist of all labor, equipment, transportation and materials required to clean and televise gravity sanitary and combined sewers for the purpose of identifying sewer segments requiring rehabilitation as authorized by OWNER, including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; ingress/egress; locating and accessing all manhole structures; bypass pumping; sewer cleaning; closed circuit television inspection including reverse set-ups as necessary; root removal; and all incidentals necessary to complete the Work as shown and specified in the Contract Documents. The primary specifications related to this Contract Item are Sections

11012 and 11013.

B. Measurement: Sewer Cleaning and Televising shall be measured in LINEAL FEET along the centerline of the sewer from the center of manhole casting of an upstream structure to the center of manhole casting of a downstream structure.

C. Basis of Payment: Sewer Cleaning and Televising shall be paid for at the contract unit price per LINEAL FOOT as shown in the Itemized Proposal and Declarations. Post-cleaning and televising related to specific rehabilitation items, such as CIPP lining, shall not be paid for separately but shall be included in the cost of other items.

1.3 PROTRUDING LATERAL REMOVAL

A. Description: This work shall consist of all labor, equipment, transportation and materials required to remove laterals protruding greater than one (1) inch as determined by ENGINEER and authorized by OWNER, including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; bypass pumping; pre- and post-cleaning and televising (as necessary); removal and disposal of protruding lateral; and all incidentals necessary to complete the work all in accordance with the Contract Documents. Laterals protruding one (1) inch or less shall be removed as needed for proper CIPP installation and shall be considered incidental to work. The primary specification related to this Contract Item is Section 11001.

B. Measurement: Acceptable Protruding Lateral Removal shall be measured by EACH protruding lateral removed.

C. Basis of Payment: Actual payment for Protruding Lateral Removal will be determined based off of actual effort, with the appropriate documentation, but cost shall be no more than the maximum established unit price in the Itemized Proposal.

1.4 CURED-IN-PLACE PIPE LINING, VARIOUS PIPE DIAMETERS, ALL DEPTHS

A. Description: This work shall consist of all labor, equipment, transportation and materials required to rehabilitate gravity sanitary and combined sewers, all depths, by installation of cured-in-place pipe (CIPP) lining including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic and bypass pumping (separate pay items for large diameter); construction engineering; safety; sewer pipe preparation; pre- and post-installation sewer cleaning and televising; protruding lateral removal less than one (1) inch protrusion; root removal; CIPP liner and installation; manhole reconstruction; testing; site restoration; clean up; and all incidentals necessary to complete the work, all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11001.

B. Measurement: Acceptable Cured-in-Place Pipe Lining, Various Pipe Diameters, All Depths shall be measured in LINEAL FEET along the centerline of the sewer from the center of manhole casting of an upstream structure to the center of manhole casting of a downstream structure.

C. Basis of Payment: Cured-in-Place Pipe Lining, Various Pipe Diameters, All Depths shall be paid for at the Contract unit price per LINEAL FOOT for the various diameters, regardless of depth, as shown in the Itemized Proposal and Declarations. The LINEAL FOOT quantity shall be determined by the length listed in the post-installation sewer cleaning and televising video or field verification, as determined by OWNER.

1.5 CIPP LATERAL REINSTATEMENTS

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reinstate laterals associated with CIPP lining operations including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; bypass pumping; man-entry/robotic reinstatement of laterals and/or services; brushing all reinstated laterals and/or services; pre- and post-installation televising; site restoration; clean up; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11001.

B. Measurement: Acceptable CIPP Lateral Reinstatements shall be measured by EACH.

C. Basis of Payment: CIPP Lateral Reinstatements shall be paid for at the Contract unit price per EACH, regardless of diameter, as shown in the Itemized Proposal and Declarations.

1.6 INTERIOR MANHOLE LINING (Cementitious, Cementitious with Epoxy, etc.)

A. Description: This work shall consist of all labor, equipment, transportation and materials required to rehabilitate sanitary or combined sewer structures including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; surface preparation; cleaning; patching; manhole step removal; manhole lining; bypass pumping; testing; site restoration; clean up; and all incidentals necessary to complete the work, all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11007.

B. Measurement: Acceptable Interior Manhole Lining shall be measured in VERTICAL FEET from the bench of the manhole to the bottom of the casting or as installed, as determined by the OWNER.

C. Basis of Payment: Interior Manhole Lining shall be paid for at the Contract unit price per VERTICAL FOOT, regardless of diameter, as shown in the Itemized Proposal and Declarations.

1.7 CHANNEL AND BENCH RECONSTRUCTION

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reconstruct existing channel and bench within a sanitary or combined sewer manhole including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; surface preparation;

cleaning; demolition and disposal of surplus materials; installation of new cast-in-place concrete channel and bench; site restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specifications related to this Contract Item are Sections 03300 and 03400.

B. Measurement: Acceptable Channel and Bench Reconstruction shall be measured by EACH channel and bench constructed or reconstructed.

C. Basis of Payment: Actual payment for Channel and Bench Reconstruction will be determined based off of actual effort, with the appropriate documentation, but cost shall be no more than the maximum established unit price in the Itemized Proposal.

1.8 CHIMNEY/RISER RECONSTRUCTION, PAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reconstruct manhole chimney/risers in paved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; saw-cutting and pavement removal; all excavation; surface preparation; cleaning; furnishing and installing precast concrete adjusting rings and/or manhole sections; materials required for Mr. Manhole chimney reconstruction method; reinstallation of the existing frame and cover if frame and cover replacement is not required; maintenance and inspection of open excavations including steel plating and daily checks (including weekends); removal and legal disposal of surplus excavated material; granular backfill/flowable fill and pavement restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11010.

B. Measurement: Acceptable Chimney/Riser Reconstruction, Paved shall be measured in VERTICAL FEET from the top of existing structure (where reconstruction begins) to the bottom of the casting.

C. Basis of Payment: Chimney/Riser Reconstruction, Paved shall be paid for at the negotiated unit price per VERTICAL FOOT, and added to the statement of work, per project. A minimum 1.0 VERTICAL FOOT payment shall be made for all instances of Chimney/Riser Reconstruction, Paved where the existing frame and cover are reinstalled.

1.9 CHIMNEY/RISER RECONSTRUCTION, UNPAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reconstruct manhole chimney/risers in unpaved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; all excavation; surface preparation; cleaning; furnishing and installing precast concrete adjusting rings and/or manhole sections; reinstallation of the existing frame and cover if frame and cover replacement is not required; maintenance and inspection of open

excavations including steel plating and daily checks (including weekends); removal and legal disposal of surplus excavated material; granular backfill/flowable fill and pavement restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11010.

B. Measurement: Acceptable Chimney/Riser Reconstruction, Unpaved shall be measured in VERTICAL FEET from the top of existing structure (where reconstruction begins) to the bottom of the casting.

C. Basis of Payment: Chimney/Riser Reconstruction, Unpaved shall be paid for at the negotiated unit price per VERTICAL FOOT, and added to the statement of work, per project.

1.10 MANHOLE FRAME AND COVER, PAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to replace all designated manhole frames and covers in paved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; saw-cutting and pavement removal; all excavation; surface preparation; cleaning; furnishing and installing manhole frames and covers; testing; removal and legal disposal of surplus materials; pavement restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11008.

B. Measurement: Acceptable Manhole Frame and Cover, Paved shall be measured by EACH replaced.

C. Basis of Payment: Manhole Frame and Cover, Paved shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

1.11 MANHOLE FRAME AND COVER, UNPAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to replace all designated manhole frames and covers in unpaved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; all excavation; surface preparation; cleaning; furnishing and installing manhole frames and covers; testing; removal and legal disposal of surplus materials; site restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11008.

B. Measurement: Acceptable Manhole Frame and Cover, Unpaved shall be measured by EACH replaced.

C. Basis of Payment: Manhole Frame and Cover, Unpaved shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

1.12 RESET MANHOLE FRAME AND COVER, PAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reset all designated manhole frames and covers in paved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; saw-cutting and pavement removal; all excavation; surface preparation; cleaning; resetting existing manhole frames and covers; removal and legal disposal of surplus materials; pavement restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11008.

B. Measurement: Acceptable Reset Manhole Frame and Cover, Paved shall be measured by EACH reset.

C. Basis of Payment: Reset Manhole Frame and Cover, Paved shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

1.13 RESET MANHOLE FRAME AND COVER, UNPAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to reset all designated manhole frames and covers in unpaved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; all excavation; surface preparation; cleaning; resetting existing manhole frames and covers; removal and legal disposal of surplus materials; site restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11008.

B. Measurement: Acceptable Reset Manhole Frame and Cover, Unpaved shall be measured by EACH reset.

C. Basis of Payment: Reset Manhole Frame and Cover, Unpaved shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

1.14 RAISE MANHOLE TO GRADE, PAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to raise buried manholes to grade in paved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; locating and accessing manhole; saw-cutting and pavement removal; all excavation; surface preparation; cleaning; furnishing and installing precast adjusting rings; testing; removal and legal disposal of

surplus materials; pavement restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specifications related to this Contract Item are Sections 11008 and 11010.

B. Measurement: Acceptable Raise Manhole to Grade, Paved shall be measured by LFT manhole raised to grade.

C. Basis of Payment: Basis of Payment: Raise Manhole to Grade shall be paid for at the Contract unit price per LFT as shown in the Itemized Proposal and Declarations.

1.15 RAISE MANHOLE TO GRADE, UNPAVED

A. Description: This work shall consist of all labor, equipment, transportation and materials required to raise buried manholes to grade in unpaved areas including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; locating and accessing manhole; all excavation; surface preparation; cleaning; furnishing and installing precast adjusting rings; testing; removal and legal disposal of surplus materials; site restoration; and all incidentals necessary to complete the work all in accordance with the Contract Documents. The primary specifications related to this Contract Item are Sections 11008 and 11010.

B. Measurement: Acceptable Raise Manhole to Grade, Unpaved shall be measured by LFT manhole raised to grade.

C. Basis of Payment: Raise Manhole to Grade, Unpaved shall be paid for at the Contract unit price per LFT as shown in the Itemized Proposal and Declarations.

1.16 GROUT SEAL MANHOLE STRUCTURES

A. Description: This work shall consist of all labor, equipment, transportation and materials required to grout seal manhole structures including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; safety; root removal and surface preparation; cleaning; bypass pumping; cementitious and chemical grouting voids and joints; testing; clean up; and all incidentals necessary to complete the work, all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 11007. At the time of rehabilitation, the manhole shall be thoroughly inspected and a final determination will be made, at the discretion of the CONSTRUCTION INSPECTOR, as to the extent of the rehabilitation measures required.

B. Measurement: Acceptable Grout Seal Manhole Structures shall be measured by EACH manhole.

C. Basis of Payment: Grout Seal Manhole Structures shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

1.17 INTERNAL DROP MANHOLE CONNECTION

A. Description: This work shall consist of all labor, equipment, transportation and materials required to furnish and install an internal drop manhole connection including, but not necessarily limited to: mobilization/demobilization; maintenance of traffic; construction engineering; safety; surface preparation; cleaning; bypass pumping; furnishing and installing pipe and fittings; testing; clean-up; and all incidentals necessary to complete the work, all in accordance with the Contract Documents. The primary specification related to this Contract Item is Section 03400.

B. Measurement: Acceptable Internal Drop Manhole Connection shall be measured by EACH drop connection complete.

C. Basis of Payment: Internal Drop Manhole Connection shall be paid for at the Contract unit price per EACH as shown in the Itemized Proposal and Declarations.

- END OF SECTION 01025-

SECTION 01050 - CONSTRUCTION ENGINEERING

PART 1 - GENERAL

1.1 DESCRIPTION

A. All construction engineering shall be performed by CONTRACTOR. Construction Engineering shall include running a level circuit to establish elevations of project benchmarks, documenting existing pavement elevations, locating existing structures, verifying existing pipe diameters and segment lengths, documenting vertical distances for rehabilitated manhole structures, and as-built documentation.

1.2 QUALITY REQUIREMENTS

A. The layout of control points, centerlines, benchmarks and other items shall be consistent with standard engineering practices. All surveys required for the layout of the Work specified in the Contract Documents shall be of second-order class I, or better, as defined in "Classification, Standards of Accuracy, and General Specifications of Geodetic Control Surveys" prepared by the Federal Geodetic Control Committee for the U.S. Department of Commerce.

PART 2 - MATERIALS

2.1 FIELD BOOKS AND PAPER

A. The field books shall be the standard six (6) ring field books (6-1/2" x 8") normally used in surveying.

B. The paper shall be the standard six (6) hole paper (5-1/2" x 7-1/4") normally used in surveying.

PART 3 - EXECUTION

3.1 CHECKS AND CONTROL

A. CONTRACTOR shall perform all necessary Construction Engineering, including layout, to insure that the Work conforms to the Contract Documents. The Construction Engineering shall include establishing all necessary lines, points, corners, etc. with adequate references for the recovery of said items during construction, running a level circuit to establish benchmarks for use during construction, setting stakes for structures, slopes, subgrade, paving and any other stakes required for control lines and grades.

B. CONTRACTOR shall furnish all equipment, personnel and materials, including stakes and flagging as necessary, for performing the Construction Engineering.

C. Field notes shall be kept in standard field notebooks supplied by CONTRACTOR in a clear, orderly and neat manner consistent with standard engineering practices and procedures. The field books shall be available for inspection by CONSTRUCTION INSPECTOR at all times and shall become the property of OWNER on completion of the Work.

D. When staking piping and structures, CONTRACTOR shall perform the necessary checking to establish the proper location and grade.

E. CONSTRUCTION INSPECTOR may check the accuracy of the Construction Engineering as necessary, but will assume no responsibility for the accuracy of engineering layout or the final result of construction accuracy.

F. The supervision of CONTRACTOR's Construction Engineering personnel shall be the responsibility of CONTRACTOR, and any errors resulting from the operations of such personnel shall be corrected at the expense of CONTRACTOR and at no additional cost to OWNER.

3.2 CONSTRUCTION ENGINEERING FOR SANITARY AND COMBINED SEWER REHABILITATION/REPLACEMENT

A. Construction engineering for sanitary and/or combined sewer rehabilitation/replacement shall be performed under the direction and supervision of a registered Land Surveyor in the State of Indiana and include but not be limited to:

1. Length and diameter of the sewer segments that are rehabilitated along with the vertical length of sanitary structures that are rehabilitated.

2. Existing utility casting or access structure elevations where modification to the existing pavement or ground elevation is required or anticipated for construction of the Work.

3. Existing pavement/ground elevations at all proposed structure locations prior to ordering materials to confirm required structure dimensions. CONTRACTOR shall account for required pavement resurfacing or replacement thicknesses and the resulting final pavement elevation and/or ground elevation when ordering and setting all adjustment items so that the top of the adjusted utility castings or access structures are flush with the specified final pavement cross-section and/or ground elevation, resulting in a smooth transition across the top.

4. Verifying and/or determining horizontal locations, elevations and dimensions of all existing sanitary facilities to where the Work will be connected. This is to be completed prior to construction of any items that may be affected by the existing facility horizontal location, elevation and/or dimension varying from what is shown on the Drawings.

B. As-Built Drawings

1. As the work progresses, CONTRACTOR shall be required to keep a daily

record of any changes in sewer length and/or diameter and manhole structure elevations and locations and to note the exact horizontal and vertical location of utilities, sewers, and other items encountered during construction.

2. Upon completion of the work and prior to acceptance of the Project, CONTRACTOR shall be required to furnish CONSTRUCTION INSPECTOR with one set of marked-up prints showing the as-built locations, pipe diameter, pipe length, and elevations of all construction.

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3.3 MEASUREMENT AND PAYMENT

A. Payment for Construction Engineering shall be made in accordance with Section 01025- Measurement and Payment.

- END OF SECTION 01050 -

SECTION 01300 – CONTRACTOR SUBMITTALS

PART 1– GENERAL

1.1 GENERAL

A. Submit all submittals required by the Contract Documents to CONSTRUCTION INSPECTOR unless otherwise noted. Electronic submission of submittals in PDF format is preferred, when applicable.

B. Within 14 days after the commencement date as stated in the Notice to Proceed, CONTRACTOR shall submit the following items to CONSTRUCTION INSPECTOR for review by ENGINEER:

1. A preliminary schedule of Shop Drawings, Samples, and proposed Substitutes ("Or-Equal") submittals listed in the Bid.

2. A list with all permits and licenses CONTRACTOR shall obtain indicating the agency required to grant the permit and the expected submittal date for the permit and required date for receiving the permit.

3. At the request of the OWNER, any new structures and/or structural modifications to existing structures required for CIPP inversion may require supporting documentation stamped by a Professional Engineer licensed in the State of Indiana, at no cost to OWNER.

1.2 PRECONSTRUCTION CONFERENCE SUBMITTALS

A. Submit the following items at the preconstruction conference referred to in Section 01318 - Meetings to CONSTRUCTION INSPECTOR for approval:

1. CONTRACTOR’s designated Project Manager and Field Superintendent

2. Preliminary progress schedule and schedule of submittals

3. Project Safety Program

4. Procedures for handling submittals such as Shop Drawings

5. Site Ingress and Egress Plan

6. Traffic Control Plan

1.3 SUBMITTAL REQUIREMENTS

A. Wherever called for in the Contract Documents or where required by ENGINEER, CONTRACTOR shall furnish to CONSTRUCTION INSPECTOR for review by ENGINEER two (2) copies plus one reproducible copy for each submittal.

B. Submittals shall be accompanied by ENGINEER's standard submittal/transmittal form, a reproducible copy of which is available from CONSTRUCTION INSPECTOR. Any submittal not accompanied by such a form, or where all applicable items on the form are not completed, shall be returned for re-submittal.

C. Organization

1. A single submittal/transmittal form shall be used for each technical specification section or item or class of material or equipment for which a submittal is required. A single submittal covering multiple sections will not be acceptable, unless the primary specification references other sections for components. Example: if a pump section references other sections for the motor, protective coating, anchor bolts, local control panel, and variable frequency drive, a single submittal would be accepted; a single submittal covering vertical turbine pumps and horizontal split case pumps would not be acceptable.

2. On the transmittal form, index the components of the submittal and insert tabs in the submittal to match the components. Relate the submittal components to specification paragraph and subparagraph, Contract Drawing number, detail number, schedule title, major component, and/or bid list item as applicable.

3. Unless indicated otherwise, terminology and equipment names and numbers used in submittals shall match those used in the Contract Documents.

D. Format

1. Minimum sheet size shall be 8.5 inches by 11 inches. Maximum sheet size shall be 24 inches by 36 inches. Number every page in sequence in each submittal. Properly collate, staple, and/or bind each copy of a submittal as appropriate.

2. Where product data from a manufacturer is submitted, clearly mark which model is proposed, with all pertinent data, capacities, dimensions, clearances, diagrams, controls, connections, anchorage, and supports. Sufficient detail level shall be presented for assessing compliance with the Contract Documents.

3. Each submittal shall be assigned a unique number, and shall be numbered sequentially. The submittal numbers shall be clearly noted on the transmittal. Original submittals shall be assigned a numeric submittal number. Re-submittals shall bear an alpha-numeric system, which consists of the number assigned to the original submittal for that item, followed by a letter of the alphabet to represent it is a subsequent re-submittal of the original. For example, if submittal 25 requires a re-submittal, the first re-submittal will bear the designation "25-A" and the second re-submittal will bear the designation "25-B" and so on.

E. Disorganized submittals which do not meet the requirements above will be returned without review.

F. Except as may otherwise be indicated herein, ENGINEER will return prints for each submittal to CONTRACTOR with comments noted thereon, within 14 calendar days following receipt by ENGINEER. It is considered reasonable that CONTRACTOR shall make a complete and acceptable submittal by the first re-submittal on an item. OWNER reserves the right to withhold monies due to CONTRACTOR to cover additional costs for ENGINEER's review beyond the first re-submittal. ENGINEER's maximum review period for each submittal or re-submittal will be 14 days. Thus, for a submittal requiring two re-submittals before it is complete, the maximum review period could be 42 days.

G. If a submittal is returned to CONTRACTOR marked "REVIEWED," formal revision and resubmission will not be required.

H. If a submittal is returned marked "MAKE CORRECTIONS NOTED," CONTRACTOR shall make the corrections on the submittal, but formal revision and resubmission will not be required.

I. If a submittal is returned marked "AMEND-RESUBMIT," CONTRACTOR shall revise it and shall resubmit the required number of copies for review. Re-submitting portions of multi-page or multi-drawing submittals will not be allowed. For example, if a Shop Drawing submittal consisting of 10 drawings contains one drawing noted as "AMEND - RESUBMIT," the submittal as a whole is deemed "AMEND - RESUBMIT," and all 10 drawings are required to be re-submitted.

J. If a submittal is returned marked "REJECTED-RESUBMIT," it shall mean either the submitted material or product does not satisfy the specification, the submittal is so incomplete it cannot be reviewed, or is a substitution request not submitted in accordance with the Contract Documents. CONTRACTOR shall prepare a new submittal and shall submit the required number of copies for review.

K. Re-submitting rejected portions of a previous submittal shall not be allowed. Every change from a submittal to a re-submittal or from a re-submittal to a subsequent re-submittal shall be identified and flagged on the re-submittal.

L. Fabricating an item shall be commenced only after ENGINEER has reviewed the pertinent submittals and returned copies to CONTRACTOR marked either "REVIEWED" or “MAKE CORRECTIONS NOTED." Corrections indicated on submittals shall be considered as changes necessary to meet the requirements of the Contract Documents, and shall not be taken as changes to the contract requirements.

M. All submittals shall be carefully reviewed by an authorized representative of CONTRACTOR, prior to submission. Each submittal shall be dated, signed, and certified by CONTRACTOR’S Quality Control Engineer as being correct and in strict conformance with the Contract Documents. ENGINEER will only review submittals which have been so certified by CONTRACTOR. All non-certified submittals will be returned to CONTRACTOR without action taken by ENGINEER, and any delays caused thereby shall be the total responsibility of CONTRACTOR.

N. ENGINEER's review of submittals shall not relieve CONTRACTOR of the entire responsibility for the correctness of details and dimensions. CONTRACTOR shall assume all responsibility and risk for any misfits due to any errors in submittals. CONTRACTOR shall be responsible for the dimensions and the design of adequate connections and details.

1.4 SHOP DRAWINGS

A. Wherever called for in the Contract Documents or where required by ENGINEER, CONTRACTOR shall furnish for review, two (2) copies plus one reproducible copy for each Shop Drawing submittal. The term "Shop Drawings" as used herein shall be understood to include detail design calculations, shop-prepared drawings, fabrication and installation drawings, erection drawings, lists, graphs, catalog sheets, data sheets, and similar items. Whenever CONTRACTOR is required to submit a design or design calculations as part of a submittal, such calculations shall bear the signature and seal of a Professional Engineer registered in the appropriate branch and in the State of Indiana, unless otherwise indicated. Formal procedures for developing and reviewing

CONTRACTOR designs shall be followed as specified in Section 01400 – Quality Control.

B. All Shop Drawings shall be carefully reviewed by an authorized representative of CONTRACTOR, prior to submission. Each sheet of a shop drawing submittal shall be dated, signed, and certified by CONTRACTOR's Quality Control Engineer as being correct and in strict conformance with the Contract Documents.

1.5 CONTRACTOR'S SCHEDULE

A. CONTRACTOR's Construction Schedule and reports shall be prepared and submitted to CONSTRUCTION INSPECTOR in accordance with Section 01311 – Progress Schedule.

1.6 SAMPLES

A. Whenever samples are required in the Contract Documents, CONTRACTOR shall submit not less than three (3) samples of each item or material, unless indicated otherwise elsewhere.

B. Unless otherwise indicated, samples shall be submitted a minimum of 30 days prior to ordering such material.

C. Samples shall be individually and indelibly labeled or tagged, indicating thereon all specified physical characteristics and Manufacturer's name. Upon receiving acceptance of ENGINEER, one set of the samples will be stamped and dated by ENGINEER and returned to CONTRACTOR, one set of samples will be retained by ENGINEER, and one set of samples shall remain at the Site until completion of the Work.

D. Unless indicated otherwise, all colors and textures for items presented in sample submittals shall be from the manufacturer's standard colors and standard materials, products, or equipment lines. If the samples represent non-standard colors, materials, products, or equipment lines and their selection will require an increase in Contract Times or Price, CONTRACTOR shall clearly indicate same on the submittal's transmittal page.

1.7 AS-BUILT AND RECORD DRAWINGS

A. As-built drawings shall be maintained and submitted in accordance with the requirements of the Contract Documents.

B. As-built drawings shall be accessible to OWNER, CONSTRUCTION INSPECTOR, and ENGINEER at all times during the construction period.

C. Final payment will not be acted on until the as-built drawings have been prepared and delivered to OWNER in the format specified in the Contract Documents.

D. The as-built information submitted by CONTRACTOR will be incorporated by OWNER or ENGINEER into Project Record Drawings. In preparing the Project Record Drawings, OWNER and ENGINEER will assume the as-built information submitted by CONTRACTOR is correct, and CONTRACTOR shall be responsible for the accuracy of such information and for any errors or omissions which may appear on the Project Record Drawings as a result.

1.8 PRE-CONSTRUCTION AUDIO-VIDEO

A. Pre-construction video photography shall be performed and submitted in accordance with the requirements of Section 01380 – Preconstruction Audio-Video Documentation.

1.9 WARRANTIES AND GUARANTEES

A. Warranties and Guarantees shall be prepared in accordance with the requirements of the Contract Documents and submitted in accordance with Section 01300 – Contractor Submittals.

2.0 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Contractor Submittals but the cost thereof shall be included in the cost of other Contract Pay Items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- END OF SECTION 01300 -

SECTION 01311 - PROGRESS SCHEDULE

PART 1 – GENERAL

1.1 CONTENT OF SCHEDULE

A. Submit and obtain acceptance, prior to any construction activities commencing on this project, a project schedule that shows all project milestones and the general work activities required to construct the project shown in a logical sequence. The activities shall show the various dependencies and relationships between each activity, along with the beginning and ending contract dates stated in documents and the critical path of the construction of the project.

B. Schedules showing completion prior to the contract completion date will be accepted but in no event will they be considered basis for a claim for delay against OWNER by CONTRACTOR for the period between the early completion date and the completion date provided in the Contract Documents.

C. Show dates for beginning and completion of each major element of construction. Elements shall include, but not necessarily be limited to the following: submittals, mobilization, maintenance of traffic, sewer cleaning and televising assessment, pre-installation sewer cleaning and televising, CIPP installations, post-installation sewer cleaning and televising, sewer manhole lining, manhole frame and cover replacements, site restoration, submittal of as- built drawings, and an allowance for inclement weather.

D. Base the schedule on the subcontractors and suppliers schedules. CONTRACTOR is responsible for any delays incurred by them.

1.2 SCHEDULE REVISIONS

A. As a minimum, revise progress schedule every 30 calendar days to reflect changes in progress of Work for duration of the Contract. Revised schedules shall be submitted by CONTRACTOR and reviewed by CONSTRUCTION INSPECTOR prior to processing any monthly progress payment.

1.3 SHOW ADVERSE WEATHER DAYS

A. The schedule shall account for adverse weather days by the use of clearly defined calendars that account for expected seasonal weather conditions and environmental permit requirements for the planning and scheduling of activities. CONTRACTOR shall also provide the work days per week, holidays, the number of shifts per day, and the number of hours per shift. CONTRACTOR shall incorporate any seasonal restrictions to work within calendars assigned to activities.

B. Any calendars related to specific resources (i.e. a specific person or piece of equipment) shall be established as Resource Calendars, with the Calendar name clearly identifying the resource.

C. All other calendars developed by CONTRACTOR shall be established as Project Calendars.

D. It is the CONTRACTOR's responsibility to determine if additional days are warranted and to apply them to the schedule calendars.

E. CONTRACTOR shall assign the restricted calendars to relevant schedule activities that would be affected by adverse weather.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 CHANGES DUE TO ADDED/DELETED/CHANGED WORK

A. Changes to the Contract.

1. In the event a notice of a change to the contract is received, the appropriate changes to the schedules shall be made, as necessary, to incorporate the anticipated added/deleted/changed work; and CONTRACTOR shall notify CONSTRUCTION INSPECTOR in writing within ten (10) calendar days the effects of such change to the schedule.

2. Change to the Contract includes, but is not limited to, extra work, Agreed Prices, Orders on Contracts, Suspensions of Work Directed by ENGINEER or CONSTRUCTION INSPECTOR, Changed Condition, and Value Engineering Change Proposals.

3. Added, deleted and/or extra work associated with Orders On Contract shall be reflected in the next Monthly Progress Schedule Submission in anticipation of and prior to the date in which the work physically takes place without regard to the dates when the actual Order On Contract was approved. The effect of the change to the contract on the projects Critical Path shall be stated. Added, deleted, and/or extra work not identified as a Change Order, work Change Directive, or Written Amendment in a progress schedule will not constitute approval of an excusable delay by OWNER.

4. Extra work or additional work that does not affect the controlling operation on the critical path will not be considered as the basis for a time extension. All schedule activities effected by added, deleted or changed work that is included in a signed Order-On-Contract, Field Change Order, or Authorization of Extra Work (with the exception of minor quantity changes that do not impact contract milestones), or work activities performed by CONTRACTOR at risk in anticipation of such OWNER approval, shall be assigned an appropriate Activity Code (Added/Changed Work) and Code Value (sequentially numbered) to denote which "Changed Contract Work" order number correlates to those activities of work. Added, deleted, and/or extra work not identified as a Change Order, work Change Directive, or

Written Amendment in a progress schedule will not constitute approval of an excusable delay by OWNER.

3.2 RECOVERY SCHEDULE

A. If the latest completion time for any work on the current project schedule results in an activity being delayed ten percent or more of the time beyond the required Contract duration or any specified Milestone duration, as adjusted if appropriate, ENGINEER or CONSTRUCTION INSPECTOR may require CONTRACTOR to submit a Recovery Schedule and written description of the plan to recover all lost time and maintain the required Completion Date or specified Interim Milestone Date(s).

B. The Recovery Schedule shall include resource assignments that show where additional labor and/or equipment resources will be allocated. The submittal may be supplemented with a request for a Contract Time Extension. CONTRACTOR shall provide a reasonable plan for accomplishing the Work of the contract within the current completion date, or to the requested contract extension date.

3.3 FAILURE TO SUBMIT RECOVERY SCHEDULE

A. No progress payment for this item of work shall be made until the progress schedule is “accepted” or “accepted as noted” by CONSTRUCTION INSPECTOR.

B. If CONTRACTOR’s revised Progress Schedule submission does not address the written comments provided by CONSTRUCTION INSPECTOR, and does not include a written explanation with a reasonable rational for not addressing those comments, the submission shall be considered deficient.

3.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Progress Schedule but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 01311-

SECTION 01318 – MEETINGS

PART 1 – GENERAL

1.1 SCOPE

A. This Section includes the requirements related to meetings required for the project.

B. In addition to the meetings described in this Section, CONTRACTOR shall attend and participate in other meetings arranged by CONSTRUCTION INSPECTOR, ENGINEER or OWNER for other purposes, including but not limited to coordination with regulatory agencies, local authorities, utilities, and property owners.

1.2 SUMMARY

A. CONTRACTOR may be required to attend a minimum of one (1) public information meeting prior to construction. Each meeting may last up to four (4) hours and will be held in Indianapolis near the project site. During each meeting, CONTRACTOR's representatives shall be prepared to answer questions from the public and to present the construction schedule, safety program, and other project elements of interest. OWNER shall be responsible for organizing and conduction the meeting and for reserving and paying for the meeting space.

B. CONSTRUCTION INSPECTOR shall schedule and conduct a preconstruction conference in accordance with the Contract Documents.

C. CONSTRUCTION INSPECTOR shall schedule and administer regular progress meetings, quality control coordination meetings, monthly as-built drawing coordination meetings, and specially called meetings throughout the progress of Work.

D. Representatives of CONTRACTOR, Subcontractors, and Suppliers attending meetings shall be qualified and authorized to act on behalf of entity each represents.

E. If no corrections/additions are received within 7 calendar days from the distribution of the minutes, the minutes automatically become a part of the official record as presented.

1.3 PRECONSTRUCTION CONFERENCE

A. When: Within 20 days after Effective Date of Contract, but before CONTRACTOR starts work at site.

B. Location: To be selected by OWNER after contract award.

C. Attendance:

1. CONTRACTOR's Project Manager.

2. CONTRACTOR's Resident Superintendent.

3. CONTRACTOR's "hands-on" person designated by CONTRACTOR to submit Shop Drawings to CONSTRUCTION INSPECTOR.

4. Subcontractors' or suppliers' representatives CONTRACTOR may desire to invite or CONSTRUCTION INSPECTOR may request.

5. ENGINEER's representatives.

6. OWNER's representatives.

7. Local utility representatives.

D. Suggested agenda includes, but is not limited to the following:

1. Project Safety.

2. Critical Contract dates.

3. Presentation of preliminary progress schedule and preliminary schedule of Shop Drawings and sample submissions.

4. Check of required bonds and insurance policies.

5. Liquidated damages.

6. Procedures for handling submittals such as substitutions and Shop Drawings.

7. Direction of correspondence, and coordinating responsibility.

8. Weekly/Bi-Weekly/Monthly progress meetings.

9. Equal opportunity requirements.

10. Laboratory and field testing requirements.

11. Provisions for inventory of material stored on-site or off-site if off-site storage is authorized.

12. Schedule of values, application for progress payment, and progress payment procedures.

13. Change Order procedures.

14. CONTRACTOR's proposed Erosion Control Plan.

1.4 QUALITY CONTROL (QC) COORDINATION MEETING

A. When: After Preconstruction Conference, before start of work, and prior to acceptance by ENGINEER of CONTRACTOR’s QC plan.

B. Location: To be selected by CONSTRUCTION INSPECTOR.

C. Attendance:

1. CONTRACTOR's Project Manager.

2. ENGINEER's representatives.

3. OWNER's representatives.

D. Suggested agenda includes, but is not limited to the following:

1. CONTRACTOR’s proposed QC system procedures, including the forms that will be used to record QC operations, control activities, testing, and administration of the system for both on-site and off-site work.

2. Discussion of the interrelationship between CONTRACTOR’s management and control and OWNER’s control specifications.

1.5 WEEKLY/BI-WEEKLY/MONTHLY PROGRESS MEETINGS

A. Schedule: weekly/bi-weekly/monthly.

B. Location: To be selected by OWNER and/or CONSTRUCTION INSPECTOR.

C. Attendance:

1. CONTRACTOR's Project Manager.

2. CONTRACTOR's Resident Superintendent.

3. ENGINEER's representatives (as-needed).

4. OWNER's representatives.

5. Affected Subcontractors, if requested.

6. Local utility representatives, if applicable.

D. Suggested Agenda:

1. Review minutes of previous meeting.

2. Review Work progress since previous meeting.

3. Project safety concerns.

4. Field observations, problems, conflicts.

5. Problems impeding Construction Schedule.

6. Review of off-site fabrication, delivery schedules.

7. Corrective measures and procedures to regain conformance with projected Construction Progress Schedule.

8. Revisions to Construction Progress Schedule.

9. Issues raised by OWNER, CONSTRUCTION INSPECTOR, and/or ENGINEER.

10. Progress and schedule for succeeding work period.

11. Coordination of schedules.

12. Review and update submittal schedules.

13. Maintenance of quality standards.

14. Pending changes and substitutions.

15. Review proposed changes for:

    a. Effect on Construction Progress Schedule and completion date.

    b. Effect on other contracts.

16. Other business.

E. At least once a month, the agenda for this meeting shall include a review of progress on the development of as-built drawings to ensure that information is being recorded correctly.

F. Agenda containing specific subjects to be discussed shall be provided to each attendee at least one (1) work day before the meeting.

1.6 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Meetings but the cost thereof shall be included in the cost of other Contract Pay Items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- END OF SECTION 01318 -

SECTION 01320 - CONSTRUCTION PROGRESS DOCUMENTATION

PART 1 – GENERAL

1.1 DESCRIPTION

A. Project Record Documents are the records that demonstrate the actions of CONTRACTOR throughout the construction and verification/testing of the project. These documents include, but are not limited to: correspondence, transmittals, submittals, Requests for Interpretation (RFIs) and responses thereto, certifications, insurance documents, training records, meeting minutes, test results, audit reports and associated documents, change documents, records of cost reimbursable work, permits and documents associated with the monitoring of those permits, documentation required for hazardous materials management, tracking logs, project record documents, operations and maintenance manuals and related documents, operator and technician training records, operations and maintenance records, and service bulletins.

B. Construction progress documentation includes:

1. CONTRACTOR's Daily Field Reports
2. Requests for Interpretation (RFIs)
3. Construction Photographs
4. Permit Documentation
5. Document Control and Tracking

C. In addition to normal business records, progress documentation requirements shall include documenting any existing environmental conditions, transportation coordination, and emergency services.

1.2 CONTRACTOR'S DAILY FIELD REPORTS

A. Submit one (1) copy of CONTRACTOR's Daily Field Report to CONSTRUCTION INSPECTOR within one (1) working day from the date work was performed. The Daily Field Report will include:

1. Contract name and number, Name of Contractor, Name, signature, and title of employee completing the report
2. Report number - number each report sequentially
3. Weather conditions
4. Date work was performed
5 Construction schedule activity number

6. Activity description

7. Current problems and constraints

8. Potential problems and delays

9. Requests for Interpretation (RFI)

10. Site Visitations to include purpose of visit

11. Daily manpower including Subcontractors: identify office, supervisory, craft personnel and schedule activity number

12. Major construction equipment used in performing work, and construction equipment idle for the day

13. Remarks, Instructions from ENGINEER, CONSTRUCTION INSPECTOR, etc.

1.3 REQUESTS FOR INTERPRETATION (RFIs)

A. Procedure: Immediately on discovery of the need for interpretation of the Contract Documents, and if not possible to request interpretation at any project meeting, prepare and submit an RFI to CONSTRUCTION INSPECTOR using a format approved by CONSTRUCTION INSPECTOR.

1. RFIs shall originate with CONTRACTOR. RFIs submitted by entities other than CONTRACTOR will be returned with no response.

2. Coordinate and submit RFIs in a prompt manner so as to avoid delays in CONTRACTOR's work or work of subcontractors.

B. Content of the RFI: Include a detailed, legible description of item needing interpretation, and the following:

1. Project name.

2. Date.

3. Name of CONTRACTOR.

4. Name of ENGINEER and CONSTRUCTION INSPECTOR.

5. RFI number, numbered sequentially.

6. Specification Section number and title and related paragraphs, as appropriate.

7. Drawing number and detail references, as appropriate.

8. Field dimensions and conditions, as appropriate.

9. CONTRACTOR's suggested solution(s). If CONTRACTOR's solution(s) impact the Contract Time or the Contract Price, CONTRACTOR shall state impact in the RFI.

10. CONTRACTOR's signature.

11. Attachments: Include drawings, descriptions, measurements, photos, Product Data, Shop Drawings, and other information necessary to fully describe items needing interpretation.

    a. Supplementary drawings prepared by CONTRACTOR shall include dimensions, thicknesses, structural grid references, and details of affected materials, assemblies, and attachments.

C. CONSTRUCTION INSPECTOR and/or ENGINEER's Action: CONSTRUCTION INSPECTOR will review each RFI and determine action required. Allow seven (7) working days for CONSTRUCTION INSPECTOR or ENGINEER's response for each RFI. RFIs received after 1:00 PM will be considered as having been received the following working day.

1. The following RFIs will be returned without action:

    a. Requests for approval of submittals.

    b. Requests for approval of substitutions.

    c. Requests for coordination information already indicated in the Contract Documents.

    d. Requests for adjustments in Contract Time or Contract Price.

    e. Requests for interpretation of ENGINEER's actions on submittals.

    f. Incomplete RFIs or RFIs with numerous errors.

2. CONSTRUCTION INSPECTOR and/or ENGINEER's action may include a request for additional information, in which case the time for response will start again.

3. If CONTRACTOR believes CONSTRUCTION INSPECTOR or ENGINEER's RFI response warrants a change in Contract Time or Contract Price, CONTRACTOR shall notify CONSTRUCTION INSPECTOR within seven (7) days of receipt of RFI response.

4. On receipt of CONSTRUCTION INSPECTOR or ENGINEER's action, CONTRACTOR shall update the RFI log and immediately distribute the RFI response to affected parties. CONTRACTOR shall review response and notify CONSTRUCTION INSPECTOR within seven (7) days if CONTRACTOR disagrees with response.

5. RFI Log: CONTRACTOR shall prepare, maintain, and submit a tabular log of RFIs organized by the RFI number. Submit log on a monthly basis. Include the following:

   a. Project name.

   b. Date the RFI was submitted.

   c. Name and address of CONTRACTOR.

   d. Name and address of CONSTRUCTION INSPECTOR.

   e. RFI number, numbered sequentially.

   f. RFI description.

   g. Date CONSTRUCTION INSPECTOR or ENGINEER's response was received.

   h. Identification of CONSTRUCTION INSPECTOR or ENGINEER's response, interpretation, and any resulting amendments or supplements to the Contract Documents, as appropriate.

1.4 CONSTRUCTION PHOTOGRAPHS

A. CONTRACTOR shall, as a part of the Work of this Contract, furnish construction photographs of each sewer replaced or structure rehabilitated to show the progress of the Work. Photographs are to be taken of the rehabilitation components of the structure. All interior photographs of the manholes shall always have north facing up in the photograph.

B. A minimum of one (1) construction photograph shall be taken of each manhole and one (1) of each open-cut lateral connection to a sanitary sewer main. Photographs shall be taken with a digital camera with a resolution of at least ten (10) megapixels. Photographs shall be submitted with the monthly estimate for progress payment for each manhole that is rehabilitated. The photographs shall be submitted electronically on a CD or thumb drive; each photograph shall be named based upon the manhole number (i.e. "MH510430 – 1" for the first photograph); the pictures shall be in .jpeg format; the CD shall be labeled with the project's name, project number, and month and year submitted.

1.5 PERMIT DOCUMENTATION

A. Maintain at the Project Site all permit drawings and permits in a manner accessible for inspection by ENGINEER or CONSTRUCTION INSPECTOR.

1.6 DOCUMENT TRACKING

A. All correspondence shall include the Project Name and Contract number along with the specific subject of the letter. When replying to a specific letter, the letter or transmittal shall be referenced by serial number, date, and subject. Where a submittal is referenced, the applicable specification section number shall also be referenced. All correspondence shall be serialized and separated into incoming and outgoing correspondence logs.

B. Maintain a computerized document control system to monitor the generation, status, and filing of documents. Documents such as Change Orders (proposed and approved), Request for Proposals, Request for Information, Design Clarifications, Meeting Minutes, Applications for Payment, reports and transmittal letters shall be controlled using the computerized system. The control system must be totally integrated so that the generation of documents automatically prepares a log with the document recorded.

C. Maintain one copy of each submittal at the Project Site at all times throughout the construction period as Project Record Documents. Incorporate all changes or corrections as soon as possible. Maintain Project Record Documents in good order in a clean, dry, legible condition at the Project Site apart from the Contract Documents. Provide access to the Project Record Documents to ENGINEER, CONSTRUCTION INSPECTOR, and OWNER during normal working hours.

1.7 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Construction Progress Documentation but the cost thereof shall be included in the cost of other Contract Pay Items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- END OF SECTION 01320 -

SECTION 01380 - PRECONSTRUCTION AUDIO-VIDEO DOCUMENTATION

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes, but is not limited to, Preconstruction Audio-Video Documentation consisting of high definition color video recording, with audio description, of surface features along the entire line of the project and including all work, easement, and storage areas and all access roadways, and, prior to audio-video recording, visual investigation of all areas to be inventoried with notations made to items not readily visible by recording methods including, but not limited to, size, type and condition of driveway culverts, headwalls, etc. Audio-video recording shall be done prior to commencement of the construction or delivery of any equipment, materials, or supplies to the site of Work.

B. The purpose of the high definition color audio-video recording of the project is to provide the necessary information for restoration of surface features after completion of the project. This recording must, therefore, cover the project area in its entirety to assist in returning those areas affected by construction to their original condition with as little controversy as possible. Video recording shall be performed no more than 14 days prior to Notice to Proceed, and any areas recorded more than 14 days prior to the Notice to Proceed shall be redone at no additional cost to OWNER.

1.2 OWNERSHIP OF RECORDINGS

A. All recordings produced will become the permanent property of OWNER. The CONTRACTOR shall deliver four (4) copies of all video recordings to CONSTRUCTION INSPECTOR for review by ENGINEER at least 30 days prior to the start of any construction.

B. Any portion of the recorded coverage deemed unacceptable by ENGINEER must be re-recorded by CONTRACTOR at no additional cost to OWNER.

PART 2 – PRODUCTS

2.1 ELECTRONIC REQUIREMENTS

A. Audio-video recording shall be DVD NTSC format.

PART 3 - EXECUTION

3.1 COVERAGE OF RECORDING

A. The area to be recorded shall include, but not be limited to, all existing driveways, sidewalks, curbs, ditches, streets, landscaping, trees, culverts, catch basins, headwalls, retaining walls, fences, visible utilities, and all buildings located within the zone of influence of construction. Of particular concern are any existing faults, fractures, defects, or other imperfections exhibited by the above mentioned surface

features. Audio description shall be made simultaneously with and support the video coverage.

1. Streets: All streets adjacent to excavation/rehabilitation sites shall be recorded for the full width of the public right-of-way.

2. Easement Areas: Easement areas shall be recorded for the full width of the perpetual and temporary easements and all other adjacent areas lying within 100 feet of the easement.

3. Building Exteriors: CONTRACTOR shall furnish color audio and video of all exterior surfaces of buildings specifically identified by ENGINEER to receive such coverage. At a minimum, any structure or building shall be recorded if located above or within 60 feet of the pipeline and within any permanent or temporary easement. Buildings so identified may include houses, apartments, factories, warehouses, retail stores and other structures. Exterior building coverage shall include, but not be limited to, walls, visible foundations, chimney, porches, and trim.

4. Bridges and those areas adjacent to and within 100 feet of any bridges appearing on the Contract Drawings shall be audio-video recorded. Exterior bridge supports, structural members, visible footings, side walls, underside, and deck shall receive especial although not exclusive attention. Existing cracks, faults, fractures, defects or other imperfections shall be of particular concern.

3.2 LOCATION INFORMATION

A. All DVD disks shall be properly identified by disk number, location, date and project name in a manner acceptable to CONSTRUCTION INSPECTOR.

B. A record of the contents of each disk shall be supplied on a run sheet identifying each segment in the disk by location, i.e., street or easement viewing side, traveling direction, sewer segment manhole numbers, and all referenced by disk indexing.

C. A brief report and inventory of all disks completed, referenced by location and disk number, shall be furnished to CONSTRUCTION INSPECTOR upon completion of the work and delivery of the disks.

D. All video recordings shall begin with the date and time of recording, the project name, the sheet numbers or sewer segment manhole numbers as shown on the Contract Drawings, the name of the street, easement or building being recorded, the direction of travel, and the viewing side.

E. Houses and buildings shall be identified visually by house or building number, when possible, in such a manner that the progress of the recording and the proposed system may be located by reference to the houses and buildings.

F. Local landmarks on the route or other recognizable features off to the side of the sewer route shall be visually and audibly noted at frequent intervals to identify the camera location.

G. All disks are to be accompanied by a log identifying areas covered by the audio-video recording.

3.3 ENTERING PROPERTY

A. If it becomes necessary to enter onto private property, CONTRACTOR shall notify the owner of such property at least 48 hours in advance of the planned entry to obtain their permission to do so. Should the owner of the property refuse to give their permission for said entry, CONTRACTOR shall notify CONSTRUCTION INSPECTOR. CONTRACTOR is advised that it shall not enter any private property before permission is granted to do so or CONSTRUCTION INSPECTOR notifies CONTRACTOR in writing that the legal right to enter the property has been obtained. CONTRACTOR shall be held liable for entry made other than stated above. CONTRACTOR shall, at its own expense, repair or restore any areas damaged during the work of this Section.

3.4 SITE RECORDING CONDITIONS

A. All recording shall be done during times of good visibility. No outside recording shall be done during periods of visible precipitation or when the ground area is covered with snow, leaves, or debris unless otherwise authorized in writing by CONSTRUCTION INSPECTOR.

B. In order to produce the proper detail and perspective, adequate auxiliary lighting will be required to fill in shadow areas caused by trees, utility poles, road signs and other such objects, as well as other conditions requiring artificial illumination.

C. The average rate of speed in the general direction of travel of the conveyance used during recording shall not exceed 48 feet per minute. Panning rates and zoom-in zoom-out rates shall be controlled sufficiently such that playback will produce adequate clarity of the objects being viewed.

D. When conventional wheeled vehicles are used as conveyances for the recording, the distance from the camera lens to the ground shall not be less than 8 feet to insure proper perspective. In instances where coverage will be required in areas not accessible to conventional wheeled vehicles, such coverage shall be obtained by walking or by special conveyance approved by CONSTRUCTION INSPECTOR, but with the same requirements for disk quality and content as specified herein except as may be specifically exempted by CONSTRUCTION INSPECTOR in writing.

3.5 MEASUREMENT AND PAYMENT

A. Payment for Preconstruction Audio-Video Documentation shall be made in accordance with Section 01025- Measurement and Payment.

- END OF SECTION 01380 -

SECTION 01400 – QUALITY CONTROL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Specific quality control requirements for the Work are indicated throughout the Contract Documents. The requirements of this Section are primarily related to performance of the Work beyond furnishing of manufactured products. The term "Quality Control" includes inspection, sampling and testing, and associated requirements.

B. Manage quality in all phases of the Project including activities of subcontractors and suppliers to achieve an end product in compliance with the Contract Documents.

1.2 INSPECTION SERVICES

A. OWNER's Access: At all times during the progress of the Work and until the date of final completion, afford OWNER and CONSTRUCTION INSPECTOR every reasonable, safe, and proper facility for inspecting the Work at the site. The observation and inspection of any Work will not relieve CONTRACTOR of any obligations to perform proper and satisfactory work as specified. Replace Work rejected due to faulty design, inferior or defective materials, poor workmanship, improper installation, excessive wear, or nonconformity with the requirements of the Contract Documents, with satisfactory Work at no additional cost to OWNER. Replace as directed, finished or unfinished Work found not to be in strict accordance with the Contract, even though such Work may have been previously approved and payment made thereof.

B. Rejection: OWNER and CONSTRUCTION INSPECTOR have the right to reject materials and workmanship which are defective or require correction. Promptly remove rejected Work and materials from the site.

C. Inferior Work Discoveries: Failure or neglect on the part of OWNER or CONSTRUCTION INSPECTOR to condemn or reject bad or inferior work or materials does not imply an acceptance of such Work or materials. Neither is it to be construed as barring OWNER or CONSTRUCTION INSPECTOR at any subsequent time from recovering damages or a sum of money needed to build anew all portions of the Work in which inferior work or improper materials were used.

D. Removal for Examination: Should it be considered necessary or advisable by OWNER or CONSTRUCTION INSPECTOR, at any time before final acceptance of the Work, to make examinations of portions of the Work already completed, by removing or tearing out such portions, promptly furnish all necessary facilities, labor, and material, to make such an examination. If such Work is found to be defective in any respect, defray all expenses of such examination and of satisfactory reconstruction. If, however, such Work is found to meet the requirements of the Contract, the cost of examination and restoration of the Work will be considered a change in the Work to be paid for in accordance with applicable provisions of the Contract.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 INSTALLATION

A. Inspection: CONTRACTOR shall inspect materials or equipment upon their arrival on the Site and immediately prior to installation, and shall reject damaged or defective items. Nonconforming material, parts, components, equipment, and supplies, as practicable, shall be identified to preclude inadvertent use.

B. Traceability: Assure that all material, parts, components, equipment, and supplies to be utilized are identified and traceable, including traceability for multiple similar items from several sources, to documentation that substantiates compliance with Contract Document requirements.

C. Measurements: CONTRACTOR shall verify measurements and dimensions of the Work as an integral step of starting each installation.

D. Manufacturer's Instructions: Where installations include manufactured products, CONTRACTOR shall comply with manufacturer's applicable instructions and recommendations for installation, to whatever extent these are more explicit or more stringent than applicable requirements indicated in the Contract Documents.

3.2 INSPECTION AT PLACE OF MANUFACTURE

A. Unless otherwise indicated, all products, materials, and equipment shall be subject to inspection by OWNER at the place of manufacture.

B. The presence of OWNER or OWNER's representative at the place of manufacture shall not relieve CONTRACTOR of the responsibility for providing products, materials, and equipment that comply with all requirements of the Contract Documents. Compliance is a duty of CONTRACTOR, and said duty shall not be avoided by any act or omission on the part of OWNER, CONSTRUCTION INSPECTOR, or ENGINEER.

C. If work done away from the construction site is to be inspected on behalf of OWNER during its fabrication, manufacture, testing, or before shipment, CONTRACTOR shall give notice to CONSTRUCTION INSPECTOR of the place and time where such fabrication, manufacture, testing, or shipping is to be done. Such notice shall be in writing and delivered to CONSTRUCTION INSPECTOR 14 days in advance so that the necessary arrangements for the inspection can be made.

3.3 SAMPLING AND TESTING

A. Unless otherwise indicated, all sampling and testing will be in accordance with the methods prescribed in the current standards of the ASTM, as applicable to the class and nature of the article or materials considered; however, OWNER reserves the right to use or require any generally-accepted system of sampling and testing which, in the opinion of ENGINEER, will assure OWNER that the quality of the workmanship is in full accord with the Contract Documents.

B. Any waiver by OWNER of any specific testing or other quality assurance measures, whether or not such waiver is accompanied by a guarantee of substantial performance as a relief from the testing or other quality assurance requirements originally indicated, and whether or not such guarantee is accompanied by a performance bond to assure execution of any necessary corrective or remedial work, shall not be construed as a waiver of any requirements of the Contract Documents.

C. Notwithstanding the existence of such waiver, OWNER reserves the right to make independent investigations and tests, and failure of any portion of the Work to meet any of the requirements of the Contract Documents shall be reasonable cause for OWNER to require the removal or correction and reconstruction of any such work in accordance with the Contract Documents.

3.4 INSPECTION AND TESTING SERVICE

A. Inspection and testing laboratory service employed by CONTRACTOR shall comply with the following:

1. CONTRACTOR shall appoint, employ, and pay for services of an independent testing agency/laboratory approved by OWNER to perform sampling and testing.

2. OWNER or independent firm will perform inspections and other services as required by ENGINEER under Paragraph 3.3.C above.

3. Reports of testing, regardless of whether the testing was OWNER's or CONTRACTOR's responsibility, will be submitted to CONSTRUCTION INSPECTOR indicating observations and results of tests and indicating compliance or non-compliance with the Contract Documents.

4. CONTRACTOR shall cooperate with OWNER or independent firm and furnish samples of materials, design mixes, equipment, tools, storage, and assistance as requested.

5. CONTRACTOR shall notify CONSTRUCTION INSPECTOR 24 hours prior to the expected time for operations.

6. Re-testing required because of non-conformance to requirements shall be performed by the same independent firm on instructions from CONSTRUCTION INSPECTOR. CONTRACTOR shall bear all costs from such re-testing.

7. For samples and test required by CONTRACTOR's use, CONTRACTOR shall utilize the services of the same independent firm noted in 3.4.A.1 above. The cost of sampling and testing for CONTRACTOR's use shall be CONTRACTOR's responsibility.

3.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Quality Control but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 01400 -

SECTION 01530 – PROTECTION OF EXISTING FACILITIES

PART 1 – GENERAL

1.1 GENERAL

A. CONTRACTOR shall protect all existing utilities and improvements not designated for removal and shall restore damaged or temporarily relocated utilities and improvements to a condition equal to or better than prior to such damage or temporary relocation, all in accordance with the Contract Documents.

1.2 RIGHTS-OF-WAY

A. CONTRACTOR shall not perform any work that may damage or otherwise impact pipelines, including but not limited to oil, gas, sewer, or water; cables, including but not limited to telephone, fiber optic, or electric transmission; fences; or any other utility or structure.

B. After authority has been obtained, CONTRACTOR shall give said party due notice of its intention to begin work, if required by said party, and shall remove, shore, support, or otherwise protect any pipeline, conduit, or structure that may be impacted by the Work.

1.3 PROTECTION OF STREET OR ROADWAY MARKERS

A. CONTRACTOR shall not destroy, remove, or otherwise disturb any existing survey markers or other existing street or roadway markers without proper authorization as approved by CONSTRUCTION INSPECTOR. No pavement breaking operations or excavation activities shall be started until CONTRACTOR completes a survey of all permanent marker points that may be disturbed by the construction operations. Survey markers or points disturbed by CONTRACTOR shall be accurately restored to the satisfaction of CONSTRUCTION INSPECTOR after street or roadway resurfacing has been completed.

1.4 RESTORATION OF PAVEMENT

A. **General**: A minimum of one travel lane of all paved areas cut or damaged during construction shall be replaced with similar materials of equal thickness to match the existing adjacent undisturbed areas, except where specific resurfacing requirements have been called for in the Contract Documents. The pavement restoration requirement to match existing sections shall apply to all components of existing sections, including sub-base, base, and pavement. Pavements which are subject to partial removal shall be neatly saw cut in straight lines.

B. **Temporary Resurfacing**: Wherever required by the Contract Documents, CONTRACTOR shall place temporary surfacing promptly after backfilling and shall maintain such surfacing for the period of time noted in the Contract Documents before proceeding with the final restoration of improvements.

C. **Permanent Resurfacing**: In order to obtain a satisfactory junction with adjacent surfaces, CONTRACTOR shall saw cut back and trim the edge so as to provide a clean, sound, vertical joint before permanent replacement of an excavated or damaged portion of pavement. Damaged edges of pavement along excavations and elsewhere shall be trimmed back by saw cutting in straight lines. All pavement restoration and other facilities restoration shall be constructed to finish grades compatible with adjacent undisturbed pavement.

D. **Restoration of Sidewalks or Private Driveways**: Whenever sidewalks or private roads have been removed for purposes of construction, CONTRACTOR shall place suitable temporary sidewalks or roadways promptly after backfilling, and shall maintain them in a satisfactory condition for the period of time noted in the Contract Documents. If no such time is so fixed, CONTRACTOR shall maintain said temporary sidewalks or roadways until the final restoration thereof has been made.

1.5 EXISTING UTILITIES AND IMPROVEMENTS

A. CONTRACTOR shall protect underground utilities and other improvements which may be impaired during construction operations, regardless of whether or not the utilities are indicated on the Contract Drawings. CONTRACTOR shall take all possible precautions for the protection of unforeseen utility lines to provide for uninterrupted service and to provide such special protection as may be necessary.

B. Coordination with any applicable utility or utilities shall be the sole responsibility of CONTRACTOR. CONTRACTOR shall be responsible for the availability and accuracy of information relating to the utilities.

C. For sewer construction within the public right-of-way, permanent easement, or temporary easement, CONTRACTOR shall coordinate with affected utilities to protect, relocate, shore, or replace existing utilities.

D. Citizens Energy Group may choose to protect its own facilities.

E. Field tile, storm drains, and culverts encountered and affected by the scope of Work specified within the Contract Documents shall be given a positive outlet. Any field tile, storm drains, or culverts damaged due to CONTRACTOR's operations shall be replaced by CONTRACTOR at its own expense.

F. **Right of Access**: The right is reserved to OWNER, ENGINEER, and to the owners of public utilities and franchises to enter at any time upon any public street, alley, right-of-way, or easement for the purpose of making changes in their property made necessary by the Work of this Contract.

G. **Underground Utilities Not Indicated:** In the event that CONTRACTOR damages existing utility lines that are not indicated or the locations of which are not made

known to CONTRACTOR prior to excavation, a verbal report of such damage shall be made immediately to CONSTRUCTION INSPECTOR and a written report thereof shall be made promptly thereafter. CONSTRUCTION INSPECTOR will immediately notify the owner of the damaged utility. If CONSTRUCTION INSPECTOR is not immediately available, CONTRACTOR shall notify the utility owner of the damage. If directed by CONSTRUCTION INSPECTOR, repairs shall be made by CONTRACTOR under the provisions for changes and extra work contained in the Contract Documents.

H. **Approval of Repairs:** All repairs to a damaged utility or improvement are subject to inspection and approval by an authorized representative of the utility or improvement owner before being concealed by backfill or other work.

I. **Maintaining in Service:** Unless indicated otherwise, oil and gasoline pipelines, power, and telephone or communication ducts, gas and water mains, irrigation lines, sewer lines, storm drain lines, poles, and overhead power and communication wires and cables encountered along the line of the Work shall remain continuously in service during all the operations under this Contract, unless other arrangements satisfactory to OWNER are made with the owner of said pipelines, ducts, main, irrigation line, sewer, storm drain, pole, wire, or cable. CONTRACTOR shall be responsible for and shall repair all damage due to its operations, and the provisions of this Section shall not be abated even in the event such damage occurs after backfilling or is not discovered until after the completion of backfilling and compaction.

1. CONTRACTOR's attention is directed to the fact that during the time period defined in the contract, no existing sewer system interruption can be accommodated without written approval from OWNER. Bypass pumping will be necessary to complete portions of the Contract Work.

1.6 TREES OR SHRUBS WITHIN STREET RIGHTS-OF-WAY AND PROJECT LIMITS

A. **General:** Except where trees or shrubs are indicated to be removed, CONTRACTOR shall exercise all necessary precautions so as not to damage or destroy any trees or shrubs, including those lying within street rights-of-way and Project limits, and shall not trim or remove any trees unless such trees have been approved for trimming or removal by OWNER. Existing trees and shrubs which are damaged during construction shall be trimmed or replaced by CONTRACTOR or a certified tree company under permit from OWNER. Contractor shall obtain a Flora permit from the City of Indianapolis' Department of Parks and Recreation for any work related to trees, including tree roots.

B. **Trimming:** Symmetry of the tree shall be preserved; no stubs or splits or torn branches left; clean cuts shall be made close to the trunk or large branch. Spikes shall not be used for climbing live trees. Cuts over 1 ½ inches in diameter shall be coated with a tree paint product that is waterproof, adhesive, and elastic, and free from kerosene's, coal tar, creosote, or other material injurious to the life of the tree.

C. **Replacement:** CONTRACTOR shall immediately notify CONSTRUCTION INSPECTOR if any tree or shrub is damaged by CONTRACTOR's operations. If, in the opinion of CONSTRUCTION INSPECTOR, the damage is such that

replacement is necessary, CONTRACTOR shall replace the tree or shrub at its own expense. The tree or shrub shall be of a like size and variety as the one damaged, or, if of a smaller size, CONTRACTOR shall pay to the owner of said tree or shrub a compensatory payment acceptable to the owner of said tree or shrub, subject to the approval of CONSTRUCTION INSPECTOR. Planting of replacement trees and shrubs shall be in accordance with Section 02900. Unless otherwise indicated, CONTRACTOR shall water and maintain the replacement trees and shrubs for 6 months after planting.

1.7 LAWN AREAS

A. Lawn or landscaped areas damaged during construction shall be repaired to match the preconstruction condition to the satisfaction of the land owner and CONSTRUCTION INSPECTOR.

1.8 MAILBOXES

A. If mailboxes need to be temporarily removed, CONTRACTOR shall obtain approval of mailbox owner before relocating any mailbox. CONTRACTOR shall coordinate the removal of the mailboxes with the local post office to ensure mail delivery can be continued. The mailboxes shall be reset as soon as possible following construction in the area. CONTRACTOR shall reinstall mailboxes in accordance with the requirements of INDOT Standard Specification Section 611.

1.9 FENCES

A. Existing Fences: Obtain written permission from the property owner prior to relocating or dismantling fences which interfere with construction operations. Reach agreements with the fence owner as to the period the fence may be left relocated or dismantled. Install adequate gates where fencing must be maintained. Keep gates closed and locked at all times when not in use.

B. Restoration: Restore all fences to their original or better condition and to their original location on completion of the Work. If replacing fence, provide materials that match the existing fence style, height, and post spacing.

1.10 PRESERVATION OF PROPERTY

A. Preserve from damage, all property along the line of the Work, in the vicinity of or in any way affected by the Work, the removal or destruction of which is not called for by the Drawings. Preserve from damage, public utilities, trees, lawn areas, building monuments, fences, mailboxes, driveways, pipe and underground structures, and public streets. Note: Normal wear and tear of streets resulting from legitimate use by CONTRACTOR is not considered damage. Whenever damages occur to such property, immediately restore to its original condition.

B. In case of failure on the part of CONTRACTOR to restore property or make good on damage or injury, OWNER may, upon 24 hours written notice, proceed to repair, rebuild, or otherwise restore such property as may be deemed necessary, and the

cost thereof will be deducted from any moneys due or which become due to CONTRACTOR under this Contract. If removal, repair, or replacement of public or private property is made necessary by alteration of grade or alignment authorized by OWNER and not contemplated by the Contract Documents, CONTRACTOR will be compensated, in accordance with the Contract Documents, provided that such property has not been damaged through fault of CONTRACTOR or CONTRACTOR's employees.

1.11 NOTIFICATION BY CONTRACTOR

A. Prior to any excavation in the vicinity of any existing underground facilities, CONTRACTOR shall notify the respective authorities representing the owners or agencies responsible for such facilities not less than three (3) days nor more than seven (7) days prior to excavation so that a representative of the said owners can be present during such work if they so desire. At least two (2) days prior to the start of any excavation, CONTRACTOR shall also contact Indiana 811.

B. CONTRACTOR shall notify the residents and businesses of a street and in an easement on which sewer construction is to take place at least one (1) week in advance of said construction. CONTRACTOR shall distribute leaflets or door hangers to each resident on the street, and such notification shall indicate the approximate date and nature of construction in the area.

1.12 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Protection of Existing Facilities but the cost thereof shall be included in the cost of other Contract Pay Items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- END OF SECTION 01530 -

SECTION 01531 – INGRESS/EGRESS ACCESS

PART 1 – GENERAL

1.1 SCOPE

A. CONTRACTOR shall limit all construction activities to remain within public right-of-way and/or sanitary or combined sewer easements. This shall include ingress/egress access to all sanitary or combined sewer pipe and structures identified to be rehabilitated.

B. If a sanitary or combined sewer easement or public right-of-way is not shown on the Contract Drawings, CONTRACTOR shall notify OWNER to coordinate work.

1.2 ACCESS CONSTRAINTS

A. CONTRACTOR is responsible to coordinate with any property owner that has an obstruction restricting and/or preventing access to a sanitary or combined sewer pipe and/or structure. These obstructions may include, but are not limited to: fences, storage sheds, trees, landscaping, and animals.

B. CONTRACTOR shall reach an agreement with the property owner to access the sanitary or combined sewer pipe and/or structure. Access may be obtained through either removing the obstruction within the easement or an agreed upon alternative route.

C. The owner's property shall be returned to equal or better condition once the Work is complete. This shall include complete restoration of the disturbed property, including but not limited to: fence repair and/or fence replacement, irrigation system repairs, and landscaping restoration.

D. The cost of all access coordination, including removing any obstructions and complete restoration, shall be included in the unit price bid for the sanitary or combined sewer pipe and manhole rehabilitation items. No additional compensation will be provided for property owner coordination and restoration.

1.3 RIGHT-OF-ENTRY AGREEMENT

A. If CONTRACTOR elects to access a sanitary or combined sewer pipe and/or manhole by a different route than following the sanitary or combined sewer alignment and/or easement, CONTRACTOR shall provide a written agreement between the property owner and CONTRACTOR clearly identifying the alternative route of access to the pipe and/or manhole. Said agreement shall be signed by both parties and provided to CONSTRUCTION INSPECTOR and OWNER prior to commencing any Work on the pipe and/or manhole located within this property.

B. The Right-of-Entry Agreement shall alleviate OWNER of any responsibility and claims to damaged land and/or property from CONTRACTOR's Work that extends beyond the public right-of-way and/or easement. CONTRACTOR shall assume this responsibility, as clearly indicated within this Right-of-Entry Agreement.

1.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Ingress and Egress Access but the cost thereof shall be included in the cost of other Contract Pay Items.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION (NOT USED)

- END OF SECTION 01531 -

SECTION 01620 - PRODUCT DELIVERY, STORAGE AND PROTECTION

PART 1 - GENERAL

1.1 APPLICABILITY

A. This Section applies to all products furnished under this Contract. Shipments of equipment or materials to be used by CONTRACTOR or its Subcontractors shall be delivered to the site only during regular working hours. All shipping papers and shipments shall be addressed and consigned to CONTRACTOR. Under no circumstances will OWNER accept shipments directed to it or CONSTRUCTION INSPECTOR unless otherwise specified.

1.2 DELIVERY

A. Products shall not be delivered to the project site until related shop drawings have been reviewed and approved by ENGINEER and until appropriate storage facilities are in place.

B. Products shall be delivered to the site in manufacturer's original, unopened, labeled containers.

C. CONTRACTOR shall not drop, roll or skid products off delivery vehicles. Hand carry or use suitable materials handling equipment.

1.3 STORAGE AND PROTECTION

A. GENERAL

1. CONTRACTOR shall store and protect products in accordance with the manufacturer's recommendations and the requirements specified herein. No on-site existing storage facilities are available for use by CONTRACTOR. All on-site facilities for storage shall be furnished by CONTRACTOR.

2. CONTRACTOR shall not block or restrict the use of the Public Right-of-Way, access roads or private property with stored materials.

3. CONTRACTOR shall not store products where they will interfere with operations of the Owner or other contractors.

4. CONTRACTOR shall protect all products from damage or deterioration by weather.

5. CONTRACTOR shall not store any products directly on the ground.

B. UNCOVERED STORAGE: Materials not subject to deterioration or contamination by weather may be stored uncovered at the project site. Such materials may include reinforcing steel, piping, precast concrete, and castings. All such

material shall be stored on wood blocking where practical. Aggregates and sand may be stored uncovered provided that they are protected from contamination by other materials.

C. COVERED STORAGE

1. The following types of material may be stored out-of-doors if covered with material impervious to water:

a. Rough Lumber

b. Concrete masonry units

b. Equipment as specifically allowed by CONSTRUCTION INSPECTOR

2. CONTRACTOR shall tie down covers with rope and slope to prevent accumulation of water on covers. All materials shall be stored on wood blocking or pallets.

D. FULLY PROTECTED STORAGE

1. CONTRACTOR shall store all products not named above in buildings or trailers which have a concrete or wooden floor, a roof, and fully closed walls on all sides.

2. CONTRACTOR shall provide heated storage space for materials which would be damaged by freezing.

3. CONTRACTOR shall protect mechanical and electrical equipment from being contaminated by dust and dirt.

4. CONTRACTOR shall maintain temperature and humidity at levels recommended by manufacturer(s) for electrical and electronic equipment.

5. Store lubricants, fluids, and fuels in compliance with OSHA and environmental requirements in a manner acceptable to CONSTRUCTION INSPECTOR.

1.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Product Delivery Storage and Protection but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 01620 -

SECTION 01940 – SUBSTITUTIONS

PART 1 – GENERAL

1.1 SCOPE

A. This Section includes the requirements related to CONTRACTOR's responsibilities for substitutions.

1.2 EQUIVALENT MATERIALS AND EQUIPMENT

A. Whenever a material, article or method is specified or described by using the name of a proprietary product or the name of a particular manufacturer(s) or vendor(s), the specific item mentioned shall be understood as establishing the type, function, dimension, appearance, and quality desired and is to be the basis upon which bids are to be prepared. Other manufacturer's materials, articles and methods not named will be considered as substitutions provided required information is submitted in the manner set forth herein and provided substitution will not require substantial revisions of the Contract Documents.

1.3 SUBMITTAL OF PROPOSED SUBSTITUTIONS

A. In order for substitutions to be considered, CONTRACTOR shall submit to ENGINEER complete data as set forth herein to permit complete analysis of all proposed substitutions.

B. The provisions of Section 01300 – Contractor Submittals concerning review time by ENGINEER do not apply to substitution requests. ENGINEER will take such time as required to ensure full compliance with all Contract requirements.

C. A request for substitution of product may be submitted, after CONTRACTOR:

1. Has investigated the proposed product and determined that it is equal to or superior to specified product, furnishes a certification to that effect and waives all rights to additional payment or time that may subsequently become necessary due to the failure of the substituted product to perform adequately.

2. Agrees to provide the same warranties or bonds for the product substitutions as for the specified product.

3. Agrees to reimburse OWNER for reasonable charges of ENGINEER for evaluating each proposed substitute.

4. Agrees to be responsible for coordinating and paying for any necessary changes to other work required by approved substitutions or product options which CONTRACTOR selects and shall pay all such costs including the costs of the services of ENGINEER to revise the Contract Documents, if such revisions are required.

5. Waives all claims for additional costs due to substitution which may subsequently become apparent.

6. Is offering either a substantial credit to OWNER for acceptance of the substitution or appropriate justification that the product to be provided as the substitution is substantially superior in quality, performance, compatibility with adjacent products, durability, vandal-resistance or in other important ways.

D. Three (3) copies of the following data shall be submitted in order for the substitutions to be considered.

1. For products provide:

a. Identification, including manufacturer's name and address.

b. Manufacturer's literature, including but not necessarily limited to:

1) Product description, performance and test data.

2) Reference standards.

c. Samples where appropriate.

d. Point-by-point comparison to the specification in these Contract Documents to show how the proposed substitution is equal or superior to the specified item.

e. Name and address of similar projects on which product was used, and date of installation.

2. For construction methods provide:

a. Detailed description of proposed method

b. Drawings illustrating methods

c. Name and address of similar projects on which method was used, and date of use.

3. Itemized comparison of proposed substitution with product or method specified. Different types of products and methods will be considered provided final performance is at least equal to that specified. The burden of responsibly in furnishing this information is with CONTRACTOR. If incomplete or irrelevant data is submitted, the data will be returned and the request will be denied.

4. Data relating to impact on construction schedule occasioned by the proposed substitution.

5. Relation to separate contracts.

6. Proposed monetary changes supported by accurate cost data on proposed substitution in comparison with product or method specified, including costs for redesigns required. Costs for redesigns due to substituted items are the responsibility of CONTRACTOR.

E. In making request for substitution, CONTRACTOR represents:

1. It has investigated proposed product or method, and determined that it is equal or superior in all respects to that specified. It shall provide the same guarantee for substitution as for product or method specified.

2. It shall coordinate installation of accepted substitution into the work, making such design and construction changes as may be required for the work to be completed in all respects in accordance with contract requirements without additional cost to OWNER.

1.4 OWNER'S DECISION

A. OWNER in consultation with ENGINEER will determine whether or not the material or article submitted is equal to the named material or article. OWNER's decisions regarding evaluation of substitutions shall be considered final and binding. Request for time extensions and additional costs based on submission of acceptance or rejection of substitutions will not be allowed.

B. All approved substitutions will be incorporated into the Contract by Change Order.

1.5 REJECTION OF PROPOSED SUBSTITUTION

A. Substitutions will not be considered at any time if:

1. They are indicated or implied on CONTRACTOR's drawings or project data submittals without formal request submitted in accordance with this Section.

2. Acceptance will require substantial revision of Contract Documents.

3. Acceptance will create problems in stocking of repair parts and in future maintenance by OWNER.

4. ENGINEER determines that the material or article submitted is not equal to the named material or article.

5. Additional costs are incurred by OWNER.

6. A time extension is required.

1.12 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Substitutions but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 01940 -

SECTION 01980 – CLOSE-OUT PROCEDURES

PART 1 – GENERAL

1.1 SCOPE

A. This Section includes administrative and procedural requirements for contract close-out.

1.2 RELATED SECTIONS

A. Section 01300 – Contractor Submittals

1.3 SUBMITTALS

A. Releases from Agreements

1. Furnish OWNER with written releases from property owners or public agencies where side agreements or special easements have been made.

B. Final Application for Payment

1. Submit in accordance with the Contract Documents. Submittals to provide with this application include, but are not limited to, the following:

a. Schedules.

b. Guarantees.

c. Bonds.

d. Certificates of Inspection.

e. As-Built Drawings.

f. Releases or waivers of liens or claims.

g. All other documents as required by the Contract Documents.

h. Final Statement of Accounting.

j. Final XBE Utilization Form.

k. Manhole and Sewer Segment Final GIS Tracking Sheet.

1.4 MEASUREMENT AND PAYMENT

No separate payment shall be made for Close Out Procedures but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 01980 -

SECTION 02015 – UTILITY RELOCATION

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. This Section covers the work necessary for utility relocation construction, including but not limited to mobilizing and preparing the sites for the Work as specified and shown on the Contract Drawings.

B. In the event additional space is required for CONTRACTOR's operations, CONTRACTOR shall make its own arrangements and pay all costs related to the utilization of such additional space.

PART 2 – PRODUCTS

2.1 MATERIALS

A. Materials shall be selected by CONTRACTOR to meet the provisions of this Section.

B. Security Fence

1. Temporary security fence may, at CONTRACTOR's option and expense, be constructed for the protection of its work, materials, tools, and equipment.

C. Utilities to be Relocated: See UTILITY RELOCATION SCHEDULE in Part 3.2 for detailed instructions.

1. Materials and labor for sanitary and storm sewer relocations shall be provided by CONTRACTOR; materials to match existing, unless otherwise instructed by OWNER.

2. Materials and labor for water main relocation to be provided by Citizens Water.

3. Materials and labor for gas main relocation to be provided by Citizens Gas.

4. Materials and labor for telephone and cable relocation to be provided by AT&T of Indiana and Comcast Cable Vision, respectively.

5. Materials and labor for overhead and underground power lines to be provided by Indianapolis Power and Light (IPL).

PART 3 – EXECUTION

3.1 WORKMANSHIP

A. Facilities Set Up

1. Set up construction facilities in a neat and orderly manner within designated area(s), as approved. Accomplish all required work in accordance with applicable portions of these Specifications, or as approved. Confine operations to the approved work area.

3.2 UTILITY RELOCATION

A. Utility relocations required for construction shall be coordinated and scheduled through the respective utility companies by CONTRACTOR. CONTRACTOR shall be responsible for identifying, verifying, locating, and relocating, when applicable, all existing utilities.

1. Gas line relocation: Citizens Gas will relocate, as needed, gas lines and customer service lines to a location outside of the Limits of Excavation.

2. Water line relocation: Citizens Water will relocate, as needed, water lines and customer service lines to a location outside of the Limits of Excavation.

3. Overhead and underground electric power line relocation: Indianapolis Power and Light Company will relocate, as needed, overhead and underground lines to a location outside of the Limits of Excavation, and will relocate, as needed, overhead power lines so the overhead power lines are safely away from construction activity, as determined by CONTRACTOR.

4. Overhead and Underground Telephone relocation: The telephone company that owns the applicable telephone line will relocate, as needed, telephone lines to a location outside of the Limits of Excavation.

5. Storm sewer relocation and CSO Bypass:

a. CONTRACTOR shall furnish, install, support, relocate, operate, and maintain bypass pumping and/or flume storm sewers at all areas indicated in the Drawings. Surface feature restoration shall be in accordance with Section 02510 – Roadways, Driveways, Walks, and Curbing and Section 02900 – Restoring Lawns and Landscaping.

B. EROSION CONTROL: Construction site erosion control must comply with the applicable local and state ordinances, construction site erosion control plan and permit. See Section 02125 – Erosion and Sediment Control for the applicable erosion control requirements.

C. SHORING, SHEETING, AND BRACING OF EXCAVATIONS

1. All sloping, sheathing, shoring, and bracing of excavations shall conform to the requirements of Subpart P, Excavations (Standard Number 1926.65 of 29 CFR) of the Occupational Safety and Health Administration (OSHA) as a minimum. CONTRACTOR shall implement whatever additional excavation support methods necessary to fully protect surrounding facilities, the Work, CONTRACTOR's workforce, and the public. Sheeting, shoring, and bracing systems shall be selected and placed in such a manner as to control the inflow of groundwater and infiltration of fines, to prevent bottom heave, and to preserve the in-situ strength of soils in the bottom of the excavation. Sheeting, shoring, and bracing systems shall be modified as necessary during the course of the Work, to suit all soil and groundwater conditions encountered.

D. GENERAL EXCAVATION

1. Perform excavation of every description, regardless of the type, nature, or condition of material encountered, as specified, and required to accomplish the construction.

2. Open excavations shall be limited to a duration of two (2) days, unless otherwise authorized by OWNER. CONTRACTOR shall conduct operations to minimize the duration excavations are open. When construction activities are not taking place, all excavations shall be secured by steel plates and, where applicable, cold mix asphalt unless otherwise authorized by OWNER. CONTRACTOR shall verify the security of all open excavations on a daily basis, including weekends at no extra cost to OWNER.

3. Structural excavation (unclassified): Excavate for structures and utilities to the lines and grades shown or as required to accomplish the utility relocation. Perform all excavation regardless of the type, nature, or condition of the material encountered. The method of excavation used is optional; however, no equipment shall be operated within 5 feet of existing structures or newly completed construction, except as approved by CONSTRUCTION INSPECTOR. Excavation that cannot be accomplished without endangering the existing or new structures shall be done with hand tools.

4. Limits of excavation:

   a. Excavation and ground support system dimensions shall provide a sufficient distance from structures for installation of ground support systems, placing and removing concrete form work, installing utility services, ancillary facilities, inspecting the work and for backfilling. Do not carry excavation for pipe bedding, footings, mats, and slabs deeper than the elevation shown except as necessary to achieve an acceptable subgrade and to install a covering to protect the subgrade. Carefully excavate to final subgrade using specialized power equipment or hand tools as required so as to not disturb or degrade the subgrade soil. Obtain subgrade inspection by CONSTRUCTION INSPECTOR and promptly upon approval of acceptability, construct a protective subgrade covering.

   b. Over-excavations carried below the subgrade lines shown on the Contract Drawings or established by CONSTRUCTION INSPECTOR shall be replaced with material as specified. Over-excavations made below proposed elevations under pipe bedding, footings or mats shall be filled with flowable fill unless the excavation is widened such that compacted granular material is placed within a 1 vertical to 1 horizontal zone extending outward from the edge of the foundation. Where subgrade material is used below granular backfill, and flowable fill is not used, a filter fabric shall be placed across the entire over-excavated surface. Filter fabric sheets shall be overlapping a minimum of 6 inches. Over-excavations below subgrade shall be transitioned into adjoining areas by cutting slopes of 1 horizontal to 1 vertical or flatter extending to firm, undisturbed soil. Unauthorized over-excavation, as well as remedial work determined by CONSTRUCTION INSPECTOR, shall be without additional cost to OWNER.

5. Inspection of subgrade: After excavation is complete, notify CONSTRUCTION INSPECTOR and allow inspection of bottom of subgrade areas intended for support of pipe, footings, mats, or slabs. CONSTRUCTION INSPECTOR will inspect the prepared subgrades within one shift after notification. If unsuitable subgrade soil is present, perform overexcavation and subgrade stabilization to a horizontal and vertical extent necessary to reach suitable subgrade soil as determined by CONSTRUCTION INSPECTOR. The unsuitable soils shall either be properly compacted in place in accordance with Section 02200 - Excavation and Backfill (if feasible based on material type, moisture content and thickness), or

overexcavations shall extend through the unsuitable soils to remove them to an underlying competent subgrade soil.

6. Protection of subgrade:

   a. Care shall be exercised to minimize disturbance and degradation of subgrade soils for relocated utilities, foundations, slabs-on-grade, pavements and areas to be filled. Promptly after excavating to undisturbed subgrade, obtain inspection by CONSTRUCTION INSPECTOR, complete any necessary backfilling, and then cover the subgrade to help protect it. Acceptable subgrade coverings include:

      1) Filter fabric placed against subgrade and then covered by a minimum 6-inch layer of subgrade stabilization material or structural backfill. If necessary, a drainage and sump-pump system shall be installed in conjunction with the covering to remove water seeping through the subgrade.

      2) Flowable fill placed over the prepared and approved subgrade with a minimum thickness of 6 inches. Flowable fill should not be placed on subgrade soils experiencing upward groundwater seepage.

      3) A combination of the above.

      4) Other coverings submitted by CONTRACTOR and accepted by CONSTRUCTION INSPECTOR.

   b. Protect subgrades and foundation soils against freezing temperatures and frost heave by use of insulating materials and/or a suitable heat source. Protect subgrades against water degradation, as specified below.

E. Control of Water: Water shall not be allowed to pond on the surface of exposed subgrade soils. Conform to Section 02140 and Section 11014 for all water removal, temporary dewatering, sewage bypass and groundwater isolation measures.

F. BACKFILL PLACEMENT AND COMPACTION

1. Preparation, placement, moisture control and compaction of backfill shall be performed in conformance with the requirements of Section 02200 – Excavation and Backfill.

2. Disposal of excess excavated material:

   a. Dispose of all excess excavated material, not required or suitable for backfill or filling.

G. WORK IN LANDSCAPED OR SURFACED AREAS

1. Protect all trees, shrubs and other vegetation in the work area from damage unless specifically designated on the Drawings for removal. Cut and remove tree branches only as approved. Should any tree, shrub or plant that has been disturbed die within one year from the time it was disturbed or damaged, CONTRACTOR shall replace such tree, shrub or plant in kind and size or satisfactorily compensate the property owner. Proof of satisfactory compensation to a property owner shall be a written release from the property owner to CONTRACTOR, a copy of which shall be provided to CONSTRUCTION INSPECTOR.

2. If topsoil is removed during construction in lawn or park areas, the topsoil may be stockpiled at an approved location or properly disposed of and replaced with imported topsoil as specified in Section 02900 – Restoring Lawns and Landscaping. Prepare, and then seed or sod the cleared and damaged areas as specified in Section 02900 – Restoring Lawns and Landscaping.

3. Where construction is conducted in existing paved or surfaced areas, restoration shall be in accordance with Section 02510 – Roadways, Driveways, Walks, and Curbing.

3.3 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Utility Relocations but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 02015 -

SECTION 02100 - SITE PREPARATION

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. The work of this Section includes measures required during CONTRACTOR's initial move onto the Site to protect existing fences, buildings and associated improvements, streets, and utilities downslope of construction areas from damage due to boulders, trees or other objects dislodged during the construction process; clearing, grubbing and stripping; and regrading of certain areas to receive embankment fill.

1.2 SITE INSPECTION

A. Prior to moving onto the Site, CONTRACTOR shall inspect the Site conditions and review maps of the existing site and pipeline routes and facilities delineating OWNER's property, right-of-way lines, and easement limits.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 PRIMARY SITE ACCESS

A. CONTRACTOR shall develop any necessary access and access restrictions to the Site, including access barriers to prohibit entry of unauthorized persons.

B. Where existing utilities interfere with the Work, CONTRACTOR shall notify the utility owner and CONSTRUCTION INSPECTOR before proceeding in accordance with the Contract Documents.

C. Where CONTRACTOR desires additional space for operations relating to the Work that is not shown in the Contract Documents, CONTRACTOR shall acquire and utilize such additional space at no additional cost to OWNER.

3.2 CLEARING, GRUBBING, AND STRIPPING

A. Construction areas shall be cleared of grass and weeds to a depth of at least 6 inches and cleared of structures, pavement, sidewalks, concrete or masonry debris, trees, logs, upturned stumps, loose boulders, and any other objectionable material of any kind which would interfere with the performance or completion of the Work, create a hazard to safety, impair the subsequent usefulness of the Work, or obstruct its operation. Loose boulders within 10 feet of the top of cut lines shall be incorporated in landscaping or removed from the Site. Trees and other natural vegetation outside the actual lines of construction shall be protected from damage during construction, as directed by CONSTRUCTION INSPECTOR.

B. Within the limits of clearing, the areas below the natural ground surface shall be grubbed to a depth necessary to remove all stumps, roots, buried logs, and all other objectionable material. Septic tanks, drain fields, and connection lines and any other underground structures, debris or waste shall be removed if found on the Site. All objectionable material from the clearing and grubbing process shall be removed from the Site and disposed of in approved safe locations. Open burning is not permitted.

C. Unless otherwise indicated, native trees larger than 3 inches in diameter at the base shall not be removed without CONSTRUCTION INSPECTOR 's approval.

D. The removal, if necessary for CONTRACTOR's choice of means and methods, of any trees, shrubs, fences, or other improvements located outside of rights-of-way and not indicated for removal on the plans, shall be arranged with the owner of the property, and shall be removed and replaced at no additional cost to OWNER.

E. Unless otherwise provided, any existing structure or parts thereof, fence, building, or other encumbrance or obstruction upon or within the limits of the right-of-way which interferes in any way with the new construction shall be removed with no additional payment. Materials belonging to owners of abutting property shall be stockpiled neatly and in an acceptable manner upon their property or otherwise disposed of as required.

F. Materials not specifically reserved on the plans or in the Contract Documents shall become the property of CONTRACTOR. Such materials shall be removed or disposed of as specified or directed. Materials reserved for use by OWNER shall be removed without damage in sections which can be readily transported. Such materials shall be stockpiled neatly at accessible points. No material shall be disposed of except as provided herein.

3.3 OVEREXCAVATION, REGRADING, AND BACKFILL UNDER FILL AREAS

A. After the fill areas have been cleared, grubbed, and excavated, the areas to receive fill will require overexcavation, regrading, and backfill, consisting of the removal and/or stockpiling of undesirable soils. The ground surface shall be recontoured for keying the fill and removing severe or abrupt changes in the topography of the Site. The overexcavated volumes to a level 2.5 feet below the existing ground contours shall be backfilled and compacted in accordance with the requirements of Section 02200 – Excavation and Backfill.

B. Unauthorized over-excavation shall be without additional cost to OWNER.

C. After excavation is complete, notify CONSTRUCTION INSPECTOR and allow inspection of bottom of subgrade areas intended for support of pipe, footings, mats, or slabs. CONSTRUCTION INSPECTOR will inspect the prepared subgrades within one shift after notification. If unsuitable subgrade soil is present, perform overexcavation and subgrade stabilization to a horizontal and vertical extent necessary to reach suitable subgrade soil as determined by CONSTRUCTION

INSPECTOR. Unsuitable soils shall be either properly compacted in place or overexcavation shall extend through the unsuitable soils to remove them to an underlying competent subsoil grade.

3.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Site Preparation but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 02100 -

SECTION 02125 - EROSION AND SEDIMENT CONTROL

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. CONTRACTOR shall provide erosion control barriers, complete and in place, in accordance with the Contract Documents and all other applicable Federal, State, and local requirements, including the requirements found in the latest edition of Chapter 600 of the City of Indianapolis Stormwater Specifications Manual.

B. All work shall comply with the requirements set forth in 327 IAC-15-1 and 327 IAC-15-5 and any and all subsequent additions and revisions.

1.2 CONTRACTOR SUBMITTALS

A. Submittals shall be in accordance with Section 01300.

PART 2 - PRODUCTS

2.1 FABRIC

A. Fabric may be woven or non-woven, made from polypropylene, polyethylene, or polyamid, and shall contain sufficient UV inhibitors so that it will last for 6 months in outdoor exposure at temperatures between zero and 120 degrees Fahrenheit.

B. Fabric shall have the following properties:

Parameter	Standard Method	Value
Grab tensile strength	ASTM D 4632	100 lb
Burst strength	ASTM D 3786	200 psi
Apparent opening size	ASTM D 4751	Between 200 and 70 sieve size

C. Fabric shall have a minimum filtering efficiency of 85%.

D. Fabric Manufacturer, or equal

1. Mirafi by TenCate Geosynthetics North America

2.2 POSTS

A. Posts shall be wood, at least 2 inches by 2 inches, or steel 1 1/2-inch, T-shaped with protective coating, at least 6 feet long with protective coating.

2.3 FENCING

A. Woven wire fabric fencing shall be galvanized, mesh spacing of 6 inches, maximum 14 gauge, at least 30 inches tall.

2.4 FASTENERS

A. Fasteners to wood posts shall be steel, at least 1-1/2 inches long.

B. Fasteners to steel posts shall be galvanized clips.

2.5 STORM INLET PROTECTION

A. Protect low-lying area drains with silt fencing. Protect street inlets/drains with gravel filter bags.

2.6 EROSION CONTROL MATS

A. Provide erosion control mats (in conjunction with grass seed) as required to prevent soil erosion and to stabilize steep-sloped areas disturbed by construction and near stream and ditch crossings.

PART 3 - EXECUTION

3.1 PREPARATION

A. Provide erosion control barriers at the indicated locations and as required to prevent erosion and silt loss from the Site.

B. CONTRACTOR shall not commence clearing, grubbing, earthwork, or other activities which may cause erosion until barriers are in place.

3.2 INSTALLATION

A. Barrier systems shall be installed in such a manner that surface runoff will percolate through the system in sheet flow fashion and allow sediment to be retained and accumulated.

B. Attach the woven wire fencing to the posts that are spaced a maximum of 8 feet apart and embedded a minimum of 12 inches. Install posts at a slight angle toward the source of the anticipated runoff.

C. Trench in the toe of the filter fabric barrier with a spade or mechanical trencher so that the downward face of the trench is flat and perpendicular to the direction of flow. Lay fabric along the edges of the trench. Backfill and compact.

D. Securely fasten the fabric materials to the woven wire fencing with tie wires.

E. Reinforced fabric barrier shall have a height of 18 inches.

F. Provide the filter fabric in continuous rolls and cut to the length of the fence to minimize the use of joints. When joints are necessary, splice the fabric together only at a support post with a minimum 6-inch overlap and seal securely.

3.3 MAINTENANCE

A. Regularly inspect and repair or replace damaged components of the barrier. Unless otherwise directed, maintain the erosion control system until final acceptance; then remove erosion and sediment control systems promptly.

B. Remove sediment deposits when silt reaches a depth of 1/2 the height of the barrier, or when the fabric begins to bulge, whichever is less. Dispose of sediments at a site arranged by CONTRACTOR which is not in or adjacent to a stream or floodplain.

C. Control dust and air-borne particulates in accordance with the requirements of the Contract Documents.

3.4 CLEAN-UP

A. Remove all erosion and sediment control temporary structures following final acceptance of the Work.

3.5 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Erosion and Sediment Control but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 02125 -

SECTION 02140 – DEWATERING

PART 1 - GENERAL

1.1 SUMMARY

A. Section Includes:

1. Dewatering system.
2. Surface water control system.
3. Monitoring wells.
4. System operation and maintenance.
5. Water disposal.

B. Related Sections:

1. Section 01300 – Contractor Submittals.
2. Section 01400 – Quality Control.
3. Section 02125 – Erosion and Sediment Control
4. Section 02200 – Excavation and Backfill.

1.2 REFERENCES

A. ASTM International: ASTM C33 Standard Specification for Concrete Aggregates.

1.3 DEFINITIONS

A. Dewatering includes the following:

1. Lowering of groundwater table and intercepting horizontal water seepage to prevent groundwater from entering excavations and tunnels.
2. Reducing piezometric pressure within strata to prevent failure or heaving of excavations and tunnels.
3. Disposing of removed water.

B. Surface Water Control: Removal of surface water within open excavations.

1.4 SYSTEM DESCRIPTION

A. Provide dewatering and surface water control systems to permit work to be completed on dry and stable subgrade.

B. Provide monitoring wells and monitoring equipment as necessary to obtain meaningful observations of conditions affecting excavation.

1.5 PERFORMANCE REQUIREMENTS

A. Furnish, operate, and maintain pumps, pumping equipment, well points, inspection tubes, and similar dewatering devices to properly dewater and maintain excavations and depressions free from standing water. Lower the natural groundwater table before start of excavation, and to a sufficient depth to ensure excavations, construction, and backfill below elevation of natural groundwater table can be performed and completed in a dry condition. It is CONTRACTOR'S responsibility to insure that dewatering is provided for proper completion of the Work and protection of its equipment and materials.

B. During periods when the subgrade area within perimeter walls of structures is exposed to elements and deleterious effects of construction operations, subgrade area shall be maintained through use of ditching, pumping, grading, or back-blading to minimize subgrade deterioration and promote natural drainage.

C. In silty and sandy soils where water is present at established subgrade level, water shall temporarily be removed by drawing water away from excavation. Dewatering methods shall consist of constructing drainage ditches at perimeter of excavation, sump pits adjacent to and near excavation, or placing well points around perimeter of excavation. Method employed should not disturb density of subgrade. Activate dewatering methods to lower water level not less than two (2) feet below subgrade before excavation has reached established subgrade level, and maintain until concrete has attained sufficient density and strength not to be affected by water and until backfilling around foundations has been completed.

D. Design dewatering systems to:

1. Lower water table within areas of excavation to permit work to be completed on dry and stable subgrade.

2. Relieve hydrostatic pressures in confined water bearing strata below excavation to eliminate risk of uplift or other instability of excavation.

3. Prevent damage to adjacent properties, buildings, structures, utilities, and facilities from construction operations.

4. Prevent loss of fines, quick condition, or softening of foundation subgrade.

5. Maintain stability of sides and bottoms of excavations.

E. Design surface water control systems to collect and remove surface water and seepage entering excavation.

1.6 SUBMITTALS (Only required for projects with complex dewatering operations that include a separate payment)

A. Section 01300 Contractor Submittals, Requirements for Submittals.

B. Shop Drawings:

1. Indicate dewatering system layout, well depths, well screen lengths, dewatering pump locations, pipe sizes and capacities, grades, filter sand gradations, surface water control devices, valves, and water disposal method and location.

2. Indicate primary power system location and capacity.

3. Indicate layout and depth of monitoring wells, piezometers and flow measuring devices for system performance measurement.

4. Include detailed description of dewatering and monitoring system installation procedures and maintenance of equipment.

5. Include description of emergency procedures to follow when problems arise.

1.7 CLOSEOUT SUBMITTALS (Only required for projects with complex dewatering operations that include a separate payment)

A. As-Built Documents: Record actual locations and depths of capped wells and piping abandoned in place.

1.8 QUALITY ASSURANCE

A. Comply with authorities having jurisdiction for the following:

1. Drilling and abandoning of wells used for dewatering systems.

2. Water discharge and disposal from pumping operations.

B. CONTRACTOR shall comply with the provisions of Article 15, Indiana Administrative Code, regulating the discharge of effluent from construction pit (trench) dewatering.

C. Perform work in accordance with Indiana Department of Environmental Management (IDEM) and/or Indiana Department of Natural Resources (IDNR) standards.

D. CONTRACTOR may need to apply to the Indiana Department of Environmental Management for a permit to discharge effluent from construction pit dewatering utilizing State Form 51957 (10-04) “National Pollutant Discharge Elimination System (NPDES) Permit Application Package 2D”. Application forms may be obtained from IDEM’s website or office. CONTRACTOR shall sample dewatering water for Group A compounds listed in Table 2D-2, and any additional compounds from Tables 2D-2, 2D-3, and 2D-4 that may be present in discharge. Sample results will be used by IDEM to determine the need for a permit.

1.9 SEQUENCING

A. Sequence work to obtain required permits before start of dewatering operations.

1.10 COORDINATION

A. Coordinate work to permit the following construction operations to be completed on dry stable substrate.

1. Excavation and Trenching as specified in Section 02200 – Excavation and Backfill.

PART 2 - PRODUCTS

2.1 DEWATERING EQUIPMENT

A. Select dewatering equipment to meet specified performance requirements.

2.2 ACCESSORIES

A. Valves and Fittings: Furnish valves and fittings to isolate each well from header pipe and to prevent loss of pump prime.

B. Filter Sand: ASTM C33; natural river or bank sand; washed; free of silt, clay, loam, friable or soluble materials, and organic matter; graded to suit well screen.

C. Grout: Mixture of Portland cement and bentonite clay or sand suitable for sealing abandoned wells and piping.

PART 3 - EXECUTION

3.1 EXAMINATION

A. Conduct additional borings and investigations to supplement subsurface investigations provided as required to complete dewatering system design.

3.2 PREPARATION

A. Protect existing adjacent buildings, structures, and improvements from damage caused by dewatering operations.

3.3 MONITORING WELLS

A. Install monitoring wells at locations indicated on shop drawings as specified for dewatering wells.

B. Test each monitoring well point to verify installation is performing properly.

C. Install piezometers, calibrate, and test for proper operation.

D. Protect monitoring well standpipes from damage by construction operations.

E. Maintain accessibility to monitoring wells continuously during construction operations.

F. Maintain monitoring wells until groundwater is allowed to return to normal level.

3.4 DEWATERING SYSTEM

A. Install dewatering system in accordance with shop drawings.

B. Locate system components to allow continuous dewatering operations without interfering with installation of permanent work and existing public rights-of-way, sidewalks, and adjacent buildings, structures, and improvements.

3.5 SURFACE WATER CONTROL SYSTEM

A. Provide ditches, berms, and other devices to divert and drain surface water from excavation area as specified in Section 02125 – Erosion and Sediment Control.

B. Divert surface water and seepage water within excavation areas into sumps and pump water into settling basins in accordance with requirements of agencies having jurisdiction.

C. Control and remove unanticipated water seepage into excavation.

3.6 SYSTEM OPERATION AND MAINTENANCE

A. Provide continuous supervision of dewatering system when operating by personnel skilled in operation, maintenance, and replacement of system components.

B. Conduct daily observation of dewatering system and monitoring system. Make required repairs and perform scheduled maintenance.

C. Fill fuel tanks before tanks reach 25 percent capacity.

D. Start emergency generators at least twice each week to check operating condition.

E. When dewatering system cannot control water within excavation, notify CONSTRUCTION INSPECTOR and stop excavation work.

1. Supplement or modify dewatering system and provide other remedial measures to control water within excavation.

2. Demonstrate dewatering system operation complies with performance requirements before resuming excavation operations.

F. Modify dewatering and surface water control systems when operation causes or threatens to cause damage to new construction, existing site improvements, adjacent property, or adjacent water wells.

G. Correct unanticipated pressure conditions affecting dewatering system performance.

3.7 WATER DISPOSAL

A. Discharge water into settling basins provided by CONTRACTOR and then into storm sewers if approved by CONSTRUCTION INSPECTOR and the jurisdictional agency concerned in accordance with IDEM and IDNR standards. No water containing settleable solids shall be discharged into the storm sewer system or other receiving waters.

3.8 SYSTEM REMOVAL

A. Remove dewatering and surface water control systems after dewatering operations are discontinued.

B. Remove piezometers and monitoring wells.

C. Fill abandoned wells with grout.

D. Fill abandoned piping with grout.

E. Repair damage caused by dewatering and surface water control systems or resulting from failure of systems to protect property.

3.9 FIELD QUALITY CONTROL

A. Section 01400 Quality Control.

B. Monitor groundwater discharge for temperature, pH, dissolved oxygen, and total suspended solids if required by relevant Regulatory Agencies or OWNER.

C. Survey existing adjacent buildings, structures, and improvements weekly to detect movement in comparison to original elevations during dewatering operations. Notify CONSTRUCTION INSPECTOR immediately of measured movement.

3.10 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for work performed under this section unless authorized by OWNER.

- END OF SECTION 02140 -

SECTION 02200 – EXCAVATION AND BACKFILL

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. Excavation and backfilling for all sanitary and combined sewer lines and other utilities as shown on the Contract Documents and specified herein.

B. Excavation and backfill for structures, structural backfill, granular bedding and backfill under concrete slabs.

C. Locating existing underground utilities and structures within the site limits.

D. Disposal of excess excavated material.

1.2 CLASSIFICATION

A. Excavated materials will be unclassified regardless of the nature of the materials encountered.

1.3 QUALITY ASSURANCE

A. Testing and inspection services as required by this Section shall be provided by OWNER.

1.4 REFERENCES

A. Indiana Department of Transportation (INDOT) Publication: Latest edition of Standard Specifications.

B. Occupational Safety and Health Administration (OSHA) Standards 29 CFR Part 1926 including Subparts A, B, C, D and P.

C. Indianapolis Sanitary and combined District Standards, Latest Edition

D. City of Indianapolis Stormwater Design and Construction Specifications Manual, Latest Edition.

1.5 RELATED SECTIONS

A. Section 01530 – Protection of Existing Facilities

1.6 CARE OF EXISTING STRUCTURES AND PROPERTY

A. All poles, fences, sewer, gas, water, drainage or other pipes, wires, conduits, manholes, buildings, structures and property in the proximity of any excavation shall be supported and protected from damage by CONTRACTOR during construction.

B. Wherever poles, sewer, gas, water, drainage or other pipes or conduits require support, CONTRACTOR shall coordinate with the owner of the utility to support said poles, pipes and conduits without damage to them and without interrupting their use during the progress of the work. The manner of supporting such pipes, etc., shall be subject to review by the CONSTRUCTION INSPECTOR.

C. Any damage to poles, fences, sewer, gas, water, drainage or other pipes, wires, conduits, manholes, buildings, structures and property resulting from CONTRACTOR's work shall be promptly repaired by CONTRACTOR at no additional cost to OWNER. The quality of all such repair work shall be to the satisfaction of the CONSTRUCTION INSPECTOR.

1.7 EXISTING UNDERGROUND STRUCTURES AND UTILITIES

A. The Contract Documents show the location of utilities based on the best available information, however, neither OWNER nor ENGINEER accepts any responsibility for the accuracy of this information nor do they guarantee that all utilities within the work area are shown.

B. CONTRACTOR, prior to the start of construction, shall verify the location of any existing underground utilities and structures within the site limits. Such verification shall include, but not be limited to, contacting the Underground Location Service (Indiana 811) at least 48 hours prior to the start of any activities involving excavation. It shall be CONTRACTOR's responsibility to make any and all exploratory investigations which may be necessary to verify or locate the utility pipes, wires, structures and appurtenances of others. CONTRACTOR shall notify CONSTRUCTION INSPECTOR of any conflicts between the location called for in the information furnished and the actual location of any existing underground utilities or structures. Any conflicts found shall be recorded as directed by the CONSTRUCTION INSPECTOR.

C. CONTRACTOR shall anticipate utility services between the sewer and individual properties and take appropriate steps to protect existing utilities.

PART 2 – PRODUCTS

2.1 PIPELINE AND UTILITY TRENCHING

A. BACKFILL MATERIALS

1. Bedding, haunching, initial backfill, and final backfill requirements are the same for sanitary and combined sewers, sanitary and combined laterals, and force mains. Bedding, haunching, and backfill requirements for storm sewers are as shown on the Contract Drawings and shall be in accordance with the City of Indianapolis Stormwater Design and Construction Specification Manual, latest edition.

2. The minimum requirements are as follows:

a. The requirements are determined by the type and size of pipe being installed and are as follows:

1) Flexible Pipe – including PVC, HDPE, Centrifugally Cast Fiberglass Reinforced Polymer Mortar, and Closed Profile Large Diameter PVC

Bedding, Haunching, and Initial Backfill – No.8 crushed stone or No. 8 fractured-faced aggregate. The minimum depths shall be as follows:

Pipe Size, inches	Depth Below Barrel, inches	Depth Above Top of Pipe, inches
6 or less	4	4
8 to 15	4	12
18 and larger	8	12

2) Semi-Rigid Pipe – Ductile Iron Pipe (DIP) and Vitrified Clay Pipe (VCP).

Bedding, Haunching, and Initial Backfill – No. 8 crushed stone or No. 8 fractured-faced aggregate. The minimum depths shall be as follows:

Pipe Size, inches	Depth Below Barrel, inches	Depth Above Top of Pipe, inches
8 to 16	4	6
18 and larger	8	6

3) Rigid Pipe – Reinforced Concrete Pipe (RCP) and Prestressed Concrete Cylinder Pipe (PCCP)

i. Bedding and Haunching – No. 8 crushed stone or No. 8 fractured faced aggregate a minimum of eight (8) inches below the pipe barrel to the springline (1/2 the outside diameter) of the pipe.

ii. Initial Backfill – Initial backfill shall be placed as shown on the Contract Drawings using clean fill material free of rocks larger than three (3) inches in diameter, frozen lumps of soil, wood, or other extraneous material unless the construction is beneath or within five (5) feet of pavement then final backfilling per these Contract Documents shall apply.

b. For all installations, the bedding material shall be placed in the trench bottom and compacted prior to laying the pipe.

3. The bell holes shall be excavated for bell and spigot pipe so the entire pipe

barrel rests on the bedding. The bedding shall be such that after the pipe has been placed to line and grade, there remains a four (4) inch minimum depth of material below the pipe barrel and a minimum of three (3) inches below the bell.

4. For all installations, the haunching material shall be shovel sliced or otherwise carefully placed and "walked" or hand tamped to the springline (1/2 the outside diameter) to ensure compaction of the haunch area and complete filling of all voids. The initial backfill shall be added in six (6) inch lifts with each "walked" in for compaction.

5. Final backfill requirements are determined by the location of the excavation, as follows:

   a. Unless directed by the CONSTRUCTION INSPECTOR, all excavations beneath existing (or proposed as a part of this contract) Class I or Class II pavement, paved shoulders, or drive approaches shall be backfilled with flowable fill. All cut areas under sidewalks shall be backfilled with sand or No. 53 stone.

   b. B-Borrow backfill may be used on trenches greater than four (4) feet in width or beneath Class III pavements.

   c. For all other installations within five (5) feet of the edge of existing or proposed pavement, curbs, gutters, or similar structures:

      1) Trenches shall be backfilled with structural "B-Borrow" for structural installations per INDOT Standard Specifications - Section 211.

      2) Backfill shall be compacted to achieve not less than 95% Standard Proctor Dry Density per ASTM D698. CONTRACTOR shall use in-house or independent testing to verify proper compaction.

   d. Outside five (5) feet of the edge of pavement, curbs, gutters, or similar structures trench shall be backfilled with clean fill material free of rocks larger than three (3) inches in diameter, frozen lumps of soil, wood, or other extraneous material. Backfill shall be compacted to achieve not less than 92% Standard Proctor maximum dry density.

   e. For definition, Pavement classes are as follows:

      1) Class I Pavement includes all streets constructed or resurfaced within five (5) years of permit application on asphalt streets and fifteen (15) years on concrete streets.

      2) Class II Roadway Pavement includes all thoroughfares and primary arterials.

3) Class III Pavements are all other streets.

6. Backfill shall be added and compacted in twelve (12) inch balanced lifts by means of mechanical tampers.

7. Flowable fill may be used as a substitute for “B-Borrow”, and shall meet the following requirements:

   a. Unconfined Compressive Strength (28 day) 50 - 150 psi

   b. Design. Mix design must be submitted to CONSTRUCTION INSPECTOR and approved by ENGINEER. A trial batch demonstration may be required. The mix design shall include a list of all ingredients, the source of all materials, the gradation of all aggregates, the names of all admixtures and dosage rates, and the batch weights. Except for adjustments to compensate for routine moisture fluctuations, minor mix design changes after the trial batch verification shall be documented and justified prior to implementation by CONTRACTOR. A change in the source of materials, or addition or deletion of admixtures or cementitious materials will require the mix design to be resubmitted for approval. CONTRACTOR may be required to provide test data from a laboratory approved by OWNER, which shows that the proposed mix design is in accordance with the requirements listed in this specification.

   c. Flow Test. The test for flow shall consist of filling a three (3) inch diameter by six (6) inch high open ended cylinder to the top with flowable fill. During filling, the cylinder shall be placed on a smooth, nonporous, level surface. The cylinder shall be pulled straight up within 5 seconds. The spread of the fill shall be measured. There shall be no noticeable segregation and the material spread shall be at least 8” diameter

   d. Placement. The mixture shall be discharged from mixing equipment by a reasonable means into the space to be filled. The flowable fill shall be brought up uniformly to the fill line. Each filling stage shall be as continuous as is practicable. Concrete may be placed on the flowable fill as soon as bleeding water has subsided. All pavements shall be placed according to flowable fill manufacturer’s recommendations.

   e. Limitations. Flowable fill shall be protected from freezing until the material has stiffened and bleeding water has subsided. As the temperature nears freezing, additional curing time may be needed.

8. Jetting or flooding of the backfill shall not be used to meet the compaction requirements.

2.2 STRUCTURAL BACKFILL

A. Structural backfill as indicated on the Contract Documents shall be No. 8 or No. 9 crushed limestone complying with the Indiana Department of Transportation Standard Specifications (Section 904.05).

B. The particle size shall be less than 2" and contain no more than 8% by weight passing a #200 sieve.

C. The uniformity coefficient shall be greater than 4.

D. The liquid limit shall not be greater than 25 and the plasticity index not more than 6.

E. Structural fill shall be compacted to at least 95% of the maximum Standard Proctor dry density, as determined by ASTM D698.

2.3 GRANULAR BACKFILL

A. Granular backfill shall be natural sand or a mixture of sand with gravel, crushed gravel or crushed stone complying with the Indiana Department of Transportation Standard Specifications. Crushed concrete shall not be used as granular backfill.

2.4 BACKFILL

A. Backfill may be previously excavated materials free from cinders, construction debris, vegetation, or other extraneous material and suitable for the intended purpose and compaction requirements.

PART 3 – EXECUTION

3.1 TRENCH INSTALLATIONS

A. The minimum width of the trench at and below the top of the sanitary and combined sewer, lateral, or force main shall be only as wide as necessary for proper installation and backfilling.

B. The minimum trench width for sanitary and combined sewers, laterals, and force mains shall not be less than the greater of the following:

Minimum Width = Pipe O.D. + 16 inches

or

Minimum Width = (Pipe O.D. x 1.25) + 12 inches

C. Under no circumstances shall the distance from the trench wall to the outside edge of the pipe be less than six (6) inches for pipes six (6) inches and less, and eight (8) inches for pipes eight (8) inches and larger.

D. For flexible conduits, the lateral resistance of in-situ soils shall be of sufficient stiffness to provide the required pipe support. Where unstable trench sidewall conditions exist, or where trench depth dictates the use of a moveable trench box, CONSTRUCTION INSPECTOR shall determine the width of compacted bedding and backfill material necessary to provide adequate pipe side support.

E. The minimum and maximum trench widths above the top of the sanitary and combined sewer, lateral, and force main shall be determined by CONTRACTOR and shall be in conformance with all applicable safety regulations including, but not limited to, those promulgated by OSHA.

3.2 GENERAL TRENCHING REQUIREMENTS

A. Whenever pipe trenches are inadvertently excavated below the designed bedding bottom, CONTRACTOR shall fill the over-excavated area with compacted No. 8 crushed stone or No. 8 fractured face aggregate and shaped to form a firm, uniform trench base at no additional cost to OWNER.

B. In cases where a firm foundation is not encountered at the required grade, CONTRACTOR shall remove the unstable material to a sufficient depth not less than six (6) inches and replace such unstable material with either No. 2 crushed stone, No. 8 crushed stone, or No. 8 fractured faced aggregate. When compacted and properly shaped, the fill material shall produce a uniform and stable foundation along the entire length of the pipe. If more than one (1) foot of unstable material is encountered, CONTRACTOR shall take additional measures to ensure that additional stabilization is provided, such as geotextile fabric wrapping of the trench section or as approved by ENGINEER.

C. All rocks, boulders and stones six (6) inches in diameter and larger shall be removed. Boulders or rocks are not to be used for any portion of the trench backfill.

D. The pipe trench shall not be excavated more than one hundred (100) feet in advance of pipe laying unless approved by CONSTRUCTION INSPECTOR.

E. In cases where material is deposited along open trenches, the material shall be placed and protected so that no damage will result to the Work or adjacent property as a result of rain or surface wash.

F. Prior to excavating paved areas, all excavation edges falling within the pavement shall be saw cut full depth in a neat straight manner. Cutting shall be performed with a saw designed specifically for this purpose. The cuts shall penetrate the entire pavement thickness, which are reopened to traffic prior to excavation. The cuts shall then be thoroughly filled with sand and maintained full until the excavation is performed.

3.3 STRUCTURAL EXCAVATION

A. Open excavations shall be limited to a duration of two (2) days, unless otherwise

authorized by OWNER. CONTRACTOR shall conduct operations to minimize the duration excavations are open. When construction activities are not taking place, all excavations shall be secured by steel plates and, where applicable, cold mix asphalt unless otherwise authorized by OWNER. CONTRACTOR shall verify the security of all open excavations on a daily basis, including weekends at no extra cost to OWNER. Excavations shall only be to the depth and dimensions necessary for the construction, maintained in good order, and safeguarded with barricades and warning lights as required. If underground utilities and/or structures not shown on the Contract Documents are encountered, notify CONSTRUCTION INSPECTOR and do not proceed until instructions are obtained. Notify CONSTRUCTION INSPECTOR if springs or running water are encountered. For all open excavations, CONTRACTOR shall provide 24-7 emergency contact information for a representative capable of arriving on-site within one (1) hour.

B. The bottom of all excavations shall be undisturbed earth unless otherwise noted, and shall be approved before subsequent work is started. Subgrade shall be proof-rolled with a loaded tandem axle dump truck or similar rubber tired vehicle, weighing at least 20 tons. Proof-rolling, as indicated, will be required only on roadways. Structure subgrades will be evaluated by CONSTRUCTION INSPECTOR as deemed necessary. Soils which are observed to rut or deflect excessively under the moving load shall either be scarified and recompacted or undercut and replaced with properly compacted fill.

C. Where excavation and backfill below the Limits of Excavation defined on the Contract Documents is ordered in writing by CONSTRUCTION INSPECTOR, such additional excavation and structural backfill will be paid for as extra Work. Where the Limit of Excavation is not defined, the limit shall be taken as the base of the footing or mud slab where applicable.

D. Do not excavate for any structure until that structure is scheduled for construction. If the bearing capacity of the foundation soils is reduced because the excavation is allowed to remain open prior to commencing work or dewatering is inadequate, the weathered or unsuitable soil shall be removed and replaced with 2000 psi compressive strength concrete or compacted structural backfill at the expense of CONTRACTOR.

E. Excavations carried below depths indicated on the Contract Documents without the previous written approval of CONSTRUCTION INSPECTOR or ENGINEER shall be filled with 2,000 psi compressive strength concrete or compacted structural backfill to the correct elevation at the expense of CONTRACTOR.

3.4 STRUCTURAL FILLING, BEDDING, AND BACKFILLING

A. General: Obtain CONSTRUCTION INSPECTOR's approval of existing conditions before starting filling operations. Remove all vegetation, formwork, rubbish and other debris. Excavate muddy subgrade. Do not fill on frozen subgrade. The quantity of structural fill or granular fill required beneath concrete slabs and foundations is dependent on the limits of excavation required to install the footings

and foundation walls as well as on the extent of any unstable soil requiring removal. Fill limits shall be from undisturbed soil to the necessary lines and grades under all concrete slabs and foundations of buildings, tanks, and miscellaneous structures.

B. Lifts shall not exceed twelve (12) inches. Backfill beneath paved areas and structures shall be compacted to 95% of Standard Proctor as determined by ASTM D-698. Backfill in other areas shall be compacted to meet the requirements of the latest edition of the Indianapolis Sanitary and combined District Standards.

C. Structural Backfill: Provide structural backfill to achieve necessary lines and grades under all structures.

D. Granular Backfill: Provide granular backfill where indicated on the Contract Documents to achieve necessary grades under concrete slabs and elsewhere as indicated.

E. Backfilling: Do not backfill until new concrete has properly cured and wall coatings have been approved. Leakage tests shall be completed before backfilling.

F. Exercise care during backfilling operations to avoid any puncture, break, or other damage to waterproofing systems. Notify CONSTRUCTION INSPECTOR at least five (5) days in advance, and allow CONSTRUCTION INSPECTOR to observe backfilling operations adjacent to waterproofing.

G. Where backfilling is required on both sides of structures, backfill and compact simultaneously on opposite sides in even layers. Other backfilling sequences shall be as specifically indicated.

H. Flowable fill shall be used for backfill where compaction requirements cannot be met due to restricted areas.

3.5 DISPOSAL OF EXCAVATED MATERIAL

A. Excavated material not used for backfilling or site grading shall either be placed in spoil areas and graded to drain in a controlled manner compliant with Rule 5 requirements (see Section 01800 – Permits and Regulatory Requirements) or removed from the site and legally disposed of. Excavated materials containing slag, cinders, foundry sand, debris or rubble shall be removed from the site and legally disposed of promptly. Stockpiling of excavated material is only permitted on site for two (2) days.

3.9 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Excavation and Backfill, but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 02200 -

SECTION 02510 - ROADWAYS, DRIVEWAYS, WALKS AND CURBING

PART 1 - GENERAL

1.1 WORK INCLUDED

A. The work of this Section includes, but is not limited to, milling and pavement construction to the satisfaction of CONSTRUCTION INSPECTOR and ENGINEER, all roadways, driveways, parking areas, walks and curbing, inclusive of all cinder, gravel, waterbound macadam, bituminous macadam, asphalt, and brick or concrete types, disturbed during the construction of the sewers and appurtenances included under this Contract.

B. Designations of types of existing pavement, drives, walks and curbs given on the Contract Drawings were determined by surface inspection only and may be at variance with the exact type in place as determined when excavated. CONTRACTOR shall be responsible for restoring the pavement of the general type encountered regardless of type indicated on the Contract Drawings at no additional cost to OWNER. It shall be the sole responsibility of CONTRACTOR to verify the pavement type to its satisfaction before entering its Proposal.

C. In order to minimize erosion and sediment runoff, roadways, parking areas, and sidewalks shall be paved or otherwise stabilized as soon as possible.

D. CONTRACTOR shall be responsible for any damage to drives, roads, sidewalks, culverts, and other structures whether existing or new as part of CONTRACTOR's work. Any repairs made due to damage caused by CONTRACTOR shall be at CONTRACTOR's expense.

E. CONTRACTOR shall comply with all City of Indianapolis and latest approved and adopted edition of the Indiana Department of Transportation (INDOT) Standard Specifications for materials and execution of pavement construction.

F. CONTRACTOR shall comply with all City of Indianapolis and Indiana Department of Transportation traffic control and safety requirements and regulations for all work along public roads.

G. CONTRACTOR shall keep all pavements completely clean from mud, loose aggregate and other debris and objectionable materials by the end of each workday.

H. CONTRACTOR shall store and protect miscellaneous items on the Project site so they do not interfere with the property owners or the general public.

I. All final paving and final fencing is to be done at the end of the project. Any damaged areas prior to acceptance are to be restored including clean-up, at no additional cost to OWNER.

1.2 RESTORATION AND CLEANUP

A. CONTRACTOR shall restore any disturbed surfaces or structures in accordance with these Specifications and as shown on the Contract Drawings. CONTRACTOR shall take particular care to ensure that all sidewalks, steps, curbs, driveways, streets, roadways, fences, mailboxes, drainage ditches, culvert pipes and other property or structures that may be disturbed or damaged during construction of the Work, either directly or indirectly, are restored to a condition equal to or better than the original condition encountered.

B. Upon completion of paving operations, CONTRACTOR shall remove all equipment and excess paving materials from the entire area paved; and all shoulders and adjacent areas shall be restored to a condition equal to or better than that at commencement of this work. When restoration work is completed, unless specifically directed to the contrary, CONTRACTOR shall place barricades on the new pavement to restrict traffic and protect pavement from possible damage prior to final inspection for acceptance.

3.14 MEASUREMENT AND PAYMENT

A. No direct payment shall be made for Roadways, Driveways, Walks and Curbing.

- END OF SECTION 02510 -

SECTION 02900 - RESTORING LAWNS AND LANDSCAPING

PART 1 – GENERAL

1.1 Indianapolis Parks & Recreation Urban Forestry Flora and Root Protection and Cutting for Public Property and Right-of-Way Flora and Tree Installation has been incorporated into this specification.

A. Existing trees not in direct conflict with construction shall be saved and protected, unless specified to be removed. Remove trees only after approval by CONSTRUCTION INSPECTOR in accordance with latest edition of ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance – Standard Practices. Prune trees only after approval by CONSTRUCTION INSPECTOR in accordance with latest edition of ANSI A300 - Tree Care Operations - Tree, Shrub and Other Woody Plant Maintenance – Standard Practices with addition of Marion County Arboricultural Standards

1.2 QUALITY ASSURANCE

A. Plant names indicated shall comply with “Standardized Plant Names” as adopted by the latest edition of the American Joint Committee of Horticultural Nomenclature. Provide stock true to botanical name. Do not substitute without permission of CONSTRUCTION INSPECTOR.

B. Comply with sizing and grading standards of the latest edition of “American Standard for Nursery Stock.” A plant shall be dimensioned as it stands in its natural position.

C. All plants shall be nursery grown under climatic conditions similar to those in the locality of the Project.

D. Stock furnished shall be at least the minimum size indicated. Larger stock is acceptable, at no additional cost to OWNER. Root systems must meet AAN standards as specified. Plants should not be altered by pruning or other means to meet specifications.

E. Plants may be inspected and approved at the place of growth, for compliance with specification requirements for quality, size and variety.

F. Only experienced workmen familiar with Department of Public Works Forestry planting procedures under the supervision of a qualified supervisor, preferably accredited or certified in the industry, shall perform planting.

1.3 DELIVERY, STORAGE, AND HANDLING

A. Take all precautions customary in good nursery practice to prepare plants for transport. Workmanship which fails to meet the highest standards shall be rejected. Spray deciduous plants in foliage with an approved anti-desiccant

immediately before digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury.

B. Cover plants transported on open vehicles with a protective covering to prevent windburn.

1.4 PROJECT CONDITIONS

A. Work notification: Notify CONSTRUCTION INSPECTOR at least five (5) working days prior to installation of plant material.

B. Protect existing utilities, paving, and other facilities from damage caused by landscaping operations. Contact the Underground Loction Service (Holey Moley) at either 811 or 800-382-5544 to mark underground utilities a minimum of 48 hours before digging.

1.5 SCOPE OF WORK

A. The work of this Section includes, but is not limited to, the surface preparation, sodding and seeding the lawn areas, and replacement of all trees, shrubs, plants, and vegetation adjacent to the Work which were disturbed or damaged, and their restoration to the same condition which prevailed at the time entry upon the Work, or as directed by CONSTRUCTION INSPECTOR, and in full accord with provisions of any easements with property owners where work is in such easements.

B. In general, this shall include the replacement of all trees, shrubs, plants and vegetation, and the re-handling and placing of stored topsoil, the furnishing and placing of additional topsoil, if required, and the furnishing and placing of all fertilizer, sod and grass seed required to plant and maintain the lawn areas and also the watering, weeding, cutting and replacement of lawn areas as required to obtain a well kept turf that is properly dense and free from weeds.

C. All existing lawns and areas of vegetative growth disturbed by CONTRACTOR and other designated areas shall be seeded unless otherwise shown on the Contract Drawings or called for in the Specifications or easements.

1.6 GUARANTY AND REPLACEMENT

A. CONTRACTOR shall maintain all plantings by watering, cultivating, weeding, pruning and protection against surface erosion during the guaranty period. The cost of the water shall be borne by CONTRACTOR.

B. All plants shall be guaranteed for one year and for the duration of one full growing season after date of acceptance of the Contract. At the end of the guarantee period, any dead, unhealthy, or badly impaired plants shall be replaced. All replacements shall be plants of the same kind as originally indicated on the Contract Drawings and of size comparable to that of growing plants adjacent to them. The cost of such replacement shall be borne by CONTRACTOR at no additional cost to OWNER.

C. CONTRACTOR shall request final inspection of plants.

D. Remove and immediately replace all plants, as determined by CONSTRUCTION INSPECTOR, to be unsatisfactory during the initial planting installation.

E. Replace once, in accordance with the specifications, all plants that are dead or, as determined by CONSTRUCTION INSPECTOR, are in a severely unhealthy condition within warranty period. Replacements to be installed immediately or at next best planting season.

F. Warranty shall not include damage or loss of trees, plants, or ground covers caused by fires, floods, drought, freezing rains, lightning storms, or winds over 75 miles per hour, winter kill caused by extreme cold and severe winter conditions not typical of planting areas; acts of vandalism or negligence on the part of OWNER. Any replacement attributed to these causes must be in addition to the contract amount.

PART 2 - PRODUCTS

2.1 QUALITY AND CHARACTERISTICS OF PLANTINGS

A. Plants: Trees shall be planted where indicated on the Contract Drawings or as directed by CONSTRUCTION INSPECTOR.

B. Trees shall be 2-1/2” diameter trunk or larger.

C. Plants shall be of sound, first quality, well cared for nursery stock. Provide only sound, healthy, vigorous plants free from defects, disfiguring knots, sunscald injuries, frost cracks, abrasions of the bark, plant diseases, insect eggs, borers, and all forms of infestation.

D. Trunks and branches shall be straight, and leaders, foliage heads and root systems shall be thrifty. All plants shall be normal for the species.

E. All plants shall be subject to inspection and approval by CONSTRUCTION INSPECTOR at the place of growth before digging, for quality, size and variety. However, such approval shall not impair the right of rejection at the project site by CONSTRUCTION INSPECTOR. CONTRACTOR shall remove rejected plants from the Site.

F. Container-grown stock shall have grown in a container for sufficient length of time for the root system to have developed to hold its soil together, firm and whole.

1. No plants shall be loose in the container.

2. Container stock shall not be pot bound or recently upsized

G. Dig balled and burlapped plants with firm, natural balls of earth of sufficient diameter and depth as necessary for full recovery of the plant. Provide ball sizes

complying with the latest edition of the “American Standard for Nursery Stock.” Cracked or mushroomed balls are not acceptable. Loose stem/root balls or otherwise mishandled plants are not acceptable.

H. Plants shall be freshly dug before shipment under favorable weather conditions and with care to preserve fibrous roots. Handling, protecting, packing and shipping shall accord with approved methods. In general, bare root stock shall have primary roots cut clean and no closer than 5 inches from the main stem. The root system shall be balanced with the center of the plant, shall be clay coated, and shall have primary root system diameters as follows:

Plant Height	Primary Root System Diameter	Plant Caliper	Primary Root System Diameter
1 to 2 ft.	12 inches	1 to 1-1/4"	24 inches
3 to 4 ft.	16 inches	1-1/2 to 1-3/4"	28 inches
5 to 6 ft.	20 inches	2 to 2-1/2"	34 inches
8 to 10 ft.	24 inches	3 to 4"	40 inches
		4 to 5"	44 inches

I. Balled and burlapped stock shall conform to the requirements for bare root stock as such apply. Intermediate heights or calipers shall be interpolated. The ball measurement given shall be that of the horizontal diameter; the vertical diameter can be 2 inches less. Balls shall be full and delivered unbroken. They shall be of sizes as follows:

Plant Height	Root System Diameter		Plant Caliper	Root System Diameter
1 to 2 ft.	8 inches		1 to 1-1/4"	20 inches
3 to 4 ft.	12 inches		1-1/2 to 1-3/4"	24 inches
5 to 6 ft.	16 inches		2 to 2-1/2"	30 inches
8 to 10 ft.	20 inches		3 to 4"	38 inches
			4 to 5"	44 inches

J. If the use of larger than specified plants is acceptable, increase the spread of roots or root ball in proportion to the size of the plant.

K. The caliper of the trees, measured 6 inches above the soil line, shall not be less than the minimum size and variety designated in the plant list and according to the latest ANSI Standards for Nursery Stock.

L. Shrubs and small plants shall meet the requirements for spread and/or height indicated in the plant list and be in accordance with ANSI standards

M. Plants with root systems normally asymmetrical with the stem shall be dug and shipped with root system 50 percent greater than that tabulated herein.

N. All trees and shrubs shall be tagged and the label shall state the botanical name and size of the respective species. The labels shall be attached firmly and of such nature as to be permanently legible.

O. Each shipment of plants shall be accompanied by all necessary certificates of nursery inspection as may be required by Federal or State statutes.

2.2 SUBSTITUTIONS

A. If reasonable proof is submitted that any plant disturbed or specified is not obtainable, a proposal will be considered for the nearest equivalent size or variety. If substitutions are approved, any reductions in cost of materials shall accrue as a credit to OWNER. Partial substitutions of any one variety and size shall not be allowed.

PART 3 - EXECUTION

3.1 PREPARATION OF LAWN AREAS

A. The sub-grade for the lawn areas shall be as specified in Section 02200 of these Specifications.

B. CONTRACTOR shall use all existing topsoil that had been previously removed and stored under this Contract before additional topsoil is obtained from another source.

C. After the topsoil has been carefully spread, CONTRACTOR shall spread and uniformly distribute commercial fertilizer conforming to Section 621 of the INDOT Standard Specifications.

D. CONTRACTOR shall perform turf rolling or compaction to reduce the potential for settling.

3.2 SODDING

A. Existing sodded lawns disturbed by CONTRACTOR and other designated shall be sodded in accordance with Section 621 of the INDOT Standard Specifications.

3.3 SEEDING

A. Seeding and mulching shall be done in conformance with Section 621 of the INDOT Standard Specifications, except all disturbed grassed areas, but not sodded, shall be seeded with the following mixture: (Percentages are by weight):

40 percent Kentucky Bluegrass,
40 percent Creeping Red Fescue and
20 percent Oregon Perennial Ryegrass.

3.4 MAINTENANCE

A. Maintenance of the sodded and the seeded areas shall consist of watering, weeding, cutting, trimming and a minimum of 2 applications of fertilizer for the grass as is necessary for obtaining and keeping of a sound weed-free turf as per Section 621 of the INDOT Standard Specifications. This requirement of maintenance shall continue until, in CONSTRUCTION INSPECTOR's opinion, a satisfactory turf is established, but in no case less than 3 months from the date of acceptance. New sodded and seeded areas shall be maintained at a blade length of between 2 inches and 3 inches.

3.5 TREES, SHRUBBERY AND GROUND COVER

A. Areas to be landscaped and planted shall include the various areas shown on the Contract Drawings and any areas disturbed by CONTRACTOR. CONTRACTOR shall turn over to OWNER these various areas with all landscaping showing proper development, satisfactory growth and properly trimmed.

B. CONTRACTOR's attention is called to the fact that the work shall include such watering, weeding of plant beds, spraying, pruning, a minimum of two (2) applications of fertilizer, and replacement per warranty requirements (paragraph 1.6).

C. In general, no planting shall be done until after the topsoil has been placed. All planting shall be watered in a manner and at times to accord with proper horticultural practice.

D. No tree over 2.5 inches in diameter, measured 6 inches above the ground surface, whether within the street right-of-way or on private property within any easement, shall be removed without the prior written approval of CONSTRUCTION INSPECTOR unless otherwise shown or noted on the Contract Drawings.

E. Wherever and whenever possible trees shall be protected and saved, and only those trees which are directly in the line of construction, as determined by CONSTRUCTION INSPECTOR, will be considered for possible removal.

F. Prior to construction, CONTRACTOR shall mark all trees over 2.5 inches in diameter at 6 inches above the ground which CONTRACTOR plans to remove and trees so marked shall not be removed until directed, in writing, by CONSTRUCTION INSPECTOR.

G. CONTRACTOR shall replace all trees which measure over 2.5 inches in diameter at 6 inches above ground which are removed from within the public right- of-way or any easement with a tree which measures not less than 2.5 inches in diameter, or larger, at 6 inches above ground.

H. Where CONSTRUCTION INSPECTOR determines a clear lane of access will be needed by OWNER to maintain the sewer, CONSTRUCTION INSPECTOR will direct, in writing, those trees which will be relocated from an easement or right-of-way when replanting.

I. Under no circumstances shall any tree over 2.5 inches in diameter at 6 inches above ground on private property be removed without the written consent of the

property owner unless such trees are clearly noted for removal on the Contract Drawings. If any such trees within the temporary easements are damaged or removed, whether purposefully or accidentally, CONTRACTOR shall be liable to the individual property owners for damage.

3.6 PREPARATION

A. Examine proposed planting areas and conditions before installation. Do not start planting work until unsatisfactory conditions are corrected.

B. Locate plants as indicated on the Contract Drawings or marked in the field. If obstructions are encountered that are not shown on the Contract Drawings, do not proceed with planting operations until CONSTRUCTION INSPECTOR has selected alternate plant locations.

C. Take all precautions customary in good nursery practice to prepare plants for transport. Workmanship, which fails to meet the highest standards, will be rejected. Spray deciduous plants in foliage with an approved anti-desiccant immediately before digging to prevent dehydration. Dig, pack, transport, and handle plants with care to ensure protection against injury.

D. Cover plants transported on open vehicles with a protective covering to prevent wind burn.

3.7 PLANTING SEASON

A. The fall planting season is considered to be from the first of September until the time when the ground is no longer workable; and the spring planting season is considered to be from the time the ground is again workable to the first of June.

B. Evergreen material: Plant evergreen materials between September 1 and December 1 or in spring before new growth begins, if possible. If CONSTRUCTION INSPECTOR requires planting at other times, plants shall be sprayed with anti-desiccant prior to digging operations, weather dependent.

C. Deciduous material: Plant deciduous materials in a dormant condition, if possible. If deciduous trees are planted in-leaf, they shall be sprayed with an anti-desiccant prior to digging operation.

3.8 PREPARATION OF BEDS AND PITS

A. CONTRACTOR shall perform all excavation to the finished grades shown on the Contract Drawings as required for the proper completion of the work of this Contract, and CONTRACTOR shall remove all excess excavated materials as described in Section 02200 of these Specifications.

B. Excavate circular plant pits with vertical sides, except for plants specifically indicated to be planted in beds. Provide shrub pits at least 1 ½ times as wide as the root system and 24” greater for trees. Depth of pit shall be no greater than

the root ball depth measured from the base of the root flare or topmost root. Scarify bottom of the pit. Remove excess excavated materials from the site.

C. Planting Beds shall be staked out to proper contour, the subsoil loosened to a depth of 3 inches and covered evenly with approximately a 6 inch deep planting beds containing 3 parts topsoil to 1 part peat moss. Over these beds, install a 2 inch deep bed of mulch before planting.

3.9 PLANTING

A. Set plant material in the planting pit to proper grade and alignment. Set plants upright, plum and faced to give the best appearance or relationship to each other or adjacent structure. Set plant material no lower than the finish grade or 2" - 3" above finished grade. No filling will be permitted around trunks or stems. Back fill the pit with existing soil or approved top soil or mix. Form a ring of soil around the edge of each planting pit to retain water.

B. After plants are set, muddle planting soil mixture around bases of balls and fill all voids.

C. Remove all non-synthetic or non-treated burlap, ropes, twine and wires from top 1/3 of root balls. Synthetic or treated burlap must be completely removed from root balls.

D. Space ground cover plants in accordance with indicated dimensions.

E. Watering: Water planting thoroughly to pull soils against root ball and settle air pockets. Additional soil may be needed, water again to ensure complete compaction.

F. Mulching:

1. Mulch tree and shrub planting pits and shrub beds with required mulching material 3 inches deep immediately after planting. After watering, rake mulch to provide a uniform finished surface.

2. Mulch ground cover beds with mulch 2 inches deep before planting.

G. Wrapping, guying, staking:

1. Wrapping should be done only on an as needed basis, using a flexible, vented wrap.

2. Stake/guy should only be used when trees are loose or weak stemmed.

3. Use two stakes with one flexible tie near the top of each.

4. Strap material shall be broad (2-3"), smooth and elastic.

5. Ties should be heavy gauge wire able to support self and strap.

6. Placed so imaginary line between stakes is at right angle to wind direction.

7. Stake into undisturbed soil

H. Pruning:

1. Remove or cut back broken, damaged, dead, diseased growth of new wood. No further pruning should be done at this time.

2. Unless otherwise directed, prune evergreens only to remove broken or damaged branches.

I. All plantings shall be watered in a manner and at times to accord with proper horticultural practices. Should plantings settle out of the vertical, they shall be straightened so as to avoid damage to the root system and even to the extent of loosening and repacking pit filling. Beddings shall be smoothed and cut to an outline that conforms to the planting.

3.10 EXISTING PLANT RELOCATION

A. Transplant trees and shrubs designated for relocation to locations shown on the drawings or marked in field. Prune, dig, ball and burlap, move and plant in accordance with specified tree-planting requirements.

B. All transplanted material shall be dug with a tree spade of adequate size to provide root system large enough to support plant. See AAN standards for rootballs.

C. Prune, dig, ball and burlap, and move designated trees for relocation to the designated plant storage area for heeling-in of materials until final planting areas are prepared, if required.

D. Maintain plants in storage areas by bracing plants in vertical position and setting balls in an enclosed berm of topsoil or bark. Water as required to maintain adequate root moisture.

E. Re-burlap plant balls if required before final transplanting operations.

F. Move to final locations shown on the drawings and plant in accordance with specified tree planting requirements.

G. Transplants may or may not be under warranty.

H. All transplanted material shall be sprayed with anti-desiccants.

3.11 MAINTENANCE

A. CONTRACTOR's maintenance shall include pruning, cultivating, weeding, watering, and application of appropriate insecticides and fungicides necessary to maintain plants free of insects and disease until acceptance.

B. Re-set settled plants to proper grade and position. Restore planting saucer and adjacent material and remove dead material, straighten trees as needed with minimal root disturbance.

C. Tighten and repair guy wires and stakes as required, only if originally needed.

D. Correct defective work as soon as possible after deficiencies become apparent and weather and season permit.

E. Water trees, plants and ground cover beds supplementing natural rainfall to provide at least one inch of water per week.

F. Duration of maintenance by CONTRACTOR shall be for one year after acceptance.

3.12 FLORA ROOT PROTECTION AND CUTTING PROTECTION DURING CONSTRUCTION ACTIVITIES

A. Tree protection fence shall be erected around, minimally, the distance of dripline of the tree to be protected. Tree protection fence shall be a minimum of four feet high welded wire or chain link fence attached to 6' minimum "T" – steel posts, driven at least 2' into ground at 10' intervals or approved equivalent.

B. Tree protection signage shall be laminated or otherwise weatherproof and printed in bold text so as to be easily read from a distance of 20 feet. Wording on signage shall be provided in both English and Spanish. Signs shall be placed every 30' along protection fence.

C. No other construction activity may occur on site until tree preservation fencing has been installed and approved.

D. All construction activity within the areas fenced off around the trees shall be prohibited. This shall include , but not be limited to, the following activities:

1. Parking or driving equipment, machinery or vehicles of any type.

2. Storage of any construction materials, equipment, stockpiling, excavation or fill, soil, gravel, etc.

3. Dumping of any chemicals, wash-out materials from cleaning equipment, concrete or mortar remainder, trash, garbage, or debris of any kind.

4. Trenching, grading or construction in the root area.

E. Fencing shall remain in place and be continuously maintained for duration of construction.

F. Root pruning shall be performed whenever grades outside the tree protection area but within an area twice the height of the tree will be lowered.

3.13 PROTECTION DURING REMOVAL OF EXISTING MATERIALS WITHIN THE DRIPLINE

A. Extra care shall be taken during the removal of existing materials within the dripline to prevent breakage of any roots within the dripline (root zone) of any public flora. Violations of these basic policies and procedures may result in fines being levied against CONTRACTOR. Additionally, negligent acts may result in the potential catastrophic failure of the affected flora leading to injury, property damage or loss of life for which CONTRACTOR shall be held responsible.

B. Dripline (root zone) dimensions are defined by size classification of flora (see Figure 1 in Part 3.16 of this Section 02900).

C. No roots are to be broken with equipment during removal of existing walks, curbs or any other facilities, unless roots are first “pre-cut” on the tree side of the excavation. Roots are to be cut with sharp tools, such as, chain saws, handsaws, loppers, or other. Equipment breakage of roots damages more of the root than necessary and creates unseen fractures beyond the soil wall (see Figure 5 in Part 3.16 of this Section 02900).

D. Pre-cutting of roots will only be permissible in situations where it is impossible to either elevate final paved grade to lay atop roots, reduce paved width to acceptable specifications while avoiding root interference or adhere to directional boring specifications.

E. Above ground portions of flora shall be protected from contact with any equipment or materials. Construction fencing shall be placed at the perimeter of the area to be protected to help prevent unnecessary damage

F. No concrete or other foreign materials shall be placed directly against cut portions of roots or within 6” of cut portions.

G. There shall be four (4) classifications of root sizes according to the size of the main stem of any particular flora.

1. Class 1: root diameter = 20-25% of main stem diameter

2. Class 2: root diameter = 15-20% of main stem diameter

3. Class 3: root diameter = 10-15% of main stem diameter

4. Class 4: root diameter = 1-10% of main stem diameter

H. No more than one (1) Class 1 root may be cut from any given flora

I. No more than two (2) Class 2 roots may be cut from any given flora

J. No more than three (3) Class 3 roots may be cut from any given flora

K. No limit for Class 4 roots

L. No more than 45% total root diameter, in any class combination, may be removed.

M. Root removal in excess of the above specifications may result in the required removal and replacement of the affected flora by CONTRACTOR.

N. Not more than one side of any flora may suffer cut roots.

O. Excavated soil shall be placed on the side of the cut opposite the tree.

P. No roots greater than 25% of the trunk diameter of flora may be cut.

Q. No structural roots shall be cut within 24" of the trunk of any flora or within the Structural Critical Rooting Distance, whichever is larger. See Table 1 in Part 3.16 of this Section 02900 - Structural Critical Rooting Distance to Minimize Catastrophic Tree Failure.

R. All pre-cut and/or damaged roots shall be clean cut with the appropriate sharp tool prior to back-filling of soil.

S. All cut roots must be clean cut perpendicular to the natural direction of root growth at the point where the cut is to occur.

T. All clean cuts shall occur on the tree side of the root beyond a point where all root tissues have been damaged.

U. All damaged roots shall be back-filled with topsoil within 60 minutes of being clean cut.

V. All damaged roots must have at least 6" clearance from all permanent construction materials except topsoil.

W. All root damaged flora must be heavily watered within 24 hours of backfilling.

3.15 GRADE CHANGE SPECIFICATIONS:

A. Elevating the final grade should be considered in all situations where the diameter of the trunk of valuable flora exceeds 10" and the location of the work to be performed is within the dripline, and/or the trunk diameter does not exceed the width of the existing tree lawn, and/or when directional boring is impractical or impossible.

B. When final grades are to be elevated above existing grades, extra care shall be taken during removal of existing materials, i.e., backhoes should "scrape" or "lift"

concrete away from roots rather than “scoop up” concrete, or concrete shall be broken with a jackhammer and removed manually, etc.

C. Grade elevations in excess of 12” depth shall require adherence to approved Tree Well Specifications.

D. When elevating grade less than 12”, not more than 20% of the surface area within the dripline of any flora may be paved or compacted with any machinery.

E. Undamaged roots should be covered with at least 2” of sand or soil base prior to installation of a gravel base or the pouring of concrete.

F. Form stakes should be at least 10” from the trunk of flora.

G. Elevation should be high enough to prevent root cutting for installation of forms.

3.16 HOW TO PROPERLY PLANT A BALLED AND BURLAPED OR CONTAINERIZED TREE

A. Dig hole at least 1½ to 2 times as wide as root ball. Dig hole 3 to 4 inches shallower than depth of root ball to keep tree from settling too deep. Rough up sides of hole to allow for root penetration into surrounding soil.

B. Remove dead, broken, and diseased branches only, do not shape or reduce tree crown. Remove water sprouts or suckers. Remove all plastic and unnatural materials from branches of tree.

C. Pull back burlap from top of root ball, or container, and identify root flare. This is the wider area at the base of tree trunk where roots begin (uppermost root should be located just below soil surface). If the root flare is not visible, expose the flare by carefully removing soil from the top of root ball to the uppermost root. The flare should be visible after tree has been planted (see diagram following Paragraph 3.16 L.).

D. Measure from root flare to bottom of root ball to determine proper depth of hole. Add or remove soil from hole as necessary to obtain proper depth when soil on bottom of hole is compacted. The majority of roots on a newly planted tree will develop in the top 12 inches of soil. If tree is planted too deep, new roots will have difficulty developing due to a lack of oxygen. It is better to plant the tree a little high to allow for some settling.

E. Push, place, or lift the tree gently into hole by the ball. Do not drag or drop tree roughly into hole. Do not lift tree by the trunk. For containerized trees, gently pull circling roots away from ball and spread out before filling in hole. Longer roots should be cut to width of hole rather than circled around hole. Root bound balls should be scarified several inches deep into the ball from top to bottom at a minimum of 4 locations around the ball to discourage continued circling. Be careful to minimize excessive root damage.

F. View tree from several directions to confirm tree is straight. Straighten tree by maneuvering root ball (do not push or pull on trunk of tree).

G. Remove at least the top one-third of wire basket from around sides of root ball, being careful not to move root ball. Remove at least the top one-third of non-synthetic or non-treated burlap and remove from hole. Remove all synthetic and treated burlap completely. Re-check tree to be sure it is positioned correctly. Re-position if necessary.

H. Fill hole with soil that came out of hole. Be careful not to damage trunk or roots in the process. Firmly pack soil around ball while filling to eliminate air pockets which may cause roots to dry out. It is best to add a few inches of soil and settle with water, alternating this process until hole is filled and tree is firmly planted. Fertilizer shall not be applied at the time of planting.

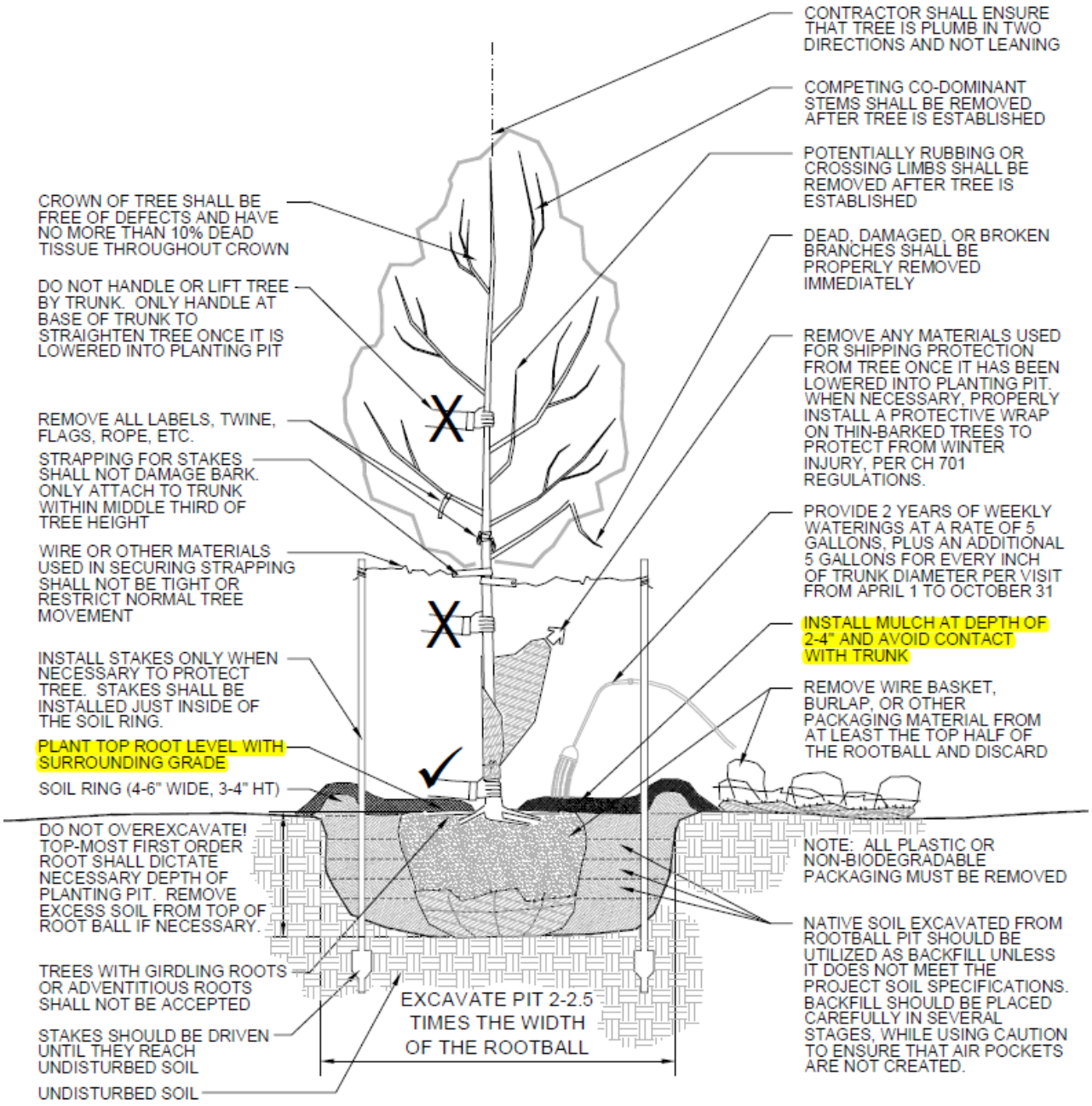
I. Mulch to width of planting hole around base of tree (minimum). A 2 to 4 inch layer is ideal. More than 4 inches may cause a problem with oxygen and moisture levels. When placing mulch, care should be taken not to cover actual trunk of tree as this may cause decay in the living bark. A mulch-free area, 1 to 2 inches wide, is sufficient to avoid moist bark conditions and prevent decay.

J. **Follow-up care:** Keep soil moist but not soaked. Water trees as necessary to provide at least 1" water per week naturally and/or supplementary. A thorough soaking is much better than light, frequent watering.

K. Staking is only necessary to support loosely planted trees that will not stand on their own after planting. Remove staking after 1 year.

L. Protect the tree from animals (including humans): Plastic, expanding tree wraps shall be used for this purpose.

Diagram for planting a balled/burlapped tree



(revised 3/8/2016)

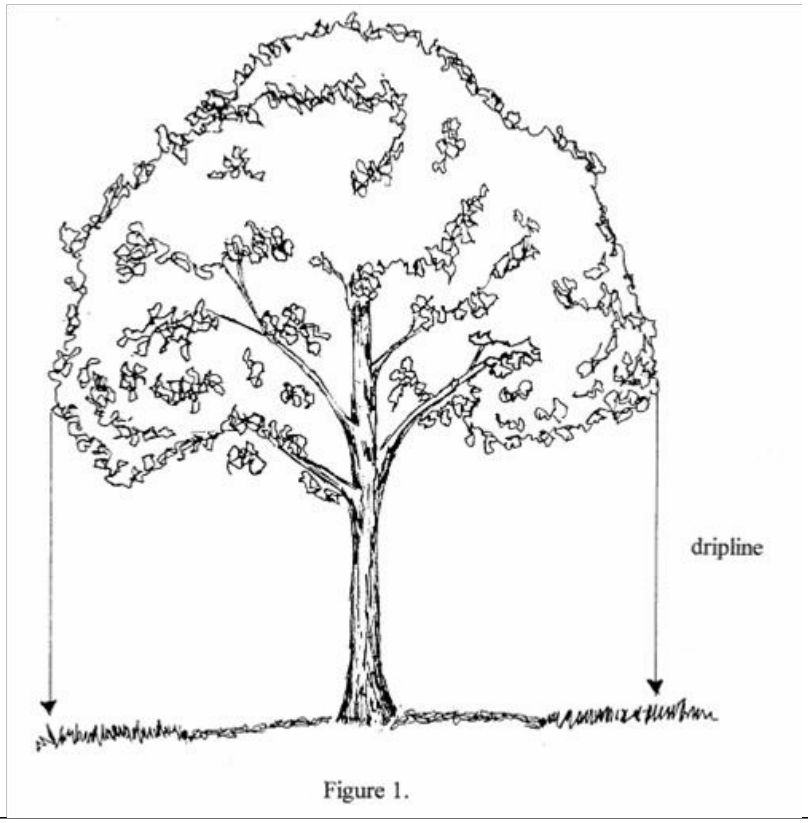


Figure 1: Drip Line definition

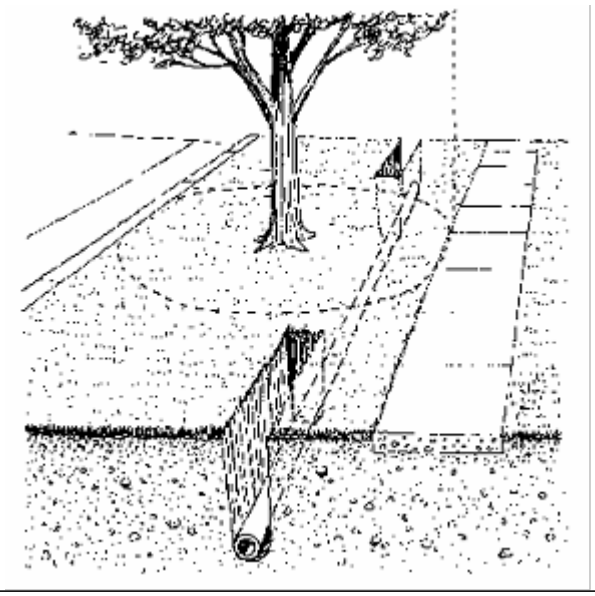


Figure 2. Location of bore pits in relation to drip line

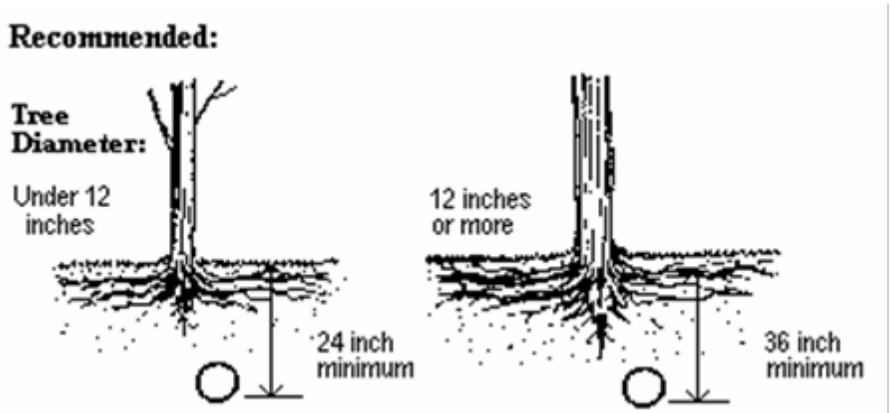


Figure 3. Depth of bore under tree

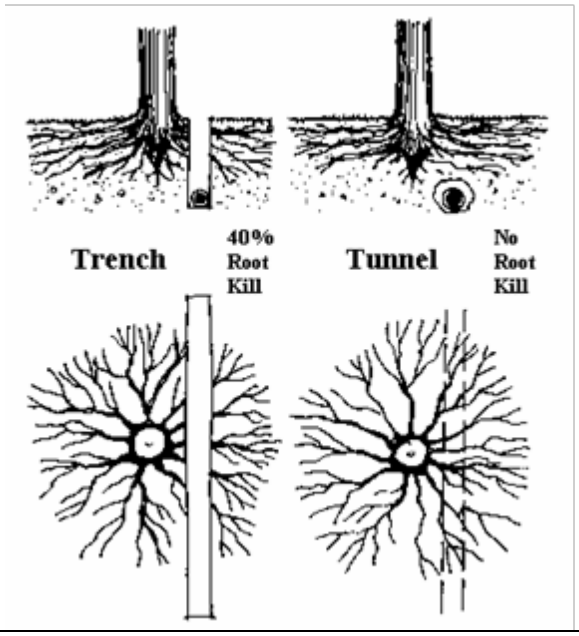


Figure 4. Trenching damage vs boring damage to roots

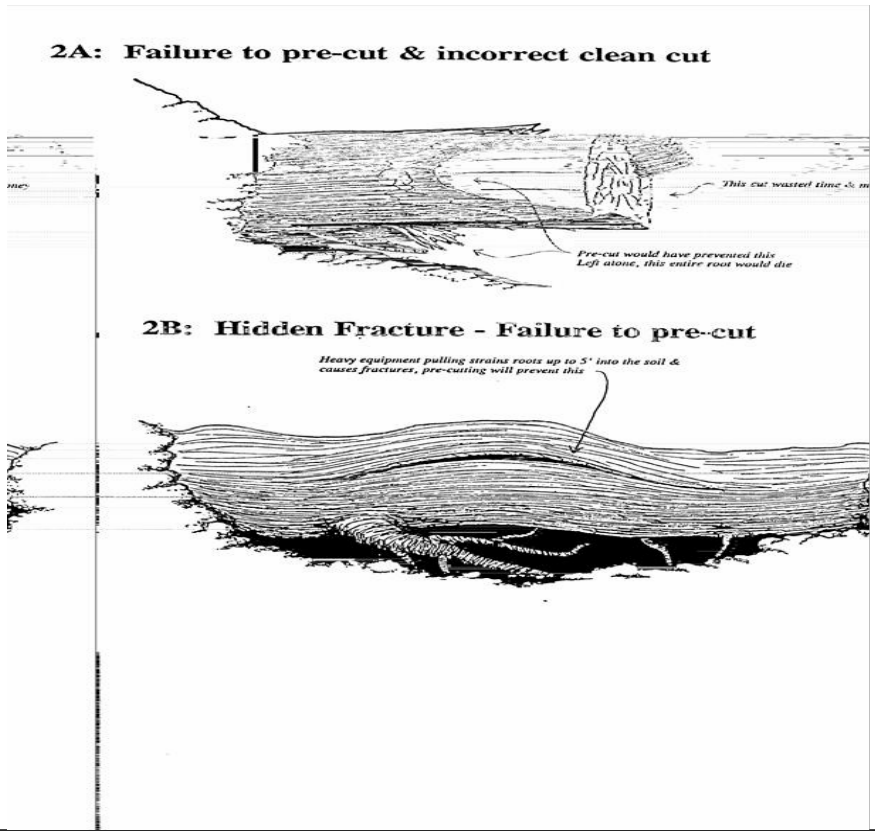


Figure 5. Fractures due to not pre-cutting

M. Structural Critical Rooting Distance to Minimize Catastrophic Tree Failure

1. Significant risk of catastrophic tree failure exists if structural roots within this given radius (Shown in Table 1 below) are destroyed or severely damaged. Structural critical rooting distance determined upon tree diameter at 4.5 feet above the ground (DBH).

Table 1.0 Structural Critical Rooting Distance to Minimize Catastrophic Tree Failure

Tree Diameter, Inches	Structural Critical Rooting Distance (Feet of radius)	Tree Diameter, Inches	Structural Critical Rooting Distance (Feet of radius)
1	2	26	10
2	2	27	10
3	2	28	10
4	3	29	10
5	3	30	10
6	4	31	10
7	4	32	10

Table 1.0 Structural Critical Rooting Distance to Minimize Catastrophic Tree Failure			
Tree Diameter, Inches	Structural Critical Rooting Distance (Feet of radius)	Tree Diameter, Inches	Structural Critical Rooting Distance (Feet of radius)
8	5	33	10
9	5	34	10
10	6	35	10
11	6	36	10
12	7	37	11
13	7	38	11
14	7	39	11
15	8	40	11
16	8	45	11
17	8	50	12
18	8	55	12
19	9	60	13
20	9	65	13
21	9	70	14
22	9	75	14
23	9	80	15
24	10	85	15
25	10	90<	16

3.17 CLEANING

A. Perform cleaning during installation and upon completion of the work. Remove from site all excess materials, soil, debris, and equipment. Repair damage resulting from planting operations

3.18 ACCEPTANCE

A. Planted areas will be inspected at completion of installation and accepted subject to compliance with specified materials and installation requirements.

B. Inspection upon CONTRACTOR's request to determine acceptance of planted areas will be made by CONSTRUCTION INSPECTOR.

C. Planted areas will be accepted provided all requirements have been complied with and plant materials are alive and in a healthy, vigorous condition.

D. Sections of the Work may be accepted when complete upon agreement of CONSTRUCTION INSPECTOR, ENGINEER and CONTRACTOR.

3.19 MEASUREMENT AND PAYMENT

A. No direct payment shall be made for seeding, sodding, pruning or tree trimming that is necessary to complete the work. Payment for Tree Replacement and Maintenance, 2.5 Inch Diameter shall be made in accordance with Section 01025- Measurement and Payment.

-END OF SECTION 02900-

SECTION 03200 - STEEL REINFORCEMENT

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. The work of this Section includes but is not limited to, all reinforcing steel required for properly reinforcing all concrete structures that are to be built and/or rehabilitated under this Contract. In general, this shall include the steel reinforcing in any type of structural elements shown on the Contract Drawings.

B. In general, the work of this Section shall include the furnishing, testing, storing, protecting, shaping, placing and maintaining in position of all steel reinforcement, irrespective of type, together with any supporting chairs and clips, tie wires, spacers, bolsters, and other fastenings, wire clips for wrapping, and the furnishing of all labor, materials, tools and equipment necessary to complete the Work as shown on the Contract Drawings, specified or required for the proper completion of the installation.

1.2 RELATED SECTIONS

A. Section 01300 – Contractor Submittals

B. Section 03300 - Cast-in-Place Concrete

C. Section 03315 - Ancillary Grout

D. Section 03400 – Precast Concrete Structures

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. ACI 301 Standard Specifications for Structural Concrete

B. ACI 315 Details and Detailing of Concrete Reinforcement

C. ACI 318 Building Code Requirements for Reinforced Concrete

D. ACI 350 Building Code Requirements for Environmental Engineering Concrete Structures

E. SP-66 ACI Detailing Manual

F. CRSI MSP-1 Concrete Reinforcing Steel Institute Manual of Standard Practice

G. WRI Manual of Standard Practice for Welded Wire Fabric

H. AWS D1.4 Structural Welding Code - Reinforcing Steel

I. ASTM A 82 Specification for Steel Wire, Plain, for Concrete Reinforcement

J. ASTM A 185 Specification for Steel Weldedl Wire Fabric, Reinforcement, for Concrete Reinforcement

K. ASTM A 497 Standard Specification for Steel Welded Wire Reinforcement, Deformed, for Concrete

L. ASTM A 615 Specification for Deformed and Plain Billet-Steel Bars for Concrete Reinforcement

M. ASTM A 706 Standard Specification for Low-Allow Steel Deformed and Plain Bars for Concrete Reinforcement

1.4 CONTRACTOR SUBMITTALS

A. Submit shop bending diagrams, placing lists, and drawings of all reinforcement steel, including bar sizes, spacings, locations, quantities and supporting and spacing devices, prior to fabrication in accordance with the requirements of Section 01300.

B. Details of the concrete reinforcement steel and concrete inserts shall be submitted by CONTRACTOR to CONSTRUCTION INSPECTOR for approval by ENGINEER within 30 days after receipt by CONTRACTOR of the Notice to Proceed. Said details of reinforcement steel for fabrication and erection shall conform to ACI 315 and the requirements specified and shown. The shop bending diagrams shall show the actual lengths of bars, to the nearest inch measured to the intersection of the extensions (tangents for bars of circular cross section) of the outside surface. The shop drawings shall include bar placement diagrams that clearly indicate the dimensions of each bar splice.

C. Where mechanical couplers are required or permitted to be used to splice reinforcement steel, CONTRACTOR shall submit manufacturer's literature which contains instructions and recommendations for installation of each type of coupler used; certified test reports which verify the load capacity of each type and size of coupler used; and shop drawings which show the location of each coupler with details of how they are to be installed in the formwork.

1.5 QUALITY ASSURANCE

A. Reinforcement bars and welded steel wire shall be inspected and tested at the mill at which they are rolled or fabricated, in accordance with ASTM Designation A 615 and A 185 respectively, and two (2) certified copies of such tests shall be furnished to CONSTRUCTION INSPECTOR. Costs for both initial tests and any costs associated with additional tests due to material failing initial tests shall be paid by CONTRACTOR.

B. If requested by ENGINEER, CONTRACTOR shall provide samples from each heat of reinforcement steel delivered in a quantity adequate for testing.

C. Do not fabricate reinforcement until shop and placement drawings have been reviewed and approved by ENGINEER.

D. Perform concrete reinforcement work in accordance with the Concrete Reinforcing Steel Institute (CRSI) Manual of Standard Practice.

PART 2 - PRODUCTS

2.1 REINFORCEMENT STEEL

A. Reinforcement Steel for all cast-in-place reinforced concrete construction shall conform to the following requirements:

1. Bar reinforcement shall conform to the requirements of ASTM A 615 for Grade 60 Billet Steel Reinforcement or as otherwise shown. Rebar conforming to ASTM A 615 shall not be welded in the shop or in the field. Tack welded pre-assemblies are not allowed unless rebar conforms to ASTM A 706.

2. Low Alloy bar reinforcement conforming to ASTM A 706, Grade 60, shall only be used where specifically shown on the Contract Drawings.

3. Welded wire fabric reinforcement shall conform to the requirements of ASTM A 185 and the details shown; provided, that welded wire fabric with longitudinal wire of W4 size wire and smaller shall be either furnished in flat sheets or in rolls with a core diameter of not less than 10 inches; and provided further, that welded wire fabric with longitudinal wires larger than W4 size shall be furnished in flat sheets only.

4. Spiral reinforcement shall be cold-drawn steel wire conforming to the requirements of ASTM A 82.

B. Accessories

1. Accessories shall include all necessary chairs, slab bolsters, concrete blocks, tie wires, dips, supports, spacers, and other devices to position reinforcement during concrete placement. All bar supports shall meet the requirements of the CRSI Manual of Standard Practice. Wire bar supports shall be CRSI Class 1 for maximum protection with a 1/8-inch minimum thickness of plastic coating that extends at least 1/2-inch from the concrete surface. Plastic shall be gray in color.

2. Concrete blocks (dobies) used to support and position reinforcement steel shall have the same or higher compressive strength as specified for the concrete in which it is located. Wire ties shall be embedded in concrete block bar supports.

2.2 MECHANICAL COUPLERS

A. Mechanical couplers shall be provided where shown and/or where approved by ENGINEER. The couplers shall develop a tensile strength that exceeds 125 percent of the yield strength of the reinforcement bars being spliced.

B. Where the type of coupler used is composed of more than one component, all components required for a complete splice shall be supplied. This shall apply to all mechanical splices, including those splices intended for future connections.

C. The reinforcement steel and coupler used shall be compatible for obtaining the required strength of the connection. Straight threaded type couplers shall require the use of the next larger size reinforcing bar or shall be used with reinforcing bars with specially forged ends which provide upset threads which do not decrease the basic cross section of the bar.

D. Couplers shall be Lenton Form Saver as manufactured by Erico Products; Dowel Bar Splicer System as manufactured by Richmond Screw Anchor Company; or approved equal.

2.3 WELDED SPLICES

A. Welding of reinforcing steel for any purpose is not permitted unless specifically detailed in the Contract Drawings. Welded reinforcing shall conform to ASTM A 706.

2.4 EPOXY GROUT

A. Epoxy for grouting reinforcing bars shall be specifically formulated for such application, for the moisture condition, application temperature, and orientation of the hole to be filled. Epoxy grout shall meet the requirements found in Section 03315 Ancillary Grout.

PART 3 - EXECUTION

3.1 GENERAL

A. All reinforcement steel, welded wire fabric, couplers, and other appurtenances shall be fabricated and placed in accordance with the requirements of the Building Code and the supplementary requirements specified herein.

3.2 FABRICATION

A. General

1. Reinforcement steel shall be accurately formed to the dimensions and shapes shown, and the fabricating details shall be prepared in accordance with ACI 315 and ACI 318, except as modified by the Contract Drawings. Stirrups and tie bars shall be bent around a pin having a diameter not less than 1-1/2-inch for No. 3 bars, 2-inch for No. 4 bars, and 2-1/2-inch for No. 5 bars. Bends for other bars shall be made around a pin having a diameter not less than 6 times the bar diameter, except for bars larger than 1 inch, in which case the bends shall be made around a pin of 8 bar diameters. Bars shall be bent cold.

2. CONTRACTOR shall fabricate reinforcement bars for structures in accordance with approved bending diagrams, placing lists, and placing drawings.

B. **Fabricating Tolerances:** Bars used for concrete reinforcement shall meet the following requirements for fabricating tolerances:

1. Sheared length: ± 1 inch

2. Depth of truss bars: + 0, - 1/2 inch

3. Stirrups, ties, and spirals: ± 1/2 inch

4. All other bends: ± 1 inch

3.3 PLACING

A. Reinforcement steel shall be accurately positioned as shown, and shall be supported and wired together to prevent displacement, using annealed iron wire ties or suitable clips at intersections. All reinforcement steel shall be supported by concrete, plastic or metal supports, spacers or metal hangers which are strong and rigid enough to prevent any displacement of the reinforcement steel. Where concrete is to be placed on the ground, supporting concrete blocks (or dobies) shall be used, in sufficient numbers to support the bars without settlement, but in no case shall such support be continuous. All concrete blocks used to support reinforcement steel shall be tied to the steel with wire ties that are embedded in the blocks. For concrete over formwork, CONTRACTOR shall furnish concrete, metal, plastic, or other acceptable bar chairs and spacers.

B. Limitations on the use of bar support materials shall be as follows.

1. Concrete Dobies: permitted at all locations except where architectural finish is required.

2. Plastic Coated Wire Bar Supports: permitted at all locations except on grade.

3. Plastic Bar Spacers: permitted on all wall forms.

C. Tie wires shall be bent away from the forms in order to provide the specified concrete coverage.

D. Bars additional to those shown which may be found necessary or desirable by CONTRACTOR for the purpose of securing reinforcement in position shall be provided by CONTRACTOR at its own expense. Do not shift reinforcement bars from positions in upper layers to positions in lower layers as a substitute for additional support bars.

E. Unless otherwise specified, reinforcement placing tolerances shall be within the limits specified in Section 7.5 of ACI 318 except where in conflict with the requirements of the Building Code.

F. Bars may be moved as necessary to avoid interference with other reinforcement steel, conduits, or embedded items. If bars are moved more than one bar

diameter or enough to exceed the above tolerances, the resulting arrangement of bars shall be acceptable to ENGINEER.

G. Welded wire fabric reinforcement placed over horizontal forms shall be supported on slab bolsters as recommended by the Wire Reinforcement Institute. Slab bolsters shall be spaced not more than 30 inches on centers, shall extend continuously across the entire width of the reinforcement mat, and shall support the reinforcement mat in the plane shown.

H. Welded wire fabric placed over the ground shall be supported on wired concrete blocks (dobies) spaced not more than 30 inches on centers in any direction in order to maintain their position with the required concrete cover and as recommended by the Wire Reinforcement Institute. The construction practice of placing welded wire fabric on the ground and hooking into place in the freshly placed concrete shall not be used.

I. Accessories supporting reinforcing bars shall be spaced such that there is no deflection of the accessory from the weight of the supported bars. When used to space the reinforcing bars from wall forms, the forms and bars shall be located so that there is no deflection of the accessory when the forms are tightened into position.

3.4 SPACING OF BARS

A. The clear distance between parallel bars (except in columns and between multiple layers of bars in beams) shall be not less than the nominal diameter of the bars nor less than 1-1/3 times the maximum size of the coarse aggregate, nor less than one inch.

B. Where reinforcement in beams or girders is placed in 2 or more layers, the clear distance between layers shall be not less than one inch unless noted otherwise on the Contract Drawings.

C. In columns, the clear distance between longitudinal bars shall be not less than 1-1/2 times the bar diameter, nor less than 1-1/2 times the maximum size of the coarse aggregate, nor less than 1-1/2 inches.

D. The clear distance between bars shall also apply to the distance between a contact splice and adjacent splices or bars.

E. Concrete cover over the principal reinforcing steel shall be provided as indicated on the Contract Drawings, unless otherwise shown.

3.5 SPLICING

A. General

1. Reinforcement bar splices shall only be used at locations shown. When it is necessary to splice reinforcement at points other than where shown, the character of the splice shall be as acceptable to ENGINEER.

2. Unless otherwise indicated, dowels shall match the size and spacing of the spliced bar.

B. Splices of Reinforcement

1. The length of lap for reinforcement bars, unless otherwise shown, shall be in accordance with ACI 318 for a Class B splice and the table listing of lap lengths on the Contract Drawings.

2. Laps of welded wire fabric shall be in accordance with ACI 318. Adjoining sheets shall be securely tied together with No. 14 tie wire, one tie for each 2 running feet. Wires shall be staggered and tied in such a manner that they cannot slip.

C. Bending or Straightening

1. Reinforcement shall not be straightened or re-bent in a manner that will injure the material. Bars with kinks or bends not shown shall not be used. All bars shall be bent cold, unless otherwise permitted by ENGINEER. No bars partially embedded in concrete shall be field-bent except as shown or specifically permitted by ENGINEER.

D. Couplers that are located at a joint face shall be a type that can be set either flush or recessed from the face as shown. The couplers shall be sealed during concrete placement to completely eliminate concrete or cement paste from entering. Couplers intended for future connections shall be recessed a minimum of 1/2 inch from the concrete surface. After the concrete is placed, the coupler shall be plugged with plastic plugs which have an O-ring seal and the recess filled with sealant to prevent any contact with water or other corrosive materials. Threaded couplers shall be plugged.

E. Unless noted otherwise, mechanical coupler spacing and capacity shall match the spacing and capacity of the reinforcing shown for the adjacent section.

3.6 STORAGE AND PROTECTION

A. All steel for reinforcement shall be delivered at the site of the Work without rust, other than that which may have accumulated in normal transit. It shall be sorted for size and length and shall be properly tagged, with substantial tags securely attached to each bundle properly identifying the bars as to use intended. Bars shall be stored in racks and protected from the weather by housing. Reinforcing steel shall not be stored in contact with the ground.

B. All steel shall be kept free from oil, grease, dirt or other objectionable adhering substances, and it shall be satisfactorily cleaned of scale and heavy or flaky rust before being placed in the Work. If, after having been placed in the Work, the concreting is delayed or interrupted for any considerable number of days, the steel shall be well protected.

3.7 CLEANING AND PROTECTION

A. Reinforcement steel shall at all times be protected from conditions conducive to corrosion until concrete is placed around it.

B. The surfaces of all reinforcement steel and other metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar and other foreign substances immediately before the concrete is placed. Where there is delay in depositing concrete, reinforcement shall be re-inspected and, if necessary re-cleaned.

3.8 EMBEDMENT OF DRILLED REINFORCING STEEL DOWELS

A. Hole Preparation

1. The hole diameter shall be as recommended by the epoxy manufacturer but shall be no larger than 0.25 inch greater than the diameter of the outer surface of the reinforcing bar deformations.

2. The depth of the hole shall be as recommended by the epoxy manufacturer to fully develop the bar but shall not be less than 12 bar diameters, unless noted otherwise.

3. The hole shall be drilled by methods that do not interfere with the proper bonding of epoxy.

4. Existing reinforcing steel in the vicinity of proposed holes shall be located prior to drilling. The location of holes to be drilled shall be adjusted to avoid drilling through or nicking any existing reinforcing bars.

5. The hole shall be blown clean with clean, dry compressed air to remove all dust and loose particles.

6. Epoxy shall be injected into the hole through a tube placed to the bottom of the hole. The tube shall be withdrawn as epoxy is placed but kept immersed to prevent formation of air pockets. The hole shall be filled to a depth that insures that excess material will be expelled from the hole during dowel placement.

7. Dowels shall be twisted during insertion into the partially filled hole so as to guarantee full wetting of the bar surface with epoxy. The bar shall be inserted slowly enough to avoid developing air pockets.

3.9 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Steel Reinforcement, but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 03200 -

SECTION 03290 - JOINTS IN CONCRETE

PART 1 - GENERAL

1.1 THE REQUIREMENT

A. CONTRACTOR shall provide joints in concrete, complete and in place, in accordance with the Contract Documents.

B. Joints in concrete structures and roads shall be the types defined below and will be permitted only where indicated, unless specifically accepted by ENGINEER.

1.2 RELATED SECTIONS

A. Section 01300 – Contractor Submittals

B. Section 03300 – Cast-in-Place Concrete

1.3 REFERENCES

A. American Society for Testing and Materials (ASTM):

1. ASTM A276: Standard Specification for Stainless Steel Bars and Shapes.

2. ASTM A775: Standard Specification for Epoxy Coated Steel Reinforcing Bars.

3. ASTM C877: Standard Specification for External Sealing Bands for Concrete Pipe, Manholes and Precast Box Sections.

4. ASTM C920: Specification for Elastomeric Joint Sealants.

5. ASTM C990: Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

6. ASTM C1193: Guide for Use of Joint Sealants.

7. ASTM D412: Standard Test Methods or Vulcanized Rubber and Thermoplastic Elastomers – Tension.

8. ASTM D570: Standard Test Method for Water Absorption of Plastics

9. ASTM D624: Standard Test method for Tear Strength of Conventional Vulcanized Rubber and Thermoplastic Elastomers.

10. ASTM D638: Standard Test Method for Tensile Properties of Plastics

11. ASTM D746: Standard Test Method for Brittleness Temperature of Plastics and Elastomers by Impact.

12. ASTM D747: Standard Test Method for Apparent Bending Modulus of Plastics by Means of a Cantilever Beam.

13. ASTM D792: Standard Test Methods for Density and Specific Gravity of Plastics by Displacement.

14. ASTM D994: Standard Specification for Preformed Expansion Joint Filler for Concrete (Bituminous Type).

15. ASTM D1056: Standard Specification for Flexible Cellular Materials – Sponge or Expanded Rubber.

16. ASTM D1171: Standard Test Method for Rubber Deterioration – Surface Ozone Cracking Outdoors or Chamber (Triangular Specimens).

17. ASTM D1259: Standard Test Methods for Nonvolatile Content of Resin Solutions.

18. ASTM D1752: Specification for Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction.

19. ASTM D2000: Standard Specification for Rubber Products in Automotive Applications.

20. ASTM D2240: Standard Test Method for Rubber Property – Durometer Hardness.

21. ASTM D2241: Standard Specification for Poly (Vinyl Chloride) (PVC) Pressure-Rated Pipe (SDR Series).

22. ASTM D2377: Standard Test Method for Tack-Free Time of Caulking Compounds and Sealants.

B. Environmental Protection Agency (EPA):

1. EPA 40 CFR 59: National Volatile Organic Compound Emission Standards for Consumer and Commercial Products.

C. US Army Corps of Engineers:

1. US Army Corps of Engineers, CRD-C 572: Specifications for Polyvinylchloride Waterstop.

D. Federal Specifications:

1. TT-S-00227E: Federal Specification, Sealing Compound.

2. TT-S-00230C: Federal Specification, Sealing Compound: Elastomeric Type, Single Component.

3. TT-S-001657: Interim Federal Specification, Sealing Compound – Single Component, Butyl Rubber Based Solvent Release Type (For Buildings and Other Types of Construction).

1.4 TYPES OF JOINTS

A. Construction Joints: When fresh concrete is placed against a hardened concrete surface, the joint between the two pours is called a construction joint (also referred to as a "cold joint". Construction joints, unlike expansion and contraction joints, are not intended to allow for movement of concrete members. Unless otherwise indicated, joints in water bearing members shall be provided with a flatstrip-type waterstop and/or sealant groove of the shape indicated. Reinforcing bars, if needed, shall be continuous through the joint, as detailed on the Contract Drawings. A bonding agent or cement grout shall be applied to the hardened concrete surface of the joint prior to placing the fresh concrete as noted on the Contract Drawings or as specified in Section 03300, Cast-in-Place Concrete.

B. Contraction Joints: Contraction joints are also formed when fresh concrete is placed against a hardened concrete surface except that the fresh concrete shall not be permitted to bond with the hardened surface of the earlier pour, which shall be coated with a bond breaker. The slab reinforcement shall be stopped 4-1/2 inches from the joint; which is provided with a sleeve-type dowel, to allow shrinkage of the concrete of the later pour. Waterstop and/or sealant groove shall also be provided when indicated.

C. Expansion Joints: To allow the concrete to expand freely, a space is provided between the two pours, and the joint shall be formed as indicated. The space is obtained by placing a filler joint material against the earlier pour, to act as a form for the later pour. Unless otherwise indicated, expansion joints in water bearing members shall be provided with a center-bulb type waterstop as indicated.

1. Premolded expansion joint material shall be installed with the edge at the indicated distance below or back from finished concrete surface, and shall have a slightly tapered, dressed, and oiled wood strip secured to or placed at the edge thereof during concrete placement, which shall later be removed to form space for sealing material.

2. The space so formed shall be filled with a joint sealant material as indicated below. In order to keep the two wall or slab elements in line, the joint shall also be provided with a sleeve-type dowel as indicated.

D. Control Joints: The function of the control joint is to provide a weaker plane in the concrete, where shrinkage cracks will probably occur. A groove, of the shape and dimensions indicated, is formed or saw-cut in the concrete. This groove is afterward filled with a joint sealant material.

1.5 CONTRACTOR SUBMITTALS

A. Furnish submittals in accordance with Section 01300.

B. Shop Drawings

1. Placement drawings showing the location and type of all joints for each structure.

2. Certified test reports from the sealant manufacturer on the actual batch of material being supplied indicating compliance with requirements shall be furnished before the sealant is used on the job.

3. Copies of Waterstop Welding Certification to be provided by manufacturer or authorized agent of manufacturer. Every person who is to be involved with waterstop installation is required to have individual Certification on file with CONSTRUCTION INSPECTOR, which states said individuals are certified and trained to install waterstop per manufacturer's recommendations and specifications.

4. Manufacturer's information demonstrating compliance of the following with indicated requirements:

   a. Bearing Pad

   b. Neoprene Sponge

   c. Preformed Joint Filler

   d. Backing Rod

   e. Bond Breaker

   f. Waterstop

   g. Slip Dowels

   h. PVC Tubing

C. Samples

1. Prior to production of the material required under this Section, qualification samples of waterstops shall be submitted which represent in all respects the material proposed. Such samples shall consist of extruded or molded sections of each size or shape to be used. The balance of the material to be used shall not be produced until after ENGINEER has reviewed the qualification samples.

D. Certificates: Written certification from the manufacturer as an integral part of the shipping form, to show that all of the material shipped to this project meets or exceeds the physical property requirements of the Contract Documents. Supplier certificates are not acceptable.

1.6 QUALITY ASSURANCE

A. Waterstop Inspection: It is required that all waterstop field joints shall be subject to inspection, and no such work shall be scheduled or started without having made prior arrangements with CONSTRUCTION INSPECTOR for the required inspections. Not less than 24 hours notice shall be given for scheduling such inspections.

B. Field joints in waterstops shall be subject to inspection for misalignment, bubbles, inadequate bond, porosity, cracks, offsets, and other defects which would reduce the potential resistance of the material to water pressure at any point. Defective joints shall be replaced with material which passes inspection; faulty material shall be removed from the Site and disposed of.

C. The following waterstop defects represent a partial list of defects which shall be grounds for rejection:

1. Offsets at joints greater than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

2. Exterior crack at joint, due to incomplete bond, which is deeper than 1/16-inch or 15 percent of material thickness, at any point, whichever is less.

3. Any combination of offset or exterior crack which will result in a net reduction in the cross section of the waterstop in excess of 1/16-inch or 15 percent of material thickness at any point, whichever is less.

4. Misalignment of joint which results in misalignment of the waterstop in excess of ½ inch in 10 feet.

5. Porosity in the welded joint as evidenced by visual inspection.

6. Bubbles or inadequate bonding which can be detected with a penknife test. (If, while prodding the entire joint with the point of a pen knife, the knife breaks through the outer portion of the weld into a bubble, the joint shall be considered defective.)

7. Visible signs of separation when the cooled splice is bent by hand at any sharp angle.

8. Any evidence of burned material.

D. PVC Waterstop Samples: Prior to use of the waterstop material in the field, a sample of a prefabricated (shop made fitting) mitered cross and a tee constructed of each size or shape of material to be used shall be submitted. These samples shall be prefabricated (shop made fitting) so that the material and workmanship represent in all respects the fittings to be provided. Field samples of prefabricated (shop made fitting) fittings (corners, crosses, tees, etc.) will also be selected at random by CONSTRUCTION INSPECTOR for testing by a

laboratory at OWNER's expense. When tested, tensile strength across the joints shall be at least 1120 psi.

E. Construction Joint Sealant: CONTRACTOR shall prepare adhesion and cohesion test specimens as required herein, at intervals of 5 working days while sealants are being installed.

F. The sealant material shall show no signs of adhesive or cohesive failure when tested in accordance with the following procedure in laboratory and field tests:

1. Sealant specimen shall be prepared between 2 concrete blocks (1-inch by 2-inch by 3-inch). Spacing between the blocks shall be 1-inch. Coated spacers (2 inch by 1-1/2 inch by ½ inch) shall be used to insure sealant cross-sections of ½ inch by 2 inches with a width of 1 inch.

2. Sealant shall be cast and cured according to manufacturer's recommendations except that curing period shall be not less than 24 hours.

3. Following curing period, the gap between blocks shall be widened to ½ inch. Spacers shall be used to maintain this gap for 24 hours prior to inspection for failure.

1.7 SPECIAL WARRANTY REQUIREMENTS

A. CONTRACTOR shall furnish a 5-year written warranty of the entire sealant installation against faulty and/or incompatible materials and workmanship, together with a statement that it agrees to repair or replace, to the satisfaction of OWNER, any such defective areas which become evident within said 5-year guarantee period.

PART 2 - PRODUCTS

2.1 GENERAL

A. Joint materials shall be listed as compliant with NSF Standard 61.

2.2 WATERSTOPS

A. PVC Waterstops: Waterstops shall be extruded from an elastomeric polyvinyl chloride compound containing the plasticizers, resins, stabilizers, and other materials necessary to meet the requirements of this Section. No reclaimed or scrap material shall be used. CONTRACTOR shall obtain from the waterstop manufacturer and shall furnish to CONSTRUCTION INSPECTOR for review by ENGINEER, current test reports and a written certification of the manufacturer that the material to be shipped to the job meets the physical requirements as outlined in the U.S. Army Corps of Engineers Specification CRD-C572-PVC Waterstops, and those listed herein.

1. Flatstrip and Center-Bulb Waterstops: Flatstrip and center-bulb waterstops shall be as manufactured by [Greenstreak Plastic Products Co., Profiles 646, 679, 732, and 735; Tamms Horn/Durajoint Types 9, 10, 11, and 11A]; or equal; provided, that at no place shall the thickness of flat strip waterstops, including the center bulb type, be less than 3/8-inch. Waterstop shall be provided with factory installed hog rings at 12 inches on centers along the waterstop.

2. Multi-Rib Waterstops: Multi-rib waterstops, where required, shall be as manufactured by [Greenstreak Plastic Products Co., Profiles 789 and 790; Tamms Horn/Durajoint Types 25 and 26;] or equal. Prefabricated (shop made fitting) joint fittings shall be used at all intersections of the ribbed-type waterstops.

3. Retrofit Waterstops: Retrofit waterstops and batten bars shall be as manufactured by [Greenstreak Plastic Products Co., Style #609], or equal. Waterstop shall be supplied as a complete system including waterstop, SS batten bar, SS anchor bolts, and epoxy gel.

4. Waterstop Testing Requirements: When tested in accordance with the test standards, the waterstop material shall meet or exceed the following requirements:

Physical Property, Sheet Material	**Value**	**ASTM Std**
Tensile Strength-min (psi)	2000	D 638 Type IV
Ultimate Elongation-min (percent)	350	D 638 Type IV
Low Temp Brittleness-max (degrees F)	-35	D 746
Stiffness in Flexure-min (psi)	600	D 747

Accelerated Extraction (CRD-C572)

Tensile Strength-min (psi)	1500	D 638, Type IV
Ultimate Elongation-min (percent)	300	D 638, Type IV

Effect of Alkalies (CRD-C572)

Change in Weight (percent)	plus 0.25/minus 0.10	------
Change in Durometer, Shore A	plus and minus 5	D 2240

Finish Waterstop

Tensile Strength-min (psi) 1	400	D 638 Type IV
Ultimate Elongation-min (percent)	280	D 638, Type IV

B. Pre-formed Hydrophilic Waterstop: Hydrophilic (bentonite-free) waterstops shall be Hydrotite CJ10202k as manufactured by Greenstreak Plastic Products Co., or Adeka Ultraseal MC2010 as manufactured by Asahi Denka., or approved equal.

1. Hydrophilic waterstop shall be the type which expands in the presence of water to form a watertight joint seal without damaging the concrete in which it is cast.

2. Waterstop shall be manufactured from chloroprene rubber and modified chloroprene rubber with hydrophilic properties. Waterstop shall have a delay coating to inhibit initial expansion due to moisture present in fresh concrete. The minimum expansion ratio of modified chloroprene shall be not less than 2 to 1 volumetric change in distilled water at 70 degrees F (21 degrees C).

Physical Property, Chloroprene	Value	ASTM Std.
Tensile Strength-min (psi)	1275	D 412
Ultimate Elongation-min (percent)	350	D 412
Hardness, Shore A	55 plus and minus 5	D 2240

Physical Property Modified Chloroprene	Value	ASTM Std.
Tensile Strength-min (psi)	300	D 412
Ultimate Elongation-min (percent)	600	D 412
Hardness, Shore A	55 plus and minus 5	D 2240

3. Bonding agent for hydrophilic waterstop shall be the manufacturer's recommended adhesive for wet, rough concrete.

C. Other Types of Waterstops: When types of waterstops not listed above are indicated, they shall be subjected to the same requirements as those listed herein. Metal waterstops shall not be used.

2.3 JOINT SEALANT FOR WATER BEARING JOINTS

A. Joint sealant shall be polyurethane polymer designed for bonding to concrete which is continuously submerged in water. No material will be acceptable which has an unsatisfactory history as to bond or durability when used in the joints of water retaining structures.

B. Joint sealant material shall meet the following requirements (73 degrees F and 5 percent R.H.):

Work Life 45 - 180 minutes

Time to Reach 20 Shore "A" Hardness (at 77 degrees F, 200 gr quantity)	24 hours, maximum
Ultimate Hardness (ASTM D 2240)	20 - 45 Shore "A"
Tensile Strength (ASTM D 412)	175 psi, minimum
Ultimate Elongation (ASTM D 412)	400 percent, minimum
Tear Resistance (Die C, ASTM D 624)	75 pounds per inch of thickness, minimum
Color	Light Gray

C. Polyurethane sealants for waterstop joints in concrete shall conform to the following requirements:

1. Sealant shall be 2-part polyurethane with the physical properties of the cured sealant conforming to or exceeding the requirements of ANSI/ASTM C 920 – Elastomeric Joint Sealant, or Federal Specification TT-S-0227 E(3) – Sealing Compound, Elastomeric Type, Multicomponent, for Caulking, Sealing, and Glazing Buildings and Other Structures, for 2-part material, as applicable.

2. For vertical joints and overhead horizontal joints, only "non-sag" compounds shall be used; all such compounds shall conform to the requirements of ANSI/ASTM C 920 Class 25, Grade NS, or Federal Specification TT-S-0227 E(3), Type II, Class A.

3. For plane horizontal joints, the self-leveling compounds which meet the requirements of ANSI/ASTM C 920 Class 25, Grade P, or Federal Specification TTS- 0227 E(3), Type I shall be used. For joints subject to either pedestrian or vehicular traffic, a compound providing non-tracking characteristics, and having a Shore "A" hardness range of 35 to 45, shall be used.

4. Primer materials, if recommended by the sealant manufacturer, shall conform to the printed recommendations of the manufacturer.

D. Sealants, indicated, shall be PSI-270 as manufactured by Polymeric Systems Inc., Sikaflex 2C, as manufactured by Sika Corporation, or approved equal.

2.4 JOINT MATERIALS

A. Bearing Pad: Bearing pad shall be neoprene conforming to ASTM D 2000 – Standard Classification System for Rubber Products in Automotive Applications, BC 420, 40 durometer hardness unless otherwise indicated.

B. Neoprene Sponge: Sponge shall be neoprene, closed-cell, expanded, conforming to ASTM D 1056 - Flexible Cellular Materials - Sponge or Expanded Rubber, type 2C5-E1.

C. Joint Filler

1. Joint filler for expansion joints in waterholding structures shall be neoprene conforming to ASTM D1056, Type 2C5-E1.

2. Joint filler material in other locations shall be of the preformed non-extruding type joint filler constructed of cellular neoprene sponge rubber or polyurethane of firm texture. Bituminous fiber type will not be permitted. All non-extruding and resilient type preformed expansion joint fillers shall conform to the requirements and tests set forth in ASTM D 1752 - Preformed Sponge Rubber and Cork Expansion Joint Fillers for Concrete Paving and Structural Construction, for Type I, except as otherwise indicated.

2.5 BACKING ROD

A. Backing rod shall be an extruded closed-cell, polyethylene foam rod. The material shall be compatible with the joint sealant material and shall have a tensile strength of not less than 40 psi and a compression deflection of approximately 25 percent at 8 psi. The rod shall be 1/8 inch larger in diameter than the joint width except that a one-inch diameter rod shall be used for a 3/4-inch wide joint.

2.6 BOND BREAKER

A. Bond breaker shall be Super Bond Breaker as manufactured by Burke Company; Select Cure CRB as manufactured by Select Products Co.; or approved equal. It shall contain a fugitive dye so that areas of application will be readily distinguishable.

B. Bonding agent for hydrophilic waterstop shall be the manufacturer's recommended adhesive for wet, rough concrete.

2.7 SLIP DOWELS

A. Slip dowels in joints shall be smooth epoxy-coated bars, conforming to ASTM A 775 - Epoxy Coated Reinforcing Steel Bars.

PART 3 - EXECUTION

3.1 GENERAL

A. Waterstops shall be embedded in the concrete across joints as indicated. Waterstops shall be fully continuous for the extent of the joint. Splices necessary to provide such continuity shall be accomplished in conformance to printed

instructions of manufacturer of the waterstops. CONTRACTOR shall take suitable precautions and means to support and protect the waterstops during the progress of the work and shall repair or replace at its own expense any waterstops damaged during the progress of the work. Waterstops shall be stored so as to permit free circulation of air around the waterstop material.

B. When any waterstop is installed in the concrete on one side of a joint, while the other half or portion of the waterstop remains exposed to the atmosphere for more than 2 days, suitable precautions shall be taken to shade and protect the exposed waterstop from direct rays of the sun during the entire exposure and until the exposed portion of the waterstop is embedded in concrete.

3.2 SPLICES IN PVC WATERSTOPS

A. Splices in PVC waterstops shall be performed by heat sealing the adjacent waterstop sections in accordance with the manufacturer's printed recommendations. It is essential that:

1. The material not be damaged by heat sealing.

2. The splices have a tensile strength of not less than 80 percent of the unspliced material tensile strength.

3. The continuity of the waterstop ribs and of its tubular center axis be maintained. No edge welding is allowed.

B. Butt joints of the ends of 2 identical waterstop sections may be made while the material is in the forms.

C. All joints with waterstops involving more than 2 ends to be jointed together, and all joints which involve an angle cut, alignment change, or the joining of 2 dissimilar waterstop sections shall be prefabricated (shop made fitting) prior to placement in the forms, allowing not less than 24-inch long strips of waterstop material beyond the joint. Upon being inspected and approved, such prefabricated (shop made fitting) waterstop joint assemblies shall be installed in the forms and the ends of the 24-inch strips shall be butt welded to the straight run portions of waterstop in place in the forms.

D. Where a centerbulb waterstop intersects and is jointed with a non-centerbulb waterstop, care shall be taken to seal the end of the centerbulb, using additional PVC material if needed.

3.3 JOINT CONSTRUCTION

A. Setting Waterstops: In order to eliminate a faulty installation that may result in joint leakage, particular care shall be taken of the correct positioning of the waterstops during installation. Adequate provisions must be made to support and anchor the waterstops during the progress of the work and to insure proper embedment in the concrete. The symmetrical halves of the waterstops shall be equally divided between the concrete pours at the joints. The center axis of the

waterstops shall be coincident with the joint openings. Maximum density and imperviousness of the concrete shall be insured by thoroughly working it in the vicinity of all joints.

B. In placing PVC waterstops in the forms, means shall be provided to prevent them from being folded over by the concrete as it is placed. Waterstops shall be held in place with light wire ties on 12-inch centers which shall be passed through hog rings at the edge of the waterstop and tied to the curtain of reinforcing steel. Horizontal waterstops, with their flat face in a vertical plane, shall be held in place with continuous supports to which the top edge of the waterstop shall be tacked. In placing concrete around horizontal waterstops, with their flat face in a horizontal plane, concrete shall be worked under the waterstops by hand so as to avoid the formation of air and rock pockets.

C. In placing centerbulb waterstops in expansion joints, the centerbulb shall be centered on the joint filler material.

D. Waterstop in vertical wall joints shall stop 6 inches from the top of the wall where such waterstop does not connect with any other waterstop and is not to be connected to a future concrete placement.

E. Joint Location: Construction joints and other types of joints shall be provided where indicated on the Contract Drawings. When not indicated, construction joints shall be provided at 25-foot maximum spacing for all concrete construction. Where joints are indicated spaced greater than 40 feet apart, additional joints shall be provided to maintain the 25-foot maximum spacing. The location and details of all joints, of any type, in concrete, shall be submitted to CONSTRUCTION INSPECTOR for acceptance by ENGINEER.

F. Joint Preparation: Special care shall be used in preparing concrete surfaces at joints where bonding between 2 sections of concrete is required. Unless otherwise indicated, such bonding will be required at all horizontal joints in walls. Surfaces shall be prepared in accordance with the requirements of Section 03300 - Cast-in-Place Concrete. Except on horizontal wall construction joints, wall to slab joints, or where otherwise indicated, at all joints where waterstops are required, the joint face of the first pour shall be coated with a bond breaker as indicated herein.

G. Retrofit Joint Preparation: Existing surfaces to receive a retrofit waterstop shall be clean and free from any loose or foreign material. Surface shall be given a light sandblast or hydroblast finish to 1/8-inch amplitude prior to application of epoxy and waterstop.

H. Construction Joint Sealant: Construction joints in water-bearing floor slabs, and elsewhere as indicated, shall be provided with tapered grooves which shall be filled with a construction joint sealant. The material used for forming the tapered grooves shall be left in the grooves until just before the grooves are cleaned and filled with joint sealant. After removing the forms from the grooves, all laitance and fins shall be removed, and the grooves shall be sand-blasted. The grooves shall be allowed to become thoroughly dry, after which they shall be blown out;

immediately thereafter, they shall be primed, bond breaker tape placed in the bottom of the groove, and filled with the construction joint sealant. The primer shall be furnished by the sealant manufacturer. No sealant will be permitted to be used without a primer. Care shall be used to completely fill the sealant grooves. Areas designated to receive a sealant fillet shall be thoroughly cleaned, as outlined for the tapered grooves, prior to application of the sealant.

I. The primer and sealant shall be placed strictly in accordance with the printed recommendations of the manufacturer, taking special care to properly mix the sealant prior to application. The sides of the sealant groove shall not be coated with bond breaker, curing compound, or any other substance which would interfere with proper bonding of the sealant. Sealant shall achieve final cure at least 7 days before the structure is filled with water.

J. Sealant shall be installed by a competent waterproofing specialty contractor who has a successful record of performance in similar installations.

K. Thorough, uniform mixing of 2-part, catalyst-cured materials is essential; special care shall be taken to properly mix the sealer before its application. Before any sealer is placed, CONTRACTOR shall arrange to have the crew doing the work carefully instructed on the proper method of mixing and application by a representative of the sealant manufacturer.

L. Any joint sealant which fails to fully and properly cure after the manufacturer's recommended curing time for the conditions of the work hereunder shall be completely removed; the groove shall be thoroughly sandblasted to remove all traces of the uncured or partially cured sealant and primer, and shall be re-sealed with the indicated joint sealant. Costs of such removal, joint treatment, re-sealing, and appurtenant work shall be CONTRACTOR's responsibility.

M. Retrofit Waterstop: Retrofit waterstops shall be set in a bed of epoxy over a sandblasted surface with stainless steel batten bars and 1/4-inch diameter stainless steel anchors at 6 inches on center, staggered, and in accordance with the manufacturer's written recommendations.

3.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Joints in Concrete, but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 03290 -

SECTION 03300 – CAST-IN-PLACE CONCRETE

PART 1 – GENERAL

1.1 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment and incidentals for cast-in-place concrete, inclusive of all required formwork, in accordance with the provisions of this Section.

B. CONTRACTOR shall form, mix, place, cure, repair, finish, and do all other cast-in-place concrete work as required to produce finished concrete, in accordance with the requirements of the Contract Documents.

C. The following types of concrete are covered in this Section:

1. Class A Concrete (5,000 psi): Shall be used for the structures as noted on the Contract Drawings. The list of structures requiring 5,000 psi Class A Concrete includes, but is not limited to, the following:

   a. Any structures or items not specifically designated elsewhere.

2. Class B Concrete (4,000 psi): Shall be used for the following structures or as noted on the Contract Drawings:

   a. Sidewalks, pavements, and other above-grade structures noted on the Contract Drawings.

3. Class C Concrete (3,000 psi): Shall be used for mud slabs, protection (working) slabs, manhole fills for sewers, concrete cradles, concrete backfill, underground concrete encasements in earth, thrust blocks in earth, fence and guard post embedment, underground ductbank encasement in earth, mass concrete fill, for shaping structure inverts, and elsewhere when so ordered by CONSTRUCTION INSPECTOR.

4. Lean Concrete (1,500 psi): Shall be used for filling cavities and for other non-structural miscellaneous use, where future excavation is not anticipated.

5. Cement Grout (4,000 psi): Use 4,000 psi grout where specified in the Contract Documents, unless other strength is specified.

D. In general, the work under this Section shall include: Concrete Testing and Inspection, as specified herein and in Section 01400 – Quality Control; labor; materials; tools and appliances necessary to complete the Work; furnishing and installing all formwork; furnishing and installing reinforcing bars, as shown on the Contract Drawings and as specified in Section 03200 – Steel Reinforcement; installing sheeting and shoring; construction and expansion joints; dewatering; furnishing of cement, aggregates, water, admixtures, and joint materials such as tar paper, polyethylene film and floor hardener; the mixing, transporting, placing, finishing, moisture proofing, curing, protecting, and repairing of the concrete; and all equipment pads and bases, pipe supports, thrust blocks and all incidentals necessary to furnish and install cast-in-place concrete.

E. Inserts, including anchor bolts, sleeves, castings, pipe, electrical conduit, toe pockets and manhole steps shall be set in conformance with this Section.

F. Concrete used to refill unauthorized excavations shall be provided at CONTRACTOR's expense at no additional cost to OWNER.

1.2 RELATED SECTIONS

A. Section 01300 – Contractor Submittals.

B. Section 01400 – Quality Control.

C. Section 02200 – Excavation and Backfill.

D. Section 03200 – Steel Reinforcement.

E. Section 03315 – Ancillary Grout.

F. Section 03400 – Precast Concrete Structures.

1.3 REFERENCE SPECIFICATIONS, CODES, AND STANDARDS

A. American Concrete Institute Standards (ACI)

1. ACI 117 - Specifications for Tolerances for Concrete Construction and Materials.

2. ACI 214R - Recommended Practice for Evaluation of Strength Test Results of Concrete.

3. ACI 301 - Standard Specifications for Structural Concrete.

4. ACI 304R - Guide for Measuring, Mixing, Transporting and Placing Concrete.

5. ACI 304.2R - Placing Concrete by Pumping Methods.

6. ACI 305R - Guide to Hot Weather Concreting.

7. ACI 305.1 – Specification for Hot Weather Concreting.

8. ACI 306R - Guide to Cold Weather Concreting.

9. ACI 306.1 – Standard Specification for Cold Weather Concreting.

10. ACI 308 - Standard Practice for Curing Concrete.

11. ACI 309R - Guide for Consolidation of Concrete.

12. ACI 315 - Details and Detailing of Concrete Reinforcement.

13. ACI 318 - Building Code Requirements for Reinforced Concrete.

14. ACI 350 - Code Requirements for Environmental Engineering Concrete Structures and Commentary.

15. ACI 350.1 - Tightness Testing of Environmental Structures.

B. American Society for Testing of Materials (ASTM)

1. ASTM C31- Standard Practice for Making and Curing Concrete Test Specimens in the Field.

2. ASTM C33 - Standard Specification for Concrete Aggregates.

3. ASTM C39 - Standard Test Method for Compressive Strength of Cylindrical Concrete Specimens.

4. ASTM C40 - Standard Test Method for Organic Impurities in Fine Aggregates for Concrete.

5. ASTM C42 - Standard Test Method for Obtaining and Testing Drilled Cores and Sawed Beams of Concrete.

6. ASTM C87 - Standard Test Method for Effect of Organic Impurities in Fine Aggregate on Strength of Mortar.

7. ASTM C88 - Standard Test Method for Soundness of Aggregates by use of Sodium Sulfate or Magnesium Sulfate.

8. ASTM C94 - Standard Specification for Ready-Mixed Concrete.

9. ASTM C109 - Standard Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in Cube Specimens).

10. ASTM C117 - Standard Test Method for Materials Finer than No 200 Sieve in Mineral Aggregates by Washing.

11. ASTM C136 - Standard Test Method for Sieve Analysis of Fine and Coarse Aggregates.

12. ASTM C138 - Standard Test Method for Unit Weight, Yield and Air Content (Gravimetric) of Concrete.

13. ASTM C143 - Standard Test Method for Slump of Hydraulic Cement Concrete.

14. ASTM C150 - Standard Specification for Portland Cement.

15. ASTM C156 - Water Retention by Concrete Curing Materials.

16. ASTM C157 - Standard Test Method for Length Change of Hardened Hydraulic Cement Mortar and Concrete.

17. ASTM C171 - Standard Specification for Sheet Materials for Curing Concrete.

18. ASTM C172 - Standard Practice for Sampling Fresh Concrete.

19. ASTM C192 - Standard Practice for Making and Curing Concrete Test Specimens in the Laboratory.

20. ASTM C231 - Standard Test Method for Air Content of Freshly Mixed Concrete by the Pressure Method.

21. ASTM C260 - Standard Specification for Air-Entraining Admixtures for Concrete.

22. ASTM C289 - Standard Test Method for Potential Alkali-Silica Reactivity of Aggregates (Chemical Method).

23. ASTM C309 - Standard Specification for Liquid Membrane-Forming Compounds for Curing Concrete.

24. ASTM C494 - Chemical Admixtures for Concrete.

25. ASTM C618 - Standard Specification for Coal Fly Ash and Raw or Calcined Natural Pozzolan for Use in Concrete.

26. ASTM C877 – Standard Specification for External Bands for Concrete Pipe, Manholes, and Pre-cast Box Sections.

27. ASTM C990 – Standard Specification for Joints for Concrete Pipe, Manholes, and Precast Box Sections Using Preformed Flexible Joint Sealants.

28. ASTM C1017 - Standard Practice for Chemical Admixtures for Use in Producing Flowing Concrete.

29. ASTM C1064 - Standard Test Method for Temperature of Freshly Mixed Portland Cement Concrete.

30. ASTM C1077 - Standard Practice for Agencies Testing Concrete and Concrete Aggregates for use in Construction and Criteria for Testing Agency Evaluation.

31. ASTM C1107 - Standard Specification for Packaged Dry, Hydraulic-Cement Grout (Nonshrink).

32. ASTM C1116 - Standard Specification for Fiber Reinforced Concrete.

33. ASTM C1218 - Standard Test Method for Water Soluble Chloride in Mortar and Concrete.

34. ASTM C1240 – Standard Specification for Silica Fume Used in Cementitious Mixtures.

35. ASTM D41 - Standard Specification for Asphalt Primer used in Roofing, Dampproofing and Waterproofing.

36. ASTM D75 - Standard Practice for Sampling Aggregates.

37. ASTM D1751 - Standard Specification for Preformed Expansion Joint Fillers for Concrete Paving and Structural Construction (Non-extruding and Resilient Bituminous Types).

38. ASTM D1752 - Standard Specification for Preformed Sponge Rubber Cork and Recycled PVC Expansion Joint Fillers for Concrete Paving and Structural Construction.

39. ASTM D448 - Standard Specification for Classification for Sizes of Aggregate for Road and Bridge Construction.

40. ASTM D449 - Standard Specification for Asphalt used in Dampproofing and Waterproofing.

41. ASTM D2419 - Standard Test Method for Sand Equivalent Value of Soils and Fine Aggregate.

42. ASTM E119 - Standard Test Methods for Fire Tests of Building Construction and Materials.

43. ASTM E329 - Standard Specification for Agencies Engaged in Construction Inspection and Testing.

44. ASTM E1643 - Standard Practice for Selection, Design, Installation, and Inspection of Water Vapor Retarders Used in Contact with Earth or Granular Fill Under Concrete Slabs.

45. ASTM E1745 - Standard Specification for Water Vapor Retarders Used in Contact with Soil or Granular Fill Under Concrete Slabs.

1.4 SUBMITTALS

A. Mix Designs:

1. Prior to beginning the Work and within 30 days of the notice to proceed, CONTRACTOR shall submit to CONSTRUCTION INSPECTOR for review by ENGINEER and in accordance with the requirements of Section 01300, proposed concrete mix designs for each class and type of concrete required for the project, certified by a Professional Engineer licensed in the State of Indiana, which shall show, as a minimum, the following:

   a. Proportions and gradations of all materials proposed.

   b. Standard deviation analysis, required average strength and documentation of average strength verifying compliance with the requirements of ACI 318, or ACI 350 as applicable.

   c. Mix proportions by weight, volume, water-cement ratio, slump and air content.

   d. Sieve analyses of fine and coarse aggregates and compliance with requirements of ASTM C33.

   e. Results of tests for water soluble chloride ion content performed in accordance with ASTM C1218.

   f. Complete list of materials specified in Part 2.1 with project information demonstrating compliance with all specified requirements.

2. An independent testing laboratory meeting ASTM E329 standards and acceptable to OWNER shall check the mix designs. This shall be accompanied by a certified test report from the testing laboratory showing, for at least 3 different water contents, the slump and the 7 and 28 day concrete strengths obtained when using the materials approved for the Work. CONTRACTOR shall pay all costs associated with the work done by the independent testing laboratory.

3. The strength determinations shall be based on not less than 3 concrete test specimens for each age and water content.

4. No concrete shall be placed in the Work until all information has been furnished to CONSTRUCTION INSPECTOR, including 28-day concrete strength test results for the different mixes which are to be used on the job.

5. All costs related to such checking shall be borne by CONTRACTOR. Since laboratory trial batches require 35 calendar days to complete, CONTRACTOR may consider testing more than one mix design for each class of concrete.

B. Furnish the following submittals in accordance with ACI 301:

1. Steel Reinforcement Shop Drawings: Placing drawings that detail fabrication, bending, and placement. Include bar sizes, lengths, material, grade, bar schedules, stirrup spacing, bent bar diagrams, bar arrangement, splices and laps, mechanical connections, tie spacing, hoop spacing, and supports for concrete reinforcement and in accordance with the requirements of Section 03200 – Steel Reinforcement.

2. Formwork Shop Drawings: Prepared by or under the supervision of a qualified Professional Engineer licensed in the State of Indiana, detailing fabrication, assembly, and support of formwork.

   a. Shoring and Reshoring: Indicate proposed schedule and sequence of stripping formwork, shoring removal, and installing and removing reshoring.

3. Joint Placement Drawings: These shall include a plan for sequencing the concrete pours as well as joint type and location. Show methods and equipment proposed for concrete transportation, pumping, placement by location, dimensions, elevations, stations, and concrete finish, as applicable.

4. Proposed Special Procedures: These include procedures for protection of concrete under wet weather and for protection and curing of concrete under hot and cold weather conditions.

5. Material Certificates signed by the manufacturer and CONTRACTOR, certifying that each of the following material items comply or exceed the specified requirements:

   a. Cementitious materials.

   b. Current mill tests for cement.

   c. Admixture certification. Chloride ion content must be included.

d. Aggregate gradation and tests for deleterious substances, impurities, soundness and alkali silicate reactivity.

e. Form materials and form-release agents.

f. Steel reinforcement and accessories.

g. Fiber reinforcement.

h. Waterstops.

i. Curing compounds and methods of curing.

j. Floor and slab treatments.

k. Bonding agents.

l. Adhesives.

m. Vapor retarders and barriers.

n. Semi-rigid joint filler.

o. Joint-filler strips.

p. Repair materials.

6. Manufacturer's data and technical information for all products and systems used in the Work.

1.5 QUALITY ASSURANCE

A. General

1. Prepare and submit Quality Work Plans as required by Section 01400 – Quality Control.

2. Tests on component materials and for compressive strength shall be performed as indicated herein. Test for determining slump will be in accordance with the requirements of ASTM C143.

3. Laboratory tests on cement, aggregates, and concrete, if directed by CONSTRUCTION INSPECTOR for verification of compliance after the approval of the mix design, will be arranged for and paid for by OWNER. However, CONTRACTOR shall pay the cost of any additional tests and investigation on work performed which does not meet the Contract Documents. In this event, the laboratory performing the tests shall meet or exceed the requirements of ASTM C1077.

4. Concrete for testing shall be supplied by CONTRACTOR at no additional cost to OWNER, and CONTRACTOR shall assist OWNER or its representative in obtaining samples inclusive of all disposal and cleanup.

B. Field Compression Tests:

1. Among criteria from which CONSTRUCTION INSPECTOR may judge the quality of concrete placed will be that of compressive strengths shown by tests on cylinders and cores. Test cylinders shall be taken by OWNER from concrete incorporated or to be incorporated into the Work.

2. Concrete cores from completed work may be taken by, or at the instance of, CONSTRUCTION INSPECTOR and at OWNER'S expense, but core holes directed by CONSTRUCTION INSPECTOR shall be repaired satisfactory to CONSTRUCTION INSPECTOR at CONTRACTOR's expense.

3. Cylinders and cores shall be made and tested in accordance with ASTM C31, C39, C42, C172 and ACI 301. Specimens shall be 6-inch diameter by 12-inch high cylinders.

4. Compression test specimens will be taken during construction from the first placement of each class of concrete each day and at intervals thereafter as selected by CONSTRUCTION INSPECTOR to insure continued compliance with the Contract Documents. Each set of test specimens shall be a minimum of 4 cylinders.

5. Compression tests shall be performed in accordance with ASTM C39. Two test cylinders shall be tested at 7 days and two at 28 days. Any remaining cylinders shall be held to verify test results, if required. The standard ages of test shall be 7 and 28 days, but 3 or 7 day tests may be used, provided the relation between the 3, 7 and 28 day strengths of the concrete has been established by test for the materials and proportions used.

6. Take additional test cylinders where required or desirable to determine concrete strength at other times or conditions, cured on job site under same conditions as concrete it represents.

7. Assist OWNER with the collection of all test cylinders, samples, field tests, and cores, and provide all required storage facilities for concrete test cylinders.

C. Field Air Content Tests:

1. Air content tests will be taken by CONSTRUCTION INSPECTOR during construction at intervals as selected by CONSTRUCTION INSPECTOR to insure continued compliance with the Contract Documents.

2. Air content tests for concrete shall be of the Pressure Method, made in accordance with ASTM C231, C172 and ACI 301.

3. Concrete which fails to meet the specified air content will be rejected.

4. Assist OWNER with the collection of all air content test samples.

D. Field Slump Tests:

1. Slump tests will be taken for each set of test cylinders taken by OWNER during construction and during discharge of loads to insure continued compliance with the Contract Documents, but not less than one test for slump per truckload of concrete.

2. Slump tests for concrete shall be made in accordance with ASTM C143, C172 and ACI 301.

3. Concrete which fails to meet the specified slump will be rejected.

4. Assist OWNER with the collection of all samples for slump tests.

E. OWNER shall record temperature of concrete samples for each strength test in accordance with ASTM C1064.

F. Concrete delivered to the jobsite that exceeds the time limits or temperature, slump or air content limitations specified will be rejected and will not be allowed to be placed.

G. Hot weather concrete to conform to ACI 305R and as specified herein.

H. Cold weather concrete to conform to ACI 306R and as specified herein.

I. Concrete shall not be placed on water or on frozen ground.

J. Workability:

1. Concrete shall be of such consistency and composition that it can be worked readily into the forms and around the reinforcement without excessive vibrating and without allowing the materials to segregate or to allow free water to collect on the surface.

2. Adjust the proportions to secure a plastic, cohesive mixture, and one that is within the specified slump range.

3. To avoid unnecessary changes in consistency, obtain the aggregate from a source with uniform quality, moisture content and grading. Handle materials to minimize variations in moisture content that would interfere with production of concrete of the established degree of uniformity and slump.

K. Evaluation and Acceptance of Concrete:

1. Evaluation and acceptance of the compressive strength of concrete will be according to the requirements of ACI 318, ACI 350 or ACI 301 as applicable and as indicated herein.

2. Where provisions of pertinent codes and standards conflict with each other or this specification, the more stringent provisions shall apply.

3. A statistical analysis of compression test results will be performed according to the requirements of ACI 214.

4. Should the strengths shown by test or tests per ACI 318, ACI 350 or ACI 301 as applicable be of values less than those required, ENGINEER or CONSTRUCTION INSPECTOR may determine and institute supplementary tests and/or corrective measures inclusive of re-testing cement and aggregates; readjusting the proportions of the ingredients of the concrete; revising procedures of mixing, transportation and placing; providing for the addition of cement; conducting load tests on structures or any other measure deemed appropriate at no additional cost to OWNER; and, for the institution

and for proving such measures, ENGINEER or CONSTRUCTION INSPECTOR may suspend concreting operations.

5. Acceptance of completed work requires conformance with dimensional tolerances, appearance and strength as indicated and as specified herein.

6. Remove and replace all concrete that fails to meet the ACI requirements and the Contract Documents at no additional cost to OWNER.

L. Construction Tolerances:

1. Set and maintain concrete forms and perform finishing operations to ensure that the completed work is within tolerances.

2. Surface defects and irregularities are defined as finishes and are to be distinguished from tolerances.

3. Tolerance is the permissible variation from lines, grades, or dimensions indicated on the Contract Drawings.

4. Where tolerances are not stated in the specifications, permissible deviations shall be in accordance with ACI 117.

5. The following construction tolerances apply to finished walls and slabs unless otherwise indicated:

Item	**Tolerance**
Variation of the constructed linear outline from the established position in plan.	In 10 feet: 1/4-inch
	In 20 feet or more: 1/2-inch
Variation from the level or from the grades shown	In 10 feet: 1/4-inch
	In 20 feet or more: 1/2-inch
Variation from the plumb	In 10 feet: 1/4-inch
	In 20 feet or more: 1/2-inch
Variation in the thickness of slabs and walls.	Minus 1/4-inch
	Plus 1/2-inch
Variation in the locations and sizes of slabs and wall openings	Plus or minus 1/4-inch

PART 2 – PRODUCTS

2.1 CONCRETE MATERIALS

A. General:

1. Cement for concrete shall not be obtained from kilns which burn hazardous waste fuel.

2. Materials shall be delivered, stored, and handled so as to prevent damage by water or breakage. Cement reclaimed from cleaning bags or leaking containers shall not be used. All cement shall be used in the sequence of receipt of shipments.

3. All materials shall comply with the requirements of Section 4 of ACI 301, as applicable.

4. Storage of materials shall conform to the requirements of Section 4 of ACI 301.

5. Ready-mixed concrete shall conform to the requirements of ASTM C94.

B. Cement:

1. Cement shall be standard brand Portland cement conforming to ASTM C150:

   a. Minimum of 85 percent of cement by weight shall pass a 325 screen.

   b. Type II.

2. Cement shall be subject to inspection at the place of manufacture and on the site of construction, and to such tests as may be ordered by CONSTRUCTION INSPECTOR. OWNER and its representatives shall, at all times, have free access to inspect the method of manufacture, storage, transportation and protection, and shall have liberty to inspect the manufacturer's daily laboratory records of tests and analyses.

3. Air-entraining cement will not be permitted.

4. A single brand of cement, acceptable to ENGINEER, shall be used throughout the Work.

5. The cement shall be suitably protected from exposure to moisture until used.

6. Cement that has become lumpy shall not be used.

7. Where storage of cement is necessary provide, at the site of the work, or accessible thereto, a weather-tight building suitable for the storage of cement. In order to prevent delays or interruptions to the work, the building shall have floors raised at least 12 inches above the ground surface and be large enough to provide storage for a sufficient supply of cement while still allowing segregation of different lots or deliveries.

8. Cement kept in storage 3 months or more shall be re-tested if required. If the tests prove any cement unsatisfactory, which has been delivered to the site of the Work, such cement shall be at once plainly marked for identification and promptly removed from the Work and its vicinity. Cubes, beams, or briquettes shall be made at any time for the purpose of tests from concrete or mortar being used in the Work, if so directed by CONSTRUCTION INSPECTOR.

9. Sacked cement shall be stored in such a manner so as to permit access for inspection and sampling.

10. Certified mill test reports, including fineness, for each shipment of cement to be used shall be submitted to CONSTRUCTION INSPECTOR, when requested, regarding compliance with the Contract Documents.

11. If concrete is mixed on the site of construction, all cement shall be delivered in paper sacks or in strong cloth bags, or stored in approved bulk storage facilities. Each bag of cement shall contain not less than 94 pounds of cement, net weight, and each barrel measure shall contain 4 bags. No cement shall be used unless delivered in the original packages with the brand and the name of the manufacturer plainly marked thereon.

12. Cement shall not be used unless it has passed satisfactorily the tests prescribed for specific gravity, fineness, time for setting, and soundness, in the form of standard briquettes. The tensile test shall conform to ASTM C190. If any cement is proven unsatisfactory on the first tests, it shall be subjected to a second set of tests, including the 28 day tensile test. Any cement used prior to the completion of the 28 day test will be at CONTRACTOR's risk, and if the cement does not comply with the requirements for the 28 day test, OWNER may require any work in which the cement was used to be removed and replaced at CONTRACTOR's expense.

13. OWNER reserves the right to take samples of cement at the place of manufacture, by a representative of OWNER, who will conduct the necessary tests at the expense of OWNER.

C. Water:

1. Water for mixing and curing shall be potable. The water shall be considered potable, for the purposes of this Section only, if it meets the requirements of the local governmental agencies. Agricultural water with high total dissolved solids (over 1000 mg/l TDS) shall not be used. Water contaminated with sewage or oil, or water containing dirt, clay, filth or vegetable matter, or river or lake water, shall not be used.

2. The water used in mixing concrete shall be accurately measured for each batch. The quantity to be added shall vary as hereinafter provided with the moisture content of the materials and with the condition of the weather. In general, all water for mixing and curing purposes shall be obtained from local utility water mains at CONTRACTOR expense.

D. Aggregates:

1. General

a. Aggregates shall be obtained from pits and locations acceptable to ENGINEER, shall be non-reactive, and shall conform to ASTM C 33. Maximum size of coarse aggregate shall be as indicated herein. Lightweight sand for fine aggregate will not be permitted.

b. Fine and coarse aggregates shall be kept separate prior to their admission into the concrete mixer, and shall be kept clean and free from foreign substances. The methods used in piling and handling of aggregates shall be such as to prevent the segregation of the several sizes of particles.

c. Adequate storage capacity shall be provided either at the source of supply or at the site of the Work so that sufficient aggregate of each kind and the specified quality may be maintained at all times.

d. When aggregates that are satisfactory to ENGINEER have been selected, CONTRACTOR shall secure its entire supply of each material from the same source so as to maintain the same quality and grading throughout the Work.

e. Should it become necessary to change the source or characteristic of the materials used, this shall only be done as additional proportioning and other tests have been completed for the new materials, and subject to such safeguards as ENGINEER may impose for the maintenance of the quality of the aggregate herein specified. ENGINEER must approve any changes to the mix design or material source suppliers.

f. Aggregates used shall be calcareous, producing concrete with alkalinity, expressed as equivalent weight of calcium carbonate per unit weight of concrete of 0.9 or higher.

2. Coarse Aggregates:

a. Indiana Department of Transportation, Standard Specifications, Class A, Size 8, 1 inch maximum size or conform to the following:

b. Coarse aggregates shall consist of clean, hard, durable gravel, crushed gravel, crushed rock, or a combination thereof. The coarse aggregates shall be prepared and handled in two or more size groups for combined aggregates with a maximum size greater than 3/4-inch. When the aggregates are proportioned for each batch of concrete, the size groups shall be combined.

c. Coarse aggregate shall meet the requirements of ASTM C33, except as herein modified. Coarse aggregate shall be composed of strong, durable, broken stone or gravel and shall conform to the following requirements:

Contained Deleterious Matter	**Percentage by Weight**
Removed by decantation	1.0
Clay lumps and friable particles	5.0
Coal	0.5
Soft particles	2.0
Chert as a soft impurity	1.0
Total soft particles and chert as a soft impurity	2.0
Flat and elongated particles (long dimension more than 5 times short)	15.0

Tests for impurities shall be made in accordance with methods listed in ASTM C33.

d. Coarse aggregate shall show good weathering qualities as it appears in pit or quarry and, when subjected to 10 cycles of the sodium sulfate tests for soundness, and according to the procedures of ASTM C88, shall not show a weighted average loss of more than 10 percent.

e. Coarse aggregate, unless otherwise specified or shown on the Contract Drawings, shall be well graded between the following limits:

For Class A, B and C Concrete
Size Number 57 (ASTM C33, Table 2)
Size Number 8(ASTM C33, Table 2)

f. In sections 8 inches in thickness and less, the maximum size of coarse aggregate to be used in the concrete shall be, as described in ASTM C33, Table 2, "Grading Requirements for Coarse Aggregates", size No. 67.

g. In thin sections, such as slab toppings and roof and floor slabs that are poured on steel deck or where otherwise directed, the maximum size of coarse aggregate to be used in the concrete shall be, as described in ASTM C33, Table 2, "Grading Requirements for Coarse Aggregates", size No. 8.

h. After acceptance of grading, a variation in the quantities passing any sieve size of more than 10 percent of the total shall not be permitted.

i. Tests for size and grading of the fine and coarse aggregates shall be made in accordance with ASTM C136.

j. The use of slag is strictly prohibited.

3. Fine Aggregates:

a. Indiana Department of Highways, Standard Specifications, Size #23 or conform to the following.

1) Fine aggregates shall be natural sand or a combination of natural and manufactured sand that are hard and durable. When tested in accordance with ASTM D2419, the sand equivalency shall not be less than 75 percent for an average of three samples, nor less than 70 percent for an individual test. Gradation of fine aggregate shall conform to ASTM C33. The fineness modulus of sand used shall not be over 3.00.

2) The fine aggregate or sand used in concrete shall meet the requirements of ASTM C33, except as herein modified.

3) Fine aggregate shall be clean, sand, having not more than 3 percent by weight of foreign matter such as loam, clay, dirt, or other impurities and shall be free from injurious amounts of organic impurities.

4) When subjected to the calorimetric tests for organic impurities and producing a color darker than the standard, it shall be rejected unless it passes the mortar strength test.

5) Fine aggregate, when subjected to the mortar strength test, shall have tensile and compressive strength, at the end of 7 and 28 days, not less than 100 percent of those developed by mortar of the same proportions and consistency, made of the same cement and standard Ottawa sand.

6) Fine aggregates shall be well graded from coarse to fine, and when tested by means of laboratory sieves shall conform to the following requirements:

Passing	**Percentage by Weight**
3/8-inch sieve	100
No. 4 sieve	95 to 100
No. 8 sieve	80 to 100
No. 16 sieve	50 to 85
No. 32 sieve	25 to 60
No. 50 sieve	10 to 30
No. 100 sieve	2 to 10
Weight Removed by Decantation	not more than 3

The decantation test shall be made in accordance with ASTM C117.

b. The use of slag is strictly prohibited.

4. Combined Aggregates:

a. Combined aggregates shall be well graded from coarse to fine sizes and shall be uniformly graded between screen sizes to produce concrete that has optimum workability and consolidation characteristics. Where a trial batch is required for a mix design, the final combined aggregate gradations will be established during the trial batch process.

b. When tested in accordance with ASTM C33, the ratio of silica released to reduction in alkalinity shall not exceed 1.0.

c. When tested in accordance with ASTM C33, the fine aggregate shall produce a color in the supernatant liquid no darker than the reference standard color solution.

d. When tested in accordance with ASTM C33, the coarse aggregate shall show a loss not exceeding 42 percent after 500 revolutions, or 10.5 percent after 100 revolutions.

e. When tested in accordance with ASTM C33, the loss resulting after five cycles shall not exceed 10 percent for fine or coarse aggregate when using sodium sulfate.

f. The use of slag is strictly prohibited.

E. Admixtures:

1. General:

a. All admixtures shall be compatible and be furnished by a single manufacturer capable of providing qualified field service representation. Admixtures shall be used in accordance with manufacturer's recommendations. If the use of an admixture is producing an inferior end result, CONTRACTOR shall discontinue use of the admixture. Admixtures shall not contain thiocyanates or more than 0.05 percent chloride ion, and shall be non-toxic after 30 days.

b. The exact formulation and amount of the admixture to be used shall be that recommended by the manufacturer of the admixture which has been approved by ENGINEER, and the use thereof shall be under the strict supervision of the manufacturer to produce a concrete of the highest possible density, impermeability, and strength. The manufacturer's recommendation in this regard shall be made after selection of the aggregates to be used and the design of the concrete mix, as provided in this Section.

c. Admixtures shall conform to the requirements of ASTM C494. The required quantity of cement shall be used in the mix regardless of whether or not an admixture is used.

2. Air-entraining Agents:

a. Air-entraining agents shall meet the requirements of ASTM C260.

b. The quantity of admixture shall be such as to produce an air content of 6 percent plus or minus 1 percent as determined in accordance with ASTM C231, unless otherwise noted on the Contract Drawings.

c. The air-entraining agent shall be added to the batch in a portion of the mixing water.

d. The solution shall be batched by means of a mechanical batcher capable of accurate measurement.

e. Air content shall be tested at the point of placement.

f. Air entraining agent shall be [Micro-Air by BASF; Daravair by W.R. Grace; Sika AEA-15 by Sika Corporation]; or approved equal.

g. OWNER reserves the right, at any time, to sample and test the air-entraining agent.

3. Set Controlling and Water Reducing Admixtures:

a. Admixtures to the concrete may be used to provide a benefit in water reduction, increased density, improved workability, control of shrinkage, or control of rate of setting, but only with the permission of ENGINEER. Acceptable evidence must be presented to ENGINEER that such proposed admixtures, in addition to imparting the desired quality, shall cause no detrimental effect in any of the other desirable properties of the concrete. The admixture, if used, shall be added by means of an approved dispenser, to accurately control the amount used in each batch of concrete.

b. Calcium chloride admixtures will not be permitted.

c. Concrete shall not contain more than one water-reducing admixture.

d. Set controlling admixture may be either with or without water-reducing properties. Where the air temperature at the time of placement is expected to be consistently greater than 80 degrees F, a set retarding admixture such as [Plastocrete by Sika Corporation; Pozzolith 300R by BASF; Daratard by W.R. Grace; or approved equal shall be used. Where the air temperature at the time of placement is expected to be consistently less than 40 degrees F, a non-corrosive set accelerating admixture such as Plastocrete 161FL by Sika Corporation; Pozzutec 20 by BASF; Daraset by W.R. Grace]; or approved equal shall be used.

e. Normal range water reducer shall conform to ASTM C 494, Type A. [WRDA 79 by W.R. Grace; Pozzolith 322-N by BASF; Plastocrete 161 by Sika Corporation]; or approved equal. The quantity of admixture used and the method of mixing shall be in accordance with the Manufacturer's instructions and recommendations.

f. Mid-range water reducer shall be Daracem by WR Grace; or Pozzolith Polyheed, by BASF, or approved equal. Mid-range water reducer shall conform to ASTM C494, Type D.

g. High range water reducer shall conform to ASTM C 494, Type F or G.[Daracem 100 or WDRA 19 by W.R. Grace; Sikament FF or Sikament 86 by Sika Corporation; Rheobuild 1000 or Rheobuild 716 by BASF]; or approved equal. High range water reducer shall be added to the concrete after all other ingredients have been mixed and initial slump has been verified. No more than 14 ounces of water reducer per sack of cement shall be used. Water reducer shall be considered as part of the mixing water when calculating water cement ratio.

h. ASTM C494, Type F admixtures: Do not combine a naphthalene based admixture with a polycarboxylate based admixture or rapid slump loss will occur. Concrete trucks must be cleaned prior to transporting new concrete mix designs.

i. If the high range water reducer is added to the concrete at the job site, it may be used in conjunction with the same water reducer added at the batch plant. Concrete shall have a slump of 3 inches plus or minus ½ inch prior to adding the high range water-reducing admixture at the job site. The high range water-reducing admixture shall be accurately measured and pressure injected into the mixer as a single dose by an experienced technician. A standby system shall be provided and tested prior to each day's operation of the job site system.

j. High range water reducer shall be used in all concrete containing silica fume admixture.

k. All water reducer admixtures in the concrete shall be by the same manufacturer.

l. Concrete shall be mixed at mixing speed for a minimum of 30 mixer revolutions after the addition of the high range water reducer.

4. Silica Fume:

a. Silica fume shall be Force 10,000 by WR Grace; or MB-SF by BASF; or approved equal, conforming to ASTM C1240.

b. Silica fume shall be shipped and added to the mix in the form of a liquid suspension.

c. Specialized dispensing equipment recommended by the manufacturer shall be used to add the admixture.

d. Mix water shall be adjusted to account for the suspension water in the admixture

e. Silica fume shall constitute no more than 10 percent of the total weight of the cementitious materials.

5. Corrosion Inhibiting Admixtures:

a. Corrosion inhibiting admixture shall be Armatec 2000 by SIKA or approved equal and shall be used per manufacturer recommendations as specified on the Contract Drawings.

6. Fly Ash:

a. Fly ash used as admixture shall conform to ASTM C618, Class F.

b. Sulfur Trioxide content shall not exceed 4 percent.

c. The loss on ignition shall not exceed 5 percent.

d. Fly ash shall constitute at least 10 percent but no more than 20 percent of the total weight of the cementitious materials.

2.2 CURING MATERIALS

A. Materials for curing concrete as indicated herein shall conform to the following requirements and ASTM C 309 Type I, Class B.

1. All curing compounds shall be clear resin based. Sodium silicate compounds shall not be allowed. Concrete curing compound shall be Kurez by Euclid Chemical Company; MB-429 as manufactured by BASF; L&M Cure R; or approved equal. Water based resin curing compounds shall be used only where local air quality regulations prohibit the use of a solvent based compound. Water based curing compounds shall be Aqua-Cure by Euclid Chemical Company; Masterkure-W by BASF; L&M Cure R-2; or approved equal. Curing compounds must contain 30% solids in accordance with ASTM C1315, Type 1, Class B.

2. Polyethylene sheet for use as concrete curing blanket shall be clear pigmented and shall have a nominal thickness of 6 mils. The loss of moisture when determined in accordance with the requirements of ASTM C156 shall not exceed 0.055 grams per square centimeter of surface.

3. Polyethylene-coated waterproof paper sheeting for use as concrete curing blanket shall also conform to ASTM C171. The waterproof paper sheeting shall consist of white polyethylene sheeting free of visible defects, uniform in appearance, have a nominal thickness of 2 mils, and be permanently bonded to waterproof paper conforming to the requirements of Federal Specification UU-B-790A (1) (2). The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 gram per square centimeter of surface.

4. Polyethylene-coated burlap for use as concrete curing blanket shall be 4-mil thick, white opaque polyethylene film impregnated or extruded into one side of the burlap. Burlap shall weigh not less than 9 ounces per square yard. The loss of moisture, when determined in accordance with the requirements of ASTM C156, shall not exceed 0.055 grams per square centimeter of surface.

5. Curing mats for use in Curing Method 6 as indicated in this Section shall be heavy shag rugs or carpets or cotton mats quilted at 4 inches on center. Curing mats shall weigh a minimum of 12 ounces per square yard when dry.

6. Evaporation retardant shall be a material such as Confilm as manufactured by BASF; Eucobar as manufactured by Euclid Chemical Company; E-CON as manufactured by L & M Construction Chemicals, Inc. or approved equal.

2.3 CONCRETE REINFORCEMENT

A. Concrete reinforcement is specified in Section 03200 – Steel Reinforcement.

2.4 MISCELLANEOUS MATERIALS

A. Dampproofing agent shall be an asphalt emulsion, such as Hydrocide 600 by Sonneborn; Dampproofing asphalt Coating by Euclid Chemical Company; Sealmastic by W.R. Meadows Inc., or approved equal.

B. The moisture proofing shall consist of one gallon asphalt primer per 100 square feet applied by brush or spray followed by 30 pounds asphalt coat per 100 square feet of surface, applied hot according to the manufacturer's recommendation.

C. Bonding agents shall be epoxy adhesives conforming to the following:

1. For bonding freshly-mixed, plastic concrete to hardened concrete, Sikadur 32 Hi-Mod Epoxy Adhesive, as manufactured by Sika Corporation; Concresive Liquid (LPL), as manufactured by BASF; BurkEpoxy MV as manufactured by The Burke Company; Weld-Crete as manufactured by Larsen Products Corporation, Rockville, Maryland; Eucoweld as manufactured by Euclid Chemical Company, Euclid, Ohio; or approved equal.

2. For bonding hardened concrete or masonry to steel, Sikadur 31 Hi-Mod Gel as manufactured by Sika Corporation; BurkEpoxy NS as manufactured by The Burke Company; Concresive Paste (LPL) as manufactured by BASF; or approved equal.

2.5 CONCRETE DESIGN REQUIREMENTS

A. General:

1. Concrete shall be composed of cement, admixtures, aggregates, and water of the qualities indicated.

2. Depending on the tests made under these Specifications and full size trial batches at the site, the water-cement ratio and mix may be varied to produce concrete of the required strength, watertightness, and resistance to weathering and chemical attack.

3. It is the intent of these Specifications to secure, for every part of the Work, concrete of homogeneous structure that, when properly cured and hardened, will have the required strength, durability, and consistency. However, when required, the mixture of cement, sand and coarse aggregate shall be modified by changing the relative volumes of fine and coarse aggregate and keeping the total volume the same.

4. The exact proportions in which these materials are to be used for different parts of the Work will be determined during the trial batch. In general, the mix shall be designed to produce a concrete capable of being deposited so as to obtain maximum density and minimum shrinkage, and, where deposited in forms, to have good consolidation properties and maximum smoothness of surface. The aggregate gradations shall be formulated to provide fresh concrete that will not promote rock pockets around reinforcing steel or embedded items. The proportions shall be changed whenever necessary or desirable to meet the required results at no additional cost to OWNER. All changes shall be subject to review by ENGINEER.

5. The concrete mix design shall limit the rise in temperature due to heat of hydration to less than 30 degrees F.

B. Fine Aggregate Composition: In mix designs for structural concrete, the percentage of fine aggregate in total aggregate by weight shall be as indicated in the following table.

Fine Aggregate	
Fineness Modulus	**Maximum Percent**
2.7 or less	41
2.7 to 2.8	42
2.8 to 2.9	43
2.9 to 3.0	44

For other concrete, the maximum percentage of fine aggregate in total aggregate, by weight, shall not exceed 50.

C. Water-Cement Ratio and Concrete Strength: The concrete mix shall be evaluated and comply with ACI 318 or ACI 350 as applicable. The concrete mix shall comply with the following properties:

Type of Concrete	Min 28-Day Compressive Strength psi	Max Size Aggregate in	Minimum Cement lbs (bags) per cu yd	Max W/C Ratio by weight
Class “A” Concrete	5,000	1	705 (7.5)	0.40
Class ”B" Concrete	4,000	1	611 (6.5)	0.45
Class “C” Concrete	3,000	1	470 (5)	0.50

NOTE: CONTRACTOR is cautioned that the limiting parameters above are not a mix design. Additional cement or water reducing agent may be required to achieve workability required by CONTRACTOR'S construction methods and aggregates. CONTRACTOR is responsible for providing concrete with the required workability. The weight of a bag of Portland cement will be taken as 94 pounds.

D. For corrosion protection of reinforcement in concrete, maximum water-soluble chloride ion concentrations in hardened concrete at ages from 28 to 42 days contributed from the ingredients including water, aggregates, cementitious materials, and admixtures shall not exceed 0.1 percent by weight of cement when tested in accordance with ASTM C1218.

E. Adjustments to Mix Design: The mixes shall be changed whenever such change is necessary or desirable to secure the required strength, durability, density, workability, and surface finish, and CONTRACTOR shall be entitled to no additional compensation because of such changes.

2.6 CONSISTENCY

A. The quantity of water in a batch of concrete shall be just sufficient, with a normal mixing period, to produce a concrete which can be worked properly into place without segregation and which can be compacted by vibratory methods to give the desired density, impermeability, and smoothness of surface.

B. The quantity of water shall be changed as necessary, with variations in the nature or moisture content of the aggregates, to maintain uniform production of a desired consistency.

C. The consistency of the concrete in successive batches shall be determined by slump tests in accordance with ASTM C143.

D. The slumps shall be as follows:

The maximum allowable slumps for the various types of construction indicated shall be:

Type of Construction	Slump
Foundation walls, external walls below grade, retaining walls, equipment foundations, all footings, slabs on grade and pavements	4"
Slabs, beams and girders poured on supported forms, building columns and all interior walls	4"
All other structures and shafts	4”

2.7 TRIAL BATCH TESTS

A. Before placing any concrete, a testing laboratory selected by CONTRACTOR and approved by ENGINEER shall prepare a trial batch of each class of concrete, based on the preliminary concrete mixes submitted by CONTRACTOR. During the trial batch the aggregate proportions may be adjusted by the testing laboratory using the two coarse aggregate size ranges to obtain the required properties. If one size range produces an acceptable mix, a second size range need not be used. Such adjustments will be considered refinements to the mix design and will not be the basis for extra compensation to CONTRACTOR. All concrete shall conform to the requirements of this Section, whether the aggregate proportions are from CONTRACTOR's preliminary mix design, or whether the proportions have been adjusted during the trial batch process. The trial batch shall be prepared using the aggregates, cement and admixture proposed for the project. The trial batch materials shall be of a quantity such that the testing laboratory can obtain 6 compression test specimens from each batch. All costs associated with such testing shall be paid by CONTRACTOR.

B. The determination of compressive strength will be made by testing 6-inch diameter by 12-inch high cylinders; made, cured and tested in accordance with ASTM C39 and ASTM C192. Three compression test cylinders will be tested at 7 days and 3 at 28 days. The average compressive strength for the 3 cylinders tested at 28 days for any given trial batch shall not be less than 125 percent of the specified compressive strength.

C. A sieve analysis of the combined aggregate for each trial batch shall be performed according to the requirements of ASTM C136. Values shall be given for percent passing each sieve.

2.8 READY-MIXED (CENTRAL-MIXED OR TRANSIT-MIXED) CONCRETE

A. When ready-mixed concrete is authorized by ENGINEER, it shall conform to the requirements of the Contract Documents.

B. Ready-mixed concrete shall meet all the requirements as to materials, batching, mixing, transporting, and placing as indicated herein and is in accordance with ASTM C94 and ACI 304R, including the following supplementary requirements.

C. A representative of OWNER shall have access to the batching or mixing plant for the purpose of inspecting materials used in the mix, for checking proportions of the mix, and for checking the time of departure of each truck from the plant to the job site.

D. The truck-mixer used in transporting central-mixed concrete shall have its drum rotating continuously at agitating speed from the time it is charged, including water, until it is discharged.

E. Transport concrete to discharge locations without altering the specified properties of water-cement ratio, slump, air entrainment, temperature and homogeneity.

F. Ready-mixed concrete shall be delivered to the site of the Work, and discharge shall be completed within one hour after the addition of the cement to the aggregates or before the drum has been revolved 250 revolutions, whichever is first. In any case the concrete shall be discharged prior to the period of initial set.

G. Truck mixers shall be equipped with counters to record the number of revolutions of the drum. The counter shall be of the recording type and able to be reset, and shall be mounted in the driver's cab. The counters shall be actuated at the time of starting mixers at mixing speeds.

H. For truck-mixed concrete, when ENGINEER requires that a specified quantity of water be added to the dry cement and aggregates in the truck-mixer drum, the mixer drum shall rotate continuously from the time water is added until the mix is discharged. The mixing period shall include not less than 50 or more than 100 revolutions of the drum or blades at rated mixing speed. Drum speeds shall be as recommended by the mixer manufacturer or as directed by CONSTRUCTION INSPECTOR or ENGINEER.

I. All materials including mixing water shall be in the mixer drum before actuating the revolution counter for determining the number of revolution of mixing.

J. The truck-mixer drum shall not be loaded beyond its rated capacity, or as such capacity is reduced to prevent spill.

K. Truck mixers and their operation shall be such that the concrete throughout the mixed batch as discharged is within acceptable limits of uniformity with respect to consistency, mix, and grading. If slump tests taken at approximately the 1/4 and 3/4 points of the load during discharge give slumps differing by more than one inch when the required slump is 3 inches or less, or if they differ by more than 2 inches when the required slump is more than 3 inches; the mixer shall not be used on the Work unless the cause is determined, corrected and verified by additional slump tests. All mechanical details of the mixer, such as water measuring and discharge apparatus, condition of the blades, speed of rotation, general mechanical condition of the unit, and clearance of the drum, shall be checked before a further attempt to use the unit will be permitted.

L. Delivery Tickets: Where ready-mix concrete is used, CONTRACTOR shall furnish delivery tickets at the time of delivery of each load of concrete. Each ticket shall show the total quantities, by weight, of cement, sand, each class of aggregate, admixtures, and the amounts of water in the aggregate added at the batching plant, and the amount allowed to be added at the site for the specific design mix. In addition, each ticket shall state the mix number, total cubic yards batched this load, total cubic yards batched this date for this Project, and the time of day, to the nearest minute, corresponding to the times when the batch was dispatched, when it left the plant, when it arrived at the site, when unloading began, and when unloading was finished.

M. Submit a delivery ticket to CONSTRUCTION INSPECTOR for information at the end of each shift for each batch of ready-mixed concrete delivered at the job site. Concrete delivered to the site without a complete delivery batch ticket as specified herein shall be cause for rejection of the concrete.

N. The use of non-agitating equipment for transporting ready-mixed concrete will not be permitted. The quality and quantity of materials used in ready-mixed concrete and in batch aggregates shall be subject to continuous inspection at the batching plant by CONSTRUCTION INSPECTOR.

O. The truck-mixer drum shall be cleaned thoroughly with clear water after each batch, and all water shall be removed from the drum. No cleaning water shall be allowed to contaminate the concrete during the discharge operation.

P. Weigh-tickets shall be prepared for each truck showing the normal batch size; the actual weights of cement, aggregate and water; and the time of loading at the plant. A blank shall also be provided on the weigh-ticket for the time of arrival at the site. A copy of the weigh-ticket shall be delivered to CONSTRUCTION INSPECTOR for each batch of concrete delivered to the site.

Q. Ready-mixed concrete (central-mixed and transit-mixed) will be rejected if there is evidence of improper proportions of ingredients, inclusive of water; if there is evidence of initial set; if more than 60 minutes transpires after batching or mixing before concrete is placed; if mixers or trucks are overloaded; or if successive batches are not uniform.

PART 3 – EXECUTION

3.1 PROPORTIONING AND MIXING

A. Proportioning of the mix shall conform to the requirements of ACI 301, Section 4 "Proportioning."

B. Mixing shall conform to the requirements of ACI 301, Section 4.

C. Slumps shall be as indicated herein.

D. Re-tempering of concrete or mortar at any time shall not be permitted.

3.2 PREPARATION OF SURFACES FOR CONCRETING

A. General

1. Wash down the rock walls of [tunnels, shafts, adits] with a blow pipe consisting of a water spray with pressurized air to the satisfaction of CONSTRUCTION INSPECTOR prior to placing concrete underground.

2. Earth and rock surfaces shall be thoroughly wetted by sprinkling prior to the placing of any concrete, and these surfaces shall be kept moist by frequent sprinkling up to the time of placing concrete thereon. The surface shall be free from standing water, mud, and debris at the time of placing concrete.

B. Joints

1. Joints, either vertical or horizontal shall be made only where called for by the Contract Drawings or as specified.

2. Concrete surfaces upon or against which concrete is to be placed, where the placement of the concrete has been stopped or interrupted so that, as determined by CONSTRUCTION INSPECTOR, the new concrete cannot be incorporated integrally with that previously placed, are defined as construction joints.

3. If CONTRACTOR chooses to make major slab pours in sections smaller than those indicated on the Contract Drawings, between expansion joints or between edges and expansion joints, CONTRACTOR shall submit its schedule of pours to CONSTRUCTION INSPECTOR for approval by ENGINEER 30 days prior to placing concrete together with the details of the reinforcing bars

for those pours. CONTRACTOR shall take into account the location of reinforcing bar laps when determining the limits of each pour.

4. When placing of concrete is to be interrupted long enough for the concrete to set, the working face shall be given a shape by the use of forms or other means that will secure proper union with subsequent work. Construction joints shall be made only where acceptable to CONSTRUCTION INSPECTOR.

5. The surfaces of horizontal and vertical joints shall be given a compacted, roughened surface with keyways and waterstops as indicated on the Contract Drawings.

6. In general, the width of keys shall be 1/3 the width of the walls; and the depth of keys shall be 1/6 the width of the walls. All keys shall be continuous, and none smaller than 4 inches in width and 1 1/2 inches in depth shall be used.

7. All horizontal and vertical construction, contraction, control and expansion joints, with the exception of joints where backfill will be placed on both sides of the joint and with the exception of floor slabs and members at or above finished grade, shall be provided with PVC waterstops.

8. Except where the Contract Drawings call for joint surfaces to be coated, the joint surfaces shall be cleaned of all laitance, loose or defective concrete, foreign material, and be roughened to a minimum 1/4-inch amplitude. Such cleaning and roughening shall be accomplished by hydro-blasting, bush hammering or sandblasting (exposing aggregate) followed by thorough washing. All pools of water shall be removed from the surface of construction joints before the new concrete is placed.

9. Where concrete is to be cast against old concrete (any concrete which is greater than 60 days of age), the surface of the old concrete shall be thoroughly cleaned and roughened by hydro-blasting or sandblasting (exposing aggregate). The joint surface shall be coated with an epoxy bonding agent unless indicated otherwise by CONSTRUCTION INSPECTOR.

10. No concrete shall be placed in any structure until all water entering the space to be filled with concrete has been properly cut off or has been diverted by pipes, or other means, and carried out of the forms, clear of the work. No concrete shall be deposited underwater nor shall CONTRACTOR allow still water to rise on any concrete until the concrete has attained its initial set. Water shall not be permitted to flow over the surface of any concrete in such manner and at such velocity as will injure the surface finish of the concrete. Pumping or other necessary dewatering operations for removing ground water, if required, shall be subject to the review of ENGINEER.

11. The exposed edges of concrete walls and wall copings and other points of protruding angle, and all "coursing" indicated on the Contract Drawings, shall be chamfered and, with special care that the lines are true, sharp and continuous and uniformly mitered at all points of juncture.

12. In all walls and in places where the working and consolidation of concrete is difficult because of the congestion of steel or because of inserts or for other reasons, as determined by CONSTRUCTION INSPECTOR, the placing of concrete shall be preceded by a deposit of grout, consisting of one (1) part

cement, three (3) parts sand and sufficient quantity of water for a grout that will flow. This grout mix shall be placed to a depth or thickness of two (2) inches.

13. At least one hour must elapse, after depositing concrete in the columns or walls, before depositing in beams, girders, or slabs supported thereon. Beams, girders, brackets, column capitals and haunches shall be considered as part of the floor or roof system and shall be placed integrally therewith.

14. Sponge Rubber Expansion Joint Filler: Where called for on the drawings and particularly where concrete pipe connects to concrete structures, CONTRACTOR shall furnish and install a premolded sponge rubber expansion joint filler equal to ASTM D 1752, Type I.

C. Care and Protection of New Work

1. Fresh concrete shall be protected from heavy rains, flowing water and mechanical injury. CONTRACTOR shall not permit walking upon concrete until it has set sufficiently. Projecting steel reinforcement or inserts shall likewise be protected from disturbance until the concrete has set. Do not place concrete underwater and do not place concrete during inclement weather.

2. Protection of new work shall include such operations as the provision and maintenance of curbs; of guard rail or bumpers to shield structures above grade; of planking over necessary traffic crossings; of wood treads upon concrete steps in a manner to safeguard surfaces and nosings from injury; and of paper or wood covering, or plank runways, on finished floors as is appropriate to obviate damage from traffic or from other work, such as the erection of piping and equipment and the finishing and painting of building interiors.

3. In each of these and similar cases, the intent of this protection is to assure concrete work free from damage or unsightly defects at the completion of the Contract, and the presence or occurrence of such damage or defect shall entail measures remedial thereof by CONTRACTOR, at its expense, and even to the extent of replacing the work if so ordered by CONSTRUCTION INSPECTOR or ENGINEER.

4. Comply with the requirements of Hot Weather Placement and Curing in Hot Weather Sections of this Section, ACI 305R, Guide to Hot Weather Concreting and ACI 305.1, Specification for Hot Weather Concreting.

5. Comply with the requirements of Cold Weather Placement and Curing in Cold Weather Sections of this Section, ACI 306R, Guide to Cold Weather Concreting and ACI 306.1 Standard Specification for Cold Weather Concreting.

D. Embedded Items

1. No concrete shall be placed until all formwork, installation of parts to be embedded, reinforcement steel, and preparation of surfaces involved in the placing have been completed and accepted by CONSTRUCTION INSPECTOR at least 4 hours before placement of concrete. All surfaces of forms and embedded items that have become encrusted with dried grout from previous work shall be cleaned before the surrounding or adjacent concrete is placed.

2. Build into the concrete the steel reinforcement, waterstops, pipes, slants, sleeves, anchor bolts, steps, castings, electrical conduits, and other inserts, and maintain the small openings shown on the Contract Drawings or as directed. Great care shall be taken to keep inserts and openings at proper lines and grade, and to thoroughly tamp under and around them so there will not be a passage for water. Where inserts are placed in the floors for openings, the top of such shall be a minimum of 2 inches above the elevation of the finished floor, unless otherwise specified.

E. Corrosion Protection: Pipe, conduit, dowels, and other ferrous items required to be embedded in concrete construction shall be so positioned and supported prior to placement of concrete that there will be a minimum of 2 inches clearance between said items and any part of the concrete reinforcement. Securing such items in position by wiring or welding them to the reinforcement will not be permitted.

F. Openings for pipes, inserts for pipe hangers and brackets, and anchors shall, where practicable, be provided during the placing of concrete.

G. Anchor bolts shall be accurately set and shall be maintained in position by templates while being embedded in concrete.

H. Cleaning: The surfaces of all metalwork to be in contact with concrete shall be thoroughly cleaned of all dirt, grease, loose scale and rust, grout, mortar, and other foreign substances immediately before the concrete is placed. Aluminum in contact with concrete shall be isolated with a protective coating.

3.3 FORMS

A. Furnish all labor and materials for all forms required for the Work, and have a sufficient number of each resource on the site to avoid unnecessary delay. It is the intent of the Contract Documents that CONTRACTOR shall provide the smoothest possible forms for all concrete surfaces which will be exposed, and for the interior surfaces of all concrete chambers which contain or transmit water or sewage. The forms for such exposed surfaces shall be of metal or plywood, adequately supported, or shall be lined with plywood, masonite board or similar lining, and/or with metal. The sections of lining material shall be as large as practical in order to minimize joints which shall be tight fitted to assure continuous smooth surfaces.

B. The design of forms shall be satisfactory to CONSTRUCTION INSPECTOR.

C. Temporary openings shall be provided to the inside of all forms and in column forms to facilitate cleaning and inspection immediately before depositing concrete.

D. All forms shall be true to the required shape, clean, of sufficient strength, and so braced that they will maintain their proper position during the placing and spading or vibrating of the concrete. They shall be watertight; and if necessary, caulking shall be used to obtain the required tightness.

E. Tie rods or other means for holding forms shall be of a type acceptable to CONSTRUCTION INSPECTOR, and no wooden spreaders shall be used unless specifically authorized, in which case special care must be used in assuring removal at time of pouring the concrete.

F. In general, where watertight work is essential, the metal wall ties shall be of a type that will permit removal to a distance approximately 1-1/2 inches from the face of the wall with plastic cones on each end, free from spalling and allowing for patching immediately after removal of forms. Ties shall include waterproofing washers placed at the center of the tie and the holes to be patched at the surface shall not be larger than 1-inch. Twisted wire ties will not be permitted.

G. Concrete blocks, non-corrosive bolsters or other approved means must be used to maintain proper distance between steel and forms.

H. All forms shall be thoroughly cleaned and wetted just before placing the concrete, and if necessary to secure a smooth surface, they shall be coated with an approved non-staining substance. Suitable chamfer or bevel strips shall be placed in the forms to prevent inside or outside sharp edges. No sharp edges will be permitted in the finished work.

I. Forms shall not be struck or removed until permitted by CONSTRUCTION INSPECTOR. In general, forms shall not be removed until the concrete has attained sufficient strength to assure structural stability under all dead and construction loads and until removal can be accomplished without marring concrete surfaces.

J. The determination of when forms may be removed shall take heed of temperature and humidity. Under favorable conditions, as determined by CONSTRUCTION INSPECTOR, forms shall be kept in place for minimum periods following completion of pour as follows:

Walls - self-supporting - depending on height and thickness	24-48 hours
Beam sides and unloaded columns	36 hours
Beam and slab bottoms - depending on span and loading and providing that CONTRACTOR may be required to reshore beams immediately after forms are removed	7-14 days

3.4 HANDLING, TRANSPORTING, AND PLACING

A. General: Placing of concrete shall conform to the applicable requirements of Section 5 of ACI 301, ACI 304R and the requirements of this Section. No aluminum materials shall be used in conveying any concrete.

B. Non-Conforming Work or Materials: Concrete that during or before placing does not conform to the requirements indicated herein shall be rejected and immediately removed from the Work. Concrete which is not placed in accordance with the Contract Documents, or which is of inferior quality, shall be removed and replaced by CONTRACTOR at no additional cost to OWNER.

C. Placing:

1. Provide CONSTRUCTION INSPECTOR a minimum of 24 hours notice of CONTRACTOR's intent to place concrete to enable prior inspection of reinforcing bars and forms and of conditions incidental to the pour. Permission

to place concrete will not be given until suitable access has been provided to all points of the proposed pour.

2. Provision shall be made for transporting the concrete rapidly from the place of mixing to the Site and with as little vibration as possible, so the tendency of the water to rise to the top may be reduced to a minimum.

3. The concrete shall be placed before it has had time to obtain its initial set, and under no conditions shall it be re-tempered and used. Any concrete that may have become compacted during transportation shall be satisfactorily re-mixed just before being placed in the form.

4. Before placing concrete, forms shall be thoroughly wetted and the space inside the forms shall be thoroughly cleaned of all chips, shavings or other debris.

5. The placing of concrete shall be a continuous operation throughout any pour and shall be carried on at such a rate that all concrete surfaces not yet to grade shall not have reached their initial set before additional concrete is placed. Do not interrupt placement of concrete and do not allow cold joints to occur.

6. Care shall be taken to avoid disturbing steel reinforcement and other embedded items that extend into concrete that has partially set.

7. Maintain records of concrete placement. Record date, location, quantity, air temperature and test samples taken.

8. Do not place concrete walls on footings or slabs until a minimum of 7 days after the footings or slabs have been cast and if field cured cylinders show a strength of 4000 psi or more in compression.

9. Do not place backfill against walls until the concrete has obtained a compressive strength equal to the 28-day compressive strength. Where backfill is to be placed on both sides of walls, place backfill uniformly on both sides.

10. Do not backfill the walls of structures that will be laterally restrained or supported by suspended slabs or slabs on grade until the slab is placed and the concrete has reached the specified compressive strength.

11. Take special care to prevent displacement or folding of PVC waterstops. Exert extra effort to embed waterstop fully on both sides in dense concrete.

12. Alternate section of concrete walls and slabs may be cast simultaneously. Allow minimum 7 days to elapse before placing concrete on against previously placed concrete in walls and slabs.

13. Provide for back-up equipment and procedures to be followed in case of an interruption in placing. Provide backup concrete vibrators at the project site. Test concrete vibrators the day before placing concrete.

D. Placement in Wall and Column Forms:

1. Concrete shall not be dropped through reinforcement steel or into any deep form, nor shall concrete be placed in any form in such a manner as to leave accumulation of mortar on the form surfaces above the placed concrete. In

such cases, means such as hoppers and, if necessary, vertical ducts of canvas, rubber, or metal shall be used for placing concrete in the forms in a manner that it may reach the place of final deposit without separation.

2. In all walls and in places where the working and consolidation of concrete is difficult because of the congestion of steel or because of inserts or for other reasons, as determined by CONSTRUCTION INSPECTOR, the placing of concrete shall be preceded by a deposit of grout, consisting of one (1) part cement, three (3) parts sand and sufficient quantity of water for a grout that will flow. Grout shall be placed to a depth or thickness of two (2) inches.

3. In no case shall the free fall of concrete exceed 6 feet in walls and 8 feet in columns below the ends of ducts, chutes, or buggies.

4. Concrete shall be uniformly distributed during the process of depositing and in no case after depositing shall any portion be displaced in the forms more than 6 feet in horizontal direction.

5. Concrete in wall forms shall be deposited in uniform horizontal layers not deeper than 2 feet; and care shall be taken to avoid inclined layers or inclined construction joints except where such are required for sloping members.

6. The rate of placing concrete in wall forms shall not exceed 5 feet of vertical rise per hour.

7. Sufficient illumination shall be provided in the interior of all forms so that the concrete at the places of deposit is visible from the deck or runway.

E. Placement in Slabs and Slopes: (NOT USED)

F. Conveyor Belts and Chutes:

1. All ends of chutes, hopper gates, and all other points of concrete discharge throughout CONTRACTOR's conveying, hoisting, and placing system shall be designed and arranged so that concrete passing from them will not fall separated into whatever receptacle immediately receives it.

2. Conveyor belts, if used, shall be of a type acceptable to CONSTRUCTION INSPECTOR.

3. Chutes longer than 50 feet will not be permitted.

4. Minimum slopes of chutes shall be such that concrete of the indicated consistency will readily flow in them.

5. If a conveyor belt is used, it shall be wiped clean by a device operated in such a manner that none of the mortar adhering to the belt will be wasted.

6. All conveyor belts and chutes shall be covered.

7. Long chutes may be permitted for moving concrete, under suitable limitations as to slope and re-handling of concrete, but such concrete from long chutes shall not be delivered directly to the forms. The use of short chutes and their arrangement for the placing of concrete will be subject to CONSTRUCTION INSPECTOR's approval.

G. Pumping of Concrete

1. General: If the pumped concrete does not produce satisfactory end results, CONTRACTOR shall discontinue the pumping operation and proceed with the placing of concrete using conventional methods.

2. Pumping Equipment: The pumping equipment shall have 2 cylinders and be designed to operate with one cylinder in case the other one is not functioning. In lieu of this requirement, CONTRACTOR may have a standby pump on the site during pumping.

3. The minimum diameter of the hose conduits shall be in accordance with ACI 304.2R.

4. Pumping equipment and hose conduits that are not functioning properly shall be immediately replaced.

5. Aluminum conduits for conveying the concrete shall not be permitted.

6. Field Control: Concrete samples for slump, air content, temperature, and test cylinders will be taken as directed by CONSTRUCTION INSPECTOR.

H. Temperature of Concrete:

1. The temperature of concrete when it is being placed shall be not more than 90 degrees F or less than 55 degrees F for sections less than 12 inches thickness nor less than 50 degrees F for all other sections. Concrete ingredients shall not be heated to a temperature higher than that necessary to keep the temperature of the mixed concrete, as placed, from falling below the minimum temperature. When the concrete temperature is 85 degrees F or above, the time between the introduction of the cement to the aggregates and discharge shall not exceed 45 minutes.

2. All concrete placed shall have a temperature of between 50 and 90 degrees F, and shall be maintained at a temperature of not less than 50 degrees F for at least 72 hours, or for as much longer time as is necessary to achieve a proper rate of curing for the concrete.

I. Hot Weather Placement:

1. If concrete is placed when the weather is such that the temperature of the concrete would exceed 90 degrees F, CONTRACTOR shall employ effective means, such as pre-cooling of aggregates and mixing water using ice or placing at night, as necessary to maintain the temperature of the concrete, as it is placed, below 90 degrees F. Any ice introduced shall be taken into account with corresponding adjustments made to the amount of mixing water.

2. When concrete is mixed during hot weather, follow ACI 305.1, Specification for Hot Weather Concreting and ACI 305R, Guide to Hot Weather Concreting.

3. When necessary pre-cool aggregates with water sprays and schedule the placing of successive layers of concrete so as to cause maximum release and dissipation of the heat of setting.

4. CONTRACTOR shall be entitled to no additional compensation on account of the foregoing requirements.

J. Cold Weather Placement:

1. All concrete materials, and all reinforcement, forms, inserts and ground with which the concrete is to come in contact, shall be free from frost.

2. When the ambient temperature is below 40 degrees F, or predicted to go below 36 degrees F in the next 24 hours, or predicted to go below 32 degrees F in the next 72 hours, no concrete shall be poured without express permission of CONSTRUCTION INSPECTOR. Permission so granted shall be for the day and location only, and must again be requested on subsequent days when temperatures are as above. When such permission is granted, no concrete shall be poured until adequate covering material is on site, and until a sufficient number of workmen are present to expedite finishing and covering to keep both as close behind the pouring as is practicable.

3. Provide and use proper facilities for heating water and aggregates and protecting the newly mixed concrete from freezing, and satisfactory appliances shall be provided and used for covering and keeping warm the newly laid concrete. The use of chemicals in the concrete mix to reduce the temperature of freezing will not be permitted. Provide heated enclosures when required to pour concrete.

4. Placement of concrete shall conform to ACI 306.1, Standard Specification for Cold Weather Concreting, ACI 306R, Guide to Cold Weather Concreting and the following:

   a. Remove all snow, ice, and frost from the surfaces, including reinforcement, against which concrete is to be placed. Before beginning concrete placement, thaw the sub-grade to a minimum depth of 6 inches. All reinforcement and embedded items shall be warmed to above 32 degrees F prior to concrete placement.

   b. The housing, covering or other protection used in connection with the curing shall remain in place and intact at least 24 hours after artificial heating is discontinued.

5. Discontinuance of protection against freezing temperatures shall be such that the drop in temperature of any portion of the concrete will be gradual and will not exceed 40 degrees F in 24 hours. In the spring, when the mean daily temperature rises above 40 degrees F for more than 3 successive days, the specified 72-hour protection at a temperature not lower than 50 degrees F may be discontinued for as long as the mean daily temperature remains above 40 degrees F; provided the concrete shall be protected against freezing temperatures for not less than 48 hours after placement.

6. CONTRACTOR shall not be entitled to additional compensation on account of the foregoing requirements.

3.5 ORDER OF PLACING CONCRETE

A. The order of placing concrete in all parts of the Work shall be acceptable to CONSTRUCTION INSPECTOR. To minimize the effects of shrinkage, the concrete shall be placed in units as bounded by construction joints at the indicated locations.

B. The surface of the concrete shall be level whenever a run of concrete is stopped. To insure a level, straight joint on the exposed surface of walls, a wood strip at least 3/4-inch thick shall be tacked to the forms on these surfaces. The concrete shall be carried about ½ inch above the underside of the strip. About one hour after the concrete is placed, the strip shall be removed and any irregularities in the edge formed by the strip shall be leveled with a trowel and all laitance shall be removed.

3.6 TAMPING AND VIBRATING

A. Concrete shall be consolidated by means of mechanical vibration equipment.

B. As concrete is placed in the forms or in excavations, it shall be thoroughly settled and compacted, throughout the entire depth of the layer which is being consolidated, into a dense, homogeneous mass, filling all corners and angles, thoroughly embedding the reinforcement, eliminating rock pockets, and bringing only a slight excess of water to the exposed surface of concrete.

C. Vibrators shall be Group 3 per ACI 309, high speed power vibrators (8,000 to 12,000 rpm) of an immersion type in sufficient number and with at least one standby unit as required. Group 2 vibrators may be used only at specific locations when accepted by CONSTRUCTION INSPECTOR.

D. Vibrators shall be used only by personnel experienced in their use, and shall be inserted and removed vertically (not dragged horizontally) at such regular intervals to insure uniform consolidation throughout the entire section of concrete being placed. In no case shall vibrators be used to transport concrete inside the forms.

E. Care shall be used in placing concrete around waterstops. The concrete shall be carefully worked by rodding and vibrating to make sure all air and rock pockets have been eliminated. Where flat-strip type waterstops are placed horizontally, the concrete shall be worked under the waterstops by hand, making sure all air and rock pockets have been eliminated. Concrete surrounding the waterstops shall be given additional vibration over and above that used for adjacent concrete placement to assure complete embedment of the waterstops in the concrete.

F. Concrete in walls shall be internally vibrated and at the same time rammed, stirred, or worked with suitable appliances, tamping bars, shovels, or forked tools until it completely fills the forms or excavations and closes snugly against all surfaces. Subsequent layers of concrete shall not be placed until the layers previously placed have been worked thoroughly.

G. Vibrators shall be provided in sufficient numbers, with standby units as required, to accomplish the required results within 15 minutes after concrete of the prescribed consistency is placed in the forms.

H. The vibrating head shall not contact the surfaces of the forms.

I. Care shall be taken not to vibrate concrete excessively or to work it in any manner that causes segregation of its constituents.

3.7 TREATMENT OF SURFACE DEFECTS

A. As soon as forms are removed, all exposed surfaces shall be carefully examined and any irregularities shall be immediately rubbed or ground in a satisfactory manner in order to secure a smooth, uniform, and continuous surface. Plastering or coating of surfaces to be smoothed will not be permitted. No repairs shall be made until after inspection by CONSTRUCTION INSPECTOR. In no case will extensive patching of honeycombed concrete be permitted. Concrete containing minor voids, holes, honeycombing, or similar depression defects shall be repaired as indicated below. Concrete containing extensive voids, holes, honeycombing, or similar depression defects shall be completely removed and replaced. All repairs and replacements herein required shall be promptly executed at no increased cost to OWNER.

B. Defective surfaces to be repaired shall be cut back from trueline a minimum depth of ½ inch over the entire area. Feathered edges will not be permitted. Where chipping or cutting tools are not required in order to deepen the area properly, the surface shall be prepared for bonding by the removal of all laitance or soft material, plus not less than 1/32-inch depth of the surface film from all hard portions by means of an efficient sandblast. After cutting and sandblasting, the surface shall be wetted sufficiently in advance of shooting with shotcrete or with cement mortar so that while the repair material is being applied, the surfaces underneath will remain moist but not so wet as to overcome the suction upon which a good bond depends. The material used for repair shall consist of an epoxy grout or a pre-mix product acceptable to ENGINEER. For exposed walls, the cement shall contain such a proportion of Atlas White Portland cement as is required to make the color of the patch match the color of the surrounding concrete.

C. Holes left by tie-rod cones shall be reamed with suitable toothed reamers so as to leave the surfaces of the holes clean and rough. Holes then shall be repaired in an approved manner with dry-packed, non-shrink non-metallic cement grout. Holes left by form-tying devices having a rectangular cross-section and other imperfections having a depth greater than their least surface dimension shall not be reamed but shall be repaired in an approved manner with non-shrink, non-metallic cement grout.

D. All repairs shall be built up and shaped in such a manner that the completed work will conform to the requirements of this Section, as applicable, using approved methods which will not disturb the bond, cause sagging, or cause horizontal fractures. Surfaces of repairs shall receive the same kind and amount of curing treatment as required for the concrete in the repaired section.

3.8 FINISHING CONCRETE SURFACES

A. Formed Surfaces:

1. All concrete surfaces built against forms shall receive the following finish:

a. Immediately after the removal of forms, the surface of the exposed concrete shall be moistened and all form ties shall be carefully snapped back, to a depth of at least 1-1/2 inches below the concrete surface. The tie holes shall be reamed and neatly pointed up with non-shrink, non-metallic grout.

b. All fins and laps shall be removed, and all voids, honeycomb and broken edges of concrete shall be picked out to sound concrete and carefully patched to correct lines with non shrink, non-metallic grout.

c. Patched areas shall be thoroughly compacted into place and screeded off, so as to leave the patches slightly higher than the surrounding surface. The patches shall be left undisturbed for a period of one to 2 hours to permit initial shrinkage before being finished to match the adjoining surfaces.

2. Upon completion of this stage of the finishing work, continue with the curing.

3. During the above work, cover all the exposed concrete with wet burlap, except that portion undergoing current finishing work, which shall be immediately recovered with burlap upon its completion.

4. In addition to the above described finishing operation, a final finish operation shall be given to all concrete surfaces (except manholes [and tunnels]) built against forms and which will normally be exposed to view. This will include all interior walls, slab bottoms, edges in buildings, and all similar exterior surfaces, to a point one (1) foot below final grade or two (2) feet below normal liquid level. The final finish operation shall be a grout finish, and shall be applied in the following manner:

a. The concrete surface shall be thoroughly moistened (but not soaked) and the entire surface painted with a sand-cement wash. The wash shall be composed of one (1) part of Portland cement, of which portion approximately thirty-three (33) percent shall be White Portland cement, and one (1) to one and one-half (1 ½) parts fine clean sand, passing a No. 30 sieve. The grout shall be of such consistency that it will not run when applied to vertical surfaces, and so that it will fill all voids in the surfaces of the concrete. The sand-cement grout shall be applied with a brush and thoroughly worked into the concrete at a rate that will completely fill all voids in the surface of the concrete and provide a firm even texture, uniform in color. After the wash has started to harden slightly, but before it has taken its initial set, any excess material shall be removed with a straight edge, and in about an hour, the surface shall be rubbed with a rough cloth or pad to remove the excess wash entirely from the surface and leave the voids filled. The wash shall be applied without a break in application (time lapse sufficient to allow wash to set up) in any wall, beam or column face except at corners, edges or other offsets. Prior to final approval of the work, any surface which has been disfigured by drippings or their causes shall be thoroughly cleaned, using a weak solution of muriatic acid, if necessary, and grout finish application repeated as required. The entire grout finish operation shall be accomplished using a single brand of Portland cement and a single source for sand throughout the Work.

B. Unformed Surfaces:

1. After proper and adequate vibration and tamping, all unformed top surfaces of slabs, floors, walls, and curbs shall be brought to a uniform surface with suitable tools. Immediately after the concrete has been screeded, it shall be treated with a liquid evaporation retardant. The retardant shall be used again after each work operation as necessary to prevent drying/shrinkage cracks.

The classes of finish specified for unformed concrete surfaces are designated and defined as follows:

a. Finish U1 - Sufficient leveling and screeding to produce an even, uniform surface with surface irregularities not to exceed 3/8-inch. No further special finish is required.

b. Finish U2 - After sufficient stiffening of the screeded concrete, surfaces shall be float finished with wood or metal floats or with a finishing machine using float blades. Excessive floating of surfaces while the concrete is plastic and dusting of dry cement and sand on the concrete surface to absorb excess moisture will not be permitted. Floating shall be the minimum necessary to produce a surface that is free from screed marks and is uniform in texture. Surface irregularities shall not exceed 1/4-inch. Joints and edges shall be tooled where indicated or as determined by CONSTRUCTION INSPECTOR.

c. Finish U3 - After the Finish U2 surface has hardened sufficiently to prevent excess of fine material from being drawn to the surface, steel troweling shall be performed with firm pressure such as will flatten the sandy texture of the floated surface and produce a dense, uniform surface free from blemishes, ripples, and trowel marks. The finish shall be smooth and free of all irregularities.

d. Finish U4 - Trowel the Finish U3 surface to remove local depressions or high points. In addition, the surface shall be given a light hairbroom finish with brooming perpendicular to drainage unless otherwise indicated. The resulting surface shall be rough enough to provide a nonskid finish.

2. Unformed surfaces shall be finished according to the following schedule:

UNFORMED SURFACE FINISH SCHEDULE

Area	Finish
Grade slabs and foundations to be covered with concrete or fill material	U1
Water bearing slabs with slopes 10 percent and less	U3
Water bearing slabs with slopes greater than 10 percent	U4
Slabs not water bearing	U3
Top surface of walls	U3

3.9 WATERTIGHT STRUCTURES

A. A specific requirement of this Contract is that of watertight structures, which applies to concrete structures designed to contain water, sewage or sludge, and also to pits, tunnels, galleries, basements and the like where the concrete is intended, among other things, to prevent the entry of moisture. Watertightness is interpreted to signify the absence of active leakage visible as streams, trickles or drops, and also complete freedom from dampness resulting from the penetration of moisture into the concrete. In particular, it is intended that [tunnels, galleries and] basements shall be dry and free of exterior moisture.

B. Moisture proofing shall be applied, as specified herein, to the exterior concrete

surfaces, below grade, of all concrete walls and top slabs which enclose usable building spaces which are designed for occupancy by either equipment or personnel, except those walls poured against sheet piling and except under slabs. Service tunnels shall be considered as usable building space. Moisture proofing on walls that intercept grade shall terminate 6 inches below finished grade.

C. Surfaces to receive moisture proofing shall be smooth, clean and dry. All holes, joints and cracks shall be pointed with mortar flush with surface, and high spots shall be cut off or ground smooth. Surfaces shall be carefully swept or dusted to remove all foreign matter immediately before application of moisture proofing.

D. The moisture proofing shall consist of one gallon of asphalt primer per 100 square feet, applied by brush or spray, followed by 30 pounds of asphalt coat per 100 square feet surface, applied hot, according to the manufacturer's recommendations. The asphalt primer and finish coat shall conform to the requirements of ASTM D41 and D449, Type 1, respectively.

E. A layer of polyethylene film 4 mils thick shall be placed on the ground as a moisture barrier, prior to placing concrete building grade slabs and basement slabs (with or without grade beams), gallery slabs, and tunnel slabs, except where pile foundations are used. All joint laps shall be a minimum of 6 inches and shall be sealed by means of polyethylene tape.

F. Under the requirement of watertight structures, remedy proven defects, even to the extent of replacing concrete work. Under certain conditions, and where acceptable to ENGINEER, correction may consist of caulking or applying waterproofing, each as approved. Any remedial work to effect watertightness shall be at CONTRACTOR's sole expense and shall not constitute grounds for additional compensation.

G. CONTRACTOR shall demonstrate the watertightness of tanks and other structures intended to contain liquids. CONTRACTOR at its expense shall provide for such testing. Testing shall conform to ACI 350.1, Tightness Testing of Environmental Structures.

3.10 CURING

A. General: All concrete shall be cured for not less than 7 days after placing, in accordance with the methods indicated below for the different parts of the Work.

Surface to be Cured or Dampproofed	**Method**
Unstripped forms	1
Wall sections with forms removed	4 or 6
Construction joints between footings and walls, and between floor slab and columns	2
Encasement concrete and thrust blocks	3 or 4
All concrete surfaces not specifically indicated in this Paragraph	4
Floor slabs on grade in Hydraulic Structures	5
Slabs not on grade	4 or 6

B. Method 1: Wooden forms shall be wetted immediately after concrete has been placed and shall be kept wet with water until removal. If steel forms are used the exposed concrete surfaces shall be kept continuously wet until the forms are removed. If forms are removed within 7 days of placing the concrete, curing shall be continued in accordance with Method 6 below.

C. Method 2: The surface shall be covered with burlap mats which shall be kept wet with water for the duration of the curing period, until the concrete in the walls has been placed. No curing compound shall be applied to surfaces cured under Method 2.

D. Method 3: The surface shall be covered with moist earth not less than 4 hours or more than 24 hours after the concrete is placed. Earthwork operations that may damage the concrete shall not begin until at least 7 days after placement of concrete.

E. Method 4: The surface shall be sprayed with a liquid curing compound.

1. It shall be applied in accordance with the manufacturer's printed instructions at a maximum coverage rate of 200 square feet per gallon and in such a manner as to cover the surface with a uniform film that will seal thoroughly.

2. Where the curing compound method is used, care shall be exercised to avoid damage to the seal during the 7-day curing period. If the seal is damaged or broken before the expiration of the curing period, the break shall be repaired immediately by the application of additional curing compound over the damaged portion.

3. Wherever curing compound has been applied by mistake to surfaces against which concrete subsequently is to be placed and to which it is to adhere, compound shall be entirely removed by wet sandblasting just prior to the placing of new concrete.

4. Curing compound shall be applied as soon as the concrete has hardened enough to prevent marring on unformed surfaces and within 2 hours after removal of forms. Repairs to formed surfaces shall be made within the 2-hour period; provided, however, that any such repairs which cannot be made within the said 2-hour period shall be delayed until after the curing compound has been applied. When repairs are to be made to an area on which curing compound has been applied, the area involved shall first be wet-sandblasted to remove the curing compound.

5. At all locations where concrete is placed adjacent to a panel which has been coated with curing compound, the panel shall have curing compound reapplied to an area within 6 feet of the joint and to any other location where the curing membrane has been disturbed.

6. Prior to placement of finished floor surfaces, all traces of curing compound shall be removed from all surfaces in such a manner that does not damage the surface finish and will not affect the bond of the finished floor surface.

7. Prior to final acceptance of the Work, all visible traces of curing compound shall be removed from all surfaces in such a manner that does not damage the surface finish.

F. Method 5:

1. Until the concrete surface is covered with curing compound, the entire surface shall be kept damp by applying water, using nozzles that atomize the flow so that the surface is not marred or washed. The concrete shall be given a coat of curing compound in accordance with Method 4 above.

2. Not less than one hour or more than 4 hours after the curing compound has been applied, the surface shall be wetted with water delivered through a fog nozzle, and concrete-curing blankets shall be placed on the slabs. The curing blankets shall be polyethylene sheet, polyethylene-coated waterproof paper sheeting, or polyethylene-coated burlap.

3. The blankets shall be laid with the edges butted together and with the joints between strips sealed with 2-inch wide strips of sealing tape or with edges lapped not less than 4 inches and fastened together with a waterproof cement to form a continuous watertight joint.

4. Wood planks shall be used over the paper or plastic sheets in areas subject to heavy traffic.

5. It is intended that all slabs be kept constantly moist up to 7 days of age.

6. The curing blankets shall be left in place during the 7-day curing period and shall not be removed until after concrete for adjacent work has been placed.

7. If the curing blankets become torn or otherwise ineffective, CONTRACTOR shall replace damaged sections.

8. During the first 3 days of the curing period, no traffic of any nature and no depositing, temporary or otherwise, of any materials shall be permitted on the curing blankets. During the remainder of the curing period, foot traffic and temporary depositing of materials that impose light pressure will be permitted only on top of plywood sheets of 5/8-inch minimum thickness, laid over the curing blanket.

9. Add water under the curing blanket as often as necessary to maintain damp concrete surfaces at all times.

G. Method 6: This method applies to both walls and slabs.

1. The concrete shall be kept continuously wet by the application of water for a minimum period of at least 7 consecutive days beginning immediately after the concrete has reached final set or forms have been removed.

2. While wall forms remain in place, the top exposed portion of the concrete shall be kept wet, in such a manner that the surplus water will find its way down between the concrete and the forms. After removal of forms, vertical surfaces shall be kept constantly moist by sprinkling with clean water at short intervals, unless otherwise directed during cold weather, or by covering with moistened burlap. A curing compound in conformance with ASTM C309 may also be used. However, it is CONTRACTOR's responsibility that subsequent finish and painting operations shall be compatible with this curing compound.

3. It is intended that all walls be kept constantly moist up to 7 days of age, and particularly so during any patching, finishing and rubdown operations.

4. Until the concrete surface is covered with the curing medium, the entire surface shall be kept damp by applying water, using nozzles that atomize the flow so that the surface is not marred or washed.

5. Heavy curing mats shall be used as a curing medium to retain the moisture during the curing period. The curing medium shall be weighted or otherwise held substantially in contact with the concrete surface to prevent being dislodged by wind or any other causes. All edges shall be continuously held in place.

6. The curing blankets and concrete shall be kept continuously wet by the use of sprinklers or other means both during and after normal working hours.

7. Immediately after the application of water has terminated at the end of the curing period, the curing medium shall be removed, any dry spots shall be re-wetted, and curing compound shall be immediately applied in accordance with Method 4 above.

8. Dispose of excess water from the curing operation to avoid damage to the Work.

3.11 CURING IN COLD WEATHER

A. Water curing of concrete may be reduced to 6 days during periods when the mean daily temperature in the vicinity of the Work is less than 40 degrees F; provided that, during the prescribed period of water curing, when temperatures are such that concrete surfaces may freeze, water curing shall be temporarily discontinued. Concrete cured by water shall be protected against freezing temperatures for 3 days immediately following the 72 hours of protection at 50 degrees F.

B. Where artificial heat is employed, special care shall be taken to prevent the concrete from drying. Using unvented heaters will be permitted only when unformed surfaces of concrete adjacent to the heaters are protected for the first 24 hours from an excessive carbon dioxide atmosphere by applying curing compound; provided, using curing compound for such surfaces is otherwise permitted by the Contract Documents.

3.12 DAMPPROOFING

A. The exterior surface of all buried roof slabs shall be dampproofed as follows:

1. Immediately after completion of curing the surface shall be sprayed with a dampproofing agent consisting of an asphalt emulsion. Application shall be in two coats. The first coat shall be diluted to ½ strength by the addition of water and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon of dilute solution. The second coat shall consist of an application of the undiluted material, and shall be sprayed on so as to provide a maximum coverage rate of 100 square feet per gallon. Dampproofing material shall be as indicated above.

2. As soon as the material has taken an initial set, the entire area thus coated

shall be coated with whitewash. Any formula for mixing the whitewash may be used if it produces a uniformly coated white surface and remains until placing of the backfill. If the whitewash fails to remain on the surface until the backfill is placed, CONTRACTOR shall apply additional whitewash at no cost to OWNER.

3.12 EQUIPMENT BASES

A. Where the Contract Drawings or the Contract Documents call for concrete foundations or bases above floor level to support equipment, such bases shall be formed as shown on the Contract Drawings, but otherwise shall be symmetrical with the equipment metal base and of plan dimensions 6 inches greater. The concrete foundation shall be poured to one inch below equipment base grade, with the upper edge chamfered on all sides. Anchor bolts, where required shall be positioned by template (furnished under the equipment item) to proper elevation and secured in place. Equipment bases shall be a minimum of 4 inches in height unless otherwise shown or required.

B. After the equipment has been set in position and shimmed to elevation, the space between the concrete foundation and the equipment metal base shall be completely filled with Embeco 636 Pre-Mixed Grout, as manufactured by the BASF Company, Cleveland, Ohio, F-100 Level Fill Grout, as manufactured by the Sauereisen Chemical Company, or approved equal. Exterior edges of the fill shall be projected slightly beyond the equipment metal base and chamfered. Where practicable, mortar filling as described shall be placed in the presence of the erector of the equipment.

3.13 PROTECTION

A. Protect all concrete against injury until final acceptance.

B. In all structures, concrete shall be prevented from drying for at least the first 7 days after placing, except where ordered otherwise during cold weather.

C. Fresh concrete shall be protected from damage due to rain, hail, sleet, or snow. Provide such protection while the concrete is still plastic and whenever precipitation is imminent or occurring.

D. During hot weather, rapid evaporation of moisture from exposed concrete slabs shall be prevented, between the time of finishing and the applying of polyethylene plastic sheets or curing paper, by means of wind barriers or fog sprays, as directed by CONSTRUCTION INSPECTOR.

E. Special attention shall be given to concrete slabs of thickness 8 inches or less.

3.14 PATCHING HOLES IN CONCRETE

A. Patching Small Holes:

1. Holes which are less than 12 inches in the least dimension shall be filled with non-shrink, non-metallic grout.

2. Small holes in members which are water-bearing or in contact with soil or other fill material shall be filled with non-shrink, non-metallic grout.

B. Patching Large Holes:

1. Holes which are larger than 12 inches in the least dimension shall have a keyway chipped into the edge of the opening all around, unless a formed keyway exists. The holes shall then be filled with concrete as indicated herein.

2. Holes which are larger than 24 inches in the least dimension and which do not have reinforcing steel extending from the existing concrete, shall have reinforcing steel set in drilled holes filled with non-shrink grout. The reinforcing added shall match the reinforcing in the existing wall unless indicated otherwise.

3. Large holes in members that are water bearing or in contact with soil or other fill shall have a pre-formed hydrophilic (bentonite-free) type waterstop material placed around the perimeter of the hole in accordance with the Contract Documents, unless there is an existing waterstop in place.

C. Bonding Agent: All exposed surfaces of existing concrete shall be coated with an epoxy bonding agent prior to patching the holes.

3.15 CARE AND REPAIR OF CONCRETE

A. Protect all concrete against injury or damage from excessive heat, lack of moisture, overstress, or any other cause until final acceptance. Particular care shall be taken to prevent the drying of concrete and to avoid roughening or otherwise damaging the surface. Any concrete found to be damaged, or which may have been originally defective, or which becomes defective at any time prior to the final acceptance of the completed Work, or which departs from the established line or grade, or which, for any other reason, does not conform to the requirements of the Contract Documents, shall be satisfactorily repaired or removed and replaced with acceptable concrete at no additional cost to OWNER.

3.16 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for Cast in Place Concrete, but the cost thereof shall be included in the cost of other Contract Pay Items.

- END OF SECTION 03300 -

SECTION 03315 – GROUT SEAL MANHOLE STRUCTURES

PART 1 - GENERAL

1.1 SCOPE OF WORK

A. CONTRACTOR shall furnish all materials for grout in accordance with the provisions of this Section and shall form, mix, place, cure, repair, finish, and do all other work as required to produce finished grout, in accordance with the requirements of the Contract Documents.

B. The following types of grout shall be covered in this Section:

1. Non-Shrink Grout: this type of grout is to be used wherever grout is shown in the Contract Documents, unless another type is specifically referenced.

2. Cement Grout

3. Epoxy Grout

4. Topping Grout and Concrete Fill

1.2 RELATED SECTIONS

A. Section 03200 - Steel Reinforcement

B. Section 03290 – Joints in Concrete

C. Section 03300 - Cast-in-Place Concrete

1.3 REFERENCE STANDARDS

A. American Society for Testing and Materials

1. ASTM C 109 Test Method for Compressive Strength of Hydraulic Cement Mortars (Using 2-in or 50-mm Cube Specimens)

2. ASTM C 531 Test Method for Linear Shrinkage and Coefficient of Thermal Expansion of Chemical- Resistant Mortars, Grouts, and Monolithic Surfacings

3. ASTM C 579 Test Methods for Compressive Strength of Chemical-Resistant Mortars and Monolithic Surfacings

4. ASTM C 827 Test Method for Early Volume Change of Cementitious Mixtures

5. ASTM D 696 Test Method for Coefficient of Linear Thermal Expansion of Plastics

B. U.S. Army Corps of Engineers

1. U.S.ACE - CRD-C 621 Corps of Engineers Specification for Non-shrink Grout

1.4 SUBMITTALS

A. CONTRACTOR submittals shall conform with Section 01300.

B. CONTRACTOR shall also submit to CONSTRUCTION INSPECTOR for information prior to use certified test results verifying the compressive strength of the proposed grout mix, shrinkage, and expansion requirements specified herein; and manufacturer's literature containing instructions and recommendations on the mixing, handling, placement and appropriate uses for each type of non-shrink and epoxy grout to be used.

1.5 QUALITY ASSURANCE

A. Field Tests

1. A testing laboratory selected and paid by OWNER will prepare not less than four compression cylinders during construction from the first placement of each type of grout, and at locations and intervals respectively thereafter as selected by CONSTRUCTION INSPECTOR.

2. Compression tests and fabrication of specimens for cement grout and non-shrink grout will be performed and paid for by OWNER as specified in ASTM C 109. Sufficient cylinders shall be prepared to provide representative compressive strength results at 7 days and 28 days both in the field and laboratory, respectively.

3. Compression tests and fabrication of specimens for epoxy grout will be performed as specified in ASTM C 579, Method B, at intervals during construction as selected by CONSTRUCTION INSPECTOR. A set of four specimens will be made for testing at 7 days, and each earlier time period as appropriate, as approved by ENGINEER.

4. All grout, already placed, which fails to meet the requirements of these specifications, is subject to removal and replacement at the cost of CONTRACTOR.

5. CONTRACTOR shall be charged for the cost of any additional tests and investigation on work performed which does not meet the Specifications.

6. Construction tolerances shall be as specified in Section 03300 – Cast in Place Concrete and elsewhere in these Contract Documents.

PART 2 - PRODUCTS

2.1 CEMENT GROUT

A. Cement grout shall be composed of one part cement, three parts sand, and the minimum amount of water necessary to obtain the desired consistency. Where needed to match the color of adjacent concrete, White Portland cement shall be blended with regular cement as needed. The minimum compressive strength at 28 days shall be 4000 psi.

B. Cement grout materials shall be as specified in Section 03300 - Cast in Place Concrete.

2.2 PREPACKAGED GROUTS

A. Non-Shrink Grout

1. Non-shrink grout shall be a prepackaged, inorganic, non-gas-liberating, non-metallic, cement-based grout requiring only the addition of water. Manufacturer's instructions shall be printed on each bag or other container in which the materials are packaged. The specific formulation for each class of non-shrink grout specified herein shall be that recommended by the manufacturer for the particular application.

2. Class A non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi; shall have no shrinkage (0.0 percent) and a maximum 4.0 percent expansion in the plastic state when tested in accordance with ASTM C-827; and shall have no shrinkage (0.0 percent) and a maximum of 0.2 percent expansion in the hardened state when tested in accordance with CRD C 621.

3. Class B non-shrink grouts shall have a minimum 28 day compressive strength of 5000 psi and shall meet the requirements of CRD C 621.

4. Application:

a. Class A non-shrink grout shall be used for the repair of all holes and defects in concrete members which are water bearing or in contact with soil or other fill material, grouting under all equipment base plates, and at all locations where grout is specified in the contract documents; except, for those applications for Class B non-shrink grout and epoxy grout specified herein. Class A non-shrink grout may be used in place of Class B non-shrink grout for all applications.

b. Class B non-shrink grout shall be used for the repair of all holes and defects in concrete members which are not water-bearing and not in contact with soil or other fill material, grouting under all base plates for structural steel members, and grouting railing posts in place.

B. Epoxy Grout

1. Epoxy grout shall be a pourable, non-shrink, 100 percent solids system. The epoxy grout system shall have three components: resin, hardener, and specially blended aggregate, all pre-measured and prepackaged. The resin

component shall not contain any non-reactive diluents. Resins containing butyl glycidyl ether (BGE) or other highly volatile and hazardous reactive diluents are not acceptable. Variation of component ratios is not permitted unless specifically recommended by the manufacturer. Manufacturer's instructions shall be printed on each container in which the materials are packaged. Epoxy grout shall be BurkEpoxy Anchoring Grout by The Burke Company, or approved equal.

2. The chemical formulation of the epoxy grout shall be that recommended by the manufacturer for the particular application.

3. The mixed epoxy grout system shall have a minimum working life of 45 minutes at 75 degrees F.

4. The epoxy grout shall develop a compressive strength of 5000 psi in 24 hours and 10,000 psi in seven days when tested in accordance with ASTM C 579, Method B. There shall be no shrinkage (0.0 percent) and a maximum 4.0 percent expansion when tested in accordance with ASTM C 827.

5. The epoxy grout shall exhibit a minimum effective bearing area of 95 percent. This shall be determined by a test consisting of filling a 2-inch diameter by 4-inch high metal cylinder mold covered with a glass plate coated with a release agent. A weight shall be placed on the glass plate. At 24 hours after casting, the weight and plate shall be removed and the area in plan of all voids measured. The surface of the grout shall be probed with a sharp instrument to locate all voids.

6. The peak exotherm of a 2-inch diameter by 4-inch high cylinder shall not exceed 95 degrees F when tested with 75 degree F material at laboratory temperature. The epoxy grout shall exhibit a maximum thermal coefficient of 30×10^{-6} inches/inch/degree F when tested according to ASTM C 531 or ASTM D 696.

7. Application: Epoxy grout shall be used to embed all anchor bolts and reinforcing steel required to be set in grout, and for all other applications required in the Contract Documents.

2.3 TOPPING GROUT AND CONCRETE FILL

A. Grout for topping of slabs and concrete fill for built-up surfaces of tank, channel, and basin bottoms shall be composed of cement, fine aggregate, coarse aggregate, water, and admixtures proportioned and mixed as specified herein. All materials and procedures specified for normal concrete in Section 03300 - Cast in Place Concrete, shall apply except as noted otherwise herein.

B. Topping grout and concrete fill shall contain a minimum of 564 pounds of cement per cubic yard with a maximum water cement ratio of 0.45. Where concrete fill is thicker than 3 inches, sitework concrete, as specified in Section 03300 may be used when accepted by ENGINEER.

C. Coarse aggregate shall be graded as follows:

U.S. STANDARD SIEVE SIZE	PERCENT PASSING BY WEIGHT
1/2"	100
3/8"	90-100
No. 4	20-55
No. 8	5-30
No. 16	0-10
No. 30	0

D. Final mix design shall be as determined by trial mix design under supervision of the approved testing laboratory.

E. Minimum compressive strength of topping grout and concrete fill at the end of 28 days shall be 3000 psi.

F. Grout shall meet the shrinkage test limitations given for Class A non-shrink grout as specified in Section 2.2 A.2 above.

2.4 CURING MATERIALS

A. Curing materials shall be as specified in Section 03300 for cement grout and as recommended by the manufacturer of prepackaged grouts.

2.5 CONSISTENCY

A. The consistency of grouts shall be that necessary to completely fill the space to be grouted for the particular application. Dry pack consistency is such that the grout is plastic and moldable but will not flow. Where "dry pack" is called for in the Contract Documents, it shall mean a grout of that consistency that behaves in a moldable, non-flowing fashion; the type of grout to be used shall be as specified herein for the particular application.

B. The slump for topping grout and concrete fill shall be adjusted to match placement and finishing conditions but shall not exceed 4 inches.

2.6 MEASUREMENT OF INGREDIENTS

A. Measurements for cement grout shall be made accurately by volume using containers. Shovel measurement shall not be allowed.

B. Prepackaged grouts shall have ingredients measured by means recommended by the manufacturer.

PART 3 - EXECUTION

3.1 GENERAL

A. All surface preparation, curing, and protection of cement grout shall be as specified in Section 03300. The finish of the grout surface shall match that of the adjacent concrete.

B. CONTRACTOR shall provide a representative from the selected manufacturer of Class A non-shrink grout and epoxy grout on-site for technical assistance upon request from CONSTRUCTION INSPECTOR.

C. Base concrete or masonry must have attained its design strength before grout is placed, unless authorized by CONSTRUCTION INSPECTOR.

3.2 GROUTING PROCEDURES

A. Prepackage Grouts: All mixing, surface preparation, handling, placing, consolidation, curing, and other means of execution for prepackaged grouts shall be done according to the instructions and recommendations of the manufacturer.

B. Base Plate Grouting

1. For base plates, the original concrete shall be blocked out or finished off at a sufficient distance below the plate to provide for a one-inch thickness of grout or a thickness as shown on the Contract Drawings.

2. After the base plate has been set in position at the proper elevation by steel wedges or double nuts on the anchor bolts, the space between the bottom of the plate and the original pour of concrete shall be filled with non-shrink-type grout. The mixture shall be of a trowelable consistency and tamped or rodded solidly into the space between the plate and the base concrete. A backing board or stop shall be provided at the back side of the space to be filled with grout. Where this method of placement is not practical or where required by ENGINEER, alternate grouting methods shall be submitted to CONSTRUCTION INSPECTOR for acceptance by ENGINEER.

C. Topping Grout

1. All mechanical, electrical, and finish work shall be completed prior to placement of topping or concrete fill. The base slab shall be given a roughened textured surface by sandblasting or hydro-blasting exposing the aggregates to ensure bonding to the base slab.

2. The minimum thickness of grout topping and concrete fill shall be one inch. Where the finished surface of concrete fill is to form an intersecting angle of less than 45 degrees with the concrete surface it is to be placed against, a key shall be formed in the concrete surface at the intersection point. The key shall be a minimum of 3-1/2 inches wide by 1-1/2 inches deep.

3. The base slab shall be thoroughly cleaned and wetted prior to placing topping and concrete fill. No topping concrete shall be placed until the slab is

completely free from standing pools or ponds of water. A thin coat of neat Type II cement grout shall be broomed into the surface of the slab just before topping of fill placement. The topping and fill shall be compacted by rolling or tamping, brought to established grade, and floated. Grouted fill for tank and basin bottoms where scraping mechanisms are to be installed shall be screeded by blades attached to the revolving mechanism of the equipment in accordance with the procedures outlined by the equipment manufacturer after the grout is brought to the established grade.

4. Topping grout placed on sloping slabs shall proceed uniformly from the bottom of the slab to the top, for the full width of the placement.

5. The surface shall be tested with a straight edge to detect high and low spots that shall be immediately eliminated. When the topping and fill has hardened sufficiently, it shall be steel troweled to a smooth surface free from pinholes and other imperfections. An approved type of mechanical trowel may be used as an assist in this operation, but the last pass over the surface shall be by hand troweling. During finishing, no water, dry cement or mixture of dry cement and sand shall be applied to the surface.

3.3 CONSOLIDATION

A. Grout shall be placed in such a manner, for the consistency necessary for each application, so as to assure that the space to be grouted is completely filled and free of any voids.

3.4 CURING

A. Cure with curing compound or as recommended by grout manufacturer.

3.5 MEASUREMENT AND PAYMENT

A. Payment for Grout Seal Manhole Structures shall be made in accordance with Section 01025- Measurement and Payment

- END OF SECTION 03315 -

SECTION 03400 - PRECAST SANITARY MANHOLES

PART 1 - GENERAL

1.1 DESCRIPTION

A. The work of this Section includes the manufacturing and installation of precast concrete structures as detailed on the Contract Drawings and specified herein. The manufacturing and installation includes all labor, materials, tools, equipment and incidentals required to complete the work.

B. Precast structures included in this Section are concrete manholes and other structural elements as indicated on the Contract Drawings.

C. CONTRACTOR is responsible for testing (when required), handling, storing, and transporting of precast structures.

1.2 SUBMITTALS

A. Shop drawings shall be submitted in accordance with Section 01300. Submittals shall include information regarding structural design, size and dimensions, reinforcing, location of openings and embedded items, and catalog cuts of all associated materials including frames, hatches, steps, etc. Submit written certification from the manufacturer that all precast structures conform to the applicable standards and requirements specified in this Section. Submit manufacturer-recommended handling and storage requirements to CONSTRUCTION INSPECTOR for information prior to shipment to site.

B. Product Data: For each type of product indicated.

C. Design Mixes: For each concrete mix.

D. Material Certificates: Signed by manufacturers certifying that each of the following items complies with requirements for:

1. Concrete materials

2. Reinforcing materials and prestressing tendons

3. Admixtures

4. Bearing pads

1.3 RELATED SECTIONS

A. Section 02200 – Excavation and Backfill

B. Section 03200 – Steel Reinforcement

C. Section 03300 – Cast-in-Place Concrete

D. Section 03315 – Ancillary Grout

1.4 DELIVERY, STORAGE AND HANDLING

A. Precast concrete structures shall be delivered to the site complete and in structurally sound condition. CONTRACTOR shall take proper care in moving the structures to prevent cracking, breaking, or otherwise damaging the structures. Handle and store precast products in accordance with manufacturer recommendations.

B. CONTRACTOR shall submit delivery tickets for all precast products to CONSTRUCTION INSPECTOR.

PART 2 – PRODUCTS

2.1 GENERAL

A. Precast manholes, including drop manholes, shall be as indicated in the Contract Documents.

B. Precast reinforced concrete manholes shall be manufactured, tested, and marked in accordance with ASTM C 478. Manhole sections shall not be installed until at least five (5) days after having been cast unless permitted in writing by OWNER.

C. All joints between precast manhole elements (excluding adjusting rings) shall have a rubber gasket per ASTM C 443, and one-half (½) inch diameter butyl rubber rope sealant per ASTM C 990.

D. No “see through” lift holes shall be allowed on precast concrete manholes.

2.2 REJECTION OF DAMAGED MANHOLES

A. Manholes possessing any of the following defects shall be subject to rejection:

1. Fractures or cracks passing through the shell, except for a single end crack that does not exceed the depth of the joint;

2. Defects that indicate imperfect proportioning, mixing and molding;

3. Surface defects indicating honeycombed or open profile; damaged ends, when such damage would prevent making a satisfactory joint;

4. The internal diameter of the manhole section shall not vary more than 1% from the nominal diameter;

5. Deviations more than one-quarter (¼) inch from the straight edge at any point across the top of the manhole cone section or riser ring;

6. Visible steel bars along the inside or outside surface of the manhole except

for reinforcement stirrups or spacers used to position the cage during manufacture, and reinforcement bars visible at the manhole structure end, provided these reinforcement bar ends are properly grouted in conformance with applicable ASTM specifications; and/or

7. Manhole sections not clearly or completely marked with date of manufacture, trade name, size designation, part number, or ASTM number.

2.3 MANHOLE CONES

A. Precast manhole cones shall be an eccentric offset type.

B. The top internal portion of the cone shall have a minimum four (4) inch uniform circumference to accept an internal chimney seal.

C. The top of the cone shall be cast to accept one precast adjusting ring.

2.4 DROP MANHOLES

A. Inside or outside drop manholes shall be constructed consistent with the requirements of Section 2.1.

2.5 MONOLITHIC (CAST-IN-PLACE) SANITARY SEWER STRUCTURES

A. Monolithic pour structures will be approved on a case-by-case basis provided information identifying the concrete mix, steel reinforcement details, pipe connections, and manhole dimensions are submitted by CONTRACTOR to CONSTRUCTION INSPECTOR and approved by ENGINEER prior to construction.

2.6 CONCRETE BASES

A. Base sections for forty-eight (48) and sixty (60) inch diameter precast manholes shall be constructed with the base and first riser section as one complete integral (monolithic) precast unit. The concrete base shall be as follows: a minimum of six (6) inch thickness for forty-eight (48) inch diameter structures and a minimum of eight (8) inch thickness for larger diameter structures. Monolithic pour or precast manholes shall be constructed of 4,000 psi structural concrete using calcareous aggregate and Type II cement as defined in Section 03300 – Cast in Place Concrete. Precast manholes seventy-two (72) inches in diameter and larger with separate base sections shall utilize a gasketed joint between the base section and first riser section. The wall and base thickness of precast concrete box inlet structures shall be as specified by the Indiana Department of Transportation Standard Specifications, and must also be constructed of 4,000 psi structural concrete using calcareous aggregate and either Type I or Type II cement.

2.7 FLOW CHANNELS AND BENCH WALLS

A. The channels shall be shaped and formed for a clean transition with proper hydraulics to allow the smooth conveyance of flow through the manholes. The bench wall shall be formed from the invert to a minimum height of 80% of the inside diameter of the inlet and outlet pipes to form a “U” shaped channel. The

bench top shall be constructed at a one-half (½) inch per foot slope from the manhole wall. Refer to the Contract Drawings for typical details of flow channels in manholes.

B. Where a flow channel is constructed as an integral part of the precast base, it shall be shaped and formed as described above, with the exception that the bottom of the flow channel may be formed from the bottom of inlet and outlet pipes if the pipe wall thickness is not greater than one (1) inch.

C. For cast-in-place flow channels, the bottom invert of all pipes entering a manhole shall be at least three (3) inches above the top of the base slab to the outlet invert so the finished sewer channel may be installed and shaped.

D. For connections to existing sanitary sewer structures, flow channels shall be shaped as if it were a new manhole.

2.8 MANHOLE ADJUSTING RINGS

A. Only concrete adjusting rings are allowed.

B. Concrete adjusting rings shall conform to ASTM C 478 and be free from voids, cracks, and other defects. The adjusting ring shall be from the same manufacturer as the manhole cone section to assure compatibility and a watertight seal as detailed in the Contract Documents. The minimum thickness of the concrete adjusting ring shall be four (4) inches.

2.9 STEPS

A. Steps shall conform to the requirements of ASTM C 478 and be manufactured using steel rods encased in polypropylene plastic. Steps shall be factory installed when the manhole is manufactured.

2.10 SEWER TO MANHOLE CONNECTORS

A. Sewer pipe connections to manholes shall be made with resilient rubber connectors manufactured in accordance with ASTM C 923. Connectors shall be secured to the manhole by either being cast-in or connected with an expandable stainless steel band. Connector shall be secured to the pipe with a stainless steel band. The stainless steel elements of the connector shall be totally nonmagnetic, Series 305 stainless steel.

B. The connector shall be the sole element relied upon to assure a flexible, watertight seal from the sewer to the manhole.

C. The connectors shall be as manufactured by Kor-N-Seal, Press Seal, A-Lok, or approved equal.

2.11 CASTINGS, FRAMES, AND COVERS

A. Casting shall be either Neenah Model R-1713-B-SP or East Jordan Iron Works Model 1022-Z1AGSHD.

B. All castings shall have a machined bearing surface with Type F concealed pickholes.

C. Sanitary sewer manhole covers shall be a solid lid casting as detailed on the Contract Drawings. The words “Sanitary Sewer” shall be cast in recessed letters one and one-half (1 ½) to two (2) inches in height onto solid lid covers.

D. Castings shall be manufactured in accordance with ASTM A 48 – Class 35B, and shall have a minimum tensile strength of 35,000 psi.

E. Boltdown castings shall be provided in Special Flood Hazard Areas.

F. Castings shall be uniform quality, free from blow holes, porosity, hard spots, shrinkage, distortion, or other defects. They shall be smooth and well-cleaned by shot blasting or other approved method.

G. All castings shall be manufactured true to pattern; component parts shall fit together in a satisfactory manner. Round frames and covers shall be of nonrocking design or shall have machined horizontal bearing surfaces to prevent rocking and rattling under traffic. All castings shall be fully interchangeable.

PART 3 – EXECUTION

3.1 BEDDING

A. The bedding for all manholes shall be a minimum of six (6) inches of No. 8 crushed stone or No. 8 fractured-face aggregate.

B. The stone and/or aggregate shall be placed to form a stable base.

C. Where poor or unstable soil conditions exist, or over excavation has occurred, additional No. 8 crushed stone, No. 8 fractured faced aggregate, No. 2 stone, or lean concrete shall be used to form a stable base.

3.2 BACKFILLING

A. Manhole backfilling and compaction requirements shall comply with the minimum requirements for the adjacent sanitary sewer pipe as found within these specifications.

3.3 PLACEMENT OF MANHOLE SECTIONS

A. Precast manhole sections shall be placed and aligned to provide vertical sides. The completed manhole shall be rigid, true to dimensions, and watertight.

B. The joints between manhole sections shall be properly sealed utilizing an approved rubber gasket and butyl rubber rope.

C. Manhole cones shall be turned away from the wheel path of paved streets and the flow line of ditches. There shall be no castings located in the flow line of ditches.

3.4 PLACEMENT OF ADJUSTING RINGS

A. Where one (1) solid riser or barrel section cannot be used, final adjustments in elevation of the casting frame and cover shall be accomplished by the use of precast concrete adjusting rings of a minimum thickness of four (4) inches as shown in the Contract Documents. The total number of adjusting rings shall not exceed three (3) and the total height of adjusting rings shall not exceed twelve (12) inches.

B. Concrete adjustment rings less than four (4) inches thick are not allowed. A water tight seal shall be provided between the cone section of the manhole and adjusting ring, each adjoining adjusting ring, and between the adjusting ring and casting by the use of two (2) rows of one-half (1/2) inch diameter cords of extrudable preformed gasket material, non-asphaltic mastic, or trowelable grade butyl rubber, as shown on the Contract Drawings. This material shall be placed in joints and keyways and be of sufficient quantity to completely fill the joint cavity.

C. The use of brick or block in lieu of adjustment rings is not allowed.

3.5 BUTYL RUBBER BACKPLASTER

A. A trowelable grade butyl rubber base exterior backplaster material one-quarter (1/4) inch minimum thickness, when dry, shall be installed on the outside of the manhole at each joint, extending six (6) inches above and below the joint. It shall also be placed on the chimney section from two (2) inches below the bottom adjustment ring on the cone section to, and covering, the base of the casting.

3.7 CONNECTIONS TO MANHOLES

A. Main line sanitary sewer connections to existing manholes shall be core-drilled and made using a flexible rubber connector as detailed within this specification.

B. Saw cutting and hammer taps are prohibited.

C. All connections shall provide for a watertight seal between the pipe and the manhole.

D. The connector shall be the sole element relied upon to assure a flexible water tight seal of the pipe to the manhole.

E. When connecting new pipe to existing manholes, a flow channel and bench walls shall be installed as detailed within this specification.

F. Lateral connections directly to manholes are not permitted.

3.8 LEAKAGE

A. All manholes shall be watertight and free from leakage.

B. Each manhole shall be visually inspected for leakage by CONSTRUCTION INSPECTOR after assembly and backfilling.

C. If the manhole shows signs of leakage, the manhole shall be repaired to the satisfaction of OWNER and reinspected.

3.9 NEGATIVE AIR (VACUUM) TEST

A. All manholes shall be tested for infiltration by means of a Negative Air (Vacuum) Pressure Test. Testing shall be done per ASTM C 1244.

B. All joints between the top of casting to the bottom of the manhole base shall be included in the test.

C. The vacuum test shall be as follows:

1. Waiting Period

   If possible, each manhole shall be tested immediately after assembly and prior to backfilling. If the test is done after backfilling, CONTRACTOR shall be responsible for re-excavation to locate and correct any leaks that have been identified. The vacuum test shall be done before the chimney seal is installed and tested.

2. Equipment

   Equipment used shall be made specifically for vacuum testing of manholes.

3. Testing Procedures

   a. Plug Installation

      All pipes entering the manhole shall be temporarily plugged, taking care to securely brace the pipes and plugs to prevent them from being drawn into the manhole.

   b. Test Head Installation

      The test head shall be placed at the top of the manhole casting in accordance with the manufacturer's recommendations.

   c. Air Evacuation

      A vacuum of ten (10) inches of mercury shall be drawn on the manhole, the valve on the vacuum line of the test head closed, and the vacuum pump shut off.

   d. Timing Pressure Rise

      The time for the vacuum reading to drop from ten (10) inches to nine (9) inches of mercury shall be measured. The allowable time shall be determined by using the following:

Minimum Test Times			
Manhole Depth, feet	Manhole Diameter, in		
	48	60	72
	Time, seconds		
8	20	26	33
10	25	33	41
12	30	39	49
14	35	46	57
16	40	52	67
18	45	59	73

20	50	65	81
22	55	72	89
24	59	78	97
26	64	85	105
28	69	91	113
30	74	98	121

e. Determination of Manhole Acceptance

If the time shown for the designated manhole depth and diameter elapses before the vacuum reading drops one (1) inch, the manhole shall have passed the test.

f. Determination of Manhole Failure

If the vacuum reading drops more than one (1) inch before the appropriate time has elapsed, the manhole shall have failed the test.

D. CONTRACTOR shall be required to uncover, replace, or repair any or all sections of the manhole and retest.

3.10 MEASUREMENT AND PAYMENT

A. Payment for Precast Sanitary Manhole shall be made in accordance with Section 01025- Measurement and Payment.

- END OF SECTION 03400 -

SECTION 11001 - CURED-IN-PLACE SEWER SEGMENT LINING

PART 1 – GENERAL

1.1 INTENT

A. It is the intent of this portion of the Technical Specifications to provide for rehabilitating sewer lines by the installation of a resin impregnated flexible tube. The tube shall be saturated with a thermosetting resin, installed into the existing pipeline and cured into a hard impermeable cured-in-place pipe (CIPP). When cured, the cured-in-place pipe shall extend from end to end in a continuous tight fitting watertight pipe-within-a-pipe.

1.2 SCOPE OF WORK

A. CONTRACTOR shall provide all labor, materials, equipment, and services necessary for sanitary and/or combined sewer pipe rehabilitation and shall comply with this Specification.

1.3 REFERENCE SPECIFICATIONS AND STANDARDS

A. This specification references American Society for Testing and Materials (ASTM) Standard Specification F1216, F1743, D790 (latest editions) and their reference standards, as well as the Water Research Centre (WRc) Sewerage Rehabilitation Manual (SRM) which are made a part hereof by such reference and shall be the latest edition and revision thereof. All work shall comply with the reference standard unless specifically stated otherwise in this Specification.

1.4 MINIMUM QUALIFICATIONS

A. CONTRACTOR's personnel shall possess the following minimum qualifications and/or experience:

1. Field Supervisor/Foreman: Minimum five (5) years as a foreman/superintendent for a cured-in-place lining crew, and the following minimum cured-in-place lining installations;

Pipe Diameter Range	Linear Feet Required
Up to and including 18-in	300,000
19-in to 30-in	100,000
31-in and larger	50,000

1.5 SUBMITTALS

A. CONTRACTOR shall submit the following information to CONSTRUCTION INSPECTOR prior to the commencement of any work:

1. CIPP System Data

2. Manufacturer's Resin Data Test Results

3. Resin Enhancer Manufacturer's Data

4. Bond Enhancer Manufacturer's Data

5. Certification of Applicability of Resin

6. CIPP Liner Installation Plan documenting proposed pre-lining preparation methods to address, at a minimum, liner inversion locations, required excavation locations, broken/collapsed laterals, sewer line holes, utility pipe conflicts, and/or blind tees/manholes.

No changes shall be allowed without written approval from ENGINEER.

PART 2 - PRODUCTS

2.1 GENERAL CORROSION REQUIREMENTS

A. The cured-in-place pipe shall be fabricated from materials which, when cured, will be able to withstand internal exposure to and corrosive effects of normal sewage effluent liquids and gases containing hydrogen sulfide, carbon monoxide, carbon dioxide, methane, dilute sulfuric acid, and external exposure to soil bacteria and chemical attack which may be due to materials in the surrounding ground or sewage within. Unless otherwise specified, corrosion requirements for sewers carrying domestic residential discharges shall be as specified in ASTM F1216, Appendix X2 and ASTM F1743 Table 2. Unless otherwise specified, corrosion requirements for sewers conveying commercial and industrial discharges shall be as specified in ASTM F1216 and ASTM F1743 with the following exceptions:

1. pH ranging from 5 to 12

2. Total petroleum hydrocarbons up to 200 mg/l

3. Limitations as set forth in Federal categorical pretreatment standards (40 CFR Chapter I, Subchapter N, Parts 405-471)

4. Limitations set forth in State pretreatment standards (327 IAC 5-16-2)B.

B. Where conflict between standards and requirements of this Specification exists, the more stringent standard shall apply.

2.2 SIZING

A. The liner shall be fabricated to a size that when installed shall neatly and tightly fit the internal perimeter of the pipe being rehabilitated as specified by ENGINEER. Allowance for circumferential and longitudinal stretching during insertion shall be made per manufacturer's standards. The dimensions indicated in the Contract Documents are approximate. It is the responsibility of CONTRACTOR to verify the actual pipe dimensions prior to bid submittal and/or prior to fabrication of the tube.

B. The length shall be that deemed necessary by CONTRACTOR to effectively carry out the insertion from inlet to outlet points (generally manhole to manhole). CONTRACTOR shall verify all lengths in the field prior to fabrication of the tube. Individual installation runs may be made over one or more access points as determined in the field by CONTRACTOR and approved by CONSTRUCTION INSPECTOR.

2.3 CURED-IN-PLACE PIPE MATERIALS

A. The liner, including any plastic covering and the thermosetting resin, shall meet the minimum mechanical properties defined in ASTM F1216. If so directed by OWNER, CONTRACTOR shall furnish prior to use of the materials satisfactory written certification of compliance with the ASTM and manufacturer's standards for all materials including the tube, resin and catalyst system, and conformance with installation methods of ASTM and the manufacturer's processes.

B. The felt material shall be manufactured by companies specializing in felt production for CIPP. The manufacturer shall have manufactured felt material for CIPP for at least two (2) years as documented by references. The felt manufacturer, references and location of the manufacturing facility shall be submitted to CONSTRUCTION INSPECTOR for review and approval by ENGINEER. The felt material manufacturer and facility shall not change throughout the duration of the Contract unless specifically approved by ENGINEER in writing.

C. **NONSTYRENATED RESIN IS REQUIRED ON ALL CIPP INSTALLATIONS.** The exact makeup of the resin shall be submitted to CONSTRUCTION INSPECTOR including chemical resistance information, cure logs and temperatures. The exact mixture ratio of resin and catalyst shall also be submitted. The catalyst system shall be identified by product name. Polyester resins shall have a minimum Heat Distortion Temperature of
212 degrees Fahrenheit per ASTM D648. Vinyl Ester resins shall have a minimum Heat Distortion Temperature of 220 degrees Fahrenheit per ASTM D648. Resins, Catalysts and resin/catalysts mixing ratios shall not be changed during the project unless specifically approved by

ENGINEER in writing.

2.4 DESIGN REQUIREMENTS

A. The proposed cured-in-place pipe liner to be used shall be designed for a minimum fifty-year service life under continuous loading conditions. Design of circular portions of the liner shall be based on the condition of the existing pipe which shall be classified as fully deteriorated based upon the definitions thereof contained in ASTM F1216 Appendix X1. In addition, the following segments require a 20 percent increase in thickness to account for additional protection due to nearby future improvements:

College Avenue	**10th Street**
MH230271-MH230287	MH230209-MH238958
MH230287-MH230288	MH238958-MH230290
	MH230290-MH230291

Design of non-circular portions of the liner shall be based upon the condition of the existing pipe which shall be classified as Type II Non-Circular Linings based upon the definitions thereof contained in WRc SRM. The liner shall be designed to withstand all imposed loads, including live loads if applicable and hydrostatic pressure. The liner shall be designed by a Registered Professional Engineer in the State of Indiana and shall have sufficient wall thickness to withstand the anticipated internal and external pressures and loads which may be imposed after installation. The design of the liner shall include considerations for ring bending, deflection, combined loading, buckling, and ovality. Calculations which determine wall thickness requirements of the liner to be used shall be submitted to CONSTRUCTION INSPECTOR for approval by ENGINEER prior to fabrication of the tube.

B. Designs for circular portions of the liner shall be based on the use of the standard flexible pipe equations as detailed in ASTM F-1216. A safety factor of 2.0 shall be utilized and the short-term flexural modulus of elasticity and flexural strength shall be reduced by 50 percent in the calculations.

C. Designs for non-circular portions of the liner shall be based on the bending stress and deflection equations detailed in the WRc SRM, Type II Non-Circular Linings. When following the guidelines of the WRc SRM, two (2) conditions must be satisfied when the lining is subjected to external loading:

1. The calculated extreme fibre stress in the non-circular portions of the pipe shall not exceed the allowable long-term flexural strength for the CIPP liner.

2. Deflection of the CIPP liner should not be excessive. The calculated deflection shall be less than 3% of the non-circular section length. This analysis is a serviceability requirement, with the liner still performing its function if the limit is exceeded.

D. In addition to the conditions above, designs for any flat or “straight” side wall

shall account for transference of soil, groundwater, and live loads. The soil and live loads acting on any flat side wall shall be assumed to be 1/3 of the soil and live loads acting on the crown of the CIPP liner.

E. The actual liner thickness for the installed CIPP liner shall be calculated based on the following minimum design assumptions:

1. The existing sewer is considered fully deteriorated.

2. The SRM critical length "L" is the length of the non-circular portion(s) of the CIPP liner.

3. For circular portions of the existing sewer, the ovality is considered to be 5 percent in circumference.

4. The CIPP is subjected to a full soil load of 120 pounds per cubic foot.

5. The CIPP is subjected to traffic line loads as calculated by AASHTO Standard Specifications for Highway Bridges, HS-20-44 Highway Loading.

6. The modulus of soil reaction for pipe zone backfill material is 700 psi.

7. The CIPP is subject to a groundwater elevation at the ground surface.

8. The CIPP Flexural Strength shall be 4,500 psi (ASTM D-790).

9. An "R" factor of 0.50 shall be utilized in deflection analysis.

10. A safety factor of 2.0 is to be utilized in the bending stress analysis. No safety factor is required in deflection analysis.

11. The CIPP Modulus of Elasticity shall be as follows:

MINIMUM PHYSICAL REQUIREMENTS			
Property	**ASTM Test Method**	**Filled Polyester System**	**Vinyl Ester System**
Flexural Strength	D790	4,500 psi	5,000 psi
Flexural Modulus (initial)	D790	400,000 psi	300,000 psi
Flexural Modulus (50-year)	D790	200,000 psi	140,000 psi
Tensile Strength[1]	D638	3,000 psi	4,000 psi
[1]For pressure piping applications only			

PART 3 - EXECUTION

3.1 COORDINATION WITH COLLECTION SYSTEM CUSTOMERS

A. CONTRACTOR shall assume all responsibility for notification to and coordination with all collection system customers connected to the sewer to be rehabilitated whose building sewer laterals will be out of service during the cured-in-place pipe installation, curing and restoration processes. Notifications shall be in writing via door hanger, door flier or U.S. mail given 24 hours but no more than 48 hours in advance of loss of service (excluding weekends and holidays). Notification shall clearly state the purpose of the work, shall advise all affected customers against water usage until the sewer line is placed back in service, and shall clearly state the potential consequences of use of residential wastewater generating facilities during the time when the building sewer service will be out of service (i.e. sewer back-up). The notice shall include a local 24-hour contact telephone number for residents to call if they have questions regarding the work. The notice shall be submitted to ENGINEER for review.

B. The maximum time of no service shall be eight (8) hours for any property served by the sewer being lined.

C. CONTRACTOR shall provide Notifications via written door hanger downstream of the sewer to be rehabilitated if there is reasonable belief or potential that odors produced by the rehabilitation will impact these customers.

D. In the event a collection system customer issues a complaint or concern about odors relating to the rehabilitation process, CONTRACTOR shall, with permission from the customer, enter their premises and perform readings of the styrene levels, if any, inside the premises using a properly calibrated and functioning photo ionization detector (PID), or other device approved by OWNER. CONTRACTOR shall notify the customer, OWNER, and CONSTRUCTION INSPECTOR of these readings. CONTRACTOR shall provide suggestions, and at the request of the customer, assistance in the ventilation of the premises.

3.2 CLEANING

A. Prior to the installation of cured-in-place liner, CONTRACTOR shall thoroughly clean the sewer designated to receive the liner. Cleaning shall constitute removal of all debris, solids, roots and other deposits in the sewer line. Sewer cleaning requirements are provided in Technical Specification Section 11012 – Sewer Line Cleaning.

B. In addition to the requirements of Section 11012, CONTRACTOR shall be responsible for clearing the designated sewer line of obstructions such as protruding lateral connections, and broken pipe which will prevent or inhibit the proper installation of liner. If pre-installation television inspection required to be performed by CONTRACTOR reveals pipe conditions or an

obstruction that cannot be removed by conventional cleaning and/or cutting equipment identified in Section 11012, CONTRACTOR shall coordinate with OWNER prior to proceeding with any work on sewer line

3.3 INSPECTION OF PIPELINES

A. Immediately prior to the installation of the cured-in-place liner, CONTRACTOR shall inspect the sewer segment(s) designated to receive the liner. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles and service connections by close circuit television. The interior of the pipeline shall be carefully inspected to determine the location of any conditions which may prevent proper installation of CIPP into the pipelines, and it shall be noted so that these conditions can be corrected. CONTRACTOR shall be responsible for confirming the locations of all branch service connections prior to installing and curing the CIPP. CONSTRUCTION INSPECTOR shall be present for and view all final inspections immediately prior to CIPP installation. CONSTRUCTION INSPECTOR can approve or prohibit installation operations based on the results of this inspection. A video and suitable log shall be kept for later reference by CONSTRUCTION INSPECTOR. Additional sewer line inspection requirements are contained in Technical Specification Section 11013 – Closed Circuit Television Inspection of Sewer Lines.

3.4 SEWAGE FLOW CONTROL

A. CONTRACTOR shall provide for maintenance of flow in the affected portions of the sewer system during installation of the cured-in-place pipe liner. Requirements for sewage flow control and bypass pumping are contained in Section 11014 – Bypass Pumping/Sewage Flow Control.

3.5 RESIN IMPREGNATION

A. CONTRACTOR shall designate a location where the uncured resin in the original containers and the unimpregnated fabric tube will be vacuum impregnated prior to installation. CONTRACTOR shall allow CONSTRUCTION INSPECTOR to inspect the materials and "wet out" procedure. The quantities of the liquid thermosetting materials shall be per ASTM and manufacturer's standards to provide the required design lining thickness. No liners shall be “wet out” more than 72 hours prior to installation.

3.6 ODOR CONTROL

A. CONTRACTOR shall take prudent measures to prevent odors resulting from the CIPP installation from entering collection system customer premises. Such measures shall include, but not be limited to, the use of blowers, sewer plugs, and other devices that will help reduce or eliminate the potential for odor migration. CONTRACTOR may be directed by OWNER and CONSTRUCTION INSPECTOR to implement measures in addition to those

planned or already implemented by CONTRACTOR.

3.7 CIPP INSTALLATION

A. The resin impregnated fabric tube shall be inserted through an existing manhole or other approved access in accordance with ASTM and manufacturer's standards. Multiple sewer segment lining with one inversion/insertion may be permitted upon approval by CONSTRUCTION INSPECTOR. Care shall be taken during the insertion process to avoid overstressing of the fabric materials. Use of a lubricant during the insertion is allowed in accordance with the manufacturer's recommendations to reduce friction. The lubricant shall be nontoxic, unable to support bacterial growth, and shall not adversely affect the fluid to be transported. Such lubricant shall be in a container clearly marked as to its contents.

3.8 CURING

A. After installation of the liner is completed and a temperature calibration mechanism is inserted, CONTRACTOR shall cure the liner in strict accordance with ASTM and manufacturer's recommendations. However, where water is utilized in the curing process, a potable water source shall be used.

B. Initial cure shall be deemed to be completed when inspection of the exposed portions of the cured-in-place pipe shows that these sections appear to be hard and sound and the thermocouples indicate that an exothermic reaction has occurred. The cure and post-cure period and temperature shall be as recommended by the resin manufacturer, modified for the cured-in-place process being used. The curing process shall take into account the existing pipe material, the resin system, and ground conditions, including, at a minimum, temperature, moisture content, and thermal conductivity.

C. CONTRACTOR shall submit curing logs prepared during CIPP installation to CONSTRUCTION INSPECTOR.

3.9 COOL DOWN

A. CONTRACTOR shall cool the finished cured-in-place pipe to specified temperature in strict accordance with ASTM and manufacturer's recommendations before relieving the internal pressure in the cured-in-place pipe. Care shall be taken in the release of the static head such that a vacuum will not be developed that could damage the newly installed cured-in-place pipe.

3.10 FINISH

A. The finished cured-in-place pipe shall be continuous over the entire length of the insertion run and be free from significant defects including dry spots, lifts, and delaminations. Any defects which will affect the integrity or

strength of cured-in-place pipe shall be removed and replaced at CONTRACTOR'S expense. For pulled-in-place installation techniques where the inflation bladder does not bond to the liner, all portions of the bladder shall be removed. Written curing and cool down logs shall be submitted to CONSTRUCTION INSPECTOR. No payment for lining work will be provided until such logs have been submitted and approved.

3.11 WATERSTOPS

A. The CIPP liner shall form a watertight seal at the upstream and downstream manholes. This may be accomplished by a waterstop or hydraulic grout.

B. The waterstop material shall be “Hydrotite RS-0723-3.51” or “DS-0520-3.51”, non-bentonite, modified chloroprene rubber expandable gasket complying with ASTM D412 and ASTM D2240 as manufactured by Western Textile Co., Greenstreak Division, or approved equal. Two rings of the waterstop gasket shall be attached to the interior wall of the host sewer pipe.

C. The hydraulic grout shall be a quick-setting, non-shrink hydraulic grout.

D. Costs for sealing CIPP liner ends shall be included in the unit bid price for Cured-In- Place-pipe for the applicable size and length.

3.12 RESTORATION OF BUILDING SEWER (LATERAL) SERVICE CONNECTIONS

A. CONTRACTOR shall fully reinstate all of the existing active service connections in each length of sewer following lining to 100% of the original service lateral inner diameter. The service connections shall be reopened from inside the sewer by means of either man-entry with a closed-circuit television camera or a closed-circuit television camera controlled cutting device appropriate for the CIPP. All openings shall be clean and neatly cut and shall be flush with the lateral pipe. The opening shall also be buffed with a wire brush to remove rough edges and provide a smooth finish. The bottom of the opening shall be flush with the bottom of the lateral pipe to remove any lip that could catch debris. Openings shall not be overcut beyond 100% of the original service lateral inner diameter. Overcut lateral reinstatements may require repair at the request of the OWNER and at no additional cost to OWNER. The CCTV video shall show each reinstatement in full and provide a 360° pan and tilt for approval by CONSTRUCTION INSPECTOR. CONTRACTOR shall re-open any service lateral that does not meet these requirements as evidenced by the post-rehabilitation inspections at no additional cost to OWNER. Coupons of pipe material resulting from service tap cutting shall be collected at the next manhole downstream of the pipe rehabilitation operation prior to leaving the site. Coupons may not be allowed to pass through the system.

B. CONTRACTOR shall certify it has a minimum of two (2) complete working

cutters plus spare key components on the site before each inversion. Unless otherwise directed by CONSTRUCTION INSPECTOR, all laterals shall be reinstated. No additional payment will be made for excavations for the purpose of reopening connections, and CONTRACTOR shall be responsible for all costs and liability associated with such excavation and restoration work.

3.13 TESTING AND ACCEPTANCE

A. The water tightness of the cured-in-place pipe shall be gauged while curing and under positive head.

B. For pulled-in-place products in which the pipe wall is cured while not in direct contact, work shall be subjected to leakage testing in accordance ASTM F1417 as modified by the requirements of ASTM F1216. For pulled-in-place products in which the pipe wall is cured while not in direct contact with the pressurizing fluid, leakage testing shall be conducted prior to restoration of building sewer (lateral) service connections.

C. For pulled-in-place products where the inflation bladder remains a permanent part of the finished work, a delamination test shall be performed on each installation length. A sample shall be fabricated from material taken from the tube and resin/catalyst system used, and cured in a clamped mold placed in the downtube. A portion of the inflation bladder material in the sample shall be dry and isolated from the resin in order to separate tube layers for testing. Delamination testing shall be conducted in accordance with ASTM D903 and the exceptions contained in ASTM F1216 or ASTM F1743 as applicable. The peeling or stripping strength between any non-homogenous layers of the product laminate shall be a minimum of 10 lb/in of width.

D. After all work is completed, CONTRACTOR shall provide CONSTRUCTION INSPECTOR with video showing both the pre- and post-installation conditions including the restored connections. Televising shall be accomplished in accordance with Technical Specification Section 11013-Closed Circuit Televising of Sewer Lines. All defects discovered during the post-installation television inspection shall be corrected by CONTRACTOR at its expense before the work under the Contract will be considered for Substantial Completion. After the defects, if any, are corrected, the affected sewer segment(s) shall be re-televised and video submitted for approval. The post-installation television inspection video shall be submitted to CONSTRUCTION INSPECTOR in sufficient time, five (5) business days minimum, to allow CONSTRUCTION INSPECTOR and ENGINEER to review the video prior to the Substantial Completion milestone.

3.14 QUALITY ASSURANCE PROCEDURES

A. For every two thousand five hundred (2,500) lineal feet of liner installed, two (2) flat plate samples shall be processed and tested. A minimum of

two (2) flat plate samples shall be required per size of CIPP installed. The flat plate samples shall be taken directly from the wet out tube, clamped between flat plates, and cured in the downtube. As an alternative, restrained end samples may be used for pipes eight to 18 inches in diameter.

B. Testing shall be completed by an accredited, independent laboratory at the Contractor's expense. The Contractor shall submit the chosen laboratory with appropriate accreditation documentation for approval by the Owner prior to testing. Testing results shall be provided to the Engineer (Owner) within seven (7) days of receipt. Retainage shall not be released until receipt of acceptable CIPP test results from Contractor.

C. Samples shall be conditioned and prepared in accordance with ASTM D618 and ASTM D 5 813 to ensure consistency in laboratory results.

D. Thickness shall be measured in accordance with ASTM D5813, latest version, with only the structural portion of the CIPP being measured.

E. Flexural testing shall be in accordance with ASTM D790, latest version, with only the structural portion of the CIPP being tested.

F. For pressure application, tensile testing shall be in accordance with ASTM D638, latest version, with only the structural portion of the CIPP being tested.

3.15 MEASUREMENT AND PAYMENT

A. Payment for non-styrenated CIPP lining shall be made in accordance with Section 01025- Measurement and Payment.

- END OF SECTION 11001 -

SECTION 11007 - LINING FOR SEWER STRUCTURES

PART - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide for the rehabilitation of complete sewer structures suffering from structural deterioration and/or infiltration/exfiltration via the installation of a cementitious, epoxy, or polyurethane liner, or a combination thereof.

1.2 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment, and services necessary for sewer manhole rehabilitation via the installation of a manhole liner and shall comply with this Specification.

1.3 MINIMUM QUALIFICATIONS

A. Application of lining materials shall be performed by operators familiar with the handling of the products and materials involved and equipment employed. CONTRACTOR's foreman and applicator(s) shall have a minimum of three (3) years' experience in the application of lining products.

B. CONTRACTOR shall provide certification from the lining material manufacturer that CONTRACTOR's personnel have been adequately trained in the application of manufacturer's product(s). Such certification shall describe manufacturer's training program and, if applicable, licensing policies and procedures for installers.

PART 2 - PRODUCTS

2.1 CHEMICAL GROUT

A. Materials

1. The following properties shall be exhibited by the grout.
    i. Documented service of satisfactory performance in similar usage.
    ii. Controllable reaction times and shrinkage through the use of chemicals supplied by the same manufacturer. The minimum set time shall be established so that adequate grout travel is achieved.
    iii. Resistance to chemicals; to most organic solvents. Mild acids and alkali.
    iv. The chemical shall be essentially non-toxic in a cured form.
    v. Sealing material shall not be rigid or brittle when subjected to dry atmosphere. The material shall be able to withstand freeze/thaw and moving load conditions.

vi. Acrylate grouts may not be used.

B. Additives

Grout conditions may be utilized for catalyzing the reaction, inhibiting the reaction, buffering the solution, lowering the freezing temperature of the solution, acting as filler, providing strength or for inhibition of root growth.

C. Material Identification

CONTRACTOR shall completely identify the types of grout, mortar, sealant, and/or root control chemicals used and provide case histories of successful use or defend the choice of grouting materials based on chemical and physical properties, ease of application, and expected performance.

D. Mixing & Handling

Mixing and handling of chemical grout, which may be toxic under certain conditions shall be in accordance with the recommendations of the manufacturer and in such a manner to minimize hazard to personnel. It is the responsibility of CONTRACTOR to provide appropriate protective measures to ensure that chemicals or gels are handled by authorized personnel in the proper manner. All equipment shall be subjected to the approval of CONSTRUCTION INSPECTOR. Only personnel thoroughly familiar with the handling of the grout material and additives shall perform the grouting operations.

2.2 SEWER STRUCTURE LINING

A. Cementitious Manhole Lining

1. Infiltration Control

CONTRACTOR shall stop all visible points of infiltration by applying, in accordance with the manufacturer's recommendations, a rapid setting hydraulic cement based product with the following minimum characteristics:

i. Compressive Strength (ASTM C109)

1 day:	2000 psi
7 days:	3500 psi
28 days:	4500 psi

ii. Tensile Strength (ASTM C109)

1 day:	175 psi
7 days:	250 psi
28 days:	350 psi

iii. Bond Strength (ASTM C321)

30 min:	50 psi
1 day:	85 psi

iv. Freeze Thaw Durability

100 cycles (ASTM C666) No Loss

v. Set Time at 70 degrees F

Initial	30 – 60 seconds
Final	1 hour

vi. Shrinkage (ASTM C157) 0%

2. Repair and Patching

CONTRACTOR shall fill/patch large voids in manhole walls and repair or reconstruct inverts where no hydrostatic pressure exists, in accordance with the manufacturer's recommendations. Material shall be a high early strength cementitious patching mortar with the following minimum characteristics:

i. Compressive Strength (ASTM C109)

1 day:	3000 psi
7 days:	4900 psi
28 days:	5500 psi

ii. Tensile Strength (ASTM C109)

1 day:	200 psi
7 days:	250 psi
28 days:	550 psi

iii. Freeze Thaw Durability (ASTM C666)

100 cycles with no damage

iv. Setting Time (Gilmore ASTM C266)

Initial:	15 – 18 minutes
Final:	22 – 25 minutes

3. Cementitious Lining

CONTRACTOR shall install cementitious coating (liner) materials that shall be specifically designed for the rehabilitation of manholes and other related wastewater structures, in accordance with the manufacturer's recommendations. Material shall have the following minimum characteristics:

i. Compressive Strength (ASTM C109) – 8000 psi

ii. Flexural Strength (ASTM C293) – 1000 psi

iii. Bond Strength (ASTM C882) – Substrate failure

iv. Freeze-Thaw (ASTM C666) – No damage in minimum 300 cycles

v. Shrinkage (ASTM C596) – 0.01%

vi. pH Range ≥ 2.0

B. Spray On Epoxy Lining

For manholes that are exposed to corrosive conditions CONTRACTOR shall install spray on epoxy lining materials that shall be specifically designed for the rehabilitation of manholes and other related wastewater structures, in accordance with the manufacturer's recommendations.

1. Any required repair, patching or resurfacing shall occur prior to applying epoxy lining material and shall have the following minimum characteristics:

i. 100% solids, solvent-free epoxy grout specifically formulated for epoxy topcoating compatibility.

ii. Factory blended, rapid setting, high early strength, fiber reinforced, non- shrink repair mortar that can be trowelled or pneumatically spray applied may be approved if specifically formulated to be suitable for epoxy topcoating with the specified product. The length of resurfacing material cure required before epoxy topcoating, shall be as recommended by the manufacturer.

2. The epoxy lining shall be applied in accordance with the manufacturer's recommendation and shall exhibit the following characteristics:

i. Product Type: amine cured epoxy

ii. VOC Content (ASTM D2584): 0

iii. Compressive Strength, psi (ASTM D695): 8,800

iv. Tensile Strength, psi (ASTM D638): 3,600 (minimum)

v. Flexural Modulus, psi (ASTM D790): 600,000 (minimum)

vi. Adhesion to Concrete, mode of failure (ASTM D4541): Substrate (concrete) failure

vii. Chemical Resistance (ASTM D543/G20) all types of service for:
   1. Municipal sanitary sewer environment
   2. Sulfuric acid, 30%
   3. Sodium hydroxide, 5%

C. Spray On Polyurethane Lining

For manholes that are exposed to corrosive conditions CONTRACTOR shall install spray on polyurethane lining materials that shall be specifically designed for the rehabilitation of manholes and other related wastewater structures, in accordance with the manufacturer's recommendations.

1. A rapid-setting cementitious grout or chemical grout specifically formulated for leak control shall be used to stop minor water infiltration. It should be mixed and applied according to the manufacturer's recommendations and shall meet the following minimum requirements:

   i. Compressive Strength (ASTM C109)

30 minutes:	1800 psi
24 hours:	4000 psi
7 days:	5000 psi

   ii. Tensile Strength (ASTM C190)

7 days:	300 psi
28 days:	350 psi

2. A chemical grout shall be used for stopping very active infiltration, filling voids and should be mixed and applied according to manufacturer's recommendations. The cementitious grout should be volume stable having a minimum 1 day compressive strength of 50 psi and a 28 day compressive strength of 250 psi.

3. A quick setting cementitious material shall be used to bring the substrate to profile by filling voids, cracks, missing mortar and other defects. It should be mixed and applied according to the manufacturer's recommendations and shall meet the following minimum requirements:

    i. Compressive Strength (ASTM C109)

1 hour:	1000 psi
48 hours:	3500 psi
28 days:	5000 psi

    ii. Tensile Strength (ASTM C190)

24 hours:	200 psi
7 days:	300 psi

4. The polyurethane resin based material shall be used to form the sprayed on/ structural enhanced monolithic covering all interior surfaces of the structure. The finished liner shall meet the following minimum requirements:

    i. Compressive Strength, psi (ASTM D695): 10,500

    ii. Tensile Strength, psi (ASTM D638): 7,000 (minimum)

    iii. Flexural Strength, psi (ASTM D790): 12,000 (minimum)

    iv. Bond: Shall exceed tensile strength of substrate

    v. Flexural modulus, psi (ASTM D790): 730,000

    vi. Density: 87 ± pcf

5. The finished structure shall be corrosion resistant to: Hydrogen Sulfide; 20% sulfuric Acid; 17% Nitric Acid; 5% Sodium Hydroxide; road salts for winter conditions as well as other common ingredients of the sanitary sewage environment.

D. If multiple manhole lining products are used to achieve a composite lining system, all products shall be designed such that they are compatible. Manhole lining products implemented shall be based on the conditions of the existing manhole and its environment (i.e. structural integrity, infiltration prevention, corrosive resistance, etc.)

PART 3 – EXECUTION

3.1 MANHOLE PREPARATION

A. CONTRACTOR shall furnish and install manhole patching and surface coating materials in all structures designated to receive rehabilitation by lining interior. All patching and surface coating materials shall be compatible with the lining product. CONTRACTOR shall not perform patching and sealing activities in any structure designated for same when the structural integrity of the structure has been severely compromised. If, in the opinion of CONTRACTOR, any structure designated to be lined has lost its structural integrity, in whole or in part, CONTRACTOR shall immediately notify CONSTRUCTION INSPECTOR. CONSTRUCTION INSPECTOR, ENGINEER and OWNER will assess the condition of the structure and provide written instruction to CONTRACTOR on how to proceed.

B. CONTRACTOR shall remove all foreign materials and matter from the interior of the structure and shall remove all steps at the discretion of the CONSTRUCTION INSPECTOR. Cleaning, surface preparation, and material removal activities shall be accomplished in strict accordance with the written instructions of the manufacturer of the patching and lining products; however, CONTRACTOR shall be required to make additional effort such as high pressure water blast, sandblast, acid wash or combination thereof at no additional cost to OWNER if manufacturer's written instructions prove insufficient to provide a thoroughly clean surface prior to application of patching and lining materials. CONTRACTOR shall take any and all necessary precautions to prevent debris from falling into the channel. Precautions may include the use of debris catchers which shall be inserted in the bottom of the structure prior to making reconstructive repairs. This precaution may also be required for lining work provided it does not interfere with the application and installation of lining materials. Regardless of the method used, CONTRACTOR shall provide a positive means of preventing debris from collecting in the bottom of the structure and entering the sewer lines. All debris removed from the interior surface of the structure shall be removed and disposed of by CONTRACTOR at its expense.

C. After surface preparation and prior to the application of patching and lining materials, CONTRACTOR shall stop all visible points of infiltration by applying a rapid setting hydraulic cement.

This product shall be applied in strict accordance with the manufacturer's specifications.

D. CONTRACTOR shall patch structure walls in areas where large voids exist (i.e., missing bricks, frames and pipes). CONTRACTOR shall remove all cracked or disintegrated material from the area to be patched exposing a sound subbase. CONTRACTOR shall apply a high early strength cementitious patching mortar.

This product shall be applied in strict accordance with the manufacturer's recommendations for surface preparation and cure/set times prior to performing lining activities.

3.2 CHEMICAL GROUT

A. Grouting should only be performed on a structurally sound manhole. All structural repairs, adjustments to the frame and cover and installation of grade rings shall be completed prior to beginning the grouting operation. Normal grouting operations shall be performed at the temperatures as recommended by the manufacturer.

B. Drilling grout injection holes in the manhole in strategic locations to re-direct flow coming through cracks and other defects in the wall, or to seal the entire exterior surface of the manhole, shall be in accordance with the recommendations of the grout manufacturer.

C. Grout shall be injected through the drilled holes using the recommended probe and applying pressures that will not cause damage to the manhole structure or the surrounding area.

D. Grout typically, shall be injected through the lowest holes first, working the grout higher until the manhole is externally sealed with grout. Additional holes may be required to verify that the grout has encompassed the entire outside of the manhole.

E. The injection holes shall be cleaned and patched as recommended by the manufacturer.

3.2.1 TESTING AND ACCEPTANCE

A. CONSTRUCTION INSPECTOR shall conduct visual inspections to verify that all leakage has been eliminated.

B. Any structure which fails testing shall be repaired by methods approved by ENGINEER at CONTRACTOR'S expense and retested as required by ENGINEER.

3.3 CEMENTITIOUS MANHOLE LINING

A. CONTRACTOR shall apply a high density cement based coating. Materials shall be applied to form a smooth continuous surface to the original configuration of the manhole wall. All products shall be furnished, mixed, applied and allowed to cure in strict accordance with manufacturer's recommendations. All surface coating materials shall be

applied to a finished thickness of the completed work of a minimum of one inch (1") with an allowable variance of + or - 10 percent (+/-10%).

3.3.1 TESTING AND ACCEPTANCE

A. CONSTRUCTION INSPECTOR shall randomly test structure lining for acceptance by wet gauge. Tested structures shall receive the minimum thickness as specified with an allowable variance of + or - 10 percent (+/-10%) of the specified thickness. Multiple gauge readings in each randomly selected structure will be averaged.

B. Any structure which fails testing shall be repaired by methods approved by ENGINEER at CONTRACTOR'S expense and retested as required by ENGINEER.

C. After all work is completed, CONTRACTOR shall provide CONSTRUCTION INSPECTOR with color photographs showing both the pre- and post-installation conditions.

3.4 SPRAY ON EPOXY LINING

A. Preparation of the Substrate

1. Temperature of the surface to be coated should be maintained between 40° F and 120° F.

2. Any and all contaminants which may affect the performance and adhesion of the coating to the substrate shall be entirely removed.

3. Concrete and/or mortar damaged by corrosion, chemical attack or other means of degradation shall be removed so that only sound substrate remains.

4. Repair products shall be used to fill voids and other surface defects which may affect the performance or adhesion of the epoxy coating product. Resurfacing products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the epoxy coating product to be applied. All repair and resurfacing products shall be handled,

   mixed, installed and cured in accordance with manufacturer recommendations.

B. Application of Epoxy Coating Product

1. Application procedures shall conform to the recommendations of the epoxy coating product manufacturer, including environmental controls, product handling, mixing, application equipment and methods.

2. Spray equipment shall be specifically designed to accurately apply the epoxy coating product, shall be in proper working order and shall be as recommended by the product manufacturer.

3. Only personnel qualified in accordance with these specifications shall perform all aspects of epoxy coating product installation.

4. Prepared surfaces shall be coated by spray application of the coating product(s) to a minimum wet film thickness as recommended by the manufacturer. CONTRACTOR shall contact the manufacturer of the epoxy coating for project specific recommendations.

5. Subsequent top coating or additional coats of the epoxy coating product shall occur within the product's recoat time.

3.4.1 TESTING AND ACCEPTANCE

A. The CONSTRUCTION INSPECTOR shall conduct a visual inspection, verifying that the final liner system is completely free of pinholes or voids.

B. During application a wet film thickness gage, such as those available through Paul N. Gardner Company, Inc. meeting ASTM D4138 – Standard Practice for Measurement of Wet Film Thickness of Organic Coatings by Notched Gages, shall be used to ensure a monolithic coating and uniform thickness during application.

C. After the protective coating has set hard to the touch it shall be inspected with high-voltage holiday detection equipment. Surface shall first be dried, an induced holiday shall then be made on to the coated concrete surface and shall serve to determine the minimum/maximum voltage to be used to test the coating for holidays at that particular area. The spark tester shall be initially set at 100 volts per 1 mil (25 microns) of film thickness applied but may be adjusted as necessary to detect the induced holiday (refer to NACE RPO188-99). All detected holidays shall be marked and repaired by abrading the coating surface with grit disk paper or other hand tooling method. After abrading and cleaning, additional protective coating material can be hand applied to the repair area. All touch-up/repair procedures shall follow the protective coating manufacturer's recommendations.

3.5 SPRAY ON POLYURETHANE LINING

A. Preparation of the Substrate

1. Any and all contaminants which may affect the performance and adhesion of the coating to the substrate shall be entirely removed.

2. Concrete and/or mortar damaged by corrosion, chemical attack or

other means of degradation shall be removed so that only sound substrate remains.

3. Repair products shall be used to fill voids and other surface defects which may affect the performance or adhesion of the epoxy coating product. Resurfacing products shall be used to repair, smooth or rebuild surfaces with rough profiles to provide a concrete or masonry substrate suitable for the epoxy coating product to be applied. All repair and resurfacing products shall be handled, mixed, installed and cured in accordance with manufacturer recommendations.

B. Application of Polyurethane Coating Product

1. Application of liner shall be made in accordance with manufacturer's recommendations.

2. Application of liner shall not be made unless the ambient temperature inside the structure is 50° F or higher.

3. If several polyurethane coats are applied to the substrate, no more than one (1) hour should be allowed between applications. Surfaces shall be cleaned thoroughly to remove any contaminants between coats.

4. Allow a minimum of 30 minutes after application before accepting flow back into the structure. Allow approximately four (4) to six (6) hours of cure time for final cure of applications.

3.5.1 TESTING AND ACCEPTANCE

A. The CONSTRUCTION INSPECTOR shall conduct a visual inspection, verifying that the final liner system is completely free of pinholes or voids.

B. If the inspections indicate a failure of 10% or greater surface area of the protective coating, the Contractor shall be responsible for the application of an additional protective coating layer matching the thickness specified herein with no additional charge to the Owner. Failure will be deemed to have occurred if the protective coating fails to A) prevent active infiltration into the structure, B) prevent the internal damage or corrosion of the structure, or C) protect the substrate and environment from contamination by effluent.

3.6 MEASUREMENT AND PAYMENT

A. Payment for Lining for Sewer Structures shall be made in accordance with Section 01025 - Measurement and Payment.

- END OF SECTION 11007 -

SECTION 11008 - REPLACEMENT OF MANHOLE FRAME AND COVER

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide for the replacement of existing manhole frames and covers with new manhole frame and solid covers. This Specification also applies to the removal and disposal of the existing casting and cover, and the removal and restoration of surfaces and all incidentals necessary to complete the Work.

1.2 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment and services necessary for the removal of existing manhole frames and covers and furnishing and installation of new manhole frames and solid covers including surface restoration as shown and specified in the Contract Documents.

PART 2 - PRODUCTS

2.1 MANHOLE FRAME AND COVER

A. Provide new manhole frames and solid covers where shown and specified in the Contract Documents. CONTRACTOR shall provide new manhole frames and solid covers as follows:

1. Neenah R-1713-B-SP, or

2. East Jordan Iron Works Model 1020AHDGS

PART 3 - EXECUTION

3.1 EXCAVATION

A. CONTRACTOR shall excavate around the manhole to remove existing manhole frames and covers as shown on the Drawings. For manhole frames and covers located in pavement, CONTRACTOR shall make a minimum 4-foot square or 4-foot diameter circular saw cut around the manhole.

B. Removed manhole frames and covers shall first be offered to the OWNER for salvage and stored as directed by the OWNER. Frames and covers that OWNER does not claim for salvage shall become the property of the CONTRACTOR, and CONTRACTOR shall immediately remove from the site and dispose of in accordance with all local, state, and federal rules, regulations, and ordinances.

3.2 PREPARATION

A. CONTRACTOR shall thoroughly clean the top adjusting ring with a whisk broom or other method to assure a clean surface suitable for the placement of a new casting.3.3 INSTALLATION

A. CONTRACTOR shall place new casting and cover on two rows of ½ inch thick trowelable grade butyl rubber.

B. Manhole frame and cover shall be replaced to provide positive drainage away from the top of casting as follows:

1. Paved areas – Top of casting flush with finished grade.

2. Unpaved areas – Top of casting a minimum of three (3) inches above finished grade.

3.4 RESTORATION

A. CONTRACTOR shall use Class B, 4,000 psi concrete to restore all pavement areas. Concrete thickness shall match existing pavement thickness, or 8 inch minimum thickness whichever is greater. Pavement restoration limits shall be limited to 3 square yards. Restore lawns in accordance with Section 02900.

3.5 TESTING AND ACCEPTANCE

A. All work shall be visually inspected by CONSTRUCTION INSPECTOR prior to backfilling and at the time of final inspection. Any defects shall be repaired by CONTRACTOR at no additional cost to OWNER.

3.6 MEASUREMENT AND PAYMENT

A. Payment for Replace Manhole Frame and Cover shall be made in accordance with Section 01025 - Measurement and Payment.

-END OF SECTION 11008-

SECTION 11010 - RECONSTRUCTION OF CHIMNEY/RISER

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide for the reconstruction of the upper portion of sanitary sewer structures suffering from significant deterioration of or offset in the frame/riser/chimney such that internal rehabilitation methods are insufficient to restore the structure. This Specification also applies to the vertical adjustment (raise manhole to grade) of sewer structures to the extent that the adjustment is being made as part of a rehabilitation project for sewer structures.

1.2 SCOPE OF WORK

A. CONTRACTOR shall furnish all labor, materials, equipment, and services necessary for the reconstruction of chimney/riser sections.

PART 2 - PRODUCTS

2.1 RISER/ADJUSTING RINGS

A. **No brick or block shall be used in the construction of a manhole or to adjust the elevation of the frame and cover.**

B. For manholes in a roadway/paved area that require 24" or less of Chimney/Riser Reconstruction, CONTRACTOR shall use the Mr. Manhole™ Sanitary Manhole Chimney Reconstruction within a Roadway/Paved Area (Concrete Collar) method of Chimney/Riser Reconstruction, where possible. **Refer to the attached Sample Specification for the Mr. Manhole™ method at the conclusion of this section. For details regarding the Mr. Manhole method, see the Sewer Rehabilitation details included in this solicitation. For the instances described above where Mr. Manhole™ is used, the remainder of this Section shall not apply.** A 2-inch riser ring shall only be used when performing the Mr. Manhole™ method on a brick or concrete block manhole; the 2-inch riser ring will serve as a level, flush surface upon which to set the Vylon chimney liner. The minimum quantity for chimney reconstruction for a given manhole is six (6) inches; where a larger quantity is called out for on the project documents, the larger quantity shall supersede the 6-inch minimum.

C. CONTRACTOR shall replace existing, deteriorated riser with new precast concrete riser rings free from cracks, voids and other defects conforming to ASTM C478.

D. To the extent practicable, CONTRACTOR shall use riser rings of a nominal thickness of not less than four (4) inches and not more than twelve (12) inches for reconstruction and/or adjustment of the manhole frame and cover. CONTRACTOR shall adjust all manholes designated to

receive casting adjustment and/or alignment. Such adjustment shall meet existing finished grade unless an alternative elevation is specified.

2.2 EXTRUDABLE PREFORMED GASKET MATERIAL

A. CONTRACTOR shall use a nominal 1/2 inch size butyl rubber base gasket material, conforming to AASHTO M-198 and Federal Specification SS-S-210A placed in all keyways as shown in Figures 5.4A and B between precast concrete adjusting ring and casting, individual precast concrete adjusting rings, and precast concrete adjusting ring and cone joints. The gasket material shall be as manufactured by Hamilton Kent-Seal, RUB'R-NEK-L-T-M by K.T. Snyder Company or an approved equal.

B. CONTRACTOR shall use a double bead of 3/16 inch to ¼ inch butyl sealant on high density polyethylene riser rings as specified.

2.3 MANHOLE FRAME AND COVER

A. Existing frames and covers which CONTRACTOR must remove to facilitate manhole rehabilitation, riser reconstruction, and/or casting alignment or grade adjustments shall be salvaged by CONTRACTOR for replacement by CONTRACTOR unless determined to be defective by CONSTRUCTION INSPECTOR. Where existing frames and/or covers have been determined to be defective by CONSTRUCTION INSPECTOR, CONTRACTOR shall replace with new frames and/or covers. Replacement frames and/or covers shall be furnished and installed in accordance with the Section 11008.

PART 3 - EXECUTION

3.1 PREPARATION

A. CONTRACTOR shall excavate and remove the existing riser rings where riser reconstruction is designated or otherwise required to provide a suitable base for casting reinstallation. CONTRACTOR shall thoroughly clean the concrete cone or top slab with a whisk broom, wire brush, chisel or other method to assure a flat seating surface free of rocks, gravel, asphalt, protruding concrete, dirt, frozen and other material and debris. For significantly damaged cone tops and top slabs, CONTRACTOR shall apply rapid setting cement mortar to a smooth finish suitable for seating riser rings, and install the riser rings in accordance with the manufacturer's recommendations.

3.2 PRECAST CONCRETE RISER RING SEALANT

A. CONTRACTOR shall provide a watertight seal between the cone and precast concrete riser ring, each adjoining precast concrete riser ring, and precast concrete riser ring and casting by applying two (2) rows of 1/2 inch extrudable preformed gasket material. A compatible primer or solvent as recommended by manufacturer of butyl base material shall be used to prepare surfaces prior to application of butyl base material and

riser rings.

3.3 EXTERIOR SEALING

A. CONTRACTOR shall reinstall existing casting or provide new casting as applicable; and prior to backfilling, shall seal the exterior of the manhole from two (2) inches below the bottom riser ring on the cone section to and covering the base of the casting, including the voids on the outside joints of the riser rings with a trowelable grade butyl rubber base exterior backplaster material, ¼ inch minimum thickness when dry.

3.4 TESTING AND ACCEPTANCE

A. All work shall be visually inspected by CONSTRUCTION INSPECTOR prior to backfilling and at the time of final inspection. Any defects shall be repaired by CONTRACTOR at no additional cost to OWNER.

3.5 MEASUREMENT AND PAYMENT

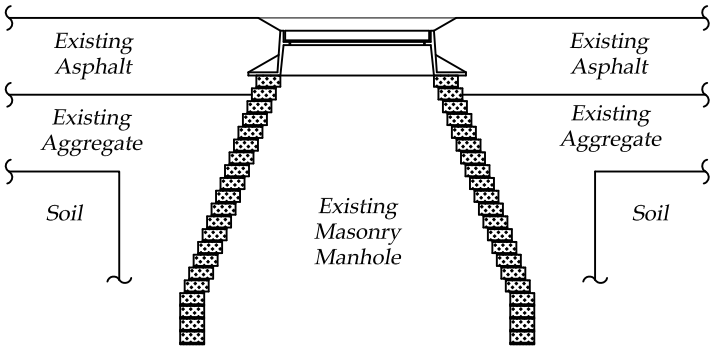
A. Payment for Chimney/Riser Reconstruction, Paved/Unpaved shall be made in accordance with Section 01025 - Measurement and Payment.

- END OF SECTION 11010 -

Sample Specification
Sanitary Manhole Chimney Reconstruction
Masonry Remediation Method

Step #1 - Chimney Removal/Preparation

Existing Manhole with Adjusting Rings and Poor Vertical Alignment (Sectional View)

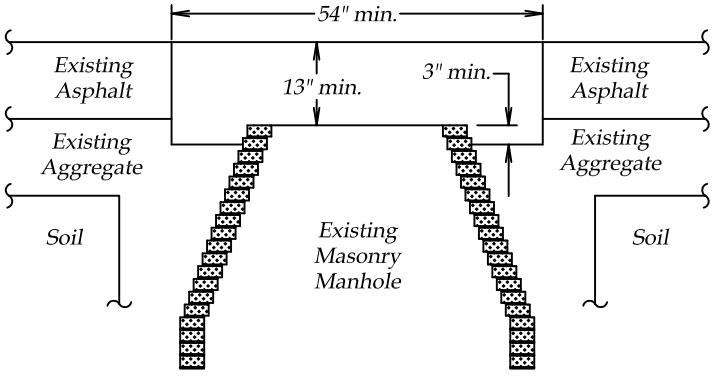


Legend

▒ = Masonry

-Precautions must be taken to prevent debris from entering the manhole during the entire removal and reconstruction process. This will prevent the possibility of plugged sewers, interruptions in sewage flow and time required to remove the debris after construction.
-Cut and remove the asphalt pavement, around the existing manhole casting, in a circular fashion with a minimum diameter of 54" and centered about the casting. Dispose of the asphalt.
-Remove the casting (manhole rim and cover) from the top of the masonry manhole. Inspect the rim and cover for defects. If defects are present, replace with new rim/cover as needed. If defects are not present, clean & retain for use in reconstruction.
-Remove masonry to the level specified below. Dispose of this material.
-Remove all aggregate around the manhole that has been exposed by the asphalt removal and dispose of this aggregate. The aggregate must be removed to a minimum of 3" below the level of the top of the remaining masonry.
-Clean and inspect the top surface of the masonry. The surface must be structurally sound. Utilize compressed air to blow dust and debris from the surface.
-The municipality shall inspect the masonry manhole for structural integrity. The remediation will only be as sound as the masonry manhole it rests upon.

Chimney Removed (Sectional View)



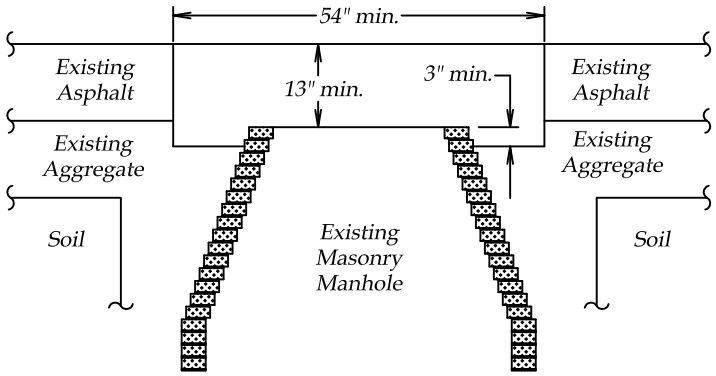
This Specification was prepared by Materials Testing, Inc.

Brad J. Core, P.E. #61122

Sample Specification
Sanitary Manhole Chimney Reconstruction
Masonry Remediation Method

Step #2 - Chimney Reconstruction

Chimney Removed (Sectional View)



Legend

- = Concrete
- = Epoxy Coated #3 Rebar
- = Vylon® pipe
- = ODOT #57 Aggregate
- = Waterstop
- = Masonry

-Bring the area around the masonry back to flush with the top of the masonry using ODOT #57 aggregate. This aggregate layer is intended to lessen the effects of freeze/thaw on the concrete collar by providing voids for excess water to expand into if subjected to freezing conditions. Manholes with excessive free water around them must be remediated on a case by case basis to further prevent freeze/thaw problems from occurring.

-Apply mortar to the top of the masonry and immediately install a concrete collar/adjusting ring (2" min. thickness) on top of the mortar. The concrete collar/adjusting ring must have an inside diameter of 24 inches. The outside diameter must be such that there is a minimum of 3 inches of the concrete collar/adjusting ring bearing on masonry all the way around the manhole

-A Vylon® pipe shall be used as a chimney liner and must be cut to the exact profile of the road in all directions such that when the manhole rim and cover are resting on top of the liner, the top of the casting shall be exactly 0.25" below flush with the pavement surface in all directions.

-The liner shall be marked in such a way, upon completion of the cutting process, that rotation does not occur, which could be detrimental to the end product. The top and/or bottom of the liner shall also be marked to prevent the liner from being installed up side down, which could be detrimental to the end product.

-Apply a liberal amount of white Mr. Manhole Sealant, MM 3006 to the bottom of the liner and set in place on top of the concrete collar/adjusting ring while making sure it is properly aligned. This will create a water tight seal between the liner and the concrete collar/adjusting ring.

-Apply a liberal amount of white Mr. Manhole Sealant, MM 3006 to the top of the liner. Set the manhole rim casting on the liner while making sure it is properly aligned. This will create a water tight seal between the liner and the manhole rim casting.

-Place the manhole lid on the rim casting to lessen the possibility of debris entering the manhole.

-Place Epoxy Coated #3 rebars as shown below. The circular shaped rebars shall have a 6" minimum overlap.

-Apply waterstop as shown below and specified on sheet 3 of 3. This will add an additional water tight seal where the liner meets the concrete collar/adjusting ring.

-Utilize ODOT-Class C concrete with black dye to cast a concrete collar around the rim casting and liner. The surface of the concrete shall be finished from flush with the pavement to flush with the rim casting. The edge of the concrete shall be rounded (1/4" radius) where it meets the asphalt. This will create a small groove for a joint sealer at this location.

-Fill the groove with a cold pour crack sealer such as Brewer Cote brand liquid crack filler or equivalent. This will prevent water from entering the circular seam where the concrete collar meets the asphalt. Brewer Cote liquid crack filler is available from the Brewer Company of Markham, Illinois.

-Apply an acrylic polymer concrete curing and sealing compound, such as Rez-Seal®, to the surface of the concrete collar. Rez-Seal® is available from the Euclid Chemical Company (www.euclidchemical.com).

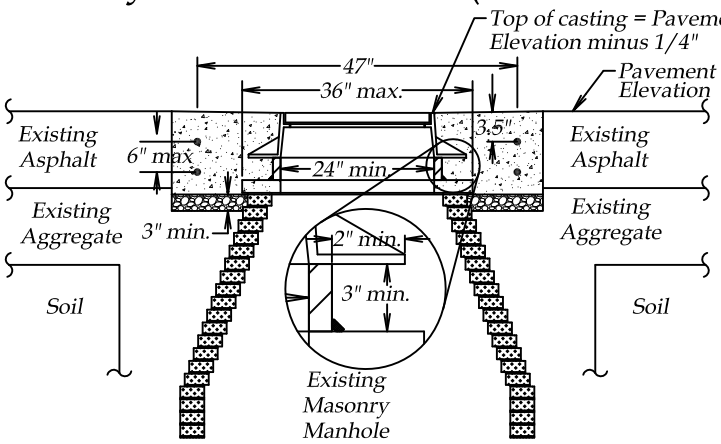
-Barricade the area around the concrete to protect it until the concrete attains a modulus of rupture of 400 pounds per square inch. A chemical admixture that acts as a concrete accelerator may be used to speed up the process if the roadway needs to be opened sooner.

-In order to minimize inconvenience to motorists, the contractor performing the work described in this specification must be capable of performing all of both steps of this specification in 1.5 hours or less.

-The contractor shall warrant the reconstructed manhole chimney to be leak free and structurally sound for a minimum of 5 years from the date of reconstruction.

-The municipality shall maintain the crack sealer over time to prevent water from entering the seam where the concrete collar meets the asphalt .

Chimney Reconstruction (Sectional View)



This Specification was prepared by Materials Testing, Inc.

Brad J. Core, P.E. #61122

Sample Specification
Sanitary Manhole Chimney Reconstruction
Masonry Remediation Method

Chimney Liner Specifications:

The chimney liner shall be constructed of Vylon Pipe, or its equivalent. The chimney liner must be made from polyvinyl chloride compounds which comply with the requirements for a minimum cell classification of 12364 as defined by ASTM D-1784.

The chimney liner must also meet all the following physical requirements:

Pipe Stiffness - minimum pipe stiffness shall be 46 psi when tested in accordance with ASTM D-2412

Impact resistance - no visual cracking or splitting of the waterway wall shall be evidenced when tested in accordance with ASTM D-2444 with a 20 lb. weight, tup B, flat plate holder B to a level of 220 ft. lbs.

Fusion quality - there shall be no sign of flaking or disintegration when immersed in anhydrous acetone for 20 minutes as described in ASTM D-2152.

Ductility - there shall be no evidence of cracking or splitting when pipe is flattened in a circumferential orientation between two flat plates by sixty percent (60%) of the original diameter.

Air tightness - each length of pipe shall pass a factory 3.5 psi air test as described in ASTM F-1803.

Waterstop Specifications:

The waterstop shall be constructed of Swellstop 3/8" x 3/4" controlled expansion waterstop or equivalent. Swellstop is available from GREENSTREAK, 3400 Tree Court Industrial Blvd., St. Louis, MO 63122.

The waterstop must meet all of the following physical requirements:

Specific Gravity - shall be 1.55 +/- 5% when tested in accordance with ASTM D-71.

Volatile Matter - shall not exceed 1% when tested in accordance with ASTM D-6.

Application Temperature - must be able to be applied from -10 degrees F to 125 degrees F as a minimum.

Service Temperature - must be able to function properly in service from -30 degrees F to 180 degrees F as a minimum.

SECTION 11012 - SEWER LINE CLEANING

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide for the cleaning of non-man entry pipelines that are intended to be subject to closed-circuit television inspection and/or sewer line rehabilitation. Pipes shall be cleaned sufficiently to allow for a closed-circuit television camera to discern 95% of the internal pipe surface, to discern all pipeline defects, and to allow ready installation of rehabilitation materials.

1.2 SCOPE OF WORK

A. CONTRACTOR shall clean all sewer segments designated for inspection and/or rehabilitation prior to performing such inspection or rehabilitation work. CONTRACTOR shall be solely responsible for its means and methods of sewer cleaning. CONTRACTOR shall provide a current copy of the CWA Authority, Inc. / Belmont AWT / United Water Liquid Waste Hauler Permit. Cleaning of the sewers shall consist of the removal of all grease, sand, silt, solids, rags, roots, and other debris from each sewer segment, including sags within any sewer segment and manholes. Work shall also include removal of protruding laterals and metal obstructions with the sewer segment. Selection of cleaning equipment and the method for cleaning shall be based on the condition and/or pipe material of the sewer segment at the time work commences, and shall comply with this Specification. **Flushing of any sewer to facilitate cleaning activities without the capture of solids and debris is expressly prohibited**.

1.3 SAFETY

A. CONTRACTOR shall be solely responsible for safety during the performance of all Work. CONTRACTOR shall take satisfactory precautions to protect the sewer segments and appurtenances from damage that might be inflicted upon them by the use of cleaning equipment. Any damage inflicted upon a sewer segment or other public or private property as a result of CONTRACTOR's cleaning operations, regardless of the cleaning method used and regardless of any other circumstance which may contribute to the damage, shall be repaired by CONTRACTOR at its sole expense.

B. CONTRACTOR shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by CONTRACTOR and/or OWNER. CONTRACTOR shall perform all work in accordance with the latest OSHA confined space entry regulations. CONTRACTOR shall coordinate its work with local fire, police and emergency rescue units. Whenever hydraulically propelled cleaning tools, which depend upon water pressure to provide their cleaning force, or any tools which retard the flow of water in the sewer segment are used, precautions shall be taken by

CONTRACTOR to ensure that the water pressure utilized does not result in any damage to, or flooding of, public or private property being served by, or in the vicinity of, the sewer segment(s) involved.

PART 2 - PRODUCTS (NOT USED)

PART 3 - EXECUTION

3.1 EQUIPMENT FOR SEWER SEGMENT CLEANING

A. Only hydraulic and/or mechanical equipment shall be used by CONTRACTOR to accomplish cleaning activities. Accuracy of equipment and operating method for cleaning shall be judged by the results obtained. When hydraulic or high velocity cleaning equipment is used, a suitable sand trap, weir, or dam shall be constructed in the downstream manhole in such a manner that all solids and debris are trapped and removed thereby preventing such material from passing into the next sewer segment. The following are general equipment and performance requirements:

1. Hydraulically Propelled Equipment

The equipment used shall be of a movable dam type and be constructed in such a way that a portion of the dam may be collapsed at any time during the cleaning operation to protect against flooding of the sewer, damage to the sewer, and/or damage to public or private property. The moveable dam shall be equal in diameter to the pipe being cleaned and shall provide a flexible scraper around the outer periphery to insure removal of grease. Sewer cleaning balls or other equipment which cannot be collapsed shall not be permitted for use.

2. High-Velocity Jet Equipment

All high-velocity sewer cleaning equipment shall be constructed for ease and safety of operation. The equipment shall have a selection of two or more high-velocity nozzles. The nozzles shall be capable of producing a scouring action from 15 to 45 degrees in all sizes of sewers designated to be cleaned. Equipment shall also include a high-velocity gun for washing and scouring manhole walls and floor. The gun shall be capable of producing flows from a fine spray to a solid stream. The equipment shall carry its own water tank, auxiliary engines, pumps, and hydraulically driven hose reel.

Liquid decanted or separated from the solids shall be returned to the sewer and shall not contain solids having greater than a 125 micron size.

3. Mechanically Powered Equipment

Power rodding machines shall be either a sectional or continuous rod type capable of holding a minimum of 750 feet of rod. The rod shall be heat-treated steel. To insure safe operation, the machine shall be fully enclosed and have an automatic safety clutch or relief valve.

Buckets, scrapers, scooters, porcupines, brushes and other mechanical equipment may also be utilized. All equipment and devices shall be operated by experienced personnel so that sewer lines are not damaged in the process of cleaning.

4. Root Removal

Roots shall be removed in the designated sections where root intrusion is a problem. Special attention shall be used during the cleaning operation to assure as complete a removal of roots from the joints. Procedures may include the use of mechanical equipment such as rodding machines, winches using root cutters and porcupines, and equipment such as high-velocity jet cleaners.

5. Protruding Lateral Connections and Other Obstructions

When specified, CONTRACTOR shall remove protruding lateral connections via the use of internal cutting devices which are capable of providing a smooth lateral cut at its internal connection to the sewer. CONTRACTOR shall also remove other obstructions, such as metal plates, within the sewer segment.

6. Larger Diameter Sewers

In sewers 24 inches in diameter and greater, CONTRACTOR may employ a combination of hydraulic high volume water pumping and solids separation system for cleaning. Flow rate shall be a minimum of 250 gpm at 2,000 psi unless otherwise specified. Solids moved to the downstream manhole shall be captured, removed and dewatered to 95% prior to transport to an approved disposal facility. The pumping and separation system shall be capable of continuous operation.

Liquid decanted or separated from the solids shall be returned to the sewer and shall not contain solids having greater than a 125 micron size.

For instances when man-entry is required to complete cleaning of the sewer, CONTRACTOR shall submit for review to CONSTRUCTION INSPECTOR a plan detailing the methods and procedures, equipment, and safety measures required for the work.

3.2 ACCESS

A. Access for cleaning purposes shall only be via existing manhole openings.

3.3 BYPASS PUMPING

A. Should bypass pumping or other form of sewage flow control be required by/of CONTRACTOR to facilitate sewer line cleaning, CONTRACTOR shall be solely responsible for providing all labor, equipment and materials necessary to control the flow of sewage in and/or around sewer segment(s) being cleaned. Requirements for sewage flow control and bypass pumping are contained in Section 11014 – Bypass Pumping/Sewage Flow Control.

3.4 BLOCKAGES PREVENTING CLEANING

A. If cleaning of an entire sewer section cannot be successfully performed from one manhole, equipment shall be set up on the other manhole and cleaning again attempted. No additional payment allowance shall be made for reverse set-ups. If successful cleaning also cannot be performed or equipment fails to traverse entire sewer line section using a reverse set-up, it shall be assumed that a major blockage or defect exists and cleaning effort shall be abandoned.

B. CONTRACTOR shall determine the location of major blockage(s) by measuring length of hose or rod inserted from manholes at each end and immediately report location of blockage(s) to CONSTRUCTION INSPECTOR. CONTRACTOR shall note these conditions in its field log.

C. CONTRACTOR shall recognize that there are some conditions such as broken pipe and major blockages that prevent cleaning from being accomplished or where damage could result if cleaning were attempted or continued. CONSTRUCTION INSPECTOR shall be immediately notified by CONTRACTOR of any and all conditions which in the opinion of CONTRACTOR warrant termination of cleaning activities. If CONTRACTOR ‘s cleaning equipment becomes lodged in a sewer, such equipment shall be removed by CONTRACTOR at its expense. This shall include excavation and repair of the sewer, underground utilities, backfilling, and surface restoration.

3.5 DEBRIS REMOVAL AND DISPOSAL

A. CONTRACTOR shall remove all sludge, dirt, sand, rocks, grease and other solid or semisolid material and debris resulting from the cleaning operations from the downstream manhole of the sewer segment being cleaned. Passing material from sewer segment to sewer segment shall not be permitted. In the event that sludge, dirt, sand, rocks, grease and other solid or semisolid material or debris resulting from the cleaning operations are observed and/or detected by CONSTRUCTION INSPECTOR as passing to downstream sewer segment(s), CONTRACTOR shall be responsible for cleaning such downstream sewer

segment(s) at no additional cost to OWNER.

B. CONTRACTOR shall be responsible for the handling, hauling and disposal of all debris, silt, and accumulated solids removed from the sewer. All debris, silt and solids removed by CONTRACTOR shall be disposed of at a facility licensed for the handling and disposal of such materials in accordance with all appropriate codes, rules and regulations for the handling and disposal of such materials. Under no circumstances shall the removed sewage or solids be dumped onto streets or into ditches, catch basins, storm drains, sanitary or combined sewer manholes, or otherwise improperly disposed. If sewage is unintentionally spilled, discharged, leaked or otherwise deposited in the open environment, CONTRACTOR shall be responsible for any clean-up and disinfection of the affected area. CONTRACTOR shall comply with all local, State and Federal regulatory requirements regarding spills. Improper disposal of sewage or solids removed from the sewers may subject CONTRACTOR to fines imposed by OWNER or other regulatory entities. In addition, CONTRACTOR may be subject to civil and/or criminal penalties for improper disposal of removed materials under the law.

3.6 ACCEPTANCE

A. Acceptance of sewer line cleaning will be based on inspection at manholes and viewing of video tape completed following cleaning.

B. If cleaning is deemed unsatisfactory, CONTRACTOR shall re-clean and re-inspect the sewer line until cleaning is shown to be satisfactory.

3.7 MEASUREMENT AND PAYMENT

A. Payment for Sewer Line Cleaning and Televising shall be made in accordance with Section 01025 - Measurement and Payment.

- END OF SECTION 11012 -

SECTION 11013 - CLOSED CIRCUIT TELEVISION INSPECTION OF SEWER LINES

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide for the inspection of pipelines utilizing closed-circuit television techniques to identify the location and extent of sewer line defects to allow for a determination of rehabilitation needs, to document pre-rehabilitation line condition, and/or to document post-rehabilitation line condition.

1.2 SCOPE OF WORK

A. Prior to performing closed circuit television inspection activities, CONTRACTOR shall thoroughly clean the sewer line(s) designated to be televised. Sewer cleaning requirements are provided in Technical Specification Section 11012 – Sewer Line Cleaning.

1.3 SAFETY

A. CONTRACTOR shall be solely responsible for safety during the performance of all Work. CONTRACTOR shall not enter into any sewer segment where hazardous conditions may exist until such time as the source of those conditions is identified and eliminated by CONTRACTOR and/or OWNER. CONTRACTOR shall perform all work in accordance with the latest OSHA confined space entry regulations. CONTRACTOR shall coordinate its work with local fire, police and emergency rescue units.

B. CONTRACTOR shall be responsible for any damage to public or private property resulting from its televising activities and shall repair or otherwise make whole such damage at no cost to OWNER.

1.4 Certification

A. Personnel operating such camera equipment shall hold current certification by National Association of Sewer Service Companies (NASSCO) Pipeline Assessment Certification Program (PACP).

PART 2 – PRODUCTS

2.1 EQUIPMENT

A. Television inspection equipment shall have an accurate footage counter that displays on a remote monitor the exact distance of the camera from the centerline of the starting manhole. The camera shall be of the remotely operated pan and tilt type. The rotating camera and lighthead configuration shall provide 240 degrees of pan and tilt angle measuring centerline to centerline and 70 degree lens viewing angle.

B. The camera shall be color and shall provide a minimum of 460 lines of horizontal resolution and 400 lines of vertical resolution. The image pick-up device shall contain in excess of 379,000 picture elements (pixels). Geometrical distortion of the image shall not exceed one percent.

C. The color camera shall be equipped with the necessary circuitry to allow for the remote adjustment of the optical focus and iris from the power control unit at the viewing station.

PART 3 - EXECUTION

3.1 INSPECTION

A. Inspection of pipelines shall be performed by experienced personnel trained in locating breaks, obstacles, and service connections by closed-circuit television inspection techniques. The interior of the pipeline shall be carefully inspected to determine the location and extent of all pipeline defects. The location of any conditions which may result in a limitation of rehabilitation techniques that could be used and/or prevent proper installation of designated rehabilitation materials in the pipelines shall be noted so that these conditions can be considered and, if necessary, corrected prior to actual rehabilitation.

B. CONTRACTOR shall internally inspect, via closed circuit television inspection, the sewer segments as required. Generally, inspection shall be completed one sewer line sections at a time. Access for televising purposes shall only be via existing manholes. Should access to a particular sewer section be difficult and adjacent sections require television inspection, CONTRACTOR may be allowed to complete inspection in multiple sewer line sections. When multiple sewer line sections are inspected using one setup, CONTRACTOR shall zero the camera's footage metering device at each subsequent sewer manhole to establish a uniform starting location of Station 0+00, in the middle of each manhole, for each line section televised.

C. At all defects and service connections, the camera shall be stopped and the pan and tilt features shall be used to obtain a clear picture. Where possible, the camera shall be panned to view up each lateral or point of connection. Operator shall also pan the pipe face while at 0+00 showing detail regarding pipe connection to manhole structure

D. CONTRACTOR shall record these inspections on indexed digital recordable disk. Video shall be recorded in a non-proprietary video format to allow for playback on any PC computer and/or DVD player. The video shall include a visual and audio narrative noting:

1. Date, time of day, and depth of flow;

2. Sewer segment number. Segment numbers shall be designated

3. Upstream manhole number.

4. Downstream manhole number.

5. Type of sewer (e.g. sanitary, storm, combined)

6. Size of sewer

7. Sewer materials of construction

8. Closest street address and street name on which sewer is located

9. Beginning and ending tape counter numbers for each run (manhole to next manhole) of sewer inspected

10. Direction of movement of camera, heading, and direction of flow

11. Locations of service connections into sewer by clock position and with counter distance in feet from beginning manhole's centerline

12. Location (start and end counter distances in feet from the beginning manhole's centerline) and description of obstructions, structural defects, missing pieces of pipe, longitudinal and/or circumferential cracking, joint deterioration including open and/or offset joints, ovality, leakage or evidence thereof, corrosion, erosion, break-in connections, protruding connections, mineral deposits, roots, previous repairs, grease/fats/oil deposits on pipe walls, sags, and other abnormalities with respect to the sewer's condition with counter distance in feet from the beginning manhole's centerline.

CONTRACTOR's log shall contain the same information.

E. All televising shall be in compliance with NASSCO's PACP requirements.

F. Digital disk shall visually display at a minimum the date, pipe segment number (manhole number) and distance from the centerline of the upstream manhole. The distance between manholes shall be verified by measuring tape. If the counter distance and the taping distance differ by more than 2 feet per 100 feet, the run shall be re-televised by CONTRACTOR at no additional cost to OWNER.

G. Digital disk shall be maintained and delivered in a case, which shall display the project name, project number, date of inspection, manhole segment number(s) inspected, certified operator PACP number, and crew ID number. The entire length of any one sewer segment shall be on one disk. No segment shall be split between two disks. A disk may have multiple segments, so long as an entire section is on one disk. Original disks of all sections shall be provided to CONSTRUCTION INSPECTOR along with the respective television inspection field logs.

H. Pre-lining CCTV videos shall be submitted to and approved by CONSTRUCTION INSPECTOR prior to commencing any CIPP lining rehabilitation on a given sewer segment. Post-lining CCTV videos shall be submitted to CONSTRUCTION INSPECTOR for review within two (2) weeks of completion of CIPP lining rehabilitation on a given sewer segment.

I. If during television operation television camera will not pass safely through entire sewer line section being investigated, CONTRACTOR shall, at no additional cost to OWNER, set up equipment so that inspection can be performed from opposite (downstream) manhole. Where an obstruction is encountered and a reverse set up is required, the distance shall be entered into the log and verbally noted on the digital disk from which manhole the measurements are being made. If under the reverse set-up the camera again fails to pass through the entire sewer line section, inspection shall be considered complete. All obstructions in the sewer segment that prohibit passage of the television camera shall be immediately reported to CONSTRUCTION INSPECTOR by CONTRACTOR referencing location and nature of the obstruction. No rehabilitation work shall proceed until CONTRACTOR receives direction from CONSTRUCTION INSPECTOR regarding removal of the obstruction.

J. Should CONTRACTOR's televising equipment become lodged in any sewer line, it shall be removed by CONTRACTOR at its expense. This shall include, if necessary, excavation and repair of the sewer, underground utility repairs, backfilling and surface restoration. CONTRACTOR shall re-televise any line segment in which its equipment became lodged after said equipment has been removed to demonstrate to OWNER that no damage exists as a result of CONTRACTOR's televising operations.

3.2 BYPASS PUMPING / FLOW CONTROL

A. Should bypass pumping or other form of sewage flow control be required by/of CONTRACTOR to facilitate sewer line televising, CONTRACTOR shall be solely responsible for providing all labor, equipment and materials necessary to control the flow of sewage in and/or around the sewer segment(s) being televised. Requirements for sewage flow control and bypass pumping are contained in Section 11014 – Bypass Pumping/Sewage Flow Control.

3.3 ACCEPTANCE

A. CONTRACTOR shall present on digital disk a continuous image in complete conformance with these Specifications of not less than ninety percent (90%) of the internal pipe surface at all times (not based on an average throughout the pipe segment), including sags in sewer lines. The digital disk shall be accompanied by a complete log. Maximum acceptable speed of camera through the sewer shall be thirty (30) feet per minute. Lighting system shall be adequate for quality color picture at

least 5 feet in front of the camera's lens. CONTRACTOR shall re-clean and televise any segment for which digital disk does not present a clear image of at least 90% of the internal pipe surface at all times, and/or is accompanied by an incomplete log.

3.4 PROJECT DOCUMENTATION

A. Contractor shall submit two (2) binders to the Engineer Owner upon completion of all work. Each binder shall include, at a minimum, the following:

1. Cover page, listing the Project Name, Contractor, Engineer, Owner, and Starting/Ending Dates of Work

2. Pre-Televising Videos on DVD. DVD(s) shall be clearly labeled as "Pre-Televising DVD: Disc _ of _", and shall include a list of each televised segment on the DVD as well as the Owner's name and date.

3. Pre-Televising field logs, in numerical order based upon upstream manhole. PDF copies shall be included on the Pre-Televising DVD(s)

4. Post-Televising Videos on DVD. DVD(s) shall be clearly labeled as "Post-Televising DVD: Disc _ of _", and shall include a list of each televised segment on the DVD as well as the Owner's name and date. Post-Televising field logs, in numerical order based upon upstream manhole. PDF copies shall be included on the Post-Televising DVD(s)

3.5 MEASUREMENT AND PAYMENT

A. Payment for Sewer Line Cleaning and Televising shall be made in accordance with Section 01025 - Measurement and Payment.

- END OF SECTION 11013 -

SECTION 11014 - BYPASS PUMPING/SEWAGE FLOW CONTROL

PART 1 - GENERAL

1.1 INTENT

A. It is the intent of this Specification to provide the minimum requirements for bypass pumping/sewage flow control necessary to facilitate sewer line inspection and/or sewer line rehabilitation activities.

1.2 SCOPE OF WORK

A. CONTRACTOR shall provide all labor, equipment, supervision and materials necessary to reduce/control flows via sewage flow control mechanisms or eliminate flows via bypass pumping through a section or sections of pipe designated for inspection and/or rehabilitation. CONTRACTOR shall be responsible for controlling and maintaining all sanitary and storm flows within the sewer system during the work. CONTRACTOR may drain flows by pipes, chases, fluming, bypass pumping, or other appropriate methods approved by CONSTRUCTION INSPECTOR. Plugging of any sewer line shall not be permitted without bypassing.

PART 2 – PRODUCTS (NOT USED)

PART 3 – EXECUTION

3.1 PROTECTION OF PUBLIC AND PRIVATE PROPERTY

A. Precautions shall be taken to ensure that flow control and dewatering operations shall not cause flooding or damage to public or private properties. In the event flooding or damage occurs, CONTRACTOR shall make provisions to correct such damage at no additional cost to OWNER. CONTRACTOR shall be responsible for any damages to public or private property, overflows from the sewer system and violations resulting in fines as a result of the dewatering/bypass operation.

B. CONTRACTOR shall assume all responsibility for notification to, and coordination with, all customers whose building sewer laterals will be out of service during the work. Notifications shall be submitted to CONSTRUCTION INSPECTOR for review prior to distribution, per Section 01300 – Contractor Submittals. Notifications shall be in writing via door hanger, door flier or U.S. mail. Notification shall be given 24 – 48 hours in advance of loss of service (excluding weekends and holidays). Notice shall clearly state the purpose of the work, shall advise all affected customers against water usage until the sewer line is placed back in service, and shall clearly state the potential consequences of use of residential wastewater generating facilities during the time when the building sewer service will be out of service (i.e. sewer back-up).

The notice shall include the project name, project number, CONSTRUCTION INSPECTOR name and number, and CONTRACTOR's local 24-hour contact number for residents to call if they have questions regarding the work.

3.2 BYPASS PUMPING

A. When required by the Contract Documents or when required by the manufacturer of the sewer line rehabilitation product in order to facilitate the installation of a sewer line rehabilitation product, CONTRACTOR shall provide all labor, equipment and materials necessary for the transfer of flow around the section or sections of pipe designated. The bypass shall be made by diversion of the flow from an existing upstream location, around the section(s) to be taken from service for inspection or rehabilitation, to an existing downstream location. The bypass system shall be of adequate capacity to handle all flows including wet weather related flows. If bypass pumping is utilized by CONTRACTOR to control flows, CONTRACTOR shall be responsible for monitoring and manning the bypass pumping operation at all times until work is complete. The location of pump(s), force main, discharge point, pumping rates, etc., shall be approved by CONSTRUCTION INSPECTOR and shall be monitored by CONTRACTOR.

B. CONTRACTOR shall prepare a detailed Flow Control Plan that describes the measures to be used to control flows. CONTRACTOR shall submit the Plan to and obtain approval of the Plan from CONSTRUCTION INSPECTOR prior to beginning any flow control work. CONTRACTOR's Plan shall include, but not necessarily be limited to, the following:

1. Location of flow diversion structures, collapsible sewer plugs, dams, pumps and related materials and equipment.

2. Key operational control factors, (i.e. maximum flow elevations upstream of dams).

3. Pump sizes and flow rates.

4. Destination of bypassed flows including routing of force mains and provisions for vehicular and pedestrian traffic as necessary.

5. Wet weather event procedures.

C. The number and size of pumps utilized in bypass pumping shall be such that if the largest pump is out of service, bypass flows will be maintained during the bypass operation.

3.3 WET WEATHER EVENTS

A. Where the flow control mechanism is not sufficient to handle a wet weather event, the flow control/diversion or pumping system shall be capable of quick removal so as not to create an overflow to surface waters, overflow to ground, or back-up in buildings. Any monetary fines associated with avoidable overflows shall be paid for by CONTRACTOR.

3.4 MEASUREMENT AND PAYMENT

A. No separate payment shall be made for small-scale bypassing that can be accomplished with trash pumps and lay-flat hosing, but the cost thereof shall be included in the cost of other Contract Pay Items. If larger pumps and piping are needed, payment shall be made in accordance with Section 01025- Measurement and Payment.

- END OF SECTION 11014 -

Date: November 1, 2019
REVISED February 18, 2020

Subject:

Utility Relocation Work Plan for:	Citizens Energy Group
Facility Type:	Water

Section 1: General Information

A. INDOT/LPA Project Information

1.	DES NO.:	1600808
2.	Route Number:	I-65/I-70 (North Split) Interchange
3.	Location:	I-65 RP 111+0.16 to RP 112+0.94 I-70 RP 81+0.72 to RP 83+0.67
4.	Work Type:	Reconstruction
5.	Letting Date:	N/A
6.	Date Work Plan Needed	10/18/2019
7.	Target Date for Utility to be out of conflict with INDOT Project	
	Intermediate Phase	N/A
	Intermediate Phase	N/A

B. Utility Designated Contact – Information

1.	Designated Contact Name:	Scott Ritter
2.	Office telephone:	317-927-4434
3.	Mobile telephone:	
4.	Email address:	sritter@citizensenergygroup.com
5.	Agency name	Citizens Energy Group
6.	Address:	2150 Dr. Martin Luther King Jr. St.
7.	City, State, Zip Code:	Indianapolis In. 46202
8.	Construction Emergency Contact:	
	Name:	Citizens Energy Group Dispatch
	Number:	317-927-6000

C. By signing here, the Utility has determined to the best of their ability that they do not have facilities within the project area:

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(C)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

D. INDOT/LPA Utility Coordinator Contact Information

1.	Utility Coordinator Name:	Doug Garvin
2.	Office Telephone:	317-917-5263
3.	Mobile Telephone:	N/A
4.	Email Address:	dgarvin@hntb.com
5.	Agency Name:	HTNB Indiana, Inc.
6.	Address:	111 Monument Circle, Suite 1200
7.	City, State, Zip Code	Indianapolis, IN 46204

Section 2: A narrative description of existing facilities within the project limits and any facility relocation that will be required. [IAC 13-3-3(c)]

A. Describe what types of existing active and inactive facilities are present.
Citizens has existing 3, 6, 8, 12, 20, and 24-inch DI, CI, PE water mains (installation dates range from 1875 to 2019), and associated hydrants and valves as shown on plan markups. Citizens also has abandoned 6-inch water main in the project area. No depth information is available at this time.

B. Describe the location of existing active and inactive facilities.
Citizens has a 20-inch CI water main running in the south lane and an abandoned 6-inch water main running in the north lane of Washington St. A 12-inch water main runs in the east lane of Pine St. between Washington St and Market St, an abandoned water main also runs in the east lane. A 12-inch water main runs in the north lane of Market St. A 6-inch water main runs in the north lane of New York St. A 6-inch water main runs in the west lane of Davidson St. A 20-inch water main runs in the south lane of Vermont St. A 24-inch and a 6-inch water main run in the east lane of Delaware St. A 6-inch water main runs in the west lane of both Alabama St and Central Ave. A 20-inch water main in an encased pipe crossed I-65 from Park Avenues west lane on either side. A 6-inch water main runs in the west lane of College Ave. Two 12-inch water main run in each lane of Commerce Ave. An 8-inch water main runs in the south lane of Michigan St. A 20-inch water main runs in the north lane of St Clair St. A 6-inch water main runs east halfway up Ohio St between College Ave and I-65.

No water mains cross I-70 at Dr. Andrew J Brown Ave, Columbia Ave, Arsenal Ave, or Yandes St.

C. Describe what will be done with existing active and inactive facilities.
All active facilities will remain in place with the exception of the following water facility lowerings and relocations. All existing active and abandoned pipe, valves and hydrants will remain in place with specific relocations and lowerings to avoid new interchange project improvements.

Additional relocations, lowerings, or other protections will be required if additional conflicts are created in future design. Citizens requires 10-ft horizontal separation and 1.5-ft vertical separation at a crossing between existing water main and storm or sanitary structures or pipe, at least 4.5-ft of cover over water mains, and drainage to follow Ten State Standards. These requirements are non-inclusive of all possible conflicts.

D. Describe the details of the proposed new facilities.
The 6-inch water main on Davidson St. between Michigan St. and North St. will be relocated and replaced with an 8-inch water main (per the Citizens Energy Group Water Standards Manual, latest edition Section 2.03 Layout Standards, B. Water Main Standard Sizes) to avoid anticipated storm drainage. Hydrant 1344 will be replaced in conjunction with this work. A water main lowering is anticipated for the 6-inch water main on Ohio St to accommodate anticipated storm drainage.
The Citizens' Water Standards Manual can be found at the following link:
https://www.citizensenergygroup.com/Documents/Standards/Water-Standards-with-appendices

E. Describe the proposed location of the new facilities.
The proposed water main on Davidson St will split the space between the two sanitary sewers on that road connecting at the Michigan St. intersection and at the PE adapter north of North St. The proposed hydrant will be placed near the original location. Based on the Marion County Thoroughfare Plan 2020, it appears that Davidson St. is a Secondary Arterial and the Contractor would be required to obtain a Local Right-of-Way Permit through the City of Indianapolis, Department of Building and Neighborhood Services (DBNS).

The location of the Ohio St water main lowering is to be determined based on storm sewer design. Based on the Marion County Thoroughfare Plan 2020, it appears that Davidson St. is a Freeway or Expressway and the Contractor would be required to obtain a Right-of-Way Permit through the Indiana Department of Transportation.

F. By signing here, the Utility has determined to the best of their ability that they have facilities within the project area and the facilities are not in conflict with the project based upon the plans received on **August 27, 2019**.

Signature of Utility Representative Print Name Date

Note: A signature by the utility representative at item "(F)" fulfills the requirement to complete the rest of this form and affirms their contact information above is correct.

Section 3: A statement whether the facility relocation is or is not dependent on the acquisition of additional property interests with a description of that work. [IAC 13-3-3(c) (2) (B)]
N/A

Section 4: A statement whether the utility is or is not willing to allow the INDOT contractor to do the required work as part of the highway contract. [IAC 13-3-3(c) (3)]
Citizens Energy Group will allow the INDOT contractor to do the required relocation with Citizens' Water Capital Programs contractors TSW Utility Solutions or Miller Pipeline in accordance with Citizens' Water Standards, inspection, and shut out procedures.

Section 5: From the date the work plan is approved by both parties; please provide the Utility's pre-construction scheduling information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A.	The expected lead time in calendar days to obtain required permits:	**5-7 days for Local R/W Permit to be obtained by the Contractor through the DBNS**
B.	The expected lead time in calendar days to obtain materials:	**30**
C.	The expected lead time in calendar days to schedule work crews:	**30**
D.	If the contractor is being selected by competitive bid what is the date of selection?	**N/A**
E.	The expected lead time in calendar days to obtain new property interests:	**N/A**
F.	The earliest date when the utility could begin to implement the pre-construction activities of the work plan:	**Drainage design completed by Design-Build Team**
G.	The total number of calendar days for pre-construction activities: (accounting for concurrent activities)	**45**

Section 6: The Utility Construction Scheduling Information. [IAC 13-3-3(c) (4), IAC 13-3-3(c) (5)]

A. A statement whether the facility relocation is or is not dependent on work to be done by another utility with a description of that work. [IAC 13-3-3(c)(2)(A)(i)]

1. Utility A, with a description of the required work.
   N/A
2. Utility B, with a description of the required work.

3. Utility C, with a description of the required work.

B. A statement whether the facility relocation is or is not dependent on work to be done by the department or the department's contractor with a description of that work. [IAC 13-3- 3(c)(2)(A)(ii)]

1. Work item A
   The facility relocation is dependent on the drainage design being completed by the department's design-build team.
2. Work item B

3. Work item C

C. How many calendar days after the events identified in Sec 6 A and B are completed can the utility begin construction: **N/A**

D. The number of calendar days to complete the relocation work: **60 days**

Section 7: A drawing of sufficient detail with station, offset, elevations, and scale to show the proposed location of the facility relocation, which takes precedence over the narrative description of the work, needs to be on INDOT Construction drawings. [IAC 13-3-3(c) (6)]. Plans must be attached to this Work Plan Document.
See attached plan sheets for verification of water main and hydrant locations and Sht. 135 for the Ohio St. 6-inch water main lowering and Sht. 71 for the Davidson St. 6-inch water main and hydrant relocation.

Section 8: For each work plan the utility shall include a cost estimate for the facility relocation. For reimbursable work the estimate will identify betterment and salvage which is not reimbursable. [IAC 13-3-3(d)]
See attached Exhibit B.

Section 9: For work the utility is entitled to be compensated by the Department, the work plan shall include documentation of property interests and compensable land rights. [IAC 13-3-3(d)]
N/A

Section 10: The implementation of this approved work plan is dependent upon the issuance of: (a notice to proceed will be provided when items in Section 6 are accomplished)

Items Completed	Yes	Not Applicable
An executed reimbursement agreement with INDOT/LPA:	☒	☐
A relocation permit from INDOT/LPA:	☒	☐

(Note: Double-click on box in Yes or NA to mark it with an "X")

for SR — Signature of Utility Representative

2/18/20 — Date

David A. Clark, P.E.
Utility Representative Name Printed

INDOT/LPA use only below this point ---------- INDOT/LPA use only below this point

The following sections are to be used by INDOT personnel to review the utility relocation work plan.

Section 11: The Department shall review the work plan to ensure that it: [IAC 13-3-3(e)]

Description	Yes	N/A	Utility Coordinator Initials
(1.a) is compatible with department permit requirements	☐	☐	
(1.b) is compatible with the project plans	☐	☐	
(1.c) is compatible with the construction schedule	☐	☐	
(1.d) is compatible with other utility relocation work plans	☐	☐	
(2.a) has reasonable relocation scheme	☐	☐	
(2.b) has a reasonable cost for compensable work	☐	☐	

(**Note**: Double-click on box under Yes or N/A to mark it with an "X")

Utility Coordinator Signature _____ Date _____

Utility Coordinator Name Printed _____

Section 12: Approved Work Plan. [IAC 13-3-3(f)]

I have reviewed the work plan and have been made aware of the schedule and budget.

Project Manager Signature (LPA Project – ERC Signature) _____ Date _____

Project Manager Name Printed (LPA Project – ERC Name Printed) _____

EXHIBIT B

Preliminary Estimate
I-65/I-70 North Split Interchange
Des. 1600808

Ohio Street Lowering

Summary	Preliminary Estimated Cost
CEG Labor	$12,585
Material	$7,620
Permits	
Contractor	$121,680
Alignment Staking	$2,117
Restoration	$6,000
Betterment	
Salvage	
Preliminary Estimated Cost	**$150,000**

Davidson Street Main Replacement

Summary	Preliminary Estimated Cost
CEG Labor	$22,653
Material	$13,716
Permits	
Contractor	$219,024
Alignment Staking	$3,810
Restoration	$10,800
Betterment	
Salvage	
Preliminary Estimated Cost	**$270,000**