ASCE – INDOT
STRUCTURAL COMMITTEE
MEETING NO. 67 AGENDA

May 7, 2015
10:00 am, INDOT Room N642

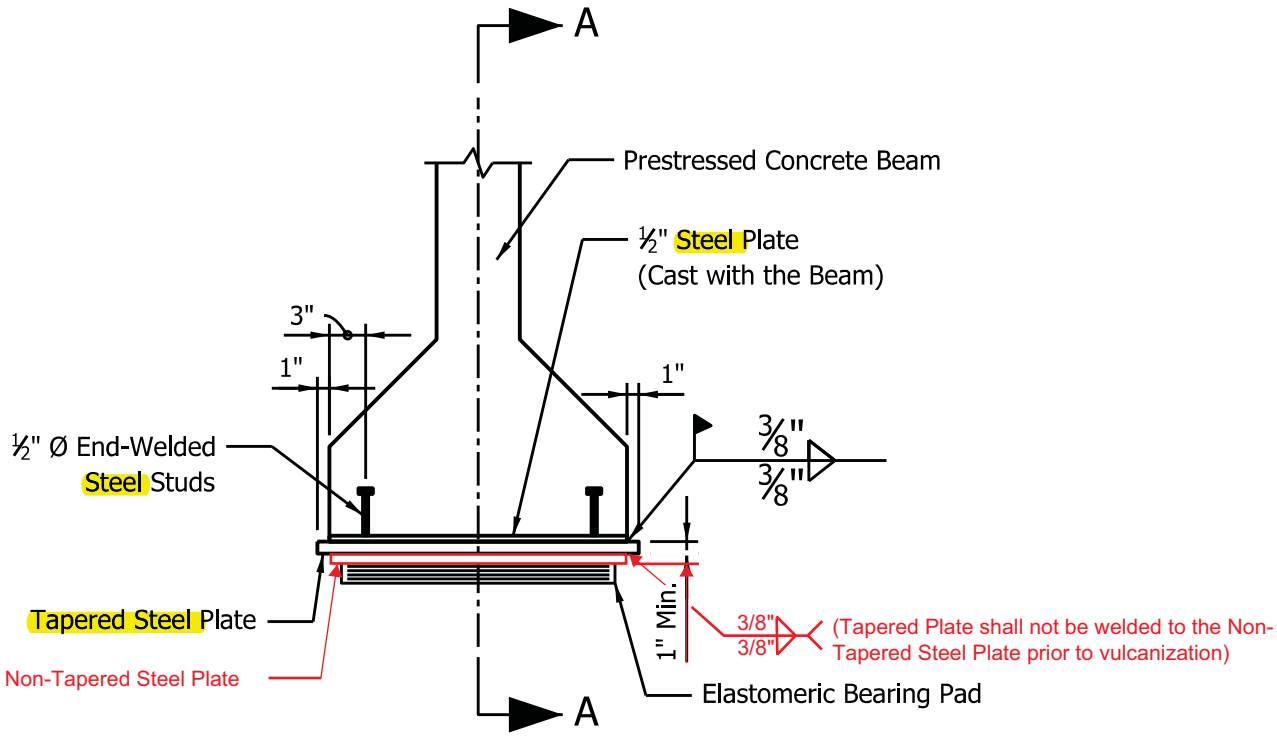
1. Review and approve Meeting 66 minutes.
2. PTFE Design Requirement (Eichenauer, McCool)
3. Bearing Assembly Details (White, Eichenauer) (submitted to INDOT)(attached)
4. Standard Beam Detail Sheets (Phillips, Law) (update)
5. Software Practice Pointers Updates (McCool, Hailat)
6. Prestressed Beam Camber (Heidenreich, McCool, Hailat, Halterman, Spaans)(attached)
7. Asymmetrical Barriers (White, Wenning, Law)
8. Continuity of Prestress Concrete Beams (Heidenreich, Phillips)
9. Law Email (Phillips)
10. Mechanically spliced reinforcing bars greater than 60 ksi (Burki, McCool)
11. Life-Cycle Cost (White) (attached)
12. Overlay Dams (White, Hunter, McCool) (attached)
13. Overlay Types (Hunter, White, Heidenreich, McCool)
14. New Business
    - Construction Loading Design Checks for deck replacements
    - Snow Plow Protectors (attached)

Recurring Business

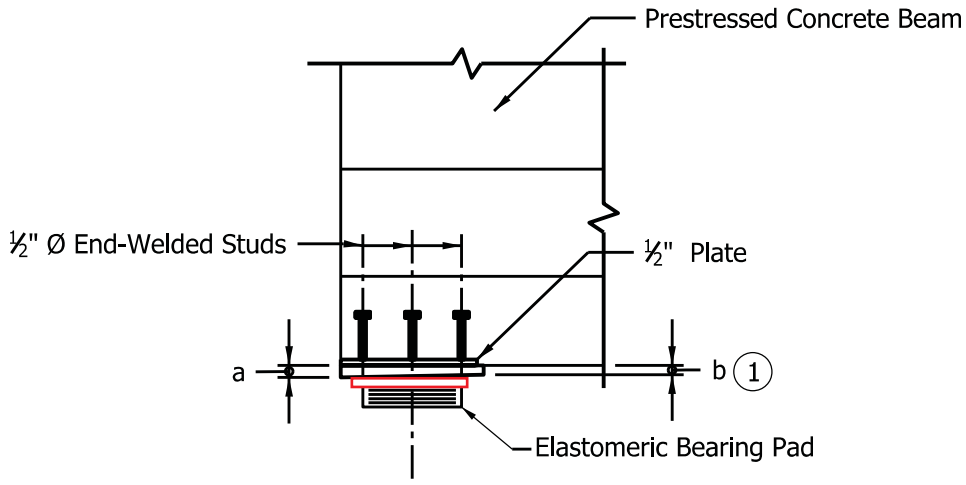
Software Practice Pointer Updates (McCool, Phillips)
Standards Committee Updates (Phillips)

Parking Lot

Concrete mix designs
Long term deflections in prestressed beams
WWF in prestressed beams
Special provision for high strength concrete
Mild reinforcement in prestressed beams (particularly 401 bars)
Post Tensioning Specs



END VIEW



SECTION A-A

If a tapered plate is required,

1/8"

NOTES:

1. Taper top of steel plate to the nearest $\frac{1}{16}$" to correct for slope.

2. When stainless steel is specified, plate cast with beam, studs, and weld must all be specified as stainless steel.

ELASTOMERIC BEARING PAD WITH TAPERED STEEL PLATE

Figure 409-7F

3. If vulcanization is not required, the Non-Tapered Steel Plate may be omitted and the minimum thickness of the Tapered Steel Plate shall be 1".

Back

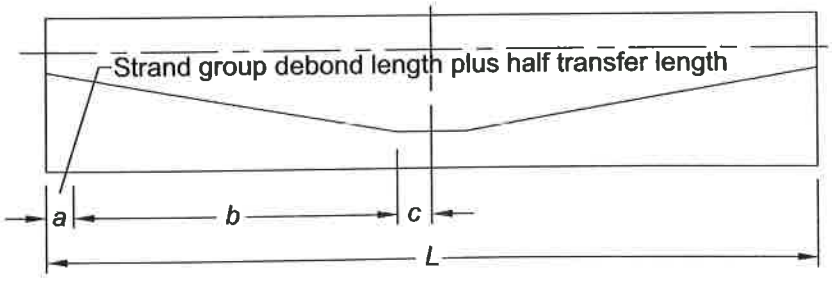
Camber Variability in Prestressed Concrete Bridge Beams

by Dr. Maher Tadros, eConstruct

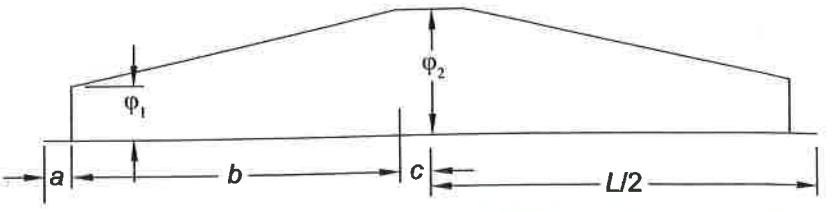
Beams cast with extra camber in storage yard at Concrete Technology Corporation; camber shown is exceptionally large for illustration purposes. Photo: Concrete Technology Corporation.

Precast, prestressed concrete girders experience camber (upward deflection) when the prestressing strands are detensioned and the prestressing force is transferred from the casting bed to the concrete member. When the girder is stored in the yard of the precast manufacturer, its camber continues to change with time, influenced by the ambient air conditions, and even the orientation of the girder as it is exposed to the sun. When the girder is erected on its seats at the bridge site and just before the deck is placed, its camber at that time affects the haunch (build up) concrete required to ensure that the top of deck surface meets the roadway profile requirements.

Initial camber after detensioning is used to indirectly check the quality of the product, for example, the level of prestress and other production issues. Camber at the time of girder shipping is sometimes required to be checked for contractual purposes. Camber just before deck placement and the elastic deflection due to deck weight are used to determine the elevation of the formwork supports at the edges of the top flange. Accurate measurements and calculations at this stage result in minimizing grinding of the deck to bring it to the required profile.



Profile of a group of strands (for one point harping, c=0)



Curvature diagram (for straight strand profile, curvature is constant)

Figure 1. Beam elevation showing general profile for a group of pretensioned strands. Figures: eConstruct.

A negative camber (downward deflection or sag) while the bridge is in service may cause concern for inspectors and the public and, if excessive, may have structural and functional impacts as well. A number of state highway authorities (SHA) have specified that the final long-term camber due to all loads, except live load, must be positive, that is, upward.

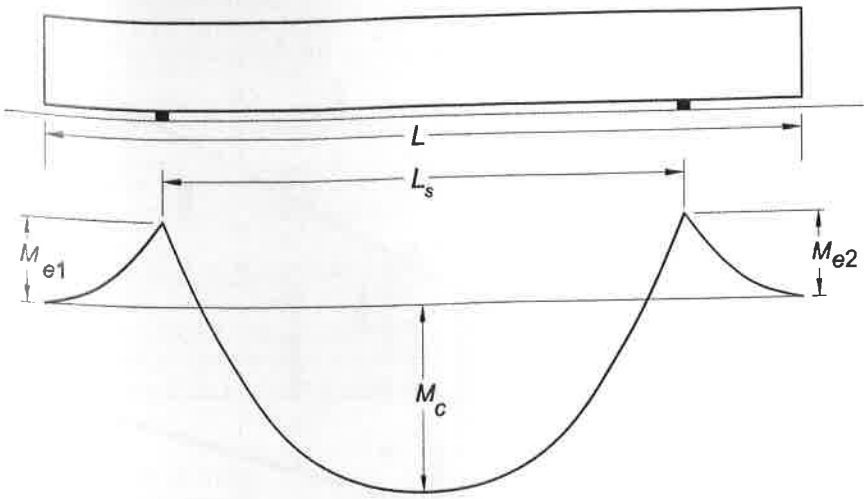


Figure 2. Bending moment diagram for beam in storage, note the considerable overhang. Figure: eConstruct.

At best, camber prediction can have ±25% variability, but more realistically it can have ±50% variability. The prediction is impacted by things that are known within a narrow band of variability such as the cross-section dimensions, amount of prestress, and span length, which are considered here to be deterministic variables. It is also impacted by random variables, outside of the control of the designer at time of design, such as source of aggregates, relative humidity and temperature of the ambient air, method of curing, method of detensioning, conditions of storage, and time elapsed between girder production and deck placement.

Calculation of Initial Camber

Reference 1 gives a survey of the history of camber prediction and proposes a method that can be programmed in a spreadsheet. Only two equations are required.

Equation 1 is used to calculate initial camber due to prestress using a general profile of a group of pretensioned strands (Fig. 1). The equation is valid for straight and draped strands and for cases where debonding at the ends is utilized. The equation may be applied to the different "types" of strand groups, and then superposition used to combine the individual results to determine the full effect.

$$\Delta_{ip} = \frac{\Phi_1}{2}(b+c)(2a+b+c) + \frac{\Phi_2}{6}(3ab + 2b^2 + 6ac + 6bc + 3c^2) \qquad \text{Eq. 1}$$

The distances *a*, *b*, and *c* are defined in Fig. 1. The curvatures φ_1 and φ_2 are equal to *P*/*EI* for Sections 1 and 2 at the location at which prestress is effective at the end of the girder (dimension *a*) and at midspan, respectively. The values of *P*, *e*, *E*, and *I* are the prestress force, its eccentricity, the concrete modulus of elasticity, and the cross section moment of inertia, respectively, at the section considered for the curvature calculation. The starting section location (at dimension *a* from the end of the girder) is affected by length of debonding plus an allowance for transfer length.

Equation 2 is used to determine deflection due to beam weight (Fig. 2). In recent years, long beams have required lifting, storage, and shipping with overhangs as long as 20 ft. The equation accounts for overhang length.

$$\Delta_{gi} = \frac{5L_s^2}{48EI}(0.1M_{e1} + M_c + 0.1M_{e2}) \qquad \text{Eq. 2}$$

For this equation, the length L_s is length between supports during beam storage. Figure 2 defines the moments in Eq. 2 and their locations.

The example in Reference 1 is used here for discussion purposes. Not all data are given here. The I-beam is 72 in. deep, 137 ft 1 in. long, and prestressed with forty-four 0.6-in.-diameter straight strands, 12 of which are debonded in three equal groups for 6, 8, and 14 ft from the beam ends. Specified concrete strength at transfer is 6 ksi and at service is 8.5 ksi.

Equation 1, applied four times for the four groups of strands, yields a predicted prestress-only camber Δ_{ip} of 5.33 in. The groups are 32 strands that are 137.1-1.5-1.5 = 134.1 ft long, and three groups of four strands that are 122.1, 118.1, and 106.1 ft long. The 1.5 ft quantity used to compute the length for the 32 strand group is an allowance for averaging the effect of the 3 ft transfer length for the 0.6-in.-diameter strands.

Equation 2 is applied assuming a storage span of 135.5 ft. The corresponding deflection is 2.32 in. The net predicted self-weight camber is therefore 5.33 – 2.32 = 3.01 in.

Causes of Initial Camber Variability

Many factors influence the value of camber at transfer of prestress, some of which are random variables beyond the control of the designer. Several of the more important factors are listed here:

- The modulus of elasticity of concrete. The computed modulus of elasticity of concrete has been shown to vary from the measured value by 22% for confidence between 10 and 90 percentiles, according to the NCHRP study[2] that proposed the aggregate correction factor, K_1, which now appears in Equation 5.4.2.4-1 of the *AASHTO LRFD Bridge Design Specifications*. The stiffness of aggregates plays an important role in the modulus variability. Thus, the results are dependent on the aggregate source. Also, a designer who specifies 6 ksi concrete transfer strength is unlikely to get it matched during production of all the beams in a project.
- Curing versus ambient temperature. This factor can be very significant in the first 48 hours of concrete age. The concrete temperature may be as much as 120°F above the ambient temperature because of curing and cement hydration. This could decrease the tension in the strands by as much as 20 ksi. This temporary difference may cause significant changes in camber and prestress loss.[3] However, within about 72 hours, this temporary effect seems to dissipate.
- Location of lifting inserts and storage supports. The effect of

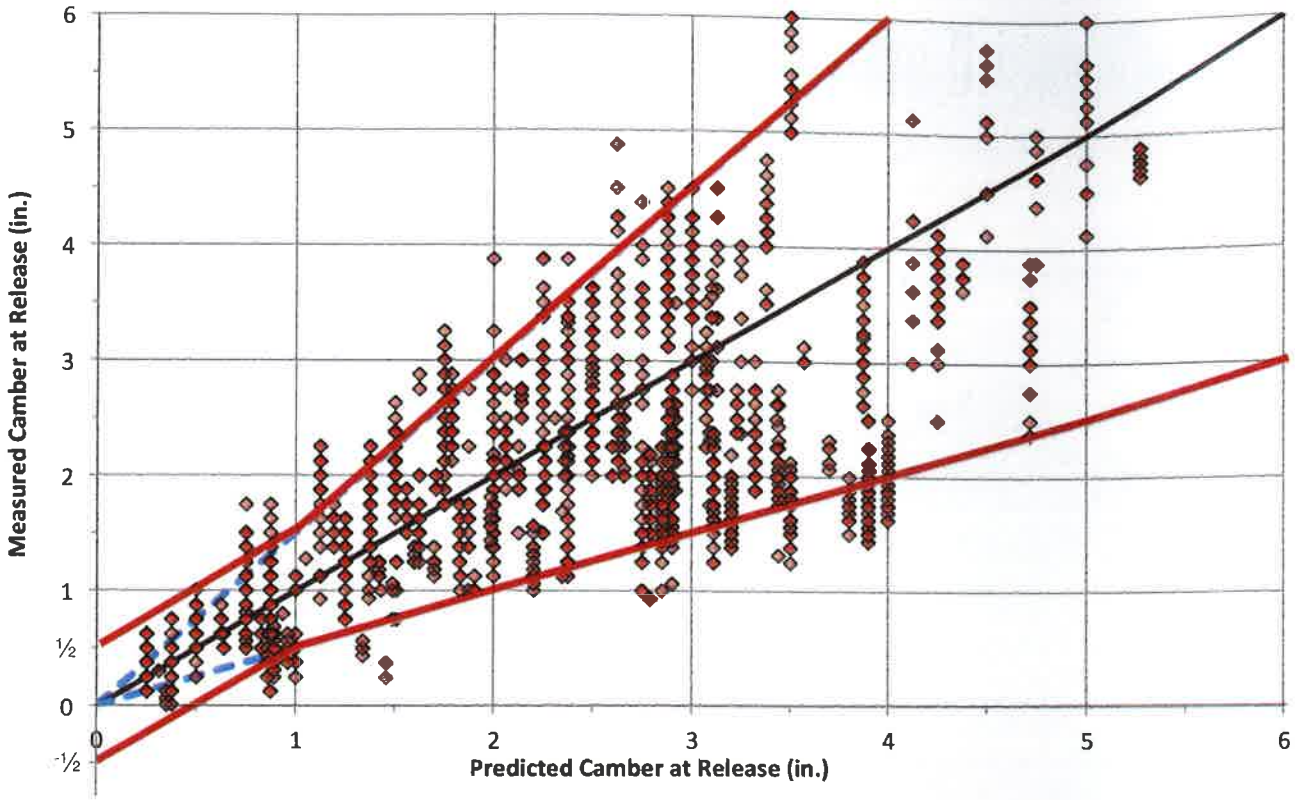


Figure 3. Initial-camber data collected by the PCI Fast Team from nine sites in eight states. The red lines show proposed ±50% ≥ ½ in. tolerance. Figure: PCI Fast Team with modification by eConstruct.

variation in support locations is illustrated using the example girder. If it is lifted and stored on supports that are 10 ft from the ends, the camber in the example used in the previous section changes by about 9%.

- If prestress is higher than the theoretical value by 5% and self-weight is lower by 5%, both of which are quite plausible, the net camber in the example in the previous section would increase by 13%.

Initial Camber Tolerance Limits

Because of the random variability of the influencing parameters, it is difficult to accurately predict initial camber immediately after strand detensioning. If the girder concrete is allowed to cool for 72 hours, prediction accuracy may be most optimistically within ±25%. Accurate formulas, such as Eq. 1 and 2, and values of the modulus of elasticity reflecting aggregate type and concrete strength would be assumed to be used. However, the designer is not likely to know producer-specific materials, environmental conditions, and production practices in advance.

The PCI Tolerance Committee has been debating in recent years how to update the tolerance limits for camber in bridge beams that are given in PCI MNL-116[4], in order to accommodate recent changes in technology. Concrete strengths in the 8 to 12 ksi range, 0.6-in.-diameter strands, and more efficient I-girder shapes have been in common use, resulting in pretensioned products as long as 200 ft.

A Fast Team was formed by the PCI Committee on Bridges and the Bridge Producers Committee to recommend adjustments to the current MNL-116 tolerances to account for the recent changes in practice. Their recommendation is shown in Fig. 3. It essentially sets the tolerance limits on camber variance from the predicted value at 0.1% of the product length with an upper limit of 1½ in. and no lower limit. Even with this proposed removal of the current upper limit of 1 in., the Fast Team report indicated that the percentage of out-of-tolerance girders longer than 80 ft was still 12%, compared to the current 37% level (using the 1 in. upper limit). Accordingly, the Fast Team stated, "out of tolerance camber should not be a sole source for rejection." While this sentence is well intentioned and justified, it seems to be in conflict with the concept of tolerance enforcement that is expected in a tolerance manual.

Proposed Initial Camber Tolerance

Because camber is an important quantity that can be easily measured, camber tolerance limits are expected to continue to be required by most owners. Based on the author's experience with this topic for nearly 40 years, and on recent discussions by PCI committees, producer groups, and state highway agencies, including Colorado, Washington, Iowa, and Pennsylvania, the following recommendations are proposed for initial camber of prestressed beams, which differ from the recommendations of the PCI Fast Team:

- Initial camber should be measured 72 to 96 hours after beam concrete placement and after the beam has been set on storage supports. This would allow for the internal concrete temperature to reach equilibrium with the ambient air and for the storage span to be set. Measurements should

be made early in the morning when the girders should have a neutral thermal gradient.

- For predicted camber ≤ 1 in., tolerance is ± ½ in.
- For predicted camber > 1 in., tolerance is ±50% of the predicted camber.
- Out-of-tolerance products should be further investigated by qualified personnel to identify the presence of possible deficiencies. Camber alone should not be the sole cause of rejection.

Camber Variability at Deck Placement

Camber prediction at time of deck placement is needed to establish elevations for beam seats and for formwork for the deck. This is necessary so that the top of road elevation and the overhead clearance below the bridge are consistent with design requirements.

Concrete creep and shrinkage cause prestress to be lost. In addition, creep causes the beam to continue to camber with time. Creep and shrinkage are functions of the concrete ingredients, section dimensions, and environmental conditions. Furthermore, it is not known in advance how much time will elapse between girder production and deck placement. Camber does not always grow between initial storage conditions and deck placement.

This observation has recently been reported for relatively long beams. The creep multiplier for prestress effects (camber) is not as large as the creep multiplier for beam self-weight because prestress continues to decrease with time. For example, a 10 in. initial camber due to prestress multiplied by a 1.7 creep factor is 17 in. An 8 in. deflection due to beam self-weight multiplied by a 2.0 creep factor is 16 in. The net predicted camber at deck placement is 1 in. This is compared to an initial camber of 10 – 8 = 2 in.

Methods of accurate prediction of camber at time of deck placement are summarized in the article by Tadros et al.[1] Several states, in collaboration with designers and precast producers, have developed their own "creep multipliers" to account for camber growth between prestress release and deck placement. It would seem reasonable to show upper and lower bound camber multipliers, based on local prevailing construction and environmental conditions.

For example, Washington State guidelines show a lower bound of 50% of the camber at 40 days, and an upper bound of 100% of the camber at 120 days. The author recommends a multiplier to be determined by each precaster for the region served by their company. For example, Supplier X serving Western State Y would provide the owner with a lower bound and upper bound multipliers of 0.9 and 2.6 applied to initial camber to predict camber at time of deck placement.

The data presented in Fig. 4, which has been supplied by Troy Jenkins of Northeast Prestressed Products, illustrates camber variability at 120 days for girders produced by his company in several states in the Northeast. The figure shows that only a few points fall outside the proposed camber tolerances indicated by the red lines.

It is suggested that the PCI Committee on Bridges and Bridge Producers Committee should consider setting up uniform national guidelines for achieving this important task.

Accommodating Differences

There are two options for accommodating differences between predicted and measured camber at deck placement.

Measured camber larger than predicted camber

Assume for this discussion that

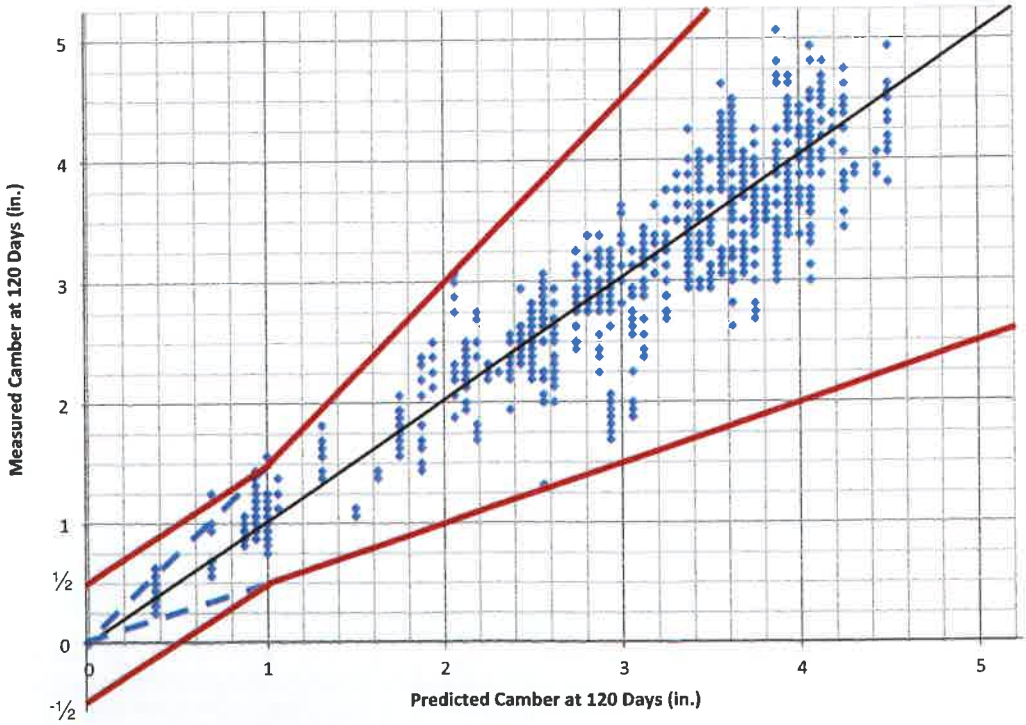


Figure 4. Measured camber at 120 days. Red lines show proposed ±50% ≥ ½ in. tolerance. Data: Northeast Prestressed Products.

predicted camber for a 150-ft-span beam is 3 in. while the measured camber is 6 in. The designer had allowed for a cast-in-place concrete haunch of 1 in. above the top flange of the beam at midspan. The simplest solution is for the owner to allow raising the roadway by 2 to 3 in. Alternatively, the girder seats could be set 2 to 3 in. lower than previously specified. This option would require appropriate preplanning.

Measured camber smaller than predicted camber

Assume for this discussion that predicted camber is 3 in. while the measured camber is 1.5 in. The seats may be raised to avoid infringing on overhead clearance below the bridge, if this is a factor, and to avoid excessive haunch concrete. Also, adequate drainage needs to be checked to avoid water ponding on the bridge.

References

1. Tadros, Maher K., F. Fawzy, and K. Hanna. 2011. "Precast, Prestressed Girder Camber Variability," *PCI Journal*, Vol. 56, No. 1: Precast, Prestressed Concrete Institute (PCI).
2. Tadros, M. K., N. Al-Omaishi, S. J. Seguirant, and J. Gallt. 2003. *Prestress Losses in High-Strength Concrete Bridge Girders*. Report 496. National Cooperative Highway Research Program (NCHRP). Washington, DC: Transportation Research Board.
3. Davison, Bill. 2013. "Prediction of Time-Dependent Stresses and Deflections in Prestressed Concrete Girders from Start of Fabrication to End of Service Life," M.S. Degree Thesis, University of Washington, Seattle, WA, 2013, Advisors John Stanton and Marc Eberhard, 158 pp.
4. PCI. 1999. *Manual for Quality Control for Plants and Production of Structural Precast Concrete Products*. MNL-116, 4th edition: PCI.

Dr. Maher Tadros is principal with eConstruct in Omaha, Neb.

6. the impacts to utilities;
7. costs associated with right-of-way requirements;
8. the costs required for additional environmental mitigation for a specific alternate; and
9. the costs associated with unusual site conditions or constraints.

All of these factors shall be calculated and included in the cost estimate for each structure alternative in order to properly identify the correct alternative to be chosen for the final design phase.

402-4.02(01) Construction Cost

The economic analysis shall compare the estimated construction cost to complete the project for each alternate investigated. To determine relative construction costs of each alternate, all quantities independent of the alternates shall be computed. Quantities that are considered equal for each alternate need not be considered, as they do not contribute to the comparative construction cost computed.

Current construction prices in materials and construction methods shall be obtained in order to obtain accurate costs.

402-4.02(02) Life-Cycle Cost

Long-term life-cycle costs of each alternate shall be considered in the overall structure size and type analysis. Different structure types and elements have different rehabilitation cycles or replacement schedules. These factors can affect the overall cost of the structure and therefore the selection of the recommended alternate. When the structure alternatives being compared have the same design life and maintenance/rehabilitation cycles, a life-cycle cost comparison is not required. A brief justification for omitting the life-cycle cost shall be provided.

402-4.02(03) Summary

The economic analysis performed will yield the respective construction costs, life-cycle costs, and overall costs of each alternate investigated. This economic analysis shall be included as part of the structure size and type analysis. A discussion of the recommended alternate, largely based on this analysis, shall be provided within the structure size and type report.

Mike McCool

From: Wagner, Stephanie J. <SWagner2@indot.IN.gov>
Sent: Tuesday, March 24, 2015 3:08 PM
To: Mike McCool; Hunter, Jeremy
Subject: Overlay Dams
Attachments: 7-2014 spec.pdf; 722_USP_ HYDRODEMOLITION FOR LMC.doc; Figures.docx; Overlay Dam info mccool.pdf

Mike and Jeremy,

I believe the three of us are the structure committee team for exploring overlay dams. Jeremy, since you and I are both relatively new to the committee we weren't on an email from Mike last fall about overlay dams. I've attached it for your information. Also, I've attached section 722 from the 2014 spec and the current hydro spec.

While Alex was in our group, I had him research INDOT history with overlay dams. He created some pretty interesting figures that I have attached. (Interesting in a relative sense, I find almost any visual representation of data interesting...)

Generalities based on these findings:

- Oddly enough since the introduction of hydrodemolition, overlay dam use has increased.
- All time, about twice as many overlays have been put down without a dam as with a dam.
- There doesn't seem to be any correlation between the use of a dam and wearing surface rating.

Current state of affairs:

- Overlay dams are not mentioned anywhere in the design manual.
- The pay item and requirements are still in Section 722 of the 2014 spec book. Overlay dams are no longer in the unique provision for hydro.
- Seems like about half of designers are using dams and half are not.

My thoughts:

- Directing the contractor to use hammers across the end of our bridges seems contrary to the benefits of hydrodemolition, but it also makes sense to me to "key in" the end of an overlay.
- I have heard the contractors can dial up the hydro machine and expose that top mat of steel if they want. Maybe requiring hydro to create a notch is a step in the right direction??
- If overlay dams are going to remain in section 722, I think we should have some kind of guidance for their use in the design manual.

What do you guys think?

Stephanie Wagner, PE
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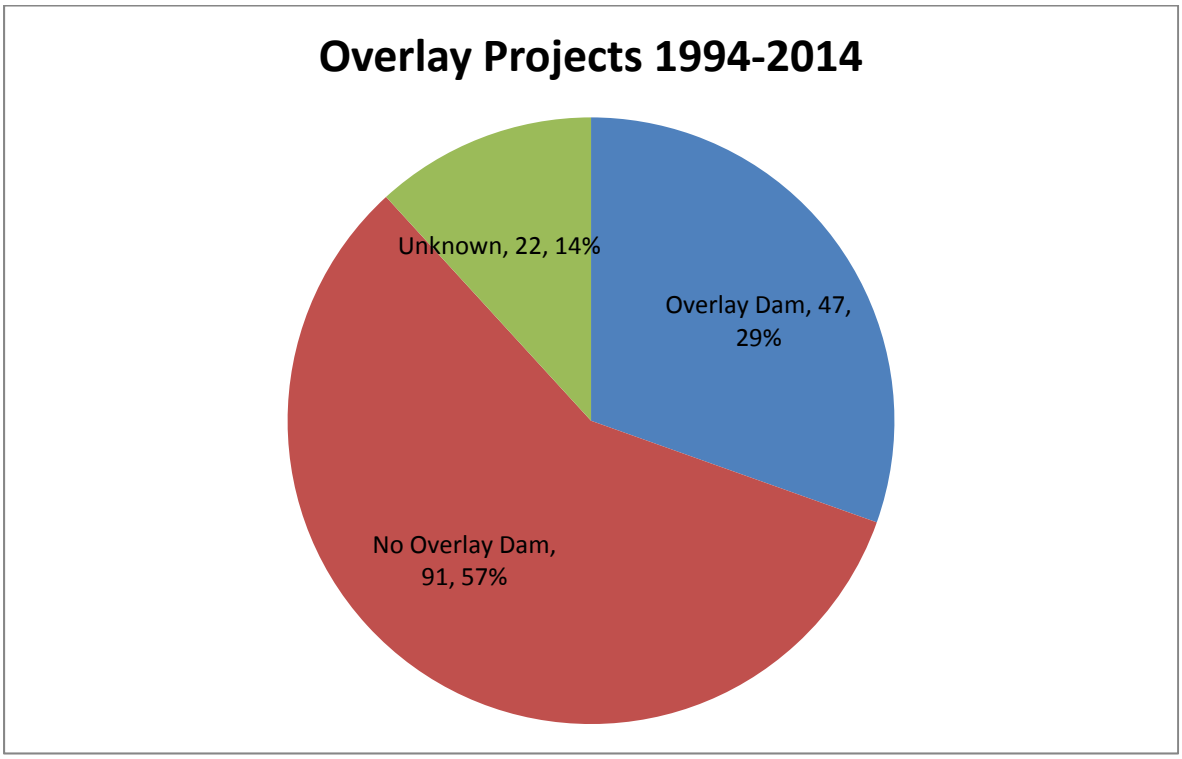
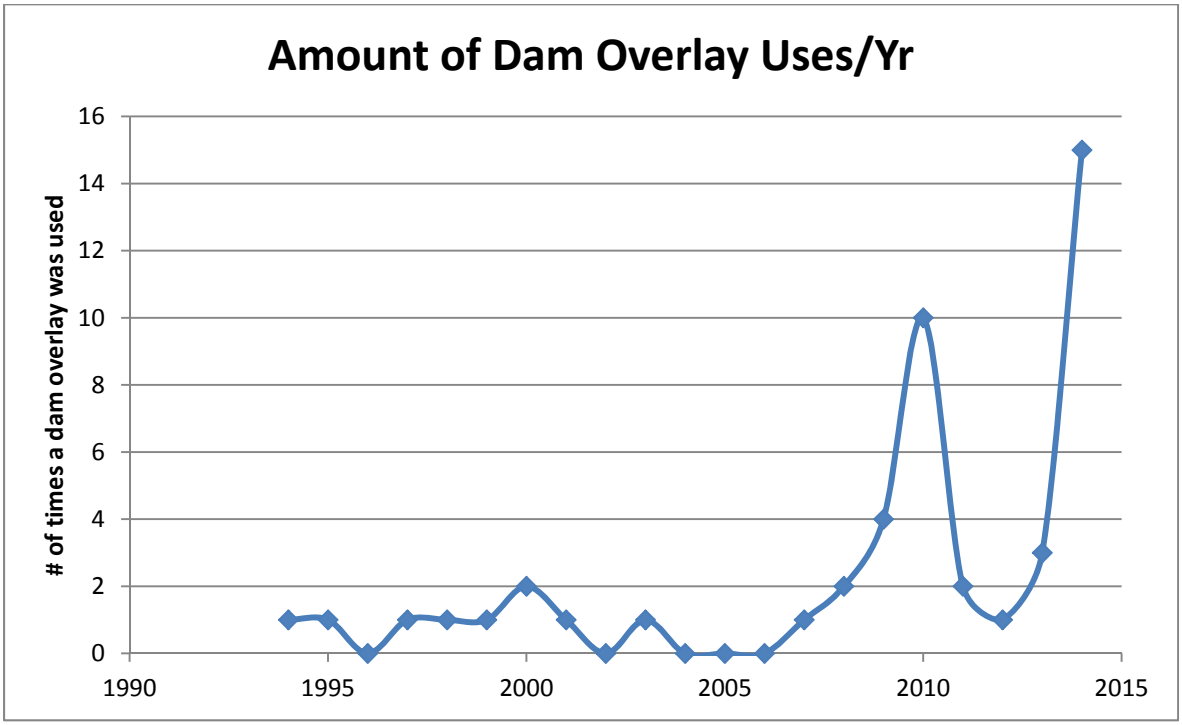
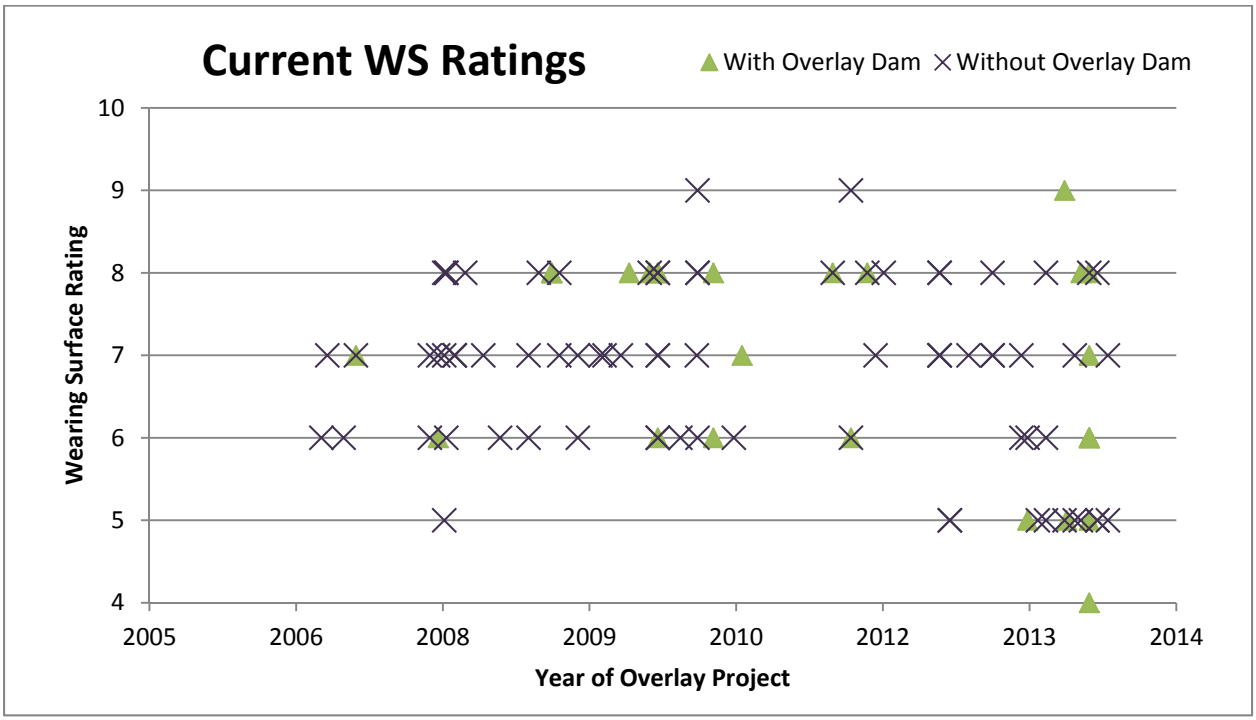
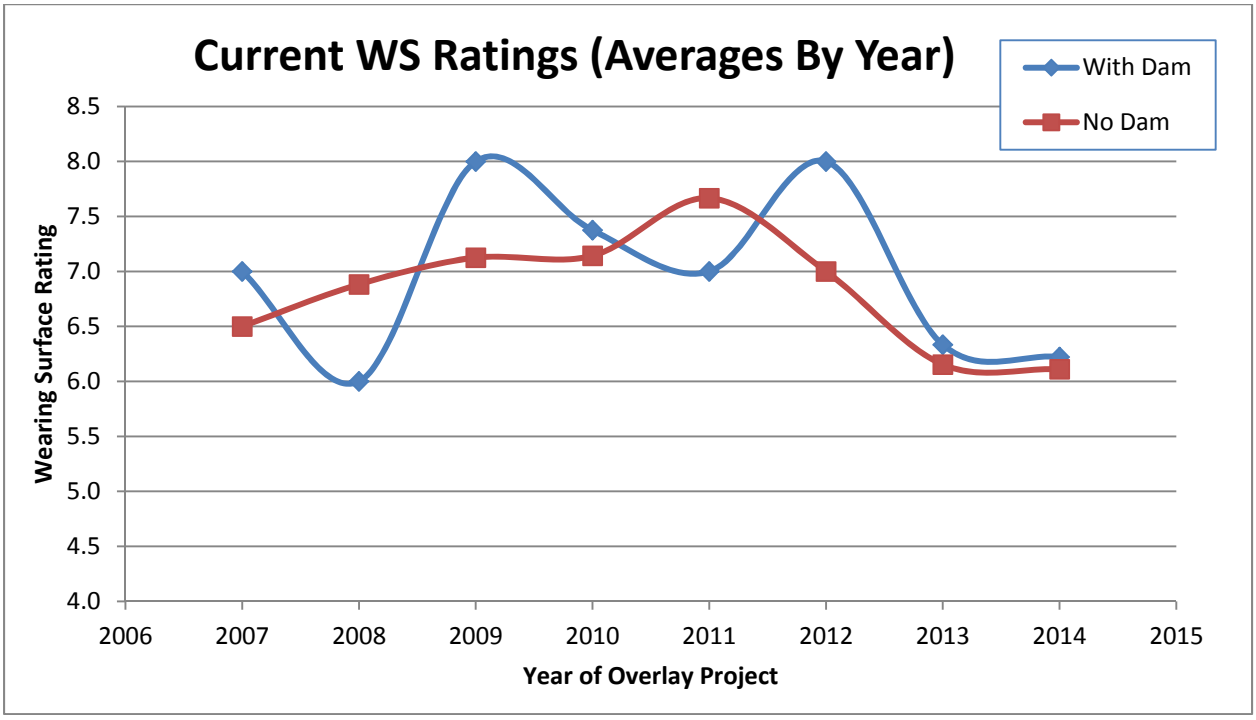

Overlay Projects 1994-2014
Unknown, 22, 14%
Overlay Dam, 47, 29%
No Overlay Dam, 91, 57%


Amount of Dam Overlay Uses/Yr
# of times a dam overlay was used
16
14
12
10
8
6
4
2
0
1990
1995
2000
2005
2010
2015

The next 2 figures compare the wearing surface ratings for structures with an overlay dam versus structure without an overlay day.





Mike McCool

From: Mike McCool
Sent: Monday, October 06, 2014 2:58 PM
To: 'Anne Rearick'; 'Naveed Burki'; 'Merril Dougherty'; 'Michael Eichenauer'; 'Phillips, Elizabeth'; 'Mike Halterman'; 'Burleigh Law'; 'Keith Hoernschemeyer'; 'Celeste Spaans'; 'Mike Wenning'; 'Jason W. Yeager'; 'mhailat@indot.IN.gov'; 'Kurt Heidenreich'; 'Tony Zander'; 'Ron McCaslin'; 'Borcherding, Ben'; 'White, Peter'
Subject: Overlay Dam

All

We have had some recent discussions on the use of overlay dams with latex modified concrete overlays. Just curious if these are still being used by most firms or have they gone away. We have been putting them in the plans but with the new SP on the street they have been removed from the latex modified concrete overlay portion. Just looking to get the groups thoughts on this.

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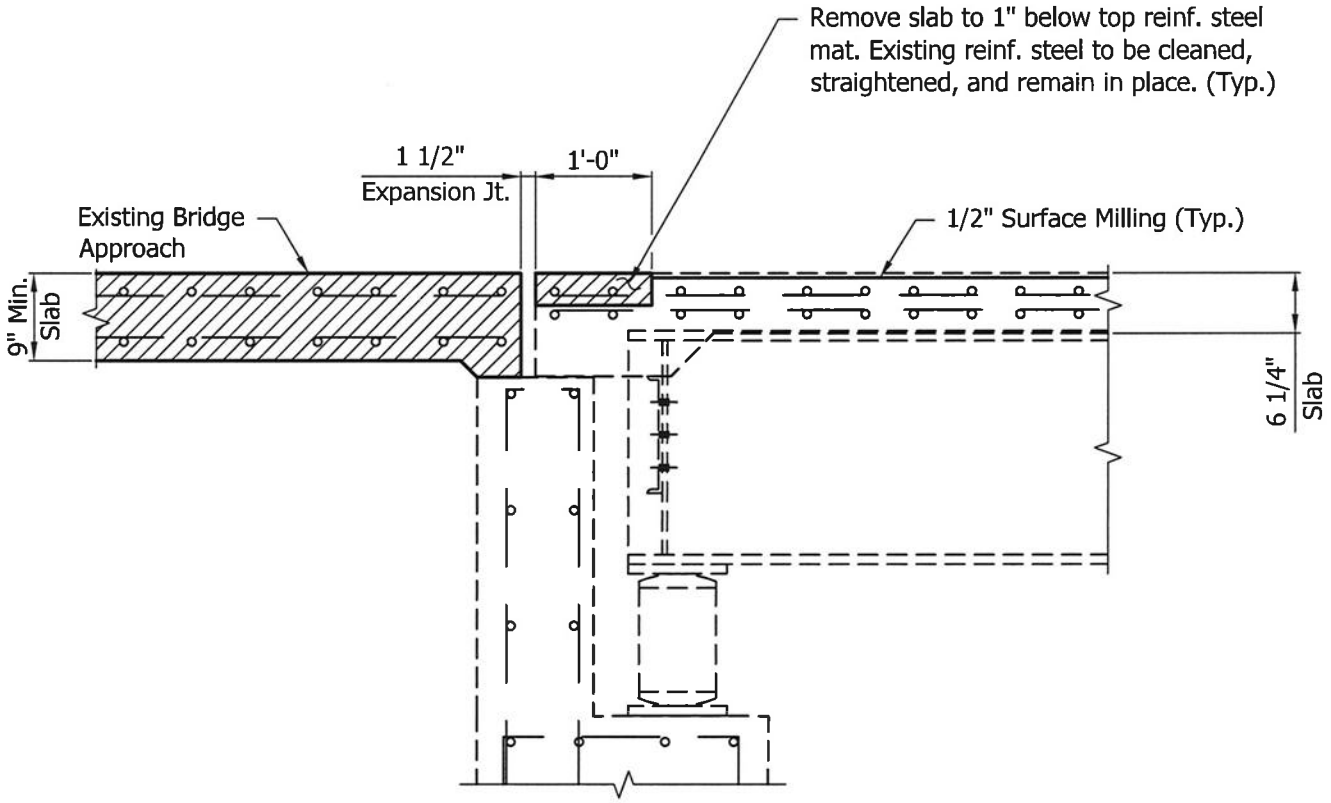
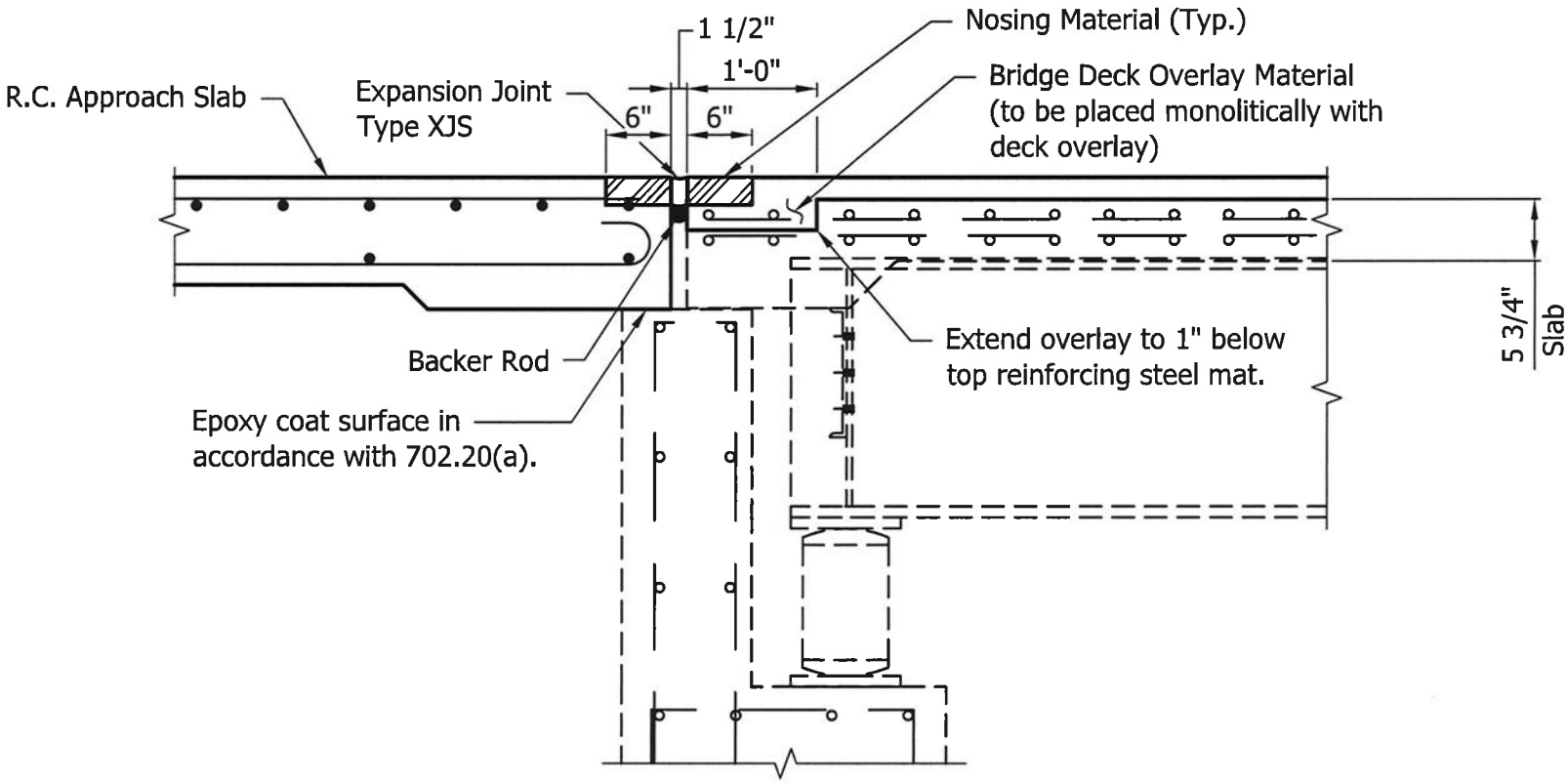


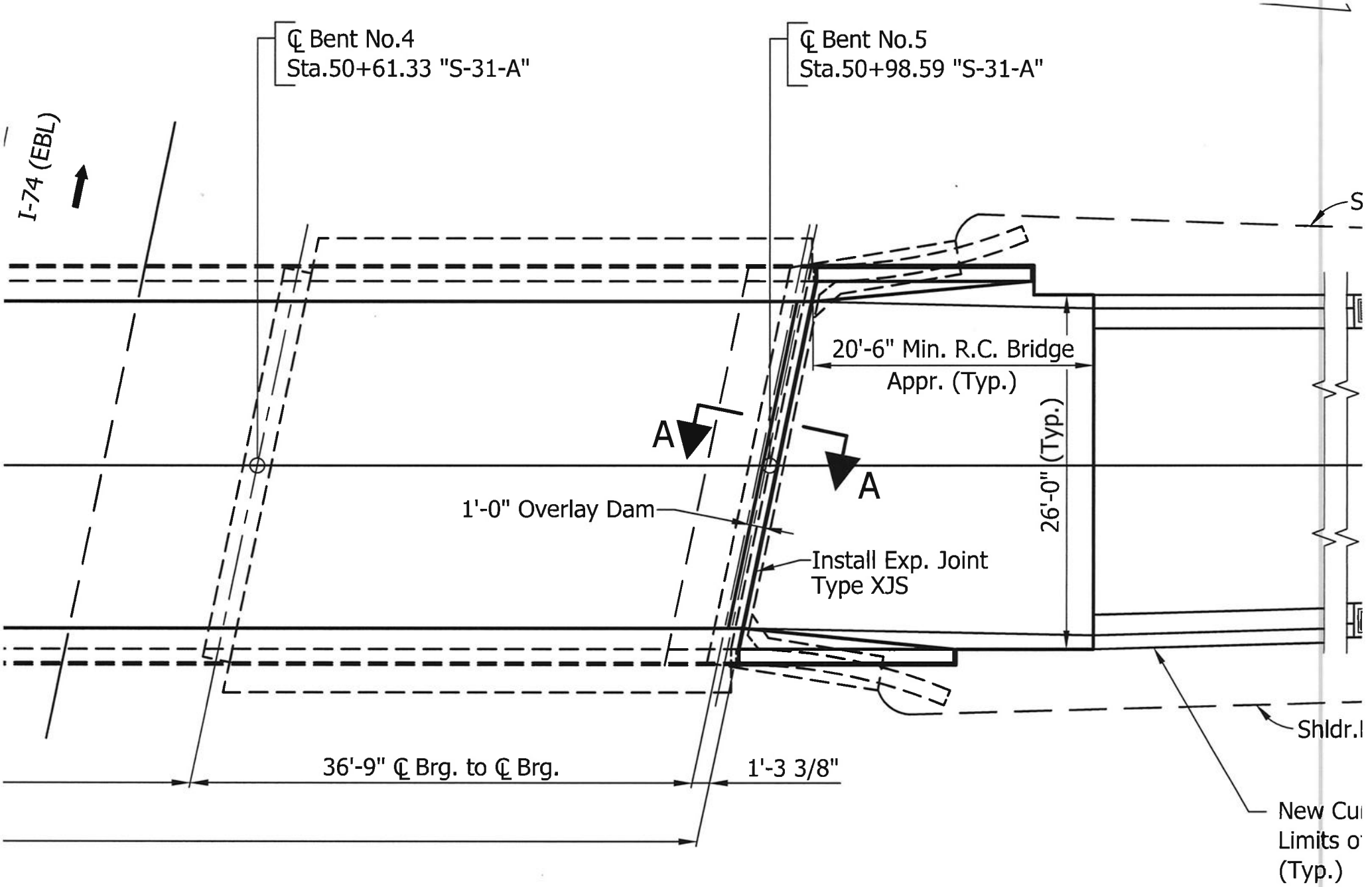
SECTION A-A - REMOVAL

Scale: 3/4"=1'-0"



SECTION A-A - RECONSTRUCTION

Scale: 3/4"=1'-0"


℄ Bent No.4
Sta.50+61.33 "S-31-A"
℄ Bent No.5
Sta.50+98.59 "S-31-A"
I-74 (EBL)
20'-6" Min. R.C. Bridge
Appr. (Typ.)
26'-0" (Typ.)
A
A
1'-0" Overlay Dam
Install Exp. Joint
Type XJS
36'-9" ℄ Brg. to ℄ Brg.
1'-3 3/8"
Shldr.
New Cu
Limits o
(Typ.)

HYDRODEMOLITION AND LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECK

Description

This work shall consist of the preparation of the exposed bridge deck surface in accordance with 722, and shall involve milling and the use of hydrodemolition. Subsequent to the deck preparation, the work shall consist of constructing a latex modified portland cement concrete overlay.

Materials

Materials shall be in accordance with 722.02 and as follows.

Evaporation retardant shall be one of the products listed below. A Type D certification in accordance with 916 shall be furnished to the Engineer prior to use.

1. MasterKure ER 50, manufactured by BASF
2. Sika-Film, manufactured by Sika Corporation
3. Eucobar, manufactured by Euclid Chemical Company

Storage and Handling of Materials

Storage and handling of materials shall be in accordance with 722.03.

Construction Requirements

Deck Scarification

The deck surface shall be scarified by surface milling to an initial depth of 1/2 in. The milling operation shall be limited to the portion of the deck that is closed to traffic at any one time. After the initial surface milling, additional milling may be required as directed.

Surface milling shall be performed with a milling machine capable of removal to the required depth. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing the existing bridge deck by means of a ski or matching shoe.

If the milling operation results in the snagging of the top mat of steel reinforcement, the milling operation shall be stopped and the depth of removal adjusted. Any damaged reinforcing bars shall be repaired as directed at no additional cost.

Hydrodemolition

Hydrodemolition shall be used to remove all unsound concrete in accordance with 722.05(a)2. The hydrodemolition equipment shall consist of a self-propelled computerized machine that utilizes a high pressure water jet stream capable of removing concrete as specified herein, as well as removing rust and concrete particles from exposed reinforcing bars. The hydrodemolition equipment shall be calibrated and approved prior to use.

Prior to hydrodemolition, the equipment shall be calibrated on an area of sound original deck concrete as designated by the Engineer.

The initial settings shall be verified on an area of unsound concrete. The initial settings may need to be adjusted in order to achieve total removal of unsound concrete. Calibration of the hydrodemolition equipment

shall be conducted for every day of operation and, if necessary, re-calibrated to ensure removal of known areas of delaminated concrete as well as to guard against removal of sound concrete. The Engineer shall be notified of the final equipment settings resulting from the calibration process.

After calibration of the equipment, concrete removal by hydrodemolition shall be conducted on the bridge deck. The removal will be verified as necessary, every 30 ft along the cutting path. Handchipping shall be used in areas that are inaccessible to the self-propelled hydrodemolition equipment. Handchipping tools may be hand or mechanically driven and operated.

The Contractor shall submit a water control plan to the Engineer for approval prior to commencing hydrodemolition activities. The plan shall include control and filtering of all water discharged during hydrodemolition operations to produce visibly clear water prior to release to the surrounding environment. The Contractor shall block all drains on the deck and install dams to strain the runoff every 150 ft or less, along the drainage path. The dams shall be constructed from aggregate or straw having minimum dimensions of 6 in. in height, by 1 ft in width. The exposed bridge deck shall be used as a settlement basin for runoff. An additional settlement basin outside the limits of the bridge deck may be required if further straining is necessary.

The Contractor shall provide shielding to ensure containment of all dislodged concrete during hydrodemolition operations to prevent damage to surrounding property and from flying debris both on and under the work site.

Cleaning of the hydrodemolition debris and slurry shall be performed with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water in the same pass. The vacuum equipment shall be capable of washing the deck with pressurized water during the vacuum operation to dislodge all debris and slurry from the bridge deck surface. Debris and slurry shall not be allowed to dry prior to vacuuming.

Additional Unsound Concrete Removal After Hydrodemolition

After hydrodemolition has been completed, the deck will undergo sounding to identify remaining areas of unsound concrete. The deck surface shall be completely dry prior to sounding.

Additional concrete removal will be directed by the Engineer and shall be performed by handchipping or hydrodemolition. Only handchipping tools shall be used when removing concrete within 1 in. of reinforcement.

Where the deck is sound for less than half of its original depth, the concrete shall be removed full depth except for limited areas as determined by the Engineer. Forms for areas of up to 4 sq ft may be suspended from wires attached to the reinforcing bars. For areas greater than 4 sq ft, the forms shall be supported from the structural members of the superstructure or by shoring from below.

Where reinforcing bars have been exposed and the bond between the existing concrete and the reinforcing bars has been destroyed, the concrete adjacent to the reinforcement shall be removed to a minimum clearance of 1 in. around the circumference of the exposed reinforcement.

Where reinforcing bars have been exposed and the concrete in contact with reinforcing bars is sound, the additional removal of 1 in. around the circumference of the exposed reinforcement may be waived by the Engineer.

Any damaged reinforcing bars shall be repaired as directed at no additional cost. The removal area shall be cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of the new concrete. A minimum 1 in. vertical surface shall remain, or be cut 1 in., outside and around the entire periphery of each full depth removal area after removal of all loose and unsound concrete. The 1-in. vertical cut may be waived by the Engineer if it is determined that a cut will damage the reinforcement.

Preparation of Bridge Floor Prior to Overlay Placement

After completion of hydrodemolition and any additional concrete removal, the deck shall be sounded to ensure that all unsound concrete has been removed. Not more than 24 h prior to the placement of the overlay, the deck shall be cleaned in accordance with 722.05(b) and as follows. Water blasting may be used in lieu of sandblasting. The sandblasting or water blasting shall be performed using two passes with the second pass being at a right angle to the first pass or a cross-blasting technique. The minimum pressure of the water blast shall be 7,500 psi.

Patching of the Bridge Floor

Full depth patching of the bridge floor shall be in accordance with 722.06(a).

Proportioning and Mixing

Proportioning and mixing of the latex modified concrete shall be in accordance with 722.04 and 722.08, respectively.

Placing and Finishing

Placement and finishing of the latex modified concrete overly shall be in accordance with 722.09 except that a bond coat shall not be applied to surfaces where the removal was accomplished by hydrodemolition. Evaporation retardant shall be applied in accordance with the evaporation retardant manufacturer's recommendations to the surface of the latex modified concrete immediately after every second transverse pass of the burlap or pan drag on the finishing machine is completed. Reapplication of the evaporation retardant shall be performed to all areas where the surface has been disturbed after the application of the evaporative retardant, such as from bull floating or hand finishing, or when drying of the surface is observed. The evaporation retardant shall be used as such and not as a finishing aid. Excessive amounts shall not be applied and worked into the latex modified concrete surface.

Texturing and Curing

Texturing and curing shall be in accordance with 722.10 and 722.11, respectively. When a portion of the grooving or tining, not to exceed 5 ft longitudinally, is complete, the evaporative retardant shall be re-applied to the freshly textured surface.

Calibration of Continuous Mixers

Calibration of continuous mixers shall be in accordance with 722.12.

Overlay Dam

Overlay dams shall be in accordance with 722.07 except that removal of the existing material shall be performed using hydrodemolition.

Method of Measurement

Removal of the existing overlay will be measured by the square yard of deck area regardless of the number of passes with the milling machine.

The surface milling operation for deck scarification will be measured by the square yard for the initial 1/2 in. depth. Surface milling below the initial 1/2 in. depth will be measured by the square yard for each increment up to 1/2 in. depth. Additional removal of unsound concrete by handchipping will not be measured.

Hydrodemolition of the bridge deck will be measured by the square yard.

Full depth patching will be measured in accordance with 722.14.

Overlay material used to fill surface irregularities will be measured in accordance with 722.14.

Bridge deck overlay will be measured in accordance with 722.14, except that when no overlay thickness is shown on the plans, the overlay thickness shall be 2 inches.

Overlay dams will be measured by the square foot.

Epoxy resin adhesive and bond coat will not be measured for payment. Blasting, cleaning, finishing, texturing, and curing will not be measured for payment.

Basis of Payment

Removal of the existing overlay will be paid for at the contract unit price per square yard of bridge deck overlay, remove.

Surface milling will be paid for in accordance with 722.15 except as follows. The initial depth to be paid for as surface milling will be 1/2 in. The increments for additional surface removal will be up to 1/2 in., for each individual increment.

Hydrodemolition of the bridge deck will be paid for at the contact unit price per square yard.

Full depth patching will be paid for in accordance with 722.15.

Overlay material used to fill surface irregularities will be paid for in accordance with 722.15.

Bridge deck overlay will be paid for in accordance with 722.15.

add square foot, Overlay dam will be paid for at the contract unit price per square foot, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Bridge Deck Overlay, Remove	SYS
Hydrodemolition	SYS
Overlay Dam	SFT

The cost of overlay removal by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of bridge deck overlay, remove. The

cost of disposing of overlay removal residue, including water, dust, concrete and incidentals shall be included in the cost of bridge deck overlay, remove.

The cost of deck scarification by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of surface milling. The removal of surface milling residue, including water, dust, concrete and incidentals shall be included in the cost of surface milling.

The cost for blocking drains, initial equipment calibration, any re-calibration, filtering of discharge water, constructing settlement basins for runoff, equipment shielding, handchipping curb areas, handchipping unsound concrete, cleaning of debris and slurry, compressed air cleaning, water blasting, and sandblasting shall be included in the contract unit price for hydrodemolition.

The cost of bond coat, furnishing and placing the overlay material, and incidentals shall be included in the cost of bridge deck overlay. Coring of the bridge deck, patching core holes, and all corrective measures required in accordance with 722.11 shall be performed at no additional cost.

Add The cost of removing the existing concrete; furnishing, hauling, and placing all materials including the epoxy; preparing the surface; and all necessary incidentals shall be included in the cost of overlay dam.

EXISTING OVERLAY REMOVAL, HYDRODEMOLITION
AND LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECK

Description

This work shall consist of the removal of the existing bridge deck overlay followed by preparation of the exposed bridge deck surface in accordance with 722, and shall involve milling and the use of hydrodemolition. Subsequent to the deck preparation, the work shall consist of constructing a latex modified portland cement concrete overlay.

Materials

Materials shall be in accordance with 722.02 and as follows.

Evaporation retardant shall be one of the products listed below. A Type D certification in accordance with 916 shall be furnished to the Engineer prior to use.

1. MasterKure ER 50, manufactured by BASF
2. Sika-Film, manufactured by Sika Corporation
3. Eucobar, manufactured by Euclid Chemical Company

Storage and Handling of Materials

Storage and handling of materials shall be in accordance with 722.03.

Construction Requirements

Removal of Existing Concrete Overlay

When an existing deck overlay is to be removed, the removal shall be performed with a milling machine. Removal in areas that are inaccessible to the milling machine, shall be done by chipping hammers or handchipping.

Deck Scarification

The deck surface shall be scarified by surface milling to an initial depth of 1/2 in. The milling operation shall be limited to the portion of the deck that is closed to traffic at any one time. After the initial surface milling, additional milling may be required as directed.

Surface milling shall be performed with a milling machine capable of removal to the required depth. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing the existing bridge deck by means of a ski or matching shoe.

If the milling operation results in the snagging of the top mat of steel reinforcement, the milling operation shall be stopped and the depth of removal adjusted. Any damaged reinforcing bars shall be repaired as directed at no additional cost.

Hydrodemolition

Hydrodemolition shall be used to remove all unsound concrete in accordance with 722.05(a)2. The hydrodemolition equipment shall consist of a self-propelled computerized machine that utilizes a high pressure water jet stream capable of removing concrete as specified herein, as well as removing rust and concrete particles from exposed reinforcing bars. The hydrodemolition equipment shall be calibrated and approved prior to use.

Prior to hydrodemolition, the equipment shall be calibrated on an area of sound original deck concrete as designated by the Engineer.

The initial settings shall be verified on an area of unsound concrete. The initial settings may need to be adjusted in order to achieve total removal of unsound concrete. Calibration of the hydrodemolition equipment shall be conducted for every day of operation and, if necessary, re-calibrated to ensure removal of known areas of delaminated concrete as well as to guard against removal of sound concrete. The Engineer shall be notified of the final equipment settings resulting from the calibration process.

After calibration of the equipment, concrete removal by hydrodemolition shall be conducted on the bridge deck. The removal will be verified as necessary, every 30 ft along the cutting path. Handchipping shall be used in areas that are inaccessible to the self-propelled hydrodemolition equipment. Handchipping tools may be hand or mechanically driven and operated.

The Contractor shall submit a waste water control and disposal plan for approval prior to commencing hydrodemolition activities. The waste water control and disposal plan shall detail how all waste water generated by the hydrodemolition activities shall be contained, tested for pH, stored and transported to a disposal facility in accordance with 202.

The Contractor shall provide shielding to ensure containment of all dislodged concrete during hydrodemolition operations to prevent damage to surrounding property and from flying debris both on and under the work site.

Cleaning of the hydrodemolition debris and slurry shall be performed with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water in the same pass. The vacuum equipment shall be capable of washing the deck with pressurized water during the vacuum operation to dislodge all debris and slurry from the bridge deck surface. Debris and slurry shall not be allowed to dry prior to vacuuming.

Additional Unsound Concrete Removal After Hydrodemolition

After hydrodemolition has been completed, the deck will undergo sounding to identify remaining areas of unsound concrete. The deck surface shall be completely dry prior to sounding.

Additional concrete removal will be directed by the Engineer and shall be performed by handchipping or hydrodemolition. Only handchipping tools shall be used when removing concrete within 1 in. of reinforcement.

Where the deck is sound for less than half of its original depth, the concrete shall be removed full depth except for limited areas as determined by the Engineer. Forms for areas of up to 4 sq ft may be suspended from wires attached to the reinforcing bars. For areas greater than 4 sq ft, the forms shall be supported from the structural members of the superstructure or by shoring from below.

Where reinforcing bars have been exposed and the bond between the existing concrete and the reinforcing bars has been destroyed, the concrete adjacent to the reinforcement shall be removed to a minimum clearance of 1 in. around the circumference of the exposed reinforcement.

Where reinforcing bars have been exposed and the concrete in contact with reinforcing bars is sound, the additional removal of 1 in. around the circumference of the exposed reinforcement may be waived by the Engineer.

Any damaged reinforcing bars shall be repaired as directed at no additional cost. The removal area shall be cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of the new concrete. A minimum 1 in. vertical surface shall remain, or be cut 1 in., outside and around the entire periphery of each full depth removal area after removal of all loose and unsound concrete. The 1-in. vertical cut may be waived if it is determined that a cut will damage the reinforcement.

Preparation of Bridge Floor Prior to Overlay Placement

After completion of hydrodemolition and any additional concrete removal, the deck shall be sounded to ensure that all unsound concrete has been removed. Not more than 24 h prior to the placement of the overlay, the deck shall be cleaned in accordance with 722.05(b) and as follows. Water blasting may be used in lieu of sandblasting. The sandblasting or water blasting shall be performed using two passes with the second pass being at a right angle to the first pass or a cross-blasting technique. The minimum pressure of the water blast shall be 7,500 psi.

Patching of the Bridge Floor

Full depth patching of the bridge floor shall be in accordance with 722.06(a).

Proportioning and Mixing

Proportioning and mixing of the latex modified concrete shall be in accordance with 722.04 and 722.08, respectively.

Placing and Finishing

Placement and finishing of the latex modified concrete overly shall be in accordance with 722.09 except that a bond coat shall not be applied to surfaces where the removal was accomplished by hydrodemolition. Evaporation retardant shall be applied in accordance with the evaporation retardant manufacturer's recommendations to the surface of the latex modified concrete immediately after every second transverse pass of the burlap or pan drag on the finishing machine is completed. Reapplication of the evaporation retardant shall be performed to all areas where the surface has been disturbed after the application of the evaporative retardant, such as from bull floating or hand finishing, or when drying of the surface is observed. The evaporation retardant shall be used as such and not as a finishing aid. Excessive amounts shall not be applied and worked into the latex modified concrete surface.

Texturing and Curing

Texturing and curing shall be in accordance with 722.10 and 722.11, respectively. When a portion of the grooving or tining, not to exceed 5 ft longitudinally, is complete, the evaporative retardant shall be re-applied to the freshly textured surface.

Calibration of Continuous Mixers

Calibration of continuous mixers shall be in accordance with 722.12.

Method of Measurement

Removal of the existing overlay will be measured by the square yard of deck area regardless of the number of passes with the milling machine.

The surface milling operation for deck scarification will be measured by the square yard for the initial 1/2 in. depth. Surface milling below the initial 1/2 in. depth will be measured by the square yard for each increment up to 1/2 in. depth. Additional removal of unsound concrete by handchipping will not be measured.

Hydrodemolition of the bridge deck will be measured by the square yard.

Full depth patching will be measured in accordance with 722.14.

Overlay material used to fill surface irregularities will be measured in accordance with 722.14.

Bridge deck overlay will be measured in accordance with 722.14, except that when no overlay thickness is shown on the plans, the overlay thickness shall be 2 in.

Epoxy resin adhesive and bond coat will not be measured for payment. Blasting, cleaning, finishing, texturing, and curing will not be measured for payment.

Basis of Payment

Removal of the existing overlay will be paid for at the contract unit price per square yard of bridge deck overlay, remove.

Surface milling will be paid for in accordance with 722.15 except as follows. The initial depth to be paid for as surface milling will be 1/2 in. The increments for additional surface removal will be up to 1/2 in., for each individual increment.

Hydrodemolition of the bridge deck will be paid for at the contact unit price per square yard.

Full depth patching will be paid for in accordance with 722.15.

Overlay material used to fill surface irregularities will be paid for in accordance with 722.15.

Bridge deck overlay will be paid for in accordance with 722.15.

Payment will be made under:

Pay Item	Pay Unit Symbol
Bridge Deck Overlay, Remove	SYS
Hydrodemolition	SYS

The cost of overlay removal by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of bridge deck overlay, remove. The cost of disposing of overlay removal residue, including water, dust, concrete and incidentals shall be included in the cost of bridge deck overlay, remove.

The cost of deck scarification by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of surface milling. The removal of

surface milling residue, including water, dust, concrete and incidentals shall be included in the cost of surface milling.

The cost of the waste water control and disposal plan, waste water containment, testing, storing, transporting and disposal, and any incidentals related to the carrying out of the plan shall be included in the cost of hydrodemolition. If the waste water is found to have a pH of 12.5 or higher and thereby classified as hazardous, the additional costs associated with this classification will be paid for in accordance with 109.05. The initial equipment calibration, any re-calibration, equipment shielding, handchipping curb areas, handchipping unsound concrete, cleaning of debris and slurry, compressed air cleaning, water blasting, and sandblasting shall be included in the contract unit price for hydrodemolition.

The cost of bond coat, furnishing and placing the overlay material, and incidentals shall be included in the cost of bridge deck overlay. Coring of the bridge deck, patching core holes, and all corrective measures required in accordance with 722.11 shall be performed at no additional cost.

EXISTING OVERLAY REMOVAL, HYDRODEMOLITION
AND LATEX MODIFIED CONCRETE OVERLAY FOR BRIDGE DECK

Description

This work shall consist of the removal of the existing bridge deck overlay followed by preparation of the exposed bridge deck surface in accordance with 722, and shall involve milling and the use of hydrodemolition. Subsequent to the deck preparation, the work shall consist of constructing a latex modified portland cement concrete overlay.

Materials

Materials shall be in accordance with 722.02 and as follows.

Evaporation retardant shall be one of the products listed below. A Type D certification in accordance with 916 shall be furnished to the Engineer prior to use.

1. MasterKure ER 50, manufactured by BASF

2. Sika-Film, manufactured by Sika Corporation

3. Eucobar, manufactured by Euclid Chemical Company

Storage and Handling of Materials

Storage and handling of materials shall be in accordance with 722.03.

Construction Requirements

Removal of Existing Concrete Overlay

When an existing deck overlay is to be removed, the removal shall be performed with a milling machine. Removal in areas that are inaccessible to the milling machine, shall be done by chipping hammers or handchipping.

Deck Scarification

The deck surface shall be scarified by surface milling to an initial depth of 1/2 in. The milling operation shall be limited to the portion of the deck that is closed to traffic at any one time. After the initial surface milling, additional milling may be required as directed.

Surface milling shall be performed with a milling machine capable of removal to the required depth. The equipment shall be self-propelled with sufficient power, traction and stability to maintain accurate depth of cut and slope. The equipment shall be capable of accurately and automatically establishing profile grades along each edge of the machine by referencing the existing bridge deck by means of a ski or matching shoe.

If the milling operation results in the snagging of the top mat of steel reinforcement, the milling operation shall be stopped and the depth of removal adjusted. Any damaged reinforcing bars shall be repaired as directed at no additional cost.

Hydrodemolition

Hydrodemolition shall be used to remove all unsound concrete in accordance with 722.05(a)2. The hydrodemolition equipment shall consist of a self-propelled computerized machine that utilizes a high pressure water jet stream capable of removing concrete as specified herein, as well as removing rust and concrete particles from exposed reinforcing bars. The hydrodemolition equipment shall be calibrated and approved prior to use.

Prior to hydrodemolition, the equipment shall be calibrated on an area of sound original deck concrete as designated by the Engineer.

The initial settings shall be verified on an area of unsound concrete. The initial settings may need to be adjusted in order to achieve total removal of unsound concrete. Calibration of the hydrodemolition equipment shall be conducted for every day of operation and, if necessary, re-calibrated to ensure removal of known areas of delaminated concrete as well as to guard against removal of sound concrete. The Engineer shall be notified of the final equipment settings resulting from the calibration process.

After calibration of the equipment, concrete removal by hydrodemolition shall be conducted on the bridge deck. The removal will be verified as necessary, every 30 ft along the cutting path. Handchipping shall be used in areas that are inaccessible to the self-propelled hydrodemolition equipment. Handchipping tools may be hand or mechanically driven and operated.

The Contractor shall submit a waste water control and disposal plan for approval prior to commencing hydrodemolition activities. The waste water control and disposal plan shall detail how all waste water generated by the hydrodemolition activities shall be contained, tested for pH, stored and transported to a disposal facility in accordance with 202.

The Contractor shall provide shielding to ensure containment of all dislodged concrete during hydrodemolition operations to prevent damage to surrounding property and from flying debris both on and under the work site.

Cleaning of the hydrodemolition debris and slurry shall be performed with a vacuum system equipped with fugitive dust control devices and capable of removing wet debris and water in the same pass. The vacuum equipment shall be capable of washing the deck with pressurized water during the vacuum operation to dislodge all debris and slurry from the bridge deck surface. Debris and slurry shall not be allowed to dry prior to vacuuming.

Additional Unsound Concrete Removal After Hydrodemolition

After hydrodemolition has been completed, the deck will undergo sounding to identify remaining areas of unsound concrete. The deck surface shall be completely dry prior to sounding.

Additional concrete removal will be directed by the Engineer and shall be performed by handchipping or hydrodemolition. Only handchipping tools shall be used when removing concrete within 1 in. of reinforcement.

Where the deck is sound for less than half of its original depth, the concrete shall be removed full depth except for limited areas as determined by the Engineer. Forms for areas of up to 4 sq ft may be suspended from wires attached to the reinforcing bars. For areas greater than 4 sq ft, the forms shall be supported from the structural members of the superstructure or by shoring from below.

Where reinforcing bars have been exposed and the bond between the existing concrete and the reinforcing bars has been destroyed, the concrete adjacent to the reinforcement shall be removed to a minimum clearance of 1 in. around the circumference of the exposed reinforcement.

Where reinforcing bars have been exposed and the concrete in contact with reinforcing bars is sound, the additional removal of 1 in. around the circumference of the exposed reinforcement may be waived by the Engineer.

Any damaged reinforcing bars shall be repaired as directed at no additional cost. The removal area shall be cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of the new concrete. A minimum 1 in. vertical surface shall remain, or be cut 1 in., outside and around the entire periphery of each full depth removal area after removal of all loose and unsound concrete. The 1-in. vertical cut may be waived if it is determined that a cut will damage the reinforcement.

Preparation of Bridge Floor Prior to Overlay Placement

After completion of hydrodemolition and any additional concrete removal, the deck shall be sounded to ensure that all unsound concrete has been removed. Not more than 24 h prior to the placement of the overlay, the deck shall be cleaned in accordance with 722.05(b) and as follows. Water blasting may be used in lieu of sandblasting. The sandblasting or water blasting shall be performed using two passes with the second pass being at a right angle to the first pass or a cross-blasting technique. The minimum pressure of the water blast shall be 7,500 psi.

Patching of the Bridge Floor

Full depth patching of the bridge floor shall be in accordance with 722.06(a).

Proportioning and Mixing

Proportioning and mixing of the latex modified concrete shall be in accordance with 722.04 and 722.08, respectively.

Placing and Finishing

Placement and finishing of the latex modified concrete overly shall be in accordance with 722.09 except that a bond coat shall not be applied to surfaces where the removal was accomplished by hydrodemolition. Evaporation retardant shall be applied in accordance with the evaporation retardant manufacturer’s recommendations to the surface of the latex modified concrete immediately after every second transverse pass of the burlap or pan drag on the finishing machine is completed. Reapplication of the evaporation retardant shall be performed to all areas where the surface has been disturbed after the application of the evaporative retardant, such as from bull floating or hand finishing, or when drying of the surface is observed. The evaporation retardant shall be used as such and not as a finishing aid. Excessive amounts shall not be applied and worked into the latex modified concrete surface.

Texturing and Curing

Texturing and curing shall be in accordance with 722.10 and 722.11, respectively. When a portion of the grooving or tining, not to exceed 5 ft longitudinally, is complete, the evaporative retardant shall be re-applied to the freshly textured surface.

Calibration of Continuous Mixers

Calibration of continuous mixers shall be in accordance with 722.12.

Method of Measurement

Removal of the existing overlay will be measured by the square yard of deck area regardless of the number of passes with the milling machine.

The surface milling operation for deck scarification will be measured by the square yard for the initial 1/2 in. depth. Surface milling below the initial 1/2 in. depth will be measured by the square yard for each increment up to 1/2 in. depth. Additional removal of unsound concrete by handchipping will not be measured.

Hydrodemolition of the bridge deck will be measured by the square yard.

Full depth patching will be measured in accordance with 722.14.

Overlay material used to fill surface irregularities will be measured in accordance with 722.14.

Bridge deck overlay will be measured in accordance with 722.14, except that when no overlay thickness is shown on the plans, the overlay thickness shall be 2 in.

Epoxy resin adhesive and bond coat will not be measured for payment. Blasting, cleaning, finishing, texturing, and curing will not be measured for payment.

Basis of Payment

Removal of the existing overlay will be paid for at the contract unit price per square yard of bridge deck overlay, remove.

Surface milling will be paid for in accordance with 722.15 except as follows. The initial depth to be paid for as surface milling will be 1/2 in. The increments for additional surface removal will be up to 1/2 in., for each individual increment.

Hydrodemolition of the bridge deck will be paid for at the contact unit price per square yard.

Full depth patching will be paid for in accordance with 722.15.

Overlay material used to fill surface irregularities will be paid for in accordance with 722.15.

Bridge deck overlay will be paid for in accordance with 722.15.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Bridge Deck Overlay, Remove	SYS
Hydrodemolition	SYS

The cost of overlay removal by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of bridge deck overlay, remove. The cost of disposing of overlay removal residue, including water, dust, concrete and incidentals shall be included in the cost of bridge deck overlay, remove.

The cost of deck scarification by handchipping in areas adjacent to the curb or otherwise inaccessible to the power-operated mechanical milling machine shall be included in the cost of surface milling. The removal of

surface milling residue, including water, dust, concrete and incidentals shall be included in the cost of surface milling.

The cost of the waste water control and disposal plan, waste water containment, testing, storing, transporting and disposal, and any incidentals related to the carrying out of the plan shall be included in the cost of hydrodemolition. If the waste water is found to have a pH of 12.5 or higher and thereby classified as hazardous, the additional costs associated with this classification will be paid for in accordance with 109.05. The initial equipment calibration, any re-calibration, equipment shielding, handchipping curb areas, handchipping unsound concrete, cleaning of debris and slurry, compressed air cleaning, water blasting, and sandblasting shall be included in the contract unit price for hydrodemolition.

The cost of bond coat, furnishing and placing the overlay material, and incidentals shall be included in the cost of bridge deck overlay. Coring of the bridge deck, patching core holes, and all corrective measures required in accordance with 722.11 shall be performed at no additional cost.

721.04 Method of Measurement

Automatic drainage gates will be measured by the number of units installed.

721.05 Basis of Payment

The accepted quantities of this work will be paid for at the contract unit price per each for automatic drainage gate, of the size specified, complete in place.

Payment will be made under:

Pay Item	Pay Unit Symbol
Automatic Drainage Gate, _____ (width) in. x _____ (height) in.	EACH

If the gate is fastened to the end of a pipe, no additional payment will be allowed for that portion of pipe extending beyond the outside face of the headwall.

SECTION 722 – LATEX MODIFIED CONCRETE BRIDGE DECK OVERLAYS

722.01 Description

This work shall consist of the construction of a latex modified portland cement concrete overlay on an existing or new bridge deck, or it shall consist of patching an existing latex modified portland cement concrete overlay on a bridge deck in accordance with 105.03.

722.02 Materials

Materials shall be in accordance with the following:

Admixtures	912.03
Coarse Aggregate, Class A or Higher, Size No. 11*	904
Epoxy Penetrating Sealer	909.09
Epoxy Resin Adhesive	909.11
Fine Aggregate	904
Fly Ash	901.02
Latex Modifier	912.04
PCC Sealer/Healer	901.06
Portland Cement	901.01(b)
Water	913.01

* Crushed stone only

722.03 Storage and Handling of Materials

Fine and coarse aggregates shall be stored and handled avoiding contamination and maintaining uniform moisture content. Fine and coarse aggregates which are stored in piles or bins shall remain separated and shall be covered with a moisture proof material which prevents variations in moisture content of the aggregates. The maximum variation of moisture content in successive concrete batches shall be 0.5%.

Cement shall be stored in weatherproof enclosures which protect the cement from dampness. Cement shall not have developed lumps.

The latex modifier shall be stored in accordance with the manufacturer's recommendations. Latex modifier shall be strained to remove solid particles during transfer of the material from storage drums to the mobile mixer tank.

722.04 Proportioning

The amount of fine aggregate shall be 60% ± 5% by dry weight of the total aggregate and shall be considered as the amount of aggregate blend passing the No. 4 (4.75 mm) sieve. The coarse aggregate shall be No. 11, class A crushed stone. The cement content shall be a minimum of 658 lbs/cu yd of concrete. The same brand of cement shall be used throughout a bridge structure. The amount of latex modifier shall be 3.5 gal. per 94 lbs of cement. The net water added shall produce a slump of 5 in. ± 1 in. at 4 to 5 minutes after discharge from the mixer. The moisture content of the aggregates shall be controlled such that the slump is within the specified limits. The air content shall be a maximum of 6%, by volume, of the plastic mix.

The yield will be checked using the 1/4 cu yd box method as follows. The chute shall be cleaned and the box shall be positioned to receive the discharged concrete. The mixer shall be operated until the cement counter indicates that 1/4 cu yd of concrete has been produced. The contents of the box shall be consolidated and struck off. If the box is not essentially full, the gates shall be adjusted and the procedure shall be repeated until the actual and calculated volumes of concrete agree. Yield tests shall be run on the first load of each truck and every third load per truck thereafter. Additional tests will be required after making any adjustments.

Slump and air content tests will be performed after each acceptable yield test. The slump test shall be in accordance with AASHTO T 119 and will be performed 4 to 5 minutes after the concrete is discharged from the mixer. The water flow meter reading will be recorded at the time the slump test is taken. The concrete shall not be disturbed during the waiting period for the slump test. The air content test shall be in accordance with 505. Any concrete mixture which is not properly proportioned or does not conform to the specified slump will be rejected.

Class F or class C fly ash may be used in the latex modified portland cement concrete. The maximum cement reduction shall be 15% and the minimum replacement ratio by weight of fly ash to cement shall be 1.25:1. A concrete mix design shall be submitted in accordance with 702.05. If portland pozzolan cement, type IP is to be used in the concrete mix design, the cement content shall be increased by a multiplier of 1.06 times the specified cement content.

Bridge deck patching concrete shall be composed of the following:

(a) Fine aggregate shall be 35% to 45% of the total weight of aggregate used.

(b) The cement shall be 564 lbs/cu yd of portland cement type III or type IIIA, or 846 lbs/cu yd of portland cement type I or type IA.

(c) Air entraining admixture shall be added to produce 5% to 8% entrained air.

(d) The net water added shall produce a slump of no more than 4 in.

722.05 Preparation of the Bridge Floor

(a) Concrete Removal

1. Deck Surface

The top 1/4 in. of the entire bridge deck surface shall be removed if the overlay is to be placed on a bridge deck constructed under a previous contract. The surface removal operation shall be limited to that portion of the bridge deck that is closed to traffic at any one time. After this initial surface removal, an additional 1/4 in. of surface removal may be required on part or all of the bridge deck as directed.

Surface removal shall be performed with a power operated mechanical milling machine. The equipment shall uniformly remove the required depth of concrete surface in a satisfactory manner. Surface removal, which is in areas adjacent to the curb that are inaccessible to milling, shall be done by handchipping. All surface removal residue, including water, dust and concrete, shall be immediately removed.

2. Bridge Floor

Following the clean up from the surface removal operation, areas of unsound concrete to be removed will be marked. Removal of the unsound concrete shall be performed by handchipping or hydrodemolition. Handchipping tools may be hand or mechanically driven. Jack hammers shall not be heavier than nominal 45 lb class and chipping hammers shall not be heavier than nominal 15 lb class. Only chipping hammers shall be used when removing concrete within 1 in. of reinforcing bars. Mechanically driven tools shall be operated at a maximum angle of 45° from the bridge floor surface.

The hydrodemolition machine shall utilize a high pressure water jet system and shall be approved prior to use. Hydrodemolition equipment shall be calibrated to remove only unsound concrete. The pressure of the water jet shall be calibrated for each structure prior to use. All water used in the hydrodemolition operation shall be potable, and stream or lake water will not be allowed. Precautions shall be taken, during the hydrodemolition operations, to prevent damage to surrounding property and traffic. Waste water shall not be discharged into a stream.

Regardless of the method of removal, the removal operation shall be stopped if it is determined that sound concrete is being removed. Appropriate recalibration, or changes in equipment and methods shall be performed prior to resuming the removal operation.

Where reinforcing bars have been exposed or the bond between the existing concrete and reinforcing bars has been destroyed, the concrete adjacent to the bars shall be removed to a minimum clearance of 1 in. around the entire periphery of the exposed bars. If the concrete is unsound down to the top layer of bottom reinforcing bars, all of the concrete within the marked area shall be removed and the cavity shall require full depth patching in accordance with 722.06(a). Prepared cavities which are deeper than the level of the adjacent prepared deck surface, but are not full depth, shall require partial depth patching in accordance with 722.06(b). Prepared partial depth cavities shall be made full depth when directed. Exposed reinforcing bars shall not be damaged by the removal operation. Any damaged reinforcing bars shall be repaired as directed with no additional payment.

The removal areas shall be thoroughly cleaned of all dirt, foreign materials and loose concrete to the extent necessary to produce a firm solid surface for adherence of the new concrete. A minimum 1 in. vertical surface shall remain, or be cut, 1 in. outside and around the entire periphery of each removal area after removal of all loose and unsound concrete.

(b) Cleaning

After the concrete removal operation is completed and just prior to placing the patches or the overlay, the entire deck shall be heavily sandblasted to expose fine and coarse aggregates and to remove unsound concrete or laitance layers from the surface. Exposed reinforcing bars and the concrete under and around the exposed bars shall be thoroughly cleaned by sandblasting. The surface shall be then cleaned free of all dust, chips, water, and foreign material to the extent necessary to produce a firm, solid surface for adherence of the new concrete. The air lines for sandblasting and air cleaning shall be equipped with oil traps.

722.06 Patching of the Bridge Floor

A vacuum device shall be used to remove all water from the prepared cavities.

(a) Full Depth Patching

The material used for full depth patching shall be either bridge deck patching concrete or latex modified concrete. Full depth patching shall be performed prior to the overlay operation unless otherwise requested and approved. The patching material shall be consolidated by internal vibration at the time of placement. Equipment shall not be operated on the repaired deck areas until the test beams indicate a minimum modulus of rupture of 550 psi. Curing of the patch shall be as directed.

1. Patching with Bridge Deck Patching Concrete

Epoxy resin adhesive shall be used to coat the surfaces of the prepared cavities and all the exposed reinforcement within the cavities. The epoxy coating shall be tacky at the time that the patching concrete is placed. If the epoxy coating has cured beyond the obvious tacky condition, it shall be re-applied prior to patching. The coated cavities shall then be filled with the patching concrete to the level of the adjacent deck surface.

2. Patching with Latex Modified Concrete

The surfaces of the prepared cavities shall be coated with a bond coat in accordance with 722.09. The cavities shall then be filled with the latex modified concrete to the level of the adjacent deck surface.

(b) Partial Depth Patching

The material used for partial depth patching shall be either bridge deck patching concrete or latex modified concrete. The patching material shall be consolidated by internal vibration at the time of placement. Curing of the patch shall be as directed.

1. Patching with Bridge Deck Patching Concrete

Partial depth patching with bridge deck patching concrete shall be in accordance with 722.06(a) and 722.06(a)1.

2. Patching with Latex Modified Concrete

The surfaces of the prepared cavities shall be coated with a bond coat in accordance with 722.09. The cavities shall then be filled with the latex modified concrete at the time that the overlay is placed.

722.07 Overlay Dam

An overlay dam shall consist of the removal of existing concrete from the bridge floor and replacing it with new concrete as shown on the plans or as otherwise directed. Overlay dam material shall be in accordance with 722.04.

The existing concrete shall be removed as required in accordance with 722.05(a). Exposed reinforcement shall not be cut or otherwise damaged.

Power driven hand tools for removal by handchipping will be allowed. Pneumatic hammers with a maximum weight of 69 lbs may be used for the tops of mudwalls. If, during the removal process, the tools or methods being used appear to cause damage such as cracks or spalling on the concrete which is to remain, the work shall cease immediately and shall not resume until the Engineer is assured the tools or methods being used will not cause further damage.

The surface to be repaired, the reinforcing bars, and the concrete under and around the bars shall be thoroughly cleaned in accordance with 722.05(b). The cavity shall be epoxy coated in accordance with 722.06(a)1 then filled with class A concrete in accordance with 702.

722.08 Mixing

Proportioning and mixing of the latex modified concrete shall be performed in a self-contained, self-propelled continuous mixer. The mixer shall be calibrated to accurately proportion the specified mix prior to starting the work. The calibration shall be in accordance with 722.12. Sufficient mixing capacity or mixers shall be provided to enable the intended pour to be placed without interruption. The mixer shall carry sufficient quantities of unmixed ingredients to produce at least 6 cu yd of latex modified concrete at the site.

The mixer shall measure and control the flow of ingredients being introduced into the mix and shall record these quantities on an approved visible recording meter equipped with a ticket printer. Water flow shall be readily adjustable to compensate for minor variations in aggregate moisture content, and shall be displayed by an approved flow meter. The flow of the latex modifier shall also be displayed by an approved flow meter. The manufacturer's inspection plate shall clearly show the serial number, proper operating revolutions per minute, and the approximate number of counts on the cement meter to deliver 94 lbs of cement.

The mixer shall automatically proportion and blend simultaneously all the ingredients of the specified mix on a continuous or intermittent basis as required by the finishing operation. The latex modified concrete shall be discharged through a conventional chute directly in front of the finishing machine. The surface ahead of the deposited mixture shall be kept damp by spraying it with water. If the water is applied by the mixer, it shall be dispensed ahead of the water flow meter.

722.09 Placing and Finishing

Existing expansion joints shall be maintained throughout the overlayment. A bulkhead, equal in thickness to the joint width, shall be installed to the required grade and profile prior to placing the overlay. Screed rails for the finishing machine shall be placed to the required profile, and stably anchored vertically and horizontally. Screed rails shall not be treated with a bond breaking compound.

The overlay shall not be placed unless the ambient temperature is 45°F and rising, unless otherwise approved in writing. Placement may be required during early morning hours, at night, or during other limited work periods if the prevailing daytime temperature exceeds 85°F. The overlay shall not be placed if rain is expected. Adequate precautions shall be taken to protect freshly placed overlay material from sudden or unexpected rain. Damaged material shall be removed and replaced with no additional payment. A construction dam or bulkhead shall be installed in case of a delay in placement of 1 h or more. During delays of less than 1 h, the end of the placed overlay material shall be protected from drying with layers of wet burlap.

After the surface has been cleaned, and immediately before placing the overlay material, the surface shall be thoroughly soaked for a period of 1 h. The surface shall

not be allowed to dry before placing the overlay material and there shall be no standing water at the time of placement. The surface shall then be thoroughly and evenly coated with a brush applied bond coat of latex modified concrete. The progress of the bond coat application shall be controlled to ensure that the bond coat does not dry before the overlay is placed to the required grade. Aggregate segregated in the brush application of the bond coat shall be removed before the overlay is placed. Surface irregularities shall be filled to approximately three-quarters of their depth sufficiently ahead of the overlay operation to allow the material to stiffen and resist rolling back during the finishing.

Following the bond coat application and partial filling of any surface irregularities, the latex modified concrete overlay shall be placed to an elevation approximately 1/2 in. above final grade. The mix shall then be consolidated and machine finished to the required grade. The machine finishing shall be to within 12 in. of the curb line or coping line unless otherwise directed. Supplemental hand finishing with a wood float shall be performed as needed to produce the required tight, uniform surface.

The finishing machine shall be self-propelled and capable of positively controlled forward and reverse motion. The machine shall be equipped with at least two finishing devices. The first finishing device shall be a vibrating mechanism, such as a vibrating pan, for consolidating the deposited mix. The vibrating pan shall be metal and of sufficient dimensions to ensure proper consolidation. The second finishing device shall be either a rotating cylindrical drum, at least 45 in. in length, or a vibrating oscillating metal faced screed of 4 in. minimum in width. The vertical position of the finishing devices shall be positively controlled and the devices shall be raised clear of the finished surface when the machine is operated in the reverse direction. The vibration frequency of any vibrating finishing device shall be variable, with positive control between 3,000 and 6,000 vibrations per minute. Alternate finishing machines may be considered for approval subject to a written request.

Screed rails and construction dams shall be separated from the newly finished overlay by passing a pointing trowel along the rail-to-overlay and dam-to-overlay interfaces after the overlay has sufficiently set such that it does not flow back. This trowel cut shall be made for the entire length and depth of the rail or dam. The rails may be removed anytime after the overlay has initially set. Adequate precautions shall be taken during and subsequent to the rail removal to protect the edge of the new overlay from damage. The finished surface shall be in accordance with 504.03.

722.10 Texturing

Immediately after the finishing is complete and before the surface film has formed, the surface of the overlay shall be textured by transverse grooving. The grooves may be formed by mechanized equipment using a vibrating beam roller, a series of discs or other approved device. Manual tools such as fluted floats, spring steel tined rakes, or finned floats with a single row of fins may be used. The grooves shall be relatively uniform and smooth and shall be formed without tearing the

surface or bringing coarse aggregate to the top. The grooves shall be in accordance with 504.03. The grooves shall be terminated approximately 18 in. from vertical faces such as curbs and concrete railing.

All areas of hardened grooved overlay which do not conform to these requirements due to either a deficiency in the grooving or a rough open textured surface shall be corrected with no additional payment. Corrections shall be made by cutting transverse grooves in the hardened overlay with an approved cutting machine or by sealing with an approved mixture and retexturing to a satisfactory finish as directed.

722.11 Curing

When fly ash is used, the requirement for additional wet or dry curing time will be determined based on the relative initial, and final time of set and a comparison of strength versus age using control concrete strengths at conventional cure period ages as the reference. Unless otherwise directed, 702.22 shall apply except that the membrane forming curing compound shall not be used to cure the bridge deck overlay.

The minimum curing shall be 24 h of wet cure followed by 72 h of dry cure. An overlaid bridge deck may be opened to traffic during the minimum curing duration when the compressive strength of test cylinders is 4,000 psi or greater. The strength requirements, and the making and curing of the cylinders, shall be in accordance with 702.24. After texturing, the plastic film which forms on the surface of the overlay shall be protected from shrinkage cracking with a single layer of well drained wet burlap. This layer of wet burlap shall be placed as soon as the overlay surface will support it without deformation. Approximately 1 h after placing the first layer of wet burlap, a second layer shall be placed and the entire covering shall be maintained in a wet condition for a minimum of 24 h. Polyethylene film may be used in lieu of the second layer of wet burlap. If the polyethylene film is used for the second covering, then the burlap already in place shall be wetted just before placing the polyethylene film and shall be maintained in a wet condition. After the 24 h elapse, all layers of covering material shall be removed.

If the ambient temperature falls below 50°F during either the wet or dry curing periods, the time that the temperature is below 50°F shall not be considered as part of the total 96 h curing period. If there is sufficient rain to wet the surface of the overlay for 1 h or more during the dry cure period, this number of hours shall not be considered as part of the 72 h dry cure period.

Immediately upon the start of the dry cure period, the surface shall be checked for cracks. If cracks exist, a thorough investigation will be conducted prior to sealing cracks. Cores may be required to determine the actual crack depth. Surface cracks not exceeding 3/8 in. in depth shall be 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.

Alternate methods of surface crack sealing may be used if approved. Cracks exceeding 3/8 in. in depth shall not be sealed at this time. Corrective procedures for repairing cracks exceeding 3/8 in. in depth will be determined after further investigation which may include additional cores. The method of repair shall be as directed in writing and may include removal and replacement or complete filling with an approved sealer/healer and a sand application on the surface. The Department will maintain a list of approved Sealer/Healers.

If it is determined by sounding or coring that adequate bonding between the overlay and the bridge deck has not been attained, the deficient areas shall be removed and replaced as directed.

722.12 Calibration of Continuous Mixers

(a) Frequency

A complete calibration shall be performed for each mixer prior to each pour unless the initial calibration was made within the previous 10 calendar days. A mixer that has been calibrated within the previous 10 calendar days may be approved for use providing that the mixer operator is in possession of the completed, signed, certified and dated Department calibration form for that mixer. A complete calibration of a mixer may be required at any time as directed. All mixers which are calibrated within the 10 day limit but are changing aggregate sources shall have an aggregate blend test performed.

(b) Equipment

All special equipment required for calibration shall be furnished. It shall include but not be limited to suitable material containers, buckets, stop watches and a set of balance beam platform scales graduated in at least 1/4 lb intervals with a minimum capacity of 500 lbs. Samples shall be obtained and handled by the Contractor. Normal testing equipment such as aggregate sieves and containers shall also be furnished.

(c) Pre-calibration

The aggregate bin shall be clean and the bin vibrators shall be in good working order. The mixer shall be equipped with a grounding strap. The cement meter feeder, the fins and all pockets shall be clean and free of any accumulated cement. The aeration system shall be equipped with a gauge or indicator to verify that the system is operating. The main belts and the latex strainer shall be clean and free of any accumulated material.

(d) Calibration

1. Cement Meter

The mixer manufacturer’s mix setting chart shall determine the specified operating revolutions per minute and the approximate number of counts required on

the cement meter to deliver 94 lbs of cement. At least 3,760 lbs of cement shall be placed in the cement bin.

The mixing unit shall rest on a level surface. The engine throttle shall be adjusted to obtain the required revolutions per minute. The unit discharging the cement shall be operated until the belt has made one complete revolution. It shall then be stopped and the cement meter shall be reset to zero.

A suitable container shall be positioned to catch the cement and at least 90 lbs of cement shall be discharged. The time required to discharge the cement shall be measured with a stop watch, the number of counts on the cement meter shall be recorded, and the weight of the discharged cement shall be determined. This process shall be repeated a total of three times. The cement counter shall be reset to zero before each repetition.

The following formulas shall be used to calculate the number of counts per 94 lbs of cement and the time required to discharge 94 lbs of cement.

$$94 \div \frac{A}{B} = \text{Counts per 94 lbs of cement}$$

$$94 \div \frac{A}{C} = \text{Time in seconds per 94 lbs of cement}$$

A = Total weight of cement in pounds for three trials
B = Total number of counts on the cement meter for three trials
C = Total time in seconds for three trials.

2. Water Flow Meter

The accuracy of the water flow meter shall be verified by adjusting the flow to 2 gal. per minute. With the equipment operating at the required revolutions per minute, the water discharged during a one minute interval shall be collected and weighed. The weight in pounds of the discharged water shall be divided by 8.33 to determine the number of gallons. This procedure shall be repeated with the flow meter adjusted to 3 gal. per minute.

3. Aggregate Bin Gates

The gate opening shall be adjusted to provide the required amount of aggregate to produce a cubic yard of the designated mix. The ratio of fine aggregate to total aggregate shall be verified by stopping the cement discharge and collecting the aggregate discharged in a container. A representative sample of the discharged aggregate shall be selected and separated on a No. 4 (4.75 mm) sieve. The fine aggregate will be considered as the amount passing the No. 4 (4.75 mm) sieve. The percentage shall be computed on a dry weight basis.

4. Latex Throttling Valve

The latex strainer shall be unobstructed. The latex throttling valve shall be adjusted to deliver the required amount of latex emulsion admixture for each 94 lbs of cement. With the unit operating at the required revolutions per minute for the calculated time in seconds per 94 lbs of cement, the latex shall be discharged into a container. The weight of the latex shall be determined and, if necessary, the valve shall be adjusted such that the amount of latex discharged is within 1/2 lb of the amount required for each 94 lbs of cement. One verification shall be performed to check the accuracy of the valve setting.

5. Admixture Dispensers

This equipment shall be calibrated in accordance with the manufacturer's instructions for the specific materials and quantities involved.

722.13 Patching an Existing Bridge Deck Overlay

(a) Materials

Materials shall be in accordance with 722.02.

(b) Storage and Handling of Materials

Storage and handling of materials shall be in accordance with 722.03.

(c) Proportioning

Proportioning shall be in accordance with 722.04.

(d) Preparation of the Bridge Floor

Preparation of the bridge floor shall be in accordance with the applicable provisions of 722.05.

(e) Patching

Patching shall be in accordance with 722.06 except as modified herein. If no new overlay is planned, bridge deck patching concrete used in patching the bridge floor shall be placed to the level of the original deck. The remainder of each cavity shall be patched with the same material as the existing overlay.

(f) Mixing

Mixing shall be in accordance with the applicable provisions of 722.08.

(g) Placing and Finishing

Placing and finishing shall be in accordance with the applicable provisions of 722.09. Machine finishing shall be required when directed.

(h) Texturing

Texturing shall be in accordance with 722.10. In addition, the surface texturing shall match the pattern of the adjacent overlay.

(i) Curing

Curing shall be in accordance with 722.11.

(j) Calibration of Continuous Mixers

Calibration shall be in accordance with 722.12.

722.14 Method of Measurement

Surface milling will be measured by the square yard for the initial 1/4 in. depth. Additional surface removal required below the initial 1/4 in. depth will be measured by the square yard for each required 1/4 in. depth. Only the portion of the bridge deck which is to remain in place will be measured for payment. The undefined areas requiring full depth deck removal will be measured for payment. The areas of the bridge floor which are shown on the plans to be removed will not be measured for payment.

Full depth patching will be measured by the square foot. The patching material used in full depth patching will not be measured for payment.

Partial depth patching will be measured by the square foot. The measurement of bridge deck patching concrete used in partial depth patching will be based on a theoretical quantity determined by multiplying the area of the appropriate partial depth patches by an assumed average depth of 2 in. and converting the resulting volume into cubic yards. Overlay material used in partial depth patching will be measured by the cubic yard. The quantities of patching material used in partial depth patching will be included in the measurement of additional bridge deck overlay.

Overlay material used to fill surface irregularities will be measured by the cubic yard. Such quantity will be included in the measurement of additional bridge deck overlay.

Bridge deck overlay will be measured by the square yard for the specified thickness. If there is no specified thickness shown on the plans, the specified thickness shall be 1 3/4 in.

Overlay dams and patching an existing overlay will be measured by the square foot.

Epoxy resin adhesive and bond coat will not be measured for payment. Blasting, cleaning, finishing, texturing, and curing will not be measured for payment.

722.15 Basis of Payment

Milling of the initial 1/4 in. depth of surface will be paid for at the contract unit price per square yard for surface milling. Additional surface removal below the initial 1/4 in. depth will be paid for at the contract unit price per square yard for surface milling for each required 1/4 in. depth.

Full depth patching will be paid for at the contract unit price per square foot for bridge deck patching, full depth.

Partial depth patching will be paid for at the contract unit price per square foot for bridge deck patching, partial depth.

Prepared partial depth cavities exceeding 2 in. in average depth, which are subsequently directed to be made full depth, will be paid for at the contract unit price per square foot for bridge deck patching, partial depth. Additional payment will be made at 80% of the contract unit price per square foot for bridge deck patching, full depth.

Prepared partial depth cavities of 2 in. or less in average depth, which are subsequently directed to be made full depth, will be paid for at the contract unit price per square foot for bridge deck patching, full depth.

Patching material used for partial depth patching will be paid for at the contract unit price of $550 per cubic yard for bridge deck overlay, additional.

Overlay material used to fill surface irregularities will be paid for at the contract unit price of $550 per cubic yard for bridge deck overlay, additional.

Bridge deck overlay will be paid for at the contract unit price per square yard.

Patching an existing bridge deck overlay will be paid for at the contract unit price per square foot for bridge deck overlay patching.

Overlay dam will be paid for at the contract unit price per square foot, complete in place.

Payment will be made under:

Pay Item	**Pay Unit Symbol**
Bridge Deck Overlay	SYS
Bridge Deck Overlay, Additional	CYS
Bridge Deck Overlay, Patching	SFT
Bridge Deck Patching, Full Depth	SFT
Bridge Deck Patching, Partial Depth	SFT
Overlay Dam	SFT
Surface Milling	SYS

The cost of milling, handchipping, removing debris and water, and necessary incidentals shall be included in the cost of surface milling.

The cost of removal of unsound concrete, preparation of cavity surfaces, furnishing and applying bond coat or epoxy resin adhesive as required, furnishing and placing patching material, and necessary incidentals shall be included in the cost of bridge deck patching, full depth, or bridge deck patching, partial depth.

The cost of patching material used for full depth patching shall be included in the cost of bridge deck patching, full depth.

The cost of furnishing and placing patching material and necessary incidentals shall be included in the cost of bridge deck overlay, additional.

The cost of removing the existing concrete; furnishing, hauling, and placing all materials including the epoxy; preparing the surface; and all necessary incidentals shall be included in the cost of overlay dam.

The cost of blasting, cleaning, furnishing, and applying epoxy resin adhesive or bond coat shall be included in the cost of other pay items.

Coring of the bridge deck, patching core holes, and all corrective measures required in accordance with 722.11 shall be performed with no additional payment.

The cost of bond coat, furnishing and placing the overlay material, and necessary incidentals shall be included in the cost of bridge deck overlay or bridge deck overlay patching.

SECTION 723 – REINFORCED CONCRETE THREE-SIDED STRUCTURES

723.01 Description

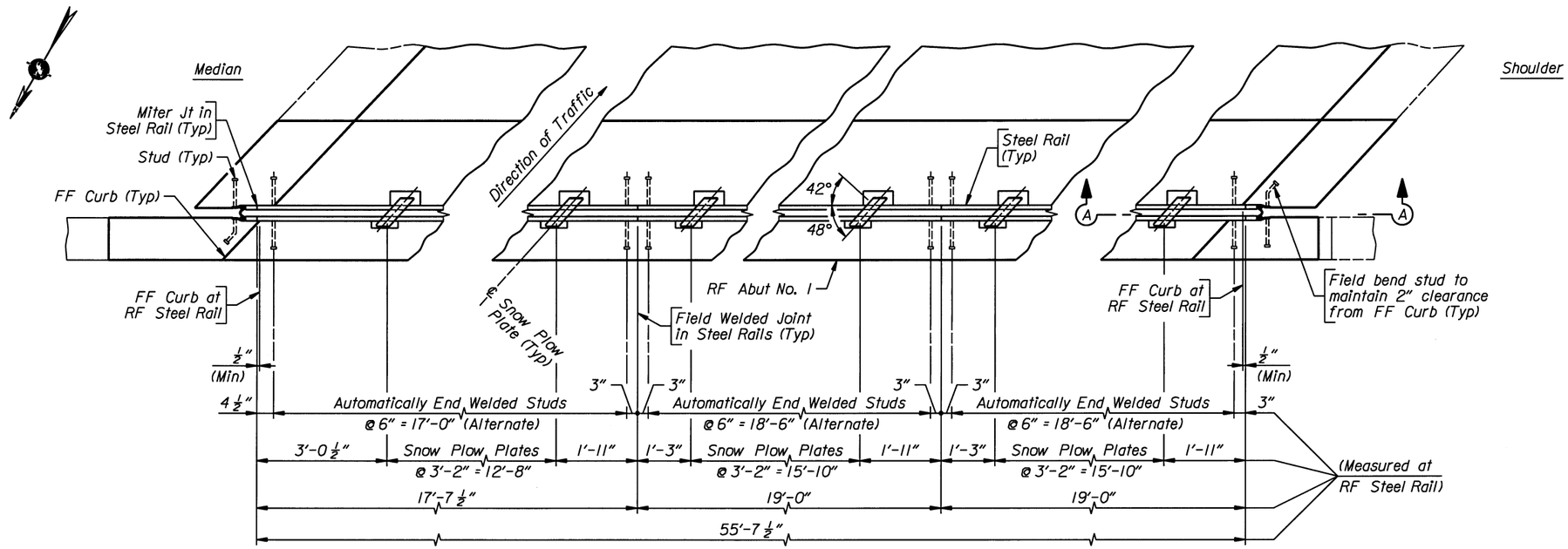
This work shall consist of constructing a reinforced concrete three-sided arch-topped structure or structure extension with headwalls and wingwalls, a reinforced concrete three-sided flat-topped structure or structure extension with headwalls and wingwalls, or a reinforced concrete true arch shape structure or structure extension with spandrel walls and wingwalls in accordance with 105.03. The reinforced concrete three-sided structure, structure extension, headwalls, wingwalls, footings, and spandrel walls may be precast or cast-in-place.

The Contractor will be allowed to substitute a box structure in accordance with 714. The box structure shall be of equivalent hydraulic capacity to that of the three-sided structure shown on the plans. The structure shall be sumped as shown on the plans.

MATERIALS

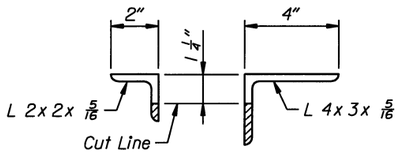
723.02 Materials

Materials shall be in accordance with the following:

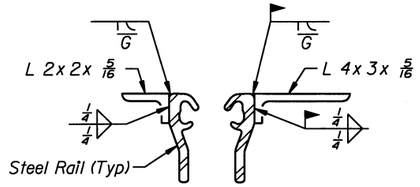


PLAN - ABUTMENT NO. 1

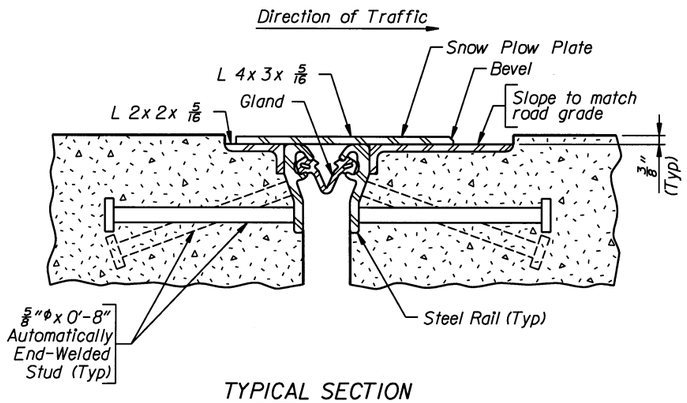
(Dimensions are horizontal and include no correction for grade and cross slope)



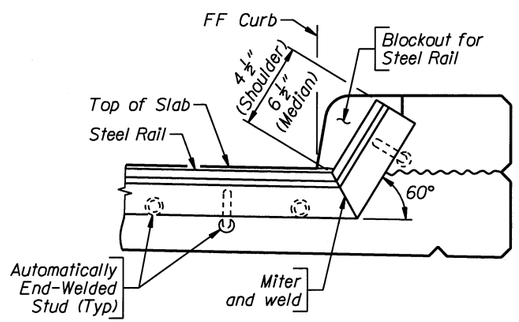
ANGLE CUT DETAIL



ANGLE WELD DETAIL



TYPICAL SECTION



VIEW A-A

(Typical each slab curb, abutment curbs similar)
(Gland not shown)

Note: 1) Ensure the expansion device fabricator includes additional length in steel rails to account for grade, slope and variances in actual conditions. Field cut steel rails for proper fit in accordance with the fabricator's recommendations.
2) For Snow Plow Plate Detail and Snow Plow Plate Assembly Detail, see Sheet No. 25.

RM 96.44 (SBL)

WYOMING DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM

REVISIONS

EXPANSION DEVICE DETAILS
BRIDGE REHABILITATIONS
VARIOUS LOCATIONS
Dwyer Jct. - Glendo
El Rancho Rd. North Sect. - SBL
0252153 PI

APPROVED
DATE

DESIGN — ✓ —
DETAIL DER ✓ WES
O'S. DER ✓ RKB

Design Section J R Booher
Drwg. No. 7531 Sheet 24 of 59

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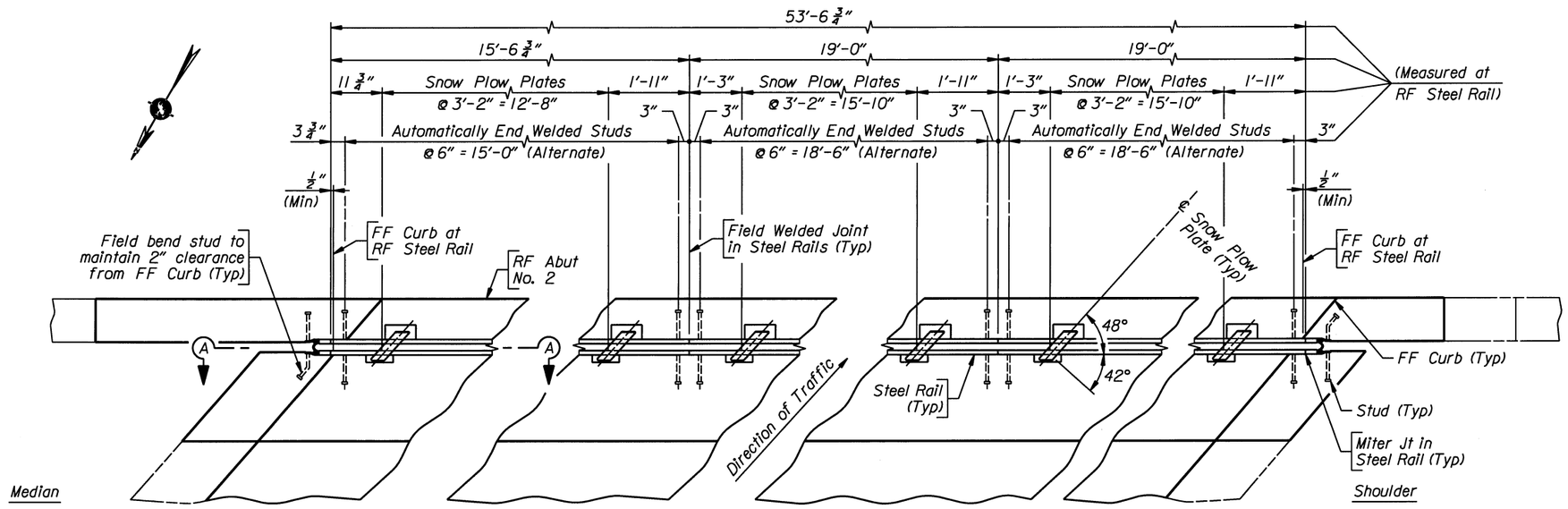
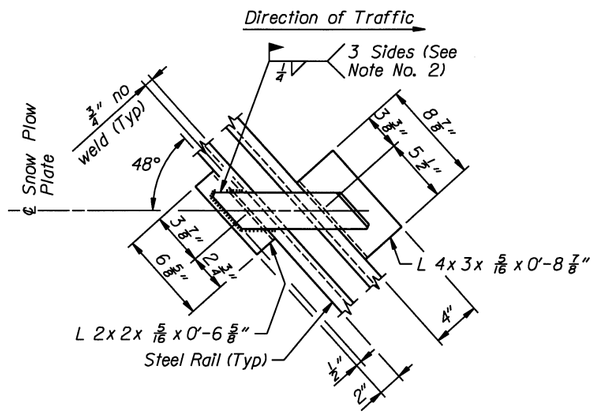
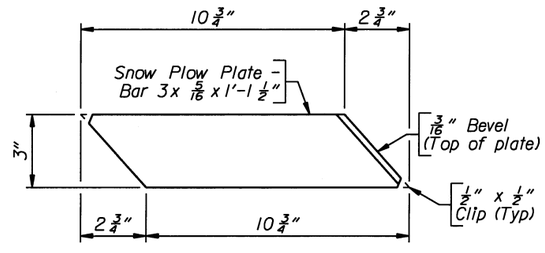


PLAN - ABUTMENT NO. 2

(Dimensions are horizontal and include no correction for grade and cross slope)



SNOW PLOW PLATE ASSEMBLY DETAIL



SNOW PLOW PLATE DETAIL

Note: 1) Ensure the expansion device fabricator includes additional length in steel rails to account for grade, slope and variances in actual conditions. Field cut steel rails for proper fit in accordance with the fabricator's recommendations.
2) Do not warp snow plow plates or damage gland during welding. Do not exceed 150° F preheat temperature.
3) For View A-A, see Sheet No. 24.

RM 96.44 (SBL)

WYOMING DEPARTMENT OF TRANSPORTATION
BRIDGE PROGRAM

REVISIONS

EXPANSION DEVICE DETAILS
BRIDGE REHABILITATIONS
VARIOUS LOCATIONS
Dwyer Jct. - Glendo
El Rancho Rd. North Sect. - SBL
0252153 PI

APPROVED
DATE

DESIGN — ✓ —
DETAIL DER ✓ WES
O'S. DER ✓ RKB

Design Section J R Booher
Drwg. No. 7531 | Sheet 25 of 59

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