INDIANA DEPARTMENT OF TRANSPORTATION

100 North Senate Avenue
Room N925 CM
Indianapolis, Indiana 46204

PHONE: (317) 232-5502
FAX: (317) 232-5551

Eric Holcomb, Governor
Joe McGuinness, Commissioner

September 11, 2019

CONSTRUCTION MEMORANDUM
19-09

TO: District Deputy Commissioners
District Construction Directors
District Technical Services Directors
District Area Engineers
District Project Management Director
Project Management Director
District LPA Coordinators
Project Engineers/Supervisors
Field Engineers

FROM: Gregory G. Pankow, P.E., Director
Division of Construction Management and District Support

SUBJECT: Guidelines for Setting Contract Time

SUPERSEDES: Construction Memorandum 97-27

The purpose of this memorandum is to offer guidance in regards to evaluating and setting contract time. Setting contract time involves accounting for an array of precedence setting considerations. This memorandum outlines the importance of each consideration along with providing some general assumptions for time sets.

1. **Plan Review and Field Visit.** A Review of the plans and contract provisions can provide the following project parameters:
   - Major pay items and what construction activities relate to them.
   - Physical length of construction limits, along with afflicting bridges.
   - Distinctive traffic features within urban or rural areas.
   - Any unique features or circumstances defined in the contract provisions.

   Furthermore, a field visit should be performed to get a feel for the extent of the work and what features might impact construction.

2. **Commitments.** Commitments are made by other entities to complete contract work, restrict lanes, or open a road by a certain time. Other commitments might be Department related and should be determined on how adjacent contracts, existing or future, any detours, restrictions, or access may affect this contract.

3. **Controlling Operation.** The controlling operation is the longest continuous chain of activities through the schedule that establishes the minimum overall contract duration. Decide if contract can be completed in one or two construction seasons. Consider how the letting date may affect the controlling operations, starting times, completion times, etc.

4. **Production Work Day Calculation**. Using the schedule of pay items, determine when each item can be constructed. Certain items control other items while some items can be done simultaneously. Mean production data for most controlling items can be used to calculate work days utilizing contract quantities (see APPENDIX B). Using the attached charts (see APPENDIX C), the total calculated work days from the controlling operation can be applied to the month in which the Notice to Proceed (NTP) was issued. A completion date can be determined by the row at which the total work days in that column was accomplished. A spreadsheet was created (Contract Time-Set Worksheet) that will automate this process and will be posted on the INDOT Construction Information website. APPENDIX E explains how the spreadsheet works and how to use it. There is also a time-set example using the Contract Time-Set Worksheet. APPENDIX F includes an a few examples for setting time on bridge contracts.

5. **Regression Work Day Calculation** can be used to calculate the amount of total workdays and hence completion date using total construction cost. Construction costs can be used as a common basis to compare construction durations because it directly reflects the amount of construction work. APPENDIX B shows the relationship between construction cost and type of construction project with a linear or non-linear regression equation. Select the contract type and insert the original contract amount into the Contract Time-Set Worksheet, and it will produce an approximate amount of work days for completion. With a given NTP, an approximate contract completion date will be determined.

6. **Interstate Highway Congestion Policy (IHCP).** The IHCP greatly affects time-sets on interstate contracts. Depending on the location, a certain amount of lanes at specific times will be allowed for closure. These restrictions can be modified but requires a Policy Exception such as full closures in extreme cases. Oftentimes lane restrictions are only allowed during nighttime hours. While this should be detailed in the Maintenance of Traffic (MOT) plans and contract documents, the time set will need to be adjusted because nighttime work is not as efficient or productive as day-time work.

7. **Full Closures.** Work performed within full closures is generally safer for workers and the traveling public. The quality and efficiency of the work should also be higher. Local viable detour routes must be available for the closed route. The viable detour route should be reviewed for conflicts with other contracts in the area.

8. **Local Factors.** How are schools, businesses, local festivals, farmers, rush hour traffic, other contracts in the area, etc., affected by the contract?

9. **Right of Way (R/W).** The anticipated clearance dates of the various parcels should be listed in the contract documents. The completion date should factor these clearance date with the contract letting and contract duration. On contracts let with parcels that have not been cleared, research the location of the parcels in question and decide how those affect the controlling operation. Additional time may be needed for either the contract itself or for an adjusted letting date.

10. **Utilities.** The utility information provided within the contract documents should indicate when utilities anticipate completion of their relocations. This information is typically provided by the Utility Coordinator. Communication with the Utility Coordinator will help identify if any relocations could be at risk. Some utilities may take all season to move and the time-set should be adjusted accordingly. On larger contracts, the utility can often be localized. Intermediate dates or delayed starts on these localized areas of the contract may help mitigate impact and expectations at time of bid.

11. **Completion Date Balancing.** Setting Completion or Intermediate Dates all at the same time in an area or district especially in the month of November can cause conflicts. It is in all parties' best interest that all work be spread out during the entire construction season. Excusable delays that occur during the construction season may potentially extend the completion date to the month of April the following year. This could lead to additional costs in escalation and overhead. Also, many operations that typically occur at the end of a contract can be weather sensitive such as pavement markings. Scheduling for specialty crews can be problematic if they are needed all in the same month.

12. **Expected Work Start.** The NTP on average is issued 30 days after letting. LPA contracts often take up to 60 days to issue the NTP after letting. Work is expected to start 15 days after NTP (Work day contracts). The Standard Specifications (*see* section 108.08) state, "For the purpose of computation, work days will be considered as beginning on the fifteenth calendar day after the date of the notice to proceed." All contract time is expected to be used, but it may not be reasonable to start for a couple of weeks.

13. **Lead Time.** Some contracts have items involving specific materials that takes considerable time to obtain. The following delivery time estimations should be considered for lead times.
    - Mast arm poles, strain poles, and high-mast poles is about 10 to 12 weeks.
    - Structural steel members (minimum 3 months).
    - Concrete structural members (about 2 months).
    - Bearing pads (about 3 months).
    - MSE wall, sound barriers, pipe orders, and other large materials.
    - Lighting and associated work (LPA decorative lighting can involve excessive lead times).

14. **Environmental Considerations.** There are several environmental concerns to consider at certain periods of the year that can affect certain construction operations.
    - Swallows (Bird Migratory Act) April 7 - September 8.
    - Adjust for Indiana Bat - no clearing between April 1 and September 30.
    - Fish Spawn - no in-channel excavations between April 1 and June 30.
    - Waterway permits obtained after letting can take several weeks to months. Therefore they should be addressed when time is set for a contract.

15. **Weather sensitive** materials should be considered when setting completion dates later in the construction season.
    - Account for late season pavement markings:
        - Traffic Paint - ambient air/pavement temperature must be 40ºF and remain there for 2 hours.

- Thermoplastic - ambient air/pavement temperature must be 50ºF.
- Preformed Plastic-Inlay - no minimum temperature, ambient temperature must be 60ºF. Pavement temperature must be 70ºF.
- Multi-Component - ambient air/pavement temperature must be above 40ºF.
- RPM's - ambient air/pavement temperature must be 50ºF.

- Construction activity considerations:

  - Polymeric Concrete Bridge Deck Overlays - deck temperature is between 50°F and 100°F, relative humidity < 75%.
  - Latex Modified Concrete Bridge Deck Overlays – ambient temperature is 45°F and rising.
  - Seal Coat - Cannot be applied before May 1st or after October 1st; ambient or pavement temperature must be greater than 60°F.
  - Fog Seal - Cannot be applied before May 1st or after October 1st; ambient or pavement temperature must be greater than 60°F.
  - Bridge Painting - Cannot be done between November 15th and April 1st; above 50°F, and the steel surface temperature is between 50°F and 100°F.
  - Planting season is from September 1st through May 25th
    - Planting trees from October 1st to April 15th
    - Crown Vetch plants and seedlings between April 15th and May 30th
    - Bare Root Seedlings for Wildlife Habitats from October 1st to April 30th.

16. **Notice of Termination (NOT)**. It is often difficult to achieve proper establishment of vegetation in the first seeding season. In most cases, vegetation is established with a second season of growing. An intermediate completion date is normally set in the fall for Substantial Completion with the expectation of the initial seeding application on all disturbed areas. The Contract Completion Date should be set in late next spring to capture the full second growing season. Warranty bond for seeding shall be posted from October 15 through January 31. Mulch must be used from May 1 through August 15. These two date ranges indicate poor growing conditions. Adjust time-set expectations accordingly.

17. **Earliest Date to Start Work**. Because of the construction staffing, certain holidays, or other influencing factors, some contracts can require delayed starting times specified in the contract provisions. Delayed starting times are normally used on resurface or maintenance type contracts but they might be considered for other types of contracts. If possible, a contract time-set may want to consider starting after a major holiday or typical local school session. Multiple early start dates can be used if desired for specific projects within a contract.

18. **Intermediate Completion Dates (ICD).** Intermediate times can address the restrictions on roads, bridges, entrances, ramps, etc., to be returned to normal use by certain times. Calendar day closures will set an expectation for the contract and public for how long the work should affect the availability of affected routes.

19. **Bundled Contracts** contain multiple projects often separated by location. It can be difficult to set-time for these contracts because we cannot always anticipate the means and methods a

contractor chooses to complete a contract. Using multiple Intermediate Completion Dates (Calendar Days/Closure Days) for each project or separate location is highly recommended. Typically each project or location is not necessarily related on the critical path. Delays to one project will not affect the work on another project. This will also promote continuous work on a project or location once it starts.

20. **A+B or Incentive/Disincentive.** Once contract time is established, an incentive/disincentive (A+B) clause might be considered. Incentive/disincentive is used to minimize the time that a facility may be affected by construction. The contractor is provided additional funds if the project is completed early, or is assessed damages if the project is not completed on time. Due to administrative concerns of implementing this concept, limit incentive/disincentive to a project that has one or more of the characteristics as follows:

    a) High traffic volume occurs in an urban area;
    b) It completes a gap in the highway facility;
    c) It severely disrupts traffic or highway services;
    d) It significantly increases road user's costs;
    e) It significantly impacts adjacent neighborhoods or businesses;
    f) It replaces a major bridge that is out of service; or
    g) It includes lengthy detours.

21. **Other Considerations.** Be lenient when possible but tight when necessary. The more you can encourage additional bidders, the better potential for lower bid prices. Furthermore, if a contract does not sell or many revisions are added, the contract time should be reconsidered too. Setting too much time can often impact the traveling public for an extended period of time. Also, periods of inactivity as a result from excessive contract time can negatively affect public perception and how the public respects our work zones. A calendar day restriction or ICD for a majority of the work with a set completion date later in the season can be an effective strategy to satisfy each concern. A calendar day completion will ensure that work will be continuous once it has commenced.

22. **Time-Set Documentation.** Lastly, keep your worksheets in a file for future reference. This can be useful when discussing expectations for executing work and communication with the field personnel and Contractor at the Pre-Construction Conference and Progress Meetings.

The above information and attached sheets are to serve as a guide only when setting contract time. It should always be kept in mind that because of the tremendous impact construction contracts have on traffic, particularly on high volume roads, the focus of our customer's (the traveling public) and worker's safety is of the utmost importance.

Any questions should be directed to your Construction Management Field Engineer.

GGP/ajp

APPENDIX A: TIME-SET CHECKLIST

NOTE: Checklist Item Details in memo 19-09

- ☐ Review plans and special provisions
- ☐ Determine if a commitment has been made by others to complete the contract, restrict lanes, or open road by a certain time
- ☐ Using the schedule of pay items in the proposal, determine the items for the controlling operation and calculate total workdays to complete contract. (Work week – assume 5 days for state and county; 6 days for interstate)
- ☐ Adjust for Interstate Congestion Policy. Investigate full closure viability
- ☐ Adjust for R/W Clearance Issues and Utility Relocations
- ☐ Adjust for Road Closures, Local Festivals, farmers, other contracts, businesses, etc.
- ☐ Consider early start times after major Holidays or bus routes and to force completion before a major Holiday or bus routes
- ☐ Avoid completion dates between November 1st and March 30th
- ☐ Avoid overlapping completion dates in area to aid balanced workload
- ☐ Swallows (Bird Migratory Act) April 7 - September 8
- ☐ Adjust for Indiana Bat - no clearing between April 1st and September 30th
- ☐ Fish Spawn- no in-channel excavations between April 1st and June 30th
- ☐ Adjust for Lead Time of Strain Poles, Structural Members or other large material orders
- ☐ Permit Restrictions
- ☐ Consider intermediate completion dates for certain roads, bridges, entrances, ramps, etc. to restore normal use by certain times. Bundled contracts should use multiple intermediate completion dates/calendar day. Consider A+B bidding or Incentive/Disincentives for special contracts involving high traffic volumes
- ☐ Account for Late Season Pavement Markings
- ☐ Weather Sensitive Materials
- ☐ NOT
    - Determine nearest preferred seeding month to Intermediate Completion Date and add 2-3 months to it. This will often extend into next season (mid-June).

APPENDIX B: DAILY PRODUCTION FOR DETERMINING WORKDAYS

NOTE: These rates are just a general or average guide to be used when setting time.
Large quantity items may increase these rates and small contracts may reduce them. Each project is unique and must be looked at closely prior to setting time.

ROADWAYS

CONSTRUCTION ACTIVITY	UNIT	Production Rate	Standard Deviation
Aggregate shoulder	TON	840	102
Backfill, Rock	TON	580	50
Barrier Delineator	EACH	20	2
Barrier Wall	TON	200	12
Box Culverts	LFT	50	1
Chain Link Fence	LFT	1330	225
Common Small Areas	CYS	520	106
Compacted Aggregate Base	TON	350	126
Compacted Aggregate for Shoulder	TON	490	159
Concrete Driveways	SYS	250	48
Construct Fill (MSE)	CYS	300	62
Contraction Joint	LFT	290	115
Crack and Seating Pavement	SYS	6580	526
Cracks, Transverse, Rout Clean and Seal	LFT	9180	5636
Curb and Gutter	LFT	330	464
Curb Ramp, Concrete	LFT	24	6
Curb, Intergral, C, Concrete	LFT	200	79
Demobilization	DAYS	1	0
Ditch or Channel	CYS	650	92
Drilled Holes	EACH	270	38
Electric Cable	LFT	2600	219
Embankment	CYS	2380	189
Erecting Handrail	LFT	80	3
Flowable Mortar	CYS	150	23
Gabions	CYS	80	17
Geotextiles	SYS	500	151
Geotextiles for Underdrain	SYS	150	28
Granular Backfill	CYS	330	46
Ground or Crushed Stone	TON	860	87
Guardrail	LFT	520	169
Guardrail, Reset	LFT	380	147

CONSTRUCTION ACTIVITY	UNIT	Production Rate	Standard Deviation
HMA Approaches	TON	230	111
HMA Base	TON	820	519
HMA Intermediate, Mainline	TON	1400	282
HMA Patching	TON	70	8
HMA Shoulders	TON	750	92
HMA Surface	TON	1060	113
HMA Surface, Mainline	TON	980	349
HMA w/ Fibers	TON	1840	776
HMA Wedge and Level	TON	530	273
HMA Widening	TON	940	366
Material Lead Time	DAYS	1	0
Mobilization	DAYS	1	0
MOT Change	DAYS	1	0
Paved Side Ditch	LFT	380	47
Pavement Markings*	LFT	7200	876
PCCP	SYS	2870	286
Pipes, Culvert	LFT	220	18
Pipes, Underdrains	LFT	1090	137
Retaining Walls (MSE)	SFT	250	36
Riprap	TON	240	134
Rubblizing Pavement	SYS	3200	227
Seal Coat	SYS	12030	6024
Sidewalk	SYS	1080	109
Signal Conduit	LFT	220	34
Slope Wall	SYS	50	7
Snowplowable Raised Pvmt Markings	EACH	150	50
Sodding	SYS	1020	1136
Soil Stabilization	CYS	4870	396
Storm sewers	LFT	200	19
Subbase	TON	860	169
Temporary Concete Barrier	LFT	2590	271

EXCAVATIONS

Common Small Areas	CYS	520	106
Drilled Holes	EACH	270	38
Compacted Aggregate Base	TON	350	126
Subballast	TONS	270	149
Rock (Excavation)	CYS	1130	139
Subgrade Treatment IC (Excavation)	CYS	1160	270
Unclassified (Excavation)	CYS	3460	305
Waterway (Excavation)	CYS	660	290

REMOVALS

Curb and Gutter	LFT	330	464
Footings	CYS	30	4
Piling, Bent	LFT	500	46
Sidewalk (Removal)	SYS	1690	80
Stump (Removal)	EACH	12	8
Other, Additional	DAYS	1	0
Top Soil (Removal)	CYS	380	29

BRIDGES

CONSTRUCTION ACTIVITY	UNIT	Production Rate	Standard Deviation	CONSTRUCTION ACTIVITY	UNIT	Production Rate	Standard Deviation
Beam Erection-Precast	LFT	400	38	Footings	CYS	30	4
Beam Erection-Steel	LFT	150	12	Parapet	LFT	100	16
Bent Cofferdams	SYS	300	35	Piling, Bent	LFT	500	46
Bridge Rail	LFT	600	86	Piling, Concrete	LFT	300	27
Concrete A Substructure	CYS	170	26	Piling, Steel	LFT	400	29
Concrete B Substructure	CYS	110	19	Piling, Timber	LFT	350	26
Concrete C Superstructure	CYS	80	11	Place Deck w/o Support Cutouts	CYS	150	18
Concrete Driveways	SYS	250	48	Reinforcement Bars (Substructure)	LBS	5000	473
Erecting Structural Steel	LBS	27500	2678	Reinforcing Steel	LBS	9220	1670
Expansion Bolts	EACH	27	2	Reinforcing Steel, Epoxy Coated	LBS	14780	2230

APPENDIX C: AVERAGE EXPECTED WORK DAYS PER MONTH (5 DAY WORK WEEK)

Medium & Heavy Grading (R,RS,M)

Distribution of Working Days by Months, Cumulative Total per Month

		Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
0	Jan												
0	Feb												
0	Mar												
4	Apr	4	4	4	4								
14	May	18	18	18	18	14							
16	Jun	34	34	34	34	30	16						
16	Jul	50	50	50	50	46	32	16					
18	Aug	68	68	68	68	64	50	34	18				
15	Sep	83	83	83	83	79	65	49	33	15			
16	Oct	99	99	99	99	95	81	65	49	31	16		
8	Nov	107	107	107	107	103	89	73	57	39	24	8	
0	Dec												
0	Jan												
0	Feb												
0	Mar												
4	Apr	111	111	111	111	107	93	77	61	43	28	12	4
14	May	125	125	125	125	121	107	91	75	57	42	26	18
16	Jun	141	141	141	141	137	123	107	91	73	58	42	34
16	Jul	157	157	157	157	153	139	123	107	89	74	58	50
18	Aug	175	175	175	175	171	157	141	125	107	92	76	68
15	Sep	190	190	190	190	186	172	156	140	122	107	91	83
16	Oct	206	206	206	206	202	188	172	156	138	123	107	99
8	Nov	214	214	214	214	210	196	180	164	146	131	115	107
0	Dec												
0	Jan												
0	Feb												
0	Mar												
4	Apr	218	218	218	218	214	200	184	168	150	135	119	111
14	May	232	232	232	232	228	214	198	182	164	149	133	125
16	Jun	248	248	248	248	244	230	214	198	180	165	149	141
16	Jul	264	264	264	264	260	246	230	214	196	181	165	157
18	Aug	282	282	282	282	278	264	248	232	214	199	183	175
15	Sep	297	297	297	297	293	279	263	247	229	214	198	190
16	Oct	313	313	313	313	309	295	279	263	245	230	214	206
8	Nov	321	321	321	321	317	303	287	271	253	238	222	214
0	Dec												

Bridge & Traffic (B,T)

Distribution of Working Days by Months, Cumulative Total per Month

		Jan											
0	Jan		Feb										
0	Feb			Mar									
0	Mar				Apr								
14	Apr	14	14	14	14	May							
17	May	31	31	31	31	17	Jun						
18	Jun	49	49	49	49	35	18	Jul					
19	Jul	68	68	68	68	54	37	19	Aug				
19	Aug	87	87	87	87	73	56	38	19	Sep			
16	Sep	103	103	103	103	89	72	54	35	16	Oct		
18	Oct	121	121	121	121	107	90	72	53	34	18	Nov	
15	Nov	136	136	136	136	122	105	87	68	49	33	15	Dec
0	Dec												
0	Jan												
0	Feb												
0	Mar												
14	Apr	150	150	150	150	136	119	101	82	63	47	29	14
17	May	167	167	167	167	153	136	118	99	80	64	46	31
18	Jun	185	185	185	185	171	154	136	117	98	82	64	49
19	Jul	204	204	204	204	190	173	155	136	117	101	83	68
19	Aug	223	223	223	223	209	192	174	155	136	120	102	87
16	Sep	239	239	239	239	225	208	190	171	152	136	118	103
18	Oct	257	257	257	257	243	226	208	189	170	154	136	121
15	Nov	272	272	272	272	258	241	223	204	185	169	151	136
0	Dec												
0	Jan												
0	Feb												
0	Mar												
14	Apr	286	286	286	286	272	255	237	218	199	183	165	150
17	May	303	303	303	303	289	272	254	235	216	200	182	167
18	Jun	321	321	321	321	307	290	272	253	234	218	200	185
19	Jul	340	340	340	340	326	309	291	272	253	237	219	204
19	Aug	359	359	359	359	345	328	310	291	272	256	238	223
16	Sep	375	375	375	375	361	344	326	307	288	272	254	239
18	Oct	393	393	393	393	379	362	344	325	306	290	272	257
15	Nov	408	408	408	408	394	377	359	340	321	305	287	272
0	Dec												

APPENDIX D: AVERAGE WORK DAYS PER CONTRACT WORK TYPE

Regression Equations for Contract Time

Project Type	Sample Size	Regression Equation	Correlation Coefficient
Asphalt Resurface	139	$Y = 3\times10^{-5}X + 23.291$	0.855
Bridge Painting	12	$Y=0.0164X^{0.7047}$	0.717
Bridge Rehabilitation (Deck Replacement)	28	$Y = 35.28Ln(X) - 360.64$	0.777
Bridge Rehabilitation (Superstructure Repair)	28	$Y = 26.67Ln(X) - 259.2$	0.691
Bridge Replacement (US)	14	$Y = 41.257Ln(X) - 445.28$	0.737
Bridge Replacement (SR)	32	$Y = 30.862Ln(X) - 310.53$	0.638
Bridge Replacement (CR)	30	$Y = 48.795Ln(X) - 537.95$	0.727
Intersection Improvement	18	$Y = 18.87761Ln(X) - 189.62836$	0.817
Mill and Asphalt Resurface	27	$Y = 3\times10^{-5}X + 19.894$	0.951
New Road Construction	9	$Y = 39.895Ln(X) - 455.48$	0.969
Pavement Rehabilitation	9	$Y = 1.2507X^{0.3108}$	0.738
Road Rehabilitation	20	$Y = 0.00001675X + 67.211$	0.794
Small Structure Replacement (US)	8	$Y = 0.0319X^{0.5866}$	0.841
Small Structure Replacement (SR)	20	$Y = 9\times10^{-5}X + 33.696$	0.737
Wedge and Level	29	$Y = 7\times10^{-5}X + 10.598$	0.818

Average Time-Sets across Indiana estimated by Area Engineers

Contract Type	Average Time (months)
Bridge Deck Overlay	4
Bridge Deck Replacement	8
New Bridge Construction	12
Resurface Contracts < 5 mi	4
Resurface Contracts > 5 mi	7
Road Reconstruction < 5 mi	18
Road Reconstruction > 5 mi	24
Intersection Improvement	5
3 Sided/4 Side Box Contracts	4
Traffic Signal Contracts	4

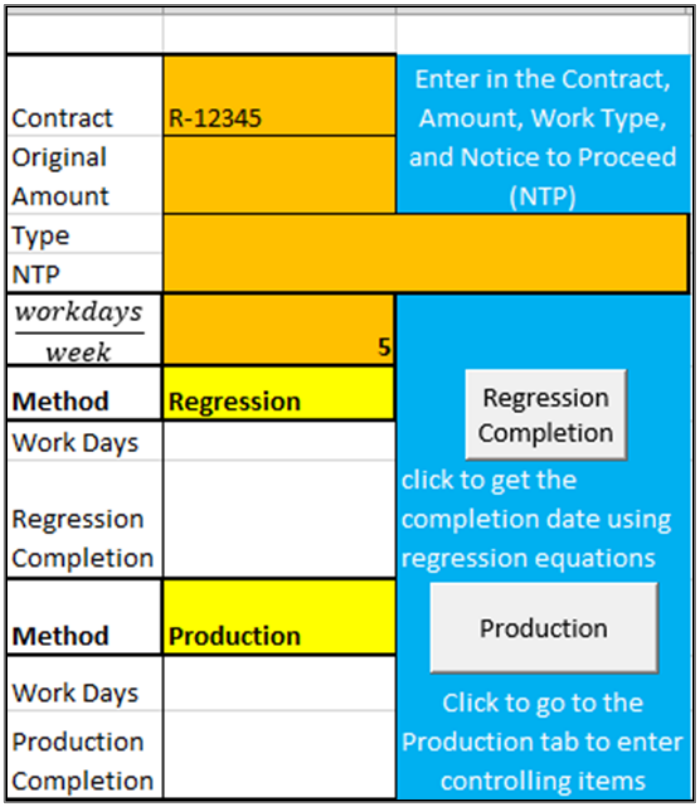
APPENDIX E: CONTRACT TIME-SET WORKSHEET

Time Set Tab

1. Fill in the orange highlighted areas with the contract specific information for contract number, amount, and the Notice to Proceed (NTP).

2. Choose the methods to calculate a completion date Regression or Production. It may be helpful to try both to compare outcomes.

3. Regression Completion – as mentioned in Construction memo 19-09, there is a correlation between contract type and dollar amount. After the original contract amount is entered, select the contract type from the drop down in the orange field adjacent to the cell Type.



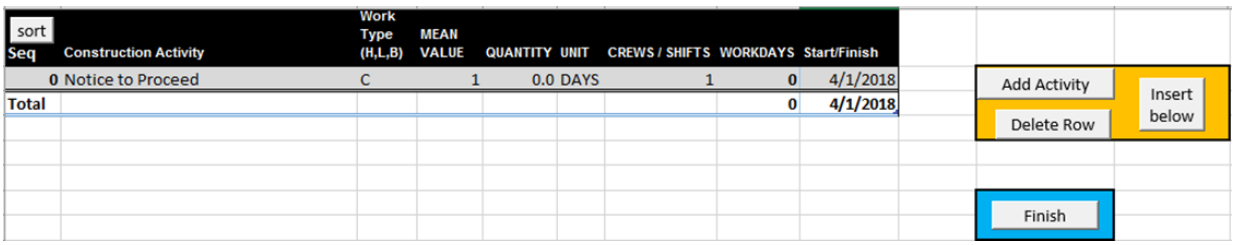
4. Enter or select the anticipated work week. A 5 day work week is set by default. This worksheet will allow calculations with a 5, 6, and 7 day work week.

5. Once the correct contract type and work week is selected, click on the Regression Completion button. This action will take the Original Contract Amount and calculate the work days based off the Regression Equations found in Appendix.

6. The calculated work days will then be used in the work day charts found in Appendix C. It will use the NTP and calculated workdays on the applicable work day chart that pertains to that contract type.

Production Tab

1. Select the *Production* button to be taken to the Production tab. Using the Schedule of Pay Items, determine which items are on the critical path. The worksheet will already have the mean production rate for each work item**.** The activity should be placed in sequential order of the controlling operation by descending rows. ***This spreadsheet must always contain the first row, Seq 0, and the Total Row to function correctly. If for either is deleted, it would be easiest to close and open the last saved spreadsheet. The first row Construction Activity can be renamed to suit the contract needs. The initial start date refers to the Notice to Proceed entered on the first tab of the spreadsheet. If you want to add 15 to 30 days duration for an expected work start, this can be entered into the Quantity value for this first row.***



2. Add as many **Construction Activities** as needed to complete the controlling operation. The construction activity column has a dropdown to select all the available activities seen from the memo. Click the *Add Activity* to insert a new activity at the bottom of the list. If you would like to insert an activity somewhere in between, click *Insert Below* and it will add a row below whichever cell is active. A user form will pop up upon clicking either *Add Activity* or *Insert Below*. You can begin typing in that box and it will auto select from the dropdown.

3. The **Work type** column signifies how sensitive this work activity is to weather. It will contain either an H, B, or C. The H corresponds to the Medium and Heavy Grading (R, RS, and M contracts), the B corresponds to Bridge (B and T contracts), and C corresponds to calendar days. Can be edited.

4. The **Production Rate** column represents the average quantity that is installed per shift for that given construction activity. If there is a production rate that can be found or calculated that is more representative for the specific contract, this number can always be edited within the table.

5. The Q**uantity** column should be either the original bid quantity or a portion, work will be done in phases or successor dependent, of that work item on the controlling operation. (i.e. milling and HMA surface)

6. **Crews/Shifts** will default as 1 when adding a new activity. For some contracts of higher production needs, more crews can be assumed will be used on certain work items.

7. **Workdays** are simply calculated by the Quantity divided by the Production Rate and then divided by the amount of crews/shifts working on them. The workday value can be

manually edited or entered if the production rate calculation is not applicable for your specific project needs.

8. **Start/Finish** will show the *Expected Finish Date* of each construction activity. The next work item will assume a start date of the previous finish date. This table assumes the next controlling operation will begin the same day. The Start/Finish dates are calculated using the tables located on the *Med&Heavy* and *Bridge* tab. These tables are a digital version of Appendix C that can be manipulated depending on the condition. Appendix C is based on a 5 day work week. The spreadsheet allows for a 6 and 7 day work week which will increase the expected workable days per month. If there is work that can be performing during winter months, workable days can be added to the tables in column B which will increase the running total of workable days at each column.

Example of a full production time-set using the Contract Time Worksheet.

Contract Overview

Resurface Contract ($10,000,000 Original Amount) – HMA, surface overlay 20 miles 4 lanes. Goal is to have this contract completed in one season.
It is important to note the regression equations suggested 187 workdays for completion. This would be good indicator that 2 crews or shifts were necessary to finish in 1 season.

0) **Notice to Proceed** – April 1, 2018.
1) **Mobilization** – Assume a calendar day or two to move in equipment.
2) **MOT Change** – Assume a calendar day or two to set up MOT.
3) **Patching** – Production Rate = 70, used 110. Very large patching quantity. The mean value was not practical for this contract.
4) **Milling** – only do the portion the milling in order to get out in front of the HMA work on the controlling operation.
5) **HMA, Surface Mainline** - this is the true controlling operation. Any surface milled, it must be covered in 5 days.
6) **HMA, Surface** – this is the true controlling operation. Any surface milled, it must be covered in 5 days. Separate HMA Surface item added with reduced production rate to pave turn lanes.
7) **HMA**, **Approaches** – Happens after mainline paving.
8) **Pavement Markings** – Significant quantity due to the very large quantity of pavement, it can be assumed 2 crews or shifts will be used like the HMA operation to install the pavement markings. Mean Value (7000 LFT) does not apply to an extensive overlay contract. Cn assume paint truck can travel at least 10 MPH.
9) **Snowplowable Raised Pavement Markers** – 2 crews assumed due to large quantity.
10) **Demobilization** - Assume a calendar day or two to move in equipment

sort

Seq	Construction Activity	Work Type (H,L,B,C)	Production Rate	QUANTITY	UNIT	CREWS / SHIFTS	WORKDAYS	Start/Finish
0	Notice to Proceed	C	1	-	DAYS	1	0	4/1/2018
1	Mobilization	C	1	2	DAYS	1	2	4/3/2018
2	MOT Change	C	1	1	DAYS	1	1	4/4/2018
3	HMA Patching	H	110	4,200	TON	2	20	5/24/2018
4	Milling, Surface (Removal)	H	10,900	20,000	SYS	2	1	5/26/2018
5	HMA Surface, Mainline	H	980	80,000	TON	2	41	8/9/2018
6	HMA Surface	H	300	11,500	TON	2	20	9/12/2018
6	HMA Approaches	H	230	2,200	TON	2	5	9/20/2018
7	Pavement Markings*	H	250,000	436,147	LFT	1	2	9/23/2018
8	Snowplowable Raised Pvmt Markings	H	150	3,000	EACH	2	10	10/10/2018
9	Demobilization	C	1	1	DAYS	1	1	10/11/2018
Total							103	10/11/2018

Add Activity
Insert below
Delete Row
Finish

The table above is an example of the finished time-set using the example contract. You can see the different parameters with multiple crews on certain operations. It may be prudent to add provisions to the contract to allow day and night work at the contract location. The quantities used were not always the original bid if it was assumed the successor operation would follow the predecessor concurrently (i.e. milling and HMA surface).

This tool can also be used simply for its work day charts. If you have a general idea of how many total work days it will take to completion, you can use the Extra Work construction activity and enter your total number of work days. Enter either H or B depending on the type of contract you have and click *Finish*.

APPENDIX F: SETTING OF WORK DAYS FOR BRIDGE CONTRACTS

When setting days for bridge contracts, it is usually best to establish the time required to accomplish each project by assigning time for each controlling operation involved.

To illustrate this let's look at three different jobs, the first being an overlay project. This contract would be set up for calendar day restriction:

1. **Widening the shoulders.** No time charged because this operation can be done without full time restriction.
2. **Traffic control items -** signals and barrier wall. Probably 3 to 4 days unless exceptionally long barrier wall.
3. **Scarifying the deck -** 1 day, if it takes longer because of size the next operation will overlap and control.
4. **Placing or forming full depth patches** - plus curing time - this item depends on quantity.
5. **Hydrodemolition -** usually takes 1 or 2 days.
6. **Forming and pouring concrete rail** - usually 72 to 108 LFT per day.
7. **Sandblast and clean deck** - usually one day operation.
8. **Overlay -** usually one day operation**.**
9. **Curing of Overlay -** three days.
10. **Bituminous approach and installation of guardrail -** normally two day's operation, unless full depth approach dictates cooling time between lays.
11. **MOT Switch** to next phase or removal of traffic control devices. - 1 day.

Another job used to illustrate the procedure is a three span steel beam contract using a temporary runaround. This job would be set on work days.

1. **Construction temporary runaround.** Depends on quantity of dirt and length of temporary structure. Use 400 to 650 CYS of fill per day with structure construction overlap.
2. **Removal of present structure** - depends on size and type of structure. Consider structure removal phases, be reasonable, and also consider phase overlap. (1 day per bent, includes superstructure.)
3. **Construction of two piers in water** - construct cofferdam (if required) four-six days, excavate cofferdam - 1 day, drive piling - 5-IO piles per day depending on driving conditions - look at borings and tip. Form and pour footing - one day - unless mandatory joints, pier stem 2 days per pour, hammerhead caps - 2 days, caps on columns - 2 days plus additional days when delays are shown on plans between construction joints.
4. Construction of the **end bents** - usually assume the dirt work on a bridge replacement is being done while the piers are being constructed. If the grade is being raised (or lowered) or has new alignment, use road procedure to assign time to dirt operation. Drive piling - 5 piles per day plus a day to core if required. Form and pour end bents - 2 days.
5. Setting of **structural steel** - usually 2 to 3 weeks.
6. **Forming the decks** - usually 4 to 5 days.
7. Placing **reinforcing bars** - usually 3 to 4 days (9 tons/day).
8. **Pouring deck** - 1 day. (380 CYS or less in deck).
9. Form and pour **mudwalls** - 1 day each, cure - 3 days.
10. Backfill and placing **R.C. approach slab** – 24 ft. wide - 2 days each - 3 days cure before access to bridge.
11. Forming and pouring **concrete rail** – 72 to 108 LFT per day - 3 day cure.
12. **Terminal Joint** - based on quantities to be placed and cool time between lays.
13. **Guardrail** - based on quantities to be installed (See road progress sheets).
14. **Removal of temporary runaround** - about 5 days. (460 to 700 CYS removed/day and 1 to 2 days to remove temporary structure per span).
15. **Clean-up** - usually 5 days.
16. **Sodding and seeding** are miscellaneous items usually accomplished during other operations.

Another is a three span slab-top on pile bents with the road being closed. This would be set as a calendar date or number calendar days to be closed.

Another is a three span slab-top on pile bents with the road being closed. This would be set as a calendar date or number calendar days to be closed.

1. **Closed road** - 1/2 day.
2. **Remove present structur**e - depends on size and type of structure. (One day per bent, includes span.)
3. **Drive piles for bents** - 5 to 10 piles per day depending on driving conditions - look at boring and tip required.
4. Construction of **end bents** - 250 CYS/day for small quantities of fill, one day to core for piling if required - 5 to 10 piles per day.
5. **Falsework and forms** - usually 2 to 3 weeks.
6. Placing **resteel** - usually 3 to 4 days (9 tons/day).
7. **Pouring deck** – 1 day (380 CYS or less in pour).
8. **Backfill** and place **R.C. approach slab** – 24 ft. wide - 2 days each - 3 days cure before access to bridge.
9. Form and pour concrete **rail** - 72 to 108 LFT per day.
10. **Terminal Joint** - based on quantities and cool time between lays.
11. **Guardrail** - based on quantities (see progress charts).
12. **Cleanup**- and traffic markings - usually 5 days.
13. **Sodding and seeding** - usually done concurrent with other operations.