SECTION 160 Construction Inspection

160.1 General

160.1.1 Construction Inspection

The department inspects work and materials to determine if it conforms to the contract before it is paid for. The department uses the Construction Critical Inspection guide to provide guidance and strengthen the application of critical inspection throughout the life of a construction project. This guidance is intended to prevent high risk consequences while providing the minimal amount of inspection to ensure a safe and successful project. The project manager is allowed the flexibility of using this guidance in its entirety, or portions of it, depending on the project conditions. The Construction Critical Inspection guide is available online at:

https://wisconsindot.gov/Documents/doing-bus/eng-consultants/cnslt-rsrces/con-inspect.pdf

To provide good inspection, an inspector must have a ready knowledge of the work required by the contract. Before construction, members of the inspection forces should thoroughly study the plans, specifications, and contract provisions to familiarize themselves with the requirements and be prepared to readily and correctly answer questions concerning the work that may arise during the construction operations. Inspectors should consult with the engineer before the work is started for clarification of provisions or requirements not thoroughly understood.

The inspector must make certain all materials and work comply with the contract. The contractor's operations should be closely observed, tested, measured, and documented. It is the inspector's responsibility to be in the right place at the right time.

Unacceptable work and proposed material rejections must be brought to the contractor's attention at once for prompt correction. If not promptly corrected, the situation should be brought before the engineer for resolution.

Most work inspection requires the inspector to be present during the operations where the inspector can observe details of the work. Instructions to the contractor about the work will be in the form of the results desired rather than of the method of doing it, except when specifications require a specific method be followed. Suggestions may be made when asked for by the contractor. A daily record will be kept, for future reference, of pertinent instructions and suggestions given the contractor, including the date, name of party to whom given, whether written or oral, and pertinent information.

Orders given to correct errors found in the work should be based on judgment that reflects fairness, impartiality, and knowledge of the work in question. If the contractor take's exception to an order, avoid arguments and refer the matter to the project engineer for interpretation and settlement before work progresses. To avoid complications in final settlement of a project and possible claim for extra compensation, differences arising between the engineer and the contractor over interpretation of the standard specifications or other requirements of the contract should be promptly referred to the region.

When checking equipment, the inspector will tell the contractor of any correction of adjustment necessary but will not specify any method of correction. The inspector will recheck upon completion of the adjustment. When a equipment is required by the contract, an inspection of the equipment furnished will be made to determine compliance with the specification requirements.

Unsafe working conditions are to be brought to the attention of the contractor for immediate correction. The circumstances should be noted in the inspector's diary. If the unsafe conditions are not promptly corrected, the situation should be brought before the engineer for resolution.

The importance of each inspector keeping a neat, complete, up-to-date, and accurate diary and submitting reports in a timely manner cannot be overemphasized. If there are disputes, the diary records are the legal documents with which the matter may be resolved. They also serve as one basis for contractor payment.

160.1.2 Structure Inspection

Department field staff need to notify the region's bridge maintenance unit two weeks before completing each structure to arrange for an initial inspection. This inspection should take place while the contractor is still on site and before opening the structure to traffic. Include bridges, retaining walls, box culverts, and noise walls.

Contractors arrange for inspection of temporary structures as specified in standard spec 526.3.3 and overhead sign structures and other ancillary structures assigned a structure ID as specified in standard spec 532.3.8. See associated guidance in CMM 565 for temporary structures and CMM 570 for ancillary structures.

160.2 Engineer's Diary

The engineer's diary is primarily a record of the contractor's daily work performance. It is also a record of other contract-related matters. This diary is an essential record and should be written so that project activities and status on any given day will be clear to present-day or future readers.

For contracts administered in AASHTOWare Project Construction and Materials®, an engineer's diary is created with the application each day of the week for an active construction project unless time has been suspended. Required data entry includes site time, diary comments, and the associated Daily Work Reports (DWRs) created by inspection staff. The engineer's diary can be edited until it is locked and associated to a payment estimate. All the diaries or selected diaries can be printed in PDF format or hardcopy at any time within the application.

A separate diary should be kept for each contract. If there is more than one project under the contract, the activities for each project should be listed separately within the diary. For contracts administered in the AASHTOWare Project Construction and Materials® the contract number, contract description, project number, the prime contractor, and the project engineer appear on printed copies of the diary.

The following information should be recorded daily:

1. Weather conditions and temperature range.
2. Contractor's work force and equipment. Describe inefficient operations and poorly maintained equipment.
3. Description of major construction activity. Include locations and approximate quantities.
4. Controlling item of work.
5. Percent of delay. Report to the nearest 1/2 working day on the controlling item and the reason for the delay such as weather, utility conflicts, or inadequate prosecution by the contractor. See standard spec 108.9.2.2 for information on charging hours.
6. Suspensions and resumptions of contractor operations. Causes and dates should be recorded.
7. Utility operations. Report on their progress, conflicts with contractor operations and any resultant delays, and quality of workmanship as it affects the project.
8. Summary of significant conversations. Include orders to the contractor, directions and advice from supervisor, and discussions with FHWA representatives, property owners, local officials, and utility and railroad representatives.
9. Reports of meetings and conferences. Record sources of dispute and decisions made.
10. Unusual or materially different physical working conditions from those expected under the contract. Record significant information about the working conditions, progress of work, work force, equipment, and materials that would be of value should the contractor file claims for extra compensation.
11. Significant information on other work operations if not recorded in a separate field inspection diary. For instance, when a separate grade inspector's diary is not kept the information should be entered in the engineer's diary to provide a record of grading performance and compaction achievement.

    When concrete and asphaltic plant inspection or job control sampling and testing is performed only on a random basis the method of acceptance must be documented by the appropriate diary entry unless a Report of Field Inspection of Material is used. The entry should be made in a section of the diary reserved for this type of entries to allow quick access for review.
12. Major discrepancies in the plans or contract. Necessary changes and subsequent actions taken to correct the situation should be recorded.
13. Prior approvals from the region for change orders. Note the date of approval and summary of work involved. Note also any special conditions related to the approval.

The diary is available to select region office staff at any time during construction through the AASHTOWare Project Construction and Materials® application.See the AASHTOWare Project Knowledge Base (AWPKB) web site for required diary data entry fields and descriptions for each field.

160.3 Inspectors' Diaries (Daily Work Reports)

The inspector for each major work operation should keep a detailed inspection diary, also known as a daily work report, with the following information recorded each day of the work operation.

1. Weather and roadway conditions
2. Contractor forces, equipment, materials used, and hours worked.
3. Detailed description of work, including location, sizes, quantities, and methods.
4. Percent of delays, reasons for the delays, and subsequent corrections by the contractor.
5. Inspection checks, tests, and samplings.
6. Instruction from WisDOT representatives.
7. Instructions given to the contractor.
8. Requests from the contractor and disposition of those requests.

9. Contact with property owners, utilities, the public, and others.
10. Contractor compliance with specifications.
11. Initials of inspector making the entry.

For contracts administered in AASHTOWare Project Construction and Materials®, the inspectors' diaries are recorded in the a Daily Work Report (DWR). Inspectors may also use Mobile Inspector®, a browser based application on a mobile device. to enter inspector diaries. Mobile Inspector® allows Project Engineers and Inspectors to collect information required for a daily work report, including item progress, contractor work force, photos, and site conditions out in the field.

The engineer also records item postings for work completed on the project on Daily Work Reports (DWRs) within AASHTOWare Project Construction and Materials®. The Daily Work Reports with item postings along with the corresponding engineer's diary with time charges are used to create payment estimates for the prime contractor.

For contracts not administered in the AASHTOWare Project Construction and Materials® software, manual entries should be made in a bound field book. The work operation that is being inspected should be printed on the cover. The project identification number, contract number, description of road, highway, and county should be recorded on the first page.

If an IDR is not used, the internal organization of the diary should be set up in conjunction with the engineer before the start of the work operation. Using standard approved formats is desirable when the diary entries are routine and repetitive daily. A standard simplified format can be entered on the margin or top of the front page. Succeeding pages can be "cut back" to reveal the line titles or column headings of the first page. This standard format provides valuable inspection control for the engineer and specific guidance for the inspector. Incorrect entries should be lined out, not erased, and after the correction is made the author should initial it.

If separate materials diaries are not kept or if pertinent materials information does not appear in the records the inspectors' diaries should contain information about materials that, when tested, failed to meet specification requirements. If the material met specifications upon retest, a simple entry such as "retest acceptable" is sufficient. The basis of acceptance of material that failed to meet tests but was used in the work should be entered. Additional information such as manufacturer, brand, model, source, lot #, batch #, or heat number should also be recorded.

The diaries need to be reviewed periodically by the engineer for completeness, clarity, and correctness. They are to be turned over to the engineer upon completion of the work operation.

160.4 Construction Inspection Checklists

The Bureau of Project Development Project Services Section has developed construction inspection checklists for select construction operations. The checklists are a good reference to prepare for field inspection, providing standard spec references that the inspector should be familiar with before inspection. They also provide many other requirements and considerations for the respective construction operations.

The Traffic Control Inspection Checklist is provided through the AASHTOware Project Knowledge Base available under Construction> Pantry> Statewide forms at:

https://awpkb.dot.wi.gov/Content/constr/PantryFiles/StatewideForms/TrafficCtrlInspectionChklst.dotm

Other checklists or job guides are provided below for the following:

- Construction Inspection Checklist for Pipe Culverts
- Construction Inspection Checklist for Piling
- Construction Inspection Checklist for Superstructures
- Job Guide for Topsoil, Fertilizer, Seeding, Mulching, and Sodding

Construction Inspector's Checklist for Pipe Culverts

This checklist has been prepared to provide the field inspector a summary of easy-to-read step-by-step requirements relative to proper installation of pipe culverts (standard spec 520). Many of these requirements apply to storm sewer (standard spec 608) as well. The following questions are based on information found in the standard specifications, and CMM.

General

Have you checked the special provisions and plans to see if any modifications have been made to the requirements listed herein?

Length Computation

Standard spec 520.3.1 specifies that, unless otherwise authorized by the engineer in writing, the contractor must not order or deliver the pipe culverts required for the project until a corrected list of sizes and lengths is furnished by the engineer. This provides WisDOT an opportunity for:

- Checking the designated plan length in the field.
- Making any necessary adjustment in length.
- Ordering the correct length of culvert pipe required at a designated location to satisfy field condition.

Are you, as a matter of routine before staking the pipe, calculating the needed length based upon shoulder and ditch elevations?

Have you accounted for skew in the computation of pipe length?

Are you checking with the contractor to see what offsets and spacings are needed?

Are you checking elevation shots for both the existing channel and the proposed grade to make sure the proposed pipe will fit field conditions? For flat sites you may need to check several hundred feet in each direction.

Are you staking the ends of the pipe or reviewing the contractor staking to determine whether the alignment shown on the plans will fit the site conditions?

Materials

Have you checked the plans to see what kind of material is specified for the installation?

Have you checked that the supplied pipe matches the class and thickness (if applicable) specified in the plans?

Is the diameter, class, and material of pipe acceptable for the anticipated depth of cover? This is especially important if the profile changed or field conditions vary from the plans.

Are you visually inspecting each section of delivered pipe for defects?

Note:

- Each load of pipe must be accompanied by a loading document.
- The pipe must be installed only after the documentation is received.
- Pipe should be inspected as soon as possible after delivery on the job. The inspection should cover DIMENSIONS, SOUNDNESS, MARKINGS, DAMAGE incurred during shipment or unloading, or DEFECTS overlooked at plant.

Culvert Pipe Installation

Is the pipe excavation and foundation being prepared in conformance with standard spec 520.3.2.1 for roadway culverts and standard spec 520.3.2.2 for entrance and temporary culverts.

Is the pipe being laid from the downstream end toward the upstream end with the bell or groove end laid in the upstream direction and pipe spigots facing downstream?

Are sections being pushed or pulled into place to ensure tight joints?

Are joints being wrapped or sealed conforming to standard spec 520.2.6 and standard spec 520.3.3?

Are separate sections of metal pipe being joined with tightly drawn, approved connectors?

Are joints in concrete pipe being completely sealed?

Note:

- At the contractor's option, sealers meeting the requirements of standard spec 608.2 may be used. Construction methods for sealing joints with these sealers must conform to standard spec 608.3.4.

Has the need for camber been considered in areas of unanticipated or unaddressed poor soils or a profile change creating higher fills?

Note:

- Coordinate with the regional soils engineer, or BTS Geotechnical Unit on the need for camber if these conditions are encountered.

Are joint ties provided on the upstream and downstream ends of concrete culvert and concrete cattle pass installations? Ties are not required on culverts with cast in place masonry endwalls unless the plans show otherwise.

Joint ties are not required for thermoplastic pipe where a full (+/- 20 foot) pipe section is utilized from the infall and outfall to the first joint. Where a partial pipe section must be used at the infall or outfall end, it should be restrained with a manufacturer supplied external mechanical coupling, a mastic impregnated geotextile wrap with mechanical fastening bands, or a concrete collar. Apron endwalls must be secured to the pipe. No ties are required on pipes with masonry endwalls unless the plans show otherwise.

Backfilling Culvert Pipe

Foundation backfill material placed in the area under the lower half of the pipe must be thoroughly compacted especially in haunch areas under the sides of the pipe. It is also essential and required by the Specifications that the remaining foundation be thoroughly compacted in 6-inch maximum layers to an elevation of the top 12 inches above of the pipe.

The trench, starting 12 inches, above the top of the pipe shall be backfilled and compacted in layers of trench backfill material not exceeding 8 inches in depth. Unless specified differently in plan documents, the trench backfill material above the top of the pipe should be similar to adjacent materials from the typical roadway section. This is to minimize differential frost heaves due to non-uniform materials and differential compactive efforts. If the materials from the roadway section are unsuitable, standard spec 520.5.2 addresses payment for separate trench backfill materials. This only applies to the material classified as trench backfill which starts 12-inches above the top of the pipe.

Deflection Testing

Has deflection testing with a certified mandrel been performed for polyethylene and polypropylene pipe culverts and storm sewers 24-inches in diameter or larger?

For polyethylene and polypropylene culverts and storm sewers less than 24-inches in diameter, has the project engineer, not the contractor, designated at least 10 percent of the installed length of pipe for mandrel testing?

Pipe is to be tested after installation but before paving or finish grading. Waiting if practical, ideally 30 days, to mandrel test is advised to allow development of the deflection in the pipe from embankment loading.

Is the mandrel used for testing department approved? Mandrels can be supplied by the pipe manufacturer or pipe supplier and should not be field or contractor made.

Pipe that fails deflection testing needs to be relayed or replaced and retested.

Note: If deflection testing fails or if significant construction issues occur with polyethylene and polypropylene pipe, please notify the statewide drainage engineers in the Central Office Roadway Standards Development Unit.

This checklist is intended primarily to assist the WisDOT inspectors, and it is not a contract document.

Construction Inspection Checklist for Piling

This checklist has been prepared to provide the field inspector a summary of easy-to-read, step-by-step requirements for the installation of foundation piling. The following questions are based on requirements found in the plans, standard specs., special provisions, bridge manual and appropriate sections of the CMM.

Plan and Specification Review

Before starting work on an item, have you checked the contract special provisions, plans, and addendums to see if any changes or modifications have been made to the standard specifications?

Currently there are differing pile driving specifications. Become familiar with the one in your plan documents. STSP 550-010 deals with penetration resistance and ultimate values, while the remaining standard specifications deal with allowable pile bearing. Contact the geotechnical unit if you have questions.

Before the start of construction, have you checked the plan elevations of the bottom of footings, intermediate substructure components, top of pile elevations and bearing seat elevation of abutments and piers to ensure they correspond to the appropriate top of deck elevations and dimensions shown on the superstructure plans?

Has the structure been surveyed to establish the baseline of the structure, bearing lines of piers and backs of abutments?

Has an independent check of your calculations and layout been performed before the contractor starts work?

Piling

General:

The length of piling shown on the plans is considered to be approximate only and has been determined for design and estimating purposes from borings and soundings.

Piling Types:

Cast-In-Place Piling (CIP) and Steel Piling (standard spec 550***):***

Normally test piling is not used with cast-in-place or steel piling, but a full-depth driving log of the first pile should be made for informational and comparative purposes (DT1315 Piling Record). (The actual required lengths of piles are determined from the bearing information obtained from driving the test piling.)

The specified pile wall thickness (gage) for steel shell piles is the minimum gage allowed.

Electronic copies (PDFs) of DT1315 are to be submitted, with Project Manager concurrence, for all structures to the BOS by email at: DOTDTSDStructuresPiling@dot.wi.gov

and to the BTS, Geotechnical Unit at: DOTDTSDGeotechnicalPiling@dot.wi.gov

Cutting off Piles:

Is the contractor cutting off driven piles at the elevation and in according to the plan details?

Salvaged Pile Cutoffs:

If the contractor is allowed to produce pile lengths by splicing together suitable cutoffs, the cutoffs length must not be less than 5 feet to fabricate such piling.

Pile Driving Hammer:

Determination of Energy Requirements

Has it been determined what type of pile hammer will be used?

Does the hammer meet the energy requirements for the type of pile to be driven?

Has the proper pile drive system (DT3550) been submitted on projects using standard spec 550? Is the contractor-provided equipment the same as shown on this form?

During the driving of a pile, was the hammer operating at the number of blows per minute required for a given energy rating?

For single acting air or steam hammers the energy output is a product of the weight of the ram and the length of the stroke at the designated number of strokes per minute. Is the stroke being measured periodically to ensure correct hammer operation?

Bearing Value or Required Driving Resistance (standard spec 550.3.6***)***

Piles must be driven to a bearing value (or required driving resistance) not less than that shown on the plans. Use the appropriate hammer drive charts from the 'Pantry' software.

Two types of Diesel hammers

The most common type has an open upper end and an unrestricted ram that is visible above the body of the hammer on rebound. Under normal driving conditions, the height of rebound will increase as the resistance of the pile (i.e. capacity) to driving increases.

Was the length of the stroke measured? Was this done by reading on a graduated rod attached to, and extending above, the hammer body or shell, the height of the top of the ram when it rebounds?

With the other type of diesel hammer, the ram operates in a closed cylinder, and the upstroke of the ram traps and compresses air in the bounce chamber. The energy output of the hammer, within the limits of its rated energy output, will increase as the resistance of the pile being driven increases.

At the end of driving, it will be necessary for the inspector to count the blows of the hammer and measure the set (movement per blow) of the pile, to determine the equivalent energy of the hammer. The proper hammer drive chart will directly relate this information to the pile capacity.

Driving Piling:

Has the contractor submitted the proper pile material certifications and drive system information/form?

Is the piling in a correct location?

Is the piling plumb, or does it have the right batter? Was this done by checking the batter of a pile made with a spirit level attached to a board which has one edge cut to the required pile batter?

Is a proper driving helmet and pile head adapter being used? This must be done to ensure the pile head isn't damaged and the hammer is centered on the head of the pile.

Has any required preboring been completed?

Have any required pile points or end-plates been correctly installed?

Have proper welding techniques and certified welders been used when splicing piles?

Has any required concrete or granular backfill material placed after pile installation been properly tested and placed?

Pile Welding:

Has DT2320 Welding Checklist for Field Welding been completed?

Pile Driving Tips:

This operation is the most dangerous operation in bridge construction. As a general rule, when the pile is being driven, the inspector should not be in the excavated area.

- Make sure the piling size and wall thickness are correct for the location.
- Check the heat number on the piling with those listed on the certification.
- Stand upwind from the pile driving operation.
- If you use a test pile, ensure it is the same pile type and size as required in the plan and locate it such that it is representative of the whole unit (usually the center pile, not in a wingwall).
- When a test pile is not required, one pile per unit should be driven like a test pile, by counting and recording the blows for each foot and the hammer strokes.
- Look for pile damage/bending/yielding as driving is proceeding. Correct as appropriate.
- Once bearing value or penetration resistance is obtained, stop driving. Continued driving may result in pile damage.
- Check CIP piles for water-tightness by dropping a stone in each pile and listening for a splash. Advance a light down the inside of each pile to ensure the sides are not collapsed. Monitor CIP concrete volumes to ensure they match computed interior pile volumes.
- The ideal situation is when all piles are driven to approximately the same tip elevation.
- Varying pile lengths can be expected, due to differing subsurface conditions. If driven lengths vary from plan by more than about 20% during installation, contact the Geotechnical Unit.

List of items to be inspected at the construction site

Record and mark all pile lengths for possible future splicing needs.

1. Are pile points required, provided and installed as specified?
2. Is there evidence that any pile has been damaged during shipping to the site?
3. Is the contractor lifting the piles properly?
4. Are the piles being stored properly? Piles should be stored above ground on adequate blocking, and in a manner which prevents undue bending stresses.
5. Is protective coating used on the piles?
6. Is the coating as specified and delivered undamaged?

7. Is the coating in the proper location (covering exposed areas) after the piling is installed?

This checklist is intended primarily to assist the WisDOT inspectors, and it is not a contract document.

Construction Inspection Checklist for Superstructures

This checklist has been prepared to provide for the field inspector a summary of easy-to-read step-by-step requirements relative to the proper construction of cast-in-place concrete bridge decks. The following questions are based on the requirements found in the standard specifications, special provisions, and appropriate sections of the CMM.

A. Preparation Before Superstructure Construction

1. Office Review

Are you reviewing the contract special provisions for modifications to the standard specifications?

Are you computing the volume of concrete and weight of reinforcement bars for agreement with the quantity shown in the bill of materials?

Are you determining what material must be inspected and tested before incorporation into the work?

Are you reviewing to determine what material certifications are required?

2. Field Review

Are you checking the bearing seat elevations before, during, and after each abutment or pier pour? Errors caught at this stage can often be easily corrected. Otherwise grinding or shimming may be necessary which can be costly (check bearing seats while concrete is still in fluid state).

Are you laying out bearing lines on top of abutments and piers for beam erection and checking span lengths between abutments and piers?

Are the bearing areas on supporting masonry being finished level and smooth? Improperly finished, deformed or irregular bearing area must be ground smooth, filled or otherwise corrected to provide even bearing on the seats.

Are you inspecting material as it is delivered to the jobsite, that the material has not been damaged due to mishandling subsequent to inspection and that it is being properly stored?

B. Beam Erection

1. Structural Steel

Field Handling and Storage (standard spec 506.3.24):

Materials to be stored must be placed on skids above the ground, upright, shored, and tied or braced to preclude tipping or overturning when exposed to high wind.

Are inaccessible areas being painted before erection (bottom and top of bearings, back of beam and diaphragms, top flange in non-shear stud areas, etc.)?

Are beams and diaphragms being handled properly to keep damage to the prime coat to a minimum?

Are they providing pads, so the painted girders are not damaged by the cables or slings?

Are they using an appropriate balance beam or spreader bar for two or more pickup points with a single crane (standard spec 506.3.27)?

Minimum number of pickup points for handling girders are:

One pickup point for 0-50 feet.

Two or more pickup points for 50 feet and over.

No bent or twisted member should be put in place until its defects are corrected.

Camber may be produced or corrected by local heating (No heating will be allowed without permission). Heating above 649 degrees C (dull red) is not allowed. Water must not be used to cool metal, nor can any area be heated more than once.

Is the contractor aware that no field welding, heating or flame cutting will be allowed on beams or girders without permission?

If a bearing area is low with respect to other areas of the structure:

- Are they using shims of the same size as the masonry plate and of the required thickness? (Avoid using number of thin shims if a single one of the required thickness can be made from standard thicknesses of plates).
- Are the shims made from the same type of steel as specified for the bearings?

2. Precast, Prestressed Concrete Girders

The maximum overhang from the point of support to the end of girder during storage, handling and transportation must not exceed the depth of the girder.

Are they handling and storing the prestressed girder in an upright position?

Upon arrival on the jobsite are you inspecting each beam for damage or cracking due to mishandling of the beam subsequent to inspection at the plant?

Beams damaged by improper handling or storing must be replaced at contractor expense.

Prestressed concrete girders must not be transported to and erected in the work until after the concrete has attained its minimum 28-day compressive strength.

If the contractor in erecting the prestressed girders elects to work with a crane on the girders of a preceding span before the concrete slab for such span has been placed and cured, the contractor must submit to the engineer for prior approval details of the proposed temporary flooring, strutting between the girders and pertinent information relating to the crane used in erecting the girders.

3. **Bearings**

   Are they only using one type of bearing pads throughout any one structure (standard spec 506.2.6)?

   Are bearings being adjusted to allow the proper clearance between units or at abutments and to provide the correct opening at expansion devices?

   If the expansion bearings are of the rocker type, are the rockers adjusted by the erector according to the prevailing temperature, so they will be vertical at the standard temperature shown on the plans?

   Are they removing excess grout or epoxy from the bolt and bearing area?

   The anchor holes should be overfilled with grout or epoxy just enough to produce a watertight fit, and excess grout or epoxy should be removed from the bolt and bearing area.

C. Placing, Finishing, and Curing Bridge Floors

The placing, finishing and curing of concrete bridge floors is the most critical aspect of bridge construction. Not only is it critical from the standpoint of the finished surface (riding qualities), but the quality of the concrete, and thus its durability, is critical because bridge floors are probably subjected to more severe conditions conducive to scaling and deterioration than any other highway element.

One of the essential ingredients of a smooth bridge floor, after the forms and screed guides are accurately set and firmly supported, is a properly proportioned, uniform concrete mix, delivered to the bridge floor at an adequate and constant rate. Another essential element is adequate equipment and manpower to place, strike-off and finish the concrete.

D. Prepour Meeting (CMM 515.6)

Preferably the day before placement of deck concrete a meeting should be held with the contractor to review the following deck placement procedures:

1. **Falsework**

   A thorough inspection of the falsework, including footings, overhang brackets, and the forms; reinforcement; etc. (If the overhang brackets are not tight to the girders the weight of the concrete causes them to settle resulting in sags, thin deck and shallow embedment.)

   Does the plan call for bracing of the exterior girders to the interior girders to preclude rotation of the exterior girders or does the contractor feel this should be done because of his falsework design and finishing rail location?

2. **Mix:**
   a. Have you discussed the properties of the proposed concrete mix with the region Materials Engineer and the contractor?
   b. Have you discussed with the contractor the air, slump and strength requirements for deck concrete and the location for a suitable site to run tests?

3. Delivery:
   a. Is the delivery commitment from the ready-mix supplier adequate so that the operations of placing and finishing will be continuous?
   b. Does the contractor have sufficient equipment and labor to maintain continuous concrete placement operation?

4. **Finishing Equipment & Requirements:**
   a. Is the finishing machine in a good mechanical condition and the crown checked?
   b. Has the dry run been made to check rebar clearance and depth of deck?
   c. Are adequate foot bridges for finishing, and texturing provided for the concrete finishers?

d. Are there enough vibrators to adequately consolidate the concrete?

5. Manpower:

Will the contractor have supervision and enough manpower to place and finish the deck concrete and also place curing covering in a timely manner?

Has the contractor designated a person responsible for placing the curing covering?

6. Deficiency Checklist:

Have you informed the contractor of any deficiencies not previously taken care of? (Forms, reinforcement, grade, equipment, etc.)

7. Curing:

Is adequate wetted burlap, or other approved coated covering and water on the jobsite to cure the deck?

E. Concrete Placement

1. Concrete Mix:

a. Revolution requirements for truck mixers
b. Time of haul
c. Concrete temperature
d. Air Content determination
e. Slump test
f. Water cement ratio
g. Adding water or admixture to trucks at jobsite
e. Concrete delivery tickets
f. Placing concrete

Is the concrete being bucketed, conveyed, pumped or otherwise placed in such a manner as to avoid segregation and is not being allowed to drop more than 4 ft.?

Are you checking for deflections at forms or rail supports during the deck pour?

Are you checking the anchor bolts for railing?

Are you checking drains and see that the flow line drains?

2. Consolidation & Finishing:

Is all concrete being compacted & sufficient vibration being applied?

Over vibration causes segregation and loss of entrained air.

Is the finishing machine in proper adjustment and producing a acceptable surface?

3. Depth Checks:

Are you checking the deck thickness and rebar depth at frequent intervals behind the finishing machine? (A device for stabbing the deck for cover or thickness has been made available to each Region for use in the field.)

If deck thickness or rebar depth deficiencies are found, is the contractor immediately notified so corrective action can be taken?

4. Finishing:

Is the deck surface being textured with either an artificial turf drag finish or broom finish, with no tining, in plastic state? (For design speed < 40 mph)

Is the deck surface being textured with either an artificial turf drag finish or broom finish, followed by a random tined finish? (For design speed > 40 mph)

Broom for a broomed surface should have fairly stiff, medium coarse bristles and the pressure on the broom should be regulated to prevent tearing of the surface yet produce an acceptable skid resistant surface.

Note: Decks having skew angle of 20 or greater must be finished on the skew.

- On skewed structures with skew angle of 20 or greater, tining must be perpendicular to the bridge center line and not along the skew.
- Straightedging should be done while the concrete is still in a condition that corrections can be made but delayed as much as possible to take advantage of the final slumping of the concrete.

- The inspector should closely observe the straightedging operations by the contractor or may elect to independently check the surface with a testing straightedge (straightedging should be done before brooming).

This checklist is intended primarily to assist the WisDOT inspectors, and it is not a contract document.

Topsoil

Refer to standard spec 625.

Topsoils are those humus-bearing soils that can sustain plant life.

The topsoil is placed and uniformly spread over the areas to a uniform depth of min. 4 inches in rural and 6 inches in urban, unless otherwise specified.

Standard spec 625.3.3 contains special requirements for urban area where a lawn-type turf is desired. During finishing operations loose or waste stones that will not pass a 1-inch sieve must be removed.

Rocks, twigs, and clods that will not break down and other foreign material must be removed, and the entire surface must be dressed to present a uniform appearance. Rolling is not required.

Where light sandy soils are covered with heavier clay bearing loam topsoil, the two types of soils must be mixed or blended to a more homogeneous mixture by means of discs, harrows or other appropriate equipment.

Fertilizer

Refer to standard spec 629.

Fertilizers type A and type B have been developed to ensure adequate fertilization of seed or sod located over most soil types in Wisconsin.

Type A: Fertilizer containing 32% sum total of Nitrogen, Phosphoric Acid, and Potash must be applied at 7 pounds per 1000 square foot.

Type B: Fertilizer containing 50% sum total of Nitrogen, Phosphoric Acid, and Potash must be applied at 7 pounds per 1000 square foot.

Are fertilizer nutrients being uniformly applied at Pounds/Acre rate specified in the contract?

When fertilizer is delivered in bags, is each bag or part of each bag that can NOT be duplicated, collected each day to determine the weight of fertilizer to be paid for?

Note: After entering the pay quantity in the Quantity Book, burn or otherwise destroy the bag so they cannot be used again for determining pay weight.

Do the fertilizer bags show the percent analysis, manufacturer brand, weight?

Is payment for fertilizer nutrients being determined on the basis of analysis and not on the total weight?

Note: The standard specifications allow the application of fertilizers containing percentages of components greater than the minimum specified.

For Type A fertilizer that contains a different percentage of components, determine the new application rate by multiplying the specified rate by a dimensionless factor determined as follows:

Conversion Factor = 32/New Percentage of Components.

For Type B fertilizer that contains a different percentage of components, determine the new application rate by multiplying the specified rate by a dimensionless factor determined as follows:

Conversion Factor = 50/New Percentage of Components

Seeding

Refer to standard spec 630.

Seeding consists of preparing seed beds and furnishing & sowing required seed. The project engineer must approve the seed mixture or mixtures. Seed samples may be taken by the project engineer.

Seeding rate: (standard spec 630.3.3.5)

Method A: (standard spec 630.3.3.1)

The selected seed mixture must be sown by means of equipment adapted to the purpose, or it may be scattered uniformly over the areas to be seeded, and lightly raked or dragged to cover the seed with approximately 1/4 inch of soil. After seeding the areas must be lightly rolled or compacted by means of suitable equipment, preferably of the cultipacker type. Slopes steeper than 1:3 need not be rolled.

Method B: (standard spec 630.3.3.2)

The seed must be sown or spread by means of a stream or spray of water under pressure operated from an engineer-approved machine designed for that purpose.

During the process, the contents of the tank must be kept stirred or agitated to provide uniform distribution of the seed. The tank must be emptied within one hour after seed is added.

The project engineer will reject seed that remains mixed with the water for longer than one hour. The project engineer will not require dragging or rolling.

Method C: (standard spec 630.3.3.3)

For spring seeding of seed mixtures 70 and 70A into existing ground cover.

1. Before seed bed preparation read standard spec 625.
2. Before commencing any seeding operations, has the right-of-way been shaped, trimmed, cleaned up and finished?
3. Is the disked seed bed free from debris, washes, gullies, clods and stones?
4. Your plan will specify which seeding type will be used. Is the correct type of seed being used?
5. Are the seed bag weight tickets collected to ensure that the minimum number of pounds of each type of seed is being sown?
6. Has the seeding equipment been properly adjusted and calibrated for the specified rate of application?
7. Is the ratio of seed to fertilizer appropriate?

Sodding

Refer to standard spec 631.

Sodding consists of the furnishing and laying of live sod. Watering sodded areas consists of furnishing and applying water to sodded areas.

Standard spec 631.2.1, requires that sod be indigenous to the general locality in which it is used. In other words, the sod should grow naturally under the same general climatic and soil conditions as exist at the site of the work.

For example, sods grown on peaty soils would not be acceptable for use on sandy soils. Varieties of grasses requiring a high degree of maintenance should not be planted either.

The inspector will lay out the sodded areas and determine that the bedding soil is properly prepared.

Before laying the sod, the soil surface should be loosened to a fine texture and to a depth of at least 1 inch in order to provide a condition suitable for the penetration of the grass roots. If the soil is dry, water should be applied to properly condition the bed.

During the laying of the sod, the inspector should check on the work to determine the sod is laid as tight as possible, joints are properly made, edges of the sod where water is apt to flow over it are properly imbedded in the soil, laid sod is tamped or rolled to make continuous contact with the underlying soil and the sod is properly held in place with stakes.

Attention is directed to the specified requirements for fertilizing, rolling or tamping and watering the placed sod in standard spec 631.3.

Frozen sod must not be placed, nor can sod be placed on frozen soil.

Mulching

Refer to standard spec 627.

This work consists of furnishing, placing, and anchoring a mulch cover. Mulching material consists of straw or hay in an air-dry condition, wood excelsior, wood chips or other suitable material of a similar nature, as approved by the project engineer, which is substantially free of noxious weed seeds and objectionable foreign matters.

Straw or hay must be treated with a tackifier, blown from a machine and uniformly deposited over designated areas in one operation. Tackifier must be selected from the tackifier PAL.

Straw or hay must be placed uniformly over the area to a depth of 1/2 inch to 1 inch, using 1/2 to 3 tons of mulch per acre.

Wood fiber, wood chips or similar material must be applied with approved blowing machines or other approved methods which will place a controlled amount of mulch uniformly over the area to a depth of 1/2 inch to 1-1/2 inch.

Areas to be mulched with wood chips must be treated with one pound of available nitrogen per 1000 square feet of area either before or after the application of the chip.

Has the mulch material been inspected and accepted reasonably dry (having moisture content of 10% or less) and free of noxious weed seed? Random bales may be tested to ensure they are free of noxious weed seed.

Note: An inspector must be present during initial applications to inspect the straw and hay for moisture content, state of deterioration, length of straw and to also check the equipment for suitability and operational capability.

Has a mulch storage location (when needed) been selected on the jobsite that is away from of _____? Mulching will be measured by the square yard or by the ton as provided in the contract.

Tackifier or nitrogen used for treating mulch will not be measured for payment but will be considered as subsidiary to and included as a part of the item.

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