Iowa Department of Transportation

MINUTES
OF
IOWA DOT SPECIFICATION COMMITTEE MEETING

May 9, 2013

Members Present:	Darwin Bishop	District 3 - Construction
	Mark Brandl	District 6 - Davenport RCE
	Donna Buchwald	Office of Local Systems
	Eric Johnsen, Secretary	Specifications Section
	Sandra Larson	Systems Operations Bureau
	Greg Mulder	Office of Construction & Materials
	Wes Musgrove	Office of Contracts
	Gary Novey	Office of Bridges & Structures
	Dan Redmond	District 4 - Materials
	Tom Reis, Chair	Specifications Section
	Brian Smith	Office of Design
	Willy Sorensen	Office of Traffic & Safety
Members Not Present:		
Advisory Members Present:	Lisa McDaniel	FHWA
	Paul Wiegand	SUDAS
Others Present:	Wayne Sunday	Office of Construction & Materials
	Melissa Serio	Office of Construction & Materials
	Michael Heller	Office of Design
	Kimberly Anderson	FHWA
	Jacqui Miskimins	Office of Employee Services

Tom Reis, Specifications Engineer, opened the meeting. The following items were discussed in accordance with the agenda dated May 2, 2013:

1. Article 1105.13, B, 3, Temporary Primary Road Haul Roads.

The Office of Construction and Materials requested to change the submittal deadline for temporary Primary Road haul roads.

2. Article 1108.01, Subletting Of Contract.

The Office of Contracts requested several revisions due to FHWA process review.

3. Article 1109.05, D, Complaints (Partial Payments).

The Office of Employee Services - Civil Rights Team requested to add a form number for prompt payment complaints.

4. Article 2102.02, D, Borrow.

The Office of Design requested to further clarify information about soil testing and match current practices in Design/Soils Design.

5. **Article 2403.03, Construction (Structural Concrete)**.

The Office of Bridges and Structures requested changes to reflect the use of 4000 psi concrete for design in lieu of 3500 psi concrete.

6. **Article 2403.05, A, Basis of Payment (Structural Concrete).**

The Office of Construction and Materials requested to eliminate restriction on dates for compensating for heating of structural concrete and correct a reference.

7. **Article 2412.03, D, Surface Finish (Concrete Bridge Decks).**

The Office of Construction and Materials requested to revise the tolerances for longitudinal grooving on bridge decks.

8. **Article 2413.03, Construction (Bridge Deck Surfacing, Repair, and Overlay).**

The Office of Construction and Materials requested to revise the concrete removal specifications to clarify intent.

9. **Section 2415, Concrete Box, Arch, and Circular Culverts.**

The Office of Bridges and Structures requested to add specifications for precast culverts.

10. **Article 2427.01, A, Bridge Cleaning.**

The Specifications Section requested to clarify that bridge cleaning plans may list specific cleaning requirements.

11. **Section 2501, Piles and Pile Driving.**

The Office of Bridges and Structures requested to revise the Piles and Pile Driving specifications due to implementing LRFD criteria.

12. **Section 2522, Tower Lighting.**

The Office of Traffic and Safety requested to update the Tower Lighting specifications.

13. **Article 2547.03, C, Construction (Temporary Stream Access).**

The Office of Construction and Materials requested to eliminate a former Iowa DNR and US Army Corps of Engineer restriction.

14. **Section 2601, Erosion Control.**

The Office of Design requested to update seeding specifications and fertilizer application rates, add specifications for Outlet or Channel Protection (Transition Mat), and reorganize the section to more closely follow order of work.

15. **Article 2602.01, Description (Water Pollution Control (Soil Erosion)).**

The Office of Construction and Materials requested to implement an erosion control training/certification program.

16. **Article 2602.04, Method of Measurement (Water Pollution Control (Soil Erosion)).**
Article 2602.05, Basis of Payment (Water Pollution Control (Soil Erosion)).

The Office of Design requested to add MOM and BOP for Removal of Perimeter and Slope Sediment Control Devices.

17. Article 4115.04, A, Coarse Aggregate for Portland Cement Concrete.

The Office of Construction and Materials requested to require Class 3 durability coarse aggregate for bridge decks on the Interstate and Primary System.

18. Section 4169, Erosion Control Materials.

The Office of Design requested to allow new Bonded Fiber Matrix and Mechanically-Bonded Fiber Matrix products that may be more effective at controlling erosion and add materials specifications for Outlet or Channel Scour Protection (Transition Mat).

19. Article 4186.10, D, 2, PSST Post Anchors.

The Office of Traffic and Safety requested to require that triangular slip base post anchor hardware be per the manufacturers specifications.

20. DS-12034, QM-C Concrete Pavement.

The Office of Construction and Materials requested to eliminate the QM-C bid item from the Developmental Specifications for QM-C Concrete Pavement.

21. DS-12xxx, Pavement Interlayer Geotextile.

The Office of Construction and Materials requested approval of Developmental Specifications for Pavement Interlayer Geotextile.

22. DS-12XXX, Precast Noise Wall.

The Specifications Section requested approval of Developmental Specifications for Precast Noise Wall.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Tom Jacobson	**Office:** Construction and Materials	**Item 1**
Submittal Date: April 29, 2013	**Proposed Effective Date:** October 2013 GS	
Article No.: 1105.13, B, 3 **Title:** Temporary Primary Road Haul Roads	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

1105.13, B, 3.

Replace the first sentence:

When temporary Primary Road haul roads are required, the Contractor shall submit the suggested haul route or routes to the Department within ~~21~~ 14 calendar days after the ~~approval for~~ award.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Replace first sentence of 1105.13,B,3 with

3. When temporary Primary Road haul roads are required, the Contractor shall submit the suggested haul route or routes to the Department within ~~21~~ 14 calendar days after the ~~approval for~~ award.

Reason for Revision: Many contracts are not awarded within 21 days after approval for award date. This change will require submittal within 14 days after the award (i.e. execution of contract).

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**

Comments: AGCI recommended specification change at April 26, 2013 AGCI/Iowa DOT Joint Specification Committee Meeting (Item #13).

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Wes Musgrove	**Office:** Contracts	**Item 2**
Submittal Date: April 23, 2013	**Proposed Effective Date:** October 2013 GS	
Article No.: 1108.01 **Title:** Subletting Of Contract	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

1108.01, Subletting of Contract.

Replace Articles B, C, and D, and the first paragraph of Article E:

B. Except for the furnishing and transportation of materials, no portion of ~~the~~ any contract let through the Department shall be sublet, assigned, or otherwise disposed of except with written ~~consent~~ authorization of the ~~Contracting Authority~~ Department. Where a subcontract has been ~~approved~~ authorized, the ~~approved~~ subcontractor shall be responsible to complete that portion of the contract with its own organization. On contracts involving federal aid, the agreement between the Contractor and subcontractor shall be in writing, and Form FHWA-1273 shall be physically attached to each such agreement.

C. ~~Where a subcontract does not exist, but a DBE firm is manufacturing, supplying, or trucking materials to the job site; terms of the agreement~~ Work performed by a DBE firm not otherwise required to be authorized as a subcontractor shall be described and documented on the Subcontract Request ~~and Approval~~ form (Form 830231). This will assure the Engineer that a Contractor is meeting commitments previously stated on the Statement of DBE Commitments form (Form 102115). This dollar value will not be used to determine the percent subcontracted as specified previously. Where Davis/Bacon wage requirements apply, the Contractor shall be responsible for collecting and submitting certified payrolls for all drivers. Owner/operators shall be listed on the certified payrolls as owner/operators.

D. Request for permission to subcontract, assign, or otherwise dispose of any portion of any contract shall be ~~submitted in writing with the Contractor's signed contract to the Office of Contracts,~~ documented on a Subcontract Request ~~and Approval~~ form (Form 830231). ~~For contracts that exceed $600,000, the Contractor shall submit the Subcontract Request and Approval form electronically~~ The form shall be prepared using the software furnished by the Department~~.~~ and submitted electronically to the Office of Contracts at the time the signed contract is returned to the Contracting Authority. On contracts where the Department is not the Contracting Authority, also provide a copy to the Engineer. In certain situations, with approval of the Department, the Contractor may request an extension of up to 30 calendar days to submit the Subcontract Request ~~and Approval~~ form~~s~~.

E. Either the Contractor or approved subcontractors ~~(e.g. contractors)~~ can use leased employees from a firm that does not perform highway construction with its own organization. Work performed by a DBE firm using leased employees will not count towards meeting the Department's annual DBE goal.

Comments: The Office of Contracts pointed out that the change from "Contracting Authority" to "Department" that they had proposed was removed in the recommended text. The Specifications Section did not know that the Department would be authorizing all subcontractors, even on local systems projects. The change was implemented with some additional language that would only apply to local systems projects that use Iowa DOT specifications that are not let by the Department.

The approved language will be added to projects by proposal note as soon as possible.

Specification Section Recommended Text:

1108.01, Subletting of Contract.

Replace Articles B, C, and D, and the first paragraph of Article E:

B. Except for the furnishing and transportation of materials, no portion of the contract shall be sublet, assigned, or otherwise disposed of except with written ~~consent~~ authorization of the Contracting

Authority. Where a subcontract has been ~~approved~~ authorized, the ~~approved~~ subcontractor shall be responsible to complete that portion of the contract with its own organization. On contracts involving federal aid, the agreement between the Contractor and subcontractor shall be in writing, and Form FHWA-1273 shall be physically attached to each such agreement.

C. ~~Where a subcontract does not exist, but a DBE firm is manufacturing, supplying, or trucking materials to the job site; terms of the agreement~~ Work performed by a DBE firm not otherwise required to be authorized as a subcontractor shall be described and documented on the Subcontract Request ~~and Approval~~ form (Form 830231). This will assure the Engineer that a Contractor is meeting commitments previously stated on the Statement of DBE Commitments form (Form 102115). This dollar value will not be used to determine the percent subcontracted as specified previously. Where Davis/Bacon wage requirements apply, the Contractor shall be responsible for collecting and submitting certified payrolls for all drivers. Owner/operators shall be listed on the certified payrolls as owner/operators.

D. Request for permission to subcontract, assign, or otherwise dispose of any portion of any contract shall be ~~submitted in writing with the Contractor's signed contract to the Office of Contracts,~~ documented on a Subcontract Request ~~and Approval~~ form (Form 830231). ~~For contracts that exceed $600,000, the Contractor shall submit the Subcontract Request and Approval form electronically~~ The form shall be prepared using the software furnished by the Department~~.~~ and submitted electronically to the Office of Contracts at the time the signed contract is returned to the Contracting Authority. On contracts where the Department is not the Contracting Authority, also provide a copy to the Engineer. In certain situations, with approval of the Department, the Contractor may request an extension of up to 30 calendar days to submit the Subcontract Request ~~and Approval~~ form~~s~~.

E. Either the Contractor or approved subcontractors ~~(e.g. contractors)~~ can use leased employees from a firm that does not perform highway construction with its own organization. Work performed by a DBE firm using leased employees will not count towards meeting the Department's annual DBE goal.

Comments:

Member's Requested Change: (Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)

B. Except for the furnishing and transportation of materials, no portion of the contract shall be sublet, assigned, or otherwise disposed of except with written ~~consent~~ authorization of the ~~Contracting Authority~~Department. Where a subcontract has been ~~approved,~~authorized the ~~approved~~ subcontractor shall be responsible to complete that portion of the contract with its own organization. On contracts involving federal aid, the agreement between the contractor and subcontractor shall be in writing, and Form FHWA-1273 shall be physically attached to each such agreement.

C. ~~Where a subcontract does not exist, but a DBE firm is manufacturing, supplying, or trucking materials to the job site; terms of the agreement~~ Work performed by a DBE not otherwise required to be authorized as a subcontractor shall be described and documented on the Subcontract Request ~~and Approval~~ form (Form 830231). This will assure the Engineer that a Contractor is meeting commitments previously stated on the Statement of DBE Commitments form (Form 102115). This dollar value will not be used to determine the percent subcontracted as specified previously. Where Davis/Bacon wage requirements apply, the Contractor shall be responsible for collecting and submitting certified payrolls for all drivers. Owner/operators shall be listed on the certified payrolls as owner/operators.

D. Request for permission to subcontract, assign, or otherwise dispose of any portion of any contract shall be documented ~~submitted in writing with the Contractor's signed contract to the Office of Contracts,~~ on a Subcontract Request ~~and Approval~~ form (Form 830231). ~~For contracts that exceed $600,000, the Contractor shall submit the Subcontract Request and Approval form electronically~~The form shall be prepared using the software furnished by the Department. Submit electronically to the Office of Contracts at the time the signed contract is returned to the contracting authority. On contracts where the Department is not the contracting authority, also provide a copy to the project engineer at this time. In certain situations, with approval of the Department, the Contractor may request an extension of up to 30 calendar days to submit the Subcontract Request ~~and Approval~~ forms.

E. Either the Contractor or approved subcontractors ~~(e.g. contractors)~~ can use leased employees from a firm that does not perform highway construction with its own organization. Work performed by a DBE firm using leased employees will not count towards meeting the Department's annual DBE goal.

Reason for Revision: To implement changes as a result of FHWA process review.					
County or City Input Needed (X one)			**Yes** x	**No**	
Comments: Office of Local Systems has participated in developing the proposed changes and will be soliciting comments from local agencies on resulting new guidelines.					
Industry Input Needed (X one)			**Yes** x	**No**	
Industry Notified:	**Yes** x	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments: AGC has been contacted for comment. Response had not been received at the time this revision was submitted. Current specification requires electronic submittal for all contracts over $600,000. Proposed change will require it for all contracts. Most use electronic submittal exclusively now.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Jacqueline Miskimins	**Office:** OES, Civil Rights Team	**Item 3**
Submittal Date: 2013.04.29	**Proposed Effective Date:** October 2013 GS	
Article No.: 1109.05, D **Title:** Complaints (Partial Payments)	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: Form 650197 is already available on the Iowa DOT forms page.

Specification Section Recommended Text:

1109.05, D, 4.

Replace the first sentence:

If the initial attempt to resolve the issue does not result in satisfactory payment for completed work, the Contractor or subcontractor shall submit a written complaint to OES-Civil Rights on Form 650197.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

D. Complaints.

1. Compliance with prompt payment is the responsibility of both the Contracting Authority and Contractor.

2. If the Contractor feels the Contracting Authority has not complied with the prompt payment provisions, the initial attempt to resolve the issue shall be with the Project Engineer, stating the project number, items of work, quantities, unit prices, dates work was performed, total amount owed, and signature of a representative of the Contractor.

3. If a subcontractor feels the Contractor has not complied with the prompt payment provisions, the initial attempt to resolve the issue shall occur with the Contractor. The attempt to resolve the issue shall include at least one written request to the Contractor, stating the project number, items of work, quantities, unit prices, dates work was performed, total amount owed, and signature of a representative of the subcontractor.

4. If the initial attempt to resolve the issue does not result in satisfactory payment for completed work, the Contractor or subcontractor shall submit a written complaint to OES-Civil Rights on Form 650197. The written complaint shall include copies of the correspondence with the Project Engineer or Contractor that provides the details stated above. The Department will investigate and provide written response to the complainant within 15 business days of receipt of the complaint.

Reason for Revision: To aid in consistency of information submitted to the Civil Rights Team which may aid in efficiently handling complaints.

County or City Input Needed (X one)	**Yes**	**No** x
Comments:		

Industry Input Needed (X one)			**Yes**	**No** x	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

Iowa Department of Transportation
Form 650197 (04-13)

PROMPT PAYMENT COMPLAINT

Iowa Department of Transportation
Office of Employee Services
Civil Rights Team

800 Lincoln Way
Ames, IA 50010
515-239-1921
515-239-1725 (FAX)

Name of Complainant _____ Name of Company _____

Address _____ City/State _____ ZIP Code _____ Telephone No. _____

Project Number _____ Prime Contractor _____

Engineer Name _____ Engineer Office/Location _____

List pay items for which payment has not been made:

Item Number	Item	Quantity	Unit Price	Amount Owed	Dates Work Performed
			Total Amount Owed		

Attach copies of documents to support complaint: subcontract, invoices, notes, time and diaries, payrolls, correspondence, etc. as well as your correspondence with the Engineer regarding prompt payment. [Prompt Payment procedure can be found in Article 1109.05, D, of the Standard Specifications]. Explain action or conditions giving rise to this complaint, including contacts made with Contractor and/or Engineer.

Signature of Complainant _____ Date _____

Return the initial prompt payment letter your firm sent to the Engineer or Contractor and this form to the Office of Employee Services. Incomplete complaints will not be processed.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Brian Smith	**Office:** Design	**Item 4**
Submittal Date: 2013.04.29	**Proposed Effective Date:** October 2013	
Article No.: 2102.02, D **Title:** Borrow	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: The Specifications Section asked if Office of Materials Test Methods should be available on the Electronic Reference Library. The Office of Construction and Materials indicated that they are reviewing the Test Methods and Materials I.M.'s for changes related to more contractor furnished borrows. Perhaps this test method will become a Materials I.M. as it is used more by the Contractor and consulting firms.

Specification Section Recommended Text:

2102.02, D, 1, a, 2.

Replace the Article:

110 pcf (1750 kg/m^3) or greater density (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103).

2102.02, D, 1, b, 2.

Replace the Article:

110 pcf (1750 kg/m^3) or greater density (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103).

2102.02, D, 2, Suitable Soils.

Replace the Article:

a. Ensure all soils provided for the construction of embankments meet the requirements below. They are suitable when moisture control or moisture and density control is designated.
  1) 95 pounds per cubic foot (1500 kg/m^3) or greater density (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103).
  2) AASHTO M 145-91 index of less than 30.
  3) Liquid Limit (LL) less than 50.

b. Soils not meeting these requirements are considered unsuitable soils, regardless of classification.

c. When placing soil below water, use clean granular material.

2102.02, D, 3, Unsuitable Soils.

Replace the Article:

~~Unsuitable soils shall be p~~Place~~d~~ in the work only as specified by Standard Road Plan ~~RL-1B~~ EW-102 ~~or shall be removed as directed by the Engineer~~. Use in the work will be according to the definitions in Table 2102.02-1:

Table 2102.02-1: Uses for Unsuitable Soils

Definition	Use
1. Peat or Muck. **2.** Soils with a plasticity index of 35 or greater. **3.** A-7-5 or A-5 having a density less than 85 pcf (1350 kg/m^3) (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103).	Slope Dressing Only.
1. All soils other than A-7-5 or A-5 having a density of 95 pcf (1500 kg/m^3) or less (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103). **2.** All soils other than A-7-5 or A-5 containing 3.0% or more carbon.	Type C placement placed 3 feet (1 m) below top of subgrade in fills.
1. A-7-6 (30 or greater). **2.** Residual clays (overlaying bedrock), Paleosols, gumbo, and	Type B placement placed 5 feet (1.5 m) below top of subgrade in fills.

	gumbotils regardless of classification.	
	1. Shale. **2.** A-7-5 or A-5 soils having a density greater than 86 pcf (1351 kg/m3) but less than 95 pcf (1500 kg/m^3) (AASHTO T 99 Proctor Density or Office of Materials Test Method No. 103).	Type A placement placed in layers 5 feet (1.5 m) below top of subgrade in fills (Alternate layers to consist of suitable soils or Type C placement soils).

Comments:

Member's Requested Change: (Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)
2102.02, D. Borrow.

1. Select Treatment Material.

a. Cohesive Soils.

Meet all of the following requirements:

1) 45% or less silt size fraction.
2) 110 pcf (1750 kg/m3) or greater density (AASHTO T 99 Proctor Density or Material Lab Test Method No. 103).
3) Plasticity index greater than 10.
4) A-6 or A-7-6 soils of glacial origin.

b. Granular Soils.

Meet all of the following requirements:

1) 15% or less silt and clay.
2) 110 pcf (1750 kg/m3) or greater density (AASHTO T 99 Proctor Density or Material Lab Test Method No. 103).
3) Plasticity index, 3 or less.
4) A-1, A-2, or A-3 (0).

2. Suitable Soils.

a. Ensure all soils provided for the construction of embankments meet the requirements below. They are suitable when moisture control or moisture and density control is designated.

1) 95 pounds per cubic foot (1500 kg/m3) or greater density (AASHTO T 99 Proctor Density or Materials Lab Test Method No. 103).
2) AASHTO M 145-91 index of less than 30.
3) Liquid Limit (LL) less than 50.

b. Soils not meeting these requirements are considered unsuitable soils, regardless of classification.
c. When placing soil below water, use clean granular material.

3. Unsuitable Soils.

~~Unsuitable soils shall be p~~Placed ~~d~~ unsuitable soils in the work only as specified by Standard Road Plan EW-102~~RL-1B or shall be removed as directed by the Engineer~~. Use in the work will be according to the definitions in Table 2102.02-1:

Table 2102.02-1: Uses for Unsuitable Soils

Definition	Use
1. Peat or Muck. **2.** Soils with a plasticity index of 35 or greater. **3.** A-7-5 or A-5 having a density less than 85 pcf (1350 kg/m3) (AASHTO T 99 Proctor Density or Materials Lab Test Method No. 103).	Slope Dressing Only.
1. All soils other than A-7-5 or A-5 having a density of 95 pcf (1500 kg/m3) or less (AASHTO T 99 Proctor Density or Materials Lab Test Method No. 103). **2.** All soils other than A-7-5 or A-5 containing 3.0% or more carbon.	Type C placement placed 3 feet (1 m) below top of subgrade in fills.
1. A-7-6 (30 or greater). **2.** Residual clays (overlaying bedrock), Paleosols, gumbo, and gumbotils regardless of classification.	Type B placement placed 5 feet (1.5 m) below top of subgrade in fills.
1. Shale. **2.** A-7-5 or A-5 soils having a density greater than 86 pcf (1351 kg/m3) but less than 95 pcf (1500 kg/m3) (AASHTO T 99 Proctor Density or Materials Lab Test Method No. 103).	Type A placement placed in layers 5 feet (1.5 m) below top of subgrade in fills (Alternate layers to consist of suitable soils or Type C placement soils).

Reason for Revision: Further clarify information about soil testing and match current practices in Design/Soils Design. Update reference to revised Standard Road Plan (RL-1B is being changed to EW-102).					
County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No** X	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Gary Novey	**Office:** Bridges and Structures	**Item 5**
Submittal Date: April 26,2013	**Proposed Effective Date:** Oct 2013	
Article No.: 2403.03, M, 2, a **Title:** Removal of Forms and Falsework **Article No.:** 2403.03, N, 2, a **Title:** Subjecting Concrete to Exterior Loads	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments:

Specification Section Recommended Text:

2403.03, M, 2, a.

Replace the second sentence:

When Maturity Method (according to Materials I.M. 383) for strength determination is used, the flexural strength of ~~550~~ 575 psi (~~3.8~~ 4.0 MPa) will be required.

2403.03, N, 2, a.

Replace the first sentence:

Unless otherwise indicated in the contract documents, concrete may be subjected to loads due to placing backfill material or to legal traffic when the concrete has reached the minimum age stipulated in Table 2403.03-2 and developed a flexural strength of at least ~~550~~ 575 psi (~~3.8~~ 4.0 MPa).

Comments: None.

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

2. Forms Which Shall Remain in Place 5 Calendar Days or Longer.

a. Except when form removal is permitted in less than 5 calendar days, forms may be removed as soon after 5 calendar days as the concrete has attained the strength required in Article 2403.03, N, 2. When Maturity Method (according to Materials I.M. 383) for strength determination is used, the flexural strength of ~~550~~ 575 psi (3.8 MPa) will be required. The days of age will depend on the Maturity Curve for the concrete mix used.

2. Loads Producing Flexural Stresses.

a. Unless otherwise indicated in the contract documents, concrete may be subjected to loads due to placing backfill material or to legal traffic when the concrete has reached the minimum age stipulated in Table 2403.03-2 and developed a flexural strength of at least ~~550~~ 575 psi (3.8 MPa).

Table 2403.03-2: Minimum Age for Concrete

Portland cement (Type I and Type II with or without Class C fly ash)	7 calendar days
With Class F fly ash substitution	8 calendar days
Class M mix (with or without Class C or Class F fly ash)	3 calendar days
If strength is not determined (regardless of type of cement or class of fly ash)	14 calendar days

Reason for Revision: Reflects the change to the use of 4000 psi concrete for design in lieu of 3500

psi concrete. The standard C mix will provide the strength required.					
County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No** X	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Tom Jacobson	**Office:** Construction and Materials	**Item 6**
Submittal Date: April 29, 2013	**Proposed Effective Date:** October 2013 GS	
Article No.: 2403.05, A **Title:** Basis of Payment (Structural Concrete)	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

2403.05, A, 2.

Replace the Article:

For concrete placed within the contract period ~~between November 15 and April 1~~, additional payment will be made for heating or protecting or both~~; however, no payment will be made when winter work is specified in the contract documents~~.

2403.05, A, 3.

Delete the last sentence:

~~Heating, protection, or both, required outside the above dates, will be paid for when approved by the Engineer.~~

2403.05, A, 4.

Replace the Article:

Payment for protection will be made when heated housing or insulated forms are used to meet requirements of Article 2403.03, ~~I~~ F. The additional payment for protection will be $7.00 per cubic yard ($9.25 per cubic meter). If a footing is protected by flooding with water, no payment will be made. If footings are protected with coverings of burlap, hay, straw, plastic, insulation, and/or other materials sufficient to meet the temperatures and time specified in Article 2403.03, ~~I~~ F, payment for protection will be made.

Comments: The Office of Bridges and Structures asked if the last half of Article 2403.05, A, 2 was still necessary. The Office of Construction and Materials proposed eliminating it so that the Contracting Authority will always pay for heating and protection. This makes bidding easier for the contractor and protects the Contracting Authority from paying for heating and protection that isn't used.

Specification Section Recommended Text:

2403.05, A, 2.

Replace the Article:

For concrete placed within the contract period ~~between November 15 and April 1~~, additional payment will be made for heating or protecting or both; however, no payment will be made when winter work is specified in the contract documents.

2403.05, A, 3.

Delete the last sentence:

~~Heating, protection, or both, required outside the above dates, will be paid for when approved by the Engineer.~~

2403.05, A, 4.

Replace the Article:

Payment for protection will be made when heated housing or insulated forms are used to meet requirements of Article 2403.03, ~~I~~ F. The additional payment for protection will be $7.00 per cubic yard ($9.25 per cubic meter). If a footing is protected by flooding with water, no payment will be made. If footings are protected with coverings of burlap, hay, straw, plastic, insulation, and/or other materials sufficient to meet the temperatures and time specified in Article 2403.03, ~~I~~ F, payment for protection will be made.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Replace 2403.05,A with the following

A. Net volume of Structural Concrete as specified above:
1. Contract unit price per cubic yard (cubic meter).
2. For concrete placed within the contract period ~~between November 15 and April 1~~, additional payment will be made for heating or protecting or both; however, no payment will be made when winter work is specified in the contract documents.
3. Payment for heating will be made when materials which are proportioned and mixed at the site are heated to meet requirements of Article 2403.03, F, or when heating is charged by the supplier of ready mixed concrete. For concrete proportioned and mixed at the site, the additional payment for heating will be $5.00 per cubic yard ($6.60 per cubic meter). For ready mixed concrete, the additional payment for heating will be the customary amount charged for heating, and separately identified on the invoice, with a maximum of $5.00 per cubic yard ($6.60 per cubic meter). ~~Heating, protection, or both, required outside the above dates, will be paid for when approved by the Engineer.~~
4. Payment for protection will be made when heated housing or insulated forms are used to meet requirements of Article 2403.03, ~~I~~F. The additional payment for protection will be $7.00 per cubic yard ($9.25 per cubic meter). If a footing is protected by flooding with water, no payment will be made. If footings are protected with coverings of burlap, hay, straw, plastic, insulation, and/or other materials sufficient to meet the temperatures and time specified in Article 2403.03, ~~I~~F, payment for protection will be made.

Reason for Revision: Eliminate restriction on dates for compensating for heating of structural concrete. Also corrects reference to 2403.03.F, rather than 2403.03.I.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**

Comments: AGCI recommended specification change at April 26, 2013 AGCI/Iowa DOT Joint Specification Committee Meeting (Item #10).

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Wayne Sunday	**Office:** Construction & Materials	**Item 7**
Submittal Date: April 29, 2013	**Proposed Effective Date:** October 15, 2013	
Article No.: 2412.03, D **Title:** Surface Finish	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2412.03, D, 4, a, 3, b.

Replace the Article:

~~1/8 inch +1/32 inch or -1/16 inch (3 mm +0.8 mm or -1.6 mm)~~ 1/8 inch to 1/4 inch (3 mm to 6 mm) deep, and

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'.Use ~~Strikeout~~ and Highlight.**

D. Surface Finish.

1. After placing and vibrating the concrete as provided in Articles 2403.03, C and D, promptly strike it off with a template to provide a smooth surface with the proper crown. Ensure supports for the strike off template are parallel to the center line of the structure, firmly fastened in place, and set to the correct elevation. Include proper allowance for deflection caused by the concrete. Ensure screed supports extend sufficiently beyond each end of the bridge to accommodate the strike off template or finishing machine. Ensure they provide support for bridges when operating a longitudinal float. If required, provide any or all of the items specified in Article 2301.03, A, 3, which may be adapted to the work.

2. In lieu of the above requirements, apply the following to all bridges longer than 60 feet (20 m):

- **a.** After depositing and vibrating the concrete as provided in Articles 2403.03, C and D, promptly strike it off to the proper elevation using an approved self propelled and mechanically operated finishing machine.
- **b.** Ensure the finishing machine operates on adequately supported rails adjusted to conform to the grade specified. Include allowance for anticipated dead load deflection shown in the contract documents.
- **c.** Ensure supporting rails extend beyond each end of the bridge a sufficient distance to accommodate the finishing machine.
- **d.** Ensure the finishing machine will not cause undue deflection of the bridge members or falsework.
- **e.** The screeds of the finishing machine may be of metal or metal shod wood.
- **f.** Make a sufficient number of passes with the finishing machine to obtain a void free surface struck off to the elevation specified.
- **g.** Finishing machines other than as described above will be considered for approval.

3. After the final pass of the finishing machine or after the floating operation (if used), smooth the surface to meet the requirements of Article 2301.03, H. Check with 10 foot (3 m) straightedges. Correct surface irregularities.

4. After smoothing and checking for smoothness, promptly give the surface a final finish while the concrete is still plastic. When the contract documents show a second course of bridge floor surfacing or other wearing course, finish the surface of the first course with a burlap drag. Smooth and check the final surface for smoothness without additional finishing for one course bridge decks on Interstate and Primary projects.

- **a. Interstate and Primary Projects.**
  - **1)** Transverse grooving or tining in plastic concrete of bridge decks (and bridge approaches when

included in the bridge project) will not be allowed unless otherwise stated in the contract documents.

2) Cut longitudinal grooves into hardened concrete surfaces using a mechanical cutting device. Perform longitudinal grooving after surface correction grinding.

3) Ensure longitudinal grooves are:

a) 1/8 inch ± 1/64 inch (3 mm ± 0.4 mm) wide,

b) ~~1/8 inch +1/32 inch or -1/16 inch (3 mm +0.8 mm or -1.6 mm)~~ 1/8 inch to ¼ inch (3mm to 6mm) deep, and

c) Uniformly spaced at 3/4 inch (19 mm) intervals measured center to center of groove.

4) Terminate longitudinal grooving approximately 6 inches (150 mm) from bridge joints.

5) Ensure longitudinal grooving on the bridge deck and double reinforced bridge approach sections is not placed within the area approximately 1.5 feet (0.5 m) adjacent to the curbs. To accommodate varying widths of grooving equipment, the width of the ungrooved area adjacent to curbs may be up to 3.0 feet (0.9 m).

6) Ensure longitudinal grooving of single reinforced and non-reinforced bridge approach sections is not placed within 6 inches (150 mm) of the edge of outside lane lines.

7) For staged bridge and bridge approach construction:

a) The Contractor may cut longitudinal grooves in the hardened concrete at the end of each stage of construction or wait until all stages have been completed. If the Contractor elects to delay cutting of the longitudinal grooves until completion of all stages, apply an interim coarse broom finish on the concrete deck and bridge approach during placement for all stages opened to traffic.

b) Within 30 calendar days following completion of the last stage of the project, establish temporary lane closures to accomplish longitudinal grooving for all stages.

c) The interim coarse broom finish will not be allowed as a surface texture when opened to traffic over a winter season. If the interim coarse broom texture is present and the Contractor is not in a position to finish all stages of the project, cut longitudinal grooving into the hardened concrete in order to establish an acceptable driving surface texture for the winter season.

Reason for Revision: Even with contractor's performing straight edge checks for surface irregularities, some surface profile irregularities occur which result in shallow or missing longitudinal grooves when they are cut into the concrete deck surface. By increasing the longitudinal groove depth allowance to1/4 inch the occurrence of missing grooved texture should be minimized.

County or City Input Needed (X one)	**Yes**	**No**
Comments:		

Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Wayne Sunday	**Office:** Construction & Materials	**Item 8**
Submittal Date: April 29, 2013	**Proposed Effective Date:** October 15, 2013	
Article No.: 2413.03, A, 2, c **Title:** Power Driven Hand Tools (Bridge Deck Surfacing, Repair, and Overlay) **Article No.:** 2413.03, C, 2 **Title:** Class A Deck Repair (Bridge Deck Surfacing, Repair, and Overlay)	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

2413.03, A, 2, C, 2.

Delete the Article:

~~**2)** Do not operate jack hammers or mechanical chipping tools at an angle exceeding 45 degrees measured from the surface of the deck.~~

2413.03, C, 2, b.

Replace the Article:

Concrete may be removed by using a jack hammer, chipping hammer, shot blasting, hydro blasting, or by a combination of these. Concrete removal beneath reinforcing bars shall be accomplished using a 15 pound (7 kg) chipping hammer. Complete final cleanup at the periphery and base of Class A repair using a 15 pound (7 kg) chipping hammer or hand tools.

2413.03, C, 3, c.

Replace the second sentence:

Accomplish final removal at the periphery and base (if not full depth) of the Class B repair using a 15 pound (7 kg) ~~jack hammer,~~ chipping hammer~~,~~ or hand tools.

Comments: The Office of Construction and Materials requested to make changes to the second sentence of Article 2413.03, C, 3, c, to cover when Class B repair is not full depth.

Specification Section Recommended Text:

2413.03, A, 2, C, 2.

Delete the Article:

~~**2)** Do not operate jack hammers or mechanical chipping tools at an angle exceeding 45 degrees measured from the surface of the deck.~~

2413.03, C, 2, b.

Replace the Article:

Concrete may be removed by using a jack hammer, chipping hammer, shot blasting, hydro blasting, or by a combination of these. Concrete removal beneath reinforcing bars shall be accomplished using a 15 pound (7 kg) chipping hammer. Complete final cleanup at the periphery and base of Class A repair using a 15 pound (7 kg) chipping hammer or hand tools.

2413.03, C, 3, c.

Replace the second sentence:

Accomplish final removal at the periphery of Class B repair using a 15 pound (7 kg) ~~jack hammer,~~ chipping hammer~~,~~ or hand tools.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'.Use ~~Strikeout~~ and Highlight.**

2. Preparation Equipment.

Use the following types of preparation equipment:

a. Sawing Equipment.

Use sawing equipment capable of sawing concrete to the specified depth.

b. Sandblasting or Shot Blasting Equipment.

Use sandblasting or shot blasting equipment capable of removing rust, oil, and concrete laitance from the existing surface of the bridge deck and exposed uncoated reinforcing bars.

c. Power Driven Hand Tools.

Power driven hand tools will be permitted with the following restrictions:

1) Do not use jack hammers heavier than nominal 30 pound class (14 kg)

~~**2) Do not operate jack hammers or mechanical chipping tools at an angle exceeding 45 degrees measured from the surface of the deck.**~~

~~**3**~~**2)** Do not use chipping hammers heavier than a nominal 15 pound (7 kg) class .

2. Class A Deck Repair.

a. Class A repair removal is considered to start 1/4 inch (5 mm) below the existing surface. This does not preclude removal coincidental with preparation for overlay. Removal for Class A repair extends at least to the level of the top reinforcing bars, and deeper, as determined by the Engineer, to remove unsound concrete.

b. Concrete may be removed by using a jack hammer, chipping hammer, shot blasting, hydro blasting, or by a combination of these. Concrete removal beneath reinforcing bars shall be accomplished using 15 pound (7 kg) chipping hammers. Complete the final cleanup at the periphery and base of the Class A repair using 15 pound (7 kg) chipping hammer or hand tools.

c. For Class A repair and in preparation for bridge deck overlay, the deck surface may also be prepared or partially prepared using a high pressure water system, at the Contractor's option. Use the equipment manufacturer's recommended procedures, subject to the Engineer's approval, and within such limitations as may be imposed.

d. Additional removal may be required to provide for test wells.

3. Class B Deck Repair.

a. Class B repair removal is considered to start 1/4 inch (5 mm) below the existing surface. This does not preclude removal coincidental with preparation for overlay. Remove all concrete within all areas designated for Class B repair, and in all areas designated for Class A repair in which the depth of the remaining sound concrete is less than 50% of the original depth of the bridge deck.

b. Designated Class A repair areas will be measured as Class B Deck Repair when full depth removal is required. At the Engineer's direction, limited areas of removal greater than 50% of the floor thickness (such as beneath reinforcing) may be allowed. These limited areas of excess depth will be measured as Class A Deck Repair.

c. Remove concrete using a jack hammer or chipping hammer, or by using a combination of a scarifyier and chipping hammer. Accomplish the final removal at the periphery of Class B repair using a 15 pound (7 kg) ~~jack hammer~~, chipping hammer, or hand tools. Provide a method of removal at the bottom of the bridge deck that will prevent feather edging of the concrete.

d. Provide forms to enable placement of new concrete in the full depth opening. Use forms that, preferably, are suspended from existing reinforcing bars by wire ties. In the case of large area openings, forms may be supported by blocking from the beam flanges. Support all forms by elements of the existing superstructure unless specifically noted or shown otherwise in the contract documents.

Reason for Revision: The current specification language is not consistent with the specification language developed in the original Supplemental Specification 756 dated February 4, 1975. The current specification language is not clear on the original intent and is being revised to clarify intent.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Gary Novey	**Office:** Bridges and Structures	**Item 9**
Submittal Date: April 25, 2013	**Proposed Effective Date:** October 2013 GS	
Section No.: 2415 **Title:** Concrete Box, Arch, and Circular Culverts	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: The Specifications Section asked if the MOM and BOP for precast culverts should refer to Section 2419. Section 2419 does not have any specific MOM and BOP, but refers back to the other Sections.

Specification Section Recommended Text:

2415, Concrete Box, Arch, and Circular Culverts.

Replace the Section:

2415.01 DESCRIPTION.

A. Cast-in-place.
Construct a cast-in-place concrete box, arch, or circular culvert.

B. Precast.

1. Apply Section 2419.

2. Use culvert sections that meet the requirements of ASTM C 1577 or Iowa DOT Single Precast RCB Culvert Standards.

3. The contract documents will designate the culvert span, rise, and ~~either~~ the design earth cover~~, or the design loading, both defined in ASTM C 1577~~.

4. Use coarse aggregate in concrete mixture from an approved source meeting requirements of Section 4115, with Class 2 or better durability rating.

5. Concrete strength will be based on cylinder tests.

6. Shop drawing submittal required as per the contract documents.

2415.02 MATERIALS.

A. Cast-in-Place.
Use Class C structural concrete meeting the requirements of Section 2403, unless specified otherwise.

B. Precast.
Apply Section 2419

2415.03 CONSTRUCTION.

A. Cast-in-Place.
Apply the requirements of Sections 2401, 2402, 2403, 2404, and 2414.

~~A~~ 1. Footings.

~~1~~ a. Construct footings to the elevations shown in the contract documents, unless directed otherwise by the Engineer.

~~2~~ b. Footing depths may be increased when necessary to prevent undermining or scour or to secure adequate bearing. In general, decrease footing depth only when solid rock is encountered at elevations above those shown.

~~3~~ c. Use suitable wood or metal forms according to Section 2403 to enclose all footing concrete.

~~B~~ 2. Placing Concrete.

~~1~~ a. Footings.

~~a.~~ 1) Do not allow dirt, mud, or other foreign material to become mixed with concrete which is being placed in the footing.

~~b.~~ 2) Monolithically construct footings, pavements, and curtain walls between construction joints if practical.

~~c.~~ 3) Provide a key notch of the form shown in the contract documents between the walls and footings to insure proper anchorage.

~~d.~~ 4) Remove all dirt, dust, shavings, or other foreign material from the key notch and wall forms before placing concrete.

~~2~~ b. Barrels of Culverts.

~~a.~~ 1) The sidewalls and top slab may be constructed as a monolith between construction joints, or the concrete in sidewalls may be placed and allowed to harden before the top slab is placed, at the discretion of the Contractor.

~~b.~~ 2) If the sidewalls and top slab are constructed as a monolith, all necessary construction joints are to be vertical and at right angles to the axis of the culvert. If the sidewalls are placed and allowed to harden before the top slab is placed, leave appropriate keys in the sidewalls for anchoring the cover slab.

~~c.~~ 3) Place forming and reinforcement for the entire barrel section between construction joints before concrete is placed in the sidewalls or headwalls.

~~3~~ c. Headwalls.

~~a.~~ 1) In general, construct headwalls monolithically. However, when construction joints are unavoidable, place them in a horizontal or vertical position and locate them so no joint is visible above the roadbed.

~~b.~~ 2) Place triangular fillet strips in the forms to avoid sharp edges and corners.

~~4~~ d. Placing Concrete in Arch Culverts.

Place concrete in arch culverts as provided in Section 2403.

~~C~~ 3. Surface Finish.

Surface all exposed parts of the wingwalls, headwalls, and railings according to Article 2403.03, P.

~~D~~ 4. Placing Backfill Material.

Place backfill material according to Article 2402.03, H.

~~E~~ 5. Protection Railings.

~~1~~ a. Furnish and install protection railings shown in the contract documents.

~~2~~ b. Paint protection railings, other than aluminum or galvanized railings, as provided in Section 2508.

B. Precast.

1. Apply Section 2419.

2. Place backfill material according to Article 2402.03, H.

2415.04 METHOD OF MEASUREMENT.

A. Excavation for structures, structural concrete, steel reinforcement, and other items in the contract documents will be the quantity shown in the contract documents.

B. Protection railing (when specified in the contract documents) will be the quantity shown in the contract documents.

C. Items for precast box culverts will be measured as noted in the contract documents.

2415.05 BASIS OF PAYMENT.

A. Payment for ~~all~~ cast-in-place concrete box, arch, or circular culverts will be the contract unit price for excavation for structures, structural concrete, steel reinforcement, and other items included in the contract documents.

B. Payment for protection railings will be the contract unit price for the railing material.

C. Payment for precast box culverts items will be as noted in the contract documents.

~~**C**~~ **D.** Payments are full compensation for furnishing all materials, equipment, and labor and for performance of all work necessary to complete the structures in conformance with the contract documents or as ordered by the Engineer.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Section 2415. Concrete Box, Arch, and Circular Culverts

2415.01 DESCRIPTION.

A. Cast-in-place.
Construct a cast-in-place concrete box, arch, or circular culvert.

B. Precast.

1. Apply Section 2419.

2. Use culvert sections that meet the requirements of ASTM C 1577 or Iowa DOT Single Precast RCB Culvert Standards

3. The contract documents will designate the culvert span, rise, and ~~either~~ the design earth cover~~, or the design loading, both defined in ASTM C 1577.~~

4. Use coarse aggregate in concrete mixture from an approved source meeting requirements of Section 4115, with Class 2 or better durability rating.

5. ~~**Deleted**~~. Shop drawing submittal required as per the contract documents.

~~**5.**~~**6** Concrete strength will be based on cylinder tests.

2415.02 MATERIALS.
Cast in Place:
Use Class C structural concrete meeting the requirements of Section 2403, unless specified otherwise.

Precast:
Apply Section 2419

2415.03 CONSTRUCTION.
Cast in Place:
Apply the requirements of Sections 2401, 2402, 2403, 2404, and 2414.

A. Footings.

1. Construct footings to the elevations shown in the contract documents, unless directed otherwise by the Engineer.

2. Footing depths may be increased when necessary to prevent undermining or scour or to secure adequate bearing. In general, decrease footing depth only when solid rock is encountered at elevations above those shown.

3. Use suitable wood or metal forms according to Section 2403 to enclose all footing concrete.

B. Placing Concrete.

1. Footings.
- **a.** Do not allow dirt, mud, or other foreign material to become mixed with concrete which is being placed in the footing.
- **b.** Monolithically construct footings, pavements, and curtain walls between construction joints if practical.
- **c.** Provide a key notch of the form shown in the contract documents between the walls and footings to insure proper anchorage.
- **d.** Remove all dirt, dust, shavings, or other foreign material from the key notch and wall forms before placing concrete.

2. Barrels of Culverts.
- **a.** The sidewalls and top slab may be constructed as a monolith between construction joints, or the concrete in sidewalls may be placed and allowed to harden before the top slab is placed, at the discretion of the Contractor.
- **b.** If the sidewalls and top slab are constructed as a monolith, all necessary construction joints are to be vertical and at right angles to the axis of the culvert. If the sidewalls are placed and allowed to harden before the top slab is placed, leave appropriate keys in the sidewalls for anchoring the cover slab.
- **c.** Place forming and reinforcement for the entire barrel section between construction joints before concrete is placed in the sidewalls or headwalls.

3. Headwalls.
- **a.** In general, construct headwalls monolithically. However, when construction joints are unavoidable, place them in a horizontal or vertical position and locate them so no joint is visible above the roadbed.
- **b.** Place triangular fillet strips in the forms to avoid sharp edges and corners.

4. Placing Concrete in Arch Culverts.
Place concrete in arch culverts as provided in Section 2403.

C. Surface Finish.
Surface all exposed parts of the wingwalls, headwalls, and railings according to Article 2403.03, P.

D. Placing Backfill Material.
Place backfill material according to Article 2402.03, H.

E. Protection Railings.

1. Furnish and install protection railings shown in the contract documents.

2. Paint protection railings, other than aluminum or galvanized railings, as provided in Section 2508.

Precast:

Apply Section 2419

Place backfill in accordance with Article 2402.03H

2415.04 METHOD OF MEASUREMENT.

A. Excavation for structures, structural concrete, steel reinforcement, and other items in the contract documents will be the quantity shown in the contract documents.

B. Protection railing (when specified in the contract documents) will be the quantity shown in the contract documents.

C. Items for precast box culverts will be measured as noted in the contract documents.

2415.05 BASIS OF PAYMENT.

A. Payment for ~~all~~ cast in place concrete box, arch, or circular culverts will be the contract unit price for excavation for structures, structural concrete, steel reinforcement, and other items included in the contract documents.

B. Payment for protection railings will be the contract unit price for the railing material.

C. Payment for precast box culverts items will be as noted in the contract documents.

~~**C**~~**D.** Payments are full compensation for furnishing all materials, equipment, and labor and for performance of all work necessary to complete the structures in conformance with the contract documents or as ordered by the Engineer.

Reason for Revision: Added reference to Iowa precast culvert standards

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: Worked with the industry to develop Iowa DOT standard for precast box sections.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Tom Reis / Eric Johnsen	**Office:** Specifications	**Item 10**
Submittal Date: April 25, 2013	**Proposed Effective Date:** October 2013	
Article No.: 2427.01, A **Title:** Bridge Cleaning	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

2427.01, Description.

Replace the Article:

Unless otherwise specified in the contract documents:

A. Remove all accumulated foreign material from the entire bridge, including the bridge deck, sidewalk, curbs, pier tops, trusses, interior of truss members, and lower flanges of beams or girders.

B. Clean expansion joints, wind links, and drains.

Comments: The Office of Bridges and Structures asked if Article 2427.01, B should also refer to work as specified in the contract documents. This change was made.

Specification Section Recommended Text:

2427.01, A.

Replace the Article:

Remove all accumulated foreign material from the entire bridge, including the bridge deck, sidewalk, curbs, pier tops, trusses, interior of truss members, and lower flanges of beams or girders; or as specified in the contract documents.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Reason for Revision: Each bridge cleaning project lists specific components and areas that must be cleaned. This revision makes it clear that the plan may specify other areas to be cleaned.

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Gary Novey	**Office:** Bridges and Structures	**Item 11**
Submittal Date: April 26,2013	**Proposed Effective Date:** October 2013 GS	
Section No.: 2501 **Title:** Piles and Pile Driving	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: The Office of Construction and Materials asked how the changes would apply to local systems projects. The Office of Bridges and structures indicated that they have had training sessions and provide tutorials on the Iowa DOT website to explain the LRFD changes.

Specification Section Recommended Text:

2501.03, A, 4, b.

Replace the Article:

Control production pile installation with vibratory hammers according to power consumption, rate of penetration, specified tip elevation, or other means acceptable to the Engineer. Assure the pile capacity equals or exceeds the ~~design~~ nominal bearing resistance. Use an approved hammer to retap piles driven to full penetration with a vibratory hammer. Nominal ~~B~~bearing resistance will be determined by an applicable wave equation analysis.

2501.03, A, 10, b, 1, b.

Replace the second bullet:

- The pile could not be driven to the required nominal bearing resistance.

2501.03, A, 10, b, 2, Alternate Approval Method.

Replace the last sentence:

This approval does not relieve the Contractor of the basic obligation to provide equipment suitable for driving the specified pile to the required nominal bearing resistance without damage.

2501.03, C, 2.

Replace the first sentence:

Determine the ~~load carrying capacity~~ nominal bearing resistance of test piles as provided in Article 2501.03, M.

2501.03, E, 3, a.

Replace the Article:

After the piles have been cut off, remove water in the piles.

2501.03, I, 3.

Replace the last sentence:

After being moved, drive the pile a sufficient amount to assure the specified minimum nominal bearing ~~value~~ resistance.

2501.03, M, Determination of Bearing Value of Piles.

Replace the Article and title:

Determination of Nominal Bearing ~~Value~~ Resistance of Piles for Load and Resistance Factor Design.

When load tests are not specified in the contract documents or are not directed by the Engineer, determine the nominal bearing ~~value~~ resistance of piles determined using one of the following methods:

1. **Wave Equation Analysis.**
   - **a.** Wave equation analysis will be used on all Interstate and Primary projects, on other projects when specified in the contract documents, or as directed by the Engineer.
   - **b.** Drive piles to full penetration using approved driving equipment.
   - **c.** Retaps or pile extensions may be necessary to obtain the required pile nominal bearing ~~capacity~~

resistance including potential adjustments for scour or downdrag conditions.

d. Do not continue driving beyond a depth at which acceptable pile stress is exceeded. With the Engineer's approval, driving may be stopped when the rate of driving exceeds 160 blows per foot (0.3 m).

2. Nominal Bearing Resistance Determinations by Formula.

a. When wave equation analysis is not required, compute the nominal bearing ~~value~~ resistance of piles using the following formulas:

For Gravity Hammers with Wood, Steel H, or Steel Pipe Piles:

English

$$P = \frac{312WH}{S+0.35} \times \frac{W}{W+M}$$

Metric

$$P = \frac{2.510WH}{S+8.9} \times \frac{W}{W+M}$$

For Gravity Hammers with Concrete Piles:

English

$$P = \frac{4.518WH}{S+0.2} \times \frac{W}{W+M}$$

Metric

$$P = \frac{3.714.8WH}{S+5.1} \times \frac{W}{W+M}$$

Set the height of fall to no less than 5 feet (1.5 m) or more than 8 feet (3 m), and the rate of driving to no less than 8 blows per minute.

Diesel Hammers with Wood, Steel H, or Steel Pipe Piles and (Construction) Steam Hammers for all Piles:

English

$$P = \frac{312E}{S+0.1} \times \frac{W}{W+M}$$

Metric

$$P = \frac{0.25E}{S+2.5} \times \frac{W}{W+M}$$

Diesel Hammers with Concrete Piles:

English

$$P = \frac{728E}{S+0.1} \times \frac{W}{W+M}$$

Metric

$$P = \frac{0.582.32E}{S+2.5} \times \frac{W}{W+M}$$

Where, for the above equations:

P = The nominal bearing ~~value~~ resistance in tons (kN),

W = The weight (mass) of the gravity hammer, or the ram of an air hammer or diesel hammer in tons (kilograms),

H = The height of free fall of the hammer or ram in feet (meters),

M = The weight (mass) in tons (kilograms) of the pile plus the weight (mass) in tons (kilograms) of the cap plus (for diesel hammers) the weight (mass) of the anvil in tons (kilograms),

E = The energy per blow in foot-tons (joules) (for single acting steam hammers E = W x H (E = 9.81 x W x H)),

S = The average penetration in inches (millimeters) of the pile per blow for the last 5 blows for gravity hammers and the last 10 blows for air or diesel hammers.

b. Apply the following conditions in the use of the above formulas:

1) Unless the hammer has free fall, substitute a value for "W" that is less than the weight (mass) of the hammer by an amount sufficient to compensate for all friction and drag tending to retard its fall.

2) With approval from the Engineer, driving may be stopped when the rate of driving exceeds 160 blows per foot (0.3 m).

3) There is no excessive bounce to the hammer after the blow.

4) For the computation of the nominal bearing ~~value~~ resistance for battered piles driven with gravity hammers, multiply the value obtained from the formulas by the following factor: (Cosine a) minus (f sine a), where "a" equals the angle the leads make with the vertical and "f" equals the coefficient of friction between the hammer or ram and the surface on which it slides. For gravity hammers sliding on greased steel surfaced leads, assume the value of "f" to be 0.1.

c. The Engineer may modify the above formulas on the basis of load tests. At the Engineer's discretion, the Wave Equation Analysis may be used to evaluate the driving system, as well as determine pile nominal bearing resistance.

3. Static Load Test.

a. When directed by the Engineer, nominal bearing ~~value~~ resistance of piles will be determined by actual load test in which the entire load is applied concentric with the pile.

b. Careful measurements will be made to determine the amount and rate of settlement.

c. Gages reading in thousandths of an inch (0.001 µm) will be used to determine the settlement.

d. The designated test pile(s) shall stand, after being driven, at least ~~40 hours~~ 3 calendar days before the test load may be applied.

e. ~~This method is~~ The Quick Test Procedure outlined in ~~Section 5.6 and 6.4 of~~ ASTM D 1143 will be followed unless otherwise directed by the Engineer. ~~The procedure in ASTM D 1143 will be followed except as modified below:~~

~~**1)** Apply the test load in increments of 10% of the proposed design load.~~

~~**2)** Apply the load at 2.5 minute intervals. Record readings of time, load, and settlement immediately before and after the application of each load. The test is to continue by adding load increments until continuous jacking is required to maintain the test load (i.e., failure by settlement), or the load limit of the jacking equipment is reached.~~

~~**3)** When the maximum load has been applied, take pile settlement readings immediately, and at 2.5 minutes and 5 minutes, after jacking has ceased. Remove the test load and immediately record pile rebound readings. Take additional rebound readings 2.5 minutes and 5 minutes later.~~

~~**4)** Use the data obtained to plot a load (tons (kilonewtons) versus settlement in inches (millimeters)) curve~~

f. Use the data obtained to plot a load displacement curve (load in tons (kilonewtons) versus settlement in inches (millimeters)).

~~**f**~~ **g.** Davisson's Method will be used to determine the nominal bearing resistance of the pile. The ~~failure load~~ nominal resistance is defined as the intersection between the ~~tangent of the linear portion of the load settlement curve and a line with a slope of 0.05 inches per ton (0.14 mm/kN) from the yield point~~ Davisson Line and the load displacement curve.

~~**g**~~ **h.** ~~The yield point is defined as the intersection between the load settlement curve and a line which is parallel to the linear portion of the load settlement curve at 0.25 inches (6 mm) of settlement.~~ The Davisson Line is a line parallel to the elastic compression line on the load displacement curve which is offset by a specified amount of displacement depending on the pile size.

~~**h**~~ **i.** ~~The safe bearing value will be 50% of the load at the failure point.~~ When dynamic testing with signal matching is used in conjunction with the static load test, the factored bearing resistance will be 80% of the nominal bearing resistance, otherwise it will be 75%.

4. Dynamic Pile Analyzer Tests.

a. The Engineer will take dynamic measurements during the driving of piles designated as dynamic load test piles, or as directed by the Engineer. Instruments for dynamic analysis will be:

- Attached near the top of the pile with bolts placed in approved masonry anchors, or
- Bolted through drilled holes in the web of steel piles, or
- Bolted with wood lag screws for timber piles.

b. The Engineer will furnish the instruments, material, and labor necessary for drilling the holes and mounting the instruments.

c. When specified in the contract documents, or ordered by the Engineer, furnish a shelter to protect the dynamic test equipment from the elements. Maintain the inside temperature of the shelter above 45°F (7°C). Locate the shelter within 100 feet (30 m) of the test location.

d. Pretest, Pile Calibration.

1) Predriving wave speed measurements will be required for concrete or wood piles. Make each designated pile available for this measurement prior to placement of the pile in the leads.

2) When predriving wave speed measurements are required, block the piling up off the ground

in a horizontal position and locate it to not contact other piling. Predriving wave speed measurements will not be required for steel piles.

e. Prior to Driving.

1) Prior to placing the designated pile in the leads, provide access to the pile and allow the Engineer time to predrill instrument mounting holes or conduct predriving wave speed measurements, or both, if required.

2) When the designated test pile is placed in the leads and is ready to drive, provide the Engineer reasonable access to the pile for testing purposes.

3) Attach the instruments and associated test cables to the top of the pile as directed by the Engineer, unless there is an acceptable personnel platform (minimum size of 4 feet x 4 feet (1.2 m x 1.2 m) designed to be raised to the top of the pile) provided for the Engineer.

4) Allow time to attach or reattach and check the instruments as needed before beginning to drive.

f. Driving.

1) Drive the designated pile to at least the depth at which the dynamic test equipment indicates that the ~~capacity~~ nominal bearing resistance shown in the contract documents has been achieved, unless the Engineer directs otherwise. The stresses in the pile will be monitored during driving with the dynamic test equipment to ensure that damage, as determined by the Engineer, does not occur.

2) If an over-stress condition is indicated, the Engineer will suspend driving and determine if plan ~~capacity~~ nominal bearing resistance has been achieved. If necessary, in order to maintain monitored stresses below the accepted values, reduce the driving energy transmitted to the pile by:

- Using additional cushion thickness,
- Reducing the energy output of the hammer, or
- Changing hammers.

3) If nonaxial driving is indicated by the dynamic test equipment measurements, immediately realign the driving system.

4) When the Engineer orders, wait a minimum of 24 hours and retap the dynamic load test pile after the instruments are reattached. Do not use a cold hammer for the retap. Warm up the hammer before the retap by applying at least 20 blows to another pile. The maximum amount of penetration required during a retap is 6 inches (150 mm). After retapping, the Engineer will determine if desired nominal bearing resistance has been achieved or if additional pile penetration is required.

5. Retaps.

a. When piles do not achieve the specified driving resistance during driving, the Engineer may require one retap per 10 piles or a minimum of 2 piles in each foundation at no additional cost to the Contracting Authority. Only piles with the lowest driving resistance will be considered for retap.

b. Perform the retap by allowing the pile to set up for 24 hours, or as directed by the Engineer.

c. Warm up hammers (other than gravity) by applying a minimum of 20 blows to another pile before the retap driving begins. Take the nominal bearing resistance for the retap within the first 6 inches (150 mm) of penetration.

d. The first two blows of a retap are for seating the cap and assuring proper operation of the hammer. Do not use the first two blows as part of bearing evaluation.

e. Measure the penetration of the next ten blows, or record the number of blows it takes to drive the pile 6 inches (150 mm). Correct to the appropriate measurement and check for nominal bearing resistance.

1) If nominal bearing resistance is achieved, driving may be halted. However, if the Engineer approves, driving may be continued to cut-off as long as acceptable pile stress is not exceeded.

2) If penetration is less than 1 inch (25 mm) for the first ten blows, discontinue driving. Record the bearing as refusal.

f. Have the Engineer evaluate piles not achieving the specified driven resistance after a retap and, if so ordered, extend as required following the procedures of Article 2501.03, P.

2501.03, N, Bearing Required.

Replace the Article and title:

Nomimal Bearing Resistance Required.

Unless modified by the Engineer, drive all piles to the ~~design~~ nominal bearing resistance specified in the contract documents. Ensure the specified ~~design~~ nominal bearing resistance is obtained below scour

elevation for substructure subject to scour.

2501.03, O, Penetration.

Replace the Article:

1. Unless provided otherwise in the contract documents, drive all piles until the ~~design~~ nominal bearing resistance, determined as provided in Article 2501.03, M, is at least equal to that specified in Article 2501.03, N.
2. Drive all piling for piers and abutments of stream crossings, and the piling for piers and abutments of other structures, when ordered by the Engineer, until the following requirements for penetration have been met:
   - **a.** The length of all piles specified in the contract documents, or ordered by the Engineer, for any specific structure is to be construed as indicating the desired penetration. Continue the effort to secure this penetration as long as the pile can be driven without damage to the pile.
   - **b.** When the pile cannot be driven to the required length without damage, the Engineer will determine if additional penetration is required. If full penetration is required, advance the pile by jetting, preboring to a maximum depth of 20 feet (6 m), or other approved methods which will secure the required penetration and nominal bearing resistance without damage to the pile.
   - **c.** The driving of wood piling in excess of ~~40~~ 160 ton (~~350~~ 1420 kN) nominal bearing resistance will not be permitted.
   - **d.** If soil conditions permit auguring, perform the auguring according to Article 2501.03, Q, except drill the holes to the approximate size of the pile measured at mid length. Do not use Bentonite slurry in prebored holes to gain additional penetration.
   - **e.** Drive piles which do not carry superimposed vertical loads, such as wingwall piles, fender piles, wing dam piles, and revetment piles, to the penetration shown in the contract documents without regard to nominal bearing resistance values.

2501.03, P, Extension and Splices.

Replace the first sentence:

Follow Article 2501.03, M, 5, when piles driven to the specified depth fail to develop the required ~~design~~ nominal bearing resistance.

2501.03, Q, 1.

Replace the last sentence:

Drive piles through the holes to at least the specified ~~design~~ nominal bearing resistance.

Appendix.

Replace the note at the bottom of Table 2501.03-1:

For ~~design~~ nominal bearing~~s~~ resistances under ~~40~~ 105 tons, minimum diesel hammer energies listed may be reduced by 20% for concrete pile and 10% for steel pile.

Replace the notes at the bottom of Table 2501.03-2:

[a] Wave equation analysis.

For ~~design~~ nominal bearing~~s~~ resistances under ~~355~~ 930 kN, minimum diesel hammer energies listed may be reduced by 20% for concrete pile and 10% for steel pile.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

See Attachment

Reason for Revision: Modification to terminology and driving formulas due to Load and Resistance Factor Design (LRFD) criteria

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No** X	**Industry Concurrence:**	**Yes**	**No**
Comments: Industry input is not necessary as the equipment required of the Contractor will not					

change. The values do appear different, however the work on the part of the Contractor is not anticipated to be impacted.

Section 2501. Piles and Pile Driving

2501.01 DESCRIPTION.

A. Furnish and place piles for foundations, trestles, and other exposed work.

B. Furnish and place piling for falsework according to Article 2403.03, L.

2501.02 MATERIALS.

Use piles that comply with the following requirements for the class of pile specified:

A. Untreated Timber Piles: apply Article 4165.03.

B. Treated Timber Foundation Piles: apply Article 4165.04.

C. Treated Timber Trestle Piles: apply Article 4165.05.

D. Concrete Piles: apply Section 4166.

E. Steel Pipe Piles: apply Section 4167.

F. Steel H-Piles: apply Section 4167.

G. Concrete Sheet Piles: apply Section 4166.

H. Steel Sheet Piles: apply Section 4167.

2501.03 CONSTRUCTION.

A. Pile Driving Equipment.

The hammer used for driving piles may be of gravity, steam, air, or diesel type. Use pile driving equipment that complies with the following provisions:

1. Gravity Hammers.

a. When gravity hammers are permitted, use a ram that weighs (has a mass) between 3000 pounds (1350 kg) and 6000 pounds (2750 kg) with a height of drop not exceeding 10 feet (3 m).

b. Equip gravity hammers with hammer guides to ensure concentric impact on the pile cap. Use hammer guides that have some method for visually determining the drop height during driving.

c. For all gravity hammers, apply Article 2501.03, A, 10, of this article.

2. Single or Double Acting Air and Steam Hammers.

a. Use equipment with sufficient capacity to maintain the hammer operation under working conditions as recommended by the manufacturer.

b. Use equipment with accurate pressure gages which are easily accessible to the Engineer.

c. Steam hammers may be air operated if the capacity and pressure of the compressor comply with recommendations of the hammer manufacturer.

d. Ensure the weight (mass) of the striking parts of air and steam hammers is no less than 33% of the combined weight (mass) of the pile cap and pile being driven. In no case allow the striking parts to have a weight (mass) less than 2750 pounds (1250 kg).

3. Diesel Hammers.

For all diesel hammers, apply Article 2501.03, A, 10, of this article.

a. Open End (Single Acting) Diesel Hammers.

1) Equip with a method to visually determine drop height during driving. Examples of measurement devices are as follows:

- A graduated scale (jump stick) extending above the ram cylinder.
- Graduated rings or grooves on the ram.
- An electronic, sound activated, remote measuring instrument.

2) Provide the Engineer with the manufacturer's chart equating stroke to blows per minute for the open end diesel hammer used.

b. Closed End (Double Acting) Diesel Hammers.

1) Equip with an accurate bounce chamber pressure gage mounted in a manner to enable easy access for the Engineer.

2) Provide the Engineer with a current, calibrated chart equating bounce chamber pressure and gage hose length to either equivalent energy or stroke for the hammer being used.

4. Driving Aids.

a. Do not use vibratory hammers, hydraulic hammers, or driving aids such as jets, followers, and prebored holes unless stated in the contract documents or authorized in writing by the Engineer. When permitted, vibratory hammers and hydraulic hammers may be used for installing production piles only after the pile tip elevation is established by load test or by test piles driven with an approved hammer. As condition for approval, perform (at no additional cost to the Contracting Authority) load tests and extra work required to drive test piles as determined by the Engineer.

b. Control production pile installation with vibratory hammers according to power consumption, rate of penetration, specified tip elevation, or other means acceptable to the Engineer. Assure the pile capacity equals or exceeds the ~~design bearing~~ nominal bearing resistance. Use an approved hammer to retap piles driven to full penetration with a vibratory hammer. ~~Bearing~~ Nominal bearing resistance will be determined by an applicable wave equation analysis.

5. Hammer Cushion.

a. Equip all impact pile driving equipment with suitable thickness hammer cushion material to prevent damage to the hammer or pile. In the Engineer’s presence, inspect the hammer cushion for condition, composition, and thickness before beginning pile driving at each structure, and regularly during driving.

b. For hammers with internal cushions, check the cushion regularly at 100 hour intervals during driving. Use the hammer manufacturer’s recommended beginning cushion thickness and composition. Report this information to the Engineer prior to driving. Replace the hammer cushion when it has less than 70% of the recommended thickness, has burned, or has been broomed.

6. Pile Cushion.

a. Protect the head of all concrete piling with a suitable pile cushion. When requested, provide the pile cushion composition and thickness to the Engineer. Determine the minimum thickness by the wave equation.

b. If alternate pile driving control methods are used, use a minimum thickness of 6 inches (150 mm) of suitable wood.

c. In the Engineer’s presence, inspect the pile cushion for condition, composition, and thickness before beginning pile driving at each structure, and regularly during driving. Replace any pile cushion when it has less than 70% of the original reported thickness, has burned, or has been broomed.

7. Pile Driving Cap.

a. Piles driven with impact hammers require an adequate cap to distribute the hammer blow evenly to the top of the pile. Align the cap axially with the hammer and the pile. Guide with leads. Use an appropriate cap for the type and size of pile. Ensure it fits around the top of the pile so that the driving unit is centered during driving.

b. For special types of piles, provide appropriate driving caps, mandrels, or other devices according to the manufacturer's recommendations so that the piles may be driven without damage.

c. Cut all pile tops squarely to ensure proper fit of the driving cap.

8. Followers.

Use followers only with the Engineer’s authorization.

9. Water Jets.

Use water jets only with the Engineer’s authorization. When jets are used, ensure the size, number, and location of jets, as well as the volume and pressure of water at the jet nozzles, is sufficient to freely erode material from under and adjacent to the pile.

10. Approval of Pile Driving Equipment.

a. On each project, the Engineer's approval is required for all pile driving equipment. Size all pile driving equipment so that the piles can be driven with reasonable effort to the required lengths without damage.

b. Pile driving equipment approval on Interstate and Primary projects will be based on the wave equation analysis. For other projects, the alternate approval method will be used unless specified otherwise.

1) Wave Equation Analysis.

a) For wave equation approval, submit to the Engineer the required data forms detailing equipment to be used on the project. Submit this information to the Engineer at least 20 calendar days prior to driving piles.

b) The Contractor will be notified of the acceptance or rejection of the driving system within 12 calendar days of the Engineer's receipt of the data forms. Modify or replace the proposed methods or equipment (at no additional cost to the Contracting Authority) if the wave equation analysis:

- Indicates pile damage could occur, or
- The pile could not be driven to the required ~~bearing~~ nominal bearing resistance.

c) Ensure the subsequent driving system results in wave equation analysis indicating the piles can be reasonably driven to the desired capacity without damage. The Engineer will notify the Contractor of the acceptance or rejection of the revised driving system within 9 calendar days of receipt of a revised data form or method plan.

d) Equipment meeting the values in Tables 2501.03-1 and 2501.03-2 in the Appendix will be acceptable for wave equation analysis.

2) Alternate Approval Method.

Use the tabulated energy values in Tables 2501.03-1 and 2501.03-2, in the Appendix, as a basis for approval of pile driving equipment for the alternate approval method. Approval will be based on meeting all requirements of this article. This approval does not relieve the Contractor of the basic obligation to provide equipment suitable for driving the specified pile to the required ~~bearing~~ nominal bearing resistance without damage.

11. Pile Driving Equipment.

a. Use an approved system or placement method. Variations in the driving system will not be permitted without the Engineer's approval. If the hammer performance deviates from the manufacturer's recommended specifications, take immediate corrective action. The Engineer will not allow driving to continue until the system is performing to the manufacturer's specifications.

b. Changes in the driving system will be considered after the Contractor has submitted the required data for review. The Contractor will be notified of the acceptance or rejection of the driving system changes within 9 calendar days of the Engineer's receipt of the requested change. Time required for submission, review, and approval of a revised driving system does not constitute the basis for a contract time extension.

B. Determination of Pile Lengths.

1. When pile length is not specified, the Engineer will determine the length from the results obtained under the procedure specified in the contract documents. Wood pile lengths will be in multiples of:

- 2 feet (0.5 m) for lengths of 20 feet (6 m) and less, and
- 5 feet (1.5 m) for lengths over 20 feet (6 m).

2. Steel H-piles and steel pipe piles will be in multiples of 5 feet (1.5 m). Precast concrete piles may be specified in any length of whole feet (to the nearest 0.5 m).

C. Test Piles.

1. When the contract documents specify that the lengths of piles are to be determined from results of driving test piles, furnish and drive piles:

- Of lengths designated in the contract documents or by the Engineer, and
- In locations designated in the contract documents or by the Engineer.

2. Determine the ~~load carrying capacity~~ nominal bearing resistance of test piles as provided in Article 2501.03, M. Drive these test piles with the same or comparable type of equipment as that which is to be used for driving other piles for the structure. The Contractor may be required to excavate the test pile

area to the proposed footing elevation before driving the test pile. Within 10 calendar days, the Engineer will determine the length of piles to be furnished by considering the results of the test pile.

D. Concrete Piles.

1. Use concrete bearing piles of the form and dimensions specified in the contract documents. Place as indicated in the contract documents.

2. Piles may be driven when the concrete compressive strength has reached a minimum of 5,000 psi (35 MPa), but no less than 7 calendar days after casting.

E. Steel Pipe Piles.

Construct steel pipe piles by first driving steel pipe of the specified type and size in the locations specified in the contract documents, and then filling the pipe with concrete. Construct the piles according to the following additional requirements:

1. Inspection.

a. Furnish a light suitable for visual interior inspection of driven pipe piles. This inspection will be conducted before cut off and filling is allowed.

b. Remove and replace, or otherwise correct as directed by the Engineer, all piles which have been improperly driven, broken, or are otherwise defective.

c. Ensure the interior of the pile is clean and free of water at the time of inspection.

2. Cut Off.

Upon completion of driving, inspection, and approval, neatly cut the pile on a horizontal plane at the elevation specified in the contract documents.

3. Filling.

a. After the piles have been cut off, remove water in the piles.

b. After reinforcement has been accurately placed, fill pile completely with Class C structural concrete meeting requirements of Section 2403. Ensure pile is free of accumulated water at the time concrete is placed.

c. In order to avoid formation of air pockets, place the concrete:

- Using vibratory methods as specified in Article 2403.03, D or
- In small charges of not over 2 cubic feet (0.05 m^3) each.

4. Painting.

After the piles have been filled with concrete, clean the exposed sections using hand methods. Paint with three coats of paint from the cap to the low water elevation or 2 feet (0.5 m) below finished ground line according to the provisions of Section 2508. Apply all three coats of paint in the field.

F. Steel H-Piles.

1. Use steel H-piles of the cross section, size, and weight per foot (mass per meter) specified in the contract documents. The contract documents may allow an option of pipe piles in place of steel H-piles. Pipe piles are also described in Section 4167.

2. When driving is complete, cut the pile off neatly at the elevation specified. The contract documents may require encasement of steel H-piles. The Contractor may increase the diameter of encasements with no additional payment. Limit the increase to 4 inches (100 mm) or less. For a structure, use encasements all of the same diameter. Clean steel H-piles that are exposed to the atmosphere in the finished structure. Paint these piles with three coats of paint as specified in Section 2508.

3. Limit the number of permitted welds used to develop plan specified lengths of steel H-piles to those in Table 2501.03-3:

Table 2501.03-3: Number of Permitted Welds.

Plan Pile Length, feet (m)	Number of Permitted Welds (splices)
0 - 50 (0-15.0)	0
51-100 (15.1-30)	1

101-150 (30.1-45.0)	2

4. Welds (splices) in excess of the number specified above will not be permitted unless required for a pile extension. When steel H-piles are to be spliced, make the last added length the shortest pile length.

G. Steel Sheet Piles.

1. For steel sheet piles that will become a part of a finished structure, use an interlocking type with a:
- Web thickness no less than 3/8 inch (9 mm),
- Section modulus no less than that specified in the contract document.

2. Use an interlock approved by the Engineer.

3. Put used sheet piles in proper condition before redriving.

4. Where steel sheet piles will receive a concrete cap, cut them off neatly in straight lines at the required elevations after driving. Adapt the details at angles in sheet pile walls to the type of pile used. Obtain the Engineer's approval.

5. Steel sheet piles need not be painted unless specified.

H. Foundation Piles.

1. The term "foundation piles" means all piles, whether of wood, concrete, or steel, which support superimposed loads and have no part of their length exposed above ground line.

2. Except as provided otherwise in the contract documents, complete excavation before driving foundation piles. After driving is completed, remove all loose and displaced material forced up during driving from around the piles, leaving a firm surface to receive the footing concrete.

3. After piles have been driven, cut the tops to the plane indicated at the required elevation. Remove all crushed or broomed wood, broken concrete, or deformed steel. Paint the tops of treated wood piles with two coats of treatment material meeting the requirements of Section 4160. Inspect steel pipe piles for damage according to Article 2501.03, E.

I. Trestle Piles.

1. The term "trestle piles" means all piles, whether of wood, steel, or concrete, which support superimposed loads, but will be exposed above the ground level for a part of their length. Bents around which fills may later be constructed are considered trestle piles.

2. Drive wood and steel piles with an accuracy that will permit them to be capped as shown in the contract documents, with only such springing and bending that will not damage the pile. If, in the Engineer's judgment, a pile has been deformed or cracked by springing after being driven, replace it. Perform all springing prior to placing the cap.

3. Drive concrete piles to stand without springing within 4 inches (100 mm) of the intended location, and in no case closer than 3 inches (75 mm), to the faces of the caps as shown in the contract documents. In case it is necessary to move a concrete pile after driving to secure the above accuracy, move it by loosening the soil surrounding the pile with jets until it can be moved and can stand without strain in the correct position. After being moved, drive the pile a sufficient amount to assure the specified minimum ~~bearing value~~.nominal bearing resistance.

4. Cut trestle piles off to be level or at the designed slope at the elevation of cut-off shown in the contract documents. Ensure the length of pile above this elevation is sufficient to permit complete removal of all material damaged by driving.

5. In treated wood piles, apply two coats of an approved treatment material meeting requirements of Section 4160 to all bolt holes, cuts, daps, or chamfers made subsequent to treatment, as well as all abrasions of the surface and the tops of piles after cut-offs. When the tops of treated piles are not to be encased in concrete, protect them as specified in Article 2409.03, D.

J. Preparation of Wood Piles for Driving.
Prepare all wood piles for driving according to the following:

1. Preparation of Pile Heads.
Trim the pile head accurately to make a driving fit into the driving cap. If the head of the pile becomes broomed or crushed before driving is completed, trim off the broomed fibers to provide sound wood accurately fitting the driving cap.

2. Preparation of Pile Points.
Cut the lower end of a pile square. If directed by the Engineer, shape it to a point no less than 4 inches by 4 inches (100 mm by 100 mm). Form the tapered point concentric to the center line of the pile.

K. Protection of Concrete Piles during Driving.
Protect the tops of all concrete bearing and sheet piles from damage by the impact of the hammer. Design, maintain, and use this protection to cause the minimum absorption of energy consistent with adequate protection of the top of the pile.

L. Accuracy in Placing and Driving Piles.

1. In spotting the points of piles in preparation for driving, use care to locate them as shown in the contract documents or as directed by the Engineer. Limit the deviation from such designated locations to 3 inches (75 mm) or less at the time driving is begun, except as may be made necessary by the presence of unavoidable obstructions.

2. While being driven, hold piles so they deviate the minimum possible amount from the vertical or batter line shown in the contract documents. Firmly and securely hold in place in proper position the leads used in driving piles to assure driving the pile in the line required.

3. Suspend pile driving during and for 12 hours following concrete placement that is within 50 feet (15 m) of the pile driving operation.

M. Determination of ~~Bearing Value~~ Nominal Bearing Resistance of Piles for Load and Resistance Factor Design.
When load tests are not specified in the contract documents or are not directed by the Engineer, determine the ~~bearing value~~ nominal bearing resistance of piles determined using one of the following methods:

1. Wave Equation Analysis.
- **a.** Wave equation analysis will be used on all Interstate and Primary projects, on other projects when specified in the contract documents, or as directed by the Engineer.
- **b.** Drive piles to full penetration using approved driving equipment.
- **c.** Retaps or pile extensions may be necessary to obtain the required pile ~~bearing capacity~~ nominal bearing resistance including potential adjustments for scour or downdrag conditions.
- **d.** Do not continue driving beyond a depth at which acceptable pile stress is exceeded. With the Engineer's approval, driving may be stopped when the rate of driving exceeds 160 blows per foot (0.3 m).

2. ~~Bearing~~ Nominal Bearing Resistance Determinations by Formula.
- **a.** When wave equation analysis is not required, compute the ~~bearing value~~ nominal bearing resistance of piles using the following formulas:

For Gravity Hammers with Wood, Steel H, or Steel Pipe Piles:

English

$$P = \frac{\text{~~3~~ 12 WH}}{\text{S+0.35}} \times \frac{\text{W}}{\text{W+M}}$$

Metric

$$P = \frac{\text{~~2.5~~ 10 WH}}{\text{S+8.9}} \times \frac{\text{W}}{\text{W+M}}$$

For Gravity Hammers with Concrete Piles:

English

$$P = \frac{\text{~~4.5~~ 18 WH}}{} \times \frac{\text{W}}{}$$

Metric

$$P = \frac{\text{~~3.7~~ 14.8 WH}}{} \times \frac{\text{W}}{}$$

S+0.2 W+M S+5.1 W+M

Set the height of fall to no less than 5 feet (1.5 m) or more than 8 feet (3 m), and the rate of driving to no less than 8 blows per minute.

Diesel Hammers with Wood, Steel H, or Steel Pipe Piles and (Construction) Steam Hammers for all Piles:

English

$$P = \frac{3\ 12\ E}{S+0.1} \times \frac{W}{W+M}$$

Metric

$$P = \frac{0.25E}{S+2.5} \times \frac{W}{W+M}$$

Diesel Hammers with Concrete Piles:

English

$$P = \frac{7\ 28\ E}{S+0.1} \times \frac{W}{W+M}$$

Metric

$$P = \frac{0.58\ 2.32\ E}{S+2.5} \times \frac{W}{W+M}$$

Where, for the above equations:

P = The bearing value nominal bearing resistance in tons (kN),

W = The weight (mass) of the gravity hammer, or the ram of an air hammer or diesel hammer in tons (kilograms),

H = The height of free fall of the hammer or ram in feet (meters),

M = The weight (mass) in tons (kilograms) of the pile plus the weight (mass) in tons (kilograms) of the cap plus (for diesel hammers) the weight (mass) of the anvil in tons (kilograms),

E = The energy per blow in foot-tons (joules) (for single acting steam hammers E = W x H (E = 9.81 x W x H)),

S = The average penetration in inches (millimeters) of the pile per blow for the last 5 blows for gravity hammers and the last 10 blows for air or diesel hammers.

b. Apply the following conditions in the use of the above formulas:
- **1)** Unless the hammer has free fall, substitute a value for "W" that is less than the weight (mass) of the hammer by an amount sufficient to compensate for all friction and drag tending to retard its fall.
- **2)** With approval from the Engineer, driving may be stopped when the rate of driving exceeds 160 blows per foot (0.3 m).
- **3)** There is no excessive bounce to the hammer after the blow.
- **4)** For the computation of the bearing value nominal bearing resistance for battered piles driven with gravity hammers, multiply the value obtained from the formulas by the following factor: (Cosine a) minus (f sine a), where "a" equals the angle the leads make with the vertical and "f" equals the coefficient of friction between the hammer or ram and the surface on which it slides. For gravity hammers sliding on greased steel surfaced leads, assume the value of "f" to be 0.1.

c. The Engineer may modify the above formulas on the basis of load tests. At the Engineer's discretion, the Wave Equation Analysis may be used to evaluate the driving system, as well as determine pile bearing.nominal bearing resistance.

3. Static Load Test.
- **a.** When directed by the Engineer, bearing value nominal bearing resistance of piles will be determined by actual load test in which the entire load is applied concentric with the pile.
- **b.** Careful measurements will be made to determine the amount and rate of settlement.
- **c.** Gages reading in thousandths of an inch (0.001 µm) will be used to determine the settlement.
- **d.** The designated test pile(s) shall stand, after being driven, at least 40 hours 3days before the test load may be applied.

e. ~~This~~ The Quick Test Procedure ~~method is~~ outlined in ~~Section 5.6 and 6.4 of~~ ASTM D 1143 will be followed unless otherwise directed by the Engineer. ~~The procedure in ASTM D 1143 will be followed except as modified below:~~

~~**1)** Apply the test load in increments of 10% of the proposed design load.~~

~~**2)** Apply the load at 2.5 minute intervals. Record readings of time, load, and settlement immediately before and after the application of each load. The test is to continue by adding load increments until continuous jacking is required to maintain the test load (i.e., failure by settlement), or the load limit of the jacking equipment is reached.~~

~~**3)** When the maximum load has been applied, take pile settlement readings immediately, and at 2.5 minutes and 5 minutes, after jacking has ceased. Remove the test load and immediately record pile rebound readings. Take additional rebound readings 2.5 minutes and 5 minutes later.~~

~~**4)** Use the data obtained to plot a load (tons (kilonewtons) versus settlement in inches (millimeters)) curve~~

f. Use the data obtained to plot a load displacement curve (load in tons (kilonewtons) versus settlement in inches (millimeters)

~~**f.**~~g Davisson's Method will be used to determine the nominal bearing resistance of the pile. The ~~failure load~~ nominal resistance is defined as the intersection between the ~~tangent of the linear portion of the load settlement curve and a line with a slope of 0.05 inches per ton (0.14 mm/kN) from the yield point.~~ Davisson Line and the load displacement curve.

~~**g.**~~h. The ~~yield point is defined as the intersection between the load settlement curve and a line which is parallel to the linear portion of the load settlement curve at 0.25 inches (6 mm) of settlement.~~ Davisson Line is a line parallel to the elastic compression line on the load displacement curve which is offset by a specified amount of displacement depending on the pile size.

~~**H**~~**i.** When dynamic testing with signal matching is used in conjunction with the static load test the ~~The safe bearing value~~ factored bearing resistance will be ~~50~~ 80% of the ~~load at the failure point~~ nominal bearing resistance, otherwise it will be 75%.

4. Dynamic Pile Analyzer Tests.

a. The Engineer will take dynamic measurements during the driving of piles designated as dynamic load test piles, or as directed by the Engineer. Instruments for dynamic analysis will be:

- Attached near the top of the pile with bolts placed in approved masonry anchors, or
- Bolted through drilled holes in the web of steel piles, or
- Bolted with wood lag screws for timber piles.

b. The Engineer will furnish the instruments, material, and labor necessary for drilling the holes and mounting the instruments.

c. When specified in the contract documents, or ordered by the Engineer, furnish a shelter to protect the dynamic test equipment from the elements. Maintain the inside temperature of the shelter above 45°F (7°C). Locate the shelter within 100 feet (30 m) of the test location.

d. Pretest, Pile Calibration.

1) Predriving wave speed measurements will be required for concrete or wood piles. Make each designated pile available for this measurement prior to placement of the pile in the leads.

2) When predriving wave speed measurements are required, block the piling up off the ground in a horizontal position and locate it to not contact other piling. Predriving wave speed measurements will not be required for steel piles.

e. Prior to Driving.

1) Prior to placing the designated pile in the leads, provide access to the pile and allow the Engineer time to predrill instrument mounting holes or conduct predriving wave speed measurements, or both, if required.

2) When the designated test pile is placed in the leads and is ready to drive, provide the Engineer reasonable access to the pile for testing purposes.

3) Attach the instruments and associated test cables to the top of the pile as directed by the Engineer, unless there is an acceptable personnel platform (minimum size of 4 feet x 4 feet (1.2 m x 1.2 m) designed to be raised to the top of the pile) provided for the Engineer.

4) Allow time to attach or reattach and check the instruments as needed before beginning to drive.

f. Driving.

1) Drive the designated pile to at least the depth at which the dynamic test equipment indicates that the ~~capacity~~ nominal bearing resistance shown in the contract documents has been achieved, unless the Engineer directs otherwise. The stresses in the pile will be monitored

during driving with the dynamic test equipment to ensure that damage, as determined by the Engineer, does not occur.

2) If an over-stress condition is indicated, the Engineer will suspend driving and determine if plan ~~capacity~~ nominal bearing resistance has been achieved. If necessary, in order to maintain monitored stresses below the accepted values, reduce the driving energy transmitted to the pile by:

- Using additional cushion thickness,
- Reducing the energy output of the hammer, or
- Changing hammers.

3) If nonaxial driving is indicated by the dynamic test equipment measurements, immediately realign the driving system.

4) When the Engineer orders, wait a minimum of 24 hours and retap the dynamic load test pile after the instruments are reattached. Do not use a cold hammer for the retap. Warm up the hammer before the retap by applying at least 20 blows to another pile. The maximum amount of penetration required during a retap is 6 inches (150 mm). After retapping, the Engineer will determine if desired ~~bearing~~ nominal bearing resistance has been achieved or if additional pile penetration is required.

5. Retaps.

a. When piles do not achieve the specified driving resistance during driving, the Engineer may require one retap per 10 piles or a minimum of 2 piles in each foundation at no additional cost to the Contracting Authority. Only piles with the lowest driving resistance will be considered for retap.

b. Perform the retap by allowing the pile to set up for 24 hours, or as directed by the Engineer.

c. Warm up hammers (other than gravity) by applying a minimum of 20 blows to another pile before the retap driving begins. Take the ~~bearing~~ nominal bearing resistance for the retap within the first 6 inches (150 mm) of penetration.

d. The first two blows of a retap are for seating the cap and assuring proper operation of the hammer. Do not use the first two blows as part of bearing evaluation.

e. Measure the penetration of the next ten blows, or record the number of blows it takes to drive the pile 6 inches (150 mm). Correct to the appropriate measurement and check for ~~bearing~~ nominal bearing resistance.

1) If ~~bearing~~ nominal bearing resistance is achieved, driving may be halted. However, if the Engineer approves, driving may be continued to cut-off as long as acceptable pile stress is not exceeded.

2) If penetration is less than 1 inch (25 mm) for the first ten blows, discontinue driving. Record the bearing as refusal.

f. Have the Engineer evaluate piles not achieving the specified driven resistance after a retap and, if so ordered, extend as required following the procedures of Article 2501.03, P.

N. ~~Bearing~~ Nomimal Bearing Resistance Required.

Unless modified by the Engineer, drive all piles to the ~~design bearing~~ nominal bearing resistance specified in the contract documents. Ensure the specified ~~design bearing~~ nominal bearing resistance is obtained below scour elevation for substructure subject to scour.

O. Penetration.

1. Unless provided otherwise in the contract documents, drive all piles until the ~~design bearing~~ nominal bearing resistance, determined as provided in Article 2501.03, M, is at least equal to that specified in Article 2501.03, N.

2. Drive all piling for piers and abutments of stream crossings, and the piling for piers and abutments of other structures, when ordered by the Engineer, until the following requirements for penetration have been met:

a. The length of all piles specified in the contract documents, or ordered by the Engineer, for any specific structure is to be construed as indicating the desired penetration. Continue the effort to secure this penetration as long as the pile can be driven without damage to the pile.

b. When the pile can not be driven to the required length without damage, the Engineer will determine if additional penetration is required. If full penetration is required, advance the pile by jetting, preboring to a maximum depth of 20 feet (6 m), or other approved methods which will secure the required penetration and ~~bearing~~ nominal bearing resistance without damage to the pile.

c. The driving of wood piling in excess of ~~40~~ 160 ton (~~350~~ 1420 kN) ~~bearing~~ nominal bearing resistance will not be permitted.

d. If soil conditions permit auguring, perform the auguring according to Article 2501.03, Q, except drill the holes to the approximate size of the pile measured at mid length. Do not use Bentonite slurry in prebored holes to gain additional penetration.

e. Drive piles which do not carry superimposed vertical loads, such as wingwall piles, fender piles, wing dam piles, and revetment piles, to the penetration shown in the contract documents without regard to ~~bearing~~ nominal bearing resistance values.

P. Extensions and Splices.

Follow Article 2501.03, M, 5, when piles driven to the specified depth fail to develop the required ~~design bearing~~ nominal bearing resistance. If the Engineer orders pile extensions, driving will continue as long as practical, then the piles will be extended in the manner specified below:

1. Concrete Piles.

a. When a concrete pile is to be extended and the pile does not require further driving, cut away the concrete at the end to expose 24 inches (600 mm) of the existing extension bars cast in the upper end of the pile, as well as 24 inches (600 mm) of the prestressing tendons. To the exposed steel, properly lap and securely wire reinforcing equivalent in cross sectional area to the exposed extension bars.

b. If for any reason extension bars do not exist at the splice, cut the concrete off squarely with at least 24 inches (600 mm) of the prestressing tendons exposed. Use eight No. 7 (No. 25) reinforcing bars, from full lap with the tendons to within 3 inches (75 mm) of the extension top.

c. In the concrete pile extension, use 5 gage (No. W 3.5) spiral reinforcing placed at a 3 inch (75 mm) pitch, and ending with six close turns at the top.

d. After the extension reinforcement is in place, place the necessary forms. Do not allow leakage along the face of the pile.

e. Use the same quality concrete for the extension used to cast the original pile.

f. Just prior to placing concrete for the extension, prepare the joint according to Article 2403.03, I. Coat with a creamy mixture composed of 1 part of water and 1.5 parts of dry cement. The grout may be poured in at the top of the form, depositing it as nearly as possible in the center of the pile.

g. After placement, the forms may be removed after 24 hours, and the extension cured by wrapping with two thicknesses of burlap kept wet for 4 calendar days. Finish the entire surface of the exposed pile to present a uniform color and texture. Splice piles that require further driving as specified in the contract documents or as directed by the Engineer.

2. Steel Piles.

a. For extensions of steel H-piles and steel pipe piles, neatly weld the entire cross section after removing all damaged metal. Ensure the axis of the extension coincides with the axis of the original pile. Perform welding of all steel piles according to Article 2408.03, B.

b. Allow only welders qualified according to Material I.M. 560 to make field extensions of steel piles. Ensure they use an approved welding procedure involving the use of backing plates according to Article 2408.03, B.

c. When designated in the contract documents, the Contractor has the option of extending steel piles by means of mechanical splices approved by the Engineer.

3. Wood Piles.

Splice wood piles as directed by the Engineer.

Q. Prebored Holes as per Plan.

1. When required by the contract documents, bore holes greater than the maximum cross sectional dimension of the pile. Bore holes to the elevations shown and to a minimum diameter 4 inches (100 mm) greater than the maximum cross sectional dimension of the pile 3 feet (1 m) from the butt. Drive piles through the holes to at least the specified ~~design bearing~~ nominal bearing resistance.

2. Use natural bentonite slurry when piling is to be advanced in prebored holes. For holes drilled in noncollapsing soils, the bentonite slurry may be placed after piles are driven. In collapsing soils, place the bentonite slurry at the time the hole is drilled. Cover holes to prevent footing concrete from entering the holes.

3. Use prebored hole filling materials consisting of polymer free sodium bentonite designed for sealing wells and bored holes. Materials may consist of American Petroleum Institute Specification 13A, sodium

bentonites, high solids bentonite grout mixes, or granular bentonites composed of approximately 1/4 inch (6 mm) or larger particles.

4. For collapsing soils, make a slurry by thoroughly mixing the bentonite with water according to the manufacturer's recommendation for the product used. In no case use more than 100 gallons (500 L) of water per 80 pounds (50 kg) of bentonite. Place slurry materials by pumping or other applicable methods that assure the hole is filled from the bottom up.

5. For noncollapsing dry holes, coarse 1/4 inch (6 mm) or larger bentonite particles may be poured directly into the hole and hydrated with water after placement.

6. Completely stabilize the hole and fill with bentonite prior to placing footing concrete.

2501.04 METHOD OF MEASUREMENT.

Measurement for the quantities of Wood Piles, Steel HP-Piles (either encased or not), Steel Pipe Piles, Concrete Piles, and Steel Sheet Piles, will be the plan quantity. The quantity may be modified by Article 2501.04, D, F, or G.

A. Wood Piles.

When a wood pile is broken in driving, through no fault of the Contractor, the length measured for payment will be the plan length.

B. Sheet Piles.

The area of walls of sheet piles will be determined from the plan length and the horizontal center line length measured to the nearest 0.1 foot (0.1 m) of wall.

C. Concrete Encasement.

The length of concrete encasement of steel HP-piles constructed will be measured to the nearest 0.1 foot (0.1 m).

D. Extension and Splices.

1. Wood and Steel Piling.

a. For Measurement for extensions of wood, steel HP (either encased or not), or steel pipe piles will be the length of the extension specified by the Engineer. Portions of pile cut-offs used as extensions on the same contract will not be remeasured as additional plan quantity.

b. Splices (welded or mechanical) are measured by count. Only splices specified by the Engineer to extend piles beyond plan length will be counted.

2. Concrete Piling.

a. Measurement for extensions of concrete piles will be the length of the extension specified by the Engineer, plus the additional length required to be removed for splicing the reinforcement.

b. Splices are not measured separately.

E. Prebored Holes.

1. The length of prebored holes will be calculated in linear feet (meters) from elevations as shown in the contract documents to the nearest 0.1 foot (0.1 m).

2. Preboring required by Article 2501.03, O, will be measured for payment to the nearest 0.1 foot (0.1 m).

F. Extra Pile.

Extra piles ordered, in addition to the plan quantities, will be measured for payment.

G. Unused Piles.

The quantity of unused piling delivered to the job site without having been placed in the leads or any attempt made to drive it will be subtracted from the plan quantity.

2501.05 BASIS OF PAYMENT.

Payment will be the contract unit price for the quantities of Wood Piles, Steel HP-Piles (either encased or not), Steel Sheet Piles, Steel Pipe Piles, and Concrete Piles measured as provided above. The price bid for piles is full compensation for delivering piles to the site, preparing, driving, cutting, and filling (steel pipe piles only) piles, except as modified in this article.

A. Unused Piles.

1. Return unused piling (either ordered as directed by the Engineer, or specified in the contract documents to the supplier. Unused piles are piles that have been delivered to the job site without having been placed in the leads or any attempt made to drive them. Payment will be made for freight, restocking, and handling charges.

2. The Contracting Authority may purchase unused piles for the invoice cost plus handling and transporting costs.

B. Extension of Concrete Piles.
Payment for the extension will be twice the contract unit price per linear foot (meter) of pile. The length of extension is to be as directed by the Engineer.

C. Extension and Splicing of Steel Piles.

1. Payment for extension will be at the contract unit price for pile.

2. Payment for splice (welded or mechanical) will be at ten times the contract unit price per linear foot (three times the contract unit price per meter) for splices (welded or mechanical) for steel HP-piles or pipe piles required to be spliced to obtain lengths greater than specified in the contract. Payment includes all equipment, labor, and materials necessary to complete the splice.

D. Extension and Splicing of Wood Piles.

1. Payment for extension will be at the contract unit price for pile.

2. Payment for splice will be according to Article 1109.03, B.

E. Pile Cut-Offs.

1. Pile cut-offs not used as extensions on the same contract become the property of the Contractor. Steel pile cut-offs used as extensions on the same contract will not be paid for as additional plan quantity.

2. All piles, or portions thereof, which become the property of the Contractor shall be removed from the project site by the Contractor.

F. Encasement.
Payment will be the contract unit price per linear foot (meter).

G. Test Piles.
The contract may provide a lump sum item for Test Piles. If an item is not provided, Test Piles ordered by the Engineer and driven under the Engineer's supervision will be considered as extra work and will be paid for as provided in Article 1109.03, B.

H. Pile Points.
When the contract documents require that points of piles be protected with metal points, furnish these points without extra compensation. When metal points are not specified in the contract documents, furnish them only upon direction of the Engineer, in which case payment will be made as provided in Article 1109.03, B.

I. Sheet Piles.
When specified to become a part of the permanent structure, payment will be at the contract unit price per square foot (square meter) for steel sheet piles of the specified weight (mass) and cross section for the area of the wall or walls placed.

J. Pile Loading Tests.

1. When required, payment will be the contract lump sum price. Payment is full compensation for all labor, material, and equipment required to comply with the procedure shown in the contract documents, including the test and anchor piles, welding, and placing and removing the test beam.

2. For pile loading tests ordered by the Engineer, payment will be a lump sum price of $3000. When this test is performed within a cofferdam, the lump sum price will be $6000. Payment is full compensation for all labor, material, welding, and equipment, for placing and removing the test beam, and loss of time.

K. Prebored Holes.

1. When required by the contract documents, payment will be the contract unit price per linear foot (meter).

2. Payment is full compensation for all labor, equipment, and materials including bentonite slurry.

3. Prebored holes required by Article 2501.03, O, will be paid for according to Article 1109.03, B.

L. Dynamic Pile Test.

1. When required by the contract documents, or ordered as directed by the Engineer, payment will be a lump sum price of $250 per test pile.

2. Payment is full compensation for all labor, materials, equipment, and time associated with this test as outlined in Article 2501.03, M.

M. Jetting.
When required by Article 2501.03, O, payment will be according to Article 1109.03, B.

N. Payment for Driving Only.
If extensions or extra piles are furnished by the Contracting Authority, payment for driving will be paid according to Article 1109.03, B.

Table 2501.03-1 (English Units)
Energy Values For Gravity And Diesel Hammers

Minimum Energy Required for Gravity Hammers (Ft. - Kips[(b)])									
Pile Length (ft.)	Wood Pile	Concrete Pile		Steel H-Pile					
		12" to 14"	16"	10 x 42	10 x 57	12 x 53	12 x 74	14 x 73	14 x 89
25' or less	15	25	27	23	23	23	25	25	32
26' to 40'	15	25	27	23	23	23	30	30	35
41' to 50'	15	25	27	25	25	25	30	30	36
51' to 65'	(a)	(a)	(a)	25	25	25	30	30	36
66' to 90'	(a)	(a)	(a)	30	30	30	33	33	36

Maximum Energy Allowed for Gravity Hammers (Ft. - Kips[(b)])									
Pile Length (ft.)	Wood Pile	Concrete Pile		Steel H-Pile					
		12" to 14"	16"	10 x 42	10 x 57	12 x 53	12 x 74	14 x 73	14 x 89
25' or less	25	34	36	28	28	28	35	35	42
26' to 40'	25	34	36	32	35	35	38	38	45
41' to 50'	25	34	36	38	38	42	42	42	48
51' to 65'	(a)	(a)	(a)	35	38	38	42	42	48
66' to 90'	(a)	(a)	(a)	35	38	38	42	42	50

Minimum Energy Required for Diesel Hammers (Ft. - Kips[(b)])									
Pile Length (ft.)	Wood Pile	Concrete Pile	Steel H-Pile						
		12" to 14"	16"	10 x 42	10 x 57	12 x 53	12 x 74	14 x 73	14 x 89
25' or less	17	23	28	22	24	24	29	29	33
26' to 40'	17	23	28	22	24	24	29	29	40
41' to 50'	17	23	28	22	26	26	33	33	40
>51' to 65'	[(a)]	[(a)]	[(a)]	22	26	26	33	33	40
66' to 90'	[(a)]	[(a)]	[(a)]	22	29	29	40	40	49
Maximum Energy Allowed for Diesel Hammers (Ft. - Kips[(b)])									
Pile Length (ft.)	Wood Pile	Concrete Pile	Steel H-Pile						
		12" to 14"	16"	10 x 42	10 x 57	12 x 53	12 x 74	14 x 73	14 x 89
25' or less	24	32	40	33	33	33	40	40	43
26' to 40'	24	32	40	33	33	33	40	40	47
41' to 50'	33	32	40	40	40	40	43	43	52
51’ to 65’	[(a)]	[(a)]	[(a)]	40	40	40	43	43	52

[(a)] Wave equation analysis.

[(b)] Ft. - Kips - 1,000 foot pounds.

For ~~design bearings~~ nominal bearing resistances under ~~40~~ 105 tons, minimum diesel hammer energies listed may be reduced by 20% for concrete pile and 10% for steel pile.

Table 2501.03-2 (Metric Units)
Energy Values For Gravity And Diesel Hammers

Minimum Energy Required for Gravity Hammers (kilojoules)									
Pile Length (meters)	Wood Pile	Concrete Pile		Steel H-Pile					
		305 mm to 356 mm	406 mm	250 x 62	250 x 85	310 x 79	310 x 110	360 x 108	360 x 132
7.5 or less	20	34	37	31	31	31	34	34	43
7.6 to 12.0	20	34	37	31	31	31	41	41	47
12.1 to 15.0	20	34	37	34	34	34	41	41	49
15.1 to 20.0	(a)	(a)	(a)	34	34	34	41	41	49
20.1 to 28.0	(a)	(a)	(a)	41	41	41	45	45	49
Maximum Energy Allowed for Gravity Hammers (kilojoules)									
Pile Length (meters)	Wood Pile	Concrete Pile		Steel H-Pile					
		305 mm to 356 mm	406 mm	250 x 62	250 x 85	310 x 79	310 x 110	360 x 108	360 x 132
7.5 or less	34	46	49	38	38	38	47	47	57
7.6 to 12.0	34	46	49	43	47	47	52	52	61
12.1 to 15.0	34	46	49	47	52	52	57	57	65
15.1 to 20.0	(a)	(a)	(a)	47	52	52	57	57	65
20.1 to 28.0	(a)	(a)	(a)	52	52	57	57	57	68

Minimum Energy Required for Diesel Hammers (kilojoules)									
Pile Length (meters)	Wood Pile	Concrete Pile		Steel H-Pile					
		305 mm to 356 mm	406 mm	250 x 62	250 x 85	310 x 79	310 x 110	360 x 108	360 x 132
7.5 or less	23	31	38	30	33	33	39	39	45
7.6 to 12.0	23	31	38	30	33	33	39	39	54
12.1 to 15.0	23	31	38	30	35	35	45	45	54
15.1 to 20.0	[a]	[a]	[a]	30	35	35	45	45	54
20.1 to 28.0	[a]	[a]	[a]	30	39	39	54	54	66
Maximum Energy Allowed for Diesel Hammers (kilojoules)									
Pile Length (meters)	Wood Pile	Concrete Pile		Steel H-Pile					
		305 mm to 356 mm	406 mm	250 x 62	250 x 85	310 x 79	310 x 110	360 x 108	360 x 132
7.5 or less	33	43	54	45	45	45	54	54	58
7.6 to 12.0	33	43	54	45	45	45	54	54	64
12.1 to 15.0	45	43	54	54	54	54	58	58	70
15.1 to 20.0	[a]	[a]	[a]	54	54	54	58	58	70
20.1 to 28.0	[a]	[a]	[a]	54	54	64	66	66	81

[a] Wave equation analysis. For ~~design bearings~~ nominal bearing resistances under ~~355~~ 930 kN, minimum diesel hammer energies listed may be reduced by 20% for concrete pile and 10% for steel pile.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Willy Sorenson / Michael Jorgensen	**Office:** Traffic & Safety	**Item 12**
Submittal Date: 04/19/2013	**Proposed Effective Date:** October 2013	
Section No.: 2522 **Title:** Tower Lighting	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

2522.01, A.

Replace the first sentence:

This specification is for design, fabrication, and construction of tower lighting systems, consisting of footings, towers, luminaires, and associated appurtenant items required by the contract documents.

2522.03, D, 2.

Replace the Article:

~~A list of approved brands of electrodes may be obtained from the Office of Materials~~. Filler metal shall comply with the requirements of the AWS D1.1, Structural Welding Code.

2522.03, E, Lighting Tower.

Replace the first paragraph:

Ensure the structural design of the tower and its appurtenances meet the requirements of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, Fifth Edition 2009 " and interims, with the following clarifications:

2522.03, E, 1, Wind Velocity.

Add as the second sentence:

Fatigue requirements shall be Category I with 2nd mode vortex shedding included.

2522.03, E, 4, Anchor Bolts, Washers, and Nuts.

Replace the Article:

a. Ensure galvanizing for anchor bolts, washers, and nuts meets the requirements of ASTM ~~A 153, Class C~~ F 2329 with zinc temperature bath limited to 850°F (455°C); or ASTM B 695, Class 55, Type 1 coating.

~~a~~ **b.** Furnish each anchor bolt with one leveling nut and two anchoring nuts. Use anchor bolts, nuts, and washers that~~:~~ meet the requirements of Materials I.M. 453.08. Anchor bolts shall be ASTM F 1554, Grade 105.

- ~~Meet the requirements of ASTM F 1554, Grade 105 (724 MPa),~~
- ~~Are full-length galvanized,~~
- ~~Are high-strength low alloy steel, and~~
- ~~Unless specified otherwise, are Unified Coarse Thread Series with Class 2A tolerance.~~

~~**b.** Color code, in red, the end of each anchor bolt intended to project from the concrete to identify the grade.~~

~~**c.** Use galvanized washers that meet the requirements of ASTM F 436.~~

~~**d.** Use heavy hex, galvanized nuts that meet the requirements of ASTM A 563, DH. Nuts may be over-tapped according to the allowance requirements of ASTM A 563.~~

2522.03, E, 5, a.

Replace the Article:

Use a solid plate. Keep the hole~~s~~ cut out in the base plate for utility lines to a ~~minimum, subject to the Engineer's approval~~ maximum diameter of 12 inches (300mm) as shown in the contract documents.

2522.03, E, 7, b.

Replace the Article:

~~When designated in the contract documents~~ Inspection:

- Visually inspect all welds,

- Radiographically inspect 100% of the full penetration sections of the longitudinal seam weld at the base plate connection location, and
- Use the magnetic particle method to inspect a random 10% of the partial penetration section of the longitudinal seam welds.

2522.03, E, 9, Poles with Telescoped Lab Joints.

Replace **the title:**

Poles with Telescoped Labp Joints.

2522.03, E, 10, Hand Hole.

Replace **the Article and title:**

Hand Hole Handhole.

a. Ensure the pole provides an opening for a minimum 10 inch by 30 inch (250 mm by 750 mm) handhole, to allow for servicing and maintenance of the lowering devices. Ensure the handhole is reinforced to maintain the design strength of the pole. Reinforce handhole as shown on the contract documents.

b. Install a neoprene or rubber gasket to make the handhole weatherproof. Obtain Engineer's acceptance for the gasket prior to installation. Foam adhesive-back rubber gaskets are unacceptable.

c. Ensure the door is hinged and handhole cover is fabricated from the same type of steel as the poles. Use 1/8 inch (3 mm) minimum thickness for the handhole cover. Ensure the securing hardware is stainless steel and provisions have been made to allow for the door to be bolted securely shut.

2522.03, E, 12, Shaft, Base Plate, and Integral Shaft.

Replace the Article:

a. Ensure the shaft, base plate, and integral shaft components are fabricated with steel meeting the requirements of ASTM A 709 Grade 50W (345W MPa) or ASTM A 871 Grade 65, with a minimum yield strength of 50,000 psi (345 MPa). All steel required to be ASTM A 709 Grade 50 (345 MPa) must meet impact requirements specified for main members in Article 4152.02. If the Engineer approves, certain components of the tower assembly may be fabricated from steel meeting requirements of ASTM A 709 Grade 36 (250 MPa). Ensure the base plate is fabricated with steel meeting the requirements of ASTM A 709 Grade 50W (345W). Steel used for shaft, base plate, and integral shaft components shall meet impact requirements specified in Article 4152.02.

b. Ensure that after fabrication pole shafts, anchor bolts, base plate, washers, nuts, and all steel items are:

- Fully galvanized inside and outside according to ASTM A 123 or ASTM A 153 as appropriate, and
- Are of uniform color and appearance.

2522.03, F, 8, Slipfitter.

Replace the Article:

Accommodate a standard two- 2 inch (50 mm) pipe bracket and provide for leveling of the luminaire.

2522.03, G, Luminaire Lowering Device.

Replace Articles 1, 2, and 3:

1. Luminaire Frame and Head Frame.

a. Ensure the luminaire frame and head frame assembly meet the requirements of ASTM A 709 Grade 50 (345 MPa). For the purpose of Charpy V-notch toughness requirements, all steel required to be ASTM A 709 Grade 50 (345 MPa) will be considered main members shall meet impact requirements specified in Article 4152.02. Miscellaneous appurtenant steel components may be constructed using ASTM A 709 Grade 36 (250 MPa) steel. Ensure all steel and the head frame dome are galvanized. Alternately, in a two cable lift system, the luminaire frame, head frame and miscellaneous appurtenant steel components will all be fabricated from ASTM A 240 Type 201LN stainless steel.

b. Attach the luminaire frame to two or three lift cables. Attach a multiple conductor electrical cable to the luminaire frame with a double weave, stainless steel, grip type, strain relief connection. Pass all cables through a head frame assembly mounted at the top of the tower shaft, as shown in the contract documents. Ensure they pass freely through the shaft during raising and lowering operations.

c. Ensure the luminaire frame is designed to accommodate the specified number of luminaires on mounts consisting of 2 inch (50 mm) slipfitters.

d. Ensure the head frame assembly is enclosed and shielded from the elements by means the

Engineer approves.

e. In a three lift cable system, ~~I~~install three or more spring loaded centering arms with rubber or nylon rollers to control lateral movement of the luminaire frame during raising or lowering operations. Ensure the centering arms interlock with each other so the tower is centered within the luminaire frame.

f. In two lift cable systems, the luminaire frame shall be protected from contact with the pole shaft by means of two 2 7/16 inch (62 mm) diameter PVC bumpers on the inner surface of the luminaire frame.

2. Support Cables.

a. Install support cables of anti-rotational aircraft type stainless steel with a minimum diameter of 3/16 inch (4.8 mm) and having a safety factor of 5.

b. In a three lift cable system, ~~S~~space them 120 degrees apart where attached to the luminaire frame. Attach them to a terminating device which is located within the tower shaft and provides a means of equalizing tension of the lift cables.

~~**b.** In a three lift cable system e~~Ensure the terminator and attached components are shaped to prevent interference to the raising or lowering operation caused by irregularities on the interior surface of the tower shaft.

c. In a two lift cable system, the cables shall be spaced 180 degrees apart and no terminating device may be used since the cables go directly to the winch drums.

3. Winch.

a. Install and securely anchor a winch assembly that:

- Consists of a worm gear speed reducer with either one or two output shafts with cable drum attached.
- Is capable of supporting five times the maximum lifted load.
- Includes an integral drag brake to prevent unwinding, slipping, or free spooling of the winch cable.
- In a three lift cable system, ~~I~~include~~s~~ a drum provided with keepers to ensure that the cable will properly wrap onto the drum.
- When powered by the internal power unit, raises the luminaire ring at a minimum rate of 12 feet (4 m) per minute.

b. Install stainless steel, anti-rotational aircraft type winch cable(s) with 1/4 inch (6.4 mm) minimum diameter and a safety factor of 3 to be used to raise and lower the luminaire frame. In a three winch cable system attach the cable to the terminator. Include a safety device that is capable of stopping upward motion of the terminator at any time, in case of winch cable failure. Include a torque limiting device with the winch or power unit.

c. In a three lift cable system, ~~I~~install a top-latching system that ensures the following:

- Latch barrels are cast, high strength, copper-free aluminum or cast stainless steel.
- Latching is accomplished by the alternate raising and lowering of the luminaire ring assembly using the winch and hoisting assembly.
- There are no moving latch parts or springs attached to the head frame assembly.
- The latch mechanism is not impaired by the formation of ice and does not require adjustment after the original installation.
- Indicator flags are used to show when the luminaire supporting ring is in the latched or unlatched position.

d. In a two lift cable system, ensure the following:

- Latch mechanism can be engaged or disengaged manually in less than 60 seconds working through the handhole at the pole base and can be disengaged without power to the pole.
- Entire Latch mechanism shall be accessible through handhole at the pole base with no pole top components to fail.
- Latching Indicator system is visible through the handhole at the pole base.
- Latching components are never exposed to ice formation so latch mechanism cannot be impaired by ice.

~~**d**~~ **e.** Install pulleys that are:

- Stainless steel type designed for the respective types and sizes of cables used, and
- Equipped with permanently lubricated, sealed bearings or oil impregnated bronze bushings mounted on stainless steel shafts.

Comments: The Office of Construction and Materials asked if there is language addressing the shape of the terminator so that it does not catch when being lowered on telescoping poles. Article 2522.03, G,

2, b, states “Ensure the terminator and attached components are shaped to prevent interference to the raising or lowering operation caused by irregularities on the interior surface of the tower shaft.” This should be adequate.

The Office of Bridges and Structures presented some small changes to the language in the specification.

The Specifications Section noted that Materials I.M. 453.08, which is referenced, contains a lot of specification language that was added in October 2012. The Specifications Section feels that specification language should be in the specifications, as this language is reviewed and approved by the Specification Committee. Materials I.M.’s should include testing procedures and approved products and approval procedures. The Office of Construction and Materials will review the Materials I.M. to see what language should go in the specifications.

The Office of Bridges and Structures indicated that there will be some future changes to the tower lighting specifications as new national standards are being released.

Specification Section Recommended Text:

2522.01, A.

Replace the first sentence:

This specification is for design, fabrication, and construction of tower lighting systems, consisting of footings, towers, luminaires, and associated appurtenant items required by the contract documents.

2522.03, D, 2.

Replace the Article:

~~A list of approved brands of electrodes may be obtained from the Office of Materials~~. Filler metal shall comply with the requirements of the AWS-Welding Code.

2522.03, E, Lighting Tower.

Replace the first paragraph:

Ensure the structural design of the tower and its appurtenances meet the requirements of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, Fifth Edition 2009 “ and interims, with the following clarifications:

2522.03, E, 1, Wind Velocity.

Add as the second sentence:

Fatigue requirements shall be Category I with 2nd mode vortex shedding included.

2522.03, E, 4, Anchor Bolts, Washers, and Nuts.

Replace the Article:

a. Ensure galvanizing for anchor bolts, washers, and nuts meets the requirements of ASTM ~~A 153, Class C~~ F 2329 with zinc temperature bath limited to 850°F (455°C); or ASTM B 695, Class 55, Type 1 coating.

~~a~~ **b.** Furnish each anchor bolt with one leveling nut and two anchoring nuts. Use anchor bolts, nuts, and washers that~~:~~ meet the requirements of Materials I.M. 453.08. Anchor bolts shall be grade 105.

- ~~Meet the requirements of ASTM F 1554, Grade 105 (724 MPa),~~
- ~~Are full-length galvanized,~~
- ~~Are high-strength low alloy steel, and~~
- ~~Unless specified otherwise, are Unified Coarse Thread Series with Class 2A tolerance.~~

~~**b.** Color code, in red, the end of each anchor bolt intended to project from the concrete to identify the grade.~~

~~**c.** Use galvanized washers that meet the requirements of ASTM F 436.~~

~~**d.** Use heavy hex, galvanized nuts that meet the requirements of ASTM A 563, DH. Nuts may be over-tapped according to the allowance requirements of ASTM A 563.~~

2522.03, E, 5, a.

Replace the Article:

Use a solid plate. Keep the holes cut out in the base plate for utility lines to a ~~minimum, subject to the Engineer’s approval~~ maximum diameter of 12 inches (300mm) as shown on the contract documents.

2522.03, E, 7, b.

Replace the Article:

~~When designated in the contract documents~~ Testing:

- Radiographically inspect 100% of the full penetration section~~s~~ of the longitudinal seam weld at the based plate connection location, and
- Use the magnetic particle method to inspect a random 10% of the partial penetration section of the longitudinal seam welds.

2522.03, E, 9, Poles with Telescoped Lab Joints.

Replace **the title:**

Poles with Telescoped Lab~~b~~p Joints.

2522.03, E, 10, Hand Hole.

Replace **the Article and title:**

~~Hand Hole~~ Handhole.

a. Ensure the pole provide an opening for a minimum 10 inch by 30 inch (250 mm by 750 mm) handhole, to allow for servicing and maintenance of the lowering devices. ~~Ensure the handhole is reinforced to maintain the design strength of the pole.~~ Reinforce handhole as shown on the contract documents.

b. Install a neoprene ~~or~~ rubber gasket to make the handhole weatherproof. Obtain Engineer's acceptance for the gasket prior to installation. Foam adhesive-back rubber gaskets are unacceptable.

c. Ensure ~~the door is hinged and~~ handhole cover is fabricated from the same type of steel as the poles. Use 1/8 inch (3 mm) minimum thickness for the handhole cover. Ensure the securing hardware is stainless steel and provisions have been made to allow for the door to be bolted securely shut.

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Replace the Article:

a. Ensure the shaft~~, base plate,~~ and integral shaft components are fabricated with steel meeting the requirements of ASTM A 709 Grade 50W ~~(345 MPa)~~ or ASTM A 871 Grade 65, with a minimum yield strength of 50,000 psi (345 MPa). ~~All steel required to be ASTM A 709 Grade 50 (345 MPa) must meet impact requirements specified for main members in Article 4152.02. If the Engineer approves, certain components of the tower assembly may be fabricated from steel meeting requirements of ASTM A 709 Grade 36 (250 MPa).~~ Ensure the base plate is fabricated with steel meeting the requirements of ASTM A 709 Grade 50W. All steel used for the shaft, base plate, and integral shaft components must meet impact requirements specified in Article 4152.02.

~~**b.** Ensure that after fabrication pole shafts, anchor bolts, base plate, washers, nuts, and all steel items are:~~

- ~~Fully galvanized inside and outside according to ASTM A 123 or ASTM A 153 as appropriate, and~~
- ~~Are of uniform color and appearance.~~

2522.03, F, 8, Slipfitter.

Replace the Article:

Accommodate a standard ~~two-~~ 2 inch (50 mm) pipe bracket and provide for leveling of the luminaire.

2522.03, G, Luminaire Lowering Device.

Replace Articles 1, 2, and 3:

1. Luminaire Frame and Head Frame.

a. Ensure the luminaire frame and head frame assembly meet the requirements of ASTM A 709 Grade 50 (345 MPa). For the purpose of Charpy V-notch toughness requirements, all steel required to be ASTM A 709 Grade 50 (345 MPa) ~~will be considered main members~~ must meet impact requirements specified in Article 4152.02. Miscellaneous appurtenant steel components may be constructed using ASTM A 709 Grade 36 (250 MPa) steel. Ensure all steel and the head frame dome are galvanized. Alternately, in a two cable lift system, the luminaire frame, head frame and miscellaneous appurtenant steel components will all be fabricated from ASTM A 240 Type 201LN stainless steel.

b. Attach the luminaire frame to two or three lift cables. Attach a multiple conductor electrical cable to the luminaire frame with a double weave, stainless steel, grip type, strain relief connection. Pass all cables through a head frame assembly mounted at the top of the tower shaft, as shown in the contract documents. Ensure they pass freely through the shaft during raising and lowering operations.

c. Ensure the luminaire frame is designed to accommodate the specified number of luminaires on mounts consisting of 2 inch (50 mm) slipfitters.

d. Ensure the head frame assembly is enclosed and shielded from the elements by means the Engineer approves.

e. In a three lift cable system, ~~I~~install three or more spring loaded centering arms with rubber or nylon rollers to control lateral movement of the luminaire frame during raising or lowering operations. Ensure the centering arms interlock with each other so the tower is centered within the luminaire frame.

f. In two lift cable systems, the luminaire frame shall be protected from contact with the pole shaft by means of two 2 7/16 inch (62 mm) diameter PVC bumpers on the inner surface of the luminaire frame.

2. Support Cables.

a. Install support cables of anti-rotational aircraft type stainless steel with a minimum diameter of 3/16 inch (4.8 mm) and having a safety factor of 5.

b. In a three lift cable system, ~~S~~space them 120 degrees apart where attached to the luminaire frame. Attach them to a terminating device which is located within the tower shaft and provides a means of equalizing tension of the lift cables.

~~**b.** In a three lift cable system e~~Ensure the terminator and attached components are shaped to prevent interference to the raising or lowering operation caused by irregularities on the interior surface of the tower shaft.

c. In a two lift cable system, the cables will be spaced 180 degrees apart and no terminating device is used since the cables go directly to the winch drums.

3. Winch.

a. Install and securely anchor a winch assembly that:

- Consists of a worm gear speed reducer with either one or two output shafts with cable drum attached.
- Is capable of supporting five times the maximum lifted load.
- Includes an integral drag brake to prevent unwinding, slipping, or free spooling of the winch cable.
- In a three lift cable system, ~~I~~include~~s~~ a drum provided with keepers to ensure that the cable will properly wrap onto the drum.
- When powered by the internal power unit, raises the luminaire ring at a minimum rate of 12 feet (4 m) per minute.

b. Install stainless steel, anti-rotational aircraft type winch cable(s) with 1/4 inch (6.4 mm) minimum diameter and a safety factor of 3 to be used to raise and lower the luminaire frame. In a three winch cable system attach the cable to the terminator. Include a safety device that is capable of stopping upward motion of the terminator at any time, in case of winch cable failure. Include a torque limiting device with the winch or power unit.

c. In a three lift cable system, ~~I~~install a top-latching system that ensures the following:

- Latch barrels are cast, high strength, copper-free aluminum or cast stainless steel.
- Latching is accomplished by the alternate raising and lowering of the luminaire ring assembly using the winch and hoisting assembly.
- There are no moving latch parts or springs attached to the head frame assembly.
- The latch mechanism is not impaired by the formation of ice and does not require adjustment after the original installation.
- Indicator flags are used to show when the luminaire supporting ring is in the latched or unlatched position.

d. In a two lift cable system, ensure the following:

- Latch mechanism can be engaged or disengaged manually in less than 60 seconds working through the handhole at the pole base and can be disengaged without power to the pole
- Entire Latch mechanism must be accessible through handhole at the pole base. with no pole top components to fail.
- Latching Indicator system is visible through the handhole at the pole base
- Latching components are never exposed to ice formation so latch mechanism cannot be impaired by ice

~~**d**~~ **e.** Install pulleys that are:

- Stainless steel type designed for the respective types and sizes of cables used, and
- Equipped with permanently lubricated, sealed bearings or oil impregnated bronze bushings mounted on stainless steel shafts.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

2522.01 DESCRIPTION.

A. This specification is for design, fabrication and construction of tower lighting systems, consisting of footings, towers, luminaires, and associated appurtenant items required by the contract documents. Apply Section 2523 to other components of this system.

B. Each individual installation consists of:

- A reinforced concrete footing,
- A tubular steel tower of circular or other approved cross-section of the length indicated in the contract documents,
- Approved luminaires of the proper number,
- An approved lowering device, and
- The electrical system described in the contract documents.

2522.02 MATERIALS.

A. Submit copies of the following to the Office of Materials for review for compliance before these materials are shipped to the project:

- A certified mill analysis for each heat of steel used in the pole and pole assembly, and
- Certified test results for support cables.

B. Refer to Article 2522.03, D for welding requirements.

C. Notify the Office of Materials of the shop fabrication schedule.

D. Verify one copy of a mill certification accompanies each shipment to the project and two copies are sent to the Office of Materials to:

- Identify materials included in each shipment, and
- Ensure that materials and fabricated materials may be used in the work promptly after delivery.

E. Final approval of all materials and fabricated materials will be based on:

- A certification that methods and materials used in fabrication comply with the contract documents,
- Satisfactory reports from random monitoring inspections performed during fabrication, and
- Verification of satisfactory compliance at the time of final inspection of the construction site.

2522.03 CONSTRUCTION.

A. Shop Drawings.

1. Submit drawings according to Article 1105.03.

a. Tower lighting equipment (if applicable):

1) Tower design data.

2) Lowering device, showing wiring diagram and materials.

3) Luminaires, including photometric data.

b. Additional drawings may be required on a project specific basis according to the contract documents.

2. Along with the shop drawings, include a statement that methods and materials to be used in fabrication comply with the contract documents. Note and identify all materials or methods for which specific requirements have not been previously stipulated.

3. Provide the Engineer with an appropriate certification of compliance with all design requirements. Along with the certification, include copies of all calculations necessary for proper design of the tower shaft and component features of the tower assembly.

4. Have a Professional Engineer licensed in the State of Iowa perform the structural design. The Contractor's certification is to appear on the drawings. Provide the Engineer with the base shear, base moments, and vertical loads on the bottom of the base plate.

5. Obtain the Engineer's written concurrence for the various items involved prior to fabricating or assembling parts.

B. Footings.

1. Construct footings as required in the contract documents at the specified locations. Unless specifically stated otherwise, construct footings using methods and materials complying with current specifications.

2. Place anchor bolts according to Article 2405.03, H, 3. Place conduit and all other appurtenant or optional features of the footing as shown in the contract documents.

C. Transporting Towers.

1. When transporting the towers over the highways of the State of Iowa, comply with all applicable laws, rules, and regulations governing such movements. Obtain all required permits for such movements.

2. Limit the overall length of the hauling unit and tower to 120 feet (35 m) or less.

D. Welding.

1. Weld and fabricate steel structures according to Article 2408.03, B except that gas~~,~~ metal arc, and flux cored arc welding processes will be permitted.

2. ~~A list of approved brands of electrodes may be obtained from the Office of Materials~~. Filler metal shall comply with the requirements of the AWS-Welding Code.

3. Examine all fillet welds accessible for inspection using magnetic particle inspection according to ASTM E 709, at no additional cost to the Contracting Authority.

4. Use ultrasonic inspection, according to the requirements of Article 2408.03, B, to perform a 100% examination of all transverse butt welds and all specified 100% penetration longitudinal butt welds on the pole. Perform a 100% visual inspection of all longitudinal butt welds. Supplement the visual inspection with magnetic particle inspection on all areas of questionable visual results. If defects are found in the area tested, perform additional inspection for a minimum of 5 feet (1.5 m) on each side of the defect, at no additional cost to the Contracting Authority. The cost of these inspections is incidental to other items in the contract.

E. Lighting Tower.

Ensure the structural design of the tower and its appurtenances meet the requirements of AASHTO "Standard Specifications for Structural Supports for Highway Signs, Luminaires and Traffic Signals, Fifth Edition 2009 " and interims with the following clarifications:

1. Wind Velocity.

Use a design wind velocity (V) of 90 mph (145 km/h). Fatigue requirements shall be

Category I with 2nd mode vortex shedding included.

2. **Total Wind Force.**
Calculate the total wind force on luminaires on the basis of the sum of projected areas for each individual luminaire. Base the projected area of individual luminaires on manufacturer's recommendations.

3. **Steel Tubular Shape.**
Use a compact section.

4. **Anchor Bolts, Washers, and Nuts.**
Ensure galvanizing for anchor bolts, washers, and nuts meets the requirements of ASTM ~~A 153, Class C~~ F 2329 with zinc temperature bath limited to 850 degrees F (455 degrees C) ; or ASTM B 695, Class 55 Type 1 coating.
   a. Furnish each anchor bolt with one leveling nut and two anchoring nuts. Use anchor bolts, nuts and washers that meet the requirements of Materials I.M. 453.08. Anchor bolts shall be grade 105. ~~Use anchor bolts that:~~

- ~~Meet the requirements of ASTM F 1554, Grade 105 (724 MPa),~~
- ~~Are full-length galvanized,~~
- ~~Are high-strength low alloy steel, and~~
- ~~Unless specified otherwise, are Unified Coarse Thread Series with Class 2A tolerance.~~

   ~~**b.** Color code, in red, the end of each anchor bolt intended to project from the concrete to identify the grade.~~
   ~~**c.** Use galvanized washers that meet the requirements of ASTM F 436.~~
   ~~**d.** Use heavy hex, galvanized nuts that meet the requirements of ASTM A 563, DH. Nuts may be over-tapped according to the allowance requirements of ASTM A 563.~~

5. **Pole Base.**
   a. Use a solid plate. Keep the holes cut out in the base plate for utility lines to a ~~minimum, subject to the Engineer's approval~~ maximum diameter of 12 inches (300mm) as shown on the contract document.
   b. Design the pole base and anchor bolt system to resist both tension and compression resulting from bending moments and direct loads.

6. **Poles.**
The poles may be furnished in single welded units or in telescoping sections.
   a. Single Welded Units.
      1) Fabricating the tower by welding two or more shaft sections together is permitted. If the pole sections are welded together, butt weld all transverse pole splices with full penetration welds.
      2) Use a method for connecting the sections that results in a smooth joint with no projections on the exterior of the shaft.
      3) Unless specifically authorized otherwise, all welded connections of shaft sections are to be made in the fabricator's shop.
      4) If hauling length restrictions do not allow the tower shaft to be shop fabricated in one piece, furnish a telescoped pole.
   b. Telescoping Sections.
      1) If the pole sections are telescoped together, ensure the overlapped splices:
         - Are equal in strength and rigidity to that of welded splices, and
         - Do not exceed four sections for poles up to and including 120 feet (35 m) in length and do not exceed five sections for poles between 120 feet (35 m) and 160 feet (50 m) in length.
      2) Ensure the telescoping sections overlap a length which is the larger of the following, and the overlap has full contact between faying surfaces:
         - 2 feet (0.6 m), or

- 1.5 times the nominal diameter of the shaft at the splice level.

3) Ensure pole sections to be telescoped together are factory test fit to verify straightness of the pole and accuracy of the mating surfaces. Ensure the sections are match marked for accurate field assembly. In the field, mechanically fit the telescoping sections using factory supplied equipment. Submit field assembly procedures for the Engineer's review and concurrence.

7. Longitudinal Seam Welds.

a. Minimum 60% penetration, except for the following areas where complete penetration welds are required:

1) Within 6 inches (150 mm) of circumferential welds which are complete penetration butt welds.

2) For a distance of the nominal splice length plus 6 inches (150 mm) on both sections of telescopic (slip type) field splices of high level lighting (pole type) supports.

b. ~~When designated in the contract documents:~~ Testing:

- Radiographically inspect 100% of the full penetration section~~s~~ of the longitudinal seam weld at the based plate connection location and
- Use the magnetic particle method to inspect a random 10% of the partial penetration section of the longitudinal seam welds.

8. Poles with Welded Transverse Splices.

Bevel all backing plates for transverse welds.

9. Poles with Telescoped La~~b~~p Joints.

Bevel the lower section of the joint. The beveling is required to prevent possible interference with the operation of the lowering device.

10. Hand ~~H~~hole.

a. Ensure the pole provide an opening for a minimum 10 inch by 30 inch (250 mm by 750 mm) handhole, to allow for servicing and maintenance of the lowering devices. ~~Ensure the handhole is reinforced to maintain the design strength of the pole.~~ Reinforce the handhole as shown in the contract documents.

b. Install a neoprene ~~or~~ rubber gasket to make the handhole weatherproof. Obtain the Engineer's acceptance for the gasket prior to installation. Foam adhesive-back rubber gaskets are unacceptable.

c. Ensure the ~~door is hinged and~~ handhole cover is fabricated from the same type of steel as the poles. Use 1/8 inch minimum thickness for the handhole cover. Ensure the securing hardware is stainless steel and provisions have been made to allow for the door to be bolted securely shut.

11. Pole Base Plate.

a. Prior to welding, ultrasonically test the pole base plate using a Straight Beam Search Unit, meeting requirements of the current AWS D1.1, Structural Welding Code, to determine the extent of laminar type discontinuities in the plate.

b. After welding the pole to the base plate, use the same ultrasonic testing described above to ensure there are no laminar tears in the base plate.

12. Shaft, Base Plate, and Integral Shaft.

a. Ensure the shaft~~, base plate,~~ and integral shaft components are fabricated with steel meeting the requirements of ASTM A 709 Grade 50W ~~(345 MPa)~~ or ASTM A 871 Grade 65, with a minimum yield strength of 50,000 psi (345 MPa). ~~All steel required to be ASTM A 709 Grade 50W (345 MPa) must meet impact requirements specified for main members in Article 4152.02. If the Engineer approves, certain components of the tower assembly may be fabricated from steel meeting requirements of ASTM A 709~~

~~Grade 36 (250 MPa).~~ Ensure the base plate is fabricated with steel meeting the requirements of ASTM A 709 Grade 50W. All steel used for the shaft, base plate, and integral shaft components must meet impact requirements specified in Article 4152.02.

~~**b.** Ensure that after fabrication pole shafts, anchor bolts, base plate, washers, nuts, and all steel items are:~~

- ~~Fully galvanized inside and outside according to ASTM A 123 or ASTM A 153 as appropriate, and~~
- ~~Are of uniform color and appearance.~~

F. Tower Lighting Luminaire.
Meet the following provisions:

1. Luminaire Assembly.
Rain tight aluminum housing and slipfitter with an internally mounted ballast designed for operation with the specified lamp.

2. Optical System (when required).
Specular aluminum or prismatic glass reflector and a prismatic glass refractor or a clear lens.

3. Luminaires with Open Bottom Optical Systems.
Prismatic glass reflectors and refractors.

4. Luminaires with Horizontal Burning Lamps
Totally enclosed optical systems with prismatic glass refractors.

5. Specular Aluminum Reflectors.
Protective coating of oxide applied by the anodic oxidation process. The manufacturer's certification that the coating is not less than 6 milligrams per square inch (0.01 mg/mm^2) and that the reflectivity of the specular surface is not less than 82% is required.

6. The Lamp Socket.
Mogul multiple and porcelain enclosed. Lamp gripping device for vertical burning lamp sockets.

7. Glassware.
Annealed, thermal-shock-resisting, borosilicate glass.

8. Slipfitter.
Accommodate a standard ~~two-~~ 2 inch (50 mm) pipe bracket and provide for leveling of the luminaire.

9. Light Source.
High pressure sodium lamp of the size shown in the contract documents.

10. Ballast.
Regulated high-power-factor type with starting current lower than operating current. Maintains lamp wattage within ± 10% with a line voltage regulation of ± 10%, with no less than 90% power factor.

G. Luminaire Lowering Device.
Consists of a luminaire frame and head frame, support cables, winch, and electrical cable, along with associated appurtenant devices. Ensure the lowering device properly lowers the luminaires to a position within 5 feet (1.5 m) of the ground for maintenance, and maintains their alignment when raised to the operational position.

1. **Luminaire Frame and Head Frame.**
   - **a.** Ensure the luminaire frame and head frame assembly meet the requirements of ASTM A 709 Grade 50 (345 MPa). For the purpose of Charpy V-notch toughness requirements, all steel required to be ASTM A 709 Grade 50 (345 MPa) ~~will be considered main members~~ must meet impact requirements specified in Article 4152.02. Miscellaneous appurtenant steel components may be constructed using ASTM A 709 Grade 36 (250 MPa) steel. Ensure all steel and the head frame dome are galvanized. Alternately, in a two cable lift system, the luminaire frame, head frame and miscellaneous appurtenant steel components will all be fabricated from ASTM A 240 Type 201LN stainless steel.
   - **b.** Attach the luminaire frame to two or three lift cables. Attach a multiple conductor electrical cable to the luminaire frame with a double weave, stainless steel, grip type, strain relief connection. Pass all cables through a head frame assembly mounted at the top of the tower shaft, as shown in the contract documents. Ensure they pass freely through the shaft during raising and lowering operations.
   - **c.** Ensure the luminaire frame is designed to accommodate the specified number of luminaires on mounts consisting of 2 inch (50 mm) slipfitters.
   - **d.** Ensure the head frame assembly is enclosed and shielded from the elements by means the Engineer approves.
   - **e.** In a three lift cable system, install three or more spring loaded centering arms with rubber or nylon rollers to control lateral movement of the luminaire frame during raising or lowering operations. Ensure the centering arms interlock with each other so the tower is centered within the luminaire frame.
   - **f.** In two lift cable systems the luminaire frame shall be protected from contact with the pole shaft by means of two 2 7/16 inch (62 mm) diameter PVC bumpers on the inner surface of the luminaire frame.

2. **Support Cables.**
   - **a.** Install support cables of anti-rotational aircraft type stainless steel with a minimum diameter of 3/16 inch (4.8 mm) and having a safety factor of 5.
   - **b.** In a three lift cable system, s~~S~~pace them 120 degrees apart where attached to the luminaire frame. Attach them to a terminating device which is located within the tower shaft and provides a means of equalizing tension of the lift cables.
   - ~~**b. In a three lift cable system**~~ Ee~~E~~nsure the terminator and attached components are shaped to prevent interference to the raising or lowering operation caused by irregularities on the interior surface of the tower shaft.
   - **c**. In a two lift cable system the cables will be spaced 180 degrees apart and no terminating device is used since the cables go directly to the winch drums.

3. **Winch.**
   - **a.** Install and securely anchor a winch assembly that:

- Consists of a worm gear speed reducer with either one or two output shafts with cable drum attached.
- Is capable of supporting five times the maximum lifted load.
- Includes an integral drag brake to prevent unwinding, slipping, or free spooling of the winch cable.
- In a three lift cable system, i~~I~~nclude~~s~~ a drum provided with keepers to ensure that the cable will properly wrap onto the drum.
- When powered by the internal power unit, raises the luminaire ring at a minimum rate of 12 feet (4 m) per minute.

   - **b.** Install stainless steel, anti-rotational aircraft type winch cable(s) with 1/4 inch (6.4 mm) minimum diameter and a safety factor of 3 to be used to raise and lower the luminaire frame. In a three winch cable system attach the cable to the terminator. Include a safety device that is capable of stopping upward motion of the terminator at any time, in case of winch cable failure. Include a torque limiting device with the winch or power unit.

c. If a three lift cable system is employed, ~~I~~install a top-latching system that ensures the following:

- Latch barrels are cast, high strength, copper-free aluminum or cast stainless steel.
- Latching is accomplished by the alternate raising and lowering of the luminaire ring assembly using the winch and hoisting assembly.
- There are no moving latch parts or springs attached to the head frame assembly.
- The latch mechanism is not impaired by the formation of ice and does not require adjustment after the original installation.
- Indicator flags are used to show when the luminaire supporting ring is in the latched or unlatched position.

d. If a two lift cable system is employed, ensure the following:

- Latch mechanism can be engaged or disengaged manually in less than 60 seconds working through the handhole at the pole base and can be disengaged without power to the pole
- Entire Latch mechanism must be accessible through handhole at the pole base. with no pole top components to fail.
- Latching Indicator system is visible through the handhole at the pole base
- Latching components are never exposed to ice formation so latch mechanism cannot be impaired by ice

~~d~~ **e.** Install pulleys that are:

- Stainless steel type designed for the respective types and sizes of cables used, and
- Equipped with permanently lubricated, sealed bearings or oil impregnated bronze bushings mounted on stainless steel shafts.

4. Electrical Cable.

a. Install a multiple conductor cable complying with the requirements for flexible cord. Ensure it is designed to meet all physical requirements for satisfactory operation of the lowering device. Ensure all provisions for electrical disconnects are accessible from ground level.

b. Attach the electrical cable to the terminator with a strain relief device as used at the luminaire frame. Ensure electrical connectors for the power and control circuits are rigidly attached to the terminator.

c. Ensure conductors for connections from the power cable to the luminaires are protected by suitable raceways or are made with weatherproof cables securely anchored to the luminaire frame. A luminaire frame of hollow cross section may be used as a raceway. Ensure all connections are made in weather tight boxes or within the luminaire housings.

H. Erection.

1. After testing has been accomplished to the satisfaction of the Engineer, the tower may be erected on the foundation.

2. Precise aligning and erecting of all components of the tower lighting system is essential. Plumb towers during full cloud cover, prior to sunrise or after sunset, as approved by the Engineer, to prevent thermal expansion effects on the steel tower due to heat from sunshine. Verify in at least two directions, 90 degrees apart, with a transit. Plumb all towers within a tolerance of 50% of the pole top diameter. Tighten anchor bolt nuts, after the tower has been plumbed, using the following procedure:

a. Perform this work only on days with winds less than 15 mph (25 km/h). Tighten all of the nuts in the presence of the inspector. Once the tightening procedure is started, it must be completed on all of the base plate nuts without pause or delay.

b. Use properly sized wrenches or sockets, or both, designed for tightening nuts or bolts, or both, to avoid rounding or other damage to the nuts. Do not use adjustable end or pipe wrenches.

c. Ensure base plates, anchor rods, and nuts are free of all dirt or debris.

d. Apply stick wax or bees wax to the threads and bearing surfaces of the anchor bolt, nuts, and washers.

e. Tighten top nuts so they fully contact the base plate. Tighten leveling nuts to snug tight condition. Snug tight is defined as the full effort of one person on a wrench with a length equal to 14 times the bolt diameter but not less than 18 inches (460 mm). Apply full effort as close to the end of the wrench as possible. Perform tightening by leaning back and using entire body weight to pull firmly on the end of the wrench until the nut stops rotating. Perform a minimum of two separate passes of tightening. Sequence tightening in each pass so that the nut on the opposite side, to the extent possible, is subsequently tightened until all of the nuts in that pass have been tightened.

f. Tighten top nuts to snug tight as described for the leveling nuts.

g. Match-mark the top nuts and base plate using paint, crayon, or other approved means to provide a reference for determining the relative rotation of the nut and base plate during tightening. Further tighten the top nuts tightened in two passes, as listed in the Table 2522.03-1, using a striking or hydraulic wrench. Follow a sequence of tightening in each pass so that the nut on the opposite side, to the extent possible, is subsequently tightened until all nuts in that pass have been turned. Do not allow the leveling nut to rotate during the top nut tightening.

Table 2522.03-1: Bolt Tightening

Anchor Bolt Size	First Pass	Second Pass	Total Rotation
Less than or equal to 1 1/2 inch (38 mm) diameter	1/6 turn	1/6 turn	1/3 turn
Greater than 1 1/2 inch (38 mm) diameter	1/12 turn	1/12 turn	1/6 turn

h. Lubricate the jam nuts, place, and tighten to snug tight.

3. Cover the void between the base plate and top of the foundation as shown in the contract documents.

4. Construct and test all other components of this system according to Section 2523.

I. Miscellaneous.

1. Have a manufacturer's service engineer present, on site, to advise during the installation of at least one complete lowering system. Duties of the manufacturer's service engineer include directing all adjustments to the lowering system to insure positive latching and unlatching (a minimum of three complete raising and lowering cycles) and other necessary work.

2. Provide three complete raising and lowering operations for the other towers, providing the same adjustment and commissioning as demonstrated by the manufacturer's service engineer on the first tower.

2522.04 METHOD OF MEASUREMENT.

Measurement for the various items of work involved in tower lighting, satisfactorily completed, will be as follows:

A. Towers.

By count for the various lengths specified in the contract documents.

B. Luminaires.

By count.

C. Footings.
As outlined in the following sections:

Piling	Section 2501
Structural Concrete	Section 2403
Reinforcement	Section 2404
Excavation	Section 2402

2522.05 BASIS OF PAYMENT.

A. Payment for the various items of work involved in tower lighting will be the contract unit price as follows:

1. Towers.
Each for the various specified lengths.

2. Luminaires.
Each.

3. Footings.
As outlined in the following sections:

Piling	Section 2501
Structural Concrete	Section 2403
Reinforcement	Section 2404
Excavation	Section 2402

B. Payment for towers is full compensation for furnishing all materials, equipment, tools, and labor for construction of the towers complete, including an approved lowering device, and related equipment, anchor bolt assembly, and responsibility during the testing period.

C. Payment for other components of the tower lighting system will be as provided in Article 2523.05.

Reason for Revision: Update requested so specifications are consistent with revisions made to the Standard Road Plan RM-44 and recent special provisions developed for tower lighting.

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes**	**No** X	**Industry Concurrence:**	**Yes**	**No**
Comments: Several vendors were contacted during the development of the specification revisions.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Tom Jacobson	**Office:** Construction	**Item 13**
Submittal Date: 2013.04.07	**Proposed Effective Date:** October 15, 2013	
Article No.: 2547.03, C **Title:** Construction (Temporary Stream Access	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2547.03, C, 2.

Delete the Article:

2. ~~Temporary structures are not to extend over 100 feet (30 m) into any swamp, bog, marsh, or similar area that is adjacent to the stream or water body.~~

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'.Use ~~Strikeout~~ and Highlight.**

2547.03 CONSTRUCTION.

C. Ensure temporary structures:

1. Maintain normal downstream flows, do not restrict expected high flows, do not disrupt the movement of aquatic life native to the stream or water body, and minimize the potential for flooding. Expected high flows are those flows which the Contractor expects to experience during the period of time that the crossing is in place.

2. ~~Temporary structures are not to extend over 100 feet (30 m) into any swamp, bog, marsh, or similar area that is adjacent to the stream or water body.~~

Reason for Revision: Iowa DNR and US Army Corp of Engineers no longer have a 100 ft restriction.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Brian Smith / Mike Heller	**Office:** Design	**Item 14**
Submittal Date: 4/30/2013	**Proposed Effective Date:** 10/15/2013	
Section No.: 2601 **Title:** Erosion Control	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See attached.

Comments:

SUDAS asked about the urban stabilizing crop seeding and fertilizing. The mix is the same as the urban seeding mix and will not quickly establish. The Office of Design indicated that grasses that establish more quickly, such as those used for the rural stabilizing crop, are not desirable in urban locations. Other erosion control measures will need to remain in place as the urban stabilizing crop is established. On Iowa DOT projects with urban seeding, a full permanent seeding will also be used with seedbed prep only in areas necessary.

The Office of Contracts asked about removing fertilizer requirements for native grass, wetland seeding, and wildflower seeding. The Office of Design indicated that the fertilizer is not necessary with the Iowa DOT topsoil requirement and residual fertilizer from the stabilizing crop.

The fertilizer rates were also lowered as the previous rates were excessive and resulted in fertilizer runoff.

The Specifications Section asked if the industry had been notified of these changes. The Office of Design indicated that they had met with the two largest seed suppliers that supply the vast majority of the seed for Iowa DOT projects. The Office of Design has met with some of the seeding contractors, but indicated that most of the changes to the contractors are related to rates, which shouldn't affect their work much.

Specification Section Recommended Text: See attached.

Comments: This is a complete reorganization of the section, so no strikethrough or highlighting is shown.

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Replace entire section. See attached.

Reason for Revision: Update seeding specifications and fertilizer application rates. Add specifications for Outlet or Channel Protection (Transition Mat). Reorganize section to more closely follow order of work and facilitate locating seeding dates, type of fertilizer, etc. for different types of seeding. Portions were combined or removed if they were covered elsewhere.

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments: Met with several suppliers and other agencies. They agree with recommended changes.					

Section 2601. Erosion Control

2601.01 DESCRIPTION.

Perform the following erosion control measures on areas within and adjacent to the right-of-way according to the contract documents:

- Seeding and fertilizing,
- Stabilizing crop seeding and fertilizing,
- Overseeding and fertilizing,
- Mulching,
- Composting,
- Sodding,
- Special ditch control,
- Turf reinforcement mat,
- Slope protection,
- Outlet or channel scour protection (transition mat), and
- Mowing.

2601.02 MATERIALS.

A. Furnish materials meeting the requirements of Section 4169.

B. Apply materials at no less than the minimum rate specified in the contract documents. Apply seed for native grass, wildflower and wetland grass seeding on a PLS basis, as computed by the Engineer.

C. Additional compensation will not be allowed for materials in excess of that specified, unless directed by the Engineer.

D. If, after application of fertilizer, it is determined by test that the fertilizer fails to comply with minimum requirements, furnish and apply additional fertilizer to comply with minimum requirements as defined in Article 4169.03.

E. Perform work in a manner that provides the Engineer the opportunity to verify the quantity of material furnished and the rate of application. Divide the project area into small natural areas that are to be constructed as identifiable units. Furnish a tally of the quantities of each material as it is used on each area. This may include the quantities below.

- Weights (mass) from approved scales of truck loads of bulk materials,
- Other scaled weights (mass),
- Counts of containers, bags, or bales, or estimates of partially used packages of materials, as approved by the Engineer.

F. Provide Engineer with the opportunity to verify the quality and quantities in a manner that will allow continuous operation with minimum delays.

G. When handling inoculants, and sticking agents, follow safety precautions as specified on the product label.

2601.03 PLACEMENT OF EROSION CONTROL.

A. Equipment.

Use equipment meeting the requirements of Section 2001 and the following, except that other equipment which produces similar results will be considered for approval. Use methods and procedures consistent with equipment manufacturers' recommendations; however, do not operate ground driven equipment at speeds greater than 10 mph (15 km/h).

1. Disk.

When preparing a seedbed on ground having heavy vegetation, use a disk having cutaway blades. Provide for the addition of weight (mass) to obtain proper cutting depth.

2. Slope Harrow.

Use a rolling weight (mass) attached by heavy chain to a tractor. Use a chain of suitable length, with picks attached and a means of rotating the picks as the rolling weight (mass) is pulled in a direction parallel to the movement of the tractor.

3. Field Tiller.
Use equipment designed for preparation of seedbed to the degree specified.

4. Rotary Tiller.
Use equipment with rotary type blades designed for preparation of seedbed to the degree specified.

5. Spike Tooth Harrow.
Use equipment designed to:
- Provide adjustment of spike teeth to level the ground, or
- Be used as specified by the Engineer.

6. Compaction Equipment.
a. Cultipacker.
1) Use a pull type cultipacker with individual rollers or wheels. Cultipackers having sprocket type spacers between the wheels may be used. Ensure cultipacker produces a corrugated surface on area being compacted.
2) Use a cultipacker that operates separate from other operations. Attachment of cultipacker to the seeder or disk will not be permitted, except when the combined cultipacker seeder is manufactured to operate as a unit. Provide for the addition of weight (mass).
b. Compaction Rollers.
Apply Article 2001.05, A.
c. Hand Tamping Equipment.
Use base plate type hand tamping equipment adapted to the performance of the work. Obtain Engineer's approval.
d. Expanded Mesh Roller.
Use open grid type equipment or cultipacker type equipment modified by covering with expanded metal mesh.

7. Hydraulic Seeder and Mulcher.
a. Use hydraulic seeding equipment with a pump rated at no less than 100 gallons (350 L) per minute. Inoculant, seed, and fertilizer may be applied in a single operation, unless stated otherwise in the contract documents. Apply hydraulic mulch as a separate operation. Ensure equipment has suitable working pressure and a nozzle adapted to the type of work.
b. Ensure supply tanks have a means of mechanical agitation. Calibrate tanks and provide a calibration stick or other approved device to indicate the volume used or remaining in the tank.

8. Gravity Seeders.
a. Ensure gravity seeders:
- Provide agitation of the seed,
- Have an adjustable gate opening, and
- Uniformly distribute seed on the prepared seedbed.

b. Use a seed hopper equipped with baffle plates spaced no more than 2 feet (0.6 m) apart. Ensure baffle plates extend from the agitator shaft to within approximately 2 inches (50 mm) of the top of the seed hopper.
c. Wind guards will be required to facilitate seeding when moderate wind conditions exist and when required by Engineer. Place wind guards in front or in back (or both) of seed outlet and extend to near ground line.
d. This seeder may be used for application of fertilizer.

9. Endgate Cyclone Seeders.
Ensure endgate cyclone seeders are:
- Suitably mounted,
- Provide movement by mechanical means, and
- Drop through an adjustable flow regulator onto a rotating, power driven, horizontal disk or fan.

10. Hand Cyclone Seeders.
Use a seeder that drops seed through an adjustable flow regulator onto a rotating, hand driven, horizontal disk or fan.

11. Native Grass Seed Drill.
Use a drill designed to provide uniform distribution of native grass and wildflower seeds. Provide separate seed boxes to apply both small seeds as well as fluffy bearded seeds. If a no till attachment is specified, use an attachment manufactured by the same manufacturer as the drill.

12. Pneumatic Seeder.
Use a pneumatic (air blower) system with enough power and hose to reach 300 feet (100 m).

13. Aerial Equipment.
When aerial application of seed and fertilizer is specified, use aerial equipment capable of providing a uniform distribution of seed and fertilizer on the specified area.

14. Straw Mulching Machine.
Use a type that will uniformly apply mulch material over desired area without excessive pulverization. Engineer may consider excessive pulverization as the general absence of straw longer than 6 inches (150 mm) after distribution.

15. Mulch Anchoring Equipment.

a. Use mulch anchoring equipment designed to anchor straw or hay mulch into soil by means of dull blades or disks. Use blades or disks that:
- Are flat,
- Have a nominal minimum diameter of 20 inches (500 mm), and
- Are spaced at approximately 8 inch (200 mm) intervals.

b. The blades may have cutaway edges. Pull mulch anchoring equipment using mechanical means. Use equipment that weighs approximately 1,000 pounds (has a mass of approximately 450 kg). When directed by the Engineer, increase the weight (mass) of the equipment by the addition of ballast.

16. Mechanical Trencher.
Use a machine designed for the specific purpose of constructing a trench for placement of check slots to depth specified.

17. Mowers.
Use rotary, flail, disk, or sickle type mowers that do not bunch or windrow mowed material.

B. Seeding and Fertilizing.

1. On various portions of the right-of-way, except the traveled portion of the roadbed:
- Prepare the seedbed,
- Furnish, sow, and cover the seed, and
- Compact the seedbed.

2. Seed other areas as may be indicated in the contract documents or directed by the Engineer. The limits of areas to be seeded will be clearly marked before seedbed is prepared.

3. Do not disturb areas having a satisfactory growth of desirable grasses or legumes.

4. Sow seed only at times of the year when temperature, moisture, and climatic conditions will promote germination and plant growth. Normal seed application dates are according to Article 2601.03, C for each seed type. Perform seeding according to the following procedures:

a. Seedbed Preparation.

1) Ensure area to be seeded is relatively smooth. Fill washes and gullies to conform to desired cross section. When such fills exceed 6 inches (150 mm), compact the material with a tractor wheel or other suitable field equipment. Coordinate preparation of ditches designated for special ditch control with the seedbed preparation.

2) Thoroughly work areas accessible to field machinery to a depth of no less than 3 inches (75 mm). Use mechanical rotary tillage equipment to prepare seedbed on earth shoulders, urban or raised medians, rest areas, and islands. Hand prepare areas inaccessible to field machinery to a depth of not less than 2 inches (50 mm). Ensure entire width of shoulder and areas around headwalls, wingwalls, flumes, and other structures are prepared in the manner specified.

3) Where weed growth has developed extensively, weeds may be disked into the ground. If weed growth develops sufficiently to interfere with proper seedbed preparation, mow weeds and remove them from project (at no additional cost to Contracting Authority).

4) Use crawler type or dual wheeled tractors to prepare seedbeds. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross section.

5) Prior to rolling with cultipacker, harrow ridging in excess of 4 inches (100 mm) caused by operation of tillage equipment. Prior to permanent seeding, roll the area with no less than one pass of cultipacker.

6) Remove ruts that develop during the sequence of operations before subsequent operations are performed.

7) After completing seedbed preparation, pick up and remove debris according to Article 1104.08, including 3 inch (75 mm) diameter or larger stones, logs, stumps, cable, or other objectionable material that may interfere with seeding operation.

b. Application of Fertilizer.

1) Spread over the areas at rate designated in Article 2601.03, C for each seed type, unless specified otherwise in the contract documents.

2) Spread with a mechanical spreader which will secure a uniform application rate. Do not use truck mounted spreading equipment for bulk fertilizer. On areas accessible to field machinery, spread after preliminary preparation of seedbed, but prior to sowing of seed. Disk in fertilizer and roll the area prior to application of permanent seed. If roller cannot be operated satisfactorily, Engineer may permit substituting a harrow for the roller. Areas inaccessible to field machinery, spread fertilizer after preparation of seedbed and thoroughly rake into the soil.

3) If using a hydraulic seeder, apply fertilizer in combination with seeding as specified in Article 2601.03, B, 4, d, 2. When the contract documents require two applications of fertilizer, perform second application during next permanent seeding period following initial seeding and fertilizer application.

c. Preparation of Seed.

1) Except when a hydraulic seeder is used, thoroughly mix all seed specified for the contract prior to placing seed in seed hopper. Ensure Engineer witnesses seed mixing for Native Grass, Wildflower, and Wetland Grass seeding mixtures. Provide 48 hour notice to Engineer prior to mixing seed.

2) Inoculate legumes with a standard culture at the rate as specified by manufacturer of inoculant, according to Article 4169.04. Use a type of inoculant specified for each legume seed and approved by the Engineer.

3) Do not allow inoculated seed to be exposed to direct sunlight for more than 30 minutes. Prior to use, reinoculate seed that is not sown within 8 hours after inoculation. Preinoculated seed with manufacturer's recommended protective coating may be used in lieu of seed with Contractor applied inoculant.

4) When gravity or cyclone seeder is used for application of seed, inoculate legume seed according to manufacturer's recommended procedures before mixing with other grass seeds for sowing. If hydraulic seeder is used, inoculant, in quantities specified above, may be applied directly into supply tank with seed, water, and other material. Furnish and apply inoculant.

5) Treat seed with a commercial sticking agent. Apply prior to application of inoculant, or as a mixture when the sticking agent is compatible with other materials, except with hydraulic equipment. A sticking agent optional if a liquid formulation of inoculant is used.

6) Use mechanical mixing equipment to apply sticking agent and inoculant on seed quantities over 50 pounds (25 kg) per batch.

d. Application of Seed.

1) Sowing, Covering, and Compaction.

a) On areas accessible to field machinery, seed may be sown with:

- A gravity, cyclone, or hydraulic seeder,
- A native grass seed drill, or
- As specified in the contract documents.

b) On areas inaccessible to field machinery, use of hand cyclone seeders may be used.

c) Sowing of seed shall be performed as a split rate application (no less than two passes).

d) Covering, compaction, rolling, dragging, or raking of seedbed will not be required provided the friable condition exists. For spring seeding (following fall seedbed preparation) after April 1, Contractor shall roll or harrow when, in the opinion of the Engineer, a friable condition does not exist. Cover stabilizing crop seeding and fertilizing with a light disking or other tillage equipment such as a rigid harrow, spring tooth harrow, or field cultivator.

e) Follow sowing of grasses and legumes with at least one complete rolling with cultipacker. Roll shoulders immediately to prevent loss of seed due to air currents caused by passing

traffic. For stabilizing crop seeding and fertilizing, follow tillage by rolling area with a cultipacker. If cultipacker cannot be operated satisfactorily, Engineer may permit harrow to be substituted for cultipacker.

f) Where compaction equipment will not operate satisfactorily, lightly drag or rake in seeded area by hand. Roll seedbed with a cultipacker before and after seeding.

2) Seeding and Fertilizing with Hydraulic Seeder.

a) A hydraulic seeder may be used when seedbed has been prepared according to Article 2601.03, B, 4, a. When a hydraulic seeder is used, apply seed or fertilizer, or both, at the rates specified in approximately 400 gallons (4000 L) of water slurry per acre (hectare).

b) Apply mixture within 1 hour after fertilizer and seed are placed in hydraulic seeder. Use continuous agitation. Seed remaining in the fertilizer solution for more than 1 hour will be unacceptable. Additional seed at the specified rate will be required.

3) Pneumatic Seeding.

Includes furnishing and applying compost to a depth of 1 inch (25 mm) on designated disturbed areas. Apply compost using a pneumatic (air blower) system with sufficient hose to reach 300 feet (100 m). Driving on soil to apply compost will not be allowed. Incorporate fertilizer into full depth of compost material. Prepare seedbed according to Article 2601.03, C, 4, a, 1. Apply seed within top 1/4 inch (6 mm) of compost material.

C. Types of Seeding.

1. Stabilizing Crop Seeding and Fertilizing (Rural).

a. Preparation and Application.

1) Prepare seedbed according to Article 2601.03, B, 4, a.

2) Prepare seed according to Article 2601.03, B, 4, c.

3) Apply seed according to Article 2601.03, B, 4, d.

4) For stockpile stabilization seeding, seedbed preparation will not be required for areas not accessible to field equipment.

b. Seed Mixture.

Unless otherwise specified in the contract documents, use rates and schedule shown in Table 2601.03-1.

Table 2601.03-1: Rural Stabilizing Crop Seeding Rates and Schedule

March 1 through October 31	
Oat Grain rye Canada wildrye (Elymus canadensis)	50 lbs. per acre (56 kg/ha) 50 lbs. per acre (56 kg/ha) 5 lbs PLS. per acre (6 kg/ha)
November 1 through February 28 (or 29)	
Oat Grain rye Canada wildrye (Elymus canadensis)	62 lbs. per acre (56 kg/ha) 62 lbs. per acre (56 kg/ha) 7 lbs. PLS. per acre (6 kg/ha)
For stabilizing crop only, Canada wildrye (Elymus canadensis) seed will not be required to be certified as Source Identified Class (Yellow Tag) Source G0-Iowa.	
Canada wildrye (Elymus canadensis) seed shall be debearded or equal to facilitate application of seed.	

c. Fertilizing.

1) Apply to seeded areas at the rate of 250 pounds per acre (280 kg/ha) of 13-13-13 (or equivalent) unless specified otherwise in the contract documents.

2) Apply provisions of Article 2601.03, B, 4, b.

d. Application Dates.

Refer to Table 2601.03-1 for normal seed application dates.

2. Stabilizing Crop Seeding and Fertilizing (Urban).

a. Preparation and Application.

1) Use a rotary tiller for preparation of seedbed according to Article 2601.03, B, 4, a. Prior to application of seed, ensure seedbed is firm, smooth, and free of material 1.5 inches (40 mm) in diameter or greater including clods, rocks, and other debris. Roll seedbed before and after application of seed. For rolling, use either open grid type equipment or cultipacker type equipment modified by covering with expanded metal mesh.

2) Prepare seed according to Article 2601.03, B, 4, c.
3) Apply seed according to Article 2601.03, B, 4, d.
4) Prepare, roll, seed, and fertilize areas inaccessible to field equipment by hand or using hand operated equipment, including lawn type, hand cyclone, or gravity equipment.

b. Seed Mixture.
Unless specified otherwise in the contract documents, use ding rates shown in Table 2601.03-2 for urban areas.

Table 2601.03-2: Urban Stabilizing Crop Seeding Rates

Bluegrass, Kentucky	122 lbs. per acre (62 kg/ha)
Ryegrass, Perennial (fineleaf variety)	35 lbs. per acre (51 kg/ha)
Fescue, Creeping Red	18 lbs. per acre (6 kg/ha)

c. Fertilizing.
1) Apply prior to preparing seedbed.
2) Apply to seeded areas at the rate of 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent) unless specified otherwise in the contract documents.
3) Apply provisions of Article 2601.03, B, 4, b.

d. Application Dates.
Normal seed application dates are March 1 through May 31, and August 10 through September 30.

3. Rural Seeding.

a. Preparation and Application.
1) Prepare seedbed according to Article 2601.03, B, 4, a.
2) Prepare seed according to Article 2601.03, B, 4, c.
3) Apply seed according to Article 2601.03, B, 4, d.

b. Seed Mixture.
Use seeding rates in Table 2601.03-3 for permanent seeding of rural areas, unless otherwise specified in the contract documents:

Table 2601.03-3: Permanent Seed Rates, Rural Areas

Fescue, Tall (Fawn)	100 lbs. per acre (112 kg/ha)
Ryegrass, Perennial (Linn)	75 lbs. per acre (84 kg/ha)
Bluegrass, Kentucky	20 lbs. per acre (22 kg/ha)

c. Fertilizing.
1) Spread over the areas at the rate designated. Unless otherwise specified in the contract documents, use a rate of 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent).
2) Apply provisions of Article 2601.03, B, 4, b.

d. Application Dates.
Normal permanent seed application dates are March 1 through May 31, and August 10 through September 30.

4. Urban Seeding.

a. Preparation and Application.
1) Use rotary tiller for preparation of seedbed according to Article 2601.03, B, 4, a. Prior to application of seed, ensure seedbed is firm, smooth, and free of material 1.5 inches (40 mm) in diameter or greater including clods, rocks, and other debris. Roll seedbed before and after application of seed. For rolling, use either open grid type equipment or cultipacker type equipment modified by covering with expanded metal mesh.
2) Prepare seed according to Article 2601.03, B, 4, c.
3) Apply seed according to Article 2601.03, B, 4, d.
4) Prepare, roll, seed, and fertilize areas inaccessible to field equipment by hand or using hand operated equipment, including lawn type, hand cyclone, or gravity equipment. Obtain Engineer's approval for such equipment.

b. Seed Mixture.
Use seeding rates in Table 2601.03-4 for permanent seeding of urban areas, including areas previously maintained as a lawn.

Table 2601.03-4: Permanent Seed Rates, Urban Areas

Bluegrass, Kentucky	122 lbs. per acre (62 kg/ha)

Ryegrass, Perennial (fineleaf variety)	35 lbs. per acre (51 kg/ha)
Fescue, Creeping Red	18 lbs. per acre (6 kg/ha)

c. Fertilizing.

1) Apply prior to preparing the seedbed.

2) Spread over the areas at a rate of 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent).

3) Apply the provisions of Article 2601.03, B, 4, b.

d. Application Dates.

Normal permanent seed application dates are March 1 through May 31, and August 10 through September 30.

5. Native Grass Seeding.

a. Preparation and Application.

1) In areas without existing stabilized crop seeding residue, prepare seedbed according to Article 2601.03, B, 4, a. Seed areas accessible to field equipment with native grass seed drill, gravity, or broadcast equipment. Cultipack as specified in Article 2601.03, B, 4, d. Broadcast seed other areas and follow with a light dragging or hand raking.

2) In areas with existing stabilized crop residue, apply seed with a native grass seed drill with a no till attachment. Seedbed preparation and cultipacking will not be required. Seedbed preparation is required for areas with rills and gullies.

3) Prepare seed according to Article 2601.03, B, 4, c.

b. Seed Mixture.

Use seeding rates in Table 2601.03-5 for areas designated for native grass seeding, unless specified otherwise in the contract documents.

Table 2601.03-5: Native Grass Seed Rates

Species (Scientific Name)	Application Rate (PLS)
Furnish seed certified as Source Identified Class (Yellow Tag) Source G0-Iowa. Oats are excluded from this requirement.	
*Big bluestem (Andropogon geradii)	6 lbs. per acre (7 kg/ha)
*Canada wildrye (Elymus canadensis)	2 lbs. per acre (2.2 kg/ha)
*Indiangrass (Sorghastrum nutans)	6 lbs. per acre (7 kg/ha)
*Little bluestem (Schizachyrium scoparium)	6 lbs. per acre (7 kg/ha)
Blackeyed susan (Rudbeckia hirta)	4 oz. per acre (280 g/ha)
Blue vervain (Verbena hastata)	1/2 oz. per acre (35 g/ha)
Gray-headed coneflower (Ratibida pinnata)	3 oz. per acre (210 g/ha)
Ironweed (Vernonia fasciculata)	3 oz. per acre (210 g/ha)
New England aster (Symphyotrichum novae-angliae)	2 oz. per acre (140 g/ha)
Pale purple coneflower (Echinacea pallida)	6 oz. per acre (420 g/ha)
Partridge pea (Chamaecrista fasciculata)	4 lbs. per acre (4.5 kg/ha)
Side-oats grama (Bouteloua curtipendula)	4 lbs. per acre (4.5 kg/ha)
Switchgrass (Panicum virgatum)	1 lbs. per acre (1.1 kg/ha)
Oats (Avena sativa)	32 lbs. per acre (36 kg/ha)
*Note: Canada wildrye, Big bluestem, Indiangrass, and Little bluestem shall be debearded or equal to facilitate the application.	

c. Fertilizing.

Not required unless specified otherwise in the contract documents.

d. Application Dates.

Normal seed application dates are April 1 through June 30.

6. Wetland Seeding.

a. Preparation and Application.

1) In areas without existing stabilized crop seeding residue, prepare seedbed according to Article 2601.03, B, 4, a. Seed areas accessible to field equipment with a native grass seed drill, gravity, or broadcast equipment. Cultipack as specified in Article 2601.03, B, 4, d. Broadcast seed other areas and follow with a light dragging or hand raking.

2) In areas with existing stabilized crop residue, apply seed with a native grass seed drill with a no till attachment. Seedbed preparation and cultipacking will not be required. Seedbed preparation is required for areas with rills and gullies.

3) Prepare seed according to Article 2601.03, B, 4, c.

b. Seed Mixture.

Use the seeding rates in Table 2601.03-6 for areas designated for wetland grass seeding, unless specified otherwise in the contract documents.

Table 2601.03-6: Wetland Grass Seed Rates

Common Name	Scientific Name	PLS (per ac)	PLS (per ha)
Blue vervain	Verbena hastata	1 oz.	70 g
Boneset	Eupatorium perfoliatum	1 oz.	70 g
Nodding bur marigold	Bidens cernua	8 oz.	560 g
Swamp milkweed	Asclepias incarnata	1 lb.	1.1 kg
Sneezeweed	Helenium autumnale	2 oz.	140 g
Water plantain	Alisma plantago-aquatica	4 oz.	280 g
Arrowhead	Sagittaria latifolia	4 oz.	280 g
New England aster	Symphyotrichum novae-angliae	2 oz.	140 g
Big Bluestem	Andropogon gerardii	1 lb.	1.1 kg
Switchgrass	Panicum virgatum	8 oz.	560 g
Prairie cordgrass	Spartina pectinata	1 lb.	1.1 kg
Virginia wild-rye	Elymus virginicus	5 lbs.	5.6 kg
Bluejoint grass	Calamagrostis	1 oz.	70 g
Rice cutgrass	Leersia oryzoides	4 oz.	280 g
Dark Green bulrush	Scirpus atrovirens	1 oz.	70 g
Fox sedge	Carex vulpinoidea	4 oz.	280 g
Softstem bulrush	Schoenoplectus tabernaemontani	8 oz.	560 g
Spike rush	Eleocharis palustris	4 oz.	280 g
Porcupine sedge	Carex hystericina	8 oz.	560 g
Broom sedge	Carex scoparia	2 oz.	140 g
Tussock sedge	Carex stricta	2 oz.	140 g

c. Fertilizing.

Not required unless specified otherwise in the contract documents.

d. Application Dates.

Normal seed application dates are April 1 through June 30.

7. Wildflower Seeding.

a. Preparation and Application.

1) Uniformly apply seed to areas with the seedbed prepared as in Article 2601.03, B, 4, a.

2) Seed areas accessible to field equipment using a native grass seed drill at an approximate depth of 1/8 inch (3 mm), or using gravity or broadcast equipment. Cultipack as specified in

Article 2601.03, B, 4, d. Broadcast seed other areas and follow with a light dragging or hand raking.

3) In areas with existing stabilized crop seeding residue, apply seed with a native grass seed drill with a no till attachment. Seedbed preparation and cultipacking will not be required.

b. Seed Mixture.
As specified in the contract documents.

c Fertilizing.
Not required unless specified otherwise in the contract documents.

d. Application Dates.
Normal seed application dates are April 15 through June 30.

8. Special Seed.

a. Preparation and Application.

1) Apply at the rate specified in the contract documents or as directed by the Engineer as a separate operation either immediately before or immediately after sowing the regular grass mixture.

2) No additional work other than sowing of the seed will be required unless specified otherwise in the contract documents.

3) On limited areas, this seed may be applied by hand cyclone seeders.

b. Seed Mixture.

1) As specified in the contract documents.

2) When not shown in the contract documents but directed by the Engineer, a special seed or seed mixture may be required in addition to the regular seed mixture.

c. Fertilizing.
As specified in the contract documents.

d. Application Dates.
As specified in the contract documents.

D. Overseeding and Fertilizing.

1. Seedbed preparation will not be required, provided overseeding is applied when ground is friable from frost action after February 1 and before April 1 or as directed by the Engineer.

2. When, in the opinion of the Engineer, a friable soil condition does not exist, roll with a cultipacker or harrow.

3. Areas with rills or gullies require seedbed preparation according to Article 2601.03, B, 4, a.

4. Apply fertilizer according to of Article 2601.03, B, 4, b.

5. Prepare seed according to of Article 2601.03, B, 4, c.

6. Apply seed according to of Article 2601.03, B, 4, d unless specified otherwise in the contract documents.

7. Overseeding will not be allowed on more than 1 inch (25 mm) of snow cover.

E. Mulching.
Mulch seeding areas unless designated otherwise in the contract documents. For disturbed areas that are mulched only, scarify area to a 3 inch (75 mm) depth prior to mulching.

1. Time of Mulching.
Apply to areas requiring mulch as soon as seed is sown and final rolling completed.

2. Application of Mulch.

a. Straw Mulch.

1) Distribute evenly and uniformly and anchor it into the soil. Use an application rate for reasonably dry material of approximately 1.5 tons per acre (3.5 Mg/ha) of dry cereal straw, native grass straw, or other approved material, depending on the type of material furnished.

2) In accessible mulched areas, anchor mulch into the soil using mulch anchoring equipment with a minimum of two passes. Operate equipment along the contour. Use crawler type or dual

wheel tractors for mulching operation. Operate equipment in a manner to minimize displacement of soil and disturbance of the design cross section.

b. Hydraulic Mulches.

1) Apply at no less than 3000 pounds per acre (3.5 Mg/ha) using standard hydraulic mulching equipment, unless specified otherwise in the contract documents.

2) If using with hydraulic seeding, apply as a separate operation.

F. Composting.

Compost may be used as a top dress application or as an incorporated soil amendment.

1. Top dress applications may be used for urban seeding or on soils that are highly erosive or sloped soils to prevent surface or rill erosion and to provide organic material and nutrients needed for vegetative establishment. Ensure areas top dressed with compost have little or no drainage onto them.

2. In highly erosive soils or sloped embankments with drainage onto the area, incorporate compost by mixing it into the top soil a minimum of 2 inches (50 mm) to prevent the compost from washing off the slope.

G. Sodding.

1. Refer to the contract documents for areas to be sodded. Engineer may designate other areas for sodding.

2. Prior to shaping the sodbed, Engineer will define upon the ground the limits of areas to be sodded, and indicate the center lines of waterways. Cover designated areas with sod meeting requirements of Article 4169.06.

3. Closely place and properly fit sod against structures and adjacent sod according to the following provisions:

a. Preparation of Sodbed.

1) Shape and prepare surfaces to be sodded. Ensure areas are firm and even surfaces. Ensure they are free of material 1.5 inches (40 mm) in diameter or greater including clods, rocks, and other debris. Ensure ditch channels, slopes, and flumes to be sodded have a typical cross section as shown in the contract documents.

2) Construct ditch channel to secure a relatively level, flat bottom ditch cross section with a minimum depth of 6 inches (150 mm), measured from the finished sodbed ground line at the edge of the ditch. Scarifying prior to shaping may be necessary to assure the minimum depth. A minimum sod ditch overall width of 7.5 feet (2.2 m) (sloping sides) will be required.

3) Use a soil compaction roller complying with Article 2601.03, A, for compaction and reshaping of ditches. Limit layers of fill materials to no more than 8 inches (200 mm) in depth.

4) After the surface of the layer has been smoothed and before material for the next layer is deposited upon it, compact the layer:

- With no less than one pass of a soil compaction roller per inch (25 mm) of loose thickness of the layer, and
- Until the roller is supported entirely on its tamping feet.

5) The roller will be considered entirely supported on its tamping feet when the tamping feet penetrate no more than 3 inches (75 mm) into an 8 inch (200 mm) layer being compacted. A single section roller may be necessary for this operation in some locations.

6) Extend compacted area approximately 6 inches to 12 inches (150 mm to 300 mm) beyond the width of the ditch.

7) After compaction, shape the ditch.

b. Fertilizer for Sod.

1) Two applications are required (initial and prior to final acceptance). After sodbed preparation and prior to placing sod, fertilize the area to be sodded and the adjacent disturbed area at a rate of 10 pounds per 1000 square feet (5 kg per 100 m^2). Use a commercial fertilizer specified for the project.

2) Place the final application of fertilizer at a rate of 10 pounds per 1000 square feet (5 kg per 100 m^2) within 5 calendar days of the end of the 30 calendar day watering period and prior to final acceptance of the project. Place the final application when the grass is dry and with a dry form of fertilizer.

3) For both applications, if the type of fertilizer is not specified, apply 13-13-13 (or equivalent). Spread with a mechanical spreader which will secure a uniform rate of application.

Manipulation or mixing with the soil, other than that incidental to Article 2601.03, G, 3, d, will not be required.

c. Placing Sod.

1) Do not place between May 31 and September 1, or on frozen ground unless otherwise directed by the Engineer.

2) Place in rows or strips. On slopes, place strips transverse to the flow of water over the area. On sides and bottoms of ditches and channels, place strips at right angles to center line of channel. Place tightly against each other so that no open joints are apparent.

3) Stagger joints at the ends of sod strips at least 1 foot (0.3 m) on adjacent rows or strips of sod. Cut sod to be placed in road ditch channels, intercepting ditches, or sod flumes where the total sodded width is less than 7.5 feet (2.2 m) into strips having lengths equal to the width of the sodded area. At the top of slope or at the edge of a channel, lay sod so water from adjacent areas will have free flow onto the sodded area. In road ditch channels and flumes, begin sodding at the outlet or lower end and progress upward. On slopes, begin sodding at the bottom and progress upward. If necessary to protect sod already laid, furnish (without extra compensation) ladders or planks for workers to use.

4) The Engineer may order sod flumes, slopes, and ditch channels to be staked to minimize erosion loss before establishment. Stake sod as shown in the contract documents and as required by the Engineer.

d. Finishing Sod.

1) Firm the soil along the edge of the sodded area. Properly shape and smooth the adjacent disturbed area to allow surface water to flow into the sod ditch. Excessive soil placed over the edge of the sod will not be permitted.

2) Prepare and seed the seedbed for all rural disturbed areas adjacent to the sod. Rake the seed in. Seed the disturbed area with the following seed mixture at the rate of 2 pounds per 1000 square feet (1 kg per 100 m^2):

- Fescue, Fawn 80%
- Ryegrass, Perennial 20%

3) For urban projects adjacent to sod, use seed mixture specified for the project. Mulch disturbed area with grass, hay, or straw at the rate of 70 pounds per 1000 square feet (35 kg per 100 m^2).

4) After sodding and seeding, water sod, sodbed, and disturbed areas according to Article 2601.03, G, 3, e.

5) When sod ditches are constructed after October 1, overseed grasses the following spring, between March 1 and April 1, when weather and soil conditions are favorable.

6) When initial watering of the sod does not secure adequate bond between the sod and soil, the Engineer may require rolling. If sod is allowed to be placed between May 31 and August 10, and it is not to be staked, roll the sod using equipment approved by the Engineer. Remove from the project sod rejected from sod ditches. Remove from the site any other material not otherwise incorporated into the work.

7) In urban areas, islands, and rest areas, roll the sod prior to or following the initial watering using a hand operated, lawn type roller approved by the Engineer.

e. Watering Sod.

1) Provide watering equipment and an approved water supply before beginning any sodding operation. Six waterings will be required. Allow no more than 1 hour to elapse between laying and initial watering. Perform second, third, and fourth waterings at 4 calendar day intervals, and fifth and sixth waterings at weekly intervals. Perform waterings unless notified by the Engineer in writing at least 1 calendar day prior to the day the watering is to occur. A price adjustment will be assessed at a rate of $200.00 per day for each calendar day that the Contractor fails to complete the watering from the day watering is to commence.

2) Ensure waterings are sufficient to thoroughly saturate sod, sodbed, and adjacent disturbed areas to a depth of approximately 4 inches (100 mm).

3) Each watering may require a maximum of 100 gallons of water per square (40 L of water per square meter). Apply water as a spray or dispersion to prevent damage to sod. Complete each watering within a 4 hour period. More than one application for each watering may be necessary to provide adequate saturation without runoff.

f. Urban, Island, and Safety Rest Area Sodding.

1) Prepare areas to be sodded, except ditch channels, according to Article 2601.03, C, 4, a.

2) During the total watering period, mow sod once to a 3 inch (75 mm) height approximately 3 weeks after placement.

H. Special Ditch Control, Turf Reinforcement Mat, Slope Protection, and Outlet or Channel Scour Protection (Transition Mat).

Use material meeting the requirements of Article 4169.10. Engineer will designate areas for each type of work.

1. Preparation of Area to be Treated with Special Ditch Control, Turf Reinforcement Mat, Slope Protection, and Outlet or Channel Scour Protection (Transition Mat).

a. Shape ditch channel in the same manner as preparing a ditch for sod as provided in Article 2601.03, G, 3, a.

b. Apply provisions of Article 2601.03, B, 4, a.

c. Remove material 1.5 inches (40 mm) in diameter or greater, including clods, rocks, and other debris, which may prevent contact of the specified material with the seedbed.

d. Coordinate preparation and placement of the specified material with the seedbed preparation, seeding (including sticking agent and inoculant), fertilizing, and mulching of the adjacent area of right-of-way.

2. Special Ditch Control.

a. Seeding.

1) Prepare seed according to the provisions of Article 2601.03 B, 4, c. Sow seed prior to placement of special ditch control material according to Article 2601.03 B, 4, d.

2) Seed ditches and depressed medians using the following seeding rates in Tables 2601.03-7 and 2601.03-8:

Table 2601.03-7: Ditches - Outside Shoulder Adjacent to Native Grass Seedings

Oats	25 lbs/Acre (28 kg/ha)
Grain Rye	25 lbs/Acre (28 kg/ha)
Switchgrass (Panicum virgatum)	3 lbs PLS/Acre (3.4 kg/ha)
Side-oats grama (Bouteloua curtipendula)	4 lbs PLS/Acre (4.5 kg/ha)
Canada wildrye (Elymus canadensis)	9 lbs PLS/Acre (10 kg/ha)
Virginia wildrye (Elymus virginicus)	5 lbs PLS/Acre (5.6 kg /ha)
Partridge pea (Chamaecrista fasciculata)	4 lbs PLS/Acre (4.5 kg/ha)
Note: Canada wildrye shall be debearded or equal to facilitate the application.	

Table 2601.03-8: Medians and Ditches - Outside Shoulder Adjacent to Rural Seedings

Fescue, Tall (Fawn)	100 lbs. per acre (112 kg/ha)
Ryegrass, Perennial (Linn)	75 lbs. per acre (84 kg/ha)
Bluegrass, Kentucky	20 lbs. per acre (6 kg/ha)

b. Fertilizing.

1) After the area is prepared and prior to laying the special ditch control material, fertilize at the rate specified. Apply provisions of Article 2601.03, B, 4, b. Spread with a mechanical spreader to secure a uniform rate of application. Manipulation or mixing with the soil other than that incidental to Article 2601.03, H, 7, will not be required.

2) If the type of fertilizer is not specified for the project, apply 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent) to Medians and Ditches - Outside Shoulder Adjacent to Rural Seedings (Table 2601.03-8).

3) No fertilizer will be required for Ditches - Outside Shoulder Adjacent to Native Grass Seedings.

c. Application.

1) Space check slots on ditch channels so one check slot occurs within each 50 foot (15 m) increment on slopes of more than 4%.

2) Apply special ditch control (wood excelsior mat) without tension and in the direction of the flow of water. Where more than one strip is required, lap the lap joint no less than 3 inches (75 mm). Bury anchor slot on top edge of special ditch control (wood excelsior mat) from 6 inches to 12 inches (150 mm to 300 mm), as designated by Engineer.

3) On junction slots, bury the upslope end of each strip of wood excelsior mat 6 inches (150 mm). Firmly tamp the soil. Overlap the ends of the special ditch control (wood excelsior mat) at least 12 inches (300 mm) and staple, with the upgrade section on top.

4) Staple terminal end at bottom of special ditch control (wood excelsior mat).

5) Use staples meeting requirements of Article 4169.10, A. Space staples as shown in the contract documents.

3. Turf Reinforcement Mat (TRM).

a. Seeding.

1) Prepare seed according to provisions of 2601.03 B, 4, c. Sow after TRM and soil fill have been placed and prior to laying the special ditch control (wood excelsior mat) according to Article 2601.03 B, 4, d.

2) Apply in ditches and depressed medians using rates in Tables 2601.03-7 and 2601.03-8.

b. Fertilizing.

1) After TRM and soil fill have been placed and prior to laying special ditch control (wood excelsior mat), apply at the rate specified. Apply provisions of Article 2601.03, B, 4, b. Spread with a mechanical spreader to secure a uniform rate of application. Manipulation or mixing with the soil other than that incidental to Article 2601.03, H, 7, will not be required.

2) If the type of fertilizer is not specified for the project, apply 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent) to Medians and Ditches - Outside Shoulder Adjacent to Rural Seedings (Table 2601.03-8).

3) No fertilizer will be required for Ditches - Outside Shoulder Adjacent to Native Grass Seedings (Table 2601.03-7).

c. Application.

Place type specified on channel or slope after shaping. Apply according to manufacturer's instructions and the contract documents. Furnish and apply a minimum of 1 inch (25 mm) of soil suitable for the establishment of vegetation on the TRM. Furnish and apply seed and fertilizer. Furnish and apply special ditch control (wood excelsior mat) one soil fill.

4. Special Ditch Control over Sod.

When shown in the contract documents, place plastic netting or other approved material over sod and staple it in place. Space staples 3 feet (1 m) apart in the row. Space rows no more than 2 feet (0.6 m) apart. Place staples alternately to adjacent rows. No junction slots or check slots are required. Anchor slots and terminal ends will be required.

5. Slope Protection.

a. Seeding.

1) Prepare seed according to Article 2601.03, B, 4, c. Sow prior to placement of slope protection according to Article 2601.03, B, 4, d.

2) Use mixture specified.

b. Fertilizing.

For slope protection, use fertilizer specified. Apply provisions of Article 2601.03, B, 4, b.

c. Application on Backslopes.

1) Where erosive gullies or rills have developed in backslope, fill with soil and compact prior to placement of mat.

2) Apply slope protection without tension in a perpendicular direction on backslopes. Where more than one strip is required, lap the lap joint no less than 3 inches (75 mm).

3) Bury the slope protection in an anchor slot on the top edge of the backslope from 6 inches to 12 inches (150 mm to 300 mm), as designated by the Engineer.

4) On junction slots, bury the upslope end of each strip of slope protection 6 inches (150 mm). Firmly tamp soil. Overlap ends of slope protection at least 12 inches (300 mm) and staple, with upgrade section on top.

5) Staple terminal end at bottom of slope protection.

6) Use staples meeting requirements of Article 4169.10, A. Space staples as shown in the contract documents.

d. Application on Foreslopes.

1) If erosive gullies or rills have developed adjacent to shoulder material, fill with suitable soil and compact prior to placement of slope protection.

2) Apply slope protection without tension parallel to the roadway on foreslopes. Where more than one strip is required, butt strips together and staple 3 inches (75 mm) from each edge.

3) Install staples 3 inches (75 mm) from upside terminal and downside terminal.

4) Use staples meeting the requirements of Article 4169.10, A. Space remaining staples as shown in the contract documents.

6. Outlet or Channel Scour Protection (Transition Mat) (TM).

a. Seeding

1) Prepare seed according to the provisions of 2601.03 B, 4, c. Sow prior to placement of TRM and TM according to Article 2601.03 B, 4, d.

2) Seed outlets or channels using rates in Tables 2601.03-7 and 2601.03-8.

b. Fertilizing

1) Prior to laying the TRM and TM, apply fertilize to the area at the rate specified. Apply provisions of Article 2601.03, B, 4, b. Spread with a mechanical spreader to secure a uniform rate of application. Manipulation or mixing with the soil other than that incidental to Article 2601.03, H, 7, will not be required.

2) If type of fertilizer is not specified, apply 300 pounds per acre (336 kg/ha) of 6-24-24 (or equivalent) to Medians and Outlets/Channels - Outside Shoulder Adjacent to Rural Seedings (Table 2601.03-8).

3) No fertilizer will be required for Outlets/Channels – Outside Shoulder Adjacent to Native Grass Seedings (Table 2601.03-7).

c. Application

1) Place TM in channels or outlets at locations specified in the contract document.

2) Prior to the placement of the TM, place TRM - Type 2 according to Article 2601.03, H, 3 to extend the entire length and width of the TM. No special ditch control (wood excelsior mat) or soil fill is required under the TM. Seed is placed under the TRM.

3) Place TM panels in such a manner as to produce a planar surface.

4) Place each TM panel longitudinally with the flow. Overlap panels upstream over downstream, and/or upslope over downslope.

5) Secure each TM panel to the soil with bullet anchors driven 30 inches (760 mm) into the ground. Anchors should be driven through both panels at the edges with overlapping panels. A minimum of eight anchors per panel is required.

7. Finishing Adjacent to Special Ditch Control, Turf Reinforcement Mat, Slope Protection Areas, and Outlet or Channel Scour Protection (Transition Mat).

For adjacent areas disturbed, uniformly shape, fertilize, seed, and rake in the seed in the same manner required for disturbed areas adjacent to sod ditches, except use the seed specified in Article 2601.03, H. Complete this work during the normal permanent seeding period or by the date specified to complete seeding.

8. Watering of Special Ditch Control, Turf Reinforcement Mat, Slope Protection, and Outlet or Channel Scour Protection (Transition Mat).

a. Provide watering equipment and an approved water supply before starting special ditch control, TRM, slope protection, or TM work. Water the area no later than the day following placement of the materials. If Contractor fails to water by second day following placement a price adjustment will be assessed at a rate of $200.00 per calendar day until the watering has been completed.

b. Apply three additional waterings at intervals of 5 to 8 calendar days. Perform waterings unless notified by Engineer in writing at least 1 calendar day prior to the day watering is to occur. If Contractor fails to complete watering before the 8th calendar day has elapsed, a price~~,~~ adjustment will be assessed at a rate of $200.00 per calendar day, beginning on the 9th day, until the watering is completed.

c. Ensure waterings are sufficient to thoroughly saturate seedbed to a depth of approximately 2 inches (50 mm).

d. Each watering may require a maximum of 50 gallons of water per square (20 L of water per square meter). Apply water as a spray or dispersion to prevent damage to the seedbed. Complete each watering within a 4 hour period.

e. More than one application for each watering may be necessary to provide adequate saturation without runoff.

I. Mowing.

1. Mowing may be required prior to permanent seeding and any time during the growing season following permanent seeding. Engineer will notify Contractor in writing prior to each mowing. Notification may be issued as early as 15 calendar days following execution of the contract. Contractor will be given 5 mowing days, plus 1 additional day for each 50 acre (20 ha) increment, that has been requested to be mowed. A mowing day is a calendar day, exclusive of Saturdays, Sundays, or recognized legal holiday, on which weather or other conditions (not under the control of the Contractor) will permit mowing operations to proceed for no less than 3/4 of a normal work day in the performance of a controlling item of work. When multiple projects are combined into a single contract, mowing days will be administered independently for each project. Mowing days will be charged starting on the day following the Contractor's notification. A price adjustment will be assessed at a rate of $200.00 per mowing day after the work was to be completed.

2. Use suitable equipment for mowing. Bunching or windrowing mowed vegetation will not be permitted. When wet soil conditions result in rutting, suspend mowing. Repair rutting damage at the direction of the Engineer at no additional expense to the Contracting Authority. Hand equipment will be required for areas inaccessible to other equipment. Set the cutting height at approximately 6 inches (150 mm). More than one pass may be required for each mowing.

J. Completion of the Work.

1. Complete all phases of this work, excluding the 30 calendar day maintenance of sodded areas, within the specified construction schedule.

2. If a fertilized or seeded area is damaged by rain prior to the required mulching, refertilize or reseed, or both, that area at a rate not to exceed the specified rate as designated by the Engineer. Perform this work at no additional cost to the Contracting Authority.

3. When any work included in the contract is washed out or damaged prior to final acceptance of the project, the Engineer may order replacement of the damaged portion at contract unit prices. The Engineer will advise the Contractor of the approximate quantity of replacement required. Perform these repairs during the normal seeding period for the seed type. Maintain the work in a manner satisfactory to the Engineer. Should the repair work not be done with reasonable promptness, payment for repair will be limited to the work described at the time of notification.

4. The Contractor is responsible for replacement in addition to the quantity directed by the Engineer to complete the work in an acceptable condition should the Contractor fail to:
- Make this replacement when directed by the Engineer, or
- Perform necessary maintenance to the area.

2601.04 METHOD OF MEASUREMENT.

Measurement for the various items of work involving erosion control, satisfactory completed, will be as follows:

A. Engineer will compute in acres to the nearest 0.1 acre (hectares to the nearest 0.1 hectare) the surface areas of
- Seeding and Fertilizing,
- Stabilizing Crop Seeding and Fertilizing,
- Native Grass Seeding,
- Wetland Grass Seeding,
- Wildflower Seeding,
- Seeding Special Areas,
- Overseeding and Fertilizing,
- Mulching, and
- Composting.

B. Surface areas of Sodding: squares of 100 square feet (square meters) calculated from measurements to the nearest foot (0.1 m).

C. Debris picked up and removed according to Article 2601.03, B, 4, a: cubic yards (cubic meters) by cross sectional measurement or in the hauling units, at the option of the Engineer.

D. Special Ditch Control, Turf Reinforcement Mat, and Slope Protection: squares of 100 square feet (square meters) calculated from measurements to the nearest foot (0.1 m). Measurement of actual ditch area covered will be used, but will not exceed an area based on the actual measured length and design width. Materials used for anchor slots, junction slots, check slots, terminal folds, lap joints, mulch, and seed and fertilizer are incidental.

E. Outlet or Channel Scour Protection (Transition Mat): square feet (square meters) calculated from measurements to the nearest foot (0.1 m).

F. Watering: by counting loads from a transporting tank of known volume or by metering.

G. Mobilization for watering: by count. Mobilization for the initial watering required at installation of the plant material will not be measured for count.

H. Mowing described in Article 2601.03, I: acres to the nearest 0.1 acre (hectares to the nearest 0.1 hectare) of surface area.

2601.05 BASIS OF PAYMENT.

A. Payment for the various items of work involved in erosion control will be made as described below.

1. When suitable soil for filling holes, gullies, or washes is not available adjacent to the area to be filled or when soil must be removed, payment for necessary loading and hauling directed by the Engineer will be as extra work according to Article 1109.03, B.

2. Contract unit price per acre to the nearest 0.1 acres (hectare to the nearest 0.1 hectares) for the following. Payment is full compensation for preparing the area and furnishing and applying each material.
- Seeding and Fertilizing,
- Stabilizing Crop Seeding and Fertilizing,
- Native Grass Seeding,
- Wetland Grass Seeding,
- Wildflower Seeding,
- Seeding Special Areas,
- Overseeding and Fertilizing, and
- Composting.

3. For sowing special seed as directed by the Engineer, but not provided for in the contract documents: delivered cost of the seed plus 10% of the contract unit price for Seeding and Fertilizing.

4. Sodding:
a. Contract unit price per square (square meter).
b. Payment is full compensation for:
- Preparing the sodbed,
- Furnishing, placing, and finishing the sod,
- Fertilizing, and
- Repair of adjacent areas disturbed by the sodding operation.

c. Payment will not be allowed for the Sod until the watering, as specified, has been completed. Replace or repair, at the discretion of the Engineer, Sod areas which are damaged by weather or other causes before the specified initial watering has been completed, at no additional cost to the Contracting Authority.

5. Squares (square meters) of staking of sod flumes, slopes, and ditch channels: 25% of the contract unit price for Sodding in addition to payment for Sodding.

6. Mulch furnished and placed: predetermined contract unit price per acre (hectare).

7. Debris picked up according to Article 2102.03, C, for grading work:
a. Payment for debris pickup of additional boulders resulting from Stabilized Crop Seeding and Fertilizing will be as described in Article 2102.05 for Class 12 boulders. If there is no Class 12 item, payment will be at 10 times the contract unit price for Class 10 excavation.
b. Payment for the number of cubic yards (cubic meters) of debris picked up and removed in conjunction with other work will be paid at 25% of the contract unit price for Stabilizing Crop Seeding or Seeding and Fertilizing, as applicable.

8. Squares (square meters) of Special Ditch Control or Special Ditch Control over Sod with material as specified:
a. Contract unit price per square (square meter).
b. Payment is full compensation for the special ditch control preparation and materials. This includes seedbed preparation, seed and fertilizer, special ditch control (wood excelsior mat), stapling and installation of materials.

9. Squares (square meters) of Turf Reinforcement Mat of the type specified:
a. Contract unit price per square (square meter).

b. Payment is full compensation for the Turf Reinforcement Mat, preparation and materials including shaping channels, ditches and slopes, soil fill, seed and fertilizing, and special ditch control (wood excelsior mat).

10. Squares (square meters) of Slope Protection with material as specified:
a. Contract unit price per square (square meter).
b. Payment is full compensation for the slope protection materials in addition to the amount paid for seed and fertilizer.

11. Square feet (square meters) of Outlet or Channel Scour Protection (Transition Mat) with material as specified:
a. Contract unit price per square feet (square meter).
b. Payment is full compensation for Outlet or Channel Scour Protection (Transition Mat), TRM, preparation and materials including shaping outlets/channels, ditches, soil fill (if required), seed, fertilizer and anchors.

12. When a large area is to be watered, the contract documents will include an item for watering. For the quantity of water applied to sod, Article 2601.03, G, 3, e, and to special ditch control, TRM, slope protection, and TM, Article 2601.03, H, 8, payment will be the predetermined contract unit price per 1000 gallons (kiloliter). When an item for watering is not included, the cost of watering is included in the amount paid for the item to be watered.

13. Mobilization for watering: pre-determined unit price for each mobilization for required watering. Payment will not be made for mobilization for watering for projects identified as erosion control or landscaping. Payment will not be made for mobilization for watering if labor and equipment is already onsite.

14. Mowing as described in Article 2601.03, I: contract unit price per acre to the nearest 0.1 acres (hectare to the nearest 0.1 hectares).

15. Payment for furnishing extra length stakes or staples when directed by the Engineer will be as extra work according to Article 1109.03, B.

B. Payment for these items is full compensation for furnishing all materials, equipment, tools, and labor necessary to complete the work according to the contract documents.

C. Payment will not be allowed for any area seeded until fertilizer, and mulch are placed.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder / Tom Jacobson / Melissa Serio	**Office:** Construction	**Item 15**
Submittal Date: 2013.04.07	**Proposed Effective Date:** Oct. 15, 2013	
Article No.: 2602.01 **Title:** Description [Water Pollution Control (Soil Erosion)]	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2602.01, Description.

Add the Article:

D. Water Pollution Control Quality Control.

1. For projects regulated by a NPDES storm water permit, maintain an individual that will be onsite daily during construction activities. This individual shall have completed Iowa DOT Erosion & Sediment Control Basics (ESC Basics) web-based training, which will be valid for 2 years. This individual shall be responsible for coordinating all erosion and sediment control operations. For this daily requirement, the Contractor may subcontract this responsibility.

2. Additional responsibilities of an ESC Basics trained individual that shall not be subcontracted include:

- Attend required storm water inspections with the Contracting Authority.
- Prepare required initial Erosion Control Implementation Plan (ECIP) submittal and ECIP updates.
- Attend construction progress meetings to discuss erosion and sediment control issues.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Add the following article:

D. Water Pollution Control Quality Control.

1. For projects regulated by a NPDES storm water permit, maintain an individual that will be onsite daily during construction activities. This individual shall have completed Iowa DOT Erosion & Sediment Control Basics (ESC Basics) web-based training, which will be valid for 2 years. This individual will be responsible for coordinating all erosion and sediment control operations. For this daily requirement, the Contractor may subcontract this responsibility.

2. Additional responsibilities of an ESC Basics trained individual that cannot be subcontracted include:
   - Attend required storm water inspections with the Contracting Authority.
   - Prepare required initial Erosion Control Implementation Plan (ECIP) submittal and ECIP updates
   - Attend construction progress meetings to discuss erosion and sediment control issues

Reason for Revision: An erosion control training/certification program has been in development since Spring/Summer 2011.

This is the first phase of implementing a two level training/certification program. First level requires taking the online web-based training course, which is available online now. The second level will be submitted in the future for the April 2014 GS and will include Erosion Control Technician (ECT) certification requirements. ECT class is being offered through TTCP beginning with this 2012-2013 training season.					
County or City Input Needed (X one)			**Yes** x	**No**	
Comments: Anticipated implementation plan for two level training/certification program has been on Office of Construction website since Oct. 2012. Local Systems sent memo to local agencies on 11/20/12 for their comments.					
Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: Anticipated implementation plan for two level training/certification program has been on Office of Construction website since Oct. 2012. IaAGC has been involved since Spring/Summer 2011. Discussed most recently with IaAGC and asphalt and concrete paving associations at a 12/4/12 meeting.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Brian Smith / Mike Heller	**Office:** Design	**Item 16**
Submittal Date: 4/30/2013	**Proposed Effective Date:** 10/15/2013	
Article No.: 2602.04 **Title:** Method of Measurement (Water Pollution Control (Soil Erosion)) **Article No.:** 2602.05 **Title:** Basis of Payment (Water Pollution Control (Soil Erosion))	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

2602.04, Method of Measurement.

Renumber Articles J and K:

~~**J**~~ **K. Mobilizations, Erosion Control.**

~~**K**~~ **L. Mobilizations, Emergency Erosion Control.**

Add the Article:

J. Removal of Perimeter and Slope Sediment Control Device.

Linear feet (meters) to the nearest foot (meter).

2602.05, A.

Add the Article:

10. Removal of Perimeter and Slope Sediment Control Device.

Per linear foot (meter) for the length of device removed.

Comments:

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

2602.04, Method of Measurement.

Add as a new article:

Removal of Perimeter and Slope Sediment Control Device.

Linear feet (meters) to the nearest foot (meter).

2602.05, Basis of Payment.

Add as a new article:

Removal of Perimeter and Slope Sediment Control Device.

Per linear foot (meter) for the length of device removed.

Reason for Revision: Add MOM and BOP for removal of Perimeter and Slope Sediment Control Devices.

County or City Input Needed (X one)	**Yes**	**No**
Comments:		
Industry Input Needed (X one)	**Yes**	**No**

Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder	**Office: Materials**	**Item 17**
Submittal Date: 2013.04.30	**Proposed Effective Date:** October 2013 GS	
Article No.: 4115.04, A **Title:** Coarse Aggregate for Portland Cement Concrete	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

4115.04, A.

Replace Table 4115.04-1, Aggregate Use Durability Requirements:

Table 4115.04-1: Aggregate Use Durability Requirements

Specification Section Number	Minimum Durability Class Required			Use
	3i	3	2	
2122, 2201, 2212, 2213, 2301, 2302, 2310, 2529, 2530 Interstate System Primary System Other	X*	X*	 X	PCC Paved Shoulders, Base, Base Repair, Base Widening PCC Pavement, Widening, PCC Overlay, Finish Patches, and Bridge Approaches
2403			X	Structural Concrete
2406 (See 2403)			X	Concrete Structures
2407			X	Precast Units
2407, 2501		X		Prestressed Units, Concrete Piles
2412 (See 2403) Interstate and Primary System Other		X	 X	Concrete Bridge Decks
2413 (See 2413.02, D, 1)		X		Bridge Deck Surfacing, Repair, & Overlay
2414 (See 2403)			X	Concrete Railings
2415 (See 2403)			X	Concrete Box, Arch, & Circular Culverts
2416 (See 4145)			X	Rigid Pipe Culverts
2424			X	Shotcrete
2503 (See 2403)			X	Storm Sewers (Catch Basins, Intakes, & Utility Access)
2505 (See 2403)			X	Guardrails (Concrete End Anchorage)
2511, 2515 (See 2403)			X	PCC Sidewalks, Paved Driveways
2512 (See 2403)			X	PCC Curb & Gutter
2513 (See 2403)			X	Concrete Barrier
2516 (See 2403)			X	Concrete Walls and Steps

Comments:

4115.04 AGGREGATE USE DURABILITY REQUIREMENTS.

A. Meet the requirements of Table 4115.04-1:

Table 4115.04-1: Aggregate Use Durability Requirements

Specification Section Number	Minimum Durability Class Required			Use
	3i	3	2	
2122, 2201, 2212, 2213, 2301, 2302, 2310, 2529, 2530 Interstate System Primary System Other	X*	X*	X	PCC Paved Shoulders, Base, Base Repair, Base Widening PCC Pavement, Widening, PCC Overlay, Finish Patches, and Bridge Approaches
2403			X	Structural Concrete
2406 (See 2403)			X	Concrete Structures
2407			X	Precast Units
2407, 2501		X		Prestressed Units, Concrete Piles
2412 (See 2403) Interstate and Primary System Other		X	X	Concrete Bridge Decks
2413 (See 2413.02, D, 1)		X		Bridge Deck Surfacing, Repair, & Overlay
2414 (See 2403)			X	Concrete Railings
2415 (See 2403)			X	Concrete Box, Arch, & Circular Culverts
2416 (See 4145)			X	Rigid Pipe Culverts
2424			X	Shotcrete
2503 (See 2403)			X	Storm Sewers (Catch Basins, Intakes, & Utility Access)
2505 (See 2403)			X	Guardrails (Concrete End Anchorage)
2511, 2515 (See 2403)			X	PCC Sidewalks, Paved Driveways
2512 (See 2403)			X	PCC Curb & Gutter
2513 (See 2403)			X	Concrete Barrier
2516 (See 2403)			X	Concrete Walls and Steps

Reason for Revision: Bridge decks should have been included when bridge deck overlays changed to Class 3 durability.

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: The Iowa limestone producers and the Iowa concrete paving association had no objections.					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Brian Smith / Mike Heller	**Office:** Design	**Item 18**
Submittal Date: 4/30/2013	**Proposed Effective Date:** 10/15/2013	
Section No.: 4169 **Title:** Erosion Control Materials	**Other:**	

Specification Committee Action: Approved as recommended.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text: See Specification Section Recommended Text.

Comments: None.

Specification Section Recommended Text:

4169.07, B, 2, Bonded Fiber Matrix.

Add the Articles:

f. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.

g. Other products not meeting requirements of Article 4169.07, B, 2, e, may be approved if they meet the following requirements:

1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.

2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.

3) Hydraulic mulch that is completely photo-degradable or biodegradable.

4) Contain a minimum 90% organic material according to ASTM D 2974.

5) Have a rainfall event (R-factor) of 140 < R according to ASTM D 6459.

6) Have a cover factor of C ≤ 0.03 according to ASTM D 6459.

7) Vegetation Establishment of 400% minimum according to ASTM D 7322.

8) Water Holding Capacity 600% minimum according to ASTM D 7367.

4169.07, B, 3, Mechanically-Bonded Fiber Matrix.

Add the Articles:

f. All components pre-packaged by manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.

g. Other products not meeting requirements in Article 4169.07, B, 3, e, may be approved if they meet the following requirements:

1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM D 7101 and EPA 2021.0-1.

2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.

3) Hydraulic mulch that is completely photo-degradable or biodegradable.

4) Contain a minimum 90% organic material according to ASTM D 2974.

5) Have a rainfall event (R-factor) of 175 < R according to ASTM D 6459.

6) Have a cover factor of C ≤ 0.01 according to ASTM D 6459.

7) Vegetation Establishment of 500% minimum according to ASTM D 7322.

8) Water Holding Capacity of 700% minimum according to ASTM D 7367.

4169.10, Special Ditch Control, Turf Reinforced Mat, and Slope Protection.

Replace the title and first paragraph:

Special Ditch Control, Turf Reinforced~~ment~~ Mat, ~~and~~ Slope Protection, and Outlet or Channel Scour Protection (Transition Mat).

~~For plastic netting, wood excelsior mat, coconut fiber mat, straw-coconut mat, straw mat, and wire staples, c~~Comply with the following and meet the requirements of Materials I.M. 469.10.

Add the Article:

F. Outlet or Channel Scour Protection (Transition Mat)

1. Mat.

a. Constructed of 85% minimum UV resistant material with a maximum ground cover of 80%.
b. Meet the requirements of Table 4169.10-2:

Table 4196.10-2: Material Property and Performance Requirements

Property	Test Method	Value
Mass/Unit Area (max)	ASTM D 6566	3 lbs/ft^2 (15 kg/m^2)
Thickness (min)	ASTM D 6525	0.4 in (10 mm)
Thickness (max)	ASTM D 6525	1.1 in (28 mm)
Tensile Strength (TD)	ASTM D 6818	550 lbs/ft (820 kg/m)
Percent Open Area (min)	ASTM D 6567	20%
UV Stability	ASTM D 4355	85%

2. Anchoring Devices.
a. Furnish bullet tip style anchors made of a metal alloy attached to a wire rope.
b. Anchors capable of withstanding a minimum 300 pounds (136 kg) of pull out resistance in cohesive soils.
c. Wire rope a minimum of 30 inches (762 mm) in length with a minimum breaking strength of at least 300 pounds (136 kg).
d. The top washer a minimum of 3 inches (76 mm) in diameter and constructed of a UV resistant plastic.
e. Each anchor equipped to allow the retightening of the anchor when deemed necessary by the Engineer.

Comments:

Member's Requested Change: (Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)

4169.07, B, 2, Bonded Fiber Matrix.
Add as Articles e and f:
f. All components pre-packaged by the manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.
g. Other products that do not meet the requirements of Article 4169.07, B, 2, e may be approved if they meet the following requirements:
1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM 7101and EPA 2021.0-1.
2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
3) Hydraulic mulch that is completely photo-degradable or biodegradable.
4) Contain a minimum 90% organic material according to ASTM D 2974.
5) Have a rainfall event (R-factor) of 140 < R according to ASTM D 6459.
6) Have a cover factor of C ≤ 0.03 according to ASTM D 6459.
7) Vegetation Establishment of 400% minimum according to ASTM D 7322.
8) Water Holding Capacity 600% minimum according to ASTM D 7367.

4169.07, B, 3, Mechanically-Bonded Fiber Matrix.
Add as Articles e and f:
f. All components pre-packaged by the manufacturer to ensure material performance and compliance. Field mixing of additives or any components will not be allowed.
g. Other products that do not meet the requirements in Article 4169.07, B, 3, e may be approved if they meet the following requirements:
1) Contain non-toxic tackifiers that upon drying become insoluble and non-dispersible to eliminate direct raindrop impact on soil according to ASTM 7101and EPA 2021.0-1.
2) Contain no germination or growth inhibiting factors and do not form a water-resistant crust that can inhibit plant growth.
3) Hydraulic mulch that is completely photo-degradable or biodegradable.
4) Contain a minimum 90% organic material according to ASTM D 2974.
5) Have a rainfall event (R-factor) of 175 < R according to ASTM D 6459.
6) Have a cover factor of C ≤ 0.01 according to ASTM D 6459.
7) Vegetation Establishment of 500% minimum according to ASTM D 7322.
8) Water Holding Capacity of 700% minimum according to ASTM D 7367.

4169.10, Special Ditch Control, Turf Reinforced Mat, and Slope Protection.
Replace the title and first paragraph:

Special Ditch Control, Turf Reinforcement Mat, ~~and~~ Slope Protection, and Outlet or Channel Scour Protection (Transition Mat)

~~For plastic netting, wood excelsior mat, coconut fiber mat, straw-coconut mat, straw mat, and wire staples, c~~Comply with the following and meet the requirements of Materials I.M. 469.10.

Add as Article F:

Outlet or Channel Scour Protection (Transition Mat)

Comply with the following and meet the requirements of Materials I.M. 469.10.

1. Mat.

a. Constructed of 85% minimum UV resistant material with a maximum ground cover of 80%.

b. Meet the requirements of Table 4169.10-2:

Table 4196.10-2: Material Property and Performance Requirements

Property	Test Method	Value
Mass/Unit Area (max)	ASTM D 6566	3 lbs/ft^2 15 kg/m^2
Thickness (min)	ASTM D 6525	0.4 in 10 mm
Thickness (max)	ASTM D 6525	1.1 in 28 mm
Tensile Strength (TD)	ASTM D 6818	550 lbs/ft 820 kg/m
Percent Open Area (min)	ASTM D 6567	20%
UV Stability	ASTM D 4355	85%

2. Anchoring Devices.

a. Furnish bullet tip style anchors made of a metal alloy attached to a wire rope.

b. Anchors capable of withstanding a minimum 300 pounds (136 kg) of pull out resistance in cohesive soils.

c. Wire rope a minimum of 30 inches (762 mm) in length with a minimum breaking strength of at least 300 pounds (136 kg).

d. The top washer a minimum of 3 inches (76 mm) in diameter and constructed of a UV resistant plastic.

e. Each anchor equipped to allow the retightening of the anchor when deemed necessary by the Engineer.

Reason for Revision: Allow new Bonded Fiber Matrix and Mechanically-Bonded Fiber Matrix products that may be more effective at controlling erosion. Add materials specifications for Outlet or Channel Scour Protection (Transition Mat)

County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes**	**No**	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Willy Sorenson / Zachary Abrams	**Office:** Traffic and Safety	**Item 19**
Submittal Date: 2013.03.08	**Proposed Effective Date:** October 2013	
Article No.: 4186.10, D, 2 **Title:** PSST Post Anchors	**Other:**	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 10/15/2013

Specification Committee Approved Text:

4186.10, D, 2, c, 2, a.

Replace the third bullet:

Galvanize by hot dip process, complying with ASTM ~~A 123, grade 85~~ F 2329 with zinc temperature bath limited to 850°F (455°C) or ASTM B 695, Class 55, Type 1 coating.

4186.10, D, 2, c, 2, b.

Add the bullet:

- Galvanize by hot dip process, complying with ASTM A 123, grade 85.

4186.10, D, 2, c, 2, c.

Replace the Article:

Hardware shall meet requirements of ~~Article 4186.09~~ the manufacturer and metal hardware shall be stainless steel or galvanized steel. Ensure galvanizing meets the requirements of ASTM F 2329 with zinc temperature bath limited to 850°F (455°C) or ASTM B 695, Class 55, Type 1 coating.

Comments: The District 4 Materials Office asked if the galvanizing reference in Article 4186.10, D, 2, c, 2, a, was correct. This has been revised to match Article 2522.03, E, 4.

Specification Section Recommended Text:

4186.10, D, 2, c, 2, c.

Replace the Article:

Hardware shall meet requirements of ~~Article 4186.09~~ the manufacturer and metal hardware shall be galvanized or stainless steel.

Comments: Do we need to indicate "*metal* hardware shall be galvanized or stainless steel"? Will there be hardware that isn't metal?

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

2. PSST Post Anchors.

a. Break-away, soil installation.
42 inch (1065 mm) minimum length, 7 gauge (4.76 mm) heavy duty winged anchor.

b. Break-away, concrete installation.
Posts installed in a concrete island, use a 48 inch (1220 mm) minimum length, 7 gauge (4.76 mm) heavy duty anchor. Core an 8 inch (200 mm) diameter hole through pavement at least 8 inches (200 mm) deep. After placing anchor, fill hole with concrete mix approved by the Engineer and level off top of concrete.

c. Triangular Slip Base Assembly.

1) Ensure design is in accordance with the AASHTO Standards and Specifications for Structural Supports for Highway Signs, Luminaires, and Traffic Signals, current edition and meets or exceeds NCHRP Report 350 or the AASHTO MASH criteria for any assembly system evaluated after January 1, 2011 and be FHWA accepted.

2) Triangular Slip Base Assembly consists of four parts: one-piece anchor, top half slip base, hardware, and concrete foundation.

a) One-piece anchor shall meet the following requirements:
Anchor shall have a triangular slip plate (1 inch (25 mm) thick) welded directly to anchor leg.
Anchoring portion shall be 3 inches (75 mm) square 7 gauge (4.76 mm) material and 42 inches (1065 mm) long.
Galvanize by hot dip process, complying with ASTM A 123, grade 85.

b) Top-half slip base shall meet the following requirements:
Cast unit from Ductile Iron meeting ASTM A 536 Class 65-45-12.
Top half slip base shall have a triangular dimension to match 8 inch (200 mm) standard triangular slip plate, and shall receive 2.5 inch (63 mm) square sign support.

c) Hardware shall meet requirements of ~~Article 4186.09.~~ the manufacturer.

d) Concrete Footings: Apply Section 2403.

Reason for Revision: It is imperative that the hardware used on any slip base system be the equivalent of what has been accepted for the slip base per the manufacturer's FHWA letter.

County or City Input Needed (X one)			**Yes**	**No** X	
Comments:					
Industry Input Needed (X one)			**Yes**	**No** X	
Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder	**Office:** Construction / Materials	**Item 20**
Submittal Date: April 2013	**Proposed Effective Date:** August 2013	
Article No.: **Title:**	**Other:** DS-12034, Developmental Specifications for Quality Management – Concrete (QM-C) Pavement	

Specification Committee Action: Approved as recommended.			
Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 8/20/2013
Specification Committee Approved Text: See attached DS-12034, QM-C Concrete Pavement.			
Comments: The Specifications Section asked if this DS should be incorporated into the Standard Specifications. The only issue to be addressed would be a restriction that QM-C only be applied to projects with greater than 50,000 square yards. The Office of Construction and Materials will review if this should be incorporated into the Standard Specifications.			
Specification Section Recommended Text: See attached Draft DS-12034, QM-C Concrete Pavement.			
Comments:			

Member's Requested Change (Redline/Strikeout):

DS-12034 Attached

Reason for Revision:

County or City Input Needed (X one)	**Yes**	**No**
Comments:		

Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes** X	**No**	**Industry Concurrence:**	**Yes** X	**No**

Comments: During the May 2012 ICPA Joint Spec meeting, the ICPA and Iowa DOT agreed to remove the QMC bid item and include the quality control costs in the pavement bid item.

Also, corrected the Note number on 12034.03 paragraph C.

DS-12XXX
(Replaces DS-12034)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS
FOR
QUALITY MANAGEMENT CONCRETE (QM-C)

Effective Date
August 20, 2013

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

12XXX.01 DESCRIPTION.

A. This specification identifies a concrete mixture design with an optimum combined aggregate gradation, and the Contractor's testing and quality control responsibilities. Optimization of the aggregates should produce concrete with low water requirement as well as improved workability and finishing characteristics. While concrete strength is important and is measured, it is not the basis for optimization of the concrete mixture design.

B. Testing and quality control apply to all Contractor produced concrete using the Concrete Design Mixture (CDM). The CDM applies to mainline slip form pavement. At the Contractor's option, the CDM may apply to any other slip form paving.

12XXX.02 MATERIALS.
For all materials, meet the quality requirements for the respective items in Division 41 of the Standard Specifications. Compatibility of all material combinations is the Contractor's responsibility based on acquired field experience with proposed materials.

12XXX.03 LABORATORY DESIGN MIXTURE.

A. Develop a CDM based on a unit volume of 1.000 according to industry standard practice, and containing proportions of materials, including admixtures. Base the proportions upon saturated surface dry aggregates to produce a workable concrete mixture meeting the constraints of Table DS-12XXX.03-1:

Table DS-12XXX.03-1: Concrete Mixture Constraints

Nominal Maximum Coarse Aggregate Size	Greater than or equal to 1 inch (25 mm)
Gradation	Materials I.M. 532
Cementitious Content	Minimum, 560 pounds per cubic yard* (333 kg/m^3 *)
Fly Ash Substitution Rate	See Article 2301.02, B, 6
Water/Cementitious Ratio	Maximum, 0.45
Air Content	6% ± 1%, Design Absolute Volume = 0.060
28 Day Flexural Strength, Third Point	Minimum, 640 pounds per square inch (4.40 MPa)

* The minimum cement content assumes the use of Type I/II cement with a specific gravity of 3.14 for an absolute volume of 0.106. If cement other than Type I/II is used, use an absolute volume of 0.106 and determine the weight (mass) of cement from the specific gravity of the cement. For Type IP cement, use an absolute volume of 0.111. Cement content may need to be increased to maintain the water to cementitious ratio during hot weather conditions.

B. Use normal production gradations to determine the relative percentage of each individual aggregate used in the CDM. Select the relative percentage of each individual aggregate to produce the desired combined aggregate gradation using the following sieves: 1.5 inch, 1 inch, 0.75 inch, 0.5 inch, 0.375 inch, No. 4, No. 8, No. 16, No. 30, No. 50, No. 100, and No. 200 (37.5 mm, 25 mm, 19 mm, 12.5 mm, 9.5 mm, 4.75 mm, 2.36 mm, 1.18 mm, 600 µm, 300 µm, 150 µm, and 75 µm).

C. Develop a target combined gradation for each CDM based on normal production gradations and the relative percentages of each individual aggregate. Limit the percent passing the No. 200 (75 µm) sieve to no more than 1.5% for the combined aggregate gradation. When the coarse aggregate used meets the increase in percent passing the No. 200 (75 µm) sieve, according to Section 4109, Aggregate Gradation Table, Note ~~11~~ 10 of the Standard Specifications, limit the percent passing the No. 200 (75 µm) sieve to no more than 2.0% for the combined aggregate gradation. Contractor may use water reducing admixture, Type A, or water reducing and retarding admixture, Type D, in the CDM.

D. Comply with AASHTO T 126 for laboratory development of the CDM. Mix designs may be conducted in a ready mix or central mix batch plant provided the following conditions are met:

- All non-mix design materials are emptied,
- Mix design materials are used, and
- Batch size is at least 3 cubic yards (2 m^3).

E. An Iowa DOT PCC Level III Certified Technician is required to oversee the development of the CDM. Allow the Engineer to witness the development of the CDM. Provide notice 7 calendar days prior to this event. Perform the tests in Table DS-12XXX.03-2 in the development of the CDM:

Table DS-12XXX.03-2: Tests for CDM

Specific Gravity of Each Individual Aggregate	Materials I.M. 307
Gradation of Each Individual Aggregate	Materials I.M. 302
Unit Weight of Plastic Concrete	AASHTO T 121
Air Content of Plastic Concrete	Materials I.M. 318
28 Day Flexural Strength	AASHTO T 97
Temperature of Plastic Concrete	ASTM C 1064

12XXX.04 MIX DESIGN DOCUMENTATION.

A. At least 7 calendar days prior to the start of paving, submit a CDM report to the District Materials Engineer for approval. Contract extensions will not be allowed due to inadequate or additional CDMs. In the CDM report include the information shown in Table DS-12XXX.04-1:

Table DS-12XXX.04-1: Items to Include in CDM Report

Cover Page	Contractor name Project number Date and location of CDM laboratory development Date Submitted Signature of Contractor representative
Material Source Information	Brand Type Source
Material Proportion Information	Specific gravity Relative percentage of each individual aggregate Target combined gradation % passing (Materials I.M. 531) Target combined gradation charts (Materials I.M. 532) Design batch weight (mass) (SSD) As mixed batch weight (mass) (SSD)
Mix Properties	Unit weight (mass) of plastic concrete Air content of plastic concrete 28 day flexural strength Slump Temperature of plastic concrete

B. The District Materials Engineer may approve the mix design without laboratory mixture testing if the proposed mix design proportions fall within Zone II-A of Materials I.M. 532. If the mix design is approved without laboratory testing, cast a set of three beams on the first day of paving from concrete meeting the mix design criteria. Test the beams for 28 day flexural strength, third point loading. When the coarse aggregate for the mix design is quartzite, cast an additional set of three beams, and test at 90 days. Submit the strength results to the Engineer.

12XXX.05 QUALITY CONTROL.

A. General.

1. The Contractor is responsible for quality control of the concrete. An Iowa DOT PCC Level II Certified Technician is required to oversee quality control operations. The individual conducting the testing on grade is required to be an Iowa DOT PCC Level I Certified Technician. Calibrate and correlate testing equipment prior to and during paving operations.

2. At least seven calendar days prior to the preconstruction conference, submit to the Engineer a Quality Control Plan ~~and Project Information Quality Control Plan~~ complying with Materials I.M. 530. Include the proposed mix design(s) with the Quality Control Plan. Do not begin paving until the plan is reviewed for compliance with the contract documents. Maintain equipment and qualified personnel to direct and perform all field quality control sampling and testing necessary to:

- Determine the various properties of the concrete governed by the contract documents, and
- Maintain the properties described in this specification.

B. Quality Control Testing.

1. Perform all quality control tests necessary to control the production and construction processes applicable to this specification and as set forth in the Quality Control Plan. Take samples for quality control testing in a random manner according to the prescribed sampling rate. Perform the tests listed in Table DS-12XXX.05-1:

Table DS-12XXX.05-1: Quality Control Table

	Limits	Testing Frequency	Test Methods
Unit Weight (Mass) of Plastic Concrete	Monitor for changes, ± 3%	Twice/day	AASHTO T 121
Gradation Combined % Passing	See Paragraph 2 below	1/1500 cubic yard (1/1200 m^3)	Materials I.M. 216, 301, 302, 531
Aggregate Moisture Contents	See Materials I.M. 527	1/1500 cubic yard (1/1200 m^3)	Materials I.M. 308
Air Content Plastic Concrete In Front of Paver	See Article 2301.02, B, 4	1/350 cubic yard (1/275 m^3) See below	Materials I.M. 318
Water/Cementitious Ratio	0.45 maximum	Twice/day	Materials I.M. 527
Vibrator Frequency	See Article 2301.03, A, 3, a, 6, a	With Electronic Vibration Monitoring: Twice/day Without Electronic Vibration Monitoring: Twice/Vibrator/Day	Materials I.M. 384

2. The running average of three combined aggregate gradation tests is required fall within the limits established by the CDM target gradation and the working ranges of Table DS-12XXX.05-2:

Table DS-12XXX.05-2: CDM Target Gradations

Sieve Size	Working Range
No. 4 or greater (4.75 mm or greater)	± 5%
No. 8 to No. 30 (2.36 mm to 600 µm)	± 4%
No. 50 (300 µm)	± 3%
No. 100 (150 µm)	± 2%
minus No. 200 (75 µm)	See Article DS-12XXX.03

C. Corrective Action.

For QM-C mixes only, plot all process control test results on control charts as described in Materials I.M. 530.

1. Aggregate Tests.

Take corrective action when the running average approaches the working range limits. When a combined gradation test result for a sieve exceeds the working range limits, adjust the target and notify the Engineer. If the verification test result for the minus No. 200 (75 µm) exceeds the limits in Article DS-12XXX.03 for the combined gradation, the material represented by that test for this sieve will be considered non-complying. Pay factors will be assessed based on Coarseness/Workability Factors as described in Article DS-12XXX.07.

2. Concrete Tests.

Take corrective action when an individual test result approaches the control limits. Notify the Engineer whenever an individual test result exceeds the control limits.

D. Acceptable Field Adjustments.

1. All mix changes must be mutually agreed upon between the Contractor and Engineer. Document all mix changes on the QM-C Mix Adjustment form. Determine batch weights using a basic water cement ratio of 0.40. When the water cement ratio varies more than ±0.03 from the basic water cement ratio, adjust the mix design to unit volume of 1.000. A change in the source of materials or an addition of admixtures or additives requires a new CDM. The following are small adjustments that may be made without a new CDM being required:

- Increase cementitious content.
- Decrease fly ash substitution rate.
- Aggregate proportions may be adjusted from CDM proportions by a maximum of ± 4% for each aggregate.
- Change water reducer to water reducer retarder.
- Adjustment in water reducer or water reducer retarder admixture dosage.
- Change in source of fly ash.
- Change in source of sand, provided target gradation limits are met.

2. When circumstances arise, such as a cement plant breakdown, that create cement supply problems, a change in cement source may be allowed with the Engineer's approval. Consult the District Materials Engineer for approval of other changes to the mix design. A set of three beams for 28 day flexural strength testing may be required to document the changes. Should conditions beyond the Contractor's control prevent completion of the work with the CDM, a Class C mix, or a mix based on Class C mix proportions using project materials, will be allowed, at no additional cost to the Contracting Authority. Mutual agreement between the Contractor and Engineer is required.

3. Prior to 28 days strength test results, paving with QM-C mix may begin if the Engineer approves when the mix design strength, based on the average of three beams, meets or exceeds 640 psi (4.4 MPa).

E. Hand Finished Pavement.
Use project materials based on Class C or Class M concrete mix proportions. With approval of the Engineer, the Contractor's CDM may be used for hand finished pavement. Quality control, as required in this specification, will not apply to hand finished pavement.

12XXX.06 METHOD OF MEASUREMENT.
Measurement will be as follows:

~~**A. Quality Management Concrete (QM-C).**~~
~~Cubic yards (cubic meters) of QM-C computed using the number of batches produced for which quality control and testing were performed. This QM-C quantity will also include: 1) the quantity of QM-C produced at the Contractor's option as referenced in Article DS-12034.01; and 2) Class C mixture used according to Article DS-12034.05, C. The amount of concrete produced for hand finished pavement and waste will be excluded from this quantity.~~

~~**B** **A. Standard or Slip-Form Portland Cement Concrete Pavement, QM-C.**~~
Square yards (square meters) shown in the contract documents.

~~**C** **B. Portland Cement Concrete Overlay, QM-C, Furnish Only.**~~
Article 2310.04, A, of the Standard Specifications applies.

~~**D** **C. Portland Cement Concrete Overlay, QM-C, Placement Only.**~~
Article 2310.04, B, of the Standard Specifications applies.

~~**E** **D. Class C and Class M Mixtures.**~~
Square yards (square meters) of Standard or Slip-Form Portland Cement Concrete Pavement, QM-C, constructed using Class C or Class M mixtures. For overlays, the Engineer will compute the number of:

- Square yards (square meters) of Portland Cement Concrete Overlay, QM-C, Placement Only, constructed using Class C or Class M mixtures, and
- Cubic yards (cubic meters) of Class C and Class M mixtures used.

12XXX.07 BASIS OF PAYMENT.

The cost for furnishing labor, equipment, and materials for the work required by the Contractor to design, test, and provide process control for production of QM-C shall be included in the contract unit price for QM-C bid items. Payment will be the contract unit prices as follows:

~~**A. Quality Management Concrete (QM-C).**~~

~~**1.** Predetermined price per cubic yard (cubic meter).~~

~~**2.** Payment is full compensation for furnishing all labor, equipment, and materials for the work required by the Contractor to design, test, and provide process control for the production of QM-C.~~

~~**B**~~ **A. Standard or Slip Form Portland Cement Concrete Pavement, QM-C.**

1. Contract unit price for Standard or Slip-Form Portland Cement Concrete Pavement, QM-C, per square yard (square meter).

2. The contract unit price per square yard (square meter) for Standard or Slip-Form Portland Cement Concrete Pavement, QM-C, constructed will be adjusted according to Table DS-12XXX.07-1 based upon the average coarseness and workability factors for each lot according to Materials I.M. 530.

Table DS-12XXX.07-1: Pay Factor Chart

Gradation Zone (Materials I.M. 532)	Pay Factor
II-A	1.03
II-B	1.02
II-C	1.01
II-D	1.00
IV	0.98
I	0.95

~~**C**~~ **B. Portland Cement Concrete Overlay, QM-C, Furnish Only.**

Article 2310.05, A, of the Standard Specifications applies. Average coarseness and workability factor for each lot will be determined according to Materials I.M. 530. The contract unit price will be adjusted according to Table DS-12XXX.07-1.

~~**D**~~ **C. Portland Cement Concrete Overlay, QM-C, Placement Only.**

Article 2310.05, B, of the Standard Specifications applies. Average coarseness and workability factor for each lot will be determined according to Materials I.M. 530. The contract unit price will be adjusted according to Table DS-12XXX.07-1.

~~**E**~~ **D. Class C and Class M Mixtures.**

1. Standard or Slip-Form Portland Cement Concrete Pavement, QM-C: per square yard (square meter).

2. Portland Cement Concrete Overlay, QM-C, Placement Only: per square yard (square meter)

3. Portland Cement Concrete Overlay, QM-C, Furnish Only: per cubic yard (cubic meter).

4. Pay Factor incentives/disincentives in Table DS-12XXX.07-1, will not be applied to Class C and Class M mixtures.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Greg Mulder			**Office:** Construction / Materials		**Item 21**
Submittal Date: April 2013			**Proposed Effective Date:** August 2013		
Article No.: **Title:**			**Other:** DS-12xxx, Developmental Specifications for Pavement Interlayer Geotextile		
Specification Committee Action: Approved with changes.					
Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 8/20/2013		
Specification Committee Approved Text: See attached DS-12XXX, Pavement Interlayer Geotextile.					
Comments: The following sentence was removed from the Description Section, as it pertains to design and not construction: The pavement interlayer geotextile is intended to be used as a bond breaker on unbounded concrete overlays with minimal faulting. There will not be a controller for this DS.					
Specification Section Recommended Text: See attached Draft DS-12XXX, Pavement Interlayer Geotextile.					
Comments:					
Member's Requested Change (Redline/Strikeout): **DS-12xxx Attached**					
Reason for Revision:					
County or City Input Needed (X one)			**Yes**	**No**	
Comments:					
Industry Input Needed (X one)			**Yes** X	**No**	
Industry Notified:	**Yes** x	**No**	**Industry Concurrence:**	**Yes** X	**No**
Comments: Pavement interlayer geotextile is used on unbonded PCC overlays as a replacement for the stress relief layer. Counties have recently added as plan notes. Creating a DS to make a standard approach for including in plans for counties and DOT.					

DS-12XXX
(New)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS
FOR
PAVEMENT INTERLAYER GEOTEXTILE

Effective Date
August 20, 2013

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

120xx.01 DESCRIPTION.
Place pavement interlayer geotextile as shown on the plans.

120xx.02 MATERIALS.

A. Pavement Interlayer Geotextile.
Provide a pavement interlayer meeting AASHTO M 288, except as modified below:

Table 12XXX.02-1: Pavement Interlayer Geotextile Properties

Property	Requirement	Test Method
Fabric Type	Non-woven Geotextile, no thermal treatment	EN 13249, Annex F
Mass per unit area	≥13.3 oz/sq.yd (450 g/m^2) and ≤16.2 oz/sq.yd (550 g/m^2)	ASTM D 5261
Thickness under load (pressure)	0.29 psi (2 kPa): ≥ 0.12 in (3.0 mm) 2.9 psi (20 kPa): ≥ 0.10 in (2.5 mm) 29 psi (200 kpa): ≥ 0.04 in (1.0 mm)	ASTM D 5199, modified under loads of 0.29, 2.9, and 29 psi (2, 20, and 200 kPa)
Tensile strength	≥ 685 lb/ft (9997 N/m)	ASTM D 4595
Maximum elongation	≤ 130%	ASTM D 4595
Water permeability in normal direction under load (pressure)	≥ 3.3×10^{-4} ft/s (0.1 mm/s) [under pressure of 2.9 psi (20 kPa)]	ASTM D 5493
Water permeability in the plane direction of the fabric (transmittivity) under load (pressure)	≥ 1.6×10^{-3} ft/s (0.5 mm/s) [under pressure of 2.9 psi (20 kPa)] ≥ 6.6×10^{-4} ft/s (0.2 mm/s) [under pressure of 29 psi (200 kPa)]	ASTM D 6574
Weather resistance	Resistance ≥ 60%	EN 12224
Alkali resistance	≥ 96% Polypropylene/Polyethylene	EN 13249, Annex B

Note: EN is European Standard

B. For each lot of material, furnish manufacturer's certification statement to Engineer stating name of

manufacturer, chemical composition of filaments or yarns, and compliance with this specification. Include test results from specific lots for all specification requirements.

12xxx.03 CONSTRUCTION.

A. Sweep pavement to remove loose debris before applying pavement interlayer geotextile**.**

B. Ensure geotextile is tight without excess wrinkles and folds.

C. Do not place more than 650 feet (200 m) of geotextile in front of paver if construction traffic is expected on the grade in front of the paver. Limit driving on geotextile to a minimum. Delay installation on areas subject to excess traffic, such as crossovers, until immediately before concrete placement.

D. Secure geotextile with pins or nails punched through 2 to 2.75 inch (50 to 70 mm) galvanized washers or disks every 6 feet (1.8 m) or less. Place additional fasteners as needed to ensure geotextile does not shift or fold during concrete placement.

E. Do not allow more than three layers of the geotextile to overlap in any location. Overlap edges of geotextile by 8 inches ± 2 inches (200 mm ± 50 mm). Sequence rolling out geotextile to ensure good lapping practice and prevent folding or tearing by construction traffic.

F. Extend free edge of geotextile interlayer a minimum of 4 inches (100 mm) beyond edge of pavement**.** Terminate interlayer in a drainable layer. Do not impair free drainage within the geotextile.

G. Keep geotextile clean and free of loose debris before concrete placement.

12XXX.04 METHOD OF MEASUREMENT.
The quantity of Pavement Interlayer Geotextile will be the quantity in square yards (square meters) shown in the contract documents.

12XXX.05 BASIS OF PAYMENT.
Payment for Pavement Interlayer Geotextile will be at the contract unit price per square yard (square meters). Payment is full compensation for furnishing materials, labor and equipment necessary to install the pavement interlayer geotextile.

SPECIFICATION REVISION SUBMITTAL FORM

Submitted by: Tom Reis / Eric Johnsen	**Office:** Specifications	**Item 22**
Submittal Date: 3/29/2013	**Proposed Effective Date:** July 16, 2013	
Article No.: **Title:**	**Other:** Developmental Specifications for Precast Noise Wall	

Specification Committee Action: Approved with changes.

Deferred:	**Not Approved:**	**Approved Date:** 5/9/2013	**Effective Date:** 7/16/2013

Specification Committee Approved Text: See attached Developmental Specifications for Precast Noise Wall.

Comments: The Office of Bridges and Structures and Office of Construction and Materials provided some comments that were incorporated.

The Office of Contracts asked if this DS should be incorporated into the Standard Specifications. It will be processed as a DS for use in the July letting and then incorporated into GS-12003 to be issued in October 2013.

There will not be a controller for this DS.

Specification Section Recommended Text: See attached Draft Developmental Specifications for Precast Noise Wall

Comments: This is an update of DS-09007, Precast Noise Wall, which also incorporates SP-09060, Concrete Drilled Shaft - Noise Wall, into one specification.

Member's Requested Change: **(Do not use 'Track Changes', or 'Mark-Up'. Use ~~Strikeout~~ and Highlight.)**

Reason for Revision:

County or City Input Needed (X one)	**Yes**	**No** X
Comments:		
Industry Input Needed (X one)	**Yes**	**No** X

Industry Notified:	**Yes**	**No**	**Industry Concurrence:**	**Yes**	**No**
Comments:					

DS-12XXX
(New)

Iowa Department of Transportation

DEVELOPMENTAL SPECIFICATIONS
FOR
PRECAST NOISE WALL

Effective Date
July 16, 2013

THE STANDARD SPECIFICATIONS, SERIES 2012, ARE AMENDED BY THE FOLLOWING MODIFICATIONS AND ADDITIONS. THESE ARE DEVELOPMENTAL SPECIFICATIONS AND THEY SHALL PREVAIL OVER THOSE PUBLISHED IN THE STANDARD SPECIFICATIONS.

12XXX.01 DESCRIPTION.

A. Construct and install precast noise wall units according to this specification and the contract documents.

B. Noise walls are precast concrete panels held in place by columns placed on concrete drilled shafts used to reduce noise pollution.

12XXX.02 MATERIALS.

A. Concrete Drilled Shafts.

1. Slurry.
Comply with Article 2433.02, A, of the Standard Specifications.

2. Concrete.
Comply with Article 2433.02, B, of the Standard Specifications.

3. Reinforcing Steel.
Shall be epoxy coated and comply with Section 4151 of the Standard Specifications.

B. Precast Noise Wall Panels and Columns.
Construct according to Materials I.M. 445.06. Manufacturer must be approved per Materials I.M. 445.06, Appendix A.

C. Neoprene Bearing Pads and Shims.
Neoprene for bearing pads shall be sized as shown in the contract documents and shall have a hardness of 70 durometer. Shims shall provide contact area equal to the neoprene bearing pad. Shims shall have a compressive strength of 5075 psi (35 MPa) or greater and shall not rust or rot. Shim material shall be approved by the Engineer.

12XXX.03 CONSTRUCTION.

A. Concrete Drilled Shafts.

1. Construction Tolerances.
Comply with Article 2433.03, A, of the Standard Specifications, with the following exceptions:
a. Set reinforcing steel as detailed in the contract documents.
b. The top elevation of the shaft may have a tolerance of plus 1 inch (25 mm) or minus 2 inches (50 mm) from the plan top of shaft elevation. Ensure sufficient reinforcement bar splice length for splices above the shaft.

2. Control and Disposal of Materials.
Comply with Article 2433.03, C, of the Standard Specifications.

3. Shaft Excavation.
Comply with Article 2433.03, D, of the Standard Specifications with the following exceptions:
a. A drilling log will not be required.
b. Shaft construction need not immediately follow shaft excavation.

4. Final Cleaning.
a. Comply with Articles 2433.03, F, 1; 2; and 3, of the Standard Specifications.
b. For slurry shafts, the Engineer will check the cleanliness of the bottom of the shaft with a weighted tape.

5. Excavation Inspection.
Comply with Article 2433.03, G, of the Standard Specifications.

6. Reinforcing Steel Cage Construction and Placement.
Comply with Article 2433.03, H, of the Standard Specifications.

7. Concrete Placement.
Comply with Article 2433.03, I, of the Standard Specifications except that rock sockets shall not apply.

B. Precast Noise Wall.

1. Concrete Columns.
Place concrete columns as follows:
a. Set plum, unless otherwise shown in the contract documents.
b. Set and secured in place to the dimensions shown in the contract documents, prior to concrete placement, unless temporary casing is used.
c. Final vertical and horizontal position of the concrete columns shall be within a 1/2 inch (13 mm) of that shown in the contract documents.
d. The wall panel seat area shall be level and within 1/4 inch (6 mm) of the elevation shown in the contract documents.
e. If temporary casing is used, concrete columns can be pushed into plastic shaft concrete a maximum of 5 feet (1.5 m). Confirm correct location of reinforcing steel cage after removal of temporary casing and before setting the concrete column in the plastic shaft concrete. Vibrate around embedded concrete columns to consolidate the plastic concrete without causing segregation.

2. Wall Panels.
Place wall panels on neoprene bearing pads between concrete columns as shown in the contract documents. Do not trim precast wall panels for fit.

12XXX.04 METHOD OF MEASUREMENT.

Quantity of Precast Noise Wall will be the quantity, in square feet (square meters), shown in the contract documents.

12XXX.05 BASIS OF PAYMENT.

A. For the number of square feet (square meters) of Precast Noise Wall shown in the contract documents, Contractor will be paid the contract unit price per square foot (square meter). This payment is full compensation for furnishing and erecting precast noise wall, including panels, columns, and concrete drilled shafts according to the contract documents.

B. Any additional length of drilled shaft required by Engineer due to unsuitable conditions at proposed shaft tip elevations will be paid according to Article 1109.03, B.