Structures

- Box Culverts
- Bridges
- Walls

Box Culverts, Bridges and Walls

DESIGN

1. The Structure Survey Report
2. Foundation Investigation and Report

CONSTRUCTION

1. Box Culvert Foundation and Backfill
2. Bridge Foundation Support: Pile and Spread Footings
3. Bridge Approaches
4. Retaining Wall Types and What to Look For

The Structure Survey Report

1. What Information is Important to You
2. What to Look For

Facilities Development Manual 11-35-1

Facilities Development Manual
Chapter 11 Design
Section 35 Structures

Wisconsin Department of Transportation

FDM 11-35-1 Widths, Clearances, Sidewalks and Protective Screening *March 31, 2017*

1.1 Structure Survey Reports

A structure survey report is required for all new, replacement, and rehabilitation bridge, retaining wall, box culvert extension and sign structure projects, or any other work performed on structures (refer to Chapter 6 of the WisDOT Bridge Manual Chapter 6 (https://wisconsindot.gov/dtsdManuals/strct/manuals/bridge/ch6.pdf). This report, including the appropriate soils information, must be received by Central Office Bridge according to the schedule. Variations to this schedule must be approved by the DTSD, Chief Structural Design Engineer. Reference should be made to the Bridge Design Manual for guidance in making this report and the selection of bridge types.

Bridge Manual 6-2

6.2 Preliminary Plans

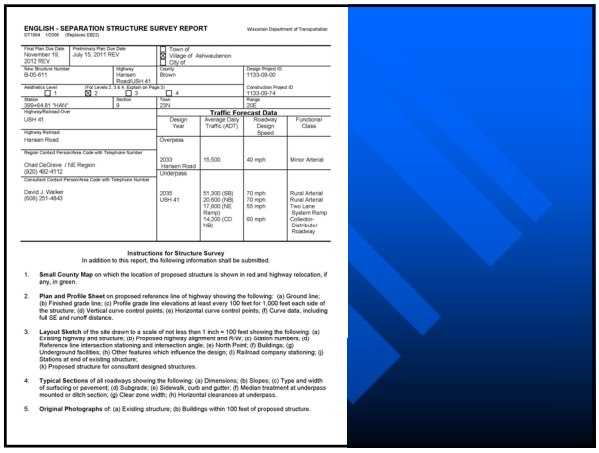
6.2.1 Structure Survey Report

The Structure Survey Report is prepared by Regional Office or consultant personnel to request a structure improvement project. The following forms in word format are used and are available at: http://www.dot.wisconsin.gov/forms/index.htm

Under the "Plans and Projects" heading:

DT1694	Separation Structure Survey Report
DT1696	Rehabilitation Structure Survey Report
DT1698	Stream Crossing Structure Survey Report (use for Culverts also)

The front of the form lists the supplemental information to be included with the report. Duplicate reports and supplemental information are required for Federal aid primary and Interstate projects.



ENGLISH - SEPARATION STRUCTURE SURVEY REPORT

DT1694 10/2009 (Replaces SSD2)

Wisconsin Department of Transportation

Final Plan Due Date: November 19, 2012 REV	Preliminary Plan Due Date: July 15, 2011 REV	☒ Town of ☐ Village of ☐ City of: Ashwaubenon	
New Structure Number: B-05-611	Highway: Hansen Road/USH 41	County: Brown	Design Project ID: 1133-09-00
Aesthetics Level: ☐ 1 ☒ 2 ☐ 3 ☐ 4 (For Levels 2, 3 & 4, Explain on Page 3)			Construction Project ID: 1133-09-74
Station: 395+64.81 "ANN"	Section: 9	Town: 20N	Range: 20E
Highway/Railroad Over: USH 41			
Highway Railroad: Hansen Road			
*Region Contact Person/Area Code with Telephone Number: Chad DeGrave / NE Region (920) 492-4112			
*Consultant Contact Person/Area Code with Telephone Number: David J. Walker (608) 251-4843			

Traffic Forecast Data

Design Year	Average Daily Traffic (ADT)	Roadway Design Speed	Functional Class
Overpass			
2033 Hansen Road	15,500	40 mph	Minor Arterial
Underpass			
2035 USH 41	51,300 (SB) 20,600 (NB) 17,800 (NE Ramp) 14,200 (CD rdy	70 mph 70 mph 55 mph 60 mph	Rural Arterial Rural Arterial Two Lane System Ramp Collector-Distributor Roadway

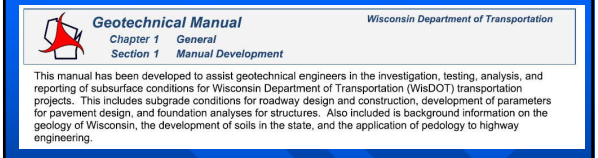
Instructions for Structure Survey
In addition to this report, the following information shall be submitted.

1. **Small County Map** on which the location of proposed structure is shown in red and highway relocation, if any, in green.
2. **Plan and Profile Sheet** on proposed reference line of highway showing the following: (a) Ground line; (b) Finished grade line; (c) Profile grade line elevations at least every 100 feet for 1,000 feet each side of the structure; (d) Vertical curve control points; (e) Horizontal curve control points; (f) Curve data, including full SE and runoff distance.
3. **Layout Sketch** of the site drawn to a scale of not less than 1 inch = 100 feet showing the following: (a) Existing highway and structure; (b) Proposed highway alignment and R/W; (c) Station numbers; (d) Reference line intersection stationing and intersection angle; (e) North Point; (f) Buildings; (g) Underground facilities; (h) Other features which influence the design; (i) Railroad company stationing; (j) Stations at end of existing structure;
   (k) Proposed structure for consultant designed structures.
4. **Typical Sections** of all roadways showing the following: (a) Dimensions; (b) Slopes; (c) Type and width of surfacing or pavement; (d) Subgrade; (e) Sidewalk, curb and gutter; (f) Median treatment at underpass mounted or ditch section; (g) Clear zone width; (h) Horizontal clearances at underpass.
5. **Original Photographs** of: (a) Existing structure; (b) Buildings within 100 feet of proposed structure.

Foundation Investigations

1. Geotechnical Manual
2. Soil Borings
3. Unusual Circumstances

Geotechnical Manual


Geotechnical Manual
Wisconsin Department of Transportation
Chapter 1 General
Section 1 Manual Development

This manual has been developed to assist geotechnical engineers in the investigation, testing, analysis, and reporting of subsurface conditions for Wisconsin Department of Transportation (WisDOT) transportation projects. This includes subgrade conditions for roadway design and construction, development of parameters for pavement design, and foundation analyses for structures. Also included is background information on the geology of Wisconsin, the development of soils in the state, and the application of pedology to highway engineering.

https://wisconsindot.gov/Pages/doing-bus/eng-consultants/cnslt-rsrces/default.aspx

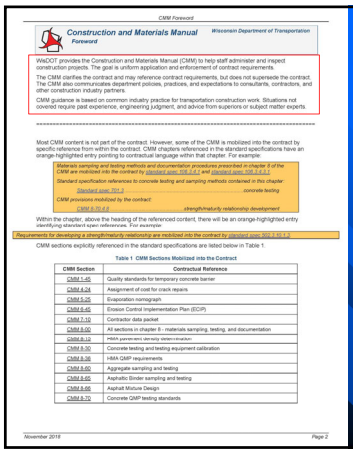
WisDOT Drill Crew

The Site Investigation Report (SIR)

1. Sometimes Called the Geotechnical Report or the Foundation Report
2. What Information is Important to You
3. What to Look For

Construction

1. Construction and Materials Manual
2. Standard Specifications
3. Plans
4. Site Investigation Report


CMM Foreword

Construction and Materials Manual
Foreword

Wisconsin Department of Transportation

WisDOT provides the Construction and Materials Manual (CMM) to help staff administer and inspect construction projects. The goal is uniform application and enforcement of contract requirements.

The CMM clarifies the contract and may reference contract requirements, but does not supersede the contract. The CMM also communicates department policies, practices, and expectations to consultants, contractors, and other construction industry partners.

CMM guidance is based on common industry practice for transportation construction work. Situations not covered require past experience, engineering judgment, and advice from superiors or subject matter experts.

Most CMM content is not part of the contract. However, some of the CMM is mobilized into the contract by specific reference from within the contract. CMM chapters referenced in the standard specifications have an orange-highlighted entry pointing to contractual language within that chapter. For example:

Materials sampling and testing methods and documentation procedures prescribed in chapter 8 of the CMM are mobilized into the contract by standard spec 106.1.6 and standard spec 106.1.6.2.1

Standard specification references to concrete testing and sampling methods contained in this chapter:
Standard spec 701.3 ..... concrete testing

CMM provisions mobilized by the contract:
CMM 8.70.4.6 ..... strength/maturity relationship development

Within the chapter, above the heading of the referenced content, there will be an orange-highlighted entry identifying standard spec references. For example:

Requirements for developing a strength/maturity relationship are mobilized into the contract by standard spec 502.3.10.1.3.

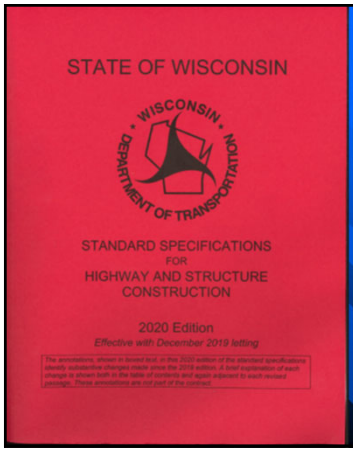
CMM sections explicitly referenced in the standard specifications are listed below in Table 1.

Table 1 CMM Sections Mobilized into the Contract

CMM Section	Contractual Reference
CMM 1.45	Quality standards for temporary concrete barrier
CMM 4.24	Assignment of cost for crack repairs
CMM 5.25	Evaporation nomograph
CMM 6.45	Erosion Control Implementation Plan (ECIP)
CMM 7.10	Contractor data packet
CMM 8.00	All sections in chapter 8 - materials sampling, testing, and documentation
CMM 8.10	HMA pavement density determination
CMM 8.30	Concrete testing and testing equipment calibration
CMM 8.36	HMA QMP requirements
CMM 8.40	Aggregate sampling and testing
CMM 8.45	Asphaltic Binder sampling and testing
CMM 8.46	Asphalt Mixture Design
CMM 8.70	Concrete QMP testing standards

November 2018 Page 2

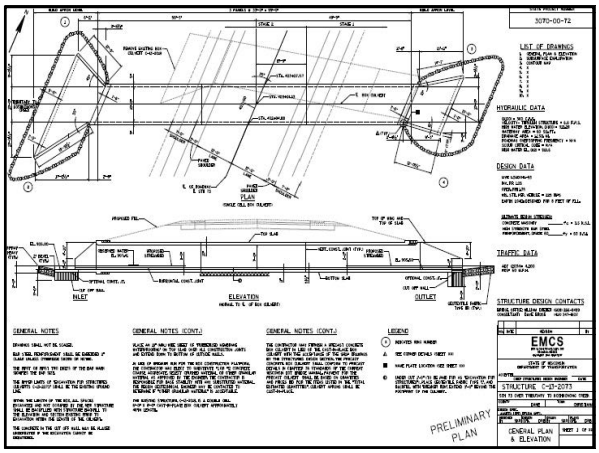
- Help staff administer & inspect construction projects.
- Uniform application & enforcement of contract requirements.
- Clarifies contract…but does not supersede contract.
- Communicates dept. policies, practices & expectations.

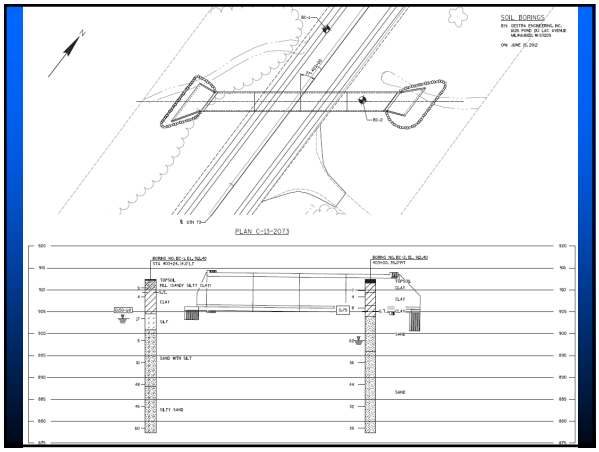


"Written directions and requirements approved for general application and repetitive use…for highway and structures construction and for administration of the contract."

Box Culverts Foundation & Backfill

1. Plans and Specifications
2. Inspection of the Foundation
3. Placing on Bedrock, Crushed Rock or Gravel
4. Backfill Material
5. Backfill Compaction
6. Backfilling the Top of the Culvert





STH 73 Culvert Structure C-13-2073, Dane County, WI October 31, 2012

Geotechnical Exploration and Engineering Report

STH 73 Culvert Structure C-13-2073
0.35 miles north of CTH B
Dane County, Wisconsin
WisDOT ID Number: 3070-00-02
GESTRA Project Number: 12010-10
October 31, 2012

Report Prepared for:
Dane Pastucco, LLC
901 Deming Way, Suite 203
Madison, WI 53717

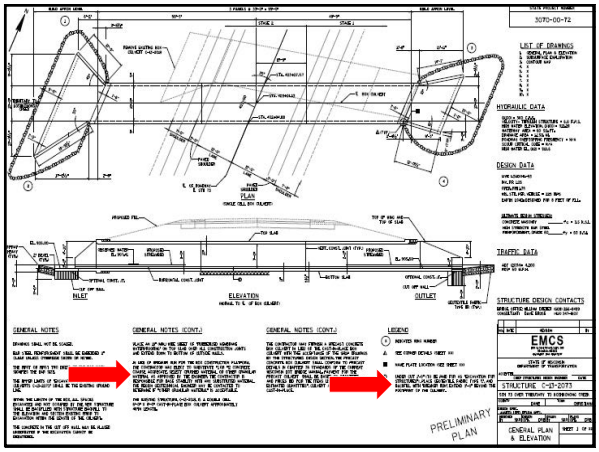
Report Prepared by:
GESTRA Engineering, Inc.
1626 W. Fond du Lac Avenue
Milwaukee, WI 53205

Gestra Engineering, Inc. Page 1 GESTRA Project No.: 12010-10

Geotechnical Report - Recommendation

We recommend an allowable bearing capacity of 2,000 psf to be used in the design of the box culvert supported over the native inorganic medium dense silt or medium dense sand soil or on engineered fill placed over this material. GESTRA understands that the culvert will be supported on the bottom slab which will be constructed on a 12 inch layer of breaker run stone placed over a Type C geotextile fabric. Based on the proposed bottom of breaker run elevations (approximate elevation 904 feet to 903.5 feet) and the soil exploration results, the bottom of the breaker run will likely be located in the observed native silt at the west side and on native sand on east side. If organic soil or fill mixed with organic is observed at the foundation level, we recommend removing the material to expose the native inorganic soil and replacing with compacted granular fill material.

Note: Allowable bearing capacity replaced by **factored bearing resistance** with adoption of LRFD.



NOTE UNDER LEGEND:

UNDER CUT 1'-0" (TO BE PAID FOR AS "EXCAVATION FOR STRUCTURES"). PLACE GEOTEXTILE FABRIC TYPE 'C', AND BACKFILL WITH 'BREAKER RUN'. EXTEND 3'-0" BEYOND THE FOOTPRINT OF THE CULVERT.

NOTE UNDER GENERAL NOTES:

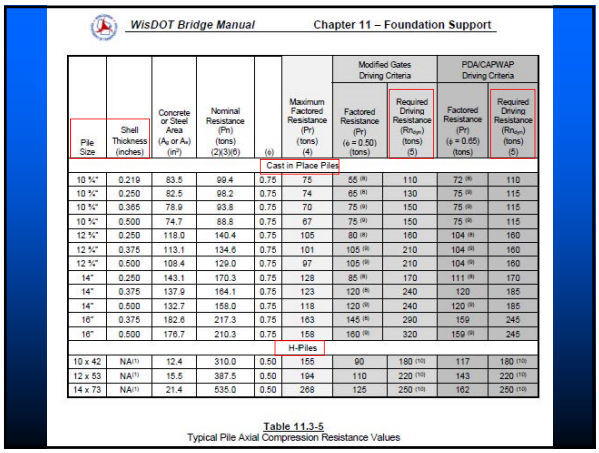
IN LIEU OF BREAKER RUN FOR THE BOX CONSTRUCTION PLATFORM, THE CONTRACTOR MAY ELECT TO SUBSTITUTE #1 OR #2 CONCRETE COARSE AGGREGATE, SELECT CRUSHED MATERIAL OR OTHER GRANULAR MATERIAL AS APPROVED BY THE ENGINEER. THE CONTRACTOR IS RESPONSIBLE FOR BASE STABILITY WITH ANY SUBSTITUTED MATERIAL. THE REGION GEOTECHNICAL ENGINEER MAY BE CONTACTED TO DETERMINE IF "OTHER GRANULAR MATERIAL" IS ACCEPTABLE.

Bridges

- **Deep Foundations (Piles and Drilled Shafts)**
- **Shallow Foundations (Spread Footings)**

Piles

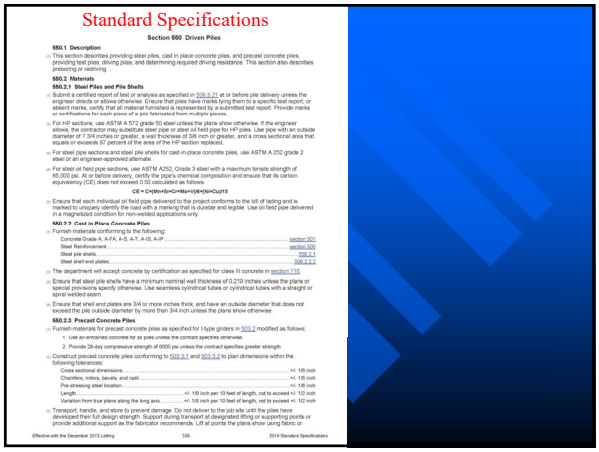
1. Types of Piles and What They Do
   - Steel H-Piles
   - Cast-In-Place Concrete (CIP)
   - Other
2. Design Pile Length
3. I Can't Get Bearing or Damage Pile



WisDOT Bridge Manual Chapter 11 – Foundation Support

Pile Size	Shell Thickness (inches)	Concrete or Steel Area (A_c or A_s) (in^2)	Nominal Resistance (Pn) (tons) (2)(3)(6)	(ϕ)	Maximum Factored Resistance (Pr) (tons) (4)	Modified Gates Driving Criteria: Factored Resistance (Pr) (ϕ = 0.50) (tons)	Modified Gates Driving Criteria: Required Driving Resistance (Rn_{Gate}) (tons) (5)	PDA/CAPWAP Driving Criteria: Factored Resistance (Pr) (ϕ = 0.65) (tons)	PDA/CAPWAP Driving Criteria: Required Driving Resistance (Rn_{PDA}) (tons) (5)
Cast in Place Piles									
10 ¾"	0.219	83.5	99.4	0.75	75	55 (8)	110	72 (8)	110
10 ¾"	0.250	82.5	98.2	0.75	74	65 (8)	130	75 (8)	115
10 ¾"	0.365	78.9	93.8	0.75	70	75 (9)	150	75 (8)	115
10 ¾"	0.500	74.7	88.8	0.75	67	75 (9)	150	75 (8)	115
12 ¾"	0.250	118.0	140.4	0.75	105	80 (8)	160	104 (8)	160
12 ¾"	0.375	113.1	134.6	0.75	101	105 (9)	210	104 (8)	160
12 ¾"	0.500	108.4	129.0	0.75	97	105 (9)	210	104 (8)	160
14"	0.250	143.1	170.3	0.75	128	85 (8)	170	111 (8)	170
14"	0.375	137.9	164.1	0.75	123	120 (8)	240	120	185
14"	0.500	132.7	158.0	0.75	118	120 (9)	240	120 (9)	185
16"	0.375	182.6	217.3	0.75	163	145 (8)	290	159	245
16"	0.500	176.7	210.3	0.75	158	160 (9)	320	159 (9)	245
H-Piles									
10 x 42	NA(1)	12.4	310.0	0.50	155	90	180 (10)	117	180 (10)
12 x 53	NA(1)	15.5	387.5	0.50	194	110	220 (10)	143	220 (10)
14 x 73	NA(1)	21.4	535.0	0.50	268	125	250 (10)	162	250 (10)

Table 11.3-5
Typical Pile Axial Compression Resistance Values



Standard Specifications

Section 550 Driven Piles

550.1 Description

(1) This section describes providing steel piles, cast in place concrete piles, and precast concrete piles; providing test piles; driving piles; and determining required driving resistance. This section also describes preboring or redriving.

550.2 Materials

550.2.1 Steel Piles and Pile Shells

(1) Submit a certified report of test or analysis as specified in 106.3.72 at or before pile delivery unless the engineer directs or allows otherwise. Ensure that piles have marks tying them to a specific test report, or absent marks, certify that all material furnished is represented by a submitted test report. Provide marks or certifications for each piece of a pile fabricated from multiple pieces.

(2) For HP sections, use ASTM A 572 grade 50 steel unless the plans show otherwise. If the engineer allows, the contractor may substitute steel pipe or steel oil field pipe for HP piles. Use pipe with an outside diameter of 7 3/4 inches or greater, a wall thickness of 3/8 inch or greater, and a cross sectional area that equals or exceeds 97 percent of the area of the HP section replaced.

(3) For steel pipe sections and steel pile shells for cast-in-place concrete piles, use ASTM A 252 grade 2 steel or an engineer-approved alternate.

(4) For steel oil field pipe sections, use ASTM A252, Grade 3 steel with a maximum tensile strength of 85,000 psi. At or before delivery, certify the pipe's chemical composition and ensure that its carbon equivalency (CE) does not exceed 0.50 calculated as follows:

$$CE = C+(Mn+Si+Cr+Mo+V)/6+Ni+Cu/15$$

(5) Ensure that each individual oil field pipe delivered to the project conforms to the bill of lading and is marked to uniquely identify the load with a marking that is durable and legible. Use oil field pipe delivered in a magnetized condition for non-welded applications only.

550.2.2 Cast in Place Concrete Piles

(1) Furnish materials conforming to the following:

Concrete Grade A, A-FA, A-S, A-T, A-IS, A-IP	section 501
Steel Reinforcement	section 505
Steel pile shells	550.2.1
Steel shell end plates	506.2.2.2

(2) The department will accept concrete by certification as specified for class II concrete in section 716.

(3) Ensure that steel pile shells have a minimum nominal wall thickness of 0.219 inches unless the plans or special provisions specify otherwise. Use seamless cylindrical tubes or cylindrical tubes with a straight or spiral welded seam.

(4) Ensure that shell end plates are 3/4 or more inches thick, and have an outside diameter that does not exceed the pile outside diameter by more than 3/4 inch unless the plans show otherwise.

550.2.3 Precast Concrete Piles

(1) Furnish materials for precast concrete piles as specified for I-type girders in 503.2 modified as follows:

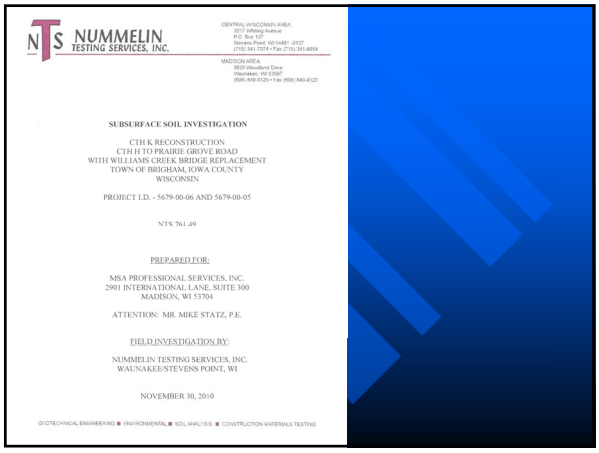
1. Use air-entrained concrete for all piles unless the contract specifies otherwise.
2. Provide 28-day compressive strength of 6000 psi unless the contract specifies greater strength.

(2) Construct precast concrete piles conforming to 503.3.1 and 503.3.2 to plan dimensions within the following tolerances:

Cross sectional dimensions	+/- 1/8 inch
Chamfers, miters, bevels, and radii	+/- 1/8 inch
Pre-stressing steel location	+/- 1/8 inch
Length	+/- 1/8 inch per 10 feet of length, not to exceed +/- 1/2 inch
Variation from true plane along the long axis	+/- 1/8 inch per 10 feet of length, not to exceed +/- 1/2 inch

(3) Transport, handle, and store to prevent damage. Do not deliver to the job site until the piles have developed their full design strength. Support during transport at designated lifting or supporting points or provide additional support as the fabricator recommends. Lift at points the plans show using fabric or

Effective with the December 2013 Letting. 336 2014 Standard Specifications



NTS NUMMELIN TESTING SERVICES, INC.

CENTRAL WISCONSIN AREA
3217 Whiting Avenue
P.O. Box 127
Stevens Point, WI 54481-0127
(715) 341-7574 • Fax (715) 341-8854

MADISON AREA
5629 Woodland Drive
Waunakee, WI 53597
(608) 849-9120 • Fax (608) 849-9127

SUBSURFACE SOIL INVESTIGATION

CTH K RECONSTRUCTION
CTH H TO PRAIRIE GROVE ROAD
WITH WILLIAMS CREEK BRIDGE REPLACEMENT
TOWN OF BRIGHAM, IOWA COUNTY
WISCONSIN

PROJECT I.D. - 5679-00-06 AND 5679-00-05

NTS 761.40

PREPARED FOR:

MSA PROFESSIONAL SERVICES, INC.
2901 INTERNATIONAL LANE, SUITE 300
MADISON, WI 53704

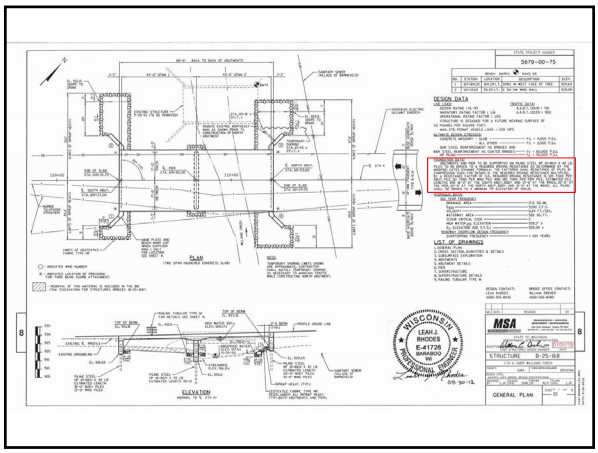
ATTENTION: MR. MIKE STATZ, P.E.

FIELD INVESTIGATION BY:

NUMMELIN TESTING SERVICES, INC.
WAUNAKEE/STEVENS POINT, WI

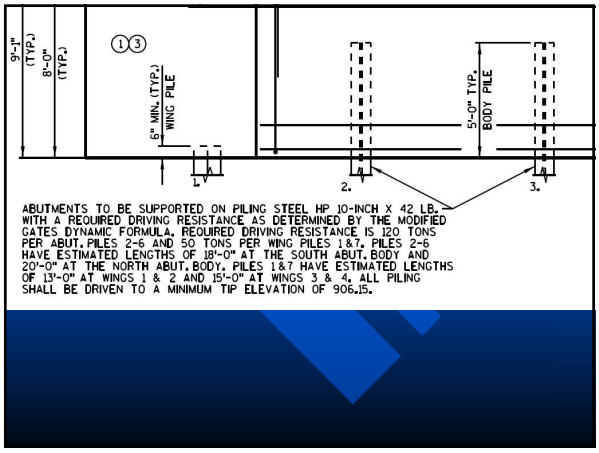
NOVEMBER 30, 2010

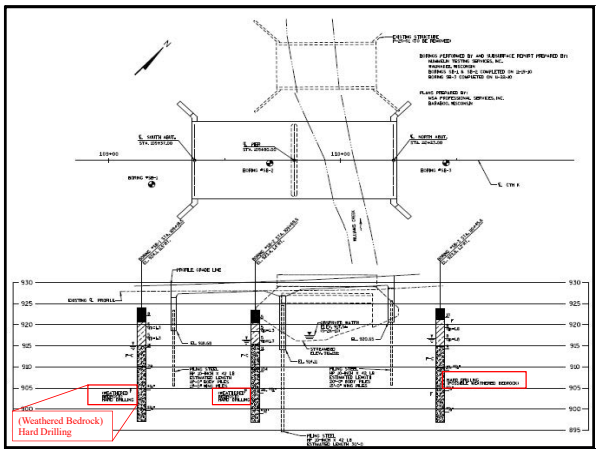
GEOTECHNICAL ENGINEERING ■ ENVIRONMENTAL ■ SOIL ANALYSIS ■ CONSTRUCTION MATERIALS TESTING

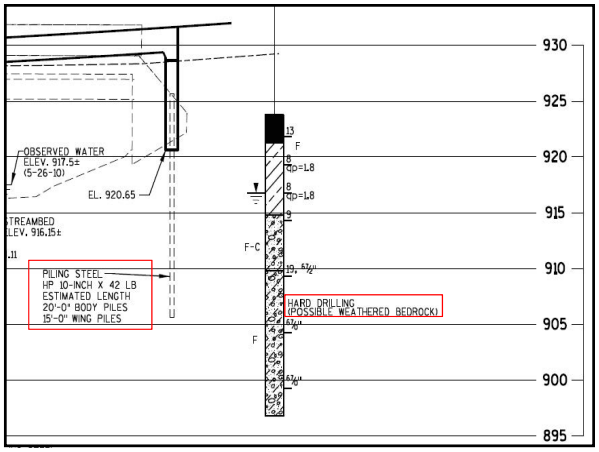


FOUNDATION DATA:

ABUTMENTS AND PIERS TO BE SUPPORTED ON PILING STEEL HP 10-INCH X 42 LB. PILES TO BE DRIVEN TO A REQUIRED DRIVING RESISTANCE AS DETERMINED BY THE MODIFIED GATES DYNAMIC FORMULA. THE FACTORED AXIAL RESISTANCE OF PILES IN COMPRESSION USED FOR DESIGN IS THE REQUIRED DRIVING RESISTANCE MULTIPLIED BY A RESISTANCE FACTOR OF 0.5. REQUIRED DRIVING RESISTANC IS 120 TONS PER ABUT. PILE, 50 TONS PER WING PILE AND 180 TONS PER PIER PILE. ESTIMATED PILE LENGTHS ARE 18'-0" AT THE SOUTH ABUT. BODY AND 13'-0" AT THE WINGS, 30'-0" AT THE PIER, 20'-0" AT THE NORTH ABUT. BODY AND 15'-0" AT THE WINGS. ALL PILING SHALL BE DRIVEN TO A MINIMUM TIP ELEVATION OF 906.15.







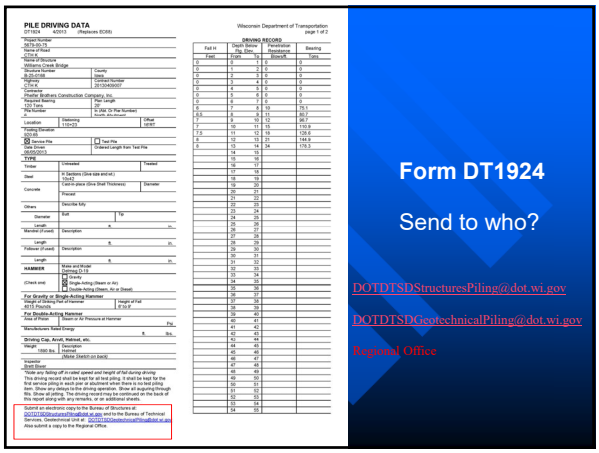
MODIFIED GATES

MANUFACTURER Delmag
MODEL D-19-32
TYPE S-A- DIESEL
STROKE 38 INCHES
STRIKING WT. 4015 POUNDS
MAXIMUM CAPACITY 300.7 TON (WHEN S=0.1)
MAX. HAMMER DROP 10 FEET
DROP INCREMENT 0.5 FEET

Range of BLOWS/FOOT desired: 20 minimum
110 maximum
Increment of BLOWS/FOOT desired: 1 BLOWS/FOOT

Required Driving Resistance (tons) as Determined by Modified Gates Formula

	HAMMER DROP IN FEET								
BLOWS/FT.	6.0	6.5	7.0	7.5	8.0	8.5	9.0	9.5	10.0
20	115.9	122.7	129.2	135.5	141.6	147.5	153.2	158.8	164.2
21	118.8	125.7	132.3	138.7	144.9	150.9	156.8	162.4	167.9
22	121.6	128.6	135.3	141.8	148.1	154.2	160.1	165.9	171.5
23	124.2	131.3	138.1	144.7	151.1	157.3	163.3	169.2	174.9
24	126.7	133.9	140.8	147.5	154.0	160.3	166.4	172.3	178.1
25	129.1	136.4	143.4	150.2	156.8	163.2	169.3	175.4	181.2
26	131.4	138.8	145.9	152.8	159.5	165.9	172.2	178.3	184.2
27	133.6	141.1	148.4	155.3	162.0	168.6	174.9	181.1	187.1
28	135.8	143.4	150.7	157.7	164.5	171.1	177.5	183.8	189.8
29	137.9	145.5	152.9	160.0	166.9	173.6	180.1	186.4	192.5
30	139.9	147.6	155.1	162.3	169.2	176.0	182.5	188.9	195.1



PILE DRIVING DATA
DT1924 4/2013 (Replaces EC68)

Wisconsin Department of Transportation
page 1 of 2

Project Number 5679-00-75	
Name of Road CTH K	
Name of Structure Williams Creek Bridge	
Structure Number B-25-0168	County Iowa
Highway CTH K	Contract Number 20130409007
Contractor Pheifer Brothers Construction Company, Inc.	
Required Bearing 120 Tons	Plan Length 20'
Pile Number 6	In (Abt. Or Pier Number) North Abutment
Location	Stationing 110+23 / Offset 16'RT
Footing Elevation 920.65	
☒ Service Pile	☐ Test Pile
Date Driven 06/05/2013	Ordered Length from Test Pile

DRIVING RECORD

Fall H	Depth Below Ftg. Elev.		Penetration Resistance	Bearing
Feet	From	To	Blows/ft.	Tons
0	0	1	0	0
0	1	2	0	0
0	2	3	0	0
0	3	4	0	0
0	4	5	0	0
0	5	6	0	0
0	6	7	0	0
6	7	8	10	75.1
6.5	8	9	11	80.7
7	9	10	12	96.7
7	10	11	15	110.9
7.5	11	12	18	128.6
8	12	13	21	144.9
8	13	14	34	178.3
	14	15		

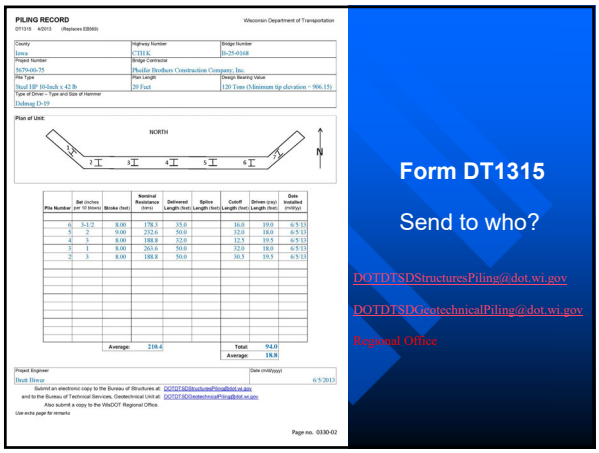
Form DT1924

Send to who?

DOTDTSDStructuresPiling@dot.wi.gov

DOTDTSDGeotechnicalPiling@dot.wi.gov

Regional Office



PILING RECORD

DT1315 4/2013 (Replaces EB560)

Wisconsin Department of Transportation

County	Highway Number	Bridge Number
Iowa	CTHK	B-25-0168
Project Number	Bridge Contractor	
5679-00-75	Pfeifer Brothers Construction Company, Inc.	
Pile Type	Pile Length	Design Bearing Value
Steel HP 10-Inch x 42 lb	20 Feet	120 Tons (Minimum tip elevation = 906.15)

Type of Driver – Type and Size of Hammer: Delmag D-19

Plan of Unit:

Pile Number	Set (inches per 10 blows)	Broke (feet)	Nominal Resistance (tons)	Delivered Length (feet)	Splice Length (feet)	Cutoff Length (feet)	Driven (cay) Length (feet)	Date Installed (mm/dd/yy)
6	3-1/2	8.00	178.3	35.0		16.0	19.0	6/5/13
5	2	9.00	232.6	50.0		32.0	18.0	6/5/13
4	3	8.00	188.8	32.0		12.5	19.5	6/5/13
3	1	8.00	263.6	50.0		32.0	18.0	6/5/13
2	3	8.00	188.8	50.0		30.5	19.5	6/5/13
Average:			210.4			Total:	94.0	
						Average:	18.8	

Project Engineer: Brett Biwer

Date (mm/dd/yyyy): 6/5/2013

Submit an electronic copy to the Bureau of Structures at: DOTDTSDStructuresPiling@dot.wi.gov
and to the Bureau of Technical Services, Geotechnical Unit at: DOTDTSDGeotechnicalPiling@dot.wi.gov
Also submit a copy to the WisDOT Regional Office.

Use extra page for remarks

Page no. 0330-02

Form DT1315

Send to who?

DOTDTSDStructuresPiling@dot.wi.gov

DOTDTSDGeotechnicalPiling@dot.wi.gov

Regional Office


10/29/2013

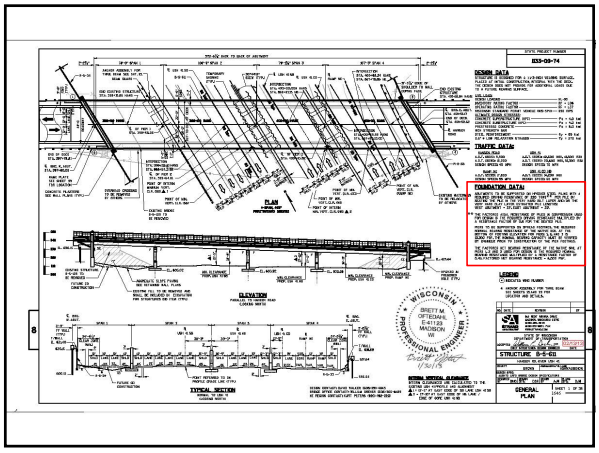

10/29/2013

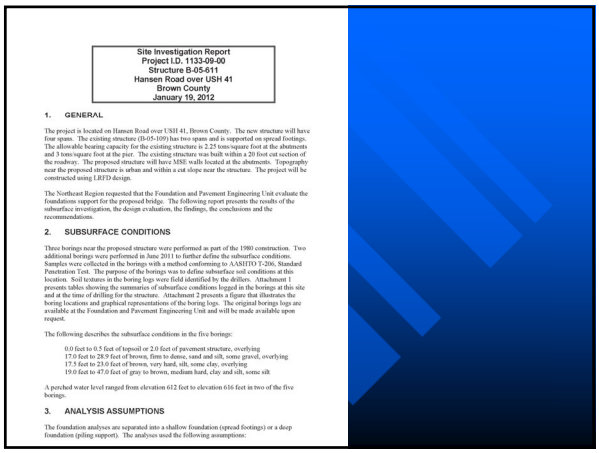

10/29/2013

Spread Footings

What to Look for With Spread Footings

- Review Plans and Site Investigation Report to Determine What Bearing Strengths are Necessary
- Check Stability of Footing Base Elevation – Drive Bar or Rod Below Base
- Check if Sidewall and Base Soils Correlate to Soil Borings
- Observe Difficulty of Excavating Material
- Contact Regional Soils Engineer as Needed





Site Investigation Report
Project I.D. 1133-09-00
Structure B-05-611
Hansen Road over USH 41
Brown County
January 19, 2012

1. GENERAL

The project is located on Hansen Road over USH 41, Brown County. The new structure will have four spans. The existing structure (B-05-109) has two spans and is supported on spread footings. The allowable bearing capacity for the existing structure is 2.25 tons/square foot at the abutments and 3 tons/square foot at the pier. The existing structure was built within a 20 foot cut section of the roadway. The proposed structure will have MSE walls located at the abutments. Topography near the proposed structure is urban and within a cut slope near the structure. The project will be constructed using LRFD design.

The Northeast Region requested that the Foundation and Pavement Engineering Unit evaluate the foundations support for the proposed bridge. The following report presents the results of the subsurface investigation, the design evaluation, the findings, the conclusions and the recommendations.

2. SUBSURFACE CONDITIONS

Three borings near the proposed structure were performed as part of the 1980 construction. Two additional borings were performed in June 2011 to further define the subsurface conditions. Samples were collected in the borings with a method conforming to AASHTO T-206, Standard Penetration Test. The purpose of the borings was to define subsurface soil conditions at this location. Soil textures in the boring logs were field identified by the drillers. Attachment 1 presents tables showing the summaries of subsurface conditions logged in the borings at this site and at the time of drilling for the structure. Attachment 2 presents a figure that illustrates the boring locations and graphical representations of the boring logs. The original borings logs are available at the Foundation and Pavement Engineering Unit and will be made available upon request.

The following describes the subsurface conditions in the five borings:

0.0 feet to 0.5 feet of topsoil or 2.0 feet of pavement structure, overlying
17.0 feet to 28.9 feet of brown, firm to dense, sand and silt, some gravel, overlying
17.5 feet to 23.0 feet of brown, very hard, silt, some clay, overlying
19.0 feet to 47.0 feet of gray to brown, medium hard, clay and silt, some silt

A perched water level ranged from elevation 612 feet to elevation 616 feet in two of the five borings.

3. ANALYSIS ASSUMPTIONS

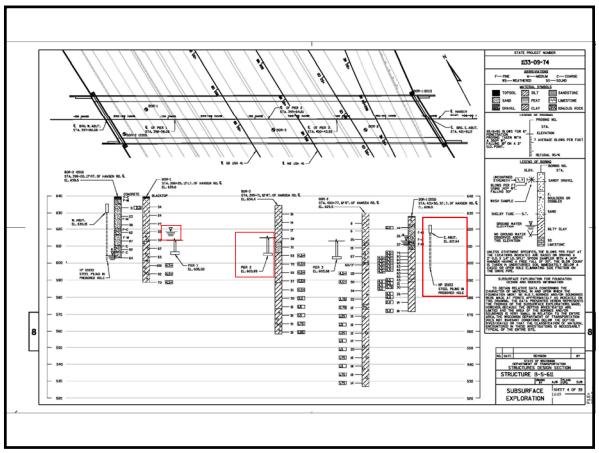
The foundation analyses are separated into a shallow foundation (spread footings) or a deep foundation (piling support). The analyses used the following assumptions:

3. The estimated factored bearing resistance was 6,000 psf for the very hard silt at the pier and 5,000 psf for the MSE wall backfill at the West Abutment and East Abutment. The calculations used a resistance factor of 0.45.

PIERS TO BE SUPPORTED ON SPREAD FOOTINGS. THE REQUIRED NOMINAL BEARING RESISTANCE OF THE NATIVE SOIL AT THE BOTTOM OF FOOTING ELEVATION FOR PIERS 1, 2 AND 3 IS 13,300 PSF. THE NOMINAL BEARING RESISTANCE MUST BE VERIFIED BY ENGINEER PRIOR TO CONSTRUCTION OF THE PIER FOOTINGS.

THE FACTORED NET BEARING RESISTANCE OF THE NATIVE SOILS AT PIERS 1, 2 AND 3 USED FOR DESIGN IS THE REQUIRED NOMINAL BEARING RESISTANCE MULTIPLIED BY A RESISTANCE FACTOR OF 0.45. FACTORED NET BEARING RESISTANCE = 6,000 PSF.

Note: The abutments are supported on HP12x53 piles installed in pre-bored holes and grouted in-place.


STATE PROJECT NUMBER
0370-09-74
STRUCTURE B-5-40
SUBSURFACE EXPLORATION

Bridge Approaches

1. Special Treatments
2. Rock and Clear Stone Under The Footing
3. Compaction Behind the Footing
4. Transition to Normal Grade Line (Blue Top)

Retaining Walls

1. Types
2. Site Investigation Report (SIR)
3. Foundation
4. Construction Methods
5. Backfilling

Retaining Walls

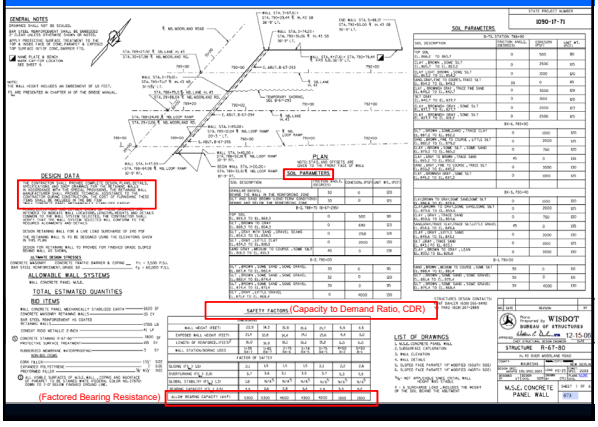
2018 Types and Quantities (WisDOT Bridge Manual)

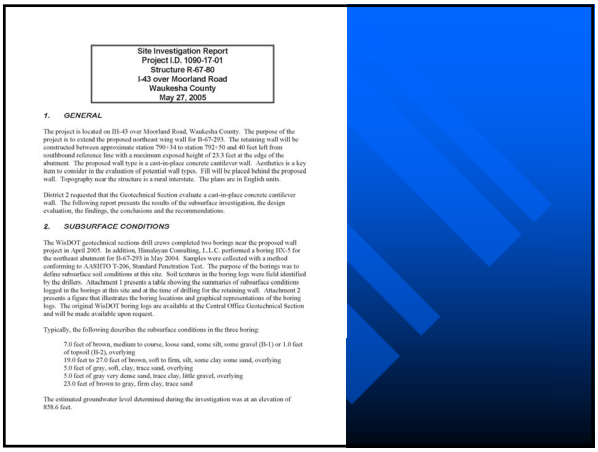
WisDOT Bridge Manual **Chapter 5 – Economics and Costs**

Retaining Wall Type	No. of Walls	Total Area (Sq. Ft.)	Total Costs	Cost per Square Foot
CIP Cantilever	0	--	--	--
CIP Facing (MSE)	0	--	--	--
MSE Block Walls	3	4,693	567,547	120.93
MSE Panel Walls	49	378,371	44,841,726	118.51
Modular Walls	3	2,402	204,002	84.93
Precast Panel and Wire Faced	1	5,945	948,347	159.53
Soldier Pile Walls	4	8,531	1,570,107	184.05
Steel Sheet Pile Walls	2	16,620	1,639,380	98.64

Table 5.4-25
Retaining Walls

MSE CONCRETE PANEL WALL PLAN





Site Investigation Report
Project I.D. 1090-17-01
Structure R-67-80
I-43 over Moorland Road
Waukesha County
May 27, 2005

1. GENERAL

The project is located on III-43 over Moorland Road, Waukesha County. The purpose of the project is to extend the proposed northeast wing wall for II-67-293. The retaining wall will be constructed between approximate station 790+34 to station 792+50 and 40 feet left from southbound reference line with a maximum exposed height of 23.3 feet at the edge of the abutment. The proposed wall type is a cast-in-place concrete cantilever wall. Aesthetics is a key item to consider in the evaluation of potential wall types. Fill will be placed behind the proposed wall. Topography near the structure is a rural interstate. The plans are in English units.

District 2 requested that the Geotechnical Section evaluate a cast-in-place concrete cantilever wall. The following report presents the results of the subsurface investigation, the design evaluation, the findings, the conclusions and the recommendations.

2. SUBSURFACE CONDITIONS

The WisDOT geotechnical sections drill crews completed two borings near the proposed wall project in April 2005. In addition, Hinshaw Consulting, L.L.C. performed a boring HS-5 for the northeast abutment for II-67-293 in May 2004. Samples were collected with a method conforming to AASHTO T-206, Standard Penetration Test. The purpose of the borings was to define subsurface soil conditions at this site. Soil textures in the boring logs were field identified by the drillers. Attachment 1 presents a table showing the summaries of subsurface conditions logged in the borings at this site and at the time of drilling for the retaining wall. Attachment 2 presents a figure that illustrates the boring locations and graphical representations of the boring logs. The original WisDOT boring logs are available at the Central Office Geotechnical Section and will be made available upon request.

Typically, the following describes the subsurface conditions in the three boring:

7.0 feet of brown, medium to course, loose sand, some silt, some gravel (B-1) or 1.0 feet of topsoil (B-2), overlying.
19.0 feet to 27.0 feet of brown, soft to firm, silt, some clay some sand, overlying
5.0 feet of gray, soft, clay, trace sand, overlying.
5.0 feet of gray very dense sand, trace clay, little gravel, overlying
23.0 feet of brown to gray, firm clay, trace sand

The estimated groundwater level determined during the investigation was at an elevation of 858.6 feet.

Standard Special Provision, SPV

Wall Concrete Panel Mechanically Stabilized Earth, Item 532.0500.S.

A Description
This special provision describes furnishing materials and erecting a permanent earth retention system in accordance with the lines, dimension, elevations and details as shown on the plans and provided in the contract. The design life of the wall and all wall components shall be 75 years.

B Materials
B.1 Proprietary Mechanically Stabilized Earth Concrete Panel Wall Systems
The department specifies approved concrete panel mechanically stabilized earth wall products on the department's approved product list.

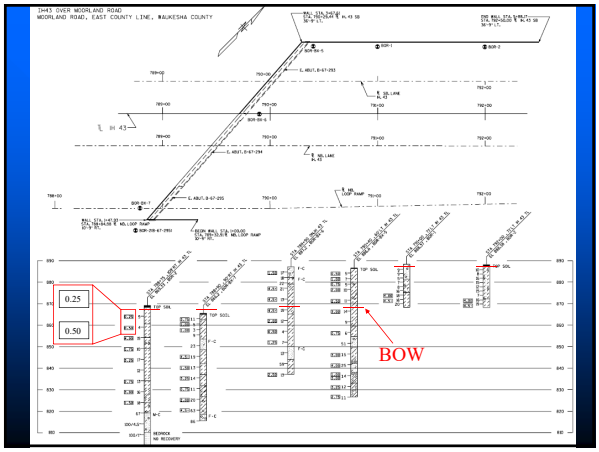
Proprietary wall systems may be used for this work, but must conform to the requirements of this specification and be pre-approved for use by the department's Bureau of Structures, Structures Development Section. The name of the pre-approved proprietary wall system selected shall be furnished to the engineer within 25 days after the award of contract. The location of the plant manufacturing the concrete panels shall be furnished to the engineer at least 14 days prior to the start of production. The department maintains a list of pre-approved systems of retaining walls. To be eligible for use on this project, a system requiring pre-approval must have been pre-approved and added to that list prior to the bid opening date.

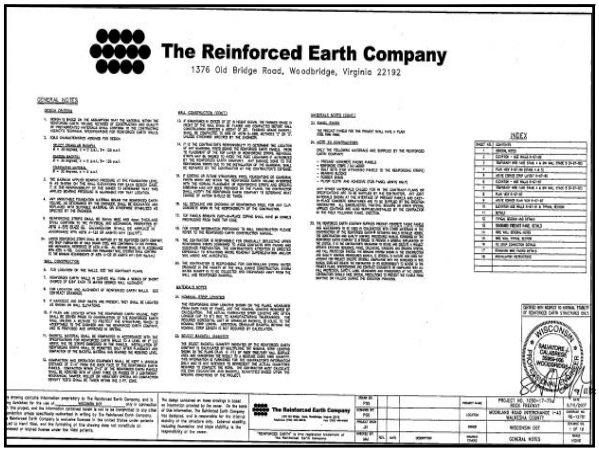
To receive pre-approval, the retaining wall system must comply with all pertinent requirements of this provision. Applications for pre-approval may be submitted at any time. Applications must be prepared in accordance with the requirements of chapter 14 of the department's Bridge Manual. Information and assistance with the pre-approval process can be obtained by contacting the Structures Development Section in Room 601 of the Hill Farms State Transportation Building in Madison or by calling (608) 266-8494.

B.2 Design Requirements
It is the responsibility of the contractor to supply a design and supporting documentation as required by this special provision for review by the department to show the proposed wall design is in compliance with the design specifications. Four copies of the following shall be submitted to the engineer for review and acceptance no later than 60 days from the date of notification to proceed with the project.

The design/shop plans shall be prepared on reproducible sheets 11 inch x 17 inch, including borders. Each sheet shall have a title block in the lower right corner. The title block shall include the project identification number and structure number. Design calculations and notes shall be on 8½ x 11 inch sheets, and shall contain the project identification number, name or designation of the wall, date of preparation, initials of designer and checker, and page number at the top of the page. All plans and calculations shall be signed, sealed and dated by a professional engineer licensed in the State of Wisconsin.

This work shall consist of furnishing the design, construction plans, construction specifications, shop drawings, materials, and the construction of a mechanically stabilized earth retaining wall






Lightweight Compaction Equipment Near Back of Wall
CATERPILLAR

Structures

A Structure Survey Report is Required for all New, Replacement, or the Rehabilitation of all Structures Constructed on DOT Projects?

What are the factors that determine the type of pile or foundation for a structure?

Under certain conditions, the contractor may be required to stop driving a pile nest for a period of time to allow required bearing to be achieved.

There is no concern if soft soils or organics are found at the bottom of a culvert trench because the Designer knew about this in the design process.

Questions ?