APPENDICES

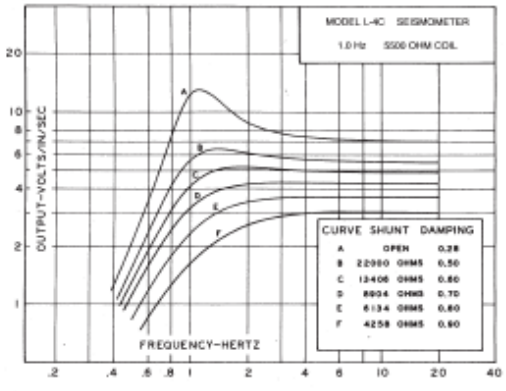
Appendix A SPECIFICATIONS AND RESPONSE CURVES OF SENSORS

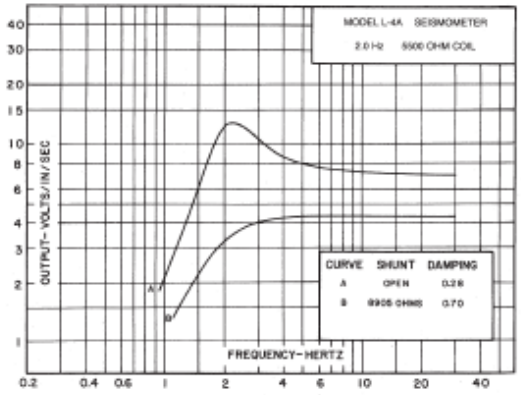
Mark Products L-4 Seismometer

The Mark Products L-4 is an INSTRUMENT QUALITY ONE Hz or TWO Hz multi-purpose seismometer that is small, light, and economical. It is designed to yield the performance needed for scientific studies, yet has the ruggedness required for petroleum exploration work.

The Mark Products L-4 design ELIMINATES the usual causes of failure in VERY LOW FREQUENCY geophones, such as SPRING FATIGUE, OVER-STRESS and INSTABILITY. This seismometer maintains a close frequency tolerance with tilt and temperature and is TRANSPORTED WITHOUT CLAMPING the moving element.

The Mark Products L-4 is available with or without calibration coils and may be obtained as VERTICAL OR HORIZONTAL elements. A variety of fittings are available for custom application.





Specifications

L-4C 1.0 Hz SEISMOMETER

Type	Moving dual coil, humbuch wound
Frequency	1.0 ± 0.05 Hz measured on 200 pound weight at 0.09 inches/second
Frequency change with tilt	Less than 0.05 Hz at 5° from vertical
Frequency change with excitation	Less than 0.05 Hz from 0 to 0.09 inches/second
Suspended mass	1000 grams
Standard coil resistances	500, 2000, 5500
Leakage to case	100 megohm minimum at 500 V
Transduction power	$0.947\sqrt{Rc}$
Open circuit damping	(bo) = 0.28 critical
Current damping	$(bc) = \frac{1.1\ Rc}{Rs + Rc}$
Coil inductance	Lc = 0.0011 Rc Lc in henries
Case to coil motion	PP 0.250 inches
Electric analog of capacity	$CC = \frac{73{,}500}{Rc}$ (microfarads)
Electric analog of inductance	Lm = 0.345Rc (henries)
Case height	5⅛ inches - 13 cm
Case diameter	3 inches - 7.6 cm
Total density	3.7 grams/cm³
Total weight	4¾ pounds - 2.15 kilograms
Operating temperature	Range : - 20° to 140°F or -29° to 60°C

COIL RESISTANCE, OHMS	500	2000	5500
Transduction, Volts/in/sec	2.12	4.23	7.02
Coil inductance, henries	0.55	2.20	6.05
Analog capacitance, microfarads	147	36.8	13.4
Analog inductance, henries	173	690	1900
Shunt for 0.70 damping, ohm	810	3238	8905

L-4A 2.0 Hz SEISMOMETER

Type	Moving dual coil, humbuch wound
Frequency	2.0 ± 0.25 Hz measured on 200 pound weight at 0.09 inches/second
Frequency change with tilt	Less than 0.10 Hz at 10° from vertical
Frequency change with excitation	Less than 0.10 Hz from 0 to 0.18 inches/second
Suspended mass	500 grams
Standard coil resistances	500, 2000, 5500
Leakage to case	100 megohm minimum at 500 V
Transduction power	$0.947\sqrt{Rc}$
Open circuit damping	(bo) = 0.28 critical
Current damping	$(bc) = \frac{1.1\ Rc}{Rs + Rc}$
Coil inductance	Lc = 0.0011 Rc Lc in henries
Case to coil motion	PP 0.250 inches
Electric analog of capacity	$CC = \frac{36{,}500}{Rc}$ (microfarads)
Electric analog of inductance	Lm = 0.17Rc (henries)
Case height	5⅛ inches - 13 cm
Case diameter	3 inches - 7.6 cm
Total density	2.9 grams/cm³
Total weight	3¾ pounds - 1.7 kilograms
Operating temperature	Range : - 20° to 140°F or -29° to 60°C

COIL RESISTANCE, OHMS	500	2000	5500
Transduction, Volts/in/sec	2.12	4.23	7.02
Coil inductance, henries	0.55	2.20	6.05
Analog capacitance, microfarads	73.0	18.3	6.64
Analog inductance, henries	85.0	340	935
Shunt for 0.70 damping, ohm	810	3238	8905

Open Circuit Damping $(b_o) = 0.28$ Critical

Coil Current Damping $(b_c) = \frac{1.1\ Rc}{Rc + Rs}$

Total Damping $(b_t) = b_o + b_c$

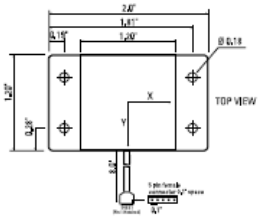
Crossbow

Specifications	CXL04GP1 CXL04GP1Z CXL04GP3	CXL10GP1 CXL10GP1Z CXL10GP3	CXL25GP1 CXL25GP1Z CXL25GP3	Remarks
Performance				
Input Range (g)	± 4	± 10	± 25	± 5%
Zero g Drift (g)	± 0.1	± 0.3	± 0.5	0ºC to 70ºC
Sensitivity (mV/g)	500 ± 15	200 ± 5	80 ± 2	
Transverse Sensitivity (% Span)	± 5	± 5	± 5	
Non-Linearity (% FS)	± 0.2	± 0.2	± 0.2	typical
Alignment Error (deg)	± 2	± 2	± 2	typical
Noise (mg rms)	10	25	25	typical
Bandwidth (Hz) [1]	DC -100	DC -100	DC -100	
Environment				
Operating Temp. Range (ºC)	-40 to +85	-40 to +85	-40 to +85	
Operating Temp. Range - AL (ºC)	-40 to +105	-40 to +105	-40 to +105	
Shock (g)	2000	2000	2000	
Electrical				
Supply Voltage (Volts)	+ 4.9 to 5.5	+ 4.9 to 5.5	+ 4.9 to 5.5	
Supply Voltage -R option (Volts)	+ 5.5 to 36	+ 5.5 to 36	+ 5.5 to 36	
Supply Current (mA)	1/axis	3/axis	3/axis	typical
Zero g Output (Volts)	+ 2.375 ± 0.1	+ 2.375 ± 0.1	+ 2.375 ± 0.1	@25ºC
Span Output (Volts)	± 2.0 ± 0.1	± 2.0 ± 0.1	± 2.0 ± 0.1	
Output Loading	> 2.0 Ω, < 2 nF	> 2.0 Ω, < 2 nF	> 2.0 Ω, < 2 nF	
Physical				
Standard package				
Size (in)	0.78 x 1.75 x 1.07	0.78 x 1.75 x 1.07	0.78 x 1.75 x 1.07	
(cm)	1.98 x 4.45 x 2.72	1.98 x 4.45 x 2.72	1.98 x 4.45 x 2.72	
Weight	1.62 oz (46 gm)	1.62 oz (46 gm)	1.62 oz (46 gm)	
Aluminum package (-AL option)				
Size (in)	0.95 x 2.00 x 1.20	0.95 x 2.00 x 1.20	0.95 x 2.00 x 1.20	
(cm)	2.41 x 5.08 x 3.05	2.41 x 5.08 x 3.05	2.41 x 5.08 x 3.05	
Weight	2.40 oz (68 gm)	2.40 oz (68 gm)	2.40 oz (68 gm)	

Notes
[1] -3dB, DC coupled sensor
Non-linearity is the deviation from a best fit straight line at full scale. Transverse sensitivity is error measured in the primary axis output created by forces induced in the orthogonal axis. Transverse sensitivity error is primarily due to the effects of misalignment. Zero g drift is specified as the typical change in 0 g level from its initial value at +25ºC to its worst case value at Tmin or Tmax. Specifications subject to change without notice.

Pin	Color	Function
1	Red	Power In
2	Black	Ground
3	White	X-axis Out
4	Yellow	Y-axis Out
5	Green	Z-axis Out

Pin Diagram



High Temperature Package Dimensions

Ordering Information

Model	Axes	Span (g)	Sensitivity (m V/g)	Noise (mg rms)	Bandwidth (Hz)
CXL04GP1	X	± 4	500	10	DC-100
CXL04GP1Z	Z	± 4	500	10	DC-100
CXL04GP3	TRI	± 4	500	10	DC-100
CXL10GP1	X	± 10	200	25	DC-100
CXL10GP1Z	Z	± 10	200	25	DC-100
CXL10GP3	TRI	± 10	200	25	DC-100
CXL25GP1	X	± 25	80	25	DC-100
CXL25GP1Z	Z	± 25	80	25	DC-100
CXL25GP3	TRI	± 25	80	25	DC-100
OPTIONS					
-R	Voltage Regulator, 5.5 – 36 VDC input. (Available in GP3 models only.)				
-AL	High Temperature Package. Operating Temperature Range (ºC): -40 to +105. (Available in GP3 models only.)				

High Temperature Package

Document Part Number: 6020-0114-01 Rev B

A 3 SPECIFICATIONS OF FREESCALE ACCELEROMETERS

Table 2. Operating Characteristics
Unless otherwise noted: -40°C ≤ T_A ≤ 85°C, 2.2 V ≤ V_{DD} ≤ 3.6 V, Acceleration = 0g, Loaded output[1]

Characteristic	Symbol	Min	Typ	Max	Unit
Operating Range[2]					
Supply Voltage[3]	V_{DD}	2.2	3.3	3.6	V
Supply Current[4]	I_{DD}	—	400	600	µA
Supply Current at Sleep Mode[4]	I_{DD}	—	3	10	µA
Operating Temperature Range	T_A	-40	—	+85	°C
Acceleration Range, X-Axis, Y-Axis, Z-Axis					
g-Select: 0	g_{FS}	—	±1.5	—	g
g-Select: 1	g_{FS}	—	±6.0	—	g
Output Signal					
Zero-g (T_A = 25°C, V_{DD} = 3.3 V)[5], [6]	V_{OFF}				
XY		1.485	1.65	1.815	V
Z[7]		1.32	1.65	1.815	v
Zero-g[4]	V_{OFF}, T_A	-2.0	±0.5	+2.0	mg/°C
Sensitivity (T_A = 25°C, V_{DD} = 3.3 V)					
1.5g	$S_{1.5g}$	740	800	860	mV/g
6g	S_{6g}	190.6	206	221.5	mV/g
Sensitivity[4]	S,T_A	-0.0075	±0.002	+0.0075	%/°C
Bandwidth Response					
XY	f_{-3dBXY}	—	400	—	Hz
Z	f_{-3dBZ}	—	300	—	Hz
Output Impedance	Z_O	—	32	—	kΩ
0g-Detect	$0g_{detect}$	-0.4	0	+0.4	g
Self Test					
Output Response					
X_{OUT}, Y_{OUT}	Δg_{STXY}	+0.05	-0.1	—	g
Z_{OUT}	Δg_{STZ}	+0.8	+1.0	+1.2	g
Input Low	V_{IL}	V_{SS}	—	0.3 V_{DD}	V
Input High	V_{IH}	0.7 V_{DD}	—	V_{DD}	V
Noise					
Power Spectral Density RMS (0.1 Hz – 1 kHz)[4]	n_{PSD}	—	350	—	$\mu g/\sqrt{Hz}$
Control Timing					
Power-Up Response Time[8]	$t_{RESPONSE}$	—	1.0	2.0	ms
Enable Response Time[9]	t_{ENABLE}	—	0.5	2.0	ms
Self Test Response Time[10]	t_{ST}	—	2.0	5.0	ms
Sensing Element Resonant Frequency					
XY	$f_{GCELLXY}$	—	6.0	—	kHz
Z	f_{GCELLZ}	—	3.4	—	kHz
Internal Sampling Frequency	f_{CLK}	—	11	—	kHz
Output Stage Performance					
Full-Scale Output Range (I_{OUT} = 3 µA)	V_{FSO}	V_{SS}+0.1	—	V_{DD}–0.1	V
Nonlinearity, X_{OUT}, Y_{OUT}, Z_{OUT}	NL_{OUT}	-1.0	—	+1.0	%FSO
Cross-Axis Sensitivity[11]	$V_{XY, XZ, YZ}$	-5.0	—	+5.0	%

1. For a loaded output, the measurements are observed after an RC filter consisting of an internal 32 kΩ resistor and an external 3.3 nF capacitor (recommended as a minimum to filter clock noise) on the analog output for each axis and a 0.1µF capacitor on V_{DD} - GND. The output sensor bandwidth is determined by the Capacitor added on the output. f = 1/2π * (32 x 10^3) * C. C = 3.3 nF corresponds to BW = 1507 HZ, which is the minimum to filter out internal clock noise.
2. These limits define the range of operation for which the part will meet specification.
3. Within the supply range of 2.2 and 3.6 V, the device operates as a fully calibrated linear accelerometer. Beyond these supply limits the device may operate as a linear device but is not guaranteed to be in calibration.
4. This value is measured with g-Select in 1.5g mode.
5. The device can measure both + and – acceleration. With no input acceleration the output is at midsupply. For positive acceleration the output will increase above V_{DD}/2. For negative acceleration, the output will decrease below V_{DD}/2.
6. For optimal 0g offset performance, adhere to AN3484 and AN3447
7. Product performance will not exceed this minimum level, however measurement over time will not be equal to time zero measurements for this specific parameter.
8. The response time between 10% of full scale V_{DD} input voltage and 90% of the final operating output voltage.
9. The response time between 10% of full scale Sleep Mode input voltage and 90% of the final operating output voltage.
10. The response time between 10% of the full scale self test input voltage and 90% of the self test output voltage.
11. A measure of the device's ability to reject an acceleration applied 90° from the true axis of sensitivity.

RGI-4.5Hz Geophone

RGI-4.5Hz Low Frequency Geophone Element

Seeking Perfection Manufacturing Excellence

Features

- High quality, reliable geophone
- Availability of horizontal element for S-wave and 3-C data acquisition
- 3-year non pro-rated warranty
- Lowest maintenance expenditure in the industry

Specifications (all parameters are specified at +22℃)	
Frequency	
Natural frequency	4.5 Hz ± 0.5 Hz
Max. tilt angle for specified fn	100
Typical spurious frequency	>160 Hz
Distortion	
Distortion	≤0.3%
Distortion measurement frequency	12 Hz
Tilt angle for distortion specification	Vertical
Damping	
Damping	0.70 ± 10%
Coil Resistance	
Standard	395 ohm ± 5%
Sensitivity	
Sensitivity without shunt resistor	23.4 V/m/s ± 10%
Physical Characteristics	
Moving mass	11g
Maximum coil excursion p-p	1.5mm
Diameter	25.4mm
Height	33.0mm
Weight	87g
Operating temperature range	-40℃ to +80℃

* Warranty excludes damage caused by high voltage and physical damage to the element case.

The RGI-4.5Hz Low Frequency geophone is a well-developed product manufactured under strict quality control and specially designed to realize reliable and stable performance for extensive field applications.

The RGI-4.5Hz Low Frequency geophone is perfectly suitable for geophysical and geological exploration, engineering, coal mine industry, national defense, security monitoring and scientific research.

Implementation: Suitable for land and TZ, 3C data acquisition with multiple RACOTECH geophone cases

RACOTECH
GEOPHYSICAL INSTRUMENTS

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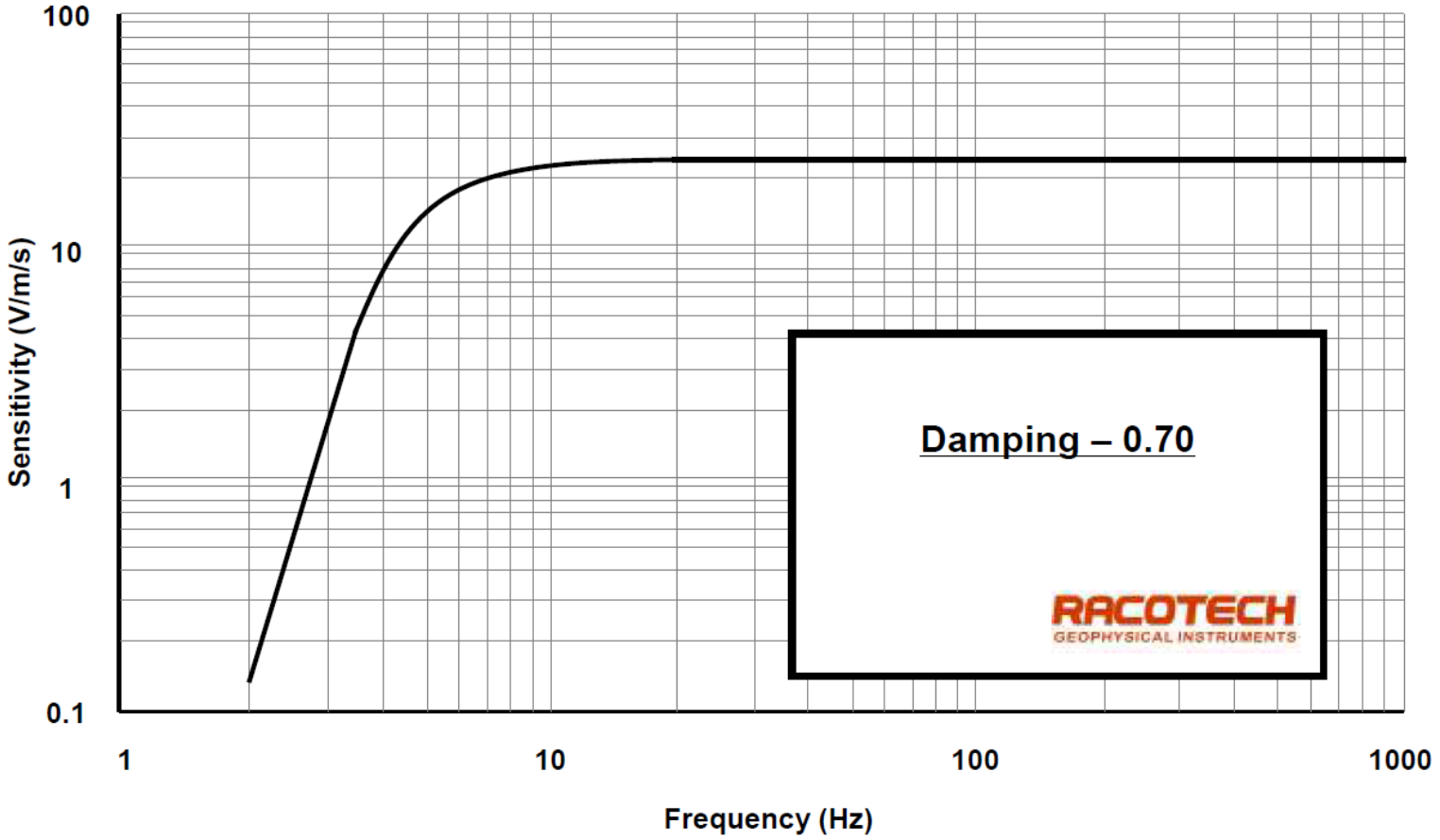
· GEOPHONE · CABLE · CONNECTOR RGI™

RGI-4.5Hz Geophone Response Curve



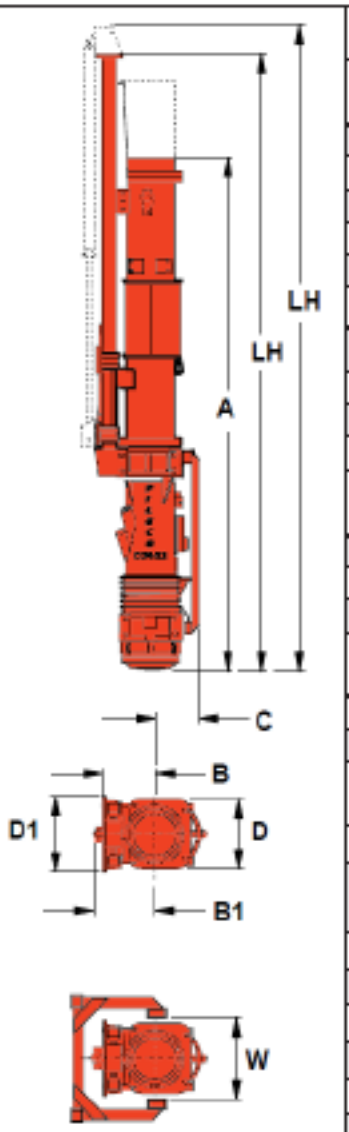
Appendix B PILE HAMMER DATA

B 1 TECHNICAL DATA SHEET OF PILECO D30-32

PILECO

D30-32

Technical Data Sheet 01/2013



Specifications*

Energy Per Blow, Adjustable

Pump Setting 1	50 %	47.9 kNm	35,400 ft.lbs.
Pump Setting 2	74 %	70.0 kNm	51,630 ft.lbs.
Pump Setting 3	90 %	85.4 kNm	62,920 ft.lbs.
Pump Setting 4	100 %	94.8 kNm	69,923 ft.lbs.
Frequency			37 - 52 blows/min
Related Piston Stroke		3.2 - 1.6 m	10.5 - 5.3 ft.
Maximum batter w/o upper cyl. ext.		1:5	-
with upper cylinder extension		1:1	-
Fuel consumption at full load		10.0 L/hr.	2.64 gal./hr.
Oil consumption		1.0 L/hr.	0.26 gal./hr.

Approx. Weights

Hammer	6110 kg	13,472 lbs.
Piston	3000 kg	6,615lbs.
Hammer with standard guiding	7210 kg	15,900 lbs.

Capacities

Fuel Tank	67 L	17.7 gal.
Oil Tank	19 L	5.0 gal.

Dimensions

A	-	Length	5425 mm	17.8 ft.
LH	-	Length, standard	6490 mm	21.3 ft.
	-	Length with hydraulic start	6860 mm	22.5 in.
B	-	Center to trip	445 mm	17.5 in.
B1	-	Center to trip with cylinder	610 mm	24.0 in.
C	-	Center to pump guard	482 mm	19.0 in.
D	-	Width of hammer	635 mm	24.5 in.
D1	-	Width of trip	812 mm	32.0 in.
W	-	Minimum lead width	660 mm	26.0 in.

Technical data are subject to change without prior notice
Operating energy based on piston stroke - values are approximate.
Hydraulic start and upper cylinder extension optional.

BAUER PILECO
BAUER-Pileco Inc.
100 N. FM 3083 East, Conroe, TX 77303
Ph.: (713) 691-3000
Fax: (713) 691-0089
E-mail: info@bauerpileco.com
www.bauerpileco.com

B 2 TECHNICAL DATA SHEET OF DELMAG D16-32

US Units

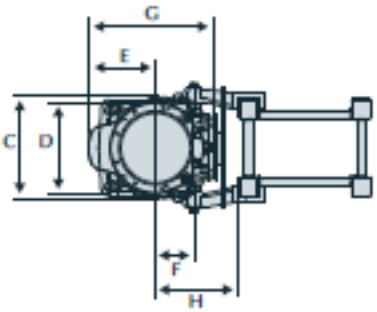
DELMAG

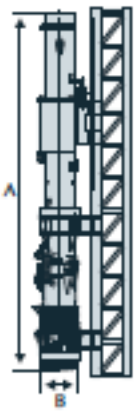
D6-32 to D19-42

Technical data		D6-32	D8-22	D12-42	D16-32	D19-42
Impact weight (piston)	lbs	1320	1765	2820	3530	4010
Energy per blow, max.	ft-lbs	14015	19915	33930	39830	48680
Energy per blow, min.	ft-lbs	6640	9590	14750	18440	21390
Number of blows	min^{-1}	38-52	36-52	35-52	36-52	35-52
Suitable for driving piles (depending on soil and pile)	lbs	660-4400	1100-6600	1760-11000	2200-13200	2420-13200
Consumption						
Diesel oil	gal/h	0,81	0,88	1	1,1	1,65
Lubricant	gal/h	0,05	0,11	0,11	0,11	0,11
Tank capacity						
Diesel oil tank	gal	5	5,3	6,6	8,45	8,45
Lube tank	gal	1,3	1,58	1,7	2,4	2,4
Max. rope diameter for deflector sheave of tripping device	in	0,78	0,78	0,78	0,78	0,78
Weight						
Tripping device	lbs	250	250	250	250	250
Diesel pile hammer	lbs	3570	4265	6030	7980	8465
Max. inclined pile driving without / with extension		1:3 / -	1:2 / -	1:5 / 1:1	1:5 / 1:1	1:5 / 1:1

Dimensions

A	Length of Diesel pile hammer without extension	in	170	185	188	203	203
B	Outer diameter of impact block	in	13,8	13,8	15,8	17,3	17,3
C	Width of Diesel pile hammer	in	18,3	16,15	17,3	18,9	18,9
D	Width for connection of guide jaws	in	12,6	12,6	12,6	12,6	12,6
E	Center of hammer to pump guard	in	12,2	12,4	13,2	13,6	13,6
F	Center of hammer to center of threads for guide jaw bolts	in	9,7	9,7	9,7	11	11
G	Depth of Diesel pile hammer	in	23,25	23,25	24	27,5	27,5
H	Standard distance from center of Diesel pile hammer up to the face of lead	in	12,6	12,6	13,4	14	14,2





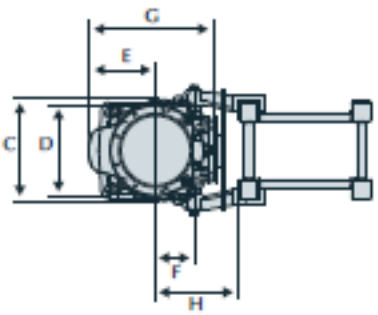
US Units

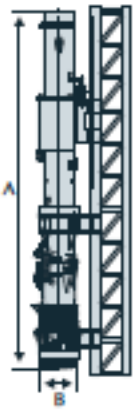
DELMAG

D25-32 to D46-32

Technical data		D25-32	D30-32	D36-32	D46-32
Impact weight (piston)	lbs	5510	6610	7940	10140
Energy per blow, max.	ft-lbs	66380	75970	90720	122435
Energy per blow, min.	ft-lbs	29500	35400	41300	52370
Number of blows	min^{-1}	35-52	36-52	36-53	35-53
Suitable for driving piles (depending on soil and pile)	lbs	3530-16535	4410-19840	5510-26455	6610-35270
Consumption					
Diesel oil	gal/h	1,65	2,2	2,53	3,52
Lubricant	gal/h	0,13	0,22	0,33	0,33
Tank capacity					
Diesel oil tank	gal	17,7	17,7	23,5	23,5
Lube tank	gal	5	5	4,5	4,5
Max. rope diameter for deflector sheave of tripping device	in	0,87	0,87	1,5	1,5
Weight					
Tripping device	lbs	410	410	992	992
Diesel pile hammer	lbs	12500	13600	18060	20485
Max. inclined pile driving without / with extension		1:5 / 1:1	1:5 / 1:1	1:5 / 1:1	1:5 / 1:1

Dimensions					
A Length of Diesel pile hammer without extension	in	216,5	216,5	215,4	215,4
B Outer diameter of impact block	in	22	22	26	26
C Width of Diesel pile hammer	in	26,4	26,4	31,4	31,4
D Width for connection of guide jaws	in	21,3	21,3	25,2	25,2
E Center of hammer to pump guard	in	16	16	17,5	17,5
F Center of hammer to center of threads for guide jaw bolts	in	9,3	9,3	10,8	10,8
G Depth of Diesel pile hammer	in	30,7	30,7	37,4	37,4
H Standard distance from center of Diesel pile hammer up to the face of lead	in	17,1	17,1	19,7	19,7





Michigan Department
Of Transportation
1998 (03/08)

LRFD PILE AND DRIVING EQUIPMENT DATA

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CONTROL SECTION	PROJECT NO.	DATE
BRT 46062	102815A	3/13/12

STRUCTURE NO.	STRUCTURE LOCATION
B02 46062	TUSCOLA M-25 O/HARBOR BEACH & HURON M-46 O/SUCKER CRK

PRIME CONTRACTOR
MILBOCKER & SONS, INC.

PILING CONTRACTOR
MILBOCKER & SONS, INC.

ENGINEER	INSPECTOR

HAMMER COMPONENTS

Hammer

Manufacturer: Pileco, Inc. Model: D30-32 (PD18)
Type: single acting diesel impact Serial No:
Manufacturer's Maximum Rated Energy: 69,925 (ft-lbs)
Stroke at Maximum Rated Energy: 10.5 (ft)
Blow Count at Maximum Rated Energy: 37 (blows/min)
Range in Operating Energy: 35400 to 69925 (ft-lb)
Range in Operating Stroke: 5.3 to 10.5 (ft)
Modifications:

Ram

Ram Weight: 6615 (lbs)
Ram Length: 122.2 (ft) (for diesel hammers)

Anvil

Anvil Cross Sectional Area: (in^2)
(With diesel hammers) Anvil Weight: 1230 (lbs)

Hammer Cushion

	Material #1	Material #2
Name:	Micarta	Aluminum
Area (in^2):	502.75	888.84
No. of Plates:	1	2
Thickness: (in):	1"	6" x 2 pieces
Mod. of Elasticity - E: (psi)	350ksi	350ksi
Stiffness: (kips/in) (Area*E)/(Thickness)		
Coefficient of Restitution - e:	0.8	0.8

Drive Head

Helmet(Drive head) + Adapter (Pile insert)
Weight: 2200 (lbs) + 890 (lbs) = 3090 (lbs)

Pile Cushion (Only for Timber Piles)

Material:
Area: (in^2)
No. of Sheets: Thickness/Sheet: (in)
Total Thickness of Pile Cushion: (in)
Mod. of Elasticity - E: (psi)
Coefficient of Restitution - e:

PILE

Pile

Diameter: (in) Wall Thickness: (in)
Taper (if any):
Ordered Length: (ft)
Required Nominal Pile Driving Resistance (Rndr) (kips)
Description of Splice:
Tip Treatment/Pile Points/Plate Description:

Submit Data Sheet for Each Proposed Hammer and Unique Driving Condition

Michigan Department Of Transportation 1956 (03/08)

LRFD PILE AND DRIVING EQUIPMENT DATA

DISTRIBUTION: ORIGINAL – Project/Resident/Delivery Engineer Files,
COPIES- Construction & Technology - Geotechnical Services Unit, Bridge Construction Unit

CONTROL SECTION	PROJECT NO.	DATE
13032	89916A	7/12/12

STRUCTURE NO.	STRUCTURE LOCATION
B02 OF 13032	M-66 OVER WANADOGA CREEK, CALHOUN CO.

PRIME CONTRACTOR: MILBOCKER & SONS, INC.

PILING CONTRACTOR: MILBOCKER & SONS, INC.

ENGINEER	INSPECTOR
ANDY STRUPULIS	

HAMMER COMPONENTS

Hammer

Manufacturer: Pileco, Inc. Model: D16-32 (PD-5)
Type: Diesel Serial No: 341
Manufacturer's Maximum Rated Energy: 39335 (ft-lbs)
Stroke at Maximum Rated Energy: 11.2 (ft)
Blow Count at Maximum Rated Energy: 36 (blows/min)
Range in Operating Energy: 19890 to 39335 (ft-lb)
Range in Operating Stroke: 4 to 11.2 (ft)
Modifications:

Ram

Ram Weight: 3528 (lbs)
Ram Length: 9.5 (ft) (for diesel hammers)

Anvil

Anvil Cross Sectional Area: 124.7 (in^2)
(With diesel hammers) Anvil Weight: 742 (lbs)

Hammer Cushion

	Material #1	Material #2
Name:	ALUMINUM CUS	PHENOLIC CUSH
Area (in^2):	227	227
No. of Plates:	2	1
Thickness: (in):	1/2	1
Mod. of Elasticity - E: (psi)	360	360
Stiffness: (kips/in) (Area*E)/(Thickness)		
Coefficient of Restitution - e:	0.5	0.8

Drive Head

Helmet(Drive head) + Adapter (Pile Insert)
Weight: 1280 (lbs) + 650 (lbs) = 1930 (lbs)

Pile Cushion (Only for Timber Piles)

Material:
Area: (in^2)
No. of Sheets: Thickness/Sheet: (in)
Total Thickness of Pile Cushion: (in)
Mod. of Elasticity - E: (psi)
Coefficient of Restitution - e:

PILE

Pile

Diameter: (in) Wall Thickness: (in)
Taper (if any):
Ordered Length: (ft)
Required Nominal Pile Driving Resistance (Rndr) (kips)
Description of Splice:
Tip Treatment/Pile Points/Plate Description:

Submit Data Sheet for Each Proposed Hammer and Unique Driving Condition

Michigan Department Of Transportation 1954 (03/06)

LRFD PILE AND DRIVING EQUIPMENT DATA

DISTRIBUTION: ORIGINAL – Project/Resident/Delivery Engineer Files,
COPIES- Construction & Technology - Geotechnical Services Unit, Bridge Construction Unit

CONTROL SECTION	PROJECT NO.	DATE
BRT 11052	86785A	2/29/12

STRUCTURE NO.	STRUCTURE LOCATION
B01 of 11052	M-139 over Dowagiac River, Niles, MI

PRIME CONTRACTOR: Davis Construction, Inc

PILING CONTRACTOR: Same

ENGINEER	INSPECTOR
Chris Jacobs	Great Lakes Engineering

HAMMER COMPONENTS

Hammer

Manufacturer: Pileco Model: D30
Type: Single acting Serial No.
Manufacturer's Maximum Rated Energy: 41,900 (ft-lbs)
Stroke at Maximum Rated Energy: 10.5 (ft)
Blow Count at Maximum Rated Energy: 37 (blows/min)
Range in Operating Energy: 35,400 to 41,900 (ft-lbs)
Range in Operating Stroke: 9.3 to 10.5 (ft)
Modifications:

Ram

Ram Weight: 6,615 (lbs)
Ram Length: 10.302 (ft) (for diesel hammers)

Anvil

Anvil Cross Sectional Area: 22.04 (in^2)
(With diesel hammers) Anvil Weight: 1356.4 (lbs)

Hammer Cushion

	Material #1	Material #2
Name:	Micarta	Aluminum
Area (in^2):	415	415
No. of Plates:	1	2
Thickness: (in):	1	5 ea
Mod. of Elasticity - E: (psi)	350 KSI	350 KSI
Stiffness: (kips/in) (Area*E)/(Thickness)	72,625	72,625
Coefficient of Restitution - e:	0.8	0.8

Drive Head

Helmet(Drive head) + Adapter (Pile insert)
Weight: 1900 (lbs) + 890 (lbs) = 2,790 (lbs)

Pile Cushion (Only for Timber Piles)

Material:
Area: (in^2)
No. of Sheets: Thickness/Sheet: (in)
Total Thickness of Pile Cushion: (in)
Mod. of Elasticity - E: (psi)
Coefficient of Restitution - e:

PILE

Pile

Diameter: HP 14x73 (in) Wall Thickness: (in)
Taper (if any):
Ordered Length: 40',45',50',55' (ft)
Required Nominal Pile Driving Resistance (Rndr): 500 (kips)
Description of Splice: alternate splice plate
Tip Treatment/Pile Points/Plate Description: points

Submit Data Sheet for Each Proposed Hammer and Unique Driving Condition

Appendix C SITE DETAILS OF FIELD TESTS

C 1 LOCATION – M-25 SITE

MICHIGAN DEPARTMENT OF TRANSPORTATION

ROUTE: M-25 & M-46
HURON & TUSCOLA COUNTY
RUBICON, WELLS & DAYTON TOWNSHIP

PART	CONTROL SEC	JOB NO.	FEDERAL PROJECT	FEDERAL ITEM
1-BRIDGE PLANS	32092	100622A		
	79042	100622A		

COUNTY KEY

CS: 32092 & 79042
JN: 100622A

GENERAL NOTES

THE DESIGN OF THESE STRUCTURES ARE BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD.

EXCEPT WHERE OTHERWISE INDICATED ON THESE PLANS, OR IN THE PROPOSAL AND SUPPLEMENTAL SPECIFICATIONS CONTAINED HEREIN, ALL MATERIALS AND WORKMANSHIP SHALL BE ACCORDING TO THE MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION 2012 EDITION.

THE DESIGN OF THE STRUCTURAL MEMBERS IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

CONCRETE: GRADE S2 f'_c = 3,000 psi
STEEL REINFORCEMENT f_y = 60,000 psi
PRECAST 3-SIDED CULVERT (f'_c = 5,000 psi min)

ALL EXPOSED CONCRETE CORNERS SHOWN SQUARE ON THE PLANS SHALL BE BEVELED WITH ½" TRIANGULAR MOLDINGS EXCEPT AS OTHERWISE NOTED.

SCANNED IMAGES OF ALL EXISTING PLAN SHEETS FOR THESE STRUCTURES ARE HEREIN.

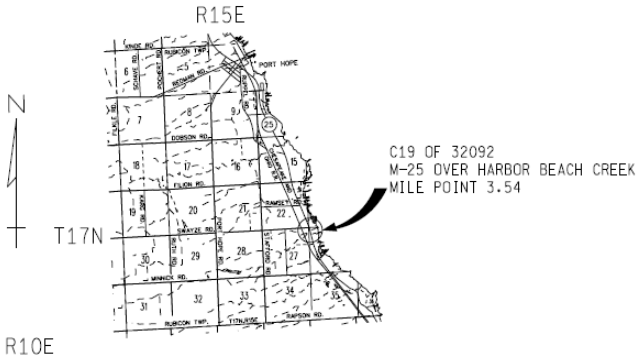
THE DESIGN OF THE FOUNDATION PILING IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES (AND LOSSES):

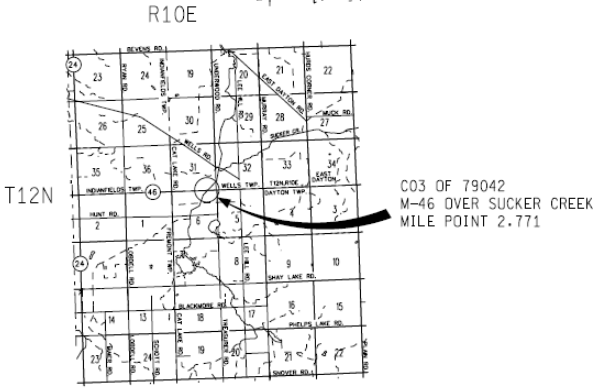
FOUNDATION PILING (STEEL H-PILING):
AASHTO M270
GRADE 50 F_y = 50,000 psi
FOUNDATION PILING (STEEL H-PILING):
AASHTO M270
GRADE 50W F_y = 50,000 psi

UNLESS OTHERWISE SHOWN ON THE PLANS PROVIDE MINIMUM CONCRETE CLEAR COVER FOR REINFORCEMENT ACCORDING TO THE FOLLOWING:

CONCRETE CAST AGAINST EARTH: 3 IN
ALL OTHER UNLESS SHOWN ON PLANS: 2 IN

THE BRIDGE DECK SURFACE HAS AN HMA OVERLAY. HMA CAP OR RMA PATCHES. REMOVAL OF HMA AS A RESULT OF REMOVAL OF OTHER SUPERSTRUCTURE ITEMS SHALL BE INCLUDED IN THE REMOVAL OF THOSE ITEMS.





TITLE SHEET LEGEND

PROPOSED BRIDGE PROJECT
EXISTING ROADS
CITY STREET
COUNTY
STATE ROUTES
FEDERAL DIVIDED ROUTES
FEDERAL DIVIDED INTERSTATE ROUTES
HOT MIX ASPHALT
GRAVEL
SECTION LINE
CITY, VILLAGE OR TOWNSHIP LIMITS
RAILROADS

APPROVALS

RECOMMENDED FOR APPROVAL BY: _____ GERARD FEUERSTEIN, P.E. - PROJECT MANAGER DATE

RECOMMENDED FOR APPROVAL BY: _____ DUANE MAAS, P.E. - DELIVERY ENGINEER DATE

MICHIGAN DEPARTMENT OF TRANSPORTATION
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: _____ MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT DATE

CONTRACT FOR:
C19 OF 32092 - REMOVE BRIDGE AND REPLACE WITH COMPOSITE ARCH CULVERT (CFRP).
C03 OF 79042 - REMOVE BRIDGE AND REPLACE WITH 3-SIDED PRECAST CULVERT.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

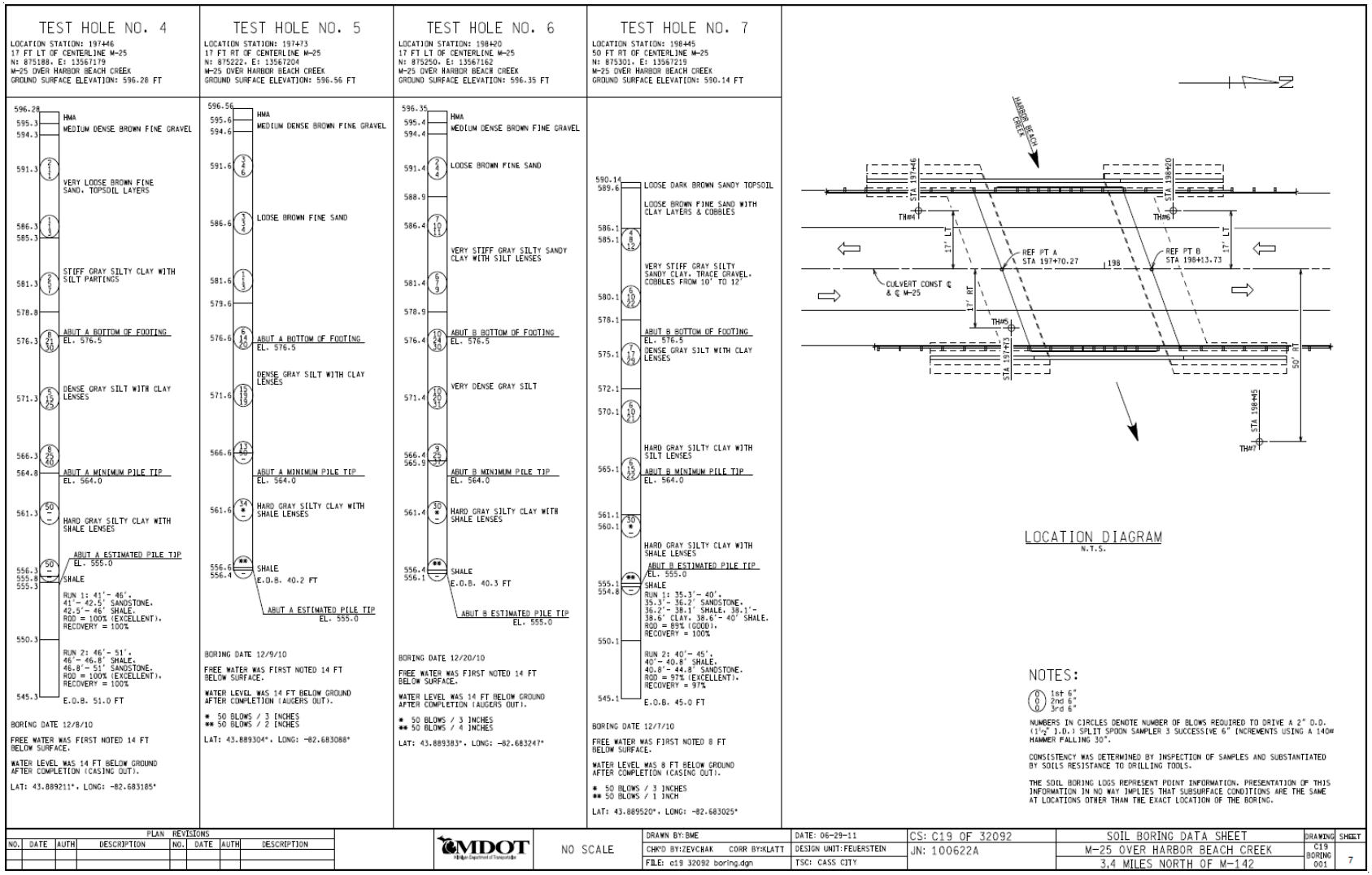
MDOT

NO SCALE

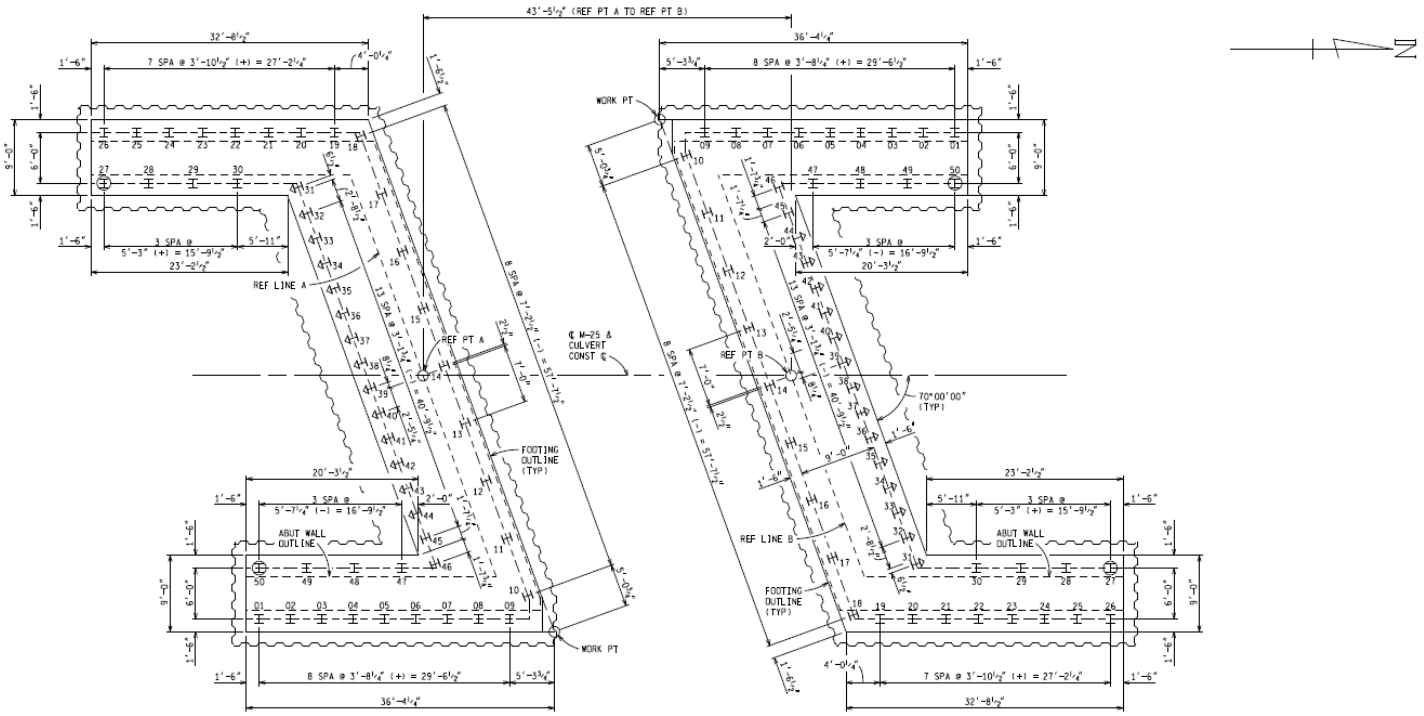
DRAWN BY: KLATT | DATE: 09-27-11 | CS: 32092 & 79042
CHK'D BY: ZEVCHAK | CORR BY: N. NELSON | DESIGN UNIT: FEUERSTEIN | JN: 100622A
FILE: 100622 title.dgn | TSC: CASS CITY

TITLE SHEET | DRAWING: 1 | SHEET: 1

C 2 SOIL BORING DATA – M-25 SITE



C 3 PLAN OF PILE LAYOUT – M-25 SITE



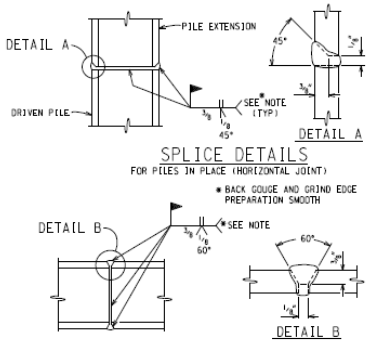
PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

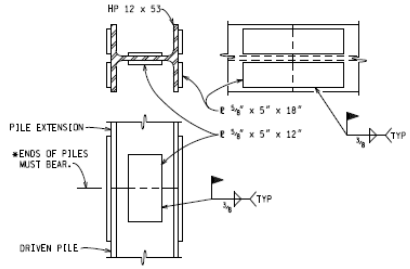
DRAWN BY: LMB	DATE: 06-29-11	CS: C19 OF 32092	PILE DETAILS	DRAWING: C19 PILE 001
CHK'D BY: A.ZEVCHAK CORR BY: LMB	DESIGN UNIT: FEUERSTEIN	JN: 100622A		SHEET: 10
FILE: c19 79042 pile.dgn	TSC: CASS CITY			

C 4 PILE DETAILS – M-25 SITE



SPLICE DETAILS
FOR PILES IN PLACE (HORIZONTAL JOINT)

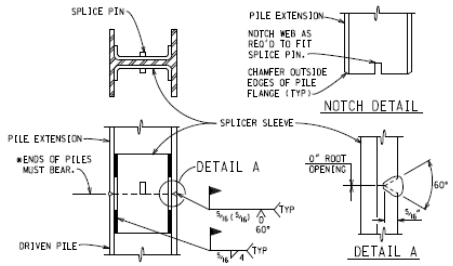
SPLICE DETAILS
FOR PILES IN HORIZONTAL POSITION



SPLICE DETAILS

* SET PILE EXTENSION IN PLACE WITH SPLICE PLATES ATTACHED. TAP SEVERAL TIMES WITH THE HAMMER TO IMPROVE BEARING CONTACT. THEN COMPLETE WELDING OF PLATES TO THE LOWER SECTION.

STEEL H-PILES (HP 12 x 53) FURNISHED AND DRIVEN						
LOCATION	PILE TYPE	NUMBER OF PILES	ESTIMATED LENGTH FURNISHED & DRIVEN		PILE POINTS	CUT-OFF ELEV.
			EACH LFT	TOTAL LFT		
ABUT A	TEST	2	35	70	2	577.50
	VERTICAL	34	25	850	34	577.50
	BATTERED	14	30	420	14	577.50
ABUT B	TEST	2	35	70	2	577.50
	VERTICAL	34	25	850	34	577.50
	BATTERED	14	30	420	14	577.50
TOTAL		100		2680	100	



ALTERNATE SPLICE DETAILS

* SET PILE EXTENSION IN PLACE WITH SPLICE PLATES ATTACHED. TAP SEVERAL TIMES WITH THE HAMMER TO IMPROVE BEARING CONTACT. THEN COMPLETE WELDING OF PLATES TO THE LOWER SECTION.

MISCELLANEOUS QUANTITIES	
2680 Ft	Pile, Steel, Furn and Driven, 12 Inch, LRFD
1 LS	Pile Driving Equipment, Furn, LRFD (C19 OF 39092)
100 Ea	Pile Point, Steel, LRFD
4 Ea	Test Pile, Steel, 12 Inch, LRFD

NOTES:

H – DENOTES VERTICAL PILES.

Ⓗ – DENOTES VERTICAL TEST PILES.

H▷ – DENOTES BATTERED PILES AND DIRECTION OF BATTER.

STEEL PILES SHALL BE HP 12 x 53.

USE STEEL FOR H-PILES AND SPLICES THAT HAVE A YIELD STRENGTH NOT LESS THAN 50,000 PSI.

THE ESTIMATED LOSS OF NOMINAL PILE RESISTANCE DUE TO SCOUR AFTER DRIVING IS 0 KIPS.

THE ESTIMATED FACTORED DOWNDRAG AFTER PILE DRIVING IS 0 KIPS.

THE FACTORED PILE RESISTANCE AVAILABLE TO RESIST ALL FACTORED LOADS, INCLUDING THE ESTIMATED FACTORED DOWNDRAG, IS EQUAL TO 50 PERCENT OF NOMINAL PILE DRIVING RESISTANCE THAT IS REDUCED BY THE LOSS DUE TO SCOUR.

DRIVE ALL PILES TO A NOMINAL PILE DRIVING RESISTANCE NOT LESS THAN 350 KIPS. DETERMINE NOMINAL PILE DRIVING RESISTANCE (Rndr) USING THE FHWA MODIFIED GATES DYNAMIC FORMULA.

THE ESTIMATED PILE LENGTH IS BASED ON THE STATIC ANALYSIS.

BATTER PILES FOR ABUTMENT(S) A AND B SHALL BE DRIVEN TO A 3V:1H BATTER ANGLE.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

DRAWN BY:LMB	DATE: 06-29-11	CS: C19 OF 32092	PILE DETAILS	DRAWING C19 PILE 002
CHK'D BY:A.ZEVCHAK CORR BY:LMB	DESIGN UNIT:FEUERSTEIN	JN: 100622A		SHEET 11
FILE: c19 79042 pile.dgn	TSC: CASS CITY			

700

THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION.

PHYSICAL ROAD NUMBER (PRN) & MILEPOST (MP) DATA ARE FROM MICHIGAN GEOGRAPHIC FRAMEWORK VERSION # 10.

MICHIGAN DEPARTMENT OF TRANSPORTATION

ROUTE: M-66
PENNFIELD TOWNSHIP
CALHOUN COUNTY

PART	CONTROL SEC	JOB NO.	FEDERAL PROJECT	FEDERAL ITEM
1 - ROAD	13032	89916A	STP 1113(030)	HH 7562
2 - BRIDGE	13032	89916A		

COUNTY KEY

CS: 13032
JN: 89916A

NOTES:

THE DESIGN OF THIS STRUCTURE IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

THE DESIGN OF THE STRUCTURAL MEMBERS IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

CONCRETE: GRADE T	f'c = 3.000 PSI
CONCRETE: GRADE S2	f'c = 3.000 PSI
CONCRETE: GRADE D	f'c = 4.000 PSI
STEEL REINFORCEMENT	fy = 60.000 PSI
STEEL REINFORCEMENT: STIRRUPS FOR PRESTRESSED BEAMS	fy = 60.000 PSI
PRESTRESSED CONCRETE	f'c = 6500 PSI
PRESTRESSING STRANDS	f's = 270.000 PSI
STRUCTURAL STEEL: AASHTO M270 GRADE 36	fy = 36.000 PSI

ALL EXPOSED CONCRETE CORNERS SHOWN SQUARE ON THE PLANS SHALL BE BEVELED WITH ½" TRIANGULAR MOLDINGS EXCEPT AS OTHERWISE NOTED.

OLD PLANS DO NOT EXIST FOR THIS STRUCTURE.

THE BRIDGE PAINT MAY CONTAIN LEAD.

THE DESIGN OF THE FOUNDATION PILING IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

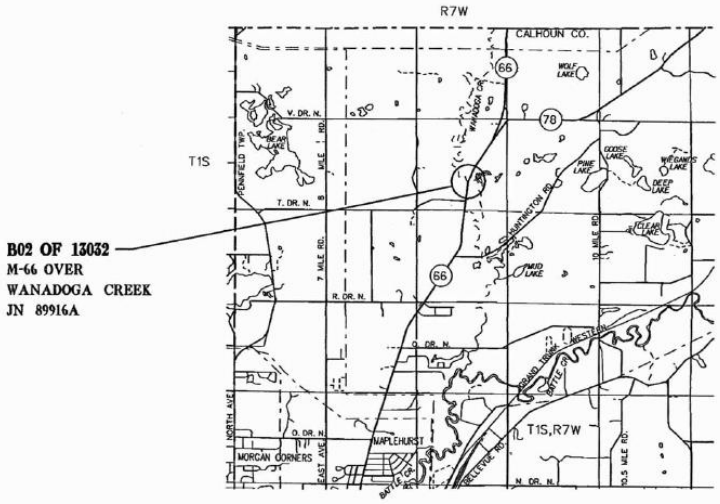
FOUNDATION PILING (STEEL H-PILING): AASHTO M270 GRADE 50	Fy = 50.000 PSI
FOUNDATION PILING (STEEL H-PILING): AASHTO M270 GRADE 50W	Fy = 50.000 PSI

UNLESS OTHERWISE SHOWN ON THE PLANS PROVIDE MINIMUM CONCRETE CLEAR COVER FOR REINFORCEMENT ACCORDING TO THE FOLLOWING:

CONCRETE CAST AGAINST EARTH:	3 IN.
PRESTRESSED BEAMS:	1 IN.
ALL OTHER UNLESS SHOWN ON PLANS:	2 IN.

THE BRIDGE DECK SURFACE HAS AN HMA OVERLAY. HMA CAP OR HMA PATCHES. REMOVAL OF HMA AS A RESULT OF REMOVAL OF OTHER SUPERSTRUCTURE ITEMS SHALL BE INCLUDED IN THE REMOVAL OF THOSE ITEMS.

N



B02 OF 13032
M-66 OVER
WANADOGA CREEK
JN 89916A

THE REGULATED WASTE ACTIVITY IDENTIFICATION NUMBERS FOR THIS PROJECT ARE AS FOLLOWS:

CONTROL SECTION NUMBER
B02 OF 13032 MIK875492860

TITLE SHEET LEGEND

- PROPOSED BRIDGE PROJECT
- EXISTING ROADS
  - CITY STREET
  - COUNTY
  - STATE ROUTES
  - FEDERAL DIVIDED ROUTES
  - FEDERAL DIVIDED INTERSTATE ROUTES
  - HOT MIX ASPHALT
  - GRAVEL
- SECTION LINE
- CITY, VILLAGE OR TOWNSHIP LIMITS
- RAILROADS

APPROVALS

RECOMMENDED FOR APPROVAL BY: CHARLES F. OCCHIUTO, P.E. - PROJECT MANAGER — DATE 8-10-11

RECOMMENDED FOR APPROVAL BY: PATTY [illegible], P.E. - CONSTRUCTION ENGINEER — DATE 8-10-11

MICHIGAN DEPARTMENT OF TRANSPORTATION
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT — DATE 8-17-11

CONTRACT FOR:
STRUCTURE REPLACEMENT, APPROACH WORK AND MAINTAINING TRAFFIC.

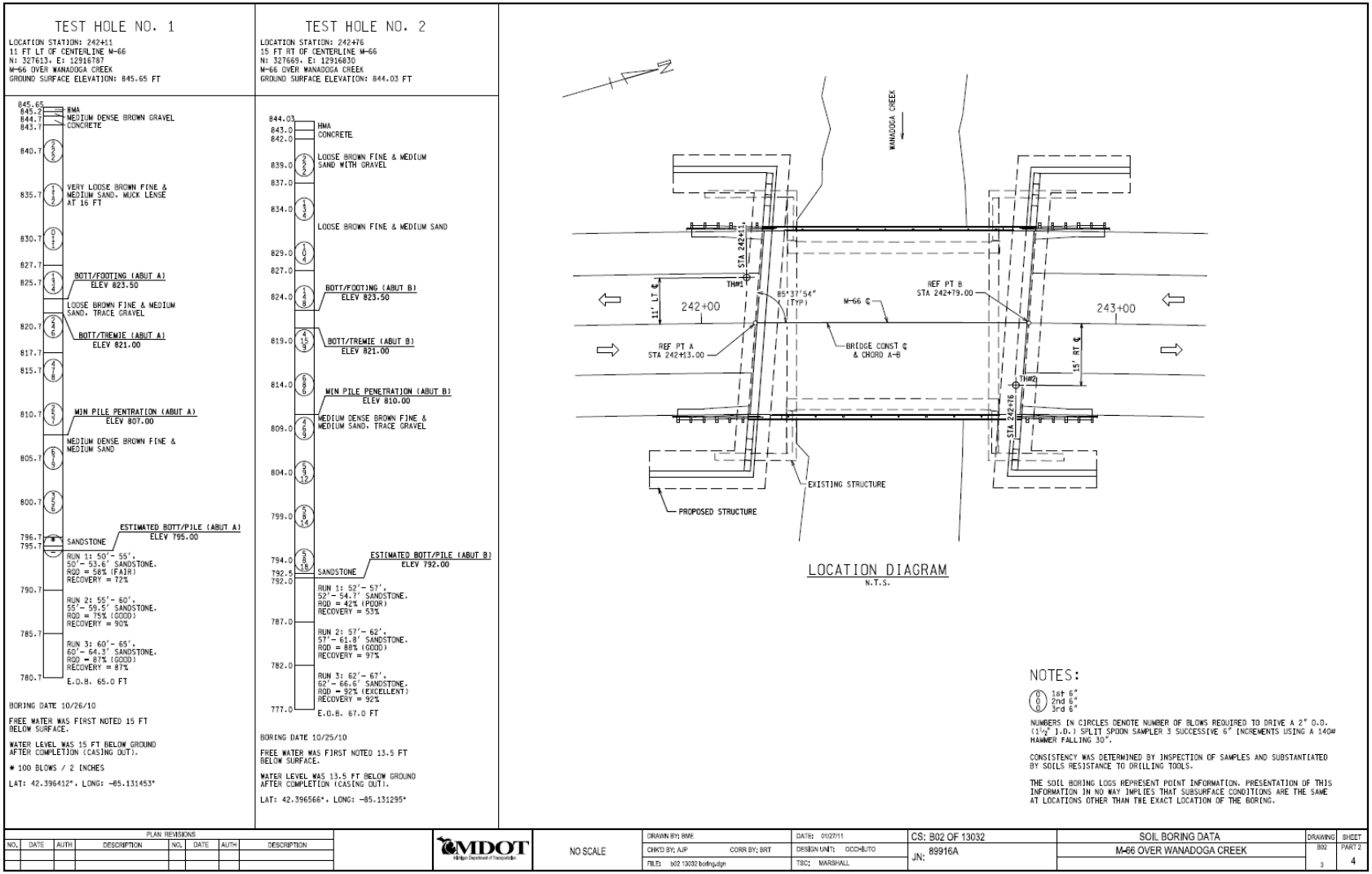
PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT

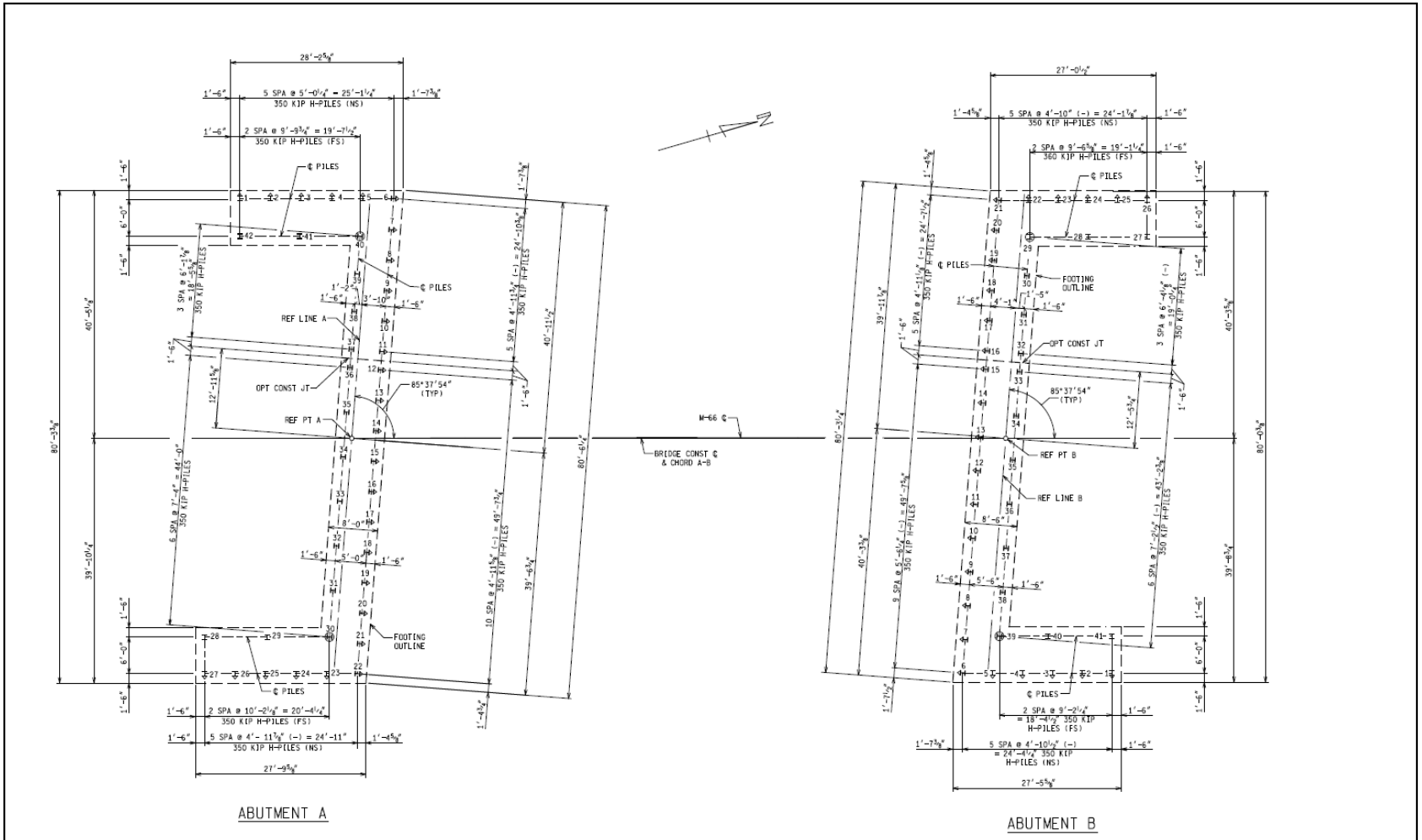
NO SCALE

DRAWN BY: BRT	DATE: 01/26/11	CS: 13032	TITLE SHEET
CHECKED BY: GEHRCKE	DESIGN UNIT: OCCHIUTO	JN: 89916A	DRAWING 1
FILE: b02 13032 title.dgn	TSC: MARSHALL		SHEET 1

C 6 SOIL BORING DATA – M-66 SITE



C 7 PLAN OF PILE LAYOUT – M-66 SITE



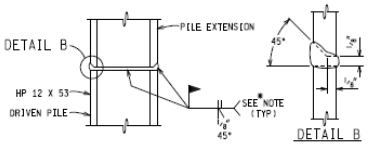
PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

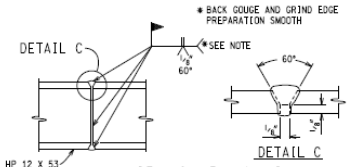
NO SCALE

DRAWN BY: BRT	DATE: 03/28/11	CS: B02 OF 13032	PILE DETAILS	DRAWING	SHEET
CHK'D BY: R.GEHRCKE CORR BY: BRT	DESIGN UNIT: OCCHUTO	JN: 89916A		B02	PART 2
FILE: b02 13032 pile.dgn	TSC: MARSHALL			11	12

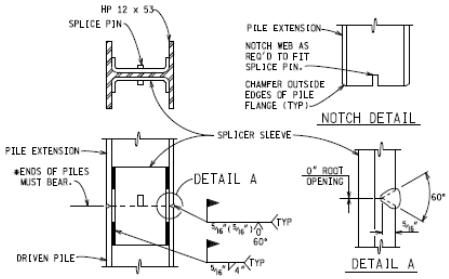
C 8 PILE DETAILS – M-66 SITE



SPLICE DETAILS
FOR PILES IN PLACE (HORIZONTAL JOINT)



SPLICE DETAILS
FOR PILES IN HORIZONTAL POSITION



ALTERNATE SPLICE DETAILS

*SET PILE EXTENSION IN PLACE WITH SPLICE SLEEVE ATTACHED. TAP SEVERAL TIMES WITH THE HAMMER TO IMPROVE BEARING CONTACT. THEN COMPLETE WELDING OF SLEEVES TO THE LOWER SECTION.

MISCELLANEOUS QUANTITIES	
1 LS	Pile Driving Equipment, Furn. (B02 of 13032)
2735 Ft	Pile, Steel, Furn and Driven, 12 Inch
83 Ea	Pile Point, Steel
4 Ea	Test Pile, Steel, 12 inch

HP 12 x 53 PILES FURNISHED AND DRIVEN

LOCATION	PILE TYPE	NUMBER OF PILES	ESTIMATED LENGTH FURNISHED & DRIVEN		PILE POINTS (EACH)	SPLICES (EACH)	CUT-OFF ELEV.
			EACH LFT	TOTAL LFT			
ABUT A	TEST	2	40	80	2		824.50
	VERTICAL	13	30	390	13		824.50
	BATTERED	27	30	810	27		824.50
ABUT B	TEST	2	45	90	2		824.50
	VERTICAL	13	35	455	13		824.50
	BATTERED	26	35	910	26		824.50
TOTAL				2735	83		

NOTES:

⊢ —DENOTES VERTICAL PILES.

⊢▷ —DENOTES BATTERED PILES.

Ⓗ --DENOTES VERTICAL TEST PILES.

(FS) DENOTES FAR SIDE
(NS) DENOTES NEAR SIDE

DRIVE ALL PILES TO A NOMINAL PILE DRIVING RESISTANCE NOT LESS THAN 350 KIPS. DETERMINE NOMINAL PILE DRIVING RESISTANCE (Rndr) USING THE FHWA MODIFIED GATES DYNAMIC FORMULA.

THE ESTIMATED PILE LENGTH IS BASED ON THE STATIC ANALYSIS.

BATTER PILES FOR ABUTMENTS SHALL BE DRIVEN TO A 3V:1H BATTER ANGLE AND DRIVEN TO A 2.5V:1H BATTER ANGLE FOR RETURN WALLS.

STEEL PILES SHALL BE HP 12 x 53.

USE STEEL FOR PROPOSED H-PILES AND SPLICES THAT HAVE A YIELD STRENGTH NOT LESS THAN 50,000 PSI.

THE ESTIMATED FACTORED DOWNDRAG AFTER PILE DRIVING IS 0 KIPS.

THE FACTORED NOMINAL PILE RESISTANCE AVAILABLE TO RESIST ALL FACTORED LOADS IS EQUAL TO 50 PERCENT OF NOMINAL PILE DRIVING RESISTANCE.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

DRAWN BY: BRT
CHK'D BY: R.GEHRCKE CORR BY: BRT
FILE: b02 13032 pile.dgn

DATE: 03/28/11
DESIGN UNIT: OCCH/UTO
TSC: MARSHALL

CS: B02 OF 13032
JN: 89916A

PILE DETAILS

DRAWING: B02 12
SHEET: PART 2 13

C 9 LOCATION – M-139 SITE

GENERAL NOTES

THE DESIGN OF THIS STRUCTURE IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION SHALL BE REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THIS 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 MOD. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF SPAN LENGTH.

EXCEPT WHERE OTHERWISE INDICATED ON THESE PLANS, OR IN THE PROPOSAL AND SUPPLEMENTAL SPECIFICATIONS CONTAINED HEREIN, ALL MATERIALS AND WORKMANSHIP SHALL BE ACCORDING TO THE MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION 2003 EDITION.

THE DESIGN OF THE STRUCTURAL MEMBERS IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

CONCRETE: GRADE S2	f'c = 3,000 PSI
CONCRETE: GRADE D	f'c = 4,000 PSI
STEEL REINFORCEMENT	fy = 60,000 PSI
STEEL REINFORCEMENT: (STIRRUPS FOR PRESTRESSED BEAMS	fy = 60,000 PSI)
STRUCTURAL STEEL: AASHTO M270 GRADE 36	Fy = 36,000 PSI
STRUCTURAL STEEL: AASHTO M270 GRADE 50	Fy = 50,000 PSI
STRUCTURAL STEEL: AASHTO M270 GRADE 50W	Fy = 50,000 PSI
PRESTRESSED CONCRETE	f'c = SEE SHEET #16
PRESTRESSING STRANDS	f's = 270,000 PSI

ALL EXPOSED CONCRETE CORNERS SHOWN SQUARE ON THE PLANS SHALL BE BEVELED WITH ½" TRIANGULAR MOLDINGS EXCEPT AS OTHERWISE NOTED.

BIDDERS WILL BE FURNISHED WITH SCANNED IMAGES OF PLAN SHEETS OF THE EXISTING STRUCTURE IF REQUESTED.

THE BRIDGE PAINT MAY CONTAIN LEAD.

THE DESIGN OF THE FOUNDATION PILING IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

FOUNDATION PILING (STEEL H-PILING): AASHTO M270 GRADE 50	Fy = 50,000 PSI
FOUNDATION PILING (STEEL H-PILING): AASHTO M270 GRADE 50W	Fy = 50,000 PSI

UNLESS OTHERWISE SHOWN ON THE PLANS PROVIDE MINIMUM CONCRETE CLEAR COVER FOR REINFORCEMENT ACCORDING TO THE FOLLOWING:

CONCRETE CAST AGAINST EARTH:	3 IN.
PRESTRESSED BEAMS:	1 IN.
ALL OTHER UNLESS SHOWN ON PLANS:	2 IN.

THE BRIDGE DECK SURFACE HAS AN HMA OVERLAY. HMA CAP OR HMA PATCHES. REMOVAL OF HMA AS A RESULT OF REMOVAL OF OTHER SUPERSTRUCTURE ITEMS SHALL BE INCLUDED IN THE REMOVAL OF THOSE ITEMS.

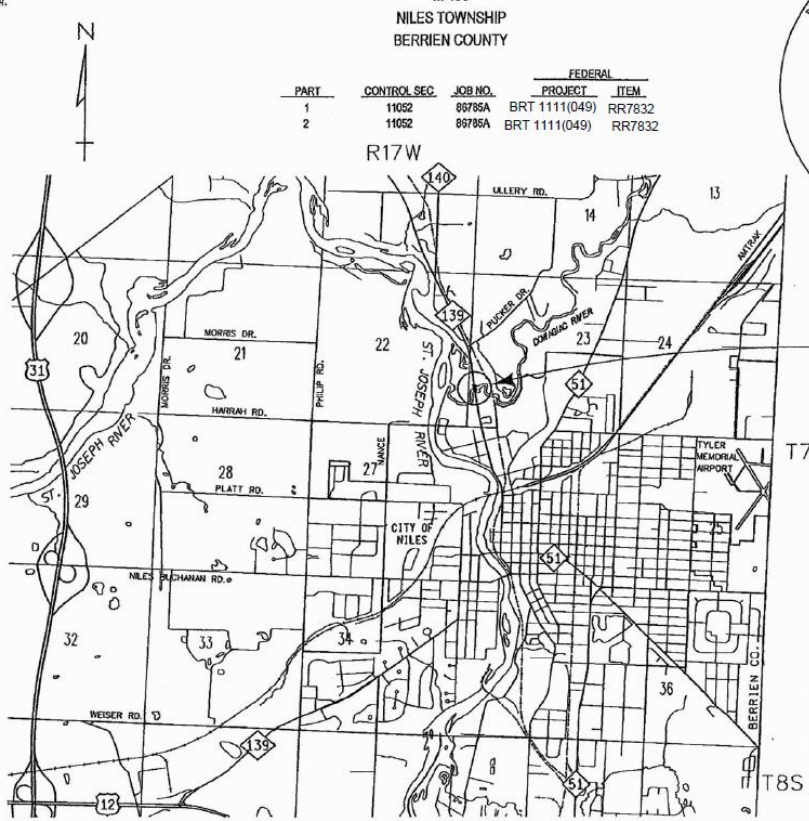
THE REGULATED WASTE ACTIVITY IDENTIFICATION NUMBER FOR THIS PROJECT IS AS FOLLOWS:

CONTROL SECTION NUMBER
B01 OF 11052 MIK962498127

MICHIGAN DEPARTMENT OF TRANSPORTATION

M-139
NILES TOWNSHIP
BERRIEN COUNTY

PART	CONTROL SEC	JOB NO.	FEDERAL PROJECT	FEDERAL ITEM
1	11052	86785A	BRT 1111(049)	RR7832
2	11052	86785A	BRT 1111(049)	RR7832



COUNTY KEY

B01 OF 11052
M-139 OVER DOWAGIAC RIVER

CS: B01 OF 11052
JN: 86785A

APPROVALS

RECOMMENDED FOR APPROVAL BY: Kayla T. Gilchrist 8/11/11
KAYLA GILCHRIST, P.E. - PROJECT MANAGER — DATE

RECOMMENDED FOR APPROVAL BY: Sarah Woolcock 8/9/11
SARAH WOOLCOCK, P.E. - DELIVERY ENGINEER — DATE

MICHIGAN
DEPARTMENT OF TRANSPORTATION
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: Mark A. Van Port Fleet 8-16-11
MARK A. VAN PORT FLEET, P.E. - ENGINEER OF DEVELOPMENT — DATE

CONTRACT FOR:
BRIDGE REPLACEMENT, APPROACH WORK & MAINTAINING TRAFFIC.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT

NO SCALE

DRAWN BY: Erik R. McCowan
CHKD BY: Anne J. Watson CORR BY: ERM
FILE: b01105201.dgn

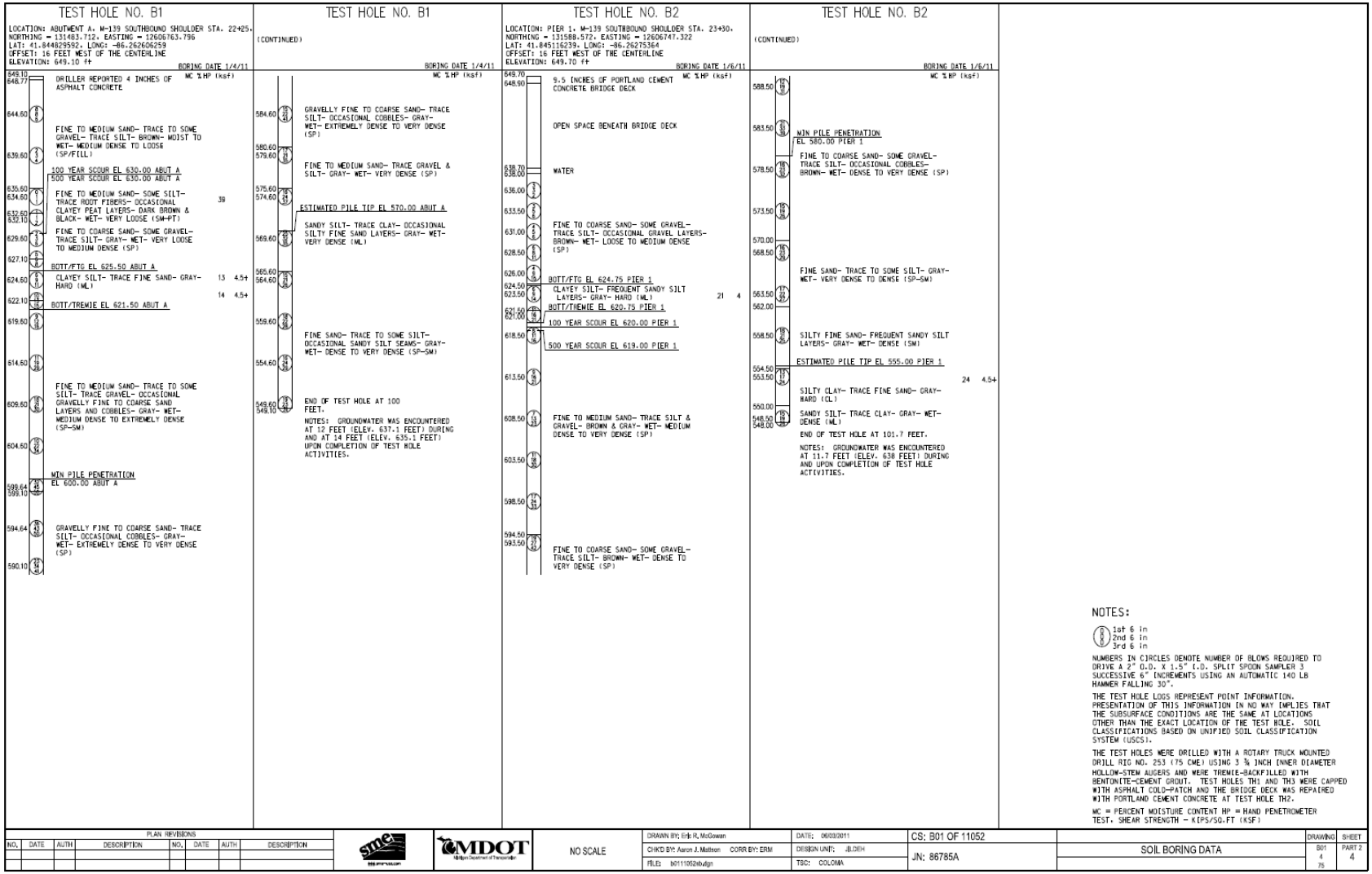
DATE: 06/09/2011
DESIGN SCRIPT: JR DEH
TSC: COLOMA

CS: B01 OF 11052
JN: 86785A

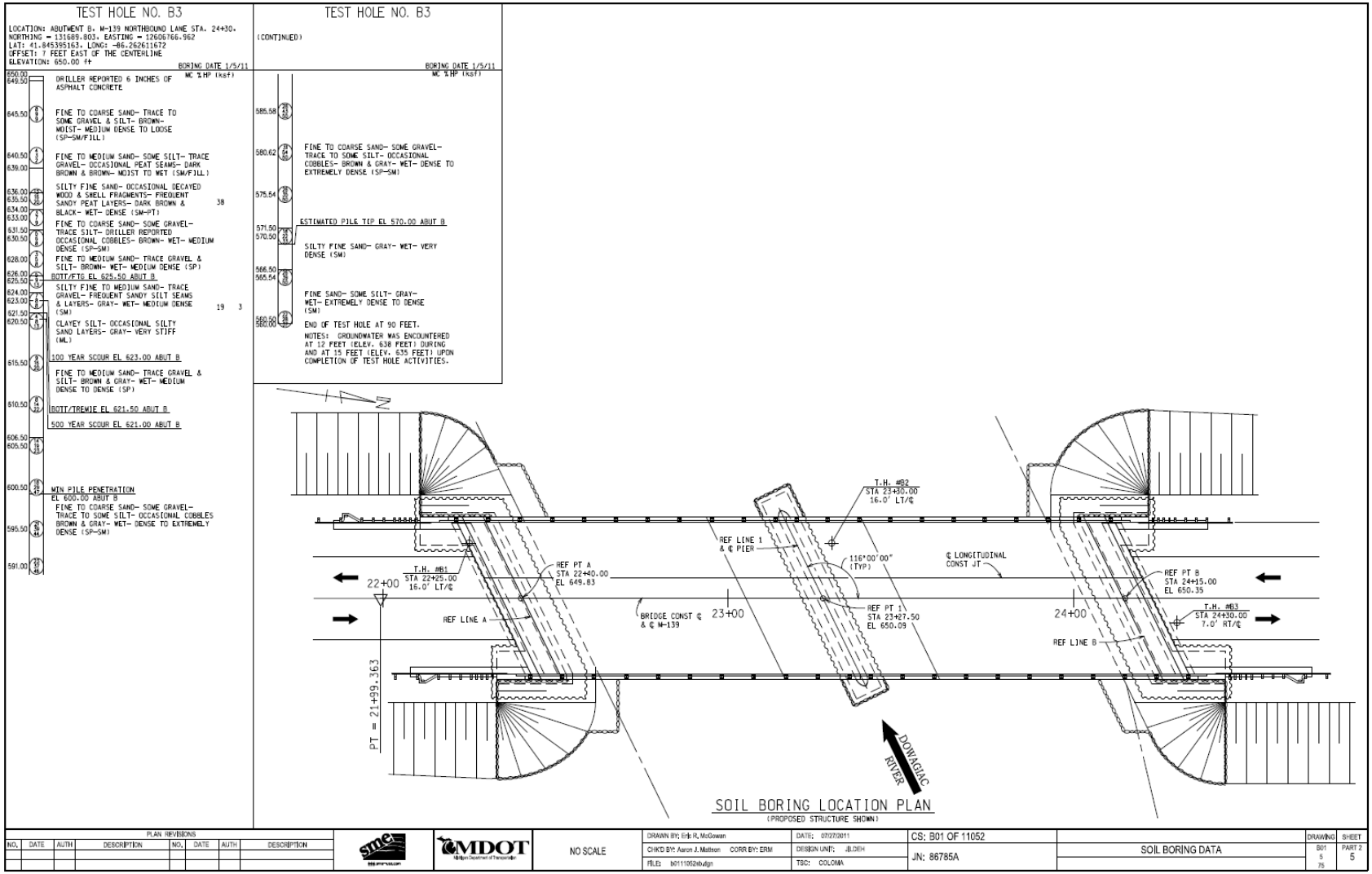
TITLE SHEET

DRAWING: 1
SHEET: 1

C 10 SOIL BORINGS B1 AND B2 – M-139 SITE



C 11 SOIL BORING B3 – M-139 SITE



C 12 SOIL BORING B4 – M-139 SITE

TEST HOLE NO. B4

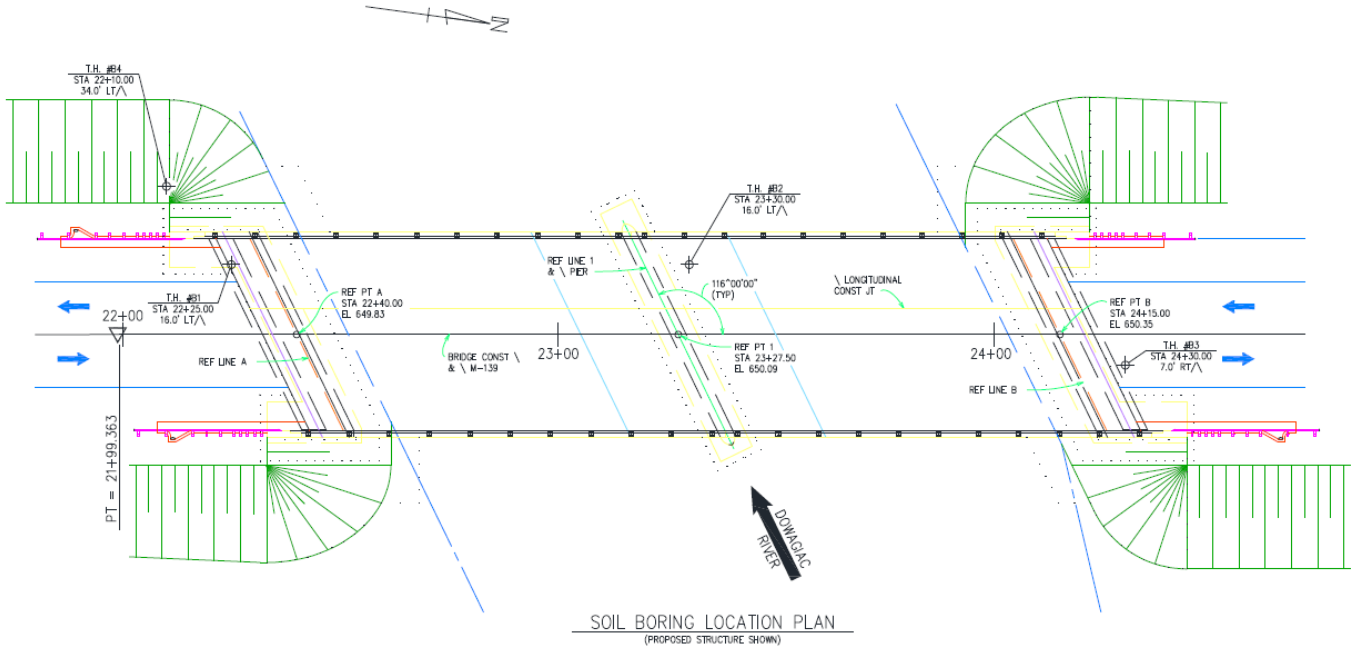
LOCATION STATION: 22+10
34 FT LT OF M-139 CENTERLINE
M-139 OVER THE DOWAGIAC RIVER
GROUND SURFACE ELEVATION: 643.15 FT

643.15		
638.2	1 3 2	LOOSE BROWN FINE & MEDIUM SAND, TRACE GRAVEL & COBBLES
637.2		
633.2	2 3 4	MUCK WITH SILT SEDIMENTS & FIBERS (PETROLEUM ODOR)
628.2	4 5 6	LOOSE GRAY FINE & MEDIUM SAND WITH GRAVEL LAYERS
623.2	3 5 7	MEDIUM DENSE GRAY SILT
622.2		
618.2	2 4 5	LOOSE GRAY FINE & MEDIUM SAND, TRACE GRAVEL
615.2		
613.2	9 8 10	MEDIUM DENSE BROWN FINE & MEDIUM SAND
608.2	10 12	
605.2		
603.2	10 18 24	DENSE BROWN FINE TO COARSE SAND, TRACE GRAVEL, GRAVEL LAYERS
598.2	14 20 23	
593.2	15 17 21	
590.2		
588.2	17 30 37	VERY DENSE BROWN FINE TO COARSE SAND, TRACE GRAVEL, GRAVEL LAYERS
583.2	10 14 24	
578.2	15 18 28	DENSE GRAY SILT WITH CLAY LAYERS
573.2	15 20 30	
572.2		
568.2	15 30 40	VERY DENSE GRAY FINE SILTY SAND WITH SILT LENSES
566.7		E.O.B. 76.5 FT

BORING DATE 9/7/12

FREE WATER WAS FIRST NOTED 5.5 FT BELOW GROUND SURFACE.

WATER LEVEL WAS 5.5 FT BELOW GROUND SURFACE AFTER COMPLETION OF DRILLING. (AUGERS OUT).



SOIL BORING LOCATION PLAN
(PROPOSED STRUCTURE SHOWN)

NOTES:

(0) (0) (0) 1st 6"
2nd 6"
3rd 6"

NUMBERS IN CIRCLES DENOTE NUMBER OF BLOWS REQUIRED TO DRIVE A 2" O.D. (1⅜" I.D.) SPLIT SPOON SAMPLER 3 SUCCESSIVE 6" INCREMENTS USING A 140# AUTOMATIC HAMMER FALLING 30".

CONSISTENCY WAS DETERMINED BY INSPECTION OF SAMPLES AND SUBSTANTIATED BY SOILS RESISTANCE TO DRILLING TOOLS AND LABORATORY TESTING.

THE SOIL BORING LOGS REPRESENT POINT INFORMATION. PRESENTATION OF THIS INFORMATION IN NO WAY IMPLIES THAT SUBSURFACE CONDITIONS ARE THE SAME AT LOCATIONS OTHER THAN THE EXACT LOCATION OF THE BORING.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

DRAWN BY: AJP
CHKD BY: AJP CORR BY:
FILE: b01110052sb_sht1.dgn

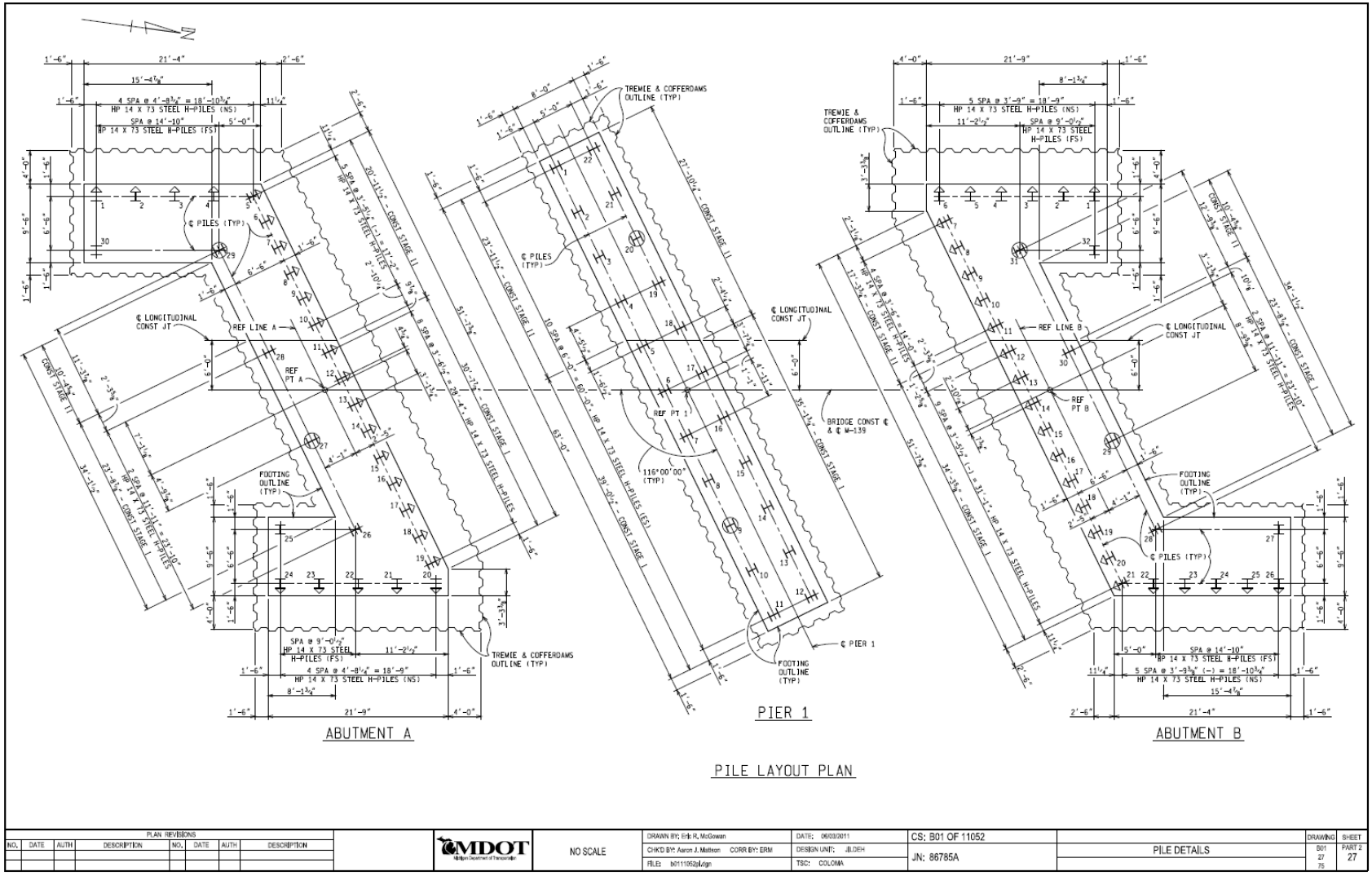
DATE: 10/24/2012
DESIGN UNIT: JILDEH
TSC: COLOMA

CS: B01_OF_11052
JN: 86785A

SOIL_BORING_DATA

DRAWING B01
SHEET PART 2

C 13 PLAN OF PILE LAYOUT – M-139 SITE



PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

DRAWN BY: Eric R. McGowan | DATE: 06/03/2011 | CS: B01 OF 11052

CHK'D BY: Aaron J. Mattson CORR BY: ERM | DESIGN UNIT: JLDEH | JN: 86785A

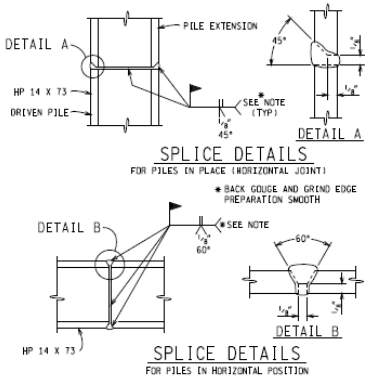
FILE: b0111052pl.dgn | TSC: COLOMA

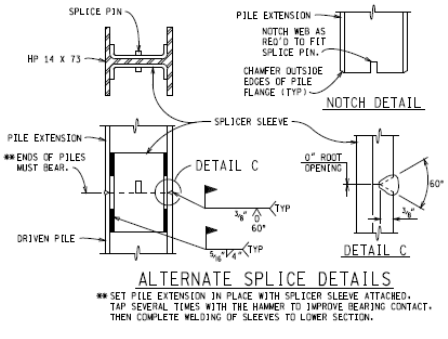
PILE DETAILS

DRAWING	SHEET
B01 27 75	PART 2 27

STEEL H-PILES (HP 14 X 73) FURNISHED AND DRIVEN

LOCATION	PILE TYPE	NUMBER OF PILES	ESTIMATED LENGTH FURNISHED & DRIVEN		PILE POINTS (EACH)	CUT-OFF ELEV.
			EACH LFT	TOTAL LFT		
ABUTMENT A	TEST	2	65	130	2	626.50
	VERTICAL	4	55	220	4	626.50
	BATTERED	24	60	1,440	24	626.50
PIER 1	TEST	2	80	160	2	625.75
	VERTICAL	20	70	1,400	20	625.75
ABUTMENT B	TEST	2	65	130	2	626.50
	VERTICAL	4	55	220	4	626.50
	BATTERED	26	60	1,560	26	626.50
TOTAL		84		5,260	84	





MISCELLANEOUS QUANTITIES

5,260 Ft	Pile, Steel, Furn and Driven, 14 Inch, LRFD
84 Ea	Pile Point, Steel, LRFD
1 LS	Pile Driving Equipment, Furn, LRFD (B01 OF 11052)
6 Ea	Test Pile, Steel, 14 Inch, LRFD

NOTES:

— DENOTES BATTERED PILES.

— DENOTES VERTICAL PILES.

— DENOTES VERTICAL TEST PILES.

DRIVE ALL PILES TO A NOMINAL PILE DRIVING RESISTANCE NOT LESS THAN 500 KIPS. DETERMINE NOMINAL PILE DRIVING RESISTANCE (Rndr) USING THE FHWA MODIFIED GATES DYNAMIC FORMULA.

THE ESTIMATED PILE LENGTH IS BASED ON THE STATIC ANALYSIS.

BATTER PILES SHALL BE DRIVEN TO A 3V:1H BATTER ANGLE.

STEEL PILES SHALL BE HP 14 X 73.

USE STEEL FOR H-PILES AND SPLICES THAT HAVE A YIELD STRENGTH NOT LESS THAN 50,000 PSI.

THE ESTIMATED LOSS OF NOMINAL PILE RESISTANCE DUE TO SCOUR AFTER DRIVING IS 0 KIPS.

THE FACTORED PILE RESISTANCE AVAILABLE TO RESIST ALL FACTORED LOADS IS EQUAL TO 50 PERCENT OF NOMINAL PILE DRIVING RESISTANCE.

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

MDOT Michigan Department of Transportation

NO SCALE

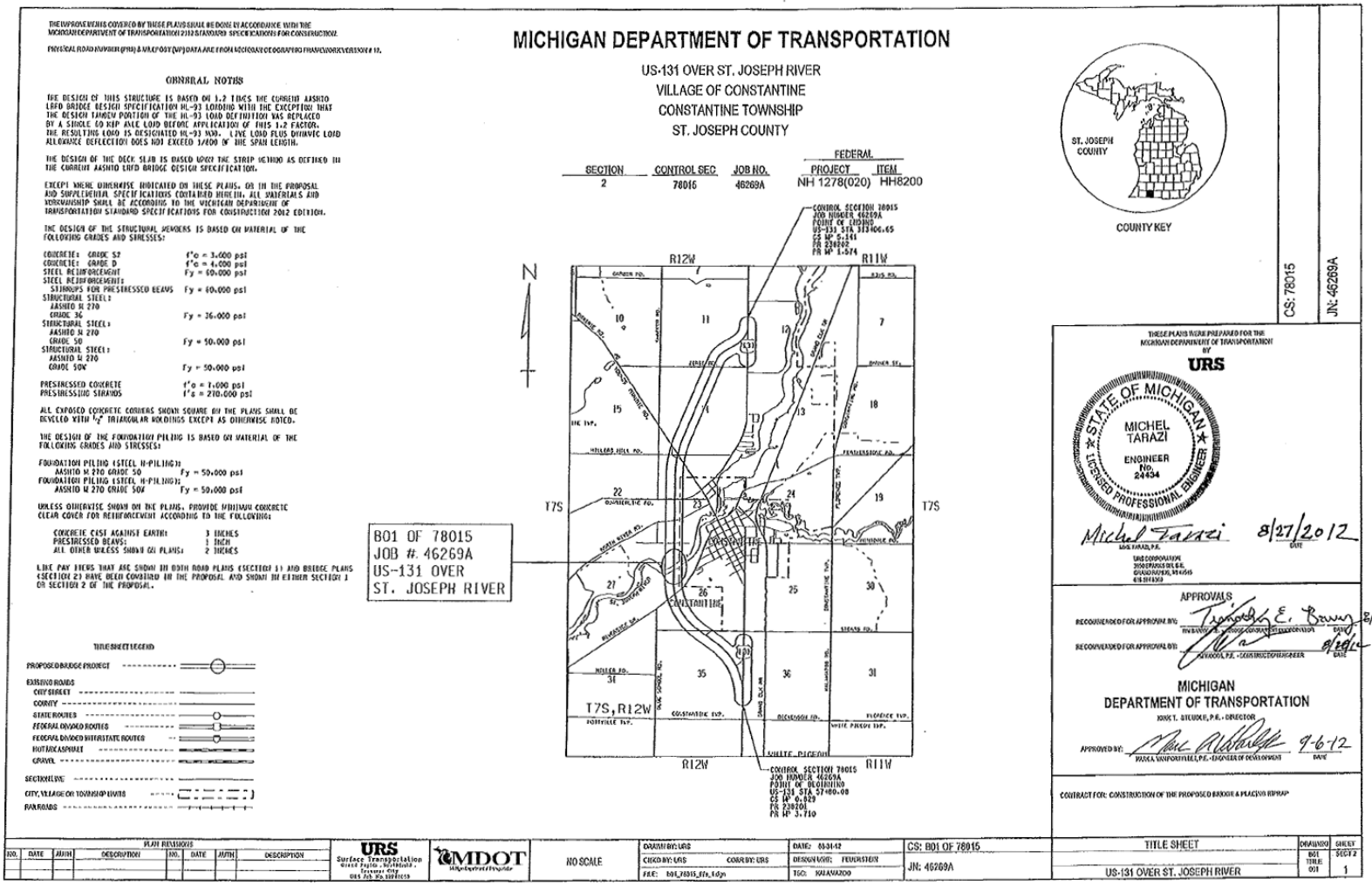
DRAWN BY: Eric R. McGowan | DATE: 07/27/2011
CHK'D BY: Aaron J. Mattson CORR BY: ERM | DESIGN UNIT: JLDEH
FILE: b0111052pl.dgn | TSC: COLOMA

CS: B01 OF 11052
JN: 86785A

PILE DETAILS

DRAWING: B01 28 75
SHEET: PART 2 28

C 15 LOCATION – US-131 SITE



THE IMPROVEMENTS COVERED BY THESE PLANS SHALL BE DONE IN ACCORDANCE WITH THE MICHIGAN DEPARTMENT OF TRANSPORTATION'S 2012 STANDARD SPECIFICATIONS FOR CONSTRUCTION.

PHYSICAL ROAD NUMBER (PRN) & MILEPOST (MP) DATA ARE FROM MICHIGAN'S GEOGRAPHIC FRAMEWORK VERSION 11.

GENERAL NOTES

THE DESIGN OF THIS STRUCTURE IS BASED ON 1.2 TIMES THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION HL-93 LOADING WITH THE EXCEPTION THAT THE DESIGN TANDEM PORTION OF THE HL-93 LOAD DEFINITION WAS REPLACED BY A SINGLE 60 KIP AXLE LOAD BEFORE APPLICATION OF THE 1.2 FACTOR. THE RESULTING LOAD IS DESIGNATED HL-93 M30. LIVE LOAD PLUS DYNAMIC LOAD ALLOWANCE DEFLECTION DOES NOT EXCEED 1/800 OF THE SPAN LENGTH.

THE DESIGN OF THE DECK SLAB IS BASED UPON THE STRIP METHOD AS DEFINED IN THE CURRENT AASHTO LRFD BRIDGE DESIGN SPECIFICATION.

EXCEPT WHERE OTHERWISE INDICATED ON THESE PLANS, OR IN THE PROPOSAL AND SUPPLEMENTAL SPECIFICATIONS CONTAINED HEREIN, ALL MATERIALS AND WORKMANSHIP SHALL BE ACCORDING TO THE MICHIGAN DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR CONSTRUCTION 2012 EDITION.

THE DESIGN OF THE STRUCTURAL MEMBERS IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

CONCRETE: GRADE S7	f'c = 3,000 psi
CONCRETE: GRADE D	f'c = 4,000 psi
STEEL REINFORCEMENT	Fy = 60,000 psi
STEEL REINFORCEMENT: STIRRUPS FOR PRESTRESSED BEAMS	Fy = 60,000 psi
STRUCTURAL STEEL: AASHTO M 270 GRADE 36	Fy = 36,000 psi
STRUCTURAL STEEL: AASHTO M 270 GRADE 50	Fy = 50,000 psi
STRUCTURAL STEEL: AASHTO M 270 GRADE 50W	Fy = 50,000 psi
PRESTRESSED CONCRETE	f'c = 7,000 psi
PRESTRESSED STRANDS	f's = 270,000 psi

ALL EXPOSED CONCRETE CORNERS SHOWN SQUARE ON THE PLANS SHALL BE BEVELED WITH ½" TRIANGULAR MOLDINGS EXCEPT AS OTHERWISE NOTED.

THE DESIGN OF THE FOUNDATION PILING IS BASED ON MATERIAL OF THE FOLLOWING GRADES AND STRESSES:

FOUNDATION PILING (STEEL H-PILING): AASHTO M 270 GRADE 50	Fy = 50,000 psi
FOUNDATION PILING (STEEL H-PILING): AASHTO M 270 GRADE 50W	Fy = 50,000 psi

UNLESS OTHERWISE SHOWN ON THE PLANS, PROVIDE MINIMUM CONCRETE CLEAR COVER FOR REINFORCEMENT ACCORDING TO THE FOLLOWING:

CONCRETE CAST AGAINST EARTH:	3 INCHES
PRESTRESSED BEAMS:	1 INCH
ALL OTHER UNLESS SHOWN ON PLANS:	2 INCHES

LIKE PAY ITEMS THAT ARE SHOWN IN BOTH ROAD PLANS (SECTION 1) AND BRIDGE PLANS (SECTION 2) HAVE BEEN COMBINED IN THE PROPOSAL AND SHOWN IN EITHER SECTION 1 OR SECTION 2 OF THE PROPOSAL.

TITLE SHEET LEGEND

PROPOSED BRIDGE PROJECT

EXISTING ROADS
CITY STREET
COUNTY
STATE ROUTES
FEDERAL DIVIDED ROUTES
FEDERAL DIVIDED INTERSTATE ROUTES
HOT MIX ASPHALT
GRAVEL
SECTION LINE
CITY, VILLAGE OR TOWNSHIP LIMITS
RAILROADS

B01 OF 78015
JOB #. 46269A
US-131 OVER
ST. JOSEPH RIVER

MICHIGAN DEPARTMENT OF TRANSPORTATION

US-131 OVER ST. JOSEPH RIVER
VILLAGE OF CONSTANTINE
CONSTANTINE TOWNSHIP
ST. JOSEPH COUNTY

SECTION	CONTROL SEC	JOB NO.	FEDERAL PROJECT	ITEM
2	78015	46269A	NH 1278(020)	HH8200

CONTROL SECTION 78015
JOB NUMBER 46269A
POINT OF BEGINNING
US-131 STA 513406.65
CS MP 5.141
FR 238202
FR MP 1.574

R12W R11W T7S T7S T7S,R12W

CONTROL SECTION 78015
JOB NUMBER 46269A
POINT OF TERMINUS
US-131 STA 574+00.08
CS MP 6.029
FR 239201
FR MP 3.710

ST. JOSEPH COUNTY

COUNTY KEY

CS: 78015

JN: 46269A

THESE PLANS WERE PREPARED FOR THE MICHIGAN DEPARTMENT OF TRANSPORTATION BY

URS

STATE OF MICHIGAN
MICHEL TARAZI
ENGINEER
No. 24434
LICENSED PROFESSIONAL ENGINEER

Michel Tarazi 8/27/2012
MICHEL TARAZI, P.E. DATE

URS CORPORATION
3950 PRIMEVAL BLVD.
OKEMOS, MICHIGAN 48864
517-381-8300

APPROVALS

RECOMMENDED FOR APPROVAL BY: Timothy E. Brown 8/30/12
TIMOTHY E. BROWN, P.E. - CONSTRUCTION ENGINEER DATE

RECOMMENDED FOR APPROVAL BY: 8/28/12
MICHAEL, P.E. - CONSTRUCTION ENGINEER DATE

MICHIGAN
DEPARTMENT OF TRANSPORTATION
KIRK T. STEUDLE, P.E. - DIRECTOR

APPROVED BY: 9-6-12
MARK VAN PORTFLIET, P.E. - ENGINEER OF DEVELOPMENT DATE

CONTRACT FOR: CONSTRUCTION OF THE PROPOSED BRIDGE & PLACED RIPRAP

PLAN REVISIONS							
NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

URS Surface Transportation

MDOT

NO SCALE

DRAWN BY: URS
CHKD BY: URS CODED BY: URS
FILE: b01_78015_ttl_1.dgn

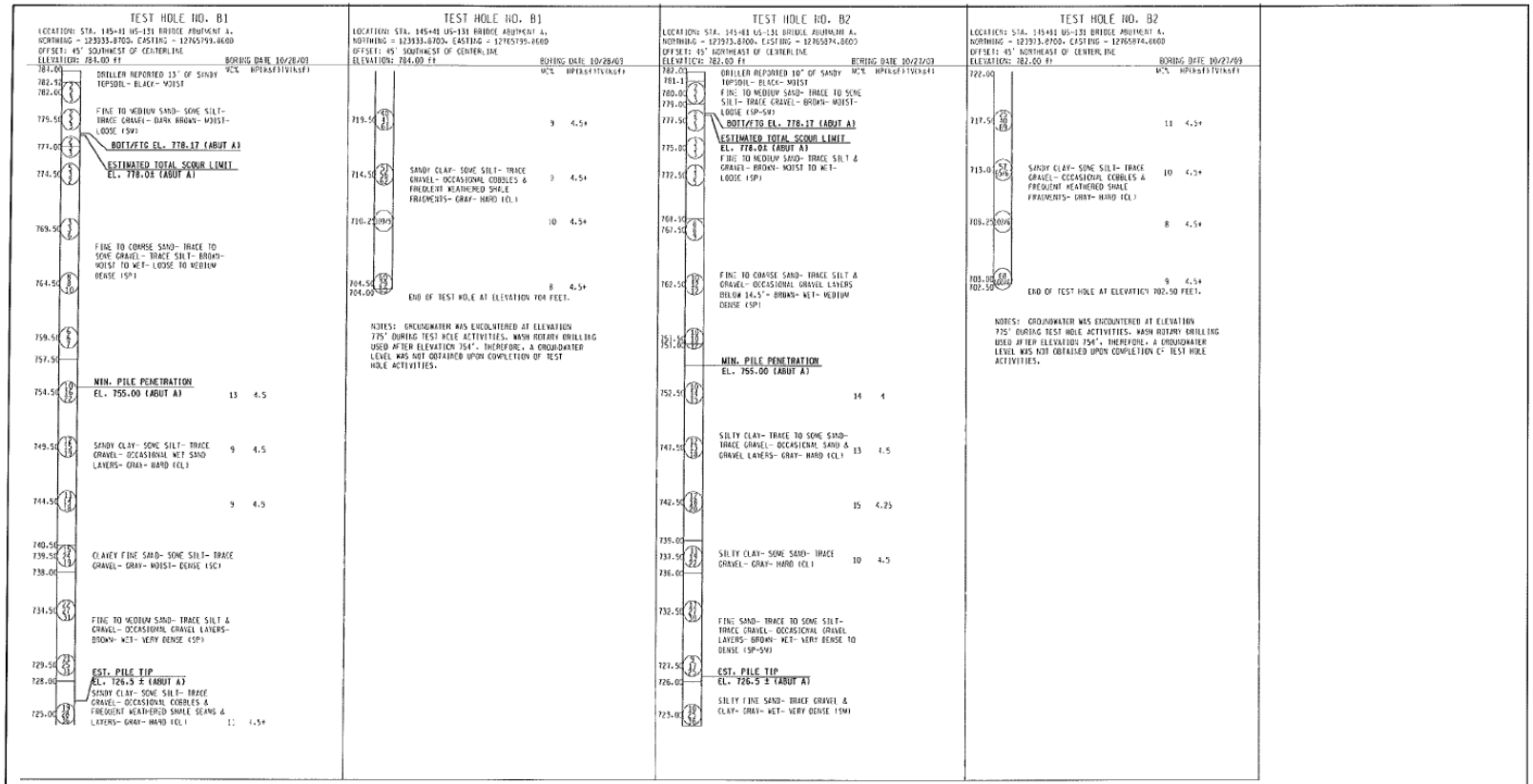
DATE: 08-31-12
DESIGN VOID: FEDERSTEIN
TSC: KALAMAZOO

CS: B01 OF 78015
JN: 46269A

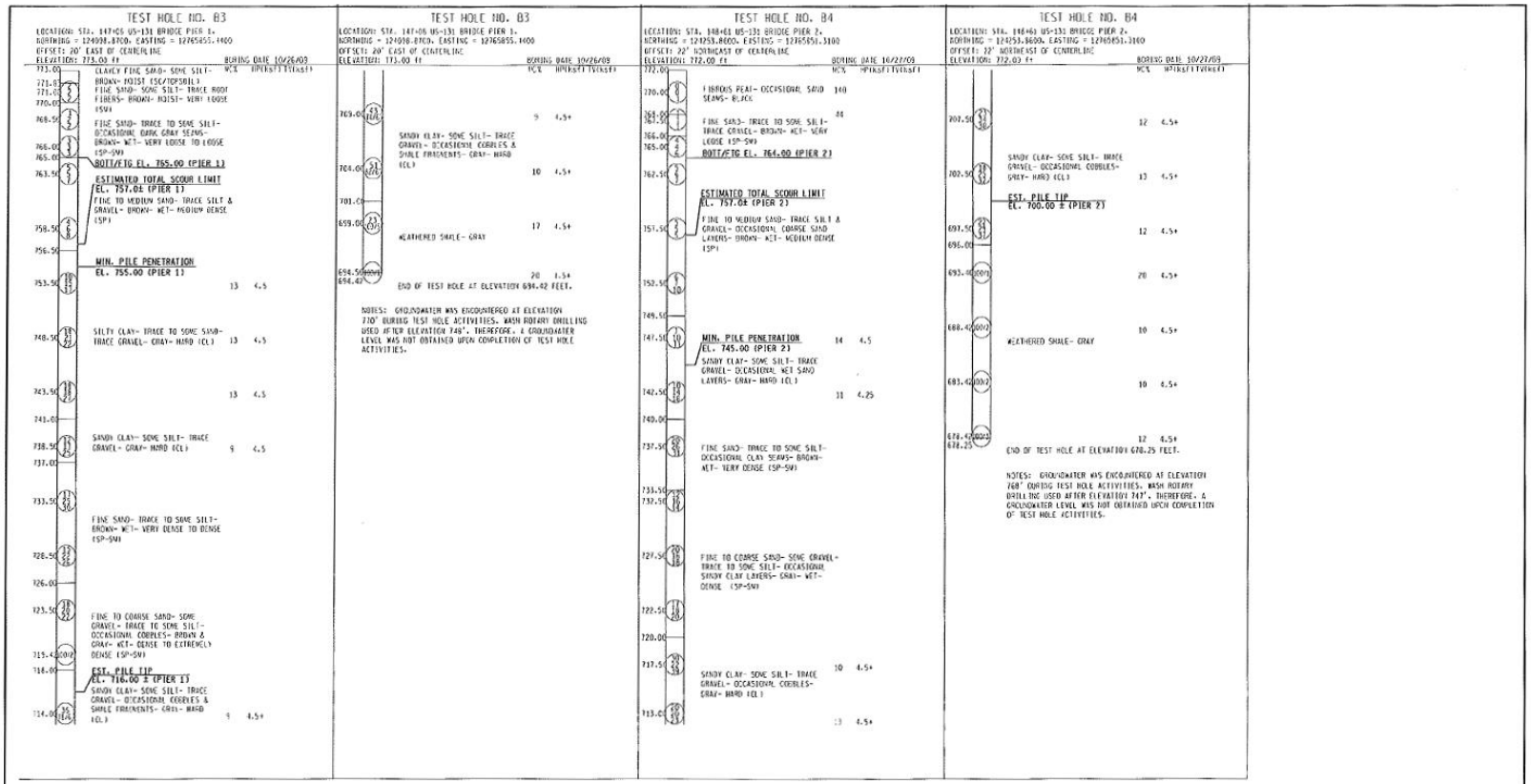
TITLE SHEET
US-131 OVER ST. JOSEPH RIVER

DRAWING: B01 TITLE 001
SHEET: SECT 2 1

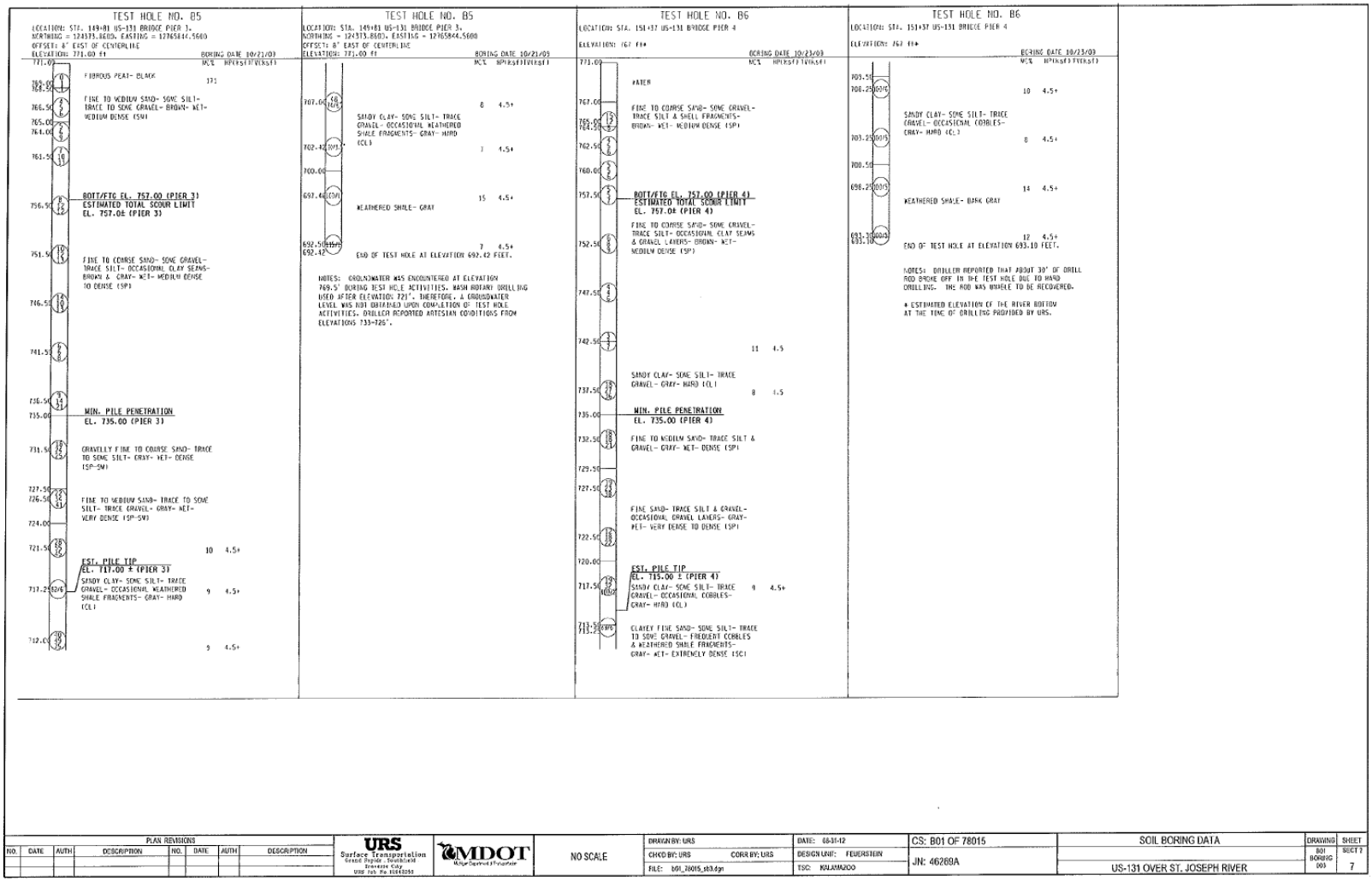
C 16 SOIL BORINGS B1 AND B2 – US-131 SITE



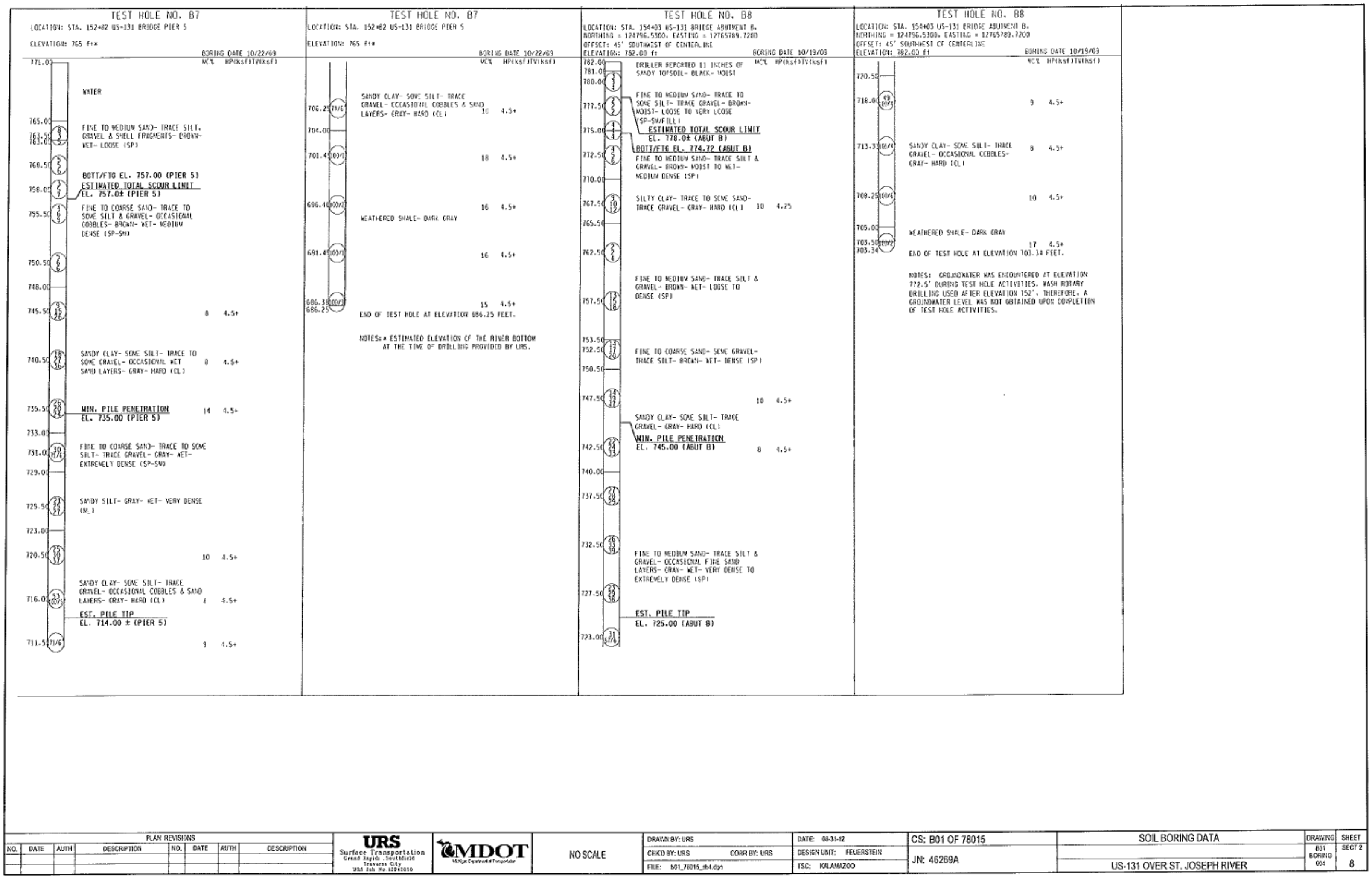
C 17 SOIL BORINGS B3 AND B4 – US-131 SITE



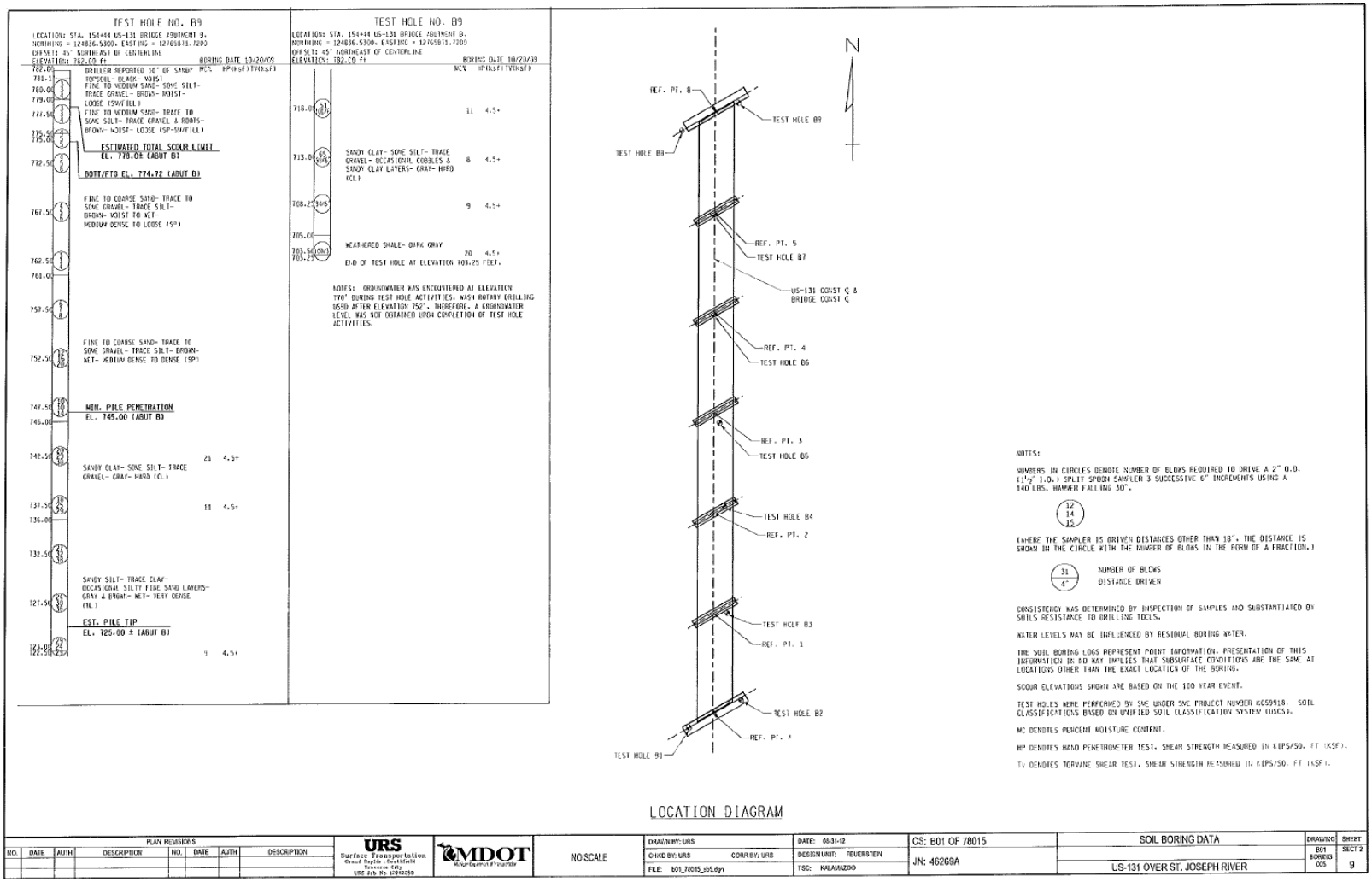
C 18 SOIL BORINGS B5 AND B6 – US-131 SITE



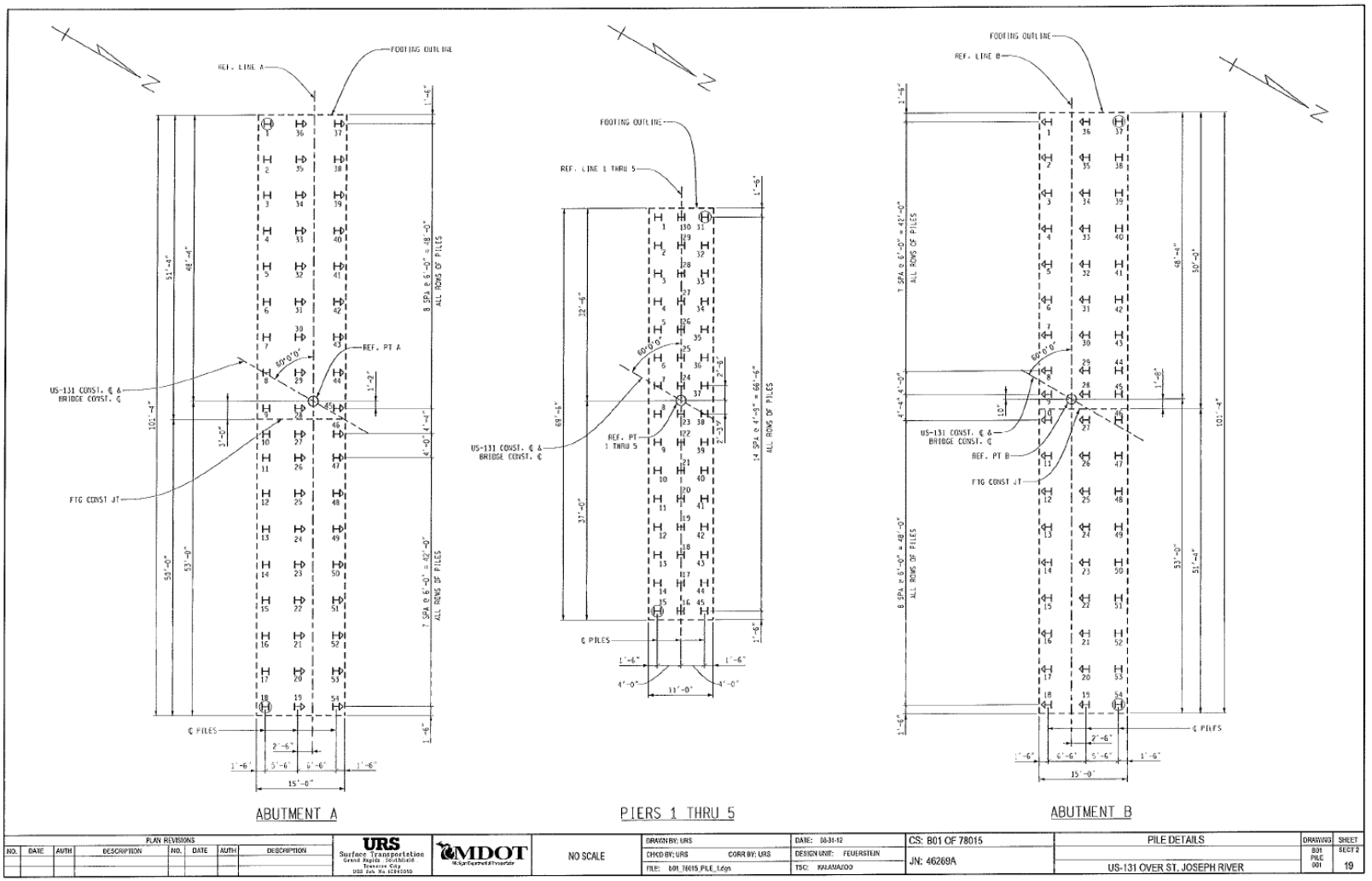
C 19 SOIL BORINGS B7 AND B8 – US-131 SITE



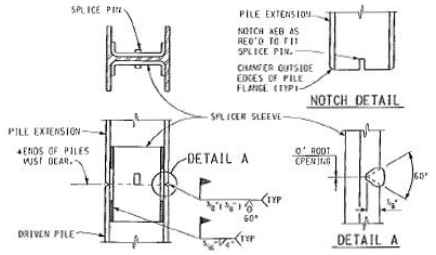
C 20 SOIL BORING B9 – US-131 SITE



C 21 PLAN OF PILE LAYOUT – US-131 SITE

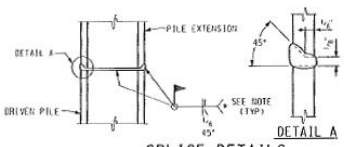


C 22 PILE DETAILS – US-131 SITE



ALTERNATE SPLICE DETAILS

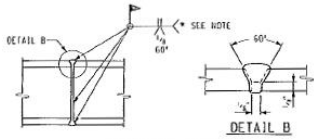
*SET PILE EXTENSION IN PLACE WITH SPLICE PLATES ATTACHED. TAP SEVERAL TIMES WITH THE HAMMER TO IMPROVE BEARING CONTACT. THEN COMPLETE WELDING OF PLATES TO THE LOWER SECTION.



SPLICE DETAILS

FOR PILES IN PLACE (HORIZONTAL JOINT)

* BACK GOUGE AND GRIND EDGE PREPARATION SMOOTH



SPLICE DETAILS

FOR PILES IN HORIZONTAL POSITION

* BACK GOUGE AND GRIND EDGE PREPARATION SMOOTH

MISCELLANEOUS QUANTITIES

AMOUNT	UNIT	ITEM
1	LS	Pile Driving Equipment, Furn (B01 of 78015)
16925	Ft	Pile, Steel, Furn and Driven, 14 inch
333	Ea	Pile Point, Steel
7	Ea	Test Pile, Furn Dyncmic Analysis Equipment
14	Ea	Test Pile, Dynamic Analysis

HP 14 x 73 PILES							
LOCATION	PILE TYPE	NUMBER OF PILES	ESTIMATED LENGTH FURNISHED & DRIVEN EACH LFT	ESTIMATED LENGTH FURNISHED & DRIVEN TOTAL LFT	PILE POINTS (EACH)	CUT-OFF ELEV.	Rndr (KIPS)
ABUT A	TEST	2	60	120	2	778.67	
	VERTICAL	16	50	800	16	778.67	350
	BATTERED	36	55	1980	36	778.67	
PIER 1	TEST	2	60	120	2	766.08	
	VERTICAL	43	50	2150	43	766.08	
PIER 2	TEST	2	75	150	2	765.00	
	VERTICAL	43	65	2795	43	765.00	
PIER 3	TEST	2	50	100	2	758.00	500
	VERTICAL	43	40	1720	43	758.00	
PIER 4	TEST	2	55	110	2	758.00	
	VERTICAL	43	45	1935	43	758.00	
PIER 5	TEST	2	55	110	2	758.00	
	VERTICAL	43	45	1935	43	758.00	
ABUT B	TEST	2	60	120	2	775.22	
	VERTICAL	16	50	800	16	775.22	350
	BATTERED	36	55	1980	36	775.22	
TOTAL		333		16,925	333		

NOTES:

DRIVE ALL PILES TO A NOMINAL PILE DRIVING RESISTANCE NOT LESS THAN 500 KIPS AT PIERS. DRIVE ALL PILES TO A NOMINAL PILE DRIVING RESISTANCE NOT LESS THAN 350 KIPS AT ABUTMENTS. DETERMINE NOMINAL PILE DRIVING RESISTANCE (RNDR) USING DYNAMIC TEST WITH SIGNAL MATCHING (PDA TESTING).

BATTER PILES FOR ABUTMENTS A AND B SHALL BE DRIVEN TO A 2.5V:1H BATTER ANGLE.

THE ESTIMATED PILE LENGTH IS BASED ON THE STATIC ANALYSIS.

THE ESTIMATED LOSS OF NOMINAL PILE RESISTANCE DUE TO SCOUR AFTER DRIVING IS 0 KIPS.

THE FACTORED PILE RESISTANCE AVAILABLE TO RESIST ALL FACTORED LOADS IS EQUAL TO 65 PERCENT OF NOMINAL PILE DRIVING RESISTANCE.

STEEL PILES SHALL BE HP 14 X 73.

USE STEEL FOR H-PILES AND SPLICES THAT HAVE A YIELD STRENGTH NOT LESS THAN 50,000 PSI.

AT THE CONTRACTORS DISCRETION, A WELDING QUALITY CONTROL PLAN CONFORMING TO SECTION 707.03.D.8.B OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION SHALL BE SUBMITTED, AND IS TO INCLUDE SUFFICIENT DETAIL FOR INSPECTION AND ACCEPTANCE OF THE WELD PER SECTION 707.03.D.4.C OF THE STANDARD SPECIFICATIONS FOR CONSTRUCTION. THE CONTRACTOR SHALL ADHERE TO THIS PLAN FOR ALL WELDED PILE SPLICES.

VISUAL INSPECTIONS OF ALL WELDS WILL BE USED AS THE PRIMARY ACCEPTANCE METHOD. THE CONTRACTOR CAN REQUEST NON-DESTRUCTIVE TESTS BE CONDUCTED ON WELDS THAT FAIL VISUAL INSPECTION. IF THE WELD PASSES THE NON-DESTRUCTIVE TEST, THE DEPARTMENT WILL PAY FOR THE TEST. IF THE WELD FAILS THE NON-DESTRUCTIVE TEST, THE CONTRACTOR SHALL PAY FOR THE TEST, AND ANY AND ALL CORRECTIVE ACTION.

THE DEPARTMENT WILL CONDUCT ONE RANDOM WELD QUALITY ASSURANCE NON-DESTRUCTIVE TEST ON THIS PROJECT. IF THE WELD DOES NOT PASS, ANY AND ALL CORRECTIVE ACTION SHALL BE DONE AT THE CONTRACTORS EXPENSE, AND THE DEPARTMENT RESERVES THE RIGHT TO TEST ADDITIONAL WELDS.

H --DENOTES VERTICAL PILES.

H --DENOTES BATTERED PILES.

H --DENOTES VERTICAL TEST PILES.

PLAN REVISIONS

NO.	DATE	AUTH	DESCRIPTION	NO.	DATE	AUTH	DESCRIPTION

URS Corporation, Grand Rapids, Michigan, Traverse City, URS Job No. 26410050

MDOT Michigan Department of Transportation

NO SCALE

DRAWN BY: URS | CHK'D BY: URS | CORR'D BY: URS | FILE: B01_78015_pda_2.dgn

DATE: 03-31-12 | DESIGN UNIT: FEVERSTEIN | TSC: KALAMAZOO

CS: B01 OF 78015 | JN: 46269A

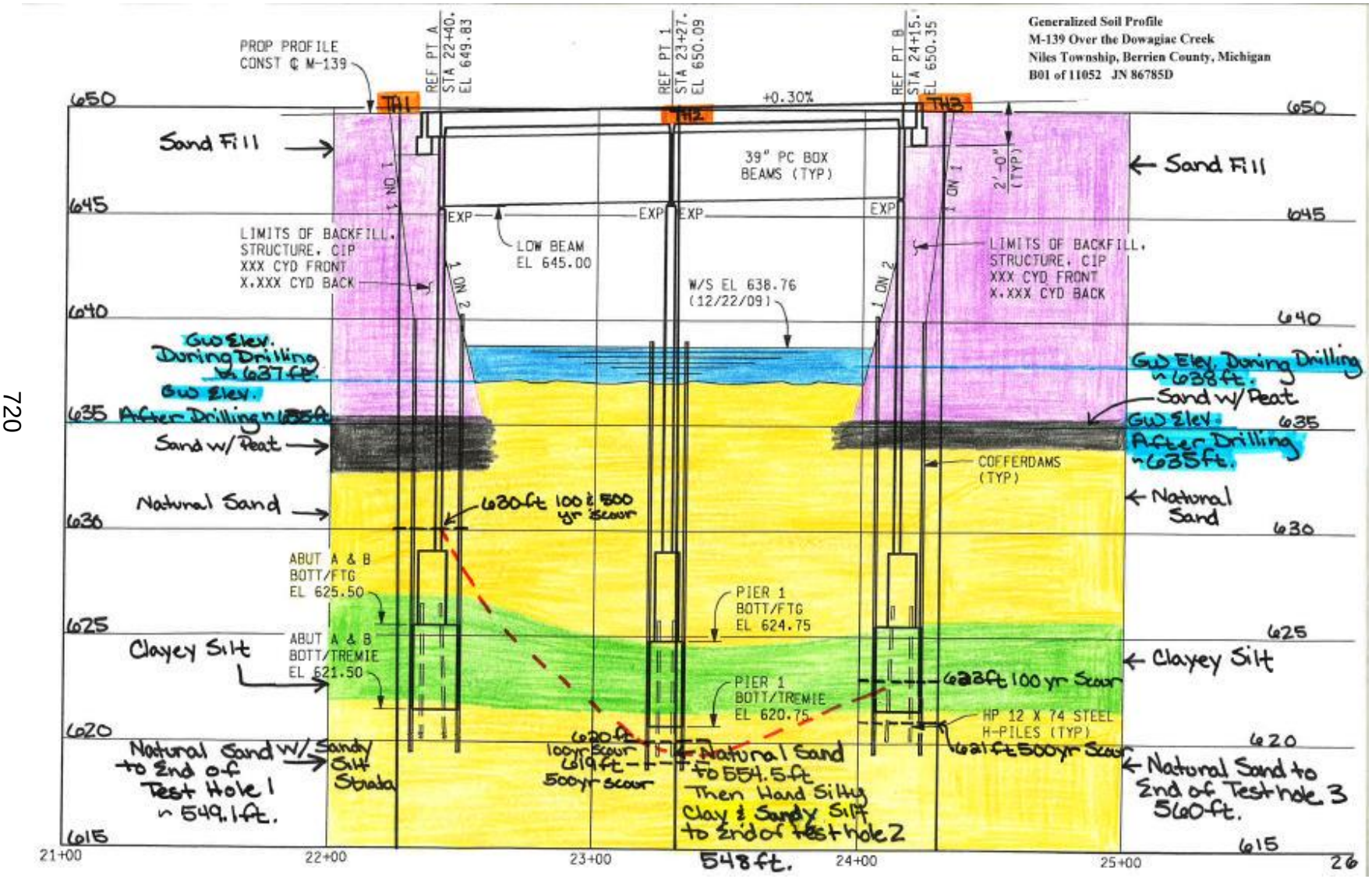
PILE DETAILS

US-131 OVER ST. JOSEPH RIVER

DRAWING: B01 PILE 092 | SHEET: SECT 2 | 20

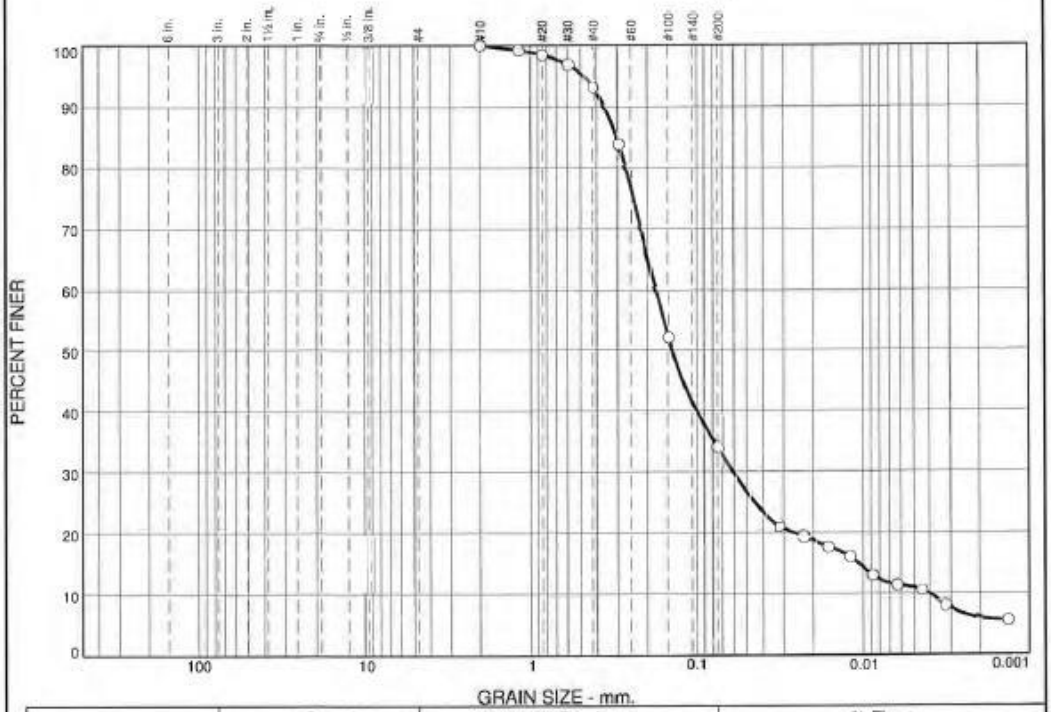
Appendix D GEOTECHNICAL EVALUATION RESULTS FOR M-139 SITE PROVIDED BY SME, INC.

D 1 GENERALIZED SOIL PROFILE – M-139 SITE



D 2 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#1 – M-139 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	0.0	0.0	6.8	59.2	23.0	11.0

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.3092	0.1790	0.1416	0.0606	0.0107	0.0041	5.04	44.00

Material Description	USCS	AASHTO
○ FINE TO MEDIUM SAND-SOME SILT-OCCASIONAL CLAYEY PEAT LAYERS-BR & BL	SM-PT	

Project No. KG62691 **Client:** MDOT C AND T GEOTECHNICAL SERVICES
Project: M-139 OVER DOWAGIAC CREEK

○ **Location:** TEST HOLE TH1 SAMPLE 3 FROM ELEVATION 635.5 TO 634.0 FEET

Remarks:
○ MDOT CS: B01 OF 11052
JN:86758D

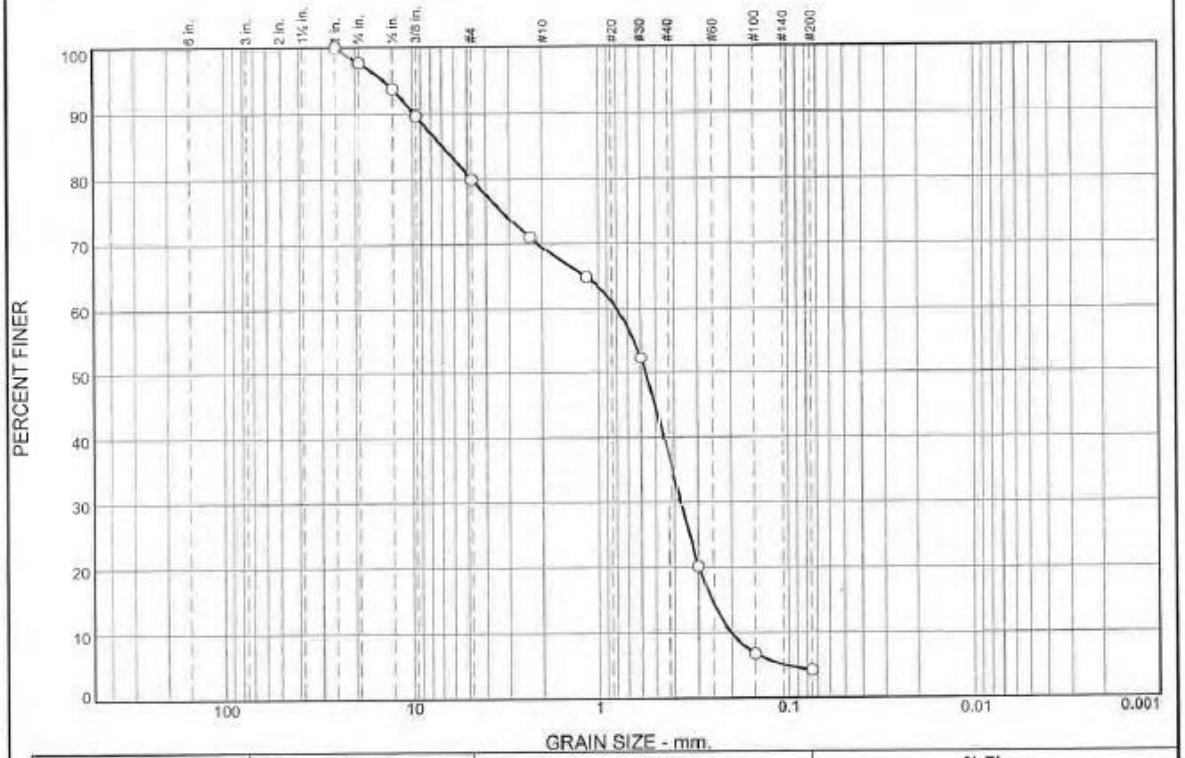
Soil and Materials Engineers, Inc.

Figure

Tested By: ERROL GILBERT **Checked By:** MYNDI BACON, PE

D 3 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#2 – M-139 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	2.3	17.8	10.5	32.9	32.3	4.2	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			6.9110	0.7950	0.5647	0.3740	0.2568	0.2032	0.87	3.91

Material Description	USCS	AASHTO
○ Fine to Coarse Sand, Some Gravel, Trace Silt, Brown	SP	

Project No. KG62691 **Client:** MDOT C and T Geotechnical Services

Project: M-139 Over Dowagiac Creek

Niles Township, MI

○ **Location:** Test Hole TH2 Sample 3 From Elevation 632 to 630.5 Feet

Remarks:

○ MDOT CS: B01 of 11052

JN:86758D

Soil and Materials Engineers, Inc.

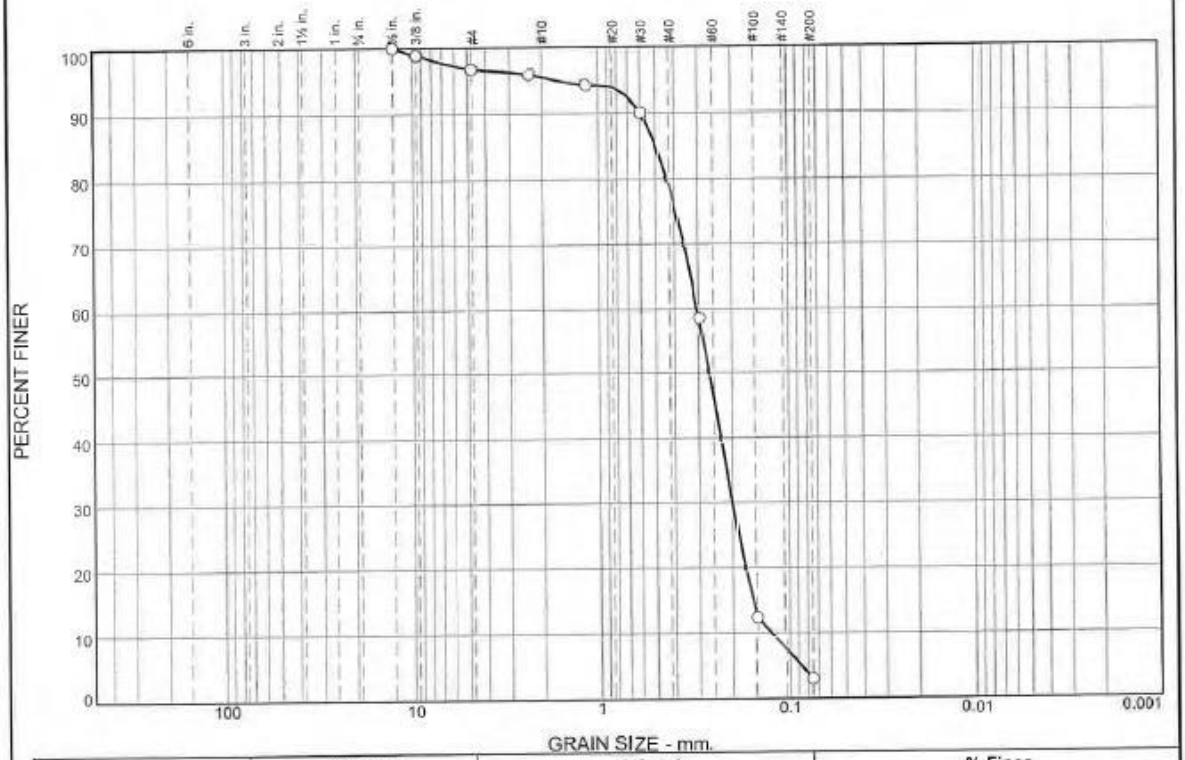
Plymouth, MI

Figure

Tested By: Errol Gilbert **Checked By:** Myndi Bacon, PE

D 4 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#3 – M-139 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	3.2	1.3	17.1	75.4	3.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.5016	0.3063	0.2656	0.2020	0.1582	0.1249	1.07	2.45

Material Description	USCS	AASHTO
○ Fine to Medium Sand, Trace Gravel & Silt, Brown	SP	

Project No. KG62691 **Client:** MDOT C and T Geotechnical Services

Project: M-139 Over Dowagiac Creek

Niles Township, MI

○ **Location:** Test Hole TH3 Sample 6 from Elevation 629 to 627.5 Feet

Remarks:

○ MDOT CS: B01 of 11052 JN: 86785D

Soil and Materials Engineers, Inc.

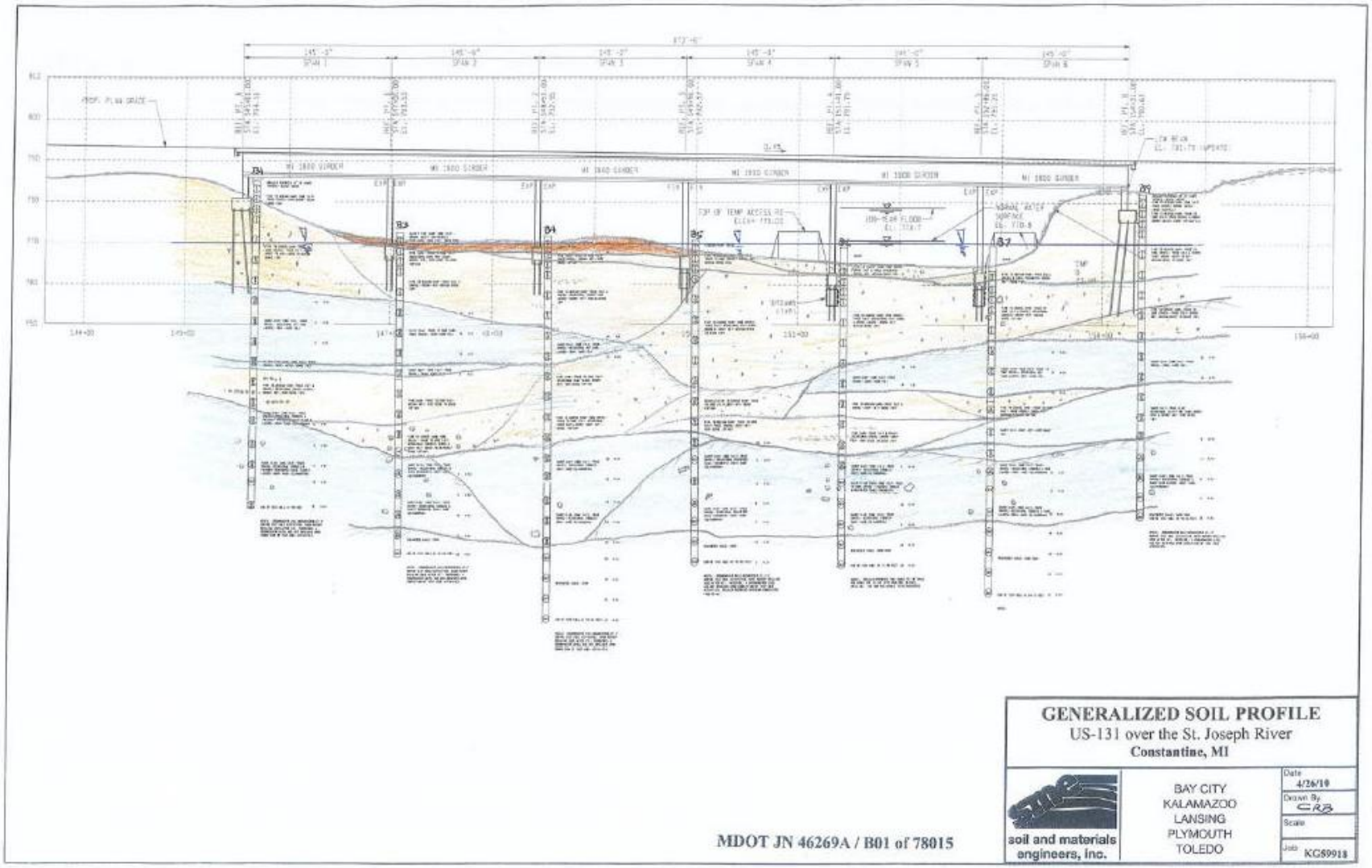
Plymouth, MI

Figure

Tested By: Errol Gilbert **Checked By:** Myndi Bacon, PE

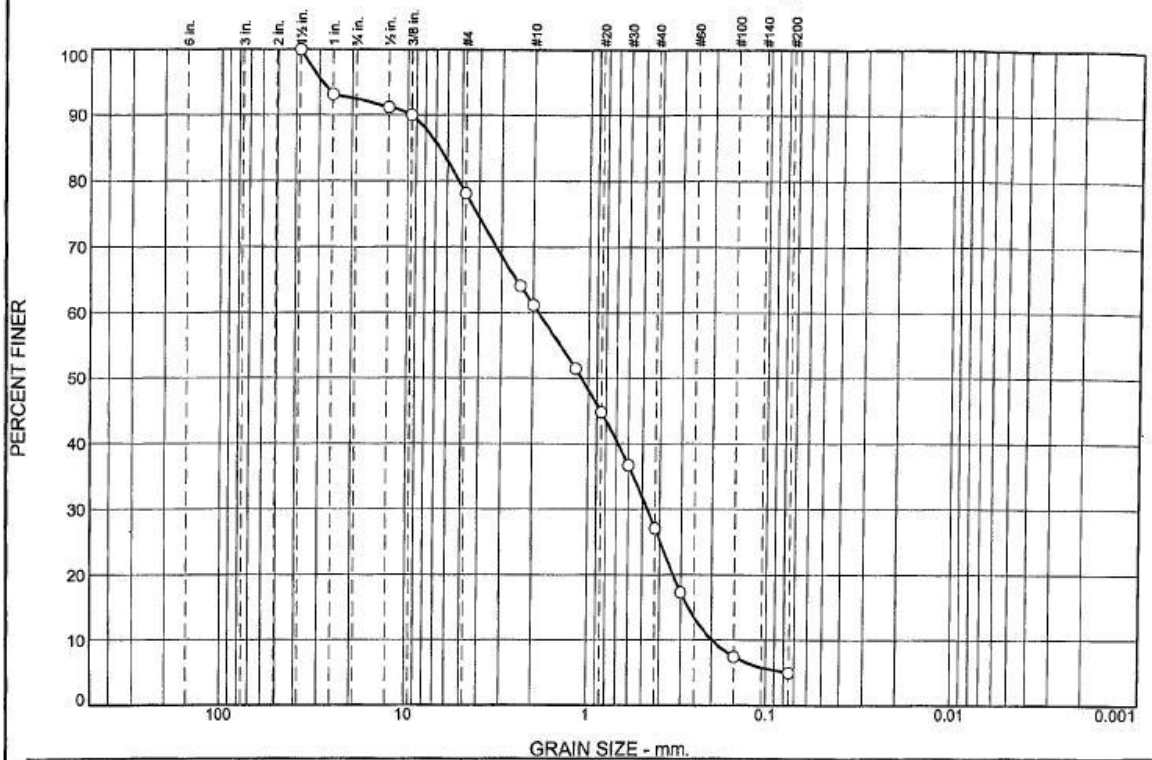
Appendix E GEOTECHNICAL EVALUATION RESULTS FOR US-131 SITE PROVIDED BY SME, INC.

E 1 GENERALIZED SOIL PROFILE – US-131 SITE



E 2 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#5 – US-131 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	7.5	14.4	17.0	34.0	22.1	5.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			6.6622	1.8757	1.0971	0.4695	0.2712	0.1986	0.59	9.45

Material Description	USCS	AASHTO
○ Fine to Coarse Sand, Some Gravel, Trace Silt	SP	

Project No. KG59918 **Client:** URS Corporation
Project: US-131 Over the St. Joseph River
MDOT Bridge B01 of 78015 MDOT JN 46269A
○ **Sample Number:** B5 (765'-736')

Remarks:

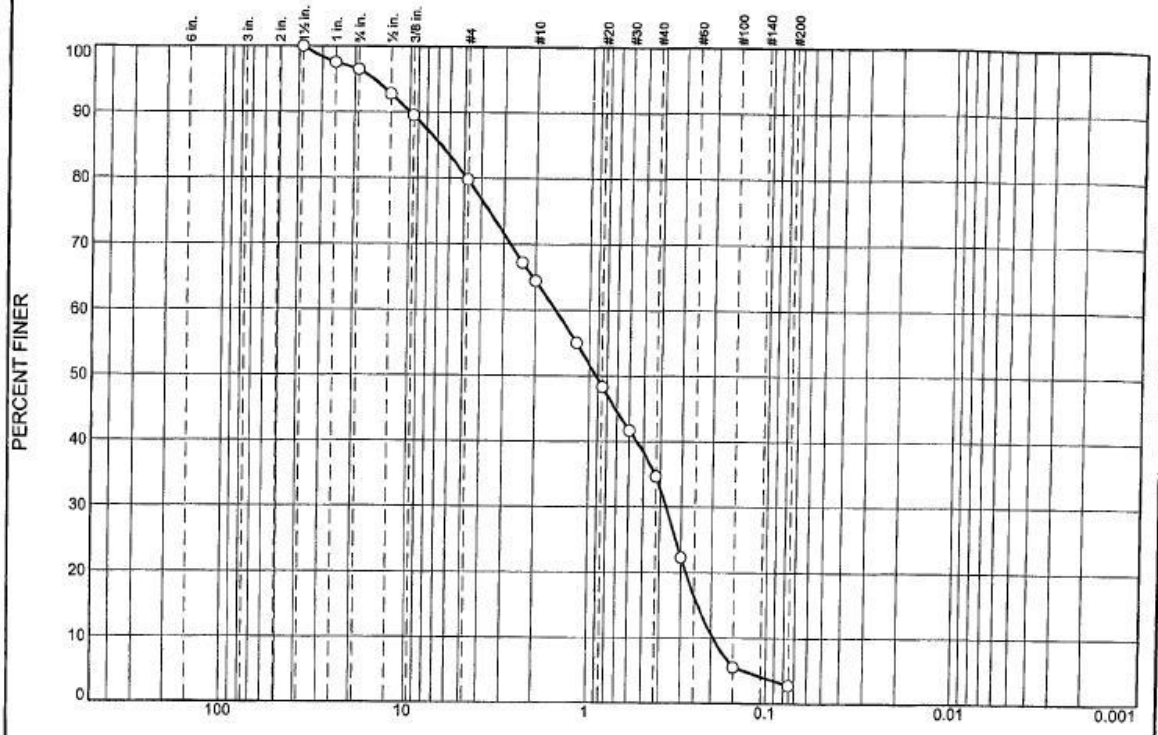
Soil and Materials Engineers, Inc.
Plymouth, MI

Figure

Tested By: C. Krug **Checked By:** Melinda Bacon, PE

E 3 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#6 – US-131 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	3.5	16.8	15.3	29.8	31.8	2.8	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			6.6929	1.5441	0.9227	0.3692	0.2394	0.1958	0.45	7.89

Material Description	USCS	AASHTO
○ Fine to Coarse Sand, Some Gravel, Trace Silt	SP	

Project No. KG59918 **Client:** URS Corporation
Project: US-131 Over the St. Joseph River
MDOT Bridge B01 of 78015 MDOT JN 46269A
○ **Sample Number:** B6 (763.5'-747')

Remarks:

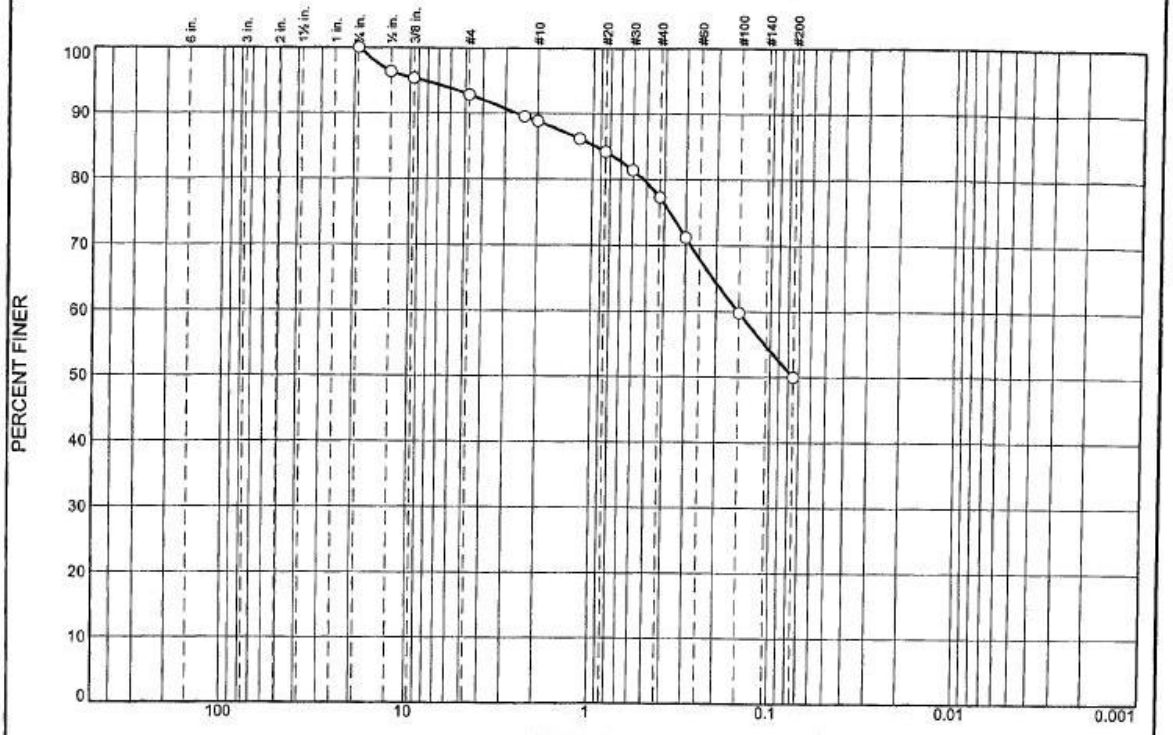
Soil and Materials Engineers, Inc.
Plymouth, MI

Figure

Tested By: C. Krug **Checked By:** Melinda Bacon, PE

E 4 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#7 – US-131 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
○	0.0	0.0	7.1	4.1	11.5	27.3	50.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
○			0.9616	0.1520	0.0751					

Material Description	USCS	AASHTO
○ Sandy Clay, Some Silt, Trace to Some Gravel	CL	

Project No. KG59918 **Client:** URS Corporation

Project: US-131 Over the St. Joseph River

MDOT Bridge B01 of 78015 MDOT JN 46269A

○ **Sample Number:** B7 (746.5'-735')

Remarks:

Soil and Materials Engineers, Inc.

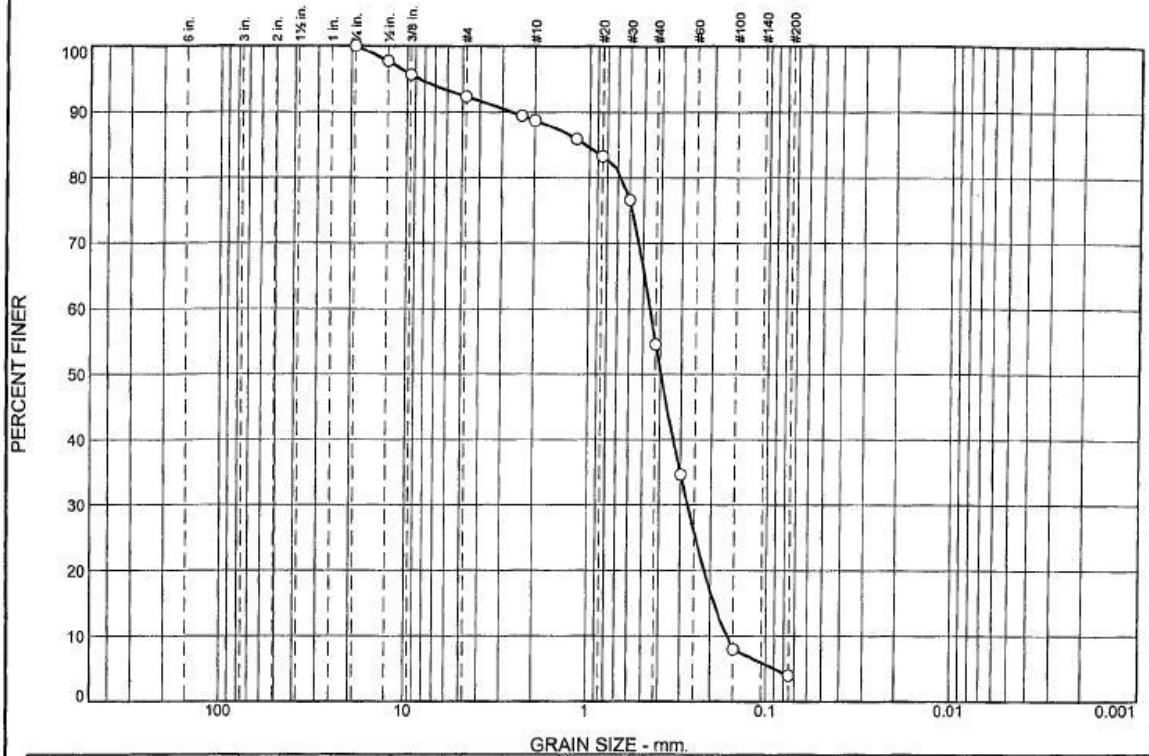
Plymouth, MI

Figure

Tested By: C. Krug **Checked By:** Melinda Bacon, PE

E 5 PARTICLE SIZE DISTRIBUTION OF SAMPLE FROM TH#9 – US-131 SITE

Particle Size Distribution Report



	% +3"	% Gravel		% Sand			% Fines	
		Coarse	Fine	Coarse	Medium	Fine	Silt	Clay
o	0.0	0.0	7.7	3.6	34.1	50.6	4.0	

	LL	PL	D_{85}	D_{60}	D_{50}	D_{30}	D_{15}	D_{10}	C_c	C_u
o			1.0479	0.4595	0.3958	0.2729	0.1917	0.1631	0.99	2.82

	Material Description	USCS	AASHTO
o	Fine to Coarse Sand, Trace to Some Gravel, Trace Silt	SP	

Project No. KG59918 **Client:** URS Corporation
Project: US-131 Over the St. Joseph River
MDOT Bridge B01 of 78015 MDOT JN 46269A
o **Sample Number:** B9 (773.5'-762')

Remarks:

Soil and Materials Engineers, Inc.
Plymouth, MI

Figure

Tested By: C. Krug **Checked By:** Melinda Bacon, PE

Appendix F SURVEY RESULTS OF ABUTMENT A AT US-131 SITE

F 1 RESULTS AFTER DRIVING PILE1

RESULTS AFTER PILE 1 (in ft)

Elev. (Z)	Horiz. Distance From First Observation	Horiz. Distance From C/L Pile 1	Δ Elevation
777.68	0.00	0.90	-1.73
778.93	0.00	1.03	-0.46
778.66	0.00	1.77	-0.64
778.95	0.00	1.90	-0.39
778.93	0.00	1.91	-0.37
778.92	0.00	2.20	-0.39
778.81	0.00	2.22	-0.50
779.14	0.00	2.35	-0.32
779.19	0.00	2.46	-0.30
779.04	0.00	3.52	-0.23
779.51	0.00	3.65	-0.18
778.97	0.00	3.70	-0.16
778.96	0.03	3.83	-0.16
779.33	0.05	3.93	-0.11
779.33	0.00	3.94	-0.10
779.35	0.00	4.66	-0.31
779.11	0.30	4.85	-0.17
779.25	0.09	5.30	-0.03
779.17	0.13	6.07	-0.05
779.10	0.01	7.12	-0.04
779.26	0.60	7.49	-0.06
779.18	0.09	9.13	-0.03
779.29	0.00	9.36	-0.21
779.44	0.91	9.95	-0.03
779.21	0.20	11.13	-0.05
779.12	0.28	11.59	-0.04
779.64	0.04	11.91	-0.02

779.21	0.01	12.66	-0.06
779.32	0.06	12.75	-0.02
779.34	1.00	14.67	-0.27
779.13	0.08	14.79	-0.01
779.17	0.04	15.21	0.00
778.96	0.07	15.66	0.01
779.49	0.29	17.01	-0.02
779.22	0.06	18.86	-0.01
779.33	0.07	19.86	-0.03
779.43	0.00	19.88	-0.01
779.47	0.24	19.94	0.00
779.31	0.14	20.45	-0.04
779.25	0.79	22.82	0.06
779.28	0.04	22.92	-0.01
779.14	0.06	23.60	0.00
779.43	0.07	24.70	-0.02
779.59	0.11	25.17	0.04
779.44	0.09	27.17	0.00
779.25	0.06	27.27	-0.01
779.30	0.04	28.66	0.00
779.52	0.12	29.65	0.01
779.52	0.05	30.09	-0.02
779.64	0.04	31.94	0.00
779.41	0.07	32.21	0.01
779.49	0.05	33.21	0.00
779.41	0.05	34.79	0.00
779.42	0.01	36.53	0.01
779.26	0.55	37.65	-0.06
779.25	0.07	38.87	-0.01
779.91	0.05	39.80	0.02
779.31	0.04	40.05	0.02

779.31	0.04	41.21	0.00
779.52	0.53	42.14	-0.13
779.18	0.03	43.56	0.02
780.41	0.10	44.78	0.04
779.36	0.01	44.99	-0.02
779.24	0.03	46.06	0.01
779.68	0.17	46.91	-0.04
779.09	0.11	48.94	0.00
780.15	0.05	49.66	-0.01
779.26	0.03	49.94	0.02
779.21	0.03	50.99	-0.02
779.25	0.48	52.46	-0.03
778.99	0.04	52.99	0.01
779.31	0.11	54.63	0.00
779.08	0.02	54.88	0.00
779.06	0.05	55.82	0.02
778.98	0.08	57.21	0.02
778.95	0.03	58.21	0.03
779.79	0.01	59.64	0.01
778.98	0.03	59.87	0.02
778.98	0.04	60.71	0.01
779.04	0.31	61.98	0.00
778.89	0.03	62.68	0.00
779.53	0.07	64.55	0.01
778.92	0.02	64.84	0.02
779.12	0.05	65.45	0.00
778.83	0.04	67.11	0.00
778.80	0.05	68.34	0.01
778.97	0.07	69.58	-0.01
778.80	0.01	69.81	0.01
778.82	0.02	70.51	0.00

778.67	0.14	72.50	0.01
778.60	0.02	73.06	0.01
778.78	0.05	74.49	0.01
778.60	0.02	74.85	0.02
778.66	0.04	75.48	0.00
778.68	0.06	76.68	-0.03
778.45	0.07	77.24	0.00
778.87	0.06	79.46	0.00
778.65	0.05	79.77	0.02
778.59	0.05	80.45	-0.01
778.74	0.01	81.72	0.01
778.62	0.08	82.30	0.01
778.87	0.03	84.37	0.00
778.85	0.01	84.82	0.00
778.65	0.03	85.28	0.00
778.91	0.02	87.59	0.01
778.75	0.06	87.89	0.00
778.82	0.10	89.51	0.00
778.95	0.00	89.75	0.00
778.59	0.03	90.23	0.00
778.95	0.16	91.84	-0.02
778.91	0.02	92.24	0.00
778.80	0.01	94.51	0.00
778.89	0.01	94.66	0.01
778.80	0.04	95.21	0.00
778.79	0.07	97.30	-0.03
778.78	0.05	97.35	-0.01
778.99	0.24	100.01	-0.06
778.87	0.04	100.09	0.01
778.75	0.01	100.29	0.00

RESULTS AFTER PILE 18 (in ft)

Elev. (Z)	Horiz. Distance From First Observation	Horiz. Distance From C/L Pile 2	Δ Elevation
777.58	0.00	0.00	-1.35
778.43	0.00	0.68	-0.55
777.83	0.00	0.69	-1.07
778.04	0.00	0.72	-0.89
778.32	0.00	0.82	-0.58
777.87	0.00	0.83	-1.03
778.58	0.00	0.95	-0.44
778.57	0.00	1.01	-0.32
778.16	0.00	1.03	-0.78
778.04	0.00	1.10	-0.96
778.11	0.00	1.17	-0.76
778.33	0.00	1.22	-0.65
778.24	0.00	1.23	-0.70
778.66	0.00	1.27	-0.22
778.72	0.00	1.33	-0.35
778.21	0.00	1.39	-0.67
778.42	0.00	1.46	-0.64
777.93	0.00	1.53	-1.04
778.68	0.00	1.60	-0.34
778.64	0.00	1.64	-0.21
778.64	0.00	1.69	-0.29
778.63	0.00	1.74	-0.31
778.66	0.00	1.83	-0.45
778.73	0.00	1.91	-0.14
778.79	0.00	1.95	-0.42
778.63	0.00	2.07	-0.35
778.71	0.00	2.12	-0.14

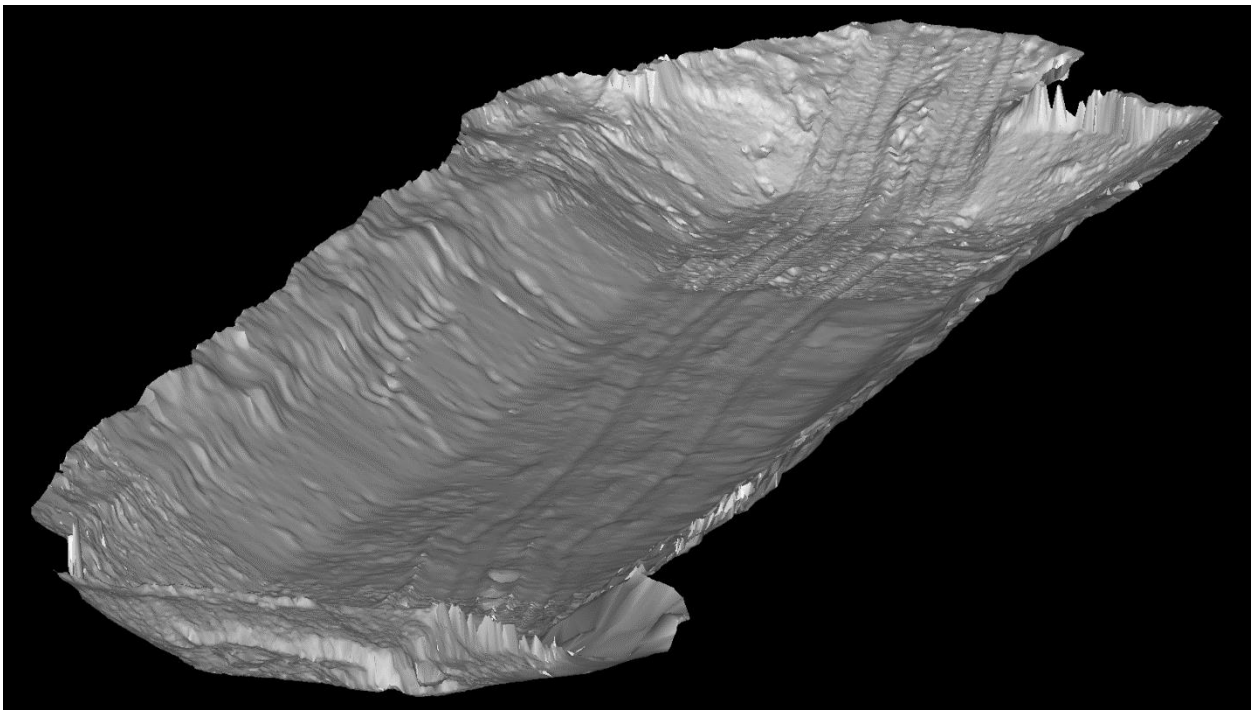
778.83	0.00	2.15	-0.32
778.75	0.00	2.46	-0.06
778.64	0.00	2.53	-0.51
778.79	0.00	2.54	-0.19
778.72	0.00	2.73	-0.19
778.71	0.00	3.04	-0.11
778.70	0.18	3.21	-0.10
778.74	0.06	3.50	-0.08
778.61	0.00	3.54	-0.64
778.89	0.00	4.02	0.02
778.90	0.06	6.63	-0.07
778.85	0.25	6.64	-0.01
778.85	0.06	7.21	-0.03
778.81	0.20	8.12	-0.01
778.79	0.03	9.41	0.00
778.91	0.11	10.21	-0.04
778.91	0.04	10.55	0.01
778.90	0.05	10.87	-0.01
778.75	0.02	12.83	0.00
778.74	0.29	13.00	-0.06
778.87	0.08	13.27	0.00
778.77	0.11	13.54	0.02
778.84	0.05	14.44	-0.01
778.61	0.05	14.78	0.02
778.77	0.09	16.31	0.04
778.65	0.06	17.84	0.00
778.61	0.06	18.22	0.00
778.87	0.05	18.23	0.00
778.64	0.07	19.11	0.01
778.71	0.04	21.32	0.00
778.60	0.06	21.83	0.00

778.47	0.04	22.77	0.02
778.79	0.04	23.17	0.02
778.59	0.04	23.89	0.01
778.69	0.12	25.49	0.03
778.65	0.06	26.08	-0.01
778.60	0.04	26.72	0.01
778.97	0.11	28.05	-0.01
778.79	0.05	28.81	0.00
778.82	0.01	30.68	0.00
778.83	0.02	30.80	0.00
778.80	0.08	31.31	0.01
779.53	0.01	33.13	0.01
778.91	0.03	33.65	0.01
779.12	0.02	35.37	0.00
779.10	0.36	35.90	0.06
778.89	0.03	36.74	0.00
779.77	0.04	38.08	-0.01
778.97	0.04	38.58	0.01
778.98	0.01	40.02	0.01
778.94	0.07	40.67	-0.02
778.93	0.08	41.32	0.01
779.31	0.06	43.10	0.00
779.07	0.04	43.52	-0.01
779.07	0.06	44.74	0.03
779.26	0.09	45.76	-0.02
778.99	0.01	46.29	0.01
780.15	0.04	48.02	-0.01
779.26	0.04	48.43	0.02
779.22	0.03	49.54	-0.01
779.08	0.06	50.40	-0.01
779.68	0.06	50.95	-0.04

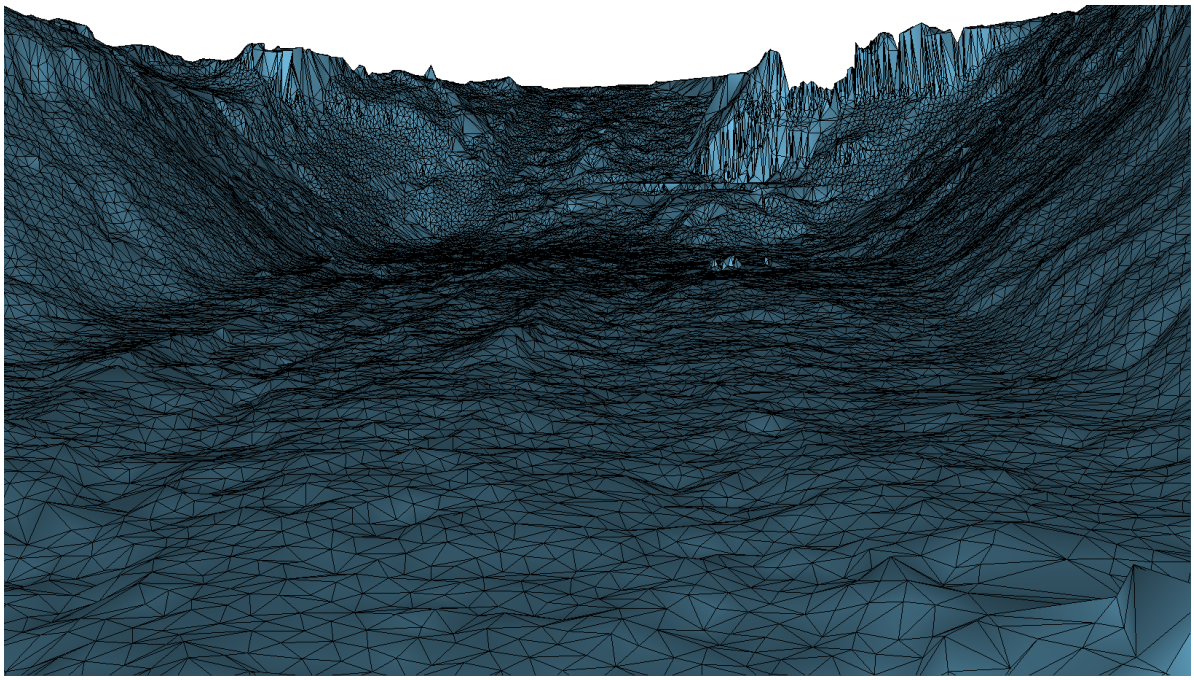
780.41	0.06	52.94	0.04
779.37	0.08	53.49	-0.01
779.24	0.03	54.42	0.01
779.17	0.08	55.76	0.01
779.55	0.35	55.85	-0.10
779.91	0.02	57.89	0.02
779.32	0.04	58.31	0.03
779.32	0.03	59.26	0.01
779.26	0.02	60.32	0.00
779.31	0.30	60.48	-0.01
779.39	0.00	62.51	0.01
779.43	0.02	62.94	0.02
779.42	0.05	64.04	0.01
779.41	0.03	65.65	0.01
779.50	0.02	66.06	0.01
779.46	0.21	68.35	-0.08
779.52	0.70	68.61	0.01
779.64	0.08	68.98	0.00
779.45	0.09	70.75	0.01
779.34	0.06	70.88	0.04
779.54	0.53	72.82	-0.01
779.44	0.11	72.95	-0.01
779.25	0.04	73.92	-0.01
779.27	0.48	75.47	0.08
779.17	0.13	76.36	0.03
779.46	0.16	77.86	-0.01
779.37	0.23	78.35	0.02
779.27	0.03	78.88	-0.02
779.57	0.58	80.32	0.06
779.35	0.09	80.46	-0.01
779.53	0.33	82.86	-0.08

Appendix G SURVEY SCREEN SHOTS OF ABUTMENT B AT US-131 SITE

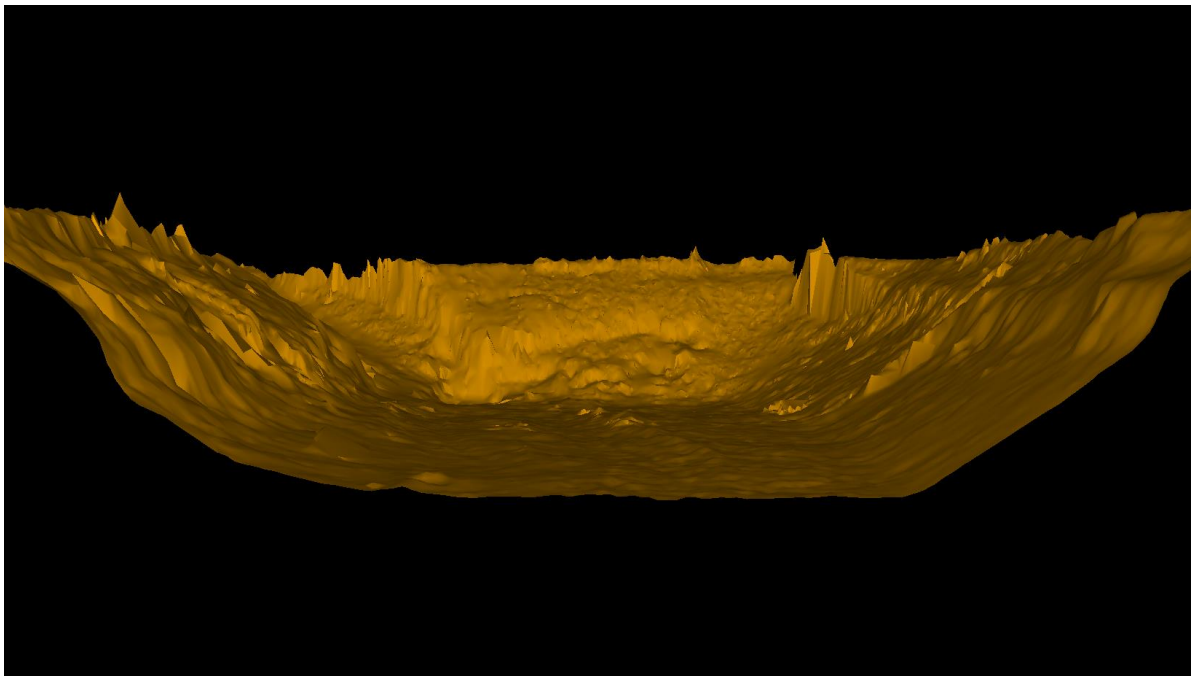
G 1 SHADED BASELINE PERSPECTIVE OF TRENCH AT ABUTMENT B OF US-131 SITE



G 2 SHADED PERSPECTIVE OF AREA THAT PILE 54 WAS DRIVEN AT ABUTMENT B OF US-131 SITE

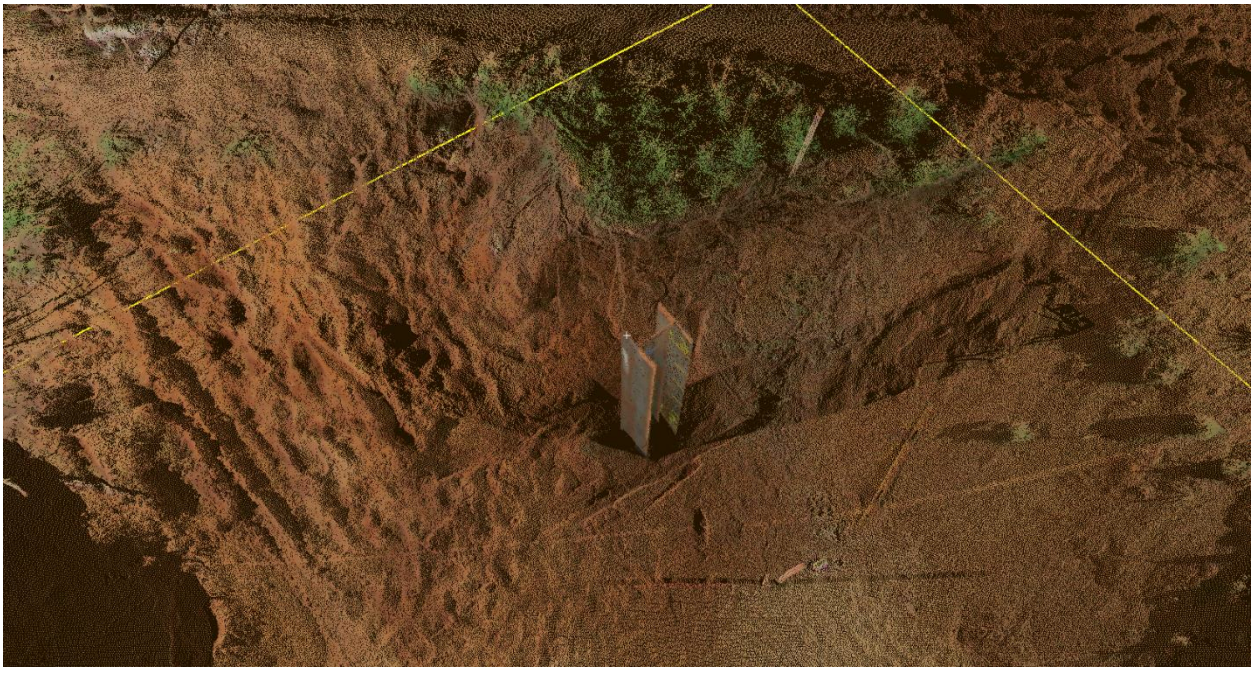


G 3 SHADED PERSPECTIVE OF AREA THAT PILE 37 WAS DRIVEN AT ABUTMENT B OF US-131 SITE



G 4 TOP SCREEN CAPTURE AT ABUTMENT B OF US-131 SITE

G 5 LOCATION OF PILE 54 AFTER END OF DRIVING AT ABUTMENT B OF US-131 SITE



Appendix H SILICA SAND SOIL PARAMETERS AND DIRECT SHEAR TEST REPORTS

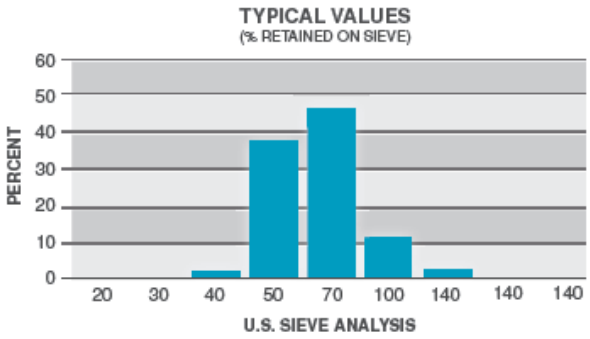
Product Data

US SILICA

F-50

WHOLE GRAIN SILICA

PLANT: OTTAWA, ILLINOIS



US STD SIEVE SIZE		TYPICAL VALUES		
		% RETAINED		% PASSING
MESH	MILLIMETERS	INDIVIDUAL	CUMULATIVE	CUMULATIVE
20	0.850	0	0	100
30	0.600	0	0	100
40	0.425	2	2	98
50	0.300	37	39	61
70	0.212	44	83	17
100	0.150	11	97	3
140	0.106	3	100	0
200	0.075	0	100	0
270	0.053	0		

TYPICAL PHYSICAL PROPERTIES	
AFS(1) Acid Demand (@pH 7)	<1.0
AFS(1) Grain Fineness	51
Grain Shape	Round
Hardness (Mohs)	7
Melting Point (Degrees F)	3100
Mineral	Quartz
Moisture Content (%)	<0.05
pH	7
Specific Gravity	2.65

TYPICAL CHEMICAL ANALYSIS, %	
SiO_2 (Silicon Dioxide)	99.8
Fe_2O_3 (Iron Oxide)	0.03
Al_2O_3 (Aluminum Oxide)	0.06
TiO_2 (Titanium Dioxide)	0.01
CaO (Calcium Oxide)	0.02
MgO (Magnesium Oxide)	<0.01
Na_2O (Sodium Oxide)	<0.01
K_2O (Potassium Oxide)	<0.01
LOI (Loss On Ignition)	0.1

(1) American Foundry Society

October 22, 2013

U.S. Silica Company
8490 Progress Drive, Suite 300
Frederick, MD 21701
(301) 682-0600 (phone)
(800) 243-7500 (toll-free)
ussilica.com

H 2 DIRECT SHEAR STRESS REPORT – LOOSE SPECIMEN, σ_N = 5.08 psi

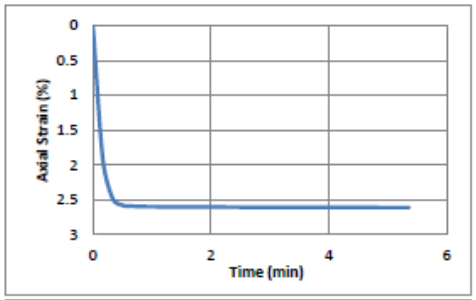
Direct Shear Test Report

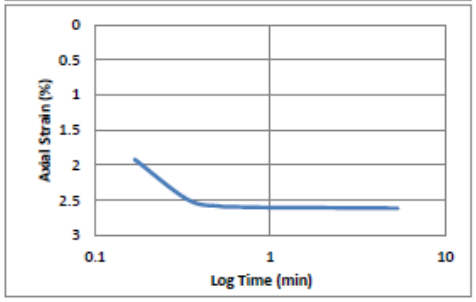
6/4/2014_Version 1.0

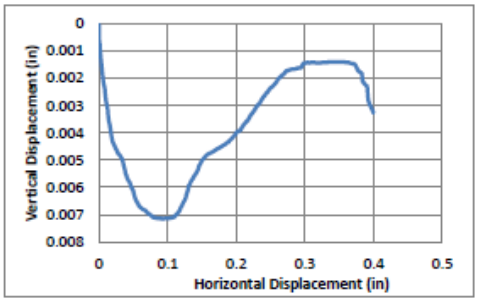
Geotechnical Engineering Laboratory

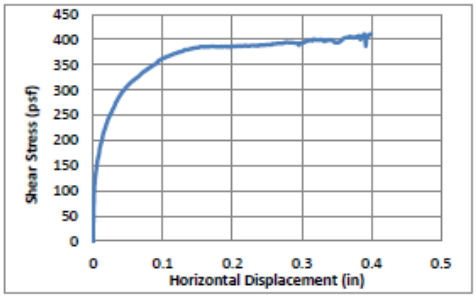
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.595
Test ID:		Height (in):	1.675
Date of Test:	1/23/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	729.45
Test Material:	Silica sand	Density (pcf):	103.69
Sample Preparation:	prepared loose	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	731.52	Type of Test:	Constant Load
Time to Compression (min):	5.4	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.553	Peak Shear Strength (psf):	410.9
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	729.45		
Density (pcf):	106.47		









H 3 DIRECT SHEAR STRESS REPORT – DENSE SPECIMEN, σ_N = 5.08 psi

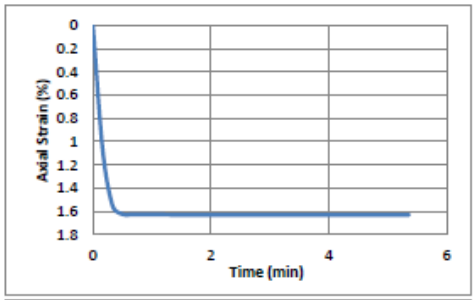
Direct Shear Test Report

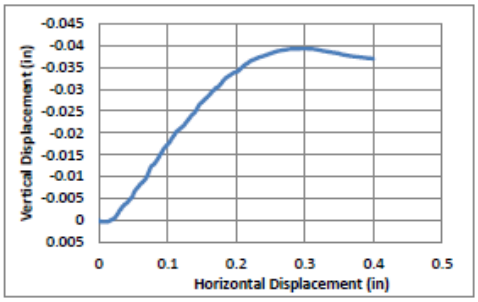
6/4/2014_Version 1.0

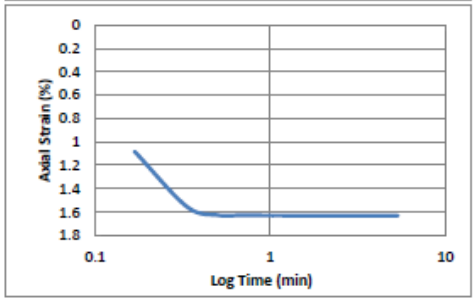
Geotechnical Engineering Laboratory

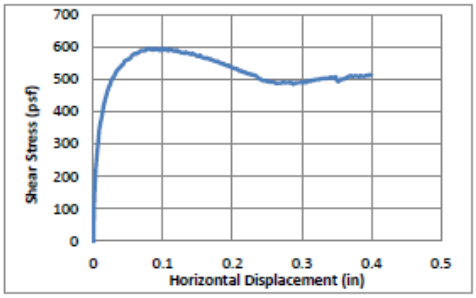
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.458
Test ID:		Height (in):	1.675
Date of Test:	1/23/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	798.12
Test Material:	Silica sand	Density (pcf):	113.45
Sample Preparation:	prepared dense	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	731.52	Type of Test:	Constant Load
Time to Compression (min):	5.4	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.434	Peak Shear Strength (psf):	595.4
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	798.12		
Density (pcf):	115.33		









H 4 DIRECT SHEAR STRESS REPORT – LOOSE SPECIMEN, σ_N = 10.15 psi

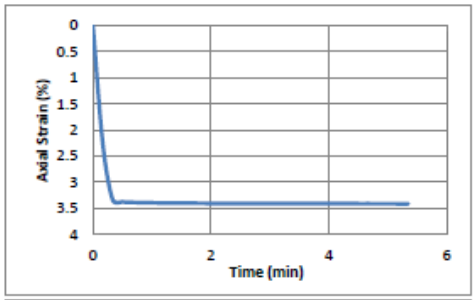
Direct Shear Test Report

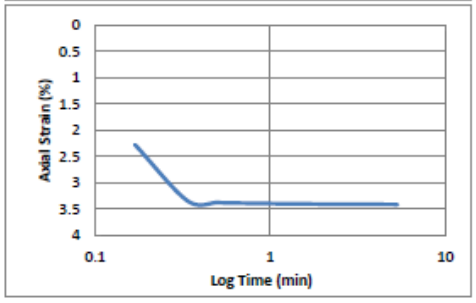
6/4/2014_Version 1.0

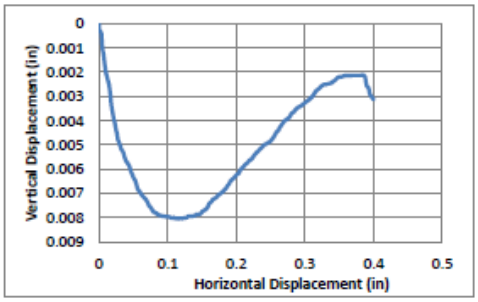
Geotechnical Engineering Laboratory

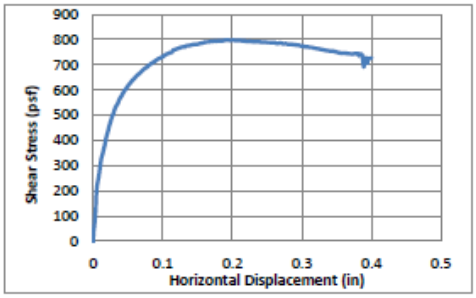
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.590
Test ID:		Height (in):	1.675
Date of Test:	1/23/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	731.43
Test Material:	Silica sand	Density (pcf):	103.97
Sample Preparation:	prepared loose	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	1461.6	Type of Test:	Constant Load
Time to Compression (min):	5.3	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.536	Peak Shear Strength (psf):	797.7
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	731.43		
Density (pcf):	107.64		









H 5 DIRECT SHEAR STRESS REPORT – DENSE SPECIMEN, σN = 10.15 psi

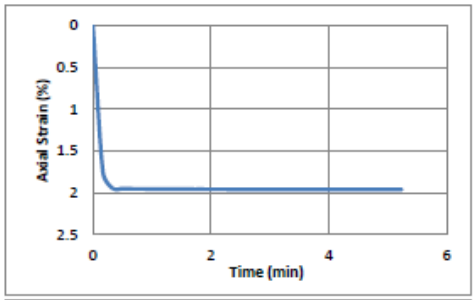
Direct Shear Test Report

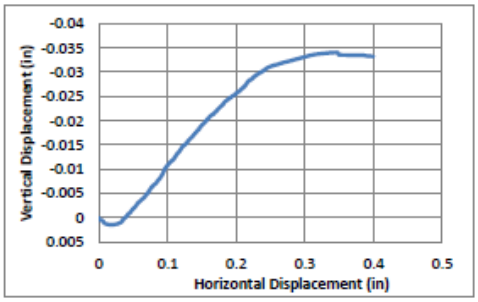
6/4/2014_Version 1.0

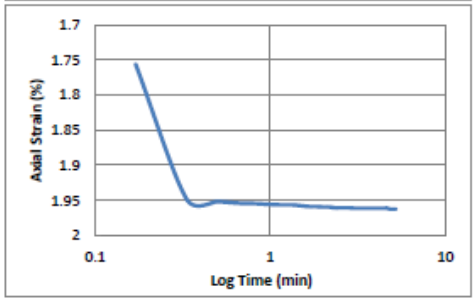
Geotechnical Engineering Laboratory

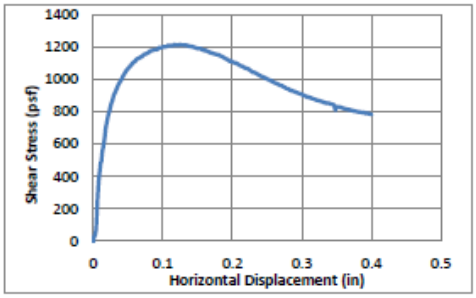
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.474
Test ID:		Height (in):	1.675
Date of Test:	1/26/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	789.42
Test Material:	Silica sand	Density (pcf):	112.22
Sample Preparation:	prepared dense	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	1461.6	Type of Test:	Constant Load
Time to Compression (min):	5.2	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.445	Peak Shear Strength (psf):	1213.0
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	789.42		
Density (pcf):	114.46		









H 6 DIRECT SHEAR STRESS REPORT – LOOSE SPECIMEN, σ_N = 15.23 psi

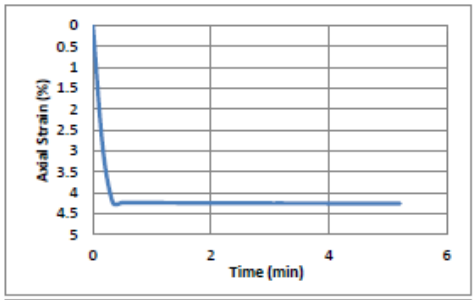
Direct Shear Test Report

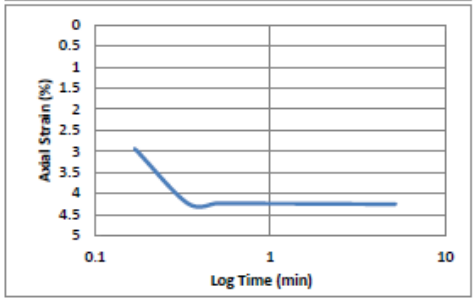
6/4/2014_Version 1.0

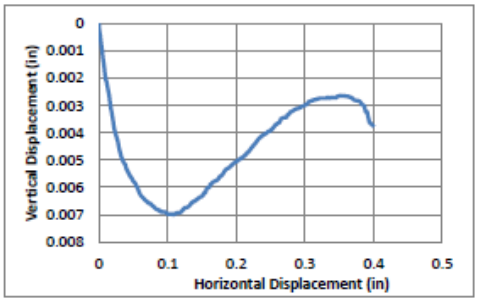
Geotechnical Engineering Laboratory

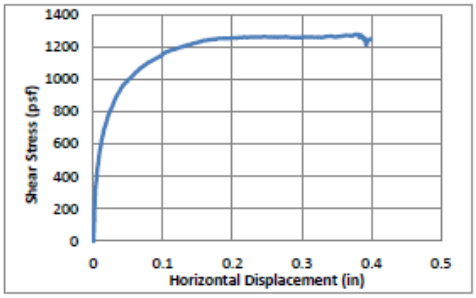
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.590
Test ID:		Height (in):	1.675
Date of Test:	1/23/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	731.8
Test Material:	Silica sand	Density (pcf):	104.02
Sample Preparation:	prepared loose	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	2193.12	Type of Test:	Constant Load
Time to Compression (min):	5.2	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.522	Peak Shear Strength (psf):	1276.0
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	731.8		
Density (pcf):	108.65		









H 7 DIRECT SHEAR STRESS REPORT – DENSE SPECIMEN, σ_N = 15.23 psi

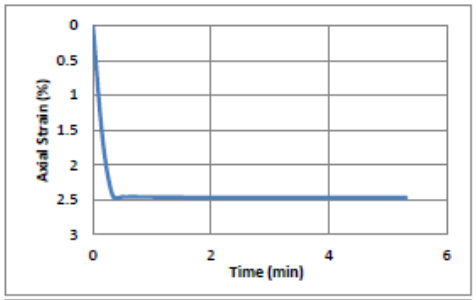
Direct Shear Test Report

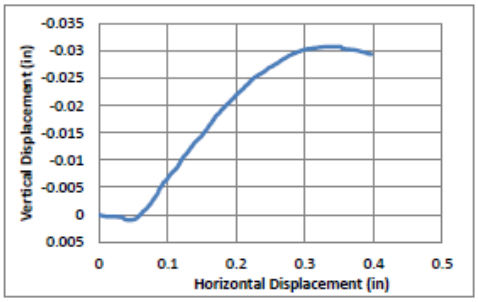
6/4/2014_Version 1.0

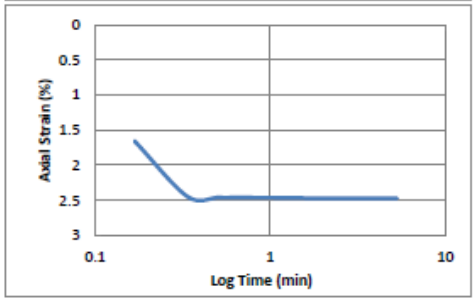
Geotechnical Engineering Laboratory

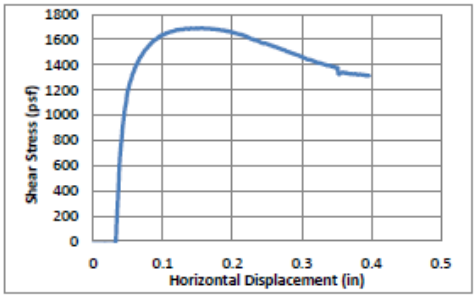
General Test Info and Sample Preparation			
Device:	square box	Relative Density (%):	#DIV/0!
Specimen ID:		Void Ratio:	0.590
Test ID:		Height (in):	1.675
Date of Test:	1/23/2015	Specimen Dimension (in):	4.0
Test Performed:	Monotonic Shear	Weight (gr):	731.43
Test Material:	Silica sand	Density (pcf):	103.97
Sample Preparation:	prepared dense	Moisture Content (%):	0%
		Saturated (Y/N):	N
		Prepared by:	Athena
		Checked by:	

Consolidation Stage		Shear Stage	
Vertical Stress (psf):	2193.12	Type of Test:	Constant Load
Time to Compression (min):	5.3	Stress or Displacement Controlled:	Displacement
Relative Density (%):	#DIV/0!	Shear Rate (in/min):	0.01
Void Ratio:	0.551	Peak Shear Strength (psf):	1690.2
Height (in):	1.675	Normal stress at peak τ (psf):	
Dimension (in):	4.0	Comments	
Weight (gr):	731.43		
Density (pcf):	106.61		





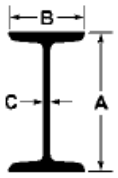




Appendix I S-BEAM PROPERTIES

AMERICAN STANDARD I BEAM

ASTM A-992/A572-50 (Grade 50)
TENSILE STRENGTH: 65,000 PSI Min
YIELD POINT: 65,000 PSI Max



A Depth	Weight (per ft.)	C Thickness of Web	B Width of Flange
3"	5.7*	.170	2.330
	7.5	.349	2.509
4"	7.7*	.193	2.663
	9.5	.326	2.796
5"	10.0	.214	3.004
6"	12.5	.232	3.332
	17.25	.465	3.565
8"	18.4	.271	4.001
	23.0	.441	4.171
10"	25.4	.311	4.661
	35.0	.594	4.944
12"	31.8	.350	5.000
	35.0	.428	5.078
	40.8	.462	5.252
	50.0	.687	5.477
15"	42.9	.411	5.501
	50.0	.550	5.640
18"	54.7	.461	6.001
	70.0	.711	6.251
20"	66.0	.505	6.255
	75.0	.635	6.385
	86.0	.660	7.060
	96.0	.800	7.200
24"	80.0	.500	7.000
	90.0	.625	7.125
	100.0	.745	7.245
	106.0	.620	7.870
	121.0	.800	8.050

*Also available in 1045 HR

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