Infrastructure Consulting Engineers

660 Woodward • Suite 2430 • Detroit • Michigan • 48226

PRELIMINARY ENGINEERING REPORT

GEOTECHNICAL CONDITIONS
M-153 (FORD ROAD) AT I-275 AREA STUDY
WAYNE COUNTY, MICHIGAN
CS: 82292 – JN: 115177

Owner:
MICHIGAN DEPARTMENT OF TRANSPORTATION

MDOT

Prepared for:

CDM Smith

CDM Smith
8164 Executive Court, Suite A
Lansing, Michigan 48917

July 10, 2013
2012101A

Somat Engineering, INCORPORATED

Somat Engineering, INCORPORATED

July 10, 2013
2012101A

Mr. Matthew Wendling, P.E.
CDM Smith
8164 Executive Court, Suite A
Lansing, Michigan 48917

RE: Preliminary Report on Geotechnical Conditions
M-153 (Ford Road) at I-1275 Area Study
Canton Township, Wayne County, Michigan
MDOT JN 115177

Dear Mr. Wendling:

We have completed our preliminary review of existing geotechnical conditions along this area of M-153/Ford Road at the I-275 freeway. This report presents a summary of the existing data, and our preliminary observations and geotechnical recommendations for the proposed design alternative.

It was a pleasure working with you on this project. If you have any questions regarding this report, please do not hesitate to contact us.

Sincerely,
Somat Engineering, Inc.

/for

Jonathan Zaremski, P.E.
Project Manager

2 pc

660 Woodward Ave, Suite 2430, Detroit, Michigan 48226 web: www.somateng.com phone: 313-963-2721 fax: 313-963-2736 email: info@somateng.com

PRELIMINARY ENGINEERING REPORT ON GEOTECHNICAL CONDITIONS
M-153 (FORD ROAD) AT I-275 AREA STUDY
CANTON TWP., WAYNE COUNTY, MICHIGAN

TABLE OF CONTENTS

PAGE

APPENDICES

PRELIMINARY ENGINEERING REPORT ON GEOTECHNICAL CONDITIONS M-153 (FORD ROAD) AT I-275 AREA STUDY WAYNE COUNTY, MICHIGAN

1.0 INTRODUCTION

1.1 GENERAL

Upon authorization from CDM Smith, Somat Engineering, Inc. (Somat) has conducted a preliminary engineering review of the geotechnical conditions for the proposed area study of M-153/Ford Road at I-275 in Wayne County, Michigan. These services and geotechnical recommendations were performed in general accordance with Somat Proposal No. P120024R2 dated March 6, 2012.

The following sections of this report will provide our understanding of the project, a description of the existing geotechnical conditions based on prior investigations and existing data, and our recommendations related to the future geotechnical investigation program for the proposed construction.

1.2 PROJECT INFORMATION

The western portion of Wayne County has experienced significant residential and commercial growth in recent years, including major commercial developments, which have strained the area's transportation infrastructure. This growth has resulted in a substantial increase in daily traffic volume and congestion along the I-275 interstate, and along key commercial corridors such as Ford Road. Ford Road at the I-275 study area has been identified as a key area of concern with respect to improving local traffic flow, pedestrian movement, and safety.

Somat has performed a review of existing geotechnical data available along this corridor of M-153/Ford Road. This report presents this information and provides preliminary discussion on the how the known geotechnical conditions may impact the final design of the corridor. Further we

performed a preliminary geotechnical analysis of proposed retaining walls in order to assess the feasibility of the proposed concepts. The results were based on a review of the soil and design loading information in the existing bridge plans [NB (S15) and SB (S08) I-275 Bridges over Ford Road, dated April 1972 (final approval)] and are presented in this report (Section 3.2).

1.3 SITE CONDITIONS

The M-153/Ford Road study area is located in Canton Township, Michigan. The area includes approximately 2.5 miles of Ford Road, 2.5 miles of I-275, and about a 0.7 mile wide corridor of I-275. The study area along Ford Road starts just east of Lotz Road and ends just west of Sheldon Road. The I-275 study area has a north boundary about 0.3 miles north of Warren Road and a south boundary about 0.4 miles south of Cherry Hill Road. The west and east boundaries of the I-275 corridor include Haggerty Road and Lotz Road, respectively.

Currently, through the immediate interchange, Ford Road carries two through lanes of traffic in either direction, with right turn/ramp lanes to the outside. Ford Road, west of I-275 to Sheldon Road carries varying two to three lanes of through traffic, with a consistent center turn lane and intermittent right turn lanes. Ford Road is asphalt surfaced the entire length of the project.

2.0 EXISTING SUBSURFACE INFORMATION

We reviewed the existing pavement core and soil data available for this section of M-153 (Ford Road) under study. Our evaluation included review of the Boring Log Plan Sheets generated from the following projects:

- NB (S15) and SB (S08) I-275 Bridges over Ford Road, dated April 1972 (final approval).
- M-153/Ford Road Pavement Scoping Project, Marlowe St. to Wayne Rd. (MDOT JN 45708), drilled April 1999;
- M-153 and SB I-275 Off-Ramp to M-153 (MDOT JN 78170A), drilled February 2004;
- I-275 Median Cable Barrier Installation project (MDOT JN 103104A), drilled November 2008;

- I-275 3R Mill and Resurface Project (MDOT JN 111073C), drilled July 2011;
- I-275 Shoulder Pavement Evaluation (MDOT JN 79694), drilled October 2011.

We also searched our internal project files to determine if Somat had performed any additional soil borings in this immediate vicinity for other local or private projects. Beyond the April 1999 Scoping project that we had performed for MDOT, we did not locate any further information. We also searched old water well logs through the MDEQ database website (Wellogic) to locate any well logs associated with abandoned wells in this immediate vicinity. Our search resulted in only two nearby wells, one along Haggerty Road about 1,500 feet south of Ford Road and one along Ford Road about 2,000 feet west of the SB I-275 exit ramp. Both are located too far away to be relevant to the immediate project site.

The most direct pavement and subgrade condition information was found in the 1999 Scoping and the 2004 SB I-275 Off-Ramp reconstruction documents, as specific pavement and subgrade information was obtained within Ford Road through this intersection. The specific relevant data from each of these projects are outlined as follows, and are presented in Appendix A:

Soil Information from February 2004 (MDOT JN 76041)				
Test Hole No.	*Approx. Location (as reported in the project documents)*	*Exploration Depth*	*Reported Pavement Info.*	*Reported Subgrade/Soil Info.*
1	WB M-153 slow lane, approx. 114 ft. west of ramp	5 ft.±	2.5 in. HMA (two layers) over 10 in. PCC	6 in. aggregate base layer over moderately compact moist fine sand
2	WB M-153, approx. 67 ft. west of ramp	5 ft.±	none	16 in. of topsoil over moderately compact moist fine sand
3	WB M-153, approx. 49 ft. east of Bob Evans driveway CL	4 ft.±	none	11 in. topsoil over moderately compact moist fine sand, trace organics
4	WB M-153, approx. 48.5 ft. east of the Midas driveway CL	5 ft.±	none	Sandy clay topsoil to 4 ft.
5	WB M-153, approx. 121.0 ft. west of	5 ft.±	none	18 in. of topsoil and silty clay over firm silty clay

	NA Mars Lumber driveway CL			
6	WB M-153, approx. 69.0 ft. east of Lilley Rd. CL	5 ft.±	none	8.5 in. of topsoil over moderately compact moist fine sand
7	EB M-153, approx. 158 ft. east of the White Castle driveway CL	5 ft.±	none	9.5 in. of topsoil over moderately compact moist fine sand
8	EB M-153, approx. 54 ft. west of EB M-153 on-ramp CL	5 ft.±	none	8.5 in. of topsoil over moderately compact moist fine sand
9	WB M-153 slow lane, approx. 46 ft. east of 2nd Shell driveway CL	5 ft.±	3.5 in. of HMA (two layers) over 7.5 in. of PCC	Moderately compact moist fine sand
10	WB M-153 right turn lane, approx. 129 ft. east of ABC Warehouse driveway CL	3.9 ft.±	11.5 in. of HMA (two layers)	27 in. aggregate base layer over firm silty clay
11	WB M-153 slow lane, approx. 121 ft west of NA Mars Lumber driveway CL	5 ft.±	9.5 in. of HMA (four layers)	1 in. aggregate base layer over moderately compact moist fine sand
12	WB M-153 slow lane, approx 85.5 ft east of Lilley Rd. CL	2.8 ft.±	3.5 in. of HMA (two layers) over 9 in. PCC	Moderately compact moist fine sand
13	WB M-153 St. 92+00, approx 47 feet left of left edge of metal	16.5 ft.±	none	2.5 in. of topsoil over moderately compact moist fine sand
14	EB M-153 St. 91+40, approx 21 feet right of right edge of metal	21.5 ft.±	none	2.5 in. of topsoil over moderately compact moist fine sand

Soil Information from April 1999 (MDOT JN 45708)

Test Hole No.	*Approx. Location (as reported in the scoping documents)*	*Exploration Depth*	*Reported Pavement Info.*	*Reported Subgrade/Soil Info.*
M-153, Core #1	3.6 miles west of Wayne Rd. (500 ft.± east of Morton Taylor) WB M-153 far right lane	1500 mm (5 ft.)±	9.5 in. ACC (two layers, reported in good condition)	Medium compact moist fine to medium sand
M-153, Core #2	2.9 miles west of Wayne Rd. (500 ft.± west of Haggerty) WB M-153 far right lane	300 mm± (core only)	3.5 in. ACC (two layers, reported in good condition) over 8.5 in. of PCC (reported in good condition)	N/A
M-153, Core #7	3.1 miles west of Wayne Rd. (1/2 way bet. Lilley and Haggerty) WB M-153 far left lane	1500 mm (5 ft.)±	11 in. ACC (two layers, reported in good condition) over 10 in. of PCC	Loose clayey sand, some organics
M-153, Core #12	3.8 miles west of Wayne Rd. (300 ft.± west of Morton Taylor) M-153 center lane	1500 mm (5 ft.)±	7.5 in. ACC (two layers, reported in fair condition) over 5 in. of PCC (reported in poor condition)	Very stiff to hard sandy clay
M-153, Core #13	3.2 miles west of Wayne Rd. (500 ft.± east of Lilley) M-153 center lane	500 mm (19 in.)± (core only)	8 in. ACC (two layers, reported in fair condition) over 11 in. PCC (reported in fair condition)	N/A
M-153, Core #14	2.8 miles west of Wayne Rd. (250 ft.± east of Haggerty) M-153 center lane	1500 mm (5 ft.)±	7.5 in. ACC (two layers, reported in good to fair condition) over 8 in. PCC (reported in poor condition)	Compact moist fine to med sand
M-153,	3.4 miles west of	1500 mm (5 ft.)±	8 in. of ACC (two	Firm to very stiff

Core #18	Wayne Rd. (400 ft.± west of Lilley) EB M-153 far left lane		layers, reported in good condition) over 12 in. of PCC (reported in fair condition)	sandy clay, some organics
M-153, Core #19	2.6 miles west of Wayne Rd. (at about the SB I-275 on-ramp) EB M-153 far left lane	200 mm (8 in.)± (core only)	8 in. PCC (reported in good condition)	20 mm void reported under slab
M-153, Core #23	4 miles west of Wayne Rd. (1/2 way bet Morton Taylor and Sheldon) EB M-153 far right lane	1500 mm (5 ft.)±	9.5 in. ACC (two layers, reported in good condition)	Very compact moist gravelly sand
M-153, Core #24	3.5 miles west of Wayne Rd. (1/2 way bet Morton Taylor and Lilley) EB M-153 far right lane	200 mm (8 in.)± (core only)	8 in. ACC (two layers, reported in good condition)	N/A
M-153, Core #25	2.5 miles west of Wayne Rd. (at about the NB I-275 on-ramp) EB M-153 far right lane	1500 mm (5 ft.)±	9.5 in. PCC (reported in good condition)	Compact brown wet silty sand

The focus of this phase of the project is to study various alternatives to improve traffic operations along Ford Road from about Sheldon Road to Lotz Road. We understand the original pavement through this area is at least 30 years old. Based on the above historical information, the existing pavement at that time of the scoping project in 1999 indicated varied pavement sections were reported in generally good to fair condition. Some exceptions included Cores #12 and #14 where the underlying Portland cement concrete was reported in poor condition. Noteworthy, Core #19 was observed to have a void of about ¾ in. below the pavement slab. In general, the subgrade soil conditions along this stretch of Ford Road did not indicate specifically poor soils. The

subgrade soils (in direct support of the pavement) were mainly reported to consist of varying gradations of sand, some containing significant fines (silt and clay), with some consisting of clay. The groundwater conditions reported were mainly deeper (deeper than the explored depth of the exploration), though locally shallow in Core #25. The information obtained in the 2004 project did not provide any information regarding pavement quality, only thicknesses. It should be noted that since most of these cores were obtained, any resurfacing work or ramp paving performed on this segment of M-153 may have changed the pavement section in some areas. Thus, some of this data, in terms of existing pavement thicknesses, may be obsolete.

In addition, Boring Log Plan Sheets from the original NB and SB I-275 design plans were also available. Based on these plans, some surficial sand layers may be encountered, though the profile below mainly consists of "firm" gray clay to a depth of about 25 feet below grade. These plan sheets also indicated observed shallow groundwater levels at about 2 to 4.5 feet below grade at the time of the soil boring operations (1967). These depths equate to an elevation of roughly 668 feet. Groundwater elevations and levels can fluctuate significantly over time, especially with the construction and development which had occurred in this area in the past 45 years.

Copies of the soil boring data sheets for these three projects discussed are included with this report for reference in Appendix A.

3.0 PRELIMINARY ANALYSIS AND RECOMMENDATIONS

The following discussion is based on the preferred design alternative (referred to as Alternate No. 3) involving transforming this Ford Road corridor into a boulevard-type roadway. This design consists of constructing islands along the center of Ford Road to control left turn movements as well as improvements to the signalization along this stretch of roadway. Further, improvements to pedestrian movement through this corridor are anticipated by enhancing the existing pedestrian pathways as well as extending them through the entire stretch of roadway.

Considering the proposed alternative, we anticipate the design phase of this project will generally focus on refining the geometrics, traffic signalization, and the design of new pavement. Improving pedestrian movement through this area will also be a consideration.

3.1 PRELIMINARY PAVEMENT DESIGN RECOMMENDATIONS

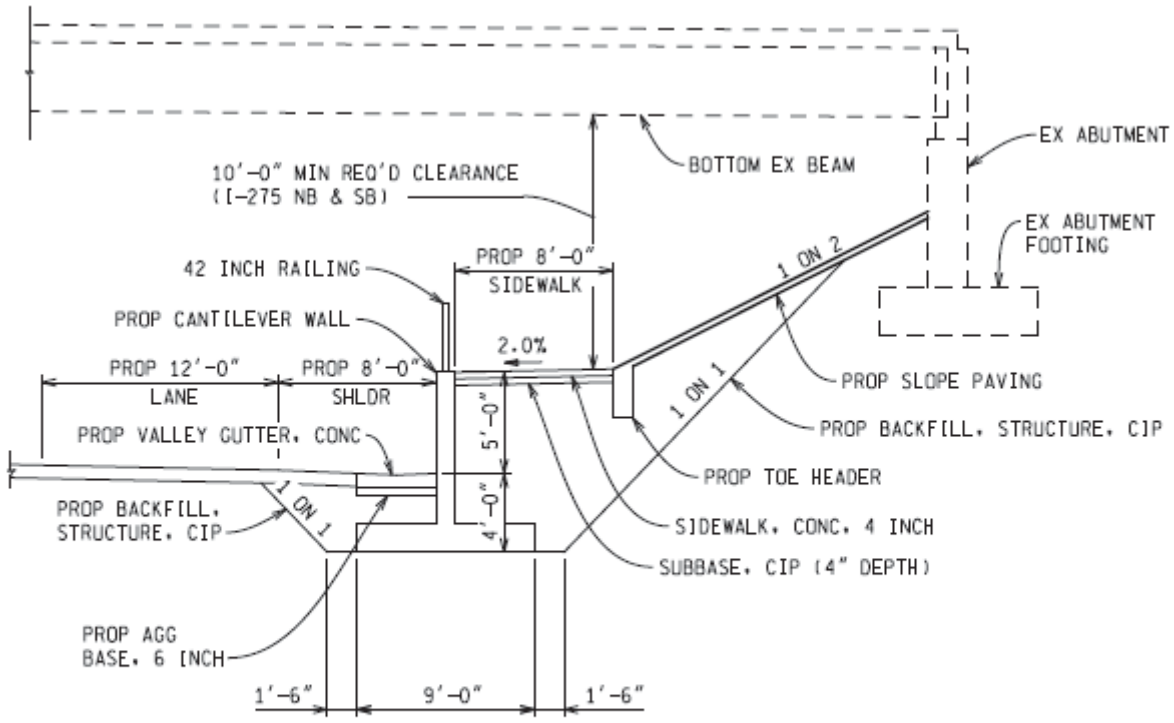
We anticipate with the age of the existing pavement along this stretch of M-153/Ford Road, that a full reconstruction may occur during construction of the median islands and loons. Based on the existing soil information, the subgrade soils below the existing pavement are quite variable. In many areas, clay soils or clayey soils were encountered. These soils are not considered suitable for direct support of new pavement without a suitable drainable base or subbase, mainly due to their impermeable nature. New pavement design will need to incorporate an appropriate drainage system to ensure groundwater does not collect below the pavement and saturate the supporting subgrade soils. Further, some of these subgrade soils were found to contain organic material. These organics (in significant amounts) are also not suitable for support of pavement, as they tend to break down over time resulting in loss of support to the pavements above.

Another consideration for the final pavement design is the type of pavement section to utilize. Typically, a Hot Mix Asphalt section is used for these long stretches of pavement. However, with the inclusion of tighter median turnaround (and left) turn lanes and associated outside loons, an asphalt material at the surface may not be the best option. Where significant traffic (and especially heavy vehicles) are consistently making tight turns and maneuvers, HMA may rut and deform.

We understand that MDOT has preliminarily specified a Portland cement concrete section. This section will be constructed of 8 inches of PCC over a 16 inch open-graded drainage course. Below the pavement layers, a 6 inch diameter drainage pipe/open graded aggregate course will be installed, and will be separated from the upper pavement layers with a geotextile separator.

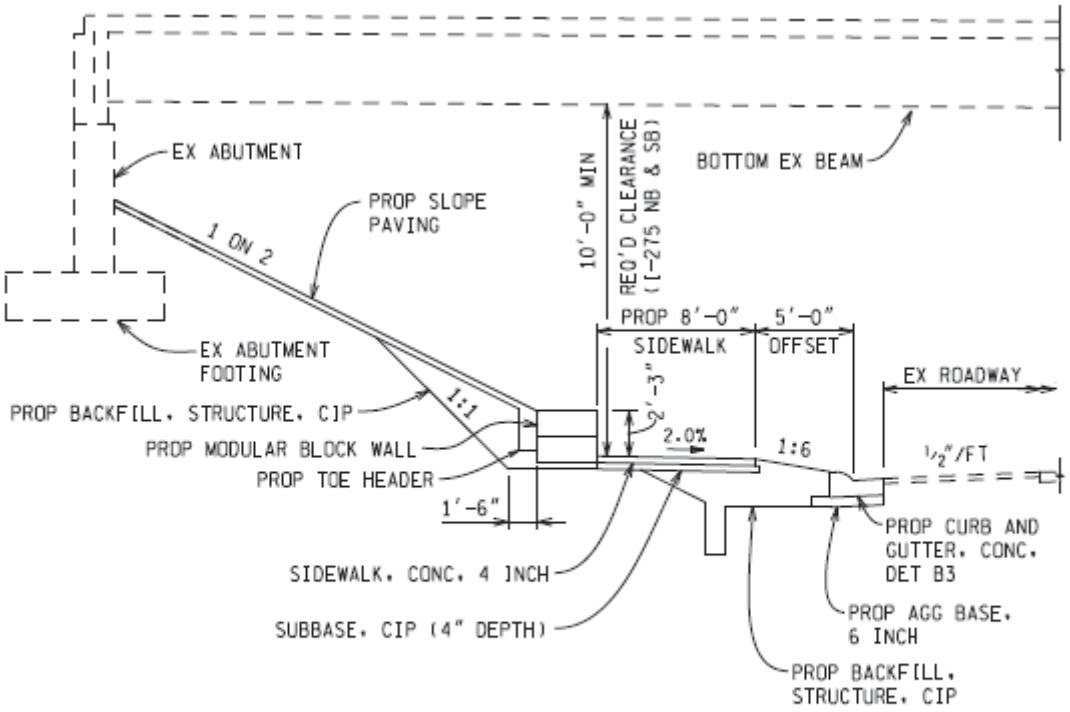
3.2 PRELIMINARY RETAINING WALL RECOMMENDATIONS

As we understand, in order to accommodate a pedestrian sidewalk under the existing I-275 bridges, the existing slope paving will need to be removed and a retaining wall constructed closer to the abutments. At this preliminary design stage, we understand two concepts have been proposed for this purpose. At this very preliminary stage, we anticipate that the wall along WB Ford Road underneath the I-275 bridges may be proposed to be designed as a cast-in-place gravity wall about 5 feet in exposed height. This wall will support an 8 foot wide sidewalk behind the wall (above) and the slope paved further back to the bridge abutment. This concept is illustrated in the figure below:



PROPOSED WB M-153 UNDER I-275

The wall along EB Ford Road underneath the I-275 bridges is proposed to be a short modular block wall about 2.5 feet in height, which will allow for an 8 foot wide sidewalk in front of the wall (set back about 5 feet from the roadway). This concept is illustrated in the figure below:



PROPOSED EB M-153 UNDER I-275

We analyzed the proposed geometry of the both retaining walls along EB and WB Ford Road (shown in the figures above). Since the geotechnical investigation has not been performed for this project yet, our preliminary analysis utilized the soil information obtained from the existing bridge plans (TH#1 through TH#4 performed for the SB I-275 bridge on 8/28/67, and TH#1 through TH#4 performed for the NB I-275 bridge on 8/28/67). Based on these soil borings, the soil profile is about 5 feet of "moderately compact" sand over "firm" gray clay. We have assumed the presence of granular engineered fill above this elevation and behind the abutments. There were no specific soil strength parameters provided, only the stated consistency of firm for the clay stratum. Based on the MDOT Soil Classification system, we have used a cohesion value of 1,500 psf for this analysis.

The slope stability analyses were performed using the "SLIDE" computer program by Rocscience of Toronto, Ontario, Canada. The SLIDE program evaluates the safety factor of circular or non-circular failure surfaces in soil or rock slopes. This program analyzes the stability of slip surfaces using vertical slice limit equilibrium methods, including the Bishop Simplified and Janbu Simplified methods. Our analysis took into consideration the following basic global stability parameters; location and shape of the potential failure surface, internal friction angle of the granular soils, cohesion of the clay soils, density of the various soils, and location of the estimated groundwater surface. These parameters were estimated, interpreted, and/or assumed based on the limited information available and our experience with similar soil types. Also, our analysis assumes proper wall drainage so that hydrostatic pressures have not developed.

We analyzed the global stability of the proposed retaining walls, considering the presence of the adjacent bridge abutments. Based on the existing plans, the abutment footings are designed for a service load of about 2,260 psf (dead load) and 4,000 psf (dead + live loads). We looked at the short term and long term conditions for the proposed (constructed) retaining walls as well as the more critical condition during the construction of the wall.

Based on our preliminary analysis of these walls, the factors of safety against global instability were found to be as follows:

	During Construction FS	*Short Term FS*	*Long Term FS*
EB (DL+LL=4000 psf)	1.10	1.21	1.20
EB (DL=2260 psf)	1.20	1.35	1.35
WB(DL+LL=4000 psf)	0.80	1.71	1.43
WB(DL=2260 psf)	0.80	2.05	1.65

Refer to Appendix B for the graphical output results from the software.

In general, a Factor of Safety of 1.33 is considered acceptable. After construction, the walls were found to generally be safe with respect to global stability, with the EB wall (DL+LL) slightly below 1.33. During construction, the factors of safety were less, and as such, we recommend measures will be taken to secure the existing bridge abutment and prevent any movement of the surrounding (supporting) soils. Depending on final geometries, this may require underpinning or shoring. It will be especially important to prevent any subsidence of surrounding soils to prevent damage or settlement to existing I-275 bridge structures. Further, analysis of the proposed construction sequence should be performed to verify that sufficient support of the bridge footings will be provided.

Again, it should be noted that is a preliminary analysis of the proposed wall design concepts using assumed information. Once the official geotechnical investigation for this project has been performed, this analysis will need to be refined and verified using the more detailed soil properties and confirmed design geometry.

3.3 FINAL GEOTECHNICAL INVESTIGATION

In terms of planning for the geotechnical investigation for the final design phase of this project, we recommend additional soil borings and pavement cores along the mainline of M-153/Ford Road to better define the subgrade soil conditions and assist with the pavement design. Based on our previous experience with MDOT pavement projects, we anticipate soil borings performed along the mainline pavement at intervals of every 500 to 1,000 feet alternating between driving lanes. These borings generally extend to a depth of 5 feet below existing grade. This subgrade information will also be useful in evaluating the subgrade drainage conditions and providing recommendations for improvement. Additional soil borings will be required in the proposed loon areas as well.

If any concurrent utility work is to be performed, pavement soil borings could be extended deeper to evaluate the subsurface conditions for design and installation of new piping.

For proposed new signing, lighting, and/or signals, one soil boring will need to be drilled at each sign or pole location. Soil borings are only expected for larger tower-type light poles. These borings will extend to a minimum depth of 25 or 50 feet below final site grade, possibly deeper depending on the proposed structure. Per MDOT standard requirements, a soil boring is required within a 10-foot radius of the proposed pole location; otherwise a hand auger will be required at the proposed location in addition to the soil boring.

More specifically, soil borings will be required for the final evaluation of the proposed retaining walls underneath the I-275 bridges. Soil and groundwater information should be obtained both in front of the wall (at the Ford Road level) as well as behind the wall and abutment (from the I-275 level). These borings should extend to a depth of at least 2 times the anticipated wall height below the foundation bearing level or to depths sufficient of the analysis of the stability of the slope and structure.

In any case, any exploration will need to be executed in accordance with MDOT's Requirements for Geotechnical Investigations.

4.0 GENERAL QUALIFICATIONS

This is a preliminary cursory geotechnical evaluation for this project. SOMAT has relied on readily available geotechnical information to formulate the recommendations. There has been no site specific borings conducted as part of this study. As this project proceeds, it is recommended to perform site specific investigations to address the new construction. At that time, the recommendations of this report will need to be modified to reflect the site specific information.

SOMAT makes no other warranties either expressed or implied as to the professional advice included in this preliminary report.

The contents of this report have been selected in order to aid in the evaluation of expected subsoil properties to assist the engineer in the preliminary planning for this project. In the event

any geotechnically related changes are made in the project, the conclusions and recommendations contained in this report shall not be considered valid unless the changes are reviewed and the conclusions of this report are modified in writing by our office.

Since the information obtained from the relied-upon test borings is specific to the exact test boring locations, soil and water information could be different from those occurring at other locations of the site. This report does not reflect variations which may occur between the borings. Site specific geotechnical investigations will need to be conducted at the appropriate time to determine the actual geotechnical conditions. The nature and extent of variations between boring locations may not become evident until the time of construction. If significant variations then become evident, it may be necessary to re-evaluate the recommendations provided in this report.

This preliminary report is strictly for preliminary evaluation purposes. It should not be made available to bidders because of the general nature of the report. If you have any questions regarding this report, please contact us.

APPENDIX A

PLAN SHEETS OF EXISTING SOIL INFORMATION

TEST HOLE NO. M-153, CORE #1

STATION NO.: 6+350 m west of Wayne Road
LAT. OFFSET: 180 cm RT of LT EOM
DATE CORED: 4/14/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
100	ACC, nat agg, good condition (leveling course)
200	
300	
400	
500	
600	
700	
800	
900	Med compact, brown, moist, fine to med sand, some clay & gravel
1000	
1100	
1200	
1300	
1400	
1500	Stiff, brown & gray, sandy clay, trace gravel
	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far RT lane

TEST HOLE NO. M-153, CORE #2

STATION NO.: 5+080 m west of Wayne Road
LAT. OFFSET: 170 cm RT of LT EOM
DATE CORED: 4/14/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
	ACC, nat agg, good condition (leveling course)
100	
200	PCC, nat agg, good condition
300	
	EOC
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = 276 mm
PCC re-steel Dia. = 9 mm
Core taken in WB M-153, far RT lane

TEST HOLE NO. M-153, CORE #3

STATION NO.: 3+850 m west of Wayne Road
LAT. OFFSET: 190 cm RT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	
200	ACC, nat agg, good condition (leveling course)
300	
400	
500	
600	
700	
800	
900	Compact, brown, moist, fine to med. sand, some silt & gravel
1000	
1100	
1200	
1300	
1400	
1500	
	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far RT lane

TEST HOLE NO. M-153, CORE #4

STATION NO.: 2+570 m west of Wayne Road
LAT. OFFSET: 150 cm LT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	
200	ACC, nat agg, good condition (leveling course)
300	
400	
	EOC
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, RT turn lane

SE S(ENGINEERING, INC.
GEOTECHNICAL - GEOENVIRONMENTAL - MATERIALS TESTING

LOG OF CORE/AUGER PROBE

TEST HOLE NO. M-153, CORE #5

STATION NO.: 1+340 m west of Wayne Road
LAT. OFFSET: 160 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/CM

DEPTH (mm)	DESCRIPTION
0	
100	ACC, slag, agg, good condition (wearing course)
200	
300	ACC, slag agg, good condition (leveling course)
400	
500	
600	
700	
800	Med compact, brown, moist, fine to med sand, trace silt
900	
1000	
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far RT lane

TEST HOLE NO. M-153, CORE #6

STATION NO.: 0+090 m west of Wayne Road
LAT. OFFSET: 160 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
	ACC, nat agg, good condition (leveling course)
100	
200	PCC, nat agg, good condition
300	EOC
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = 210 mm
PCC re-steel Dia. = 9 mm
Core taken in WB M-153, far RT lane

TEST HOLE NO. M-153, CORE #7

STATION NO.: 5+360 m west of Wayne Road
LAT. OFFSET: 947 cm RT of LT EOM
DATE CORED: 4/14/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
100	ACC, nat agg, good condition (wearing course)
200	ACC, nat agg, good condition (leveling course)
300	
400	PCC, slag agg, good condition
500	
600	
700	
800	
900	
1000	Loose, black/gray, moist, clayey sand, some organics, trace gravel
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far LT lane

TEST HOLE NO. M-153, CORE #8

STATION NO.: 4+100 m west of Wayne Road
LAT. OFFSET: 907 cm RT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
100	PCC, slag agg, good condition*
200	
300	EOC
400	*Field Engineer reported 10 mm thick void beneath PCC slab
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far LT lane

S r ENGINEERING, INC.
GEO..CHNICAL - GEOENVIRONMENTAL - MATERIALS TESTING

LOG OF CORE/AUGE 'ROBE

TEST HOLE NO. M-153, CORE #9

STATION NO.: 2+760 m west of Wayne Road
LAT. OFFSET: 927 cm RT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
	ACC, slag agg, good condition (wearing course)
100	
	ACC, slag agg, good condition (leveling course)
200	
	ACC, slag agg, good condition
300	
400	
500	
600	
700	
800	
	Compact, brown, moist, fine to med sand, some gravel
900	
1000	
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far LT lane

TEST HOLE NO. M-153, CORE #10

STATION NO.: 1+500 m west of Wayne Road
LAT. OFFSET: 957 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
	ACC, slag agg, good condition (wearing course)
100	
	ACC, nat agg, good condition (leveling course)
200	
	PCC, nat agg, fair condition
300	
400	
	EOC
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far LT lane

TEST HOLE NO. M-153, CORE #11

STATION NO.: 0+350 m west of Wayne Road
LAT. OFFSET: 947 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
	ACC, slag agg, good condition (wearing course)
100	
	ACC, slag agg, good condition (leveling course)
200	
300	
400	
500	
600	
	Med compact, brown, moist, fine to med sand, trace silt
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in WB M-153, far LT lane

TEST HOLE NO. M-153, CORE #12

STATION NO.: 6+610 m west of Wayne Road
LAT. OFFSET: 1257 cm RT of LT EOM
DATE CORED: 4/14/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	
	ACC, nat agg, fair condition (wearing course)
100	
	ACC, nat agg, fair condition (leveling course)
200	
	PCC, nat agg, poor condition, somewhat deteriorated
300	
400	
500	
600	
700	
800	
	Very stiff to hard, brown/black, sandy clay, trace gravel
900	
1000	
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

SOMAT ENGINEERING, INC.
GEOTECHNICAL - GEOENVIRONMENTAL - MATERIALS TESTING

LOG OF CORE/AUGER PROBE

TEST HOLE NO. M-153, CORE #13

STATION NO.: 5+570 m west of Wayne Road
LAT. OFFSET: 1297 cm RT of LT EOM
DATE CORED: 4/14/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, fair condition (wearing course)
100	ACC, nat agg, fair condition (leveling course)
200	
300	PCC, slag agg, good condition
400	
500	EOC
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

TEST HOLE NO. M-153, CORE #14

STATION NO.: 4+825 m west of Wayne Road
LAT. OFFSET: 1293 cm RT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
100	ACC, nat agg, fair condition (leveling course)
200	
300	PCC, nat agg, poor condition, somewhat deteriorated
400	
500	
600	Compact, dark brown, moist, fine to med sand, some gravel & clay
700	
800	
900	
1000	
1100	
1200	Compact, brown, moist, fine to med sand, trace silt
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

TEST HOLE NO. M-153, CORE #15

STATION NO.: 3+150 m west of Wayne Road
LAT. OFFSET: 1267 cm RT of LT EOM
DATE CORED: 4/13/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
	ACC, slag agg, good condition (wearing course)
100	
200	ACC, nat agg, good condition (leveling course)
300	
400	
	EOC
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

TEST HOLE NO. M-153, CORE #16

STATION NO.: 1+860 m west of Wayne Road
LAT. OFFSET: 1287 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition
100	
200	PCC, slag agg, good condition
300	
400	
500	
600	
700	
800	V. compact, brown, moist, fine to med sand, trace silt
900	
1000	
1100	
1200	
1300	V. compact, gray, wet, fine to med sand, some silt
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

r ENGINEERING, INC.
GEOTECHNICAL - GEOENVIRONMENTAL - MATERIALS TESTING

LOG OF CORE/AUG PROBE

TEST HOLE NO. M-153, CORE #17

STATION NO.: 0+590 m west of Wayne Road
LAT. OFFSET: 1257 cm RT of LT EOM
DATE CORED: 4/12/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	ACC, crushed limestone agg, poor condition, some voids (leveling course)
200	EOC
300	
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in M-153, Center lane

TEST HOLE NO. M-153, CORE #18

STATION NO.: 5+850 m west of Wayne Road
LAT. OFFSET: 927 cm LT of RT EOM
DATE CORED: 4/15/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
100	ACC, crushed limestone agg, good condition (leveling course)
200	
300	PCC, nat agg, fair condition
400	
500	
600	
700	
800	
900	Firm to v. stiff, brown/gray, sandy clay, some organics
1000	
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far LT lane

TEST HOLE NO. M-153, CORE #19

STATION NO.: 4+550 m west of Wayne Road
LAT. OFFSET: 917 cm LT of RT EOM
DATE CORED: 4/19/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	PCC, slag agg, good condition*
100	
200	EOC
300	*Field Engineer reported 20 mm thick void beneath PCC slab
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = 86 mm
PCC re-steel Dia. = 6 mm
Core taken in EB M-153, far LT lane

TEST HOLE NO. M-153, CORE #20

STATION NO.: 3+400 m west of Wayne Road
LAT. OFFSET: 917 cm LT of RT EOM
DATE CORED: 4/20/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	
200	ACC, nat agg, good condition (leveling course)
300	
400	PCC, nat agg, fair condition, top somewhat deteriorated
500	
600	
700	Med compact, dark brown, moist, clayey sand
800	
900	
1000	
1100	
1200	Med compact, brown, moist, silty sand
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far LT lane

TEST HOLE NO. M-153, CORE #21

STATION NO.: 2+100 m west of Wayne Road
LAT. OFFSET: 917 cm LT of RT EOM
DATE CORED: 4/20/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	ACC, nat agg, good condition (leveling course)
200	EOC
300	
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far LT lane

TEST HOLE NO. M-153, CORE #22

STATION NO.: 0+895 m west of Wayne Road
LAT. OFFSET: 957 cm LT of RT EOM
DATE CORED: 4/21/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, slag agg, good condition (wearing course)
100	ACC, nat agg, good condition (leveling course)
200	PCC, nat agg, good condition
300	
400	Med compact, brown & black, moist, clayey sand
500	
600	
700	
800	
900	
1000	Compact, brown, moist, fine to med sand
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far LT lane

TEST HOLE NO. M-153, CORE #23

STATION NO.: 6+910 m west of Wayne Road
LAT. OFFSET: 180 cm LT of RT EOM
DATE CORED: 4/15/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
100	ACC, nat agg, good condition (leveling course)
200	
300	
400	V. compact, brown, moist, gravelly sand
500	
600	
700	
800	
900	
1000	Hard, brown/gray, sandy clay, trace organics
1100	
1200	
1300	
1400	
1500	EOC
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far RT lane

TEST HOLE NO. M-153, CORE #24

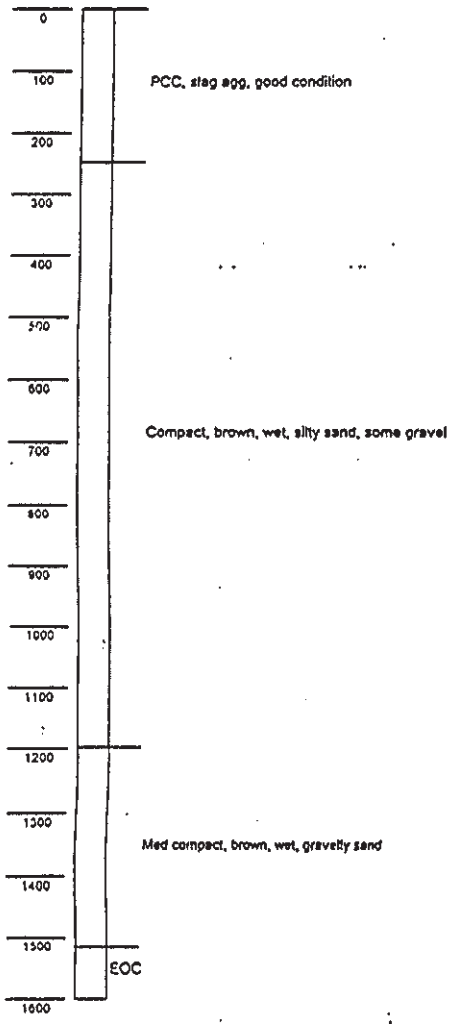
STATION NO.: 6+120 m west of Wayne Road
LAT. OFFSET: 160 cm LT of RT EOM
DATE CORED: 4/15/99
FIELD CREW: JZ/BM

DEPTH (mm)	DESCRIPTION
0	ACC, nat agg, good condition (wearing course)
100	ACC, nat agg, good condition (leveling course)
200	EOC
300	
400	
500	
600	
700	
800	
900	
1000	
1100	
1200	
1300	
1400	
1500	
1600	

PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far RT lane

TEST HOLE NO. M-153, CORE #25

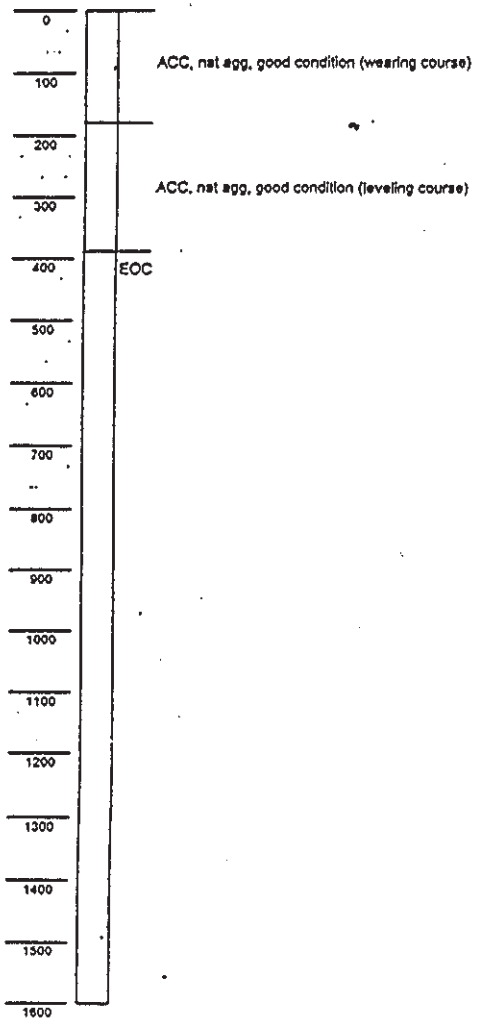
STATION NO.: 4+330 m west of Wayne Road
LAT. OFFSET: 190 cm LT of RT EOM
DATE CORED: 4/19/99
FIELD CREW: JZ/BM



PCC re-steel depth = 96 mm
PCC re-steel Dia. = 9 mm
Core taken in EB M-153, far RT lane

TEST HOLE NO. M-153, CORE #26

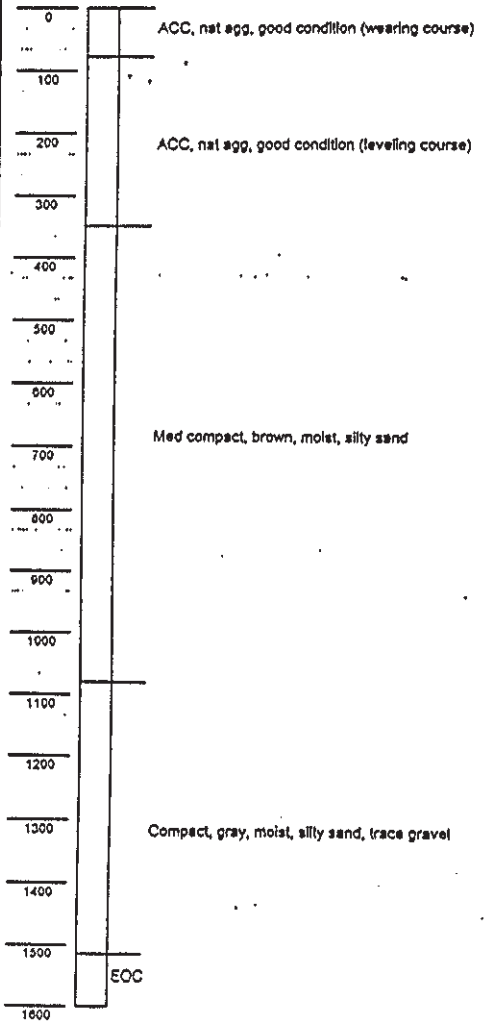
STATION NO.: 3+590 m west of Wayne Road
LAT. OFFSET: 170 cm LT of RT EOM
DATE CORED: 4/19/99
FIELD CREW: JZ/BM



PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far RT lane

TEST HOLE NO. M-153, CORE #27

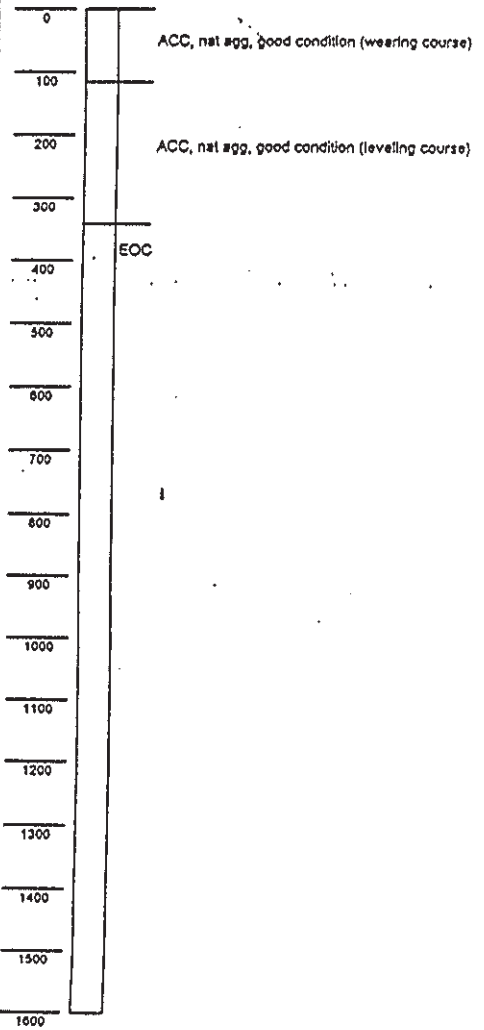
STATION NO.: 2+355 m west of Wayne Road
LAT. OFFSET: 180 cm LT of RT EOM
DATE CORED: 4/20/99
FIELD CREW: JZ/BM



PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far RT lane

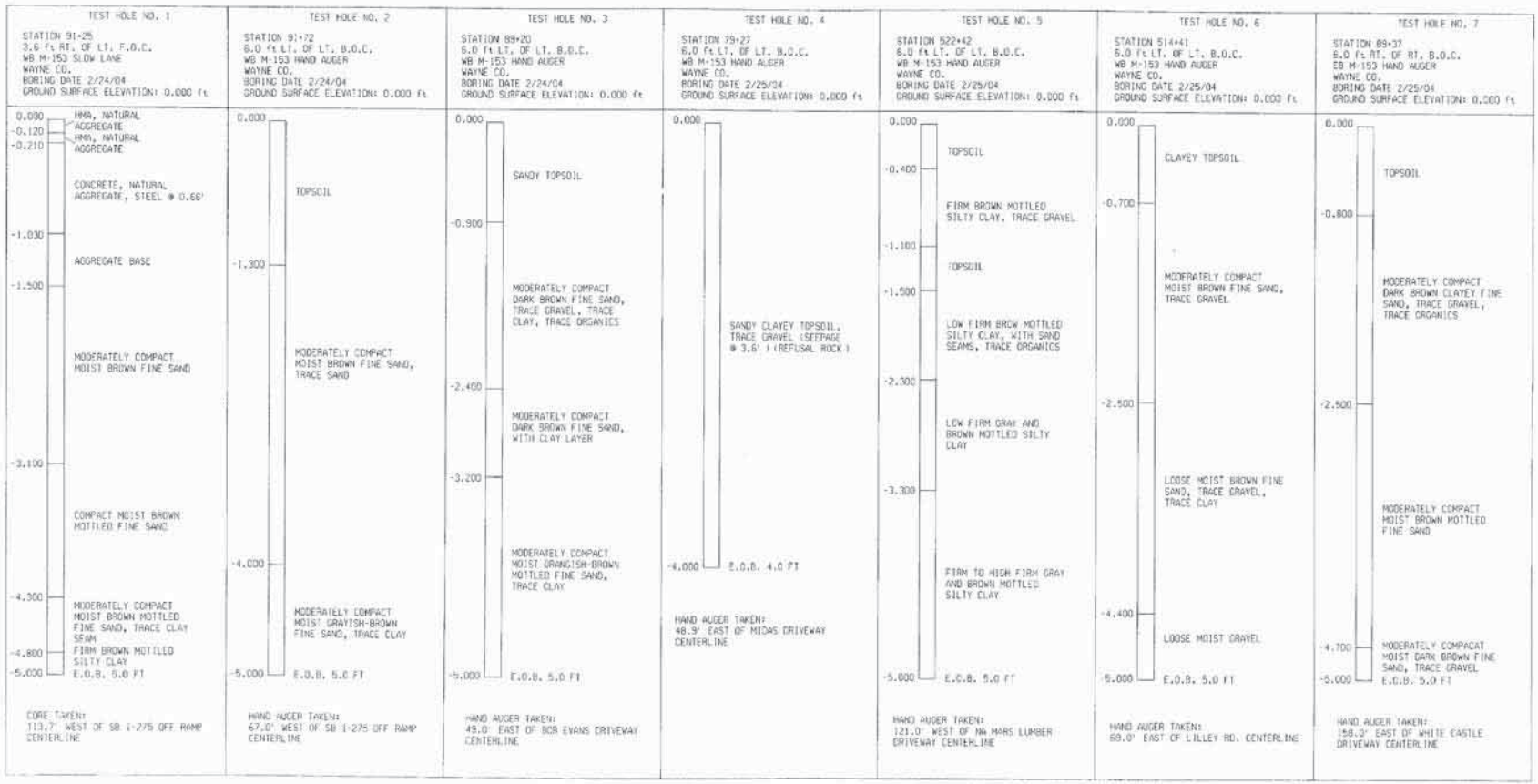
TEST HOLE NO. M-153, CORE #28

STATION NO.: 1+090 m west of Wayne Road
LAT. OFFSET: 180 cm LT of RT EOM
DATE CORED: 4/21/99
FIELD CREW: JZ/BM



PCC re-steel depth = None
PCC re-steel Dia. = None
Core taken in EB M-153, far RT lane

AUTH	DATE	NO.	REVISION
			FINAL R.O.W.



WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER

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

URS Corporation
Surface Transportation
Grand Rapids Farmington Hills
Traverse City Saginaw

MDOT
Michigan Department of Transportation

SOIL BORINGS & PAVEMENT CORES

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
12/28/04	1" = NONE	82081	78170A	SWEENEY	M.D.W. CONST. 100

DATE: 12/16/04
DRAWN BY: JB
DATE: 12/17/04
CHECKED BY: JPK

AUTH	DATE	NO.	FINAL R.O.W. REVISION

TEST HOLE NO. 8

STATION 91+95
6.0 ft RT. OF RT. B.O.C.
EB M-153 HAND AUGER
WAYNE CO.
BORING DATE 2/26/04
GROUND SURFACE ELEVATION: 0.000 ft

HAND AUGER TAKEN:
54.0' WEST OF EB M-153 ON RAMP CENTERLINE

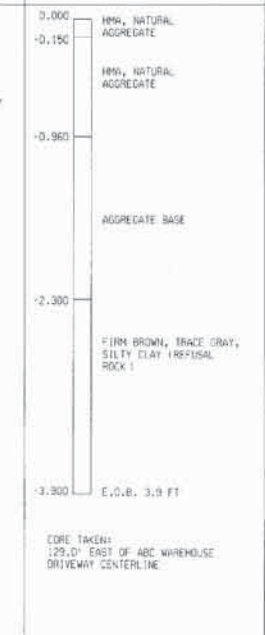
TEST HOLE NO. 9

STATION 82+43
5.0 ft RT. OF LT. E.O.M.,
WB M-153 SLOW LANE
WAYNE CO.
BORING DATE 2/27/04
GROUND SURFACE ELEVATION: 0.000 ft

CORE TAKEN:
46.0' EAST OF SHELL 2ND DRIVEWAY CENTERLINE

TEST HOLE NO. 10

STATION 76+05
7.2 ft LT. OF LT. E.O.M.,
WB M-153 RT. TURN LANE
WAYNE CO.
BORING DATE 2/27/04
GROUND SURFACE ELEVATION: 0.000 ft



CORE TAKEN:
129.0' EAST OF ABC WAREHOUSE DRIVEWAY CENTERLINE

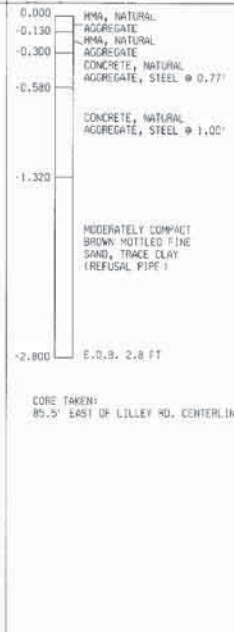
TEST HOLE NO. 11

STATION 522+42
6.2 ft RT. OF LT. E.O.M.
WB M-153 SLOW LANE
WAYNE CO.
BORING DATE 2/27/04
GROUND SURFACE ELEVATION: 0.000 ft

CORE TAKEN:
121.0' WEST OF NA MARS LUMBER DRIVEWAY CENTERLINE

TEST HOLE NO. 12

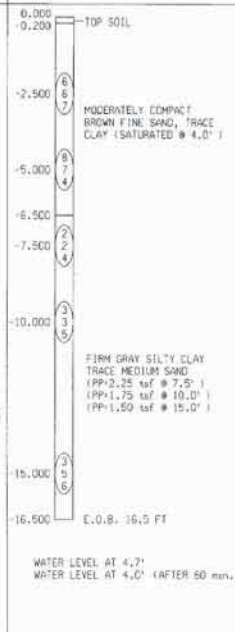
STATION 514+58
6.3 ft RT. OF LT. E.O.M.
WB M-153 SLOW LANE
WAYNE CO.
BORING DATE 2/27/04
GROUND SURFACE ELEVATION: 0.000 ft



CORE TAKEN:
85.5' EAST OF LILLEY RD. CENTERLINE

TEST HOLE NO. 13

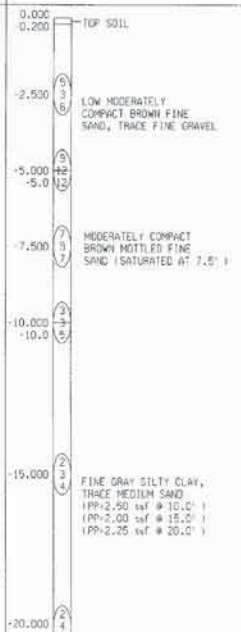
STATION 92+00
47.0 ft LT. OF LT. E.O.M.
WB M-153 SLOW LANE
WAYNE CO.
BORING DATE 9/21/04
GROUND SURFACE ELEVATION: 0.000 ft



WATER LEVEL AT 4.2'
WATER LEVEL AT 4.0' (AFTER 60 min.)

TEST HOLE NO. 14

STATION 91+40
21.0 ft RT. OF RT. E.O.M.
EB M-153 SLOW LANE
WAYNE CO.
BORING DATE 9/21/04
GROUND SURFACE ELEVATION: 0.000 ft



WATER LEVEL AT 16.4'
WATER LEVEL AT 8.2' (AFTER 60 min.)

WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER

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

NUMBERS IN CIRCLES DENOTE NUMBER OF BLOWS RECORDED TO DRIVE A 2" O.D., 1 3/8" I.D., SPLIT SPOON SAMPLER 3 SUCCESSIVE 6" INCREMENTS

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

(0) 1st 6 in
(3) 2nd 6 in
(7) 3rd 6 in

USING A 140 lb HAMMER FALLING 30"

URS Surface Transportation
Grand Rapids Farmington Hills Traverse City Lansing

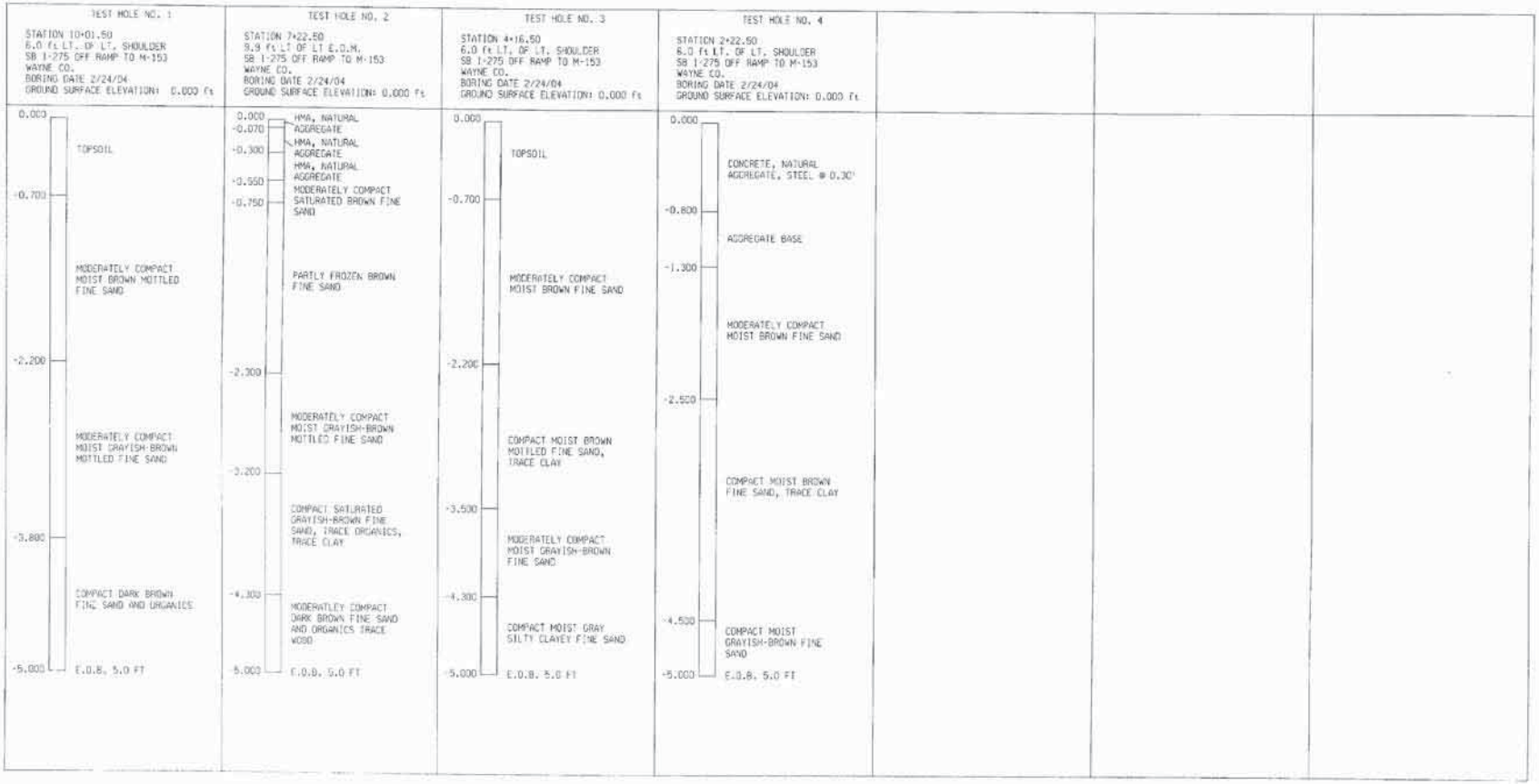
MDOT Michigan Department of Transportation

SOIL BORINGS & PAVEMENT CORES

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO.
12/28/04	1" = NONE	82081	78170A	SWEENEY	R.O.W. 101 / CONST.

DATE: 12/16/04 WORKED ON BY: JB DATE: 12/17/04 CHECKED BY: JRK

AUTH	DATE	NO.	REVISION
			FINAL R.O.W.



WATER LEVELS MAY BE INFLUENCED BY RESIDUAL BORING WATER

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

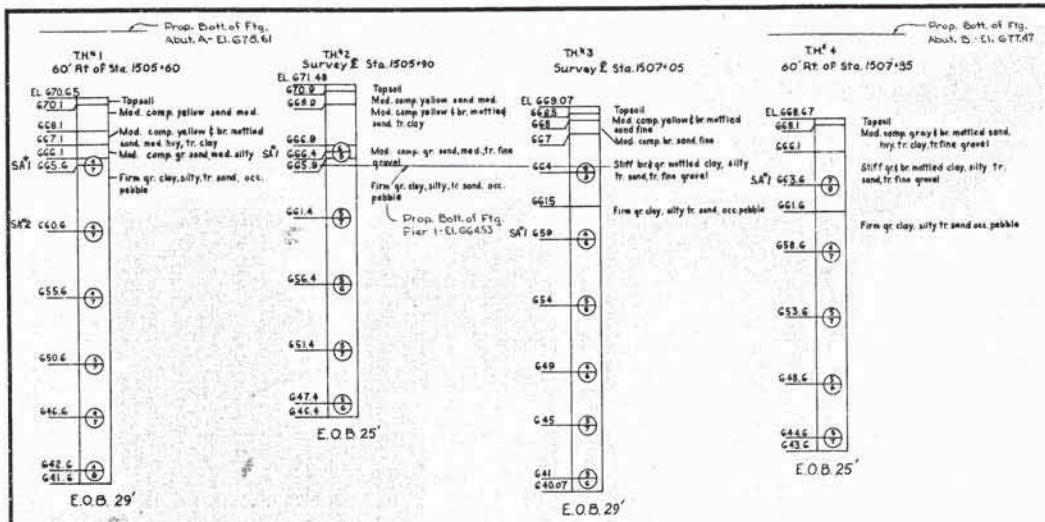
URS
Surface Transportation
Grand Rapids, Farmington Hills, Traverse City, Lansing

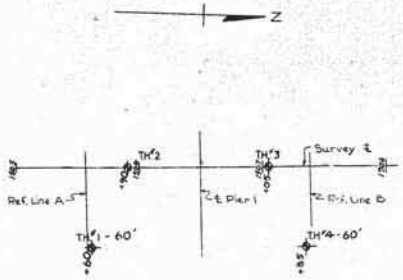
MDOT
Michigan Department of Transportation

SOIL BORINGS & PAVEMENT CORES

DATE	SCALE	CONT. SEC.	JOB NO.	DESIGN UNIT	SHEET NO. R.O.W.	SHEET NO. CONST.
12/28/04	1" = NONE	82292	76041A	SWEENEY		102

DATE: 12/16/04
WORKED ON BY: JB
DATE: 12/17/04
PLOTTED BY: JB





BORING LOCATION SKETCH
Scale 1"=40'

Water level below ground after completion (casing pulled).
T.H. 1---------- 24 hr.- 4 ft.
T.H. 2---------- 24 hr.- 4.5 ft.
T.H. 3--1/4 hr.- 1 ft., 24 hr.- 2 ft.
T.H. 4--1/4 hr.-05ft; 24 hr.- 2 ft.

NOTES:
(12/6) Numbers in circle denotes number of blows required to drive 1 3/4" O.D. x 1 3/8" I.D. split spoon sampler 12" (two 6" increments) using a 140 lb. hammer falling 30 in..

Consistency determined by inspection of samples and by soils resistance to penetration by jetrod and casing or auger.

Date of Boring 8/28/67

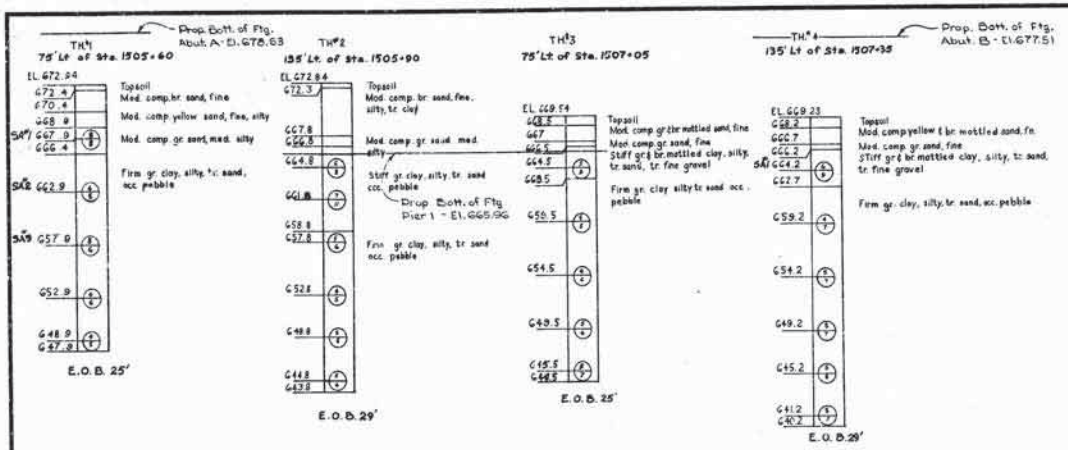
MICHIGAN DEPARTMENT OF STATE HIGHWAYS

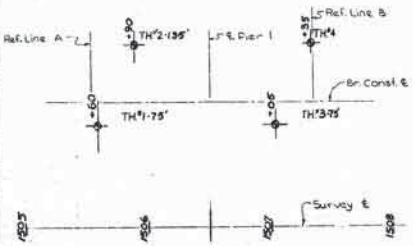
LOG of BORINGS

REVISIONS			
NO.	DESCRIPTION	DATE	BY

SI5 of 82292D

04744





BORING LOCATION SKETCH
Scale 1" = 40'

Water level below ground after completion (casing pulled).
TH#1---------- 24 hr. - 4 ft.
TH#2---------- 24 hr. - 4.5 ft.
TH#3 -- 1/4 hr. - 1 ft. , 24 hr. - 2 ft.
TH#4 -- 1/4 hr. - 0.5 ft. , 24 hr. - 2 ft.

NOTES:
(16) 16 Numbers in circle denotes number of blows required to 2nd 6" drive 1 3/4" O.D. x 1 3/8" I.D. split spoon sampler 12" (two 6" increments) using a 140 lb. hammer falling 30 in..

Consistency determined by inspection of samples and by soils resistance to penetration by jet rod and casing or auger.

Date of Boring 8/28/67

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

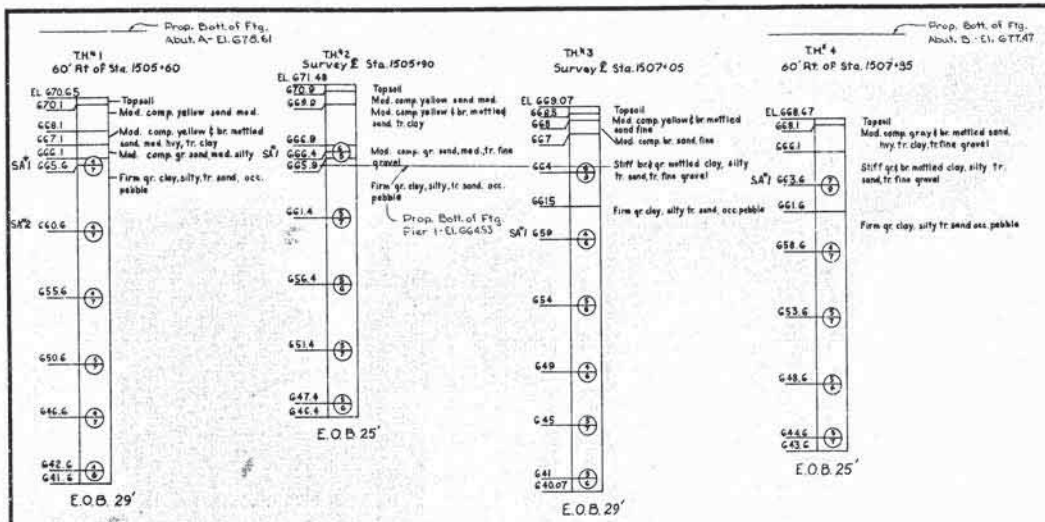
LOG of BORINGS

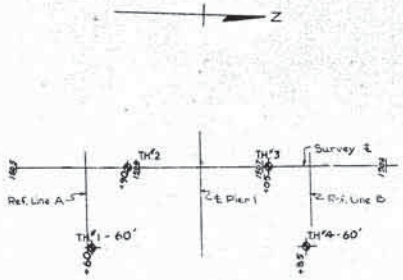
REVISIONS			
NO.	DESCRIPTION	DATE	BY

TRACED BY	J.L.V.	9/11/67
CHECKED BY	COL.	CHC 7-9-69
SHEET	3	OF 14

S08 of 82292D

04744A





BORING LOCATION SKETCH
Scale 1"=40'

Water level below ground after completion (casing pulled).
T.H. 1---------- 24 hr.- 4 ft.
T.H. 2---------- 24 hr.- 4.5 ft.
T.H. 3--1/4 hr.- 1 ft., 24 hr.- 2 ft.
T.H. 4--1/4 hr.-05ft; 24 hr.- 2 ft.

NOTES:
(12/6) Numbers in circle denotes number of blows required to drive 1 3/4" O.D. x 1 3/8" I.D. split spoon sampler 12" (two 6" increments) using a 140 lb. hammer falling 30 in..

Consistency determined by inspection of samples and by soils resistance to penetration by jetrod and casing or auger.

Date of Boring 8/28/67

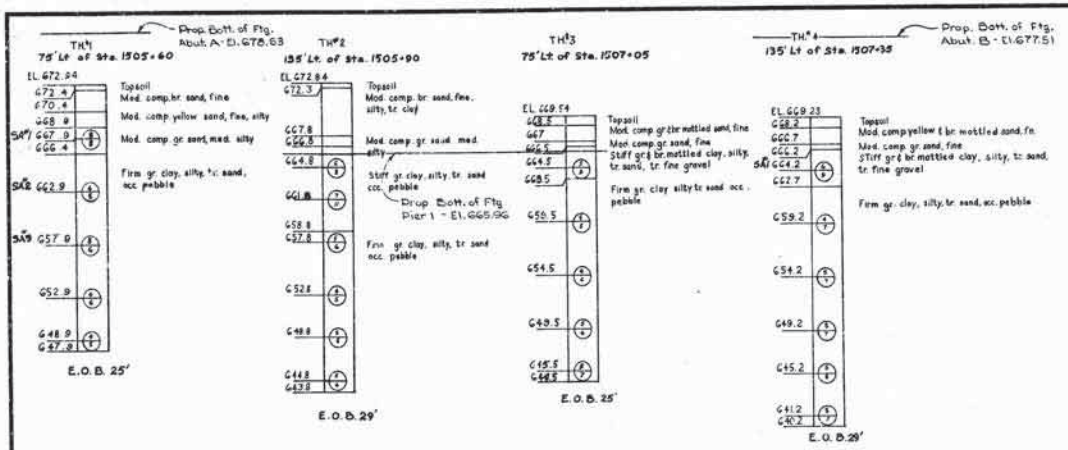
MICHIGAN DEPARTMENT OF STATE HIGHWAYS

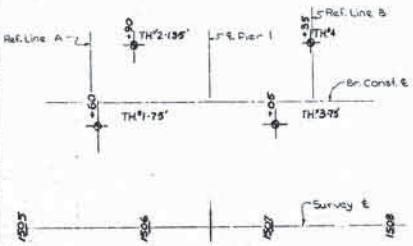
LOG of BORINGS

REVISIONS			
NO.	DESCRIPTION	DATE	BY

SI5 of 82292D

04744





BORING LOCATION SKETCH
Scale 1" = 40'

Water level below ground after completion (casing pulled).
TH#1---------- 24 hr. - 4 ft.
TH#2---------- 24 hr. - 4.5 ft.
TH#3 -- 1/4 hr. - 1 ft. , 24 hr. - 2 ft.
TH#4 -- 1/4 hr. - 0.5 ft. , 24 hr. - 2 ft.

NOTES:
(16) 16 Numbers in circle denotes number of blows required to 2nd 6" drive 1 3/4" O.D. x 1 3/8" I.D. split spoon sampler 12" (two 6" increments) using a 140 lb. hammer falling 30 in..

Consistency determined by inspection of samples and by soils resistance to penetration by jet rod and casing or auger.

Date of Boring 8/28/67

MICHIGAN DEPARTMENT OF STATE HIGHWAYS

LOG of BORINGS

REVISIONS			
NO.	DESCRIPTION	DATE	BY

TRACED BY	J.L.V.	9/11/67
CHECKED BY	COL.	CHC 7-9-69
SHEET	3	OF 14

S08 of 82292D

04744A

List of Test Holes by Project:

MDOT CS 82081 JN 45708, April 1999
Somat Project G99043D:
Test Hole No. M-153, Core #23
Test Hole No. M-153, Core #12
Test Hole No. M-153, Core #1

Legend:

Approximate Test Hole Locations
Based on Historical Scoping Documents

Somat Engineering

Somat Project No.
2012101A
Date: 8/9/2013

Test Hole Location Diagram
From Previous Projects
Ford Road (M-153) From Sheldon Rd
to Lotz Rd in Canton, Michigan

List of Test Holes by Project:

MDOT CS 82081 JN 45708, April 1999
Somat Project G99043D:
Test Hole No. M-153, Core #24
Test Hole No. M-153, Core #18
Test Hole No. M-153, Core #13
Test Hole No. M-153, Core #7

MDOT CS 82081 JN 78170A, February 2004:
Test Hole No. 6
Test Hole No. 12
Test Hole No. 5
Test Hole No. 11
Test Hole No. 10

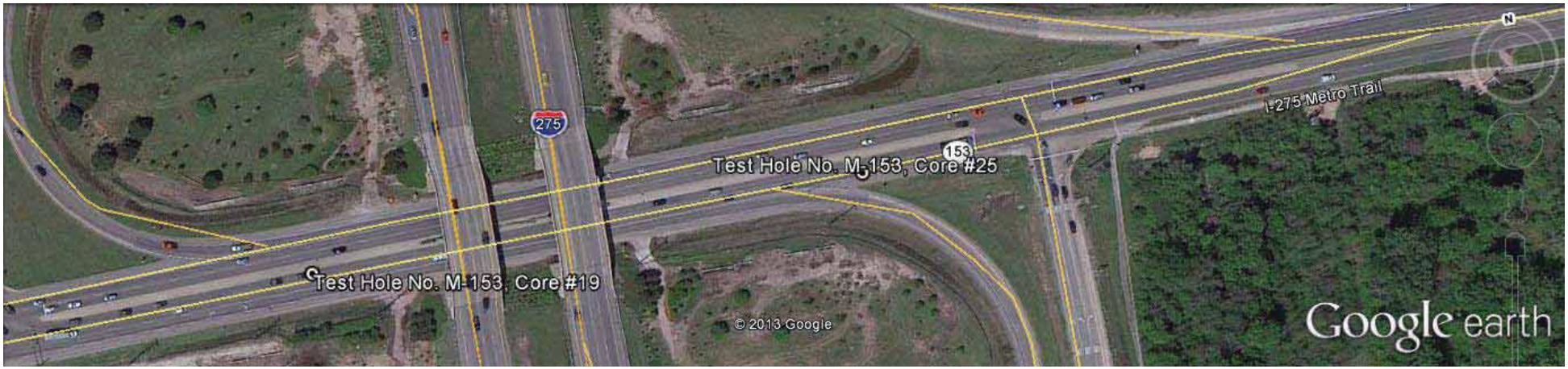
Legend:

⊙ Approximate Test Hole Locations
Based on Historical Scoping Documents

Somat Engineering

Somat Project No.
2012101A
Date: 8/9/2013

Test Hole Location Diagram
From Previous Projects
Ford Road (M-153) From Sheldon Rd to Lotz Rd in Canton, Michigan



List of Test Holes by Project:

MDOT CS 82081 JN 45708, April 1999
Somat Project G99043D:
Test Hole No. M-153, Core #2
Test Hole No. M-153, Core #14
Test Hole No. M-153, Core #19
Test Hole No. M-153, Core #25

MDOT CS 82081 JN 78170A, February 2004:
Test Hole No. 4
Test Hole No. 9
Test Hole No. 3
Test Hole No. 7
Test Hole No. 1
Test Hole No. 2
Test Hole No. 8

MDOT CS 82081 JN 78170A, September 2004:
Test Hole No. 13
Test Hole No. 14

Legend:

⊙ Approximate Test Hole Locations
Based on Historical Scoping Documents

List of Test Holes by Project:

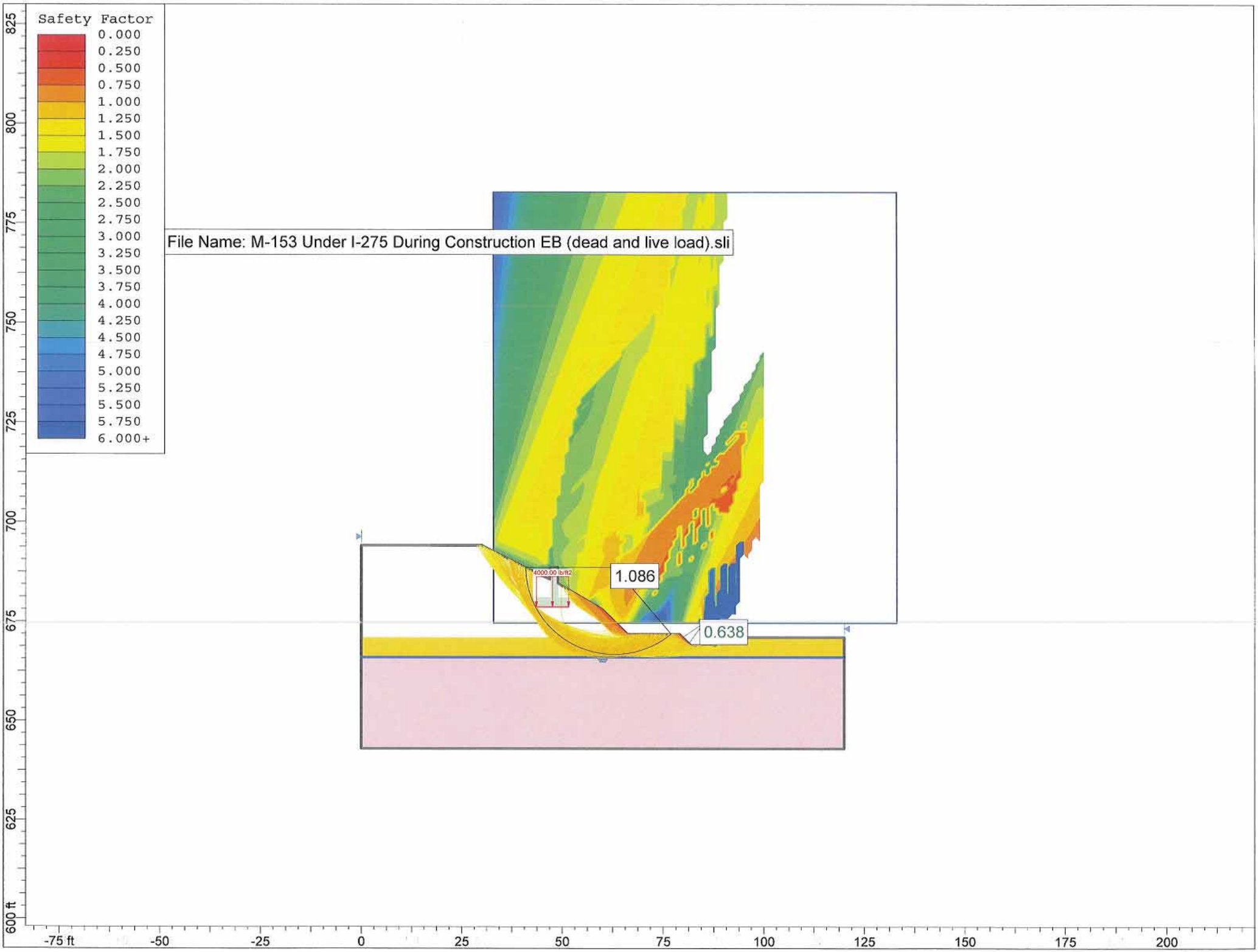
MDOT CS 82081 JN 45708, April 1999
Somat Project G99043D:
Test Hole No. M-153, Core #8

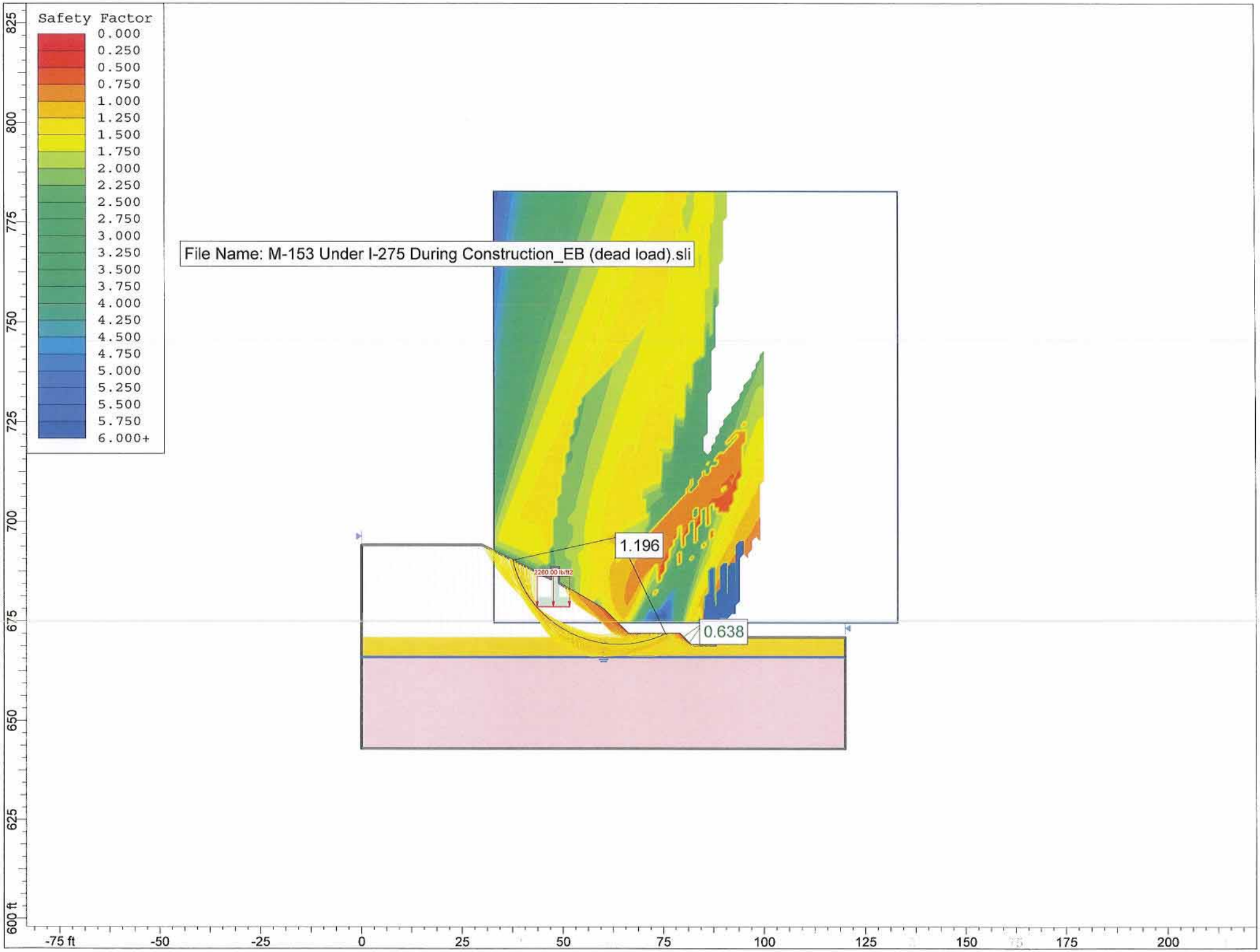
Legend:

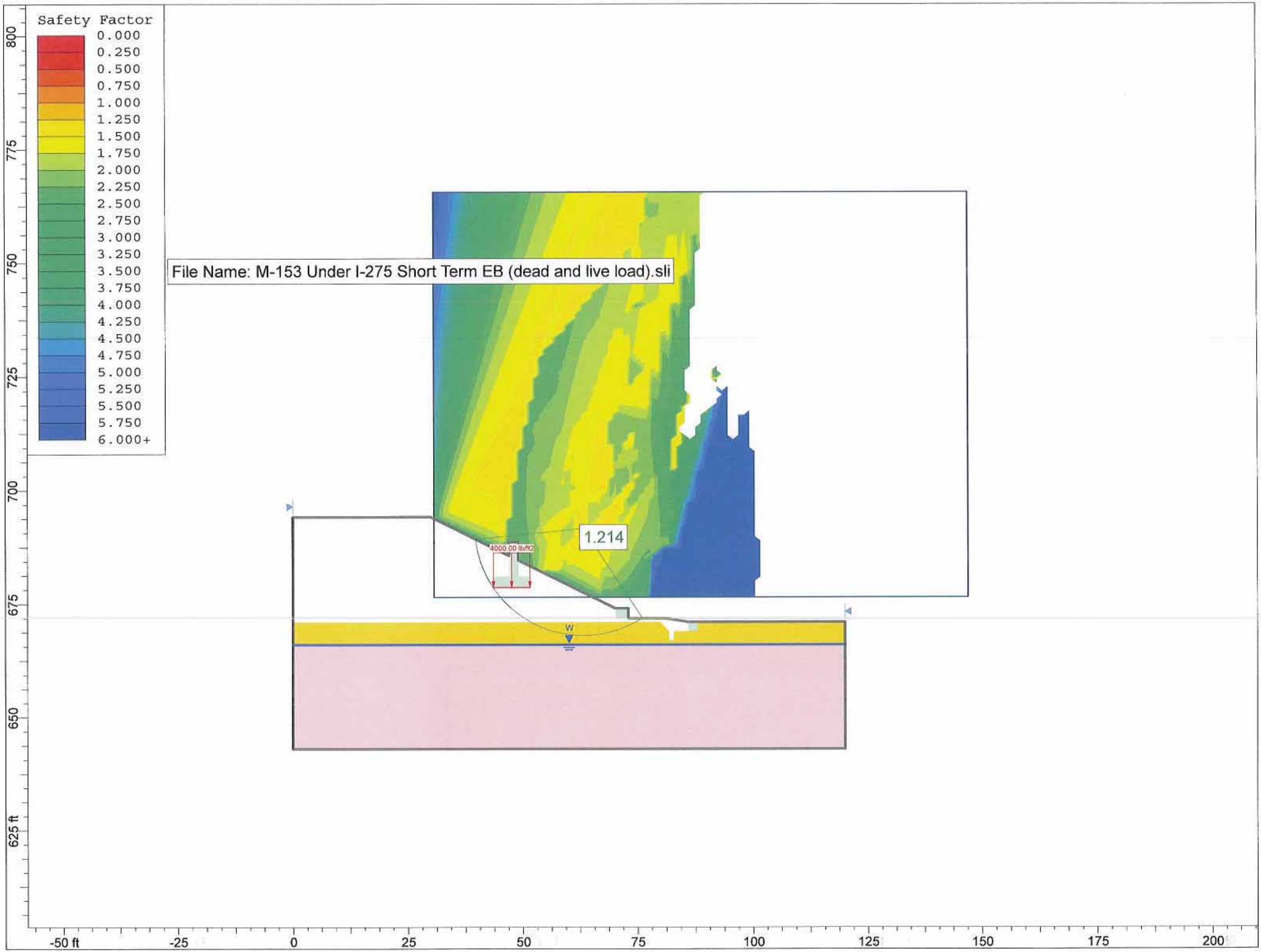
Approximate Test Hole Locations
Based on Historical Scoping Documents

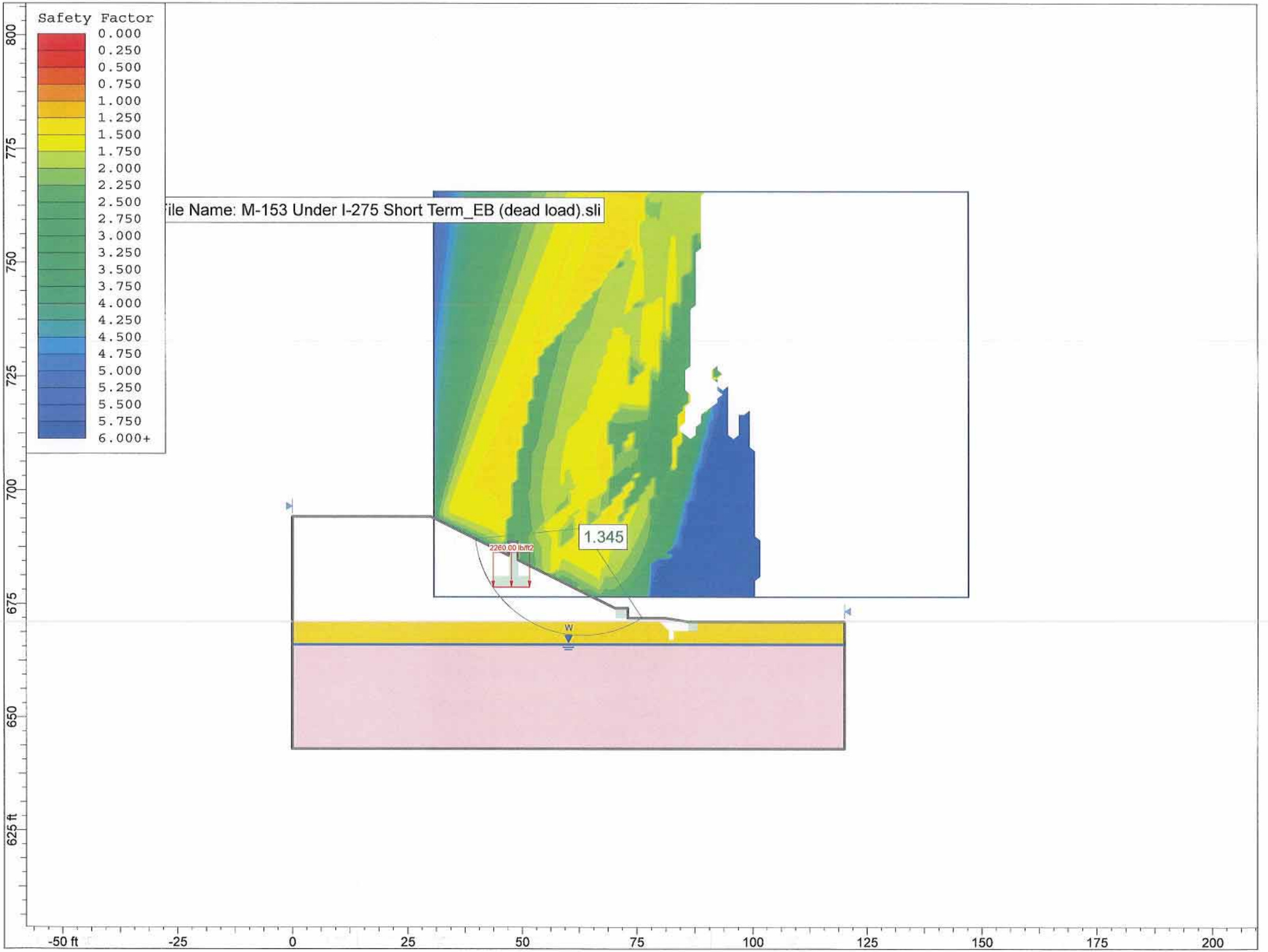
APPENDIX B

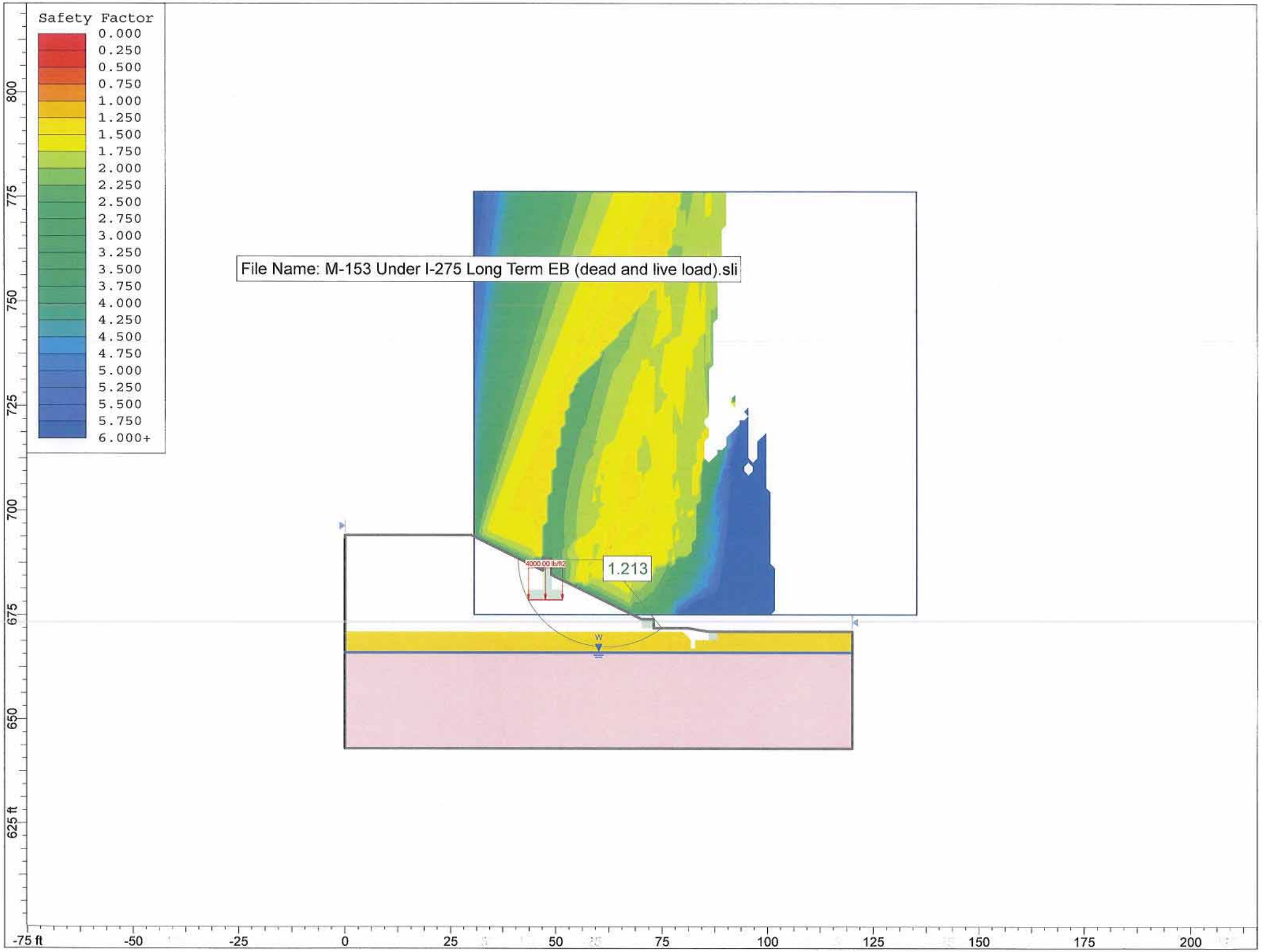
GRAPHICAL RESULTS OF PRELIMINARY GLOBAL STABILITY ANALYSIS

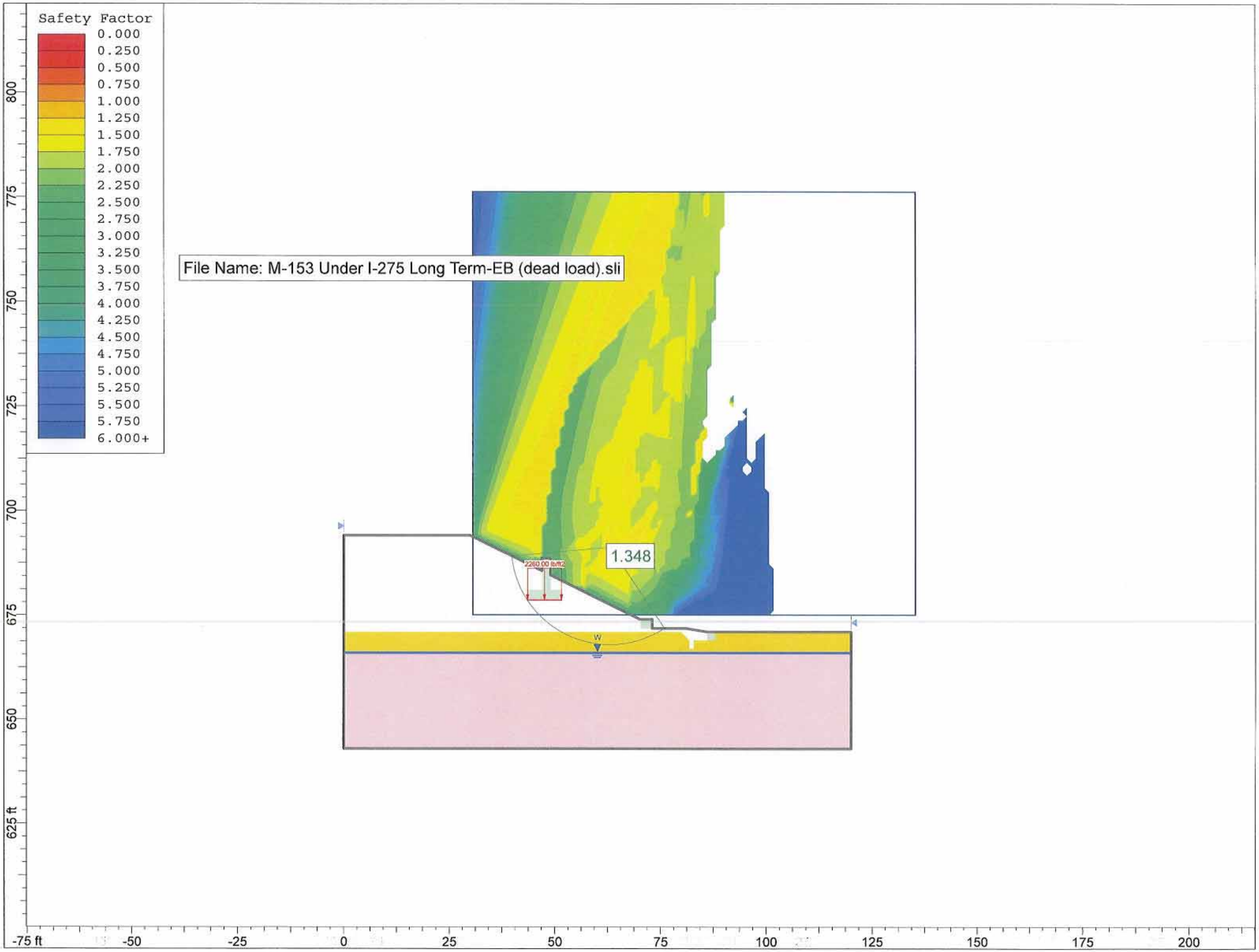

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 During Construction EB (dead and live load).sli
1.086
0.638
825
800
775
750
725
700
675
650
625
600 ft
-75 ft
-50
-25
0
25
50
75
100
125
150
175
200

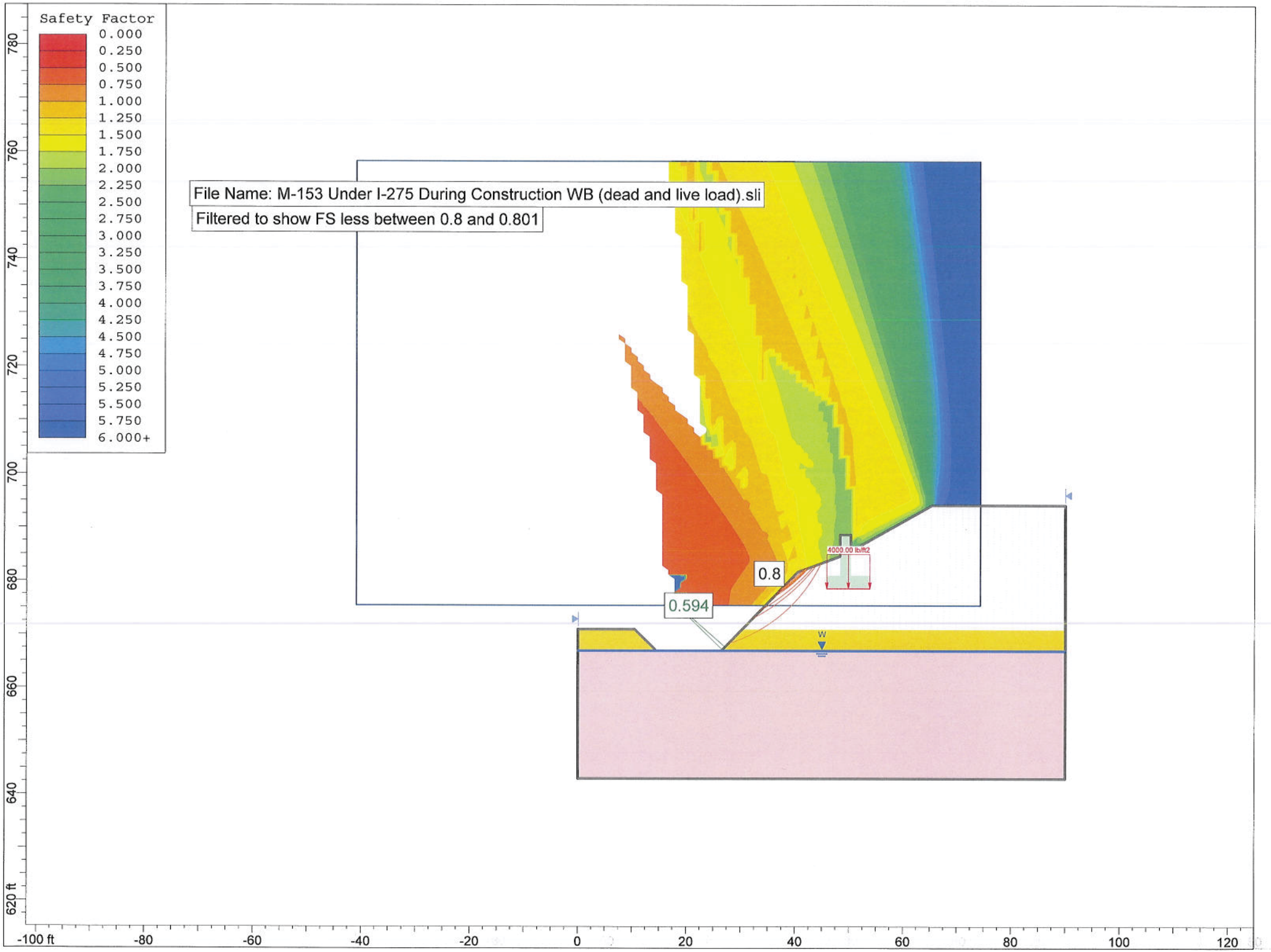

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 During Construction_EB (dead load).sli
1.196
0.638
2280.00 lb/ft2
825
800
775
750
725
700
675
650
625
600 ft
-75 ft
-50
-25
0
25
50
75
100
125
150
175
200

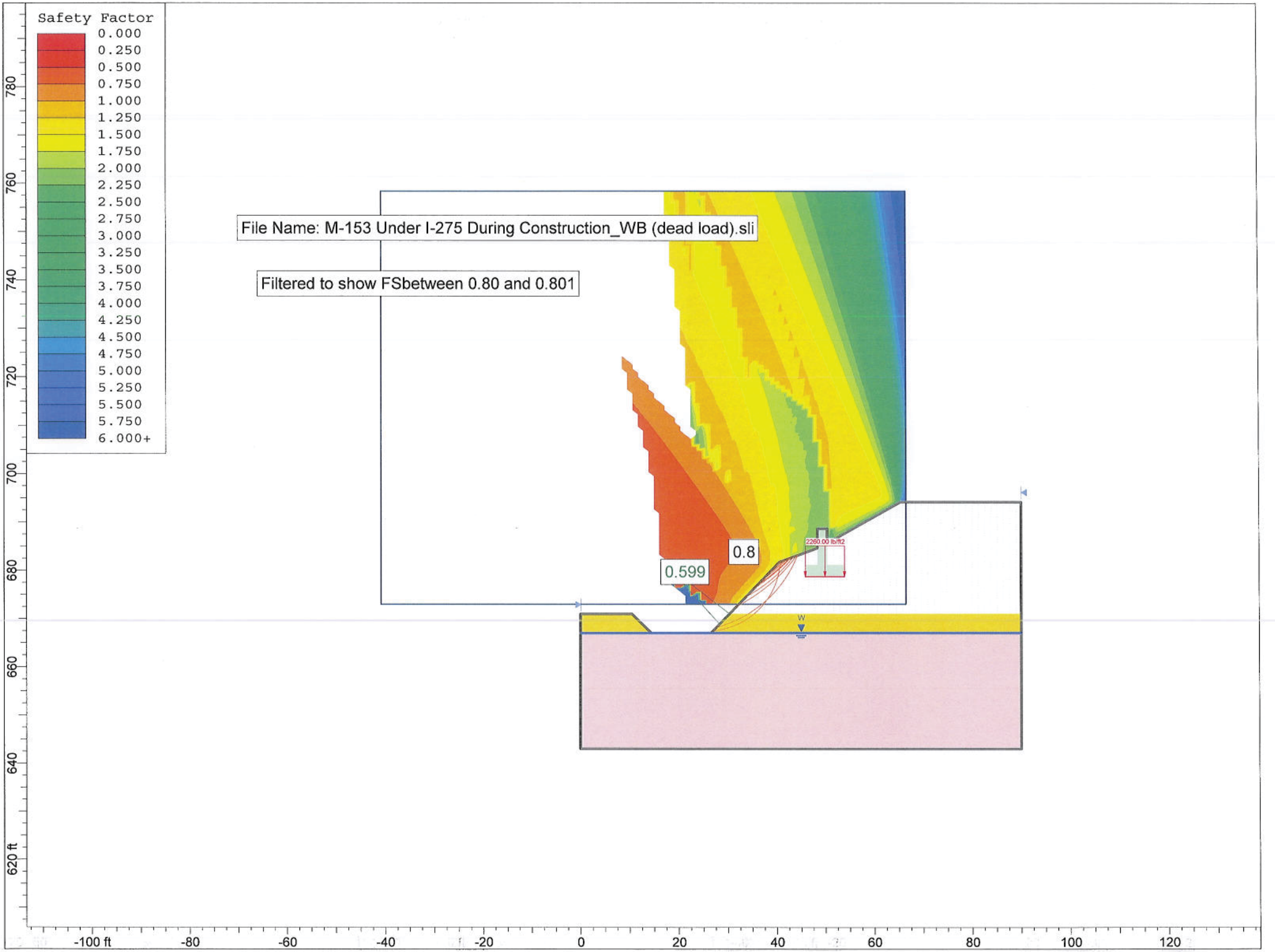

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Short Term EB (dead and live load).sli
1.214
4000.00 lb/ft2
W
800
775
750
725
700
675
650
625 ft
-50 ft
-25
0
25
50
75
100
125
150
175
200

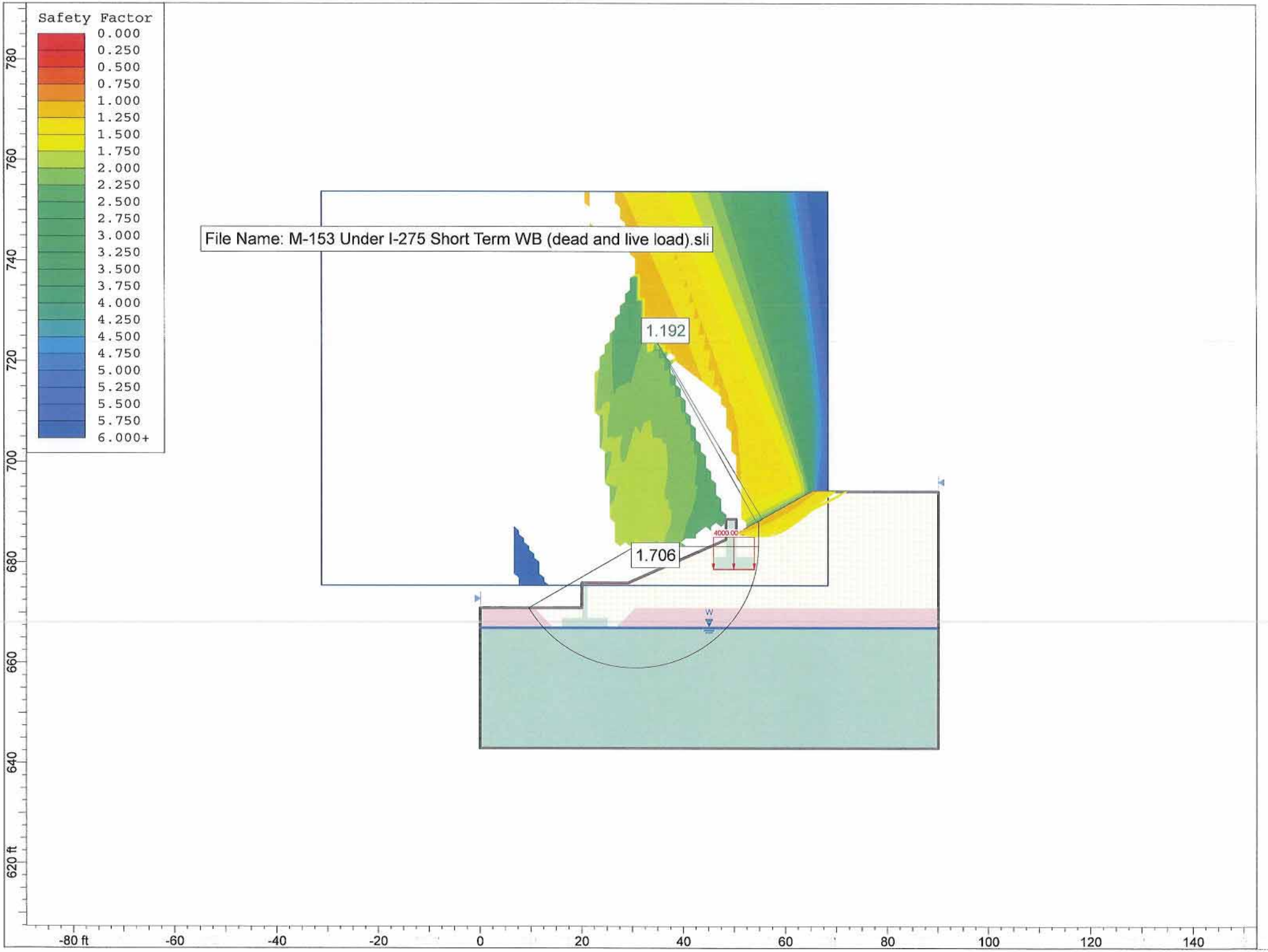

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Short Term_EB (dead load).sli
1.345
2260.00 lb/ft2
W
800
775
750
725
700
675
650
625 ft
-50 ft
-25
0
25
50
75
100
125
150
175
200

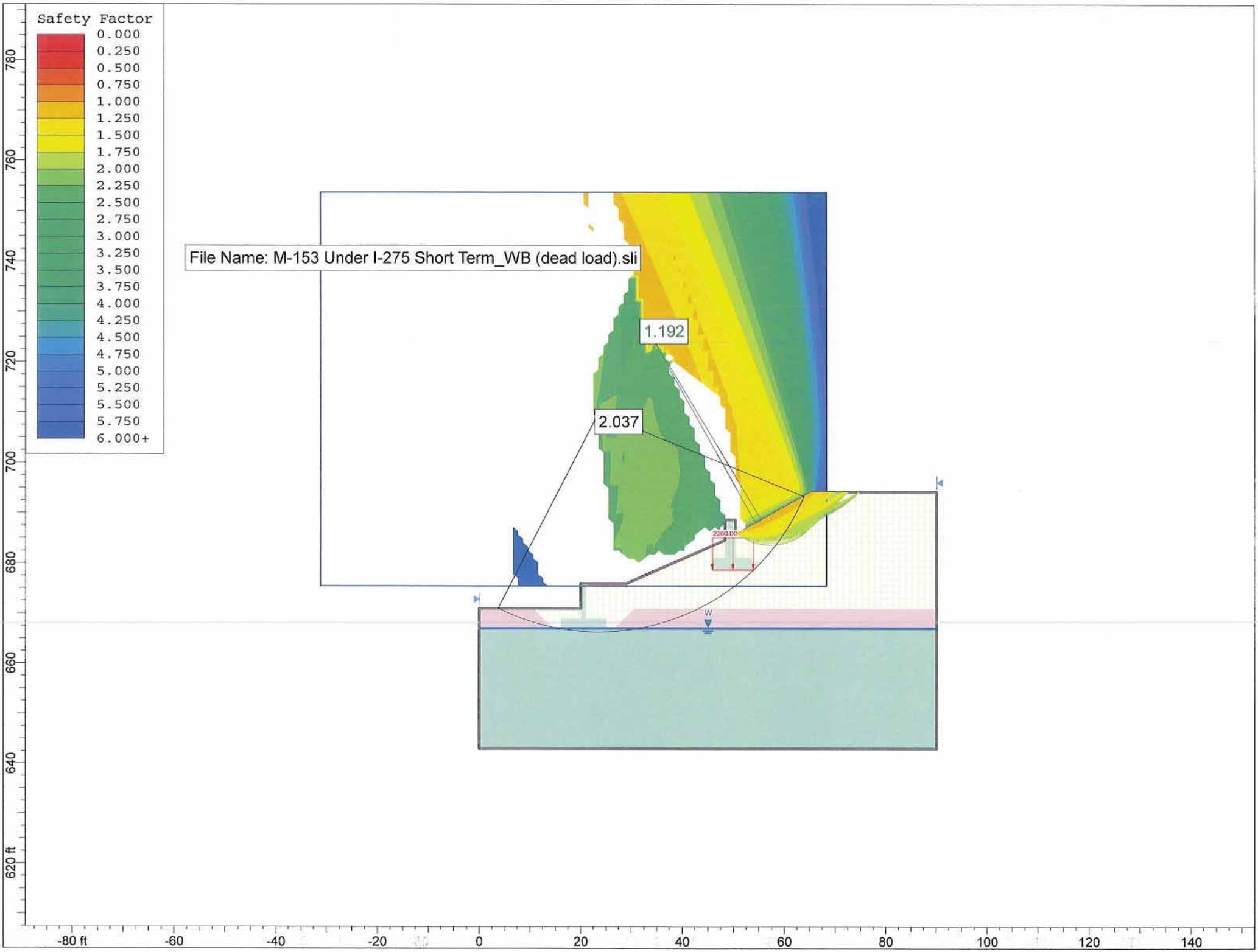

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Long Term EB (dead and live load).sli
1.213
4000.00 lb/ft2
W
800
775
750
725
700
675
650
625 ft
-75 ft
-50
-25
0
25
50
75
100
125
150
175
200

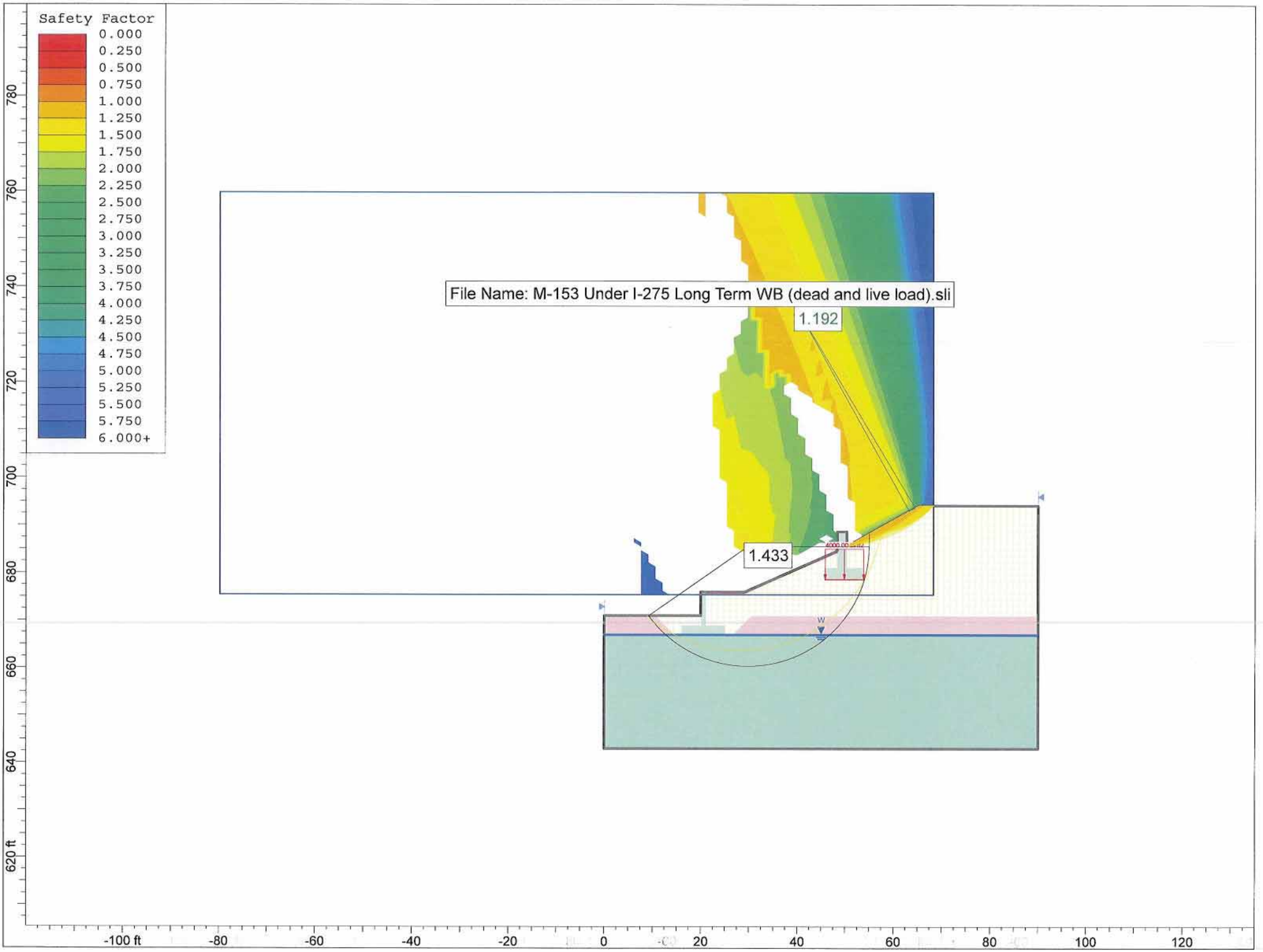

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Long Term-EB (dead load).sli
1.348
2260.00 lb/ft2
W
800
775
750
725
700
675
650
625 ft
-75 ft
-50
-25
0
25
50
75
100
125
150
175
200

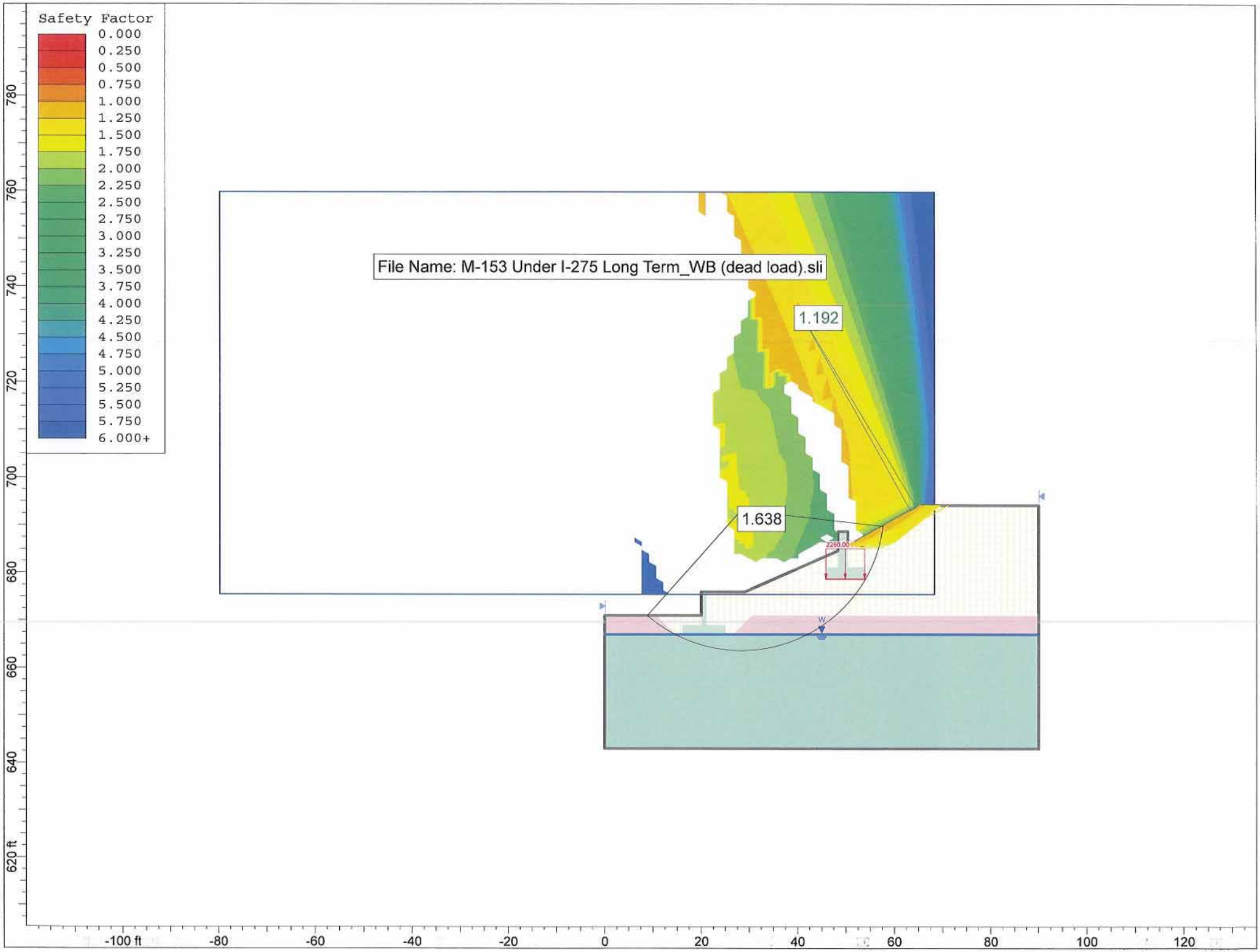

Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 During Construction WB (dead and live load).sli
Filtered to show FS less between 0.8 and 0.801
0.8
0.594
4000.00 lb/ft2
W
780
760
740
720
700
680
660
640
620 ft
-100 ft
-80
-60
-40
-20
0
20
40
60
80
100
120


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 During Construction_WB (dead load).sli
Filtered to show FSbetween 0.80 and 0.801
0.8
0.599
2260.00 lb/ft2
W
780
760
740
720
700
680
660
640
620 ft
-100 ft
-80
-60
-40
-20
0
20
40
60
80
100
120


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Short Term WB (dead and live load).sli
1.192
1.706
4000.00
W
780
760
740
720
700
680
660
640
620 ft
-80 ft
-60
-40
-20
0
20
40
60
80
100
120
140


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Short Term_WB (dead load).sli
1.192
2.037
2260.00
W
780
760
740
720
700
680
660
640
620 ft
-80 ft
-60
-40
-20
0
20
40
60
80
100
120
140


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Long Term WB (dead and live load).sli
1.192
1.433
W
780
760
740
720
700
680
660
640
620 ft
-100 ft
-80
-60
-40
-20
0
20
40
60
80
100
120


Safety Factor
0.000
0.250
0.500
0.750
1.000
1.250
1.500
1.750
2.000
2.250
2.500
2.750
3.000
3.250
3.500
3.750
4.000
4.250
4.500
4.750
5.000
5.250
5.500
5.750
6.000+
File Name: M-153 Under I-275 Long Term_WB (dead load).sli
1.192
1.638
2260.00
780
760
740
720
700
680
660
640
620 ft
-100 ft
-80
-60
-40
-20
0
20
40
60
80
100
120

APPENDIX C

"IMPORTANT INFORMATION ABOUT YOUR GEOTECHNICAL REPORT"

Important Information about Your

Geotechnical Engineering Report

Subsurface problems are a principal cause of construction delays, cost overruns, claims, and disputes.

While you cannot eliminate all such risks, you can manage them. The following information is provided to help.

Geotechnical Services Are Performed for Specific Purposes, Persons, and Projects

Geotechnical engineers structure their services to meet the specific needs of their clients. A geotechnical engineering study conducted for a civil engineer may not fulfill the needs of a construction contractor or even another civil engineer. Because each geotechnical engineering study is unique, each geotechnical engineering report is unique, prepared *solely* for the client. No one except you should rely on your geotechnical engineering report without first conferring with the geotechnical engineer who prepared it. *And no one — not even you* — should apply the report for any purpose or project except the one originally contemplated.

Read the Full Report

Serious problems have occurred because those relying on a geotechnical engineering report did not read it all. Do not rely on an executive summary. Do not read selected elements only.

A Geotechnical Engineering Report Is Based on A Unique Set of Project-Specific Factors

Geotechnical engineers consider a number of unique, project-specific factors when establishing the scope of a study. Typical factors include: the client's goals, objectives, and risk management preferences; the general nature of the structure involved, its size, and configuration; the location of the structure on the site; and other planned or existing site improvements, such as access roads, parking lots, and underground utilities. Unless the geotechnical engineer who conducted the study specifically indicates otherwise, do not rely on a geotechnical engineering report that was:

- not prepared for you,
- not prepared for your project,
- not prepared for the specific site explored, or
- completed before important project changes were made.

Typical changes that can erode the reliability of an existing geotechnical engineering report include those that affect:

- the function of the proposed structure, as when it's changed from a parking garage to an office building, or from a light industrial plant to a refrigerated warehouse,
- elevation, configuration, location, orientation, or weight of the proposed structure,
- composition of the design team, or
- project ownership.

As a general rule, *always* inform your geotechnical engineer of project changes—even minor ones—and request an assessment of their impact. *Geotechnical engineers cannot accept responsibility or liability for problems that occur because their reports do not consider developments of which they were not informed.*

Subsurface Conditions Can Change

A geotechnical engineering report is based on conditions that existed at the time the study was performed. *Do not rely on a geotechnical engineering report* whose adequacy may have been affected by: the passage of time; by man-made events, such as construction on or adjacent to the site; or by natural events, such as floods, earthquakes, or groundwater fluctuations. *Always* contact the geotechnical engineer before applying the report to determine if it is still reliable. A minor amount of additional testing or analysis could prevent major problems.

Most Geotechnical Findings Are Professional Opinions

Site exploration identifies subsurface conditions only at those points where subsurface tests are conducted or samples are taken. Geotechnical engineers review field and laboratory data and then apply their professional judgment to render an opinion about subsurface conditions throughout the site. Actual subsurface conditions may differ—sometimes significantly—from those indicated in your report. Retaining the geotechnical engineer who developed your report to provide construction observation is the most effective method of managing the risks associated with unanticipated conditions.

A Report's Recommendations Are *Not* Final

Do not overrely on the construction recommendations included in your report. *Those recommendations are not final,* because geotechnical engineers develop them principally from judgment and opinion. Geotechnical engineers can finalize their recommendations only by observing actual

subsurface conditions revealed during construction. *The geotechnical engineer who developed your report cannot assume responsibility or liability for the report's recommendations if that engineer does not perform construction observation.*

A Geotechnical Engineering Report Is Subject to Misinterpretation

Other design team members' misinterpretation of geotechnical engineering reports has resulted in costly problems. Lower that risk by having your geotechnical engineer confer with appropriate members of the design team after submitting the report. Also retain your geotechnical engineer to review pertinent elements of the design team's plans and specifications. Contractors can also misinterpret a geotechnical engineering report. Reduce that risk by having your geotechnical engineer participate in prebid and preconstruction conferences, and by providing construction observation.

Do Not Redraw the Engineer's Logs

Geotechnical engineers prepare final boring and testing logs based upon their interpretation of field logs and laboratory data. To prevent errors or omissions, the logs included in a geotechnical engineering report should *never* be redrawn for inclusion in architectural or other design drawings. Only photographic or electronic reproduction is acceptable, *but recognize that separating logs from the report can elevate risk.*

Give Contractors a Complete Report and Guidance

Some owners and design professionals mistakenly believe they can make contractors liable for unanticipated subsurface conditions by limiting what they provide for bid preparation. To help prevent costly problems, give contractors the complete geotechnical engineering report, *but* preface it with a clearly written letter of transmittal. In that letter, advise contractors that the report was not prepared for purposes of bid development and that the report's accuracy is limited; encourage them to confer with the geotechnical engineer who prepared the report (a modest fee may be required) and/or to conduct additional study to obtain the specific types of information they need or prefer. A prebid conference can also be valuable. *Be sure contractors have sufficient time* to perform additional study. Only then might you be in a position to give contractors the best information available to you, while requiring them to at least share some of the financial responsibilities stemming from unanticipated conditions.

Read Responsibility Provisions Closely

Some clients, design professionals, and contractors do not recognize that geotechnical engineering is far less exact than other engineering disciplines. This lack of understanding has created unrealistic expectations that have led to disappointments, claims, and disputes. To help reduce the risk of such outcomes, geotechnical engineers commonly include a variety of explanatory provisions in their reports. Sometimes labeled "limitations" many of these provisions indicate where geotechnical engineers' responsibilities begin and end, to help others recognize their own responsibilities and risks. *Read these provisions closely.* Ask questions. Your geotechnical engineer should respond fully and frankly.

Geoenvironmental Concerns Are Not Covered

The equipment, techniques, and personnel used to perform a *geoenvironmental* study differ significantly from those used to perform a *geotechnical* study. For that reason, a geotechnical engineering report does not usually relate any geoenvironmental findings, conclusions, or recommendations; e.g., about the likelihood of encountering underground storage tanks or regulated contaminants. *Unanticipated environmental problems have led to numerous project failures.* If you have not yet obtained your own geoenvironmental information, ask your geotechnical consultant for risk management guidance. *Do not rely on an environmental report prepared for someone else.*

Obtain Professional Assistance To Deal with Mold

Diverse strategies can be applied during building design, construction, operation, and maintenance to prevent significant amounts of mold from growing on indoor surfaces. To be effective, all such strategies should be devised for the *express purpose* of mold prevention, integrated into a comprehensive plan, and executed with diligent oversight by a professional mold prevention consultant. Because just a small amount of water or moisture can lead to the development of severe mold infestations, a number of mold prevention strategies focus on keeping building surfaces dry. While groundwater, water infiltration, and similar issues may have been addressed as part of the geotechnical engineering study whose findings are conveyed in this report, the geotechnical engineer in charge of this project is not a mold prevention consultant; ***none of the services performed in connection with the geotechnical engineer's study were designed or conducted for the purpose of mold prevention. Proper implementation of the recommendations conveyed in this report will not of itself be sufficient to prevent mold from growing in or on the structure involved.***

Rely on Your ASFE-Member Geotechnical Engineer for Additional Assistance

Membership in ASFE/The Geoprofessional Business Association exposes geotechnical engineers to a wide array of risk management techniques that can be of genuine benefit for everyone involved with a construction project. Confer with your ASFE-member geotechnical engineer for more information.

ASFE THE GEOPROFESSIONAL BUSINESS ASSOCIATION

8811 Colesville Road/Suite G106, Silver Spring, MD 20910
Telephone: 301/565-2733 Facsimile: 301/589-2017
e-mail: info@asfe.org www.asfe.org

IIGER01115.0MRP