ROADWAY GEOTECHNICAL REPORT

SLOPE STABILITY INVESTIGATION AND STUDY

ILLINOIS 71 AT DIMMICK HILL

FAP 627 (IL 71)
Section (I)I2
D-93-018-16
C-93-017-16
Contract 66F07
LaSalle County

Illinois Department of Transportation

Region 2, District 3

Prepared by:
Mike Short
District 3 Geotechnical Engineer
1-815-433-7085
Michael.Short@Illinois.gov

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LIST OF APPENDICES

I. GENERAL INFORMATION

A. Report Purpose

The purpose of this report is to present recommendations on how to repair the existing slope stability problems at the project location.

B. Project Location, Description, and Scope

A location map is provided in Appendix A.

The project is located on Illinois 71, 0.4 miles east of 1101st Road in Kaskaskia Canyon, in Starved Rock State Park. The site is in Deer Park Township, Section 25 of T33N, R2E, 3rd Principal Meridian, LaSalle County, Illinois.

The proposed improvements include repairs to the existing slope to provide a suitable factor of safety against slope failure to minimize future maintenance at this location.

A plan and typical section of the existing roadway and the slope failure are in Appendix B-1. Existing cross sections are in Appendix B-2.

C. Construction History

Illinois 71 at this location was originally constructed in the 1920s.

In 1987, Contract 42442 involved removing and replacing the existing pavement with 4 inches of sub-base granular material, 9 inches of PCC base course, 1.5 inches of HMA leveling binder, and 1.5 inches of HMA surface. The travel lanes were constructed to be 10 feet wide. In addition, curb and gutter was constructed.

In 1998, Contract 86785 involved widening the pavement and embankment to improve the ability of trucks to maneuver through the curve. This improvement involved widening the pavement with up to 9 feet of variable width 11 inch thick PCC base course, which was tied to the existing PCC base course. New curb and gutter, a variable depth HMA surface, and guardrail were also constructed. In addition, the embankment was widened to accommodate the wider pavement. A plan view and typical section of these improvements is provided in Appendix C-1.

Interviews of the IDOT construction staff involved with the inspection of Contract 86785 were performed. Additionally, some documentation from this project was found in the District's geotechnical files. The key information obtained from the interviews and geotechnical records is provided below:

- There were no signs of slope stability problems at the beginning of construction. However, a memorandum was located that indicated slope stability problems had occurred in the past at the south end of the curve. The memorandum does not indicate an exact location of the slope failure. A copy of this memorandum is in Appendix C-2.
- Soil borings were performed and a slope stability analysis was performed prior to construction.

- The unsuitable material shown at the toe of the slope in the proposed typical sections was found during construction. This material was removed and replaced with new embankment. A memorandum with this information is in Appendix C-3.
- Efforts were made during construction to ensure the embankment was constructed to specifications with particular attention being paid to moisture content and density.
- During construction, two or three areas were identified where water was seeping out of the existing slope. These areas were treated by placing geotechnical fabric and CA 07 aggregate to create a French drain which was day-lighted at the face of the slope. The exact locations, size, and number of these drains could not be determined. A memorandum and field book sheet with this information is in Appendix C-4.
- Standard Proctor information for the new embankment material is available and included in Appendix C-5. Unfortunately, exactly where each of the various soil types was used is not available. In addition, information on density test results could not be located.

D. Slope Failure History

By 2009, failure of the slope was evident by visual inspection. A field inspection was performed on February 4, 2010. Photos from this inspection are included in Appendix D-1.

In August 2010 the Bureau of Operations repaired the slope. They used a bulldozer to push the embankment material back into place, placed additional embankment material, shaped the slope, placed grass seed and installed an erosion control blanket. Observations made during this work indicated that the soil was very wet as it was being moved back into place and no aggregate drains or drainage pipes were found.

In December 21, 2011 a field inspection was performed. No major problems were identified. Photos from this inspection are included in Appendix D-2.

On May 5, 2014 a field inspection was performed. Significant signs of slope failures were identified. Photos from this inspection and a drawing showing the limits of the slope failure are included in Appendix D-3.

On April 10, 2015 a field inspection was performed. It was observed that the slope failure had progressed so the main scarp of the slide was closer to the roadway. A drawing showing the limits of the slope failure are included in Appendix D-4.

On July 15, 2015 a field inspection was performed. It was observed that the slope failure had progressed so the head of the slide was closer to the roadway. Some test holes were dug by hand and it was observed that the soils near the surface were very soft and wet while the soils deeper than 12 inches below the surface were firmer. One sample was taken to determine the Atterberg Limits and grain size of the soil. Photos from this inspection, a drawing showing the limits of the slope failure, and the results of the laboratory testing are included in Appendix D-5.

On August 12, 2015 a field inspection consisting of soil borings and dynamic cone penetrometer (DCP) testing was performed. The DCP testing and soil borings are discussed later in this report.

On December 11, 2015 a field inspection consisting DCP testing was performed. The results are discussed later in this report. Photos from this inspection are included in Appendix D-6

On January 25, 2016 a field inspection consisting DCP testing was performed. The results are discussed later in this report. In addition a drawing showing the limits of the slope failure was prepared. Photos from this inspection and the drawing showing the limits of the slope failure are included in Appendix D-7.

E. Soils

The soils used to construct the 1998 embankment generally consist of clay and silty clay. The soils used to construct the original embankment generally consist of silty clay loam till mixed with weathered shale.

F. Bedrock

The bedrock underlying the project has a highly variable surface elevation. At STA 9+80, a sandstone wall is present approximately 30 feet left of centerline, while at 13 feet right of centerline, a soil boring identified the bedrock surface at 31 feet below the roadway surface. Approximately 100 feet to the south of this improvement, Illinois 71 cuts through the sandstone on both the left and right sides of the roadway. The depth to bedrock was determined at various locations on the project and is discussed later in this report.

II. SUBSURFACE INVESTIGATION

A. Field Investigation

A subsurface investigation of soil borings and dynamic cone penetrometer (DCP) testing was executed to determine the physical characteristics of the soils beneath the pavement. Appendix E-1 shows the approximate locations of the soils borings and dynamic cone penetrometer tests. Appendix E-2 has logs for soil boring logs performed prior to the 1998 construction. Appendix E-3 has logs for soil borings performed in August 2015. Appendix E-4 has the results of the dynamic cone penetrometer tests.

A summary of the subsurface investigation locations is provided in Table 1.

Identification Number	Investigation Type	Station	Offset	Ground Surface Elevation	Bedrock Elevation
			Feet	Feet	Feet
1 (1997)	Soil Boring	11+67	50 RT	476.83	464.8
1 (2015)	Soil Boring	9+10.42	9 RT	519.32	515.3
2 (1997)	Soil Boring	9+60	50 RT	487.40	466.4
2 (2015)	Soil Boring	9+82.95	13 RT	510.94	479.9
3 (1997)	Soil Boring	11+67	5 RT	497.60	465.1
4 (1997)	Soil Boring	9+60	5 RT	515.24	505.2
DCP #1 (2015)	DCP			511.64	N/A
DCP #2 (2015)	DCP			509.63	N/A
DCP #3 (2015)	DCP			503.30	N/A
DCP #4 (2015)	DCP			506.12	N/A
DCP #5 (2015)	DCP			497.02	N/A
DCP #6 (2015)	DCP			490.57	N/A
DCP #7 (2015)	DCP			480.98	N/A
DCP #8 (2015)	DCP			483.11	N/A
DCP #9 (2015)	DCP			484.07	N/A
DCP #10 (2015)	DCP			505.41	N/A
DCP #11 (2015)	DCP			506.15	N/A
DCP #12 (2015)	DCP			509.34	N/A
DCP 101 (2015)	DCP			481.31	466.1
DCP 102 (2015)	DCP			491.61	482.8
DCP 103 (2015)	DCP			488.81	N/A
DCP 104 (2015)	DCP			513.97	504.8
DCP 105 (2016)	DCP			517.56	513.8
DCP 106 (2016)	DCP			509.24	N/A
DCP 107 (2016)	DCP			484.25	N/A
DCP 108 (2016)	DCP			498.21	485.4

Table 1: Subsurface Investigation Summary. Note: stations and offsets were not determined for DCP tests.

B. Groundwater Conditions

Complete precipitation data for the period prior to the subsurface investigation is provided in Table 2. Variations in groundwater elevation caused by precipitation are not expected to be significant.

Visual inspections of the exposed bedrock indicate the presence of moisture within the bedrock formation. On multiple field inspections, water was observed flowing out of the exposed bedrock to the left of Illinois 71. It is believed that this condition continues in the bedrock located under Illinois 71 and contributes a great amount of moisture to the existing embankment.

Month	Year	Actual Precipitation	Normal Precipitation	Departure from Normal (+/-)	Cumulative Actual Precipitation	Cumulative Normal Precipitation
		inch	inch	inch	inch	inch
April	2015	3.52	3.22	0.30	3.52	3.22
May	2015	4.99	4.11	0.88	8.51	7.33
June	2015	9.30	3.98	5.32	17.81	11.31
July	2015	3.50	3.85	-0.35	21.32	15.16
August	2015	1.93	3.89	-1.96	23.25	19.05

Table 2: Precipitation Data for Ottawa, Illinois

C. Existing Pavement Conditions and Previous Investigations

The existing pavement is in excellent condition. There is no evidence of cracking, heaving, or settling of the existing pavement which would indicate a problem with the underlying soils. However, the pavement does have a PCC base, which tends to “bridge” underlying soil problems more than HMA, so it cannot be assumed that there are no subsurface problems directly under the pavement.

D. Soils

The soils used to construct the original 1920’s era embankment have strength and moisture properties suitable for their use as an embankment.

The soils at the slope failure are extremely wet. It is believed moisture is coming through the underlying bedrock and seeping into the embankment. The moisture reduces the shear strength of the embankment material, which caused the slope failure.

When DCP testing was performed in the location of the current slope failure, between 2 and 3.5 feet of material at the surface demonstrated very low resistance. The underlying material exhibited a much higher penetration resistance, which indicates the shear strength of the soil is much higher at a depth of 3.5 feet below the surface. This observation indicates that the slope failure is caused by excessive moisture and the corresponding low shear strengths in the upper 3.5 feet of the embankment.

E. Bedrock

The depth to bedrock was identified in all of the soil borings. In addition, DCP tests were performed at selected locations to determine the elevation of DCP tip refusal, which is assumed to be the bedrock surface elevation.

Table 1 shows all of the soil borings and DCP tests which encountered bedrock. Appendix E-5 shows a plan view with locations and elevations of the bedrock surface shown.

III. SLOPE FAILURE INVESTIGATION

A. Failure Cause

Based on the visual inspections, construction records, interviews of inspection personnel, and an analysis of the existing slope, it is believed that the underlying cause of the slope failure is excessive moisture within the embankment.

B. Slope Modeling by District 3

The slope constructed in 1998 was evaluated using the Slide 5.044 software package to evaluate the conditions leading to the slope failure.

The geometry of the slope was determined using cross sections from the survey completed in 2015. The cross sections from the 1998 plans were used to define the limits of the embankment constructed in 1998. The embankment constructed in 1998 was divided into two soil types, the deeper soil located below the failure plane has a higher cohesion than the soil located at and above the failure plane. These are designated as "1998 Fill" and "1998 Fill – Weak" in the model. The location of the failure plane was estimated based on DCP testing, field inspections, and trial calculations of the model.

The properties of the soil under Illinois 71 were determined using Boring No. 2 (2015). The values for the angle of internal friction of granular soils were determined using the correlation provided in Table 4.4.6.1.2-1 of the Department's Geotechnical Manual. The unit weight of these soils was assumed to be 120 pcf. The cohesion value of cohesive soils was determined using the assumption that the soils are saturated, so the cohesion is equal to the shear strength.

The unit weight of the "1998 Fill" and "1998 Fill – Weak" was determined by reviewing the information available in the soil proctor memorandums found in the file from the 1998 embankment construction. The median unit weight of the soils tested was 109.2 pcf. Therefore a unit weight of 109 pcf is used in the analysis.

The cohesion of the "1998 Fill" was estimated using the results of the DCP testing. The IBV of the soils below the failure plane ranges from approximately 2.5 to 9, which corresponds to cohesion of 720 to 1880 psf. The cohesion value of cohesive soils was determined using the assumption that the soils are saturated, so the cohesion is equal to the shear strength. Cohesion of 1000 psf is used in the analysis.

The cohesion of the "1998 Fill – Weak" soil type is a critical parameter in the evaluation of the slope stability. In order to estimate this value, two methods were used. The results of these methods were compared to the cohesion determined from a back analysis of the slope. The cohesion value of cohesive soils was determined using the assumption that the soils are saturated, so the cohesion is equal to the shear strength.

The first method utilized Figure 5.16 of *Soil Strength and Slope Stablity* by Duncan and Wright. This figure provides a relationship between the Plasticity Index (PI), shear strength, and Standard Penetration Test blow count (SPT N). The PI was determined in the laboratory to be 18.2%. The SPT N value is assumed to be 2.0 based on DCP test #108, which had a penetration rate of 18 inches per blow. Figure 5.16 was used with these input values to determine the shear strength is 234 pounds per square foot.

The second method utilized a conversion of Immediate Bearing Value (IBV) as determined by the DCP testing. A table showing the IBV and associated shear strength of the "1998 Fill – Weak" material is provided in Table 3. This table shows it is reasonable for the shear strength to be between 36 psf and 216 psf when the slope failed.

Test Location	Measured IBV	Shear Strength (psi)	Shear Strength (psf)
DCP 108	0.2	0.25	36
DCP 1	0.5	1.25	180
DCP 2	0.4	1.00	144
DCP 3	0.6	1.50	216
DCP 4	1.3	2.80	403
DCP 5	0.3	0.40	58
DCP 6	0.2	0.25	36

Table 3: IBV and Shear Strength at Selected Locations

When the back analysis of the slope was performed, the cohesion of the "1998 Fill – Weak" material was originally estimated as 150 psf. Several iterations of the analysis were performed until the Factor of Safety was equal to 1.0. The corresponding value of cohesion was 129 psf for both a circular failure surface and for a non-circular failure surface. Since the soil is assumed to be saturated, the cohesion is equal to the shear strength. The shear strength value of 129 psf is reasonable when compared to the estimated values predicted using the two methods outlined above.

C. Slope Modeling by Independent Geotechnical Consultant

In order to validate the slope modeling performed by the District, an independent slope model was prepared by a geotechnical engineer hired by the District. This analysis results similar to those obtained in the slope model prepared by the District.

Information on the independent slope modeling is provided in Appendix F-2.

D. Slope Failure Summary

The two independent slope models were able to create a failure plane at a depth similar to what has been identified in the field. In addition, both slope models determined that an increase in strength of the soil to a cohesion of 214 psf at the failure plane will provide a suitable factor of safety. This supports the conclusion that only a minor increase in cohesion or support of the soil is necessary to provide a suitable factor of safety.

IV. SLOPE REPAIR OPTIONS

A. Repair Options Considered

Several mechanisms exist to repair the slope:

- Install plate piles to stabilize the existing embankment
- Completely remove and replace the existing embankment with soil
- Completely remove and replace the existing embankment with granular material
- Flatten the existing embankment to create a stable slope
- Construct a retaining wall
- Remove and replace the embankment material above the failure plane with soil

B. Install Plate Piles

Plate piles consist of relatively small steel pile with a flat steel plate attached to one end of the pile. The piles are driven vertically into the ground so the steel plate is parallel to the slope failure and the top of the pile rests approximately 12 inches below the finished ground surface.

This technology is owned exclusively by the GeoPier Foundation Company. Therefore, an experimental feature request must be submitted to the Bureau of Materials and Physical Research for review and approval by the Federal Highway Administration before this technology can be specified. The experimental feature work plan is included in Appendix G.

This technology is typically contracted as a complete system where the price includes the detailed design, fabrication of the pile elements, and installation. A specialty contractor must perform this work. The cost for this method is estimated to be between $20 and $30 per square foot of slope stabilized. Additional costs will be necessary for shaping the embankment, erosion control, seeding, and traffic control. A local contractor can perform the grading, seeding, and other non-specialty parts of the work.

In order to help determine the feasibility of the plate pile system, a phone conference was held with representatives of the GeoPier Foundation Company on October 26, 2015. The critical discussion items of the phone conference are:

- This site is an excellent candidate for the plate pile technology.
- It is necessary to identify the top of rock elevation as the plate piles cannot be driven into rock.
- It is not necessary to provide subsurface drainage for the plate pile system to be effective. The plate pile system is intended to provide enough support to the soils so subsurface drainage is not necessary.
- A production rate of 50-60 plate piles per day is expected.
- The estimated cost of the plate piles is $20-$30 per square foot of surface area treated.
- A suitable area for storage of materials is needed.
- Access to the slope is necessary.
- It is necessary to reshape the slope prior to installing the plate piles.

C. Remove and Replace Existing Embankment with Soil

Removing and replacing the existing embankment will consist of removing all of the existing wet soils, installing new embankment, and constructing a drainage system to allow water to drain out of the embankment.

In order to maintain the integrity of Illinois 71 during the embankment removal process, a temporary retaining wall will need to be constructed. Due to the presence of bedrock and the height of the soil that will need to be retained, design and construction of the temporary retaining wall may be complicated.

This method requires various environmental approvals before the project can be advertised on a letting. The timing of the project schedule prevents obtaining these approvals before the required letting date.

This method can be performed by local contactors using common construction equipment.

D. Remove and Replace Existing Embankment with Granular Material

Removing and replacing the existing embankment will consist of removing all of the existing wet soils, installing new granular material, and constructing a drainage system to allow water to drain out of the embankment.

In order to maintain the integrity of Illinois 71 during the embankment removal process, a temporary retaining wall will need to be constructed. Due to the presence of bedrock and the height of the soil that will need to be retained, design and construction of the temporary retaining wall may be complicated.

This method requires various environmental approvals before the project can be advertised on a letting. The timing of the project schedule prevents obtaining these approvals before the required letting date.

This method can be performed by local contactors using common construction equipment.

E. Flatten the Existing Embankment

Flattening the existing embankment will consist of removing a large number of trees beyond the toe of the existing slope, removing any existing embankment material that is excessively wet, and constructing new embankment to create a flatter and more stable slope.

This method can be performed by local contactors using common construction equipment. A temporary retaining wall will not be required.

This method requires various environmental approvals before the project can be advertised on a letting. The timing of the project schedule prevents obtaining these approvals before the required letting date. In addition, since this project is located in Starved Rock State Park, removing trees is not a feasible alternative.

This method can be performed by local contactors using common construction equipment.

F. Construct a Retaining Wall

A retaining wall located behind the existing guardrail would begin at STA 8+85 and end at STA 10+50. It would have a retained height of approximately 10 feet.

Due to the proximity of bedrock, steel sheet pile or driven soldier pile retaining walls are not feasible. A drilled soldier pile wall and a soil nail wall will require extensive subsurface investigations to delineate the locations of the underlying bedrock as well as the strength of the bedrock. Due to the urgent nature of this project, there is not enough time to perform these investigations.

This method requires various environmental approvals before the project can be advertised on a letting. The timing of the project schedule prevents obtaining these approvals before the required letting date.

This method can be performed by local contactors using common construction equipment.

G. Remove and Replace Existing Embankment Above the Failure Plane with Soil

Removing and replacing the portion of the embankment above the failure plane is not a feasible option to repair this slope. In order for this option to provide acceptable long term performance, an extensive subsurface drainage system must also be designed and constructed to intercept groundwater before it can reach the embankment. In addition, the subsurface drainage system will need to be monitored and maintained in perpetuity.

This method requires various environmental approvals before the project can be advertised on a letting. The timing of the project schedule prevents obtaining these approvals before the required letting date.

This method can be performed by local contactors using common construction equipment.

V. RECOMMENDATIONS

A. Plate Piles

Plate piles are the recommended method to repair this slope. This recommendation is based on the following reasons:

- Environmental approvals are not needed.
- Tree removal is minimized.
- Extensive subsurface drainage system is not needed.
- Extensive subsurface investigation to delineate the top of bedrock is not needed.
- TSL and SGR are not needed.
- Construction can be completed in the summer of 2016.

A special provision for plate piles is provided in Appendix H-1. Plan details for plate piles are provided in Appendix H-2. A special provision for shaping the existing embankment is provided in Appendix H-3

B. Limits of Slope Stabilization

The slope stabilization should be performed in both Area 1 and Area 2 as shown in Appendix I. While Area 2 is not currently showing significant slope movement, this area has had significant movement in the past. If Area 2 is not stabilized as part of the current project, the Department must be prepared to experience slope failures in this location in the future. In order to minimize future maintenance expenses, it is recommended to stabilize Area 1 and Area 2 at the present time.

C. Geotechnical Reports

The Roadway Geotechnical Report for this project should be made available to the contractor. A special provision for this is included in Appendix J.

D. Additional Information

If there are any questions about this report or any additional information is required, please contact the District Geotechnical Engineer.

APPENDIX

A

Project Location Map

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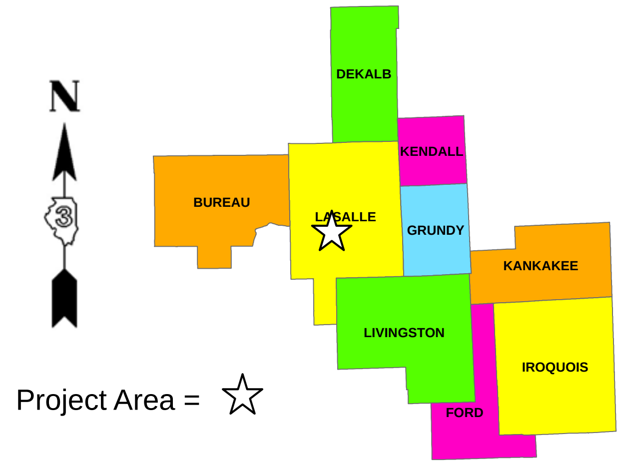
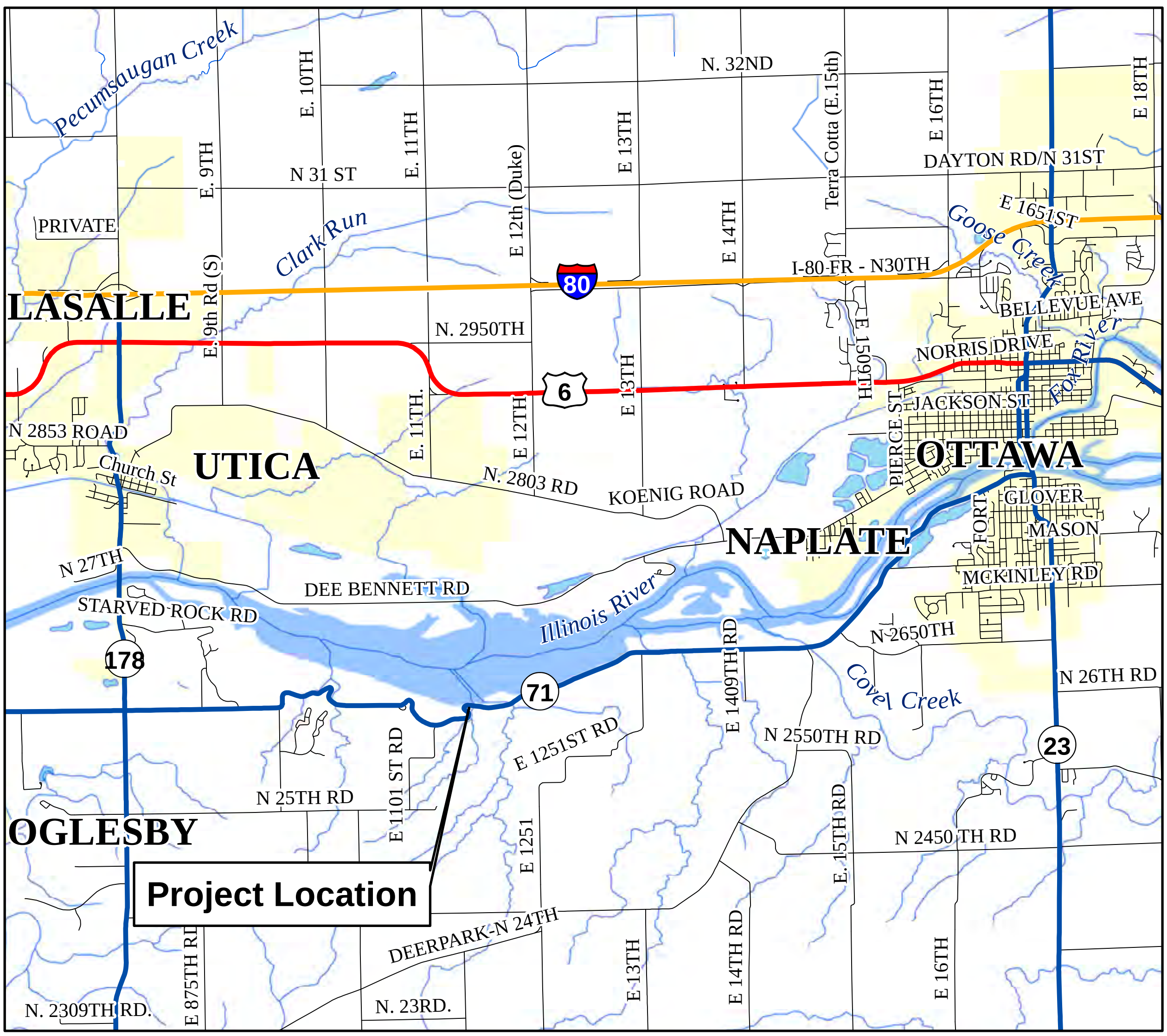
Section (I)I-2
LaSalle County
0.4 mile east of E 1101st Road
D-93-018-16
Contract No.66F07





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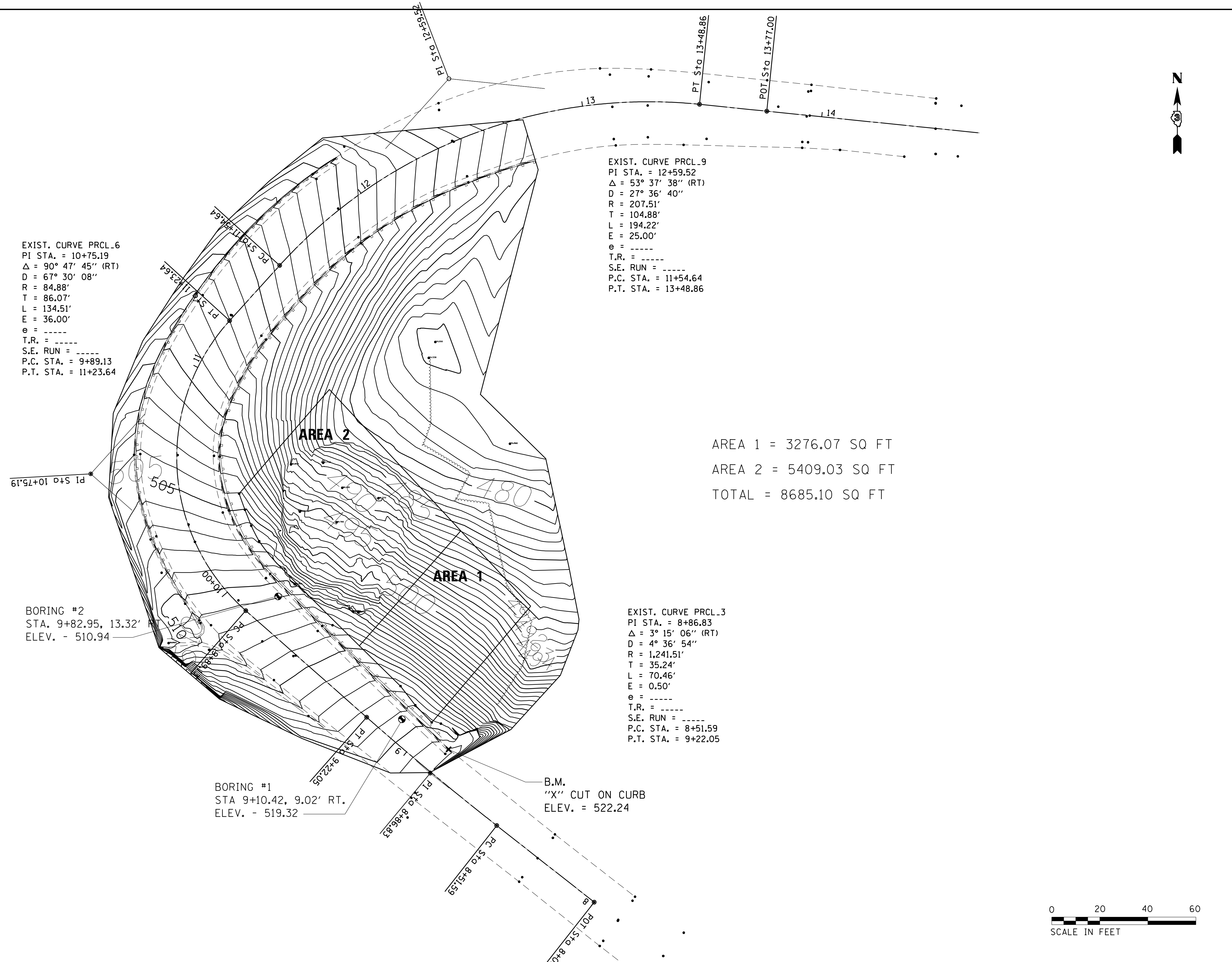
APPENDIX

B-1



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

EXISTING PLAN AND CONTOURS

SCALE: | SHEET OF SHEETS | STA. TO STA.

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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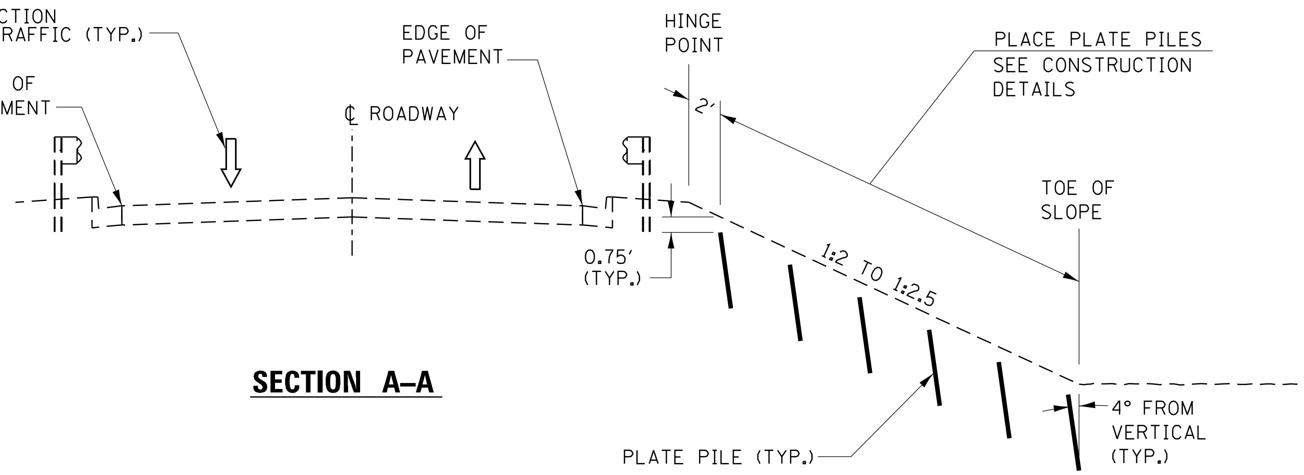
CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT



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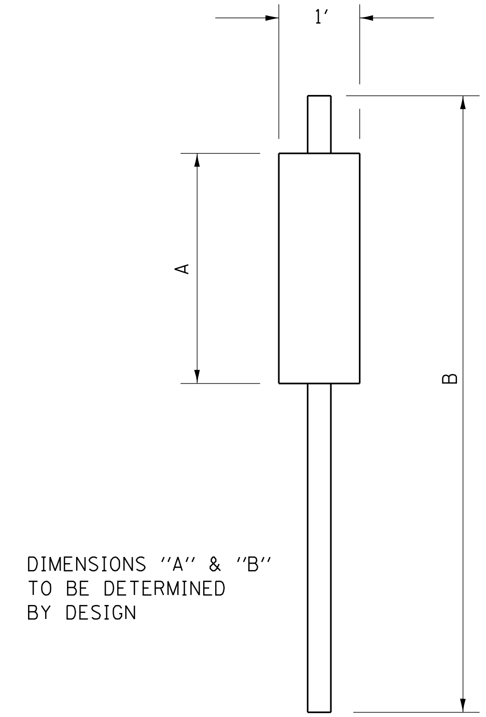
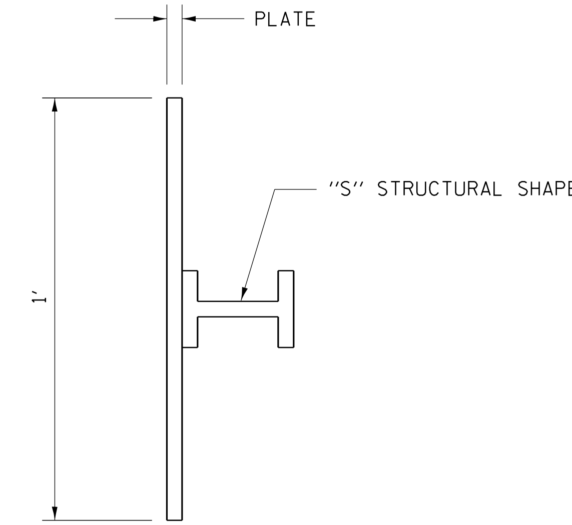


SIDE VIEW



TOP VIEW

PLATE PILE DETAILS

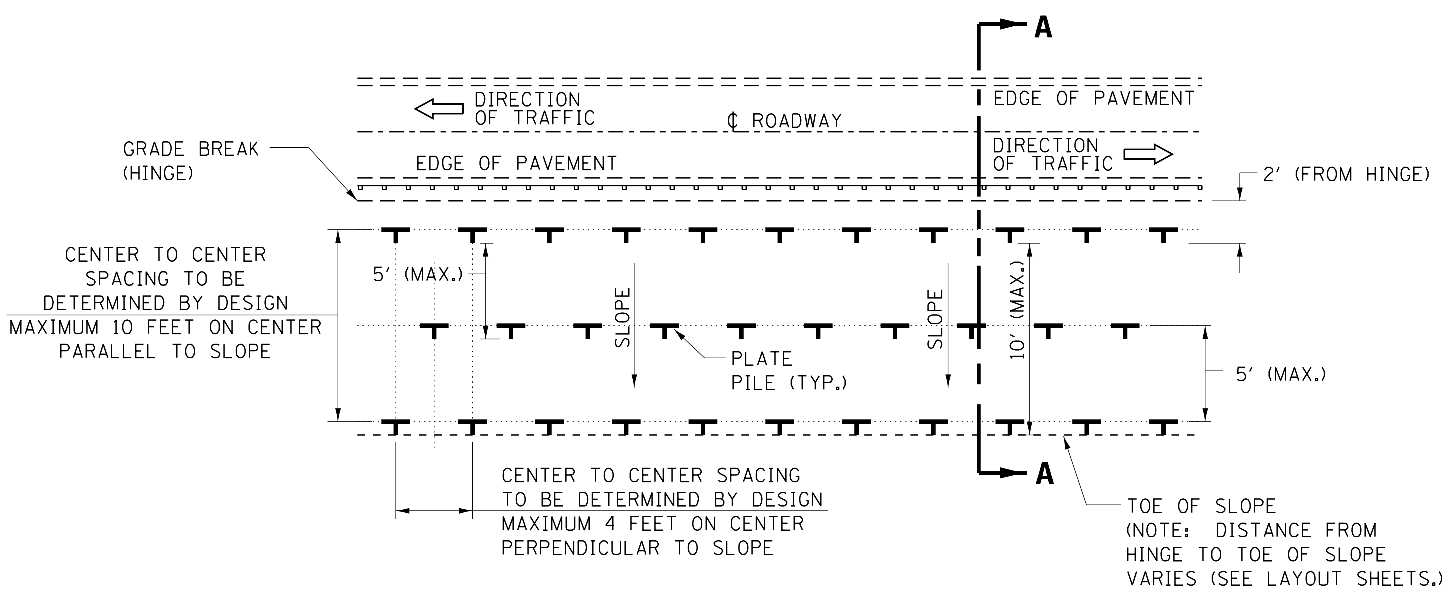


PLATE PILE LAYOUT

PLAN VIEW

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

PLATE PILES
LAYOUT AND DETAILS

SHEET OF SHEETS STA. TO STA.

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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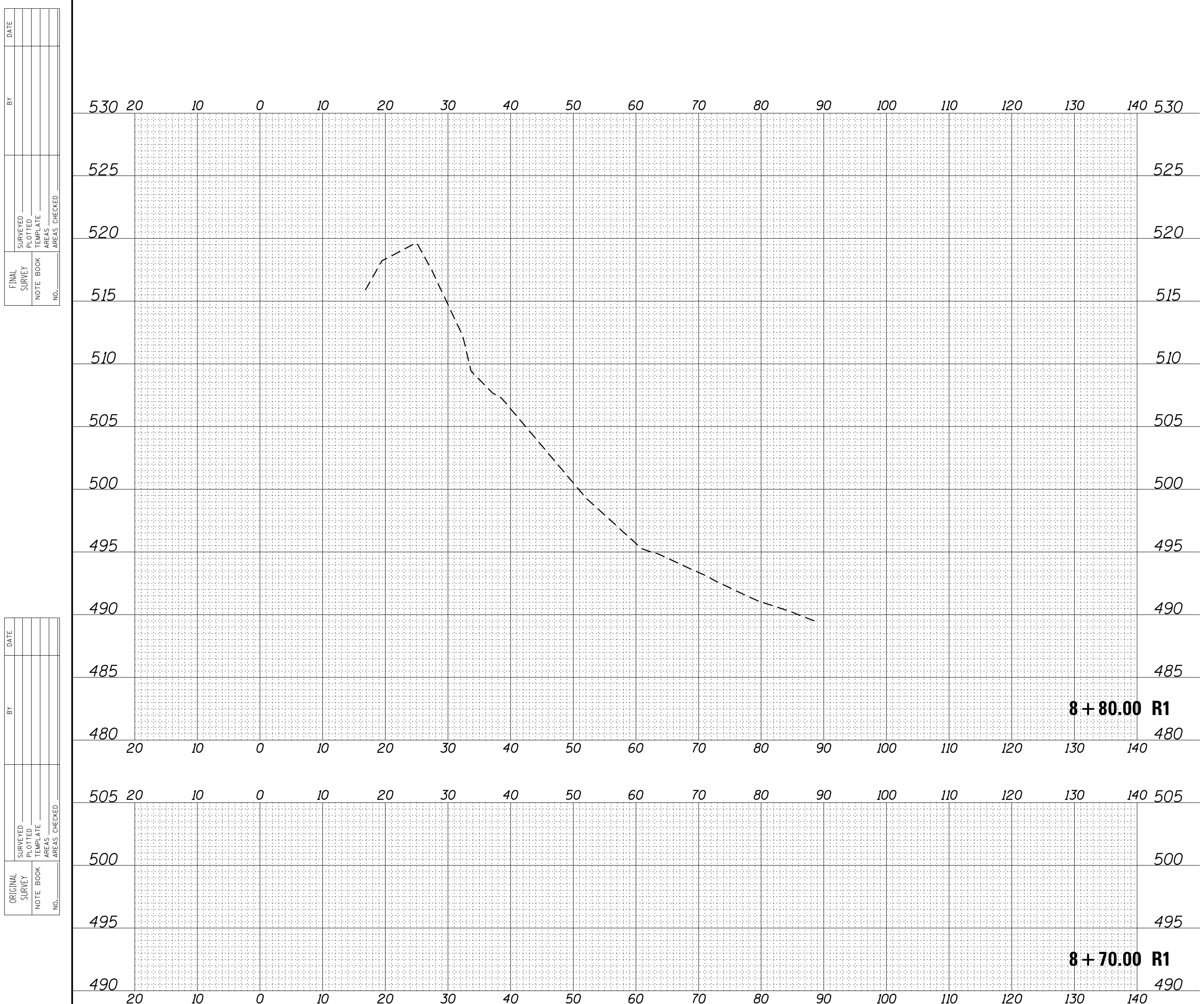
CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT

APPENDIX

B-2



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DEPARTMENT OF TRANSPORTATION

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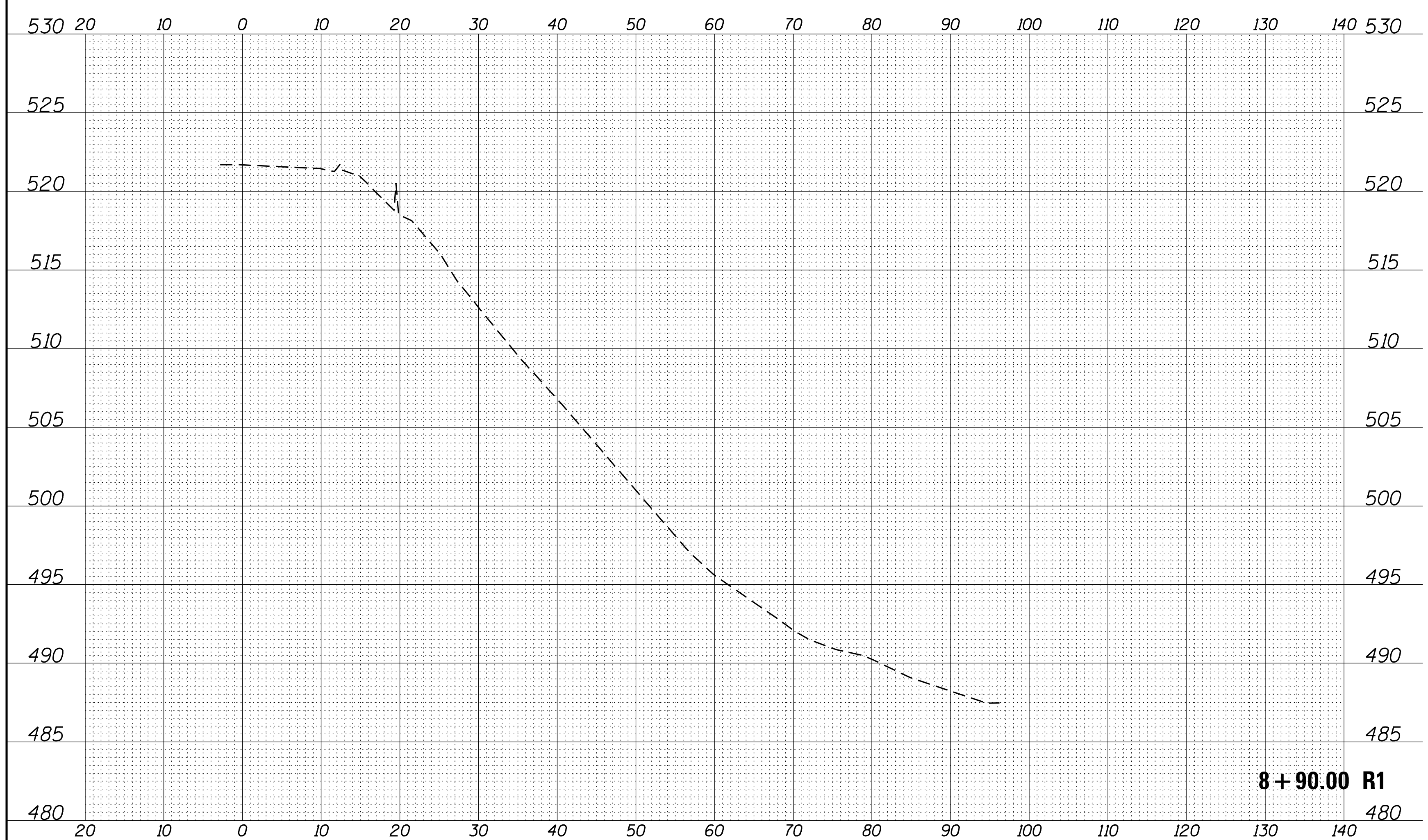
CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE:	SHEET OF SHEETS	STA. 8+90.00 R1 TO STA. 8+90.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
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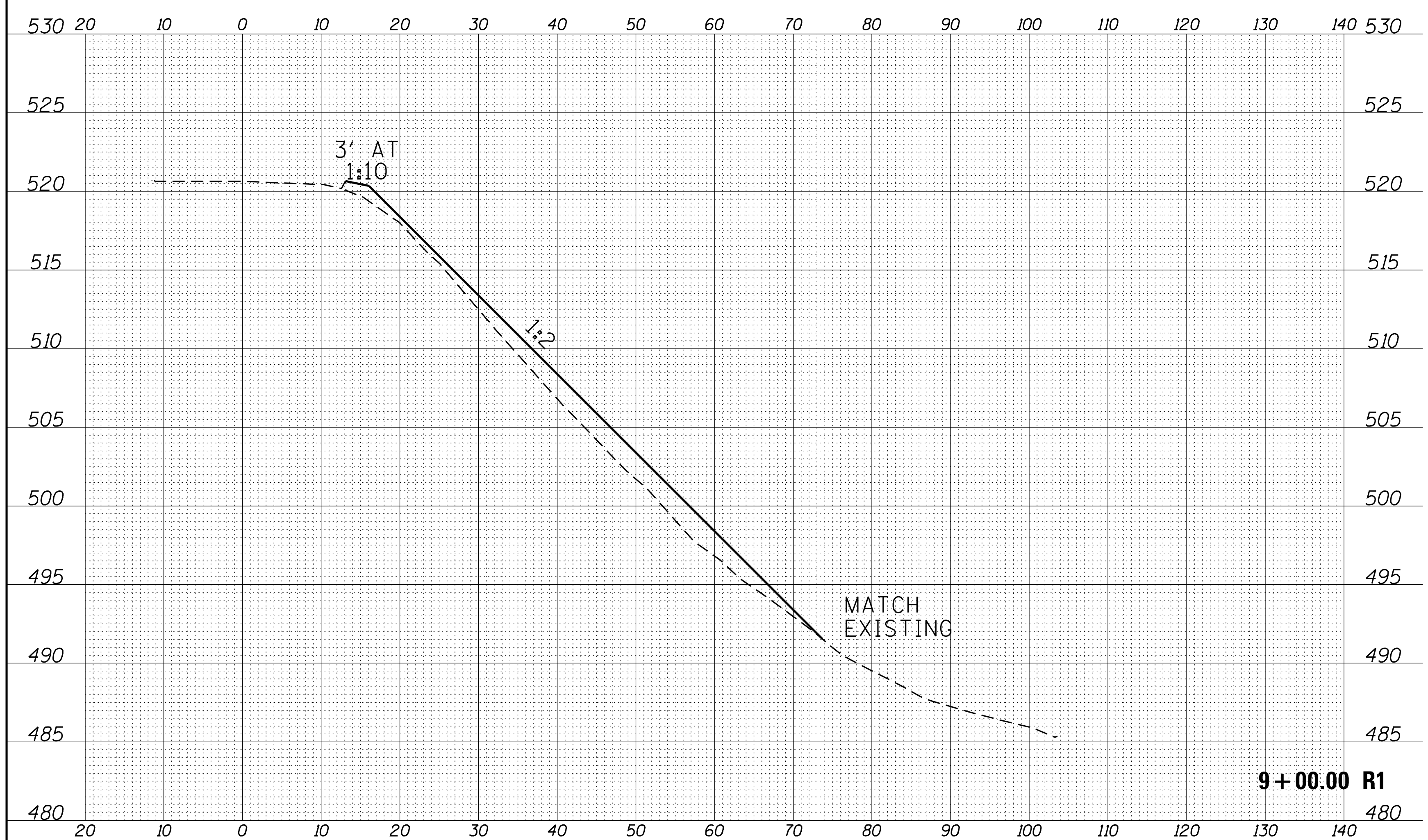
	ILLINOIS FED. AID PROJECT			

FINAL SURVEY		
NOTE BOOK NO.	SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED	BY	DATE

ORIGINAL SURVEY		
NOTE BOOK NO.	SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED	BY	DATE



FINAL SURVEY — NOTE BOOK NO. — SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED — BY — DATE

ORIGINAL SURVEY — NOTE BOOK NO. — SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED — BY — DATE

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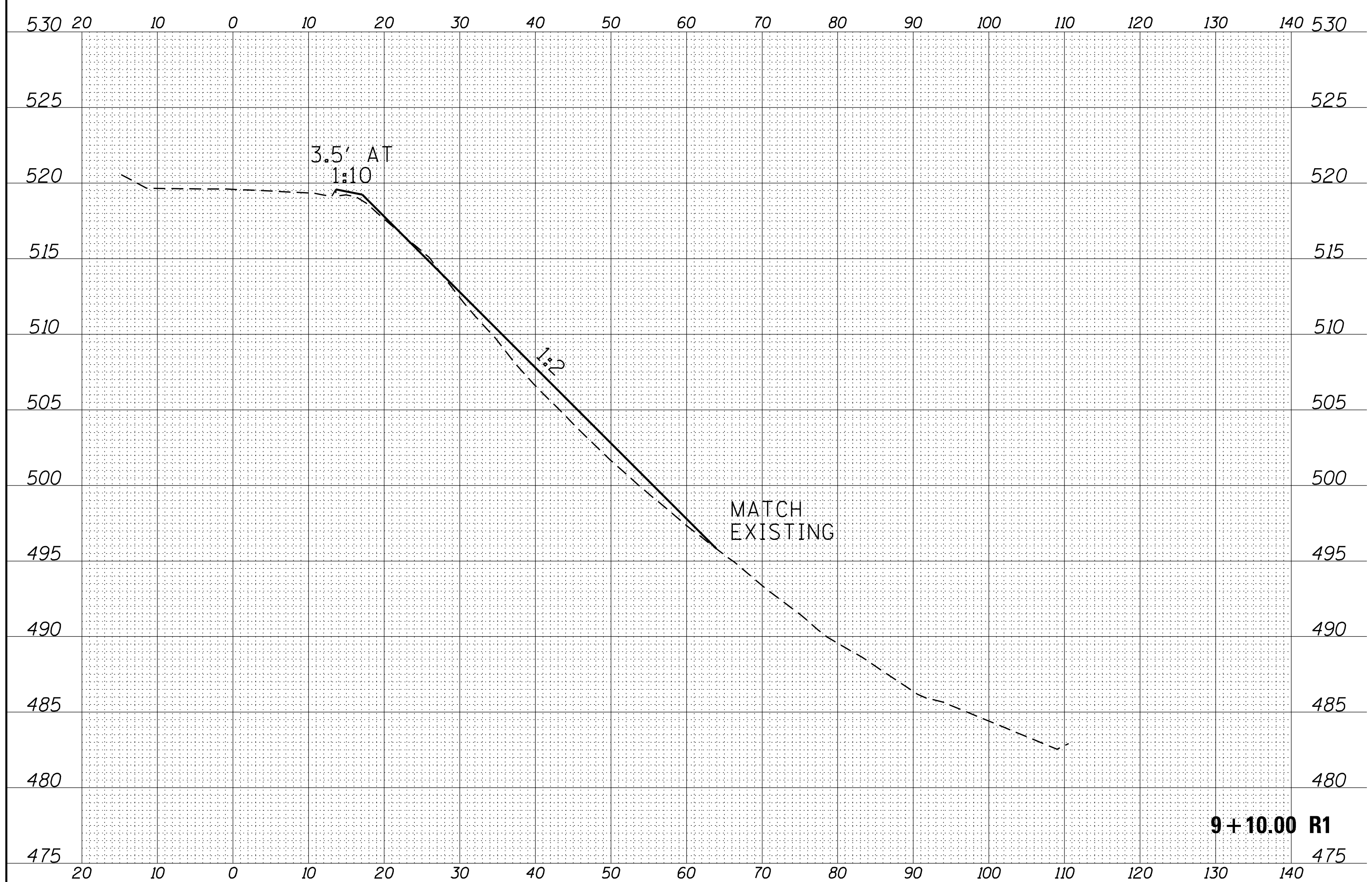
		DRAWN	REVISED -	
	PLOT SCALE = 20.0000 ' / in.	CHECKED -	REVISED -	
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -	

SCALE:	SHEET OF SHEETS	STA. 9+00.00 R1 TO STA. 9+00.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	19
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		



FINAL SURVEY
NOTE BOOK NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

ORIGINAL SURVEY
NOTE BOOK NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

FILE NAME = pw:\\IL084EBIDINTEG.illinois.gov:PWIDOT\Documents\IDOT Offices\District 3\Projects\D366F07\CADD\Design\D366F07-xsc.dgn

PrCL.2

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PLOT DATE = 3/21/2016

DESIGNED -
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CHECKED -
DATE -

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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: SHEET OF SHEETS STA. 9+10.00 R1 TO STA. 9+10.00 R1

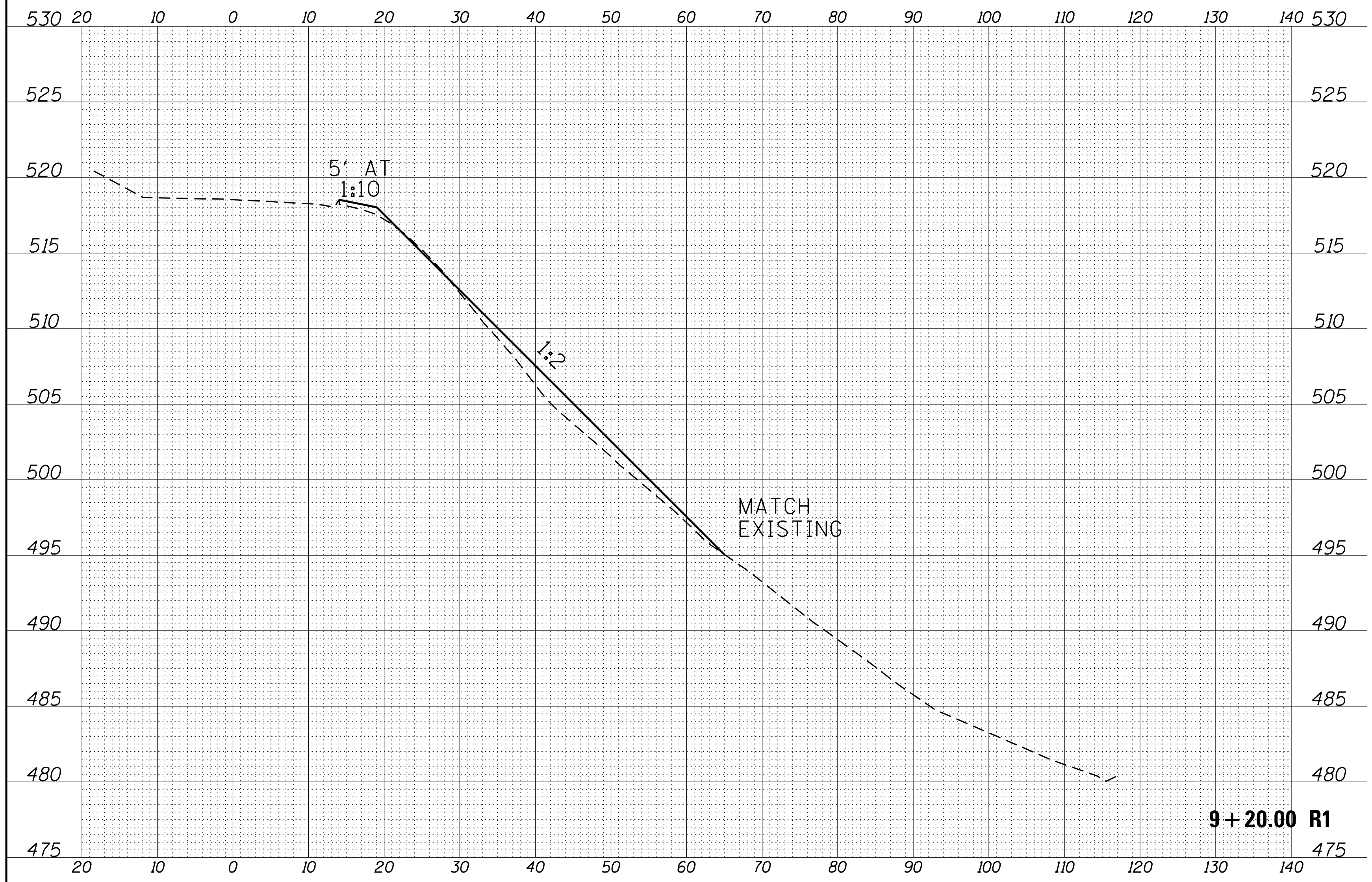
F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	20

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT

FINAL SURVEY		
NOTE BOOK NO.	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
AREAS		
AREAS CHECKED		

ORIGINAL SURVEY		
NOTE BOOK NO.	BY	DATE
SURVEYED		
PLOTTED		
TEMPLATE		
AREAS		
AREAS CHECKED		



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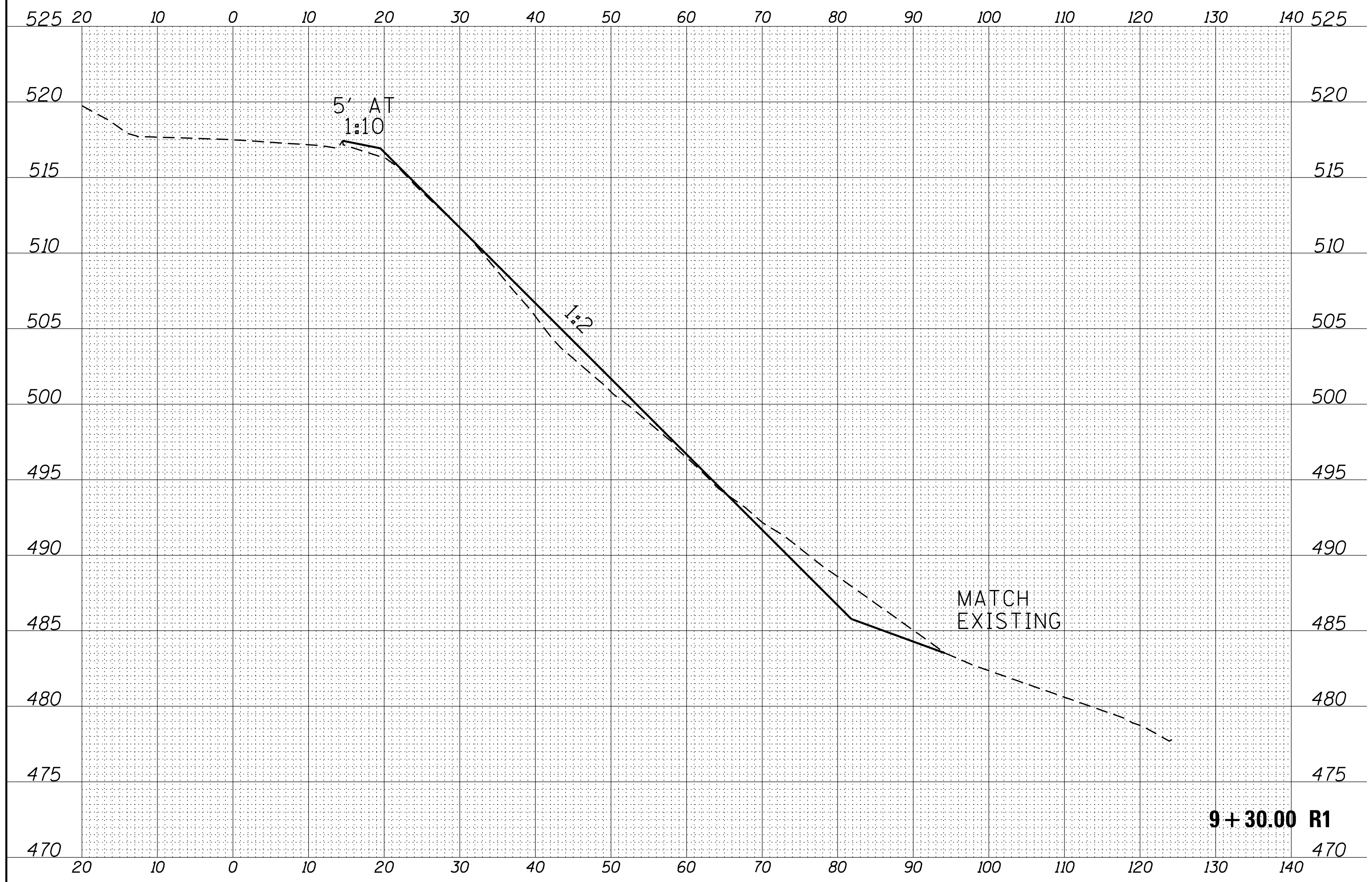
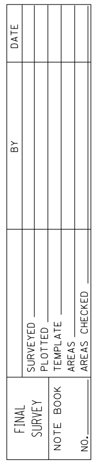
	PLOT SCALE = 20.0000 ' / in.	CHECKED -	REVISED -
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

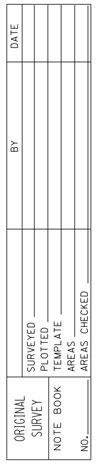
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE:	SHEET OF SHEETS	STA. 9+20.00 R1 TO STA. 9+20.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	21
		CONTRACT NO. 66F07		
	ILLINOIS	FED. AID PROJECT		







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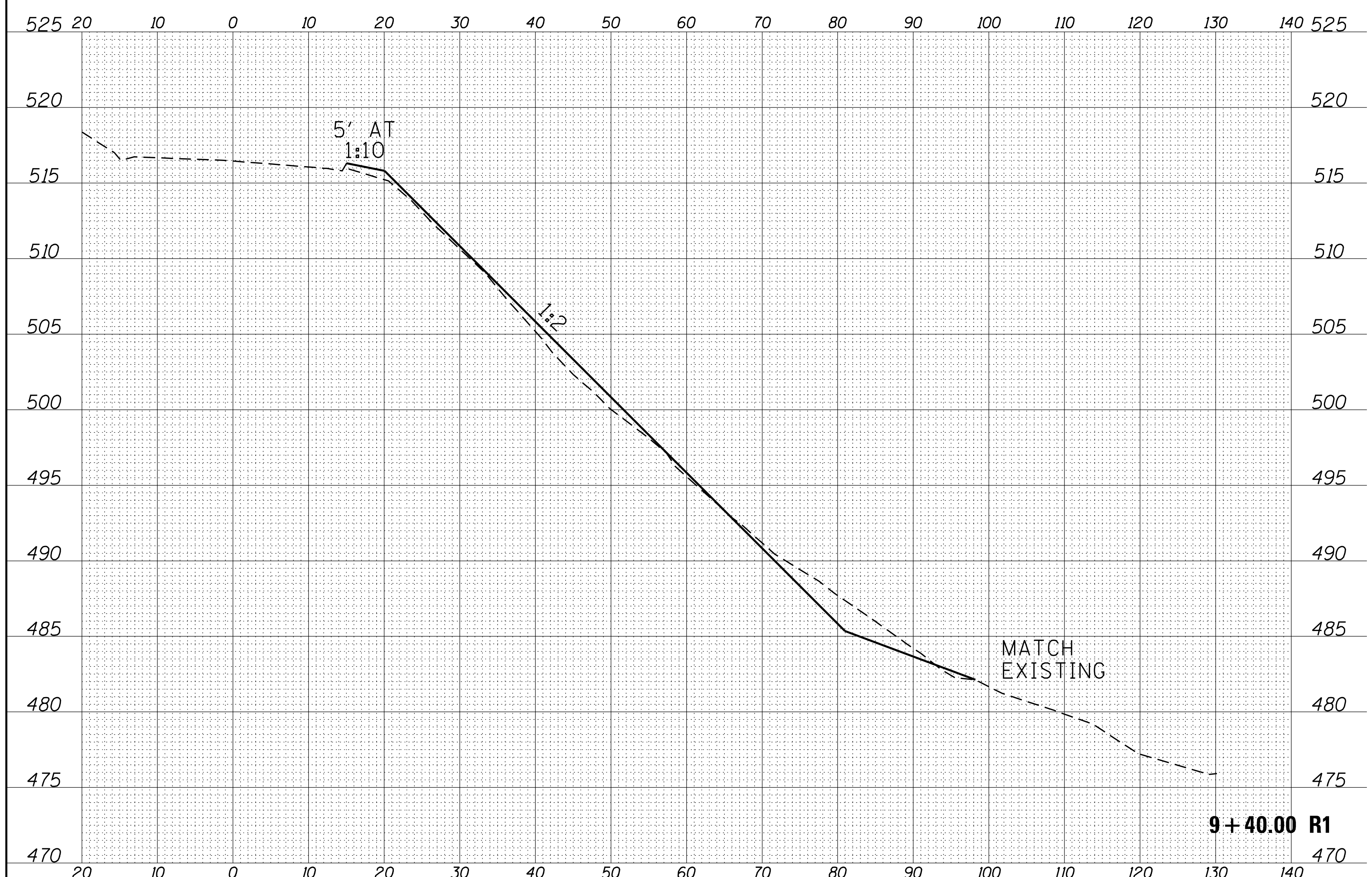
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. 9+30.00 R1 TO STA. 9+30.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	22
		CONTRACT NO. 66F07		
	ILLINOIS FED. AID PROJECT			



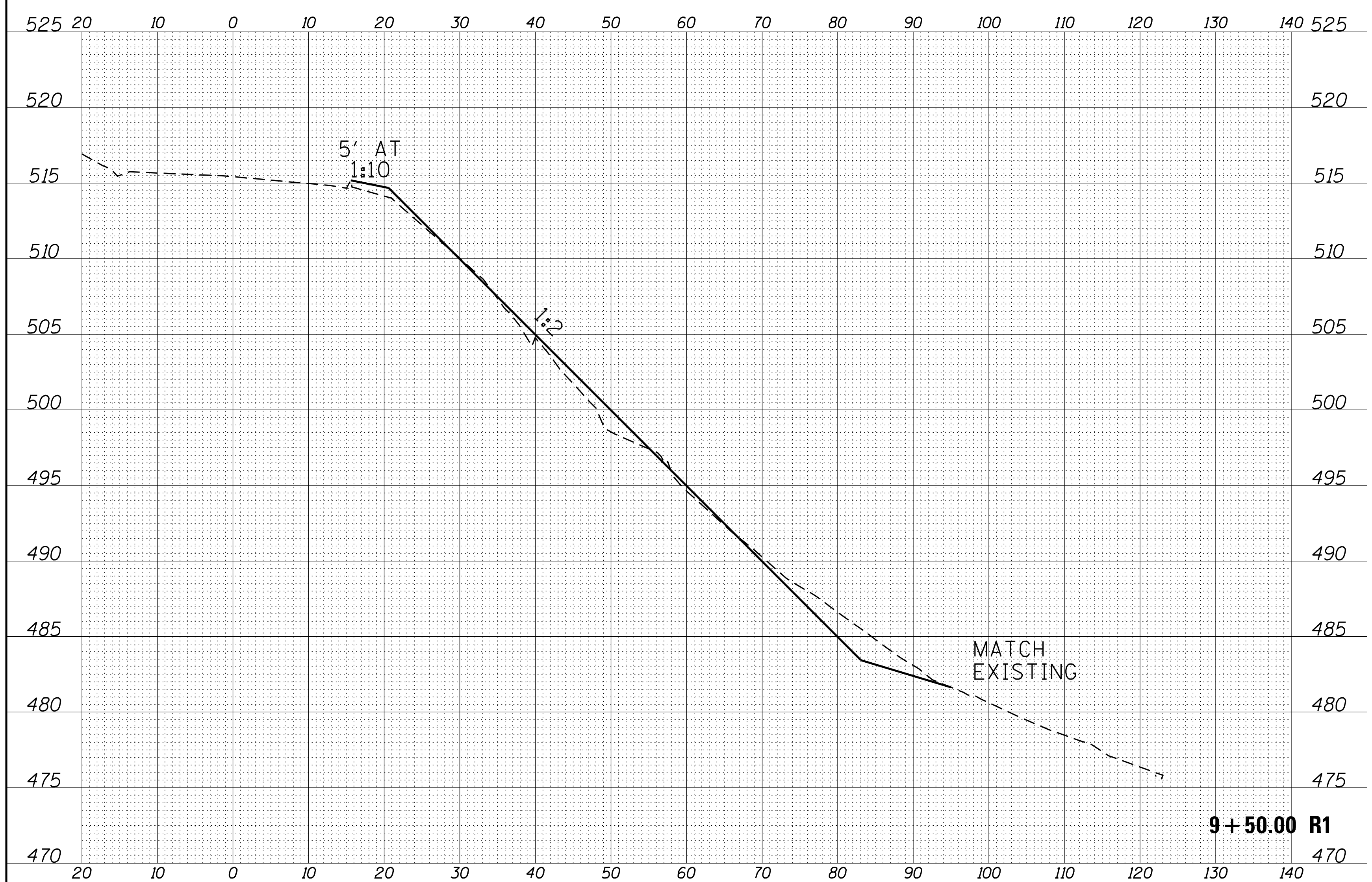
FINAL SURVEY
NOTE BOOK
NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

ORIGINAL SURVEY
NOTE BOOK
NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE

FILE NAME =	USER NAME = schwankerg	DESIGNED -	REVISED -	STATE OF ILLINOIS
pw:\\IL084EBIDINTEG.illinois.gov:PWIDOT\Documents\IDOT Offices\District 3\Projects\D366F07\CADD\Design\D366F07-xsc.dgn		DRAWN -	REVISED -	DEPARTMENT OF TRANSPORTATION
	PLOT SCALE = 20.0000 ' / in.	CHECKED -	REVISED -	
P=CL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -	

SCALE: | SHEET OF SHEETS | STA. 9+40.00 R1 TO STA. 9+40.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	23
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		



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ORIGINAL SURVEY — NOTE BOOK NO. — SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED — BY — DATE

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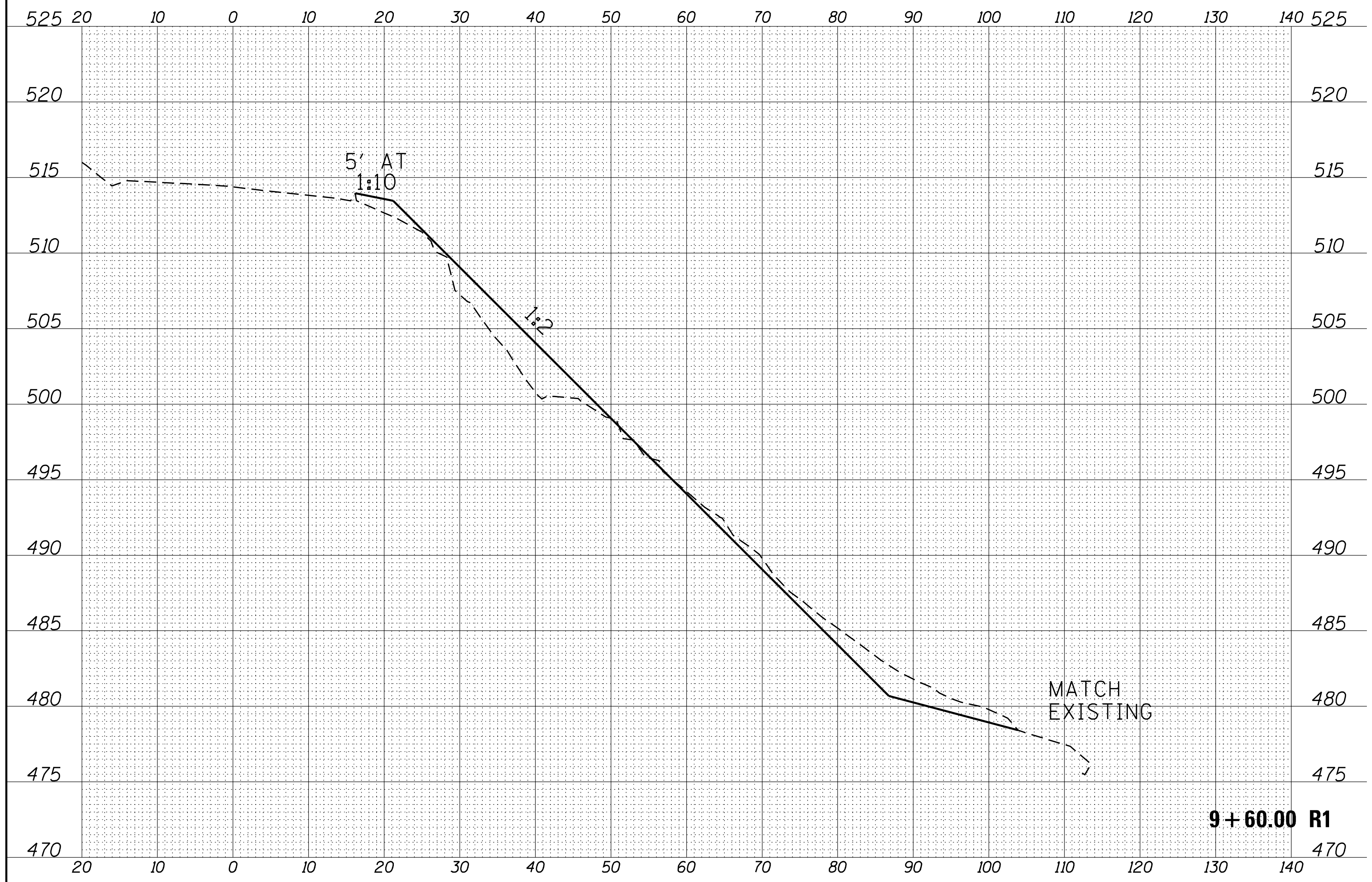
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. 9+50.00 R1 TO STA. 9+50.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	24
		CONTRACT NO. 66F07		

ILLINOIS FED. AID PROJECT



FINAL SURVEY | NOTE BOOK NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE

ORIGINAL SURVEY | NOTE BOOK NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE

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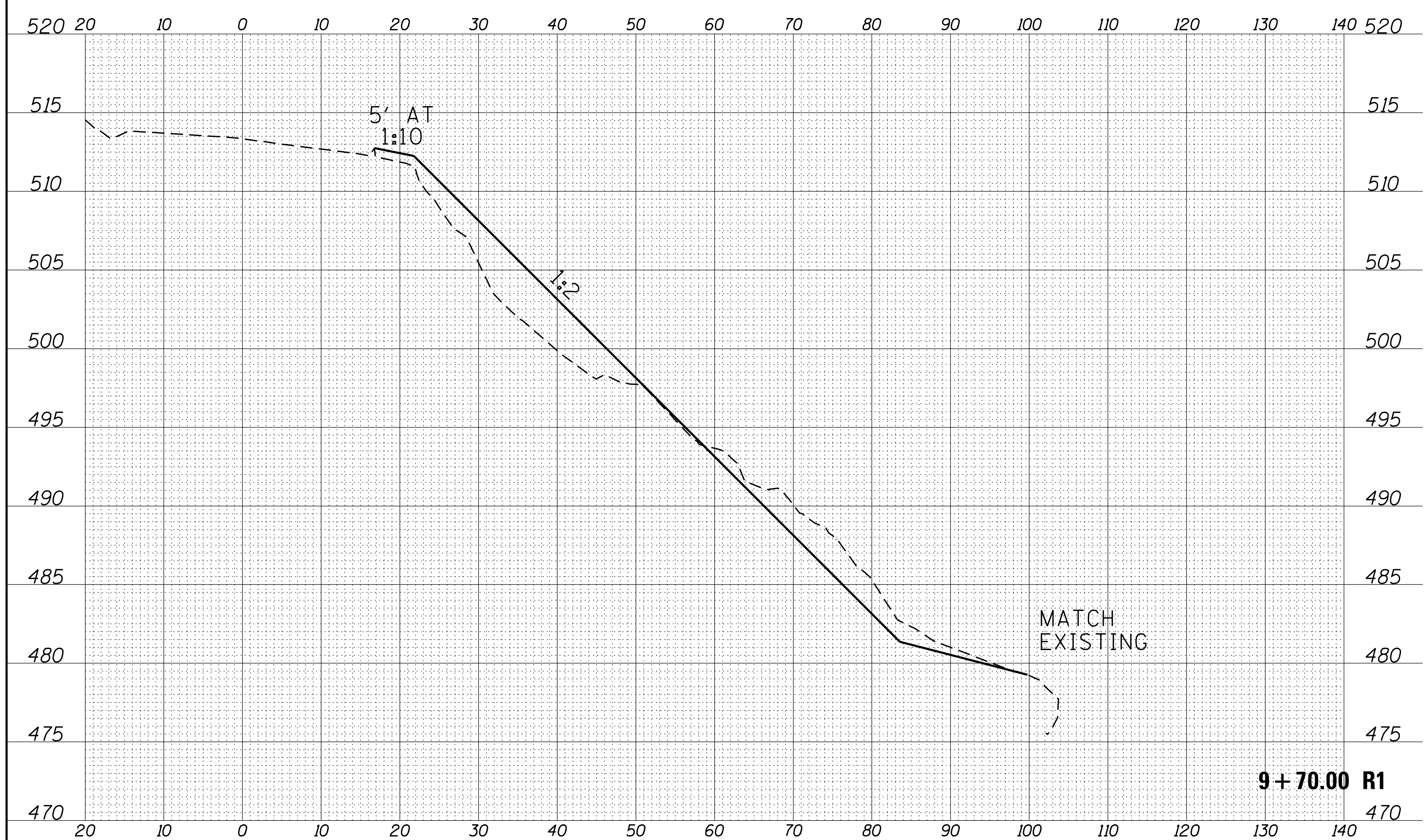
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. 9+60.00 R1 TO STA. 9+60.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	25
		CONTRACT NO. 66F07		
	ILLINOIS FED. AID PROJECT			



FINAL SURVEY: SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED, NOTE BOOK NO., BY, DATE

ORIGINAL SURVEY: SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED, NOTE BOOK NO., BY, DATE

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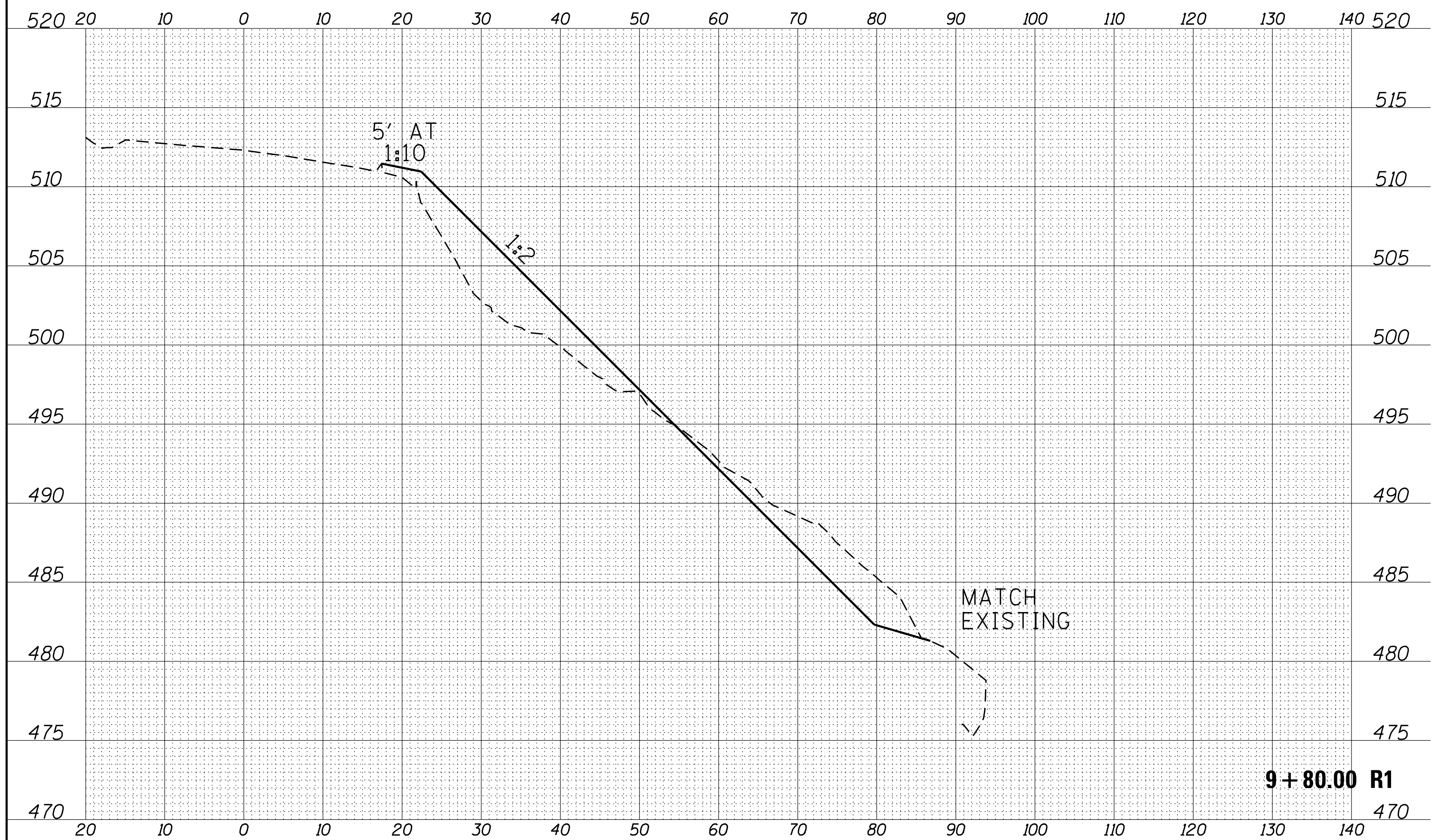
		DRAWN	REVISED -			627	(1)I-2	LASALLE	41	26
	PLOT SCALE = 20.0000 ' / in.	CHECKED -	REVISED -			CONTRACT NO. 66F07				
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -		SCALE: SHEET OF SHEETS STA. 9+70.00 R1 TO STA. 9+70.00 R1	ILLINOIS FED. AID PROJECT				



FINAL SURVEY: SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED, NOTE BOOK NO., BY, DATE

ORIGINAL SURVEY: SURVEYED, PLOTTED, TEMPLATE, AREAS, AREAS CHECKED, NOTE BOOK NO., BY, DATE

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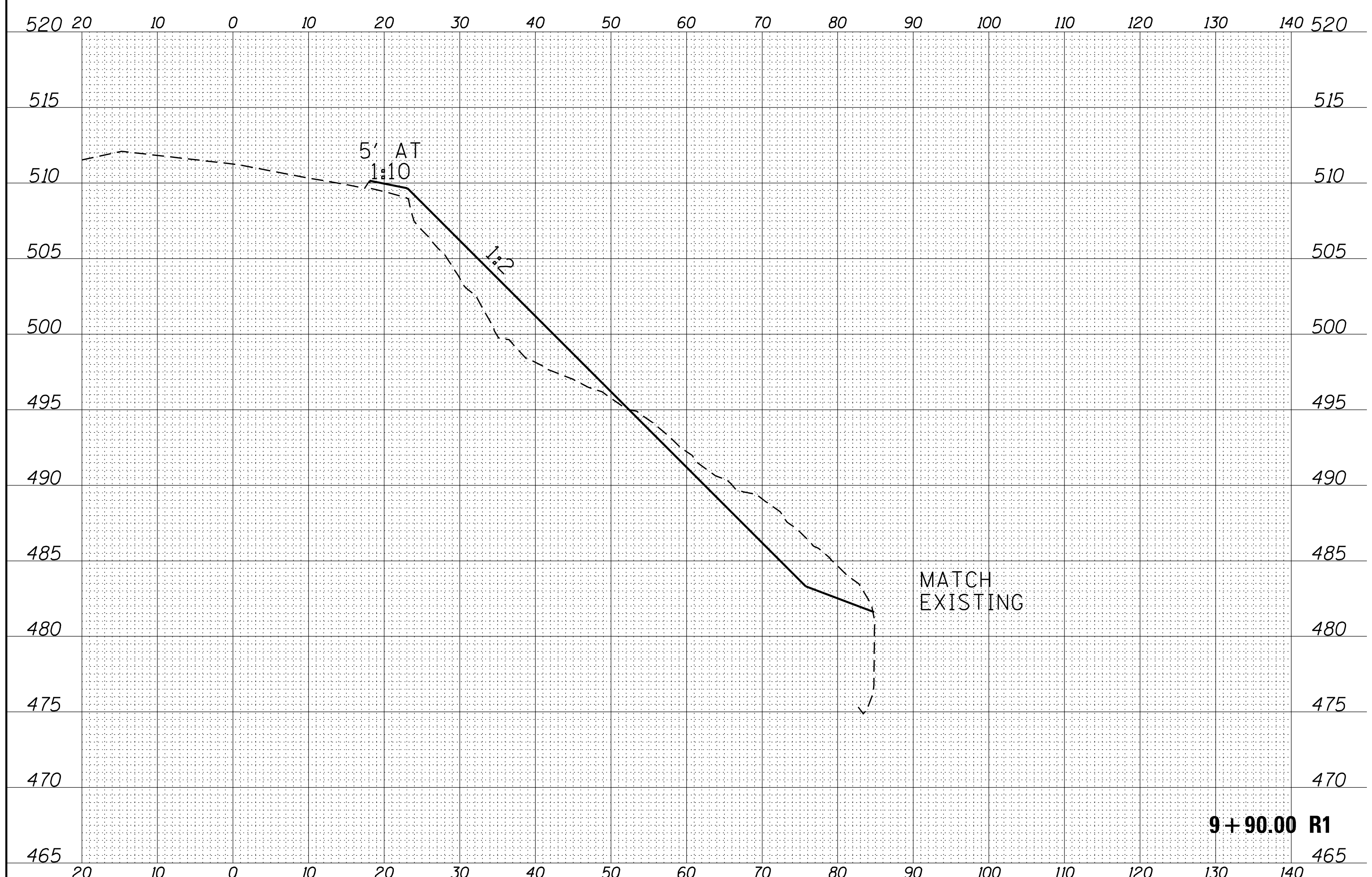
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. 9+80.00 R1 TO STA. 9+80.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	27
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		



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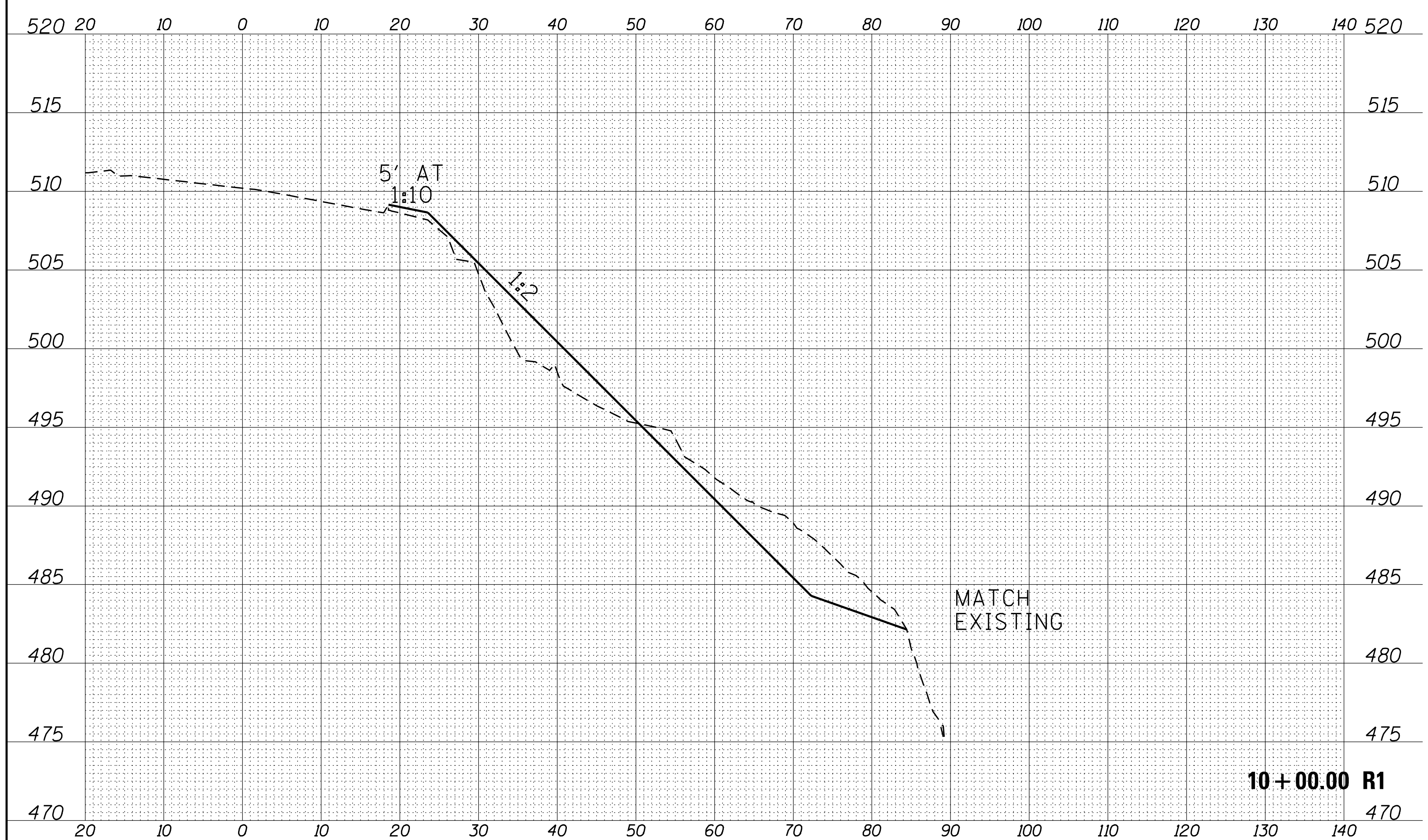
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE: | SHEET OF SHEETS | STA. 9+90.00 R1 TO STA. 9+90.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	28
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		

FINAL SURVEY	SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED
NOTE BOOK NO.	BY / DATE



ORIGINAL SURVEY	SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED
NOTE BOOK NO.	BY / DATE

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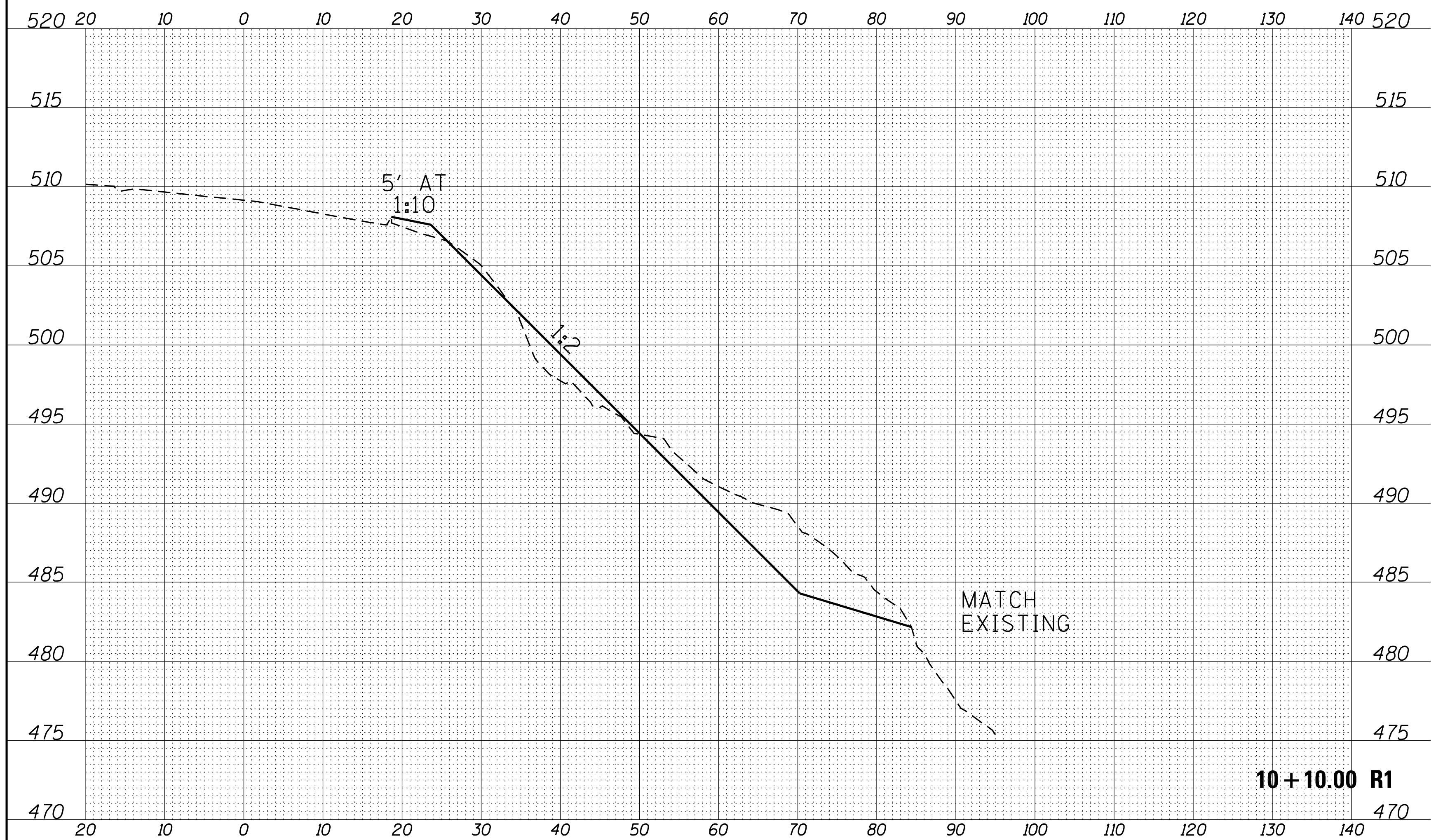
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

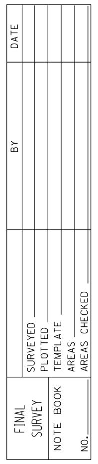
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

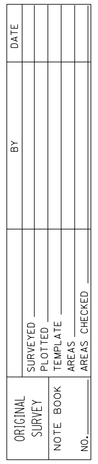
SCALE: | SHEET OF SHEETS | STA. 10+00.00 R1 TO STA. 10+00.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	29
		CONTRACT NO. 66F07		

ILLINOIS FED. AID PROJECT







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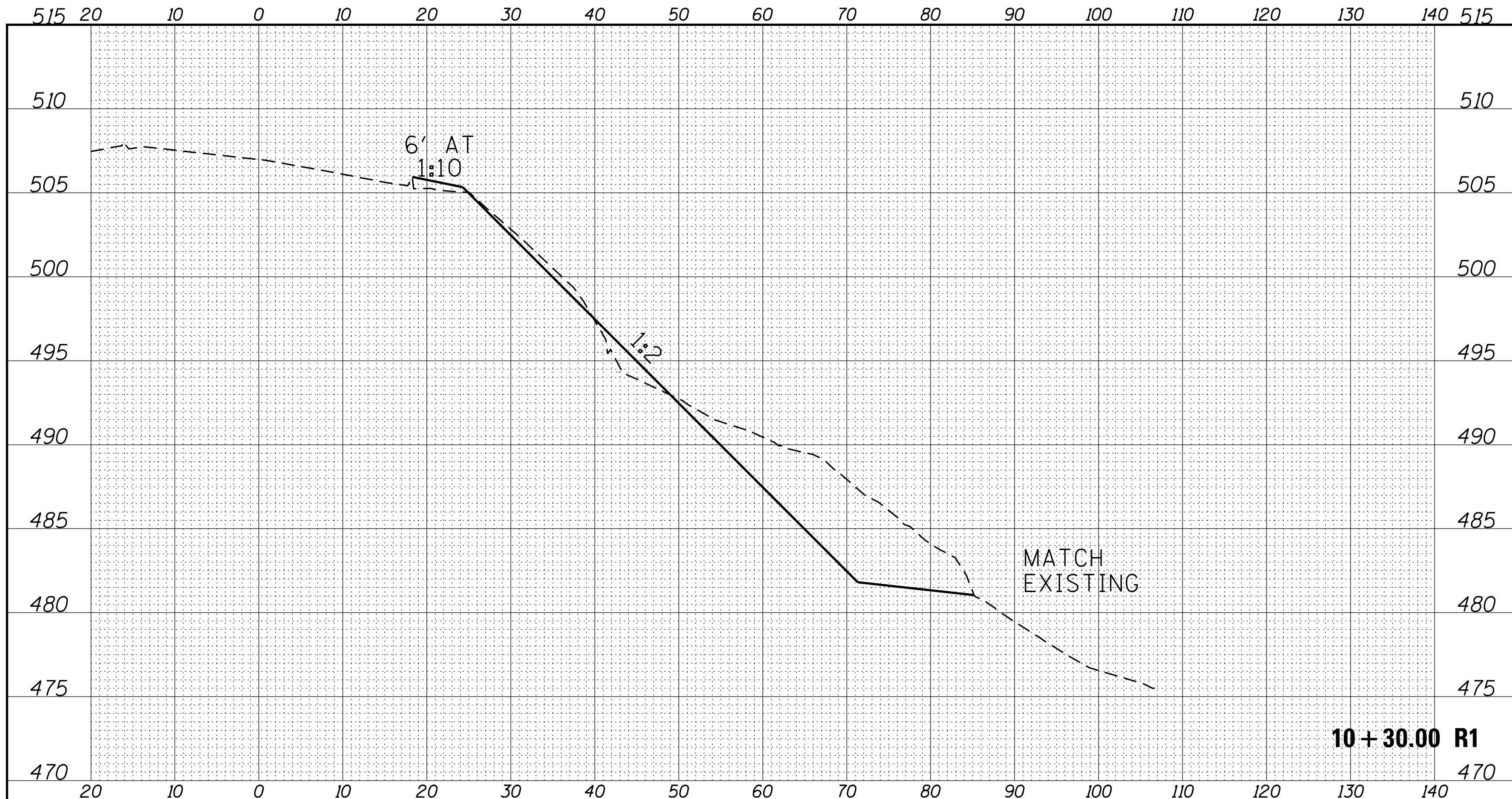
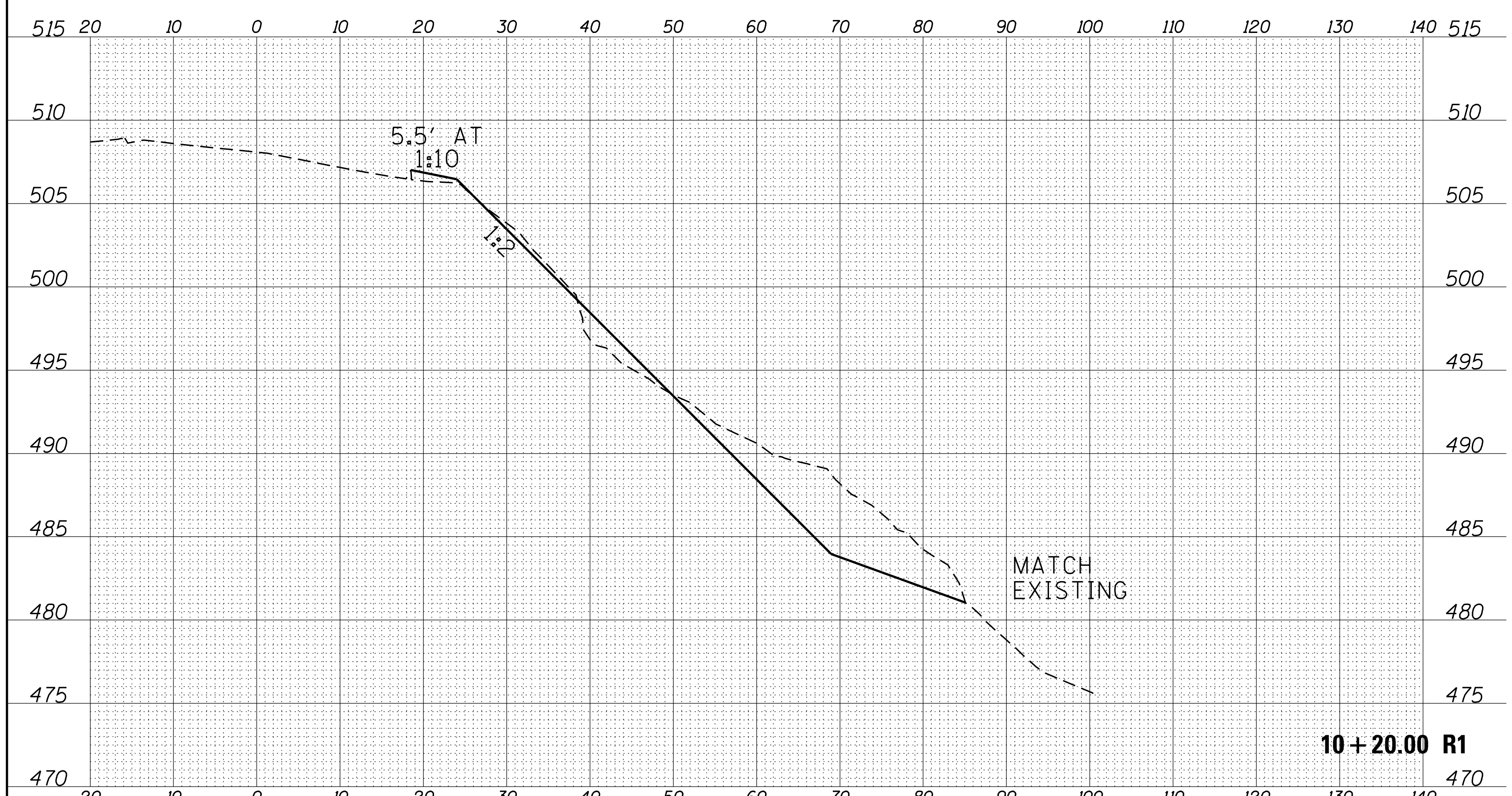
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -		SCALE: SHEET OF SHEETS STA. 10+10.00 R1 TO STA. 10+10.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	30
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		





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PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

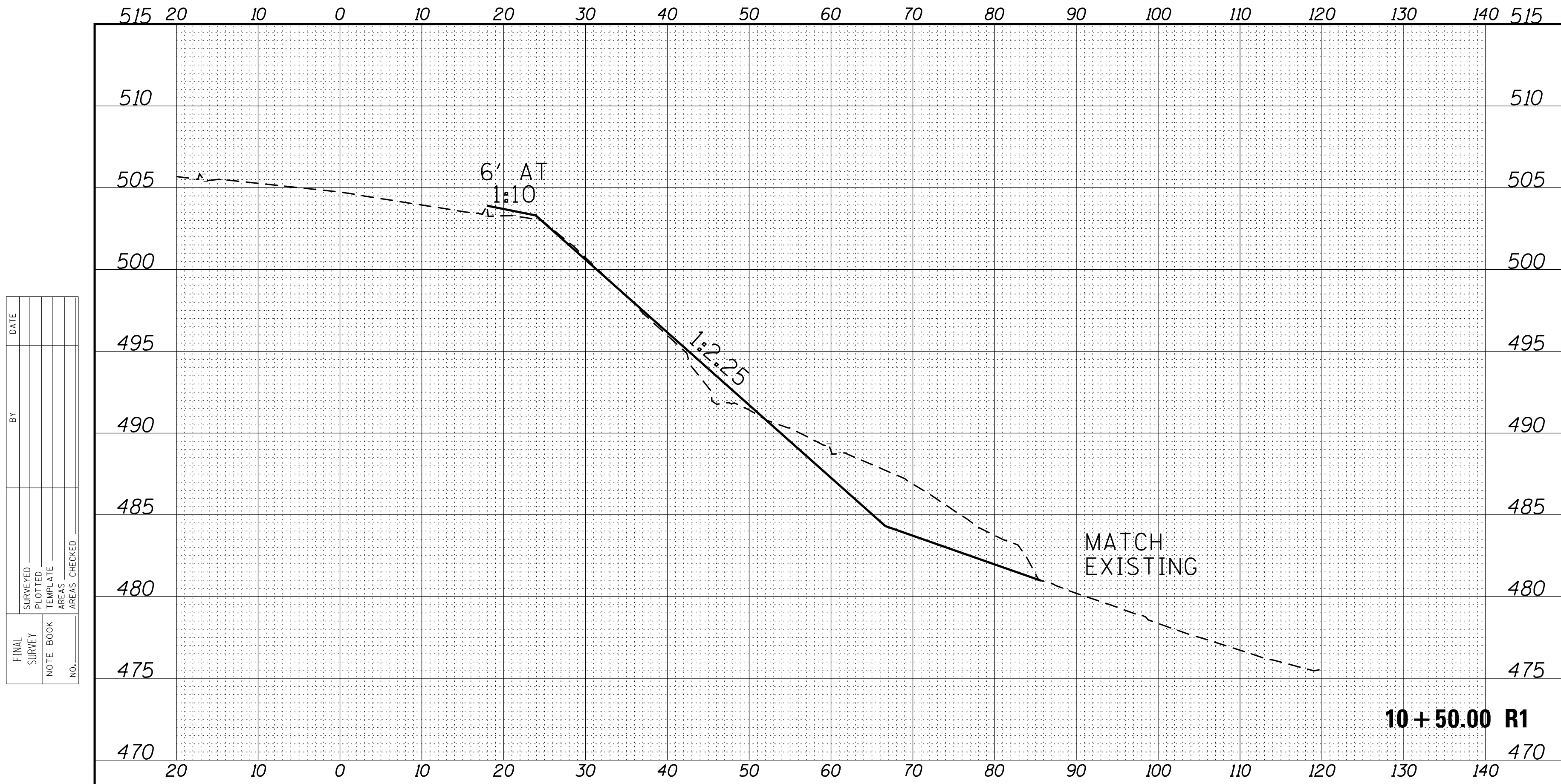
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

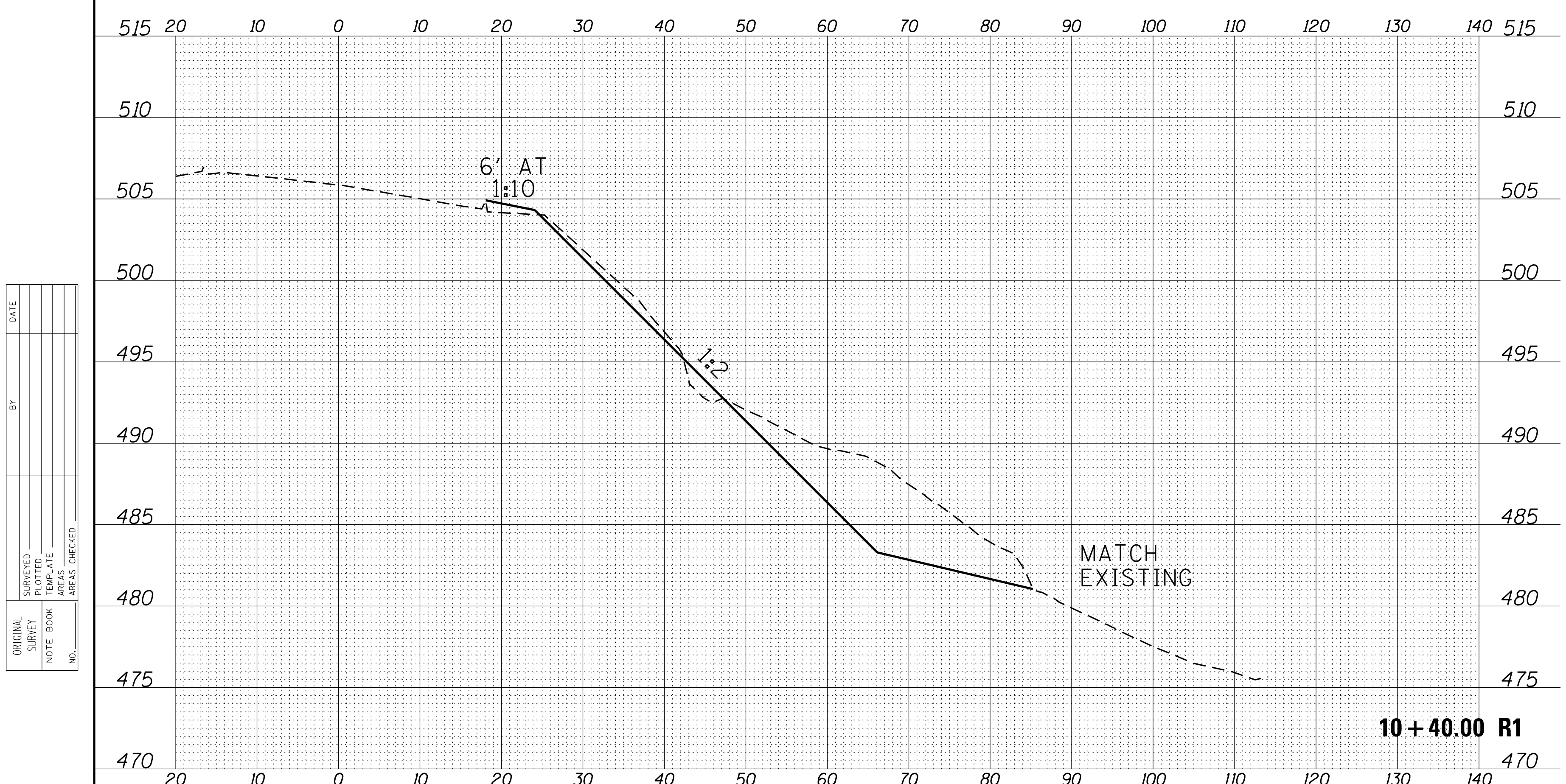
SCALE: | SHEET OF SHEETS | STA. 10+20.00 R1 TO STA. 10+30.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	31

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT





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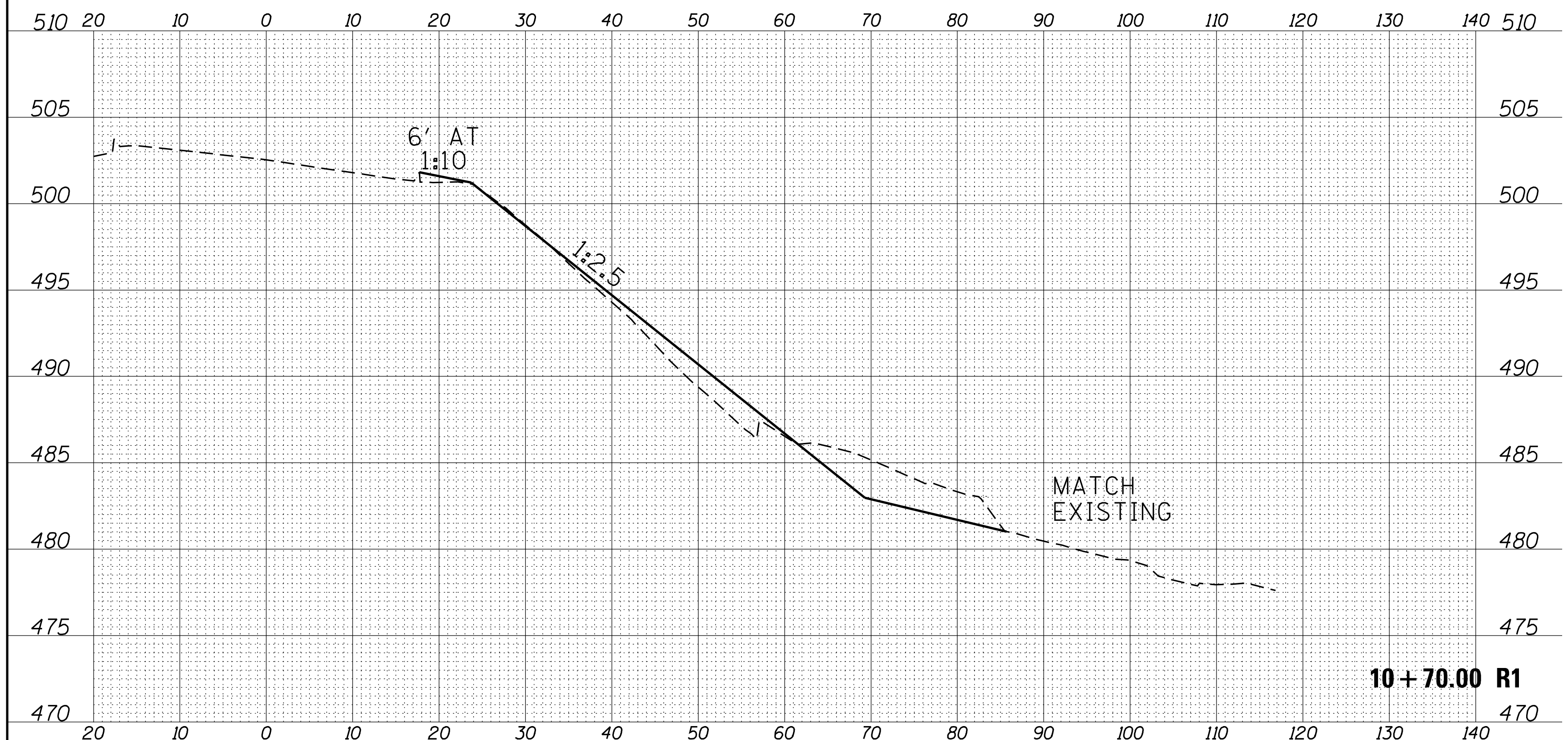
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -	

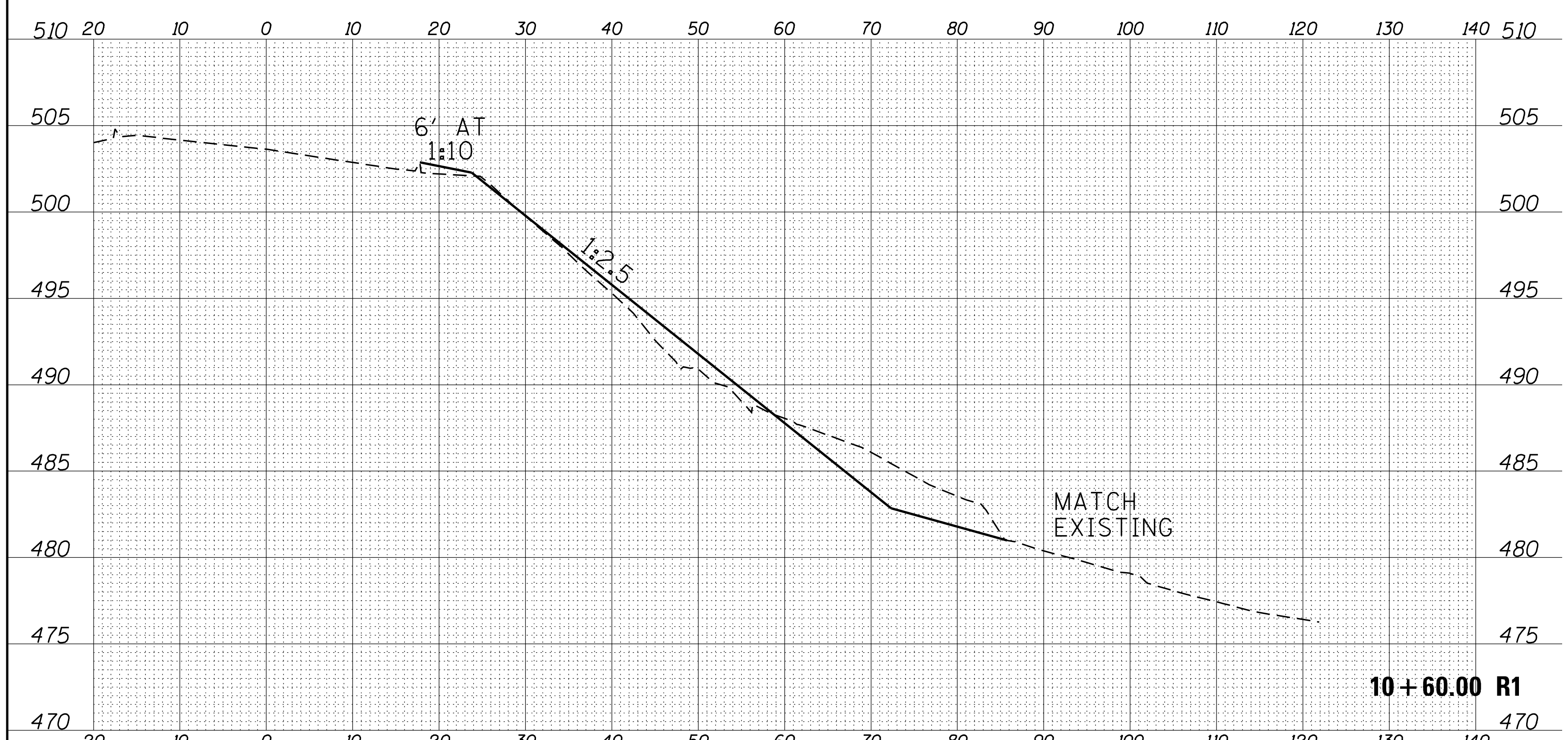
SCALE: | SHEET OF SHEETS | STA. 10+40.00 R1 TO STA. 10+50.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	32

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT





FINAL SURVEY		ORIGINAL SURVEY	
NOTE BOOK NO.		NOTE BOOK NO.	
SURVEYED		SURVEYED	
PLOTTED		PLOTTED	
TEMPLATE		TEMPLATE	
AREAS		AREAS	
AREAS CHECKED		AREAS CHECKED	
BY		BY	
DATE		DATE	

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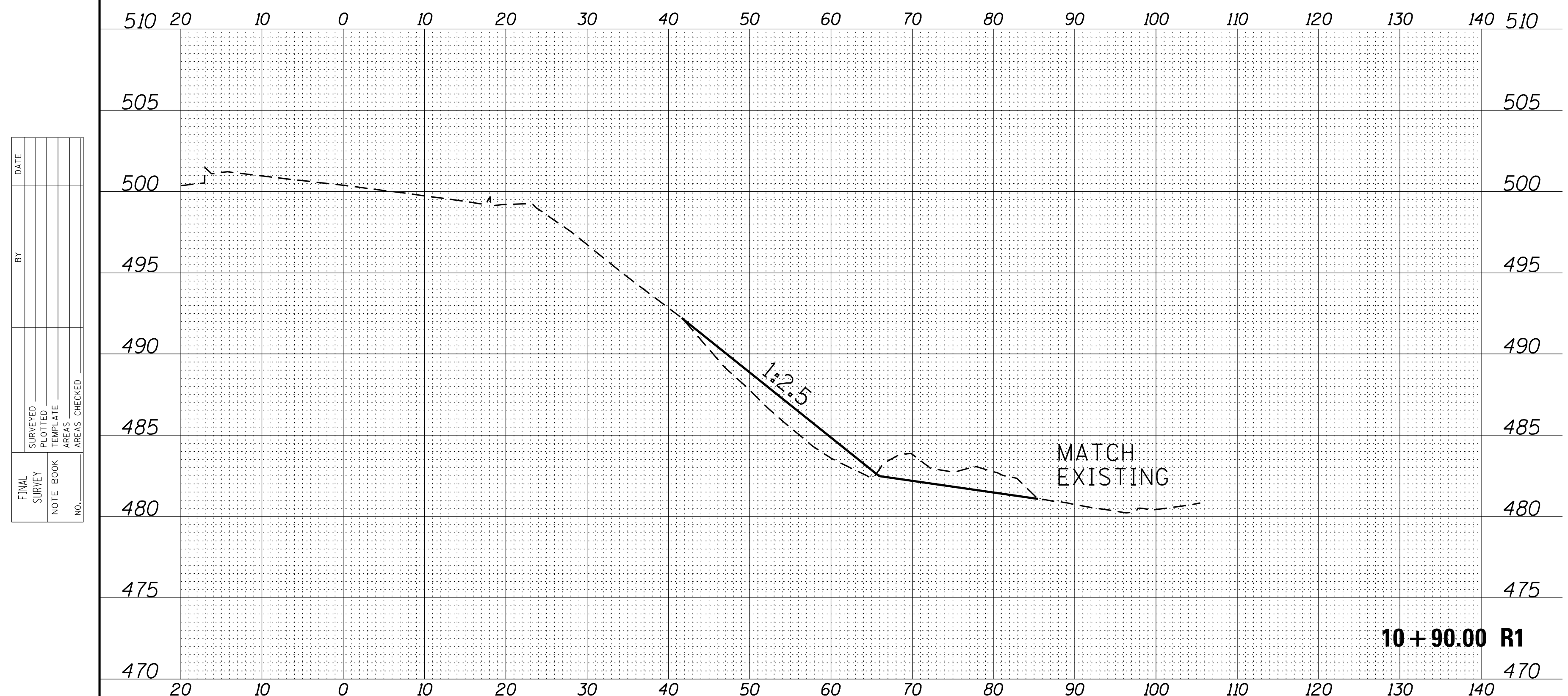
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

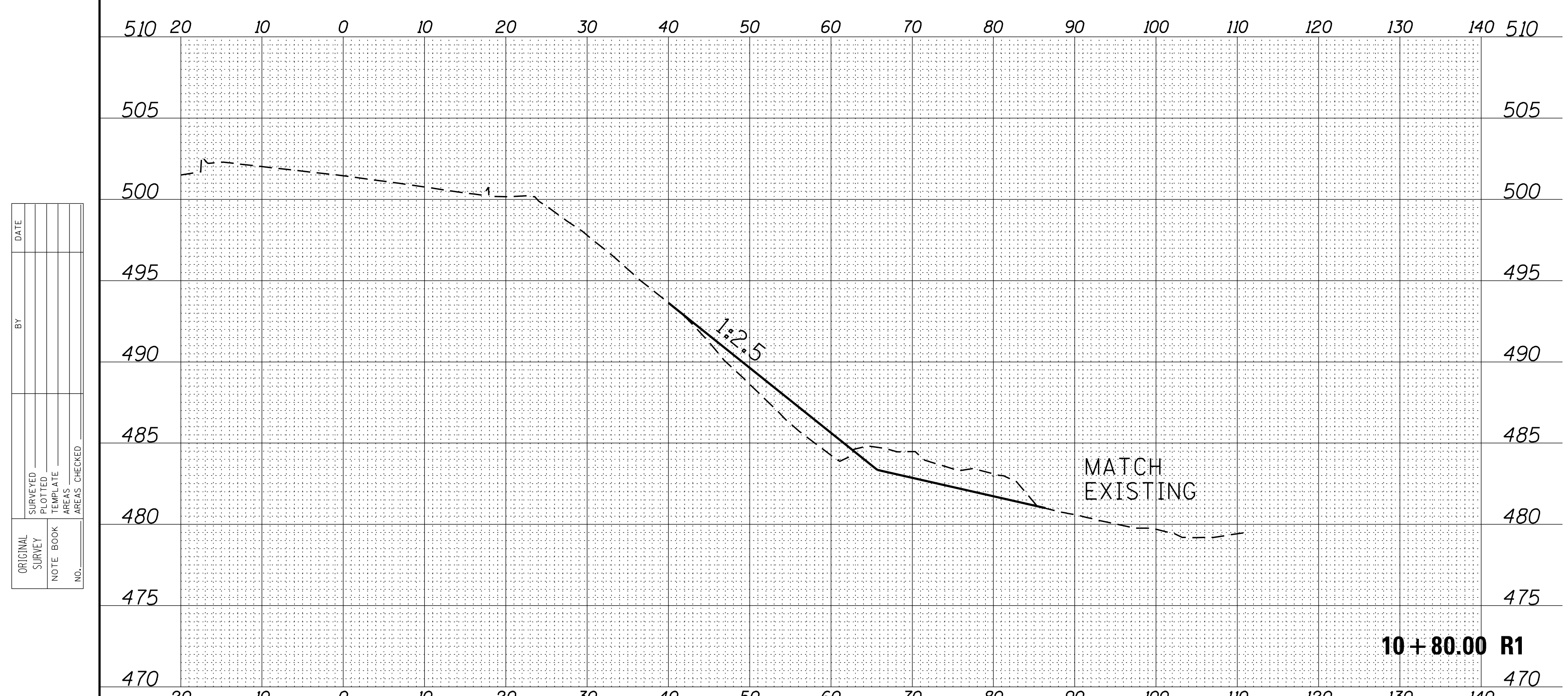
SCALE: | SHEET OF SHEETS | STA. 10+60.00 R1 TO STA. 10+70.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	33

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT





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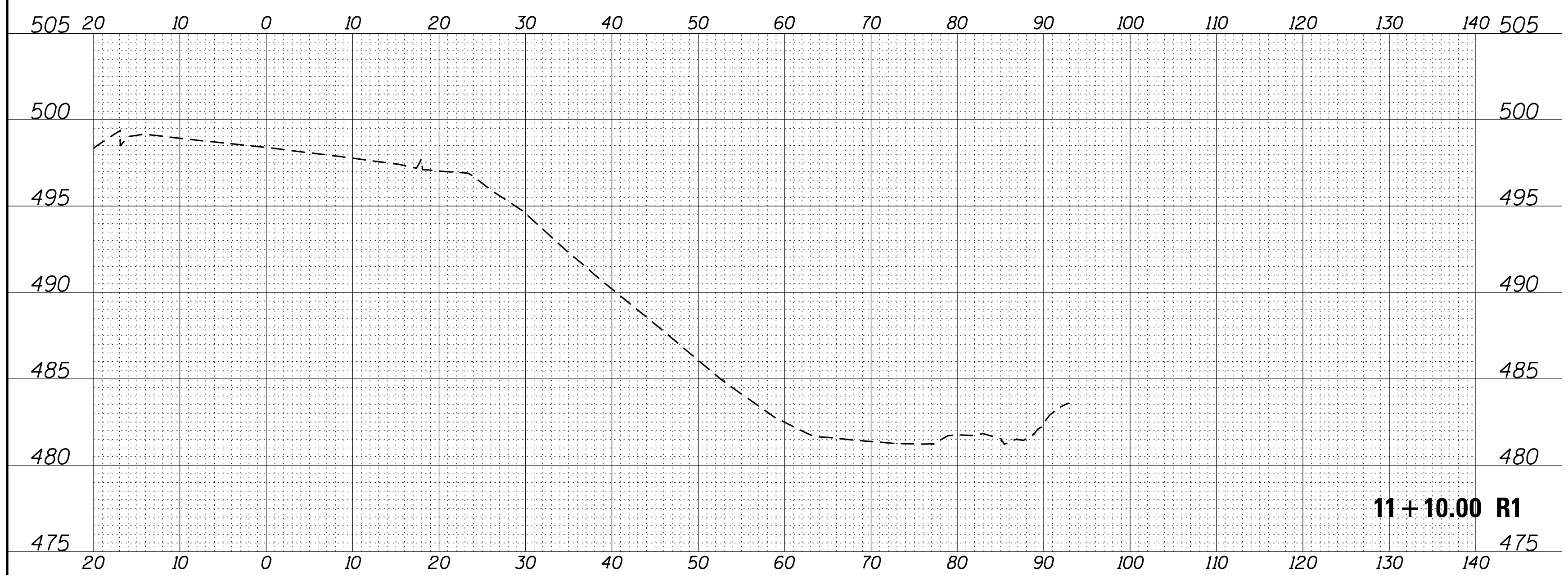
PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -	

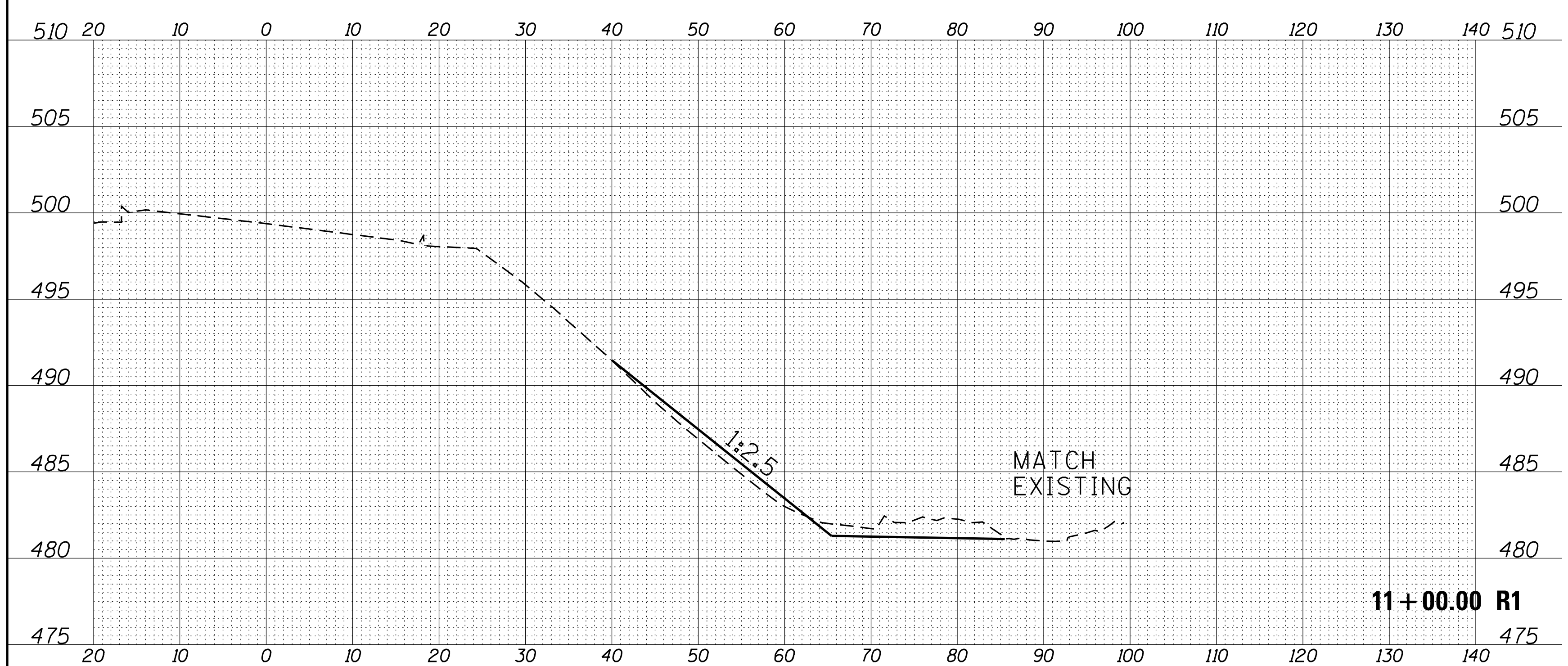
SCALE: | SHEET OF SHEETS | STA. 10+80.00 R1 TO STA. 10+90.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	34
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		

FINAL SURVEY | NOTE BOOK | NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE



ORIGINAL SURVEY | NOTE BOOK | NO. | SURVEYED | PLOTTED | TEMPLATE | AREAS | AREAS CHECKED | BY | DATE



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	PLOT SCALE = 20.0000 '/ in.	CHECKED -	REVISED -
PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

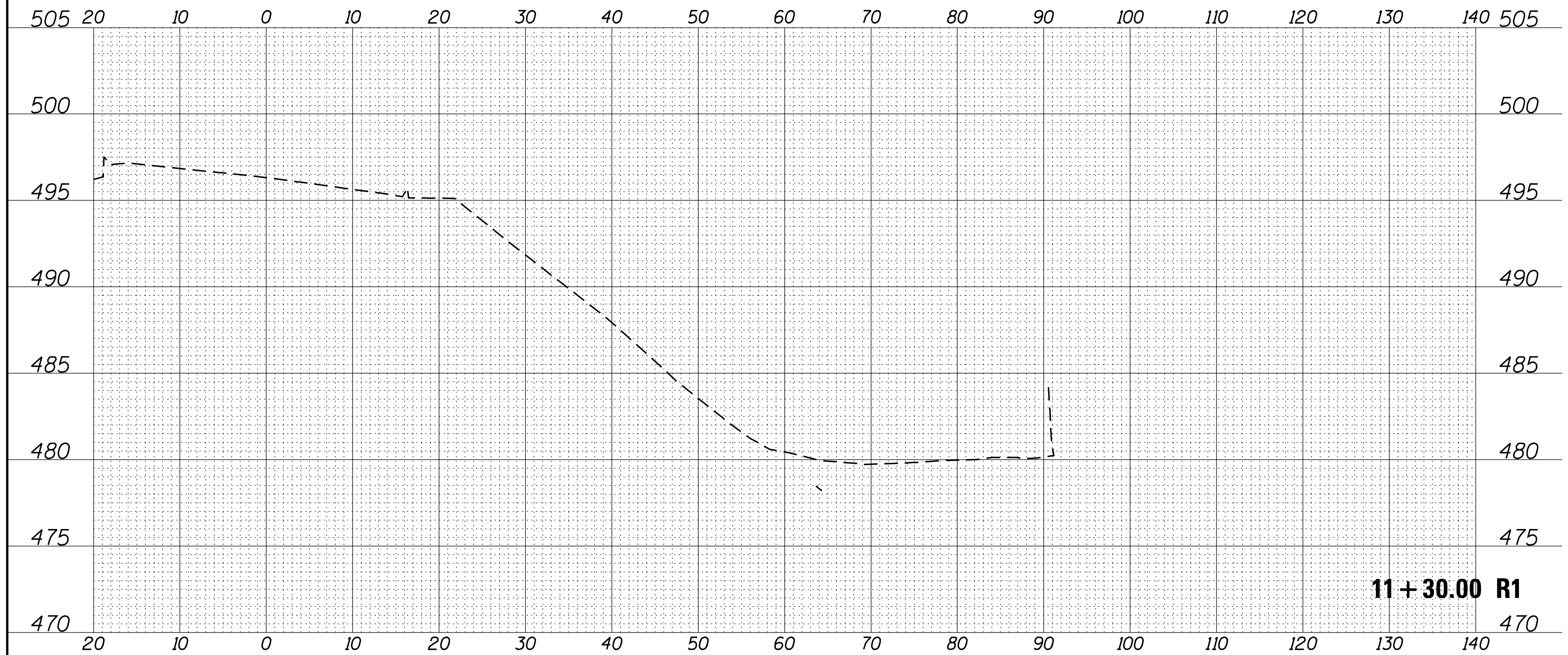
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

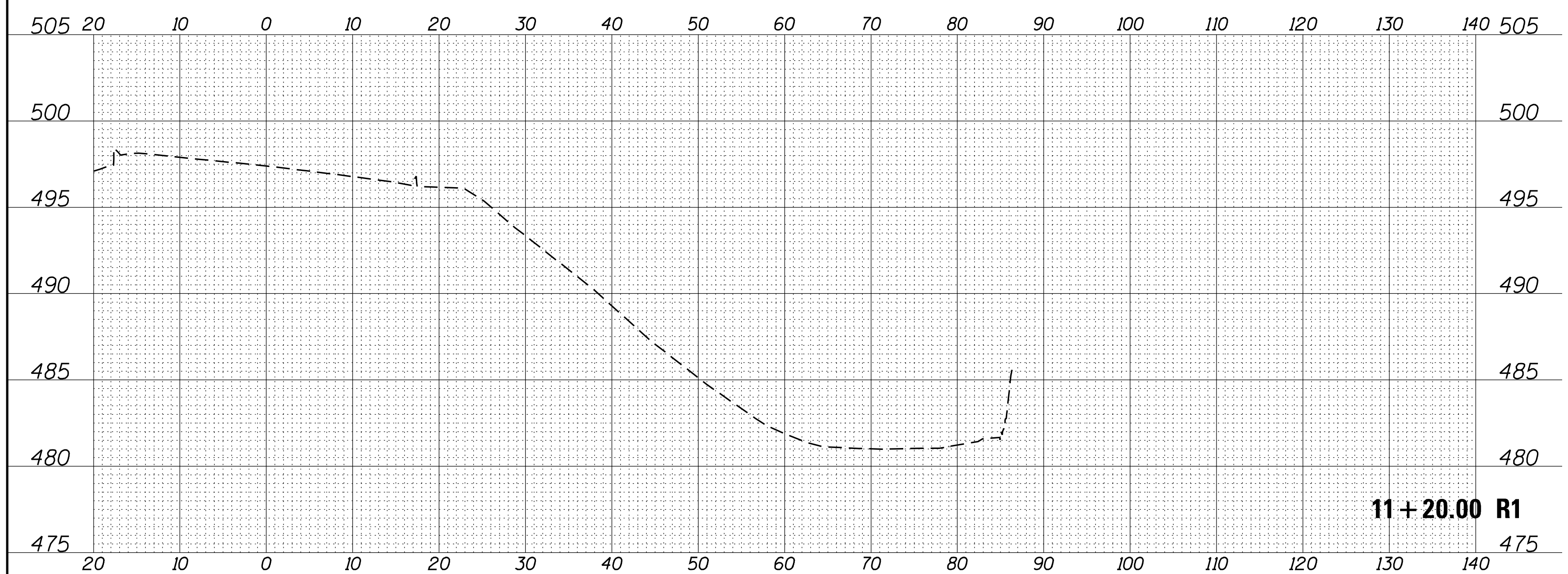
SCALE: | SHEET OF SHEETS | STA. 11+00.00 R1 TO STA. 11+10.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	35

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT





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PrCL.2	PLOT DATE = 3/21/2016	DATE -	REVISED -	

SCALE: | SHEET OF SHEETS | STA. 11+20.00 R1 TO STA. 11+30.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(1)I-2	LASALLE	41	36
		CONTRACT NO. 66F07		
		ILLINOIS FED. AID PROJECT		

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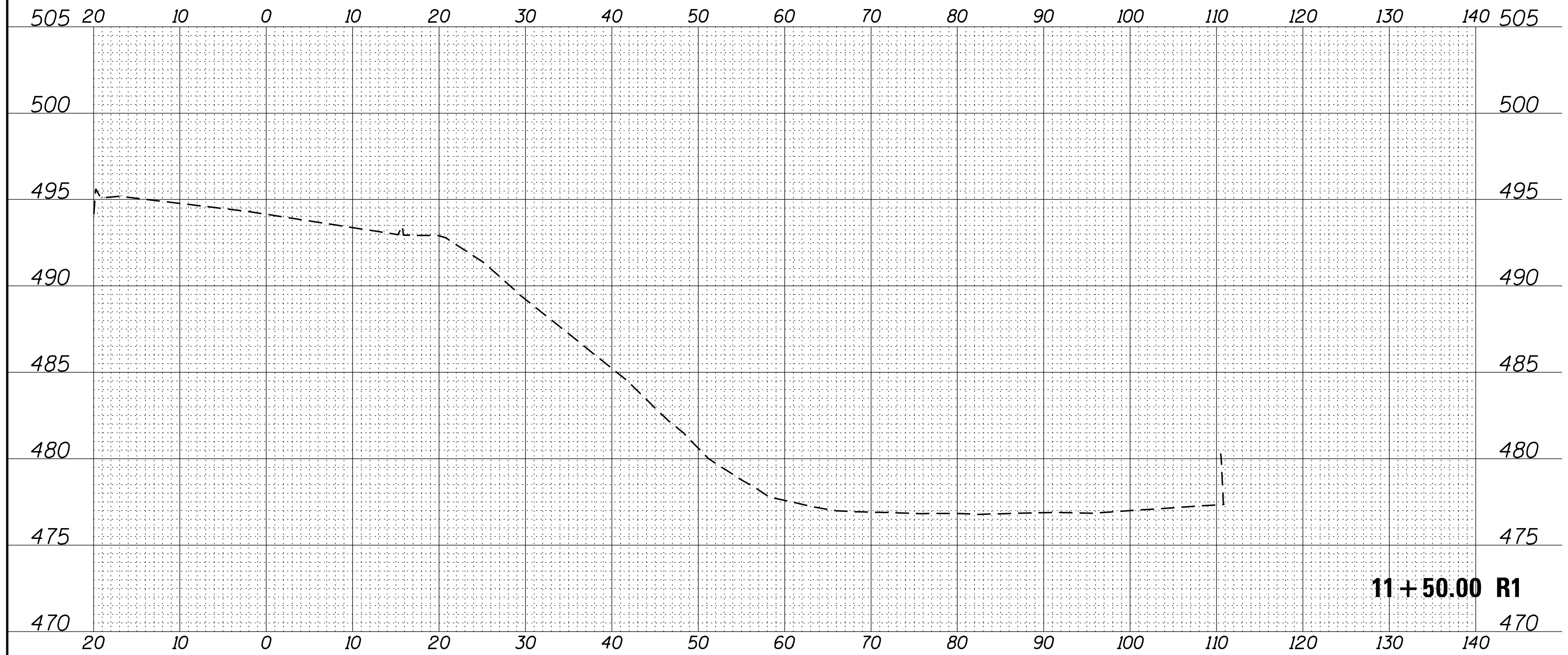
NOTE BOOK
NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE



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NOTE BOOK
NO.
SURVEYED
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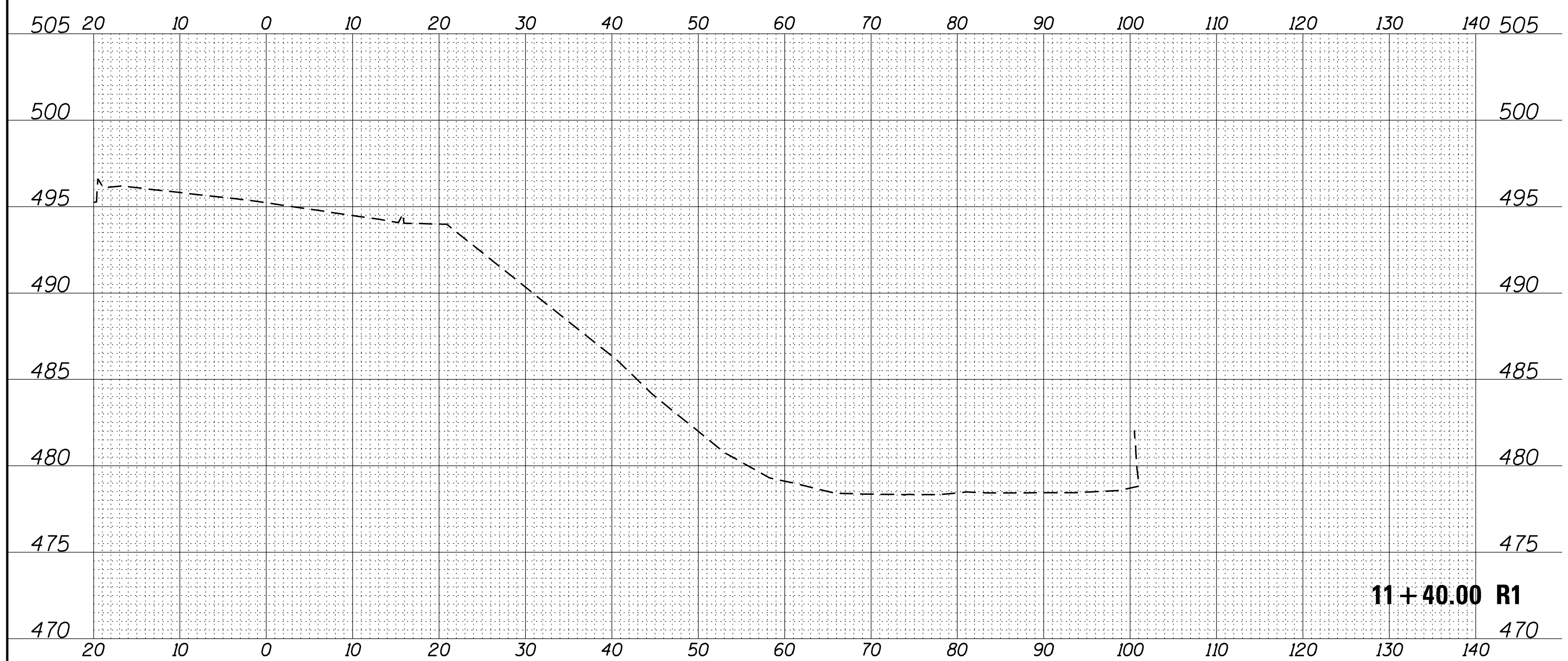
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE



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PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

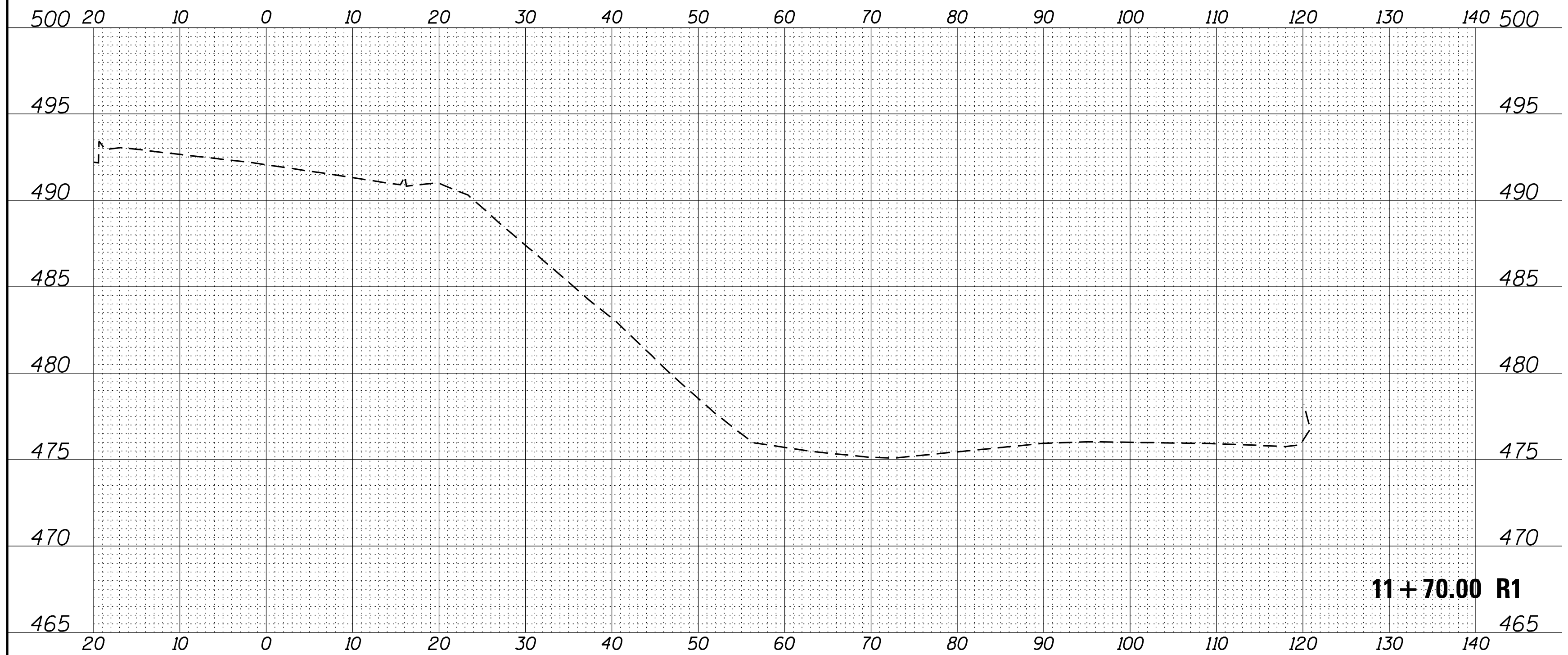
SCALE: | SHEET OF SHEETS | STA. 11+40.00 R1 TO STA. 11+50.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	37

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT

FINAL SURVEY
NOTE BOOK NO.
SURVEYED
PLOTTED
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE



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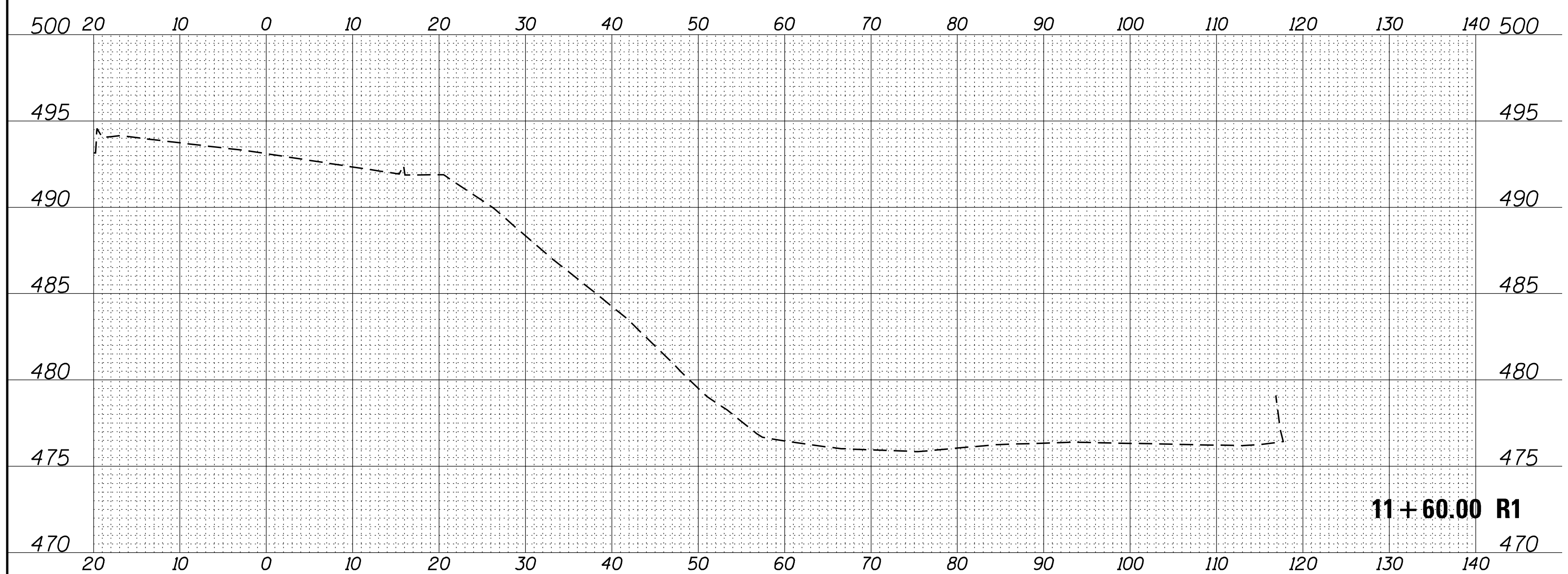
TEMPLATE
AREAS
AREAS CHECKED
BY
DATE



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PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

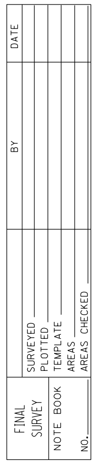
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

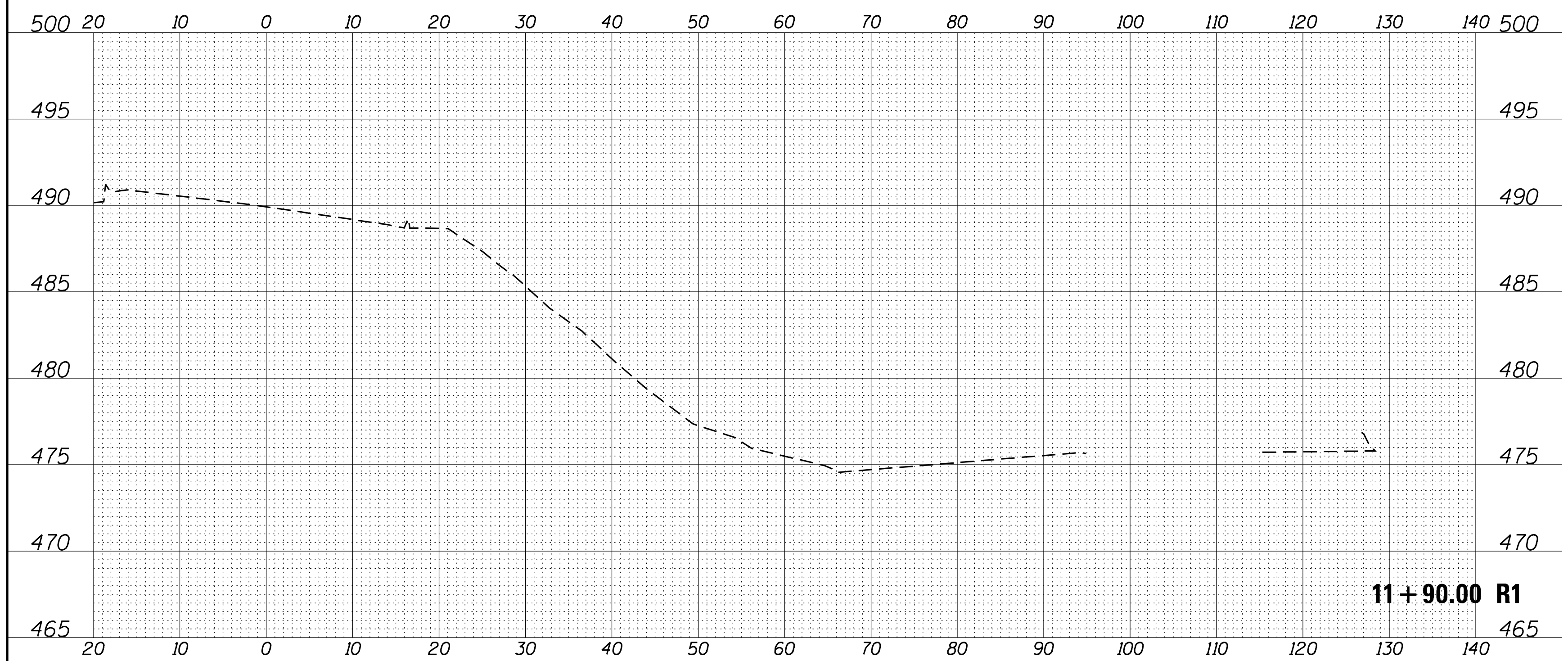
SCALE: | SHEET OF SHEETS | STA. 11+60.00 R1 TO STA. 11+70.00 R1

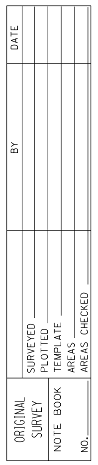
F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	38

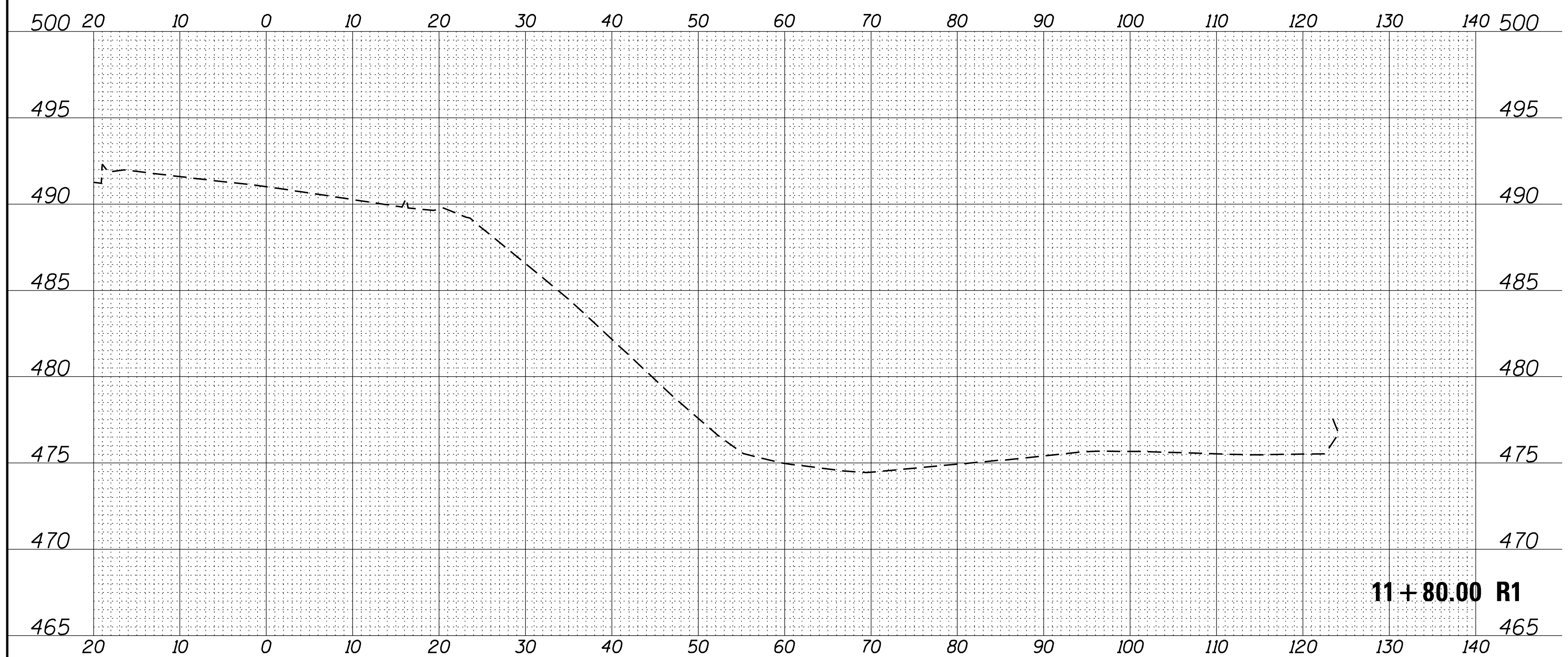
CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT









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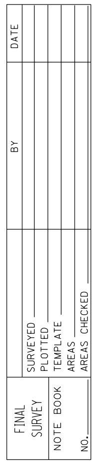
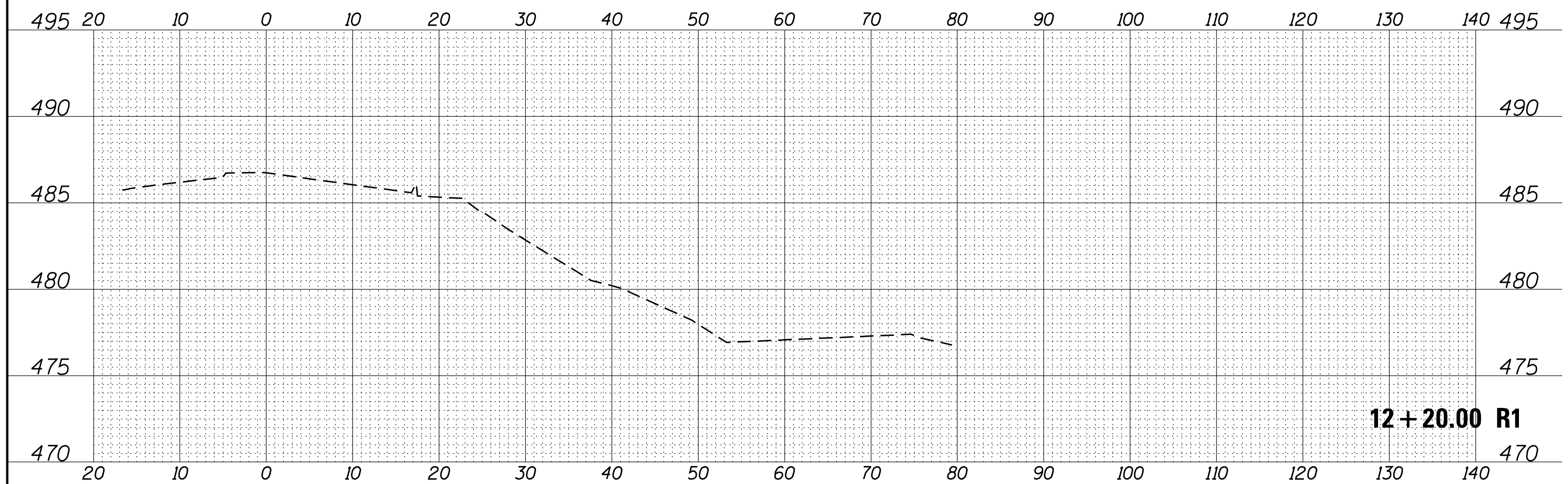
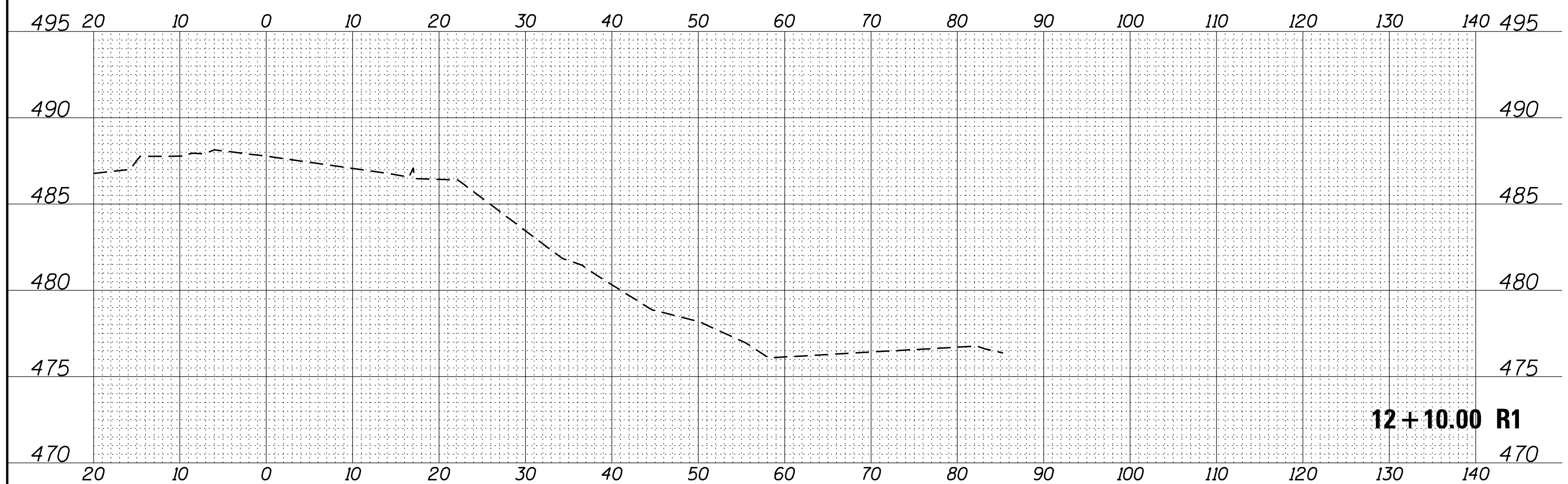
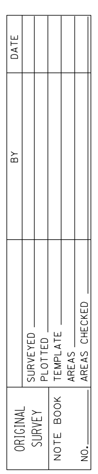
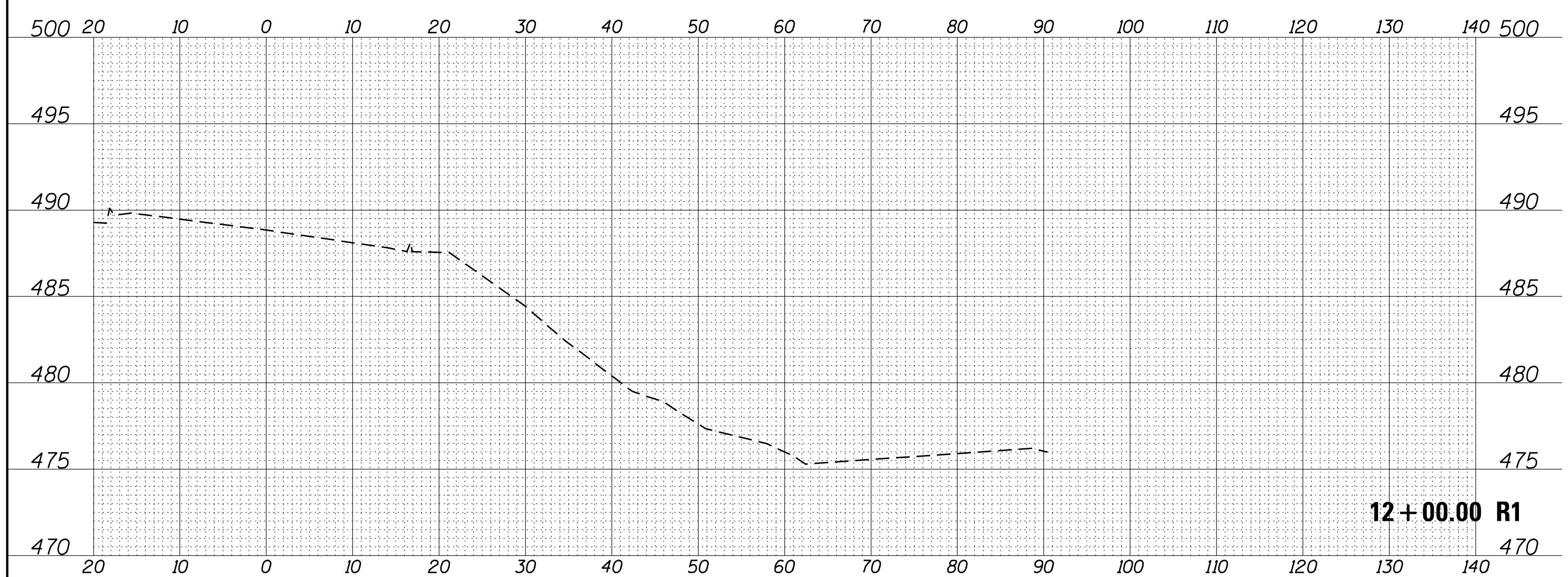
	PLOT SCALE = 20.0000 ' / in.	DRAWN	REVISED -			627	(I)I-2	LASALLE	41	39
	PLOT DATE = 3/21/2016	CHECKED -	REVISED -			CONTRACT NO. 66F07				
PrCL_2		DATE -	REVISED -		SCALE: SHEET OF SHEETS STA. 11+80.00 R1 TO STA. 11+90.00 R1	ILLINOIS FED. AID PROJECT				











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PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

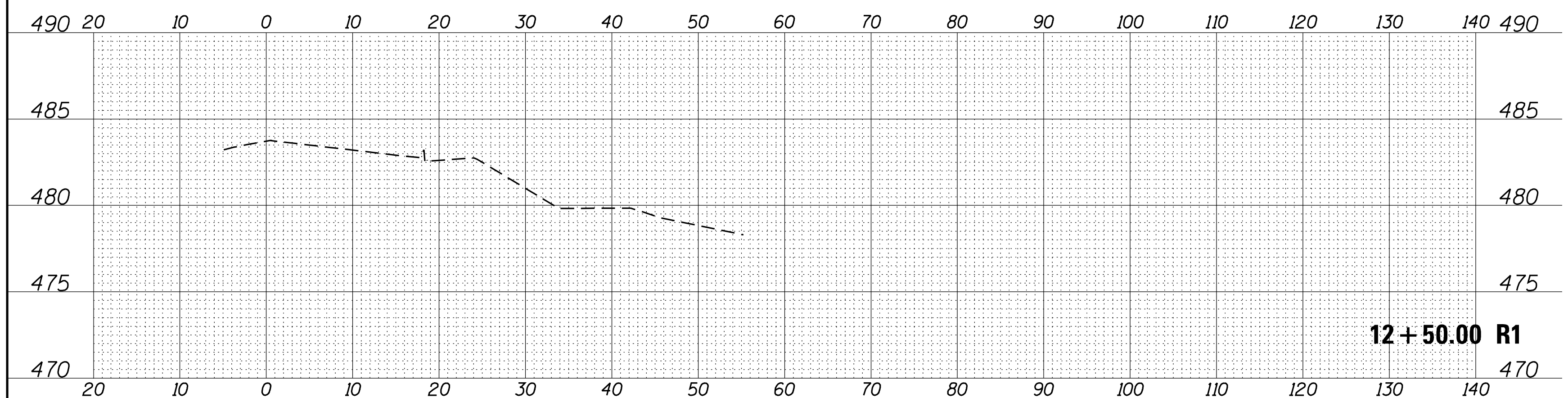
STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

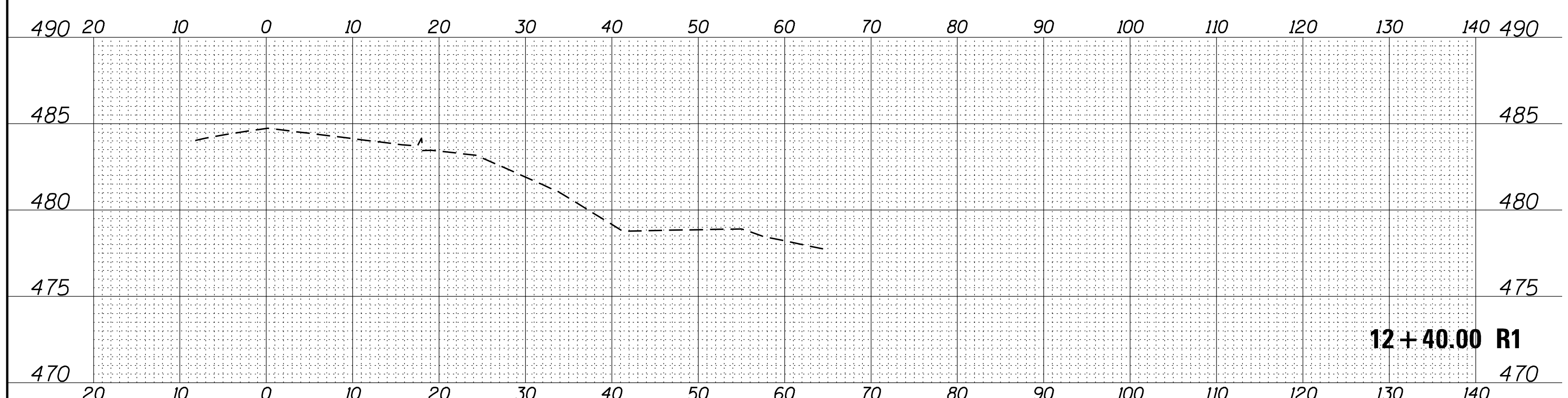
SCALE: | SHEET OF SHEETS | STA. 12+00.00 R1 TO STA. 12+20.00 R1

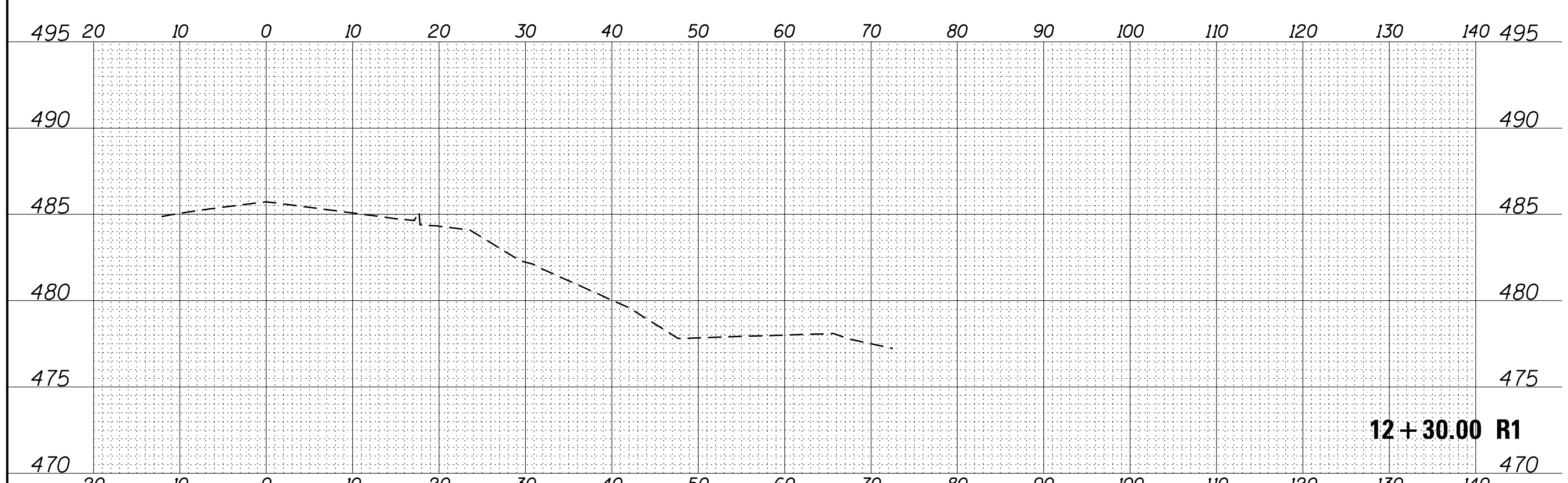
F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	40

CONTRACT NO. 66F07

ILLINOIS FED. AID PROJECT







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PrCL_2	PLOT DATE = 3/21/2016	DATE -	REVISED -

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

SCALE:	SHEET OF SHEETS	STA. 12+30.00 R1 TO STA. 12+50.00 R1

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	41
		CONTRACT NO. 66F07		
	ILLINOIS	FED. AID PROJECT		

APPENDIX

C-1

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
527	*	LASALLE	26	9
STA.		TO STA.		
FED. ROAD DIST. NO.		ILLINOIS FED. AID PROJECT		

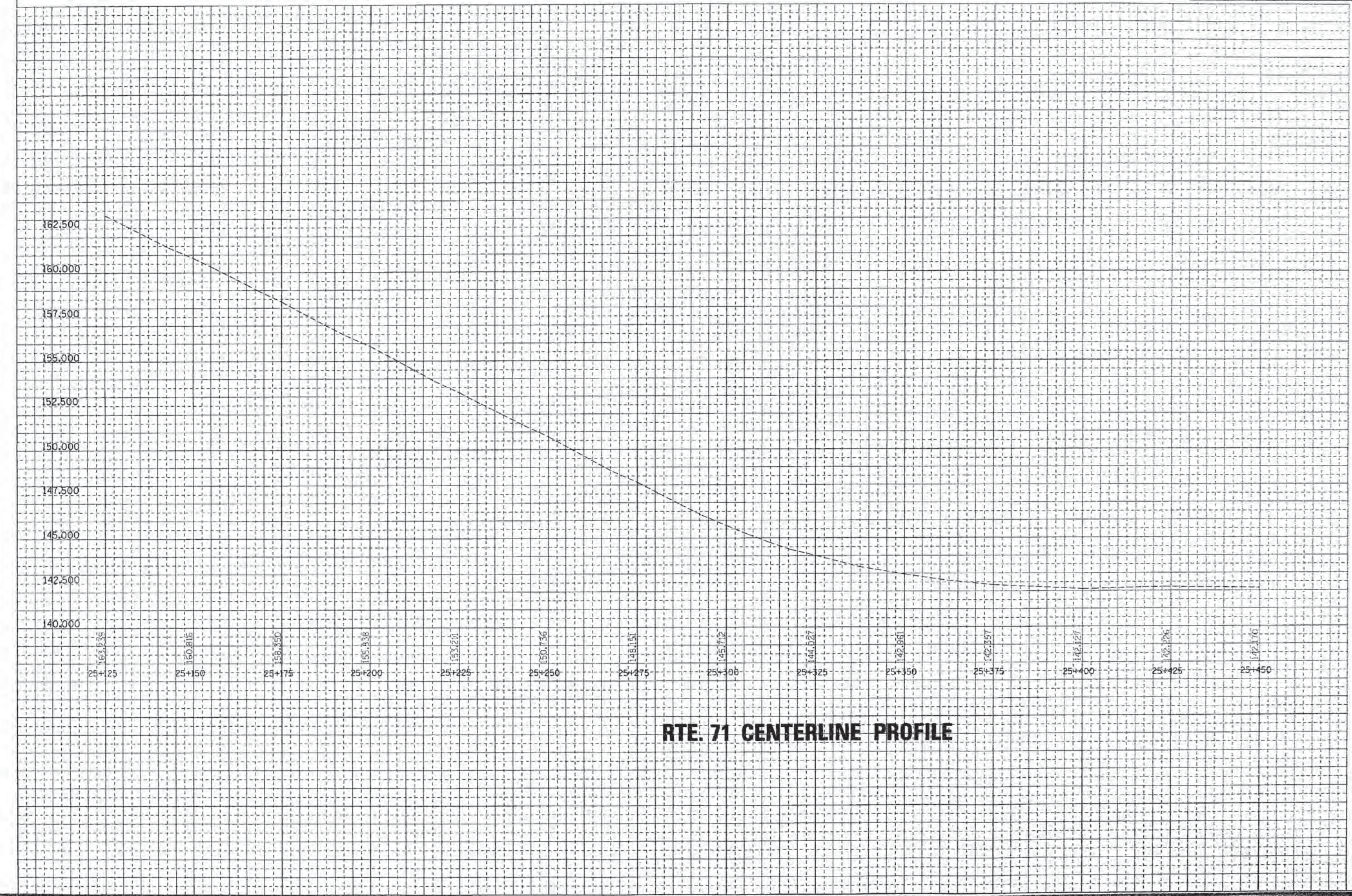
*(C.IR.B.L.M.C.U.N.W)RS-2

APRIL 24,1997
DMD06797J DIMSHTS.DGN

D C B A 0 A B C

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	*	LASALLE	26	10
STA.		TO STA.		
FED. ROAD DIST. NO.		ILLINOIS FED. AID PROJECT		

* (C,IR,B,L,M,I,U,N,W)RS-2



RTE. 71 CENTERLINE PROFILE

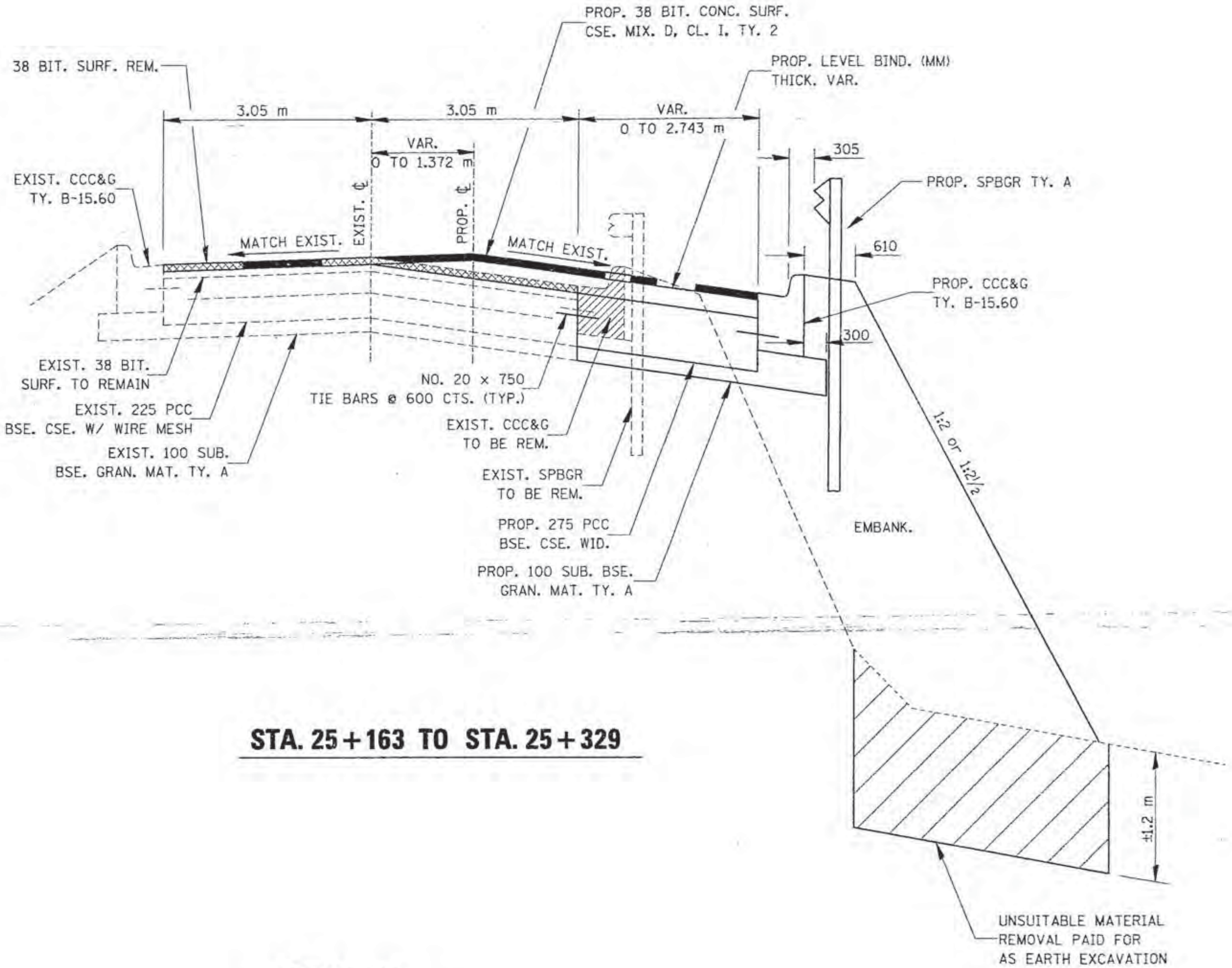
APRIL 30, 1997
[M006797] DIMSHTS.DGN

D C B A 0 A B

EXISTING PROFILE

F.A.P. RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	*	LASALLE	26	4
STA.	TO STA.			
FED. ROAD DIST. NO. 4	ILLINOIS	FED. AID PROJECT		

* [illegible]



STA. 25+163 TO STA. 25+329

STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION
DISTRICT THREE

PREPARED BY: *Lyle Schank*
DISTRICT STUDIES & PLANS ENGINEER

DATE: *April 30, 1997*

EXAMINED BY: *D. L. Matelle*
DISTRICT CONSTRUCTION ENGINEER

[signature]
DISTRICT MATERIALS ENGINEER

[signature]
DISTRICT OPERATIONS ENGINEER

ALL DIMENSIONS ARE IN MILLIMETERS UNLESS OTHERWISE SHOWN.

APRIL 24, 1997
ZF5:CMD06797IDMDETAL.DGN;

D C B A 0 A B C

TYPICAL SECTION

APPENDIX

C-2

Illinois Department of Transportation

Memorandum

To:	Dan Mestelle
From:	Ken Lang BY: Terry McCleary
Subject:	Unsuitable Material*
Date:	October 31, 1997

Kenneth R. Lang

* FAP Route 627 (IL 71)
Section (C,IR,B,L,M,U,N,W)RS-2
LaSalle County
Contract No. 86785
Dimmick Hill

This morning I visited the above project. I was asked to look at the material on the face of the existing slope. The organic material along the entire slope should be removed.

At some point in time there was a slope failure where the existing roadway fill met the rock face at the south end of the curve. To fix the problem Operations backfilled the area with riprap.

The muddy rock at the toe of the slope in this area should be removed. The dryer rocky material higher up the slope may be used in the fill. It should be spread over the entire lift and not left as a pocket of cover aggregate in the slope.

APPENDIX

C-3

Illinois Department of Transportation

Memorandum

To: Dan Mestelle

From: Kenneth R. Lang By: Terry L. McCleary

Subject: Earth Excavation*

Date: October 21, 1997

Kenneth R. Lang

---

* FAP 627 (IL 71)
Section (C,1R,B,L,M,I,U,N,W)RS-2
LaSalle County
Contract No. 86785

This morning, the contractor dug three test pits along the toe of slope of Dimmick Hill. The material found in each of the test pits was a sandy loam to a sandy clay loam. This material also had roots, bricks, and other deleterious material.

Therefore, I recommend all of the excavated material be removed from the job site.

TLM:lw/EARTH785

cc: Joe Lindenmier

APPENDIX

C-4

Illinois Department of Transportation

Memorandum

To:	Dan Mestelle	Attn: Andy Mrowicki
From:	Kenneth R. Lang	By: Terry L. McCleary
Subject:	French Drain*	
Date:	June 4, 1998	

* FAP 627 (IL 71)
Section (C,1R,B,L,M,I,U,N,W)R
LaSalle County
Contract No. 86785

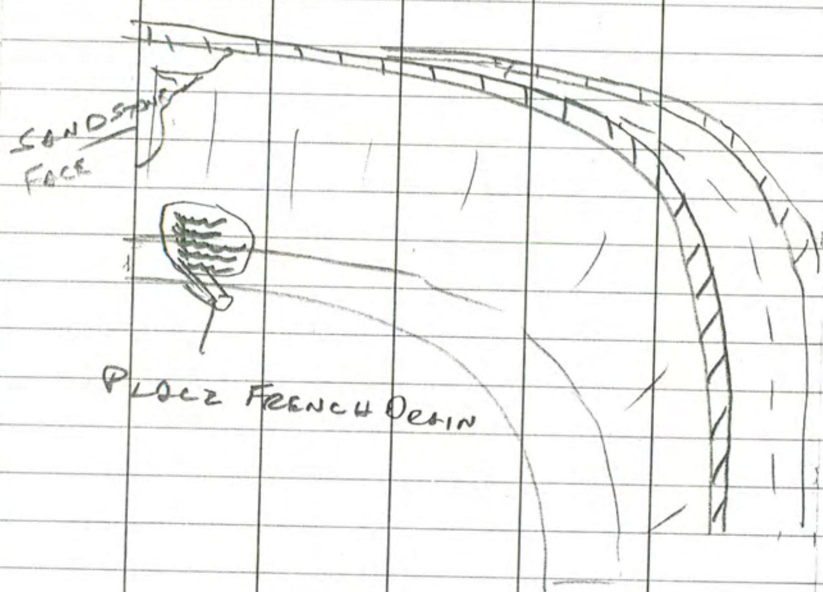
On Monday, June 1, 1998, Brad Thompson asked me to look at the Dimmick Hill slope. An area near the south end of the slope was very wet from moisture coming out of the existing fill. I checked again Tuesday morning. Water was still coming out of the hillside.

To allow this moisture to get out of the existing and new fill, I recommend an aggregate drain made of CA 7 wrapped with fabric be installed.

TLM:lw/FRENCH

cc: Joe Lindenmier

JOB Dimmick Hill
DATE PAGE



PARTY CHIEF
WEATHER

JOB
DATE 6/1/98 PAGE 40

Water Comming Out of Hill Near Sandstone Face.
The Contractor Has Removed The Poor Base Material. The New Embankment Will Be Setting On A Med Sand Or Some Bearing.

I Recommended A French Drain From The Existing Fill To Beyond The New Fill To Drain The Water Coming Out Of The Hill Side.

PARTY CHIEF
WEATHER

APPENDIX

C-5

IL 71 SOIL PROCTOR DATA

Memo Date	Sample	Proctor Density (pcf)	Optimum Moisture	Field Moisture
10/7/1997	Starved Rock Clay Products	112.0	15.5%	18.8%
10/31/1997	#1: Silty Clay Loam Till	115.7	14.8%	17.6%
10/31/1997	#2: Silty Clay	101.7	22.5%	19.2%
10/31/1997	#3: Silty Clay Loam Till	110.7	17.8%	20.0%
10/31/1997	50/50 Mix	107.6	19.0%	
6/12/1998	Silty Clay	107.0	19.1%	
6/12/1998	Silty Clay Loam - Silty Clay Till	98.9	22.7%	
6/12/1998	Shale	112.2	16.2%	
	Average	108.2		
	Maximum	115.7		
	Minimum	98.9		
	Median	109.2		

S:\MAT\SOILS\Soils Reports\IL 71 Slide at Dimmick Hill\Slope Stability STA 9+80\[Proctor Data.xlsx]Sheet1

Illinois Department of Transportation

Memorandum

To:	Dan Mestelle	Attn: Joe Spika
From:	Ken Lang	By: Terry McCleary
Subject:	Proctor Data *	TLM
Date:	October 7, 1997	

FAP 627 (IL 71)
Section (C,IR,B,L,M,I,U,N,W)R
LaSalle County
Contract No. 86785

A sample was received on October 2, 1997. The results of our tests are below.

Sample	Soil	Color	Proctor Dervisity	Optimum Moisture	Field Moisture
Starved Rock Clay Products	SIC Till & SICL Mix	Brown	1794 Kg/m^3 (112 lb/ft^3	15.5%	18.8%

TM:as
mem86785

cc: J. Lindenmier

Illinois Department of Transportation

Memorandum

To:	Dan Mestelle	Attn: Andy Mrowicki
From:	Kenneth R. Lang	By: Terry L. McCleary
Subject:	Soil Proctor*	
Date:	June 12, 1998	

* FAP 627 (IL 71)
Section (C,1R,B,L,M,I,U,N,W)R
LaSalle County
Contract No. 86785

Three samples have been brought in since June 2, 1998. The results are listed below:

DATE OF SAMPLE	SOIL TYPE	SOIL COLOR	PROCTOR DENSITY	OPTIMUM MOISTURE
6/2/98	Silty Clay	Yellow/Brown	1714.14 kg/cu m^3 (107.0 lb/ft^3)	19.1
6/8/98	Silty Clay Loam-Silty Clay Till	Black & Yellow Brown	1584.38 kg/cu m^3 (98.9 lb/ft^3)	22.7
6/10/98	Shale	Gray/Green	1797.44 kg/cu m^3 (112.2 lb/ft^3)	16.2

TLM:lw/PROC785

cc: Lindenmier

Illinois Department of Transportation

Memorandum

To:	Dan Mestelle	
From:	Kenneth R. Lang	By: Terry L. McCleary
Subject:	Proctor Data*	
Date:	October 31, 1997	

Kenneth R. Lang

---

* FA 627 (IL 71)
Section (C,1R,B,L,M,I,U,N,W)RS-2
LaSalle County
Contract No. 86785
Dimmick Hill

Four samples were brought in on October 23, 1997. Sample 1 is from Pike Subdivision. Sample 2 is a "B" horizon sample from Boehm Brothers. Sample 3 is a "C" horizon sample from Boehm Brothers. Sample 4 is a 50/50 mix of Samples 2 and 3. The results of our tests are below:

SAMPLE	SOIL TYPE	SOIL COLOR	PROCTOR DENSITY	OPTIMUM MOISTURE	FIELD MOISTURE
1	Silty Clay Loam Till	Brown	1854 kg/m^3 (115.7 lb/ft^3)	14.8%	17.6%
2	Silty Clay	Brown	1629 kg/m^3 (101.7 lb/ft^3)	22.5%	19.2%
3	Silty Clay Loam Till	Brown	1773 kg/m^3 (110.7 lb/ft^3)	17.8%	20.0%
4	50/50 Mix	Brown	1724 kg/m^3 (107.6 lb/ft^3)	19.0%	

All of the above samples are approved for use as embankment. However, for construction this time of year I recommend Samples No. 2 and 3 or a mixture there of because they are either dry of optimum or near 110% of optimum.

TLM:lw/PROC785

cc: Joe Lindenmier

APPENDIX

D-1

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
February 4, 2010






APPENDIX

D-2

ILLINOIS 71 AT DIMMICK HILL

Field Inspection

December 21, 2011




APPENDIX

D-3

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
May 5, 2014













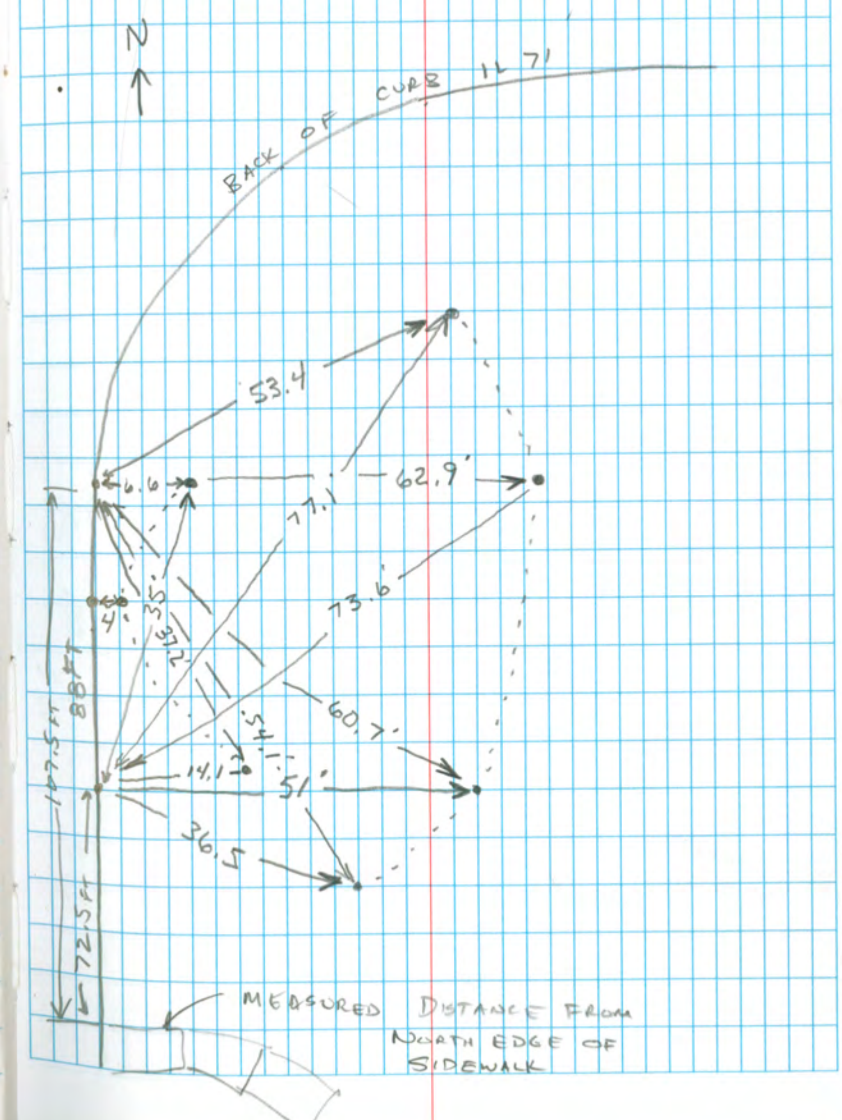
APPENDIX

D-4

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
April 10, 2015

IL 71 - Dimmick Hill
Starved Rock Park

Site Visit April 10, 2015
MAS JK LC



APPENDIX

D-5

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
July 15, 2015


07/15/2015

07/15/2015

07/15/2015

07/15/2015


07/15/2015


07/15/2015


07/15/2015


07/15/2015


07/15/2015

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07/15/2015

07/15/2015


07/15/2015

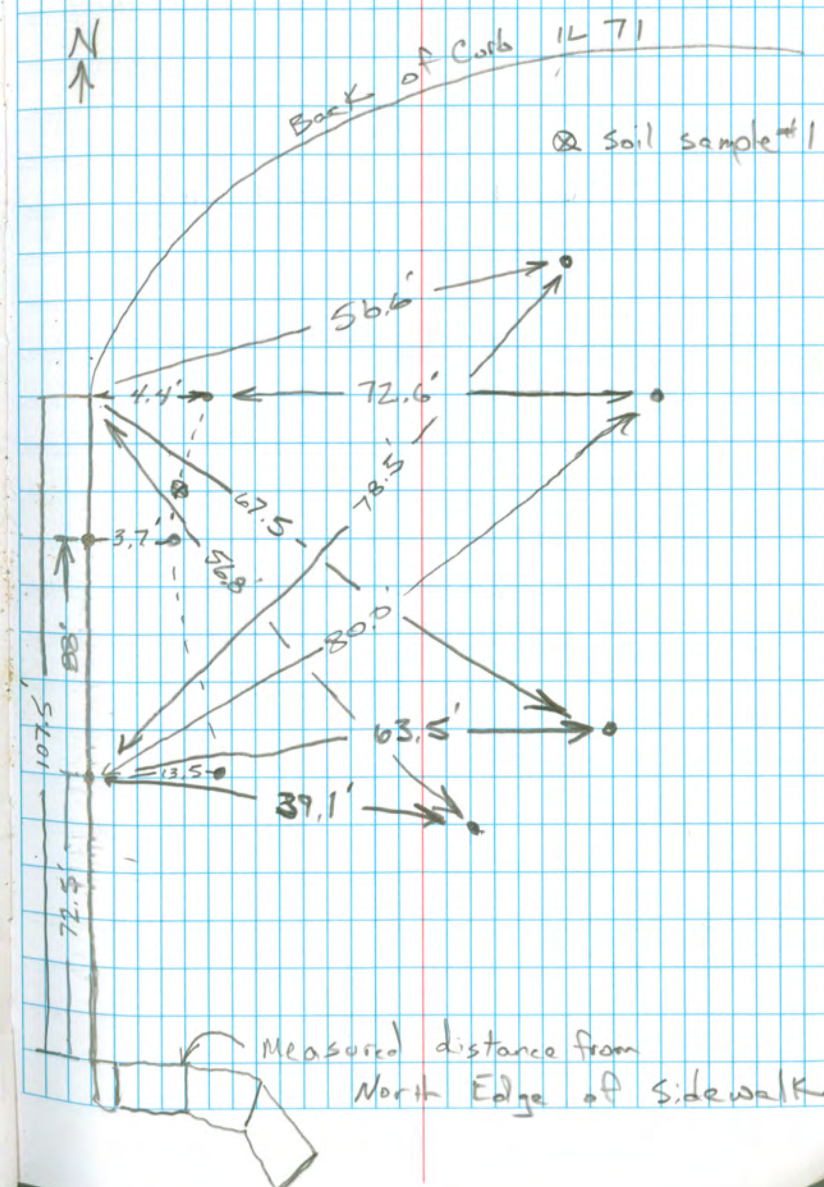

07/15/2015

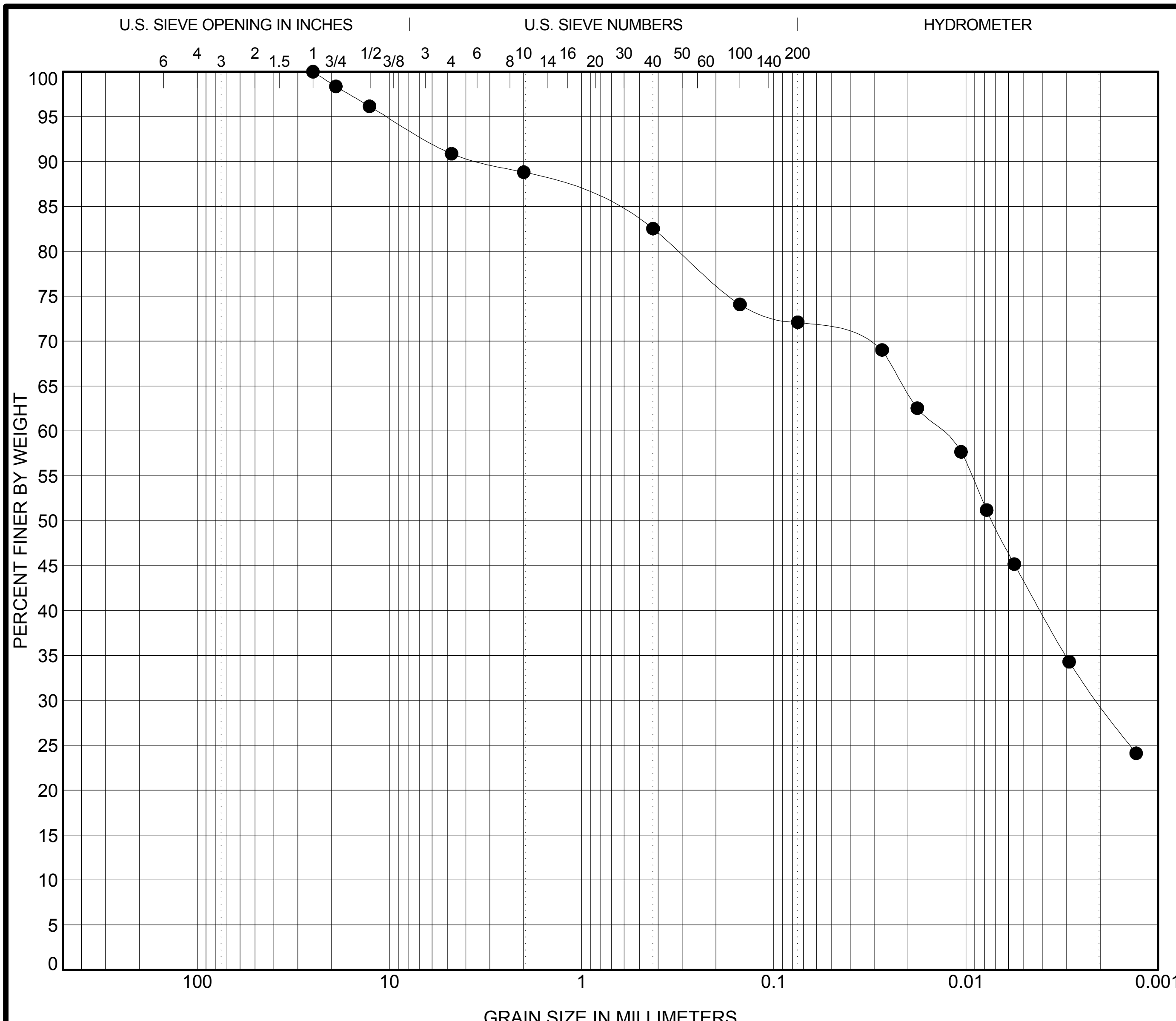

07/15/2015

IL 71 Dimmick Hill
Starved Rock Park

Soil Sample #1
92.0' from N. Edge Sidewalk
5.5' o/s from Back of curb

Site Visit July 15, 2015
~~JK~~ MAS





COBBLES	GRAVEL	SAND coarse	SAND fine	SILT	CLAY

	Specimen Identification		Classification	LL	PL	PI	Cc	Cu
●	**002**	**1.00**	**A-6 (12) CLAY LOAM**	**39.3**	**21.1**	**18.2**		

	Specimen Identification		D100	D60	D30	D10	%Gravel	%Sand	%Silt	%Clay
●	**002**	**1.00**	**25**	**0.014**	**0.002**		**11.2**	**16.7**	**42.5**	**29.6**

Illinois Department of Transportation
Division of Highways
IDOT

IDH GRAIN SIZE DISTRIBUTION

Route: FAP 627 (IL 71)

Section: (I)I-2

County: LaSalle

APPENDIX

D-6

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
December 11, 2015













APPENDIX

D-7

ILLINOIS 71 AT DIMMICK HILL
Field Inspection
January 25, 2016











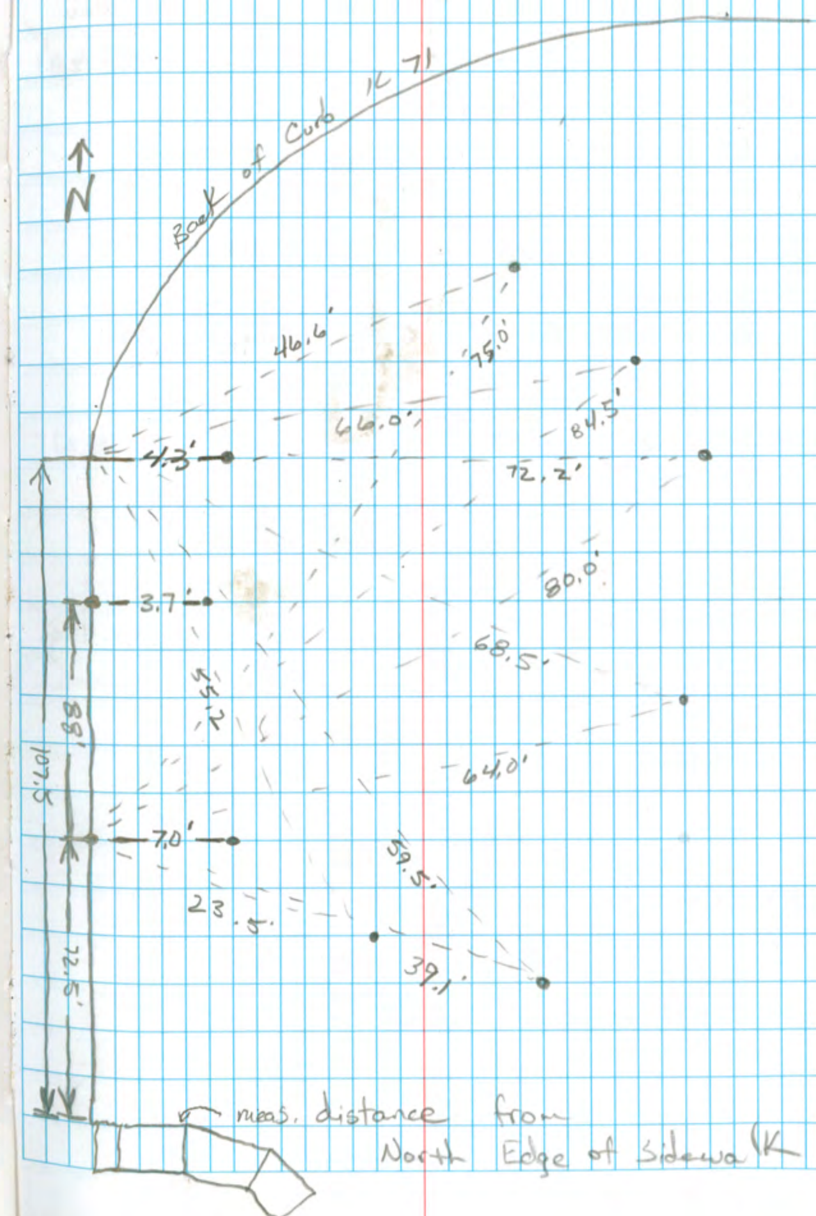





IL 71 Dimmick Hill

DCP Testing

Loc #8	Depth	Blows/6"		
Frozen	6"	20	132"	34
	12"	1	138"	32
	18"		144"	30
	24"		150"	31
	30"	8	154"	100
	36"	3		
	42"	7		
	48"	8		
	54"	15		
	60"	22		
	66"	25		
	72"	20		
	78"	23		
	84"	15		
	90"	28		
	96"	38		
	102"	38		
	108"	18		
	114"	37		
	120"	28		
	126"	27		



APPENDIX

E-1

IL 71 at Dimmick Hill
Subsurface Data Locations

APPENDIX

E-2

Illinois Department of Transportation

Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 3/12/97

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY** Terry McCleary

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** , **Longitude**

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE**

STRUCT. NO.
Station

BORING NO. 1 (1997)
Station 11+67
Offset 50.0 ft Rt.
Ground Surface Elev. 476.83 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After 24 **Hrs.** Dry ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Soft Black Clay Loam	473.83				
Soft Brown Sandy Loam			1		
			2	0.4	12
			2	B	
		-5			
			4		
	470.83		7	0.8	10
Medium Brown Sand Loam	469.83		10	B	7
Stiff Brown Sandy Loam			6		
			8	1.3	9
			7	S	
		-10			
			2		
	465.83		4	0.6	
Stiff Brown / Gray Clay Loam	464.83		4	S	
				1.3	
St. Peter Sandstone	464.00			B	
			150/4"		
End of Boring					
		-15			
		-20			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

SOIL BORING DIMMICK HILL SLIDE (IL 71).GPJ IL_DOT.GDT 3/2/16

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 3/12/97

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY** Terry McCleary

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** , **Longitude**

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE**

STRUCT. NO.
Station

BORING NO. 2 (1997)
Station 9+60
Offset 50.0 ft Rt.
Ground Surface Elev. 487.40 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After 24 **Hrs.** 484.4 ft ▽

Description	Elev. (ft)	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Not Recorded	485.90				
Medium to Firm Brown Clay Loam			1 1 1	0.8 S	17
▽					
2" Sand Layer at 4.5'		-5	4 6 7	0.8 S	11
			4 6 8	2.8 S	10
	478.90				
Stiff Brown Silty Clay Loam	477.40	-10	4 6	3.2	14
Very Stiff Brown Clay Loam			9	S 0.8 S	12
			4 6 10	3.9 S	16
	472.90		8	3.5	12
Medium Brown Sand		-15	9 10	P	5
Saturated at 16.5'			3 4 7		14
		-20	4 4		13
Medium Brown Sand *(continued)*			4		
2" Silty Loam Layer at 20.0'	466.40				
St. Peter Sandstone			28 120/4" 148/10"		
	463.11		100/3.5"		4
End of Boring		-25			
		-30			
		-35			
		-40			

SOIL BORING DIMMICK HILL SLIDE (IL 71).GPJ IL_DOT.GDT 3/2/16

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 3/12/97

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY**

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** , **Longitude**

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE**

STRUCT. NO.
Station

BORING NO. 3 (1997)
Station 11+67
Offset 5.0 ft Rt.
Ground Surface Elev. 497.60 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Pavement, Stone & Soil	495.10				
Stiff to Medium Brown Silty Clay Loam Till with Weathered Shale (Fill)			2 2 3	1.5 P	19
				0.5 P	
		-5	2 2 3	1.5 P	16
	490.60				
Stiff Brown / Gray Silty Clay Loam Till (Fill) Mix with Weathered Shale			2 2 3	1.4 B	18
		-10	2 2 4	1.3 P	18
			2 2 5	1.1 B	18
		-15	3 4 4	1.0 B	19
	480.10				
2" Till at top, Yellow / Brown Loose Sand			2 3 5		5
		-20			

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
2" Till at top, Yellow / Brown Loose Sand *(continued)* (20.0' - 22.5' Pieces of Sandstone)			3 4 4		4
	474.90				
Stiff Brown to Black Silty Clay Loam / Clay Loam (Organic open) Original Ground?			3		8
			3 4	0.8 B	20
	473.10				
Stiff Brown Clay as Boring 01 and Boring 02		-25	2 3 6	1.8 S	16
			2 5 10	1.8 B	12
	468.10				
Medium Brown Sandy Loam		-30	7 7 10	0.8 B	9
	465.10				
Sandstone			170/2"		7
		-35			
	462.27		100/4"		14
End of Boring					
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 3/12/97

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY**

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** , **Longitude**

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE**

STRUCT. NO.
Station

BORING NO. 4 (1997)
Station 9+60
Offset 5.0 ft Rt.
Ground Surface Elev. 515.24 ft

Surface Water Elev. ft
Stream Bed Elev. ft

Groundwater Elev.:
First Encounter ft
Upon Completion ft
After Hrs. ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Pavement & Soil					
	512.74				
Mix Sand, Shoulder* Till (Fill)			2		
* It is unclear exactly what was intended based on the field logs.			2	2.0	13
			2	P	
		-5			
			2		
			5	2.0	15
			4	S	
	507.74				
Very Soft Fine Sand	507.24		1	<0.2	16
Very Dense Brown Sand			3	P	
			100		5
	505.24	-10			
Sandstone			100/4"		
					8
			162/6"		12
	501.24				
End of Boring		-15			
		-20			

SOIL BORING DIMMICK HILL SLIDE (IL 71).GPJ IL_DOT.GDT 3/2/16

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

APPENDIX

E-3

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 8/12/15

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY** Larry Myers

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** 41.308486, **Longitude** -88.946528

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. ____
Station ____

BORING NO. 1 (2015)
Station 9+10.42
Offset 9.0 ft Rt.
Ground Surface Elev. 519.32 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion Dry ft
After ____ **Hrs.** Dry ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Cored Bituminous & Concrete Pavement, CA6 & White Sand	516.82				
Very Dense White Sand, Weathered St. Peters Sandstone	515.32		100/3"		3
Very Dense Rusty Brown & White Sand & Sandstone Pieces	514.99	-5	100/4"		3
End of Boring		-10			
		-15			
		-20			

SOIL BORING DIMMICK HILL SLIDE (IL 71).GPJ IL_DOT.GDT 3/2/16

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

BBS, form 137 (Rev. 8-99)

Illinois Department of Transportation
Division of Highways
Illinois Department of Transportation, District 3

SOIL BORING LOG

Date 8/12/15

ROUTE FAP 627 (IL 71) **DESCRIPTION** Slope Stability Investigation at Dimmick Hill in Starved Rock State Park **LOGGED BY** Larry Myers

SECTION (I)I-2 **LOCATION** NW 1/4, **SEC.** 25, **TWP.** 33N, **RNG.** 2E, 3rd **PM**, **Latitude** 41.308642, **Longitude** -88.946693

COUNTY LaSalle **DRILLING METHOD** Hollow Stem Auger **HAMMER TYPE** CME Automatic

STRUCT. NO. ____
Station ____

BORING NO. 2 (2015)
Station 9+82.95
Offset 13.3 ft Rt.
Ground Surface Elev. 510.94 ft

Surface Water Elev. ____ ft
Stream Bed Elev. ____ ft

Groundwater Elev.:
First Encounter ____ ft
Upon Completion Dry ft
After ____ **Hrs.** Dry ft

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
Cored Bituminous & Concrete Pavement, Gray Silty Clay Loam Fill	508.44				
Very Stiff Gray & Brown Silty Clay Fill with Gravel Pieces & White Sandstone Seams & Pockets			1		
			3	2.5	17
			5	P	
			3		
		-5	3	2.0	17
			3	P	
			3		
			3	2.0	17
	503.94		3	P	
Very Loose Brown & White Sand with some Organic Pockets up to 6" thick			2		
			1		6
			2		
			1		
			1		21
		-10	1		
			1		
			4		7
	499.44		3		
Medium Gray, Brown & Black Sandy Loam with Organics & Unconsolidated Layers			1		
			2	1.0	16
			3	P	
			2		
			3		12
	496.44		4		
Medium Brown to Gray Loamy Sand with Minor Sandy Loam Layers		-15	4		
			5		10
			6		
			5		
			6		10
			9		
			3		
			8		9
	491.94		13		
Hard Brown & Gray Silty Clay with Sand Layers & Sandstone Pieces			5		
		-20	7	4.0	14

Description	Elev.	DEPTH (ft)	BLOWS (/6")	UCS Qu (tsf)	MOIST (%)
	490.44		9	P	
Hard Reddish Brown to Gray Silty Clay Loam with Sandy Loam Layers & Sandstone Pieces			9		
			13	4.5	15
			16	P	
			5		
			8	4.0	17
			9	P	
			5		
			7	4.5	19
	485.94	-25	9	P	
Very Stiff Reddish Brown Sandy Loam & Silty Loam with some Sand Layers & Pieces			4		
			5	3.0	16
			7	P	
		-30			
			4		
	479.94		5	4.0	14
White Weathered St. Peter Sandstone Surface	479.44		100	P	
End of Boring					
		-35			
		-40			

The Unconfined Compressive Strength (UCS) Failure Mode is indicated by (B-Bulge, S-Shear, P-Penetrometer)
The SPT (N value) is the sum of the last two blow values in each sampling zone (AASHTO T206)

APPENDIX

E-4

IL 71 AT DIMMICK HILL
DCP DATA
AUGUST 2015
Measurement Method: Penetration For Each Blow

IL 71 at Dimmick Hill DCP	*Note: Field Measurements taken on* ***08-12-2015***															
DCP NUMBER	#1				#2				#3				#4			
ELEVATION	511.64				509.63				503.30				506.12			
STATION																
OFFSET																
BLOWS	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV
0	2.9	0	0		3.1	0	0		2.5	0	0		6.0		0	
1	11.3	8.4	8.4	0.5	12.5	9.4	9.4	0.4	9.3	6.8	6.8	0.62	9.8	3.8	3.8	1.29
2	16.7	13.8	5.4	0.8	21.6	18.5	9.10	0.43	13.5	11.0	4.20	1.13	12.3	6.3	2.50	2.18
3	22.3	19.4	5.6	0.8	25.5	22.4	3.90	1.25	16.2	13.7	2.70	1.98	15.2	9.2	2.90	1.81
4	26.3	23.4	4.0	1.2	29.3	26.2	3.80	1.29	19.5	17.0	3.30	1.54	17.7	11.7	2.50	2.18
5	29.0	26.1	2.7	2.0	32.2	29.1	2.90	1.81	21.4	18.9	1.90	3.08	20.4	14.4	2.70	1.98
6	32.4	29.5	3.4	1.5	34.6	31.5	2.40	2.30	22.8	20.3	1.40	4.53	22.7	16.7	2.30	2.42
7	35.1	32.2	2.7	2.0	37.6	34.5	3.00	1.73	24.6	22.1	1.80	3.30	25.1	19.1	2.40	2.30
8	38.9	36.0	3.8	1.3	40.5	37.4	2.90	1.81	26.1	23.6	1.50	4.15	26.9	20.9	1.80	3.30
9	41.0	38.1	2.1	2.7	42.2	39.1	1.70	3.55	27.5	25.0	1.40	4.53	28.8	22.8	1.90	3.08
10	42.5	39.6	1.5	4.2	44.0	40.9	1.80	3.30	29.0	26.5	1.50	4.15	31.2	25.2	2.40	2.30
11	44.1	41.2	1.6	3.8					30.6	28.1	1.60	3.83	33.5	27.5	2.30	2.42
12									32.2	29.7	1.60	3.83	35.5	29.5	2.00	2.89
13									33.9	31.4	1.70	3.55	37.5	31.5	2.00	2.89
14									35.6	33.1	1.70	3.55	38.9	32.9	1.40	4.53
15									37.0	34.5	1.40	4.53	40.3	34.3	1.40	4.53
16									38.5	36.0	1.50	4.15	42.0	36.0	1.70	3.55
17									40.0	37.5	1.50	4.15	43.9	37.9	1.90	3.08
18									41.0	38.5	1.00	6.92	45.4	39.4	1.50	4.15
19									42.4	39.9	1.40	4.53				
20									43.2	40.7	0.80	9.16				
21									43.6	41.1	0.40	21.95				
22									43.9	41.4	0.30	31.54				
23									44.3	41.8	0.40	21.95				
24									45.1	42.6	0.80	9.16				
25																
26																
27																
28																
29																
30																
31																
32																

LEGEND:	
(pink)	IBV <1
(orange)	1 < IBV < 2
(blue)	2 < IBV < 3
(green)	IBV > 3

IL 71 AT DIMMICK HILL
DCP DATA
AUGUST 2015
Measurement Method: Penetration For Each Blow

IL 71 at Dimmick Hill DCP	*Note: Field Measurements taken on 08-12-2015*															
DCP NUMBER	#5				#6				#7				#8			
ELEVATION	497.02				490.57				480.98				483.11			
STATION																
OFFSET																
BLOWS	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV
0	3.1	0	0		2.6		0		1.3	0	0		2.0	0	0	0
1	15.0	11.9	11.9	0.31	22.6	20.0	20.0	0.16	4.7	3.4	3.4	1.5	23.1	21.1	21.1	0.15
2	21.2	18.1	6.20	0.69	30.2	27.6	7.60	0.54	6.4	5.1	1.7	3.5	25.1	23.1	2.00	2.89
3	25.2	22.1	4.00	1.21	37.0	34.4	6.80	0.62	8.1	6.8	1.7	3.5	27.0	25.0	1.90	3.08
4	30.2	27.1	5.00	0.91	40.7	38.1	3.70	1.33	10.1	8.8	2.0	2.9	28.7	26.7	1.70	3.55
5	35.5	32.4	5.30	0.85	42.8	40.2	2.10	2.72	12.0	10.7	1.9	3.1	30.3	28.3	1.60	3.83
6	37.9	34.8	2.40	2.30	44.8	42.2	2.00	2.89	14.2	12.9	2.2	2.6	31.8	29.8	1.50	4.15
7	39.9	36.8	2.00	2.89					16.7	15.4	2.5	2.2	32.8	30.8	1.00	6.92
8	42.0	38.9	2.10	2.72					19.2	17.9	2.5	2.2	33.2	31.2	0.40	21.95
9	43.7	40.6	1.70	3.55					20.6	19.3	1.4	4.5	33.9	31.9	0.70	10.84
10									21.3	20.0	0.7	10.8	34.9	32.9	1.00	6.92
11									22.0	20.7	0.7	10.8	36.1	34.1	1.20	5.50
12									22.9	21.6	0.9	7.9	37.4	35.4	1.30	4.97
13									23.9	22.6	1.0	6.9	38.6	36.6	1.20	5.50
14									24.9	23.6	1.0	6.9	39.9	37.9	1.30	4.97
15									25.9	24.6	1.0	6.9	40.9	38.9	1.00	6.92
16									26.6	25.3	0.7	10.8	41.9	39.9	1.00	6.92
17									27.8	26.5	1.2	5.5	42.6	40.6	0.70	10.84
18									28.6	27.3	0.8	9.2	43.1	41.1	0.50	16.57
19									29.9	28.6	1.3	5.0	43.7	41.7	0.60	13.17
20									31.0	29.7	1.1	6.1	44.2	42.2	0.50	16.57
21									32.3	31.0	1.3	5.0				
22									33.9	32.6	1.6	3.8				
23									36.1	34.8	2.2	2.6				
24									38.3	37.0	2.2	2.6				
25									39.9	38.6	1.6	3.8				
26									41.4	40.1	1.5	4.2				
27									42.6	41.3	1.2	5.5				
28									43.7	42.4	1.1	6.1				
29									44.7	43.4	1.0	6.9				
30																
31																
32																

LEGEND:	
	IBV <1
	1 < IBV < 2
	2 < IBV < 3
	IBV > 3

IL 71 AT DIMMICK HILL
DCP DATA
AUGUST 2015
Measurement Method: Penetration For Each Blow

IL 71 at Dimmick Hill DCP	*Note: Field Measurements taken on 08-12-2015*															
DCP NUMBER	**#9**				**#10**				**#11**				**#12**			
ELEVATION	484.07				505.41				506.15				509.34			
STATION																
OFFSET																
BLOWS	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV	ROD READING DEPTH (in)	CUMMULATIVE DEPTH (in)	RATE (IN / BLOW)	IBV
0	**3.2**	**0**	**0**		**0.4**	**0**	**0**		**0.2**	**0**	**0**		**0.8**	**0**	**0**	
1	7.2	4.0	4.0	**1.21**	2.2	1.8	1.8	**3.3**	2.5	2.3	2.3	**2.42**	15.0	14.2	14.2	**0.2**
2	9.5	6.3	2.30	**2.42**	4.3	3.9	2.1	**2.7**	4.2	4.0	1.70	**3.55**	19.4	18.6	4.4	**1.1**
3	11.5	8.3	2.00	**2.89**	6.8	6.4	2.5	**2.2**	5.8	5.6	1.60	**3.83**	22.9	22.1	3.5	**1.4**
4	13.2	10.0	1.70	**3.55**	9.5	9.1	2.7	**2.0**	8.2	8.0	2.40	**2.30**	26.8	26.0	3.9	**1.2**
5	14.8	11.6	1.60	**3.83**	12.2	11.8	2.7	**2.0**	10.3	10.1	2.10	**2.72**	30.3	29.5	3.5	**1.4**
6	16.7	13.5	1.90	**3.08**	14.0	13.6	1.8	**3.3**	12.3	12.1	2.00	**2.89**	33.1	32.3	2.8	**1.9**
7	18.2	15.0	1.50	**4.15**	15.4	15.0	1.4	**4.5**	14.6	14.4	2.30	**2.42**	35.5	34.7	2.4	**2.3**
8	19.5	16.3	1.30	**4.97**	17.5	17.1	2.1	**2.7**	17.0	16.8	2.40	**2.30**	38.2	37.4	2.7	**2.0**
9	20.8	17.6	1.30	**4.97**	19.0	18.6	1.5	**4.2**	19.4	19.2	2.40	**2.30**	41.0	40.2	2.8	**1.9**
10	22.2	19.0	1.40	**4.53**	23.8	23.4	4.8	**1.0**	21.5	21.3	2.10	**2.72**	43.6	42.8	2.6	**2.1**
11	23.7	20.5	1.50	**4.15**	25.8	25.4	2.0	**2.9**	23.1	22.9	1.60	**3.83**				
12	25.5	22.3	1.80	**3.30**	27.8	27.4	2.0	**2.9**	24.6	24.4	1.50	**4.15**				
13	26.9	23.7	1.40	**4.53**	30.0	29.6	2.2	**2.6**	26.6	26.4	2.00	**2.89**				
14	28.4	25.2	1.50	**4.15**	31.9	31.5	1.9	**3.1**	28.6	28.4	2.00	**2.89**				
15	29.3	26.1	0.90	**7.90**	33.5	33.1	1.6	**3.8**	30.3	30.1	1.70	**3.55**				
16	30.0	26.8	0.70	**10.84**	35.1	34.7	1.6	**3.8**	32.1	31.9	1.80	**3.30**				
17	30.6	27.4	0.60	**13.17**	36.7	36.3	1.6	**3.8**	34.1	33.9	2.00	**2.89**				
18	31.2	28.0	0.60	**13.17**	38.0	37.6	1.3	**5.0**	36.1	35.9	2.00	**2.89**				
19	31.9	28.7	0.70	**10.84**	39.2	38.8	1.2	**5.5**	38.0	37.8	1.90	**3.08**				
20	32.6	29.4	0.70	**10.84**	40.3	39.9	1.1	**6.1**	39.7	39.5	1.70	**3.55**				
21	33.4	30.2	0.80	**9.16**	41.2	40.8	0.9	**7.9**	41.5	41.3	1.80	**3.30**				
22	34.3	31.1	0.90	**7.90**	42.1	41.7	0.9	**7.9**	43.4	43.2	1.90	**3.08**				
23	35.2	32.0	0.90	**7.90**	43.0	42.6	0.9	**7.9**								
24	36.2	33.0	1.00	**6.92**	43.8	43.4	0.8	**9.2**								
25	37.1	33.9	0.90	**7.90**	44.6	44.2	0.8	**9.2**								
26	38.0	34.8	0.90	**7.90**												
27	38.9	35.7	0.9	**7.9**												
28	39.6	36.4	0.7	**10.8**												
29	40.4	37.2	0.8	**9.2**												
30	41.5	38.3	1.1	**6.1**												
31	42.7	39.5	1.2	**5.5**												
32	44.5	41.3	1.8	**3.3**												

LEGEND:	
(pink)	**IBV <1**
(orange)	**1 < IBV < 2**
(blue)	**2 < IBV < 3**
(green)	**IBV > 3**

IL 71 AT DIMMICK HILL
DCP DATA
DECEMBER 2015 AND JANUARY 2016
Measurement Method: Blows Per 6 Inches of Penetration

IL 71 at Dimmick Hill DCP	*Notes: **DCP # 1 to #4** - Measured on 12-11-2015. **DCP #5 to #8** - Measured on 01-25-2016.*															
DCP NUMBER	**101**				**102**				**103**				**104**			
ELEVATION	481.31				491.61				488.81				513.97			
ROCK SURFACE ELEVATION	**466.10**				**482.80**				**N/A**				**504.80**			
INTERVAL	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**
1	**0.0**	**2**	**3**	**1.7**	**0.0**	**1**	**24**	**0.1**	**0.0**	**1**	**24**	**0.1**	**0.0**	**1**	**42**	**0.1**
2	6.0	3	2.0	**2.9**	24.0	4	1.5	**4.2**	24.0	7	0.9	**8.4**	42.0	5	1.2	**5.5**
3	12.0	3	2.0	**2.9**	30.0	5	1.2	**5.5**	30.0	8	0.8	**9.9**	48.0	5	1.2	**5.5**
4	18.0	13	0.5	**18.3**	36.0	7	0.9	**8.4**	36.0	6	1.0	**6.9**	54.0	6	1.0	**6.9**
5	24.0	9	0.7	**11.5**	42.0	6	1.0	**6.9**	42.0	10	0.6	**13.2**	60.0	6	1.0	**6.9**
6	30.0	8	0.8	**9.9**	48.0	5	1.2	**5.5**	48.0	10	0.6	**13.2**	66.0	6	1.0	**6.9**
7	36.0	8	0.8	**9.9**	54.0	7	0.9	**8.4**	54.0	22	0.3	**35.6**	72.0	4	1.5	**4.2**
8	42.0	13	0.5	**18.3**	60.0	10	0.6	**13.2**	60.0	23	0.3	**37.6**	78.0	7	0.9	**8.4**
9	48.0	18	0.3	**27.6**	66.0	10	0.6	**13.2**	66.0	45	0.1	**87.6**	84.0	7	0.9	**8.4**
10	54.0	20	0.3	**31.5**	72.0	11	0.5	**14.8**	72.0	23	0.3	**37.6**	90.0	7	0.9	**8.4**
11	60.0	24	0.3	**39.7**	78.0	15	0.4	**21.9**	78.0	31	0.2	**54.8**	96.0	8	0.8	**9.9**
12	66.0	30	0.2	**52.6**	84.0	16	0.4	**23.8**	84.0	34	0.2	**61.5**	102.0	8	0.8	**9.9**
13	72.0	42	0.1	**80.3**	90.0	24	0.3	**39.7**	90.0	33	0.2	**59.3**	108.0	35	0.0	**366.1**
14	78.0	28	0.2	**48.2**	96.0	16	0.4	**23.8**	96.0	24	0.3	**39.7**	109.5			
15	84.0	27	0.2	**46.0**	102.0	20	0.2	**52.6**	102.0	30	0.2	**52.6**				
16	90.0	25	0.2	**41.8**	106.0				108.0	34	0.2	**61.5**				
17	96.0	46	0.1	**90.1**					114.0	40	0.2	**75.5**				
18	102.0	33	0.2	**59.3**					120.0	27	0.2	**46.0**				
19	108.0	26	0.2	**43.9**					126.0	33	0.2	**59.3**				
20	114.0	28	0.2	**48.2**					132.0	38	0.2	**70.8**				
21	120.0	37	0.2	**68.5**					138.0	52	0.1	**105.1**				
22	126.0	33	0.2	**59.3**					144.0	42	0.1	**80.3**				
23	132.0	28	0.2	**48.2**					150.0	41	0.1	**77.9**				
24	138.0	21	0.3	**33.5**					156.0	73	0.1	**161.2**				
25	144.0	30	0.2	**52.6**					162.0	85	0.1	**195.3**				
26	150.0	33	0.2	**59.3**					168.0							
27	156.0	28	0.2	**48.2**												
28	162.0	33	0.2	**59.3**												
29	168.0	35	0.2	**63.8**												
30	174.0	37	0.2	**68.5**												
31	180.0	25	0.1	**166.8**												
32	182.0	10	0.0	**2290.9**												
33	182.1															

LEGEND:	
	IBV <1
	1 < IBV < 2
	2 < IBV < 3
	IBV > 3

IL 71 AT DIMMICK HILL

DCP DATA

DECEMBER 2015 AND JANUARY 2016

Measurement Method: Blows Per 6 Inches of Penetration

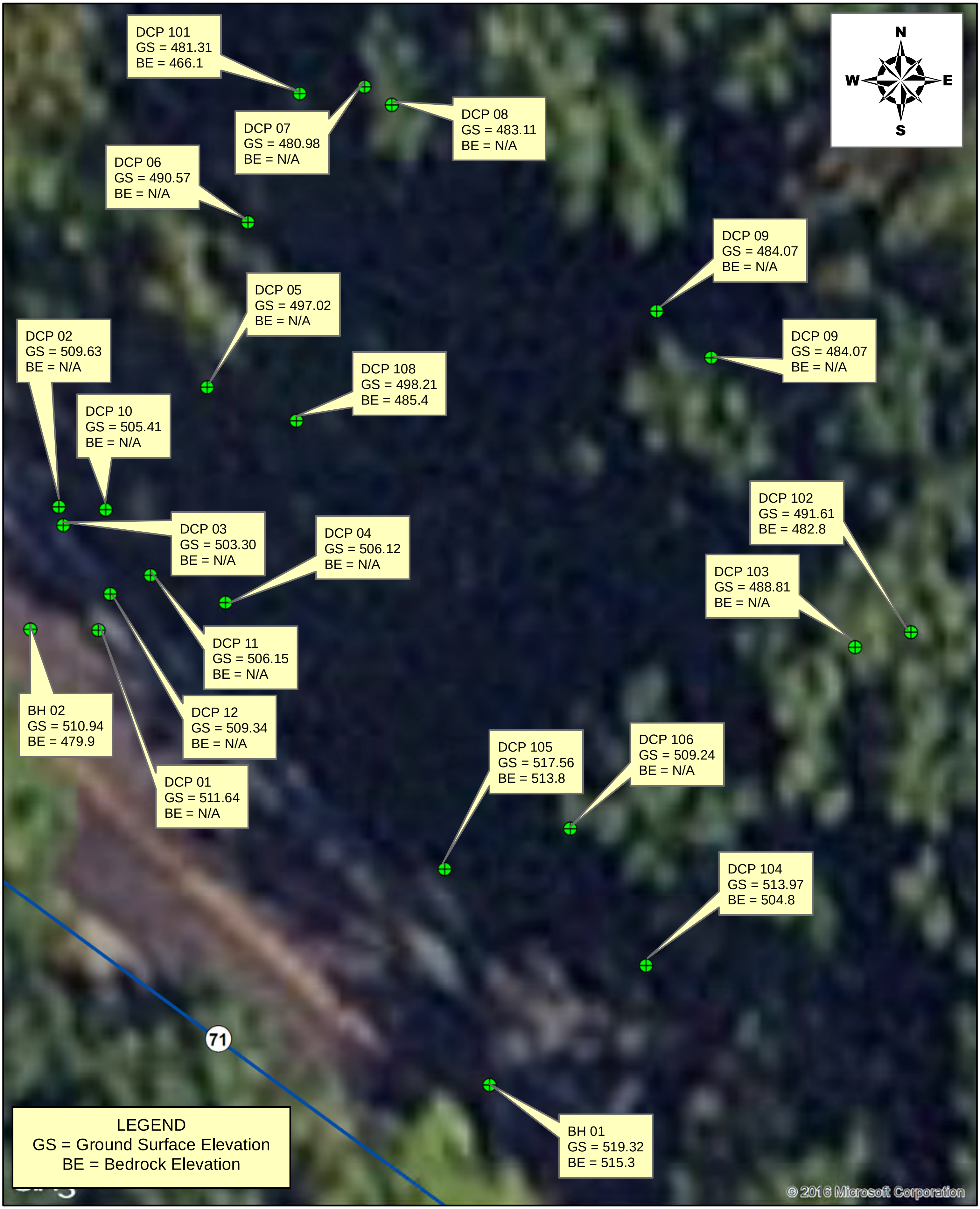
IL 71 at Dimmick Hill DCP	*Notes:* ***DCP # 1 to #4*** *- Measured on 12-11-2015.* ***DCP #5 to #8*** *- Measured on 01-25-2016.*															
DCP NUMBER	**105**				**106**				**107**				**108**			
ELEVATION	517.56				509.24				484.25				498.21			
ROCK SURFACE ELEVATION	**513.80**				**N/A**				**N/A**				**485.40**			
INTERVAL	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**	DEPTH (IN)	BLOWS / 6 INCH	**RATE (IN / BLOW)**	**IBV**
1	**0.0**	**22**	**0.27**	**35.6**	**0.0**	**22**	**0.27**	**35.6**	**0.0**	**13**	**0.46**	**18.3**	**0.0**	**20**	**0.30**	**31.5**
2	6.0	8	0.8	**9.9**	6.0	11	0.5	**14.8**	6.0	4	1.5	**4.2**	6.0	1	18.0	**0.2**
3	12.0	2	3.0	**1.7**	12.0	1	6.0	**0.7**	12.0	3	2.0	**2.9**	24.0	8	0.8	**9.9**
4	18.0	2	3.0	**1.7**	18.0	1	6.0	**0.7**	18.0	5	1.2	**5.5**	30.0	3	2.0	**2.9**
5	24.0	15	0.4	**21.9**	24.0	17	0.4	**25.7**	24.0	10	0.6	**13.2**	36.0	7	0.9	**8.4**
6	30.0	8	0.8	**9.9**	30.0	6	1.0	**6.9**	30.0	7	0.9	**8.4**	42.0	8	0.8	**9.9**
7	36.0	3	2.0	**2.9**	36.0	3	2.0	**2.9**	36.0	16	0.4	**23.8**	48.0	15	0.4	**21.9**
8	42.0	30	0.1	**125.9**	42.0	5	1.2	**5.5**	42.0	10	0.6	**13.2**	54.0	22	0.3	**35.6**
9	45.0				48.0	9	0.7	**11.5**	48.0	9	0.7	**11.5**	60.0	25	0.2	**41.8**
10					54.0	13	0.5	**18.3**	54.0	13	0.5	**18.3**	66.0	20	0.3	**31.5**
11					60.0	8	0.8	**9.9**	60.0	14	0.4	**20.1**	72.0	23	0.3	**37.6**
12					66.0	12	0.5	**16.6**	66.0	13	0.5	**18.3**	78.0	15	0.4	**21.9**
13					72.0	18	0.3	**27.6**	72.0	11	0.5	**14.8**	84.0	28	0.2	**48.2**
14					78.0	14	0.4	**20.1**	78.0	13	0.5	**18.3**	90.0	38	0.2	**70.8**
15					84.0	16	0.4	**23.8**	84.0	15	0.4	**21.9**	96.0	38	0.2	**70.8**
16					90.0	13	0.5	**18.3**	90.0	22	0.3	**35.6**	102.0	18	0.3	**27.6**
17					96.0	21	0.3	**33.5**	96.0	25	0.2	**41.8**	108.0	37	0.2	**68.5**
18					102.0	18	0.3	**27.6**	102.0	20	0.3	**31.5**	114.0	28	0.2	**48.2**
19					108.0	21	0.3	**33.5**	108.0	24	0.3	**39.7**	120.0	27	0.2	**46.0**
20					114.0	42	0.1	**80.3**	114.0	32	0.2	**57.0**	126.0	34	0.2	**61.5**
21					120.0	38	0.2	**70.8**	120.0	39	0.2	**73.2**	132.0	32	0.2	**57.0**
22					126.0	29	0.2	**50.4**	126.0	40	0.2	**75.5**	138.0	30	0.2	**52.6**
23					132.0	23	0.3	**37.6**	132.0	40	0.2	**75.5**	144.0	31	0.2	**54.8**
24					138.0	28	0.2	**48.2**	138.0	38	0.2	**70.8**	150.0	100	0.0	**399.4**
25					144.0	23	0.3	**37.6**	144.0	42	0.1	**80.3**	154.0			
26					150.0	20	0.3	**31.5**	150.0	36	0.2	**66.1**				
27					156.0	32	0.2	**57.0**	156.0	45	0.1	**87.6**				
28					162.0	27	0.2	**46.0**	162.0	46	0.1	**90.1**				
29					168.0	30	0.2	**52.6**	168.0	41	0.1	**77.9**				
30					174.0	22	0.3	**35.6**	174.0	33	0.2	**59.3**				
31					180.0	30	0.2	**52.6**	180.0	45	0.1	**87.6**				
32					186.0	13	0.3	**30.5**	186.0	40	0.1	**125.9**				
33					190.0				190.0							

LEGEND:	
	IBV <1
	1 < IBV < 2
	2 < IBV < 3
	IBV > 3

APPENDIX

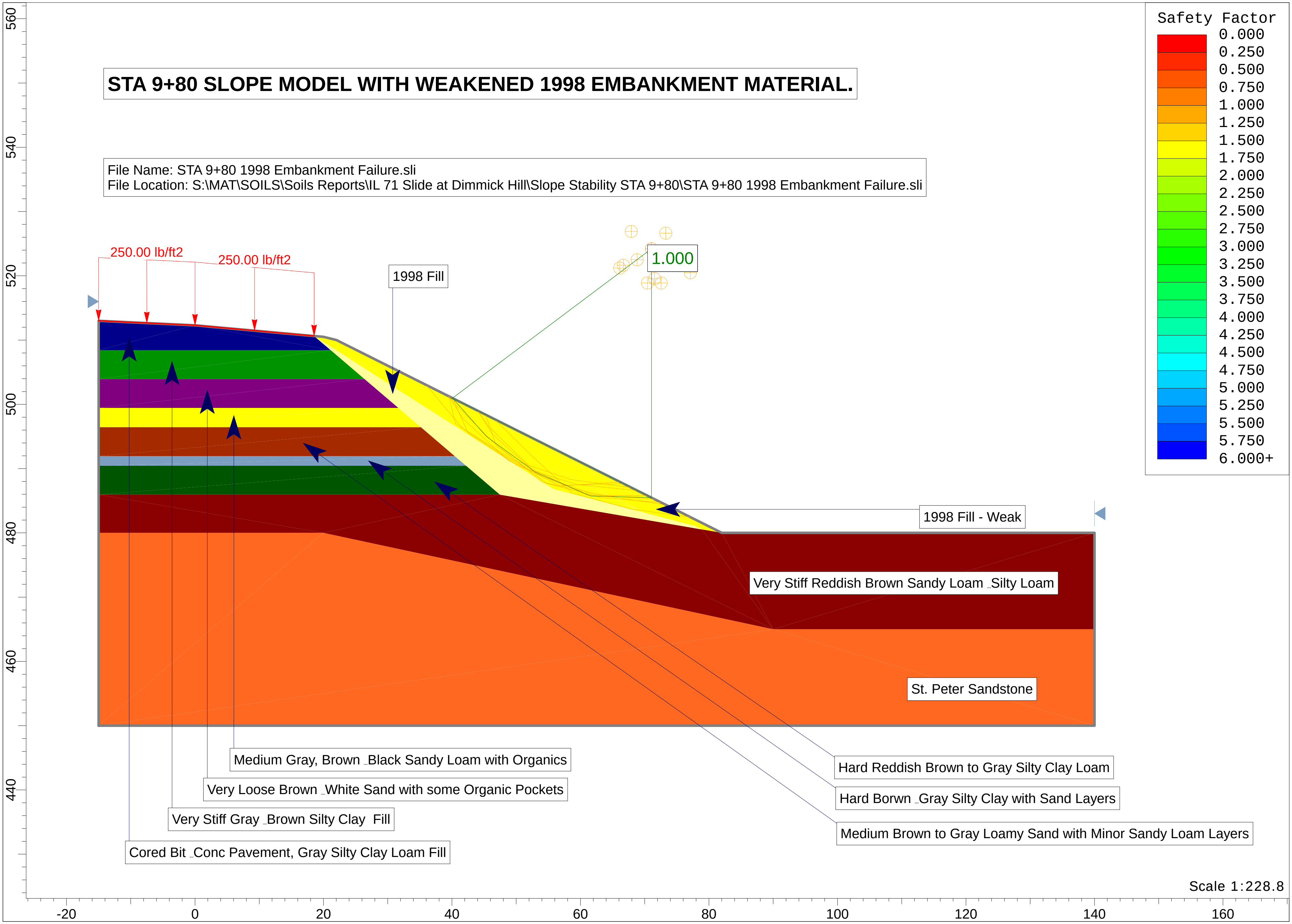
E-5

IL 71 at Dimmick Hill
Bedrock Surface Elevations



APPENDIX

F-1



STA 9+80 SLOPE MODEL WITH WEAKENED 1998 EMBANKMENT MATERIAL.
File Name: STA 9+80 1998 Embankment Failure.sli
File Location: S:\MAT\SOILS\Soils Reports\IL 71 Slide at Dimmick Hill\Slope Stability STA 9+80\STA 9+80 1998 Embankment Failure.sli
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+
250.00 lb/ft2
250.00 lb/ft2
1998 Fill
1.000
1998 Fill - Weak
Very Stiff Reddish Brown Sandy Loam _Silty Loam
St. Peter Sandstone
Medium Gray, Brown _Black Sandy Loam with Organics
Very Loose Brown _White Sand with some Organic Pockets
Very Stiff Gray _Brown Silty Clay Fill
Cored Bit _Conc Pavement, Gray Silty Clay Loam Fill
Hard Reddish Brown to Gray Silty Clay Loam
Hard Borwn _Gray Silty Clay with Sand Layers
Medium Brown to Gray Loamy Sand with Minor Sandy Loam Layers
Scale 1:228.8
560
540
520
500
480
460
440
-20
0
20
40
60
80
100
120
140
160

Slide Analysis Information

Document Name

File Name: STA 9+80 1998 Embankment Failure.sli

Project Settings

Project Title: IL 71 Dimmick Hill STA 9+80
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: 45
Lower Angle: -45

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 250 lb/ft2

Material Properties

Material: Cored Bit & Conc Pavement, Gray Silty Clay Loam Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 0 degrees

Water Surface: None

Material: Very Stiff Gray & Brown Silty Clay Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 2000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Very Loose Brown & White Sand with some Organic Pockets
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 28 degrees
Water Surface: None

Material: Medium Gray, Brown & Black Sandy Loam with Organics
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 28 degrees
Water Surface: None

Material: Medium Brown to Gray Loamy Sand with Minor Sandy Loam Layers
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 32 degrees
Water Surface: None

Material: Hard Borwn & Gray Silty Clay with Sand Layers
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 4 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Hard Reddish Brown to Gray Silty Clay Loam
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 4000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Very Stiff Reddish Brown Sandy Loam & Silty Loam
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 3000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: St. Peter Sandstone
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 5000 psf
Friction Angle: 0 degrees

Water Surface: None

Material: 1998 Fill
Strength Type: Mohr-Coulomb
Unit Weight: 109 lb/ft3
Cohesion: 1000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: 1998 Fill - Weak
Strength Type: Mohr-Coulomb
Unit Weight: 109 lb/ft3
Cohesion: 129 psf
Friction Angle: 0 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 0.999706
Axis Location: 71.043, 524.197
Left Slip Surface Endpoint: 40.068, 500.966
Right Slip Surface Endpoint: 71.043, 485.478
Resisting Moment=181311 lb-ft
Driving Moment=181365 lb-ft

Method: janbu simplified
FS: 0.994659
Axis Location: 73.277, 526.625
Left Slip Surface Endpoint: 39.466, 501.267
Right Slip Surface Endpoint: 73.277, 484.361
Resisting Horizontal Force=4361.61 lb
Driving Horizontal Force=4385.03 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3408
Number of Invalid Surfaces: 1592
Error Codes:
Error Code -106 reported for 3 surfaces
Error Code -107 reported for 182 surfaces
Error Code -108 reported for 684 surfaces
Error Code -111 reported for 46 surfaces
Error Code -112 reported for 641 surfaces
Error Code -116 reported for 2 surfaces
Error Code -1000 reported for 34 surfaces

Method: janbu simplified
Number of Valid Surfaces: 2985
Number of Invalid Surfaces: 2015
Error Codes:
Error Code -106 reported for 3 surfaces
Error Code -107 reported for 182 surfaces
Error Code -108 reported for 1174 surfaces

Error Code -111 reported for 285 surfaces
Error Code -112 reported for 335 surfaces
Error Code -116 reported for 2 surfaces
Error Code -1000 reported for 34 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than
0.0001 * (maximum horizontal extent of soil region).
This limitation is imposed to avoid numerical errors
which may result from too many slices, or too
small a slip region.

-107 = Total driving moment or
total driving force is negative. This will occur
if the wrong failure direction is specified,
or if high external or anchor loads are applied
against the failure direction.

-108 = Total driving moment
or total driving force < 0.1. This is to
limit the calculation of extremely high safety
factors if the driving force is very small
(0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F)
< 0.2 for the final iteration of the safety factor calculation. This screens out
some slip surfaces which may not be valid in the context of the analysis, in
particular, deep seated slip surfaces with many high negative base angle
slices in the passive zone.

-116 = Not enough slices to analyze the surface
Increase the number of slices in the job control in the modeler.

-1000 = No valid slip surfaces are generated
at a grid center. Unable to draw a surface.

Probabilistic Analysis Input

Project Settings
Sensitivity Analysis: On
Probabilistic Analysis: Off

Material: 1998 Fill
Property: Cohesion
Distribution: Normal
Minimum: 750 (relative minimum: 250)
Mean: 1000
Maximum: 1250 (relative maximum: 250)

Material: 1998 Fill
Property: Phi
Distribution: Normal
Minimum: 0 (relative minimum: 0)
Mean: 0
Maximum: 0 (relative maximum: 0)

Material: 1998 Fill
Property: Unit Weight
Distribution: Normal
Minimum: 94 (relative minimum: 15)
Mean: 109
Maximum: 124 (relative maximum: 15)

Material: 1998 Fill - Weak
Property: Cohesion
Distribution: Normal
Minimum: 79 (relative minimum: 50)
Mean: 129
Maximum: 179 (relative maximum: 50)

Material: 1998 Fill - Weak
Property: Phi
Distribution: Normal
Minimum: 0 (relative minimum: 0)
Mean: 0
Maximum: 0 (relative maximum: 0)

Material: 1998 Fill - Weak
Property: Unit Weight
Distribution: Normal
Minimum: 99 (relative minimum: 10)
Mean: 109
Maximum: 119 (relative maximum: 10)

List of All Coordinates

Material Boundary

18.540	510.631
21.966	508.440
29.002	503.940
36.037	499.440
40.728	496.440
47.764	491.940
50.109	490.440
55.800	486.800
59.114	485.940
70.222	483.057
77.748	481.104
82.000	480.000

Material Boundary

-15.000	508.440
21.106	508.440
21.966	508.440

Material Boundary

-15.000	503.940
26.376	503.940
29.002	503.940

Material Boundary

-15.000	499.440
31.646	499.440
36.037	499.440

Material Boundary

-15.000	496.440
35.159	496.440
40.728	496.440

Material Boundary

-15.000	491.940
40.429	491.940
47.764	491.940

Material Boundary

-15.000	490.440
42.185	490.440
50.109	490.440

Material Boundary

-15.000	485.940
47.455	485.940
59.114	485.940

Material Boundary

-15.000	480.000
20.000	480.000
90.000	465.000
140.000	465.000

Material Boundary

18.540	510.631
21.106	508.440
26.376	503.940
31.646	499.440
35.159	496.440
40.429	491.940
42.185	490.440
47.455	485.940
78.919	480.530

Material Boundary

21.966	508.440
77.748	481.104
78.919	480.530
82.000	480.000

Material Boundary

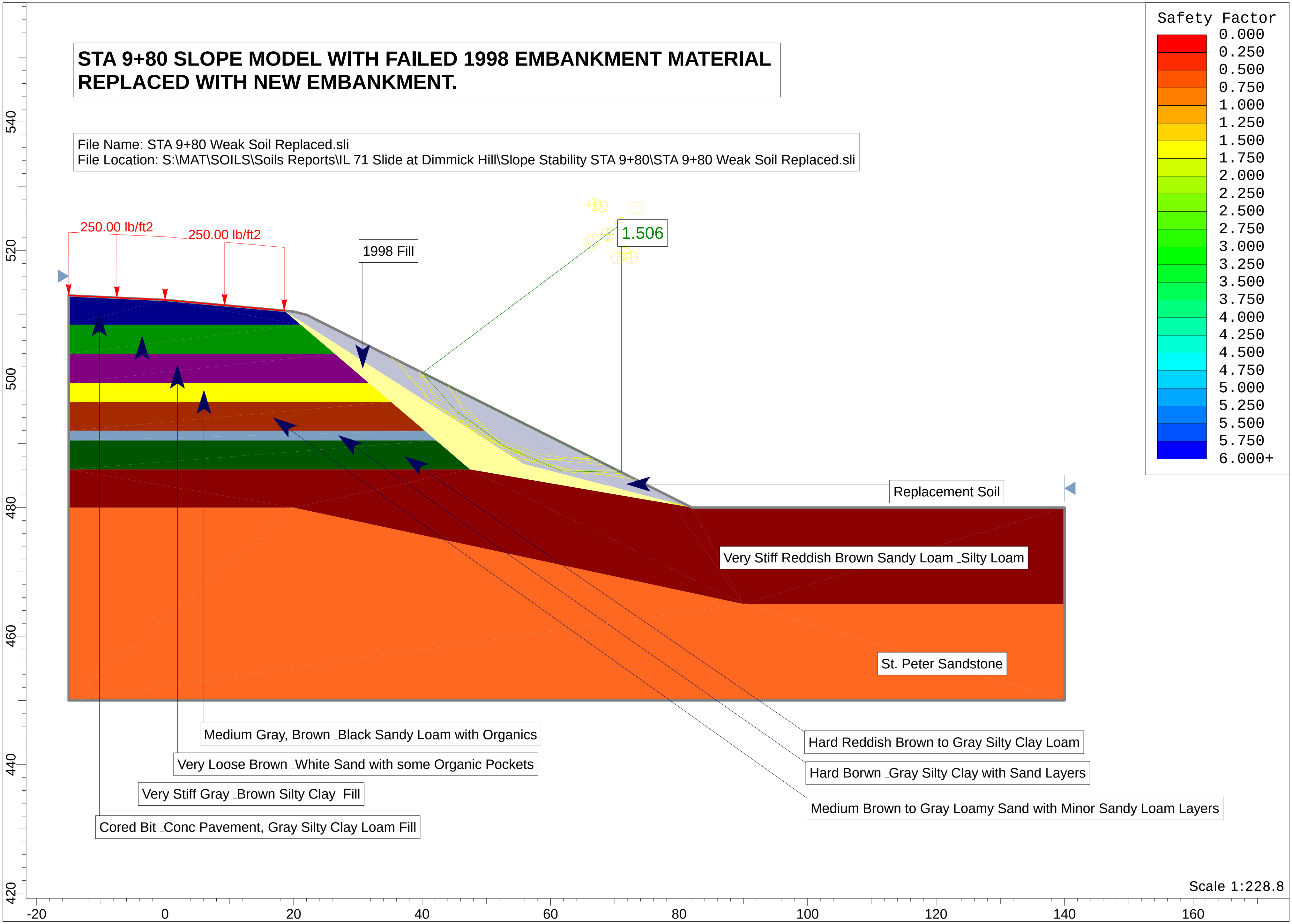
21.966	508.440
70.222	483.057

External Boundary

-15.000	450.000
140.000	450.000
140.000	465.000
140.000	480.000
82.000	480.000
22.000	510.000
20.000	510.500
18.540	510.631
0.000	512.300
-15.000	513.000
-15.000	508.440
-15.000	503.940
-15.000	499.440
-15.000	496.440
-15.000	491.940
-15.000	490.440
-15.000	485.940
-15.000	480.000

Distributed Load

-15.000	513.000
0.000	512.300
18.540	510.631



STA 9+80 SLOPE MODEL WITH FAILED 1998 EMBANKMENT MATERIAL REPLACED WITH NEW EMBANKMENT.
File Name: STA 9+80 Weak Soil Replaced.sli
File Location: S:\MAT\SOILS\Soils Reports\IL 71 Slide at Dimmick Hill\Slope Stability STA 9+80\STA 9+80 Weak Soil Replaced.sli
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+
250.00 lb/ft2
250.00 lb/ft2
1998 Fill
1.506
Replacement Soil
Very Stiff Reddish Brown Sandy Loam _Silty Loam
St. Peter Sandstone
Medium Gray, Brown _Black Sandy Loam with Organics
Very Loose Brown _White Sand with some Organic Pockets
Very Stiff Gray _Brown Silty Clay Fill
Cored Bit _Conc Pavement, Gray Silty Clay Loam Fill
Hard Reddish Brown to Gray Silty Clay Loam
Hard Borwn _Gray Silty Clay with Sand Layers
Medium Brown to Gray Loamy Sand with Minor Sandy Loam Layers
Scale 1:228.8
540
520
500
480
460
440
420
-20
0
20
40
60
80
100
120
140
160

Slide Analysis Information

Document Name

File Name: STA 9+80 Weak Soil Replaced.sli

Project Settings

Project Title: IL 71 Dimmick Hill STA 9+80
Failure Direction: Left to Right
Units of Measurement: Imperial Units
Pore Fluid Unit Weight: 62.4 lb/ft3
Groundwater Method: Water Surfaces
Data Output: Standard
Calculate Excess Pore Pressure: Off
Allow Ru with Water Surfaces or Grids: Off
Random Numbers: Pseudo-random Seed
Random Number Seed: 10116
Random Number Generation Method: Park and Miller v.3

Analysis Methods

Analysis Methods used:
Bishop simplified
Janbu simplified

Number of slices: 25
Tolerance: 0.005
Maximum number of iterations: 50

Surface Options

Surface Type: Non-Circular Path Search
Number of Surfaces: 5000
Pseudo-Random Surfaces: Enabled
Convex Surfaces Only: Disabled
Segment Length: Auto Defined
Minimum Elevation: Not Defined
Minimum Depth: Not Defined
Upper Angle: 45
Lower Angle: -45

Loading

1 Distributed Load present:
Distributed Load Constant Distribution, Orientation: Vertical, Magnitude: 250 lb/ft2

Material Properties

Material: Cored Bit & Conc Pavement, Gray Silty Clay Loam Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1000 psf
Friction Angle: 0 degrees

Water Surface: None

Material: Very Stiff Gray & Brown Silty Clay Fill
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 2000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Very Loose Brown & White Sand with some Organic Pockets
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 28 degrees
Water Surface: None

Material: Medium Gray, Brown & Black Sandy Loam with Organics
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 28 degrees
Water Surface: None

Material: Medium Brown to Gray Loamy Sand with Minor Sandy Loam Layers
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 1 psf
Friction Angle: 32 degrees
Water Surface: None

Material: Hard Borwn & Gray Silty Clay with Sand Layers
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 4 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Hard Reddish Brown to Gray Silty Clay Loam
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 4000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Very Stiff Reddish Brown Sandy Loam & Silty Loam
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 3000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: St. Peter Sandstone
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 5000 psf
Friction Angle: 0 degrees

Water Surface: None

Material: 1998 Fill
Strength Type: Mohr-Coulomb
Unit Weight: 109 lb/ft3
Cohesion: 1000 psf
Friction Angle: 0 degrees
Water Surface: None

Material: 1998 Fill - Weak
Strength Type: Mohr-Coulomb
Unit Weight: 109 lb/ft3
Cohesion: 129 psf
Friction Angle: 0 degrees
Water Surface: None

Material: Replacement Soil
Strength Type: Mohr-Coulomb
Unit Weight: 120 lb/ft3
Cohesion: 214 psf
Friction Angle: 0 degrees
Water Surface: None

Global Minimums

Method: bishop simplified
FS: 1.506410
Axis Location: 71.043, 524.197
Left Slip Surface Endpoint: 40.068, 500.966
Right Slip Surface Endpoint: 71.043, 485.478
Resisting Moment=300780 lb-ft
Driving Moment=199666 lb-ft

Method: janbu simplified
FS: 1.498330
Axis Location: 73.277, 526.625
Left Slip Surface Endpoint: 39.466, 501.267
Right Slip Surface Endpoint: 73.277, 484.361
Resisting Horizontal Force=7235.54 lb
Driving Horizontal Force=4829.07 lb

Valid / Invalid Surfaces

Method: bishop simplified
Number of Valid Surfaces: 3410
Number of Invalid Surfaces: 1590
Error Codes:
Error Code -106 reported for 3 surfaces
Error Code -107 reported for 182 surfaces
Error Code -108 reported for 683 surfaces
Error Code -111 reported for 46 surfaces
Error Code -112 reported for 640 surfaces
Error Code -116 reported for 2 surfaces
Error Code -1000 reported for 34 surfaces

Method: janbu simplified
Number of Valid Surfaces: 2981
Number of Invalid Surfaces: 2019
Error Codes:
Error Code -106 reported for 3 surfaces
Error Code -107 reported for 182 surfaces
Error Code -108 reported for 1170 surfaces
Error Code -111 reported for 300 surfaces
Error Code -112 reported for 328 surfaces
Error Code -116 reported for 2 surfaces
Error Code -1000 reported for 34 surfaces

Error Codes

The following errors were encountered during the computation:

-106 = Average slice width is less than 0.0001 * (maximum horizontal extent of soil region). This limitation is imposed to avoid numerical errors which may result from too many slices, or too small a slip region.

-107 = Total driving moment or total driving force is negative. This will occur if the wrong failure direction is specified, or if high external or anchor loads are applied against the failure direction.

-108 = Total driving moment or total driving force < 0.1. This is to limit the calculation of extremely high safety factors if the driving force is very small (0.1 is an arbitrary number).

-111 = safety factor equation did not converge

-112 = The coefficient M-Alpha = cos(alpha)(1+tan(alpha)tan(phi)/F) < 0.2 for the final iteration of the safety factor calculation. This screens out some slip surfaces which may not be valid in the context of the analysis, in particular, deep seated slip surfaces with many high negative base angle slices in the passive zone.

-116 = Not enough slices to analyze the surface
Increase the number of slices in the job control in the modeler.

-1000 = No valid slip surfaces are generated at a grid center. Unable to draw a surface.

Probabilistic Analysis Input

Project Settings
Sensitivity Analysis: On
Probabilistic Analysis: Off

Material: 1998 Fill
Property: Cohesion
Distribution: Normal
Minimum: 750 (relative minimum: 250)
Mean: 1000
Maximum: 1250 (relative maximum: 250)

Material: 1998 Fill
Property: Phi
Distribution: Normal
Minimum: 0 (relative minimum: 0)
Mean: 0
Maximum: 0 (relative maximum: 0)

Material: 1998 Fill
Property: Unit Weight
Distribution: Normal
Minimum: 94 (relative minimum: 15)
Mean: 109
Maximum: 124 (relative maximum: 15)

Material: 1998 Fill - Weak
Property: Cohesion
Distribution: Normal
Minimum: 79 (relative minimum: 50)
Mean: 129
Maximum: 179 (relative maximum: 50)

Material: 1998 Fill - Weak
Property: Phi
Distribution: Normal
Minimum: 0 (relative minimum: 0)
Mean: 0
Maximum: 0 (relative maximum: 0)

Material: 1998 Fill - Weak
Property: Unit Weight
Distribution: Normal
Minimum: 99 (relative minimum: 10)
Mean: 109
Maximum: 119 (relative maximum: 10)

List of All Coordinates

Material Boundary

18.540	510.631
21.966	508.440
29.002	503.940
36.037	499.440
40.728	496.440
47.764	491.940
50.109	490.440
55.800	486.800
59.114	485.940
70.222	483.057

77.748	481.104
82.000	480.000

Material Boundary

-15.000	508.440
21.106	508.440
21.966	508.440

Material Boundary

-15.000	503.940
26.376	503.940
29.002	503.940

Material Boundary

-15.000	499.440
31.646	499.440
36.037	499.440

Material Boundary

-15.000	496.440
35.159	496.440
40.728	496.440

Material Boundary

-15.000	491.940
40.429	491.940
47.764	491.940

Material Boundary

-15.000	490.440
42.185	490.440
50.109	490.440

Material Boundary

-15.000	485.940
47.455	485.940
59.114	485.940

Material Boundary

-15.000	480.000
20.000	480.000
90.000	465.000
140.000	465.000

Material Boundary

18.540	510.631
21.106	508.440
26.376	503.940
31.646	499.440
35.159	496.440
40.429	491.940
42.185	490.440
47.455	485.940
78.919	480.530

Material Boundary

21.966	508.440
77.748	481.104
78.919	480.530
82.000	480.000

Material Boundary

21.966	508.440
70.222	483.057

External Boundary

-15.000	450.000
140.000	450.000
140.000	465.000
140.000	480.000
82.000	480.000
22.000	510.000
20.000	510.500
18.540	510.631
0.000	512.300
-15.000	513.000
-15.000	508.440
-15.000	503.940
-15.000	499.440
-15.000	496.440
-15.000	491.940
-15.000	490.440
-15.000	485.940
-15.000	480.000

Distributed Load

-15.000	513.000
0.000	512.300
18.540	510.631

APPENDIX

F-2

March 4, 2016

Mike Short
Geotechnical Engineer
Illinois Department of Transportation
Region 2, District 3
700 East Norris Drive
Ottawa, IL 61350

RE: Field investigation and slope stability analysis for Dimmick Hill along IL 71 at the eastern edge of Starved Rock.

Dear Mr. Short:

Per your request through work order #20, McCleary Engineering (McE) has assisted in the collection of soil strength data and performed an independent slope stability analysis for the following scenarios:

1. Existing slope (McE chose to use drained conditions)
2. Slope with mud wave removed and the scarp area repaired with materials similar to the 1997 repair - Undrained conditions.
3. Slope with mud wave removed and the scarp area repaired with materials similar to the 1997 repair - Drained conditions.
4. Slope with mud wave removed and the scarp area repaired with materials similar to the 1997 repair – Both cohesion and frictional soil properties.

It is our understanding that you were performing an analysis for the existing slope using undrained conditions. McE created a model in the commercially available software package, Slide 6.0, of the existing slope as it was at the time it was cross sectioned. The cross section chosen for the model was 9+90. Table 1 through Table 4 show the soil properties used in the model for the various scenarios. McE staff attempted to accurately recreate the slope configuration at this station in the software, but noticed recently that the slope may have continued its downhill movement. Therefore the model may not exactly represent what is there today. When the reader sees the term "existing slope", this is referring to the slope at the time it was surveyed.

The factor of safety (FS) of the existing slope modeled at station 9+90 is estimated to be 0.128. The location of this failure surface was at the near vertical portion of the slope at the bottom end of the mud wave. Many failure surfaces with similar factors of safety exist up and down the slope within the upper 5 ft. of the slope surface.

The material properties shown in Table 1.0, are that of drained soil conditions for the existing slope model.

Table 1- Drained Material Properties for Current Conditions Model of Slope at 9+90

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	0	30	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	0	35	None	0
Soft, Unconsolidated Scarp Material		120	Mohr-Coulomb	0	20	None	0
1997 Embankment		120	Mohr-Coulomb	0	30	None	0

The second scenario modeled was the new slope using only cohesion in the soils that would have cohesion in an undrained condition. The sand layers encountered were modeled with friction only. The cohesion of the material labeled "1997 Embankment" was manipulated until the FS of the slope was 1.50.

Table 2-Undrained Material Properties for Model of Slope at 9+90

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	2500	0	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	4000	0	None	0
1997 Embankment		120	Mohr-Coulomb	316	0	None	0

The third scenario modeled was the new slope using only friction in the soils that would have cohesion in an undrained condition. The sand layers encountered were modeled with friction only, as in the previous models. The friction of the material labeled "1997 Embankment" was manipulated until the FS of the slope was 1.50. It is unlikely that the 1997 Embankment material would have a friction angle of 38°.

Table 3-Drained Material Properties for Model of Slope at 9+90

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	0	30	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	0	35	None	0
1997 Embankment		120	Mohr-Coulomb	0	38	None	0

The fourth scenario modeled was the new slope using both estimated friction and cohesion values in the soils that would have cohesion in an undrained condition. The sand layers encountered were modeled with friction only, as in the previous models. In this scenario both the cohesion and the friction of the material labeled "1997 Embankment" was manipulated until the FS of the slope was 1.50.

Table 4-(C-Phi) Material Properties for Model of Slope at 9+90

Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	500	20	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	200	28	None	0
1997 Embankment		120	Mohr-Coulomb	100	25.5	None	0

The goal of these models were to estimate the soil properties needed to achieve an FS of 1.5. Keep in mind there may be other soil property combinations that can achieve this factor of safety. No models other than those shown in this letter were completed. Please see the graphical results of each of the four scenarios attached to this report.

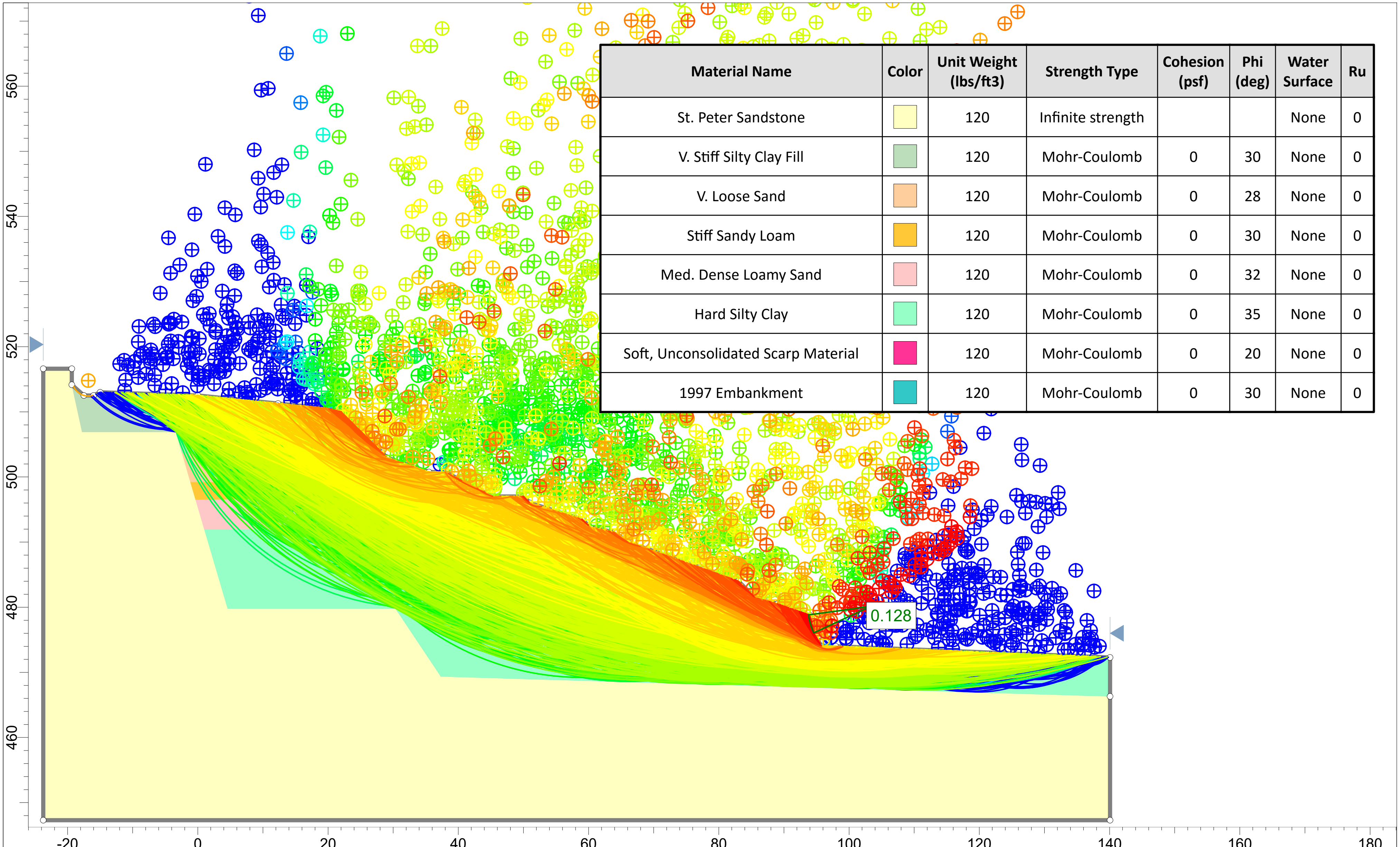
There are a number of reasons why this slope failed, weak soils, water from the sandy soils added hydrostatic forces onto the 1997 embankment material, etc. No matter the fix, it is my opinion that the sandy layers should be tiled to drain this moisture away from the slope surface.

As always, it was a pleasure working with you on this project. If you have any questions, please don't hesitate to contact me at your convenience.

Respectfully submitted,

Terrence L. McCleary

STATE OF ILLINOIS
062-050019
TERRENCE L.
MC CLEARY
LICENSED ENGINEER



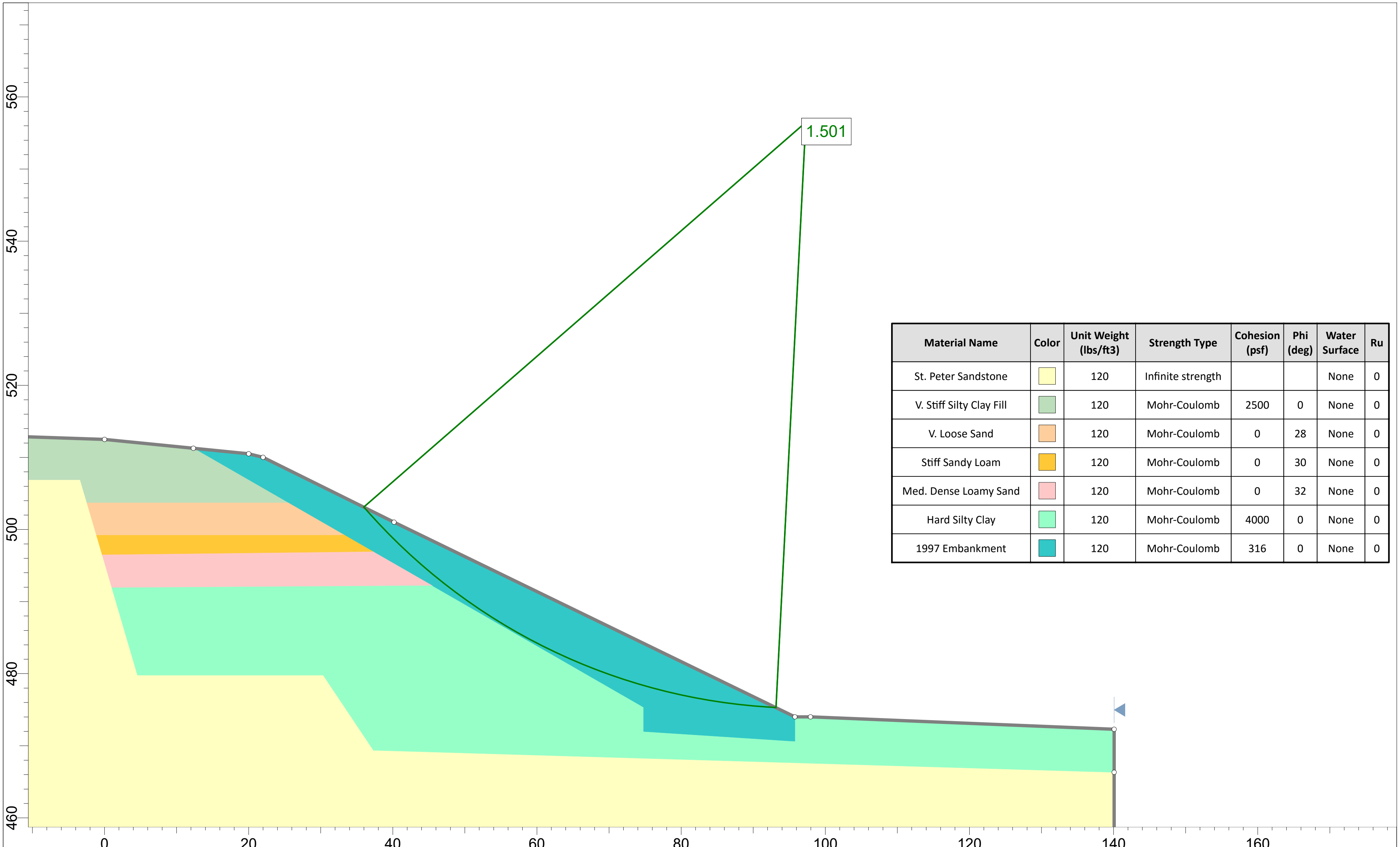
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	0	30	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	0	35	None	0
Soft, Unconsolidated Scarp Material		120	Mohr-Coulomb	0	20	None	0
1997 Embankment		120	Mohr-Coulomb	0	30	None	0

SLIDEINTERPRET 6.033

IL 71 - Dimmick Hill

Bishop - Existing Slope with Drained Material Properties

Drawn By	TLM	*Company*	McCleary Engineering
Date	3-4-16	*File Name*	9+90 Dimmick Hill.slim



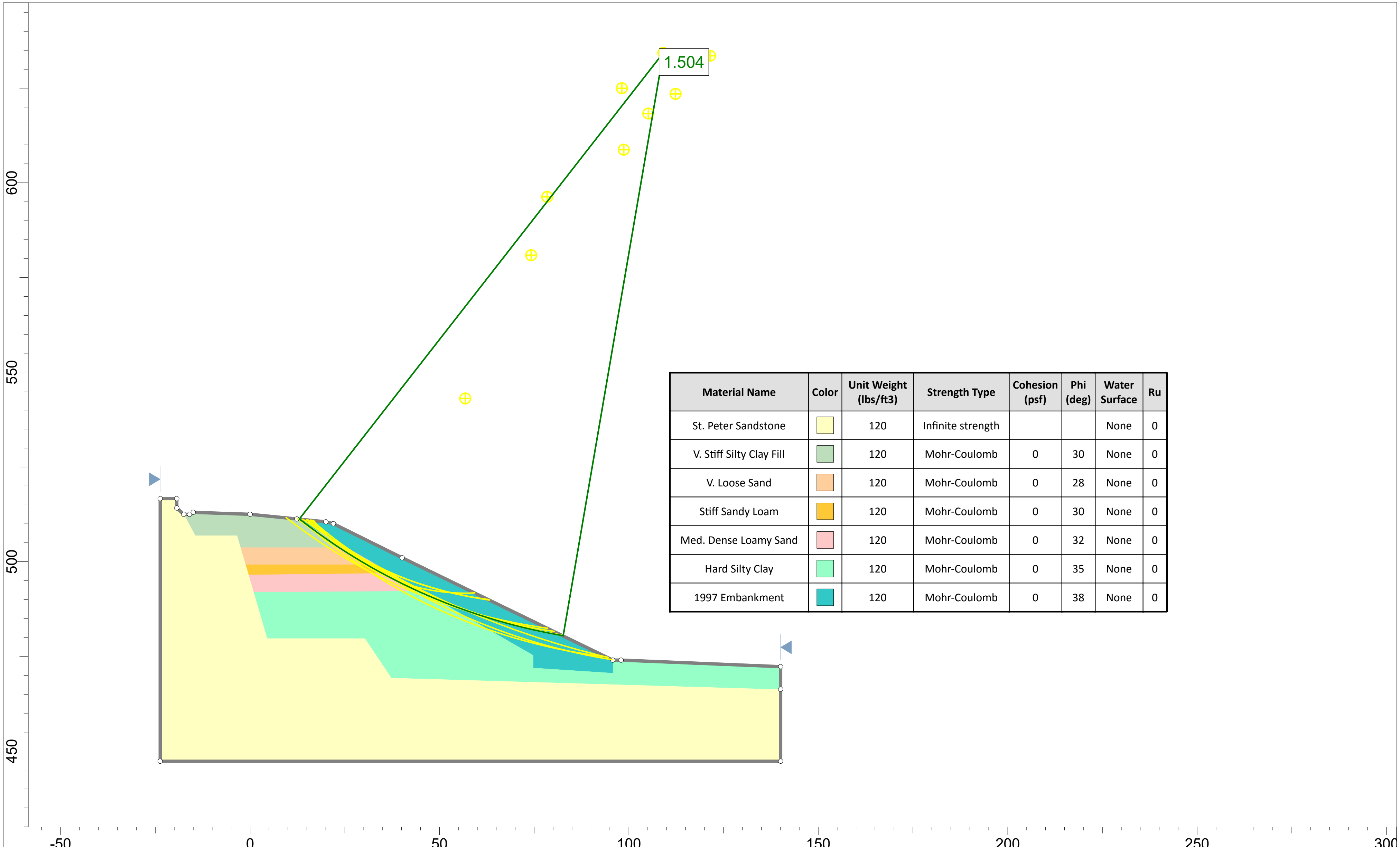
Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	2500	0	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	4000	0	None	0
1997 Embankment		120	Mohr-Coulomb	316	0	None	0

SLIDEINTERPRET 6.033

IL 71 - Dimmick Hill

Bishop - New Embankment with Undrained Material Properties

Drawn By	TLM	*Company*	McCleary Engineering
Date	3-4-16	*File Name*	9+90 Dimmick Hill with scarp removed and new embankment cohesion.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	0	30	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	0	35	None	0
1997 Embankment		120	Mohr-Coulomb	0	38	None	0

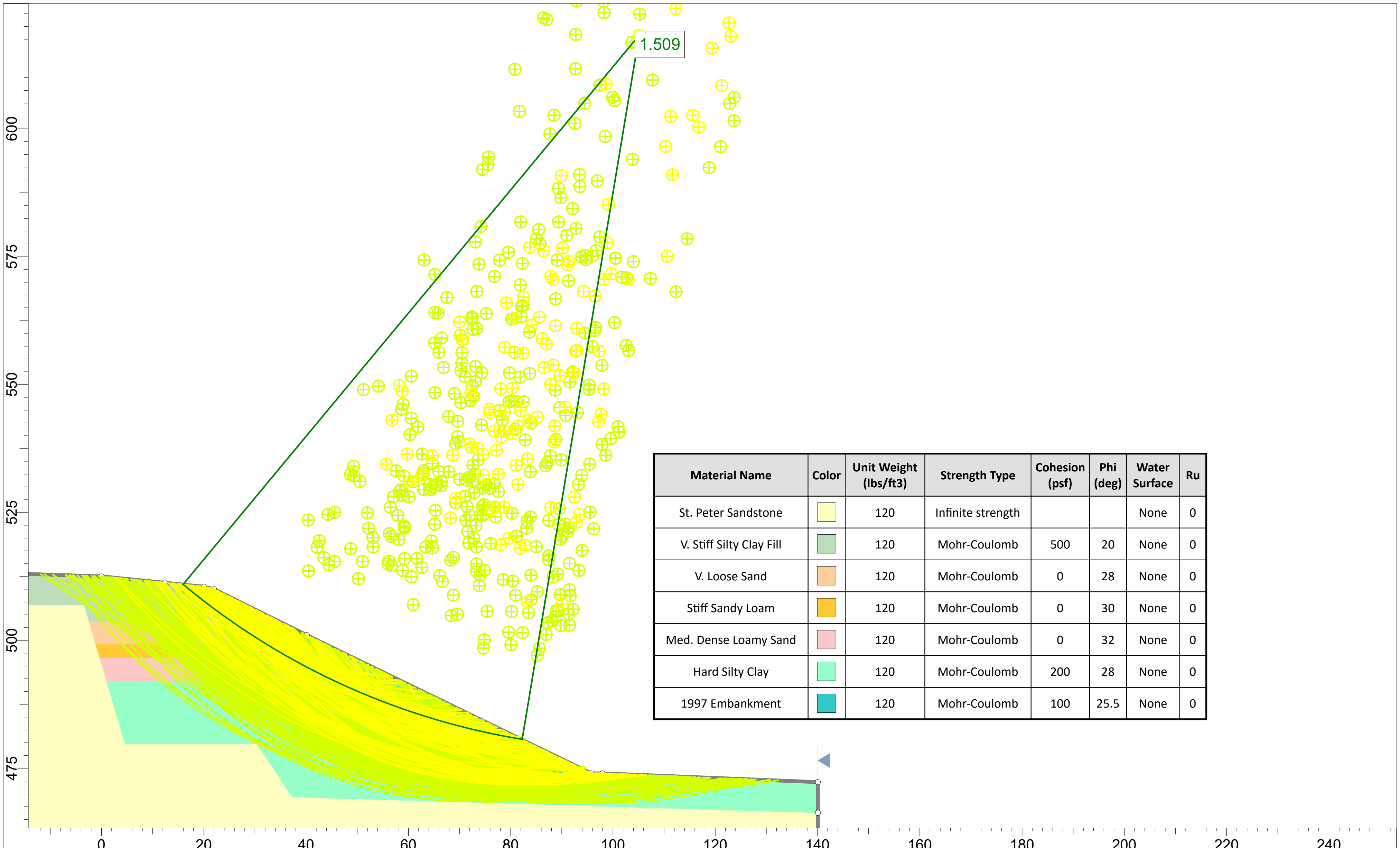
rocscience

SLIDEINTERPRET 6.033

IL 71 - Dimmick Hill

Bishop - Drained Conditions with New Embankment

Drawn By	TLM	*Company*	McCleary Engineering
Date	3-4-16	*File Name*	9+90 Dimmick Hill with scarp removed and new embankment.slim



Material Name	Color	Unit Weight (lbs/ft3)	Strength Type	Cohesion (psf)	Phi (deg)	Water Surface	Ru
St. Peter Sandstone		120	Infinite strength			None	0
V. Stiff Silty Clay Fill		120	Mohr-Coulomb	500	20	None	0
V. Loose Sand		120	Mohr-Coulomb	0	28	None	0
Stiff Sandy Loam		120	Mohr-Coulomb	0	30	None	0
Med. Dense Loamy Sand		120	Mohr-Coulomb	0	32	None	0
Hard Silty Clay		120	Mohr-Coulomb	200	28	None	0
1997 Embankment		120	Mohr-Coulomb	100	25.5	None	0

SLIDEINTERPRET 6.033

IL 71 - Dimmick Hill

Bishop - New Embankment with c-phi Material Properties

Drawn By TLM

Company McCleary Engineering

Date 3-4-16

File Name 9+90 Dimmick Hill with scarp removed and new embankment c-phi.slim

APPENDIX

G

Experimental Feature Work Plan

Slope Stabilization with Plate Piles

INTRODUCTION

The Illinois Department of Transportation (IDOT), District 3, desires to use IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION consisting of a system called Plate Piles to stabilize a slope failure. Plate Piles are a proprietary technology owned by GeoPier Foundation Company. This system is a form of in situ soil reinforcement, which means that the existing soil is left in-place with minimal disturbance while the reinforcement elements are installed. Other types of in situ soil reinforcement methods include launched soil nails and pin piles (micro piles). For sites which are compatible with a specific type of in situ soil reinforcement treatment, use of such systems are typically more cost effective and may be more practical for areas with limited site access.

The Plate Pile product consists of a structural steel S--shaped post with a rectangular-shaped steel plate attached to one end of the post. These elements are driven into the ground in a staggered array in order to develop a phenomenon known as soil arching between the adjacent elements. The intended design of the Plate Pile system is to install the elements to depths extending a sufficient depth below the location where movement of the slope is occurring (failure plane) in order to provide a resistance force to counteract the sliding force. The objective of doing this is to provide enough resistance to increase the slope's factor of safety against sliding to a sufficient level to prevent further movement.

OBJECTIVE

Plate Piles have not previously been utilized by IDOT as a means of slope stability remediation. If the Plate Piles are a successful method of stabilizing the slope on this project, this technology may be considered viable as an option for treatment of other shallow slope failures throughout the state. This research is aimed at gaining experience with the Plate Pile technology, identifying best practices during construction, and evaluating the effectiveness of its performance. If this technology is successful, it could potentially be a cost effective stabilization option, especially, for areas with limited site access. The results of this study would provide IDOT insight into the viability of this technology for use on similar sites as an alternative method of stabilizing shallow slope failures compared to traditional techniques, such as removing and replacing the existing soils and purchasing additional right-of-way to construct flatter slopes.

SUPPORTING RESEARCH

Plate Piles have been used by CalTrans, and they are being offered as an alternative bid on a project by the Ohio Department of Transportation for slope stabilization. Plate Piles are discussed in NCHRP Synthesis 430: *Cost-Effective and Sustainable Road Slope Stabilization and Erosion Control* (2012) as well as in the following articles:

Cost Effective Stabilization of Clay Slopes and Failures Using Plate Piles by William McCormick and Richard Short, Proceedings of the 10th IAEG International Congress, September 2006.

Modeling a Full Scale Landslide Test by Richard Short and Yogesh Prashar, Geo-Frontiers 2011, American Society of Civil Engineers.

PLAN OF STUDY AND EVALUATION

A shallow and slow moving slope failure is currently located along Illinois Route 71 in LaSalle County within the limits of Starved Rock State Park. This slide area is located on the roadway side slope and is encroaching on the guardrail. Utilization of the Plate Pile system as the method of slope stabilization is expected to be more economical and less invasive than traditional slope remedial treatments utilized by IDOT. Plate Piles are the preferred slope repair option over tradition methods at this site because they:

- Appear to be technically feasible for the site's soil/failure conditions
- Are anticipated to be more cost effective than traditional remediation
- Do not require additional right-of-way,
- Are anticipated to be constructed within a short time period
- Would minimize roadway lane closures during construction
- Do not require removal of the existing embankment materials
- Do not require temporary soil retention adjacent to the roadway

A special provision for IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION will specify use of the Plate Pile technology in Contract 66F07. The special provision will require the contractor to contact the GeoPier Foundation Company to develop and submit design details and shop drawings of the Plate Pile system including: size, spacing, depth(s) of installation, number of rows, and extent of the installation area. This contract is currently scheduled for a June 2016 letting with construction to be completed in the 2016 season. The plan of study will be to observe and document the construction activities for the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION using Plate Piles, as well as, monitor slope movement for a period after construction to document and evaluate its performance.

The evaluation process for the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION using Plate Piles include: cost, speed of construction, difficulty of construction, labor requirements, equipment requirements, availability of materials, embankment settlement, material durability, and general performance.

A control section is not practical for this experimental feature. Instead, success of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Pile) system will be determined based on measurements of slope movement during the inspection and reporting period.

INSPECTION AND REPORTING

The construction activities of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles) will be monitored. The total time for the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION construction will be documented along with any difficulties encountered during construction.

After construction, the slope will be monitored to evaluate the effectiveness of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles). Inclinometers and survey markers will be installed on the slope. The inclinometers will be read and the distances between the survey markers will be measured quarterly for the first year following the completion of construction and at least annually thereafter by IDOT District 3 staff for a total monitoring period of five years to evaluate the effectiveness of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles).

A final report will be written at the completion of the evaluation, documenting the construction, cost, quarterly and annual surveys, and performance of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION.

In addition to the final report:

1. Initial reporting (BMPR 1461) is to be submitted once FHWA approval is received.
2. Documentation is to include photos obtained during construction, at completion, and annually.
3. Long-term survey of the inclinometers and survey markers shall be provided. Number and location to be specified in the plans.
4. An Interim Report is to be submitted within 6 months after construction is completed (attached to a BMPR 1461 form) documenting construction and project cost.
5. Annual interim reports (BMPR 1461) are to be submitted.
6. A final completed BMPR 1461 form is to be submitted concurrently with the Final Report.

METHOD OF CONSTRUCTION

The IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles) will be constructed by a contractor as part of Contract 66F07. A special provision will be included in the contract to state the requirements for materials, design, and construction.

The general construction sequence will be as follows:

1. Strip existing vegetation
2. Regrade the existing slope
3. Install Plate Piles
4. Install seed, fertilizer, and erosion control blanket

ESTIMATED COST

The cost for the design, fabrication, and installation of the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles) is expected to be between $20 and $30 per square foot of treated slope area. The construction contract will have additional costs for shaping of the existing embankment, erosion control, seeding, and traffic control.

IDOT District 3 personnel will monitor the slope and prepare the final report, which will not require any substantial additional costs.

ESTIMATED TIME TO COMPLETE EVALUATION

Construction of the project with the IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION (Plate Piles) is anticipated to start in fall 2016, with an estimated duration of four weeks. The estimated time to complete all aspects of the experimental feature evaluation is 5 years from the completion of construction. The final report will be issued by December 2021.

CONTACT INFORMATION

IDOT District 3 will be responsible for preparing the Work Plan, initial reporting, construction and monitoring of this experimental feature, collecting and documentation project information, and preparing the Interim Report, annual interim reports, and Final Report. Correspondence should be directed to:

Mike Short
District Geotechnical Engineer
Illinois Department of Transportation
700 East Norris Drive
Ottawa, IL 61350
1-815-433-7085
Michael.Short@Illinois.gov

ATTACHMENTS

The following additional information is attached:

- Contract Special Provisions
- Contract Plan Sheets

APPENDIX

H-1

IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION
3-17-2016

Description. This work shall include the design, furnishing, installing, and quality control of a plate pile system as in situ soil reinforcement for slope stabilization (ISSRSS).

Approved System. The Plate Pile system by the GeoPier Foundation Company, Inc. is the only approved system for this work: GeoPier Foundation Company, Inc; 130 Harbour Place Drive, Suite 280; Davidson, NC 28036. The installer of the Plate Pile system shall be approved by the GeoPier Foundation Company, Inc. and must provide documentation of their work on a minimum of five similar projects in the past three years. This documentation shall include a description of the project, installation technique, soil conditions, and name and phone number of the contracting authority.

Materials. Plate Piles shall consist of a steel pile and an attached steel plate. The steel pile shall be an "S" shape according to ASTM A992. The steel plate shall be according to ASTM A 709, Grade 50. The steel plate shall have a minimum thickness of 0.25 inches (6.5 mm) at the end of the 50 year design life. The steel plate shall be welded to the steel pile according to AWS D1.1.

A signed and notarized certification statement stating that the materials comply with this specification shall be provided. This certification shall include mill certifications from the steel mills for the steel pile and the steel plate.

The requirements of Article 106.01 of the Standard Specifications shall apply to the steel pile, steel plate, and the fabrication of the Plate Piles.

Equipment. Plate Piles shall be installed using either a vibratory or impact hammer approved by the Engineer.

Submittals. Submittals shall include all shop drawings and design computations. The submittals shall address all details, dimensions, quantities, general notes, and cross sections necessary to construct the ISSRSS. The submittal shall be submitted to the Engineer for review and approval no later than 30 days prior to construction of the ISSRSS. Both the computations and shop drawings shall be prepared and sealed by an Illinois Licensed Professional Engineer. Shop drawings shall be prepared according to Article 1042.03(b). Shop drawings shall include a method to uniquely identify each individual Plate Pile. Design computations shall include a detailed description of the design procedure, design parameters, assumptions, computer programs used, and any other information utilized in the design.

Design Criteria. The Contractor shall be responsible for all stability aspects of the ISSRSS and shall submit to the Engineer computations for each designed ISSRSS.

The ISSRSS shall be designed according to "Plate Pile Slope Stabilization Design Guidelines, Second Edition" by Richard Short and Yogesh Prashar and "Plate Pile

Design and Construction for Emergency Repairs" by Richard Short and Yogesh Prashar.

External loads, such as those applied through structure foundations, from traffic or railroads, slope surcharge, etc., shall be accounted for in the stability analysis. The presence of all appurtenances behind, in front of, mounted upon, or passing through the slope such as drainage structures, utilities, structure foundation elements, or other items shall be accounted for in the stability analysis of the slope.

The ISSRSS shall be designed to have a factor of safety against slope failure of 1.5 and a maximum lateral deflection of the Plate Piles of 1.5 in. (38 mm).

The fabricated Plate Piles shall be sized to provide a 50-year design life. The design life shall be provided using either a sacrificial steel thickness computed for all surfaces or galvanization according to AASHTO M 111 or AASHTO M 232.

The ISSRSS shall be designed so the spacing between rows of Plate Piles shall not exceed 4 ft (1.2 m) perpendicular to the slope and 10 ft (3.0 m) parallel to the slope. Successive rows of Plate Piles shall be staggered so that each Plate Pile is centered between the Plate Piles of adjacent rows.

Construction. Installation of the ISSRSS shall not begin until the existing slope has been graded, shaped, and approved by the Engineer.

Plate Piles shall be driven to a depth so that the top surface of the Plate Pile is 9 in. (225 mm) below the finished ground surface.

Quality Control. A quality control technician shall be on site during installation of the Plate Piles. Any unusual conditions, obstructions, or other factors that may affect the performance of the ISSRSS shall be immediately reported to the Engineer and the designer of the ISSRSS.

A record of each day's construction activities shall be provided to the Engineer. This record shall include the method of driving the Plate Piles, a list of all Plate Piles installed and their locations, locations of any obstructions, locations of any Plate Piles damaged during installation, any difficulties with installation of Plate Piles, and records of any conversations with the designer of the ISSRSS.

Obstructions. If a Plate Pile hits an obstruction, the Plate Pile shall be removed and relocated or modified and reinstalled as directed by the quality control technician.

Tolerances. The following construction tolerances shall apply to all Plate Piles:

(a) Location of Plate Pile. The Plate Pile shall be within 6 in. (150 mm) of the location shown on the approved shop drawings.

(b) Top of Plate Pile. The top of the Plate Pile shall be no less than 6 in. (150 mm) and no more than 12 in. (300 mm) below the proposed ground surface.

(c) Vertical Plumbness of Plate Pile. The Plate Pile shall be installed at an angle no less than 3 degrees and no more than 5 degrees off vertical towards the top of the slope.

Any Plate Pile installed outside of these tolerances shall be removed and replaced.

Method of Measurement. This work will be measured for payment in square feet (square meters) of slope surface area reinforced. Measurement will be made along the surface of the slope from the center of individual Plate Piles that form the perimeter of the in situ soil reinforcement for slope stabilization system.

Basis of Payment. This work will be paid for at the contract unit price per square foot (square meter) for IN SITU SOIL REINFORCEMENT FOR SLOPE STABILIZATION.

Obstruction mitigation will be paid for according to Article 109.04.

APPENDIX

H-2

Embankment for Slope Shaping
Revised 3-17-2016

Description. This work shall consist of shaping the existing embankment to match the lines and grades shown on the plans.

Construction. Before any embankment is shaped, all clearing shall be performed in accordance with Section 201. Embankment shaping shall be performed by pushing the existing embankment material from the toe of the slope up the slope. The embankment material shall be compacted in place to the satisfaction of the Engineer. Upon completion, the embankment shall be according to the lines, grades, and cross sections shown on the plans.

If additional embankment is needed, it shall be according to Section 204 of the Standard Specifications.

The embankment shall be maintained to the proper elevation and cross section until acceptance.

Method of Measurement. This work will be measured for payment according to Article 202.07.

Basis of Payment. Embankment for slope shaping will be paid for at the contract unit price per cubic yard (cubic meter) for EMBANKMENT FOR SLOPE SHAPING.

APPENDIX

H-3

Markers for Slope Monitoring
Revised 2-25-2016

Description. This work shall consist of installing markers for slope monitoring.

Materials. Materials shall be according to the following.

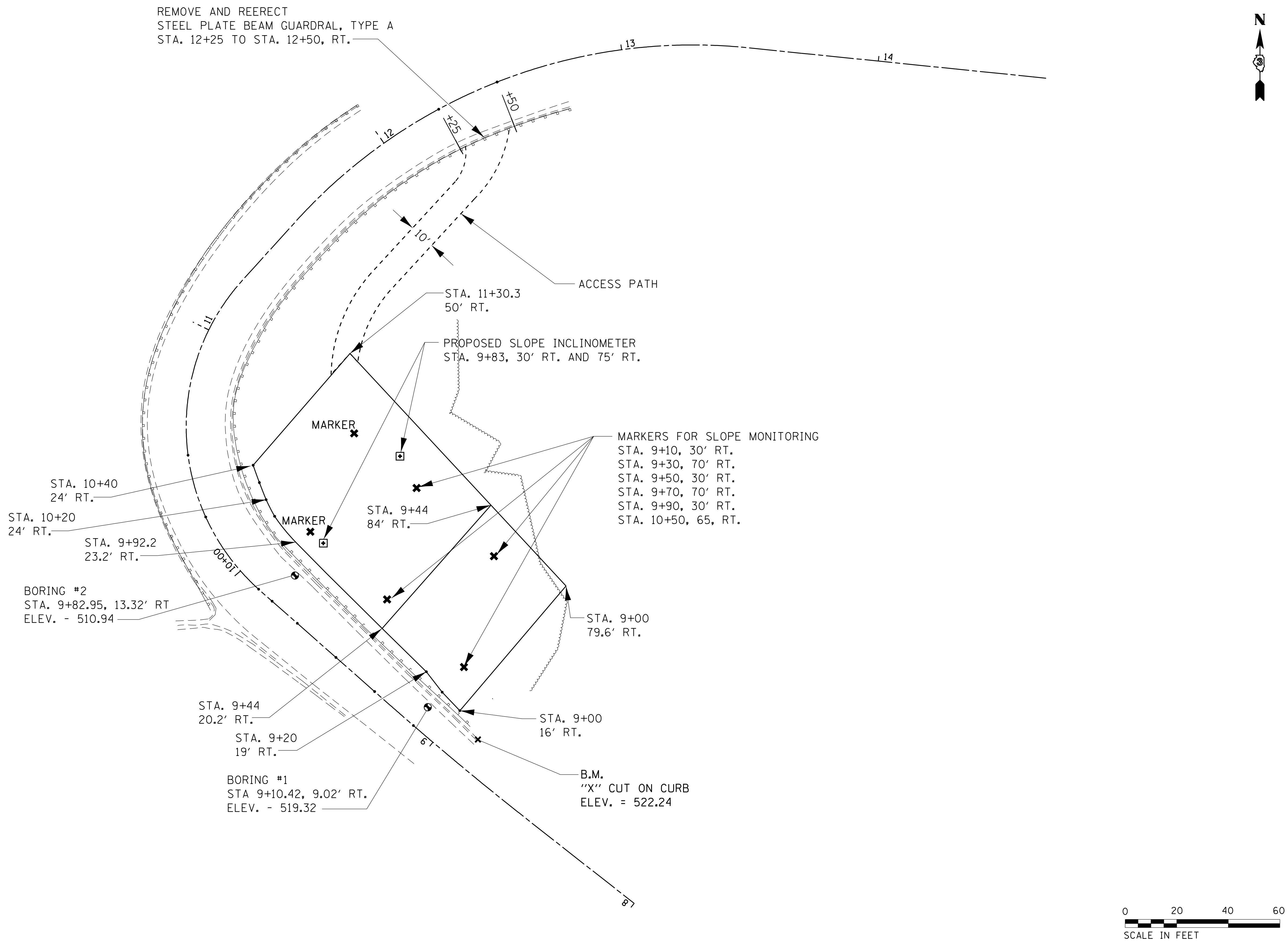
Item	Article/Section
(a) Portland Cement Concrete	1020
(b) Reinforcement Bars	1006.10

Construction. The markers shall be placed at the locations directed by the Engineer and shall be installed in such a manner that there will be no future settlement or horizontal shifting of the marker.

Basis of Payment. The work of installing markers for slope monitoring will be paid for at the contract unit price per each for MARKERS FOR SLOPE MONITORING.

APPENDIX

I



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STATE OF ILLINOIS
DEPARTMENT OF TRANSPORTATION

WORK AREA AND ACCESS

SCALE: SHEET OF SHEETS STA. TO STA.

F.A.P RTE.	SECTION	COUNTY	TOTAL SHEETS	SHEET NO.
627	(I)I-2	LASALLE	41	9
		CONTRACT NO. 66F07		
	ILLINOIS FED. AID PROJECT			

APPENDIX

J

Geotechnical Reports
Revised 3-15-2016

A Roadway Geotechnical Report has been prepared for this project. Copies can be obtained by contacting Mike Short, District Geotechnical Engineer, at 1-815-433-7085 or Michael.Short@Illinois.gov.