Report for

Illinois State Toll Highway Authority

Barrier Warrant Analysis
For
Design Contract #: RR-21-4802
Construction Contract #:

IL-390 (Elgin – O'Hare Tollway)

Mile Post 6.0 (Lake Street) to
Mile Post 11.2 (Meacham Road)

Preliminary Plan Submittal
Volume 1 & Volume 2

Submitted By:
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Subconsultant to:
HBM Engineering Group, LLC.

January 25, 2023

This review by WSP USA was performed solely to determine compliance with established Illinois Tollway Policies, Criteria and Standards and is limited to facilities under Illinois Tollway jurisdiction. WSP USA has not performed this review for the purpose of determining any design errors or omissions and assumes no responsibility, nor liability for any errors or omissions in any of these designs. The Design Section Engineer is responsible for completing its own review for technical adequacy and performance of internal QC/QA reviews.

This review was performed utilizing Bluebeam and the DSE shall utilize Bluebeam to review and dispose of the comments made within this review session. Additional resources on how to properly dispose of comments may be found in the following folder on the WBPM system: 0016 WBPM e-Builder Program Wide \ Documents \ Consultant Information \.

Illinois Tollway

MILLENNIA PROFESSIONAL SERVICES

DESIGN CONTRACT # RR-21-4802
CONSTRUCTION CONTRACT
IL ROUTE 39 (I-390)
(ELGIN - O'HARE TOLLWAY)

Please list the BWA Introduction as described in TBG article 6.3. In this section, please include your ADT maps and the required AASHTO Tables.

BARRIER WARRANT ANALYSES

Table of Contents

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Illinois Tollway
Open Roads for a Faster Future

INTRODUCTION

ROADSIDE SAFETY FEATURES

A barrier warrant analysis will be performed for each Area of Concern (AOC) within the contract RR-21-4802 limits, milepost 6.0 (Lake Street) to milepost 7.75 (Irving Park), in accordance with the following:

- Illinois Tollway's Traffic Barrier Guidelines (March 2022)
- Illinois Tollway's Standard Drawings
- BDE Manual_IDOT_Chapter 38 – Roadside Design (November 2019)
- IDOT Standard Specifications
- Illinois Tollway's Supplemental Specifications to IDOT Standard Specifications
- American Association of State Highway and Transportation Officials Roadside Design Guide

A field inspection will be performed for each AOC along the project corridor limits as shown on the location maps, which includes the analysis of any existing obstacle requiring shielding, relocation, or complete removal. The existing geometry will be used to establish the clear zone parameters, identify, and classify types of AOCs, and create Table logs of AOCs to be carried forward through the design process (Level 0 Table, Level 1 Table).

The report for this submittal will include the overall project location maps, Level 0 Table, Level 1 Table, Level 2 Analysis, and Level 3 Analysis for discussion and review. (Any Obstacles that fall outside of the 4" overlay limits will be reviewed and listed on the Level 0 Table.)

Any Obstacles within portions of the project that fall under IDOT's jurisdiction will not be included as part of the barrier warrant analysis submittals to the Illinois Tollway. IDOT procedures for safety warrants and design will be followed at these locations.

Please add a discussion of the methodology of how the 4" overlay will will relate to the existing concrete barriers, gutters and drainage structures.

In particular, the existing concrete barriers are F-shape barriers and accordingly, the maximum overlay at the face of the barrier is 3" (Article 13.1 of the TBG). Thus the shoulder slope will need to change to accommodate this. How is this going to be handled; Design Deviation?

Also please add a statement saying where the shoulder is being overlaid and where guardrail is present, the guardrail will be replaced. (That is the assumption we are reviewing under.)

Consider contacting Mike Dever (michael.dever@wsp.com) of the GEC BWA team to schedule a virtual review meeting for this report. The purpose of the meeting would be to go over any comments, help the reviewers understand the scope/intent of the project, the methodology of how the overlay and guardrail/ concrete barrier heights are related and to discuss a few general comments and recurring issues. The goal is to get everyone on the same page and have fewer comments next time.

Please place a copy of the AASHTO Tables, unannotated, in this introduction section. See article 6.3 of the TBG for what should be included. They no longer need to be included in each analysis.

LEGEND

2021 CURRENT EXISTING AVERAGE DAILY TRAFFIC (ADT)
Illinois Route 390 (I-390) Elgin-O'hare Tollway

ILLINOIS ROUTE 390 (I-390) ELGIN-O'HARE TOLLWAY

No.	Segment	Direction	Current Existing 2021 ADT
1	WB I-390 to Ramp Lake 4	WB	12,040
2	SB US-20 to Ramp Lake 1	EB	8,900
3	NB US-20 to Ramp Lake 3	Ramp Lake 3	4,060
4	Ramp A1 to WB I-390	Ramp A1	910
5	EB I-390 to Ramp A2	Ramp A2	900
6	Ramp B1 to SB Gary Ave	Ramp B1	4,680
7	NB Gary Ave to Ramp B2	Ramp B2	4,460
8	Ramp A3 to EB I-390	Ramp A3	5,820
9	WB I-390 to Ramp A4	Ramp A4	5,940

US-20 LAKE STREET

No.	Segment	Direction	Current Existing 2021 ADT
10	US-20 LAKE STREET	NB & SB	33,400

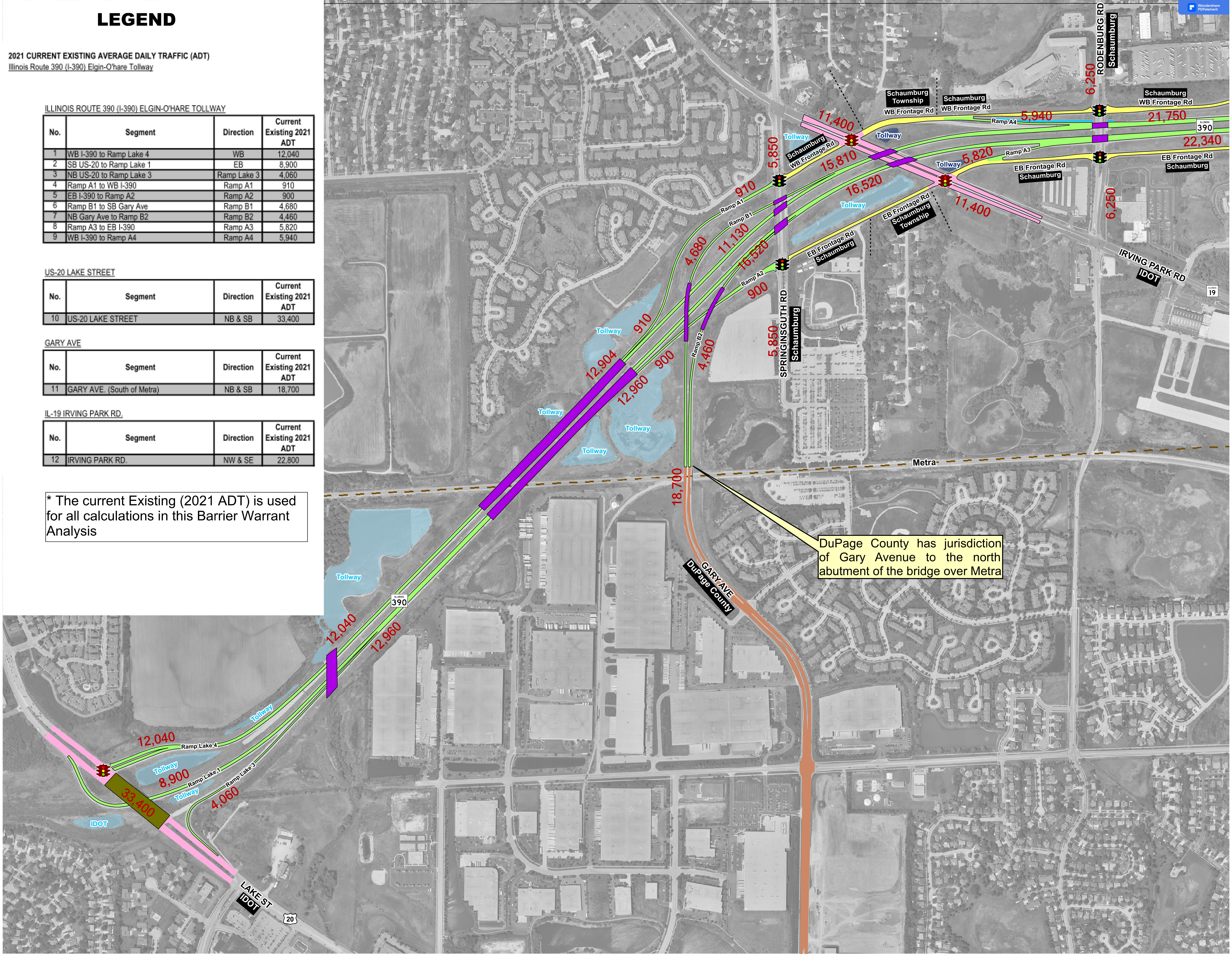
GARY AVE

No.	Segment	Direction	Current Existing 2021 ADT
11	GARY AVE. (South of Metra)	NB & SB	18,700

IL-19 IRVING PARK RD.

No.	Segment	Direction	Current Existing 2021 ADT
12	IRVING PARK RD.	NW & SE	22,800

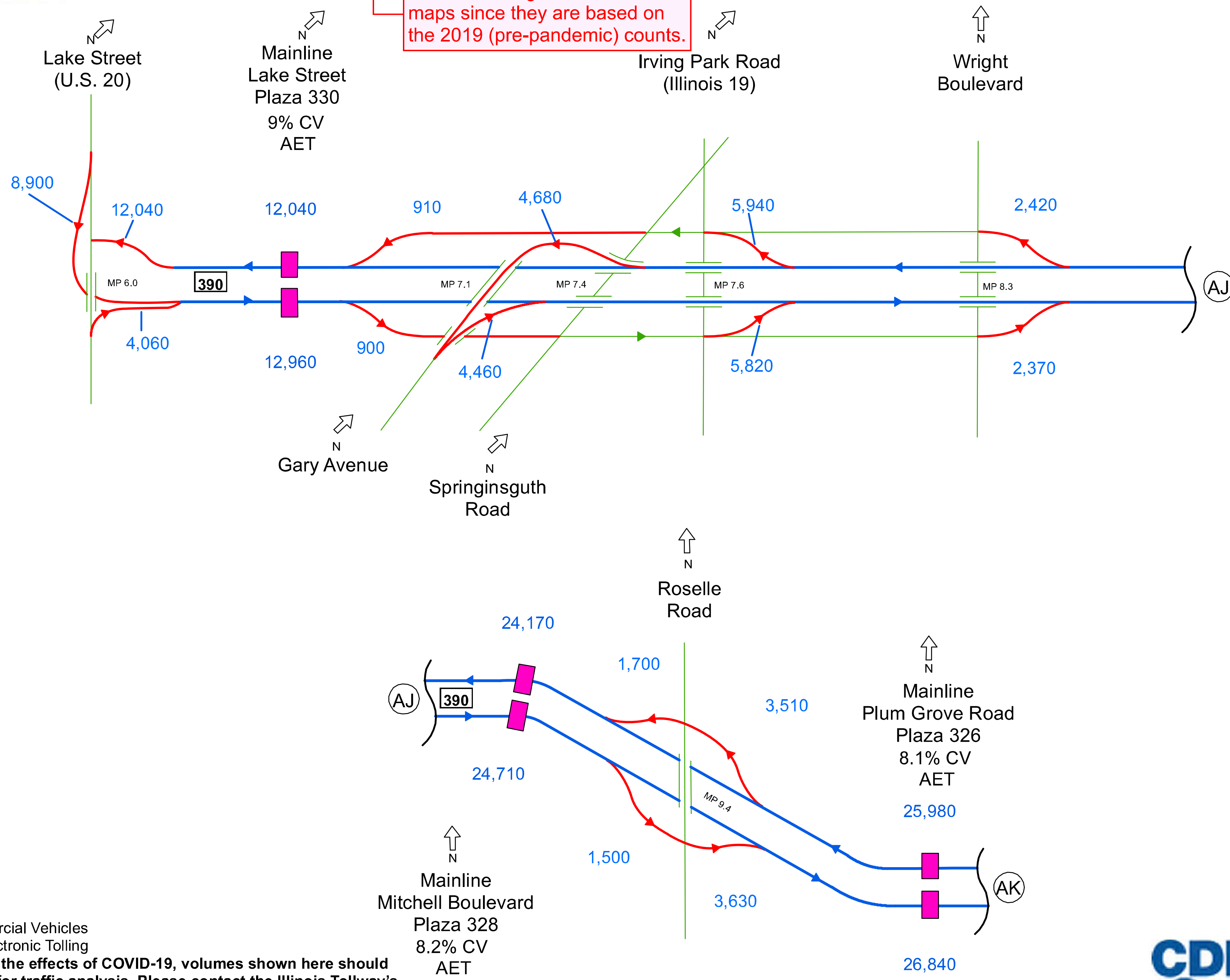
* The current Existing (2021 ADT) is used for all calculations in this Barrier Warrant Analysis



2021 Annual Average Daily Traffic

On IL 390, from Lake Street to Plum Grove Road (Plaza 326)

Consider using the 2020 ADT maps since they are based on the 2019 (pre-pandemic) counts.



CV = Commercial Vehicles
AET = All Electronic Tolling
Note: Due to the effects of COVID-19, volumes shown here should not be used for traffic analysis. Please contact the Illinois Tollway's traffic engineer for more up-to-date traffic information.

TABLE 6-A: AVERAGE DAILY TRAFFIC VOLUMES* BETWEEN INTERCHANGES 2016-2021 (WESTBOUND)

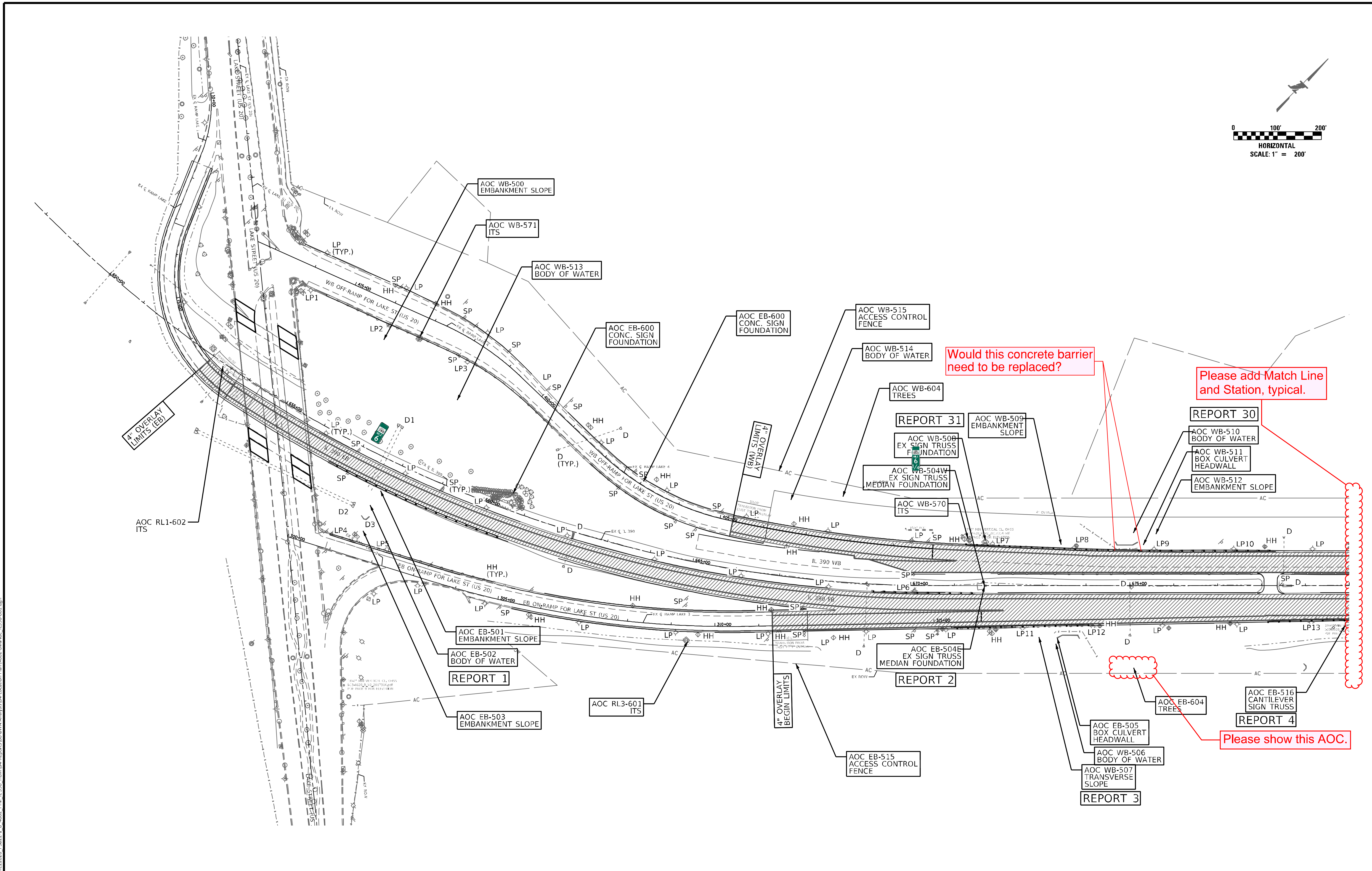
Location	Mile Post	Miles Btwn. Int.	ADT 2016	Annual Percent Change	ADT 2017	Annual Percent Change	ADT 2018	Annual Percent Change	ADT 2019	Average Annual Percent Change	ADT 2021
Busse Road (IL 83)	15.8										
Toll Plaza 320		1.0			4,680	41.5	6,620	17.5	7,780	-6.2	6,850
Wood Dale Road	14.8										
Toll Plaza 322		1.0			9,260	24.3	11,510	12.3	12,930	-6.1	11,410
Prospect Avenue	13.8										
Toll Plaza 324		0.5			11,270	17.7	13,270	9.8	14,570	-5.7	12,960
Ketter Drive	13.3										
		0.8			15,840	12.0	17,740	6.3	18,850	-8.6	15,730
I-290 (Eisenhower Expressway)	12.5										
		0.4	6,730	-41.3	3,950	30.1	5,140	20.6	6,200	-22.0	3,770
Rohlwing Road	12.1										
		0.9	31,140	-3.0	30,210	1.6	30,690	3.0	31,610	-8.0	26,740
Meacham Road	11.2										
Toll Plaza 326		1.8	28,210	-0.4	28,100	0.7	28,290	3.1	29,160	-5.6	25,980
Roselle Road	9.4										
Toll Plaza 328		1.1	27,110	-0.3	27,040	0.0	27,050	1.6	27,490	-6.2	24,170
Wright Boulevard	8.3										
		0.7	24,520	-0.4	24,420	-0.3	24,350	1.7	24,760	-6.3	21,750
Irving Park Road (IL 19)	7.6										
		0.2	18,170	-1.0	17,990	-1.5	17,720	2.0	18,070	-6.5	15,810
Springinsguth Road	7.4										
		0.3	13,170	-1.9	12,920	-3.3	12,500	2.4	12,800	-6.8	11,130
Gary Avenue	7.1										
Toll Plaza 330		1.1	14,070	-1.8	13,810	-3.3	13,360	2.2	13,650	-6.1	12,040
Lake Street (US 20)	6.0										

*Toll collection on Illinois Route 390 began July 5, 2016 for segments west of I-290 and on November 1, 2017 for segments east of I-290. Volumes shown are during tolled periods only.

TABLE 6-B: AVERAGE DAILY TRAFFIC VOLUMES* BETWEEN INTERCHANGES 2016-2021 (EASTBOUND)

Location	Mile Post	Miles Btwn. Int.	ADT 2016	Annual Percent Change	ADT 2017	Annual Percent Change	ADT 2018	Annual Percent Change	ADT 2019	Average Annual Percent Change	ADT 2021
Busse Road (IL 83)	15.8										
Toll Plaza 320		1.0			6,470	22.7	7,940	12.5	8,930	-5.4	8,000
Wood Dale Road	14.8										
Toll Plaza 322		1.0			10,940	16.8	12,780	9.2	13,950	-4.6	12,690
Prospect Avenue	13.8										
		0.5			11,050	20.4	13,300	12.3	14,930	-4.1	13,720
Ketter Drive	13.3										
Toll Plaza 324		0.8			11,050	20.4	13,300	12.3	14,930	-4.1	13,720
I-290 (Eisenhower Expressway)	12.5										
		0.4	6,930	-51.1	3,390	48.7	5,040	26.8	6,390	-3.0	6,010
Rohlwing Road	12.1										
		0.9	26,420	-2.9	25,650	1.9	26,130	2.3	26,730	-5.5	23,860
Meacham Road	11.2										
Toll Plaza 326		1.8	29,590	-1.1	29,270	1.2	29,630	1.6	30,110	-5.6	26,840
Roselle Road	9.4										
Toll Plaza 328		1.8	27,940	-1.1	27,630	0.7	27,810	0.5	27,940	-6.0	24,710
Wright Boulevard	7.6										
		0.2	25,400	-1.4	25,050	0.3	25,130	0.5	25,250	-5.9	22,340
Irving Park Road (IL 19)	7.4										
		0.3	19,170	-2.3	18,730	-0.9	18,560	0.5	18,650	-5.9	16,520
Springinsguth Road	7.1										
		0.9	19,170	-2.3	18,730	-0.9	18,560	0.5	18,650	-5.9	16,520
Gary Avenue	6.2										
Toll Plaza 330		0.2	15,290	-3.5	14,750	-2.6	14,360	0.4	14,420	-5.2	12,960
Lake Street (US 20)	6.0										

*Toll collection on Illinois Route 390 began July 5, 2016 for segments west of I-290 and on November 1, 2017 for segments east of I-290. Volumes shown are during tolled periods only.



MILESTONE:	DESIGNED BY: TVN	DATE: 1/6/2023	
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/6/2023	
	CHECKED BY: TVN	DATE: 1/6/2023	

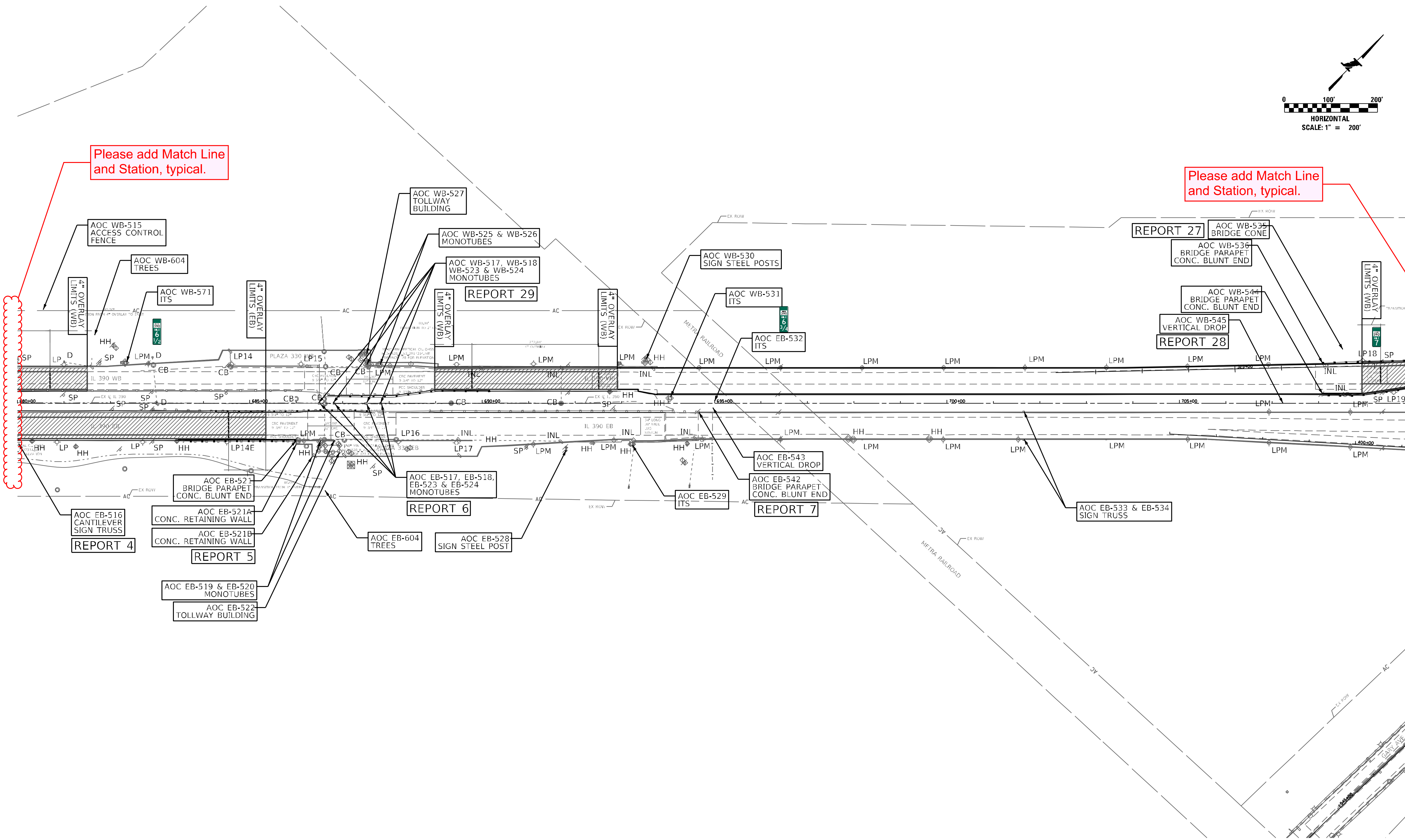
MILLENNIA

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802
BARRIER WARRANT
ELGIN O'HARE TOLLWAY (I-390) - LOCATION MAP 1

SHEET NO. LOC-1
DRAWING NO. 01 OF 04



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2700 OGDEN AVENUE
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ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

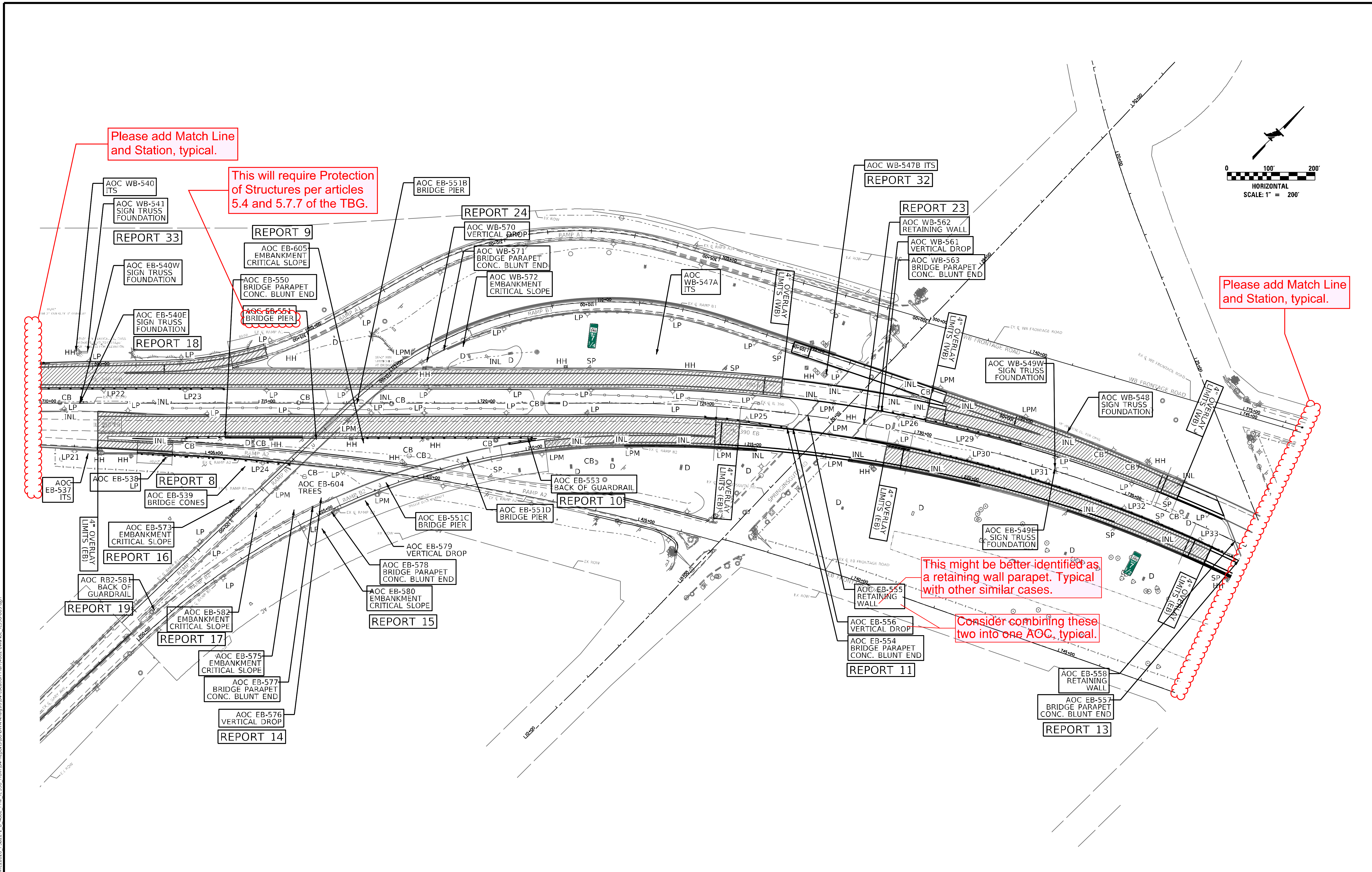
CONTRACT NO. RR-21-4802

BARRIER WARRANT

ELGIN O'HARE TOLLWAY (I-390) - LOCATION MAP 2

SHEET NO. LOC-2

DRAWING NO. 02 OF 04



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/6/2023
	CHECKED BY: TVN	DATE: 1/6/2023

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REVISIONS		
NO.	DATE	DESCRIPTION

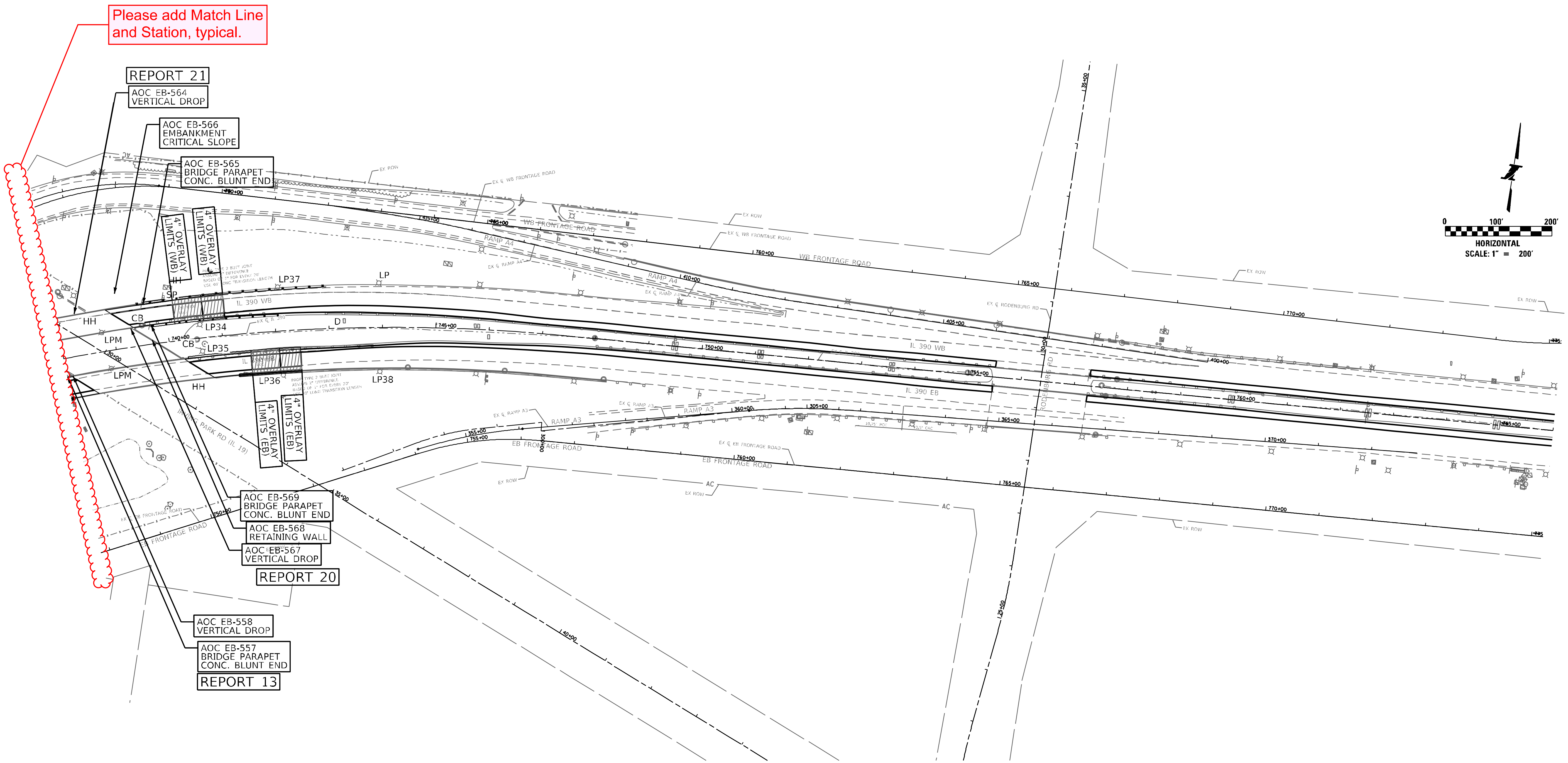
CONTRACT NO. RR-21-4802

BARRIER WARRANT

ELGIN O'HARE TOLLWAY (I-390) - LOCATION MAP 3

SHEET NO. LOC-3

DRAWING NO. 03 OF 04



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/6/2023	
	CHECKED BY: TVN	DATE: 1/6/2023	

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THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT

ELGIN O'HARE TOLLWAY (I-390) - LOCATION MAP 4

SHEET NO. LOC-4

DRAWING NO. 04 OF 04

LEVEL 0 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT / RT	Existing, Existing to Remain, or Proposed	Description	Reason for no Further Action	Remarks
AOC RL3-601	Ramp Lake 3	309+36	6.2	RT (F.S.)	Existing to Remain	ITS Pole	7' Outside of clear zone	
AOC RL1-602	Ramp Lake 1	17+00	6.0	RT (F.S.)	Existing to Remain	ITS Pole	6' Outside of clear zone	
AOC D1, D2, D3	IL-390	657+56.00	6.0	LT/RT	Existing to Remain	Sloped Headwall	Well beyond the clear zone	
AOC LPM	IL-390	--		LT/RT	Existing to Remain (Numerous locations)	Light Pole (Mountable)	Signs integrated to existing concrete single face barrier	
AOC LP14 (WB)	IL-390	684+61.00	6.5	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP15 (WB)	IL-390	686+11.00	6.5	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP16 (EB)	IL-390	688+20.00	6.6	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP17 (EB)	IL-390	688+20.00	6.6	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP21 (EB)	Ramp A2	402+01.00	7.0	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP36 (EB)	IL-390	742+09.00	7.6	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC LP38 (EB)	IL-390	743+92.00	7.6	RT	Existing to Remain	Light Pole	Shielded by Existing Concrete Single Face Barrier	
AOC EB-503	Ramp Lake 3	301+00 to 305+00	6.0	LT (F.S.)	Existing to Remain	Critical Slope	Outside of 4" pavement overlay limits	Shielded by Existing Guardrail
AOC WB-500	Ramp Lake 4	406+00 to 415+70	6.0	LT (F.S.)	Existing to Remain	Critical Slope	Outside of 4" pavement overlay limits	Shielded by Existing Guardrail
AOC WB-571	Ramp Lake 4	413+17.00	6.0	LT (F.S.)	Existing to Remain	ITS Pole	Outside of 4" pavement overlay limits	Shielded by Existing Guardrail
AOC WB-513	Ramp Lake 4	(408+00 - 415+00)	6.0	LT (F.S.)	Existing to Remain	Body of Water	20' + outside of clear zone	Shielded by existing guardrail
AOC EB-514	Ramp Lake 4	(405+00 - 408+00)	6.0	LT (F.S.)	Existing to Remain	Body of Water	18' outside of clear zone	To Remain?
AOC EB-600	IL-390	660+75.00	6.1	LT (F.S.)	Existing to Remain	Concrete Sign Foundation	8' Outside of clear zone	

F.S = Foreslope B.S. = Backslope

LEVEL 0 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT / RT	Existing, Existing to Remain, or Proposed	Description	Reason for no Further Action	Remarks
AOC EB-515/WB515	IL-390	--		LT/RT	Existing to Remain (Numerous locations)	Access Control Fence	Well beyond the clear zone	
AOC EB-604/WB604	IL-390	--		LT/RT	Existing to Remain (Numerous locations)	Trees	Well beyond the clear zone	
AOC WB-504	IL-390	671+70.00	6.3	MED	Existing to Remain	Overhead Sign Foundation	22' outside of clear zone	
AOC WB-571	IL-390	682+31.00	6.5	LT	Existing to Remain	ITS Pole	Shielded by Existing Concrete Single Face Barrier	
AOC EB-522	IL-390	686+75.00	6.6	RT	Existing to Remain	IL Tollway Building	Shielded by Existing Concrete Single Face Barrier	
AOC EB-519 & EB-520	IL-390	686+53 & 686+82	6.6	RT	Existing to Remain	Monotubes	Integrated on top of the Existing Concrete Single Face Barrier	
AOC WB-525 & WB-526	IL-390	687+52 & 687+79	6.6	LT	Existing to Remain	Monotubes	Integrated on top of the Existing Concrete Single Face Barrier	
AOC WB-527	IL-390	687+45.00	6.6	LT	Existing to Remain	IL Tollway Building	Shielded by Existing Concrete Single Face Barrier	
AOC EB-528	IL-390	691+85.00	6.7	RT	Existing to Remain	Sign Steel Post Foundation	Shielded by Existing Concrete Single Face Barrier	
AOC EB-529	IL-390	693+22.00	6.7	RT	Existing to Remain	ITS Pole	Shielded by Existing Concrete Single Face Barrier	
AOC WB-530	IL-390	693+51.00	6.7	LT	Existing to Remain	Sign Steel Post Foundation	Shielded by Existing Concrete Single Face Barrier	
AOC WB-531	IL-390	694+00.00	6.7	LT	Existing to Remain	ITS Pole	Shielded by Existing Concrete Single Face Barrier	
AOC EB-532	IL-390	695+00.00	6.7	LT	Existing to Remain	ITS Pole	Shielded by Existing Concrete Single Face Barrier	
AOC EB-542	IL-390	694+75.00	6.7	LT	Existing to Remain	Bridge Parapet Conc. Blunt end	Outside of 4" pavement overlay limits	Marked as (REPORT 7)
AOC EB-543	IL-390	694+75.00	6.7	LT	Existing to Remain	Vertical Drop	Outside of 4" pavement overlay limits	Marked as (REPORT 7)

Report 7 is not listed in the index. Will it be included in the Pre-final submittal?

MILLENNIA PROFESSIONAL SERVICES

F.S = Foreslope B.S. = Backslope

LEVEL 0 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT / RT	Existing, Existing to Remain, or Proposed	Description	Reason for no Further Action	Remarks
AOC EB-533 & EB-534	IL-390	701+67.00	6.8	LT/RT	Existing to Remain	Overhead Sign Foundation	Shielded by Existing Concrete Single Face Barrier	
AOC EB-537	IL-390	711+00.00	7.0	RT	Existing to Remain	ITS Pole	Shielded by Existing Concrete Single Face Barrier	
AOC EB-540E	IL-390	711+00.00	7.0	MED	Existing to Remain	Sign Steel Post Foundation	5' Outside of clear zone	Marked as (REPORT 18)
AOC WB-540W	IL-390	711+00.00	7.0	MED	Existing to Remain	Sign Steel Post Foundation	Behind Guardrail - 7' Outside of Clear Zone	
AOC RB2-581	Ramp B2	122+75.00	7.0	Ramp	Existing to Remain	Back of Guardrail	Outside of 4" pavement overlay limits	Marked as (REPORT 19)
AOC EB-573	Ramp B2	119+50.00	7.0	Ramp	Existing to Remain	Embankment Critical Slope	Outside of 4" pavement overlay limits	Marked as (REPORT 16)
AOC EB-582	Ramp B2	119+50.00	7.0	Ramp	Existing to Remain	Embankment Critical Slope	Outside of 4" pavement overlay limits	Marked as (REPORT 17)
AOC EB-575	Ramp B2	205+00.00	7.0	Ramp	Existing to Remain	Embankment Critical Slope	Outside of 4" pavement overlay limits	Marked as (REPORT 14)
AOC EB-576	Ramp B2	205+00.00	7.0	Ramp	Existing to Remain	Vertical Drop	Outside of 4" pavement overlay limits	Marked as (REPORT 14)
AOC EB-577	Ramp B2	205+00.00	7.0	Ramp	Existing to Remain	Bridge Parapet Conc. Blunt end	Outside of 4" pavement overlay limits	Marked as (REPORT 14)
AOC EB-578	Ramp B2	205+20.00	7.0	Ramp	Existing to Remain	Bridge Parapet Conc. Blunt end	Outside of 4" pavement overlay limits	Marked as (REPORT 15)
AOC EB-579	Ramp B2	205+20.00	7.0	Ramp	Existing to Remain	Vertical Drop	Outside of 4" pavement overlay limits	Marked as (REPORT 15)

LEVEL 0 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT / RT	Existing, Existing to Remain, or Proposed	Description	Reason for no Further Action	Remarks
AOC EB-580	Ramp B2	205+20.00	7.0	Ramp	Existing to Remain	Embankment Critical Slope	Outside of 4" pavement overlay limits	Marked as (REPORT 15)
AOC EB-540W	IL-390	711+00.00	7.0	MED	Existing to Remain	Sign Steel Post Foundation	7' Outside of clear zone	
AOC EB-551B	IL-390	717+23.00	7.1	LT	Existing to Remain	Bridge Pier	5.5' outside of clear zone	
AOC EB-551C	Ramp A2	409+16.00	7.1	RT (F.S)	Existing to Remain	Bridge Pier	Located outside of clear zone	Outside of 4" pavement overlay limits
AOC EB-551D	Ramp A2	410+89.00	7.1	LT (F.S)	Existing to Remain	Bridge Pier	Located outside of clear zone	Outside of 4" pavement overlay limits
AOC WB-570	Ramp B2	114+10.00	7.1	Ramp	Existing to Remain	Vertical Drop	Outside of 4" pavement overlay limits	Marked as (REPORT 24)
AOC WB-571	Ramp B2	114+10.00	7.1	Ramp	Existing to Remain	Bridge Parapet Conc. Blunt end	Outside of 4" pavement overlay limits	Marked as (REPORT 24)
AOC WB-572	Ramp B2	114+10.00	7.1	Ramp	Existing to Remain	Embankment Critical Slope	Outside of 4" pavement overlay limits	Marked as (REPORT 24)
AOC WB-547A	IL-390	724+00.00	7.3	LT	Existing to Remain	ITS Pole	Located outside of clear zone	
AOC WB-548	Ramp B1	98+80.00	7.4	RT	Existing to Remain	Overhead Sign Foundation	Integrated to Existing Concrete Single Face Barrier	
AOC WB-549W	IL-390	733+91.00	7.5	MED	Existing to Remain	Overhead Sign Foundation	8' outside of clear zone	
AOC EB-549E	IL-390	733+91.00	7.5	MED	Existing to Remain	Overhead Sign Foundation	8' outside of clear zone	Shielded by existing guardrail

F.S = Foreslope B.S. = Backslope

LEVEL 1 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT. / RT.	Existing to Remain or Proposed	Description	Traversable Element	Recommendations	Remarks
AOC LP (TYP) EB/WB	IL-390	--	--	LT/RT	Existing to Remain	Light Poles	Yes	All poles have approved breakaway bases	Foundations shall be flush with the ground and be Traversable Elements
AOC LP1	Ramp Lake 4	414+35.00	6.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP2	Ramp Lake 4	413+89.00	6.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP3	Ramp Lake 4	411+80.00	6.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP4	Ramp Lake 3	301+12.00	6.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP5	Ramp Lake 3	302+25.00	6.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP6	IL-390 (EB)	670+09.00	6.2	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP7	IL-390 (WB)	671+87.00	6.3	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP8	IL-390 (WB)	673+74.00	6.3	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP9	IL-390 (WB)	675+56.00	6.3	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP10	IL-390 (WB)	677+37.00	6.4	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP11	IL-390 (EB)	672+55.00	6.3	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP12	IL-390 (EB)	674+16.00	6.3	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.

LEVEL 1 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT. / RT.	Existing to Remain or Proposed	Description	Traversable Element	Recommendations	Remarks
AOC LP13	IL-390 (EB)	679+14.00	6.4	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP14E	IL-390 (EB)	684+51.00	6.5	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP18	IL-390 (WB)	708+95.00	7.0	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP19	IL-390 (WB)	709+62.00	7.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP22	IL-390 (WB)	711+47.00	7.0	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP23	IL-390 (WB)	713+32.00	7.1	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP25	IL-390 (EB)	726+16.00	7.3	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP26	IL-390 (WB)	729+57.00	7.4	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP29	IL-390 (WB)	731+41.00	7.4	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP30	IL-390 (EB)	731+37.00	7.4	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP31	IL-390 (EB)	733+24.00	7.4	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP32	IL-390 (EB)	735+10.00	7.5	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP33	IL-390 (EB)	737+00.00	7.5	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.

LEVEL 1 TABLE - STA. 655+00.00- STA. 750+00.00

AOC#	Alignment	Station	MP	LT. / RT.	Existing to Remain or Proposed	Description	Traversable Element	Recommendations	Remarks
AOC LP34	IL-390 (WB)	740+61.00	7.6	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP35	IL-390 (EB)	740+61.00	7.6	LT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC LP37	IL-390 (WB)	742+10.00	7.6	RT	Existing to Remain	Light Pole	Yes	All poles have approved breakaway bases (Shielded by Guardrail)	Foundations shall be flush with the ground and be Traversable Elements.
AOC SP (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Ground Mounted Signs	Yes	All posts are break-away	Sign bases are traversable elements
AOC HW (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Sloped Headwall	Yes	N/A	
AOC HH (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Handholes	Yes	N/A	Please state if these are Traversable elements.
AOC D (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Drainage structure			
AOC CB (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Catch Basin	Yes	N/A	
AOC INL (TYP) EB/WB	IL-390	--	--	LT/RT	Existing (numerous locations)	Inlet	Yes	N/A	

F.S = Foreslope B.S. = Backslope

VOLUME I

EASTBOUND

REPORT 2

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC EB-504E - Report 2

These tables are no longer required as part of the individual analysis. Unannotated copies are required in the BWA Introduction section as described in article 6.3 of the TBG. Typical all analyses.

TABLE OF CONTENTS

MILLENNIA PROFESSIONAL SERVICES

Illinois Tollway Open Roads for a Faster Future

DATA SHEET

Location AOC EB-504E

Mile Post: 6.25

DESCRIPTION OF OBSTACLE

Existing Sign Truss Foundation, STA. 671+69.16 to STA. 671+72.67, (foundation coordinate 1936847.703, 1038453.055)

3.5' X 3.5' Concrete Foundation

Per Section 5.7.4 Traffic Barrier Guidelines, March 2022, existing overhead sign supports located within the clear zone require a Level 3 Analysis. However, this is not feasible to install a longer span length which places the foundation well outside the clear zone. Therefore, a Level 2 Analysis is performed for this Area of Concern.

DESIGN CONCEPTS

The current edition is 2011.
Typical throughout.

Design Speed = 60 MPH (ISTHA Design Speed)

Design Year = 2021

ADT = 12960 (2021), Eastbound I-390

Clear Zone, Lc = 32 ft based on 1:6 V:H foreslope from Sta. 666+00 to 668+00, 670+00 to 674+00

Clear Zone, Lc = 44 ft based on 1:4 - 1:5 V:H foreslope from Sta. 668+00 to 670+00

(From Table 3-1 AASHTO Roadside Design Guide 2015)

Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

PHOTOS

Photo 1: Existing Street view - guardrail barrier - Looking East on Elgin O'Hare I-390

Photo 2: Existing Median Sign Truss Foundation

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

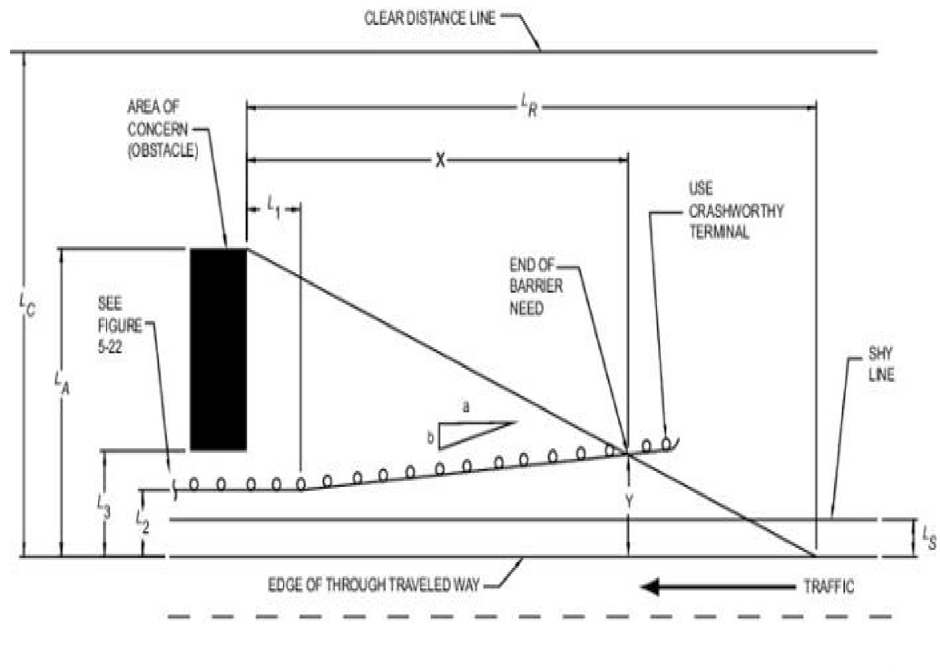


Figure 5-39. Approach Barrier Layout Variables

Consider listing L3.

BARRIER WARRANTS

Location AOC EB-504E - Sign Truss Foundation

L_A = **31.00'** *(Measures to back of Sign Truss Foundation)*

Lc = **32.00'**

This check should be L3 ≤ Lc.

$L_A < L_C$

L_2 = **10.80** 10.80'

This is probably the existing L2 offset. For the purpose of this analysis, please place the new guardrail at the proper offset (1' off the EOS), or 11'

L_R = **300.00'**

Y = L_2 + 0.69 = 10.80' + 0.69' **Y = 11.49'**

Obstacles:

ST_US $_{\text{UPStream\_Sta}}$ **= 671+69.16** *(Sign Truss Foundation, AOC EB-504E)* **ST_US = 671+69.16'**

ST_DS $_{\text{\_DownStream\_Sta}}$ **= 671+72.67** *Traffic going oppistite direction of Alignment Station* **ST_DS = 671+72.67'**

L_{AOC} = Length of AOC = 3.51'

Length of Need - Formula

X = (L_a - Y) / (La / Lr) *(If L_a <=Y, then the value for X =0)*

X = (31.00' - 11.49') / (31.00' / 300.00') **X = 188.81'**

The formula is used to determine X for AOCs on the inside of a curve, when the radius is less than 5000' (5.11.2, TBG, March 2022).

Point of Need= PON = ST_US - X

Please review, this should be (L3 - L2)/Tan25° Typical throughout.

PON = (671+69.16) - 188.81' **PON = (669+80.35)**

BCD$_{\text{Barrier Clearance Distance}}$ = La-L2-Obstacles Width-Guardrail Width

BCD$_{\text{Barrier Clearance Distance}}$ = 31.0' - 10.8' - 3.51' - (3 1/4" + 1' + 5 7/8") = 14.93'

(Distance from back of guardrail posts to face of foundation is 14.93'

Therefore, downstream guardrail shortened using a 25-degree angle procedure from the downstreams end of the obstacle.

See condition 2, TBG Figure 5.14)

The T2 terminal and the 25' of guardrail immediately upstream of the terminal do not contribute toward the LON (See articles 5.14 and 10.5 of the TBG). Thus please add 25' of guardrail here. Typical all analyses that have a trailing T2 terminal.

DS_25* = 34.27' **DS_25* = 34.27'**

Length of Need = LON = X + LAOC - (DS_25*)

LON = 188.81' + 3.51 - 34.27' **LON = 158.05'**

Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

+25' due to T2 ternimal

$L_{guardrail}$ = LON - T1

$L_{guardrail}$ = 158.05' - 34.38' **$L_{Guardrail}$ = 123.67'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 125.00'**

The new Length of Guardrail is 12.5' shorter than the existing one

because the existing BWA analysis determines To determine the X value was measured graphically.

(Meets the Illinois Tollway minimum length of a "free-standing" run of guardrail of 112.5')

$T2_{End\_Station}$ = ST_US - US_25* + T2

$T2_{End\_Station}$ = (671+69.16) - (34.27') + (12.50') **$T2_{End\_Station}$ = (671+47.39)**

$T2_{Begin\_Station}$ = (671+47.39) - (12.50') **$T2_{Begin\_Station}$ = (671+34.89)**

$GR_{End\ \_Station}$ = $T2_{Begin\_Station}$ **$GR_{End\ Station}$ = (671+34.89)**

$GR_{Begin\_Station}$ = $GR_{End\ Station}$ + $L_{Guardrail, R}$

$GR_{Begin\_Station}$= (671+34.89) -125.00' **$GR_{Begin\_Station}$= (670+09.89)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (670+09.89)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ - 46.88'

T1 $_{Begin\_Station}$ = (670+09.89) - 46.88' **T1 $_{Begin\_Station}$ = (669+63.01)**

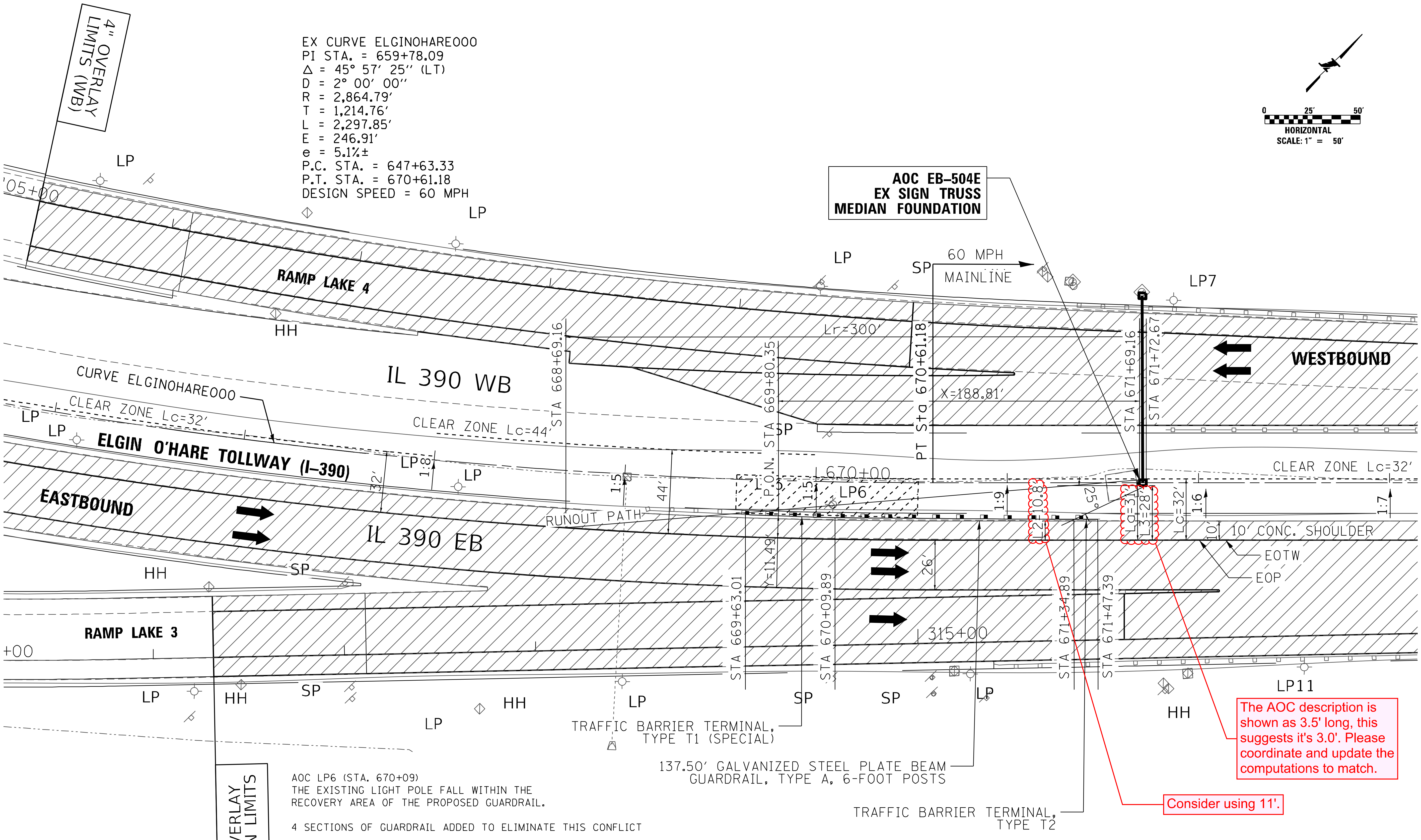
Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (669+80.35) - (669+63.01) < 25'

12.5' < 17.34' < 25' **OK**

Please correct these stations after addressing the comments above.



AOC LP6 (STA. 670+09)
THE EXISTING LIGHT POLE FALL WITHIN THE RECOVERY AREA OF THE PROPOSED GUARDRAIL.

4 SECTIONS OF GUARDRAIL ADDED TO ELIMINATE THIS CONFLICT

SEE SHEET RP2.9 SUMMARY SITE PLAN

RECOVERY AREA (20′X95′)

MILESTONE:	DESIGNED BY: TVN	DATE: 1/17/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/17/2023
	CHECKED BY: JGM	DATE: 1/17/2023

MILLENNIA

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802
BARRIER WARRANT
REPORT 2 - AOC EB-504E - SITE PLAN

SHEET NO. EB-RP2.7
DRAWING NO. 07 OF 15

BARRIER WARRANTS

Location AOC EB-504E - Sign Truss Foundation (cont.)

RECOMMNDATION

Adding the new proposed 4" WMA overlay on top of the existing Concrete Pavement
will reduce the height to the top of the existing MGS guardrail to below 31" and it will not meet the Tollway Standard.
Therefore, consider replacing the existing guardrail with the new guardrail system.

Based on the Barrier Warrant Analysis, the existing light pole at Sta. 670+09 falls within the Recovery Area.
An additional 50.0' of guardrail is requried upstream to move the Recovery Area beyond the existing light pole.

1. Remove existing guardrail systems;
2. Install Traffic Barrier Terminal, Type 2;
3. Install 14 Sections of Galvanized Steel Plate Beam Guardrail, Type A, 6-ft posts (175 ft) to the upstream end of T2 Terminal;
   Should meet the TBW Tollway Standard
4. Install Traffic Barrier Terminal, Type 1 (Special) to the upstream end of the guardrail installation.

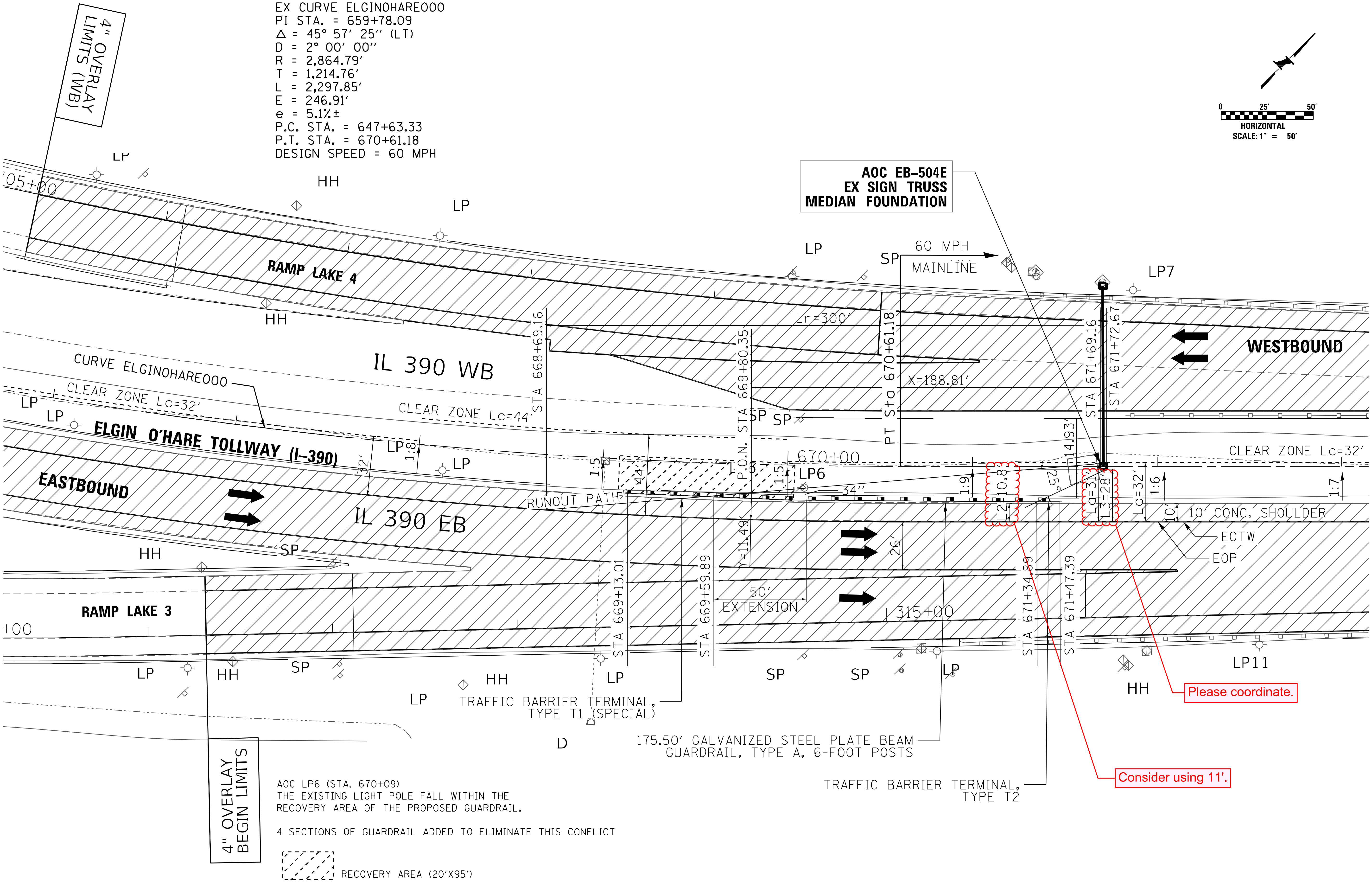
Barrier Limits Determination

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment)	**$L_{Guardrail R}$ =**	**125.00'**
50 ' 4 Sections of Guardrail Extended	**$L_{Guardrail EXT}$ =**	**50.00'**
$L_{Guardrail, Total}$ = $L_{guardrail T}$	**$L_{Guardrail TOTAL}$ =**	**175.00'**

(Meet the Illinois Tollway minimum length of a "free-standing" run of guardrail of 112.5')

$T2_{End\_Station}$ =	**$T2_{End\_Station}$ =**	**(671+47.39)**
$T2_{Begin\_Station}$ =	**$T2_{Begin\_Station}$ =**	**(671+34.89)**
$GR_{End\ \_Station}$ = $T2_{Begin\_Station}$	**$GR_{End\ Station}$ =**	**(671+34.89)**
$GR_{Begin\_Station}$ = $GR_{End\ Station}$ + $L_{Guardrail, R}$		
$GR_{Begin\_Station}$= (671+34.89) -175.00'	**$GR_{Begin\_Station}$=**	**(669+59.89)**
$T1_{End\_Station}$ = $GR_{Begin\_Station}$	**$T1_{End\_Station}$ =**	**(669+59.89)**
$T1_{End\_Station}$ = $GR_{Begin\_Station}$ - 46.88'		
$T1_{Begin\_Station}$ = (669+59.89) - 46.88'	**$T1_{Begin\_Station}$ =**	**(669+13.01)**

EX CURVE ELGINOHARE000
PI STA. = 659+78.09
Δ = 45° 57′ 25″ (LT)
D = 2° 00′ 00″
R = 2,864.79′
T = 1,214.76′
L = 2,297.85′
E = 246.91′
e = 5.1%±
P.C. STA. = 647+63.33
P.T. STA. = 670+61.18
DESIGN SPEED = 60 MPH



AOC LP6 (STA. 670+09)
THE EXISTING LIGHT POLE FALL WITHIN THE RECOVERY AREA OF THE PROPOSED GUARDRAIL.

4 SECTIONS OF GUARDRAIL ADDED TO ELIMINATE THIS CONFLICT

RECOVERY AREA (20′X95′)

MILESTONE:	DESIGNED BY: TVN	DATE: 1/17/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/17/2023
	CHECKED BY: JGM	DATE: 1/17/2023

MILLENNIA

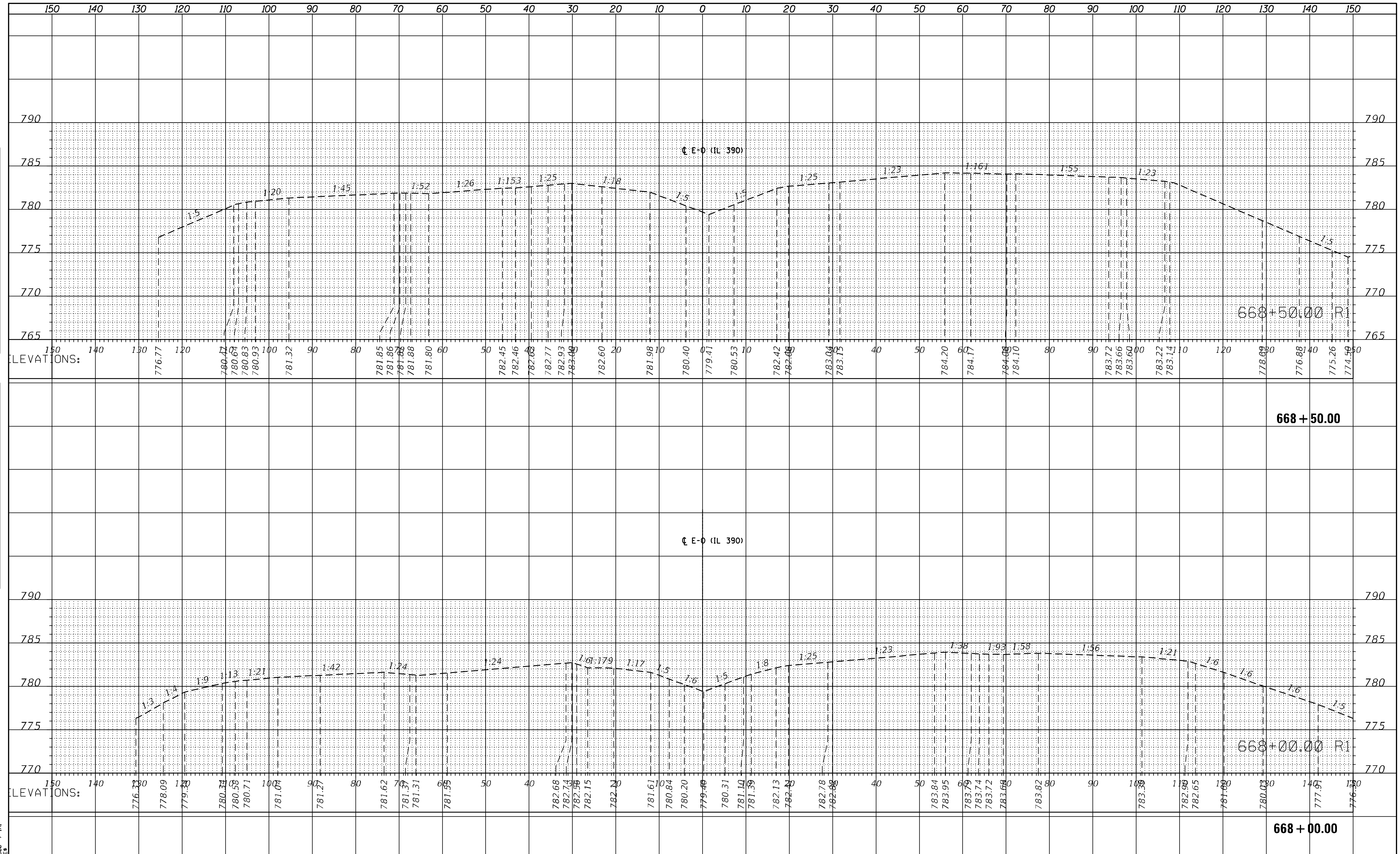
THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802
BARRIER WARRANT
REPORT 2 - SUMMARY SITE PLAN

SHEET NO. EB-RP2.9
DRAWING NO. 09 OF 15



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630.705.0110 voice, 630.839.2566 fax
www.mps-il.com
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THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.

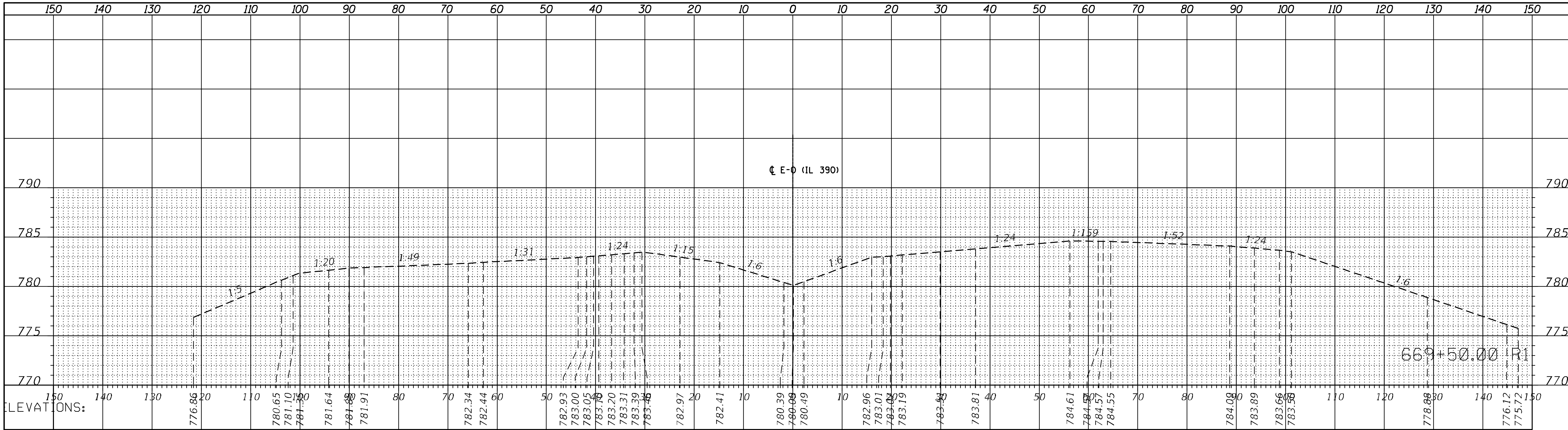
BARRIER WARRANT PLAN
REPORT 2
AOC # EB-504E

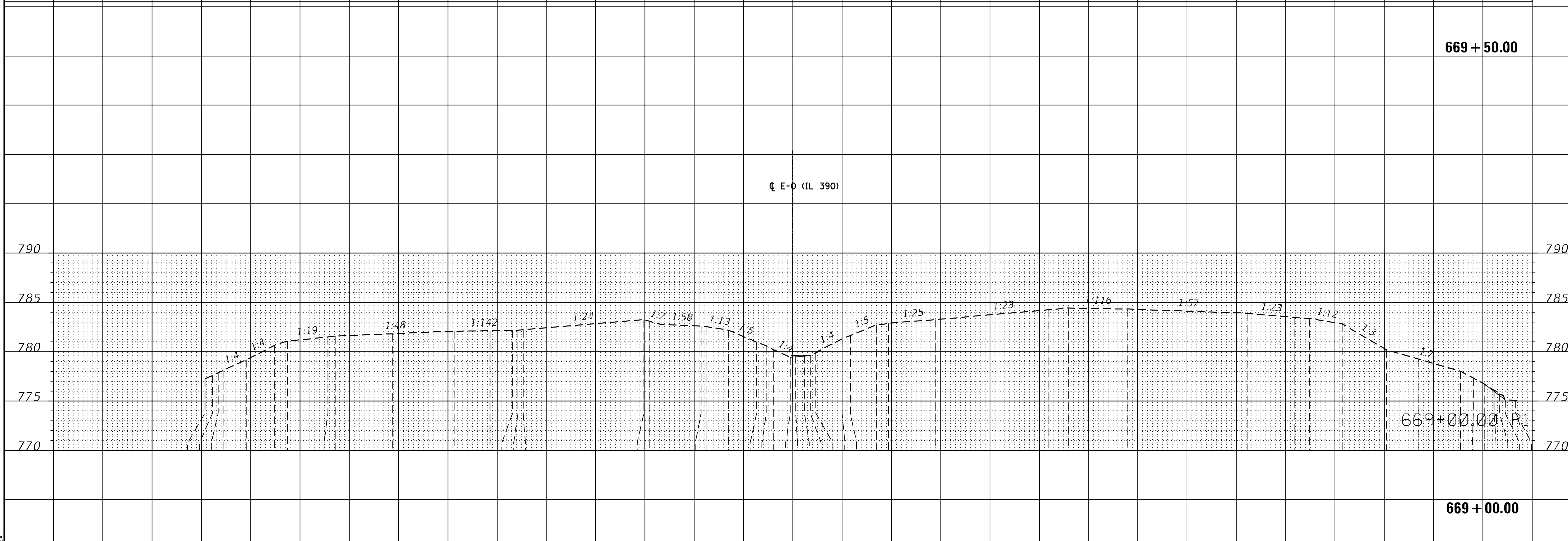
DRAWING NO.
EB-RP2.10

$FILE$

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 BY LN	DATE 1/17/2023	200 22ND Street, Suite 216, Lombard, IL 60148 630.705.0110 voice, 630.839.2566 fax www.mps-il.com MILLENNIA PROFESSIONAL SERVICES	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY 2700 OGDEN AVENUE DOWNERS GROVE, ILLINOIS 60515	DESIGN CONTRACT NO. RR-21-4802 CONST. CONTRACT NO. BARRIER WARRANT PLAN REPORT 2 AOC # EB-504E
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REVISIONS		
NO.	DATE	DESCRIPTION

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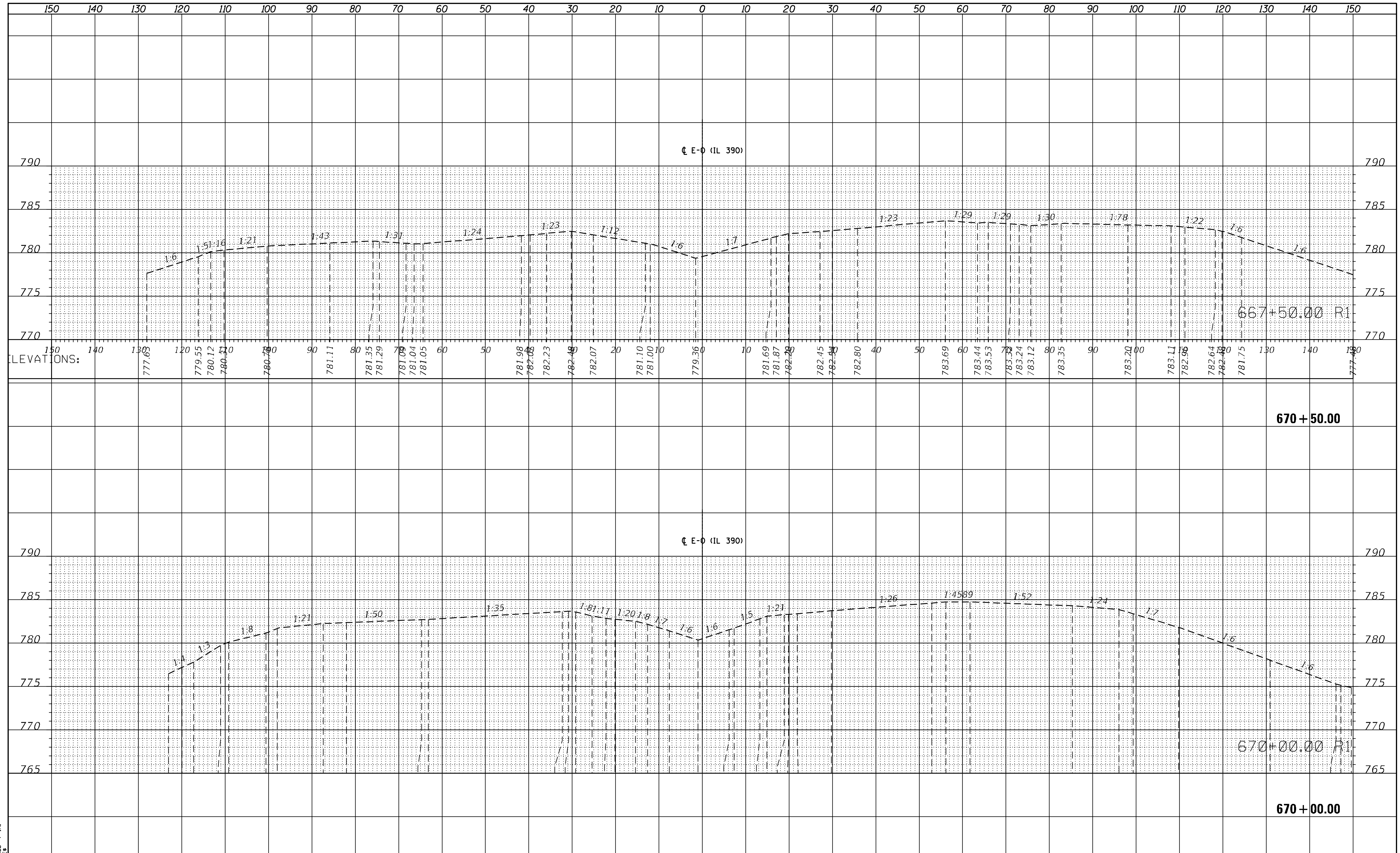

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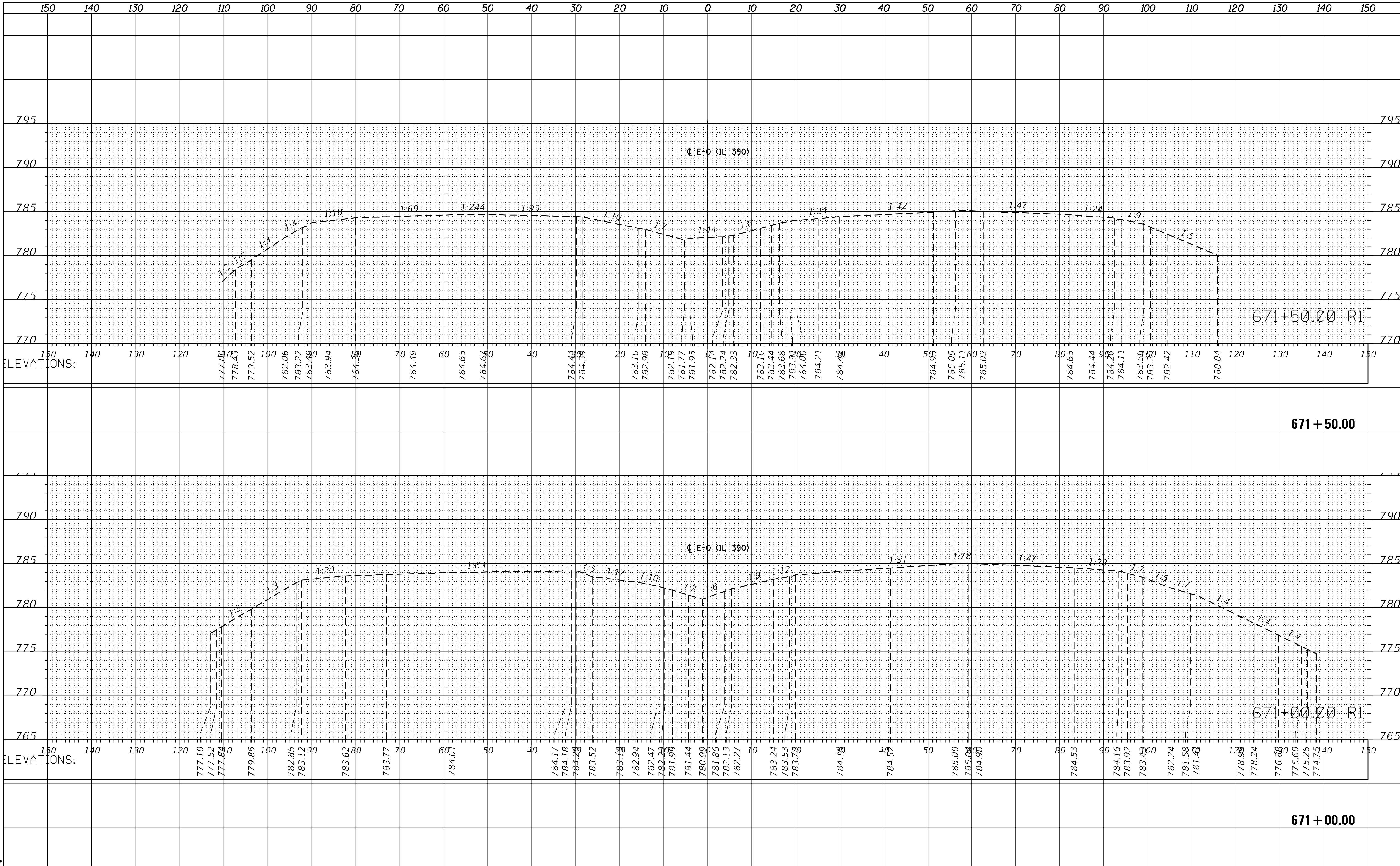

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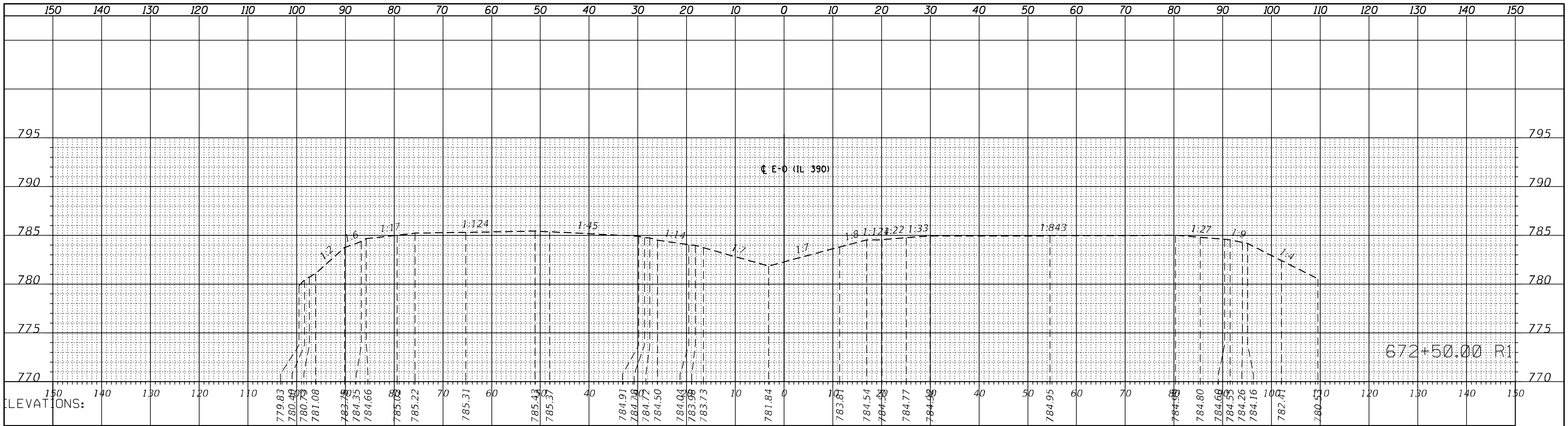

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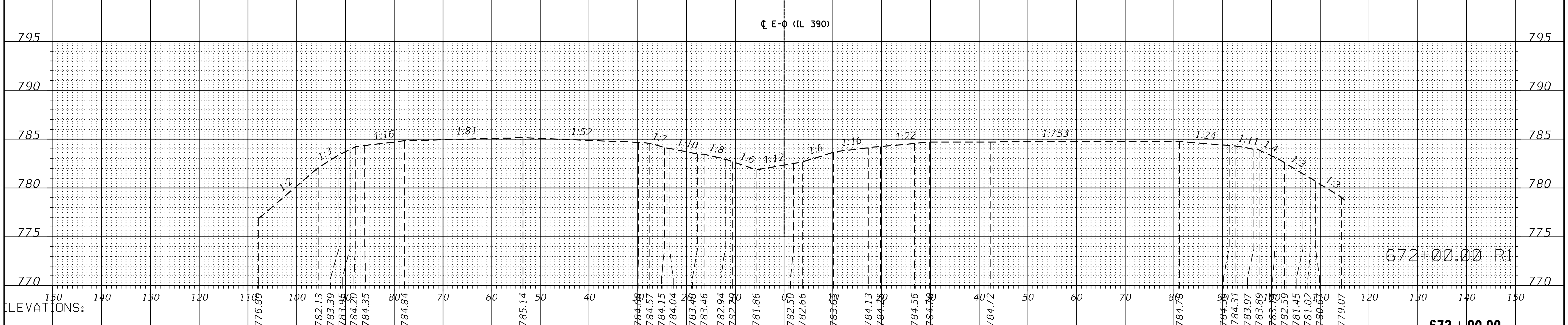

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AOC # EB-504E

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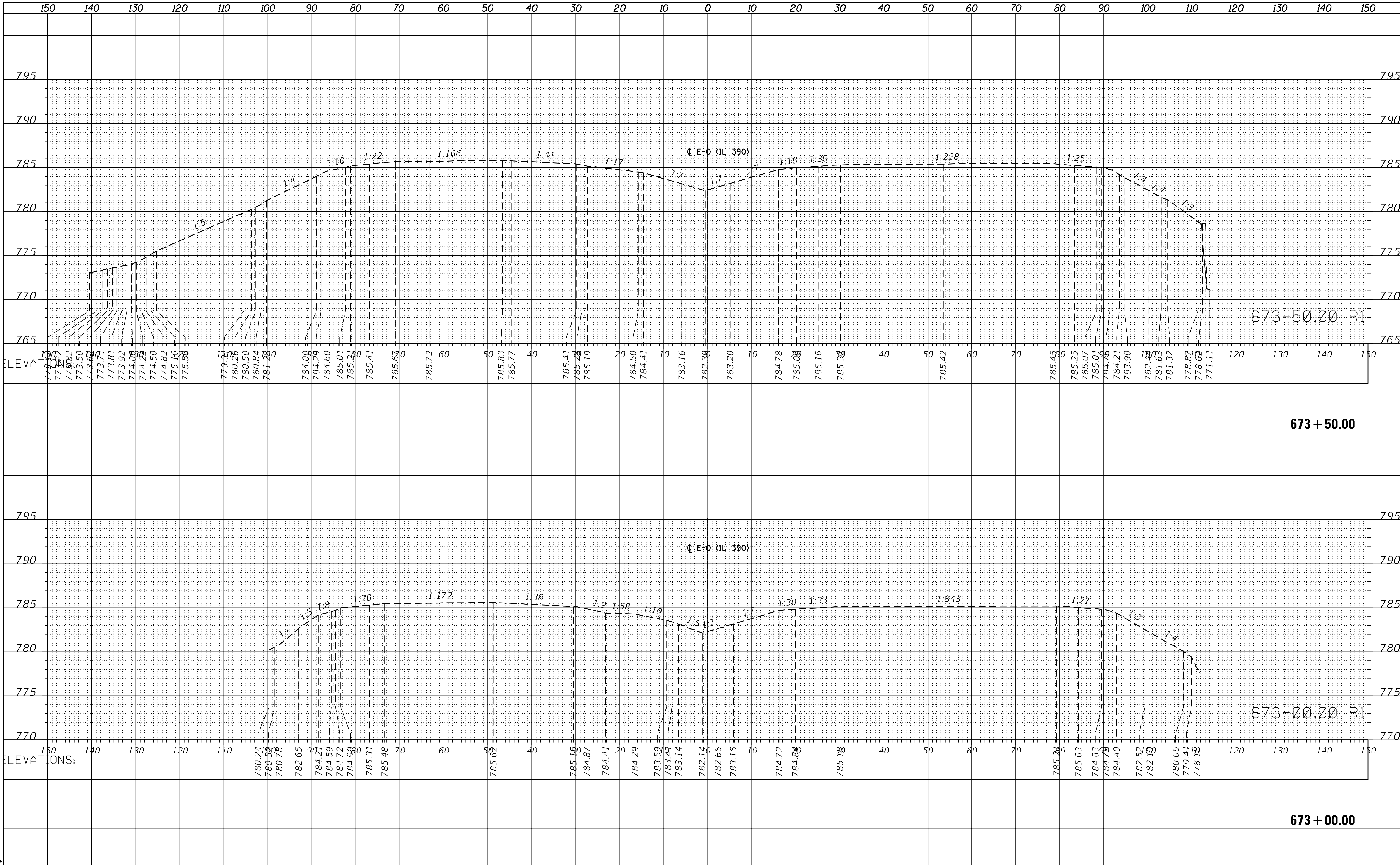

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CONST. CONTRACT NO.
BARRIER WARRANT PLAN
REPORT 2
AOC # EB-504E

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EB-RP2.15

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REPORT 5

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC EB-521 (Existing CONC. Blunt End) - Report 5

Location AOC EB-521A, EB-521B (Existing Retaining Wall) - Report 5

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Illinois Tollway
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DATA SHEET

Location AOC EB-521 (Existing Conc. Blunt End) - Report 5
Location AOC EB-521A, EB-521B (Existing Retaining Wall) - Report 5

Mile Post: 6.58

DESCRIPTION OF OBSTACLE

Existing Concrete Blunt End - AOC EB-521 (coordinate: 1937813.118, 1039511.578)	STA. 685+99.45
Existing Retaining Wall - AOC EB-521A (coordinate: 1937807.683, 1039517.113)	STA. 685+99.45
Existing Retaining Wall - AOC EB-521B (coordinate: 1937814.415, 1039560.642)	STA. 686+35.25

A Level 2 Barrier Warrant Analysis performed for this Area of Concern is to check if the Lenght of Need is meeting the current Tollway Standard.

The Retaining Wall - AOC EB-521B control the Upstream end limits of Analysis

Therefore, the calculation for AOC EB-521B is used.

DESIGN CONCEPTS

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 12960 (2021), Eastbound I-390

Clear Zone, Lc = 32 ft based on 1:6 V:H or flatter foreslope, from Sta. 683+00 to Sta. 686+35.25
Clear Zone, Lc = Undefined, from Sta. 686+35.25 and beyond
(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, L_s (AASHTO Table 5-7): 8'
Lateral Distance, L_2 (from EOTW): 13'
Lateral Extent of AOC, (EB-521B, La=22.00'), (EB-521B, La=49.00')

PHOTOS

Photo 1: Existing Street view condition - guardrail barrier - Looking East on Elgin O'Hare I-390

Photo 2: Existing Concrete Barrier shelding the Tollway building, Electrical Boxes)
(Monotube Foundations seat on top)

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

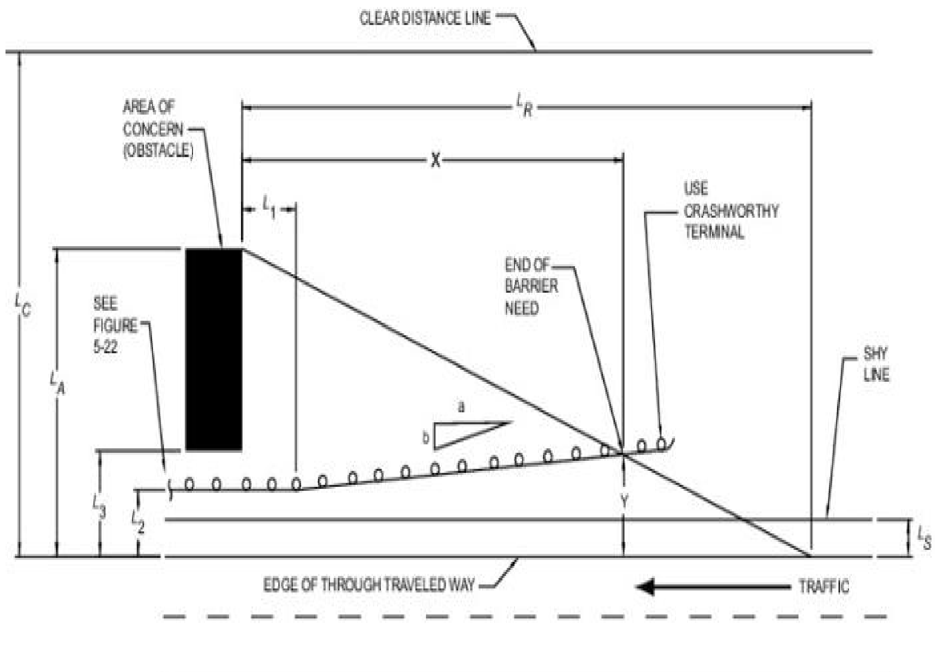


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC EB-521 Conc. Blunt End, AOC EB-521A & EB-521B Retaining Wall

AOC EB-521A L_A = 49.00'
AOC EB-521B L_A = 22.00'

These should probably be switched.

Lc = **Undefined**

L_2 = **13.00** 13.00'

L_R = **300.00'**

Y = L2 + 0.69' **Y = 13.69'**

Obstacles:

$BL\_End_{US\_Sta.}$	**= 685+99.45**	*(Blunt End UpStream Station, AOC EB-521)*	**BL_End_US =(685+99.45)**
$RE\text{-}WL\_US_{UPStream\_Sta}$	**= 685+99.45**	*(Existing Retaining Wall, AOC EB-521A)*	**ST_DS =(685+99.45)**
$RE\text{-}WL\_DS_{DPStream\_Sta}$	**= 686+35.25**	*(Existing Retaining Wall, AOC EB-521B)*	**ST_US = (686+35.25)**
$LBL\_End_{Contribute}$	**= -35.80'**		
L_{AOC} = Length of AOC =	**= 0.00'**		

Length of Need - Formula

$X = (L_a - Y) / (L_a / Lr)$ *(If L_a <=Y, then the value for X =0)*

X = (22.00' - 13.69') * (22.00' / 300.00')	AOC EB-521A	**X = 113.32'**	
X = (49.00' - 13.69') * (49.00' / 300.00')	AOC EB-521B	**X = 216.18'**	**(control AOC)**

Point of Need= PON = ST_US - X

PON = (685+99.45) - 113.32'	AOC EB-521A	**PON = (684+86.13)**
PON = (686+35.25) - 216.18'	AOC EB-521B	**PON = (684+19.07)**

Length of Need = LON = X + LAOC - (LBL_End $_{Contribute}$)

LON = 216.18' + 0.00' + (-35.80') **LON = 180.38'**

The newer T6 & T6B termianls contribute 36.90' toward the LON. Typical throughout.

Terminals

Terminal = Type T6B = T6B = 43.15' (counts toward the length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T1 - T6B

36.9'

$L_{guardrail}$ = 180.38' - 34.38' - 43.15' **$L_{Guardrail}$ = 102.85'**

$L_{Guardrail, R} = L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 112.50'**

$T6B_{End\_Station}$ = BL_End_US

$T6B_{End\_Station}$ = 685+99.45 **$T6B_{End\_Station}$ = (685+99.45)**

36.9'

$T6B_{Begin\_Station} = T6B_{End}$ - T6B

$T6B_{Begin\_Station}$ (685+99.45) - 43.15' **$T6B_{Begin\_Station}$= (685+56.30)**

$GR_{End\_Station} = T6B_{Begin\_Station}$ **$GR_{End\ Station}$ = (685+56.30)**

$GR_{Begin\_Station} = GR_{End\ Station} - L_{Guardrail, R}$

$GR_{Begin\_Station}$= (685+56.30) -112.50' **$GR_{Begin\_Station}$= (684+43.80)**

$T1_{End\_Station} = GR_{Begin\_Station}$ **$T1_{End\_Station}$ = (684+43.80)**

$T1_{End\_Station} = GR_{Begin\_Station}$ - 46.88'

$T1_{Begin\_Station}$ = (684+43.80) - 46.88' **$T1_{Begin\_Station}$ = (683+96.92)**

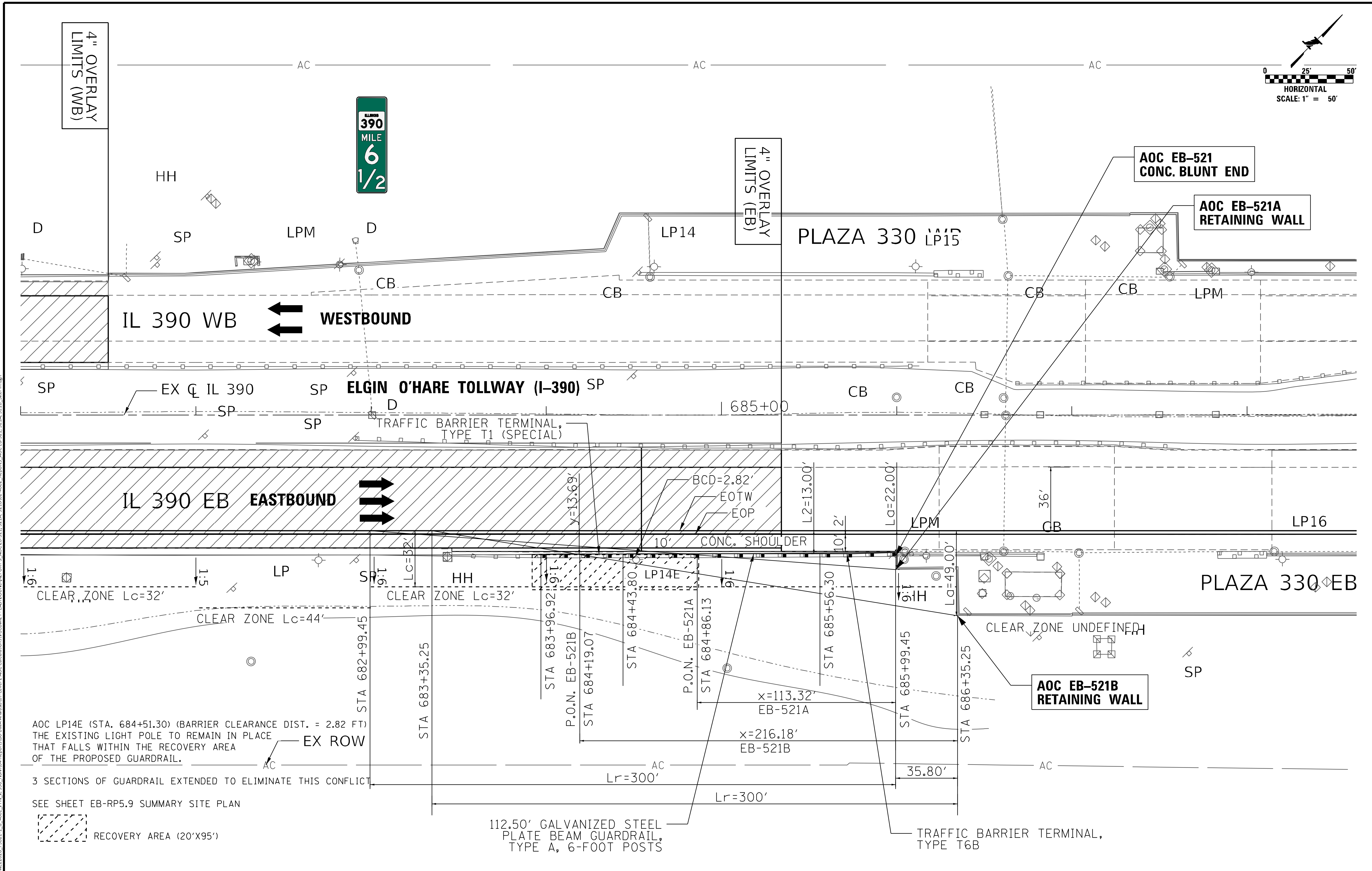
Please update.

Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (684+19.07) - (683+96.92) < 25'

12.5' < 22.15' < 25' **OK**



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/10/2023
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CONTRACT NO. RR-21-4802

BARRIER WARRANT REPORT 5 - SITE PLAN

SHEET NO. EB-RP5.7

DRAWING NO. 07 OF 12

BARRIER WARRANTS

Location AOC EB-521 Conc. Blunt End, AOC EB-521A & EB-521B Retaining Wall

RECOMMENDATION

Adding the new proposed 4" WMA overlay on top of the existing Concrete Pavement,
will reduce the height to the top of the existing MGS guardrail to below 31" and will not meet the Tollway Standard.
Therefore, consider replacing the existing guardrail with the new guardrail system.

You might need to add 50' once the T6 terminal length is corrected.

Based on the Barrier Warrant Analysis, the existing light pole at Sta. 684+51.30 falls within the Recovery Area.
An additional 37.50' of guardrail is requried upstream to move the Recovery Area beyond the existing light pole.
Light Pole Barrier Clearance Distance = 2.82' = 33.84" - REMAIN IN PLACE

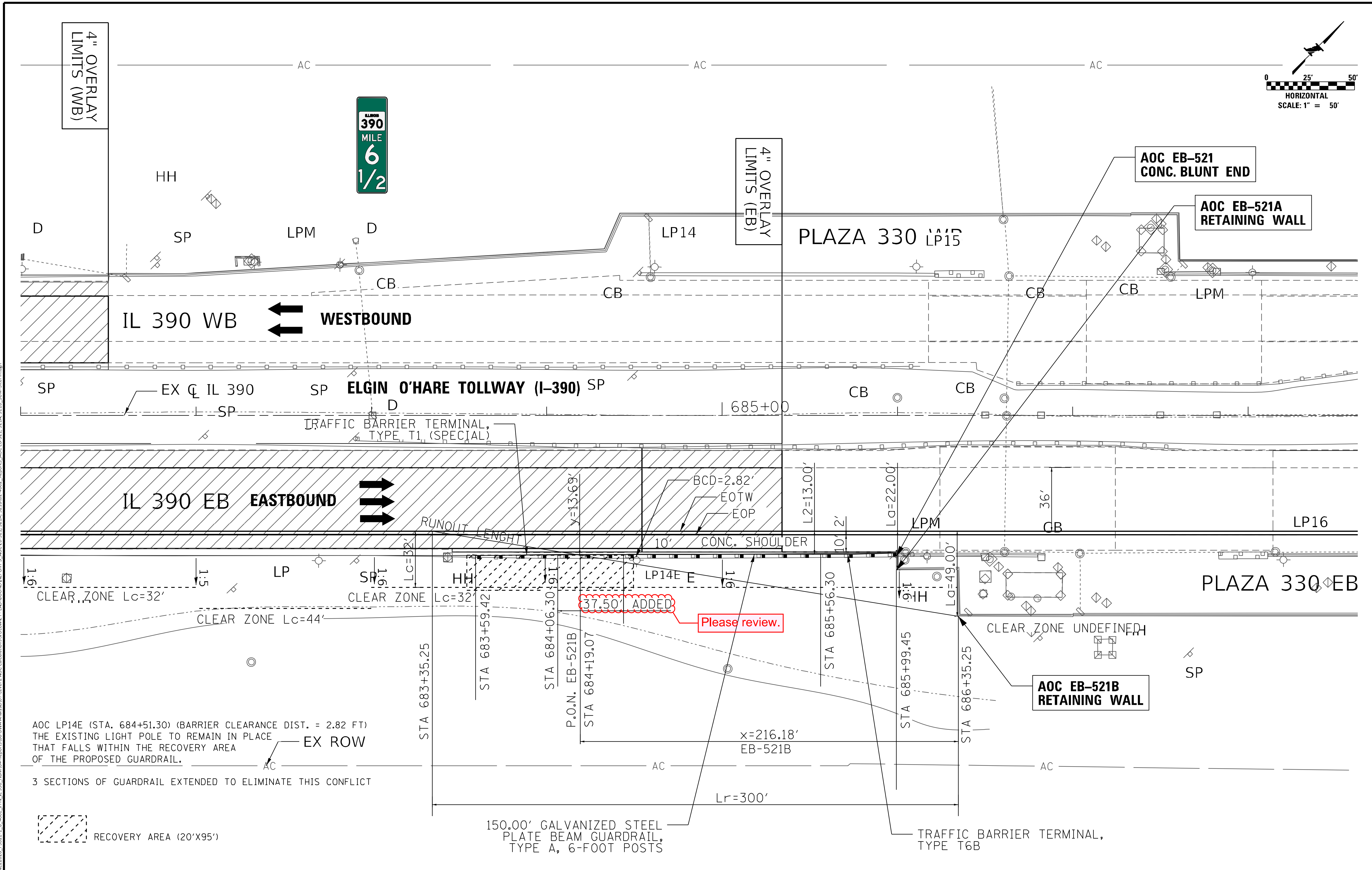
1. Remove existing guardrail systems;
2. Install Traffic Barrier Terminal, Type T6B;
3. Install 12 Sections of Galvanized Steel Plate Beam Guardrail, Type A, 6-ft posts (150.00 ft) to the upstream end of the T6B Terminal;
   Should meet the TBW Tollway Standard
4. Install Traffic Barrier Terminal, Type 1 (Special) to the upstream end of the guardrail installation.

Barrier Limits Determination

$L_{Guardrail, R} = L_{Guardrail}$ (Round up to the nearest 12.5' increment)	**$L_{Guardrail\ R}$ = 112.50'**
37.50 ' 3 Sections of Guardrail Extended	**$L_{Guardrail\ EXT}$ = 37.50'**
$L_{Guardrail, Total} = L_{guardrail\ T}$	**$L_{Guardrail\ TOTAL}$ = 150.00'**
Matching the Existing Guardrail Barrier length	
$T6B_{End\_Station}$ = BL_End_US	
$T6B_{End\_Station}$ = (685+99.45)	**$T6B_{End\_Station}$ = (685+99.45)**
$T6B_{Begin\_Station} = T6B_{End} - T6B$	
$T6B_{Begin\_Station}$ (685+99.45) - 43.15'	**$T6B_{Begin\_Station}$= (685+56.30)**
$GR_{End\ \_Station} = T6B\ _{Begin\_Station}$	**$GR_{End\ Station}$ = (685+56.30)**
$GR_{Begin\_Station} = GR_{End\ Station} - L_{Guardrail, R}$	
$GR_{Begin\_Station}$= (685+56.30) -150.00'	**$GR_{Begin\_Station}$= (684+06.30)**
$T1\ _{End\_Station} = GR_{Begin\_Station}$	**$T1\ _{End\_Station}$ = (684+06.30)**
$T1\ _{End\_Station} = GR_{Begin\_Station}$ - 46.88'	
$T1\ _{Begin\_Station}$ = (684+06.30) - 46.88'	**$T1\ _{Begin\_Station}$ = (683+59.42)**

36.9'

Please review/correct as necessary.



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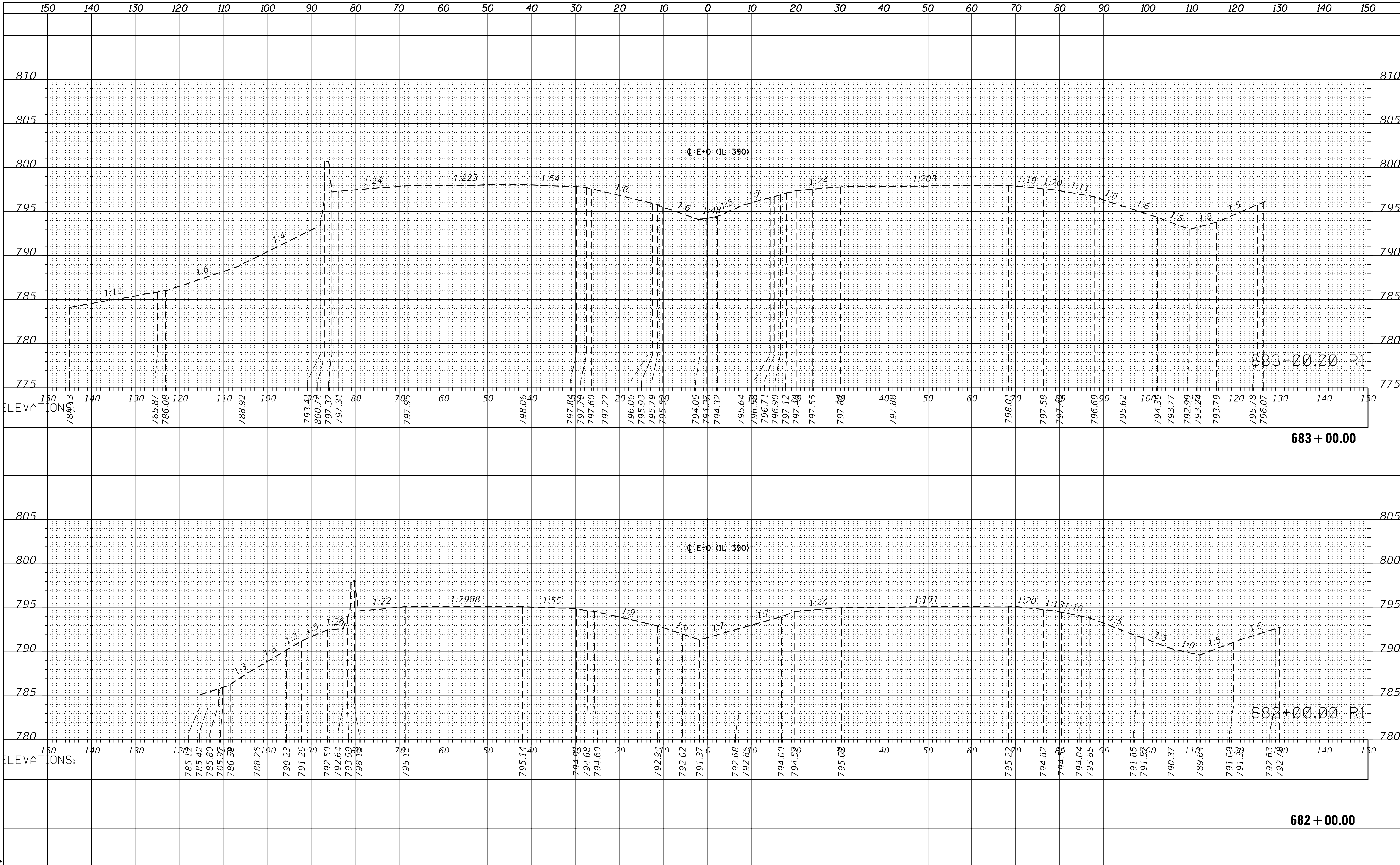
CONTRACT NO. RR-21-4802
BARRIER WARRANT
REPORT 5 - SUMMARY SITE PLAN

SHEET NO. EB-RP5.9
DRAWING NO. 09 OF 12



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DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 5
AOC * EB-521, 521A, 521B

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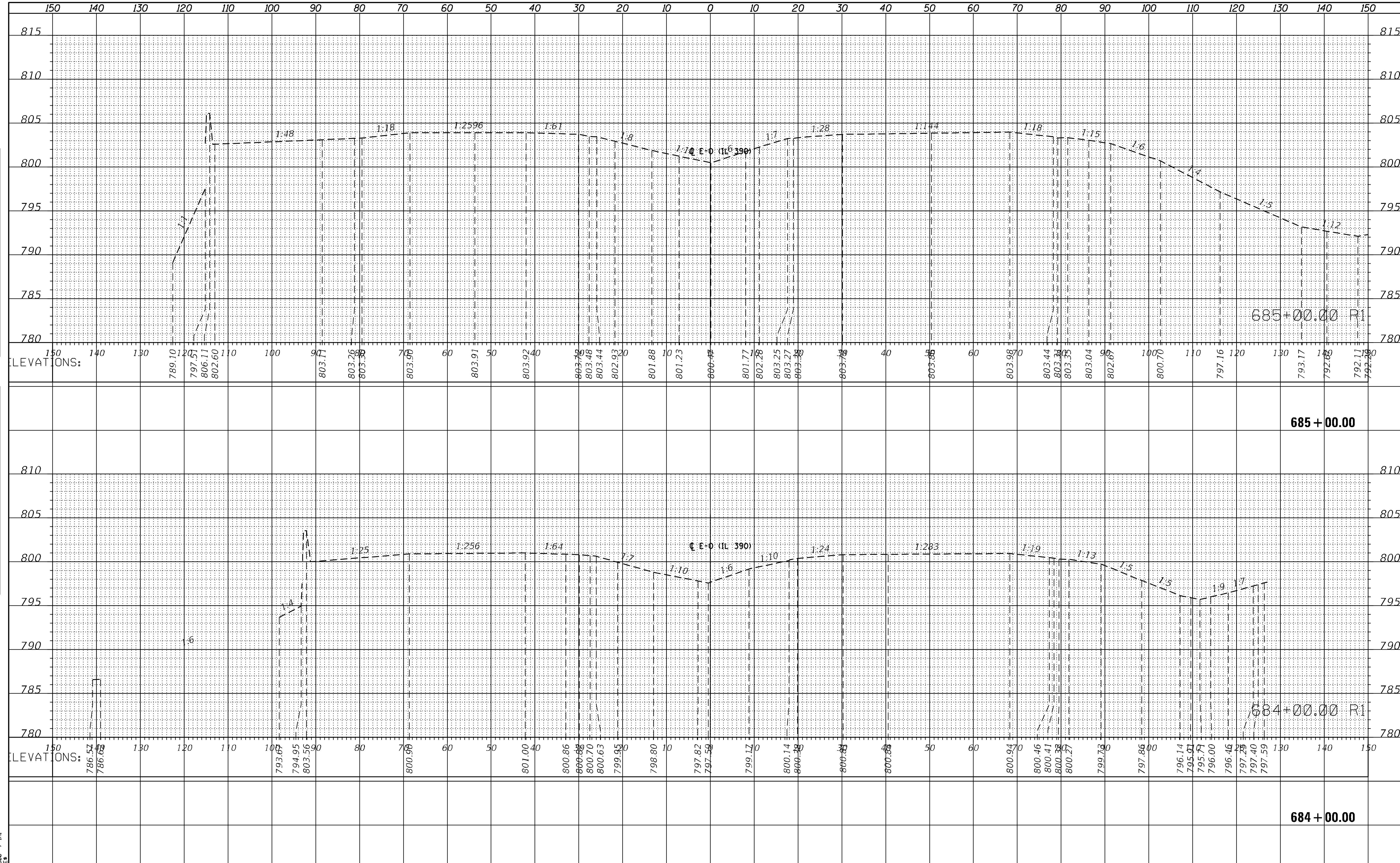

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CONST. CONTRACT NO.
BARRIER WARRANT PLAN
REPORT 5
AOC * EB-521, 521A, 521B

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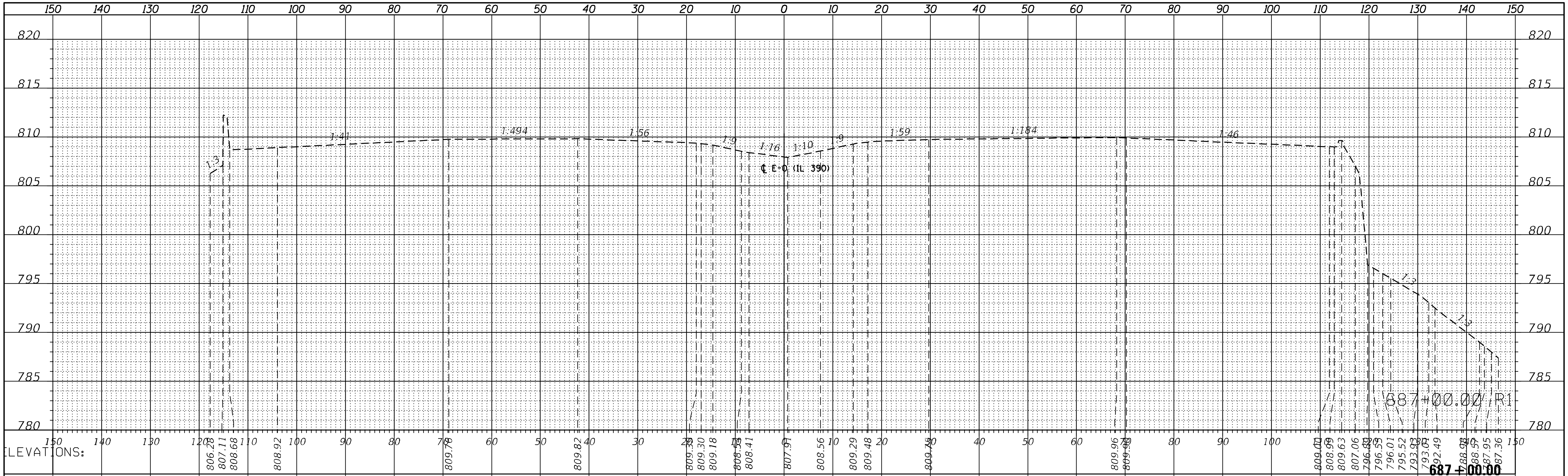

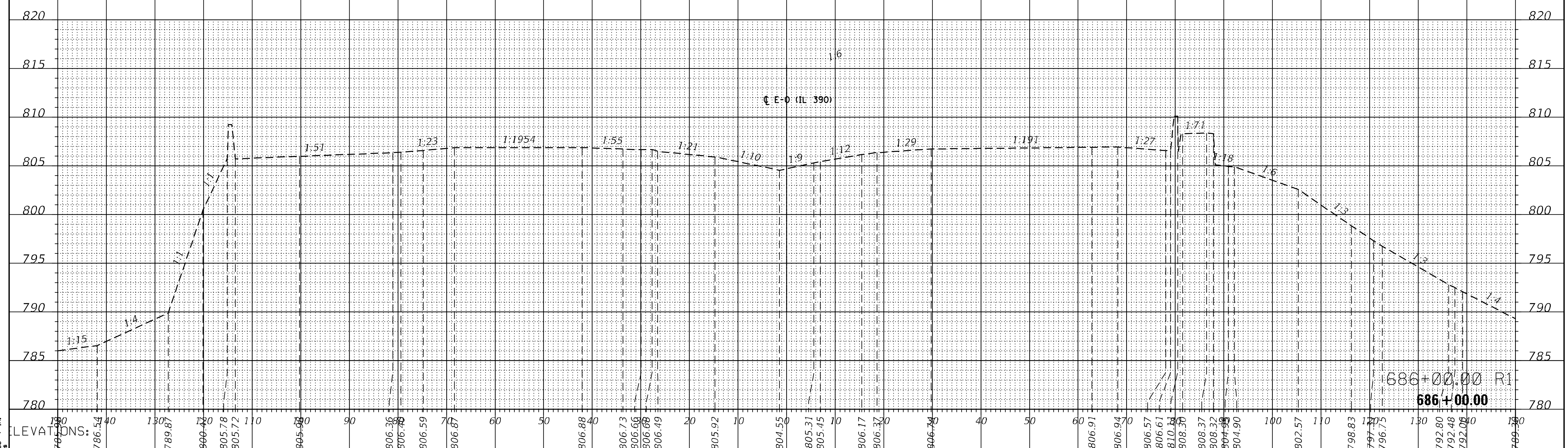

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AOC * EB-521, 521A, 521B

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REPORT 6

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC EB-517 - 518 - 523 & 524 (Existing Monotubes - Median Foundation) - Report 6

TABLE OF CONTENTS

DATA SHEET

Location AOC EB-517, 518, 523 & 524 (Existing Monotubes - Median Foundation)

Mile Post: 6.58

DESCRIPTION OF OBSTACLE

Existing Monotubes - Median Foundation
AOC EB-517, 518, 523 & 524 (Coordinate: 1937905.447, 1039486.6780) STA. 686+48.00 to STA. 687+84.00

Per Section 5.7.7 Traffic Barrier Guidelines, March 2022, the existing foundations, or other above-ground obstacles shall be relocated, unless located behind, otherwise warranted barrier. The existing monotubes, located on the median foundations can't be relocated elsewhere; therefore, will remain shielded. A Level 2 Barrier Warrant Analysis performed for this Area of Concern is to check if the Length of Need is meeting the current Tollway Standard.

The existing monotubes are located less than 100' apart; therefore, existing monotubes are combined for this analysis.

DESIGN CONCEPTS

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 12960 (2021), Eastbound I-390

Clear Zone, Lc = 32 ft based on 1:6 V:H or flatter foreslope, from Sta. 681+00 to Sta. 688+50
(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, L_s (AASHTO Table 5-7): 8'
Lateral Distance, L_2 (from EOTW): 11'
Lateral Extent of AOC, L_A: 31.80'

PHOTOS

Photo 1: Existing Street view condition barrier - Looking East on Elgin O'Hare I-390

Photo 2: Existing Median Monotubes Foundation

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

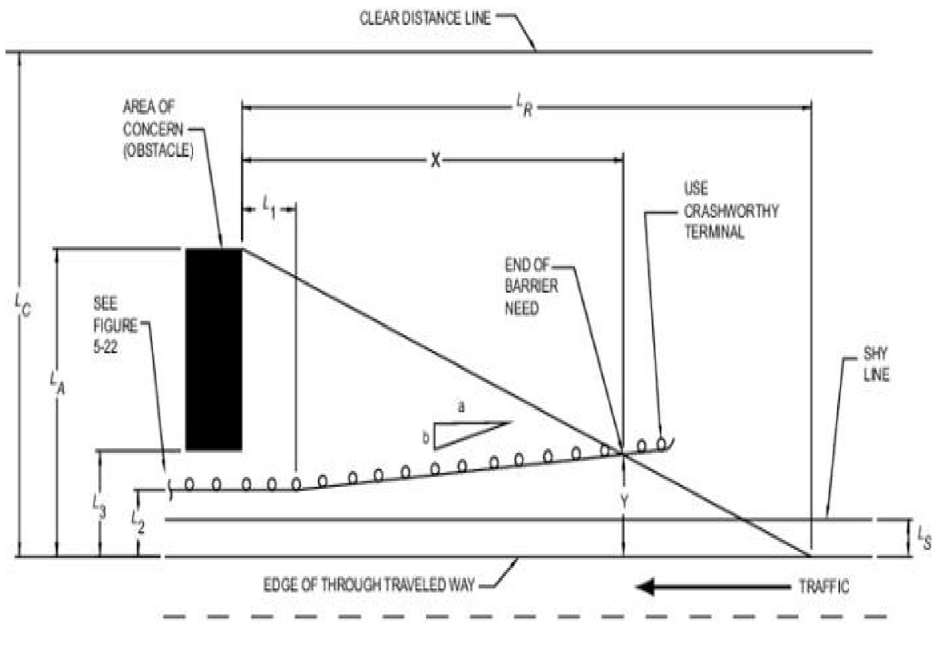


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC EB-517, 518, 523 & 524 - Monotubes Foundations

L_A = **31.80'**
Lc = **32.00'** Consider adding the L3 value.
L_A < L_C
L3
L_2 = **11.00** 11.00'

L_R = **300.00'**

Y = L2 + 0.69' **Y = 11.69'**

Obstacles:
ST_US $_{UPStream\_Sta}$ **= 686+48.00** *(Existing Monotube Foundation, AOC EB-517)* **ST_US = 686+48.00'**
ST_DS $_{\_DownStream\_Sta}$ **= 687+84.00** *(Existing Monotube Foundation, AOC EB-524)* **ST_DS = 687+84.00'**
L_{AOC} = Length of AOC = 136.00'

Length of Need - Formula

Note: the graphical method is employed due to a kink in the EOTW within Lr & flared guardrail installation.

X= measured graphically **X = (196.85)**

Point of Need= PON = ST_US - X (Traffic Flow The Opposite Direction)
PON = (686+48.00) - 196.85' **PON = (684+51.15)**

$BCD_{Barrier\ Clearance\ Distance}$ = La-L2-Obstacles Width-Guardrail Width
$BCD_{Barrier\ Clearance\ Distance}$ = 31.80' - 11.0' - 3.48' - (3 1/4" + 1' + 5 7/8") = 15.56'
(Distance from back of guardrail posts to face of foundation is 15.56'
Therefore, downstream guardrail shortened using a 25-degree angle procedure from the downstreams end of the obstacle.
See condition 2, TBG Figure 5.14) Consider showing this computation (L3-L2)/Tan25 or determine it graphically since the shoulder is on a taper.

DS_25* = 35.95' **DS_25* = 35.95'**

Length of Need = LON = X + LAOC - (DS_25*)
LON = 196.85' + 136.00' - 35.95' **LON = 296.90'**

Terminals
Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)
Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

+25' due to the T2 terminal

Barrier Limits Determination
$L_{guardrail}$ = LON - T1
$L_{guardrail}$ = 296.90' - 34.38' **$L_{Guardrail}$ = 262.52'**

$L_{Guardrail,\ R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 275.00'**
(Meet the Illinois Tollway minimum length of a "free-standing" run of guardrail of 112.5')

+ 25'

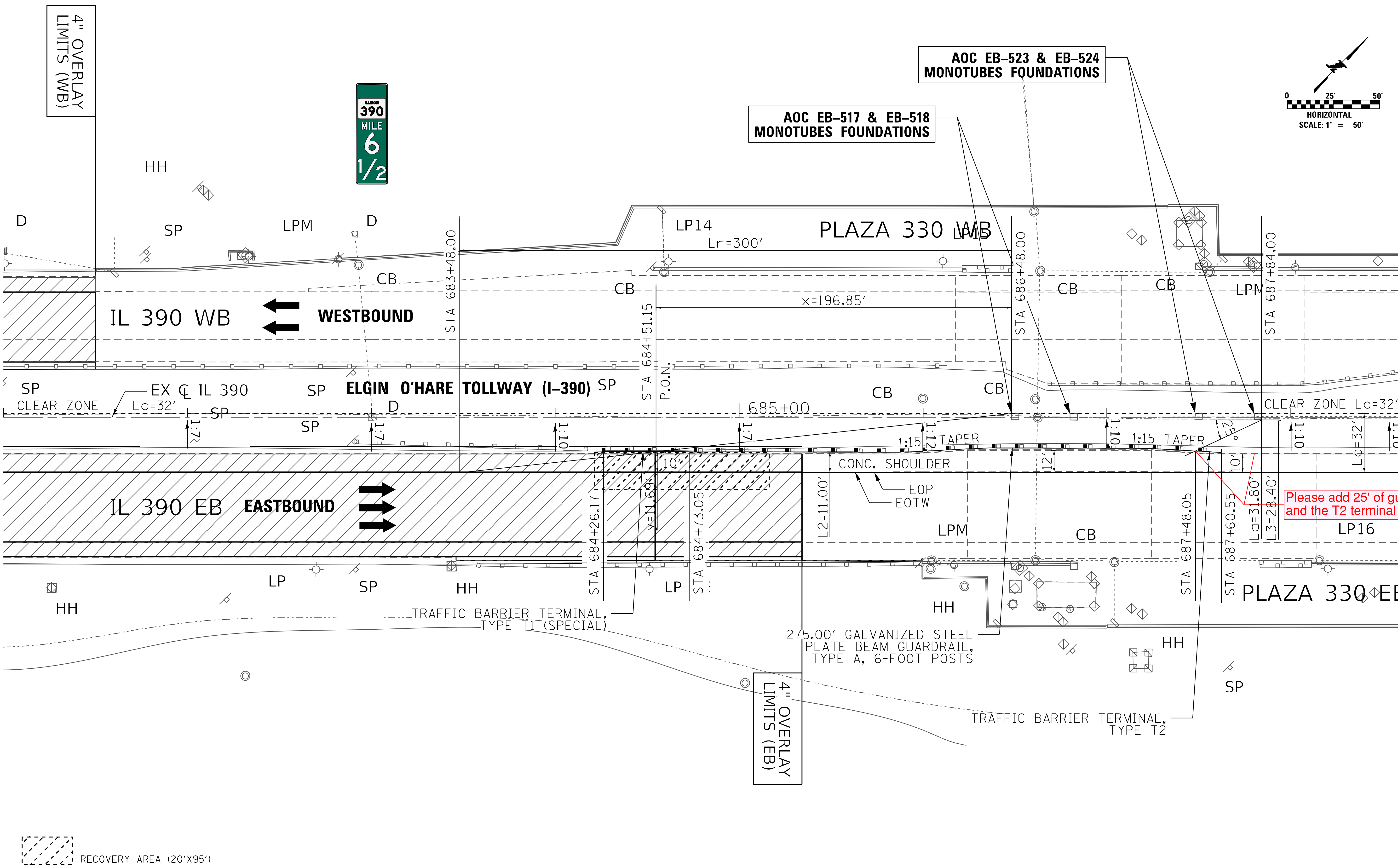
$T2_{End\_Station}$ = ST_DS -DS_25*+12.50'
$T2_{End\_Station}$ = (687+84.00) - (35.95') + (12.50') **$T2_{End\_Station}$ = (687+60.55)**
$T2_{Begin\_Station}$ = (687+60.55) - (12.50') **$T2_{Begin\_Station}$ = (687+48.05)**

$GR_{End\ \_Station}$ = $T2_{Begin\_Station}$ **$GR_{End\ Station}$ = (687+48.05)**
$GR_{Begin\_Station}$ = $GR_{End\ Station}$ - $L_{Guardrail,\ R}$
$GR_{Begin\_Station}$= (687+48.05) -275.00' **$GR_{Begin\_Station}$= (684+73.05)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (684+73.05)**
T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ - 46.88'
T1 $_{Begin\_Station}$ = (684+73.05) - 46.88' **T1 $_{Begin\_Station}$ = (684+26.17)**

Please review and update as necessary.

Barrier Limits Check:
12.5' < PON - T1 < 25'
12.5' < (684+51.15) - (684+26.17) < 25'
12.5' < 24.98' < 25' **OK**



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/17/2023
	CHECKED BY: JGM	DATE: 1/17/2023

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BARRIER WARRANT REPORT 6 - SITE PLAN

SHEET NO. EB-RP6.7

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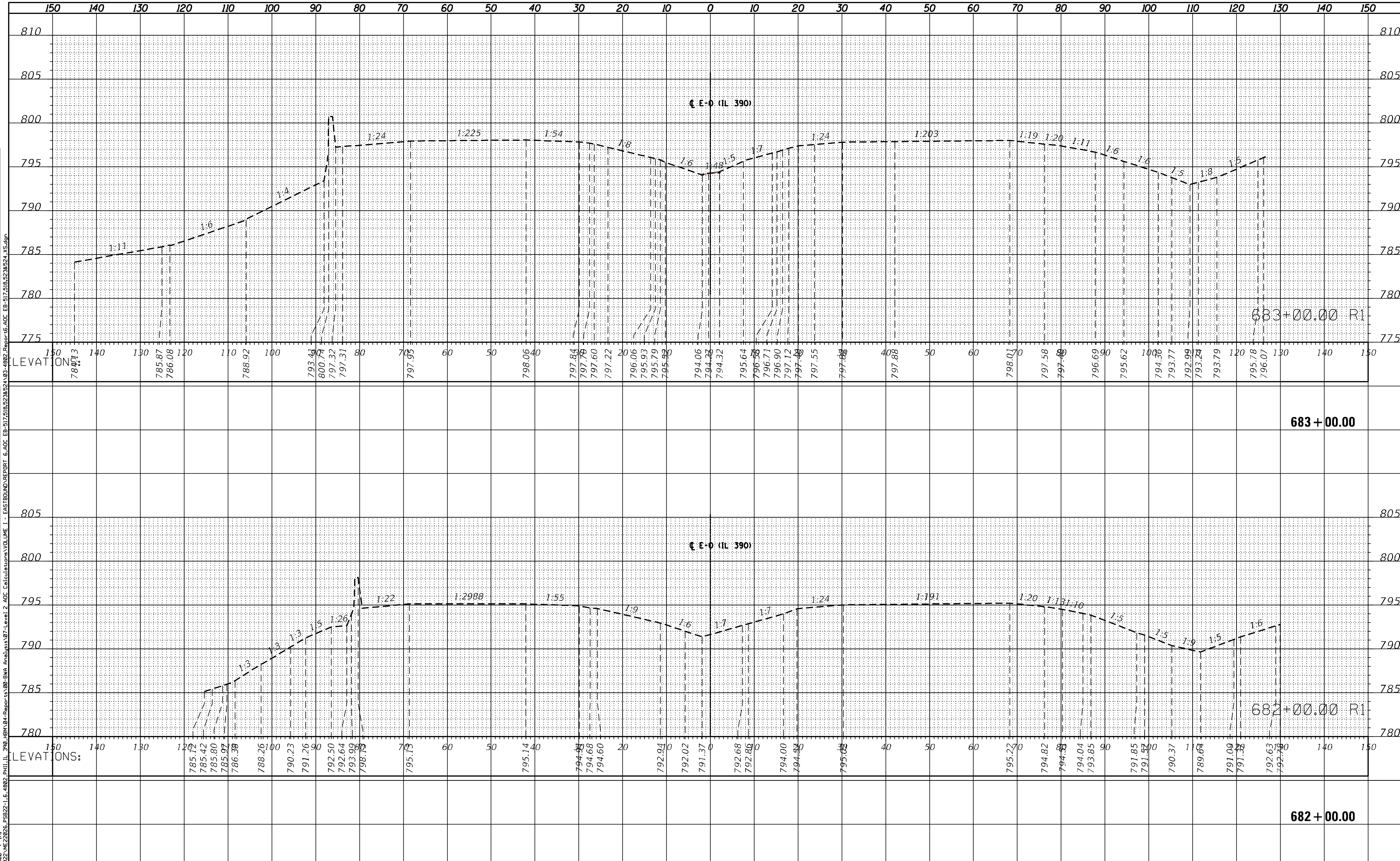

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BARRIER WARRANT PLAN
REPORT 6
AOC • EB-517-518, 523-524

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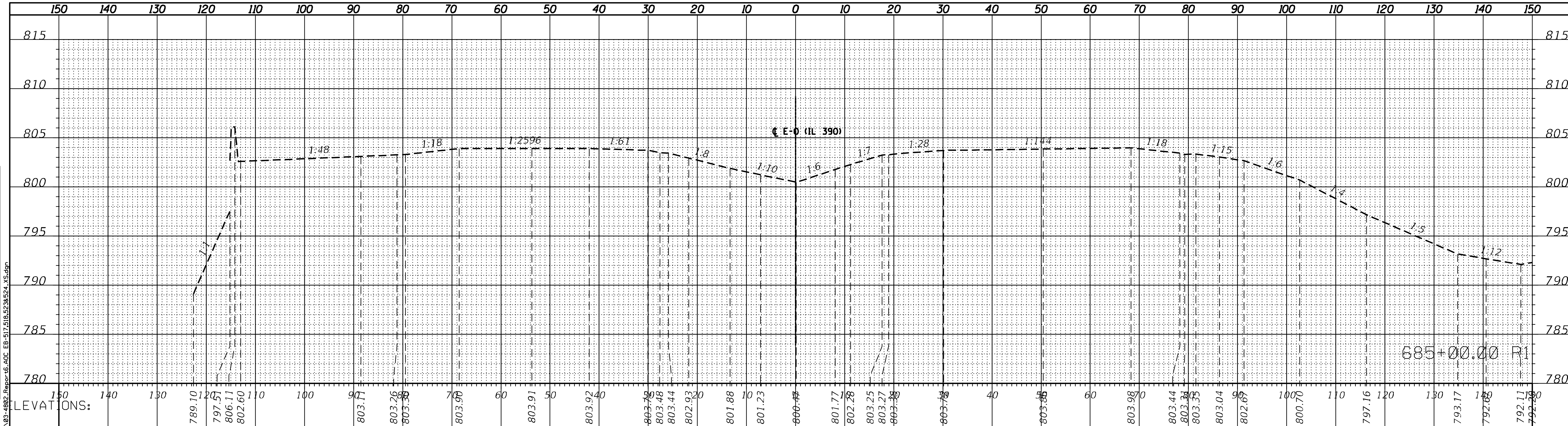

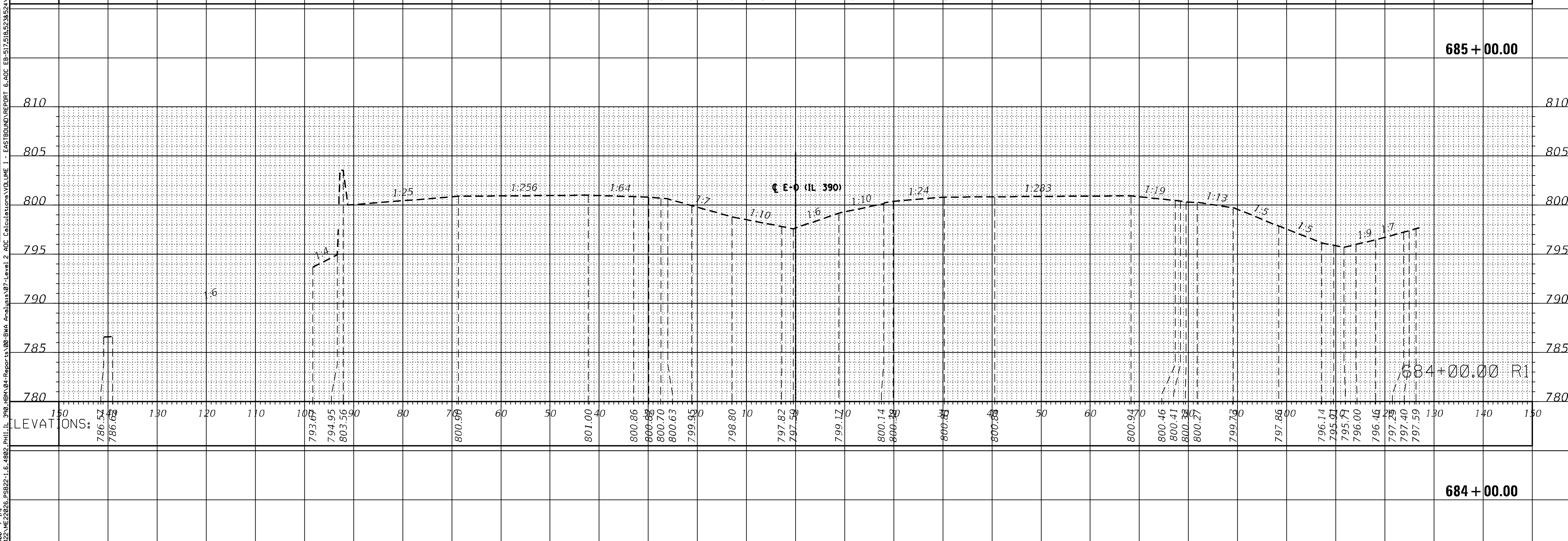

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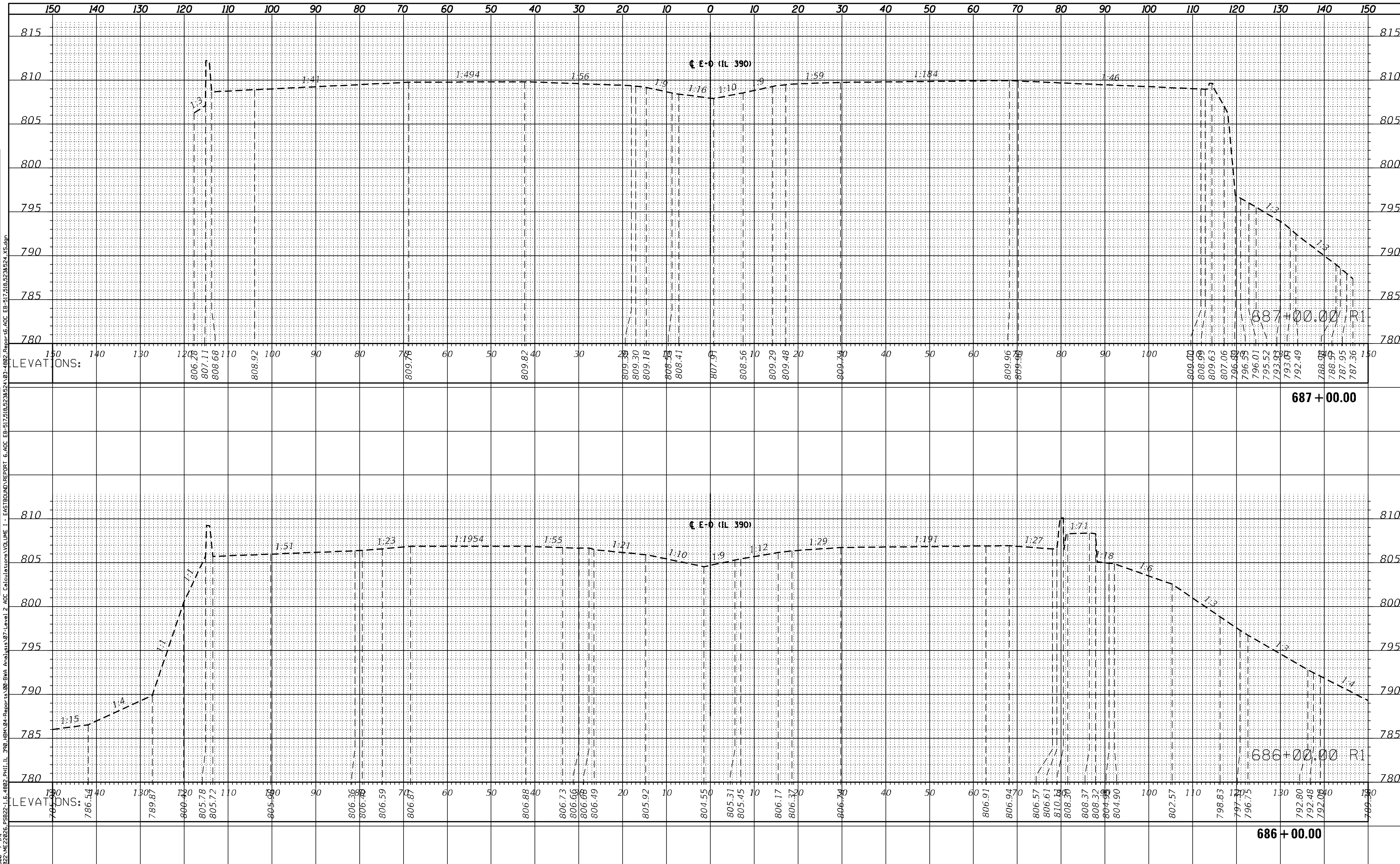

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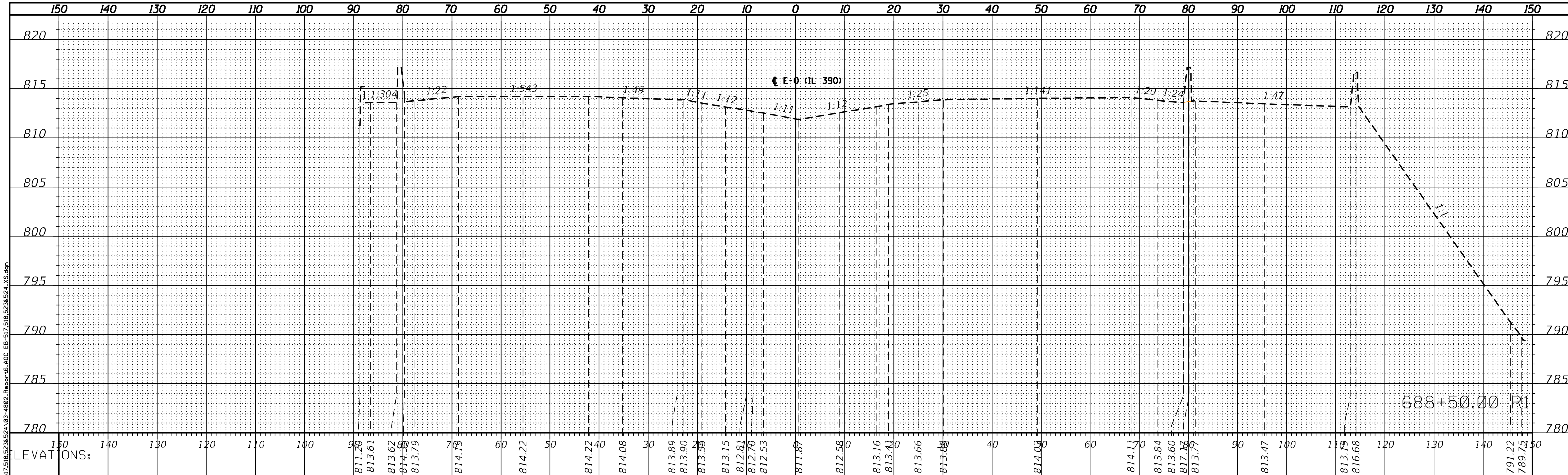

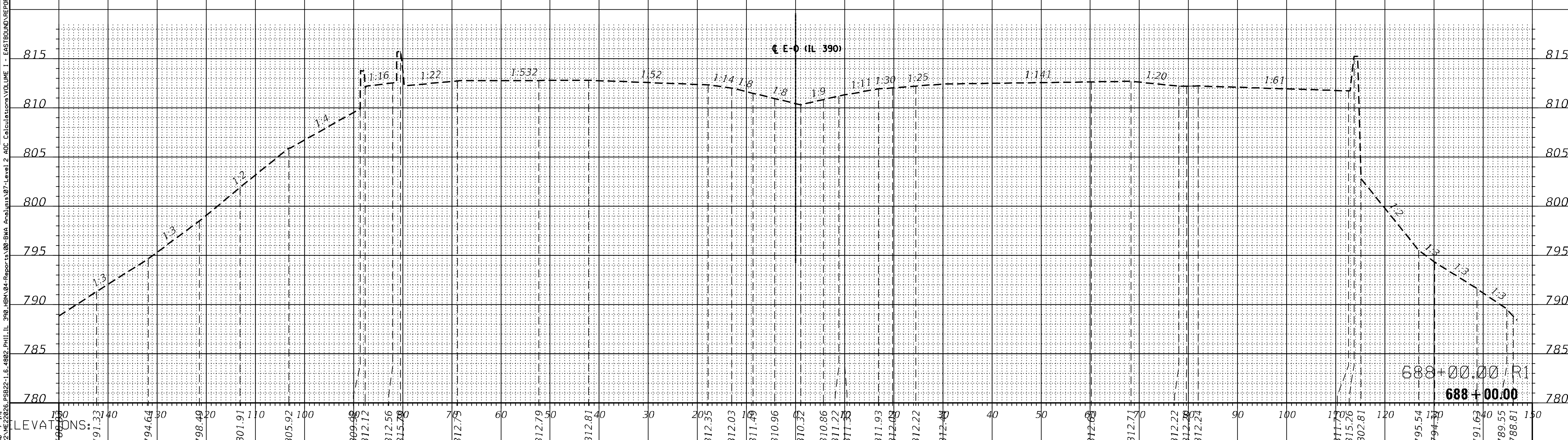

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RECOMMENDATION

REPORT 6 - AOC EB-517, 518, 523 & 524 – EXISTING MONOTUBE FOUNDATIONS

Adding the new proposed 4" WMA overlay on top of the existing Concrete Pavement will reduce the height to the top of the existing MGS guardrail to below 31" and it will not meet the Tollway Standard. Therefore, consider replacing the existing guardrail with the new guardrail system.

1. Install Traffic Barrier Terminal, Type T1 (Special);
2. Install 275.00' Galvanized Steel Plate Beam Guardrail, Type A, 6-Foot Posts to the end of Terminal Type T1.
3. Install the Traffic Barrier Terminal, Type T2 to a downstream end of the Guardrail.

* There are 2 1:15 Tapers within the installation.

Consider adding that the tapers meet the minimum flare rates (14:1) per AASHTO RDG Table 5-9.

* The new BWA Calculated result is yielding the same value when compared to the 2015 BWA submittal. However, both are found to be approximately 135' shorter than the existing current guardrail shown in the Topo.

After checking the area around and upstream of this location. We found there are no other obstacles upstream that need to be shielded, and the guardrail does not need to be at this length. Therefore, install the new guardrail to the length shown in the proposed plan submittal.

REPORT 9

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC EB-550 (Conc. Blunt End) - Report 9

Location AOC EB-551 (Existing Bridge Pier) - Report 9

TABLE OF CONTENTS

DATA SHEET

Location AOC EB-550 Concrete Barrier Blunt End
Location AOC EB-551 Existing Bridge Pier
Mile Post: 7.1

DESCRIPTION OF OBSTACLE

Existing Bridge Pier STA. 716+19.45 to 716+25.55 (Coordinate N 1939964.043, E 1041635.8487)
Conc. Barrier Blunt End STA. 714+22.76 (Coordinate N 1939834.886, E 1041482.2250)

Per Section 5.7.7 Traffic Barrier Guidelines, March 2022, a Level 3 Analysis shall be performed to determine the most cost-effective alternative for the existing bridge pier located within the clear zone. However, relocating the existing bridge pier well outside of the defined clear zone without shielding is not feasible and there is no other alternative that fit better than the existing conditional layout. Therefore, a Level 2 Barrier Warrant Analysis performed for this Area of Concern is to check if the Lenght of Need is meeting the current Tollway Standard.

Existing conditions in this area show the TL-4 single-face median barrier wall that shields the Bridge Pier. If we add an additional 4" on top of the existing surface. The TL-4 single-face height may not meet the 44" tall requirement of the Current Tollway Standard.

Please see articles 5.4 and 5.7.7 of the TBG, which covers Protection of Structures. Some new guidance has been provided recently that addresses bridge piers. When within the clear zone a TL-5 concrete barrier is needed to protect the pier.

DESIGN CONCEPTS

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 12960 (2021), Eastbound I-390

Clear Zone, Lc = 44 ft based on 1:4 V:H or flatter foreslope, from Sta. 712+30 to Sta. 713+00
Clear Zone, Lc = 32 ft based on 1:6 or flatter V:H foreslope from Sta. 713+00 to Sta. 714+00
Clear Zone, Lc = undefined based on 1:3 and higher foreslope from Sta. 714+00 to Sta. 721+00

(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

PHOTOS

Photo 1 : Existing Street view - guardrail & TL4 barrier - Looking East on Elgin O'Hare I-390

Photo 2 : Existing Street view - TL-4 barrier - Looking East on Elgin O'Hare I-390

Photo 3: Existing Pier Foundation on the front slope shielded by TL-4

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

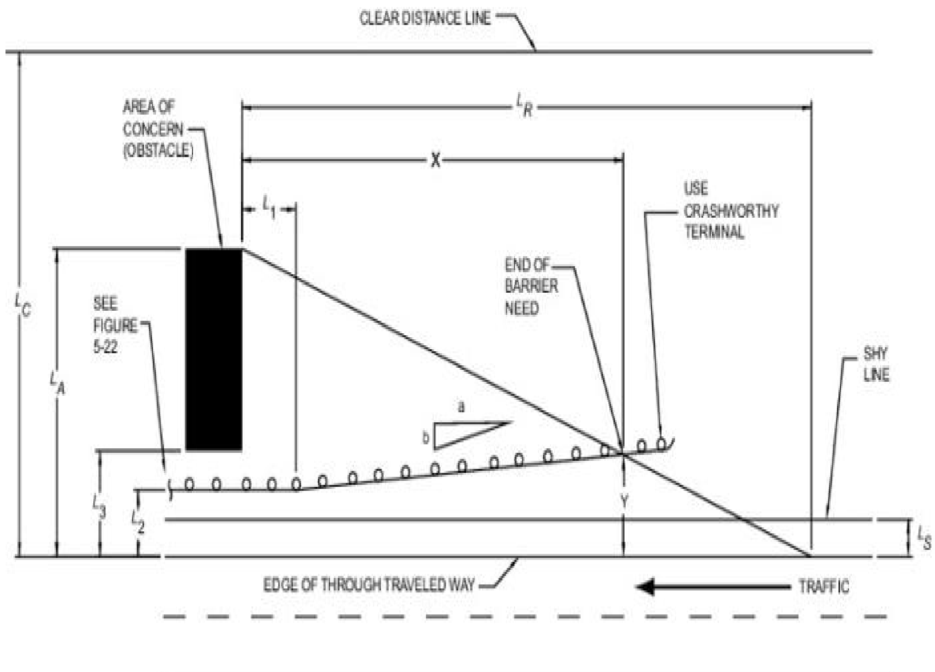


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC EB-550 & EB-551 - Concrete Blunt End and Existing Bridge Pier

Please add L3.

L_A = **31.78'**

Lc = **undefined**

$L_A < L_C$

L3

L_2 = **10.00** 10.00'

L_R = **300.00'**

Y = L2

The existing concrete barrier is not adequate for Protection of Structures, as it is not a TL-5 barrier and would thus need to be replaced.

The first step in this process is to address the Protection of Structures requirements (TL-5 Barrier across the face of the pier plus 60' on the upstream end), then extend a TL-4 barrier out to the PON.

Y = 10.00'

For a concrete barrier, Y can be the back of the barrier (L2+1.58') per article 5.14 of the TBG.

Obstacles:

$ST\_US_{UPStream\_Sta}$	**= 716+19.45**	*(Existing Bridge Pier, AOC EB-551)*	**ST_US = 716+19.45**
$ST\_DS_{DownStream\_Sta}$	**= 716+25.55**		**ST_DS = 716+25.55**
L_{AOC} = Length of AOC =	6.10'		**L_AOC = 6.10'**
$CBLE_{Begin}$	**= 714+22.76**	*(Existing CONC. BLUNT END, AOC EB-550)*	**CBLE_Begin = 714+22.76**
$CBLE_{Begin}$	**= 716+00.00**		**CBLE_End = 716+00.00**
Length of Barrier = L_{CB}		**CB_{End} - CB_{Begin}**	**L_{CB} = 177.24'**

Length of Need - Formula

X = (L_a - Y) / (La / Lr) *(If L_a <=Y, then the value for X =0)*

X = (31.78' - 10.00') / (31.78' / 300.00') **X = 205.60'**

Consider correction above.

This would be the upstream end of the TL-4 barrier.

Point of Need= PON = ST_US - X (Traffic Flow The Opposite Direction)

PON = (716+19.45) - 205.60' **PON = (714+13.85)**

The downstream end of a rigid barrier, shielding an obstacle, should be determined using Condition 2 (25-degree angle).

See condition 2, TBG Figure 5.14)

DS_25* = 34.77' **DS_25* = 34.77'**

Because we have a TL-5 barrier for Protection of Structures, the TL-4 barrier would end at the TL-5 barrier, thus Condition 2 would not be used.

Length of Need = LON = X + L_{AOC} - (DS_25*)

LON = 205.60' + 6.10' - 34.77' **LON = 176.93'**

The existing 42" tall F-shape barrier cannot be used with a 4" shoulder overlay. Please see article 13.1 for a discussion. Consider replacing it with the current TL-4 barrier (Std C3).

Terminals

36.90'

Terminal = Type T6B = T6B = 43.15' (count toward length of need)
Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T6B - T1 - L_{CB}

$L_{guardrail}$ = 176.93' - 43.15' - 34.38' - 177.24' **$L_{Guardrail}$ = -77.84'**

The existing TL-4 Single Face Concrete Barrier Wall remains in place and contributed to the length of need and shields the AOC EB-551

Terminals installation required, Type T1 (Special) and Type T6B only to shield the blunt end of AOC 550

$T6B_{End\_Station}$ = CB_{Begin}

$T6B_{End\_Station}$ = 716+25.55 **$T6B_{End\_Station}$ = (714+22.76)**

This should be the PON from above

$T6B_{Begin\_Station}$ = $T6B_{End}$ - T6B

$T6B_{Begin\_Station}$ (713+79.61) - 43.15' **$T6B_{Begin\_Station}$= (713+79.61)**

36.90'

$T1_{End\_Station}$ = $T6B_{Begin\_Station}$ **$T1_{End\_Station}$ = (713+79.61)**

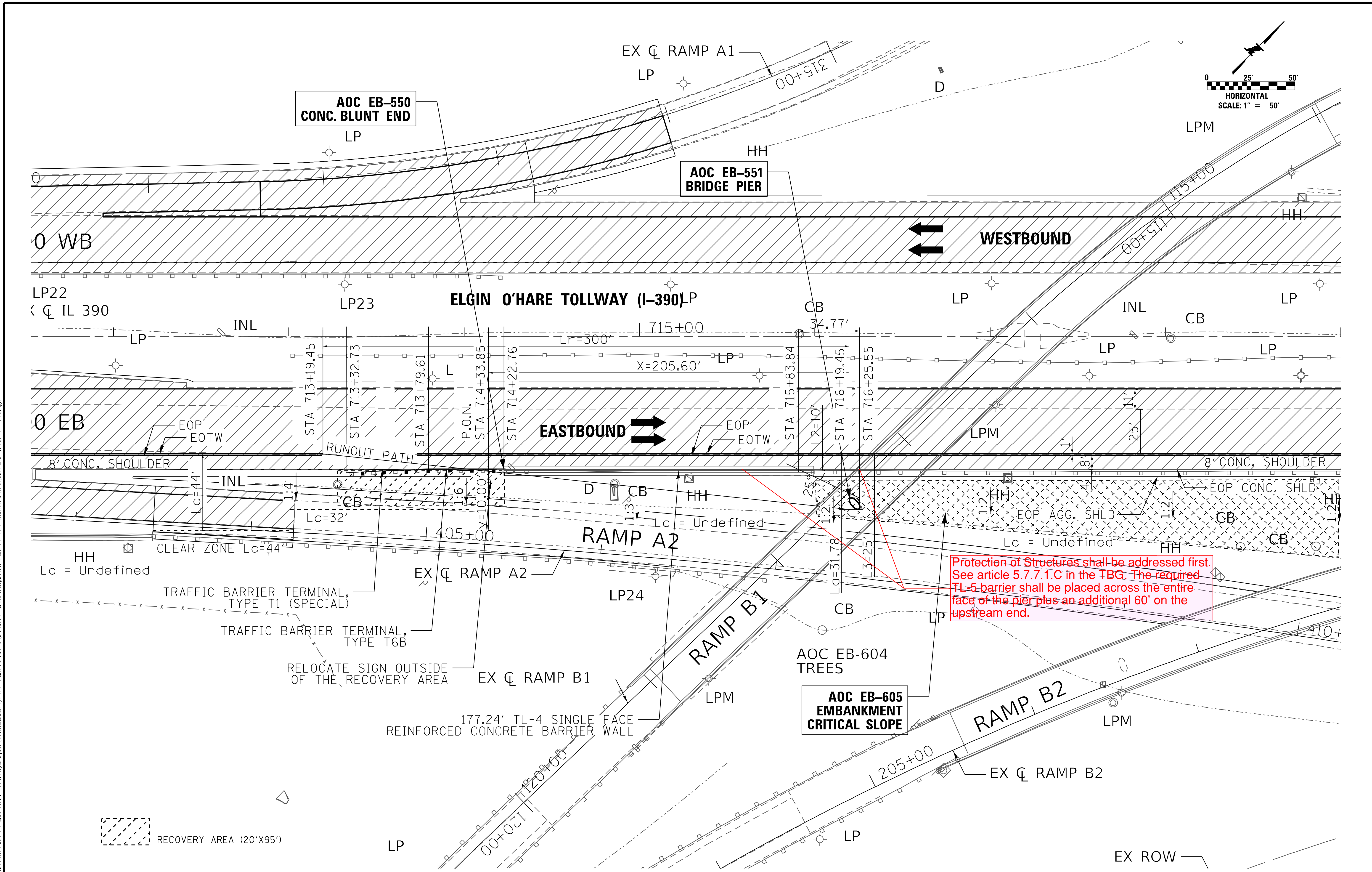
$T1_{Begin\_Station}$ = $T1_{End\_Station}$ - 46.88'

$T1_{Begin\ Station}$ = (713+79.61) - 46.88' **$T1_{Begin\ Station}$ = (713+32.73)**

Barrier Limits Check:
Terminals installation only

Please review and update

The recommendation should be something like:
TL-5 Concrete Barrier (Protection of Structures) Sta.715+59.45 to 716+25.55
TL-4 Concrete Barrier Sta. 714+28.76 (PON) to 715+59.45
T6B Terminal 713+91.86 to 714+28.76
T1(SP) Terminal Sta 713+44.98 to 713+91.86.



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AOC EB-550-551 - SITE PLAN

SHEET NO. EB-RP9.7

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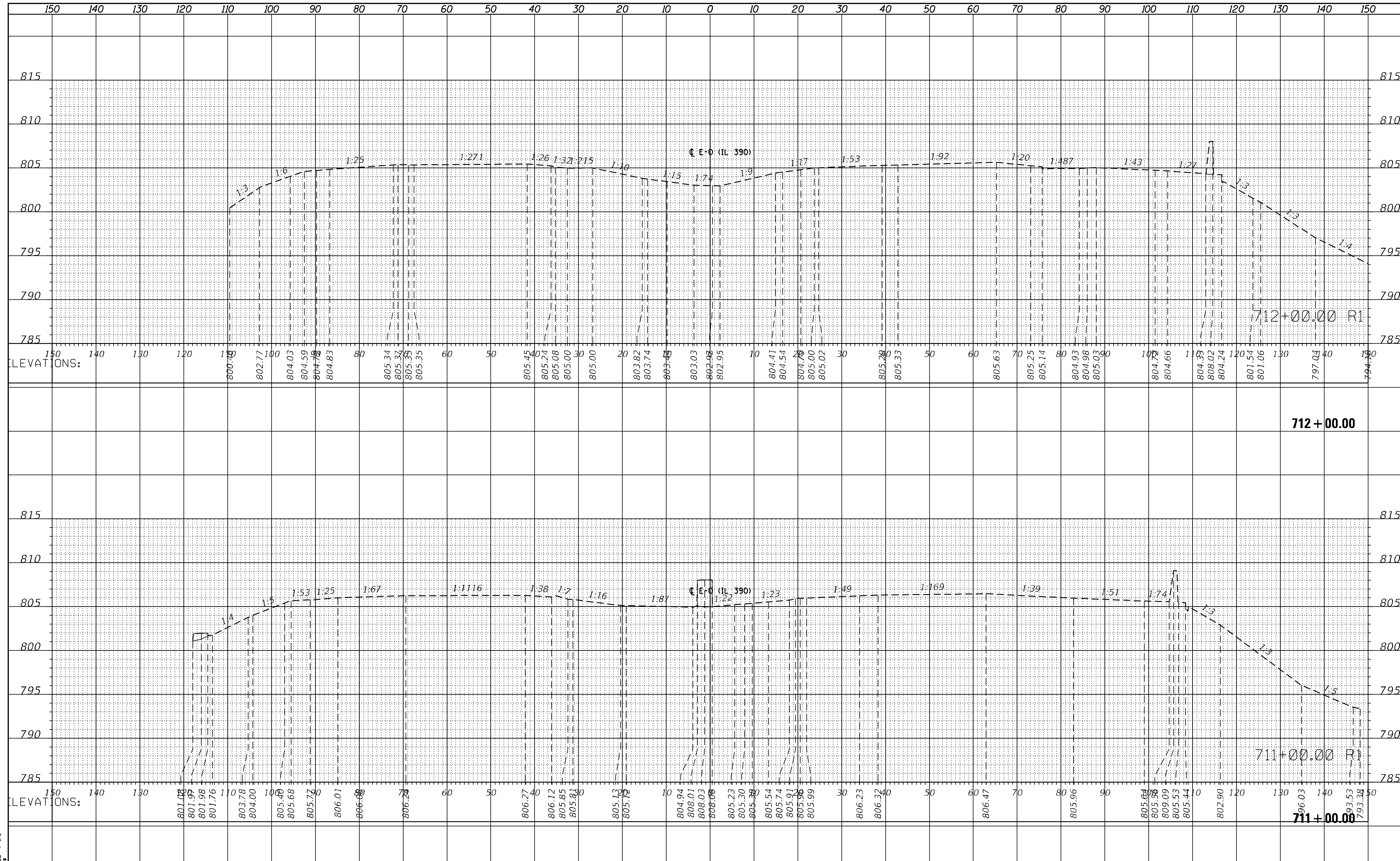

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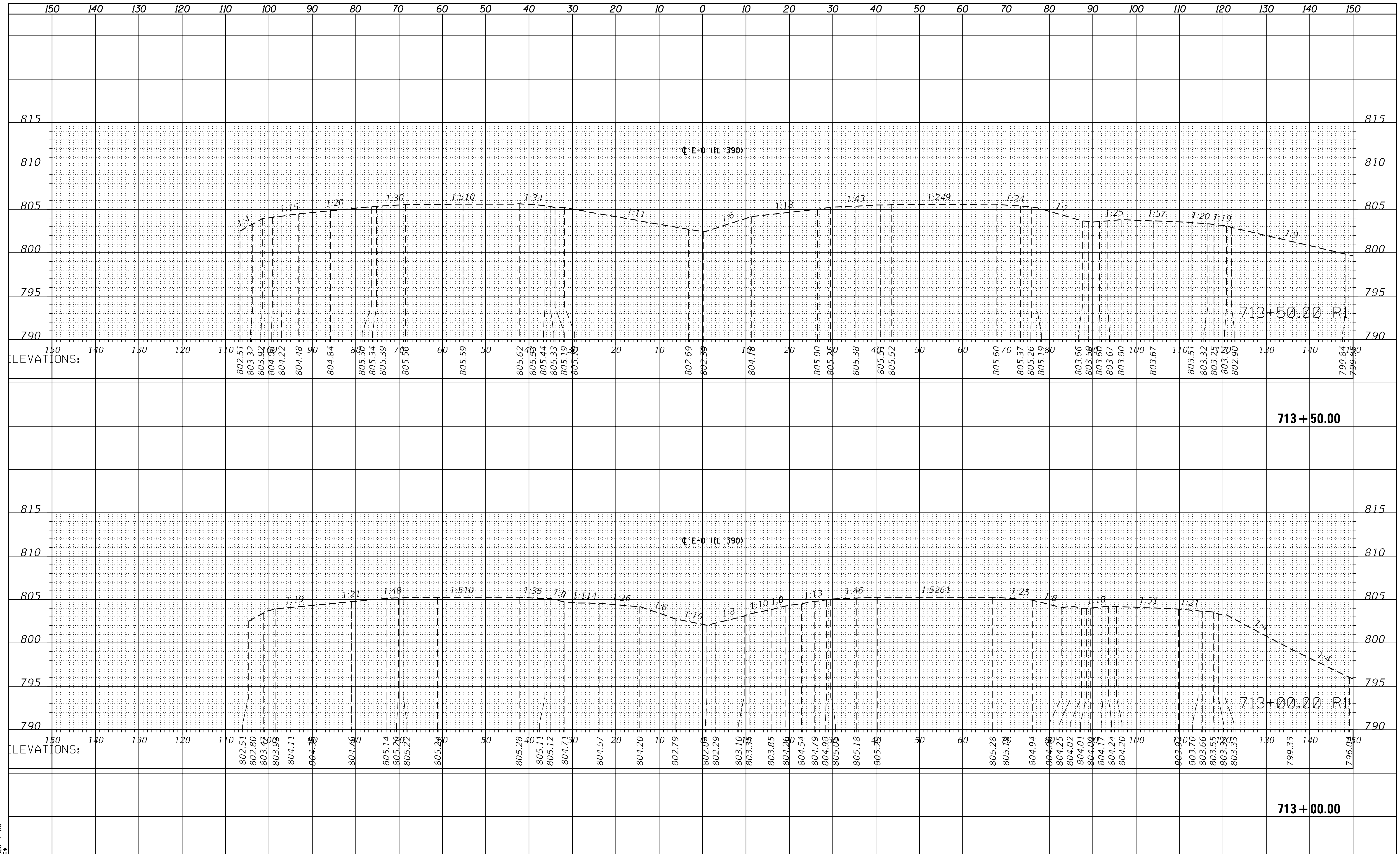

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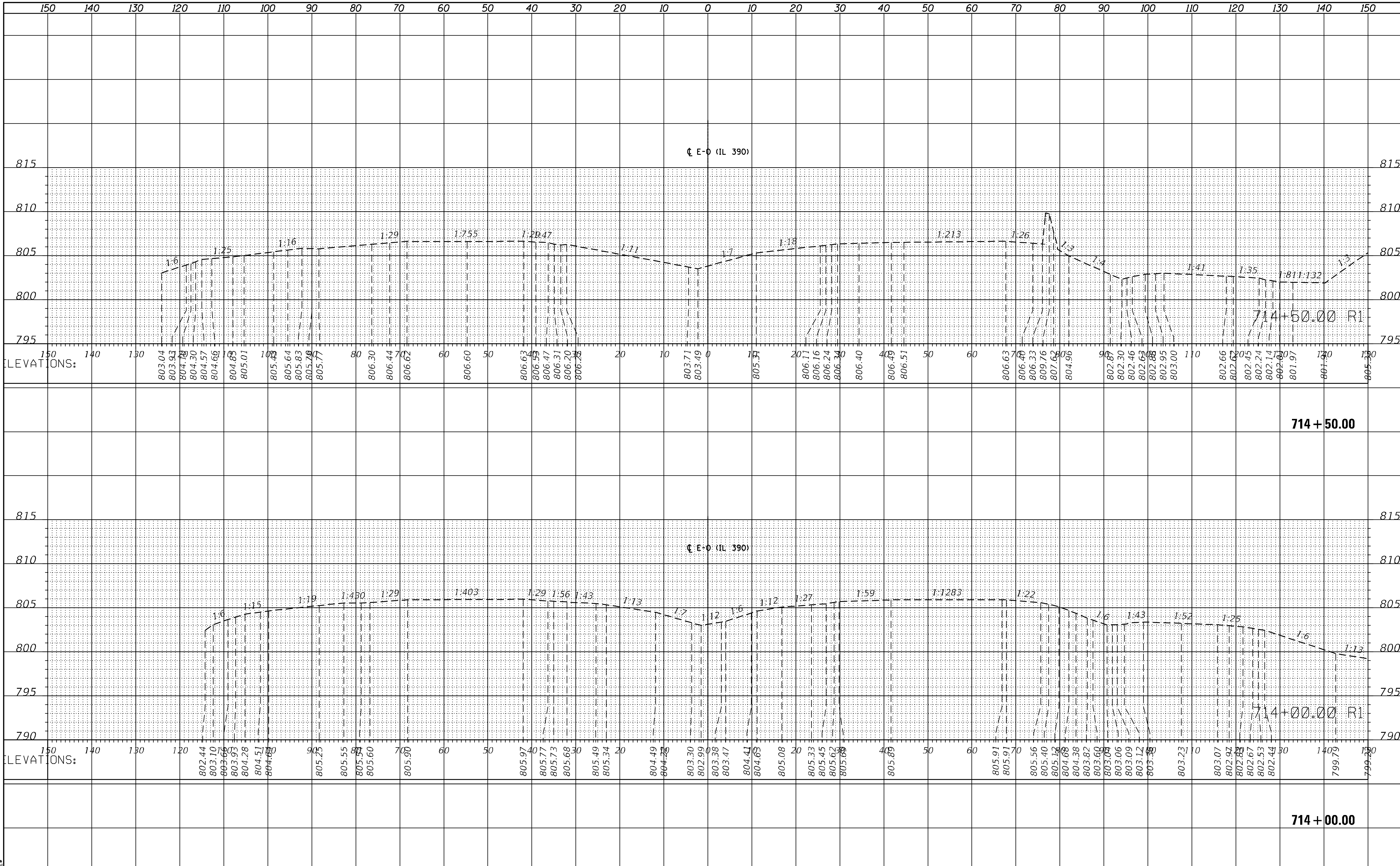

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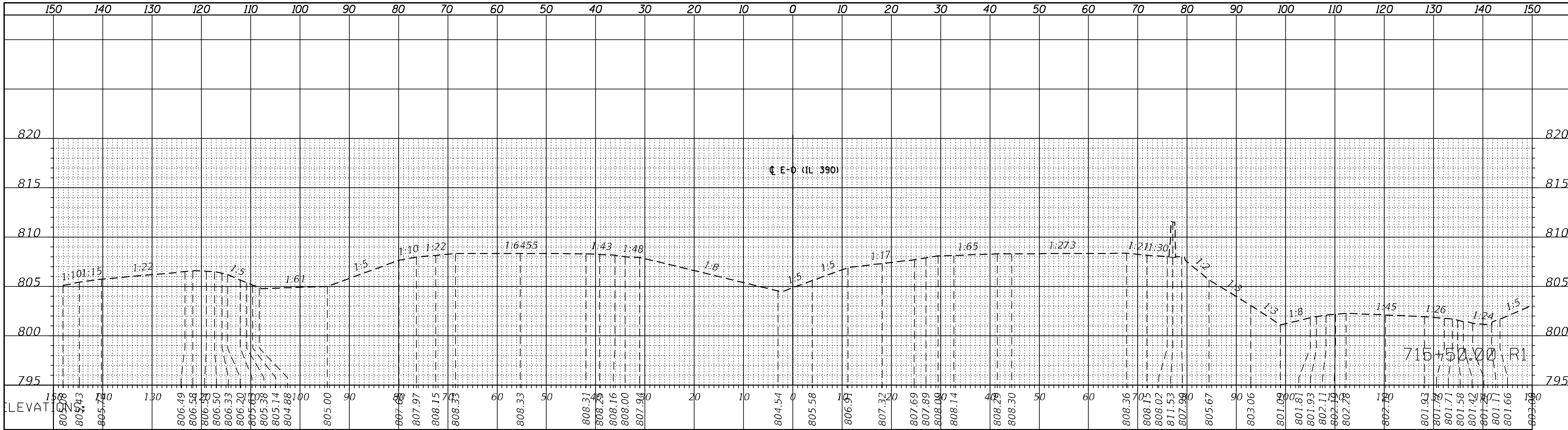

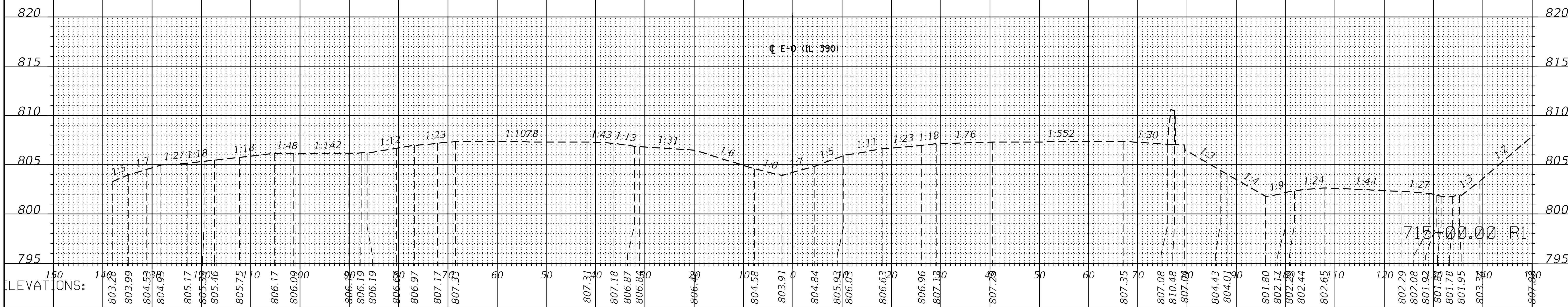

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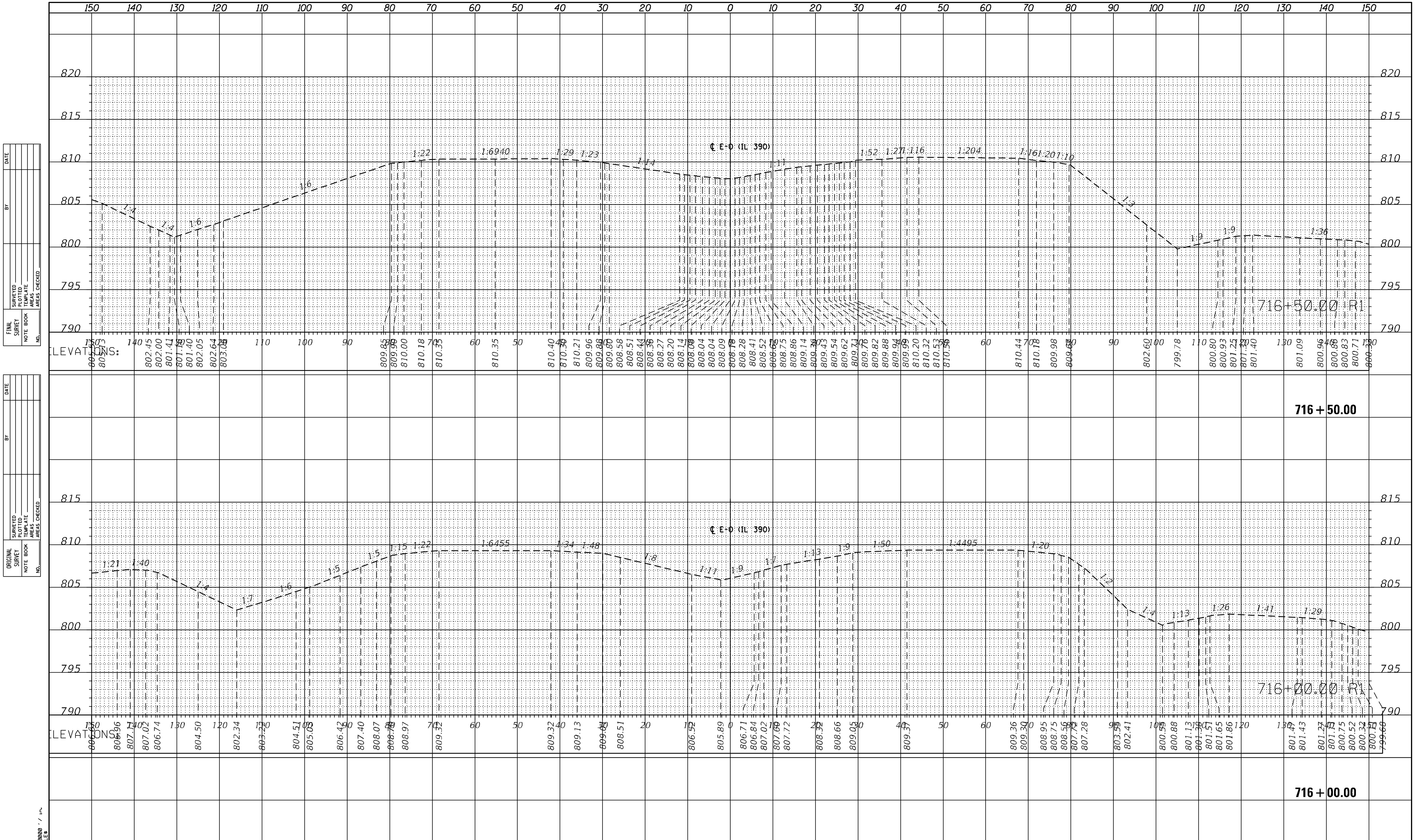

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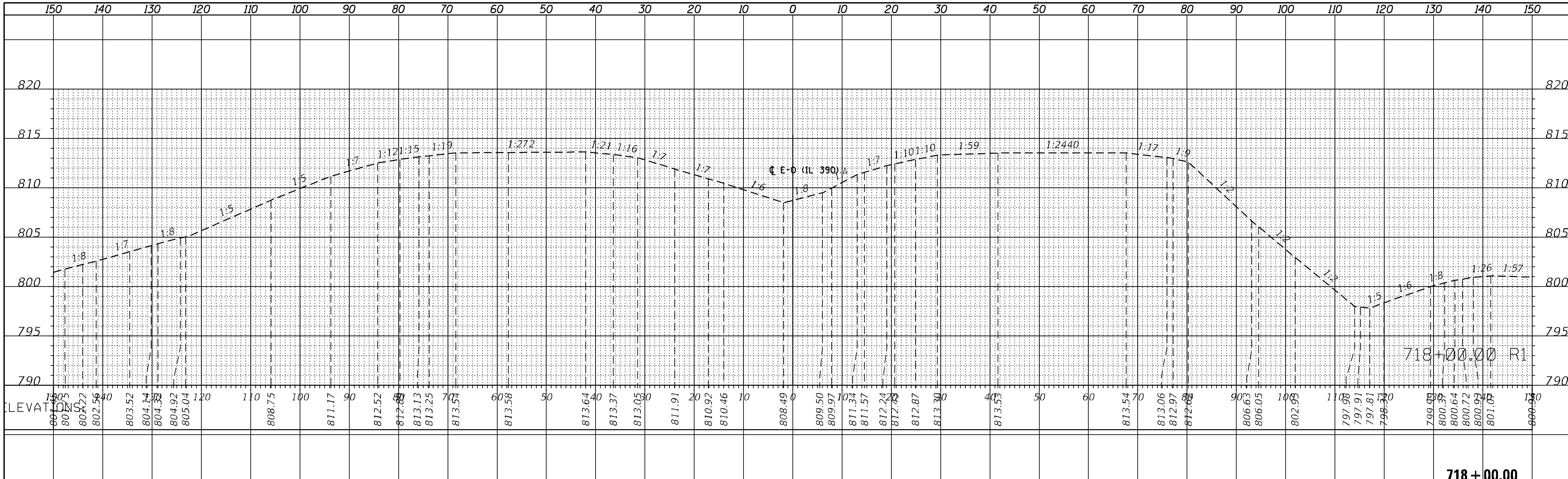

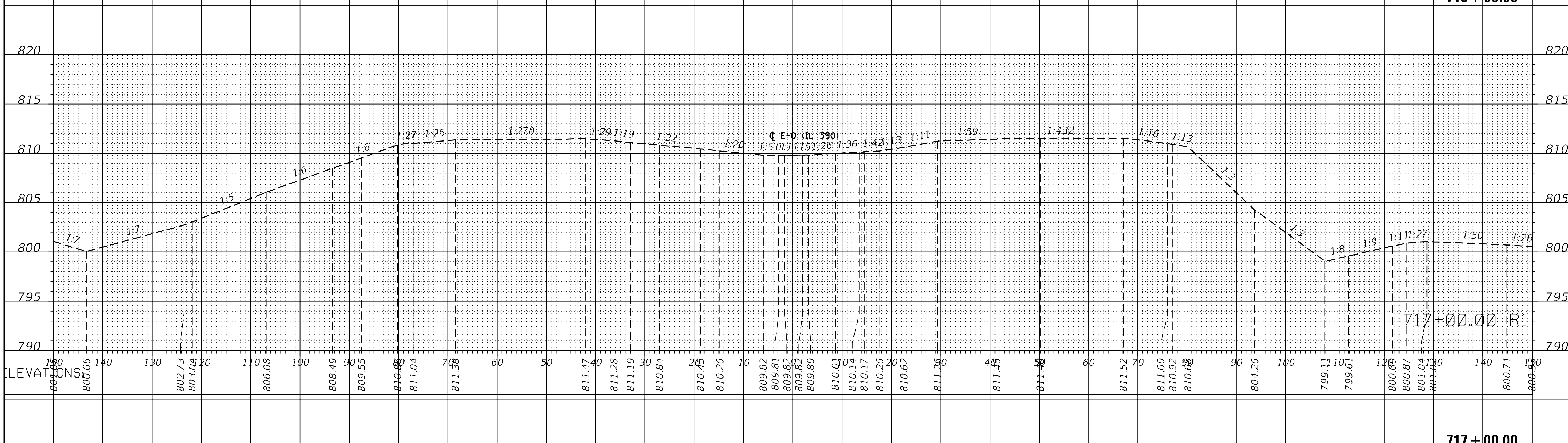

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BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC EB-605 (Embankment Critical Slope) - Report 9

Location AOC EB-605A (Bridge Structure) - Report 9

TABLE OF CONTENTS

DATA SHEET

Location AOC EB-605 (Embankment Critical Slope) (Coordinate: N1939943.519, E1041623.8695)
Location AOC EB-605A (BRIDGE STRUCTURE) (Coordinate: N1940210.289, E1041897.655)
Mile Post: 7.1

DESCRIPTION OF OBSTACLE

Embankment Foreslope Steeper than 1:2 (V:H) STA. 716+00.00 to STA. 720+50.00
Per Section 5.7.1 Traffic Barrier Guidelines, March 2022. However, the Fill Section Height from Sta. 720+50.00 to Sta. 721+00.00 is less than 9.0'; therefore, Barrier is not considered for this Area.

Rip Rap STA. 720+69.45 to STA. 721+11.52
Guardrail extended downstream to Sta. 721+11.52 to cover the riprap in this area.

Consider adding that it is greater than 10' beyond the bottom of the slope.

Bridge Structure STA. 719+87.45 to STA. 720+69.45
No Barrier Warrant analysis for this AOC, shielded by the proposed guardrail for AOC EB-605

Regrade the slope around signpost to 1:6 or flatter to make the existing sign as a traversable element.

DESIGN CONCEPTS

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 16520 (2021), Eastbound I-390

Clear Zone, Lc = 44 ft based on 1:4 V:H or flatter foreslope, from Sta. 712+30 to Sta. 713+00
Clear Zone, Lc = 32 ft based on 1:6 or flatter V:H foreslope from Sta. 713+00 to Sta. 714+00
Clear Zone, Lc = undefined based on 1:3 and higher foreslope from Sta. 714+00 to Sta. 721+00

(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

PHOTOS

Photo 1 : Existing Street view - with guardrail Looking East on Elgin O'Hare I-390 - new proposed to not include any barrier to shield the embankment slope

Photo 2 : Existing Street view - with guardrail Looking East on Elgin O'Hare I-390 -

Photo 3: Existing Embankment Slope was regraded to a flatter slope.

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

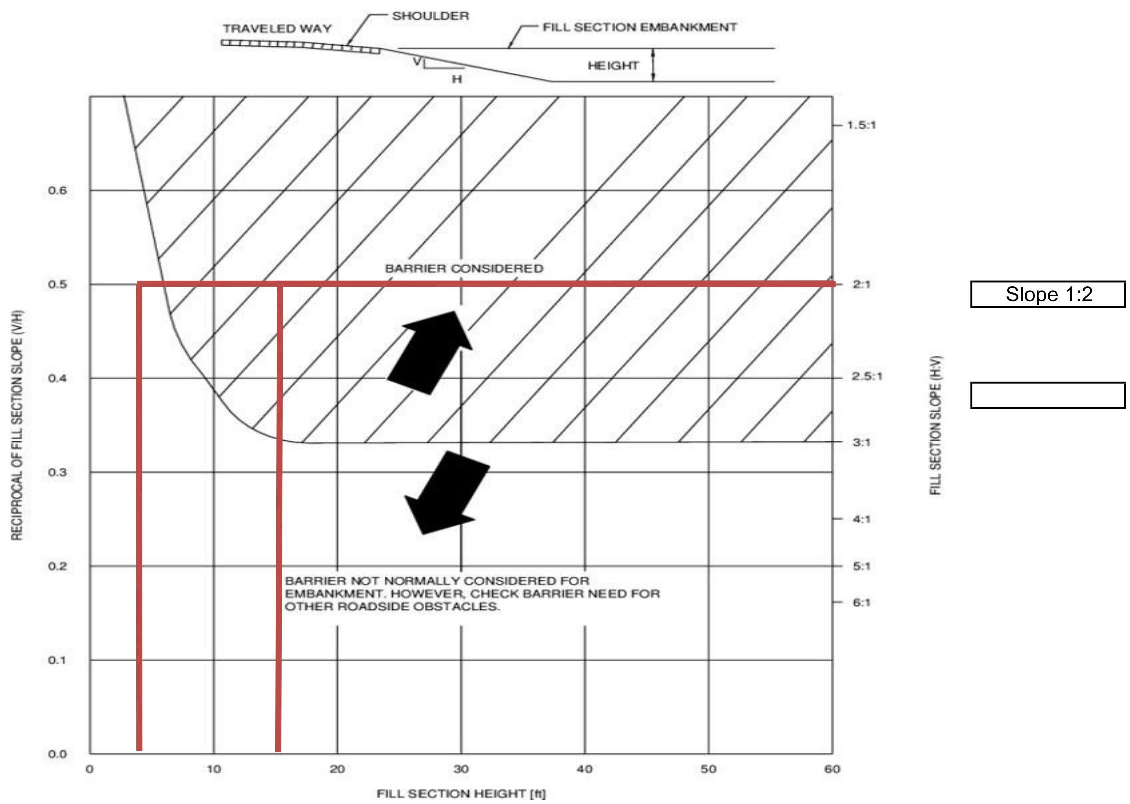


Figure 5-1b. Comparative Barrier Consideration for Embankments (U.S. Customary Units) (15)

15.0' @ Station 720+00.00

3' @ Station 720+50.00

* Consider a 3.0' Fill Section Height and 1:2 Foreslope from Sta. 720+50.00 and downstream
the Length of AOC should end @ Station 720+50.00 to be more conservative

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	**Runout Length (L_R) Given Traffic Volume (ADT) (ft)**			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

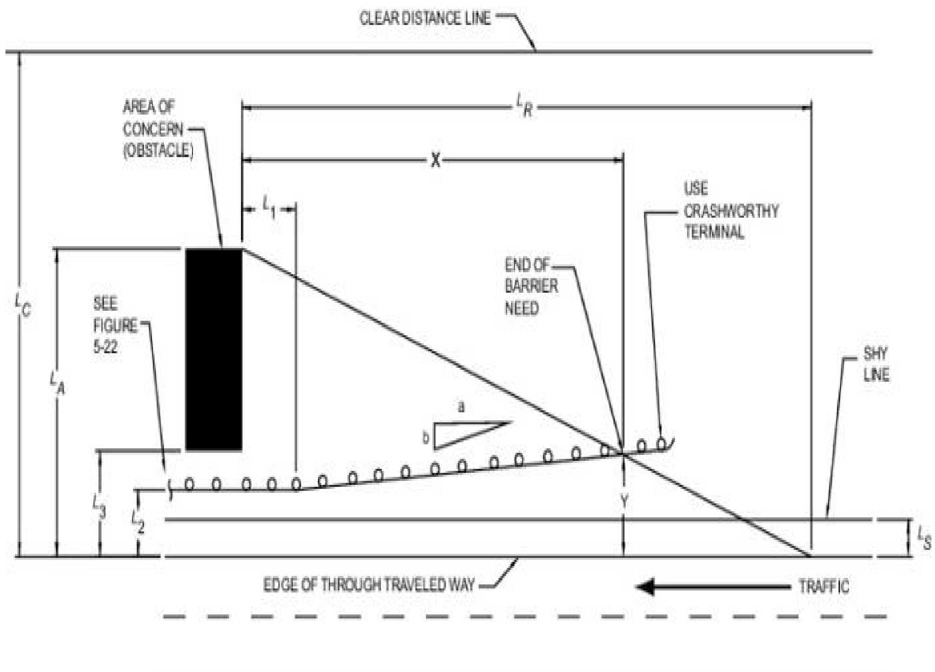


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC EB-605 - Embankment Critical Slope

L_A = **34.58'** *(Measures to bottom of slope) Varies*
Lc = **Undefined** *(Undefined)*

L_2 = **10.00** 10.00'

L_R = **300.00'**

Y = L_2 + 0.69 = 10.00' + 0.69' **Y = 10.69'**

Obstacles:

EMB CS_US $_{UPStream\_St}$ = **716+00.00** *(Embankment Critical slope US, AOC EB-605)* **EMB CS_US = 716+00.00'**
EMB CS_DS $_{DownStream}$ = **720+50.00** *(Embankment Critical slope US, AOC EB-605)* **EMB CS_DS = 720+50.00'**
RipR_DS $_{DownStream\_Sta}$ = **721+11.52** *(RipRap DS)* **RipR_DS = 721+11.52'**
L_{AOC} = Length of AOC = 450.00' **L_AOC = 450.00'**
LAOC + RipR **L_AOC+RR = 511.52'**

Consider with a 3.0' and Less in the Fill Section Height and 1:2 Foreslope
See Figured 5-1b, Barrier not considered for Embankment with Fill less than 9.0'

Length of Need - Formula

X = (L_a - Y) / (La / Lr) *(If L_a <=Y, then the value for X =0)*
X = (34.58' - 10.69') / (34.58' / 300.00') **X = 207.26'**

Point of Need= PON = ST_US - X
PON = (716+00.00) - 207.26' **PON = (713+92.74)**

Length of Need = LON = X + L_{AOC+RR}
LON = 207.26' + 511.52 **LON = 718.78'**

Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)
Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

A portion of the LON is covered by the TL-4/5 barrier from the previous analysis.

$L_{guardrail}$ = LON - T1
$L_{guardrail}$ = 718.78' - 34.38' $L_{Guardrail}$ = **684.40'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) $L_{Guardrail\ R}$ = **687.50'**

Guardrail 9' length should be used for slopes steeper than 1:3 fill height greater than 9'

It looks like you might need to break this up into two separate runs, one on each end of the concrete barrier.

$T2_{End\_Station}$ = RipR_DS + T2
$T2_{End\_Station}$ = (721+11.52) + (12.50') **$T2_{End\_Station}$ = (721+24.02)**
$T2_{Begin\_Station}$ = (721+24.02) - (12.50') **$T2_{Begin\_Station}$ = (721+11.52)**

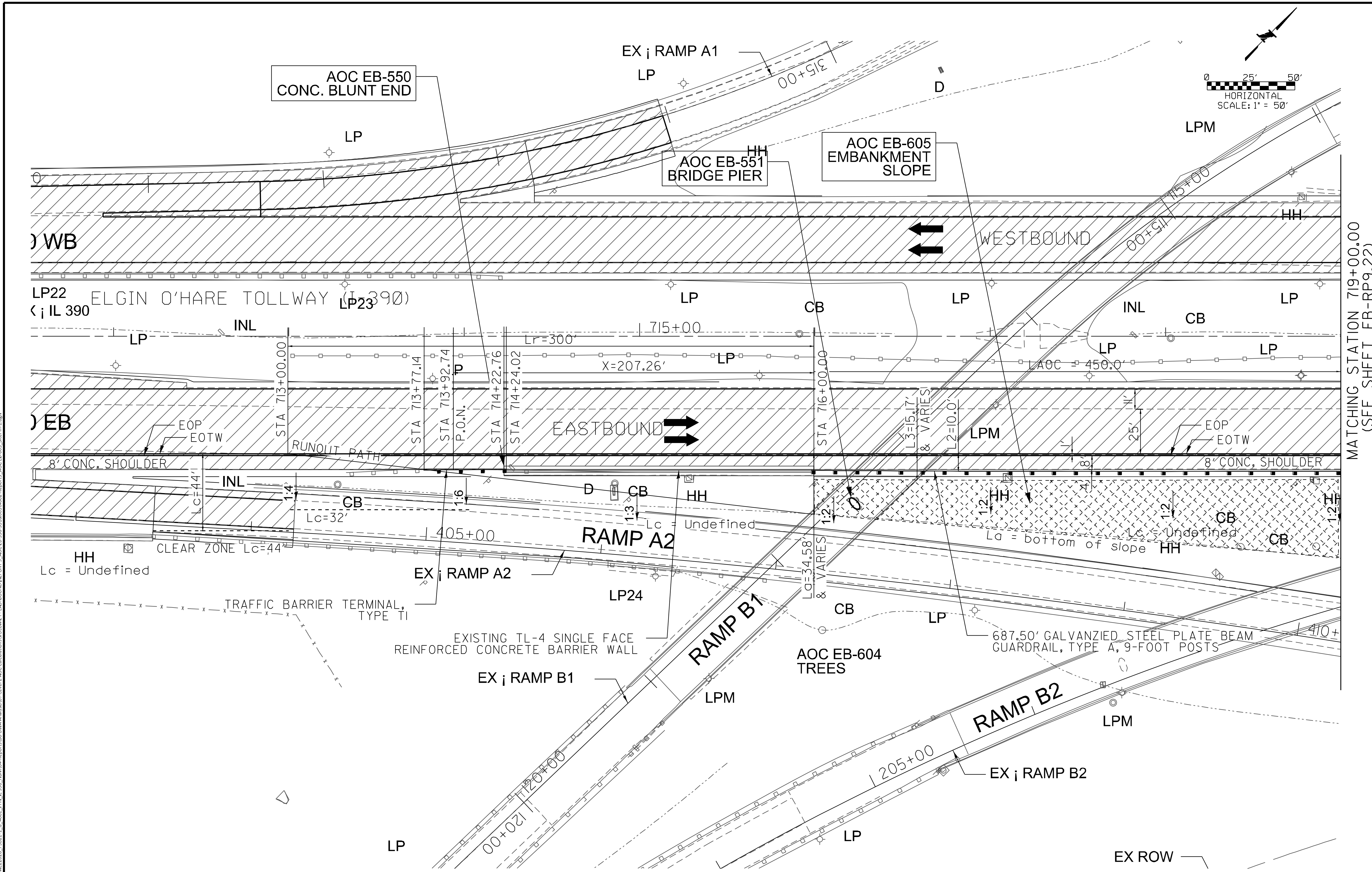
+ 25'

$GR_{End\_Station}$ = $T2_{Begin\_Station}$ **$GR_{End\ Station}$ = (721+11.52)**
$GR_{Begin\_Station}$ = $GR_{End\ Station}$ - $L_{Guardrail, R}$
$GR_{Begin\_Station}$= (721+11.52) - 687.50' **$GR_{Begin\_Station}$= (714+24.02)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (714+24.02)**
T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ - 46.88'
T1 $_{Begin\_Station}$ = (714+24.02) - 46.88' **T1 $_{Begin\_Station}$ = (713+77.14)**

Barrier Limits Check:

12.5' < PON - T1 < 25'
12.5' < (713+92.74) - (713+77.14) < 25'
12.5' < 15.60' < 25' **OK**



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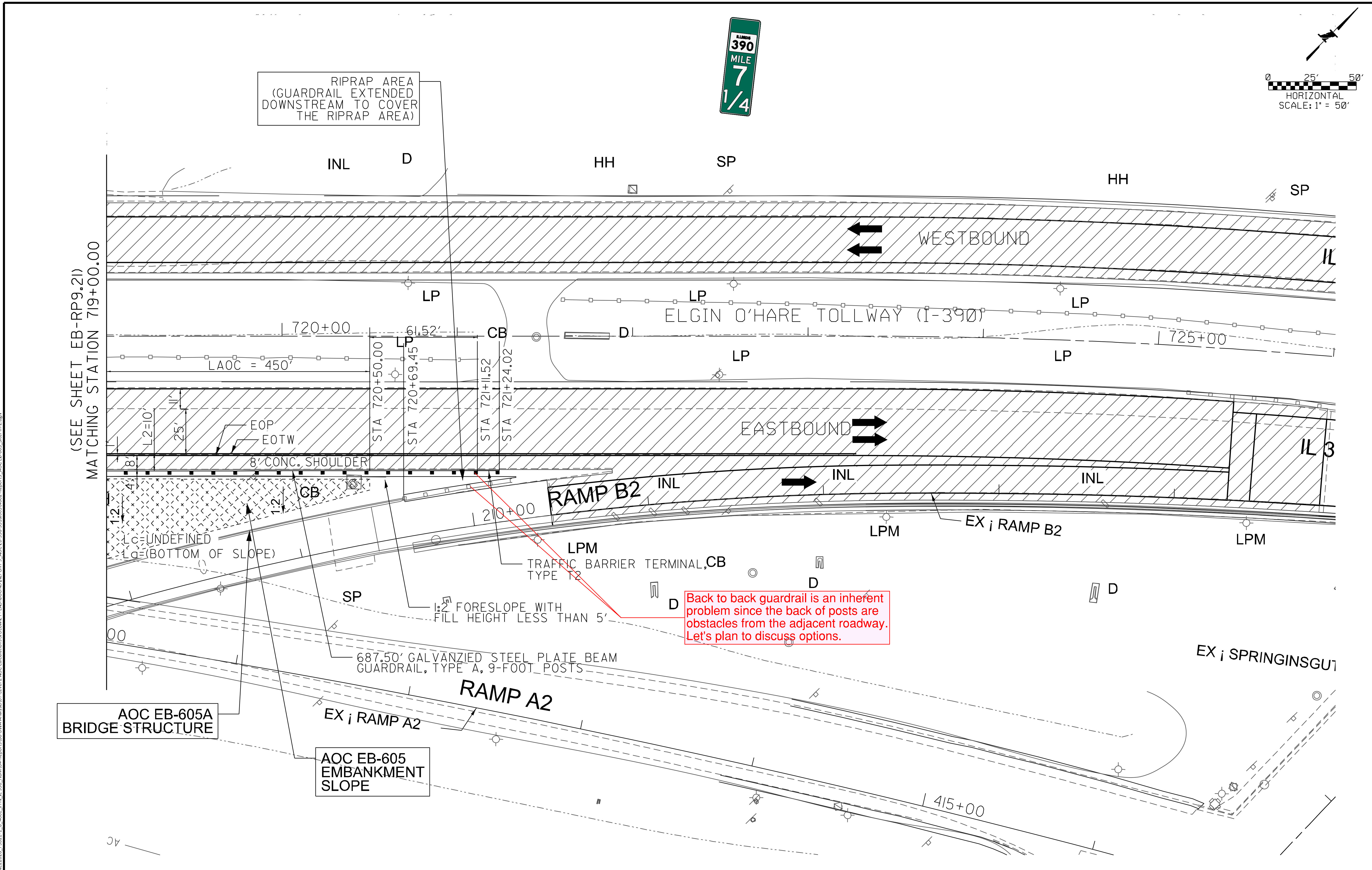

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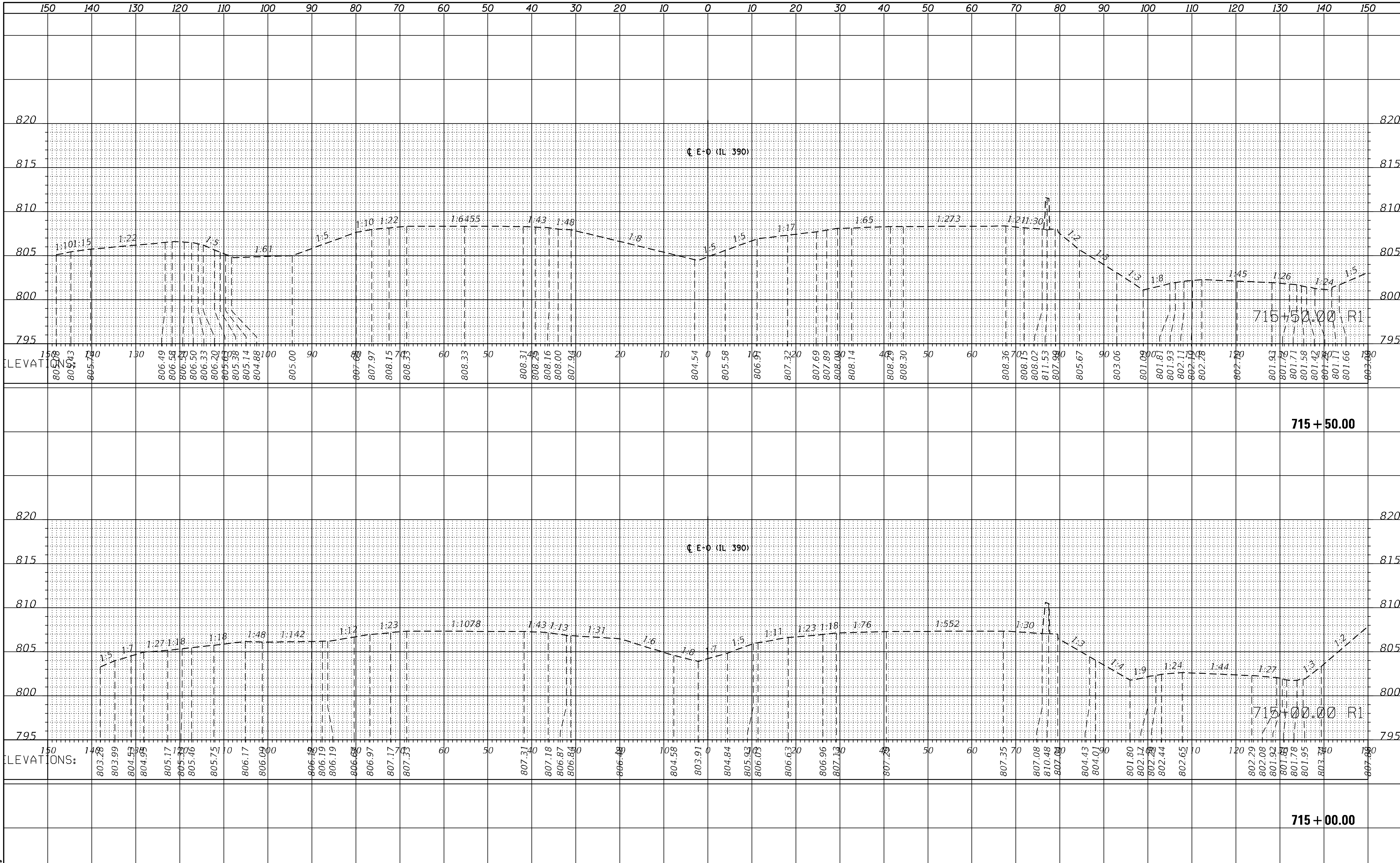

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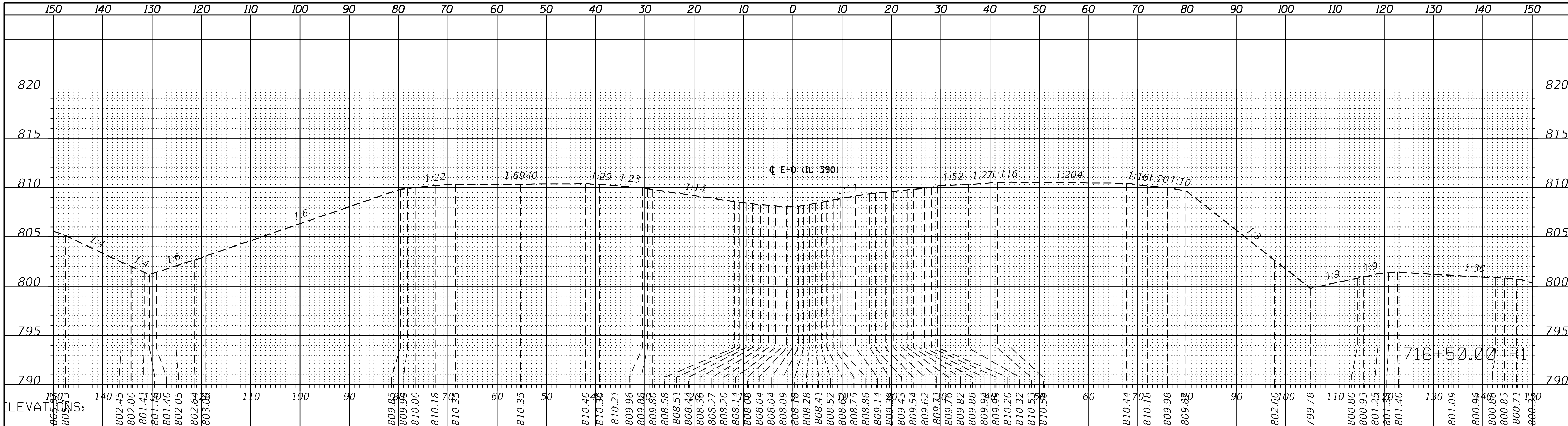
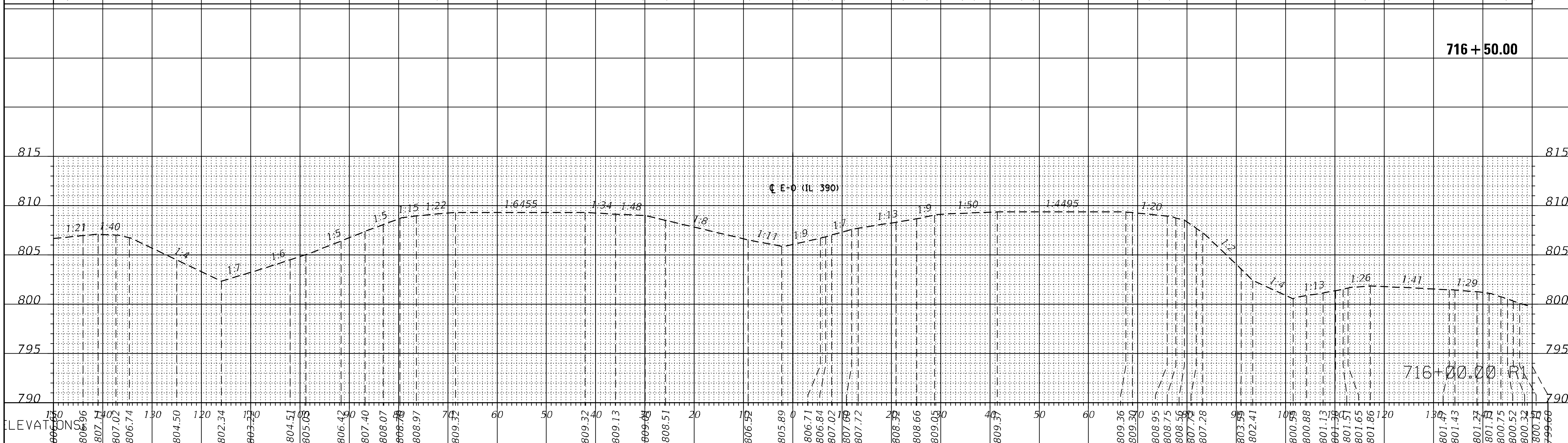


716 + 50.00



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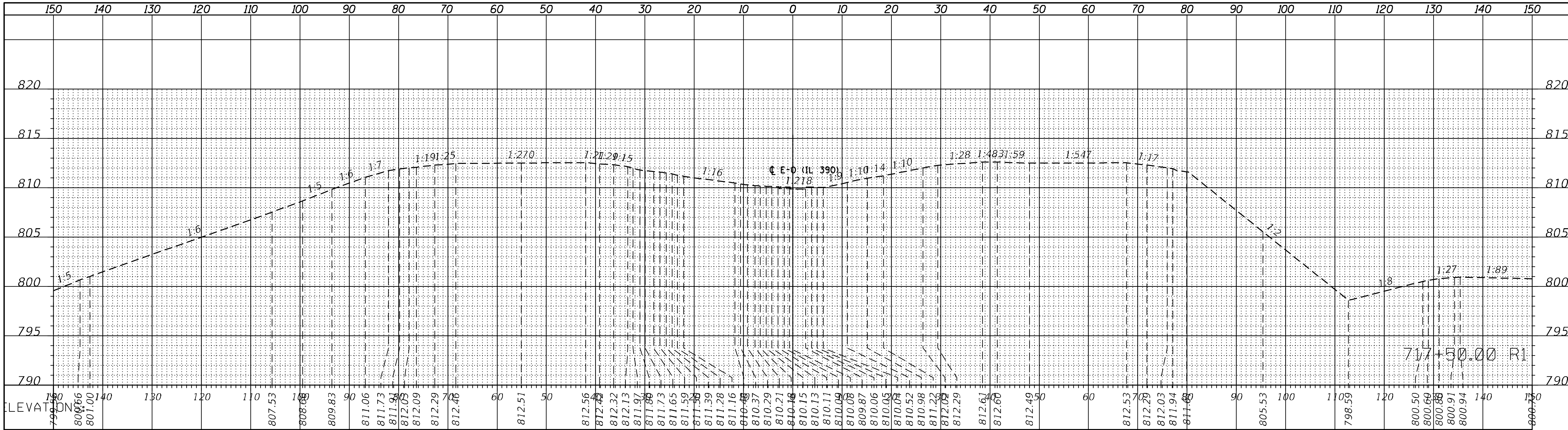

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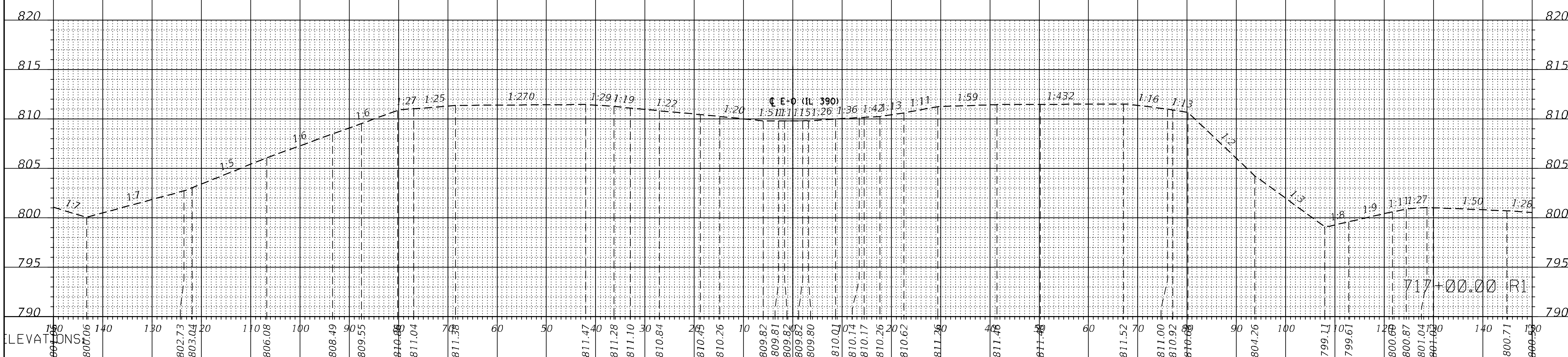

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REPORT 9
AOC - EB-605

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lnguyen
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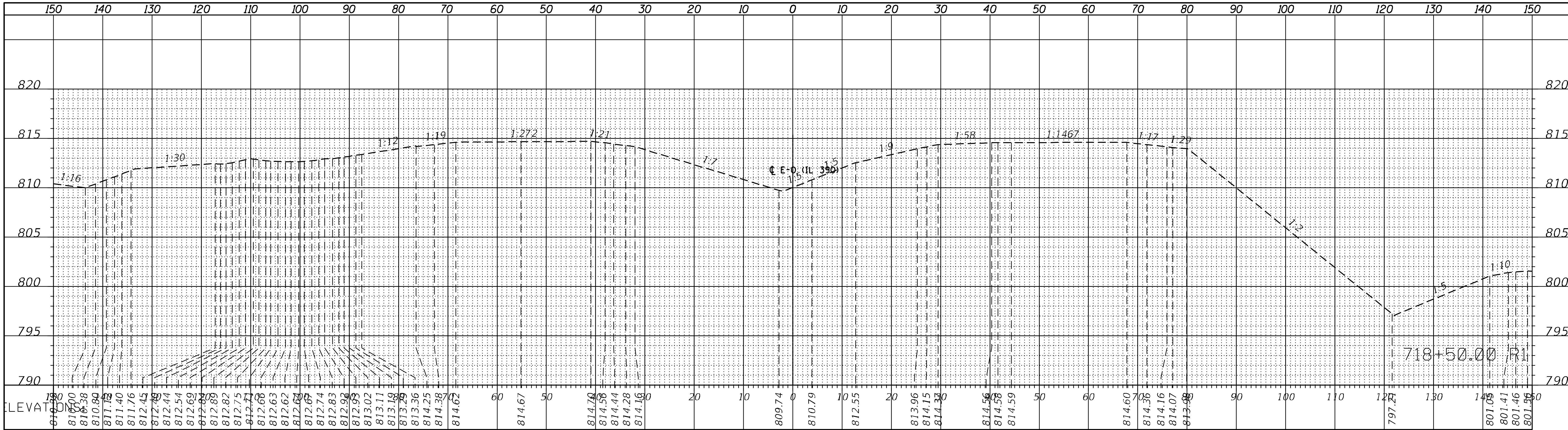

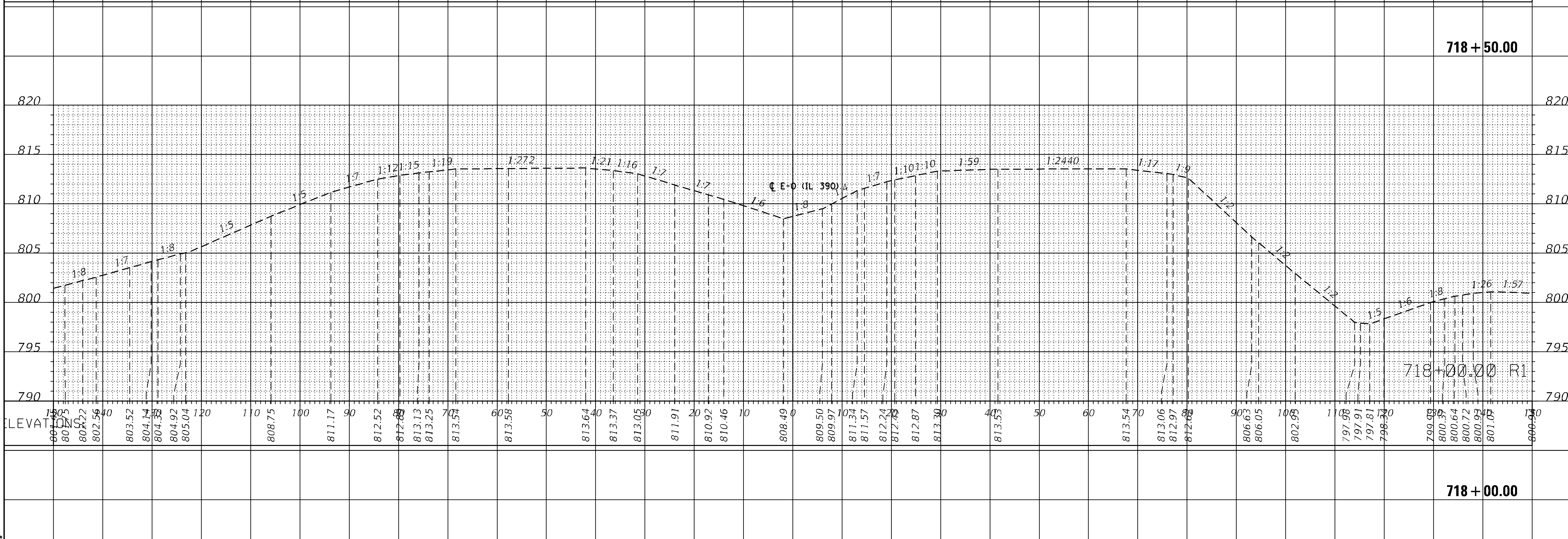

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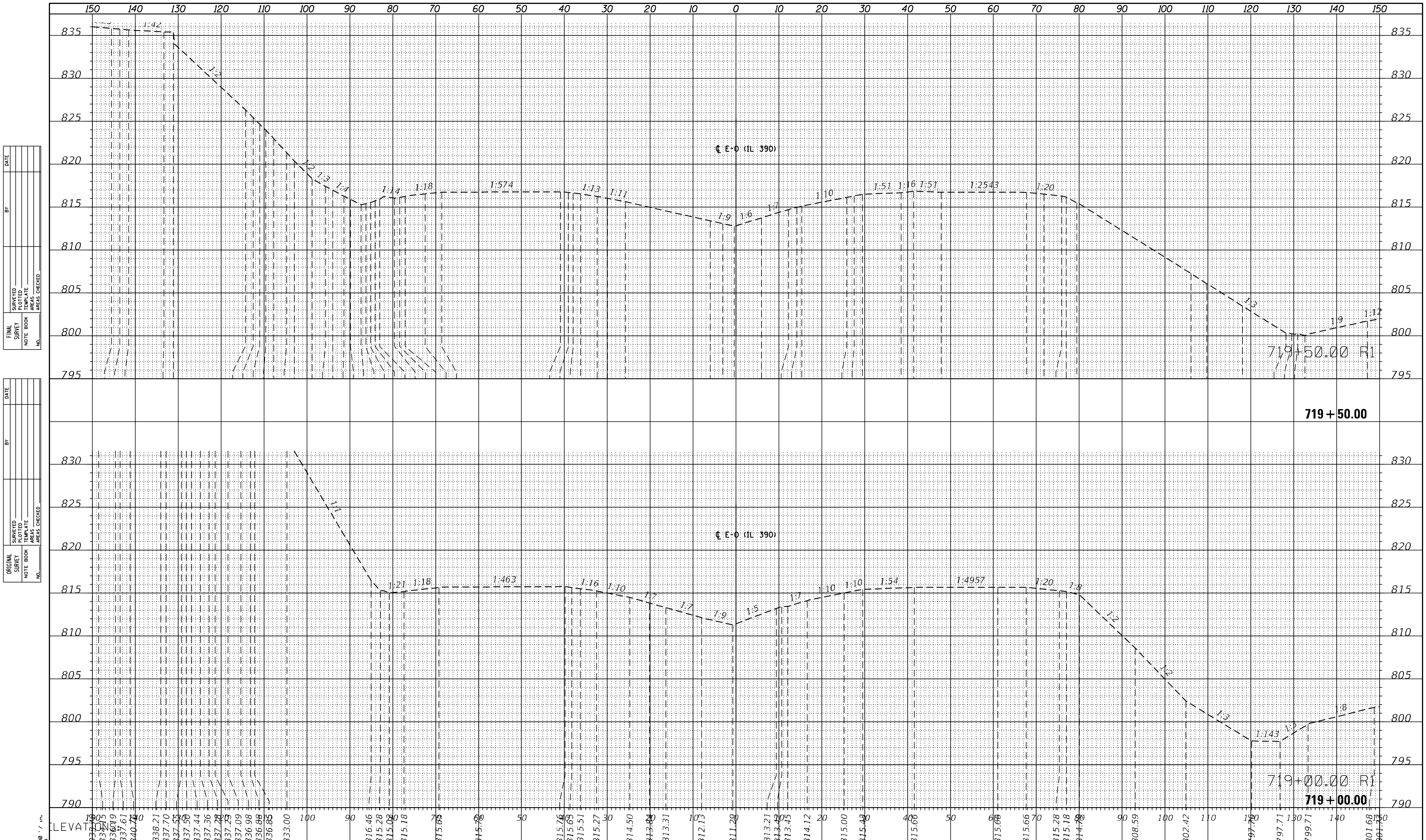

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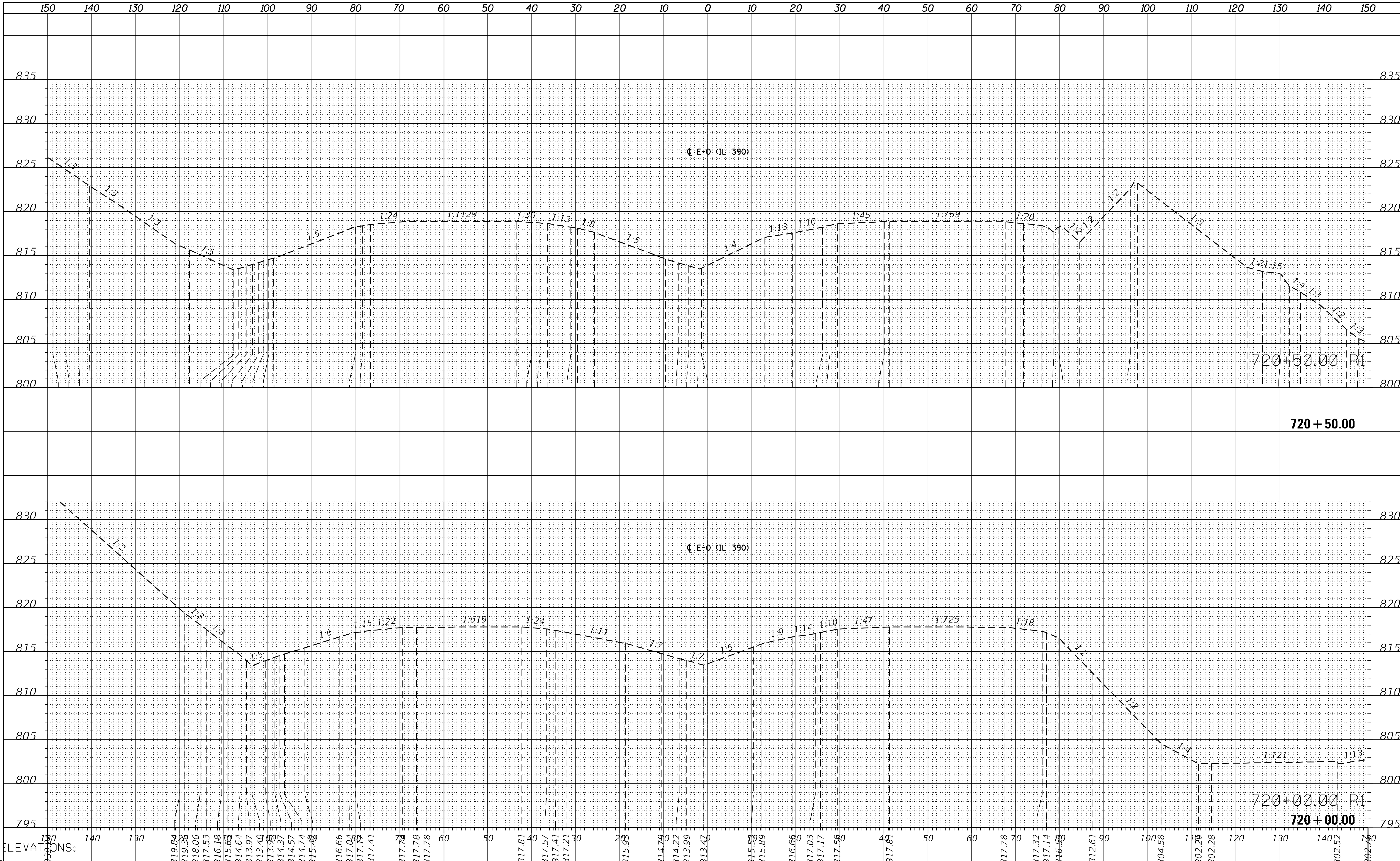

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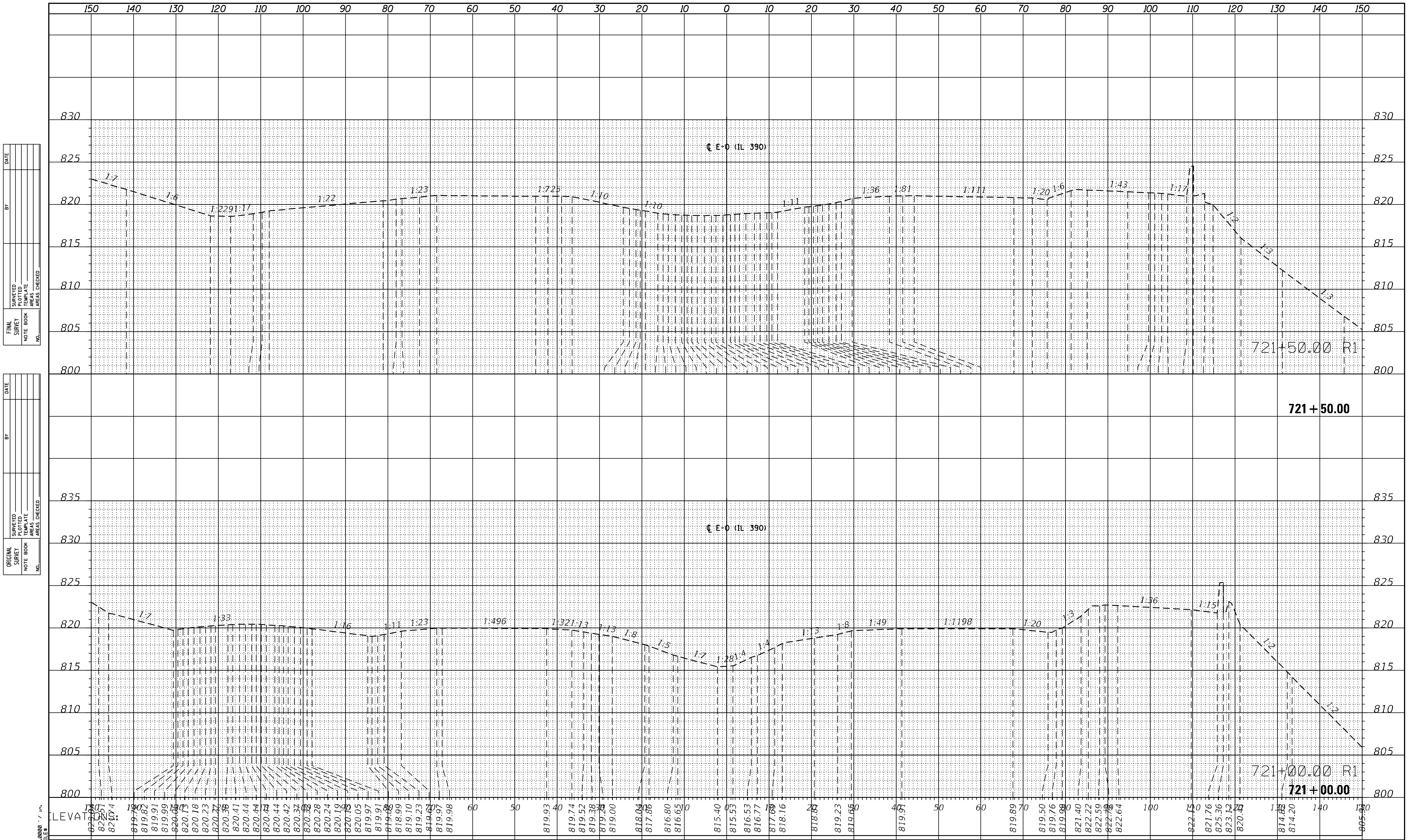

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REPORT 9
AOC # EB-605

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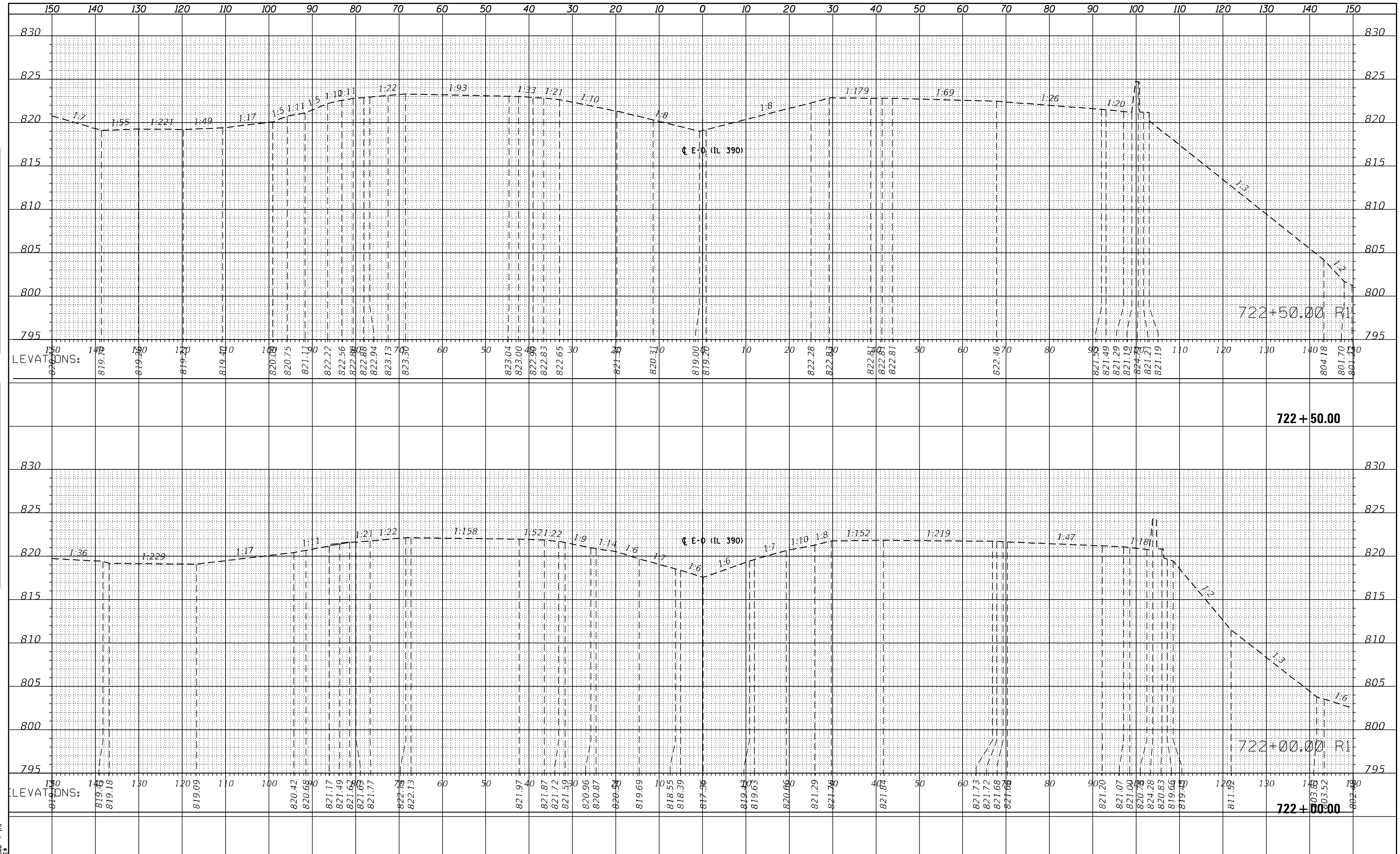

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REPORT 9
AOC * EB-605

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BARRIER WARRANTS

Location AOC EB-550, EB-551 & EB-605 - REPORT 9

Overall Barrier Limits Determination

Upstream

The bridge pier analysis AOC EB-551 governs the upstream end and installs Traffic Barrier Terminal Type T1 (Special) and Type T6B to the blunt end of the single face concrete barrier.

Downstream

The new guardrail limits below are calculated for the downstream end of the concrete barrier wall to shield the remaining embankment obstacle.

Guardrail extended downstream to Sta. 721+11.52 to cover the riprap in this area.

Please coordinate with EB-551 analysis.

Obstacles:

$CB_{\_End\_Station}$ =	**= 716+00.00**	*(Concrete Barrier End Station)*	**CB_End Sta = 716+00.00**
EMB $CS\_US_{\_UPStream\_Sta}$	**= 716+00.00**	*(Embankment Critical slope US, AOC EB-605)*	**EMB CS_US = 716+00.00**
EMB $CS\_DS_{\_DownStream\_Sta}$	**= 720+50.00**	*(Embankment Critical slope US, AOC EB-605)*	**EMB CS_DS = 720+50.00**
$RipR\_DS_{\_DownStream\_Sta}$	**= 721+11.52**	*(RipRap DS)*	**RipR_DS = 721+11.52**
L_{AOC} = Length of AOC = 450.00'			**L_AOC = 450.00'**
LAOC + RipR			**L_AOC+RR = 511.52'**

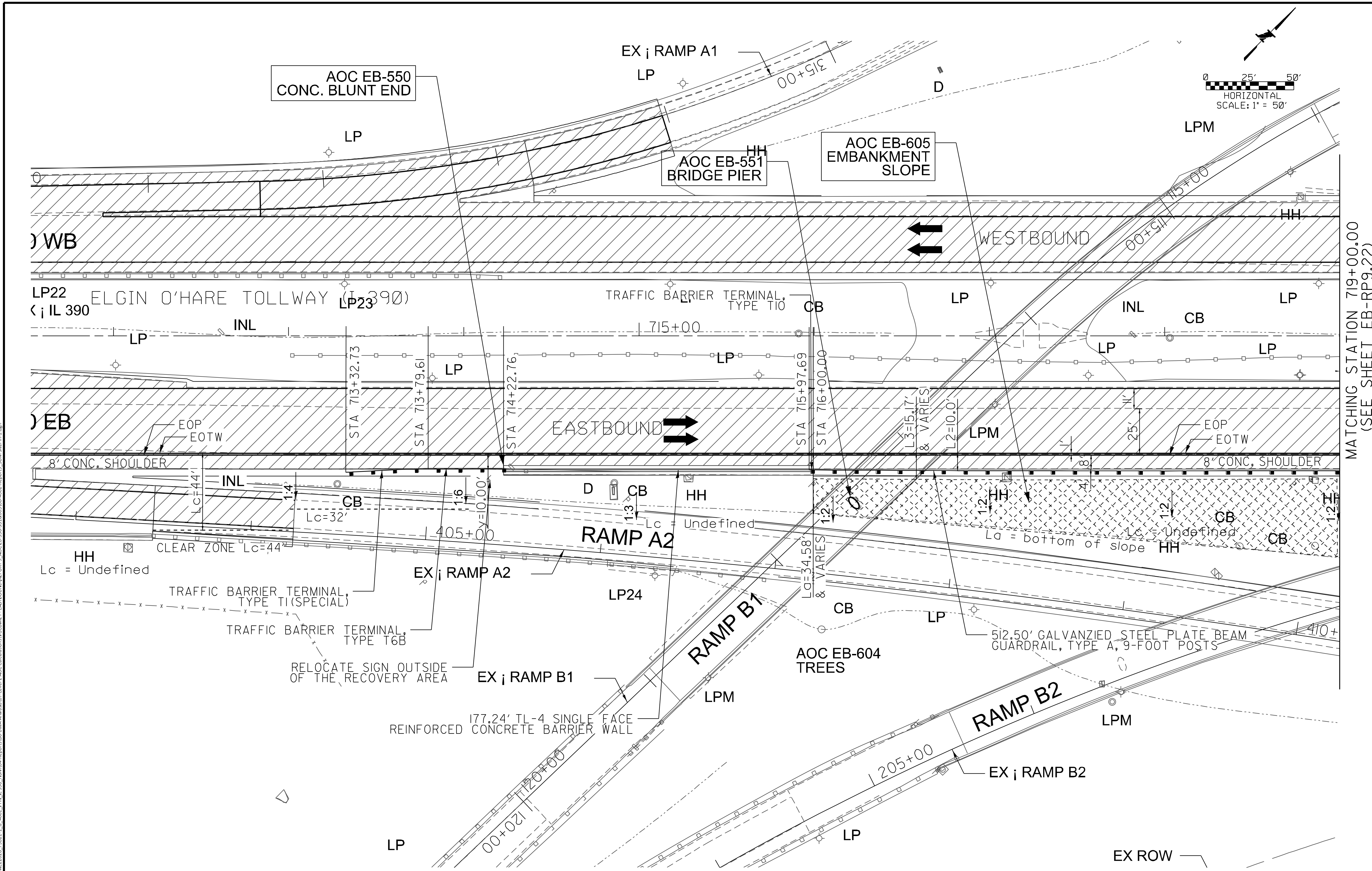
Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)
Terminal = Type T10 = T10 = 2.31 (does not counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$		$L_{Guardrail}$ =	**511.52'**
$L_{Guardrail, R} = L_{Guardrail}$ (Round up to the nearest 12.5' increment)		$L_{Guardrail\ R}$ =	**512.50'**
$T10_{Begin\_Station}$ =	$CB_{\_End}$ - (+T10)		
$T10_{Begin\_Station}$ =	(716+00.00) -2.31'	**$T10_{Begin\_Station}$ =**	**(715+97.69)**
$GR_{Begin\ \_Station} = T10_{\_End\_Station} = CB_{End}$		**$GR_{Begin\ Station}$ =**	**(716+00.00)**
$GR_{End\_Station} = GR_{Begin\ Station} + L_{Guardrail,\ R}$			
$GR_{End\_Station}$=	(716+00.00) +512.50'	**$GR_{Begin\_Station}$=**	**(721+12.50)**
$T2_{Begin\_Station} = GR_{End\_Station}$		**$T2_{\ Begin\_Station}$ =**	**(721+12.50)**
$T2_{\ End\_Station}$ = T2Begin Station + 12.50'			
$T2_{End\_Station}$ =	(721+12.50) +12.50'	**$T2_{\ End\_Station}$ =**	**(721+25.00)**

25' fo guardrail is always needed ahead of the T2 terminal. None of this 25' counts toward the LON.



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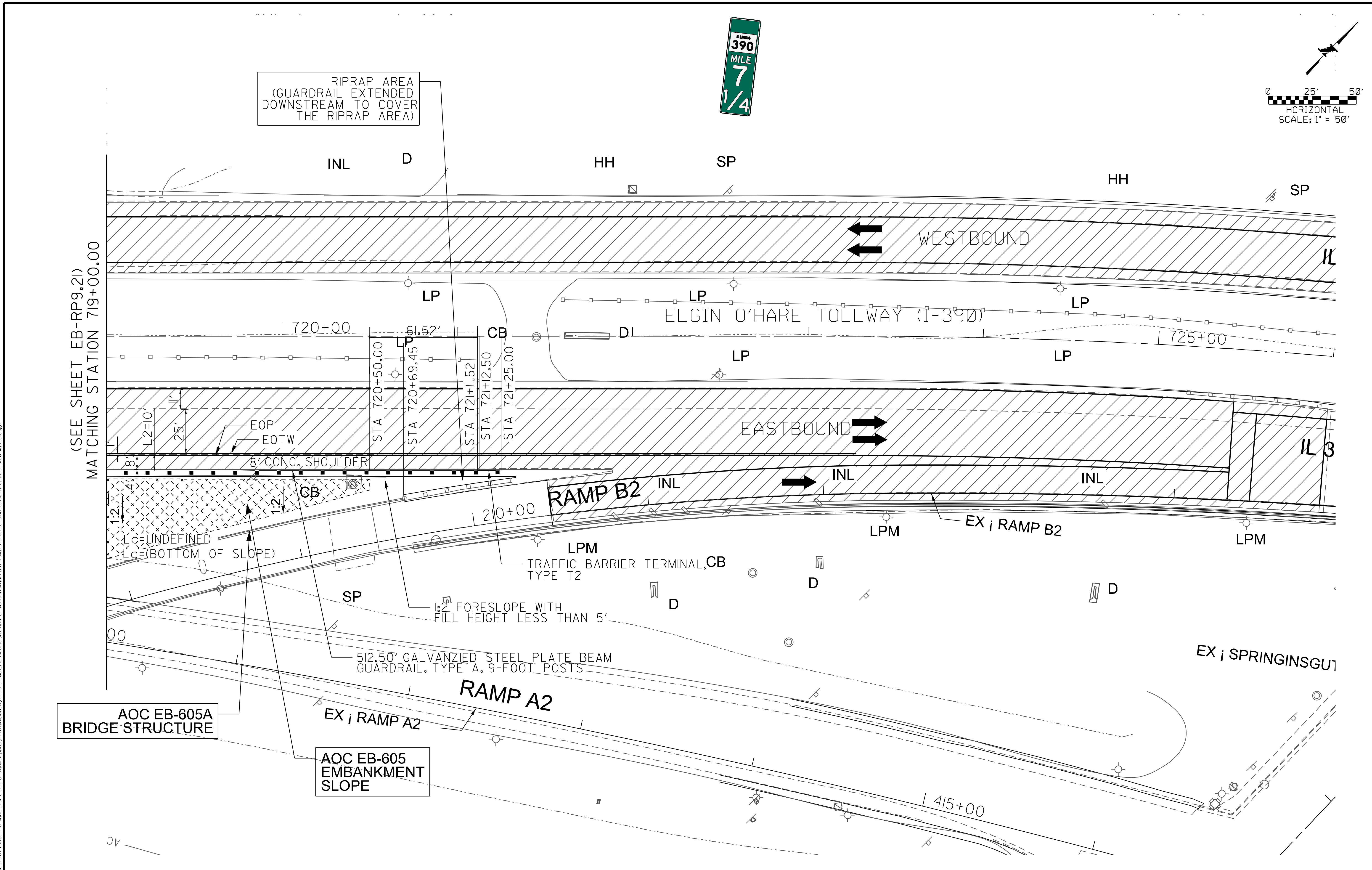
BARRIER WARRANT
REPORT 9 - SUMMARY SITE PLAN - I

SHEET NO. EB-RP9.32

DRAWING NO. 32 OF 34



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CONTRACT NO. RR-21-4802

BARRIER WARRANT
AOC EB-606 - SITE PLAN

SHEET NO. EB-RP9.33

DRAWING NO. 33 OF 34

RECOMMENDATION

Adding the new proposed 4" WMA overlay on top of the existing Concrete Pavement will reduce the height to the top of the existing MGS guardrail to below 31" and it will not meet the Tollway Standard.
Therefore, consider replacing the existing guardrail with the new guardrail system.

The existing barrier cannot remain in place with a 4" overlay. Because it is an F-shape barrier, 3" is the maximum overlay. Please see article 13.1 of the TBG.

AOC EB-550 & EB-551

The TL-4 single-face median barrier wall shall remain in place. Consider adding 4" on top to meet the 44" tall requirement of the current Tollway Standard.

1. Install Traffic Barrier Terminal, Type T1 (Special);
2. Install Traffic Barrier Terminal, Type T6B to downstream end of T1 Terminal;

AOC EB-605

The new guardrail limits are calculated for the downstream end of the concrete barrier wall to shield the remaining embankment obstacle and then extended downstream to Sta. 721+11.52 to cover the riprap in this area.

1. Install the Traffic Barrier Terminal, Type T10, to the downstream end of the concrete barrier.
2. Install 512.50' Galvanized, Type A, 9-foot posts;
3. Install Traffic Barrier Terminal, Type T2;

Regrade the slope around all signposts to 6:1 or flatter to make all the existing signs a traversable element.

The situation where there is back to back guardrail runs (from mainline and Ramp B2) no longer meets current criteria since the last 37.5' of guardrail is not considered re-directive and the back of the guardrail posts are considered an obstacle to adjacent traffic.
We should discuss removing the guardrail from Ramp B2 and shortening the guardrail along the mainline, if necessary, to be outside of the 25° departure angle at the parapet corner.

VOLUME II

WESTBOUND

REPORT 20

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC WB-569 - (Concrete Blunt End) - Report 20

Location AOC WB-568 - (Retaining Wall) - Report 20

Location AOC WB-567 - (Vertical Drop) - Report 20

Consider redefining AOCs WB-567 and WB-568 into a single AOC. It would be better described as a retaining wall parapet. The vertical drop-off AOC requires a TL-5 barrier to shield it, whereas existing parapet makes the drop-off virtually inaccessible to traffic.

TABLE OF CONTENTS

DATA SHEET

Location AOC WB-569 - (Concrete Blunt End) - Report 20 (Upstream Coordinate: 1941410.802, 1043440.614)
Location AOC WB-568 - (Retaining Wall Point Intersection) - Report 20 (Coordinate: 1941385.943, 1043443.657)
Mile Post: 7.5

DESCRIPTION OF OBSTACLE

AOC WB-569 Existing Conc. Blunt End, STA. 739+71.30
AOC WB-568 Retaining Wall, STA. 739+66.40

Per Section 5.7.10 Traffic Barrier Guidelines, March 2022, if it is not feasible to relocate a structural element, then a Level 2 Analysis should be performed. Since the existing retaining Wall AOC WB-568 will remain at its current location, a Level 2 is performed for this Area of Concern. AOC WB-568's point of need is further Upstream, therefore, it is the main control AOC for this location

The downstream end of the Type T6B Terminal will be connected to the upstream bridge parapet blunt end (Sta. 739+71.30) placed 1' off the edge of the shoulder.

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 15810 (2021), Westbound I-390
Clear Zone, Lc = Undefined based from Sta. 737+81.95 - Sta. 739+66.40
Clear Zone, Lc = 32 ft based on 1:6 H:V or flatter foreslope from Sta. 739+66.40 to Sta. 744+50.00

(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): Ls = 8'
Lateral Extent of AOC La = 32'
Lateral Distance, (from EOTW): L_2 = 7.8' & Varies
Offset, (from EOTW): L_3 =7.33'

PHOTOS

Photo 1: Existing condition & guardrail barrier I-390 Elgin O'Hare (Westbound)

Photo 2: Existing condition & guardrail terminal connect to the bridge parapet blunt end

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

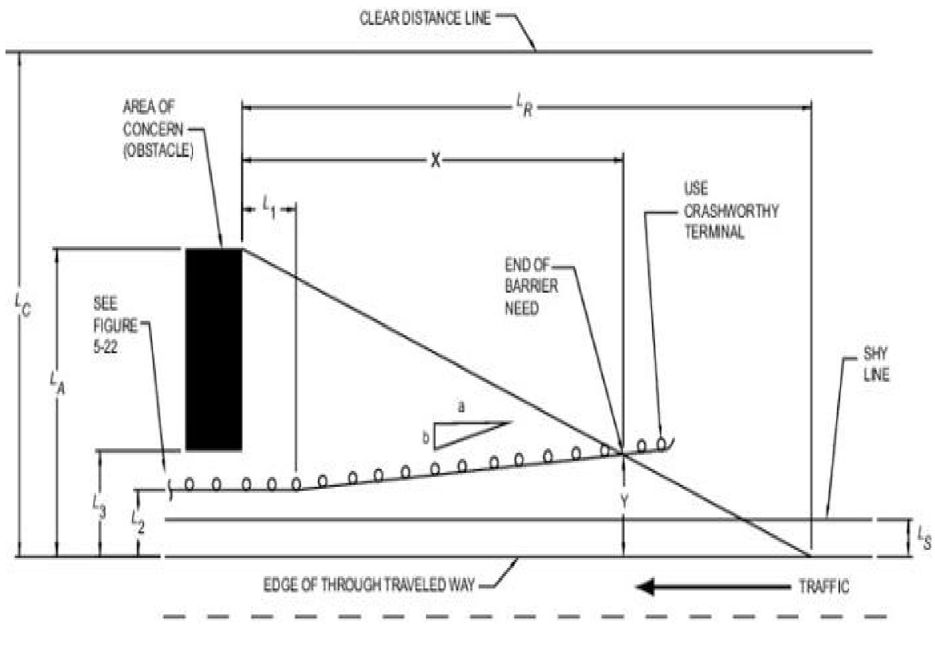

Figure 5-39. Approach Barrier Layout Variables

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Construction Contract
IL-390 ELGIN O'HARE TOLLWAY
Tollway M.P. 6.0 (LAKE STREET) to M.P. 11.2 (MEACHAM ROAD)
Barrier Warrant Analysis

BARRIER WARRANTS

Location AOC WB-568 & 569 - Conc. Blunt End & Retaining Wall

L_A = **32.00'** *(Measures to 32' Clear Zone Intercept point with Conc. Retaining Wall)*

L_C = **32.00'**

L_2 = **7.80** 7.80'

L_R = **300.00'**

Y = L_2 + 0.69 = 7.80' + 0.69' **Y = 8.49'**

Obstacles:

CBLE-ST $_{\text{US\_UPStream\_Sta}}$ **= 739+71.30** *(Concrete Blunt End, AOC WB-569)* **CBLE-ST_US = 739+71.30**

ReWall $_{\text{Sta-Point}}$ **= 739+66.40** *(Retaining Wall Station Intersection Point)* **TSLP-ST = 739+66.40**

L_{AOC} = Length of AOC = 0.00'

$L_{CB\_Contribute}$ = Length of Concrete Barrier Contributed = -4.90'

X should be determined graphically because the shoulder is on a taper per article 5.11.2 of the TBG.

Length of Need - Formula

X = (L_a - Y) / (La / Lr) *(If L_a <=Y, then the value for X =0)*

X = (32.00' - 8.49') / (32.00' / 300.00') **X = 220.41'**

The formula is used to determine X for AOCs on the inside of a curve, when the radius is less than 5000' (5.11.2, TBG, March 2022).

Point of Need= PON = REWall_Sta + X

PON = (739+66.40) + 220.41' **PON = (741+86.81)**

Length of Need = LON = X + L_{AOC} +(L_{CB_contb})

LON = 220.41' + 0.00' + (-4.90') **LON = 215.51'**

Terminals

36.90'

Terminal = Type T6B = T6 = (43.15' Counts toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T1 - T6B 36.90'

$L_{guardrail}$ = 215.51' - 34.38' - 43.15' **$L_{Guardrail}$ = 137.98'**

$L_{Guardrail,\ R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 150.00'**

T6B $_{\text{End\_Sta}}$ = CBLE-ST

CBLE-ST = (739+71.30) **CBLE-ST = (739+71.30)**

T6B $_{\text{Begin\_Station}}$ = T6B $_{\text{End}}$ + T6B 36.90'

T6B $_{\text{Begin\_Station}}$ (739+71.30) + 43.15' **T6B $_{\text{Begin\_Station}}$= (740+14.45)**

GR $_{\text{End \_Station}}$ = T6B $_{\text{Begin\_Station}}$ **GR $_{\text{End Station}}$ = (740+14.45)**

GR $_{\text{Begin\_Station}}$ = GR $_{\text{End Station}}$ + $L_{Guardrail,\ R}$

GR $_{\text{Begin\_Station}}$= (740+14.45) + 150.00' **GR $_{\text{Begin\_Station}}$= (741+64.45)**

T1 $_{\text{End\_Station}}$ = GR $_{\text{Begin\_Station}}$ **T1 $_{\text{End\_Station}}$ = (741+64.45)**

T1 $_{\text{End\_Station}}$ = GR $_{\text{Begin\_Station}}$ + 46.88'

T1 $_{\text{Begin\_Station}}$ = (741+64.45) + 46.88' **T1 $_{\text{Begin\_Station}}$ = (742+11.33)**

Please review.

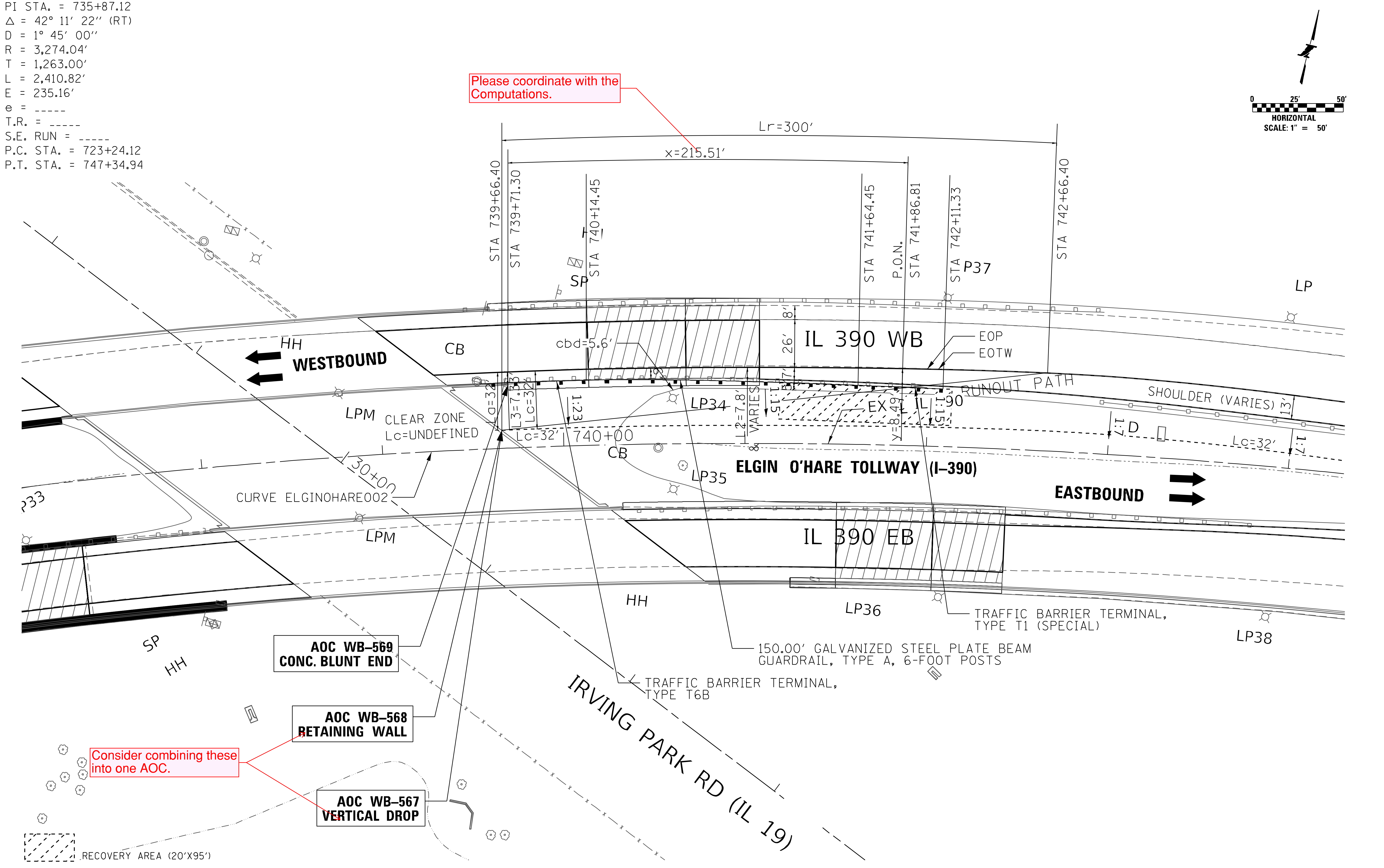
Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (741+86.81) - (742+11.33) < 25'

12.5' < -24.52' < 25' **OK** *Traffic flow the opposite stationing*

EXIST. CURVE ELGINOHARE002
PI STA. = 735+87.12
△ = 42° 11′ 22″ (RT)
D = 1° 45′ 00″
R = 3,274.04′
T = 1,263.00′
L = 2,410.82′
E = 235.16′
e = -----
T.R. = -----
S.E. RUN = -----
P.C. STA. = 723+24.12
P.T. STA. = 747+34.94



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AOC WB-568 & WB-569 - SITE PLAN

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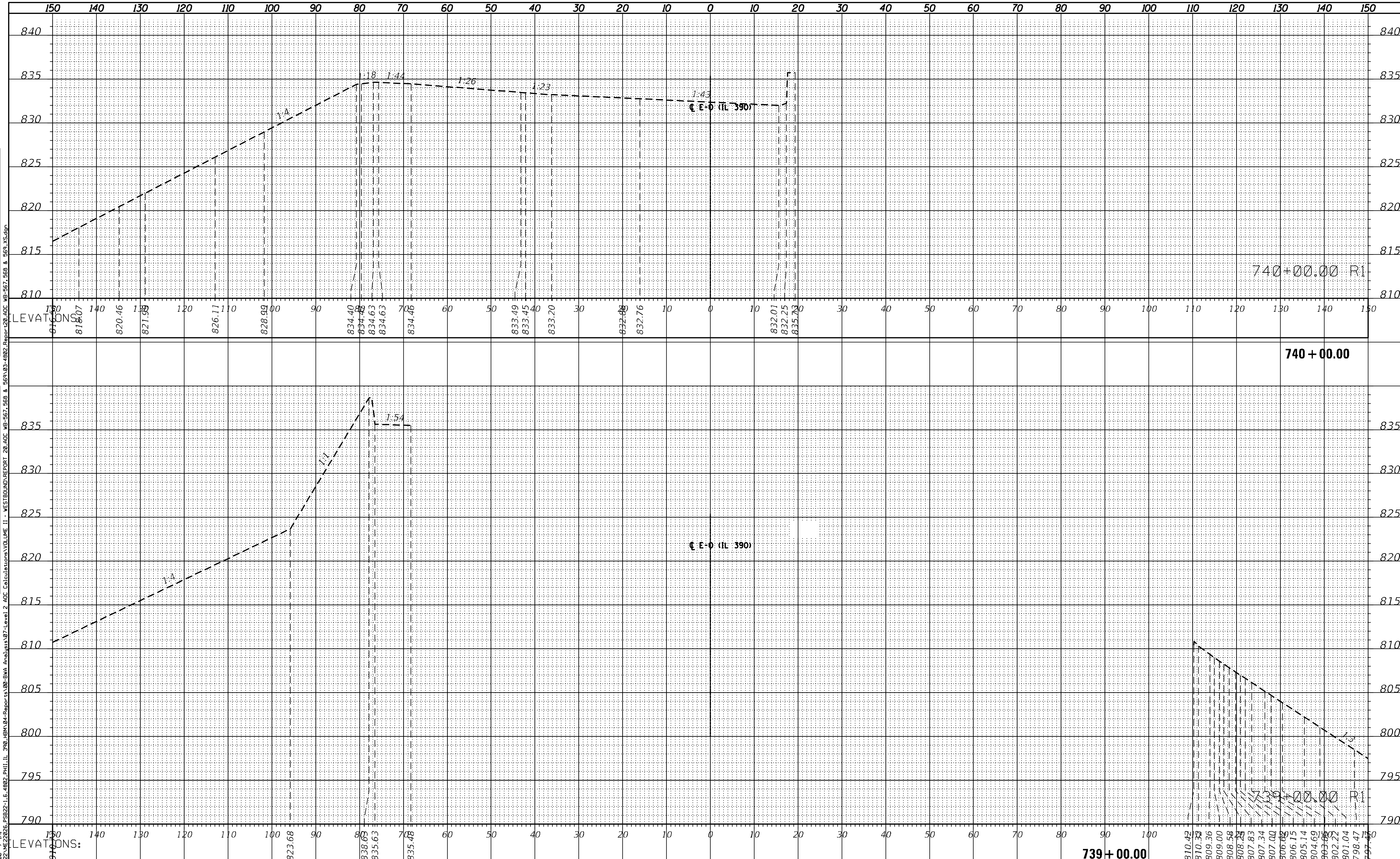

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BARRIER WARRANT PLAN
REPORT 20
AOC * WB-567, WB-568 & WB-569

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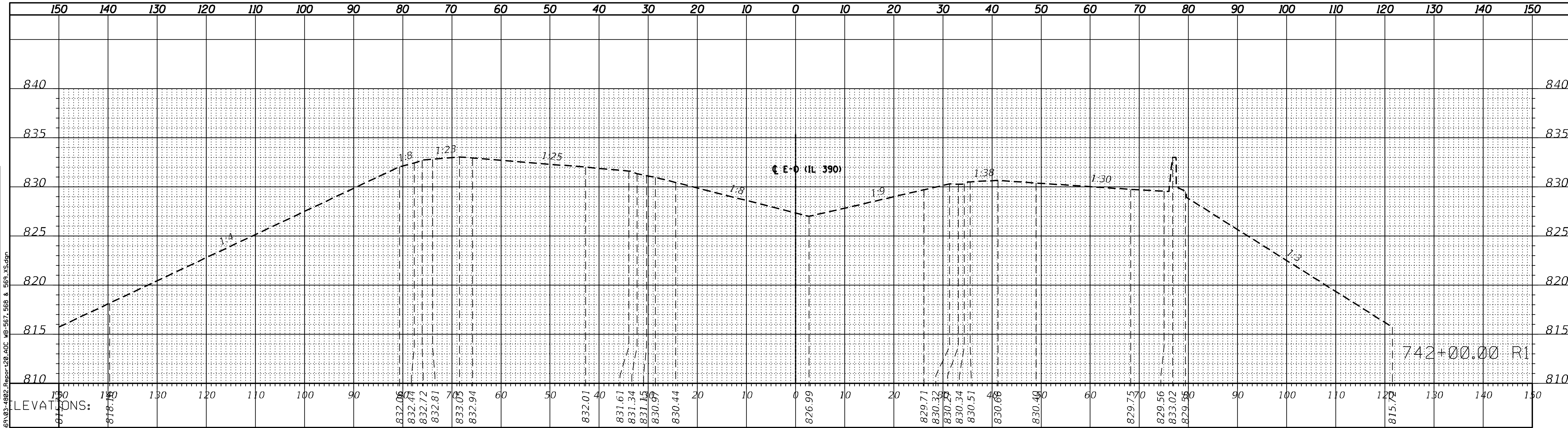

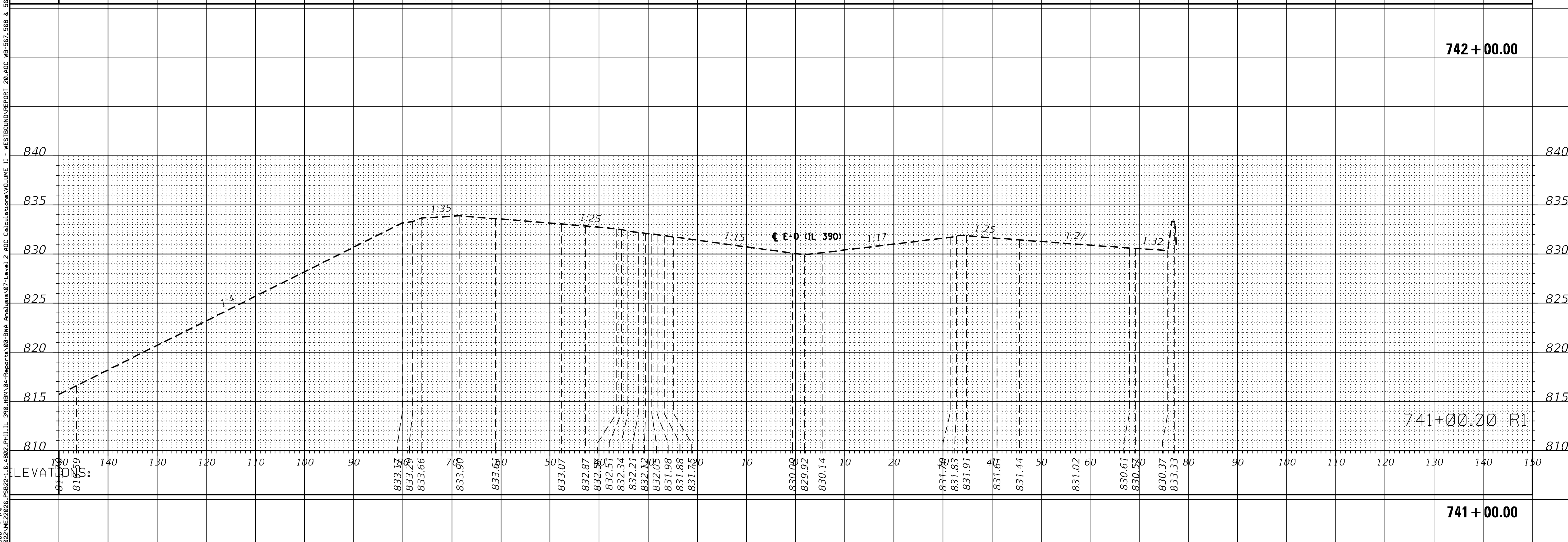

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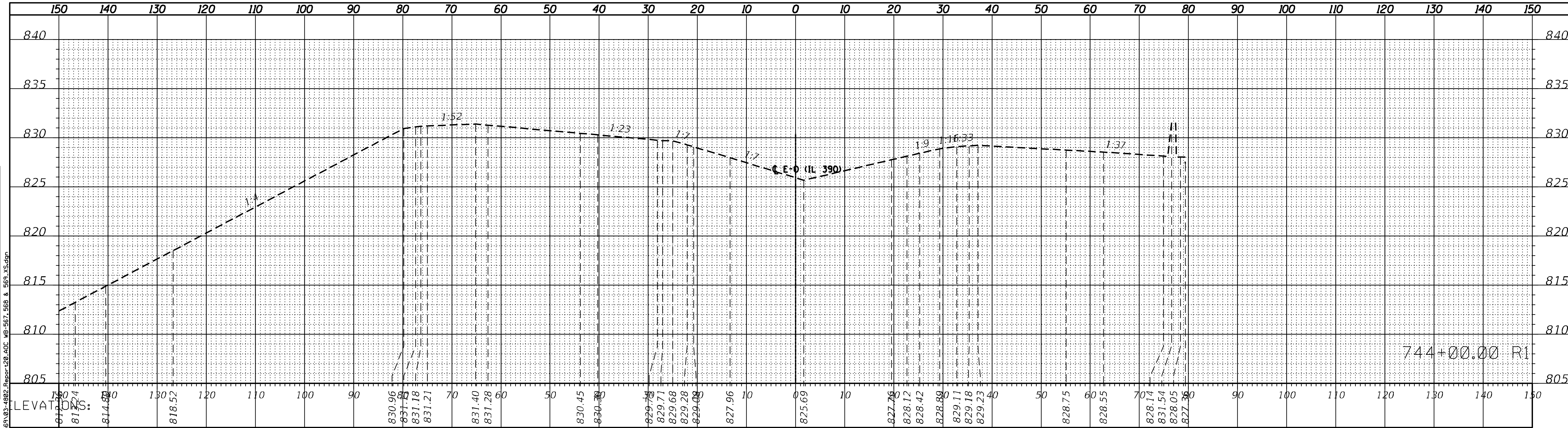

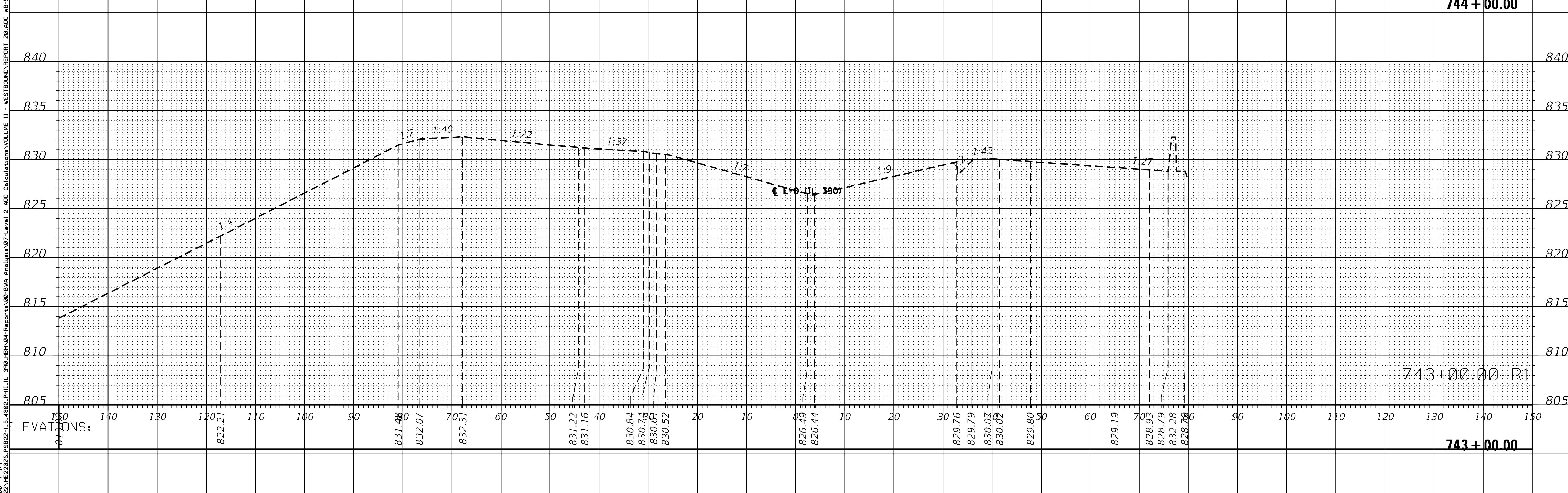

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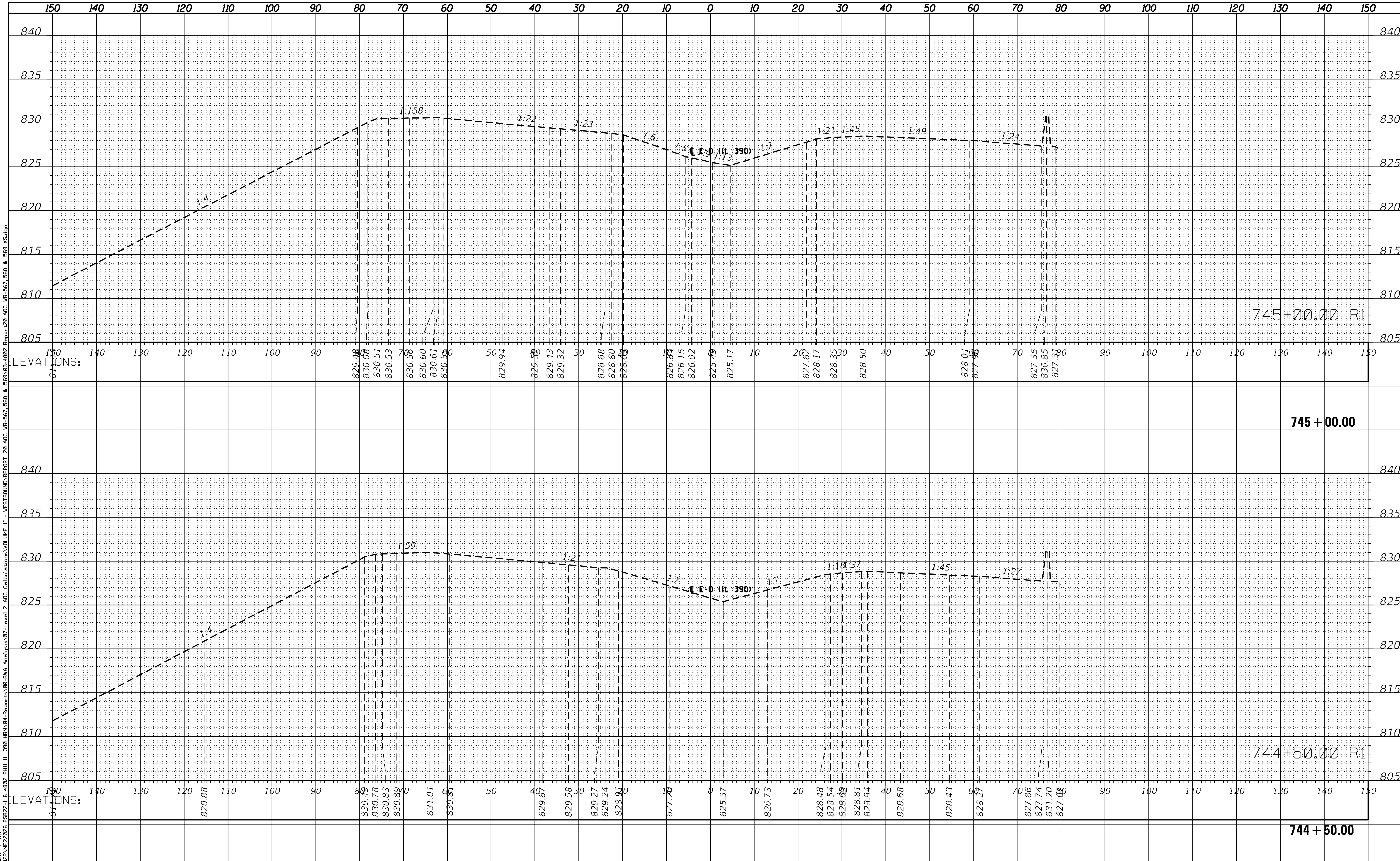

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RECOMMENDATION

REPORT 20 - AOC WB-567, 568 & 569 – EXISTING RETAINING WALL, CONCRETE BLUNT END

Adding a 4" WMA surface overlay will decrease the guardrail height from the surface to the top of the existing MGS guardrail and can make it substandard of a Min 31" requirement. Therefore, consider replacing the existing guardrail with the new guardrail system.

1. Install Traffic Barrier Terminal, Type T6B to the Concrete Blunt End.

2. Install 150.0' Galvanized Steel Plate Beam Guardrail, Type A, 6-Foot Posts to the Upstream of Terminal Type T6B.

3. Install the Traffic Barrier Terminal, Type T1 to the Upstream end of the Guardrail.

* The new BWA Calculated result is yielding the same value when compared to the existing condition and the 2015 BWA submittal.

REPORT 21

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC WB-565 - (Concrete Blunt End) - Report 21

Location AOC WB-566 - (Intersecting Negative Critical Slope) - Report 21

TABLE OF CONTENTS

DATA SHEET

Location AOC WB-565 - (Concrete Blunt End) - Report 21 (Upstream Coordinate: 1941449.253, 1043419.006)
Location AOC WB-566 - (Intersecting Negative Critical Slope) - Report 21 (Coordinate: 1941512.638, 1043402.645)
Mile Post: 7.5

DESCRIPTION OF OBSTACLE

AOC WB-565 Existing Conc. Blunt End, STA. 739+62.50
AOC WB-566 Intersecting Negative Critical Slope, STA. 738+79.80 to STA. 739+66.40

Westbound approach to the Irving Park Road bridge, the intersecting negative slope obstacle extends to 75' from the EOTW.

The downstream end of the Type T6B Terminal will be connected to the upstream bridge parapet blunt end (Sta. 739+62.50) placed 1' off the edge of the shoulder.

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 15810 (2021), Eastbound I-390
Clear Zone, Lc = Undefined based from Sta. 738+79.80 to STA. 739+66.40
Clear Zone, Lc = 44 ft based on 1:4 H:V foreslope from Sta. 739+62.50 to Sta. 744+50.00

(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): Ls = 8'
Lateral Extent of AOC La = 75'
Lateral Distance, (from EOTW): L_2 = 8.7' & Varies
Offset, (from EOTW): L_3 =7.95'

Per article 5.6 of the TBG, if the clear zone is defined within 100' upstream of the obstacle, then use the defined clear zone for L_A.

PHOTOS

Photo 1: Existing condition & guardrail barrier I-390 Elgin O'Hare (Westbound)

Photo 2: Existing condition & guardrail terminal connect to the bridge parapet blunt end

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	**Runout Length (L_R) Given Traffic Volume (ADT) (ft)**			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

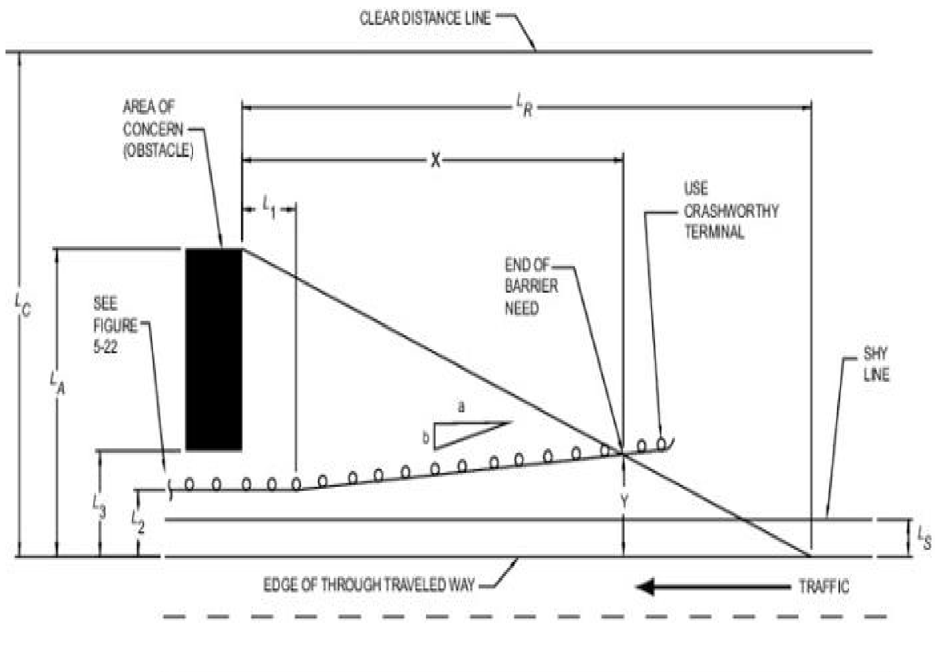


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC WB-565 & 566 - Conc. Blunt End & Bridge Cone Intersecting Negative Critical Slope

L_A = **75.00'** *(Measures to 75' Bottom of slope)*

Consider using 44'

Lc = **44.00'**

L_2 = **8.70** 8.70'

L_R = **300.00'**

Y = L_2 + 0.69 = 8.70' + 0.69' **Y = 9.39'**

Obstacles:

CBLE-ST $_{US\_UPStream\_Sta}$ **= 739+62.50** *(Concrete Blunt End, AOC WB-565)* **CBLE-ST_US = 739+62.50**

BridgCone_Slope $_{UpSta}$ **= 739+62.50** *(Bridge Cone Intersecting Negative Critical Slope, AOC WB-566)* **BCS_Up-ST = 739+62.50**

BridgCone_Slope $_{DownSta}$ **= 738+79.80** **BCS_Dwn-ST = 738+79.80**

L_{AOC} = Length of AOC = 82.70'

$L_{CB\_Contribute}$ = Length of Concrete Barrier Contributed = -82.70'

Length of Need - Formula

The graphical method is employed due to a shoulder width transition exists (5.11.2, TBG, March 2022)

X = 248.25' (Graphically)

Point of Need= PON = REWall_Sta + X

PON = (739+62.50) + 248.25' **PON = (742+10.75)**

Length of Need = LON = X + L_{AOC} **+(**L_{CB_contb}**)**

LON = 248.25' + 82.70' + (-82.70') **LON = 248.25'**

Terminals

36.90'

Terminal = Type T6B = T6B = (43.15' Counts toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T1 - T6B

$L_{guardrail}$ = 248.25' - 34.38' - 43.15' 36.90' **$L_{Guardrail}$ = 170.72'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 175.00'**

T6B $_{\_End\_Sta}$ = CBLE-ST

CBLE-ST = (739+62.50) **CBLE-ST = (739+62.50)**

$T6B_{Begin\_Station}$ = $T6B_{End}$ + T6B

$T6B_{Begin\_Station}$ (739+62.50) + 43.15' 36.90' **$T6B_{Begin\_Station}$= (740+05.65)**

$GR_{End\ \_Station}$ = T6B $_{Begin\_Station}$ **$GR_{End\ Station}$ = (740+05.65)**

$GR_{Begin\_Station}$ = $GR_{End\ Station}$ + $L_{Guardrail,\ R}$

$GR_{Begin\_Station}$= (740+05.65) + 175.00' **$GR_{Begin\_Station}$= (741+80.65)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (741+80.65)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ + 46.88'

T1 $_{Begin\_Station}$ = (741+80.65) + 46.88' **T1 $_{Begin\_Station}$ = (742+27.53)**

Please review.

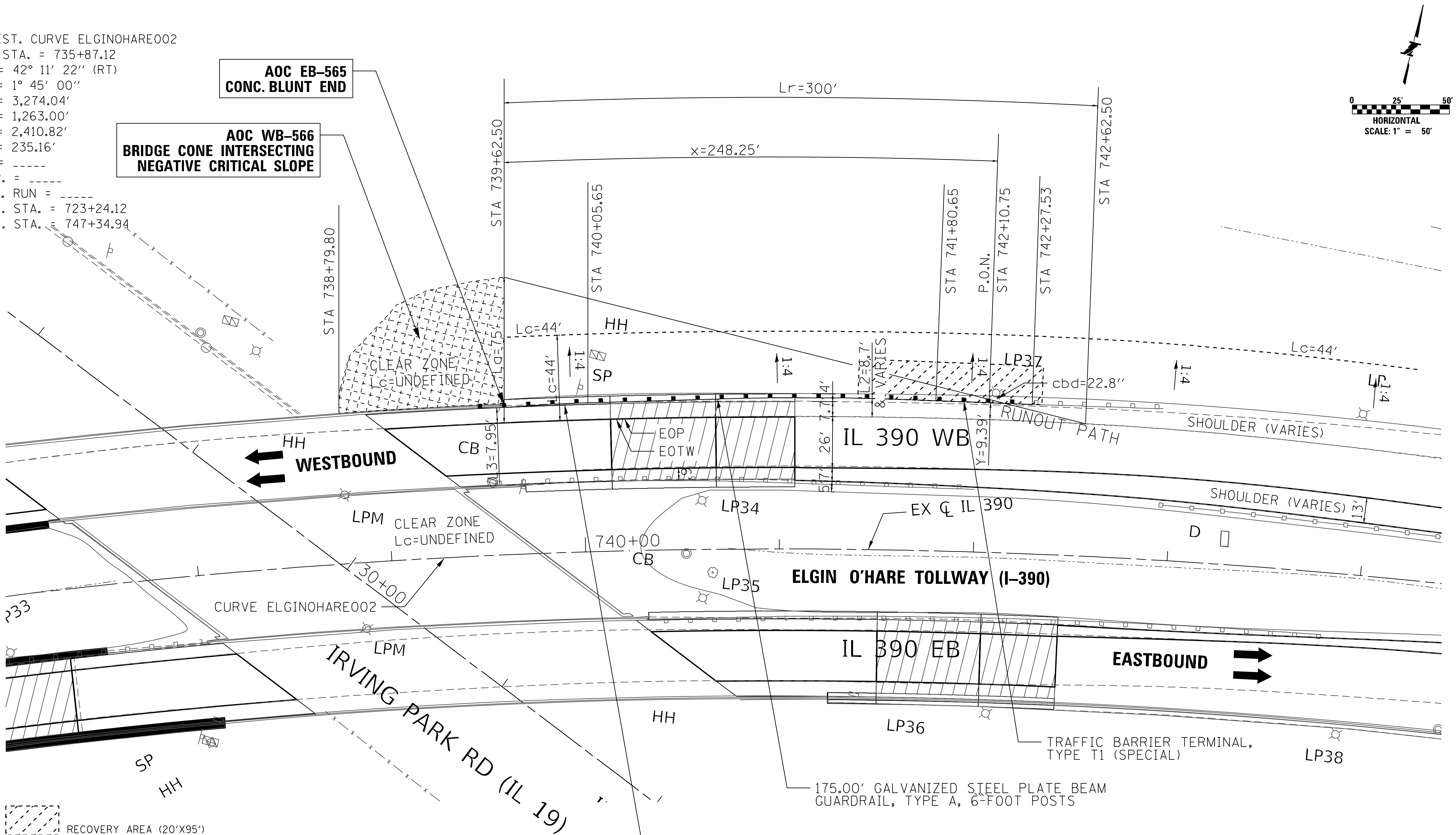
Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (742+10.75) - (742+27.53) < 25'

12.5' < -16.78' < 25' **OK** *Traffic flow the opposite stationing*

EXIST. CURVE ELGINOHARE002
PI STA. = 735+87.12
Δ = 42° 11′ 22″ (RT)
D = 1° 45′ 00″
R = 3,274.04′
T = 1,263.00′
L = 2,410.82′
E = 235.16′
e = _____
T.R. = _____
S.E. RUN = _____
P.C. STA. = 723+24.12
P.T. STA. = 747+34.94



RECOVERY AREA (20′X95′)

AOC LP37 (STA. 742+9.38)
THE EXISTING LIGHT POLE FALL WITHIN THE
RECOVERY AREA OF THE PROPOSED GUARDRAIL.

EXTEND GUARDRAIL UPSTREAM TO ELIMINATE THIS CONFLICT

SEE SHEET WB-RP21.9 SUMMARY SITE PLAN FOR DETAILS

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BARRIER WARRANTS

Location AOC WB-565 & 566 - Conc. Blunt End & Bridge Cone Intersecting Negative Critical Slope

OVERALL BARRIER LIMITS DETERMINATION - REPORT 21

Obstacles:

$CBLE\text{-}ST_{\_US\_UPStream\_Sta}$ **= 739+62.50** *(Concrete Blunt End, AOC WB-565)* **CBLE-ST_US = 739+62.50**

$BridgCone\_Slope_{\_UpSta}$ **= 739+62.50** *(Bridge Cone Intersecting Negative Critical Slope, AOC WB-566)* **BCS_Up-ST = 739+62.50**

$BridgCone\_Slope_{\_DownSta}$ **= 738+79.80** **BCS_Dwn-ST = 738+79.80**

L_{AOC} = Length of AOC = 0.00'

$L_{CB\_Contribute}$ = Length of Concrete Barrier Contributed = 0.00'

Length of Need - Formula

The graphical method is employed due to a shoulder width transition exists (5.11.2, TBG, March 2022)

X = 248.25' (Graphically)

Point of Need= PON = REWall_Sta + X

PON = (739+62.50) + 248.25' **PON = (742+10.75)**

Length of Need = LON = X + L_{AOC} +(L_{CB_contb})

LON = 248.25' + 82.70' + (-82.70') **LON = 248.25'**

Terminals

36.90'

Terminal = Type T6B = T6B = (43.15' Counts toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T1 - T6B

36.90'

$L_{guardrail}$ = 248.25' - 34.38' - 43.15' **$L_{Guardrail}$ =** **170.72'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ =** **175.00'**

EXTEND 75' (6 SECTIONS) GUARDRAIL UPSTREAM TO ELIMINATE LIGHT POLE FALL WITHIN THE RECOVERY AREA.

$L_{Guardrail\ R\text{-}EXT}$ = **250.00'**

$T6B_{\_End\_Sta}$ = CBLE-ST

CBLE-ST = (739+62.50) **CBLE-ST = (739+62.50)**

36.90'

$T6B_{Begin\_Station}$ = $T6B_{End}$ + T6B

$T6B_{Begin\_Station}$ (739+62.50) + 43.15' **$T6B_{Begin\_Station}$= (740+05.65)**

$GR_{End\ \_Station}$ = $T6B_{\ Begin\_Station}$ **$GR_{End\ Station}$ = (740+05.65)**

$GR_{Begin\_Station}$ = $GR_{End\ Station}$ + $L_{Guardrail,\ R}$

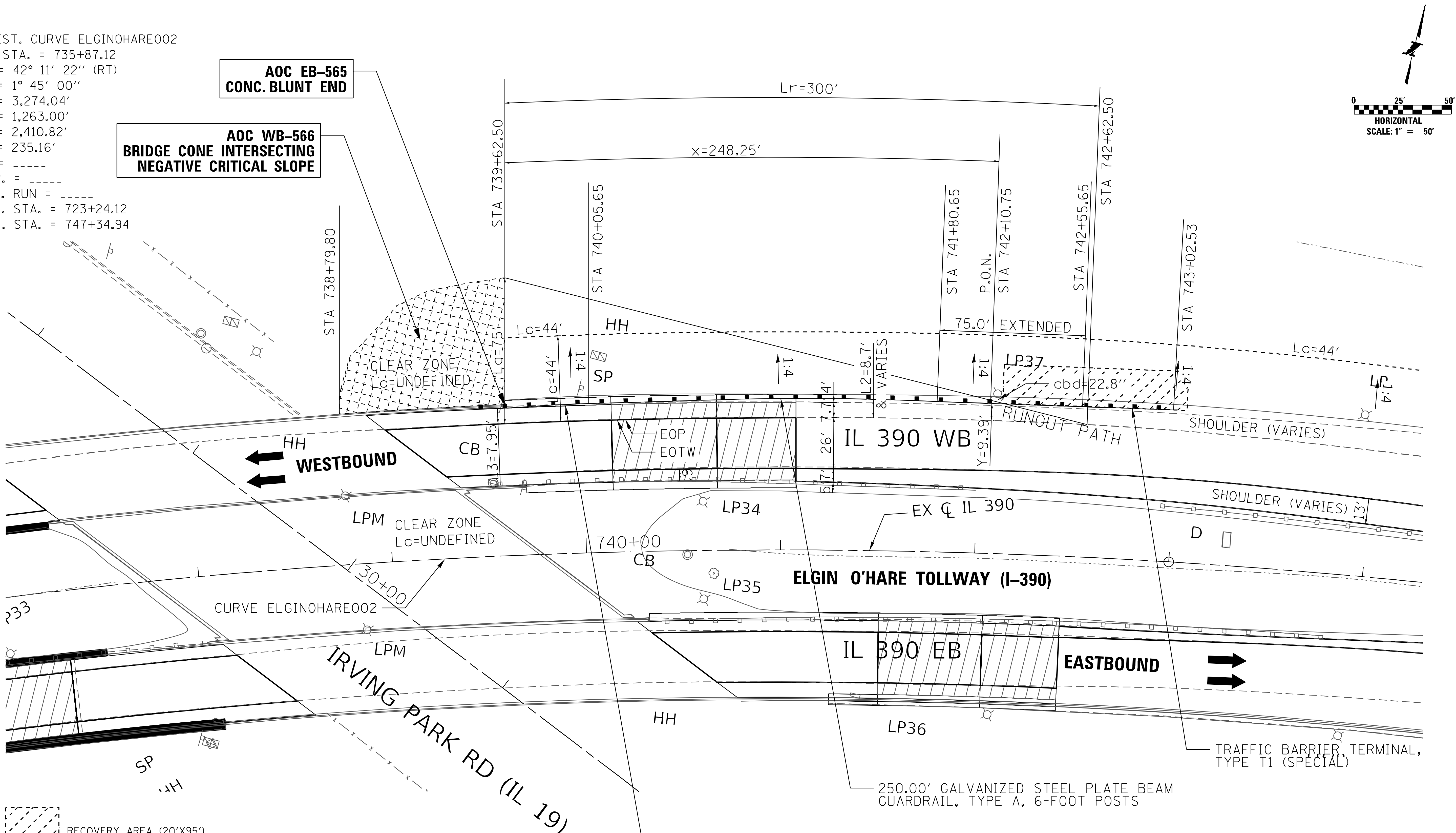
$GR_{Begin\_Station}$= (740+05.65) + 175.00' **$GR_{Begin\_Station}$= (742+55.65)**

$T1_{\ End\_Station}$ = $GR_{Begin\_Station}$ **$T1_{\ End\_Station}$ = (742+55.65)**

$T1_{\ End\_Station}$ = $GR_{Begin\_Station}$ + 46.88'

$T1_{\ Begin\_Station}$ = (742+55.65) + 46.88' **$T1_{\ Begin\_Station}$ = (743+02.53)**

Please review.



RECOVERY AREA (20′X95′)

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THE EXISTING LIGHT POLE FALL WITHIN THE
RECOVERY AREA OF THE PROPOSED GUARDRAIL.

EXTEND 75.0′ (6 SECTIONS) GUARDRAIL UPSTREAM TO ELIMINATE THIS CONFLICT

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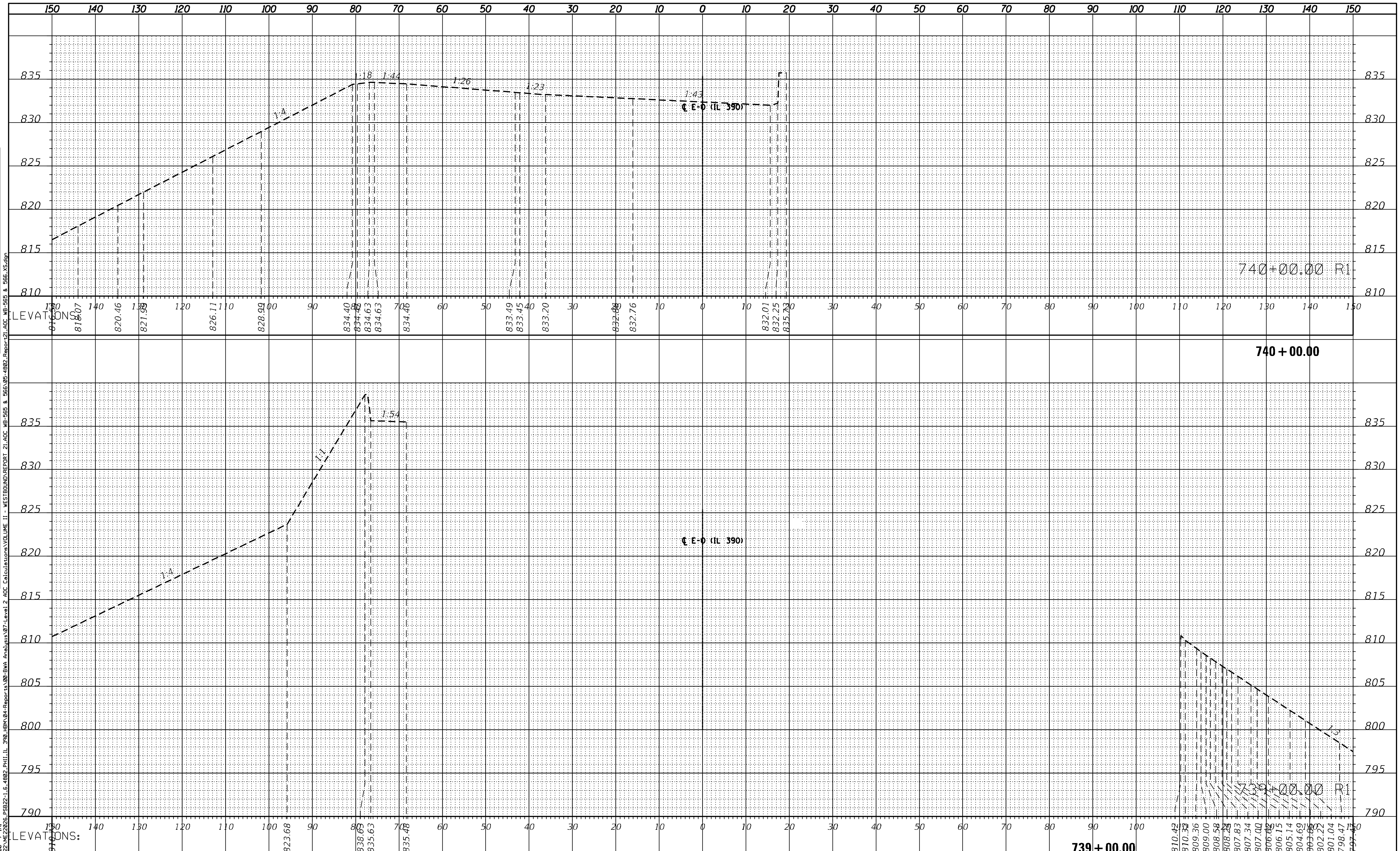

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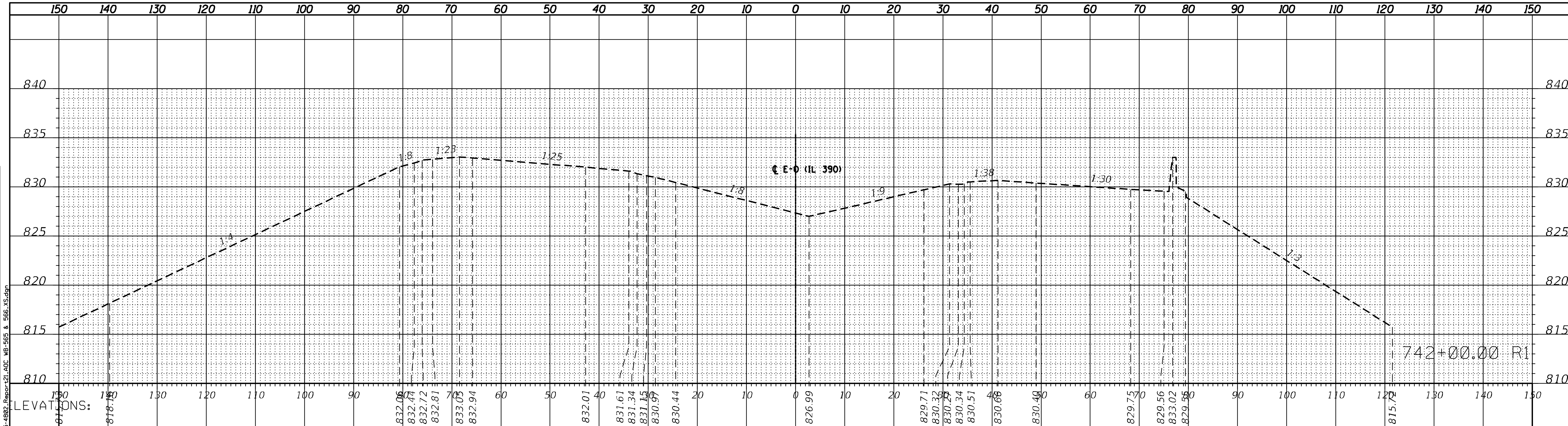

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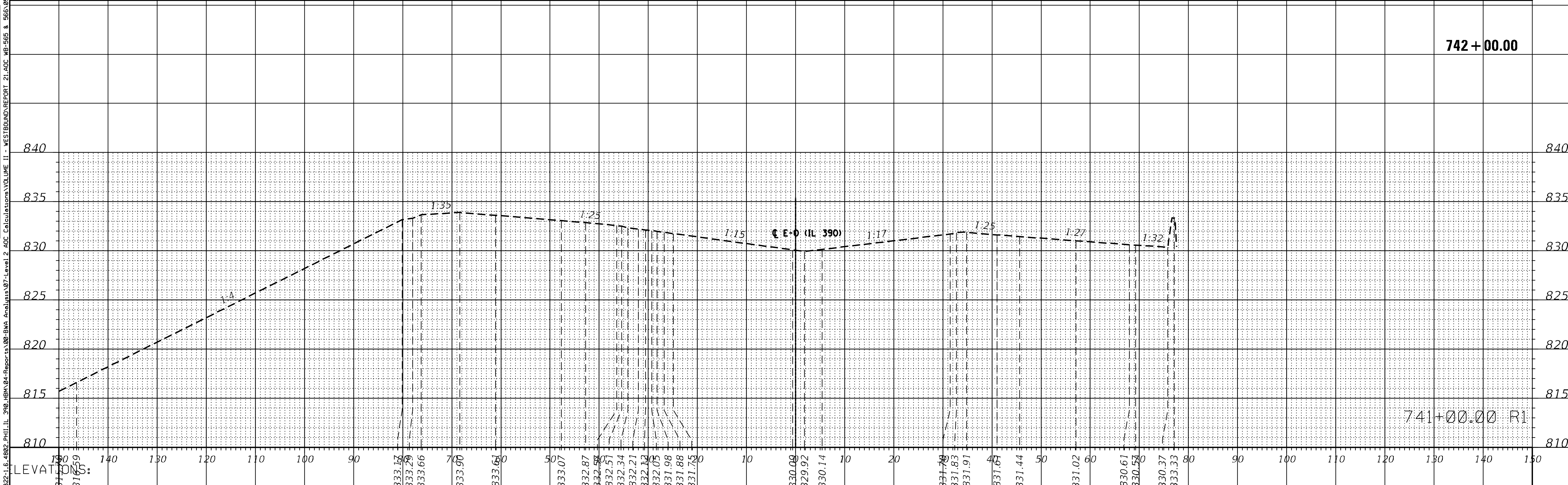

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REPORT 21
AOC - WB-565 & WB-566

DRAWING NO.
WB-RP20.11

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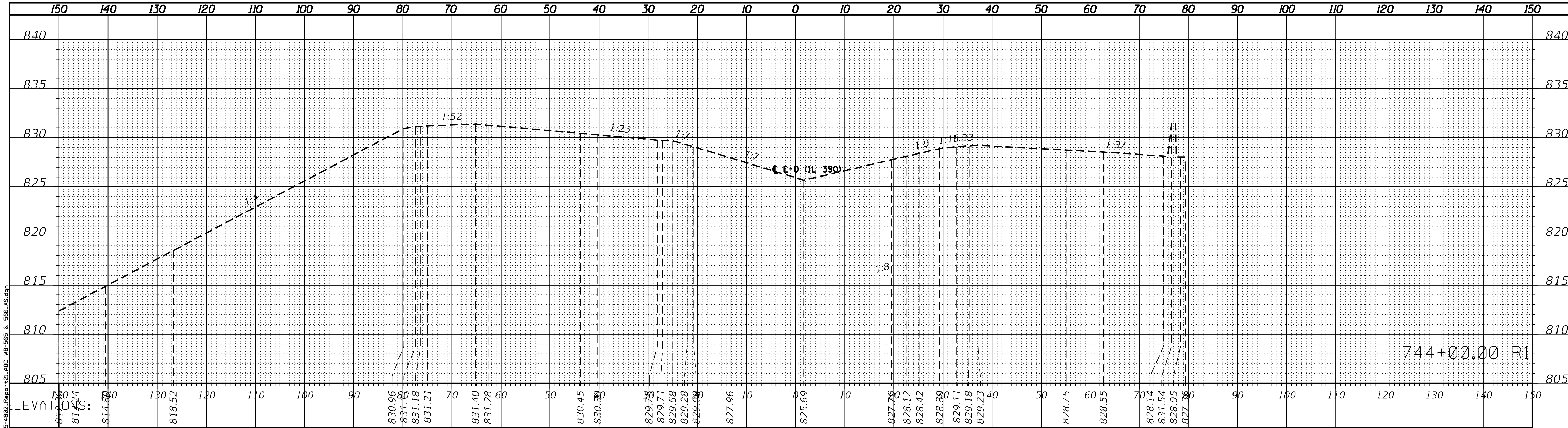

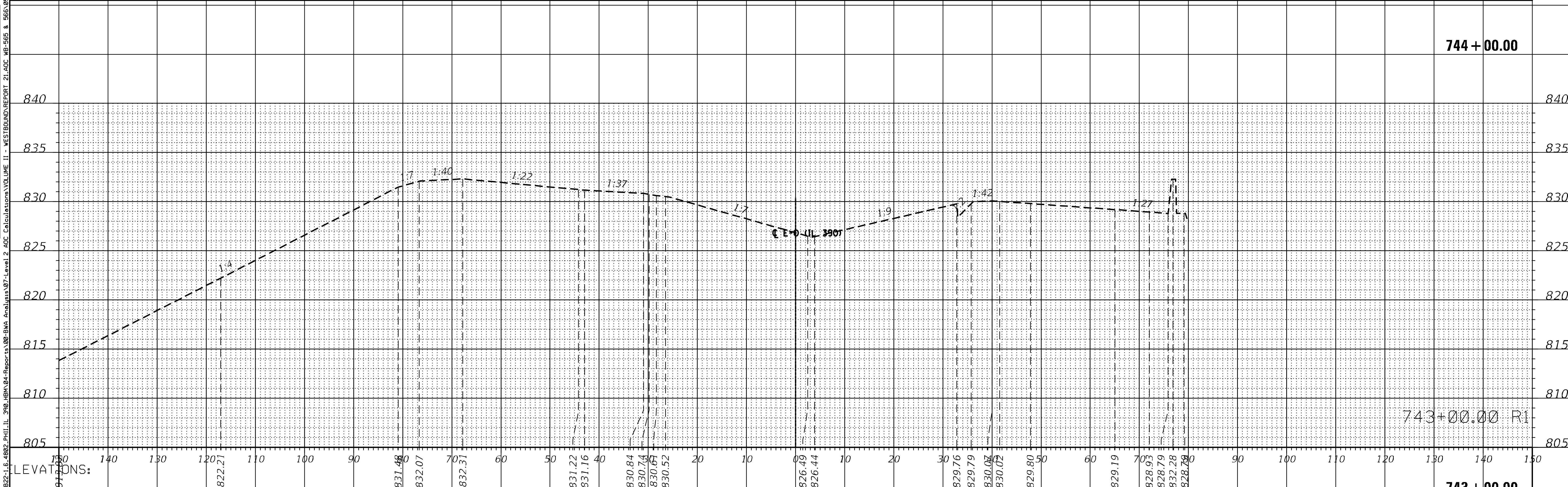

DRAWN BY LN	DATE 1/16/2023	MILLENNIA PROFESSIONAL SERVICES 200 22ND Street, Suite 216, Lombard, IL 60148 630.705.0110 voice, 630.839.2566 fax www.mps-il.com	THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY 2700 OGDEN AVENUE DOWNERS GROVE, ILLINOIS 60515	DESIGN CONTRACT NO. RR-21-4802 CONST. CONTRACT NO.
CHECKED BY JGM	SCALE - V: 1"=10' H: 1"=20'			BARRIER WARRANT PLAN REPORT 21 AOC - WB-565 & WB-566

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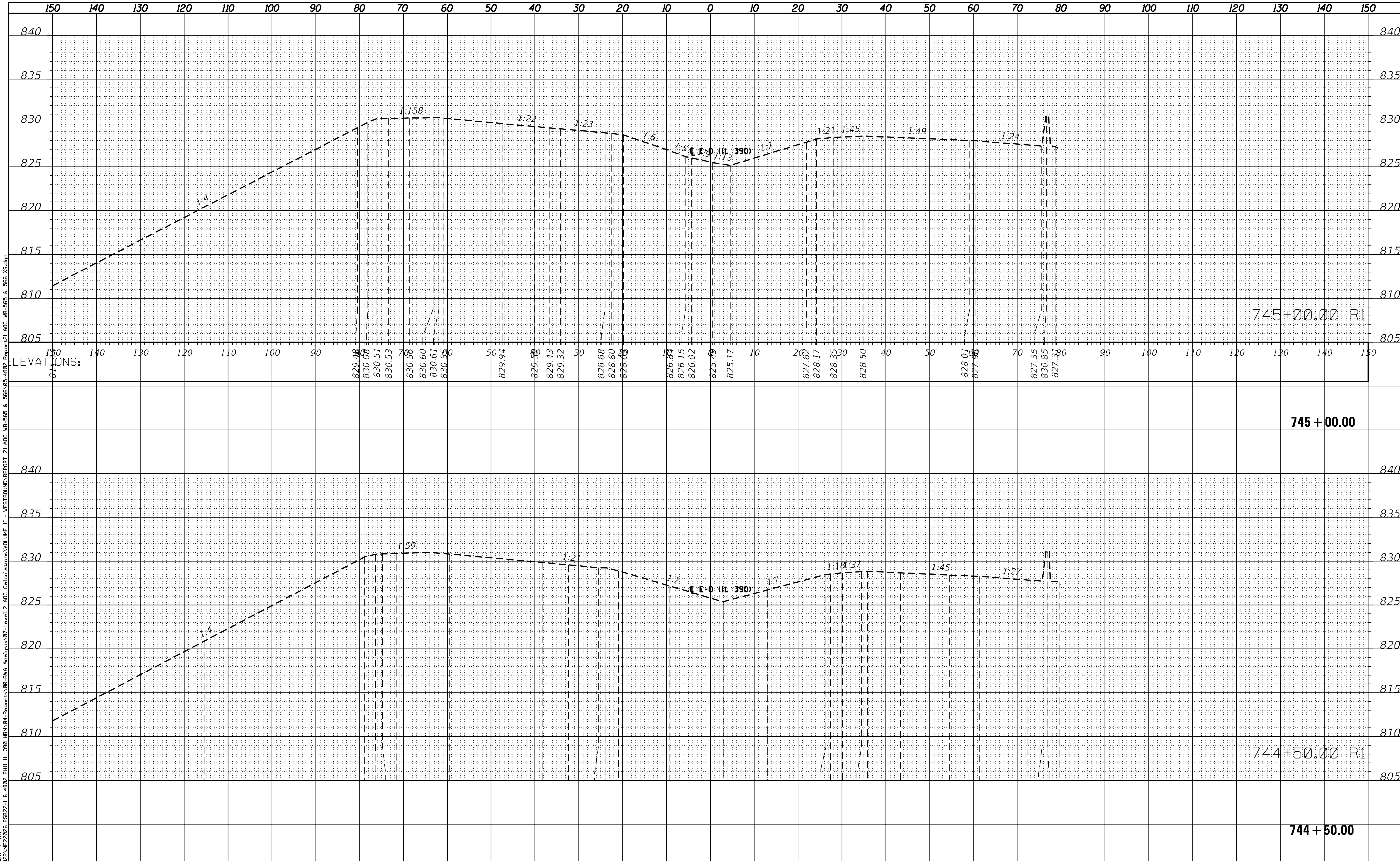
lnguyen



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DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 21
AOC • WB-565 & WB-566

DRAWING NO.
WB-RP20.13

FINAL SURVEY	ORIGINAL SURVEY
NOTE BOOK NO.	NOTE BOOK NO.
SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED	SURVEYED / PLOTTED / TEMPLATE / AREAS / AREAS CHECKED
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RECOMMENDATION

REPORT 21 - AOC WB-565 & 566 – Existing Conc. Blunt End & Bridge Cone Intersecting Negative Critical Slope

Adding a 4" WMA surface overlay will decrease the guardrail height from the surface to the top of the existing MGS guardrail and can make it substandard of a Min 31” requirement. Therefore, consider replacing the existing guardrail with the new guardrail system.

1. Install Traffic Barrier Terminal, Type T6B to the Concrete Blunt End.

2. Install 250.0’ Galvanized Steel Plate Beam Guardrail, Type A, 6-Foot Posts to the Upstream of Terminal Type T6B.

3. Install the Traffic Barrier Terminal, Type T1 to the Upstream end of the Guardrail.

(GUARDRAIL EXTENDED 75' (6 SECTIONS) UPSTREAM TO ELIMINATE LIGHT POLES THAT FALL WITHIN THE RECOVERY AREA.)

* The new BWA Calculated result is yielding the same value when compared to the existing condition and the 2015 BWA submittal.

REPORT 30

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC WB-510 & 511 - Report 30

Location AOC WB-512 - Report 30

TABLE OF CONTENTS

DATA SHEET

Location AOC WB-510 & WB-511

Mile Post: 6.35

This water body appears to be the controlling AOC for this analysis, as it is a lateral obstacle and a larger L_A.

DESCRIPTION OF OBSTACLE

AOC WB-510 Body of Water (the AOC WB-511 controls the Upstream End Calculation, therefore no further analysis for this AOC)
AOC WB-511 Existing Box Culvert Headwall, STA. 674+66.65 to STA. 675+17.45
Existing Concrete Single Face Barrier Wall, STA. 674+61.60 to STA. 675+28.39

Per Section 5.7.12 Traffic Barrier Guidelines, March 2022, existing outlets located on the foreslope when the clear zone is undefined that are not Traversable Elements require a Level 3 Analysis, which evaluates (1) not shielding the existing headwall provided that the 44' offset in Table 5.8.1 is met; (2) existing remains with shielding; (3) modified the structure; (4) extended the outlet headwall well outside the 44' offset.

The existing headwall does not meet the 44' offset requirement and also, the current configuration does not allow traversable grates to be added; therefore, the structure is unable to be modified to include new safety end treatment without shielding. Lastly, extending the pipe and placing the outlet well outside of the 44' offset without shielding, is not feasible. Therefore, a Level 2 Analysis is performed to shield the existing box culvert headwall with a guardrail.

The existing F- Shape barrier cannot be used with a 4" overlay.

The existing Single Face Concrete Barrier remains in place due to the post depth not being achieved - Add a 4" barrier topper to the existing concrete barrier that shields portion of the AOC, to meet the 44" requirement.

No gutter is required at this location since the existing conditions in this area contains mature vegetation and show no signs of significant embankment erosion.

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 12040 (2021), Westbound I-390
Clear Zone, Lc = Undefined based on 1:3 H:V or stepper foreslope from Sta. 674+50 to Sta. 676+00
Clear Zone, Lc = 44 ft based on 1:4 -1:5 H:V foreslope from Sta. 676+00 to Sta. 676+50
Clear Zone, Lc = 32 ft based on 1:6 and flatter H:V foreslope from Sta. 676+50 to Sta. 680+00
(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): 8'

PHOTOS

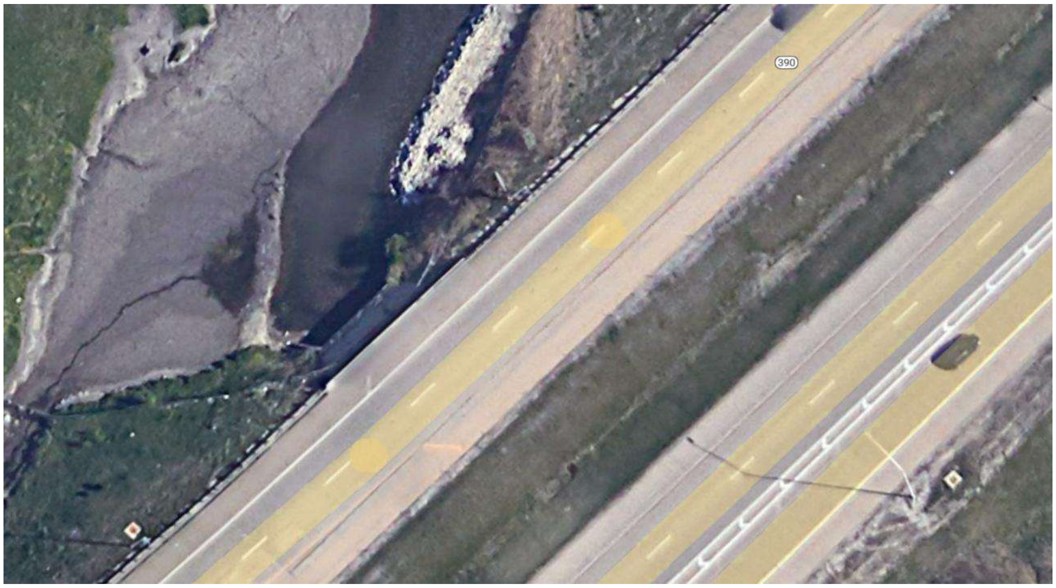


Photo 1: Aerial view - Elgin O'Hare I-390

Photo 2: Existing guardrail and Single Face barrier

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

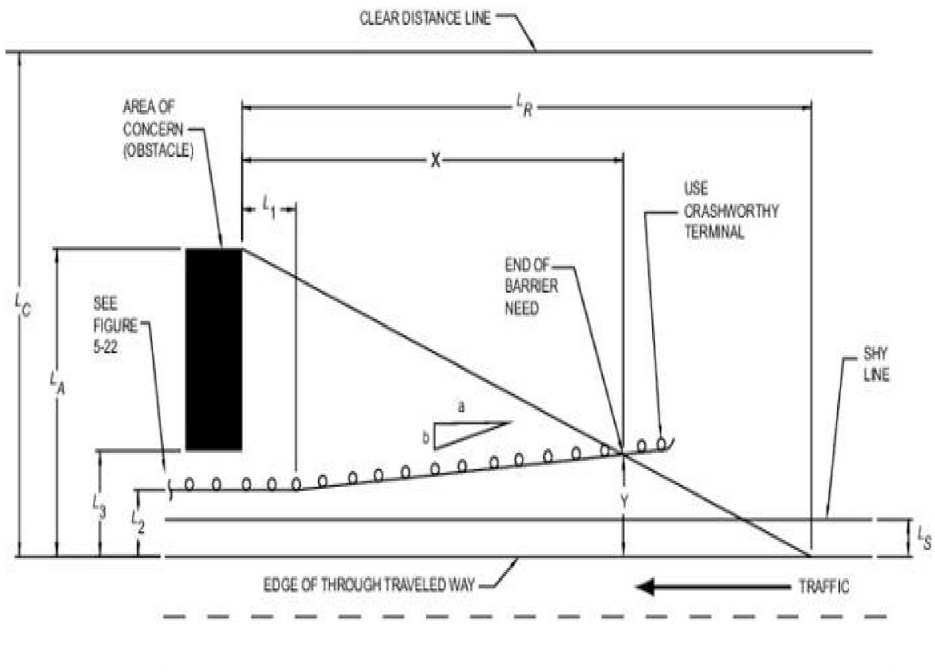


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC WB-511 - Box Culvert Headwall

Consider 44'

L_A = **33.00'** *(Measures to Conc. Headwall Wing)*

L_C = **Undefined**

For the L_A of these lateral obstacles please see article 5.5 of the TBG, that says when the CZ is defined within 100' upstream of the AOC, then use the defined clear zone for L_A.

L_2 = **11.00** 11.00'

L_R = **300.00'**

Y = L_2 + 0.69 = 11.00' + 0.69' **Y = 11.69'**

Obstacles:

$BCH\text{-}ST_{\_US\_UPStream\_Sta}$	**= 675+17.45**	*(Box Culvert Headwall, AOC WB-511)*	**BCH-ST_US = 675+17.45**
$BCH\text{-}ST_{\_DS\_DownStream\_Sta}$	**= 674+66.65**	*Traffic going oppistite direction of Alignment Station*	**BCH-ST_DS = 674+66.65**
L_{AOC} = Length of AOC =	50.80'		
$CB\text{-}ST\_US_{\_UpStream\_Sta}$	**= 675+28.39**	*(Conc. Barrier Wall US Station)*	**CB-ST_US = 675+28.39**
$CB\text{-}ST\_DS_{\_DownStream\_Sta}$	**= 674+61.60**	*(Conc. Barrier Wall DS Station)*	**CB-ST_DS = 674+61.60**

Length of Need - Formula

The graphical method is employed to determine the true distance of the value X

X = 207.00' (Graphically)

Point of Need= PON = ST_US + X

PON = (675+17.45) + 207.00' **PON = (677+24.45)**

Existing Single Face Concrete Barrier Wall remains in place and shield part of the AOC

CB_L_{CON} = **(675+28.39') - (674+66.65')**

CB_L_{CON} **= 61.74** *(Conc. Barrier Lengths of Contributed)* **CB_L_{CON} = 61.74'**

Length of Need = LON = X + L_{AOC} - CB_L_{Con}

LON = 207.00' + 50.80 - 61.74' **LON = 196.06'**

36.90'

Terminals

Terminal = Type T6B = T6B = 43.15' (count toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

$L_{guardrail}$ = LON - T6B - T1

36.90'

$L_{guardrail}$ = 196.06' - 43.15' - 34.38' **$L_{Guardrail}$ = 118.53'**

$L_{Guardrail,\,R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 125.00'**

$T6B_{\_End\_Sta}$ = $CB_{\_ST\_US}$

$T6B_{\_End\_Sta}$ = (675+28.39) **$T6B_{\_End\_Sta}$ = (675+28.39)**

$T6B_{Begin\_Sta}$ = $CB\text{-}_{ST\_DS}$ + T6B

36.90'

$T6B_{Begin\_Sta}$ = (675+28.39) + (43.15') **$T6B_{Begin\_Stat}$ = (675+71.54)**

GR_{End_Sta} = $T6B_{Begin\_Sta}$ **GR_{End_Sta} = (675+71.54)**

GR_{Begin_Sta} = GR_{End_Sta} + $L_{Guardrail,}$

GR_{Begin_Sta} = (675+71.54) + 125.00' **GR_{Begin_Sta} = (676+96.54)**

$T1_{\ End\_Sta}$ = $GR_{\ Begin\_Sta}$ **$T1_{\ End\_Sta}$ = (676+96.54)**

$T1_{\ Begin\_Sta}$ = $T1_{\ End\_Sta}$ + 46.88' **$T1_{\ Begin\_Sta}$ = (677+43.42)**

Please review.

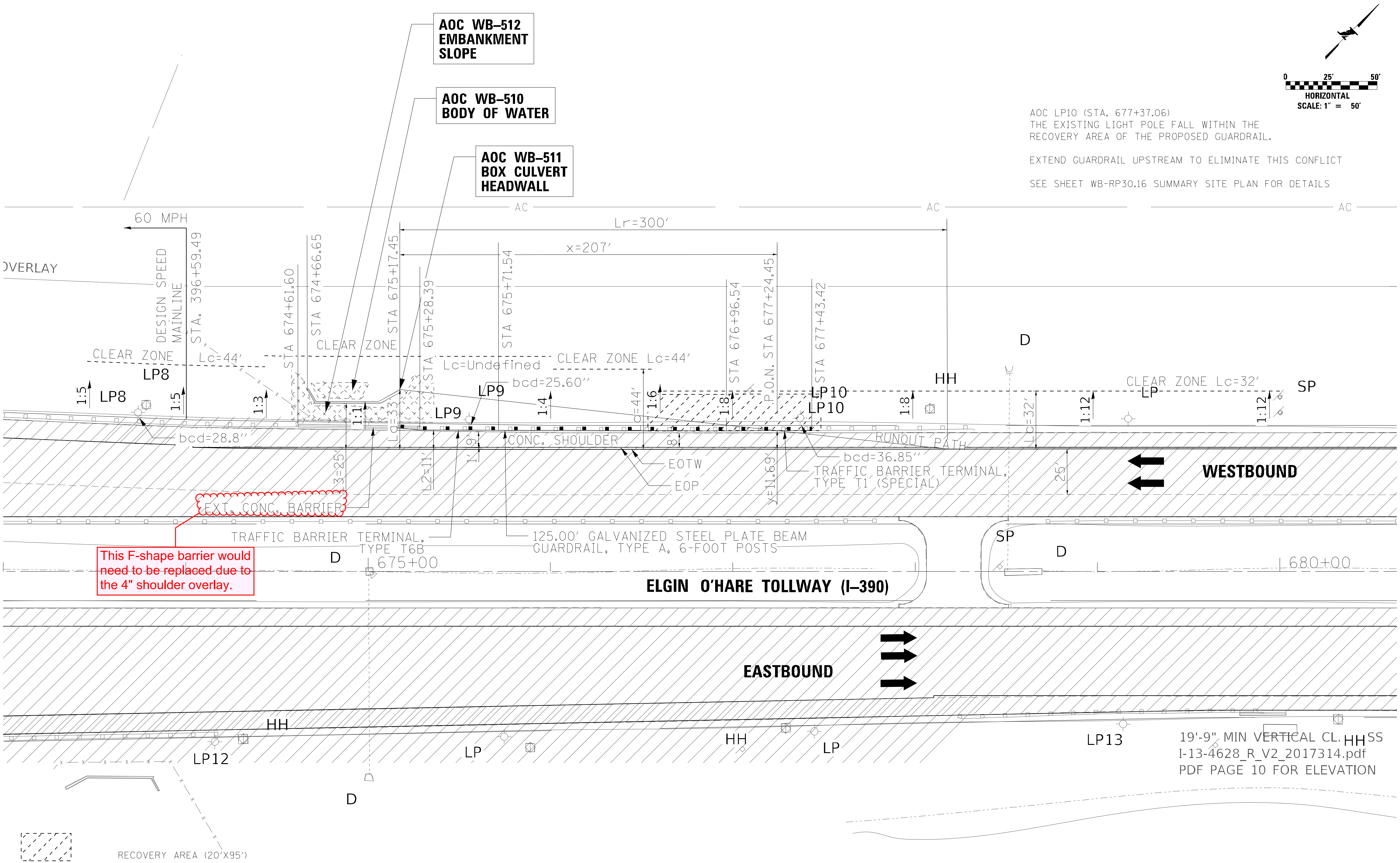
Barrier Limits Check:

Guardrail added to meet the length requirement between the two terminals for Ramp

12.5' < PON - T1 < 25'

12.5' < (677+24.45) - (677+43.42) < 25'

12.5' < -18.97' < 25' **OK** (Traffic Flow The Opposite Direction)



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	DRAWN BY: LDN	DATE: 1/18/2023
	CHECKED BY: JGM	DATE: 1/18/2023

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

REVISIONS

NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
AOC WB-511 - SITE PLAN

SHEET NO. WB-RP30.7
DRAWING NO. 7 OF 21

DATA SHEET
Location AOC WB-512
Mile Post: 6.35

DESCRIPTION OF OBSTACLE
Embankment Slope Steeper than 1:3 (V:H), STA. 672+50.00 to STA. 673+00.00 $L_{\_AOC}$ = 50.00'
Existing Concrete Barrier, STA. 674+61.60 to STA. 675+28.39 $L_{\_CB}$ = 66.79'

Per Section 5.7.1 Traffic Barrier Guidelines, March 2022, an embankment obstacle typically requires a Level 3 Analysis to determine if flatting of the existing foreslopes is cost-effective. However, the existing foreslopes in this location are steeper than 1:4 and encroach into the wetland, and also tie into the existing headwall slope. This is not practical or feasible to flatten the foreslope within the defined clear zone to meet the recoverable and traversable slopes requirement. Therefore; a Level 2 Analysis is performed for this Area of Concern.

TBG Article 13.1 discussed the situations where an existing concrete barrier can be used on a resurfacing project. Please review those limitations.

The existing Single Face Concrete Barrier remains in place due to the post depth not being achieved - Add a 4" barrier topper to the existing concrete barrier that shields portion of the AOC, to meet the 44" requirement.

No gutter is required at this location since the existing conditions in this area contains mature vegetation and show no signs of significant embankment erosion.

Design Speed = 60 MPH (ISTHA Design Speed)
Design Year = 2021
ADT = 12040 (2021), Westbound I-390
Clear Zone, Lc = Undefined based on 1:3 H:V or stepper foreslope from Sta. 674+50 to Sta. 676+00
Clear Zone, Lc = 44 ft based on 1:4 -1:5 H:V foreslope from Sta. 676+00 to Sta. 676+50
Clear Zone, Lc = 32 ft based on 1:6 or flatter H:V foreslope from Sta. 676+50 to Sta. 680+00
(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): 8'

PHOTOS

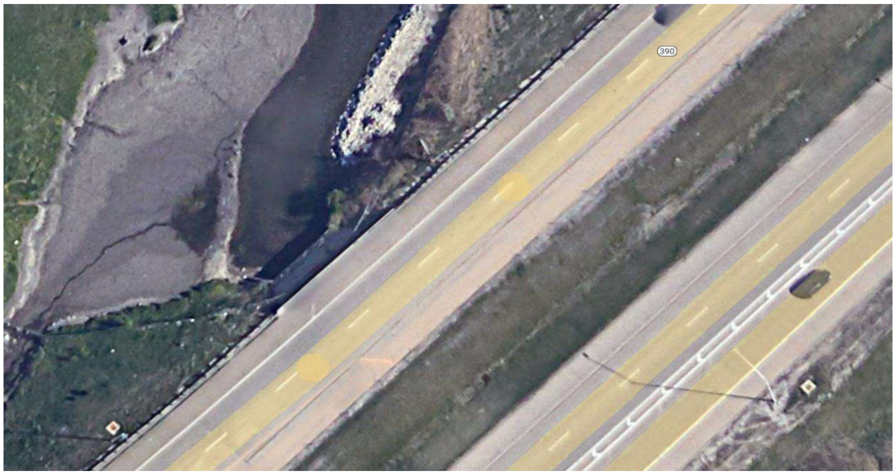


Photo 1: Aerial view - Elgin O'Hare I-390

Photo 2: Existing guardrail and Single Face barrier

Photo 3: Existing guardrail looking West on I-390 Elgin-O'Hare Tollway

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

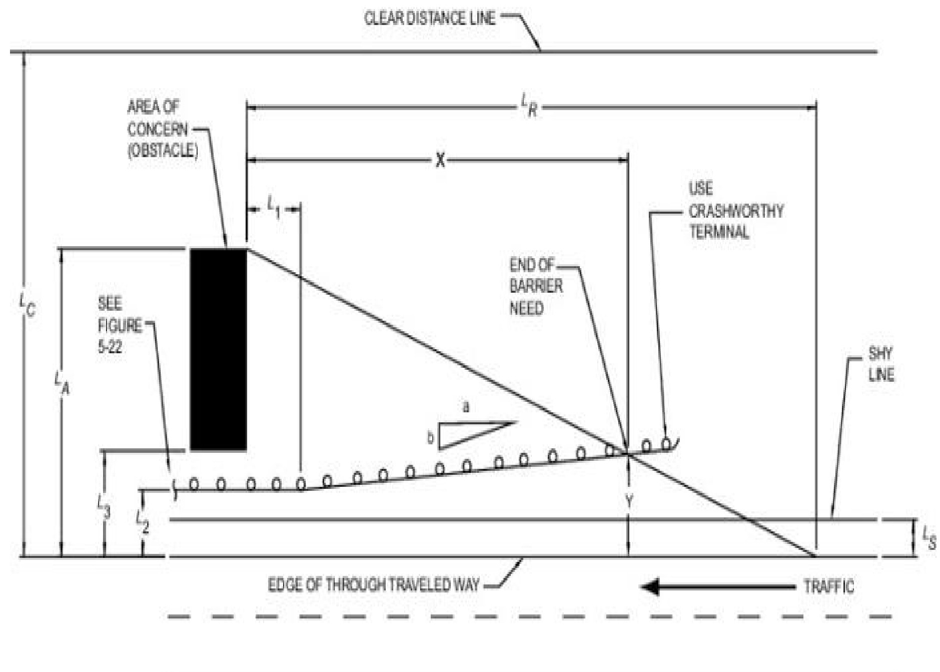


Figure 5-39. Approach Barrier Layout Variables

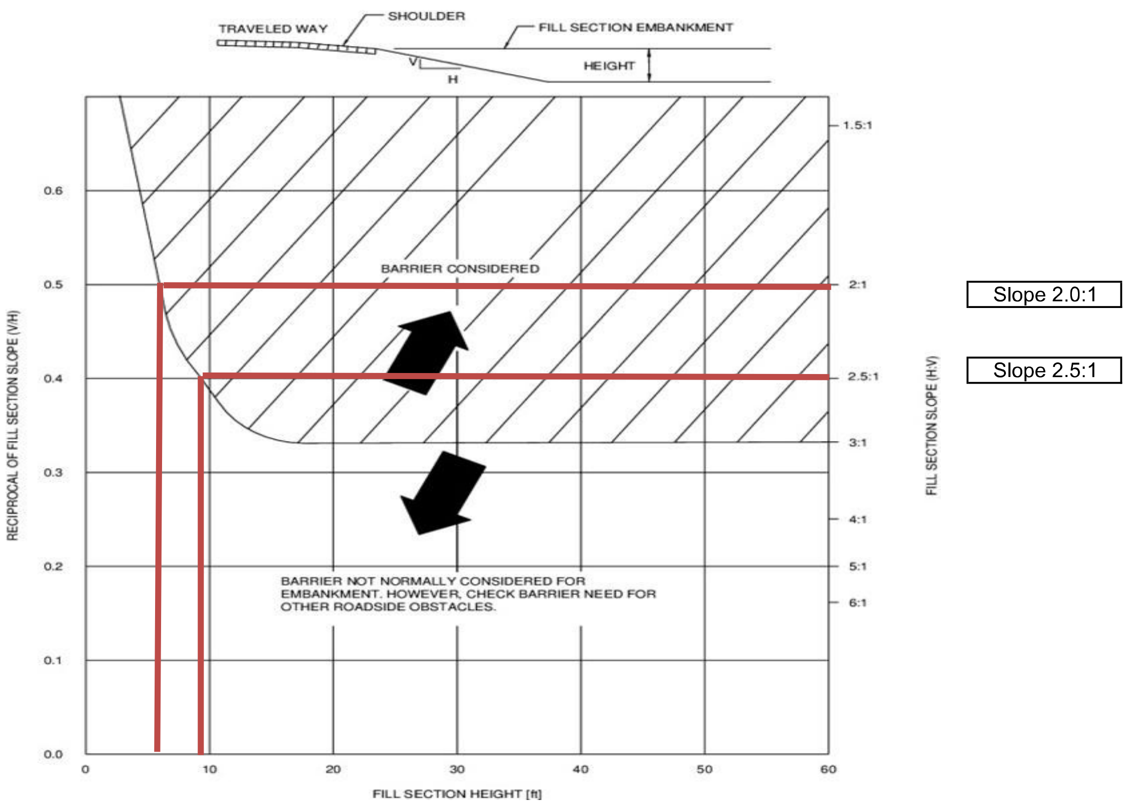


Figure 5-1b. Comparative Barrier Consideration for Embankments (U.S. Customary Units) (15)

BARRIER WARRANTS

Location AOC WB-512 - Embankment Slope

L_A = **44.00'** *(Measures to Slope Break Point)*

Lc = **Undefined**

The upstream L2 appears to be 10' (1' EOTW-EOP + 8' Shld + 1' Guardrail offset) Please verify.

L_2 = **11.00** 11.00'

L_R = **300.00'**

Y = L_2 + 0.69 = 11.00' + 0.69' **Y = 11.69'**

Obstacles:

EMB-ST_US $_{UPStream\_Sta}$ **= 675+36.00** *(Embankment Slope UpStream, AOC WB-512)* **EMB-ST_US = 675+36.00**

EMB-ST_DS $_{DownStream\_Sta}$ **= 674+58.00** **EMB-ST_DS = 674+58.00**

L_{AOC} = Length of AOC = 78.00'

CB-ST_US $_{UPStream\_Sta}$ **= 675+28.39** *(Conc. Barrier Wall US Station)* **CB-ST_US = 675+28.39**

CB-ST_DS $_{DownStream\_Sta}$ **= 674+61.60** *(Conc. Barrier Wall DS Station)* **CB-ST_DS = 674+61.60**

L $_{\_CB}$ = Length of Concrete Barrier = 66.79'

Length of Need - Formula

The graphical method is employed to determine the true distance of the value X

X = 229.80' (Graphically)

Point of Need= PON = EMB-ST_US + X

PON = (675+36.00) + 229.80' **PON = (677+65.80)**

Existing Single Face Concrete Barrier Wall remains in place and shield part of the AOC

CB_L_{CON} = **(675+28.39) - (674+61.60)**

CB_L_{CON} **= 66.79** *(Conc. Barrier Lengths Contributed)* **CB_L_{CON} = 66.79'**

Part of the Proposed Guardrail Barrier that shielding AOC WB-509 will contribute to the LON.

GR_L_{CON} = **(674+61.60) - (674+58.00)**

GR_L_{CON} **= 3.60** *(Proposed Guardrail Lengths Contributed)* **GR_L_{CON} = 03.60'**

Length of Need = LON = X + L_{AOC} - CB $_{\_LCON}$ - GR $_{\_LCON}$

LON = 229.80' + 78.00 - 66.79' - 3.60' **LON = 237.41'**

Terminals

36.90'

Terminal = Type T6B = T6B = 43.15' (count toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

Please review.

36.90'

$L_{guardrail}$ = LON - T6B - T1

$L_{guardrail}$ = 237.41' - 43.15' - 34.38' **$L_{Guardrail}$ = 159.88'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 162.50'**

T6B $_{\_End\_Sta}$ = CB $_{\_ST\_US}$

T6B $_{\_End\_Sta}$ = (675+28.39) **T6B $_{\_End\_Sta}$ = (675+28.39)**

36.90'

T6B $_{Begin\_Sta}$ = CB- $_{ST\_DS}$ + T6B

T6B $_{Begin\_Sta}$ = (675+28.39) + (43.15') **T6B $_{Begin\_Stat}$ = (675+71.54)**

GR $_{End\_Sta}$ = T6B $_{Begin\_Sta}$ **GR $_{End\_Sta}$ = (675+71.54)**

GR $_{Begin\_Sta}$ = GR $_{End\_Sta}$ + $L_{Guardrail,}$

GR $_{Begin\_Sta}$ = (675+71.54) + 162.50' **GR $_{Begin\_Sta}$ = (677+34.04)**

T1 $_{End\_Sta}$ = GR $_{Begin\_Sta}$ **T1 $_{End\_Sta}$ = (677+34.04)**

T1 $_{Begin\_Sta}$ = T1 $_{End\_Sta}$ + 46.88' **T1 $_{Begin\_Sta}$ = (677+80.92)**

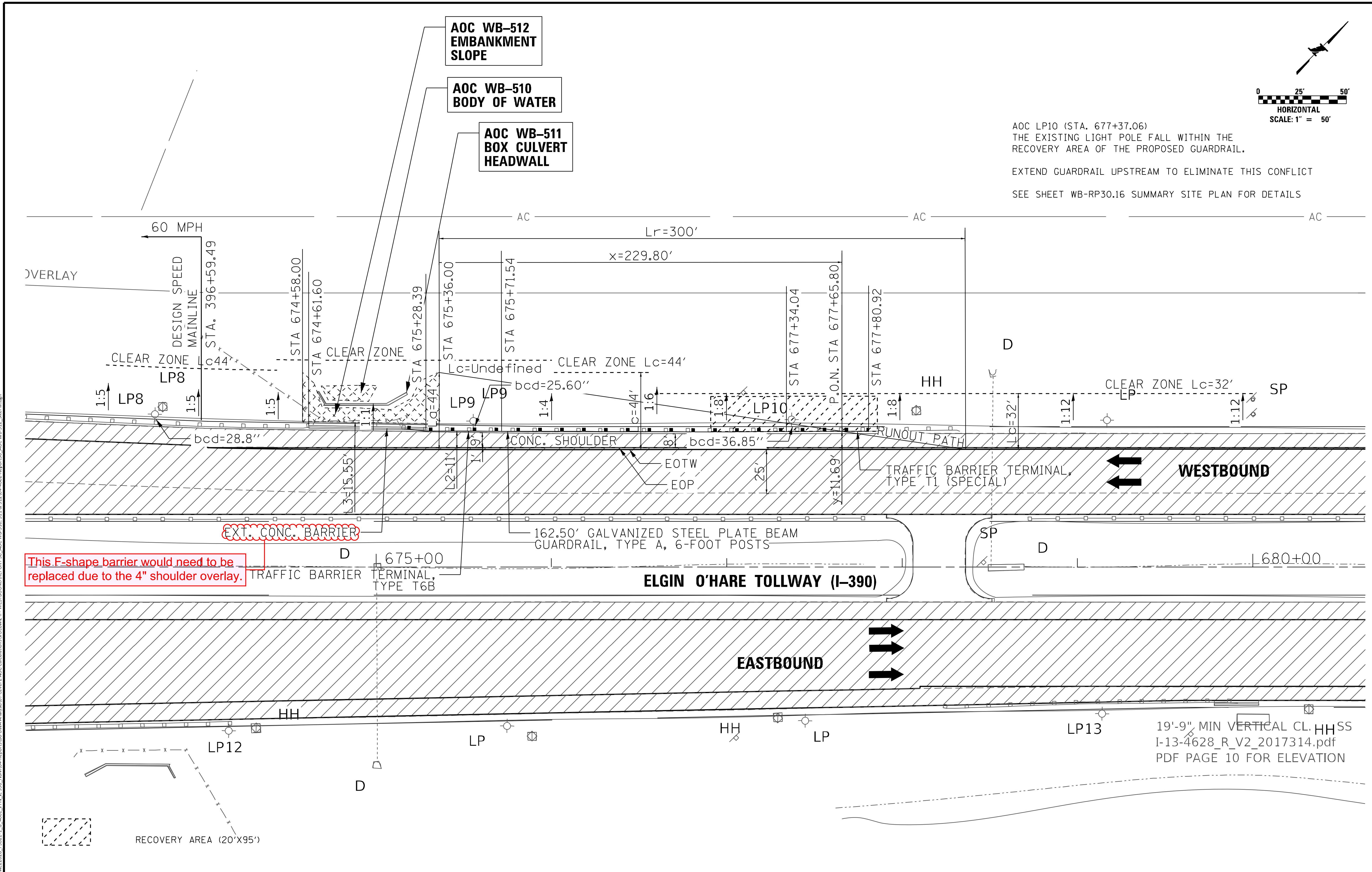
Please review.

Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (677+65.80) - (677+80.92) < 25'

12.5' < -15.12' < 25' **OK** (Traffic Flow The Opposite Direction)



MILESTONE:	DESIGNED BY: TVN	DATE: 1/18/2023		THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY	REVISIONS	CONTRACT NO. RR-21-4802	SHEET NO. WB-RP30.14
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/18/2023	MILLENNIA	2700 OGDEN AVENUE	NO. / DATE / DESCRIPTION	BARRIER WARRANT	DRAWING NO.
	CHECKED BY: JGM	DATE: 1/18/2023		DOWNERS GROVE, ILLINOIS 60515		AOC WB-512 - SITE PLAN	14 OF 21

BARRIER WARRANTS

REPORT 30 - Location AOC WB-510, WB-511 & WB-512

OVERALL BARRIER LIMITS DETERMINATION - REPORT 30

AOC WB-512 governs the upstream end of the analysis for Report 30
Existing Single Face Concrete Barrier Wall TL-4 is to remain and shield part of the AOC WB-512
AOC WB-509 (Report 31) governs the downstream end of TL-4 SFBW placed along the area above the culvert (AOC WB-511), and and shield part of the AOC
Therefore; limits are combined to provide continuous guardrail upstream and downstream of the concrete barrier wall

UPSTREAM OF CONCRETE BARRIER WALL

Obstacles:

WB-512$_{PON}$	**= 677+65.80**	*(AOC WB-512 - Point of Needed)*	**WB-512_PON = 677+65.80**
WB-512$_{DSLS}$	**= 674+58.00**	*(AOC WB-512 - Down Stream Limit Station)*	**WB-512_DSLS = 674+58.00**
CB-ST_US$_{UpStream_Sta}$	**= 675+28.39**	*(Conc. Barrier Wall Up Stream Station)*	**CB-ST_US = 675+28.39**
CB-ST_DS$_{DownStream_Sta}$	**= 674+61.60**	*(Conc. Barrier Wall Down Stream Station)*	**CB-ST_DS = 674+61.60**
GR-509_L$_{CON}$	**= -3.60**	*(AOC WB-509 - Guardrail Contributed)*	**GR-509_LCON = -3.60'**
CB_L$_{CON}$	**= -66.79**	*(Conc. Barrier Lengths of Contributed)*	**CB_L$_{CON}$ = -66.79'**

Total Length of Need = T-LON = (WB-512$_{PON}$) - (WB-512$_{DSLS}$) - (CB-L$_{CON}$) - (GR-509_L$_{CON}$)
T-LON =(677+65.80) - (674+58.00) + (-66.79') + (-3.60') **T-LON = 237.41'**

Terminals
Terminal = Type T6B = T6B = 43.15' (count toward length of need)
Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination
$L_{guardrail}$ = LON - T6B - T1
$L_{guardrail}$ = 237.41' - 43.15' - 34.38' **$L_{Guardrail}$ = 159.88'**

$L_{Guardrail,\ R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 162.50'**

The Existing Light Pole fall within the Recovery Area; therefore,
Guardrail extend 50' upstream to eliminate the conflict **$L_{Guardrail\ RT}$ = 212.50'**

T6B$_{_End_Sta}$ = CB$_{_ST_US}$
T6B$_{_End_Sta}$ = (675+28.39) **T6B$_{_End_Sta}$ = (675+28.39)**

T6B$_{Begin_Sta}$ = CB-$_{ST\_DS}$ + T6B
T6B$_{Begin_Sta}$ = (675+28.39) + (43.15') **T6B$_{Begin_Stat}$ = (675+71.54)**

GR$_{End_Sta}$ = T6B$_{Begin_Sta}$ **GR$_{End_Sta}$ = (675+71.54)**

GR$_{Begin_Sta}$ = GR$_{End_Sta}$ + L$_{Guardrail,}$
GR$_{Begin_Sta}$ = (675+71.54) + 212.50' **GR$_{Begin_Sta}$ = (677+84.04)**
T1 $_{End\_Sta}$ = GR $_{Begin\_Sta}$ **T1 $_{End\_Sta}$ = (677+84.04)**

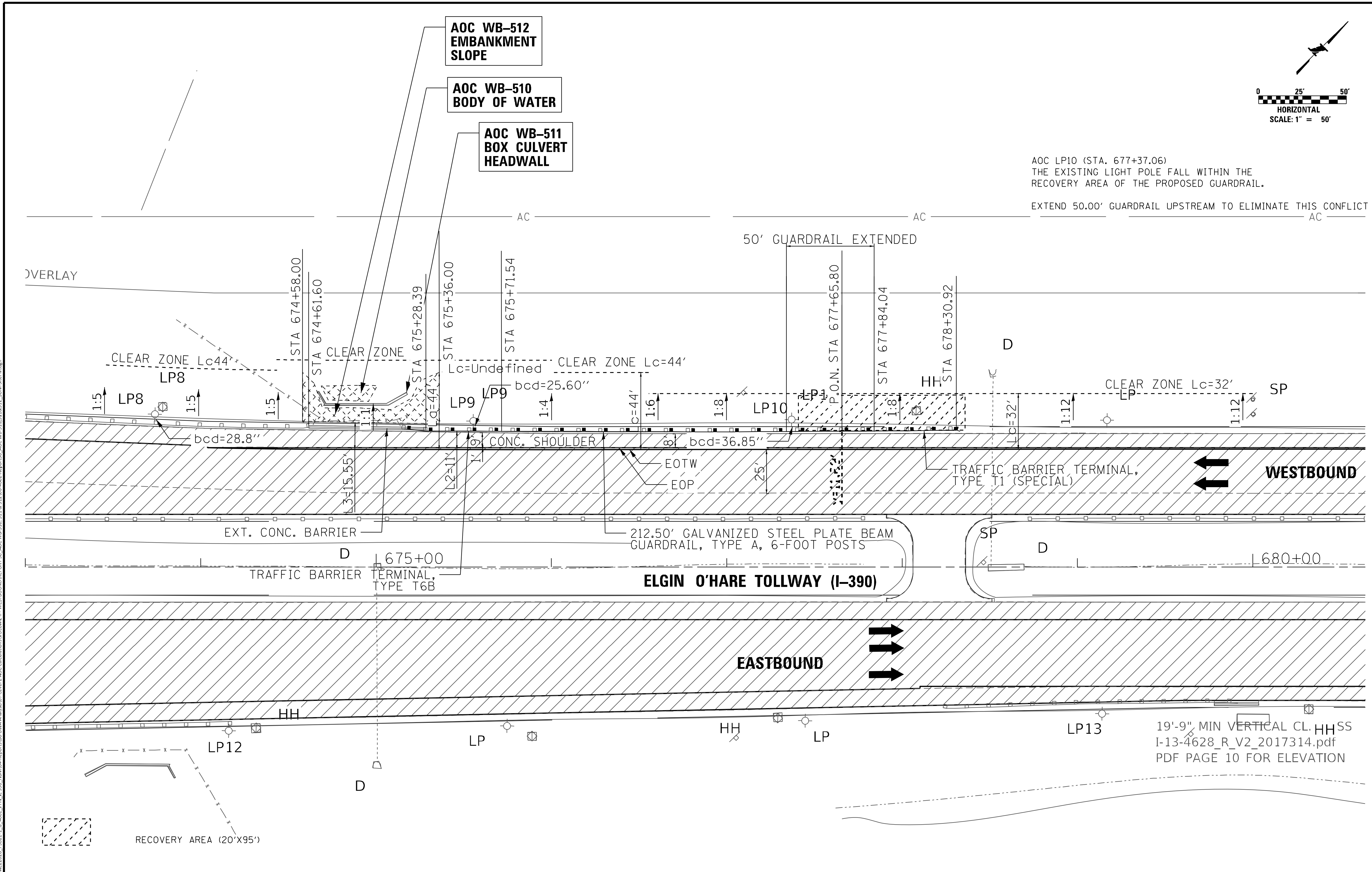
T1 $_{Begin\_Sta}$ = T1 $_{End\_Sta}$ + 46.88' **T1 $_{Begin\_Sta}$ = (678+30.92)**

Barrier Limits Check:
N/A

Please see article 13.1 of the TBG for the conditions where an existing F-shape barrier can be utilized on an overlay project.

NOTE
The proposed guardrail upstream of the SFBW TL-4 is the same as the existing guardrail (302.5' including terminals)

RECOMMENDATION
Adding a 4" WMA surface overlay will decrease the guardrail height form the surface to the top of the existing MGS guardrail and can make it substandard of a Min 31" requirement.
Therefore, consider replacing the existing guardrail with the new guardrail system
The existing concrere barrier to be remain in place. Check height to see if it is meet the standard.



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/18/2023
	CHECKED BY: JGM	DATE: 1/18/2023

MILLENNIA

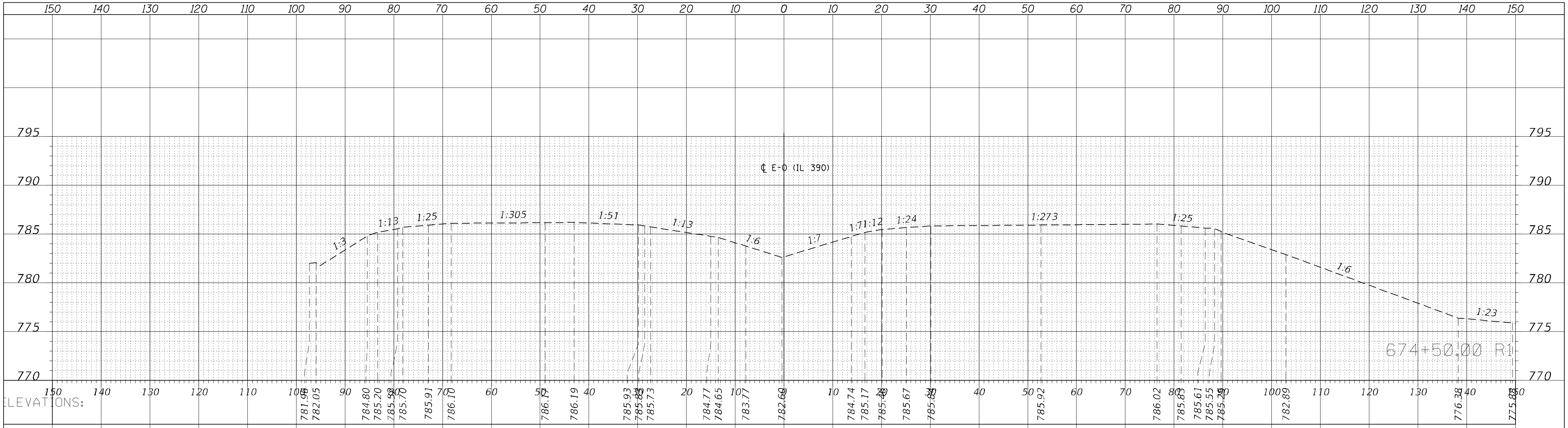
THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

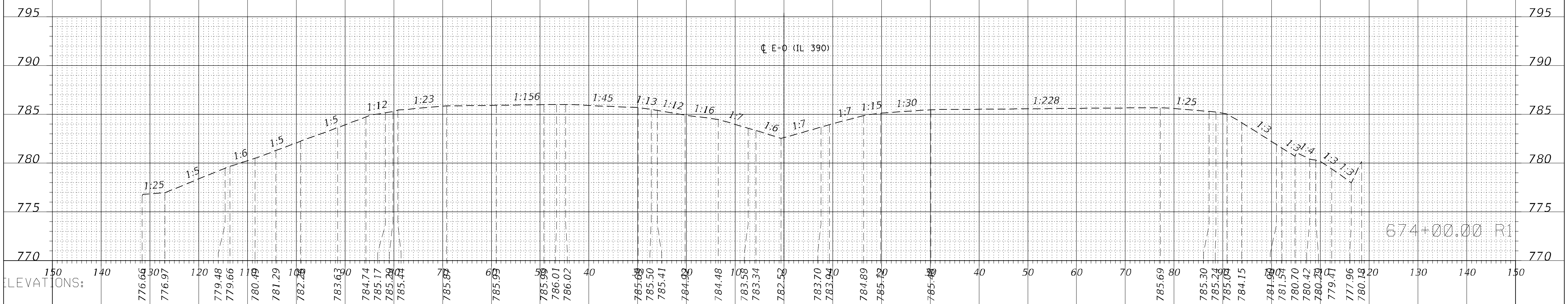
CONTRACT NO. RR-21-4802

BARRIER WARRANT
REPORT 30 - SUM SITE PLAN

SHEET NO. WB-RP30.16
DRAWING NO. 16 OF 21



674 + 50.00



674 + 00.00

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

PLOT SCALE = 20.0000 ' / in.
FILE NAME = $FILE$

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WB-RP30.17

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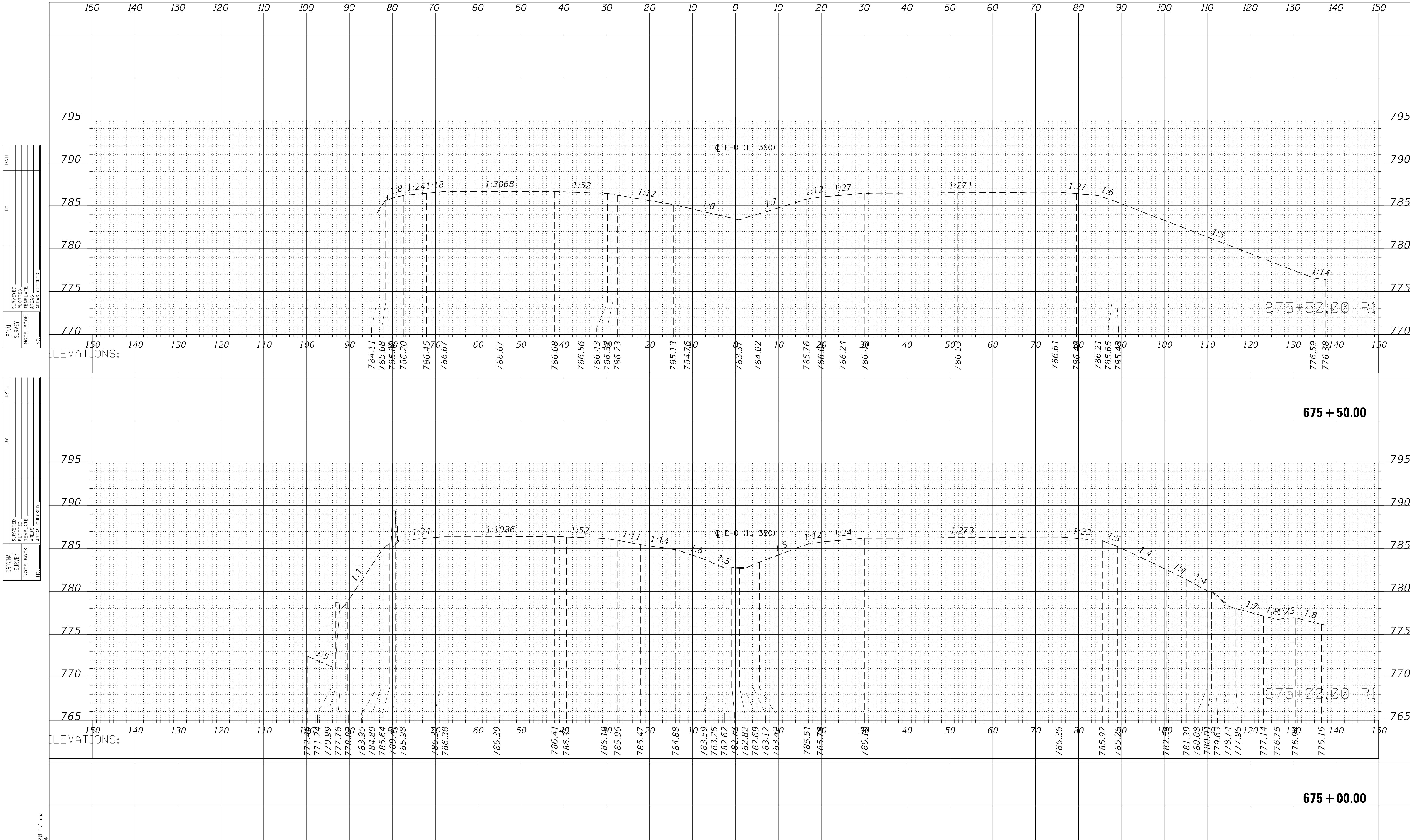

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DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 31
AOC # WB-508 & WB-509

DRAWING NO.
WB-RP30.18

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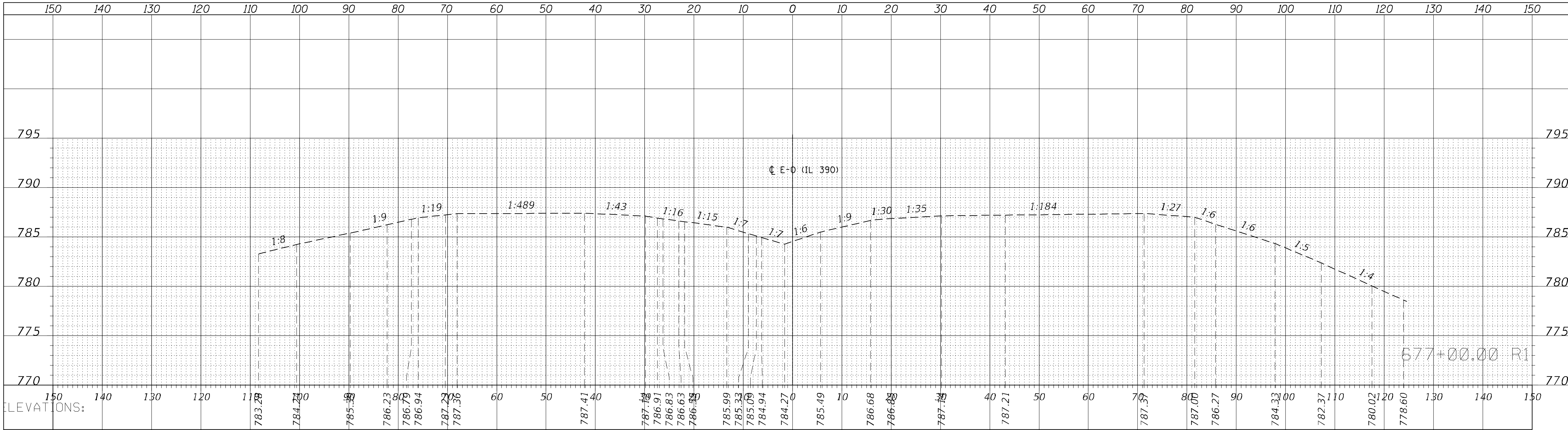
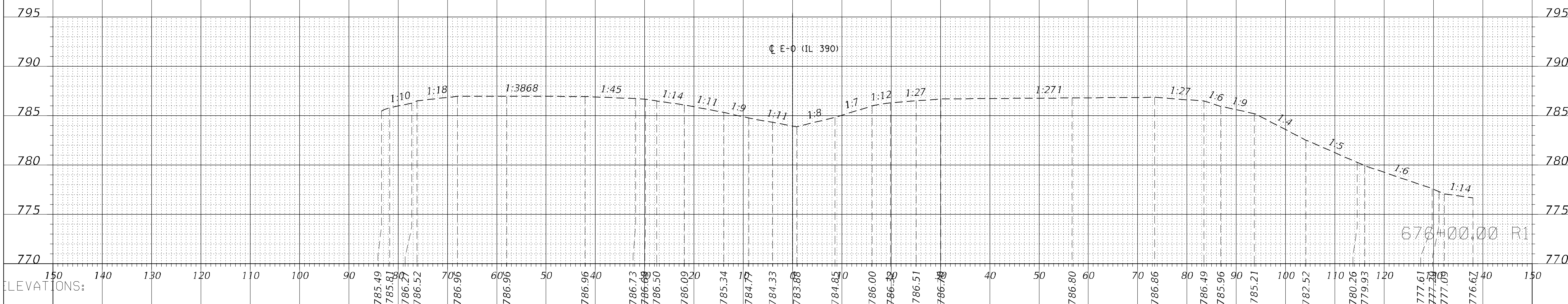


677+00.00



676+00.00

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FILE NAME = $FILE$

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CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 30
AOC # WB-510, WB-511 & WB-512

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WB-RP30.19

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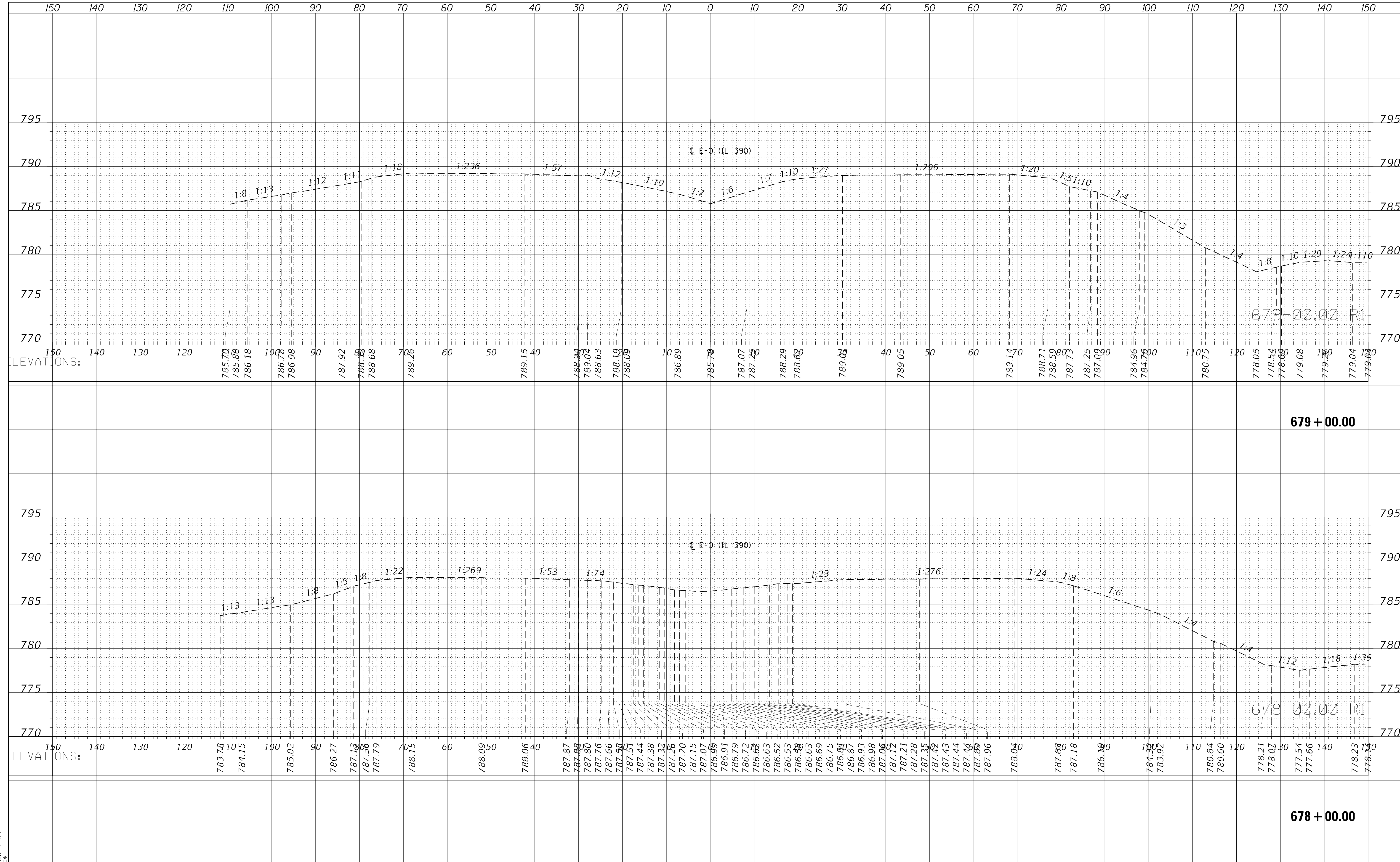

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CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 30
AOC # WB-510, WB-511 & WB-512

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WB-RP30.20

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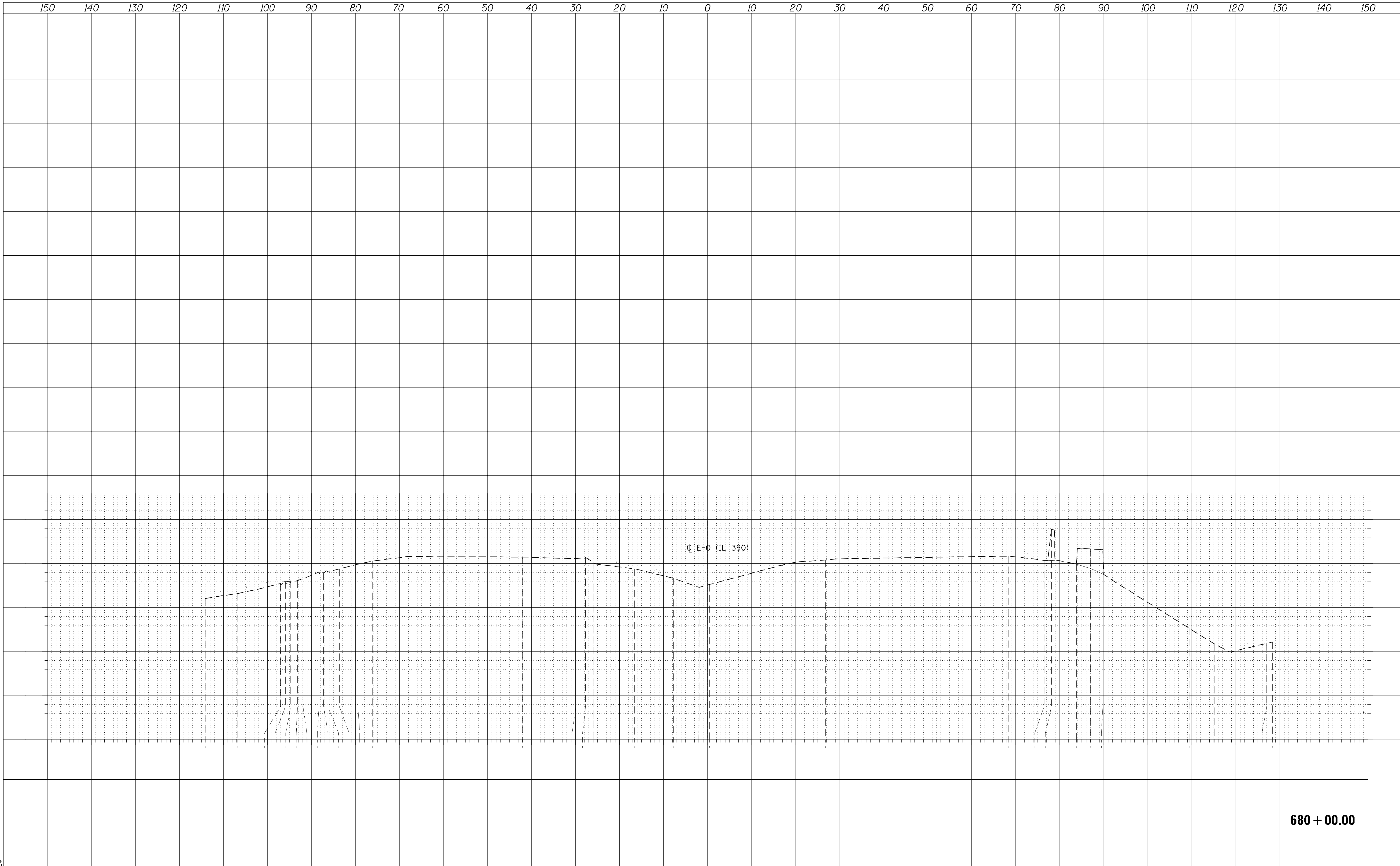

FINAL SURVEY	NOTE BOOK	NO.		
SURVEYED	PLOTTED	TEMPLATE	AREAS	AREAS CHECKED
BY				
DATE				

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

PLOT SCALE = 20.0000 ' / in.
FILE NAME = $FILE$

DRAWN BY LN DATE 1/18/2023
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NO.	DATE	DESCRIPTION

DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.
BARRIER WARRANT PLAN
REPORT 30
AOC # WB-510, WB-511 & WB-512

DRAWING NO.
WB-RP30.21

lnguyen
$FILE$

REPORT 31

BARRIER WARRANT ANALYSIS AND DESIGN

Location AOC WB-508 & 570 - Report 31
Location AOC WB-509 - Report 31

TABLE OF CONTENTS

BARRIER WARRANTS

Location: WB-508, 509, 510 & 511

STOP CONDITION AT STA. 416+50.00
RAMP LAKE 4 & WB I-390 ELGIN - O'HARE TOLLWAY
DESIGN SPEED FOR MAINLINE CURVE 3A, CURVE 3B & CURVE 3C IS 40 MPH
40 MPH DESIGN SPEED AT STA. 400+09.49

STOP Condition at Sta. 416+50.00
STOP = STA. 416+50.00

FIND STA. @ 30 MPH
30 MPH to STOP = 225' (Table 10-5)
416+50.00 - 235 = *414+15.00*

FIND STA. @ 40 MPH
40 MPH to STOP = 320' (Table 10-5)
416+50.00 - 320 = *413+30.00*

Using 40 MPH thru. Curve 3C, Curve 3B & Curve 3A to Sta. 400+09.49

Using 40 MPH Design Speed at Sta. 400+09.49
40 MPH = STA. 400+09.49

FIND STA. @ 50 MPH
50 MPH to 40 MPH = 225' (Table 10-5)
400+09.49 - 225 = *397+84.49*

FIND STA. @ 60 MPH
60 MPH to 40 MPH = 350'(Table 10-5)
400+09.49 - 350 = *396+59.49*

Continue 60 MPH on WB I-390 Elgin - O'Hare Tollway

STOP = STA. 416+50.00
30 MPH = STA. 414+15.00
40 MPH = STA. 413+30.00
Using 40 MPH from STA. 413+30.00 to STA. 400+09.49
50 MPH = STA. 397+84.49
60 MPH = STA. 396+59.49

Table 10-5. Minimum Deceleration Lengths for Exit Terminals with Flat Grades of Two Percent or Less

Metric									
Deceleration Length, *L* (m) for Design Speed of Exit Curve, *V'* (km/h)									
Highway Design Speed, *V* (km/h)	Speed Reached, V_a (km/h)	Stop Condition	20	30	40	50	60	70	80
		For Average Running Speed on Exit Curve V'_a (km/h)							
		0	20	28	35	42	51	63	70
50	47	75	70	60	45	—	—	—	—
60	55	95	90	80	65	55	—	—	—
70	63	110	105	95	85	70	55	—	—
80	70	130	125	115	100	90	80	55	—
90	77	145	140	135	120	110	100	75	60
100	85	170	165	155	145	135	120	100	85
110	91	180	180	170	160	150	140	120	105
120	98	200	195	185	175	170	155	140	120

V = design speed of highway (km/h)

V_a = average running speed on highway (km/h)

V' = design speed of exit curve (km/h)

V'_a = average running speed on exit curve (km/h)

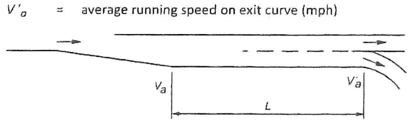
U.S. Customary										
Deceleration Length, *L* (ft) for Design Speed of Exit Curve *V'* (mph)										
Highway Design Speed, *V* (mph)	Speed Reached, V_a (mph)	Stop Condition	15	20	25	30	35	40	45	50
		For Average Running Speed on Exit Curve, V'_a (mph)								
		0	14	18	22	26	30	36	40	44
30	28	235	200	170	140	—	—	—	—	—
35	32	280	250	210	185	150	—	—	—	—
40	36	320	295	265	235	185	155	—	—	—
45	40	385	350	325	295	250	220	—	—	—
50	44	435	405	385	355	315	285	225	175	—
55	48	480	455	440	410	380	350	285	235	—
60	52	530	500	480	460	430	405	350	300	240
65	55	570	540	520	500	470	440	390	340	280
70	58	615	590	570	550	520	490	440	390	340
75	61	660	635	620	600	575	535	490	440	390

V = design speed of highway (mph)

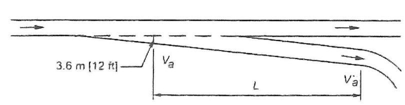
V_a = average running speed on highway (mph)

V' = design speed of exit curve (mph)

V'_a = average running speed on exit curve (mph)



Parallel Type

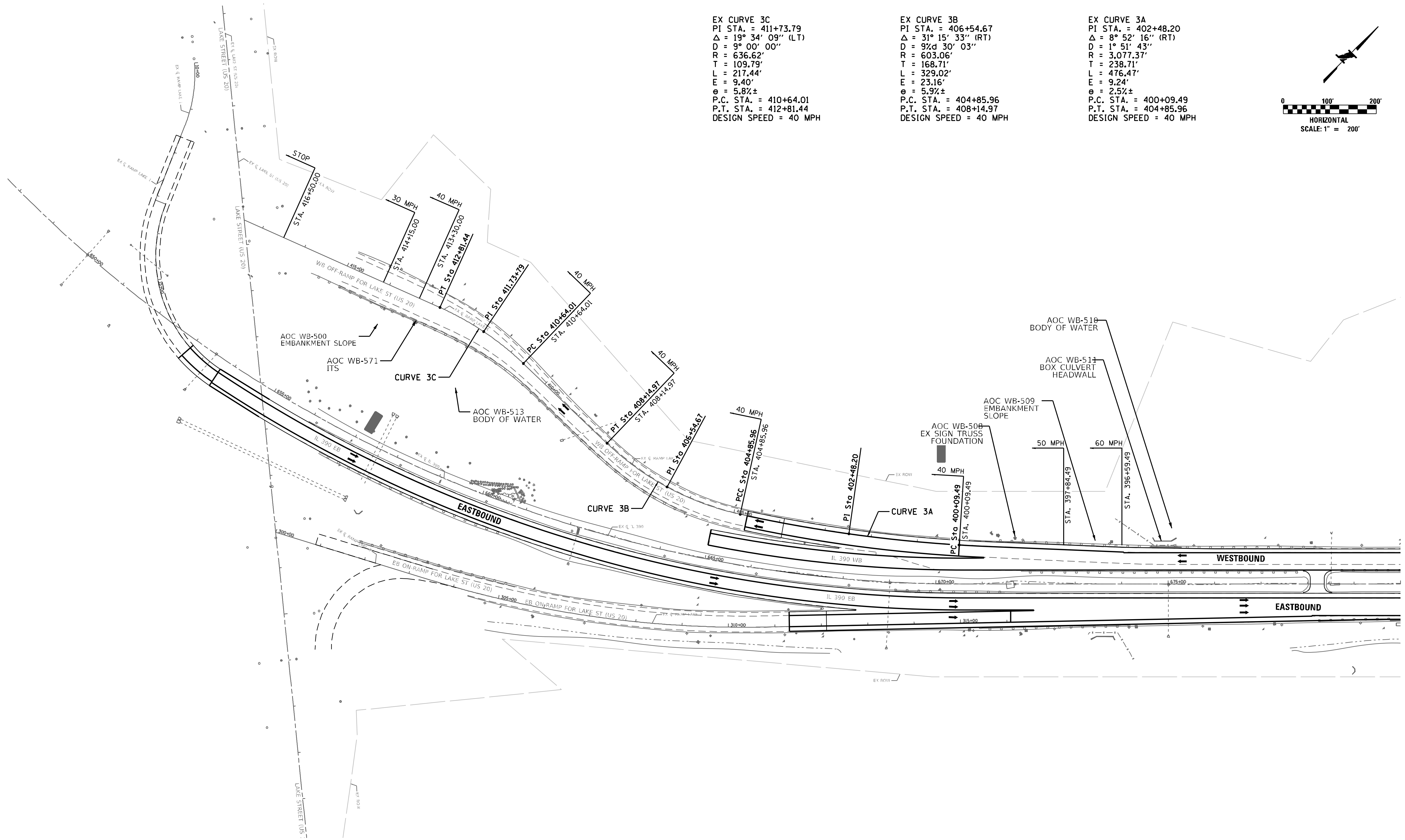


Taper Type

EX CURVE 3C
PI STA. = 411+73.79
Δ = 19° 34' 09" (LT)
D = 9° 00' 00"
R = 636.62'
T = 109.79'
L = 217.44'
E = 9.40'
e = 5.8%±
P.C. STA. = 410+64.01
P.T. STA. = 412+81.44
DESIGN SPEED = 40 MPH

EX CURVE 3B
PI STA. = 406+54.67
Δ = 31° 15' 33" (RT)
D = 9%d 30' 03"
R = 603.06'
T = 168.71'
L = 329.02'
E = 23.16'
e = 5.9%±
P.C. STA. = 404+85.96
P.T. STA. = 408+14.97
DESIGN SPEED = 40 MPH

EX CURVE 3A
PI STA. = 402+48.20
Δ = 8° 52' 16" (RT)
D = 1° 51' 43"
R = 3,077.37'
T = 238.71'
L = 476.47'
E = 9.24'
e = 2.5%±
P.C. STA. = 400+09.49
P.T. STA. = 404+85.96
DESIGN SPEED = 40 MPH



MILESTONE:	DESIGNED BY: TVN	DATE: 11/7/2022
60% PRELIMINARY	DRAWN BY: LDN	DATE: 11/7/2022
	CHECKED BY: TVN	DATE: 11/7/2022

MILLENNIA

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802
BARRIER WARRANT
RAMP LAKE 4 SPEED PROFILE PLAN

SHEET NO. RP31.4
DRAWING NO. 04 OF 24

DATA SHEET

Location AOC WB-508 & 570
Mile Post: 6.28

DESCRIPTION OF OBSTACLE

Existing Sign Truss Foundation, STA. 671+68.67 to STA. 671+72.67 4.0' X 3.0' Concrete Foundation
Sign Truss Foundation Coordinate: N 1936918.400, E 1038385.583)

Existing ITS POLE FOUNDATION, STA. 671+35.98 (Coordinate: N 1936895.048, E 1038354.403)

Per Section 5.7.4 Traffic Barrier Guidelines, March 2022, existing overhead sign supports located on the foreslope when the clear zone is undefined require a Level 3 Analysis. The existing sign foundation is located in the undefined clear zone and does not meet the 28' offset recommendation. It is not feasible to install a longer span length that places the foundation well outside the clear zone and meets the 28' offset in Table 5.8.1. Therefore, a Level 2 Analysis is performed for this Area of Concern.

You still need to show the ITS Pole is shielded by the proposed guardrail.

The existing ITS Pole Foundation is located behind and shielded by the proposed guardrail, therefore, no further analysis needed.

The slopes downstream of the existing sign ITS pole are flatter than 1:2.5 with fill a height of 6'. Based on the AASHTO Roadside Design Guide, Figure 5-1b, shielding is not required for slopes flatter than 1:2.5 with height less than 9'.

Design Speed = 50 MPH (ISTHA Design Speed) (Using 50 mph design speed to be more conservative)
Design Year = 2021
ADT = 12040 (2021), Westbound I-390
Clear Zone, Lc = Undefined based on 1:3 H:V foreslope from Sta. 670+00 to Sta. 673+50 & Sta. 674+50 to Sta. 676+00
Clear Zone, Lc = 44 ft based on 1:4 -1:5 H:V foreslope from Sta. 673+50 to Sta. 670+50 & Sta. 676+00 677+00
(From Table 3-1 AASHTO Roadside Design Guide 2015)
Runout Length = 230 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): 6.5'

PHOTOS

Photo 1: Existing Street view - guardrail barrier - Looking West on Elgin O'Hare I-390

Photo 3: Existing Sign Truss foundation and ITS pole

Photo 3: Existing guardrail barrier shielding the Critical Slope embankment tie in the existing Conc. Barrier

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

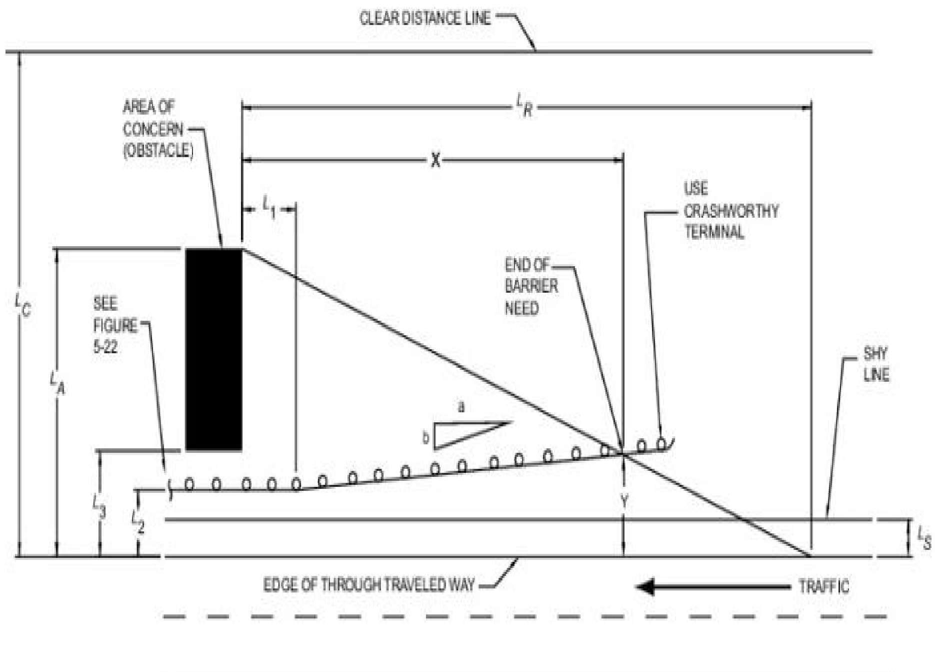


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC WB-508 - Sign Truss Foundation

L_A = **20.30'** *(Measures to back of Sign Truss Foundation)*

Lc = **Undefined**

For the proposed guardrail, please use the shoulder width + 1' per the IL Tollway standard C1.

L_2 = **11.30** 11.30'

L_R = **230.00'**

Y = L_2 + 0.69 = 11.30' + 0.69' **Y = 11.99'**

Obstacles:

ST_US $_{UPStream\_Sta}$ **= 671+72.67** *(Sign Truss Foundation, AOC WB-508)* **ST_US = 671+72.67**

ST_DS $_{DownStream\_Sta}$ **= 671+68.67** *Traffic going oppistite direction of Alignment Station* **ST_DS = 671+68.67**

L_{AOC} = Length of AOC = 4.00'

ITS $_{STA}$ *(ITS POLE, AOC WB-570)* **ITS_STA = 671+35.98**

Length of Need - Formula

The graphical method is employed to determine the true distance of the value X

X = 103.00' (Graphically)

Point of Need= PON = ST_US + X (Traffic Flow The Opposite Direction)

PON = (671+72.67) + 103.00' **PON = (672+75.67)**

BCD$_{\text{Barrier Clearance Distance}}$ = La-L2-Obstacles Width-Guardrail Width

BCD$_{\text{Barrier Clearance Distance}}$ = 20.51' - 11.30' - 3.0' - (3 1/4" + 1' + 5 7/8") = 4.24'

(Distance from back of guardrail posts to face of foundation is 4.24'

Therefore, the downstream guardrail shall be extended an additional 25' past the downstream end of the obstacle.

See condition 1, TBG Figure 5.14)

If shielding the ITS pole also, then add the distance to the end of the ITS pole.

DS $_{Extnd25}$ = 25.00' **DS_Extnd25 = 25.00'**

Length of Need = LON = X + LAOC + (DS $_{Extnd25}$)

LON = 103.00' + 4.00 + 25.00' **LON = 132.00'**

Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)

Terminal = Type T1A (Special) = T1A = 46.88' (34.38' counts toward length of need)

Use T1(Special) terminal when the design speed is 45 mph or greater.

Barrier Limits Determination

$L_{guardrail}$ = LON - T1

$L_{guardrail}$ = 132.00' - 34.38' **$L_{Guardrail}$ = 97.62'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 100.00'**

The new Calculated Length of Guardrail Length is the same as the 2015 BWA submittal for this AOC Analysis.

(Round up to meet the Illinois Tollway minimum length of a "free-standing" run of guardrail of 137.5' - for Ramp) **$L_{Guardrail\ RUp}$ = 137.50'**

T2$_{End_Station}$ = ST_US - DS_Extnd25 - T2

T2$_{End_Station}$ = (671+72.67) - (25.00') - (12.50') **T2$_{End_Station}$ = (671+35.17)**

T2$_{Begin_Station}$ = (671+35.17) + (12.50') **T2$_{Begin_Station}$ = (671+47.67)**

Use min. of 112.5' when using the T1(Special) terminal per article 5.16 of the TBG.

GR$_{End_Station}$ = T2$_{Begin_Station}$ **GR$_{End\ Station}$ = (671+47.67)**

GR$_{Begin_Station}$ = GR$_{End\ Station}$ + L$_{Guardrail,\ Rup}$

GR$_{Begin_Station}$= (671+47.67) +137.50' **GR$_{Begin_Station}$= (672+85.17)**

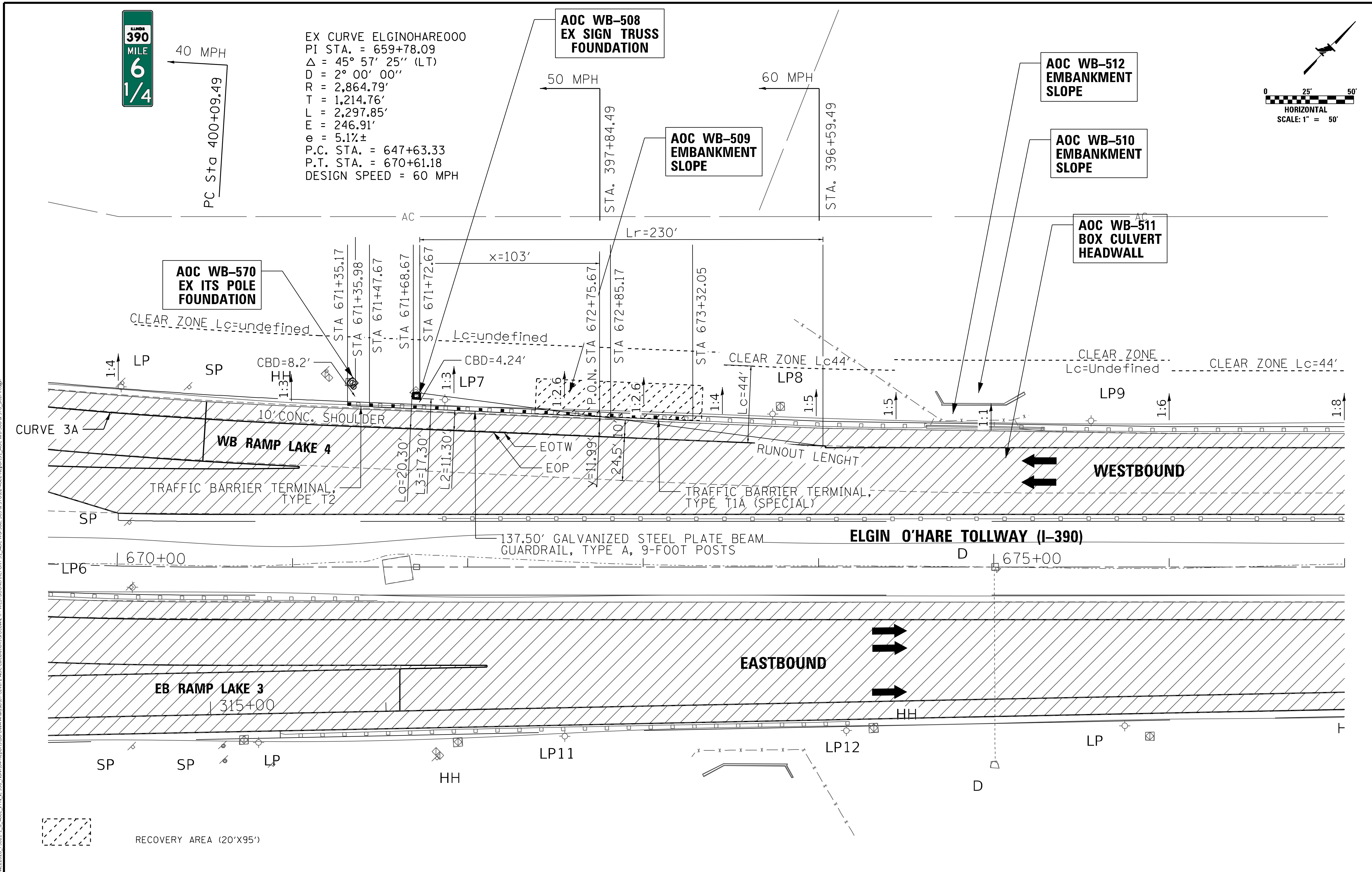
T1A $_{End\_Station}$ = GR$_{Begin_Station}$ **T1A $_{End\_Station}$ = (672+85.17)**

T1A $_{End\_Station}$ = GR$_{Begin_Station}$ + 46.88'

T1A $_{Begin\_Station}$ = (672+85.17) + 46.88' **T1 $_{Begin\_Station}$ = (673+32.05)**

Barrier Limits Check:

Guardrail added to meet the length requirement between the two terminals for Ramp



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60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

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2700 OGDEN AVENUE
DOWNERS GROVE,
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NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
AOC WB-508 - SITE PLAN

SHEET NO. WB-RP31.10

DRAWING NO. 10 OF 22

DATA SHEET

Location AOC WB-509

Mile Post: 6.35

DESCRIPTION OF OBSTACLE

Embankment Slope Steeper than 1:3 (V:H), STA. 672+50.00 to STA. 673+00.00 $L_{\_AOC}$ = 50.00'

(Coordinate: 1936973.325, 1038440.527 - 1937008.862 1038477.386)

Existing Concrete Barrier, STA. 674+61.60 to STA. 675+28.39 $L_{\_CB}$ = 66.79'

Per Section 5.7.1 Traffic Barrier Guidelines, March 2022, an embankment obstacle typically requires a Level 3 Analysis to determine if flatting of the existing foreslopes is cost-effective. However, the existing foreslopes in this location are steeper than 1:4 and encroach into the drainage ditch and this is not practical and not feasible to flatten the foreslope within the defined clear zone to meet the recoverable and traversable slopes requrirement. Therefore, a Level 2 Analysis is performed for this Area of

The existing Concrete Barrier remains in place and shields a portion of the AOC WB-512, AOC WB-511

Design Speed = 60 MPH (ISTHA Design Speed) (Use 60 mph to be more conservative)

Design Year = 2021

ADT = 12040 (2021), Westbound I-390

Clear Zone, Lc = Undefined based on 1:3 H:V foreslope from Sta. 670+00 to Sta. 673+50 & Sta. 674+50 to Sta. 676+00

Clear Zone, Lc = 44 ft based on 1:4 -1:5 H:V foreslope from Sta. 673+50 to Sta. 674+50 & Sta. 676+00 to Sta. 677+00

(From Table 3-1 AASHTO Roadside Design Guide 2015)

Runout Length = 300 feet (From Table 5-10b AASHTO Roadside Design Guide 2015)

Shy Line Offset, Ls (AASHTO Table 5-7): 8'

PHOTOS

Photo 1: Existing Street view - guardrail barrier - Looking West on Elgin O'Hare I-390

Photo 2: Existing guardrail barrier shielding the Critical Slope embankment tie in the existing Conc. Barrier

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	**Design ADT**	**Foreslopes**			**Backslopes**		
		1V:6H or flatter	**1V:5H to 1V:4H**	**1V:3H**	**1V:3H**	**1V:5H to 1V:4H**	**1V:6H or flatter**
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	10–12	10–12	10–12
	1500–6000	12–14	14–16	[b]	12–14	12–14	12–14
	OVER 6000	14–16	16–18	[b]	14–16	14–16	14–16
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

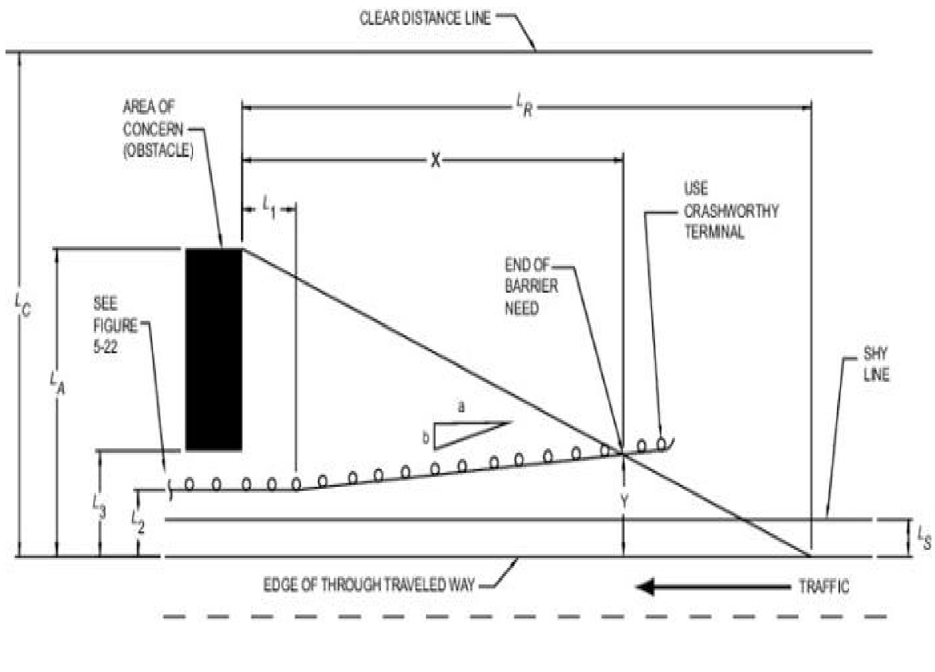


Figure 5-39. Approach Barrier Layout Variables

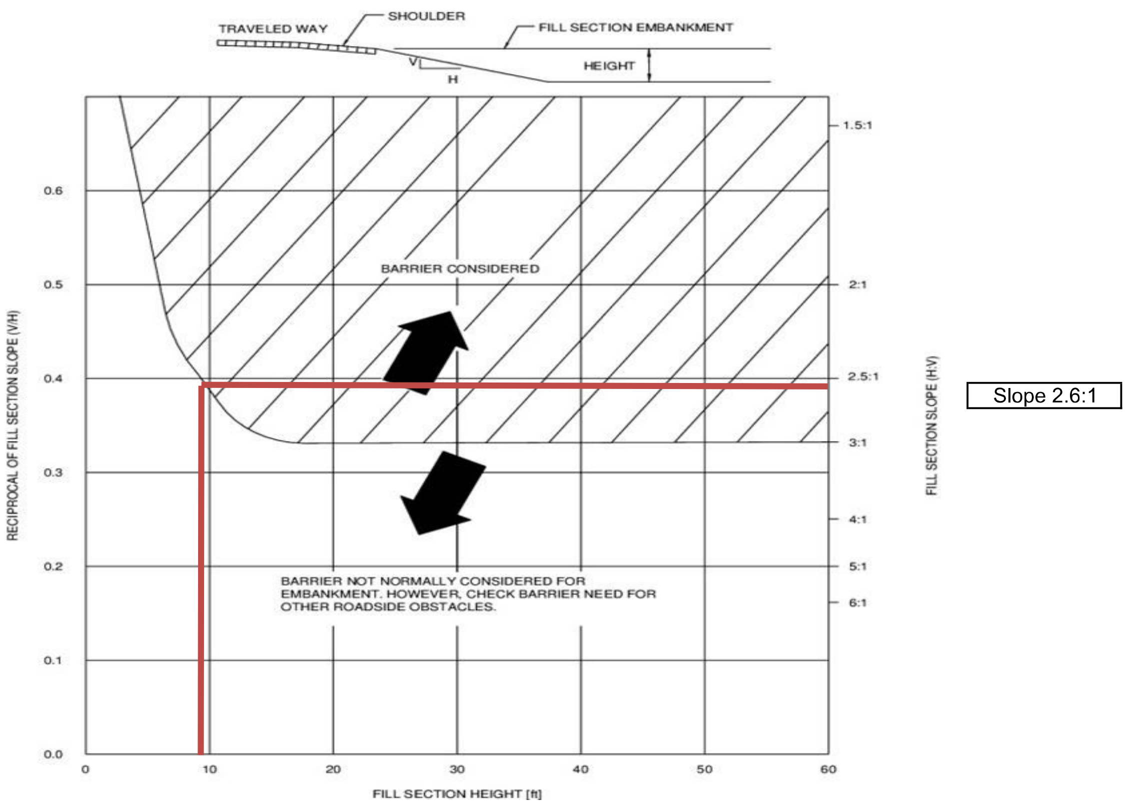


Figure 5-1b. Comparative Barrier Consideration for Embankments (U.S. Customary Units) (15)

BARRIER WARRANTS

Location AOC WB-509 - Embankment Slope

L_A = **39.00'** *(Measures to Slope Break Point)*

Lc = **Undefined**

For the proposed guardrail, please use the shoulder width + 1' per the IL Tollway standard C1.

L_2 = **11.28** 11.28'

L_R = **300.00'**

Y = L_2 + 0.69 = 11.28' + 0.69' **Y = 11.97'**

Obstacles:

EMB-ST_US $_{UPStream\_Sta}$ **= 673+00.00** *(Embankment Slope UpStream, AOC WB-509)* **EMB-ST_US = 673+00.00**

EMB-ST_DS $_{DownStream\_Sta}$ **= 672+50.00** **EMB-ST_DS = 672+50.00**

L_{AOC} = Length of AOC = 50.00'

CB-ST_US $_{UPStream\_Sta}$ **= 675+28.39** **EMB-ST_US = 675+28.39**

CB-ST_DS $_{DownStream\_Sta}$ **= 674+61.60** **EMB-ST_DS = 674+61.60**

L $_{\_CB}$ = Length of Concrete Barrier = 66.79'

Length of Need - Formula

The graphical method is employed to determine the true distance of the value X

X = 229.72' (Graphically)

Point of Need= PON = EMB-ST_US + X

PON = (673+00.00) + 229.72' **PON = (675+29.72)**

Length of Need = LON = X + LAOC

LON = 229.72' + 50.00 **LON = 279.72'**

Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)
Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

The min. length is associated with the design speed (T1 or T1-A terminal), not just if along a ramp.

$L_{guardrail}$ = LON - T1

$L_{guardrail}$ = 279.72' - 34.38' **$L_{Guardrail}$ = 245.34'**

$L_{Guardrail, R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 250.00'**

The new Calculated Length of Guardrail Length is the same as the 2015 BWA submittal for this AOC Analysis.

(Meet the Illinois Tollway minimum length of a "free-standing" run of guardrail of 137.5' - for Ramp) **$L_{Guardrail\ R}$ = 250.00'**

$T2_{End\_Station}$ = EMB-ST_DS - T2

$T2_{End\_Station}$ = (672+50.00) - (12.50') **$T2_{End\_Station}$ = (672+37.50)**

$T2_{Begin\_Station}$ = (672+37.50) + (12.50') **$T2_{Begin\_Station}$ = (672+50.00)**

$GR_{End\_Station}$ = $T2_{Begin\_Station}$ **$GR_{End\ Station}$ = (672+50.00)**

$GR_{Begin\_Station}$ = $GR_{End\ Station}$ + $L_{Guardrail, R}$

$GR_{Begin\_Station}$= (672+50.00) +250.00' **$GR_{Begin\_Station}$= (675+00.00)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (675+00.00)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ + 46.88'

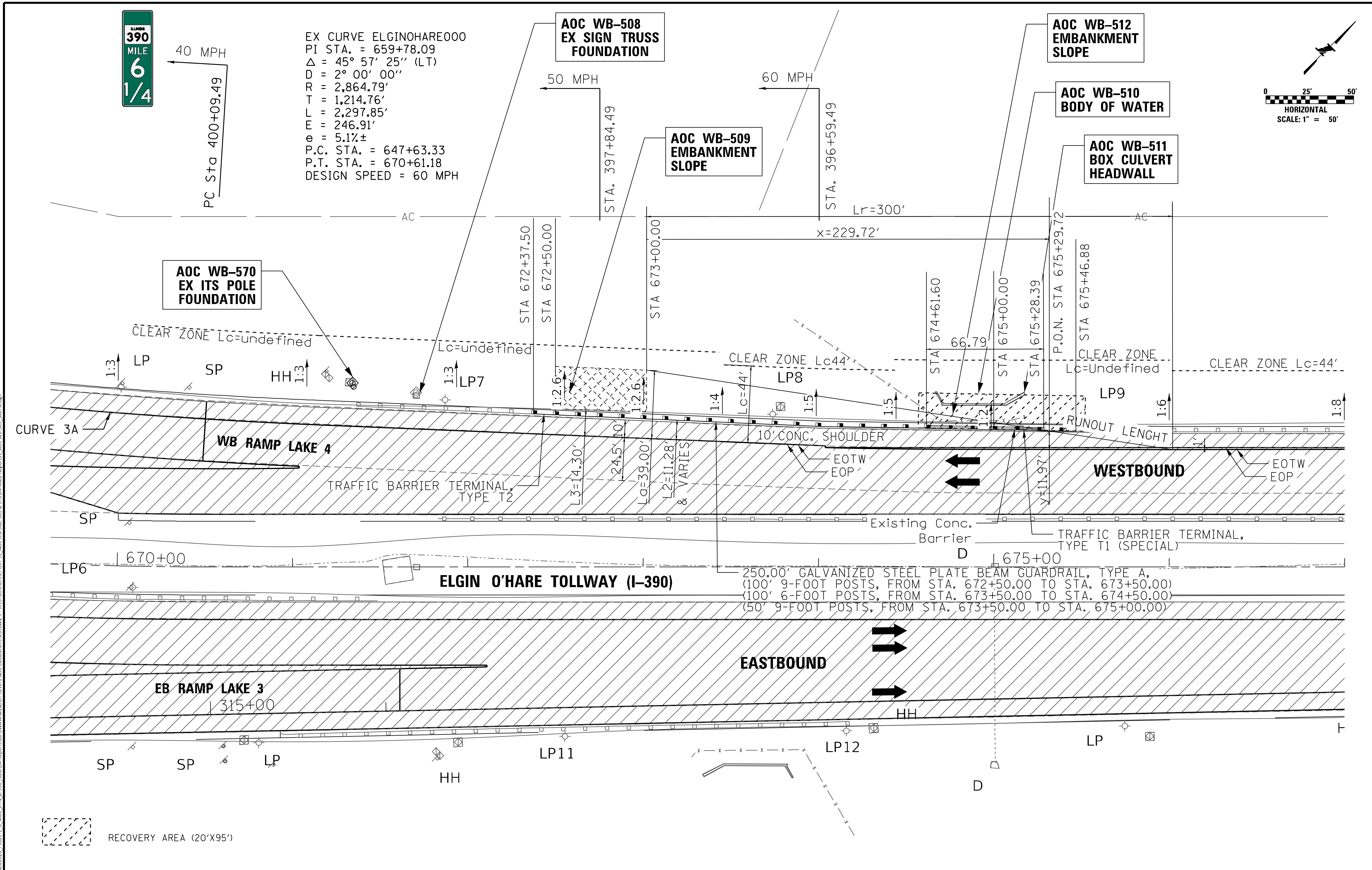
T1 $_{Begin\_Station}$ = (675+00.00) + 46.88' **T1 $_{Begin\_Station}$ = (675+46.88)**

Barrier Limits Check:
Guardrail added to meet the length requirement between the two terminals for Ramp

12.5' < PON - T1 < 25'

12.5' < (675+29.72) - (675+46.88) < 25'

12.5' < -17.16' < 25' **OK** (Traffic Flow The Opposite Direction)



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NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
AOC WB-509 - SITE PLAN

SHEET NO. WB-RP31.17

DRAWING NO. 17 OF 22

BARRIER WARRANTS

REPORT 31 - Location AOC WB-508, WB-509 & WB-570

OVERALL BARRIER LIMITS DETERMINATION - REPORT 31

AOC WB-508 governs the downstream end of the analysis for Report 31
AOC WB-509 governs the upstream end of the downstream end of TL-4 SFBW placed along the area above the culvert (AOC WB-511)
Therefore, limits are combined to provide continuous guardrail downstream of the concrete barrier wall

DOWNSTREAM OF CONCRETE BARRIER WALL

Obstacles:

$WB\text{-}509_{\_GR\text{-}Begin}$	**= 675+00.00**	*(AOC WB-509 - Guardrail Begin Station)*	**WB-509_GR-Begin = 675+00.00**
$CB\text{-}ST\_DS_{\_DownStream\_Sta}$	**= 674+61.60**	*(Conc. Barrier Wall DS Station)*	**CB-ST_DS = 674+61.60**
$WB\text{-}508_{\_GR\text{-}End}$	**= 671+47.67**	*(AOC WB-508 - Guardrail End Station)*	**WB-509_GR-Begin = 671+47.67**
CB_L_{CON}	**= 38.40**	*(Conc. Barrier Lengths of Contributed)*	**CB_L_{CON} = 38.40'**

Total Length of Need = T-LON = ($WB\text{-}509_{\_GR\text{-}Begin}$) - ($WB\text{-}508_{\_GR\text{-}End}$) - ($CB\text{-}L_{\_CON}$)

T-LON = 675+00.00 - 671+47.67 - 38.40' **T-LON = 313.93'**

Please add WB-570, the ITS pole which will control the downstream end of the guardrail.

Terminals
Terminal = Type T2 = T2 = 12.5' (does not counts toward length of need)
Terminal = Type T10 = T10 = 2.31' (does not counts toward the length of need)

Barrier Limits Determination

$L\text{-}Total_{guardrail}$ = T- LON

$L\text{-}Total_{guardrail}$ = 313.93 | **$L\text{-}Total_{Guardrail}$ = 313.93'**

$L_{Guardrail,\ T\text{-}R} = L_{Guardrail}$ (Round up to the nearest 12.5' increment) | **$L_{Guardrail\ T\text{-}R}$ = 325.00'**

$T10_{Begin\_Sta}$ = CB-ST_DS + T10

$T10_{Begin\_Sta}$ = (674+61.60) + (2.31') | **$T10_{Begin\_Stat}$ = (674+63.91)**

$GR_{Begin\ \_Sta} = T10_{End\_Sta}$ = CB-ST_D | **GR_{Begin_Sta} = (674+61.60)**

$GR_{End\_Sta} = GR_{Begin\_Sta} - L_{Guardrail,\ TR}$

GR_{End_Sta} = (674+61.60) - 325.00' | **GR_{End_Sta} = (671+36.60)**

$T2_{\ Begin\_Sta} = GR_{\ End\_Sta}$ | **$T2_{\ Begin\_Sta}$ = (671+36.60)**

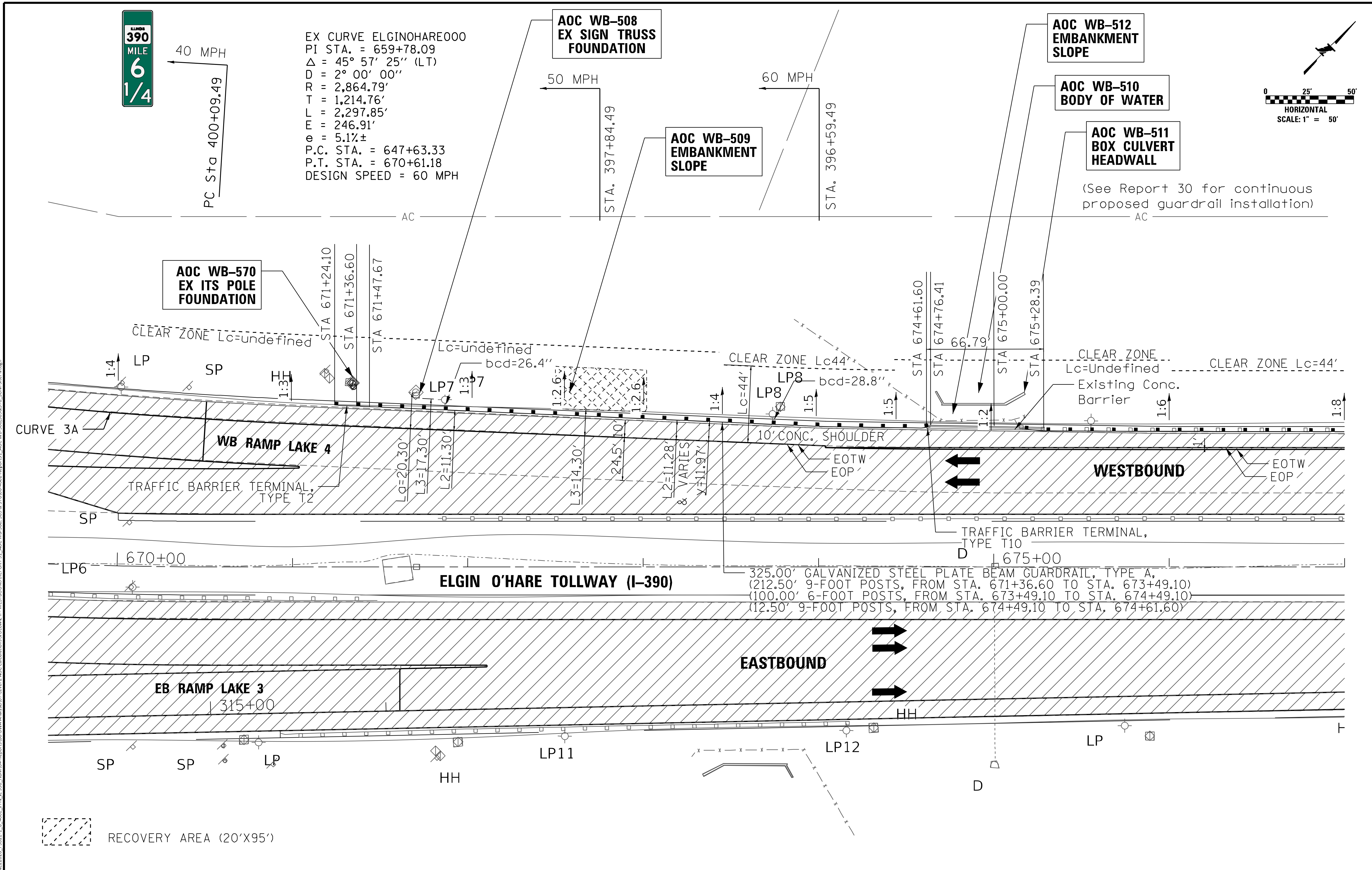
$T2_{\ End\_Sta} = T2_{\ Begin\_Sta}$ - 12.50' | **$T1_{\ Begin\_Station}$ = (671+24.10)**

Barrier Limits Check:
N/A

NOTE
The proposed guardrail downstream of the SFBW TL-4 is 12.50' longer than the existing guardrail
The changes may be due to the difference in design criteria utilized.

RECOMMENDATION
Adding a 4" WMA surface overlay will decrease the guardrail height form the surface to the top of the existing MGS guardrail and can make it substand of a Min 31" requirement.
Therefore, consider replacing the existing guardrail with the new guardrail system.

The existing concrere barrier to be remain in place. Check height to see if it is meet the standard.



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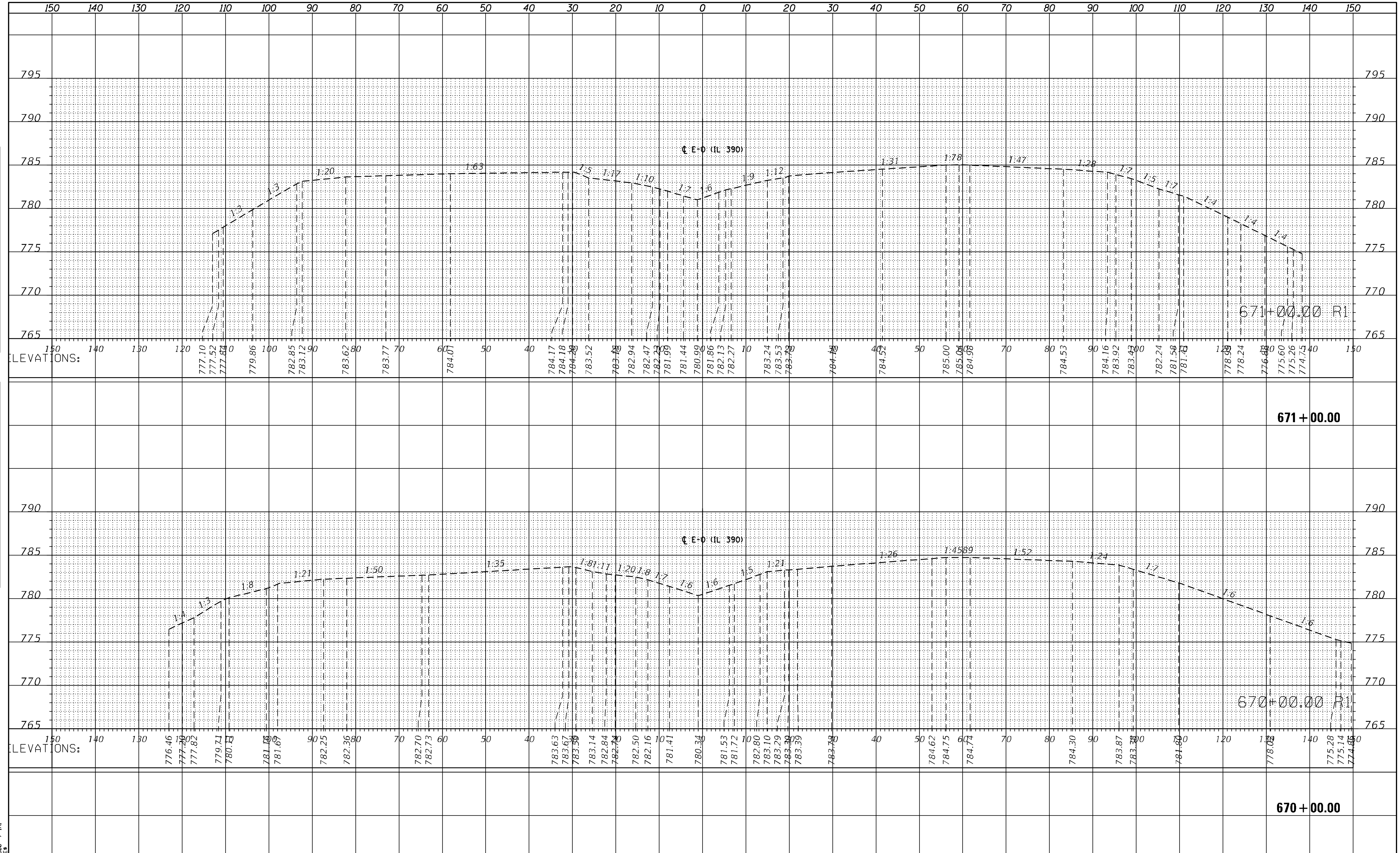
CONTRACT NO. RR-21-4802

BARRIER WARRANT
REPORT 31 - SUM SITE PLAN

SHEET NO. WB-RP31.19

DRAWING NO. 19 OF 22



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CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 31
AOC # WB-508 & WB-509

DRAWING NO.
WB-RP31.20

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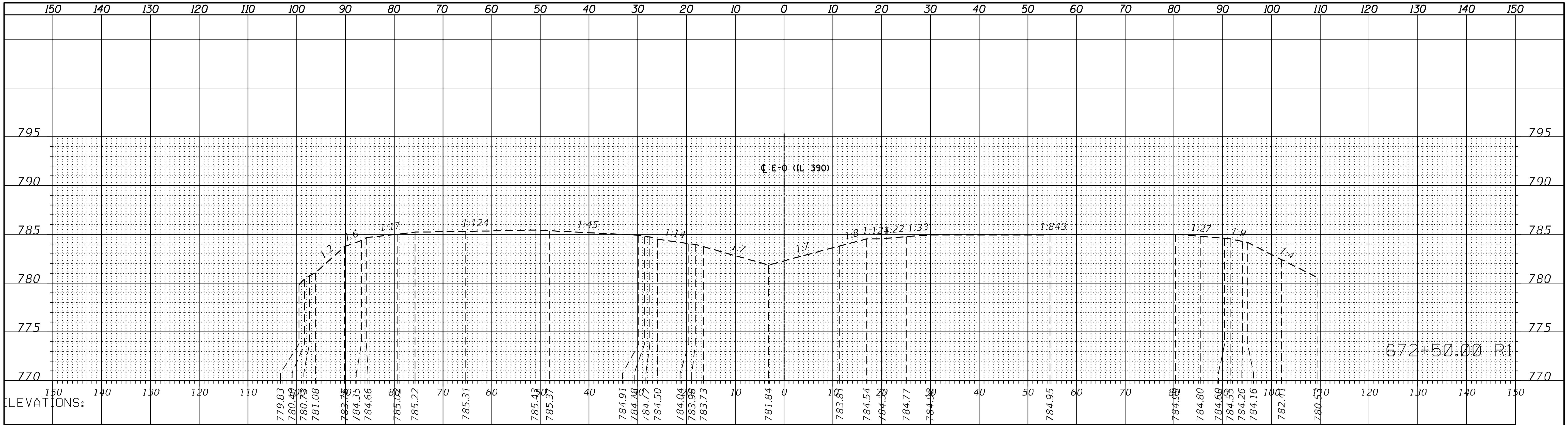

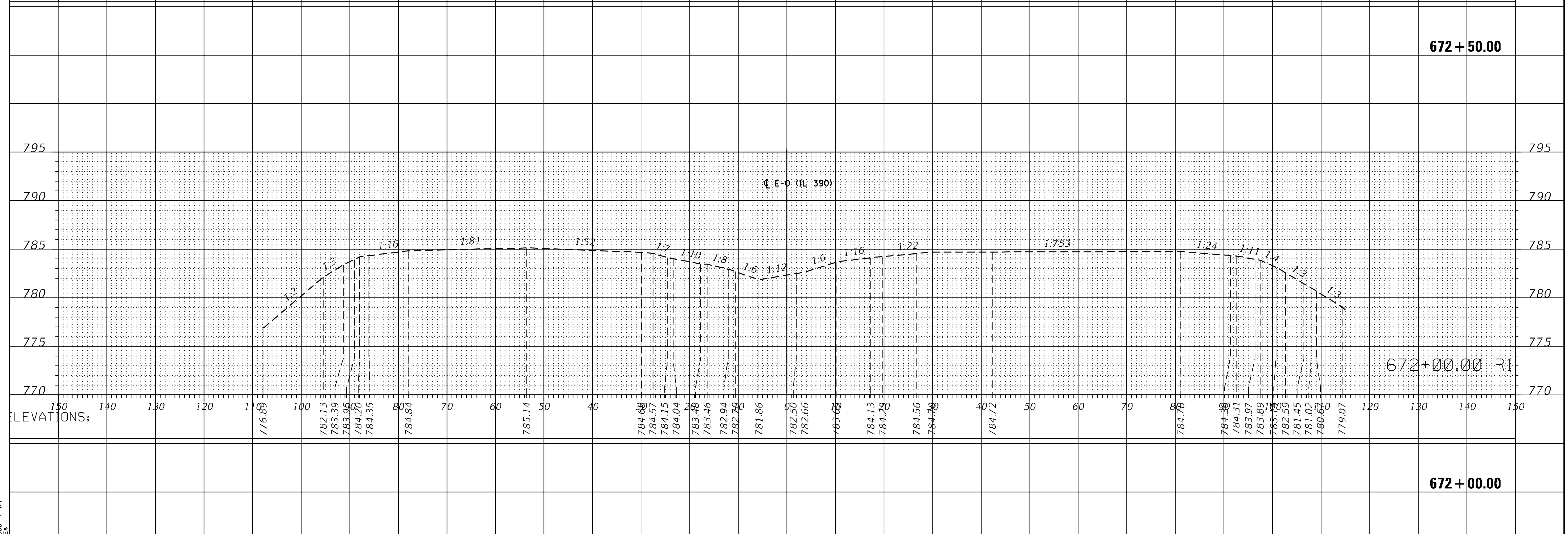

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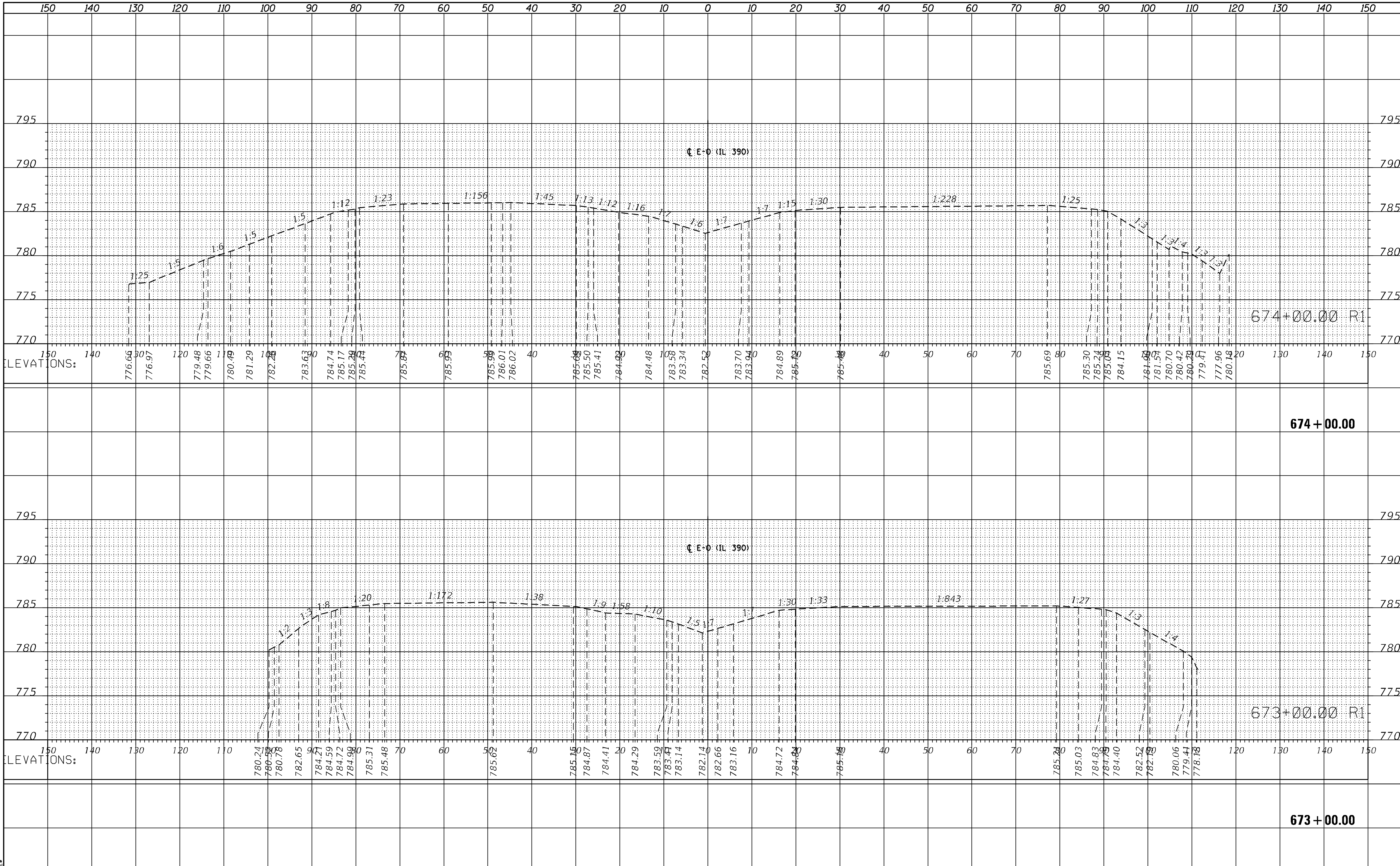

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2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

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CONST. CONTRACT NO.

BARRIER WARRANT PLAN
REPORT 31
AOC # WB-508 & WB-509

DRAWING NO.
WB-RP31.22

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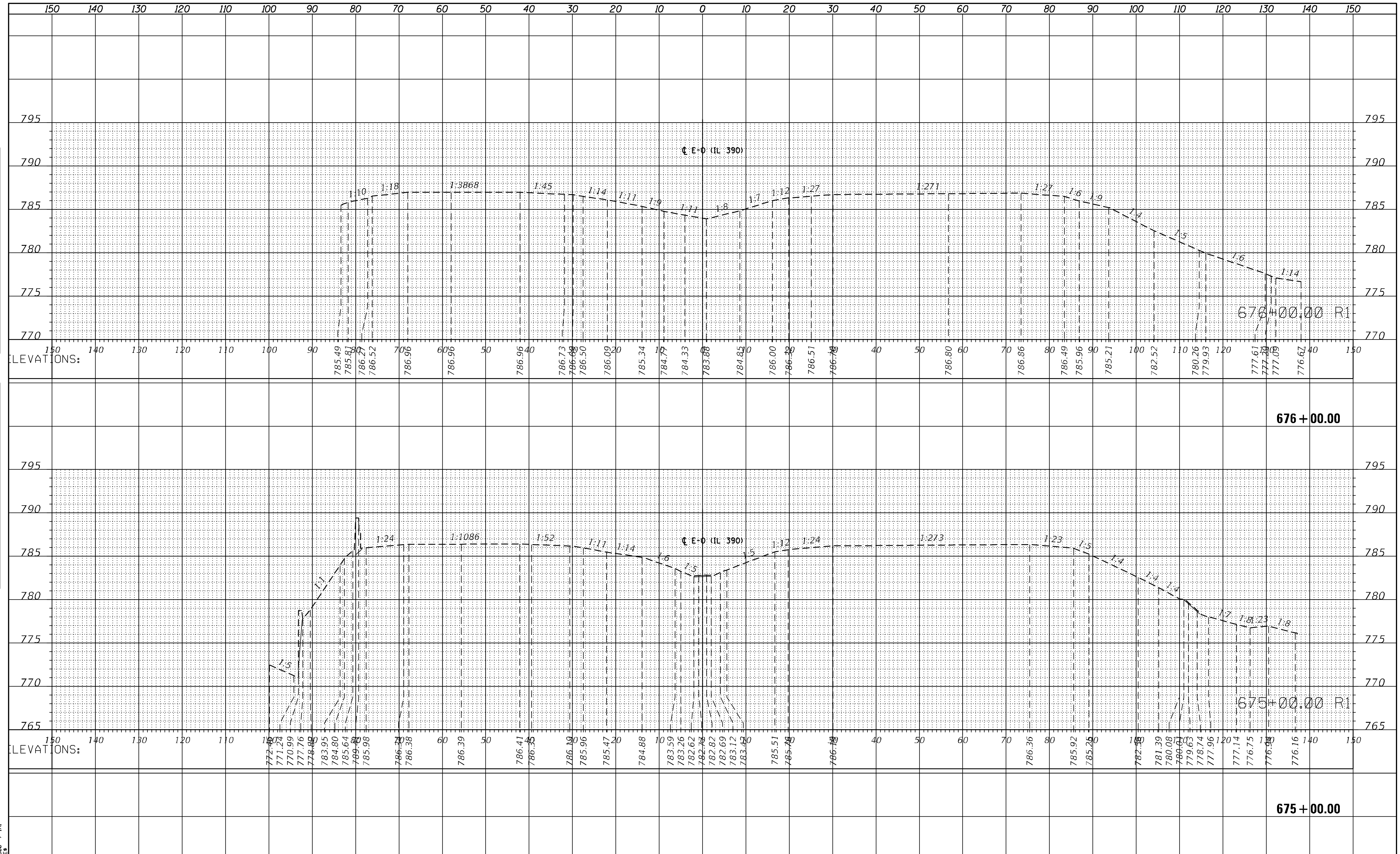

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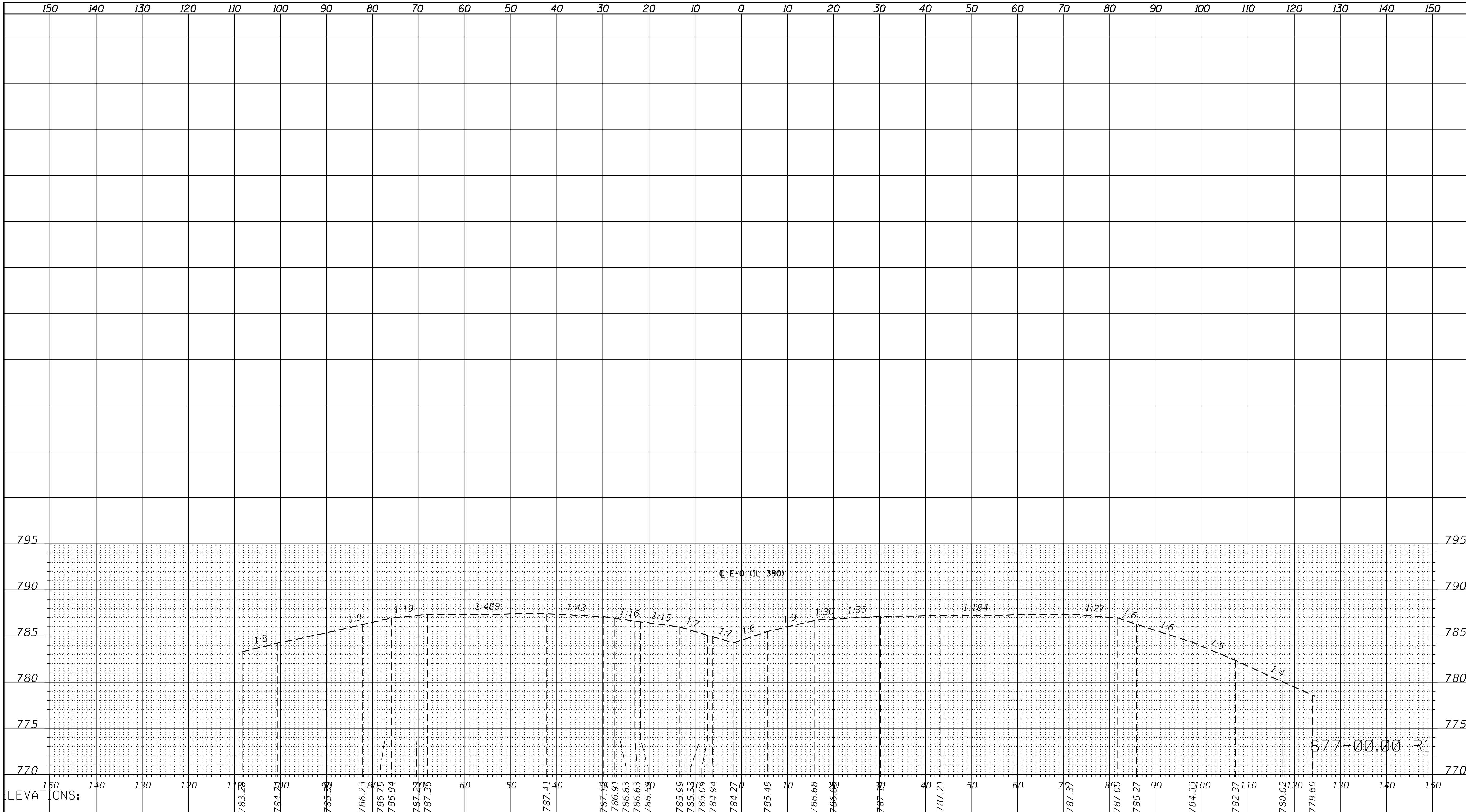

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REPORT 31
AOC # WB-508 & WB-509

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REPORT 33

BARRIER WARRANT ANALYSIS AND DESIGN

Location I-390 (Ramp A1)

AOC WB-541 - Existing Sign Truss Foundation

TABLE OF CONTENTS

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Illinois Tollway
Open Roads for a Faster Future

DATA SHEET

Location AOC WB-541

Ramp A1

Consider using the ramp stationing for the analysis.

DESCRIPTION OF OBSTACLE

the Existing Overhead Sign Structure Foundation and ITS placed directly behind the sign truss foundation at Sta. 711+00.00

18'-0" X 3'6" Foundation (Coordinate: N 1939735.435, E 1041134.4803)

NOTE

Per Tollway Standard Drawing F1 the following spans over 100' are available: 105', 110', 115', and 120'. The span lenghts are based upon the median foundation being centered at 1' LT of the Elgin O'Hare centerline. Existing drainage conflicts required the median foundation to be placed near the centerline and the 1' LT offset allows for the 115' span to be just outside the clear zone. A max span of 160' will put the foundation of the sign well beyond the clear zone. Analysis from mainline is not required since all alternatives are outside the clear zone of the mainline.

The 2020 ADT maps (which is based on the 2019 counts) show this as 1020 veh/day. That might be a better volume to use.

DESIGN CONCEPTS

Design Speed = 55 MPH (ISTHA Design Speed)

Design Year = 2021

ADT = 910 (2021), Westbound I390 Exit Ramp A1

Clear Zone = 24 ft based on 1:6 and flatter foreslope (From Sta. 710+00.00 to Sta. 711+00.00)

Clear Zone = 32 ft based on 1:5 foreslope (From Sta. 319+85.00 to Sta. 321+25.00)

Clear Zone = 18 ft based on 1:6 and flatter foreslope (From Sta. 318+54.18 to Sta. 319+85.00)

(From Table 3-1 AASHTO Roadside Design Guide 2011)

It appears a majority of this analysis uses the ramp stationing. Consider using the same baseline station throughout.

Runout Length = 200 feet (From Table 5-10b AASHTO Roadside Design Guide 2011)

Please verify.

LEVEL 3 ALTERNATIVES

1. Proposed 100' span length within the clear zone and shielded it with a guardrail.

2. Existing 115' span length which places the foundation just outside the clear zone and does not require shielding.

3. Proposed 120' span length which places foundation just outside the clear zone and does not require shielding.

4. Proposed 130' span length which places foundation well outside the clear zone and does not require shielding.

Generally 3 alternatives are adequate. Consider combining these and using a 125' span for the well outside the CZ alternate.

PHOTOS

Photo 1: Existing condition - no barrier shielding - view from Ramp A1 Looking West on Elgin O'Hare I-

Photo 2: Existing condition - Existing sign truss foundation - ITS pole - Light Pole

BARRIER WARRANTS
Location: AOC WB-541, 560, 535 & 536

RAMP A1 & WB I-390 ELGIN - O'HARE TOLLWAY
DESIGN SPEED FOR MAINLINE IS 60 MPH
45 MPH DESIGN SPEED FOR RAMP A1 CURVE SPRNG-RC001 & CURVE SPRNG-RC003
INITIAL SPEED AT STA. 301+50.00

Initial Speed 25 MPH Design Speed at Sta. 301+50.00
25 MPH = STA. 301+50.00

FIND STA. @ 40 MPH
25 MPH to 40 MPH = 210' (Table 10-3)
301+50.00 + 210 = *303+60.00*

FIND STA. @ 45 MPH
25 MPH to 45 MPH = 380' (Table 10-3)
301+50.00 + 380 = *305+30.00*

Continue 45 MPH thru. Curve SPRNG-RC001 & Curve SPRNG-RC003 to Sta. 318+34.93
45 MPH = STA. 318+34.93

FIND STA. @ 55 MPH
45 MPH to 55 MPH = 150' (Table 10-3)
318+34.93 + 150 = *319+84.93*

FIND STA. @ 60 MPH
45 MPH to 60 MPH = 420' (Table 10-3)
318+34.93 + 420 = *322+54.93*

Continue 60 MPH on WB I-390 Elgin - O'Hare Tollway

25 MPH = STA. 301+50.00
40 MPH = STA. 303+60.00
45 MPH = STA. 305+30.00
45 MPH = STA. 306+13.73 to STA. 318+34.93
55 MPH = STA. 319+84.93
60 MPH = STA. 322+54.93

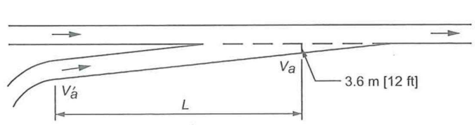
Table 10-3. Minimum Acceleration Lengths for Entrance Terminals with Flat Grades of Two Percent or Less

Metric									
Acceleration Length, *L* (m) for Entrance Curve Design Speed (km/h)									
Highway		Stop Condition	20	30	40	50	60	70	80
Design Speed, *V* (km/h)	Speed Reached, V_a (km/h)	and Initial Speed, V'_a (km/h)							
		0	20	28	35	42	51	63	70
50	37	60	50	30	—	—	—	—	—
60	45	95	80	65	45	—	—	—	—
70	53	150	130	110	90	65	—	—	—
80	60	200	180	165	145	115	65	—	—
90	67	260	245	225	205	175	125	35	—
100	74	345	325	305	285	255	205	110	40
110	81	430	410	390	370	340	290	200	125
120	88	545	530	515	490	460	410	325	245

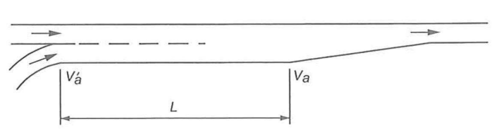
Note: Uniform 50:1 to 70:1 tapers are recommended where lengths of acceleration lanes exceed 400 m.

U.S. Customary										
Acceleration Length, *L* (ft) for Entrance Curve Design Speed (mph)										
Highway		Stop Condition	15	20	25	30	35	40	45	50
Design Speed, *V* (mph)	Speed Reached, V_a (mph)	and Initial Speed, V'_a (mph)								
		0	14	18	22	26	30	36	40	44
30	23	180	140	—	—	—	—	—	—	—
35	27	280	220	160	—	—	—	—	—	—
40	31	360	300	270	210	120	—	—	—	—
45	35	560	490	440	380	280	160	—	—	—
50	39	720	660	610	550	450	350	130	—	—
55	43	960	900	810	780	670	550	320	150	—
60	47	1200	1140	1100	1020	910	800	550	420	180
65	50	1410	1350	1310	1220	1120	1000	770	600	370
70	53	1620	1560	1520	1420	1350	1230	1000	820	580
75	55	1790	1730	1630	1580	1510	1420	1160	1040	780

Note: Uniform 50:1 to 70:1 tapers are recommended where lengths of acceleration lanes exceed 1,300 ft.



Taper Type

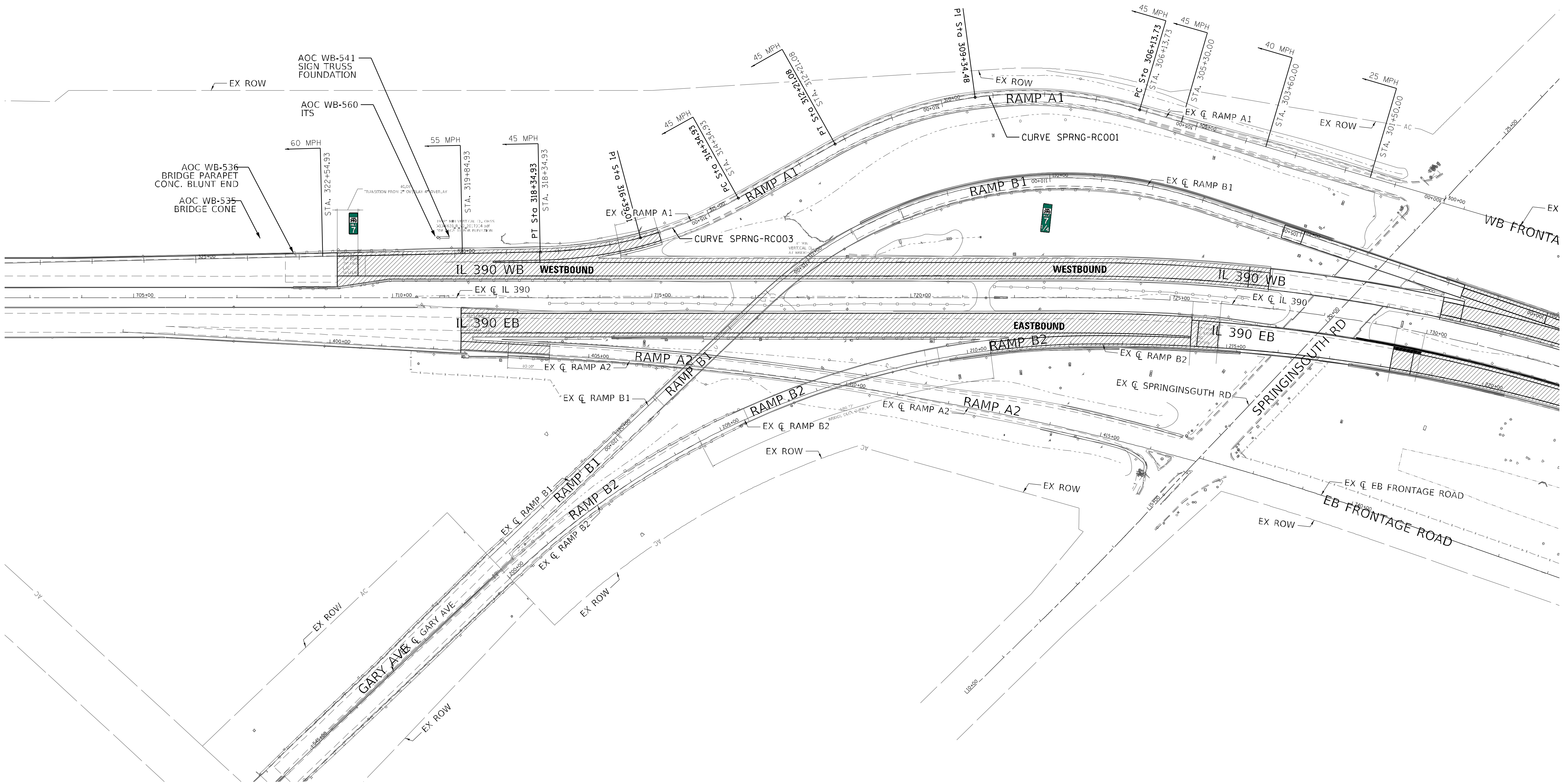


Parallel Type

EX CURVE SPRNG-RC003
PI STA. = 316+39.01
Δ = 28° 00' 00" (RT)
D = 7° 00' 00"
R = 818.51'
T = 204.08'
L = 400.00'
E = 25.06'
e = 6.0%±
P.C. STA. = 314+34.93
P.T. STA. = 318+34.93
DESIGN SPEED = 45 MPH

EX CURVE SPRNG-RC001
PI STA. = 309+34.48
Δ = 45° 33' 04" (LT)
D = 7° 30' 00"
R = 763.94'
T = 320.75'
L = 607.35'
E = 64.60'
e = 6.0%±
P.C. STA. = 306+13.73
P.T. STA. = 312+21.08
DESIGN SPEED = 45 MPH

0 100' 200'
HORIZONTAL
SCALE: 1" = 200'



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BARRIER WARRANT
RAMP A1 - SPEED PROFILE PLAN

SHEET NO. WB - RP33.6

DRAWING NO. 06 OF 40

TABLE 3-1. Suggested Clear-Zone Distances in Meters (Feet) from Edge of Through Traveled Lane (6)

U.S. Customary Units							
Design Speed (mph)	Design ADT	Foreslopes			Backslopes		
		1V:6H or flatter	1V:5H to 1V:4H	1V:3H	1V:3H	1V:5H to 1V:4H	1V:6H or flatter
≤40	UNDER 750[c]	7–10	7–10	[b]	7–10	7–10	7–10
	750–1500	10–12	12–14	[b]	12–14	12–14	12–14
	1500–6000	12–14	14–16	[b]	14–16	14–16	14–16
	OVER 6000	14–16	16–18	[b]	16–18	16–18	16–18
45–50	UNDER 750[c]	10–12	12–14	[b]	8–10	8–10	10–12
	750–1500	14–16	16–20	[b]	10–12	12–14	14–16
	1500–6000	16–18	20–26	[b]	12–14	14–16	16–18
	OVER 6000	20–22	24–28	[b]	14–16	18–20	20–22
55	UNDER 750[c]	12–14	14–18	[b]	8–10	10–12	10–12
	750–1500	16–18	20–24	[b]	10–12	14–16	16–18
	1500–6000	20–22	24–30	[b]	14–16	16–18	20–22
	OVER 6000	22–24	26–32[a]	[b]	16–18	20–22	22–24
60	UNDER 750[c]	16–18	20–24	[b]	10–12	12–14	14–16
	750–1500	20–24	26–32[a]	[b]	12–14	16–18	20–22
	1500–6000	26–30	32–40[a]	[b]	14–18	18–22	24–26
	OVER 6000	30–32[a]	36–44[a]	[b]	20–22	24–26	26–28
65–70[d]	UNDER 750[c]	18–20	20–26	[b]	10–12	14–16	14–16
	750–1500	24–26	28–36[a]	[b]	12–16	18–20	20–22
	1500–6000	28–32[a]	34–42[a]	[b]	16–20	22–24	26–28
	OVER 6000	30–34[a]	38–46[a]	[b]	22–24	26–30	28–30

Notes:

a) When a site-specific investigation indicates a high probability of continuing crashes or when such occurrences are indicated by crash history, the designer may provide clear-zone distances greater than the clear zone shown in Table 3-1. Clear zones may be limited to 30 ft for practicality and to provide a consistent roadway template if previous experience with similar projects or designs indicates satisfactory performance.

b) Because recovery is less likely on the unshielded, traversable 1V:3H fill slopes, fixed objects should not be present in the vicinity of the toe of these slopes. Recovery of high-speed vehicles that encroach beyond the edge of the shoulder may be expected to occur beyond the toe of slope. Determination of the width of the recovery area at the toe of slope should consider right-of-way availability, environmental concerns, economic factors, safety needs, and crash histories. Also, the distance between the edge of the through traveled lane and the beginning of the 1V:3H slope should influence the recovery area provided at the toe of slope. While the application may be limited by several factors, the foreslope parameters that may enter into determining a maximum desirable recovery area are illustrated in Figure 3-2. A 10-ft recovery area at the toe of slope should be provided for all traversable, non recoverable fill slopes.

c) For roadways with low volumes it may not be practical to apply even the minimum values found in Table 3-1. Refer to Chapter 12 for additional considerations for low-volume roadways and Chapter 10 for additional guidance for urban applications.

d) When design speeds are greater than the values provided, the designer may provide clear-zone distances greater than those shown in Table 3-1.

Table 5-10b. Suggested Runout Lengths for Barrier Design (U.S. Customary Units)

Design Speed (mph)	Runout Length (L_R) Given Traffic Volume (ADT) (ft)			
	Over 10,000	5,000 to 10,000	1,000 to 5,000	Under 1,000
80	470	430	380	330
70	360	330	290	250
60	300	250	210	200
50	230	190	160	150
40	160	130	110	100
30	110	90	80	70

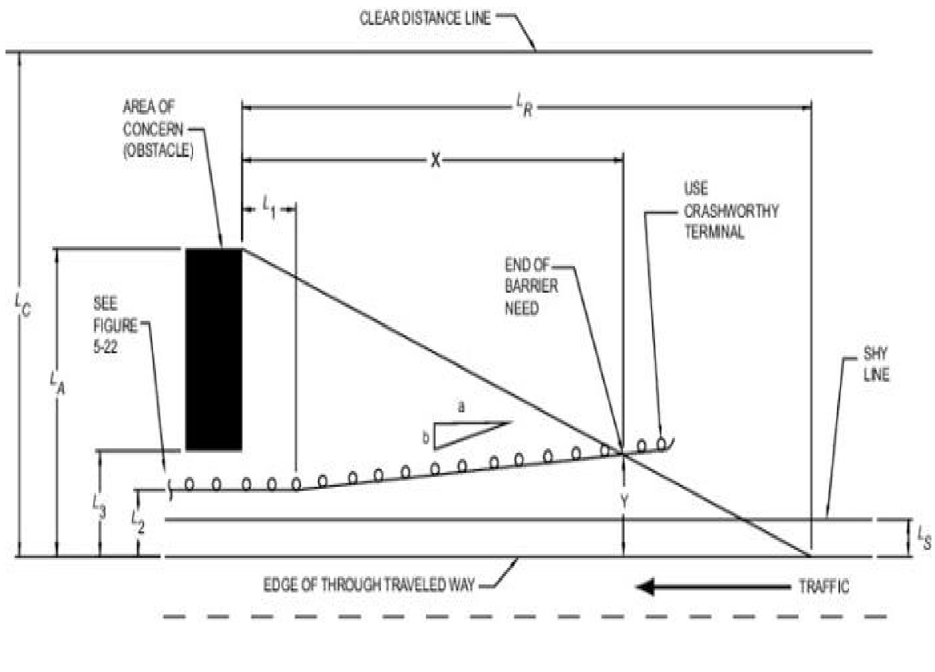


Figure 5-39. Approach Barrier Layout Variables

BARRIER WARRANTS

Location AOC WB-541 - Sign Truss Foundation - Alternative 1 - 100' Span

L_A = **20.40'** *(Measures to back of Sign Truss Foundation)*

Lc = **32.00'**

$L_A < L_C$ Use L3 $\leq$ Lc

Please verify the shoulder width. The L2 offset should be 1' beyond the EOS per standard C1 and article 9.6 of the TBG.

L_2 = 9.00'

L_R = **200.00'**

Y = L_2 + 0.69 = 9.00' + 0.69' **Y = 9.69'**

This is not consistent with 55mph and 2010 ADT. Please verify.

Obstacles:

ST_US $_{UPStream\_Sta}$ **= 320+10.95** *(Sign Truss Foundation, AOC WB-541)*

ST_DS $_{DownStream\_Sta}$ **= 320+28.95**

L_{AOC} = Length of AOC = 18.00' **L_AOC = 18.00'**

Length of Need - Formula

X = (L_a - Y) / (L_a / Lr) *(If L_a <=Y, then the value for X =0)*

X = (20.40' - 9.69') / (20.40' / 200.00') **X = 105.00'**

Point of Need= PON = ST_US $_{Sta}$ - X

PON = (320+10.95) - 105.00' **PON = (319+05.95)**

$BCD_{Barrier\ Clearance\ Distance}$ = La-L2-Obstacles Width-Guardrail Width

$BCD_{Barrier\ Clearance\ Distance}$ = 20.4' - 9.00' - 3.5' - (3 1/4" + 1' + 5 7/8") = 6.14'

(Distance from back of guardrail posts to foundation is 6.41'

Therefore, downstream guardrail shall be shortened using a 25-degree angle from the downstream end of the obstacle.

See Condition 2, TBG Figure 5.14)

Consider showing this computation, which is (L3-L2)/Tan25°.

DS_25*_Shortened **DS_25* = 15.39'** Please verify.

Length of Need = LON = X + L_{AOC} - DS_25*

LON = 105.00' +18.00' - 15.39' **LON = 107.61'**

Terminals

Terminal = Type T2 = T2 = 12.5' (does not count toward length of need)

Terminal = Type T1 (Special) = T1 = 46.88' (34.38' counts toward length of need)

Barrier Limits Determination

+ 25' (See articles 5.14, Condition #2 and 10.5.1.2 of the TBG.)

$L_{guardrail}$ = LON - T1

$L_{guardrail}$ = 107.61' - 34.38' **$L_{Guardrail}$ = 73.23'**

$L_{Guardrail,\ R}$ = $L_{Guardrail}$ (Round up to the nearest 12.5' increment) **$L_{Guardrail\ R}$ = 75.00'**

Round up to meet the Illinois Tollway minimum length of a "free-standing" run of guardrail of 112.50') **$L_{Guardrail\ RoundUP}$ = 112.50'**

+25'

$T2_{End\_Station}$ = ST_DS - DS_25* + T2

$T2_{End\_Station}$ = (320+28.95) - (15.39') + (12.50') **$T2_{End\_Station}$ = (320+26.06)**

$T2_{Begin\_Station}$ = (320+26.06) - (12.50') **$T2_{Begin\_Station}$ = (320+13.56)**

$GR_{End\_Station}$ = $T2_{Begin\_Station}$ **$GR_{End\ Station}$ = (320+13.56)**

$GR_{Begin\_Station}$ = $GR_{End\ Station}$ - $L_{Guardrail,\ R}$

$GR_{Begin\_Station}$= (320+13.56) - 112.50' **$GR_{Begin\_Station}$= (319+01.06)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ **T1 $_{End\_Station}$ = (319+01.06)**

T1 $_{End\_Station}$ = $GR_{Begin\_Station}$ - 46.88'

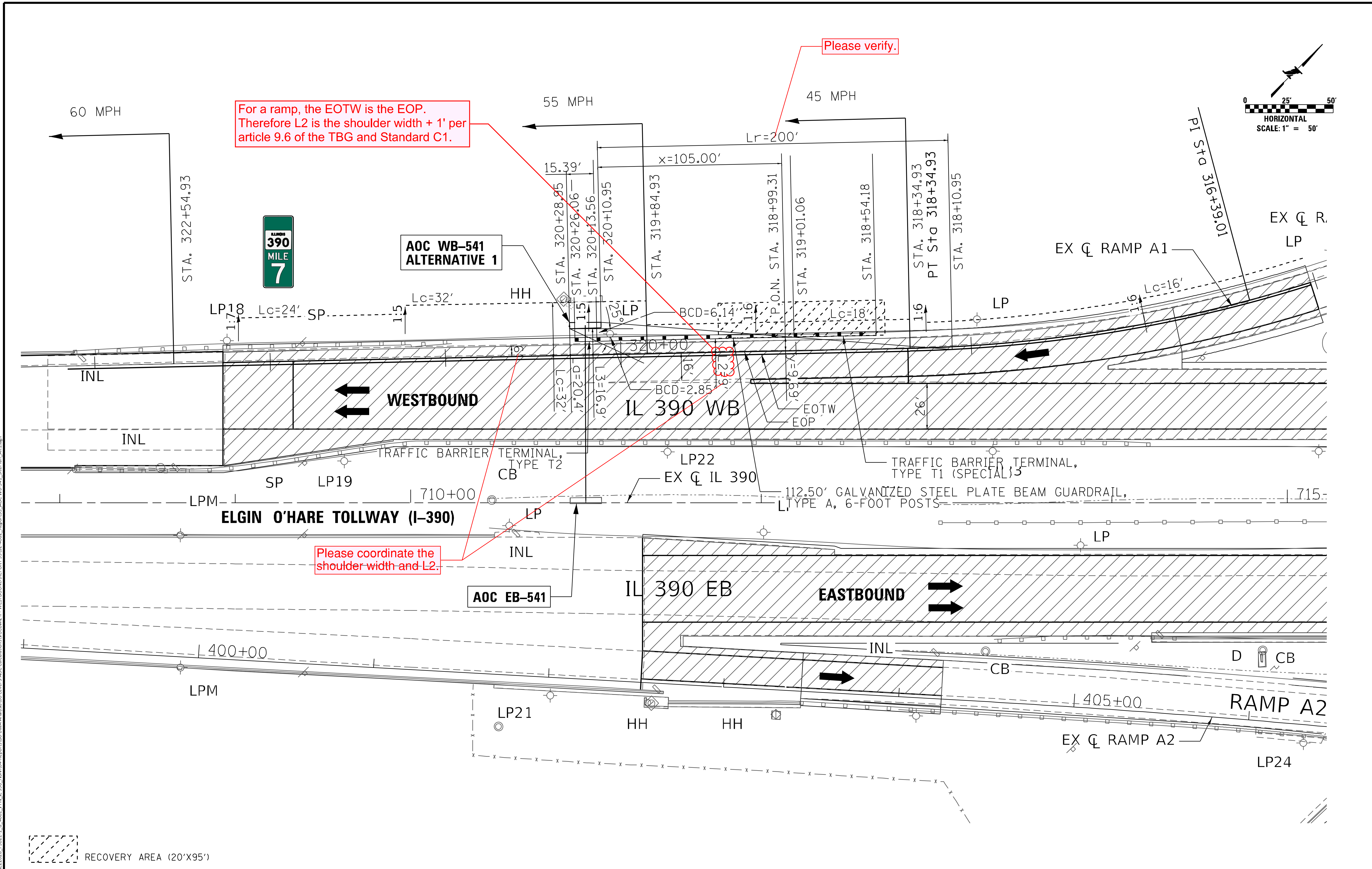
T1 $_{Begin\_Station}$ = (319+01.06) - 46.88' **T1 $_{Begin\_Station}$ = (318+54.18)**

Barrier Limits Check:

12.5' < PON - T1 < 25'

12.5' < (319+05.95) - (318+54.18) < 25'

12.5' < 51.77' < 25' **N/A** (Guardrail Round Up)



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ALT-1 SITE PLAN - AOC WB 541 RAMP A1

SHEET NO. WB - RP33.10
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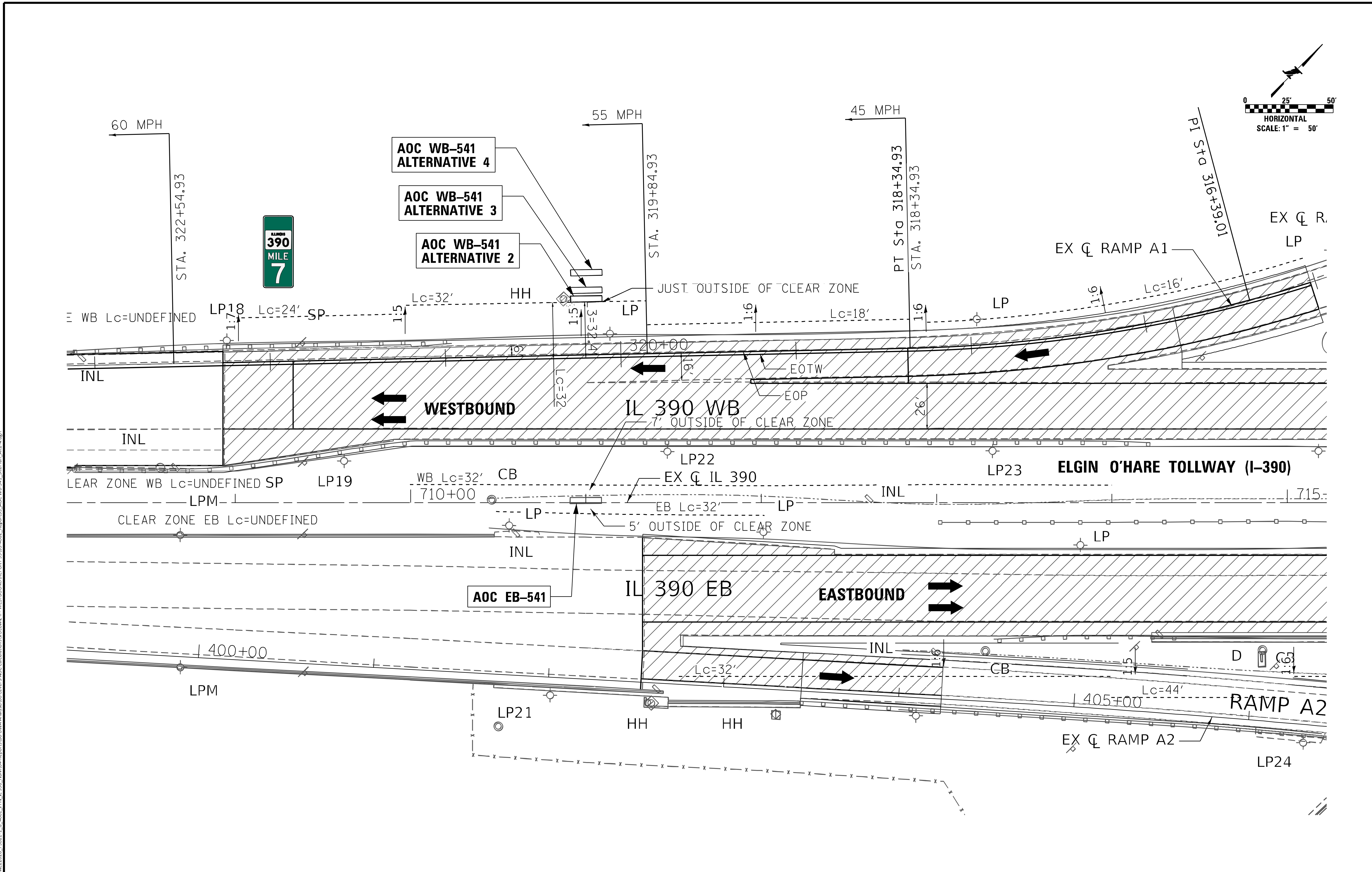

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BARRIER WARRANT
ALT2-4 SITE PLAN - AOC WB 541 RAMP A1

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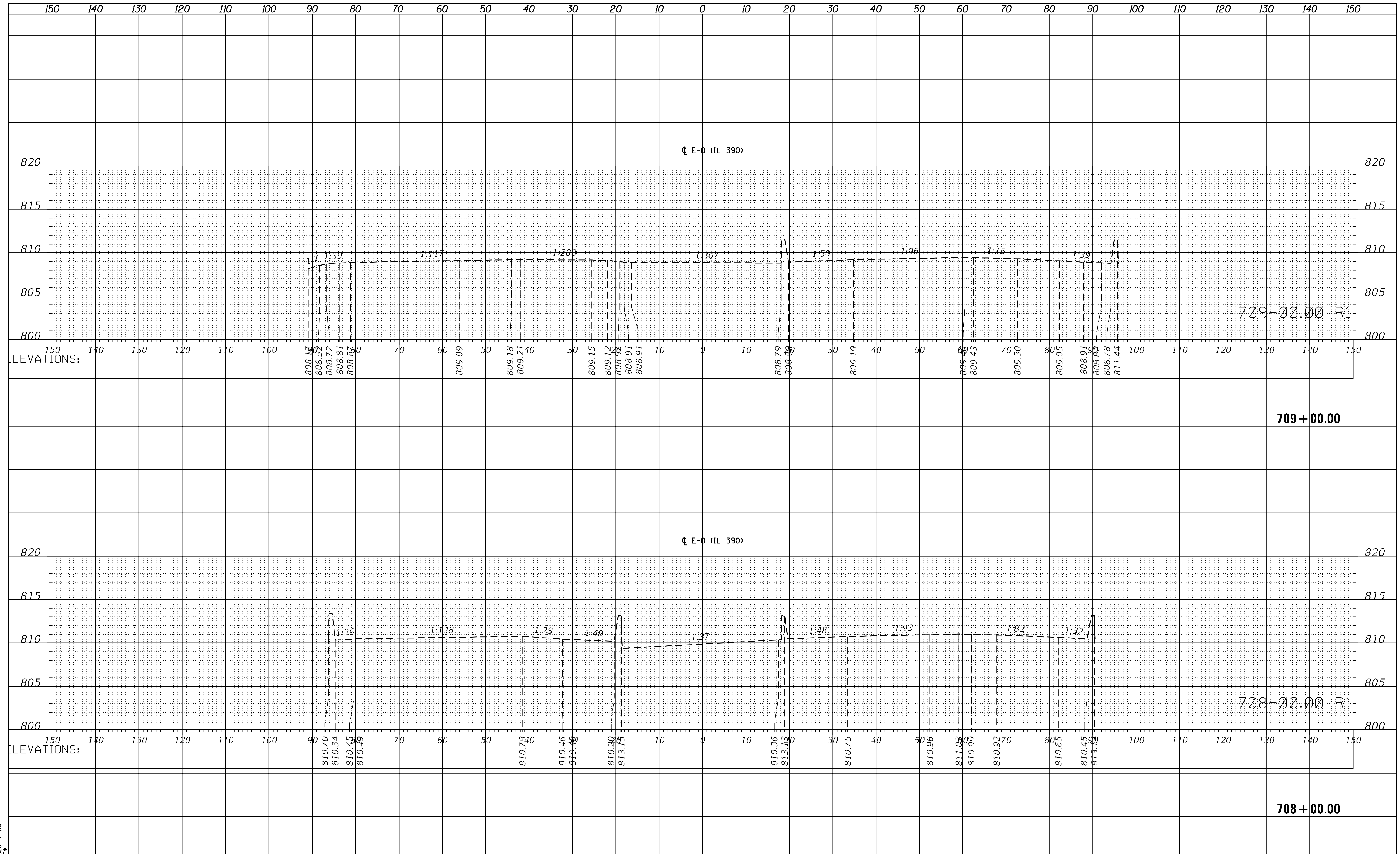

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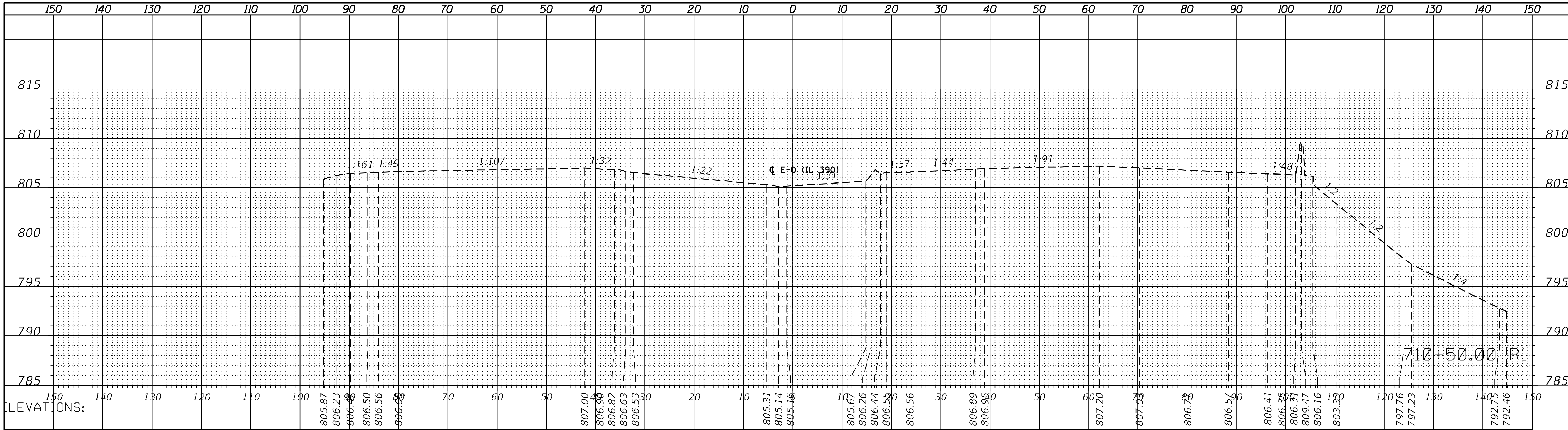

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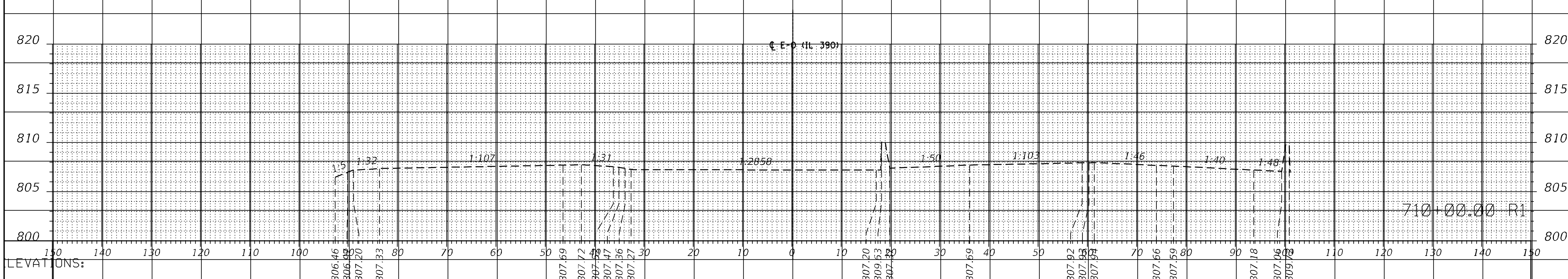

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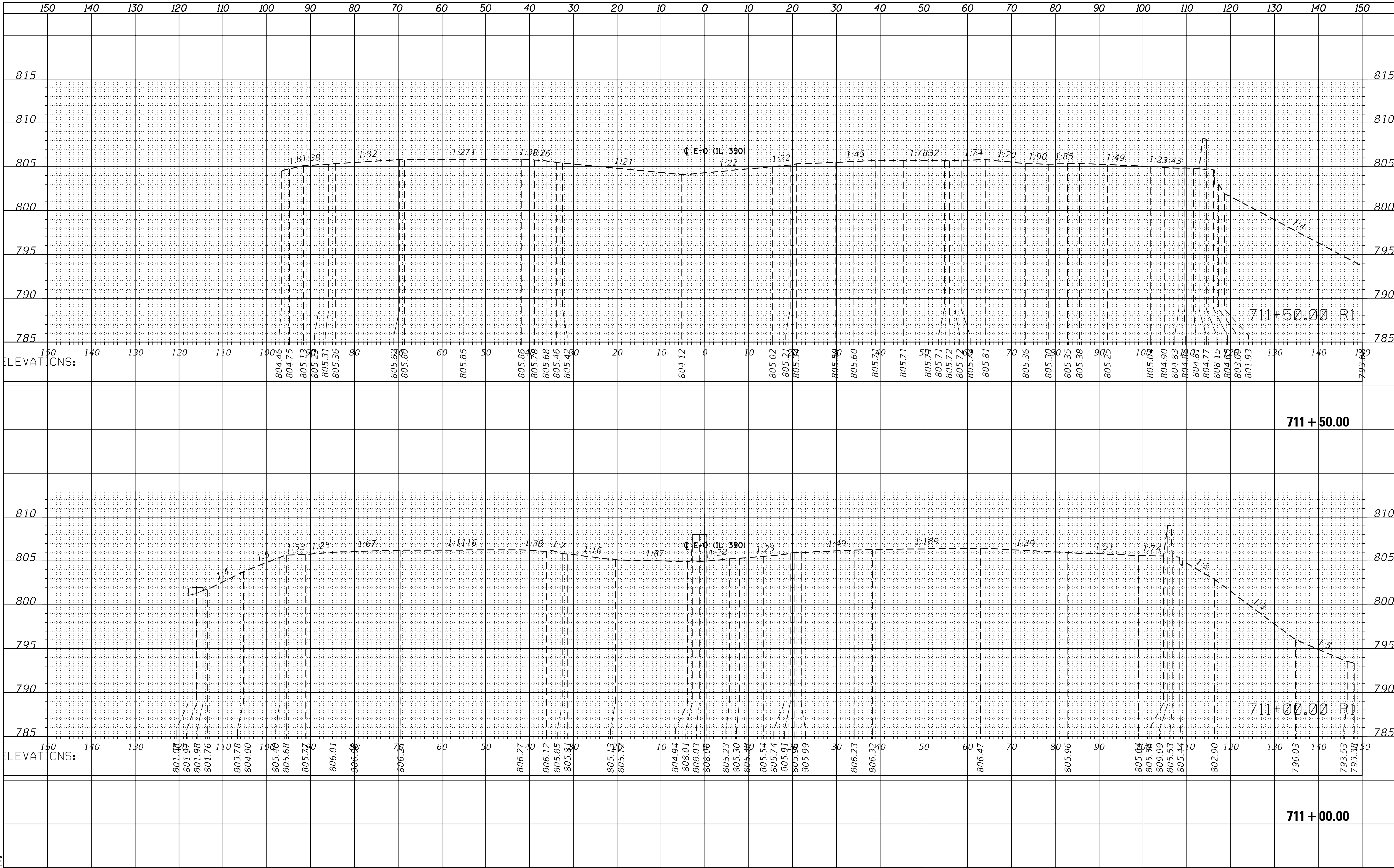

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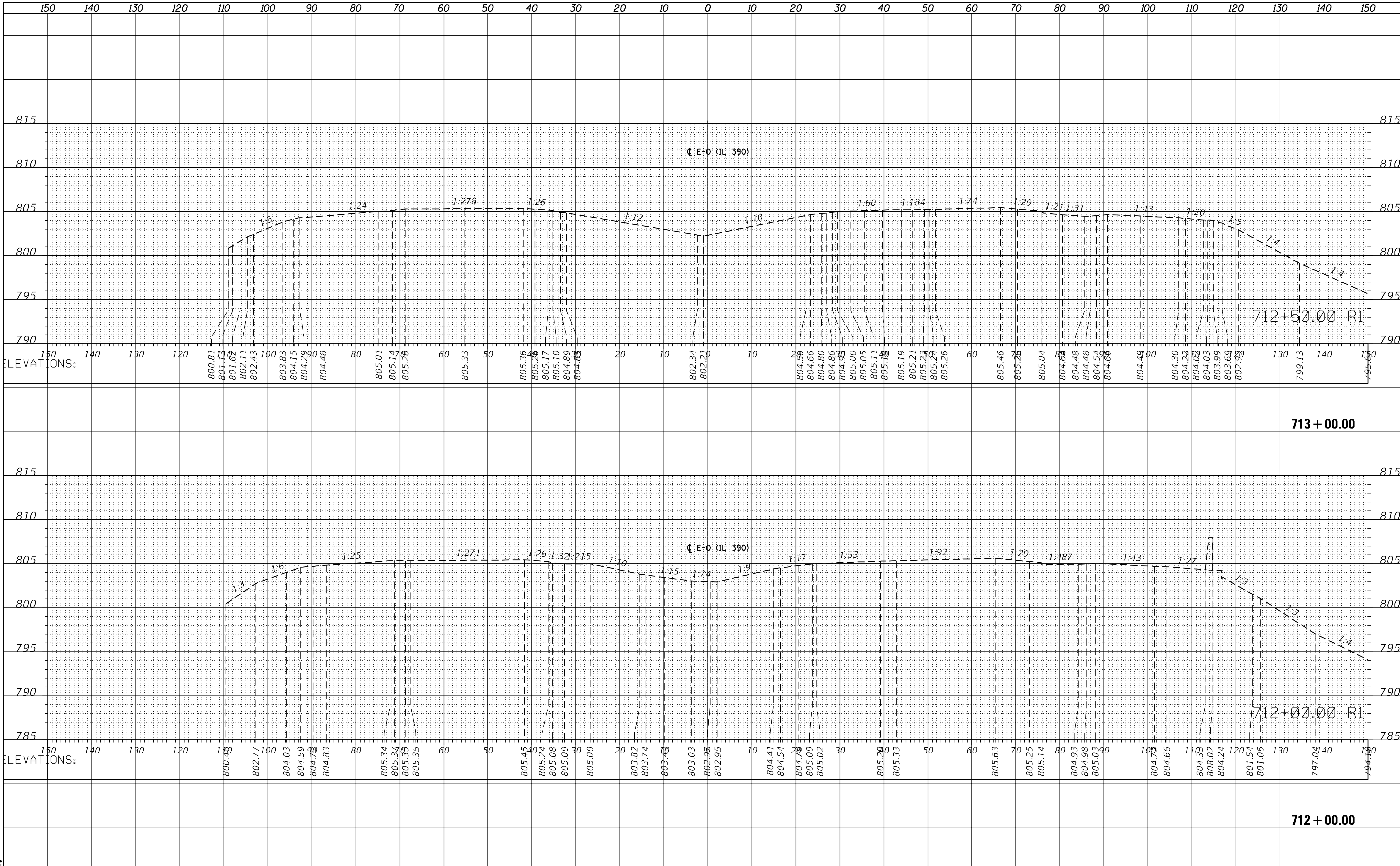
$USERNAME$
$FILE$



PLOT SCALE = 20.0000 ' / in.
FILE NAME = $FILE$

DRAWN BY LN	DATE 1/19/2023		
CHECKED BY TN	SCALE V: 1"=10' H: 1"=20'		

200 22ND Street, Suite 216, Lombard, IL 60148
630.705.0110 voice, 630.839.2566 fax
www.mps-il.com
MILLENNIA PROFESSIONAL SERVICES

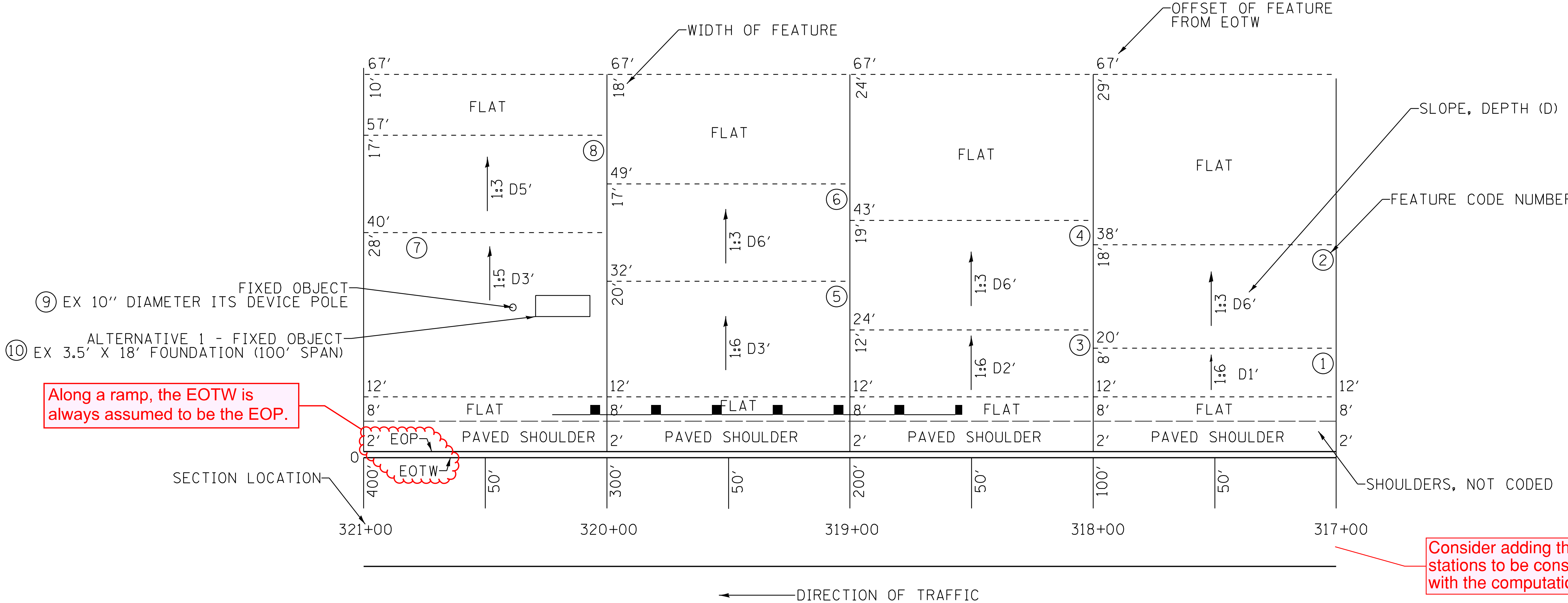
THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE, ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

DESIGN CONTRACT NO. RR-21-4802
CONST. CONTRACT NO.

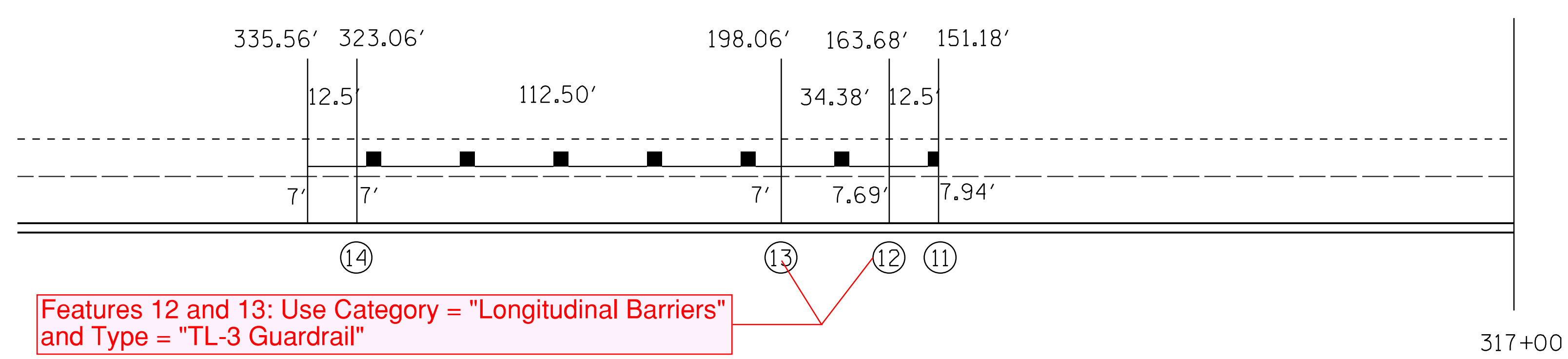
BARRIER WARRANT PLAN
REPORT 33
AOC = WB-541

DRAWING NO.
WB-RP33.15



Along a ramp, the EOTW is always assumed to be the EOP.

Consider adding the ramp stations to be consistent with the computations.



Features 12 and 13: Use Category = "Longitudinal Barriers" and Type = "TL-3 Guardrail"

ALTERNATIVE 1 GUARDRAIL SCHEMATIC

MILESTONE:	DESIGNED BY: TVN	DATE: 1/19/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

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THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
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ILLINOIS 60515

REVISIONS

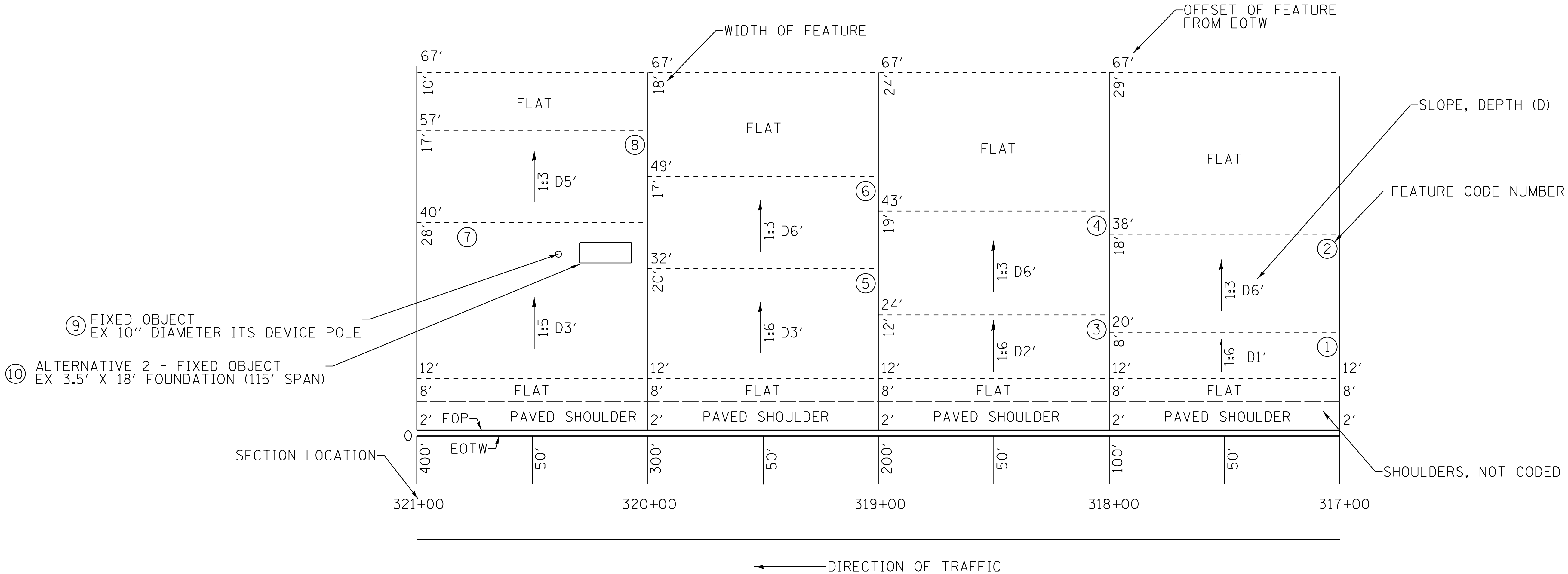
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
RSAP FEATURE SKETCH - WB-541 (ALT. 1)

SHEET NO. WB - RP33.16

DRAWING NO. 16 OF 40



MILESTONE:	DESIGNED BY: TVN	DATE: 1/19/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

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2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

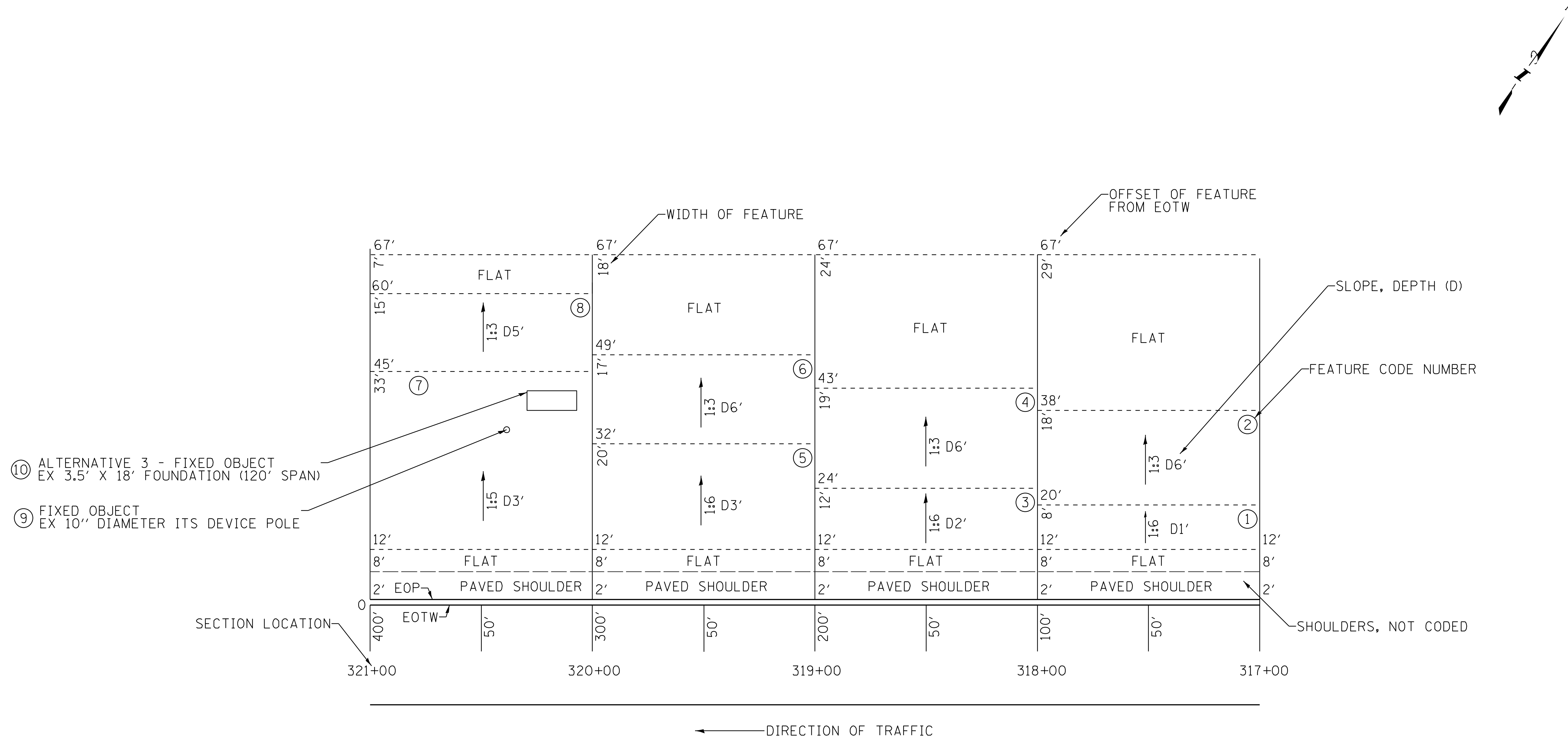
REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
RSAP FEATURE SKETCH - WB-541 (ALT. 2)

SHEET NO. WB - RP33.17

DRAWING NO. 17 OF 40



MILESTONE:	DESIGNED BY: TVN	DATE: 1/19/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

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THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

REVISIONS

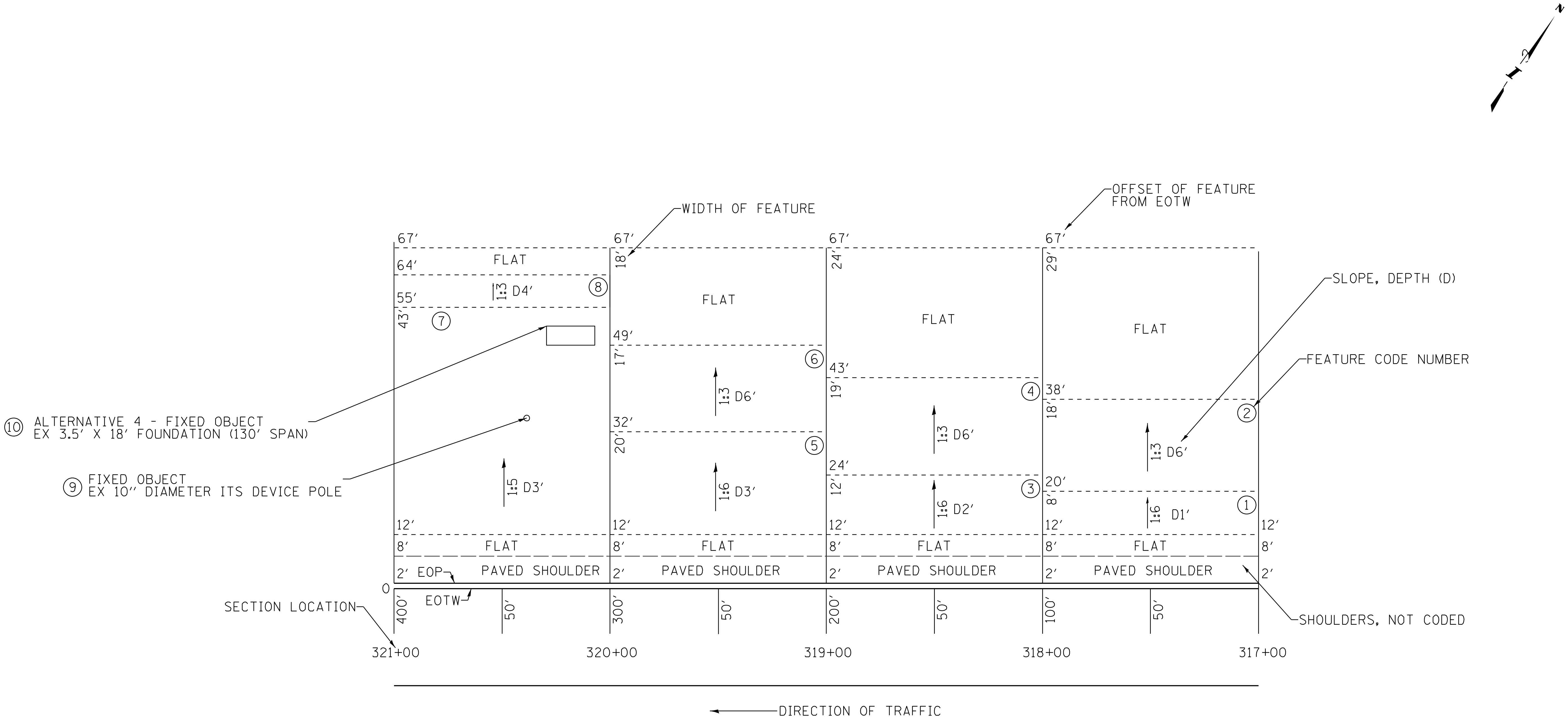
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
RSAP FEATURE SKETCH - WB-541 (ALT. 3)

SHEET NO. WB - RP33.18

DRAWING NO. 18 OF 40



MILESTONE:	DESIGNED BY: TVN	DATE: 1/19/2023
	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

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THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
RSAP FEATURE SKETCH - WB-541 (ALT. 4)

SHEET NO. WB - RP33.19

DRAWING NO. 19 OF 40

AOC WB-541 Cost Calculation

Alternative 1 (Sign Truss Foundation inside clear zone 100' span, with shielding)

	Quantity	Unit	Initial unit price	Initial Cost	Maintenance unit price	Maintenance Cost
Sign Truss Span	100	LF	$ 2,000.00	$ 200,000.00	0	$ -
Type 1 (Spl) Terminal	1	EACH	$ 2,500.00	$ 2,500.00	$ 2.00	$ 93.76
Type A, 6ft Posts	112.5	LF	$ 22.00	$ 2,475.00	$ 2.00	$ 225.00
Type 2 Terminal	1	EACH	$ 1,000.00	$ 1,000.00	$ 2.00	$ 25.00
		TOTAL:		$ 205,975.00		$ 343.76

The initial cost of this alternate is $0 since it is existing.

Alternative 2 (Existing Sign Truss Foundation outside clear zone 115' span, with no shielding)

	Quantity	Unit	Initial unit price	Initial Cost	Maintenance unit price	Maintenance Cost
Sign Structure (Span Type)	115	LF	$ 2,000.00	$ 230,000.00	0	0
		TOTAL:		$ 230,000.00		0

Alternative 3 (Place Sign Truss Foundation outside clear zone 120' span, with no shielding)

	Quantity	Unit	Initial unit price	Initial Cost	Maintenance unit price	Maintenance Cost
Sign Structure (Span Type)	120	LF	$ 2,000.00	$ 240,000.00	0	0
		TOTAL:		$ 240,000.00		0

Alternative 4 (Place Sign Truss Foundation outside clear zone 130' span, with no shielding)

	Quantity	Unit	Initial unit price	Initial Cost	Maintenance unit price	Maintenance Cost
Sign Structure (Span Type)	130	LF	$ 2,000.00	$ 260,000.00	0	0
		TOTAL:		$ 260,000.00		0

Date: January 19, 2023

Time: 18:02:22PM

Benefit/Cost Ratio Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative	Description
1	Sign Truss foundation inside clear zone, 100' span, with shielding
2	Sign Truss foundation outside clear zone, 115' span, with no shielding
3	Place Sign Truss foundation outside clear zone, 120' span, with no shielding
4	Place Sign Truss foundation outside clear zone, 130' span, with no shielding

As stated above, consider combining into one Alternate, 125' span.

	Alternative			
Alternative	**1**	**2**	**3**	**4**
1	0.00	0.42	0.28	0.16
2	0.00	0.00	0.03	0.00
3	0.00	0.00	0.00	-0.01
4	0.00	0.00	0.00	0.00

Date: January 19, 2023 **Time:** 18:02:23PM

Alternative Cost Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative	Description
1	Sign Truss foundation inside clear zone, 100' span, with shielding
2	Sign Truss foundation outside clear zone, 115' span, with no shielding
3	Place Sign Truss foundation outside clear zone, 120' span, with no shielding
4	Place Sign Truss foundation outside clear zone, 130' span, with no shielding

Alternative	Expected Crash Frequency (Acc/Yr)	Annual Crash Cost ($)	Annual Installation Cost ($)
1	0.038704	1005.58	13184.86
2	0.018892	510.47	14722.75
3	0.016803	494.20	15362.87
4	0.015299	512.20	16643.11

Date: January 19, 2023

Time: 18:02:23PM

Feature Cost Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative: 1

Description: **Sign Truss foundation inside clear zone, 100' span, with shielding**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category
1.1	0.0	0.006595	1.77	1.79	Foreslopes
2.1	0.0	0.004204	3.65	134.01	Foreslopes
3.1	100.0	0.002719	1.79	0.00	Foreslopes
4.1	100.0	0.001911	3.72	40.74	Foreslopes
5.1	200.0	0.005237	1.79	0.00	Foreslopes
6.1	200.0	0.000553	3.81	4.31	Foreslopes
7.1	300.0	0.004663	2.72	27.57	Foreslopes
8.1	300.0	0.000123	3.88	5.36	Foreslopes
9.1	328.0	0.000103	5.95	43.53	Fixed Objects
10.1	309.7	0.001210	6.13	136.42	Fixed Objects
11.1	151.2	0.001916	3.25	32.61	Terminals and Crasl
12.1	163.7	0.002249	3.25	70.79	Terminals and Crasl
13.1	198.1	0.006440	3.04	467.11	Longitudinal Barrier
14.1	323.1	0.000781	3.24	41.35	Terminals and Crasl

This should be coded as Longitudinal Barrier, TL-3 Guardrail.

Date: January 19, 2023 **Time:** 18:02:23PM

Feature Cost Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative: **2**

Description: **Sign Truss foundation outside clear zone, 115' span, with no shielding**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category
1.1	0.0	0.005315	1.62	1.56	Foreslopes
2.1	0.0	0.003223	3.38	104.90	Foreslopes
3.1	100.0	0.002653	1.64	0.16	Foreslopes
4.1	100.0	0.001687	3.43	67.66	Foreslopes
5.1	200.0	0.000084	1.65	0.08	Foreslopes
6.1	200.0	0.000728	3.48	24.55	Foreslopes
7.1	300.0	0.004625	2.49	68.97	Foreslopes
8.1	300.0	0.000210	3.58	25.55	Foreslopes
9.1	328.0	0.000008	5.69	7.25	Fixed Objects
10.1	309.7	0.000359	5.98	209.78	Fixed Objects

Date: January 19, 2023 **Time:** 18:02:23PM

Feature Cost Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative: **3**

Description: **Place Sign Truss foundation outside clear zone, 120' span, with no shielding**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category
1.1	0.0	0.004796	1.62	1.57	Foreslopes
2.1	0.0	0.002833	3.38	104.35	Foreslopes
3.1	100.0	0.002362	1.64	0.15	Foreslopes
4.1	100.0	0.001486	3.43	64.15	Foreslopes
5.1	200.0	0.000936	1.66	0.08	Foreslopes
6.1	200.0	0.000643	3.47	21.47	Foreslopes
7.1	300.0	0.003466	2.50	75.57	Foreslopes
8.1	300.0	0.000097	3.63	16.67	Foreslopes
9.1	328.0	0.000077	5.69	81.57	Fixed Objects
10.1	309.7	0.000107	6.20	128.61	Fixed Objects

Date: January 19, 2023

Time: 18:02:23PM

Feature Cost Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative: 4

Description: **Place Sign Truss foundation outside clear zone, 130' span, with no shielding**

Feature	Distance From Beginning Of First Segment	Expected Crash Freq (Acc/Year)	Average Severity	Annual Crash Cost ($)	Category
1.1	0.0	0.004518	1.62	1.56	Foreslopes
2.1	0.0	0.002625	3.38	98.72	Foreslopes
3.1	100.0	0.002208	1.64	0.17	Foreslopes
4.1	100.0	0.001373	3.42	60.59	Foreslopes
5.1	200.0	0.000838	1.65	0.09	Foreslopes
6.1	200.0	0.000600	3.46	20.39	Foreslopes
7.1	300.0	0.003008	2.51	84.21	Foreslopes
8.1	300.0	0.000011	3.78	3.78	Foreslopes
9.1	328.0	0.000066	5.65	111.83	Fixed Objects
10.1	309.7	0.000052	6.50	130.85	Fixed Objects

Date: January 19, 2023 **Time:** 18:02:23PM

Input Data Report

File Name:	07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd
Project Description:	RP33_WB-541

Alternavtive **1[Baseline(Existing)Condition]**

Description	Sign Truss foundation inside clear zone, 100' span, with shielding
Life(years)	25
Total Installation Cost ($)	205975.00
Annual Maintenance Cost ($)	343.76
Discount Rate	4.00
Area Type	Urban
Functional Class	Freeway
Highway Type	One-Way
Number of Lanes	2
Lane Width(ft)	16.0
Right Shoulder Width(ft)	6.0
Left Shoulder Width(ft)	0.0
Speed Limit(mph)	60.0
Nominal Percent Truck(%)	10.0
ADT	910
Traffic Growth Factor(%)	1.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	67587000 (Auto Generated)

Please use 3 lanes and the total WB Mainline + Ramp ADT = 10,770.

Please verify

The computations and other Alternatives are using 55 mph.

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)

Date: January 19, 2023 **Time:** 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **1 [Baseline(Existing) Conditions]**

Feature	Category		Type
1	Foreslopes		6:1, H >= 0.3 m (1 ft)
2	Foreslopes		3:1, H = 2.0 m (7 ft)
3	Foreslopes		6:1, H >= 0.3 m (1 ft)
4	Foreslopes		3:1, H = 2.0 m (7 ft)
5	Foreslopes		6:1, H >= 0.3 m (1 ft)
6	Foreslopes		3:1, H = 2.0 m (7 ft)
7	Foreslopes		4:1, H >= 2.0 m (7 ft)
8	Foreslopes		3:1, H = 2.0 m (7 ft)
9	Fixed Objects		Round, 0.5 m (1.5 ft) Dia.
10	Fixed Objects	WB-RP33.28	Rectangle, W >= 2.0 m (7 ft), H > 1.0 m (3 ft)
11	Terminals and Crash Cushions		TL-3 Guardrail Terminal

Please include all features.
12 - 14 are missing.

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative 1 [Baseline(Existing) Conditions]

Verify the offsets are consistent with the EOTW location.

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)
1	100.0	8.0	0.000	Right	12.0	0.0
2	100.0	18.0	0.000	Right	20.0	0.0
3	100.0	12.0	0.000	Right	12.0	100.0
4	100.0	19.0	0.000	Right	24.0	100.0
5	200.0	20.0	0.000	Right	12.0	200.0
6	100.0	17.0	0.000	Right	32.0	200.0
7	100.0	28.0	0.000	Right	12.0	300.0
8	100.0	17.0	0.000	Right	40.0	300.0
9	0.8	0.8	0.000	Right	34.2	328.0
10	18.0	3.5	WB-RP33.29 0.000	Right	16.9	309.7
11	12.5	1.8	0.020	Right	9.9	151.2

Update feature distances if stations change.

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternavtive **2**

Description	Sign Truss foundation outside clear zone, 115' span, with no shielding
Life(years)	25
Total Installation Cost ($)	230000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Urban
Functional Class	Freeway
Highway Type	One-Way
Number of Lanes	2
Lane Width(ft)	16.0
Right Shoulder Width(ft)	6.0
Left Shoulder Width(ft)	0.0
Speed Limit(mph)	55.0
Nominal Percent Truck(%)	10.0
ADT	910
Traffic Growth Factor(%)	1.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	67587000 (Auto Generated)

Zero if this is the existing condition. Note: you might need to make this Alt-1 due to the Zero cost and a quirk in RSAP.

Please use 3 lanes and the total WB Mainline + Ramp ADT.

WB-RP33.30

Segment	Length(ft)	Median Width(ft)	Percent Grade(%)

Date: January 19, 2023 **Time:** 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **2**

Feature	Category		Type
1	Foreslopes		6:1, H >= 0.3 m (1 ft)
2	Foreslopes		3:1, H = 2.0 m (7 ft)
3	Foreslopes		6:1, H >= 0.3 m (1 ft)
4	Foreslopes		3:1, H = 2.0 m (7 ft)
5	Foreslopes		6:1, H >= 0.3 m (1 ft)
6	Foreslopes		3:1, H = 2.0 m (7 ft)
7	Foreslopes		4:1, H >= 2.0 m (7 ft)
8	Foreslopes		3:1, H = 2.0 m (7 ft)
9	Fixed Objects		Round, 0.5 m (1.5 ft) Dia.
10	Fixed Objects	WB-RP33.31	Rectangle, W >= 2.0 m (7 ft), H > 1.0 m (3 ft)

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **2**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)
1	100.0	8.0	0.000	Right	12.0	0.0
2	100.0	18.0	0.000	Right	20.0	0.0
3	100.0	12.0	0.000	Right	12.0	100.0
4	100.0	19.0	0.000	Right	24.0	100.0
5	100.0	20.0	0.000	Right	12.0	200.0
6	100.0	17.0	0.000	Right	32.0	200.0
7	100.0	28.0	0.000	Right	12.0	300.0
8	100.0	17.0	0.000	Right	40.0	300.0
9	0.8	0.8	0.000	Right	34.2	328.0
10	18.0	3.5	0.000	Right	32.4	309.7

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternavtive **3**

Description	Place Sign Truss foundation outside clear zone, 120' span, with no shielding
Life(years)	25
Total Installation Cost ($)	240000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Urban
Functional Class	Freeway
Highway Type	One-Way
Number of Lanes	2
Lane Width(ft)	16.0
Right Shoulder Width(ft)	6.0
Left Shoulder Width(ft)	0.0
Speed Limit(mph)	55.0
Nominal Percent Truck(%)	10.0
ADT	910
Traffic Growth Factor(%)	1.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	67587000 (Auto Generated)

Please use 3 lanes and the total WB Mainline + Ramp ADT.

WB-RP33.33

		Median	Percent
Segment	Length(ft)	Width(ft)	Grade(%)

Date: January 19, 2023 **Time:** 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **3**

Feature	Category		Type
1	Foreslopes		6:1, H >= 0.3 m (1 ft)
2	Foreslopes		3:1, H = 2.0 m (7 ft)
3	Foreslopes		6:1, H >= 0.3 m (1 ft)
4	Foreslopes		3:1, H = 2.0 m (7 ft)
5	Foreslopes		6:1, H >= 0.3 m (1 ft)
6	Foreslopes		3:1, H = 2.0 m (7 ft)
7	Foreslopes		4:1, H >= 2.0 m (7 ft)
8	Foreslopes		3:1, H = 2.0 m (7 ft)
9	Fixed Objects		Round, 0.5 m (1.5 ft) Dia.
10	Fixed Objects	WB-RP33.34	Rectangle, W >= 2.0 m (7 ft), H > 1.0 m (3 ft)

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **3**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)
1	100.0	8.0	0.000	Right	12.0	0.0
2	100.0	18.0	0.000	Right	20.0	0.0
3	100.0	12.0	0.000	Right	12.0	100.0
4	100.0	19.0	0.000	Right	24.0	100.0
5	100.0	20.0	0.000	Right	12.0	200.0
6	100.0	17.0	0.000	Right	32.0	200.0
7	100.0	33.0	0.000	Right	12.0	300.0
8	100.0	15.0	0.000	Right	45.0	300.0
9	0.8	0.8	0.000	Right	34.2	328.0
10	18.0	3.5	0.000	Right	37.4	309.7

Date: January 19, 2023

Time: 18:02:23PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternavtive **4**

Description	Place Sign Truss foundation outside clear zone, 130' span, with no shielding
Life(years)	25
Total Installation Cost ($)	260000.00
Annual Maintenance Cost ($)	0.00
Discount Rate	4.00
Area Type	Urban
Functional Class	Freeway
Highway Type	One-Way
Number of Lanes	2
Lane Width(ft)	16.0
Right Shoulder Width(ft)	6.0
Left Shoulder Width(ft)	0.0
Speed Limit(mph)	55.0
Nominal Percent Truck(%)	10.0
ADT	910
Traffic Growth Factor(%)	1.0
Encroachment Rate Adjustment Factor	1
Random Seed Number	67587000 (Auto Generated)

Please use 3 lanes and the total WB Mainline + Ramp ADT.

Segment	Length (ft)	Median Width (ft)	Percent Grade (%)

Date: January 19, 2023

Time: 18:02:24PM

Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **4**

Feature	Category		Type
1	Foreslopes		6:1, H >= 0.3 m (1 ft)
2	Foreslopes		3:1, H = 2.0 m (7 ft)
3	Foreslopes		6:1, H >= 0.3 m (1 ft)
4	Foreslopes		3:1, H = 2.0 m (7 ft)
5	Foreslopes		6:1, H >= 0.3 m (1 ft)
6	Foreslopes		3:1, H = 2.0 m (7 ft)
7	Foreslopes		4:1, H >= 2.0 m (7 ft)
8	Foreslopes		3:1, H = 2.0 m (7 ft)
9	Fixed Objects		Round, 0.5 m (1.5 ft) Dia.
10	Fixed Objects	WB-RP33.37	Rectangle, W >= 2.0 m (7 ft), H > 1.0 m (3 ft)

Date: January 19, 2023

Time: 18:02:24PM

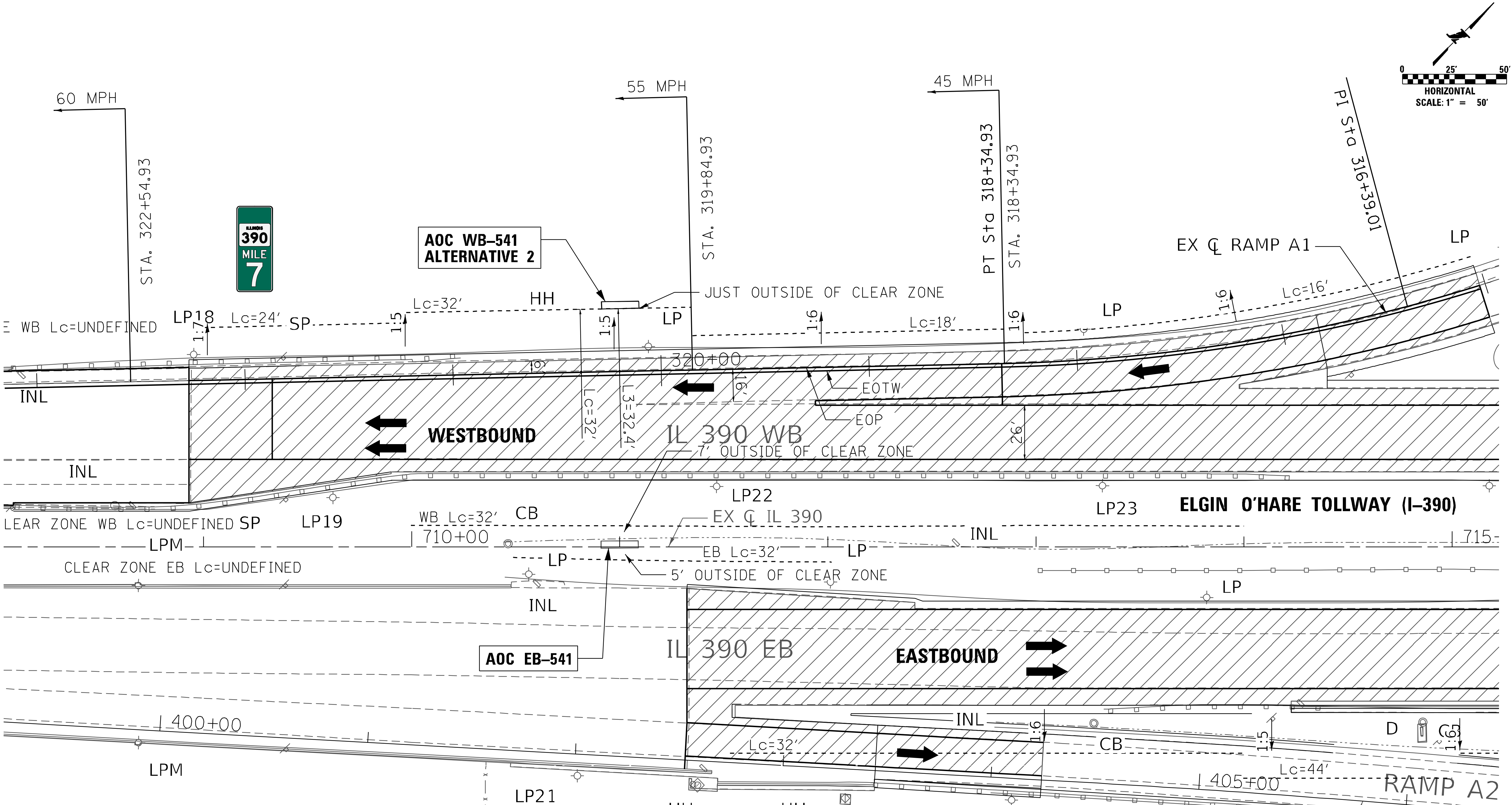
Input Data Report

File Name: 07_4802_Report33_AOC WB-541_RSAP_20221116_60%.rpd

Project Description: RP33_WB-541

Alternative **4**

Feature	Length(ft)	Width(ft)	Flare Rate	Location	Offset(ft)	Distance(ft)
1	100.0	8.0	0.000	Right	12.0	0.0
2	100.0	18.0	0.000	Right	20.0	0.0
3	100.0	12.0	0.000	Right	12.0	100.0
4	100.0	19.0	0.000	Right	24.0	100.0
5	100.0	20.0	0.000	Right	12.0	200.0
6	100.0	17.0	0.000	Right	32.0	200.0
7	100.0	43.0	0.000	Right	12.0	300.0
8	100.0	9.0	0.000	Right	55.0	300.0
9	0.8	0.8	0.000	Right	34.2	328.0
10	18.0	3.5	0.000	Right	47.4	309.7



RECOMMENDATION:

KEEP THE EXISTING FOUNDATION AS IS WITH 115' SPAN LENGTH
JUST JUSTOUTSIDE THE CLEAR ZONE, WITH NO SHIELDING.

THE RSAP PROGRAM SUGGEST THE ALTERNATIVE 1 AS THE RECOMMENDED ALTERNATIVE.
HOWEVER, BASE ON ENGINEERING JUDGMENT WE RECOMMEND ALTERNATIVE 2.

ALTERNATIVE 1 PLACES THE FOUNDATION WITHIN THE CLEAR ZONE WHICH REQUIRES GUARDRAIL SHIELDING.
GUARDRAIL ITSELF IS A POTENTIAL OBSTACLE FOR TRAFFIC, MAKING ALTERNATIVE 2 A SAFER ALTERNATIVE.
WE PREFER TO LIMIT ROADSIDE OBSTACLES AS MUCH AS POSSIBLE.

MILESTONE:	DESIGNED BY: TVN	DATE: 1/19/2023
60% PRELIMINARY	DRAWN BY: LDN	DATE: 1/19/2023
	CHECKED BY: JGM	DATE: 1/19/2023

MILLENNIA

THE ILLINOIS STATE TOLL HIGHWAY AUTHORITY
2700 OGDEN AVENUE
DOWNERS GROVE,
ILLINOIS 60515

REVISIONS		
NO.	DATE	DESCRIPTION

CONTRACT NO. RR-21-4802

BARRIER WARRANT
SUMMARY SITE PLAN - AOC WB-541 RAMP A1

SHEET NO. WB - RP33.39

DRAWING NO. 39 OF 40

BARRIER WARRANT ANALYSIS AND DESIGN

Summary AOC WB-541 RAMP A1

COMMENTS

1. A level 3 analysis was performed to determine the best location for the sign truss foundation based on the March 2022 IL Tollway Traffic Barrier Guidelines .

Four alternatives listed below were analyzed:

Alternative 1: Shield obstacle inside of clear zone with guardrail
(100' span with Shielded, face of foundation located 16.9' from EOTW)
Alternative 2: Place obstacle just outside of clear zone, with no shielding
(115' span, face of foundation located 32.4' from EOTW)
Alternative 3: Place obstacle outside of clear zone, with no shielding
(120' span, face of foundation located 37.4' from EOTW)
Alternative 4: Place obstacle well outside of clear zone, with no shielding
(130' span, face of foundation located 47.4' from EOTW)

When corrected with no initial cost for Alt-2 (existing conditions), the least cost alternative can be selected of the marginally different alternatives.

Alt. 1 vs. Alt. 2 has a positive B/C ratio (0.42) but is less than 1.5, so Alt. 1 is better.
Alt. 1 vs. Alt. 3 has a positive B/C ratio (0.28) but is less than 1.5, so Alt. 1 is better.
Alt. 1 vs. Alt. 4 has a positive B/C ratio (0.16) but is less than 1.5, so Alt. 1 is better.

Based on the B/C Ratios
The B/C ratios of all four Alternatives are marginal compared with each other.
The Alternatvie 1 indicated the lowest crash costs for all alternatvies.

However, based on our engineering judgment, Alternative 1 will also introduce an additional Potential Roadside Obstacles and will not provides the safest conditions for the road. And also keeping the Alt.2 will limit the remove and relocation cost of the sign truss foundation.

Therefore, we suggest keeping the existing foundation as is with a 115' span just outside of the clear zone, with no Guardrail sh
And Alternative 2 is our best option.

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RECOMMENDATION

1. **Therefore, The Recommended alternative is Alternative 2.**
Keep the Sign Truss foundation as is, 115' span just outside of the clear zone, with no Shielding.