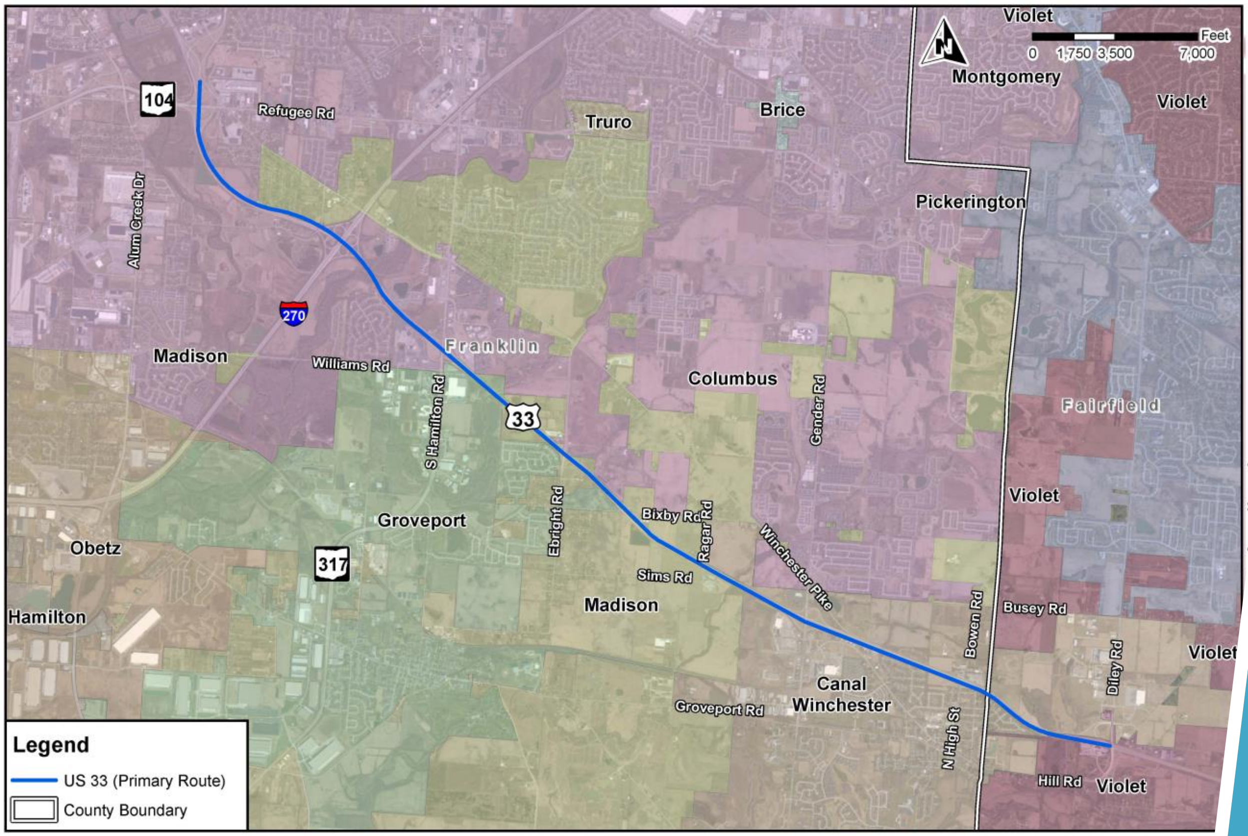
PID 121811, FRA/FAI-33-22.99/0.00
US 33 Widening Feasibility Study
(As developed under PID 119387, FRA-33-24.76 Feasibility Study)

ODOT District 6
June 10, 2025



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Executive Summary

Project Overview

The Ohio Department of Transportation (ODOT) District 6 initiated the US 33 Widening Feasibility Study (PID 121811) to address growing congestion and safety concerns along the US 33 corridor from SR 104 (Refugee Road) in Franklin County to Diley Road in Fairfield County. This corridor is a critical transportation link in Central Ohio, experiencing increasing traffic volumes and crash rates. This feasibility study evaluates two primary build alternatives: widening to the inside (Alternative 1) and widening to the outside (Alternative 2)—to determine a preferred approach for improving capacity and safety.

This document presents the final summary documentation of the alternative evaluation for the US 33 corridor including the evaluation of the design elements determined to influence selection of a preferred alternative. While the evaluation of capacity and safety along the corridor has been provided based on updated traffic volumes prepared for this study to support development and updates to the purpose and need, these elements were not determined to influence selection of a preferred alternative.

Purpose and Need

The project aims to:

- Reduce congestion and improve traffic flow.
- Enhance safety by addressing high crash rates.
- Accommodate future traffic growth and regional mobility needs.

Traffic analyses show that without improvements, the corridor will experience severe congestion and unacceptable levels of service (LOS F) by 2050. Safety data from 2021–2023 revealed 516 crashes, including 5 fatalities and 12 serious injuries, with several segments listed on ODOT's 2024 HSIP Priority List.

Alternatives Considered

No Build – Retains current conditions; fails to meet project goals.

Alternative 1: Widening to the Inside – Adds a third lane in each direction within the existing median. Requires minimal right-of-way (ROW) acquisition and supports future hard shoulder running (HSR).

Alternative 2: Widening to the Outside – Adds lanes on the outside shoulders. Requires significant ROW acquisition, bridge replacements, and has higher environmental and construction impacts.

Key Findings

- Both build alternatives improve LOS and reduce crash potential compared to the No Build scenario.
- Alternative 1 offers better safety outcomes and lower environmental and structural impacts.
- Alternative 2 is more costly due to bridge replacements, ROW needs, and greater stream/wetland impacts.

Cost Comparison

CATEGORY	ALTERNATIVE 1	ALTERNATIVE 2
Total Construction Cost	$154.6M	$167.0M
Total Project Cost	$203.3M	$221.4M
ROW Required	None	5 acres perm, 20 acres temp
Benefit-Cost Ratio (Safety)	0.16	Not calculated

Total Project Cost includes preliminary engineering/detailed design, ROW, CE, and inflation.

Recommendation

Alternative 1 (Widening to the Inside) is recommended as the preferred alternative. It meets the project's purpose and need, minimizes environmental and ROW impacts, supports future Hard Shoulder Lane implementation, and is more cost-effective.

Next Steps

Finalization of Stage 1 design is expected by late Summer 2025, with construction targeted for Fall 2026.

Conclusion

The US 33 Widening Feasibility Study (PID 121811) presents a comprehensive evaluation of alternatives to address critical congestion and safety issues along a key corridor in Central Ohio. Both build alternatives—widening to the inside and widening to the outside—offer operational improvements over the No Build scenario. However, Alternative 1 (widening to the inside) emerges as the preferred solution due to its lower cost, minimal right-of-way and environmental impacts, and compatibility with future capacity enhancements such as hard shoulder running.

Alternative 1 not only meets the project's purpose and need but also provides a more efficient path forward in terms of design, construction, and long-term flexibility. With this recommendation, the project is positioned to move into environmental clearance and detailed design, keeping it on track for construction in Fall 2026.

Introduction

ODOT District 6 pursued Transportation Review Advisory Council (TRAC) funding to improve safety and reduce congestion on US 33, from the I-270 interchange to the Franklin/Fairfield County line, based on multiple studies highlighting these issues. The FRA-US33-24.76 Feasibility Study (PID 119387) was launched to explore corridor improvements including widening US 33 to increase capacity, upgrading the I-270/US 33 interchange, and evaluating a new interchange at Bixby Road.

Due to delays in adding the project to regional and state plans, ODOT split the project into two parts to meet the May 2024 TRAC funding deadline for the US 33 corridor widening. Despite setbacks from survey data processing and regional travel model updates, the evaluation of alternatives and determination of a preferred alternative for the TRAC application was completed. The preferred alternative, widening US 33 by adding an additional lane to the inside in both directions, was submitted to TRAC in May 2024.

Further delays in authorizing the second part of the contract put the US 33 widening project at risk of not having an approved environmental document before TRAC funding decisions in October 2024. To address this, ODOT split the feasibility study into two phases: (1) an alternative determination memo to select a preferred option using available data, and (2) a final Feasibility Study report (i.e. this report), including updated traffic and safety analysis once the second part of the contract is authorized.

The FRA/FAI-33-22.99/0.00 (US 33 Widening) Preferred Alternative Determination Memo was submitted in September 2024, documenting the evaluation of the two widening alternatives—widening to the inside and widening to the outside—and presenting the recommended preferred alternative for review and approval. At the time of the submittal, updated traffic volumes were not available therefore the memo was submitted without updated capacity and safety analysis. Submission of the preferred alternative recommendation without the analysis was determined to be acceptable. Capacity and safety analysis were not expected to influence the selection of the preferred alternative. In November 2024, the preferred alternative recommendation was approved, allowing the environmental document to be prepared and submitted. Approval of the Environmental Document and Environmental Clearance was received for the project on April 24, 2025.

This feasibility study presents the final summary of the alternative evaluation presented in the Preferred Alternative Determination including the updated capacity and safety analysis that was unavailable at the time of the preferred alternative determination for PID 121811. As noted in the preferred alternative determination memo and demonstrated herein, the capacity and safety analysis are comparable between the two alternatives, confirming the prior conclusion. No new findings have been presented in this document.

Project Background

Central Ohio is among the fastest growing areas in the country and the US 33/Southeast Expressway is a key corridor in the Central Ohio regional transportation network. The FRA-US33-24.76 Feasibility Study (PID 119387) began as part of the 2017 Southeast Corridor study. This study considered several improvements to US 33 southeast of Columbus, including widening of US 33, interchange improvements at I-270, and conversion of at-grade intersections with grade-separated interchanges at Bixby Road and Pickerington Road.

Several elements of the 2017 Southeast Corridor study are in various stages of development. Recently completed improvements include the addition of auxiliary lanes between IR 270 and

Hamilton Road and the restriction of turn movements at Bixby Road. District 5 is in the final stages of design for an interchange at Pickerington Road with construction expected to begin in 2026.

The purpose of the FRA-33-24.76 Feasibility Study, PID 119387, is to identify and recommend preferred alternatives for the US 33 corridor, I-270 interchange, and Bixby Road intersection, with NEPA clearance, to support the leveraging of available funding for future construction.

In consultation with OES, it was determined that the proposed improvements at each of the study components could be designed such that they have independent utility. Each was assigned a unique PID to be utilized as the projects progress through the project development process, environmental clearance, and into detailed design.

1. **FRA/FAI-33-22.99/0.00, PID 121811-** Widen US 33 from 2 to 3 lanes in each direction from SR-104 (Refugee Road) in Franklin County to Diley Road (TR-207) in Fairfield County
2. **FRA-270/33-45.808/24.375, PID 121812-** Upgrade the interchange of IR 270 and US 33 in southeastern Franklin County to increase mobility and improve safety at the interchange between I-270 and US 33.
3. **FRA-33-27.831, PID 121814-** Construct a new interchange at the intersection of US 33 and TR 229 (Bixby Road) in southeast Franklin County.

The feasibility study and evaluation of alternatives for these projects are being completed under the FRA-33-24.76 Feasibility Study (PID 119387) contract. However, each of the projects has independent utility and will be carried forward as separate projects, identified by PID as noted above, during environmental clearance and detailed design phases.

Given US 33 is a critical link within the transportation network in central Ohio the need to meet existing and future travel demands on US 33 via widening (PID 121811) was identified as the priority and programmed to be the first of the three projects to go to construction, presently targeted for the Fall of 2026. The intent is for PID 121812 and 121814 to progress to construction within 2-3 years after PID 121811.

FRA/FAI-33-22.99/0.00, PID 121811

The FRA/FAI-33-22.99/0.00 project (PID 121811) aims to reduce congestion, improve safety, and enhance regional mobility on US 33 from SR 104 to Hill-Diley Rd in southeastern Franklin County. The project's key goals are to optimize traffic flow, improve safety within the corridor, and integrate local access.

This section of US 33 has been identified by ODOT as having congestion and safety issues, with two locations ranking on the HSIP priority list. Recent studies, including the 2021 FRA-FAI-33 TSMO Study, explored improvement options, comparing "No Build," hard shoulder running, and traditional widening alternatives. Both build options addressed congestion, but the hard shoulder running option was more costly and had greater construction impacts due to the required ITS infrastructure.

Study Area

The study area extends along US 33 from north of the SR 104 interchange to east of the Hill Road/Diley Road interchange, encompassing areas that contribute to the transportation problem and a range of potential solutions. A project area map is shown in Figure 1.

Within project limits, US 33 typical section includes two through lanes in each direction with

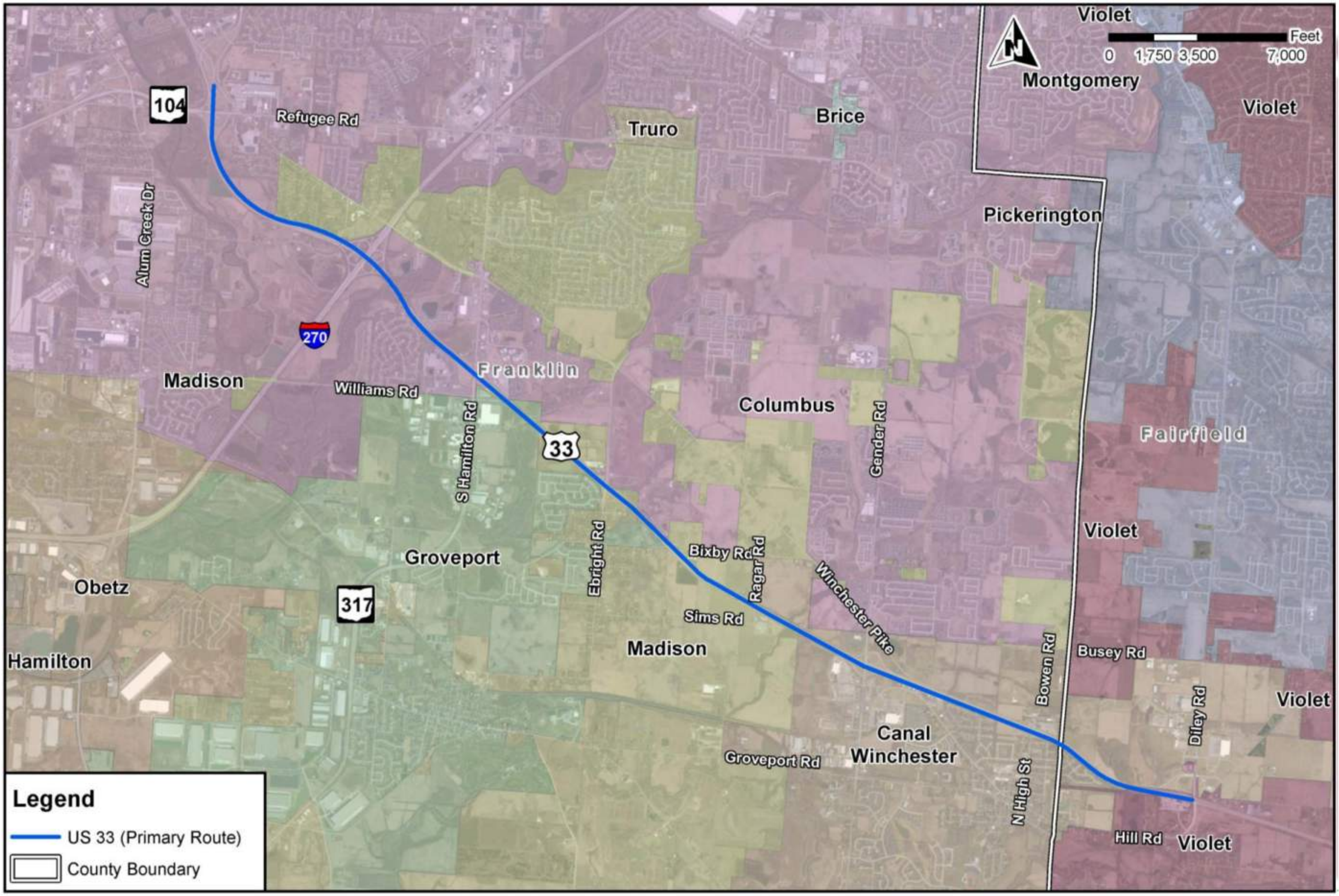


FIGURE 1. FRA/FAI-33-22.99/0.00, PID 121811 (ALSO FRA-33-24.76 FEASIBILITY STUDY, PID119387) PROJECT AREA MAP

a grass median and a 60-mph speed limit between SR 104 and Pickerington Road. In 2019, an auxiliary lane project was completed for US 33 that added a third lane from I-270 interchange to Hamilton Road interchange in both directions. The existing median is approximately 60 feet wide from SR 104 to Gender Road, where it narrows to 40 feet wide for the remainder of the study area.

It is functionally classified as an "Other Freeway and Expressway". The AADT on US 33 ranges from approximately 50,000 north west of I-270 to 80,000 between I-270 and Hamilton Road to 55,000 in the vicinity of Hill Diley interchange, and the daily truck percentage varies between 5% and 8% along the corridor (based on 2023 TIMS data). The approximately nine-mile US 33 corridor includes 4 interchanges and 3 at-grade intersections.

The surrounding land uses are primarily rural/undeveloped land, however, land uses along the existing surface streets with an interchange access to US 33 are urban in nature.

Evaluation Methodology

This US 33 Widening Feasibility Study documents the additional investigation into alternatives for the US 33 corridor widening (PID 121811 completed as part of the FRA-33-24.76 Feasibility Study PID 119387) and identifies the preferred alternative for the US 33 corridor between Refugee Road (SR 104) through the Hill-Diley Interchange.

Logical Termini

The US 33 Widening project has logical termini that were evaluated individually for eastbound and westbound traffic based on volumes and interchange configurations. Widening for an additional eastbound lane begins just in advance of the entrance ramp from Refugee Rd, creating additional through capacity through the I-270 interchange. The additional lane in the eastbound direction ends at the Hill-Diley interchange, either as a drop lane or by reducing the number of lanes downstream from the eastbound exit ramp. East of this interchange, volumes were observed to be lower than to the west of the corridor.

Westbound, the additional lane begins just prior to the westbound entrance from the Hill-Diley interchange. This allows motorists to shift left prior to the entrance ramp while preventing right-of-way needs for a ramp realignment.

This project has independent utility in that while other projects at US 33 interchanges may be considered to address access and safety, US 33 needs additional capacity through this area. If no other actions are taken, the project could be constructed and address this need by providing additional lanes.

Purpose and Need Summary

Purpose Statement

The purpose of the US 33 Widening project, PID 121811, is to reduce congestion and improve safety on the US 33 corridor southeast of Columbus.

Need Elements

The US 33 corridor is a prominent corridor in Central Ohio, moving people and goods across the region. In the current condition, US 33 corridor experiences severe congestion during peak hours that has resulted in safety concerns and reduced reliability for drivers to use this corridor. During peak hours in the existing conditions, sections throughout the corridor between SR 104/Refugee Rd and Hill-Diley are over capacity. Traffic projections in future years show volumes are expected to rise, worsening conditions. Higher volumes and oversaturated conditions also contribute to increased crash risk on a corridor with sections listed on ODOT's 2024 HSIP Priority List, including:

- US 33/I-270 Interchange Area (MP 24.50-25.00): #46 Urban Non-Freeway segment
- US 33/Hamilton Rd Interchange Area (MP 25.50-26.00): #319 Urban Non-Freeway segment
- US 33 near Ebright Rd (MP 27.00-27.50): #333
- US 33/Hill-Diley Rd Interchange Area (MP 0.9-1.40): #348 Suburban Non-Freeway segment

Congestion

Analysis in the TSMO study found that in the 2025 No Build Scenario, this section of eastbound US 33 operates at an acceptable LOS, with the exception of the section from Hamilton Rd to Gender Rd, which experiences congestion resulting in an unacceptable LOS in the PM peak. Between Gender Rd and Pickerington Rd, the LOS is acceptable, but volumes reach 75% of the capacity or higher.

Westbound US 33 experiences the highest volumes in the AM peak. In the 2025 No Build Scenario, demand in some sections exceeds capacity. The freeway operates at LOS F from Gender Rd to Hamilton Rd and at LOS E between ramps in the I-270 interchange.

Volumes in the 2045 Design Year are higher due to anticipated development. These higher volumes result in LOS F in most sections and ramp entrances and exits on US 33 in both directions during either the AM or PM peak. Several other sections experience LOS E. Demand exceeds capacity by as much as 57% in some sections and is greater than capacity along much of the corridor.

More recent model forecasts for Opening Year 2030 and Design Year 2050 show volumes that are higher than the 2025/2045 volumes analyzed previously, suggesting that congestion will continue to worsen if no improvements are constructed.

Safety

Sections of this study area were ranked on ODOT's 2024 HSIP Priority List. In the three-year period from 2021-2023, 516 crashes were observed on US 33 from east of Refugee Rd/SR 104 interchange and through the Hill/Diley Road interchange. The crash data includes crashes at any grade separated interchanges and at-grade intersections. Key observations include:

- The most common crash types were rear end (191 crashes), sideswipe-passing (110 crashes), and fixed object/out of control (84 crashes).
- Fatal & Injury crashes: During this 3-year period, 5 fatal crashes were recorded that resulted in 6 fatalities and 12 crashes resulted in serious injuries. An additional 104 crashes resulted in minor injuries.
- The area with the most crashes was the US 33 & I-270 interchange (131 crashes), and the intersection of US 33 with Bixby Road experienced 58 crashes. The US 33 between Hamilton and Bixby Rd experienced the third highest (42 crashes).

With volumes continuing to rise, crash trends are likely to continue or worsen without improvements.

Summary Statement

The purpose of this project is to improve congestion and safety on the US 33 corridor southeast of Columbus. During peak hours in the existing conditions, sections throughout the corridor between SR 104/Refugee Rd and Hill-Diley are over capacity. Traffic projections in future years show volumes are expected to rise, worsening conditions. Higher volumes and oversaturated conditions would also contribute to increased crash risk on a corridor with sections listed on ODOT's 2024 HSIP Priority List.

Alternatives

Three alternatives were evaluated for the US 33 corridor widening improvement project:

- No-Build Alternative – No change to existing conditions
- Build Alternative 1 – Widening to the inside
- Build Alternative 2 – Widening to the outside

No Build Alternative - Considered and Dismissed

The No-Build alternative maintains the existing configuration of the US 33 corridor, does not impact adjacent parcels, and does not include any new construction or improvements to accommodate increasing traffic demand or safety concerns along the US 33 corridor. As such, the No Build alternative does not meet the critical Purpose and Need elements to be considered a feasible alternative.

While analysis and evaluation of the No Build alternative with updated traffic volumes will be documented within this feasibility study it will be carried forward only to be used as the baseline to compare the alternatives. Only limited reference and comparison to No Build has been made within this document as it does not meet the purpose and need of the project and is not considered a feasible alternative.

Feasible Build Alternatives

The two alternatives considered in this evaluation were based upon the same basic concept: to add a third lane in both directions beginning in the west at approximately the SR 104 (Refugee Road) interchange and extending to the east to end at the Hill-Diley interchange. The primary difference between alternatives is how the lane is added, whether to the inside in the median, or to the outside in the outside shoulder.

Build Alternative 1 will widen US 33 to add a third eastbound and westbound lane in both directions to the inside within the median, paving the median, and constructing a center barrier. **Appendix A** includes drawings and typical sections for Build Alternative 1.

Build Alternative 2 will widen US 33 to add a third eastbound and westbound lane in both directions to the outside in the shoulder. This alternative also requires widening of the inside shoulder. **Appendix B** includes drawings and typical sections for Build Alternative 2.

The scope of the contract called for electronic file deliverables for the alignments and did not plan for hard copy. However, for ease of review, plan sheets were created with this document. To minimize lost work, plans for Alternative 2 have been developed only for critical areas. Additional locations can be reviewed with ODOT during the over-the-shoulder review meetings.

Both alternatives include improvements to ramp merge and diverge areas to accommodate a future posted speed of 65 mph and mainline design speed of 70 mph, will provide for maintenance or repair of existing drainage structures and bridges within the study area limits, include the repair and/or complete replacement of deficient pavements, and be constructed under permissible lane closure hours for the ramps and freeway segments in the project area.

Widening to the inside median within the median is only feasible within the portion of the study area that has the existing 60-foot median. Both alternatives will require inside and outside widening beginning from the vicinity of the High/Bowen intersection through the eastern termini due to a constrained median width in the existing condition. The typical sections of the proposed alternatives are generally the same from Gender Road to the southern/eastern terminus of the study area.

Key Issues

The key issues for determining the recommended preferred alternative have been determined in consultation with ODOT. The key issues include the primary purpose and need elements of safety and congestion, roadway and drainage design, ITS, structures, maintenance of traffic, right of way, environmental considerations, and cost.

The following sections provide additional explanation of the basis of comparison for each of the key issues identified for the US 33 Corridor widening.

Congestion and Safety

Safety and congestion have been identified as the key purpose and need elements for the projects that will originate out of the US 33 feasibility study. Specifically, the projects that will be developed from this study should consider the following with respect to the primary needs, congestion and safety:

- The recommended alternative should not result in a significant adverse impact in either operations or safety from No Build/existing conditions; the proposed should be no worse than No Build/existing.
- While portions of this project area may see traffic operations worsen from No Build, in aggregate, the alternative should generally reduce congestion and safety as compared to No Build.
- In areas where impacts differ negatively from the No Build condition, other mitigating strategies should be considered to minimize/mitigate for the impact.

Certified traffic for 2030/2050 is pending, therefore this study is using 2025/2045 data which is acceptable because the geometric configuration of the alternatives will provide the same capacity improvements and the capacity and safety evaluations of Alternatives 1 and 2 build conditions are expected to be very similar. Both Alternatives are expected to improve capacity along the corridor.

Congestion/Capacity

LJB has been contracted by ODOT to conduct capacity analysis for the US 33 corridor as part of the FRA-33-24.76 feasibility study contract. **Table 1** summarizes the three subareas and associated projects being studied under FRA-33-24.76.

TABLE 1: FRA-33-24.76 STUDY AREA PROJECTS

PID	Project Name	Description
121811	**FRA/FAI-33-22.99/0.00**	**Widen US 33 to six lanes from SR 104 to Hill Rd./Diley Rd.**
121812	FRA-270/33-45.808/24.375	Mobility/safety upgrade of the I-270/US 33 interchange
121814	FRA-33-27.831	Construct new interchange at US 33 and TR 229, Bixby Rd.

While there are three distinct projects being studied as part of the FRA-33-24.76, the focus of this study is the capacity analysis for the US 33 Widening project, PID121811. It is anticipated that the US 33 widening project will occur prior to the construction of either the I-270 / US 33 interchange expansion and the Bixby Road interchange projects. As such, all improvements recommended in this report are independent of any future impacts or influence of these subsequent projects.

This document evaluates the current and future traffic conditions along the US 33 corridor, focusing on the impact of widening the road from four lanes to six lanes between the SR 104 interchange and Hill Rd. / Diley Rd Interchange. The analysis includes various design scenarios for the FRA- US 33 Widening project, such as No Build, Build, and Build with Hard Shoulder Running, and assesses their effectiveness in improving traffic flow and reducing congestion. The document concludes with recommendations for operational improvements and additional capacity enhancements to address bottlenecks and ensure smoother traffic operations. The proposed design for the US 33 widening is included in **Appendices A (Build Alternative 1)** and **Appendix B (Build Alternative 2).**

Study Area and Analysis Scenarios

The study area for the US 33 Widening extends along US 33 from SR 104 in Franklin County to east of Hill Road / Diley Road in Fairfield County.

The scope of this analysis is to evaluate the US 33 corridor with the addition of a third lane in both directions (Build) condition between the SR 104 and Hill Road/Diley Road interchanges and compare the Build analysis to the existing (No-Build) conditions. This analysis assumes a "no build" condition at both the I-270/US 33 and Bixby Road interchanges. As the report will show that while the Build condition under the projected 2050 Design Year AM and PM peak hour traffic volumes is expected to result in significant improvement over the No-Build, operations would not be the typically preferred levels of service during the peak hours. Therefore, a third option, Scenario 3, which includes opening the hard shoulder lane to traffic, was evaluated.

Table 2 shows a summary and description of the design scenarios that were studied for US 33 Widening project (PID 121811)

TABLE 2: CAPACITY ANALYSIS SCENARIOS

Scenario #	Corridor Design	I-270 / US 33 Interchange	Bixby Rd Interchange
1	No Build	No Build	No Build
2	Build	No Build	No Build
3	Build w/ Hard Shoulder Running*	No Build	No Build
*Hard Shoulder Running modeled with an additional inside lane from west of I-270 to Hill / Diley interchange			

Appendix C includes a copy of the traffic volumes used in the analysis of the No-Build and Build conditions.

Background Improvement Considerations:

The following project is expected to be completed prior to the opening year of the proposed project (2030), and has been applied for all scenarios, including the No Build (Scenario 1):

- FRA-33-21.71 at Petzinger Rd improvements (PID 113744)

For Build scenarios (Scenarios 2 & 3), it is assumed that the north leg of Rager Road will be converted to a cul-de-sac at US 33 and will not have direct access to Westbound US 33.

The capacity analyses for the mainline US 33 corridor, ramp merge/diverge elements and weave locations were conducted using Highway Capacity Software (HCS version 2025) per ODOT's OATS Manual guidelines. The HCS Freeway Facilities module was utilized for all freeway segment analyses.

Freeway, ramp merge/diverge elements and weave segments are graded using a level of service (LOS) designation expressed in terms of letter grades. Level of service is a quality measure describing operational conditions with a traffic stream with LOS A representing the highest quality traffic flow (free flow conditions) and minimal delay, and LOS F representing poor traffic/unstable operations, significant delays, and substantial queuing. Level of service is defined in terms of density, as published in the Highway Capacity Manual, Chapters 12, 13, and 14 (HCM 7th Edition). For the capacity analysis, the US 33 corridor was analyzed as a freeway segment. Level of service thresholds for basic freeway segments, merge/diverge sections and weave sections have been summarized in Table 3.

TABLE 3: LEVELS OF SERVICE THRESHOLDS FOR FREEWAY ELEMENTS

LEVEL OF SERVICE	DENSITY (PC/MI/LN)		
	BASIC FREEWAY	MERGE/DIVERGE	WEAVING
A	≤ 11	≤ 10	≤ 10
B	> 11 and ≤ 18	> 10 and ≤ 20	> 10 and ≤ 20
C	> 18 and ≤ 26	> 20 and ≤ 28	> 20 and ≤ 28
D	> 26 and ≤ 35	> 28 and ≤ 35	> 28 and ≤ 35
E	> 35 and ≤ 45	> 35	> 35 and ≤ 43
F	D/C* > 1 OR density > 45	D/C* > 1	D/C* > 1 OR density > 43

* D/C = Demand to capacity ratio

For the US 33 corridor analysis, level of service (LOS), demand-to-capacity (D/C) and volume-to-capacity (V/C) ratios have been summarized for each freeway and ramp segment.

The demand-to-capacity (D/C) ratio is calculated by comparing the true demand (the volume of vehicles requesting access to the segment) to the segment's capacity (the maximum number of vehicles the segment can handle). When the D/C ratio exceeds 1.0, it typically indicates oversaturated conditions, meaning demand exceeds capacity, which can lead to congestion.

The volume-to-capacity (V/C) ratio is similar but differs in that it is based on the actual volume of traffic that successfully enters or travels through the segment and can be influenced by system constraints and limitations such as downstream bottlenecks, traffic signal constraints, etc. Like the D/C ratio, a V/C ratio greater than 0.93 indicates over-capacity conditions. The V/C ratio is not always an accurate reflection of the severity of congestion in oversaturated conditions as it doesn't fully capture the extent to which the segment is overwhelmed. In oversaturated conditions, the V/C ratio focuses on the volume that is able to travel through the segment rather than the total demand. To provide the most reliable determination of severity, this report focuses primarily on D/C ratios and level of service to evaluate operational performance.

Additionally, the HCS software bases freeway segment LOS on both the individual segment capacity and downstream segment capacity. When downstream segments are nearing or over capacity it may influence upstream segments and result in upstream segments operating at lower levels of service than would be expected if considering the upstream segment alone. For example, this is why there are some segments shown in our analysis summaries with D/C and V/C ratios of less than 1.0, but LOS F conditions.

It should be noted that “gap” segments were utilized in the freeway facilities files at the existing at-grade intersections: Bixby Road, Rager Road, and High Street / Bowen Road. This was done based on coordination with ODOT staff to account for the distance in between ramps and for the ramp connections to address entering and exiting volumes to and from the surface streets. However, these results are not included in the LOS summary tables.

Operational Goals of Mainline Freeway Analysis

Analysis of the US 33 corridor was prepared in accordance with the ODOT OATS manual and in coordination with the Office of Roadway Engineering/Division of Engineering. Table 4 summarizes the operational goals for mainline analysis per the OATS manual.

TABLE 4: OPERATIONAL GOALS OF MAINLINE ANALYSIS

METRIC	VALUE
LOS	D or Better
d/c (Demand-to-Capacity Ratio)	< 0.93

The study area falls entirely within the limits of the Mid-Ohio Regional Planning Commission Metropolitan Planning Organization, therefore only goals applicable inside an MPO have been included in Table 4.

Scenario 1: Design Year (2050) No Build Capacity Analysis

HCS was used to analyze the No Build condition for the US 33 mainline, ramp merge/diverge and weave segments, accounting for any bottlenecks/queue spillbacks along the network. As noted previously, the No Build scenario assumes the Petzinger Road project (PID 113744) has been completed. The results of the No Build analysis for the design year (2050) from the HCS software are summarized in **Tables 5 and 6** for eastbound US 33 and westbound US 33, respectively. The HCS output reports are included in **Appendix D.**

Eastbound US 33

During the AM peak, eastbound US 33 operates at an acceptable LOS D or better on all segments. During the PM peak, eastbound US 33 experiences severe congestion, particularly in the segments east of I-270, where all segments are expected to operate at LOS F. Demand-to-capacity ratios (D/C) begin to approach one (1.0) at the SR 104 On-Ramp. As traffic approaches I-270, the LOS F conditions become more widespread, with backups forming near the I-270 SB Off-Ramp and extending through the I-270 NB On-Ramp. The congestion worsens beyond Hamilton Road, where demand exceeds capacity, resulting in gridlock conditions. Segments between Hamilton and Gender Road experience some of the worst conditions, with D/C ratios reaching as high as 1.54, further exacerbating travel delays and increasing queue lengths. These issues continue eastward through the High Street / Bowen Road and Hill Road / Diley Road interchanges, where the over-saturated conditions impact overall corridor performance. The results indicate a need for capacity improvements to US 33.

TABLE 5: 2050 NO-BUILD – EASTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	West of SR 104	0.52		0.52	C	0.60		0.60	C
2	SR 104 Off-Ramp	0.52	0.10	0.52	C	0.60	0.09	0.60	C
3	Winchester Off-Ramp	0.48	0.37	0.48	C	0.56	0.48	0.56	C
4	Btwn Winchester & James Rd Ramps	0.31		0.31	B	0.35		0.35	B
5	James Rd On-Ramp	0.40	0.21	0.40	B	0.45	0.22	0.44	B
6	SR 104 On-Ramp	0.60	0.44	0.60	C	0.89	1.00	0.89	D
7	Btwn SR 104 & I-270	0.60		0.60	C	0.90		0.89	E
8	I-270 SB Off-Ramp	0.60	0.20	0.60	C	0.90	0.15	0.90	E
9	Btwn I-270 SB Ramps (2 lanes)	0.51		0.51	C	0.84		0.82	D
10	Btwn I-270 SB Ramps (3 lanes)	0.34		0.34	B	0.56		0.54	F

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
11	Btwn I-270 SB & NB Loops	0.78		0.78	C	1.04		0.81	F
12	Btwn I-270 NB Ramps	0.52		0.52	C	0.81		0.57	F
13	I-270 NB On-Ramp	0.66	0.46	0.66	C	1.06	0.84	0.72	F
14	Btwn I-270 & Hamilton	0.66		0.66	C	1.06		0.70	F
15	Hamilton Off-Ramp	0.66		0.66	C	1.06	0.52	0.68	F
16	Btwn Hamilton Ramps	0.68		0.68	C	1.37		0.77	F
17	Hamilton SB On-Ramp	0.70	0.04	0.70	C	1.43	0.13	0.82	F
18	Hamilton NB On-Ramp	0.75	0.12	0.75	D	1.54	0.25	0.93	F
19	Btwn Hamilton & Bixby	0.74		0.74	D	1.51		0.93	F
23	Btwn Bixby & Rager	0.73		0.73	D	1.45		0.86	F
27	Btwn Rager & Gender	0.74		0.74	D	1.48		0.88	F
28	Gender Off-Ramp	0.74	0.48	0.74	D	1.48	0.79	*	F
29	Btwn Gender Ramps	0.56		0.56	C	1.14		0.53	F
30	Gender On-Ramp	0.68	0.27	0.68	C	1.39	0.57	0.78	F
31	Btwn Gender & High/Bowen	0.70		0.70	C	1.40		0.78	F
35	Btwn High/Bowen & Diley	0.68		0.68	C	1.34		0.72	F
36	Diley Off-Ramp	0.68	0.34	0.68	D	1.34	0.54	*	F
37	Btwn Diley Ramps	0.52		0.52	C	1.09		0.48	F
38	Diley On-Ramp	0.64	0.28	0.64	C	1.23	0.31	0.62	F
39	East of Diley	0.62		0.62	C	1.21		0.62	F

* Value reported in HCS was > 1.0 which is not possible for V/C ratio

Note: Segments 20 through 26 and 32 through 34 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

0.93 <= Ratio < 1.0	LOS F or Ratio > 1.0

Westbound US 33

In the AM peak, westbound US 33 experiences severe congestion, with all segments from Hill Road / Diley Road to Hamilton Road expected to operate at LOS F. The sections from Hill Road / Diley Road to Gender Road generally see D/C ratios ranging from 1.03 to 1.28. The Gender Road SB on-ramp begins the increase in D/C ratios, which range from 1.20 to 1.43 through the I-270 northbound off-ramp. The congestion begins to ease west of the I-270 northbound off-ramp, where segments are expected to improve to LOS B, indicating a smoother traffic flow.

During the PM peak, westbound US 33 is expected to experience slightly better conditions than the AM peak, but congestion is expected. The worst-performing segments are concentrated between Gender Road and the I-270 northbound off-ramp, where LOS D and E conditions persist, with D/C ratios very close to 1.0. While LOS E conditions are expected, there are no segments which experience a D/C ratio greater than one (1.0) in the PM peak. Segments west of the I-270 northbound off-ramp are expected to improve, with all segments reporting LOS C or better.

Overall, the No-Build scenario is expected to experience significant congestion along westbound US 33, particularly in the AM peak. The worst delays occur between Diley Road and I-270, where traffic demand far exceeds available capacity. The severe congestion at major interchanges such as Gender Road and Hamilton Road leads to excessive queuing, long delays, and poor travel conditions. The corridor performs better west of I-270, where traffic levels decrease, allowing for improved operations.

TABLE 6: 2050 NO-BUILD – WESTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	East of Diley	1.03		0.91	F	0.74		0.74	D
2	Diley Off-Ramp	1.03	0.44	0.90	F	0.74	0.23	0.74	C
3	Btwn Diley Ramps	0.90		0.65	F	0.65		0.65	C
4	Diley On-Ramp	1.17	0.61	0.86	F	0.87	0.51	0.87	D
5	Btwn Diley & High/Bowen	1.20		0.84	F	0.87		0.87	D
9	Btwn High/Bowen & Gender	1.20		0.76	F	0.87		0.87	D
10	Gender Off-Ramp	1.20	0.36	0.74	F	0.87	0.37	0.87	E
11	Btwn Gender Ramps	1.03		0.55	F	0.70		0.70	C
12	Gender NB On-Ramp	1.28	0.59	0.79	F	0.86	0.37	0.86	D
13	Gender SB On-Ramp	1.43	0.32	0.93	F	0.94	0.18	0.94	D
14	Btwn Gender & Rager	1.40		0.93	F	0.94		0.94	E
18	Btwn Bixby & Rager	1.41		0.93	F	0.94		0.94	E
22	Btwn Bixby & Hamilton	1.43		0.93	F	0.99		0.99	E
23	Hamilton Off-Ramp	1.43	0.29	0.93	F	0.99	0.27	0.99	E
24	Btwn Hamilton Ramps	1.31		0.80	F	0.87		0.87	D
25	Btwn Hamilton & I-270 NB Off-Ramp	1.20		0.82	F	0.95		0.95	E
26	Btwn I-270 NB & SB Ramps	0.92		0.50	B	0.65		0.65	C
27	Btwn I-270 SB Ramps	0.84		0.33	B	0.53		0.53	C
28	I-270 SB On-Ramp	0.92	0.18	0.41	B	0.58	0.13	0.58	C
29	Btwn I-270 SB Ramp & SR 104	0.93		0.41	B	0.58		0.58	C
30	SR 104 EB Off-Ramp	0.93	0.07	0.41	B	0.58	0.13	0.58	C
31	Btwn SR 104 Ramps	0.90		0.37	B	0.52		0.52	C
32	Btwn SR 104 EB & WB Loop Ramps	0.88		0.44	B	0.67		0.67	C
33	James Rd Off-Ramp	0.76	0.60	0.27	A	0.58	0.48	0.58	C
34	Btwn James Rd & Winchester Ramps	0.51		0.00	A	0.36		0.36	B
35	Winchester On-Ramp	0.69	0.39	0.18	A	0.53	0.35	0.53	B
36	West of Winchester	0.70		0.18	A	0.53		0.53	C

Note: Segments 6 through 8 and 15 through 21 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

LOS E or 0.93 <= Ratio < 1.0	LOS F or Ratio > 1.0

Scenario 2: Design Year (2050) Build Capacity Analysis – US 33 Widening

HCS was used to evaluate the Build scenario for the US 33 widening. This scenario assumes an additional lane in both directions of US 33 from west of SR 104 to the Hill Road / Diley Road interchange. Two build scenarios were evaluated for the Feasibility Study: an additional lane added to the inside shoulder versus an additional lane added to the outside shoulder. For the purposes of the capacity analysis, the differences in geometry between inside versus outside widening were considered negligible; therefore, only one Build scenario based on the inside widening is presented. These results should be very similar for the outside widening scenario.

The design year (2050) results for the Build scenario are included **in Tables 7 and 8** for eastbound and westbound US 33, respectively. The HCS files and output reports are included in **Appendix D**.

Eastbound US 33

The 2050 Build scenario for eastbound US 33 shows improved levels of service (LOS) compared to the No Build scenario.

The AM peak period sees improvement from generally LOS C and D in the No Build to mostly LOS B and C in the Build. All segments in the Build operate acceptably with LOS C or better conditions.

During the PM peak period, the congestion is reduced along eastbound US 33 with the additional through lane when compared to the No Build; however, some sections are still expected to experience congestion, particularly east of I-270. Segments between Hamilton Road and Diley Road show most D/C ratios near or exceeding 1.0, indicating demand is expected to surpass available capacity. The most constrained areas within the widened section include the weave section between the I-270 loop ramps and the segments between Hamilton Road and Gender Road. These locations experience some congestion, with D/C ratios reaching up to 1.06, highlighting potential operational challenges closer to the design year and the need for additional capacity improvements. While many segments east of I-270 are still expected to fail, the congestion is reduced compared to the No Build. The peak D/C ratio in the No Build scenario was 1.54 at the Hamilton northbound on-ramp and is reduced to 1.06. Within the unwidened section, the peak D/C ratio will be 1.31, which occurs after the additional lane is dropped east of Diley Road.

TABLE 7: 2050 BUILD – EASTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	West of SR 104 (nominal length)	0.53		0.53	C	0.62		0.62	C
2	SR 104 Off-Ramp	0.53	0.10	0.53	C	0.62	0.10	0.62	C
3	Winchester Off-Ramp	0.49	0.36	0.49	C	0.58	0.47	0.58	C
4	Btwn Winchester & James Rd Ramps	0.32		0.32	B	0.37		0.37	B
5	James Rd On-Ramp	0.42	0.22	0.42	B	0.48	0.23	0.47	C
6	Btwn James Rd & SR 104	0.28		0.28	A	0.32		0.32	B
7	SR 104 On-Ramp	0.41	0.45	0.41	B	0.62	1.02	0.61	C
8	Btwn SR 104 & I-270	0.42		0.42	B	0.62		0.61	C
9	I-270 SB Off-Ramp	0.42	0.20	0.42	B	0.62	0.15	0.62	C
10	Btwn I-270 SB Ramps	0.35		0.35	B	0.58		0.57	C

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
11	Btwn I-270 SB & NB Loops	0.79		0.79	C	1.03		1.00	F
12	Btwn I-270 NB Ramps	0.54		0.54	C	0.83		0.76	D
13	I-270 NB On-Ramp	0.52	0.49	0.52	C	0.82	0.87	0.77	D
14	Btwn I-270 & Hamilton	0.51		0.51	C	0.82		0.77	D
15	Hamilton Off-Ramp	0.51	0.76	0.51	C	0.82	0.52	0.82	D
16	Btwn Hamilton Ramps	0.48		0.48	B	0.94		0.85	F
17	Hamilton SB On-Ramp	0.50	0.05	0.50	B	0.98	0.14	0.88	F
18	Hamilton NB On-Ramp	0.54	0.12	0.54	B	1.06	0.26	0.95	F
19	Btwn Hamilton & Bixby	0.52		0.52	C	1.04		0.94	F
23	Btwn Bixby & Rager	0.52		0.52	C	1.05		0.92	F
27	Btwn Rager & Gender	0.54		0.54	C	1.06		0.93	F
28	Gender Off-Ramp	0.54	0.54	0.54	C	1.06	0.84	*	F
29	Btwn Gender Ramps	0.40		0.40	B	0.82		0.68	C
30	Gender On-Ramp	0.48	0.27	0.48	B	0.99	0.54	0.84	D
31	Btwn Gender & High/Bowen	0.49		0.49	B	1.00		0.84	D
35	Btwn High/Bowen & Diley	0.48		0.48	B	0.95		0.79	F
36	Diley Off-Ramp	0.48	0.36	0.48	C	0.95	0.59	0.77	F
37	Btwn Diley Ramps (3 lanes)	0.37		0.37	B	0.78		0.54	F
38	Btwn Diley Ramps (2 lanes)	0.55		0.55	C	1.16		0.79	F
39	Diley On-Ramp (2 lanes)	0.68	0.28	0.68	C	1.31	0.32	0.93	F
40	East of Diley (2 lanes)	0.66		0.66	C	1.28		0.93	F

* Value reported in HCS is >1.0 which is not possible for V/C ratio
Note: Segments 20 through 26 and 32 through 34 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

0.93 <= Ratio < 1.00	LOS F or Ratio > 1.00

Westbound US 33

The 2050 Build scenario for westbound US 33 shows significant improvement compared to the No Build scenario. Some segments are still expected to experience congestion, particularly in the AM peak period, but the frequency and intensity of congestion is expected to be greatly reduced.

During the AM peak, segments east of Diley Road, where the number of lanes is expected to remain at two (2) in each direction, will continue to experience LOS F conditions with D/C ratios ranging from 0.91 to 1.05. Among sections with the additional through lane, demand hovers around capacity between Gender Road and I-270 with the highest D/C ratios expected near I-270; the segment between Hamilton Road and the I-270 NB off-ramp is expected to reach a D/C ratio of 1.17 and a V/C ratio of 0.93, indicating a likely bottleneck.

During the PM peak, westbound US 33 operates at an acceptable LOS D or better, with most segments expected to operate at LOS B or C. The only segment which approaches capacity is the section between Hamilton Road and the I-270 northbound off-ramp, which reaches a D/C of 0.96 during the AM peak hour.

Overall, the 2050 Build scenario improves westbound flow considerably in both peak hours, but congestion remains in the AM peak, particularly in the un-widened sections and areas between Gender Road and I-270. Addressing these bottlenecks may require additional capacity, ramp modifications, or other operational improvements to enhance performance.

TABLE 8: 2050 BUILD – WESTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	East of Diley (2 lanes)	1.05		1.00	F	0.78		0.78	D
2	Diley Off-Ramp (2 lanes)	1.05	0.48	*	F	0.78	0.23	0.78	C
3	Btwn Diley Ramps (2 lanes)	0.91		0.79	D	0.69		0.69	C
4	Btwn Diley Ramps (3 lanes)	0.60		0.53	C	0.46		0.46	B
5	Diley On-Ramp	0.79	0.63	0.72	C	0.62	0.52	0.62	C
6	Btwn Diley & High/Bowen	0.81		0.72	D	0.61		0.61	C
10	Btwn High/Bowen & Gender	0.81		0.73	D	0.62		0.62	C
11	Gender Off-Ramp	0.81	0.35	0.81	D	0.62	0.37	0.62	C
12	Btwn Gender Ramps	0.70		0.62	C	0.50		0.50	C
13	Gender NB On-Ramp	0.88	0.64	0.80	D	0.61	0.38	0.61	C
14	Gender SB On-Ramp	0.99	0.35	0.91	D	0.66	0.17	0.66	C
15	Btwn Gender & Bixby	0.97		0.91	E	0.65		0.65	C
19	Btwn Bixby & Hamilton	1.00		0.91	F	0.69		0.69	C
20	Hamilton Off-Ramp	1.00	0.29	0.90	F	0.69	0.28	0.69	C
21	Btwn Hamilton Ramps	0.92		0.79	F	0.61		0.61	C
22	Btwn Hamilton & I-270 NB Off-Ramp	1.17		0.93	F	0.96		0.96	D
23	Btwn I-270 NB & SB Ramps	0.74		0.52	B	0.64		0.64	B
24	Btwn I-270 SB Ramps	0.59		0.35	B	0.37		0.37	B
25	I-270 SB On-Ramp	0.64	0.18	0.41	B	0.41	0.12	0.41	B
26	Btwn I-270 SB Ramp & SR 104	0.65		0.41	B	0.41		0.41	B
27	SR 104 EB Off-Ramp	0.65	0.07	0.65	B	0.41	0.13	0.41	B
28	Btwn SR 104 Ramps	0.63		0.39	B	0.37		0.37	B
29	Btwn SR 104 EB & WB Loop Ramps	0.86		0.57	B	0.68		0.68	B
30	James Rd Off-Ramp	0.53	0.60	0.53	B	0.40	0.48	0.40	B
31	Btwn James Rd & Winchester Ramps	0.54		0.19	A	0.39		0.39	B
32	Winchester On-Ramp	0.74	0.43	0.39	B	0.57	0.39	0.57	C
33	West of Winchester (nominal length)	0.75		0.39	B	0.58		0.58	C

* Value reported in HCS is >1.0 which is not possible for V/C ratio
Note: Segments 7 through 9 and 16 through 18 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

0.93 <= Ratio < 1.00	LOS F or Ratio > 1.00

Scenario 3: Design Year (2050) Build Improved Capacity Analysis – US 33 with HSR

The initial scope for the US 33 widening project included evaluation of Scenarios 1 and 2 listed above: No Build and Build conditions for the design year of 2050 only. However, as noted previously, as the analysis progressed, additional alternatives became necessary to evaluate due to failing traffic conditions on US 33 even with a 6-lane section.

An additional Build scenario was evaluated which included the addition of a hard shoulder running (HSR) lane to the inside shoulder in both directions of US 33 from just west of the I-270 interchange to Diley Road. The design year (2050) results for the Build Improved scenario are included **in Tables 9 and 10** for eastbound and westbound US 33, respectively. The HCS output reports are included in **Appendix D**.

Eastbound US 33

The 2050 Build Improved scenario for eastbound US 33 shows continued acceptable operations in the AM peak hour and improved conditions within the HSR portion of the corridor in the PM peak hour. Four (4) segments between I-270 and Diley Road which include the HSR are expected to operate at LOS F compared to 11 segments in the Build scenario. Of those, three (3) segments will experience LOS F due to queue spillback from the unwidened section. Only one (1) segment in the HSR section is expected to operate with a D/C greater than one (1.0) compared to six (6) in the Build scenario. The design for the remainder of the corridor is unchanged and thus is expected to operate similar to the Build scenario.

TABLE 9: 2050 BUILD W/ HARD SHOULDER RUNNING – EASTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	West of SR 104 (nominal length)	0.53		0.53	C	0.62		0.62	C
2	SR 104 Off-Ramp	0.53	0.10	0.53	C	0.62	0.10	0.62	C
3	Winchester Off-Ramp	0.49	0.36	0.49	C	0.58	0.47	0.58	C
4	Btwn Winchester & James Rd Ramps	0.32		0.32	B	0.37		0.37	B
5	James Rd On-Ramp	0.42	0.22	0.42	B	0.48	0.23	0.47	C
6	Btwn James Rd & SR 104	0.28		0.28	A	0.32		0.32	B
7	SR 104 On-Ramp	0.41	0.45	0.41	B	0.62	1.02	0.61	C
8	Btwn SR 104 & I-270 (3-lane)	0.42		0.42	B	0.58		0.61	C
9	Btwn SR 104 & I-270 (4-lane)	0.31		0.31	B	0.47		0.46	B
10	I-270 SB Off-Ramp	0.31	0.20	0.31	B	0.47	0.15	0.47	B
11	Btwn I-270 SB Ramps	0.26		0.26	A	0.43		0.43	B
12	Btwn I-270 SB & NB Loops	0.79		0.79	B	1.03		1.00	F
13	Btwn I-270 NB Ramps	0.41		0.41	B	0.63		0.57	C
14	I-270 NB On-Ramp	0.41	0.49	0.41	B	0.66	0.87	0.61	C
15	Btwn I-270 & Hamilton	0.41		0.41	B	0.65		0.61	C
16	Hamilton Off-Ramp	0.41	0.76	0.41	C	0.65	0.52	0.65	C
17	Btwn Hamilton Ramps	0.36		0.36	B	0.71		0.65	C

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
18	Hamilton SB On-Ramp	0.37	0.05	0.37	B	0.74	0.14	0.68	C
19	Hamilton NB On-Ramp	0.40	0.12	0.40	B	0.80	0.26	0.74	C
20	Btwn Hamilton & Bixby	0.39		0.39	B	0.78		0.74	D
24	Btwn Bixby & Rager	0.39		0.39	B	0.78		0.74	D
28	Btwn Rager & Gender	0.40		0.40	B	0.80		0.75	D
29	Gender Off-Ramp	0.40	0.54	0.40	B	0.80	0.84	0.80	D
30	Btwn Gender Ramps	0.30		0.30	A	0.62		0.57	C
31	Gender On-Ramp	0.36	0.27	0.36	B	0.74	0.54	0.69	C
32	Btwn Gender & High/Bowen	0.37		0.37	B	0.75		0.69	C
36	Btwn High/Bowen & Diley	0.36		0.36	B	0.71		0.62	F
37	Diley Off-Ramp	0.36	0.36	0.36	B	0.71	0.59	0.57	F
38	Btwn Diley Ramps (3 lanes)	0.37		0.37	B	0.78		0.54	F
39	Btwn Diley Ramps (2 lanes)	0.55		0.55	C	1.16		0.79	F
40	Diley On-Ramp (2 lanes)	0.68	0.28	0.68	C	1.31	0.32	0.93	F
41	East of Diley (2 lanes)	0.66		0.66	C	1.28		0.93	F

Note: Segments 21 through 27 and 33 through 35 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

Segments with HSRL	0.93 <= Ratio < 1.00	LOS F or Ratio > 1.00

Westbound US 33

The 2050 Build Improved scenario for westbound US 33 continues to show acceptable (LOS D or better) operations in the PM peak hour, as was the case for the 2050 Build scenario. Operations in the AM peak hour are expected to improve, with only four (4) segments expected to operate at LOS F; two of those are in the section where the freeway will remain two lanes. The addition of the HSR eliminates LOS F conditions on all but two segments within the section where it would be applied. It should be noted that the D/C ratio remains 1.17, as it was in the Build scenario, in the segment between Hamilton Road and I-270, despite a fifth lane on the freeway in the Build Improved scenario.

TABLE 10: 2050 BUILD W/ HARD SHOULDER RUNNING – WESTBOUND US 33 LOS

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
1	East of Diley (2 lanes)	1.05		1.00	F	0.78		0.78	D
2	Diley Off-Ramp (2 lanes)	1.05	0.48	*	F	0.78	0.23	0.78	C
3	Btwn Diley Ramps (2 lanes)	0.91		0.79	D	0.69		0.69	C
4	Btwn Diley Ramps (3 lanes)	0.60		0.53	C	0.46		0.46	B
5	Diley On-Ramp	0.59	0.63	0.54	C	0.46	0.52	0.46	B
6	Btwn Diley & High/Bowen	0.61		0.54	C	0.46		0.46	B
10	Btwn High/Bowen & Gender	0.61		0.54	C	0.46		0.46	B
11	Gender Off-Ramp	0.61	0.35	0.61	C	0.46	0.37	0.46	B

Seg #	Segment Description	AM Peak Hour				PM Peak Hour			
		D/C		V/C	LOS	D/C		V/C	LOS
		Fwy	Ramp	Fwy		Fwy	Ramp	Fwy	
12	Btwn Gender Ramps	0.53		0.47	B	0.38		0.38	B
13	Gender NB On-Ramp	0.66	0.64	0.60	C	0.46	0.38	0.46	B
14	Gender SB On-Ramp	0.74	0.35	0.68	C	0.50	0.17	0.50	B
15	Btwn Gender & Bixby	0.73		0.68	C	0.49		0.49	B
19	Btwn Bixby & Hamilton	0.75		0.70	C	0.52		0.52	C
20	Hamilton Off-Ramp	0.75	0.29	0.75	C	0.52	0.28	0.52	C
21	Btwn Hamilton Ramps	0.69		0.61	F	0.46		0.46	B
22	Btwn Hamilton & I-270 NB Off-Ramp	1.17		0.93	F	0.96		0.96	C
23	Btwn I-270 NB & SB Ramps	0.74		0.52	B	0.64		0.64	B
24	Btwn I-270 SB Ramps	0.44		0.27	A	0.28		0.28	A
25	I-270 SB On-Ramp	0.48	0.18	0.31	B	0.31	0.12	0.31	B
26	Btwn I-270 SB Ramp & SR 104	0.49		0.31	B	0.30		0.30	A
27	SR 104 EB Off-Ramp	0.65	0.07	0.65	A	0.41	0.13	0.41	A
28	Btwn SR 104 Ramps	0.63		0.39	B	0.37		0.37	B
29	Btwn SR 104 EB & WB Loop Ramps	0.86		0.57	B	0.68		0.68	B
30	James Rd Off-Ramp	0.53	0.60	0.53	B	0.40	0.48	0.40	B
31	Btwn James Rd & Winchester Ramps	0.54		0.19	A	0.39		0.39	B
32	Winchester On-Ramp	0.74	0.43	0.39	B	0.57	0.39	0.57	C
33	West of Winchester (nominal length)	0.75		0.39	B	0.58		0.58	C

* Value reported in HCS is >1.0 which is not possible for V/C ratio

Note: Segments 7 through 9 and 16 through 18 are "gap" segments created to account for at-grade intersections at Bixby Rd, Rager Rd, and High St/Bowen Rd. Values are therefore not reported for those segments.

Segments with HSRL	0.93 <= Ratio < 1.00	LOS F or Ratio > 1.00

Design Year (2050) Build Analysis Summary

Table 11 below shows a comparison of the operations between the No Build, Build, and Build Improved scenarios. It includes the number and percentage of segments that experience LOS F conditions and the number and percentage of segments which experience D/C ratios of greater than one (1).

TABLE 11: 2050 BUILD CAPACITY ANALYSIS COMPARISON

HCS Results Summary US 33 Widening		Total # Segments	AM Peak Hour		PM Peak Hour	
			# (%) Segments LOS F	# (%) Segments d/c > 1	# (%) Segments LOS F	# (%) Segments d/c > 1
US 33 Eastbound	No Build	30	0 (0%)	0 (0%)	**21 (70%)**	19 (63%)
	Build US 33 Widening	31	0 (0%)	0 (0%)	**14 (45%)**	9 (29%)
	Build US 33 Widening w/ HSR	32	0 (0%)	0 (0%)	7 (22%)	4 (13%)

US 33 Westbound	No Build	27	**16 (59%)**	15 (56%)	0 (0%)	0 (0%)
	Build US 33 Widening	27	**6 (22%)**	3 (11%)	0 (0%)	0 (0%)
	Build US 33 Widening w/ HSR	27	4 (15%)	3 (11%)	0 (0%)	0 (0%)

Note: Segment # and % values include "gap" segments

In the No Build condition without improvements in place, 70% of eastbound segments fail in the PM peak with 63% experiencing a d/c of greater than 1.0. Of the westbound segments, 59% are expected to operate at LOS F in the AM peak, with 56% experiencing a d/c greater than 1.0.

The addition of a through lane in the Build US 33 Widening scenario provides some improvements to traffic flow along US 33 but does not fully resolve all congestion issues. Forty-five percent of eastbound segments are expected to fail, with 29% experiencing a d/c of greater than 1.0. The westbound direction sees greater improvement with the additional lane in place, with only 22 percent of segments expected to fail. Still, there are clearly areas of the network that will continue to see congestion even with the proposed improvement in place.

The last scenario, which assumes a hard shoulder running lane in both directions of US 33 shows the most improvement, with only four (4) westbound segments expected to fail and three with a D/C greater than one. The eastbound direction shows seven (7) segments with LOS F, but it should be noted that six (6) of those are a result of the lane reduction from four to two lanes in the area near Hill Road / Diley Road. Only one segment in the widened area, the weave between the I-270 northbound and southbound loops, is expected to see demand exceed capacity.

Overall, in both Build scenarios, with or without the HSR, conditions in both directions of US 33 are expected to improve considerably compared to the No Build condition.

The analysis for Scenario 3 assumes that a HSR lane will be provided for the majority of US 33 corridor from Hill Road/Diley Road interchange to west of I-270 in both directions. These additional lanes are not necessary for the opening year traffic conditions. Based on the design year (2050) LOS results in Tables 6 and 8, a fourth lane is likely necessary in the westbound direction from Gender Road interchange through I-270 interchange. It is recommended that the opening year configuration include a six-lane section, and as traffic demand approaches capacity, then traffic forecasts and capacity analysis should be updated to determine the limits for HSR lane implementation by direction.

Further enhancements such as interchange modifications or alternative traffic management strategies may be needed to fully address long-term capacity challenges.

Conclusions and Recommendations

The capacity analysis for the US 33 corridor indicates significant congestion issues in the No Build scenario. The analysis shows that during peak hours, several segments of US 33, especially east of I-270, operate at LOS F, indicating severe congestion and poor traffic flow. The demand-to-capacity ratios in these segments often exceed 1.0, highlighting the need for capacity improvements.

Recommendations

1. **US 33 Widening**: The Build scenario, which includes adding a lane in both directions of US 33, shows improved levels of service compared to the No Build scenario. However, some segments still experience congestion, particularly east of I-270. It is recommended to proceed with the widening project to alleviate congestion.
2. **Hard Shoulder Running (HSR)**: An additional Build scenario with Hard Shoulder Running (HSR) was evaluated. This scenario shows further improvements in traffic flow, reducing the number of segments operating at LOS F. It is recommended to consider implementing HSR as an alternative to further enhance capacity and reduce congestion.
3. **Operational Improvements:** Addressing bottlenecks, particularly at major interchanges such as I-270, Hamilton Road, and Gender Road, may require additional capacity, ramp modifications, or other operational improvements to enhance performance.

In summary, adding through lanes significantly enhances corridor operations. As congestion increases, additional improvements—such as interchange modifications or hard shoulder running—may be necessary to meet capacity demands. However, given the substantial operational benefits, it is recommended that ODOT proceed with the widening project while monitoring corridor performance to determine the need for future enhancements.

Safety

Highway Safety Manual Analysis

The predictive method described in Part C of the Highway Safety Manual (HSM) provides steps to estimate the expected average crash frequency of a site for a given time period, geometric design, traffic control features, and traffic volumes. The expected average crash frequency ($N_{expected}$) is estimated using a predictive model estimate of crash frequency for a specific site type ($N_{predicted}$) together with observed crash frequency.

The difference between the predicted and expected average crash frequencies is termed the "Expected Excess Crashes" for the site. If the expected average crash frequency is greater than the predicted average crash frequency, then the site has potential for safety improvement. If expected frequency is less than predicted frequency, then the site is expected to experience fewer crashes per year on average than its peers. HSM analysis was conducted using ODOT's Economic Crash Analysis Tool (ECAT). Injury severity is described using the KABCO scale, where:

- K = Fatal crash
- A = Serious injury
- B = Minor Injury
- C = Possible injury
- O = Property damage only

Comparison of Alternatives

To assess the difference in safety performance between widening inside or outside, ECAT analysis was performed for a typical 2000' freeway segment for no-build and both alternatives. No access points were included in this representative section. Full-length median barrier was assumed to require full-length median barrier, while the no build and outside widening did not use any barrier. Volumes from the Travel Demand Model between Bixby and Gender were used to complete this analysis, representing the highest volumes within the proposed new three lane section. The results of the analysis are shown in **Table 12**.

TABLE 12: EXISTING CONDITIONS PROJECT ELEMENT PREDICTED CRASH SUMMARY

SCENARIO	CRASH SEVERITY LEVEL				
	KA	B	C	O	Total
No Build	0.15	0.45	0.62	3.15	4.38
Alternative 1: Inside Widening	0.08	0.38	0.48	2.85	3.80
Alternative 2: Outside Widening	0.10	0.40	0.55	2.78	3.83

Based on these results, both alternatives are predicted to improve safety along the corridor, with Alternative 1 expected to produce a slightly higher safety improvement when compared to Alternative 2.

Inside Widening HSM Analysis

Following the comparison analysis, a detailed analysis was conducted for inside widening. The HSM predictive method for Freeway Segments was applied to mainline US 33 in each direction. The methodology for Rural Intersections was applied to each at-grade intersection. Ramps at interchanges were not included in the analysis due to minimal changes to ramp geometry outside merge/diverge areas, which are included in the Freeway Segment methodology. Results are presented in **Table 13**.

TABLE 13: SUMMARY OF HSM ANALYSIS BY SEGMENTS AND INTERSECTIONS

CRITERIA	US 33 NORTH BOUND	US 33 SOUTH BOUND	US 33 & BIXBY RD	US 33 & RAGER RD	US 33 & HIGH-BOWEN	OVERALL
Predicted Average Crash Frequency ($N_{predicted}$)	121.5	90.0	3.1	2.2	4.6	221.3
Expected Average Crash Frequency – Existing Conditions ($N_{expected}$, existing)	101.3	80.6	11.8	7.0	4.0	204.7
Potential for Safety Improvement	-20.2	-9.4	8.7	4.8	-0.6	-16.6
Proposed Condition Expected Crashes($N_{expected}$, proposed)	106.1	79.5	5.1	2.2	6.2	199.1

Crash data from 2021-2023 was used in the HSM analysis. The results show there is a potential for safety improvement at the US 33 intersections with Bixby Rd and Rager Rd. The primary changes in safety function between Existing and Proposed were number of lanes (which fundamentally changes the base safety performance function), shoulder width, median width, and presence of median barrier. The Proposed condition showed a lower number of expected crashes for US 33 northbound and southbound, as well as at two at-grade intersections, as well as for all injury severities, as shown in **Table 14**.

TABLE 14: SUMMARY OF HSM ANALYSIS BY INJURY SEVERITY

CRITERIA	KA	B	C	O	OVERALL
Predicted Average Crash Frequency ($N_{predicted}$)	6.9	24.3	30.2	159.9	221.3
Expected Average Crash Frequency – Existing Conditions ($N_{expected}$, existing)	7.2	24.4	29.4	143.6	204.7
Potential for Safety Improvement	0.32	0.13	-0.78	-16.30	-16.63
Proposed Condition Expected Crashes($N_{expected}$, proposed)	5.0	20.1	24.3	149.8	199.1
Expected Annual Crash Reduction	1.9	4.2	5.9	10.1	22.2

A Benefit-Cost analysis was conducted by considering the economic cost of crashes and comparing the anticipated project cost, including design, construction engineering, and inflation. Detailed reports are provided in **Appendix E**. This comparison is shown in **Table 15**. A positive value indicates that the project will improve safety. A value of 1 or more indicates that the safety benefits alone are expected to return the cost of implementing the project over the course of the infrastructure's lifespan. The resulting ratio of 0.16 reflects that widening US 33 to the inside would improve safety and provide a return of about 16% of the project cost.

TABLE 15: BENEFIT-COST ANALYSIS

CRITERIA	VALUE
Net Present Cost of Project	$200,933,000
Net Present Value of Safety Benefits	$32,621,678
Annual Crash Reduction	22.2
Benefit-Cost Ratio	0.16

Roadway Design

The alignments for both alternatives were developed per the ODOT L&D Manual. A tabulation of design criteria consistent with the ODOT Location and Design Manual Volume 1 is shown in Appendix F. The following provides a summary of key design criteria. Where applicable a summary of the difference in impact due to the criteria for the two alternatives has been included.

Typical Section

US 33 Mainline - The typical section for the mainline facility meets the requirements of L&D Manual Section 300. While the typical section varies throughout the length of the corridor, it generally consists of three through lanes in each direction. Within the study area, the median width is 60 feet from the western terminus to just east of the N. High St. / Bowen Road intersections, where it transitions to 40 feet which continues to and beyond the eastern terminus.

Alternative 1 – Add a 12′ through lane in each direction within the 60′ median area and 11′ lane in each direction within the existing 40′ median.

Alternative 2 – Add a 12′ through lane along the outside in each direction and increase median shoulder to 10′ in each direction.

Typical section details for each alternative have been included in Appendices A and B with each respective alternative's horizontal alignment.

Ramps - No changes to the typical sections for the ramps have been proposed for either alternative as part of this evaluation. Ramp operation and capacity and connections to and from the mainline corridor will be reevaluated with the updated certified traffic when available. However, the volumes will be the same for both alternatives as would any required modifications to alignment or number of lanes; therefore, the capacity at the connections would not influence determination of a preferred alternative. Ramp cross section and design will be addressed with Stage 1 detailed design should the need for modifications be identified.

Horizontal Alignment

Mainline - All mainline segment and ramp improvements have been designed to the design speed of 70 mph except for two locations:

- **The westbound exit to Hamilton Road, both alternatives**. Existing right of way limits constrain the ability to improve the alignment without acquiring additional right of way. This constraint would necessitate a design variance and would apply to both alternatives. Therefore, it is not an influencing factor in the determination of a preferred alternative. The condition will be further evaluated with Stage 1 design to determine the means necessary to address the deficiency and the appropriate project with which to associate the improvement should ODOT desire to address the condition. – either with the US 33 widening project or when/if future improvements were to be constructed at the Hamilton Road interchange.
- **Inside shoulder at FRA-33-26.60 Bike Path Overpass, inside widening Alt 1**. The overhead bridge pier infringes upon the required vertical clearance of 16′. A design exception would be required for shoulder width to permit this design deficiency. A minor shift to the alignment through this overpass will be evaluated with detailed design to determine if the deficiency can be resolved without additional impacts.

Ramps - the extent of impact and reconstruction to the ramps is greater for Alternative 2. Widening to the outside pushes the tie in points further up the ramps increasing the length of reconstruction required to accommodate the outside widening alternative.

Cross Sections

Cross sections were created at 1000-foot intervals and are provided in the plans in **Appendix A** for Build Alternative 1 and **Appendix B** for Build Alternative 2. Safety grading is used where feasible, and guardrail is used where not feasible. Construction limits were set a minimum of 10 feet beyond the points where proposed grading meets existing. The estimated proposed right-of-way was established using these limits.

Pavement Design

The proposed design includes full depth pavement replacement for the US 33 corridor. A Pavement design was provided by ODOT. This build-up includes 1.5" asphalt surface course, 2.25" intermediate course, 8.5" asphalt base, 6"/8" aggregate base, and 14" of subgrade stabilization. A portion of the project requires full-depth pavement due to new horizontal and vertical alignments. However, the potential to preserve additional existing pavement and/or alternative methods of executing the major rehab will be investigated further for cost savings opportunities via separate documentation. Sawcut, milling and resurfacing may be considered and evaluated for existing pavement and areas along U.S. 33 where only pavement markings are being modified. If subgrade conditions are adequate, crack and seat and/or rubblize and roll options may be considered. All pavement preservation options will consider long term maintenance implications as part of their evaluation.

Drainage

Approximately 52 known drainage structures/conduit exist along the corridor. The proposed drainage will be both open and close systems, depending on the selected alternative. ODOT is in the process of completing the inspection of these structures to determine the conditions of these structures. It is assumed that both alternatives would include the replacement and/or repair of deficient structures with the extent of repairs confirmed with inspection data/reports from ODOT.

- Alt 1 – Culverts will require minimal extension with the inside widening. Impact to culverts/conduit will be limited with work limited to needed repairs as noted in the conditions data. The extent of repairs will be confirmed with inspection data/reports.
- Alternative 2 – Impacts to culverts would require extension due to widening on the outside in addition to needed repairs as noted in the conditions data.

BMP requirements will be met by BMPs will primarily be filter strips with vegetative bioswales. There may be locations where detention may be used near the interchanges. Underdrains will be provided, as shown in the typical sections in **Appendix A** and **Appendix B**. In general, BMP requirements/costs are similar between alternatives.

Traffic Control/ Signing/ Lighting

The existing lighting system will be modified as necessary to meet the requirements of the Traffic Engineering Manual. The removal and replacement of lighting will be required for both alternatives to different degrees related to the widening approach.

ITS/Mobility

FRA-33 ITS project work will include various ODOT Freeway Management System (FMS) proposed and existing device sites and communications infrastructure for both the ODOT FMS and Columbus Traffic Signal System (CTSS) networks along the FRA-33 project corridor. Proposed improvements to the ODOT FMS include the replacement of an existing dynamic message sign, several new traffic surveillance cameras and ramp metering signals, and conduit systems for future fiber optic interconnect. Proposed improvements to the Columbus Traffic Signal System include conduit and fiber optic interconnect to replace the temporary aerial fiber optic interconnect installed previously by the City of Columbus to bypass the US-33 widening project construction work. Existing ITS devices and the temporary CTSS fiber network are to remain in service throughout the duration of project construction.

ODOT FMS Proposed/Existing Sites - Widening of the US-33 mainline towards the inside median vs. the outside shoulder will not impact the proposed design of ODOT ITS sites or the maintenance of existing sites during construction. The estimated cost for this work, for both mainline widening alternatives selected for construction, is the same.

ODOT FMS/Columbus CTSS -The design and installation of the proposed communications infrastructure and fiber optic cable will vary considerably between the two build alternatives. If the US-33 mainline widening occurs towards the inside median and a concrete center median barrier wall is constructed, communications infrastructure for both ODOT and CTSS networks will be constructed within the proposed median barrier wall, along with lateral crossings to ITS devices for fiber optic cable access and slack cable storage. Conversely, if the US-33 mainline widening occurs towards the outside shoulder and the grassy center median will remain then communications infrastructure for both ODOT and CTSS networks will primarily be trenched within the LA/RW and attached to bridge structures.

The total estimated cost for ODOT FMS and CTSS communications network infrastructure work for the inside median widening alternative is estimated at $3,301,692. The estimated cost for ODOT and CTSS communications network infrastructure work for the outside shoulder widening alternative is estimated at $3,754,664.

Refer to Appendix G for details on proposed ITS/CTSS work and cost breakdown.

Structures Assessment

Design Criteria and Assumptions

All structures will be designed in accordance with the latest editions of the AASHTO LRFD Bridge Design Specifications (currently 9th edition), the ODOT Bridge Design Manual, and relevant ODOT standard drawings and specifications. Unless otherwise noted, all bridge widening schematics and costs assume that each structure will use the same superstructure type, beam spacing (where applicable), substructure sections, and foundation types as the existing bridges. This information is based on the existing plans for structures located in the project area. Soil borings and geotechnical analysis have not been performed for this assessment.

Rehabilitation or improvements to the existing structures are included in the cost estimates as outlined in **Appendix H** – FRA-33 Widening Bridge Condition Summary. Additional inspection information for the bridges over the Cable Bowman Ditch and the Tussing-Bachman Ditch is included in **Appendix I** – Culvert Inspection Summary.

Looking at the latest inspection reports and field notes, most of the structures are in good to excellent condition and will require little to no rehabilitation. The exceptions to this are the SR 317/Hamilton Road overpass (fair condition, controlled by substructure) and the structures over George Creek (poor condition westbound and fair condition eastbound, both controlled by substructure), and the Gender Road overpass (serious condition superstructure rating due to impact damage on 5/20/2024).

TABLE 16: BRIDGE CONDITION RATING SUMMARY

Bridge Condition Rating Summary		
Bridge Name	Structure File Number	General Appraisal Condition Rating
FRA-33-25.03 L over Walnut Creek Overflow	2501929	7
FRA-33-25.03 R over Walnut Creek Overflow	2501953	7
FRA-33-25.09 R over Big Walnut Creek	2502011	8
FRA-33-25.09 L over Big Walnut Creek	2501988	8
FRA-317-9.14 (or FRA-33-26.32) Hamilton Road Overpass	2516381	5
FRA-33-26.49 L over Blacklick Creek	2502046	7
FRA-33-26.49 R over Blacklick Creek	2502070	7
FRA-33-26.60 Bike Path Overpass	2502038	9
FRA-CR118-5.71 Ebright Road Overpass	2502089	7
FRA-33-27.51 L over Cable Bowman Ditch	2502100	7
FRA-33-27.51 R over Cable Bowman Ditch	2502135	7
FRA-33-29.00 L over George Creek	2502194	4
FRA-33-29.00 R over George Creek	2502224	5
FRA-222-2.25 Gender Road Overpass	2517361	3*
FRA-33-30.30 over Tussing-Bachman Ditch	2502267	8

*Note: * low condition rating due to impact damage on 5/20/2024.*

Condition rating definitions: 9 = excellent; 8 = very good; 7 = good; 6 = satisfactory; 5 = fair; 4 = poor; 3 = serious.

For the purposes of this assessment the spread of flow for drainage on the bridge decks has not been investigated. Depending on the length and grade of each structure there is potential that scuppers could be required in some locations. During detailed design, scupper locations will be determined and adjustments to the structures made as needed.

The following subsections provide a summary and any notable assumptions for each structure within the assessment area that will be impacted by one or both of the widening alternatives:

FRA-33-25.03 L/R over Big Walnut Creek Overflow

Structure File Numbers: 2501929 (Left/WB), 2501953 (Right/EB)

The bridges over the Big Walnut Creek Overflow are three-span continuous concrete slabs on capped pile piers and abutments. The structures were originally built in 1963 and widened in 2018. The overall bridge lengths are 93.5 ft (left) and 92.5 ft (right).

FRA-33-25.09 L/R over Big Walnut Creek

Structure File Numbers: 2501988 (Left/WB), 2502011 (Right/EB)

The bridges over Big Walnut Creek are four-span prestressed concrete I-beams on reinforced concrete piers and abutments, supported by pile foundations. The structures were originally built in 1963 and widened in 2018. The overall bridge length is 303.2 ft for both the left and right bridges. The Big Walnut Trail, which connects to nearby Elk Run Park and is being developed by the Columbus Recreation and Parks Department, runs under the southeastern spans of the bridges. Trail overhead protection will be provided in the design to allow the trail to remain open during construction.

FRA-33-26.32 (or FRA-317-9.14) SR 317/Hamilton Road over US-33

Structure File Number: 2516381

The Hamilton Road overpass is a four-span continuous welded steel plate girder on reinforced concrete piers and abutments, supported by pile foundations. The bridge was originally built in 1962 and rehabilitated with a deck overlay in 2003. The overall bridge length is 338.1 ft. The bridge’s general appraisal condition rating of 5 (satisfactory) is controlled by the substructure. Pier patching and composite fiber wrap is included in the cost estimates to improve the structural integrity and durability of the piers. Improving the substructure condition can raise the general appraisal to the limiting deck condition of 7 (good). The vertical under-clearance of the bridge is listed as 14.8 ft according to the bridge inventory (BM-191) and the measurements from LJB’s bridge survey scans. At this stage, the roadway profile has been adjusted down to increase the vertical clearance to a minimum of 16.0 ft. The impact of the profile adjustments on the drainage and pier footing cover will be further evaluated before Stage 1.

FRA-33-26.49 L/R over Blacklick Creek

Structure File Numbers: 2502046 (Left/WB), 2502070 (Right/EB)

The bridges over Blacklick Creek are three-span continuous rolled steel beams on pile-supported reinforced concrete stub abutments and capped pile piers. The structures were originally built in 1963 and rehabilitated in 2017. The overall bridge length is 147.8 ft for both the left and right bridges.

FRA-33-26.60 Blacklick Trail Bike Path over US-33

Structure File Number: 2502038

The Blacklick Trail Bike Path overpass is an eight-span prefabricated truss superstructure on reinforced concrete piers and abutments, supported by pile foundations. The bridge was originally built in 2011. The overall bridge length is 878.5 ft. The bridge is in excellent condition (condition rating 9) and has a vertical under-clearance of 17.2 ft per the bridge inventory (BM-191) and 17.7 ft per LJB's bridge survey scans. Therefore, no modifications are proposed for this structure. However, pier protection will be required for the widening alternatives and the location of the barriers must account for the horizontal clearances to the skewed piers.

FRA-CR118-5.71 Ebright Road over US-33

Structure File Number: 2502089

The Ebright Road overpass is a two-span continuous welded steel plate girder on pile-supported reinforced concrete abutments behind MSE walls and a reinforced concrete pile-supported pier. The bridge was originally built in 2007. The overall bridge length is 254.3 ft. The bridge is in good condition (condition rating 7) and has a vertical under-clearance of 17.1 ft per the bridge inventory (BM-191) and LJB's bridge survey scans. Therefore, no modifications are proposed for this structure. However, pier protection may be required for the widening alternatives.

FRA-33-27.51 L/R over Cable Bowman Ditch

Structure File Numbers: 2502100 (Left/WB), 2502135 (Right/EB)

The bridges over Cable Bowman Ditch are single-span slabs on reinforced concrete abutments with spread footings. The structures were originally built in 1963 and rehabilitated in 2017. The overall bridge length is 17.8 ft for both the left and right bridges. A complete replacement is planned for these bridges. The structure/culvert type is to be determined by hydraulic analyses and Structure Type Study after the preferred alignment and MOT alternatives have been determined. Structure types to be studied include a 3-sided box culvert, 4-sided box culvert, and a corrugated metal arch.

FRA-33-29.00 L/R over George Creek

Structure File Numbers: 2502194 (Left/WB), 2502224 (Right/EB)

The bridges over George Creek are three-span continuous concrete slabs on capped pile piers and abutments. The structures were originally built in 1963 and rehabilitated in 2017. The overall bridge length is 79.5 ft for both the left and right bridges. The general appraisal bridge conditions are controlled by the substructure for both bridges with the left bridge rated as a 4 (poor condition) and the right bridge rated as a 5 (fair condition). Additional substructure patching and rehabilitation costs have been included in the cost estimates for this bridge. A more thorough inspection of the bridge condition will be performed during Stage 1 to document and quantify the rehabilitation work.

FRA-CR222-0.00 Gender Road over US-33

Structure File Number: 2517361

The Gender Road overpass is a four-span continuous steel beam superstructure on pile-supported reinforced concrete abutments and reinforced concrete piers supported by spread footings. The bridge was originally built in 1971 and rehabilitated with a deck overlay in 2003. A project to add a sidewalk to the east side of the bridge is currently underway in coordination with the City of Canal Winchester. The overall bridge length is 285.4 ft. The bridge has a general appraisal condition rating of 3 (serious). This condition rating reflects the effects of impact damage to the bridge beams caused by a truck hauling an excavator on 5/20/2024. The bridge was inspected on the date of impact. Previously, the bridge condition was rated as 7 (good). The vertical under-clearance of the bridge is listed as 15.0 ft according to the bridge inventory (BM-191) and measured to be 14.9 ft from LJB's bridge survey scans. The bridge has a history of over-height vehicle impacts to the girders that have been repaired. At this stage, the roadway profile has been adjusted down to increase the vertical clearance to a minimum of 16.0 ft. The impact of the profile adjustments on the drainage and pier footing cover will be further evaluated before Stage 1. No bridge work is anticipated.

FRA-33-02.92 over Tussing-Bachman Ditch

Structure File Number: 2502267

The bridge over Tussing-Bachman Ditch is a single-span, four-sided precast concrete culvert. The bridge was originally built in 2011. The overall bridge length is 11.8 ft (span) and the total longitudinal culvert length is 148.1 ft. The bridge has a general appraisal condition rating of 8 (very good) and is already wide enough to accommodate additional lanes. No modifications are anticipated. However, Alternative 2 – Widening to the Outside includes the cost of adding bridge railing/barrier at the bridge/culvert ends.

Alternative 1 – Widening to the Inside

For Alternative 1, all bridges are assumed to be widened through the entire median with a 2-inch gap between the median bridge railings. This assumption will allow for the option to implement hard shoulder running and is the more conservative choice for the cost estimates.

Alternative 1 includes widening of eight mainline structures, pier protection at two overpass structures, and minor substructure rehabilitation on the Hamilton Road overpass. The total estimated cost for the structures work (without contingency or inflation) is $8,997,223. While cost is the main difference between the alternatives in relation to the structures, there is also a difference in the stream impacts between the alternatives. Alternative 1 has an estimated sum of stream impacts (added for all structures) of 1080 ft.

Alternative 2 – Widening to the Outside

The largest structures-related impact for Alternative 2 relates to the available space for outside widening at the Hamilton Road and Gender Road overpasses. There is not enough space to accommodate outside widening at these structures. Therefore, Alternative 2 costs assume that these two structures will be replaced. In addition to the higher construction costs for bridge replacements, there would also be considerable user costs on both US-33 and local networks due to maintenance of traffic on Hamilton and Gender Roads. The user costs have not been quantified in this assessment.

Alternative 2 includes widening of eight mainline structures, complete bridge replacements at Hamilton and Gender Roads, pier protection at two overpass structures, and barrier added at the Tussing-Bachman Ditch. The total estimated cost for this structures work (without contingency or inflation) is $22,201,862. While cost is the main difference between the alternatives in relation to the structures, there is also a difference in the stream impacts between the alternatives. Alternative 2 has an estimated sum of stream impacts (added for all structures) of 1665 ft.

Summary

In terms of the structural assessment, Alternative 1 has significant advantages over Alternative 2. Alternative 2 costs more than 2.5 times more than Alternative 1. In addition, the bridge replacements required for Alternative 2 (outside widening) would have significant user costs that have not been quantified in this assessment. The total stream impacts for Alternative 1 are approximately 64% of the impacts for Alternative 2, based on preliminary assessment of the temporary access fill needed for construction.

Maintenance of Traffic

Conceptual Maintenance of Traffic (MOT) schemes were analysed for FRA-33-24.76 to identify key MOT cost drivers, impacts on existing structures, and the pros and cons of the anticipated MOT approach for each alternative. While typically the MOTAA would address this evaluation after a preferred alternative has been selected, it was critical to understand and compare the worst-case impacts, cost and schedule implications of the likely MOT scheme for each alternative. See **Appendix J** for a copy of the complete MOT Analysis.

For this evaluation, the project area was divided into two sections based on the existing median width: the western section, featuring a 60-foot edge-to-edge median, extends along US 33 from SR 104 to Gender Road in Franklin and Fairfield County, while the eastern section, with a 40-foot median, runs along US 33 from Gender Road to Diley Road in Fairfield County.

While the conclusions noted herein were based on a combination of data and engineering judgement, they are not intended to be a replacement for the MOTAA for the preferred alternative. The MOTAA will be completed for the preferred alternative and provide a more comprehensive evaluation of MOTAA schemes for the projects. The conclusions included herein may be confirmed and/or modified through the MOTAA analysis and report.

MOT Scheme Selection – Part-Width vs. Crossover

Per ODOTs Traffic Engineering Manual (TEM)Section 630-5.2 - MOTAA:

> *"For Interstate and Interstate Look-alike Work Zones (Projects on PDP Paths 3, 4, or 5): Analyse the maintenance of traffic (MOT) for both part-width construction and crossover construction. Should the part-width and crossover alternatives prove to have significant MOT constraints, or prove impractical or otherwise not possible to construct, the analysis should then include a contraflow and a hybrid construction technique as additional alternatives. Although individual project needs vary, the additional alternatives are more likely to be necessary due to constraints or practicality in replacement-type projects rather than widening-type projects."*

Based on this guidance, both part-width and crossover schemes were screened for applicability and to determine the most likely MOT configuration for each alternative.

The screening considered big picture items such as potential ROW impacts, cost, construction sequencing and schedule. This screening concluded the following:

Alternative 1 - Inside Widening - Part-width construction was identified as the likely MOT scheme to be selected for Alternative 1. Part-width construction can be completed within the existing ROW, would require less temporary pavement and PCB and fewer construction stages.

Alternative 2 – Outside Widening – Crossover construction was identified as the likely MOT scheme to be selected for Alternative 2, Outside widening. Part-Width construction with outside construction was eliminated as a potential MOT scheme given the larger impacts created by that alternative compared to the two alternatives shown above. In the western section, part-width construction with outside widening would require an MOT cross section approximately 6 ft wider than the proposed final cross section, after accounting for two separate pre-phases for outside and inside shoulder reconstruction to minimize the MOT widening. It is expected that the additional width of this alternative will require roadside grading that extends beyond the existing right of way limits, thereby requiring right of way acquisition, which would not be required by the MOT schemes carried forward.

Contraflow Construction (Not Considered)

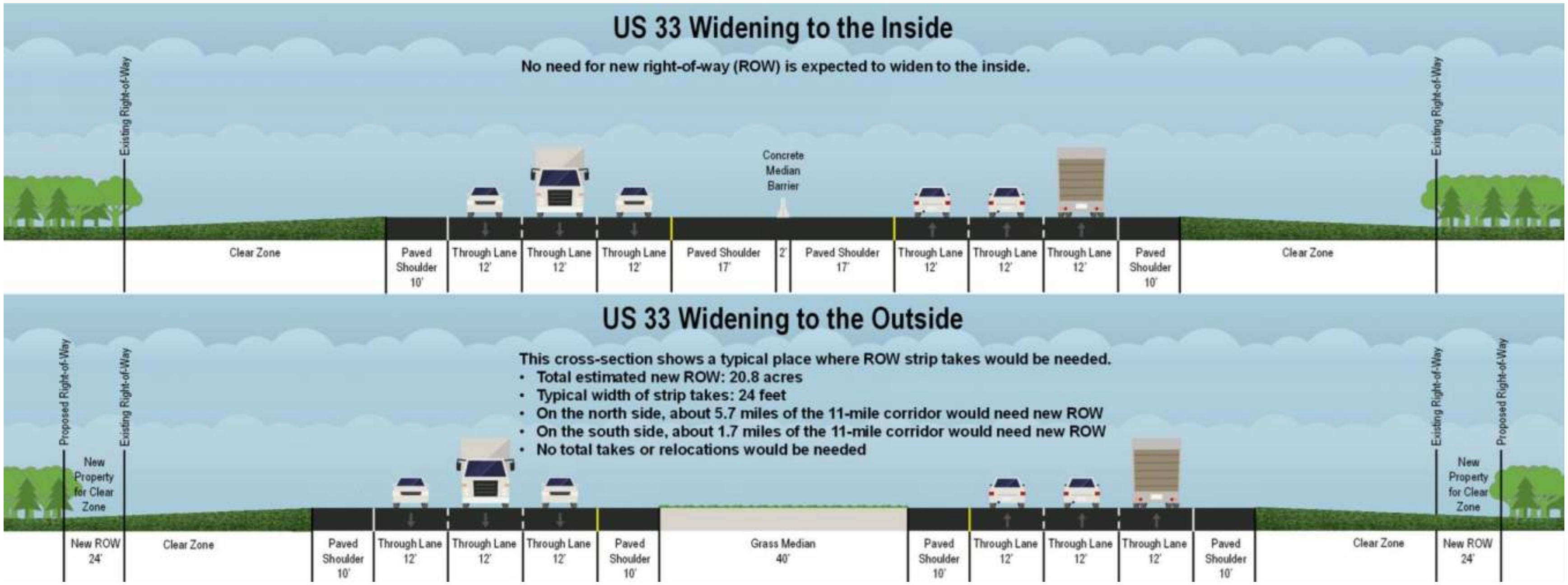
Contraflow construction was eliminated from consideration because of impacts that fall beyond that of the part-width and crossover MOT schemes. Contraflow is a MOT scheme typically deployed in dense urban areas when part-width or crossover alternatives have been determined impractical due to physical impacts or the need to maintain lanes to meet the permitted lane closure schedule. Additionally, it is challenging to analyse from a safety perspective and would present an unconventional arrangement of vehicle movements for the at grade intersections along the corridor during construction. Finally, a contra-flow arrangement would require widening for the contra-flow lanes, potentially requiring additional temporary pavement and additional phases that would extend the construction schedule.

Right-of-Way Impacts

Figure 2, shown below, illustrates a comparison of the typical section for both alternatives and includes a comparison of the anticipated ROW impacts associated with each alternative.

- Alternative 1 can be designed to fit within existing right-of-way limits.
- Alternative 2 will require new right of way in strip takes equating to approximately 5 acres of permanent and 20 acres of temporary right-of-way.

FIGURE 2: US 33 TYPICAL SECTIONS, WIDENING TO THE INSIDE AND OUTSIDE



Environmental Analysis

This section summarizes the environmental analysis and investigations conducted to date. A Level D1 Categorical Exclusion was approved on April 24, 2025.

Cultural Resources

The US 33 widening project will not impact any historic structures, known archaeological resources, or pass through historic districts. While some bridge work will be necessary in both alternatives, there are no historic bridges along the US 33 corridor. No Section 106 impacts are anticipated.

Section 4(f)

Two Section 4(f) resources are present in the project area:

- The Blacklick Trail bridge, maintained by Franklin County Metroparks, crosses over US 33 about 2000' east of the Hamilton Rd interchange. No modifications or closures are anticipated to the structure in either alternative.
- A recreational trail passes under the bridge that carries US 33 over Big Walnut Creek. The trail is maintained by the City of Columbus Department of Parks and provides the only connection over US 33 between Watkins Rd and Hamilton Rd, although neither of these routes have pedestrian infrastructure. To reduce the amount of trail closures, a protective walkway cover will be placed over affected portions of the walkway to protect from overhead debris. Up to four overnight closures will be needed to set girders on the widened bridge for either alternative. The Section 4(f) finding for this facility was Temporary No Use.

Section 6(f)

No Section 6(f) resources are present in the project area.

Ecological Resources

Field surveys were conducted from June 4 to June 10, 2024. A Level 1 Ecological Survey Report (ESR) was submitted and is currently awaiting agency responses. At the time, plans had not been fully developed for the two alternatives, so the worst-case area was studied: the anticipated construction limits of Alternative 2, including the full existing US 33 right-of-way and proposed right-of-way needed for Alternative 2. No right-of-way would be needed for Alternative 1. Impacts are likely to be less than reported as the design is refined and known resources can be avoided. Appendix K includes maps documenting the extent of the ecological field study area for this project.

Several streams were identified in the project area. Those that pass under US 33 in an existing culvert would not be impacted by Alternative 1 because widening would occur in the median above the culvert. Alternative 2 would require some impacts to these streams to extend or replace culverts. Five additional waterways are crossed by pairs existing bridges, one for US 33 EB and another for US 33 WB:

- Big Walnut Creek Overflow
- Big Walnut Creek
- Blacklick Creek
- Cable-Bowman Ditch

- Tussing Ditch
- Georges Creek
- Wild Violet Run

The ESR showed all portions of these streams inside the project area to be impacted, but further design will refine these impacts prior to the Waterway Permit Determination Request. Impacts will be greater for Alternative 2 than Alternative 1. Both alternatives are expected to require waterway permits for multiple streams, although the impacts in each case will be greater for Alternative 2, and Alternative 1 is unlikely to require work in Tussing Ditch or Wild Violet Run.

Similarly, 13 wetlands were identified in the project area. None are isolated. The total wetland area inside the project area was 0.912 acres. The ESR assumed impacts for all wetlands, but detailed design will likely be able to reduce or avoid impacts to some. Because no wetlands were found in the median outside of those at stream crossings, Alternative 2 has the potential to impact more wetlands than Alternative 1.

Mussel surveys were conducted at Blacklick Creek and Georges Creek, each finding mussels or fresh remains. A survey for a separate project in 2017 found mussels at Big Walnut Creek. Both alternatives will require mussel relocations prior to in-stream work at each waterway.

Regulated Materials

An RMR screening was submitted to ODOT OES. Due to limited plan information, it was assumed that deep excavation could occur near all adjacent properties. Alternative 2 has a higher potential to require further RMR activities due to work closer to the ROW boundaries and ROW acquisition. An environmental commitment was made to reevaluate high risk sites prior to construction as detailed design becomes available.

Noise

A noise analysis was completed and submitted to ODOT for approval, shown in **Appendix L,** the Noise Wall Preliminary Placement Plan. The analysis evaluated the need for noise walls on US 33 within the project limits. Noise analysis was conducted for Alternative 1 with the understanding that if Alternative 2 were selected, further analysis would be necessary due to the lanes of travel being closer to receptors in an outside widening scenario than in an inside widening scenario. However, Alternative 1 also adds capacity and therefore required quantitative noise analysis.

Based on the analysis of Alternative 1, there are four locations where noise walls are feasible and reasonable. All could be constructed inside the existing ROW. For comparing alternatives, Alternative 2 would have at least the same four locations and potentially more. In addition, there would be ROW impacts and likely utility impacts. If Alternative 2 is selected, further analysis would be necessary to quantify the potential additional noise impacts.

A public commitment was included in the NEPA document to carry out noise public involvement for the feasible and reasonable noise walls, incorporating them into the design project if desired.

Air Quality

Air quality analysis is currently in progress. The results are expected to be equal for both alternatives since each adds the same amount of capacity to US 33.

Public Involvement

A Public Engagement Plan was developed for this project. Project owner notification letters were sent to owners of properties adjacent to the US 33 right-of-way or where Alternative 2 proposed right-of-way at the property and tax mailing addresses. A virtual public open house (https://www.transportation.ohio.gov/projects/projects/121811) was held from September 2 to October 2, 2024. Invitations were sent on August 16, 2024 to residents, commercial properties, and a church near the Bixby Rd and Rager Rd intersections where access would be modified by either alternative. Invitations were also advertised via social media and sent to stakeholders, including counties, cities, emergency responders, school districts, and elected officials. The website provided information on these access changes, the scope of the US 33 widening project, and methods to comment.

Comments were generally in support of the project, with specific safety concerns regarding at-grade intersections. The most frequent comments included:

- Support for widening US 33: 212
- Support for Alternative 1 (inside widening): 80
- Support for Alternative 2 (outside widening): 31
- Opposed to widening US 33: 19
- Expressed safety concerns with existing at-grade intersections: 101
- Prefer to spend money on transit, bike, or passenger rail: 10
- Prefer to extend the project limits: 19
- Expressed concerns about noise or requested noise barriers: 16
- Expressed support for other projects:
  - Grade separated interchange at Bixby & US 33: 19
  - Grade separated interchange at Pickerington Rd: 16
  - Improvements to SR 104/James Rd interchange: 9
  - Improvements to US 33 interchange with I-270: 4

Cost Estimates and Comparison of Alternatives

Table 17 summarizes the comparative analysis that was completed for the key issue evaluation documented herein and highlights key determining factors used to inform the recommendation of a preferred alternative for US 33 Widening.

Table 17 also summarizes the evaluation in terms of project costs, rounded. Refer to **Appendix M** to view the detailed project alternatives cost estimates.

Comparison Matrix

TABLE 17: ALTERNATIVES COMPARISON MATRIX

ANALYSIS CATEGORY	ALTERNATIVE 1	COST	IMPACT	ALTERNATIVE 2	COST	IMPACT
Purpose & Need Elements						
Congestion	Congestion improvement to acceptable LOS Accommodates future HSR without substantial additional roadway improvements	N/A	🟢	Congestion improvement to acceptable Levels of Service **Requires future widening of inside lane, shoulder and bridges in eastbound direction for HSR lane/ shoulder per TSMO analysis (not included in cost)**		🟡
Safety	Improves safety compared to no-build	N/A	🟢	Improves safety compared to no-build	N/A	🟢
Key Issues						
Roadway & Drainage	Widening to the inside No new ROW required Design exception for shoulder width or mainline alignment shift required due to bridge pier encroachment at Bike Path Overpass Accommodates future HSR without substantial additional roadway improvements (included in cost)	$ 90,612,900	🟢	Widening to the outside **New ROW required** **Extended project development for ROW acquisition** Extension of existing conduit/culverts required **Horizontal alignment shift required to avoid impact to bridges at I-270 and Wilkens (not included in cost)** More earthwork to address side slopes **Requires future widening of inside lane, shoulder and bridges in eastbound direction for HSR lane/ shoulder per TSMO analysis (not included in cost)**	$ 79,332,000	🔴
ITS	Communications infrastructure constructed in median barrier wall with lateral crossings	$ 3,301,700	🟢	Communications infrastructure trenched and/or attached to structures	$ 3,754,700	🟡

ANALYSIS CATEGORY	ALTERNATIVE 1	COST	IMPACT	ALTERNATIVE 2	COST	IMPACT
Structures	Rehab/repaired structures modified to fill in median	$ 9,872,500	●	**Replacement of Hamilton Road and Gender Road overpasses** Requires more retaining wall to minimize ROW impacts and at steep side slopes Impacts to I-270 bridges without shift at interchange Additional temp access fills needed for substructure construction	$ 24,302,100	●
MOT	Part-width construction Shorter construction duration Pavements est. = 101,500 SY PCB est. = 194,300 LF Additional pavement width required (beyond proposed final) in southern section May require dedicated construction ingress/egress points More options for at-grade intersections No ROW impacts, fewer impacts to schedule/ duration, and MOT cost Existing structures can maintain two lanes of travel during construction	$ 10,483,300 (pavement, PCB) 5% addnl. MOT added below	●	Crossover construction Pre-phases required to widen structures **Longer construction duration by up to 0.5 seasons** Pavements est. = 177,500 SY PCB est. = 97,000 LF **Access at at-grade intersections may be difficult to maintain, detours likely** Impacts to ramp access Likely impacts to noise walls **Detours and MOT for Hamilton Rd. and Gender Rd. with bridge replacements** Temp lighting at crossovers Potential ROW impacts	$ 13,478,600 (pavement, PCB) 7% addnl. MOT added below	●

ANALYSIS CATEGORY	ALTERNATIVE 1	COST	IMPACT	ALTERNATIVE 2	COST	IMPACT
Environmental Resource Impacts	Increased capacity/through traffic near sensitive receptors Four noise walls found to be reasonable and feasible (no ROW or utility impacts required) Stream Impact = 1,080 Ft, includes 990 Ft. mussel streams Waterway permits required for multiple streams, lesser impact and no work anticipated in Tussing Ditch or Wild Violet Run The Blacklick Trail bridge, no modifications or closures are anticipated to the structure in either alternative. Recreational trail passes under US 33 over Big Walnut Creek bridge - no differences in either alternative.	$ 4,801,000 (noise barrier) Conservative estimate. Will be revised and reduced with detailed design.		Increased capacity/through traffic near sensitive receptors At least four noise walls found to be reasonable and feasible (ROW impacts and likely utility impacts required) Stream Impact = 1,665 ft, includes 1,365 Ft. mussel streams Waterway permits required for multiple streams including Tussing Ditch and Wild Violet Run The Blacklick Trail bridge, No modifications/closures in either alternative. Recreational trail under the US 33 over Big Walnut Creek bridge - no differences in either alternative. Due to work outside of existing ROW, greater impact/potential for impacts for noise, RMR, streams, wetlands Potential for higher level waterway permits	$4,801,000 (noise barrier) Conservative estimate. Expected to be higher than Inside Widening.	

CONSTRUCTION	ALTERNATIVE 1	COST	IMPACT	ALTERNATIVE 2	COST	IMPACT
	5% addnl. MOT Factor	$ 5,953,600		7% addnl. MOT Factor	$ 8,796,800	
30% Contingency		$ 35,721,400			$ 37,700,400	
Total Construction Cost		$ 160,746,400			$ 172,165,100	
Preliminary Engineering (15%)		$ 24,112,000			$ 25,824,800	
Right of Way	No new ROW		●	New ROW		●
Permanent		$ -		5 Acres	$ 920,000	
Temporary		$ -		20 Acres	$ 800,000	
Construction Engineering (10%)		$ 16,074,600			$ 17,216,506	
Inflation (5.2%)		$ 10,448,400			$ 11,280,200	
Total Cost [1]		**$ 211,381,400**			**$ 228,206,500**	**(2)**

(1) - Construction costs were estimated using 2024 unit prices and inflated to 2026 estimates using ODOT's inflation calc.
(2) - Cost for outside widening does not include additional construction cost to accommodate fourth eastbound lane between Hamilton and Gender for HSR on outside widening alternative or improvements to bridges at the I-270 interchange.

Legend

● - Low Impact ● -Medium Impact ● -High Impact

Conclusion

This document serves as the draft feasibility study for the US 33 Widening Project (PID 121811). In late 2024, a Preferred Alternative recommendation was submitted and accepted by ODOT for submittal with the Environmental Document. In April 2025 the Environmental Document was approved, and environmental clearance was received for the project. This final Feasibility Study has been submitted with the addition of refined traffic volumes, safety and capacity analysis to complete the documentation of the evaluation of alternatives.

Previous studies identified two viable options for addressing congestion and safety through the addition of through lanes in both the eastbound and westbound directions:

- Alternative 1: Widening to the Inside
- Alternative 2: Widening to the Outside

Both alternatives are expected to meet the primary purpose and need of the project, namely reducing congestion and improving safety. However, they are expected to have significantly different impacts in key areas that will influence the selection of the preferred alternative.

This analysis compares the two alternatives based on several factors:

- Primary purpose and need elements (safety and congestion)
- Roadway and drainage design
- Intelligent Transportation Systems (ITS)
- Structures
- Maintenance of traffic
- Right-of-way impacts
- Environmental considerations

Additionally, the study provides project cost estimates for the construction of each of these elements, offering a comprehensive evaluation to guide the decision-making process for the preferred alternative.

The evaluation of two alternatives shows that both meet the project's primary goals but differ in key areas like drainage, bridges, ITS, and traffic maintenance. Alternative 2 (widening to the outside) has greater impacts, higher costs, and a longer timeline compared to Alternative 1, which requires no new right-of-way acquisition and offers flexibility for future hard shoulder running (HSR). A 2021 study identified the need for a fourth lane in the future, and Alternative 1 accommodates this better. Though both alternatives are feasible, Alternative 1 is recommended due to its advantages in cost, timeline, and flexibility.

Next Steps

Given prior approval of the preferred alternative, widening to the inside, this document is being submitted as a reference document in conjunction with the Stage 1 design submittal. Review and approval of the Stage 1 design including this document is expected to be completed by late Summer 2025, keeping the project on track for final design and construction.

APPENDIX A:
Build Alternative 1 Plans

LEGEND

1 ITEM 442 - 1.5" ASPHALT CONCRETE SURFACE COURSE, 12.5 MM, TYPE A (447)

2 ITEM 407 - NON-TRACKING TACK COAT (APPLIED AT 0.055 GAL/SY)

3 ITEM 442 - 2.25" ASPHALT CONCRETE INTERMEDIATE COURSE, 19mm, TYPE A (446)

4 ITEM 407 - NON-TRACKING TACK COAT (APPLIED AT 0.085 GAL/SY)

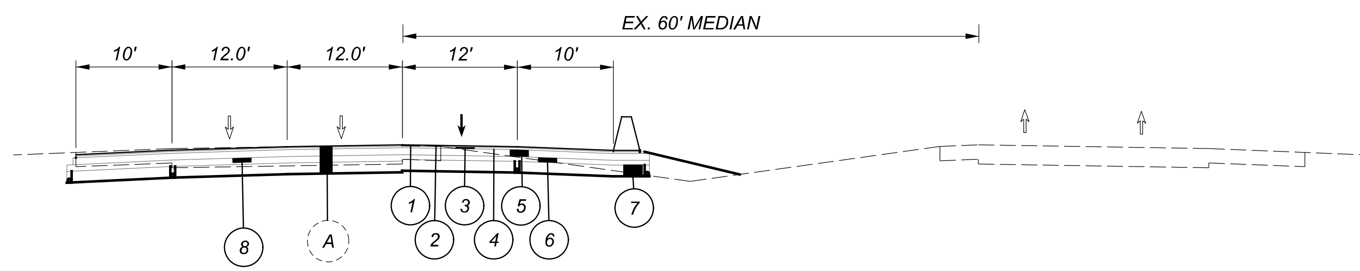
5 ITEM 302 - 8.5" ASPHALT CONCRETE BASE COURSE

6 ITEM 304 - 6" AGGREGATE BASE COURSE (FOR WIDENING AREAS)

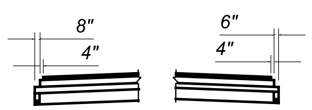
7 ITEM 206, CEMENT STABILIZED SUBGRADE, 14 INCHES DEEP

8 ITEM 304 - 8" AGGREGATE BASE COURSE (FOR EXISTING PAVEMENT AREAS)

A EXISTING FULL DEPTH PAVEMENT



INSIDE WIDENING, 60' MEDIAN (STA. 1205+00)



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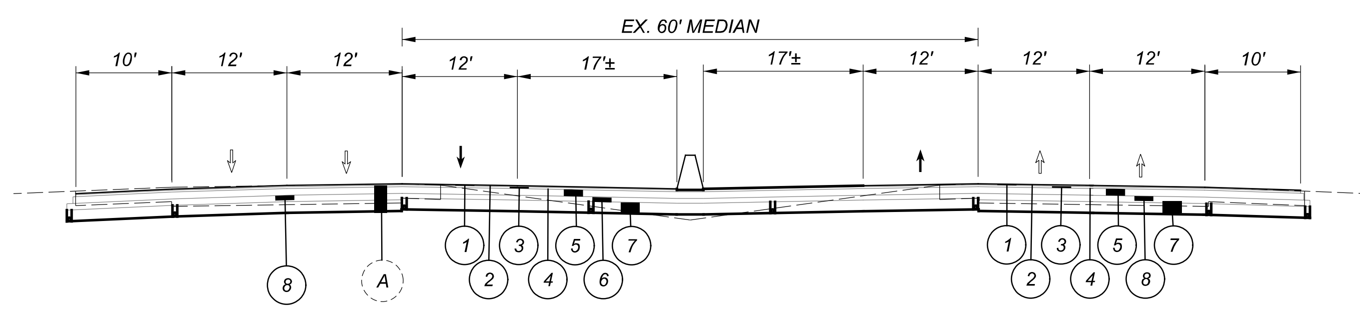

INSIDE WIDENING, 60' MEDIAN, 6-LANES (STA. 1245+00)

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REVIEWER XXX MM-DD-YY

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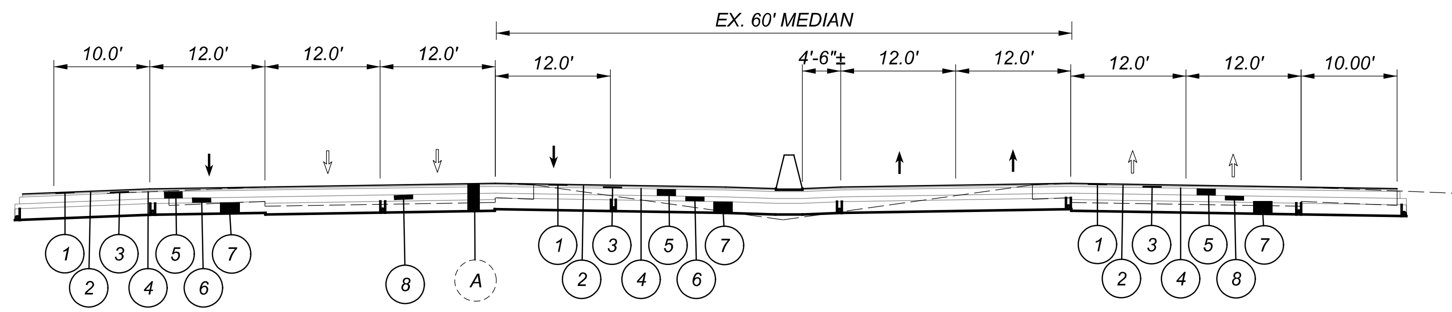

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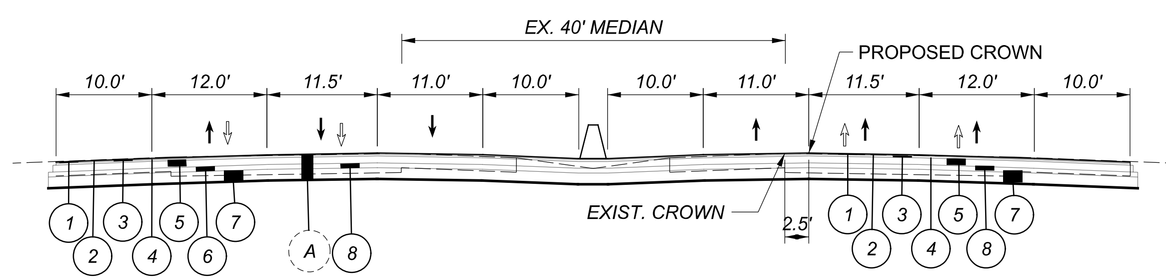

INSIDE WIDENING, 40' MEDIAN, 6-LANES (STA. 1400+00)

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HBK

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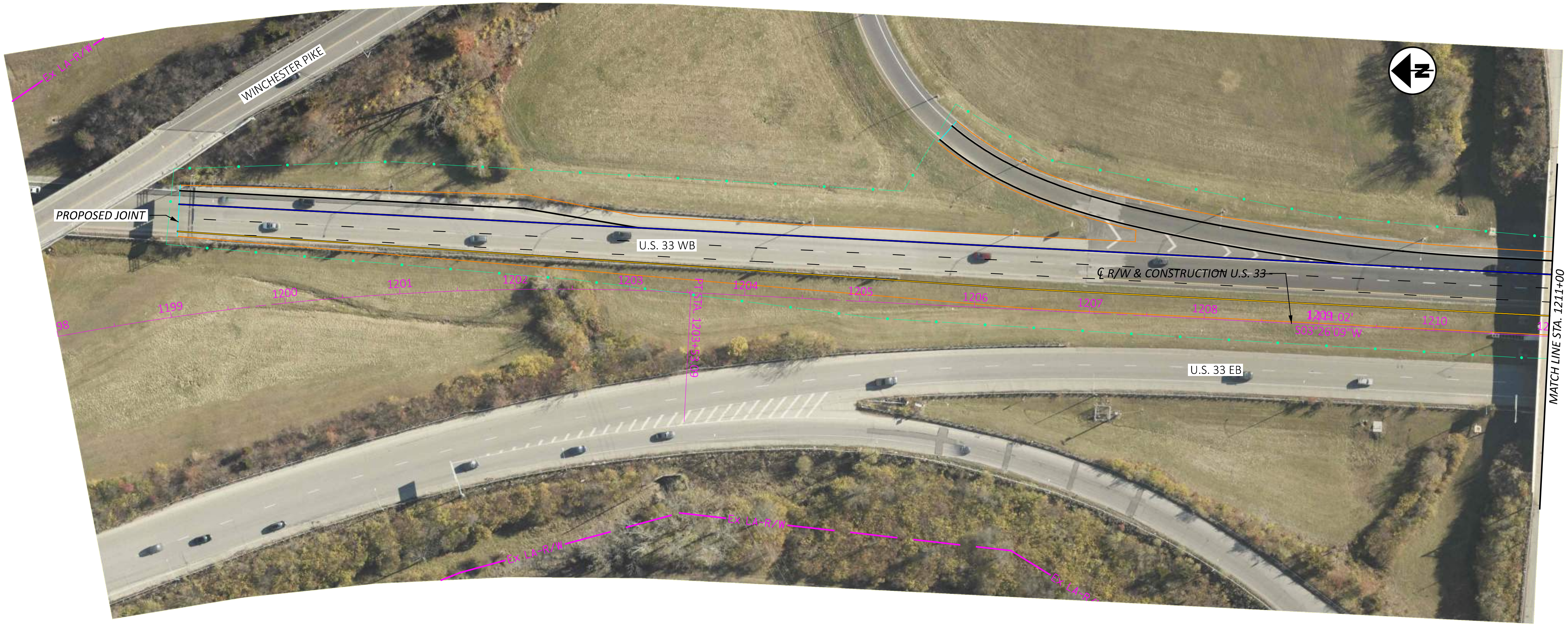

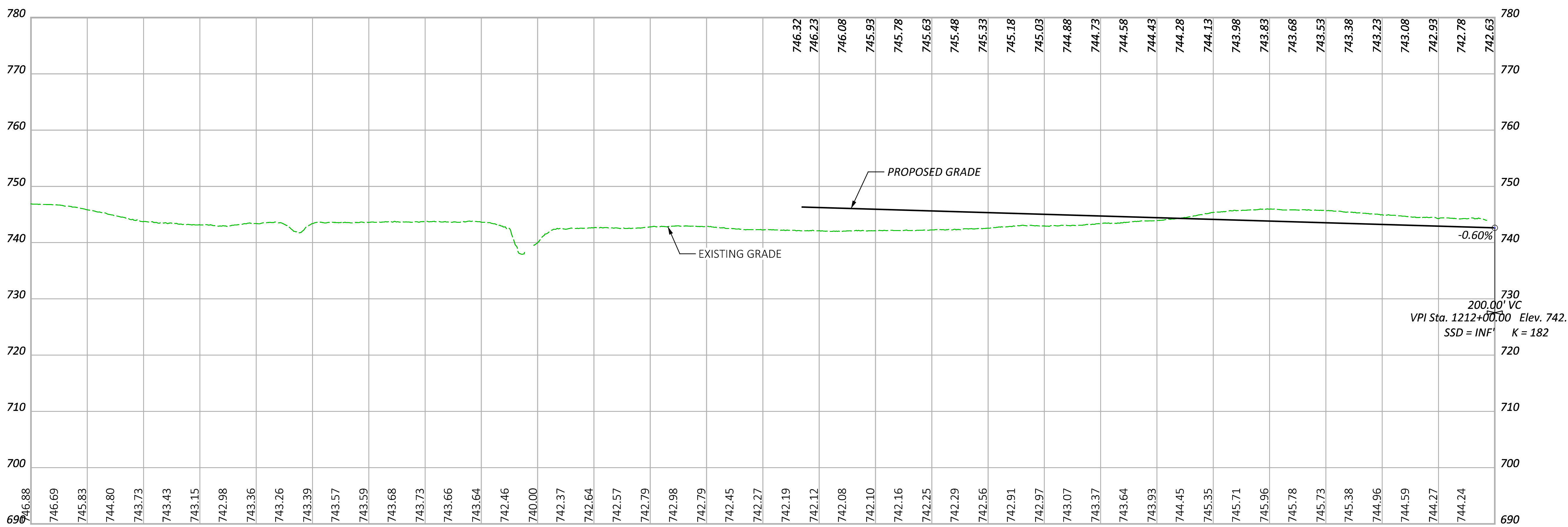

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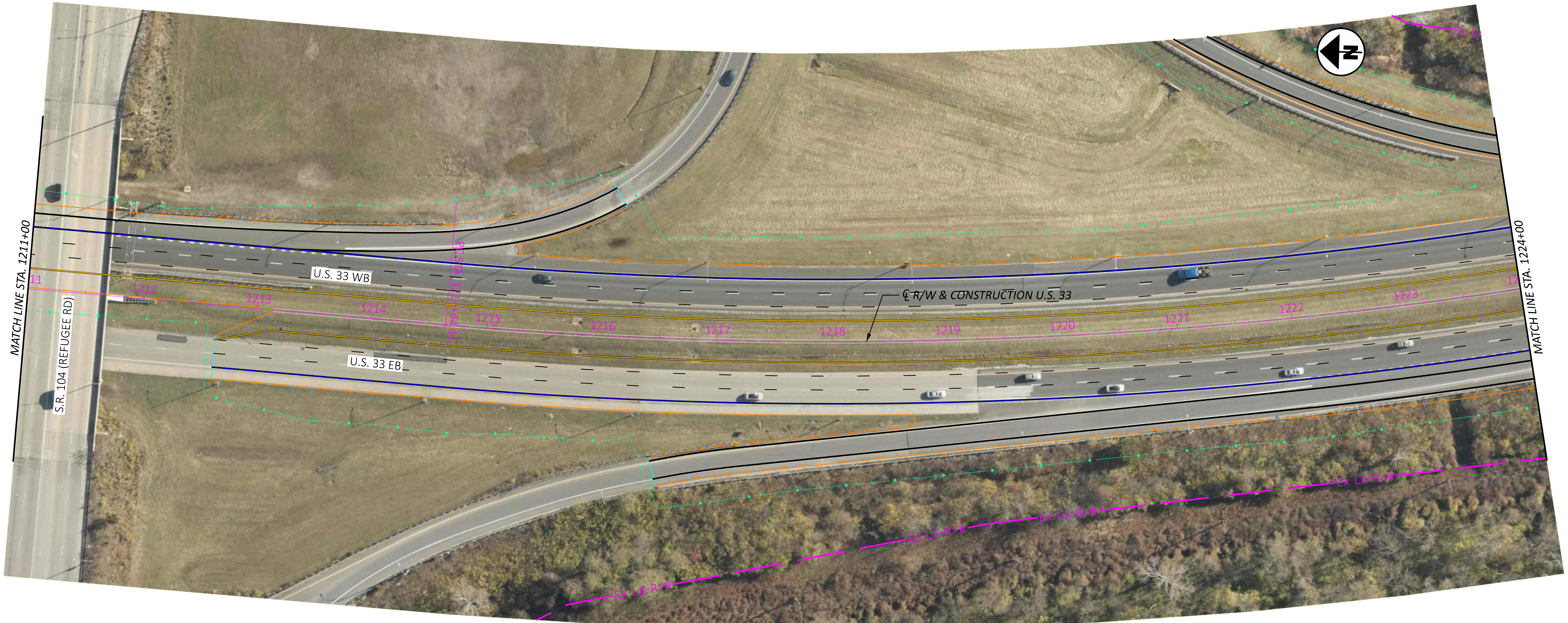

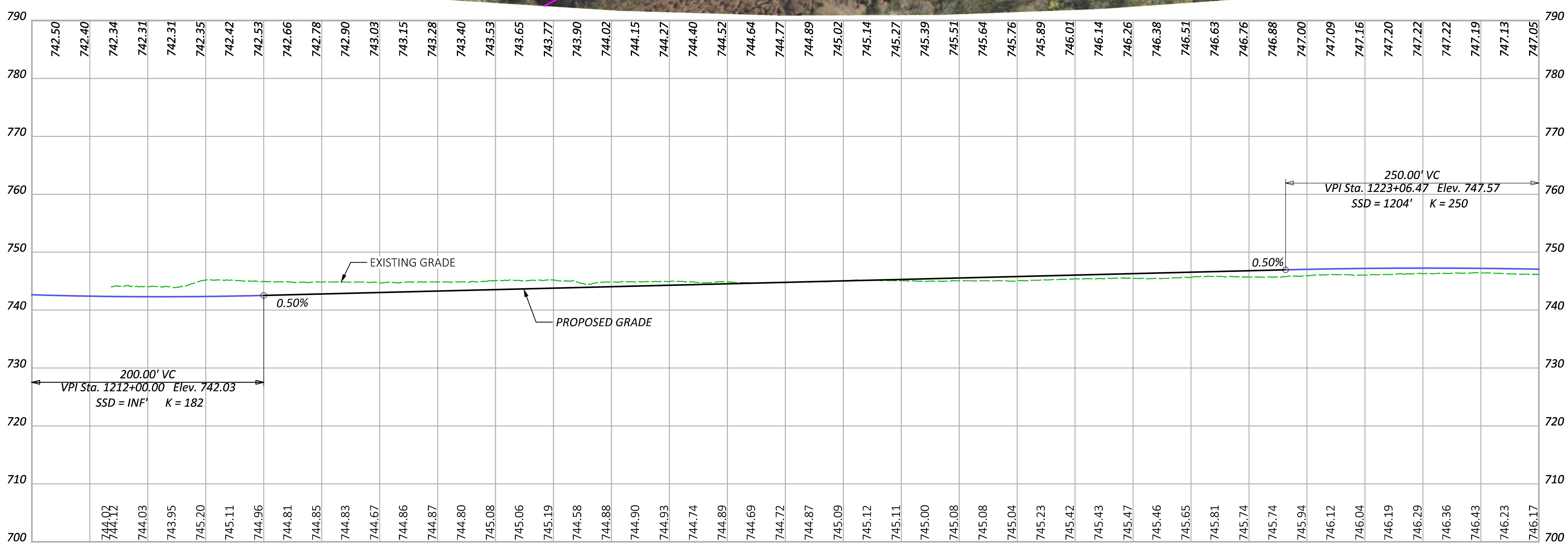

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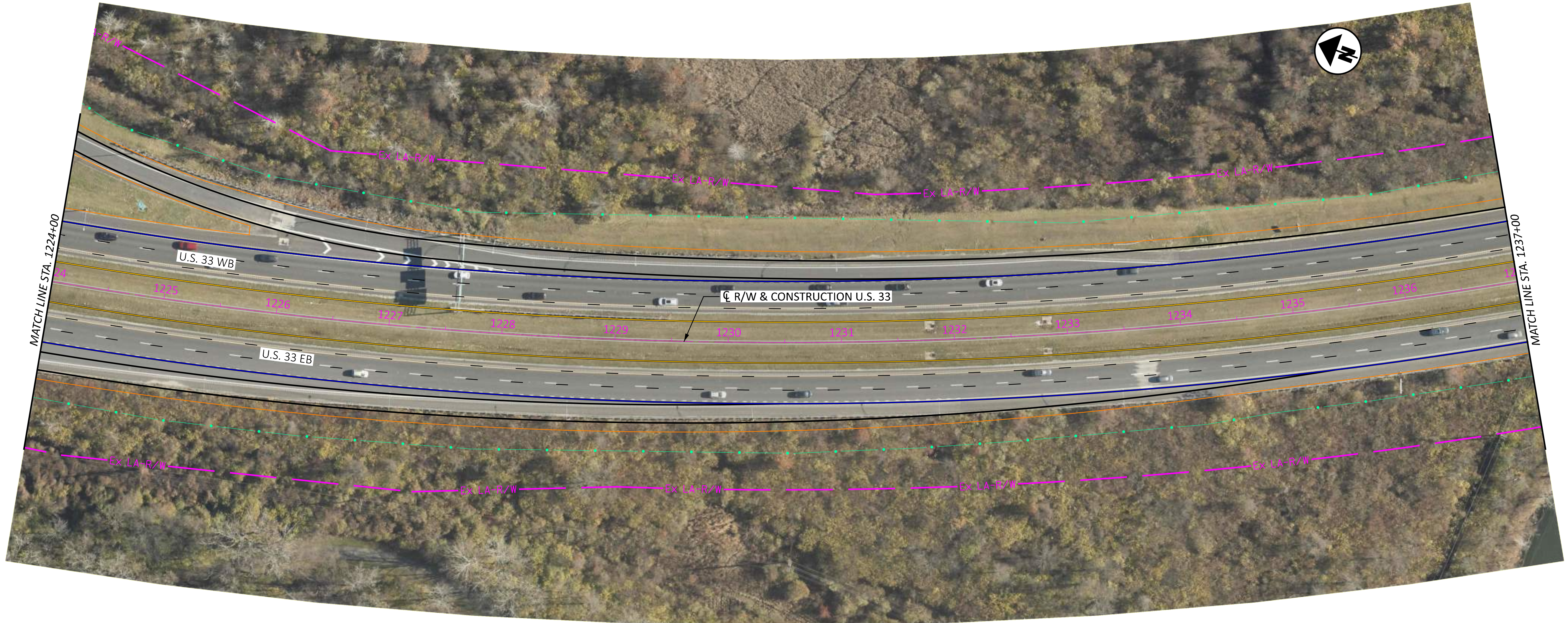

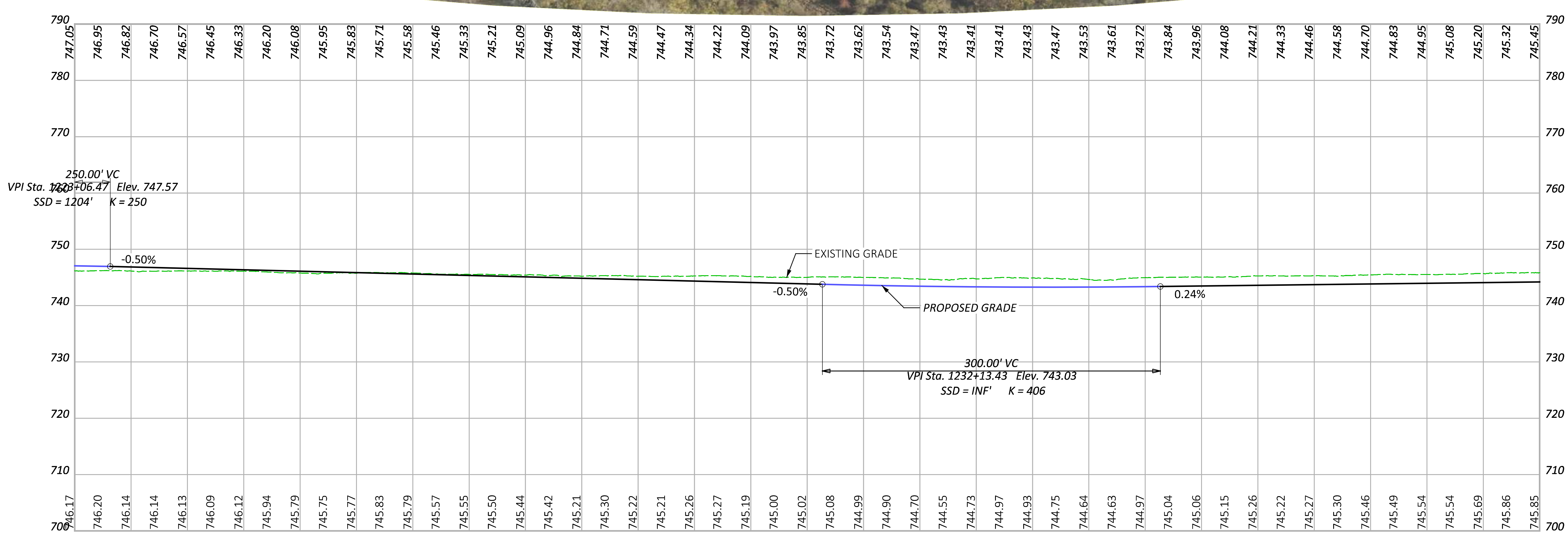

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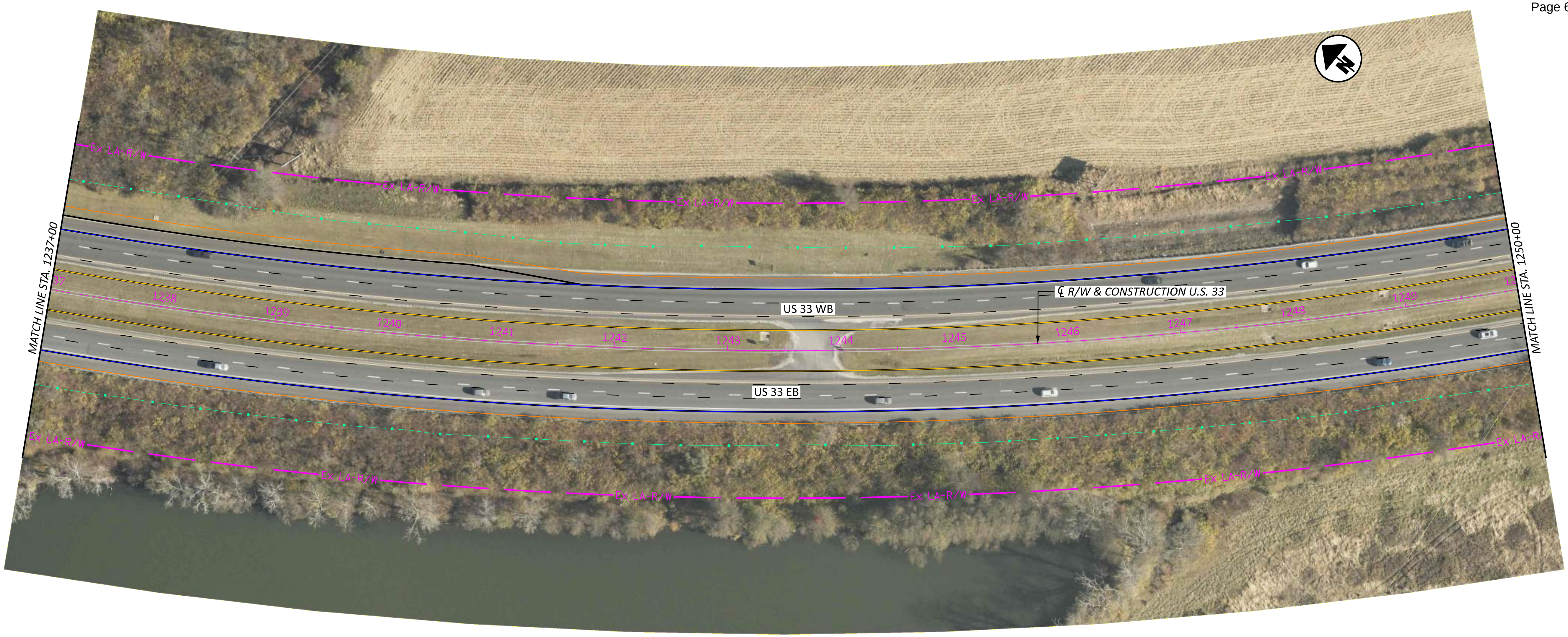

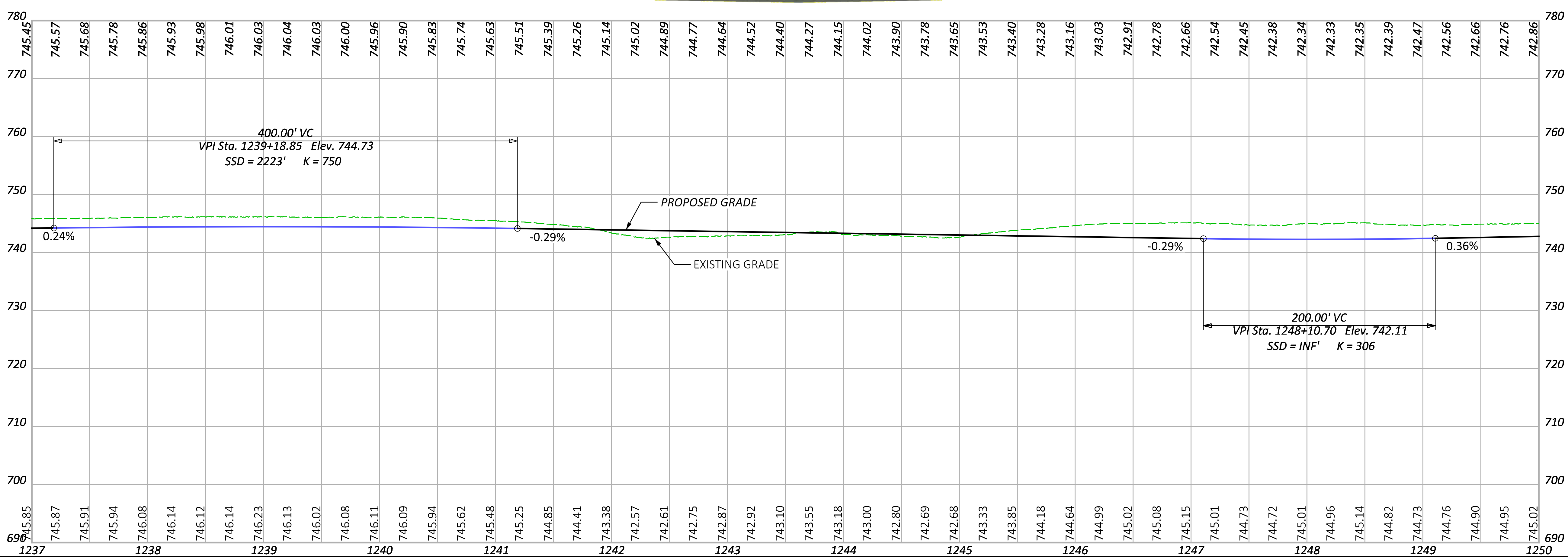

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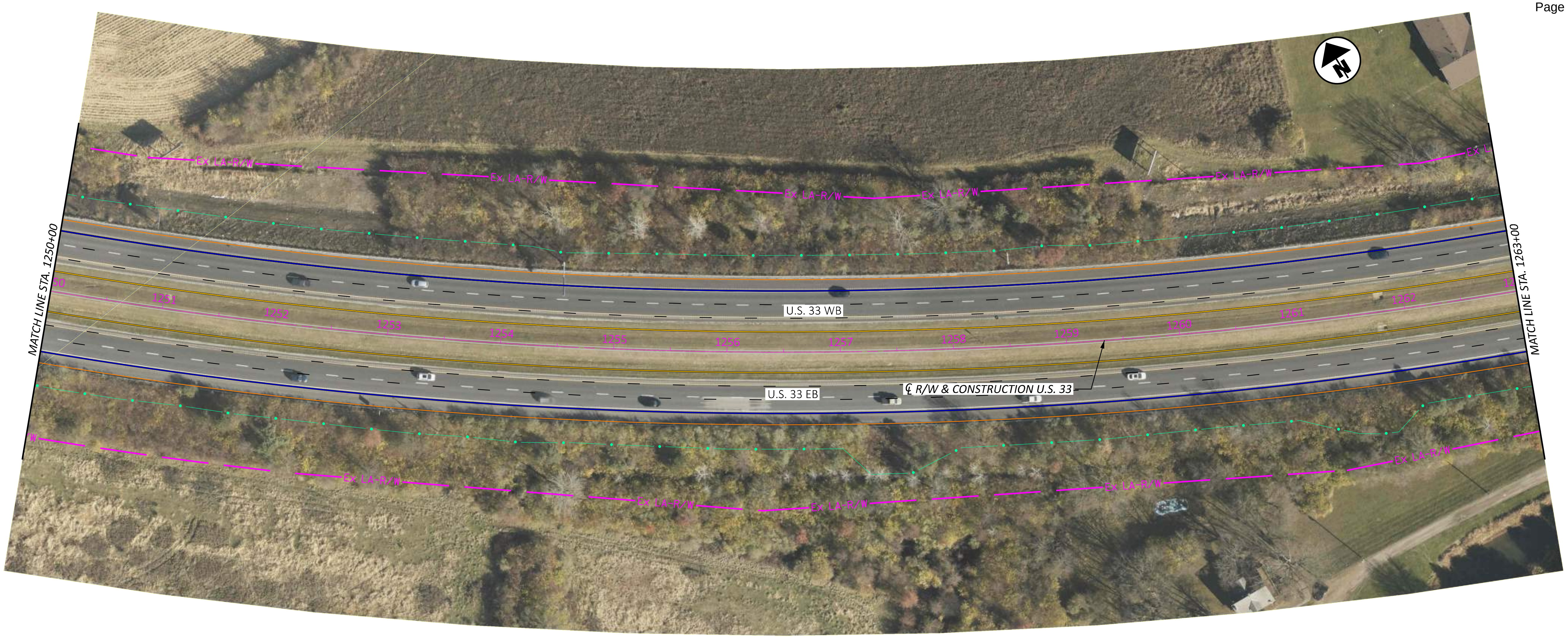

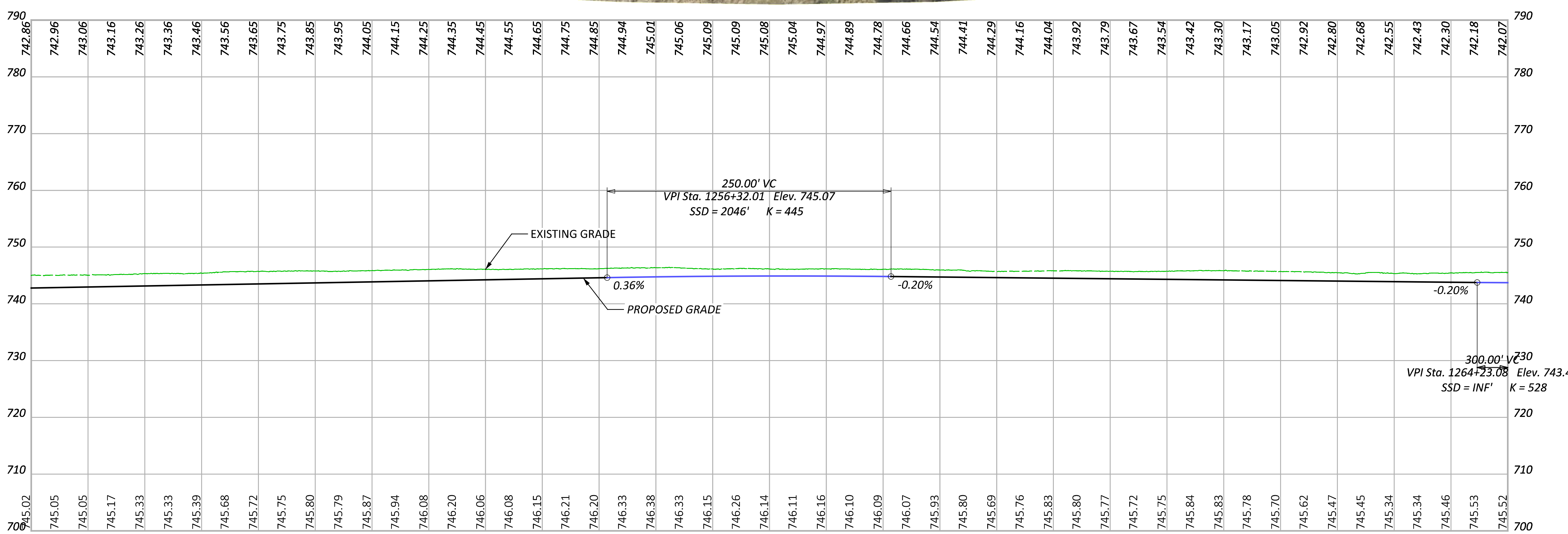

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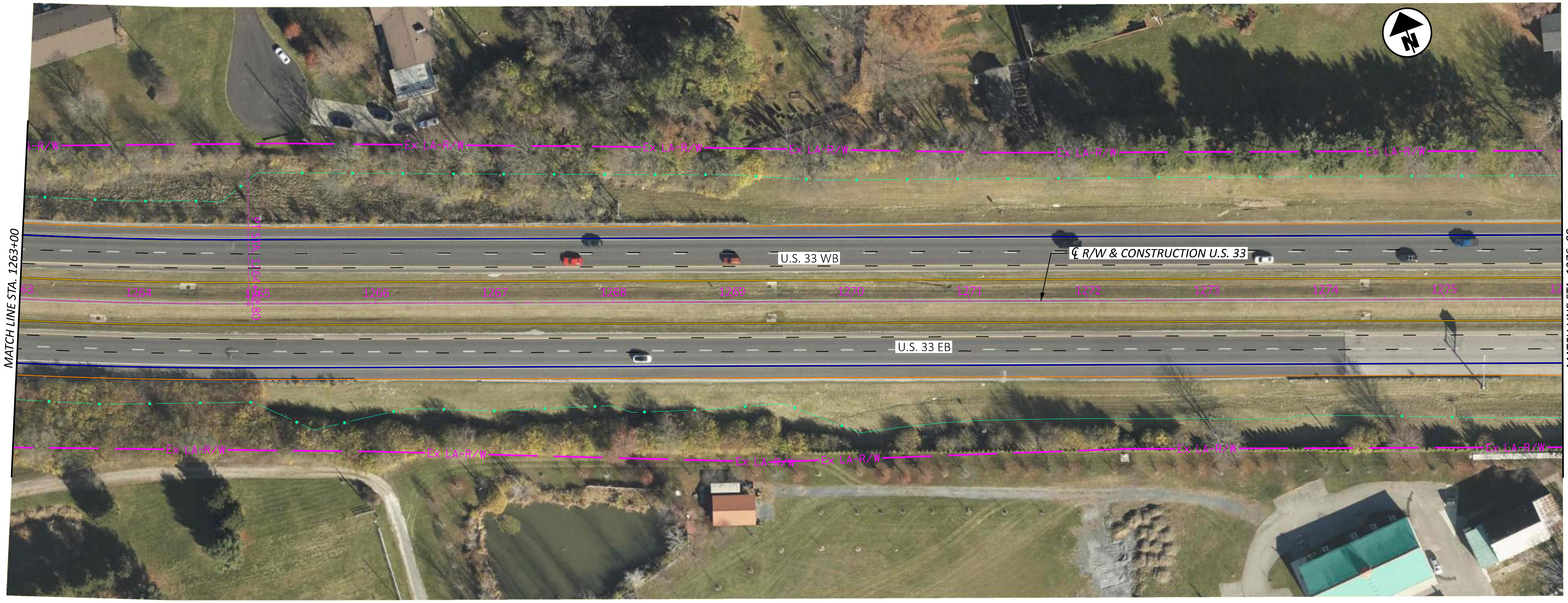

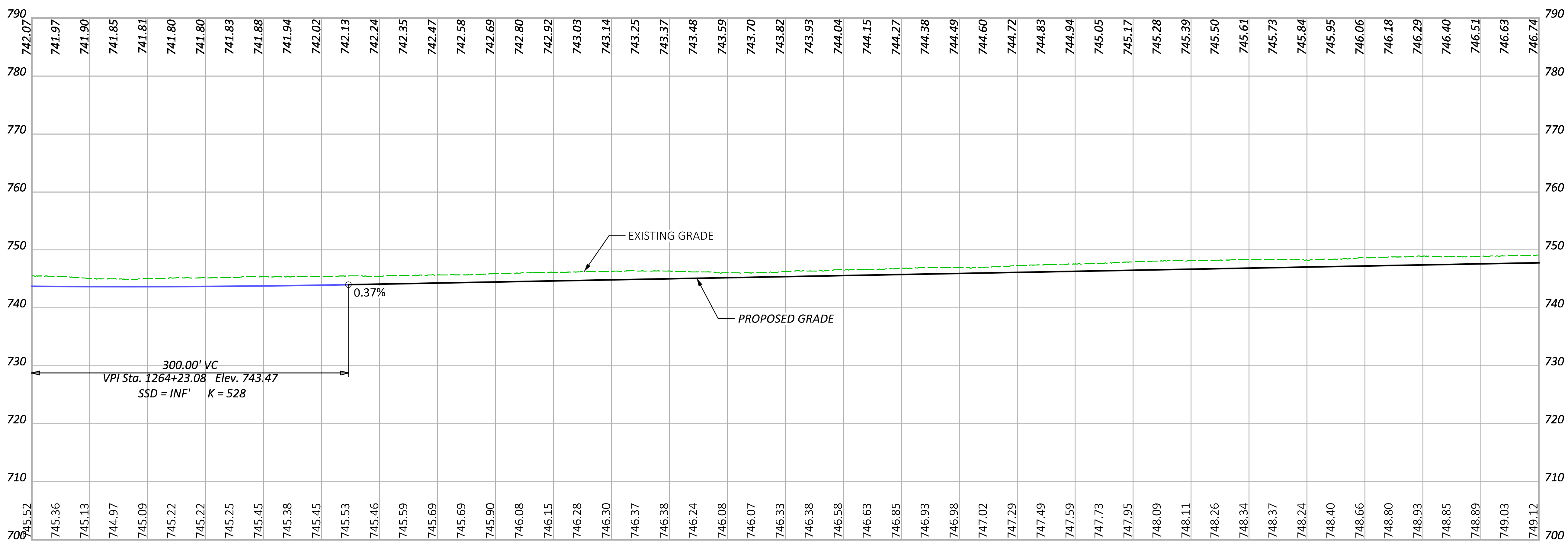

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1263+00 TO STA. 1276+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 6 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:09:59 AM USER: jespelage
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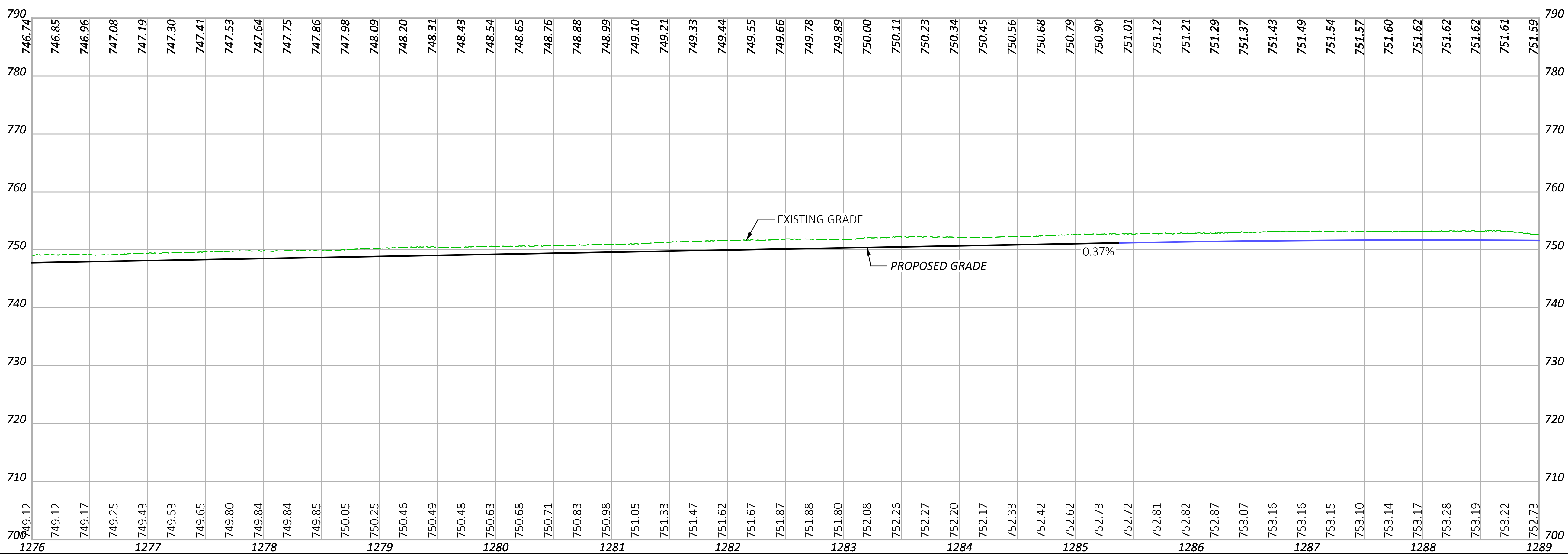

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1276+00 TO STA. 1289+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 7 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:11:50 AM USER: jespelage
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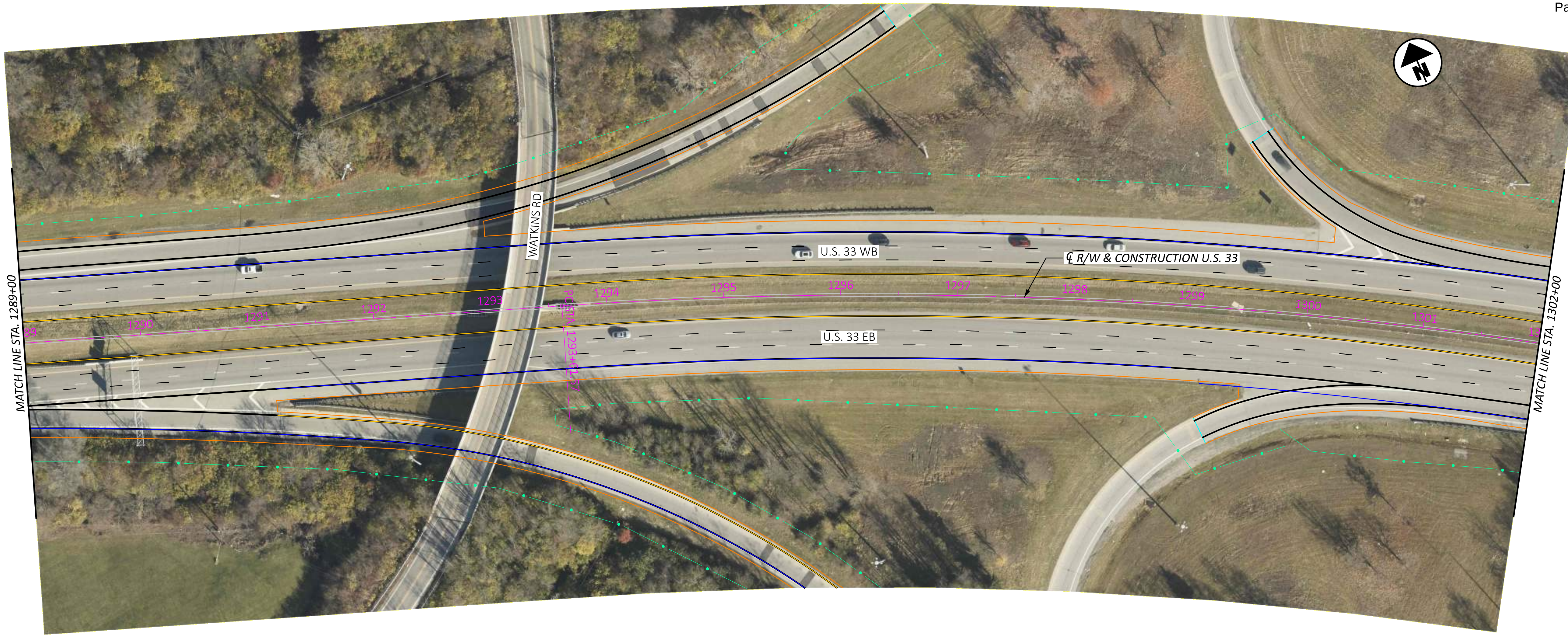

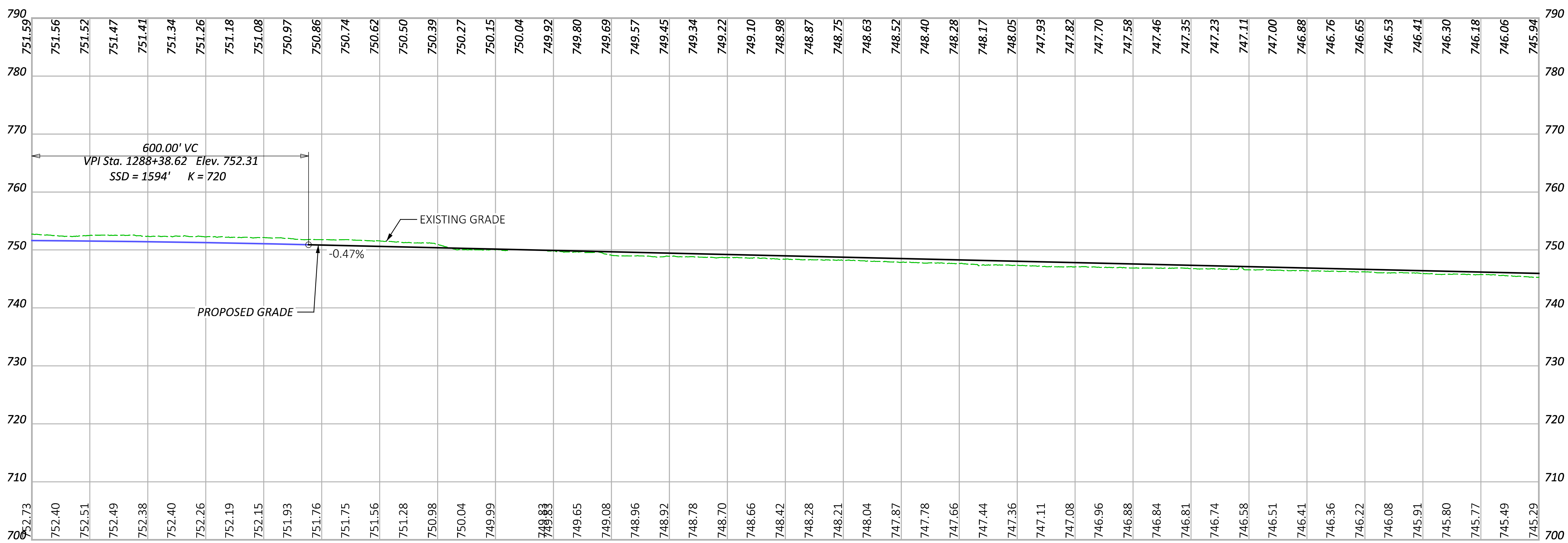

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1289+00 TO STA. 1302+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 8 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:13:58 AM USER: jespelage
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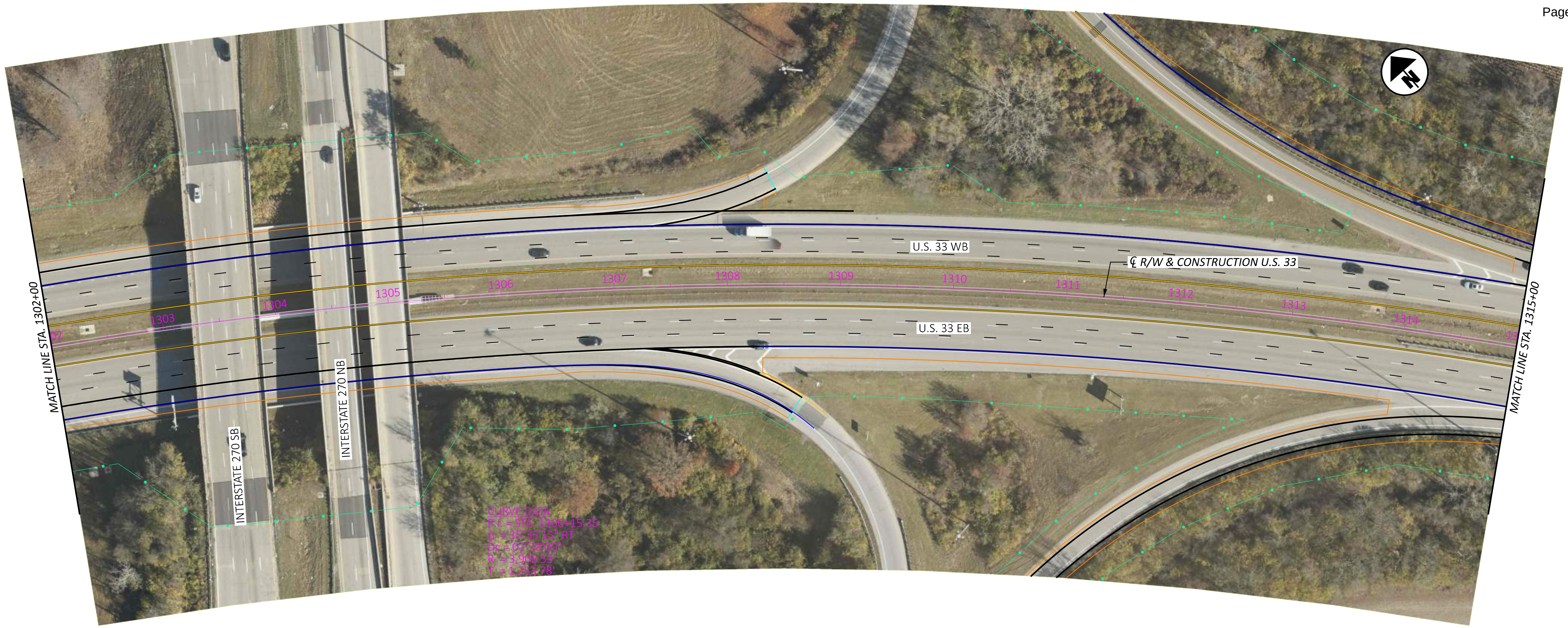

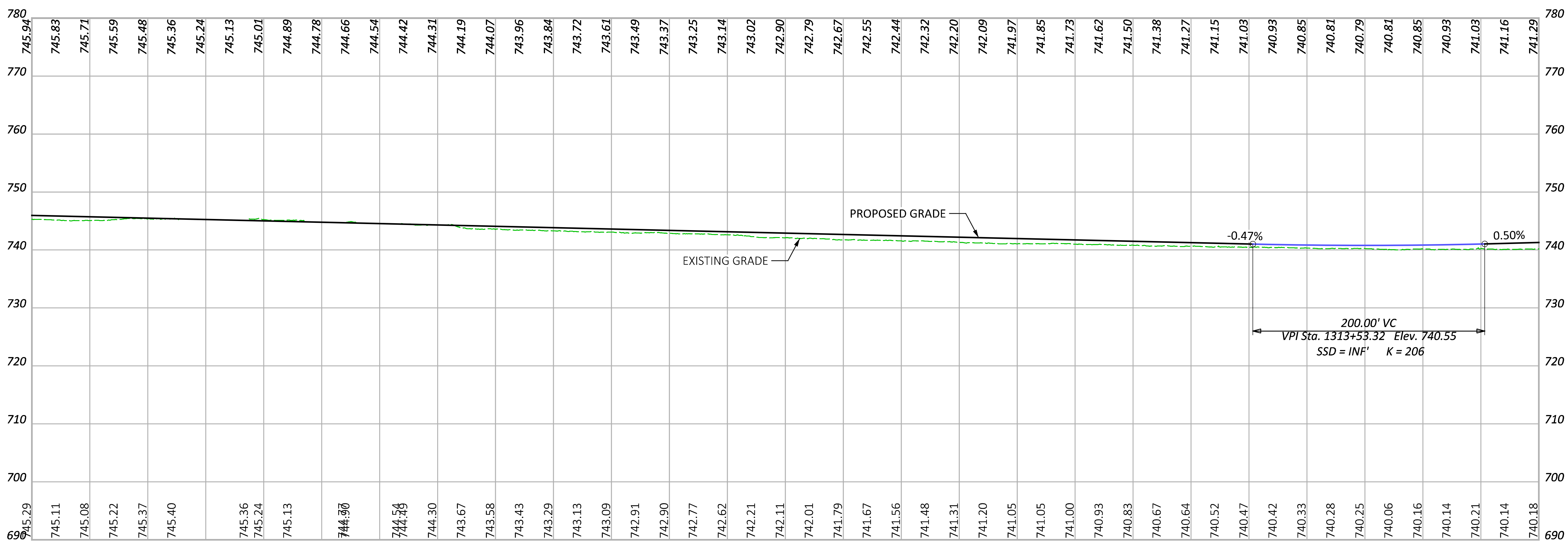

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1302+00 TO STA. 1315+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 9 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:15:56 AM USER: jespelage
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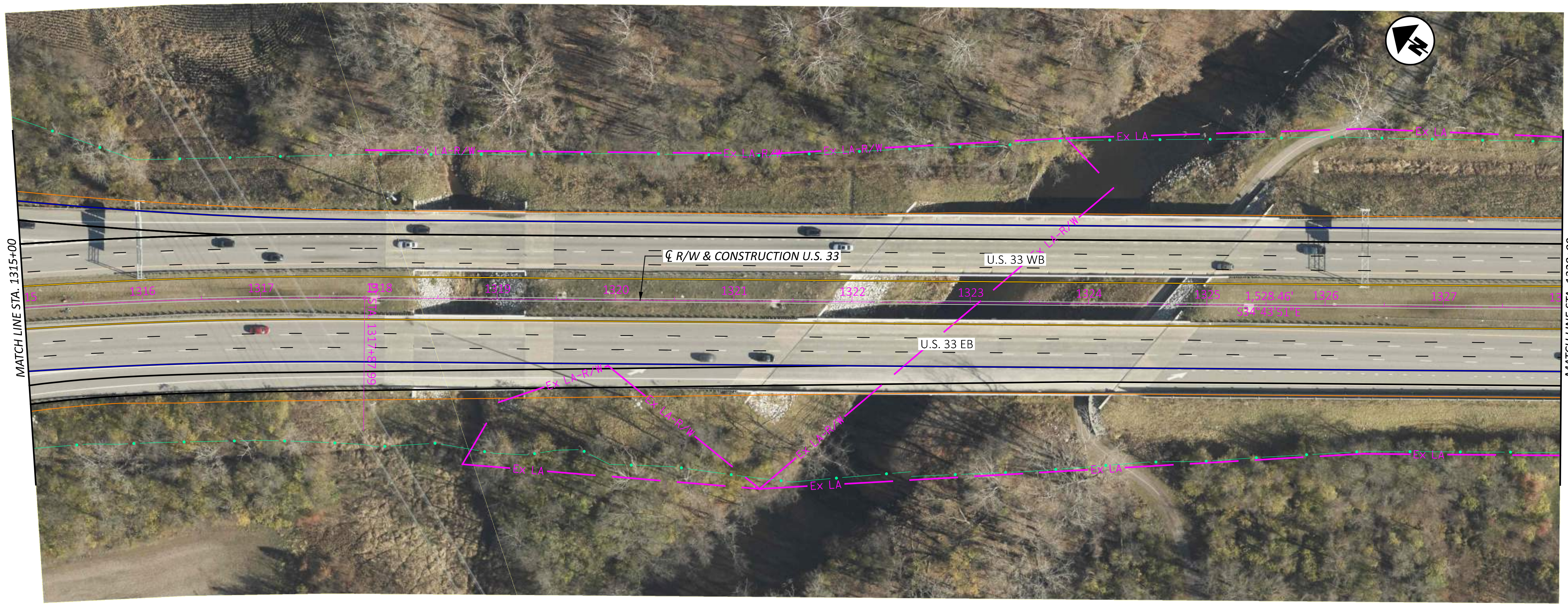
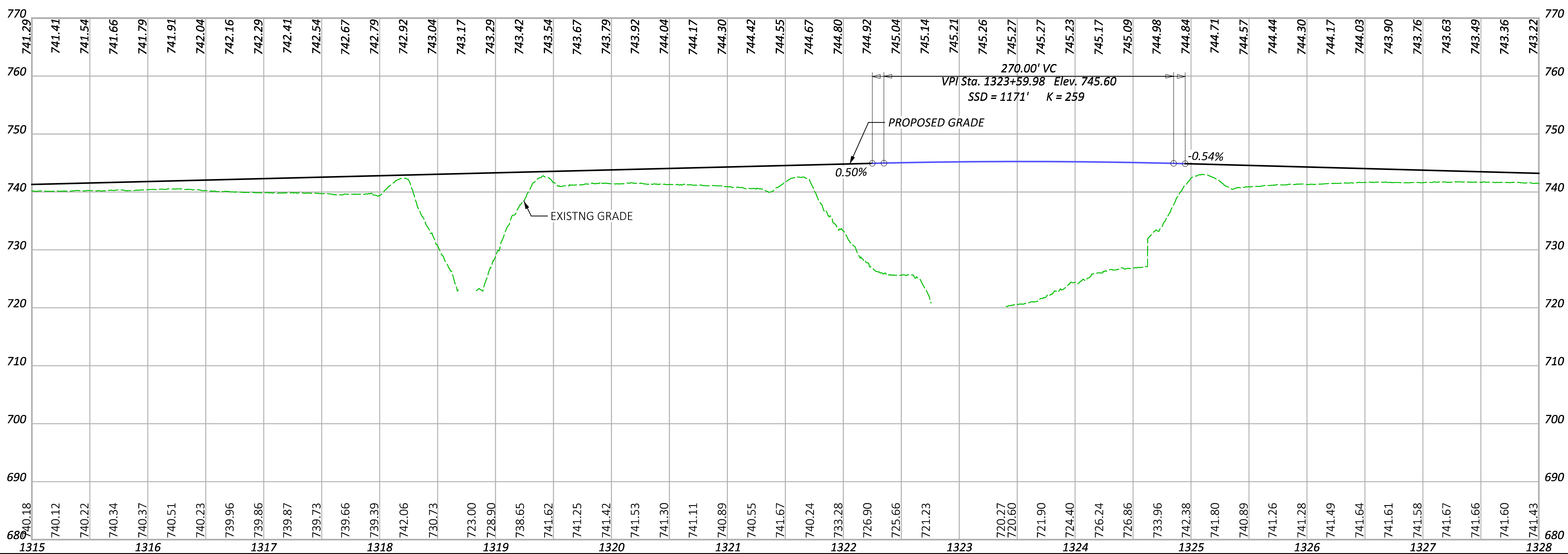
HORIZONTAL SCALE IN FEET

0 25 50 100





PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1315+00 TO STA. 1328+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 10 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:19:20 AM USER: jespelage
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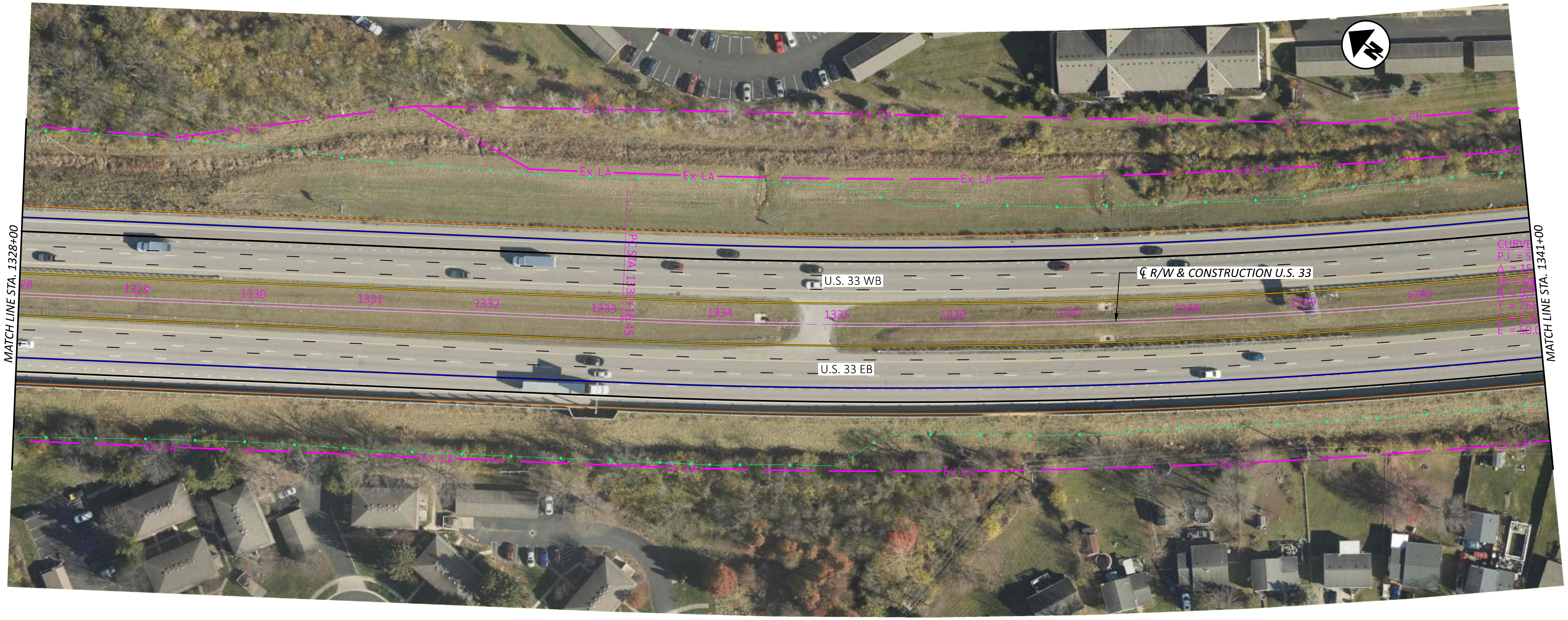

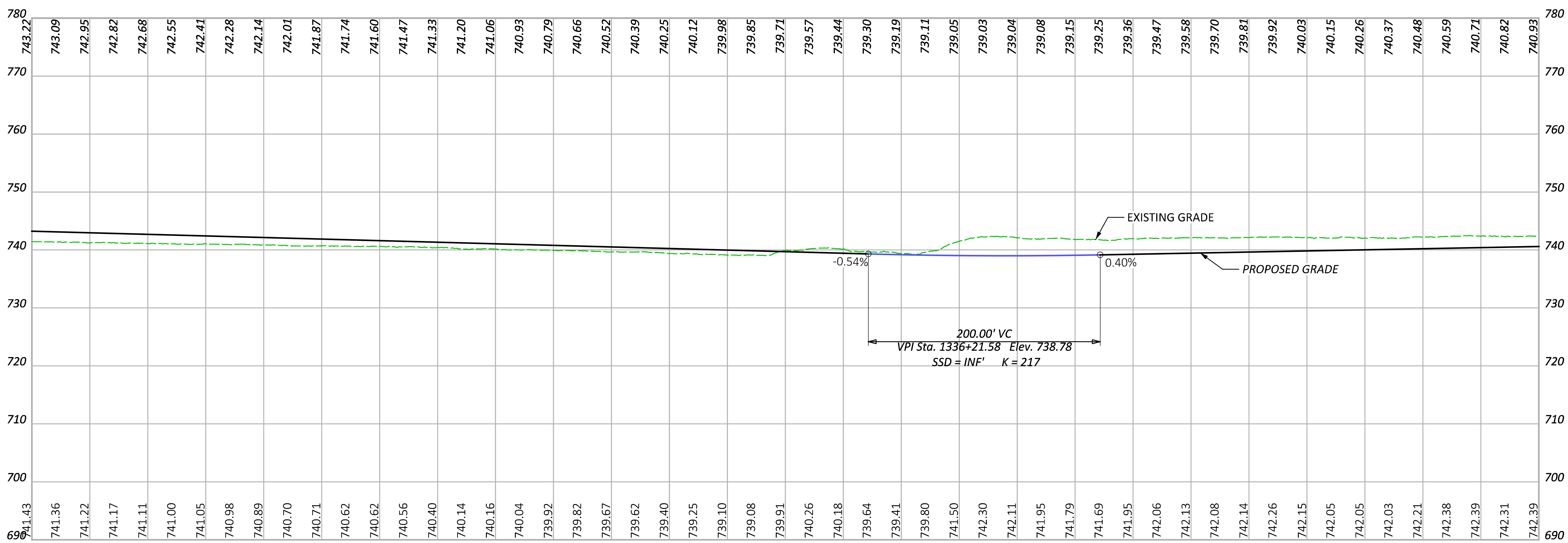

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1328+00 TO STA. 1341+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 11 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:22:37 AM USER: jespelage
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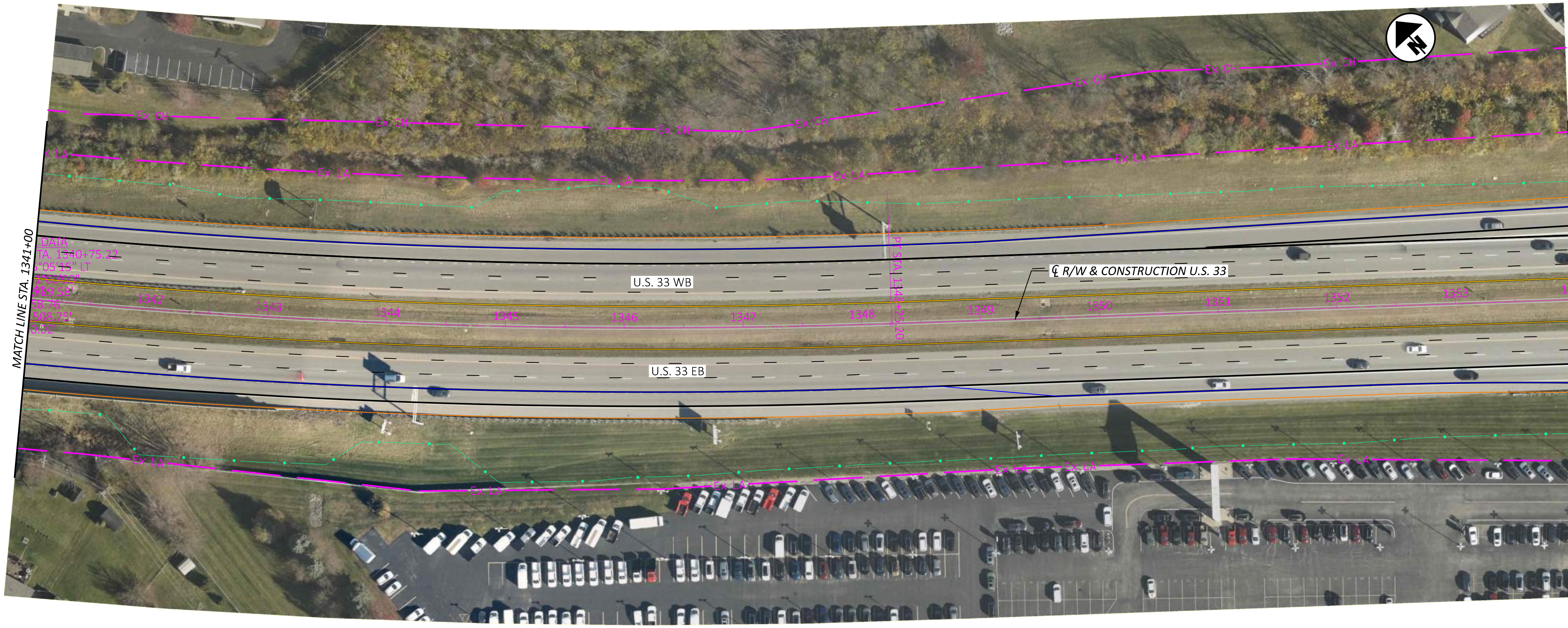

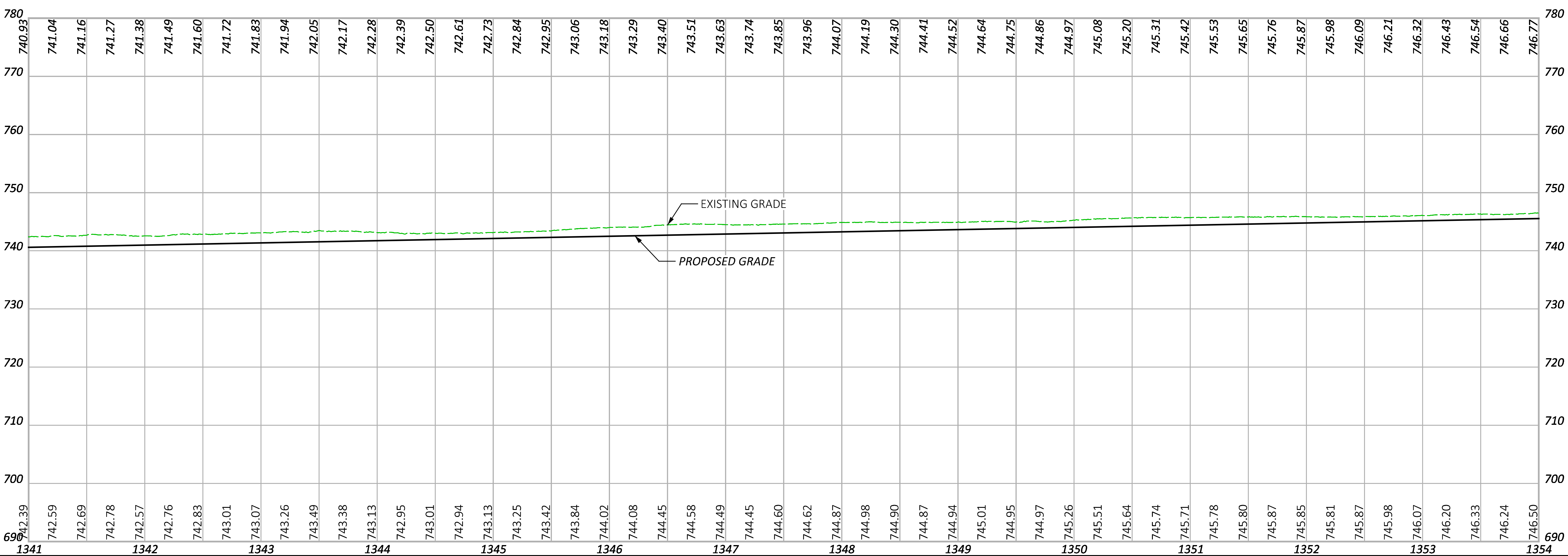

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 12 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:25:27 AM USER: jespelage
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HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1341+00 TO STA. 1354+00

DESIGN AGENCY

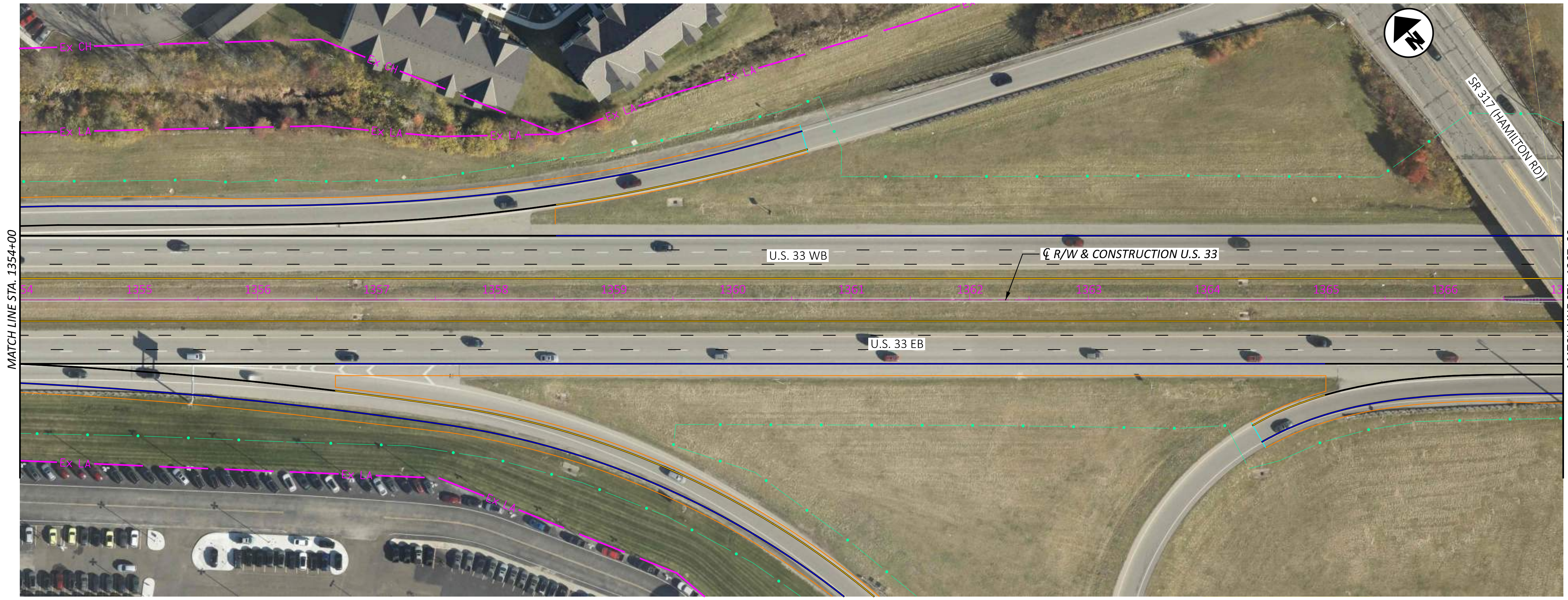
DESIGNER
XXX

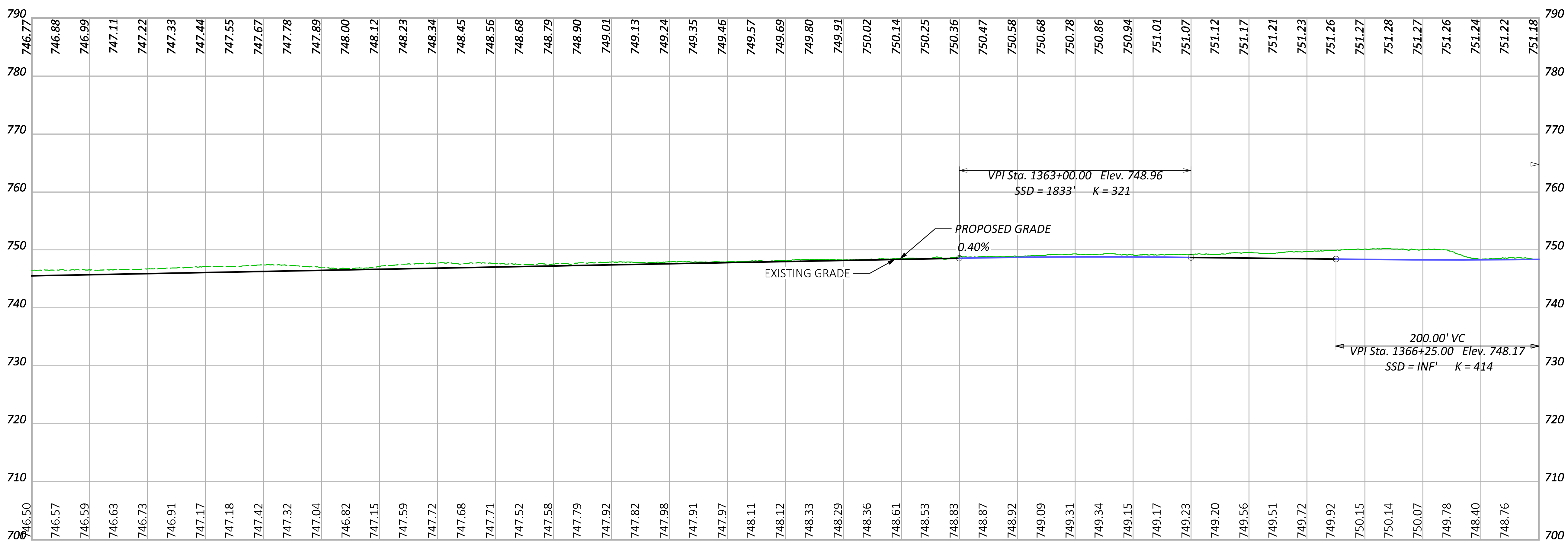
REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0

HORIZONTAL SCALE IN FEET 0 25 50 100





PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1354+00 TO STA. 1367+00

DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET TOTAL
P.0 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 13 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:28:26 AM USER: jespelage
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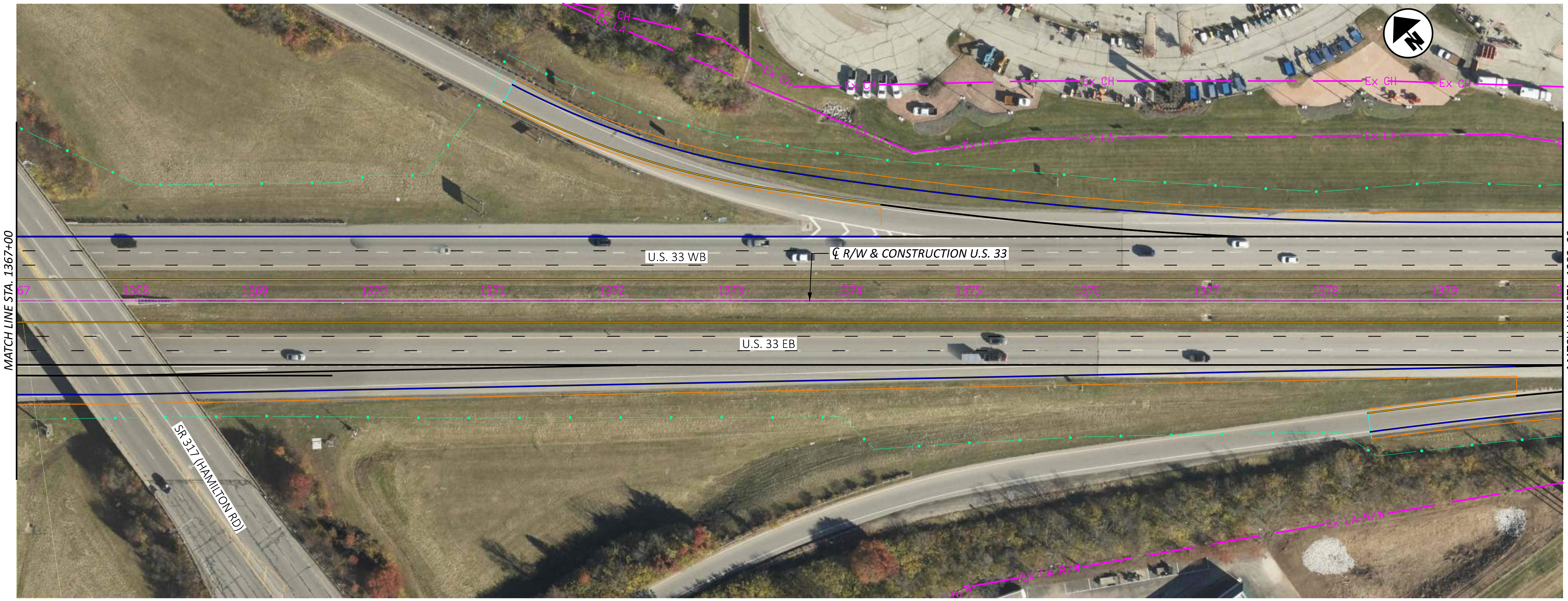

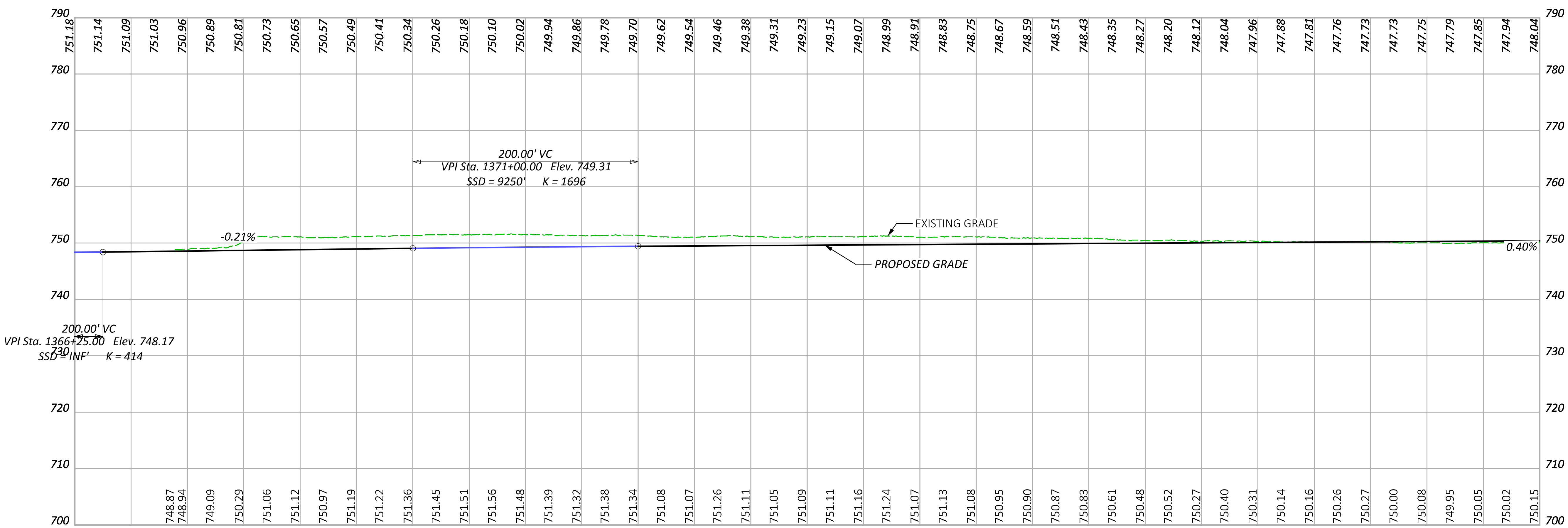

HORIZONTAL SCALE IN FEET 0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1367+00 TO STA. 1380+00

DESIGN AGENCY

DESIGNER XXX
REVIEWER XXX MM-DD-YY
PROJECT ID 121811
SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 14 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:31:28 AM USER: jespelage
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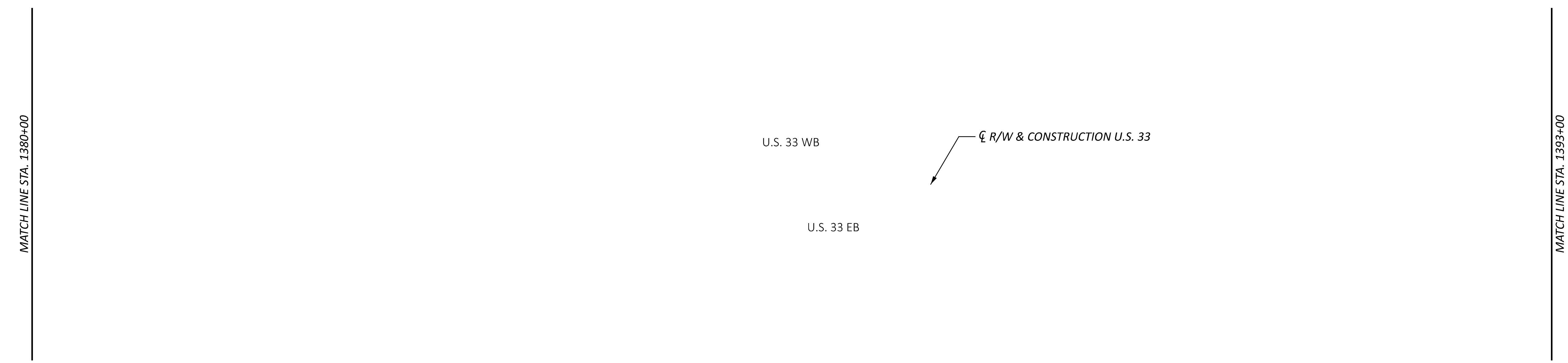

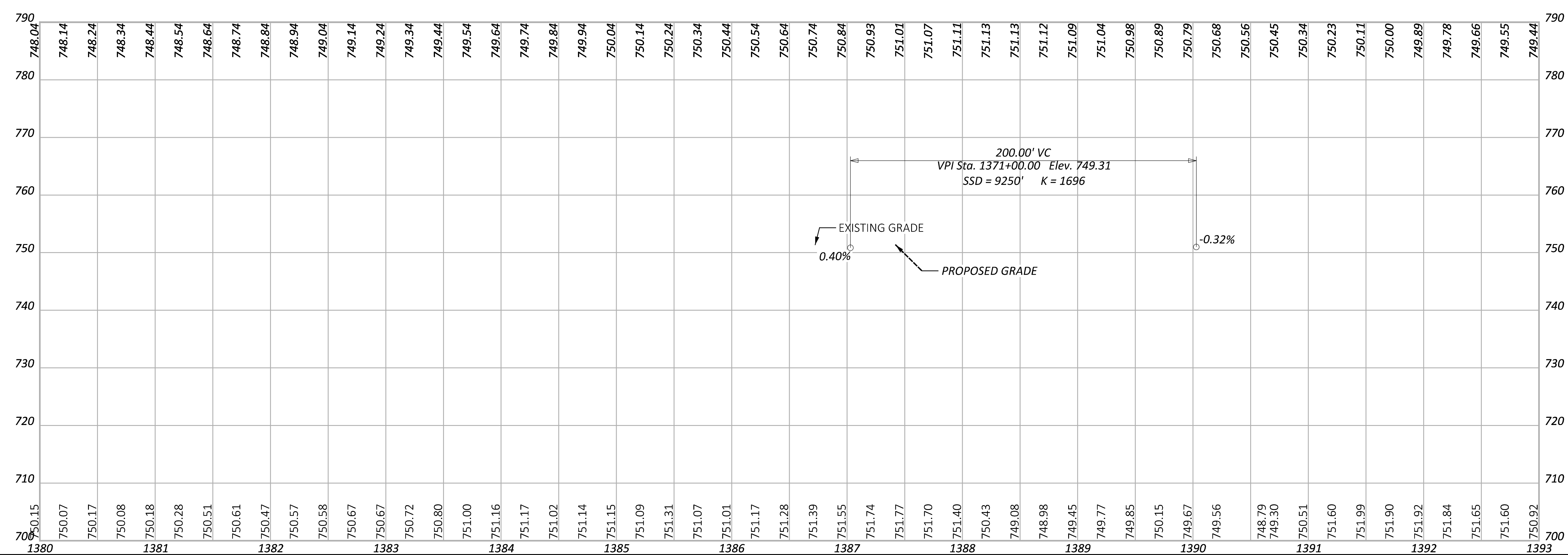

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1380+00 TO STA. 1393+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 15 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:32:07 AM USER: jespelage
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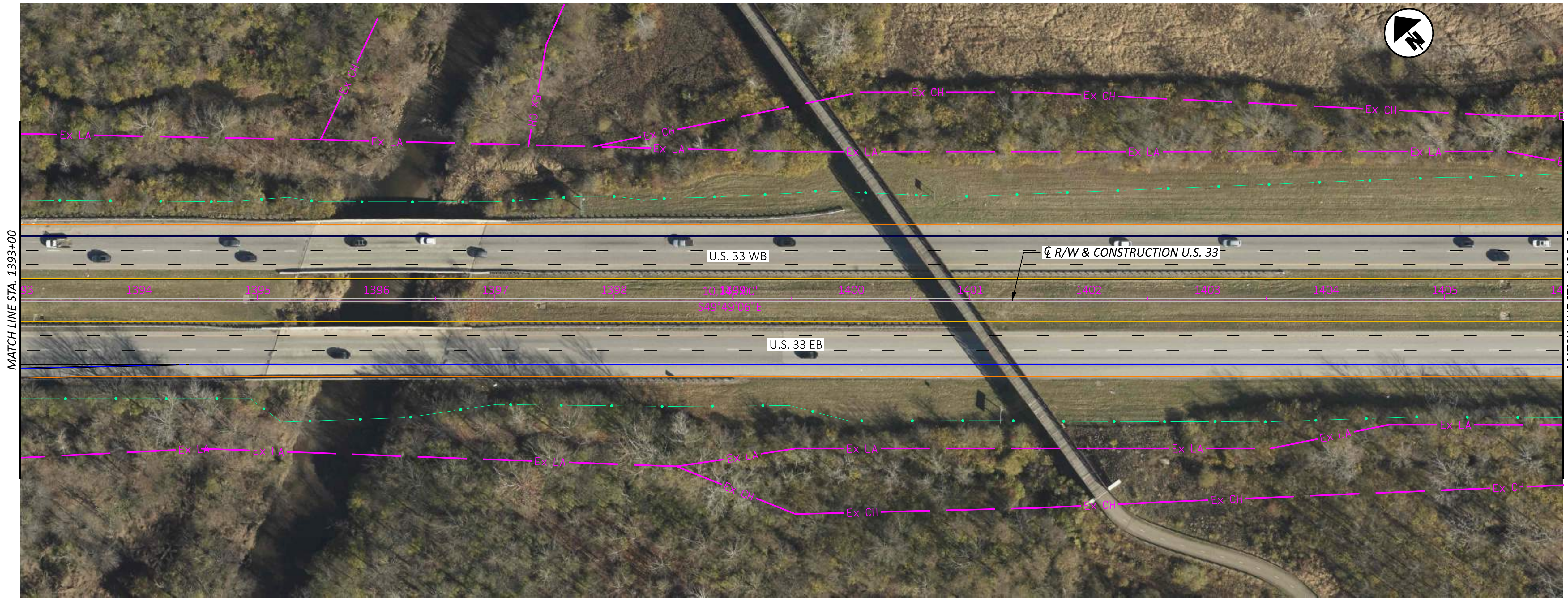

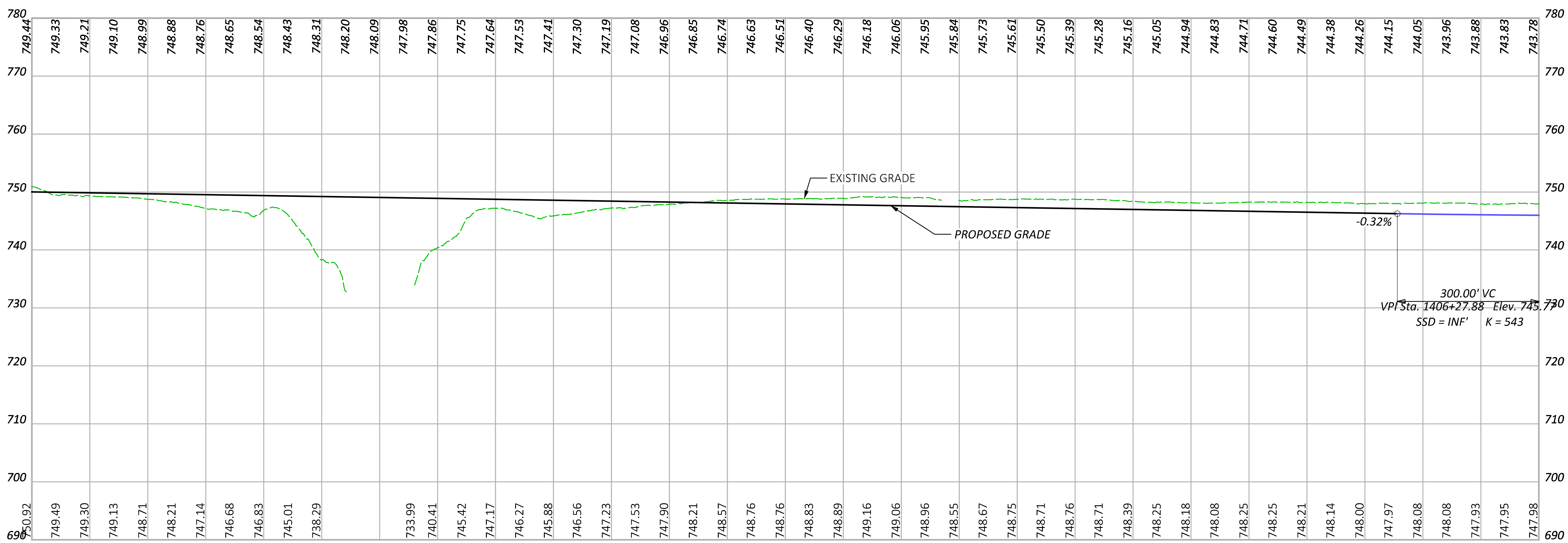

HORIZONTAL SCALE IN FEET 0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1393+00 TO STA. 1406+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 16 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:34:53 AM USER: jespelage
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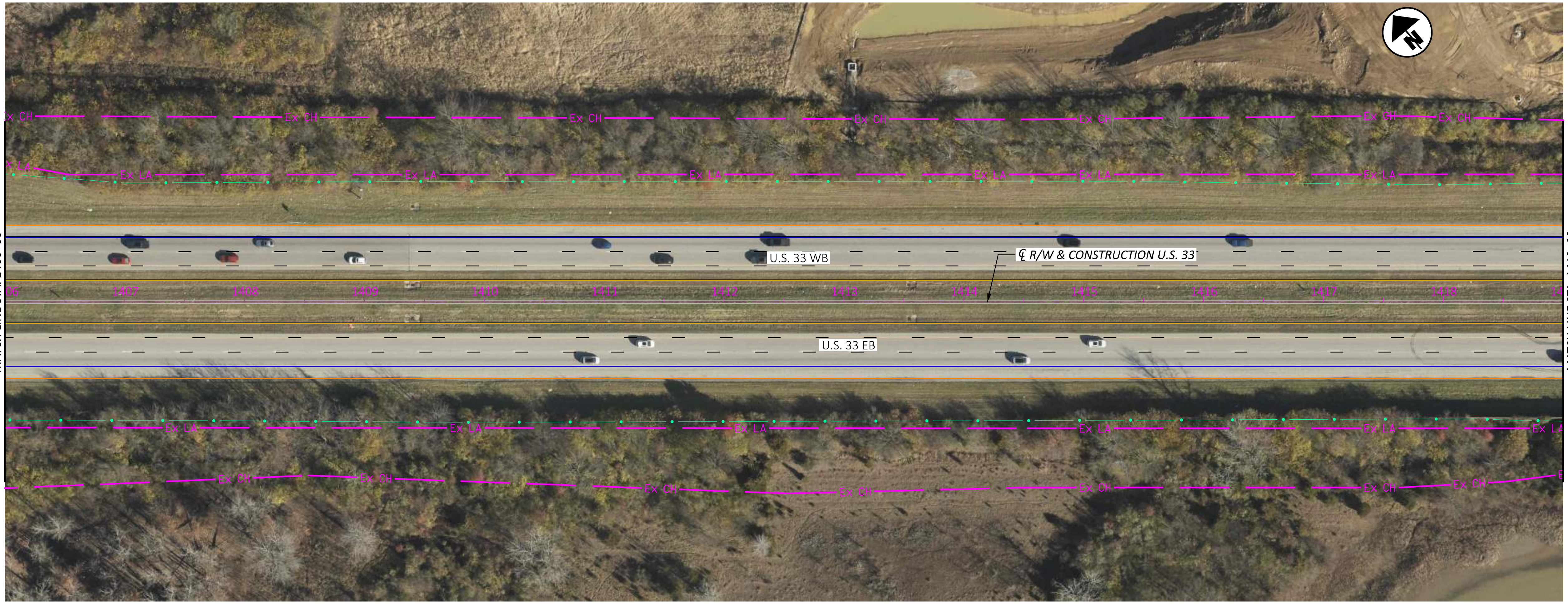
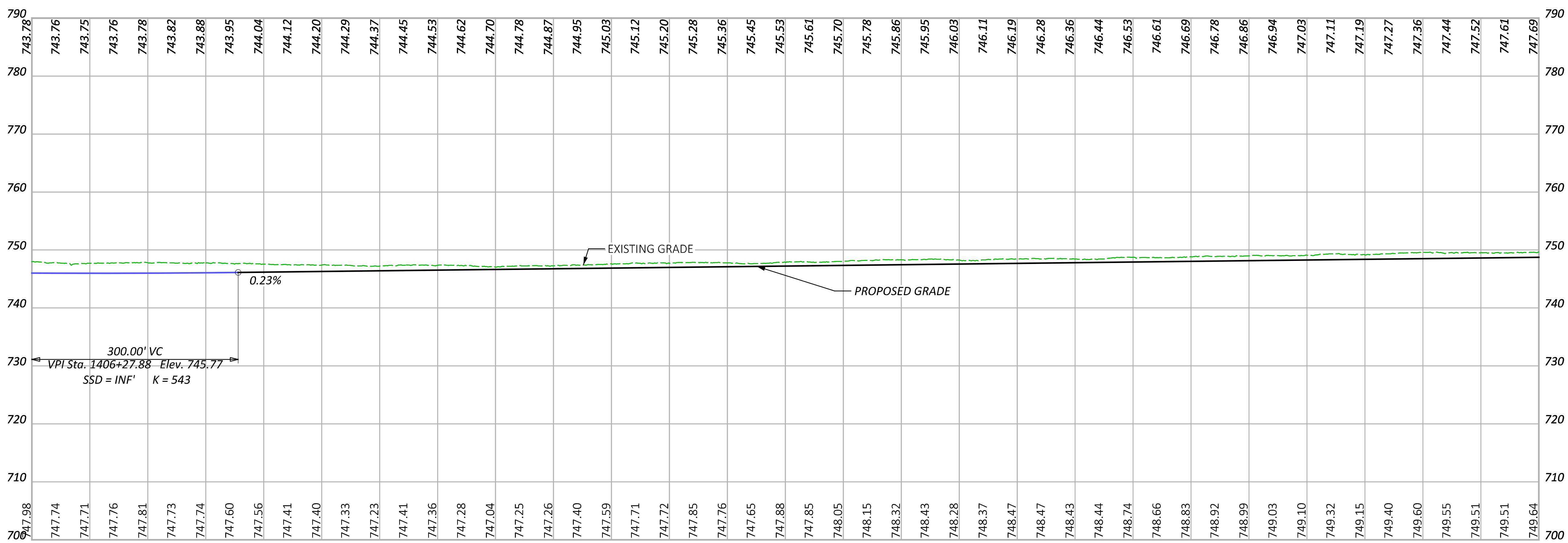
HORIZONTAL SCALE IN FEET

0 25 50 100





PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1406+00 TO STA. 1419+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 17 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:37:03 AM USER: jespelage
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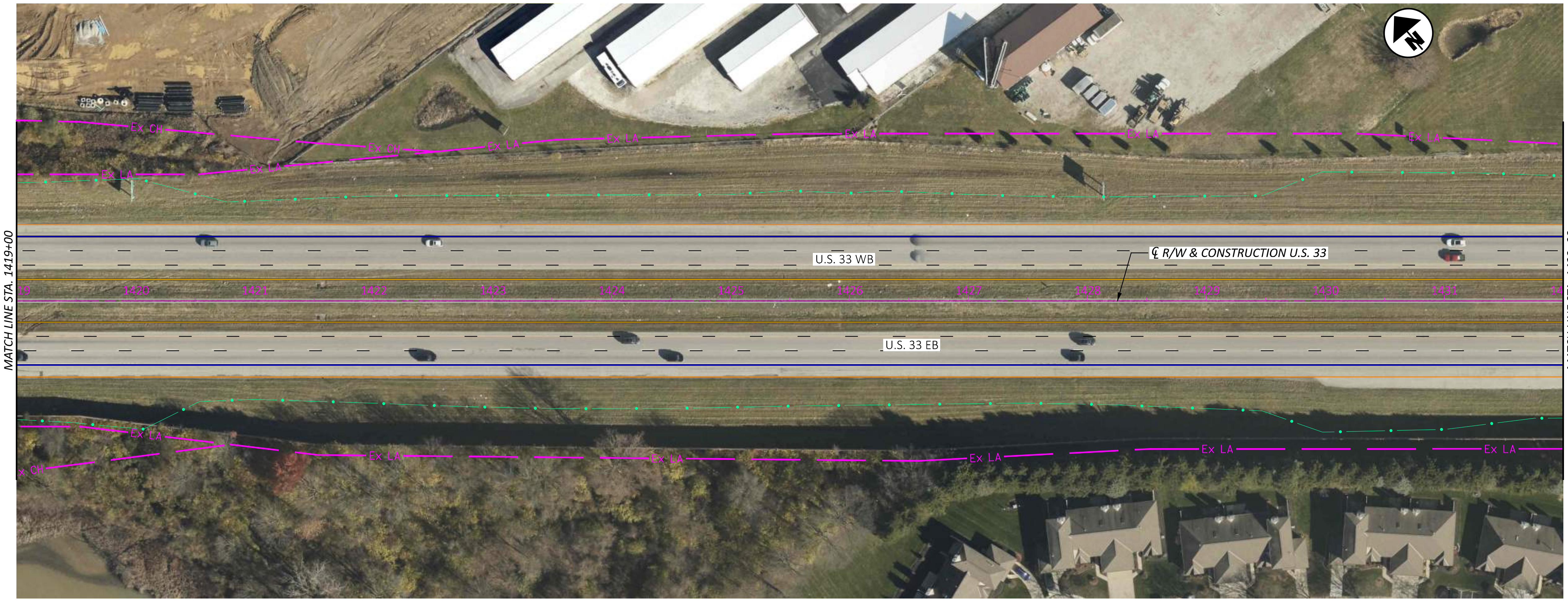

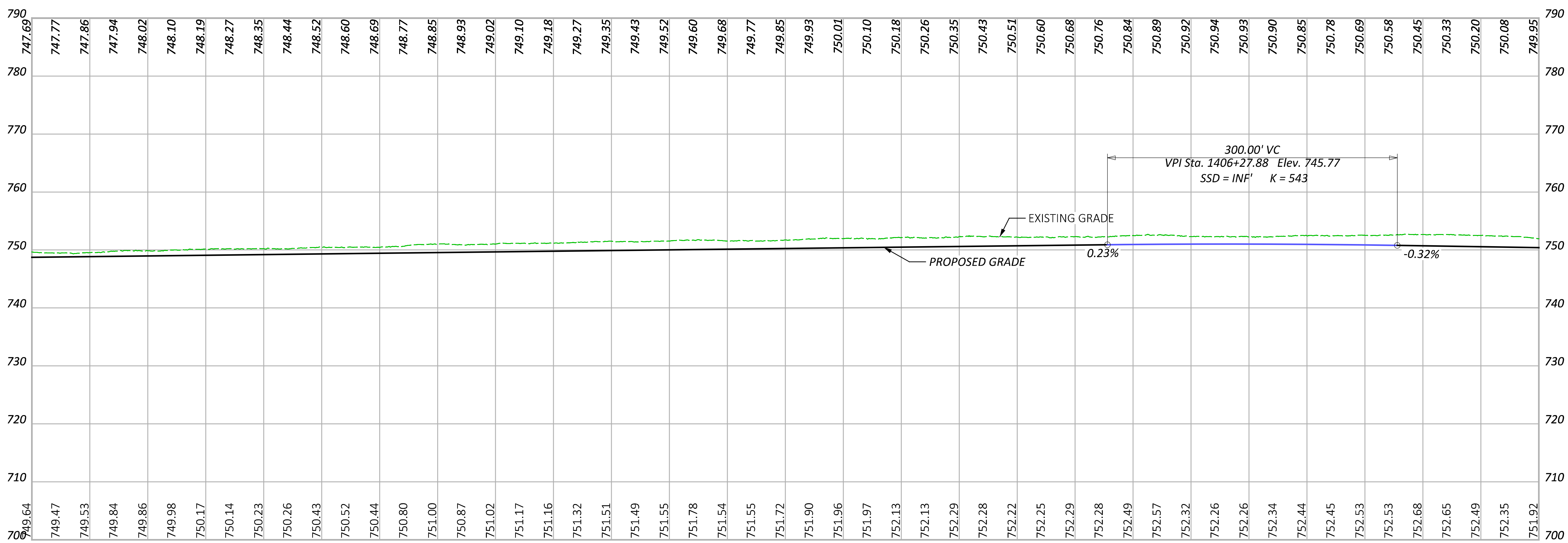

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1419+00 TO STA. 1432+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 18 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:39:09 AM USER: jespelage
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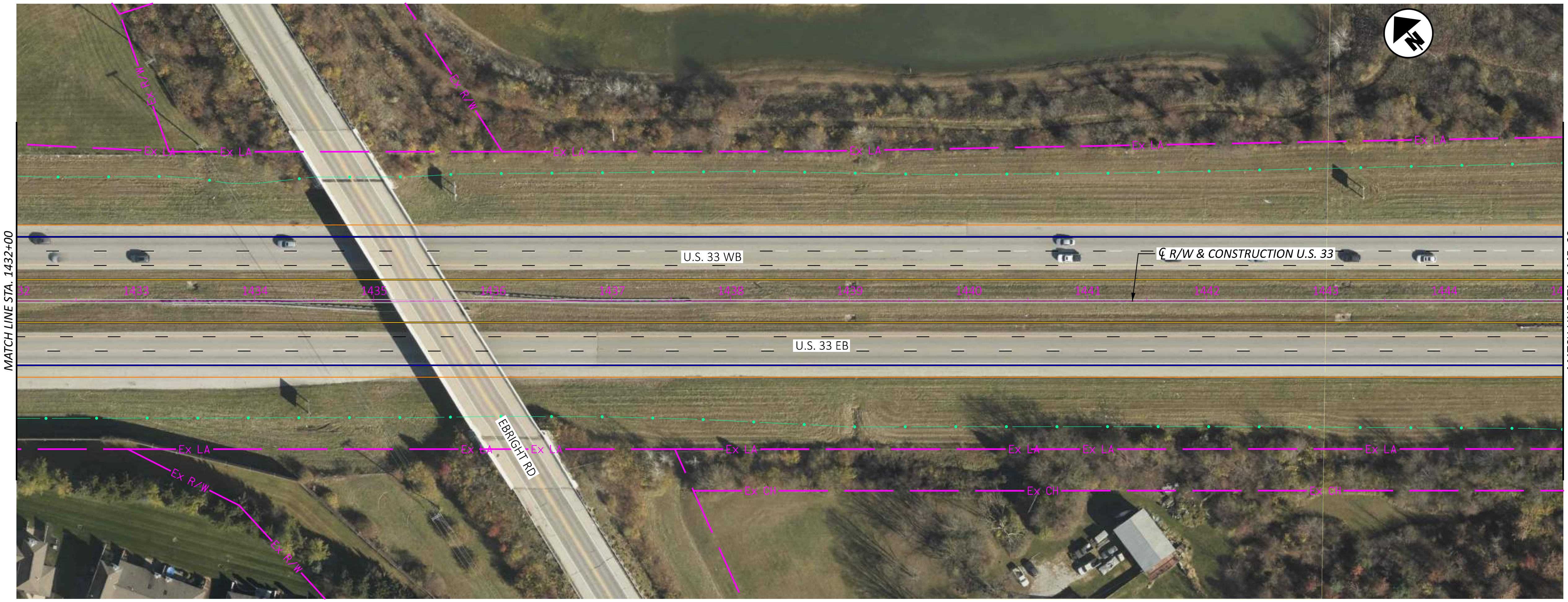

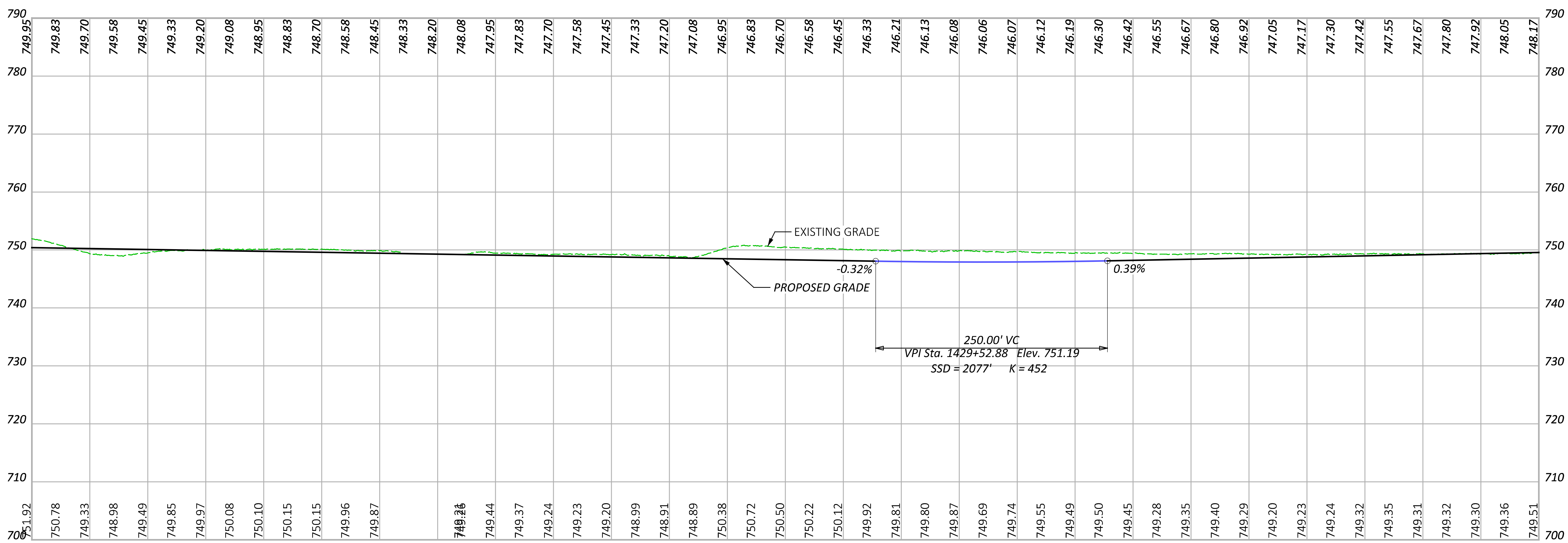

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1432+00 TO STA. 1445+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 19 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:41:08 AM USER: jespelage
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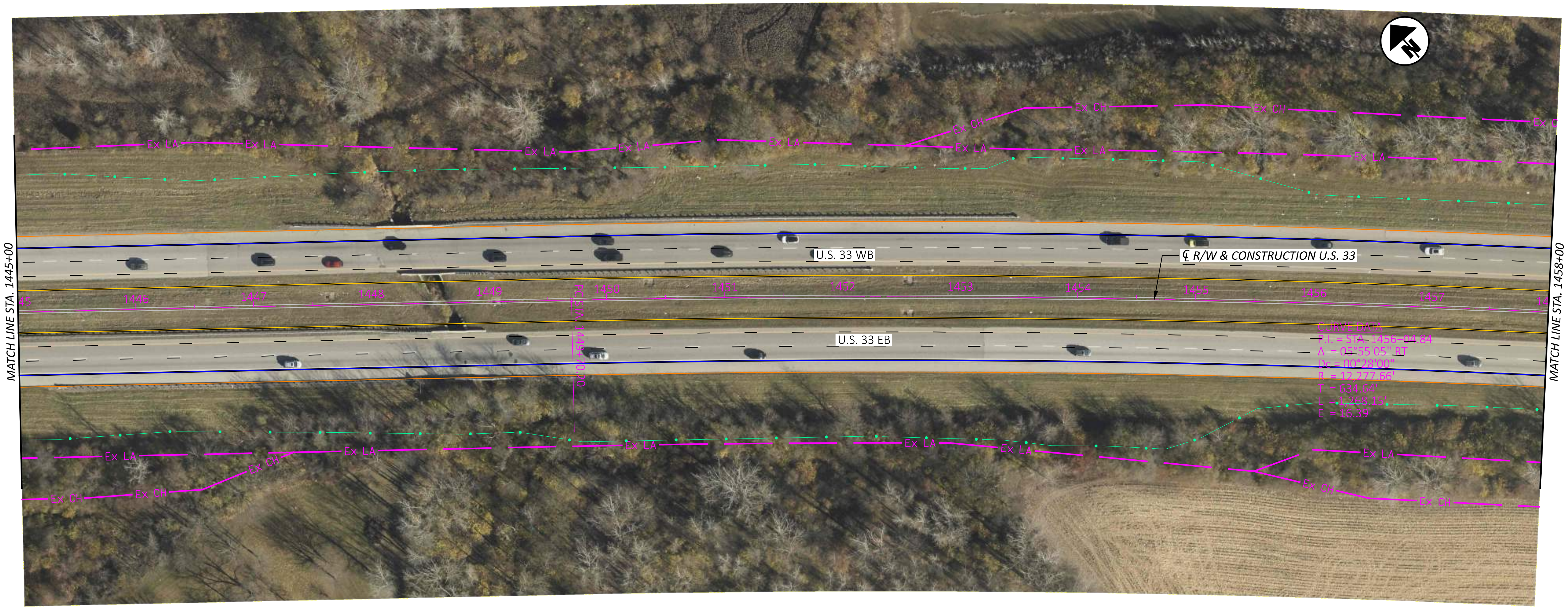

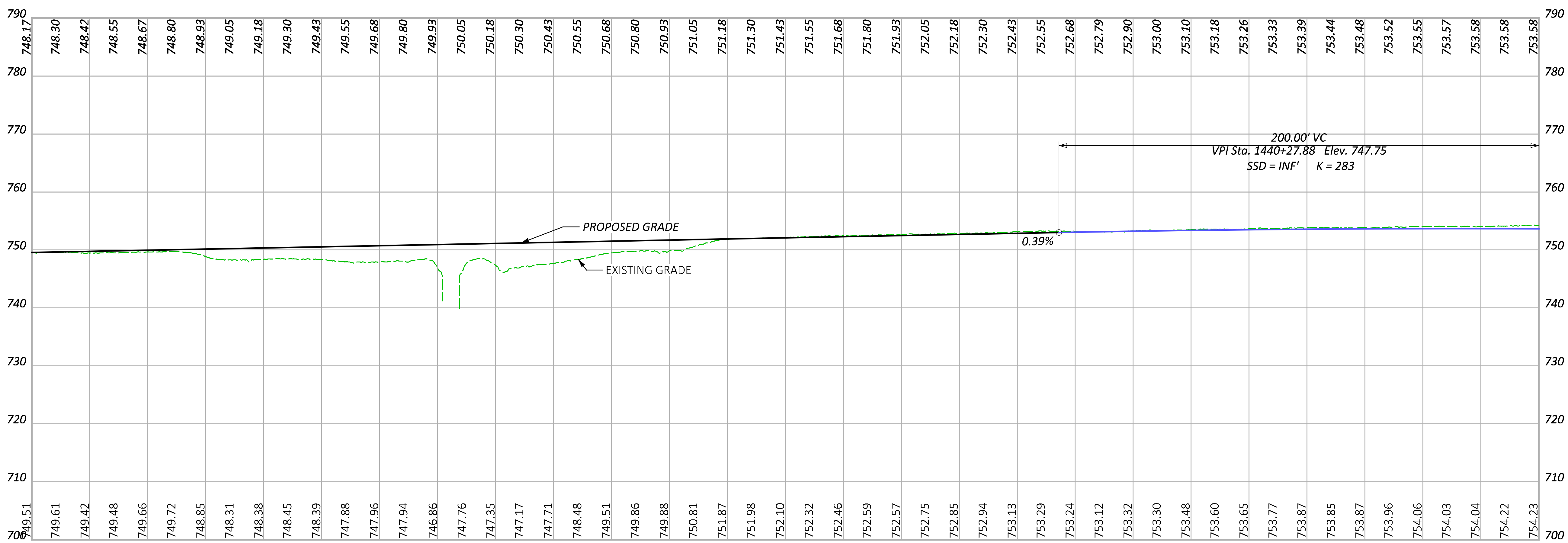

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1445+00 TO STA. 1458+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 20 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:43:02 AM USER: jespelage
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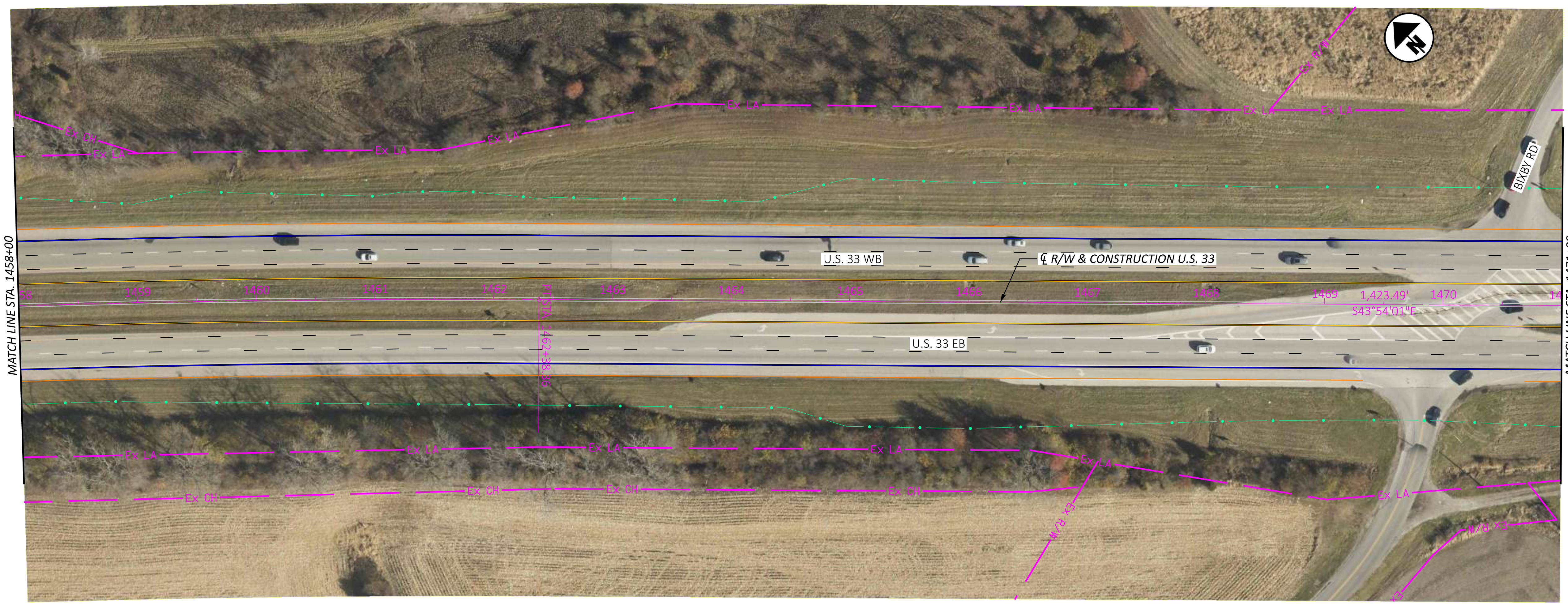

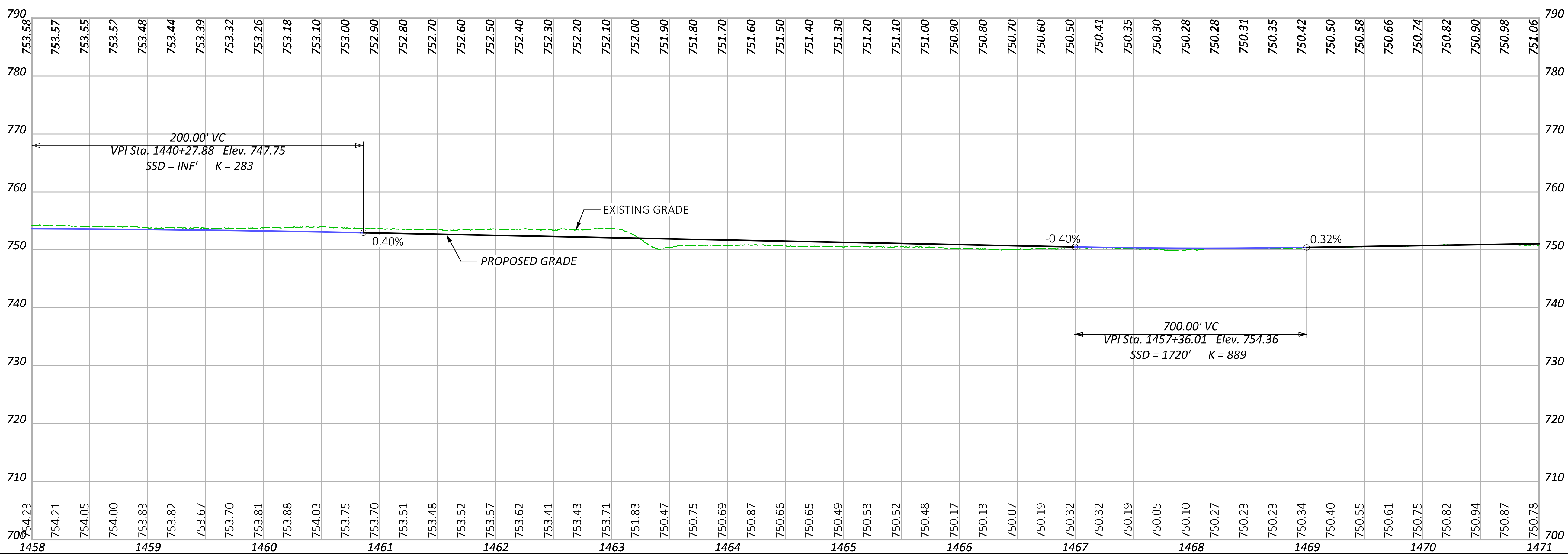

HORIZONTAL SCALE IN FEET

0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1458+00 TO STA. 1471+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 21 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:44:54 AM USER: jespelage
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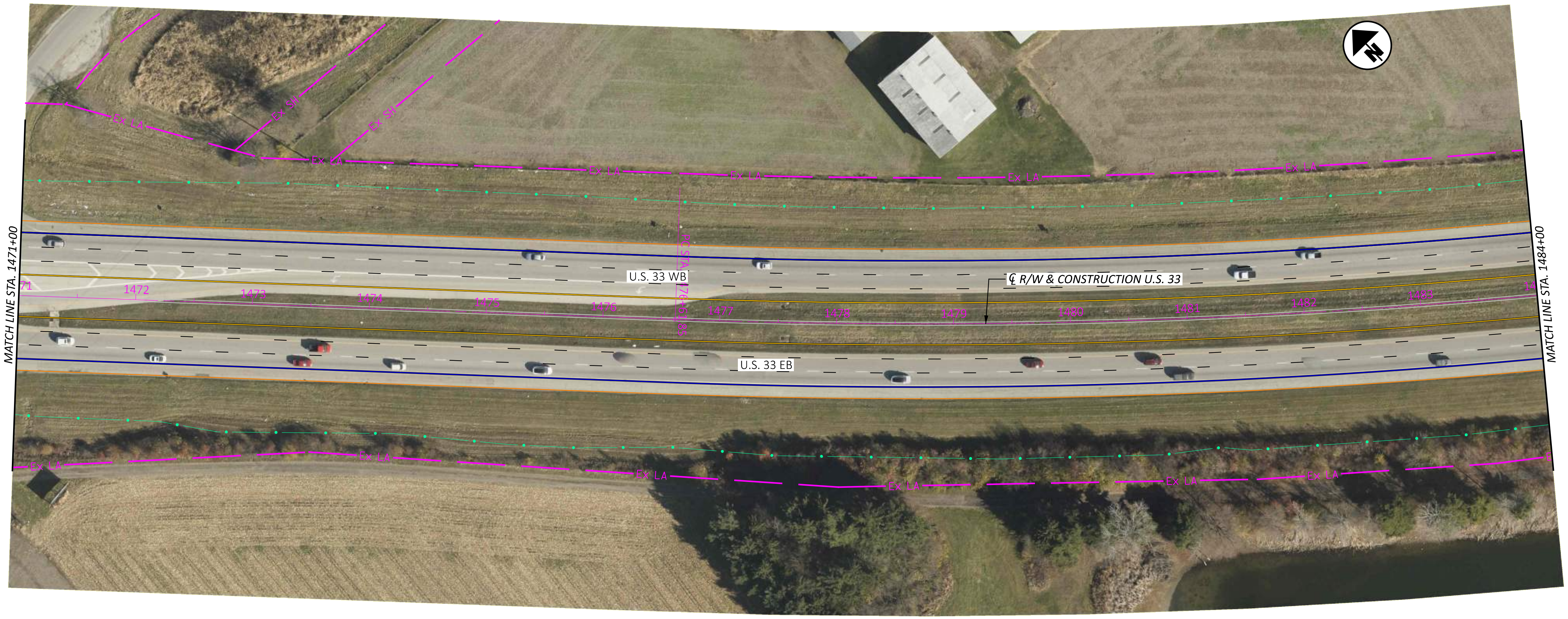

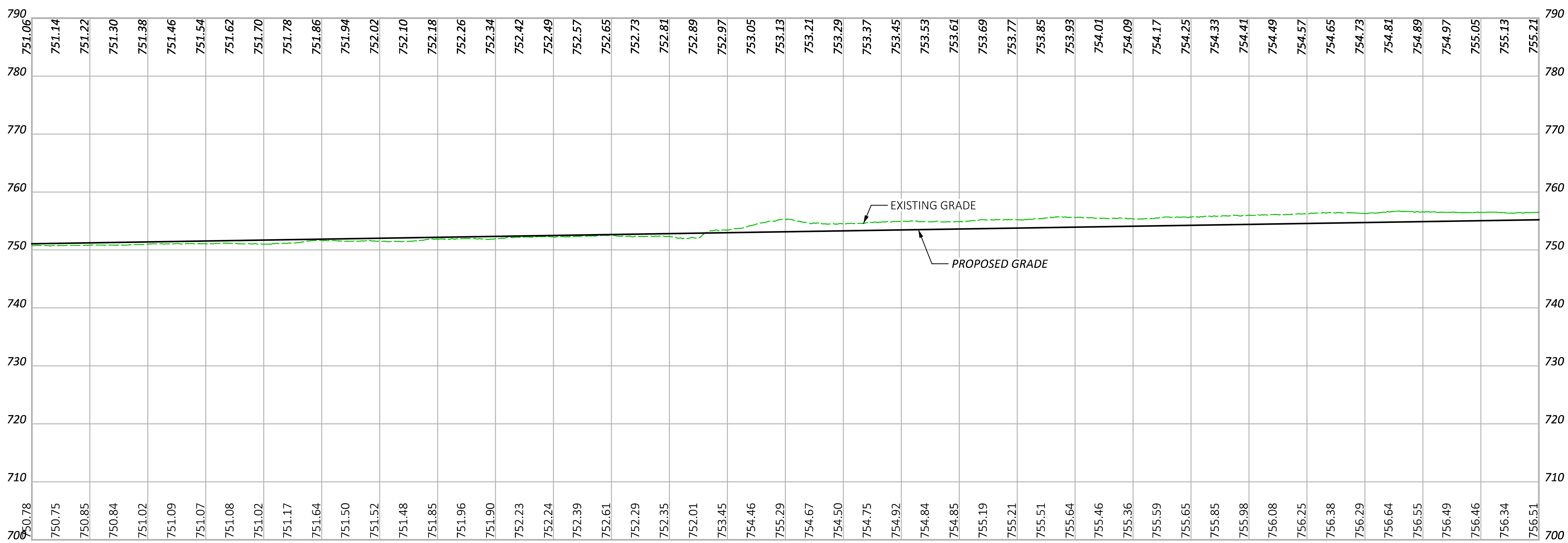

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1471+00 TO STA. 1484+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 22 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:46:42 AM USER: jespelage
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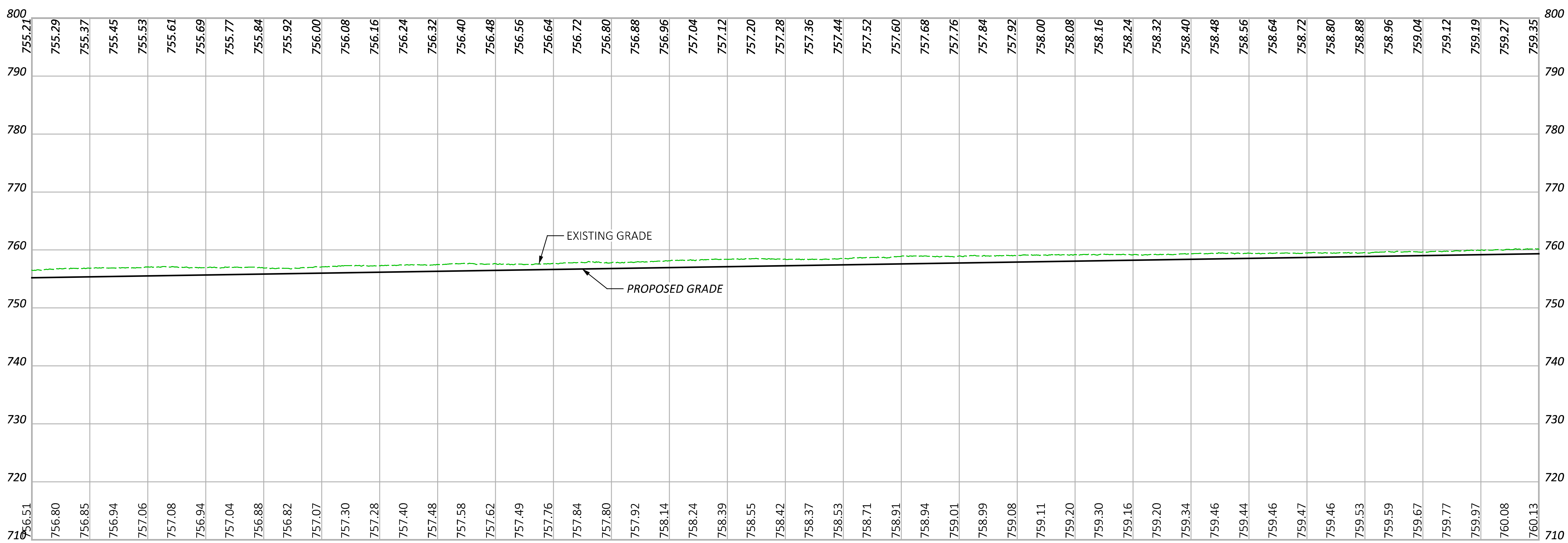

HORIZONTAL SCALE IN FEET 0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1484+00 TO STA. 1497+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 23 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:48:31 AM USER: jespelage
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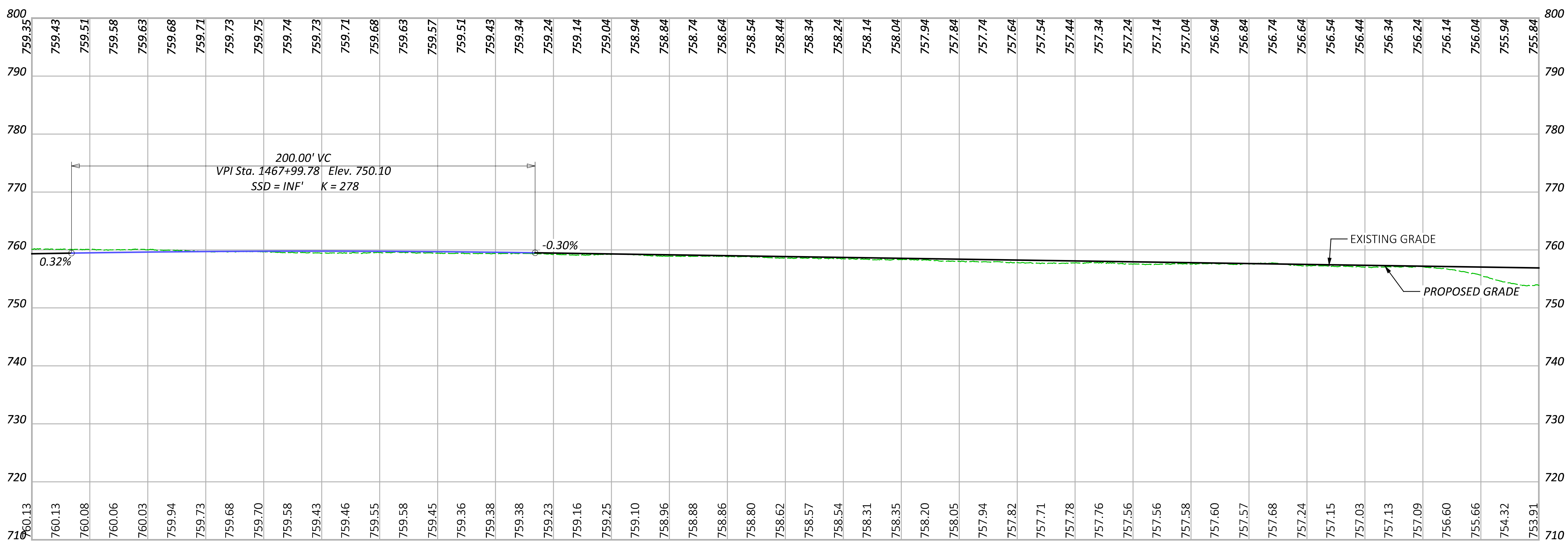
PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1497+00 TO STA. 1510+00

HORIZONTAL SCALE IN FEET
0 25 50 100



FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 24 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:50:15 AM USER: jespelage
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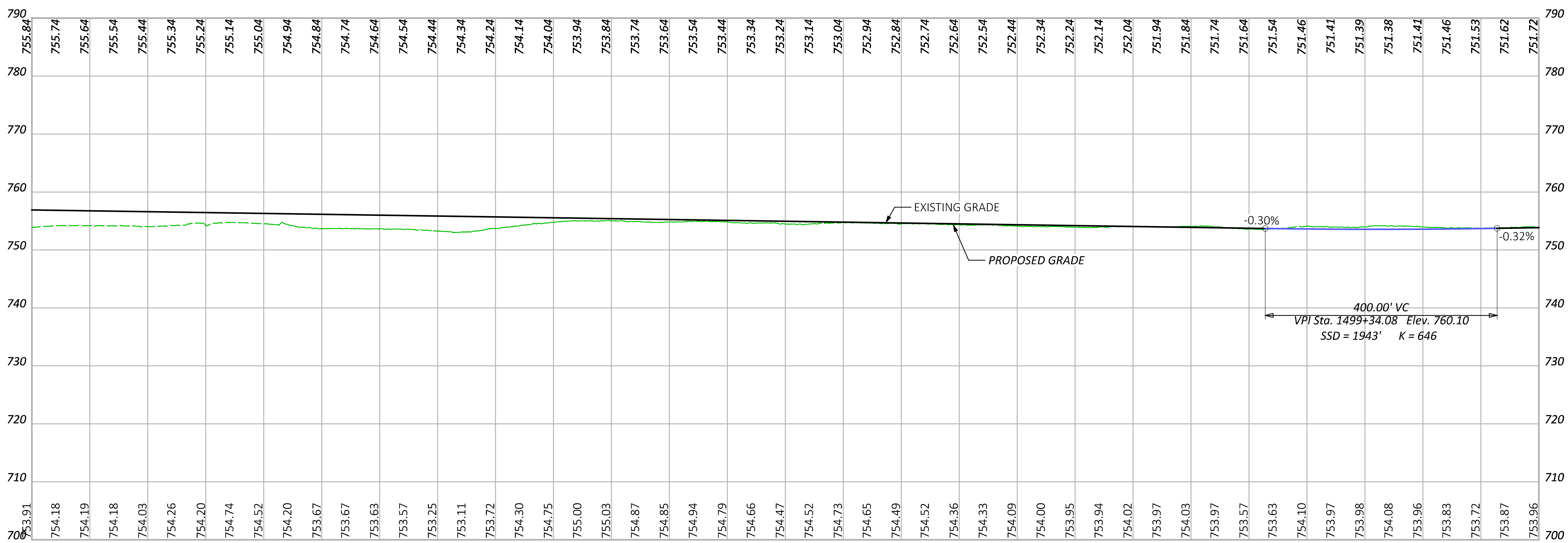
DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET P.0
TOTAL 0



HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1510+00 TO STA. 1523+00

DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 25 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:51:59 AM USER: jespelage
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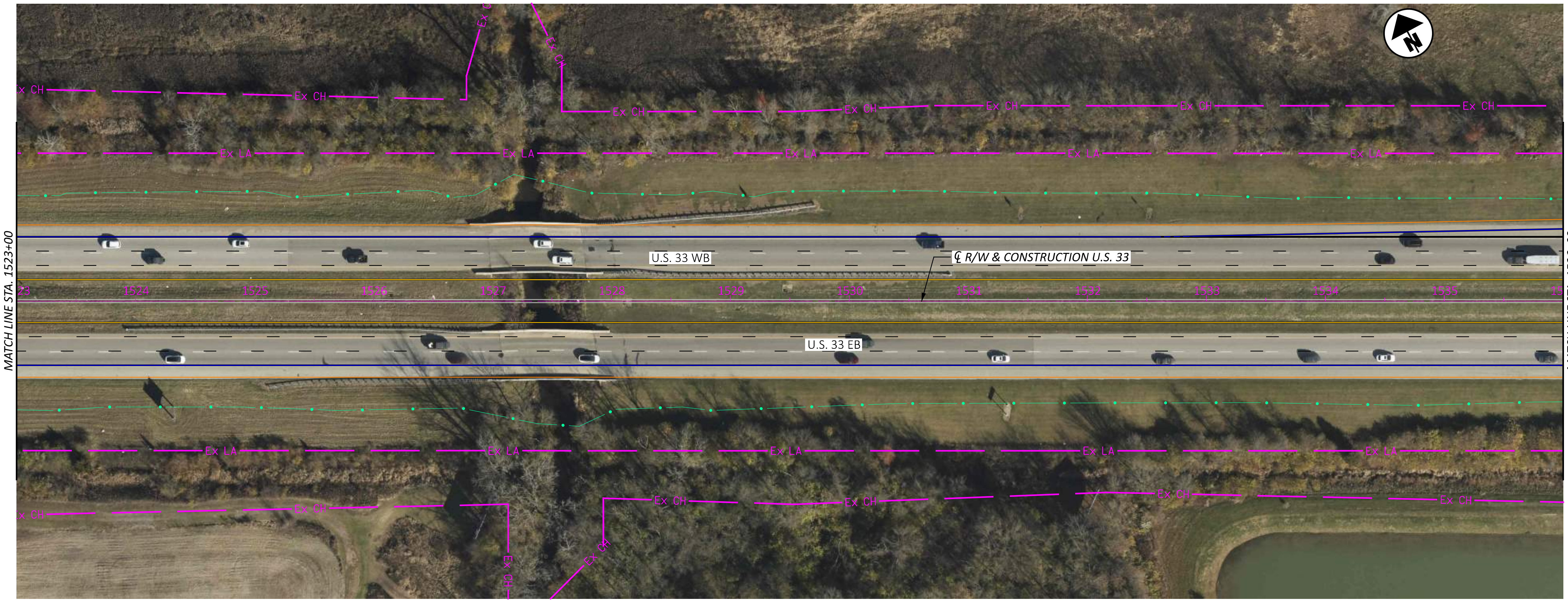

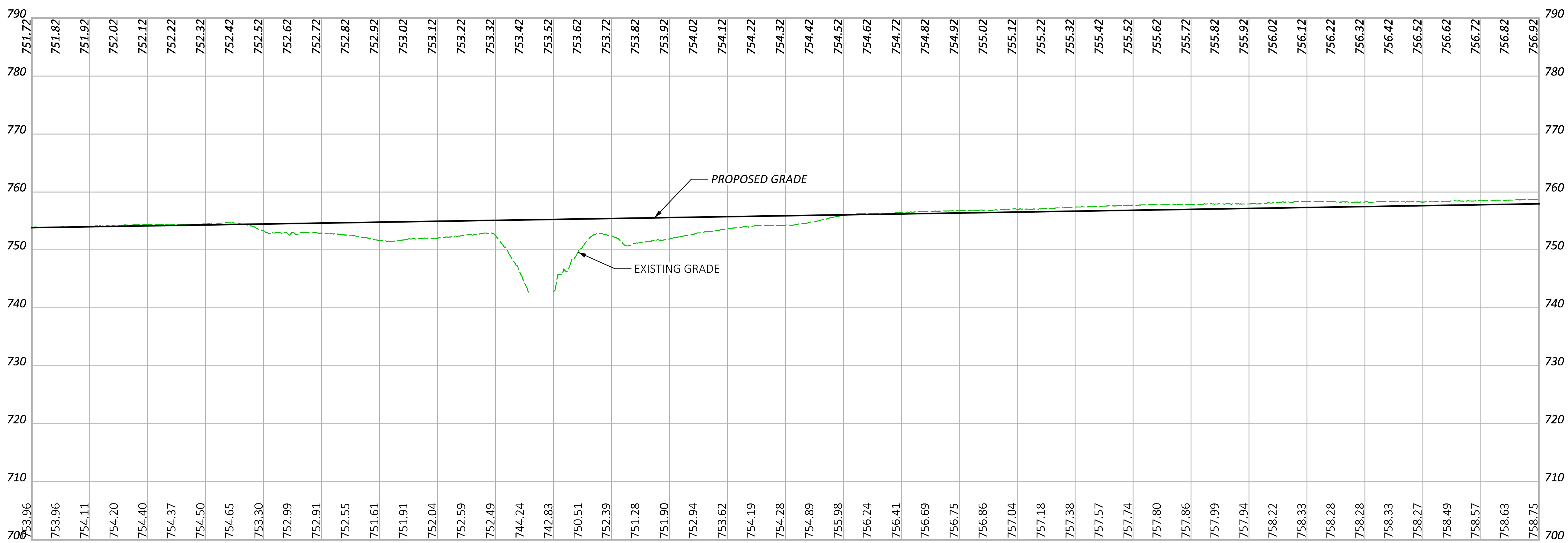

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1523+00 TO STA. 1536+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 26 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:53:43 AM USER: jespelage
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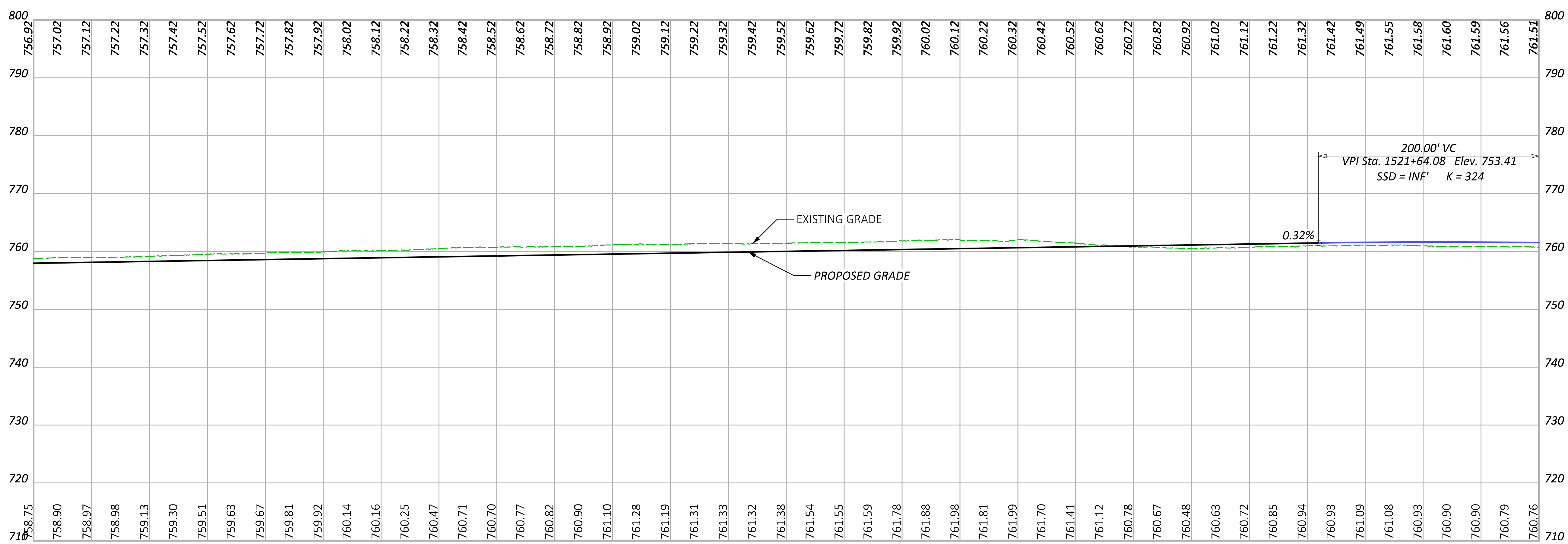

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 27 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:55:28 AM USER: jespelage
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HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1536+00 TO STA. 1549+00

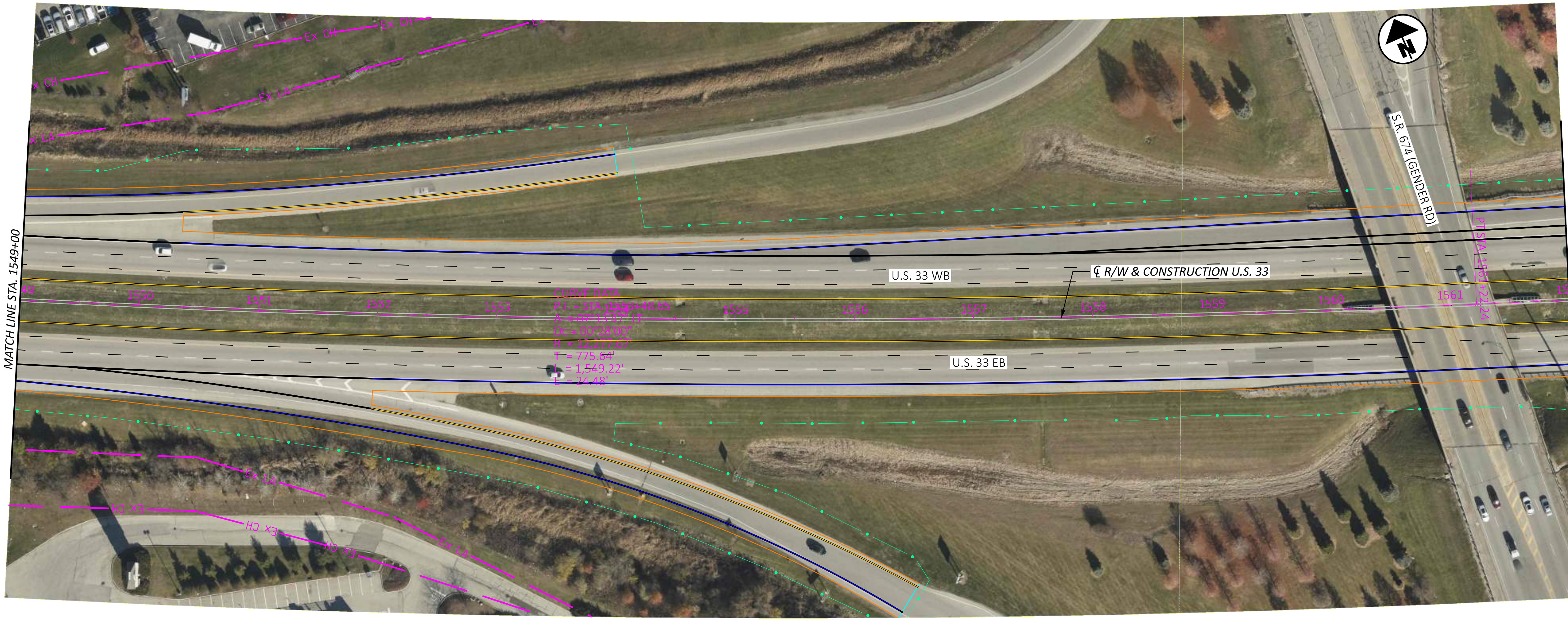
DESIGN AGENCY

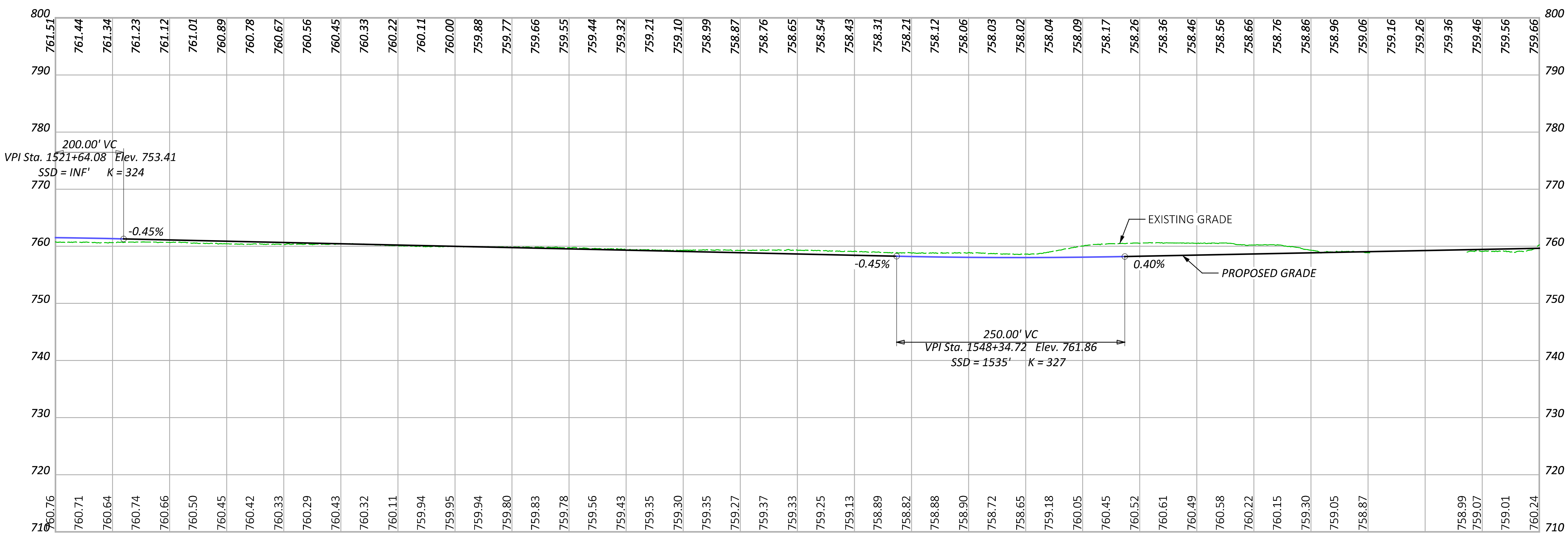
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0





HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1549+00 TO STA. 1562+00

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 28 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:57:13 AM USER: jespelage
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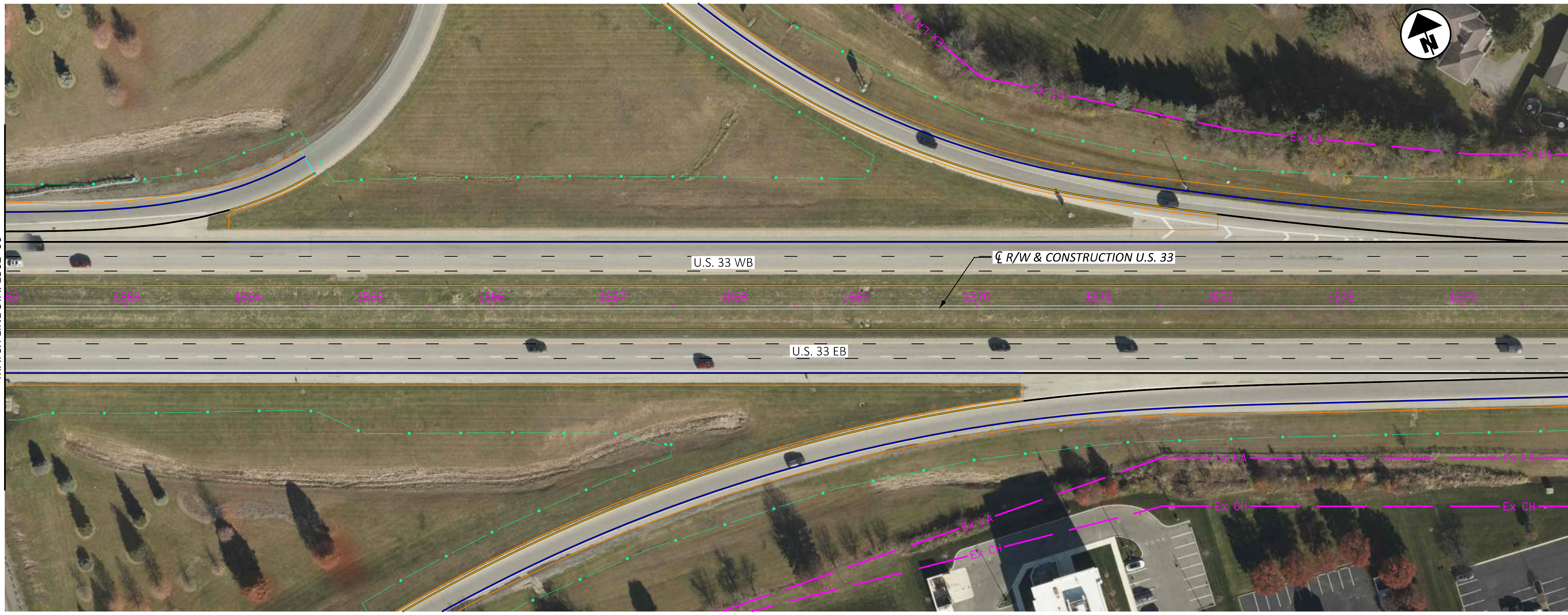
DESIGN AGENCY

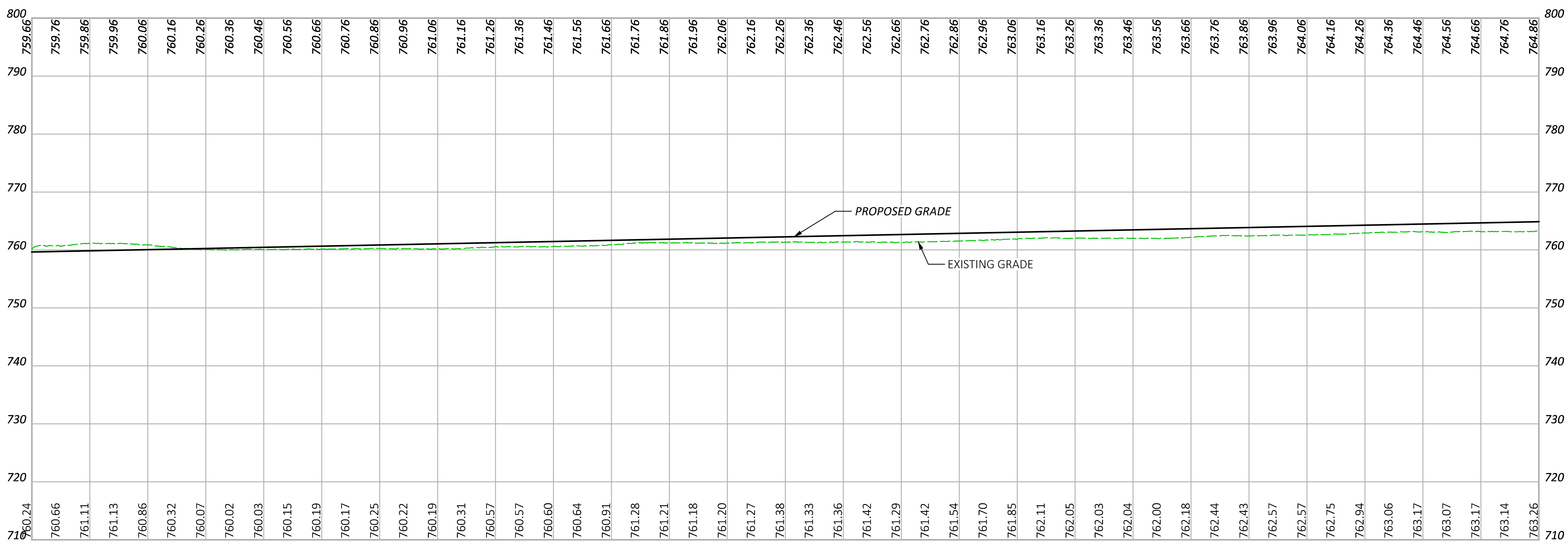
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0





HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1562+00 TO STA. 1575+00

DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 29 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 8:59:07 AM USER: jespelage
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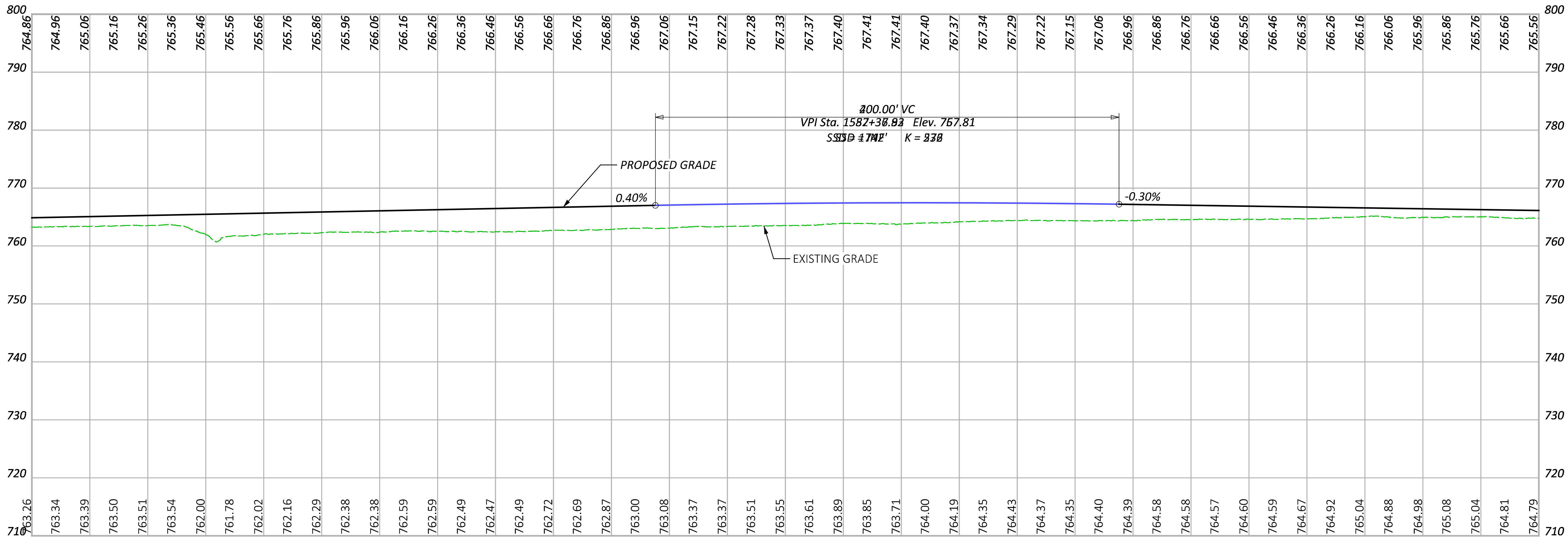
HORIZONTAL SCALE IN FEET
0 25 50 100



PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1575+00 TO STA. 1588+00

DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 30 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:00:55 AM USER: jespelage
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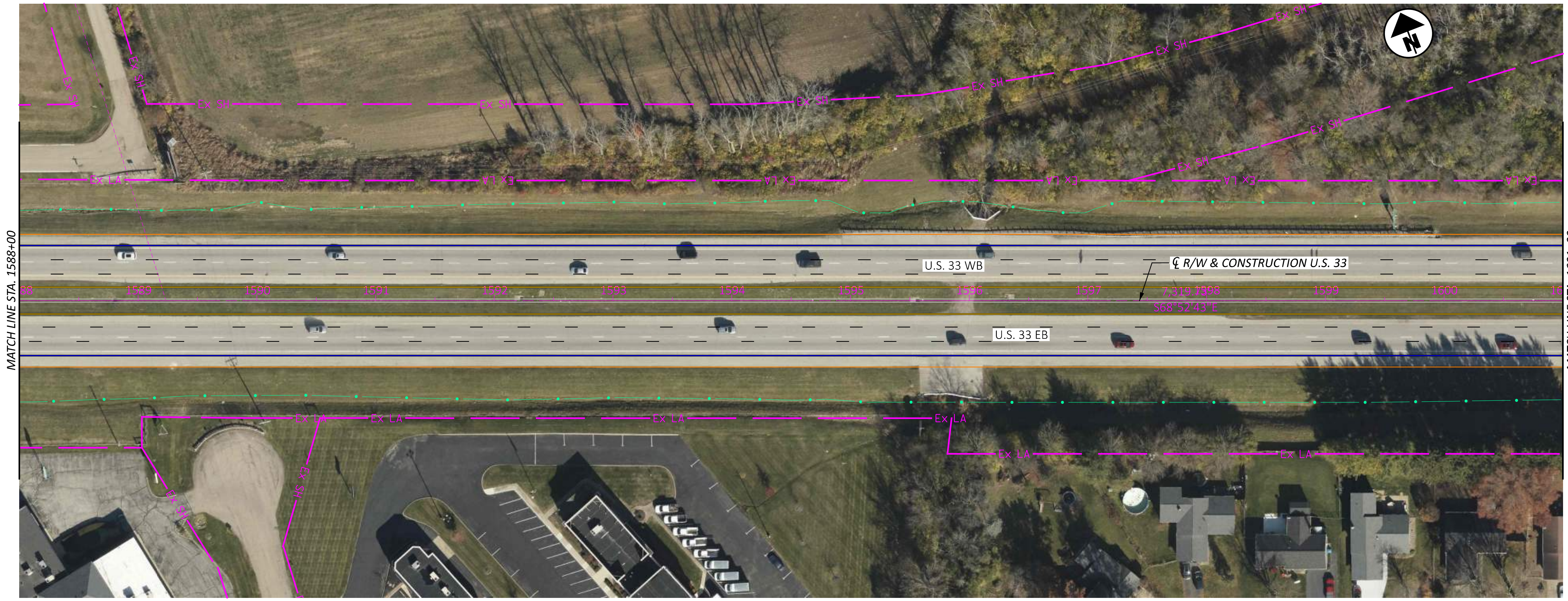

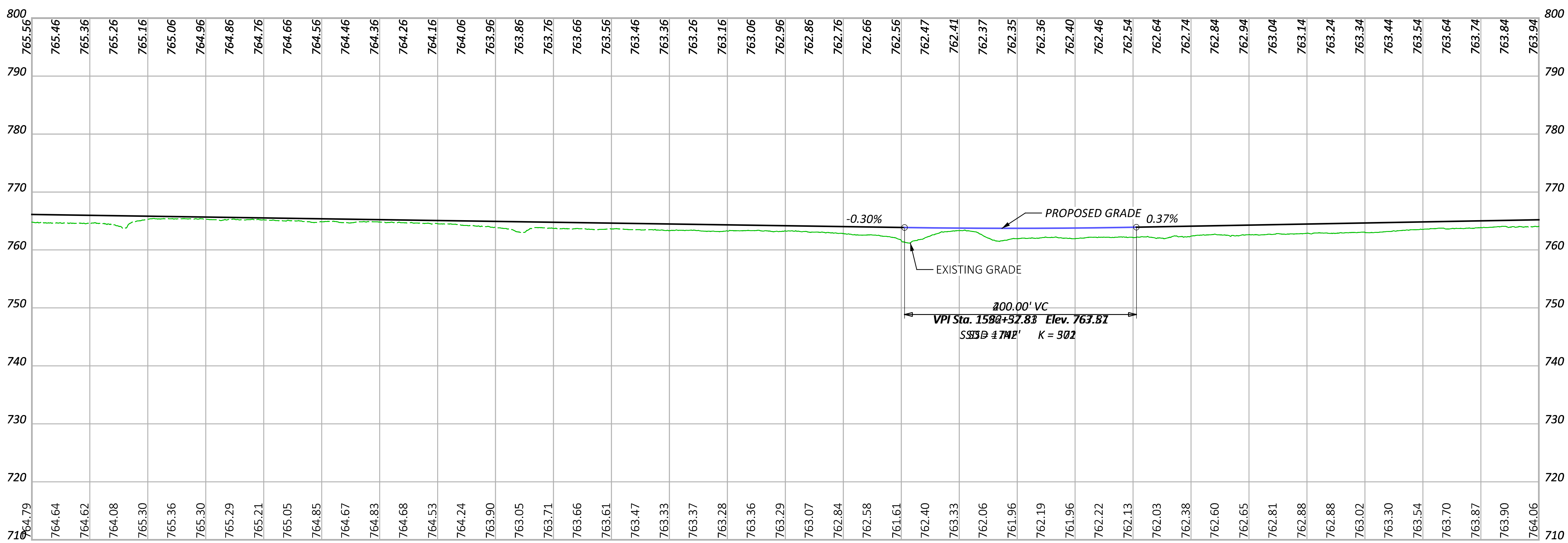

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1588+00 TO STA. 1601+00

DESIGN AGENCY

DESIGNER
XXX
REVIEWER
XXX MM-DD-YY
PROJECT ID
121811
SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 31 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:02:41 AM USER: jespelage
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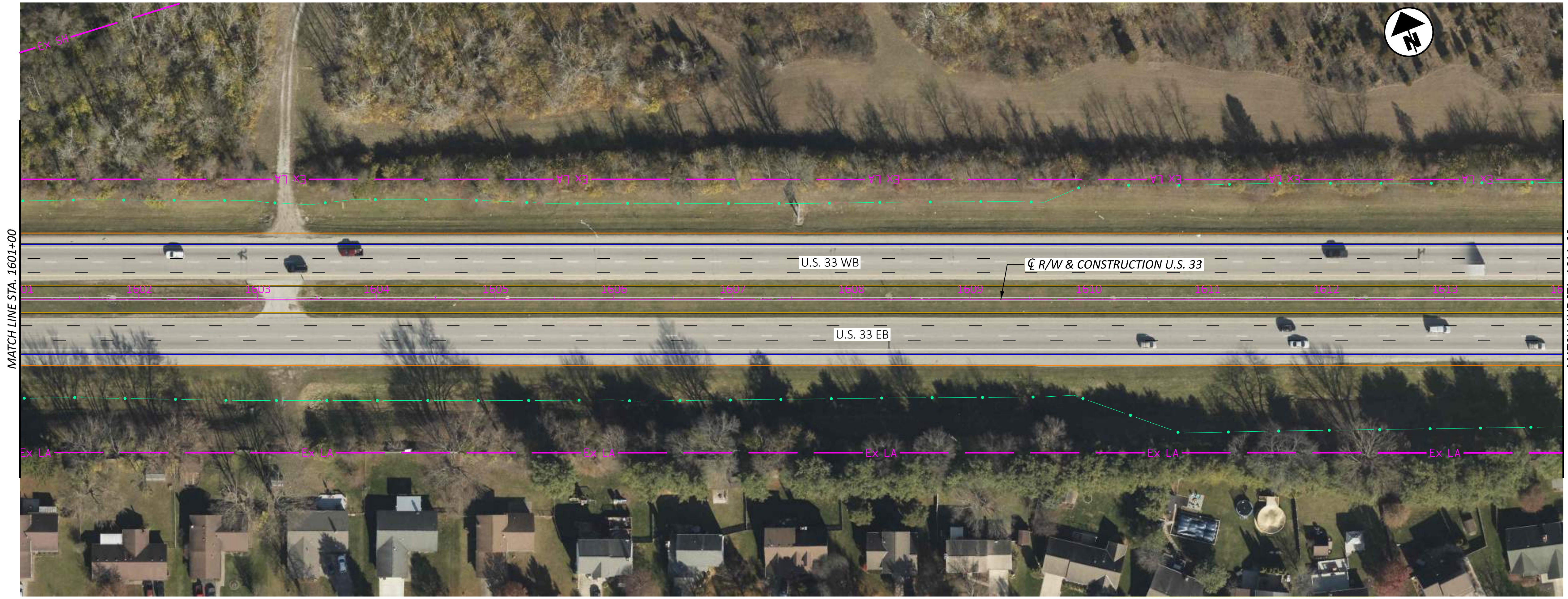

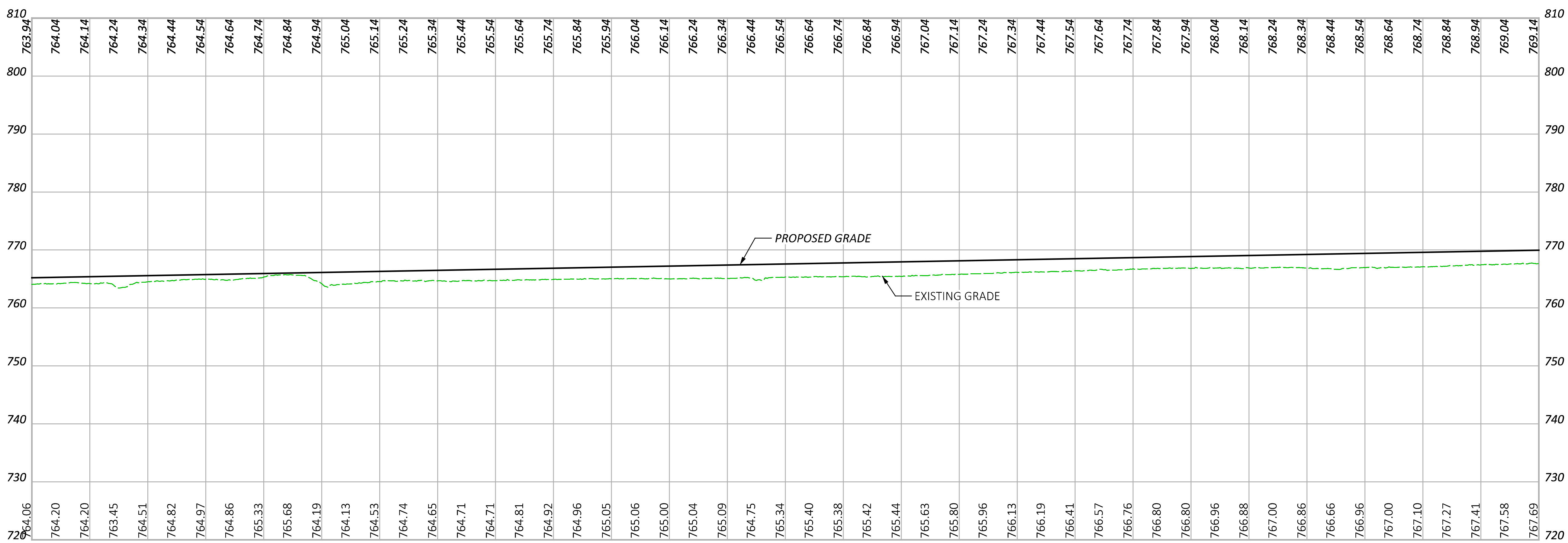

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1601+00 TO STA. 1614+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 32 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:04:22 AM USER: jespelage
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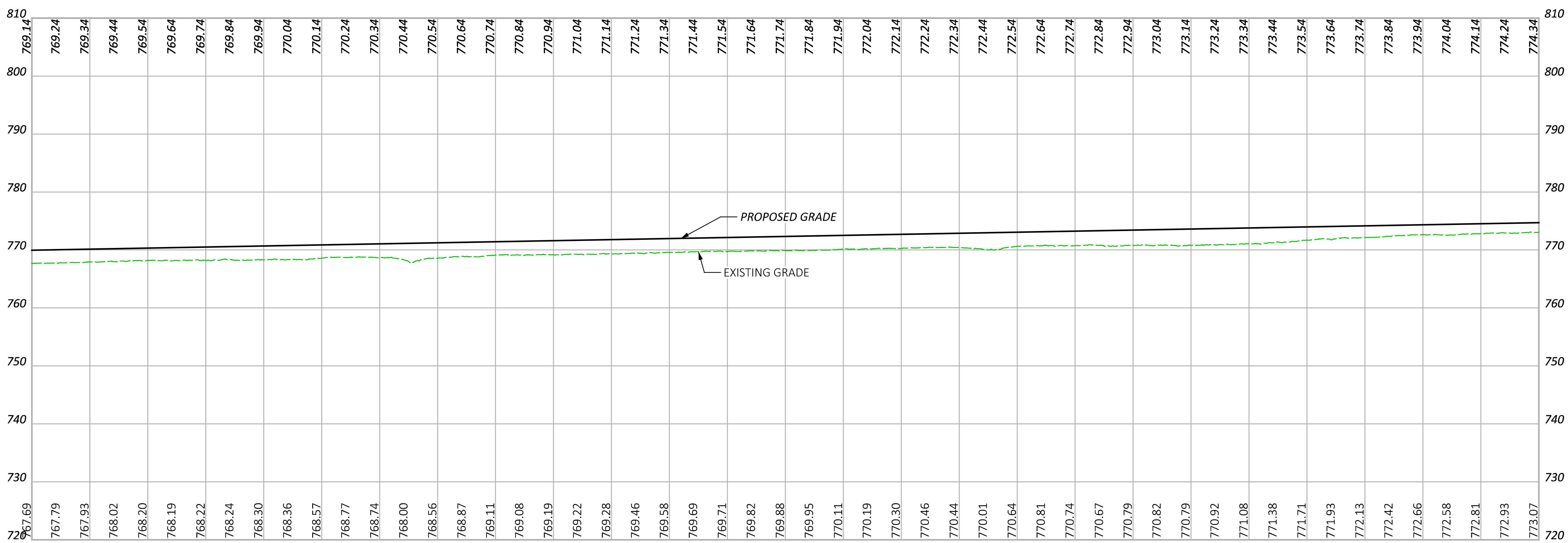

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1614+00 TO STA. 1627+00

DESIGN AGENCY
DESIGNER XXX
REVIEWER XXX MM-DD-YY
PROJECT ID 121811
SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 33 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:06:03 AM USER: jespelage
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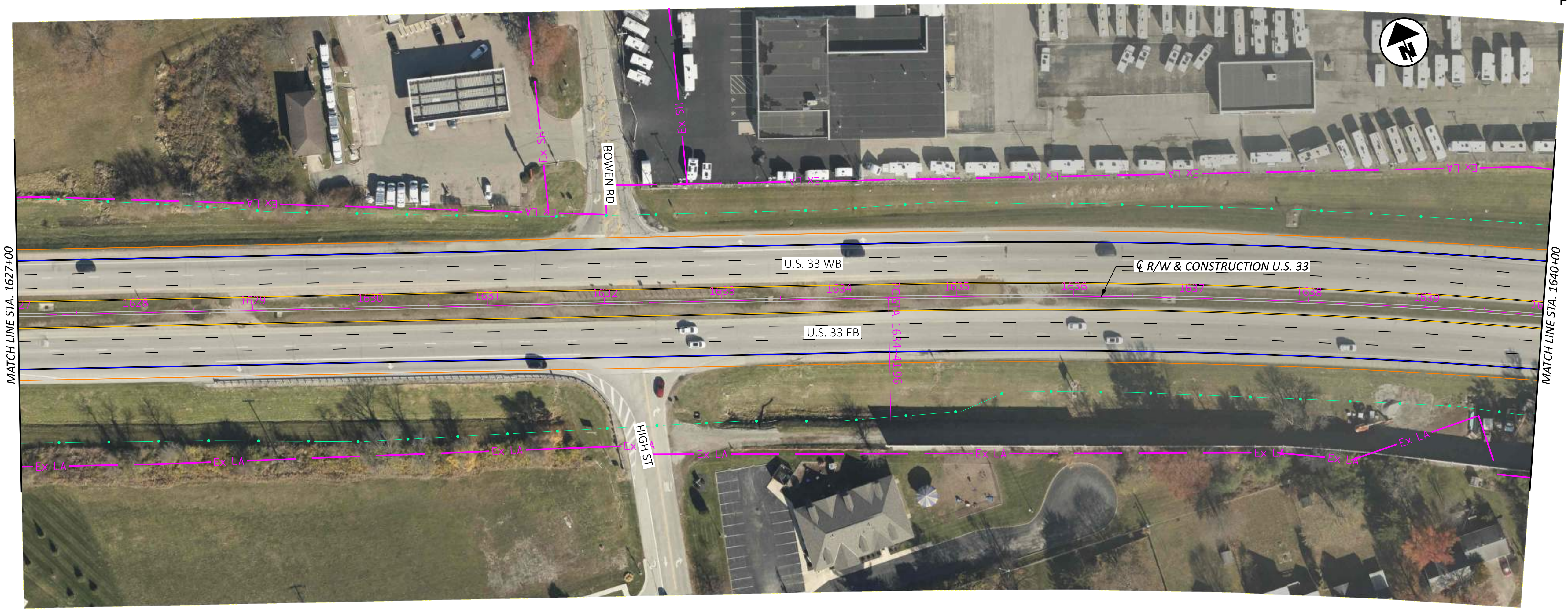
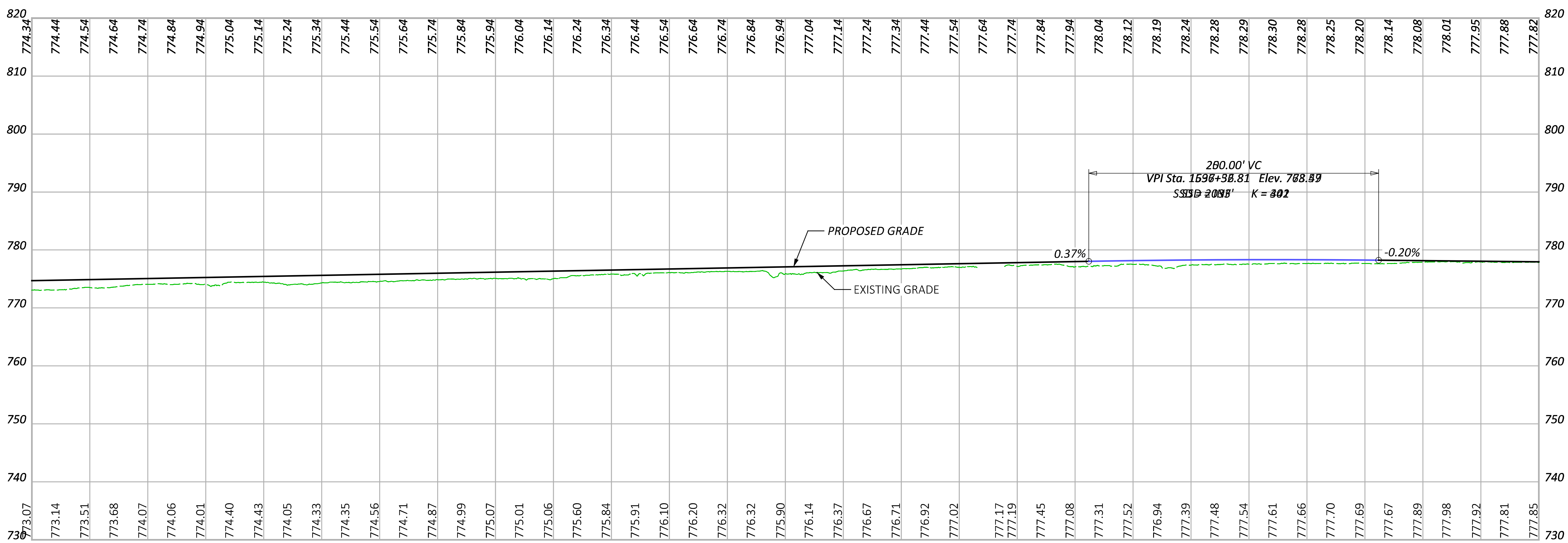
HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1627+00 TO STA. 1640+00





FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 34 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:07:50 AM USER: jespelage
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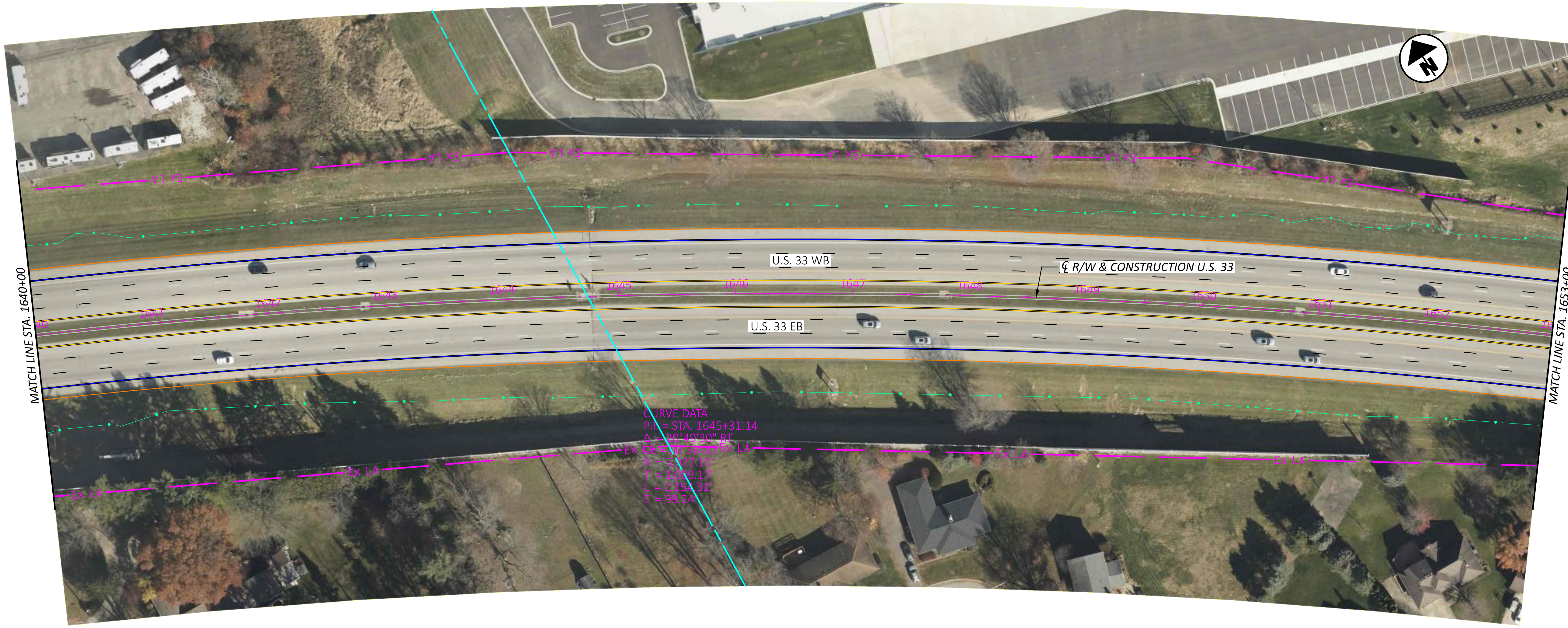
DESIGN AGENCY

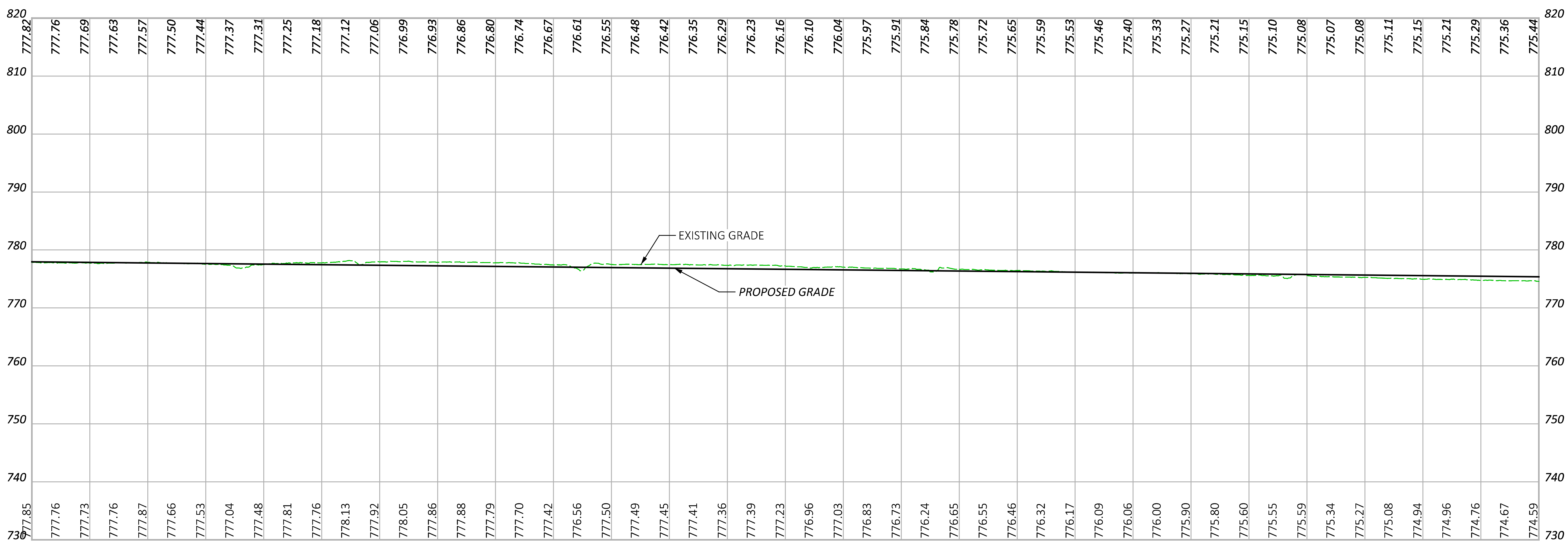
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0





HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1640+00 TO STA. 1653+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 35 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:09:35 AM USER: jespelage
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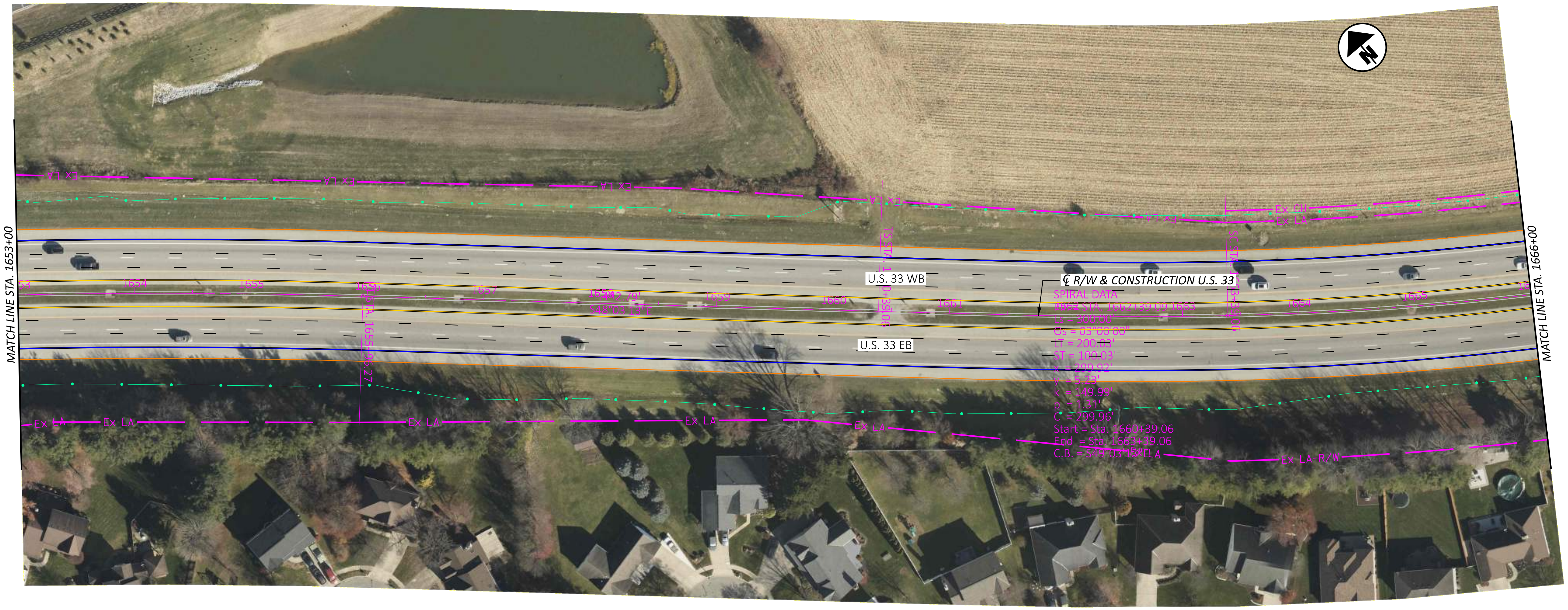

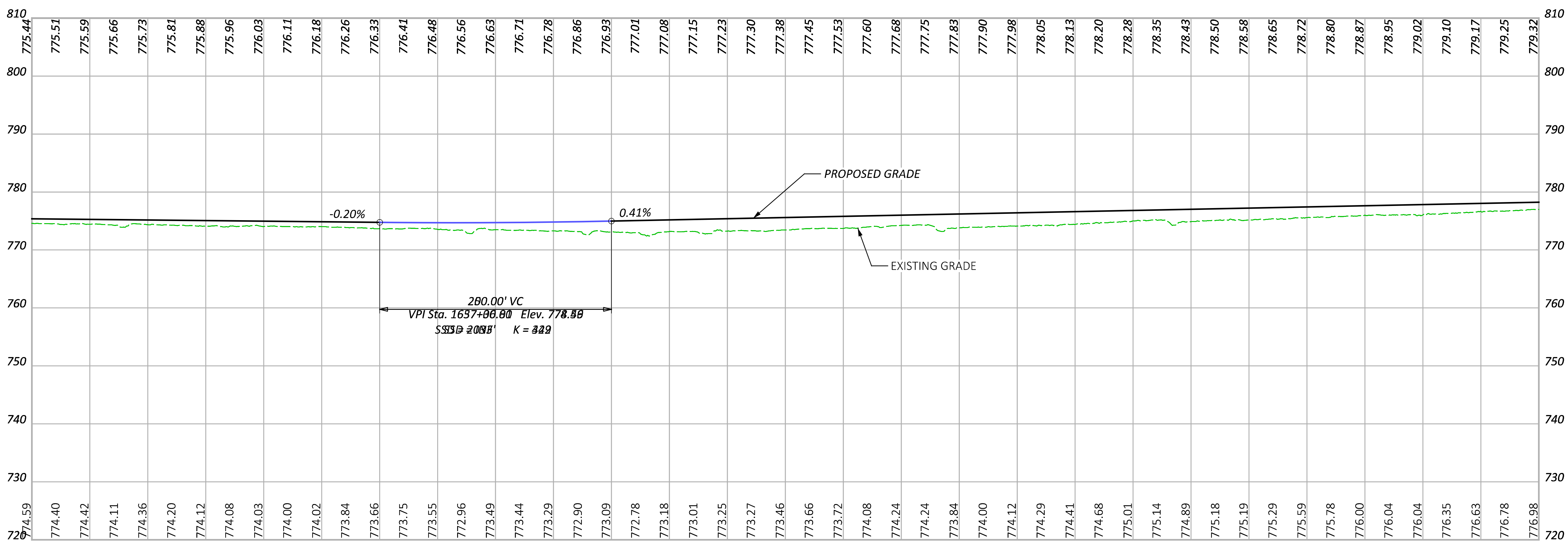

HORIZONTAL SCALE IN FEET
0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1653+00 TO STA. 1666+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 36 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:11:22 AM USER: jespelage
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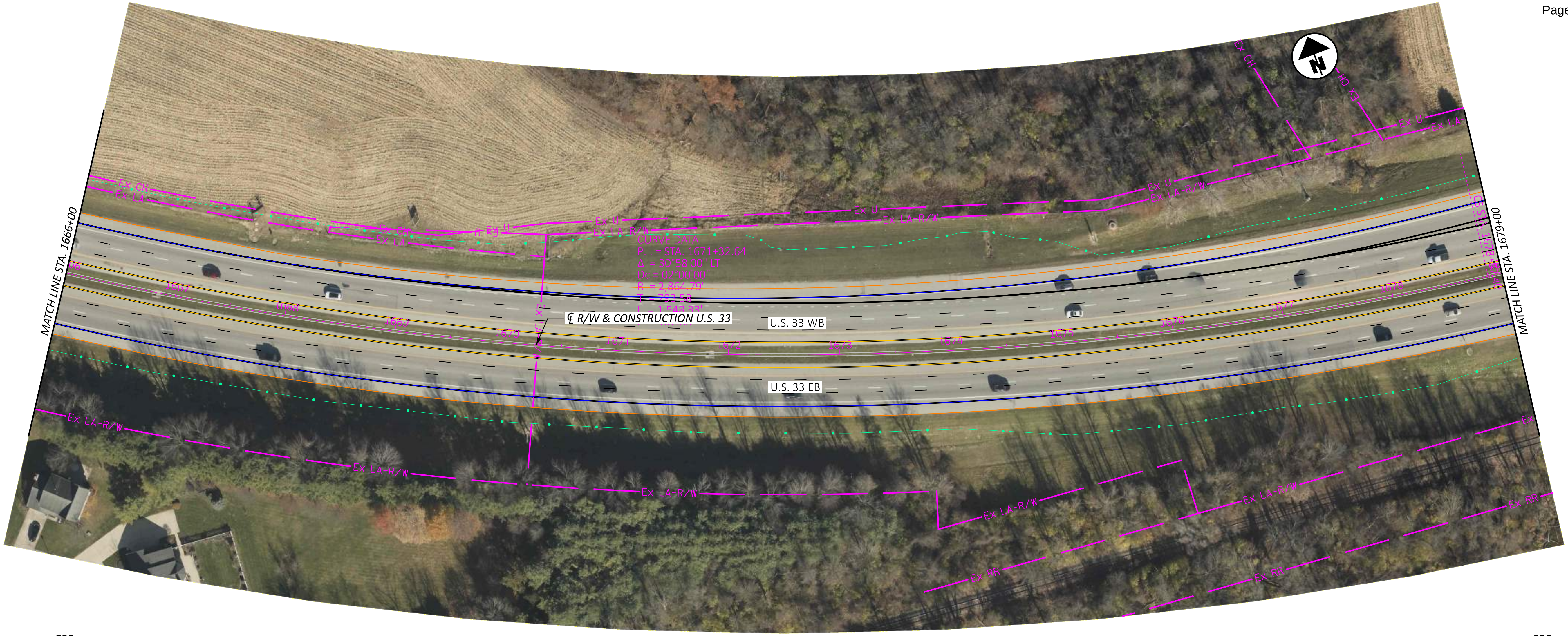
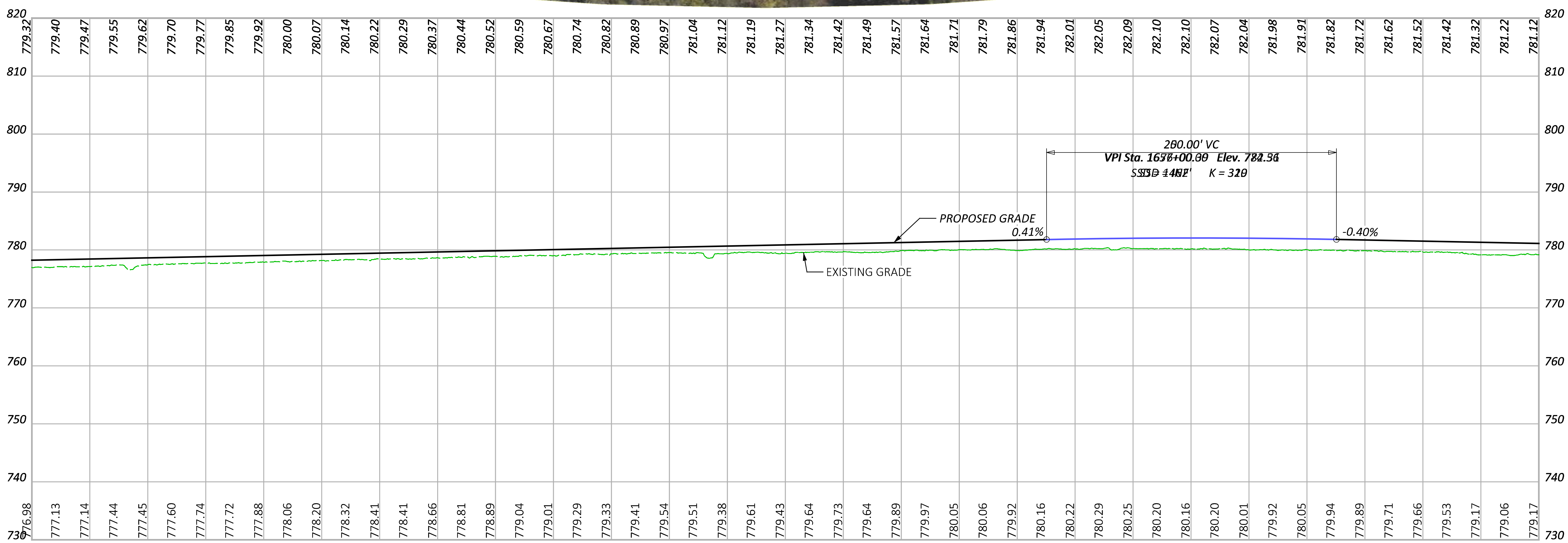
HORIZONTAL SCALE IN FEET
0 25 50 100





PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1666+00 TO STA. 1679+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 37 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:13:08 AM USER: jespelage
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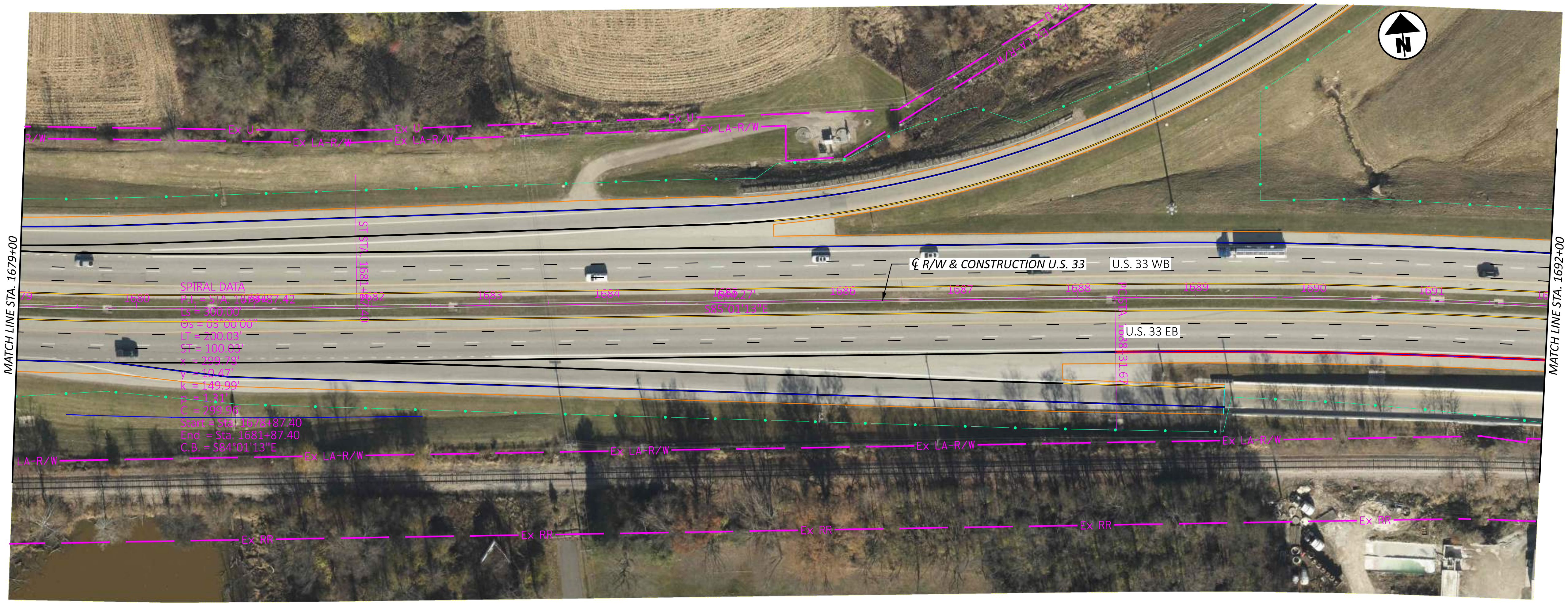

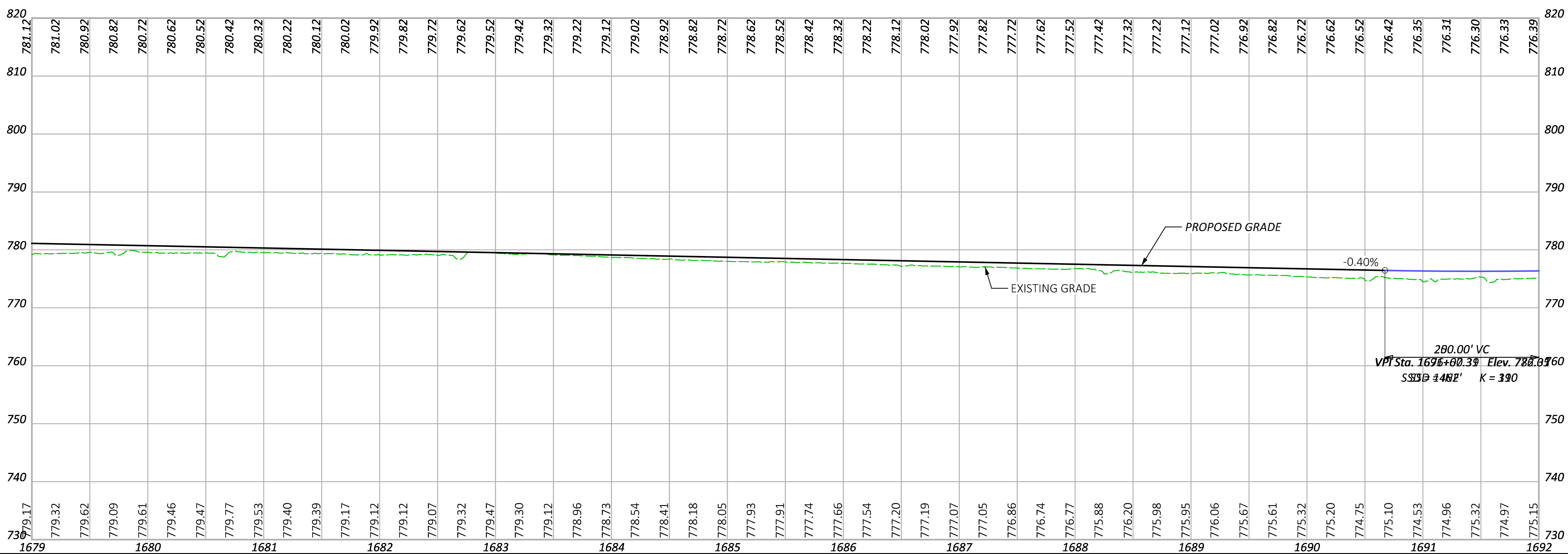

HORIZONTAL SCALE IN FEET

0 25 50 100

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1

STA. 1679+00 TO STA. 1692+00

DESIGN AGENCY

DESIGNER XXX

REVIEWER XXX MM-DD-YY

PROJECT ID 121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 38 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:14:53 AM USER: jespelage
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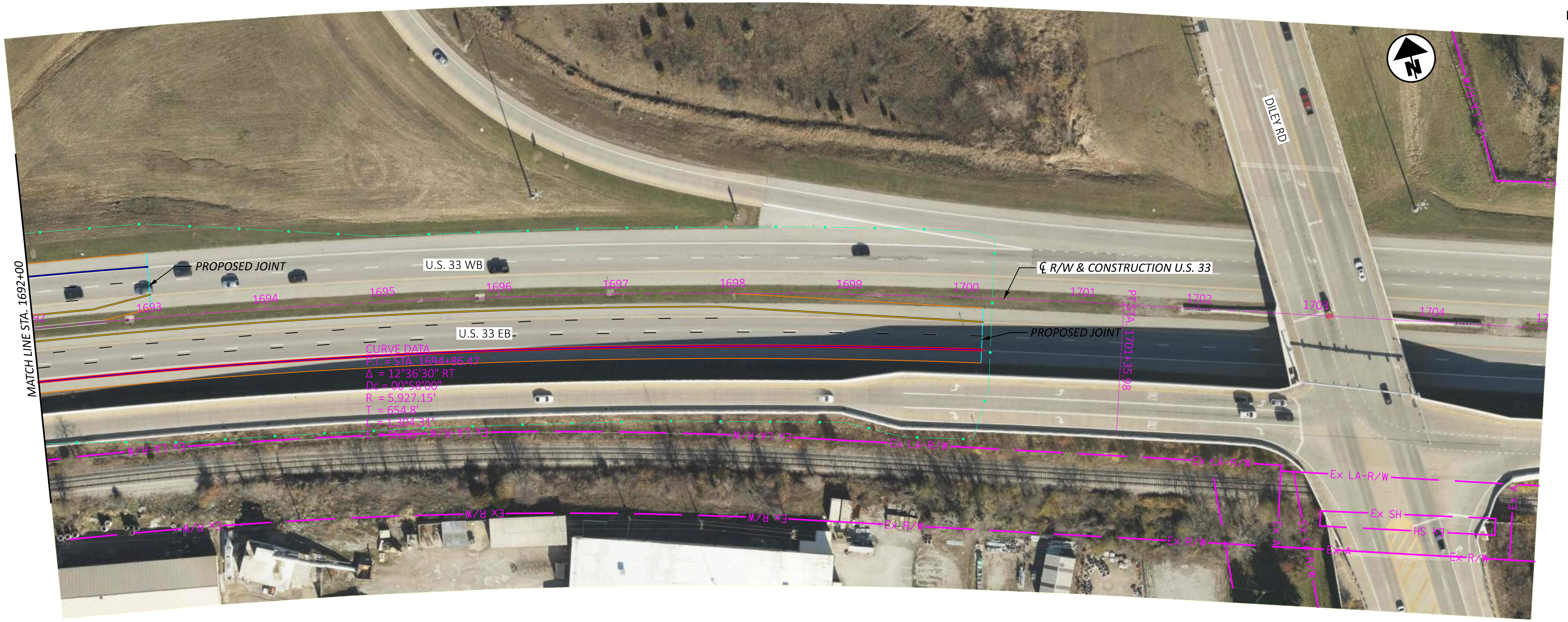

HORIZONTAL SCALE IN FEET
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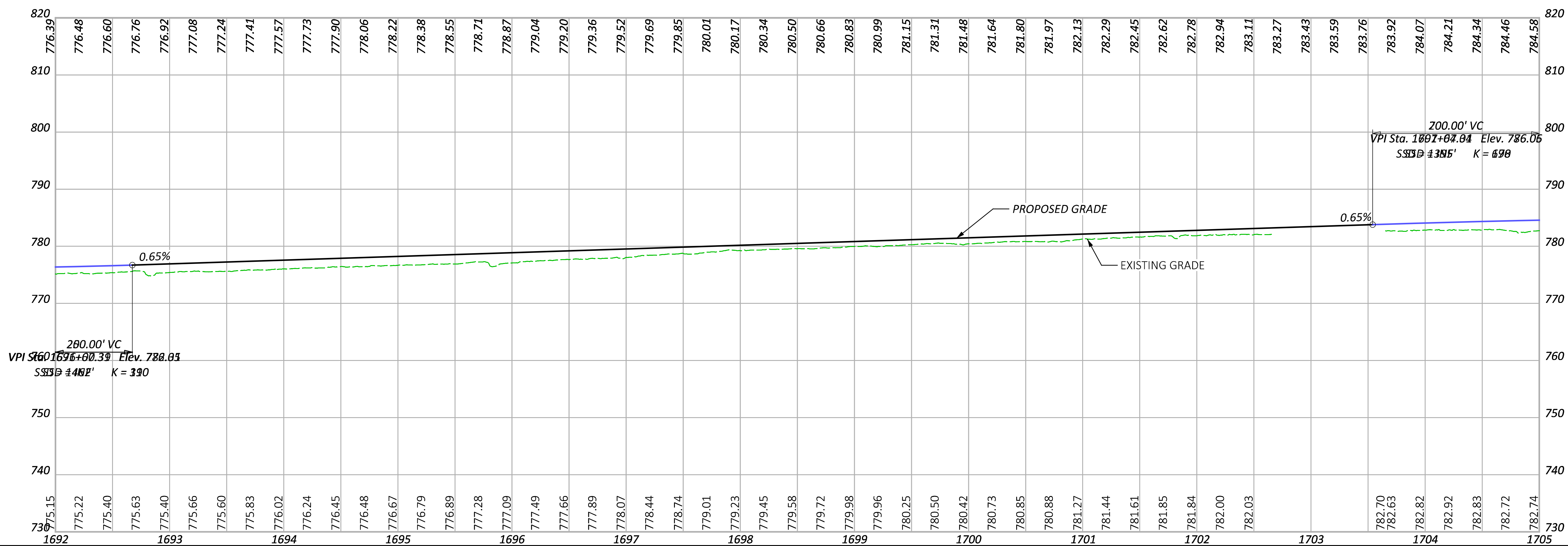

PLAN & PROFILE - U.S. 33, ALTERNATIVE 1
STA. 1692+00 TO STA. 1705+00

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33 - Plan 39 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:16:36 AM USER: jespelage
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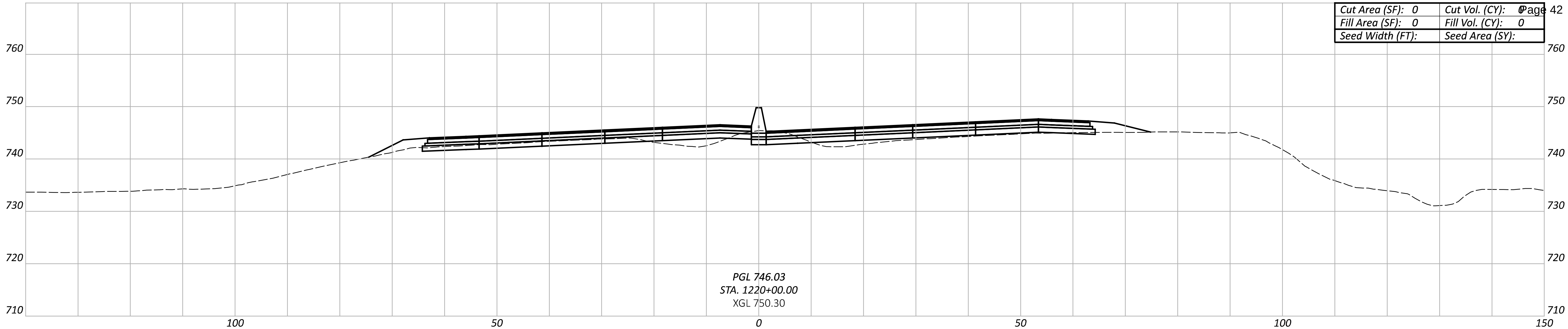
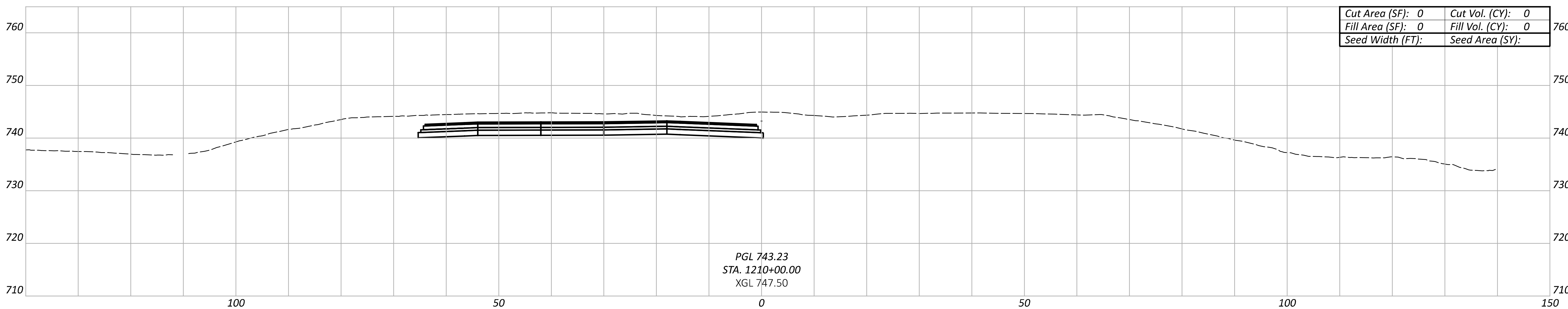
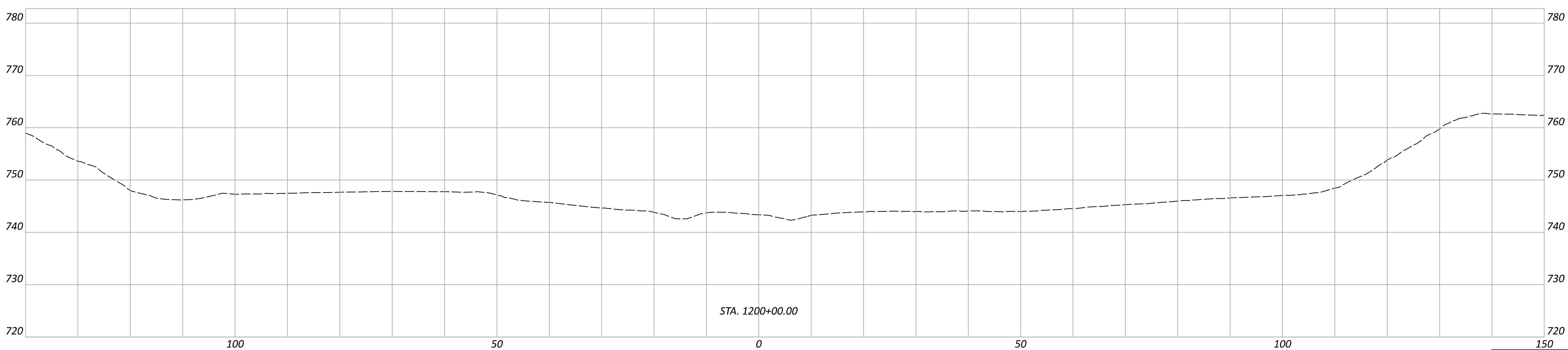






CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33_5 - 1200+00.00 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:18:27 AM USER: jespelage
pw:\\ohiodot-pw.bentley.com:ohiodot-pw-02\Documents\01 Active Projects\District 06\Franklin\119387\401-Engineering_LJB\Roadway\Sheets\119387_XS001.dgn

Sheet Totals		
Seeding	Cut	Fill

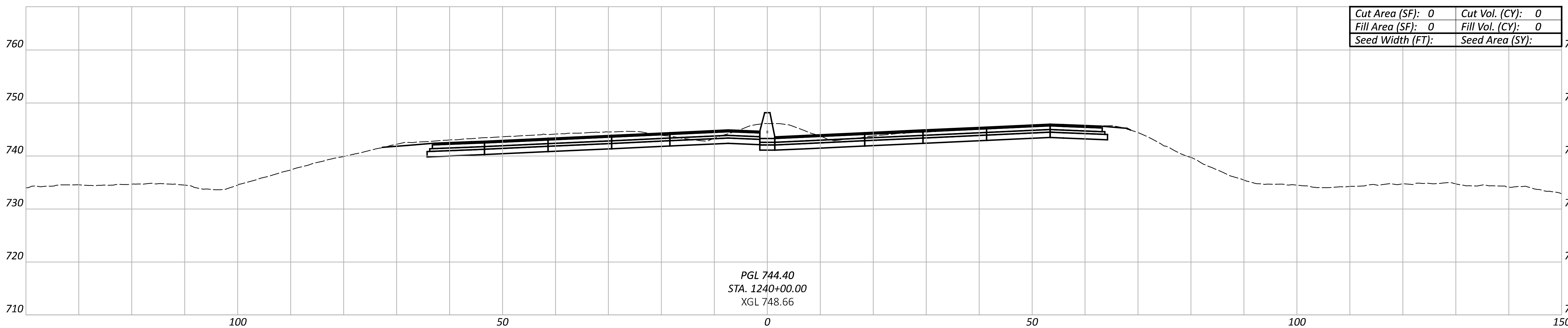
DESIGN AGENCY

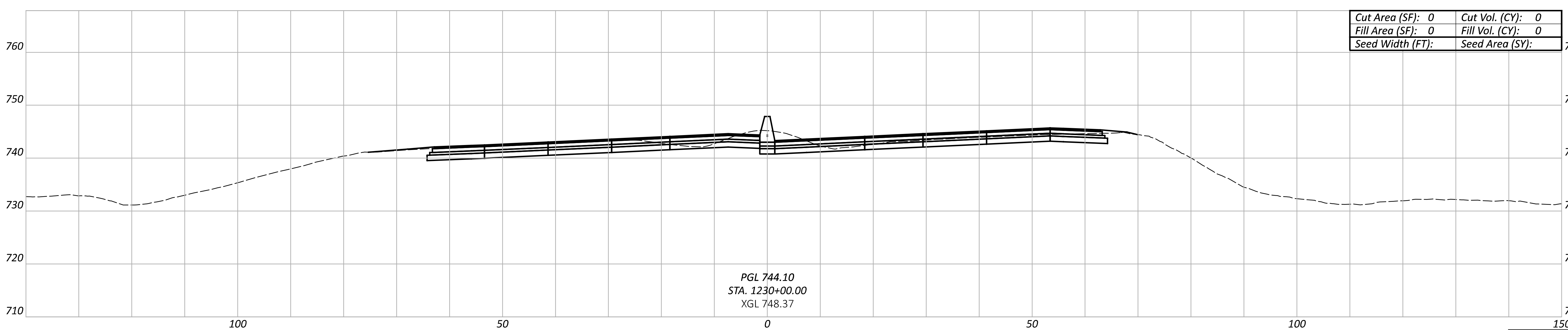
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0





Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33_5 - 1230+00.00 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:18:38 AM USER: jespelage
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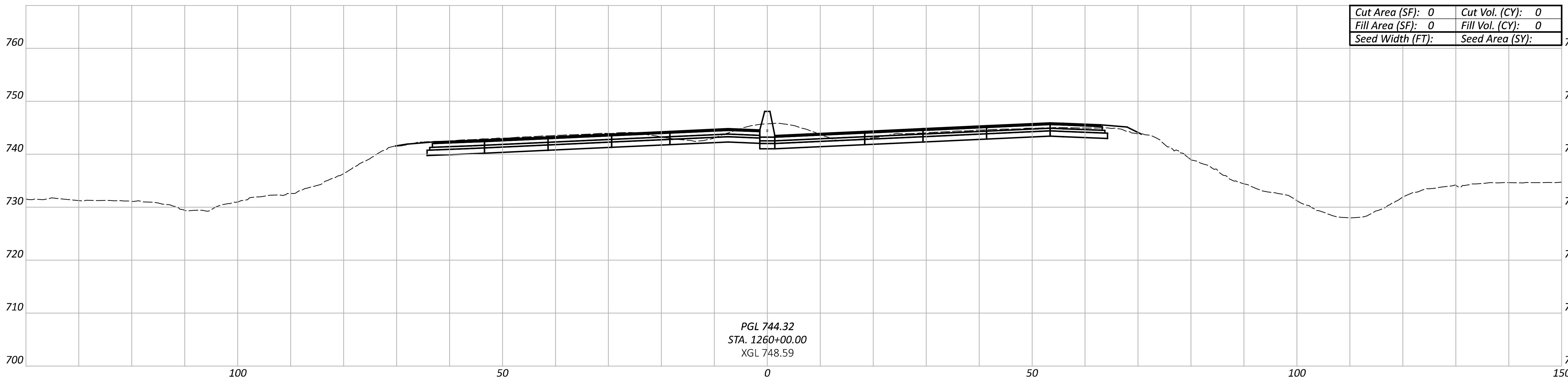
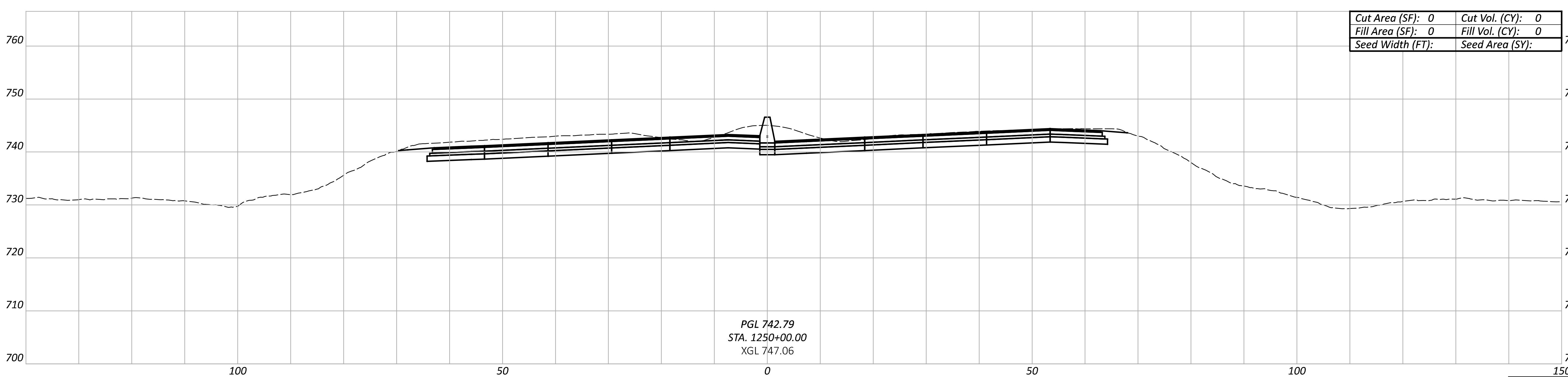
CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY





Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33_5 - 1250+00.00 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:18:46 AM USER: jespelage
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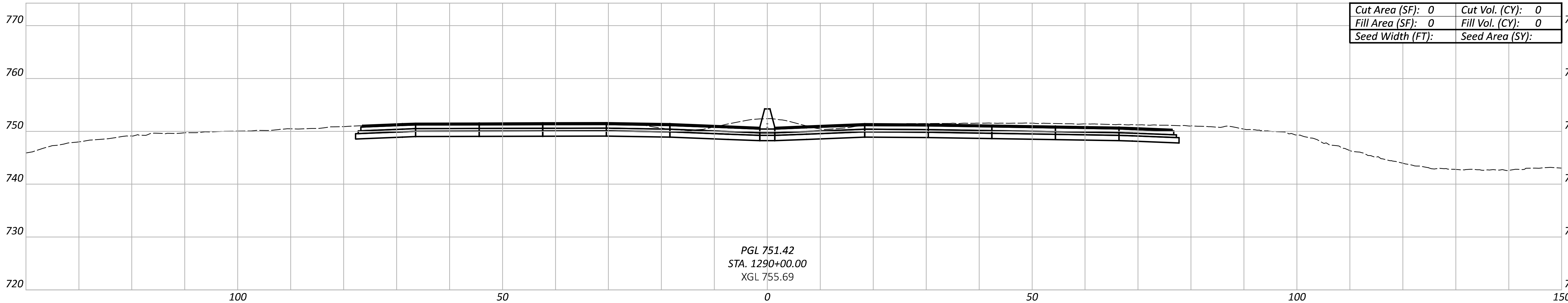

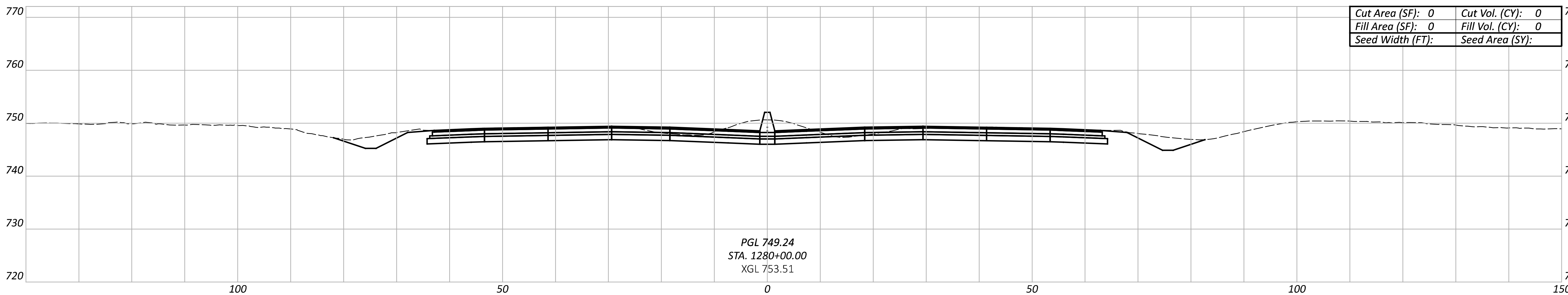

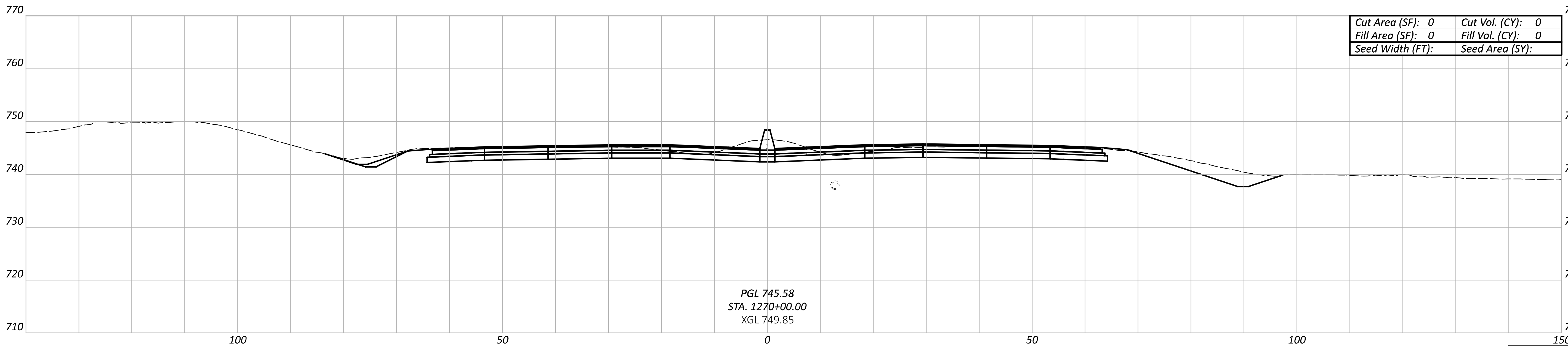

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

MODEL: CLX_RW_US33_5 - 1270+00.00 PAPERSIZE: 17x11 (in.) DATE: 9/23/2024 TIME: 9:18:54 AM USER: jespelage
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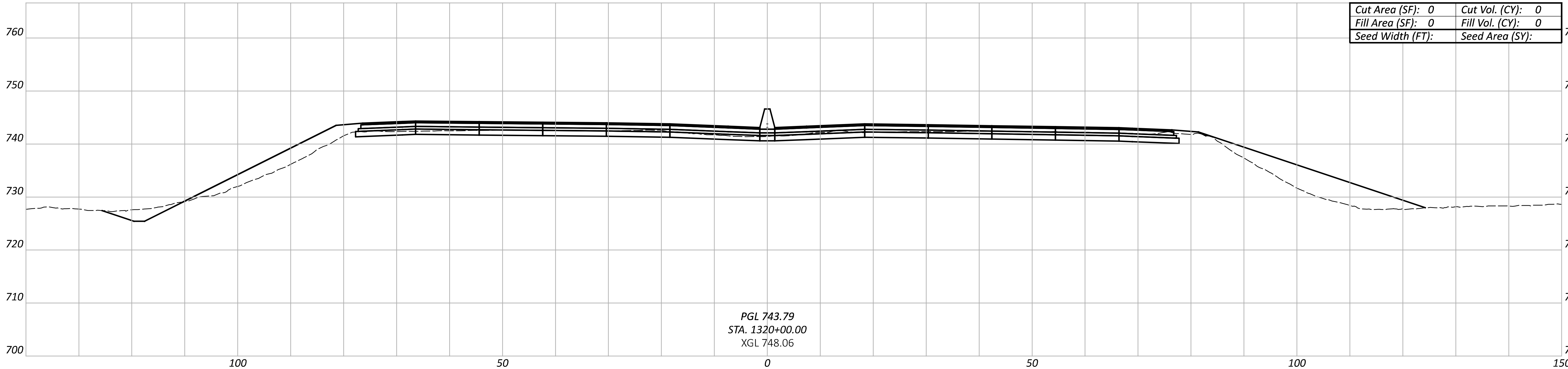

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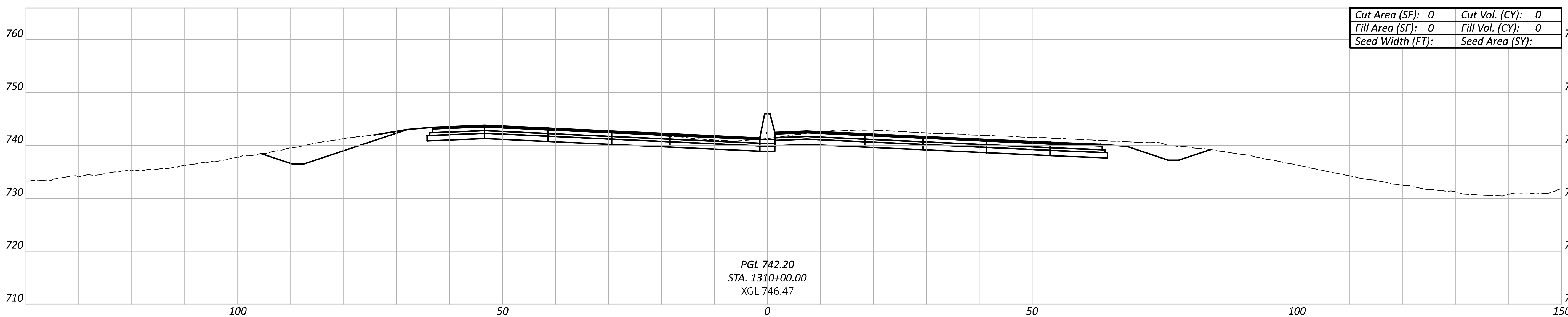

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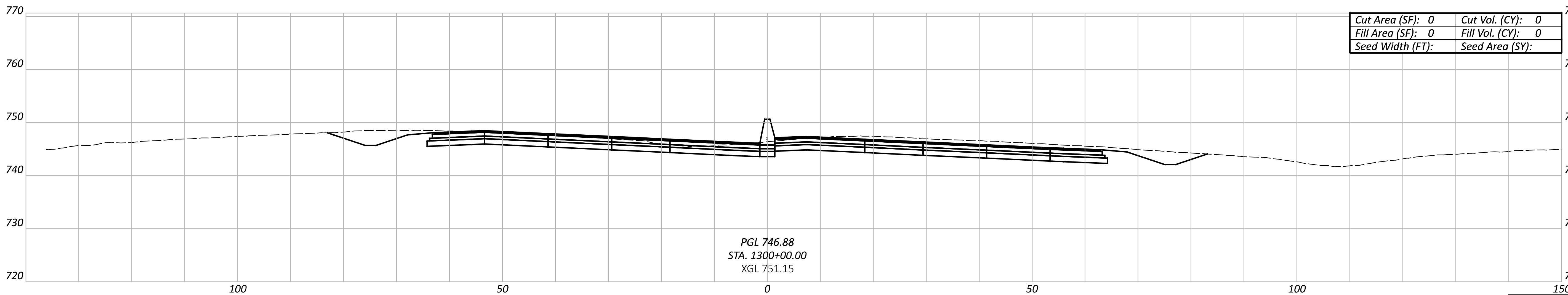

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Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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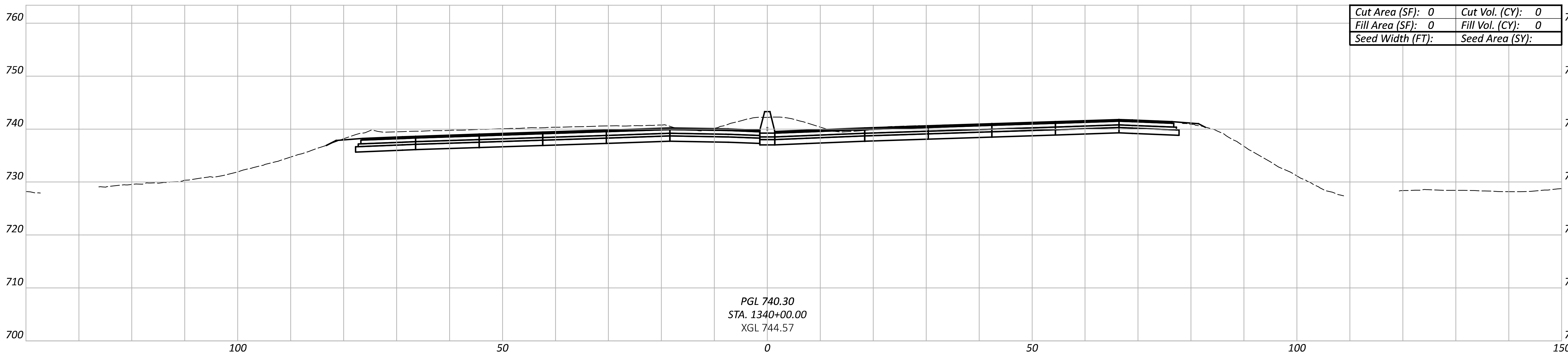

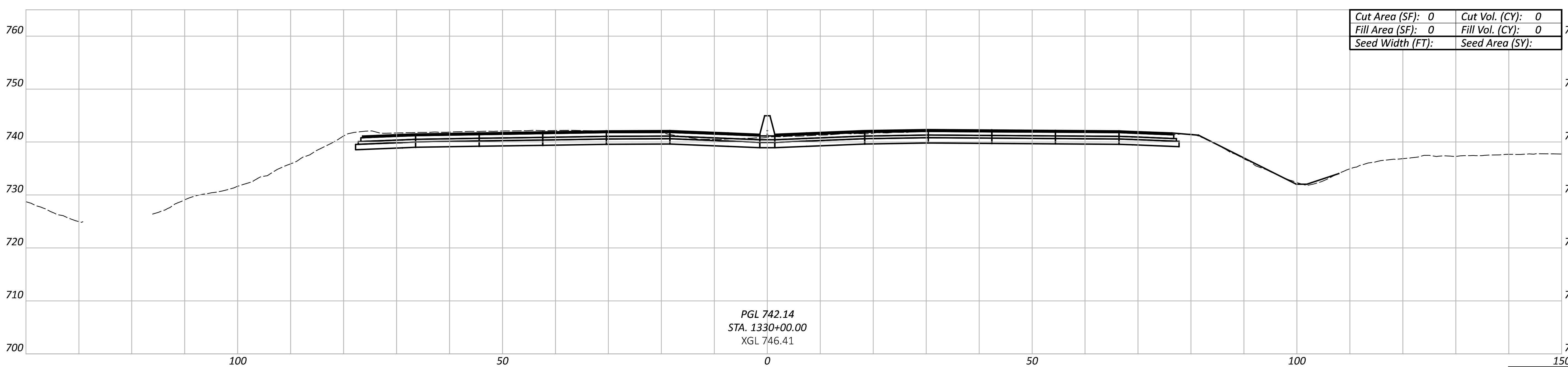

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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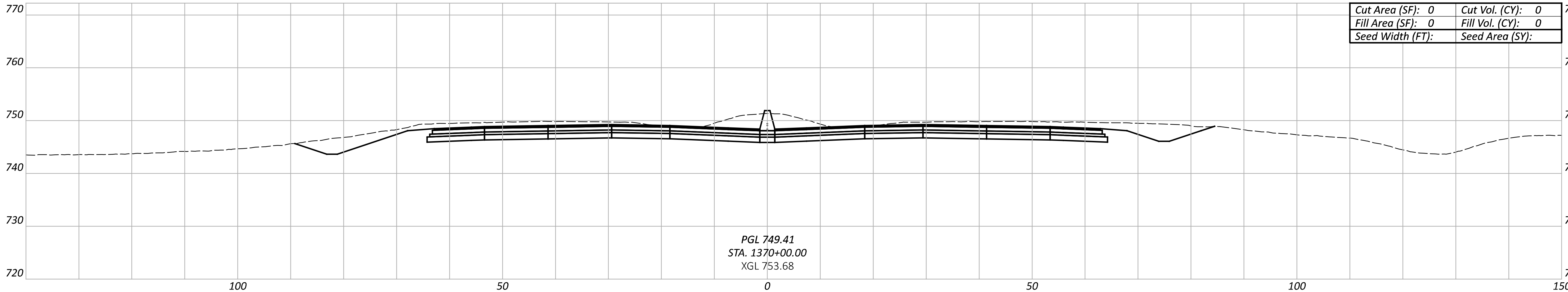

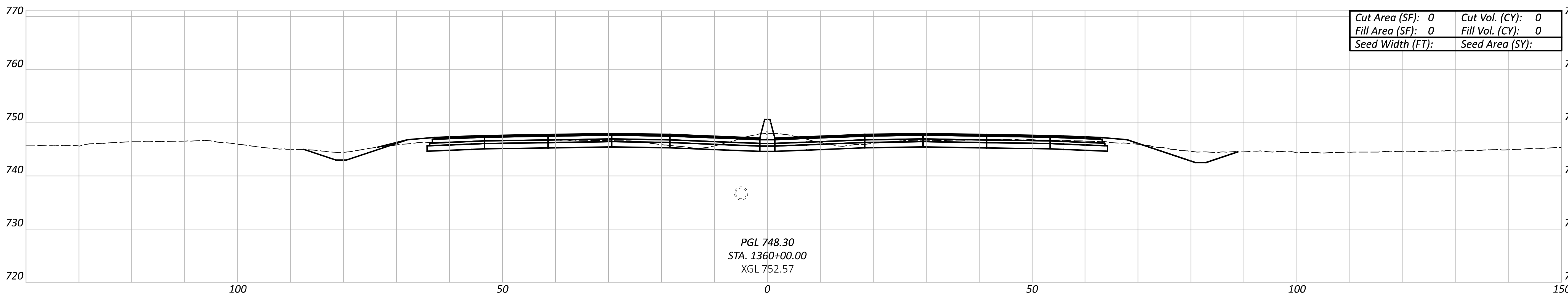

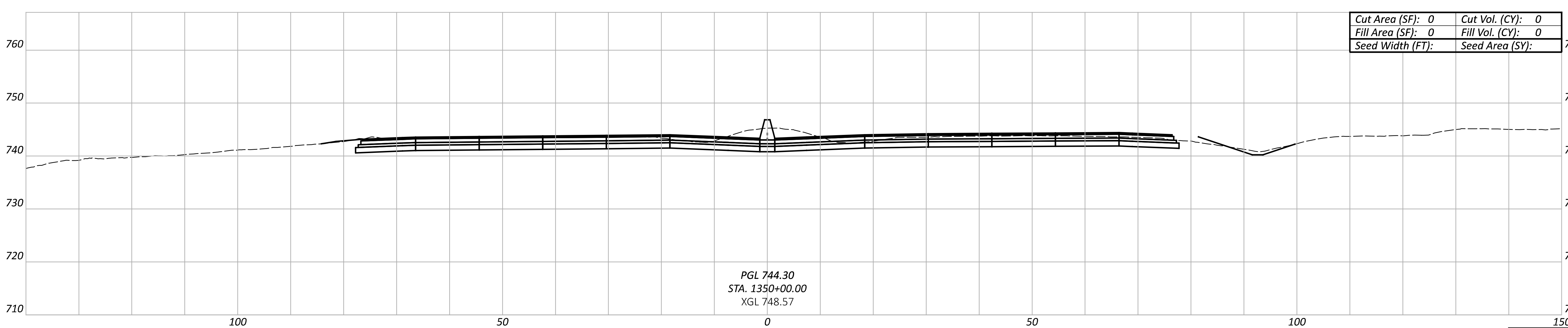

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0

FRA/FAI-33-22.99/0.00

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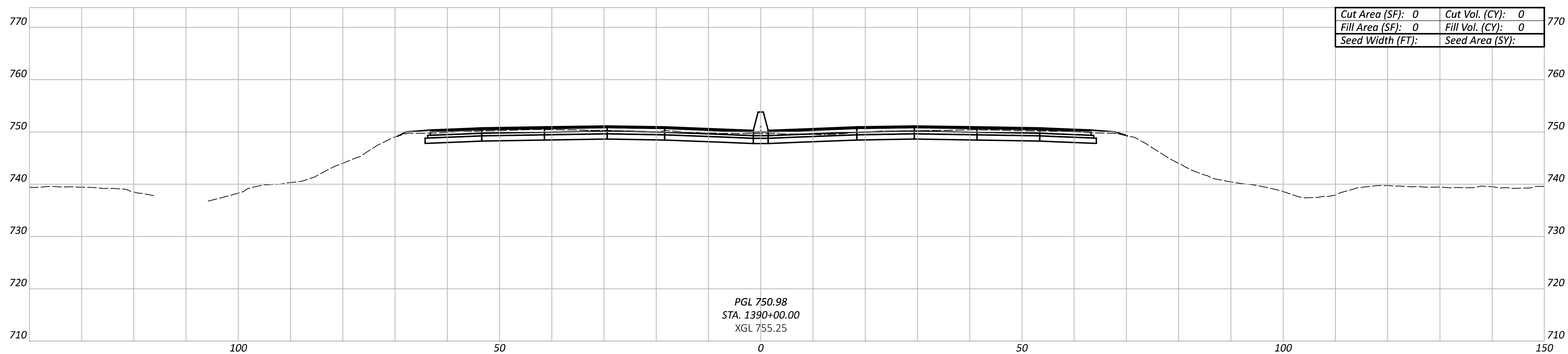

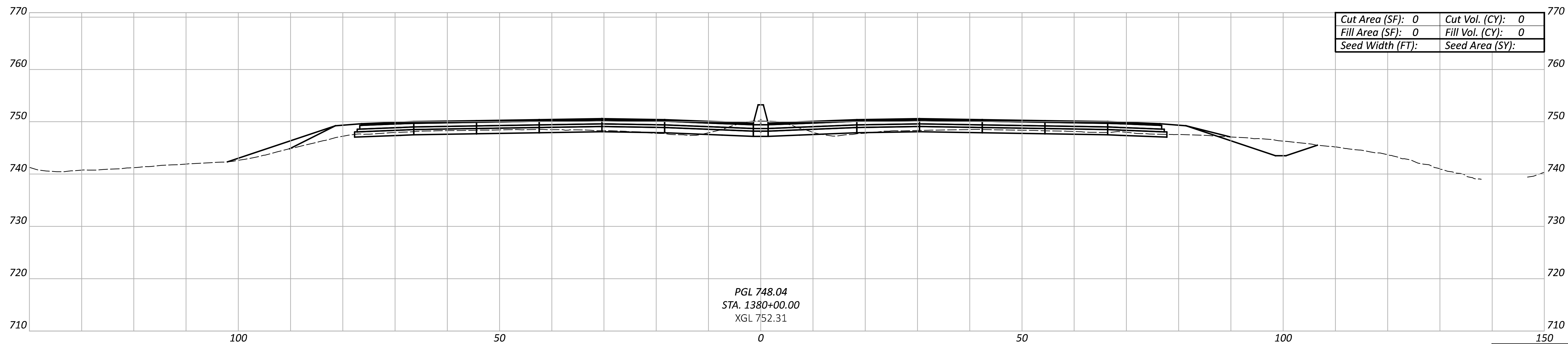

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
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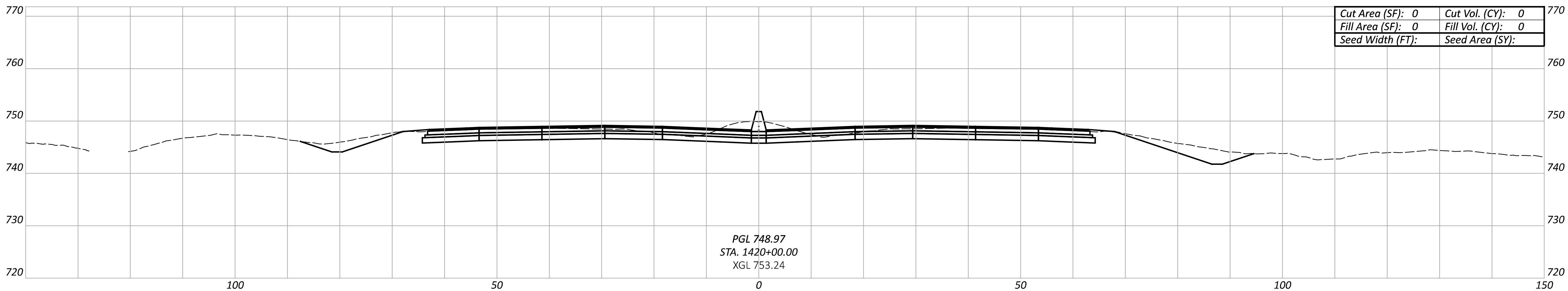

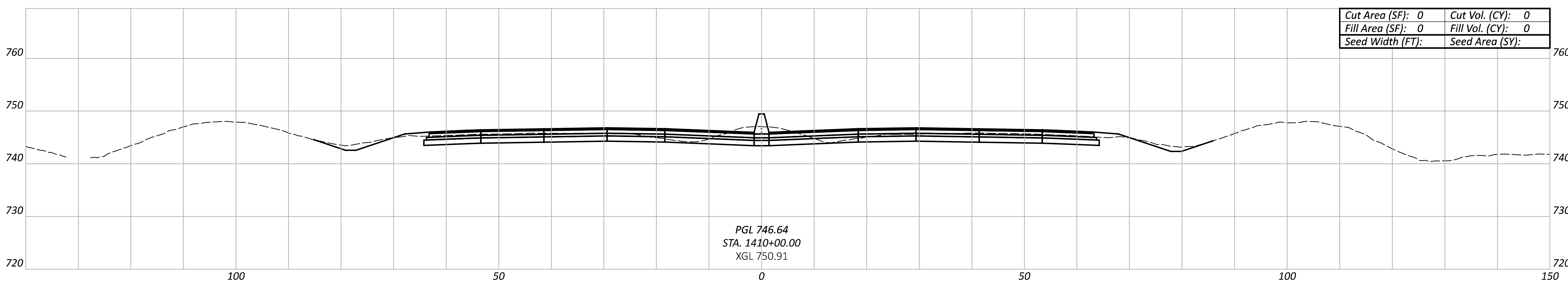

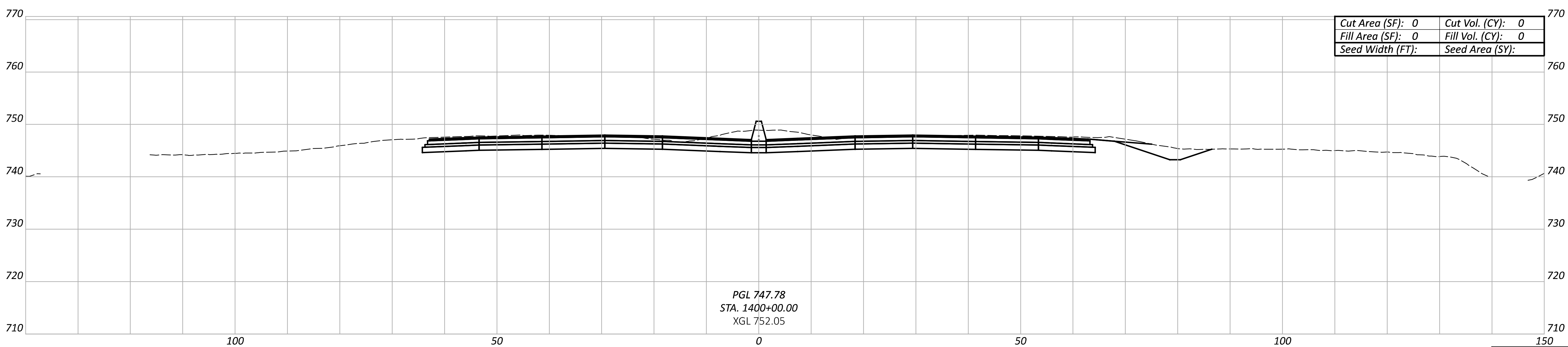

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

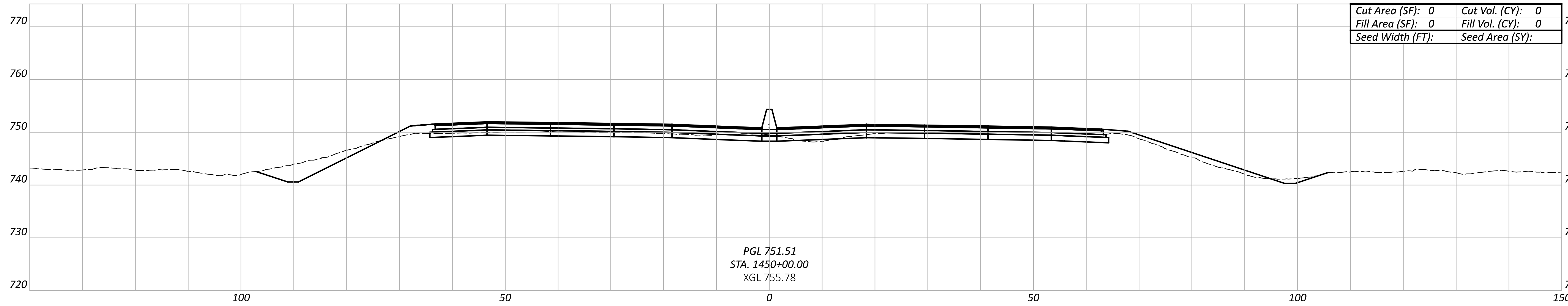
DESIGN AGENCY

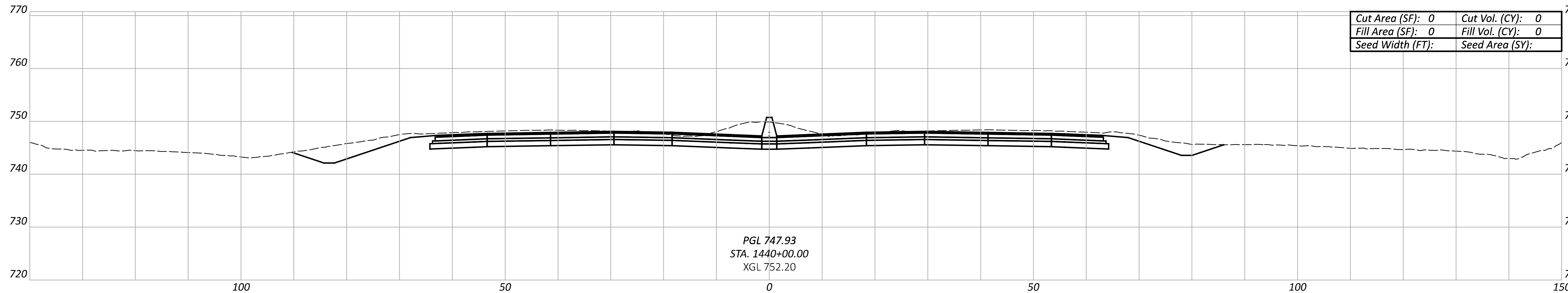
DESIGNER
XXX

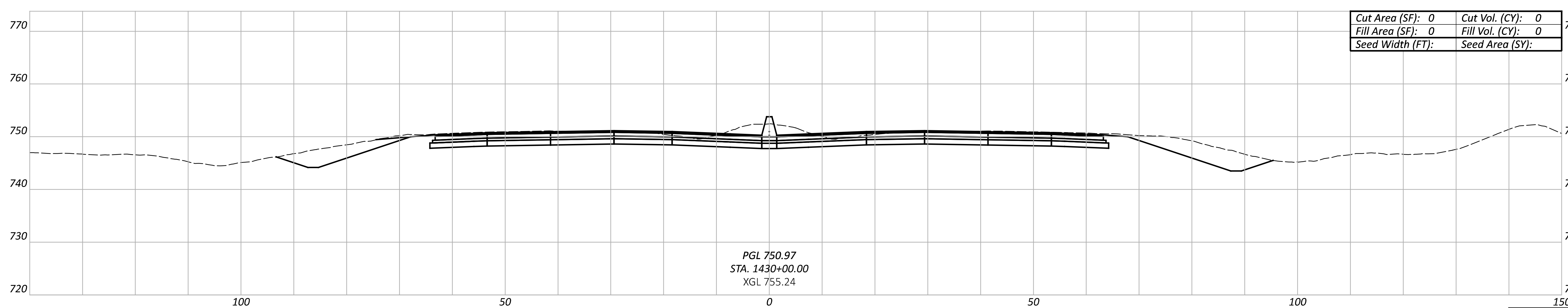
REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
TOTAL 0







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Seeding	Cut	Fill

FRA/FAI-33-22.99/0.00

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
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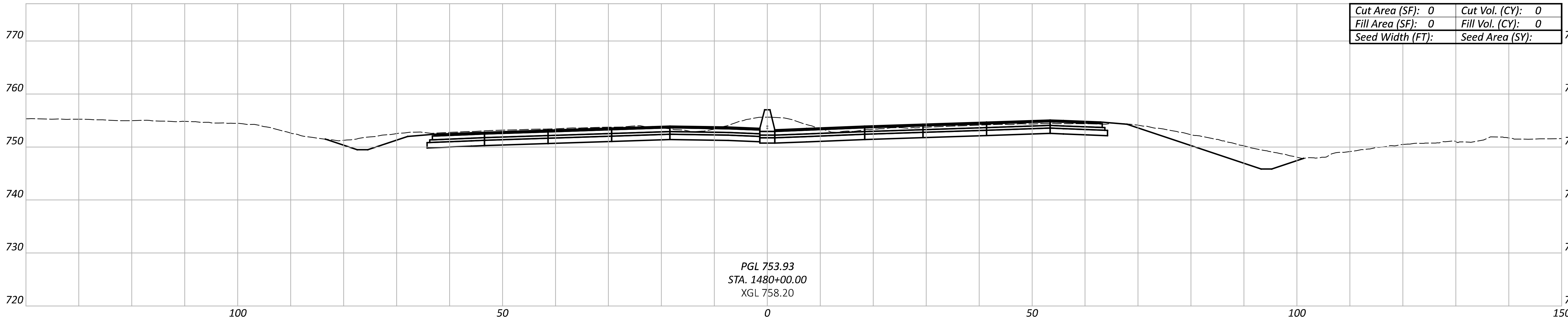

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STA. 1480+00.00
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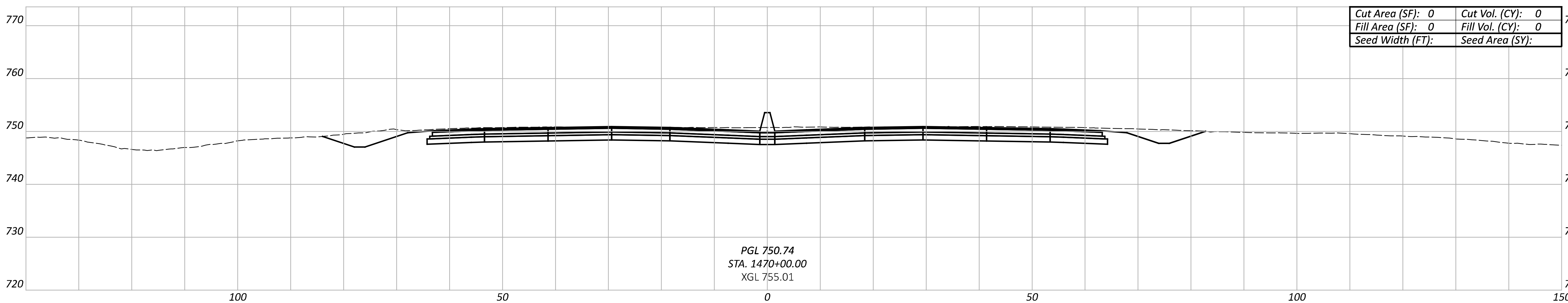

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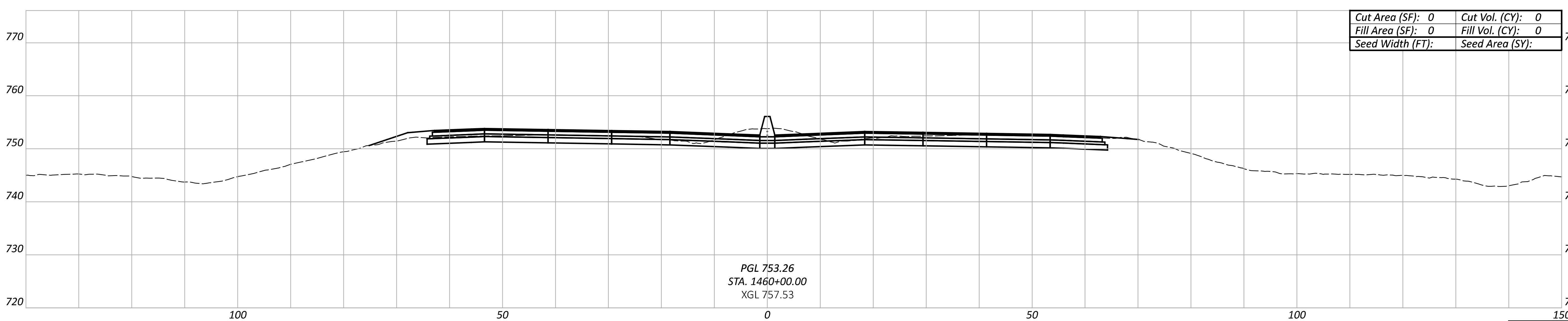

PGL 753.26
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Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
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REVIEWER
XXX MM-DD-YY

PROJECT ID
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SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

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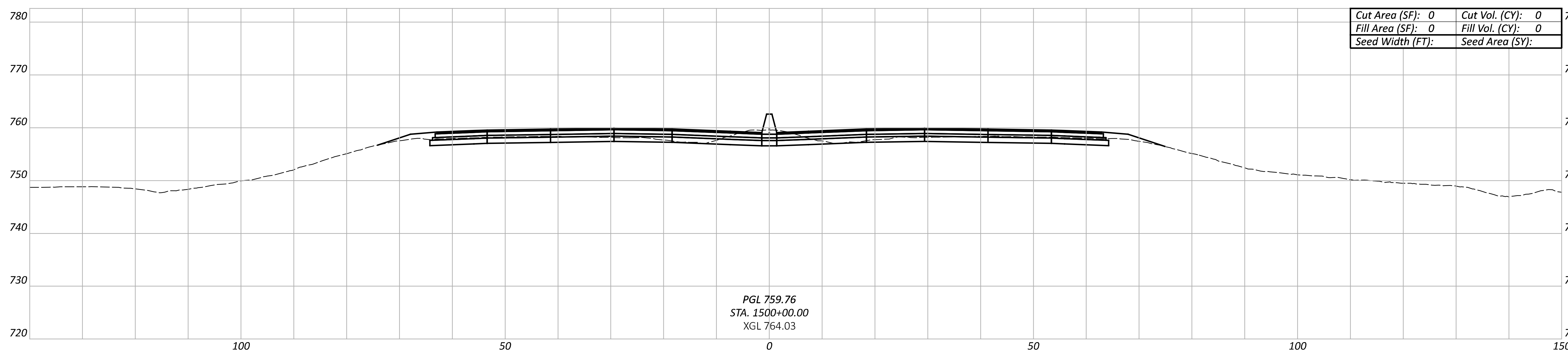
CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY



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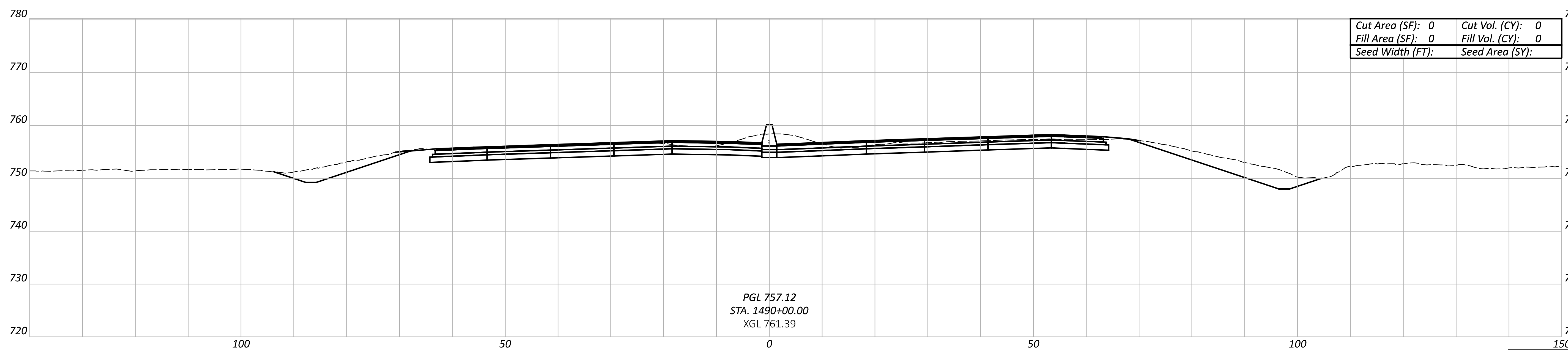

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Sheet Totals		
Seeding	Cut	Fill

FRA/FAI-33-22.99/0.00

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DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

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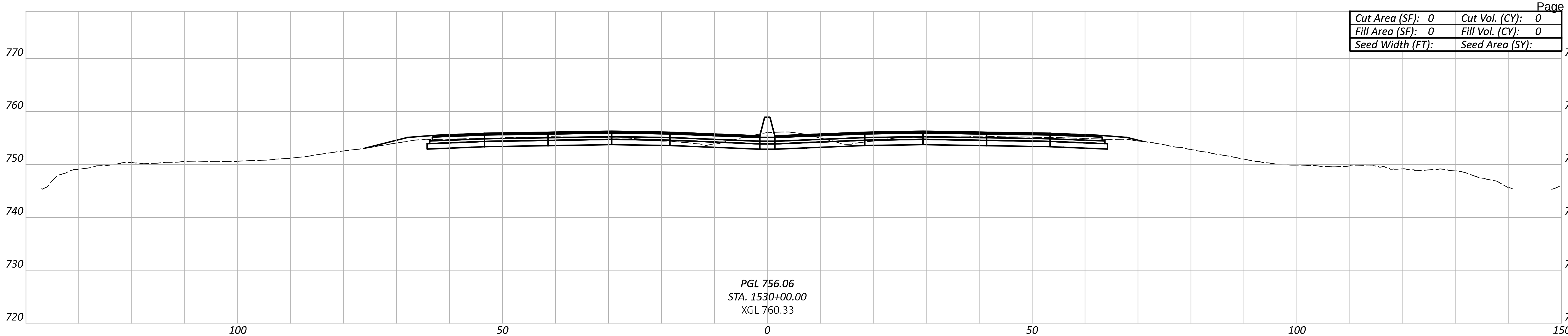

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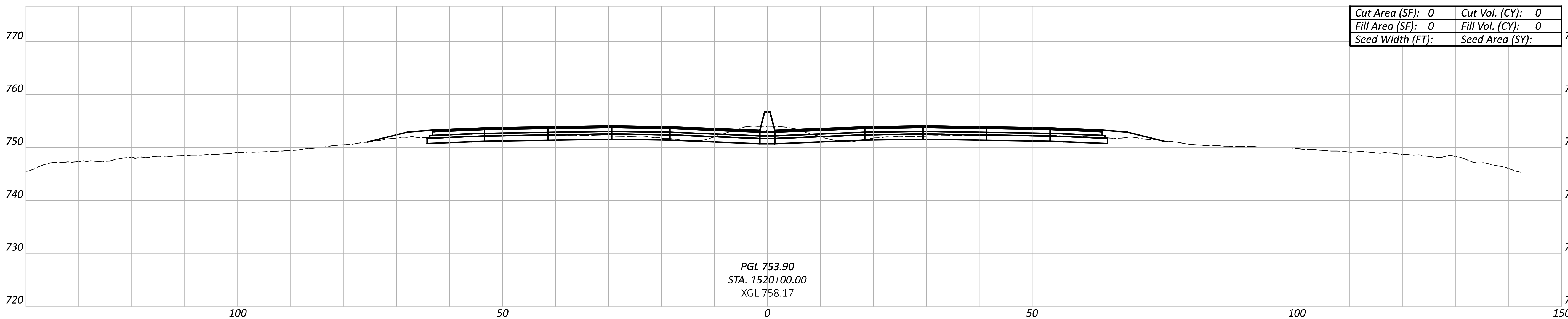

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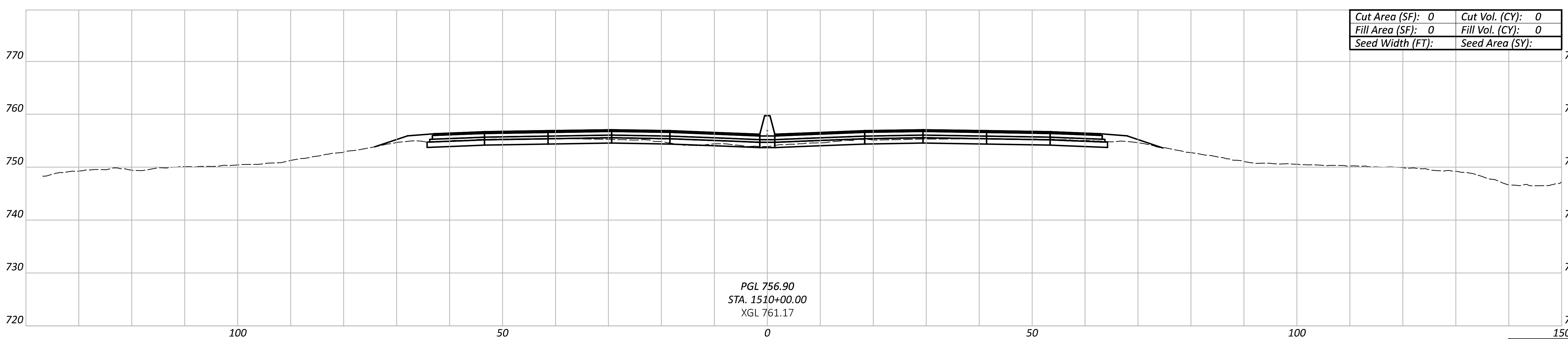

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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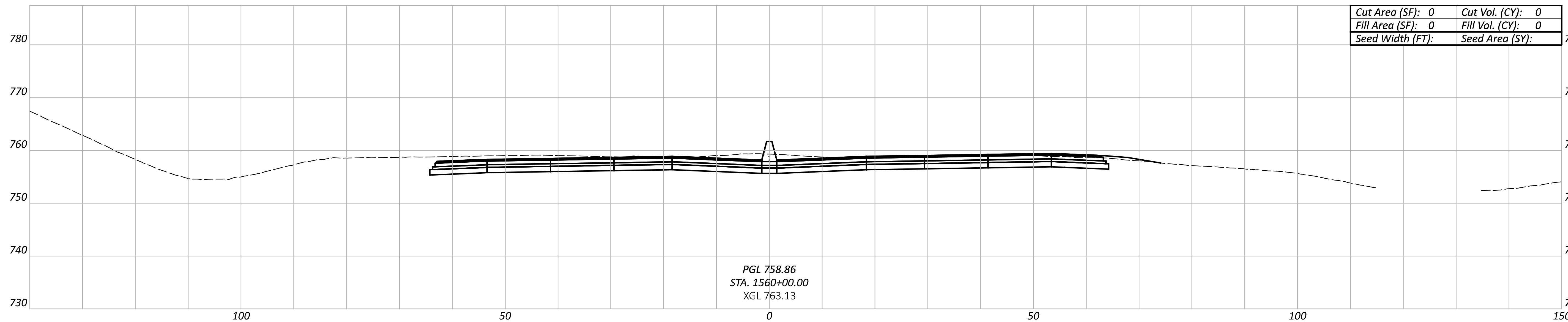

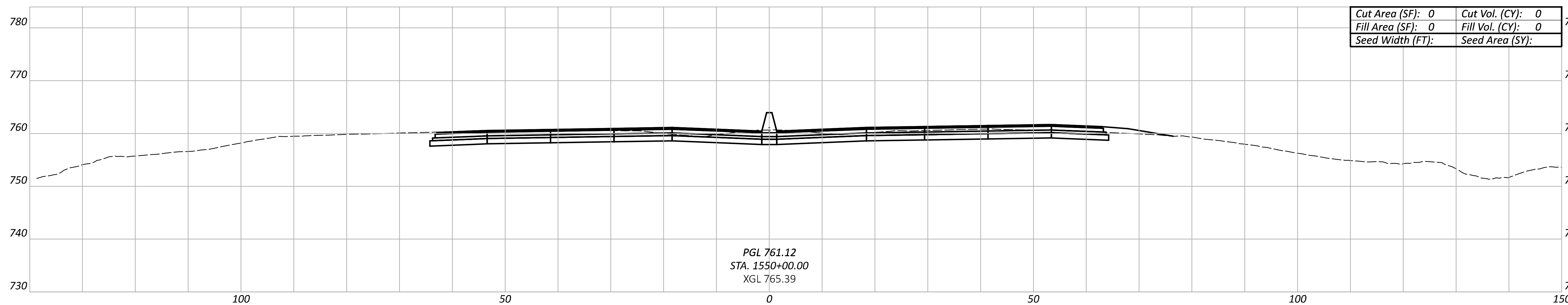

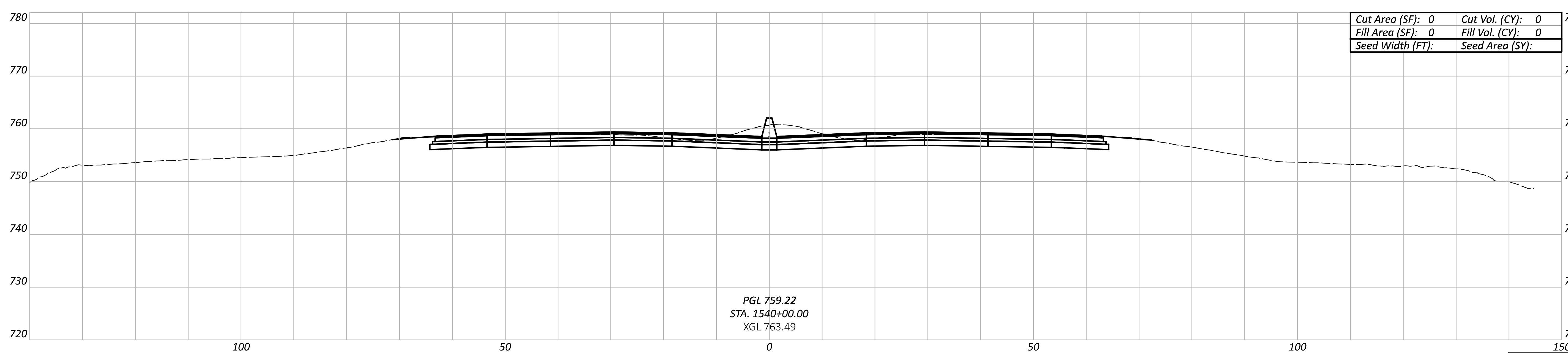

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

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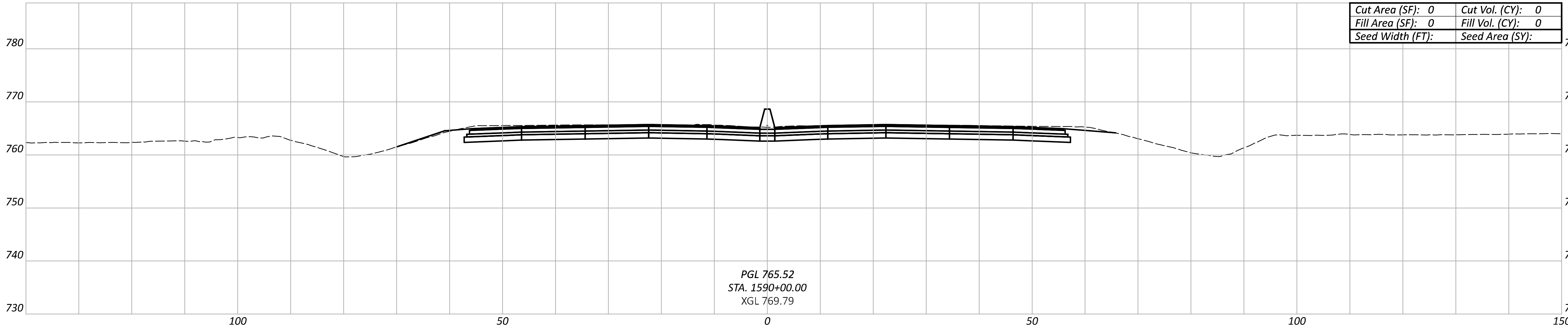

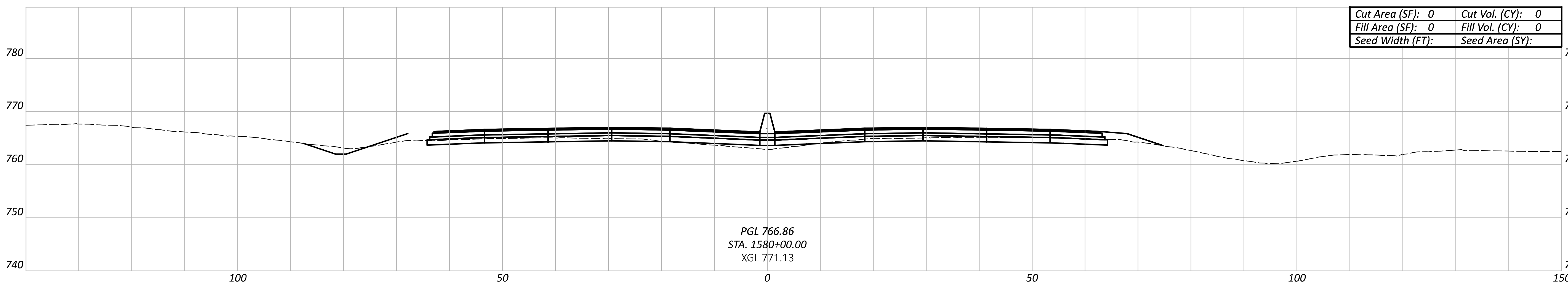

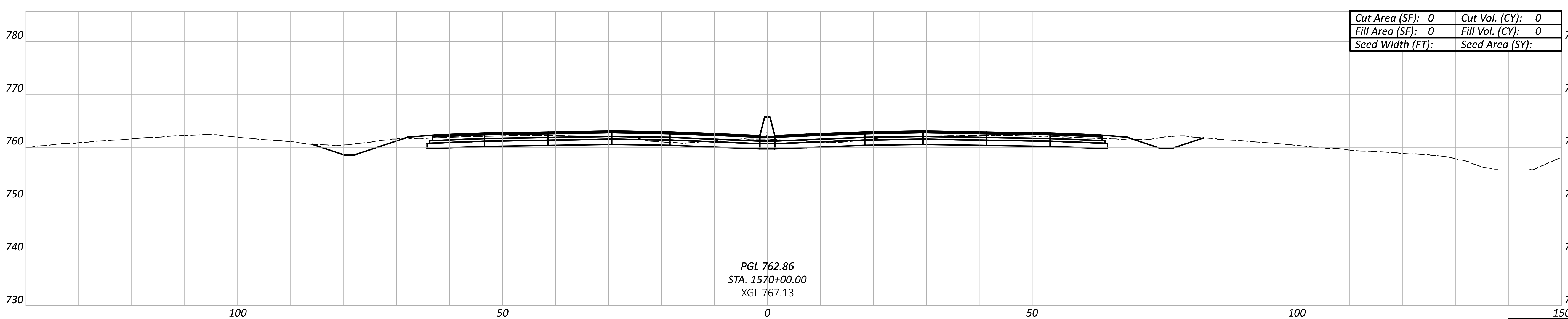

Sheet Totals		
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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

FRA/FAI-33-22.99/0.00

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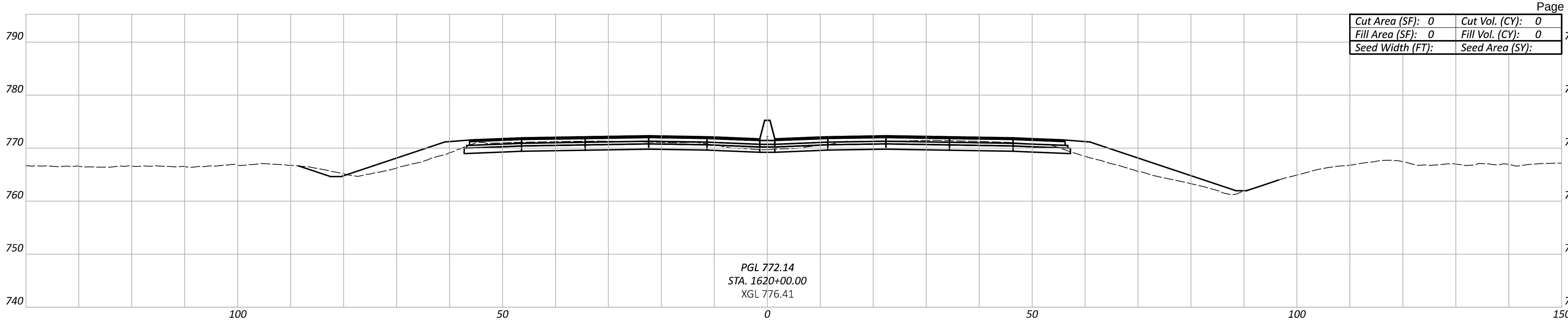

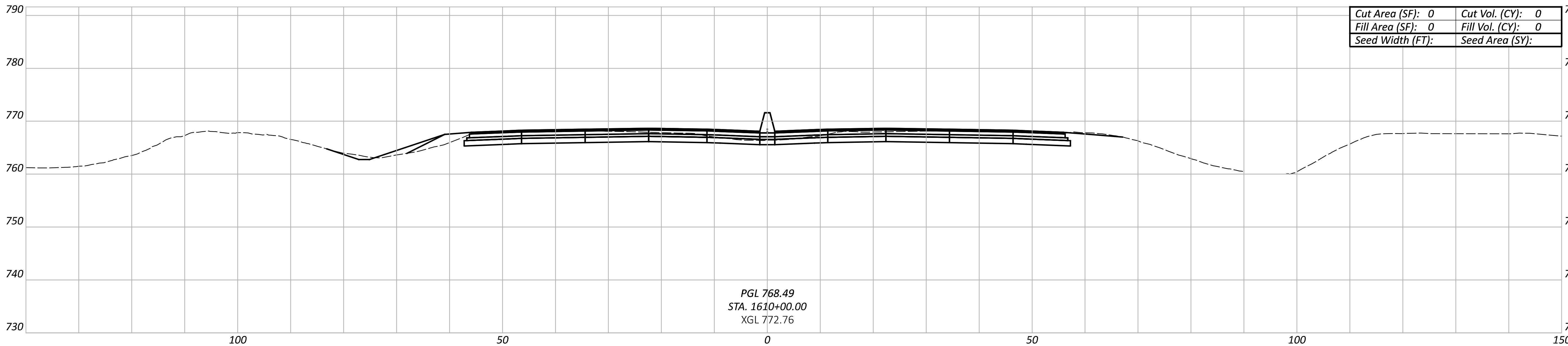

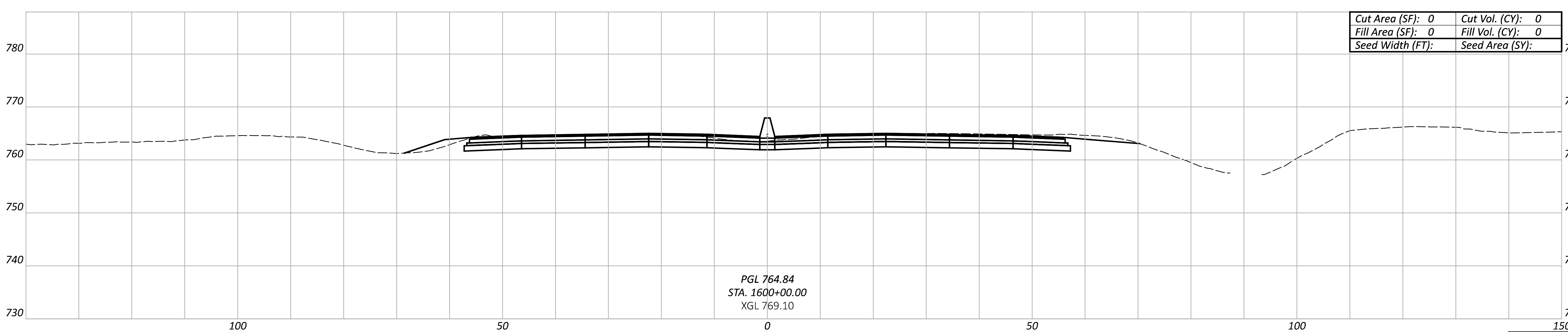

Sheet Totals		
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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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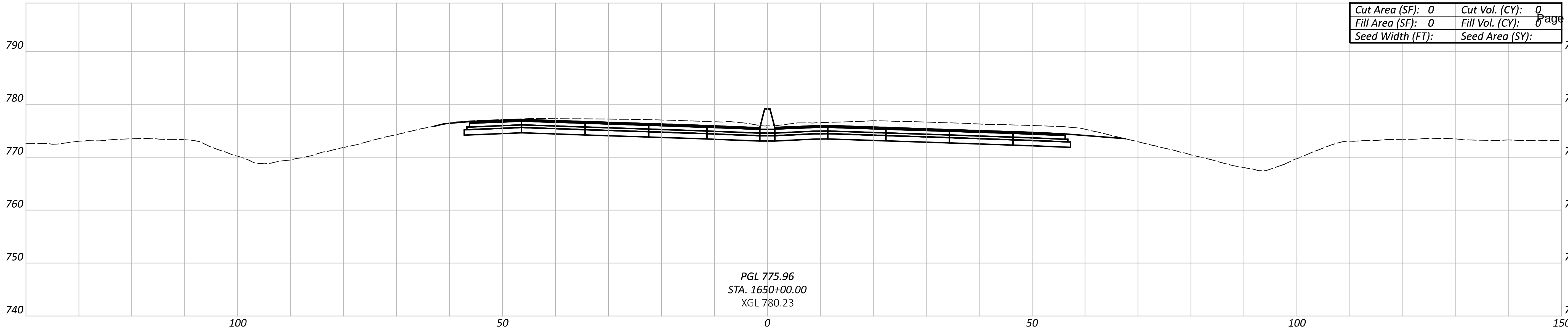

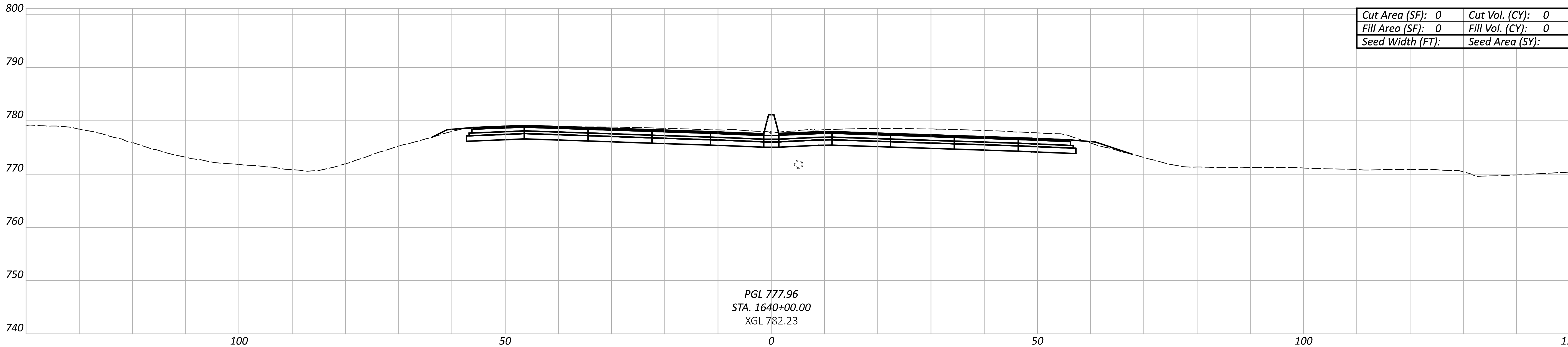

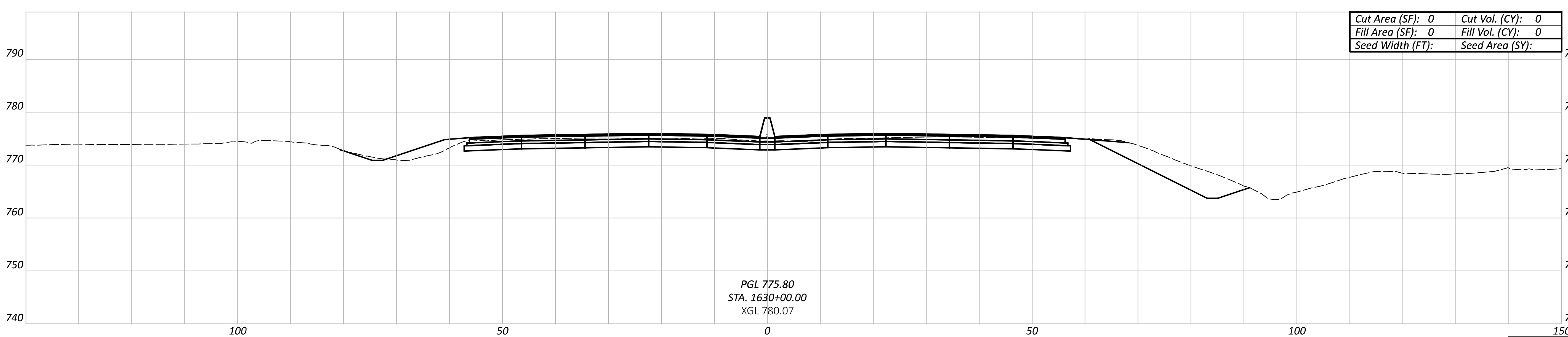

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
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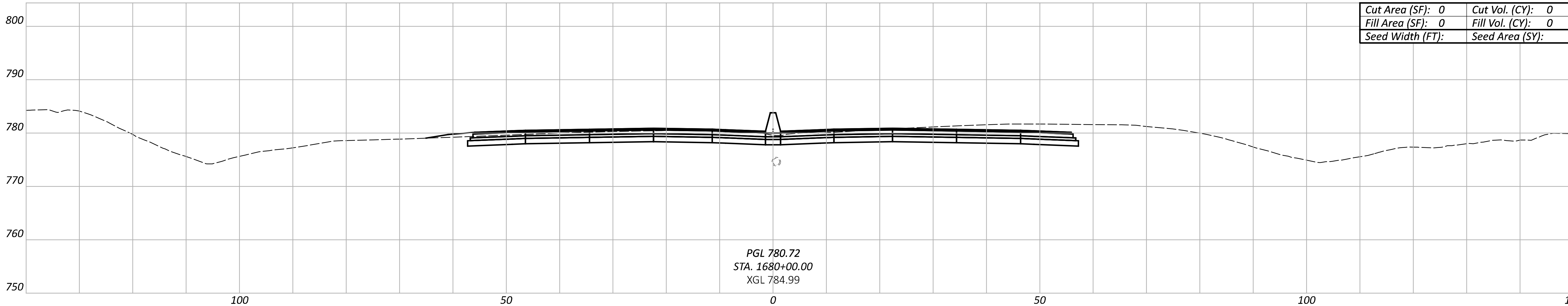

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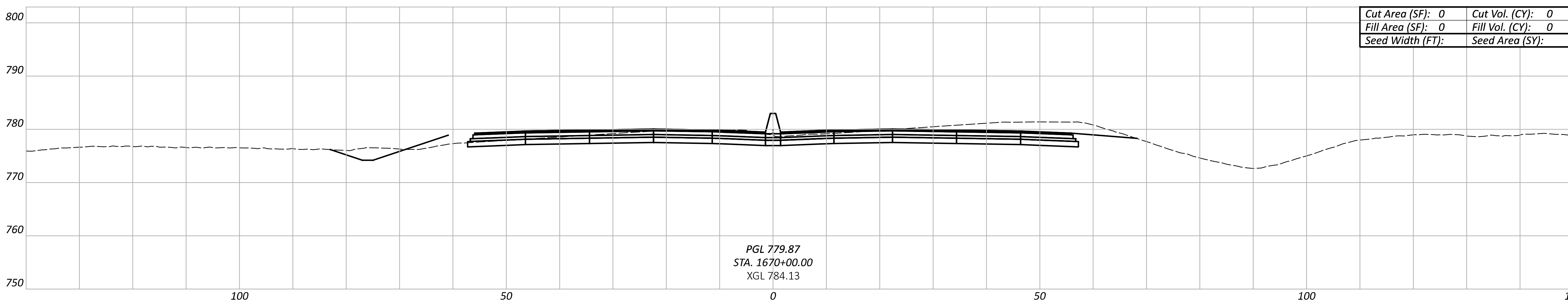

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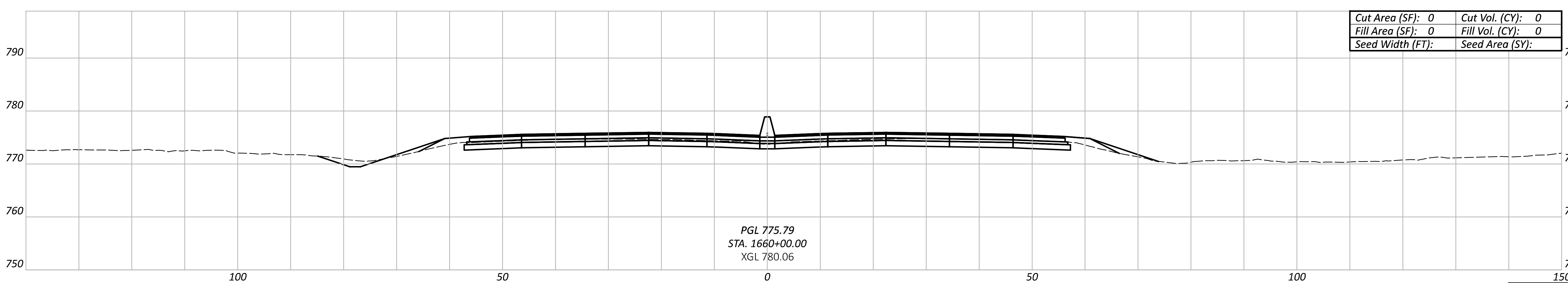

Sheet Totals		
Seeding	Cut	Fill

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

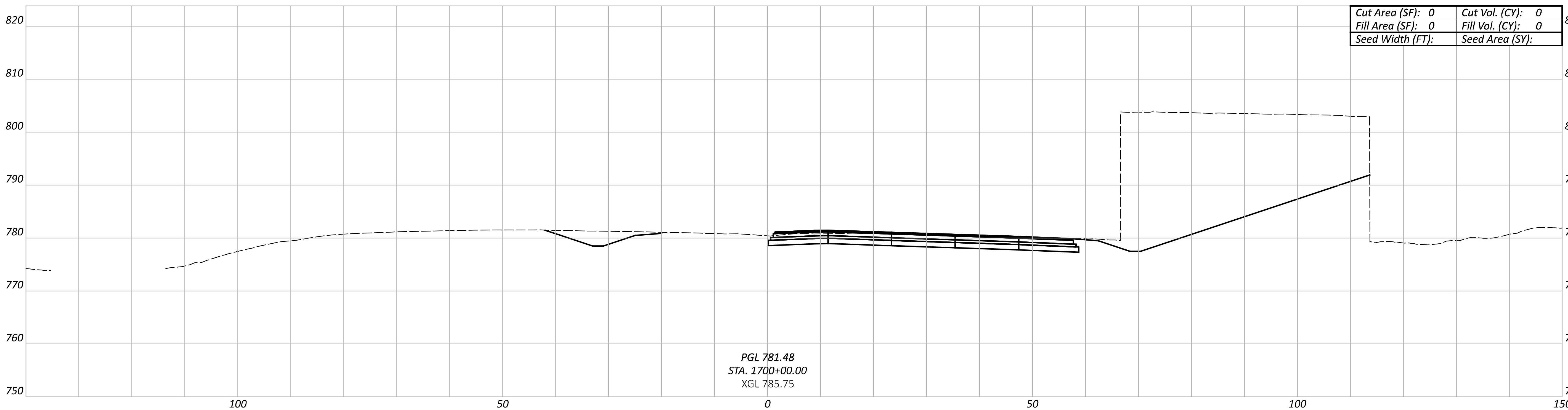
DESIGN AGENCY

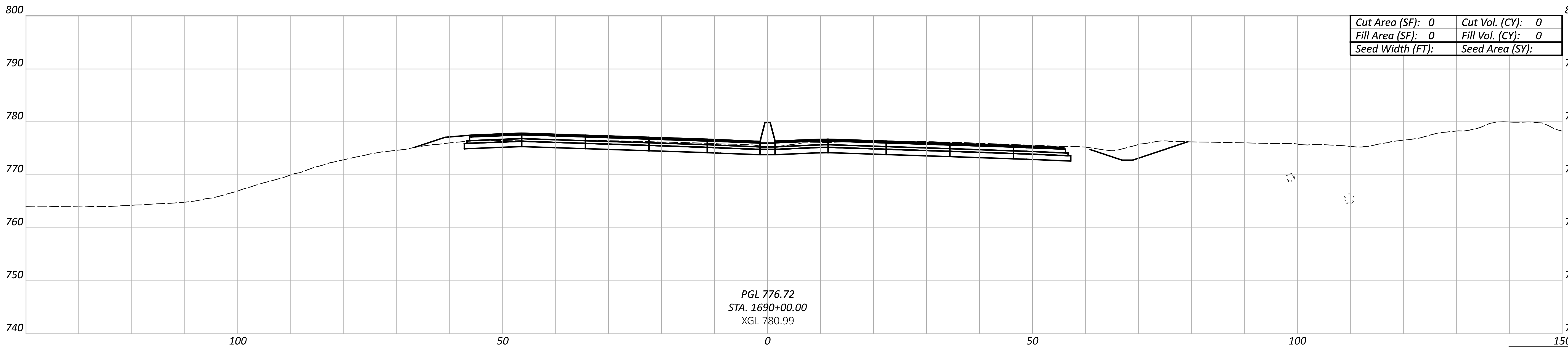
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0





Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
TOTAL 0

FRA/FAI-33-22.99/0.00

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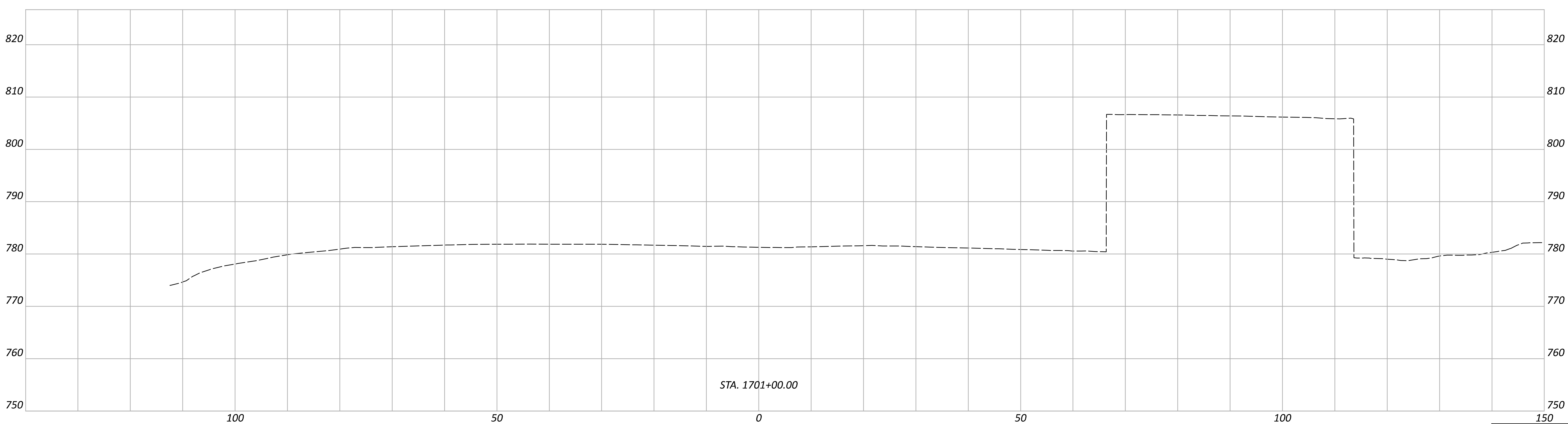

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
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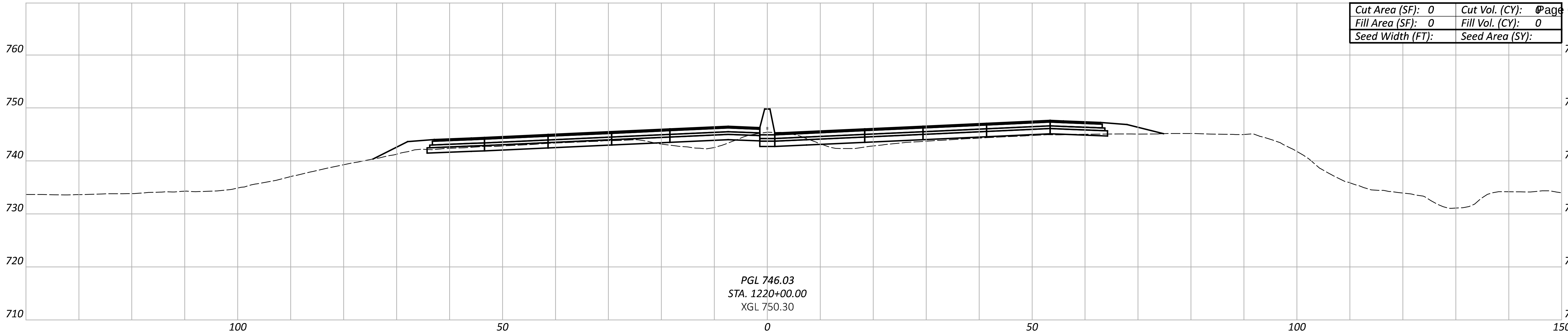

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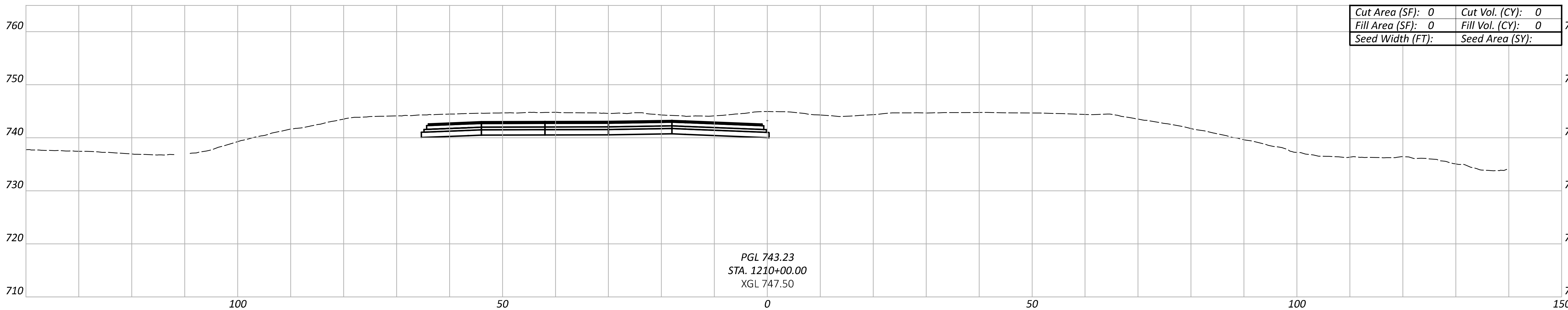

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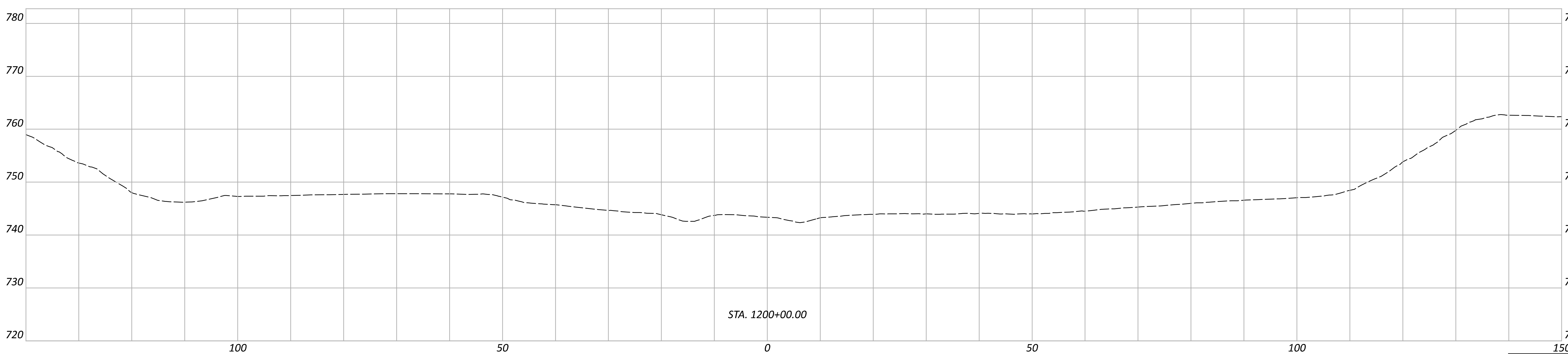

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Sheet Totals		
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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
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PROJECT ID
121811

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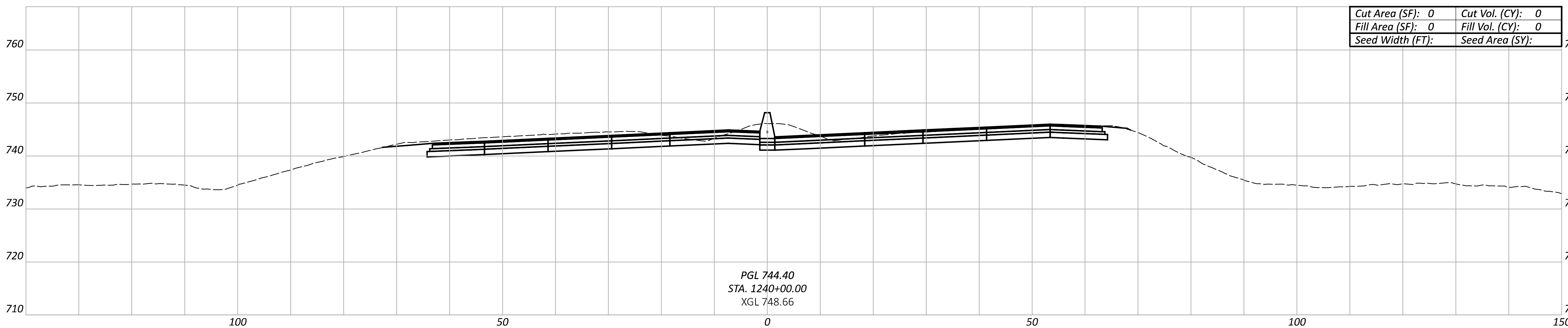
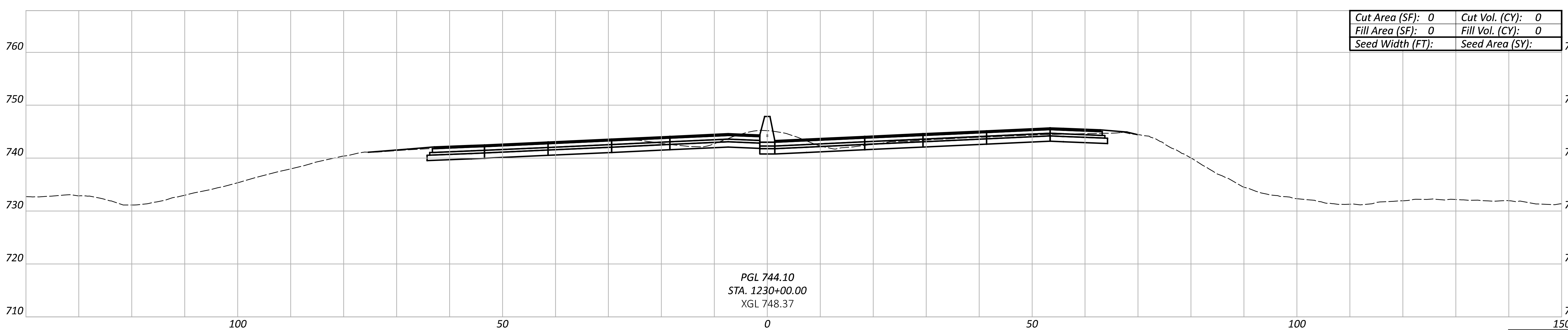
CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY





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DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
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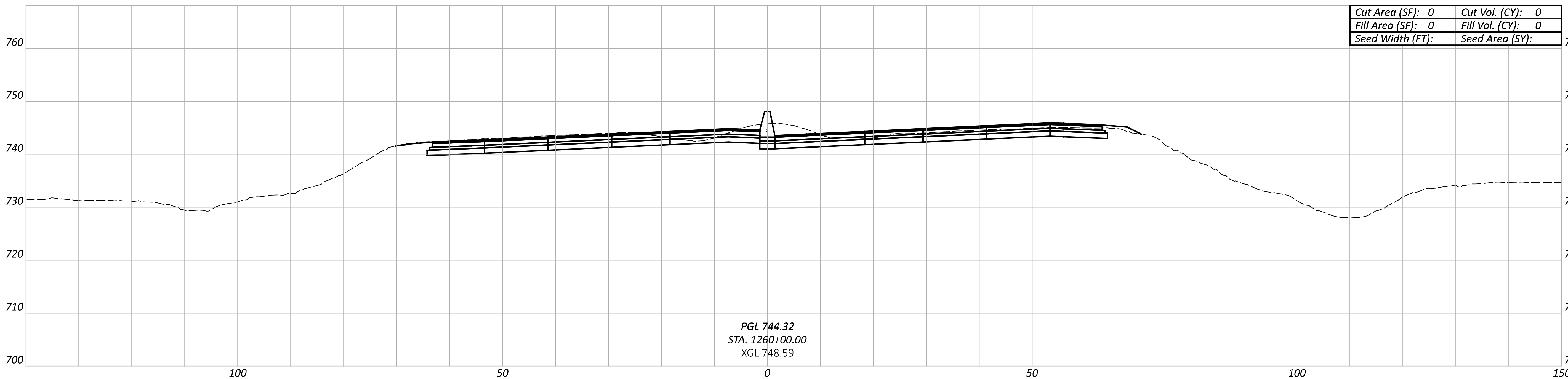

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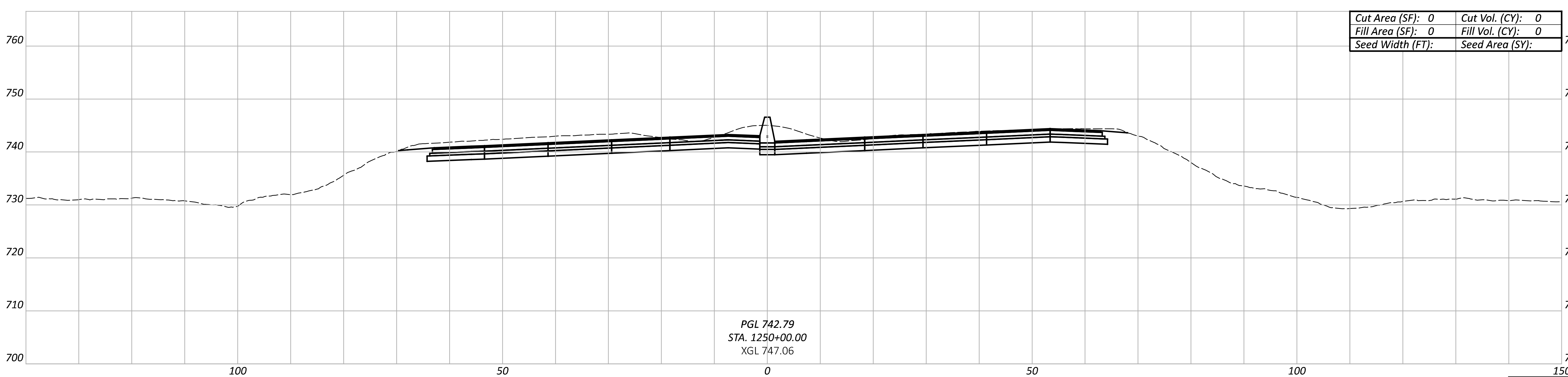

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Sheet Totals		
Seeding	Cut	Fill

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PRELIMINARY

DESIGN AGENCY

DESIGNER
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PROJECT ID
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SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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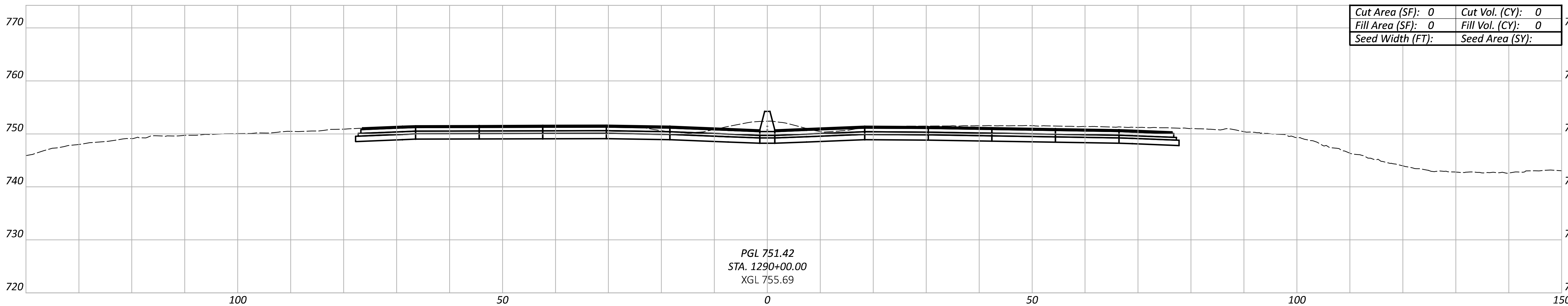

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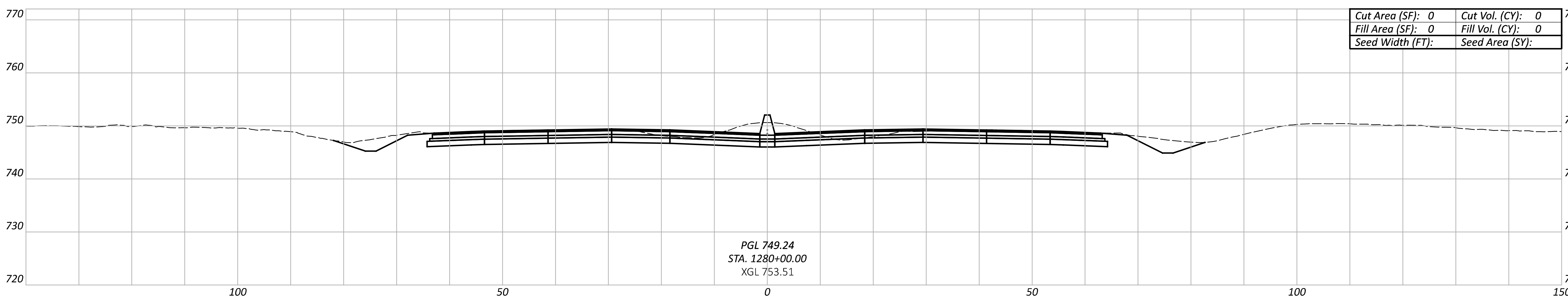

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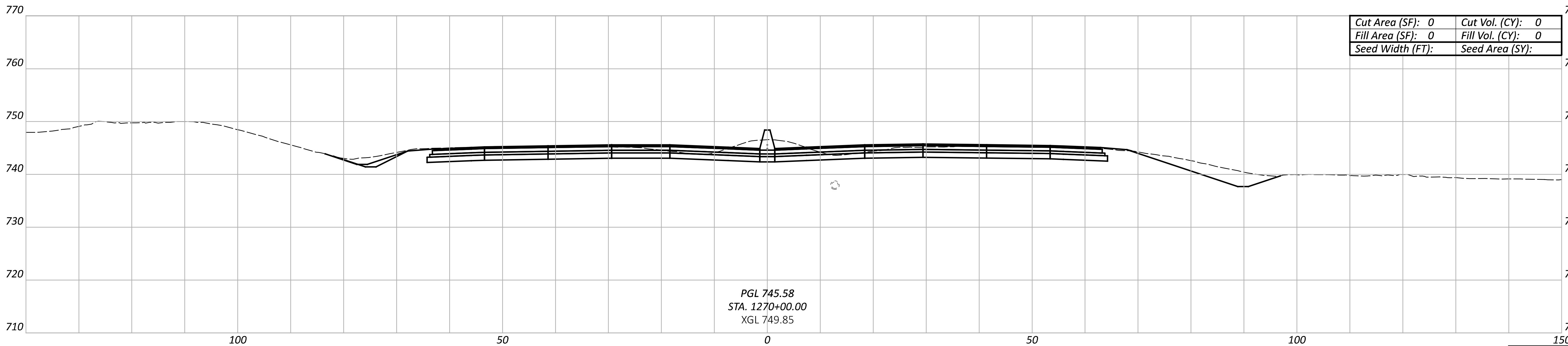

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CROSS SECTIONS - ALTERNATIVE 1
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DESIGNER
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REVIEWER
XXX MM-DD-YY

PROJECT ID
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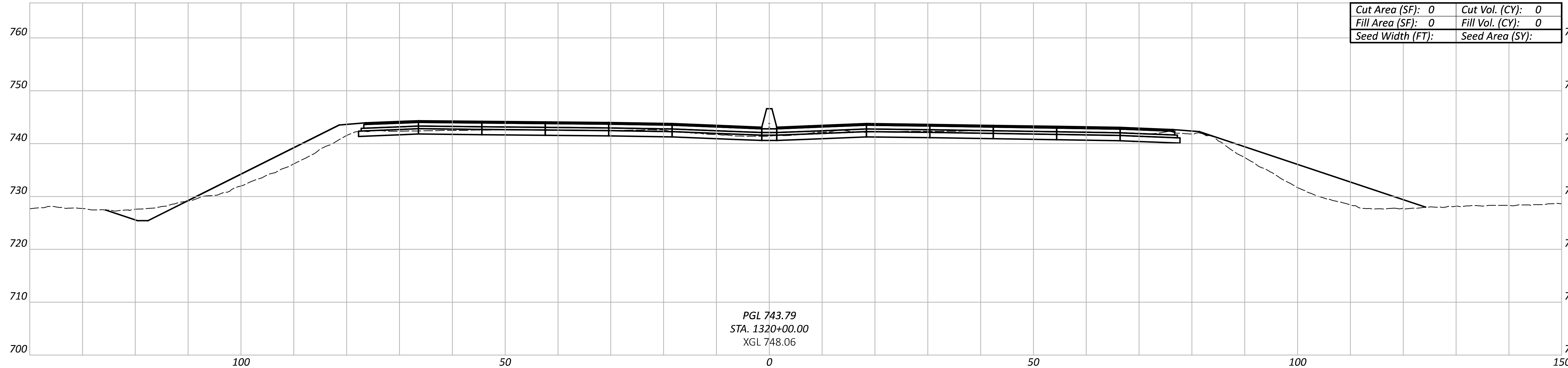

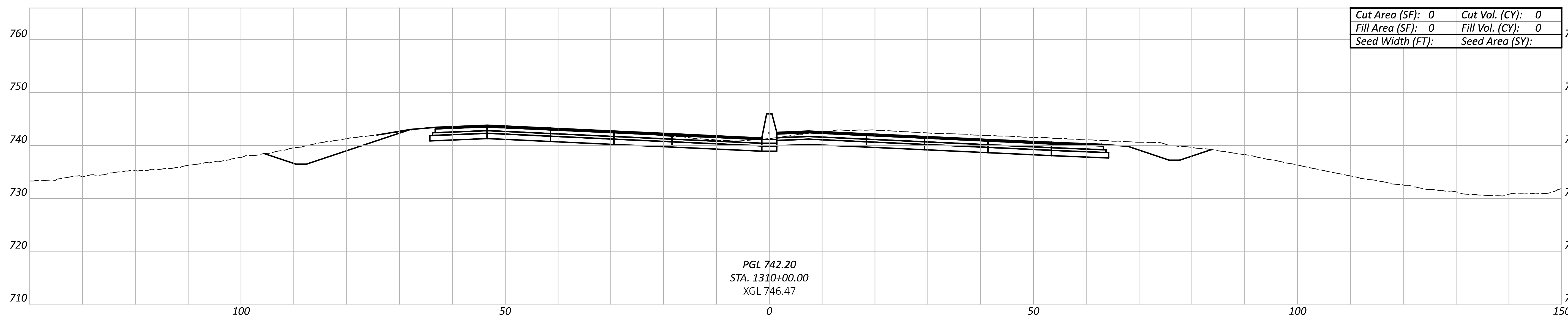

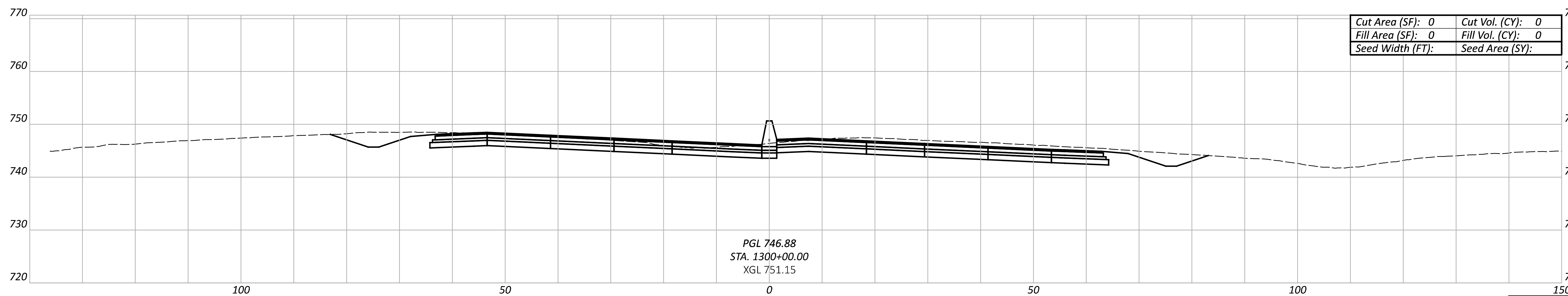

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Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

DESIGNER
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PROJECT ID
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CROSS SECTIONS - ALTERNATIVE 1
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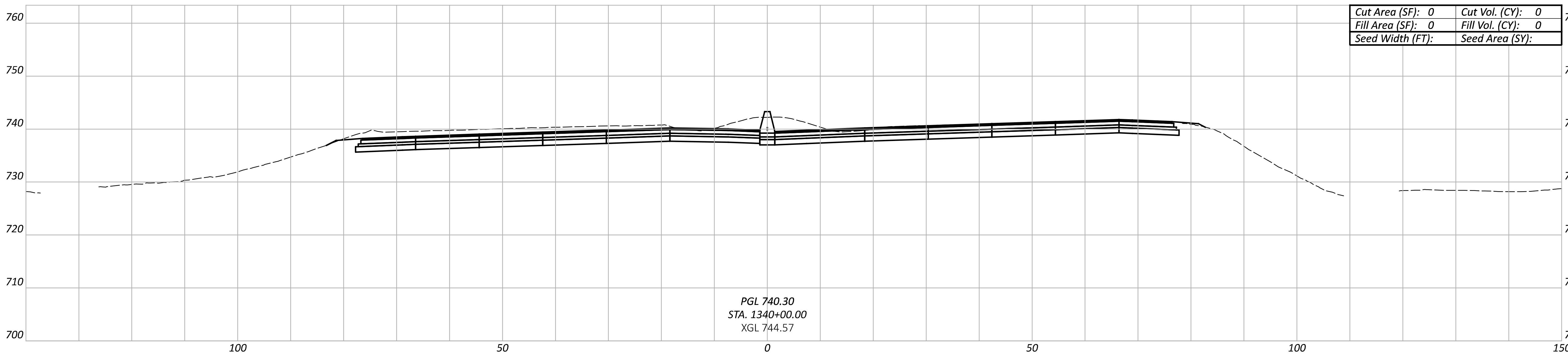

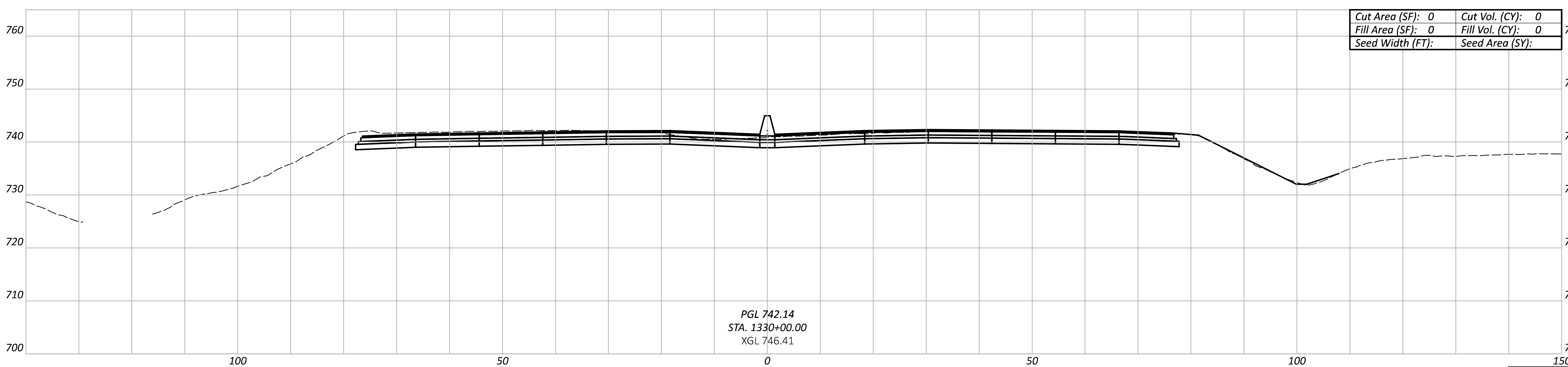

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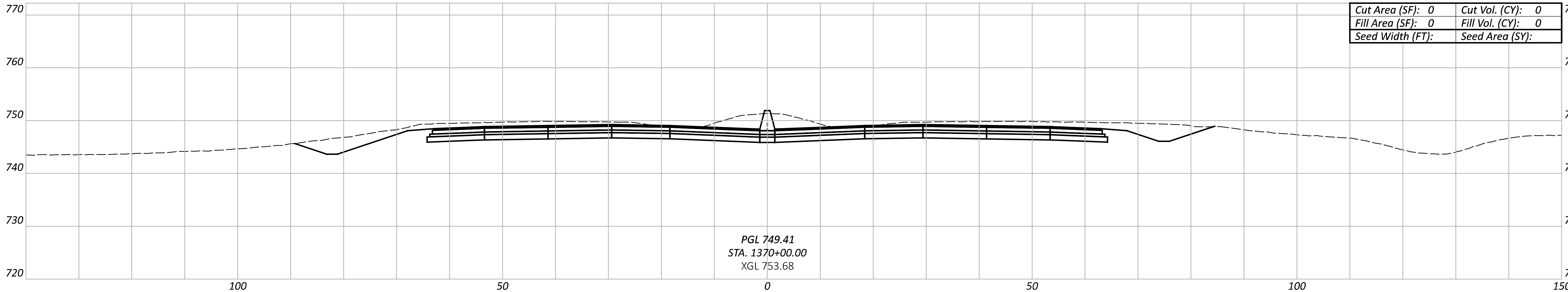

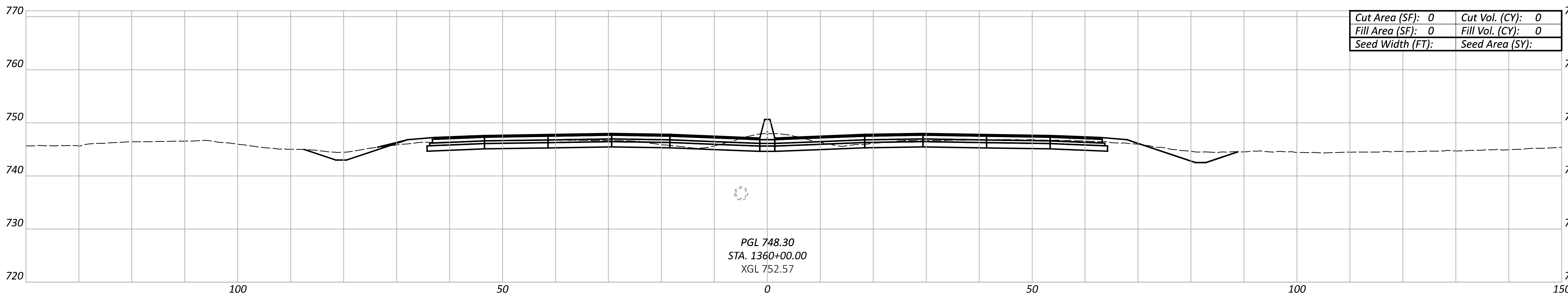

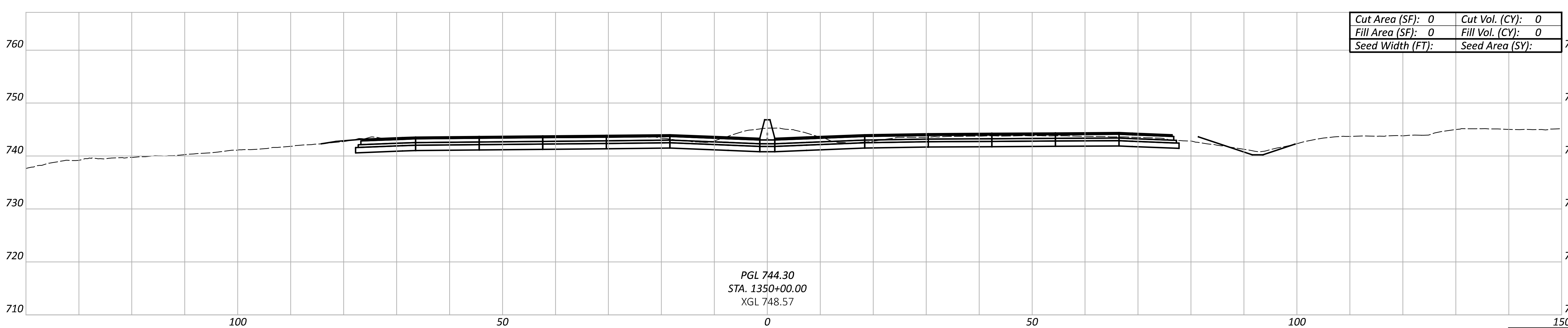

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Seeding	Cut	Fill

DESIGN AGENCY

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PROJECT ID
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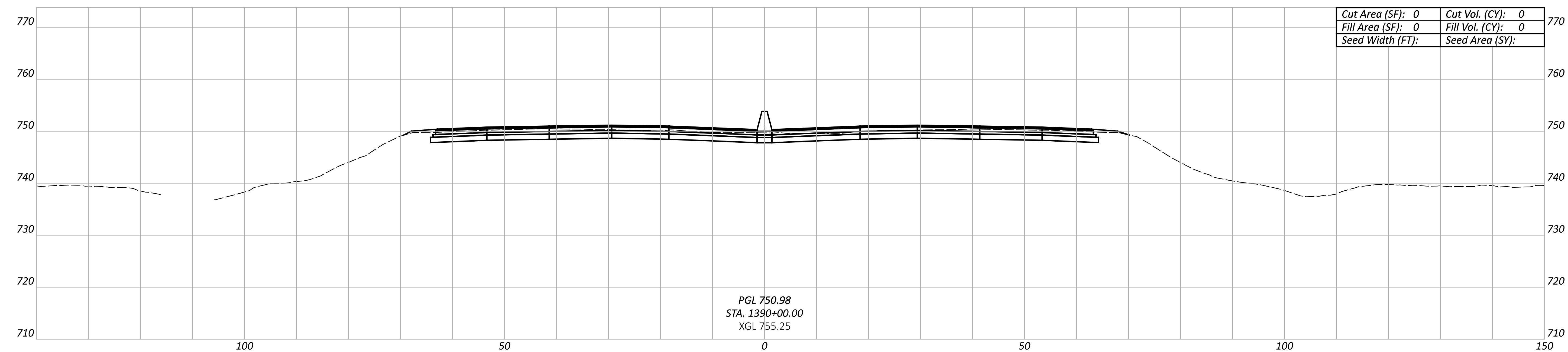
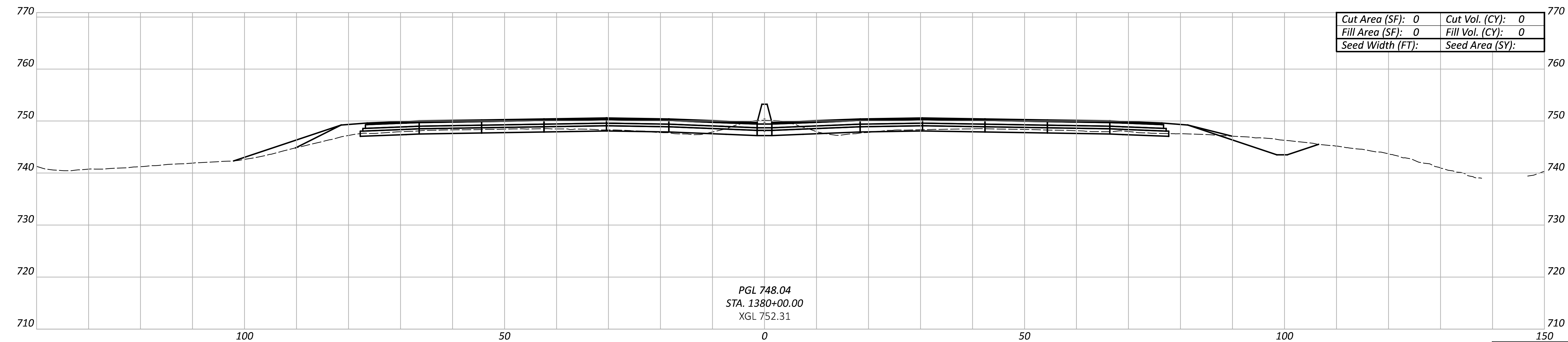
CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY





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REVIEWER
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PROJECT ID
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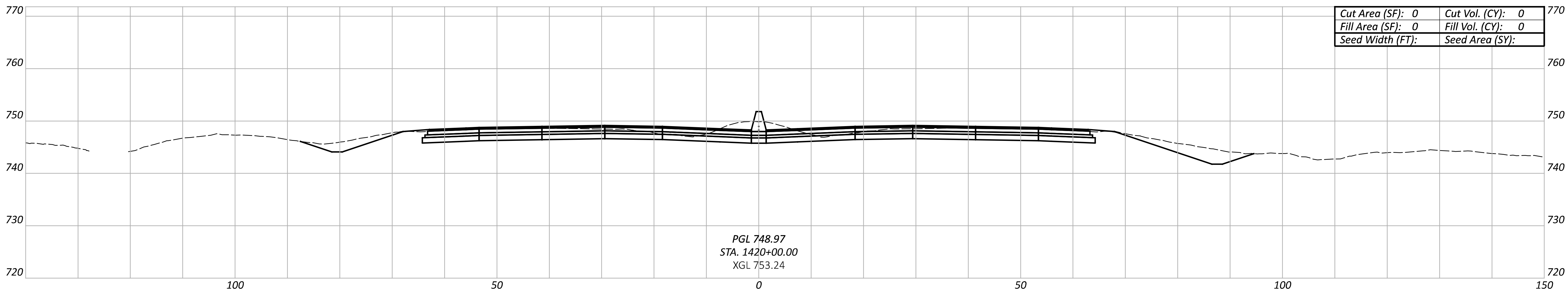

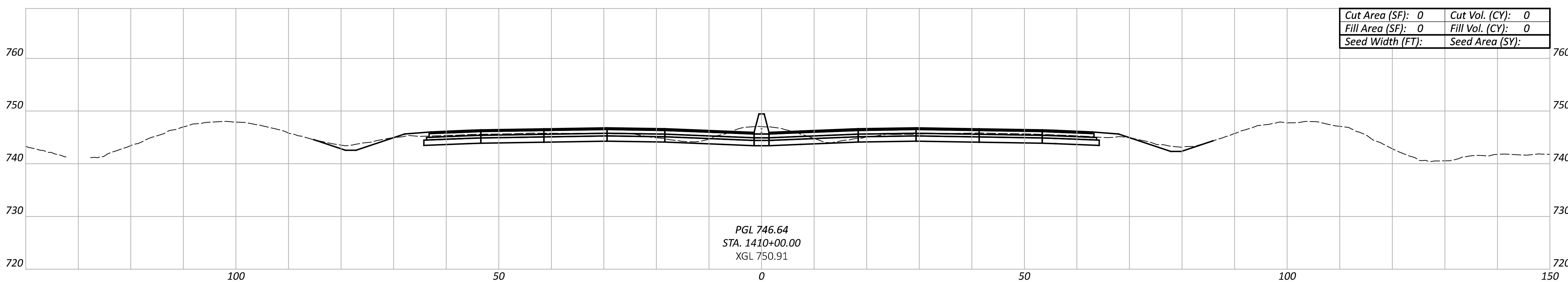

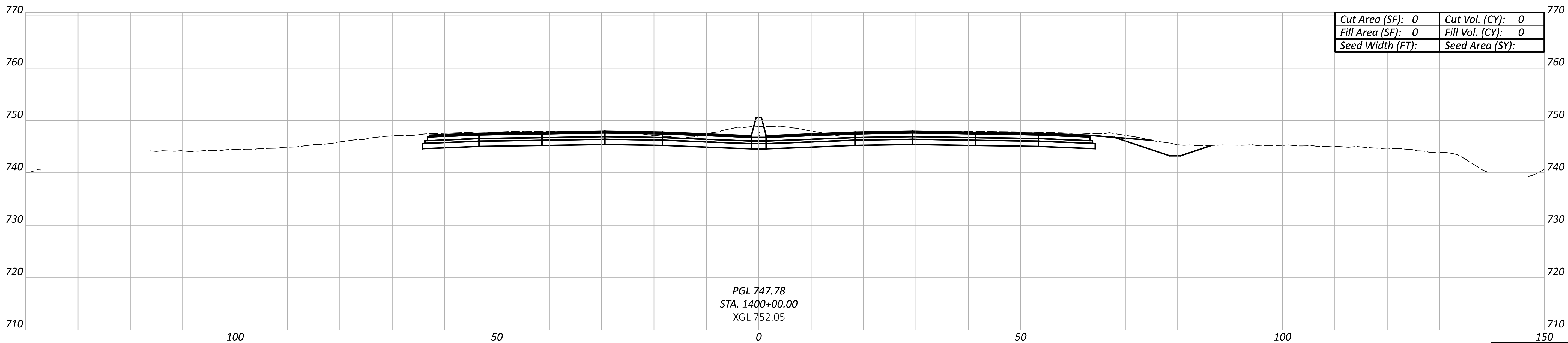

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CROSS SECTIONS - ALTERNATIVE 1
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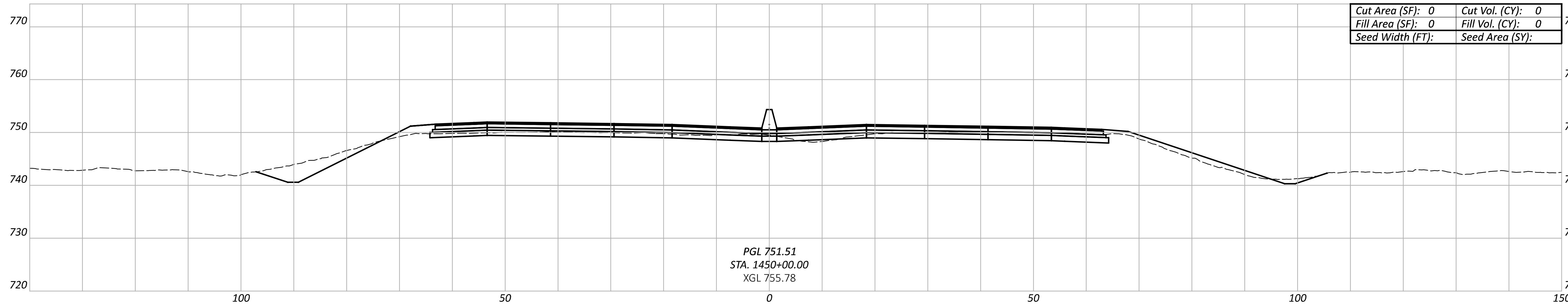

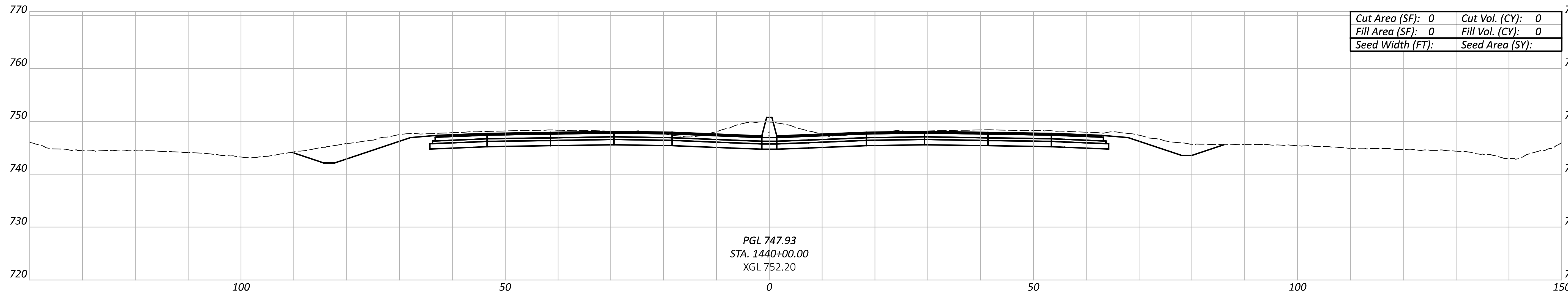

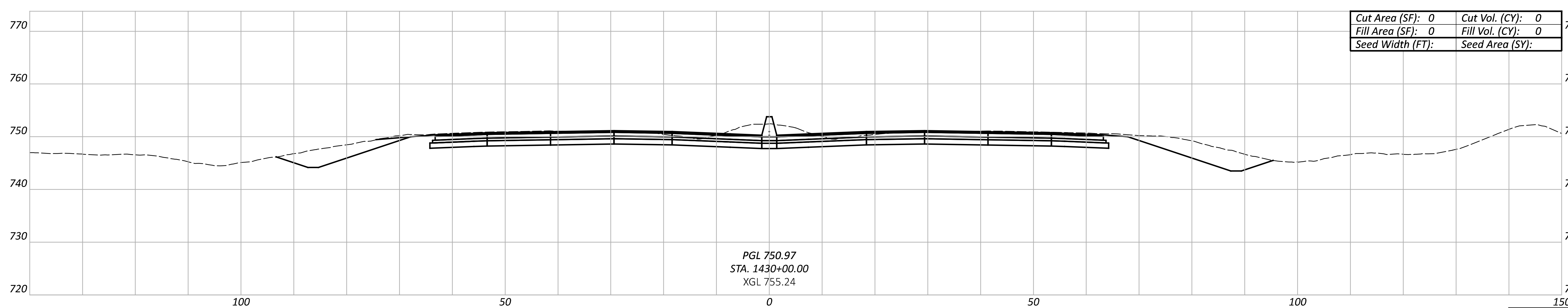

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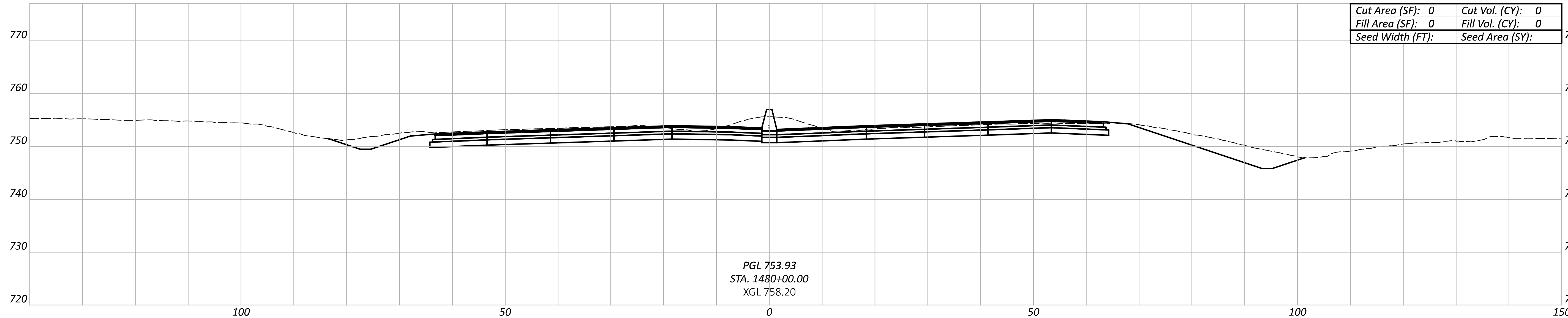

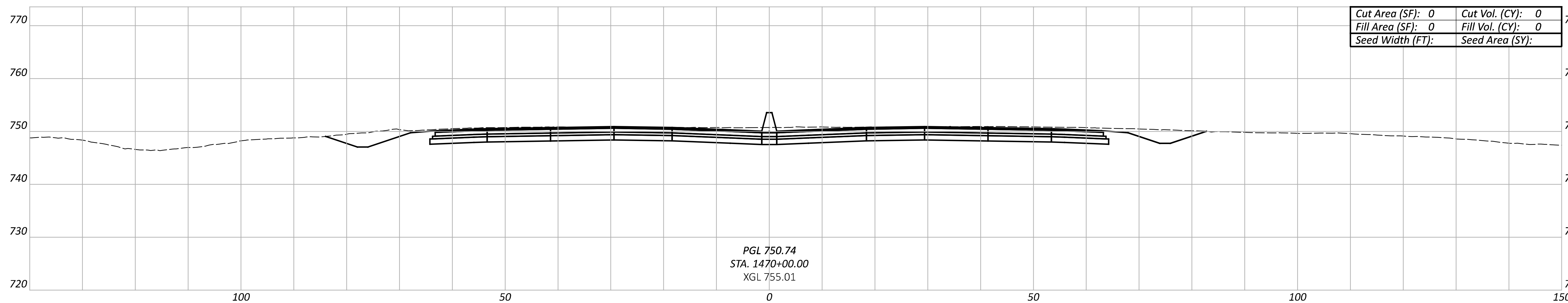

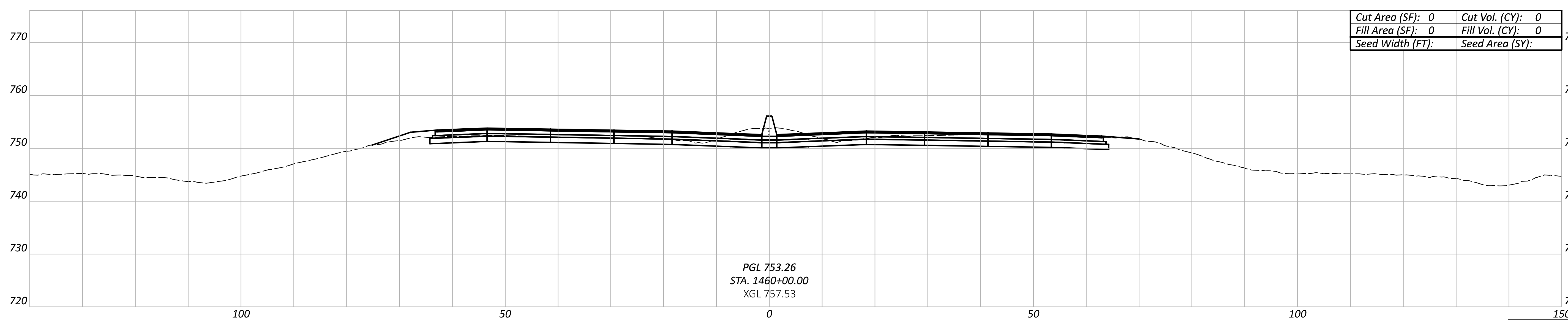

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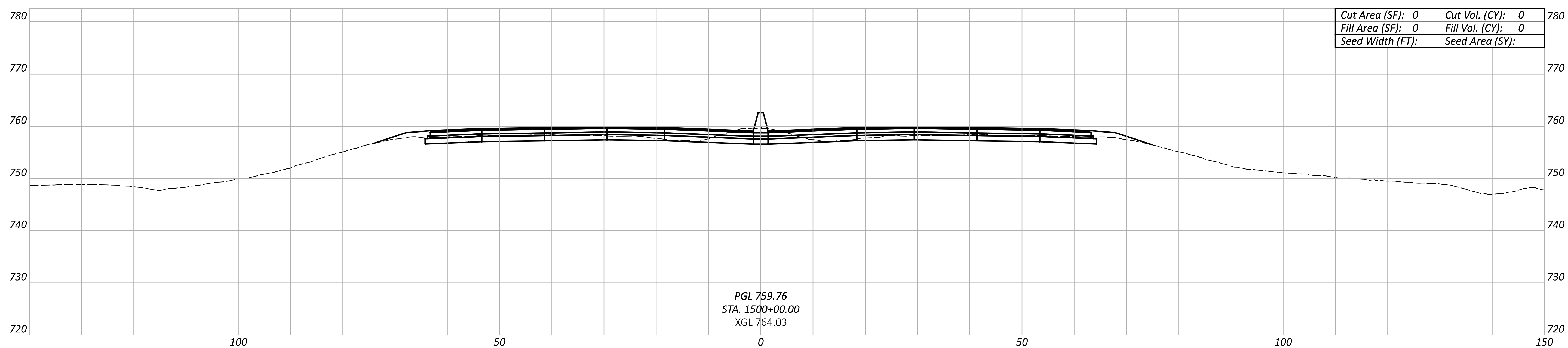

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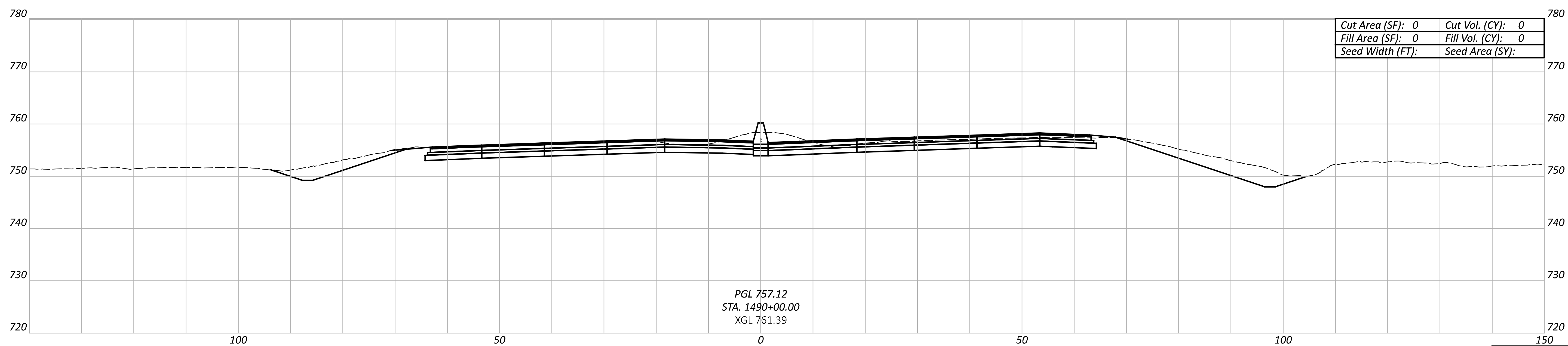

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Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
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DESIGN AGENCY

DESIGNER
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XXX MM-DD-YY

PROJECT ID
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SHEET	TOTAL
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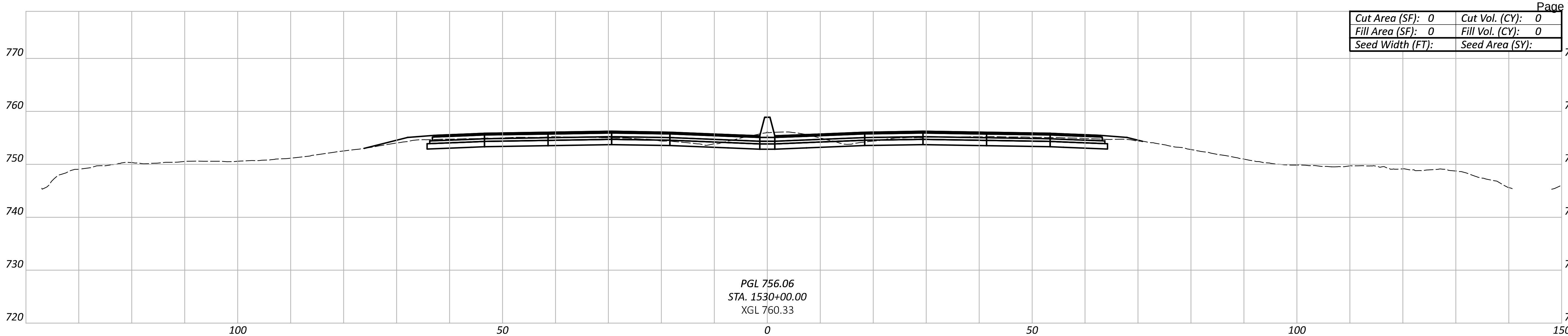

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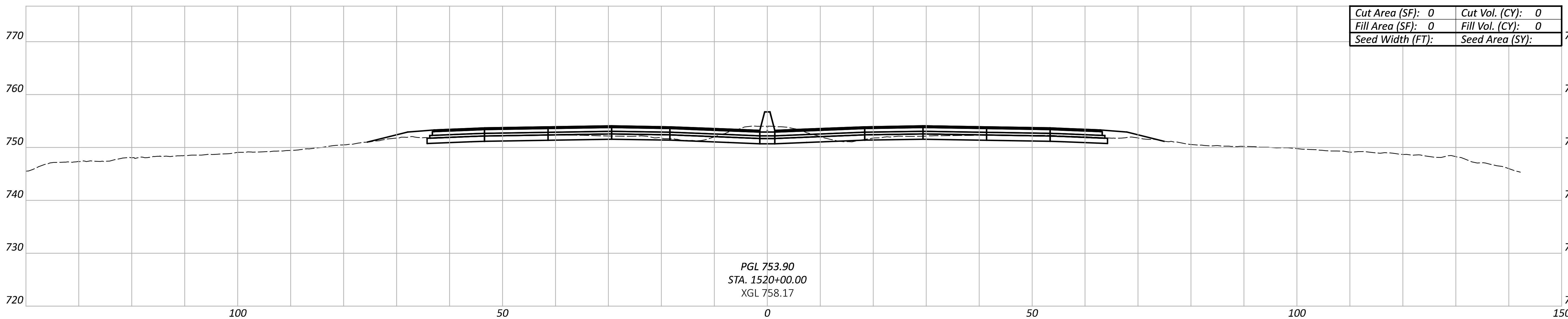

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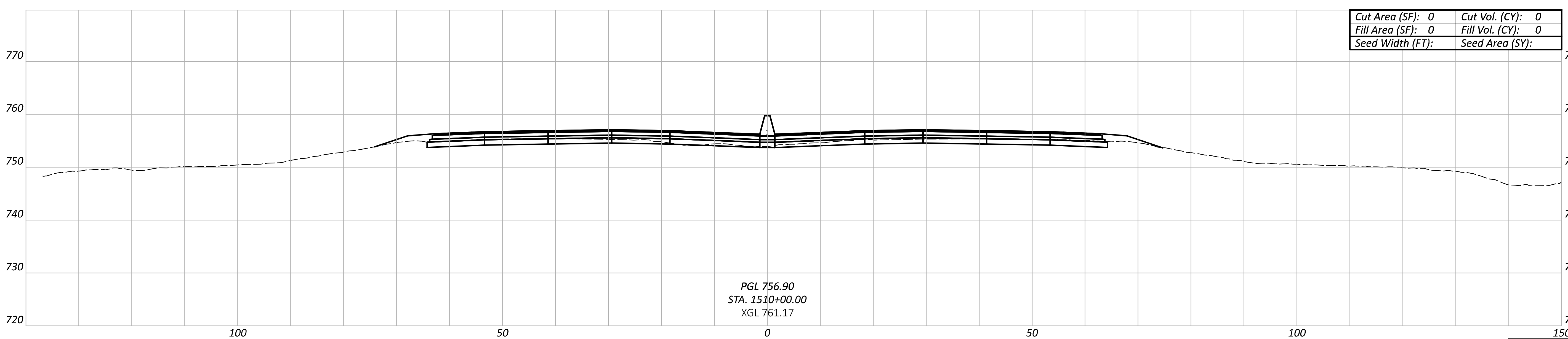

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CROSS SECTIONS - ALTERNATIVE 1
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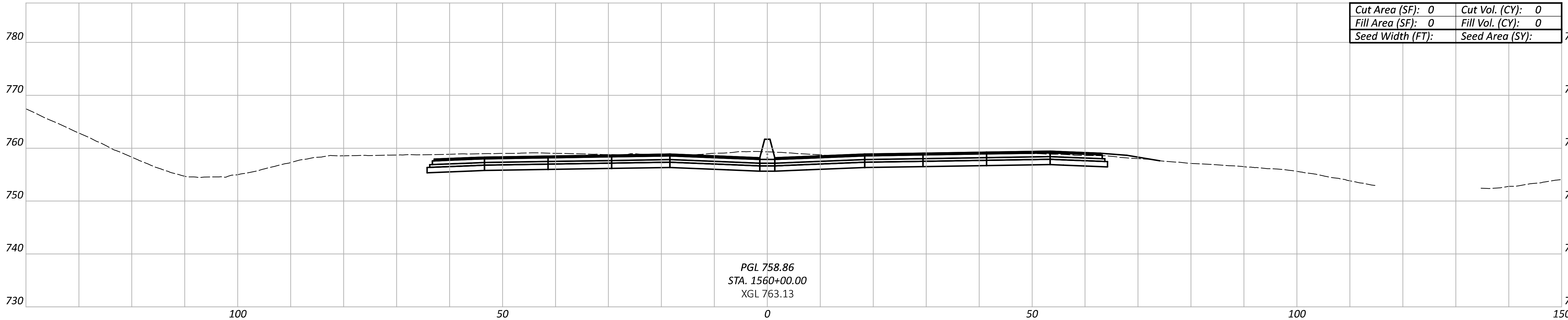

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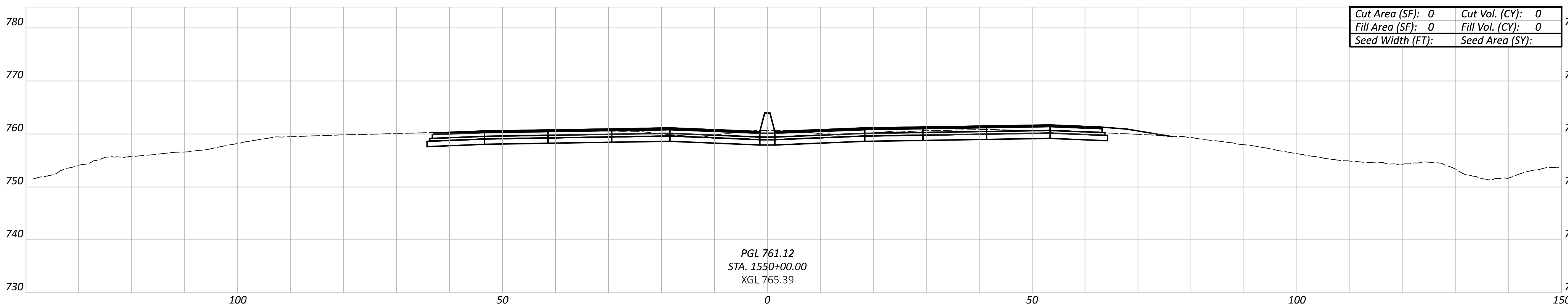

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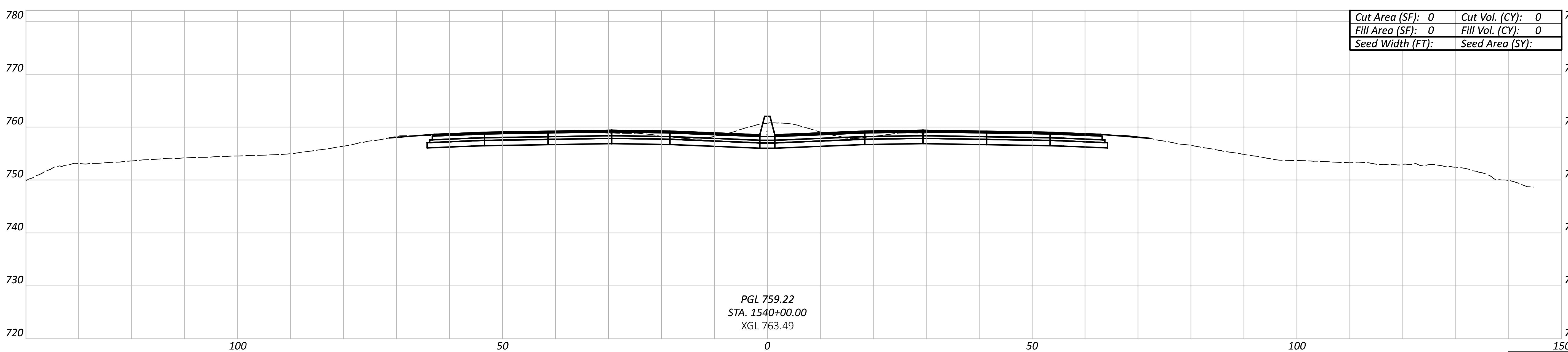

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Sheet Totals		
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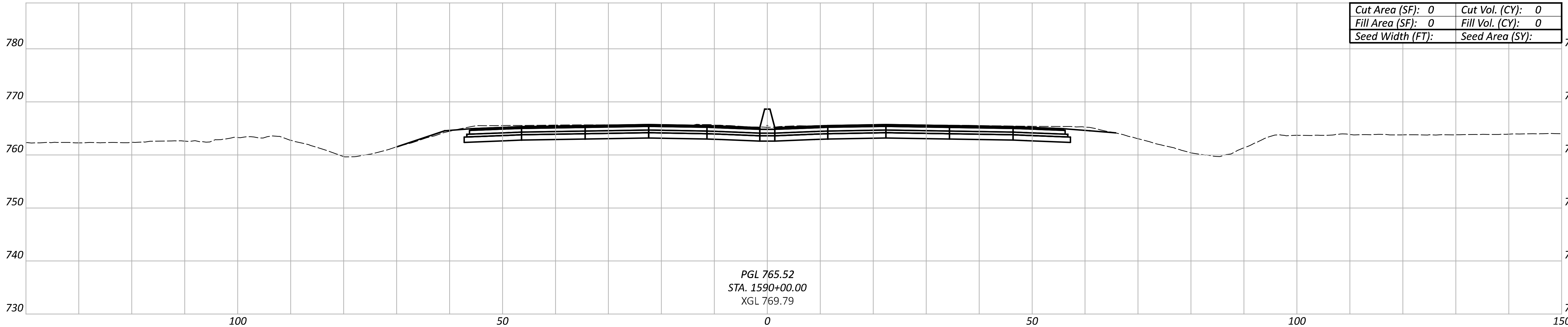

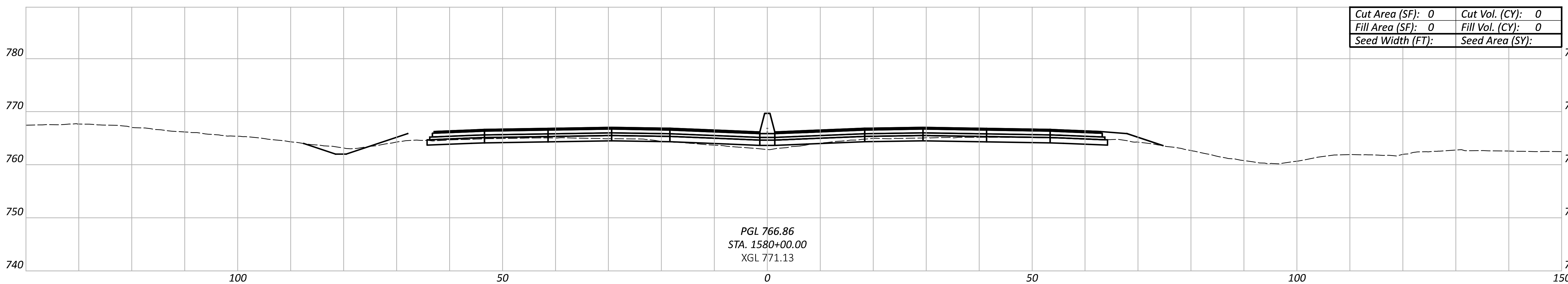

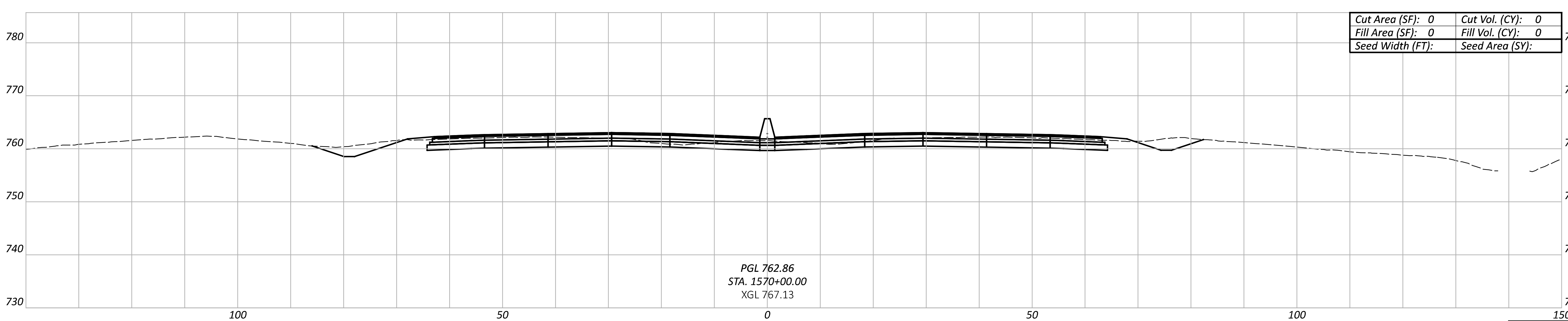

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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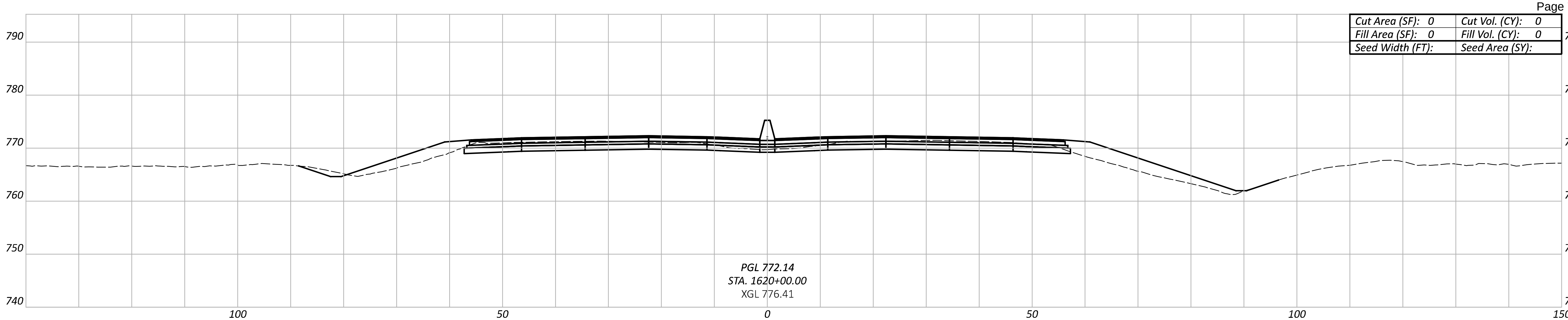

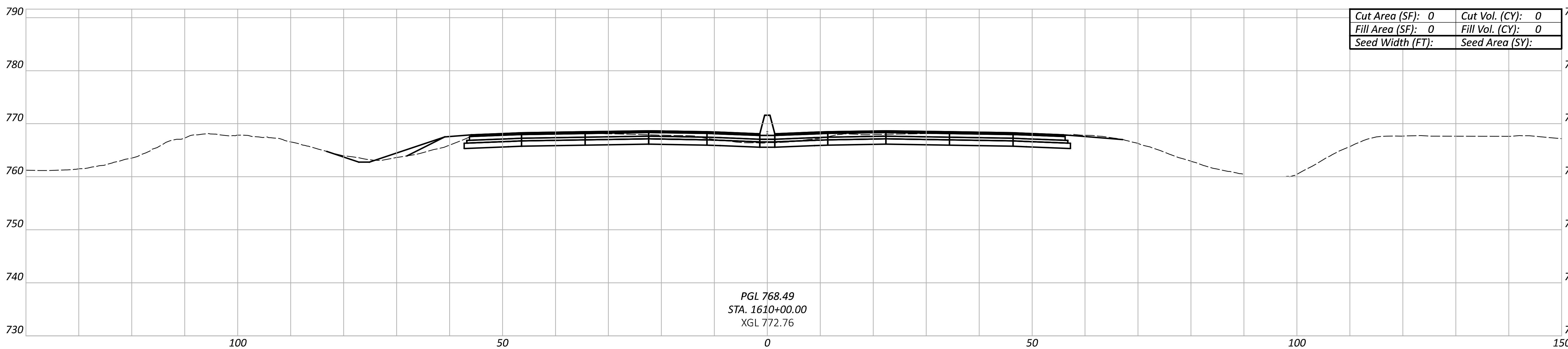

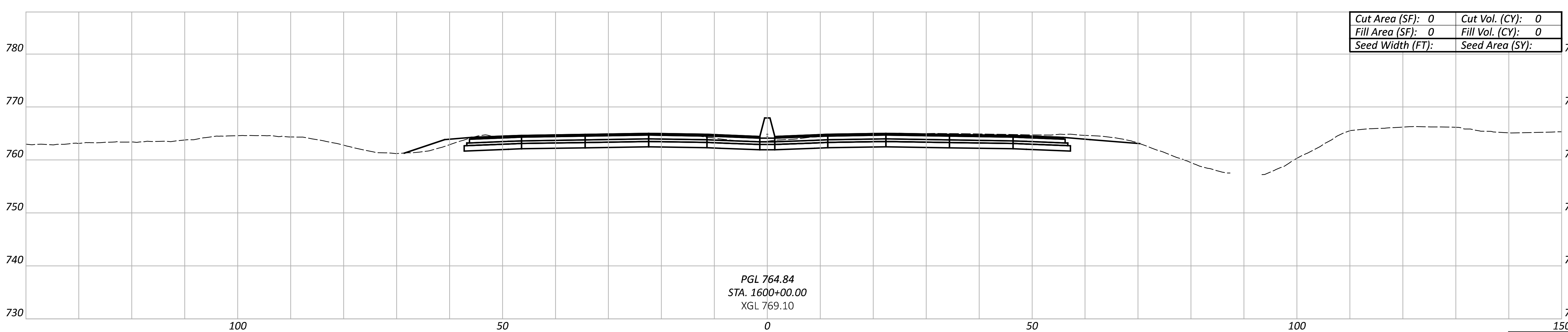

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

FRA/FAI-33-22.99/0.00

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DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0 | TOTAL 0

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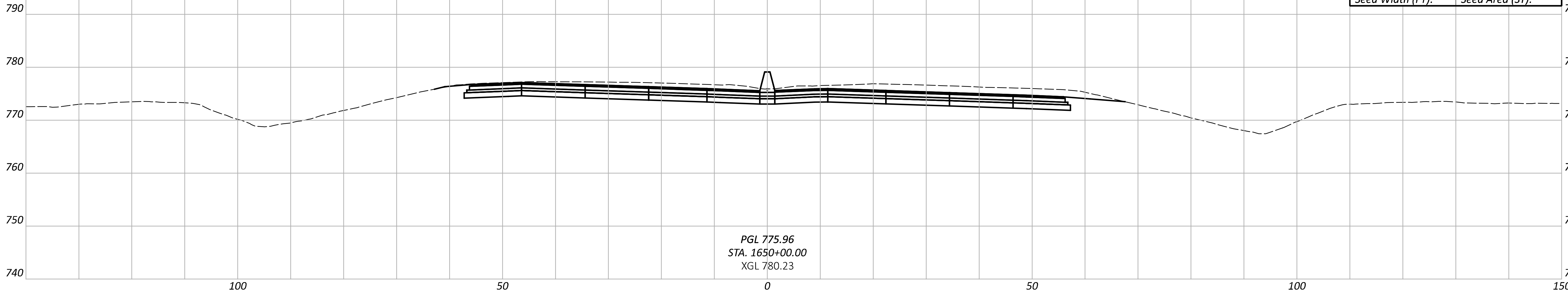
Fill Area (SF): 0	Fill Vol. (CY): 0
Seed Width (FT):	Seed Area (SY):



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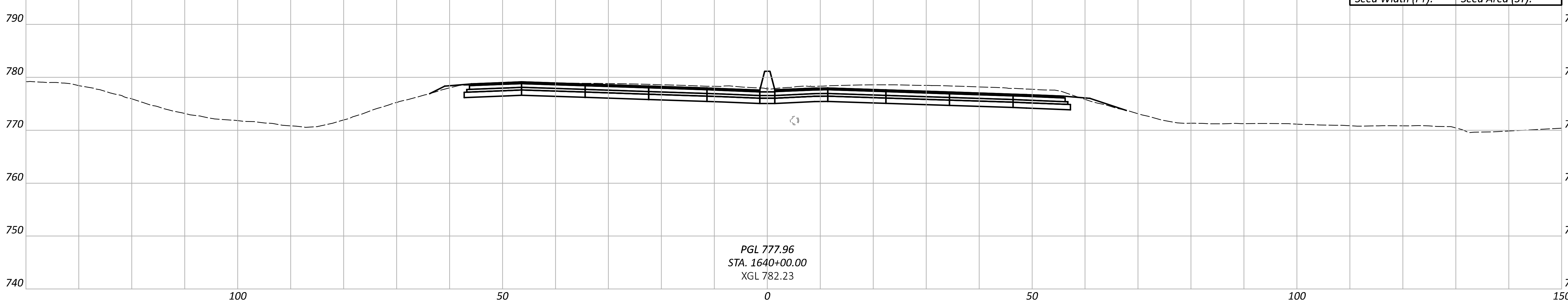

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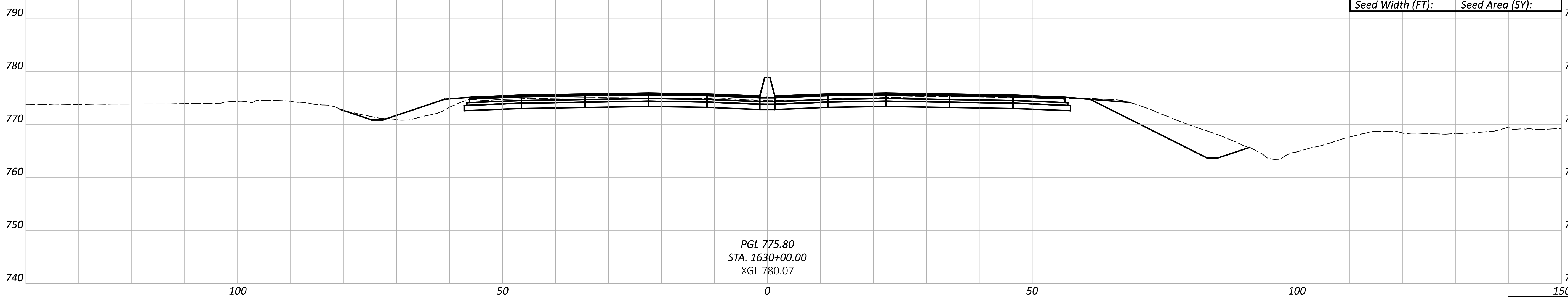

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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
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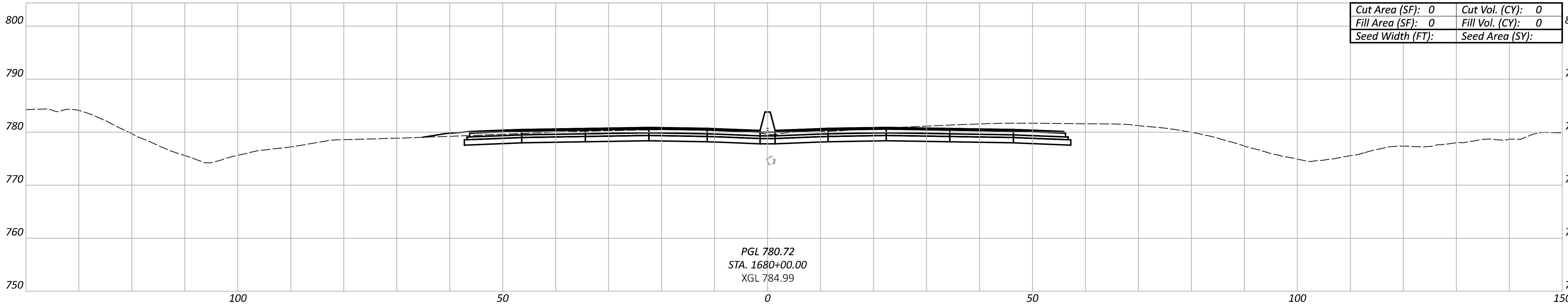
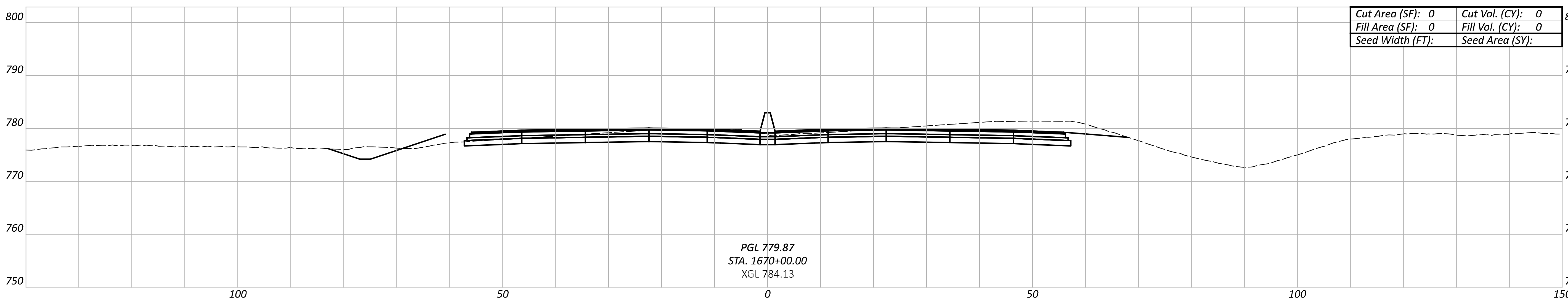
REVIEWER
XXX MM-DD-YY

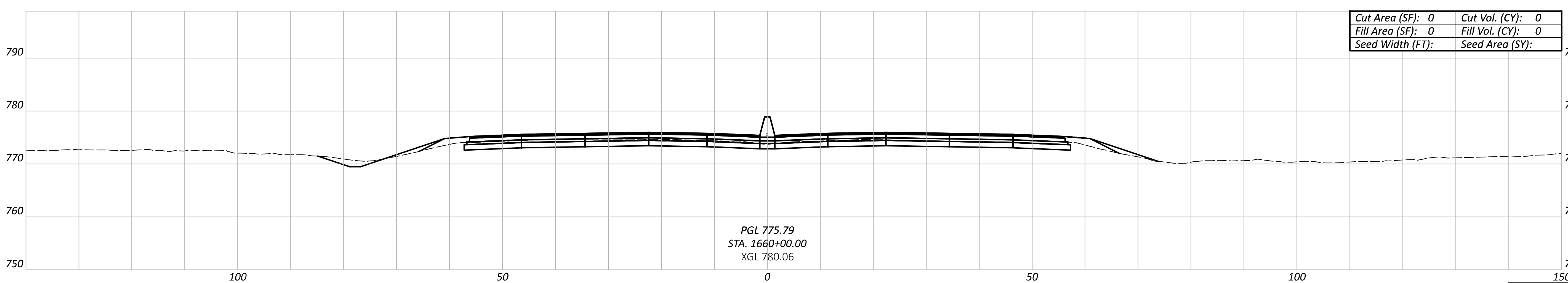
PROJECT ID
121811

Sheet Totals		
Seeding	Cut	Fill

SHEET	TOTAL
P.0	0







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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

Sheet Totals		
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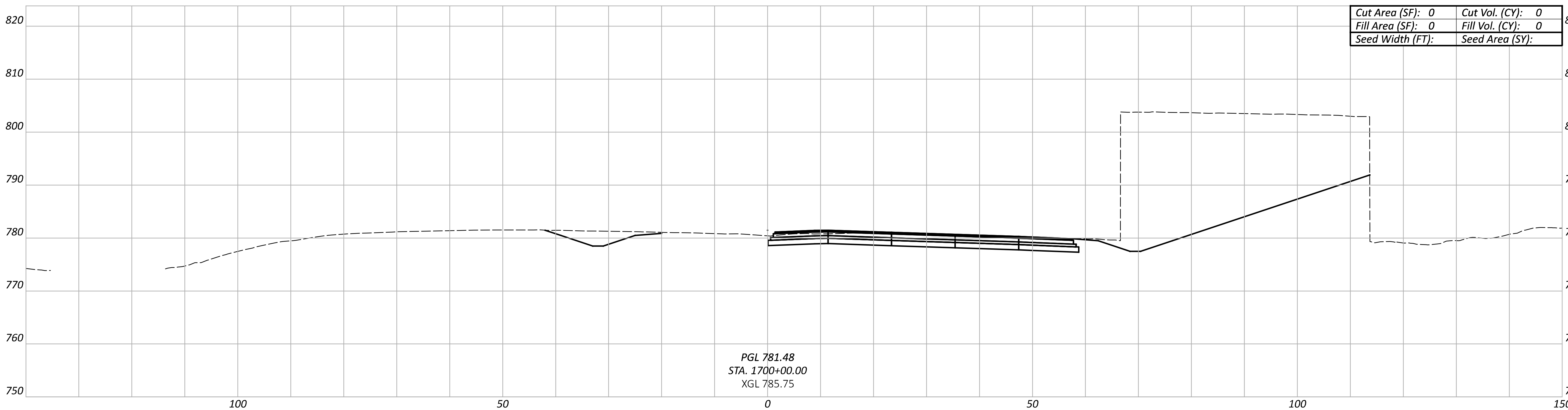
DESIGN AGENCY

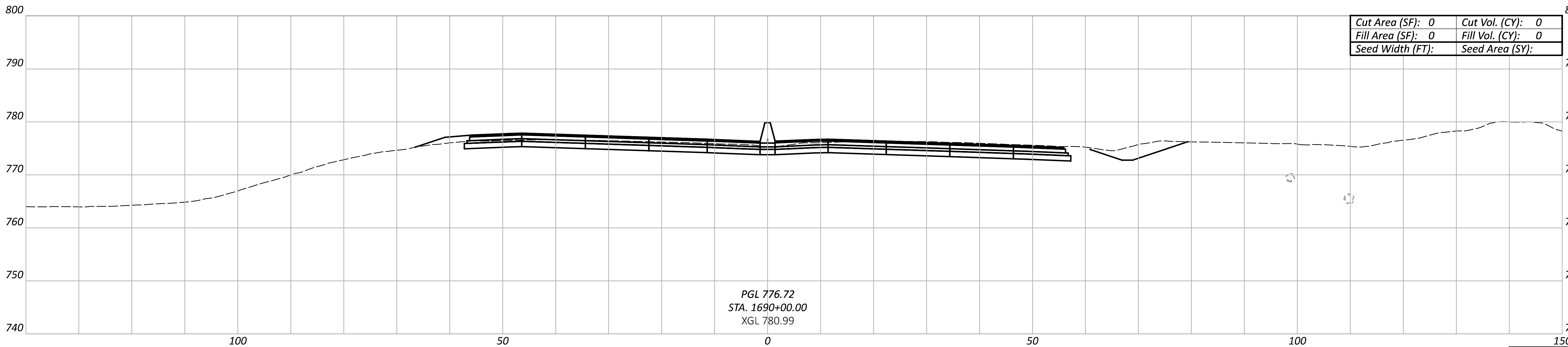
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0





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CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET P.0
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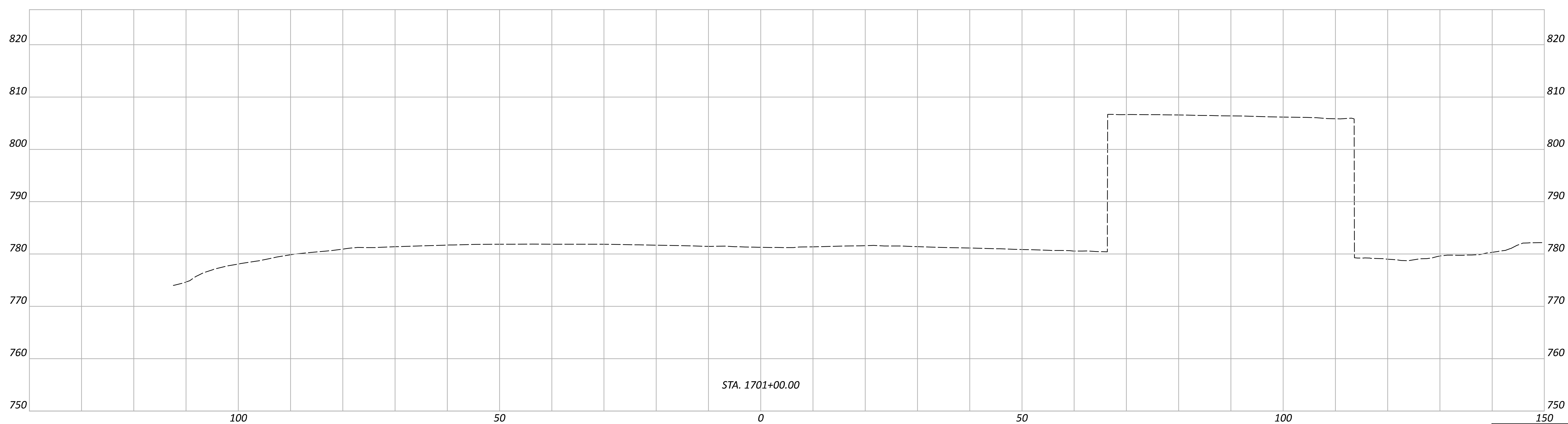

Sheet Totals		
Seeding	Cut	Fill

CROSS SECTIONS - ALTERNATIVE 1
PRELIMINARY

DESIGN AGENCY

DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
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FRA/FAI-33-22.99/0.00

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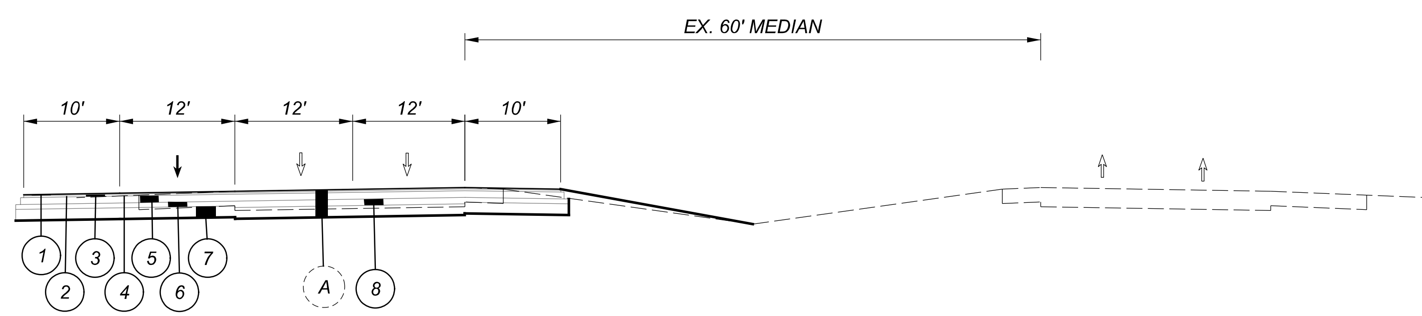
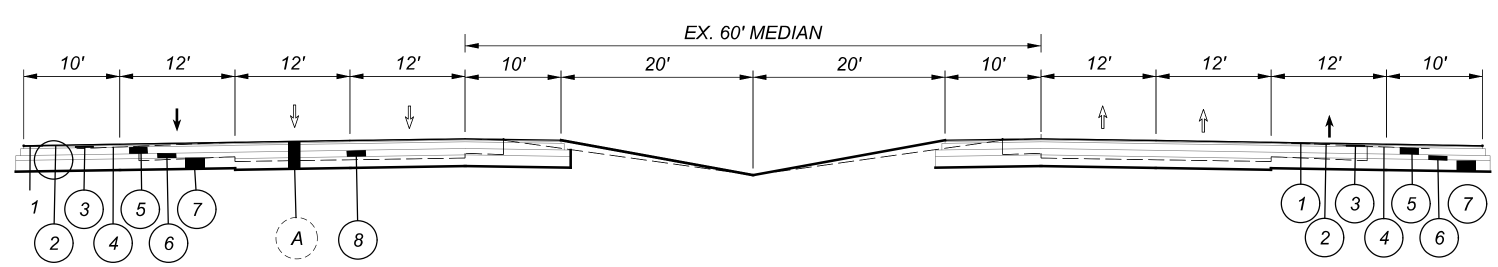
APPENDIX B:

Build Alternative 2 Plans



OUTSIDE WIDENING, 60' MEDIAN (STA 1205+00)



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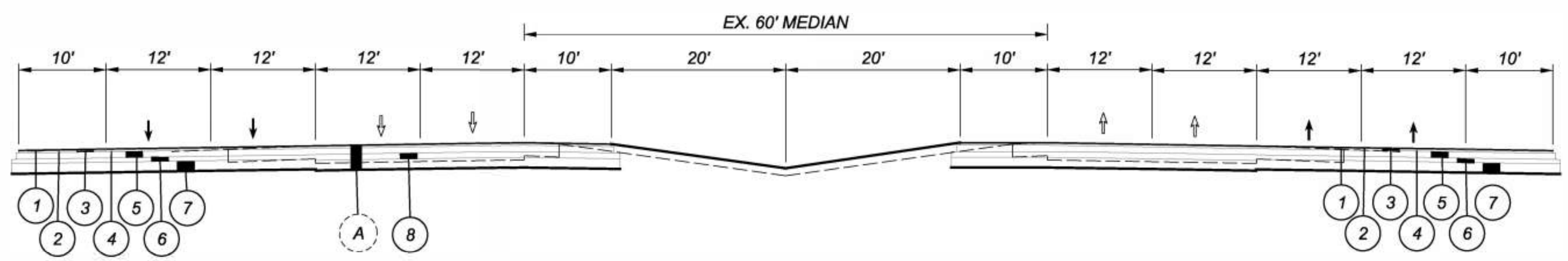
TYPICAL SECTIONS

DESIGN AGENCY	
DESIGNER	XXX
REVIEWER	XXX MM-DD-YY
PROJECT ID	121811
SUBSET 0	TOTAL 0
SHEET P.0	TOTAL 0



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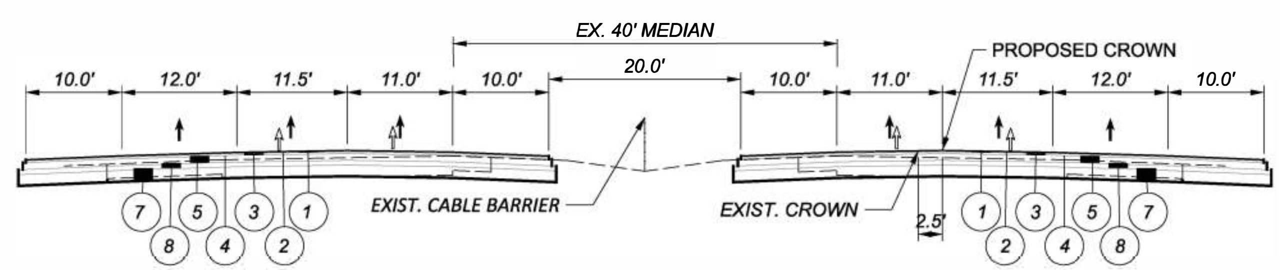

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TYPICAL SECTIONS

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REVIEWER XXX MM-DD-YY	
PROJECT ID 121811	
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Refer to Appendix A, pages 3–6, for the corresponding view in ALT 1.

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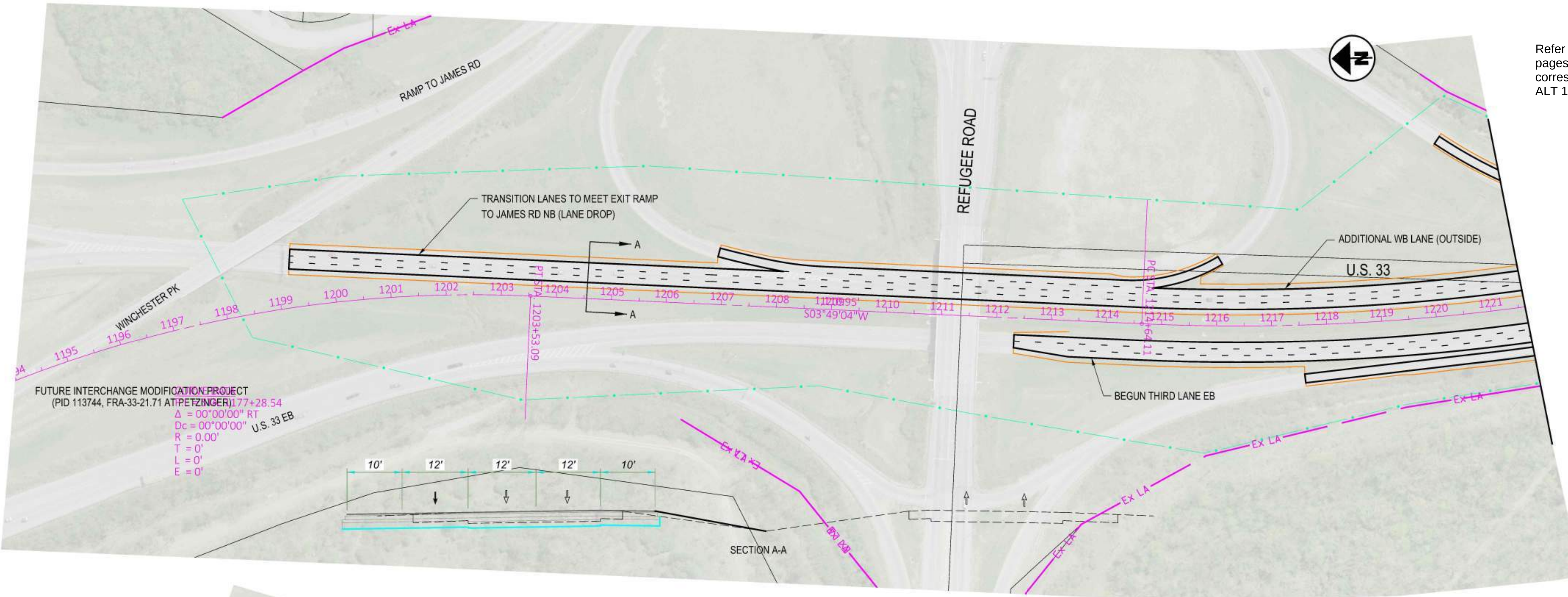

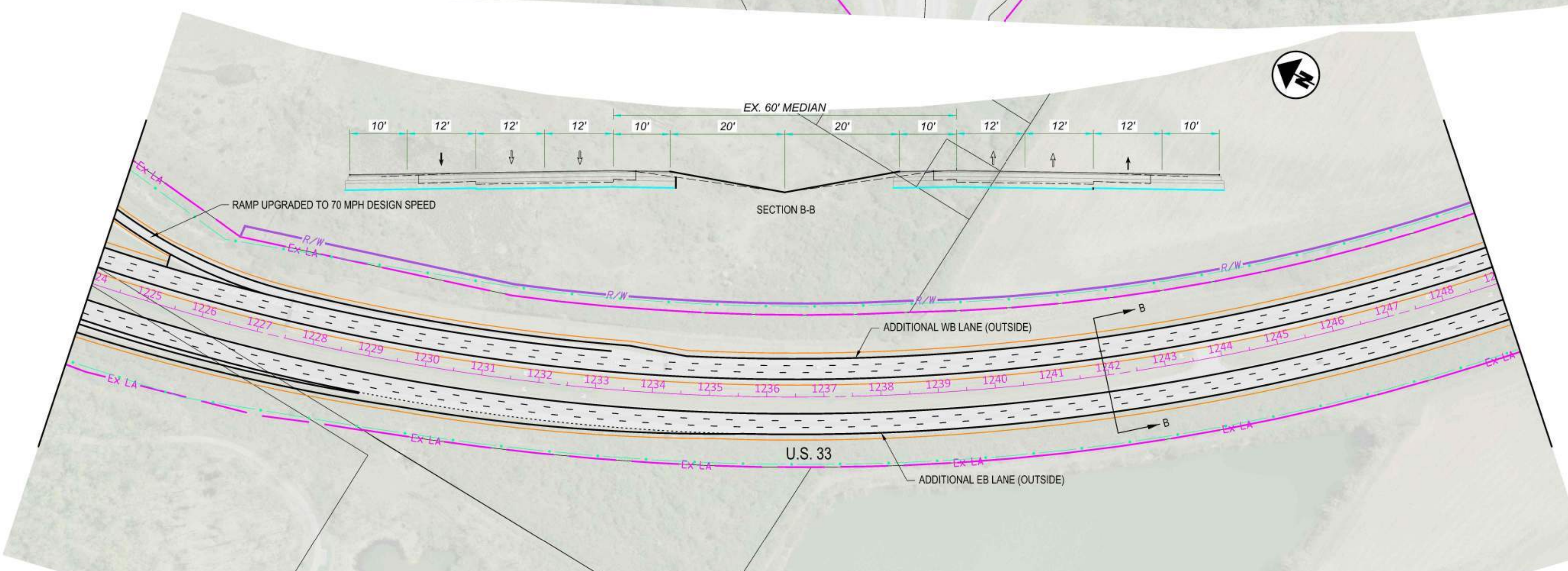

NOTE: BASELINE FOR U.S. 33 IS FOR INFORMATION ONLY AND NOT INTENDED TO REFLECT EXISTING RECORDS.

U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

DESIGNER

REVIEWER

PROJECT ID 111460

SHEET TOTAL

Refer to Appendix A, pages 7-10, for the corresponding view in ALT 1.

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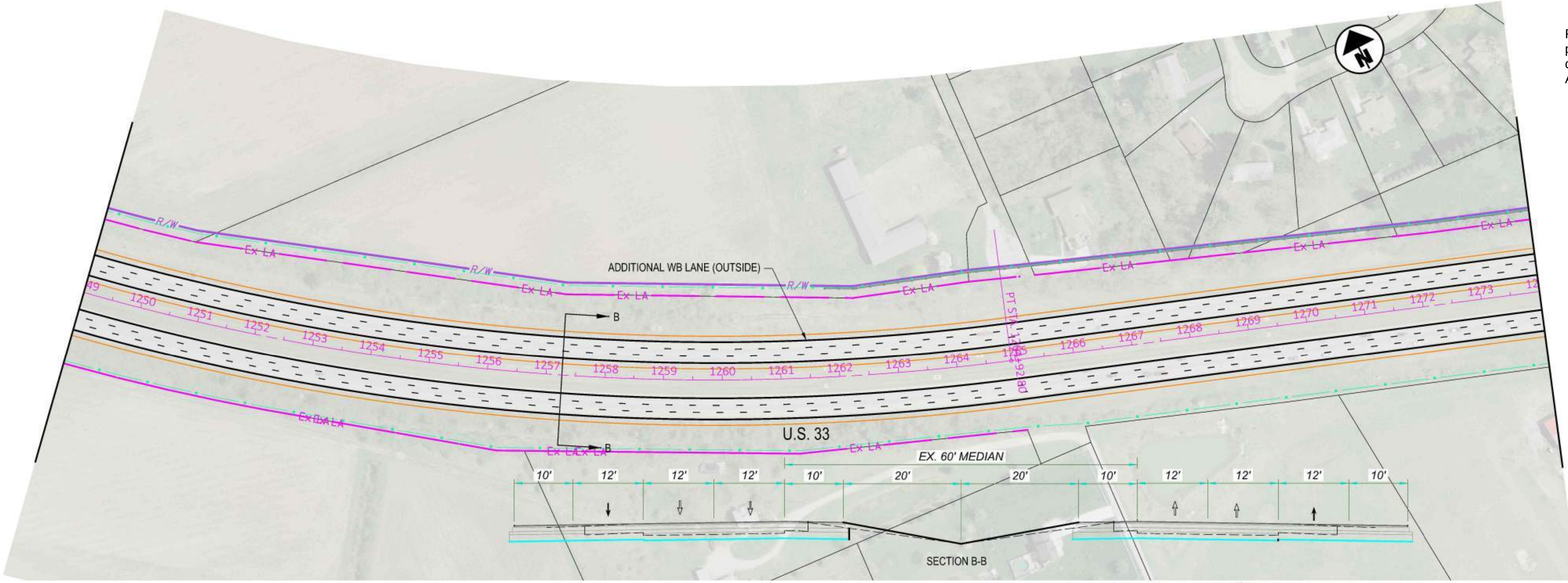


U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

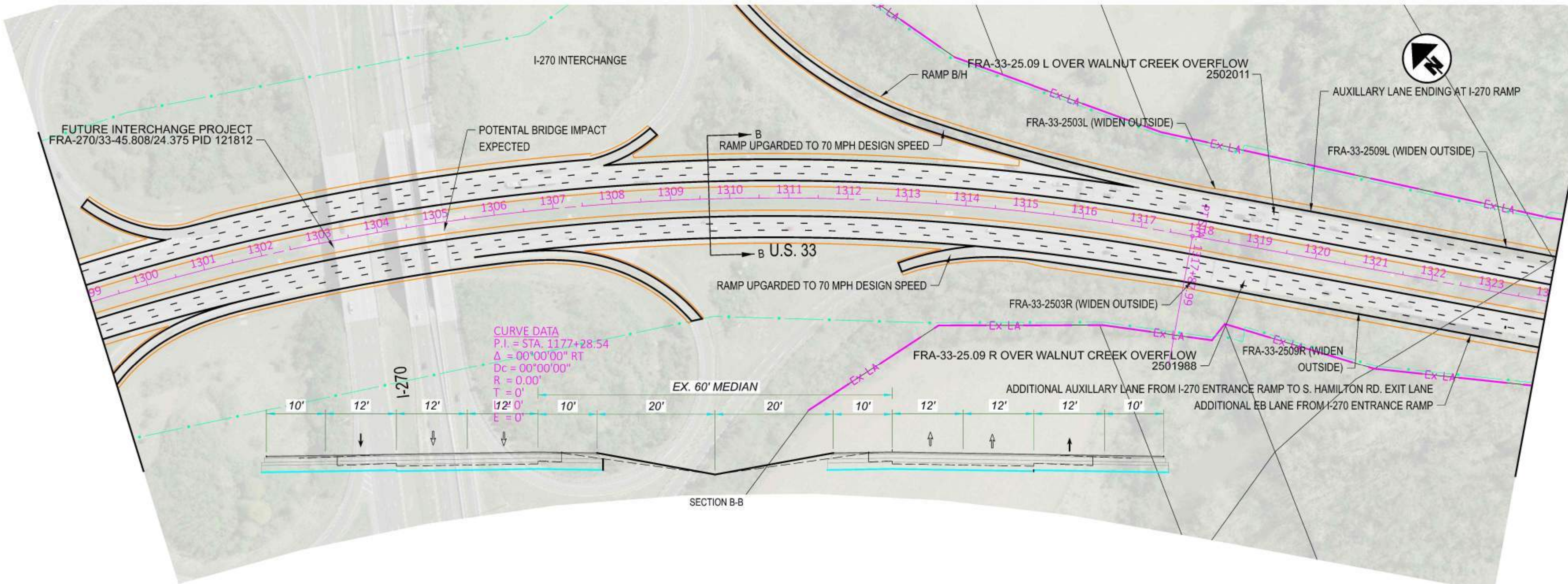
DESIGNER

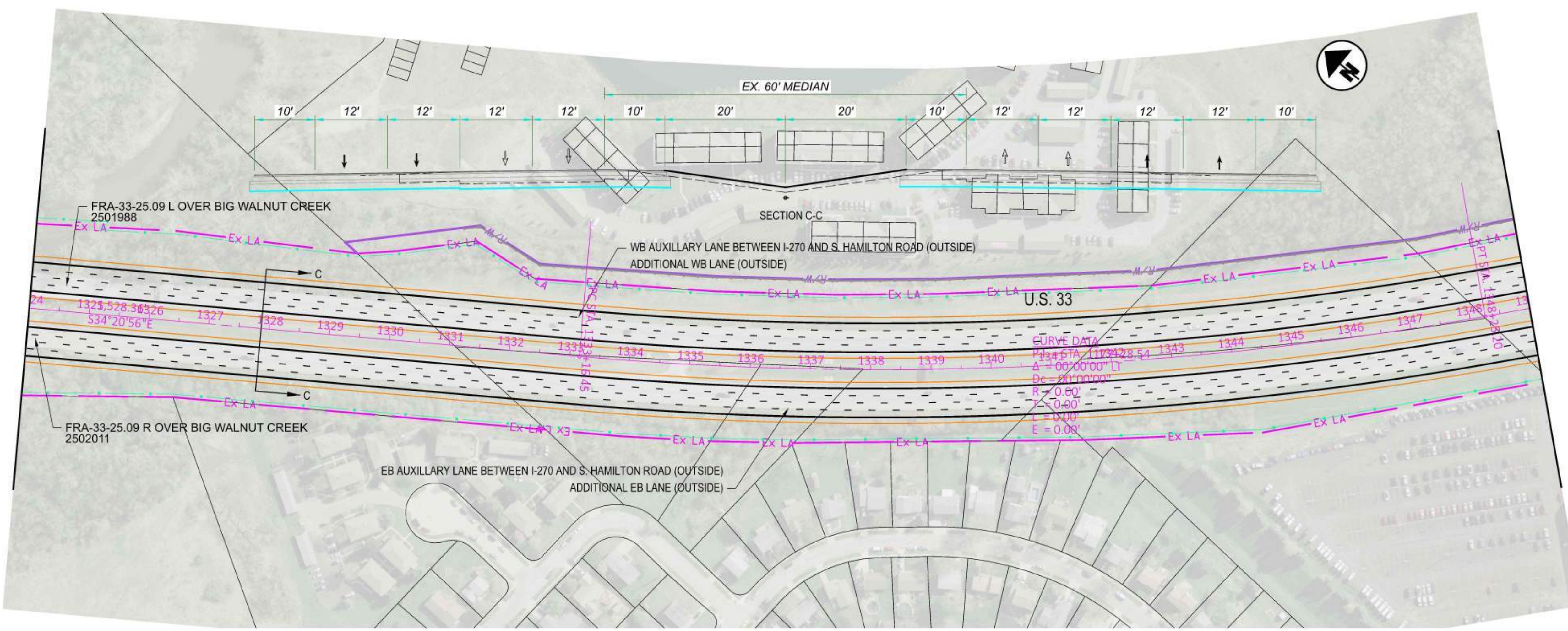
REVIEWER

PROJECT ID
111460

SHEET TOTAL

Refer to Appendix A, pages 11-14, for the corresponding view in ALT 1.





HORIZONTAL SCALE IN FEET
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U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

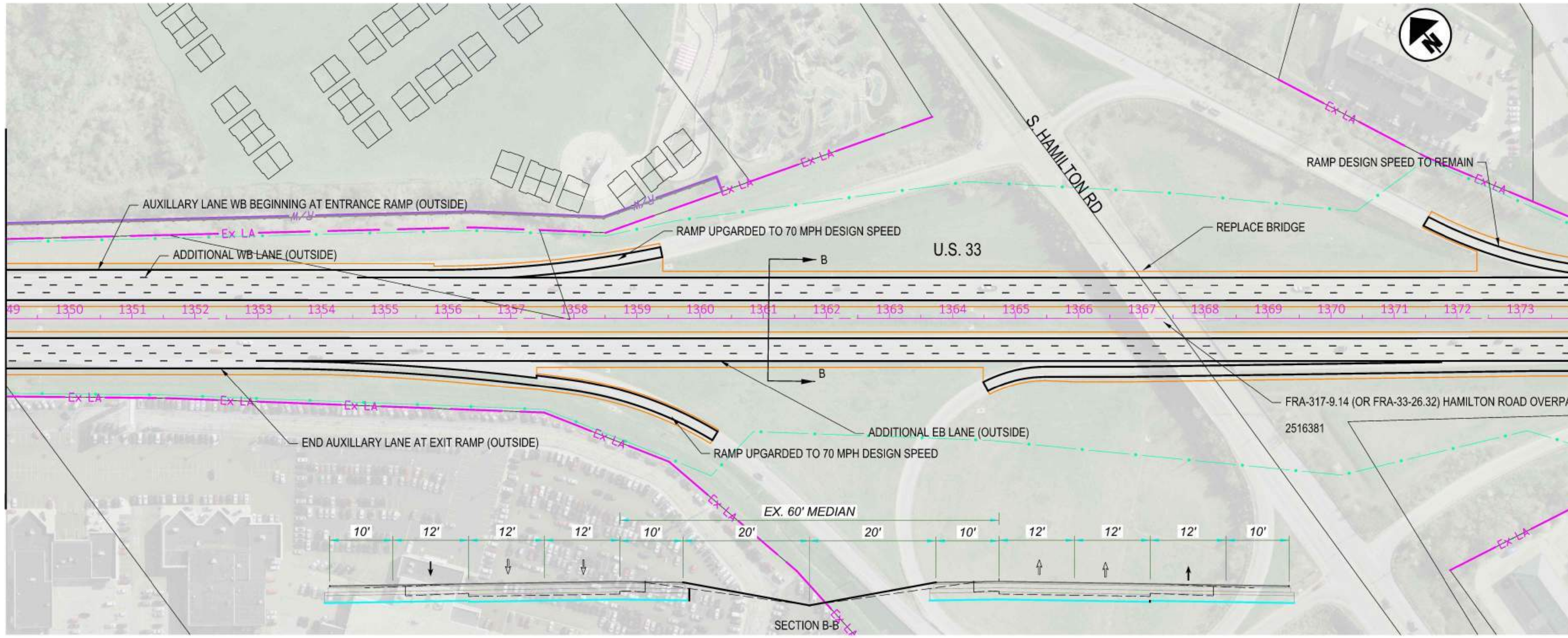
DESIGNER

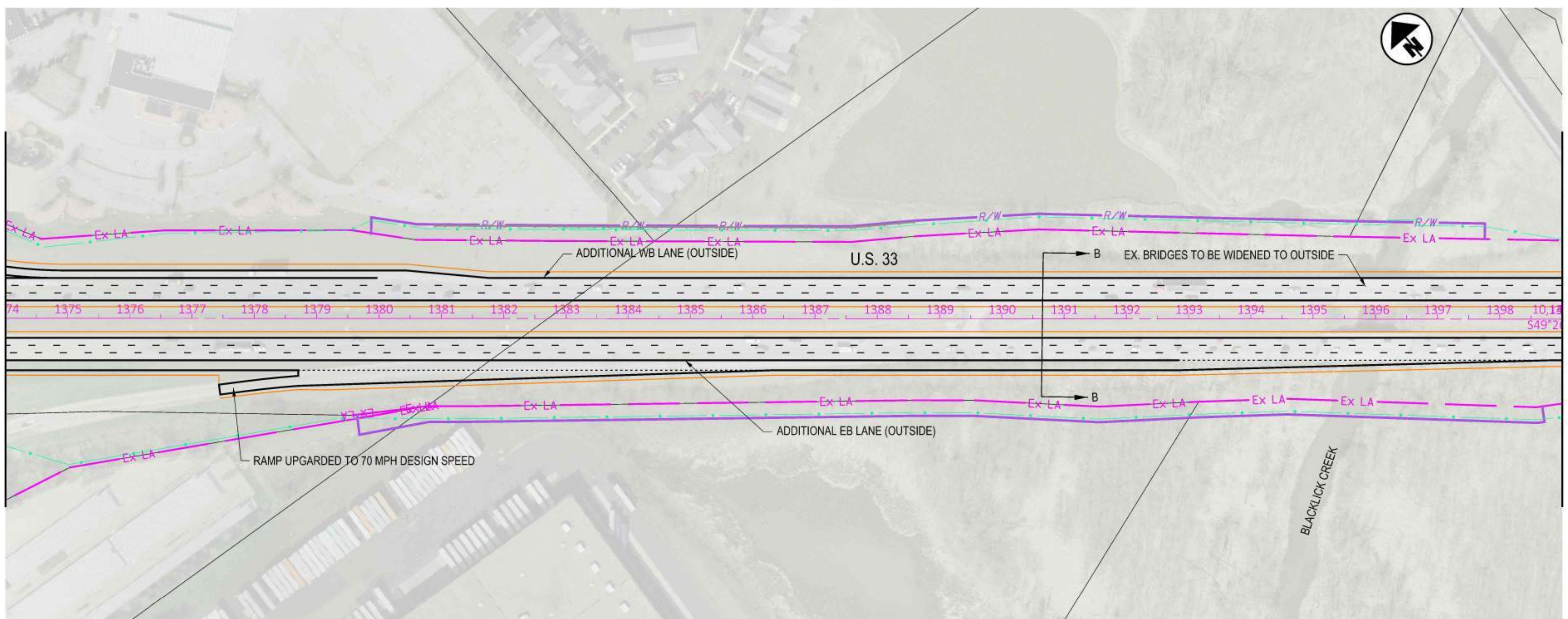
REVIEWER

PROJECT ID
111460

SHEET TOTAL

Refer to Appendix A, pages 14-18, for the corresponding view in ALT 1.





HORIZONTAL SCALE IN FEET
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U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

DESIGNER

REVIEWER

PROJECT ID
111460

SHEET TOTAL

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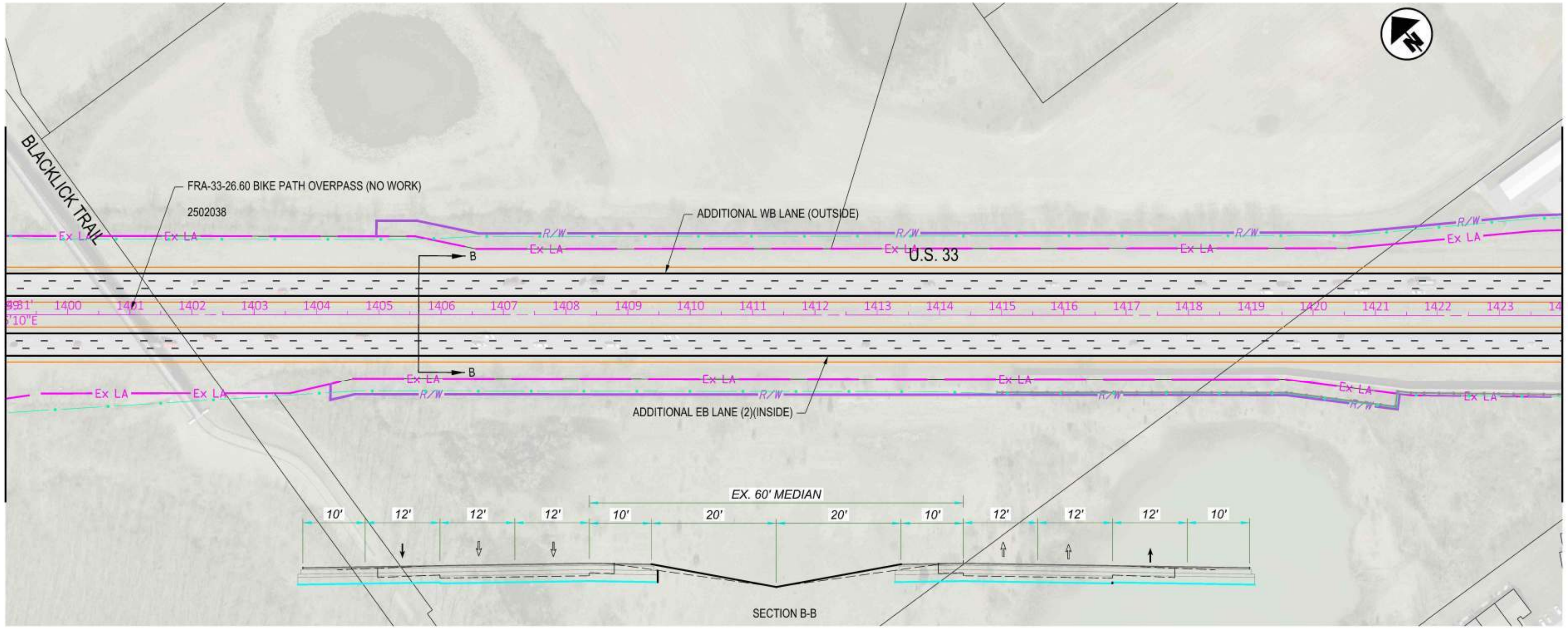

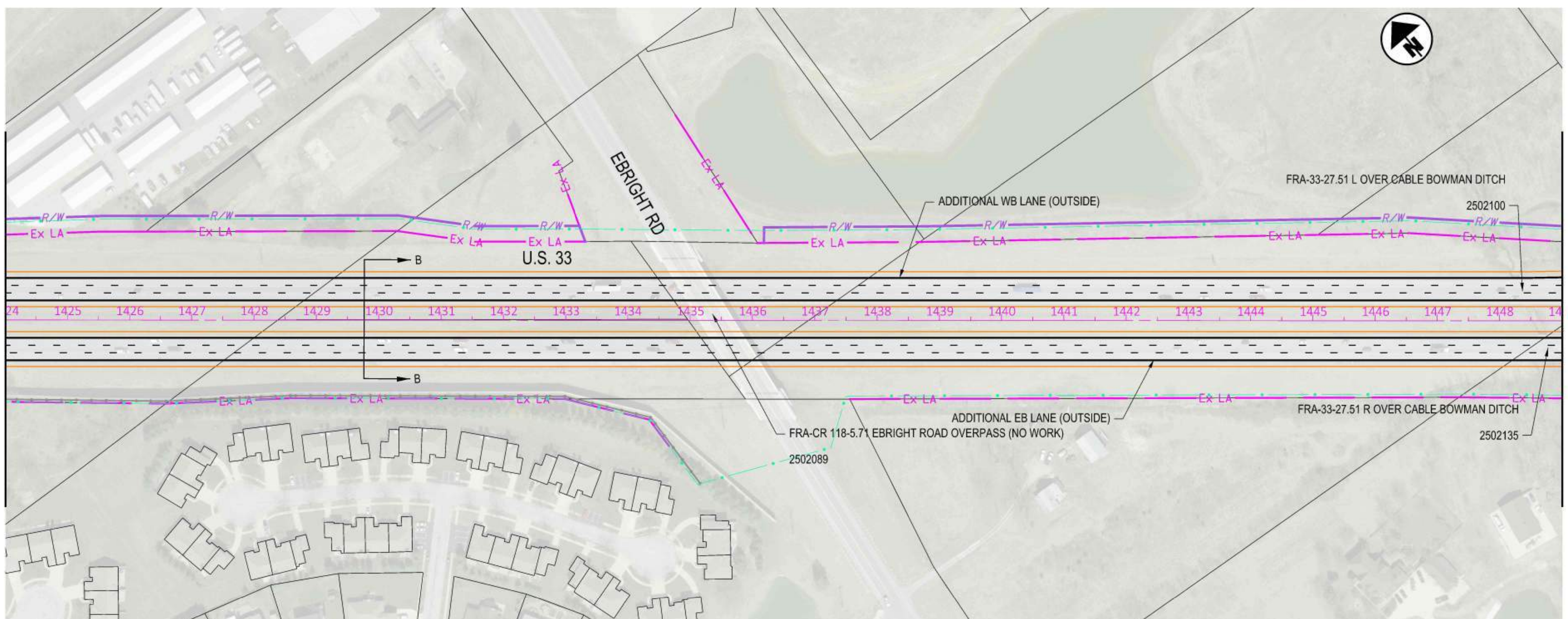

HORIZONTAL SCALE IN FEET

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U.S. 33 CONCEPT PLAN - OUTSIDE WIDENING ALTERNATIVE
STA. 300+00 TO STA. 350+00

DESIGN AGENCY

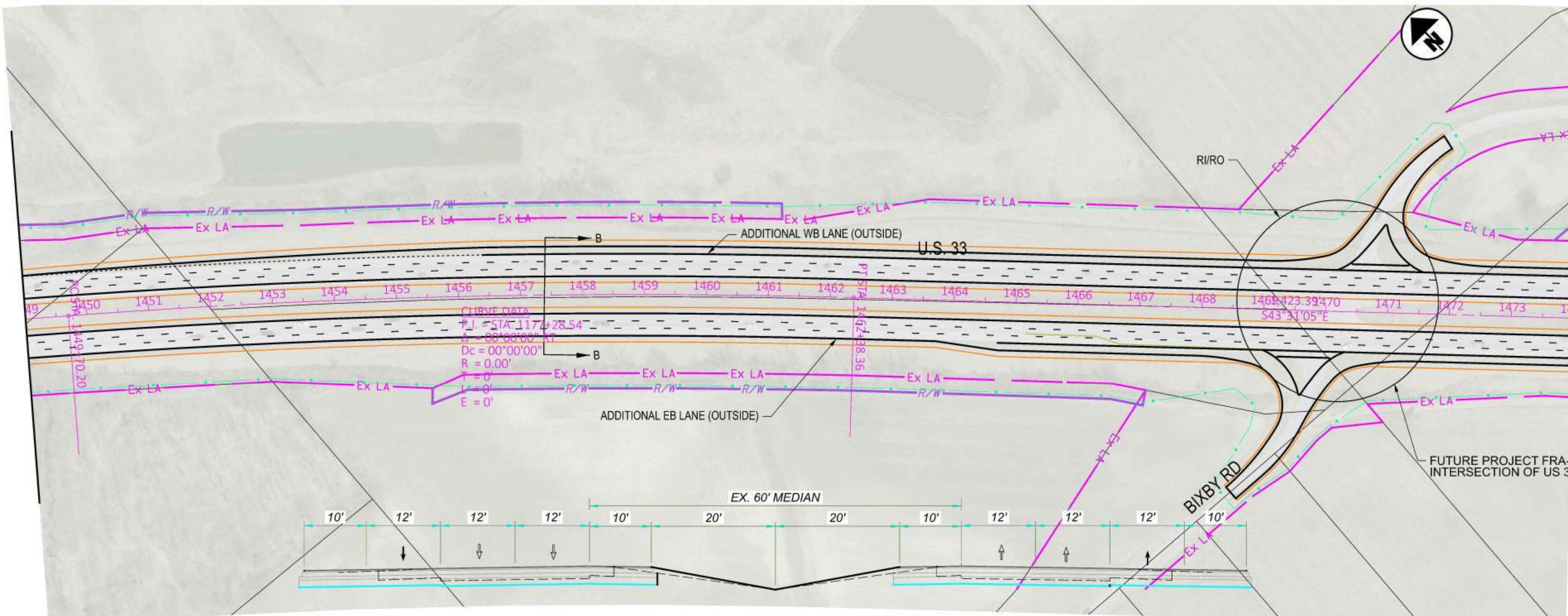
DESIGNER
HBK

REVIEWER
JRE 05/16/24

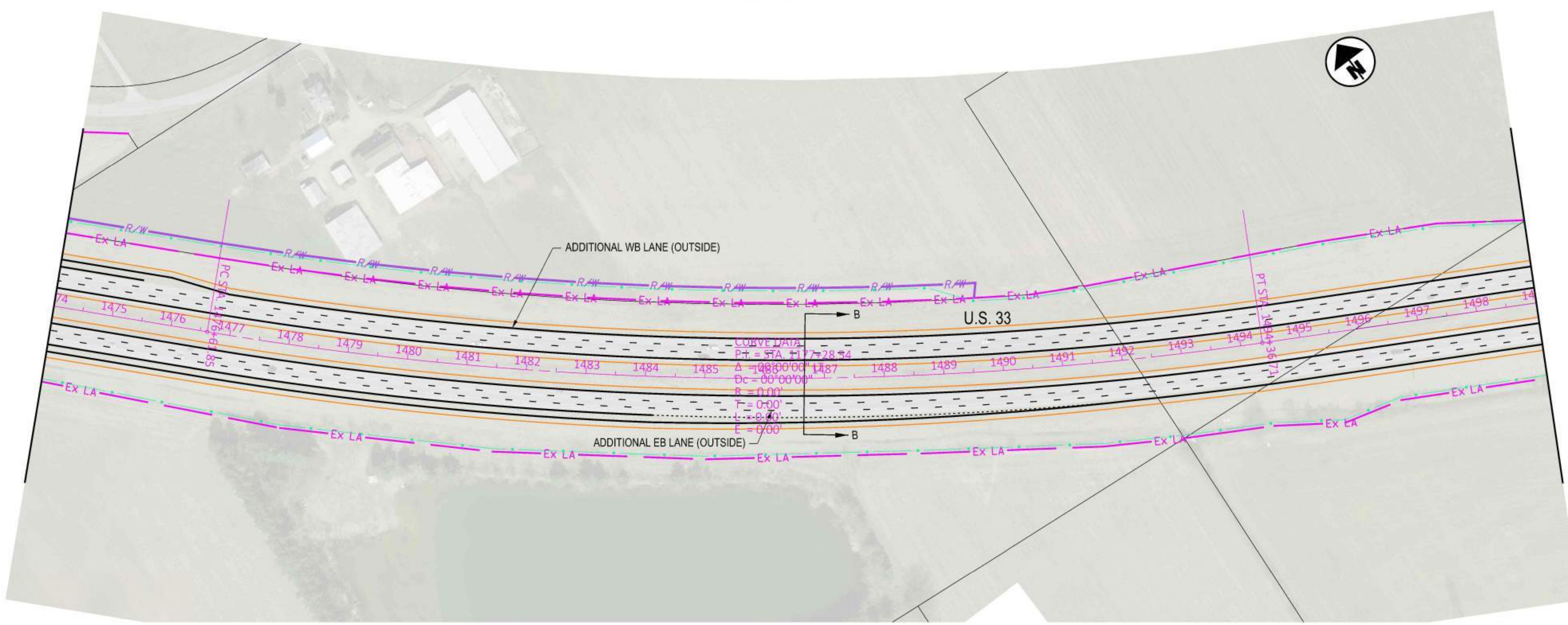
PROJECT ID
111460

SHEET 20 | TOTAL 26

Refer to Appendix A, pages 22-26, for the corresponding view in ALT 1.



SECTION B-B



HORIZONTAL SCALE IN FEET

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U.S. 33 CONCEPT PLAN - ALTERNATIVE 2

PRELIMINARY

DESIGN AGENCY

DESIGNER

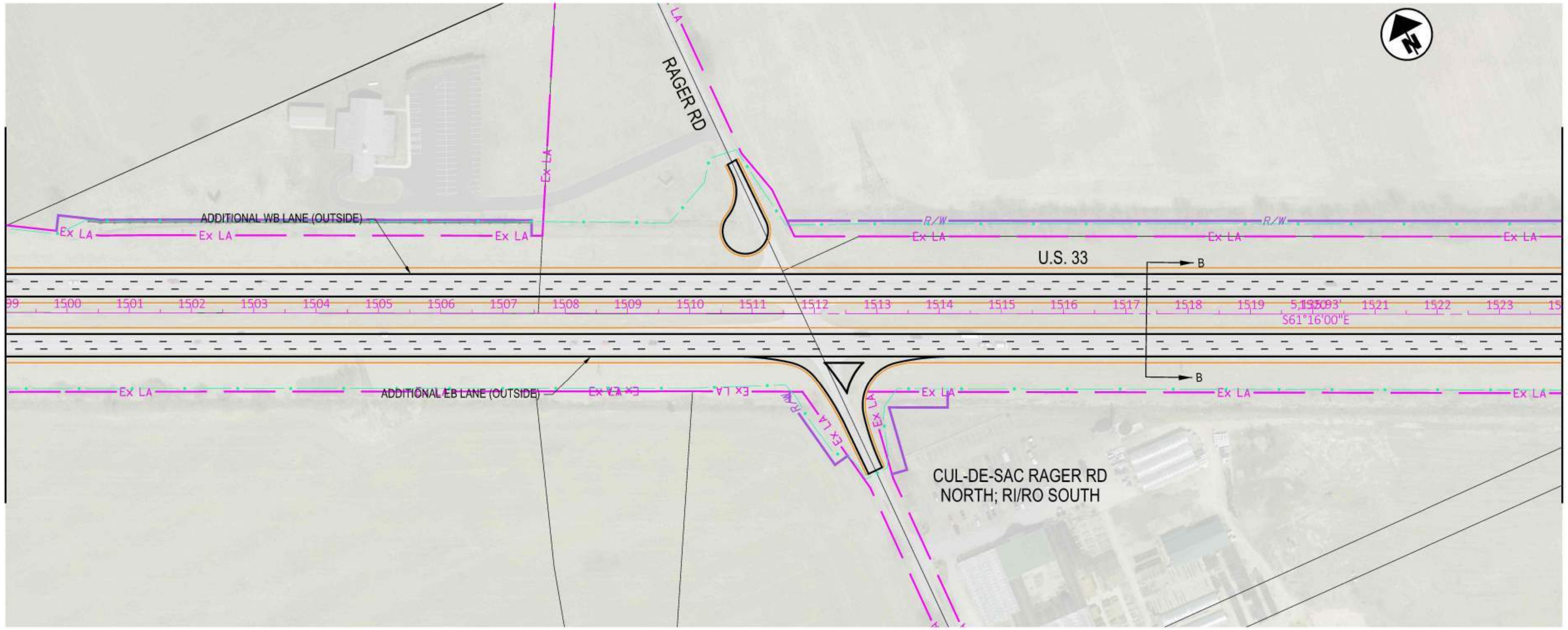
REVIEWER

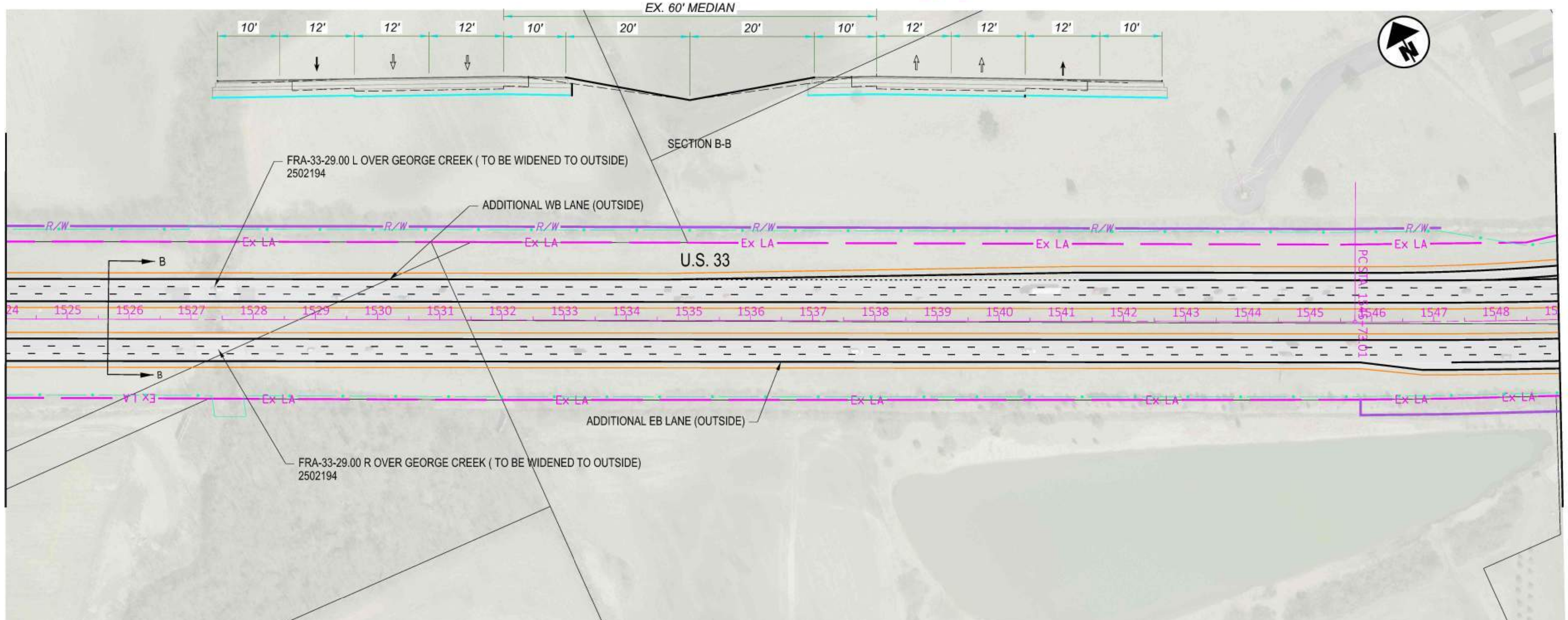
PROJECT ID

111460

SHEET TOTAL

Refer to Appendix A, pages 26-29, for the corresponding view in ALT 1.





HORIZONTAL SCALE IN FEET
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U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

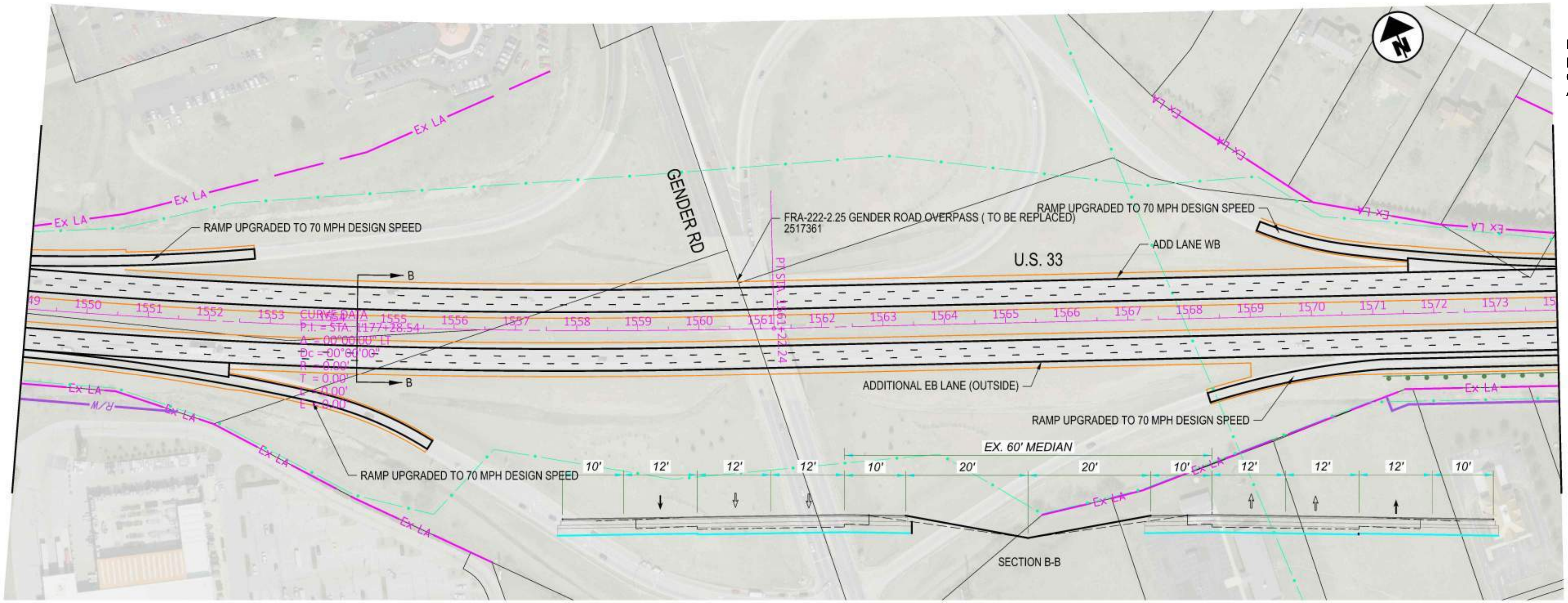
DESIGNER

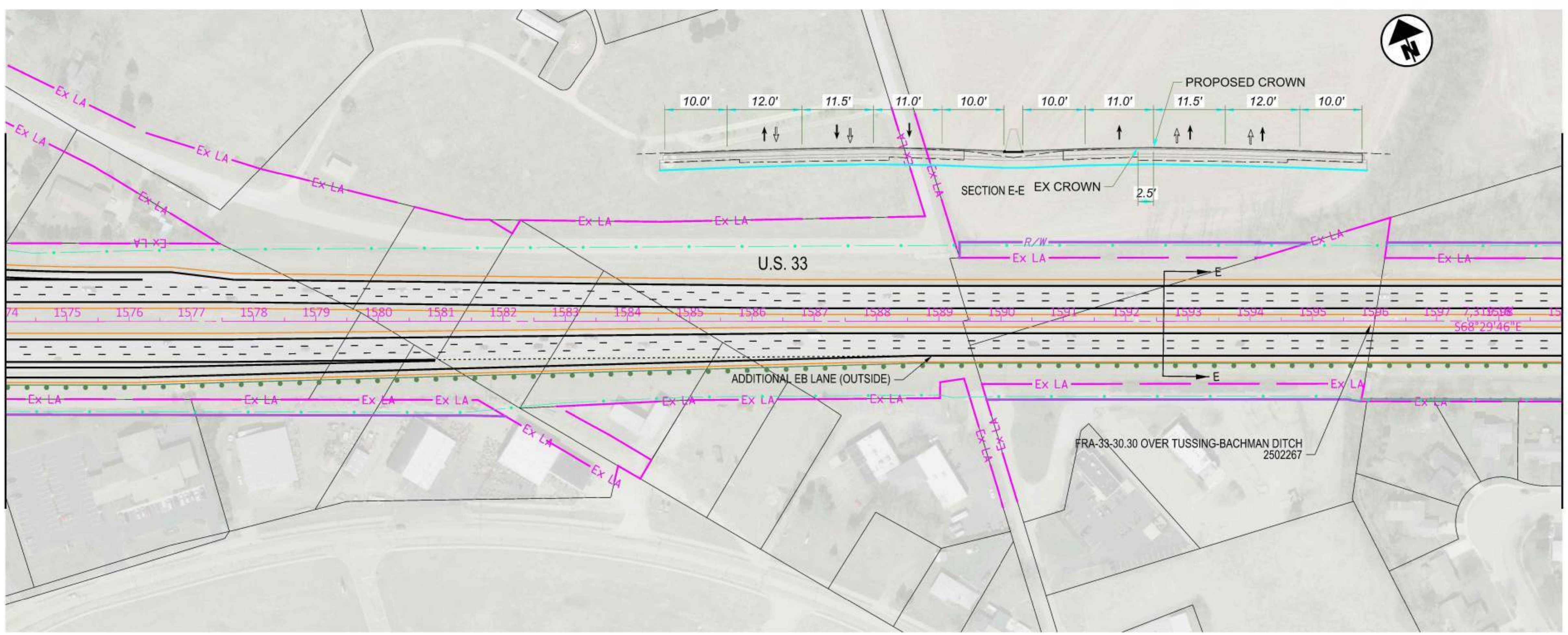
REVIEWER

PROJECT ID
111460

SHEET TOTAL

Refer to Appendix A, pages 30-33, for the corresponding view in ALT 1.





HORIZONTAL SCALE IN FEET 0 50 100 200

U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

DESIGNER

REVIEWER

PROJECT ID
111460

SHEET TOTAL

Refer to Appendix A, pages 33-37, for the corresponding view in ALT 1.

HORIZONTAL SCALE IN FEET
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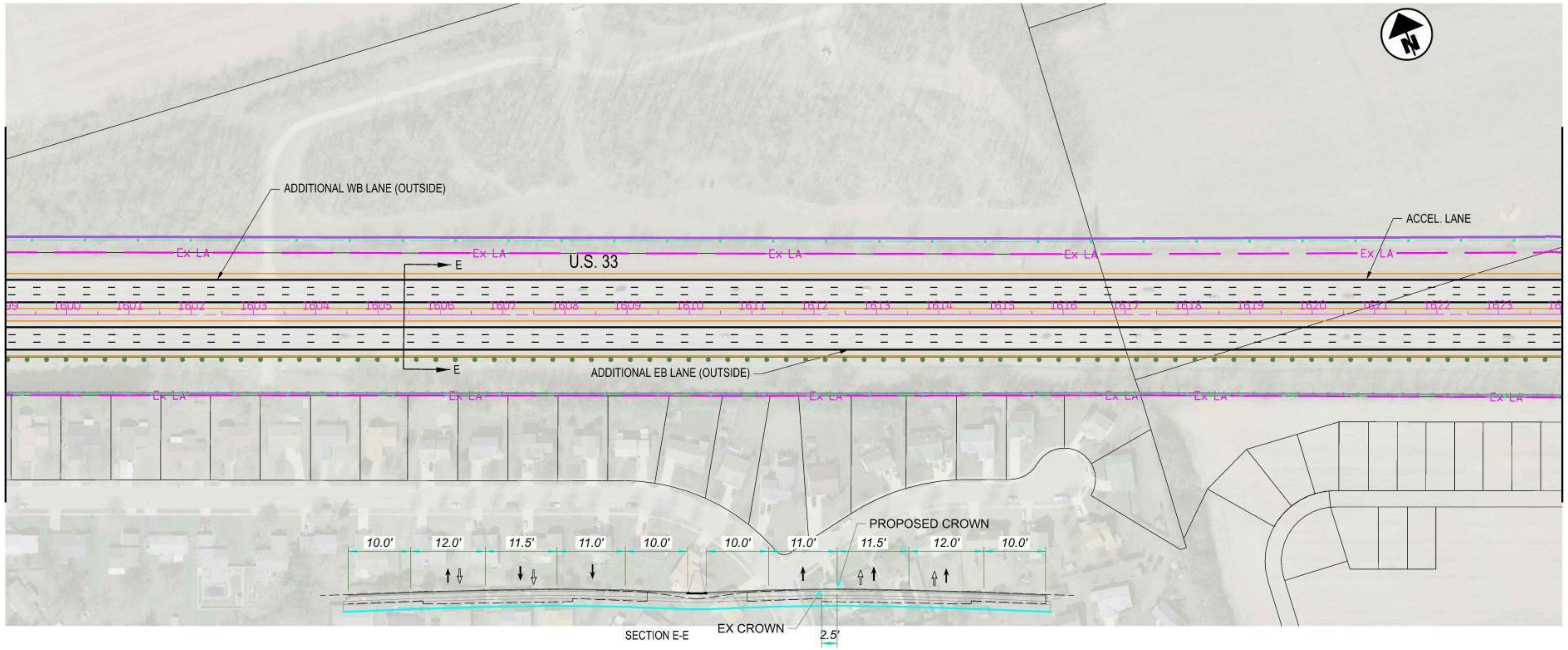

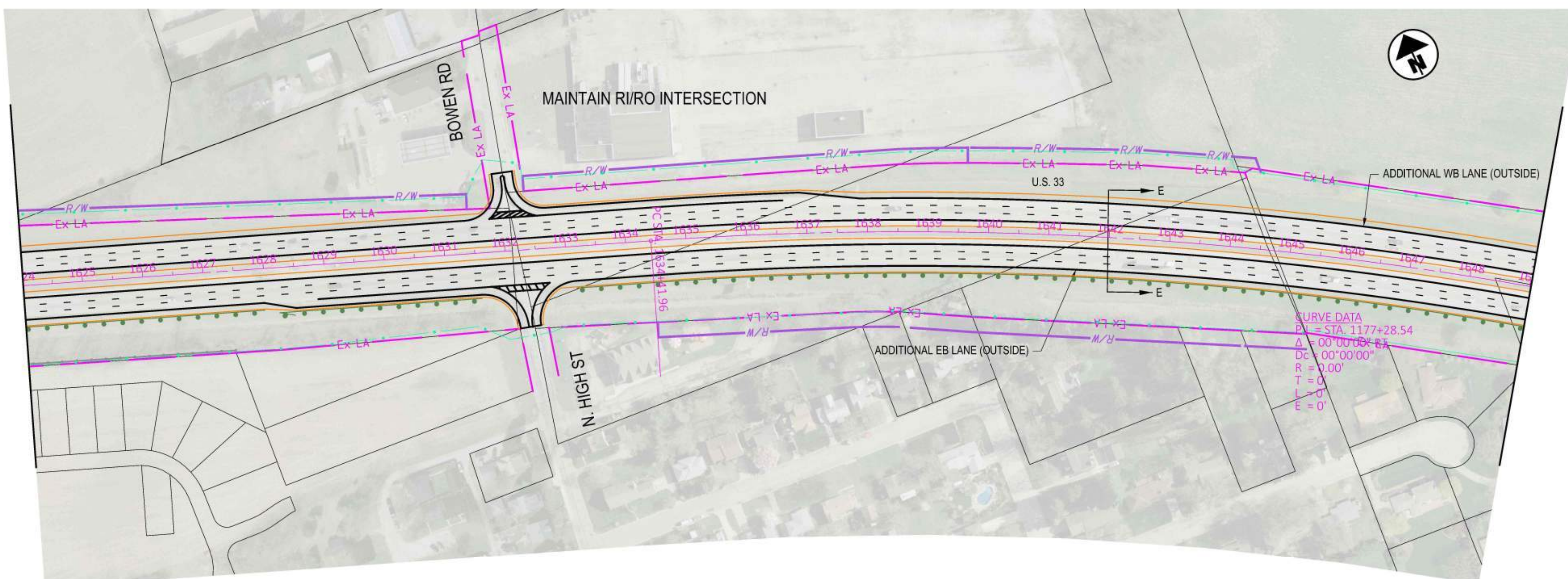

U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

DESIGNER

REVIEWER

PROJECT ID
111460

SHEET TOTAL

Refer to Appendix A, pages 37-41, for the corresponding view in ALT 1.

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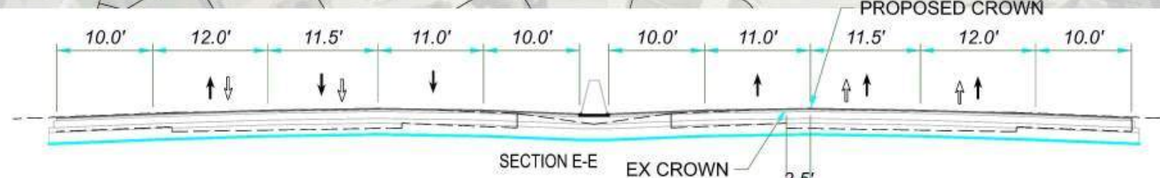

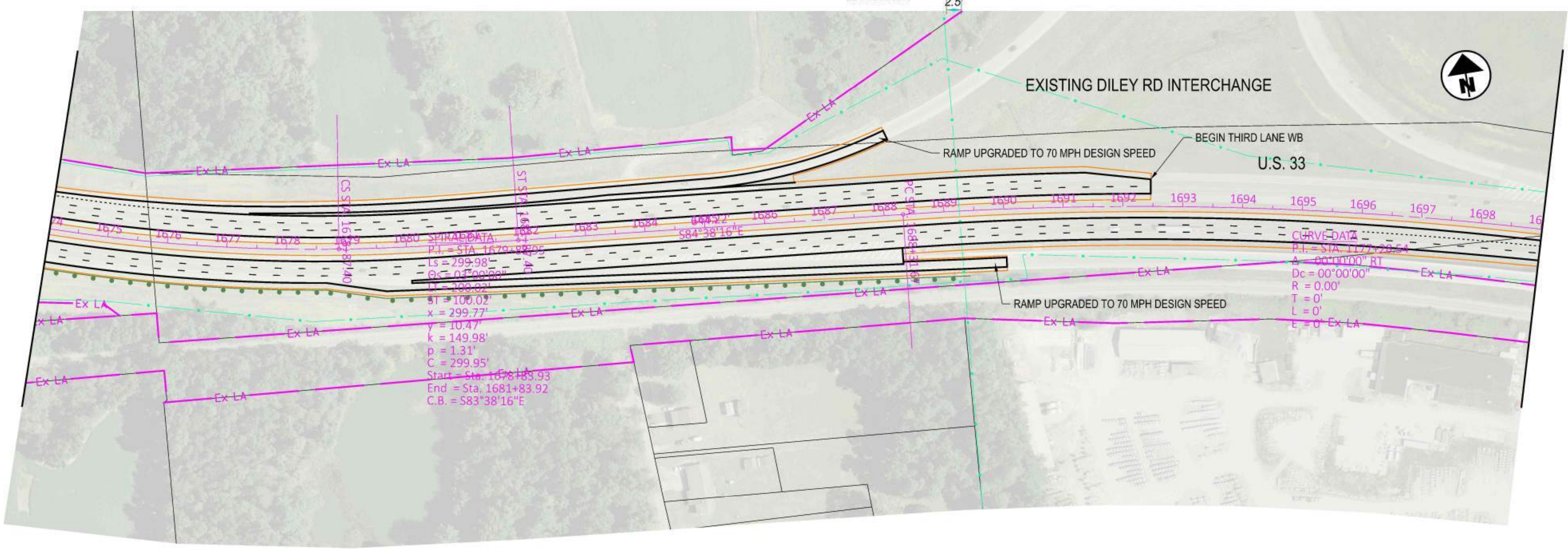

U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

DESIGNER

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PROJECT ID
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SHEET TOTAL

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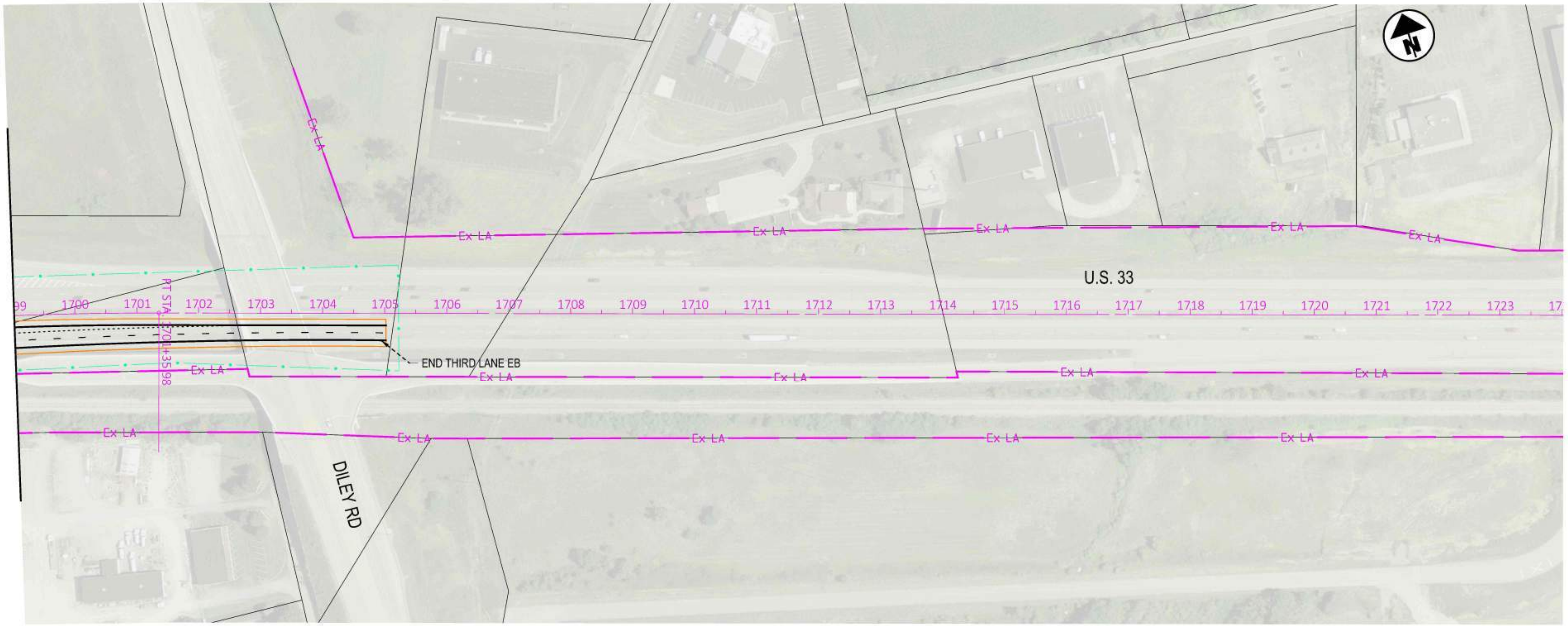


HORIZONTAL SCALE IN FEET
0 50 100 200

U.S. 33 CONCEPT PLAN - ALTERNATIVE 2
PRELIMINARY

DESIGN AGENCY

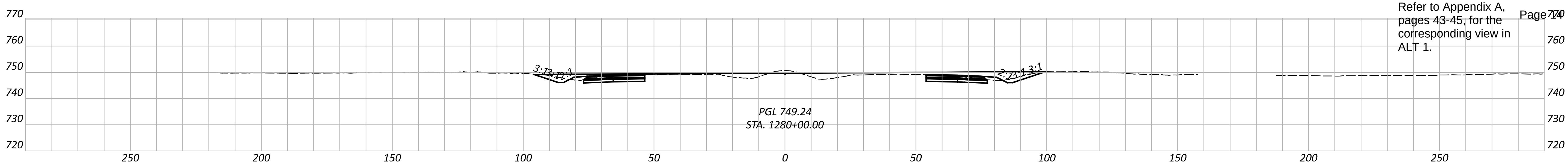
DESIGNER

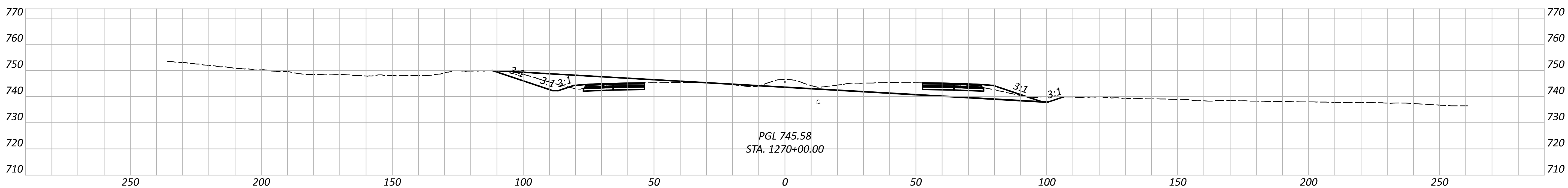
REVIEWER

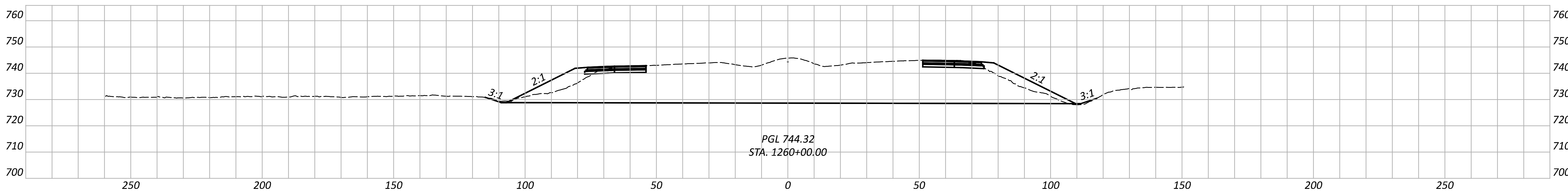
PROJECT ID
111460

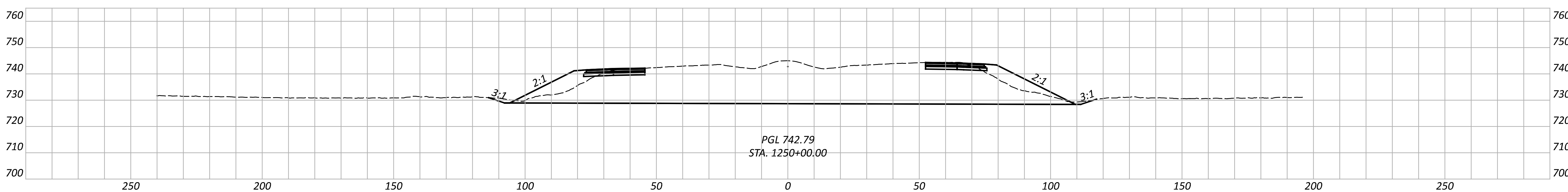
SHEET TOTAL

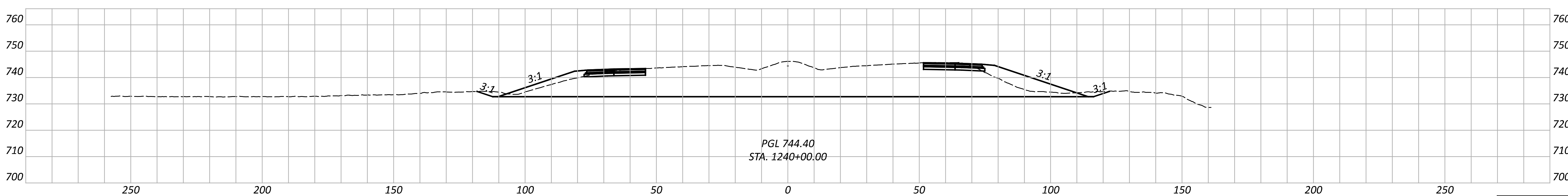
Refer to Appendix A, pages 43-45, for the corresponding view in ALT 1.











CROSS SECTIONS - ALTERNATIVE 2
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Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

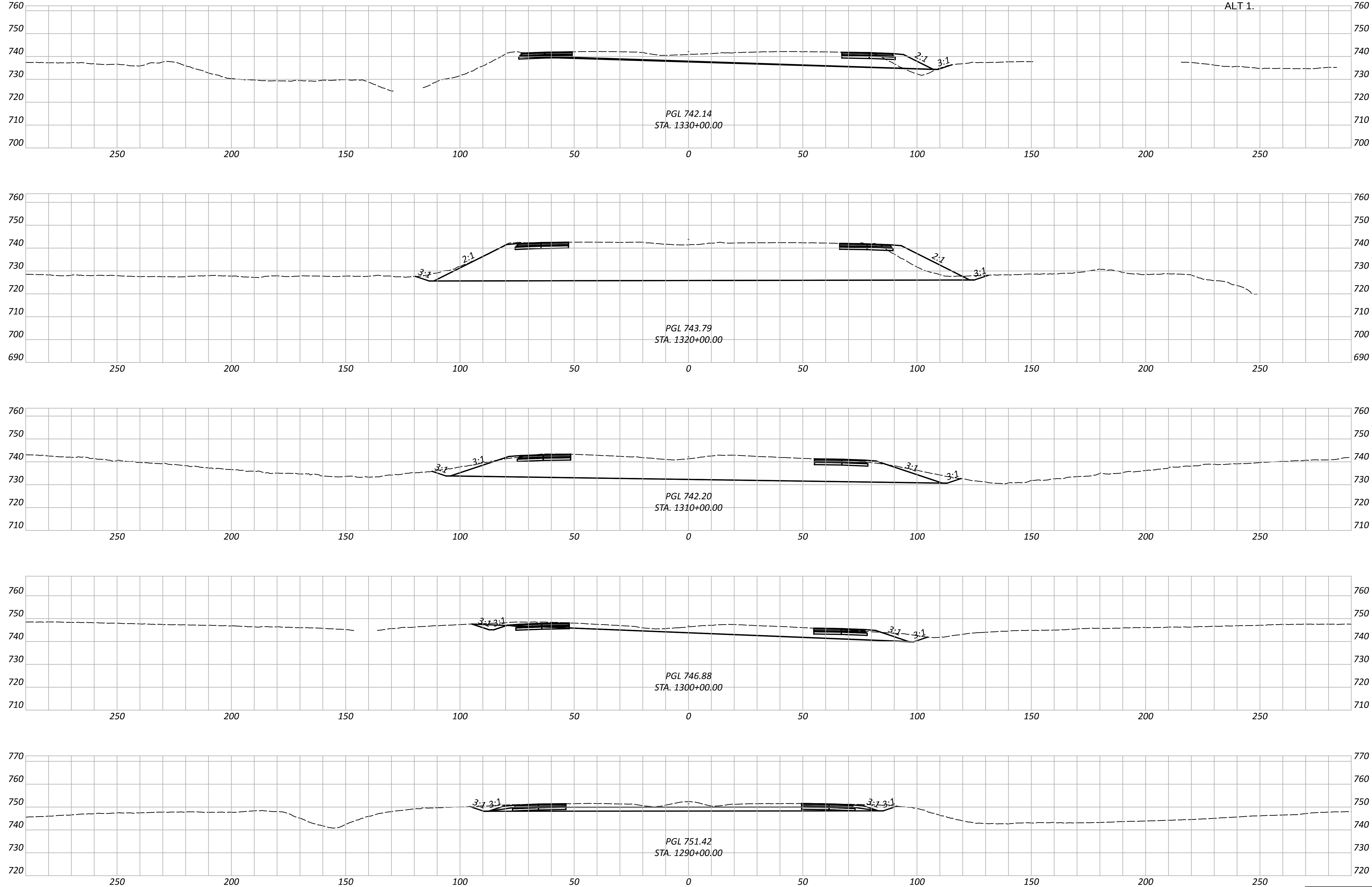
DESIGNER
XXX

REVIEWER
XXX MM-DD-YY

PROJECT ID
121811

SHEET	TOTAL
P.0	0

Refer to Appendix A, pages 46-47, for the corresponding view in ALT 1.



CROSS SECTIONS - ALTERNATIVE 2
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Sheet Totals		
Seeding	Cut	Fill

DESIGN AGENCY

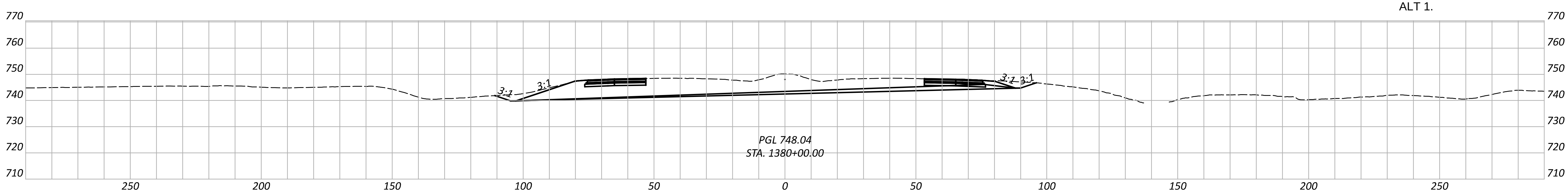
DESIGNER
XXX

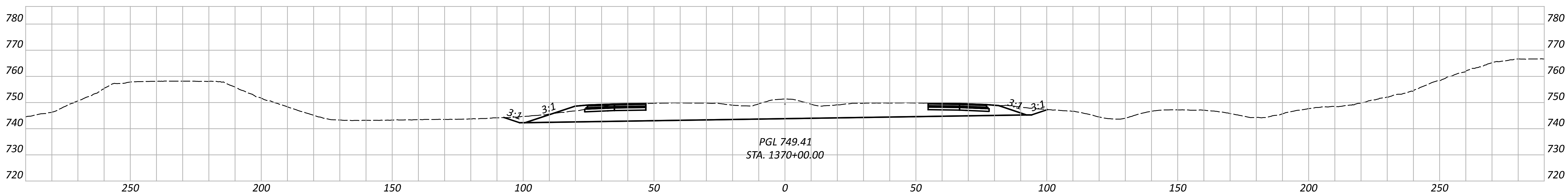
REVIEWER
XXX MM-DD-YY

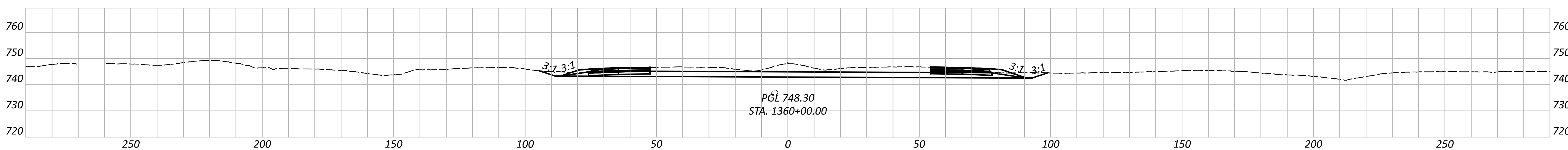
PROJECT ID
121811

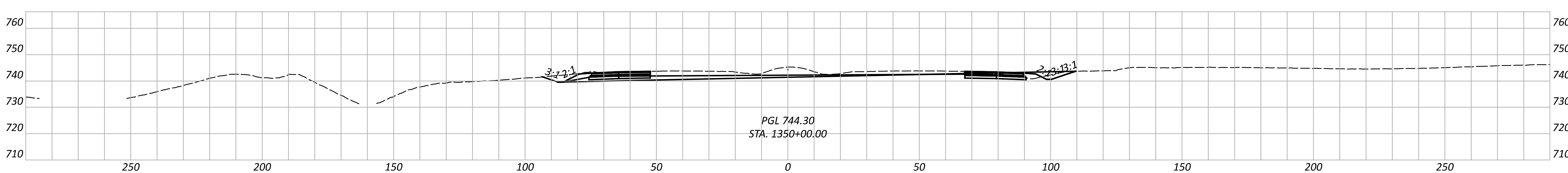
SHEET P.0 TOTAL 0

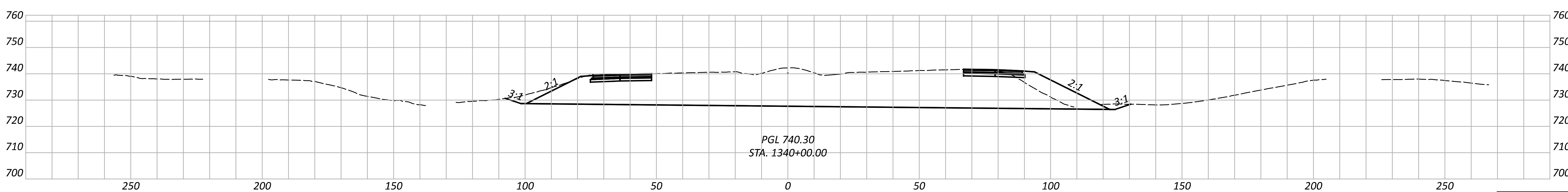
Refer to Appendix A, pages 47-49, for the corresponding view in ALT 1.











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PRELIMINARY

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Sheet Totals		
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DESIGN AGENCY

DESIGNER
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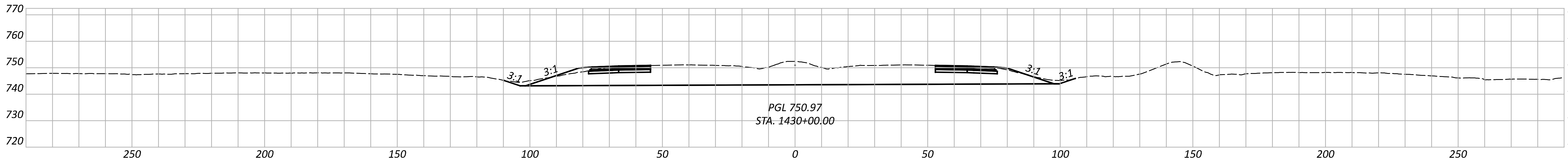
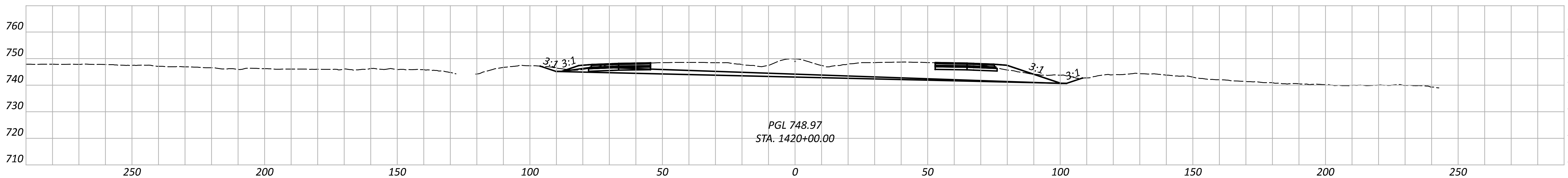
REVIEWER
XXX MM-DD-YY

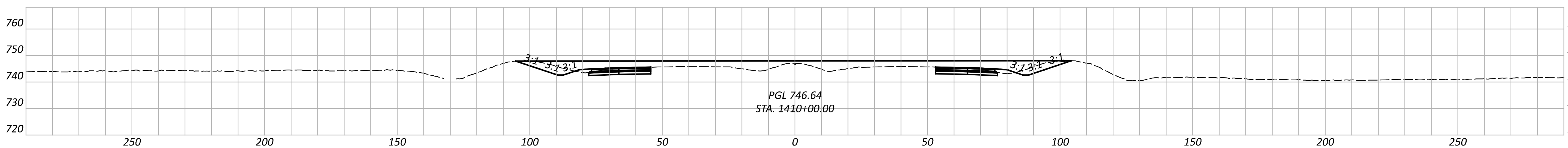
PROJECT ID
121811

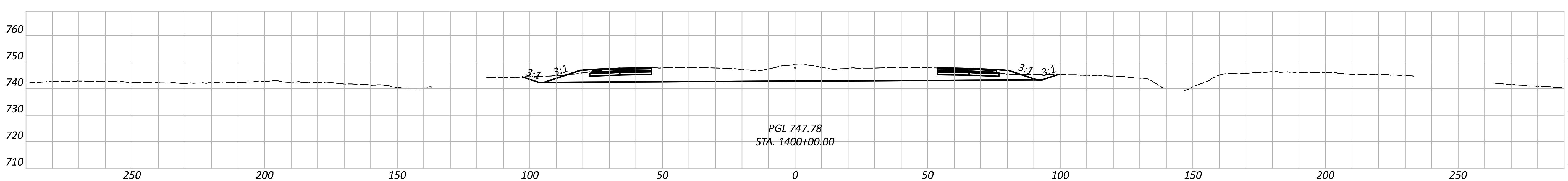
SHEET P.0 TOTAL 0

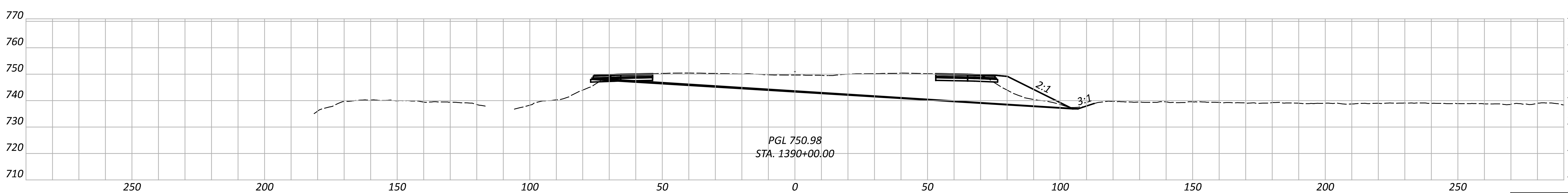
Refer to Appendix A, pages 49-51, for the corresponding view in ALT 1.











CROSS SECTIONS - ALTERNATIVE 2
PRELIMINARY

FRA/FAI-33-22.99/0.00

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Sheet Totals		
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DESIGN AGENCY

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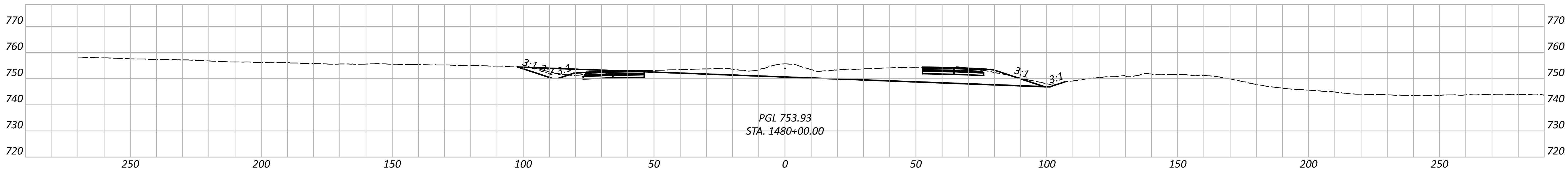
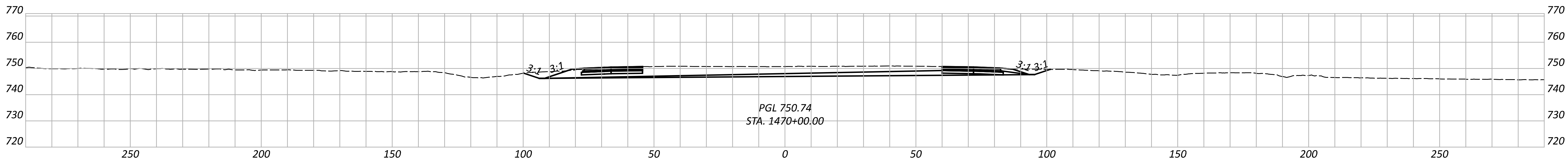
REVIEWER
XXX MM-DD-YY

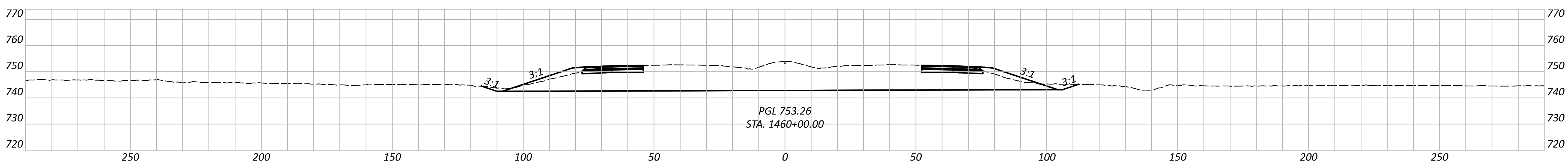
PROJECT ID
121811

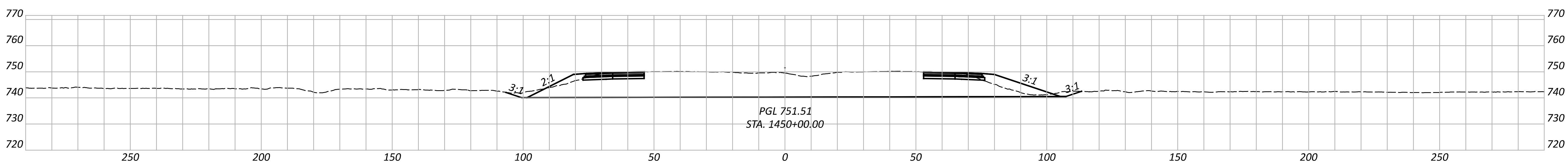
SHEET P.0 TOTAL 0

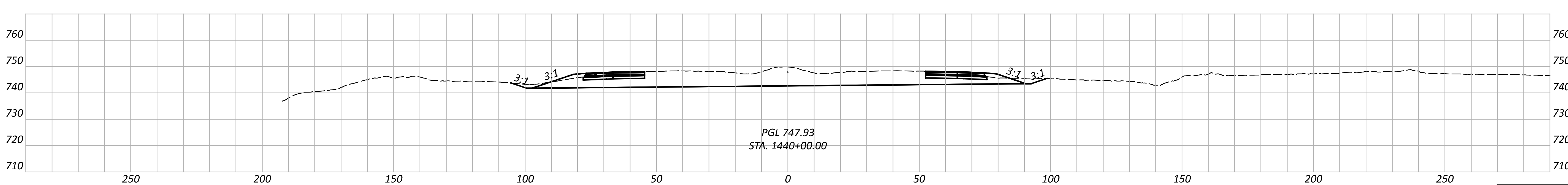
Refer to Appendix A, pages 51-52, for the corresponding view in ALT 1.











CROSS SECTIONS - ALTERNATIVE 2
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Sheet Totals		
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DESIGN AGENCY

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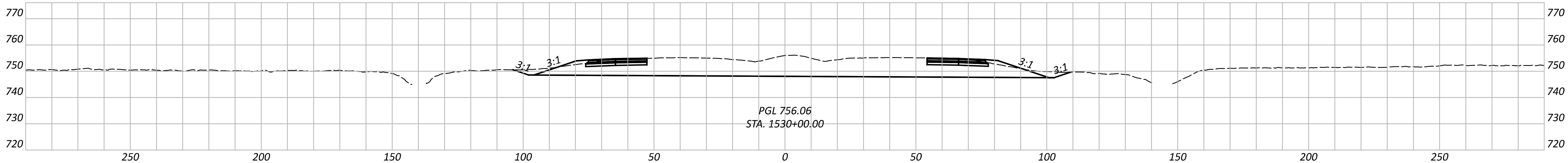
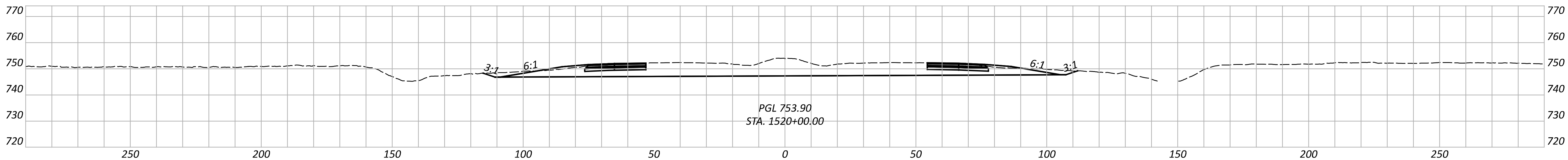
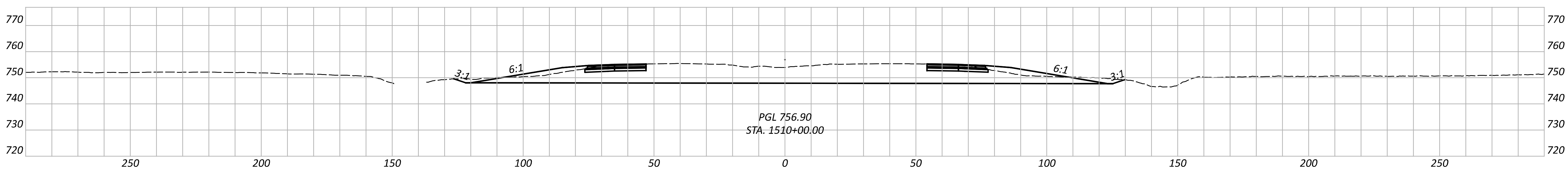
PROJECT ID
121811

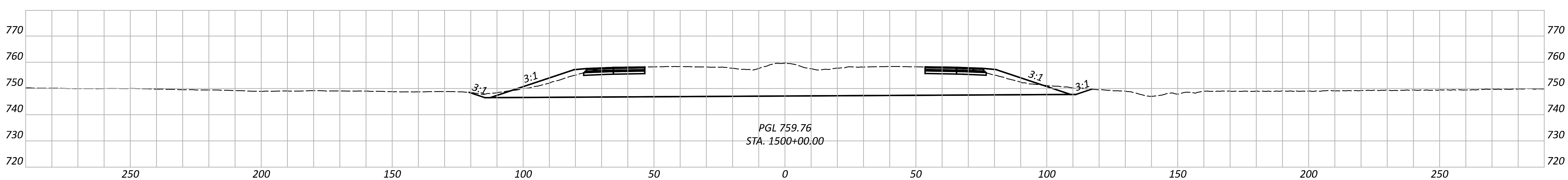
SHEET P.0 | TOTAL 0

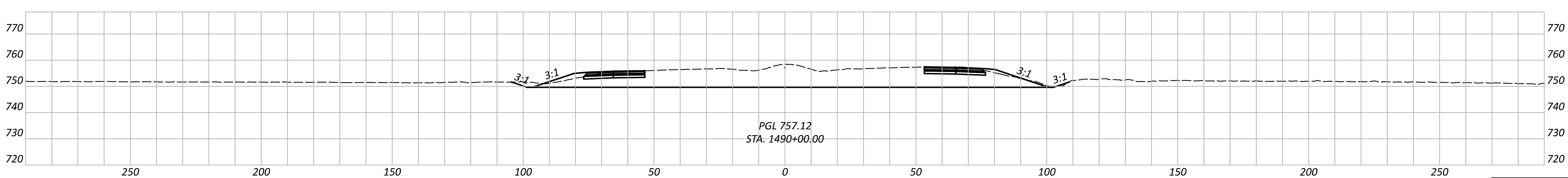
Refer to Appendix A, pages 53-54, for the corresponding view in ALT 1.











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CROSS SECTIONS - ALTERNATIVE 2
PRELIMINARY

Sheet Totals		
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PROJECT ID
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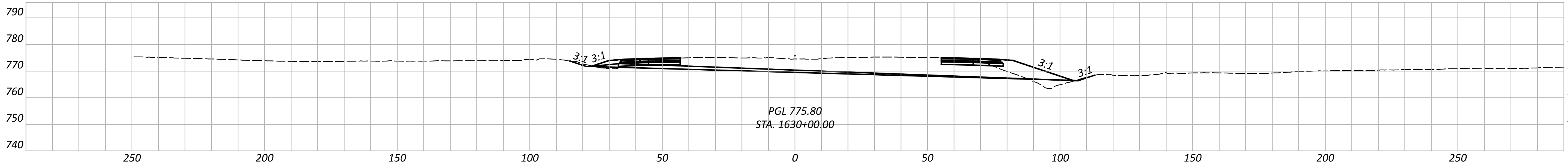
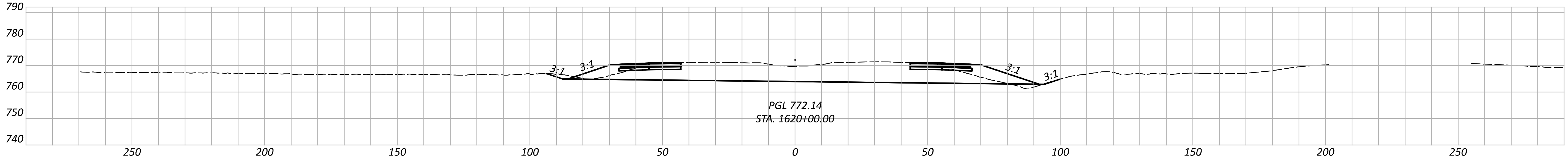
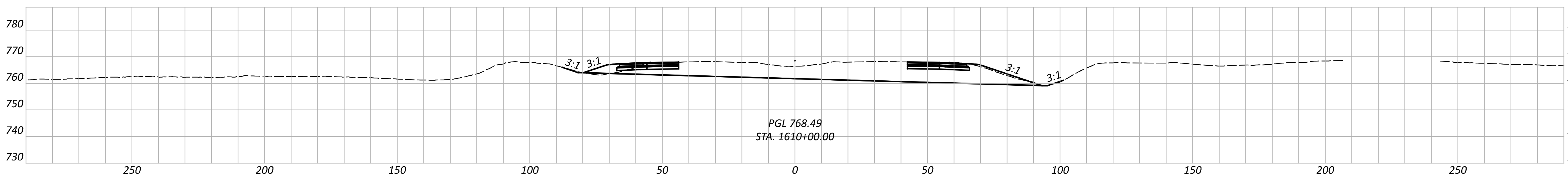
SHEET P.0 | TOTAL 0

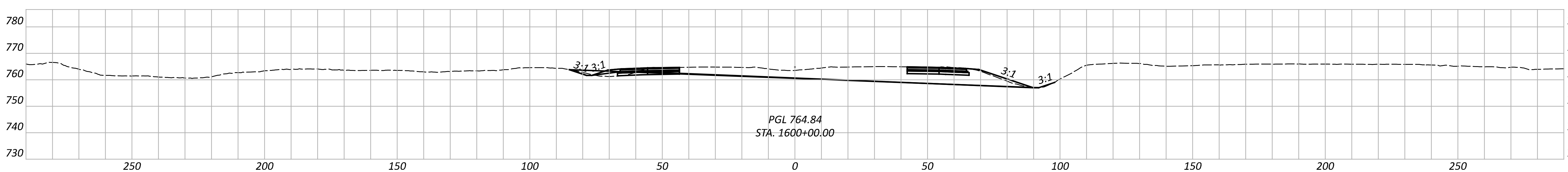
Refer to Appendix A, pages 56-58, for the corresponding view in ALT 1.

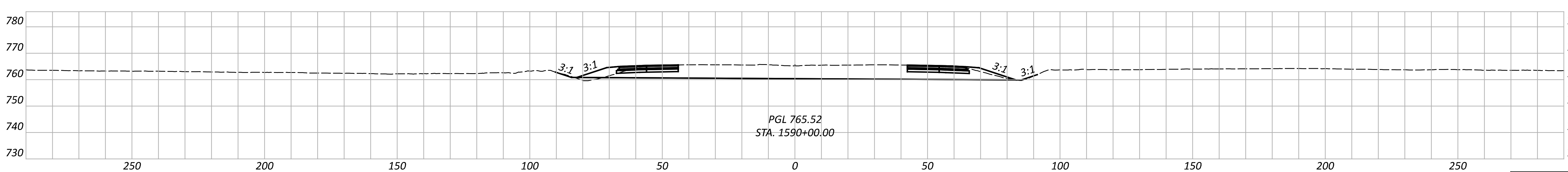
CROSS SECTIONS - ALTERNATIVE 2 PRELIMINARY











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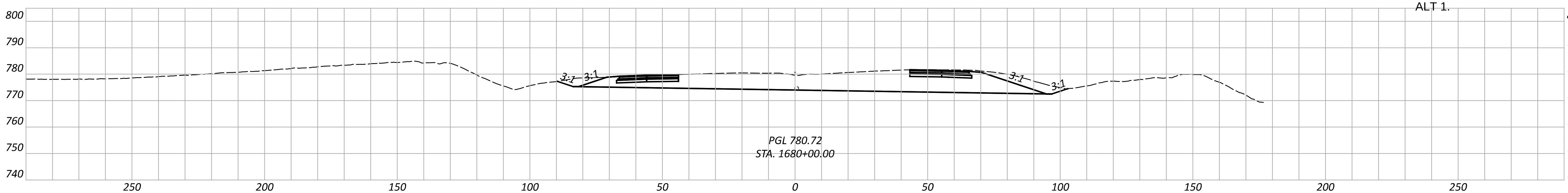
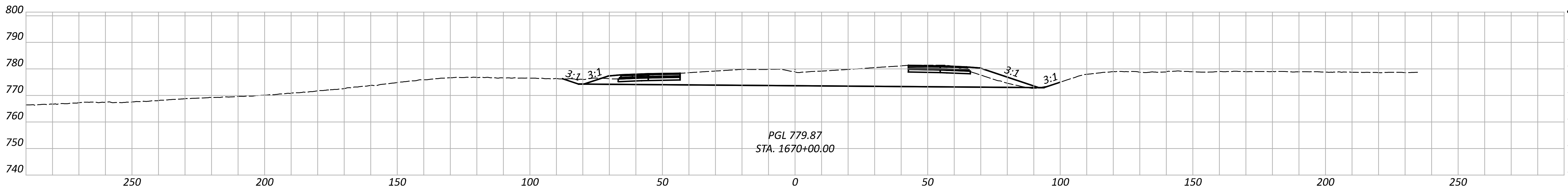
PROJECT ID
121811

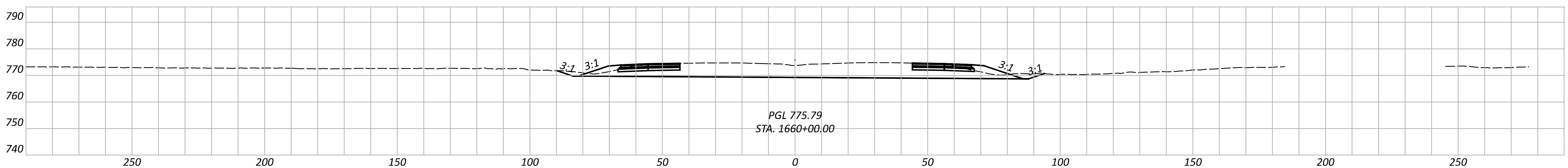
SHEET P.0 | TOTAL 0

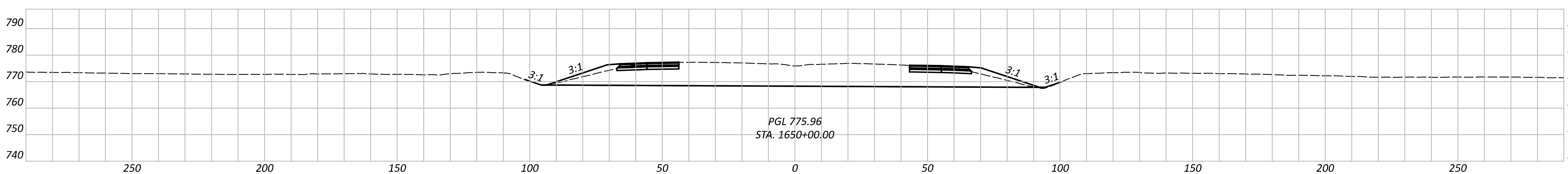
Refer to Appendix A, pages 58-59, for the corresponding view in ALT 1.

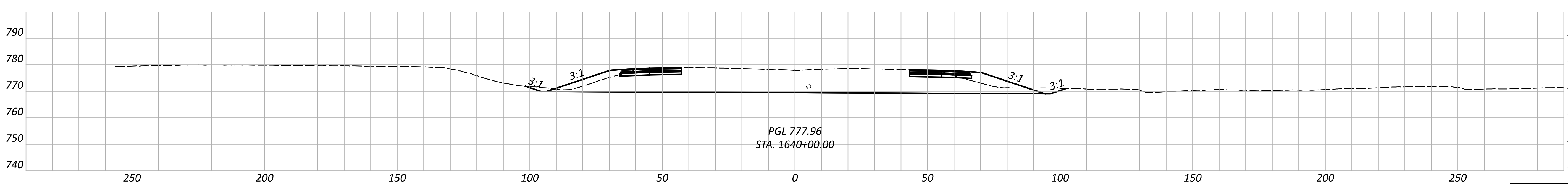
CROSS SECTIONS - ALTERNATIVE 2
PRELIMINARY











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Sheet Totals		
Seeding	Cut	Fill

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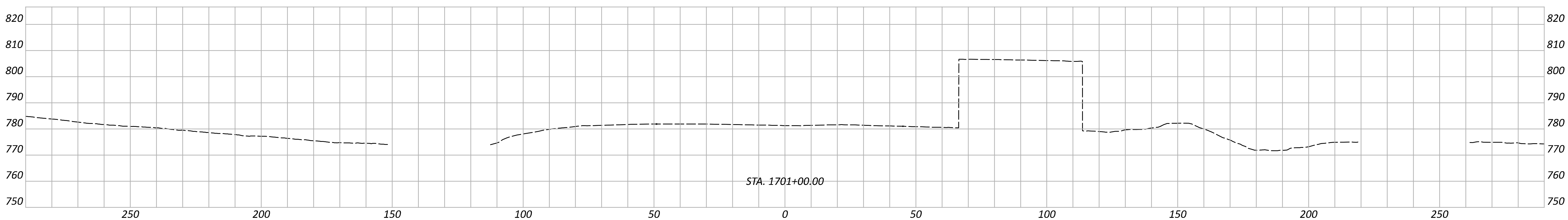
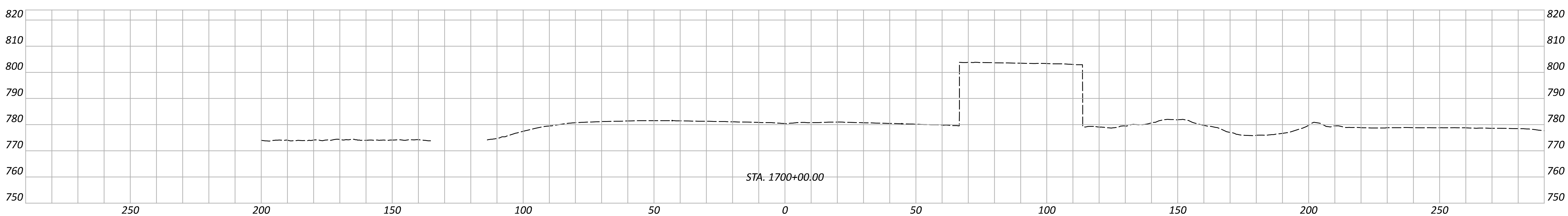
PROJECT ID
121811

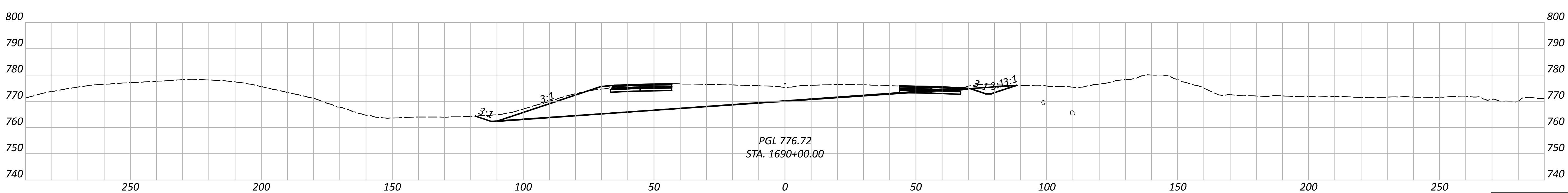
SHEET P.0 | TOTAL 0

Refer to Appendix A, page 60, for the corresponding view in ALT 1.

CROSS SECTIONS - ALTERNATIVE 2
PRELIMINARY







Sheet Totals		
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DESIGN AGENCY

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PROJECT ID
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SHEET P.0 TOTAL 0

FRA/FAI-33-22.99/0.00

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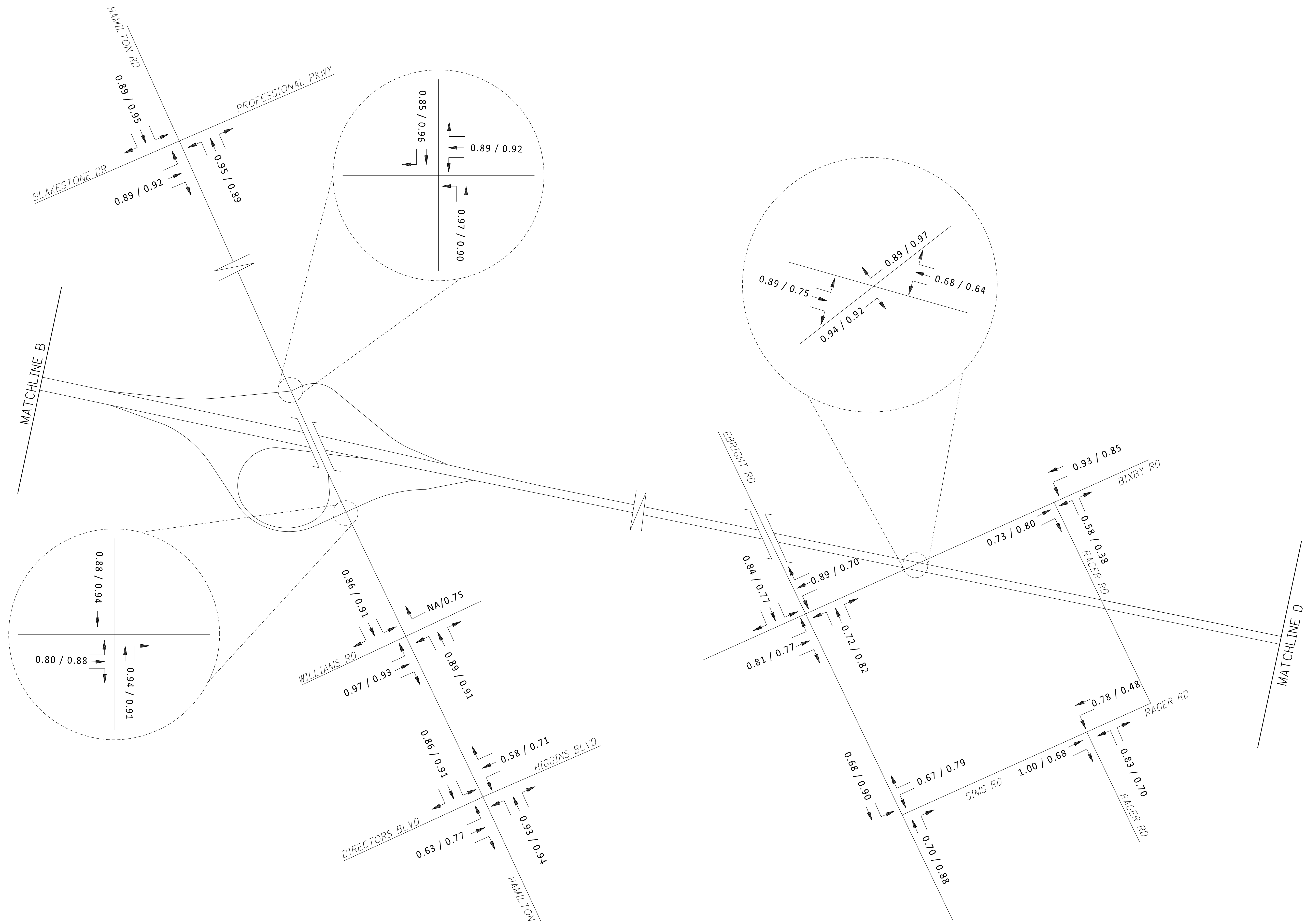
APPENDIX C:
Traffic Volume Plates



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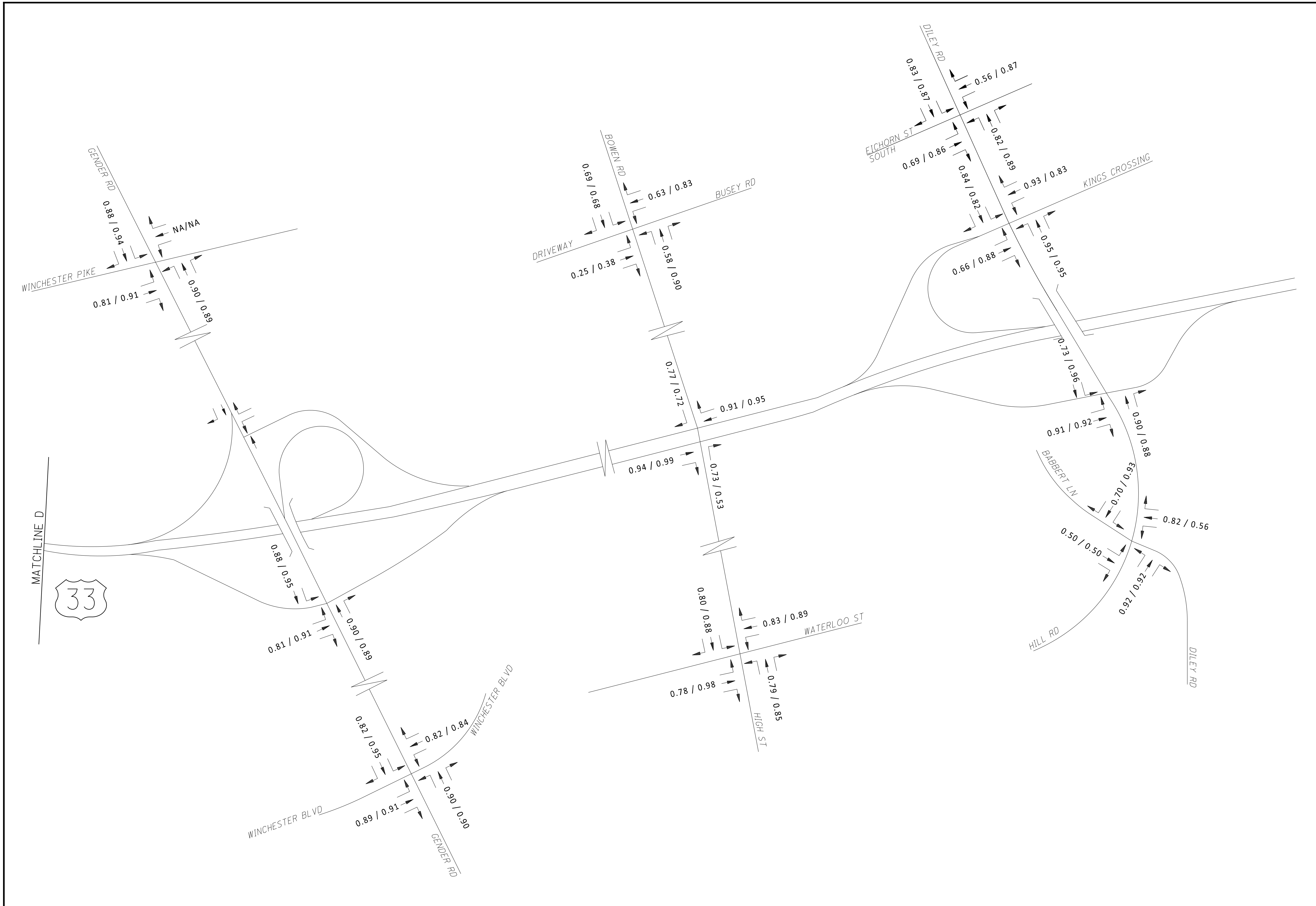
ANALYST HBK

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
AM/PM PEAK HOUR FACTOR

PID 119387

1/2



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NOT TO SCALE

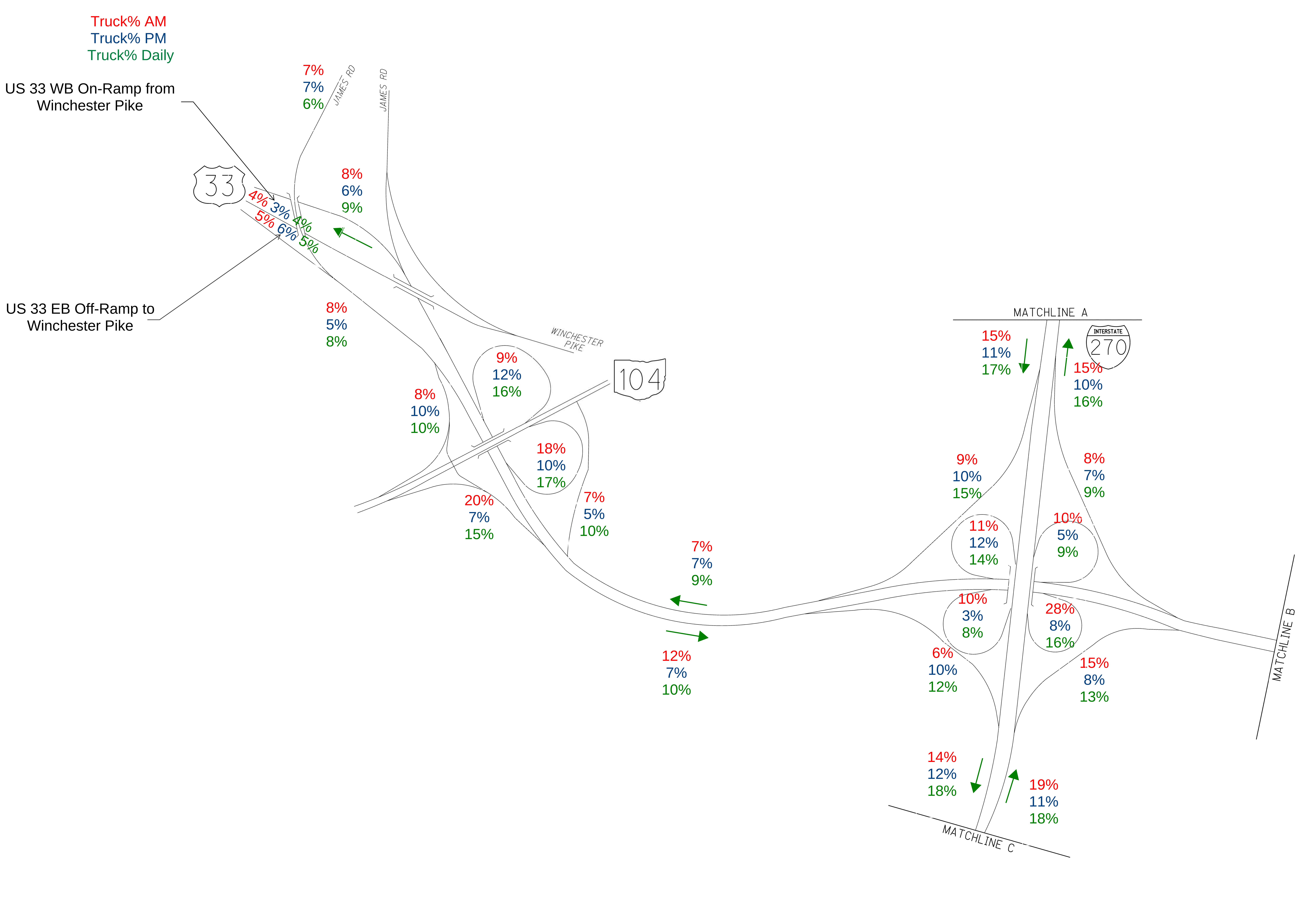
ANALYST HBK

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
AM/ PM PEAK HOUR FACTOR

PID 119387

2
2

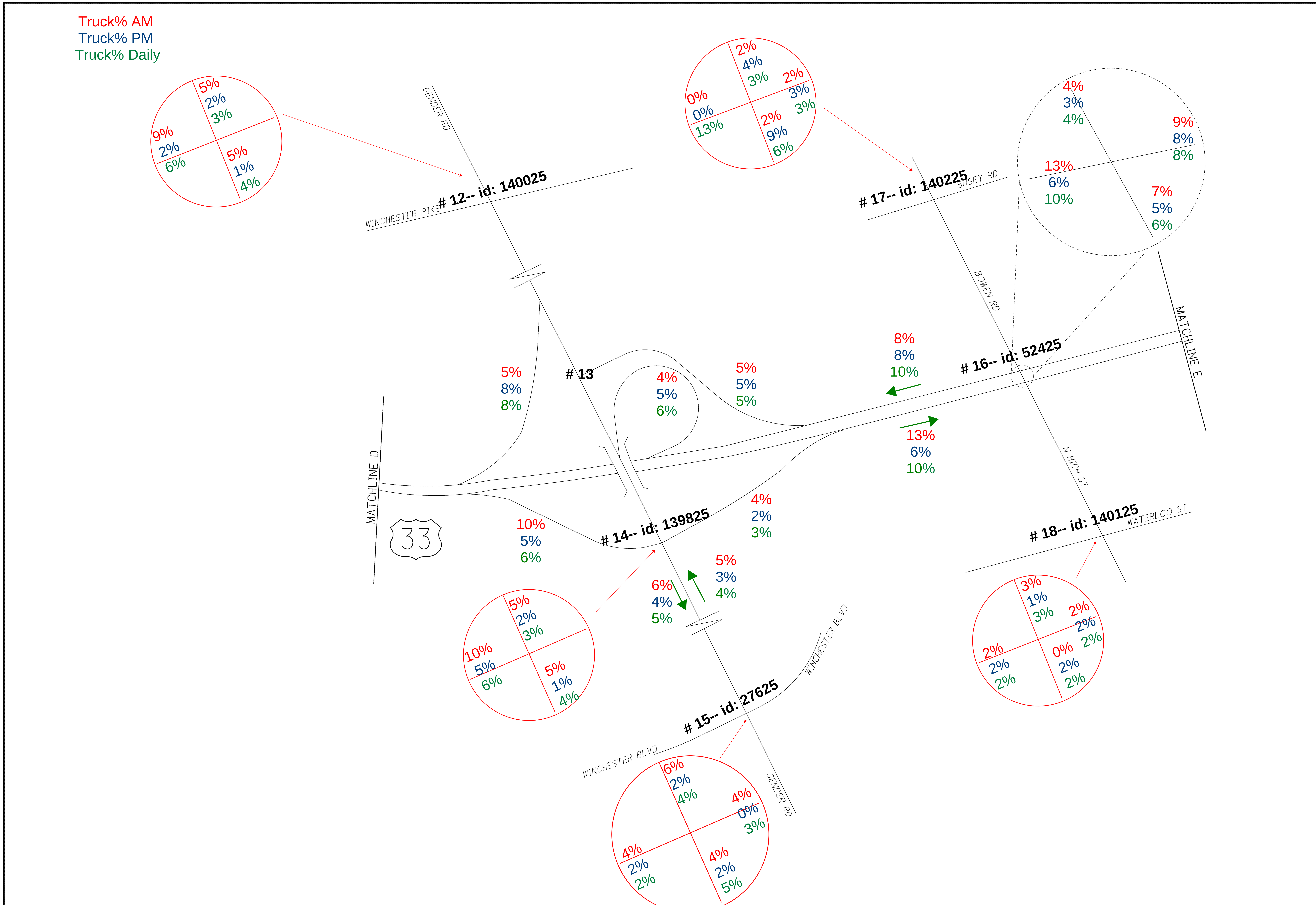


ANALYST HBK
DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
T24/AM/PM TRUCK PERCENTAGES

PID 119387

Truck% AM
Truck% PM
Truck% Daily
1-- id: 139725
Blakestone Ln
Professional Pkwy
2-- id: 101525
3-- id: 101625
4-- id: 101725
WILLIAMS RD
5-- id: 101825
HIGGINS BLVD
HAMILTON RD
6
7
BIXBY RD
RAGER RD
8-- id: 140525
EBRIGHT RD
9- id: 140425
10- id: 140325
SIMS RD
11
MATCHLINE B
MATCHLINE D
NOT TO SCALE
ANALYST HBK
DATE 10/01/24
FRA-33-24.76 FEASIBILITY STUDY
T24/ AM/PM TRUCK PERCENTAGES
PID 119387
34
37



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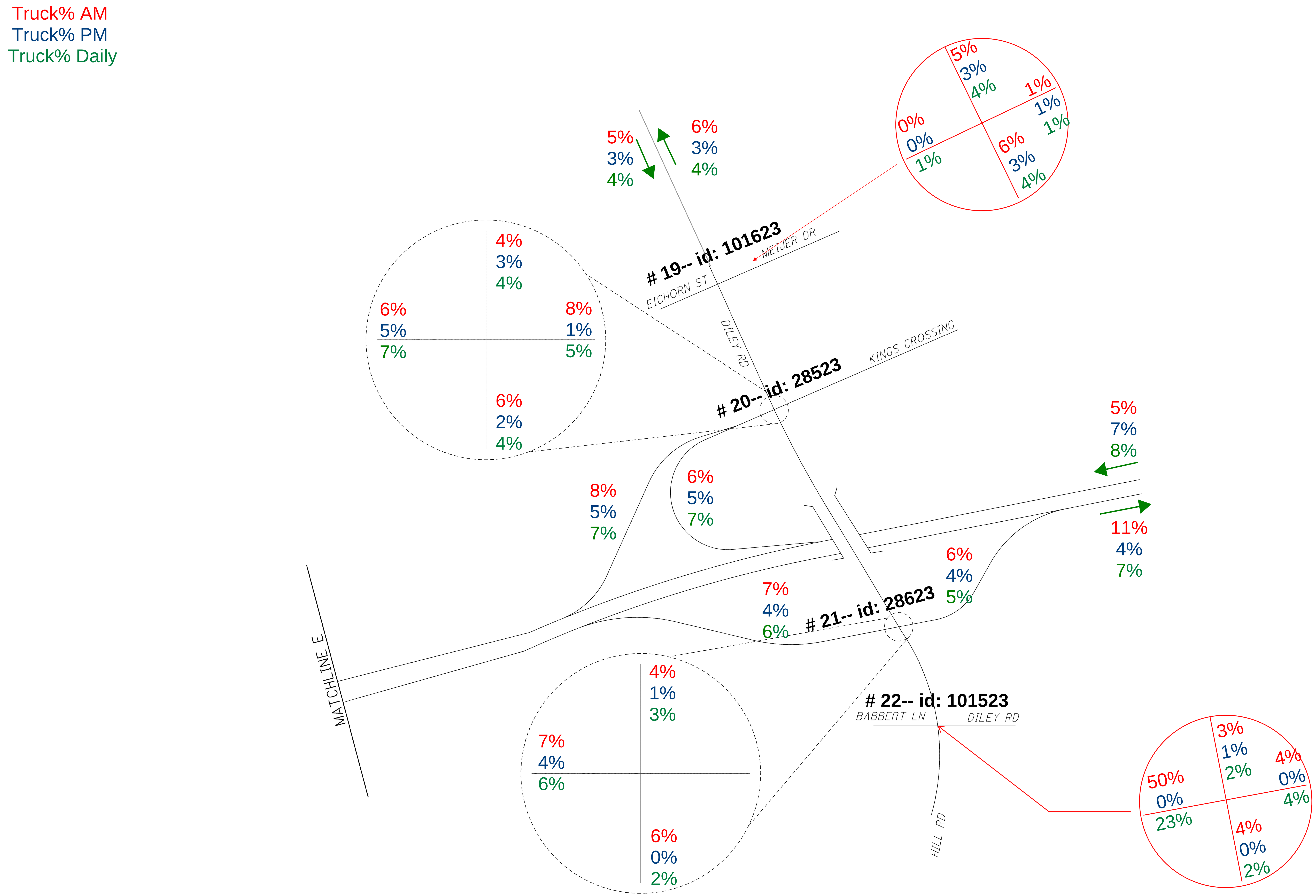
ANALYST HBK

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

T24 / AM / PM TRUCK PERCENTAGES

PID 119387



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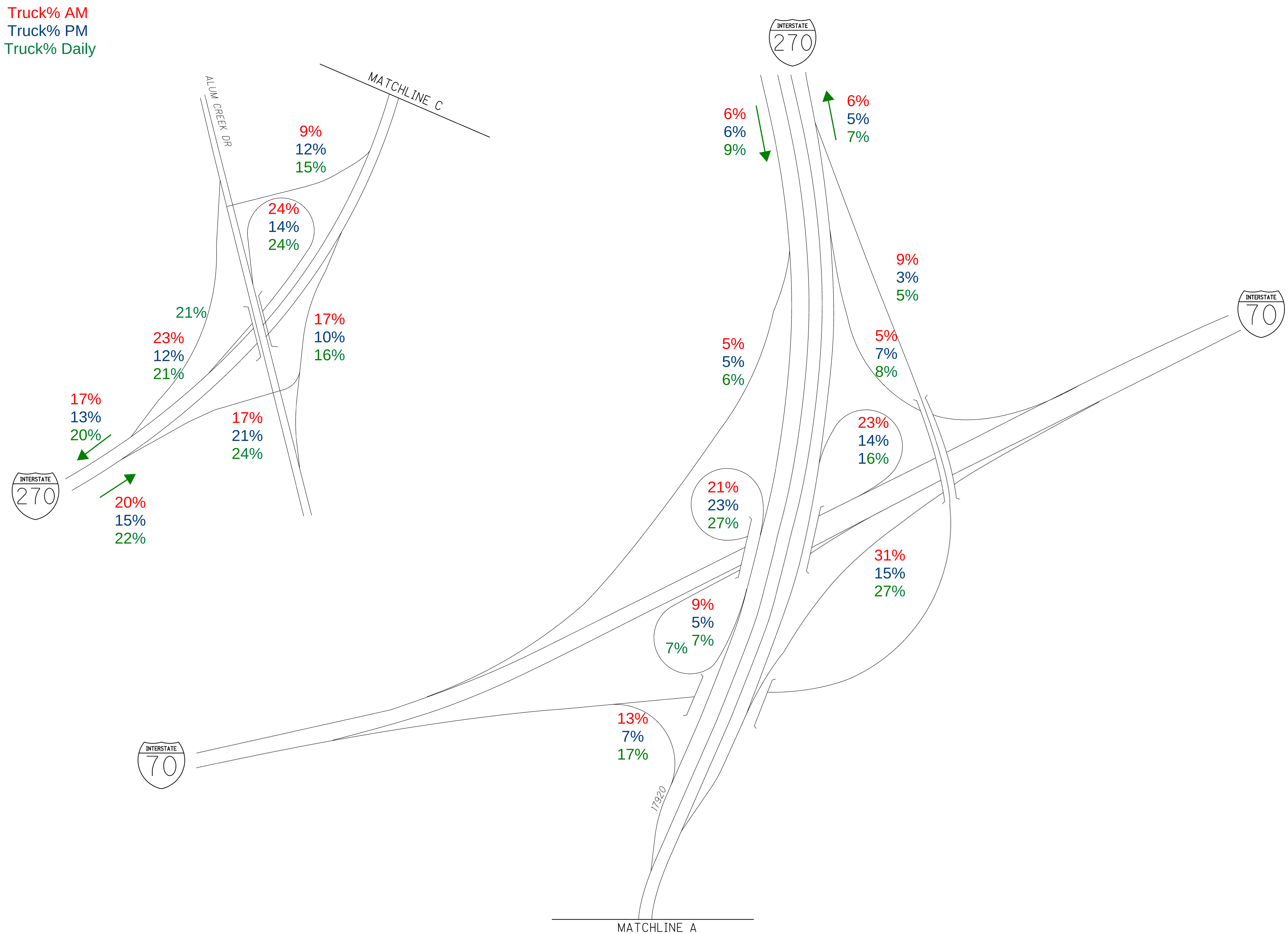
ANALYST HBK

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

T24/ AM/ PM TRUCK PERCENTAGES

PID 119387



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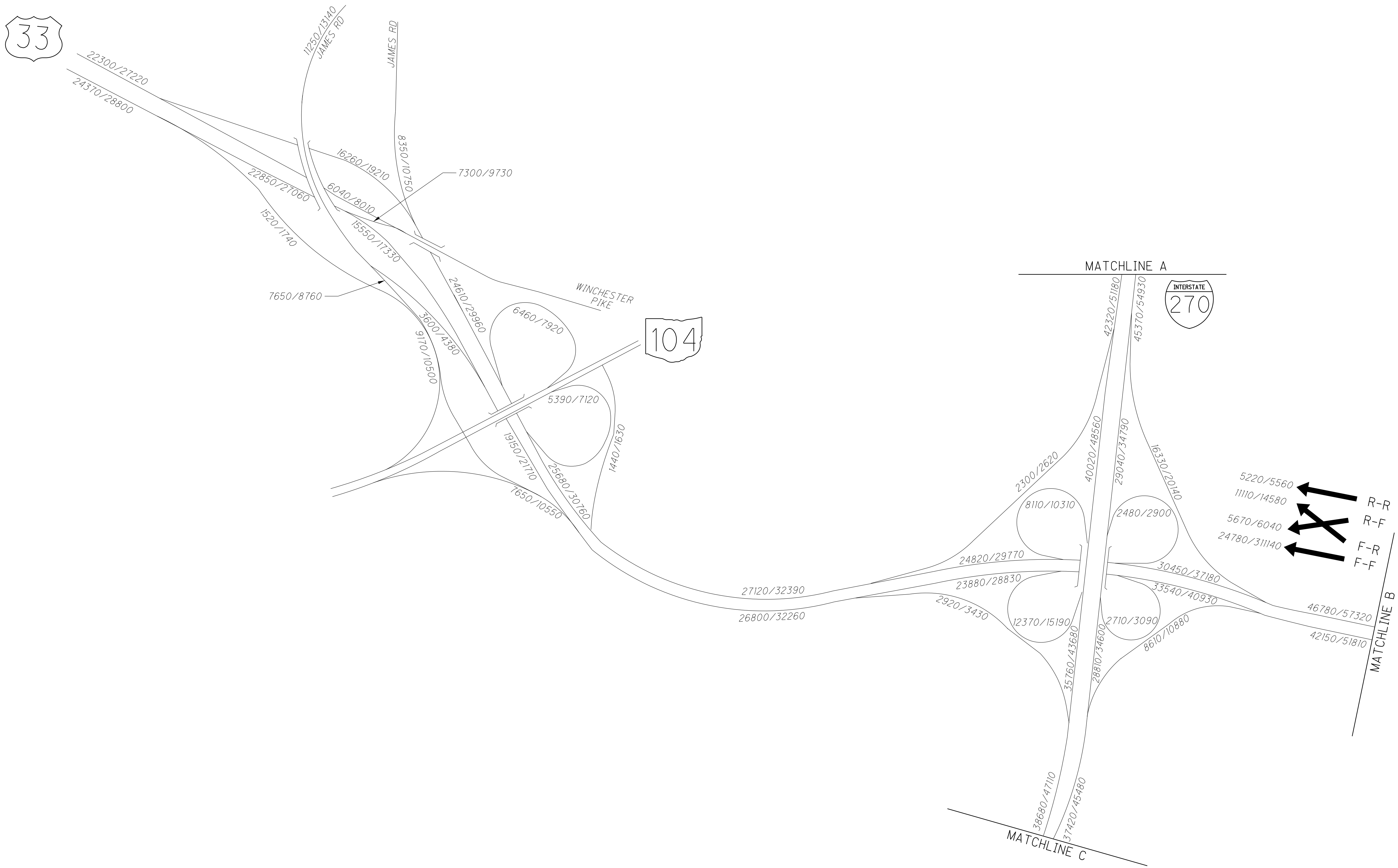
ANALYST HBK
DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
T24/ AM/PM TRUCK PERCENTAGES

PID 119387



NOT TO SCALE

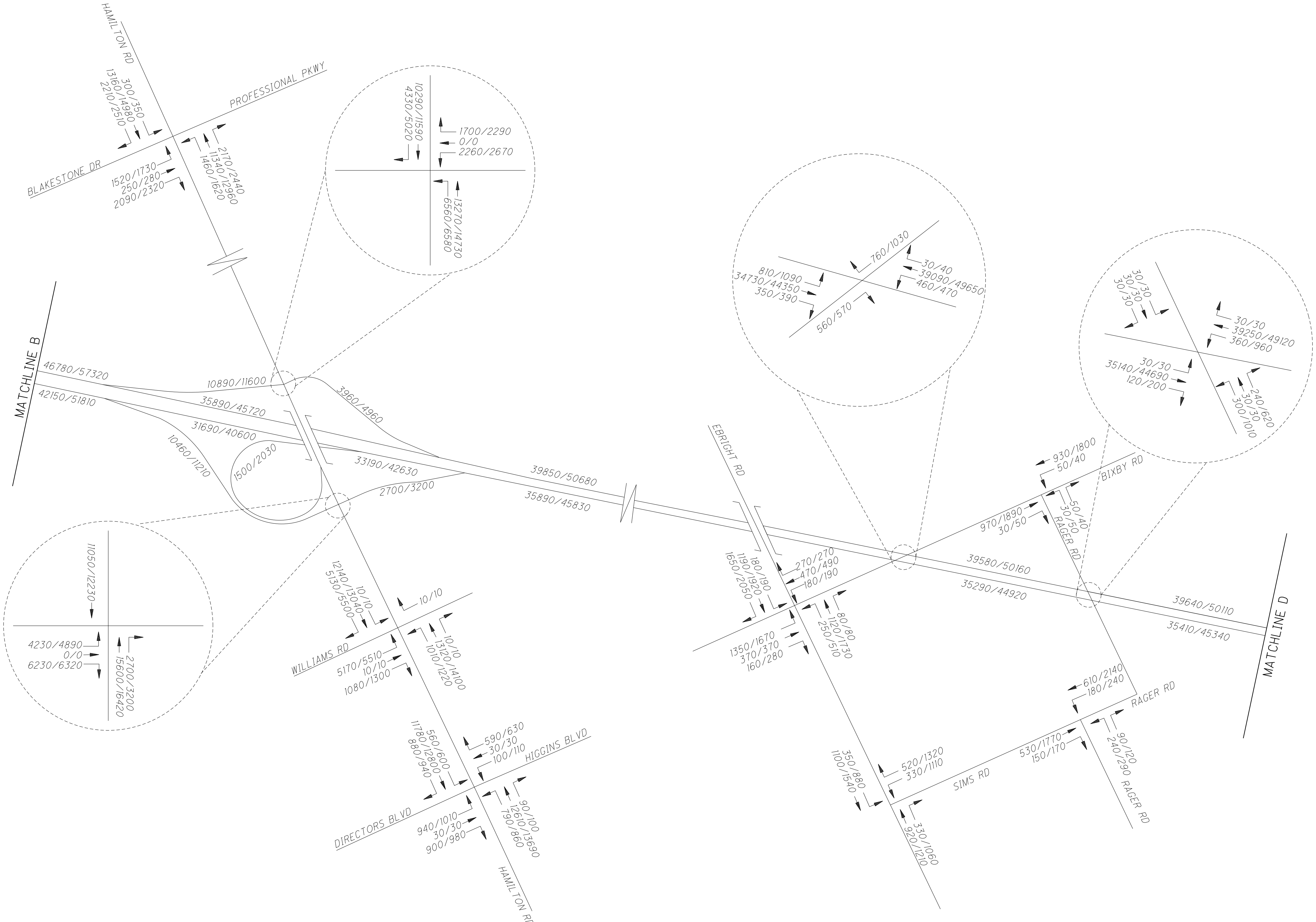
ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

2030/ 2050 NO-BUILD ADT VOLUMES

PID 119387



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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 NO-BUILD ADT VOLUMES

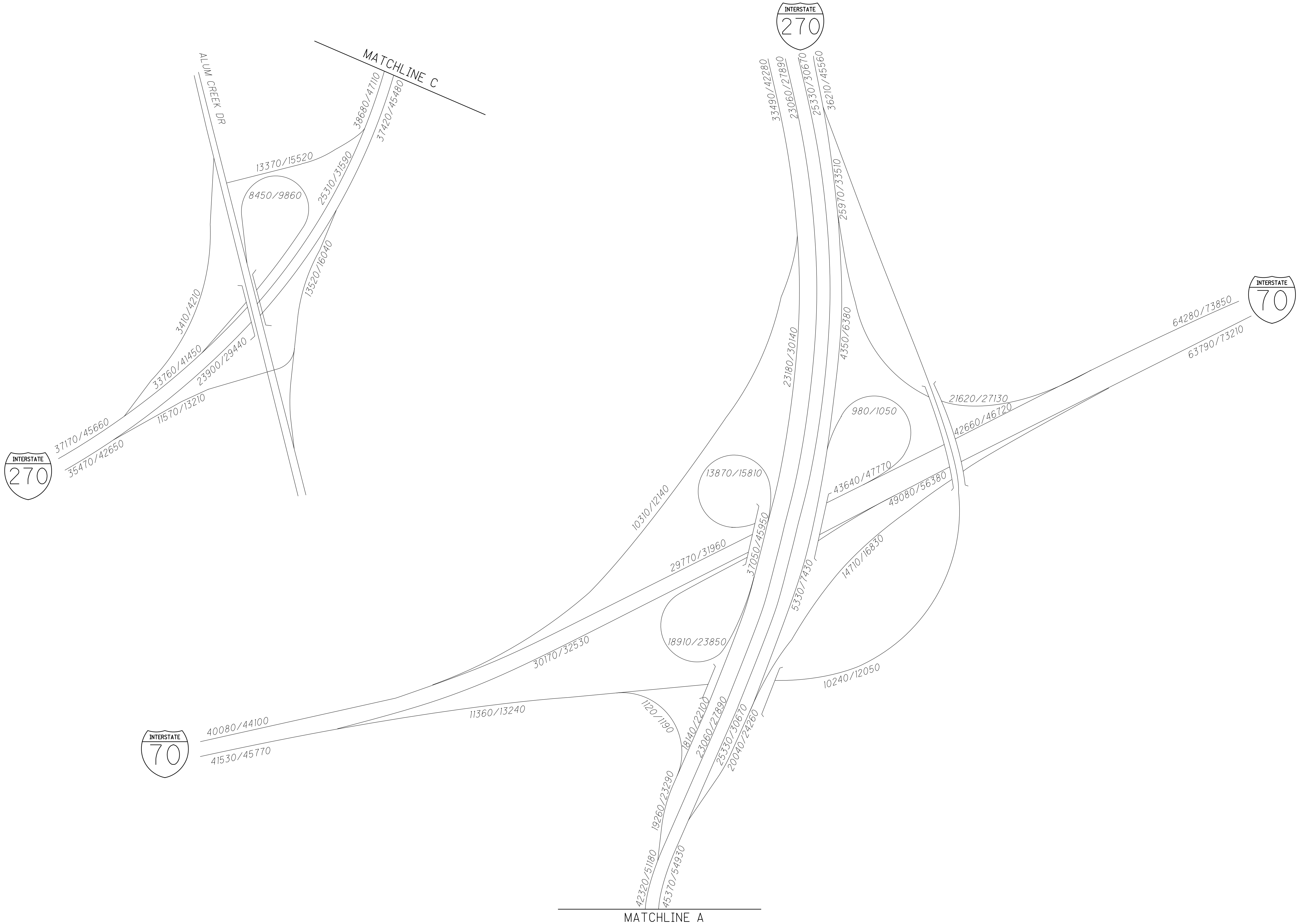
PID 119387

NOT TO SCALE

ANALYST HM
DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 NO-BUILD ADT VOLUMES

PID 119387



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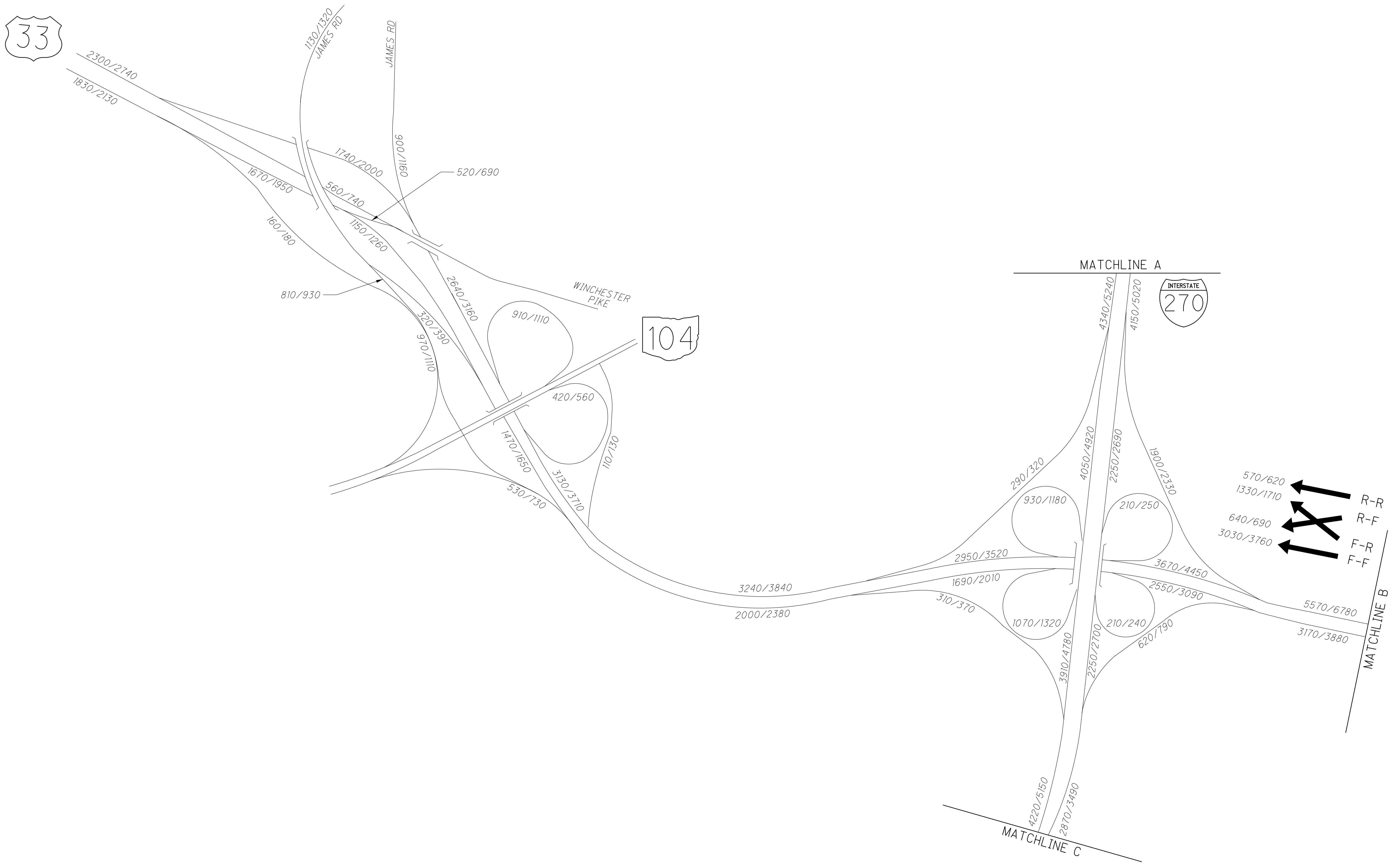
ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

2030/ 2050 NO-BUILD ADT VOLUMES

PID 119387



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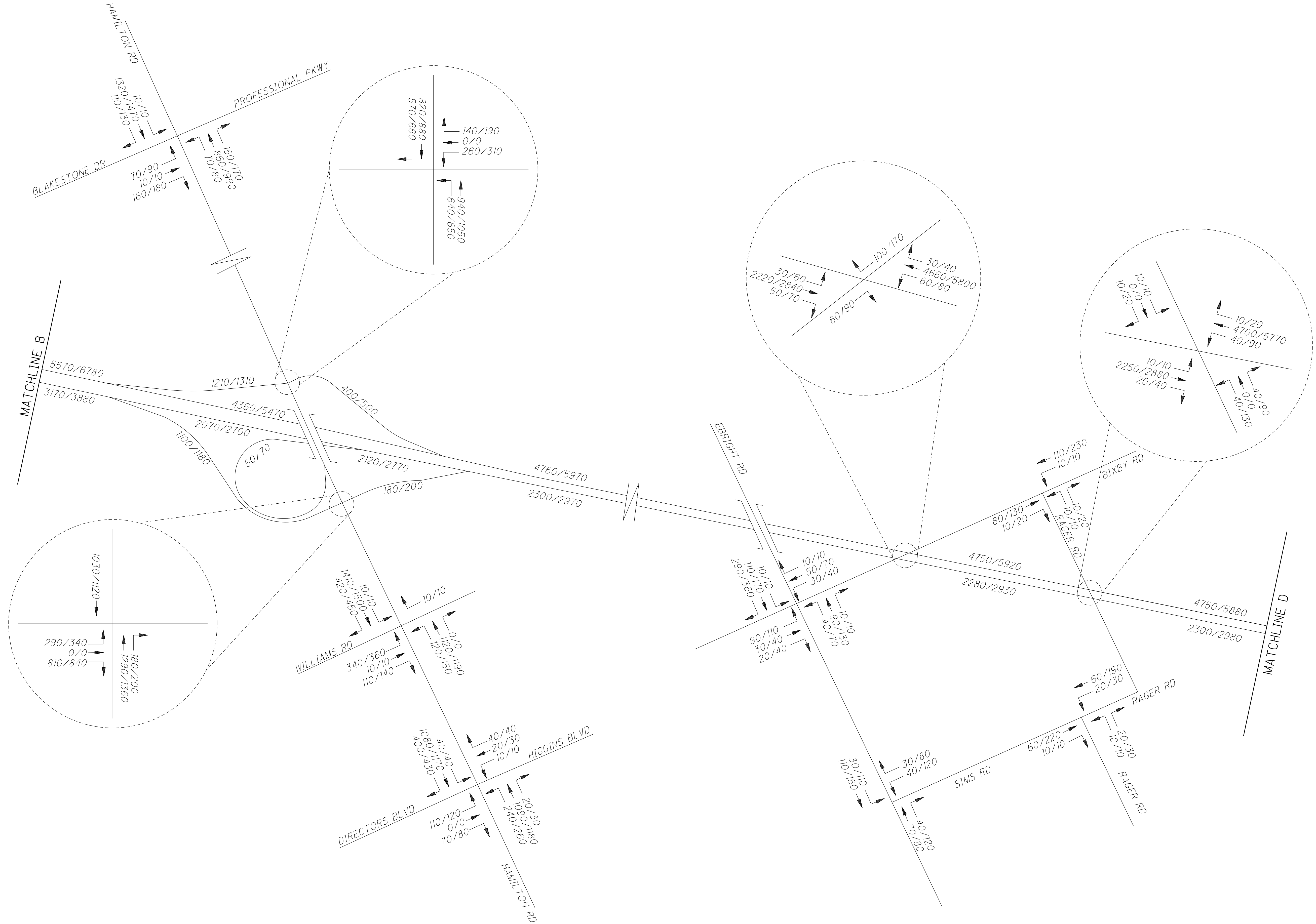
ANALYST HM DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 NO-BUILD AM VOLUMES

PID 119387



FRA-33-24.76 FEASIBILITY STUDY
2030/2050 NO-BUILD AM VOLUMES

NOT TO SCALE

ANALYST HM
DATE 10/01/24

PID 119387

14
37

NOT TO SCALE

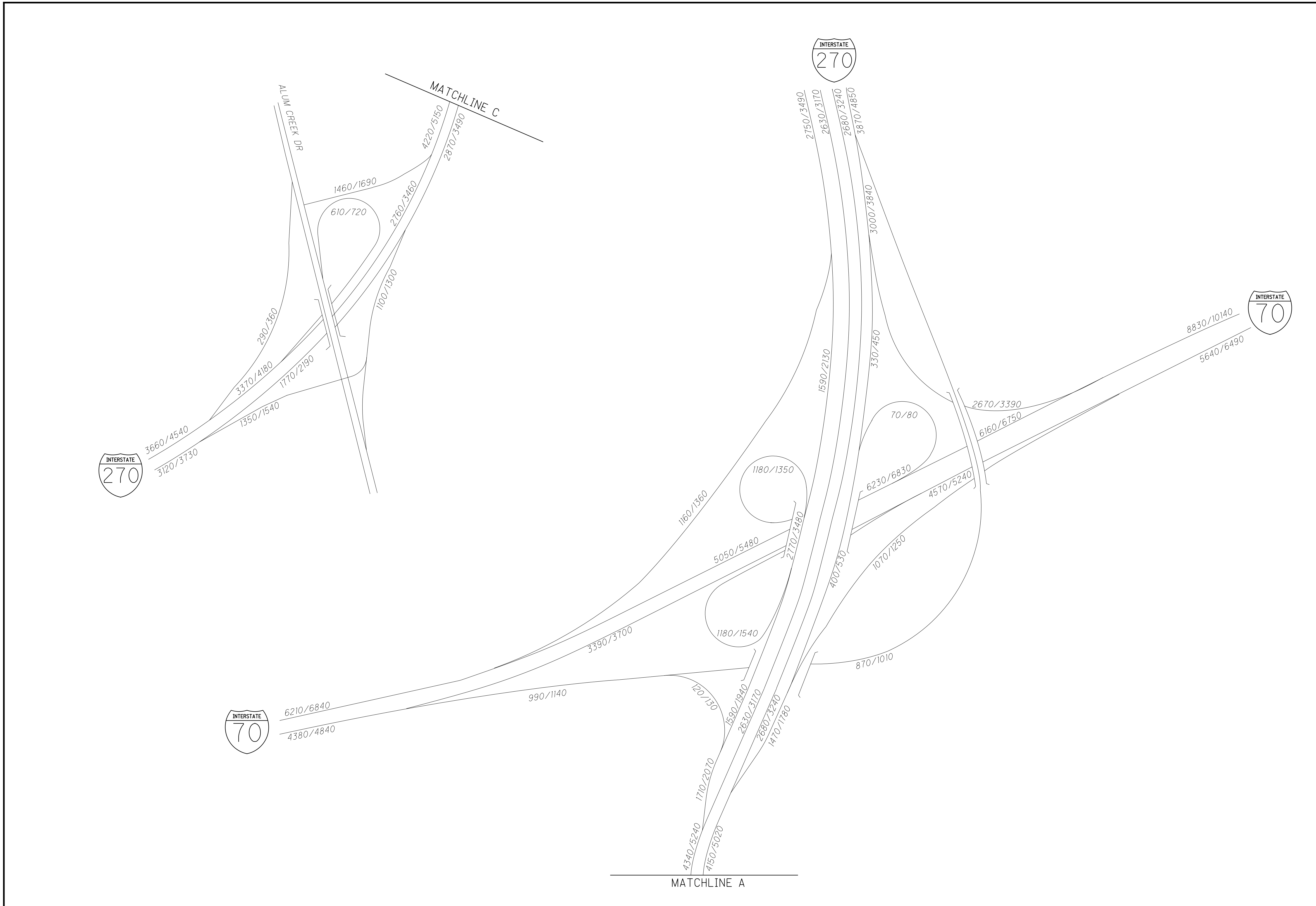
ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 NO-BUILD AM VOLUMES

PID 119387

15
37



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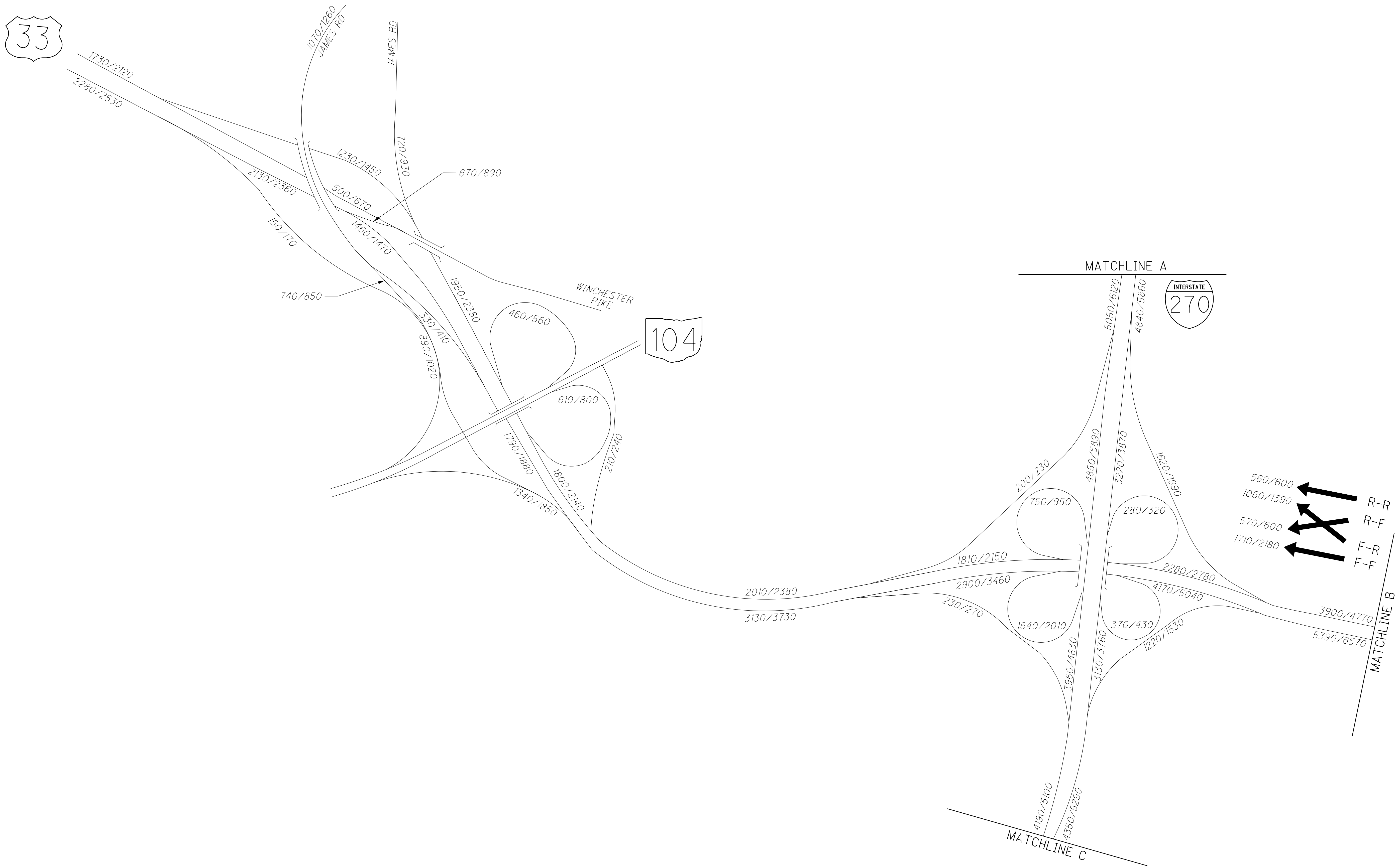
DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 NO-BUILD AM VOLUMES

PID 119387



NOT TO SCALE

ANALYST HM DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY 2030/ 2050 NO-BUILD PM VOLUMES

PID 119387

NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 NO-BUILD PM VOLUMES

PID 119387

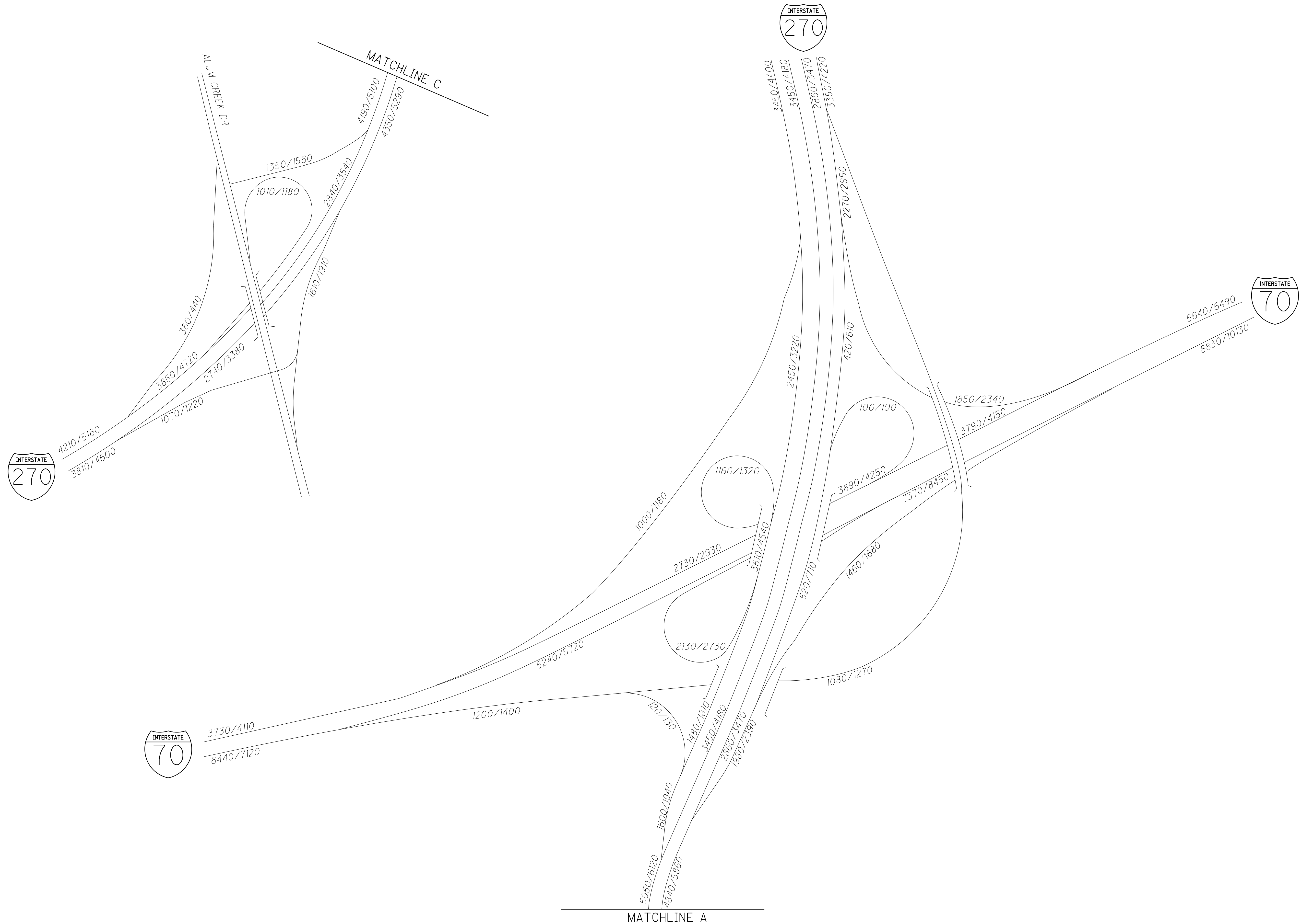
NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 NO-BUILD PM VOLUMES

PID 119387



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ANALYST HM

DATE 10/01/24

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2030/2050 NO-BUILD PM VOLUMES

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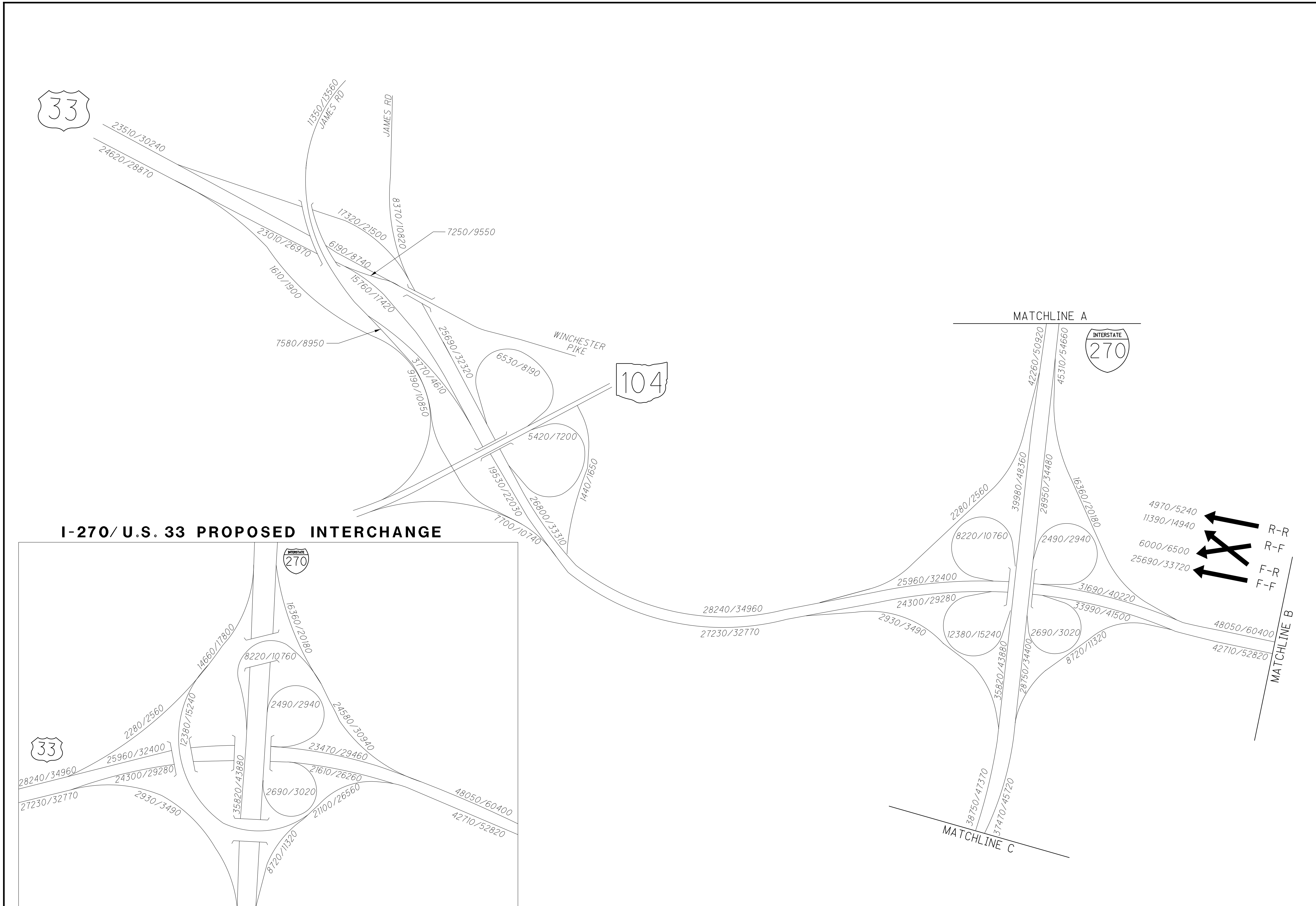

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ANALYST HM | DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 US 33 BUILD ADT VOLUMES

PID 119387

21
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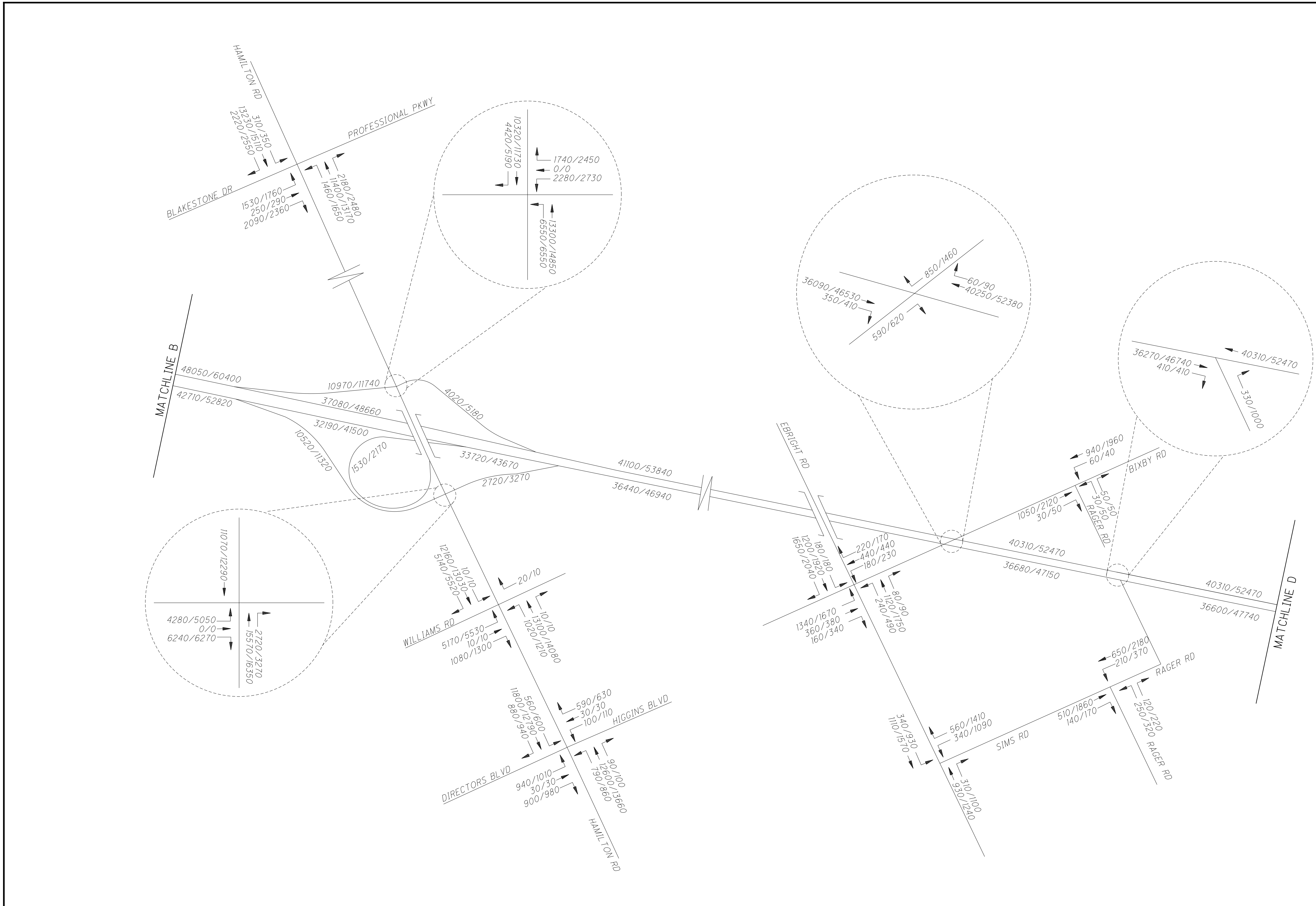

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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/2050 US 33 BUILD ADT VOLUMES

PID 119387

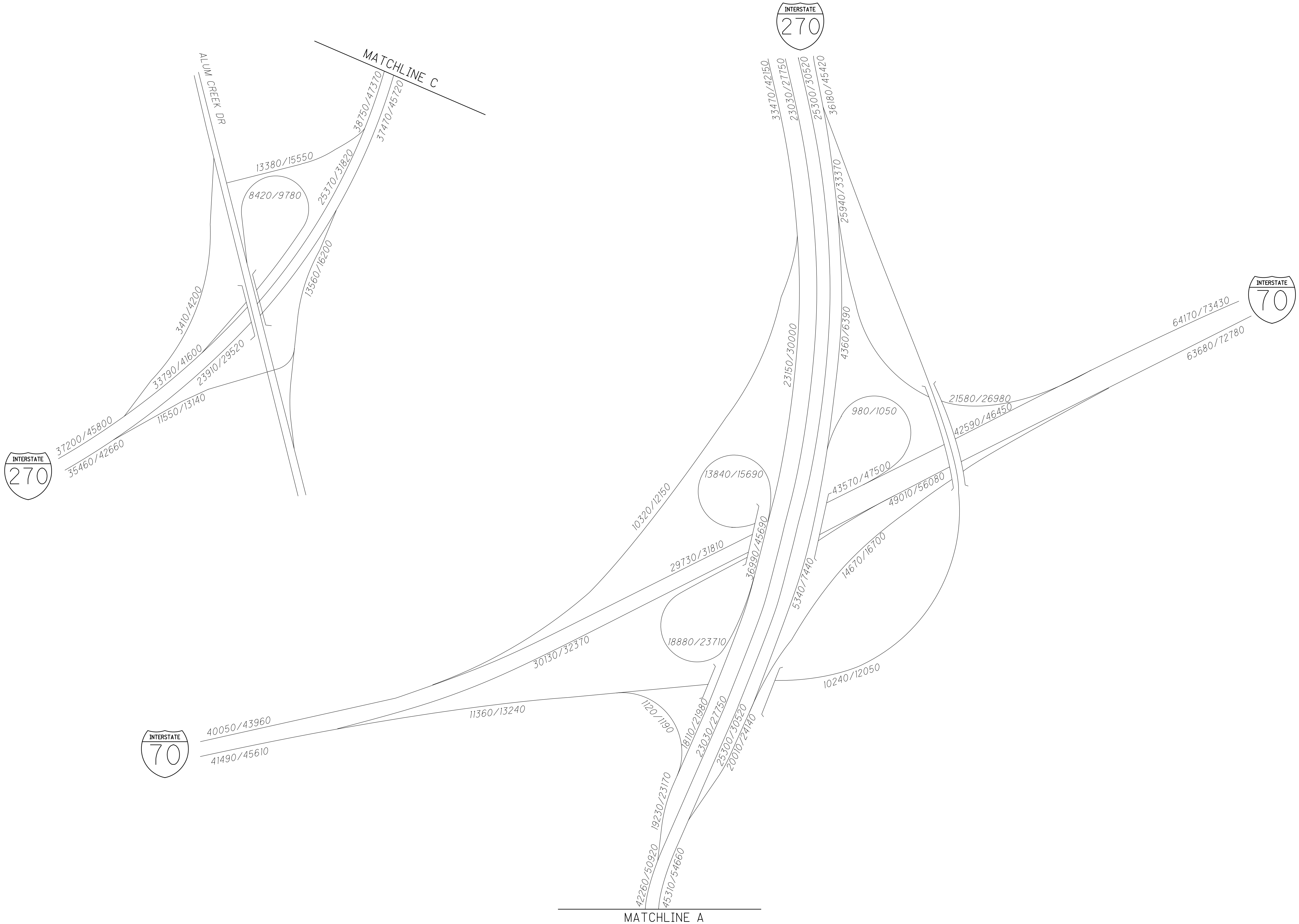
FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD ADT VOLUMES

PID 119387

NOT TO SCALE

ANALYST HM

DATE 10/01/24



NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

2030/ 2050 US 33 BUILD ADT VOLUMES

PID 119387

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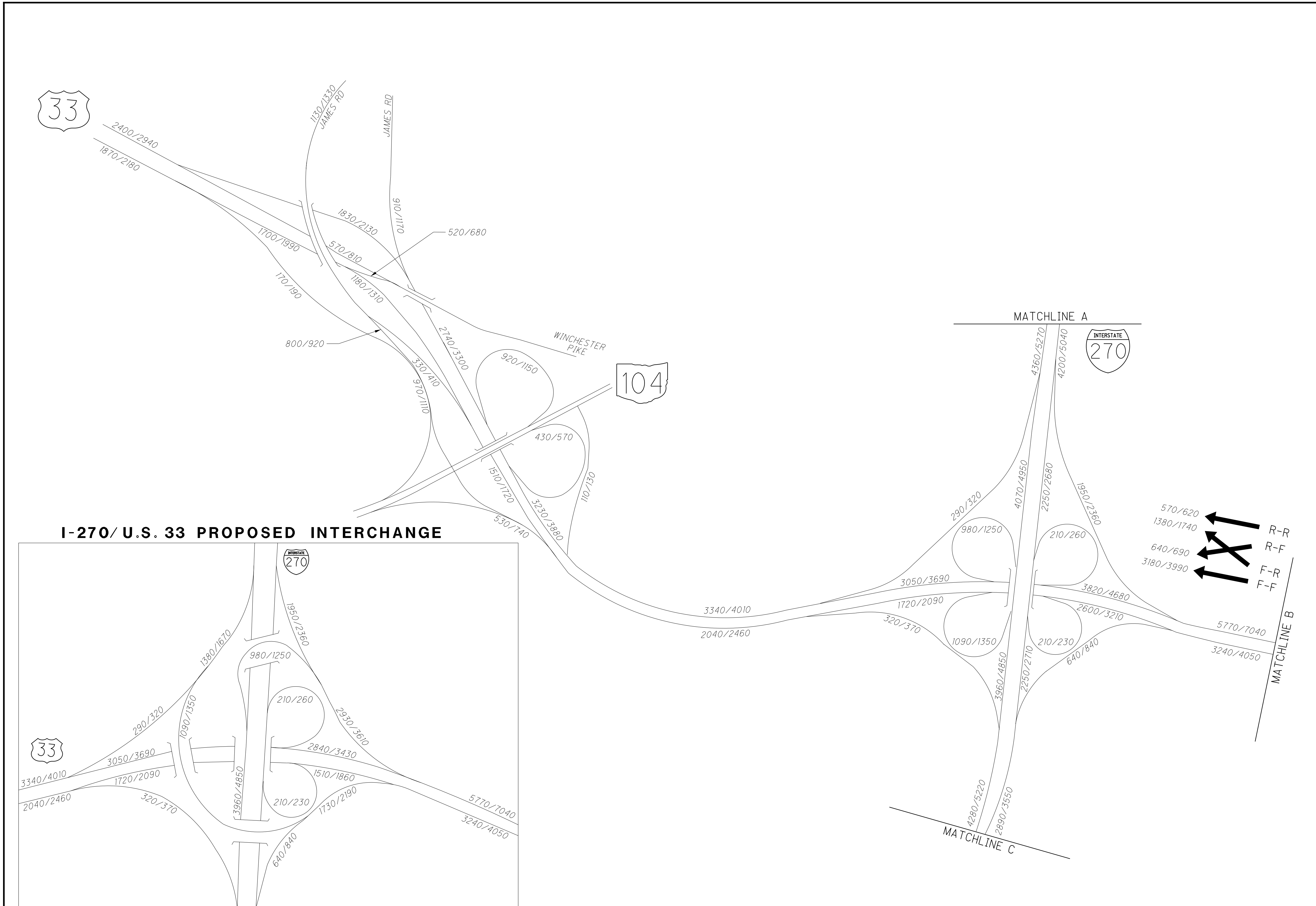
37



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DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
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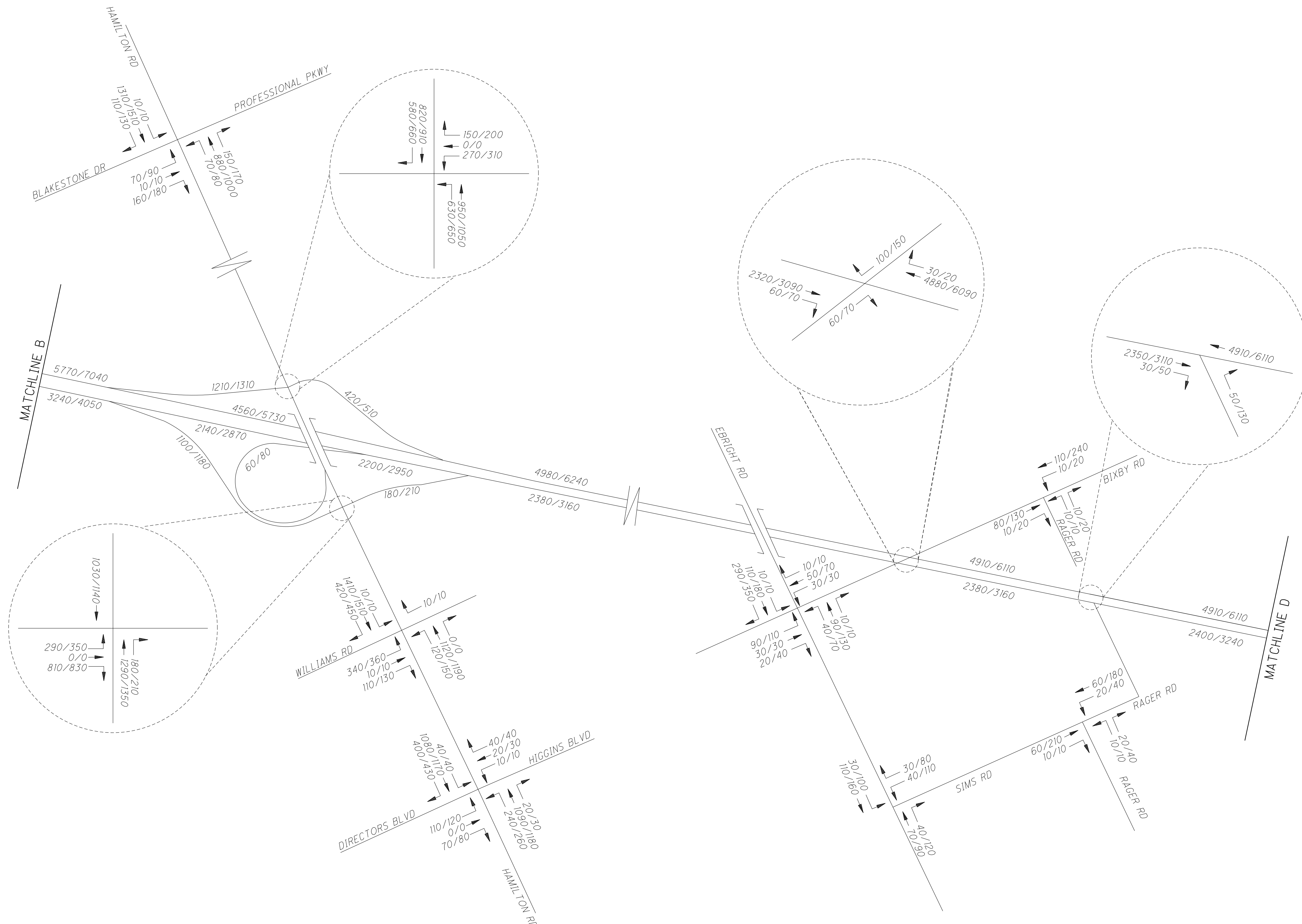

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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD AM VOLUMES

PID 119387

NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

2030/ 2050 US 33 BUILD AM VOLUMES

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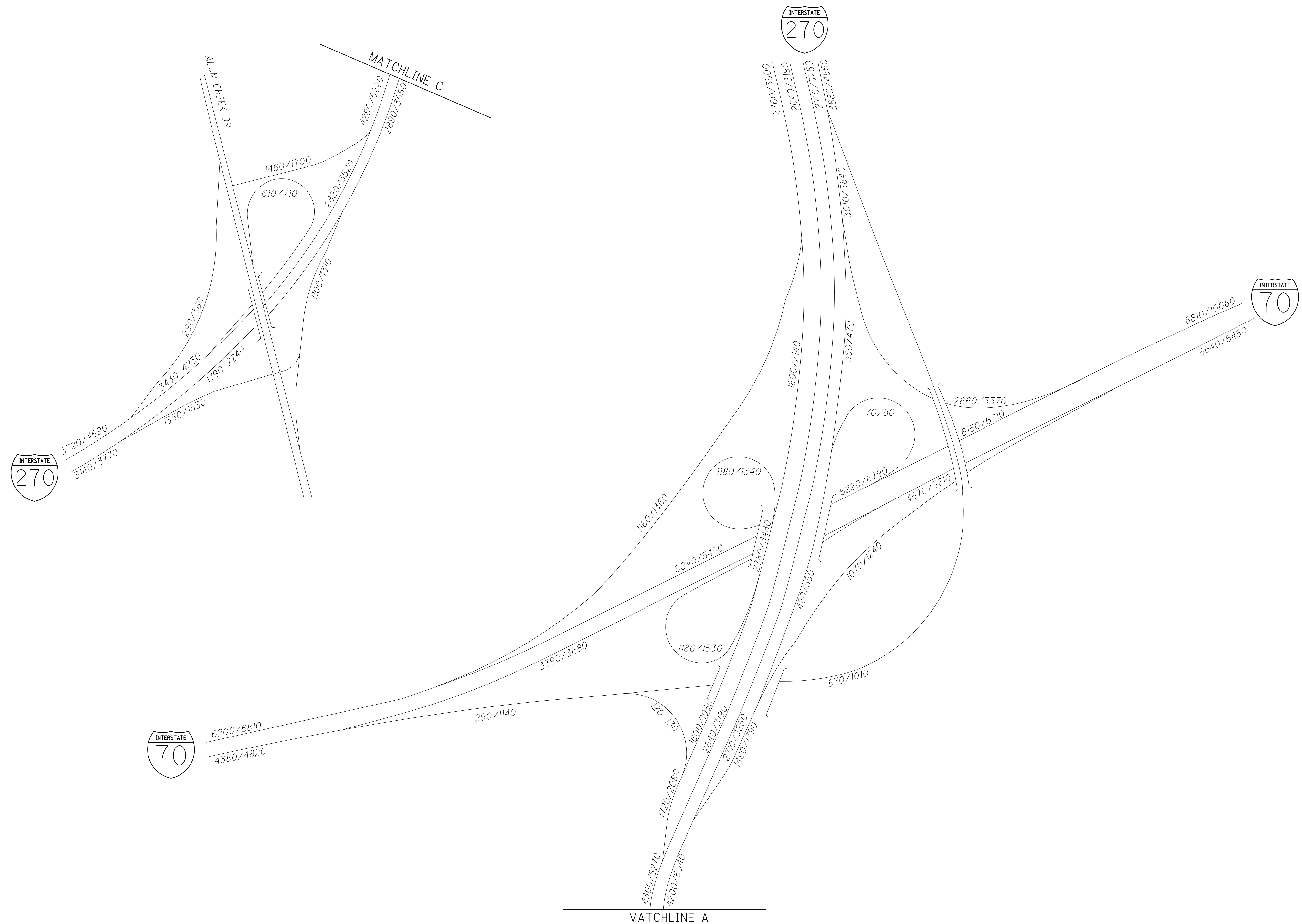

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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD AM VOLUMES

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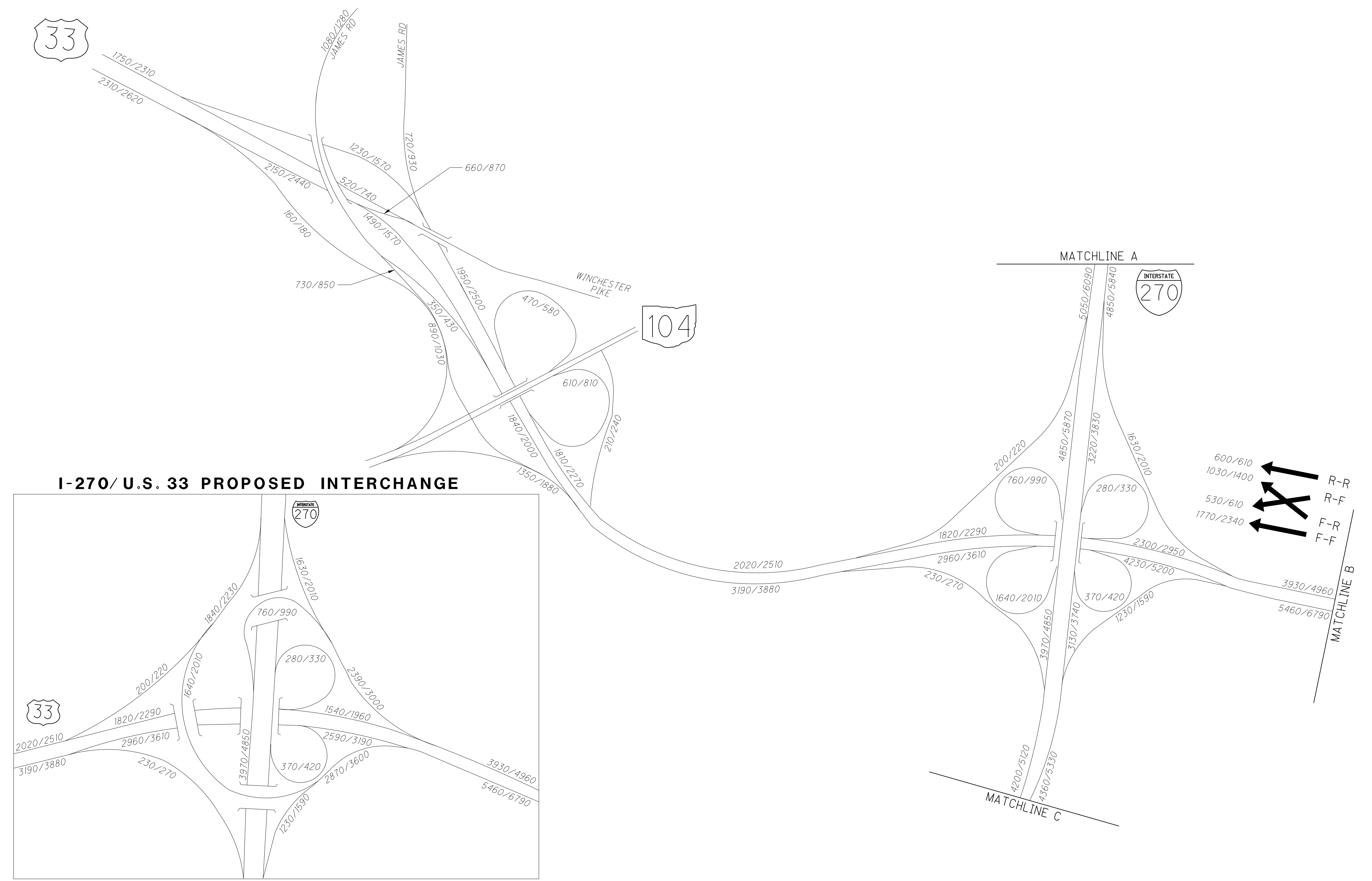


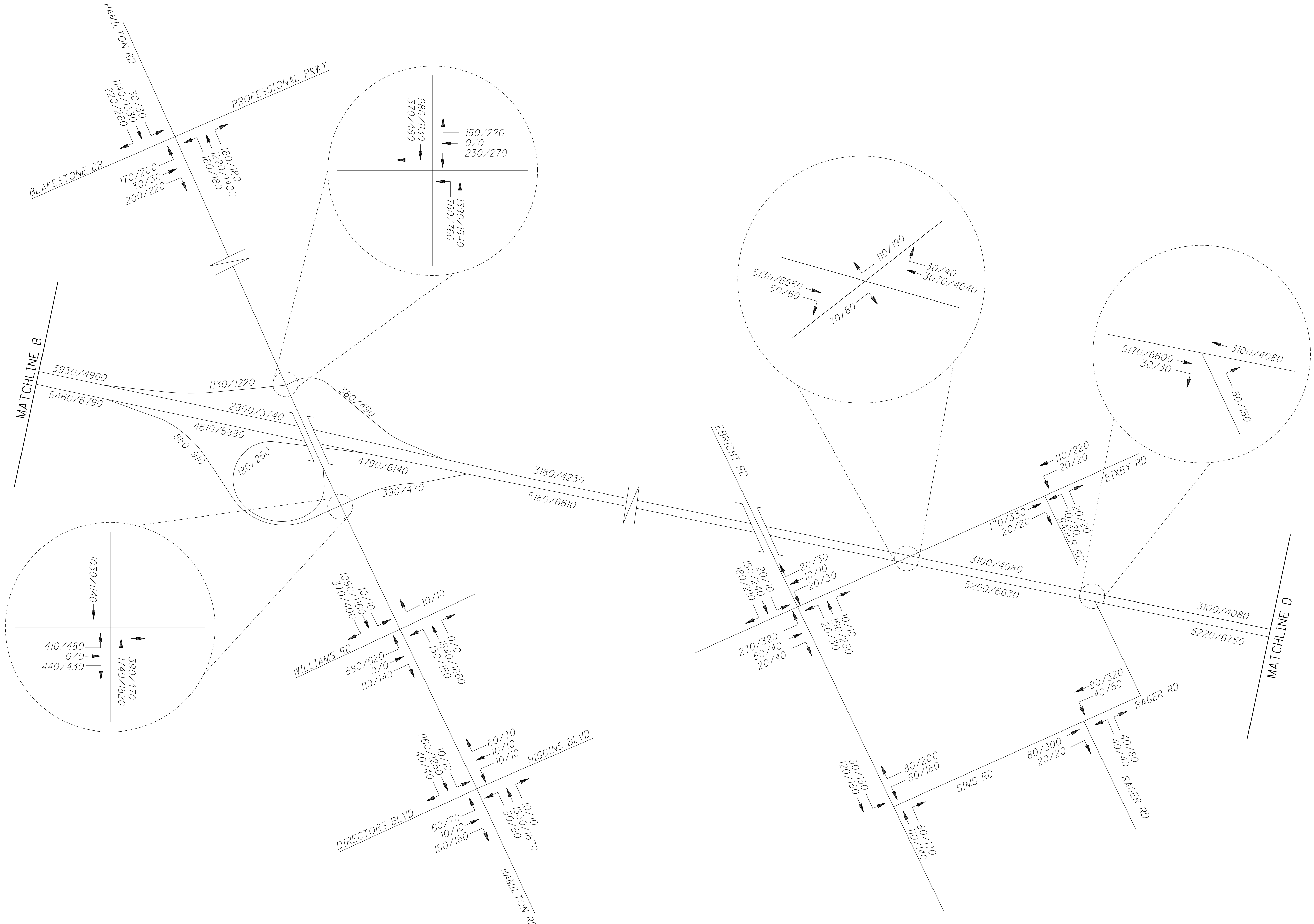
NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD PM VOLUMES

PID 119387



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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY

2030/ 2050 US 33 BUILD PM VOLUMES

PID 119387

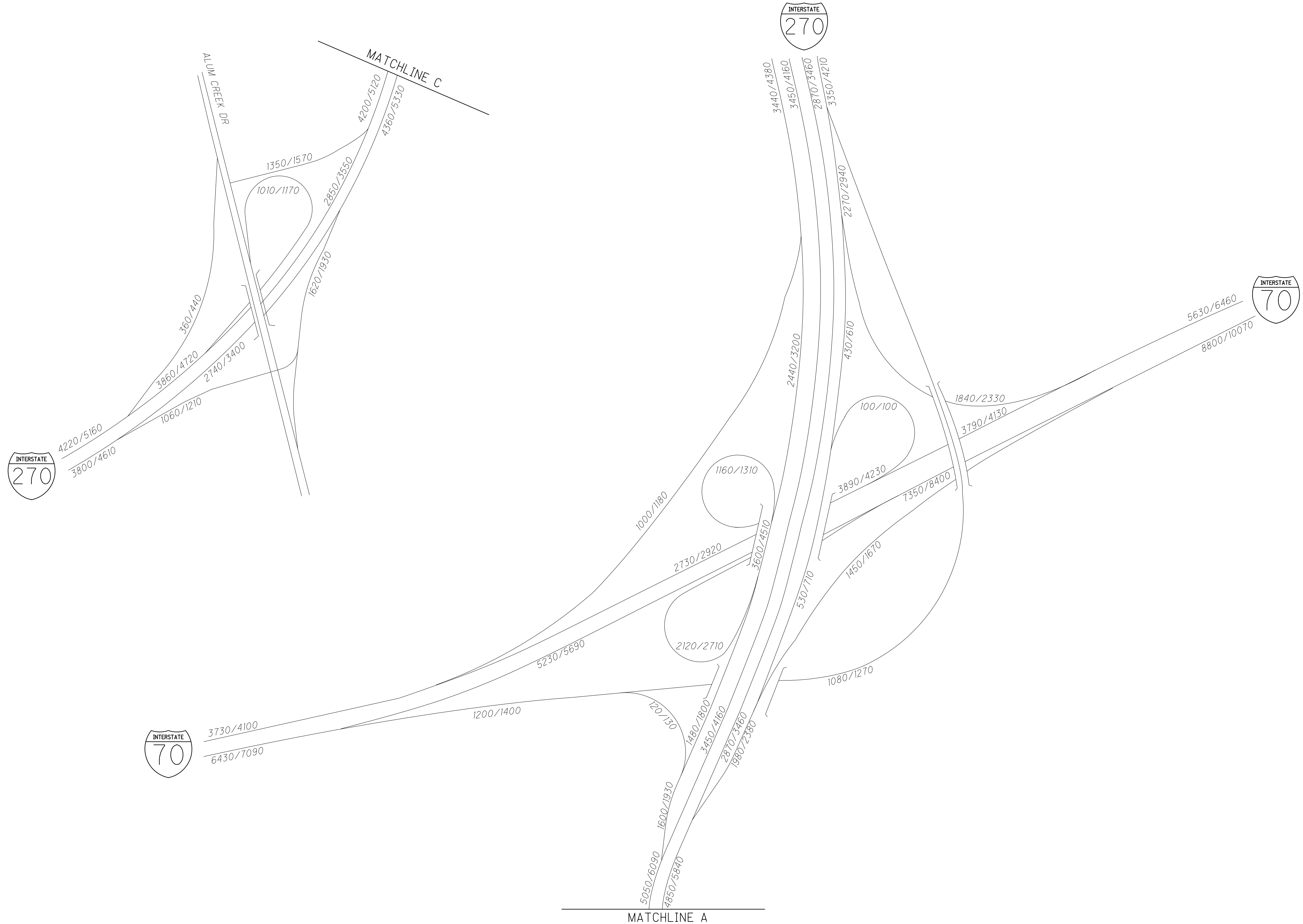
NOT TO SCALE

ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD PM VOLUMES

PID 119387



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ANALYST HM

DATE 10/01/24

FRA-33-24.76 FEASIBILITY STUDY
2030/ 2050 US 33 BUILD PM VOLUMES

PID 119387

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APPENDIX D:
Capacity Analysis

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	3/21/2024
Agency	LJB Inc	Analysis Year	2050 No Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	AM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	39
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.71		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Merge	US 33 EB - James Rd On-Ramp	1500	2
6	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	2
7	Basic	Basic	US 33 EB - Btwn SR 104 & I-270	3640	2
8	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	2
9	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps (2 lanes)	580	2
10	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps (3 lanes)	330	3
11	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1480	4
12	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	390	3
13	Merge	Merge	US 33 EB - I-270 NB On-Ramp	1500	3
14	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	1030	3
15	Diverge	Basic	US 33 EB - Hamilton Off-Ramp	1500	3
16	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1350	2
17	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1370	2
18	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	2
19	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2390	2
20	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	2
21	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	2
22	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	2
23	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	2

24	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	2
25	Basic	Basic	(dummy) US 33 EB - Btwn Rager "ramps"	1000	2
26	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	2
27	Basic	Basic	US 33 EB - Btwn Rager & Gender	2390	2
28	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	2
29	Basic	Basic	US 33 EB - Btwn Gender Ramps	2350	2
30	Merge	Merge	US 33 EB - Gender On-Ramp	1500	2
31	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1950	2
32	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	2
33	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	2
34	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	2
35	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1950	2
36	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	2
37	Basic	Basic	US 33 EB - Btwn Diley Ramps	4100	2
38	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
39	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2447	4700	0.52	65.0	18.8	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	2447	207	4700	2100	0.52	0.10	59.2	59.2	20.7	20.3	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	2240	771	4700	2100	0.48	0.37	58.1	58.1	19.3	20.8	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1448	4700	0.31	63.8	11.1	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.935	1892	444	4700	2100	0.40	0.21	59.3	59.3	16.0	13.8	B

Segment 6: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.833	2828	932	4700	2100	0.60	0.44	58.4	58.4	24.2	20.9	C

Segment 7: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2835	4700	0.60	64.9	21.8	C

Segment 8: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.943	2835	417	4700	2100	0.60	0.20	58.8	58.8	24.1	24.0	C

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2395	4700	0.51	63.9	18.4	C

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2395	7050	0.34	64.4	12.3	B

Segment 11: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3981	5107	0.78	45.3	22.0	C

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3681	7050	0.52	60.7	18.9	C

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.870	4647	966	7050	2100	0.66	0.46	59.7	58.8	25.9	21.0	C

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	4622	7050	0.66	64.3	23.8	C

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.80	0.893	0.926	4622	1593	7050	2100	0.66	0.76	64.7	64.7	23.8	23.8	C

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3217	4700	0.68	64.4	25.0	C

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.893	0.885	3307	90	4700	2000	0.70	0.04	56.4	56.4	29.3	27.0	C

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.862	3547	247	4700	2100	0.75	0.12	56.3	56.3	31.5	28.1	D

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3476	4700	0.74	63.4	27.4	D

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.909	0.952	3476	153	4700	2000	0.74	0.08	54.8	54.8	31.7	30.5	D

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3324	4700	0.71	63.7	26.0	C

Segment 22: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.909	3429	105	4700	2000	0.73	0.05	56.1	56.1	30.6	27.2	C

Segment 23: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3429	4700	0.73	63.6	26.9	D

Segment 24: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.980	3429	54	4700	2000	0.73	0.03	55.0	55.0	31.2	30.1	D

Segment 25: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3371	4700	0.72	63.7	26.4	D

Segment 26: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.980	3480	109	4700	2000	0.74	0.05	56.0	56.0	31.1	27.6	C

Segment 27: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3488	4700	0.74	63.3	27.6	D

Segment 28: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.81	0.909	0.909	3488	1005	4700	2100	0.74	0.48	57.6	57.6	30.3	28.9	D

Segment 29: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	2622	4700	0.56	64.7	20.2	C

Segment 30: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.909	0.962	3194	572	4700	2100	0.68	0.27	57.4	57.4	27.8	24.9	C

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3282	4700	0.70	64.2	25.6	C

Segment 32: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.885	0.935	3282	137	4700	2000	0.70	0.07	54.9	54.9	29.9	28.9	D

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3137	4700	0.67	63.7	24.3	C

Segment 34: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.73	0.885	0.935	3181	44	4700	2000	0.68	0.02	56.7	56.7	28.1	25.3	C

Segment 35: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3173	4700	0.68	64.5	24.6	C

Segment 36: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.885	0.935	3173	717	4700	2100	0.68	0.34	58.1	58.1	27.3	28.2	D

Segment 37: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	2440	4700	0.52	64.9	18.8	C

Segment 38: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.82	0.885	0.943	3022	582	4700	2100	0.64	0.28	58.4	58.4	25.9	21.6	C

Segment 39: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.901	2928	4700	0.62	64.9	22.6	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	7750	7750	9.76	243.89	56.7	24.4	21.9	12.40	C

Facility Overall Results

Space Mean Speed, mi/h	56.7	Average Density, veh/mi/ln	21.9
Average Travel Time, min	12.40	Average Density, pc/mi/ln	24.4
Total VMT, veh-mi/AP	7750	Total VHD, veh-h	9.76
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	243.89

 HCS™ Freeways Version 2025 Generated: 06/05/2025 11:43:26

Design Year No Build AM - US 33 EB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	3/21/2024
Agency	LJB Inc	Analysis Year	2050 No Build
Jurisdiction	FRA-FAI, ODOT District 6 & 5	Time Analyzed	AM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	36
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.34		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps	2040	2
4	Merge	Merge	US 33 WB - Diley On-Ramp	1500	2
5	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1810	2
6	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	2
7	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	2
8	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	2
9	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1810	2
10	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	2
11	Basic	Basic	US 33 WB - Btwn Gender Ramps	1460	2
12	Merge	Merge	US 33 WB - Gender NB On-Ramp	1210	2
13	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	2
14	Basic	Basic	US 33 WB - Btwn Gender & Rager	2610	2
15	Diverge	Diverge	(dummy) US 33 WB - Rager "off-ramp"	1500	2
16	Basic	Basic	(dummy) US 33 WB - Btwn Rager "ramps"	1000	2
17	Merge	Merge	(dummy) US 33 WB - Rager "on-ramp"	1500	2
18	Basic	Basic	(dummy) US 33 WB - Btwn Bixby & Rager	1000	2
19	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	2
20	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	2
21	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	2
22	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2610	2
23	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	2

24	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1790	2
25	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4550	3
26	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1510	3
27	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	2
28	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	2
29	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	2
30	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	2
31	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	2
32	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	3
33	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	2
34	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
35	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
36	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4268	4700	1.03	36.6	58.3	F

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.66	0.952	0.943	4220	884	4700	2000	1.03	0.44	39.1	54.8	54.0	33.9	F

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3066	4700	0.90	18.5	82.7	F

Segment 4: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.926	4055	1282	4700	2100	1.17	0.61	35.9	51.1	56.4	41.4	F

Segment 5: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	3930	4700	1.20	32.4	60.6	F

Segment 6: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.91	0.917	0.962	3826	80	4700	2000	1.20	0.04	29.2	55.0	65.4	49.1	F

Segment 7: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	3674	4700	1.18	25.2	73.0	F

Segment 8: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.77	0.917	0.962	3709	135	4700	2000	1.21	0.07	26.3	50.0	70.5	44.9	F

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3588	4700	1.20	24.1	74.6	F

Segment 10: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	3489	760	4700	2100	1.20	0.36	22.1	58.1	79.0	48.2	F

Segment 11: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2580	4700	1.03	12.3	105.0	F

Segment 12: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	3694	1172	4700	2000	1.28	0.59	24.5	49.9	75.4	47.8	F

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4376	682	4700	2100	1.43	0.32	52.6	52.6	41.6	33.5	F

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4376	4700	1.40	56.2	38.9	F

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	4355	119	4700	2000	1.40	0.06	46.1	54.9	47.3	57.2	F

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.94	0.952	4213	4700	1.37	37.4	56.3	F

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	4376	163	4700	2000	1.41	0.08	51.8	51.8	42.2	34.6	F

Segment 18: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4376	4700	1.41	56.2	38.9	F

Segment 19: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.68	0.952	0.980	4376	180	4700	2000	1.41	0.09	54.8	54.8	39.9	38.3	F

Segment 20: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4181	4700	1.38	41.8	50.0	F

Segment 21: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.952	0.980	4376	195	4700	2000	1.42	0.10	51.8	51.8	42.2	34.6	F

Segment 22: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4376	4700	1.43	56.2	38.9	F

Segment 23: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.943	0.935	4376	601	4700	2100	1.43	0.29	58.4	58.4	37.5	35.9	F

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3775	4700	1.31	61.6	30.6	F

Segment 25: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5315	6453	1.20	45.7	38.8	F

Segment 26: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2931	5823	0.92	51.1	19.1	B

Segment 27: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	1538	4700	0.84	63.0	11.8	B

Segment 28: Merge														
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)	LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.
1	0.94	0.94	0.943	0.917	1909	371	4700	2100	0.92	0.18	58.5	58.5	16.3	16.3	B

Segment 29: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	1909	4700	0.93	64.8	14.7	B

Segment 30: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.935	1909	148	4700	2100	0.93	0.07	59.3	59.3	16.1	15.5	B

Segment 31: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	1761	4700	0.90	64.2	13.5	B

Segment 32: Weaving								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2464	5607	0.88	49.4	16.6	B

Segment 33: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	1263	1259	4700	2100	0.76	0.60	57.0	57.0	11.1	9.8	A

Segment 34: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4	4500	0.51	55.0	0.0	A

Segment 35: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	822	818	4500	2100	0.69	0.39	51.8	51.8	7.9	6.4	A

Segment 36: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	822	4500	0.70	53.9	7.5	A

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	10300	13971	105.59	2639.83	39.0	43.7	41.0	17.50	F

Facility Overall Results

Space Mean Speed, mi/h	39.0	Average Density, veh/mi/ln	41.0
Average Travel Time, min	17.50	Average Density, pc/mi/ln	43.7
Total VMT, veh-mi/AP	10300	Total VHD, veh-h	105.59
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	2639.83

 HCS™ Freeways Version 2025 Generated: 06/05/2025 12:00:12

Design Year No Build AM - US 33 WB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	3/21/2024
Agency	LJB Inc	Analysis Year	2050 No Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	PM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	39
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.71		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Merge	US 33 EB - James Rd On-Ramp	1500	2
6	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	2
7	Basic	Basic	US 33 EB - Btwn SR 104 & I-270	3640	2
8	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	2
9	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps (2 lanes)	580	2
10	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps (3 lanes)	330	3
11	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1480	4
12	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	390	3
13	Merge	Merge	US 33 EB - I-270 NB On-Ramp	1500	3
14	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	1030	3
15	Diverge	Basic	US 33 EB - Hamilton Off-Ramp	1500	3
16	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1350	2
17	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1370	2
18	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	2
19	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2390	2
20	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	2
21	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	2
22	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	2
23	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	2

24	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	2
25	Basic	Basic	(dummy) US 33 EB - Btwn Rager "ramps"	1000	2
26	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	2
27	Basic	Basic	US 33 EB - Btwn Rager & Gender	2390	2
28	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	2
29	Basic	Basic	US 33 EB - Btwn Gender Ramps	2350	2
30	Merge	Merge	US 33 EB - Gender On-Ramp	1500	2
31	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1950	2
32	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	2
33	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	2
34	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	2
35	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1950	2
36	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	2
37	Basic	Basic	US 33 EB - Btwn Diley Ramps	4100	2
38	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
39	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2827	4700	0.60	65.0	21.7	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.909	2827	199	4700	2100	0.60	0.09	59.2	59.2	23.9	23.6	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.943	2628	1004	4700	2100	0.56	0.48	57.6	57.6	22.8	24.2	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	1624	4700	0.35	63.8	12.5	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	2090	466	4700	2100	0.45	0.22	59.2	59.2	17.7	15.4	B

Segment 6: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	4190	2105	4700	2100	0.89	1.00	54.0	54.0	38.8	31.0	D

Segment 7: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4190	4700	0.90	58.2	36.0	E

Segment 8: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.909	4190	316	4700	2100	0.90	0.15	59.0	59.0	35.5	35.7	E

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3874	4700	0.84	60.9	31.8	D

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3822	7050	0.56	63.0	19.6	F

Segment 11: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4615	5715	1.04	20.0	57.6	F

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4048	7050	0.81	15.8	85.3	F

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.926	5074	1758	7050	2100	1.06	0.84	21.1	52.1	80.0	36.8	F

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4959	7050	1.06	19.5	85.0	F

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.943	4792	1085	7050	2100	1.06	0.52	17.8	17.8	89.9	89.9	F

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3636	4700	1.37	23.6	77.1	F

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.962	3845	265	4700	2000	1.43	0.13	27.2	49.9	70.7	53.5	F

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.935	0.952	4376	531	4700	2100	1.54	0.25	52.3	52.3	41.8	34.5	F

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4376	4700	1.51	56.2	38.9	F

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.75	0.952	0.971	4376	453	4700	2000	1.51	0.23	54.2	54.2	40.4	38.3	F

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3923	4700	1.44	60.5	32.4	F

Segment 22: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.877	4022	99	4700	2000	1.46	0.05	53.9	53.9	37.3	31.9	F

Segment 23: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4022	4700	1.45	59.7	33.7	F

Segment 24: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	4022	54	4700	2000	1.45	0.03	55.0	55.0	36.6	35.2	F

Segment 25: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3968	4700	1.44	60.2	33.0	F

Segment 26: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	4131	163	4700	2000	1.48	0.08	53.3	53.3	38.8	32.7	F

Segment 27: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4131	4700	1.48	58.7	35.2	F

Segment 28: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.952	4131	1662	4700	2100	1.48	0.79	56.2	56.2	36.8	34.5	F

Segment 29: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2469	4700	1.14	64.6	19.0	F

Segment 30: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.980	3656	1187	4700	2100	1.39	0.57	56.1	56.1	32.6	28.3	F

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3656	4700	1.40	62.4	29.3	F

Segment 32: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.99	0.943	0.952	3656	350	4700	2000	1.40	0.18	54.4	54.4	33.6	32.1	F

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3306	4700	1.32	63.6	25.8	F

Segment 34: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.53	0.943	0.952	3405	99	4700	2000	1.34	0.05	56.2	56.2	30.3	27.0	F

Segment 35: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3405	4700	1.34	63.7	26.7	F

Segment 36: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	3405	1141	4700	2100	1.34	0.54	57.3	57.3	29.7	30.2	F

Segment 37: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2264	4700	1.09	64.9	17.4	F

Segment 38: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	2908	644	4700	2100	1.23	0.31	58.6	58.6	24.8	20.7	F

Segment 39: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.962	2908	4700	1.21	65.0	22.4	F

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	9975	15162	70.64	1765.98	44.5	38.2	36.0	15.80	F

Facility Overall Results

Space Mean Speed, mi/h	44.5	Average Density, veh/mi/ln	36.0
Average Travel Time, min	15.80	Average Density, pc/mi/ln	38.2
Total VMT, veh-mi/AP	9975	Total VHD, veh-h	70.64
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	1765.98

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	3/21/2024
Agency	LJB Inc	Analysis Year	2050 No Build
Jurisdiction	FRA-FAI, ODOT District 6 & 5	Time Analyzed	PM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	36
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.34		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps	2040	2
4	Merge	Merge	US 33 WB - Diley On-Ramp	1500	2
5	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1810	2
6	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	2
7	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	2
8	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	2
9	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1810	2
10	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	2
11	Basic	Basic	US 33 WB - Btwn Gender Ramps	1460	2
12	Merge	Merge	US 33 WB - Gender NB On-Ramp	1210	2
13	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	2
14	Basic	Basic	US 33 WB - Btwn Gender & Rager	2610	2
15	Diverge	Diverge	(dummy) US 33 WB - Rager "off-ramp"	1500	2
16	Basic	Basic	(dummy) US 33 WB - Btwn Rager "ramps"	1000	2
17	Merge	Merge	(dummy) US 33 WB - Rager "on-ramp"	1500	2
18	Basic	Basic	(dummy) US 33 WB - Btwn Bixby & Rager	1000	2
19	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	2
20	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	2
21	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	2
22	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2610	2
23	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	2

24	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1790	2
25	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4550	3
26	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1510	3
27	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	2
28	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	2
29	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	2
30	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	2
31	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	2
32	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	3
33	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	2
34	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
35	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
36	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3470	4700	0.74	63.4	27.4	D

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.952	3470	454	4700	2000	0.74	0.23	55.7	55.7	31.1	22.2	C

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3038	4700	0.65	64.5	23.4	C

Segment 4: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.87	0.935	0.952	4100	1062	4700	2100	0.87	0.51	54.6	54.6	37.5	30.5	D

Segment 5: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4078	4700	0.87	59.2	34.4	D

Segment 6: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.95	0.926	0.971	4078	119	4700	2000	0.87	0.06	54.9	54.9	37.1	35.7	E

Segment 7: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3952	4700	0.84	60.3	32.8	D

Segment 8: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.72	0.926	0.971	4138	186	4700	2000	0.88	0.09	53.3	53.3	38.8	32.7	D

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4101	4700	0.87	59.0	34.7	D

Segment 10: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4101	782	4700	2100	0.87	0.37	58.0	58.0	35.4	35.1	E

Segment 11: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3297	4700	0.70	64.1	25.7	C

Segment 12: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4035	738	4700	2000	0.86	0.37	53.7	53.7	37.6	32.6	D

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	4423	368	4700	2100	0.94	0.18	52.3	52.3	42.3	34.0	D

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4423	4700	0.94	55.7	39.7	E

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.980	4423	163	4700	2000	0.94	0.08	54.8	54.8	40.4	38.7	E

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.94	0.926	4251	4700	0.90	57.5	37.0	E

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.980	4468	217	4700	2000	0.95	0.11	51.1	51.1	43.7	35.3	E

Segment 18: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4400	4700	0.94	55.9	39.4	E

Segment 19: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.64	0.943	0.980	4400	80	4700	2000	0.94	0.04	55.0	55.0	40.0	38.5	E

Segment 20: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4343	4700	0.92	56.6	38.4	E

Segment 21: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.97	0.943	0.980	4543	200	4700	2000	0.97	0.10	50.5	50.5	45.0	35.9	E

Segment 22: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4641	4700	0.99	53.0	43.8	E

Segment 23: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.926	0.909	4641	562	4700	2100	0.99	0.27	58.5	58.5	39.7	38.1	E

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4101	4700	0.87	59.0	34.7	D

Segment 25: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	5459	5769	0.95	44.6	40.8	E

Segment 26: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3592	5567	0.65	46.7	25.6	C

Segment 27: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2470	4700	0.53	62.3	19.0	C

Segment 28: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.909	2739	269	4700	2100	0.58	0.13	57.7	57.7	23.7	22.8	C

Segment 29: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2708	4700	0.58	64.8	20.8	C

Segment 30: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.952	2708	268	4700	2100	0.58	0.13	59.1	59.1	22.9	22.4	C

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2435	4700	0.52	64.2	18.7	C

Segment 32: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3401	5096	0.67	46.3	24.5	C

Segment 33: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	2708	1010	4700	2100	0.58	0.48	57.5	57.5	23.5	22.2	C

Segment 34: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	1636	4500	0.36	55.0	14.9	B

Segment 35: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.943	0.971	2370	734	4500	2100	0.53	0.35	51.3	51.3	23.1	18.6	B

Segment 36: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2392	4500	0.53	53.7	21.7	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	9534	9534	28.13	703.21	51.6	33.0	30.3	13.20	D

Facility Overall Results			
Space Mean Speed, mi/h	51.6	Average Density, veh/mi/ln	30.3
Average Travel Time, min	13.20	Average Density, pc/mi/ln	33.0
Total VMT, veh-mi/AP	9534	Total VHD, veh-h	28.13
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	703.21

 HCS™ Freeways Version 2025 Generated: 06/05/2025 12:03:59
Design Year No Build PM - US 33 WB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	AM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	40
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.70		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Basic	US 33 EB - James Rd On-Ramp	900	2
6	Basic	Basic	US 33 EB - Btwn James Rd & SR 104	600	3
7	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	3
8	Basic	Basic	US 33 EB - Btwn SR 104 & I-270	3640	3
9	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	3
10	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps	770	3
11	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1630	4
12	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	270	3
13	Merge	Basic	US 33 EB - I-270 NB On-Ramp	1500	4
14	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	900	4
15	Diverge	Basic	US 33 EB - Hamilton Off-Ramp	1500	4
16	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1570	3
17	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1410	3
18	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	3
19	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2290	3
20	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	3
21	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	3
22	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	3
23	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	3
24	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	3
25	Basic	Basic	(dummy) US 33 EB - Btwn Rager	1000	3

			"ramps"		
26	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	3
27	Basic	Basic	US 33 EB - Btwn Rager & Gender	2290	3
28	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	3
29	Basic	Basic	US 33 EB - Btwn Gender Ramps	2390	3
30	Merge	Merge	US 33 EB - Gender On-Ramp	1500	3
31	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1930	3
32	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	3
33	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	3
34	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	3
35	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1920	3
36	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	3
37	Basic	Basic	US 33 EB - Btwn Diley Ramps (3 lanes)	1830	3
38	Basic	Basic	US 33 EB - Btwn Diley Ramps (2 lanes)	2400	2
39	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
40	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2504	4700	0.53	65.0	19.3	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	2504	218	4700	2100	0.53	0.10	59.2	59.2	21.1	20.8	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	2286	760	4700	2100	0.49	0.36	58.1	58.1	19.7	21.2	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1505	4700	0.32	63.8	11.6	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.935	1971	466	4700	2100	0.42	0.22	64.9	65.0	15.2	15.2	B

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1976	7050	0.28	65.0	10.1	A

Segment 7: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.833	2921	945	7050	2100	0.41	0.45	60.4	59.2	16.1	15.6	B

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2931	7050	0.42	64.9	15.0	B

Segment 9: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.943	2931	417	7050	2100	0.42	0.20	61.7	58.8	15.8	18.1	B

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2490	7050	0.35	64.5	12.8	B

Segment 11: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	4109	5207	0.79	46.3	22.2	C

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3824	7050	0.54	61.0	19.6	C

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.870	4851	1027	9400	2100	0.52	0.49	64.0	65.0	18.7	18.7	C

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	4825	9400	0.51	64.9	18.6	C

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.80	0.893	0.926	4825	1593	9400	2100	0.51	0.76	65.0	65.0	18.6	18.6	C

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.94	0.893	3419	7050	0.48	65.0	17.5	B

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.893	0.885	3522	103	7050	2000	0.50	0.05	60.0	58.8	19.6	15.8	B

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.862	3773	259	7050	2100	0.54	0.12	60.1	59.1	20.9	17.4	B

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3698	7050	0.52	64.8	19.0	C

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.909	0.952	3698	83	7050	2000	0.52	0.04	59.3	55.0	20.8	22.0	C

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3616	7050	0.51	64.2	18.5	C

Segment 22: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.909	3698	82	7050	2000	0.52	0.04	59.4	58.1	20.8	18.1	B

Segment 23: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3698	7050	0.52	64.3	19.0	C

Segment 24: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.980	3698	54	7050	2000	0.52	0.03	59.3	55.0	20.8	22.0	C

Segment 25: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3640	7050	0.52	64.2	18.7	C

Segment 26: Merge

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.980	3781	141	7050	2000	0.54	0.07	59.3	58.0	21.3	18.7	B
Segment 27: Basic															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
1	0.94		0.909		3792		7050		0.54		64.7		19.4		C
Segment 28: Diverge															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
	F	**R**	**F**	**R**	**Freeway**	**Ramp**	**Freeway**	**Ramp**	**F**	**R**	**F**	**R Infl.**	**F**	**R Infl.**	
1	0.94	0.81	0.909	0.909	3792	1127	7050	2100	0.54	0.54	60.5	57.3	20.9	23.0	C
Segment 29: Basic															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
1	0.94		0.909		2820		7050		0.40		64.8		14.5		B
Segment 30: Merge															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
	F	**R**	**F**	**R**	**Freeway**	**Ramp**	**Freeway**	**Ramp**	**F**	**R**	**F**	**R Infl.**	**F**	**R Infl.**	
1	0.94	0.89	0.909	0.962	3392	572	7050	2100	0.48	0.27	60.6	59.5	18.7	15.7	B
Segment 31: Basic															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
1	0.94		0.885		3486		7050		0.49		64.7		17.9		B
Segment 32: Diverge															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
	F	**R**	**F**	**R**	**Freeway**	**Ramp**	**Freeway**	**Ramp**	**F**	**R**	**F**	**R Infl.**	**F**	**R Infl.**	
1	0.94	0.94	0.885	0.935	3486	137	7050	2000	0.49	0.07	59.2	54.9	19.6	21.0	C
Segment 33: Basic															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
1	0.94		0.885		3342		7050		0.47		64.2		17.1		B
Segment 34: Merge															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
	F	**R**	**F**	**R**	**Freeway**	**Ramp**	**Freeway**	**Ramp**	**F**	**R**	**F**	**R Infl.**	**F**	**R Infl.**	
1	0.94	0.73	0.885	0.935	3386	44	7050	2000	0.48	0.02	59.6	58.2	18.9	16.5	B
Segment 35: Basic															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**
1	0.94		0.885		3378		7050		0.48		64.7		17.3		B
Segment 36: Diverge															
AP	**PHF**		**fHV**		**Volume Served (pc/h)**		**Capacity (pc/h)**		**d/c Ratio**		**Speed (mi/h)**		**Density (pc/mi/ln)**		**LOS**

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.885	0.935	3378	764	7050	2100	0.48	0.36	61.3	58.1	18.4	23.4	C

Segment 37: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	2596	7050	0.37	64.8	13.3	B

Segment 38: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	2596	4700	0.55	65.0	20.0	C

Segment 39: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.82	0.885	0.943	3191	595	4700	2100	0.68	0.28	58.1	58.1	27.5	22.8	C

Segment 40: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.901	3093	4700	0.66	64.7	23.9	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	8198	8198	6.43	160.69	58.2	18.6	16.7	12.10	C

Facility Overall Results

Space Mean Speed, mi/h	58.2	Average Density, veh/mi/ln	16.7
Average Travel Time, min	12.10	Average Density, pc/mi/ln	18.6
Total VMT, veh-mi/AP	8198	Total VHD, veh-h	6.43
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	160.69

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Design Year Build AM - US 33 EB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	AM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	33
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.35		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps (2 lanes)	750	2
4	Basic	Basic	US 33 WB - Btwn Diley Ramps (3 lanes)	1230	3
5	Merge	Merge	US 33 WB - Diley On-Ramp	1500	3
6	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1800	3
7	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	3
8	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	3
9	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	3
10	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1800	3
11	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	3
12	Basic	Basic	US 33 WB - Btwn Gender Ramps	1400	3
13	Merge	Merge	US 33 WB - Gender NB On-Ramp	1500	3
14	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	3
15	Basic	Basic	US 33 WB - Btwn Gender & Bixby	7420	3
16	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	3
17	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	3
18	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	3
19	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2420	3
20	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	3
21	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1750	3
22	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4790	4
23	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1570	4

24	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	3
25	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	3
26	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	3
27	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	3
28	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	3
29	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	4
30	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	3
31	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
32	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
33	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4700	4700	1.05	52.2	45.0	F

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.66	0.952	0.943	4700	964	4700	2000	1.05	0.48	54.6	54.6	43.0	32.8	F

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3736	4700	0.91	61.9	30.2	D

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3736	7050	0.60	64.4	19.2	C

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.926	5065	1329	7050	2100	0.79	0.63	58.3	57.0	29.0	25.9	C

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	5065	7050	0.81	63.8	26.5	D

Segment 7: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.917	0.962	5065	80	7050	2000	0.81	0.04	59.1	55.0	28.6	28.4	D

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	4985	7050	0.80	64.0	26.0	C

Segment 9: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.77	0.917	0.962	5120	135	7050	2000	0.82	0.07	57.9	56.9	29.5	24.9	C

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	5120	7050	0.81	63.7	26.8	D

Segment 11: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	5120	726	7050	2100	0.81	0.35	61.2	58.1	27.9	28.3	D

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4394	7050	0.70	64.6	22.6	C

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	5666	1272	7050	2000	0.88	0.64	56.2	54.4	33.6	31.3	D

Segment 14: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	6392	726	7050	2100	0.99	0.35	56.0	54.6	38.0	30.0	D

Segment 15: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6392	7050	0.97	57.4	37.1	E

Segment 16: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.68	0.952	0.980	6392	30	7050	2000	0.97	0.02	58.8	55.1	36.2	33.7	D

Segment 17: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6362	7050	0.97	57.6	36.8	E

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.952	0.980	6516	172	7050	2000	0.99	0.09	55.2	54.1	39.3	31.5	F

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6419	7050	1.00	44.1	48.5	F

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.943	0.935	6337	613	7050	2100	1.00	0.29	42.4	58.4	49.9	37.0	F

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5576	7050	0.92	27.4	67.9	F

Segment 22: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6385	6857	1.17	46.6	34.3	F

Segment 23: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3978	7619	0.74	49.8	20.0	B

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2502	7050	0.59	62.9	12.8	B

Segment 25: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.943	0.917	2873	371	7050	2100	0.64	0.18	60.1	58.5	15.9	15.8	B

Segment 26: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2873	7050	0.65	64.9	14.7	B

Segment 27: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.935	2873	148	7050	2100	0.65	0.07	62.5	59.3	15.3	16.3	B

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2725	7050	0.63	64.7	14.0	B

Segment 29: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3441	6030	0.86	47.3	18.2	B

Segment 30: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	2107	1270	7050	2100	0.53	0.60	58.6	57.0	12.0	14.5	B

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	837	4500	0.54	55.0	7.6	A

Segment 32: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	1733	896	4500	2100	0.74	0.43	51.6	51.6	16.8	13.5	B

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1733	4500	0.75	53.8	15.8	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	13644	14466	48.82	1220.41	52.7	31.3	29.5	12.90	F

Facility Overall Results

Space Mean Speed, mi/h	52.7	Average Density, veh/mi/ln	29.5
Average Travel Time, min	12.90	Average Density, pc/mi/ln	31.3
Total VMT, veh-mi/AP	13644	Total VHD, veh-h	48.82
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	1220.41

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	PM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	40
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.70		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Basic	US 33 EB - James Rd On-Ramp	900	2
6	Basic	Basic	US 33 EB - Btwn James Rd & SR 104	600	3
7	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	3
8	Basic	Basic	US 33 EB - Btwn SR 104 & I-270	3640	3
9	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	3
10	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps	770	3
11	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1630	4
12	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	270	3
13	Merge	Basic	US 33 EB - I-270 NB On-Ramp	1500	4
14	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	900	4
15	Diverge	Diverge	US 33 EB - Hamilton Off-Ramp	1500	4
16	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1570	3
17	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1410	3
18	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	3
19	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2290	3
20	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	3
21	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	3
22	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	3
23	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	3
24	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	3
25	Basic	Basic	(dummy) US 33 EB - Btwn Rager	1000	3

			"ramps"		
26	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	3
27	Basic	Basic	US 33 EB - Btwn Rager & Gender	2290	3
28	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	3
29	Basic	Basic	US 33 EB - Btwn Gender Ramps	2390	3
30	Merge	Merge	US 33 EB - Gender On-Ramp	1500	3
31	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1930	3
32	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	3
33	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	3
34	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	3
35	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1920	3
36	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	3
37	Basic	Basic	US 33 EB - Btwn Diley Ramps (3 lanes)	1830	3
38	Basic	Basic	US 33 EB - Btwn Diley Ramps (2 lanes)	2400	2
39	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
40	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2928	4700	0.62	64.9	22.6	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.909	2928	211	4700	2100	0.62	0.10	59.2	59.2	24.7	24.5	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.943	2717	981	4700	2100	0.58	0.47	57.6	57.6	23.6	24.9	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	1736	4700	0.37	63.8	13.4	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	2225	489	4700	2100	0.48	0.23	58.9	58.9	18.9	18.9	C

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2225	7050	0.32	63.2	11.4	B

Segment 7: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	4325	2139	7050	2100	0.62	1.02	58.2	57.0	25.0	25.5	C

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4325	7050	0.62	64.9	22.2	C

Segment 9: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.909	4325	316	7050	2100	0.62	0.15	62.2	59.0	23.2	24.3	C

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4009	7050	0.58	64.6	20.6	C

Segment 11: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	5861	5868	1.03	42.1	34.8	F

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	5379	7050	0.83	60.1	28.6	D

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.926	7206	1827	9400	2100	0.82	0.87	58.3	58.3	30.9	30.9	D

Segment 14: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	7206	9400	0.82	62.7	28.7	D

Segment 15: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.943	7206	1097	9400	2100	0.82	0.52	62.2	57.4	29.0	31.7	D

Segment 16: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

1	0.94	0.935	6012	7050	0.94	59.8	33.5	F

Segment 17: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.962	6214	288	7050	2000	0.98	0.14	41.5	53.0	49.9	32.2	F

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.935	0.952	6712	543	7050	2100	1.06	0.26	44.6	51.2	50.1	36.0	F

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6644	7050	1.04	43.0	51.5	F

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.75	0.952	0.971	6599	82	7050	2000	1.04	0.04	41.6	55.0	52.9	40.6	F

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6483	7050	1.03	39.3	55.0	F

Segment 22: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.877	6538	99	7050	2000	1.05	0.05	39.9	50.0	54.6	37.0	F

Segment 23: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6509	7050	1.05	39.1	55.4	F

Segment 24: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	6465	33	7050	2000	1.05	0.02	38.3	55.1	56.3	40.8	F

Segment 25: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6402	7050	1.04	36.9	57.9	F

Segment 26: Merge

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	6565	163	7050	2000	1.06	0.08	54.6	52.7	40.1	33.5	F

Segment 27: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6565	7050	1.06	56.2	38.9	F

Segment 28: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.952	6565	1755	7050	2100	1.06	0.84	59.2	56.0	37.0	35.7	F

Segment 29: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4810	7050	0.82	64.4	24.9	C

Segment 30: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.980	5952	1142	7050	2100	0.99	0.54	56.5	55.0	35.1	29.4	D

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5952	7050	1.00	60.2	33.0	D

Segment 32: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.99	0.943	0.952	5952	361	7050	2000	1.00	0.18	58.4	54.4	34.0	32.4	D

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5591	7050	0.94	62.0	30.1	D

Segment 34: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.53	0.943	0.952	5690	99	7050	2000	0.96	0.05	57.0	55.8	33.3	28.1	D

Segment 35: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5580	7050	0.95	62.0	30.0	F

Segment 36: Diverge

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	5405	1232	7050	2100	0.95	0.59	35.2	57.1	51.2	38.2	F

Segment 37: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3821	7050	0.78	15.5	82.2	F

Segment 38: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3709	4700	1.16	25.1	73.8	F

Segment 39: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	4376	667	4700	2100	1.31	0.32	53.2	53.2	41.1	32.0	F

Segment 40: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.962	4376	4700	1.28	56.2	38.9	F

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	14693	15996	81.40	2035.05	47.8	38.6	36.6	14.70	F

Facility Overall Results

Space Mean Speed, mi/h	47.8	Average Density, veh/mi/ln	36.6
Average Travel Time, min	14.70	Average Density, pc/mi/ln	38.6
Total VMT, veh-mi/AP	14693	Total VHD, veh-h	81.40
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	2035.05

 HCS™ Freeways Version 2025 Generated: 06/05/2025 12:04:46
Design Year Build PM - US 33 EB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	PM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	33
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.35		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps (2 lanes)	750	2
4	Basic	Basic	US 33 WB - Btwn Diley Ramps (3 lanes)	1230	3
5	Merge	Merge	US 33 WB - Diley On-Ramp	1500	3
6	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1800	3
7	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	3
8	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	3
9	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	3
10	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1800	3
11	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	3
12	Basic	Basic	US 33 WB - Btwn Gender Ramps	1400	3
13	Merge	Merge	US 33 WB - Gender NB On-Ramp	1500	3
14	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	3
15	Basic	Basic	US 33 WB - Btwn Gender & Bixby	7420	3
16	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	3
17	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	3
18	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	3
19	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2420	3
20	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	3
21	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1750	3
22	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4790	4
23	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1570	4

24	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	3
25	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	3
26	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	3
27	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	3
28	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	3
29	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	4
30	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	3
31	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
32	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
33	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3686	4700	0.78	62.2	29.6	D

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.952	3686	466	4700	2000	0.78	0.23	55.7	55.7	33.1	24.1	C

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3243	4700	0.69	63.5	25.2	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3243	7050	0.46	64.7	16.6	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.87	0.935	0.952	4342	1099	7050	2100	0.62	0.52	59.4	58.3	24.4	21.8	C

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4320	7050	0.61	64.6	22.2	C

Segment 7: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.95	0.926	0.971	4320	119	7050	2000	0.61	0.06	59.1	54.9	24.4	25.1	C

Segment 8: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4193	7050	0.59	64.2	21.5	C

Segment 9: Merge														
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)	LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.72	0.926	0.971	4393	200	7050	2000	0.62	0.10	58.7	57.5	24.9	21.6	C

Segment 10: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4354	7050	0.62	64.6	22.3	C

Segment 11: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4354	782	7050	2100	0.62	0.37	61.3	58.0	23.7	25.0	C

Segment 12: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3550	7050	0.50	64.6	18.2	C

Segment 13: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4310	760	7050	2000	0.61	0.38	58.6	57.2	24.5	23.6	C

Segment 14: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	4687	356	7050	2100	0.66	0.17	59.4	58.7	26.3	20.9	C

Segment 15: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4603	7050	0.65	64.7	23.7	C

Segment 16: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.64	0.943	0.980	4603	64	7050	2000	0.65	0.03	59.2	55.0	25.9	26.3	C

Segment 17: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4558	7050	0.65	64.2	23.4	C

Segment 18: Merge														
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.97	0.943	0.980	4758	200	7050	2000	0.67	0.10	58.3	57.2	27.2	23.3	C

Segment 19: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4860	7050	0.69	64.3	25.2	C

Segment 20: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.926	0.909	4860	586	7050	2100	0.69	0.28	61.5	58.4	26.3	27.2	C

Segment 21: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4297	7050	0.61	64.7	22.0	C

Segment 22: Weaving								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	5677	5940	0.96	45.7	31.1	D

Segment 23: Weaving								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3800	5897	0.64	48.5	19.6	B

Segment 24: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2631	7050	0.37	62.7	13.5	B

Segment 25: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.909	2888	257	7050	2100	0.41	0.12	60.1	58.6	16.0	15.6	B

Segment 26: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2856	7050	0.41	64.9	14.6	B

Segment 27: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.952	2856	268	7050	2100	0.41	0.13	62.2	59.1	15.3	16.4	B

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2583	7050	0.37	64.6	13.2	B

Segment 29: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3562	5218	0.68	46.6	19.1	B

Segment 30: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	2844	1010	7050	2100	0.40	0.48	60.2	57.5	15.7	17.8	B

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	1771	4500	0.39	55.0	16.1	B

Segment 32: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.943	0.971	2582	811	4500	2100	0.57	0.39	51.2	51.2	25.2	20.2	C

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2606	4500	0.58	53.7	23.7	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	10087	10087	16.67	416.66	55.2	23.3	21.5	12.30	C

Facility Overall Results

Space Mean Speed, mi/h	55.2	Average Density, veh/mi/ln	21.5
Average Travel Time, min	12.30	Average Density, pc/mi/ln	23.3
Total VMT, veh-mi/AP	10087	Total VHD, veh-h	16.67
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	416.66

 HCS™ Freeways Version 2025 Generated: 06/03/2025 09:37:45

Design Year Build PM - US 33 WB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	AM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	41
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.70		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Basic	US 33 EB - James Rd On-Ramp	900	2
6	Basic	Basic	US 33 EB - Btwn James Rd & SR 104	600	3
7	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	3
8	Basic	Basic	US 33 EB - Btwn SR 104 & I-270 (3-lane)	310	3
9	Basic	Basic	US 33 EB - Btwn SR 104 & I-270 (4-lane)	3330	4
10	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	4
11	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps	770	4
12	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1630	5
13	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	270	4
14	Merge	Basic	US 33 EB - I-270 NB On-Ramp	1500	5
15	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	900	5
16	Diverge	Diverge	US 33 EB - Hamilton Off-Ramp	1500	5
17	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1570	4
18	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1410	4
19	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	4
20	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2290	4
21	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	4
22	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	4
23	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	4

24	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	4
25	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	4
26	Basic	Basic	(dummy) US 33 EB - Btwn Rager "ramps"	1000	4
27	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	4
28	Basic	Basic	US 33 EB - Btwn Rager & Gender	2290	4
29	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	4
30	Basic	Basic	US 33 EB - Btwn Gender Ramps	2390	4
31	Merge	Merge	US 33 EB - Gender On-Ramp	1500	4
32	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1930	4
33	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	4
34	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	4
35	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	4
36	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1920	4
37	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	4
38	Basic	Basic	US 33 EB - Btwn Diley Ramps (3 lanes)	1830	3
39	Basic	Basic	US 33 EB - Btwn Diley Ramps (2 lanes)	2400	2
40	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
41	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2504	4700	0.53	65.0	19.3	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	2504	218	4700	2100	0.53	0.10	59.2	59.2	21.1	20.8	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	2286	760	4700	2100	0.49	0.36	58.1	58.1	19.7	21.2	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1505	4700	0.32	63.8	11.6	B

Segment 5: Merge

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.935	1971	466	4700	2100	0.42	0.22	64.9	65.0	15.2	15.2	B

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1976	7050	0.28	65.0	10.1	A

Segment 7: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.833	2921	945	7050	2100	0.41	0.45	60.4	59.2	16.1	15.6	B

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2931	7050	0.42	63.9	15.0	B

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2931	9400	0.31	64.9	11.3	B

Segment 10: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.943	2931	417	9400	2100	0.31	0.20	64.2	58.8	11.4	12.6	B

Segment 11: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	2490	9400	0.26	64.9	9.6	A

Segment 12: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	4109	5207	0.79	46.6	17.6	B

Segment 13: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3824	9400	0.41	61.1	14.7	B

Segment 14: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.870	4851	1027	11750	2100	0.41	0.49	64.1	65.0	14.9	14.9	B

Segment 15: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	4825	11750	0.41	64.9	14.8	B

Segment 16: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.80	0.893	0.926	4825	1593	11750	2100	0.41	0.76	60.9	56.4	14.3	23.4	C

Segment 17: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.893	3419	9400	0.36	64.7	13.2	B

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.893	0.885	3522	103	9400	2000	0.37	0.05	61.4	59.2	14.3	10.3	B

Segment 19: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.893	0.862	3773	259	9400	2100	0.40	0.12	61.5	59.6	15.3	12.4	B

Segment 20: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3698	9400	0.39	64.8	14.2	B

Segment 21: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.909	0.952	3698	83	9400	2000	0.39	0.04	62.9	55.0	14.7	14.9	B

Segment 22: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3616	9400	0.38	64.7	13.9	B

Segment 23: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.909	3698	82	9400	2000	0.39	0.04	61.0	58.5	15.2	12.4	B

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3698	9400	0.39	64.5	14.2	B

Segment 25: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.94	0.909	0.980	3698	54	9400	2000	0.39	0.03	63.0	55.0	14.7	14.8	B

Segment 26: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3640	9400	0.39	64.7	14.0	B

Segment 27: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.909	0.980	3781	141	9400	2000	0.40	0.07	61.0	58.5	15.5	12.9	B

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	3792	9400	0.40	64.8	14.6	B

Segment 29: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.81	0.909	0.909	3792	1127	9400	2100	0.40	0.54	62.1	57.3	15.3	19.0	B

Segment 30: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.909	2820	9400	0.30	64.9	10.8	A

Segment 31: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.909	0.962	3392	572	9400	2100	0.36	0.27	61.7	59.8	13.7	11.3	B

Segment 32: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3486	9400	0.37	64.8	13.4	B

Segment 33: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.885	0.935	3486	137	9400	2000	0.37	0.07	62.7	54.9	13.9	14.4	B

Segment 34: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3342	9400	0.36	64.7	12.9	B

Segment 35: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.73	0.885	0.935	3386	44	9400	2000	0.36	0.02	61.2	58.5	13.8	11.3	B

Segment 36: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	3378	9400	0.36	64.8	13.0	B

Segment 37: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.885	0.935	3378	764	9400	2100	0.36	0.36	63.2	58.1	13.4	18.8	B

Segment 38: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	2596	7050	0.37	64.9	13.3	B

Segment 39: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.885	2596	4700	0.55	65.0	20.0	C

Segment 40: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.82	0.885	0.943	3191	595	4700	2100	0.68	0.28	58.1	58.1	27.5	22.8	C

Segment 41: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.901	3093	4700	0.66	64.7	23.9	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	8198	8198	5.08	126.95	58.8	14.7	13.2	11.90	B

Facility Overall Results

Space Mean Speed, mi/h	58.8	Average Density, veh/mi/ln	13.2
Average Travel Time, min	11.90	Average Density, pc/mi/ln	14.7
Total VMT, veh-mi/AP	8198	Total VHD, veh-h	5.08
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	126.95

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Design Year Build AM Improved - US 33 EB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	AM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	33
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.35		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps (2 lanes)	750	2
4	Basic	Basic	US 33 WB - Btwn Diley Ramps (3 lanes)	1230	3
5	Merge	Basic	US 33 WB - Diley On-Ramp	1500	4
6	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1800	4
7	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	4
8	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	4
9	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	4
10	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1800	4
11	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	4
12	Basic	Basic	US 33 WB - Btwn Gender Ramps	1400	4
13	Merge	Merge	US 33 WB - Gender NB On-Ramp	1500	4
14	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	4
15	Basic	Basic	US 33 WB - Btwn Gender & Bixby	7420	4
16	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	4
17	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	4
18	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	4
19	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2420	4
20	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	4
21	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1750	4
22	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4790	5
23	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1570	5

24	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	4
25	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	4
26	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	4
27	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	3
28	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	3
29	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	4
30	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	3
31	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
32	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
33	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	4700	4700	1.05	52.2	45.0	F

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.66	0.952	0.943	4700	964	4700	2000	1.05	0.48	54.6	54.6	43.0	32.8	F

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3736	4700	0.91	61.9	30.2	D

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	3736	7050	0.60	64.4	19.2	C

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.926	5065	1329	9400	2100	0.59	0.63	60.4	60.4	21.0	21.0	C

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	5065	9400	0.61	64.7	19.5	C

Segment 7: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.917	0.962	5065	80	9400	2000	0.61	0.04	62.3	55.0	20.3	20.0	B

Segment 8: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.917	4985	9400	0.60	64.6	19.2	C

Segment 9: Merge														
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)	LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.77	0.917	0.962	5120	135	9400	2000	0.61	0.07	60.0	58.1	21.3	17.1	B

Segment 10: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	5120	9400	0.61	64.7	19.7	C

Segment 11: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	5120	726	9400	2100	0.61	0.35	63.5	58.1	20.2	22.1	C

Segment 12: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4394	9400	0.53	64.9	16.9	B

Segment 13: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	5666	1272	9400	2000	0.66	0.64	59.2	56.9	23.9	24.6	C

Segment 14: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	6392	726	9400	2100	0.74	0.35	59.7	58.7	26.8	20.6	C

Segment 15: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6392	9400	0.73	64.4	24.8	C

Segment 16: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.68	0.952	0.980	6392	30	9400	2000	0.73	0.02	61.8	55.1	25.9	24.8	C

Segment 17: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6362	9400	0.72	64.5	24.7	C

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.952	0.980	6534	172	9400	2000	0.74	0.09	58.9	57.5	27.7	21.6	C

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6534	9400	0.75	64.2	25.4	C

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.89	0.943	0.935	6534	613	9400	2100	0.75	0.29	63.2	58.4	25.8	27.1	C

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5732	9400	0.69	64.9	22.0	F

Segment 22: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6385	6857	1.17	47.9	26.7	F

Segment 23: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3978	7619	0.74	50.3	15.8	B

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2502	9400	0.44	62.9	9.6	A

Segment 25: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.943	0.917	2873	371	9400	2100	0.48	0.18	61.5	58.8	11.7	12.0	B

Segment 26: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2873	9400	0.49	64.9	11.1	B

Segment 27: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.935	2873	148	7050	2100	0.65	0.07	62.5	59.3	15.3	9.4	A

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2725	7050	0.63	64.7	14.0	B

Segment 29: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3441	6030	0.86	47.3	18.2	B

Segment 30: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	2107	1270	7050	2100	0.53	0.60	58.6	57.0	12.0	14.5	B

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	837	4500	0.54	55.0	7.6	A

Segment 32: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.962	1733	896	4500	2100	0.74	0.43	51.6	51.6	16.8	13.5	B

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	1733	4500	0.75	53.8	15.8	B

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	13683	14466	22.90	572.51	58.5	22.6	21.2	11.60	F

Facility Overall Results

Space Mean Speed, mi/h	58.5	Average Density, veh/mi/ln	21.2
Average Travel Time, min	11.60	Average Density, pc/mi/ln	22.6
Total VMT, veh-mi/AP	13683	Total VHD, veh-h	22.90
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	572.51

 HCS™ Freeways Version 2025 Generated: 06/03/2025 10:40:41
Design Year Build AM Improved - US 33 WB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	PM Peak
Facility Name	US 33 EB	Units	U.S. Customary
Project Description	FRA-33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	41
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.70		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 EB - west of SR 104 (nominal length)	500	2
2	Diverge	Diverge	US 33 EB - SR 104 Off-Ramp	575	2
3	Diverge	Diverge	US 33 EB - Winchester Off-Ramp	300	2
4	Basic	Basic	US 33 EB - Btwn Winchester & James Rd Ramps	1900	2
5	Merge	Basic	US 33 EB - James Rd On-Ramp	900	2
6	Basic	Basic	US 33 EB - Btwn James Rd & SR 104	600	3
7	Merge	Merge	US 33 EB - SR 104 On-Ramp	1500	3
8	Basic	Basic	US 33 EB - Btwn SR 104 & I-270 (3-lane)	310	3
9	Basic	Basic	US 33 EB - Btwn SR 104 & I-270 (4-lane)	3330	4
10	Diverge	Diverge	US 33 EB - I-270 SB Off-Ramp	1500	4
11	Basic	Basic	US 33 EB - Btwn I-270 SB Ramps	770	4
12	Weaving	Weaving	US 33 EB - Btwn I-270 SB & NB Loops	1630	5
13	Basic	Basic	US 33 EB - Btwn I-270 NB Ramps	270	4
14	Merge	Basic	US 33 EB - I-270 NB On-Ramp	1500	5
15	Basic	Basic	US 33 EB - Btwn I-270 & Hamilton	900	5
16	Diverge	Basic	US 33 EB - Hamilton Off-Ramp	1500	5
17	Basic	Basic	US 33 EB - Btwn Hamilton Ramps	1570	4
18	Merge	Merge	US 33 EB - Hamilton SB On-Ramp	1410	4
19	Merge	Merge	US 33 EB - Hamilton NB On-Ramp	1500	4
20	Basic	Basic	US 33 EB - Btwn Hamilton & Bixby	2290	4
21	Diverge	Diverge	(dummy) US 33 EB - Bixby "off-ramp"	1500	4
22	Basic	Basic	(dummy) US 33 EB - Btwn Bixby "ramps"	1000	4
23	Merge	Merge	(dummy) US 33 EB - Bixby "on-ramp"	1500	4

24	Basic	Basic	(dummy) US 33 EB - Btwn Bixby & Rager	1000	4
25	Diverge	Diverge	(dummy) US 33 EB - Rager "off-ramp"	1500	4
26	Basic	Basic	(dummy) US 33 EB - Btwn Rager "ramps"	1000	4
27	Merge	Merge	(dummy) US 33 EB - Rager "on-ramp"	1500	4
28	Basic	Basic	US 33 EB - Btwn Rager & Gender	2290	4
29	Diverge	Diverge	US 33 EB - Gender Off-Ramp	1500	4
30	Basic	Basic	US 33 EB - Btwn Gender Ramps	2390	4
31	Merge	Merge	US 33 EB - Gender On-Ramp	1500	4
32	Basic	Basic	US 33 EB - Btwn Gender & High/ Bowen	1930	4
33	Diverge	Diverge	(dummy) US 33 EB - High/Bowen "off-ramp"	1500	4
34	Basic	Basic	(dummy) US 33 EB - Btwn High/Bowen "ramps"	1000	4
35	Merge	Merge	(dummy) US 33 EB - High/Bowen "on-ramp"	1500	4
36	Basic	Basic	US 33 EB - Btwn High/Bowen & Diley	1920	4
37	Diverge	Diverge	US 33 EB - Diley Off-Ramp	1500	4
38	Basic	Basic	US 33 EB - Btwn Diley Ramps (3 lanes)	1830	3
39	Basic	Basic	US 33 EB - Btwn Diley Ramps (2 lanes)	2400	2
40	Merge	Merge	US 33 EB - Diley On-Ramp	1500	2
41	Basic	Basic	US 33 EB - east of Diley	5280	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2928	4700	0.62	64.9	22.6	C

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.909	2928	211	4700	2100	0.62	0.10	59.2	59.2	24.7	24.5	C

Segment 3: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.943	2717	981	4700	2100	0.58	0.47	57.6	57.6	23.6	24.9	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	1736	4700	0.37	63.8	13.4	B

Segment 5: Merge

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS

	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	2225	489	4700	2100	0.48	0.23	58.9	58.9	18.9	18.9	C

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	2225	7050	0.32	63.2	11.4	B

Segment 7: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.935	4325	2139	7050	2100	0.62	1.02	58.2	57.0	25.0	25.5	C

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	1.000	4325	7050	0.58	63.4	22.2	C

Segment 9: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4325	9400	0.47	64.9	16.6	B

Segment 10: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.909	4325	316	9400	2100	0.47	0.15	64.6	59.0	16.7	17.3	B

Segment 11: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	4009	9400	0.43	64.9	15.4	B

Segment 12: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	5861	5868	1.03	43.0	27.3	F

Segment 13: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	5379	9400	0.63	60.3	20.7	C

Segment 14: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.926	7206	1827	11750	2100	0.66	0.87	59.8	59.8	20.1	20.1	C

Segment 15: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	7206	11750	0.65	64.3	22.2	C

Segment 16: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.943	7206	1097	11750	2100	0.65	0.52	62.6	62.6	18.4	18.4	C

Segment 17: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	6109	9400	0.71	64.8	23.6	C

Segment 18: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.962	6397	288	9400	2000	0.74	0.14	59.3	58.2	27.0	20.1	C

Segment 19: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.935	0.952	6940	543	9400	2100	0.80	0.26	59.1	58.1	29.4	22.8	C

Segment 20: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6940	9400	0.78	63.4	27.4	D

Segment 21: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.75	0.952	0.971	6940	82	9400	2000	0.78	0.04	61.4	55.0	28.3	27.1	C

Segment 22: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6858	9400	0.77	63.6	27.0	D

Segment 23: Merge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.877	6957	99	9400	2000	0.79	0.05	58.6	57.4	29.7	22.7	C

Segment 24: Basic								
AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6957	9400	0.78	63.4	27.4	D

Segment 25: Diverge															
AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.94	0.952	0.980	6957	33	9400	2000	0.78	0.02	61.5	55.1	28.3	26.9	C

Segment 26: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	6924	9400	0.78	63.4	27.3	D

Segment 27: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.952	0.980	7087	163	9400	2000	0.80	0.08	58.4	57.2	30.3	23.3	C

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	7087	9400	0.80	63.0	28.1	D

Segment 29: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.91	0.952	0.952	7087	1755	9400	2100	0.80	0.84	61.0	56.0	29.0	34.4	D

Segment 30: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.952	5332	9400	0.62	64.8	20.5	C

Segment 31: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.952	0.980	6474	1142	9400	2100	0.74	0.54	59.4	58.0	27.2	23.1	C

Segment 32: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6474	9400	0.75	64.3	25.2	C

Segment 33: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.99	0.943	0.952	6474	361	9400	2000	0.75	0.18	61.1	54.4	26.5	26.7	C

Segment 34: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	6113	9400	0.71	64.5	23.6	C

Segment 35: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	

1	0.94	0.53	0.943	0.952	6212	99	9400	2000	0.72	0.05	59.2	57.8	26.2	20.3	C

Segment 36: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	5800	9400	0.71	64.6	22.3	F

Segment 37: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	5405	1232	9400	2100	0.71	0.59	19.6	57.1	69.0	33.5	F

Segment 38: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3821	7050	0.78	13.4	95.0	F

Segment 39: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	3709	4700	1.16	25.0	74.1	F

Segment 40: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.943	0.962	4376	667	4700	2100	1.31	0.32	53.2	53.2	41.1	32.0	F

Segment 41: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.962	4376	4700	1.28	56.2	38.9	F

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	15279	15996	57.26	1431.54	52.3	29.1	27.5	13.40	F

Facility Overall Results

Space Mean Speed, mi/h	52.3	Average Density, veh/mi/ln	27.5
Average Travel Time, min	13.40	Average Density, pc/mi/ln	29.1
Total VMT, veh-mi/AP	15279	Total VHD, veh-h	57.26
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	1431.54

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Design Year Build PM Improved - US 33 EB.xuf

HCS Freeway Facilities Report

Project Information

Analyst	LJB (KLR)	Date	6/21/2024
Agency	LJB Inc	Analysis Year	Design Year Build
Jurisdiction	FRA-FAI (ODOT D6/D5)	Time Analyzed	PM Peak
Facility Name	US 33 WB	Units	U.S. Customary
Project Description	US 33 Widening		

Facility Global Input

Jam Density, pc/mi/ln	190.0	Density at Capacity, pc/mi/ln	45
Queue Discharge Capacity Drop, %	7	Total Segments	33
Total Analysis Periods	1	Analysis Period Duration, min	15
Facility Length, mi	11.35		

Facility Segment Data

No.	Coded	Analyzed	Name	Length, ft	Lanes
1	Basic	Basic	US 33 WB - east of Diley	5280	2
2	Diverge	Diverge	US 33 WB - Diley Off-Ramp	1500	2
3	Basic	Basic	US 33 WB - Btwn Diley Ramps (2 lanes)	750	2
4	Basic	Basic	US 33 WB - Btwn Diley Ramps (3 lanes)	1230	3
5	Merge	Basic	US 33 WB - Diley On-Ramp	1500	4
6	Basic	Basic	US 33 WB - Btwn Diley & High/Bowen	1800	4
7	Diverge	Diverge	(dummy) US 33 WB - High/Bowen "off-ramp"	1500	4
8	Basic	Basic	(dummy) US 33 WB - Btwn High/ Bowen "ramps"	1000	4
9	Merge	Merge	(dummy) US 33 WB - High/Bowen "on-ramp"	1500	4
10	Basic	Basic	US 33 WB - Btwn High/Bowen & Gender	1800	4
11	Diverge	Diverge	US 33 WB - Gender Off-Ramp	1500	4
12	Basic	Basic	US 33 WB - Btwn Gender Ramps	1400	4
13	Merge	Merge	US 33 WB - Gender NB On-Ramp	1500	4
14	Merge	Merge	US 33 WB - Gender SB On-Ramp	1500	4
15	Basic	Basic	US 33 WB - Btwn Gender & Bixby	7420	4
16	Diverge	Diverge	(dummy) US 33 WB - Bixby "off-ramp"	1500	4
17	Basic	Basic	(dummy) US 33 WB - Btwn Bixby "ramps"	1000	4
18	Merge	Merge	(dummy) US 33 WB - Bixby "on-ramp"	1500	4
19	Basic	Basic	US 33 WB - Btwn Bixby & Hamilton	2420	4
20	Diverge	Diverge	US 33 WB - Hamilton Off-Ramp	1500	4
21	Basic	Basic	US 33 WB - Btwn Hamilton Ramps	1750	4
22	Weaving	Weaving	US 33 WB - Btwn Hamilton & I-270 NB Off-Ramp	4790	5
23	Weaving	Weaving	US 33 WB - Btwn I-270 NB & SB Ramps	1570	5

24	Basic	Basic	US 33 WB - Btwn I-270 SB Ramps	860	4
25	Merge	Merge	US 33 WB - I-270 SB On-Ramp	1500	4
26	Basic	Basic	US 33 WB - Btwn I-270 SB Ramp & SR 104	2930	4
27	Diverge	Diverge	US 33 WB - SR 104 EB Off-Ramp	1500	3
28	Basic	Basic	US 33 WB - Btwn SR 104 Ramps	940	3
29	Weaving	Weaving	US 33 WB - Btwn SR 104 EB & WB Loop Ramps	1410	4
30	Diverge	Diverge	US 33 WB - James Rd Off-Ramp	750	3
31	Basic	Basic	US 33 WB - Btwn James Rd & Winchester Ramps	1510	2
32	Merge	Merge	US 33 WB - Winchester On-Ramp	820	2
33	Basic	Basic	US 33 WB - west of Winchester (nominal length)	500	2

Facility Segment Data

Segment 1: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3686	4700	0.78	62.2	29.6	D

Segment 2: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.88	0.935	0.952	3686	466	4700	2000	0.78	0.23	55.7	55.7	33.1	24.1	C

Segment 3: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3243	4700	0.69	63.5	25.2	C

Segment 4: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3243	7050	0.46	64.7	16.6	B

Segment 5: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.87	0.935	0.952	4342	1099	9400	2100	0.46	0.52	65.0	65.0	16.7	16.7	B

Segment 6: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4320	9400	0.46	65.0	16.6	B

Segment 7: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.95	0.926	0.971	4320	119	9400	2000	0.46	0.06	62.5	54.9	17.3	17.4	B

Segment 8: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4193	9400	0.45	64.7	16.1	B

Segment 9: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.72	0.926	0.971	4393	200	9400	2000	0.47	0.10	60.5	58.3	18.2	15.1	B

Segment 10: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4354	9400	0.46	64.7	16.7	B

Segment 11: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4354	782	9400	2100	0.46	0.37	63.5	58.0	17.1	19.5	B

Segment 12: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3550	9400	0.38	64.9	13.7	B

Segment 13: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.952	4310	760	9400	2000	0.46	0.38	60.4	58.0	17.8	18.3	B

Segment 14: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.926	4687	356	9400	2100	0.50	0.17	61.1	59.8	19.2	13.7	B

Segment 15: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4603	9400	0.49	65.0	17.7	B

Segment 16: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.64	0.943	0.980	4603	64	9400	2000	0.49	0.03	62.5	55.0	18.4	18.2	B

Segment 17: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	4558	9400	0.48	64.7	17.5	B

Segment 18: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.97	0.943	0.980	4758	200	9400	2000	0.51	0.10	60.3	58.2	19.7	16.2	B

Segment 19: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4860	9400	0.52	64.8	18.7	C

Segment 20: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.92	0.926	0.909	4860	586	9400	2100	0.52	0.28	63.8	58.4	19.0	20.7	C

Segment 21: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	4297	9400	0.46	64.9	16.5	B

Segment 22: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	5677	5940	0.96	46.4	24.5	C

Segment 23: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	3800	5897	0.64	48.7	15.6	B

Segment 24: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.926	2631	9400	0.28	62.7	10.1	A

Segment 25: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.926	0.909	2888	257	9400	2100	0.31	0.12	61.5	58.8	11.7	11.6	B

Segment 26: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2856	9400	0.30	64.9	11.0	A

Segment 27: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.952	2856	268	7050	2100	0.41	0.13	62.2	59.1	15.3	9.5	A

Segment 28: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	2583	7050	0.37	64.6	13.2	B

Segment 29: Weaving

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.935	3562	5218	0.68	46.6	19.1	B

Segment 30: Diverge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.935	0.980	2844	1010	7050	2100	0.40	0.48	60.2	57.5	15.7	17.8	B

Segment 31: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	1771	4500	0.39	55.0	16.1	B

Segment 32: Merge

AP	PHF		fHV		Volume Served (pc/h)		Capacity (pc/h)		d/c Ratio		Speed (mi/h)		Density (pc/mi/ln)		LOS
	F	R	F	R	Freeway	Ramp	Freeway	Ramp	F	R	F	R Infl.	F	R Infl.	
1	0.94	0.94	0.943	0.971	2582	811	4500	2100	0.57	0.39	51.2	51.2	25.2	20.2	C

Segment 33: Basic

AP	PHF	fHV	Volume Served (pc/h)	Capacity (pc/h)	d/c Ratio	Speed (mi/h)	Density (pc/mi/ln)	LOS
1	0.94	0.943	2606	4500	0.58	53.7	23.7	C

Facility Analysis Results

AP	VMT veh-mi/AP	VMT-Demand veh-mi/AP	VHD veh-h/AP	Total Delay Cost $/AP	Speed mi/h	Density pc/mi/ln	Density veh/mi/ln	TT min	LOS
1	10087	10087	13.98	349.46	56.1	18.4	17.0	12.10	C

Facility Overall Results

Space Mean Speed, mi/h	56.1	Average Density, veh/mi/ln	17.0
Average Travel Time, min	12.10	Average Density, pc/mi/ln	18.4
Total VMT, veh-mi/AP	10087	Total VHD, veh-h	13.98
Vehicle Value of Time (VOT), $/h	25.00	Total Delay Cost, $	349.46

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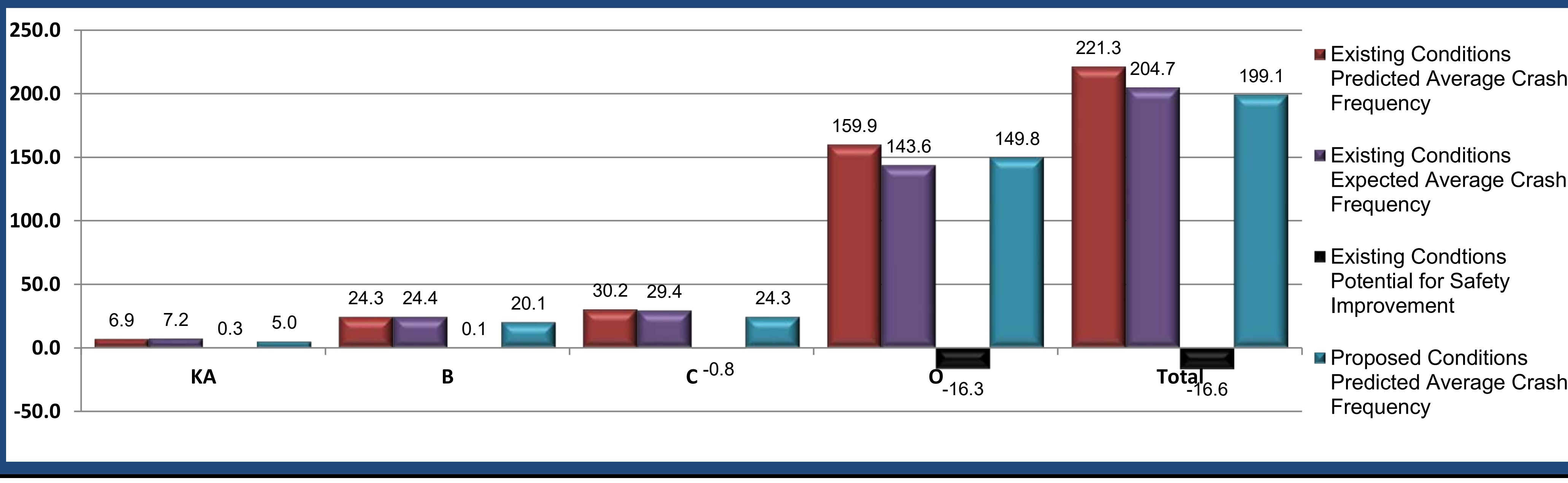
APPENDIX E:
Safety Analysis

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Summary of Anticipated Safety Performance of the Project (average crashes/year)



Project Summary Results (Without Animal Crashes)

	KA	B	C	O	Total
$N_{predicted}$ - Existing Conditions	6.8944	24.3151	30.2147	159.8658	221.2900
$N_{expected}$ - Existing Conditions	7.2187	24.4453	29.4305	143.5634	204.6579
$N_{potential\ for\ improvement}$ - Existing Conditions	0.3243	0.1302	-0.7842	-16.3024	-16.6321
$N_{expected}$ - Proposed Conditions	4.9741	20.0962	24.2733	149.7574	199.1010

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Existing Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US33; 0-0.65	US 33 EB (FRA/FAI County Line to Hill/Diley E	0.1061	0.4796	0.5565	4.1251	5.2673
US33; 0.65-0.91	US 33 EB (Hill/Diley Exit Ramp to Project End	0.0318	0.1307	0.196	1.224	1.5825
US33; 31.01-31.145	US 33 EB (E of US 33/High-Bowen Intersectio	0.0208	0.0912	0.1089	0.7648	0.9857
US33N; 0-0.46	US 33 WB (FRA/FAI County Line to W of Hill/D	0.0839	0.3991	0.4747	3.113	4.0707
US33N; 0.46-0.91	US 33 WB (Between Hill/Diley Ramps (Project	0.1702	0.7365	0.9274	3.3378	5.1719
US33; 22.95-23.31	US 33 EB (Project start to E of SR104 NB ram	0.2448	0.9782	1.2878	3.3609	5.8717
US33; 23.31-24.39	US 33 EB (SR104 entrance to I-270 SB exit)	0.2395	0.8233	1.0056	5.5948	7.6632
US33; 24.39-24.48	US 33 EB (I-270 SB off-ramp to Watkins Rd B	0.0165	0.0696	0.0954	0.54	0.7215
US33; 24.48-24.62	US 33 EB (Watkins Rd Bridge to I-270 SB on-	0.0276	0.0987	0.1313	0.7441	1.0017
US33; 24.62-24.75	US 33 EB (Between I-270 Ramps-Weave)	0.1419	0.4352	0.5688	2.227	3.3729
US33; 24.75-25.06	US 33 EB (E of I-270 loop ramps)	0.1986	0.7494	1.1316	4.5172	6.5968
US33; 25.06-25.22	US 33 EB (E of I-270 loop ramps)	0.0417	0.1969	0.2478	1.4408	1.9272
US33; 25.22-25.65	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.1622	0.6152	0.819	4.4067	6.0031
US33; 25.65-25.91	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.0969	0.3485	0.4751	2.5378	3.4583
US33; 25.91-26.2	US 33 EB (E of SB Hamilton Entrance Ramp t	0.1709	0.7751	0.9686	2.7418	4.6564
US33; 26.2-27.06	US 33 EB (NB Hamilton Entrance Ramp to W	0.3295	1.2892	1.616	7.1644	10.3991
US33; 27.06-27.17	US 33 EB (W of Ebright Rd)	0.0357	0.1037	0.124	0.7131	0.9765
US33; 27.17-27.7	US 33 EB (W of US 33/Bixby Rd Intersection)	0.1644	0.495	0.6456	3.5103	4.8153
US33; 27.96-28.54	US 33 EB (E of US 33/Bixby Rd Intersection)	0.186	0.5626	0.7112	3.9718	5.4316
US33; 28.72-29.37	US 33 EB (E of US 33/Rager Rd Intersection)	0.211	0.6843	0.95	4.9869	6.8322
US33; 29.37-29.96	US 33 EB (W of Gender off-ramp to E of Gene	0.1629	0.6611	0.9125	3.6159	5.3524
US33; 29.96-30.79	US 33 EB (W of US 33/High-Bowen Intersectio	0.2364	0.865	1.0496	4.9085	7.0595
US33N; 22.71-22.88	US 33 WB (W of SR 104 SB off-ramp)	0.0152	0.085	0.1181	0.7487	0.967
US33N; 22.88-23.24	US 33 WB (SR 104 NB off-ramp to SR 104 SE	0.119	0.4985	0.658	2.7218	3.9973
US33N; 23.24-24.26	US 33 WB (I-270 SB on-ramp to SR 104 off-ra	0.2837	0.9984	1.3243	7.4319	10.0383
US33N; 24.26-24.62	US 33 WB (I-270 SB off-ramp to W of I-270 SE	0.1206	0.5307	0.6965	2.6281	3.9759
US33N; 24.62-24.9	US 33 WB (I-270 NB off-ramp to I-270 SB off-	0.2301	0.7259	0.6725	2.8582	4.4867
US33N; 24.9-25.63	US 33 WB (SB Hamilton Entrance Ramp to I-2	0.5832	2.1737	2.2745	27.4838	32.5152
US33N; 25.63-26.02	US 33 WB (Hamilton NB off-ramp to SB Hamil	0.2401	0.889	1.2268	4.5285	6.8844
US33N; 26.02-27.7	US 33 WB (US 33/Bixby Rd Intersection to Ha	0.5869	1.8684	2.4441	13.1693	18.0687
US33N; 27.96-28.54	US 33 WB (Rager Rd to Bixby Rd)	0.223	0.6224	0.8315	4.2766	5.9535
US33N; 28.72-29.3	US 33 WB (Gender SB on-ramp to E of US 33	0.2607	1.0297	1.3853	4.9414	7.6171
US33N; 29.3-29.39	US 33 WB (E of Gender SB on-ramp)	0.0958	0.4179	0.5532	1.0693	2.1362
US33N; 29.39-29.79	US 33 WB (Between Gender Ramps)	0.1857	0.7362	1.009	3.5149	5.4458
US33N; 29.79-30.2	US 33 WB (E of Gender off-ramp)	0.1191	0.4054	0.5194	2.9847	4.0286
US33N; 30.2-30.24	US 33 WB (E of Cemetery Rd)	0.0129	0.0344	0.0415	0.2465	0.3353
US33N; 30.24-30.79	US 33 WB (W of US 33/High/Bowen Intersecti	0.1724	0.4815	0.6561	3.2683	4.5783
US33N; 31.01-31.156	US 33 WB (E of US 33/High/Bowen Intersectio	0.0256	0.1192	0.1447	0.9139	1.2034
US33; 27.83	US 33/Bixby Rd Intersection	0.1617	0.3319	0.1959	2.4037	3.0932
US33; 28.63	US 33/Rager Rd Intersection	0.1114	0.2287	0.1352	1.7107	2.186
US33; 30.9	US 33/High-Bowen Intersection	0.268	0.5501	0.3247	3.4188	4.5616

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Existing Conditions Project Element Expected Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US33; 0-0.65	US 33 EB (FRA/FAI County Line to Hill/Diley E	0.106	0.476	0.5517	3.6107	4.7444
US33; 0.65-0.91	US 33 EB (Hill/Diley Exit Ramp to Project End	0.0318	0.1291	0.1924	1.1198	1.4731
US33; 31.01-31.145	US 33 EB (E of US 33/High-Bowen Intersectio	0.0207	0.0905	0.1078	0.7022	0.9212
US33N; 0-0.46	US 33 WB (FRA/FAI County Line to W of Hill/[	0.0837	0.3955	0.4696	2.7349	3.6837
US33N; 0.46-0.91	US 33 WB (Between Hill/Diley Ramps (Project	0.1669	0.6821	0.8457	2.7248	4.4195
US33; 22.95-23.31	US 33 EB (Project start to E of SR104 NB ram	0.2372	0.8718	1.1099	2.5209	4.7398
US33; 23.31-24.39	US 33 EB (SR104 entrance to I-270 SB exit)	0.239	0.8199	0.9959	5.1538	7.2086
US33; 24.39-24.48	US 33 EB (I-270 SB off-ramp to Watkins Rd B	0.0164	0.076	0.0992	0.5226	0.7142
US33; 24.48-24.62	US 33 EB (Watkins Rd Bridge to I-270 SB on-	0.0275	0.1048	0.1299	0.7737	1.0359
US33; 24.62-24.75	US 33 EB (Between I-270 Ramps-Weave)	0.1402	0.4211	0.5415	1.9191	3.0219
US33; 24.75-25.06	US 33 EB (E of I-270 loop ramps)	0.1953	0.7108	1.0374	3.5194	5.4629
US33; 25.06-25.22	US 33 EB (E of I-270 loop ramps)	0.0416	0.1941	0.2433	1.2519	1.7309
US33; 25.22-25.65	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.1615	0.6049	0.8009	3.7094	5.2767
US33; 25.65-25.91	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.0965	0.3435	0.4658	2.2022	3.108
US33; 25.91-26.2	US 33 EB (E of SB Hamilton Entrance Ramp t	0.167	0.7039	0.8561	2.1105	3.8375
US33; 26.2-27.06	US 33 EB (NB Hamilton Entrance Ramp to W	0.3261	1.2213	1.5151	6.1232	9.1857
US33; 27.06-27.17	US 33 EB (W of Ebright Rd)	0.0355	0.1025	0.1223	0.6867	0.947
US33; 27.17-27.7	US 33 EB (W of US 33/Bixby Rd Intersection)	0.1646	0.4936	0.6377	3.213	4.5089
US33; 27.96-28.54	US 33 EB (E of US 33/Bixby Rd Intersection)	0.1854	0.557	0.7023	3.509	4.9537
US33; 28.72-29.37	US 33 EB (E of US 33/Rager Rd Intersection)	0.2101	0.6743	0.9441	4.4043	6.2328
US33; 29.37-29.96	US 33 EB (W of Gender off-ramp to E of Gene	0.1617	0.6391	0.8758	3.3198	4.9964
US33; 29.96-30.79	US 33 EB (W of US 33/High-Bowen Intersectio	0.2356	0.852	1.0257	4.3704	6.4837
US33N; 22.71-22.88	US 33 WB (W of SR 104 SB off-ramp)	0.0152	0.0867	0.1172	0.7204	0.9395
US33N; 22.88-23.24	US 33 WB (SR 104 NB off-ramp to SR 104 SE	0.118	0.4895	0.6303	2.4182	3.656
US33N; 23.24-24.26	US 33 WB (I-270 SB on-ramp to SR 104 off-ra	0.2823	0.9869	1.2964	6.4081	8.9737
US33N; 24.26-24.62	US 33 WB (I-270 SB off-ramp to W of I-270 SE	0.1203	0.5093	0.6549	2.2215	3.506
US33N; 24.62-24.9	US 33 WB (I-270 NB off-ramp to I-270 SB off-r	0.2262	0.6937	0.6426	2.4756	4.0381
US33N; 24.9-25.63	US 33 WB (SB Hamilton Entrance Ramp to I-2	0.5781	2.1882	2.1996	15.2423	20.2082
US33N; 25.63-26.02	US 33 WB (Hamilton NB off-ramp to SB Hamil	0.238	0.8544	1.1742	4.0255	6.2921
US33N; 26.02-27.7	US 33 WB (US 33/Bixby Rd Intersection to Ha	0.5848	1.8625	2.4058	11.9287	16.7818
US33N; 27.96-28.54	US 33 WB (Rager Rd to Bixby Rd)	0.2221	0.621	0.8262	3.8477	5.517
US33N; 28.72-29.3	US 33 WB (Gender SB on-ramp to E of US 33	0.258	0.9822	1.3079	4.4724	7.0205
US33N; 29.3-29.39	US 33 WB (E of Gender SB on-ramp)	0.0946	0.3955	0.5148	0.9424	1.9473
US33N; 29.39-29.79	US 33 WB (Between Gender Ramps)	0.1831	0.6924	0.9293	3.1859	4.9907
US33N; 29.79-30.2	US 33 WB (E of Gender off-ramp)	0.1187	0.4033	0.5149	2.6282	3.6651
US33N; 30.2-30.24	US 33 WB (E of Cemetery Rd)	0.0128	0.034	0.041	0.2277	0.3155
US33N; 30.24-30.79	US 33 WB (W of US 33/High/Bowen Intersecti	0.1719	0.4772	0.6481	2.9447	4.2419
US33N; 31.01-31.156	US 33 WB (E of US 33/High/Bowen Intersectio	0.0255	0.118	0.1431	0.8298	1.1164
US33; 27.83	US 33/Bixby Rd Intersection	0.4478	0.9196	0.543	9.8901	11.8005
US33; 28.63	US 33/Rager Rd Intersection	0.2657	0.5459	0.3225	5.8484	6.9825
US33; 30.9	US 33/High-Bowen Intersection	0.2053	0.4212	0.2486	3.1035	3.9786

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Existing Conditions Project Element Potential for Safety Improvement Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US33; 0-0.65	US 33 EB (FRA/FAI County Line to Hill/Diley E	-0.0001	-0.0036	-0.0048	-0.5144	-0.5229
US33; 0.65-0.91	US 33 EB (Hill/Diley Exit Ramp to Project End	6.93889E-18	-0.0016	-0.0036	-0.1042	-0.1094
US33; 31.01-31.145	US 33 EB (E of US 33/High-Bowen Intersectio	-1E-04	-0.0007	-0.0011	-0.0626	-0.0645
US33N; 0-0.46	US 33 WB (FRA/FAI County Line to W of Hill/D	-0.0002	-0.0036	-0.0051	-0.3781	-0.387
US33N; 0.46-0.91	US 33 WB (Between Hill/Diley Ramps (Project	-0.0033	-0.0544	-0.0817	-0.613	-0.7524
US33; 22.95-23.31	US 33 EB (Project start to E of SR104 NB ram	-0.0076	-0.1064	-0.1779	-0.84	-1.1319
US33; 23.31-24.39	US 33 EB (SR104 entrance to I-270 SB exit)	-0.0005	-0.0034	-0.0097	-0.441	-0.4546
US33; 24.39-24.48	US 33 EB (I-270 SB off-ramp to Watkins Rd B	-1E-04	0.0064	0.0038	-0.0174	-0.0073
US33; 24.48-24.62	US 33 EB (Watkins Rd Bridge to I-270 SB on-r	-1E-04	0.0061	-0.0014	0.0296	0.0342
US33; 24.62-24.75	US 33 EB (Between I-270 Ramps-Weave)	-0.0017	-0.0141	-0.0273	-0.3079	-0.351
US33; 24.75-25.06	US 33 EB (E of I-270 loop ramps)	-0.0033	-0.0386	-0.0942	-0.9978	-1.1339
US33; 25.06-25.22	US 33 EB (E of I-270 loop ramps)	-0.0001	-0.0028	-0.0045	-0.1889	-0.1963
US33; 25.22-25.65	US 33 EB (W of Hamilton Exit Ramp to SB Ha	-0.0007	-0.0103	-0.0181	-0.6973	-0.7264
US33; 25.65-25.91	US 33 EB (W of Hamilton Exit Ramp to SB Ha	-0.0004	-0.005	-0.0093	-0.3356	-0.3503
US33; 25.91-26.2	US 33 EB (E of SB Hamilton Entrance Ramp t	-0.0039	-0.0712	-0.1125	-0.6313	-0.8189
US33; 26.2-27.06	US 33 EB (NB Hamilton Entrance Ramp to W	-0.0034	-0.0679	-0.1009	-1.0412	-1.2134
US33; 27.06-27.17	US 33 EB (W of Ebright Rd)	-0.0002	-0.0012	-0.0017	-0.0264	-0.0295
US33; 27.17-27.7	US 33 EB (W of US 33/Bixby Rd Intersection)	0.0002	-0.0014	-0.0079	-0.2973	-0.3064
US33; 27.96-28.54	US 33 EB (E of US 33/Bixby Rd Intersection)	-0.0006	-0.0056	-0.0089	-0.4628	-0.4779
US33; 28.72-29.37	US 33 EB (E of US 33/Rager Rd Intersection)	-0.0009	-0.01	-0.0059	-0.5826	-0.5994
US33; 29.37-29.96	US 33 EB (W of Gender off-ramp to E of Gene	-0.0012	-0.022	-0.0367	-0.2961	-0.356
US33; 29.96-30.79	US 33 EB (W of US 33/High-Bowen Intersectio	-0.0008	-0.013	-0.0239	-0.5381	-0.5758
US33N; 22.71-22.88	US 33 WB (W of SR 104 SB off-ramp)	0	0.0017	-0.0009	-0.0283	-0.0275
US33N; 22.88-23.24	US 33 WB (SR 104 NB off-ramp to SR 104 SE	-0.001	-0.009	-0.0277	-0.3036	-0.3413
US33N; 23.24-24.26	US 33 WB (I-270 SB on-ramp to SR 104 off-ra	-0.0014	-0.0115	-0.0279	-1.0238	-1.0646
US33N; 24.26-24.62	US 33 WB (I-270 SB off-ramp to W of I-270 SE	-0.0003	-0.0214	-0.0416	-0.4066	-0.4699
US33N; 24.62-24.9	US 33 WB (I-270 NB off-ramp to I-270 SB off-r	-0.0039	-0.0322	-0.0299	-0.3826	-0.4486
US33N; 24.9-25.63	US 33 WB (SB Hamilton Entrance Ramp to I-2	-0.0051	0.0145	-0.0749	-12.2415	-12.307
US33N; 25.63-26.02	US 33 WB (Hamilton NB off-ramp to SB Hamil	-0.0021	-0.0346	-0.0526	-0.503	-0.5923
US33N; 26.02-27.7	US 33 WB (US 33/Bixby Rd Intersection to Ha	-0.0021	-0.0059	-0.0383	-1.2406	-1.2869
US33N; 27.96-28.54	US 33 WB (Rager Rd to Bixby Rd)	-0.0009	-0.0014	-0.0053	-0.4289	-0.4365
US33N; 28.72-29.3	US 33 WB (Gender SB on-ramp to E of US 33	-0.0027	-0.0475	-0.0774	-0.469	-0.5966
US33N; 29.3-29.39	US 33 WB (E of Gender SB on-ramp)	-0.0012	-0.0224	-0.0384	-0.1269	-0.1889
US33N; 29.39-29.79	US 33 WB (Between Gender Ramps)	-0.0026	-0.0438	-0.0797	-0.329	-0.4551
US33N; 29.79-30.2	US 33 WB (E of Gender off-ramp)	-0.0004	-0.0021	-0.0045	-0.3565	-0.3635
US33N; 30.2-30.24	US 33 WB (E of Cemetery Rd)	-1E-04	-0.0004	-0.0005	-0.0188	-0.0198
US33N; 30.24-30.79	US 33 WB (W of US 33/High/Bowen Intersecti	-0.0005	-0.0043	-0.008	-0.3236	-0.3364
US33N; 31.01-31.156	US 33 WB (E of US 33/High/Bowen Intersectio	-0.0001	-0.0012	-0.0016	-0.0841	-0.087
US33; 27.83	US 33/Bixby Rd Intersection	0.2861	0.5877	0.3471	7.4864	8.7073
US33; 28.63	US 33/Rager Rd Intersection	0.1543	0.3172	0.1873	4.1377	4.7965
US33; 30.9	US 33/High-Bowen Intersection	-0.0627	-0.1289	-0.0761	-0.3153	-0.583

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Proposed Conditions Project Element Predicted Crash Summary (Without Animal Crashes)

Project Element ID	Common Name	Crash Severity Level				
		KA	B	C	O	Total
US33; 0-0.65	US 33 EB (FRA/FAI County Line to Hill/Diley E	0.1127	0.4859	0.5836	3.9429	5.1251
US33; 0.65-0.91	US 33 EB (Hill/Diley Exit Ramp to Project End	0.0347	0.1318	0.1955	1.2782	1.6402
US33; 31.01-31.145	US 33 EB (E of US 33/High-Bowen Intersectio	0.0221	0.0922	0.1143	0.7314	0.96
US33N; 0-0.46	US 33 WB (FRA/FAI County Line to W of Hill/[	0.0839	0.3991	0.4747	3.113	4.0707
US33N; 0.46-0.91	US 33 WB (Between Hill/Diley Ramps (Project	0.1292	0.572	0.716	3.1983	4.6155
US33; 22.95-23.31	US 33 EB (Project start to E of SR104 NB ram	0.1726	0.678	0.8933	3.0367	4.7806
US33; 23.31-24.39	US 33 EB (SR104 entrance to I-270 SB exit)	0.1307	0.668	0.9082	5.032	6.7389
US33; 24.39-24.48	US 33 EB (I-270 SB off-ramp to Watkins Rd B	0.0116	0.0522	0.0678	0.4507	0.5823
US33; 24.48-24.62	US 33 EB (Watkins Rd Bridge to I-270 SB on-	0.0145	0.0788	0.1046	0.6967	0.8946
US33; 24.62-24.75	US 33 EB (Between I-270 Ramps-Weave)	0.1173	0.3469	0.4359	1.9591	2.8592
US33; 24.75-25.06	US 33 EB (E of I-270 loop ramps)	0.1641	0.6248	0.937	4.1821	5.908
US33; 25.06-25.22	US 33 EB (E of I-270 loop ramps)	0.0265	0.168	0.2321	1.3535	1.7801
US33; 25.22-25.65	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.1054	0.5269	0.7242	4.0929	5.4494
US33; 25.65-25.91	US 33 EB (W of Hamilton Exit Ramp to SB Ha	0.0636	0.2992	0.4193	2.3489	3.131
US33; 25.91-26.2	US 33 EB (E of SB Hamilton Entrance Ramp t	0.1168	0.5227	0.611	2.5008	3.7513
US33; 26.2-27.06	US 33 EB (NB Hamilton Entrance Ramp to W	0.2173	0.9906	1.2102	6.6137	9.0318
US33; 27.06-27.17	US 33 EB (W of Ebright Rd)	0.019	0.0839	0.1078	0.6505	0.8612
US33; 27.17-27.7	US 33 EB (W of US 33/Bixby Rd Intersection)	0.0889	0.4125	0.5261	3.2101	4.2376
US33; 27.96-28.54	US 33 EB (E of US 33/Bixby Rd Intersection)	0.1021	0.4683	0.5855	3.6891	4.845
US33; 28.72-29.37	US 33 EB (E of US 33/Rager Rd Intersection)	0.1241	0.5645	0.7101	4.3865	5.7852
US33; 29.37-29.96	US 33 EB (W of Gender off-ramp to E of Gene	0.1102	0.5426	0.6819	3.8579	5.1926
US33; 29.96-30.79	US 33 EB (W of US 33/High-Bowen Intersectio	0.1483	0.636	0.7787	4.4319	5.9949
US33N; 22.71-22.88	US 33 WB (W of SR 104 SB off-ramp)	0.0331	0.1086	0.1546	0.7763	1.0726
US33N; 22.88-23.24	US 33 WB (SR 104 NB off-ramp to SR 104 SE	0.119	0.4984	0.6579	2.7219	3.9972
US33N; 23.24-24.26	US 33 WB (I-270 SB on-ramp to SR 104 off-ra	0.1632	0.8044	1.0059	6.4577	8.4312
US33N; 24.26-24.62	US 33 WB (I-270 SB off-ramp to W of I-270 SE	0.0695	0.2821	0.4116	2.2407	3.0039
US33N; 24.62-24.9	US 33 WB (I-270 NB off-ramp to I-270 SB off-r	0.1645	0.4793	0.4291	2.4353	3.5082
US33N; 24.9-25.63	US 33 WB (SB Hamilton Entrance Ramp to I-2	0.3045	1.7499	1.702	25.3294	29.0858
US33N; 25.63-26.02	US 33 WB (Hamilton NB off-ramp to SB Hamil	0.1382	0.6646	0.843	4.019	5.6648
US33N; 26.02-27.7	US 33 WB (US 33/Bixby Rd Intersection to Ha	0.3327	1.5444	1.9464	11.7962	15.6197
US33N; 27.96-28.54	US 33 WB (Rager Rd to Bixby Rd)	0.1129	0.5043	0.6465	3.8663	5.13
US33N; 28.72-29.3	US 33 WB (Gender SB on-ramp to E of US 33	0.2135	0.8768	1.286	4.9666	7.3429
US33N; 29.3-29.39	US 33 WB (E of Gender SB on-ramp)	0.0478	0.1784	0.2714	0.8521	1.3497
US33N; 29.39-29.79	US 33 WB (Between Gender Ramps)	0.1128	0.4525	0.6657	3.1275	4.3585
US33N; 29.79-30.2	US 33 WB (E of Gender off-ramp)	0.0813	0.3306	0.458	2.5671	3.437
US33N; 30.2-30.24	US 33 WB (E of Cemetery Rd)	0.007	0.0284	0.0367	0.2156	0.2877
US33N; 30.24-30.79	US 33 WB (W of US 33/High/Bowen Intersecti	0.0973	0.3913	0.5042	2.9659	3.9587
US33N; 31.01-31.156	US 33 WB (E of US 33/High/Bowen Intersectio	0.0265	0.1191	0.1541	0.8657	1.1654
US33; 27.83	US 33/Bixby Rd Intersection	0.2949	0.6054	0.3575	3.8605	5.1183
US33; 28.63	US 33/Rager Rd Intersection	0.086	0.2008	0.1745	1.7092	2.1705
US33; 30.9	US 33/High-Bowen Intersection	0.4538	0.932	0.5504	4.2275	6.1637

Project Safety Performance Report

General Information

Project Name	US 33 Widening	Contact Email	tflask@ljbinc.com
Project Description	US 33 Feasibility Study	Contact Phone	216-303-6055
Reference Number	121811	Date Performed	6/2/2025
Analyst	TVF	Analysis Year	2021-2023
Agency/Company	LJB Engineering		

Summary by Crash Type

Crash Type	Existing			Proposed
	Predicted Crash Frequency	Expected Crash Frequency	PSI	Predicted Crash Frequency
Unknown	0.4782	0.4874	**0.0092**	0.4697
Head On	1.4801	1.5986	**0.1186**	1.2963
Rear End	73.2827	65.7850	-7.4977	62.3314
Backing	8.2747	8.6042	**0.3295**	7.3092
Sideswipe - Meeting	2.0503	2.0368	-0.0135	1.7291
Sideswipe - Passing	68.4178	54.9720	-13.4459	59.1455
Angle	4.4929	8.3678	**3.8749**	5.3155
Parked Vehicle	0.3883	0.8518	**0.4635**	0.4889
Pedestrian	0.2717	0.2901	**0.0183**	0.2346
Animal	11.6989	11.0667	-0.6322	12.0307
Train	0.0000	0.0000	0.0000	0.0000
Pedalcycles	0.0603	0.0711	**0.0108**	0.0535
Other Non-Vehicle	0.0000	0.0000	0.0000	0.0000
Fixed Object	47.3597	45.5498	-1.8098	45.4343
Other Object	6.5731	6.4244	-0.1487	6.8415
Overturning	1.5868	1.6737	**0.0869**	1.4099
Other Non-Collision	5.2252	5.4134	**0.1882**	5.3082
Left Turn	1.0157	1.7329	**0.7172**	1.1497
Right Turn	0.3320	0.7991	**0.4671**	0.4432

APPENDIX F:
Design Criteria

FRA-33-24.76 Feasibility Study
US 33 Widening

Roadway Design Criteria

PID 119387
PID 121811
9/20/2024
Completed by: HBK
Checked: JRE
LJB Inc.

Geometric Elements	**Mainline US-33 Threshold**	**Mainline US-33 Threshold**	**Mainline US-33 Threshold**	**Ramps Criteria Threshold**	**Reference/Comments**
General					
Functional classification	Urban Freeway	Urban Freeway	Urban Freeway	Urban Freeway	ODOT Funtional Classification Listings
Design speed	60	65	70	70/50/45/30	Design Designation & Scope of Services
Design year					Certified Traffic
Design year ADT	>6000	>6000	>6000		Certified Traffic
Sight Distance					L&D Section 201
Stopping	570'	645'	730'	730'/425'/360'/200'	L&D Figure 201-1
Intersection (left turn)	N/A	N/A	N/A	N/A	L&D Figure 201-5
Intersection (right turn)	N/A	N/A	N/A	N/A	L&D Figure 201-5
Decision	1280'	1365'	1445'	1445'/1030'/930'/620'	L&D Section 201.5 & Figure 201-6
Horizontal Alignment					L&D Section 202
Max. deflection with no curve	0^55'	0^50'	0^45'	0^45'/1^05'/1^40'/3^45'	L&D Figure 202-1
Max. degree of curvature	4^15'	3^30'	2^45'	N/A/N/A/9^00'/24^45'	L&D Figure 202-2
Spiral curve required	1910' MIN.	2292' MIN	2546' MIN	1273' MIN. (50 MPH)	L&D Section 202.5 & Figure 202-11
Lane drop taper	60':1	65':1	70':1	L=WS^2/60, S:Speed	L&D Section 301.1.4
Lane add taper	100'	100'	100'	100'	L&D Section 301.1.4
Minimum lateral clearance	10'RT/ 4'LT	10'RT/ 4'LT	10'RT/ 4'LT	10'RT/ 4'LT	L&D Figure 302-1
Superelevation					L&D Section 202.4
Max. curvature without superelevation	0^33'	0^29'	0^26'	0^26'/0^47'/5^40'/17^30'	L&D Section 202.4.3 & Figure 202-3
Maximum rate	8.0%	8.0%	8.0%	8%/6%/6%/4%	L&D Figure 202-7 - 10
Transition (G Rate)	222	233	250	250/200/185/152	L&D Figure 202-4
Position	Baseline	Baseline	Baseline	Baseline	L&D Figure 202-5(4)
Vertical Alignment					L&D Section 203
Maximum continuous grade	4%	4%	4%	4%/5%/N/A/N/A	L&D Figure 203-1
Minimum continuous grade	0.00%	0.00%	0.00%	0.00%	L&D Section 203.2.2
Max. grade breaks w/o vertical curve	0.30%	0.30%	0.25%	%	L&D Figure 203-2
Min. rate of vertical curvature (crest)	151	193	247	84/61/19	L&D Figure 203-3
Min. rate of vertical curvature (sag)	136	157	181	96/79/37	L&D Figure 203-6
Minimum vertical clearance	16.5'	16.5'	16.5'	16.5'	L&D Figure 302-1
Cross Section					L&D Section 300
Cross slope (normal crown)	0.016	0.016	0.016	0.016	L&D Section 301.1.5
Lane width	12'	12'	12'	12'	L&D Figure 301-2 & 301-4 & 303-1
Treated shoulder width (with curb)	10'Rt/4'Med	10'Rt/4'Med	10'Rt/4'Med	N/A	L&D Figure 301-4 & 303-1
Treated shoulder width (without curb)	10'RT/4'Med	10'RT/4'Med	10'RT/4'Med	3'LT/6'RT	L&D Figure 303-1& 301-3 & 301-4
Graded shoulder width (without curb)	15'RT/9'MED	15'Rt./9'Med	15'Rt./9'Med	6'LT8'RT	L&D Figure 303-1& 301-3 & 301-4
Curb type	N/A	N/A	N/A	N/A	L&D Section 305.2
Sidewalk width (to f/c if no tree lawn)	N/A	N/A	N/A	N/A	L&D Figure 306-2
Sidewalk buffer width (from traveled way)	N/A	N/A	N/A	N/A	L&D Figure 306-2
Intersection approach radii	N/A	N/A	N/A	N/A	L&D Section 401.5.2 & 401.8.1
Roadside grading	Safety Grading	Safety Grading	Safety Grading	Safety Grading	L&D Section 307.2.1
Clear Zone Width					L&D Section 600.2 & Figure 600-1
Additional Comments					
ODOT Permitted Lane Closures					
http://plcm.dot.state.oh.us//Default.aspx					

APPENDIX G:
ITS Evaluation

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September 18, 2024

Cindy Yerkey, PE
Transportation Operations Leader
LJB Engineering
6480 Rockside Woods South
Suite 290
Independence, OH 43131

Re: FRA-33-24.76 Proposed ITS alternatives for Feasibility Study

Dear Cindy

The following includes a preliminary summary outline of improvements and high-level construction cost estimate for two proposed alternatives of ITS infrastructure deployments based on potential US-33 widening alternatives currently being evaluated by ODOT. ITS alternative #1 assumes that the existing grassy/earthen berm center median of US-33 will be replaced by a concrete center median wall and an additional travel lane in both directions of the mainline. ITS alternative #2 assumes that the existing center median will remain intact and an additional travel lane in both directions of the mainline will be constructed along the right shoulder within the LA/RW.

ITS improvements evaluated consist of new and upgraded CCTV, Dynamic Message Sign(DMS), and Ramp Meter Signal(RMS) sites, power service upgrades, and communications infrastructure for both the ODOT Freeway Management System(FMS) and Columbus Traffic Signal System(CTSS)

Best regards,

Matt Graf
Project Manager
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ITS Alternative Summary Outline

Alternative 1 - Widen Pavement Towards Center Median

1. Dynamic Message Sign (DMS)

    1.1. Remove existing pedestal mounted DMS and equipment cabinet near Sta 1339+00.

    1.2. Install new truss mounted DMS (westbound)
    - 1.2.1. DMS will be Daktronics VF-2020, walk-in full color display (RGB), 96 x 336 pixel matrix
    - 1.2.2. Install DMS on truss centered over left three lanes. Co-locate N I-270 exit only sign on DMS truss centered over right exit lane.
    - 1.2.3. Install ground mounted DMS equipment cabinet.
    - 1.2.4. Maintain existing power service (approx. Sta 1341+19, 129 RT), extend to new location and upgrade conductor size if needed.
    - 1.2.5. Install FOC drop (replace wireless until ODOT can install and activate fiber)
    - 1.2.6. Installing at Sta 1343+00 (preferred location) will result in a viewing angle of 1°27' from Sta 1355+00
    - 1.2.7. Installing at Sta 1339+00 will result in a viewing angle of 3°16' from Sta 1352+00

    1.3. Maintain existing DMS operation until proposed DMS is ready to be put in service.

    1.4. Truss mounted DMS replacement - estimated cost $155,550.

2. CCTV

    2.1. Proposed ODOT CCTV at Sta 1435+50 (Ebright Rd)
    - 2.1.1. Install 70' concrete pole with PTZ CCTV and lowering device.
    - 2.1.2. Install new power service.
    - 2.1.3. Connect conduit to interconnect duct bank system (install wireless until ODOT can install and activate fiber).

    2.2. Proposed ODOT CCTV as Sta 1702+00, LT (Diley Rd)
    - 2.2.1. Install 70' concrete pole with PTZ CCTV and lowering device.
    - 2.2.2. Install new power service.
    - 2.2.3. Connect conduit to interconnect duct bank system (install wireless until ODOT can install and activate fiber).

    2.3. Proposed ODOT CCTV at Sta 1470+00 (Bixby Rd)
    - 2.3.1. Install 70' concrete pole with PTZ CCTV and lowering device.

2.3.2. Will be incorporated into Bixby Rd interchange design and built by that project (PID 76687)

2.4. Maintain existing ODOT CCTV sites during construction
- 2.4.1. CCTV (I-270/US-33) FRA-270-28.247; FOC
- 2.4.2. CCTV (US-33/Hamilton Rd); FRA-317-9.189; Ethernet Radio
- 2.4.3. CCTV (US-33/Gender Rd); FRA-33-29.576; Ethernet Radio

2.5. 70' pole w/CCTV installation – estimated cost $73,500 per site. Total $147,000 for Ebright Rd and Diley Rd installations

3. Road Weather Information Sensor (RWIS)

3.1. Do not disturb existing RWIS (US-33/Hamilton Rd); FRA-33-25.934; Ethernet Radio

3.2. Negligible cost anticipated to maintain existing RWIS.

4. Ramp Meter Signal (RMS)

4.1. Proposed RMS at Sta 1358+42, 105' LT (Hamilton Rd onramp to WB US-33)
- 4.1.1. Approx 1300' single lane storage capacity.
- 4.1.2. Length of acceleration lane is sufficient past stop bar location.

4.2. Proposed RMS at Sta 1358+42, LT (Bixby Rd to WB US-33)
- 4.2.1. May be incorporated into Bixby Rd interchange design project. (PID 76687)

4.3. Proposed RMS at Sta 1550+75, 115' LT (SB Gender Rd onramp to WB US-33)
- 4.3.1. Length of acceleration lane is sufficient past stop bar location.

4.4. Proposed RMS at Sta 1563+32, 100' LT (NB Gender Rd onramp to WB US-33)
- 4.4.1. RMS at this location is not advisable because of SSD constraints due to geometrics of loop ramp.

4.5. Proposed RMS at Sta 1686+00, 105' LT (Diley Rd onramp to WB US-33)
- 4.5.1. Approx 1750' single lane storage capacity.
- 4.5.2. Length of acceleration lane is sufficient past stop bar location.

4.6. RMS installation – estimated cost $79,050 per site. Total $237,150 for Hamilton Rd to WB, Gender Rd to WB, and Diley Rd to WB ramps.

5. Communications interconnect along project extents from Sta 1213+00 to 1693+00

5.1. Median Barrier Wall
   5.1.1. Install 2” conduit with 10mm innerducts for ODOT ITS for future fiber optic interconnect.
   5.1.2. Install 2” conduit and 288 strand fiber optic cable for City of Columbus CTSS interconnect.
   5.1.3. Install poly concrete junction boxes in median wall, spaced approximately 750-1000ft apart along each ODOT and CTSS conduit. Alternate access between ODOT and CTSS conduits, maintain separation of conduit/ducts between ODOT and CTSS networks except for where ODOT/CTSS devices are collocated at shared access/device locations (CCTV, DMS, communications node)
   5.1.4. Bore or trench 2-2” conduits under roadway to existing and planned equipment or fiber access sites. Tie into proposed and/or existing 32in/48in concrete pull boxes.

5.2. Communications interconnect – estimated cost $1,367,916 for ODOT infrastructure and $1,394,076 for CTSS infrastructure.

5.3. Do not disturb existing CTSS interconnect and network equipment:
   5.3.1. Communications node (I-270/US-33)
   5.3.2. Communications node (US-33/Hamilton Rd)
   5.3.3. Communications node (US-33/Gender Rd)
   5.3.4. Temporary aerial fiber backbone cable (EB US-33 from I-270 to Gender Rd)
   5.3.5. Underground fiber backbone cable (US-33 north of SR-104)

6. ITS Total estimated cost for Alternative 1 - $3,301,692

Alternative 2 - Widen Towards Outside Shoulders

7. Dynamic Message Sign (DMS)

7.1. Remove existing pedestal mounted DMS and equipment cabinet near Sta 1339+00.

7.2. Install new truss mounted DMS (westbound)
   7.2.1. DMS will be Daktronics VF-2020, walk-in full color display (RGB), 96 x 336 pixel matrix
   7.2.2. Install DMS on truss centered over left three lanes. Co-locate N I-270 exit only sign on DMS truss centered over right exit lane.
   7.2.3. Install ground mounted DMS equipment cabinet.
   7.2.4. Maintain existing power service (approx. Sta 1341+19, 129 RT), extend to new location and upgrade conductor size if needed.
   7.2.5. Install FOC drop (replace wireless until ODOT can install and activate fiber)
   7.2.6. Installing at Sta 1343+00 (preferred location) will result in a viewing angle of 1°27’ from Sta 1355+00

7.2.7. Installing at Sta 1339+00 will result in a viewing angle of 3°16’ from Sta 1352+00

7.3. Maintain existing DMS operation until proposed DMS is ready to be put in service.

7.4. Truss mounted DMS replacement - estimated cost $155,550.

8. CCTV

8.1. Proposed ODOT CCTV at Sta 1435+50 (Ebright Rd)
8.1.1. Install 70’ concrete pole with PTZ CCTV and lowering device.
8.1.2. Install new power service.
8.1.3. Connect conduit to interconnect duct bank system (install wireless until ODOT can install and activate fiber).

8.2. Proposed ODOT CCTV as Sta 1702+00, LT (Diley Rd)
8.2.1. Install 70’ concrete pole with PTZ CCTV and lowering device.
8.2.2. Install new power service.
8.2.3. Connect conduit to interconnect duct bank system (install wireless until ODOT can install and activate fiber).

8.3. Proposed ODOT CCTV at Sta 1470+00 (Bixby Rd)
8.3.1. Install 70’ concrete pole with PTZ CCTV and lowering device.
8.3.2. Will be incorporated into Bixby Rd interchange design and built by that project (PID 76687)

8.4. Maintain existing ODOT CCTV sites during construction
8.4.1. CCTV (I-270/US-33) FRA-270-28.247; FOC
8.4.2. CCTV (US-33/Hamilton Rd); FRA-317-9.189; Ethernet Radio
8.4.3. CCTV (US-33/Gender Rd); FRA-33-29.576; Ethernet Radio

8.5. 70’ pole w/CCTV installation – estimated cost $73,500 per site. Total $147,000 for Ebright Rd and Diley Rd installations

9. RWIS

9.1. Do not disturb existing RWIS (US-33/Hamilton Rd); FRA-33-25.934; Ethernet Radio

9.2. Negligible cost anticipated to maintain existing RWIS.

10. Ramp Meter

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10.1. Proposed RMS at Sta 1358+42, 105’ LT (Hamilton Rd onramp to WB US-33)
   10.1.1. Approx 1300’ single lane storage capacity.
   10.1.2. Length of acceleration lane is sufficient past stop bar location.

10.2. Proposed RMS at Sta 1358+42, LT (Bixby Rd to WB US-33)
   10.2.1. May be incorporated into Bixby Rd interchange design project. (PID 76687)

10.3. Proposed RMS at Sta 1550+75, 115’ LT (SB Gender Rd onramp to WB US-33)
   10.3.1. Length of acceleration lane is sufficient past stop bar location.

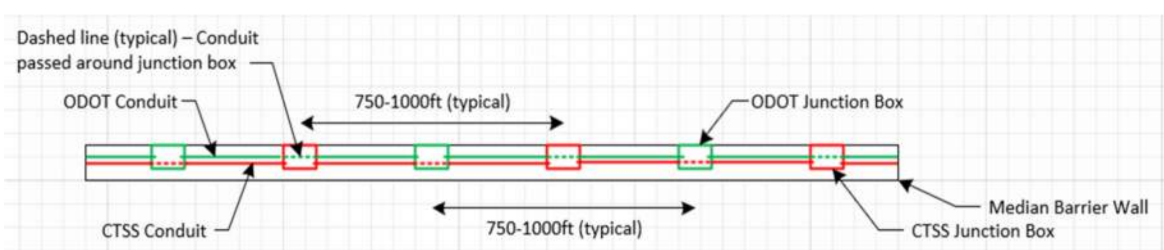
10.4. Proposed RMS at Sta 1563+32, 100’ LT (NB Gender Rd onramp to WB US-33)
   10.4.1. RMS at this location is not advisable because of SSD constraints due to geometrics of loop ramp.

10.5. Proposed RMS at Sta 1686+00, 105’ LT (Diley Rd onramp to WB US-33)
   10.5.1. Approx 1750’ single lane storage capacity.
   10.5.2. Length of acceleration lane is sufficient past stop bar location.

10.6. RMS installation – estimated cost $79,050 per site. Total $237,150 for Hamilton Rd to WB, Gender Rd to WB, and Diley Rd to WB ramps.

11. Communications Interconnect along project extents from Sta 1213+00 to 1693+00

11.1. Trench in center median
   11.1.1. Install 2” conduit with 10mm innerducts for ODOT ITS for future fiber optic interconnect.
   11.1.2. Install 2” conduit and 288 strand fiber optic cable for City of Columbus CTSS interconnect.
   11.1.3. Install 32in/48in concrete pull boxes, spaced approximately 750-1000ft apart along each ODOT and CTSS conduit. Alternate access between ODOT and CTSS conduits, maintain separation of conduit/ducts between ODOT and CTSS networks except for where ODOT/CTSS devices are collocated at shared access/device locations (CCTV, DMS, communications node)



11.1.4. Bore or trench 2-2" conduits under roadway to existing and planned equipment or fiber access sites. Tie into proposed and/or existing 32in/48in concrete pull boxes.

11.2. Communications interconnect – estimated cost $1,833,416 for ODOT infrastructure and $1,381,548 for CTSS infrastructure.

11.3. Do not disturb existing CTSS interconnect and network equipment:
- 11.3.1. Communications node (I-270/US-33)
- 11.3.2. Communications node (US-33/Hamilton Rd)
- 11.3.3. Communications node (US-33/Gender Rd)
- 11.3.4. Temporary aerial fiber backbone cable (EB US-33 from I-270 to Gender Rd)
- 11.3.5. Underground fiber backbone cable (US-33 north of SR-104)

12. ITS Total estimated cost for Alternative 2 - $3,754,664

13. Construction Alternative 1 vs. Construction Alternative 2

13.1. Both construction alternatives will result in the same overall functional improvements for both the ODOT FMS and Columbus CTSS systems.

13.2. Construction Alternative 1 will install the majority of communications interconnect infrastructure within the concrete median barrier wall as opposed to Construction Alternative 2 which will install communications interconnect infrastructure underground within the LA/RW. Both installation methods are acceptable and there are unique costs/benefits associated with both, although utilizing the concrete barrier wall (Construction Alternative 1) is typically preferred by both clients when given a choice.

13.3. Construction Alternative 1 is estimated to be $452,972 less than Construction Alternative 2.

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Alternative 1 vs Alternative 2 Estimated ITS Construction Costs

	DESCRIPTION	CONDUIT, 2", 725.052, AS PER PLAN	CONDUIT, 2", 725.052, AS PER PLAN, WITH 4-10/8MM MICRODUCTS	TRENCH, 30" DEEP	CONDUIT, 2", ATTACHED TO STRUCTURE	CONDUIT, JACKED OR DRILLED, 725.052, AS PER PLAN, 2" WITH 4-10/8MM MICRODUCTS	BARRIER JUNCTION BOX	PULL BOX, 725.08, 32"	POWER SERVICE	REMOVAL OF OVERHEAD DMS WITH SUPPORT AND DELIVERY	CCTV	FIBER OPTIC CABLE, 288 FIBER	CCTV CONCRETE POLE WITH LOWERING UNIT, 70 FEET	ITS CABINET - GROUND MOUNTED	REMOVAL OF DMS TRUSS AND DISPOSAL	OVERHEAD SIGN SUPPORT FOUNDATION, DMS TRUSS	DYNAMIC MESSAGE SIGN (DMS), FULL-SIZE WALK-IN	SPECIAL - CCTV INTEGRATION	RAMP METER SIGNAL	CONTROLLER WORK PAD, AS PER PLAN	Itemized Subtotal
	UNIT PRICE	$12.00	$18.00	$10.15	$45.00	$52.00	$3,200.00	$2,500.00	$7,500.00	$12,000.00	$6,650.00	$5.50	$45,800.00	$10,250.00	$4,500.00	$40,000.00	$80,000.00	$2,000.00	$60,000.00	$13.00	
	UNIT	FT	FT	FT	FT	FT	EA	EA	EA	EA	EA	FT	EA	EA	EA	EA	EA	EA	EA	SF	
	ITEM	625E25411	625E25411	625E29010	625E25900	625E25909	625E29940	625E30710	625E34000	630E89710	809E60000	804E15050	809E61000	809E65000	809E81002	630E70080	809E63000	809E99100	809E67000	633E67202	
	Alt 1 -Widen towards center median																				
Quantity	ODOT Interconnect		48,000			5,520	48	24												252	
Quantity	ODOT DMS								1	1				1	1	1	1			100	
Quantity	ODOT CCTV								2		2		2	2				2		200	
Quantity	ODOT RMS								3					3					3	300	
Quantity	CTSS Interconnect	48,000				5,520	48	24				57,120								252	
Quantity	TOTAL QUANTITY	48,000	48,000	-	-	11,040	96	48	6	1	2	57,120	2	6	1	1	1	2	3	1,104	
Itemized Cost	ODOT Interconnect		$864,000			$287,040	$153,600	$60,000												$3,276	$1,367,916
Itemized Cost	ODOT DMS								$7,500	$12,000				$10,250	$4,500	$40,000	$80,000			$1,300	$155,550
Itemized Cost	ODOT CCTV								$15,000		$13,300		$91,600	$20,500				$4,000		$2,600	$147,000
Itemized Cost	ODOT RMS								$22,500					$30,750					$180,000	$3,900	$237,150
Itemized Cost	CTSS Interconnect	$576,000				$287,040	$153,600	$60,000				$314,160								$3,276	$1,394,076
Itemized Cost	TOTAL COST	$576,000	$864,000	$0	$0	$574,080	$307,200	$120,000	$45,000	$12,000	$13,300	$314,160	$91,600	$61,500	$4,500	$40,000	$80,000	$4,000	$180,000	$14,352	$3,301,692
	Alt 2 -Widen towards outside shoulder																				
Quantity	ODOT Interconnect		47,520	47,250	480	5,520		72												756.0	
Quantity	ODOT DMS								1	1				1	1	1	1			100.0	
Quantity	ODOT CCTV								2		2		2	2				2		200.0	
Quantity	ODOT RMS								3					3					3	300.0	
Quantity	CTSS Interconnect	47,520			480	5,520		72				56,880								756.0	
Quantity	TOTAL QUANTITY	47,520	47,520	47,250	960	11,040	-	144	6	1	2	56,880	2	6	1	1	1	2	3	2,112	
Itemized Cost	ODOT Interconnect		$855,360	$479,588	$21,600	$287,040		$180,000												$9,828	$1,833,416
Itemized Cost	ODOT DMS								$7,500	$12,000				$10,250	$4,500	$40,000	$80,000			$1,300	$155,550
Itemized Cost	ODOT CCTV								$15,000		$13,300		$91,600	$20,500				$4,000		$2,600	$147,000
Itemized Cost	ODOT RMS								$22,500					$30,750					$180,000	$3,900	$237,150
Itemized Cost	CTSS Interconnect	$570,240			$21,600	$287,040		$180,000				$312,840								$9,828	$1,381,548
Itemized Cost	TOTAL COST	$570,240	$855,360	$479,588	$43,200	$574,080	$0	$360,000	$45,000	$12,000	$13,300	$312,840	$91,600	$61,500	$4,500	$40,000	$80,000	$4,000	$180,000	$27,456	$3,754,664

APPENDIX H:
Bridge Condition Summary

FRA-33 Widening Bridge Condition Summary

PID 121811
ODOT District 6
September 20, 2024

ljb Engineering
Building Partnerships

Prepared by:
Angela Tremblay, PE
atremblay@ljbinc.com
937-259-5798

Table of Contents

Big Walnut Creek Overflow

SFNs 2501929 and 2501953

SFN 2501929 (WB)	SFN 2501953 (EB)
INSPECTION SUMMARY	INSPECTION SUMMARY
(58) Deck: 7	(58) Deck: 8
(59) Superstructure: 7	(59) Superstructure: 8
(60) Substructure: 7	(60) Substructure: 7
(62) Culvert: N	(62) Culvert: N
(61) Channel: 8	(61) Channel: 9
(C6) Approaches:	(C6) Approaches:
General Appraisal: 7	General Appraisal: 7
(41) Operational Status: A	(41) Operational Status: A
(90) Inspection date: 4/17/2023	(90) Inspection date: 4/17/2023
(91) Desig Insp Freq: 24 Mos	(91) Desig Insp Freq: 24 Mos

Some deterioration of protective coating system (PCS) on piles (both bridges) – no work assumed for cost estimate.

SFN 2501929 (WB)	SFN 2501953 (EB)
	Investigate the cause of the crack at the slab seat/interface of abutment during design. Widening will remove and replace a portion of the fascia and this is included in the cost estimate.
	

Big Walnut Creek

SFNs 2501988 and 2502011

SFN 2501988 (WB)	SFN 2502011 (EB)
INSPECTION SUMMARY	INSPECTION SUMMARY
(58) Deck: 8	(58) Deck: 8
(59) Superstructure: 8	(59) Superstructure: 8
(60) Substructure: 8	(60) Substructure: 8
(62) Culvert: N	(62) Culvert: N
(61) Channel: 7	(61) Channel: 9
(C6) Approaches:	(C6) Approaches:
General Appraisal: 8	General Appraisal: 8
(41) Operational Status: A	(41) Operational Status: A
(90) Inspection date: 4/17/2023	(90) Inspection date: 4/17/2023
(91) Desig Insp Freq: 24 Mos	(91) Desig Insp Freq: 24 Mos

Both structures are in good condition. Repair or rehabilitation is not anticipated. Resealing of parapets is included in the cost estimates. Representative photos below.

Hamilton Road Overpass

SFN 2516381

INSPECTION SUMMARY
(58) Deck: 7
(59) Superstructure: 8
(60) Substructure: 5
(62) Culvert: N
(61) Channel: N
(C6) Approaches:
General Appraisal: 5
(41) Operational Status: A
(90) Inspection date: 10/12/2023
(91) Desig Insp Freq: 12 Mos

Rehabilitation considered to improve the bridge condition rating is included in the cost estimate, assuming the following improvements:

- Pier concrete patching and composite fiber wrap
- Substructure concrete patching with galvanic anodes

Approach pavement/joint rehabilitation or replacement could also be considered to improve the bridge condition and durability, although this would require work zones and maintenance of traffic on Hamilton Road.

Worst case pier deterioration is likely controlling the substructure condition rating

Blacklick Creek

SFNs 2502046 and 2502070

SFN 2502046 (WB)	SFN 2502070 (EB)
INSPECTION SUMMARY	**INSPECTION SUMMARY**
(58) Deck: 9	(58) Deck: 9
(59) Superstructure: 7	(59) Superstructure: 8
(60) Substructure: 7	(60) Substructure: 7
(62) Culvert: N	(62) Culvert: N
(61) Channel: 8	(61) Channel: 8
(C6) Approaches:	(C6) Approaches:
General Appraisal: 7	General Appraisal: 7
(41) Operational Status: A	(41) Operational Status: A
(90) Inspection date: 4/18/2023	(90) Inspection date: 4/18/2023
(91) Desig Insp Freq: 24 Mos	(91) Desig Insp Freq: 24 Mos

Some deterioration of the protective coating system (PCS) on piles (both bridges) – no work assumed for cost estimate.

SFN 2502046 (WB)	SFN 2502070 (EB)
	
Concrete patching included in the cost estimate.	
	
Painting costs included in estimate for fascia beams in their entirety and all bottom flanges for both bridges. This adds approximately $150,000 per bridge.	

Bikepath Overpass

SFN 2502038

INSPECTION SUMMARY
(58) Deck: 9
(59) Superstructure: 9
(60) Substructure: 9
(62) Culvert: N
(61) Channel: 9
(C6) Approaches:
General Appraisal: 9
(41) Operational Status: A
(90) Inspection date: 4/18/2023
(91) Desig Insp Freq: 24 Mos

Built in 2011. No rehabilitation work anticipated.

Ebright Road Overpass

SFN 2502089

INSPECTION SUMMARY
(58) Deck: 7
(59) Superstructure: 9
(60) Substructure: 7
(62) Culvert: N
(61) Channel: N
(C6) Approaches:
General Appraisal: 7
(41) Operational Status: A
(90) Inspection date: 4/18/2023
(91) Desig Insp Freq: 24 Mos

Abutment seats could use some patching. However, no other bridge work is anticipated with the FRA-33 widening; therefore, costs for patching are not included in the cost estimate.

Cable Bowman Ditch

SFNs 2502100 and 2502135

SFN 2502100 (WB)	SFN 2502135 (EB)
INSPECTION SUMMARY (58) Deck: 7 (59) Superstructure: 7 (60) Substructure: 7 (62) Culvert: N (61) Channel: 6 (C6) Approaches: General Appraisal: 7 (41) Operational Status: A (90) Inspection date: 5/22/2024 (91) Desig Insp Freq: 24 Mos	INSPECTION SUMMARY (58) Deck: 7 (59) Superstructure: 7 (60) Substructure: 7 (62) Culvert: N (61) Channel: 6 (C6) Approaches: General Appraisal: 7 (41) Operational Status: A (90) Inspection date: 5/22/2024 (91) Desig Insp Freq: 24 Mos

Detailed inspection was not performed at this stage. Minor patching and crack repair assumed for the cost estimate. A full Structure Type Study is planned for this structure and will be performed after the preferred alternative is determined.

George Creek

SFNs 2502194 and 2502224

SFN 2502194 (WB)	SFN 2502224 (EB)
INSPECTION SUMMARY	INSPECTION SUMMARY
(58) Deck: 7	(58) Deck: 8
(59) Superstructure: 7	(59) Superstructure: 8
(60) Substructure: 4	(60) Substructure: 5
(62) Culvert: N	(62) Culvert: N
(61) Channel: 9	(61) Channel: 9
(C6) Approaches:	(C6) Approaches:
General Appraisal: 4	General Appraisal: 5
(41) Operational Status: A	(41) Operational Status: A
(90) Inspection date: 3/29/2024	(90) Inspection date: 3/29/2024
(91) Desig Insp Freq: 12 Mos	(91) Desig Insp Freq: 12 Mos

Substructure patching included in the cost estimate. Our survey pictures do not show why the substructure would be rated a 4. Will need a more thorough inspection during Stage 1 design to quantify. For the cost estimate, a larger amount of patching was assumed.

Gender Road Overpass

SFN 2517361

INSPECTION SUMMARY
(58) Deck: 8
(59) Superstructure: 7
(60) Substructure: 7
(62) Culvert: N
(61) Channel: N
(C6) Approaches:
General Appraisal: 7
(41) Operational Status: A
(90) Inspection date: 4/18/2023
(91) Desig Insp Freq: 24 Mos

INSPECTION SUMMARY
(58) Deck: 8
(59) Superstructure: 3
(60) Substructure: 7
(62) Culvert: N
(61) Channel: N
(C6) Approaches:
General Appraisal: 3
(41) Operational Status: A
(90) Inspection date: 5/20/2024
(91) Desig Insp Freq: 12 Mos

No rehabilitation was originally anticipated with this project. The serious (3) superstructure condition rating shown on the inspection date of 5/20/2024 is a result of impact damage to the bridge beams caused by a truck hauling an excavator. The bridge was inspected on the date of impact. The vertical clearance is being increased with this project by lowering the profile of US-33.

APPENDIX I:
Culvert Inspection Summary

Existing Conditions

Existing Site Description

The project sites are located on US-33, over Cable Boweman Ditch and Tussing-Bachman Ditch, in Franklin County, Ohio. The structures over Cable Boweman Ditch are located 2.76 miles east of I270. Structure over Tussing Bachman Ditch is located 0.67 miles east of Gender Rd. The structures are on a tangent alignment and the profile is on a tangent grade. The approach roadway is 44' wide for all four structures. Each structure consists of two 11' lanes, grass median plus shoulders on each side.

Existing Structure File Number: 2502100 (L) & 2502135 (R)

Existing Structure Information
Bridge Number: FRA-33-27510 L & R
Year Built: 1963
Existing O/A Length: 17.8 Ft.; Span: 14'-0"
Structure Type: Single span reinforced concrete slab bridge
Number of Spans: 1
Skew: 26 degrees

Built in 1963, both the structures are single span reinforced concrete slab bridge on cantilevered abutments on spread footings. The alignment is on a tangent and there is a 26 degree skew. Both the structures share a common wingwall in the middle at both abutments.

Condition Summary
Roadway has longitudinal cracks as well as spalling of the wearing surface in which some areas were repaired. A pothole was observed at the edge of the outside northbound travel lane. Roadway Parapets are in good condition. The bridge had lots of cracking and efflorescence under the roadway sections for both walls and ceiling. Evidence of leakage was observed at both abutment slab seats. Heavy efflorescence, delaminations and spalling was identified at the forward abutment and minimum deteriorations at the rear abutment. During concrete sounding, the southeast headwall has a 1-foot by 2-foot area of unsound concrete. Certain areas of the channel had ground buildup and southside water seemed to be undermining the southeast headwall.

The general appraisal based on the most recent BR-86 bridge inspection performed on 04/18/2023 is ***7 (good)*** for both the bridges. Channel under the bridge is appraised at 6.

Existing Conditions

Existing Structure File Number: 2502267

Existing Structure Information
Bridge Number: FRA-33-30300
Year Built: 2011
Length of Culvert: 148.17 Ft.; Span: 10 Ft
Bridge Type: Concrete Culvert
Skew: 9 degrees

Condition Summary
Roadway is in good condition. Both of the culvert headwalls have small areas of delamination and spalling concrete. The North headwall is not in alignment of the adjacent wingwalls at both sides, the joints are off by ¾” to 1”. No joint material was observed in any of the joints between the headwalls and wingwalls. Erosion of the roadway surface was observed at the south headwall east corner. The culvert sections and joints inside the culvert are in good condition. Rest of culvert is in good condition

The general appraisal based on the most recent culvert inspection performed on 03/29/2024 is ***8 (very good)*** . Channel is appraised at 9.

Inspector:	Shah,Meet	**Structure Number:**	2502100
Inspection Date:	05/22/2024	**Facility Carried:**	US 33

Ohio Bridge Inspection Summary Report

FRA-00033-2751L (2502100)

2: District	District 06	46410 - MADISON TWP (FRA county)	5A: Inventory Route	1	00033
21: Major Maint A/B	01 - State Highway Agency	/	7: Facility On	US 33	
225 Routine Main A/B	01 - State Highway Agency	/	6: Feature Ints	CABLE BOWMAN DITCH	
221 Inspection A/B	01 - State Highway Agency	/	9: Location	2.76 MI E OF SR270	
220: Inv. Location	DISTRICT 06		Lat, Lon	39.875214	,-82.860947

Condition

58: Deck	**7 - Good Condition**
58.01 Wearing Surface	8 - Very Good (isolated or minor problems)
58.02 Joint	N- Not Applicable
59: Superstructure	**7 - Good Condition**
59.01 Paint & PCS	N - Not Applicable
60: Substructure	**7 - Good Condition**
61: Channel	**6**
61.01 Scour	**8 - Very Good**
62: Culverts	**N - Not Applicable**
67.01 GA	**7**

Appraisal

Sufficiency Rating	97.1	SD/FO 0 - ND		
36: Rail, Tr, Gd, Term Std	1	1	1	N
72: Approach Alignment	8 - Equal to present desirable criteria			
113: Scour Critical	8 - Stable for scour conditions			
71: Waterway Adequacy	8 - Bridge Above Approaches			

Geometric

48: Max Span Length (ft)	14.0
49: Structure Length (ft)	17.8
52: Deck Width, Out-To-Out (ft)	42.0
424: Deck Area (sf)	747.6
32: Appr Roadway Width (ft)	44.0
51: Road Width, Curb-Curb (ft)	42.0
50A: Curb/SW Width: Left (ft)	0
50A: Curb/SW Width: Right (ft)	0
34: Skew (deg)	26
33: Bridge Median	0 - No median
54B: Min Vert Underclearance (ft)	0
336A: Min Vert Clrnce IR Cardinal (ft)	99
336B: Min V Clr IR Non-Cardinal (ft)	0
578: Culvert Length (ft)	0

Load Posting

41: Op/Post/Closed	A - Open
70: Posting	5 - Equal to or above legal loads
70.01: Date	
70.02: Sign Type	
734: Percent Legal (%)	150
704: Analysis Date	07/01/2007
63: Analysis Method	6 - Load Factor (LF) rating reported by rating factor (RF) method using MS18 loading.

Structure Type

43: Bridge Type	1 - Concrete	
	01 - Slab	
	N- Not Applicable	
45: Spans Main / Approach	1	/ 0
107: Deck Type	1 - Concrete Cast-in-Place	
408: Composite Deck	N - Non-composite Construction	
414A Joint Type 1	N - None	
414B: Joint Type 2	N - None	
108A: Wearing Surface	6 - Bituminous	
	N- Not Applicable	
422: WS Date	10/18/2000	
423: WS Thick (in)	3.0	
482: Protective Coating	N - None or Not Applicable	
483: PCS Date		
453: Bearing Type 1	N - None	
455: Bearing Type 2	N - None	
528: Foundn: Abut Fwd	4 - Spread Footing (on soil)	
533: Foundn: Abut Rear	4 - Spread Footing (on Soil)	
536: Foundn: Pier 1	N - None (Such as most Culverts)	
539: Foundn: Pier 2	N - None (Such as most Culverts)	

Age and Service

27: Year Built/ 106 Rehab	1963	/ 0000
42A: Service On	1 - Highway	
42B: Service Under	5 - Waterway	
28A: Lanes on	02	
28B: Lanes Under	00	
19: Bypass Length	1	
29: ADT	31397	
109: % Trucks (%)	8	

Inspections

		Months	
90: Routine Insp.		24	05/22/2024
92A: FCM Insp.	N	0	
92B: Dive Insp.	N	0	
92C: Special Insp.	N	0	
92D: UBIT Insp.	N	0	
92E: Drone Insp.	N	0	

Inspector Shah,Meet

Inspector Comments - Deck and Approach

Deck

Floor/Slab (SF)

LG.CRACK CENTER W/SPALL.,DECK ENDS SATURATED.

Edge of Floor/Slab (LF)

EDGES CRACKED,SPALLED.

Bridge Wearing Surface (SF)

2 POT HOLES REAR.

Approach

Approach Wearing Surface (EA)

2020 BREAKING UP WITH POTHOLES FORMING REAR, CAUSING A BUMP

Inspector Comments - General Appraisal

Superstructure

Slab (SF)

LG CRACK CENTER W/SPALL.,ENDS SATURATED.

Substructure

Abutment Walls (LF)

SEEPING W/EFFLOR. REAR AND FWD.AT TOP.

Wingwalls (EA)

SPALLED AT TOP CORNERS NEAR ABUTMENT.

CRACK OBSERVED AT SW WINGWALL (2024).

Culvert

Inspector:	Shah,Meet	**Structure Number:**	2502100
Inspection Date:	05/22/2024	**Facility Carried:**	US 33

Inspector Comments - Waterway

Waterway Adequacy

Channel Hydraulic Opening (EA)

,LG. MUD BAR,GROWTH.FLOW REAR/FWD.

Channel

Channel Alignment (LF)

WAVEY,NARROW

Scour Critical

Pictures

PHOTO 16 Condition

Description South Parapet

PHOTO 17 Condition

Description Crack at SW Wingwall

Pictures

PHOTO 18 Condition

Description Forward Approach

PHOTO 19 Condition

Description Wearing Surface

Pictures

PHOTO 20 Condition

Description NE Wingwall

PHOTO 21 Condition

Description North Parapet

Pictures

PHOTO 22 Condition

Description Channel / Rear Abutment

PHOTO 23 Condition

Description Underside Slab near edge of roadway

Pictures

PHOTO 24 Condition

Description Cacking and delamination at underside of deck at C/L

PHOTO 25 Condition

Description Isolated Cracking

Inspector:	Shah,Meet	**Structure Number:**	2502135
Inspection Date:	05/22/2024	**Facility Carried:**	US 33

Ohio Bridge Inspection Summary Report

FRA-00033-2751R (2502135)

2: District District 06 46410 - MADISON TWP (FRA county)

5A: Inventory Route 1 00033

21: Major Maint A/B	01 - State Highway Agency	/
225 Routine Main A/B	01 - State Highway Agency	/
221 Inspection A/B	01 - State Highway Agency	/
220: Inv. Location	DISTRICT 06	

7: Facility On	US 33	
6: Feature Ints	CABLE BOWMAN DITCH	
9: Location	2.76 MI E OF SR270	
Lat, Lon	39.874942	,-82.861028

Condition

58: Deck	**7 - Good Condition**
58.01 Wearing Surface	7 - Good (1% distress)
58.02 Joint	N- Not Applicable
59: Superstructure	**7 - Good Condition**
59.01 Paint & PCS	N - Not Applicable
60: Substructure	**7 - Good Condition**
61: Channel	**6**
61.01 Scour	**7 - Good**
62: Culverts	**N - Not Applicable**
67.01 GA	**7**

Appraisal

Sufficiency Rating	97.1	SD/FO 0 - ND		
36: Rail, Tr, Gd, Term Std	1	1	1	1
72: Approach Alignment	8 - Equal to present desirable criteria			
113: Scour Critical	8 - Stable for scour conditions			
71: Waterway Adequacy	8 - Bridge Above Approaches			

Geometric

48: Max Span Length (ft)	14.0
49: Structure Length (ft)	17.8
52: Deck Width, Out-To-Out (ft)	42.0
424: Deck Area (sf)	747.6
32: Appr Roadway Width (ft)	44.0
51: Road Width, Curb-Curb (ft)	42.0
50A: Curb/SW Width: Left (ft)	0
50A: Curb/SW Width: Right (ft)	0
34: Skew (deg)	26
33: Bridge Median	0 - No median
54B: Min Vert Underclearance (ft)	0
336A: Min Vert Clrnce IR Cardinal (ft)	99
336B: Min V Clr IR Non-Cardinal (ft)	0
578: Culvert Length (ft)	0

Load Posting

41: Op/Post/Closed	A - Open
70: Posting	5 - Equal to or above legal loads
70.01: Date	
70.02: Sign Type	
734: Percent Legal (%)	150
704: Analysis Date	07/01/2007
63: Analysis Method	6 - Load Factor (LF) rating reported by rating factor (RF) method using MS18 loading.

Structure Type

43: Bridge Type	1 - Concrete	
	01 - Slab	
	N- Not Applicable	
45: Spans Main / Approach	1	/ 0
107: Deck Type	1 - Concrete Cast-in-Place	
408: Composite Deck	N - Non-composite Construction	
414A Joint Type 1	N - None	
414B: Joint Type 2	N - None	
108A: Wearing Surface	6 - Bituminous	
	N- Not Applicable	
422: WS Date	10/18/2000	
423: WS Thick (in)	3.0	
482: Protective Coating	N - None or Not Applicable	
483: PCS Date		
453: Bearing Type 1	N - None	
455: Bearing Type 2	N - None	
528: Foundn: Abut Fwd	4 - Spread Footing (on soil)	
533: Foundn: Abut Rear	4 - Spread Footing (on Soil)	
536: Foundn: Pier 1	N - None (Such as most Culverts)	
539: Foundn: Pier 2	N - None (Such as most Culverts)	

Age and Service

27: Year Built/ 106 Rehab	1963	/ 0000
42A: Service On	1 - Highway	
42B: Service Under	5 - Waterway	
28A: Lanes on	02	
28B: Lanes Under	00	
19: Bypass Length	1	
29: ADT	31397	
109: % Trucks (%)	8	

Inspections

		Months	
90: Routine Insp.		24	05/22/2024
92A: FCM Insp.	N	0	
92B: Dive Insp.	N	0	
92C: Special Insp.	N	0	
92D: UBIT Insp.	N	0	
92E: Drone Insp.	N	0	

Inspector Shah,Meet

Inspector:	Shah,Meet	**Structure Number:**	2502135
Inspection Date:	05/22/2024	**Facility Carried:**	US 33

FRA-00033-2751R_(2502135)

ODOT District:	District 06					Date Built:	07/01/1963
Major Maint:	01 - State Highway Agency	Facility Carried:	US 33	Traffic On:	1 - Highway	Rehab Date:	
Routine Maint:	01 - State Highway Agency	Feature Inters:	CABLE BOWMAN DITCH	Traffic Under:	5 - Waterway	Insp. Resp A:	01 - State Highway Agency
FIPS Code:	46410 - MADISON TWP (FRA county)	Location:	DISTRICT 06	2.76 MI E OF SR270		Insp Resp B:	

Inspector Shah,Meet Inspection Date 05/22/2024 Reviewer Eudaily,Jim

Inspector Comments - Deck and Approach

Deck

Floor/Slab (SF)

SMALL SPALL CENTER,EXPOSED REBAR

Edge of Floor/Slab (LF)

SPALLED RT. 2020 SATURATED AREA RT SEEPING EFFLOR

Bridge Wearing Surface (SF)

POTHOLES REAR. 25 SF

Bridge Railing (LF)

Approach

Approach Wearing Surface (EA)

BREAKING UP @ SLAB END FWD

Inspector Comments - General Appraisal

Superstructure

Slab (SF)

SPALLED C/L 4SF

ISOLATED SPOTS OF LEAKAGE AND EFFLORESCENCE (2024)

Substructure

Abutment Walls (LF)

LG.SEEPING CRACK FWD.W/EFFLOR.SPALLED AT CORNERS AND C/L 2020 SPALLED FWD @ JOINT FWD 15 SF

Wingwalls (EA)

SPALLED AT TOPS NEAR ABUTMENT,CRACKS

Culvert

Inspector Comments - Waterway

Waterway Adequacy

Channel Hydraulic Opening (EA)

GROWTH AND SILT AT INLET AND OUTLET ,FWD.FLOW. 2020 MUD BAR THROUGH REAR

Channel

Scour Critical

Pictures

PHOTO 16 Condition

Description Wearing Surface

PHOTO 17 Condition

Description Wearing Surface

Pictures

PHOTO 18 Condition

Description Forward Abutment

PHOTO 19 Condition

Description Underside Deck

Pictures

PHOTO 20 Condition

Description

PHOTO 21 Condition

Description SW Wingwall

Pictures

PHOTO 22 Condition

Description Forward Abutment Delaminated Area

PHOTO 23 Condition

Description Forward Abutment

Pictures

PHOTO 24 Condition

Description Rear Abutment

PHOTO 25 Condition

Description Outlet

Pictures

PHOTO 26 Condition

Description Leakage & Efflorescence underside of the deck

PHOTO 27 Condition

Description Cracking at NE Wingwall

Pictures

PHOTO 28 Condition

Description Leakage & Efflorescence underside of the deck

PHOTO 29 Condition

Description Leakage at Forward Abutment

Inspector:	Shah,Meet	**Structure Number:**	2502267
Inspection Date:	05/22/2024	**Facility Carried:**	US-33

Ohio Bridge Inspection Summary Report

FRA-00033-3030 (2502267)

2: District	District 06	11332 - CANAL WINCHESTER (FAI & FRA county)	5A: Inventory Route	1 00033
21: Major Maint A/B	01 - State Highway Agency /		7: Facility On	US-33
225 Routine Main A/B	04 - City or Municipal Highway Agency /		6: Feature Ints	TUSSING-BACHMAN DITCH
221 Inspection A/B	01 - State Highway Agency /		9: Location	0.93 W OF FAIRFIELD CO.
220: Inv. Location	DISTRICT 06		Lat, Lon	39.854708 ,-82.816311

Condition

58: Deck	**N - Not Applicable**
58.01 Wearing Surface	N - Not Applicable
58.02 Joint	N- Not Applicable
59: Superstructure	**N - Not Applicable**
59.01 Paint & PCS	N - Not Applicable
60: Substructure	**N - Not Applicable**
61: Channel	**9**
61.01 Scour	**8 - Very Good**
62: Culverts	**8 - No noticeable or noteworthy deficiencies**
67.01 GA	**8**

Appraisal

Sufficiency Rating	79.1	SD/FO 0 - ND		
36: Rail, Tr, Gd, Term Std	N	N	N	N
72: Approach Alignment	8 - Equal to present desirable criteria			
113: Scour Critical	U - Unknown foundation			
71: Waterway Adequacy	8 - Bridge Above Approaches			

Geometric

48: Max Span Length (ft)	10.0
49: Structure Length (ft)	11.8
52: Deck Width, Out-To-Out (ft)	0.0
424: Deck Area (sf)	1250.8
32: Appr Roadway Width (ft)	106.0
51: Road Width, Curb-Curb (ft)	0.0
50A: Curb/SW Width: Left (ft)	0
50A: Curb/SW Width: Right (ft)	0
34: Skew (deg)	9
33: Bridge Median	0 - No median
54B: Min Vert Underclearance (ft)	0
336A: Min Vert Clrnce IR Cardinal (ft)	99
336B: Min V Clr IR Non-Cardinal (ft)	0
578: Culvert Length (ft)	148.167

Load Posting

41: Op/Post/Closed	A - Open
70: Posting	5 - Equal to or above legal loads
70.01: Date	
70.02: Sign Type	
734: Percent Legal (%)	150
704: Analysis Date	07/01/2011
63: Analysis Method	8 - Load and Resistance Factor Rating (LRFR) rating report by rating factor (RF) method using HL-93 loadings.

Structure Type

43: Bridge Type	1 - Concrete
	19 - Culvert (includes frame culverts)
	N- Not Applicable
45: Spans Main / Approach	1 / 0
107: Deck Type	N - Not Applicable
408: Composite Deck	N - Non-composite Construction
414A Joint Type 1	N - None
414B: Joint Type 2	N - None
108A: Wearing Surface	6 - Bituminous
	N- Not Applicable
422: WS Date	12/08/2011
423: WS Thick (in)	7.5
482: Protective Coating	N - None or Not Applicable
483: PCS Date	
453: Bearing Type 1	N - None
455: Bearing Type 2	N - None
528: Foundn: Abut Fwd	N - None (Such as most Culverts)
533: Foundn: Abut Rear	N - None (such as most Culverts)
536: Foundn: Pier 1	N - None (Such as most Culverts)
539: Foundn: Pier 2	N - None (Such as most Culverts)

Age and Service

27: Year Built/ 106 Rehab	2011 / 0000
42A: Service On	1 - Highway
42B: Service Under	5 - Waterway
28A: Lanes on	04
28B: Lanes Under	00
19: Bypass Length	1
29: ADT	51718
109: % Trucks (%)	10

Inspections

		Months	
90: Routine Insp.		12	05/22/2024
92A: FCM Insp.	N	0	
92B: Dive Insp.	N	0	
92C: Special Insp.	N	0	
92D: UBIT Insp.	N	0	
92E: Drone Insp.	N	0	

Inspector Shah,Meet

FRA-00033-3030 _(2502267)

ODOT District:	District 06					Date Built:	12/08/2011
Major Maint:	01 - State Highway Agency	Facility Carried:	US-33	Traffic On:	1 - Highway	Rehab Date:	
Routine Maint:	04 - City or Municipal Highway Agency	Feature Inters:	TUSSING-BACHMAN DITCH	Traffic Under:	5 - Waterway	Insp. Resp A:	01 - State Highway Agency
FIPS Code:	11332 - CANAL WINCHESTER (FAI & FRA county)	Location:	DISTRICT 06	0.93 W OF FAIRFIELD CO.		Insp Resp B:	
Inspector	Shah,Meet	Inspection Date	05/22/2024	Reviewer	Eudaily,Jim		

Inspector Comments - Deck and Approach

Deck

Approach

Approach Embankment (EA)

WASHING RT.FWD.AT END OF WING,STONE HAS BEEN ADDED. 2020 WASHING RT FWD AND REAR, BOTH NEED STONE ADDED.

SIGNS OF SCOUR NEAR OUTLET SE WINGWALL (2024).

Approach Guardrail (EA)

LT REAR COLLISION DMG

Inspector Comments - General Appraisal

Superstructure

Substructure

Culvert

Wingwalls (EA)

Misaligned Wingwall-Headwall joints. No PEJF (2024)

Inspector Comments - Waterway

Waterway Adequacy

Channel Hydraulic Opening (EA)

1 FT OF MUCK IN THE CULVERT.

Channel

Inspector:	Shah,Meet	**Structure Number:**	2502267
Inspection Date:	05/22/2024	**Facility Carried:**	US-33

Scour Critical

Pictures

PHOTO 1

Description 2024 outlet

PHOTO 2

Description 2024 inlet

Pictures

PHOTO 3 Condition

Description Insided Structure Looking from Inlet

PHOTO 4 Condition

Description Wearing Surface near Outlet

Pictures

PHOTO 5 Condition

Description SE Wingwall embankment scour

PHOTO 6 Condition

Description SE Wingwall embankment scour

Pictures

PHOTO 7 Condition

Description Overview Outlet

PHOTO 8 Condition

Description Outlet Channel

Pictures

PHOTO 9 Condition

Description Wearing Surface

PHOTO 10 Condition

Description Wearing Surface

Pictures

PHOTO 11 Condition

Description Wearing Surface

PHOTO 12 Condition

Description NE Wingwall

Pictures

PHOTO 13 Condition

Description Inside Structure

PHOTO 14 Condition

Description Inside Structure

Pictures

PHOTO 15 Condition

Description NW Wingwall

PHOTO 16 Condition

Description Inlet Overview

Pictures

PHOTO 17 Condition

Description Inlet NW Wingwall-Headwall Damage

PHOTO 18 Condition

Description Inlet Channel

Pictures

PHOTO 19 Condition

Description Misaligned Wingwall/Headwall (Typical)

APPENDIX J:
MOT Analysis Summary

WOOLPERT

Memo

To:	LJB, Inc.
From:	Woolpert, Inc.
Date:	September 19, 2024
Subject:	FRA-33-24.76 MOT Analysis Summary

Woolpert evaluated conceptual Maintenance of Traffic (MOT) schemes for FRA-33-24.76 to identify high-level MOT cost drivers, MOT impacts to existing structures, and pros/cons for both evaluated MOT schemes. For the analysis, Woolpert divided the project section into two parts based on existing median width. The northern section, with a 60 ft edge line to edge line median extends along US 33 from SR 104 to Gender Rd in Franklin and Fairfield County, and the southern section, with a 40 ft edge line to edge line median extends along US 33 from Gender Rd to Diley Rd in Fairfield County. This memo provides a high-level summary of the MOT Analysis Table dated May 10, 2024. This memo is not intended to replace a Maintenance of Traffic Alternatives Analysis (MOTAA), which will be prepared upon confirmation of the preferred alternative. The conclusions and considerations presented in this memo will be further evaluated during the MOTAA development process and do not consider all aspects of an MOTAA evaluation, such as local detours, local street impacts, and major impacts to structures.

Maintenance of Traffic (MOT) Schemes

The FRA-33-24.76 (ODOT PID 119378) project will widen US 33 from SR 104 to Diley Rd from two lanes to three lanes, along with widening of existing structures to accommodate the proposed cross section. Woolpert evaluated the following MOT schemes for both the northern and southern MOT analysis sections:

- Part-Width Construction with Inside Widening
- Crossover Construction with Outside Widening

All MOT schemes assume 11.5 ft MOT travel lane widths with 2 ft offsets to barrier/shoulder.

*Part-Width Construction with **Outside Widening** (Not Considered)*

Part-Width construction with outside construction was eliminated from this analysis as a potential MOT scheme given the significant impacts created by that alternative compared to the two alternatives shown above. In the northern section, part-width construction with outside widening would require an MOT cross section approximately 6 ft wider than the proposed final cross section, after accounting for two separate pre-phases for outside and inside shoulder reconstruction to minimize the MOT widening. It is expected that the additional width of this alternative will require roadside grading that extends beyond the existing right of way limits, thereby requiring right of way acquisition, which would not be required by the MOT schemes carried forward.

In the southern section, the difference in impacts between the alternatives carried forward and part-width construction for outside widening is negligible as both alternatives carried forward will require both inside and outside widening due to a constrained median width in the existing condition. Outside of the physical and temporary cost impacts of part width construction with outside widening, the additional overnight pre-phases for shoulder reconstruction may add to overall construction duration.

Contraflow Construction for Inside or Outside Widening (Not Considered)

Contraflow construction for either inside or outside widening was eliminated from this analysis as a potential MOT scheme because of impacts that fall beyond that of part-width and crossover MOT schemes. Contraflow is an MOT scheme typically deployed in dense urban areas where all part-width and crossover alternatives have already been exhausted either due to physical impacts, or the need to maintain a certain number of lanes to meet the requirements of the permitted lane closure schedule (PLCS). Contraflow construction is also challenging to analyze from a safety perspective and presents an unconventional arrangement of vehicle movements for at-grade intersections, likely requiring several movement restrictions or complete side-street intersection closures and additional local detours. Some additional disadvantages of contraflow construction for this project include:

- Extended construction schedule to accommodate additional phases necessary to widen for contraflow lanes
- While contraflow could maintain some access to local roadways, additional temporary pavement may be necessary for acceleration lanes for permitted turning movements
- Contraflow is typically a “last resort” MOT option when all other options have been exhausted, analysis indicates that impacts from part-width construction, inside widening would be less than contraflow.

Construction Sequencing

At a high-level, in both the northern and southern sections, Part-Width construction can be accomplished in three phases with one pre-phase:

- Pre-Phase: Outside shoulder widening using overnight lane closures and drums
- Phase 1: Construct EB/WB inside final pavement and inside structures
- Phase 2A: Construct EB outside final pavement and EB outside structures
- Phase 2B: Construct WB outside final pavement and WB outside structures

In the southern section, part width construction requires 16 ft of additional pavement (8 ft on both sides) for a maximum cross section of 128 ft in Phase 1 vs the currently proposed final cross section of 112 ft. This additional pavement may be removed if desired after Phase 1.

Crossover construction can be accomplished in two phases with three pre-phases:

- Pre-Phase A: Part-Width construction of all project structures to final proposed pavement width
- Pre-Phase B: WB Inside shoulder reconstruction using overnight lane closures and drums
- Pre-Phase C: WB Outside shoulder reconstruction and install crossovers per MT-100.00
- Phase 1: EB full construction with two lanes maintained (both directions) on WB temp. and existing pavement
- Phase 2: WB full construction with two lanes maintained (both directions) on EB final pavement

In the southern section, crossover construction requires 3 ft of additional pavement (1.5 ft on both sides) for a maximum MOT cross section of 115 ft in Phase 1 vs the currently proposed final cross section of 112 ft. Crossover construction would require the additional 3 ft to be carried through the end of construction for MOT purposes. This additional pavement may be removed if desired after Phase 1.

Woolpert prepared conceptual MOT typical sections dated May 10, 2024, to go along with the MOT Analysis Table of the same date.

Temporary Pavement

Based on the high-level MOT typical sections produced for both MOT schemes evaluated, Woolpert calculated anticipated temporary pavement totals for each scheme, in each section, as shown below and as detailed in the MOT Analysis Table:

Table 1 - Temporary Pavement Calculations

Section	Part Width	Crossover
Northern **SR 104 to Gender Rd**	38,134 SY	122,028 SY
Southern **Gender Rd to Diley Rd**	63,360 SY	55,440 SY
Total (SY)	101,494 SY	177,468 SY

Temporary pavement calculations assume a continuous section along the entire length of the project segment, and does not account for minor variations at structures, interchanges, or at-grade intersections. Importantly, for crossover construction, temporary pavement values do not include crossovers. Multiple additional full or partial crossovers may be required to maintain ramp movements in a crossover construction MOT scheme.

Portable Concrete Barrier

Woolpert utilized the proposed construction sequencing and high-level typical sections to evaluate lengths of portable concrete barrier (PCB) required for MOT during construction. As with temporary pavement, the calculations assume a continuous section, and do not account for variations at structures, interchanges, or at-grade intersections. Additionally, per direction from ODOT District 6, certain shoulder reconstruction operations are permitted to occur during overnight hours with single lane closures protected by drums.

Table 2 - PCB Calculations

Section	Part Width	Crossover
Northern **SR 104 to Gender Rd**	137,280 LF	68,640 LF
Southern **Gender Rd to Diley Rd**	57,024 LF	28,512 LF
Total (LF)	194,304 LF	97,152 LF

MOT Impact on Existing Structures

A high-level evaluation of existing structures on the northern section of the project suggest that sufficient toe/toe width exists to maintain at least two lanes of traffic while constructing the inside of proposed structures during part width construction, this includes maintaining at least three lanes at the Big Walnut structures immediately south and east of I-270. The absolute minimum width required to maintain 11 ft lanes and 2 ft shoulders is 26 ft. Including the 2 ft barrier and a 2 ft offset from barrier to work zone increases the absolute minimum width to 30 ft. The minimum width of the existing two-lane bridges is approximately 40 ft, with an overall range from 40 ft to 45 ft, therefore, the existing bridges do not require widening for the purposes of part-width construction MOT.

For crossover construction, it is assumed all structures will be widened to their final proposed cross section in a pre-phase prior to construction. The existing bridges are not wide enough for crossover MOT in their current form, and partial widenings for MOT would likely create inefficiencies in construction. A minimum of 56 ft toe/toe is required to maintain two 11.5 ft lanes in both directions during MOT.

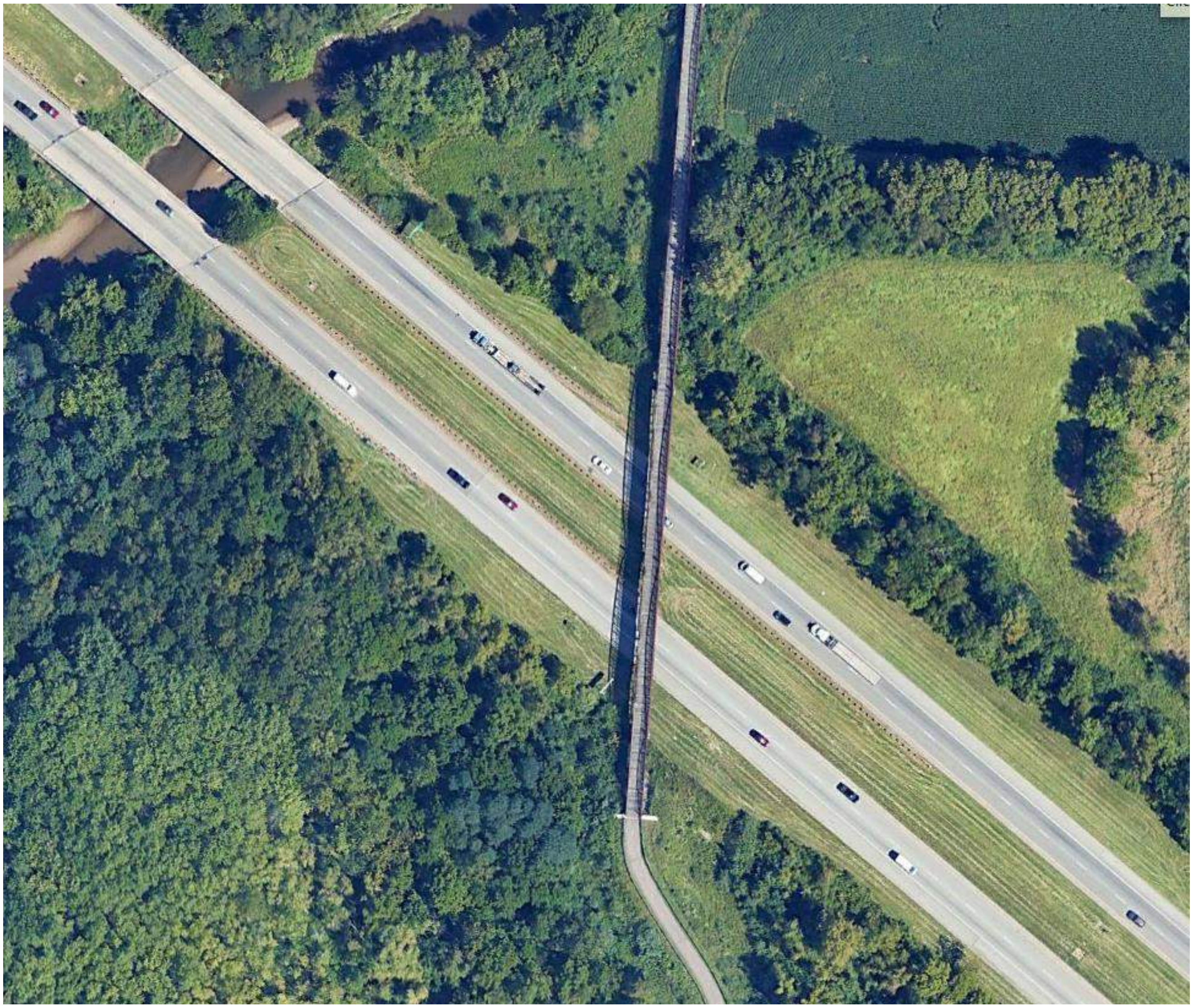


Figure 1 - Blacklick Trail over US 33

The Blacklick Trail overpass runs diagonal to the alignment of US 33 in the northern section (Figure 1). While no piers intersect with proposed inside or outside pavement widening, the central pier cap may create a vertical clearance interaction during maintenance of traffic with the inner most lanes of Phase 2 in the part-width, inside widening scheme. Further evaluation of this vertical clearance interaction is warranted during detailed MOT design. Lane width reductions or temporary widening to the outside may be necessary to limit the impact of the pier cap overhang on proposed MOT.

An ODOT ITS changeable message sign is in the median of in the northern section, south and east of the Big Walnut Creek structures and I-270. In part-width, inside construction, this sign will be impacted and will require reconstruction either as an outside structure, or as a new truss mounted overhead structure.

In the southern section, the culvert at SLM 30.22 may need to be widening or reconstructed in a pre-phase to accommodate the proposed cross section regardless of which MOT scheme is selected. The part-width, inside widening scheme would require additional widening of the culvert structure vs. the crossover construction scheme.

Advantages and Disadvantages

Both evaluated MOT schemes provide advantages and disadvantages as it relates to the construction of the project, and anticipated MOT costs. At a high-level, major advantages and disadvantages are presented below:

Part-Width Construction, Inside Widening

Advantages:
- Minimal MOT related impacts to existing structures
- No temporary lighting required
- Limited impact to existing noise walls (northern section)
- Better access options at interchanges and at-grade intersections, especially at Bowen Rd (southern section)
- Shorter construction duration vs. Crossover, potentially as much as half a construction season

Disadvantages:
- Non-concurrent outside construction phases may increase construction duration vs. crossover
- Inside construction may require dedicated construction vehicles ingress/egress points
- Part-Width MOT would place traffic immediately adjacent to active work-zones
- Additional pavement width (beyond proposed final width) required for MOT (southern section)
- Direct impact to existing ODOT ITS equipment
- Optimizing MOT plan for longitudinal phase joint locations may increase temporary pavement needs or require MOT lane width reductions.

Crossover Construction, Outside Widening

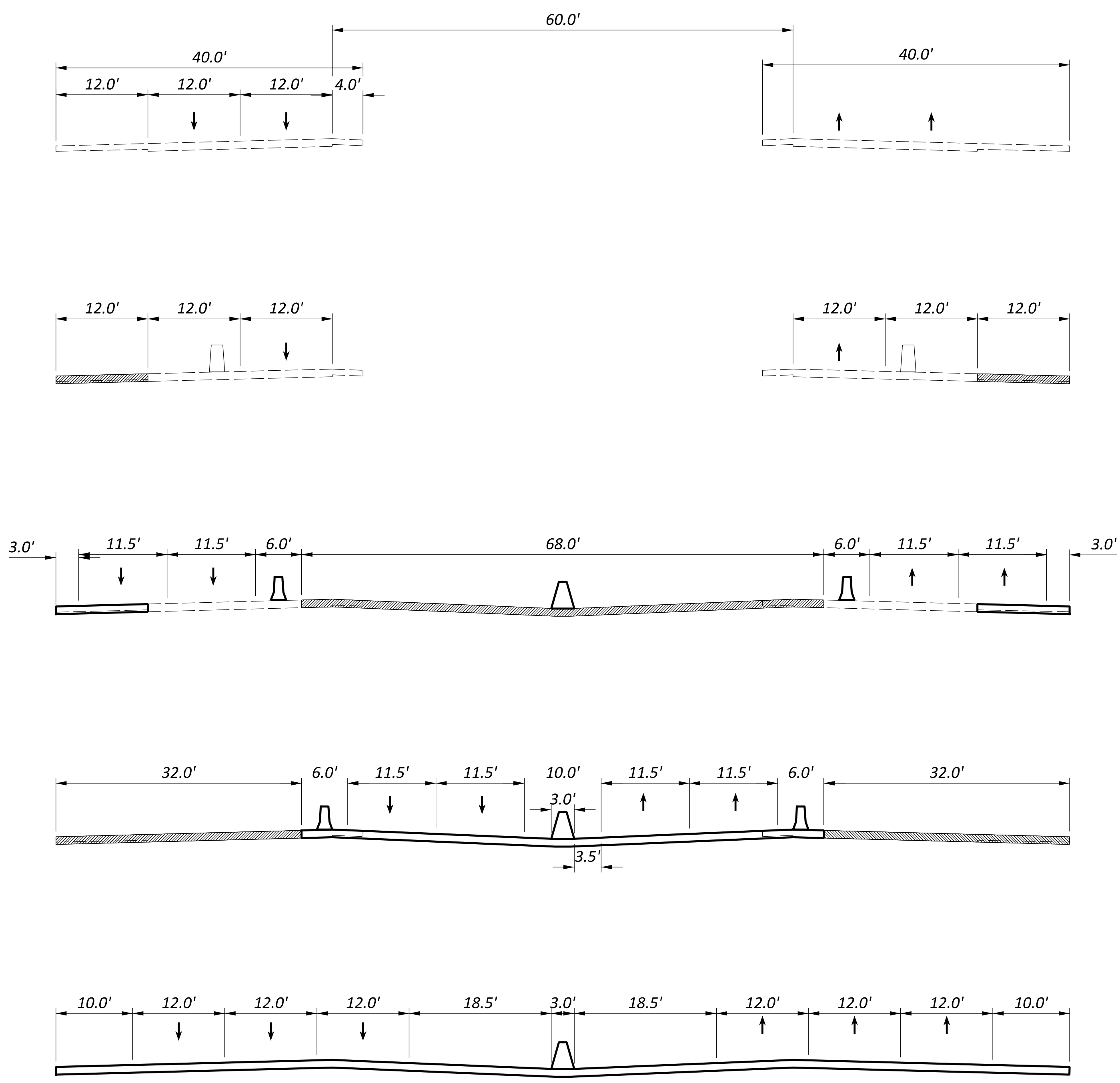
Advantages:
- Efficiencies in construction, can optimize location of crown and joints as necessary
- Possibility of reusing temporary pavement as permanent pavement
- Less temporary pavement required for MOT compared to part-width (**southern section only**)

Disadvantages:
- A pre-phase is likely for structure widening to accommodate MOT and final proposed cross-section
- Impacts to ramp access at interchanges without additional intermediate crossovers
- Each crossover requires a temporary lighting system, access to power may present additional challenges
- Likely impacts to existing noise walls (northern section)
- Access at at-grade interchanges may be difficult to maintain, detours likely
- Maintaining ramp access at US-33/I-270 interchange may be challenging given existing interchange geometry

Conclusions

At a high-level, part width construction with inside widening is the less impactful and less disruptive MOT alternative. There are minimal impacts to existing ROW with the part width/inside widening alternative, and fewer impacts to construction scheduling, duration, and MOT cost compared to the crossover. As noted previously, these conclusions do not replace the analysis of an MOTAA, but provide a high-level overview of potential impacts, advantages, and disadvantages to identify ideal MOT schemes at an early stage of project development.

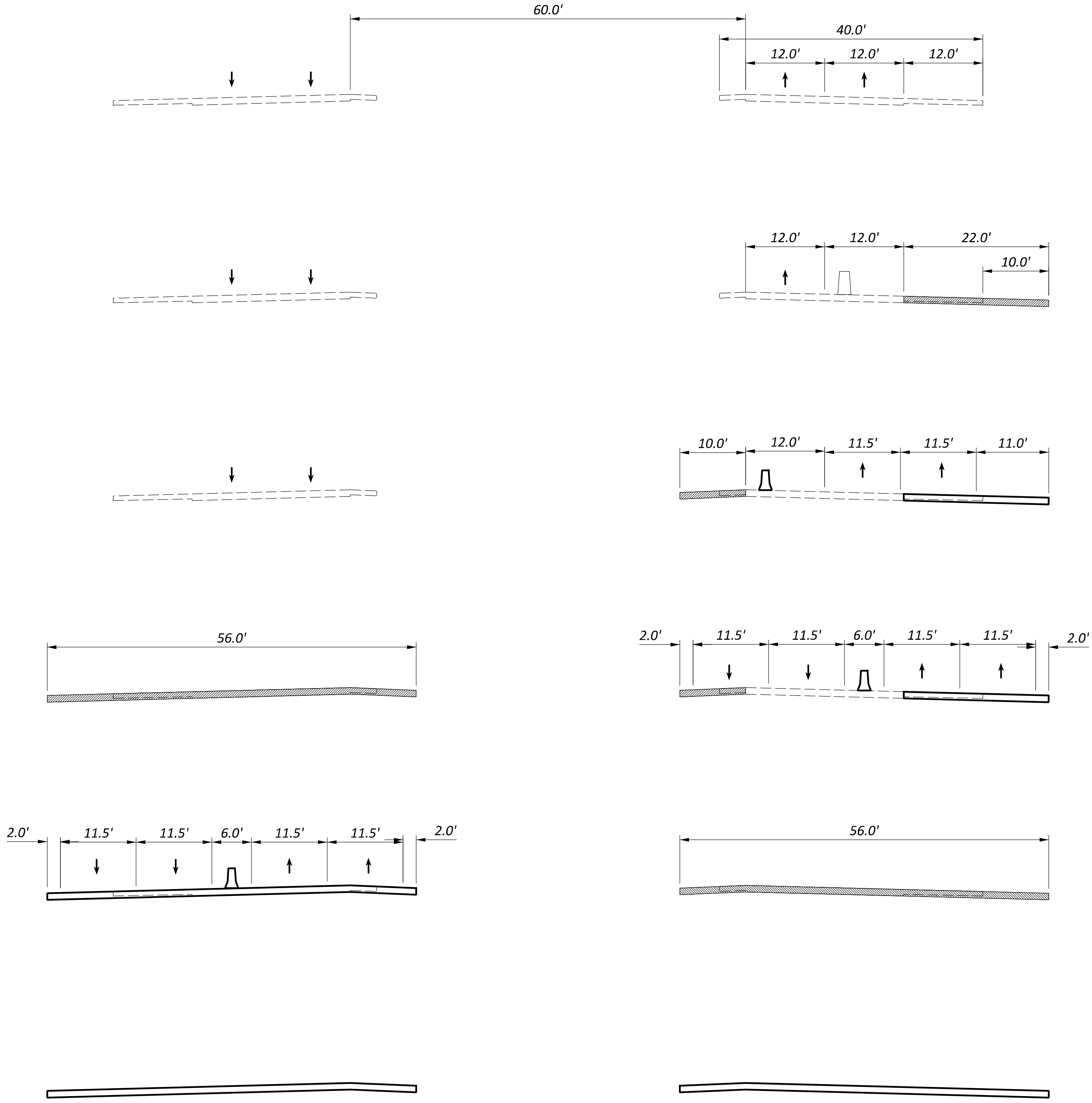
NORTHERN SECTION PART WIDTH



CTY-RTE-SECTION

MODEL: Sheet_SurvFt PAPERSIZE: 17x11 (in.) DATE: 5/10/2024 TIME: 12:13:50 AM USER: Chock
G:\DE\Clients\LJB\10017857_FRA-33-24-76\119387\400-Engineering\MOT\Sheets\119387_MY997.dgn

NORTHERN SECTION CROSSOVER



SHEET P.0 | TOTAL 0

PROJECT ID 0

REVIEWER XXX MM-DD-YY

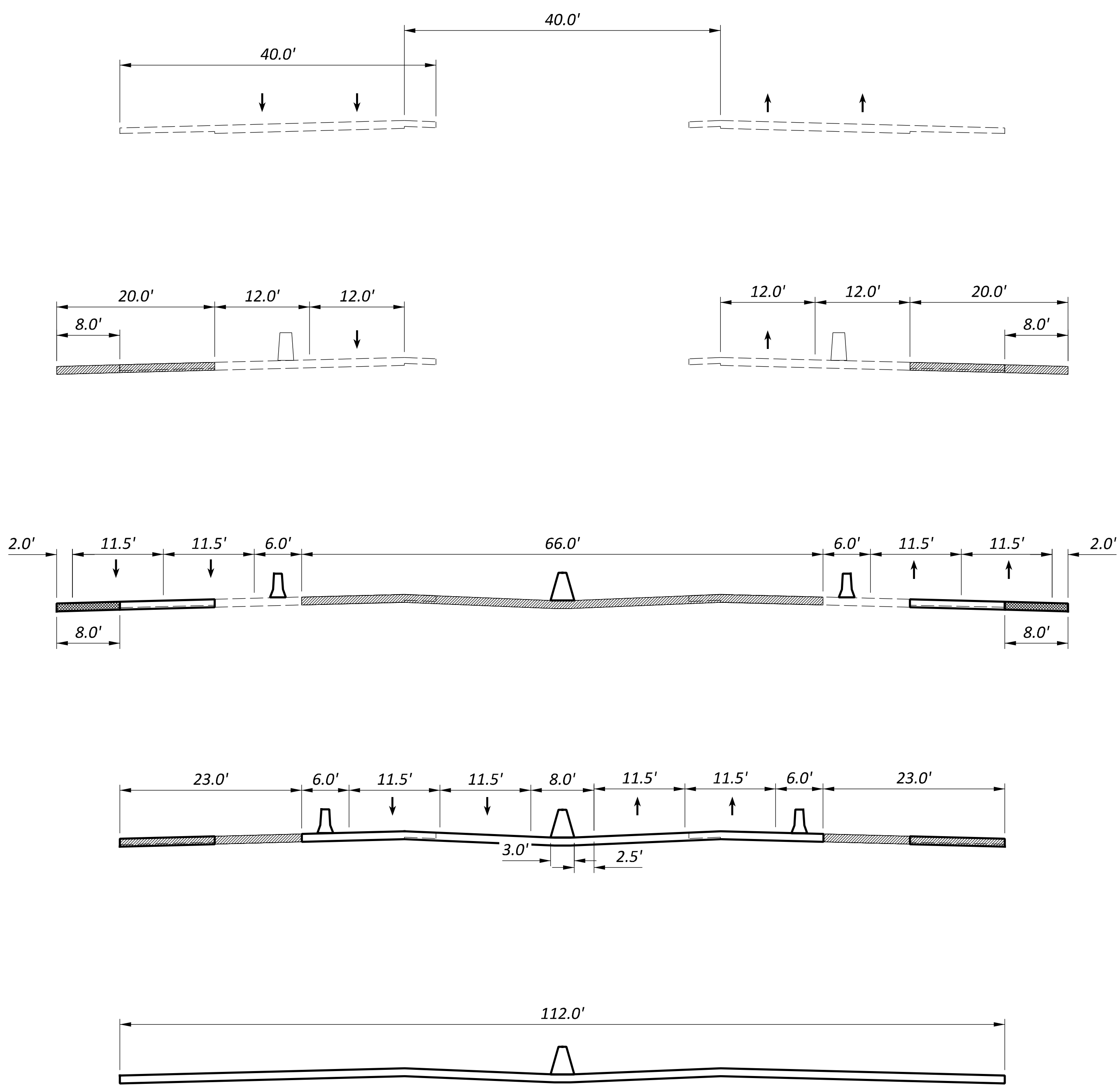
DESIGNER XXX

WOOLPERT

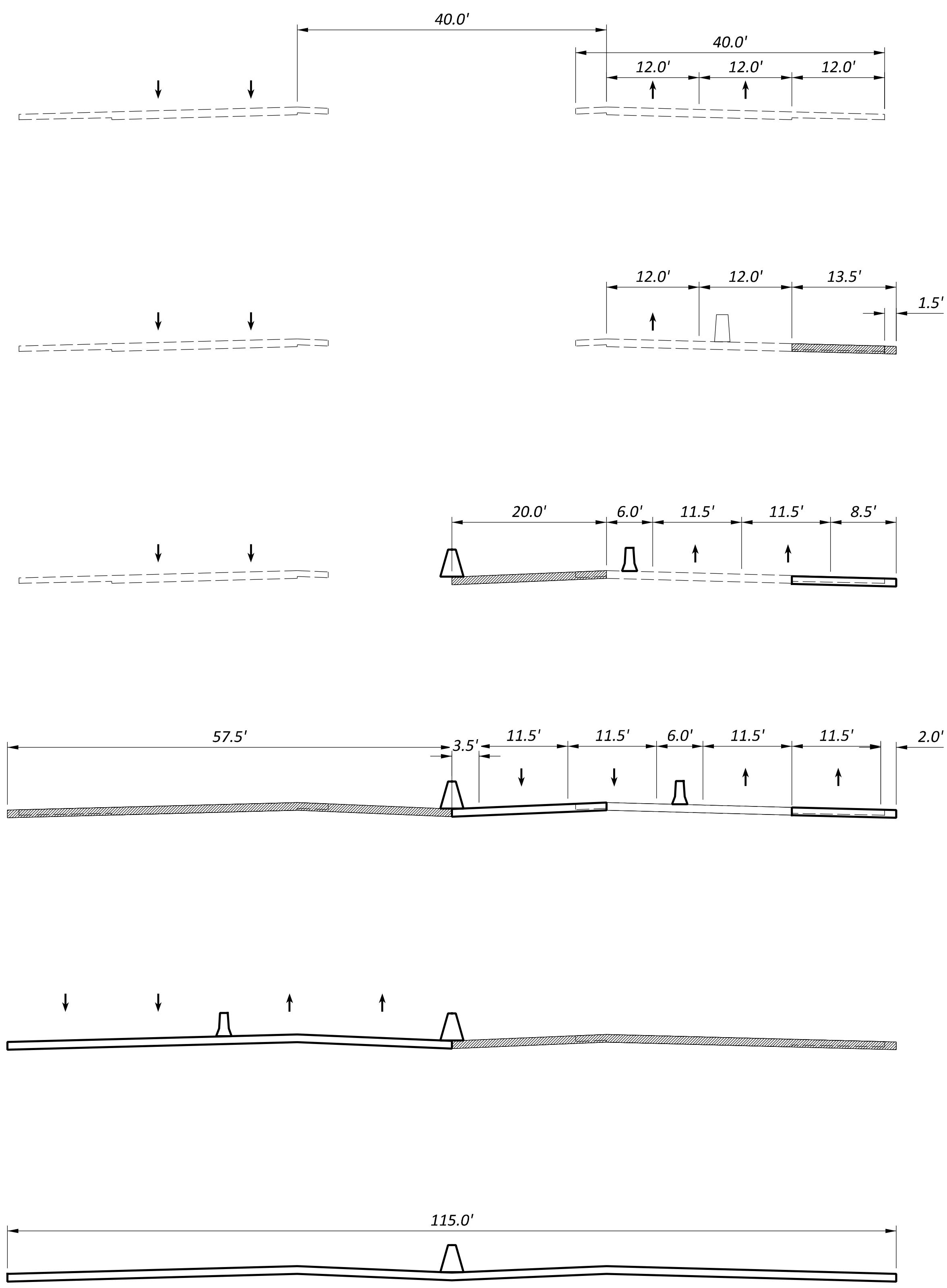
DESIGN AGENCY

SHEET TITLE

SOUTHERN SECTION PART WIDTH



SOUTHERN SECTION CROSSOVER



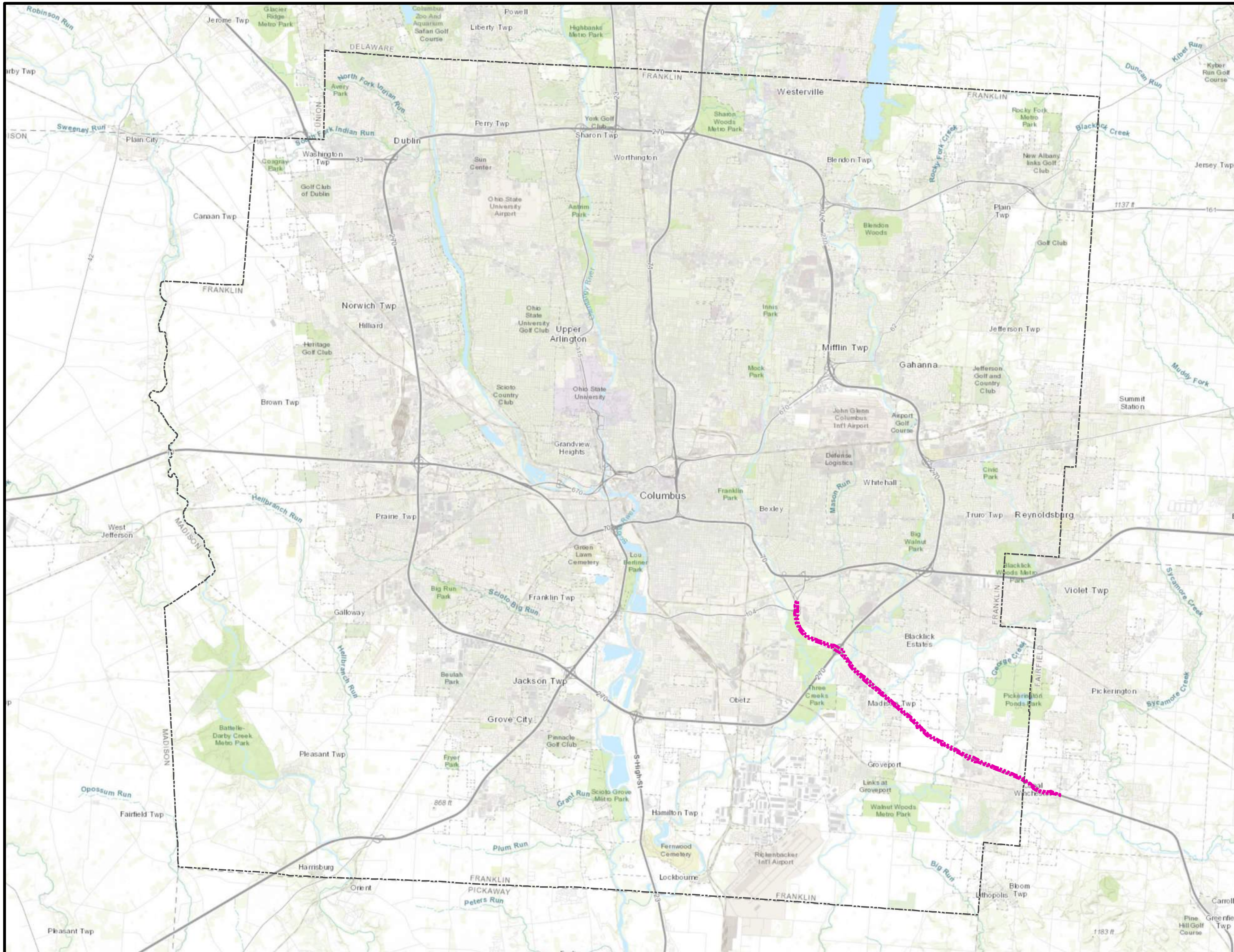
Analysis Area	Northern Section (SR 104 to Gender Rd)							
	Assumed MOT: 11.5 ft Travel Lanes, 2 ft Outside Shoulders, 2 ft Inside Shoulders							
	Inside Widening, Part-Width				Outside Widening, Crossover			
Construction Sequencing	**Phase 1** Construct Inside EB/WB **Likely Phase 0 - Outside Shoulder**		**Phase 2A** Construct Outside EB	**Phase 2B** Construct Outside WB	**Pre-Phase 0B** WB Inside Shoulder Reconstruction	**Pre-Phase 0C** WB Outside Shoulder Reconstruction	**Phase 1** Construct EB	**Phase 2** Construct WB
MOT Cross Section Impacts	None, maintain 2+11.5+11.5+2 = 27 ft on existing and Phase 0 pavement. Phase 0 to be during off-peak single lane closure (see below).		None, utilize Phase 1 New Pavement	None, utilize Phase 1 New Pavement	Maintain single lane during off peak construction with drums	Maintain 2+11.5+11.5+2 on existing and Phase 0B pavement	None, utilize WB pavement constructed in Pre-Phase 0B/C at 2+11.5+11.5+6+11.5+11.5+2 = Final Cross Section = 56 ft	None, utilize EB pavement constructed in Phase 0B/C and Phase 1
Temporary Pavement	Assume reconstruct outside shoulder in Phase 0 = ~10 ft shoulder x 6.5 mi = 38,134 SY District suggestion to complete work during off peak periods with drums (no PCB). **Maintain single lane during shoulder reconstruction.**		None	None	~10 ft shoulder x 6.5 mi = ~38,134 SY District suggestion to complete work during off peak periods with drums (no PCB). **Maintain single lane during shoulder reconstruction.**	~22 ft shoulder x 6.5 mi = ~83,894 SY District suggestion to complete work during off peak periods with drums (no PCB). **Maintain single lane during shoulder reconstruction.**	None	None
PCB Estimated Impacts	Drums (Phase 0) 6.5 mi total length x 2 = 68,640 LF (Phase 1)		6.5 mi = 34,320 LF	6.5 mi = 34,320 LF	400 LF * 4 Structures * 2 Phases * 2 sides = 6,400 LF (Phase 0Aa/b) Otherwise Drums	Drums	6.5 mi = 34,320 LF	6.5 mi = 34,320 LF
Structures Widths (Approximate)	**Big Walnut (x2)** Ex Width: 62 ft EB/50ft WB MOT Width: 38.5 ft (3 lanes) Final Width: 150 ft (one unit)	**Blacklick Creek** Ex Width: 45 ft EB/WB MOT Width: 27 ft (2 lanes) Final Width: 150 ft (one unit)	**Culvert (SLM 27.43)** Ex Width: 40 ft (EB/WB) MOT Width: 27 ft (2 lanes) Final Width: N/A***	**George Creek** Ex Width: 42 ft (EB/WB) MOT Width: 27 ft (2 lanes) Final Width: N/A***	Crossover requires significantly more temporary pavement than part-width construction. **Structure work likely needs to precede pavement construction for ease of construction and timing.** Crossover may necessitate t+G10emporary or phase-length closures of ramps and intersections if additional crossovers for ramps are infeasible. Each crossover requires its own temporary lighting system per MT-100.00			
Structures Impacts	EB bridges can maintain 3 lanes during MOT with inside part width widening of structure. WB bridges can maintain 3 lanes during MOT if necessary. MOT does not exceed final bridge width.	Existing structures can carry 2 lanes MOT for part width construction without exceeding proposed cross section.	Existing structures can carry 2 lanes MOT for part width construction without exceeding proposed cross section.	Existing structures can carry 2 lanes MOT for part width construction without exceeding proposed cross section.	Widen WB Structure in Phase 0Aa/b using part Width Construction to meet final cross section. EB Structure constructed in Phase 1.	Widen WB Structure in Phase 0Aa/b using part Width Construction to meet final cross section. EB Structure constructed in Phase 1.	Widen WB Structure in Phase 0Aa/b using part Width Construction to meet final cross section. EB Structure constructed in Phase 1.	Widen WB Structure in Phase 0Aa/b using part Width Construction to meet final cross section. EB Structure constructed in Phase 1.
Clearance Obstructions Pinch Points	Existing pier cap on Blacklick Trail overpass central pier may create vertical obstruction on shoulder of proposed final cross section. This may be an impediment to future 4 lane section, or any inside HSR. Inside widening will require openings in the construction zone for entry/exit of construction vehicles and machines, this may produce pinch points, or areas that may need to be constructed in a subphase. Existing ITS devices in median.				Existing structures create pinch points for MOT phasing purposes, options include strip widening of bridges, or complete widening of structures to proposed cross section width in pre-phase prior to shoulder reconstruction.			
Ramps Interchanges Intersections	All ramp movements at interchanges (including US-33/I-270 systems interchange can be maintained during inside construction. During outside construction, ramps can be maintained with crossovers through the outside work zone. A subphase may be necessary with a temporary ramp closure to complete work in ramp areas.				Ramps in the normal direction of travel relative to the crossover side can be maintained on existing pavement but would likely have reduced acceleration lengths or would require accelerations lanes on temporary pavement. Ramps opposite the crossover would need additional crossovers to rejoin the MOT section, which would significantly increase MOT pavement/MOT lighting impacts. Access to at-grade intersections likely needs to be significantly restricted or detoured.			
Environmental	Limited to no impact to existing noise walls.				Proposed final cross section may impact existing noise walls.			
General Advantages	Part width construction optimizes impacts to existing structures, and minimizes temporary pavements needs vs. crossover construction. Part-width construction does not require additional temporary lighting (for crossovers). Existing structures can maintain two lanes of travel during construction. Access at interchanges and at-grade intersections can be maintained more easily.				Crossover construction allows the entire cross section to be constructed in one operation, which may optimize joint lines and any modification to the proposed crown. It may be possible to reuse temporary pavement as permanent pavement during Phase 2, which may save time.			
General Disadvantages	While the single inside work zone for both directions may be advantageous, outside work zones likely need to occur separately, which may add time/complexity to construction. Inside construction will need construction vehicle access points. Part-width construction requires work zones to be immediately adjacent to moving traffic. Requires full depth inside shoulders at minimum for MOT purposes.				Crossover requires significantly more temporary pavement than part-width construction. **Structure work likely needs to precede pavement construction for ease of construction and timing**. Crossover may necessitate temporary or phase-length closures of ramps and intersections if additional crossovers for ramps are infeasible. Each crossover requires its own temporary lighting system per MT-100.00			

Analysis Area	Northern Section (SR 104 to Gender Rd)	
	Inside Widening, Part-Width	Outside Widening, Crossover
Construction Sequencing	Some Constraints	Less Advantageous
MOT Cross Section Impacts	Limited Constraints	Limited Constraints
Temporary Pavement	Some Constraints	Less Advantageous
PCB Estimated Impacts	Some Constraints	Limited Constraints
Structures Widths (Approximate)	Limited Constraints	Less Advantageous
Structures Impacts	Limited Constraints	Limited Constraints
Clearance Obstructions Pinch Points	Some Constraints	Limited Constraints
Ramps Interchanges Intersections	Limited Constraints	Less Advantageous
Environmental	Limited Constraints	Limited Constraints
General Advantages	Limited Constraints	Limited Constraints
General Disadvantages	Some Constraints	Less Advantageous

Analysis Area	Southern Section (Gender Rd to Diley Rd)							
	Assumed MOT: 11.5 ft Travel Lanes, 2 ft Outside Shoulders, ~1.5-2 ft Inside Shoulders							
	Inside Widening, Part-Width				Outside Widening, Crossover			
Construction Sequencing	**Phase 0** Temporary Pavement for Outside Shoulder	**Phase 1** Construct Inside	**Phase 2A** Construct Outside EB	**Phase 2B** Construct Outside WB	**Pre-Phase 0B** WB Inside Shoulder Reconstruction (Phase 0B assumes a Phase 0Aa/b in Northern Section)	**Pre-Phase 0C** WB Outside Shoulder Reconstruction	**Phase 1** Construct EB	**Phase 2** Construct WB
MOT Cross Section Impacts	Maintain 2+11.5+11.5+2 on existing inside pavement (partial MOT travel lane on existing shoulder).	None, utilize existing pavement and Phase 0 pavement.	None, utilize Phase 1 pavement	None, utilize Phase 1 pavement	Maintain 2+11.5+11.5+2 on existing inside pavement (partial MOT travel lane on existing shoulder).	Maintain 2+11.5+11.5+2 on Phase 0B and existing pavement. Phase 0C widening will result in MOT cross section that exceeds final cross section by 1.5 ft.	None, utilize WB pavement constructed in Pre-Phase 0B/C at 2+11.5+11.5+6+11.5+11.5+2 = 56 ft > 54.5 ft proposed.	Approximately 1.5 ft of additional pavement width required in WB section to maintain proposed MOT section of 2+11.5+11.5+6+11.5+11.5+2 = 56 ft > 54.5 ft proposed.
Temporary Pavement	Part-width construction requires approximately 8 ft of additional widening for temporary pavement, this pavement can ultimately be removed for the final section if desired, but additional widening may cause slope/drainage issues not currently anticipated. 8 additional ft + 12 ft = 20 ft 20 ft x 2.7 mi x 2 sides = 63,360 SY **Maintain single lane during shoulder reconstruction.**	None	None	None	Construct full depth shoulder on WB inside and final median barrier. ~20 ft x 2.7 mi = 31,680 SY **Maintain single lane during shoulder reconstruction.**	Construct full depth shoulder on WB outside pavement. 13.5 ft x 2.7 = 21,384 SY **Maintain single lane during shoulder reconstruction.**	Additional EB pavement for EB crossover during phase 2 = 1.5 ft x 2.7 mi = 2,376 SY	None
PCB Estimated Impacts	Drums (See Northern Section Discussion on District Preference)	2.7 mi x 2 sides = 28,512 LF	2.7 mi x 1 side = 14,256 LF	2.7 mi x 1 side = 14,256 LF	Drums (See Northern Section Discussion on District Preference)	Drums (See Northern Section Discussion on District Preference)	2.7 mi x 1 side = 14,256 LF	2.7 mi x 1 side = 14,256 LF
Structures Widths (Approximate)	None, See Below				None, See Below			
Structures Impacts	Culvert (SLM 30.22) requires further exploration as to potential widening or reconstruction necessary to accommodate future condition EOP and loading.				Culvert (SLM 30.22) requires further exploration as to potential widening or reconstruction necessary to accommodate future condition EOP and loading.			
Clearance Obstructions Pinch Points	Existing culvert at SLM 30.22				Existing culvert at SLM 30.22			
Ramps Interchanges Intersections	No interchange impacts. Access to Bowen Rd intersection may need to be restricted or detoured during outside construction.				No interchange impacts. Partial closure of Bowen Rd intersection likely based on which phase of construction is active.			
Environmental	No noise walls present, impacts to Culvert at SLM 30.22 should be investigated further.				No noise walls present, impacts to Culvert at SLM 30.22 should be investigated further.			
General Advantages	Better access options for Bowen Rd intersection.				Rural section decreases complexity for crossover (eg ramps/intersections). Requires less temporary pavement than part width construction due to existing and proposed cross sections. Crossover construction allows for more flexibility in joint locations and flexibility with the placement of the final crown.			
General Disadvantages	Inside construction will require access points for construction vehicles and machines. Requires more temporary pavement than crossover construction, and requires 8 ft beyond proposed EOP. Phase 0 may add some time to construction duration. Modification of the crown vs. existing may add complexity to a part-width operation.				Significant temporary pavement needs vs. part-width construction. Proposed MOT section for crossover exceeds proposed final section by approximately 1.5 ft. Temporary or Phase-Length closures at Bowen Rd likely in crossover construction.			

Analysis Area	Southern Section (Gender Rd to Diley Rd)	
	Inside Widening, Part-Width	Outside Widening, Crossover
Construction Sequencing	Limited Constraints	Less Advantageous
MOT Cross Section Impacts	Limited Constraints	Less Advantageous
Temporary Pavement	Less Advantageous	Some Constraints
PCB Estimated Impacts	Some Constraints	Some Constraints
Structures Widths (Approximate)	Some Constraints	Some Constraints
Structures Impacts	Less Advantageous	Less Advantageous
Clearance Obstructions Pinch Points	Some Constraints	Some Constraints
Ramps Interchanges Intersections	Limited Constraints	Limited Constraints
Environmental	Limited Constraints	Limited Constraints
General Advantages	Limited Constraints	Limited Constraints
General Disadvantages	Some Constraints	Less Advantageous

APPENDIX K:
Environmental Studies



Overview of Ohio

Legend

Franklin County

Study Area

N

0 1 2 4 Miles

FRA/FAI-33-22.99/0.00
PID: 121811

Franklin County Map with an Overview of Ohio

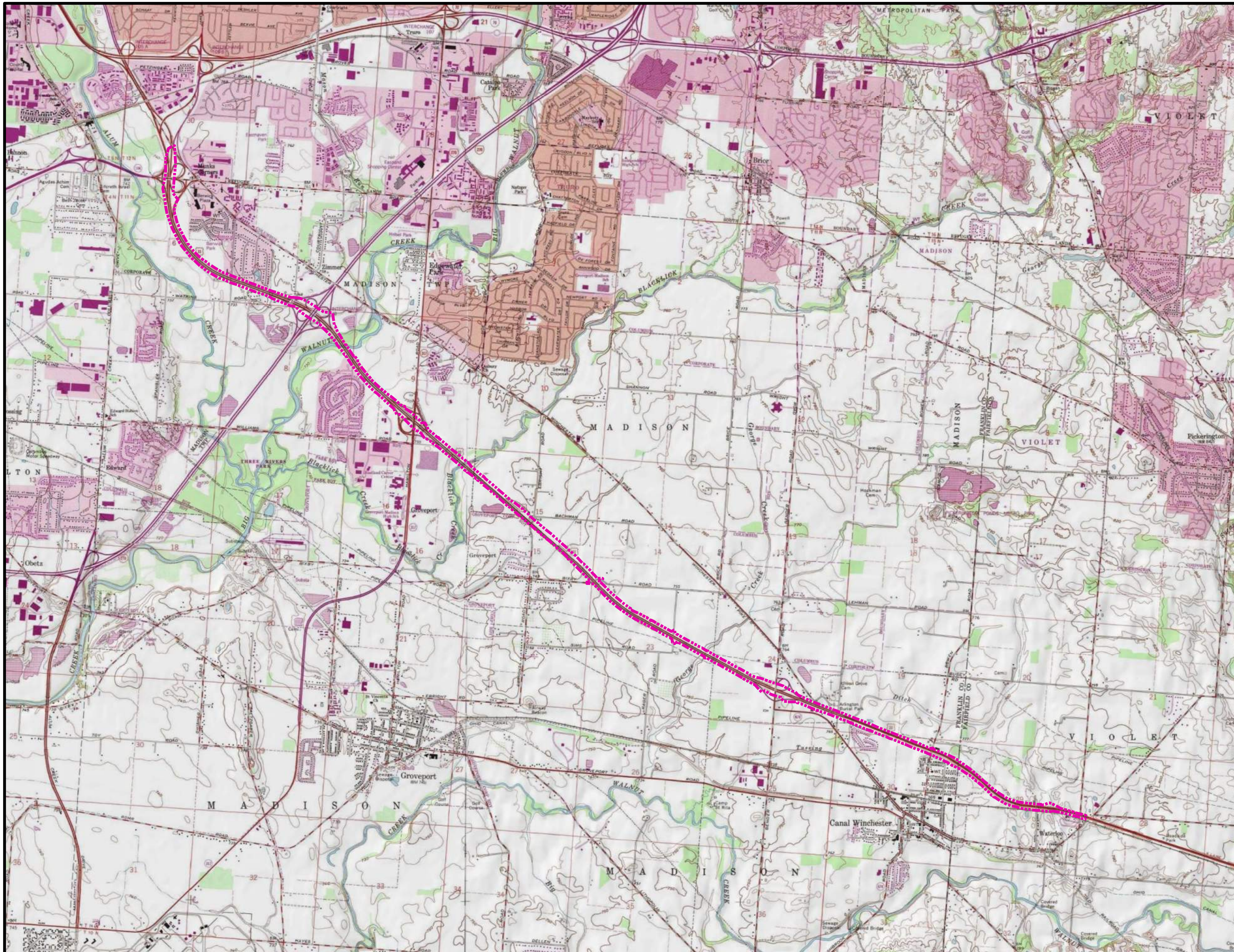
Lawhon & Associates, Inc.

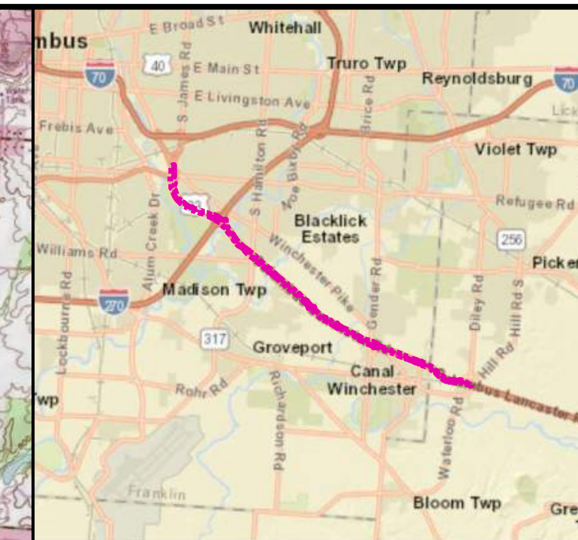
Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	1

Source: Esri World Topo

File Name: 01-County.mxd

Edited: 7/24/2024 By: dwilliams





Site Location Map

Legend

Study Area

N

0 2,000 4,000 8,000 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

USGS Topographic Map SE Columbus, Reynoldsburg, Canal Winchester Quads

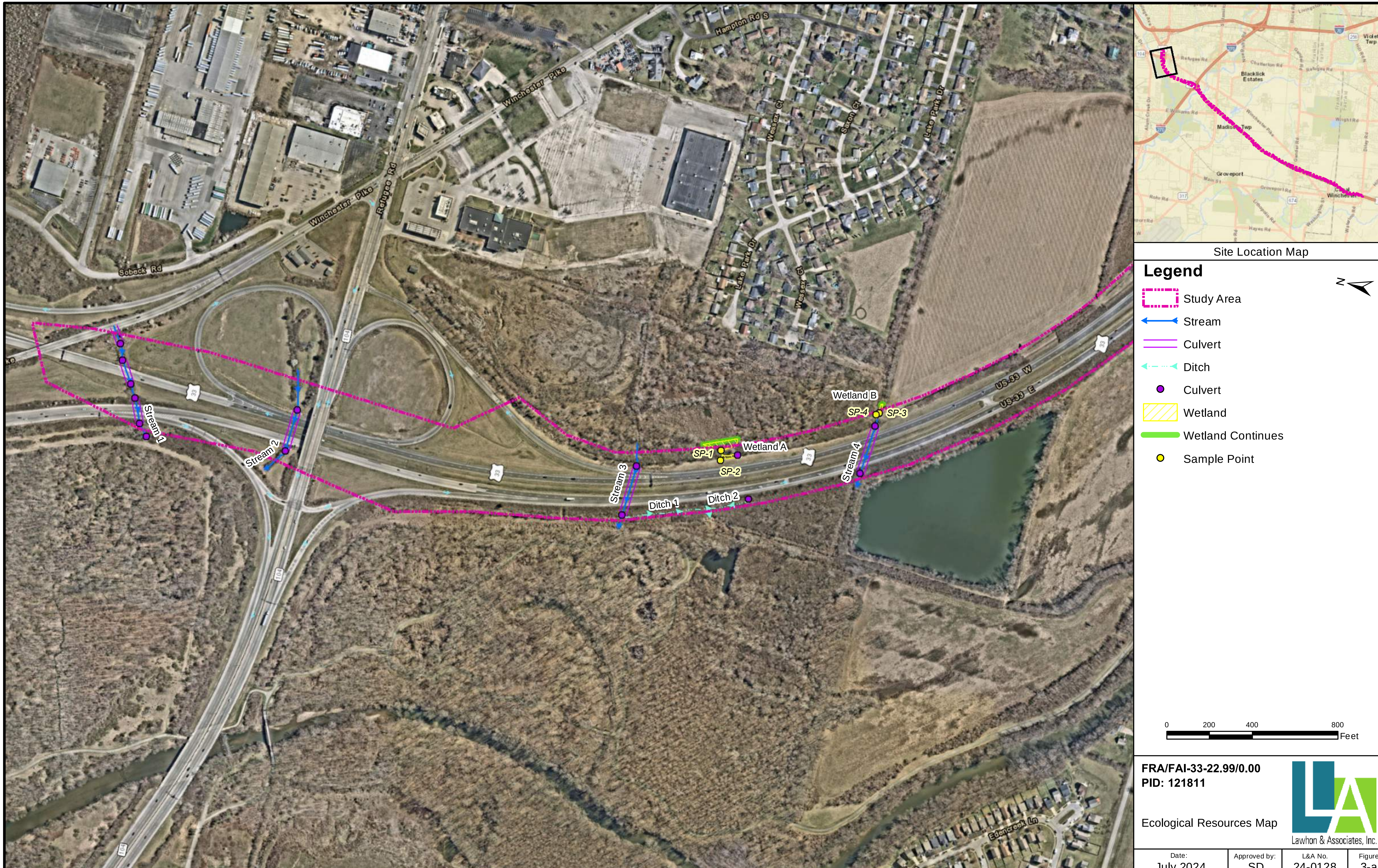
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	2

Source: Esri USA Topo

File Name: 02-Topo.mxd

Edited: 7/24/2024 By: dwilliams



FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

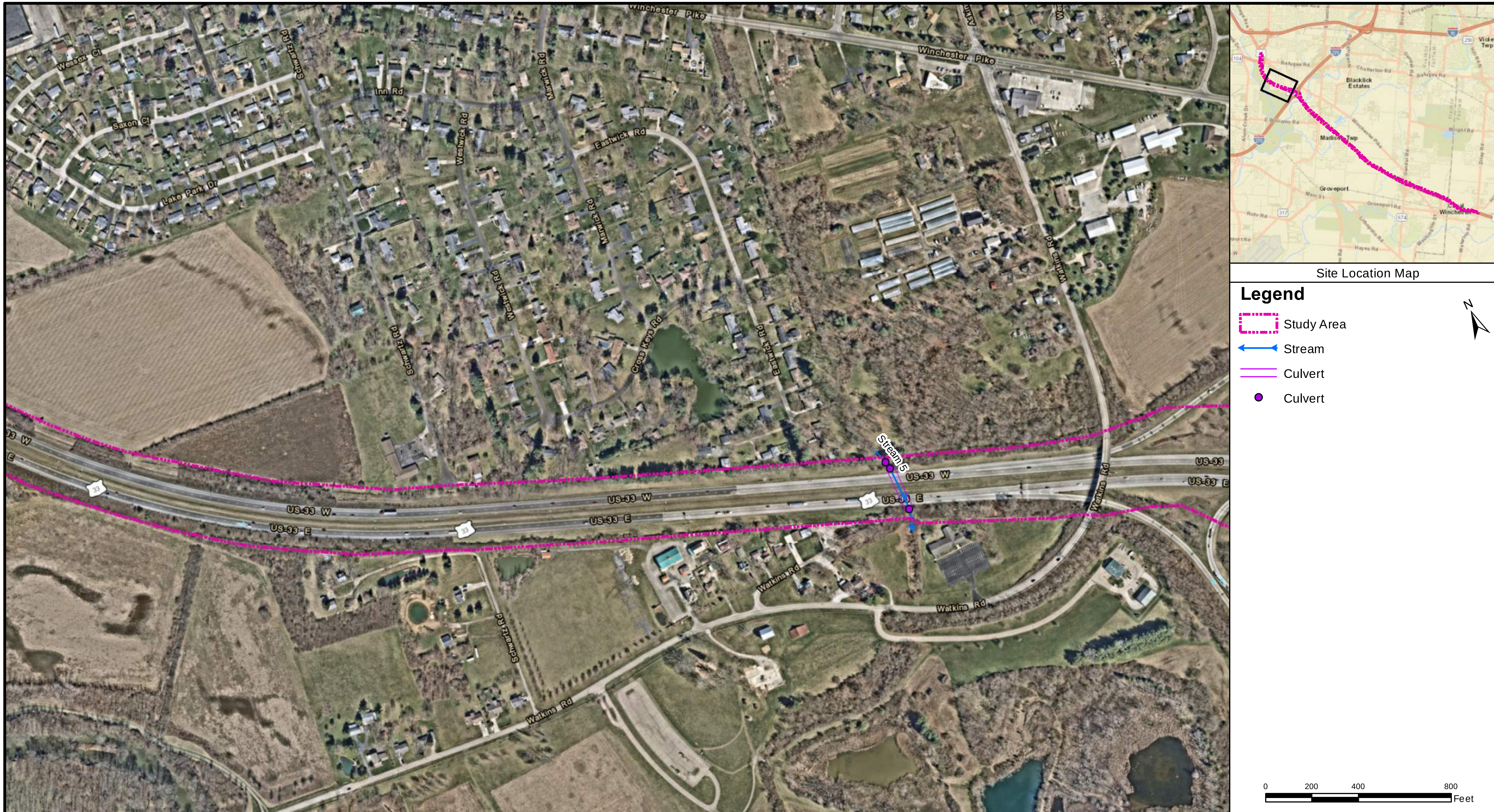
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-a

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

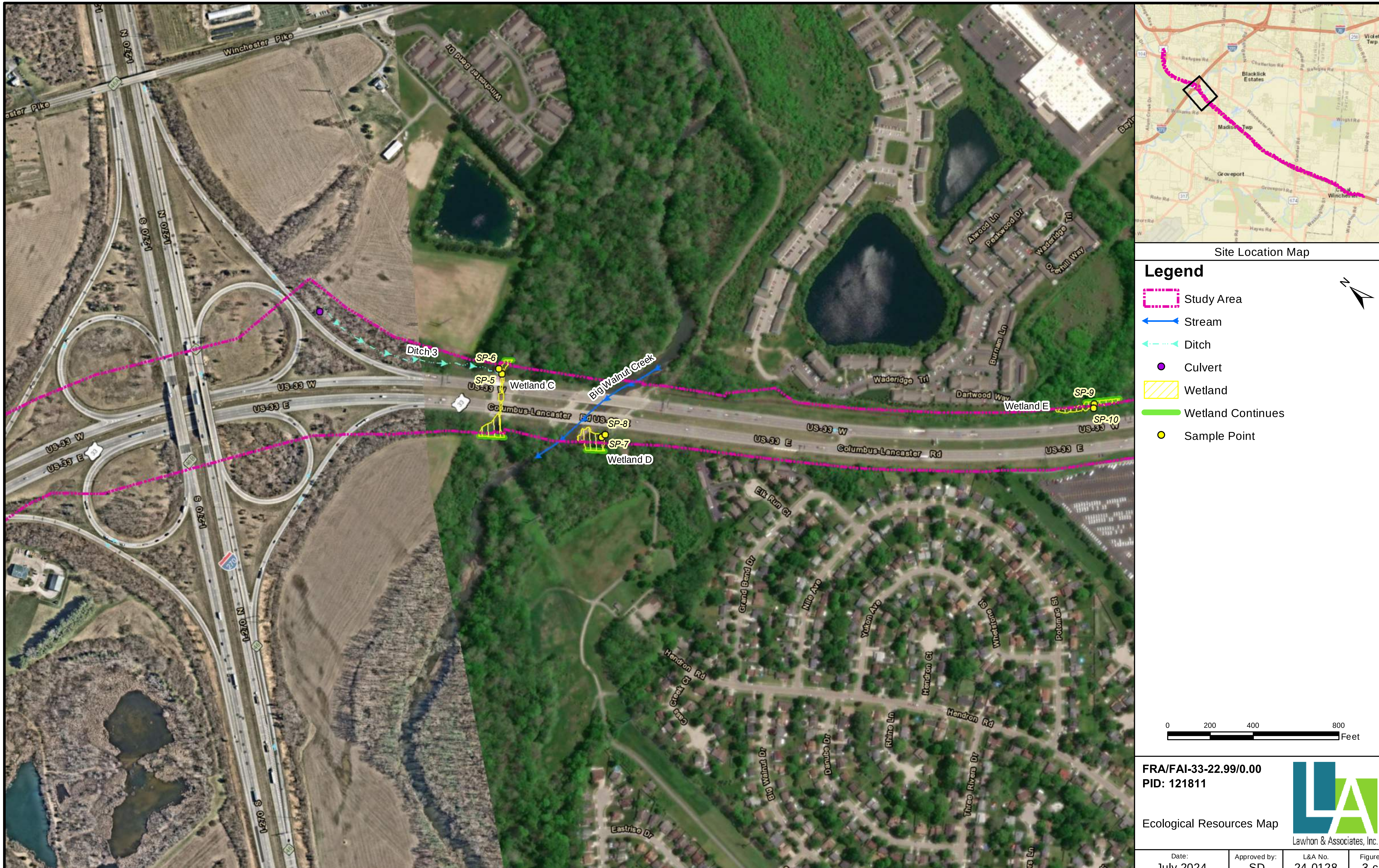
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-b

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

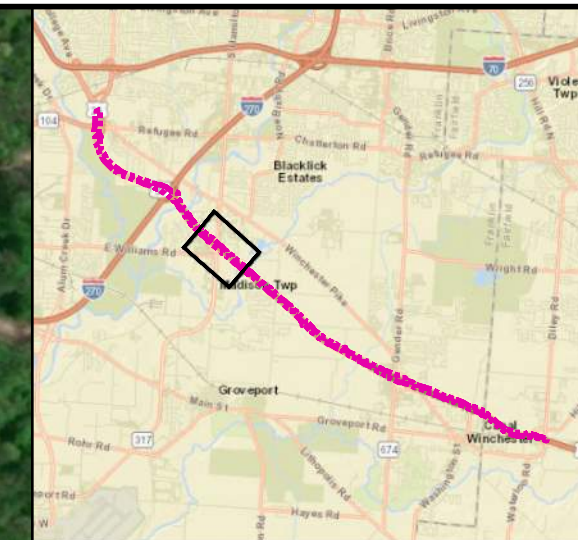
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-c

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Site Location Map

Legend

- Study Area
- Stream
- Wetland
- Wetland Continues
- Sample Point

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

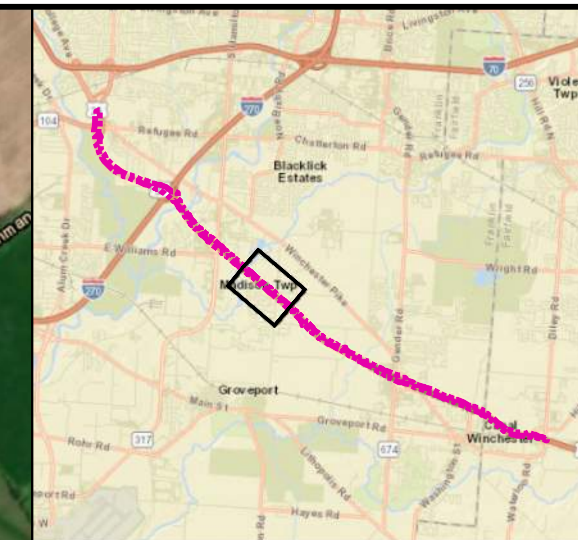
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-d

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Site Location Map

Legend

- Study Area
- Stream
- Wetland
- Sample Point

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

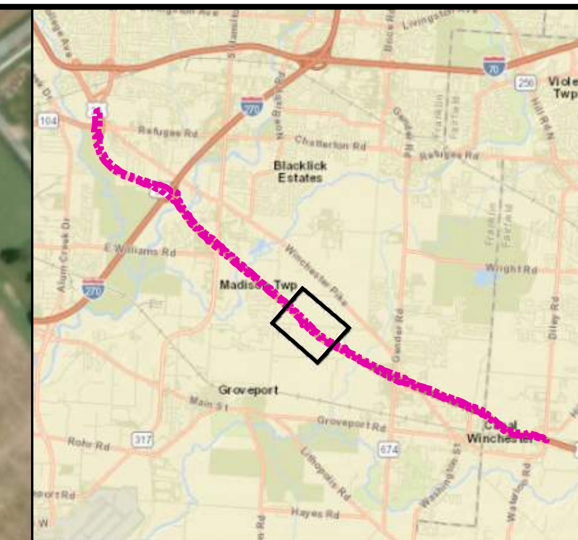
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-e

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Site Location Map

Legend

- Study Area
- Stream
- Wetland
- Sample Point

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

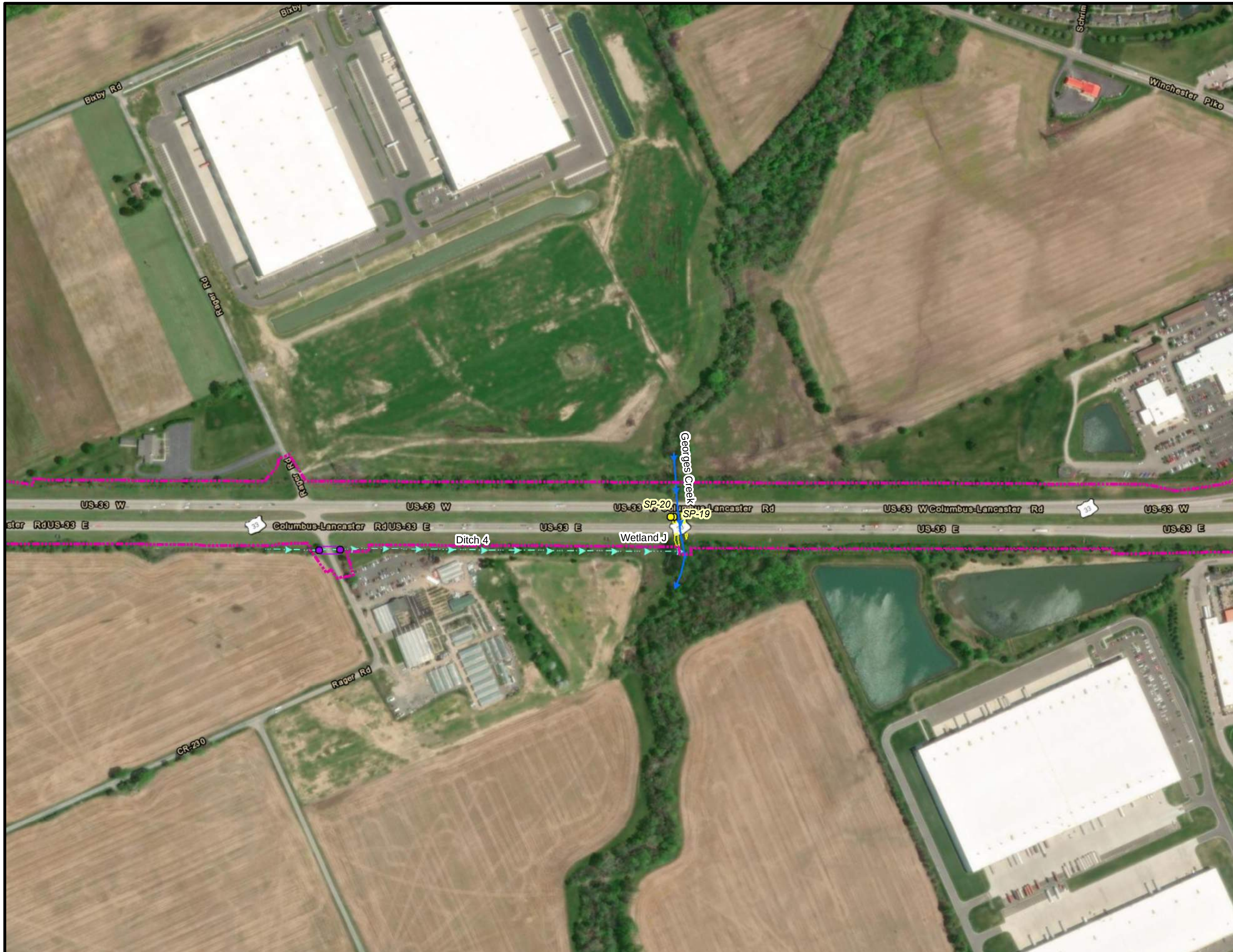
Lawhon & Associates, Inc.

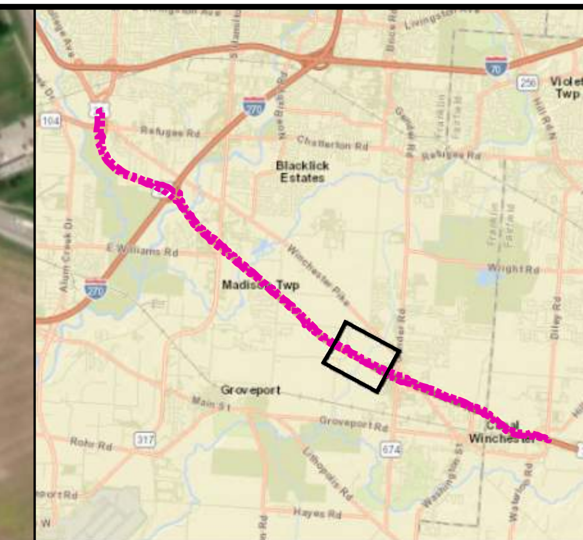
Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-f

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams





Site Location Map

Legend

- Study Area
- Stream
- Culvert
- Ditch
- Culvert
- Wetland
- Sample Point

N

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

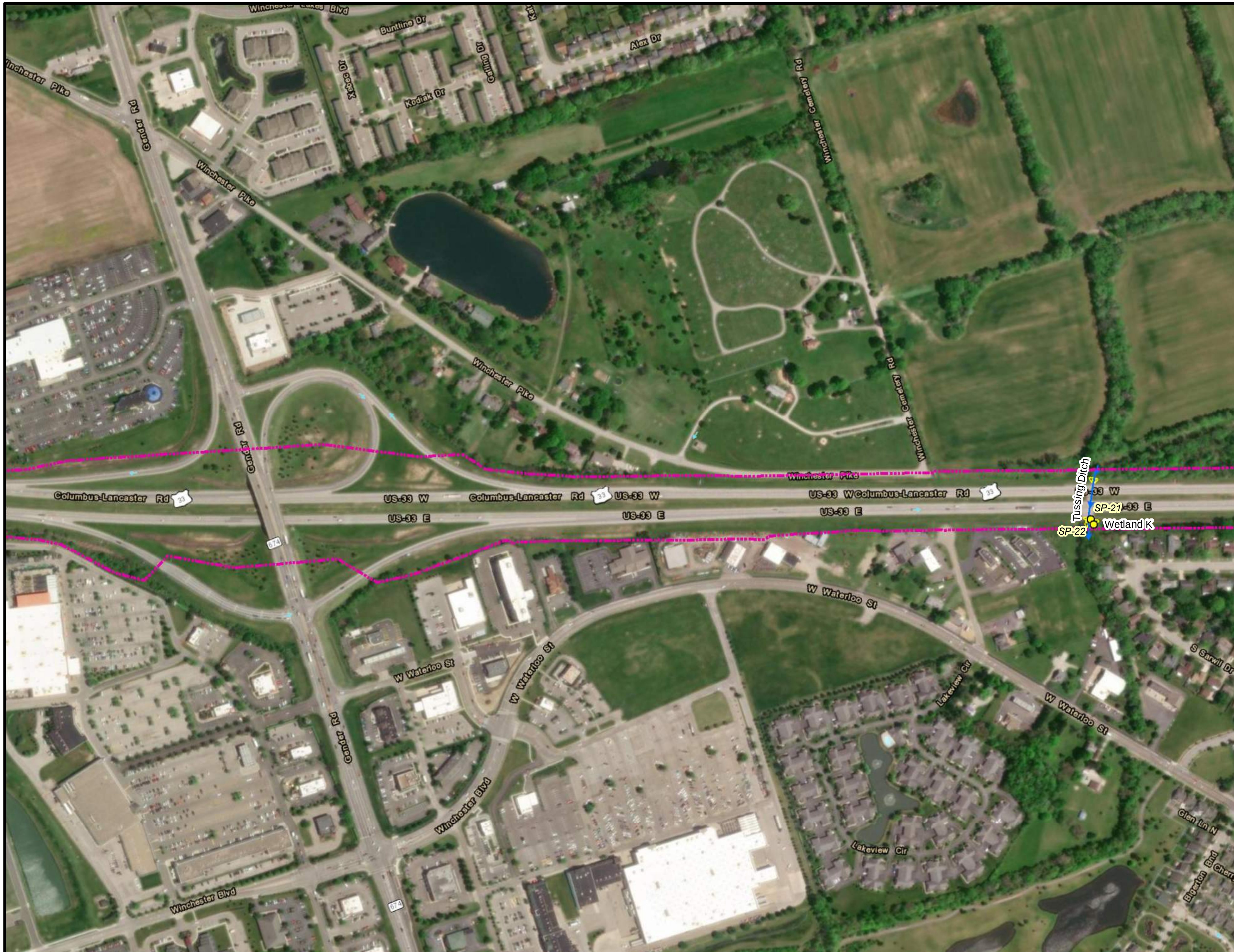
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-g

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Legend

- Study Area
- Stream
- Wetland
- Sample Point

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

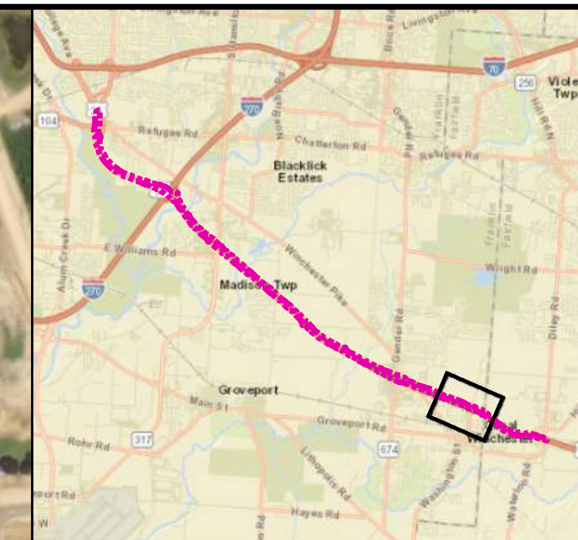
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-h

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Site Location Map

Legend

Study Area

N

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

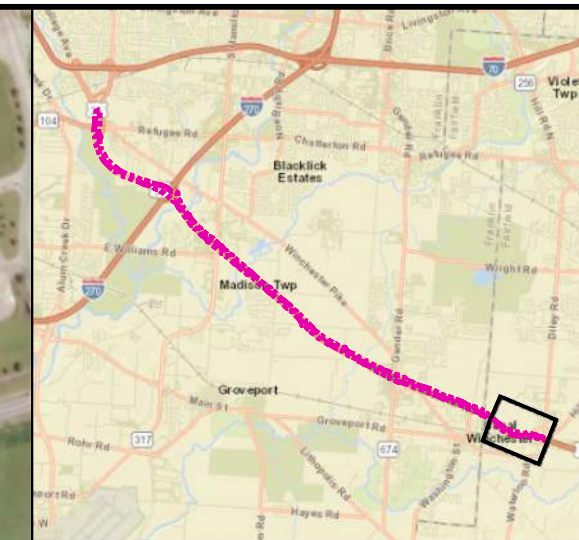
Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-i

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams



Site Location Map

Legend

- Study Area
- Stream
- Culvert
- Culvert
- Wetland
- Wetland Continues
- Sample Point

N

0 200 400 800 Feet

FRA/FAI-33-22.99/0.00
PID: 121811

Ecological Resources Map

Lawhon & Associates, Inc.

Date:	Approved by:	L&A No.	Figure
July 2024	SD	24-0128	3-j

Source: Esri World Imagery

File Name: 03-Eco.mxd

Edited: 7/24/2024 By: dwilliams

APPENDIX L:
Draft Noise Wall Preliminary Placement Plan

FRA/FAI-33-22.99/0.00 (PID 121811)
Noise Wall Preliminary Placement Plan (NWPPP)

Executive Summary

ODOT has proposed the widening of United States Route 33 (US 33) from the Refugee Road/US 33 interchange, an approximate distance of 9.25 miles to the Diley Road/US 33 interchange. The project proposes the construction of new travel lanes in each direction on the inside of the existing US 33 roadway. Major interchanges with US 33 along the project corridor are at I-270, SR 317 (Hamilton Road), and Gender Road. No modification or reconstruction is proposed at any of the interchanges. The study area and project location are shown on Figure 1.

A noise analysis was prepared for all noise sensitive receivers (NSA) located within 500 feet of the existing driving lanes along US 33 from approximately one-half mile west of the US 33/ Refugee Road interchange to approximately one-half mile east of the US 33/Diley Road interchange.

As shown on Figure 2,twelve NSAs were identified as being located within the project limits. Four of the twelve NSAs currently have noise barrier walls constructed as part of previous projects. The noise analysis included the evaluation of the existing noise barrier walls to determine if they would continue to provide a high level of noise abatement with the increase in traffic volume as a result of the proposed project. The noise analysis determined that noise sensitive receptors located within all eight of the NSAs without existing noise barriers would experience traffic noise levels above the applicable FHWA Noise Abatement Criteria (NAC) in the design year with construction of the proposed project. All four of the existing noise barriers would continue to provide a similar level of noise abatement in the design year with construction of the proposed project

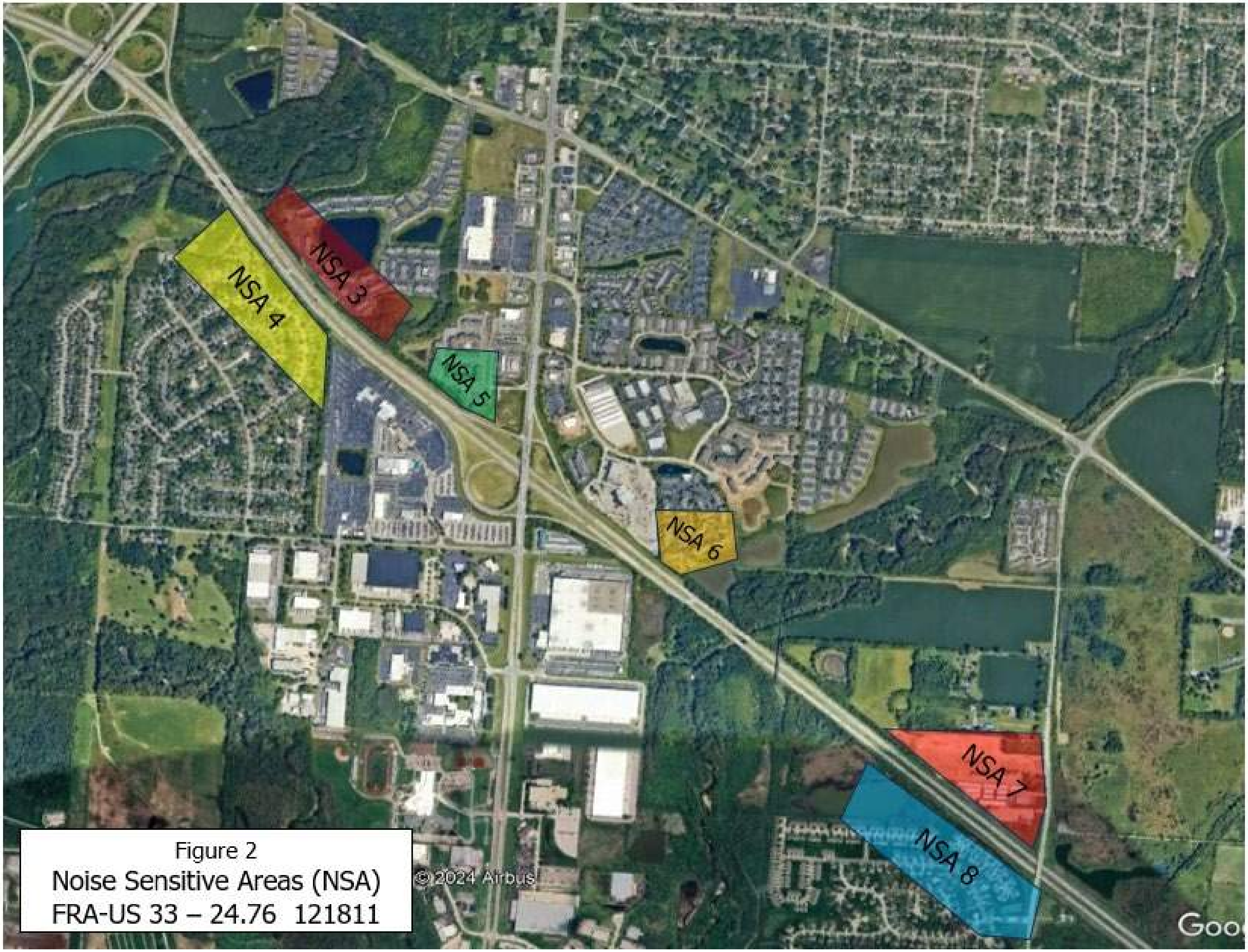
Noise abatement, in the form of noise barrier walls, was considered at eight NSAs. In general, two noise barrier wall location scenarios were evaluated for each of the NSAs with identified noise impact. A noise barrier wall located along the edge of shoulder (EOS) and a noise barrier wall located along the right of way line (ROW) were evaluated for most NSAs. ODOT recommended preliminary barrier locations and lengths for four NSAs where only one barrier location was evaluated.

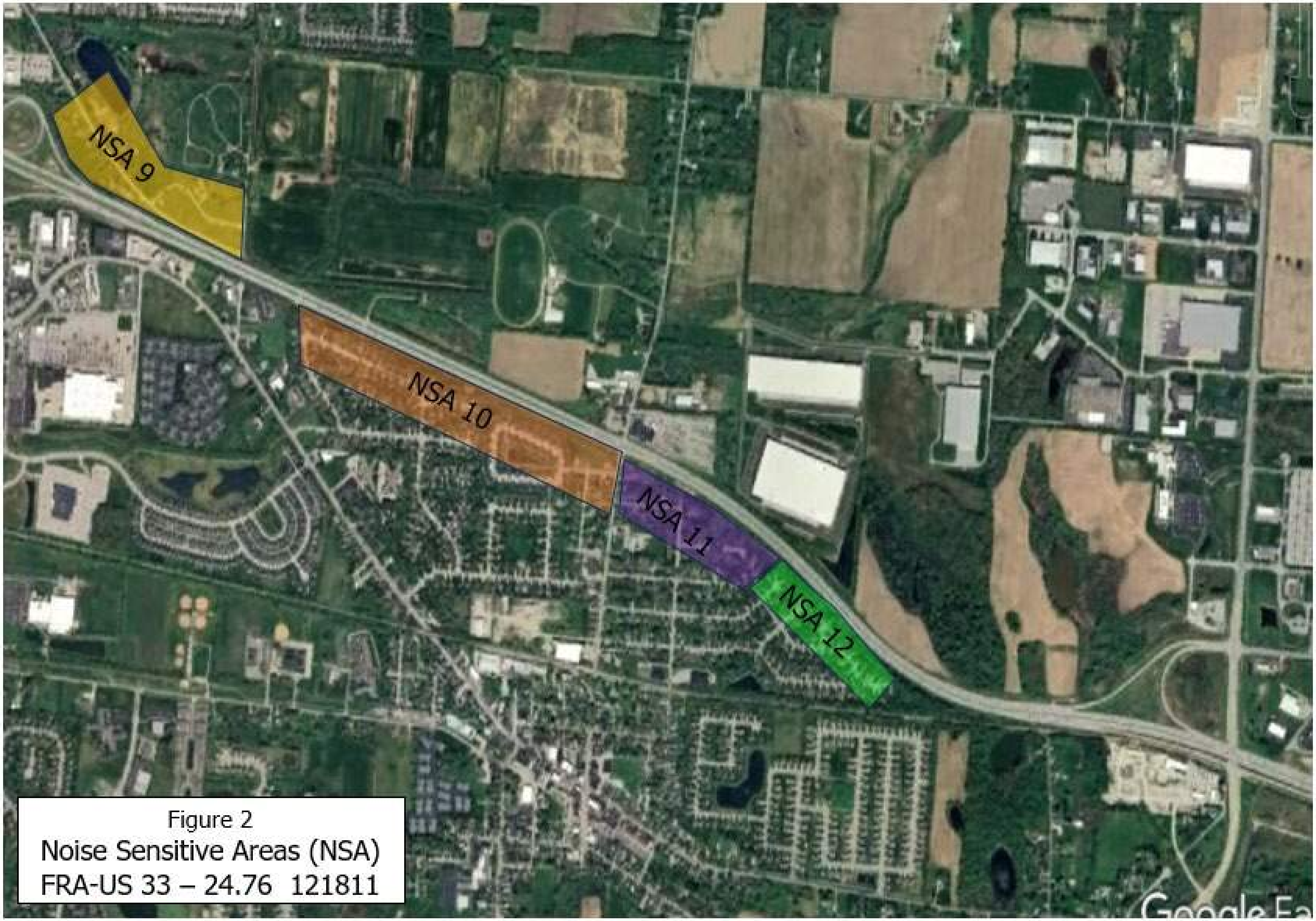
- <u>NSA 1</u> - Two noise barrier wall location scenarios were evaluated for NSA 1. Both scenarios could provide a substantial reduction in noise level for receptors in NSA 1; however, no scenario could meet the cost reasonable criterion of $56,000 per benefited receptor. The noise receptors within the NSA are spread too far apart resulting in the need for a long noise barrier wall pushing the cost above the reasonable criterion. **No noise barrier wall is recommended for construction at NSA 1.**

- <u>NSA 2</u> - There is a group of eight homes and a church near the east side of NSA 2. Two homes located on the north end of Swartz Road near the west side of NSA 2 are too isolated (600' to 1,300') from the main group of receptors and were not included in the abatement analysis. Two noise barrier wall locations were analyzed for NSA 2 and both were able to provide a substantial noise reduction; however, neither scenario could meet the cost reasonable criterion of $56,000 per benefited receptor. There are too few receptors in this NSA to be cost reasonable. A noise barrier wall at NSA 2 would not be

Figure 1
Project Location Map
FRA-US 33–24.76 121811

Figure 2
Noise Sensitive Areas (NSA)
FRA-US 33 – 24.76 121811


NSA 3
NSA 4
NSA 5
NSA 6
NSA 7
NSA 8
©2024 Airbus
Figure 2
Noise Sensitive Areas (NSA)
FRA-US 33 – 24.76 121811


NSA 9
NSA 10
NSA 11
NSA 12
Figure 2
Noise Sensitive Areas (NSA)
FRA-US 33 – 24.76 121811

- considered a feasible and reasonable noise abatement measure. **No noise barrier wall is recommended for construction at NSA 2.**

- NSA 3 – NSA 3 is a large multi-family residential community on the north side of US 33 located approximately one-half mile east of I-270. Almost all of the noise sensitive receptors in NSA 3 have areas for frequent outdoor use that face away from US-33. The receptors are shielded from traffic noise from US 33 by the building location itself and/or by garages that are located along the right of way line. The US 33 roadway and the noise receptors in NSA 3 are situated at about the same elevation. For drainage purposes, there is a low area that runs along the right of way line directing drainage to the west. Due to this low area, the right of way line is six to eight feet lower than both the roadway and the receptors. Locating a noise barrier wall along the EOS takes advantage of higher elevation compared to the ROW. Positioning a noise barrier wall along the ROW would require a much higher noise barrier wall to break the line of sight between the traffic on US 33 and the receptors. For this reason, a noise barrier wall was not modeled along the ROW. A noise barrier wall along the EOS can provide a substantial reduction in noise level but it cannot meet the $56,000 cost reasonable criterion. **No noise barrier wall is recommended for construction at NSA 3.**

- NSA 4 - NSA 4 is a large residential development on the south side of US 33 located approximately one-half mile east of I-270. A noise barrier wall, constructed as part of a previous project is situated along the south EOS of US 33. According to the ODOT Transportation Information Mapping System (TIMS) the noise barrier is 1,884 feet in length and a height of 14 feet. The existing noise barrier wall was re-evaluated using the updated traffic volumes for this project. The results showed that the existing noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the development. **The existing noise barrier wall at NSA 4 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**

- NSA 5 – NSA 5 is a multi-family residential community located to the east of NSA 3 and about 1,000 feet west of SR 317. A noise barrier wall along the edge of clear zone (EOCZ) at a length of 1,426 feet at a height of 14 feet was found to be both a reasonable and feasible noise abatement measure for the receivers in NSA 5. **A noise barrier wall is recommended for construction at NSA 5 as part of the project.**

- NSA 6 - NSA 6 is a multi-family residential development on the north side of US 33 located approximately 0.3 mile east of SR 317. A noise barrier wall, constructed as part of a previous project is situated along the south EOS of US 33. According to the ODOT TIMS, the noise barrier is 580 feet in length and a height of 16 feet. The existing noise barrier wall was re-evaluated using the updated traffic volumes for this project. The results showed that the existing noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the development. **The existing noise barrier wall at NSA 6 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**

- NSA 7 – NSA 7 is a newer multi-family residential development on the north side of US 33 situated about 1,200 feet west of the Ebright Road overpass. A noise barrier wall along the ROW at a length of 964 feet at a height of 17 feet was found to be both a reasonable and feasible noise abatement measure for the receivers in NSA 7. **A noise barrier wall is recommended for construction at NSA 7 as part of the project.**

- NSA 8 - NSA 8 is a large residential development on the south side of US 33 located just west of the Ebright Road overpass of US33. A noise barrier wall, constructed as part of a previous project is situated along the south ROW of US 33. According to the ODOT Transportation Information Mapping System (TIMS) the noise barrier is 2,174 feet in length and a height of 15 feet. The existing noise barrier wall was re-evaluated using the updated traffic volumes for this project. The results showed that the existing noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the development. All of the impacted receptors will continue to be benefited by the barrier wall. **The existing noise barrier wall at NSA 8 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**

- NSA 9- NSA 9 is a small residential community located on the north side of US33 just east of the Gender Road interchange. Seven residential receivers are located on the north and south sides of Winchester Pike. Part of this NSA includes the Union Grove cemetery that has an area of frequent outdoor use on the north side of Winchester Road that runs through the cemetery. A Noise barrier wall running along the US 33 ROW and continuing along the US 33 WB exit ramp to Gender Road was evaluated at a length of 950 feet at a height of 17' would be feasible in benefiting five of the receptor sites. However, the configuration of this noise barrier wall would exceed the $56,000 cost criterion. **A noise barrier wall at NSA 7 would not be cost reasonable and is not recommended for construction as part of the project.**

- NSA 10 – NSA 10 is a large residential development located on the south side of US 33 and situated just west of the North High Street intersection at US 33. A noise barrier wall along the ROW at a length of 3,500 feet at a height of 16 feet was found to be both a reasonable and feasible noise abatement measure for the receivers in NSA 10. All of the impacted receiver sites, except for the western-most receiver will be benefited by the noise barrier wall. The western-most receiver cannot be benefited due to a drainageway that limits the noise barrier extent to the west. **A noise barrier wall is recommended for construction at NSA 10 as part of the project.**

- NSA 11 - NSA 11 is a large residential development located on the south side of US 33 beginning just east of the North High Street intersection at US 33. The NSA extends east a distance of approximately 1,700 to a point just north of Jennings Drive. Dwelling units located within NSA 11 are shielded from traffic noise on US 33 by an existing noise barrier wall located along the US 33 ROW. The noise barrier wall extends the full length of NSA 11. According to the ODOT TIMS, the existing noise barrier is 1,676 feet in length and a height of 18 feet. Residential dwelling units located south of Jennings Drive are left unshielded from traffic noise. The existing noise barrier wall was re-evaluated using the updated traffic volumes for this project. The results showed that the existing noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the development. All of the impacted receptors, except for two receivers located on the far west end where the noise barrier cannot be extended further west due to the location of North Main Street, were found to be benefited by the noise barrier. A total of 11 dwelling units are benefited by the existing noise barrier. **The existing noise barrier wall at NSA 11 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**

- NSA 12 – NSA 12 is, essentially, the same residential development described in NSA 11. It is proposed that the existing noise barrier wall be extended further south, from the point where the noise barrier currently ends. NSA 12 includes the residential dwelling units that were not shielded from traffic by the existing noise barrier wall. Noise barrier NSA 12 was evaluated at a length of 1,900 feet at a height similar to noise barrier NSA 11. With the additional length at a height of 16 feet, the noise barrier will benefit 43 additional receivers. **Adding 1,900 feet to the existing noise barrier will be a reasonable and feasible noise abatement measure and is recommended for construction as part of the project.**

Noise barrier walls evaluated at four NSAs: NSA 5, NSA 7, NSA 10 and NSA 12 were found to be both reasonable and feasible noise abatement measures. The four noise barrier walls are recommended for construction as part of the project and are summarized in the following table.

Recommended Noise Barrier Walls											
Barrier	Barrier Length (feet)	Barrier Height (feet)	Square Footage of Barrier	Maximum Insertion Loss[a] (dB)	Benefitted Properties [b]	Barrier Cost [c]	Cost per benefited receptor	Effectiveness		Barrier Location [f]	Barrier Recommended [g]
								Feasible [d]	Reasonable [e]		
NSA 5	1,426	14	18,200	7.7	42	$798,000	$19,000	Yes	Yes	EOS	**Yes**
NSA 7	964	16	15,424	7.2	30	$616,800	$20,500	Yes	Yes	ROW	**Yes**
NSA 10	3,500	16	56,000	8.5	53	$2,240,000	$42,300	Yes	Yes	ROW	**Yes**
NSA12	1,900	16	30,400	12.3	43	$1,216,000	$28,000	Yes	Yes	ROW	**Yes**

[a] Insertion Loss (IL) is the maximum noise reduction provided by the noise barrier.
[b] A receptor is considered benefited by the noise barrier if the IL is 5dB or greater.
[c] Cost is based on $25 per square foot of noise barrier constructed on ground and $100 per square foot constructed on structure.
[d] A noise barrier is considered feasible if it can provide a substantial noise reduction of at least 7dB at one receptor location.
[e] A noise barrier is considered cost reasonable if the cost per benefited receptor is less than $35,000.
[f] The location of the noise barrier wall: ROW=noise barrier is located along the right of way line; EOS=noise barrier is located along the edge of shoulder.
[g] Noise barrier recommendation is based on the number of benefited receptors and the relative cost per benefited receptor.

Introduction
The project limits and study area for this noise analysis are shown on Figure 1 and includes all noise sensitive receivers located within 500 feet of the existing driving lanes and ramps along US 33 from the US 33/Refugee Road interchange to the US 33/Diley Road interchange. The project is located in Groveport and Canal Winchester, Franklin County, Ohio and will consist of widening US 33 by adding a third lane in each direction within the median of US33 and adding auxiliary lanes to the inside of the westbound and eastbound lanes between the entrance/exit ramps on the east side of the US 33/I-270 interchange and the exit/entrance ramps on the west side of the US 33/Hamilton Road interchange.

Noise Sensitive Areas
Twelve noise sensitive areas (NSA) were identified within the project limits and the locations are shown on Figure 2. Four of the NSAs have existing noise barrier walls built during previous roadway construction projects. The NSAs are shown on Figure 2 and are described as follows:

<u>NSA 1</u> - NSA 1 is located on the east side of US 33 approximately one-half mile west of the US 33/I-270 interchange. NSA 1 consists of around 30 single family residential dwelling units and one church property located within 500 feet of the westbound US 33 travel lanes. The NSA includes noise receptors located on Schwartz Road, Westwick Road, Cross Keys Road, and Eastwick Road.

<u>NSA 2</u> - NSA 2 is located on the west side of US 33 approximately one-half mile west of the US 33/I-270 interchange. NSA 2 consists of 10 single family residential dwelling units and one church property located within 500 feet of the eastbound US 33 travel lanes. NSA 2 is in the vicinity of Three Creeks Park, however, there are no developed park facilities located within 500 feet of the eastbound US 33 travel lanes. NSA 2 includes noise receptors located on Schwartz Road and Wilkins Road.

<u>NSA 3</u> - NSA 3 is located on the east side of US 33 approximately 2,100 feet (0.4 mile) west of the Hamilton Road/US 33 interchange. NSA 3 is comprised of two apartment complexes known as Winchester Park and Winchester Crossing. Winchester Park has nine (9) multi-family residential buildings located within 500 feet of the proposed travel lane on US 33. Winchester Crossing has two multi-family residential buildings located within 500 feet of the proposed travel lane on US 33. Of the nine multi-family buildings located within NSA 3, five buildings have patios and balconies that face away from US 33 and three of the buildings have no patios or balconies. One building does have patios and balconies facing US 33 however the areas for outdoor use are screened from noise by garages situated between the receivers and traffic on US 33. The three buildings having no areas for frequent outdoor use were not evaluated as part of this analysis. The apartment complex has a swimming pool, but the pool is located about 900 feet from US 33 and was not analyzed for noise.

<u>NSA 4</u> - NSA 4 is located on the west side of US 33 approximately 2,500 feet (0.5 mile) west of the US33/Hamilton Road interchange. NSA 4 is comprised of single-family and multifamily residential dwelling units that are situated at an elevation of about 5 to 10 feet lower than US 33. There is an apartment complex known as Elk Park Villas located in the northwest portion of NSA 4. Elk Park Villas is comprised of ten (10) four-unit buildings with each unit having a ground floor patio. About forty (40) single-family residential dwelling units are also located within 500 feet of US 33. Elk Run Park is located west of NSA 4. Developed recreational areas

within the park include a playground, basketball courts and pavilion. All of the developed park facilities are located about 800 feet from US 33 and were not analyzed for potential noise impact as part of this project. Dwelling units located in NSA 4 are shielded from traffic noise by a noise barrier wall located along the US 33 EOS and is 1,884 feet in length and a height of 14 feet.

NSA 5 – NSA 5 is located on the east side of US 33 west of SR 317 and is known as The Baylor multi-family development. The Baylor consists of 12, three-story buildings with six dwelling units per floor. The Baylor has an outdoor pool area which is located more than 500 feet from US 33.

NSA 6 - NSA 6 is located on the east side of US33 east of the Hamilton Road/US 33 interchange. NSA 6 is comprised of two hotels and five building units of the Bennington Pond Apartment complex located within 500 feet of the westbound US 33 travel lanes. Each ground floor apartment unit in the Bennington Pond complex has a patio for outdoor use. The upper floor units each have a balcony for outdoor use. A noise barrier wall, constructed as part of a previous project is situated along the south EOS of US 33. The noise barrier is 580 feet in length at a height of 16 feet.

NSA 7 - NSA 7 is located on the east side of US 33 north of Ebright Road. NSA 7 is a newly constructed multi-family residential development consisting of 10, three-story buildings with 10 dwelling units per story. All units appear to have balconies for outside use.

NSA 8 – NSA 8 is a large residential development located on the west side of US 33 north of Ebright Road. NSA 8 consists of 24 single and multi-family dwelling units located within 500 feet of US 33. The dwelling units in NSA 8 are shielded from traffic noise on US 33 by a 2,174-foot-long noise barrier wall at a height of 15 feet.

NSA 9 – NSA 9 is located on the east side of US 33 south of the Gender Road interchange. NSA 9 consists of eight single-family residential dwelling units and a cemetery situated along Winchester Pike.

NSA 10- NSA 10 is a large residential neighborhood located on the west side of US 33 north of North High Street. The residential neighborhood is comprised of 54 single and multi-family dwelling units situated within 500 feet of US 33.

NSA 11- NSA 11 is a large residential neighborhood located on the west side of US 33 south of North High Street. The residential neighborhood is comprised of 33 single and multi-family dwelling units situated within 500 feet of US 33. The dwelling units within NSA 11 are shielded by a noise barrier wall that is 1,676 feet in length at a height of 18 feet. The noise barrier ends just north of Jennings Drive.

NSA 12 – NSA 12 is the large residential neighborhood east of NSA 11. The NSA begins south of Jennings Drive and is comprised of xx dwelling units situated within 500 feet of US 33. Different from NSA 11, the dwelling units located in NSA 12 are not shielded from traffic noise on US 33 by a noise barrier.

Noise Analysis and Noise Abatement
A noise analysis was prepared using traffic data for the Opening Year 2030 and the Design Year 2050. The traffic data was provided by ODOT in an email dated August 29, 2024.

NSA 1 - The noise analysis determined that seven residential dwelling units and one church facility would experience design year noise levels that would exceed the respective Category B (residential) NAC and Category C (exterior) NAC.

The noise receptors located at the west side of NSA 1 on Swartz Road are situated six to eight feet lower than the eastbound travel lanes of US 33. The receptors along Cross Key Road are situated about eight feet higher than US 33 and the receptors near the east end of the NSA along Eastwick Road are situated at a similar elevation to US 33. The difference in elevations between US 33 and the noise receptors makes it difficult to locate a noise barrier solely along the right of way line or along the edge of shoulder and obtain adequate levels of noise abatement. Three noise barrier location scenarios were evaluated for NSA 1.

<u>NSA 1 Scenario 1 - noise barrier wall located along the EOS</u>
Scenario 1 places the noise barrier wall along the EOS of westbound US 33 and extending a distance of 1,850 feet. NSA 1 Scenario 1 is shown on Figure 9. The efficiency of noise barrier wall NSA 1 Scenario 1 at various heights and lengths is shown in Table 1.

Table 1.
Barrier Wall NSA 1 Scenario 1
Barrier Wall Located along the US 33 Westbound Edge of Shoulder

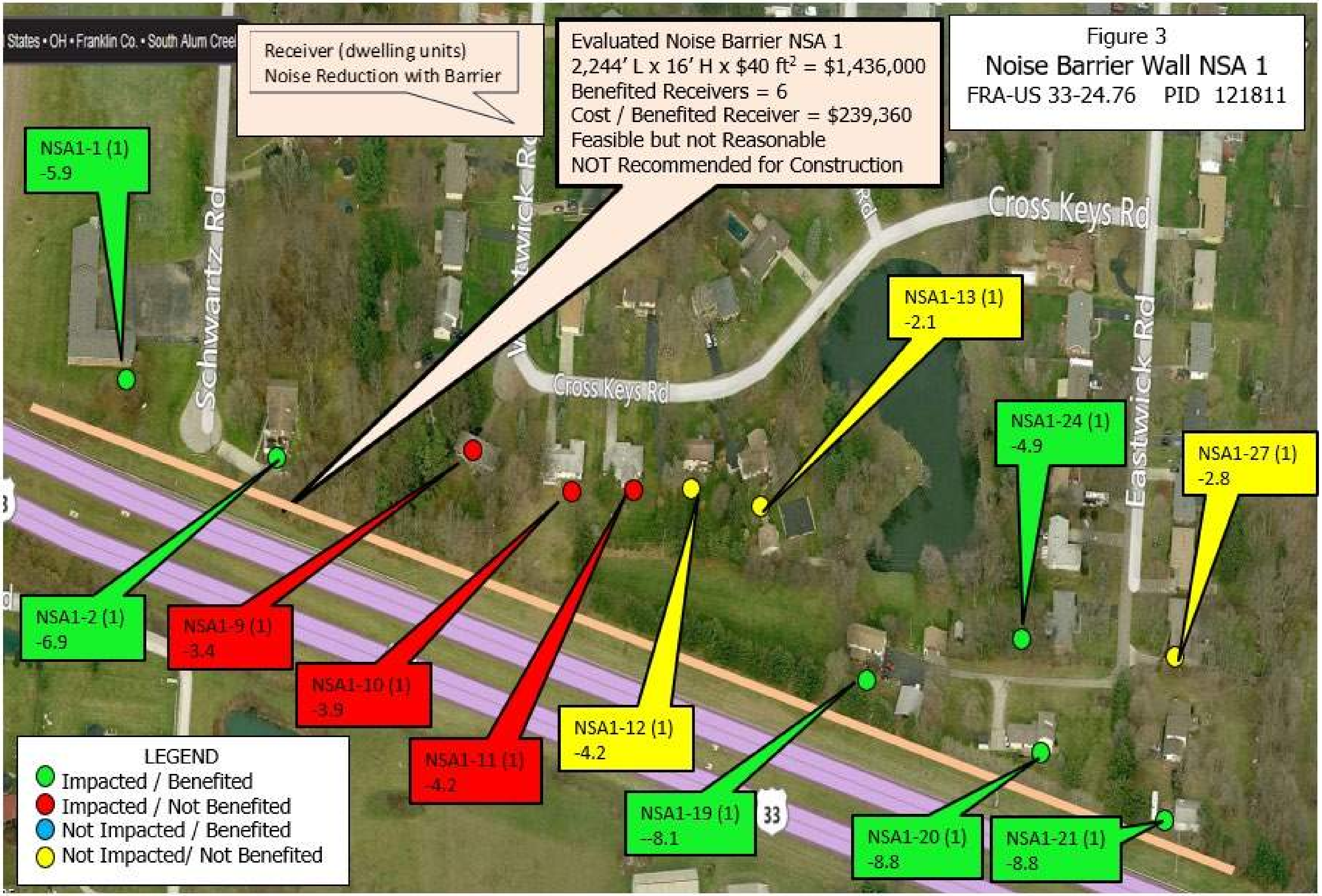
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
16	2,240	$1,436,000	6	$239,360
15	2,240	$1,346,500	5	$269,300
14	2,240	$1,257,000	5	$251,500
13	2,240	$1,167,000	9	$292,000

As shown in Table 1 the most efficient noise barrier wall for NSA 1 Scenario 1 would be at an average height of 16 feet with a length of approximately 1,850 feet (shaded green). In this configuration, NSA 1 Scenario would cost about $239,360 per benefited receptor which exceeds the $56,000 cost reasonable criterion. NSA 1 Scenario 1 is not a feasible and reasonable noise abatement measure. NSA 1 Scenario1 is shown is shown on Figure 3.

<u>NSA 1 Scenario 2 - noise barrier wall along the ROW</u>
As shown on Figure 3, the east end of noise barrier wall NSA 1 Scenario 2 would begin along the US 33 EOS where the roadway elevation is similar to the adjacent homes. At a point just east of Eastwick Road the noise barrier wall begins to transition to the ROW where the ground elevation is higher than US 33. The noise barrier wall transitions back to the edge of shoulder near Swartz Road where the ground elevation is higher along the EOS. The location of Scenario 2 takes advantage of the highest elevations where possible. The efficiency of noise barrier wall NSA 1 Scenario 2 at various heights is shown in Table 2.

Table 2. **Barrier Wall NSA 1 Scenario 2** Barrier Wall Located along the US 33 north right of way line				
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
20	1,482	$1,186,000	7	$169,500
19	1,482	$1,126,500	7	$160,900
18	1,482	$1,067,000	7	$152,500
17	1,482	$1,008,000	7	$144,000
16	1,482	$948,500	6	$158,000
15	1,482	$889,500	5	$178,000

As shown in Table 2 the most efficient noise barrier wall for NSA 1 Scenario 2 would be at an average height of 17 feet with a length of approximately 2,280 feet. Even though it is the most efficient configuration, at a cost of $144,000 per benefited receiver, it is higher than the $56,000 cost reasonable criterion. NSA 1 Scenario 2 is not a feasible and reasonable noise abatement measure. None of noise barrier wall scenarios at NSA 1 could provide both a feasible and reasonable noise abatement measure. **No noise barrier wall is recommended for construction at NSA 1.**



States • OH • Franklin Co. • South Alum Creek
Receiver (dwelling units)
Noise Reduction with Barrier
Evaluated Noise Barrier NSA 1
2,244' L x 16' H x $40 ft² = $1,436,000
Benefited Receivers = 6
Cost / Benefited Receiver = $239,360
Feasible but not Reasonable
NOT Recommended for Construction
Figure 3
Noise Barrier Wall NSA 1
FRA-US 33-24.76 PID 121811
NSA1-1 (1) -5.9
Schwartz Rd
Cross Keys Rd
Cross Keys Rd
Eastwick Rd
NSA1-13 (1) -2.1
NSA1-24 (1) -4.9
NSA1-27 (1) -2.8
NSA1-2 (1) -6.9
NSA1-9 (1) -3.4
NSA1-10 (1) -3.9
NSA1-11 (1) -4.2
NSA1-12 (1) -4.2
NSA1-19 (1) --8.1
33
NSA1-20 (1) -8.8
NSA1-21 (1) -8.8
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited


NSAI-4
NSAI-3
NSAI-5
NSAI-14
NSAI-6
NSAI-18
NSAI-16
NSAI-17
NSAI-15
NSAI-7
NSAI-1 Church
NSAI-8
NSAI-2
NSAI-9
NSAI-10
NSAI-11
NSAI-12
NSAI-13
NSAI-22
NSAI-25
NSAI-23
NSAI-26
NSAI-24
NSAI-19
NSAI-27
NSAI-20
NSAI-21
NSAP-2

			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NSA1-28	66	1	58.9	60.1	66	1.2	10	—	60.0	0.1	4	-4.4
NSA1-25	63	1	58.1	59.4	66	1.3	10	—	56.9	2.5	4	-2.0
NSA1-26	64	1	59.1	60.2	66	1.1	10	—	57.6	2.6	4	-1.9
NSA1-27	65	1	61.8	62.7	66	0.9	10	—	59.4	3.3	4	-1.2
NSA1-21	59	1	65.9	66.7	66	0.8	10	Snd Lvl	60.8	5.9	4	1.4
NSA1-19	57	1	69.0	69.3	66	0.3	10	Snd Lvl	61.2	8.1	4	3.6
NSA1-20	58	1	69.7	69.9	66	0.2	10	Snd Lvl	61.1	8.8	4	4.3
NSA1-24	62	1	63.5	64.2	66	0.7	10	—	59.4	4.8	4	0.3
NSA1-23	61	1	61.3	62.0	66	0.7	10	—	58.4	3.6	4	-0.9
NSA1-22	60	1	59.8	60.7	66	0.9	10	—	57.5	3.2	4	-1.3
NSA1-18	56	1	56.8	57.9	66	1.1	10	—	56.3	1.6	4	-2.9
NSA1-16	54	1	58.0	59.1	66	1.1	10	—	57.5	1.6	4	-2.9
NSA1-17	55	1	58.9	59.9	66	1.0	10	—	58.5	1.4	4	-3.1
NSA1-14	52	1	57.7	58.9	66	1.2	10	—	57.9	1.0	4	-3.5
NSA1-15	53	1	60.0	60.9	66	0.9	10	—	59.6	1.3	4	-3.2
NSA1-13	51	1	63.3	64.0	66	0.7	10	—	59.9	4.1	4	-0.4
NSA1-12	50	1	64.4	65.2	66	0.8	10	—	61.0	4.2	4	-0.3
NSA1-11	49	1	67.3	67.8	66	0.5	10	Snd Lvl	63.6	4.2	4	-0.3
NSA1-10	48	1	68.3	68.8	66	0.5	10	Snd Lvl	64.9	3.9	4	-0.6
NSA1-9	47	1	69.7	70.5	66	0.8	10	Snd Lvl	67.1	3.4	4	-1.1
NSA1-2	40	1	68.6	68.9	66	0.3	10	Snd Lvl	62.0	6.9	4	2.4
NSA1-8	46	1	66.4	67.2	66	0.8	10	Snd Lvl	65.2	2.0	4	-2.5
NSA1-7	45	1	63.8	64.7	66	0.9	10	—	63.6	1.1	4	-3.4
NSA1-6	44	1	61.9	62.7	66	0.8	10	—	62.0	0.7	4	-3.8
NSA1-5	43	1	60.2	61.1	66	0.9	10	—	60.6	0.5	4	-4.0
NSA1-3	41	1	60.7	61.7	66	1.0	10	—	61.0	0.7	4	-3.8
NSA1-4	42	1	58.6	59.6	66	1.0	10	—	59.2	0.4	4	-4.1
NSA1-1 Church	39	1	69.0	71.0	66	2.0	10	Snd Lvl	65.1	5.9	4	1.4

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	28	0.1	3.1	8.8
All Impacted	9	2.0	5.5	8.8
All that meet NR Goal	6	4.8	6.7	8.8

NSA 2 - The noise analysis determined that two residential dwelling units would experience noise levels that would exceed the Category B (residential) NAC. The church facility has a small playground located to the east of the structure. The noise analysis determined that the play area would experience design year noise levels above the Category C (exterior) NAC. The existing and design year noise levels at NSA 2 are shown on Figure 4.

The receptors located in NSA 2 are generally situated at a similar elevation than US 33. Two noise barrier wall scenarios were evaluated for NSA 2. Scenario 1 was evaluated with a noise barrier wall located along the EOS of US 33. Scenario 2 was evaluated with a noise barrier wall located along the ROW line of US 33.

<u>NSA 2 Scenario 1 - noise barrier wall located along the EOS</u>
Noise barrier wall NSA 4 Scenario 1 would begin along the US 33 edge of shoulder about 1,200 feet west of the I-270/US 33 interchange. From this point, noise barrier NSA 2 Scenario 1 would extend west along the edge of shoulder for an approximate distance of 1,466 feet. The efficiency of noise barrier wall NSA 2 Scenario 1 at various heights is shown in Table 9.

Table 3.
Barrier Wall NSA 2 Scenario 1
Noise Barrier Wall Located along the US 33 eastbound Edge of Shoulder

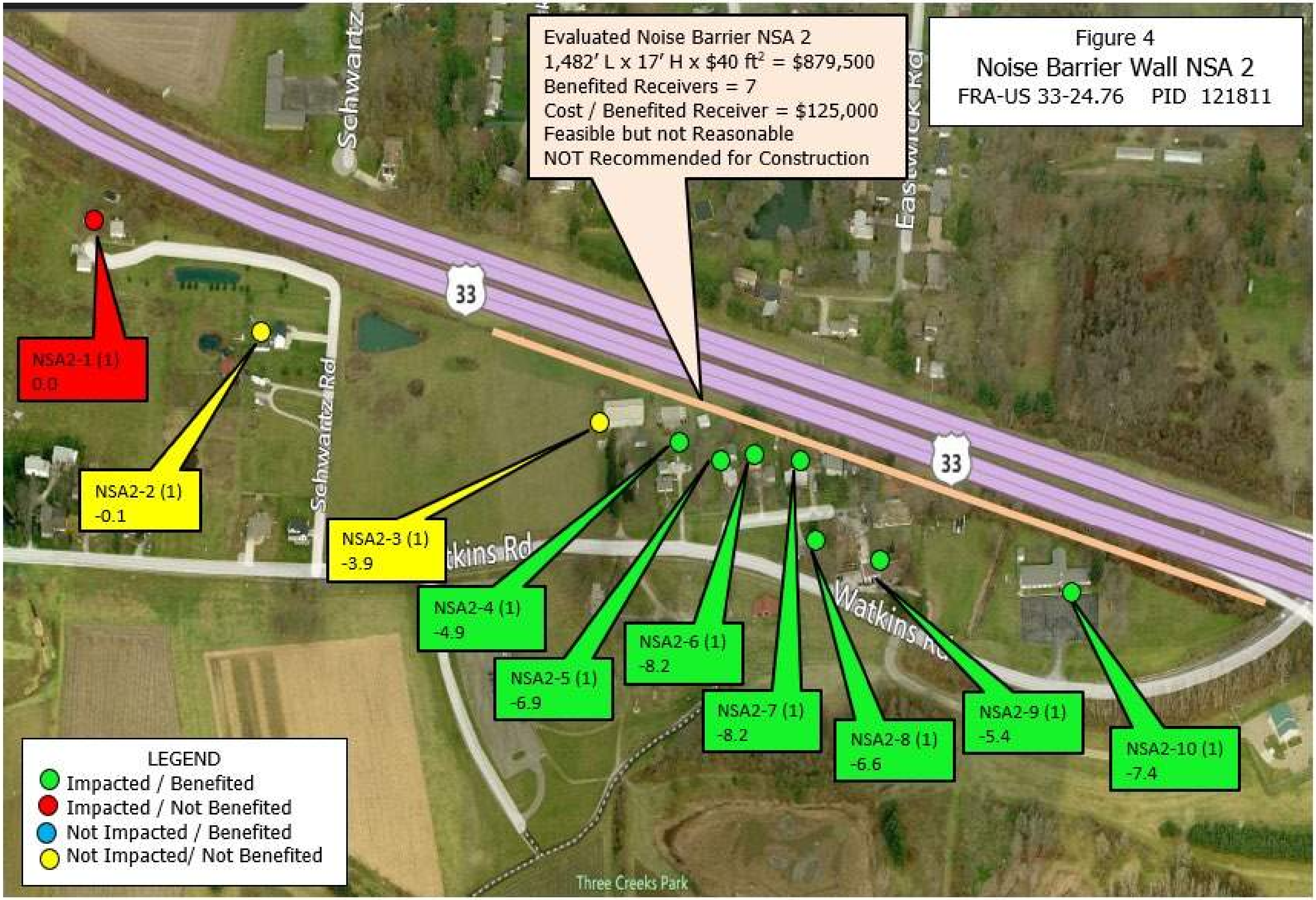
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
19	1,563	$1,188,000	8	$148,500
18	1,563	$1,125,500	8	$140,500
17	1,660	$1,129,000	8	$141,000
16	1,466	$938,000	7	$134,000
15	1,466	$879,500	7	$125,500
14	1,466	$821,000	5	$164,000

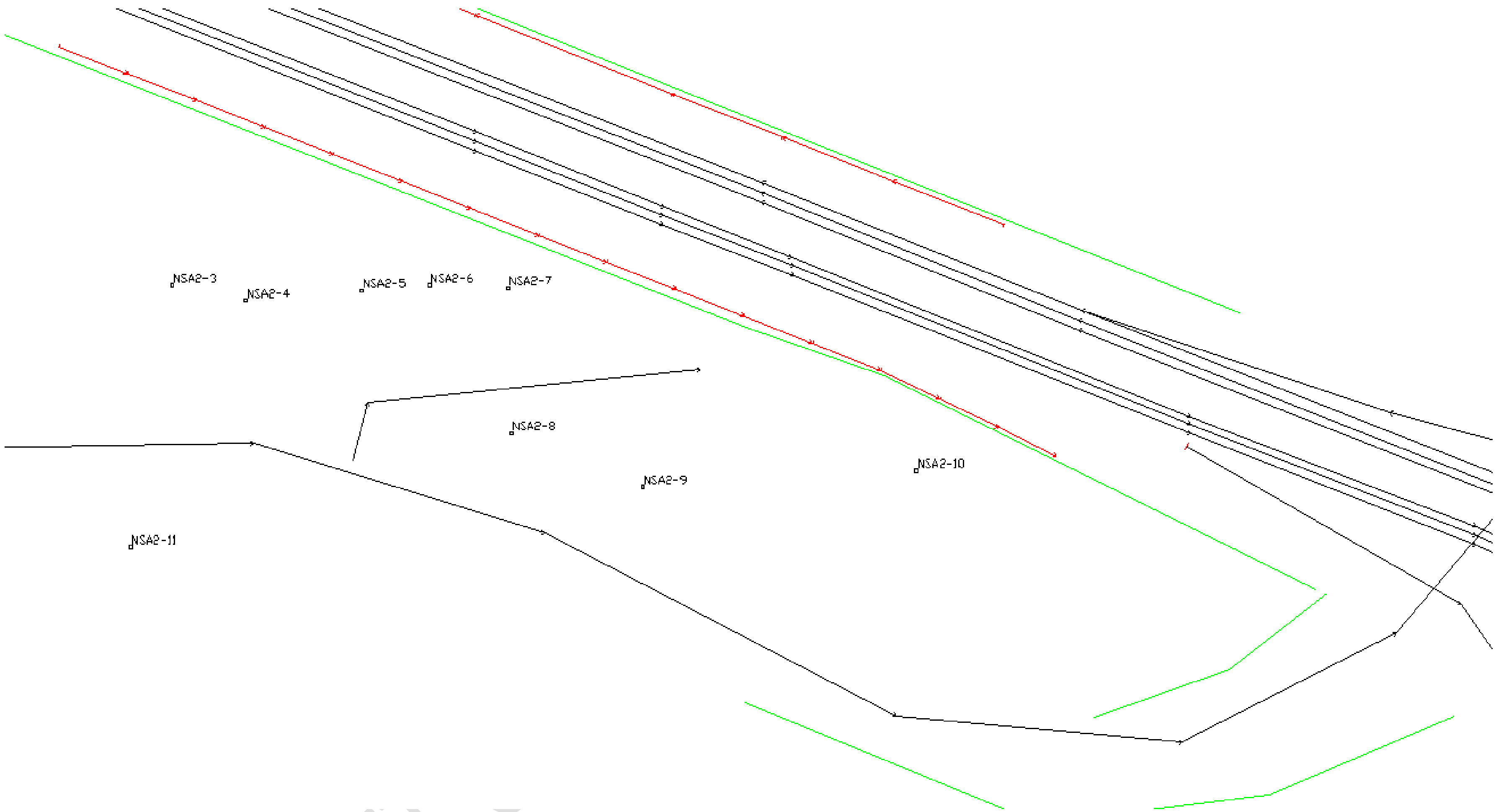
As shown in Table 3 the most efficient noise barrier wall for NSA 2 Scenario 1 would be at an average height of 15 feet with a distance of approximately 1,466 feet. Even though it is the most efficient configuration, at a cost of $125,000 per benefited receptor, it is higher than the $56,000 cost reasonable criterion. NSA 2 Scenario 1 is not a cost reasonable noise abatement measure and is not recommended for construction. Noise barrier wall NSA 2 Scenario 1 is shown on Figure4.

<u>NSA 2 Scenario 2 - noise barrier wall along the ROW</u>
Noise barrier wall NSA 2 Scenario 2 would begin along the US 33 ROW about 1,350 feet west of the I-270/US 33 interchange. From this point, noise barrier NSA 2 Scenario 2 would extend west along the US 33 south ROW line for an approximate distance of 1,089 feet. The efficiency of noise barrier wall NSA 2 Scenario 2 at various heights is shown in Table 4.

Table 4. **Barrier Wall NSA 2 Scenario 2** Noise Barrier Wall Located along the US 33 eastbound Right of Way				
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
19	1,089	$827,500	6	$138,000
18	1,191	$857,500	6	$128,500
17	1,089	$740,500	5	$148,000
16	1,089	$697,000	4	$174,240

As shown in Table 4, the most efficient noise barrier wall for NSA 2 Scenario 2 would be at an average height of 18 feet with a distance of approximately 1,191 feet. Even though it is the most efficient configuration, at a cost of $128,500 per benefited receptor, the cost is higher than the $56,000 cost reasonable criterion. NSA 2 Scenario 2 is not a feasible and reasonable noise abatement measure and is not recommended for construction. No configuration of noise barrier wall at NSA 2 proved to be both feasible and reasonable; therefore, **no noise barrier wall is recommended for construction at NSA 2.**


Evaluated Noise Barrier NSA 2
1,482′ L x 17′ H x $40 ft² = $879,500
Benefited Receivers = 7
Cost / Benefited Receiver = $125,000
Feasible but not Reasonable
NOT Recommended for Construction
Figure 4
Noise Barrier Wall NSA 2
FRA-US 33-24.76 PID 121811
Schwartz
Eastwick Rd
33
Schwartz Rd
Watkins Rd
Three Creeks Park
NSA2-1 (1) 0.0
NSA2-2 (1) -0.1
NSA2-3 (1) -3.9
NSA2-4 (1) -4.9
NSA2-5 (1) -6.9
NSA2-6 (1) -8.2
NSA2-7 (1) -8.2
NSA2-8 (1) -6.6
NSA2-9 (1) -5.4
NSA2-10 (1) -7.4
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited


NSA2-3
NSA2-4
NSA2-5
NSA2-6
NSA2-7
NSA2-8
NSA2-9
NSA2-10
NSA2-11

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22 October 2024
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: FRA-US33-24.76 (121811)
RUN: Design Year 2050 NSA 1
BARRIER DESIGN: NSA2 19' Not Reas
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	No Barrier LAeq1h Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NSA2-10	220	1	67.9	68.8	66	0.9	10	Snd Lvl	61.4	7.4	4	2.9
NSA2-9	219	1	62.6	63.2	66	0.6	10	—	57.8	5.4	4	0.9
NSA2-8	218	1	62.7	63.2	66	0.5	10	—	57.5	5.7	4	1.2
NSA2-11	221	1	56.6	57.3	66	0.7	10	—	55.5	1.8	4	-2.7
NSA2-7	217	1	68.4	69.0	66	0.6	10	Snd Lvl	59.1	9.9	4	5.4
NSA2-6	216	1	66.8	67.2	66	0.4	10	Snd Lvl	59.0	8.2	4	3.7
NSA2-5	215	1	65.2	65.6	66	0.4	10	—	58.7	6.9	4	2.4
NSA2-4	214	1	63.0	63.1	66	0.1	10	—	58.2	4.9	4	0.4
NSA2-3	213	1	62.1	62.2	66	0.1	10	—	58.3	3.9	4	-0.6
NSA2-2	212	1	63.2	63.5	66	0.3	10	—	63.4	0.1	4	-4.4
NSA2-1	211	1	71.1	71.0	66	-0.1	10	Snd Lvl	71.0	0.0	4	-4.5

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	11	0.0	4.9	9.9
All Impacted	4	0.0	6.4	9.9
All that meet NR Goal	7	4.9	6.9	9.9

NSA 3 is comprised of the Winchester Park and Winchester Crossing apartment complexes. There are several different configurations for the apartment buildings with some buildings having no areas of frequent outdoor use, buildings where areas for outdoor use face away from US 33 and a building that has areas for outdoor use facing US 33. The noise analysis determined that three noise receptors, representing six dwelling units in the Winchester Park Apartments complex, would experience design year noise levels above the Category B NAC. The noise analysis determined that six ground floor residential dwelling units at the Benning Pond Apartment complex would experience design year noise levels above the Category B NAC.

The receptors located in NSA 3 are generally situated at a similar elevation to US 33. One noise barrier wall location, along the EOS was evaluated for NSA 3. As shown in Figure 5, noise barrier wall NSA 3 would begin along the US 33 EOS about ½ mile west of Hamilton Road and would extend west a distance of approximately 1,580 feet to the west. The efficiency of noise barrier wall NSA 3 at various heights is shown in Table 5.

Table 5.
Barrier Wall NSA 3
Noise Barrier Wall Located along the US 33 Westbound Edge of Shoulder

Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
17	1,730	$1,178,500	16	$73,500
16	1,730	$1,109,000	16	$69,300
15	1,730	$1,040,000	16	$65,000
14	1,730	$970,500	16	$60,500
13	1,730	$901,500	13	$69,300
12	1,730	$899,500	11	$81,800

As shown in Table 5 the most efficient noise barrier wall for NSA 3 would be at an average height of 14 feet with a distance of approximately 1,730 feet. At an average cost of $64,700 per benefited receptor, the noise barrier is higher than the $56,000 cost reasonable criterion. Noise barrier wall NSA 3 is not a feasible and reasonable noise abatement measure and **no noise barrier wall is recommended for construction at NSA 3.**

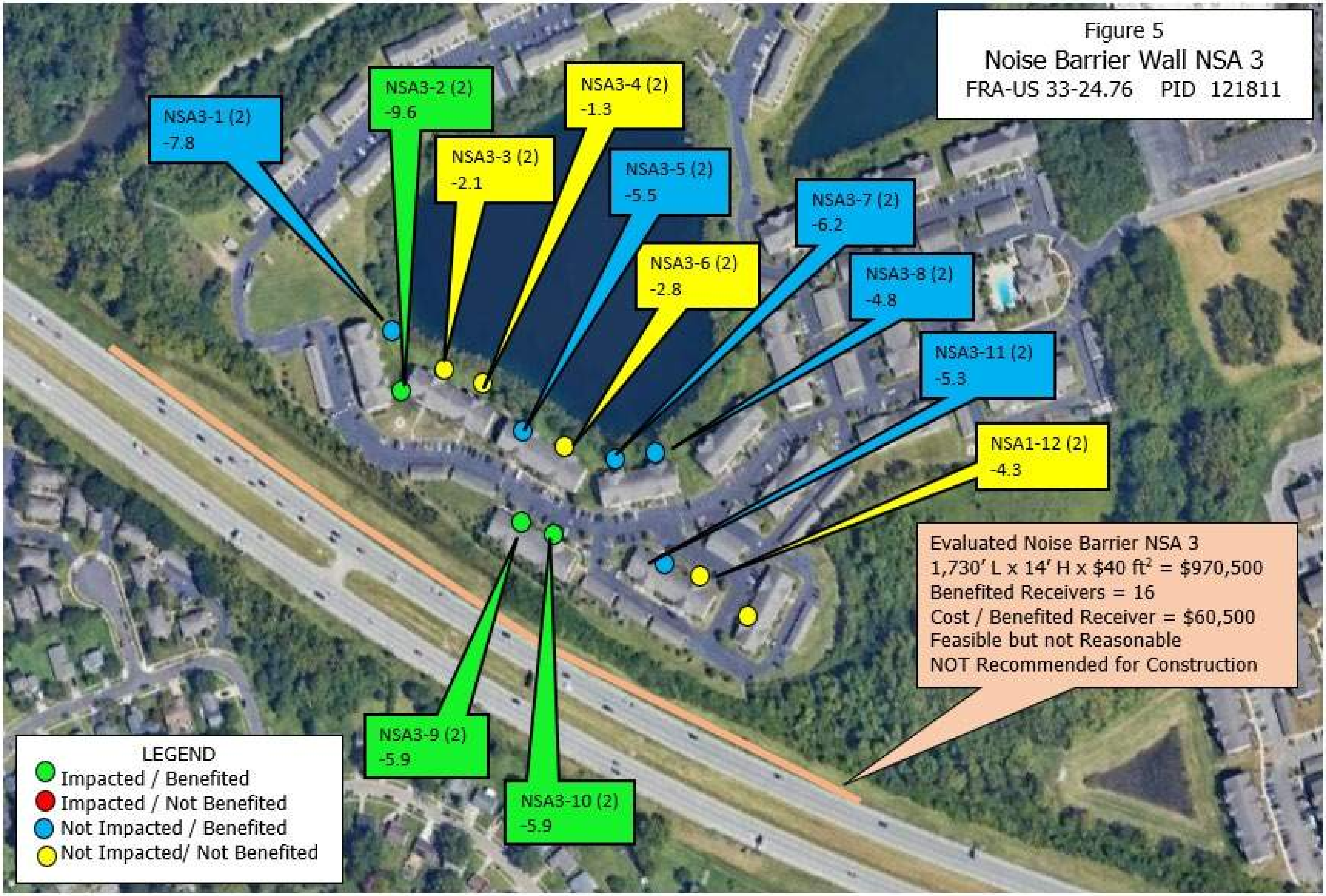
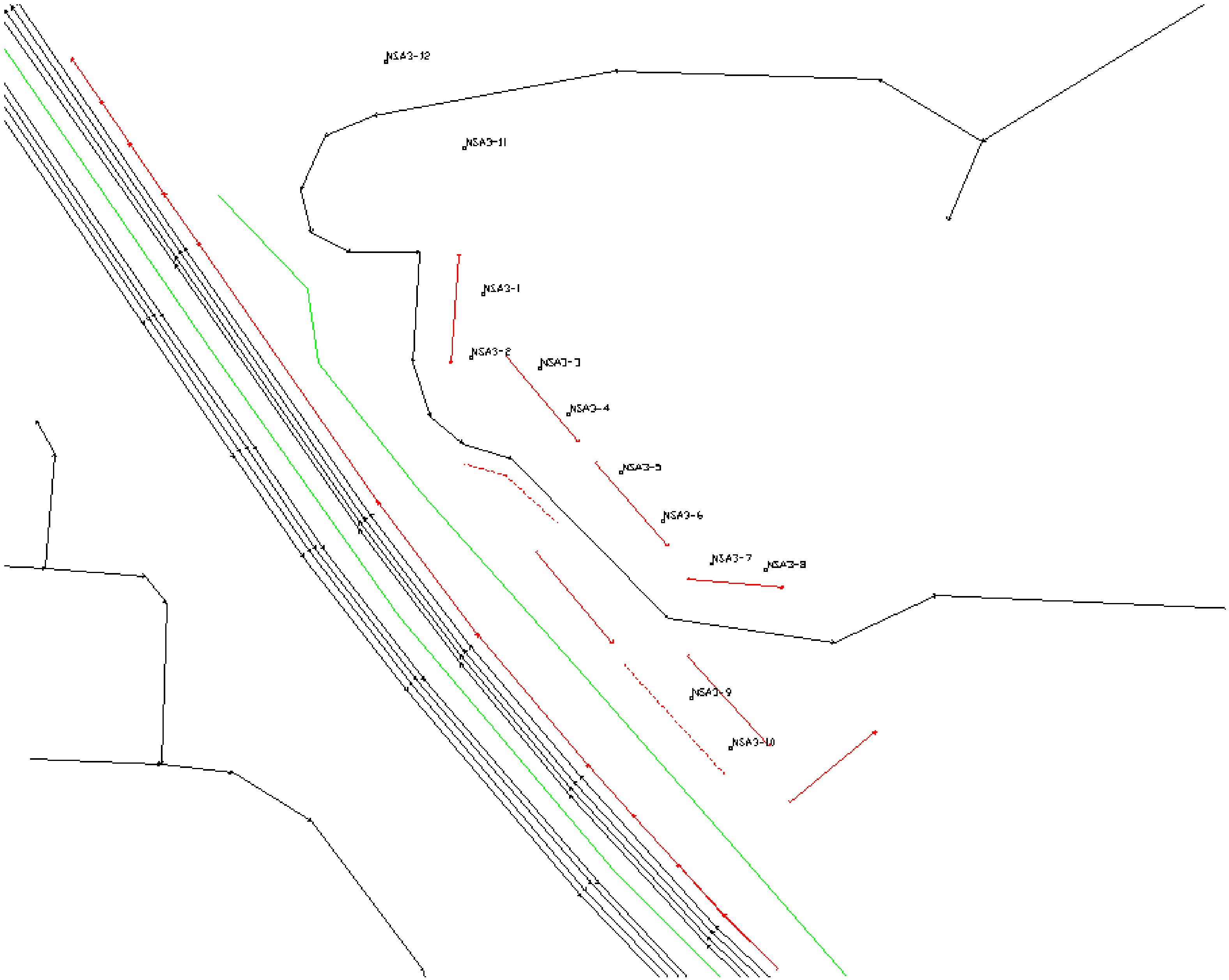


Figure 5
Noise Barrier Wall NSA 3
FRA-US 33-24.76 PID 121811
NSA3-1 (2)
-7.8
NSA3-2 (2)
-9.6
NSA3-3 (2)
-2.1
NSA3-4 (2)
-1.3
NSA3-5 (2)
-5.5
NSA3-6 (2)
-2.8
NSA3-7 (2)
-6.2
NSA3-8 (2)
-4.8
NSA3-11 (2)
-5.3
NSA1-12 (2)
-4.3
Evaluated Noise Barrier NSA 3
1,730' L x 14' H x $40 ft² = $970,500
Benefited Receivers = 16
Cost / Benefited Receiver = $60,500
Feasible but not Reasonable
NOT Recommended for Construction
NSA3-9 (2)
-5.9
NSA3-10 (2)
-5.9
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited


NSA3-12
NSA3-11
NSA3-1
NSA3-2
NSA3-3
NSA3-4
NSA3-5
NSA3-6
NSA3-7
NSA3-8
NSA3-9
NSA3-10

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22 October 2024
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: FRA-US33-24.76 (121811)
RUN: Design Year 2050 NSA 3
BARRIER DESIGN: Noise barrier NSA3 14' NR

ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver												
Name	No.	#DUs	Existing	No Barrier					With Barrier			
			LAeq1h	LAeq1h		Increase over existing		Type	Calculated	Noise Reduction		
				Calculated	Crit'n	Calculated	Crit'n Sub'l Inc	Impact	LAeq1h	Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NSA3-1	68	2	59.0	61.2	66	2.2	10	—	53.4	7.8	4	3.3
NSA3-2	69	2	65.1	67.4	66	2.3	10	Snd Lvl	57.8	9.6	4	5.1
NSA3-3	70	2	49.3	50.6	66	1.3	10	—	48.5	2.1	4	-2.4
NSA3-4	71	2	50.3	51.9	66	1.6	10	—	50.6	1.3	4	-3.2
NSA3-5	72	2	53.6	55.8	66	2.2	10	—	50.3	5.5	4	1.0
NSA3-6	73	2	47.9	49.3	66	1.4	10	—	47.5	1.8	4	-2.7
NSA3-7	75	2	54.7	56.7	66	2.0	10	—	50.5	6.2	4	1.7
NSA3-8	76	2	52.1	53.9	66	1.8	10	—	49.1	4.8	4	0.3
NSA3-9	77	2	65.1	66.3	66	1.2	10	Snd Lvl	61.1	5.2	4	0.7
NSA3-10	78	2	66.6	67.3	66	0.7	10	Snd Lvl	62.6	4.7	4	0.2
NSA3-11	79	1	62.3	64.4	66	2.1	10	—	59.1	5.3	4	0.8
NSA3-12	80	1	62.3	64.3	66	2.0	10	—	60.0	4.3	4	-0.2

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	22	1.3	4.9	9.6
All Impacted	6	4.7	6.5	9.6
All that meet NR Goal	15	4.7	6.1	9.6

NSA 4 - Residential dwelling units located in NSA 4 are currently shielded from noise on US 33 by a noise barrier wall located along the edge of shoulder of US 33. A noise analysis for the Design Year 2050 was run for NSA 4 using updated traffic volumes and the existing noise barrier wall. The analysis showed that the existing noise barrier wall would continue to provide a high level of noise abatement for the receivers in NSA 4. At least 10 dwelling units would continue to receive a 10 dB or greater noise reduction and all but two impacted receivers would be benefited by the noise barrier wall. As shown on Figure 6, t**he existing noise barrier wall at NSA 4 will continue to provide a comparable level of noise abatement in the design year 2050 with no addition or modification to the barrier.**

NSA 5 – Dwelling units at eight receiver locations in NSA 5 were predicted to experience noise levels above the Category B NAC in the design year with construction of the proposed project. A noise barrier wall located along the edge of clear zone was evaluated for NSA 5.

Table 6.
Barrier Wall NSA 5
Noise Barrier Wall Located along the US 33 Westbound Edge of Clear Zone

Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
15	1,426	$855,300	42	$20,364
14	1,426	$798,800	42	$19,000

Table 6. **Barrier Wall NSA 5** Noise Barrier Wall Located along the US 33 Westbound Edge of Clear Zone				
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
13	1,426	$741,300	36	$20,600
12	1,426	$684,300	30	$22,810
11	1,426	$571,800	24	$23,800

As shown on Figure 7 and in the table above, **a noise barrier wall at a height of 14 feet and a length of 1,426 feet is a reasonable and feasible noise abatement measure and is recommended for construction as part of the project.**

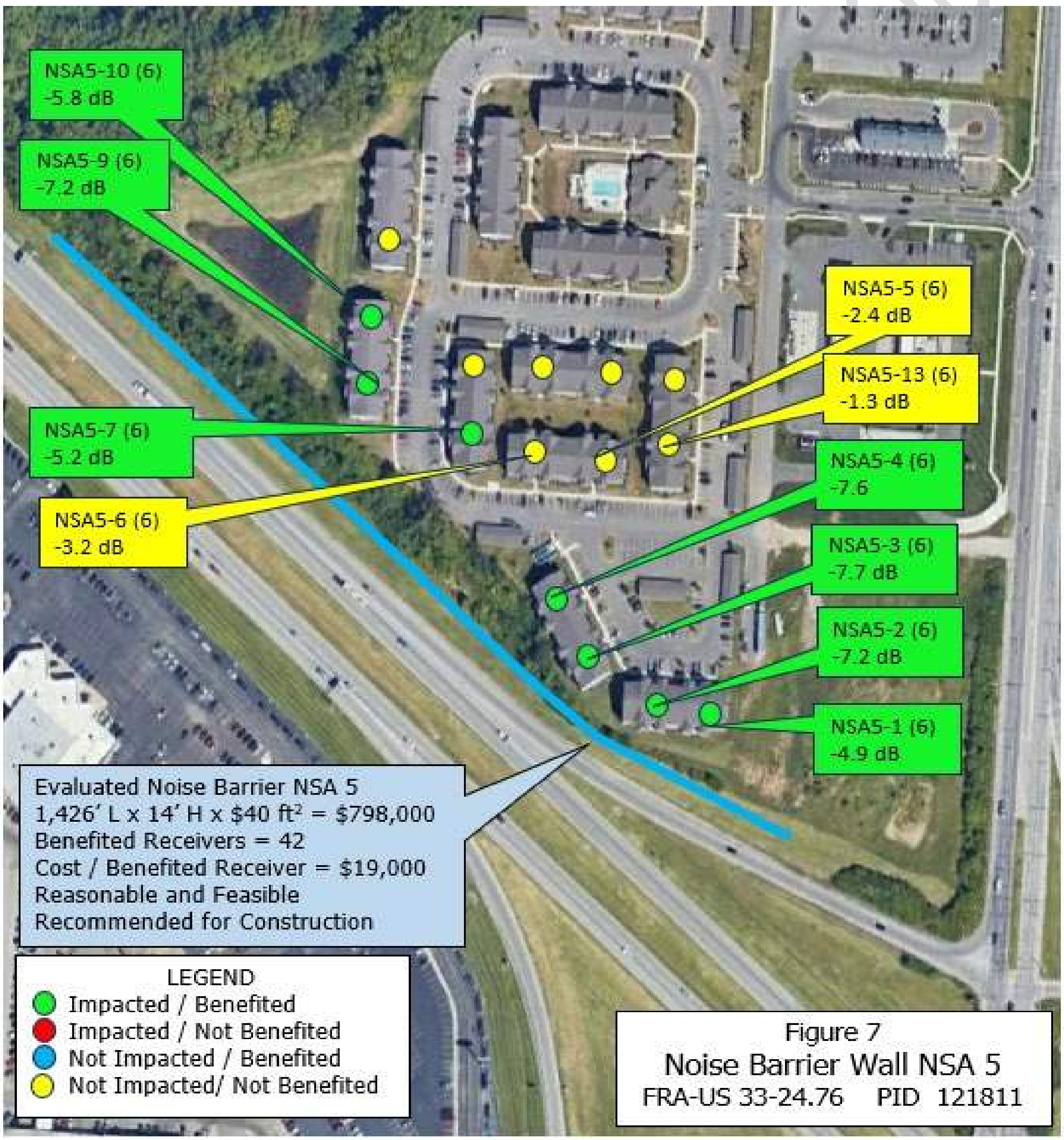
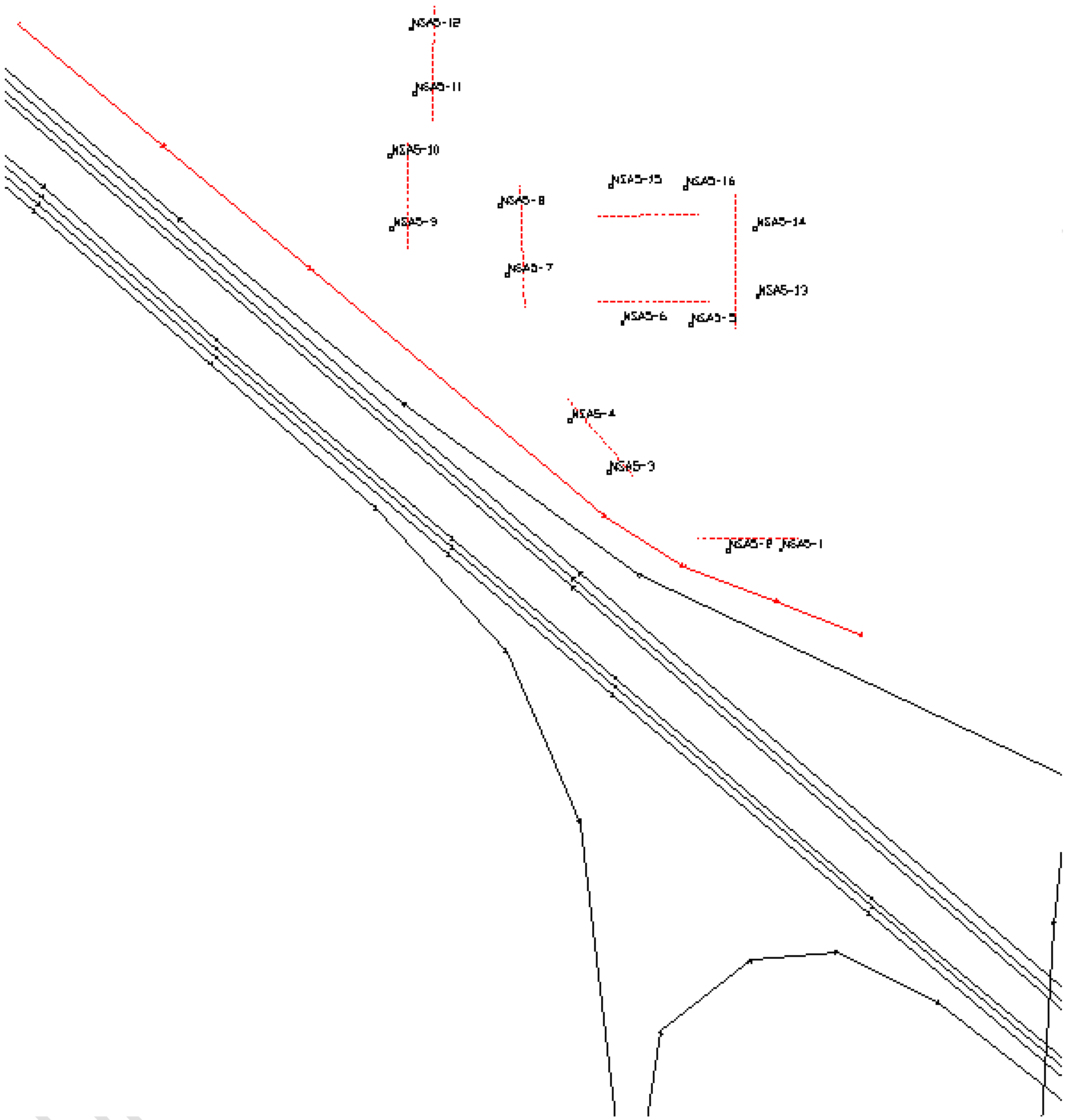


Figure 7
Noise Barrier Wall NSA 5
FRA-US 33-24.76 PID 121811


NSAS-12
NSAS-11
NSAS-10
NSAS-9
NSAS-8
NSAS-7
NSAS-15
NSAS-16
NSAS-14
NSAS-13
NSAS-6
NSAS-5
NSAS-4
NSAS-3
NSAS-2
NSAS-1

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22 October 2024
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS

PROJECT/CONTRACT: FRA US33 24.76 (121811)
RUN: Design Year 2050 NSA5
BARRIER DESIGN: Noise Barrier NSA5 at 14'

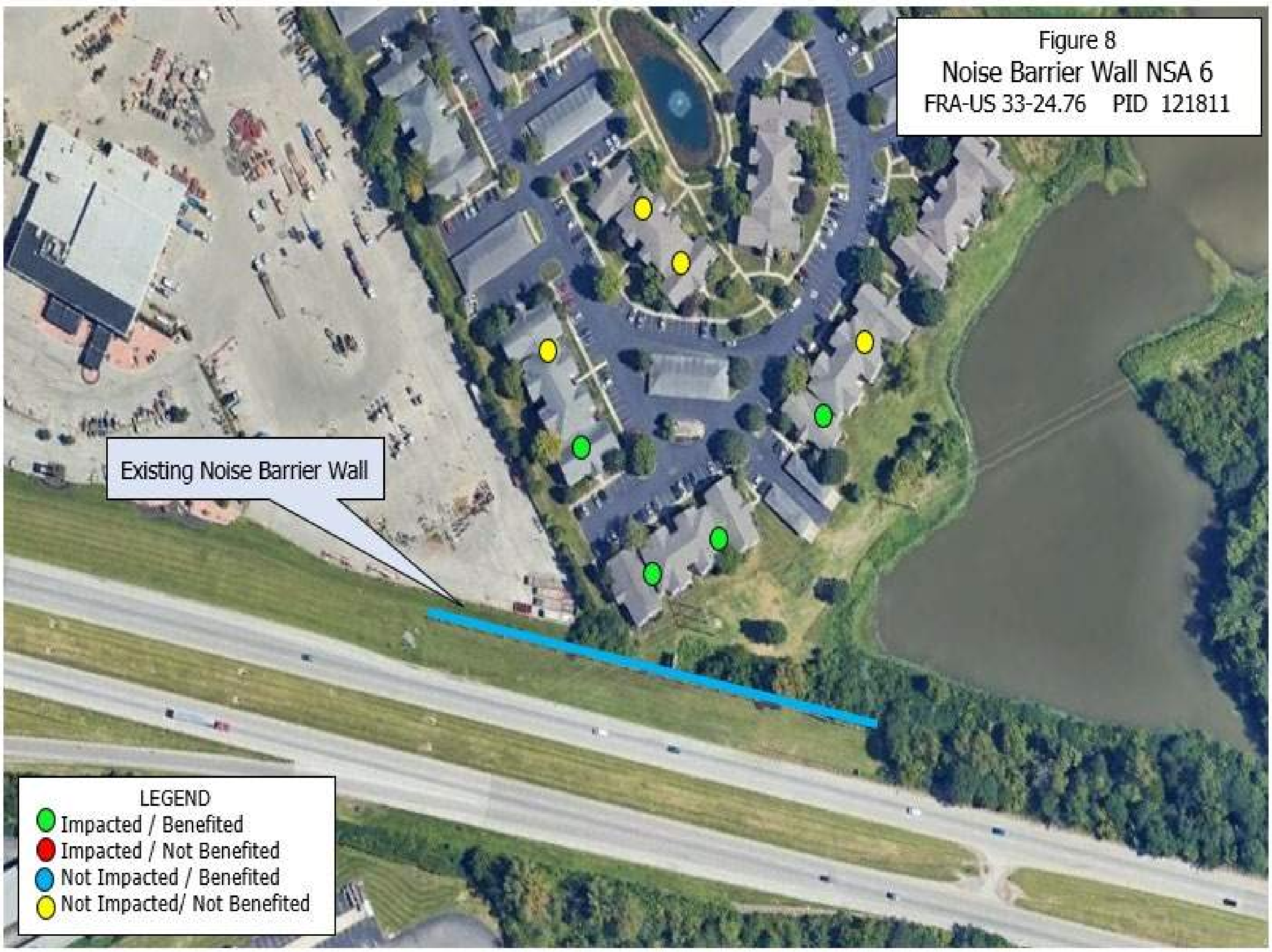
ATMOSPHERICS: 68 deg F, 50% RH

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NSA5-1	128	6	66.7	68.5	66	1.8	10	Snd Lvl	63.6	4.9	4	0.4
NSA5-2	263	6	69.5	71.1	66	1.6	10	Snd Lvl	63.9	7.2	4	2.7
NSA5-3	264	6	71.6	74.1	66	2.5	10	Snd Lvl	66.4	7.7	4	3.2
NSA5-4	265	6	70.3	72.1	66	1.8	10	Snd Lvl	64.5	7.6	4	3.1
NSA5-5	266	6	61.7	62.9	66	1.2	10	—	60.5	2.4	4	-2.1
NSA5-6	267	6	63.9	65.0	66	1.1	10	—	61.8	3.2	4	-1.3
NSA5-7	268	6	67.3	68.7	66	1.4	10	Snd Lvl	63.5	5.2	4	0.7
NSA5-8	269	6	64.3	65.3	66	1.0	10	—	61.4	3.9	4	-0.6
NSA5-9	270	6	69.9	71.2	66	1.3	10	Snd Lvl	64.0	7.2	4	2.7
NSA5-10	271	6	66.9	68.2	66	1.3	10	Snd Lvl	62.4	5.8	4	1.3
NSA5-11	272	6	64.2	65.8	66	1.6	10	—	61.8	4.0	4	-0.5
NSA5-12	273	6	62.6	64.3	66	1.7	10	—	61.2	3.1	4	-1.4
NSA5-13	274	6	58.2	59.5	66	1.3	10	—	58.1	1.4	4	-3.1
NSA5-14	275	6	56.1	57.3	66	1.2	10	—	56.4	0.9	4	-3.6
NSA5-15	276	6	58.6	60.0	66	1.4	10	—	58.3	1.7	4	-2.8
NSA5-16	277	6	56.9	58.3	66	1.4	10	—	57.2	1.1	4	-3.4

Dwelling Units	# DUs	Noise Reduction Min	Avg	Max
		dB	dB	dB
All Selected	96	0.9	4.2	7.7
All Impacted	42	4.9	6.5	7.7
All that meet NR Goal	42	4.9	6.5	7.7

NSA 6 – Residential dwelling units located in NSA 6 are currently shielded from noise on US 33 by a noise barrier wall located along the edge of shoulder of US 33. A noise analysis for the Design Year 2050 was run for NSA 4 using updated traffic volumes and the existing noise barrier wall. The analysis showed that the existing noise barrier wall would continue to provide a high level of noise abatement for the receivers in NSA 6. All of the impacted receivers would continue to be benefited by the noise barrier wall. As shown on Figure 8, **the existing noise barrier wall at NSA 6 will continue to provide a comparable level of noise abatement in the design year 2050 with no addition or modification to the barrier.**



NSA 7 - Dwelling units at three receiver locations in NSA 7 were predicted to experience noise levels above the Category B NAC in the design year with construction of the proposed project. A noise barrier wall located along the ROW was evaluate at a length 964 feet. Result of the noise barrier wall at various heights is shown in the table below.

Table 7.
Barrier Wall NSA 7
Noise Barrier Wall Located along the US 33 Westbound Right of Way

Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
18	964	$694,000	30	$23,100
17	964	$655,300	30	$21,800
16	964	$616,800	30	$20,500
15	964	$578,200	20	$28,900
14	964	$569,700	20	$28,500

As shown in the table above, **a noise barrier wall at a height of 16 feet and a length of 964 feet would be the most efficient reasonable and feasible noise barrier configuration. The noise barrier is a reasonable and feasible noise abatement measure and is recommended for construction as part of the project.**
The proposed noise barrier wall NSA 7 is shown on Figure 9.

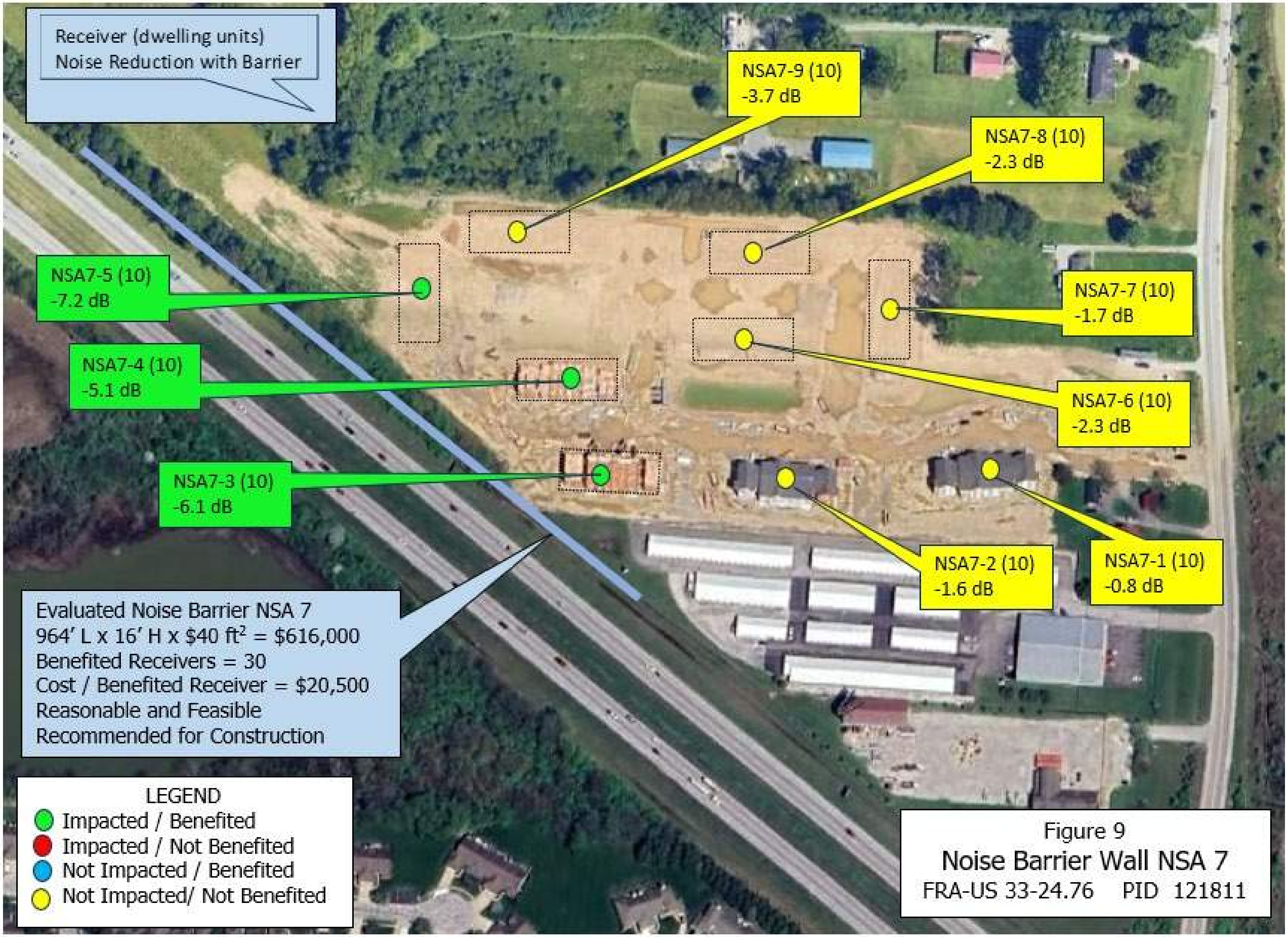
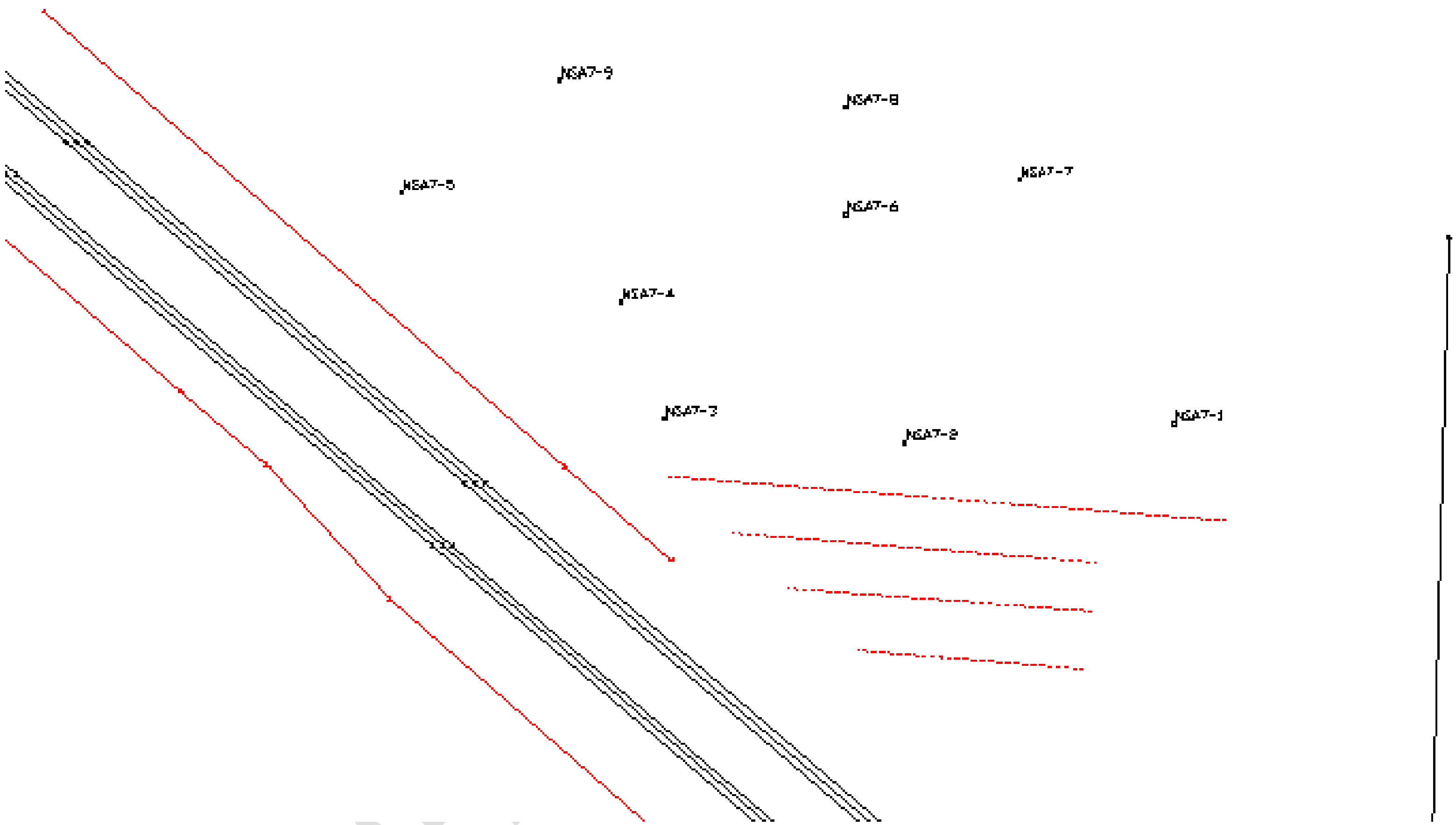


Figure 9
Noise Barrier Wall NSA 7
FRA-US 33-24.76 PID 121811


NSA7-9
NSA7-8
NSA7-7
NSA7-5
NSA7-6
NSA7-4
NSA7-3
NSA7-2
NSA7-1

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CCox

22 October 2024
TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: FRA-US 33-24.76 (121811)
RUN: Design Year 2050 NSA 7
BARRIER DESIGN: Noise Barrier NSA 7 17'

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

ATMOSPHERICS: 68 deg F, 50% RH

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	No Barrier LAeq1h Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
NSA7-1	24	10	57.5	59.3	66	1.8	10	—	58.5	0.8	4	-3.7
NSA7-2	25	10	61.1	62.0	66	0.9	10	—	60.4	1.6	4	-2.9
NSA7-3	26	10	67.0	69.2	66	2.2	10	Snd Lvl	63.1	6.1	4	1.6
NSA7-4	27	10	64.5	66.7	66	2.2	10	Snd Lvl	61.6	5.1	4	0.6
NSA7-5	28	10	67.1	69.2	66	2.1	10	Snd Lvl	62.0	7.2	4	2.7
NSA7-6	29	10	59.0	60.3	66	1.3	10	—	58.0	2.3	4	-2.2
NSA7-7	30	10	57.0	58.2	66	1.2	10	—	56.5	1.7	4	-2.8
NSA7-8	31	10	57.9	59.2	66	1.3	10	—	56.9	2.3	4	-2.2
NSA7-9	32	10	60.9	62.4	66	1.5	10	—	58.7	3.7	4	-0.8

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	90	0.8	3.4	7.2
All Impacted	30	5.1	6.1	7.2
All that meet NR Goal	30	5.1	6.1	7.2

NSA 8 - Residential dwelling units located in NSA 8 are currently shielded from noise on US 33 by a noise barrier wall located along the edge of shoulder of US 33. The noise barrier is 2,174 feet in length and a height of 15 feet. A noise analysis for the Design Year 2050 was run for NSA 8 using updated traffic volumes for Design Year 2050 and the existing noise barrier wall. The results showed that the existing noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the development. All of the impacted receptors will continue to be benefited by the barrier wall. As shown on Figure 10, t**he existing noise barrier wall at NSA 8 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**

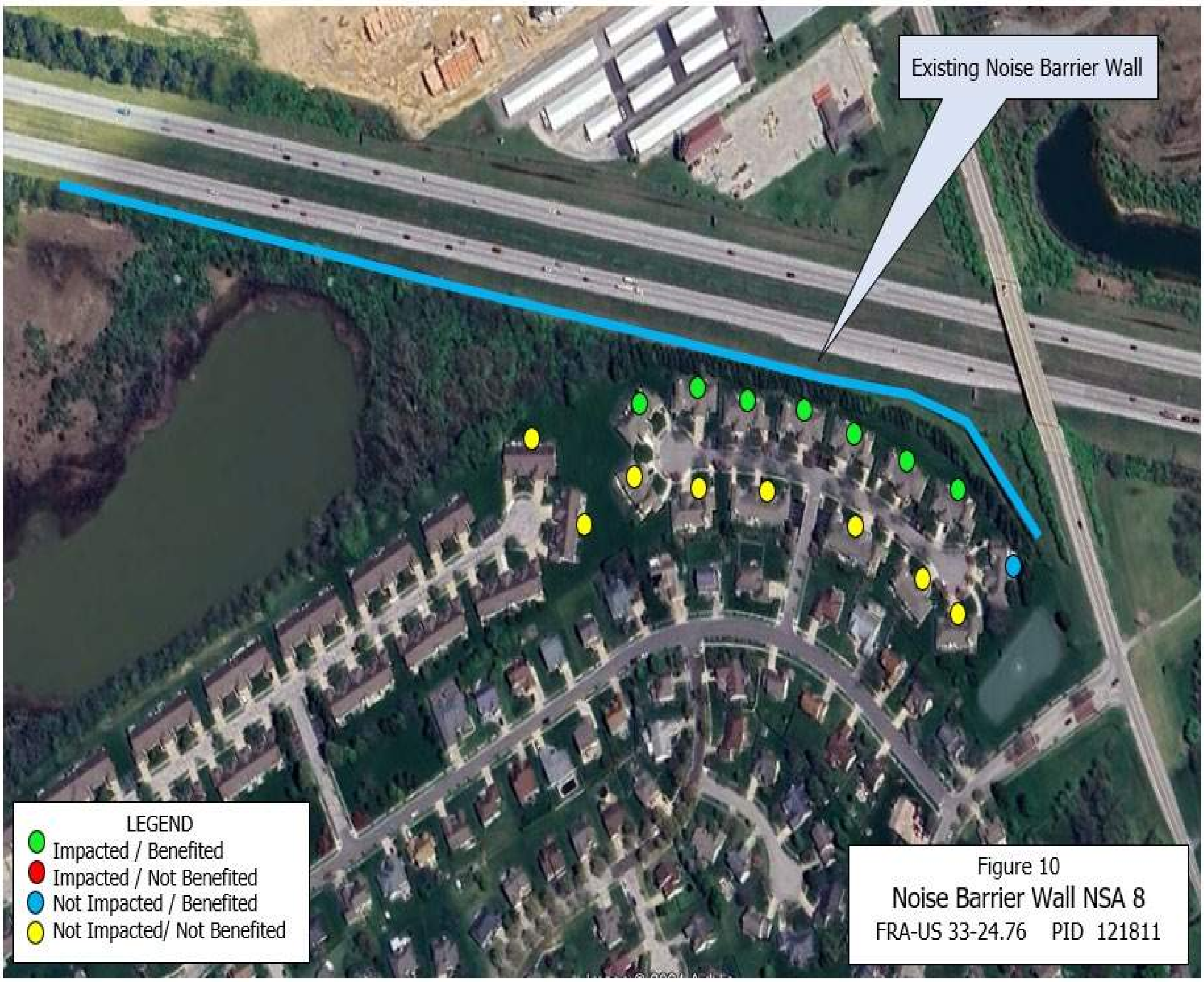


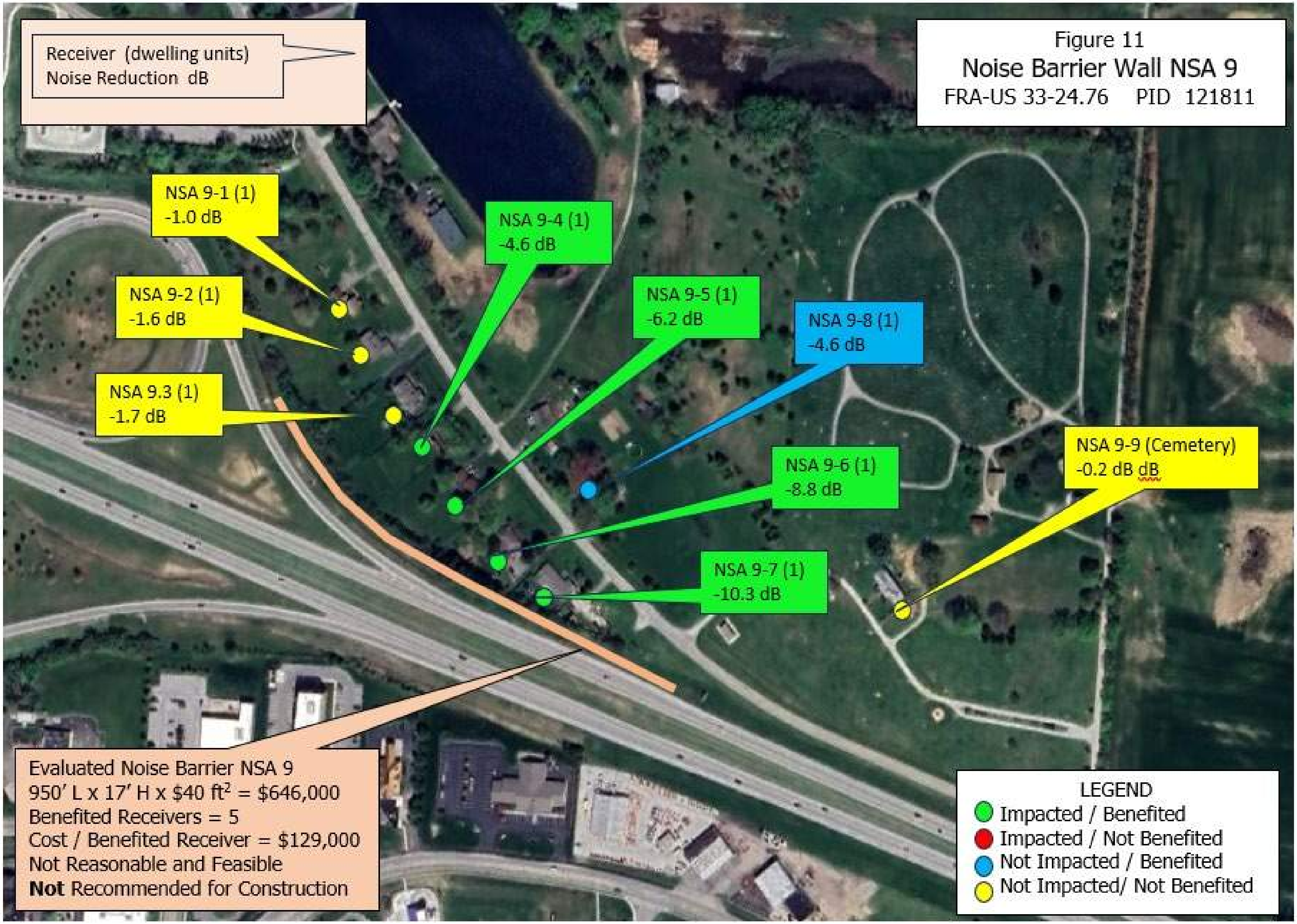
Figure 10
Noise Barrier Wall NSA 8
FRA-US 33-24.76 PID 121811

NSA 9 - Dwelling units at eight receiver locations in NSA 9 were predicted to experience noise levels above the Category B NAC in the design year with construction of the proposed project. A noise barrier wall located along the ROW was evaluate at a length 950 feet was evaluated for the receivers in NSA 9. Result of the noise barrier wall at various heights is shown in the table below.

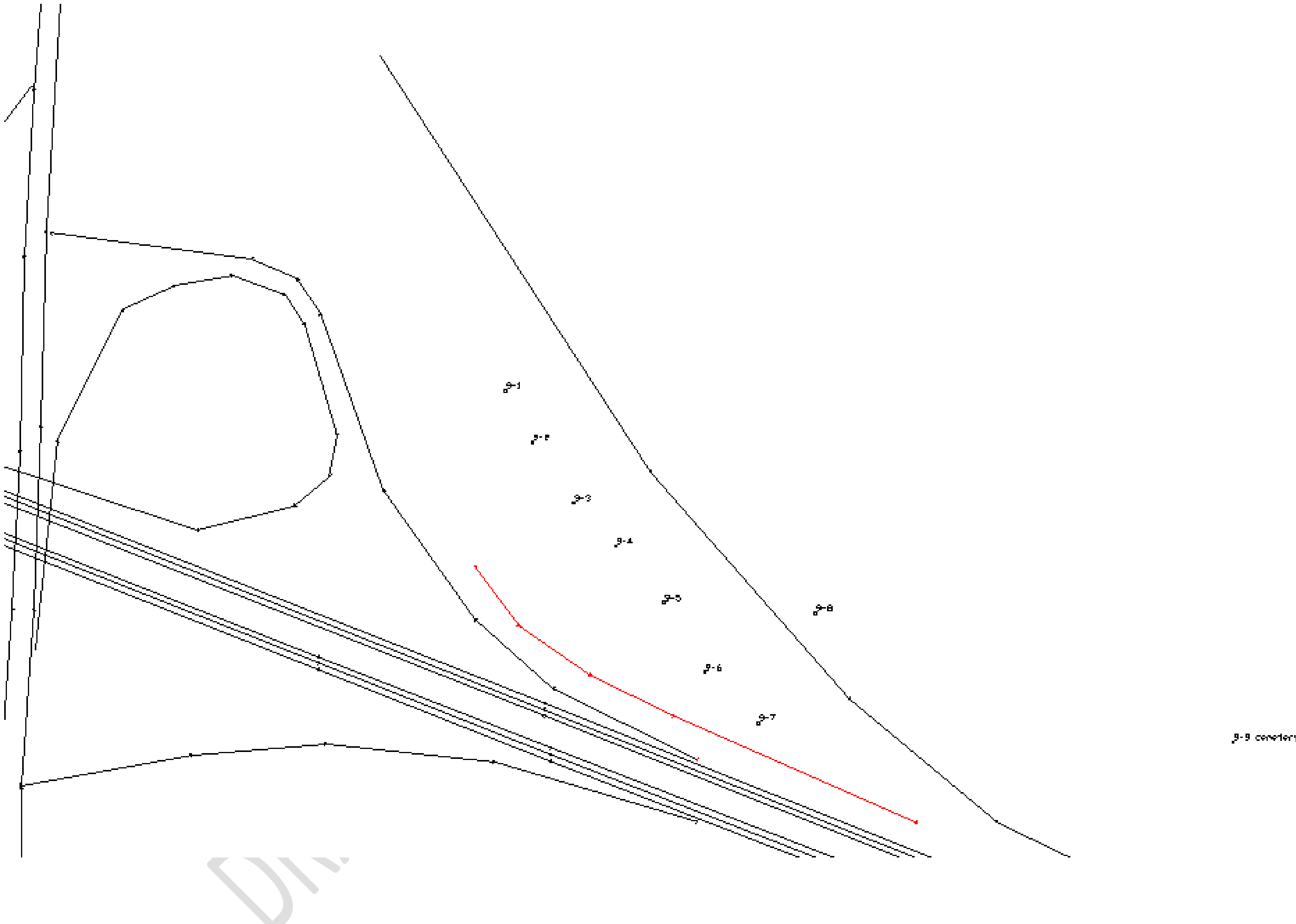
Table 8.
Barrier Wall NSA 9
Noise Barrier Wall Located along the US 33 Westbound Right of Way

Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
18	950	$684,000	5	$136,800
17	950	$646,000	5	$129,000
16	950	$602,000	3	$200,500
15	950	$564,300	3	$188,000
14	950	$526,700	3	$175,500
13	950	$489,000	2	$244,500

As shown on Figure 11 and in the above table, the most efficient noise barrier wall for NSA 9 would be at a height of 17 feet with a length of 950 feet. At an average cost of $129,000 per benefited receptor, the noise barrier is higher than the $56,000 cost reasonable criterion. Noise barrier wall NSA 9 is not a feasible and reasonable noise abatement measure and **no noise barrier wall is recommended for construction at NSA 9.**



Receiver (dwelling units)
Noise Reduction dB
Figure 11
Noise Barrier Wall NSA 9
FRA-US 33-24.76 PID 121811
NSA 9-1 (1)
-1.0 dB
NSA 9-2 (1)
-1.6 dB
NSA 9.3 (1)
-1.7 dB
NSA 9-4 (1)
-4.6 dB
NSA 9-5 (1)
-6.2 dB
NSA 9-8 (1)
-4.6 dB
NSA 9-6 (1)
-8.8 dB
NSA 9-7 (1)
-10.3 dB
NSA 9-9 (Cemetery)
-0.2 dB dB
Evaluated Noise Barrier NSA 9
950' L x 17' H x $40 ft² = $646,000
Benefited Receivers = 5
Cost / Benefited Receiver = $129,000
Not Reasonable and Feasible
Not Recommended for Construction
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited


g-1
g-3
g-4
g-5
g-6
g-7
g-8
g-9 cemetery

Lawhon & Assoc.		22 October 2024
CMCox		TNM 2.5
		Calculated with TNM 2.5
RESULTS: SOUND LEVELS		
PROJECT/CONTRACT:	FAI-US 33-24.76 PID 121811	
RUN:	Design Year 2050 NSA 9	
BARRIER DESIGN:	NSA 9 17' NR	Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.
ATMOSPHERICS:	68 deg F, 50% RH	

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	No Barrier LAeq1h Crit'n	Increase over existing Calculated	Increase over existing Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Noise Reduction Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
9-1	377	1	60.8	62.8	66	2.0	10	—	61.8	1.0	4	-3.5
9-2	378	1	61.5	63.5	66	2.0	10	—	61.9	1.6	4	-2.9
9-3	379	1	62.6	64.7	66	2.1	10	—	61.5	3.2	4	-1.3
9-4	380	1	63.7	66.0	66	2.3	10	Snd Lvl	61.4	4.6	4	0.1
9-5	381	1	65.6	68.1	66	2.5	10	Snd Lvl	61.9	6.2	4	1.7
9-6	382	1	68.9	71.7	66	2.8	10	Snd Lvl	62.9	8.8	4	4.3
9-7	383	1	71.0	74.0	66	3.0	10	Snd Lvl	63.7	10.3	4	5.8
9-8	384	1	63.0	65.0	66	2.0	10	—	60.4	4.6	4	0.1
9-9 cemetery	385	1	60.7	63.2	66	2.5	10	—	63.0	0.2	4	-4.3

Dwelling Units	# DUs	Noise Reduction Min	Noise Reduction Avg	Noise Reduction Max
		dB	dB	dB
All Selected	9	0.2	4.5	10.3
All Impacted	4	4.6	7.5	10.3
All that meet NR Goal	5	4.6	6.9	10.3

NSA 10 – A total of 28 residential dwelling units were predicted to experience Design Year 2050 traffic noise levels that would exceed the Activity Category B NAC with construction of the proposed project. A noise barrier wall located along the ROW was evaluate at a length 3,500 feet was evaluated for the receivers in NSA 10. Results of the noise barrier wall at various heights is shown in the table below.

Table 9. **Barrier Wall NSA 10** Noise Barrier Wall Located along the US 33 Eastbound Right of Way				
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
18	3,500	$2,519,000	102	$24,700
17	3,500	$2,379,000	101	$23,600
16	3,500	$2,239,000	99	$22,500
15	3,500	$2,099,000	86	$24,400
14	3,500	$1,959,500	76	$25,800
13	3,500	$1,859,500	59	$30,800

As shown in the table above, **a noise barrier wall at a height of 16 feet and a length of 3,500 feet is the most efficient reasonable and feasible noise abatement measure for NSA 10 and is recommended for construction as part of the project.**

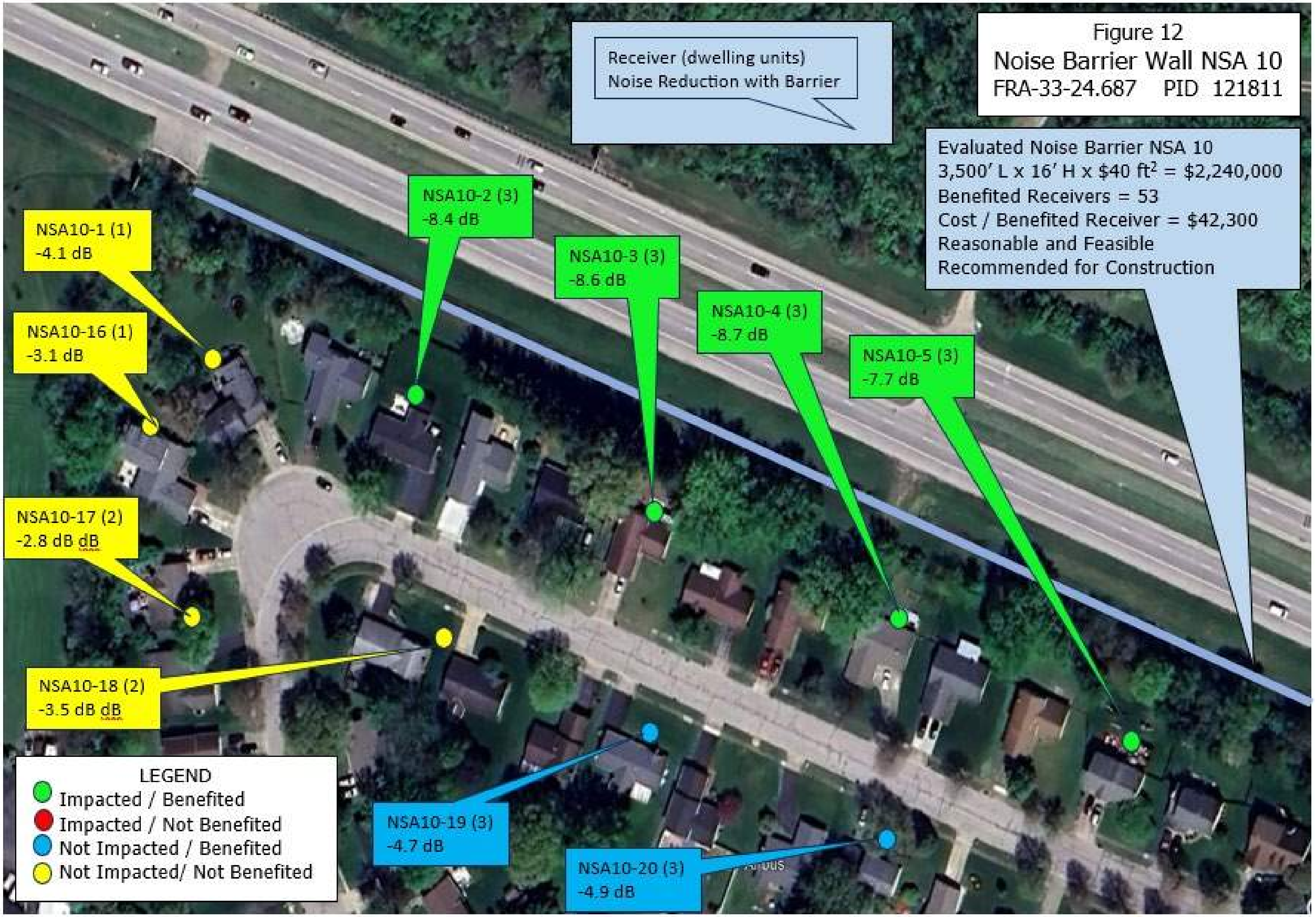


Figure 12
Noise Barrier Wall NSA 10
FRA-33-24.687 PID 121811
Receiver (dwelling units)
Noise Reduction with Barrier
Evaluated Noise Barrier NSA 10
3,500' L x 16' H x $40 ft² = $2,240,000
Benefited Receivers = 53
Cost / Benefited Receiver = $42,300
Reasonable and Feasible
Recommended for Construction
NSA10-1 (1)
-4.1 dB
NSA10-16 (1)
-3.1 dB
NSA10-2 (3)
-8.4 dB
NSA10-3 (3)
-8.6 dB
NSA10-4 (3)
-8.7 dB
NSA10-5 (3)
-7.7 dB
NSA10-17 (2)
-2.8 dB dB
NSA10-18 (2)
-3.5 dB dB
NSA10-19 (3)
-4.7 dB
NSA10-20 (3)
-4.9 dB
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited

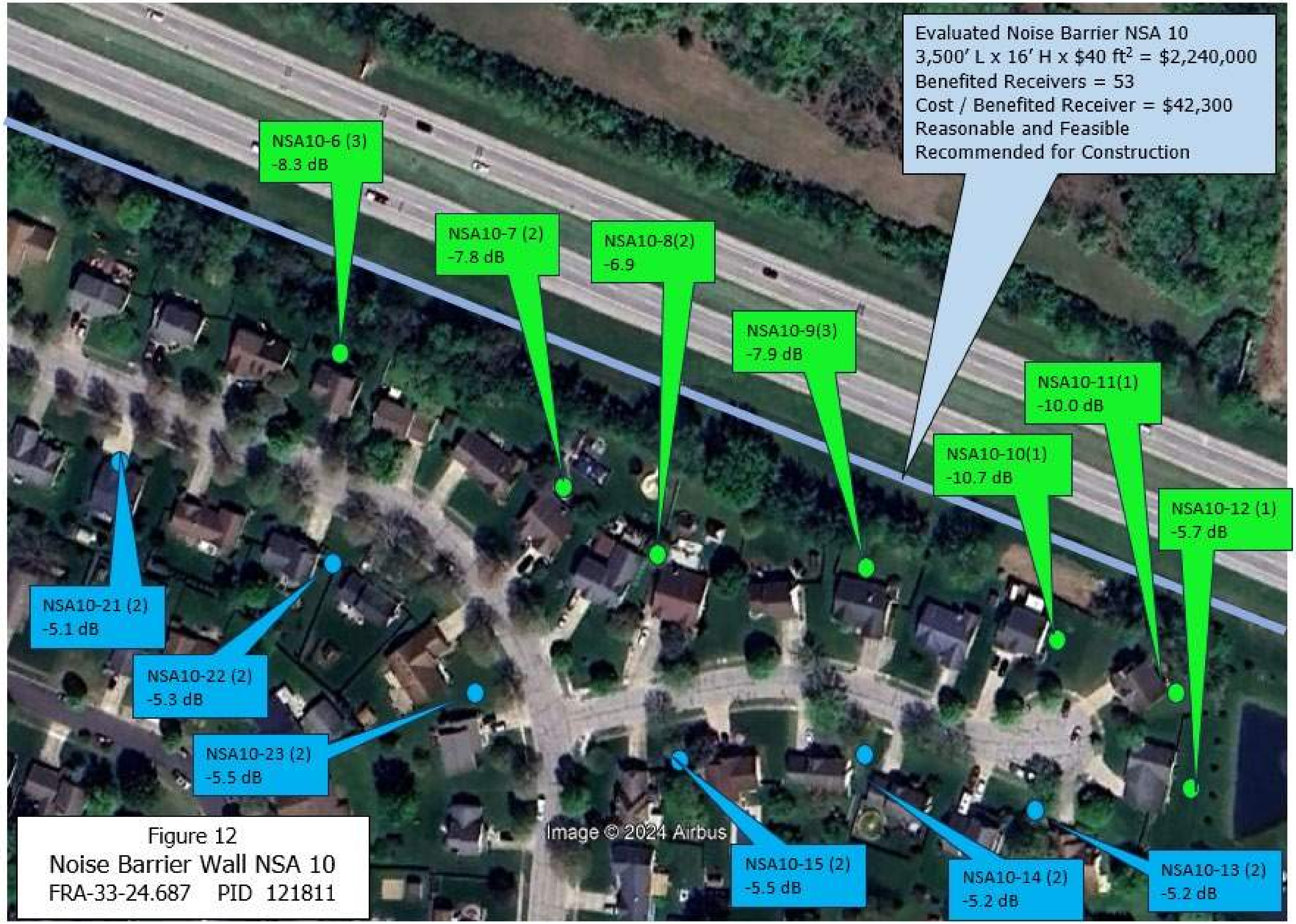


Figure 12
Noise Barrier Wall NSA 10
FRA-33-24.687 PID 121811

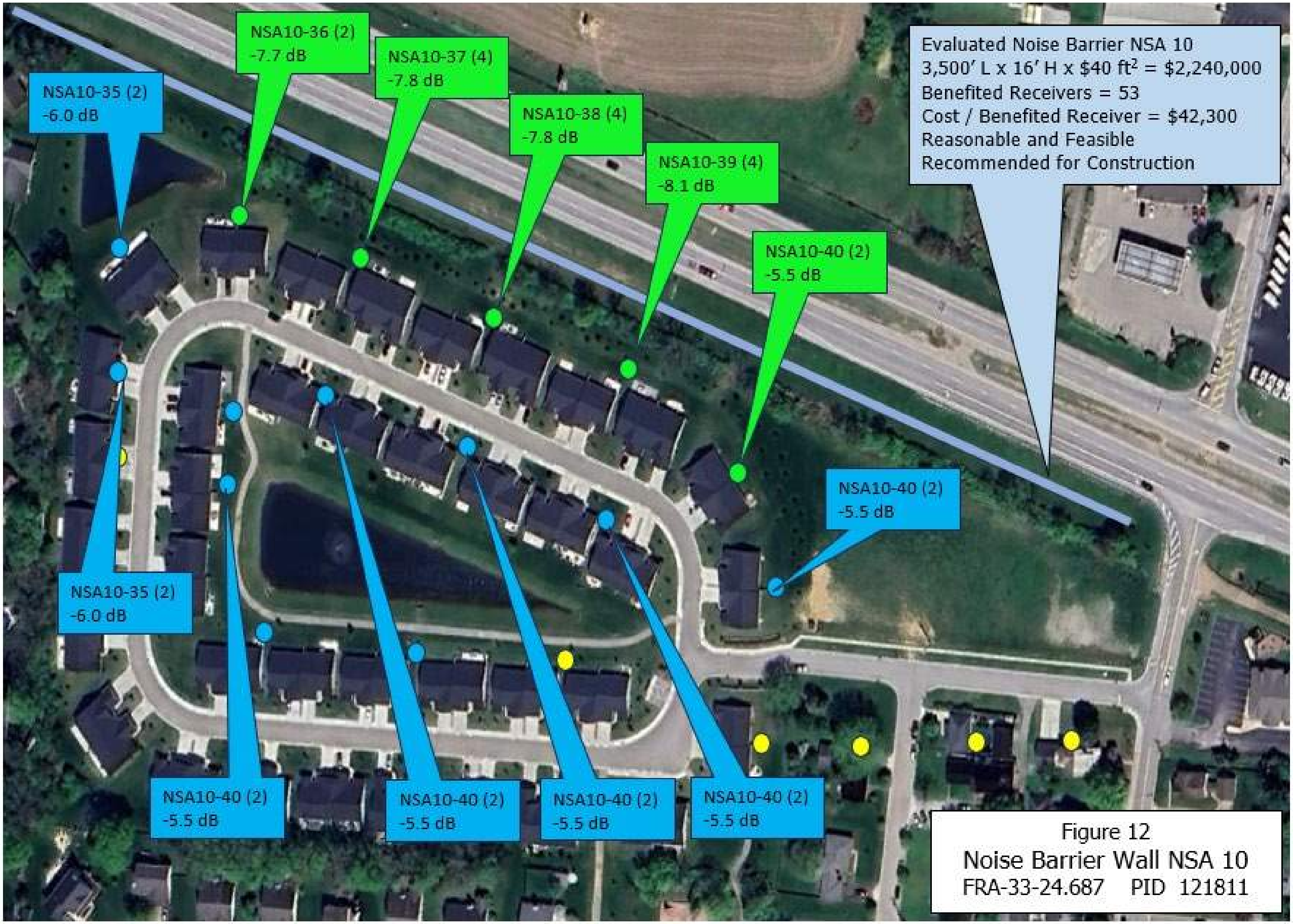
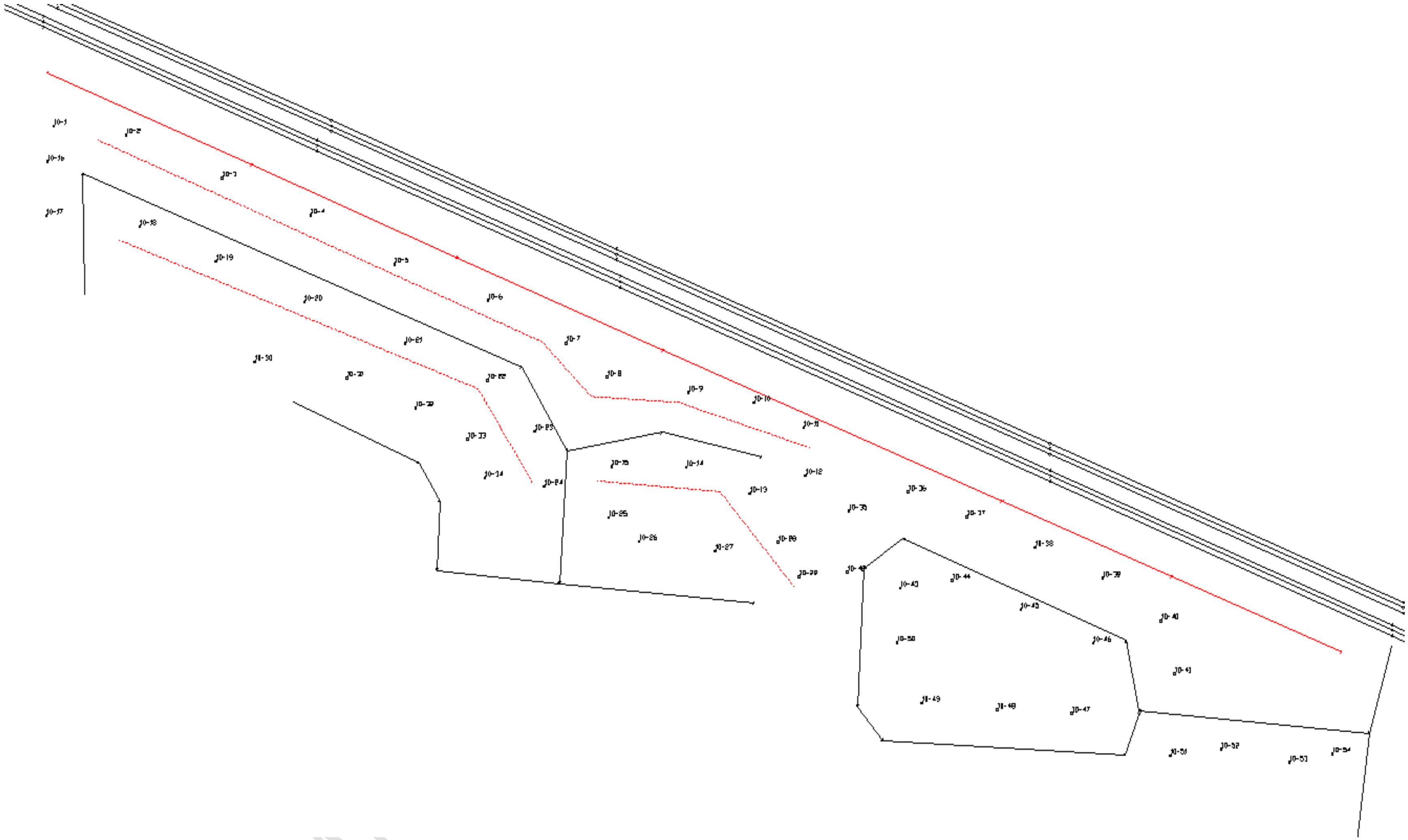


Figure 12
Noise Barrier Wall NSA 10
FRA-33-24.687 PID 121811



Lawhon & Assoc. | 22 October 2024
CMCox | TNM 2.5
Calculated with TNM 2.5

RESULTS: SOUND LEVELS
PROJECT/CONTRACT: FAI-33-24.26 PID 98111
RUN: Design Year 2050 NSA 10
BARRIER DESIGN: Noise Barrier NSA 10 16'

Average pavement type shall be used unless a State highway agency substantiates the use of a different type with approval of FHWA.

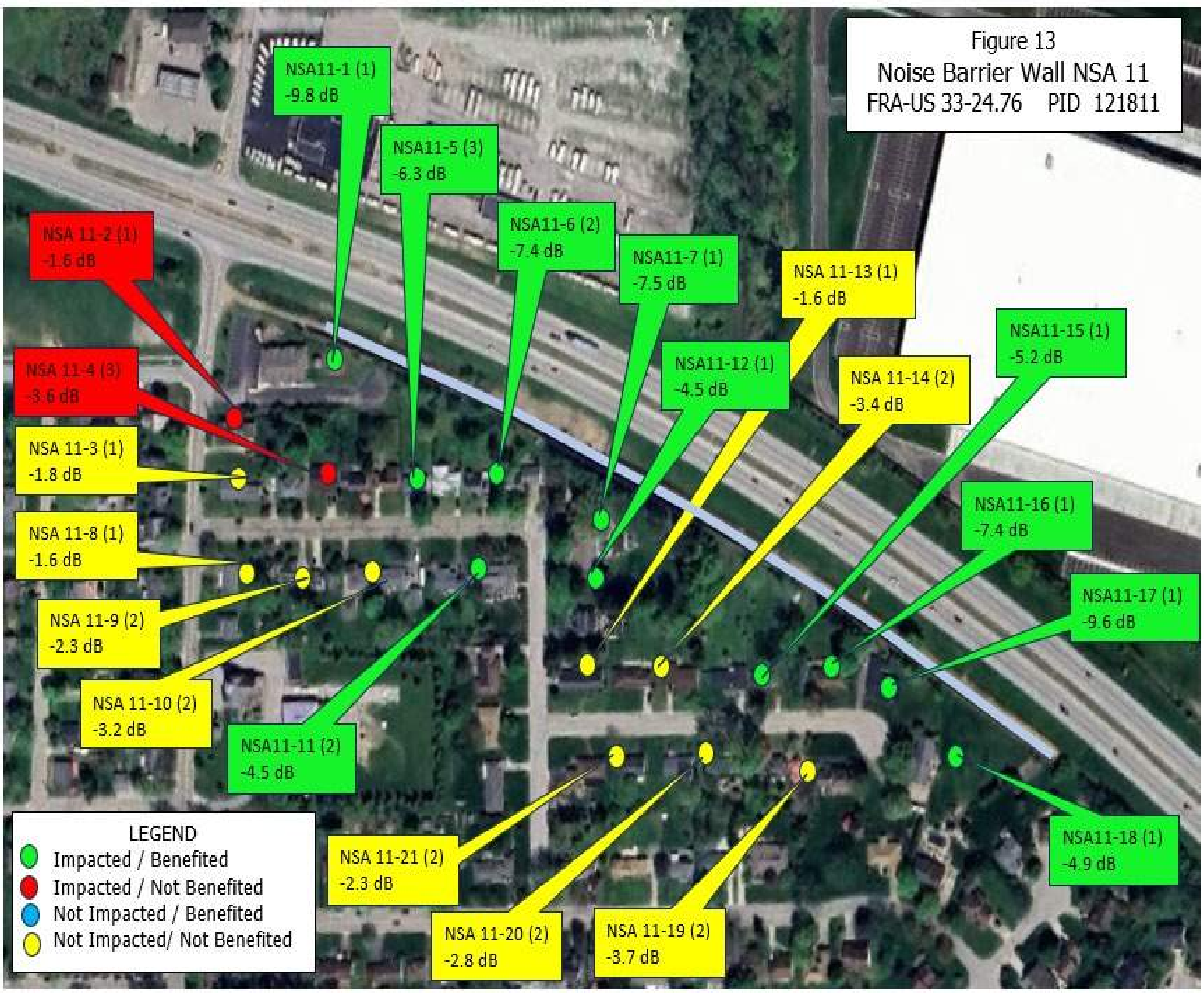
ATMOSPHERICS: 68 deg F, 50% RH

Receiver Name	No.	#DUs	Existing LAeq1h	No Barrier LAeq1h Calculated	Crit'n	Increase over existing Calculated	Crit'n Sub'l Inc	Type Impact	With Barrier Calculated LAeq1h	Noise Reduction Calculated	Goal	Calculated minus Goal
			dBA	dBA	dBA	dB	dB		dBA	dB	dB	dB
10-1	323	1	66.1	66.6	66	0.5	10	Snd Lvl	62.5	4.1	4	-0.4
10-2	324	3	68.4	68.6	66	0.2	10	Snd Lvl	60.2	8.4	4	3.9
10-3	325	3	68.4	68.3	66	-0.1	10	Snd Lvl	59.7	8.6	4	4.1
10-4	326	3	68.4	67.4	66	-1.0	10	Snd Lvl	58.7	8.7	4	4.2
10-5	327	3	67.4	65.8	66	-1.6	10	—	58.1	7.7	4	3.2
10-6	328	3	68.0	66.1	66	-1.9	10	Snd Lvl	57.8	8.3	4	3.8
10-7	329	2	67.2	65.5	66	-1.7	10	—	57.7	7.8	4	3.3
10-8	330	2	65.8	64.6	66	-1.2	10	—	57.7	6.9	4	2.4
10-9	331	3	67.8	66.3	66	-1.5	10	Snd Lvl	58.4	7.9	4	3.4
10-10	332	1	70.2	68.8	66	-1.4	10	Snd Lvl	58.1	10.7	4	6.2
10-11	333	1	69.9	68.9	66	-1.0	10	Snd Lvl	58.9	10.0	4	5.5
10-12	334	1	64.9	64.3	66	-0.6	10	—	58.6	5.7	4	1.2
10-13	335	2	62.6	62.0	66	-0.6	10	—	56.8	5.2	4	0.7
10-14	336	2	62.4	61.5	66	-0.9	10	—	56.3	5.2	4	0.7
10-15	337	2	60.9	60.7	66	-0.2	10	—	55.2	5.5	4	1.0
10-16	338	1	63.2	64.1	66	0.9	10	—	61.0	3.1	4	-1.4
10-17	339	2	60.8	62.2	66	1.4	10	—	59.4	2.8	4	-1.7
10-18	340	2	61.2	61.6	66	0.4	10	—	58.1	3.5	4	-1.0
10-19	341	3	61.5	61.6	66	0.1	10	—	56.9	4.7	4	0.2
10-20	342	3	61.2	61.1	66	-0.1	10	—	56.2	4.9	4	0.4
10-21	343	3	61.5	60.9	66	-0.6	10	—	55.8	5.1	4	0.6
10-22	344	2	61.7	61.0	66	-0.7	10	—	55.7	5.3	4	0.8
10-23	345	2	61.0	60.5	66	-0.5	10	—	55.0	5.5	4	1.0

10-22	344	2	61.7	61.0	66	-0.7	10	—	55.7	5.3	4	0.8
10-23	345	2	61.0	60.5	66	-0.5	10	—	55.0	5.5	4	1.0
10-24	346	1	59.9	60.0	66	0.1	10	—	53.8	6.2	4	1.7
10-25	347	1	57.5	58.3	66	0.8	10	—	53.3	5.0	4	0.5
10-26	348	3	56.9	57.3	66	0.4	10	—	53.3	4.0	4	-0.5
10-27	349	2	58.1	58.2	66	0.1	10	—	53.6	4.6	4	0.1
10-28	350	1	61.3	61.3	66	0.0	10	—	56.4	4.9	4	0.4
10-29	351	1	60.6	61.1	66	0.5	10	—	56.3	4.8	4	0.3
10-30	352	1	58.5	59.1	66	0.6	10	—	53.3	5.8	4	1.3
10-31	353	3	57.8	58.3	66	0.5	10	—	52.8	5.5	4	1.0
10-32	354	2	57.3	57.9	66	0.6	10	—	53.8	4.1	4	-0.4
10-33	355	1	57.0	57.4	66	0.4	10	—	52.9	4.5	4	0.0
10-34	356	1	56.7	57.0	66	0.3	10	—	52.6	4.4	4	-0.1
10-35	357	2	63.9	63.4	66	-0.5	10	—	57.4	6.0	4	1.5
10-36	358	2	67.6	65.7	66	-1.9	10	—	58.0	7.7	4	3.2
10-37	359	4	67.8	65.9	66	-1.9	10	—	58.1	7.8	4	3.3
10-38	360	4	67.8	66.3	66	-1.5	10	Snd Lvl	58.5	7.8	4	3.3
10-39	361	4	68.1	66.7	66	-1.4	10	Snd Lvl	58.6	8.1	4	3.6
10-40	362	2	67.3	66.2	66	-1.1	10	Snd Lvl	58.5	7.7	4	3.2
10-41	363	2	65.1	64.2	66	-0.9	10	—	59.5	4.7	4	0.2
10-42	364	2	61.3	61.7	66	0.4	10	—	56.4	5.3	4	0.8
10-43	365	2	61.5	62.0	66	0.5	10	—	56.0	6.0	4	1.5
10-44	366	4	62.6	62.9	66	0.3	10	—	56.6	6.3	4	1.8
10-45	367	4	63.1	62.8	66	-0.3	10	—	57.7	5.1	4	0.6
10-46	368	4	65.2	63.5	66	-1.7	10	—	58.2	5.3	4	0.8
10-47	369	4	60.6	60.9	66	0.3	10	—	57.1	3.8	4	-0.7
10-48	370	4	59.8	60.2	66	0.4	10	—	55.9	4.3	4	-0.2
10-49	371	4	58.9	59.3	66	0.4	10	—	54.8	4.5	4	0.0
10-50	372	4	59.9	60.4	66	0.5	10	—	55.4	5.0	4	0.5
10-51	373	2	60.3	60.5	66	0.2	10	—	57.2	3.3	4	-1.2
10-52	374	1	61.3	61.1	66	-0.2	10	—	58.2	2.9	4	-1.6
10-53	375	2	62.3	61.4	66	-0.9	10	—	59.9	1.5	4	-3.0
10-54	376	1	64.3	63.0	66	-1.3	10	—	62.2	0.8	4	-3.7

Dwelling Units	# DUs	Noise Reduction		
		Min	Avg	Max
		dB	dB	dB
All Selected	125	0.8	5.6	10.7
All Impacted	28	4.1	8.2	10.7

NSA 11 - NSA 11 is a large residential development located on the south side of US 33 and situated just east of the North High Street intersection at US 33. The NSA extends a distance of approximately 1,700 feet east of North High Street and ending just north of Jennings Drive. Within the NSA is an existing noise barrier wall located along the US 33 ROW that begins just east of North Main Street. According to the ODOT TIMS, the existing noise barrier is 1,676 feet in length and a height of 18 feet. The existing noise barrier wall was re-evaluated using the updated traffic volumes for Design Year 2050. In its existing configuration, results showed that the noise barrier wall would continue to provide a similar level of noise abatement that it currently provides to the receivers within the NSA. All of the impacted receptors, except for two receivers located on the far west end where the noise barrier cannot be extended further west due to the location of North Main Street, will continue to be benefited by the barrier wall. **The existing noise barrier wall at NSA 11 will continue to provide a high level of noise abatement for receivers in the NSA and no additional modifications or additions to the noise barrier wall would be required.**



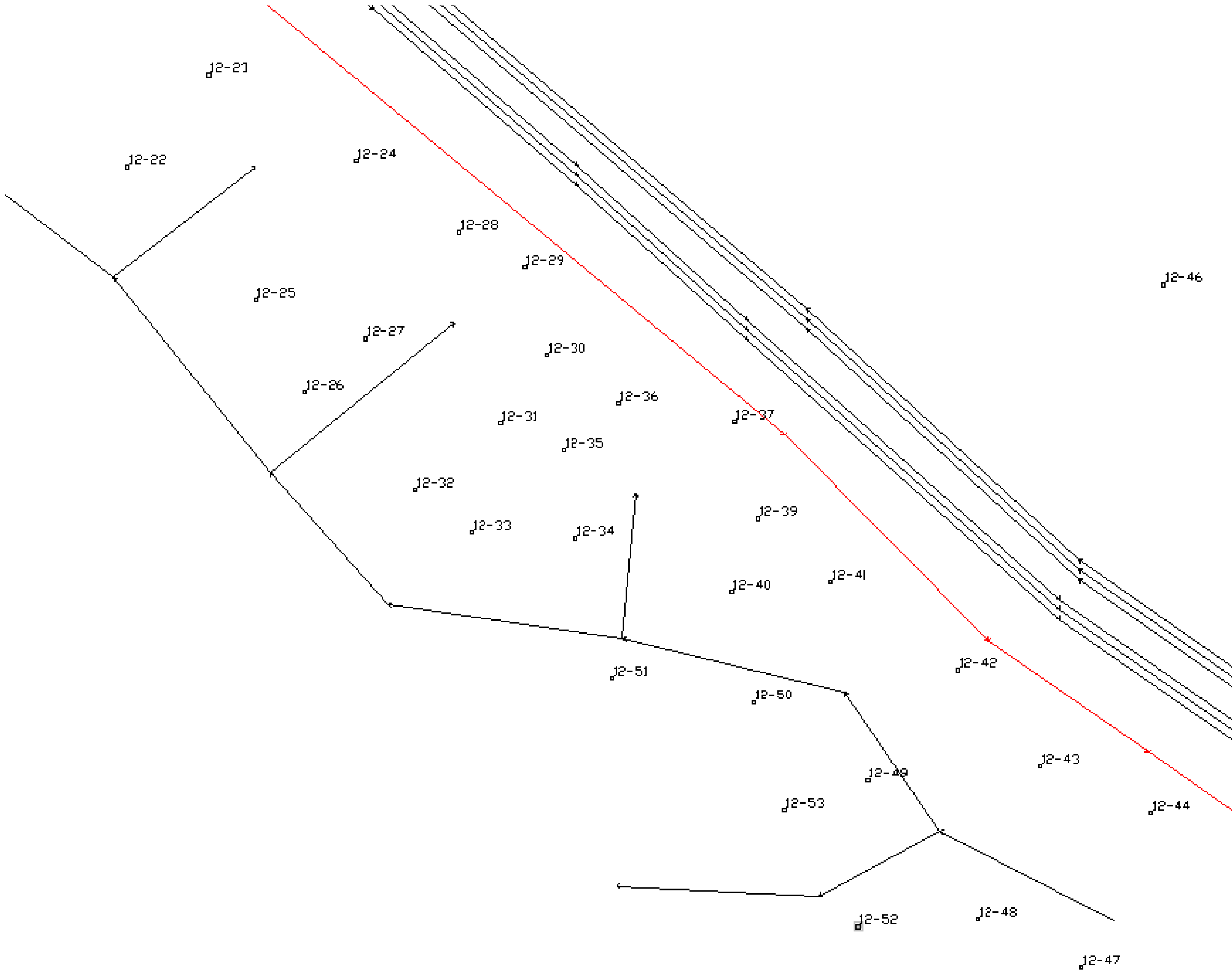
NSA 12 - As part of the analysis for NSA 11, it is proposed that the existing noise barrier wall be extended further east, from the point where the noise barrier currently ends, a distance of 1,900 feet. This noise barrier extension and the dwelling units left unshielded by noise barrier NSA 11 will be called NSA 12. The extended barrier, at a length of 1,900 feet is shown at various heights in the table below.

Table 10. **of Noise Barrier Wall NSA 12** Noise Barrier Wall Located along the US 33 Eastbound Right of Way				
Height (ft)	Length (ft)	Total cost	Benefited receptors	Cost per benefited receptor
18	1,900	$1,368,000	43	$31,800
17	1,900	$1,292,000	43	$30,000
16	1,900	$1,216,000	43	$28,000
15	1,900	$1,140,000	33	$34,500
14	1,900	$1,064,000	25	$44,500
13	1,900	$988,000	20	$49,400

As shown in the table above, a noise barrier wall at a height of 16 feet and a length of 1,900 feet is the most efficient reasonable and feasible noise abatement measure. With the additional length, the noise barrier will benefit 43 more receivers. **Adding 1,900 feet to the existing noise barrier wall will be a reasonable and feasible noise abatement measure and is recommended for construction as part of the project.**


Figure 14
Noise Barrier Wall NSA 12
FRA-US 33-24.76 PID 121811
Existing Noise Barrier
NSA12-23 (2)
-8.5 dB
NSA12-24 (2)
-9.4 dB
NSA12-22 (1)
-5.7 dB
NSA12-28 (1)
-10.1 dB
NSA12-29 (1)
-11.1 dB
NSA12-30 (1)
-8.5 dB
NSA12-25 (2)
-5.5 dB
NSA12-36 (1)
-9.1 dB
NSA12-37 (1)
-13.3 dB
NSA12-27 (2)
-5.9 dB
NSA12-39 (1)
-9.7 dB
NSA12-26 (1)
-5.6 dB
NSA12-32 (2)
-5.6 dB
NSA 11-19 (2)
-3.7 dB
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited
NSA12-40 (2)
-7.6 dB

Evaluated Noise Barrier NSA 12
1,900' L x 16' H x $40 ft² = $1,216,000
Benefited Receivers = 43
Cost / Benefited Receiver = $28,000
Reasonable and Feasible
Recommended for Construction
Figure 14
Noise Barrier Wall NSA 12
FRA-US 33-24.76 PID 121811
NSA12-41 (2)
-9.8 dB
NSA12-42 (2)
-10.7 dB
NSA12-43 (2)
-9.6 dB
NSA12-44 (2)
-11.1 dB
NSA12-45 (1)
-7.3 dB
NSA12-47 (1)
-5.7 dB
NSA12-48 (2)
-5.8 dB
LEGEND
Impacted / Benefited
Impacted / Not Benefited
Not Impacted / Benefited
Not Impacted/ Not Benefited


J2-21
J2-22
J2-24
J2-28
J2-29
J2-46
J2-25
J2-27
J2-30
J2-26
J2-36
J2-31
J2-37
J2-35
J2-32
J2-39
J2-33
J2-34
J2-41
J2-40
J2-42
J2-51
J2-50
J2-43
J2-49
J2-53
J2-44
J2-52
J2-48
J2-47

			dBA	dBA	dBA	dB	dB		dBA	dB
12-23	399	2	0.0	69.7	66	69.7	10	Snd Lvl	61.2	
12-22	398	1	0.0	65.3	66	65.3	10	—	59.6	
12-24	400	2	0.0	71.6	66	71.6	10	Snd Lvl	62.2	
12-25	401	2	0.0	64.9	66	64.9	10	—	59.4	
12-26	402	1	0.0	64.2	66	64.2	10	—	58.6	
12-27	403	2	0.0	65.9	66	65.9	10	—	60.0	
12-28	404	1	0.0	72.6	66	72.6	10	Snd Lvl	62.5	1
12-29	405	1	0.0	73.7	66	73.7	10	Snd Lvl	62.6	1
12-30	406	1	0.0	70.1	66	70.1	10	Snd Lvl	61.6	
12-31	407	1	0.0	66.5	66	66.5	10	Snd Lvl	60.1	
12-32	408	2	0.0	64.1	66	64.1	10	—	58.5	
12-33	409	2	0.0	64.2	66	64.2	10	—	58.5	
12-34	410	1	0.0	65.7	66	65.7	10	—	59.3	
12-35	411	1	0.0	67.2	66	67.2	10	Snd Lvl	60.4	
12-36	412	1	0.0	70.8	66	70.8	10	Snd Lvl	61.7	
12-37	413	1	0.0	75.3	66	75.3	10	Snd Lvl	62.0	1
12-39	415	1	0.0	71.1	66	71.1	10	Snd Lvl	61.4	
12-40	416	1	0.0	67.6	66	67.6	10	Snd Lvl	60.0	
12-41	417	2	0.0	71.4	66	71.4	10	Snd Lvl	61.6	
12-42	418	2	0.0	72.4	66	72.4	10	Snd Lvl	61.7	1
12-43	419	2	0.0	71.0	66	71.0	10	Snd Lvl	61.4	
12-44	420	2	0.0	72.7	66	72.7	10	Snd Lvl	61.6	1
12-45	421	1	0.0	68.5	66	68.5	10	Snd Lvl	61.2	
12-47	423	1	0.0	65.1	66	65.1	10	—	59.4	
12-48	424	2	0.0	64.8	66	64.8	10	—	59.0	
12-49	425	1	0.0	65.5	66	65.5	10	—	58.7	
12-50	426	2	0.0	65.5	66	65.5	10	—	58.8	
12-51	427	2	0.0	64.1	66	64.1	10	—	58.1	
12-52	428	1	0.0	62.9	66	62.9	10	—	57.8	
12-53	429	1	0.0	64.0	66	64.0	10	—	57.6	

Dwelling Units		# DUs	Noise Reduction		
			Min	Avg	Max
			dB	dB	dB
All Selected		43	5.1	7.7	13.3
All Impacted		22	6.4	9.3	13.3
All that meet NR Goal		43	5.1	7.7	13.3

NWPPP Summary
Twelve NSAs were identified as being located within the project limits. Four of the twelve NSAs currently have noise barrier walls constructed as part of previous projects. The noise analysis included the evaluation of the existing noise barrier walls and determined that all existing noise barriers would continue to provide a similar level of noise abatement in the Design Year 2050 with the increase in traffic volume as a result of the proposed project.

The noise analysis also determined that noise sensitive receptors located within eight of the NSAs without existing noise barriers would experience traffic noise levels above the applicable FHWA Noise Abatement Criteria (NAC) in the design year with construction of the proposed project. Noise abatement, in the form of noise barrier walls, was considered at all eight NSAs. Noise barrier walls were determined to be both a feasible and reasonable noise abatement measure at four of the NSAs. Noise abatement considered for all 12 NSAs is summarized on Table 11. The four noise barrier walls recommended for construction as part of the project are summarized in Table 12.

Table 11.
Noise Barrier Evaluation Summary

Barrier	Barrier Length (feet)	Barrier Height (feet)	Square Footage of Barrier	Maximum Insertion Loss[a] (dB)	Benefitted Properties [b]	Barrier Cost [c]	Cost per benefited receptor	Effectiveness		Barrier Location [f]	Barrier Recommended [g]
								Feasible [d]	Reasonable [e]		
NSA 1 Scenario 1	1,850	17	31,450	9.7	5	$1,258,000	$251,600	Yes	No	EOS	**No**
NSA 1 Scenario 2	2,244	16	35,904	8.8	6	$1,436,000	$239,360	Yes	No	ROW/EOS	**No**
NSA 2 Scenario 1	1,482	17	23,712	9.2	7	$879,500	$125,500	Yes	No	EOS	**No**
NSA 2 Scenario 2	1089	18	19,602	4.9	6	$857,500	$128,500	No	No	ROW	**No**
NSA 3	1,730	14	24,220	9.6	15	$970,500	$60,500	Yes	No	EOS	**No**
NSA 4	1,884	14	26,375	11.5	49	$1,055,000	$21,531	Yes	Yes	EOS	Existing
NSA 5	1,426	14	19,964	7.7	42	$798,000	$19,000	Yes	Yes	EOS	**Yes**
NSA 6	580	16	9,280	8.2	10	$371,200	$37,120	Yes	Yes	ROW	Existing
NSA 7	964	16	15,424	7.2	30	$616,800	$20,500	Yes	Yes	ROW	**Yes**
NSA 8	2,174	15	32,610	9.7	24	$1,304,000	$54,300	Yes	Yes	ROW	Existing
NSA 9	950	17	16,150	10.3	5	$639,500	$128,000	Yes	No	ROW	**No**
NSA 10	3,500	16	56,000	8.5	53	$2,240,000	$42,300	Yes	Yes	ROW	**Yes**
NSA 11	1,676	18	30,168	9.6	14	$1,206,700	$86,200	Yes	No	ROW	Existing
NSA12	1,900	16	30,400	12.3	43	$1,216,000	$28,000	Yes	Yes	ROW	**Yes**

[a] Insertion Loss (IL) is the maximum noise reduction provided by the noise barrier.
[b] A receptor is considered benefited by the noise barrier if the IL is 5dB or greater.
[c] Cost is based on $40 per square foot of noise barrier constructed on ground and $100 per square foot constructed on structure.
[d] A noise barrier is considered feasible if it can provide a substantial noise reduction of at least 7dB at one receptor location.
[e] A noise barrier is considered cost reasonable if the cost per benefited receptor is less than $56,000.
[f] The location of the noise barrier wall: ROW=noise barrier is located along the right of way line; EOS=noise barrier is located along the edge of shoulder.
[g] Noise barrier recommendation is based on the number of benefited receptors and the relative cost per benefited receptor.

Table 12.
Recommended Noise Barrier Walls

Barrier	Barrier Length (feet)	Barrier Height (feet)	Square Footage of Barrier	Maximum Insertion Loss[a] (dB)	Benefitted Properties [b]	Barrier Cost [c]	Cost per benefited receptor	Effectiveness		Barrier Location [f]	Barrier Recommended [g]
								Feasible [d]	Reasonable [e]		
NSA 5	1,426	14	19,964	7.7	42	$798,000	$19,000	Yes	Yes	EOS	**Yes**
NSA 7	964	16	15,424	7.2	30	$616,800	$20,500	Yes	Yes	ROW	**Yes**
NSA 10	3,500	16	56,000	8.5	53	$2,240,000	$42,300	Yes	Yes	ROW	**Yes**
NSA12	1,900	16	30,400	12.3	43	$1,216,000	$28,000	Yes	Yes	ROW	**Yes**

[a] Insertion Loss (IL) is the maximum noise reduction provided by the noise barrier.
[b] A receptor is considered benefited by the noise barrier if the IL is 5dB or greater.
[c] Cost is based on $25 per square foot of noise barrier constructed on ground and $100 per square foot constructed on structure..
[d] A noise barrier is considered feasible if it can provide a substantial noise reduction of at least 7dB at one receptor location.
[e] A noise barrier is considered cost reasonable if the cost per benefited receptor is less than $35,000.
[f] The location of the noise barrier wall: ROW=noise barrier is located along the right of way line; EOS=noise barrier is located along the edge of shoulder.
[g] Noise barrier recommendation is based on the number of benefited receptors and the relative cost per benefited receptor.

APPENDIX M:
Cost Estimates

		FRA-33-2476 PID 119387 INSIDE WIDENING COST ESTIMATE			TOTAL	
LINE NO.	ODOT ITEM	DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL COST
		Roadway				
1	201	Clearing and Grubbing	LS	$ 500,000.00	1	$ 500,000
2	202	Guardrail removed	FT	$ 3.00	29048	$ 87,144
3	202	Pavement removed (Widening Section)	SY	$ 9.00	59707	$ 537,363
4	202	Pavement removed (Existing Lane Section)	SY	$ 8.00	441571	$ 3,532,568
5	203	Excavation	CY	$ 18.00	75000	$ 1,350,000
6	203	Embankment	CY	$ 15.00	250000	$ 3,750,000
7	204	Subgrade compaction (Widening Section)	SY	$ 2.25	294296	$ 662,166
8	204	Subgrade compaction (Existing Lane Section)	SY	$ 2.25	458833	$ 1,032,374
9	206	Cement Stabilized Subgrade 12 Inches Deep (Widening Section)	SY	$ 5.00	294296	$ 1,471,480
10	206	Cement Stabilized Subgrade 12 Inches Deep (Existing Lane Section)	SY	$ 5.00	458833	$ 2,294,165
11	605	6" Shallow Pipe Underdrains	FT	$ 10.00	285120	$ 2,851,200
12	606	Guardrail, Type MGS	FT	$ 20.00	36341	$ 726,820
13	622	Concrete Barrier, Single Slope, Type C1	FT	$ 90.00	48085	$ 4,327,618
		Erosion Control				
14	832	Storm Water Pollution Prevention Plan	LS	$ 100,000.00	1	$ 100,000
15	832	Erosion Control	EA	$ 500,000.00	1	$ 500,000
		Drainage				
16	611	18" conduit, Type B	FT	$ 130.00	17820	$ 2,316,600
17	611	Manhole, No. 3	EA	$ 4,000.00	119	$ 475,200
18	SPEC	BMP	LS	$ 400,000.00	1	$ 400,000
19	611	Inlet, No 3 For Single Slope Barrier, Type C1	EA	$ 8,000.00	238	$ 1,900,800
		Pavement For Widening Section				
20	302	Asphalt Concrete Base Course	CY	$ 150.00	69487	$ 10,422,983
21	304	Aggregate Base Course	CY	$ 60.00	65399	$ 3,923,947
22	442	Asphalt Concrete Surface Course, 12.5mm, Type A, (447)	CY	$ 200.00	12262	$ 2,452,467
23	442	Asphalt Concrete Intermediate Course, 19MM, Type A (446)	CY	$ 210.00	18394	$ 3,862,635
		Pavement For Existing Lanes				

FRA-33-2476 PID 119387					TOTAL	
INSIDE WIDENING						
COST ESTIMATE						
LINE NO.	ODOT ITEM	DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL COST
24	302	Asphalt Concrete Base Course	CY	$ 150.00	107065	$ 16,059,701
25	304	Aggregate Base Course	CY	$ 60.00	76472	$ 4,588,329
26	442	Asphalt Concrete Surface Course, 12.5mm, Type A, (447)	CY	$ 215.00	18744	$ 4,030,014
27	442	Asphalt Concrete Intermediate Course, 19MM, Type A (446)	CY	$ 210.00	28116	$ 5,904,439
Lighting						
28	SPEC	Lighting work	LS	$ 8,650,000.00	1	$ 8,650,000
Traffic Control						
29	SPEC	Pavement Markings and Ground Mounted Signing	LS	$ 1,750,000.00	1	$ 1,750,000
30	SPEC	Major Overhead Sign Work	LS	$ 152,000.00	1	$ 152,000
ITS Devices						
31	SPEC	ITS Devices/Communication Infrastructure	LS	$ 3,301,692.00	1	$ 3,301,692
Retaining Walls						
31	SPEC	Retaining Wall	SF	$ 100.00	8750	$ 875,000
Bridge Work						
32	SPEC	FRA-33-25.03 L Over Walnut Creek Overflow	LS	$ -	0	$ -
33	SPEC	FRA-33-25.03 R Over Walnut Creek Overflow	LS	$ 1,180,645.00	1	$ 1,180,645
34	SPEC	FRA-33-25.09 R Over Big Walnut Creek Overflow	LS	$ -	0	$ -
35	SPEC	FRA-33-25.09 R Over Big Walnut Creek Overflow	LS	$ 3,913,513.00	1	$ 3,913,513
36	SPEC	FRA-317-9.14 (Or FRA-33-26.32) Hamilton Road Overpass	LS	$ -	0	$ -
37	SPEC	FRA-33-26.49 L Over Blacklick Creek	LS	$ -	0	$ -
38	SPEC	FRA-33-26.49 R Over Blacklick Creek	LS	$ 2,094,058.00	1	$ 2,094,058
39	SPEC	FRA-33-26.60 Bike Path Overpass	LS	$ 22,000.00	1	$ 22,000
40	SPEC	FRA-CR118-5.71 Ebright Road Overpass	LS	$ 22,000.00	1	$ 22,000
41	SPEC	FRA-33-27.51 L Over Cable Bowman Ditch	LS	$ -	0	$ -
42	SPEC	FRA-33-27.51 R Over Cable Bowman Ditch	LS	$ 935,000.00	1	$ 935,000
43	SPEC	FRA-33-29.00 L Over George Creek	LS	$ -	0	$ -
44	SPEC	FRA-33-29.00 R Over George Creek	LS	$ 830,007.00	1	$ 830,007
45	SPEC	FRA-222-2.25 Gender Road Overpass	LS	$ -	0	$ -

FRA-33-2476 PID 119387					TOTAL	
INSIDE WIDENING						
COST ESTIMATE						
LINE NO.	ODOT ITEM	DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL COST
46	SPEC	FRA-33-30.30 Over Tussing-Bachman Ditch	LS	$ -	0	$ -
47	SPEC	FAI-33-02.292 Over Sycamore Creek	LS	$ -	0	$ -
Noise Wall						
48	SPEC	Noise Barrier	SF	$ 40.00	120,024	$ 4,800,960
Maintenance of Traffic						
49	615	Pavement for Maintaining Traffic	SY	$ 65.00	101494	$ 6,597,110
50	622	Portable Barrier	FT	$ 20.00	194304	$ 3,886,080
			CONSTRUCTION COST			$ 119,070,077
		MAINTENANCE OF TRAFFIC (5%)				$ 5,953,504
		CONTINGENCY (30%)				$ 35,721,023
		TOTAL CONSTRUCTION COST				**$ 160,744,604**
		PRELIMINARY ENGINEERING (15%)				**$ 24,111,691**
		RIGHT OF WAY (PERMANENT)	AC	$ 200,000.00	0	$ -
		RIGHT OF WAY (TEMPORARY)	AC	$ 40,000.00	0	$ -
		CONSTRUCTION ENGINEERING (10%)				**$ 16,074,460**
		INFLATION (5.2%)				**$ 10,448,399**
				TOTAL		**$ 211,379,154**

FRA-33-2476 PID 119387						
OUTSIDE WIDENING					TOTAL	
COST ESTIMATE						
LINE NO.	ODOT ITEM	DESCRIPTION	UNIT	UNIT COST	ESTIMATED QUANTITY	TOTAL COST
		Roadway				
1	201	Clearing and Grubbing	LS	$ 2,000,000.00	1	$ 2,000,000
2	202	Guardrail removed	FT	$ 3.00	31568	$ 94,705
3	202	Pavement removed (Widening Section)	SY	$ 9.00	139642	$ 1,256,778
4	202	Pavement removed (Existing Lane Section)	SY	$ 8.00	356189	$ 2,849,512
5	203	Excavation	CY	$ 18.00	60000	$ 1,080,000
6	203	Embankment	CY	$ 15.00	200000	$ 3,000,000
7	204	Subgrade compaction (Widening Section)	SY	$ 2.25	283071	$ 636,909
8	204	Subgrade compaction (Existing Lane Section)	SY	$ 2.25	414519	$ 932,667
9	206	Cement Stabilized Subgrade 12 Inches Deep (Widening Section)	SY	$ 5.00	283071	$ 1,415,353
10	206	Cement Stabilized Subgrade 12 Inches Deep (Existing Lane Section)	SY	$ 5.00	403566	$ 2,017,831
11	605	6" Shallow Pipe Underdrains	FT	$ 10.00	285120	$ 2,851,200
12	606	Guardrail, Type MGS	FT	$ 20.00	31768	$ 635,360
		Erosion Control				
13	832	Storm Water Pollution Prevention Plan	LS	$ 100,000.00	1	$ 100,000
14	832	Erosion Control	EA	$ 1.00	1000000	$ 1,000,000
		Drainage				
15	611	18" conduit, Type B	FT	$ 130.00	7128	$ 926,640
16	611	24" conduit, Type C	FT	$ 150.00	10000	$ 1,500,000
17	607	BMP	LS	$ 400,000.00	1	$ 400,000
18	611	Catch Basin, 2-3	EA	$ 3,500.00	20	$ 70,000
19	611	Manhole, No. 3	EA	$ 4,000.00	100	$ 400,000
		Pavement For Widening Section				
20	302	Asphalt Concrete Base Course	CY	$ 150.00	65112	$ 9,766,823
21	304	Aggregate Base Course	CY	$ 60.00	62499	$ 3,749,937
22	442	Asphalt Concrete Surface Course, 12.5mm, Type A, (447)	CY	$ 200.00	11338	$ 2,267,653

FRA-33-2476 PID 119387						TOTAL
OUTSIDE WIDENING						
COST ESTIMATE						
LINE NO.	**ODOT ITEM**	**DESCRIPTION**	**UNIT**	**UNIT COST**	**ESTIMATED QUANTITY**	**TOTAL COST**
23	442	Asphalt Concrete Intermediate Course, 19MM, Type A (446)	CY	$ 210.00	17007	$ 3,571,553
Pavement For Existing Lanes						
24	302	Asphalt Concrete Base Course	CY	$ 150.00	96148	$ 14,422,269
25	304	Aggregate Base Course	CY	$ 60.00	68782	$ 4,126,932
26	442	Asphalt Concrete Surface Course, 12.5mm, Type A, (447)	CY	$ 215.00	16815	$ 3,615,281
27	442	Asphalt Concrete Intermediate Course, 19MM, Type A (446)	CY	$ 200.00	25223	$ 5,044,578
Lighting						
28	SPEC	Lighting Work	LS	$ 6,650,000.00	1	$ 6,650,000
Traffic Control						
29	SPEC	Pavement Markings and Ground Mounted Signing	LS	$ 2,000,000.00	1	$ 2,000,000
30	SPEC	Major Overhead Sign Work	LS	$ 950,000.00	1	$ 950,000
ITS Devices						
31	SPEC	ITS Devices/Communication Infrastructure	LS	$ 3,754,664.00	1	$ 3,754,664
Retaining Walls						
31	SPEC	Retaining Wall	SF	$ 100.00	21000	$ 2,100,000
Bridge Work						
32	SPEC	FRA-33-25.03 L Over Walnut Creek Overflow	LS	$ -	0	$ -
33	SPEC	FRA-33-25.03 R Over Walnut Creek Overflow	LS	$ 689,358.00	1	$ 689,358
34	SPEC	FRA-33-25.09 R Over Big Walnut Creek Overflow	LS	$ -	0	$ -
35	SPEC	FRA-33-25.09 R Over Big Walnut Creek Overflow	LS	$ 3,100,903.00	1	$ 3,100,903
36	SPEC	FRA-317-9.14 (Or FRA-33-26.32) Hamilton Road Overpass	LS	$ 7,759,500.00	1	$ 7,759,500
37	SPEC	FRA-33-26.49 L Over Blacklick Creek	LS	$ -	0	$ -
38	SPEC	FRA-33-26.49 R Over Blacklick Creek	LS	$ 1,607,194.00	1	$ 1,607,194
39	SPEC	FRA-33-26.60 Bike Path Overpass	LS	$ 22,000.00	1	$ 22,000
40	SPEC	FRA-CR118-5.71 Ebright Road Overpass	LS	$ 22,000.00	1	$ 22,000
41	SPEC	FRA-33-27.51 L Over Cable Bowman Ditch	LS	$ -	0	$ -

FRA-33-2476 PID 119387					TOTAL	
OUTSIDE WIDENING						
COST ESTIMATE						
LINE NO.	**ODOT ITEM**	**DESCRIPTION**	**UNIT**	**UNIT COST**	**ESTIMATED QUANTITY**	**TOTAL COST**
42	SPEC	FRA-33-27.51 R Over Cable Bowman Ditch	LS	$ 1,182,500.00	1	$ 1,182,500
43	SPEC	FRA-33-29.00 L Over George Creek	LS	$ -	0	$ -
44	SPEC	FRA-33-29.00 R Over George Creek	LS	$ 775,508.00	1	$ 775,508
45	SPEC	FRA-222-2.25 Gender Road Overpass	LS	$ 7,020,900.00	1	$ 7,020,900
46	SPEC	FRA-33-30.30 Over Tussing-Bachman Ditch	LS	$ 22,000.00	1	$ 22,000
47	SPEC	FAI-33-02.292 Over Sycamore Creek	LS	$ -	0	$ -
Noise Wall						
48	SPEC	Noise Barrier	SF	$ 40.00	120,024	$ 4,800,960
Maintenance of Traffic						
49	615	Pavement for Maintaining Traffic	SY	$ 65.00	177468	$ 11,535,420
50	622	Portable Barrier	FT	$ 20.00	97152	$ 1,943,040
			CONSTRUCTION COST			$ 125,667,927
		MAINTENANCE OF TRAFFIC (7%)				$ 8,796,755
		CONTINGENCY (30%)				$ 37,700,378
		TOTAL CONSTRUCTION COST				**$ 172,165,060**
		PRELIMINARY ENGINEERING (15%)				**$ 25,824,759**
		RIGHT OF WAY (PERMANENT)	AC	$ 200,000.00	4.6	$ 920,000
		RIGHT OF WAY (TEMPORARY)	AC	$ 40,000.00	20	$ 800,000
		CONSTRUCTION ENGINEERING (10%)				**$ 17,216,506**
		INFLATION (5.2%)				**$ 11,280,169**
				TOTAL		**$ 228,206,494**