

## FINAL PROJECT CONCEPT STATEMENT

Bridge on Iowa 15 over Lotts Creek

Kossuth County  
Project # BRFN-015-3(16)--39-55  
PIN: 18-55-015-010  
Maint. No. 5539.2S015  
FHWA No. 33020

Prepared for:  
Iowa Department of Transportation  
District 2  
Nick Humpal, P.E.

Prepared by: Snyder & Associates, Inc. / Shuck-Britson Inc.

April 9, 2020

### I. STUDY AREA

#### A. Project Description

This project involves replacement of the Iowa 15 bridge over Lotts Creek (Maint. No. 5539.2S015) near Fenton, approximately 8.5 miles north of Highway 18 and 0.5 mile south of Fenton, in Kossuth County.

#### B. Present Facility--Need for Project

The existing bridge is a 60' x 24' single span, steel I-beam bridge constructed in 1939. The roadway approaches are 38' wide and the bridge is not skewed. Past repairs consist of strengthening of steel beams (1987), low-slump concrete overlay (1987), retrofit of the barrier rails (1987), and epoxy-injected deck (2017).



The bridge was last inspected in August, 2019 and has deck, superstructure and substructure condition rating of 5, 6, and 6, respectively on a scale of 0 to 9. A rating of '4' or less on any of the condition ratings would make the bridge "Structurally Deficient". Maintenance and repairs have been made over the years to extend the life of the bridge. Repairs done to typical bridges with this current level of condition ratings are often an exercise in diminishing returns. It is likely that at least one of the condition ratings will drop to a '4' in the near future which would make the bridge both "Structurally Deficient" and eligible for federal funds through the Highway Bridge Replacement and Rehabilitation Program.

The bridge also has a Deck Geometry appraisal rating of '4' on a scale of 0 to 9 determined by the roadway width on the bridge available for the Average Daily Traffic. Under old bridge deficiency procedures, a rating of '3' would have made the bridge "Functionally Obsolete"

For these reasons, the bridge is not a rehabilitation or widening candidate but should be held as a replacement candidate for a future letting. The bridge's expected replacement type and total project cost should be determined with this Project Concept phase.

North and south of the bridge, the roadway is a 24 foot wide paved rural section with 5 foot wide granular shoulders. Roadway foreslopes are 3:1.

Iowa 15 intersects County Road B19 approximately 2,100 feet north of the bridge location. Entrances are present on the left side of the roadway approximately 360 feet south and 520 feet north of the bridge.

#### C. Hydrology

The discharges are 945 cfs (50-year) and 1161 (100-year) for the 5.8 square mile drainage area based on the "DOT Regional Equation Annual Exceedance – Probability Discharge" spreadsheet and compare well with StreamStats numbers.

The Location and Environment Bureau and Kossuth County requested that the culvert be buried one foot. The box culvert will be buried one foot, therefore functioning and modeled as 14' x 13' for hydraulic purposes.

The structure is located in FEMA Zone A. A floodplain permit will not be required for construction of the replacement structure.

#### D. Traffic Estimates

The 2015 traffic count was 730 vehicles per day (VPD), with trucks comprising

approximately 21% of total traffic (approximately 150 trucks per day). Historical traffic counts from 1999-2015 vary between 710 VPD and 820 VPD.

Iowa DOT Office of Systems Planning forecasts an AADT of 700 VPD for year 2023 and 800 VPD for year 2043, with truck percentage of 21% for both forecast years. The year 2043 design hour forecast volume is 80 vehicles per hour (VPH).

E. Crash History

One single vehicle crash was reported near the bridge location in the last 10 years. A southbound motorcycle lost control near the bridge on 09/29/2013 during daylight and dry pavement conditions; one possible injury was reported. The roadway profile near the bridge is relatively flat and has adequate sight distance available.

F. Sufficiency Ratings

The official Federal bridge sufficiency rating is 48.5 and the unofficial Federal bridge sufficiency rating is 75.2. A drop in any of the aforementioned bridge condition ratings is expected to lower both of the sufficiency ratings to near or below 50. In the past, those determining appropriate rehabilitation or replacement strategies for bridges eligible for federal funding were instructed that both rehabilitation and replacement options should be evaluated when the sufficiency rating was between 50 and 80. With a sufficiency rating at or below 50 and the near-deficiency condition ratings of a major bridge component (deck), replacement is the clear choice.

G. Accelerated Bridge Construction Score

The Accelerated Bridge Construction (ABC) normalized score when using county roads is 24, which is far below the threshold (50) that would qualify for further evaluation of ABC techniques. The contributing factors to the raw score are the out of distance travel (OODT) raw score of 20, average annual daily traffic (AADT) raw score of 10, a daily road user costs (DRUC) raw score of 10, and an economy of scale (EOS) raw score of 0.

The Accelerated Bridge Construction (ABC) normalized score using state routes is 36, which is below the threshold (50) that would qualify the project for further evaluation of ABC techniques. The largest contributing factor to the raw score is the out of distance travel (OODT) of just under 20 miles, which contributes 40 to the raw score total. The remainder of the raw score is due to an average annual daily traffic (AADT) raw score of 10, a daily road user costs (DRUC) raw score of 10, and an economy of scale (EOS) raw score of 0. The ABC normalized score of 24 when using county roads for the detour route is significantly less than the normalized score of 36 when using state roads.

H. Access Control

Access rights will not be acquired on this project.

II. PROJECT CONCEPT

A. Proposed Improvements

Three options were explored for replacement of the existing bridge, with each option varying by the number of bends in the RCB Culvert. Refer to attached sheets for additional information.

The concept discussed during kickoff meeting involved placing a new reinforced concrete box culvert under the existing bridge. Several factors caused us to look at removing the existing bridge with this project rather than leaving it in place. These factors include:

- Low traffic volumes.
- Availability of nearby detour route.
- Stream geometry.
- Cost.
- Hydraulic evaluations of box culverts incrementally made taller and wider eventually left insufficient vertical clearance.

1. Alternative Number 1: 14' x 14' x 85'-6" RCB Culvert With 3 Bends; Remove Existing Bridge

This alternative removes the existing bridge and installs a new box culvert in the existing stream bed. A series of bends will be necessary at the outlet end of the culvert to direct water along the bend in the existing channel. The bend will be accomplished using three back-to-back 15 degree bend sections in the box culvert. The existing bridge approach pavement will be removed and replaced with 24 foot wide PCC pavement and 6 foot wide granular shoulders. A barnroof section with a 24 foot clear zone will be utilized at the box culvert, per Standard Detail 4312. A 6:1 / 3:1 barnroof will be used in lieu of the typical 6:1 / 3.5:1 in order to better fit the culvert inlet and outlet to the existing waterway.

Iowa 15 has a very low traffic volume, and a parallel marked county road is available for use as a detour route three miles east of the bridge site.

Estimated Construction Cost

<u>Structural Item</u>	<u>Estimated Cost</u>
Removals, As Per Plan	\$ 12,000
Excavation, Class 20	\$ 5,100
Precast Box Culvert, 14 Ft. x 14 Ft.	\$ 77,400
Precast End Section, 14 Ft. x 14 Ft.	\$ 40,000
Structural Concrete (RCB Culvert)	\$ 92,200
Reinforcing Steel	\$ 38,400
Revetment	\$ 25,000
Staging (0%)	\$ 0
Aesthetics (0%)	\$ 0
Mobilization (10%)	\$ 29,000
Contingency (20%)	<u>\$ 63,800</u>
<b>Structure Total</b>	<b>\$382,900</b>

<u>Roadway Item</u>	<u>Estimated Cost</u>
Embankment-in-Place	\$ 38,010
Compacting Backfill Adjacent to Structures	\$ 1,116
Modified Subbase	\$ 8,002
Granular Shoulders, Type B	\$ 4,704
PCC Pavement, Class C, Class 3, 10"	\$ 31,471
Flooded Backfill	\$ 2,765
CMP Entrance Pipe, 12" Dia.	\$ 3,024
Removal of Pavement	\$ 3,700
Traffic Control (5%)	\$ 4,640
Mobilization (5%)	\$ 4,640
Contingency (30%)	<u>\$ 30,622</u>
<b>Roadway Total</b>	<b>\$132,964</b>

**Project Total: \$515,864**

2. Alternative Number 2: 14' x 14' x 106'-6" RCB Culvert With 4 Bends; Remove Existing Bridge

This alternative removes the existing bridge and installs a new box culvert in the existing stream bed. A series of bends will be necessary at the outlet end of the culvert to direct water along the bend in the existing channel. The bend will be accomplished using four back-to-back 15 degree bend sections in the box culvert. The existing bridge approach pavement will be removed and replaced with 24 foot wide PCC pavement and 6 foot wide granular shoulders. A barnroof section with a

24 foot clear zone will be utilized at the box culvert, per Standard Detail 4312. A 6:1 / 3:1 barnroof will be used in lieu of the typical 6:1 / 3.5:1 in order to better fit the culvert inlet and outlet to the existing waterway.

Iowa 15 has a very low traffic volume, and a parallel marked county road is available for use as a detour route three miles east of the bridge site.

Estimated Construction Cost

<u>Structural Item</u>	<u>Estimated Cost</u>
Removals, As Per Plan	\$ 12,000
Excavation, Class 20	\$ 6,300
Precast Box Culvert, 14 Ft. x 14 Ft.	\$ 90,000
Precast End Section, 14 Ft. x 14 Ft.	\$ 40,000
Structural Concrete (RCB Culvert)	\$109,100
Reinforcing Steel	\$ 46,100
Revetment	\$ 25,000
Staging (0%)	\$ 0
Aesthetics (0%)	\$ 0
Mobilization (10%)	\$ 32,900
Contingency (20%)	\$ 72,300
<b>Structure Total</b>	<b>\$433,700</b>

<u>Roadway Item</u>	<u>Estimated Cost</u>
Embankment-in-Place	\$ 38,010
Compacting Backfill Adjacent to Structures	\$ 1,116
Modified Subbase	\$ 8,002
Granular Shoulders, Type B	\$ 4,704
PCC Pavement, Class C, Class 3, 10"	\$ 31,471
Flooded Backfill	\$ 2,765
CMP Entrance Pipe, 12" Dia.	\$ 3,024
Removal of Pavement	\$ 3,700
Traffic Control (5%)	\$ 4,640
Mobilization (5%)	\$ 4,640
Contingency (30%)	\$ 30,622
<b>Roadway Total</b>	<b>\$132,964</b>

**Project Total: \$566,664**

3. Alternative Number 3: 14' x 14' x 146'-6" RCB Culvert With 6 Bends; Remove Existing Bridge

This alternative removes the existing bridge and installs a new box culvert in the existing stream bed. A series of bends will be necessary at the outlet end of the culvert to direct water along the bend in the existing channel. The bend will be accomplished using six back-to-back 15 degree bend sections in the box culvert. The existing bridge approach pavement will be removed and replaced with 24 foot wide PCC pavement and 6 foot wide granular shoulders. A barnroof section with a 24 foot clear zone will be utilized at the box culvert, per Standard Detail 4312. A 6:1 / 3:1 barnroof will be used in lieu of the typical 6:1 / 3.5:1 in order to better fit the culvert inlet and outlet to the existing waterway.

Iowa 15 has a very low traffic volume, and a parallel marked county road is available for use as a detour route three miles east of the bridge site.

Estimated Construction Cost

<u>Structural Item</u>	<u>Estimated Cost</u>
Removals, As Per Plan	\$ 12,000
Excavation, Class 20	\$ 8,600
Precast Box Culvert, 14 Ft. x 14 Ft.	\$133,200
Precast End Section, 14 Ft. x 14 Ft.	\$ 40,000
Structural Concrete (RCB Culvert)	\$128,400
Reinforcing Steel	\$ 55,000
Revetment	\$ 25,000
Staging (0%)	\$ 0
Aesthetics (0%)	\$ 0
Mobilization (10%)	\$ 40,200
Contingency (20%)	<u>\$ 88,500</u>
<b>Structure Total</b>	<b>\$530,900</b>

<u>Roadway Item</u>	<u>Estimated Cost</u>
Embankment-in-Place	\$ 38,010
Compacting Backfill Adjacent to Structures	\$ 1,116
Modified Subbase	\$ 8,002
Granular Shoulders, Type B	\$ 4,704
PCC Pavement, Class C, Class 3, 10"	\$ 31,471
Flooded Backfill	\$ 2,765
CMP Entrance Pipe, 12" Dia.	\$ 3,024
Removal of Pavement	\$ 3,700
Traffic Control (5%)	\$ 4,640

Mobilization (5%)	\$ 4,640
Contingency (30%)	<u>\$ 30,622</u>
<b>Roadway Total</b>	<b>\$132,964</b>

**Project Total: \$663,864**

B. Recommendations

We recommend Alternative Number 2 which would remove the existing bridge and construct in the channel a new reinforced concrete box culvert with four 15 degree bends. Although this will require a roadway closure, the traffic volume on Iowa 15 is low, and a simple detour route is available. This option is more expensive than Alternative Number 1, but with the four bends the culvert aligns much better with the downstream channel. Alternative Number 2 is much cheaper than the six-bend Alternative Number 3 that would have the downstream headwall running parallel to Highway 15.

C. Detour Analysis

Iowa 15 will be closed to traffic during construction. Through traffic will be detoured east on U.S. 18 3 miles to P20, then north to B19. Out-of-distance travel for this option is 6 miles. Refer to Sheet J.2 of the attached plans.

D. Special Considerations

Right-of-way will be necessary to construct the right side of the box culvert.

E. Construction Sequence

It is anticipated that all work will be awarded to one prime contractor. The Bridges and Structures Bureau will coordinate the plan preparation with Snyder & Associates, Inc. / Shuck-Britson.

F. Program Status

This project is listed in the 2020-2024 Iowa Transportation Improvement Program with \$500,000 programmed for construction in FY 2023. The project is currently scheduled for a November 15, 2022 letting.



PROJECT: Iowa DOT On-Call 213AE NO: 119.1213.01D  
 DATE: 4/7/2020  
 SUBJECT: Kossuth Co. – IA 15 over Lotts Creek BY: TAB CK: SAK  
Summary of Conceptual Hydraulic Modeling Results PAGE: 1 OF: 1



Conceptual hydraulic modeling was performed for the IA 15 bridge over Lotts Creek to determine feasible replacement culvert sizes to meet the DOT criteria of no more than 1-2 feet of head over the culvert at the 50YR design storm.

The project site is in a FEMA designated Zone A flood hazard area and has a drainage area of 5.8 square miles. According to IAC 567, Chapter 71.1, this site does not require Iowa DNR floodplain permitting as the drainage area is below the 100 square mile threshold.

Design discharges for the Q50 and Q100 events were determined to be 945cfs and 1,161cfs, respectively. These discharges were determined using rural regression equations outlined in USGS Scientific Investigations Report 2013-5086 using the SSRE2013 method. Due to the presence of the cemetery on the south side of the drainage ditch and the lagoon on the north side, the 100YR storm was evaluated to determine inundation impacts. No survey was taken at these locations, but LiDAR data shows the cemetery to be safely above the 100YR event expected inundation. The lagoon was constructed too recently for LiDAR data, but the embankment likely puts it well above the 100YR inundation level. Per DOT guidelines, the 50YR storm was still selected as the design storm.

Initially, a single 10' x 9' RCB culvert or a twin 8' x 7' RCB culvert were the recommended options. With Lotts Creek taking a sharp turn south after passing under Highway 15, a skewed or bent culvert option was deemed necessary. A single RCB was preferred from a structural standpoint, so the single box option was selected. The inundation footprint for the 10' x 9' culvert at Highway 15 was large, with both the 50YR and 100YR storms spilling well outside the banks of the creek. As such, a 12' x 10' RCB culvert was recommended. This option kept the head above the culvert at a reasonable level while significantly reducing the inundation footprint. Kossuth County was contacted to allow for feedback on this project as it is within a drainage district. The IDOT then requested that a 12' x 12' RCB be modeled to determine if this size was large enough to keep flows within the channel at the 100YR storm event. Based on these modeling results and input from the drainage district about the proposed channel slope, a 14' x 14' RCB was selected as the desired alternative. Both Kossuth County and the DOT requested the culvert be buried one foot within the channel. The culvert and channel slopes were based upon the County's drainage ditch reconstruction plans, which are scheduled to be completed in December 2021. Refer to Sheet D.25 for plan and profile details.

The design proceeded with the following alternative: a single 14' x 14' RCB with four 15 degree bends and a square headwall. This option is discussed below:

Assumptions for this option:

- Elevation data obtained from field survey and LiDAR
- Box will be buried one foot, therefore functioning and modeled as a 14' x 13' for hydraulic purposes

1. 106'-6 Single 14' x 14' RCB Culvert With Four 15° Bends
  1. 106'-6 Reinforced Concrete Box Culvert
    - a. Existing bridge will be removed
    - b. Some channel grading may be needed on the downstream side to align the culvert with the channel
    - c. Q50 high water elevation = 1230.52'
    - d. Q100 high water elevation = 1231.66'
    - e. Q50 outlet velocity = 6.50ft/s
    - f. 3' riprap boundary around the culvert entrance/exit with a 10' riprap pad on the upstream entrance and a roughly 30' riprap stilling basin on the downstream end. The basin will include riprap to the tailwater elevation



Highway 15

**Legend**

- 14x14 RCB 100YR Inundation
- 14x14 RCB 50YR Inundation

## RECORD OF COORDINATION FLOODPLAIN DEVELOPMENT

The purpose of this form is to document Iowa Department of Transportation coordination with the local community for projects which are not within the Iowa Department of Natural Resources' permitting jurisdiction and which are in a community that is participating in the National Flood Insurance Program.

1. Highway Number: 15 Stream Lotts Creek Project Number BRFN-015-3(16)--39-55  
File No.: 31711 Design No. 123 Project Location: SW  $\frac{1}{4}$ , NW  $\frac{1}{4}$ , T 97N ,S 20 ,R 30W  
Description of Location: Highway 15 over Lotts Creek approximately 1/2 mile south of Fenton

City/County: Kossuth County

2. Flood Insurance Rate Map/Floodway Map:  
Panel Number: 19109C0358C , Effective Date of Map: March 20, 2018

3. Type of Development:  Filling  Grading  Excavation  Bridge Construction  Road Construction  
Channel Improvement: None  
Description of Development: Replacement of existing bridge with box culvert

4. Is project located in a designated 100-year floodplain?  
 Yes (check the appropriate zone:  A  A1-30  AE  AO  AH)  No

5. Has a detailed Flood Insurance Study (FIS) been published?  Yes  No  
If yes, what is the Base Flood Elevation (BFE) at project site? N/A  
If no, what is the estimated BFE at project site? 1231.66

6. Is project located in designated floodway?  Yes  No

7. Does FIS need to be revised?  Yes  No  
If yes, describe type and extent of revision: N/A

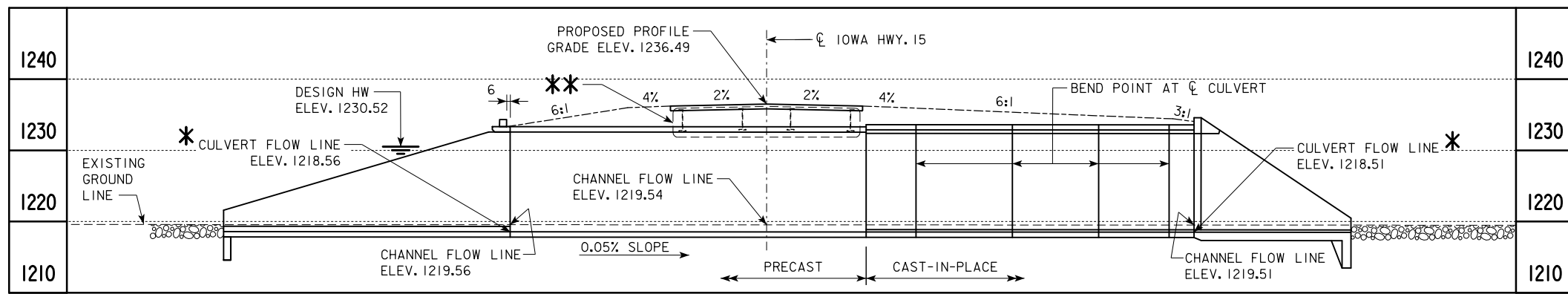
\_\_\_\_\_  
IDOT Preliminary Bridge Design Engineer Signature Date

\_\_\_\_\_  
IDOT District Engineer Signature Date

Community Official Concurrence:  
\_\_\_\_\_  
Community Official Signature Date

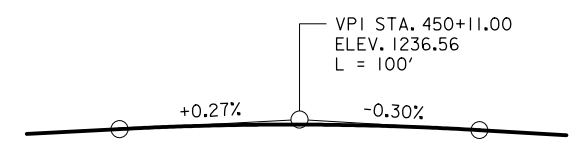
NOTE: Office of Bridges and Structures to submit copy to:  
Bill Cappuccio  
NFIP State Coordinator  
Iowa Department of Natural Resources  
Wallace State Office Building  
502 East Ninth Street  
Des Moines, IA 50319  
515-281-8942

BM500 NORTHING 9603152.654 EASTING 11720445.56 ELEVATION 1233.234  
 DESCRIPTION: SET RAILROAD SPIKE IN NORTH SIDE OF 1ST POWER POLE SOUTH OF BRIDGE.



**LONGITUDINAL SECTION ALONG CULVERT**  
 DESIGN FILL HEIGHT = 2'

- \* CULVERT FLOW LINE BURIED 1.0 FEET BELOW CREEK BOTTOM.
- \*\* INSUFFICIENT VERTICAL CLEARANCE EXISTS FOR THE FLOWABLE MORTAR ALTERNATIVE FOR CONSTRUCTING REINFORCED CONCRETE BOX CULVERT UNDER EXISTING BRIDGE.



**PROPOSED PROFILE GRADE**

**TRAFFIC ESTIMATE**

2023 AADT	700	V.P.D.
2043 AADT	800	V.P.D.
TRUCKS	21	%

GROUND SHAPING AND CHANNEL ADJUSTMENTS WILL BE NEEDED AT THE INLET AND OUTLET ENDS OF THE CULVERT, BUT ARE NOT SHOWN FOR CLARITY.

**UTILITIES LEGEND**

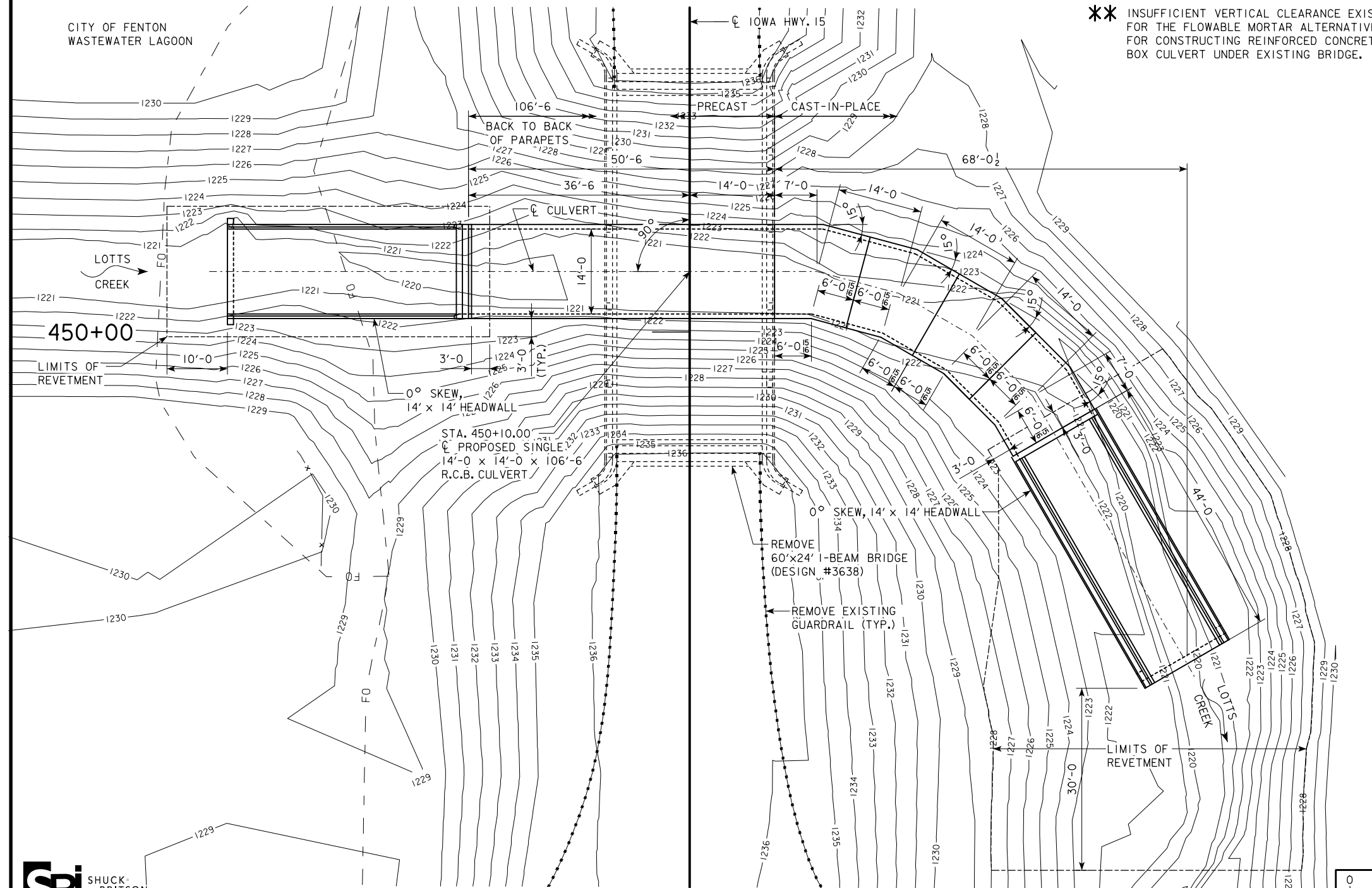
- FO - FIBER OPTIC - FENTON COOPERATIVE COMMUNICATIONS
- T - TELEPHONE - FENTON COOPERATIVE COMMUNICATIONS

**HYDRAULIC DATA**

DRAINAGE AREA = 5.8 SQ. MI.  
 STREAM SLOPE = 2.6 FT./MI.  
 DESIGN DISCHARGE,  $Q_{50}$  = 945 CFS  
 HW ELEV. = 1230.52 FT.  
 OUTLET VELOCITY = 6.50 FPS  
 DISCHARGE,  $Q_{100}$  = 1161 CFS  
 HW ELEV. = 1231.66 FT.  
 OUTLET VELOCITY = 7.40 FPS

**LOCATION**

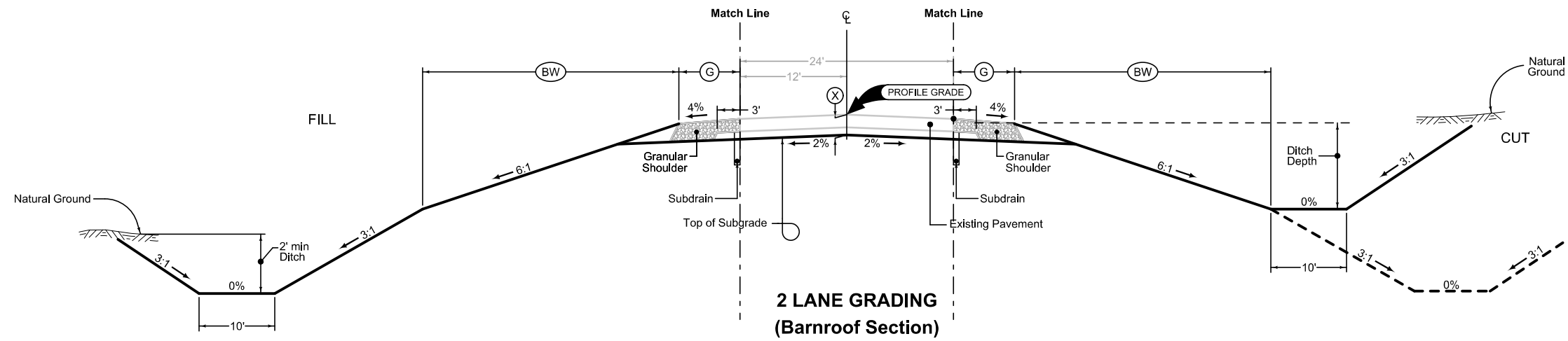
IOWA 15 OVER LOTTS CREEK  
 8.5 MILES NORTH OF HWY 18  
 T-97N R-30W  
 SECTION 20  
 FENTON TOWNSHIP  
 KOSSUTH COUNTY  
 LATITUDE 43.206397°  
 LONGITUDE -94.423434°



**SITUATION PLAN**

DESIGN FOR 0° SKEW  
**SINGLE 14'-0 x 14'-0 x 106'-6**  
**R. C. B. CULVERT**  
**SITUATION PLAN**  
 STATION 450+10.00  
**KOSSUTH COUNTY**  
 MARCH 2020

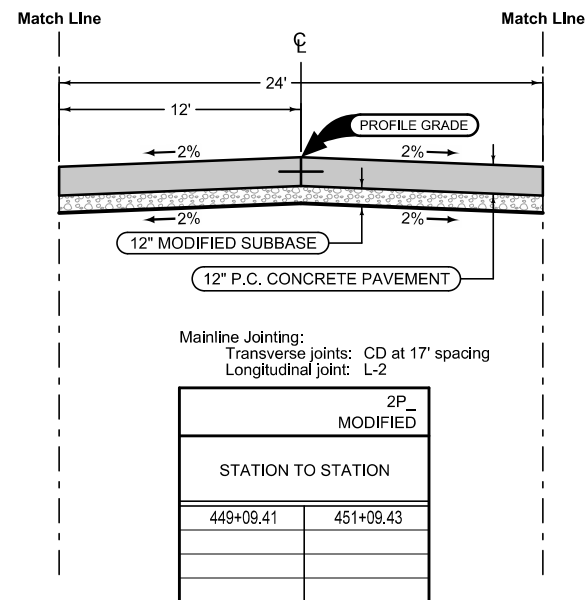




Normal section shown may be modified appropriately in areas of superelevated curves or other locations specifically designated by the Engineer.

See Plan & Profile sheets and cross sections for additional details of ditches and backstops.

LOCATION			
ROAD IDENTIFICATION	STATION TO STATION		(BW) Feet
Iowa 15	449+09.41   451+09.43		18

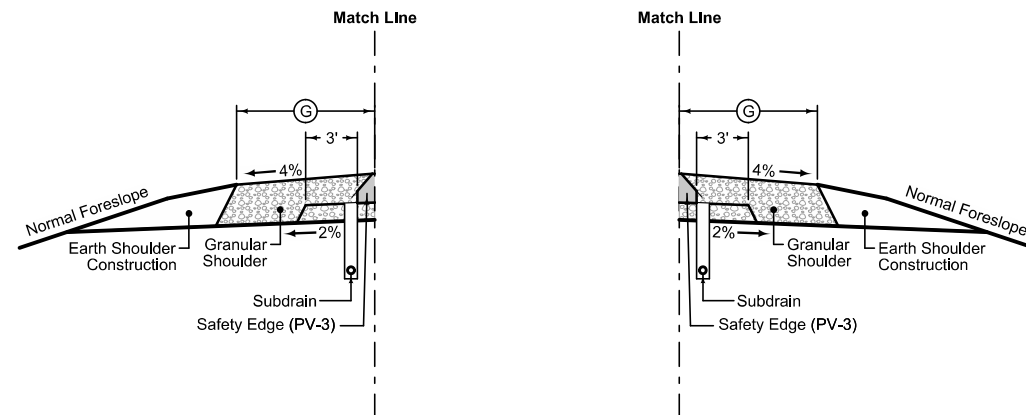


Mainline Jointing:  
 Transverse joints: CD at 17' spacing  
 Longitudinal joint: L-2

2P MODIFIED		
STATION TO STATION		
449+09.41	451+09.43	

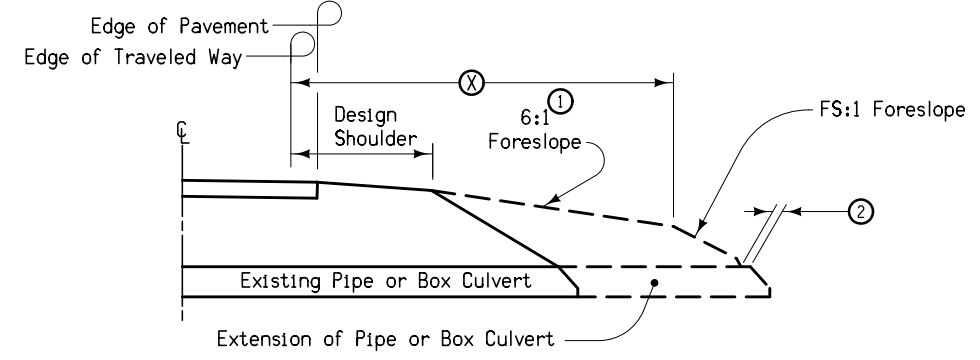
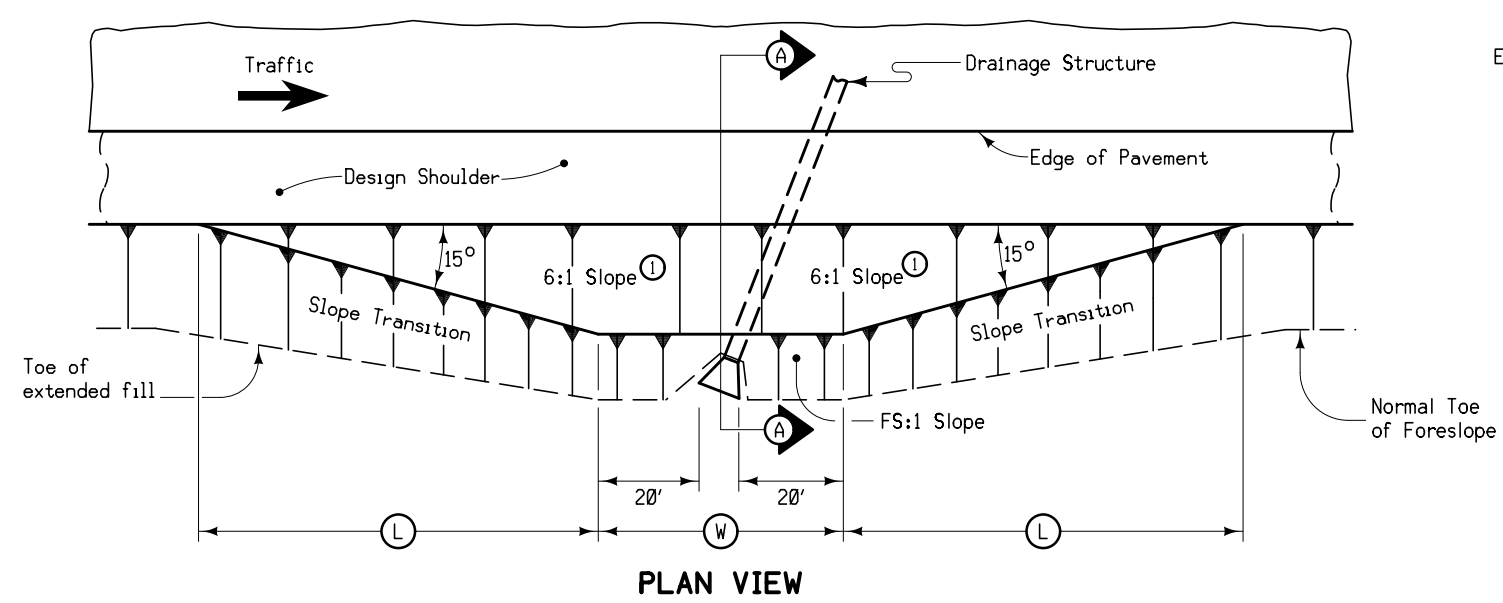
**Granular Shoulder with Safety Edge**

2_G 10-21-14		
STATION TO STATION		(G) Feet
449+09.41	451+09.43	6



**Granular Shoulder with Safety Edge**

2_G 10-21-14		
STATION TO STATION		(G) Feet
449+09.41	451+09.43	6



SECTION A-A

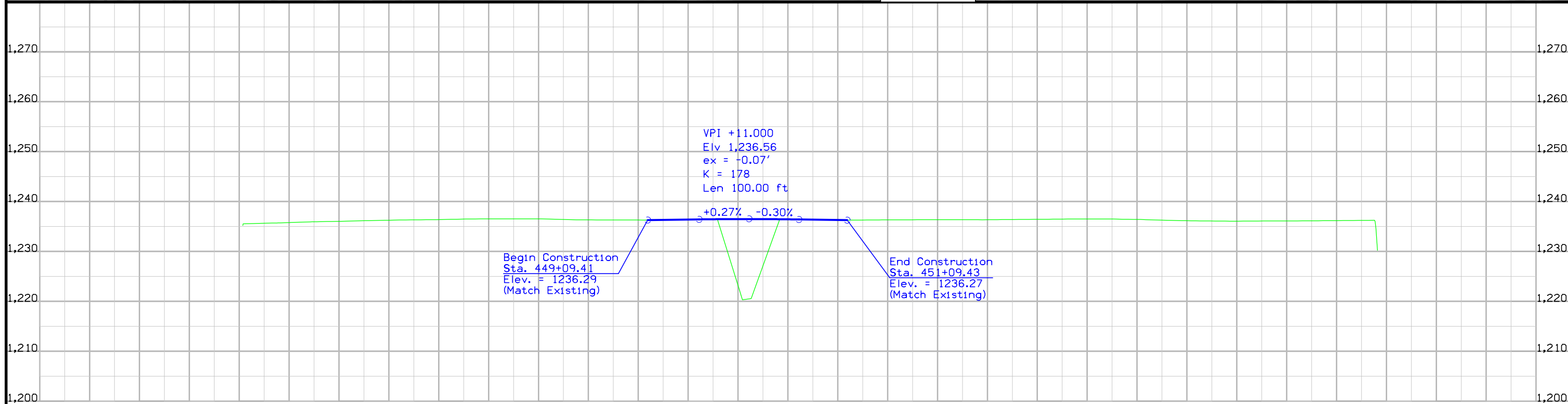
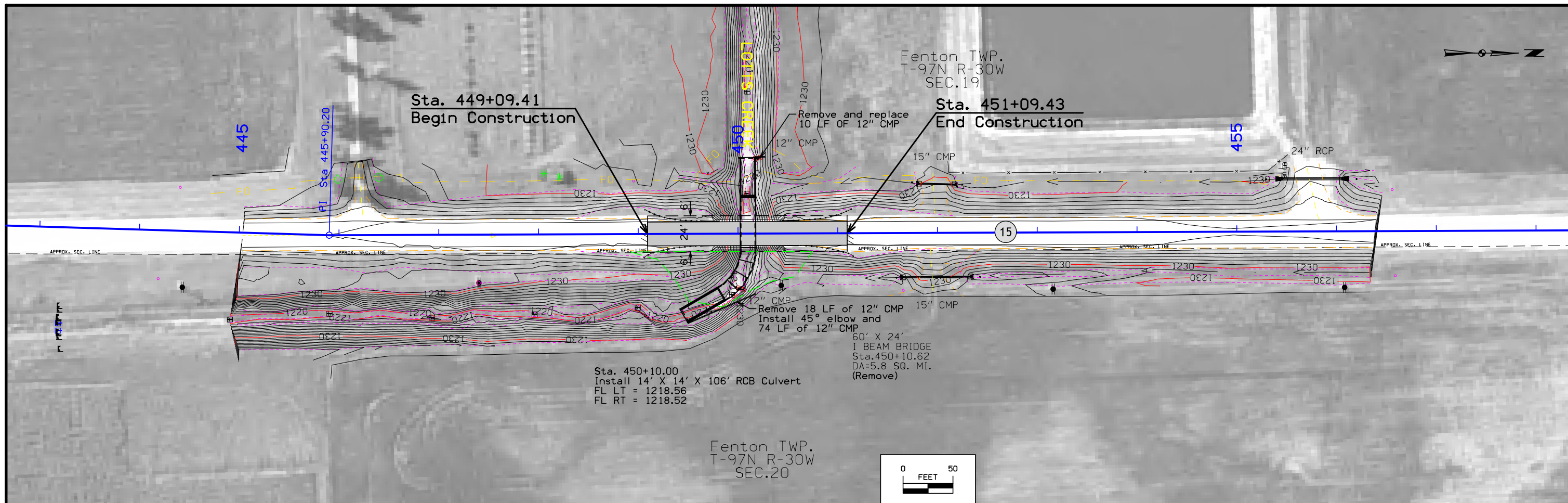
At locations where an extended or newly constructed drainage structure extends beyond the normal foreslope cover, flatten as indicated so as to cover the structure. Minimum earth cover is 6 inches.

- ① Slope may be flatter than 6:1.
- ② 6 inch minimum for pipe installations or to top of headwall on RCB.
- ③ At  $\bar{C}$  of roadway.
- Ⓜ = Pipe or RCB opening width plus 20 feet each side.

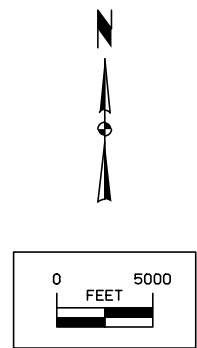
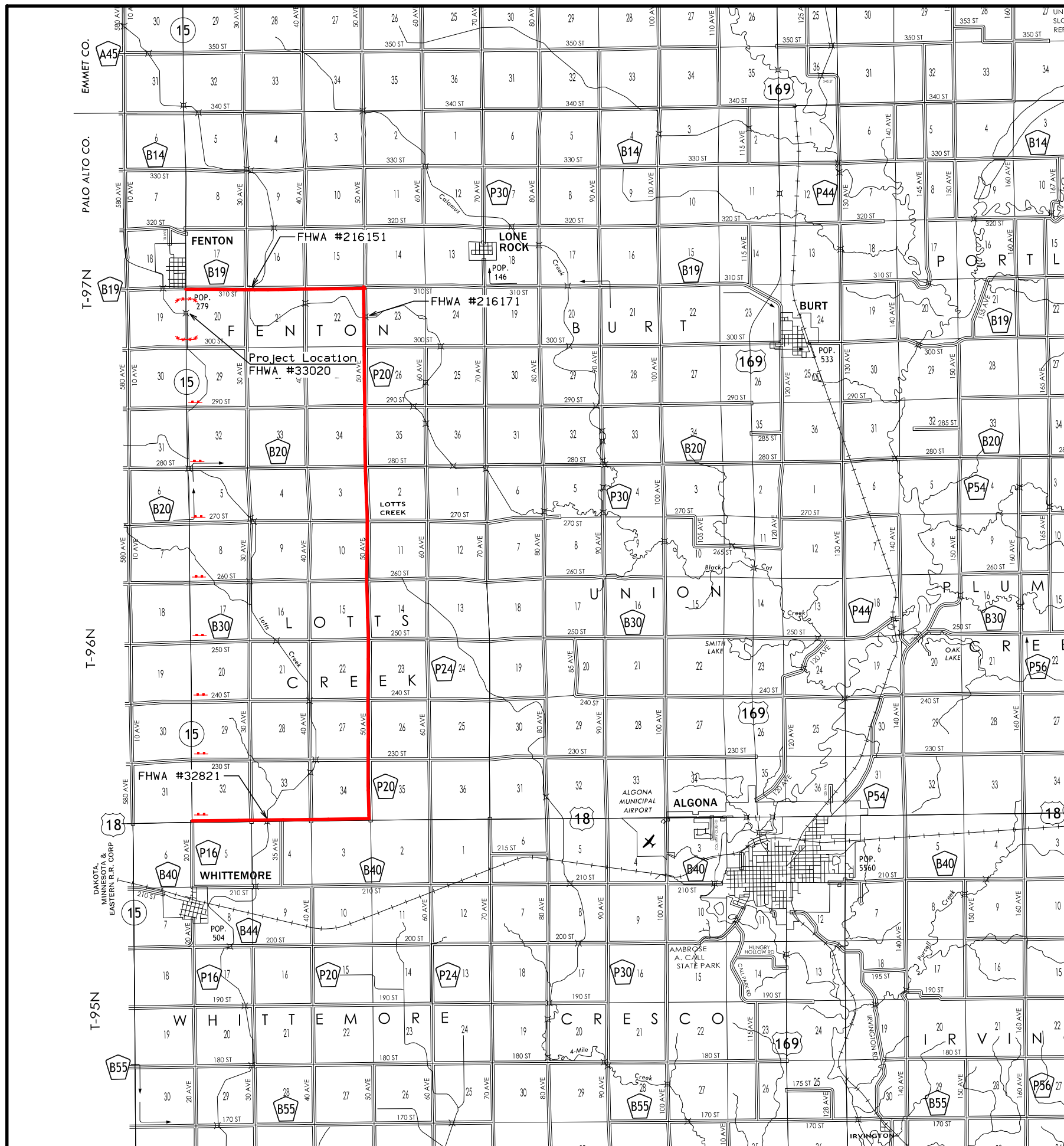
STRUCTURE LOCATION		Ⓜ	Ⓛ	Ⓧ	ⓕS
STATION ③	SIDE	Feet	Feet	Feet	
450+10.00	BOTH	47.93	67.18	24	3

**BARNROOF FORESLOPE AT SKEWED DRAINAGE STRUCTURE**





443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458
FILE NO.	ENGLISH	DESIGN TEAM	SNYDER AND ASSOCIATES, INC.			KOSSUTH COUNTY			PROJECT NUMBER	BRFN-015-3(16)--39-55			SHEET NUMBER	D.1	



**LEGEND**

- DETOUR ROUTE
- - - HAZARD CLOSURE
- | | ROAD CLOSURE

**DETOUR ROUTE**



## Bridge Office Attachment for Concept Statement

**Date:** April 7, 2020  
**By:** Chris J. Criswell, P.E.  
**Location:** Iowa 15 over Lotts Creek

County: Kossuth  
Project No.: BRFN-015-3(16)--39-55  
Pin No.: 18-55-015-010

1. Regulatory/Coordination
  - a. Iowa DNR Flood Plain permit = Not required
  - b. Iowa DNR Sovereign Lands permit = Not required
  - c. Local Record of Coordination = Form has been completed
  - d. Flood Insurance Study = No. Zone A Panel 19109C0358C, March 20, 2018
  - e. Drainage District = Yes. Joint Drainage District No. 1, Kossuth and Palo Alto County
  - f. Corps of Engineers Section 408 = No
2. Hydrologic/Hydraulic Analysis/RIDB Dataset
  - a. Design discharges determined = Yes (USGS 13-5086)
  - b. Hydraulic analysis done = Yes, (1D model with Iowa DOT culvert program)
  - c. Riverine Infrastructure Database (RIDB) = No, Drainage Area < 10 sq. mi.
  - d. Location and Environment Bureau requested culvert floor be buried 1'. Subsequent hydraulic analyses of culvert sizes did not consider the buried foot.
  - e. Cemetery and City of Fenton wastewater lagoons were upstream features potentially impacted by backwater.
  - f. DOT requested evaluation of culvert size to keep the 100-year discharge with the channel.
  - g. Drainage ditch improvement plans for construction to be done by December 1, 2021 were obtained and aided the determination of flowline elevations and culvert slope.
3. Structure/Roadway Layout Considerations
  - a. For roadway grading, used 6:1 / 3.5:1 barnroof section with a 24' clear zone per Standard Detail 4311. On the outlet side, this created a situation where the proposed embankment filled over the existing stream throughout the construction area. The following alternative designs were considered at the suggestion of the Bridges and Structure Bureau:
    - i. Constructing a retaining wall or extended the box culvert wingwalls / parapets on the outlet end of the culvert was considered but not chosen.
    - ii. Realigning the channel to be outside the barnroof grading section on the outlet end was considered but not chosen.
    - iii. Starting the 4:1 slope at the edge of shoulder was considered but not chosen.
    - iv. Using a 6:1 / 3:1 barnroof section facilitated a workable culvert solution and eliminated fill in the existing stream.

Concept Statement - Bridge Office Attachment

- b. Evaluated utilizing outlet headwalls with 0 degree through 45 degree skews as a means to reduce the impact on the channel from the embankment.
  - c. Evaluated culvert options with three 15-degree bends, four bends and six bends to better orient the outlet headwall with the ditch that makes a 90 degree bend downstream/east of Highway 15.
  - d. Evaluated a four bend culvert option with the parapet of the downstream headwall located just outside of the clear zone. This option located the outlet end further from the outside bank giving more room for flow to align its direction with the creek downstream.
  - e. Evaluated an option to align a culvert without bends at a 45 degree skew to Highway 15.
  - f. Revetment and stilling basin design will be necessary at the outlet end because of the headwall's alignment with the existing channel.
  - g. Evaluated options of replacing the existing bridge or leaving existing bridge in place and installing the culvert underneath.
  - h. Evaluated options for cast-in-place (CIP) and precast RCB for the straight portion of the culvert. CIP is necessary for the portion with bends. The Bridges and Structures Bureau (BSB) desires to use CIP for the portion with bends and to have options (precast and CIP) for the straight portion.
  - i. BSB verified that the county bridges along the proposed detour route can carry state legal loads.
  - j. District 2 verified that the off-site detour route is acceptable to them.
4. Special construction issues
- a. Right-of-way will be necessary to construct the outlet end of the box culvert.
5. Special survey = Yes. See below.
6. Aesthetic enhancements = No.
7. Other
- a. The roadway will be closed during construction with traffic placed on an off-site detour when the bridge is removed. The roadway could have remained open to traffic if the culvert were able to be constructed under the existing bridge. Insufficient vertical clearance exists for the flowable mortar alternative for constructing a 14' x 14' reinforced concrete box culvert under the existing bridge.

**Special Survey:**

- a. None required.

RCB CULVERT REPLACEMENT - SINGLE BOX  
 BRFN-015-3(16)--39-55  
 LETTING DATE  
 11-15-2022

KOSSUTH COUNTY - DESIGN NO. 0123

**LEGEND**

INTERSTATE HIGHWAY	
PRIMARY HIGHWAY-DIVIDED	
PRIMARY HIGHWAY	
PORTLAND CEMENT CONCRETE ROAD	
ASPHALT ROAD	
BITUMINOUS ROAD	
GRAVEL ROAD	
EARTHEN ROAD	
INTERSTATE HIGHWAY	
UNITED STATES HIGHWAY	
STATE HIGHWAY	
COUNTY HIGHWAY	
RAILROAD	
PIPELINE	
AIRPORT	
HYDROLOGY	
BRIDGE	
STATE BOUNDARY	
COUNTY BOUNDARY	
CORPORATE BOUNDARY	
TOWNSHIP LINE	
SECTION LINE	
ROAD NAMES	
UNINCORPORATED PLACE	
ABBAY ROAD	
ELWOOD	



Highway Division

PLANS OF PROPOSED IMPROVEMENTS ON THE

**PRIMARY ROAD SYSTEM**

**KOSSUTH COUNTY**

**RCB CULVERT REPLACEMENT - SINGLE BOX**

**IOWA 15 OVER LOTTS CREEK**

THE IOWA DEPARTMENT OF TRANSPORTATION STANDARD SPECIFICATIONS FOR HIGHWAY AND BRIDGE CONSTRUCTION, SERIES 2015, PLUS APPLICABLE GENERAL SUPPLEMENTAL SPECIFICATIONS, DEVELOPMENTAL SPECIFICATIONS, SUPPLEMENTAL SPECIFICATIONS AND SPECIAL PROVISIONS SHALL APPLY TO CONSTRUCTION WORK ON THIS PROJECT.

**ENGLISH STANDARD CULVERT PLANS**

STANDARD	ISSUED	REVISED
RCB G2-20	07-20	
RCB G3-20	07-20	
RCB 14-14-20	07-20	
PWH 0-1-20	07-20	
PWH 0-2-20	07-20	
PWH 0-3-20	07-20	
PWH 0-4-20	07-20	
PWH 0-6-20	07-20	
PEP 1-13	01-13	12-15

TOTAL SHEETS  
22

PROJECT NUMBER

BRFN-015-3(16)--39-55

R.O.W. PROJECT NUMBER

STPN-015-3(17)--25-55

PROJECT IDENTIFICATION NUMBER

18-55-015-010

**INDEX OF SHEETS**

NO.	DESCRIPTION
I	TITLE SHEET
V.1-V.2	DESIGN NO. 0123
B.1-B.2	TYPICAL SECTION AND DETAILS
C.1	TABULATIONS
D.1-D.2	IOWA 15 PLAN AND PROFILE
G.1-G.3	SURVEY INFORMATION
J.1-J.2	TRAFFIC CONTROL
W.1-W.9	CROSS SECTION

**PRELIMINARY**  
 NOT FOR CONSTRUCTION



1-800-292-8989

www.iowaonecall.com



Know what's below. Call before you dig.

REVISIONS TO THIS DESIGN PLAN AND/OR PROJECT SPECIFICATIONS SHOULD BE SUBMITTED BY \_\_\_\_\_

**STANDARD ROAD PLANS**

STANDARD ROAD PLANS ARE LISTED ON SHEET NUMBER \_\_\_\_\_

**DESIGN DATA RURAL**

2023 AADT	700	V.P.D.
2043 AADT	800	V.P.D.
2043 DHV	80	V.P.H.
TRUCKS	21	%
Total Design ESALs	?	

**INDEX OF SEALS**

SHEET NO.	NAME	TYPE
I	CHRISTOPHER J. CRISWELL	STRUCTURAL DESIGN
V.1	STEVEN A. KLOCKE	HYDRAULIC DESIGN
B.1	CINDY A. SPENCER	ROADWAY DESIGN
P/C CULVERT STANDARDS	NORMAN L. MCDONALD	STRUCTURAL DESIGN
CULVERT STANDARDS	JAMES S. NELSON	STRUCTURAL DESIGN

**STRUCTURAL DESIGN**



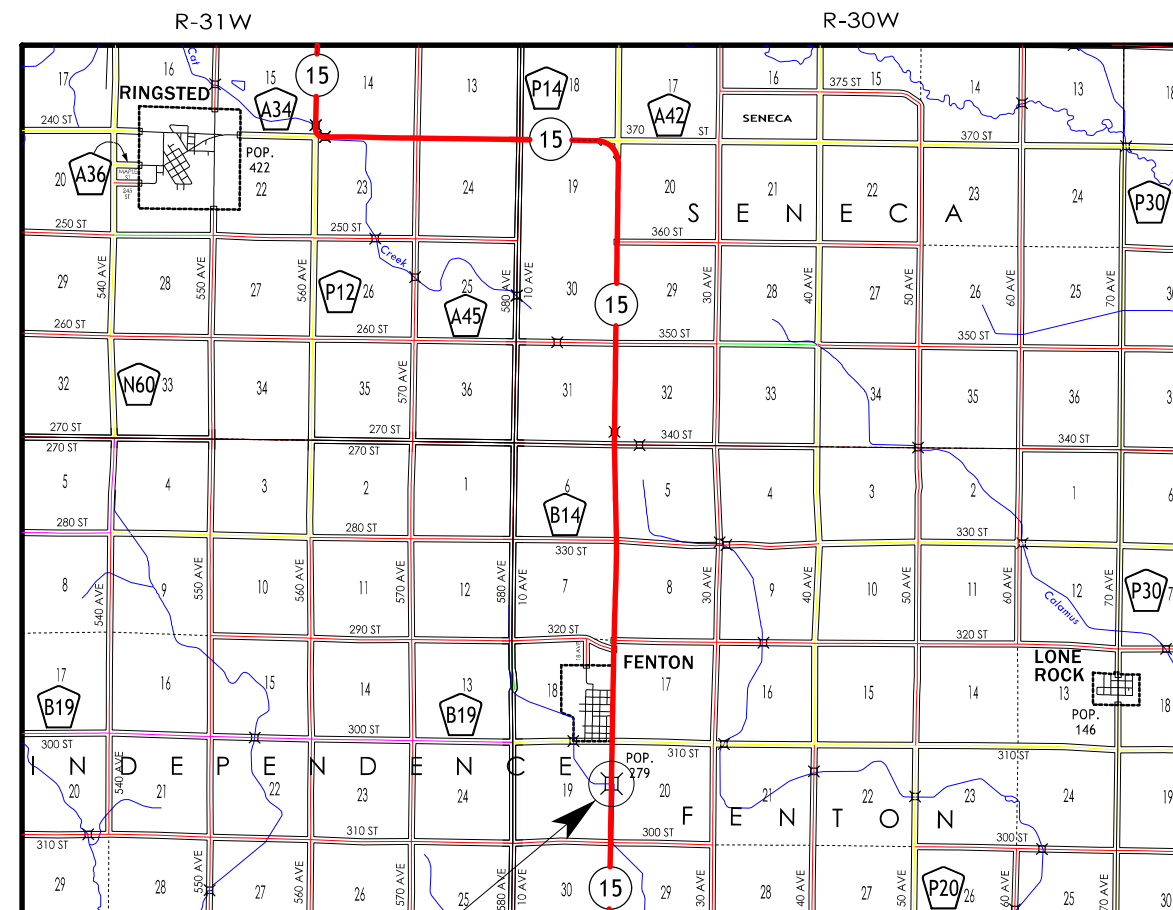
I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly licensed Professional Engineer under the laws of the State of Iowa.

**D.02 SUBMITTAL**

Signature: Christopher J. Criswell Date: \_\_\_\_\_  
 Printed or Typed Name

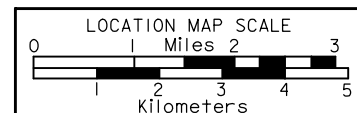
My license renewal date is December 31, 2021

Pages or sheets covered by this seal: SHEETS ? THRU ? OF ?

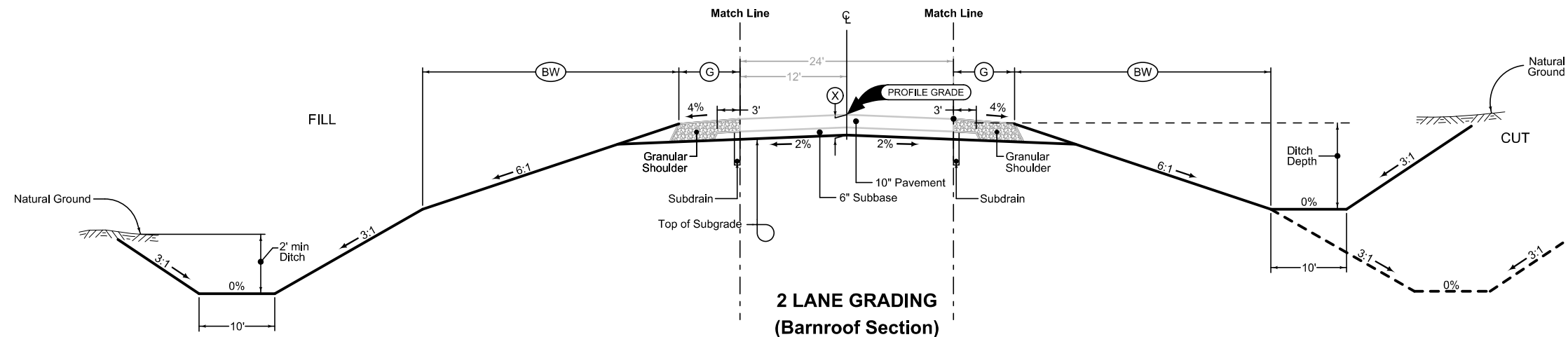


DESIGN NO. 0123

**LOCATION MAP**



PROJECT DIRECTORY NAME: 5501501018

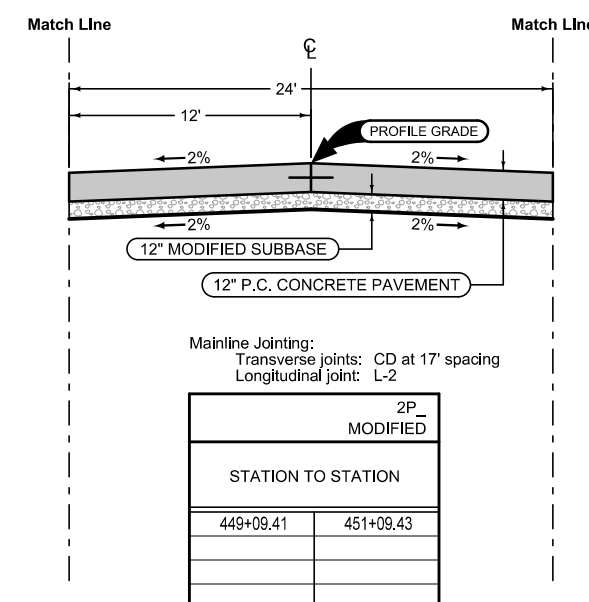


Normal section shown may be modified appropriately in areas of super-elevated curves or other locations specifically designated by the Engineer.

See Plan & Profile sheets and cross sections for additional details of ditches and backstops.

**2 LANE GRADING  
(Barnroof Section)**

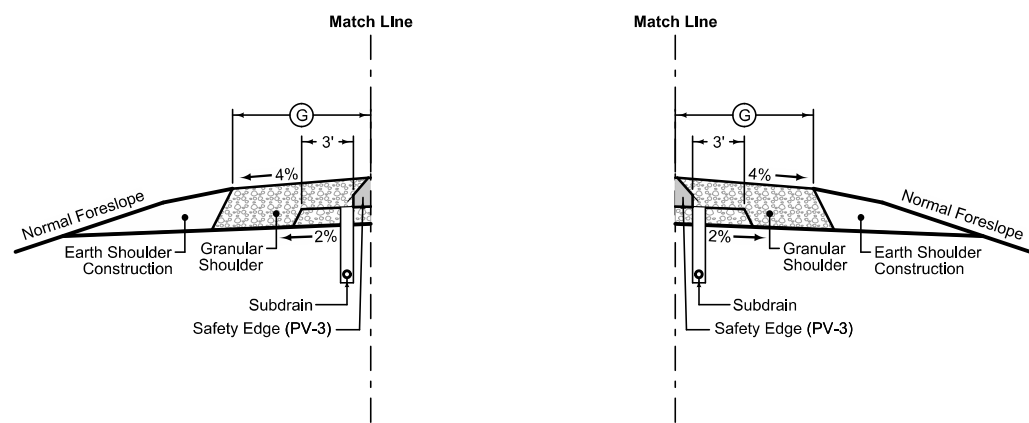
LOCATION				
ROAD IDENTIFICATION	STATION TO STATION	(BW) Feet	(X) Inches	
Iowa 15	449+09.41   451+09.43	18	16	



2P MODIFIED	
STATION TO STATION	
449+09.41	451+09.43

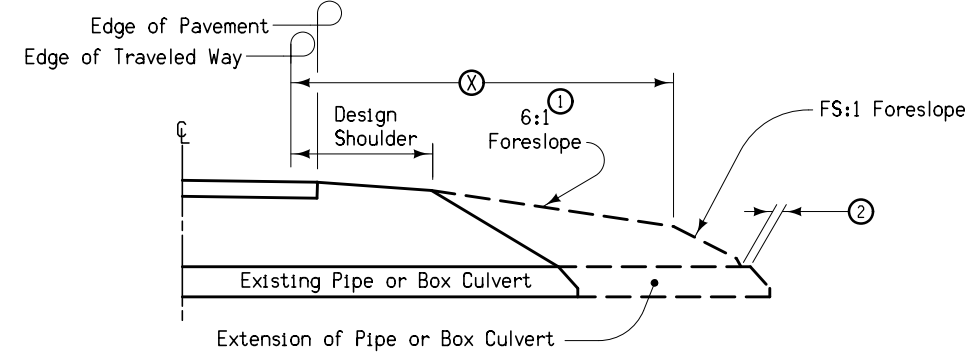
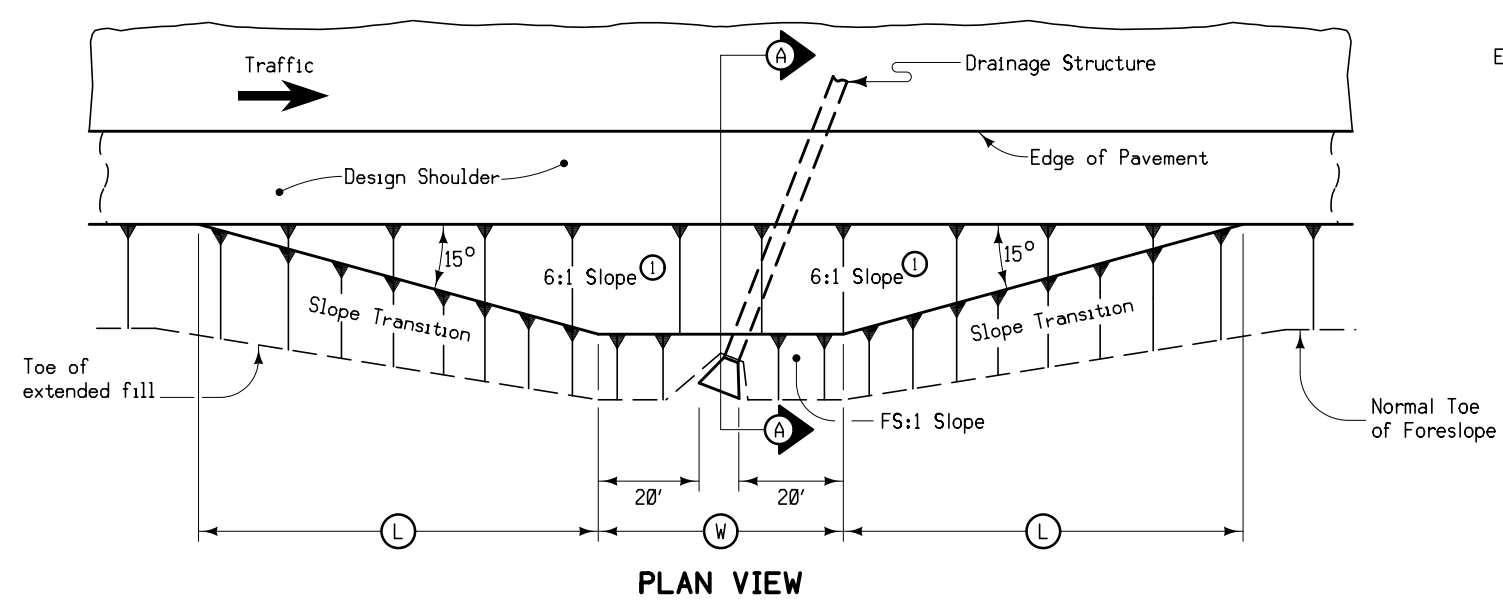
**Granular Shoulder with Safety Edge**

2_G 10-21-14		
STATION TO STATION	(G) Feet	
449+09.41   451+09.43	6	



**Granular Shoulder with Safety Edge**

2_G 10-21-14		
STATION TO STATION	(G) Feet	
449+09.41   451+09.43	6	



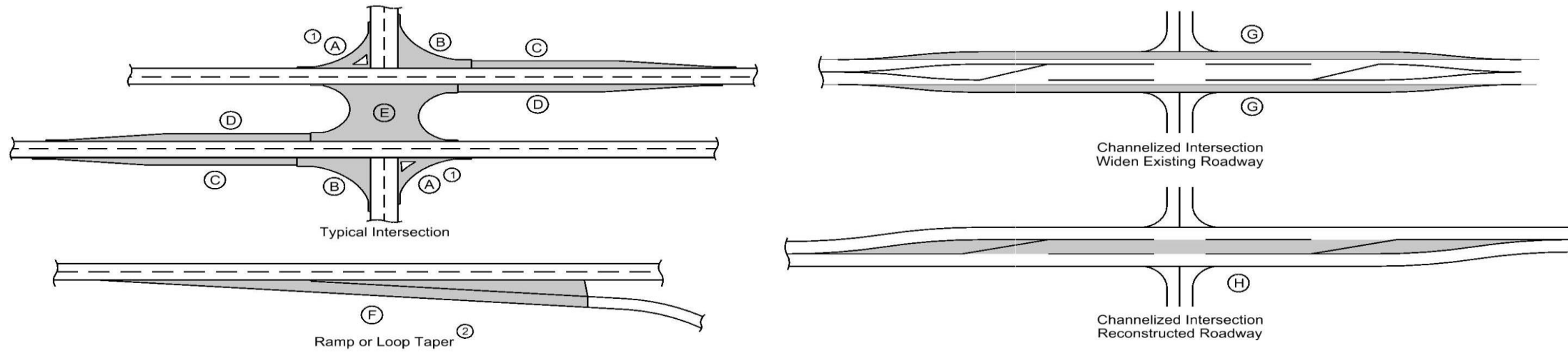
At locations where an extended or newly constructed drainage structure extends beyond the normal foreslope cover, flatten as indicated so as to cover the structure. Minimum earth cover is 6 inches.

- ① Slope may be flatter than 6:1.
- ② 6 inch minimum for pipe installations or to top of headwall on RCB.
- ③ At  $\bar{C}$  of roadway.
- Ⓜ = Pipe or RCB opening width plus 20 feet each side.

STRUCTURE LOCATION		Ⓜ	Ⓛ	Ⓧ	ⓕS
STATION ③	SIDE	Feet	Feet	Feet	
450+10.00	BOTH	47.93	67.18	24	3

**BARNROOF FORESLOPE AT SKEWED DRAINAGE STRUCTURE**

**PCC PAVEMENT**



- ① Does not include raised island area or curb. Refer to tabulation 112-4 for quantities.
- ② Refer to PV-410, PV-411, PV-412, and PV-414.
- ③ Quantity includes Pavement Header.

Road Identification	Location		Mainline			Area ③								Total Area By Pavement Thickness			Special Backfill	Modified Subbase	Granular Subbase	Remarks		
	Direction of Travel	Station to Station	Width	Length	Area	A ①	B	C	D	E	F ②	G	H	SY		TONS					CY	SY
														10 IN	10% IN							
Iowa 15	BOTH	449+09.41 451+09.43	24.0	200.0	533.4									533.4			222.3					

**SHOULDERS**

- ① Lane(s) to which the shoulder is adjacent.
- ② Bid Item
- ③ Applies only for Paved Shoulders constructed on project with existing granular shoulders.
- ④ Does not include shrink.

Calculations assume a HMA unit weight (lbs/cf) of 0, a Special Backfill unit weight (lbs/cf) of 140, and a Granular Shoulder unit weight (lbs/cf) of 140.

Road Identification	Direction of Traffic	Location				Quantities														Remarks		
		Station to Station	Side	P Width	G Width	L Length	Class 13 Excavation	Hot Mix Asphalt		Binder	Paved Shoulder	Reinforced Paved Shoulder	Special Backfill				Modified Subbase	Granular Shoulder			Earth Shoulder Construction Alternates	
								TON	TON/STA				HMA Alternate		PCC Alternate			TON	TON/STA		STA	HMA
Iowa 15	NB	449+09.41 451+09.43	R		6.0	200.0											112.011	56.000	2.0			
	SB	449+09.41 451+09.43	L		6.0	200.0											112.011	56.000	2.0			

**REMOVAL OF PAVEMENT**

Refer to Tabulation 102-5

\* Not a Bid Item

Begin Station	End Station	Side	Pavement Type	Area	Saw Cut*	Remarks
				SY	LF	
449+09.41	449+79.30	BOTH		188.5	24.0	
450+41.94	451+09.43	BOTH		181.3	24.0	

**SURVEY SYMBOLS**

**UTILITY LEGEND**

**PLAN VIEW COLOR LEGEND OF PLAN AND PROFILE SHEETS**

LINEWORK		Design Color No.	
Green	(2)		Existing Topographic Features and Labels
Blue	(1)		Proposed Alignment, Stationing, Tic Marks, and Alignment Annotation
Magenta	(5)		Existing Utilities
SHADING		Design Color No.	
Yellow	(4)		Highlight for Critical Notes or Features
Red	(3)		Delineates Restricted Areas
Lavender	(9)		Temporary Pavement Shading
Gray, Light	(48)		Proposed Pavement Shading
Gray, Med	(80)		Proposed Granular Shading
Gray, Dark	(112)		Proposed Grade and Pave Shading "In conjunction with a paving project"
Brown, Light	(236)		Grading Shading
Tan	(8)		Proposed Sidewalk Shading
Blue, Light	(230)		Proposed Sidewalk Landing Shading
Pink	(11)		Proposed Sidewalk Ramp Shading

**PROFILE VIEW COLOR LEGEND OF PLAN AND PROFILE SHEETS**

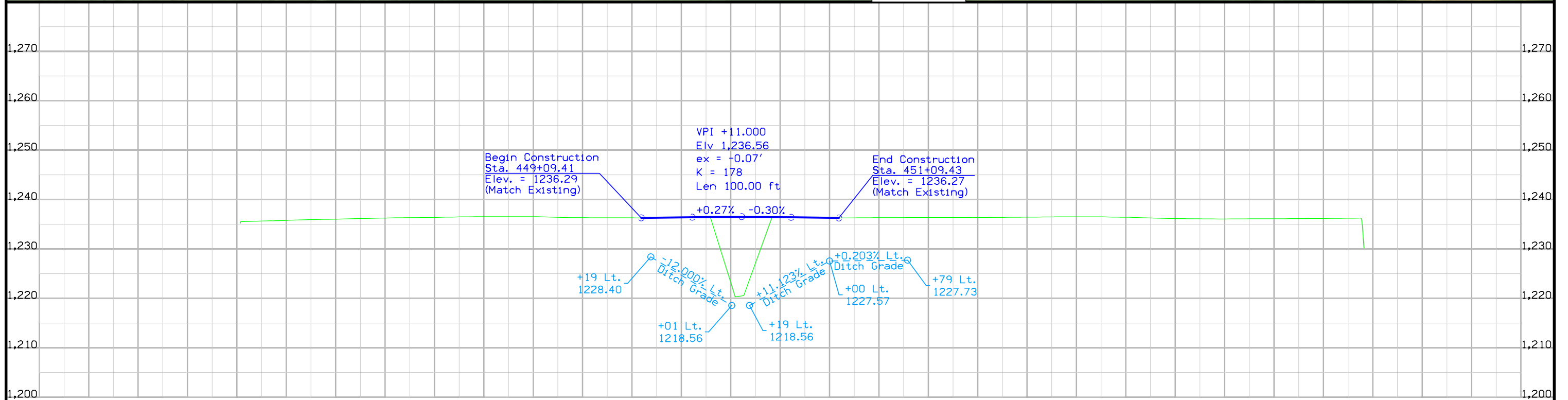
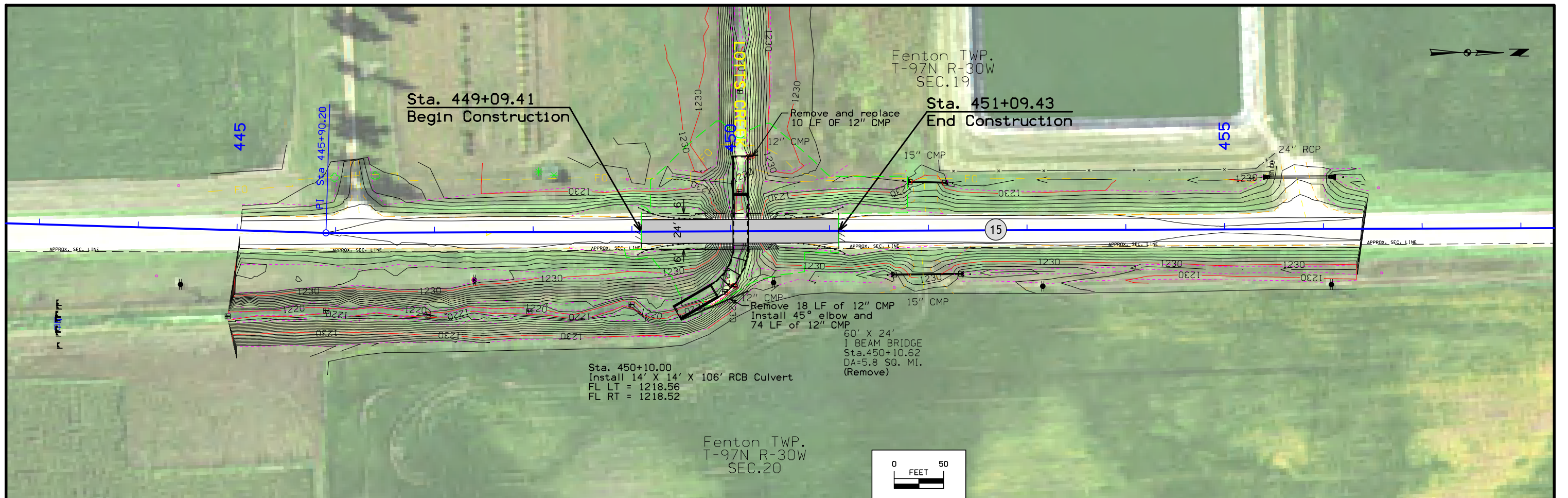
LINEWORK		Design Color No.	
Green	(2)		Existing Ground Line Profile
Blue	(1)		Proposed Profile and Annotation
Magenta	(5)		Existing Utilities
Blue, Light	(230)		Proposed Ditch Grades, Left
Black	(0)		Proposed Ditch Grades, Median
Rust	(14)		Proposed Ditch Grades, Right

	Reference Point
	Station
	Survey Line
	Section Corner
	Ground Line Intercept
	Saw Cut
	Guardrail
	Trench Drain
	HighTension Cable Guardrail
	Sheet Pile
	Pavement Removal
	Clearing & Grubbing Area

RIGHT-OF-WAY LEGEND	
	Proposed Right-of-Way
	Existing Right of Way
	Existing and Proposed Right-of-Way
	Easement and Existing Right-of-Way
	Easement (Temporary)
	Easement
	Access Control
	Property Line

**PLAN AND PROFILE  
LEGEND AND SYMBOL  
INFORMATION SHEET**

(COVERS SHEET SERIES D, E, F, & K)



443	444	445	446	447	448	449	450	451	452	453	454	455	456	457	458
FILE NO.	ENGLISH	DESIGN TEAM	SNYDER AND ASSOCIATES, INC.			KOSSUTH COUNTY			PROJECT NUMBER	BRFN-015-3(16)--39-55			SHEET NUMBER	D.2	



## Survey Information

KOSSUTH County  
BRFN-015-3(16)--39-55  
Bridge Replacement Concept – HWY 15 Kossuth County  
PIN 18-55-015-010  
SAP-06581

### General Information

Measurement units for this survey are US survey feet. This survey is for the proposed bridge replacement on Iowa 15 over Lots Creek, just south of the City of Fenton. This project is a Full DTM survey. However, the survey collected is limited to the existing right-of-way and creek in the vicinity surrounding the existing bridge.

### Vertical Control

Vertical datum for this survey is relative to NAVD88, Geoid 12a.

Vertical positions were established by static observations and post processed using concurrent observations from the IARTN reference stations at Emmetsburg and Algona and Sioux City. A digital level loop was run from CP1 through the project benchmarks and returned to CP1. The loop error was allowable and the error was distributed proportionately among the project marks.

Averaged RTK observations were also collected on Kossuth County BM#17 and BM#29 with results shown below. Additional benchmarks were established with a digital level loop relative to CP1.

This survey observed two Kossuth County Control Monuments with published NAVD88 heights to compare to local ground control:

IDOT As-Built Plans 829A(1) Benchmark #17 has a published Elev. of 675.02  
Survey Elev. = 1243.26

IDOT As-Built Plans 829A(1) – Benchmark #29 has a published Elev. of 670.76  
Survey Elev. = 1238.57

No NGS Benchmarks are located within 2 miles of the project location.

### Horizontal Control

The project coordinate system is the Iowa Regional Coordinate System, Zone 1. Horizontal datum is NAD83 (2011) for Epoch 2010.00. The projection parameters for Zone 1 of the IaRCS is defined below:

Lambert Conformal Conic Projection North American Datum of 1983  
Origin Std. Parallel & Grid: 43°12'00"N  
Origin Central Meridian: 095°15'00"W  
Standard Parallel Scale: 1.000052  
False Northing: 9,600,000  
False Easting: 11,500,000

Coordinates were determined by averaging a minimum of three IARTN observations with appropriate time spans between. The horizontal standard deviation of these observations was less than 0.05' at 95% confidence level.

### Alignment Information

The horizontal alignment for this survey is a retrace of As-built Plans Project No. 829A(1). Survey stationing was equated to the plan PI at STA 445+90.20 and run back and ahead without equation throughout the survey.

Survey stationing relates to as built plan stationing as follows:

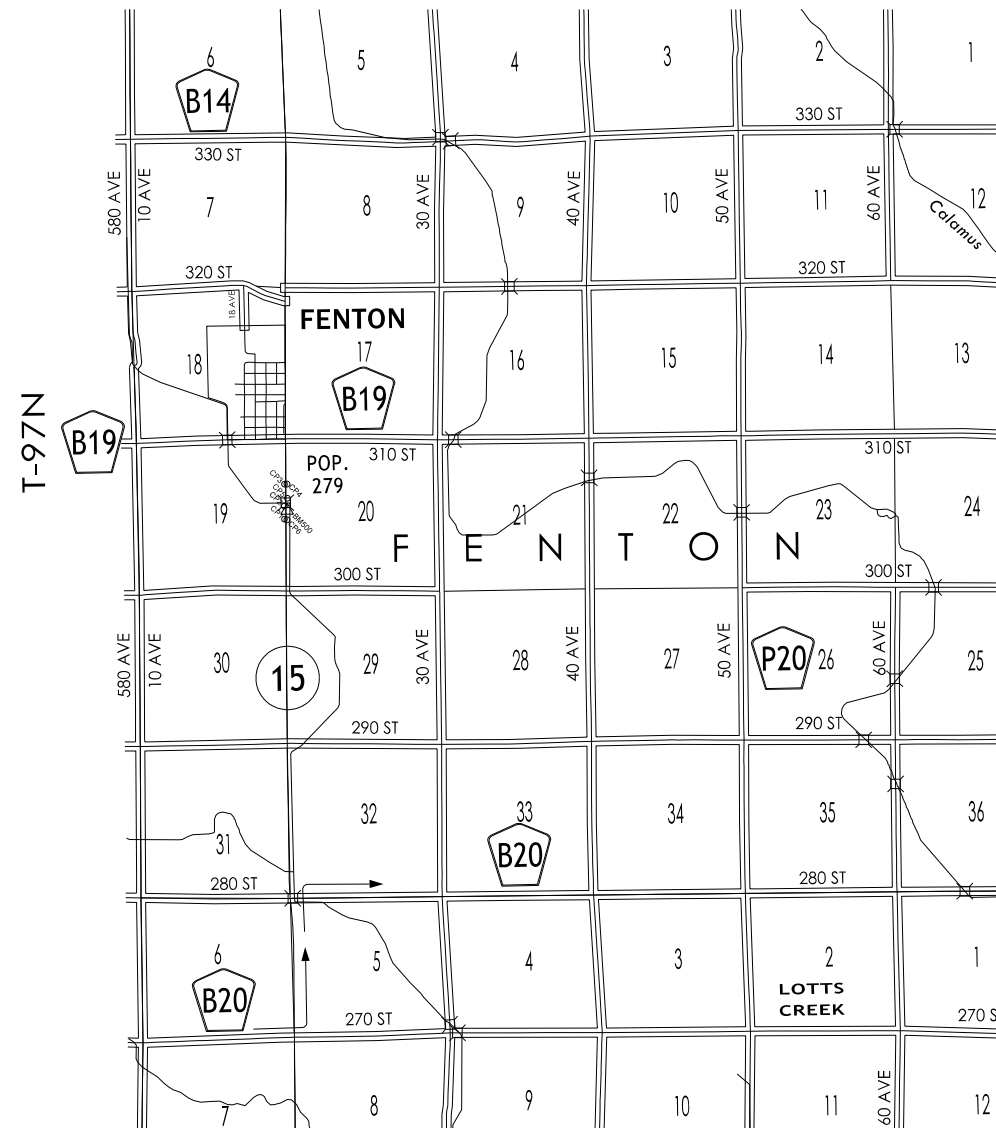
PI Sta. 419+46.0 As-built Plans Project No. 829A(1)  
Survey PI Sta. 419+45.56

PI Sta. 445+90.2 As-built Plans Project No. 829A(1)  
Survey PI Sta. 445+90.20

PI Sta. 472+28.1 As-built Plans Project No. 829A(1)  
Survey PI Sta. 472+28.13

## CONTROL POINT VICINITY MAP

This map is a guide to the vicinity of the primary project control points  
 Primary control is for use with RTK base stations and for RTN validation.  
 Future surveys will use primary project control to establish temporary  
 control as needed for construction or other surveying applications.



HORIZ. DATUM: NAD83(2011) EPOCH 2010.00

VERT. DATUM: NAVD88

1a. Regional Coordinate System Zone 1

Coordinate listing from next sheet will be used with 1aRTN for monument  
 recovery. No other reference ties are given.

# HORIZONTAL AND VERTICAL PROJECT CONTROL COORDINATE LISTING

HORIZ. DATUM: NAD83(2011) EPOCH 2010.00

VERT. DATUM: NAVD88

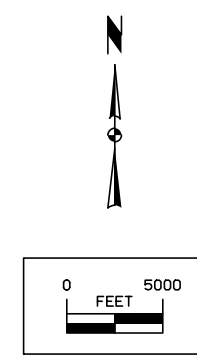
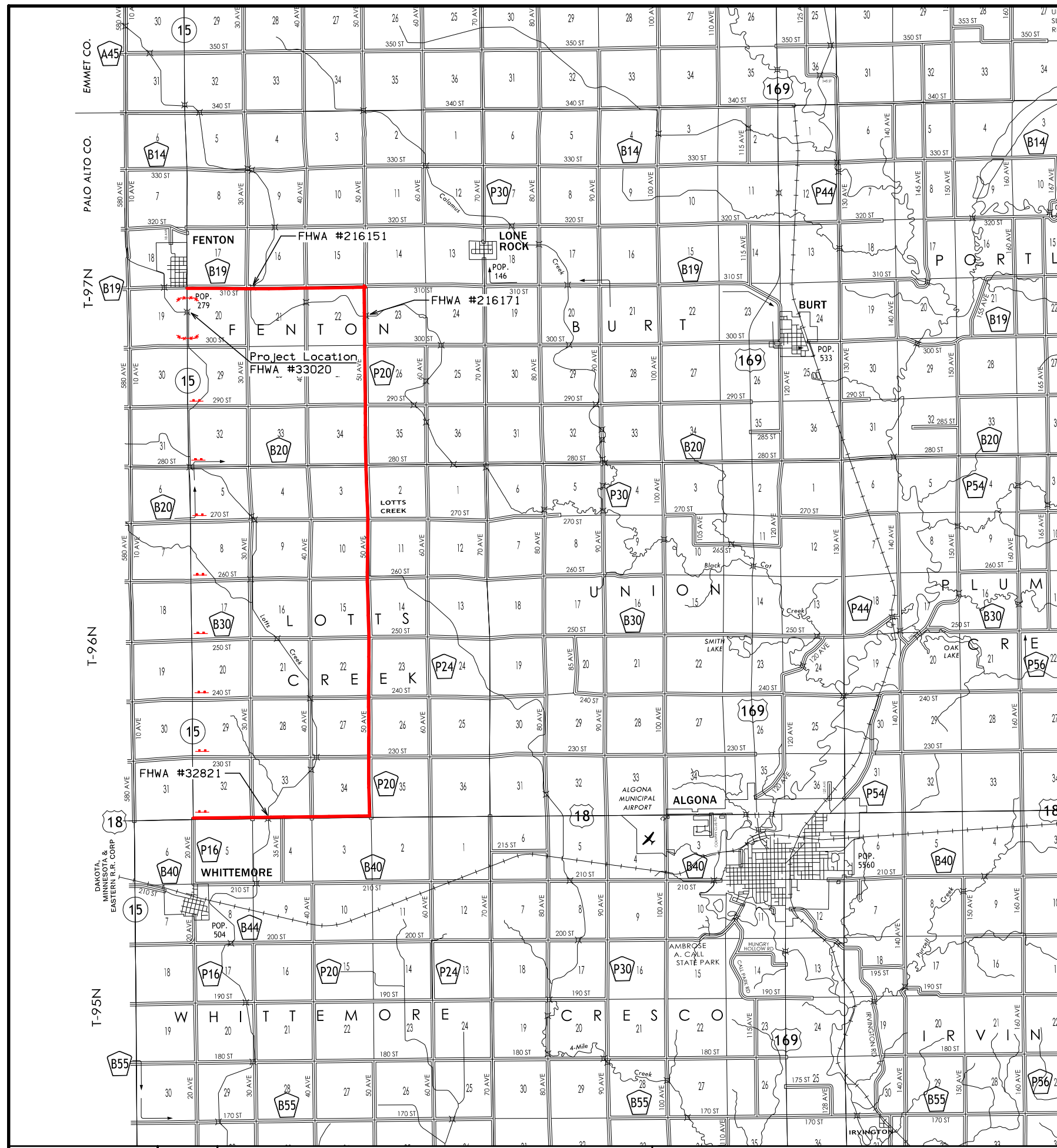
Ia. Regional Coordinate System Zone 1

Point Name	Northing	Easting	Elevation	Feature Definition	Description
CP1	9602853.344	11720349.94	1229.510	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-35FT WEST OF HIGHWAY 15 ACROSS FROM 1ST POWER POLE SOUTH OF CEMETARY ENTRANCE.
CP2	9603307.801	11720343.43	1228.775	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-25FT WEST OF HIGHWAY 15 +/-90FT SOUTH OF END OF BRIDGE.
CP3	9604068.15	11720352.12	1230.209	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-25FT WEST OF HIGHWAY 15 +/-50FT NORTH OF DRIVE TO WASTEWATER POND.
CP4	9604071.379	11720438.26	1229.817	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-25FT EAST OF HIGHWAY 15 +/-50FT NORTH OF 3RD POWER POLE NORTH OF BRIDGE.
CP5	9603578.01	11720453.02	1227.664	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-30FT EAST OF HIGHWAY 15 +/-100FT NORTH OF END OF BRIDGE +/-5FT EAST OF CULTIVATION LIMIT.
CP6	9602831.031	11720441.33	1230.771	CP	SET 1/2IN REBAR WITH RED PLASTIC CAP +/-25FT EAST OF HIGHWAY 15 +/-20FT SOUTH OF 1ST POWER POLE SOUTH OF CEMETARY ENTRANCE.
BM500	9603152.654	11720445.56	1233.234	BM	SET RAILROAD SPIKE IN NORTH SIDE OF 1ST POWER POLE SOUTH OF BRIDGE.

108-23A  
08-01-08

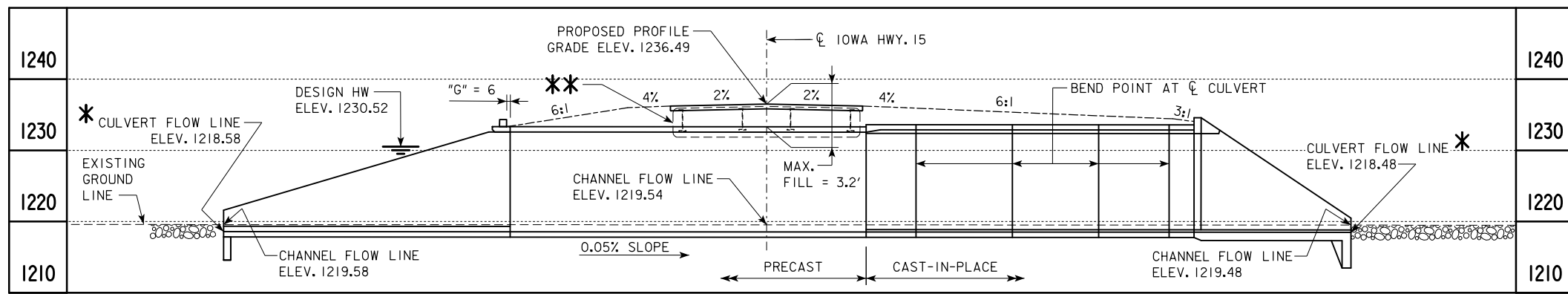
### TRAFFIC CONTROL PLAN

1. Iowa 15 will be closed to traffic during construction. Traffic will be detoured as shown on Sheet J.2.
2. Access to individual properties shall be maintained at all times.

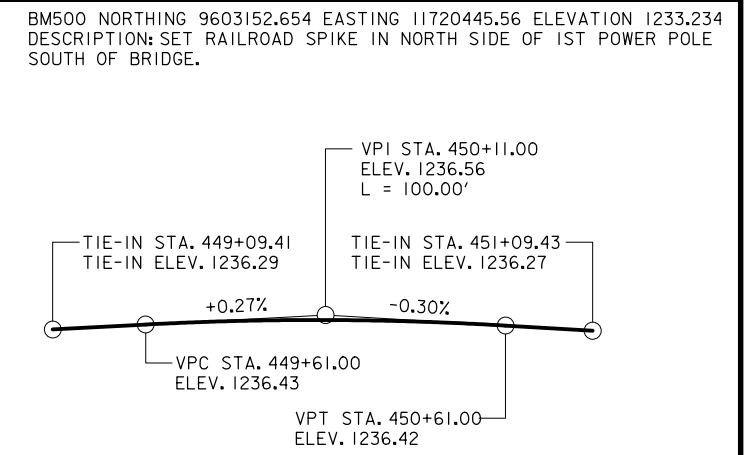


LEGEND	
	DETOUR ROUTE
	HAZARD CLOSURE
	ROAD CLOSURE

**DETOUR ROUTE**



LONGITUDINAL SECTION ALONG CULVERT



PROPOSED PROFILE GRADE ON IOWA HIGHWAY 15

TRAFFIC ESTIMATE

2023 AADT	700	V.P.D.
2043 AADT	800	V.P.D.
2043 DHV	80	V.P.H.
TRUCKS	21	%

UTILITIES LEGEND

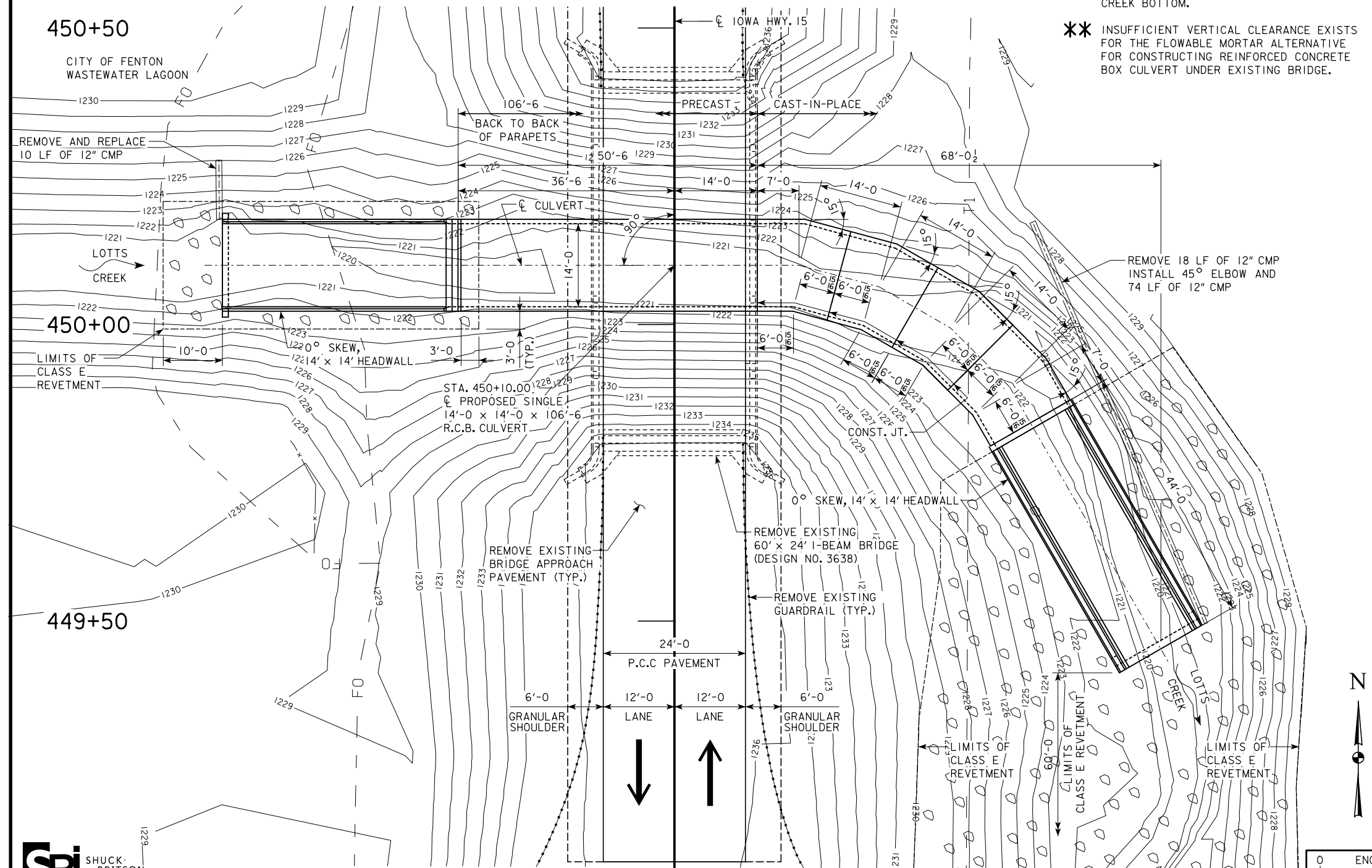
FO - FIBER OPTIC - FENTON COOPERATIVE COMMUNICATIONS  
 TI - TELEPHONE - FENTON COOPERATIVE COMMUNICATIONS

HYDRAULIC DATA

DRAINAGE AREA = 5.8 SQ. MI.  
 STREAM SLOPE = 2.6 FT./MI.  
 DESIGN DISCHARGE,  $Q_{50}$  = 945 CFS  
 HW ELEV. = 1230.52 FT.  
 OUTLET VELOCITY = 6.50 FPS  
 DISCHARGE,  $Q_{100}$  = 1161 CFS  
 HW ELEV. = 1231.66 FT.  
 OUTLET VELOCITY = 7.40 FPS

LOCATION

IOWA 15 OVER LOTTS CREEK  
 8.5 MILES NORTH OF HWY 18  
 T-97N R-30W  
 SECTION 20  
 FENTON TOWNSHIP  
 KOSSUTH COUNTY  
 LATITUDE 43.206397°  
 LONGITUDE -94.423434°



SITUATION PLAN

**HYDRAULIC DESIGN**

I hereby certify that this engineering document was prepared by me or under my direct personal supervision and that I am a duly Licensed Professional Engineer under the laws of the State of Iowa.

**D.02 SUBMITTAL**

Signature: Steven A. Klocke Date: \_\_\_\_\_  
 Printed or Typed Name: Steven A. Klocke  
 My license renewal date is December 31, 2021

Pages or sheets covered by this seal: V.1 & V.2 (HYDRAULIC DATA, CHANNEL GRADING AND REVETMENT)

PRELIMINARY

DESIGN FOR 0° SKEW

**SINGLE 14'-0 x 14'-0 x 106'-6 R. C. B. CULVERT**

**SITUATION PLAN**

STATION 450+10.00 NOVEMBER 2022

**KOSSUTH COUNTY**

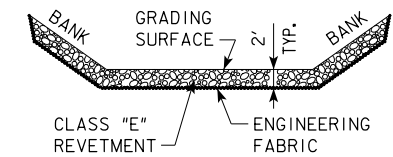
IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 1 OF 2 FILE NO. 31711 DESIGN NO. 123



BM500 NORTHING 9603152.654 EASTING 11720445.56 ELEVATION 1233.234  
 DESCRIPTION: SET RAILROAD SPIKE IN NORTH SIDE OF 1ST POWER POLE SOUTH OF BRIDGE.

TYPICAL CHANNEL PROTECTION			
ESTIMATED REVETMENT QUANTITIES INCLUDED WITH ROAD PLANS			
LOCATION	REVETMENT CL. "E" (TON)	ENGINEERING FABRIC (SY)	EXCAVATION (CY)
INLET	XX	53	XX
OUTLET	XX	636	XX
TOTALS	XX	860	XX

EXCAVATION QUANTITY CALCULATED FROM GRADING SURFACE. QUANTITIES SHOWN FOR INFORMATION ONLY. SEE ROAD SHEETS.

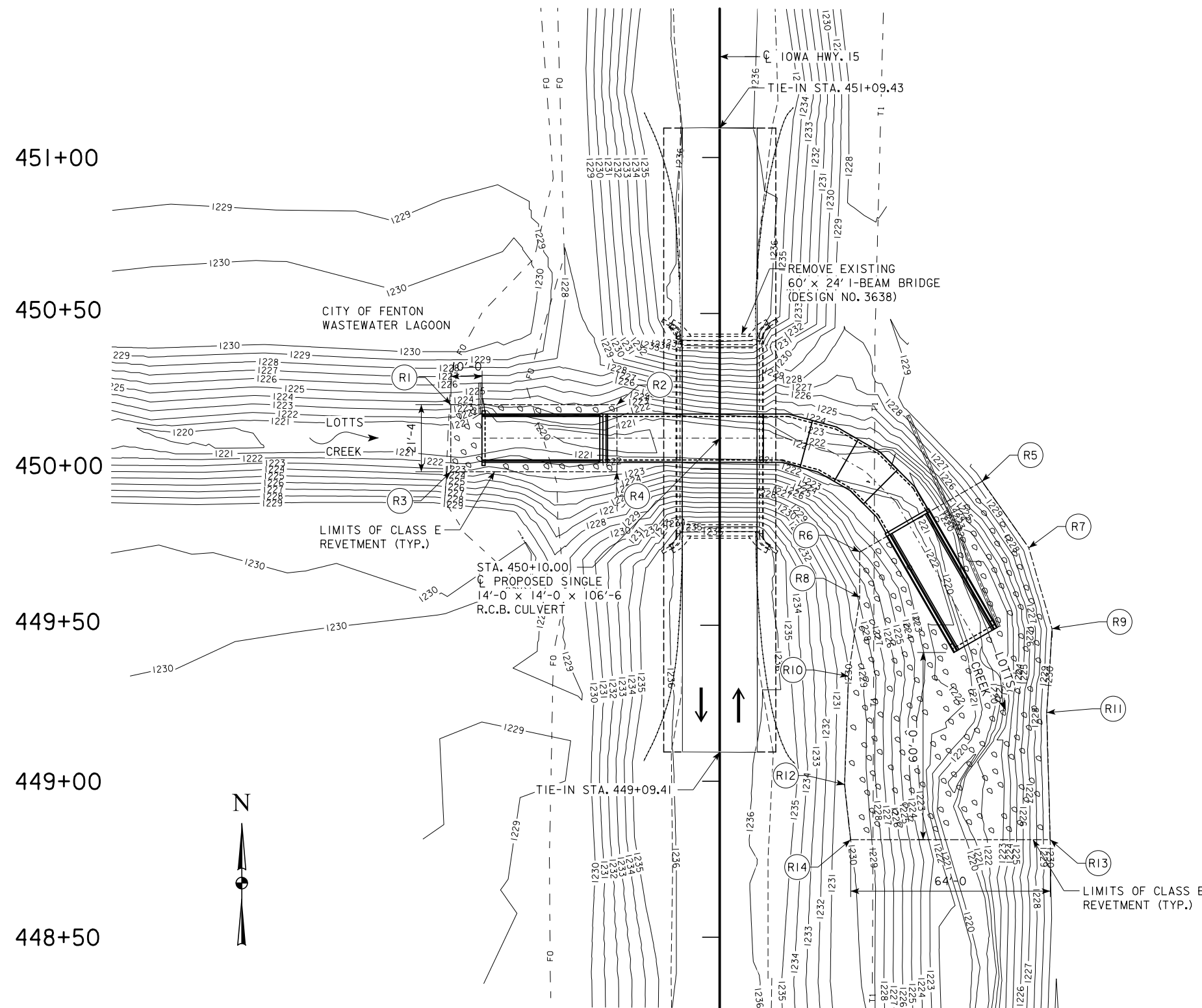


**REVETMENT LAYOUT:**

- (R1) HWY. 15 450+20.75, 86.25' LT:
- (R2) HWY. 15 450+20.75, 33.00' LT:
- (R3) HWY. 15 449+99.25, 86.25' LT:
- (R4) HWY. 15 449+99.25, 33.00' LT:
- (R5) HWY. 15 449+96.15, 84.11' RT:
- (R6) HWY. 15 449+73.52, 44.91' RT:
- (R7) HWY. 15 449+14.87, 99.12' RT:
- (R8) HWY. 15 449+58.98, 44.90' RT:
- (R9) HWY. 15 449+48.93, 106.59' RT:
- (R10) HWY. 15 449+33.69, 41.29' RT:
- (R11) HWY. 15 449+22.05, 104.90' RT:
- (R12) HWY. 15 448+98.97, 44.05' RT:
- (R13) HWY. 15 448+81.28, 105.98' RT:
- (R14) HWY. 15 448+81.28, 41.98' RT:

**UTILITIES LEGEND**

FO - FIBER OPTIC - FENTON COOPERATIVE COMMUNICATIONS  
 TI - TELEPHONE - FENTON COOPERATIVE COMMUNICATIONS



**SITE PLAN**



PRELIMINARY  
 DESIGN FOR 0° SKEW  
**SINGLE 14'-0 x 14'-0 x 106'-6  
 R. C. B. CULVERT**  
**SITUATION PLAN - SITE**  
 STATION 450+10.00 NOVEMBER 2022  
**KOSSUTH COUNTY**  
 IOWA DEPARTMENT OF TRANSPORTATION - HIGHWAY DIVISION  
 DESIGN SHEET NO. 2 OF 2 FILE NO. 31711 DESIGN NO. 123



**LINE STYLE LEGEND OF CROSS SECTION SHEETS (ROAD)**

- Existing Ground Line
- ===== Proposed Template
- ===== Proposed Topsoil Placement
- Additional Topsoil Removal
- Subgrade Treatment
- Granular Shoulder
- ===== Pavement
- Existing Pipe\R/CB
- ===== Proposed Pipe\R/CB
- ===== Proposed Dike
- ===== All Elements Associated with Proposed Entrances

**LINE STYLE LEGEND OF CROSS SECTION SHEETS (SOILS)**

- TOPSOIL ----- Topsoil (Class 10)
- Slope Dressing Only
- CL 10 ----- Class 10 Materials
- SL LO ----- Select Loams And Clay-Loams
- SL SA ----- Select Sand
- UNS A ----- Unsuitable Type A Disposal
- UNS B ----- Unsuitable Type B Disposal
- UNS C ----- Unsuitable Type C Disposal
- SHALE ----- Shale
- WASTE ----- Waste
- BRK LS ----- Broken and Weathered Rock
- ROCK ----- Solid Rock
- BLDGS ----- Boulders

Note: All layer lines and descriptions identify layers above the line.

Note: Vertical or near vertical lines connecting soil layers at edges of cross sections are only for the purpose of calculating template quantities and do not depict soil stratification.

**SYMBOL LEGEND OF CROSS SECTION SHEETS**

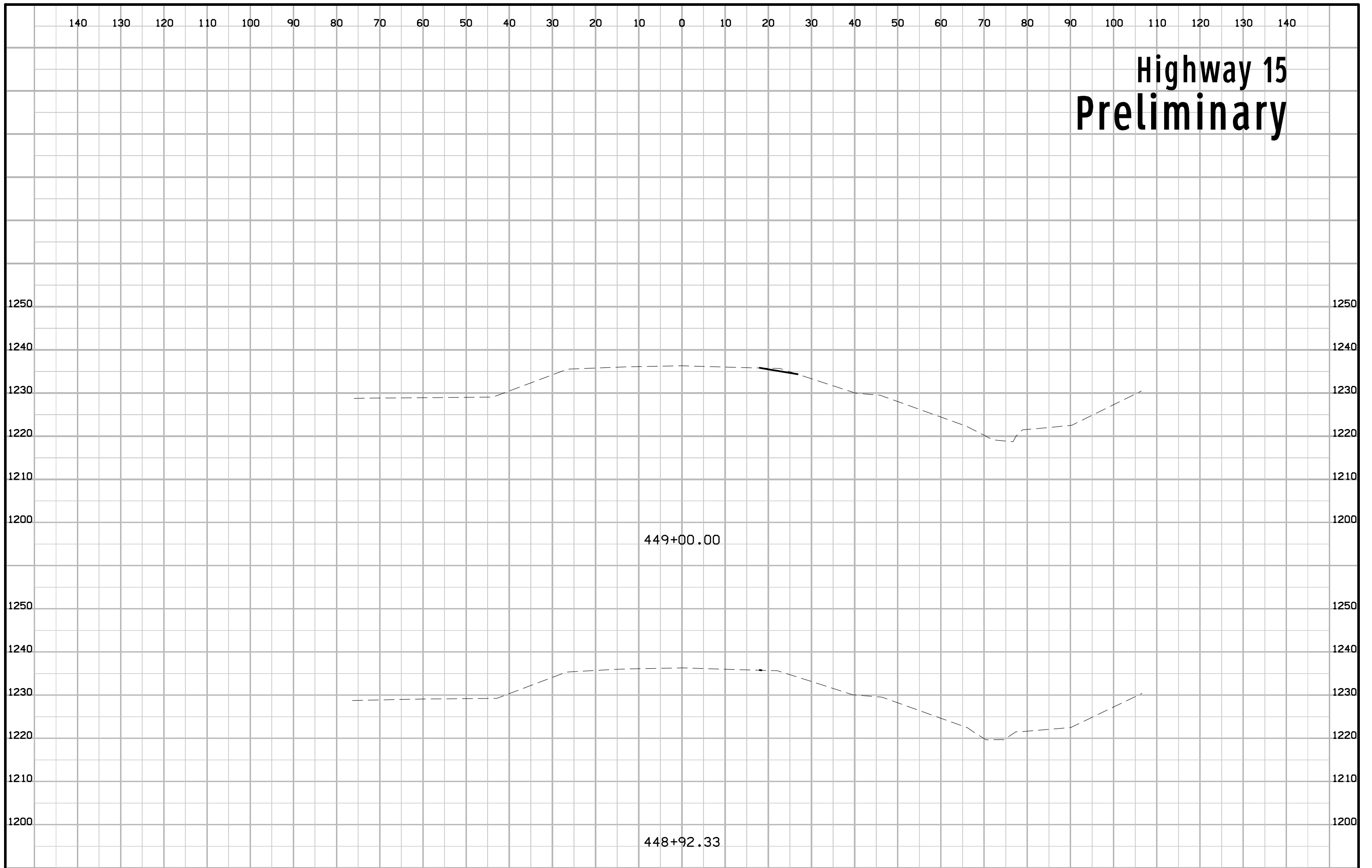
- Existing ROW  
----- Existing Right-of-Way Limit
- Proposed ROW  
----- Proposed Right-of-Way Limit
- Temporary ROW  
----- Temporary Right-of-Way Limit

**CROSS SECTION  
LEGEND AND SYMBOL  
INFORMATION SHEET**

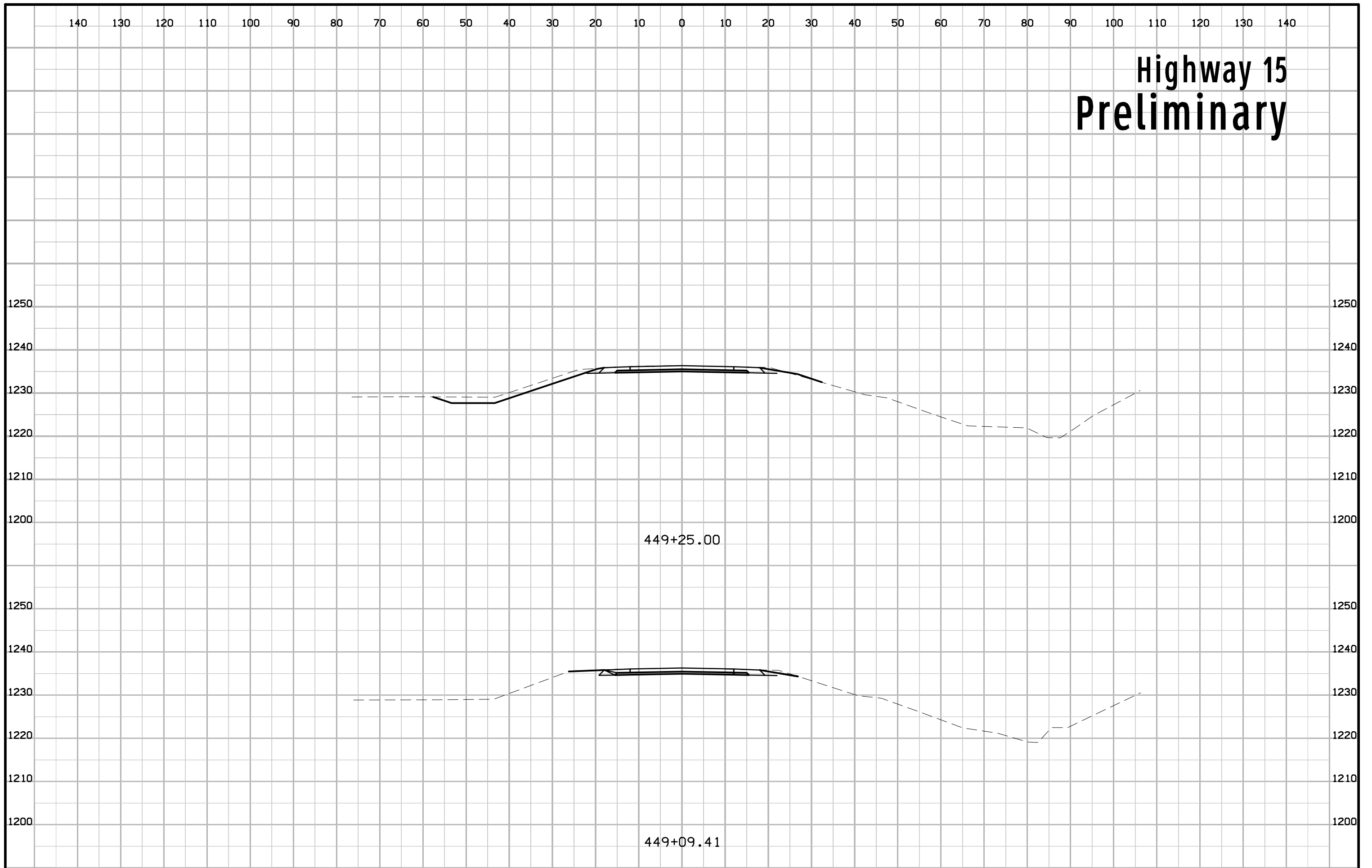
(COVERS SHEET SERIES W, X, Y, & Z)



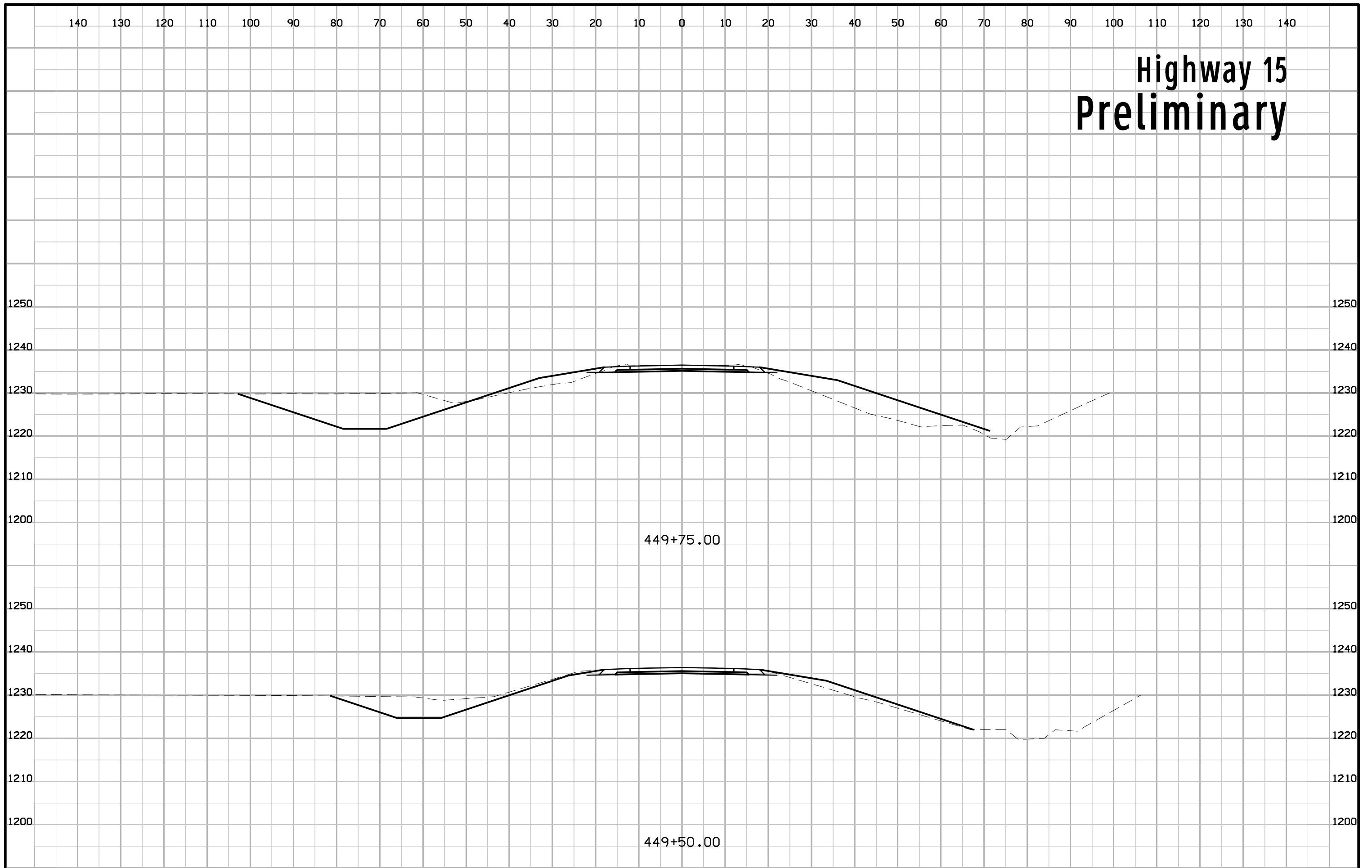
# Highway 15 Preliminary



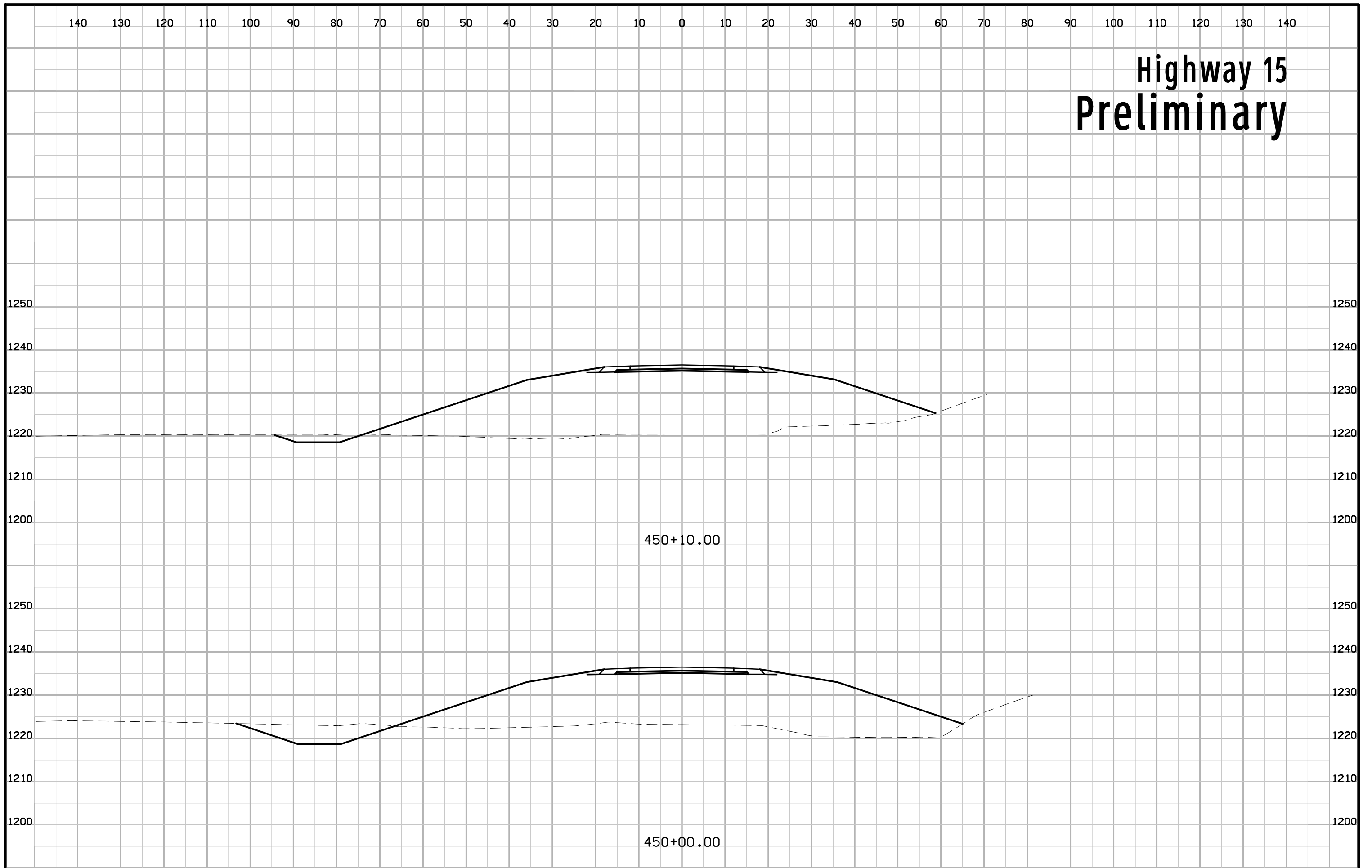
# Highway 15 Preliminary



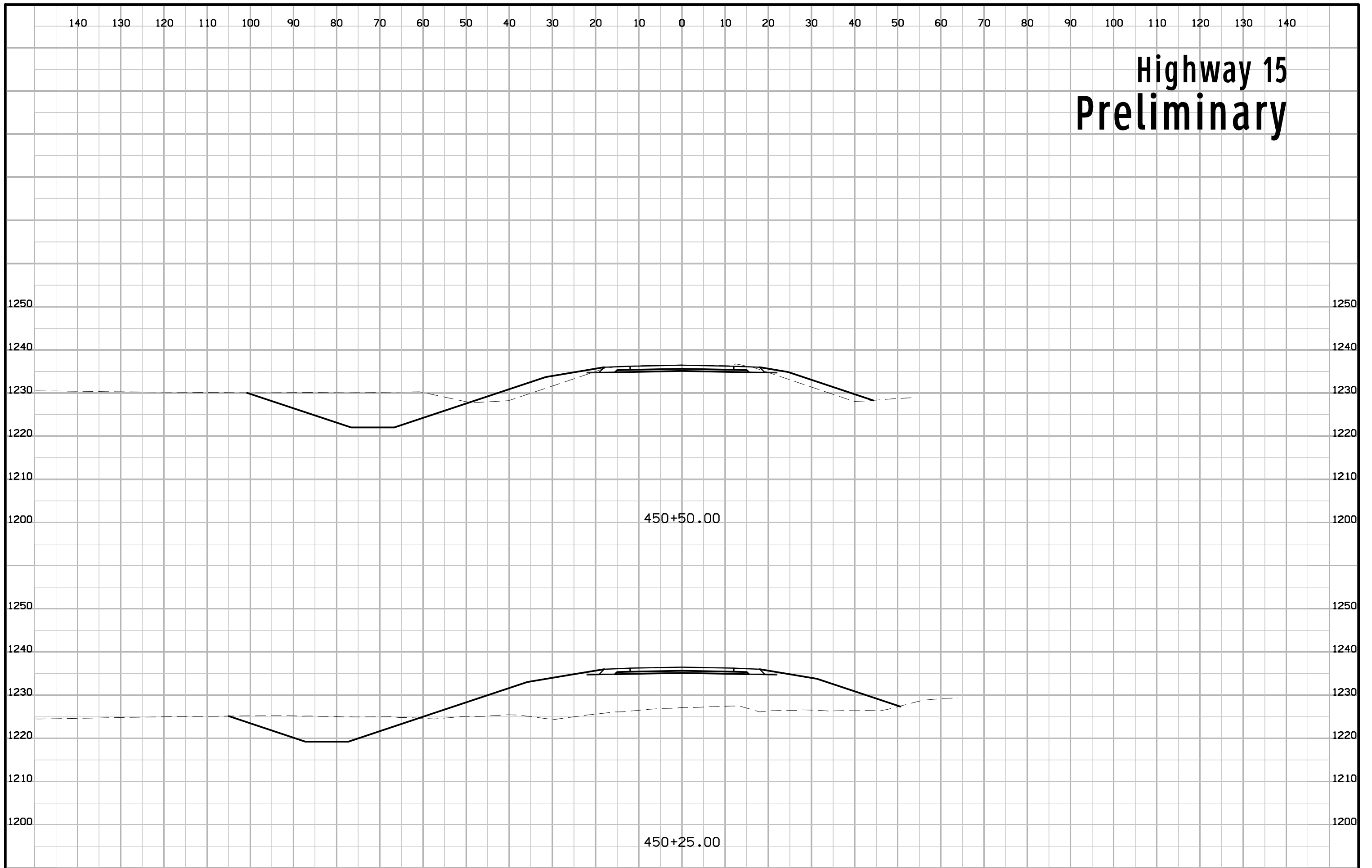
# Highway 15 Preliminary



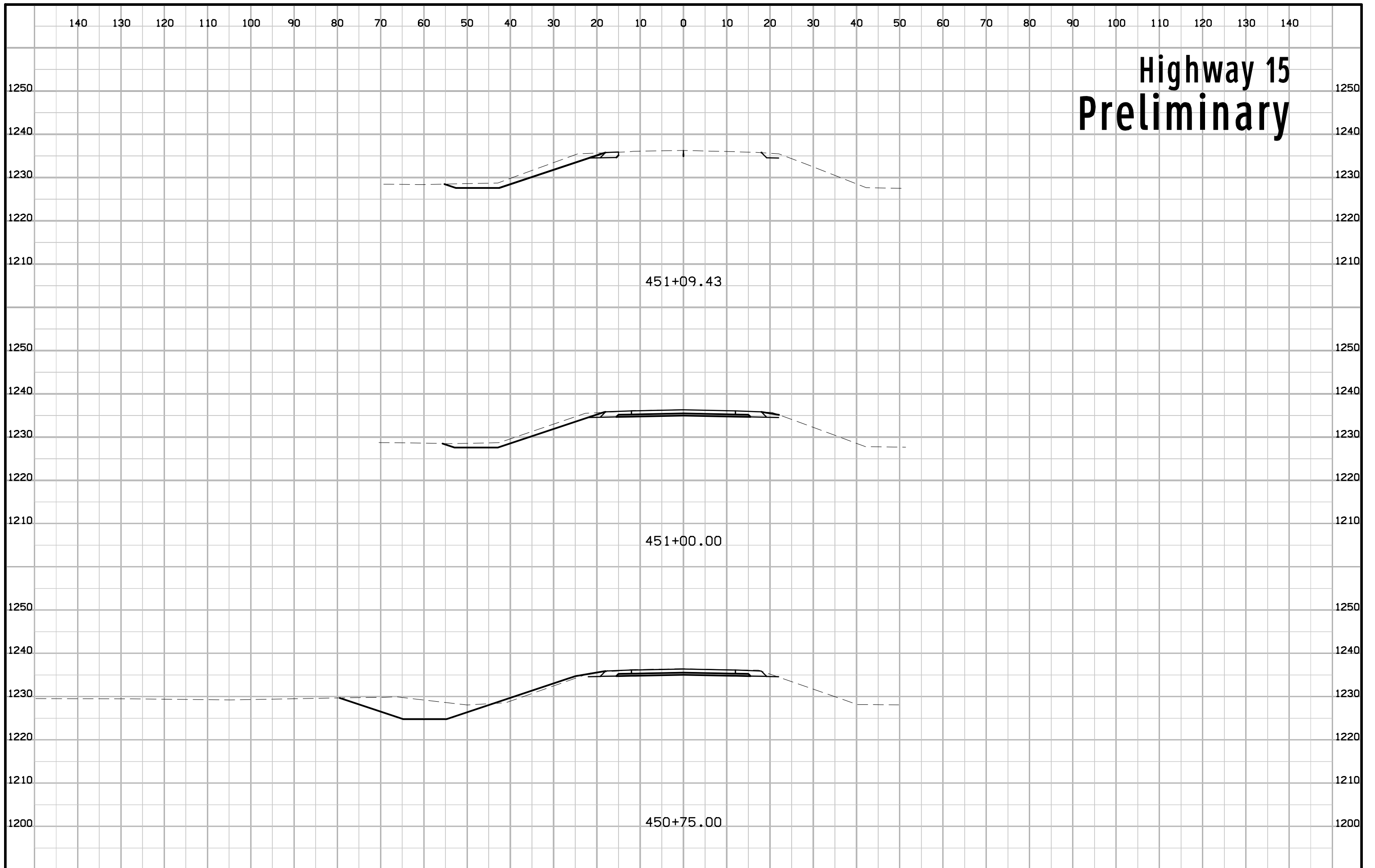
# Highway 15 Preliminary



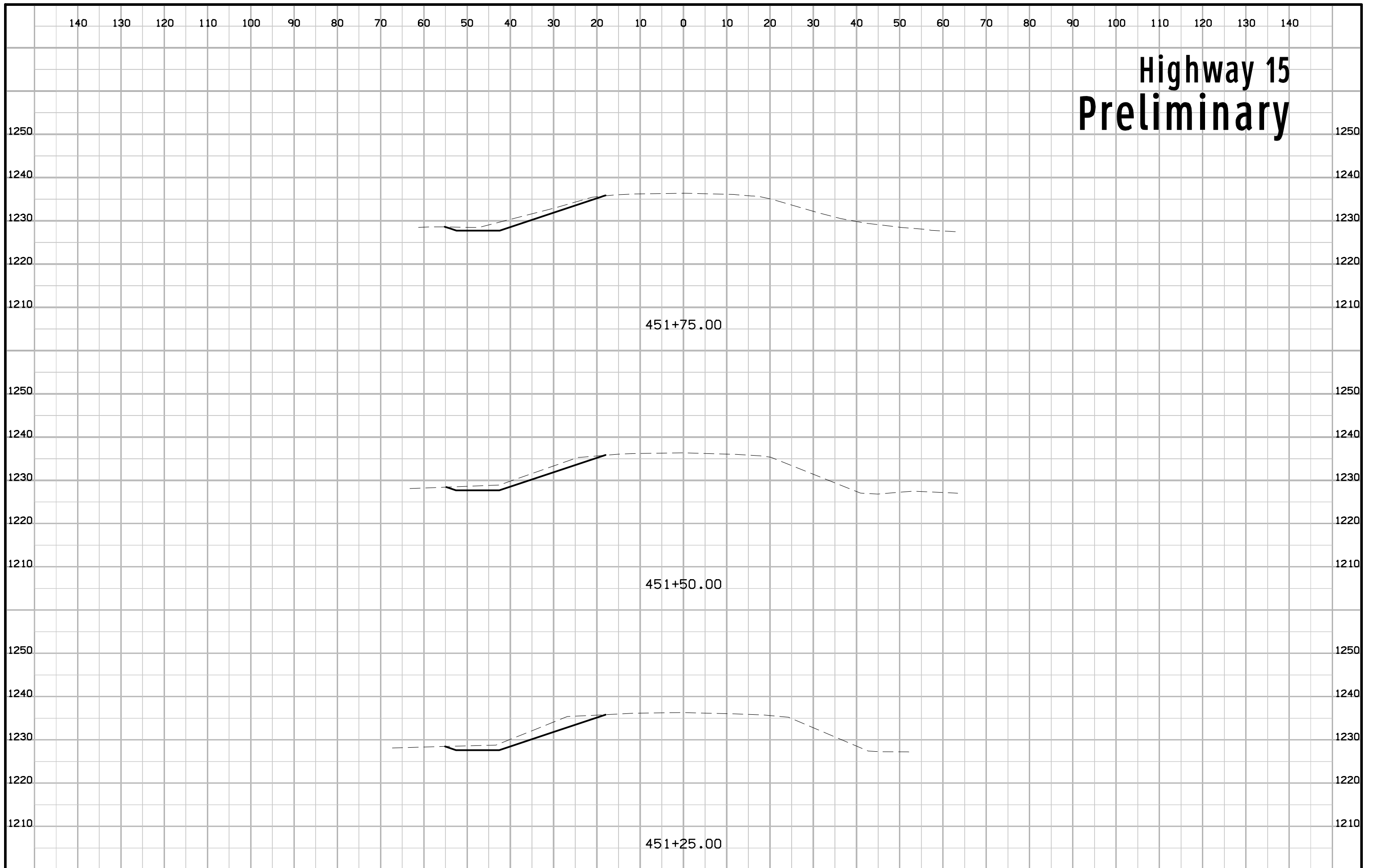
# Highway 15 Preliminary



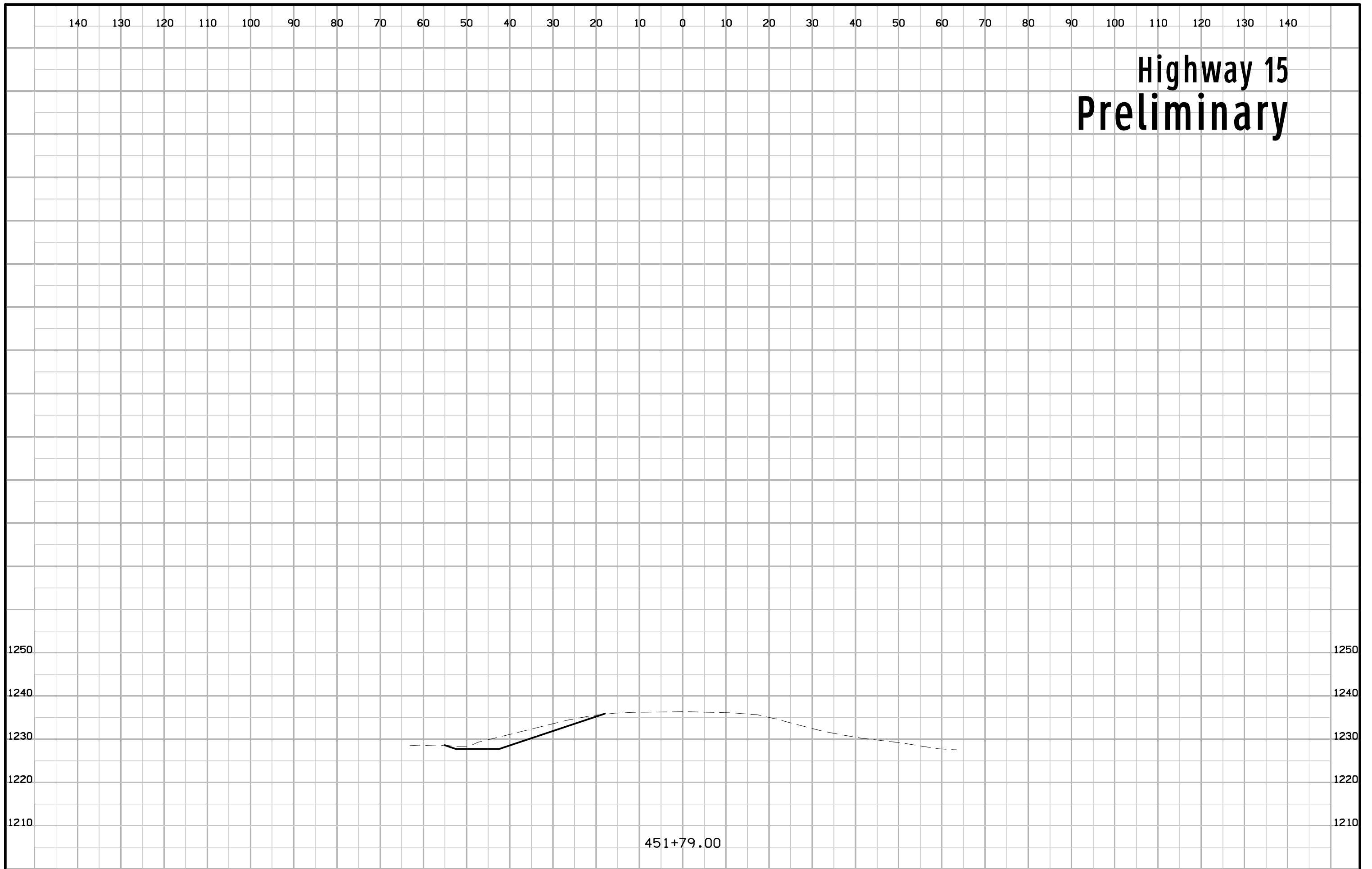
# Highway 15 Preliminary



# Highway 15 Preliminary



# Highway 15 Preliminary



451+79.00