



# F.E. Everett Turnpike Bridge Replacement

## Over Baboosic Brook

Will Fogarty, Eddie Schluter, Ian Becker, Patrick Thavisouk  
 Civil and Environmental Engineering,  
 University of New Hampshire, Durham, NH 03824



McFarland Johnson

### Introduction

- F.E. Everett Turnpike (FEET) is a major arterial highway in Merrimack, NH
- Current AADT = 70,000, projected 100,000 by 2035
- Currently a 4-lane highway, 2 each way
- Existing crossing: Twin Cell Box Culvert
- Hydraulic deficiencies causing flooding risks due to upstream Improvements

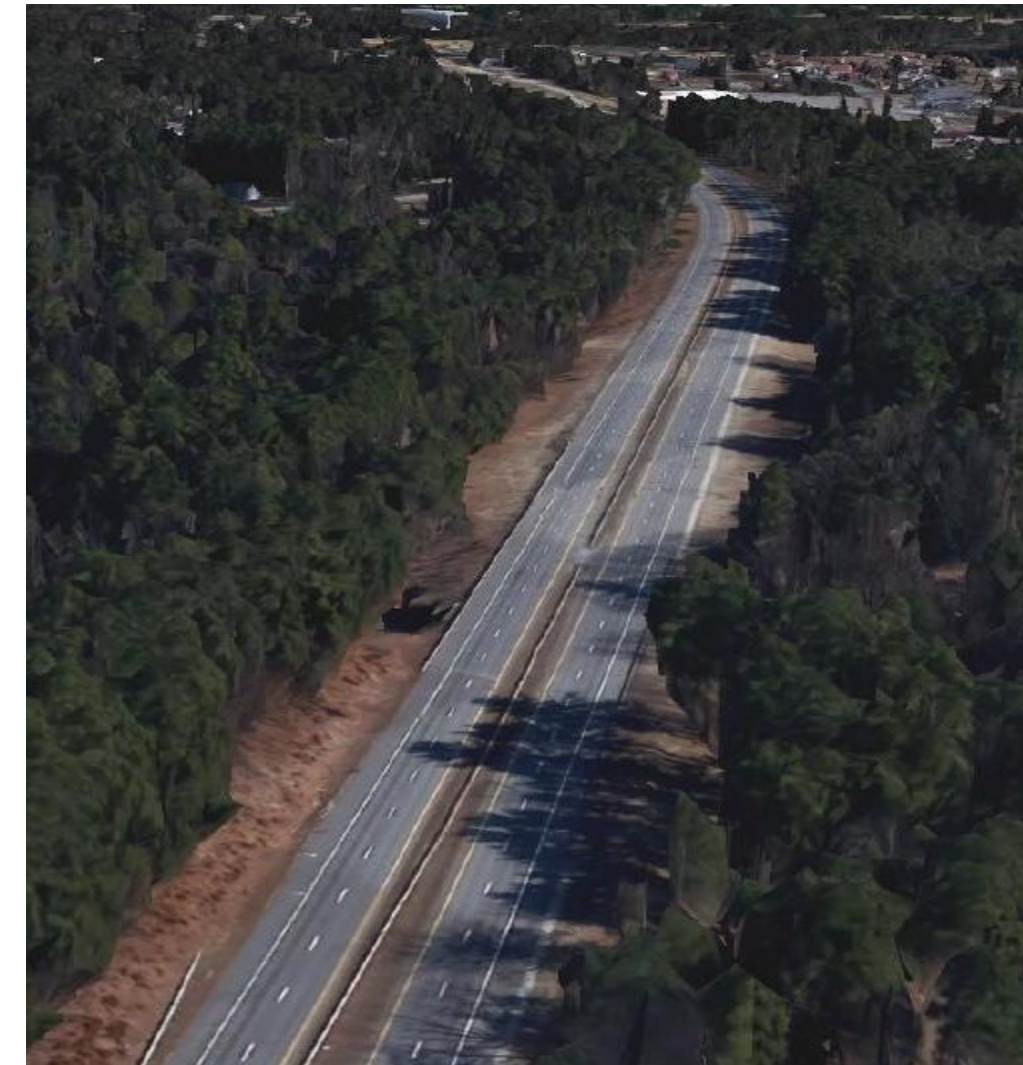


Image #1 Aerial View of FEET

- Design Criteria:**
- 100-year design storm
  - 500-year check storm
  - 1 ft freeboard
  - 6 total travel lanes
  - Maintain traffic during construction
  - Strength I design

### Existing Conditions

#### Locus Map

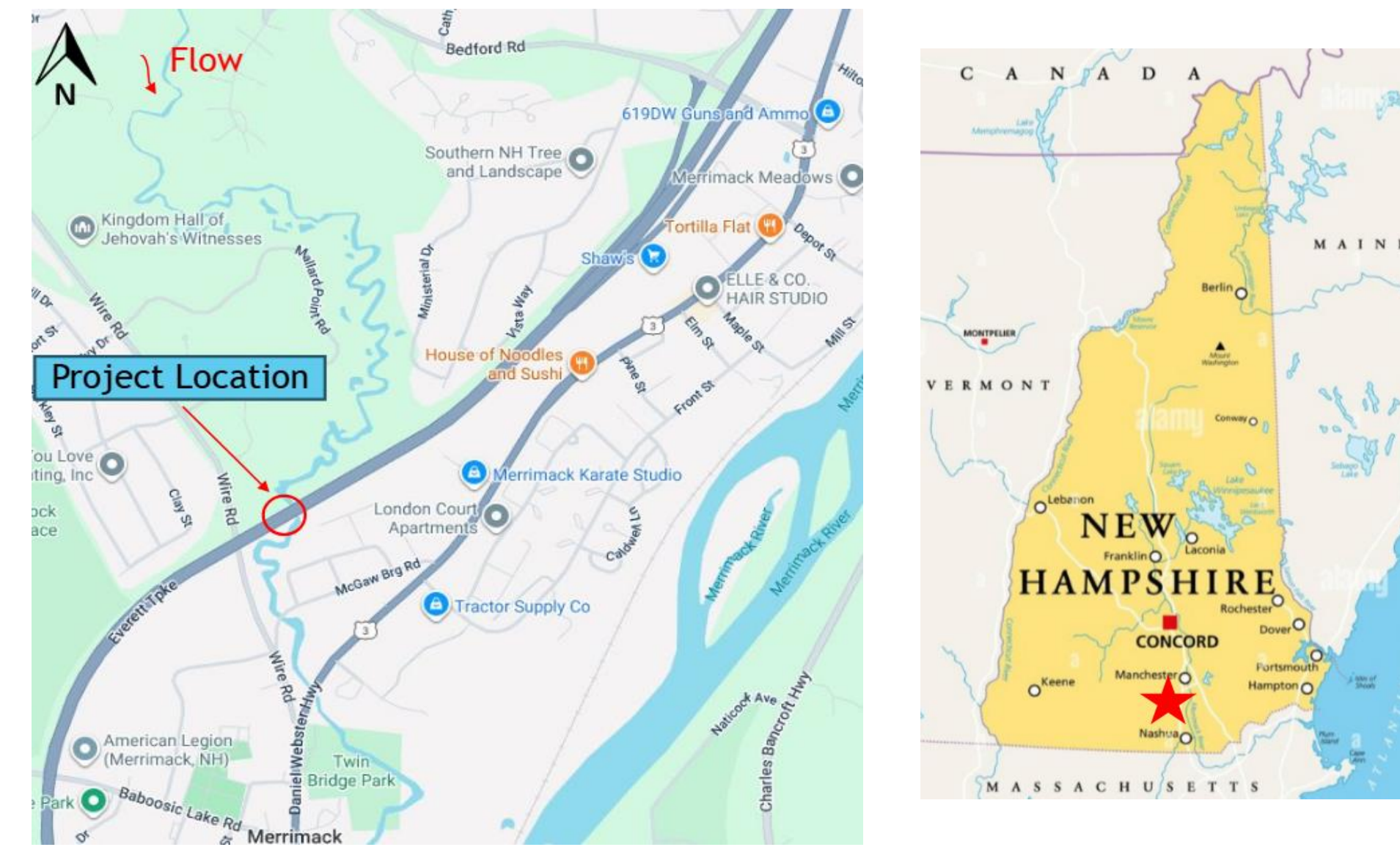


Image #2 Location of Bridge

#### Existing Bridge



Image #3 Existing Condition of Bridge

### Hydraulic Study

- Drainage area: 48.41 mi<sup>2</sup>
- 100-Year Peak Flood (Design): 3630 cfs
- 500-Year Peak Flood (Check): 5063 cfs
- 100-Year Peak Velocity (Design): 4.8 fps
- 500-Year Peak Velocity (Check): 5.6 fps

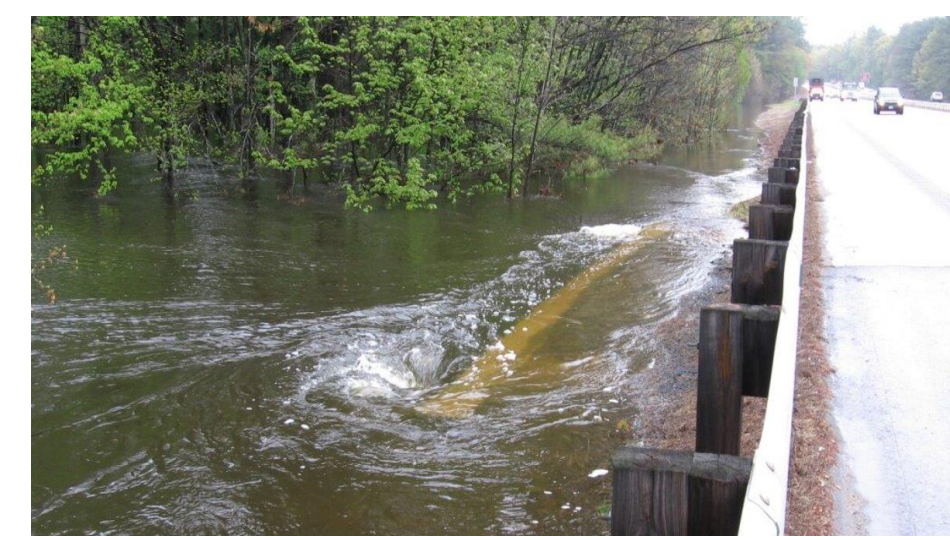


Image #4 2006 Mother's Day Storm

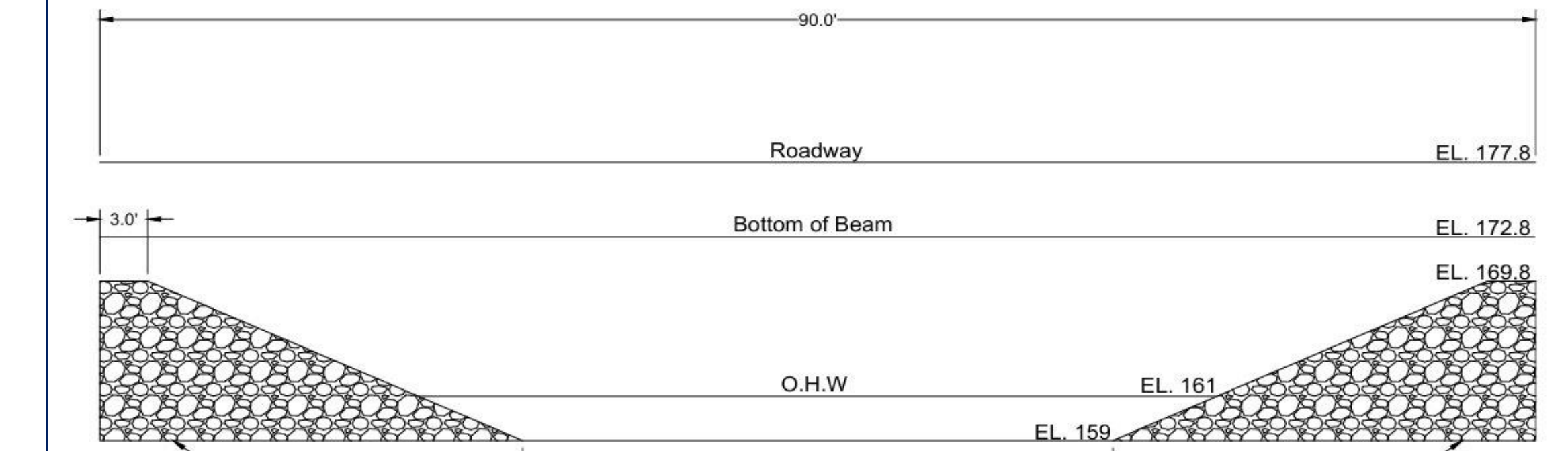


Figure #1 Hydraulic Opening

### Geotechnical Report

- Loose soils
- Low blow counts
- Bedrock 40'-50' below EG
- Deep foundation
- Steel H-Pile

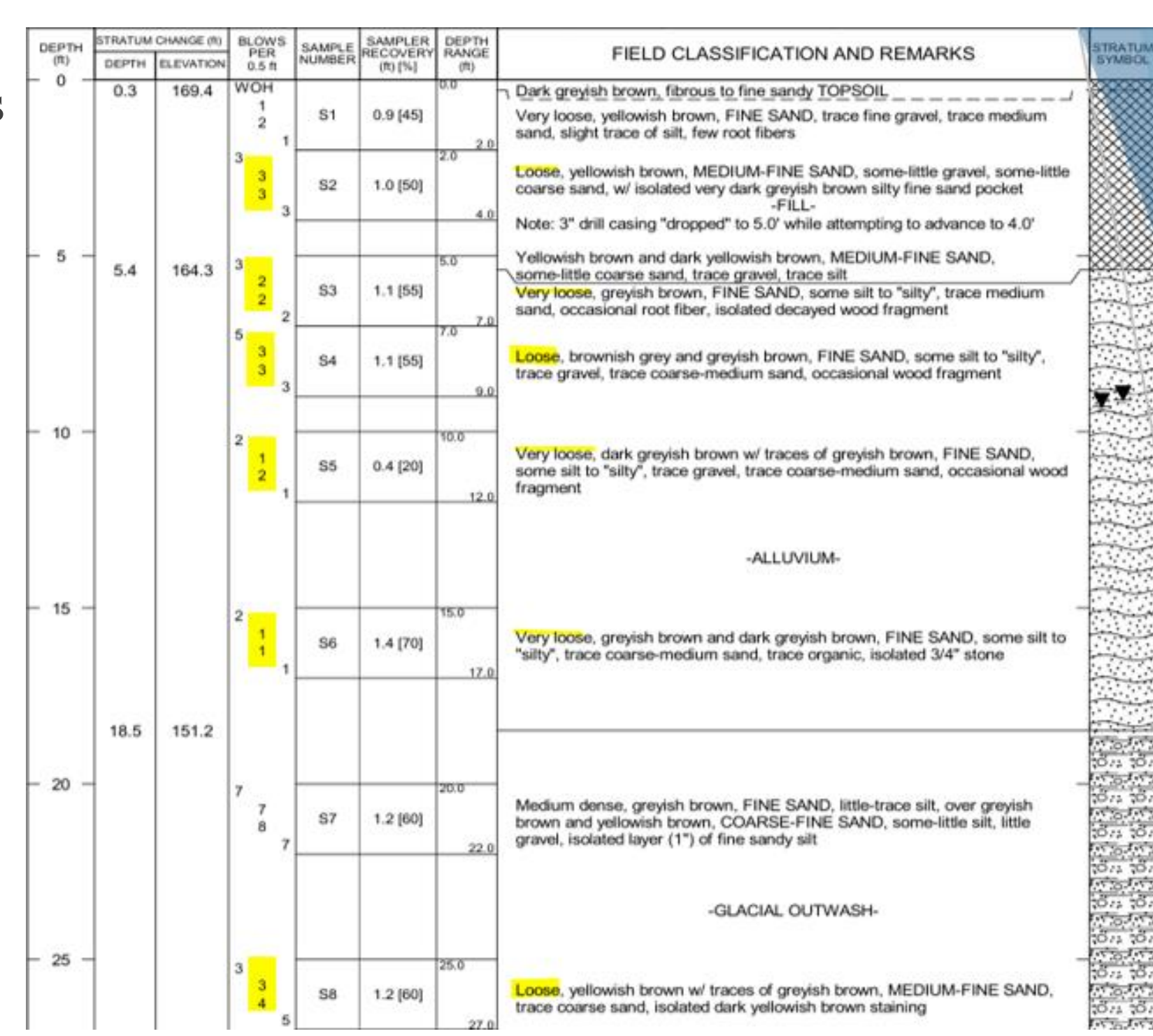


Figure #2 Snip of a boring log

### Substructure Design

#### Displacement vs. Depth

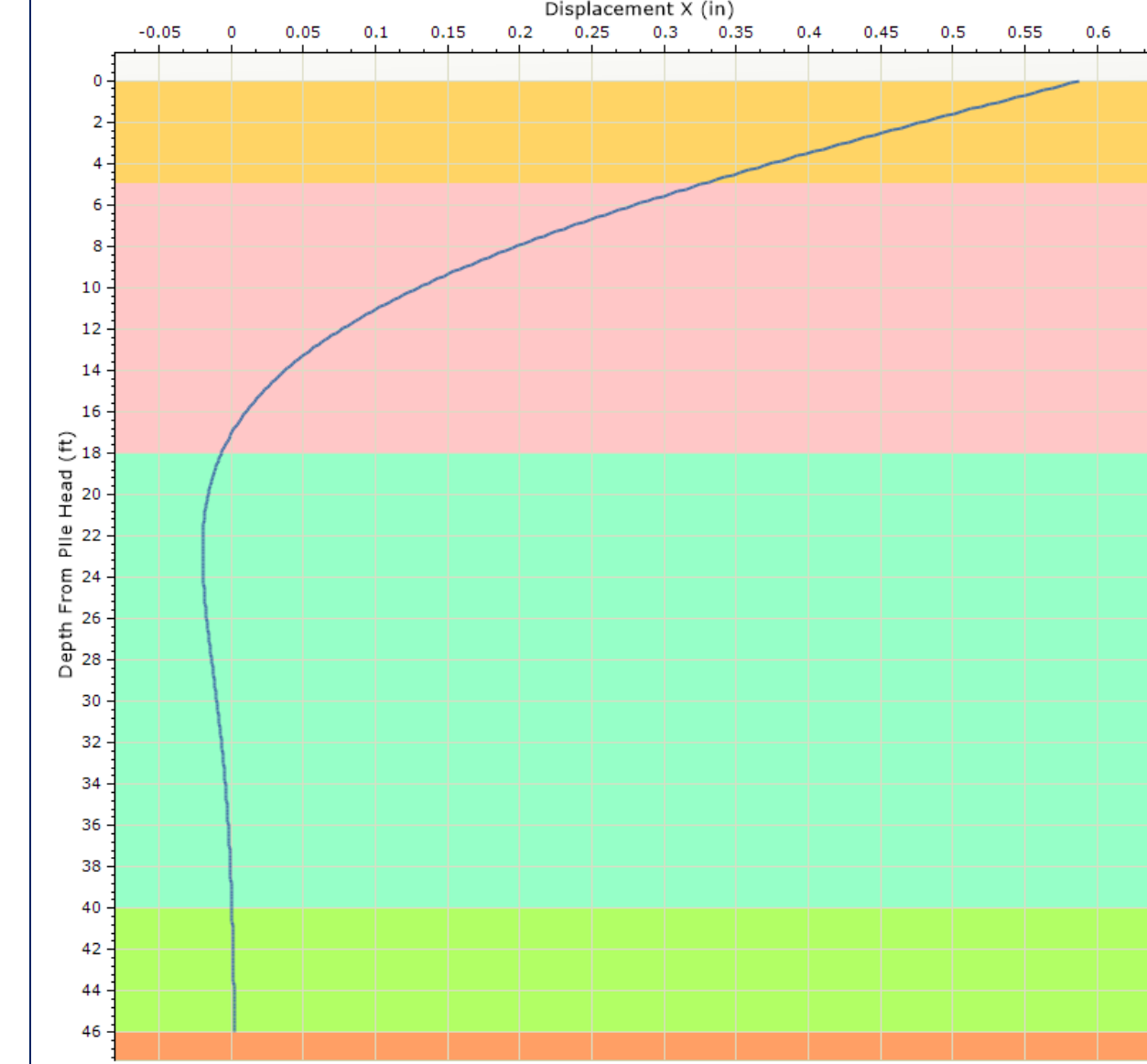


Chart #1 Horizontal displacement (in.) vs. Depth (ft.)

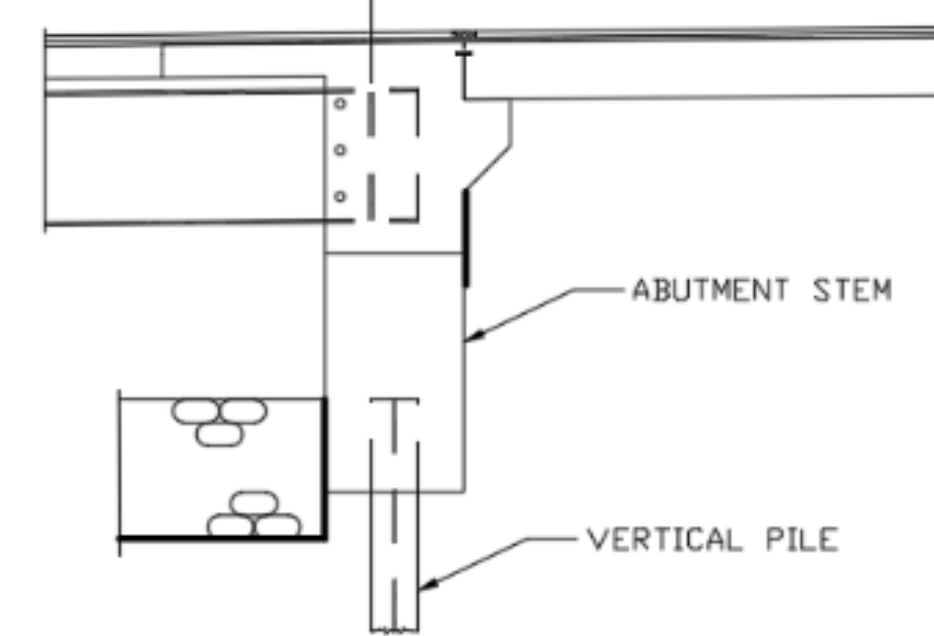


Figure #3 NHDOT Integral Abutment Section

### Traffic Control Plan

#### Figure #4 Existing traffic pattern

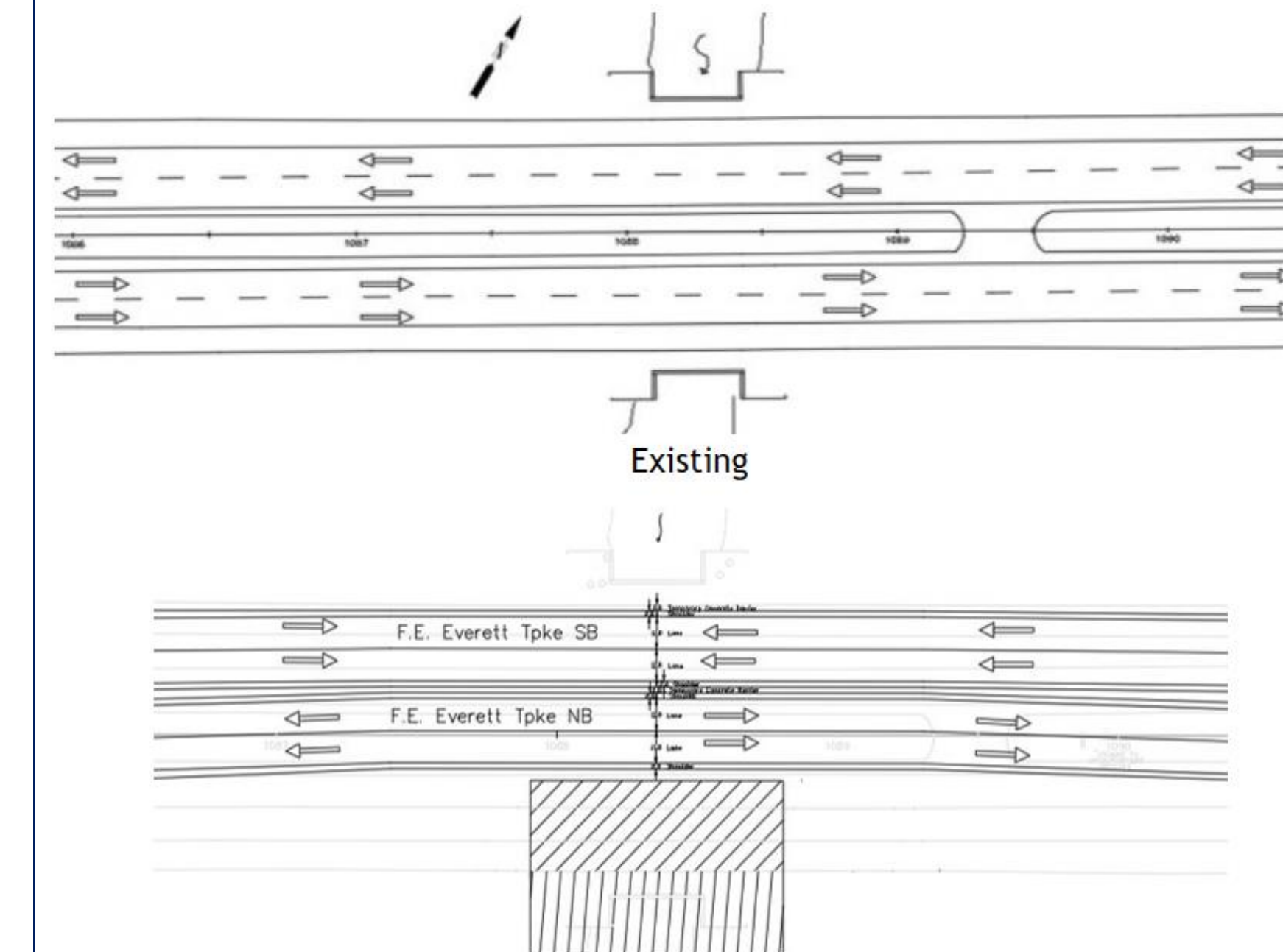


Figure #5 Proposed phase 1 traffic plan

#### Figure #6 Proposed phase 2 traffic plan

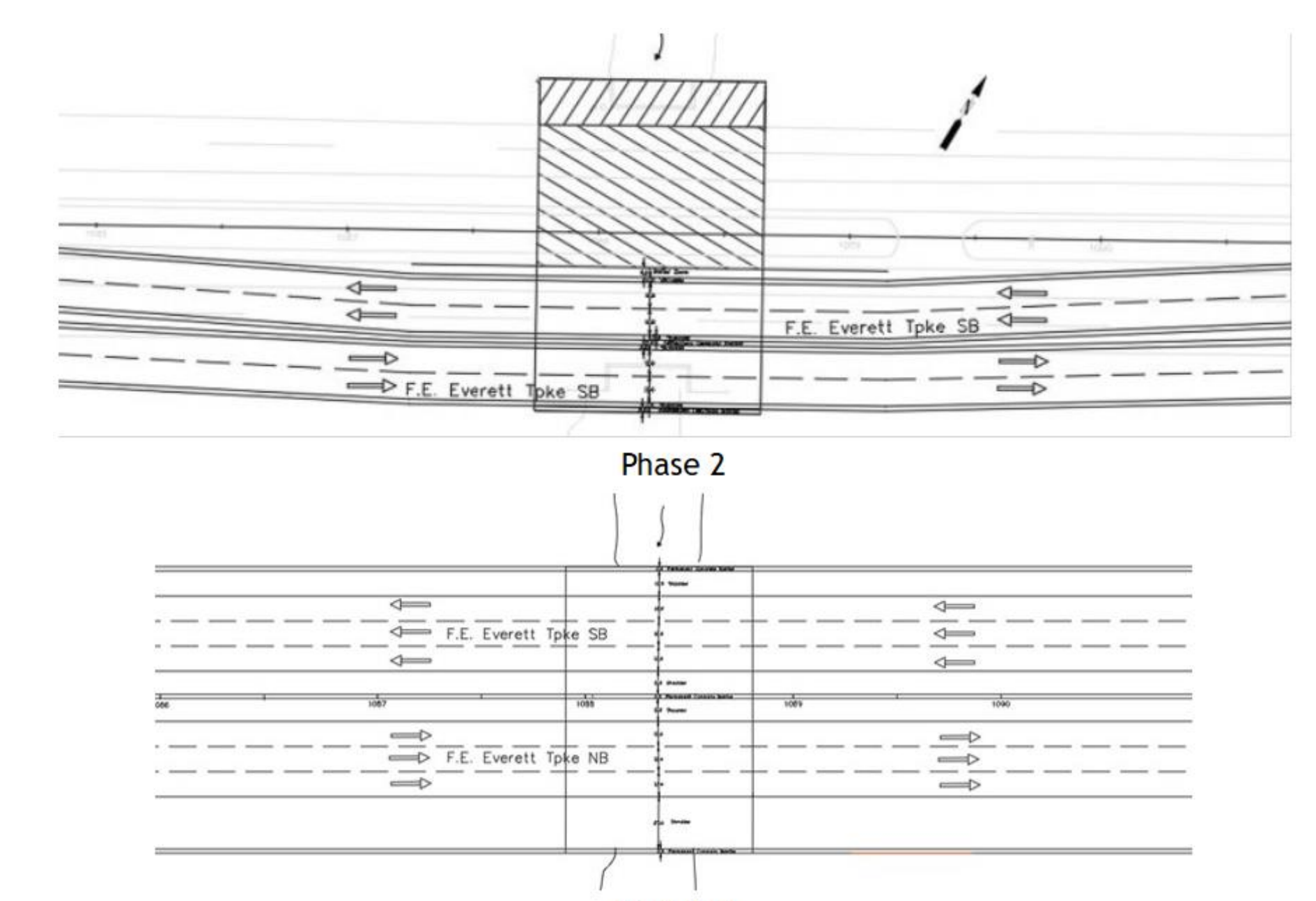


Figure #7 Proposed final layout

### Superstructure Design

#### Bridge Model and Outputs

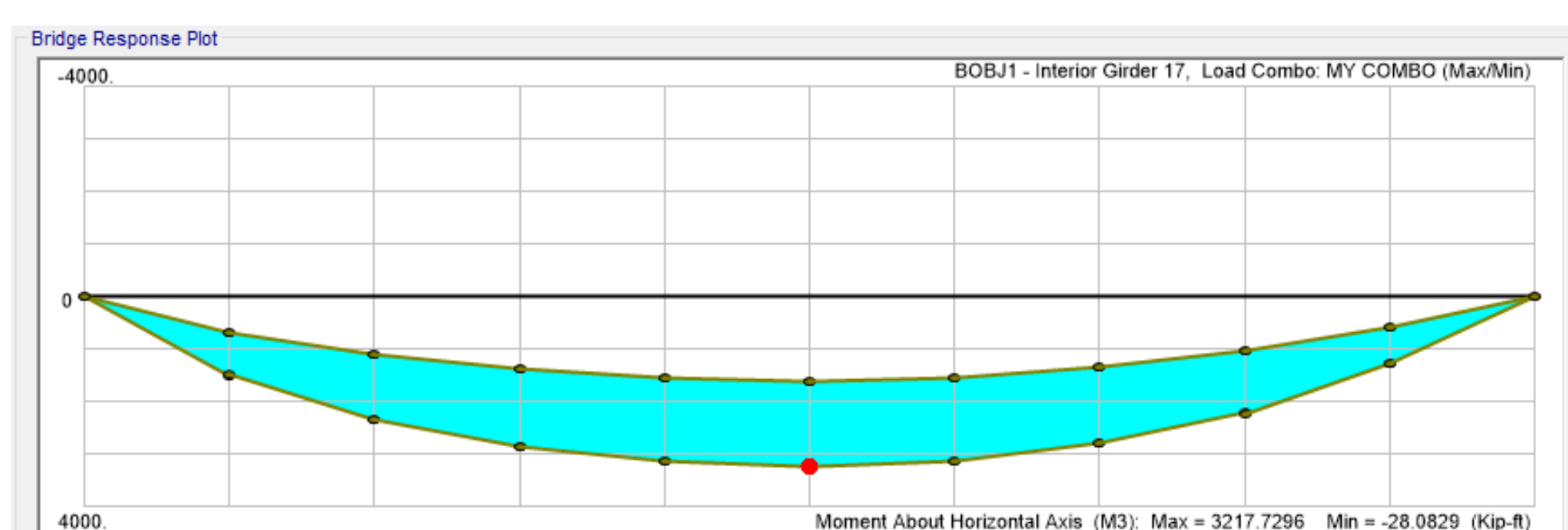
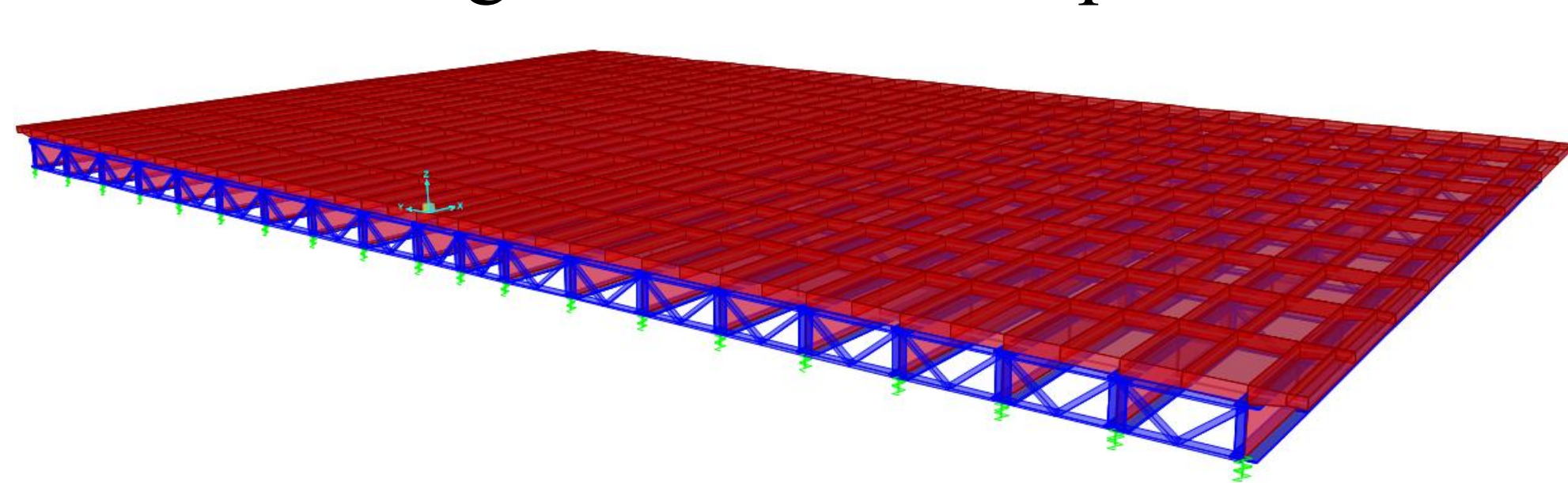


Figure #8 Fully modeled bridge superstructure with controlling moments demand found in interior girder 17.

#### Proposed Plate Girder Section

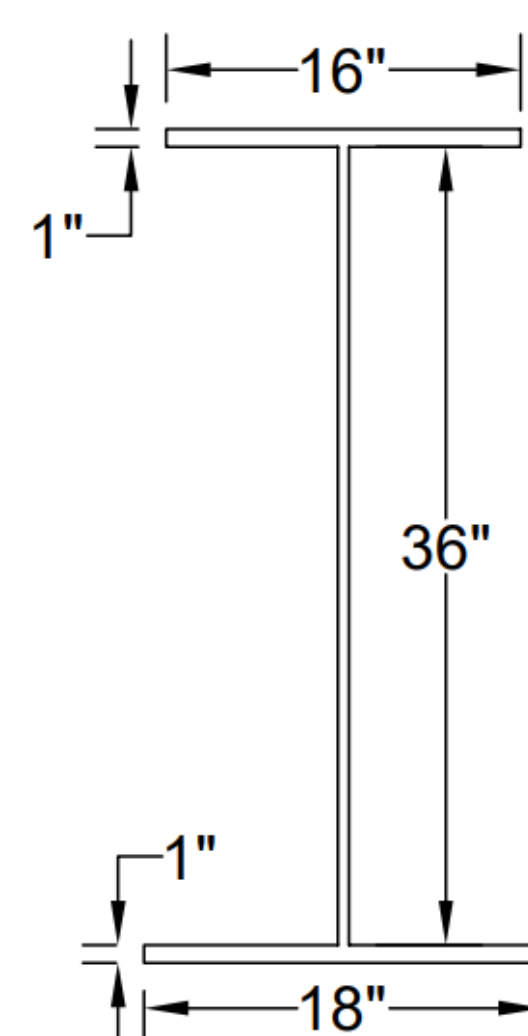


Plate Girder

Figure #9 Cross-section of one of the 20 proposed plate girders that will support the bridge.

### Cost Estimate

Item #	Item Description	Unit	Average Unit Price	Quantity	Item Cost
403.21053	HBP-3/8" Mix, Machine Method (Bridge Base)	TON	\$ 261.27	462.375	\$ 120,804.72
502	Removal of Existing Bridge Structure	U	\$ 251,750.00	1	\$ 251,750.00
503.201	Cofferdams	U	\$ 94,913.75	4	\$ 379,655.00
510.61	Furnishing and Driving Steel Bearing Piles	LB	\$ 1.20	160200	\$ 192,240.00
520.0302	Concrete Class AA Approach Slab (QC/QA) (F)	CY	\$ 1,000.00	254	\$ 254,000.00
520.7002	Concrete Bridge Deck (QC/QA) (F)	CY	\$ 1,650.00	342.5	\$ 565,125.00
528.51	Prestressed Concrete Deck Panels (F)	SF	\$ 33.35	12330	\$ 411,205.50
520.0201	Concrete Class AA, Above Footings	CY	\$ 2,141.67	240	\$ 514,000.80
547	Shear Connectors (F)	EA	\$ 10.93	1800	\$ 19,674.00
548.21	Elastomeric Bearing Assemblies (F)	EA	\$ 2,854.00	40	\$ 114,160.00
550.1	Structural Steel (F)	LB	\$ 3.02	294000	\$ 887,880.00
559.4	Asphaltic Plug Expansion Joint (F)	LF	\$ 107.83	274	\$ 29,545.42
563.23	T3 Steel Bridge Rail	LF	\$ 358.52	180	\$ 64,533.60
565.232	T3 Steel Bridge Approach Rail (Steel Posts)	U	\$ 10,697.94	4	\$ 42,791.76
606.41741	Portable Concrete Barrier for Traffic Control (Bridge)	LF	\$ 62.17	200	\$ 12,434.00
544.3	Reinforcing Steel (Contractor Detailed)	LB	\$ 3.00	164907	\$ 494,722.22
544.2	Reinforcing Steel, Epoxy Coated (F)	LB	\$ 3.00	36000	\$ 108,000.00
510.65	Driving-Points For Steel Bearing Piles	EA	\$ 1,000.00	40	\$ 40,000.00
504.101	Common Bridge Excavation	CY	\$ 75.00	480	\$ 36,000.00
Subtotal					\$ 4,538,522.02
Survey/Design/Permitting/Legal			20%		\$ 907,704.40
Resident Engineer/Inspection			10%		\$ 453,852.20
Inflation (3 years at 5%)			16%		\$ 715,384.53
Structure Subtotal					\$ 6,615,463.16
Items not Estimated			80%		\$ 5,292,370.53
<b>Total Construction Cost</b>					<b>\$12,000,000.00</b>

### Acknowledgments

Project Sponsor: Chris Gagne, PE and Lauren Robbins, EIT with McFarland Johnson  
 Project Advisor: Matthew Low, PE  
 Project Guidance: Dr. Azam, Dr. Bell, Dr. Han

### References/Software

AASHTO LRFD Bridge Design Specifications.  
 NHDOT Bridge Design Manual  
 AISC Steel Construction Manual 16<sup>th</sup> Edition  
 CSI Bridge 2024  
 RS-Pile