Grade separated interchange at the intersection of

U.S. Hwy 17 Bypass and Farrow Parkway

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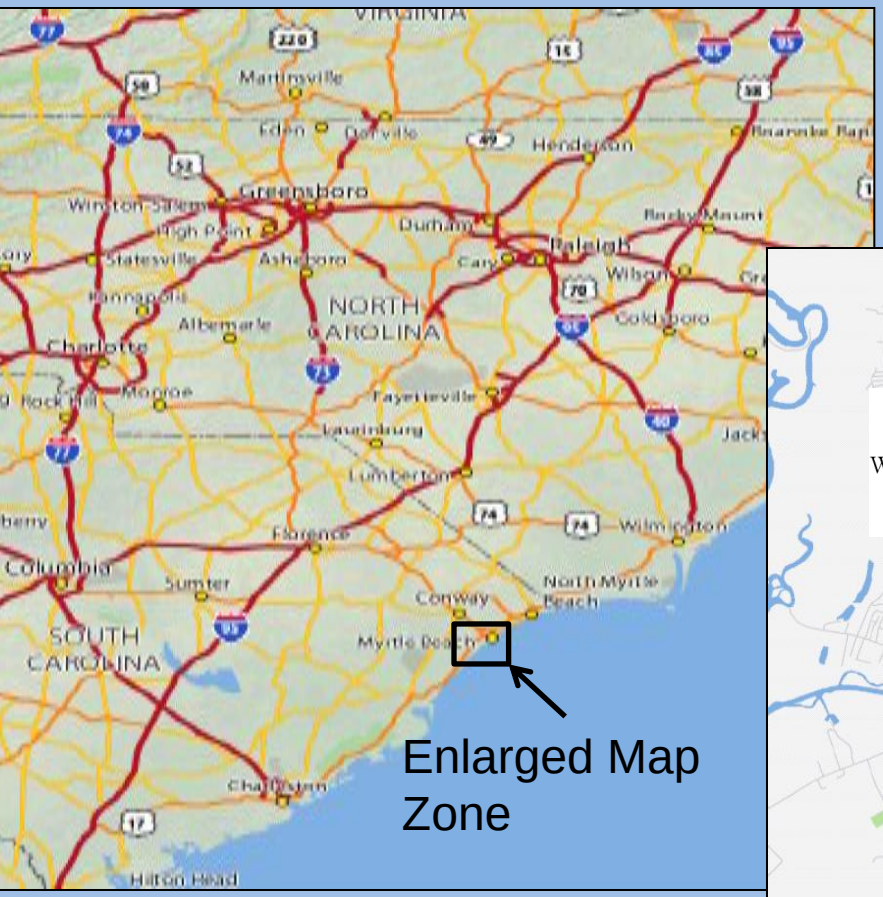
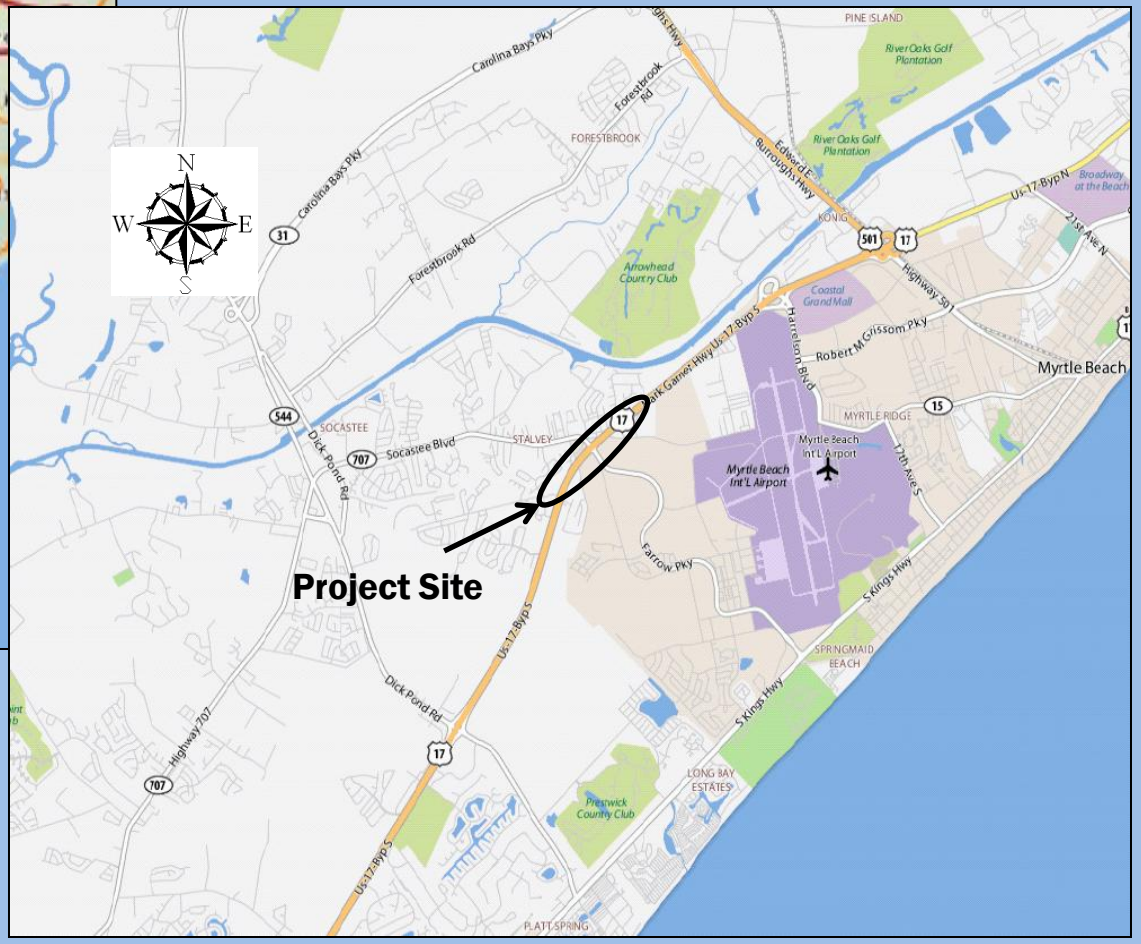
Need for Project:

"The purpose of the project is to improve traffic flow, increase intersection capacity, and improve safety within the intersection and along US 17. The US 17 and SC 707/ Farrow Parkway intersection is currently experiencing substantial congestion during peak morning and afternoon travel periods."

Project Site

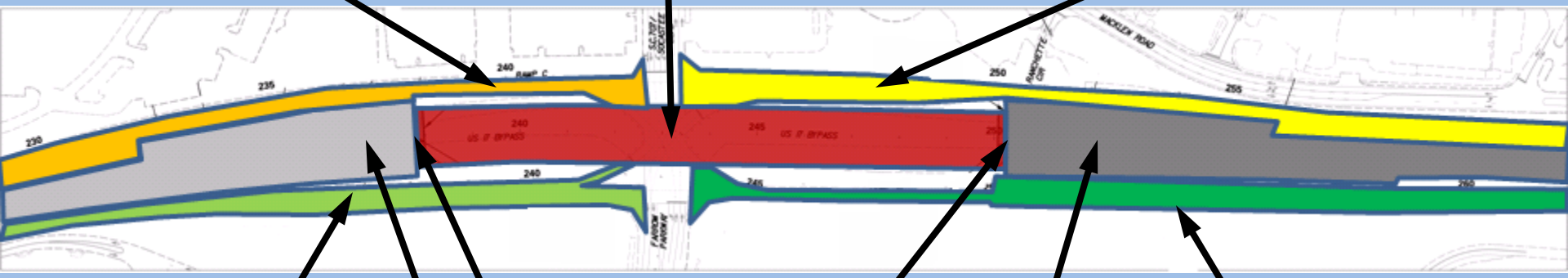




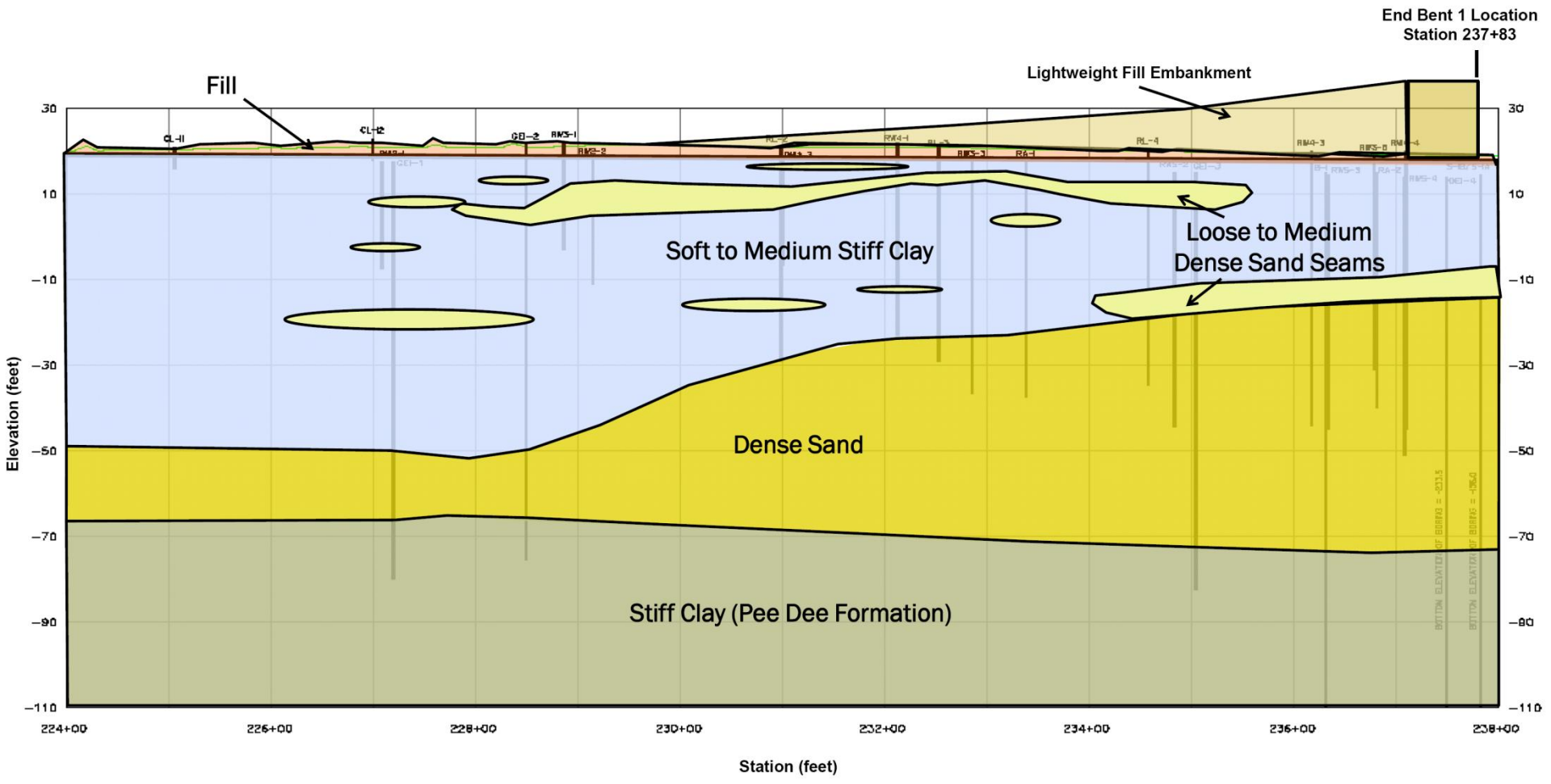
Existing US 17 Bypass

Proposed US17 Bypass

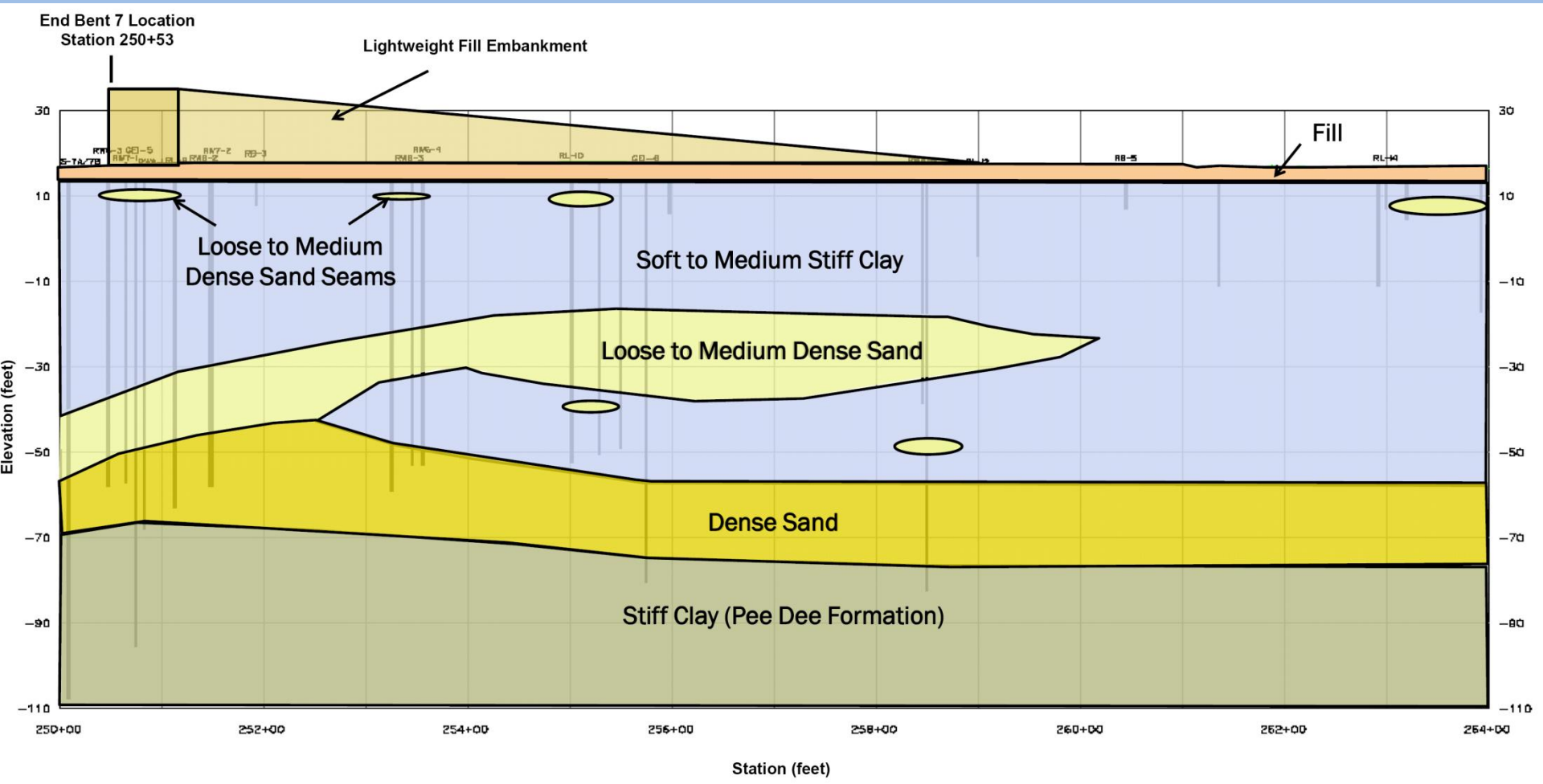
Project Layout



South Subsurface Profile



North Subsurface Profile



Geotechnical concerns?

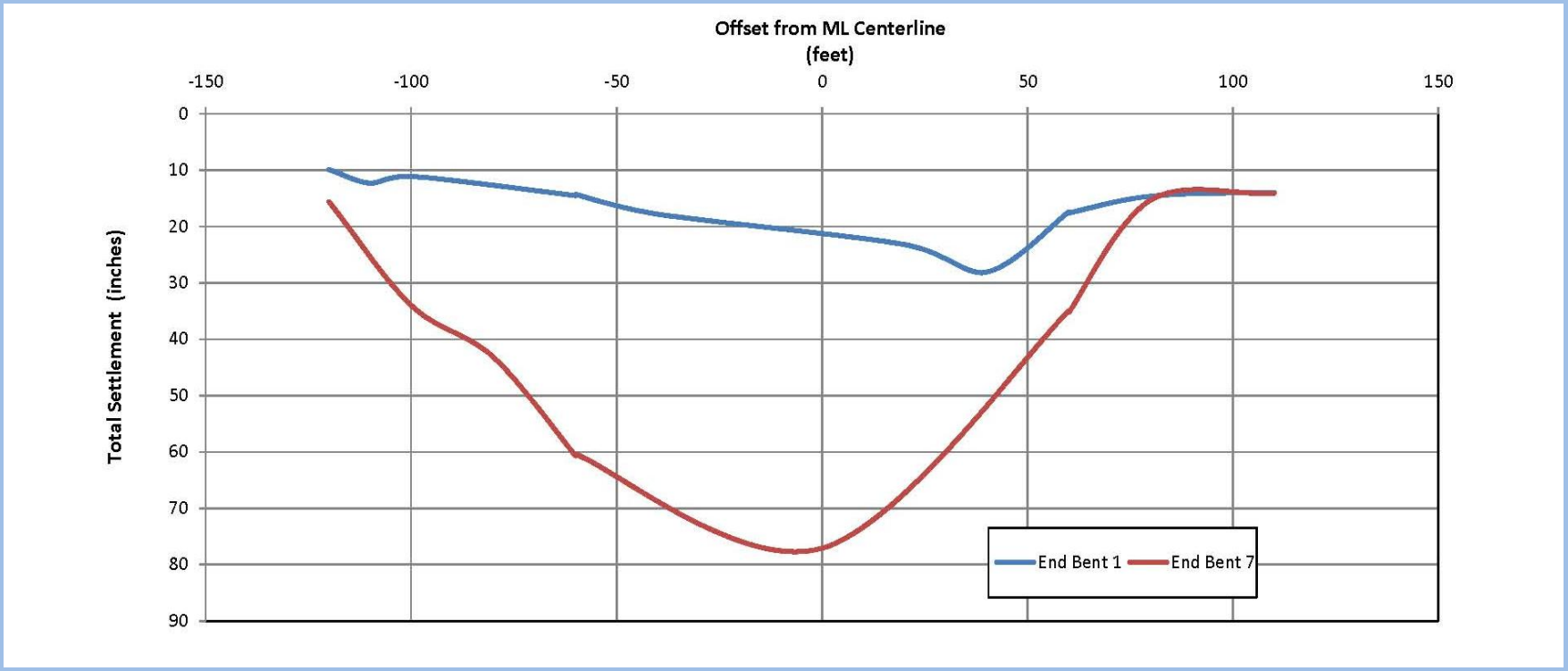
Project Design Constraints

- **Project Geometry and Layout** – Project Constructed on Existing Alignment while maintaining all traffic movements
- **Complex Traffic Control Staging Plan** (traffic moved around several times)
- **Total Project Construction Time Requirements** – Approx. 3.5 years
- **High Traffic Volume Combined with Limited Construction Staging Areas**

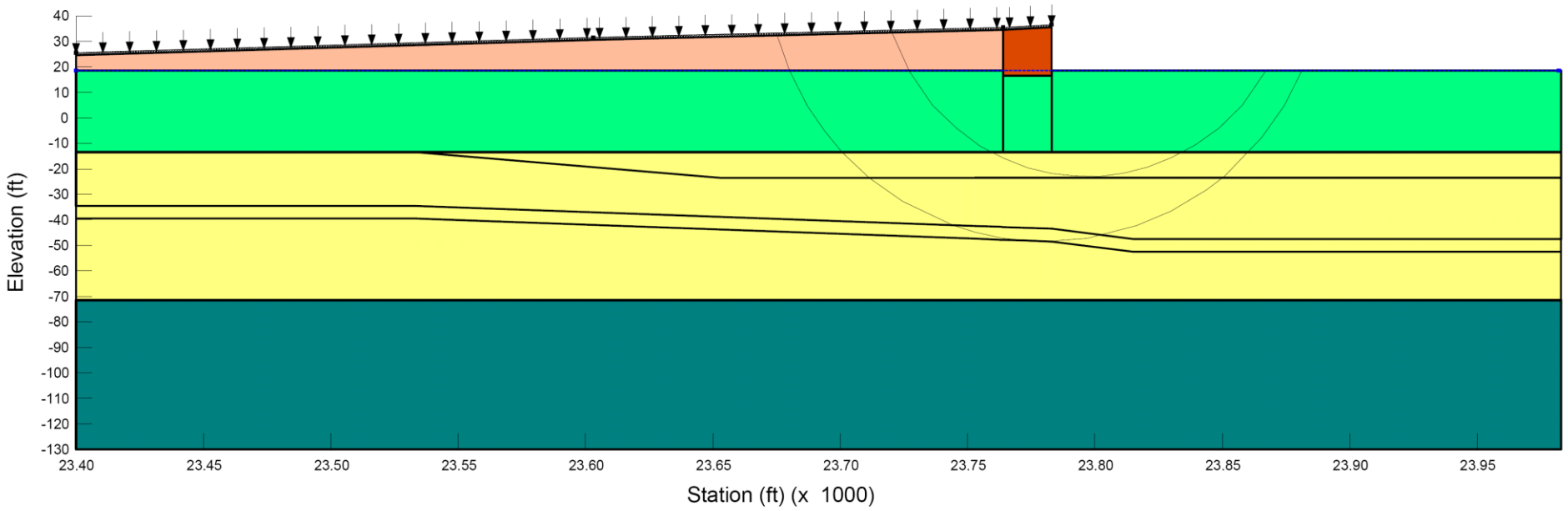
Geotechnical Key Issues

- **Consolidation Settlement, both total and differential**
- **Seismic Slope Stability (Liquefaction)**
- **Bridge Abutment Foundation Performance Extreme Event I and II**

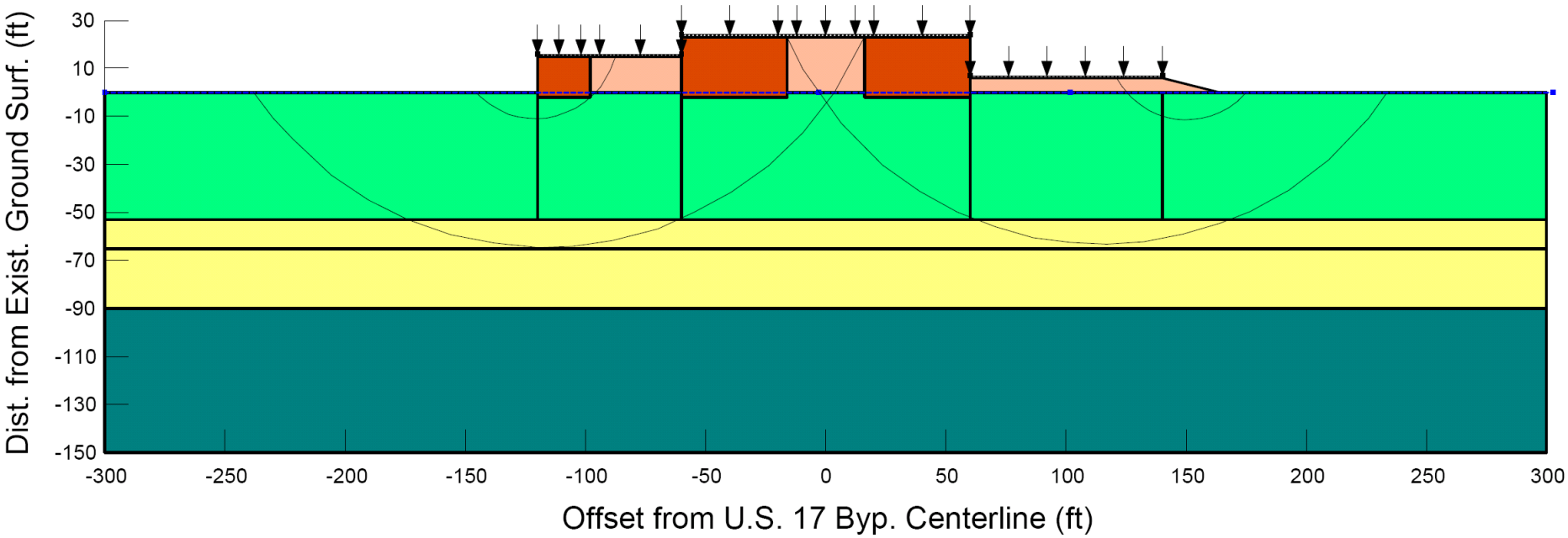
Settlement At Bridge Abutments
(Normal Weight Fill)



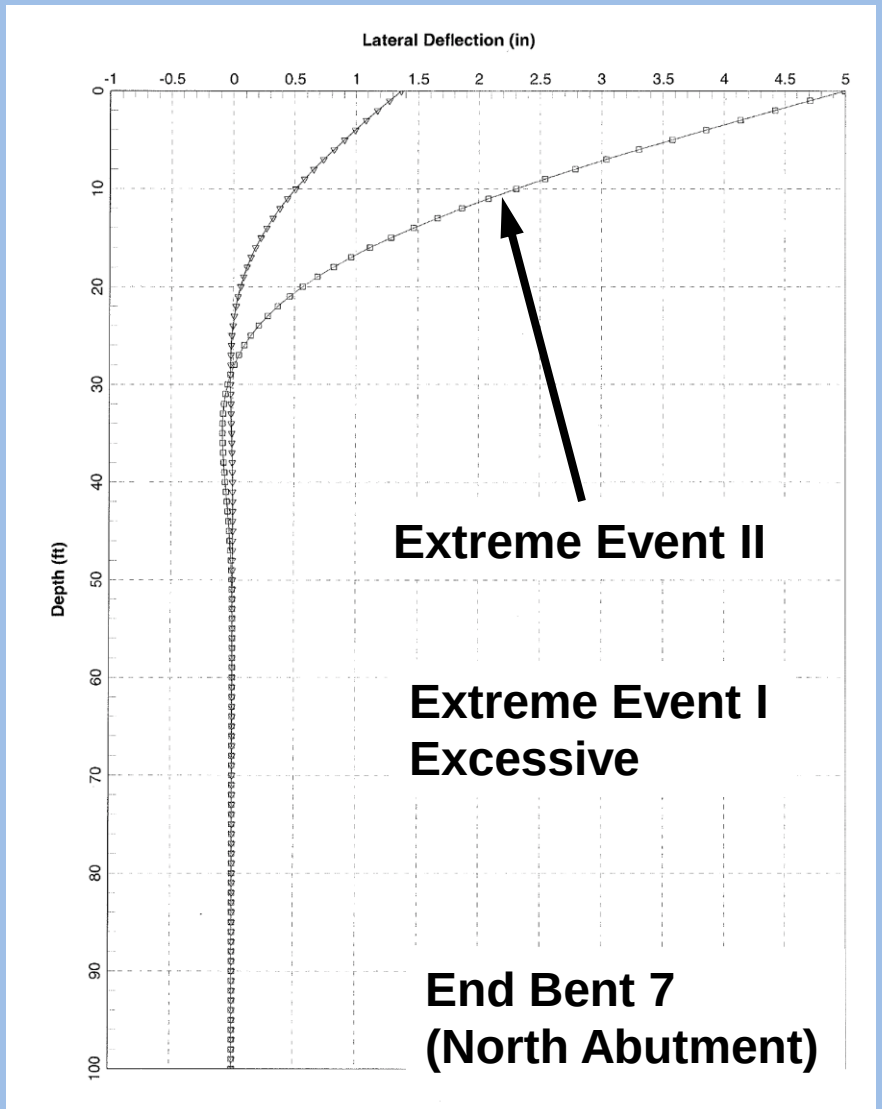
Longitudinal Seismic Slope Instability

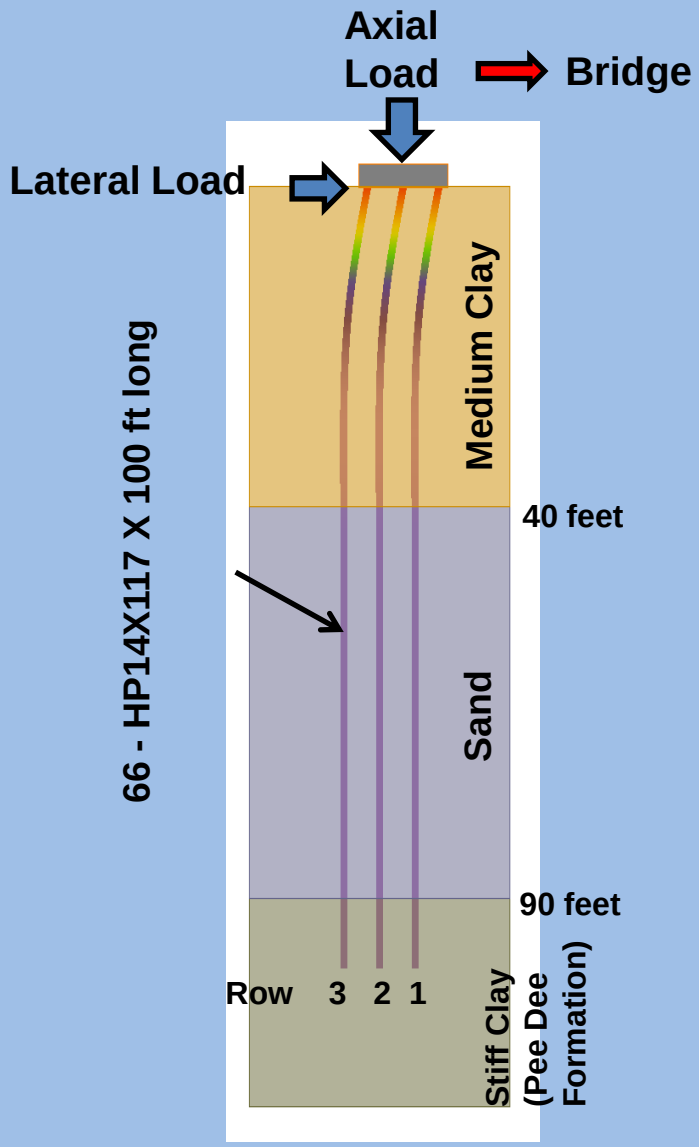


Transverse Seismic Slope Instability



Bridge Abutment Unimproved Foundation Performance





Ground Improvement Methods

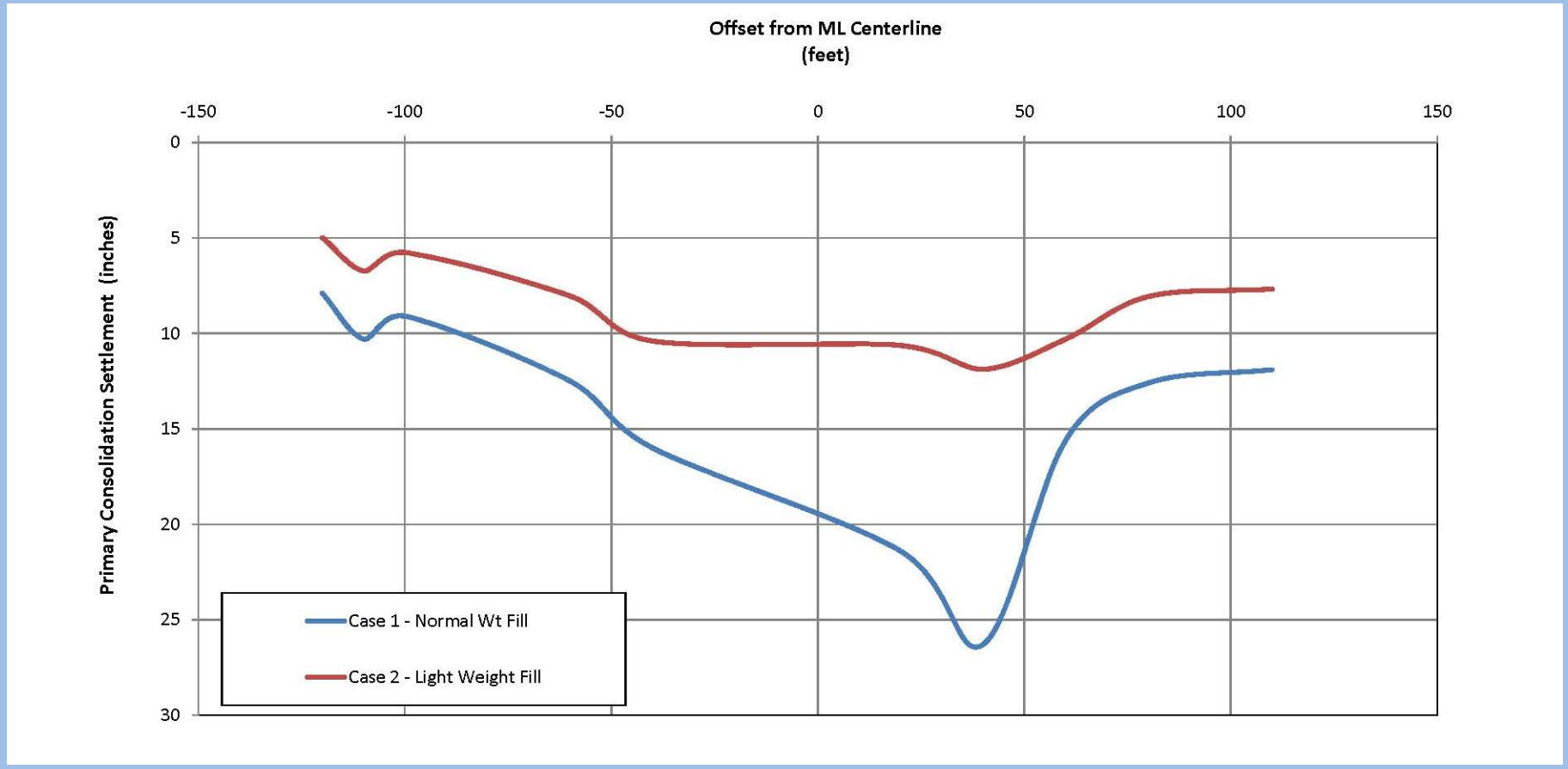
- **Lightweight Aggregate Borrow Material** – Reduce Magnitude of total and differential Settlement
- **Prefabricated Vertical Drain (PVD) / Granular Surcharges** – Increased Rate of Settlement during Construction to meet project time constraints
- **Deep Soil Mixing** – used to establish Seismic Slope Stability and to improve Bridge Abutment Foundation Performance
- **Mechanically Stabilized Earth (MSE) Walls** – Temporary faced MSE Walls used to allow wall deformations along the panel facing (2 stage walls)

Lightweight Aggregate
(Rotary Kiln Produced)

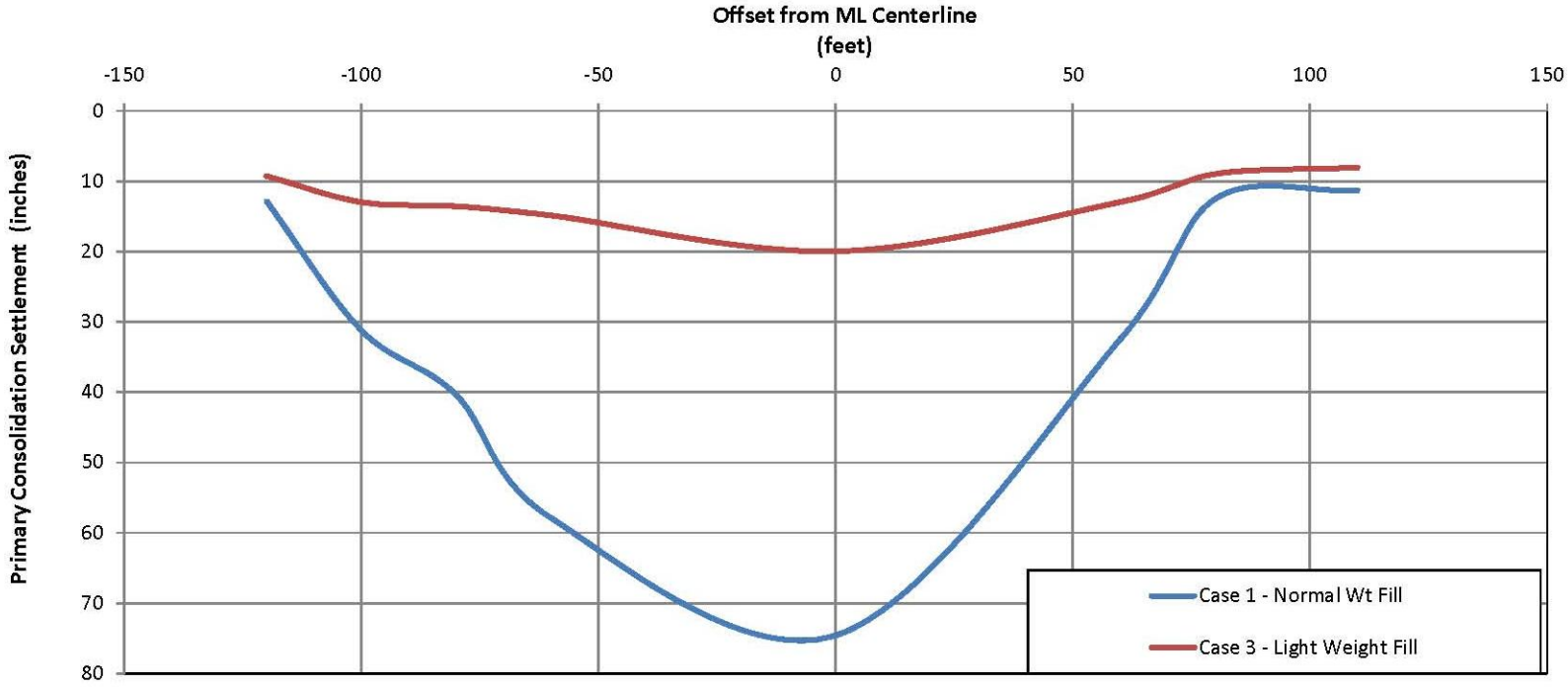
Required Properties:

- Internal Friction Angle 40 degrees
- Unit Weight: 60 pcf minimum (Long-term 70 pcf maximum)
- MSE Wall Reinforced Backfill Properties

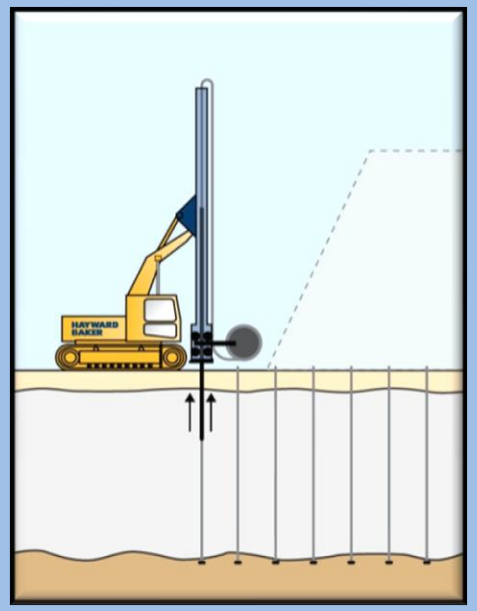
Settlement South Bridge Abutment (End Bent 1)



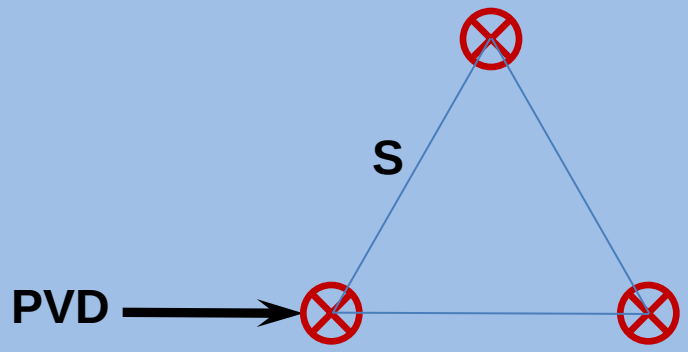
Settlement North
Bridge Abutment (End Bent 7)



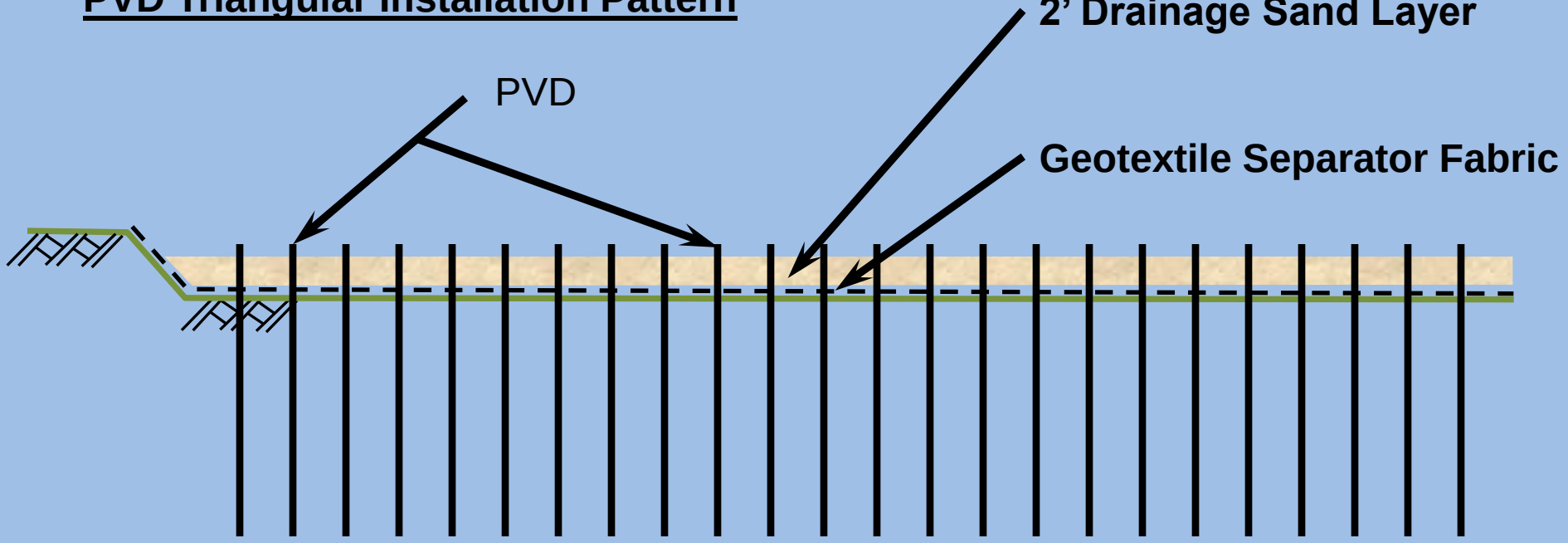
Prefabricated Vertical Drains (PVD)



PVD Installation



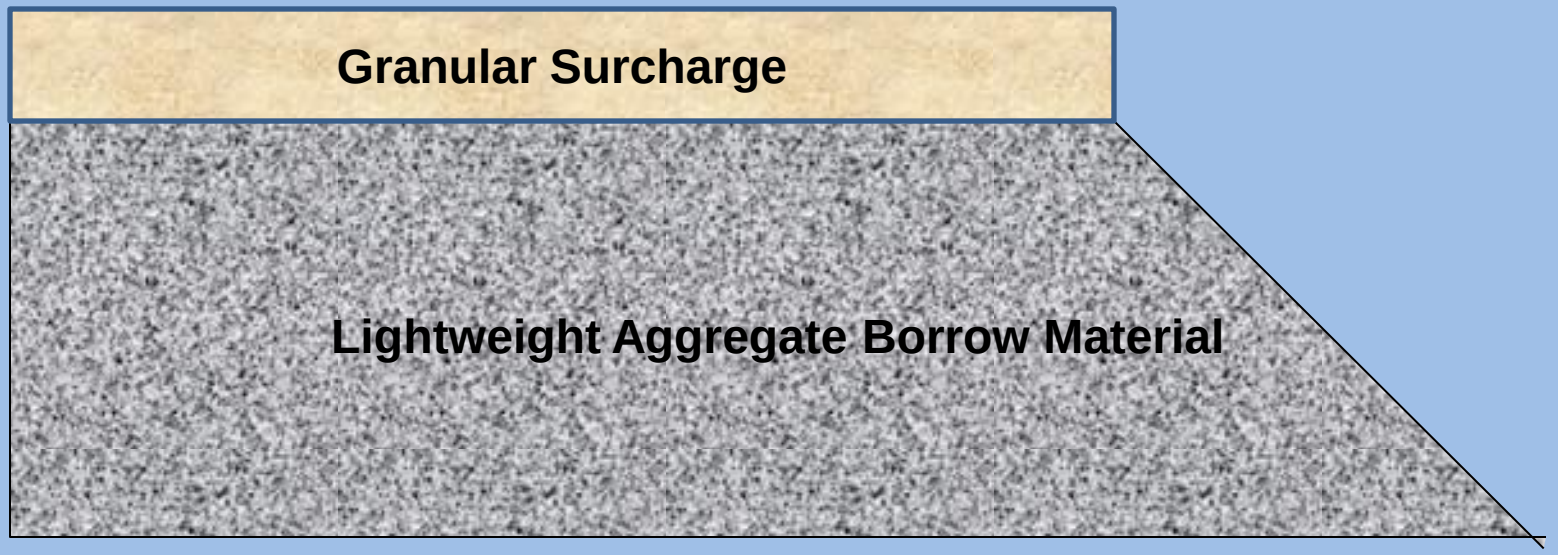
PVD Triangular Installation Pattern



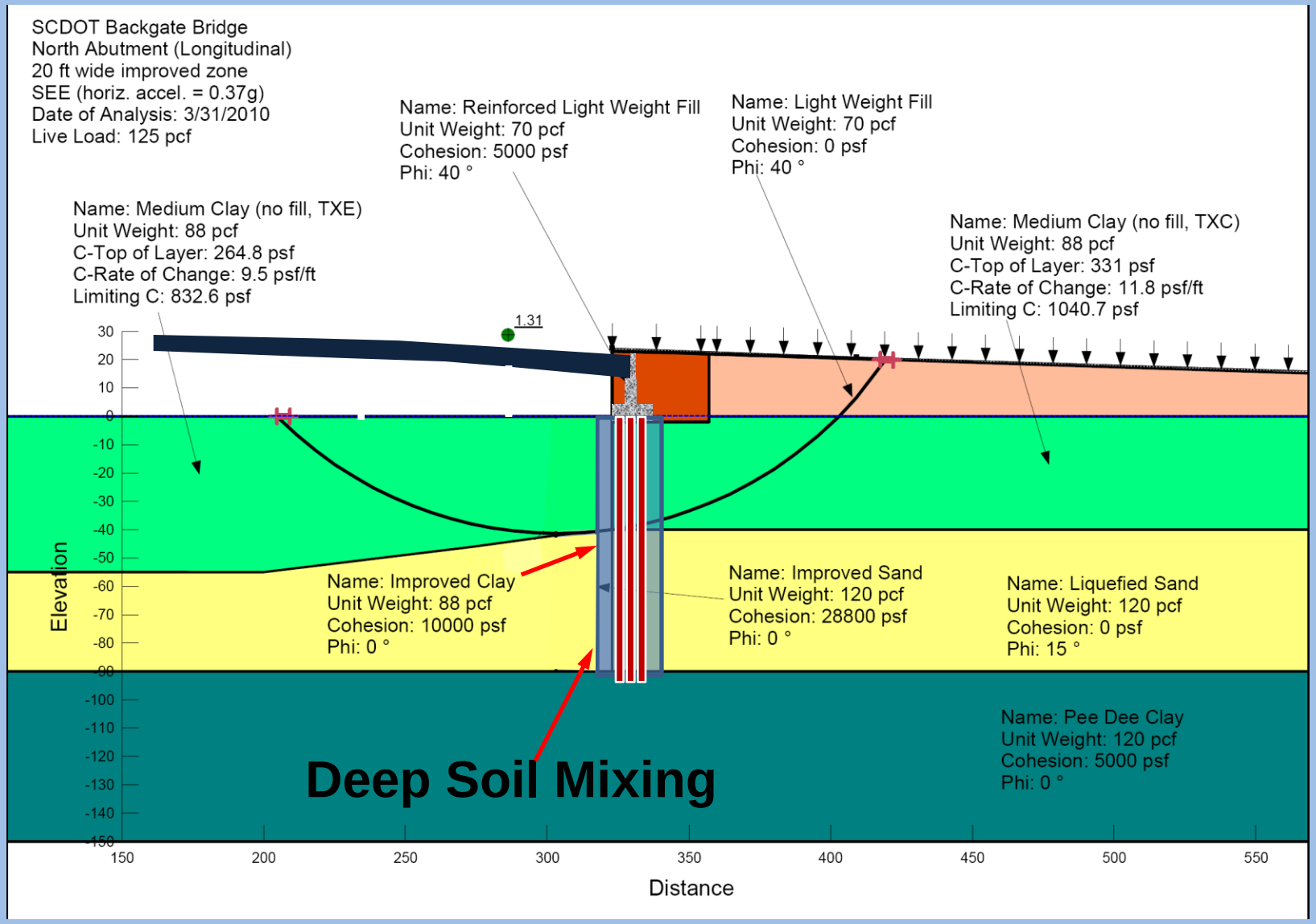
Granular Surcharges

Required Properties:

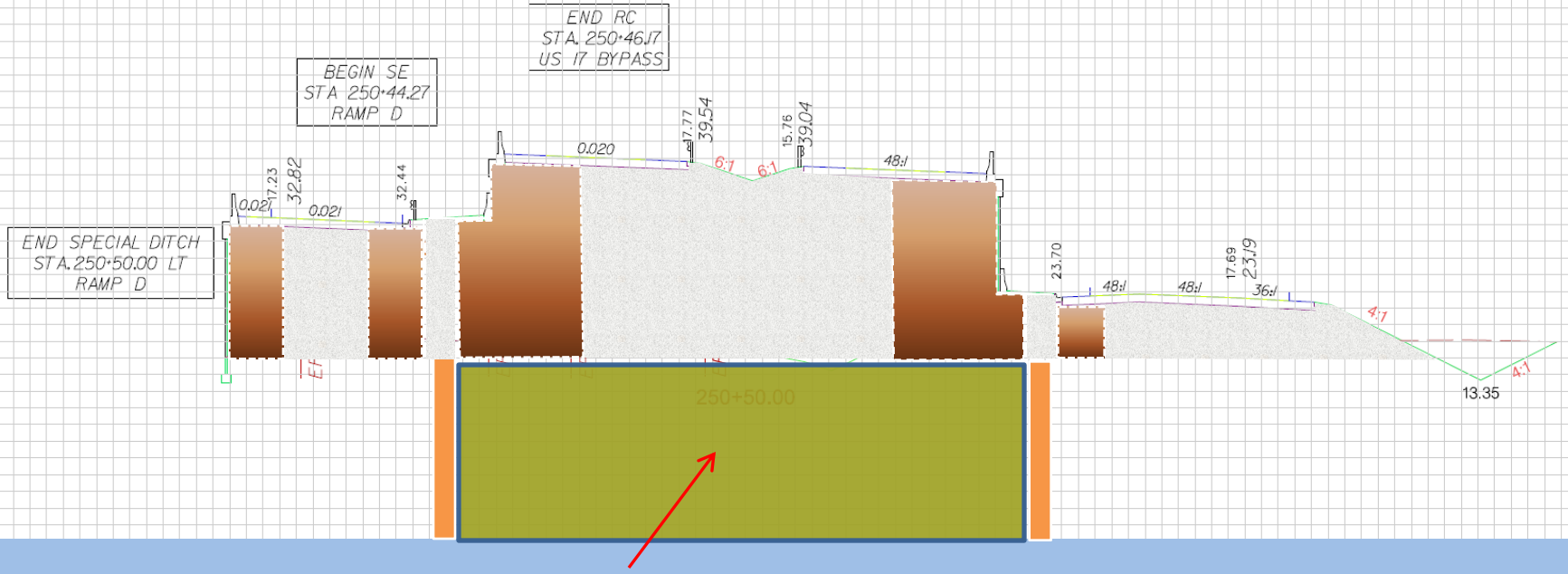
- Internal Friction Angle 32 degrees
- Unit Weight: 120 pcf



Seismic Slope Stability Improved



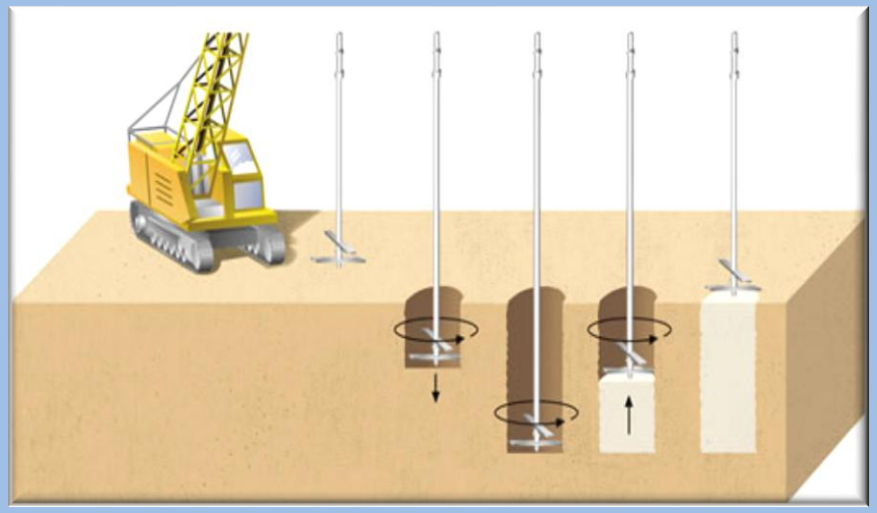
Ground Improvement
North/South Abutment (Typical)

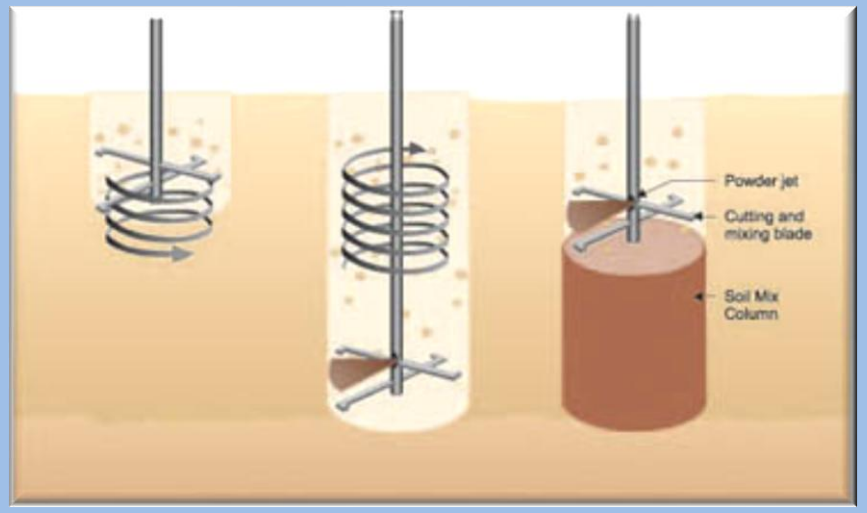


Deep Soil Mixing

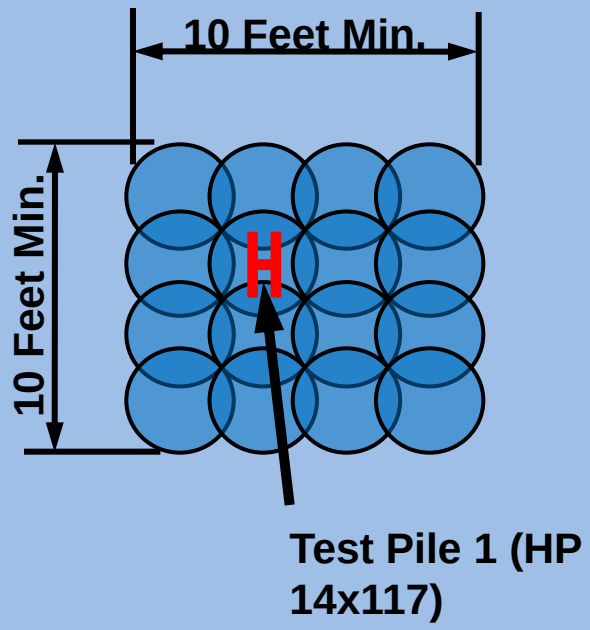
Deep Soil Mixing
Lime-Cement Columns
Block Type Pattern - Overlapping
(Dry Mix Method)

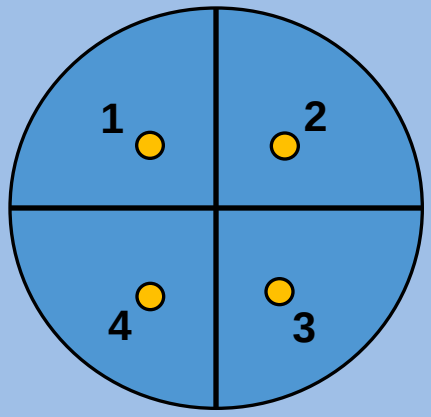
- Seismic Slope Stabilization – Shear Key
- Improved Performance of Bridge Abutment Foundations

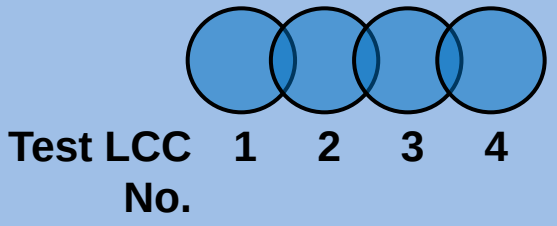




DSM-LCC Test Sections







DSM-LCC Test Section 1

(Block Type Pattern)

Test LCC Sampling Quadrants

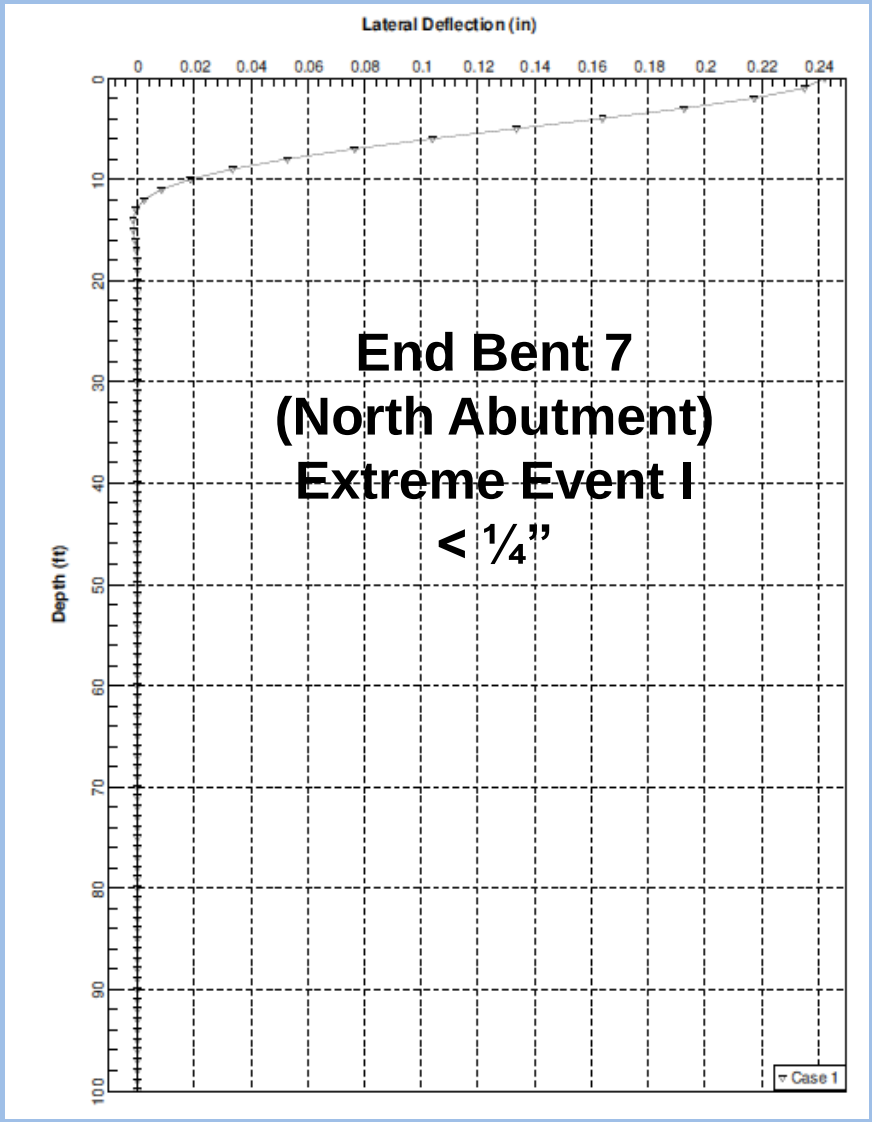
DSM-LCC Test Section 2

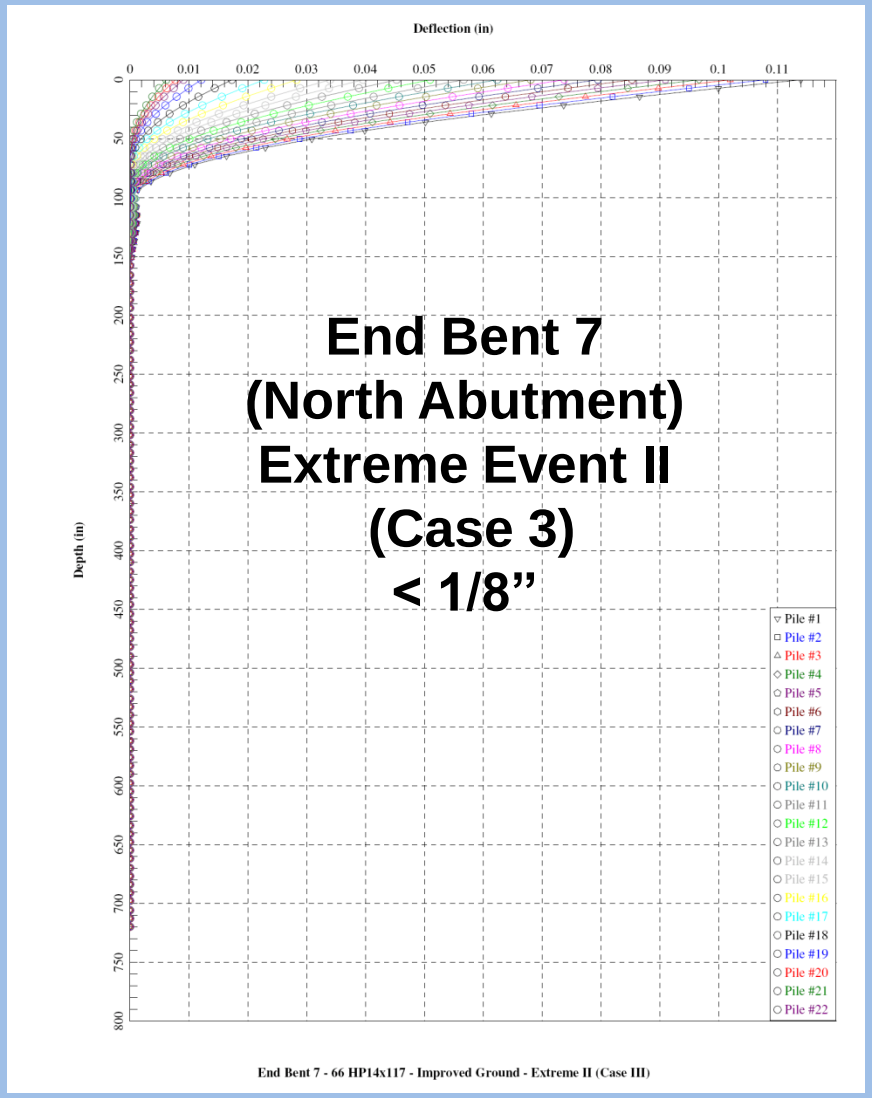
(Single Line Pattern)

Legend

Test Lime-Cement Columns (Test LCC)

Bridge Abutment Improved Foundation Performance





Geotechnical Instrumentation

Settlement Monitoring

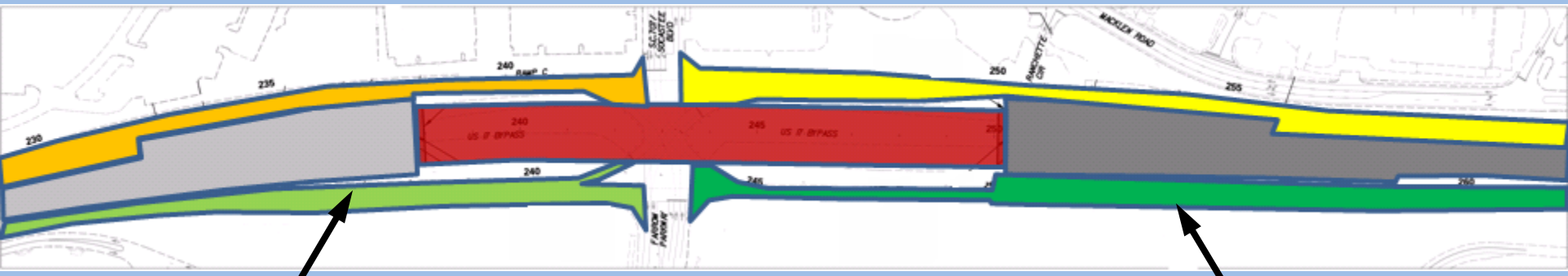
- 12 VW Settlement Sensors (SS)
- 15 VW Piezometers (P)
- 2 VW Data Collection Centers
- 10 Settlement Plates (SP)
- 2 Magnetic Extensometer (ME)

Slope Stability

- 6 Slope Indicator

Traffic Control

Stage 2



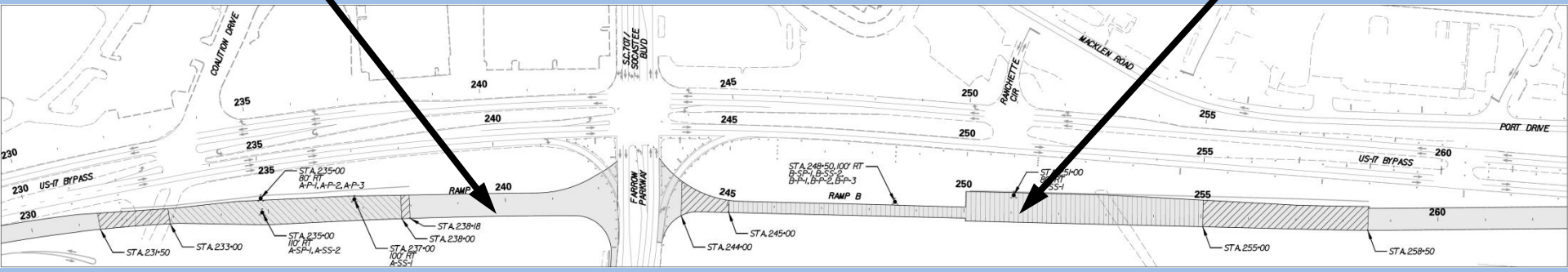
Ramp A

Ramp B

Traffic Stage 2 – Ground Improvement

Ramp A

Ramp B



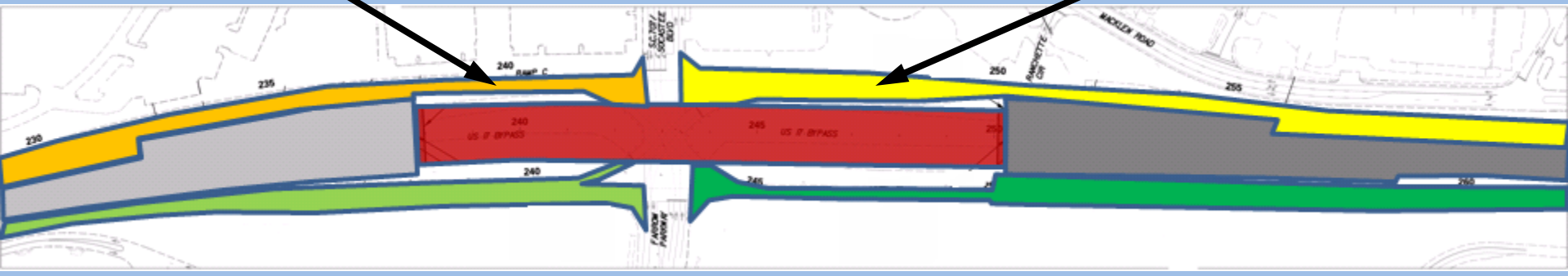
- MSE Walls
- Lightweight Aggregate Borrow Material
- 2’, and 3’ Granular Surcharge (Normal Weight)
- 3’ and 4’ Triangular Spacing PVD
- Geotechnical Instrumentation

Traffic Control

Stage 3

Ramp C

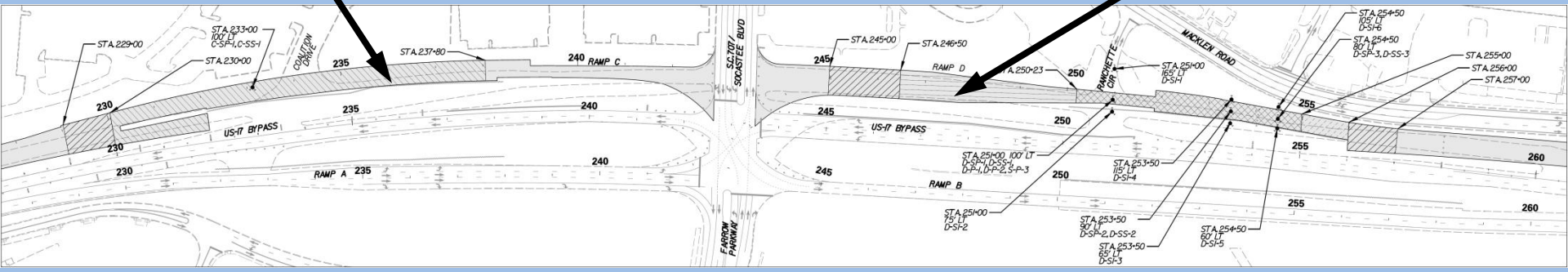
Ramp D



Traffic Stage 3 -Ground Improvement

Ramp C

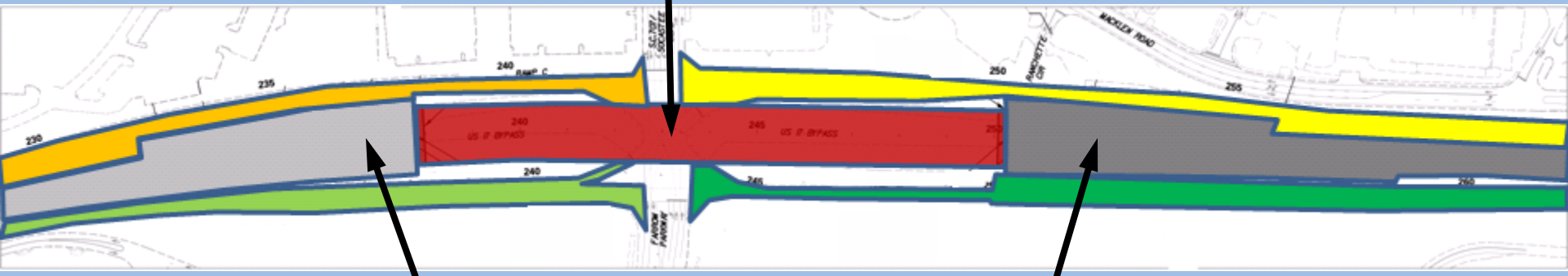
Ramp D



- MSE Walls
- Lightweight Aggregate Borrow Material
- 1’, 2’, and 4’ Granular Surcharge (Normal Weight)
- 3’ and 4’ Triangular Spacing PVD
- Geotechnical Instrumentation

Traffic Control
Stage 4

Backgate Bridge



South Bridge Approach

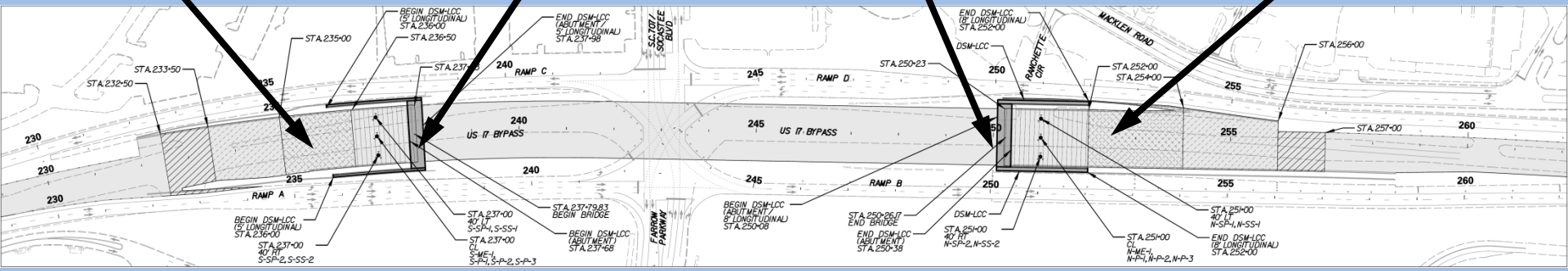
North Bridge Approach

Traffic Stage 4 -Ground Improvement

South Bridge Approach

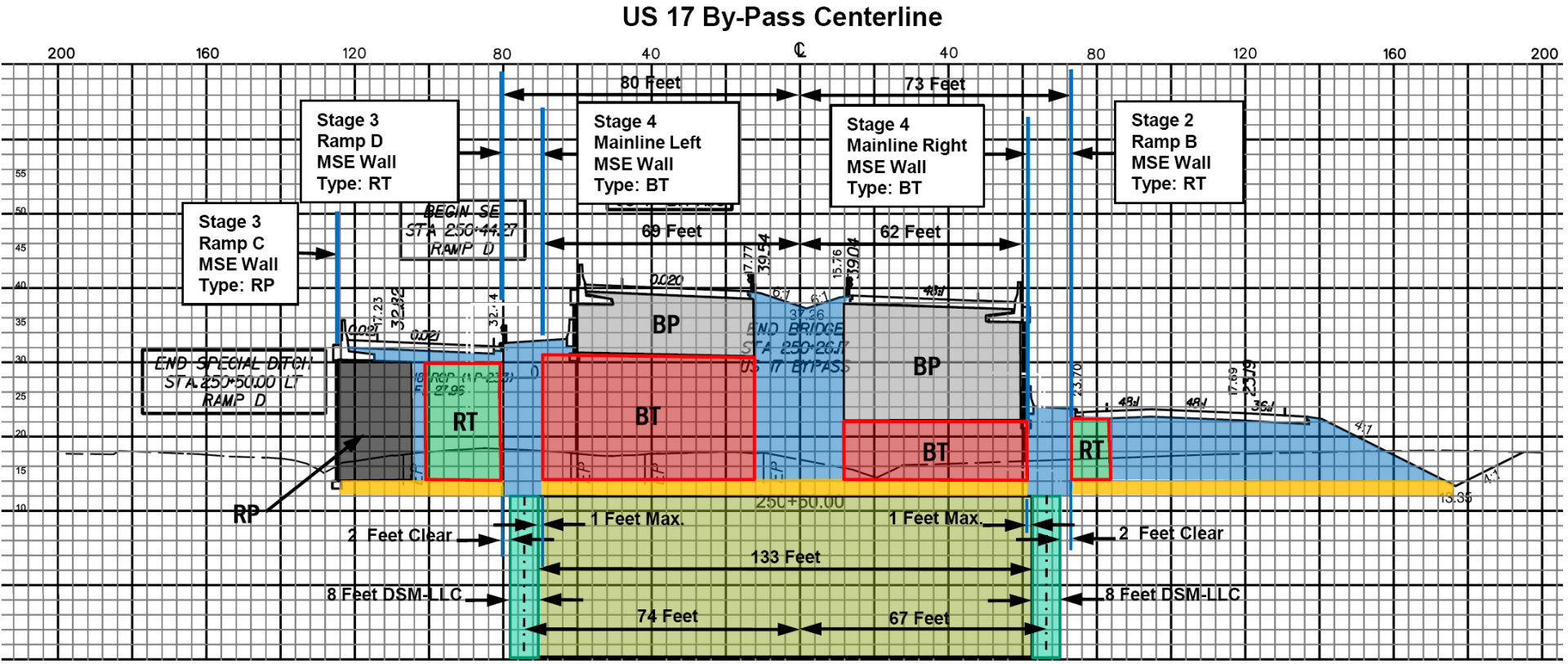
Bridge

South Bridge Approach



- MSE Walls
- Lightweight Aggregate Borrow Material
- 1’, 2’, and 3’ Granular Surcharge (Normal Weight)
- 3’ Triangular Spacing PVD
- Geotechnical Instrumentation
- Bridge Abutment DSM-LCC
  (South 30’ x 133’ x 50’deep – North 30’ x 141’ x 70’deep)
- Longitudinal DSM-LCC (South 5’ Wide / North 8’ Wide)

X- Section End Bent 7 (250+26)



MSE Wall Type: BP

Light Weight Fill

Deep Soil Mixing Lime-Cement Columns – Grout Design A

Deep Soil Mixing Lime-Cement Columns – Grout Design B

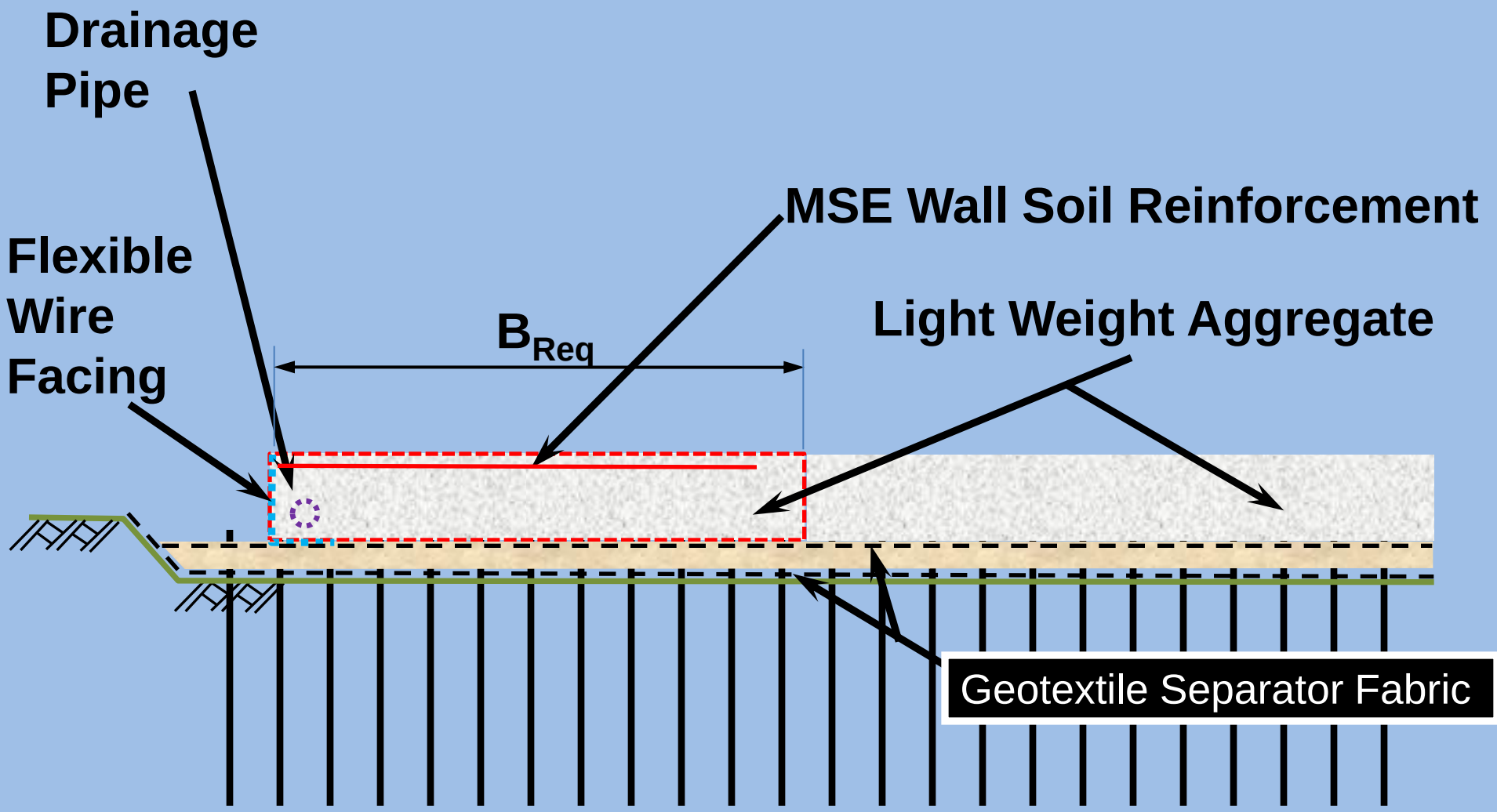
MSE Wall Type: BT

MSE Wall Type: RT

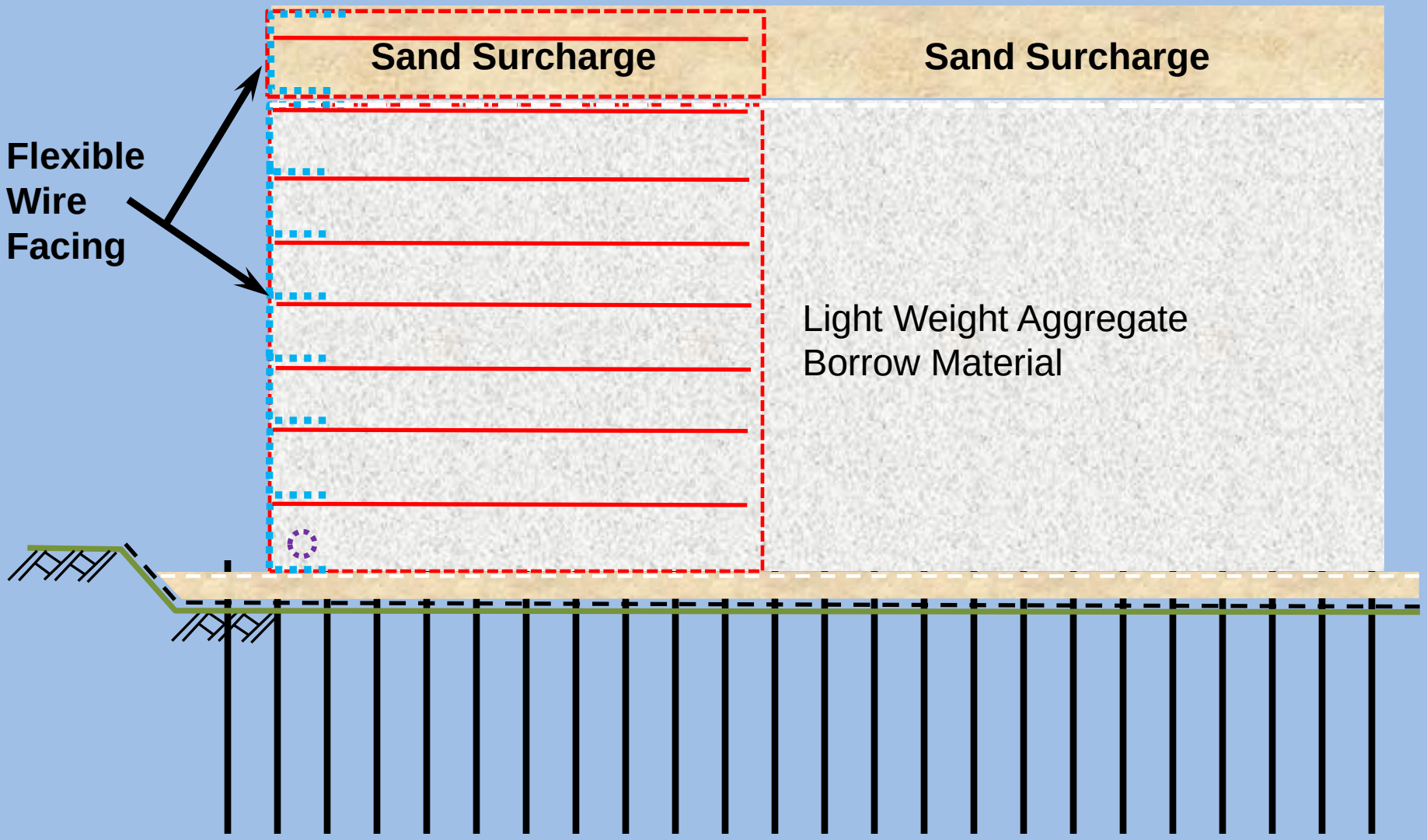
MSE Wall Type: RP

Sand Drainage Layer (PVD Drainage)

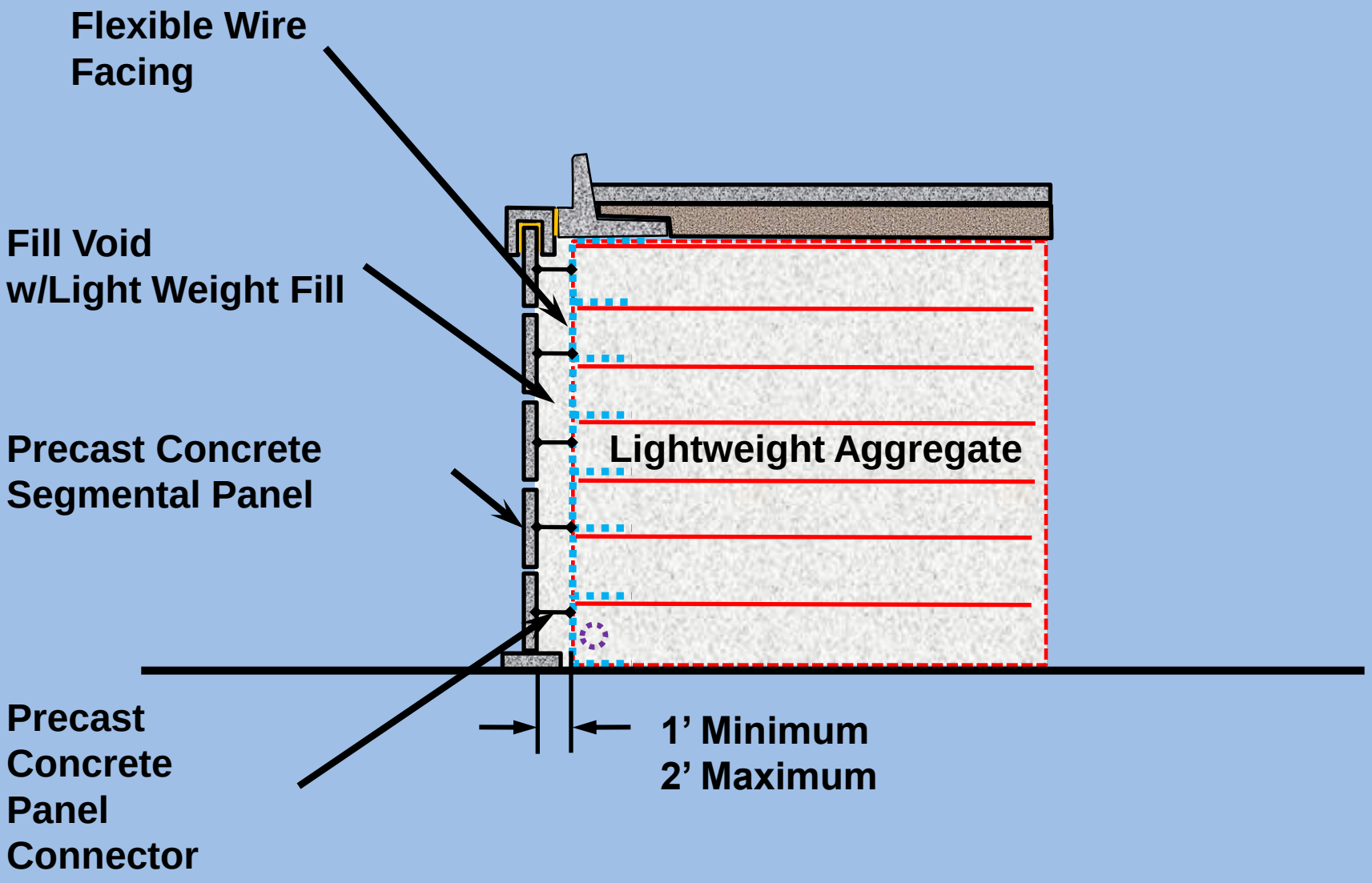
Initial MSE Wall Construction
(2 & 3 Stage Wall Construction)



2-Stage MSE Wall Construction
(Stage 1 of 2)



Permanent Precast Concrete Segmental Panel



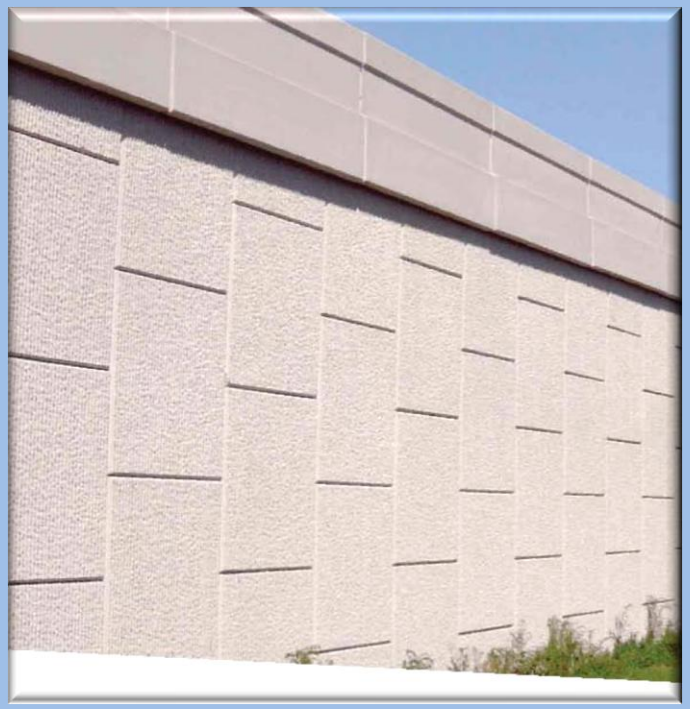
MSE Walls

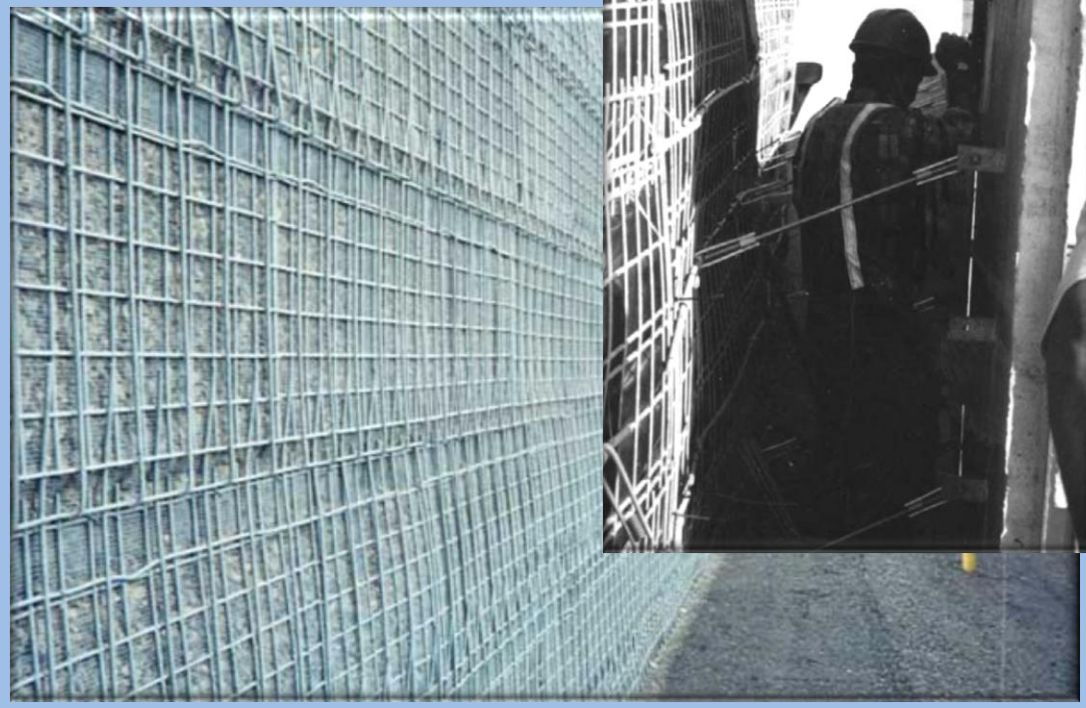
Permanent MSE Walls

- Two-Stage Construction
- Three-Stage Construction (w/Drainage Structures)

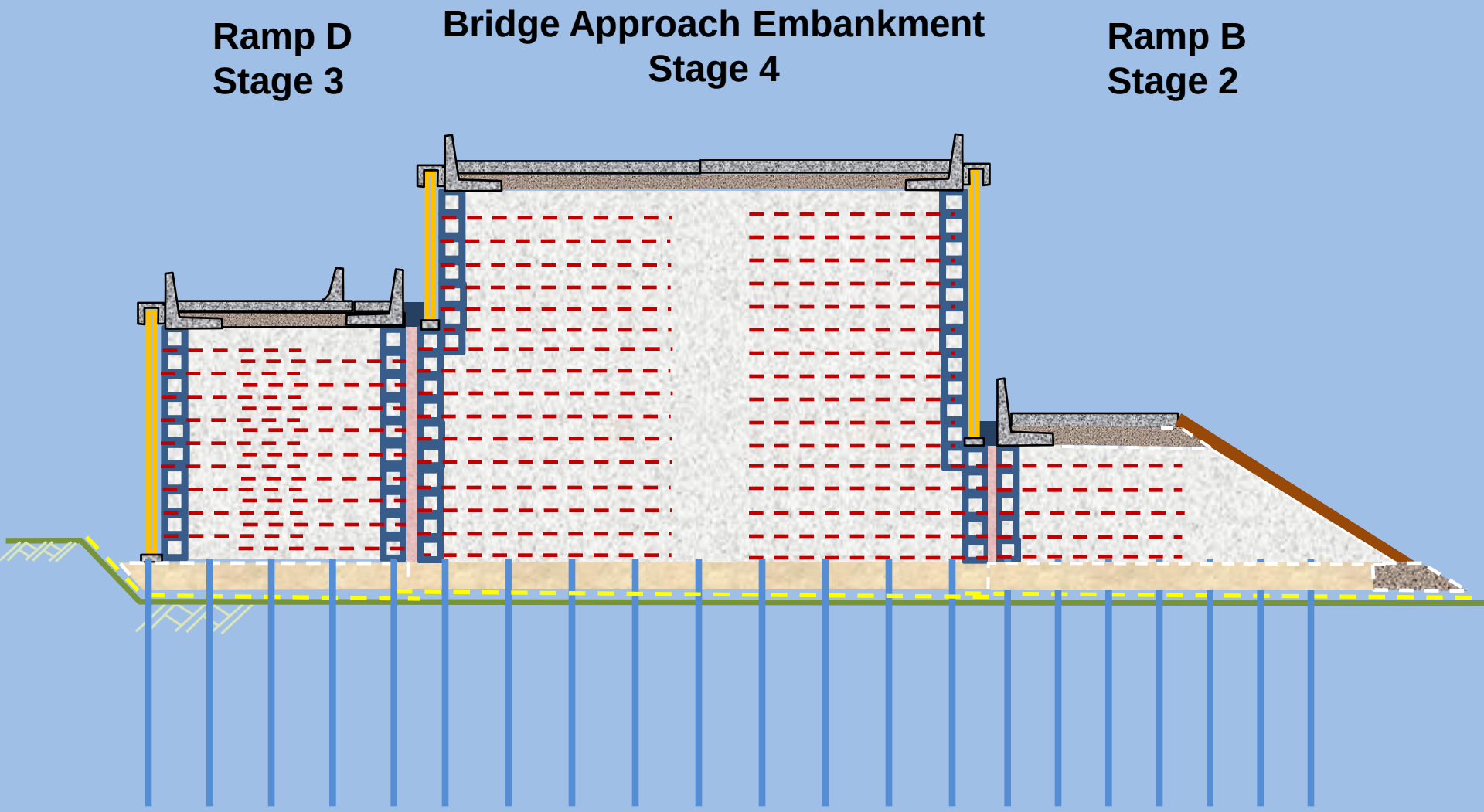
Temporary MSE Walls

(Welded Wire Mesh Facing)

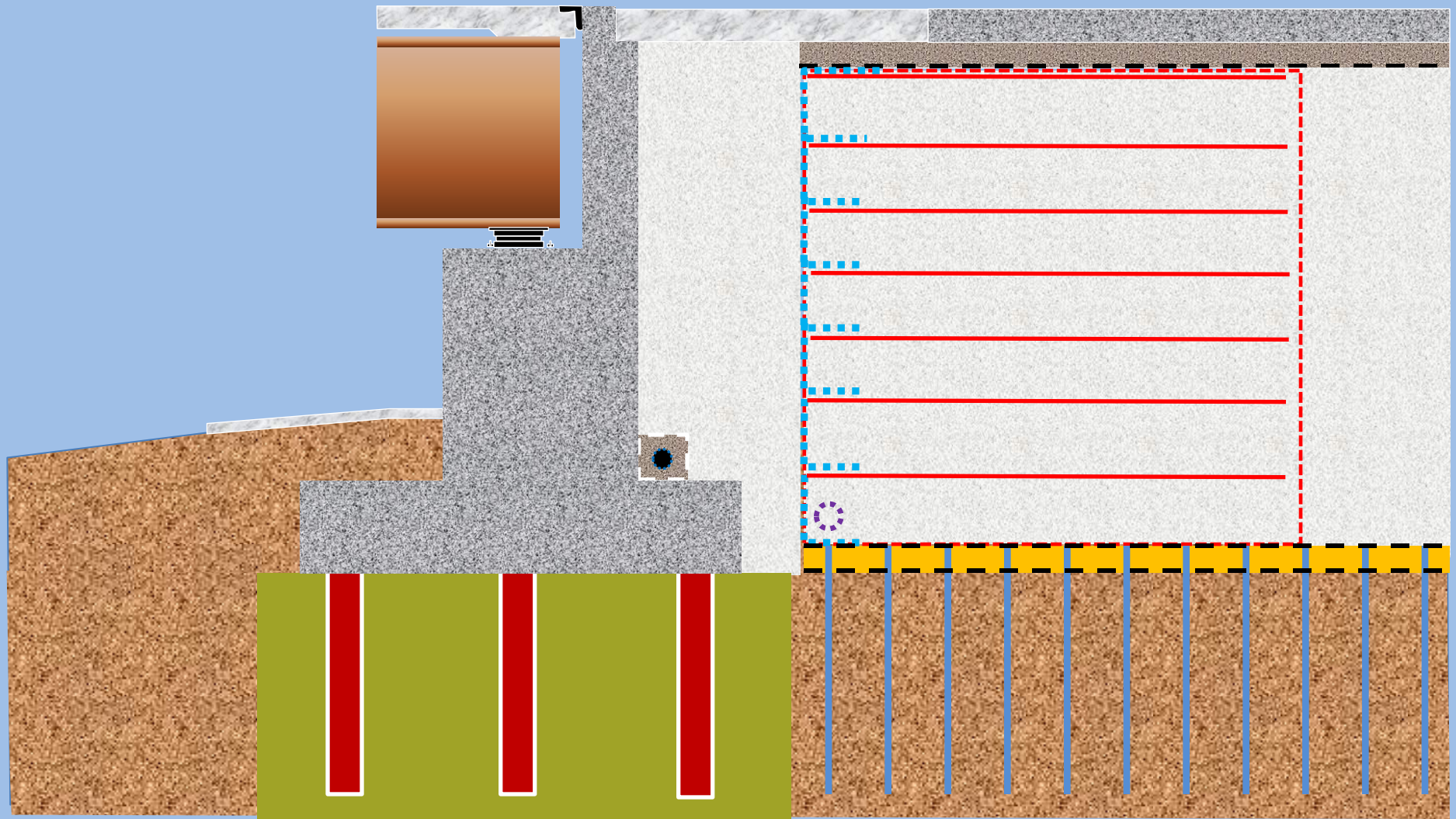




Project Construction Phase (North Abutment – Sta. 252+00)



Bridge Abutment Construction (North Abutment – End Bent 7)



US 17- Bypass Over SC707/Farrow Parkway
(Backgate Bridge)
Myrtle Beach, SC
Horry County

Thank You
Any Questions?