

Grade separated interchange at the intersection of U.S. Hwy 17 Bypass and Farrow Parkway

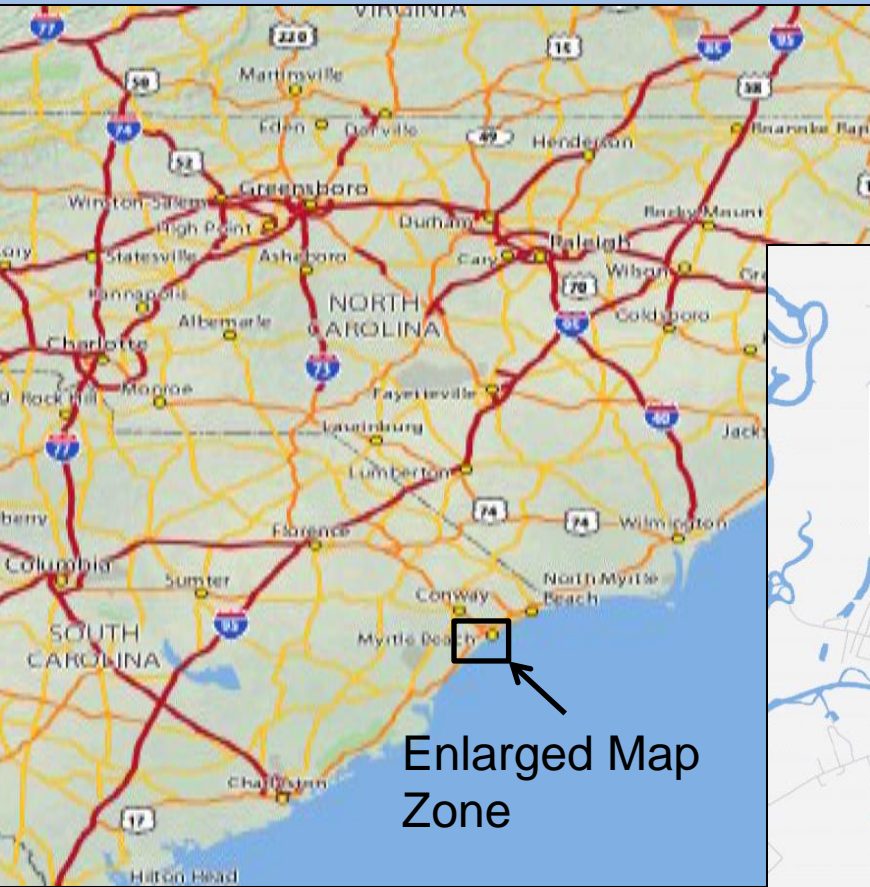
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Geotechnical Engineer
Geoengineers

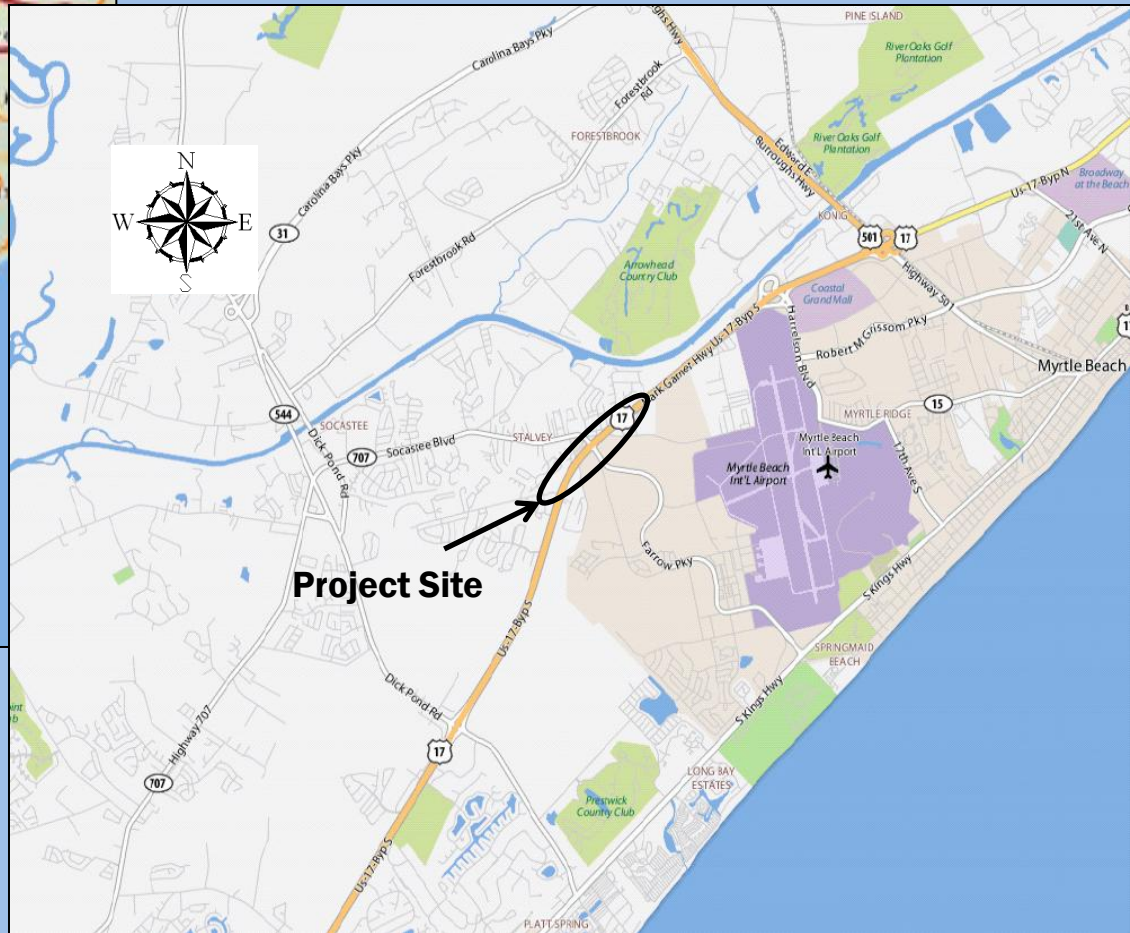
Need for Project:

“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



Enlarged Map
Zone



Existing US 17 Bypass



US 17 Bypass at SC 707/Farrow Parkway
Myrtle Beach, SC
Existing Conditions

Proposed US17 Bypass



US 17 BP

Farrow Pkwy



US 17 Bypass at SC 707/Farrow Parkway
Myrtle Beach, SC
Concept Rendering

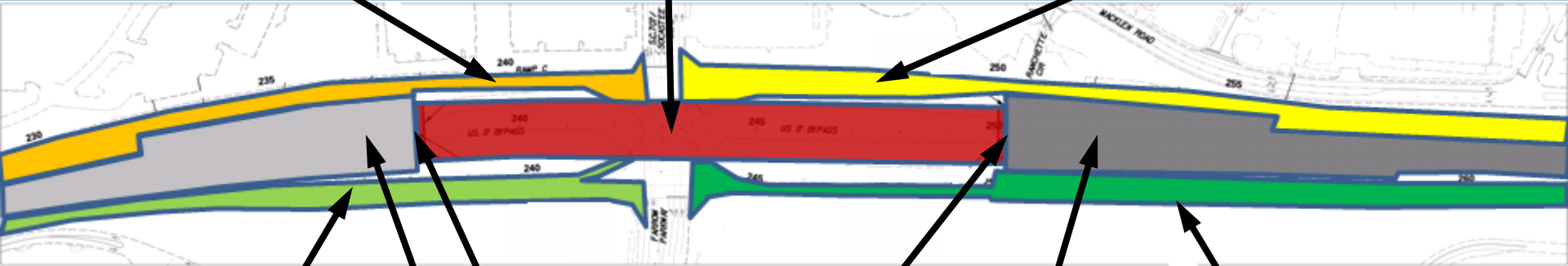
Project Layout



Backgate Bridge

Ramp C

Ramp D



**End
Bent 1**

**End
Bent 7**

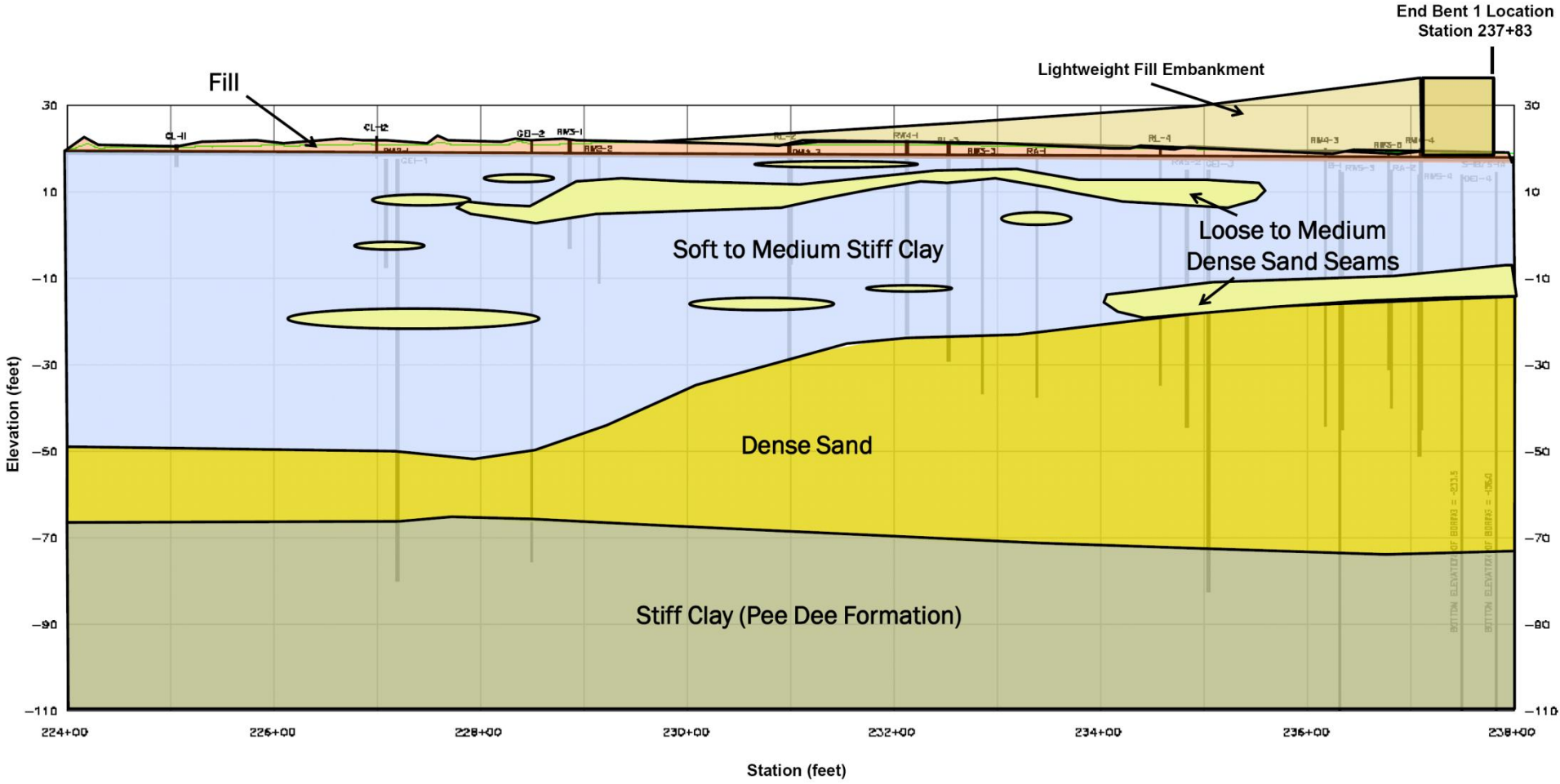
Ramp A

Ramp B

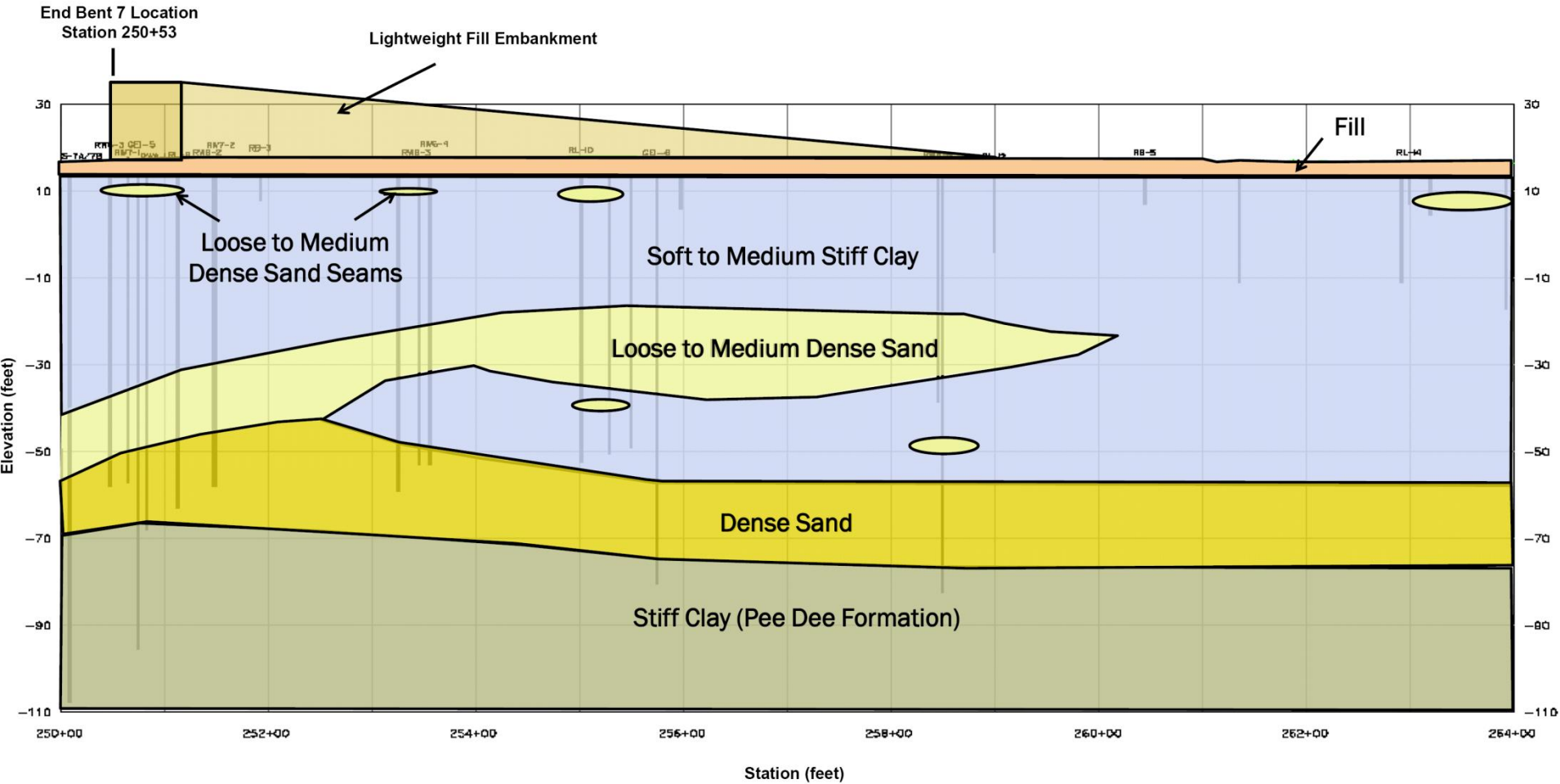
**South Bridge
Approach**

**North Bridge
Approach**

South Subsurface Profile



North Subsurface Profile



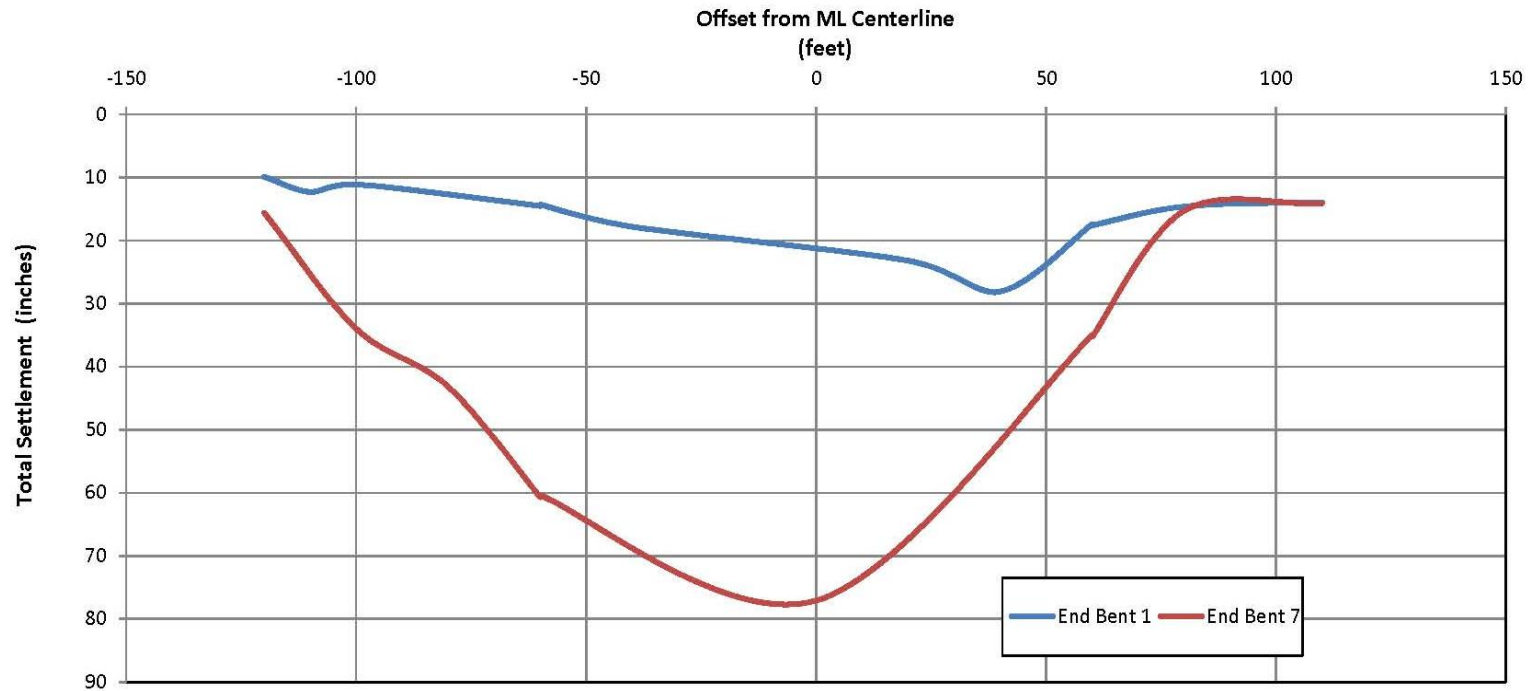
Project Design Constraints

- **Project Geometry and Layout** – Project Constructed on Existing Alignment
- **Complex Traffic Control Staging Plan** (Geotechnical Designs Constructed in Stages 2, 3, and 4)
- **Total Project Construction Time Requirements** – Approx. 3.5 years
- **High Traffic Volume Combined with Limited Construction Staging Areas**

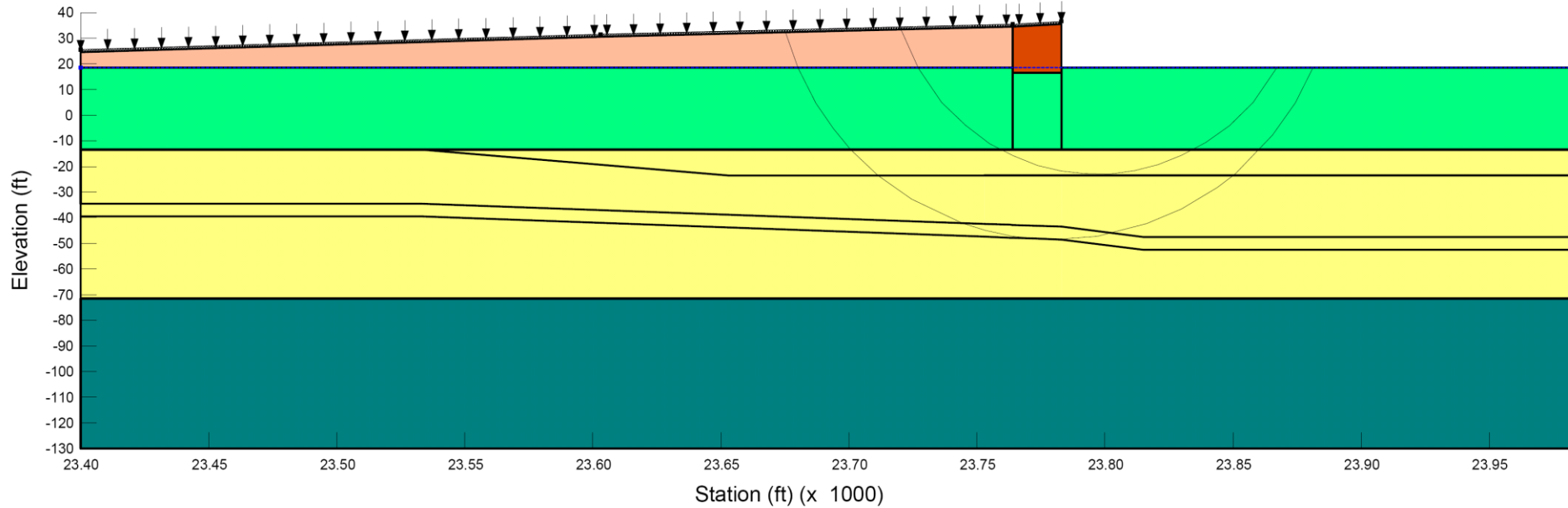
Geotechnical Key Issues

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

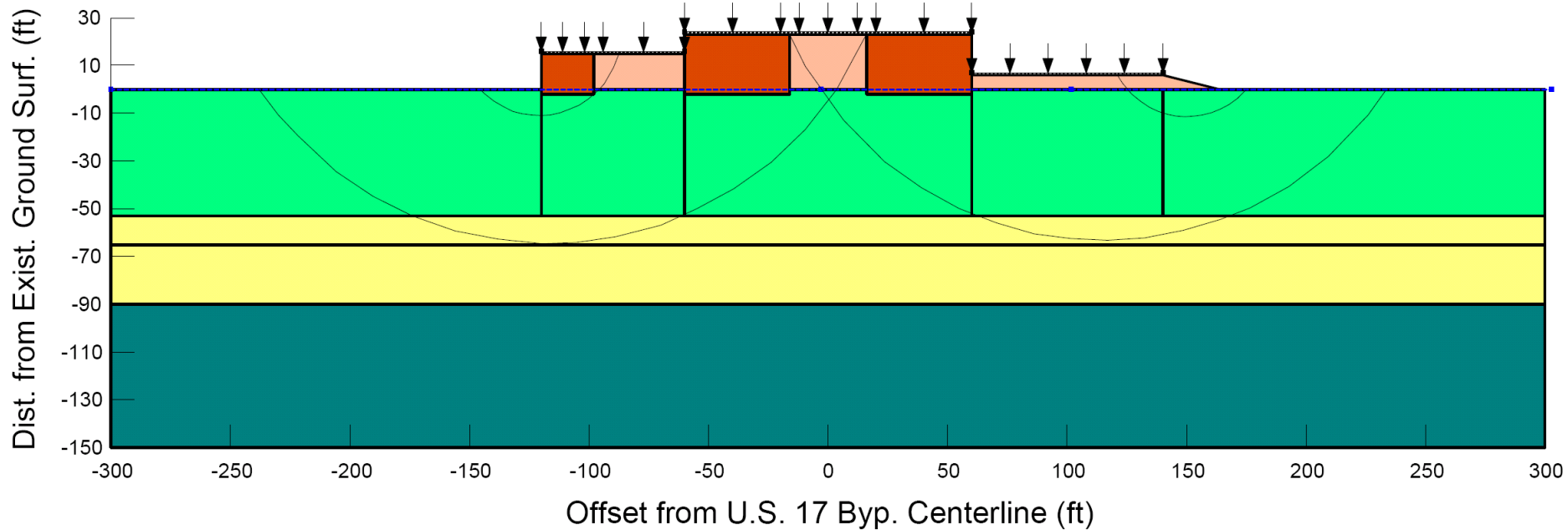
Settlement At Bridge Abutments (Normal Weight Fill)



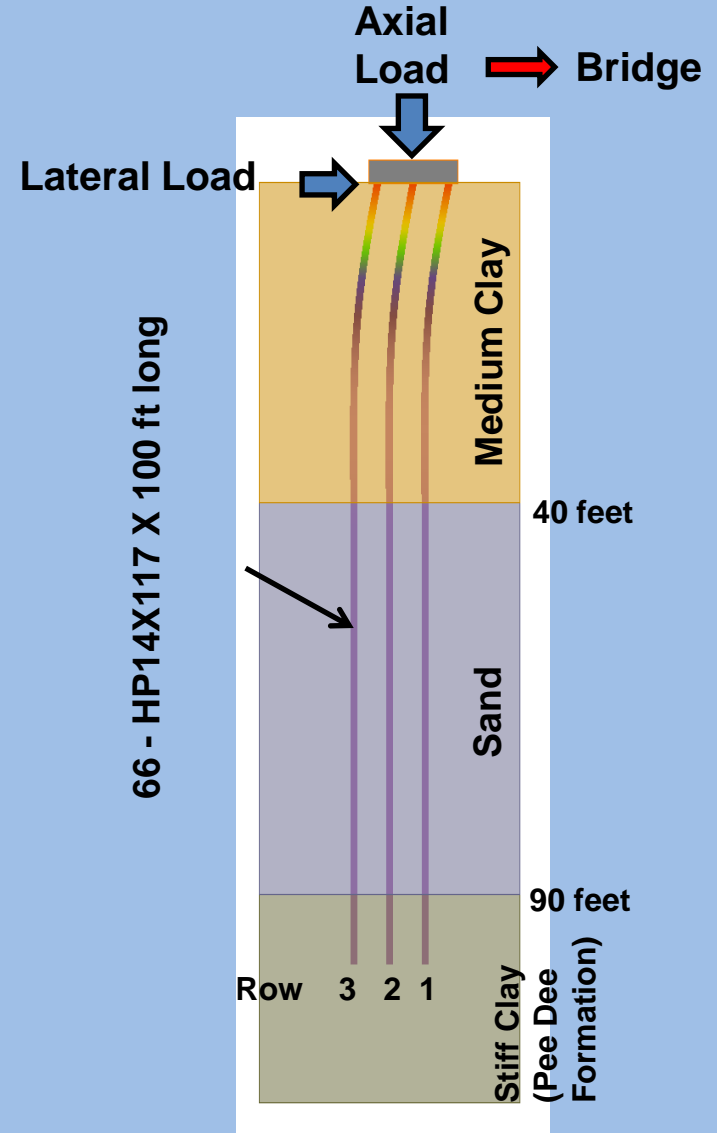
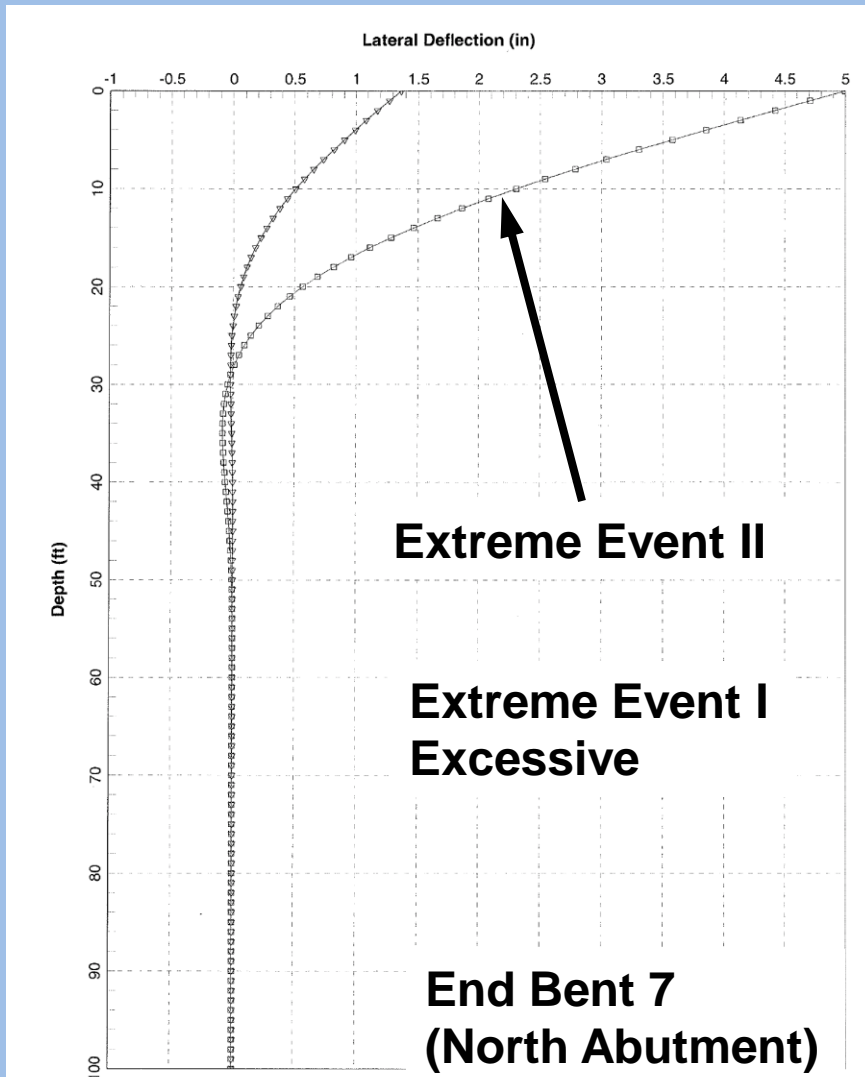
Longitudinal Seismic Slope Instability



Transverse Seismic Slope Instability



Bridge Abutment Unimproved Foundation Performance



Ground Improvement Methods

- **Lightweight Aggregate Borrow Material** – Reduce Magnitude of Settlement
- **Prefabricated Vertical Drain (PVD) / Granular Surcharges** – Increased Rate of Settlement during Construction
- **Deep Soil Mixing** – Seismic Slope Stability and Bridge Abutment Foundation Improved Performance
- **Mechanically Stabilized Earth (MSE) Walls** – Permanent and Temporary Retaining Walls

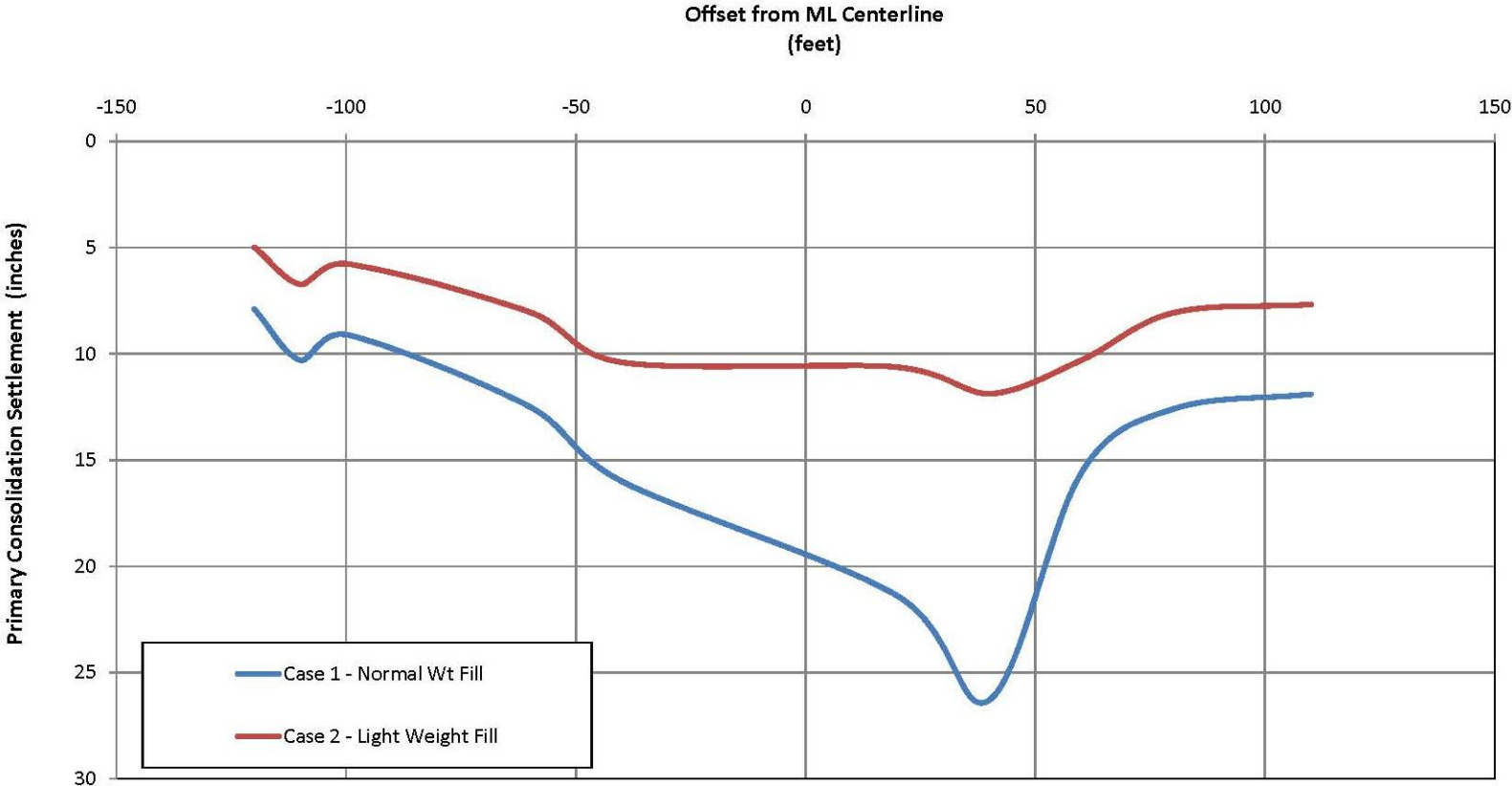
Lightweight Aggregate (Rotary Kilin Produced)

Required Properties:

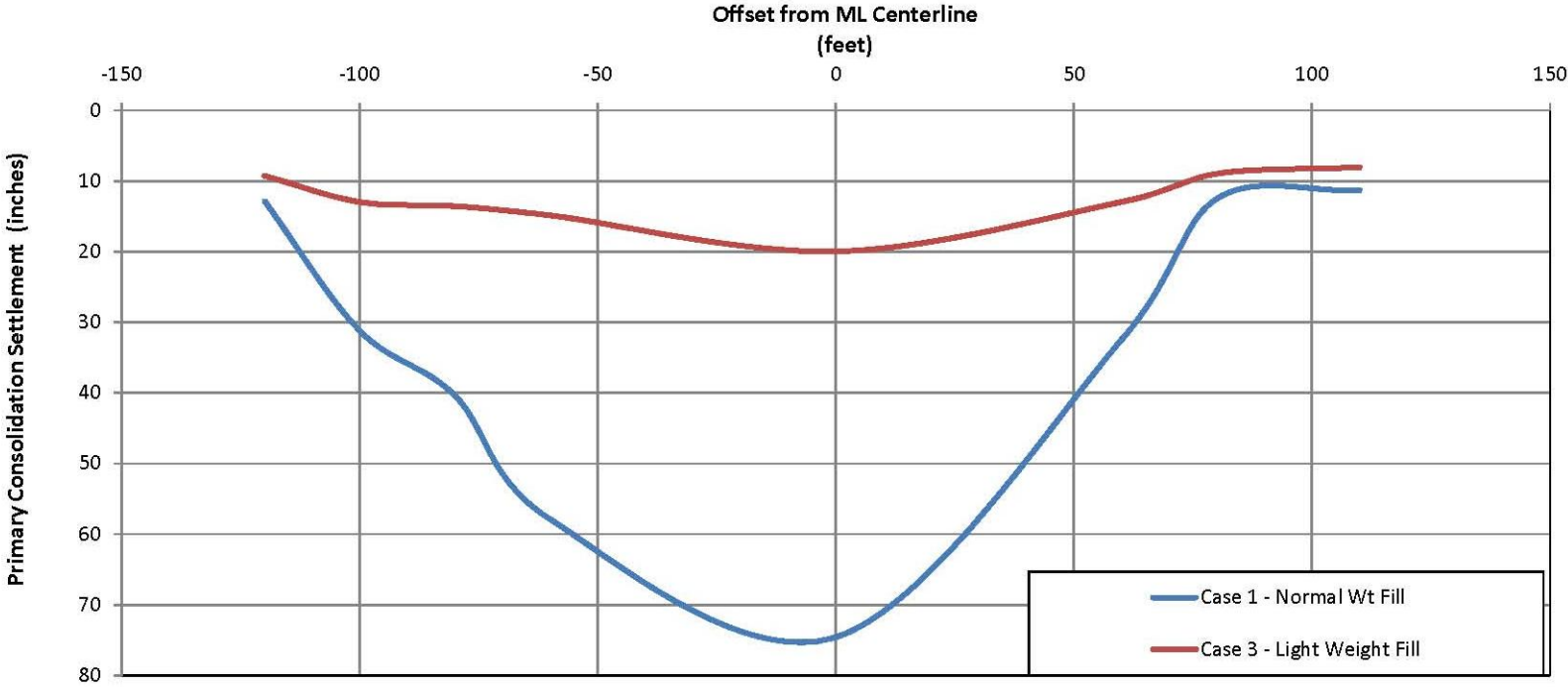
- Internal Friction Angle 40 degrees
- Unit Weight: 60 pcf minimum (Long-term 70 pcf maximum)
- MSE Wall Reinforced Backfill Properties



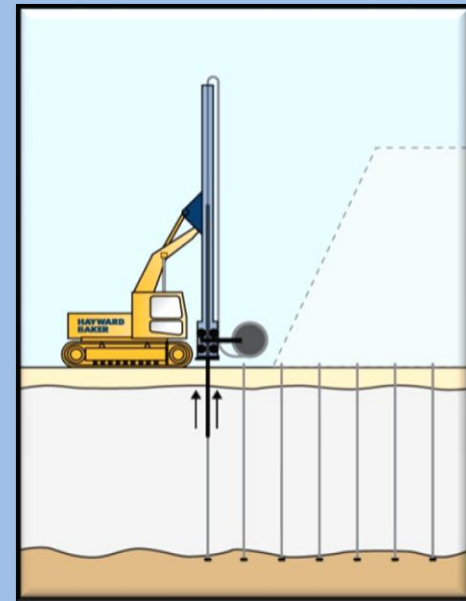
Settlement South Bridge Abutment (End Bent 1)



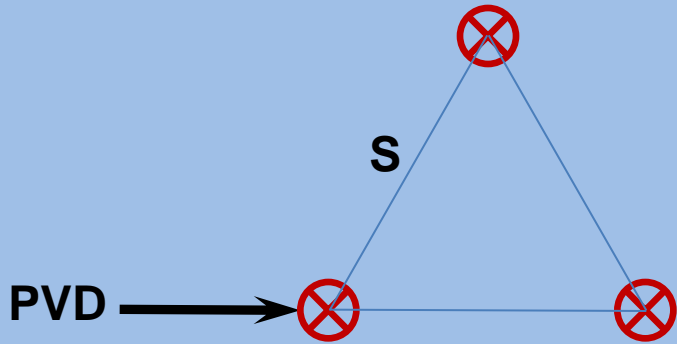
Settlement North Bridge Abutment (End Bent 7)



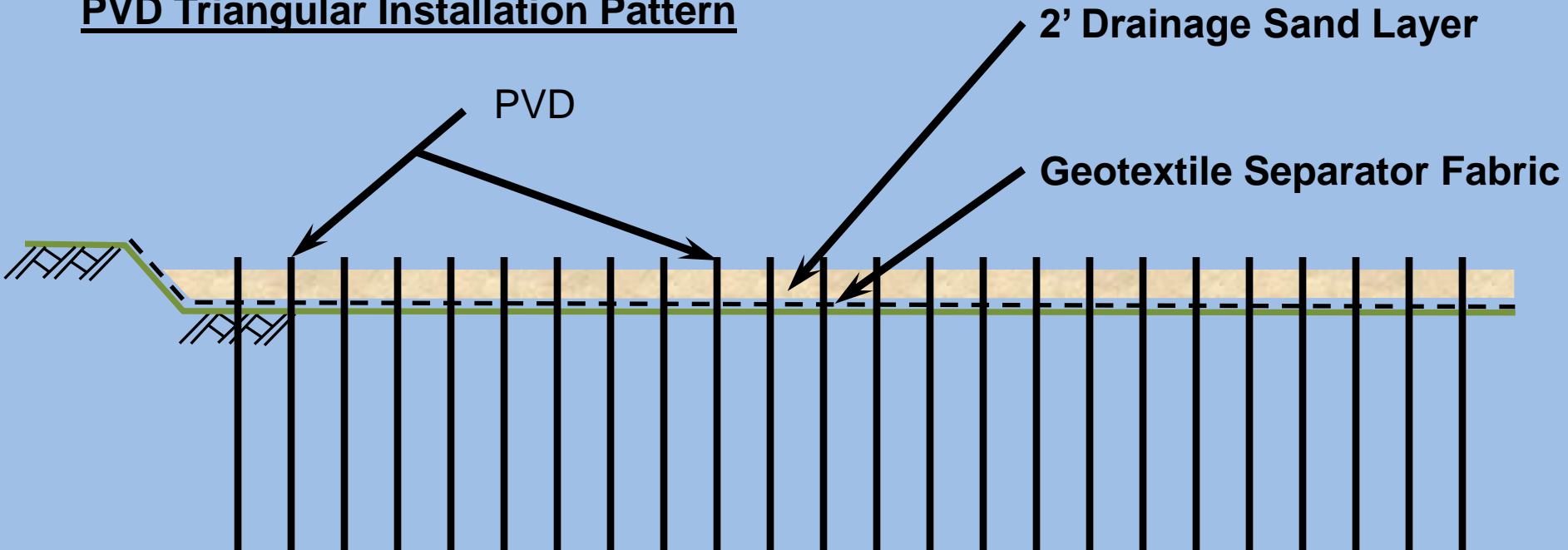
Prefabricated Vertical Drains (PVD)



PVD Installation



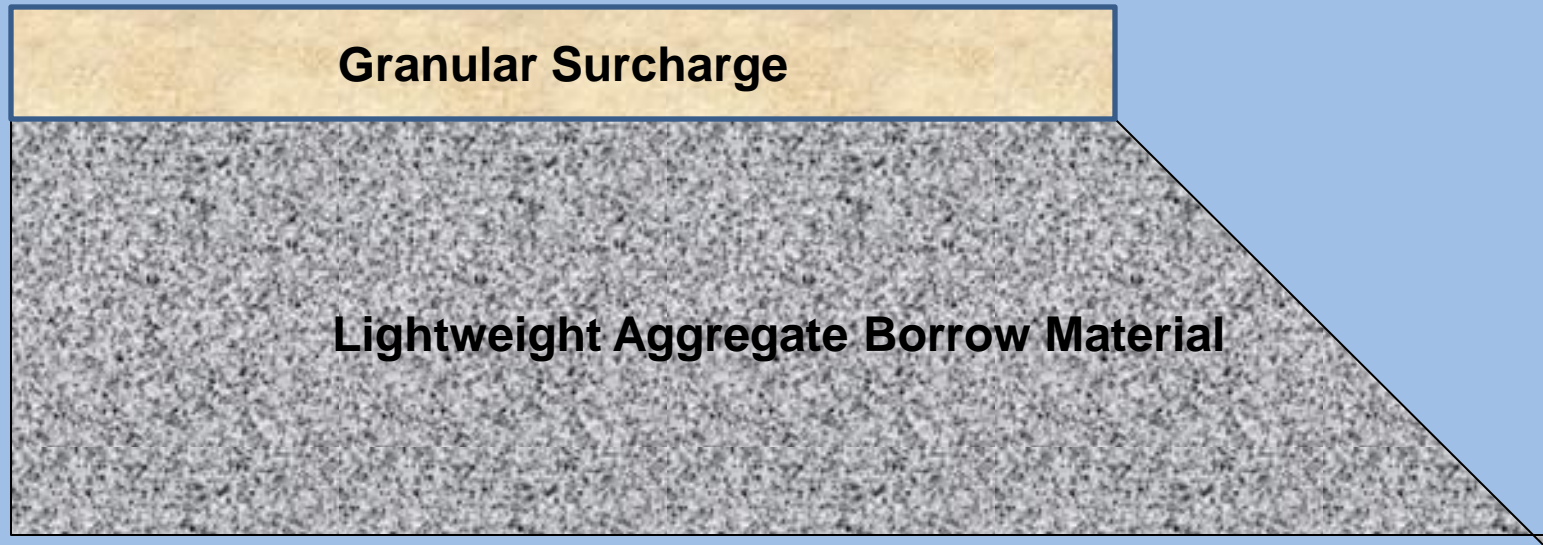
PVD Triangular Installation Pattern



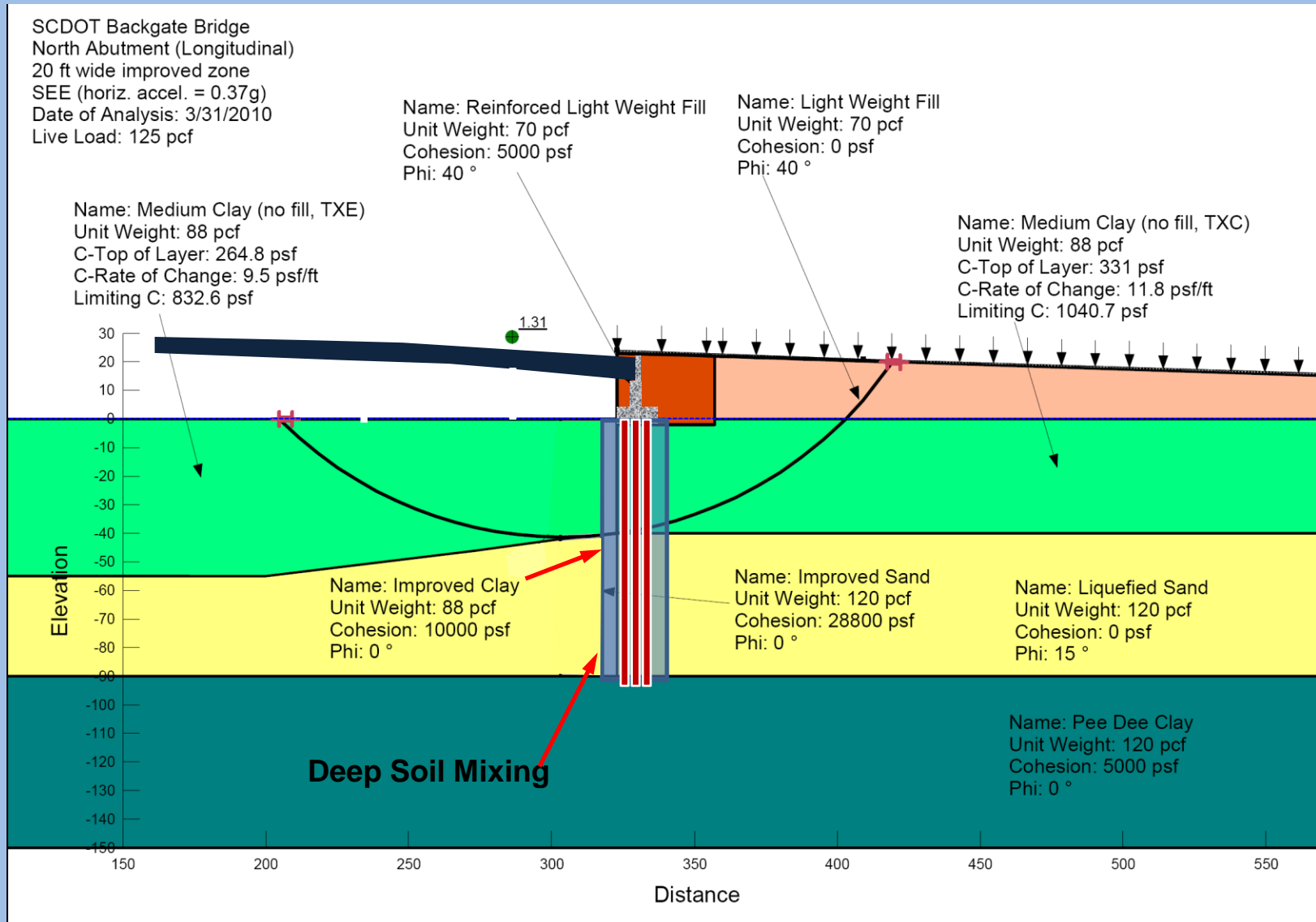
Granular Surcharges

Required Properties:

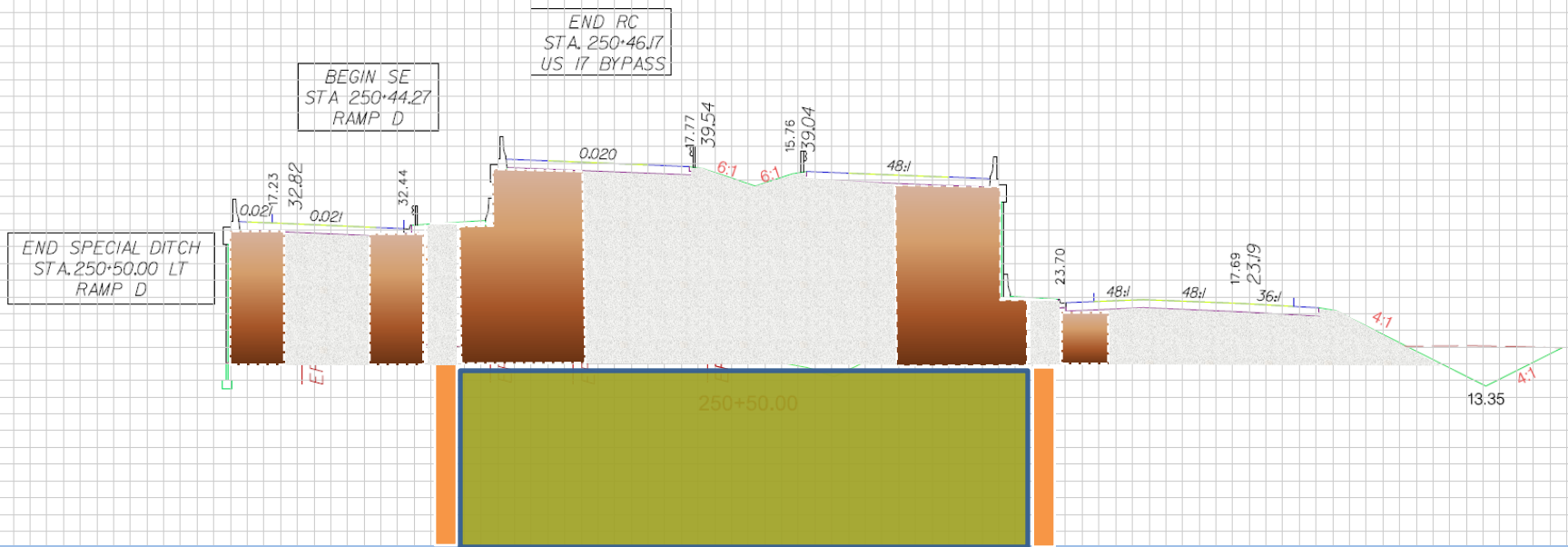
- Internal Friction Angle 32 degrees
- Unit Weight: 120 pcf



Seismic Slope Stability Improved



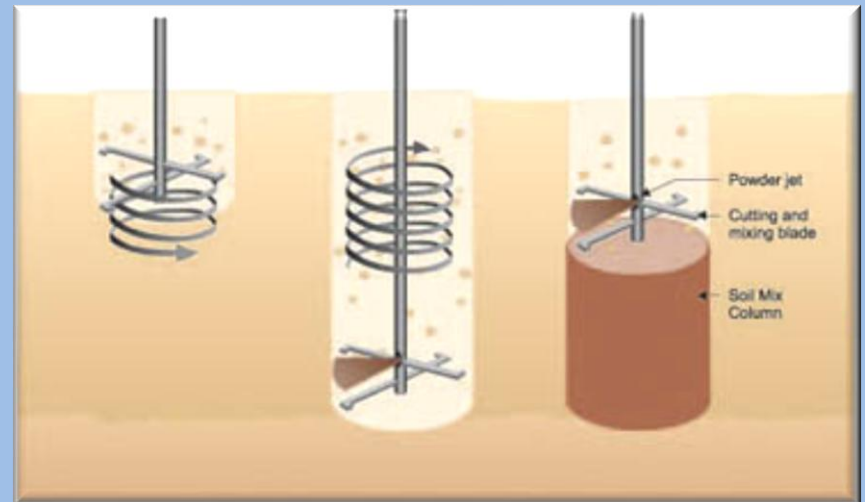
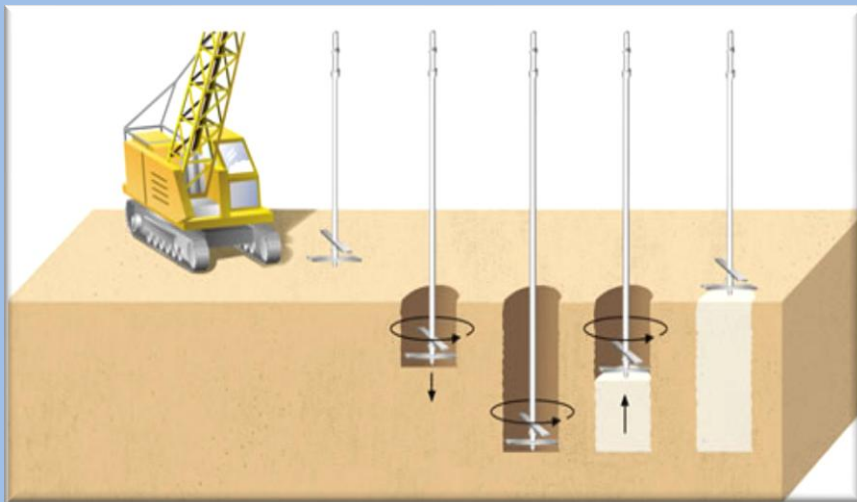
Stage 4 – Ground Improvement North/South Abutment (Typical)



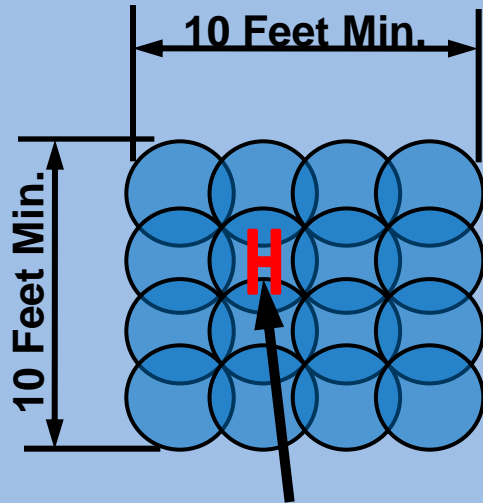
Deep Soil Mixing Lime-Cement Columns Block Type Pattern - Overlapping (Dry Mix Method)



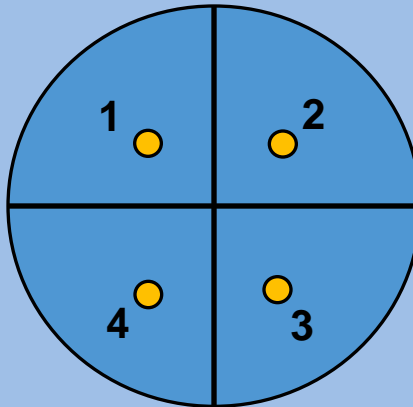
- Seismic Slope Stabilization – Shear Key
- Improved Performance of Bridge Abutment Foundations



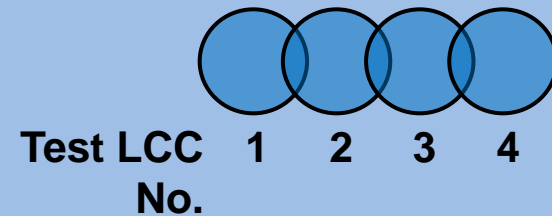
DSM-LCC Test Sections



Test Pile 1 (HP
14x117)



Test LCC Sampling
Quadrants



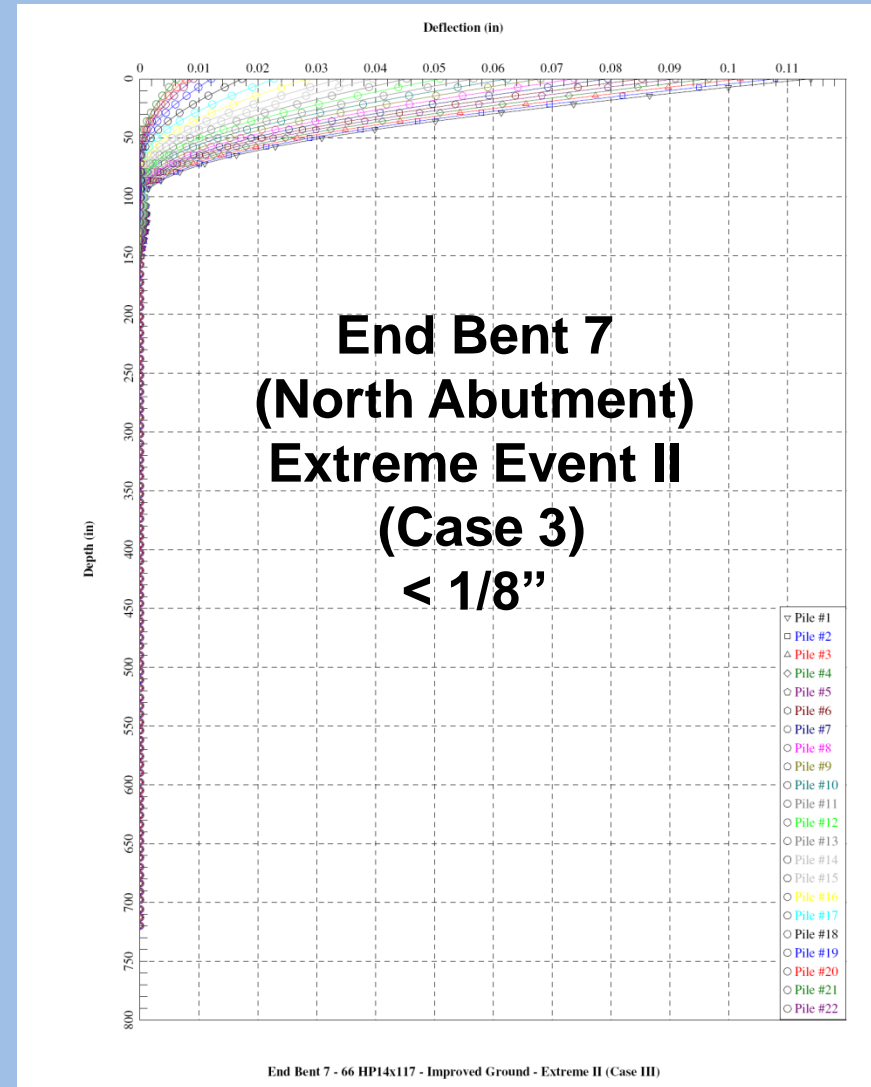
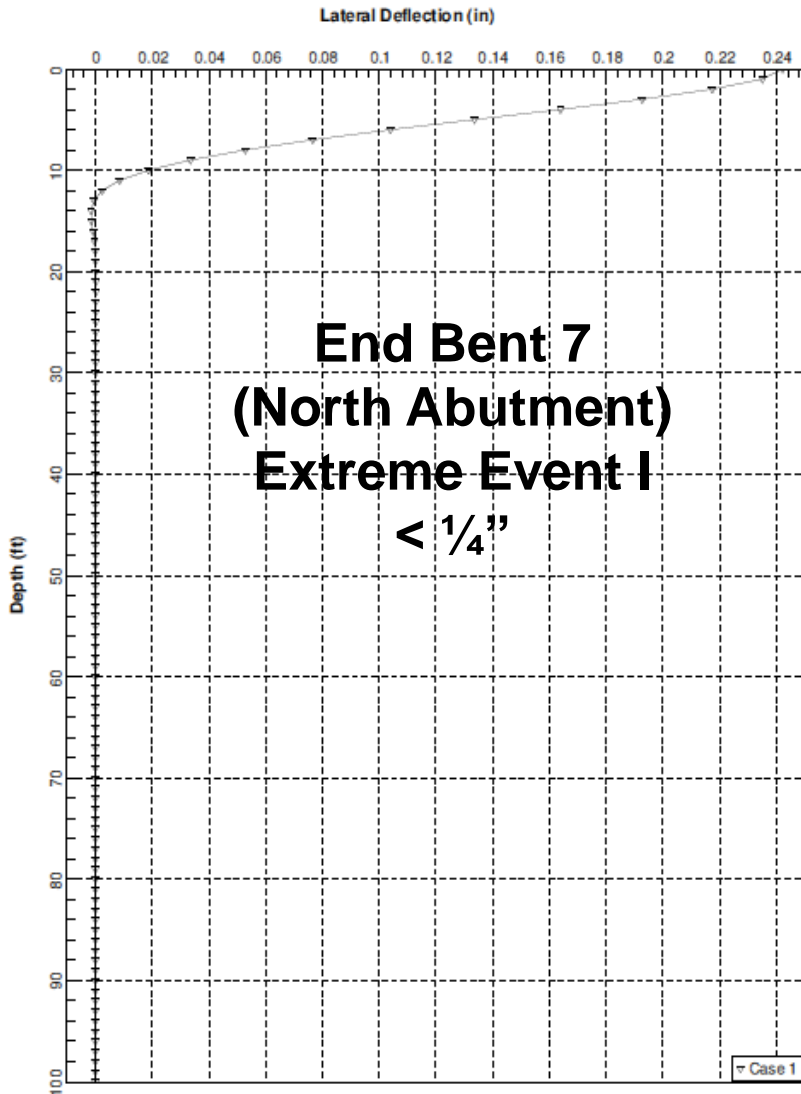
DSM-LCC Test Section 2
(Single Line Pattern)

Legend



Test Lime-Cement Columns (Test LCC)

Bridge Abutment Improved Foundation Performance



Geotechnical Instrumentation

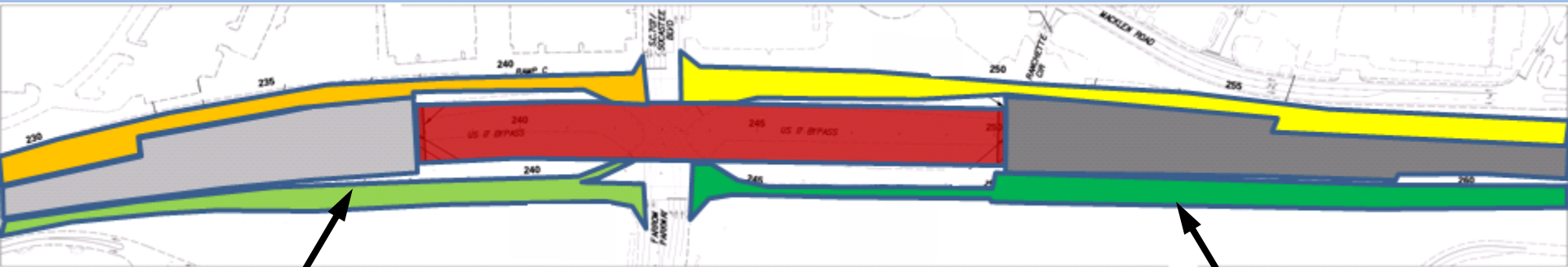
Settlement Monitoring

- 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



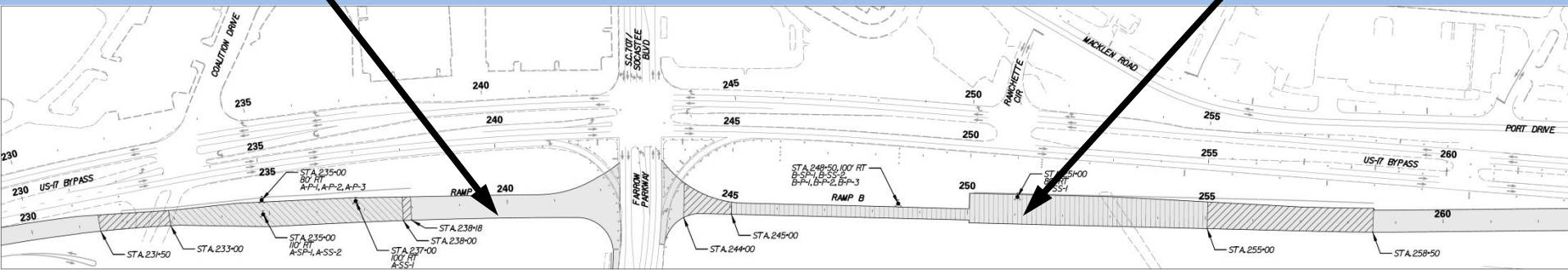
Ramp A

Ramp B

Traffic Stage 2 – Ground Improvement

Ramp A

Ramp B

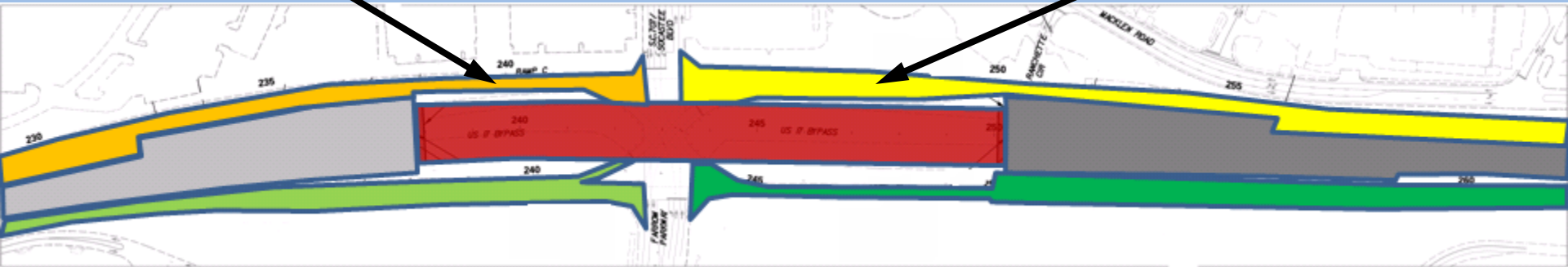


- MSE Walls
- Lightweight Aggregate Borrow Material
- 2', and 3' Granular Surcharge (Normal Weight)
- 3' and 4' Triangular Spacing PVD
- Geotechnical Instrumentation

Traffic Control Stage 3

Ramp C

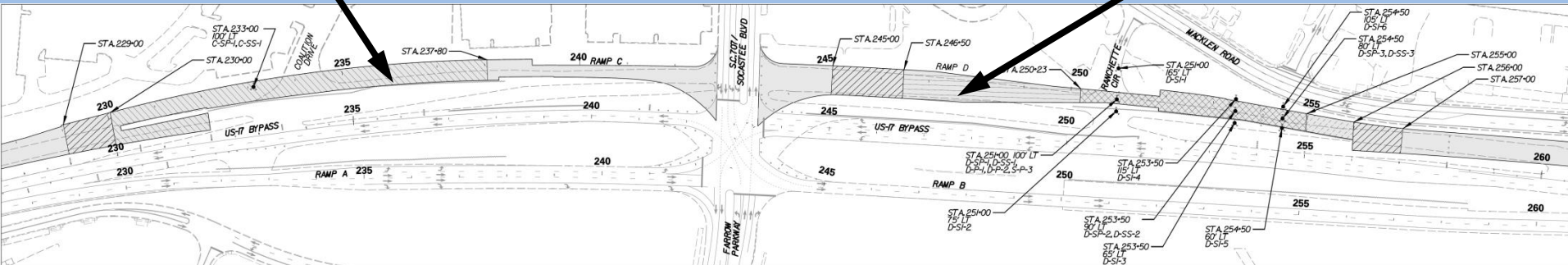
Ramp D



Traffic Stage 3 -Ground Improvement

Ramp B

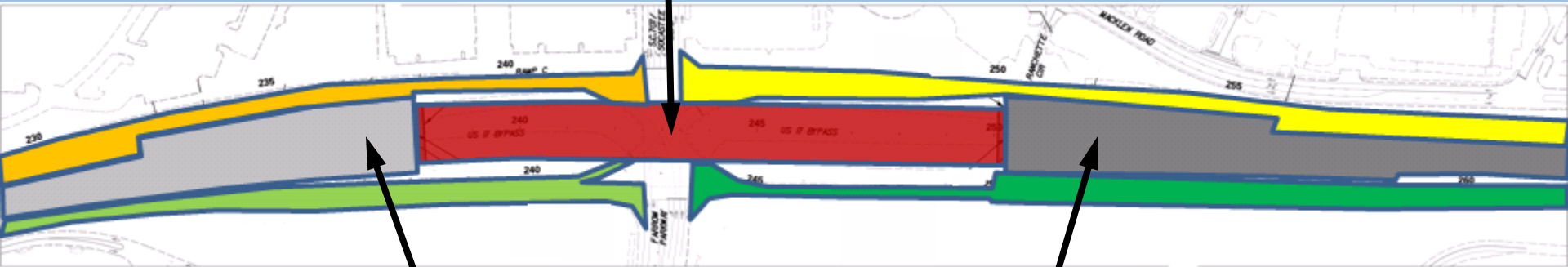
Ramp C



- 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

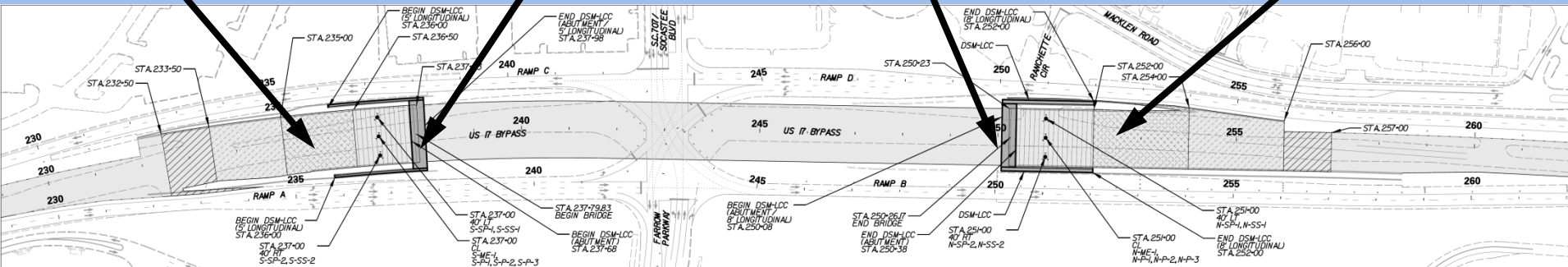
North Bridge
Approach

Traffic Stage 4 -Ground Improvement

South
Bridge
Approach

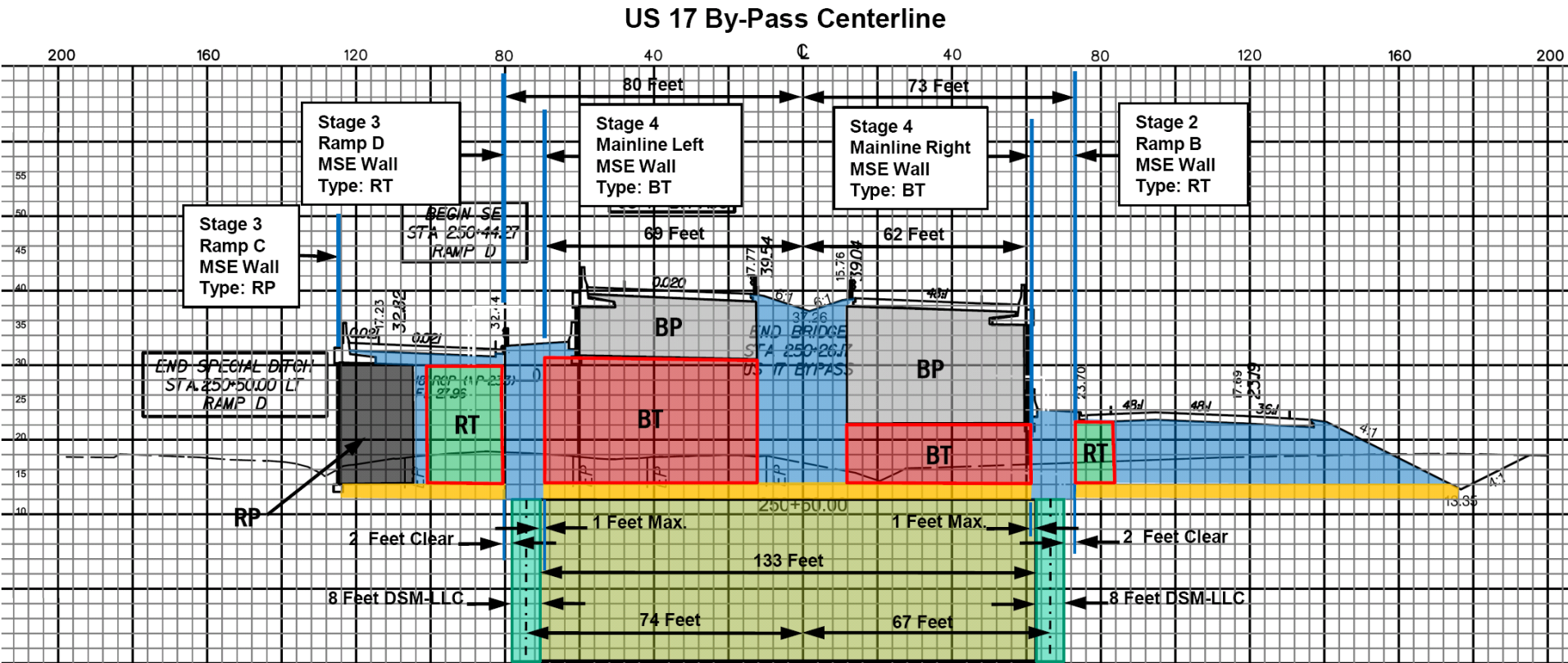
Bridge

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)

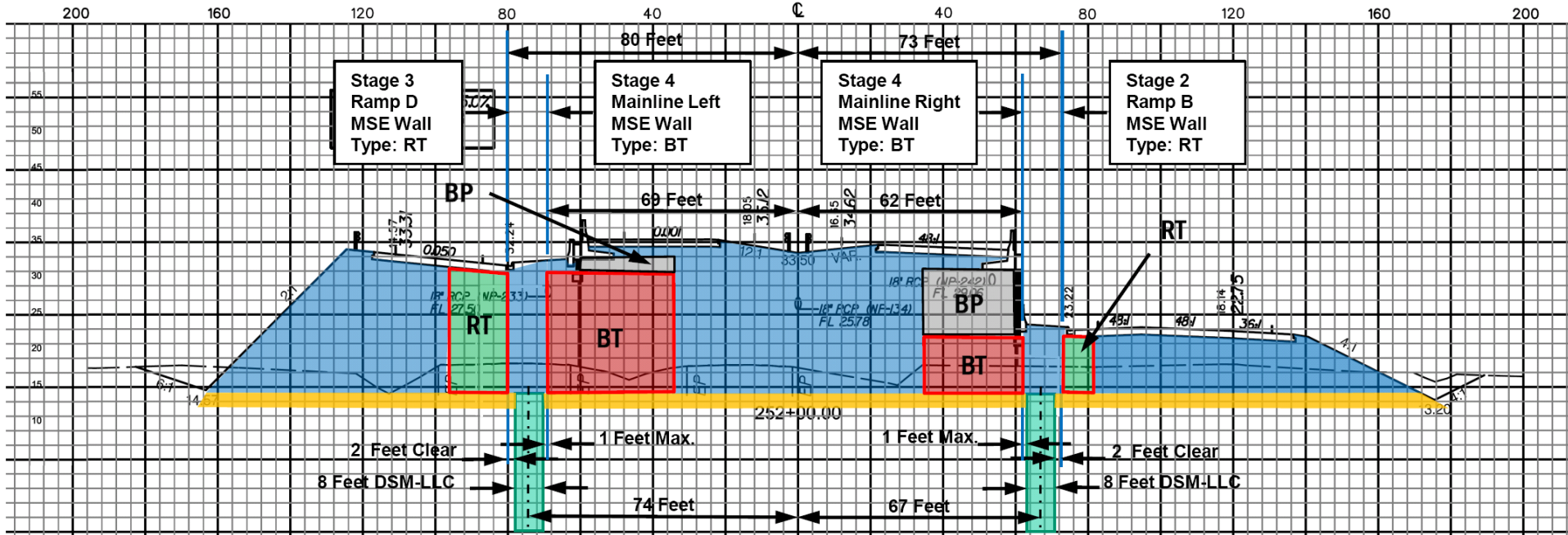
X- Section End Bent 7 (250+26)



- | | | | | | |
|-----------------------------------------------------------------------------------|-------------------------------------------------------|-------------------------------------------------------------------------------------|-------------------|---------------------------------------------------------------------------------------|------------------------------------|
|  | MSE Wall Type: BP |  | MSE Wall Type: BT |  | Sand Drainage Layer (PVD Drainage) |
|  | Light Weight Fill |  | MSE Wall Type: RT | | |
|  | Deep Soil Mixing Lime-Cement Columns - Grout Design A |  | MSE Wall Type: RP | | |
|  | Deep Soil Mixing Lime-Cement Columns - Grout Design B | | | | |

X- Section End Bent 7 (252+00)

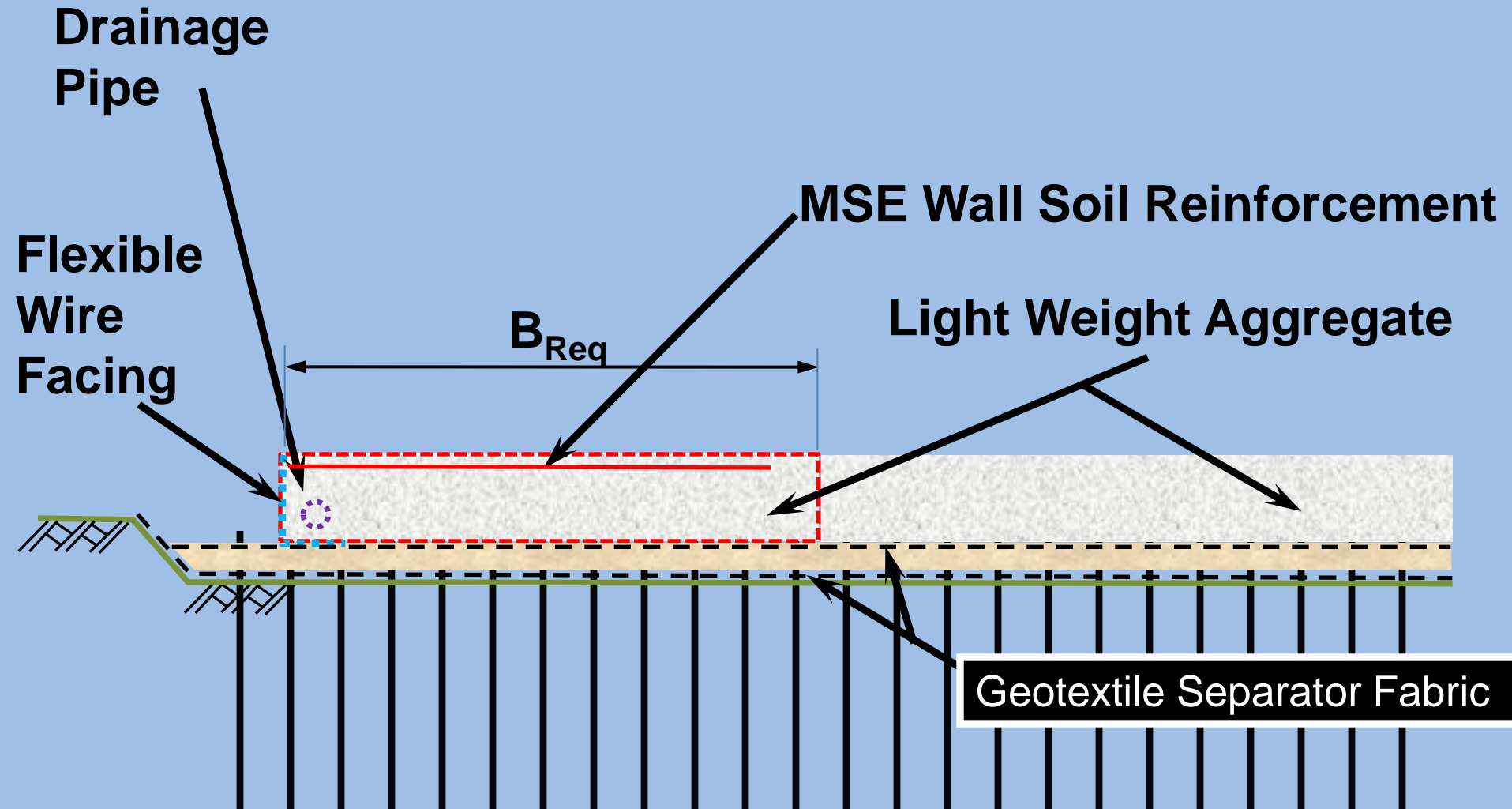
US 17 By-Pass Centerline



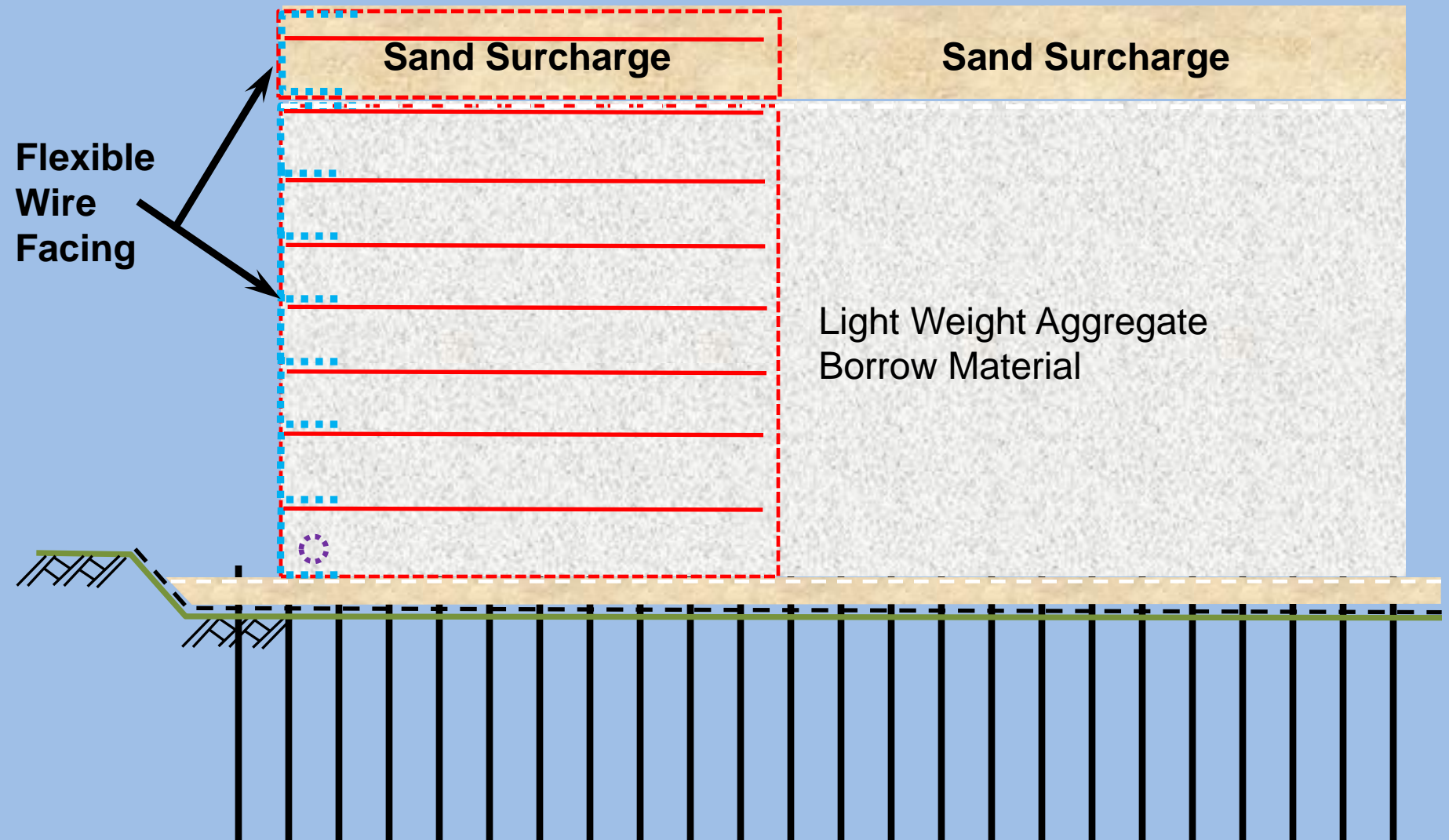
Legend

- MSE Wall Type: BP
- MSE Wall Type: BT
- Sand Drainage Layer (PVD Drainage)
- Light Weight Fill
- MSE Wall Type: RT
- MSE Wall Type: RP
- Deep Soil Mixing Lime-Cement Columns - Grout Design A

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



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



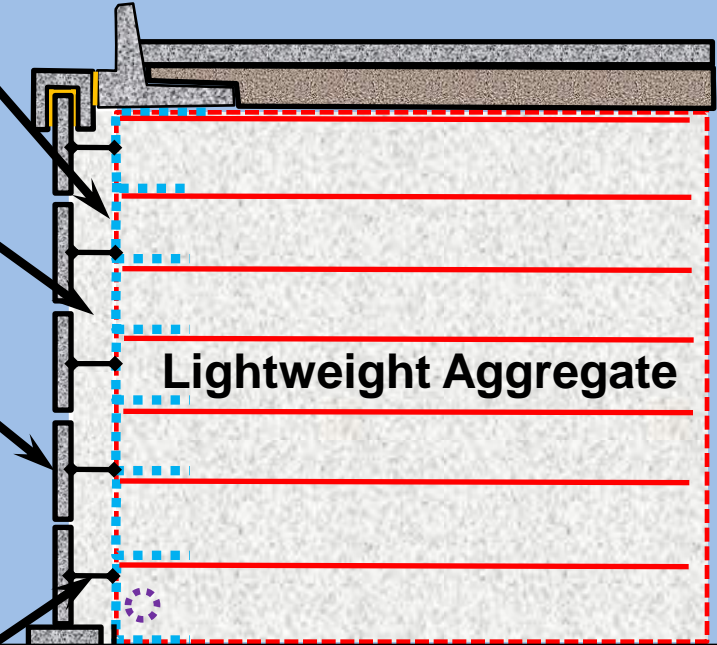
Permanent Precast Concrete Segmental Panel

Flexible Wire Facing

Fill Void w/Light Weight Fill

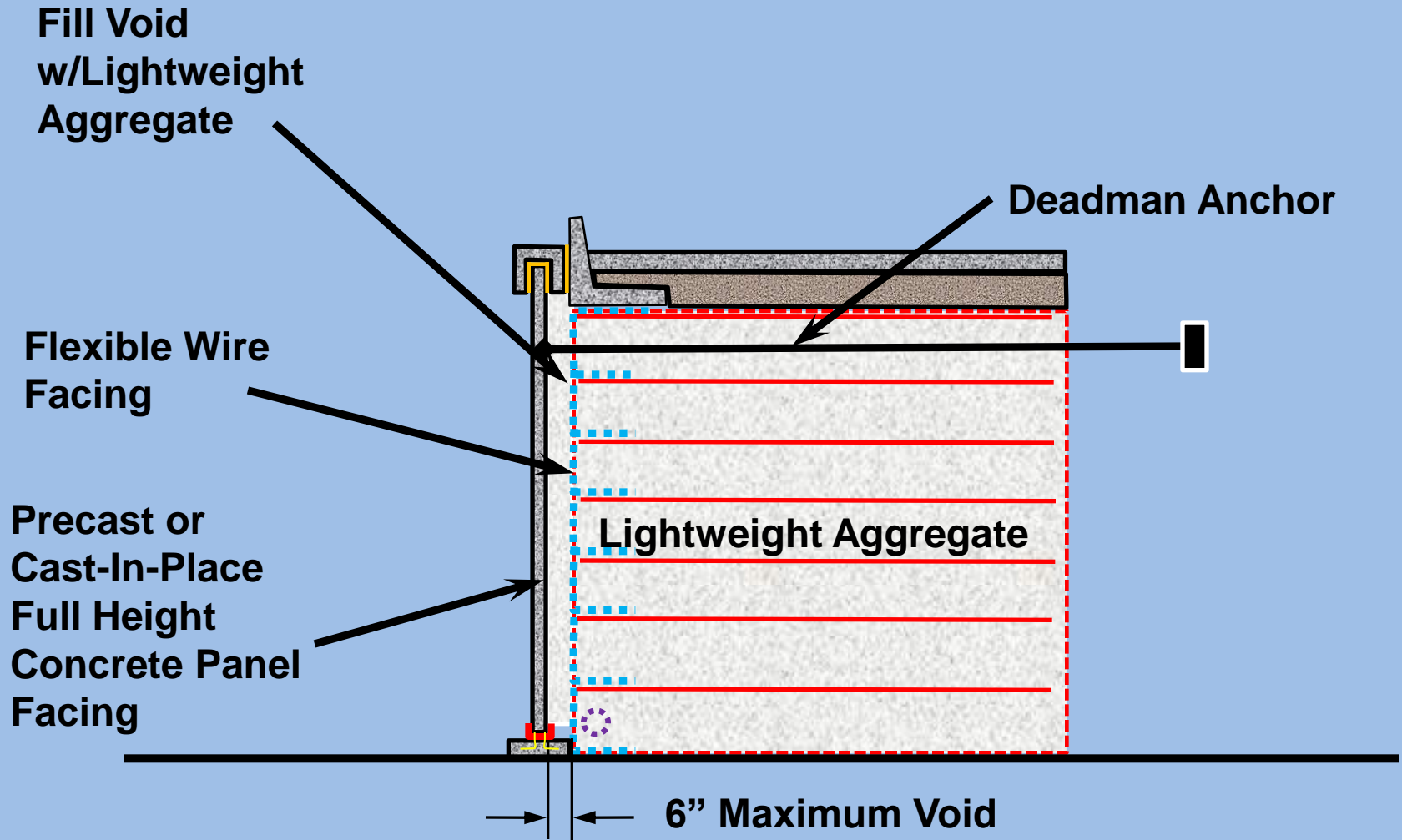
Precast Concrete Segmental Panel

Precast Concrete Panel Connector



1' Minimum
2' Maximum

Permanent Full Height Concrete Panel (Pre-Cast or Cast-In-Place)



MSE Walls

Permanent MSE Walls

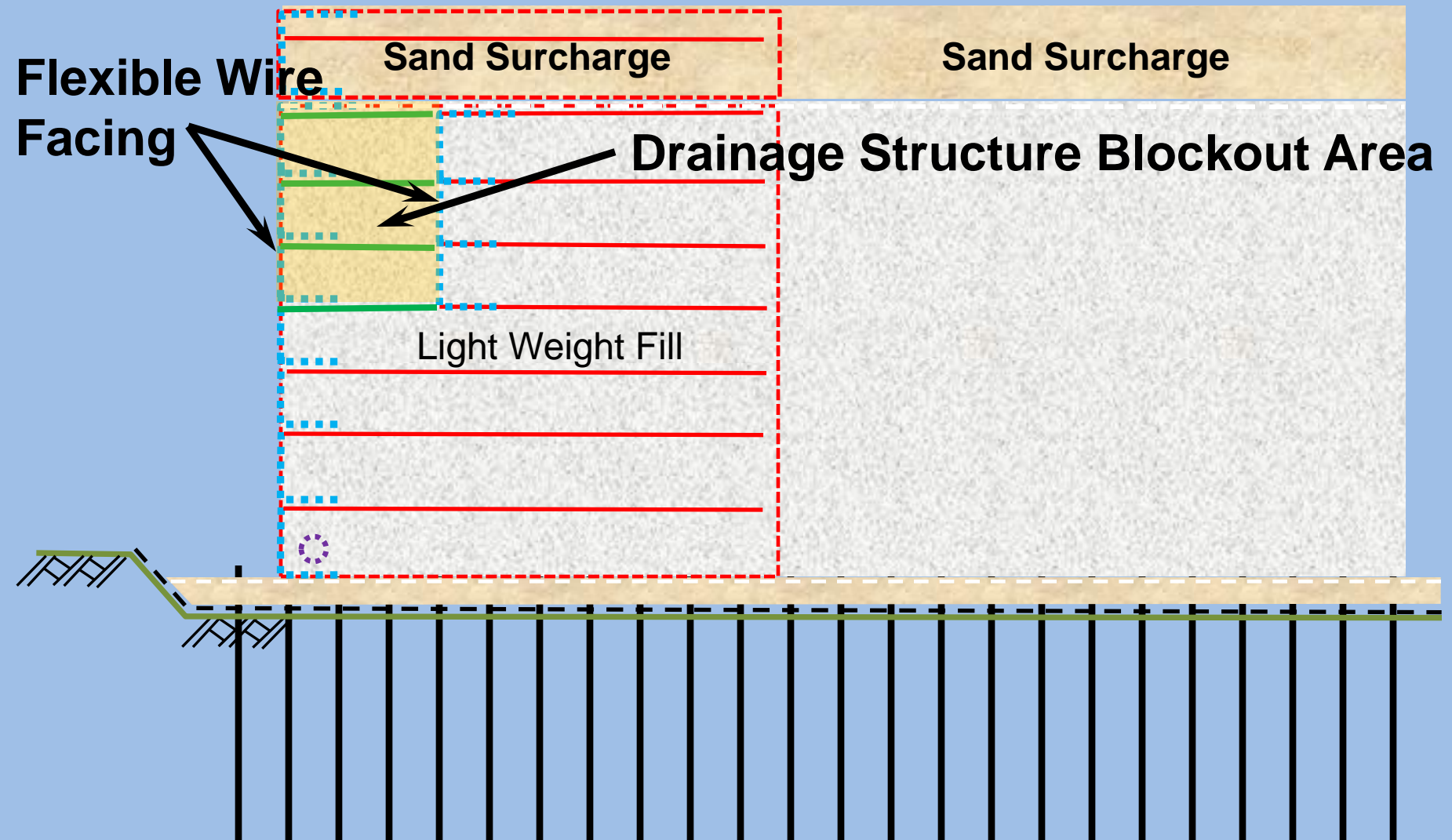
- Two-Stage Construction
- Three-Stage Construction (w/Drainage Structures)

Temporary MSE Walls

(Welded Wire Mesh Facing)



3-Stage MSE Wall Construction With Drainage Structure (Stage 1 of 3)

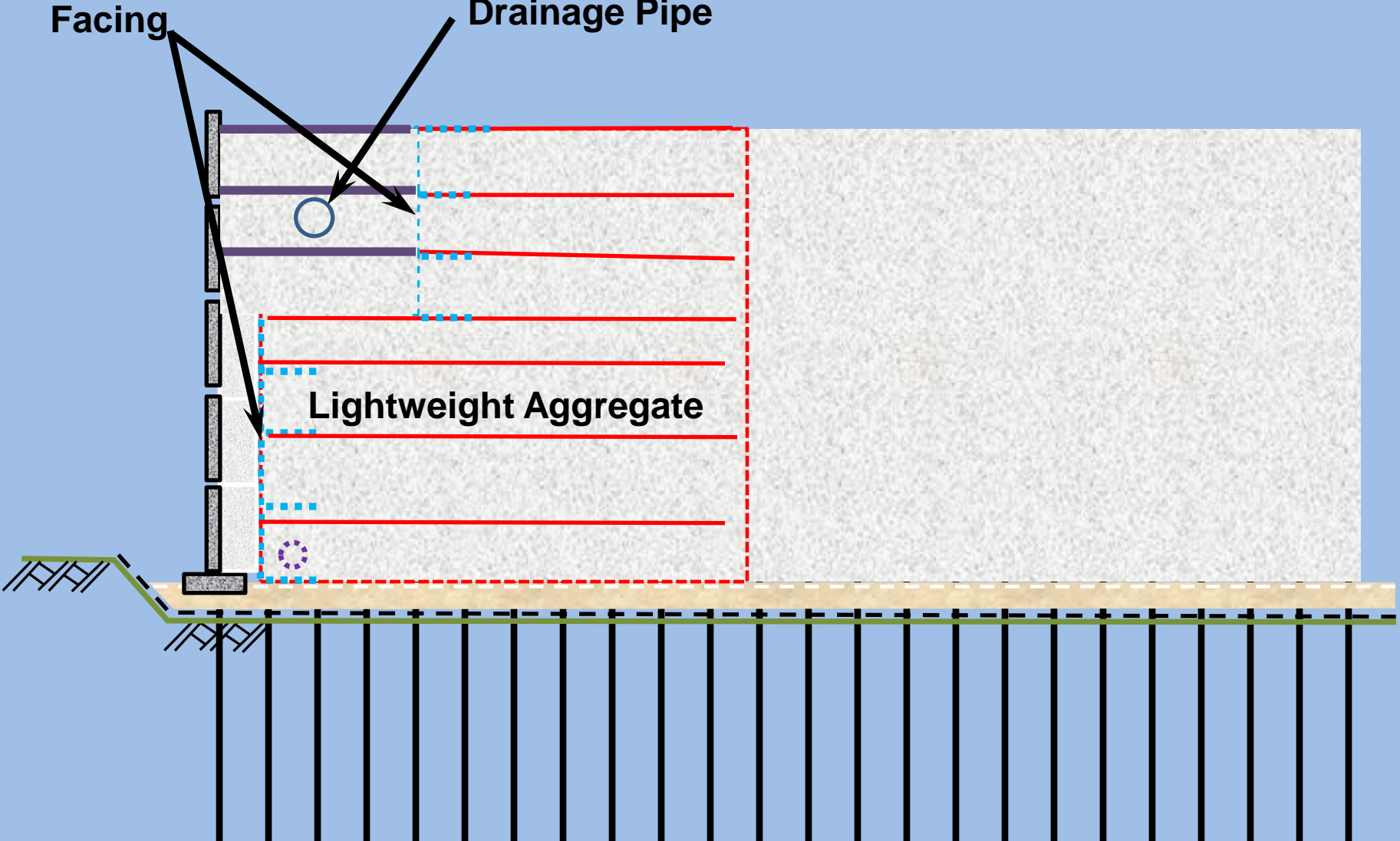


3-Stage MSE Wall Construction With Drainage Pipe (Stage 2 of 3)

Flexible Wire Facing

Drainage Pipe

Lightweight Aggregate

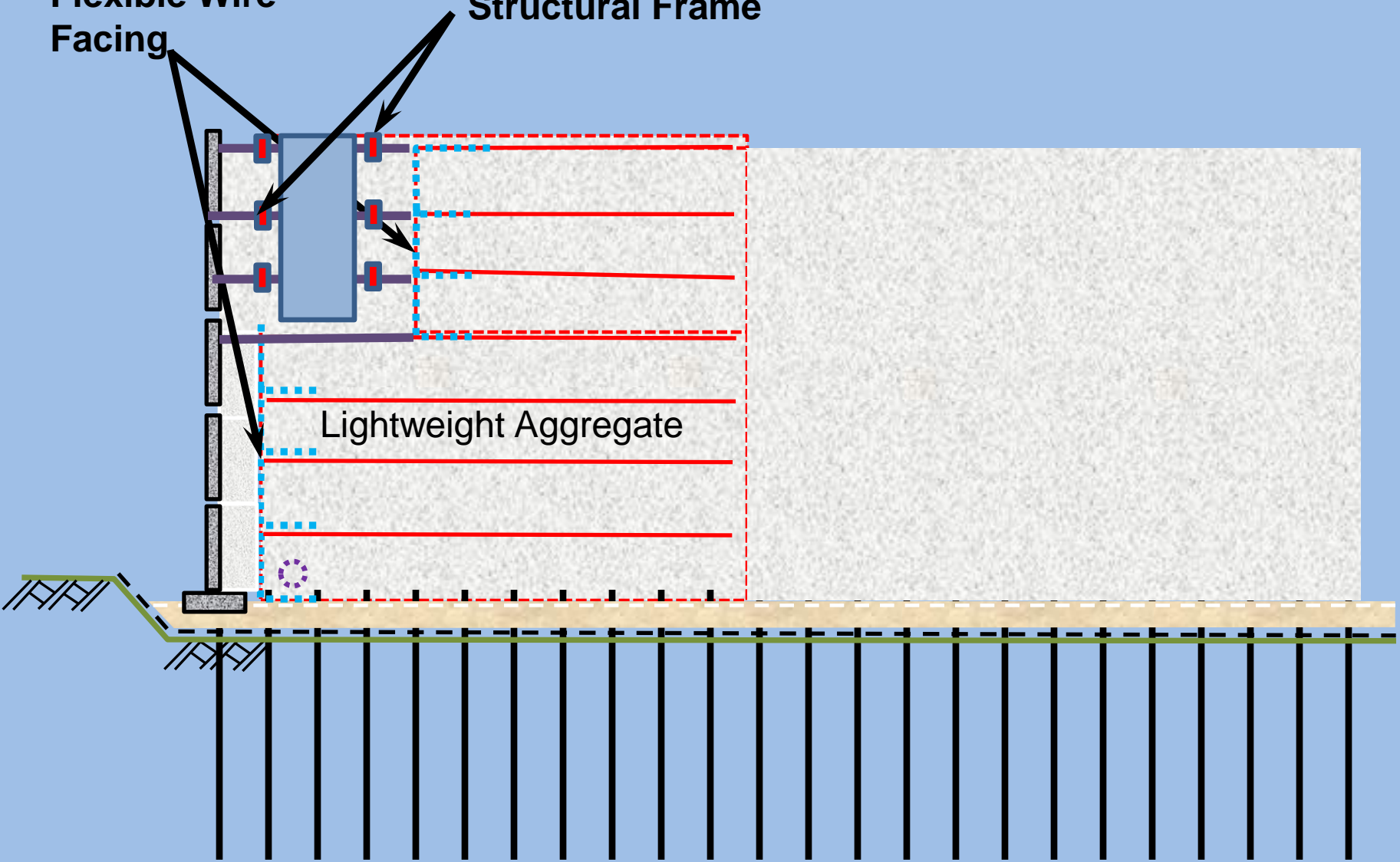


3-Stage MSE Wall Construction With Drainage Structure (Stage 2 of 3)

Flexible Wire Facing

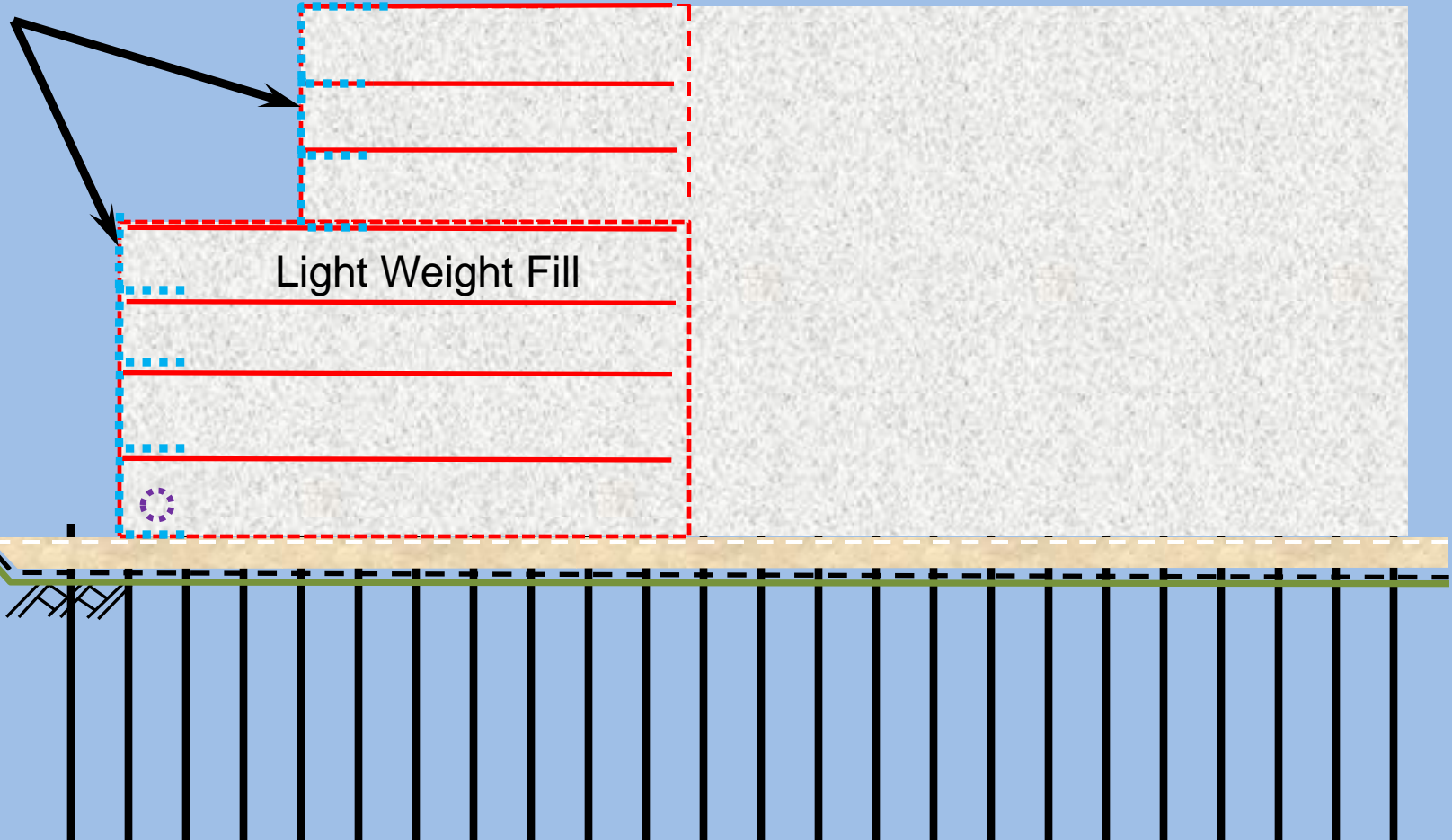
Structural Frame

Lightweight Aggregate



3-Stage MSE Wall Construction With Drainage Structure (Stage 2 of 3)

Flexible Wire Facing

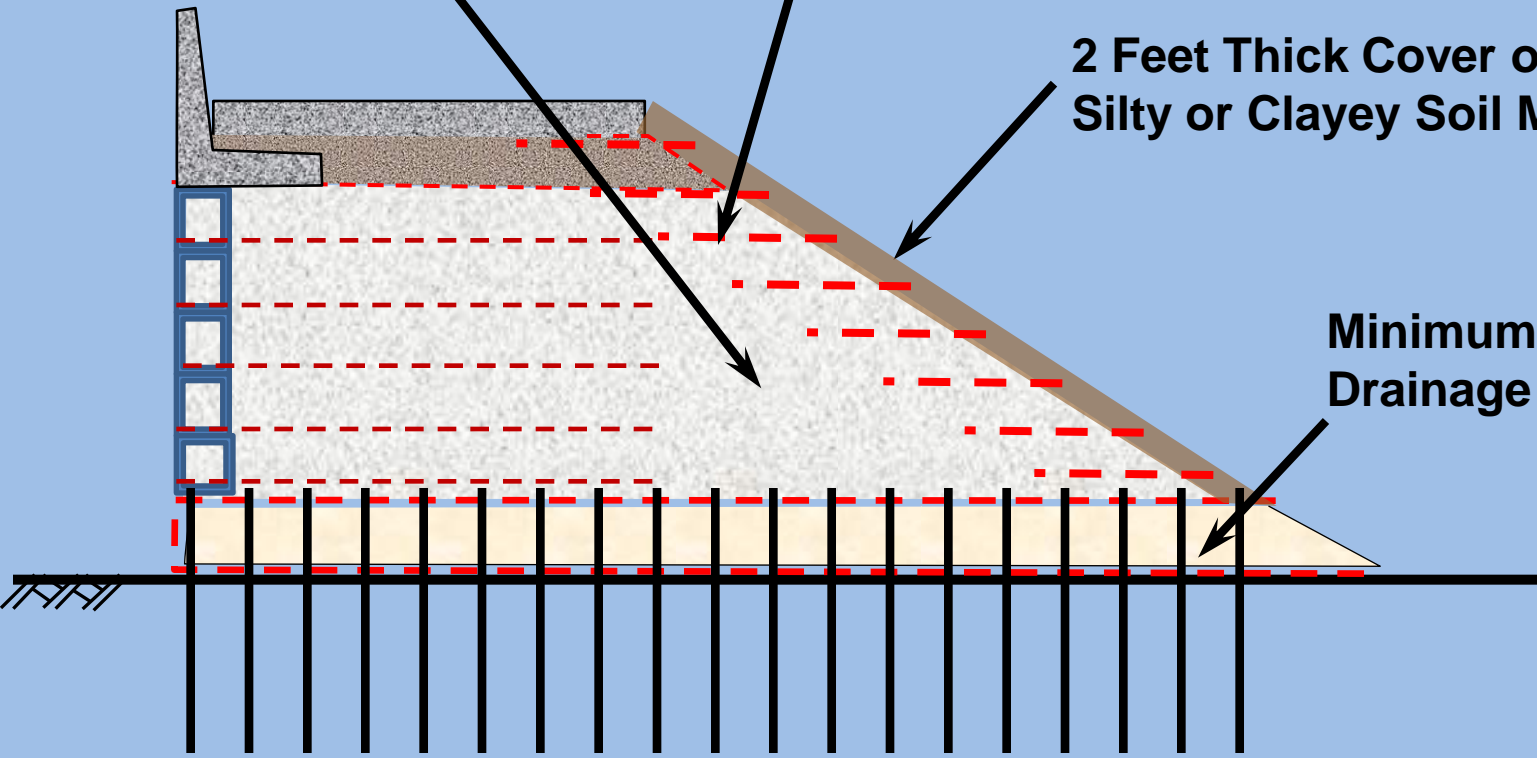


Lightweight Aggregate Borrow Material

4 Feet Long Biaxial Geogrids Placed on 2 Feet Vertical Spacing

2 Feet Thick Cover of Borrow Silty or Clayey Soil Materials

Minimum 2 Feet Drainage Layer

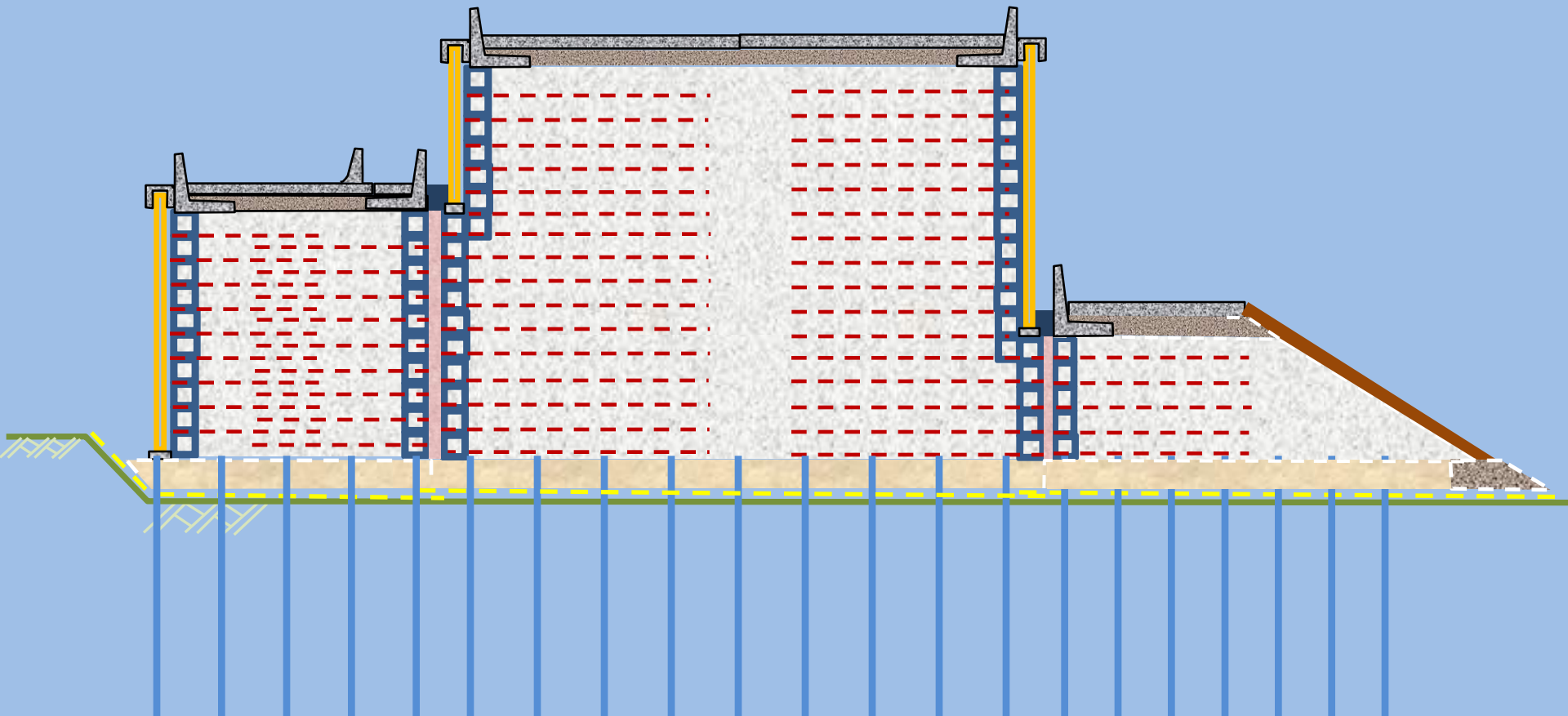


Project Construction Phase (North Abutment – Sta. 252+00)

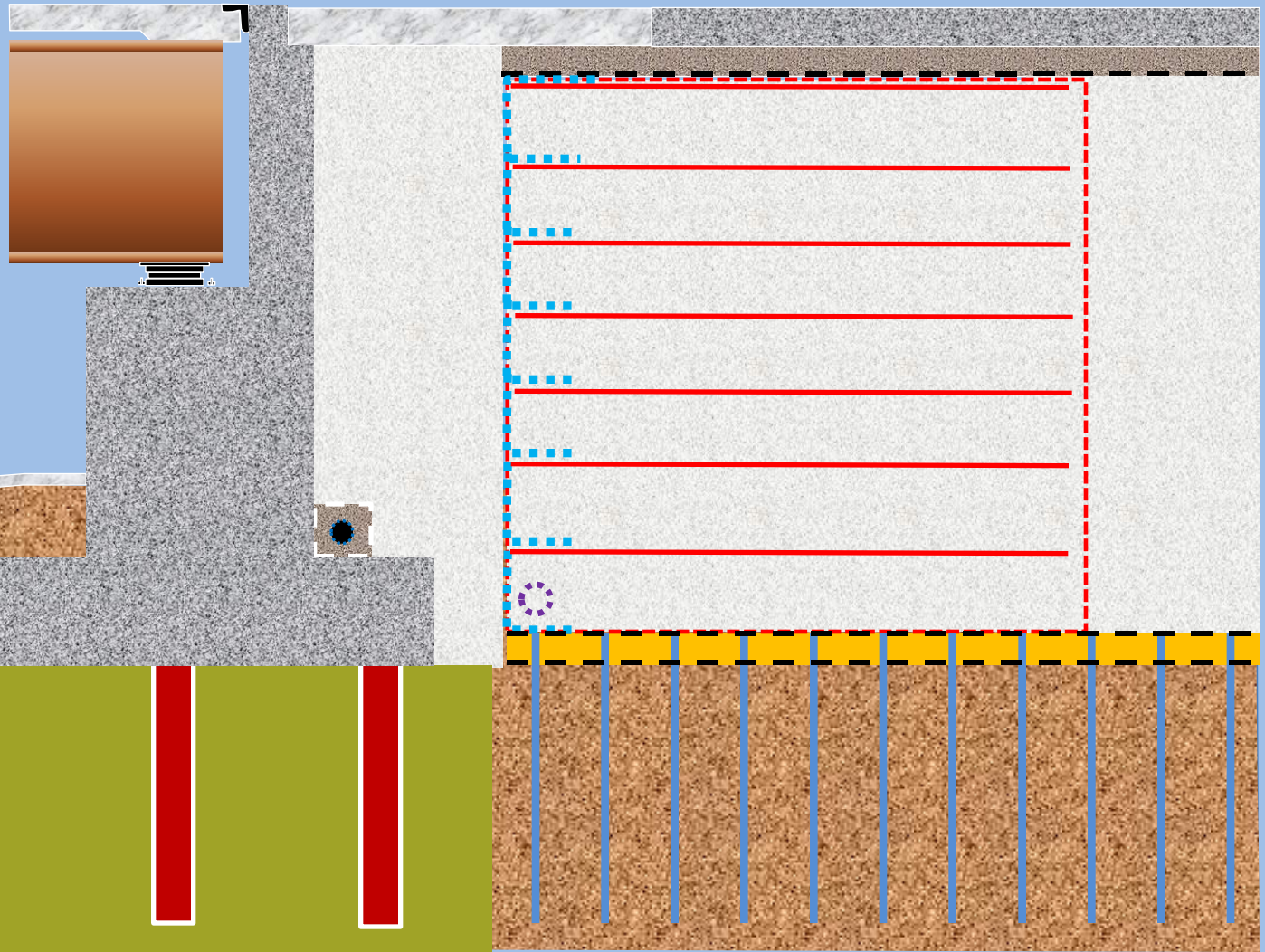
Ramp D
Stage 3

Bridge Approach Embankment
Stage 4

Ramp B
Stage 2



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?**