Wall Considerations

INDOT Bridge Design Conference - 2025

Agenda

- Summary of basic wall types
- Geometry and situational considerations
- Phaseline and temporary walls
- Pre-cast concrete modular walls
- MSE wall updates

Explore with

Wall Types by Construction Method

Fill Wall - Walls built from the bottom up


CAT

Wall Types by Construction Method

Cut Wall - Walls built from the top down


CAT
315F


JLG
JLG LIFT


RR
RIETH-RILEY
CAT
336E

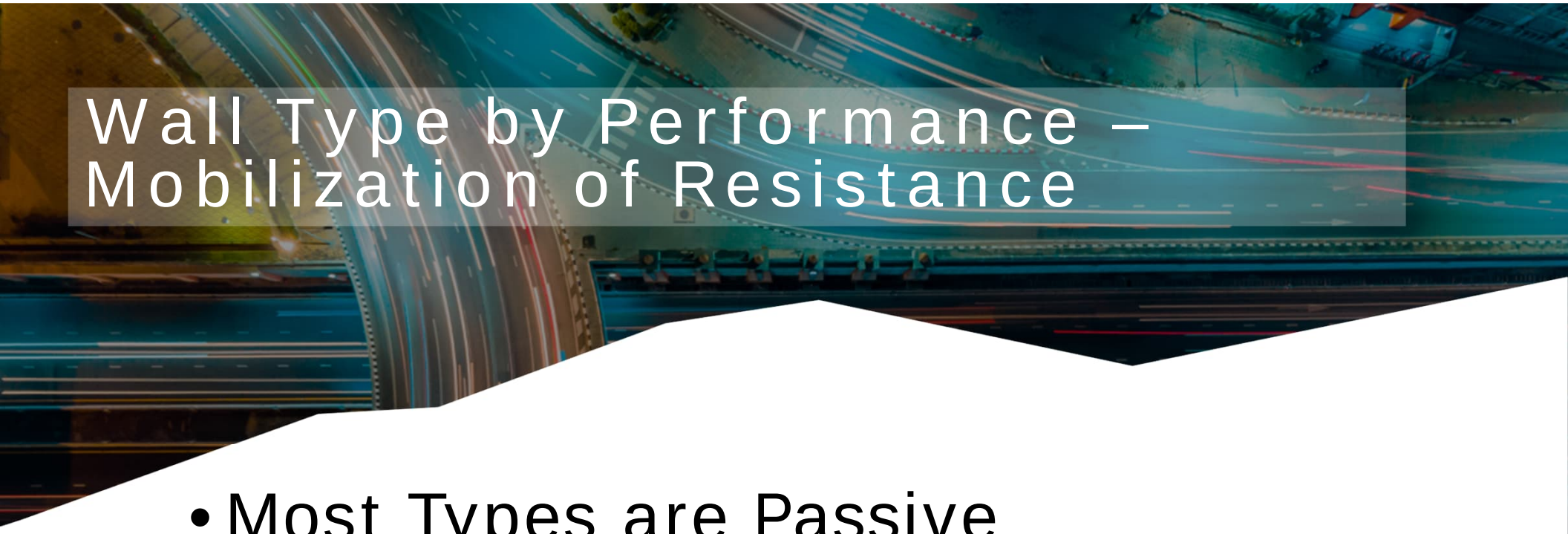
Wall Types – Development of Resistance

Internally Stabilized

Wall Types – Development of Resistance

Externally Stabilized


A-87 1" 24/40
A-88 1" 24/40



Wall Type by Performance – Mobilization of Resistance

- Most Types are Passive
  - Friction
  - Bearing
  - Passive Earth Pressure

  *Deflections are geotechnical

Wall Type by Performance – Mobilization of Resistance

- Versus Non-Passive
  - Strutted
  - Braced
  - Tied

  *Deflections are structural or a combination of structural and geotechnical (soil-structure interaction)


To perform the most

Wall Types – Groups per Chp 410

- Group 1
  - Completely detailed by designer
  - Not proprietary

Wall Types – Groups per Chp 410

- Group 2
  - Envelope, aesthetics, performance provided by designer
    - This includes certain minimum dimensions for external stability
  - Supplier completes detailed design
  - Proprietary

Wall Types – Cost Considerations

- 731 – about $70/sq ft (permanent)
  - Two Systems on Approval List
- 735 – about $25/sq ft (temporary)
- Cost is in the facing (tripled the cost)

Explore with

Wall Types – Cost Considerations

- 734 – $200 to $300+ /sq ft (permanent)
- 3 to 5 Times The Cost of a Fill Wall
- Labor, Time

Explore with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321D

Wall Types – Cost Considerations

- Fill walls are almost always less expensive even in cut situations.
- Why?

Explore with


REMINGTON

Wall Types – Cost Considerations

- Let Contractor Optimize & Take the Risk (ISS 734)

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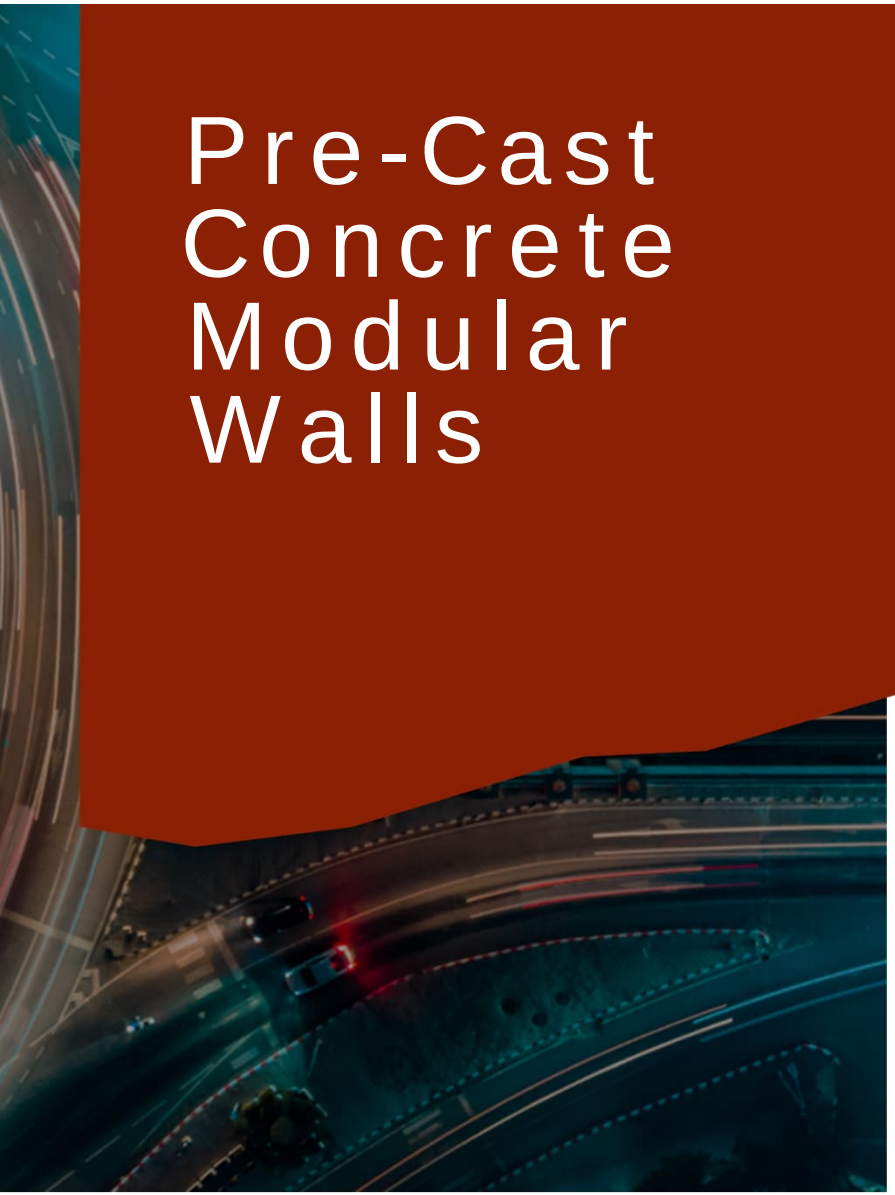
Phaseline & Temporary Walls

- Types fall into the same buckets as permanent walls
- Phaseline Construction Typical Wall Types
  - Cut in Phase 1 and fill in Phase 2
  - Costs add up fast

Explore with



Pre-Cast Concrete Modular Walls

Explore with


45th St - Google Maps
https://www.google.com/maps/@41.5400401,-87.5058875,3a,75y,81.83h,77.95t/data=!3m7!1e1!3m5!1sYS_2rTOuSCRdavpNUdajGA!2e0!6shttps:%2F%2Fstreetviewpixels-pa.googleapis.com%2Fv1%2Fthumbnail%3Fcb_clien...
41°32'24.9"N 87°30'19.2"W
45th St
Munster, Indiana
Google Street View
Jun 2024
See more dates
Share
45th St
Google
Image capture: Jun 2024 © 2025 Google United States Terms Privacy Report a problem

Pre-Cast Concrete Modular Walls

- What type of wall is it?
- Driven, in part, by railroad industry
- No INDOT list of pre-approved vendors
- RECo and Gravix most-known

Pre-Cast Concrete Modular Walls

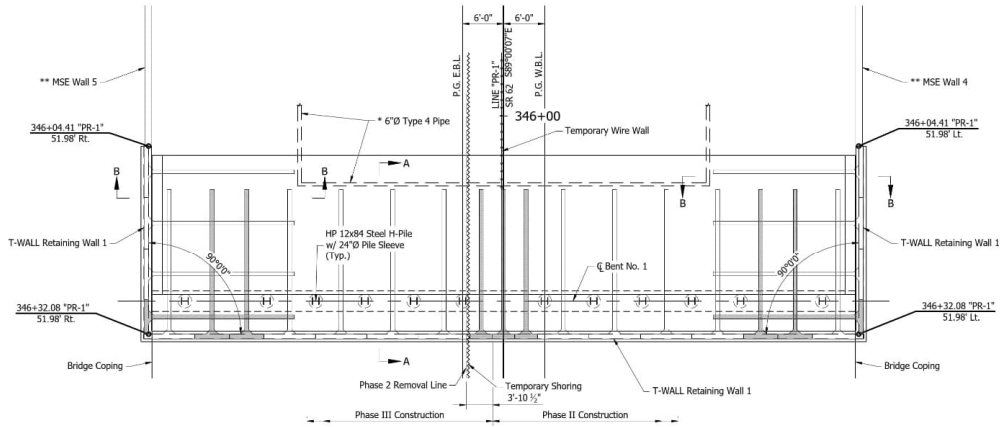
- What do we need to show in plans?
  - Geotech determines “strap” length
    - 0.6H min stem length
  - Piling and pile spacing
- Bin Wall Approach for Bearing, Sliding

LEGEND

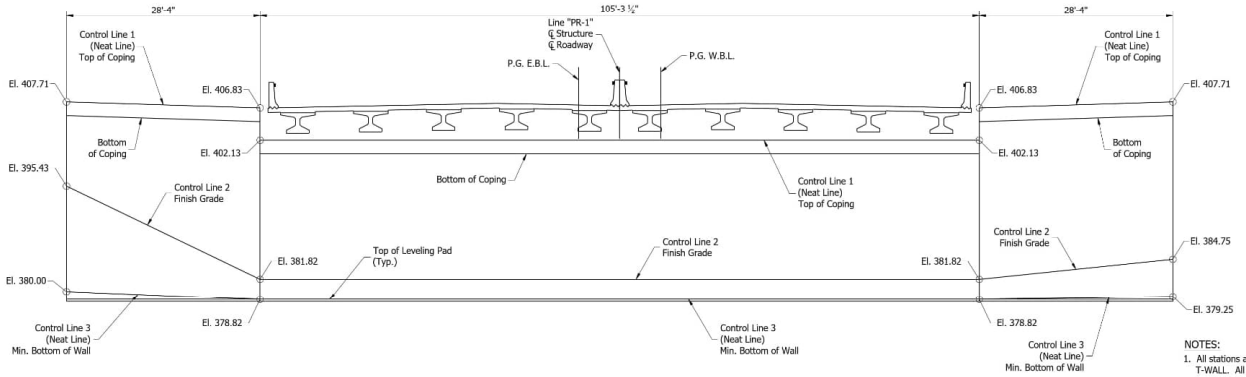
Denotes 5'-0" T-WALL Panel Face Width

Denotes 3'-3" T-WALL Panel Face Width

Denotes 7'-6" T-WALL Panel Face Width



PLAN
(AT BENT NO. 1)



ELEVATION
(AT BENT NO. 1)

* Pipe shall tie into MSE Wall drainage.

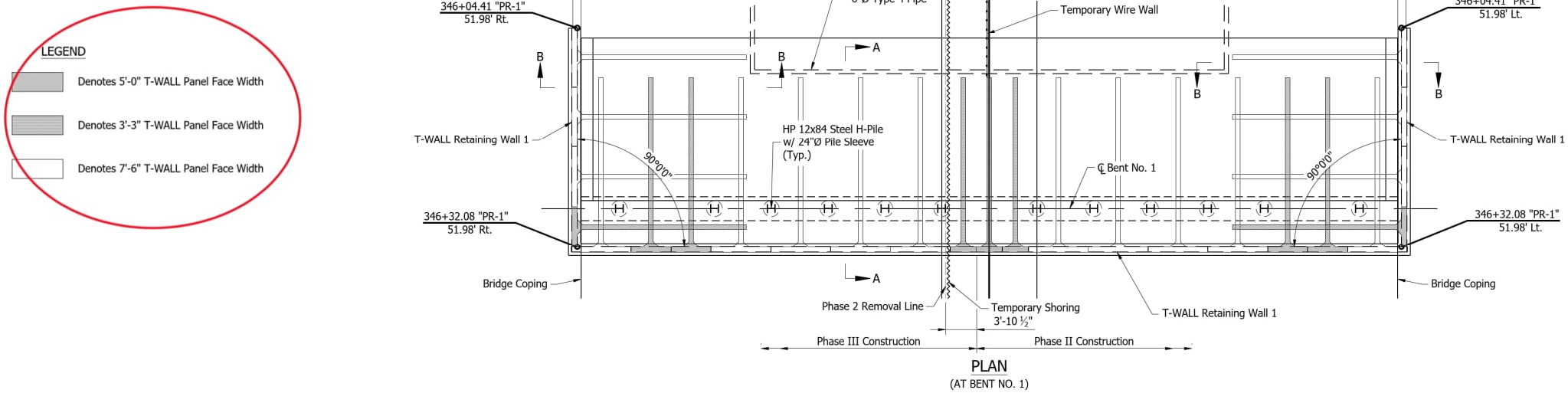
** The back face of MSE Wall and T-WALL Retaining Wall coping interface shall be flush. There shall be a vertical slip joint between the MSE Wall and T-WALL Retaining Wall.

NOTES:

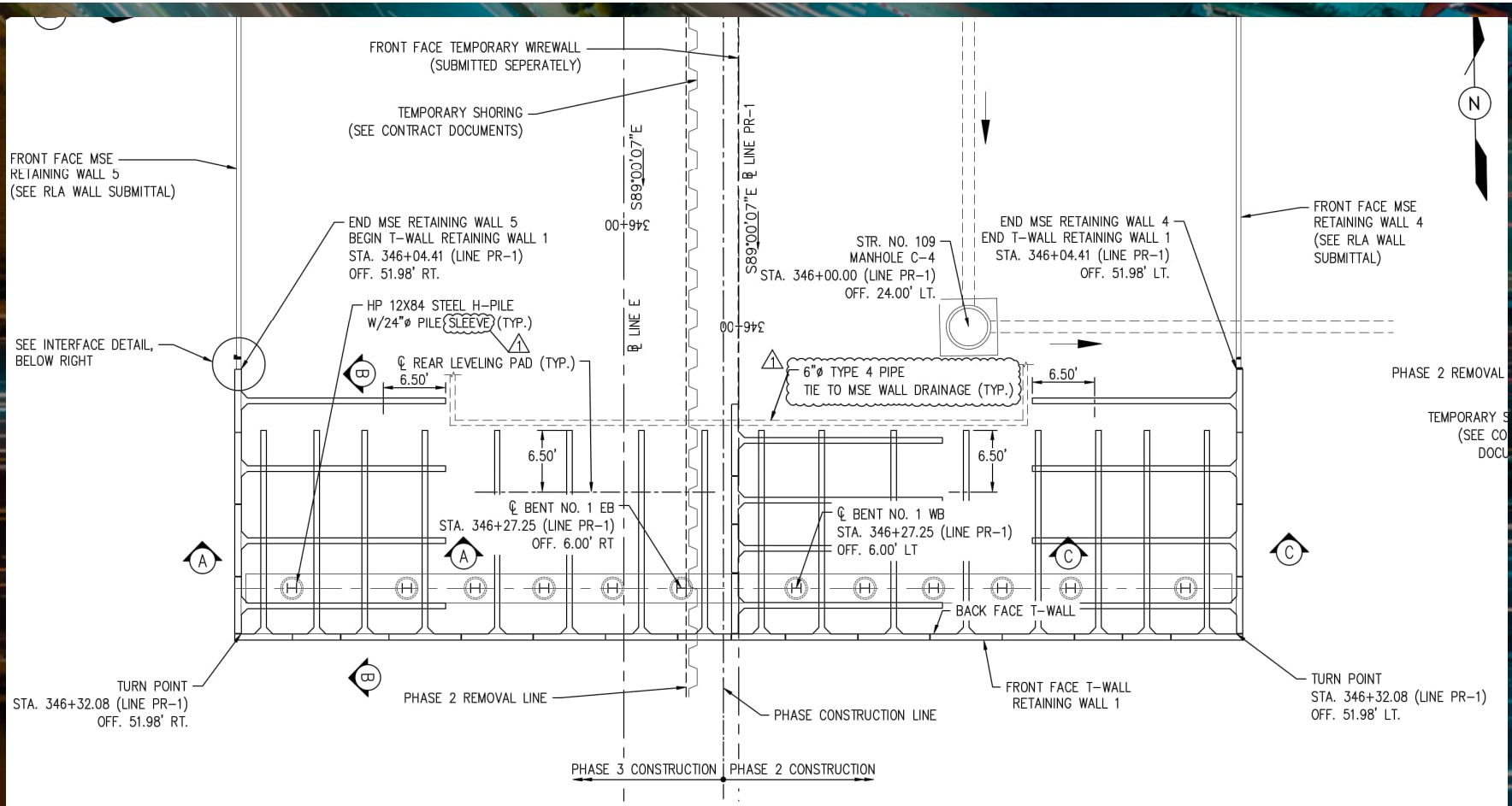
1. All stations and offsets in Plan View are taken from the back face of T-WALL. All stations, lengths and elevations are taken from the front face of T-WALL in Elevation View.
2. For Section A-A & B-B, see Sheet 12.
3. Invert elevations for 6"ϕ Type 4 Pipe to be determined by Contractor.
4. Minimum factored bearing resistance of 7,000 psf.

RECOMMENDED FOR APPROVAL	DESIGN ENGINEER	10/31/2023 DATE	INDIANA DEPARTMENT OF TRANSPORTATION
DESIGNED: ACS	DRAWN: VCH		T-WALL DETAILS
CHECKED: MAR	CHECKED: ACS		

HORIZONTAL SCALE	BRIDGE FILE
1/8"=1'-0"	062-82-10333
VERTICAL SCALE	DESIGNATION
1/8"=1'-0"	1600060
SURVEY BOOK	SHEET
ELECTRONIC	10 of 40
CONTRACT	PROJECT
R-42287	1900308

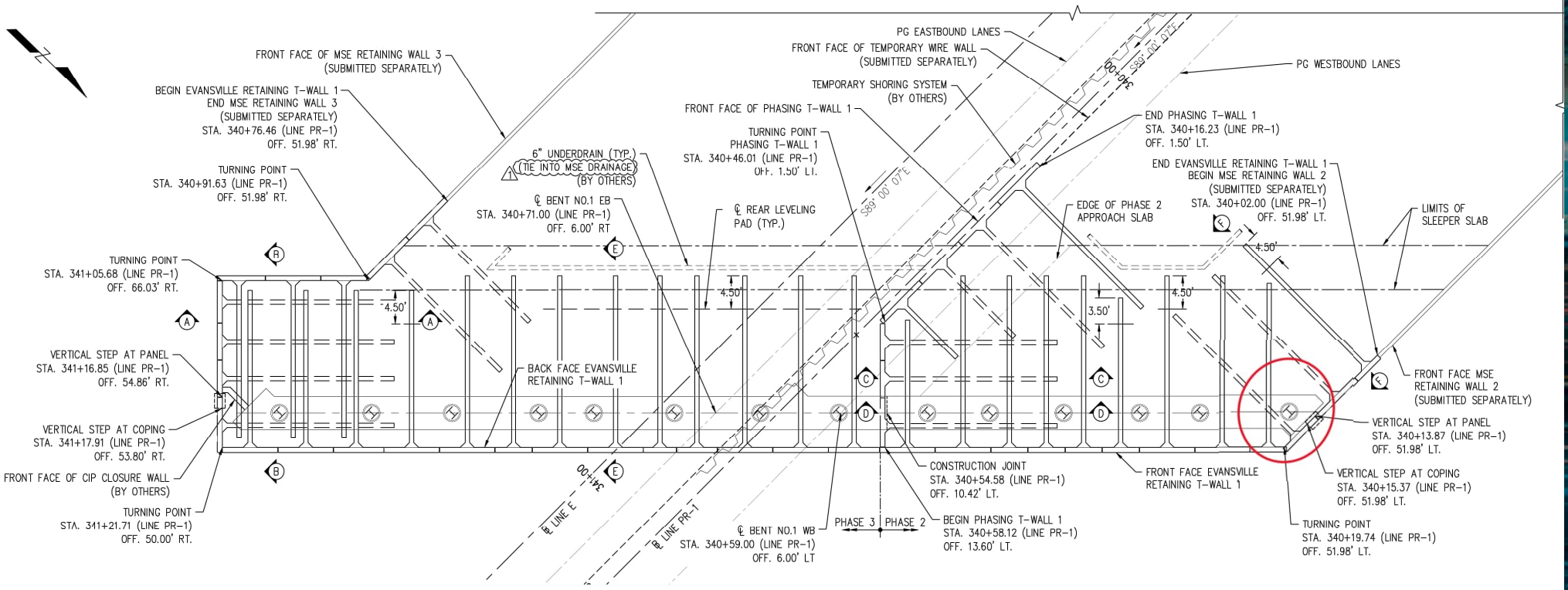


PLAN
(AT BENT NO. 1)

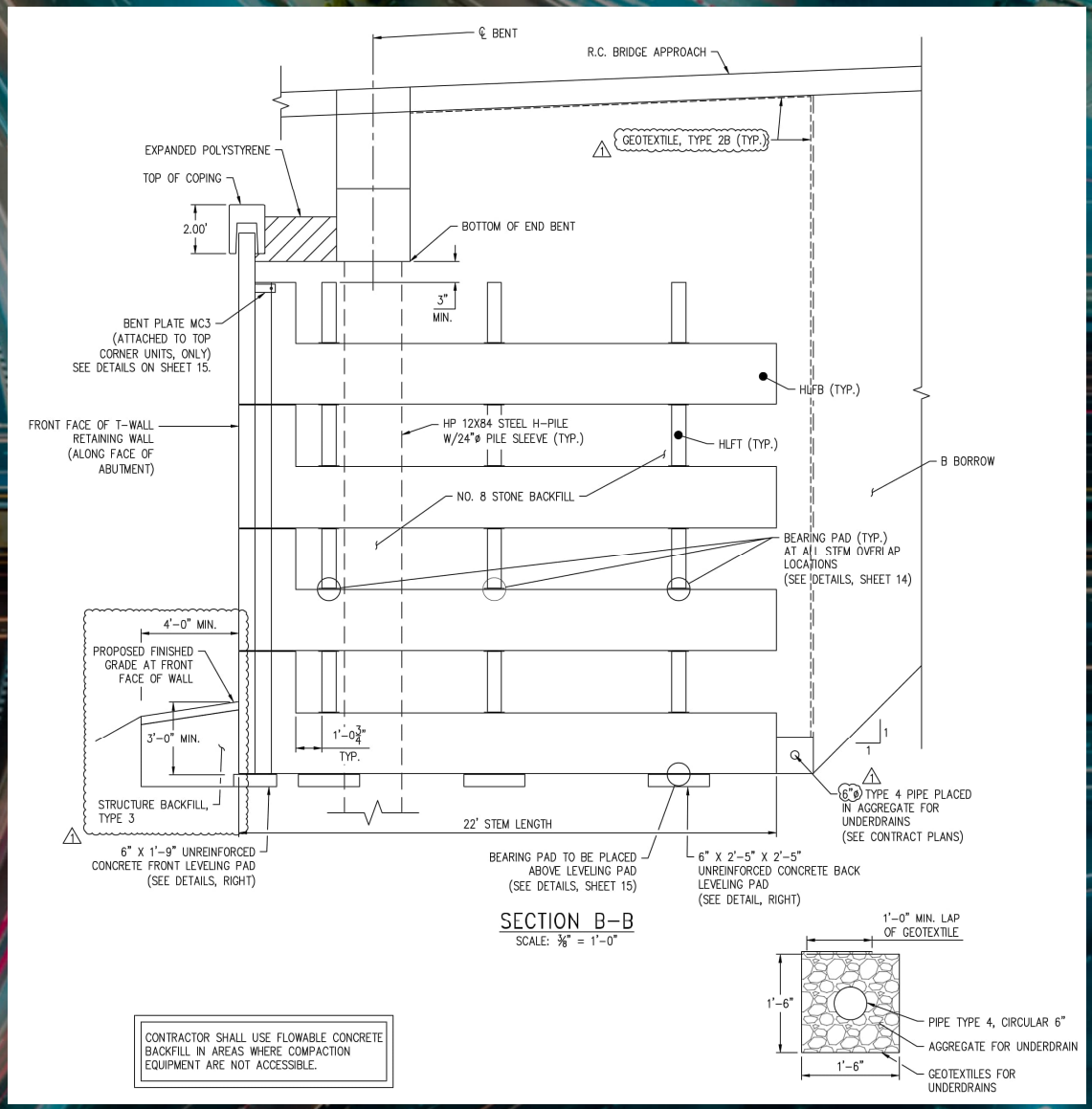


PLAN VIEW – T-WALL RETAINING WALL 1 AT BENT NO. 1

ENSION IN FEET UNLESS OTHERWISE NOTED



PLAN VIEW – EVANSVILLE RETAINING T-WALL 1 AT BENT NO. 1


℄ BENT
R.C. BRIDGE APPROACH
GEOTEXTILE, TYPE 2B (TYP.)
EXPANDED POLYSTYRENE
TOP OF COPING
2.00'
BOTTOM OF END BENT
3" MIN.
BENT PLATE MC3 (ATTACHED TO TOP CORNER UNITS, ONLY) SEE DETAILS ON SHEET 15.
HLFB (TYP.)
FRONT FACE OF T-WALL RETAINING WALL (ALONG FACE OF ABUTMENT)
HP 12X84 STEEL H-PILE W/24"ø PILE SLEEVE (TYP.)
HLFT (TYP.)
B BORROW
NO. 8 STONE BACKFILL
BEARING PAD (TYP.) AT ALL STEM OVERLAP LOCATIONS (SEE DETAILS, SHEET 14)
4'-0" MIN.
PROPOSED FINISHED GRADE AT FRONT FACE OF WALL
3'-0" MIN.
1'-0¾" TYP.
1
1
6"ø TYPE 4 PIPE PLACED IN AGGREGATE FOR UNDERDRAINS (SEE CONTRACT PLANS)
STRUCTURE BACKFILL, TYPE 3
22' STEM LENGTH
6" X 1'-9" UNREINFORCED CONCRETE FRONT LEVELING PAD (SEE DETAILS, RIGHT)
BEARING PAD TO BE PLACED ABOVE LEVELING PAD (SEE DETAILS, SHEET 15)
6" X 2'-5" X 2'-5" UNREINFORCED CONCRETE BACK LEVELING PAD (SEE DETAIL, RIGHT)
SECTION B-B
SCALE: ⅜" = 1'-0"
1'-0" MIN. LAP OF GEOTEXTILE
1'-6"
1'-6"
PIPE TYPE 4, CIRCULAR 6"
AGGREGATE FOR UNDERDRAIN
GEOTEXTILES FOR UNDERDRAINS
CONTRACTOR SHALL USE FLOWABLE CONCRETE BACKFILL IN AREAS WHERE COMPACTION EQUIPMENT ARE NOT ACCESSIBLE.


DEERE

Pre-Cast Concrete Modular Walls

- USP is from Railroad, Needs editing
- Lloyd Expressway
  - Cost was 2 to 2.5 times MSE

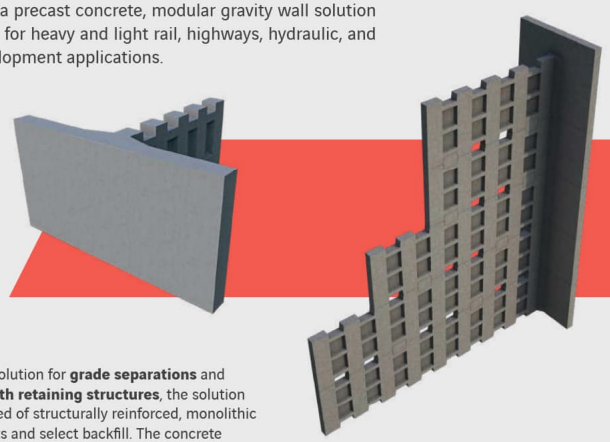
Pre-Cast Concrete Modular Walls

- Feedback from the Lloyd
  - Break out pay items.
  - ¼ in. tolerance between panels too much.
  - Consider allowing variable stem lengths.
  - Watch transition at MSE wall.

T-Wall

Precast modular gravity wall

T-Wall is a precast concrete, modular gravity wall solution designed for heavy and light rail, highways, hydraulic, and site development applications.



A proven solution for **grade separations** and typical **earth retaining structures**, the solution is composed of structurally reinforced, monolithic T-Wall units and select backfill. The concrete facing units have monolithic perpendicular stems**, forming the shape of a "T".**

The stems internally stabilize the wall, providing **pullout resistance** against the lateral earth pressure exerted on the back of the facing.

The T-Wall design methodology allows for a **stem length that varies over the height of the wall.** For routine applications, as the courses of units are stacked, the stems decrease in length and therefore **require less select backfill than alternatives.**

For special and permissible applications, the shortest possible T-Wall units are placed at the bottom of the retaining wall structure with successively longer units stacked above. This is referred to as **"Inverted T-Wall".**

T-Wall meets **AASHTO service life design requirements** (up to 100 years for bridges and 75 years for retaining walls) and can be designed for a **service life of up to 150 years.**

Benefits

- Essentially **maintenance-free**
- **No mechanical connections** or **external bracing** required
- In addition to using imported granular backfills, a wider range of backfills are possible such as on-site granular soils, recycled crushed concrete, bottom ash, slag, sand, flowable fill, and cellular concrete
- Variable length stems reduce **backfill quantities**
- Can be built **vertical** or **inclined**
- Allows choices for **architectural treatments, copings, barriers, utility conduits** and **catenary systems**

Robust T-Wall units efficiently provide the **stability** needed for building concrete **gravity retaining walls** that require performance **under extreme loading conditions**, for instance railways and bridges.


CAT

Pre-Cast Concrete Modular Walls

In cut scenarios

Using slot construction

Explore with

ACCEPTABLE SOILS FOR SLOT CUT:

OSHA Soil Classification

Type A Soils	Temporary Face Cut - 0.75H:1.00V (53 degrees) Slot Cut - 20' tall max.* and only open for 2 days max.
Type B Soils	Temporary Face Cut - 1H:1V (45 degrees) Slot Cut - 20' tall max.* and only open for 2 days max.
Type C Soils	Do not use slot cut (Consider inverted cross section)

*Note: All slot cuts greater than 20 feet in height must be approved by project geotechnical engineer.

OSHA SOIL CLASSIFICATION

Type A soil is cohesive and has a high unconfined compressive strength; 3,000 lbs per square soil is cohesive and has a high unconfined compressive strength; 3,000 lbs per square foot or greater. examples of type a soil include clay, silty clay, sandy clay, and clay loam. soil cannot be classified as type A if it is fissured, if it has been previously disturbed, if it has water seeping through it, or if it is subject to vibration from sources such as heavy traffic or pile drivers.

Type B soil is cohesive and has often been cracked or disturbed, with pieces that don't stick soil is cohesive and has often been cracked or disturbed, with pieces that don't stick together as well as type a soil. type b soil has medium unconfined compressive strength; between 1,000 lbs and 3,000 lbs per square foot. examples of type b soil include angular gravel, silt, silt loam, and soils that are fissured or near sources of vibration, but could otherwise be type a.

Type C soil is the least stable type of soil. type c includes granular soils in which particles soil is the least stable type of soil. type c includes granular soils in which particles don't stick together and cohesive soils with a low unconfined compressive strength; 1,000 lbs per square foot or less. examples of type c soil include gravel, and sand. because it is not stable, soil with water seeping through it is also automatically classified as type c soil, regardless of its other characteristics.

For additional information refer to osha "soil classification" and "sloping and benching"

EARTH WALL PRODUCTS

earthwallproducts.com

PH 678.594.3451

SCALE: N.T.S.

MSE Walls

- Checked with Aamir – not sure when shop review checklist will be updated.

Explore with

MSE Wall Repairs

- IDIQ Contract for MSE Wall Repairs

- Contract No. B-43196-A
- January 2021 Letting
- 30 Wall Locations on Original List
- Beaty, American Structurepoint, Terracon

Explore with

MSE Wall Repairs

- Most Common Issue
  - Loss of Structure Fill
    - From erosion
    - From leaks through joints
  - Insufficient Compactive Efforts?

Explore with

MSE Wall Repairs

- Loss of Structure Fill From Erosion
  - Water from deck and roadway coming down into the wall envelope
  - Water entering structure fill from joint at deck and approach slab and also between approach slab and barrier

MSE Wall Repairs

- Loss of Structure Fill From Erosion
  - Remove riprap, reset panels, fill voids with flowable fill
  - Install curb and redirect water
  - Use pre-compressed foam for joint repair

MSE Wall Repairs

- Supplemental Panel Support via Nails
  - Review shop drawings – typically available.
  - Review calculations for internal stability – available about half the time.

Explore with

MSE Wall Repairs

- Changes in Design and Construction
  - Pay attention to the details for managing water runoff
  - Structure fill type – change has been made in 2024 ISS.
  - Enforce ISS already in place.

Explore with


Terracon
QUESTIONS, COMMENTS,
DISCUSSION