

Geotech Feedback for Designers

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Outline

- Geotechnical Investigation Requirements
- Timeline for Geotechnical investigation
- Potential Design Issues
- How to Avoid Problems During/Post Construction
- Recommendations



Geotechnical Investigation Requirements

- Projects that do not need geotechnical investigation
- Projects that Qualify for Soil Waivers
- Pavement Parameter Report
- Pavement Core Report
- Geotechnical Data Report
- Full Geotechnical Report

Note: INDOT Geotechnical Engineering Division does not get involved in LPA projects

107-2.0 Geotechnical Waiver or Investigation

The following project work types will not require a geotechnical waiver or investigation:

No waiver needed for non-earthwork maintenance activities.

Examples: pavement markings, guardrails, signals, mowing, etc.

Beautification / Wildflowers	Bridge Inspection	Remove & Replace Beam
Centerline & Edge Line Rumble Stripes Installation	Bridge Painting	Repair Or Replace Joints
Centerline Rumble Stripes Installation	ITS Operations And Maintenance Contracts	Repair Or Replace Lighting
Channel Clearing And Protection	ITS Program Contracted Services	Repair/Replace Cathodic Protection
Raised Pavement Markings, Closed Loop Interconnect System	ITS Program Equipment	Bridge Deck Sealing
	ITS Traffic Management Systems	Replace Guard Rail
Crack Sealing	ITS Traffic Monitoring Systems	Roadside Maintenance, Herbicide Treatment
Culvert Clean And Repair	ITS Traveler Information Systems	Roadside Maintenance, Mech.Sweeping
Curve Sign and Marking Visibility Improvements	Landscaping	Roadside Maintenance, Mowing
Debris Removal From Channel	Lighting	Roadside Maintenance, Tree Remov/Trimmg
Demolition	Lighting Installation / Maintenance	Small Structure Maint and Repair
Demolition, Remove Buildings, Foundations	Lighting Maintenance	Small Structure Paved Invert
Refurbished	Mitigate Runoff Pollution	Small Structure Pipe Lining
Environmental Mitigation	Modernize Continuous Lighting	Straighten Beam
Flashers, Modernize	New Flasher Installation	Substructure Repair And Rehabilitation
Guard Rail Attenuators, New Or Modernize	New Traf Flow Detection Devices/Hardware	Traffic Hardware Modernization
Guard Rail Work	Overhead Sign Repair	Traffic Signal Maintenance
Guardrail, Maintenance	Pavement Markings	Traffic Signal Repair
Guardrail, Maintenance Or Repair	PCCP Cleaning and Sealing Joints	Traffic Signal Visibility Improvements
Historical Site Preservation	Pedestrian Flashing Beacons, Installed	Un-Signalized Intersection Sign & Marking Visibility Imp
Install Loop Detector	Protective Buying	Utility Relocation
	Railing Replace Or Repair	

107-2.0 Geotechnical Waiver or Investigation

A project belonging to one of the following work types may qualify for a waiver but will require review by the Office of Geotechnical Engineering prior to that determination:

Arch Reconstruction Or Repair	Erosion Control	Railroad Work
Bridge Deck Overlay	Install Lighting	Repair Or Replace Barrier Wall
Bridge Deck Overlay and Widening	Install New Guard Rail	Replace Superstructure
Bridge Deck Patching	Median Construction	Rest Area Modernization
Bridge Deck Reconstruction	New Sign Installation	Safety Revisions
Bridge Deck Replacement	New Signal Installation	Scour Protection (Erosion)
Bridge Deck Replacement & Widening	Other Intersection Improvement	Sewer / Curb / Gutter Const/Reconstr
Bridge Maintenance And Repair	Other Project Type	Sewer / Curb / Gutter Construction
Bridge Rehabilitation Or Repair	Other Roadside Maintenance	Sign Modernization (Series Of Units)
Bridge Rehab-Pipe Lining	Other Sewer/Curb/Gutter Construction	Signing
Bridge Removal	Other Type Project (Miscellaneous)	Signing Installation / Repair
Bridge Thin Deck Overlay	Overhead Sign Install	Signs, Lighting, Signals And Markings
Construct ADA Approved Sidewalk Ramps	Railroad Crossing	Traffic Signals
Covered Bridge Rehabilitation	Railroad Protection	Traffic Signals Modernization
Enhancement	Railroad Protection & Surface	Traffic Signals, New Or Modernized
Channel Realign And Reshape	Relinquishments/Road Transfer	Drainage Ditch Correction
Traffic Mgmt Facility Modernization		

Waiver Policy

- Pipe structures smaller than 42 in. in diameter or equivalent
- Structure extension of less than 5 ft. may be eligible for waiver
- Rehabilitation with ≤ 2 ft shoulder widening and < 2 ft cut/fill
- Bridge maintenance without foundation modification
- Review time: INDOT Geotechnical Manager responds within 15 days. If eligible, waiver issued within 30 days

Geotechnical Investigation Request Form

GEOTECHNICAL WAIVER OR INVESTIGATION REQUEST TRANSMITTAL

Click or tap to enter a date.

MEMORANDUM

To: Click or tap here to enter text.
Director, Geotechnical Engineering Division

Thru: Click or tap here to enter text.
Project Manager

From: Click or tap here to enter text.
Designer
Click or tap here to enter text.
INDOT location or consulting-firm name

Re: Geotechnical Waiver ☐ Investigation ☐

Route: Click or tap here to enter text.
Des. No.: Click or tap here to enter text.
Project Location: Click or tap here to enter text.
Project Description: Click or tap here to enter text.

A geotechnical waiver ☐ investigation ☐ is requested for the above referenced project.
The following documents are included:

- ☐ Plans (*Indiana Design Manual* Section 107-2.03)
- ☐ Cross Sections (including a list of areas where side slopes are 2:1 or steeper)
- ☐ Scoping Document (e.g. Engineer's Report, Abbr. Engineer's Assessment)
- ☐ Bridge Information (IDM Section 107-2.03(01) or 107-2.03(02), as applicable)
- ☐ A minimum of six existing pavement photographs

The geotechnical investigation results are requested by Click or tap to enter a date.. If additional items which would require a geotechnical investigation are anticipated to be added to the plans after this submission, list those items and the estimated number of locations below.

Item: Click or tap here to enter text.
Item: Click or tap here to enter text.
Item: Click or tap here to enter text.

No. of Locations: Click or tap here to enter text.
No. of Locations: Click or tap here to enter text.
No. of Locations: Click or tap here to enter text.

CC: Click or tap here to enter text.

Geotechnical Review Final Check Prints Form

GEOTECHNICAL REVIEW OF FINAL CHECK PRINTS

Route: Click or tap here to enter text.

Des.: Click or tap here to enter text.

Bridge File: Click or tap here to enter text.

Over: Click or tap here to enter text.

Project No.: Click or tap here to enter text.

Date of Geotechnical Report: Click or tap here to enter text.

Date of Addenda to Geotechnical Report: Click or tap here to enter text.

I have reviewed the Final Check Prints and the geotechnical summary for the project described above.

- ☐ The Final Check Prints and the special provisions are consistent with the Geotechnical Report and its addenda. No changes are required.
- ☐ The Final Check Prints and the special provisions are not consistent with the Geotechnical Report and its addenda. The following must be addressed.
Click or tap here to enter text.
- ☐ The geotechnical summary as submitted by the designer is satisfactory to include in the Contract Information book.
- ☐ The geotechnical summary as submitted by the designer is not satisfactory. The following must be addressed.
Click or tap here to enter text.
- ☐ The MSE wall feasibility review has been completed by the INDOT Geotechnical Engineering Division, if applicable.
Click or tap here to enter text.

Signature of Geotechnical Engineer

Click or tap here to enter text.

INDOT entity or consultant

Click or tap to enter a date.

date

Projects need Geotechnical Investigation

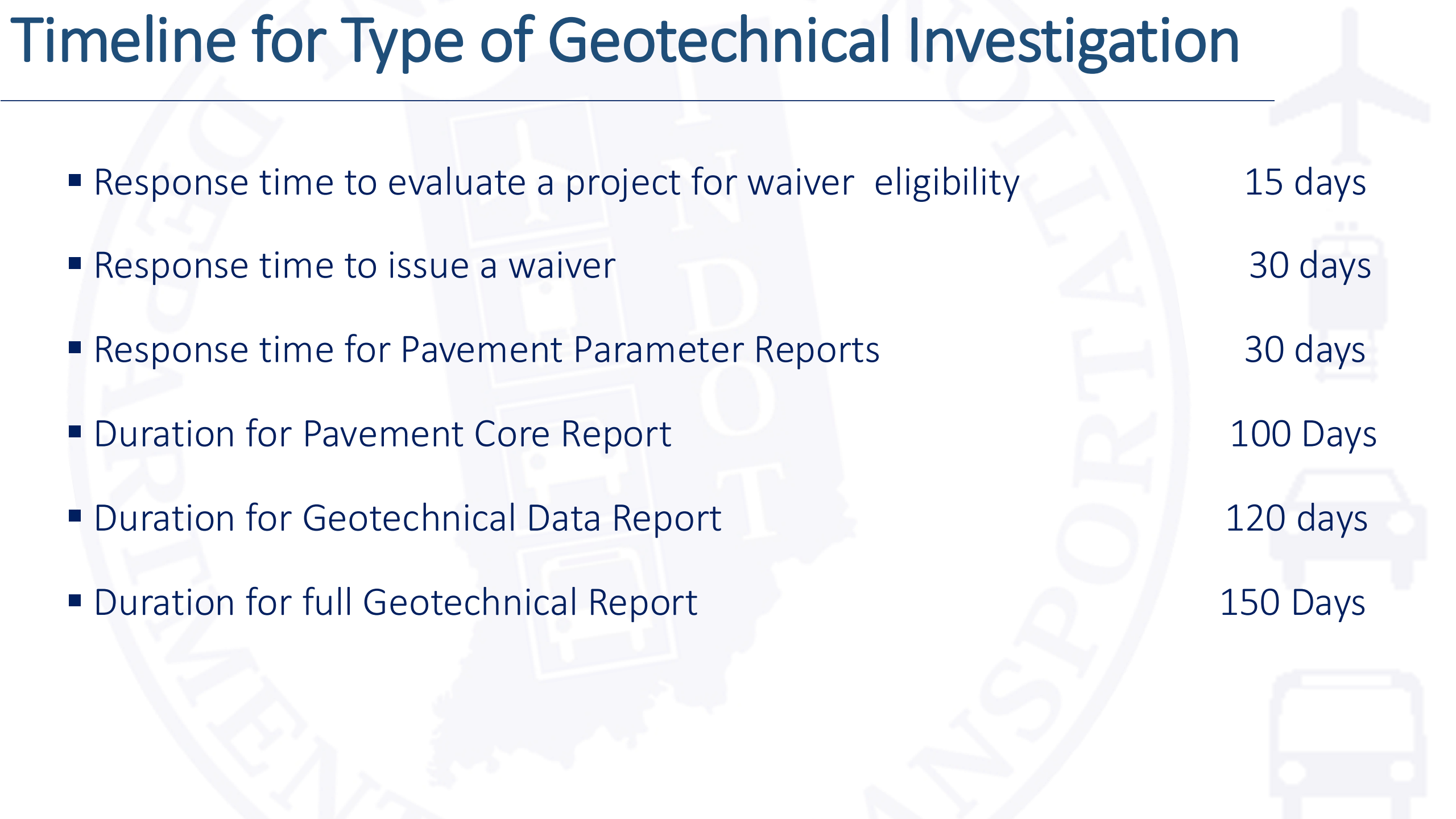
The Geotechnical Engineering Division is responsible for performing geotechnical investigation and providing foundation design recommendations for the following:

- Roadways
- Bridge Structures
- Pavements
- Retaining Structures
- Drainage Structures
- Traffic Signage & Communication Towers
- Landslide Corrections
- Others: Such as Rest Areas & other state facilities

Geotech Workload

- Historically: 350 to 400 projects per year
- Recently: 1000 to 1350 projects per year
- Division's In-House Capability: 100 to 150 projects per year
- Geotechnical Consultants are used for most state and LPA projects

Timeline for Type of Geotechnical Investigation



■ Response time to evaluate a project for waiver eligibility	15 days
■ Response time to issue a waiver	30 days
■ Response time for Pavement Parameter Reports	30 days
■ Duration for Pavement Core Report	100 Days
■ Duration for Geotechnical Data Report	120 days
■ Duration for full Geotechnical Report	150 Days

Duration for Full Geotechnical Investigation

- **Total time needed:** 150 calendar days
- **Field work:** 60 calendar days
 - (which includes POs, coordination with property owners, utilities, field
 - checks, marking borings, scope approval, traffic control, and actual drilling)
- **Laboratory Testing:** 30 calendar days
- **Engineering Time:** 60 calendar days (includes INDOT review time)

Geotechnical Engineering Tracking System

Geotechnical - Internet Explorer

1400234 - Maintenance

Project Header

Des / Alt #: 1400234

Project Manager: [McMullen, Kenneth](#)

Road: I 65

Location: 0.01 mi N of US 231

Geotechnical Subsurface Status:

Contract: R-36689

County: White

Work Type: Small Structure Replacement

Soil Investigation Status:

Designed By: Crawfordsville District

District: Crawfordsville

From To: 193+040 193+040

Letting Fiscal Year: 2018

Pavement Design Finish Date:

Status: Active

RFC Date: 01/03/2018

How many days until you reach 60%:
0

Letting Date: 03/14/2018

[Design Finish Status:](#)

Design Analyses Complete



Geotechnical - 1400234

[EDIT]

▼ Project(A)

▼ Documents (2)

▼ **Geotechnical Engineering Report (A)**

▷ Purchase Order

▷ Activities (4)

▷ Field Work (1)

▷ Laboratory Work (9)

▷ Construction Support (A)

Documents

Filter: AND



Document Type	Initiation Date	Completion Date	Project Engineer	Consultant	Design Consultant	Contractor	Status	
Geotechnical Engineering Report	06/15/2017	10/05/2017	Belew, Youlanda	INDOT Geotechnical Engineering	Michael Baker International, Inc.		Active	  

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* This color background fields are mandatory.

Indiana Department of Transportation 2.2.0.0

Potential Design Issues

- MSE Walls
- Subgrade Treatment Options (Limit to one if economical)
- Steeper Slopes (could be an issue in certain areas)

When MSE Walls Are Appropriate

- Reinforced zone footprint free of utilities, culverts, guardrail posts
- Water/drainage conditions manageable without special protection
- Simple geometry with adequate footprint:

Geotextile requirement between the in-situ soils and backfill at the leveling pad elevation reduces the F^* by a $1/3$, resulting in longer reinforcements (more than typical 0.7 -1.1 times the height). Not feasible. We recommend a minimum 2 ft undercut below leveling pad for all MSE Walls.

Major Red Flags – Avoid MSE Walls

- Tight ROW or Geometry: acute corners (with temporary or permanent walls), short radii, insufficient embedment
- Obstructions in reinforced zone: utilities, culverts, guardrail posts, sign foundations
- High groundwater (within 3 ft of leveling pad elevation)
- Special details needed for storm sewer if proposed

Better Alternatives When MSE Fails Screening

- Cast-in-place cantilever or counterfort walls (tight footprint, utilities)
- Anchored or soldier pile walls (ROW constraints, top-down construction)
- Sheet pile or drilled shaft walls (water, scour, durability challenges)
- Soil-nailed walls (limited excavation, staging constraints)

Typical MSE Wall Problems



Typical MSE Wall Problems



Typical MSE Wall Problems



Typical MSE Wall Problems



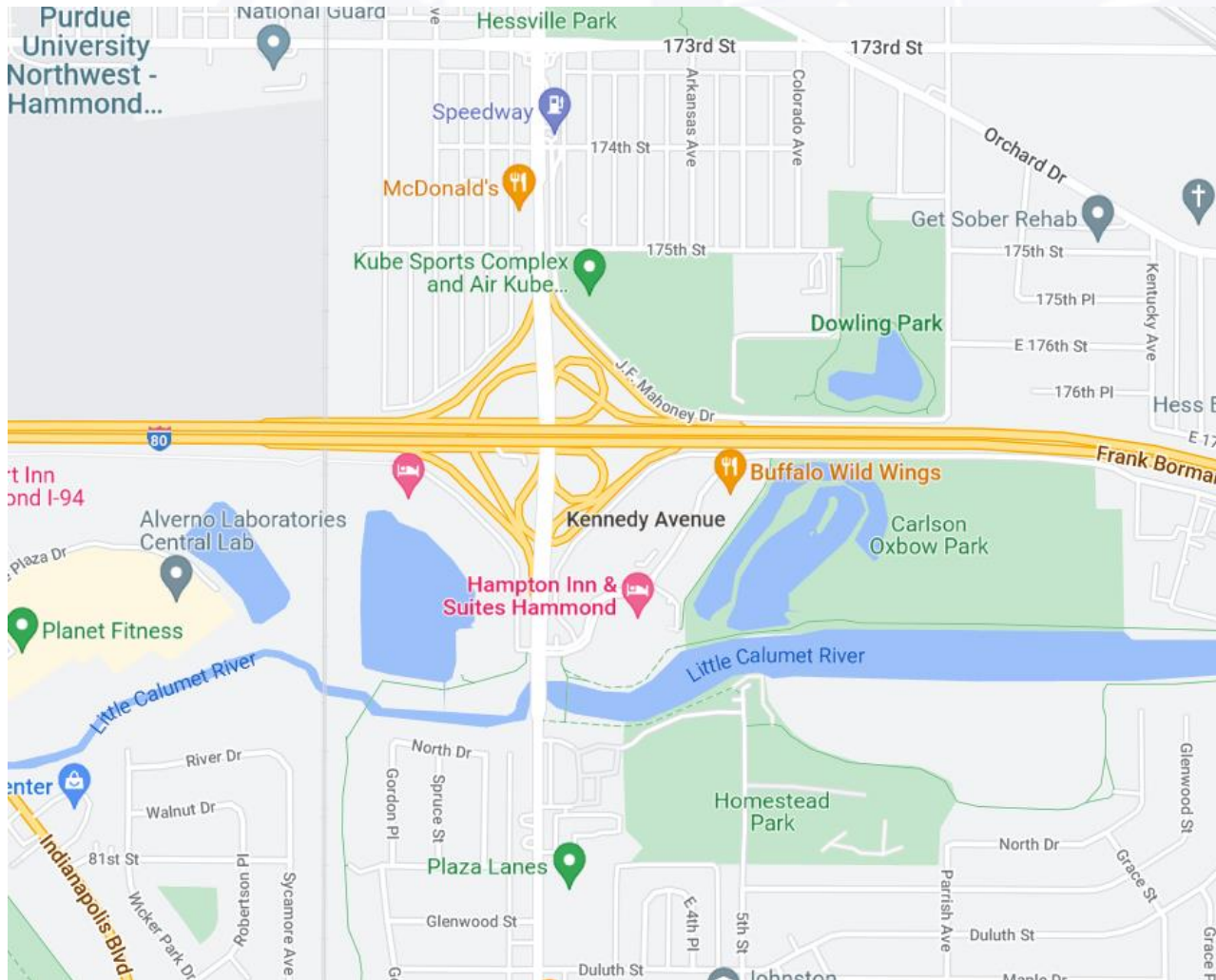
Typical MSE Wall Problems



Typical MSE Wall Problems



Project Location



Problem encountered during construction

- Used grout for undersealing and filling void
- Grout kept disappearing
- After losing around 20 tons of grout, PE contacted us on July 7, 2019
- Geotech, research, and pavement folks along with Barry Christopher went to the site
- Following observations were made:
 - No sign of backfill loss in the vicinity
 - Broke a section of the approach slab to view the void
 - Noticed a storm sewer going underneath the MSE wall
 - Possible missing reinforcing straps

Opened a Portion of approach Slab

Limit of A Line Cut no closer to Parapet Wall, then blue pavement cross markings shown

Photo A



Photo B



Opened a Portion of approach Slab



Void Underneath Approach Slab



Void Underneath Approach Slab



Avoid Problems During/Post Construction

- Embankment Construction (Specify limits for ground modification where needed)
- Shallow Utilities (specify if within subgrade treatment zone)
- Do not specify chemical modification/stabilization on MSE walls
- Unsuitable Soils (specify limits on plans for ground modification)
- Constructability should be high Priority such as phasing etc.

Recommendations

- The Division of Geotechnical Engineering should be involved with every project as early as possible, no later than the preliminary field check
- If a soils waiver is needed, the request should be made as early as possible, so that a Geotechnical Investigation can still be performed, if needed
- All specific recommendations should be included in the plans along with any special provisions
- The designer should evaluate the site conditions for positive drainage for underdrains and their outlet locations.
- The designer should pay more attention to geotechnical recommendations for foundation improvement and its limits.

Thank you!

