I-240 CMGC PROJECT

MEMPHIS, TN

TN TDOT Department of Transportation

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CMGC PROCESS

- Construct … actor
- Why CMG …
- Designer … ment
- Contracto … ons and fee
- Taskforce …
- Weekly Ta … sign
- Work clos …
- Independ …

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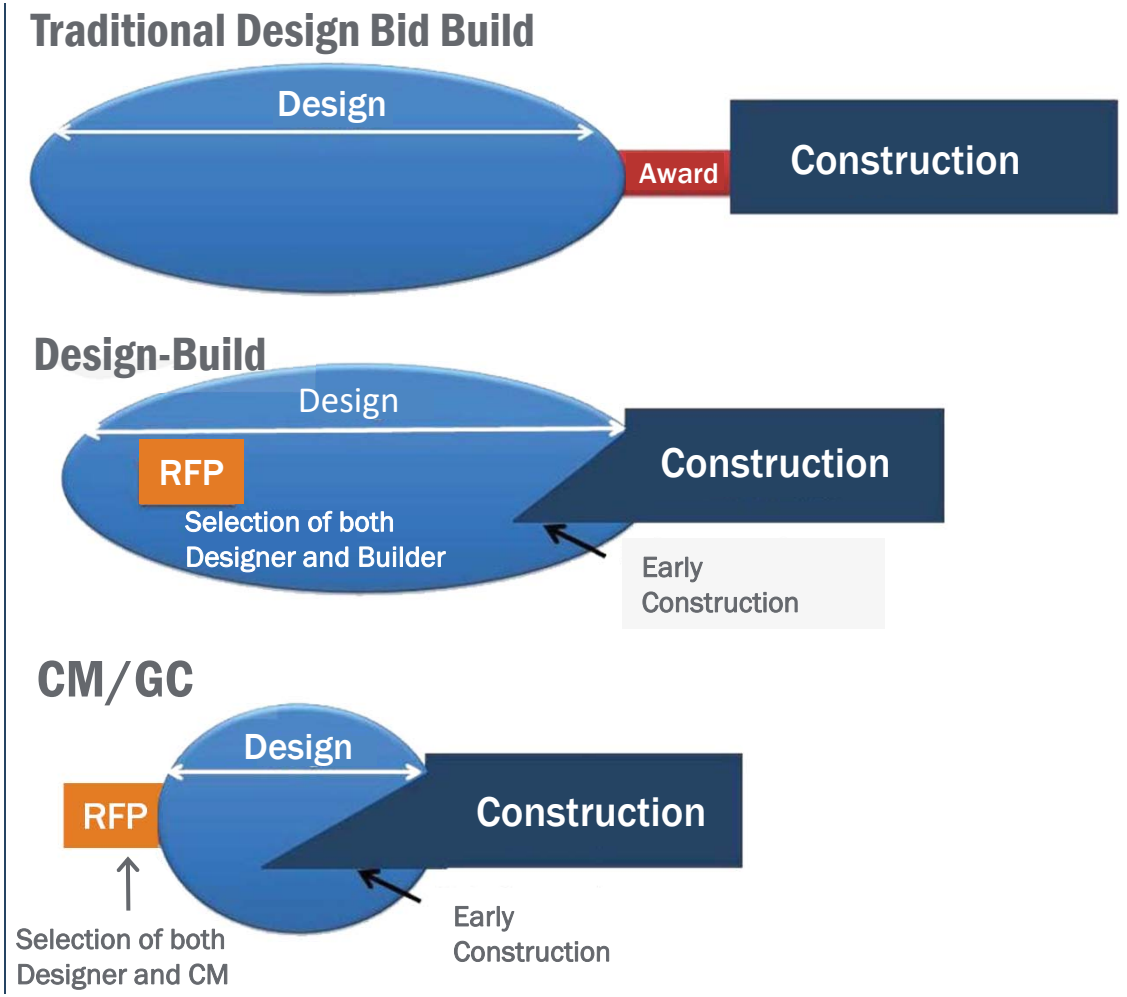
CMGC PROCESS



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GOALS OF CMGC

- Expedite complex project delivery
- Design based on contractor capabilities and DOT expectations
- Mutually agreed distribution of risk
- Provide the best product in the shortest time frame at an agreed upon price (one contractor, one price)
- Owner retains greater control of design vs. design-build
- Early involvement of third parties during design (utilities, railroad, cities, major stakeholders)
- Daily peer exchange

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STARTING A CMGC PROGRAM

- TDOT wanted a “New Tool in the Tool Box”
- Enabling Legislation in July 2014
- Up to Three Pilot Projects
- Constraints on Maximum Contract Size ($)
- Time Frame – Pilot Program Expires in July 2019
- Defines the Selection Process
  - Does not require prior CMGC experience
  - Defines Selection Committee for the CM
  - Independent Cost Estimator (ICE)
  - Bid by CM must be within 10% of ICE or In-House Estimate
- *Search for TDOT Construction – Alternative Contracting – CMGC Services*

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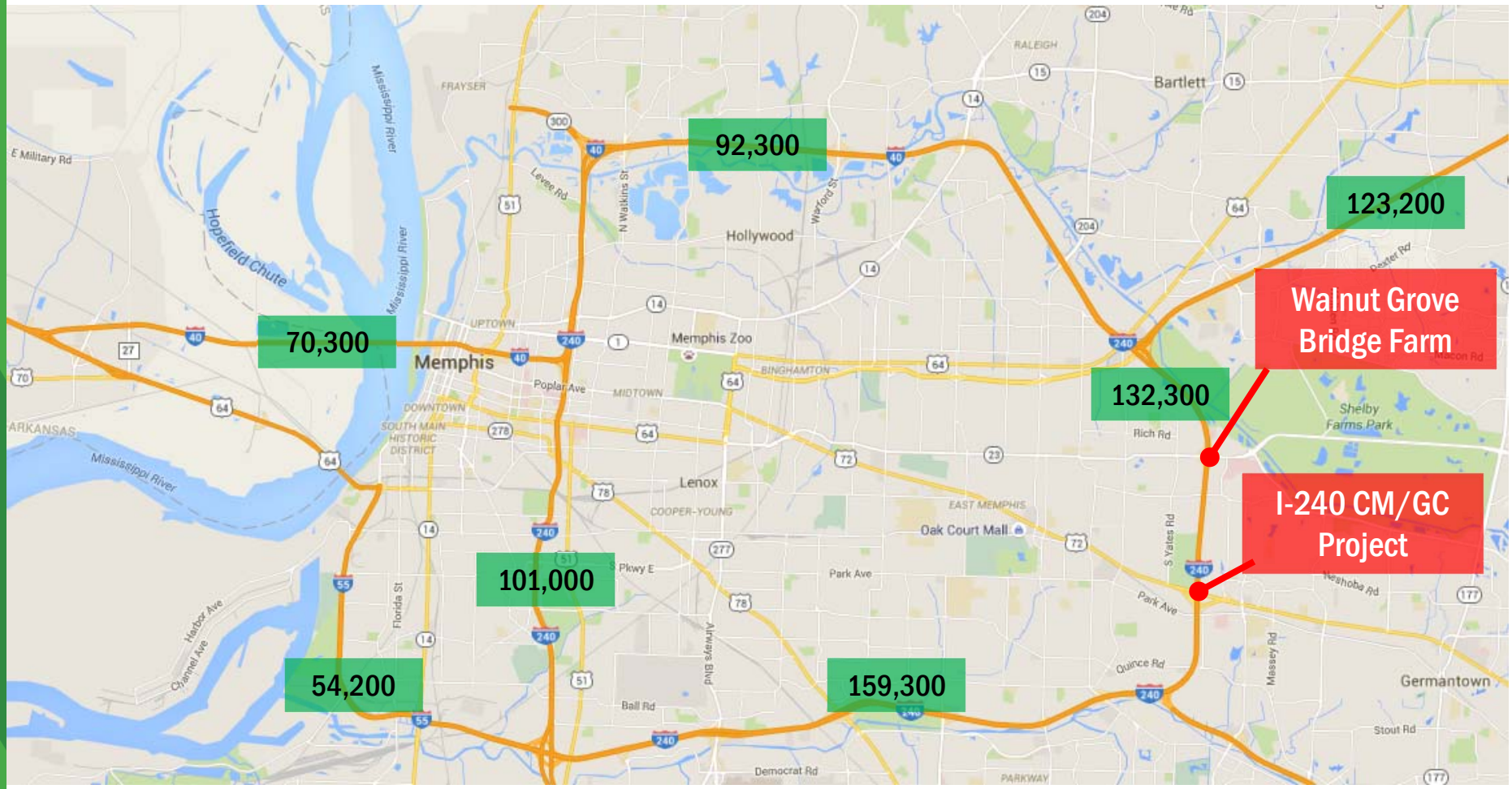
REGIONAL IMPACTS



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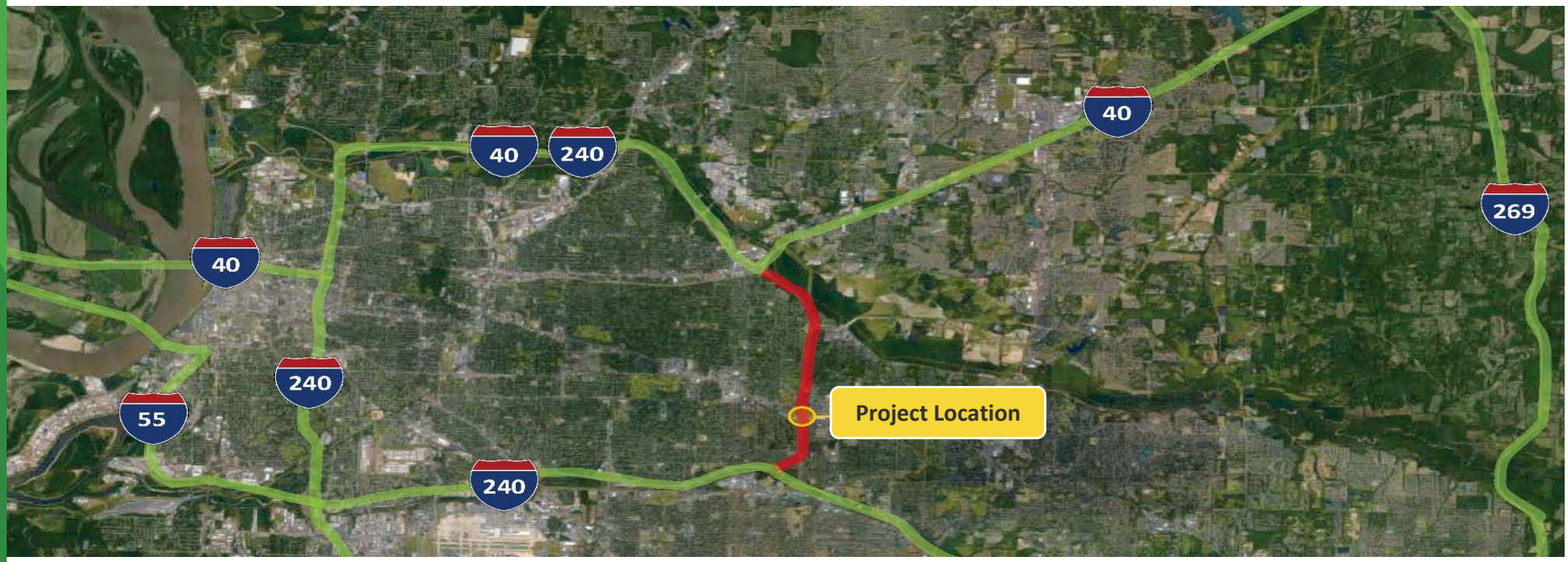
PROJECT LOCATION



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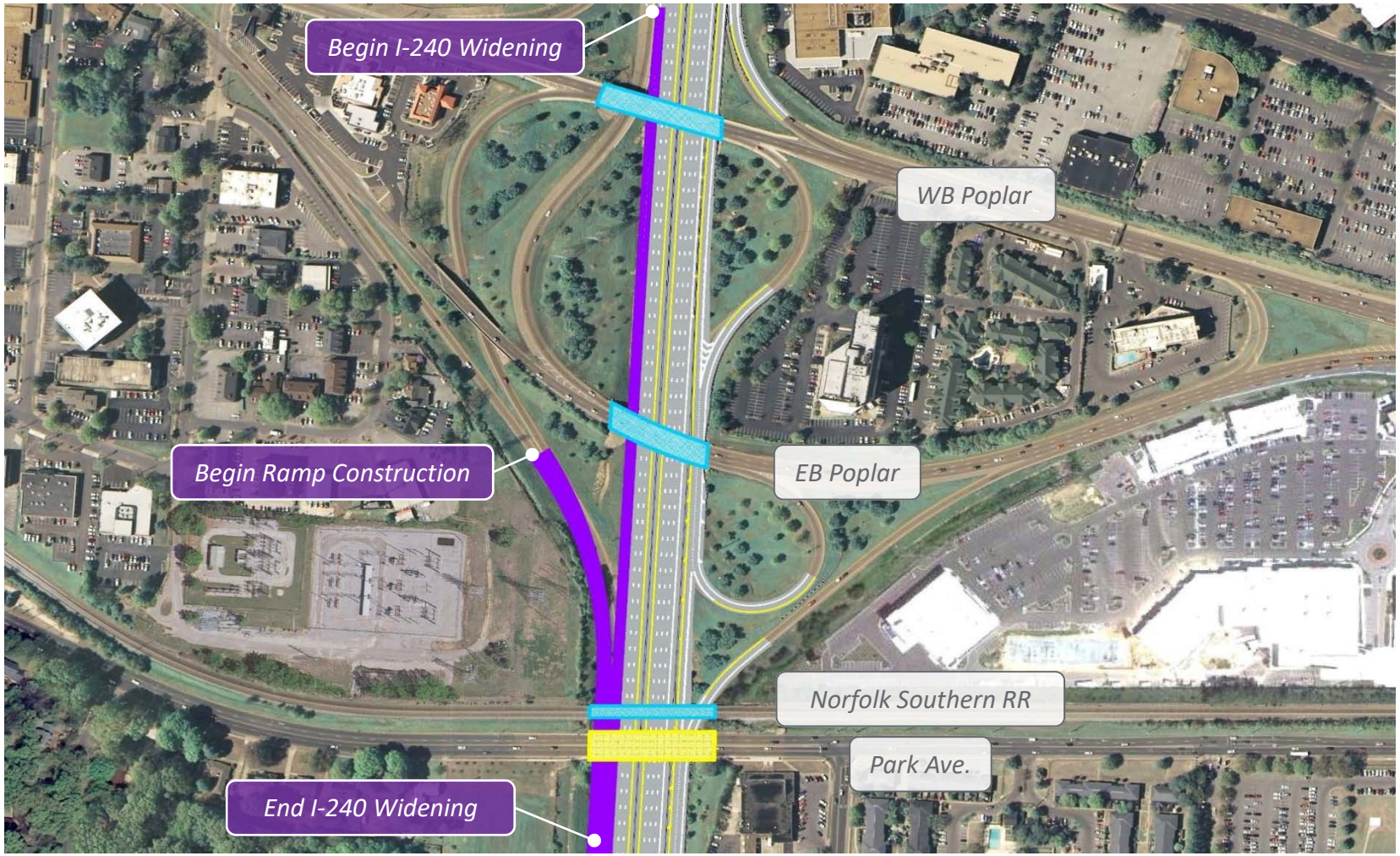
PROJECT LOCATION



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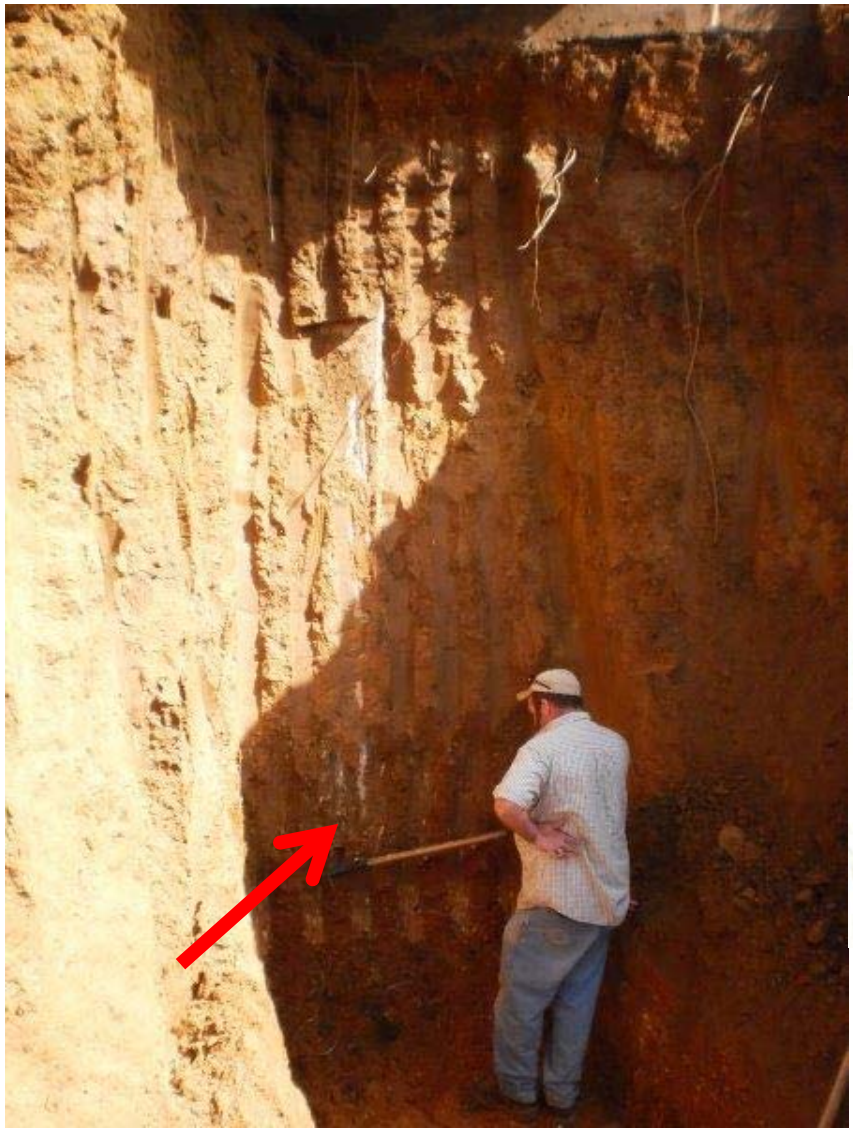
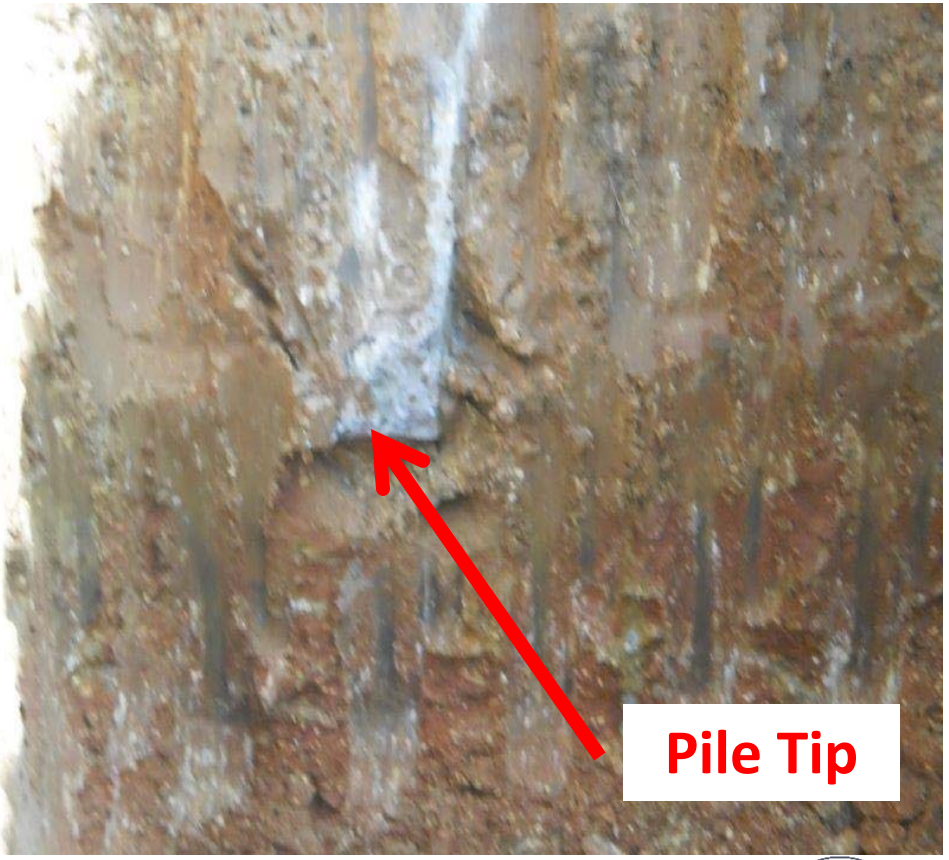
PREVIOUS I-240 WIDENING CHALLENGES





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CHALLENGES

- Seismic zone
- No piles
- Sandy soil
- No bed rock
- Several physical constraints
  - Significant utilities
  - Commercial businesses
  - High traffic volumes
- Railroad involvement

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PROJECT OBJECTIVES

- Provide an eight-lane I-240 mainline (complete the planned widening of I-240).
- Improve four deficient bridges over I-240:
  - Replace WB & EB Poplar Avenue.
  - Replace NS Railroad bridge (owned by TDOT).
  - Rehab or replace Park Avenue.
- Improve horizontal and vertical clearances.
- Minimize construction time and impacts by using Accelerated Bridge Construction (ABC).
- Satisfy the public project requirements of NS Railroad.

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PROJECT TIMELINE

1. Initial Design Phase – Spring 2016
   - Initial Utility Coordination
   - Coordination with Locals
   - Assist TDOT with CM RFP
2. CM Advertisement – Summer 2016
3. CM Selection – August 2016
4. Design Kickoff – September 2016
   - Design Charrette
   - Weekly Task Force Mtgs
   - Opinion of Cost 60%
   - ICE Began after 30%
   - Finalize Plans
   - Up To 3 Official Bids
   - Final Bid (10% of ICE)
5. 3rd Bid Accepted– November 2017
6. Construction Began – January 2018
7. Construction Complete – July 2019

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PROJECT TEAM

TDOT Department of Transportation

Owner

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Prime Consultant

Kiewit

Construction Management

GEOTECHNOLOGY INC

FROM THE GROUND UP

Geotech

Gresham Smith

ITS and Utility Coordination

BARGE DESIGN SOLUTIONS

Structural, Survey and Traffic Control

HDR

Independent Cost Engineer

SO-DEEP Inc.

SUE Services

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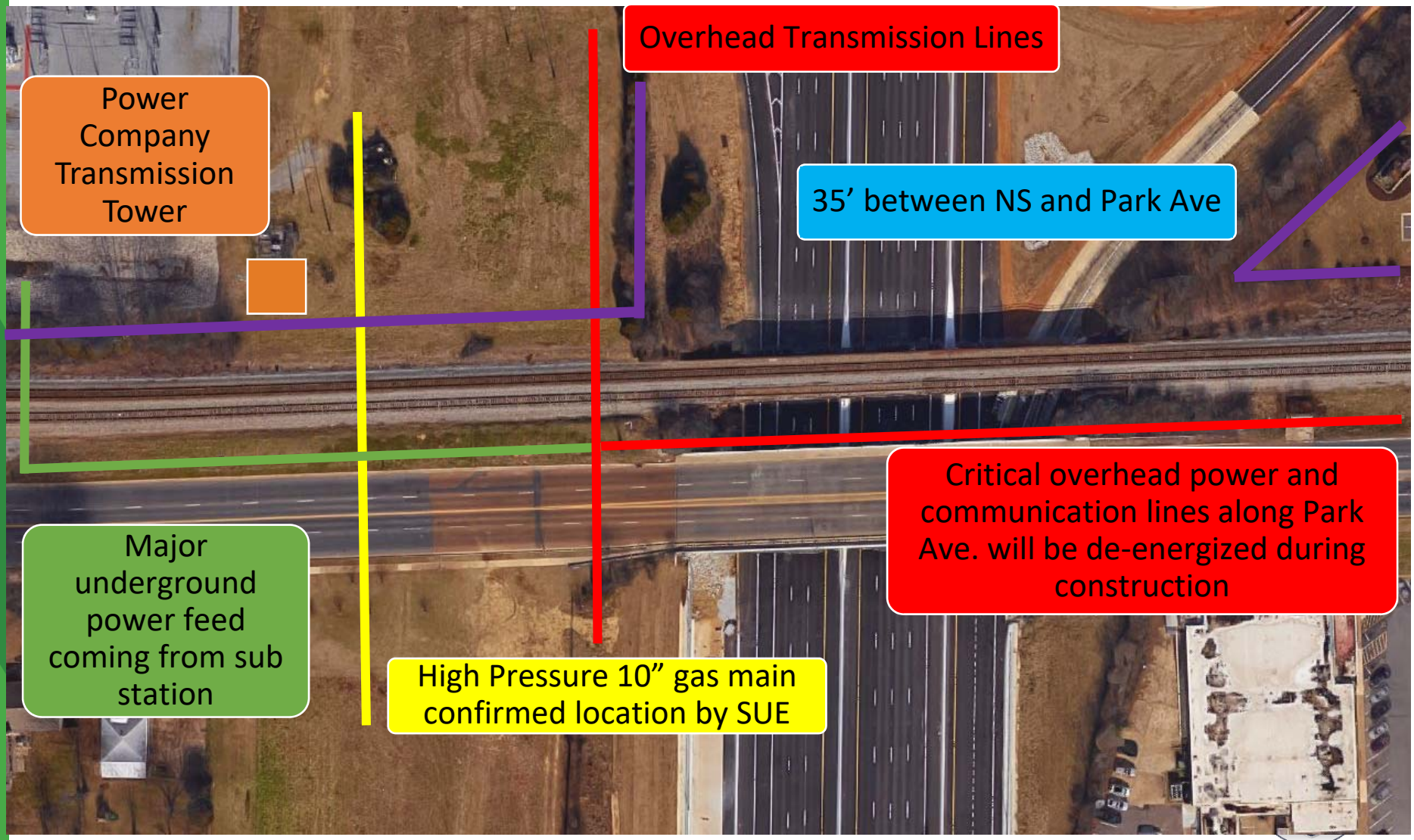
SITE AND UTILITY CONSTRAINTS



EXISTING WEST BOUND POPLAR AVE.

- 295’ – 5 Span
- Tangent
- Concrete Beam
- 54’ Ex. Width
- 3 Travel Lanes w/ Sidewalks
- Min. Vert. Clearance 16.21’

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COMPLETED WEST BOUND POPLAR AVE.

263’ – 2 Span Steel Girder Bridge

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EXISTING EAST BOUND POPLAR AVE.

- 246’ – 4 Span
- Curved
- Concrete Beam
- 60’ Ex. Width
- 3 Travel Lanes - No Sidewalks
- Min. Vert. Clearance 16.34’
- No Utility Conflicts

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COMPLETED EAST BOUND POPLAR AVE.

222’ – 2 Span Steel Girder Bridge

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EXISTING NORFOLK SOUTHERN RAILROAD

- 320’ – 6 Span
- Tangent
- Steel Beam
- 2 Track Ballast Deck
- Min. Vert. Clearance 15.61’
- 100’ Railroad ROW

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NORFOLK SOUTHERN RAILROAD (cont.)

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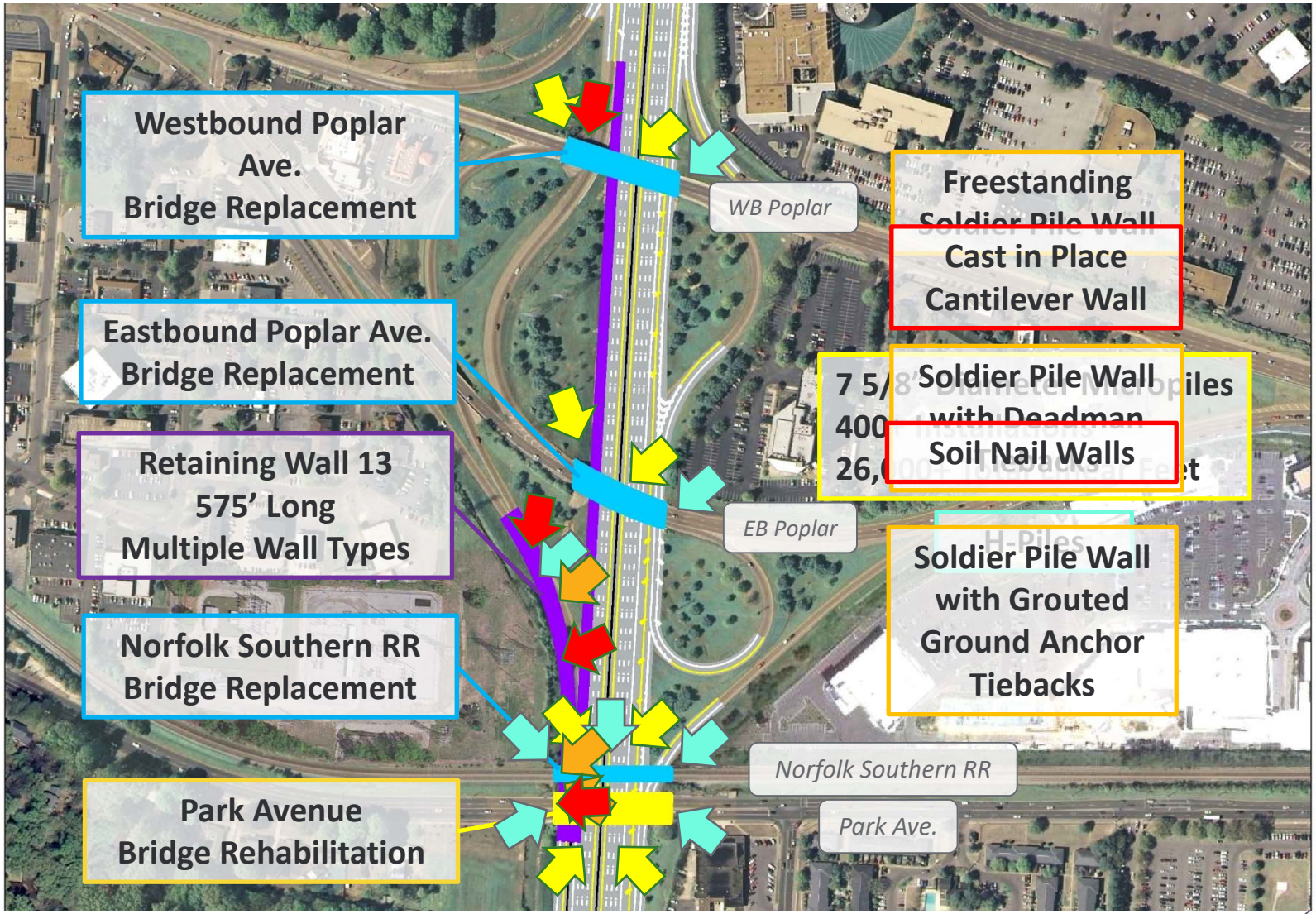
COMPLETED NSRR BRIDGE SLIDE

STRUCTURE PROJECT OVERVIEW



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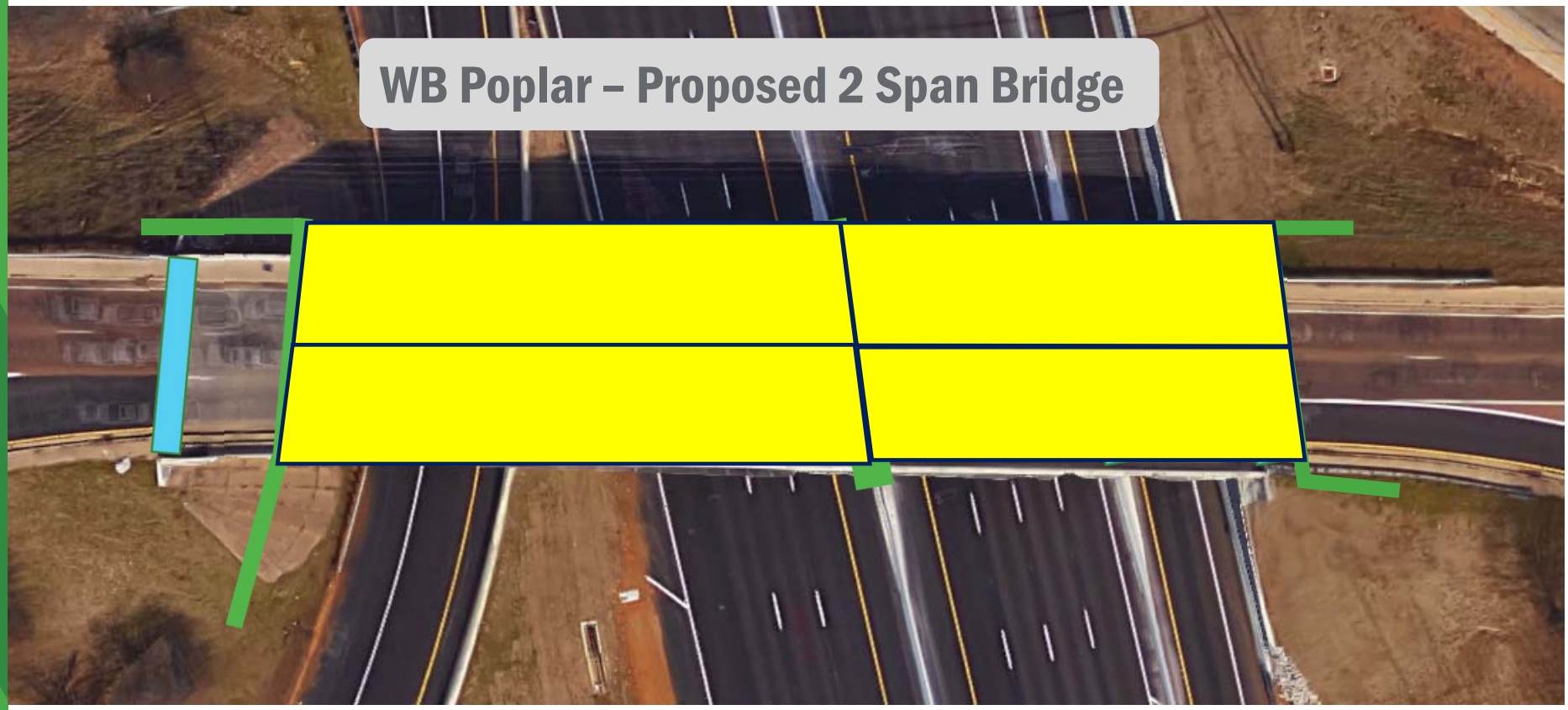
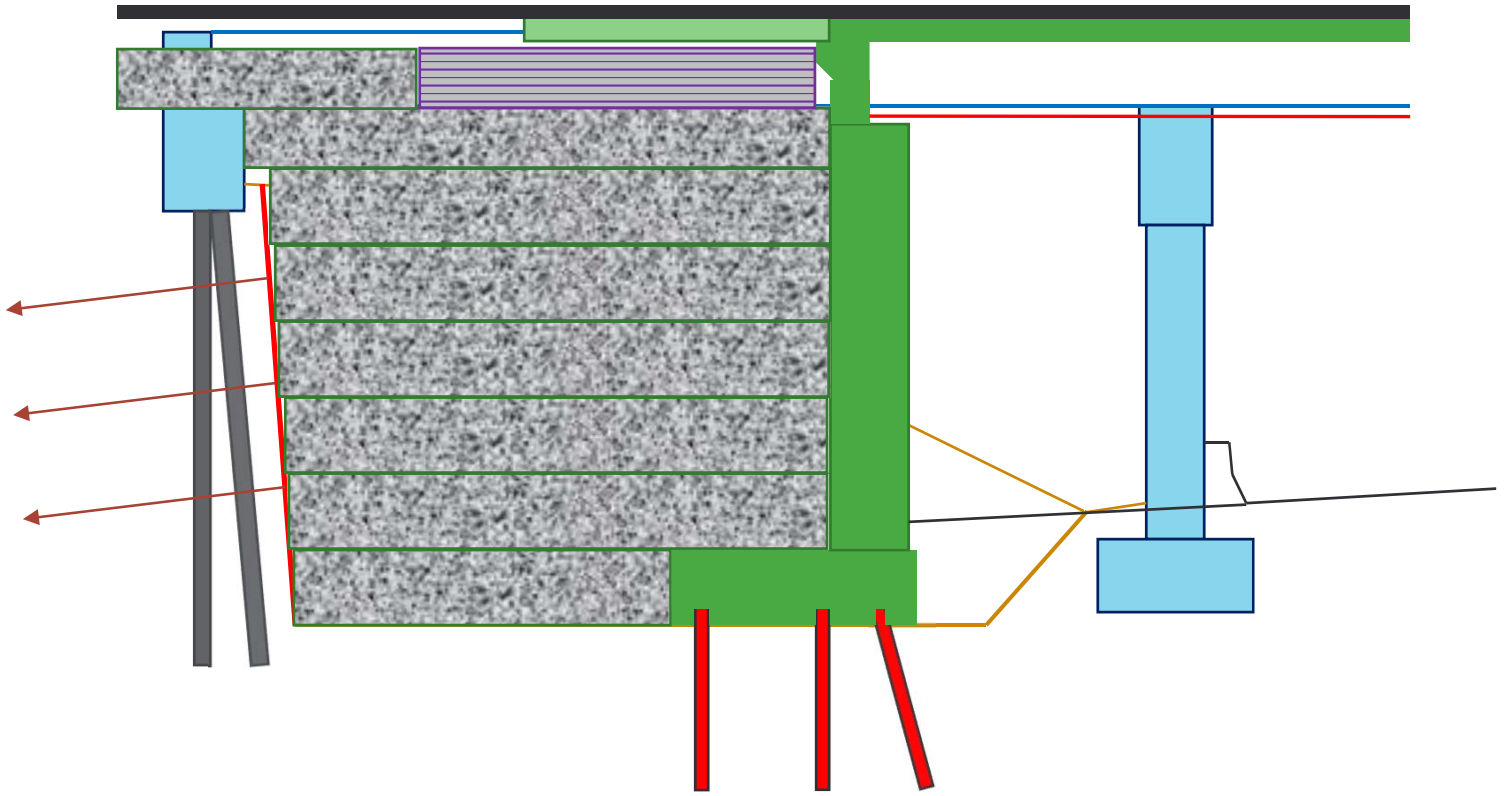
WB/EB POPLAR BRIDGE REPLACEMENTS

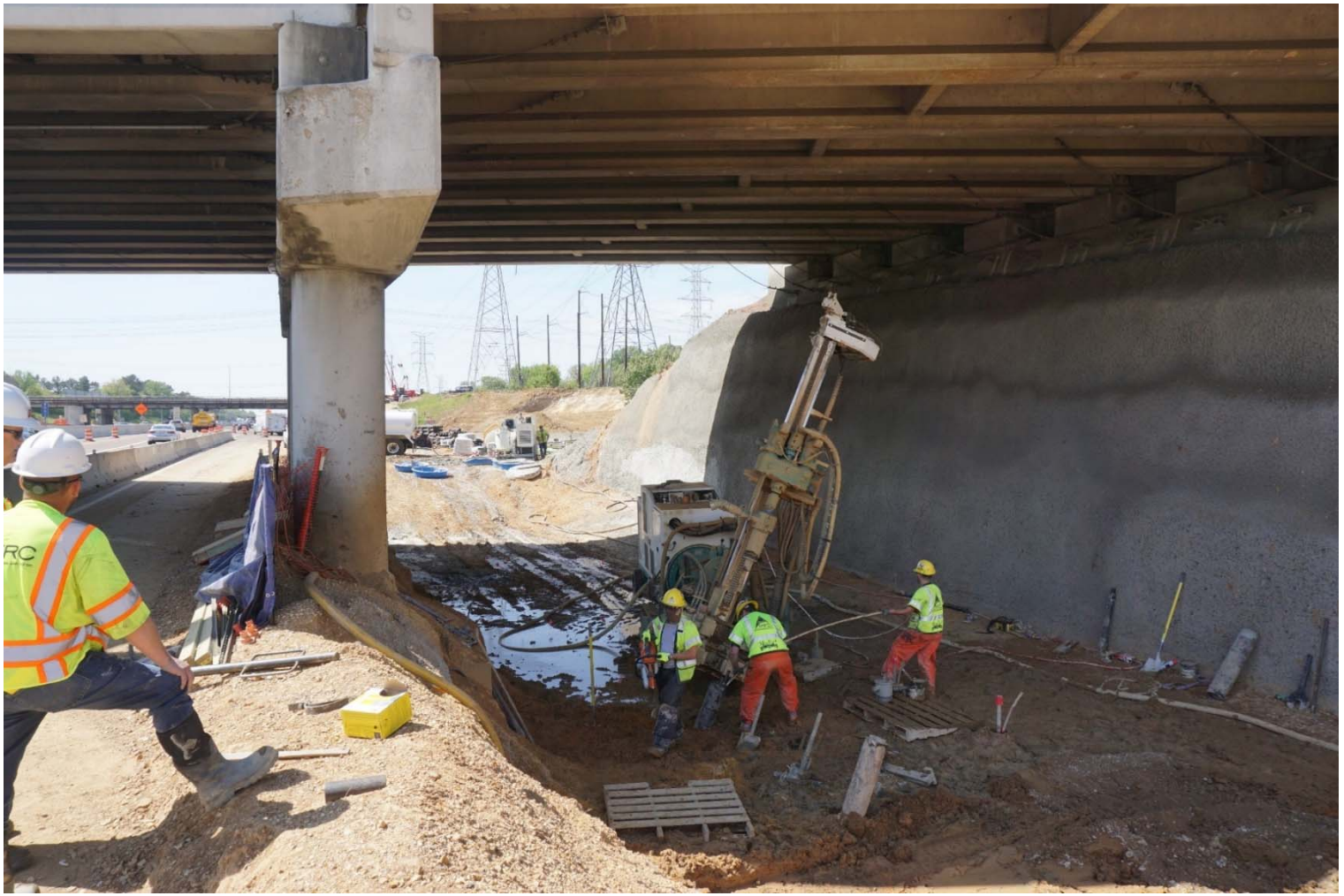


WB/EB POPLAR WEST ABUTMENTS



WB/EB POPLAR WESTERN ABUTMENTS

WEST ABUTMENT CONSTRUCTION



WEST ABUTMENT CONSTRUCTION

WEST ABUTMENT CONSTRUCTION

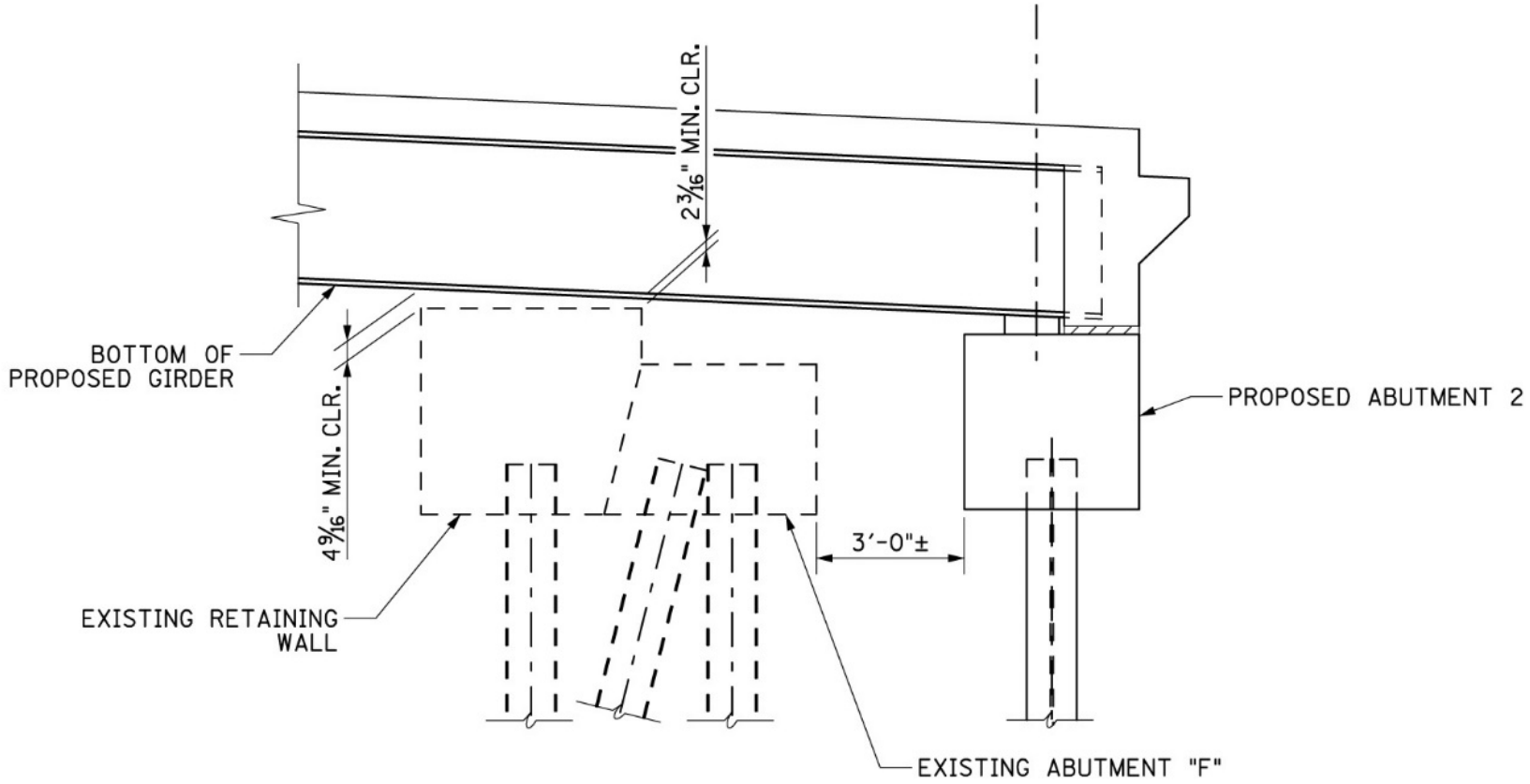
WEST ABUTMENT CONSTRUCTION

GEOGRID UNDER APPROACH SLAB

WB/EB POPLAR EASTERN ABUTMENTS

WB/EB POPLAR EASTERN ABUTMENTS

WB/EB POPLAR EASTERN ABUTMENTS



SECTION "B"-"B"

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WB/EB EASTERN ABUTMENTS

WB/EB EASTERN ABUTMENTS

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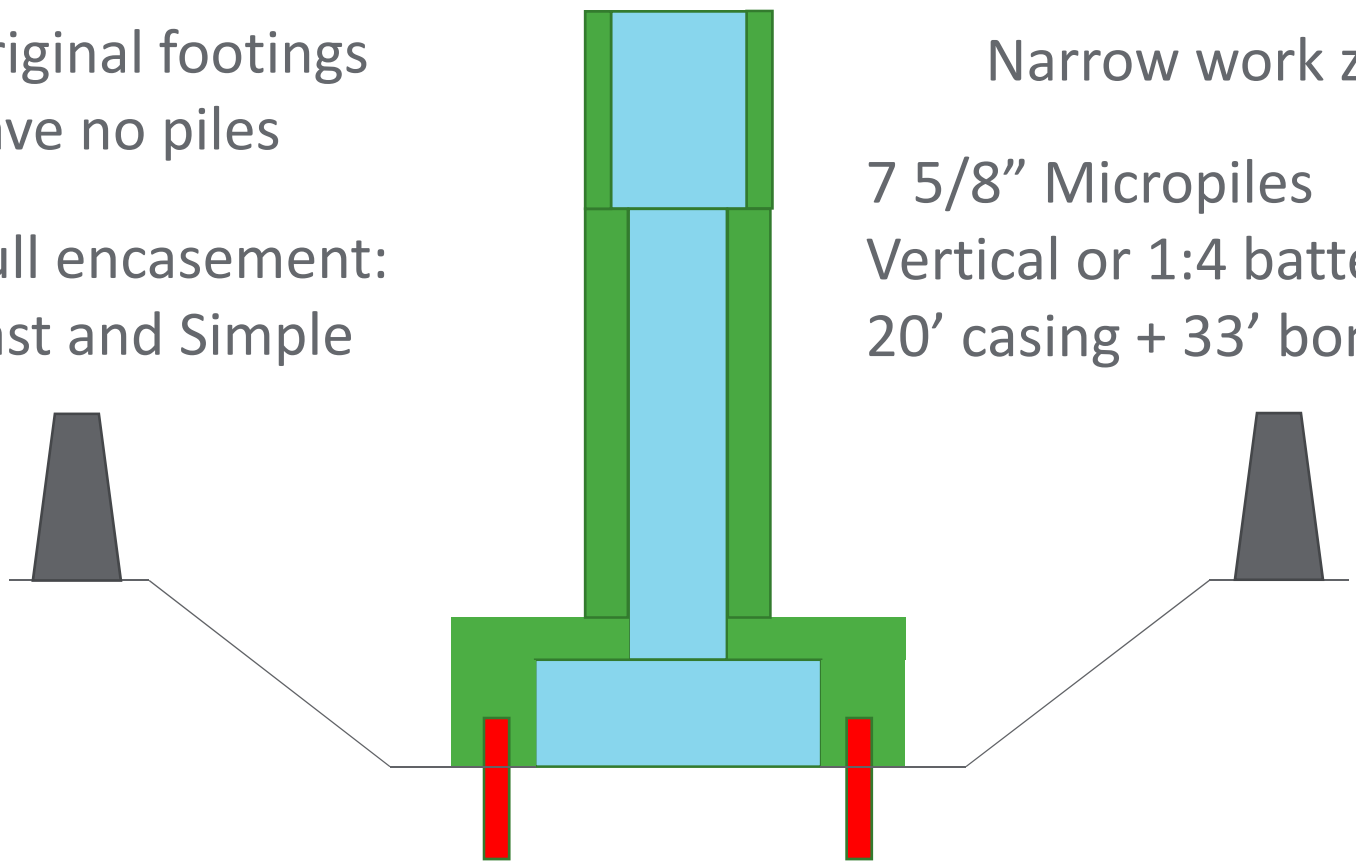
WB/EB POPLAR PIERS

Original footings have no piles

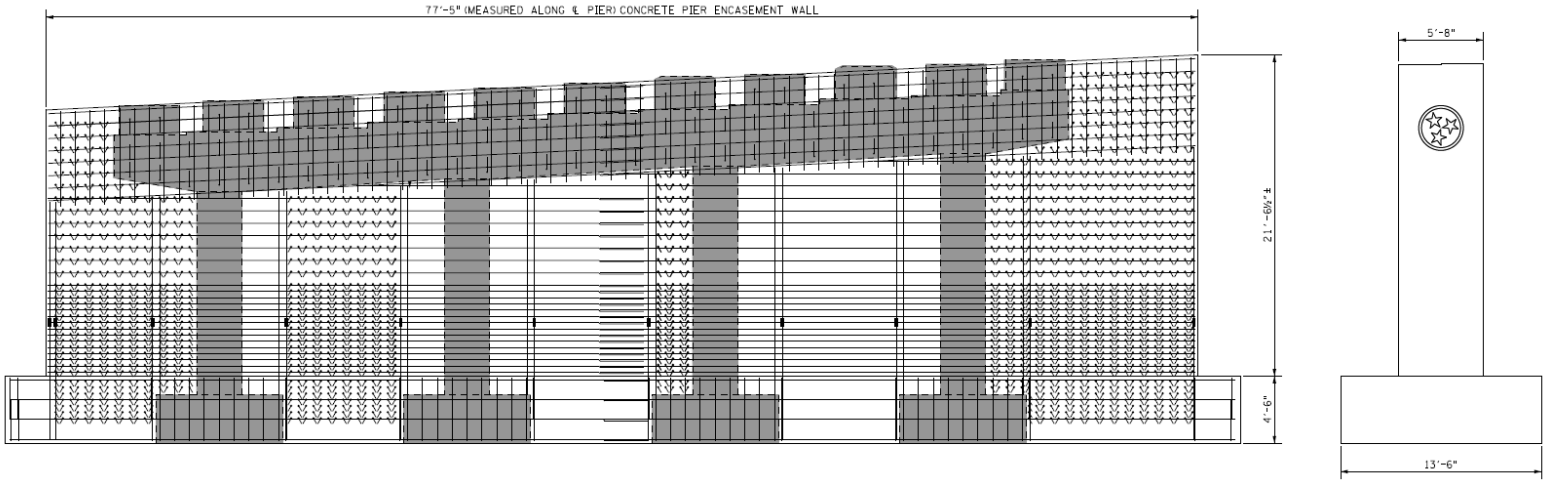
Full encasement:
Fast and Simple



Narrow work zone

7 5/8” Micropiles
Vertical or 1:4 batter
20’ casing + 33’ bond zone

WB/EB POPLAR PIERS



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WB/EB POPLAR PIERS

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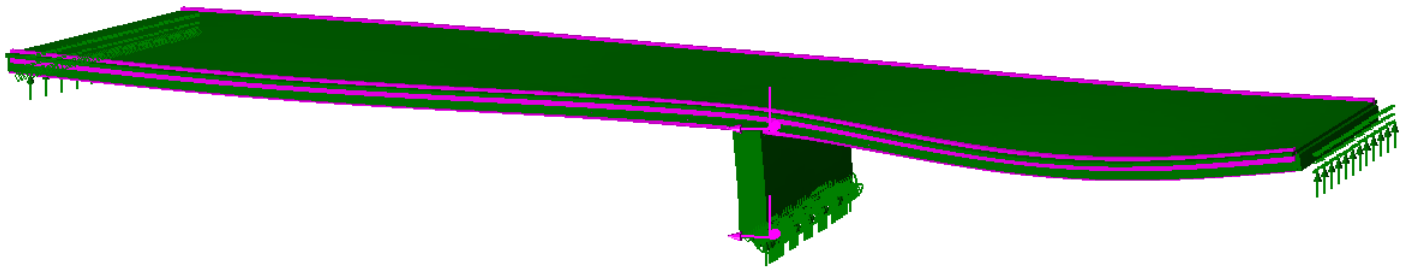
WB/EB POPLAR PIER CHALLENGES

- Wall pier has high stiffness and mass for seismic
- Seismic loads on micropiles
  - 291 kips – compression per micropile
  - 121 kips – tension per micropile
  - 28 kips – lateral bending load per micropile
- LUSAS used for seismic modeling
- Sensitivity of pier design required use of A706 rebar



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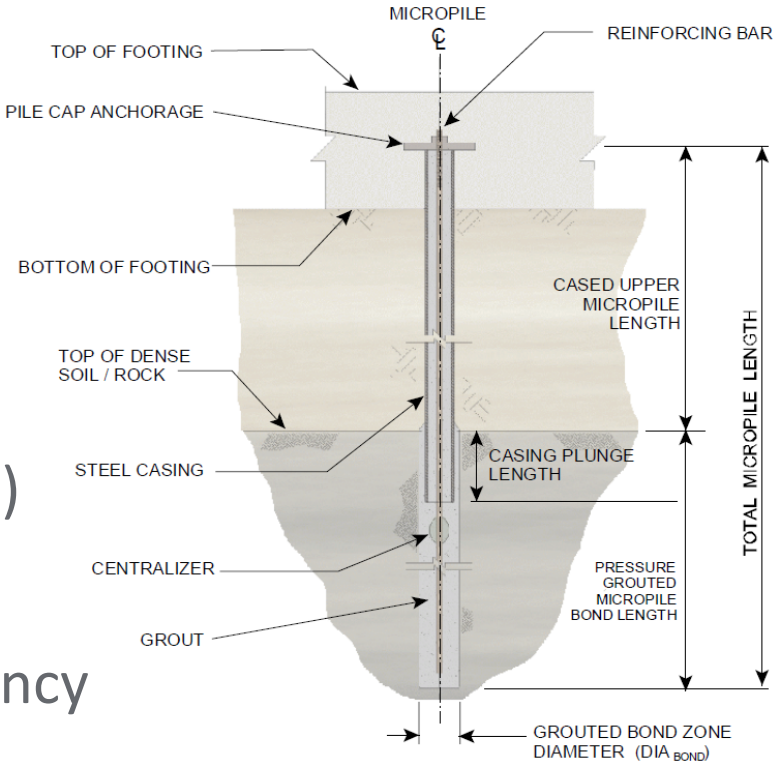
Micropiles

- 7 5/8” x 0.5” Micropiles
- API N80 Casing
- 58 Installations for WB Pier
- 56 Installations for EB Pier
- Cased Length 20 Feet (+/-)
- Bond Zone Length 33 Feet (+/-)



Benefits of CMGC:

- Design -> Construction Efficiency
- Buy America Act
- 9” vs. 7 5/8”

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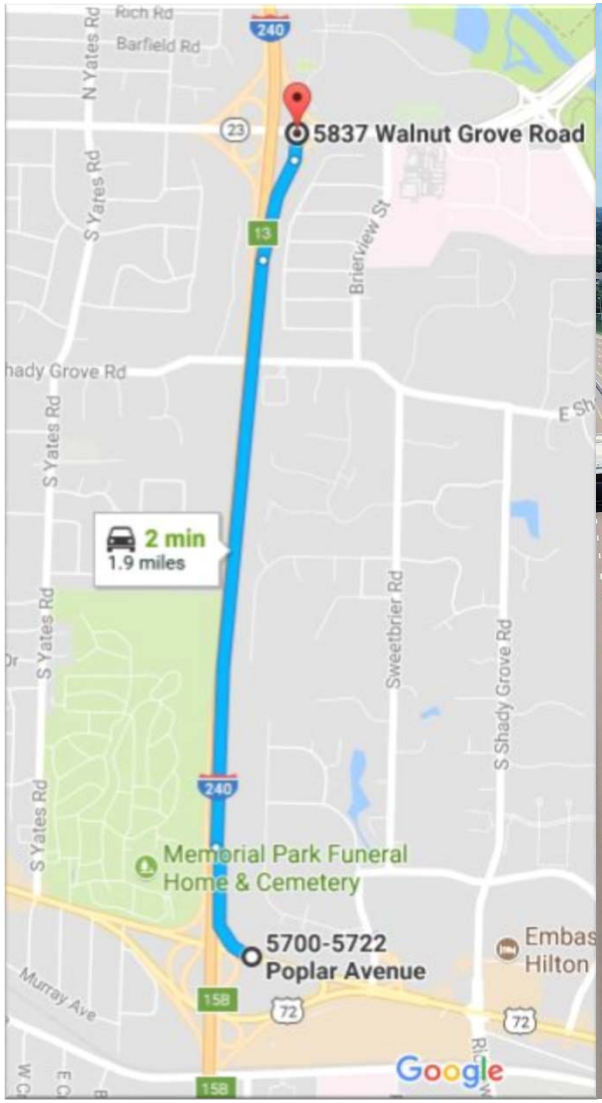
WALNUT GROVE BRIDGE FARM



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BRIDGE FARM

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BRIDGE FARM

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SELF PROPELLED MOBILE TRANSPORT
(SPMT)

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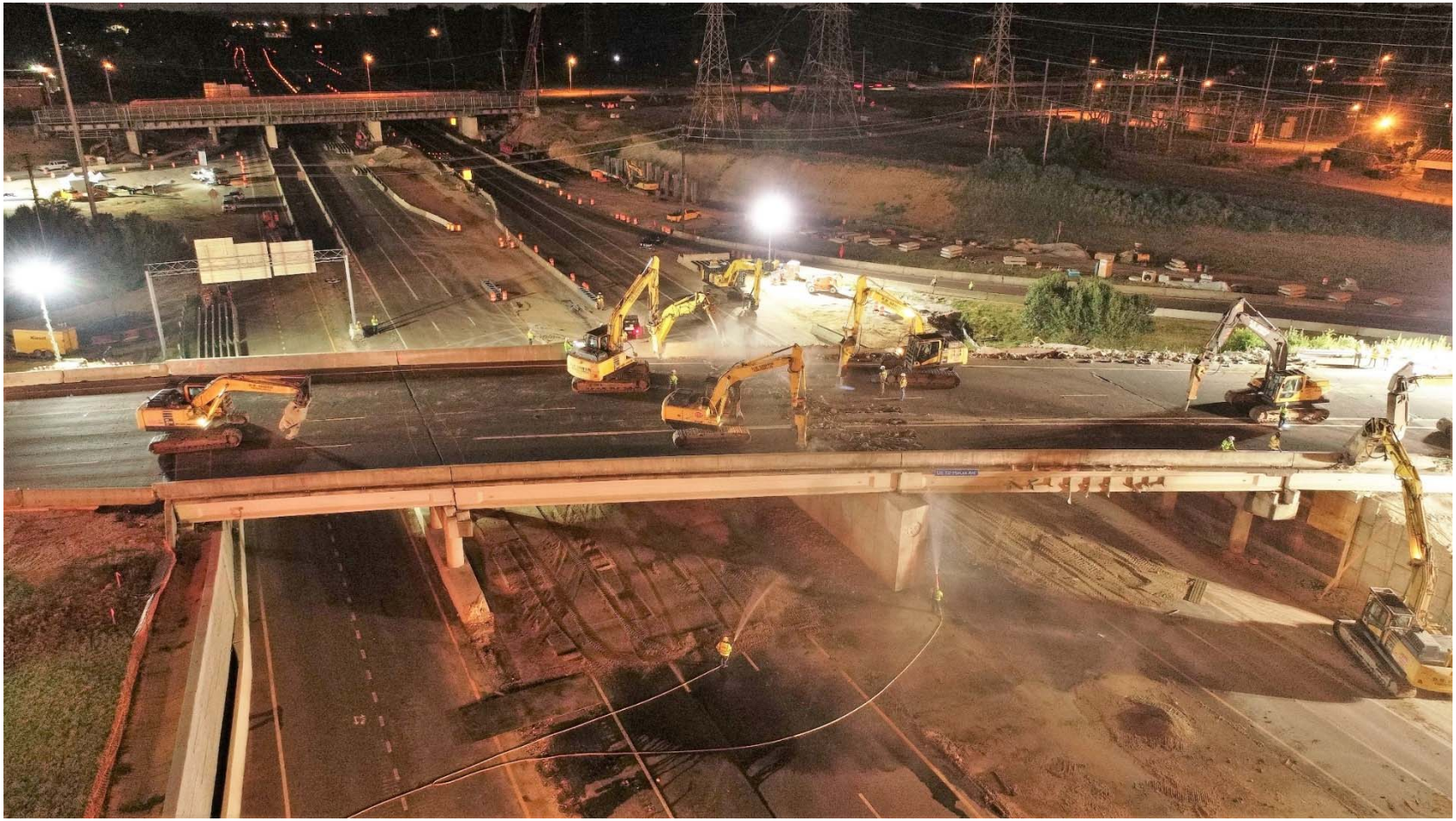
SPMT

DEMOLITION



DEMOLITION

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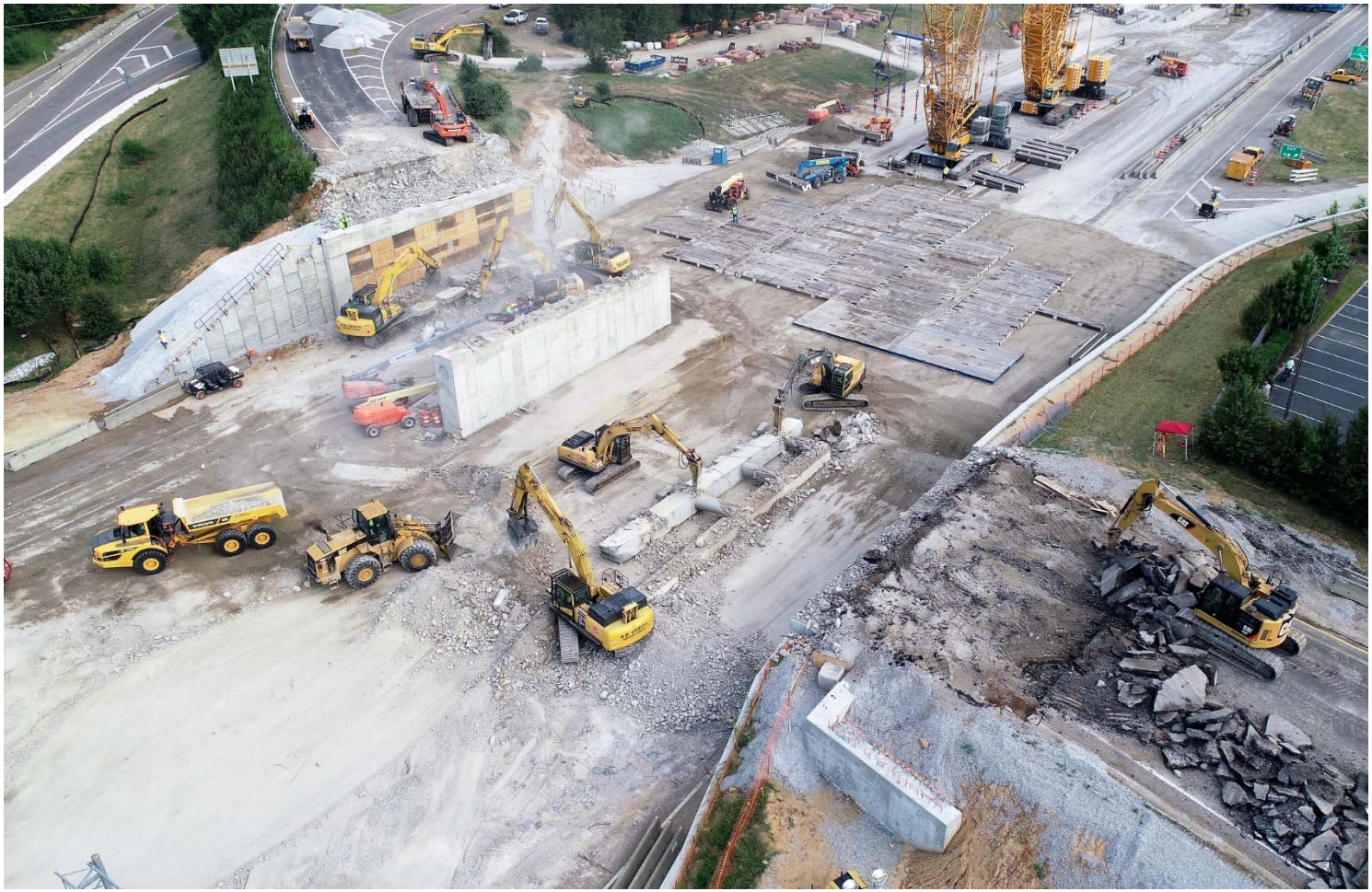
DEMOLITION



SUPERSTRUCTURE UNIT INSTALLATION

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SUPERSTRUCTURE UNIT INSTALLATION

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SUPERSTRUCTURE CLOSURE POUR

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SUPERSTRUCTURE CLOSURE POUR

SUPERSTRUCTURE CLOSURE POUR

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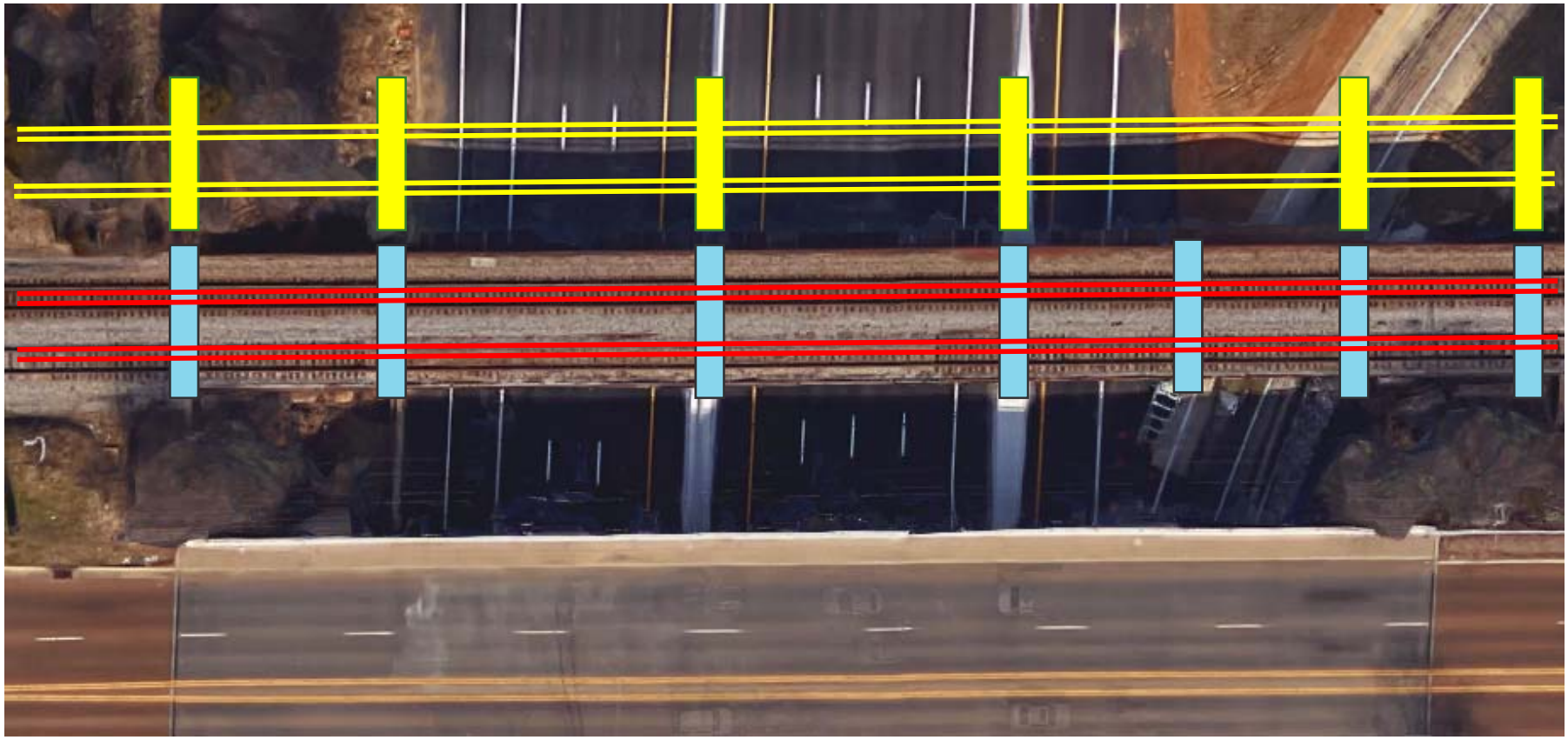
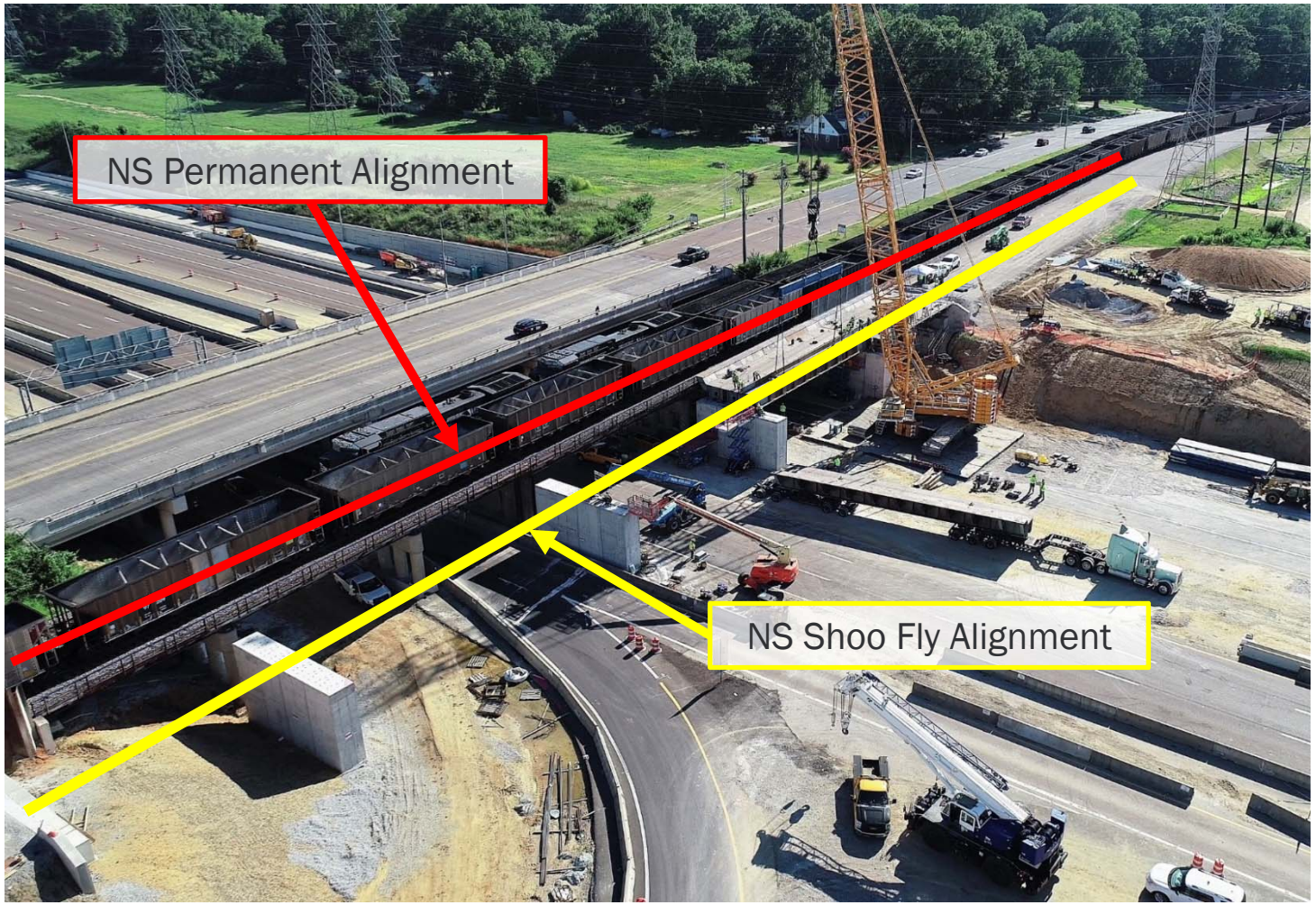
NORFOLK SOUTHERN BRIDGE



NORFOLK SOUTHERN BRIDGE



NS BRIDGE SHOO FLY AND EXISTING…TIGHT FIT

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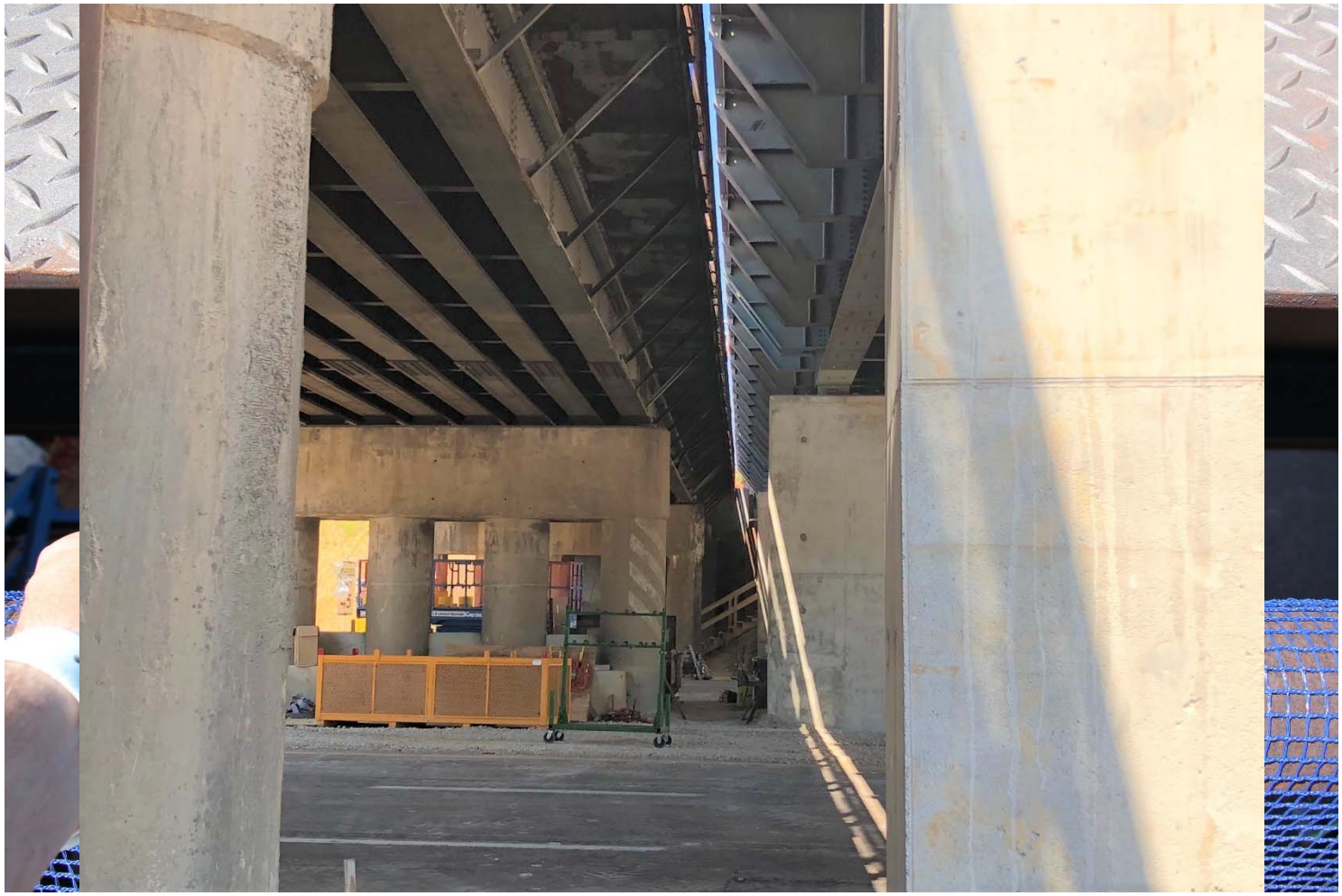
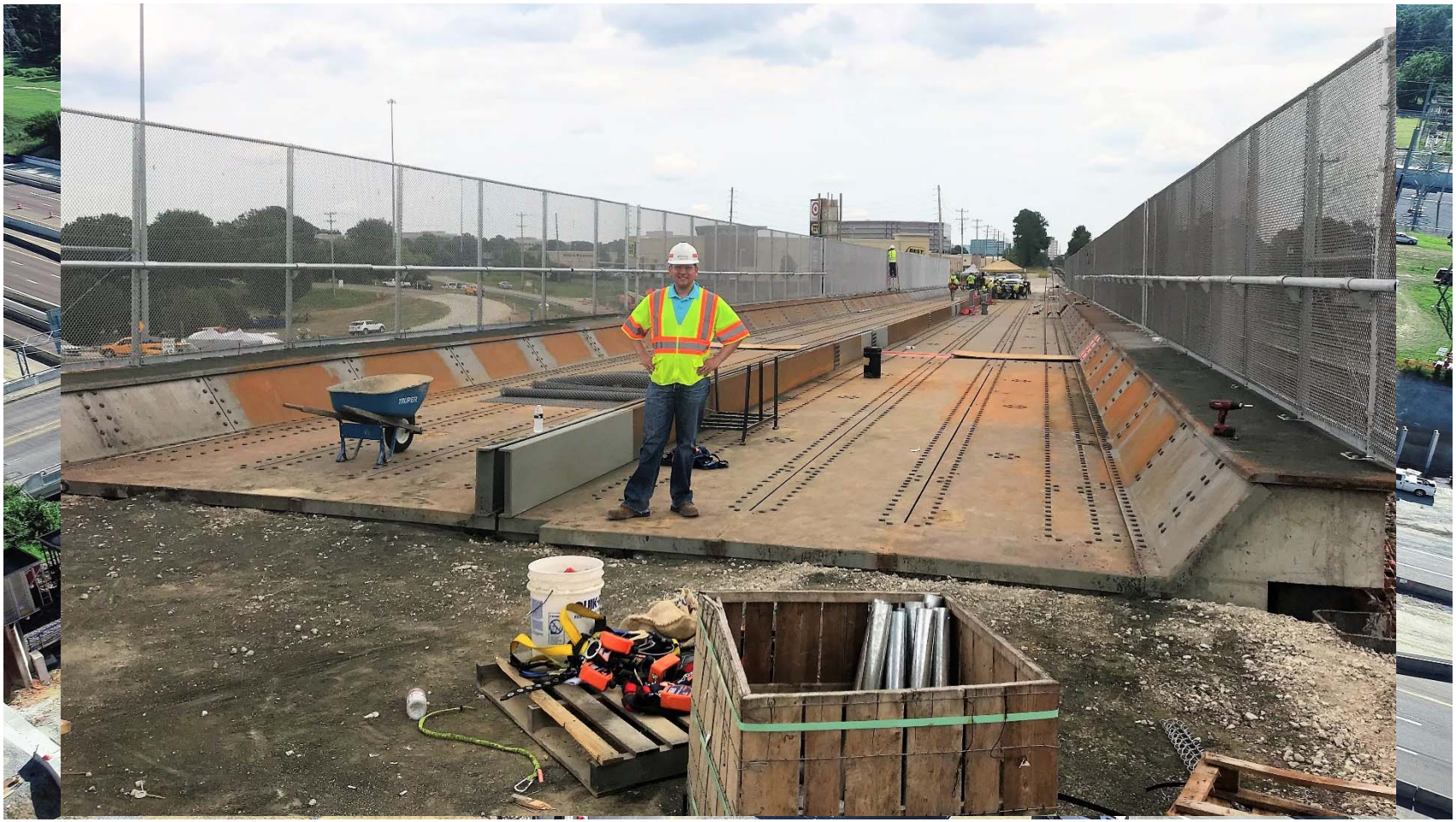
A 2-INCH GAP IS ALL YOU REALLY NEED

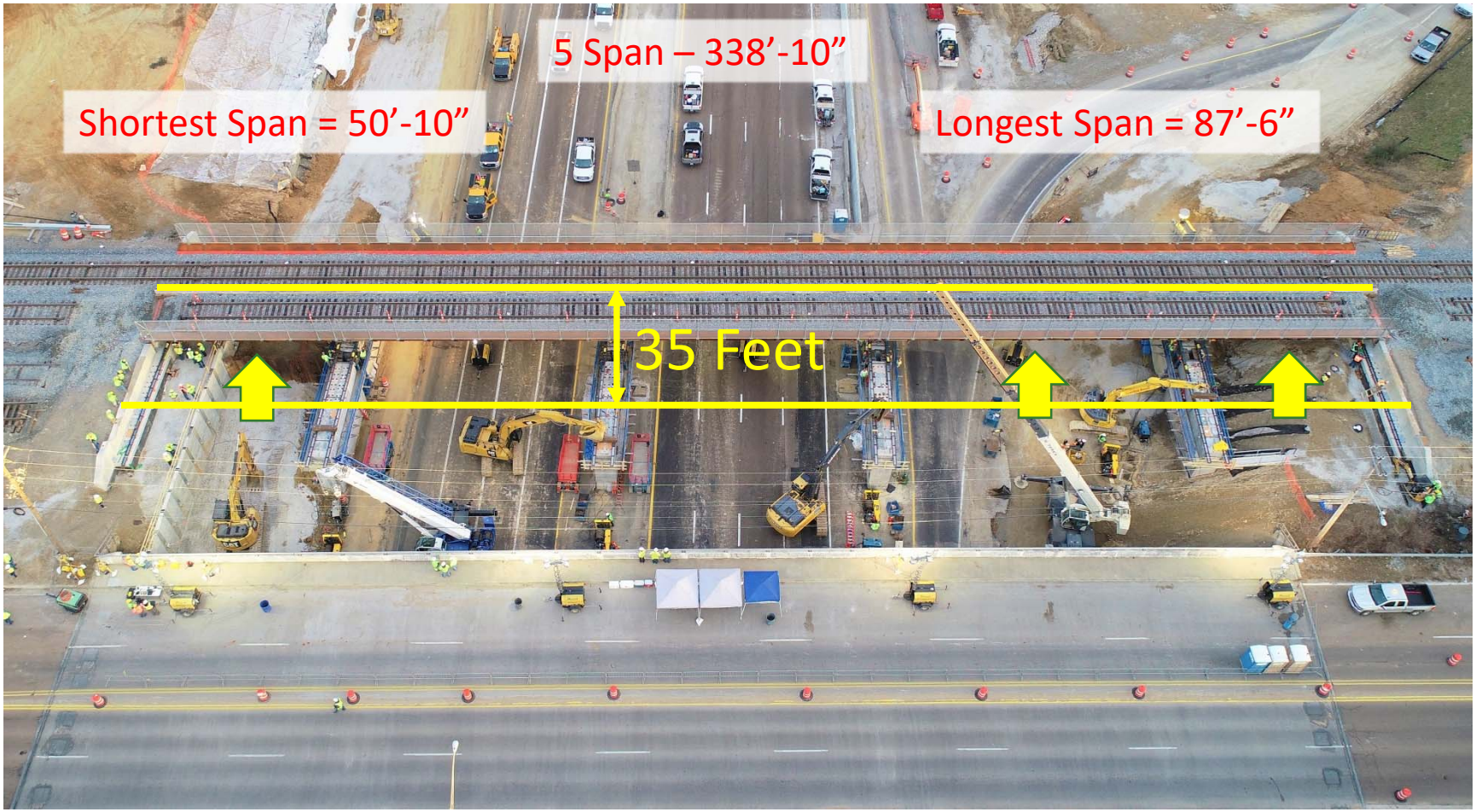


NSRR SUPERSTRUCTURE ERECTION



DRIVING PILES FOR NS PERMANENT PIERS

NSRR PRE-SLIDE



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NSRR FIRST TRACK SLIDE

NSRR SECOND TRACK SLIDE

NSRR BRIDGE SLIDE

Total Bridge Weight with Track and Ballast = 4,000 Kips

….so 2,000,000 lbs per half

Lateral Jacking Force (Kip)		
Location	Net Load *	150%
Abutment 1	20.94	31.41
Pier 2 Span 1	20.94	31.41
Pier 2 Span 2	32.98	49.47
Pier 3 Span 2	32.98	49.47
Pier 3 Span 3	32.98	49.47
Pier 4 Span 4	32.98	49.47
Pier 4 Span 5	43.52	65.28
Abutment 2	43.52	65.28
* Lateral load based on static friction coefficient μ = 0.15 for greased steel on steel		

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NSRR BRIDGE SLIDE

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NSRR BRIDGE SLIDE

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CMGC PROJECT BENEFITS

- ABC resulted in less than 1 year of lane closures
- Design developed to expedite construction
- Micropiles – maximized efficiency
- Designed for tight working conditions with contractor input
- Minimized utility relocations
- Efficient issue identification – timely responses
- Contractor aware of design intent when developing bid

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