

2025 Annual Pitt
Transportation Forum

March 19, 2025

I-95 Bridge Collapse

*Temporary Roadway &
Permanent Bridge Replacement*



Agenda



Incident and Site History



Evaluating Damage



Developing a Solution



Temporary Roadway



Traffic Impacts



Permanent Bridge Replacement



Summary

Incident & Site History

Incident

- Sunday, June 11, 2023, 6:17 am
- Philadelphia, PA
- PennDOT District 6-0

Photo 1



Photo 2

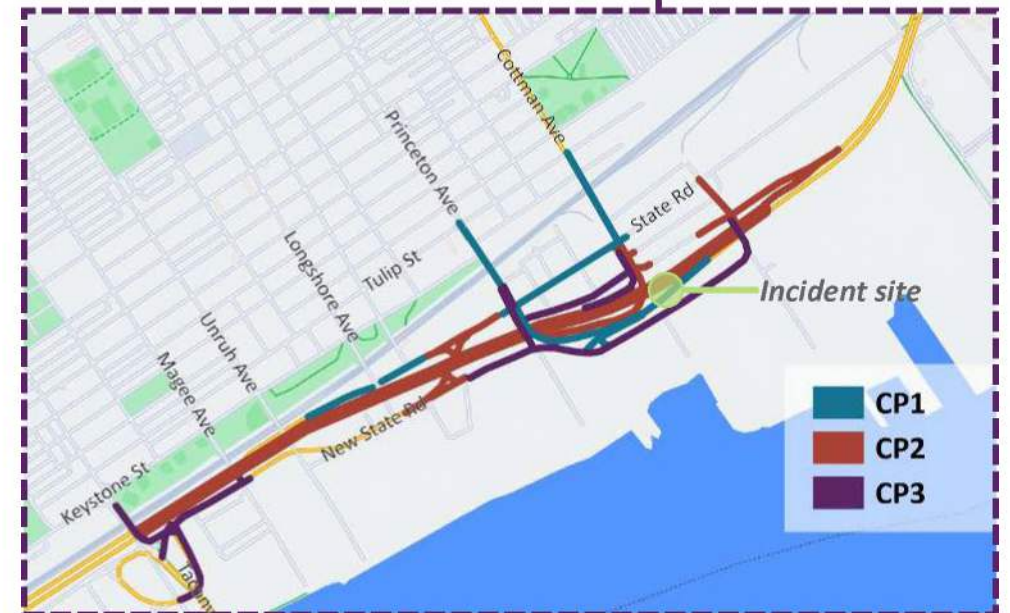
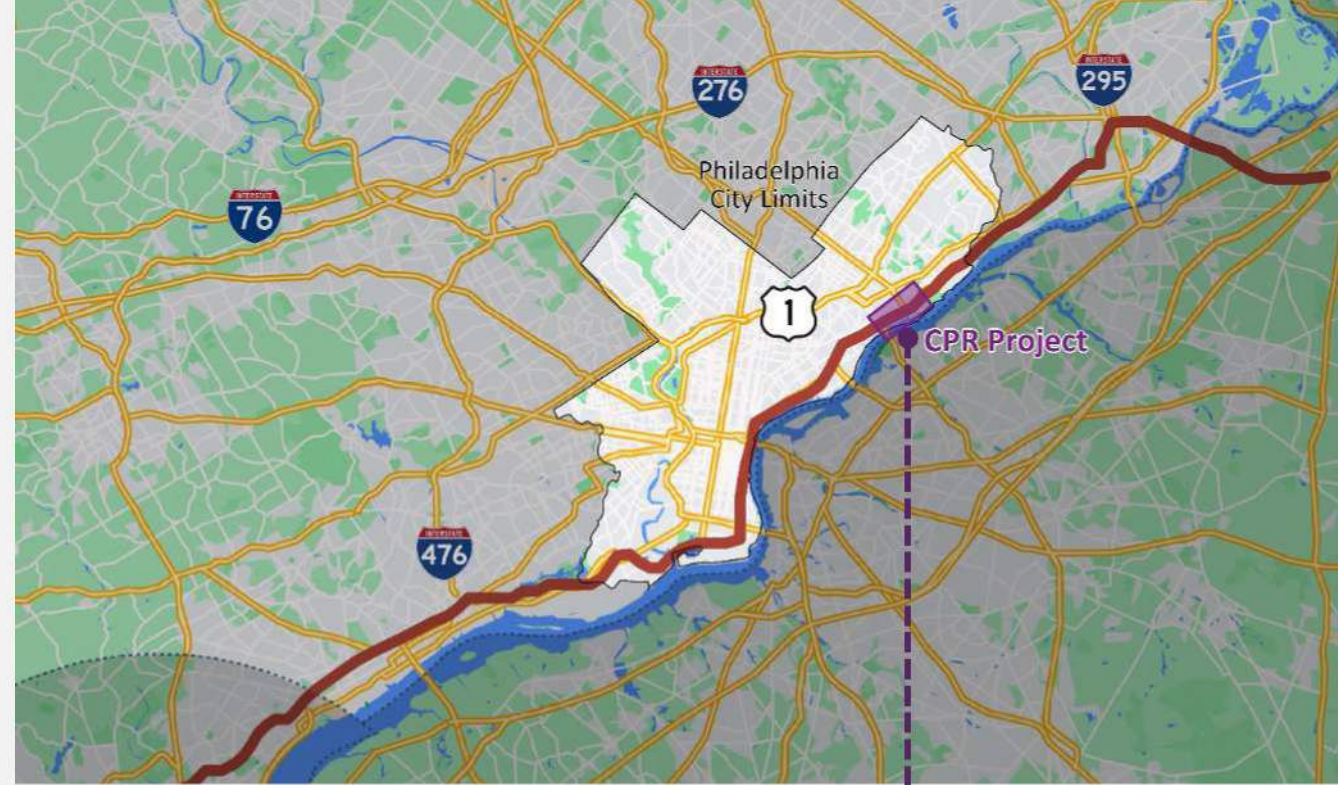


Photo 3



Benesch & I-95

- Cottman-Princeton Interchange (CPR)
 - PennDOT District 6-0
 - Interchange improvements
 - Reconstruction of 1.4 miles of I-95
 - 5 Contracts: CP1, CP2, CP3, ITF, ITB
 - Total cost: \$340M



I-95 over Cottman Ave



Photo from 2020



June 11, 2023



Evaluating Damage I

Southbound Bridge Inspection

- June 11th
- Visual & hands-on
- Heavy soot staining limited visual inspection
- Could not inspect connections for displacement-induced cracking



*Underside of the southbound structure, looking back.
Note the heavy soot staining*

Southbound Bridge Inspection Findings

Severe cross frame distortion



Web distortion up to 2 ½"



Bottom flange lateral and vertical distortion

Southbound Bridge Inspection Findings

- Social media image of SB
- During fire: midspan sag ~9"
- During inspection: no sag

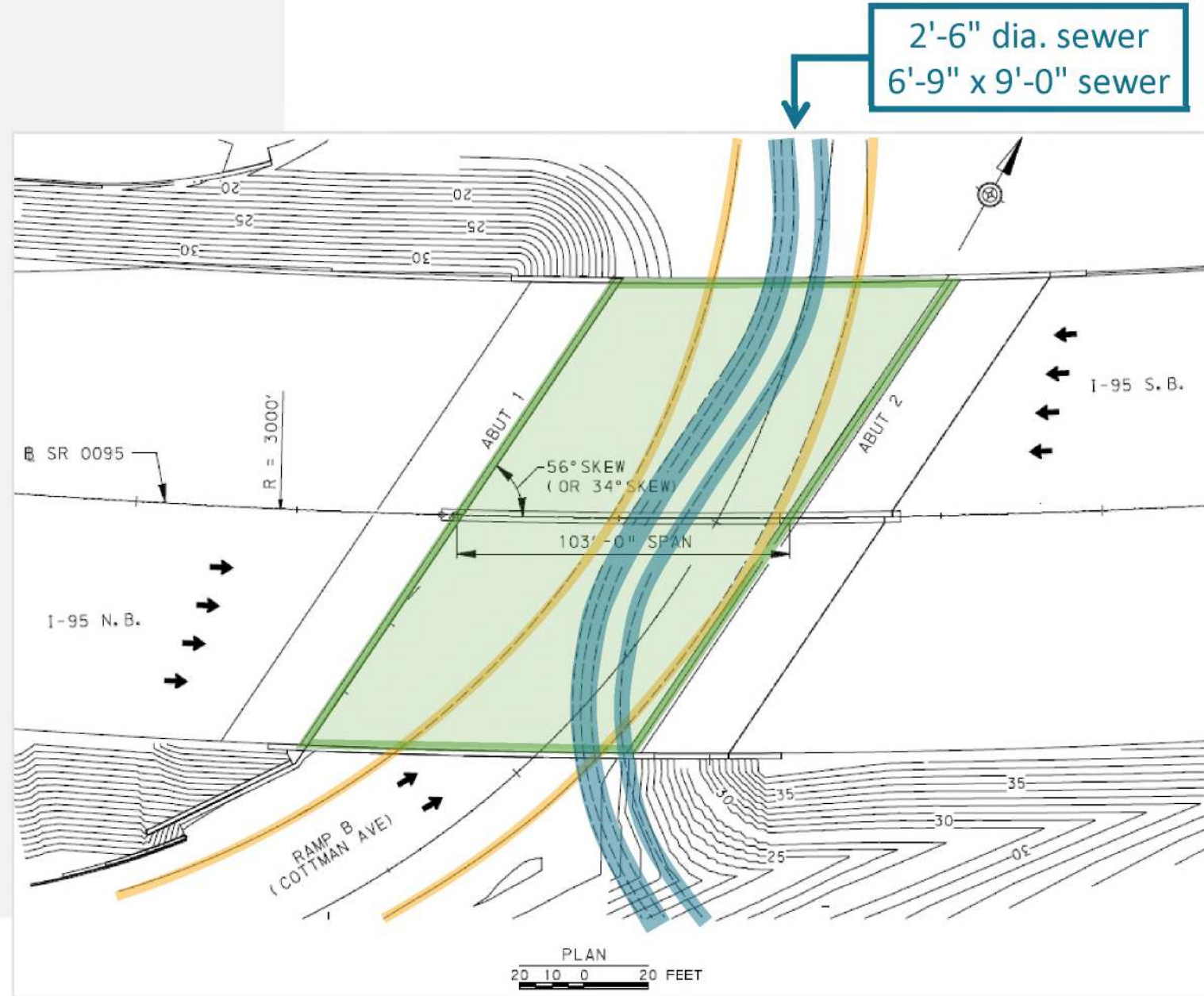




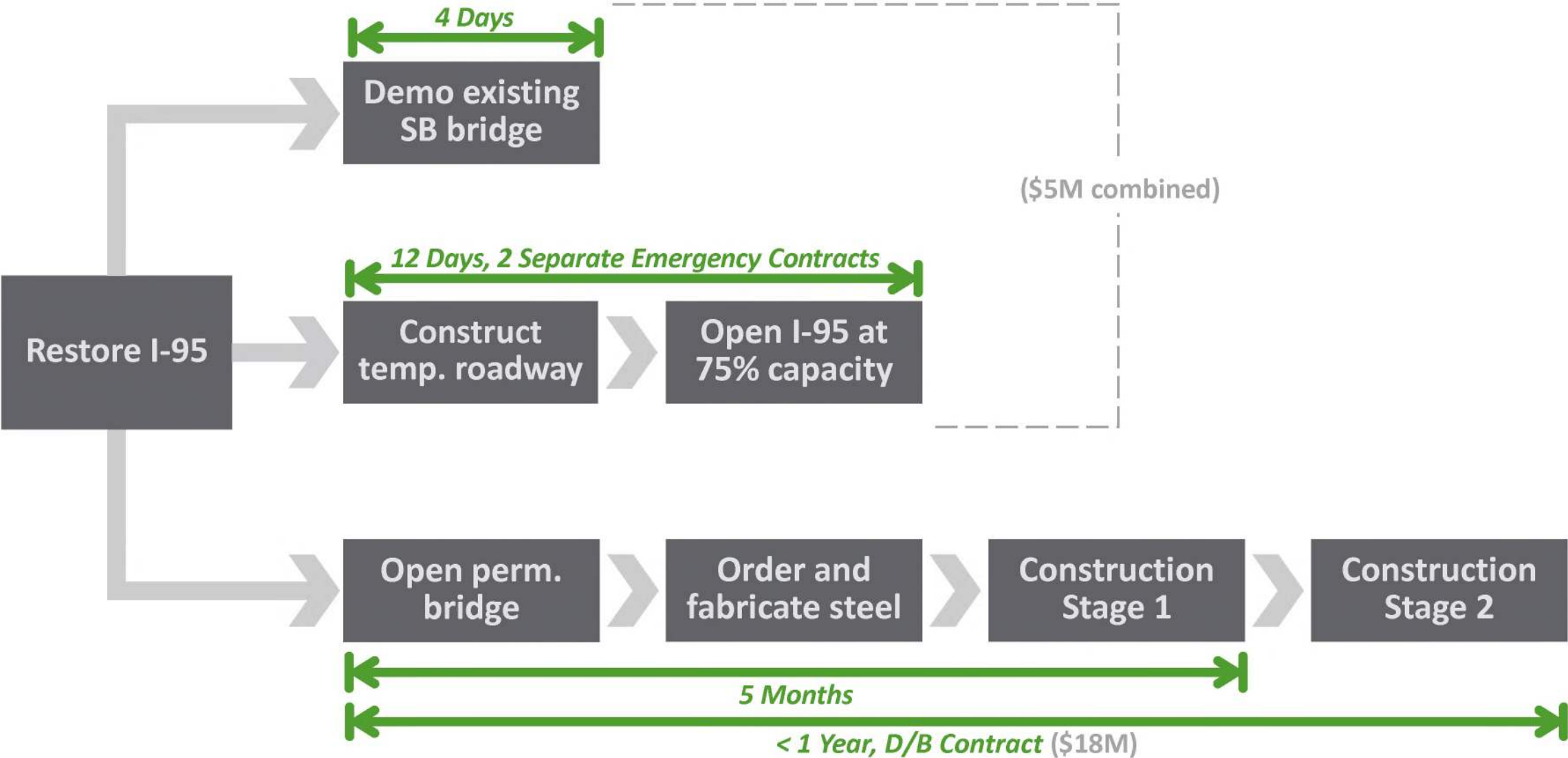
Developing a Solution

Existing Bridge

- 2 structures (NB & SB)
- 8 steel plate girders, (16 total)
- Concrete deck (composite)
- 103' span
- 56° skew
- 3000' radius
- Superelevated
- Bifurcated median barrier
- 74' -7 ¾" width (SB & NB)
- Water dept. facilities

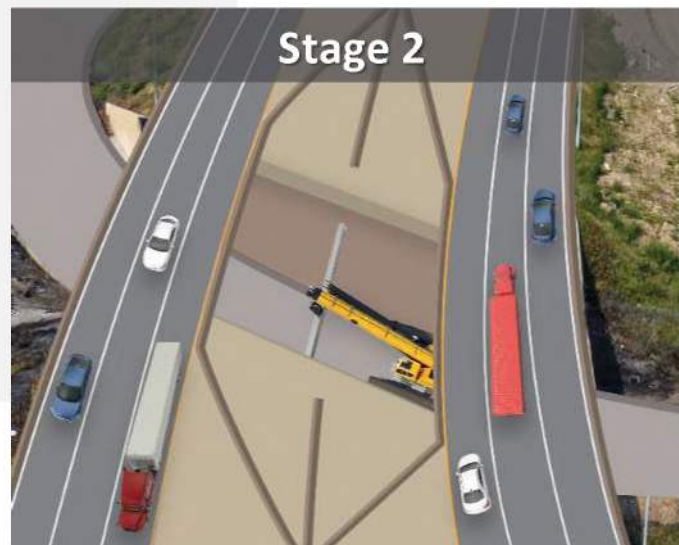
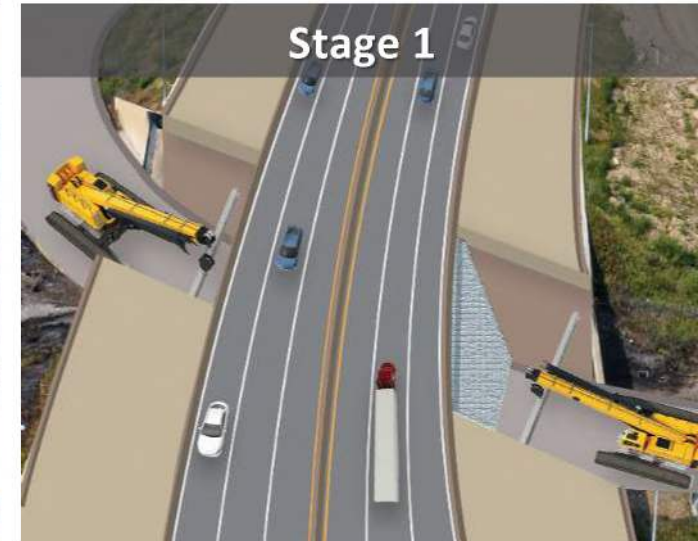
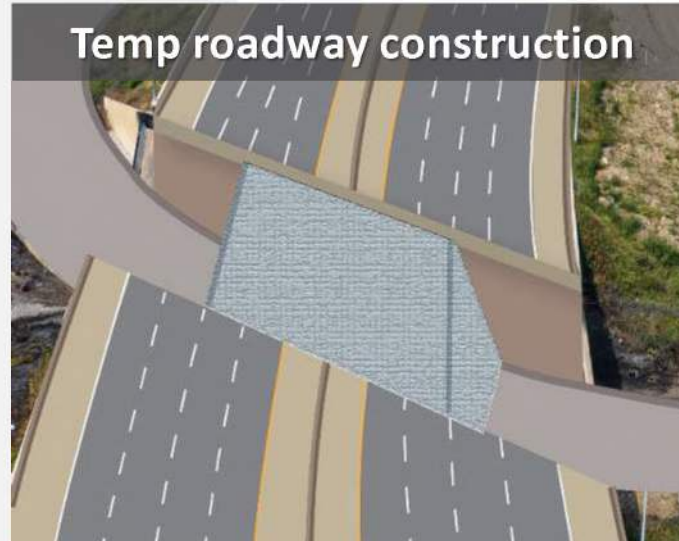


Finding a Solution



Temporary Roadway Solution

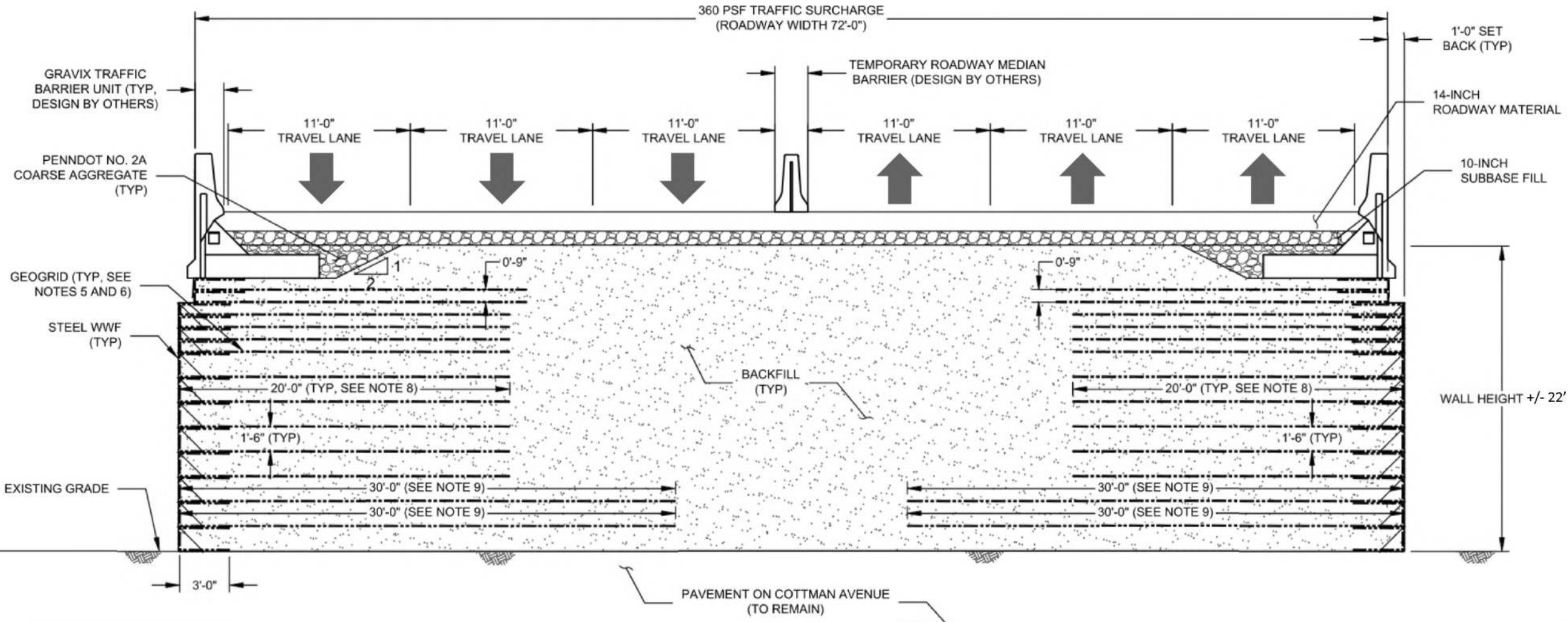
- Temporary retaining wire walls
- Lightweight fill
- Roadway with barrier
- Existing:
 - Four 12 ft lanes (each direction) with full inside/outside shoulders
- Temporary roadway:
 - Three 11 ft lanes (each direction)



An aerial photograph of a construction site, overlaid with a semi-transparent green filter. The image shows a multi-lane road under construction, with temporary concrete barriers and a temporary roadway. A white van is driving on the temporary roadway. In the background, there are buildings, including one with a sign that says "ELITE", and an American flag. A large crane is visible in the lower right quadrant. The text "Temporary Roadway" is written in large, white, bold letters on the right side of the image, with a white horizontal line underneath it.

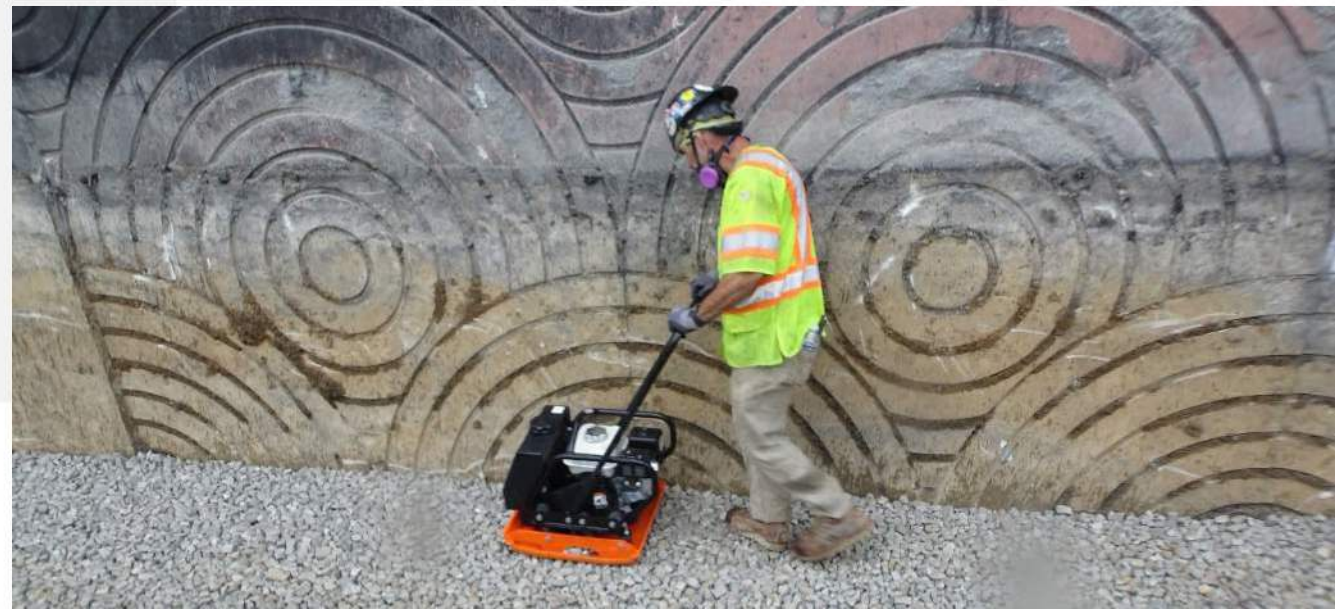
Temporary Roadway

Temporary Roadway Section



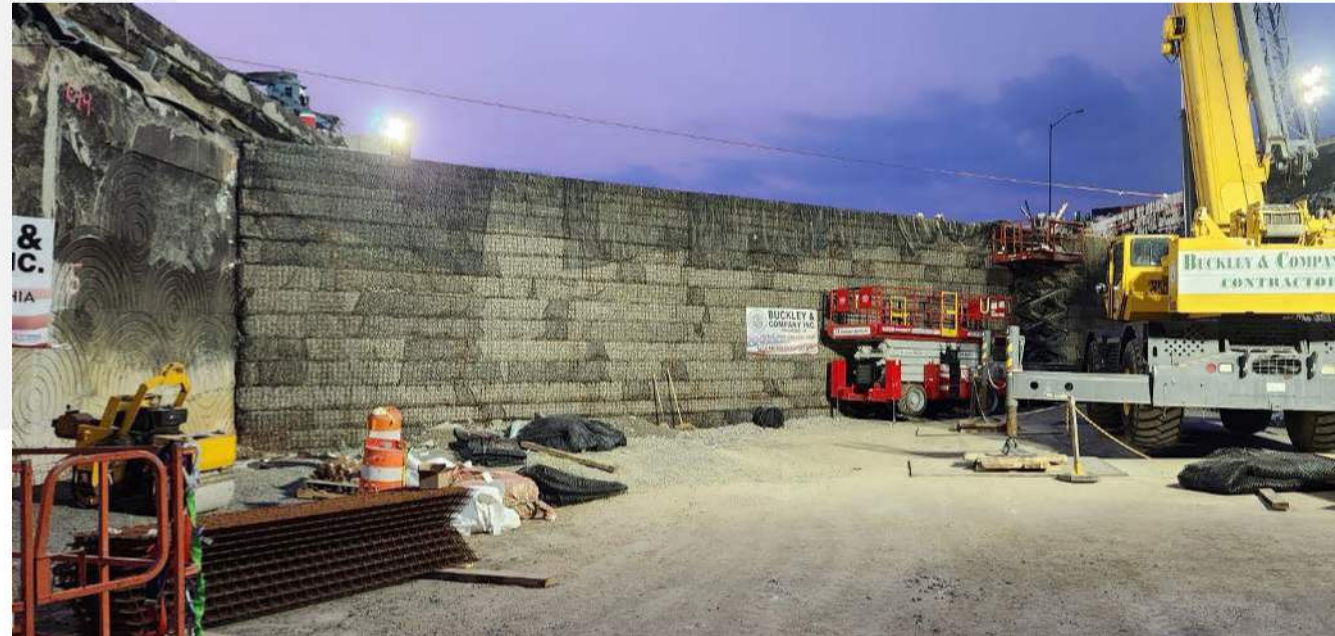
Ultra-Lightweight Foamed Glass Aggregate

- 20 lbs/ft³, $\Phi = 40^\circ$
- 8,000 CY produced from 8 million recycled glass bottles
- Ship by truck (100 CY) or even plane
- Non-toxic, non-flammable, non-porous, insulated
- Pennsylvania-made
- Available
- In use at adjacent/nearby sites



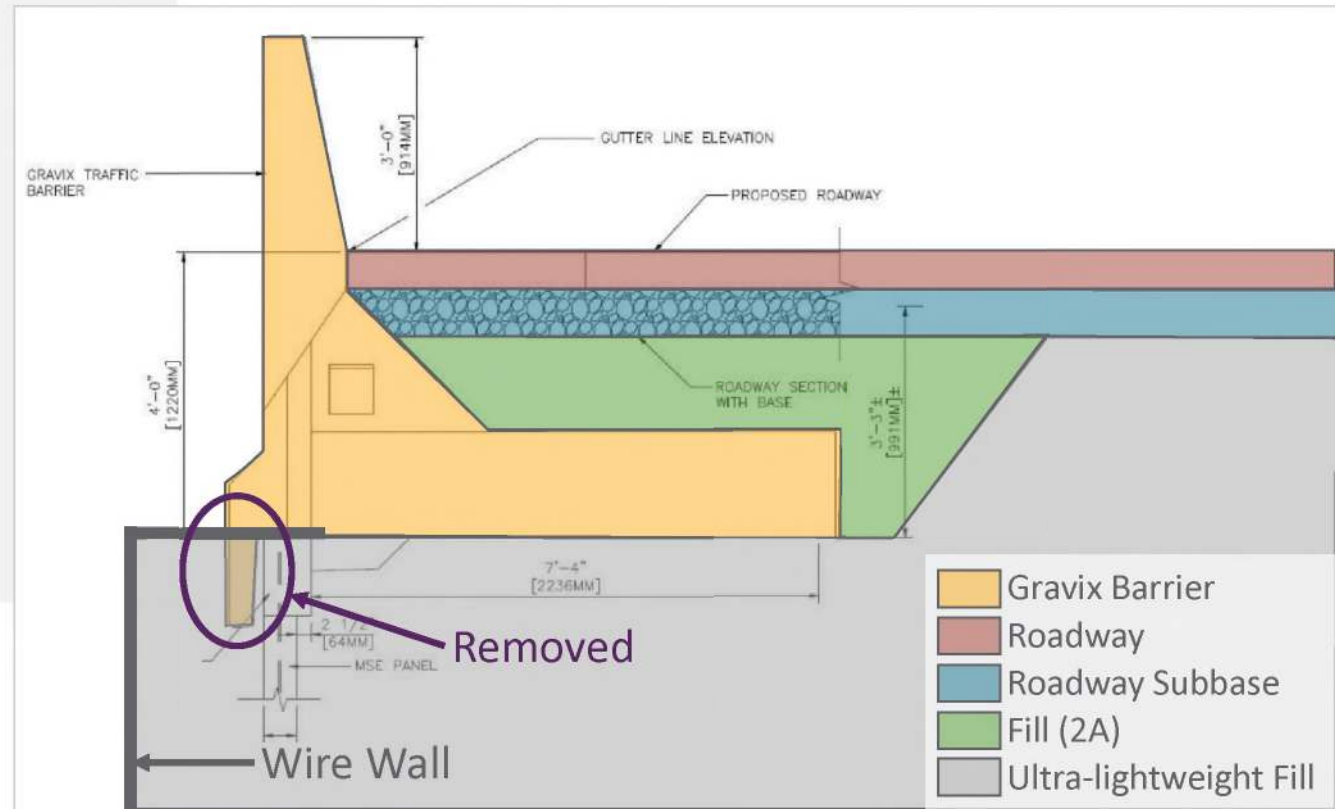
Retaining Walls

- Welded wire form
 - Filled with lightweight fill
- Geogrid
- ~22 feet high



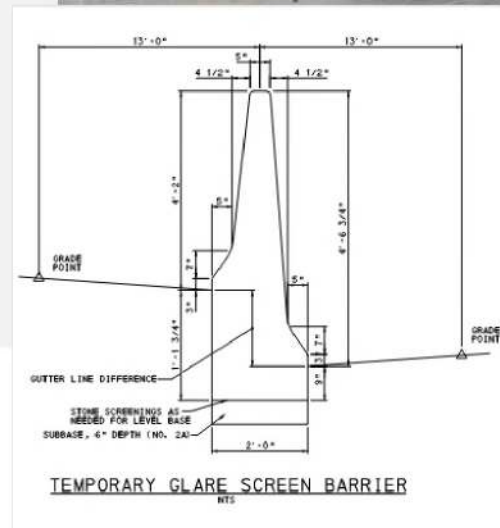
Gravix Barriers

- Precast units available (sitting in yard)
- MASH TL-4
- Bottom 4' of unit backfilled roadway subbase 2A to load integral moment slab
- Units were not cut, so additional diaphragm, backwall, and approach slab removal required



Median Barrier

- Bifurcated 4.75"
- Cast with existing formwork
 - Only two forms available
- Turnaround time
 - 5 days 24/7, including weekend
- Strength (shipping) = 3,000 psi
 - 1-hour core breaks to accelerate segment delivery
- Strength (28 day) = 4,500 psi



From Rendering to Reality



June 15, 2023



June 23, 2023



Evaluating Damage II

Assessing the Damage



Assessing Substructure Damage

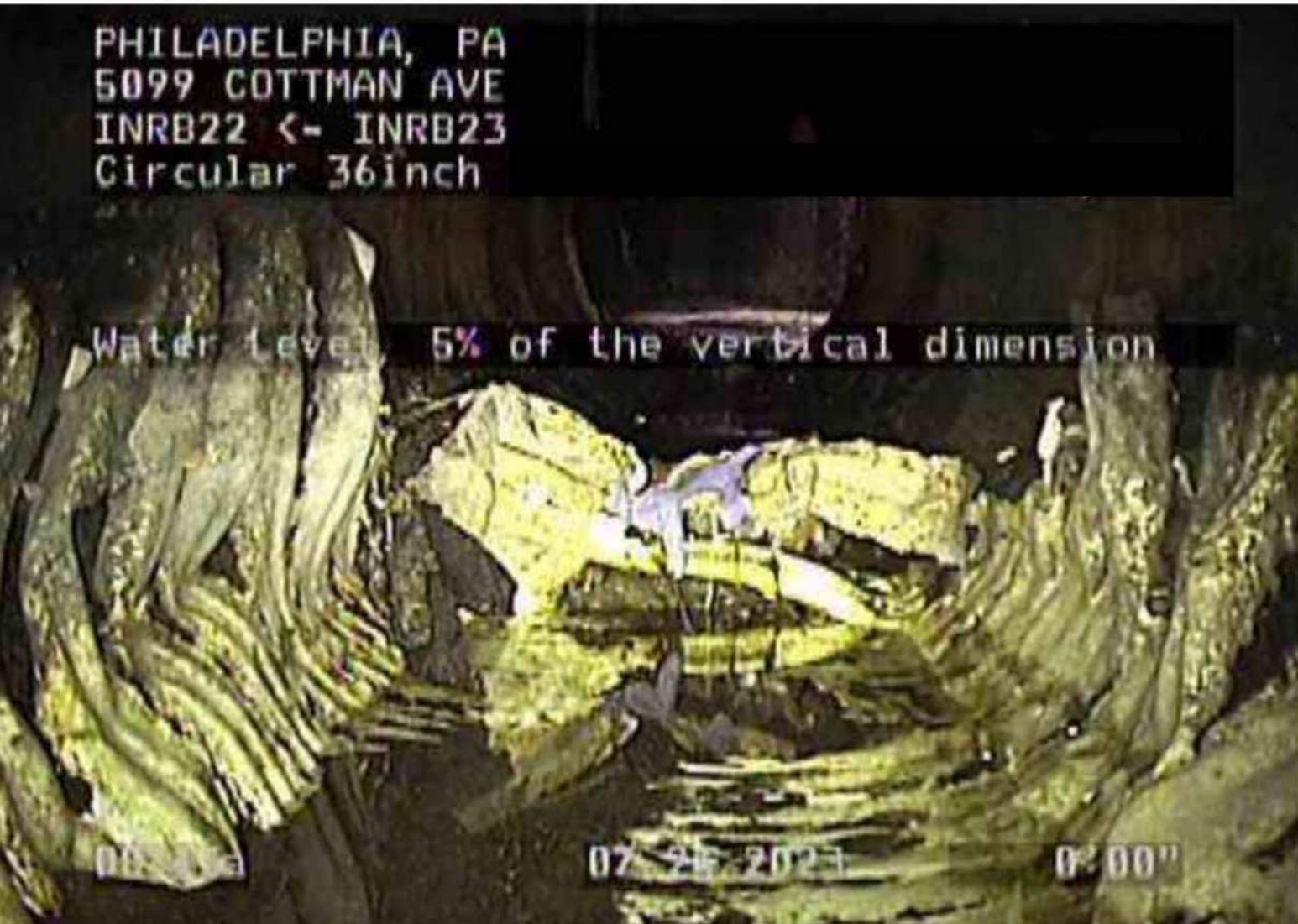
- Concrete cores
- Microcracks
- Assess capacity
- Microscopic, petrographic & fluorescent (UV) light examinations
- Fire spalled up to 6" to 7" of concrete
- Repair / replace depths = 1" to 4" with overall removal up to 9" from original face
- Compressive strength = 4700 psi to 6610 psi
- Estimated temperature in concrete
 - 300°F to 500°F



3³/₄" diameter core



Drainage Pipe Damage



Plastic Pipe Damage



Normal Concrete Pipe



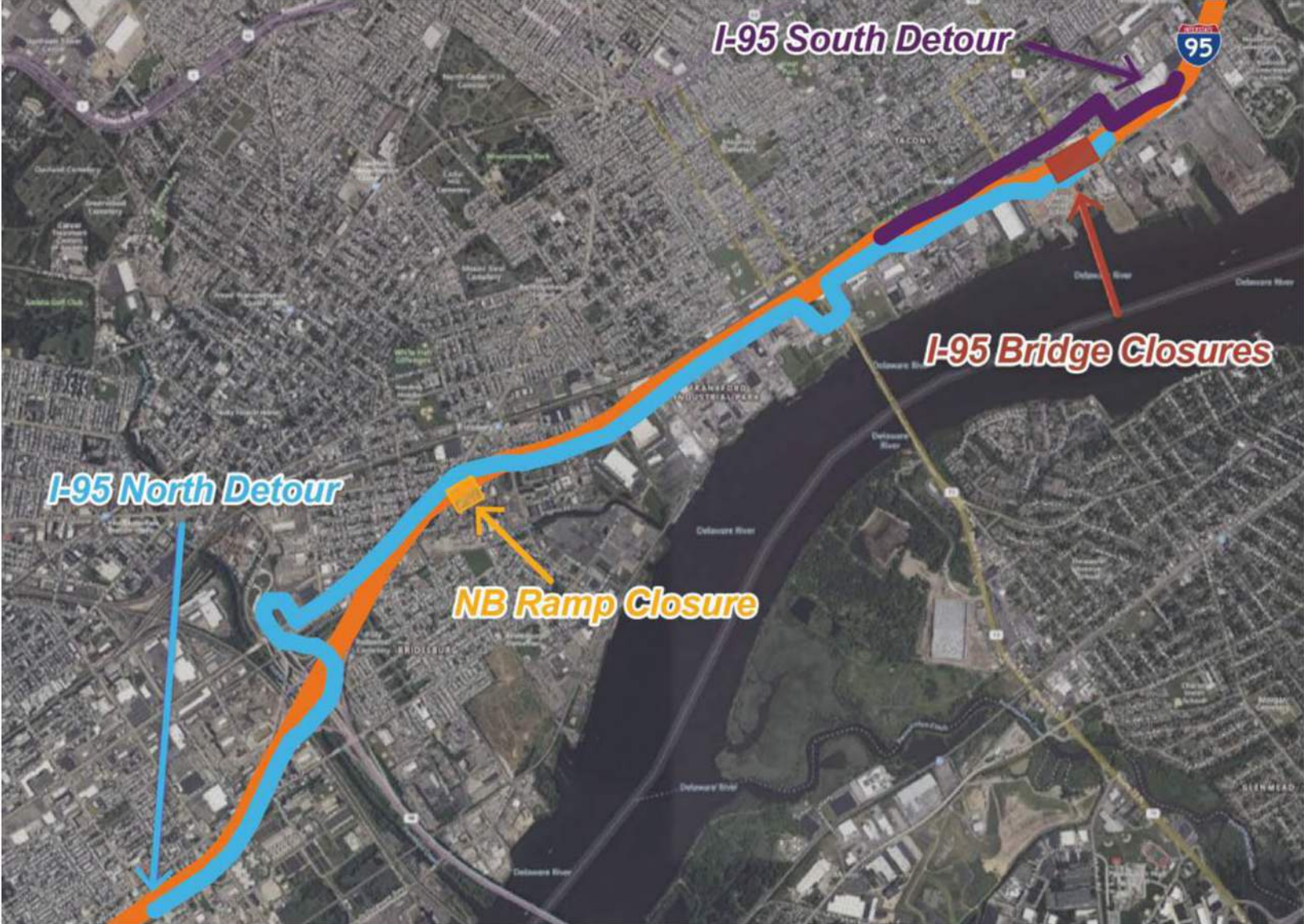
Damaged Concrete Pipe



Traffic Impacts

Local Detour

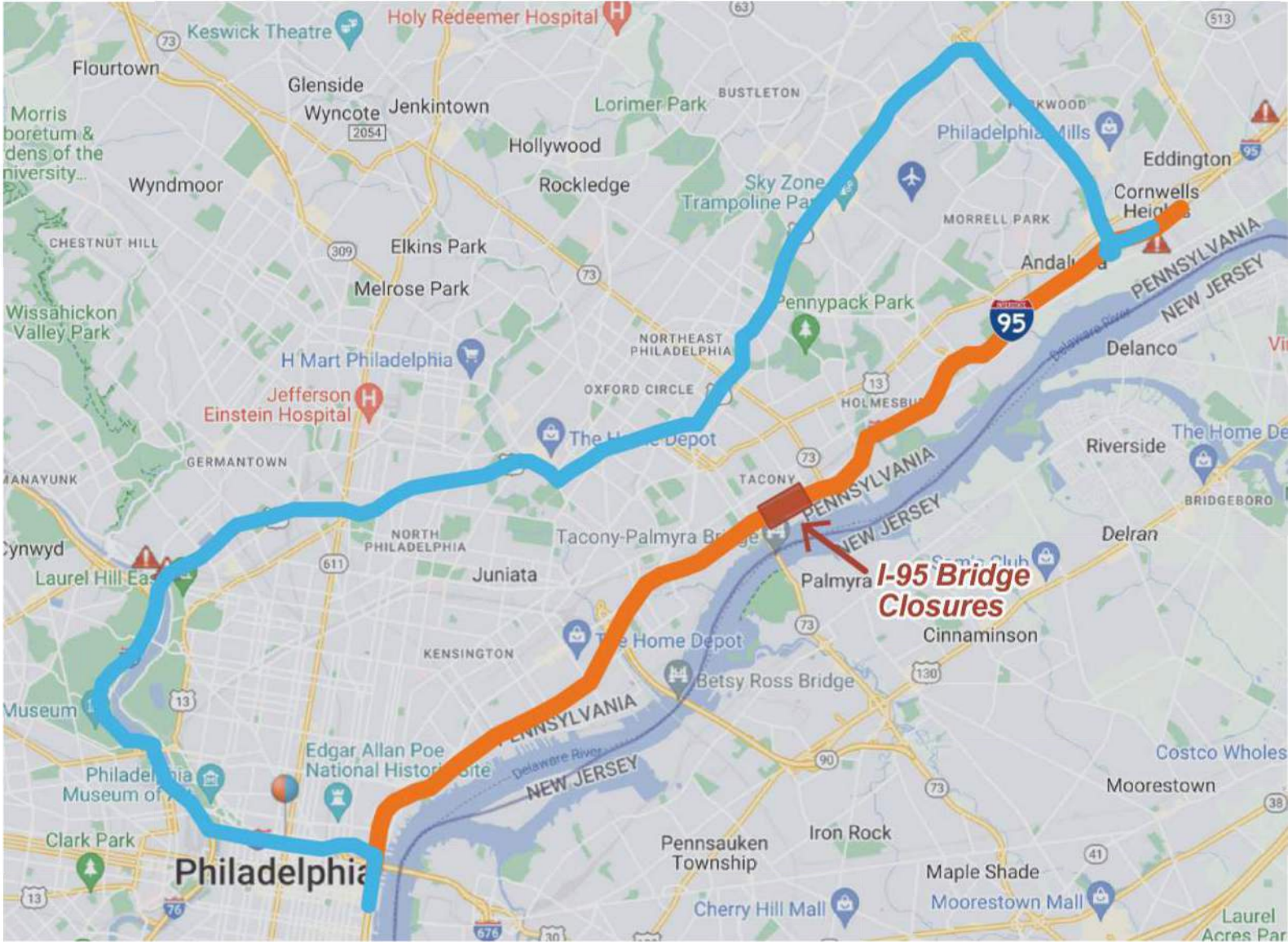
1 mile



Regional Detour

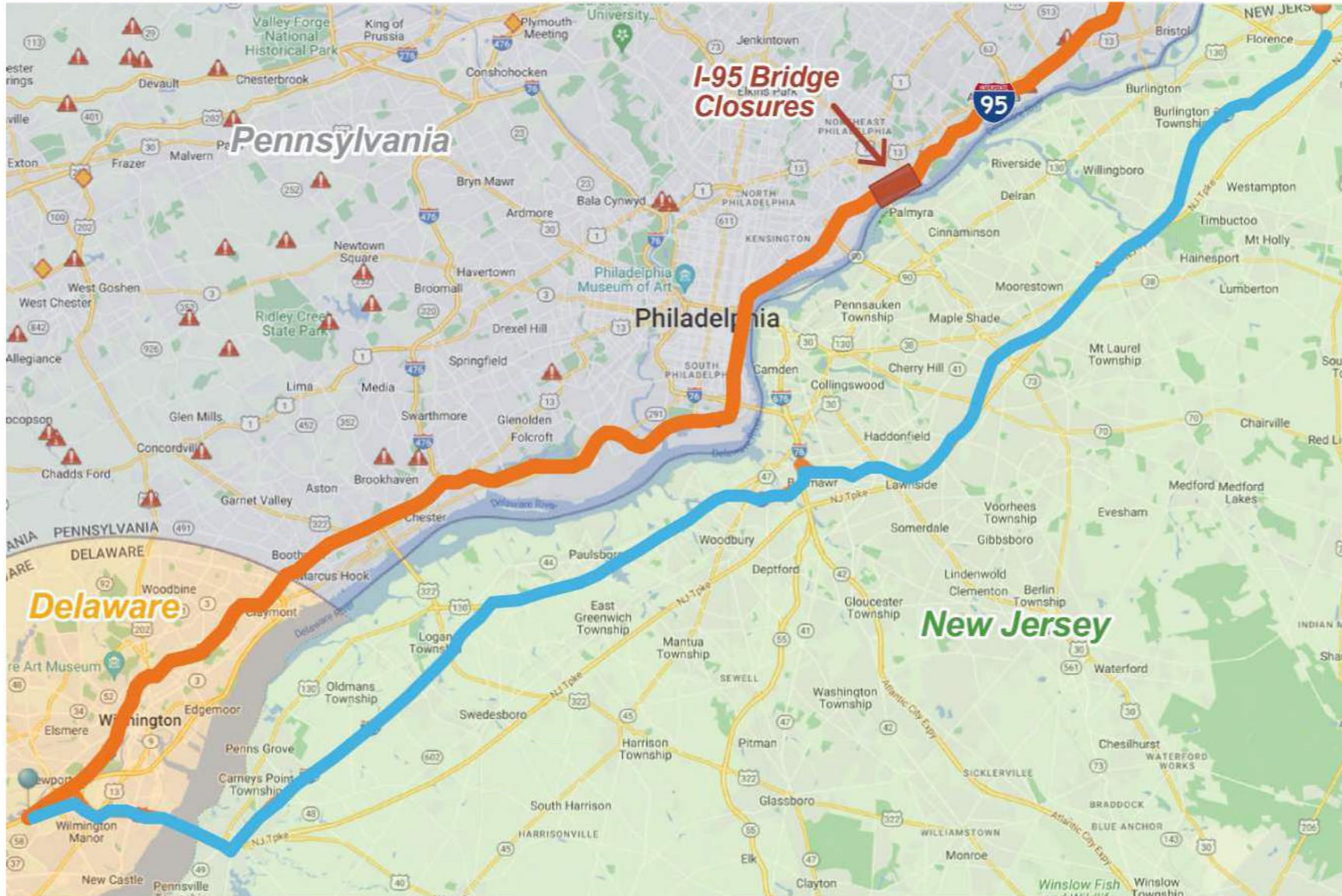
1 mile

5 miles

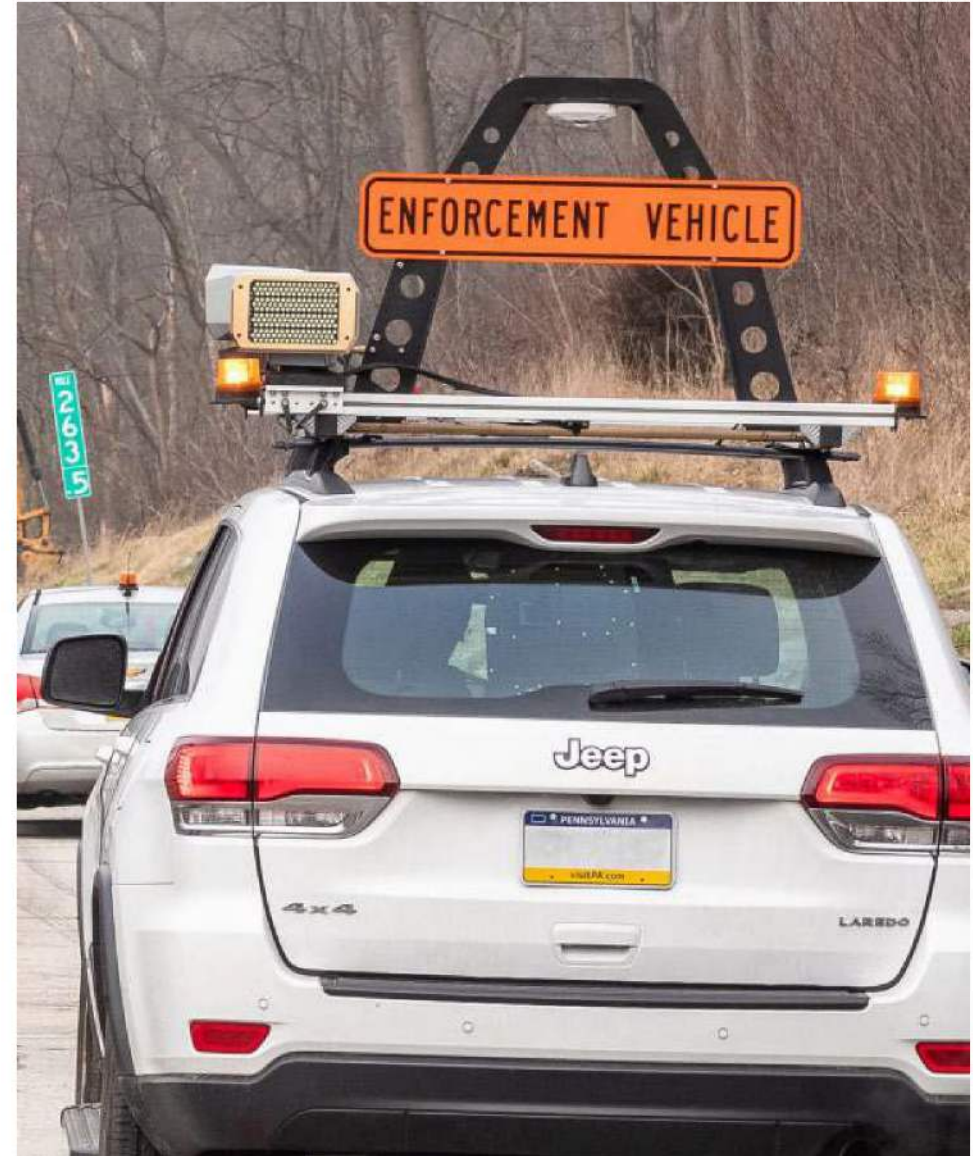
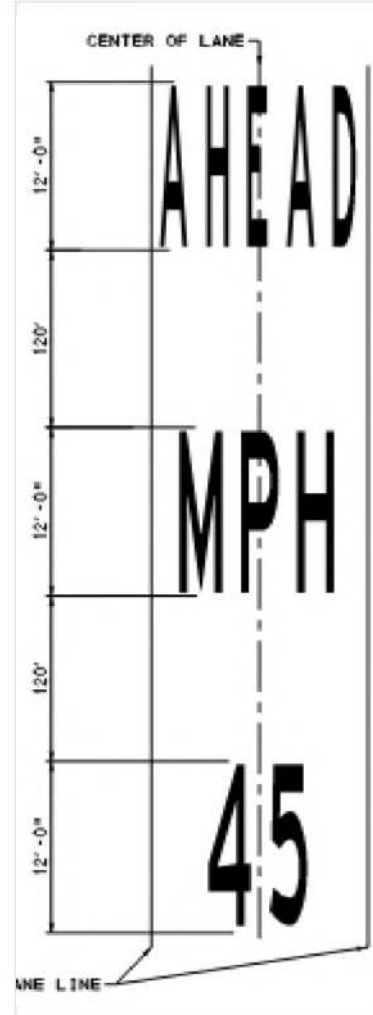


Global Detour

5 miles



Temporary Roadway

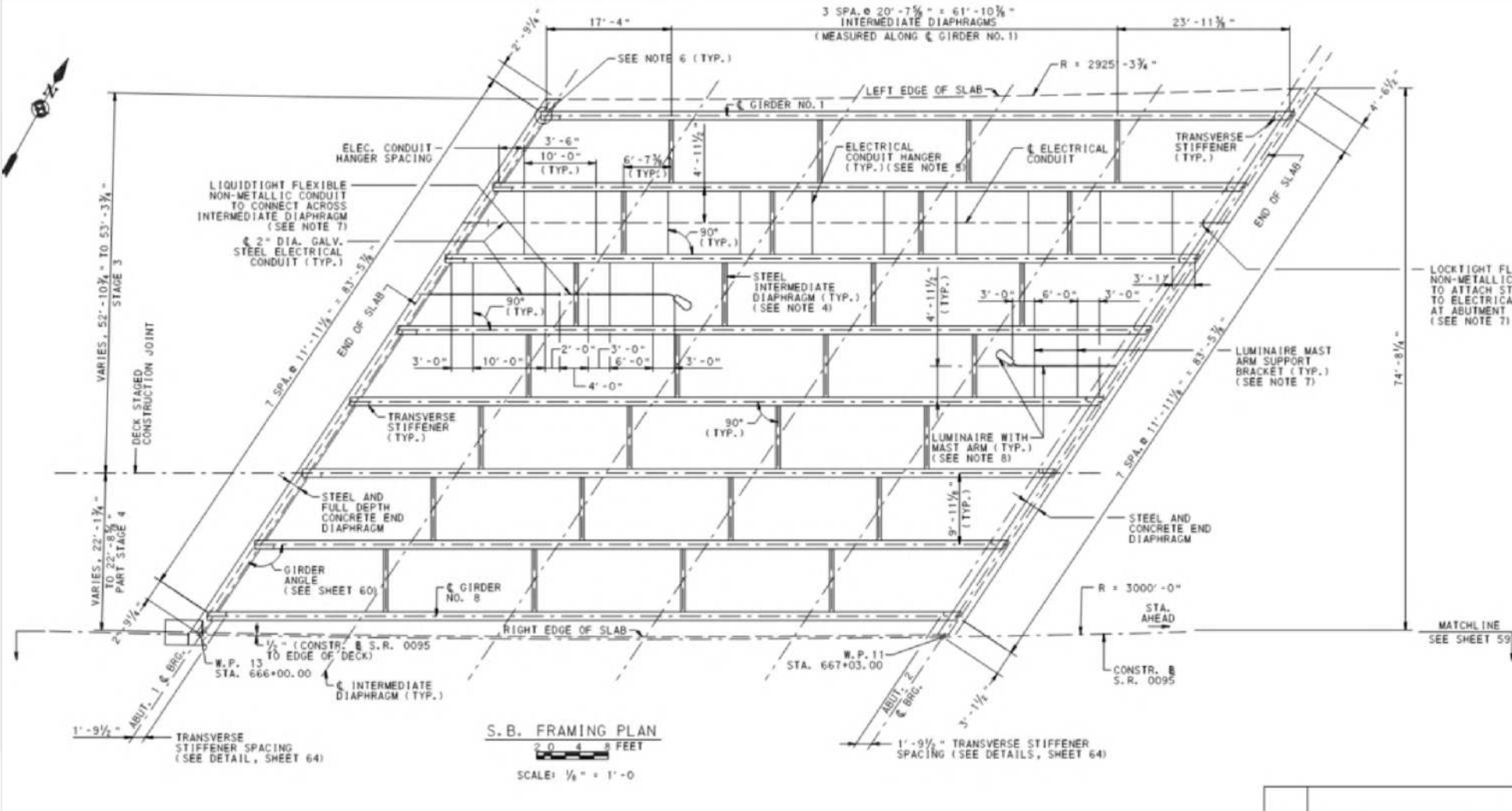


Automated Work Zone Speed Enforcement

Permanent Bridge Replacement

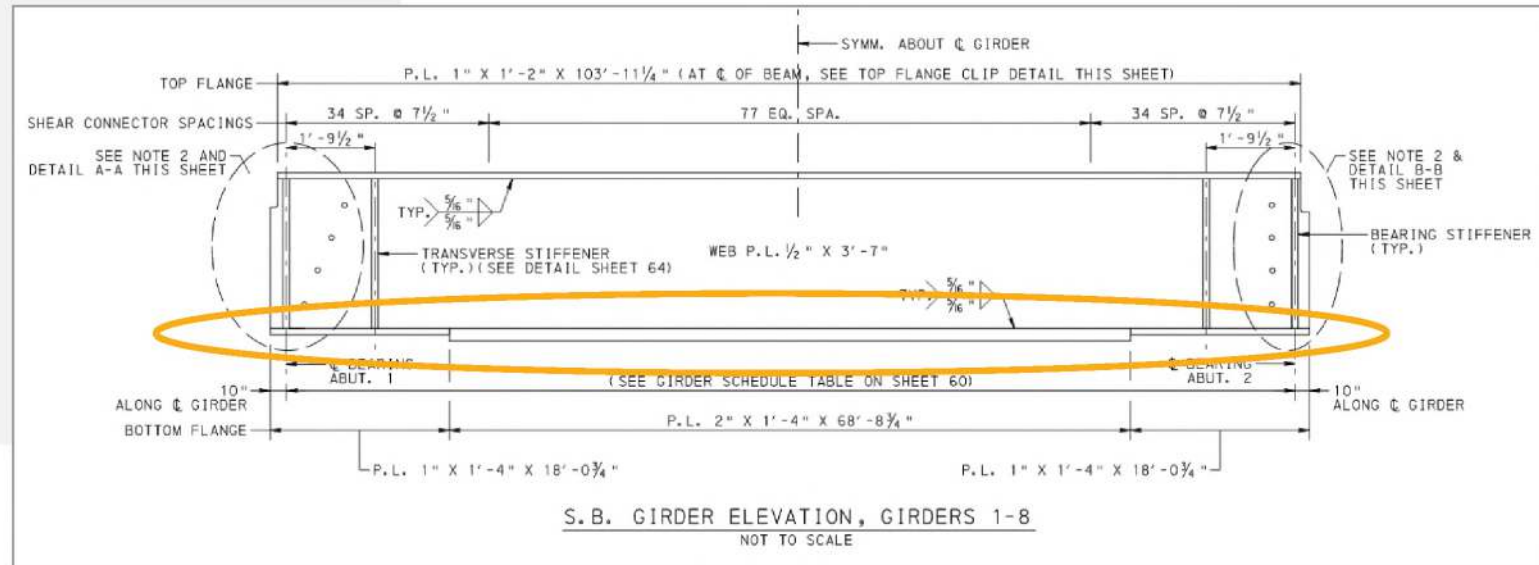
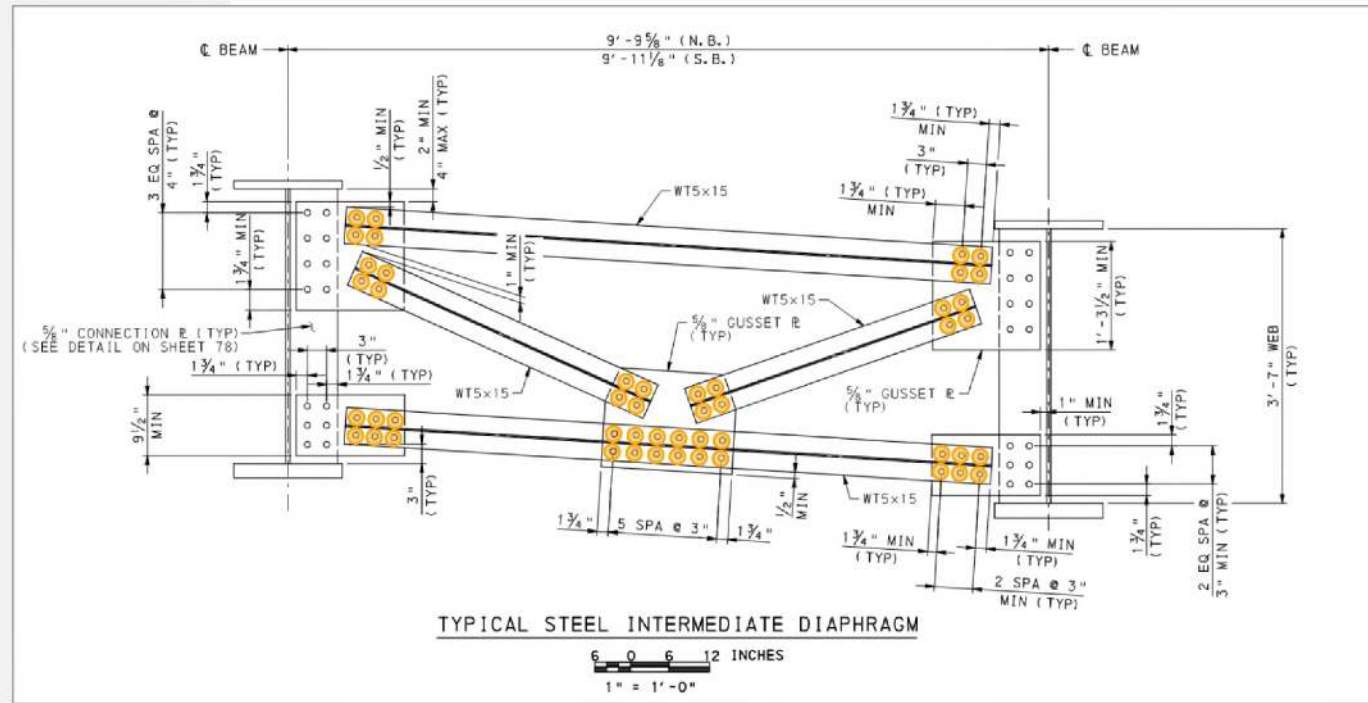
Existing Structure

- 8 beam lines
- SB: 9'-11 1/8"
- NB: 9'-9 5/8"



Design Updates

- Codes:
 - AASHTO: 3rd Ed. to 8th Ed.
 - DM-4: 2007 Ed. to 2019 Ed.
- MASH barrier update
 - Height changed from 42" to 45"
- PennDOT design truck update
 - P2016-13 permit
- Relocated stage construction joint



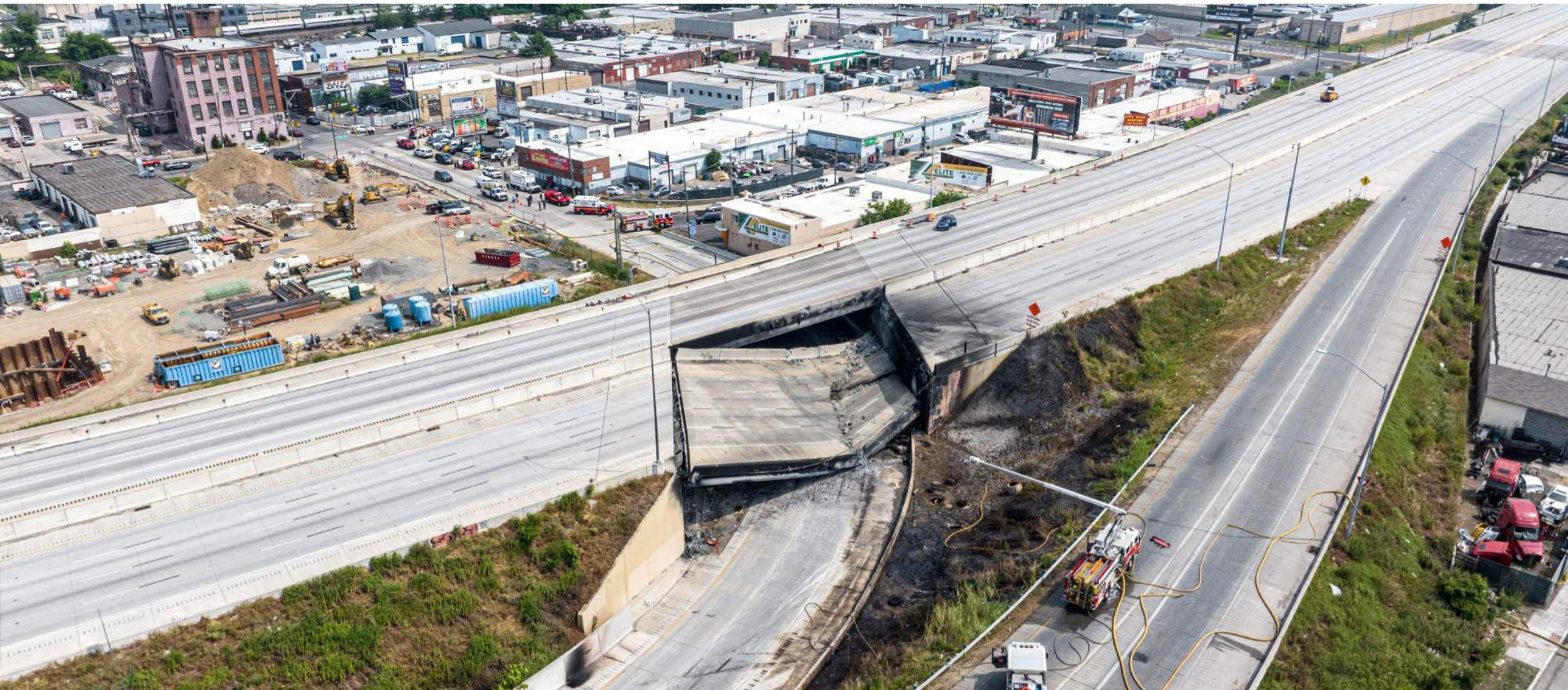
Project Summary

 **BUCKLEY & COMPANY INC.**
Philadelphia, PA
REBUILDING PHILADELPHIA
EMERGENCY JOB

 **AER**
CONSTRUCTION

 **BUCKLEY & COMPANY INC.**
CONTRACTORS

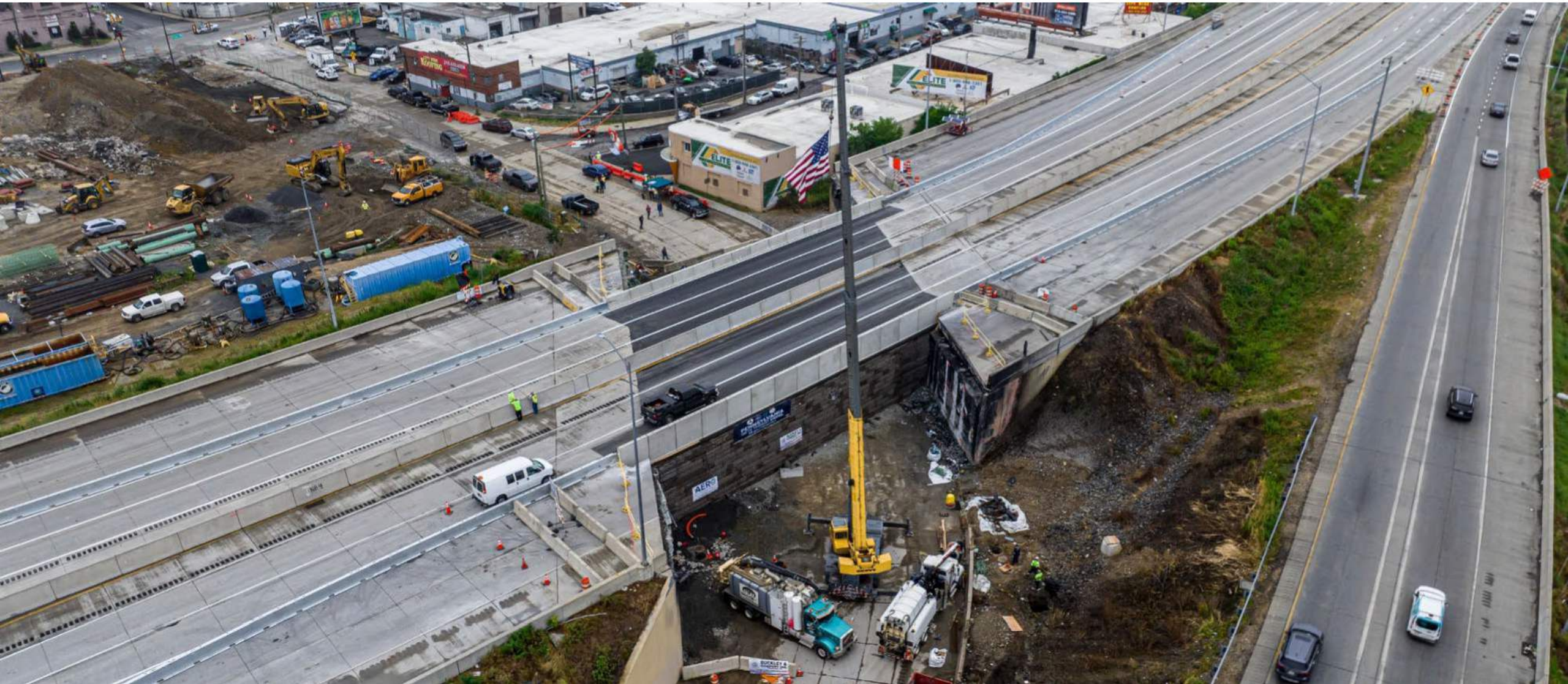
Collapsed Bridge



Project Site after Bridge Demolition



Completed Temporary Roadway



Permanent Replacement: Stage 1



Permanent Replacement: Stage 2



Permanent Replacement: Complete



Team Acknowledgements



Owner



Contractor



Designer



Ultra-lightweight fill supplier



Environmental clearance documentation



Bifurcated Median Barrier Fabrication



Bridge demolition



Initial damage inspection



Immediate MPT/detour plans



Steel beam fabrication



Construction inspection



Construction management



Settlement assessment for temporary roadway loading



Wire retaining wall system design
(hired by Buckley & AeroAggregates)



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Questions?

