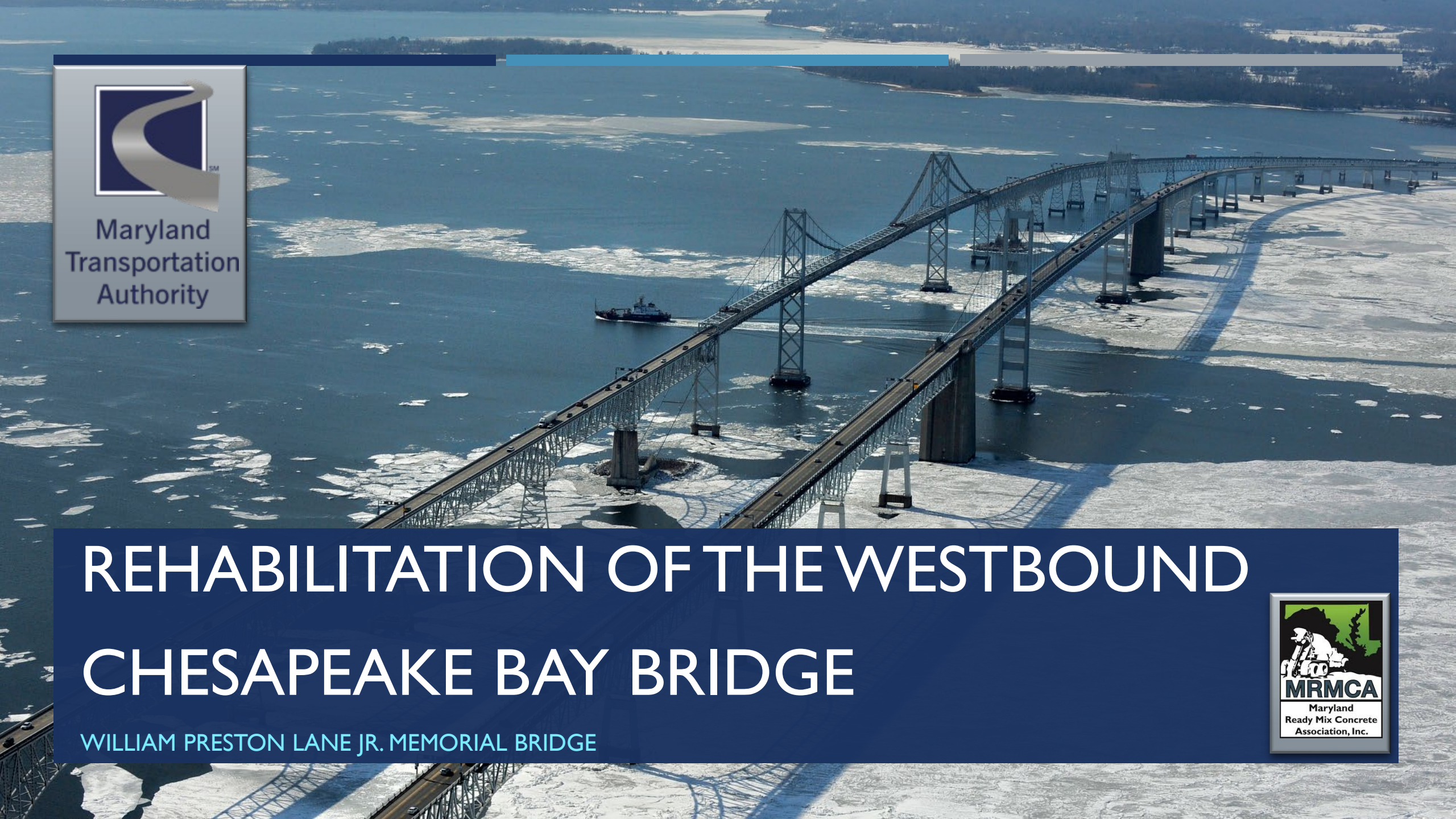

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REHABILITATION OF THE WESTBOUND CHESAPEAKE BAY BRIDGE

WILLIAM PRESTON LANE JR. MEMORIAL BRIDGE

MRMCA
Maryland Ready Mix Concrete Association, Inc.

AGENDA

- Project Background
- Purpose and Need / Scope of Work
- Design Process
- Construction Operations
- Overcoming Construction Challenges
- Partnering During Construction
- Q&A

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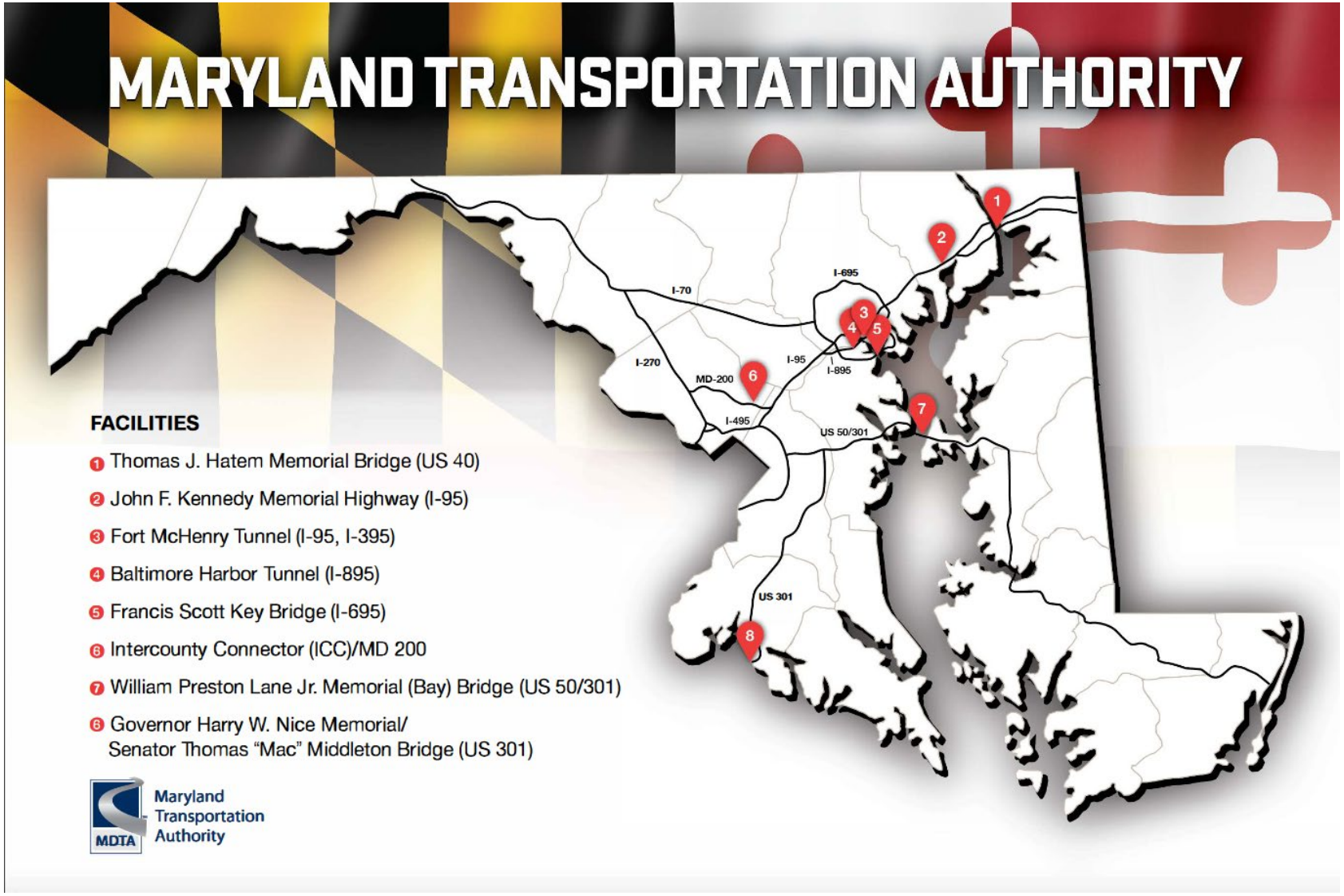
ABOUT THE MDTA



- Constructing, managing, operating 8 toll facilities
- Financing new revenue producing transportation projects
- 2 Turnpikes
  2 Tunnels
  4 Bridges
- All funding through tolls

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PROJECT BACKGROUND

<u>William Preston Lane Jr. Memorial (Bay) Bridge:</u>

- Dual Spans – Eastbound and Westbound Bridges
- Eastbound Opened 1952 (2 Lanes) ($45 M)
- Westbound Opened 1973 (3 Lanes) ($148 M)

<u>Westbound Bridge:</u>

- Overall Length: 4 miles
- 122 spans – 5 Major Types:
  - Main Suspension Spans / Through-Truss / Deck Truss / Steel Girder / Prestressed Girder Spans
- Vertical Clearance: 186-ft. / Tower Height: 379-ft.
- Over 13M Vehicles Cross Bridge Each Year
- During Peak Travel Time – One Lane WB will carry EB Traffic (Contraflow)

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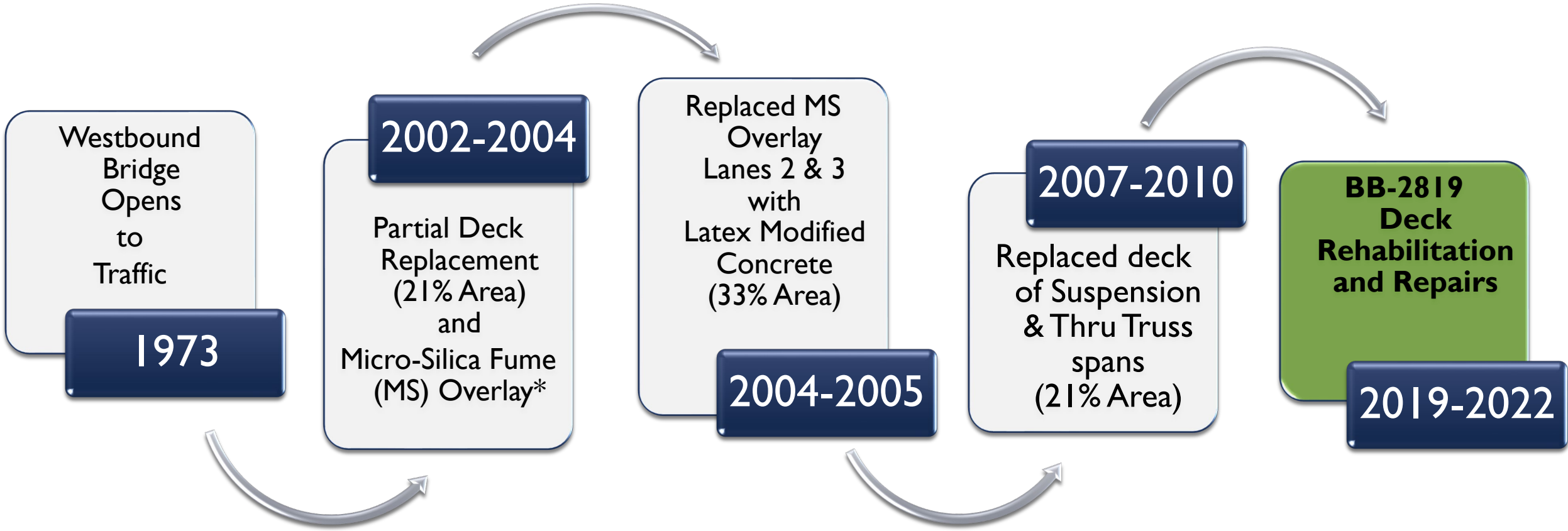
BRIDGE DECK HISTORY



**2002 MS Overlay Excluded the Through Truss and Suspension Spans*

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PURPOSE AND NEED

Existing Conditions:

- Micro-Silica Concrete Overlay remained in right-most lane (Lane 1) from 2004
- Lane 1 – Heavy Patching / Poor Condition
- Lanes 2 and 3 - Good Condition
- Deck Patching was a nightly operation in Lane 1

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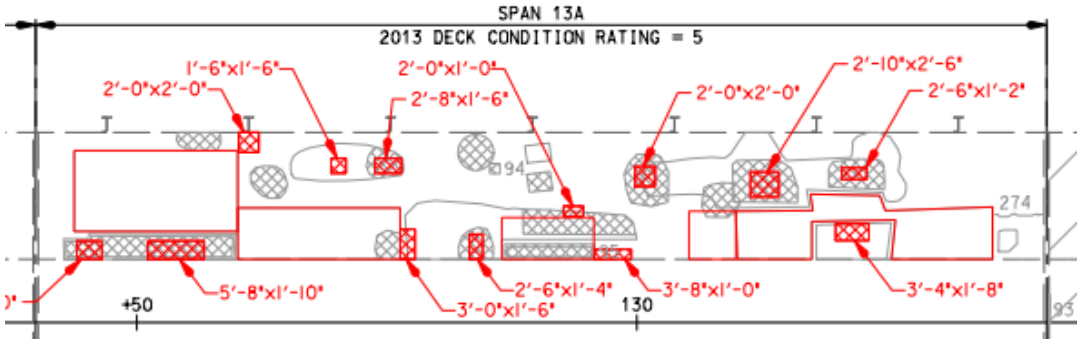
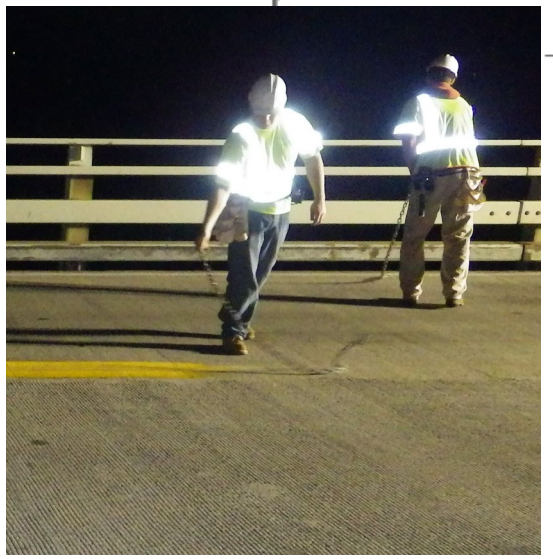
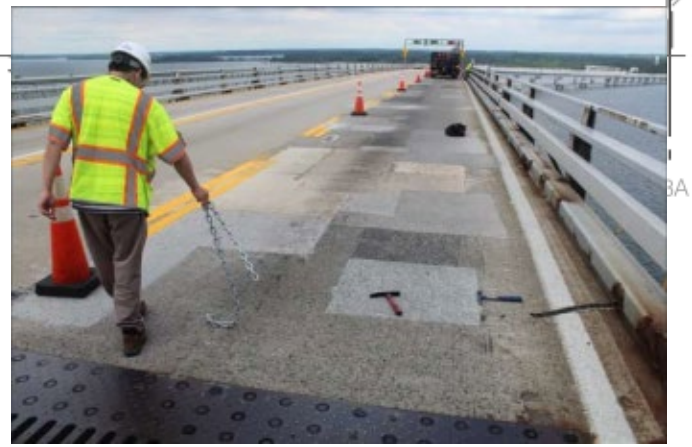
PURPOSE AND NEED

Detailed Field Investigation:

- Chain Drag 100% of bridge deck surface
- Mapped all defects / spalling / hollow sounding areas
- Overlay with prior defect mapping to look for deterioration growth
- Many Spans – 50% of Deck Area Patched or Delaminated Lane 1.
- Up to 75% of Deck Area Patched or Delaminated in Span B13A Lane 1







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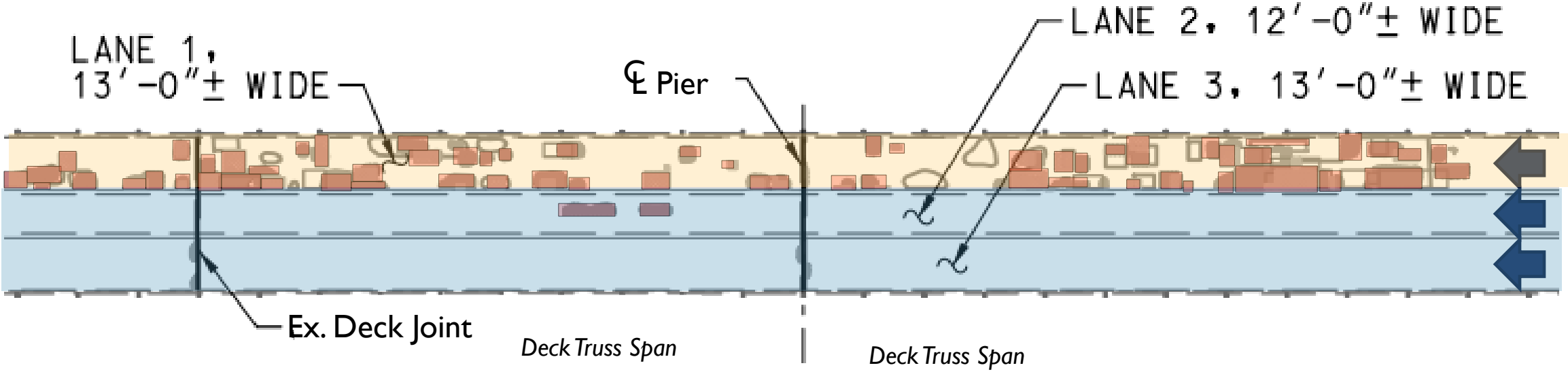
PURPOSE AND NEED

Detailed Field Investigations:



Sample Deck Evaluation Survey Showing Previous Patches and Areas of Delamination

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PURPOSE AND NEED

Material Testing Program:

- 125 Deck Cores Taken throughout the entire bridge length
- 53 Chloride Ion Tests (ASTM C1218)
- 9 Petrographic Analysis (ASTM C856-14)
- Confirmed information from Visual Inspections

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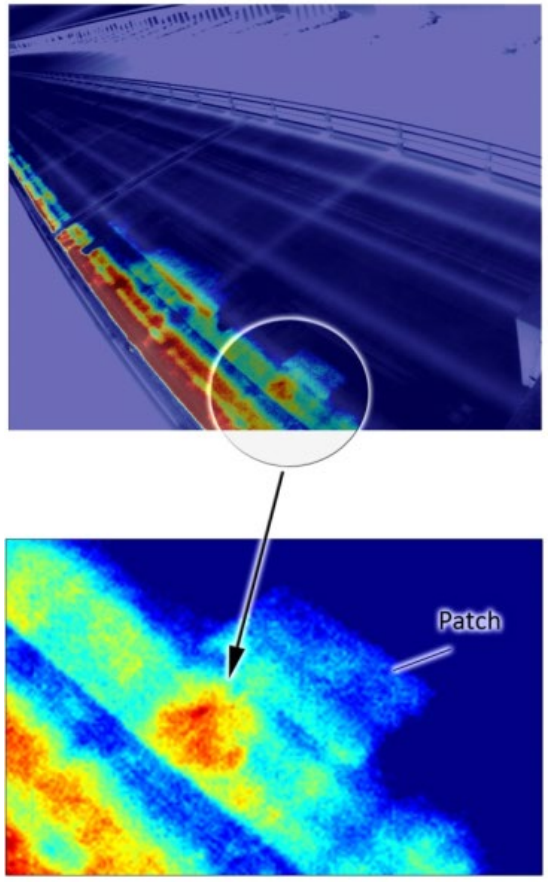
PURPOSE AND NEED

Innovative Deck Testing:

- Infrared Ultra Time Domain System (IR-UTD)
- AECOM / Thermal Stare Partners Prepared Detailed Report
- Four Locations Tested for approx. 3 weeks



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SCOPE OF WORK

Scope of Work:

- Latex Modified Concrete Overlay Lane 1 – 12,350-LF
- All Spans Except those previously replaced under prior contracts
- Silane Sealant Applied to 100% of Bridge Deck
- Replacement of 22 Expansion Joints
- Localized Deck Patching
- 200+ Bridge Rail Post Replacements
- Replacement of 17 Overhead Lane Use Signal Gantries

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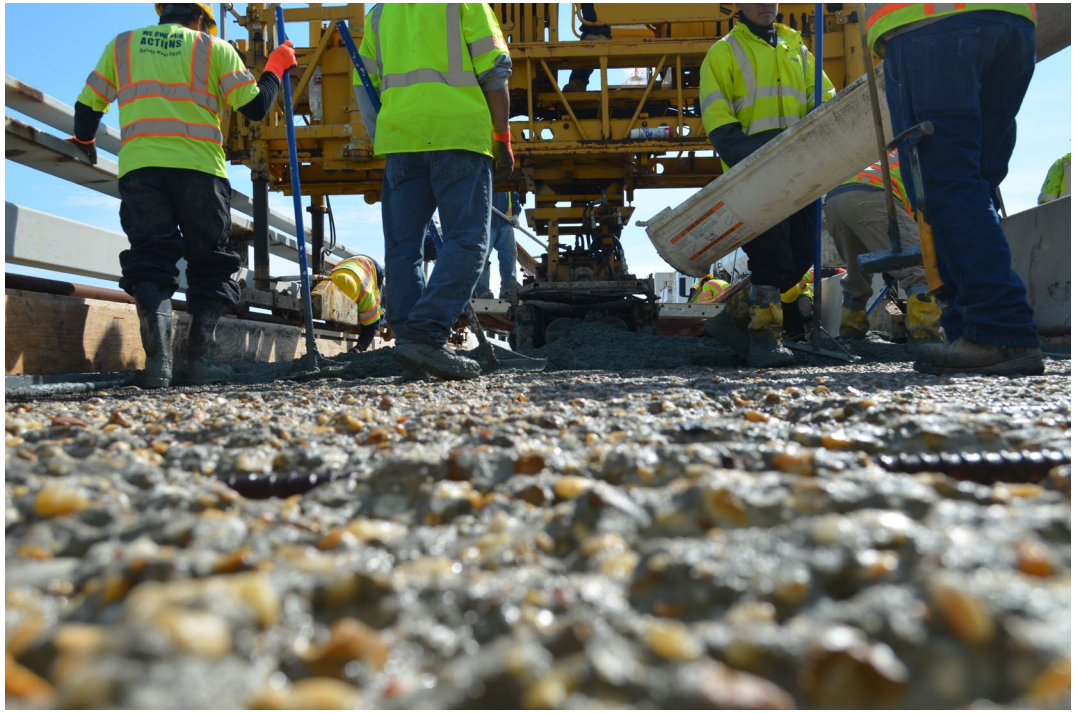
SCOPE OF WORK

Project Requirements:

- Complete Removal of the Existing Micro Silica Fume Overlay
- Maintenance of Traffic
  - Nighttime Single and Double Lane Closures
  - Nighttime Full Bridge Closures
  - Avoid daytime lane closures
- ITS Upgrades
  - Upgrades to Lane Use Signals
  - Upgrades to ITS Control Systems / New Cabinets and Hardware
  - Enhancements to Access Systems
  - Added Bridge Mounted Cameras
- Reduce Impacts - Incentive Based Schedule
- Coordinate with Multiple On-Going Contracts



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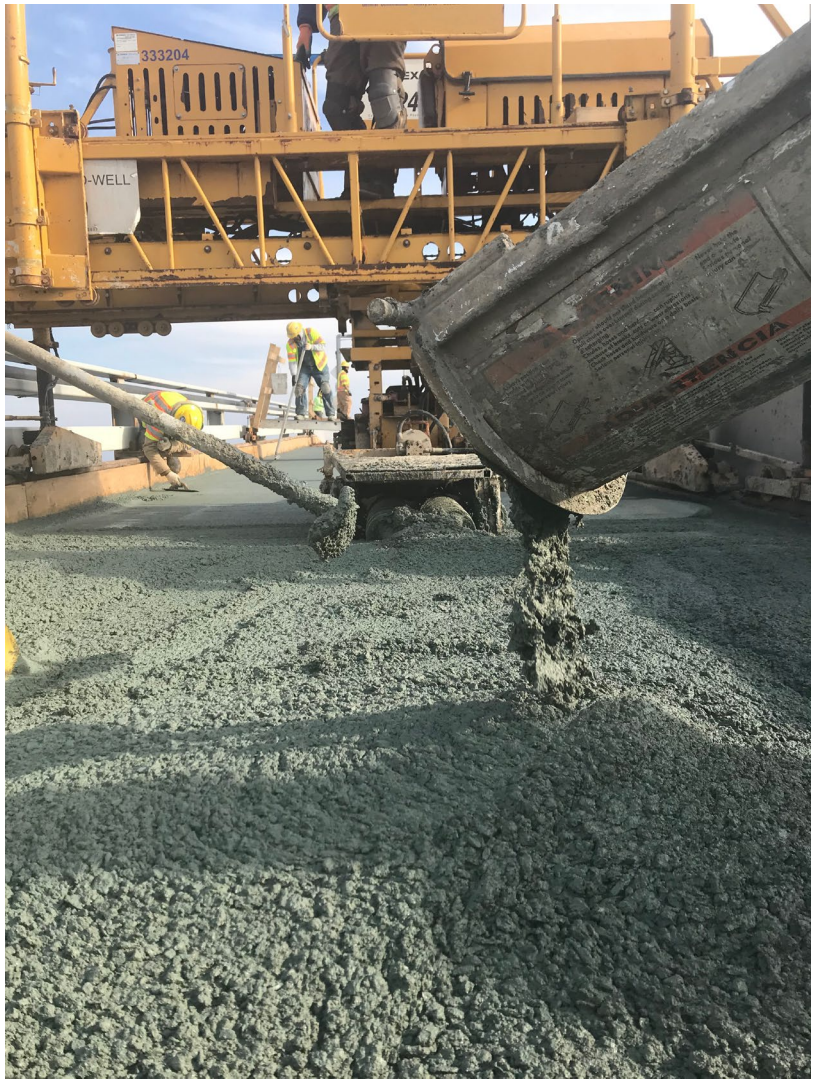
DESIGN PROCESS



Why Choose Latex Modified Concrete?

- ✓ Tested Material Technology since 1970's
- ✓ Extensive Use in MD and Mid-Atlantic; Similar Climate Conditions
- ✓ Bond Strength Exceeds Based Concrete Strength
- ✓ Low Permeability Reduces and Chloride Penetration
- ✓ Low Modulus of Elasticity – Flexible and Provides extended service life
- ✓ **Proven Performance in Lanes 2 and 3 since 2005**

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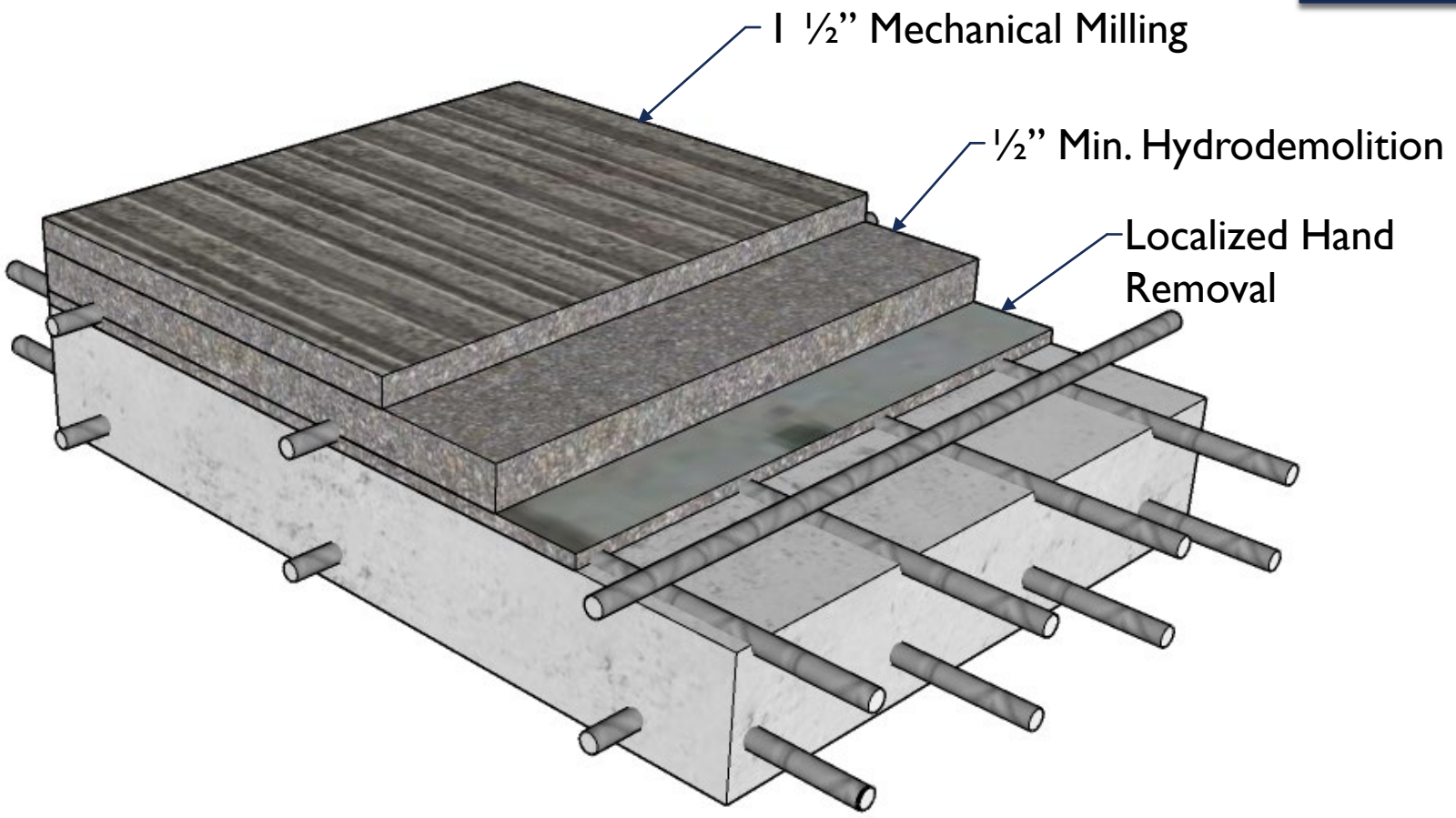
DESIGN PROCESS

Surface Prep is key to a strong bond between the Latex Concrete and Existing Deck

Deck Removal Process:



Demolition Process:

1. Maximize Mechanical Milling
2. ½" Minimum Hydrodemolition
3. Hand Removal – Time Consuming

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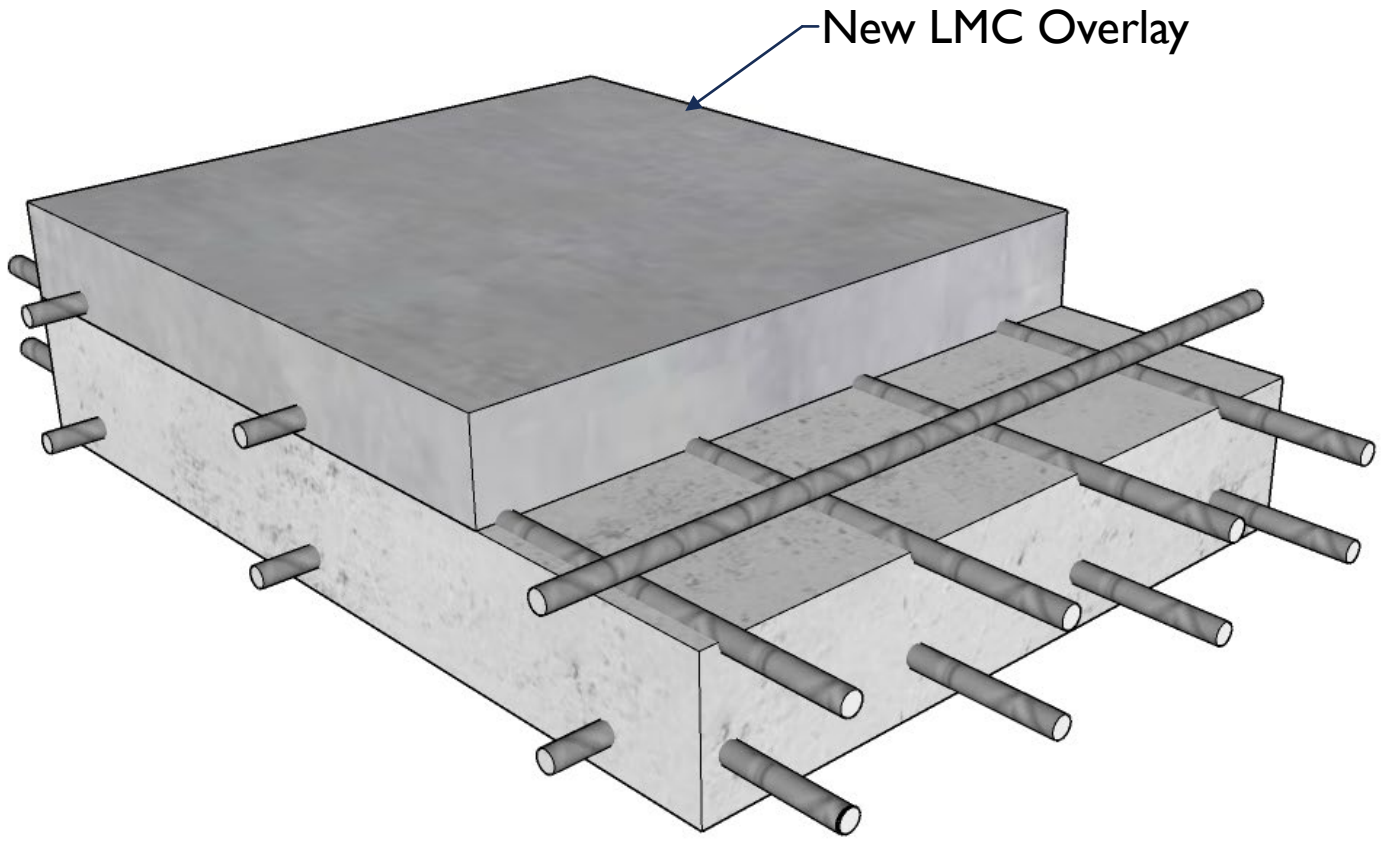
DESIGN PROCESS

New Latex Modified Concrete:



LATEX MODIFIED CONCRETE	
MATERIAL	**SPECIFICATION LIMITS**
Portland Cement, CWT/yd^3, min	6.6
Latex Emulsion/Cement Ratio	0.31–0.34
Water/Cement Ratio, max	0.22
Entrained Air, %	6.0±3
Slump, in.	5±1

Latex Modified Concrete:

- f'c (7-days) = 3,000 psi
- f'c (28-day) = 3,500 psi
- Ec = 2,900 ksi (15% reduction)
- 28-Day Flexural Strength = 650 psi (+50%)

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MAINTENANCE OF TRAFFIC

Traffic Impacts:

- Daily Congestion on US-50 and local roads:
- Impacts to Emergency Services
- Impacts to Residents and Local Businesses
- Queues longer during holidays, incidents and poor weather
- Extensive Public Outreach Essential

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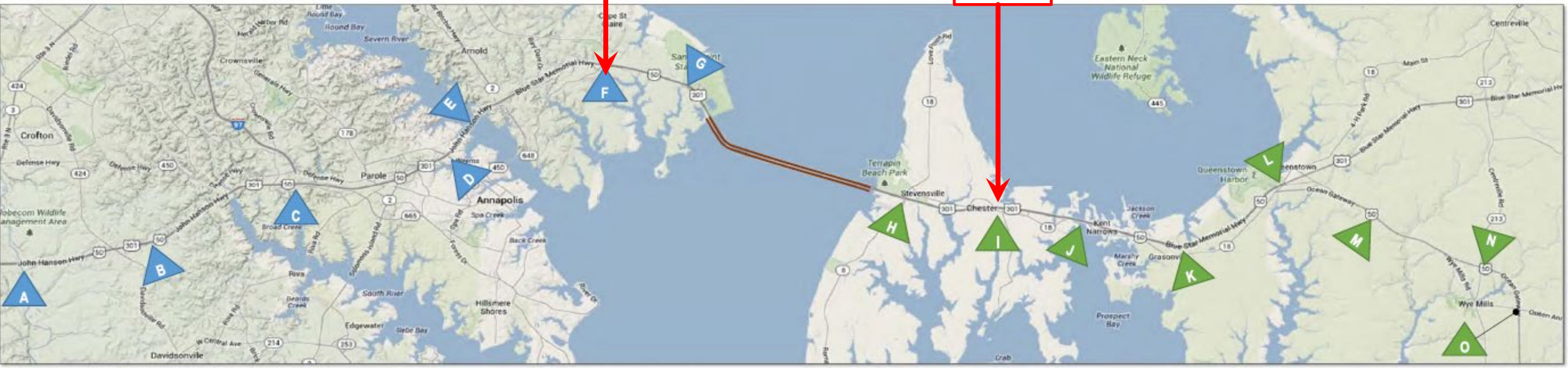
MAINTENANCE OF TRAFFIC

Anticipated Traffic Impacts:

Peak hour backups of about 3 miles (30 minutes)

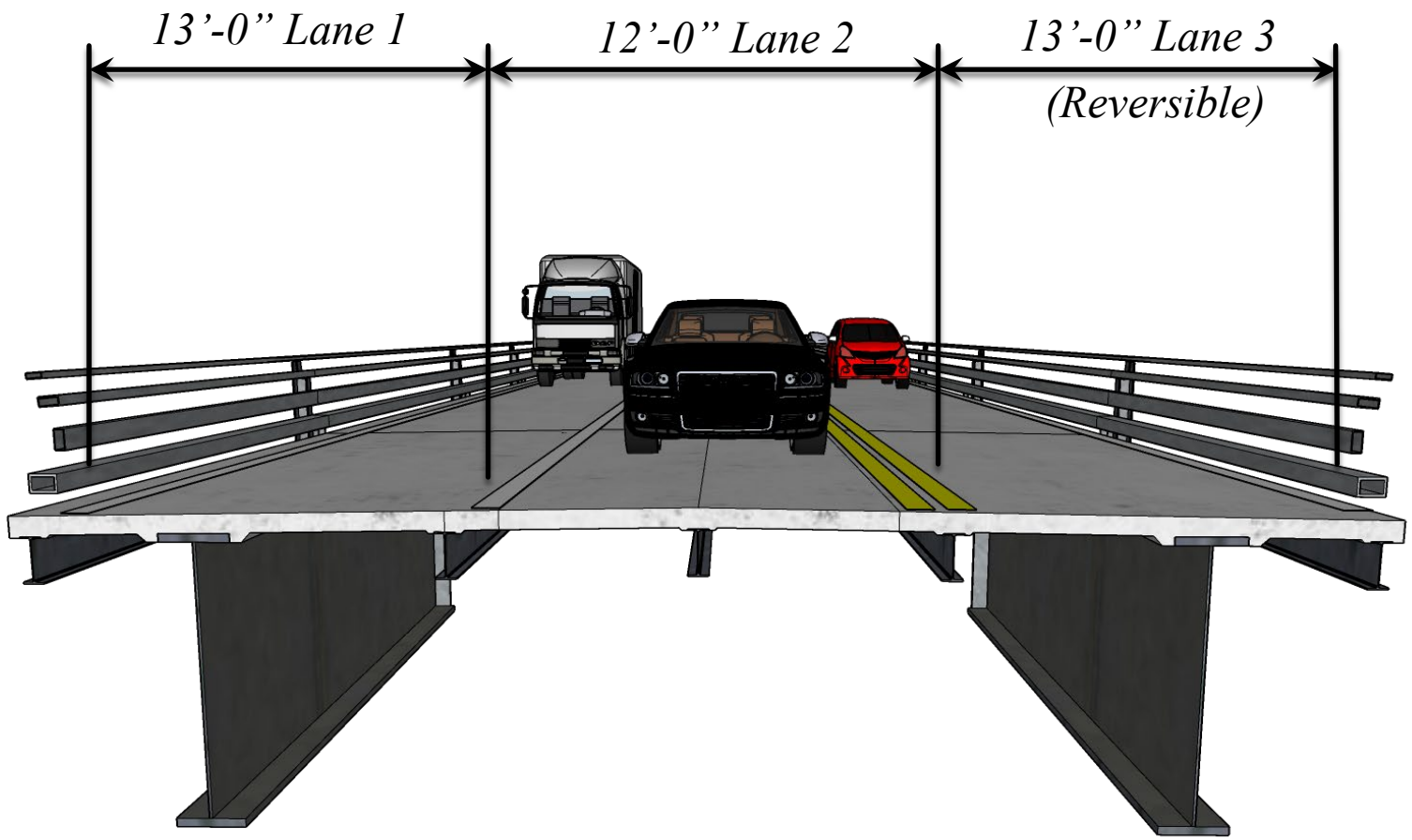
	A	B	C	D	E	F	G
Miles from Bridge (delay)	**17.7 (3½ hrs)**	**14.2 (3 hrs)**	**10.8 (2 hrs)**	**7.3 (1½ hrs)**	**6.4 (1¼ hrs)**	**3.0 (½ hr)**	**0.7 (15 min)**
Landmark/ Interchange	Prince George's County line	VMS Sign	I-97	Rowe Boulevard	Severn River Bridge	MD 179 (Cape St. Clair Road)	Oceanic Drive

H	I	J	K	L	M	N	O
1.1 (15 min)	**3.2 (½ hr)**	**5.2 (1 hr)**	**7.6 (1½ hrs)**	**9.9 (2 hrs)**	**12.6 (2½ hrs)**	**15.4 (3 hrs)**	**16.9 (3½ hrs)**
MD 8	MD 18 Bridge	Kent Narrows Bridge	MD 8/VFW Road	US 301 Split	Blooming-dale Road	MD 213	MD 404



MAINTENANCE OF TRAFFIC

Sequence of Construction:



Existing Typical Section:

- 3 Travel Lanes
- Lane 3 Reversible for Contraflow Operations
- Contraflow used for Peak Eastbound Travel (Thur and Fri Afternoon)

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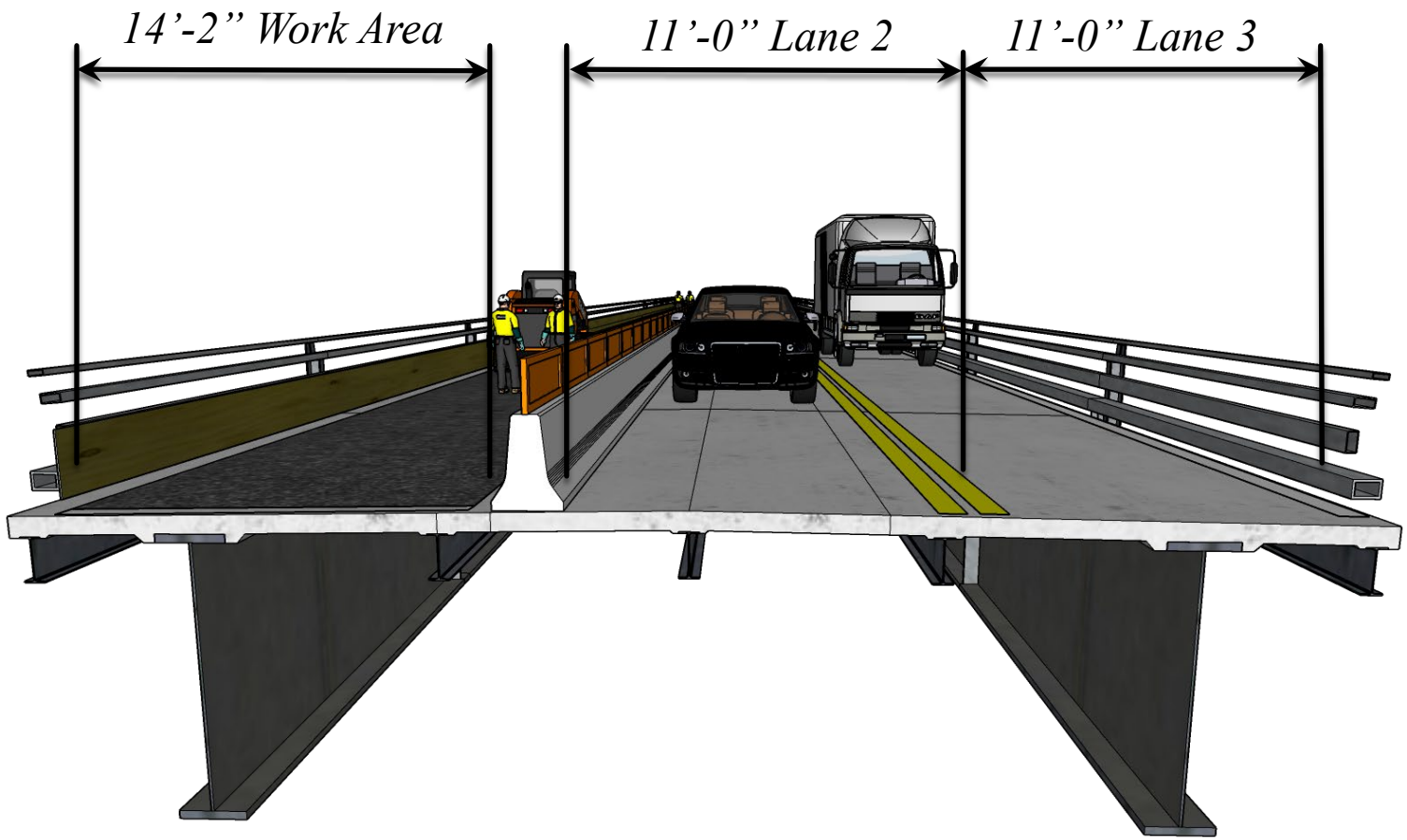
MAINTENANCE OF TRAFFIC

Sequence of Construction:



Lane 1 Closure:

- Reduced Lane Widths
- No Contraflow
- Include Visibility Barrier

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CONSTRUCTION SCHEDULE

LMC Standard Specification 426:

- Placement Between May 1 – November 30
- Do not Place below 45 degrees
- Begin Placement at 45 degrees if rising >8hrs.
- Additional curing if below 55 degrees
- Temperatures below 50 degrees – do not count day as a cure day

Traffic Restrictions:

- No Lane Closures during Spring / Summer Peak Travel Season (No Work Memorial Day to September 30)
- Reopen all lanes for Thanksgiving Day Weekend

About 30 Working Days for LMC IF WEATHER PERMITS!

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DESIGN PROCESS

Work Requirements:

- Maximum 62-working days behind barrier over 2 years
- Required Production Rate: 1,500 LF per week

Incentive:

- $1M Incentive for Completion of all Latex In the First Year
- Requires Double the Production Rate

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CONTRACT AWARD

<u>Award:</u>

$26,700,000 Low Bid Award to Wagman Heavy Civil

Construction NTP……*September 9, 2019*

<u>Year 1:</u>

- Lane 1 Closure……*October 1, 2019 to April 15, 2020*
- Thanksgiving Day Weekend……*All lanes reopen to traffic*
- Deck Patching & Gantries……*April 16, 2020 to September 30, 2020*

<u>Year 2:</u>

- Lane 1 Closure……*October 1, 2020 to April 15, 2021*
- Thanksgiving Day Weekend……*All lanes reopen to traffic*
- Deck Patching, Sealing, Gantries…*April 16, 2021 2021 to August 2021*

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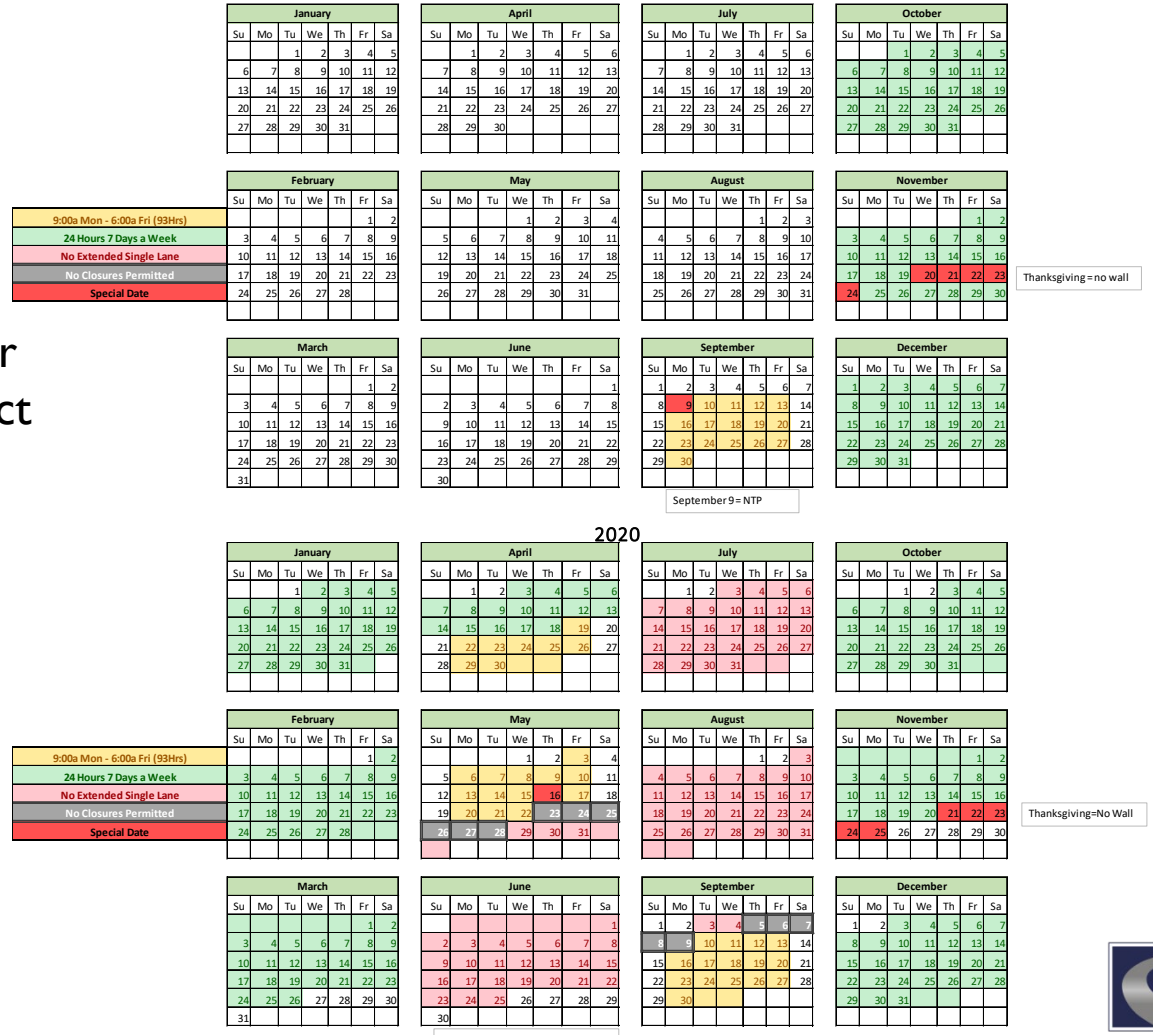
CONSTRUCTION APPROACH

Wagman's original plan never included achieving the project incentive for placing LMC. Our plan was to go after Work Area 4 & 2 Year one, and Work Area 3 & 1 Year two.



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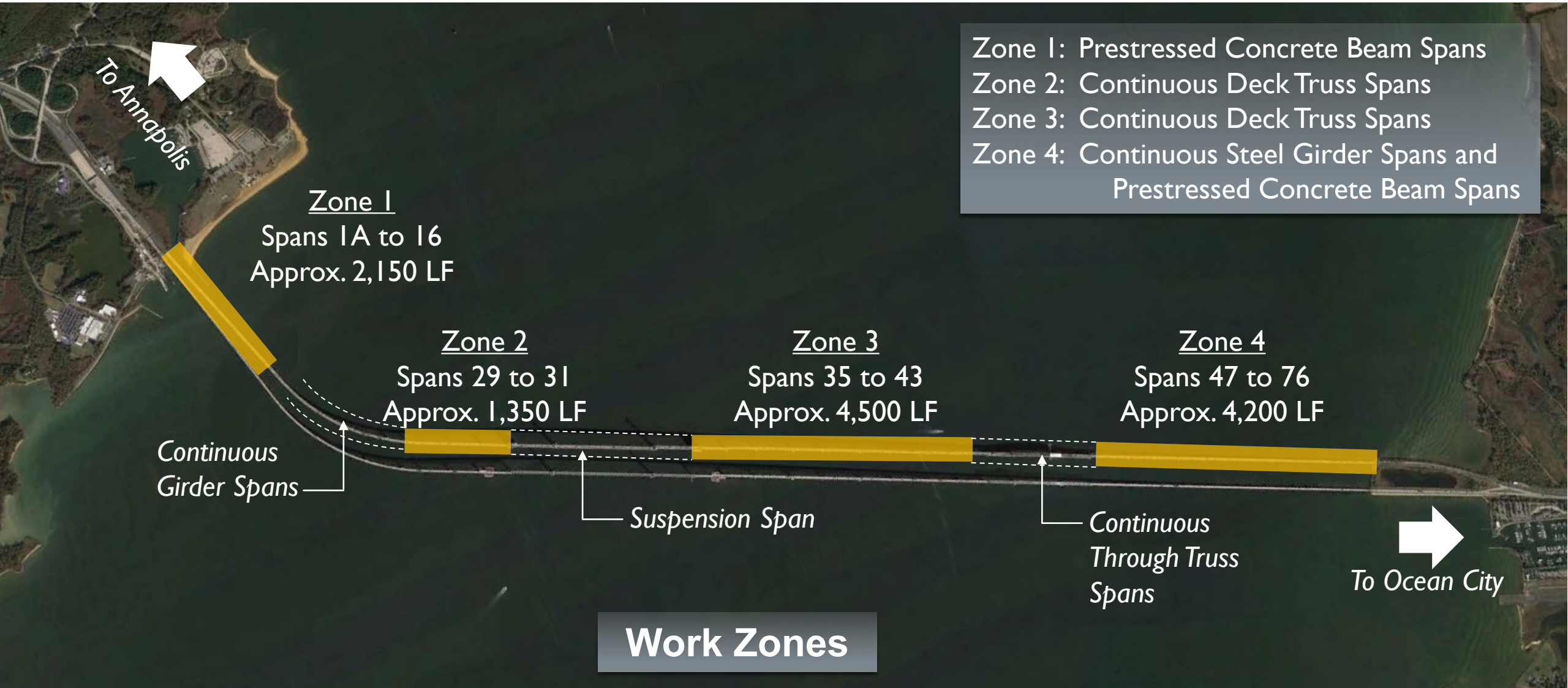
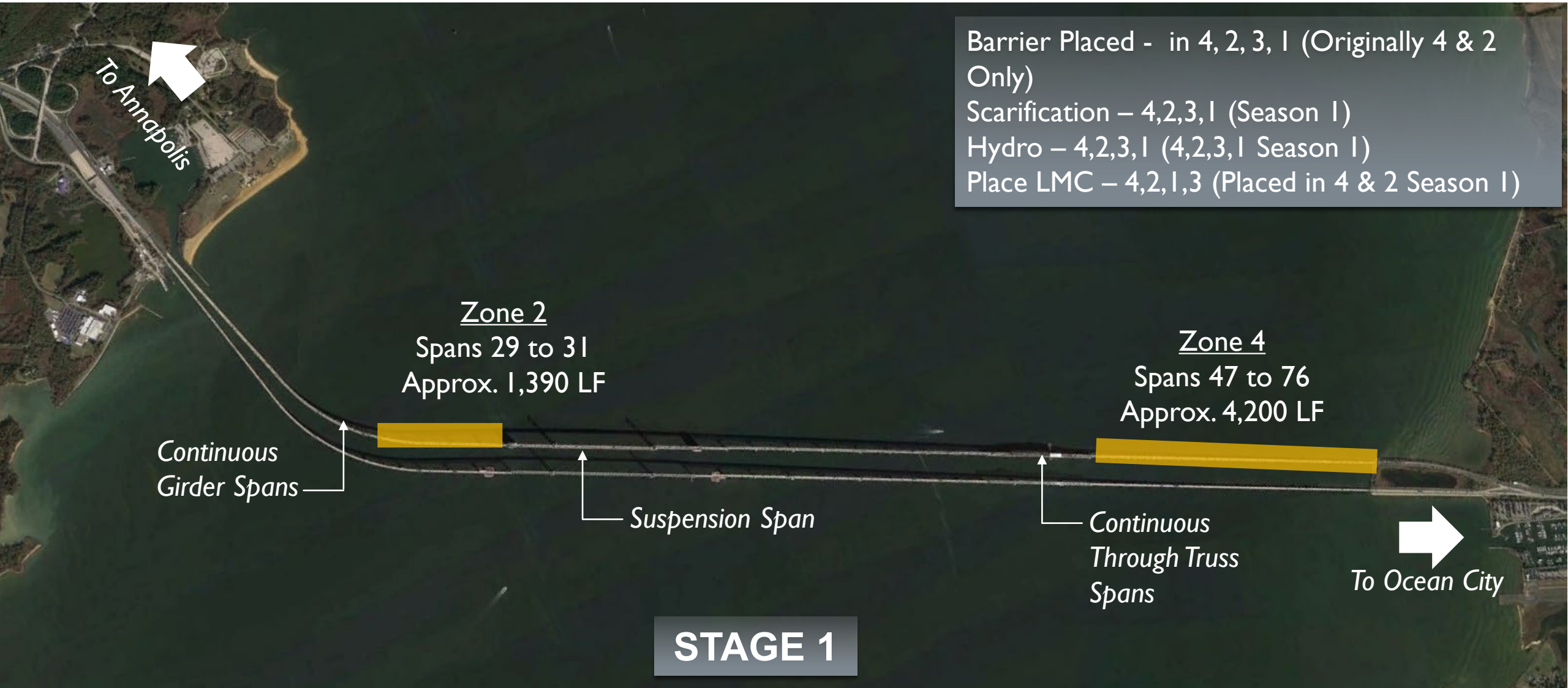
CONSTRUCTION APPROACH



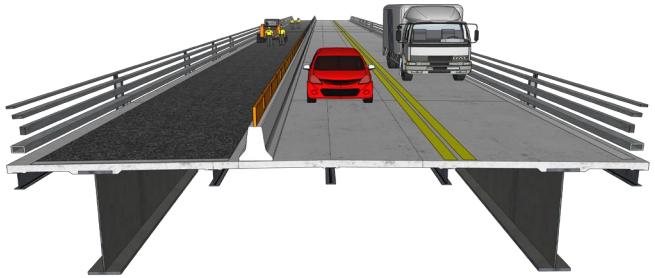
CONSTRUCTION APPROACH

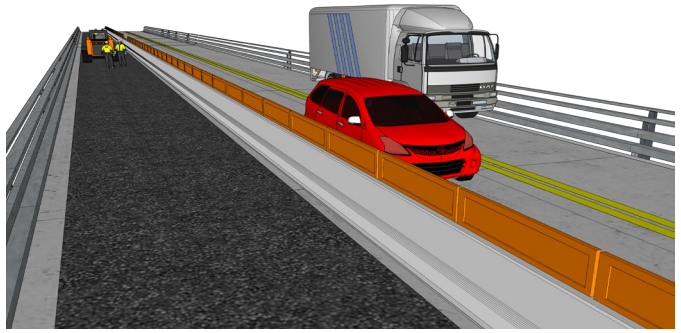


CONSTRUCTION APPROACH

Pre-Overlay Construction:

- Mobilizing the Work Area
  - Restriping lanes; narrow from 12'-0" to 11'-0" wide lanes
  - Placing temporary concrete traffic barrier
  - Long term closure of Lane 1
  - Scarification occurring immediately after barrier wall was placed.





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CONSTRUCTION APPROACH

LMC Overlay – Mechanical Grinding:

- Mechanical (Grinding) - Average >1½" Depth
- Equipment Used – Why did we select what we did?
  - Plans call for 1"-1.5" Mechanical, and or ½" – 1" hydro.
  - It was advantageous to scarify as deep as possible without damaging rebar, since scarification is much faster than hydrodemolition.
- Engineering analysis to ensure the machine did not overstress the remaining deck.

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CONSTRUCTION APPROACH

LMC Overlay - Hydrodemolition:

- Average Hydro-Demolition Depth of 1”
- Hydro-Demo Sub Contractor: Arsenal Restoration & Construction LLC
- Optimal Results Achieved with:
  - Constant monitoring / required to avoid blowout
- Completed Initial Pass to achieve desired Removal

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CONSTRUCTION APPROACH

LMC Overlay Hydrodemolition:

- Desired Surface Texture

Initial Settings

Adjusted Settings

Desired Surface Profile

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CONSTRUCTION APPROACH

LMC Overlay – Hydrodemolition:

- Water Sources
  - Eastern Shore
    - Water was pumped 5,500 LF to Bridge
    - From the bridge abutment, It was stored in large tanks, and then pumped again up the deck, even up and over main span. Traveling from one side of the bridge to the other. From Work Area 4 to Work Area 1

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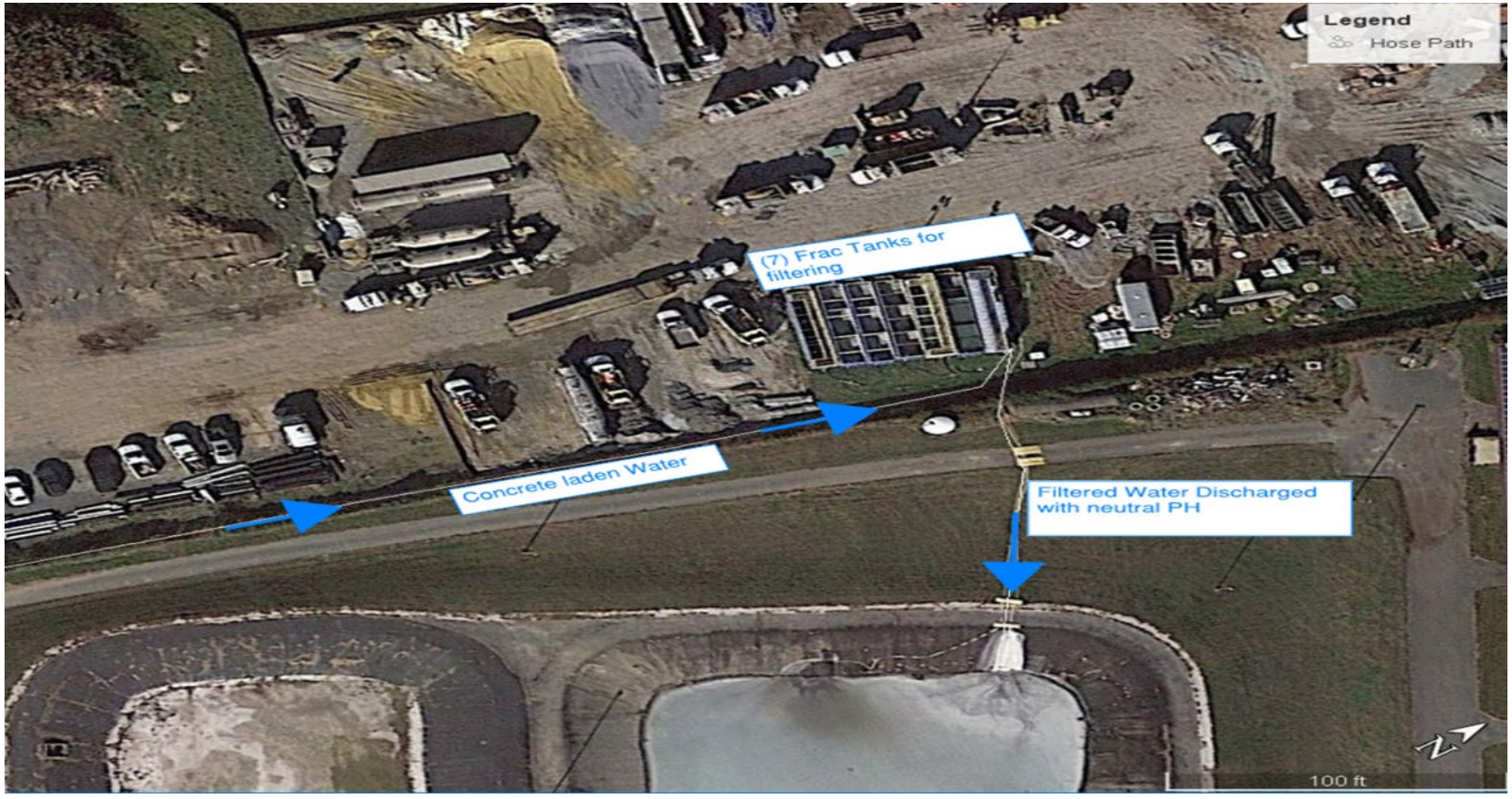
CONSTRUCTION APPROACH

LMC Overlay – Hydrodemolition:

- Waste Water / Effluent Collection and Treatment



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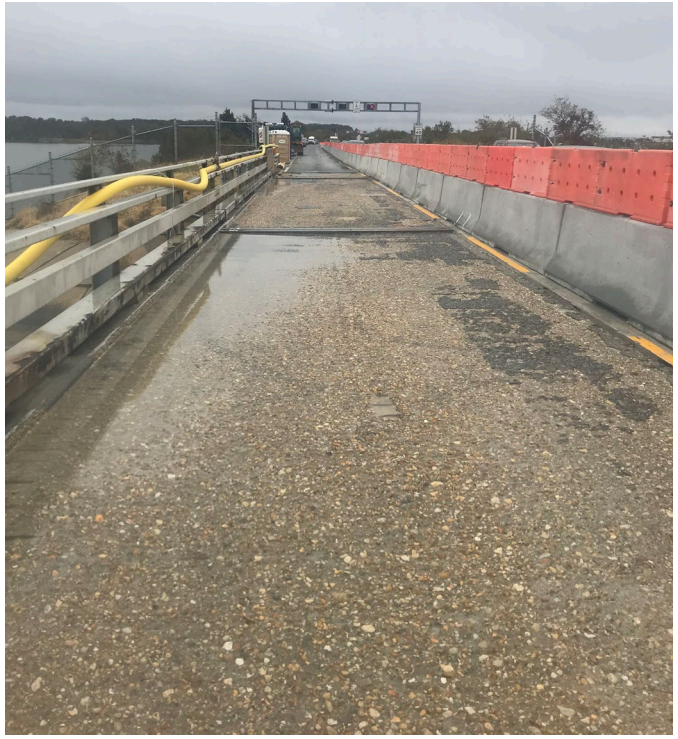
CONSTRUCTION APPROACH

LMC Overlay – Hand Removal and Final Surface Preparation:

- Hand Removal of Areas Inaccessible
- Remaining This Layer of Bonded Micro-Silica - 100% Removal
- Powerwashing Deck Surface



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CONSTRUCTION APPROACH

LMC Overlay Hand Removal of Micro:

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CONSTRUCTION APPROACH

LMC Overlay Final Preparation:

- Tying Loose Rebar
- Sandblast and Clean Surface

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CONSTRUCTION APPROACH

LMC Overlay Procedure (Con't):

- Place LMC Overlay (approx. 400 LF in one night shift)
  - LMC Mixer Truck pump mixture into work area from adjacent lane
  - Screed / Finishing Concrete

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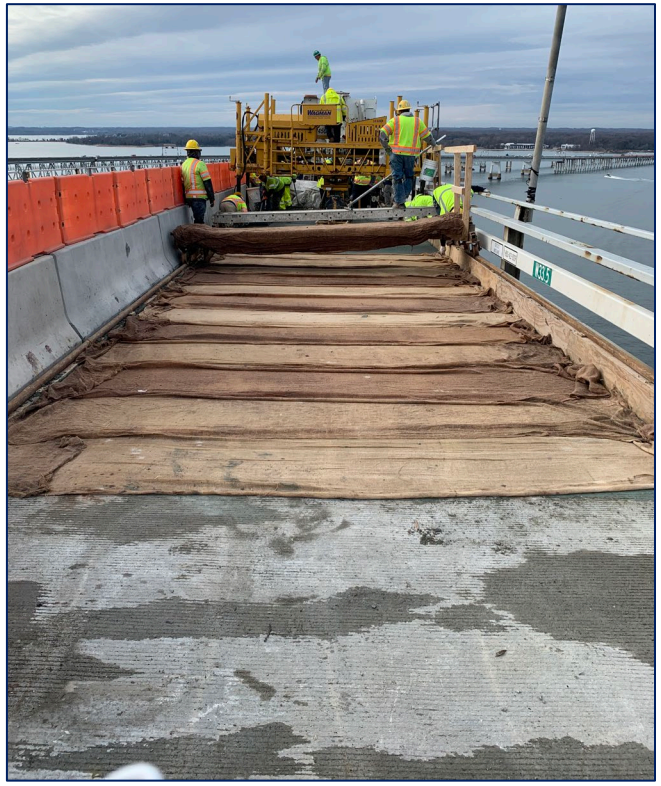
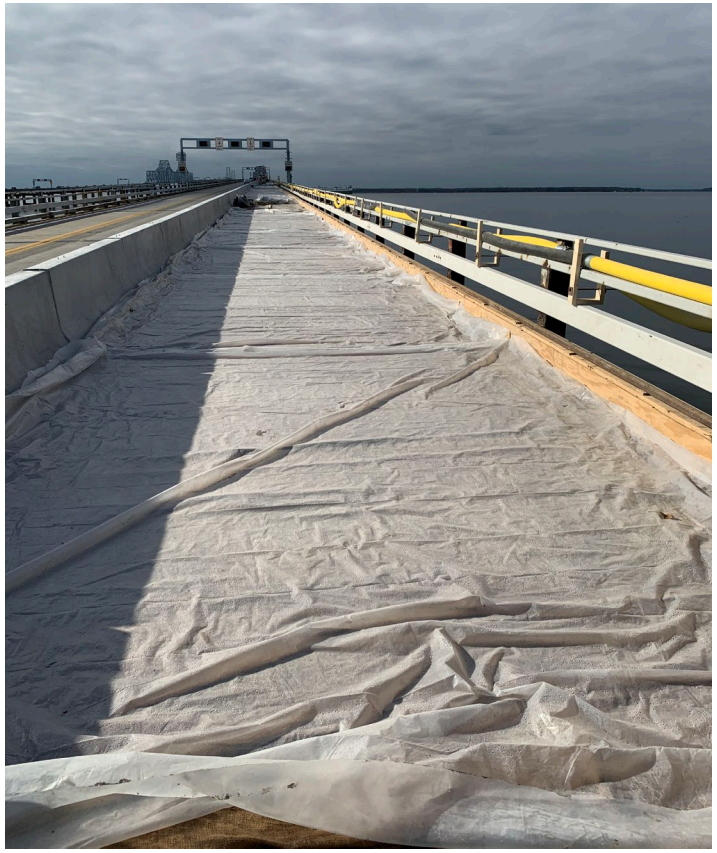
CONSTRUCTION APPROACH

LMC Overlay Procedure (Con't):

- Cure LMC – SHA Standard Procedure
  - 48 Hour Wet Cure (Burlap / Polyethylene), 72 Hour Air Cure
  - LMC may not be placed between December 1 and April 30, unless otherwise approved by MDTA
  - Modifications made for cold weather curing developed to expedite schedule





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WM

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CONSTRUCTION APPROACH

Expansion Joint Replacement:

- Replace Bridge Expansion Joints – 22 Locations

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CONSTRUCTION APPROACH

Silane Sealant Application

- Seal 100% of Bridge Deck Area

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CONSTRUCTION APPROACH

Final LMC Overlay Pour
March 19, 2020

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #1 - Accelerating Construction:

Friday, October 4, 2019: Eastbound Delays 7 miles

Sunday, October 6, 2019: Westbound Delays 8.7 miles

Accelerating the Project:

- *Extensive coordination between Wagman, the designer, and MDTA to determine any possible solutions.*
- *Nothing was off the table.*
- *Multiple Options to Accelerate the Project Considered*
  - *Rapid setting materials*
  - *Specification flexibility*
  - *Limiting hydrodemolition (time consuming)*
  - *Additional crews and resources*
- *Evaluated the Pros and Cons of each alternative*

Must ensure the quality of work and long-term durability of the finished product!

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #1 - Accelerating Construction:

Operational Changes:

- Implementation of cashless tolling during peak hours
- It was never intended to allow 2-way traffic during construction due to the narrow lane widths.
- During 2-way operations on WB Bridge, commercial trucks are not permitted to travel EB or WB on the WB span due to the narrow lane configuration
- Barrier to remain in place through the night of April 30th with normal traffic patterns restored by 5 AM on May 1st, 2020

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #2 – Cold Weather Restrictions:

Standard Specification Requirements:

- Wet Cure 48 hours / Air Cure 72 hours (426.03.07)
- Wet cure shall be performed using wetted burlap and poly film
- After 48 hours, remove burlap and poly film to achieve air cure
- LMC shall not be placed at ambient air temperature below 45 degrees (426.03.09)
- Cure LMC at a minimum of 50 degrees. If the cure temperature falls below 50 degrees, extend the cure duration by the number of additional required cure days.

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #2 – Cold Weather Restrictions:

Specification Adjustments:

- Do not place LMC if ambient air temperatures are anticipated to be below freezing (32 degrees) within the 5-day cure period of any cure.
- If ambient temperatures are anticipated to be 40 degrees or below during the cure period, provide supplemental heat in a manner sufficient to maintain cure temperatures of 50 degrees or higher.
- Introduction of artificial heat will be within the first 12 hours of cure and remain in place for the remaining 5 days of cure
- Use insulating blankets to maintain cure temperature above 50 degrees, as required. Do not remove blankets if ambient temperatures are below 50 degrees, even if it is the achieve the 72-hours air cure.

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #3 – Advanced Deck Deterioration:

- Hydrodemolition removal all bad concrete
- Significant deterioration in localized areas
- Larger scale patching and partial deck replacement

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OVERCOMING CONSTRUCTION CHALLENGES

Challenge #3 – Advanced Deck Deterioration:

- Heavy deterioration surrounded previously patched areas
- Hydrodemolition removed greater depths of concrete than anticipated
- Lightweight concrete spans were particularly vulnerable
- Repair / Replace Deteriorated Reinforcing Steel
- Large areas of deterioration were replaced with full depth concrete
- Mix No. 6 Concrete for full-depth repairs

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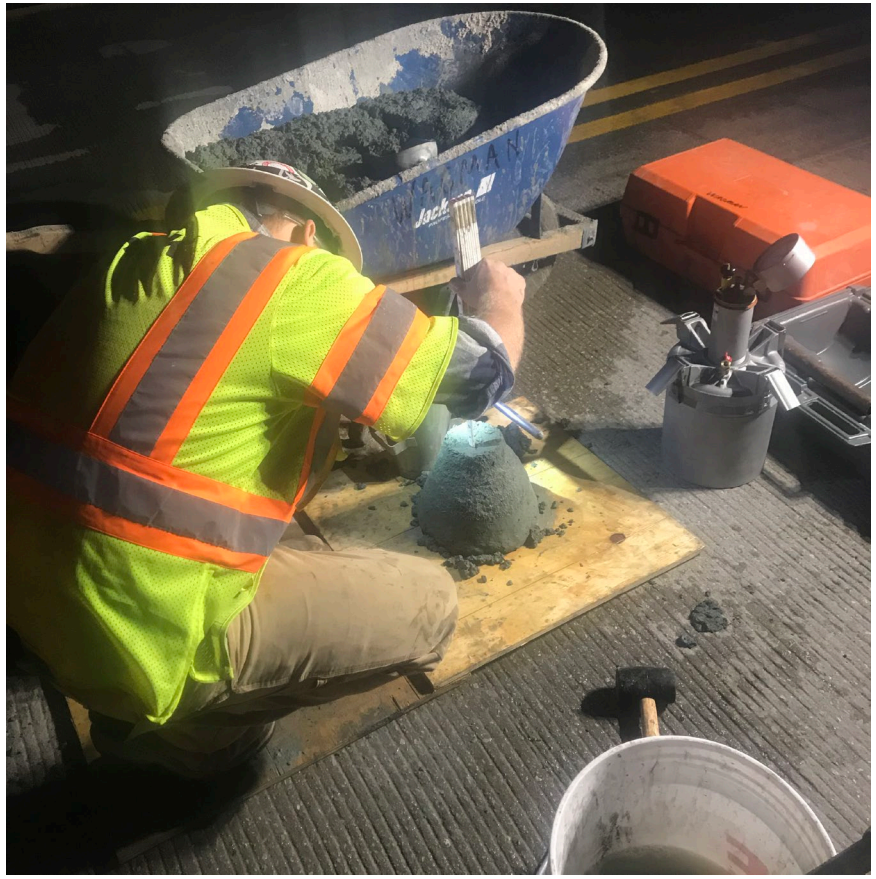
OVERCOMING CONSTRUCTION CHALLENGES

Challenge #4 – Contingency Plans:

- Innovative Ideas - Pilot Rapid Set LMC
- Backup options if we ran out of time and needed to re-open lanes faster



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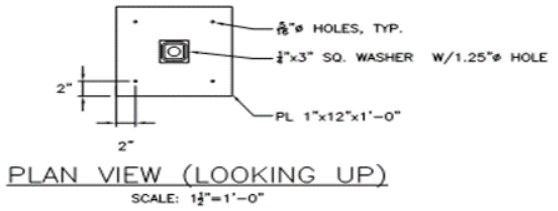
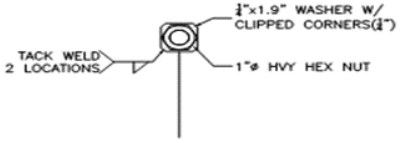
OVERCOMING CONSTRUCTION CHALLENGES

Challenge #5 – Temporary Plating:

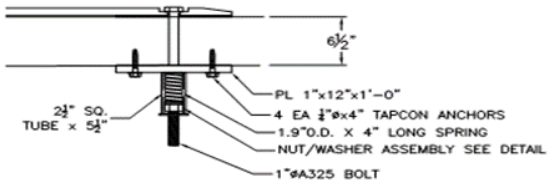
- Innovative Temporary Plating for Joint Replacement in Active Travel Lanes 2 and 3
- Spring Box Mounted below the deck – Only required access from top to remove and reset
- Time savings maximized productivity for joint replacement



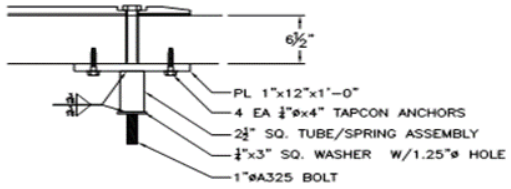
PLAN VIEW (LOOKING UP)
SCALE: 1½"=1'-0"



NUT WASHER ASSEMBLY
SCALE: 3"=1'-0"



SECTION THROUGH BOX
SCALE: 1½"=1'-0"



SIDE VIEW
SCALE: 1½"=1'-0"

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PARTNERING DURING CONSTRUCTION

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PARTNERING CHARTER

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MDTA Contract No. BB-2819-0000
Deck Rehabilitation to Westbound W.M. Preston Lane, Jr. Memorial Bridge

We, the stakeholders of the WPL Deck Rehabilitation project, commit to work together to ensure a high-quality product that will benefit our customers. We resolve to maintain the partnership we've established on this day which incorporates our goals of safety, environmental stewardship, sustainability, profitability and completing the project on time and under budget.

"ZERO REWORK"

We, the partners of the WPL Deck Rehabilitation Project, using open communication, commit to meeting Project requirements and exceeding the Project goals and expectations for Safety, Environment, Quality, Schedule, Budget, Community Outreach, Work Processes and Issue Resolution. We will direct our efforts at providing a superior product, with sensitivity to the expectations and needs of all stakeholders, including the community. Our goal is to design and construct an outstanding Project using innovative and time-proven strategies and skills that set the standard for project communication, integrity and excellence in teamwork.

Project Partners

We will use Partnering principles and open communication to:

- Design, plan, implement and emphasize **SAFETY** for **ALL** in all of our actions and attitudes;
- Meet the requirements & exceed the expectations for **ENVIRONMENTAL** commitments at all organizational levels;
- Maintain **EXCELLENCE** through **QUALITY** design and workmanship by emphasizing a **"zero rework"** attitude;
- Complete all tasks and the Project on or ahead of **SCHEDULE** and under **BUDGET**;
- Foster **TEAMWORK** by creating an environment of open **COMMUNICATION**, **TRUST** and **RESPECT**;
- We will be a good neighbor by **VALUING** the needs of the community while working to impact their daily routines as little as possible;
- Promote **COOPERATION** through thoughtful utilization of the **ISSUE RESOLUTION** process;
- Manage the project processes to ensure the Minority Business Enterprise (**MBE**) goals are met or surpassed;
- Have **FUN** and take **PRIDE** in our work by recognizing, celebrating, and enjoying our accomplishments, awards, and roles.

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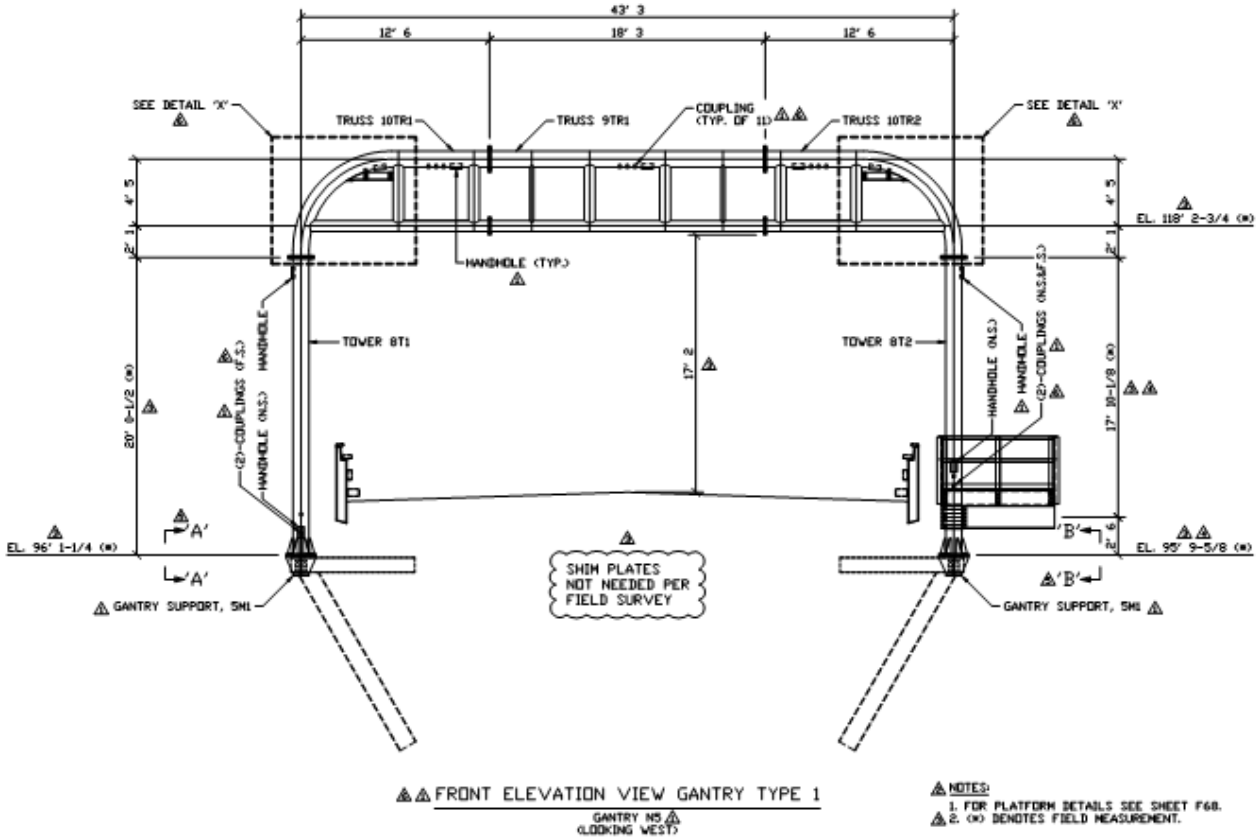
UPCOMING & REMAINING WORK

- Replacement of Overhead Gantries
- New Safety Platforms and Walkways
- Camera Installation / ITS Upgrades
- Full Depth Asphalt Patches, Mill and Overlay Eastern shore



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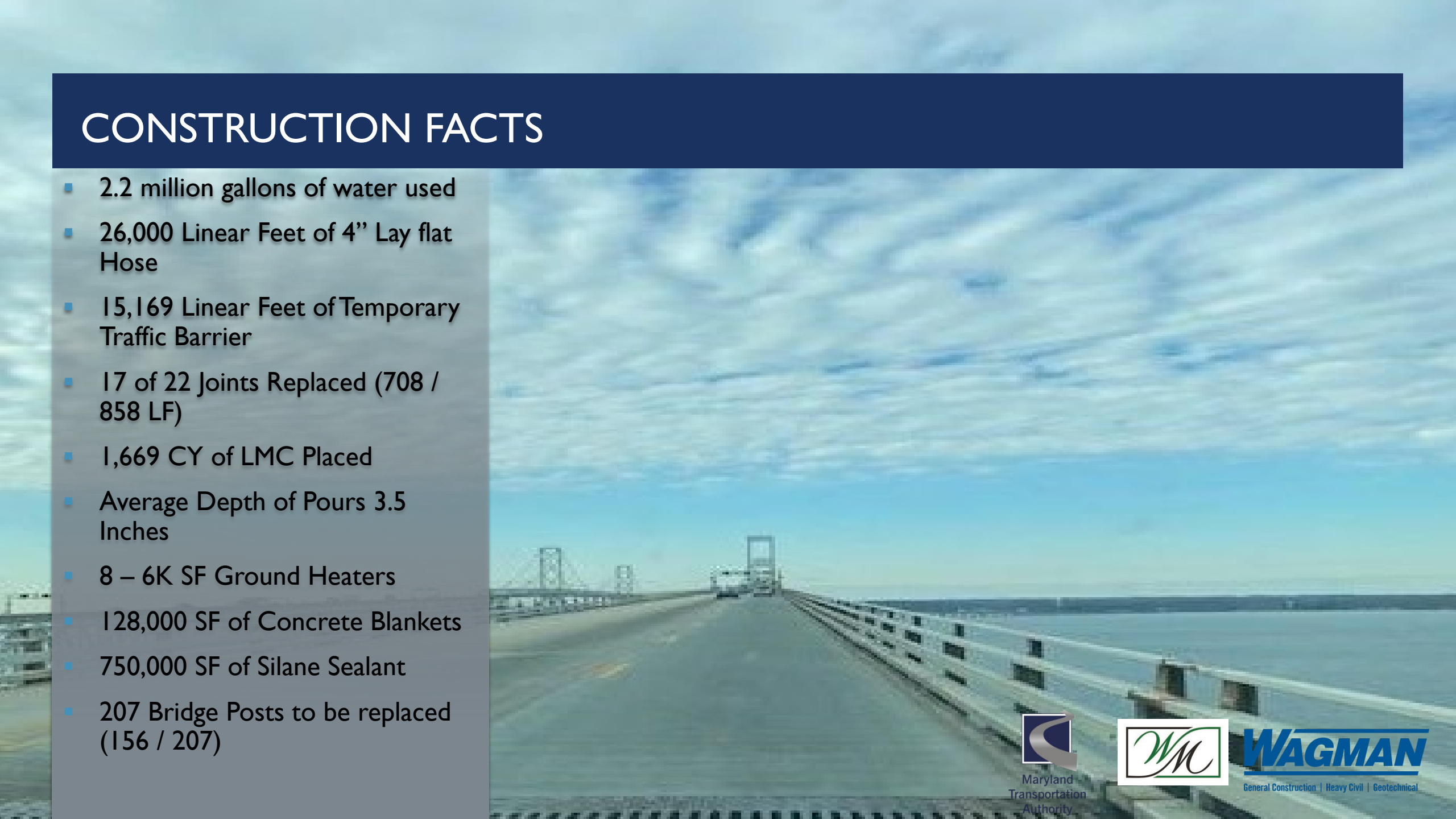
CONSTRUCTION FACTS

- 2.2 million gallons of water used
- 26,000 Linear Feet of 4” Lay flat Hose
- 15,169 Linear Feet of Temporary Traffic Barrier
- 17 of 22 Joints Replaced (708 / 858 LF)
- 1,669 CY of LMC Placed
- Average Depth of Pours 3.5 Inches
- 8 – 6K SF Ground Heaters
- 128,000 SF of Concrete Blankets
- 750,000 SF of Silane Sealant
- 207 Bridge Posts to be replaced (156 / 207)



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QUESTIONS?

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THANK YOU!

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WALLACE MONTGOMERY

MRMCA
Maryland Ready Mix Concrete Association, Inc.

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