



REPAIR & RESTORATION

WESTBOUND BAY BRIDGE (US 50 / 301) DECK REHABILITATION

William Preston Lane, Jr. Memorial Bridge, 850 Revell
Highway, Annapolis, MD 21409

Owner: Maryland Transportation Authority

Engineer: Wallace, Montgomery & Associates, LLP

General Contractor: Wagman Heavy Civil, Inc.

Concrete / LMC: Wagman Heavy Civil, Inc.

Cement: CTS Cement

Admixture: GCP / Chryso Saint-Gobain

Aggregates: Chaney Enterprises & S.W. Barrick

Submitted by: Wagman Heavy Civil, Inc.



Project Background

- Westbound Bay Bridge originally opened in 1973
- Between 2002 – 2004, the WB lanes were overlaid with Micro-Silica (MS) fume overlay, but caused immediate issues
- Wagman was hired in 2004-2005 to replace the defective MS overlays in Lanes 2 and 3 with LMC (~ 33% of deck area)
- Lane 1 MS had nearly 50% of deck area patched or delaminated until it was replaced under this project

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Project Background

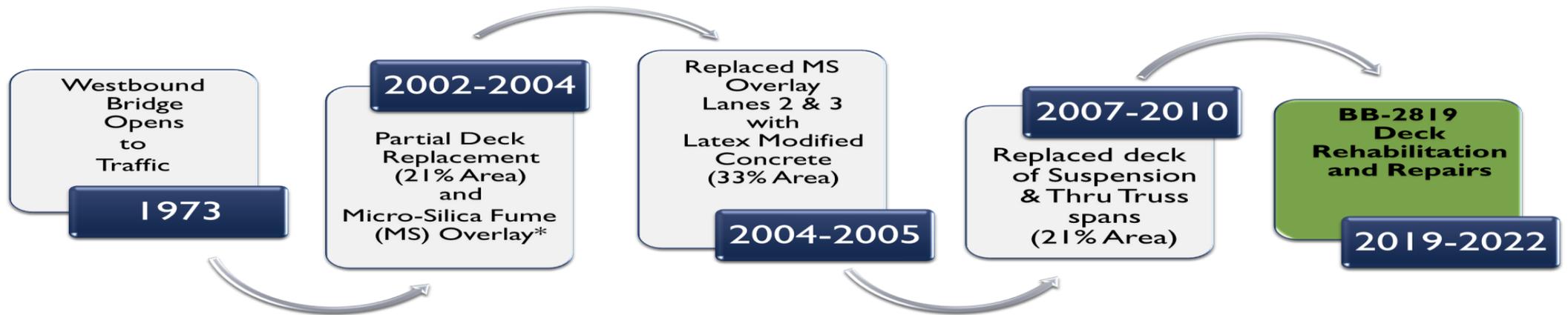
- Replace the existing bridge deck surface with Latex Modified Concrete (LMC) on the right westbound lane (lane "1" at this facility)
 - Complete Removal of the Existing Micro Silica Fume Overlay
 - This project included mechanical milling and hydro demolition remove all existing MS overlay so LMC could bond to original substrate
- Replace existing expansion joints
- Intelligent Transportation Systems (ITS) Upgrades
 - Gantries
 - Lane Use Control Signals
- Reduce Impacts - Incentive Based Schedule
- Coordinate with Multiple On-Going Contracts
- High profile, high traffic volume project, carrying 45,000 vehicles daily, in each direction, in the summer



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Project Background

- 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



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

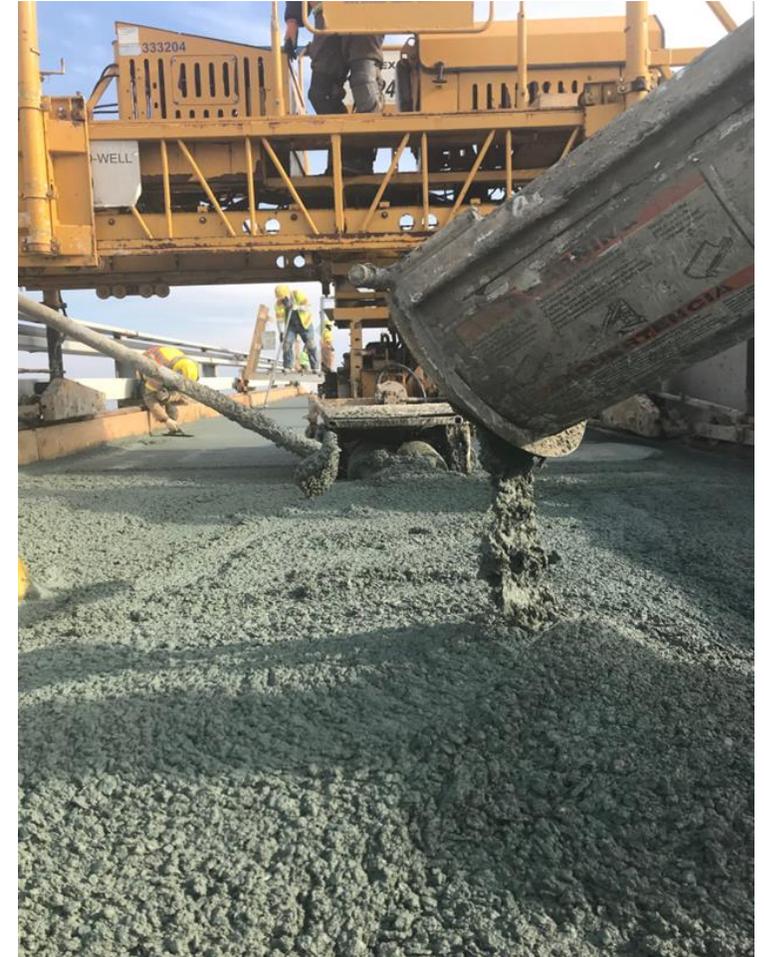
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Project Background

- 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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Scope of Work

Project Requirements:

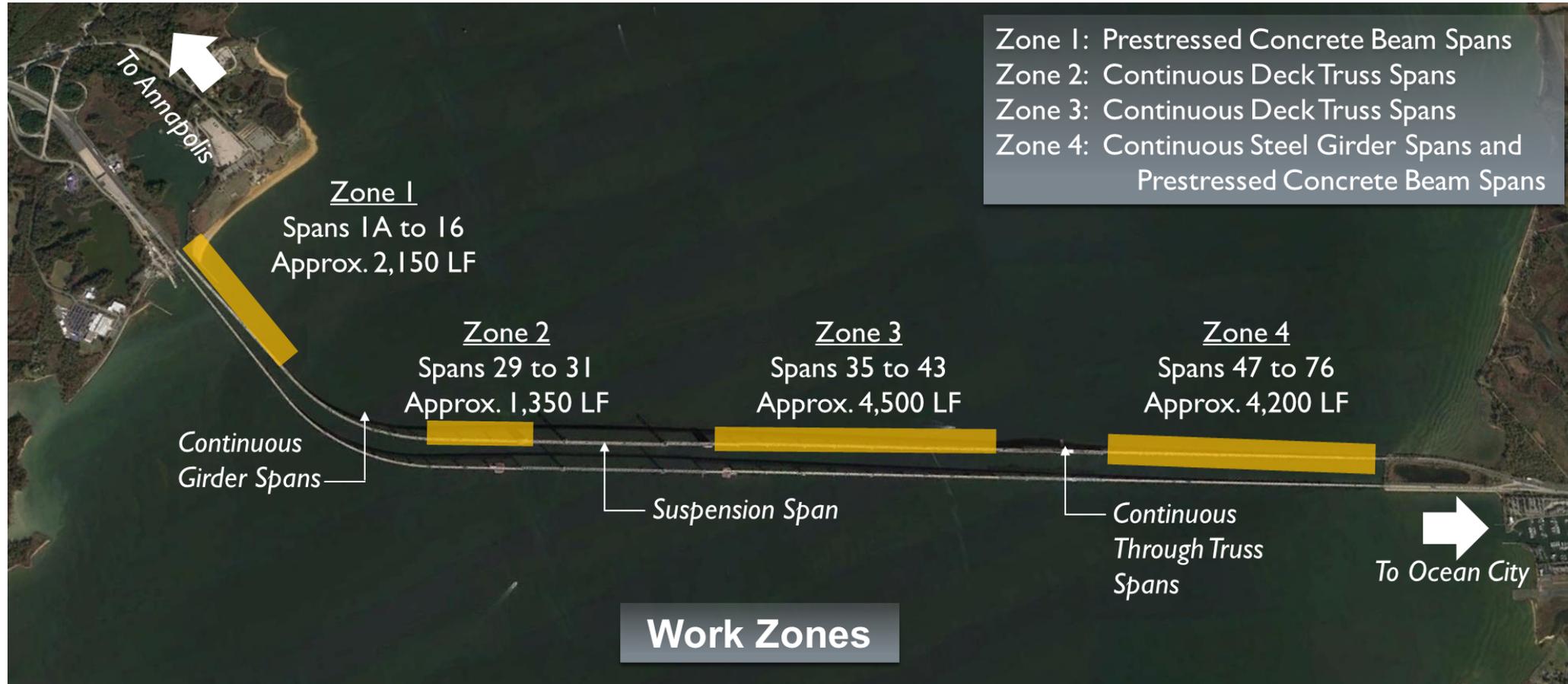
- Complete Removal of the Existing Micro Silica Fume Overlay
 - All Spans Except those previously replaced under prior contracts
 - Latex Modified Concrete Overlay Lane 1 – 12,350-LF
 - Average depth 3.5 inches
- Localized Deck Patching
- Replacement of 22 Expansion Joints
- Silane Sealant Applied to 100% of Bridge Deck
- Maintenance of Traffic
 - Nighttime Single and Double Lane Closures
 - Nighttime Full Bridge Closures
 - Avoid daytime lane closures
- Replacement of 17 Overhead Lane Use Signal Gantries
 - Enhancements to Access Systems
- ITS Upgrades
 - Upgrades to Lane Use Signals
 - Upgrades to ITS Control Systems / New Cabinets and Hardware
 - Added Bridge Mounted Cameras
- 200+ Bridge Rail Post Replacements



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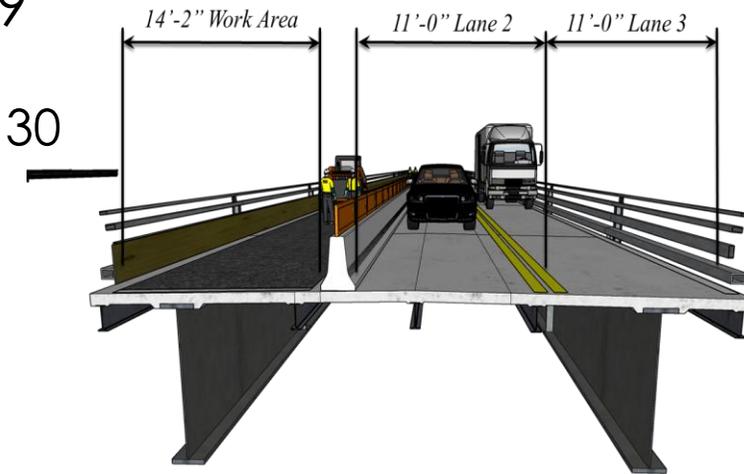
Scope of Work



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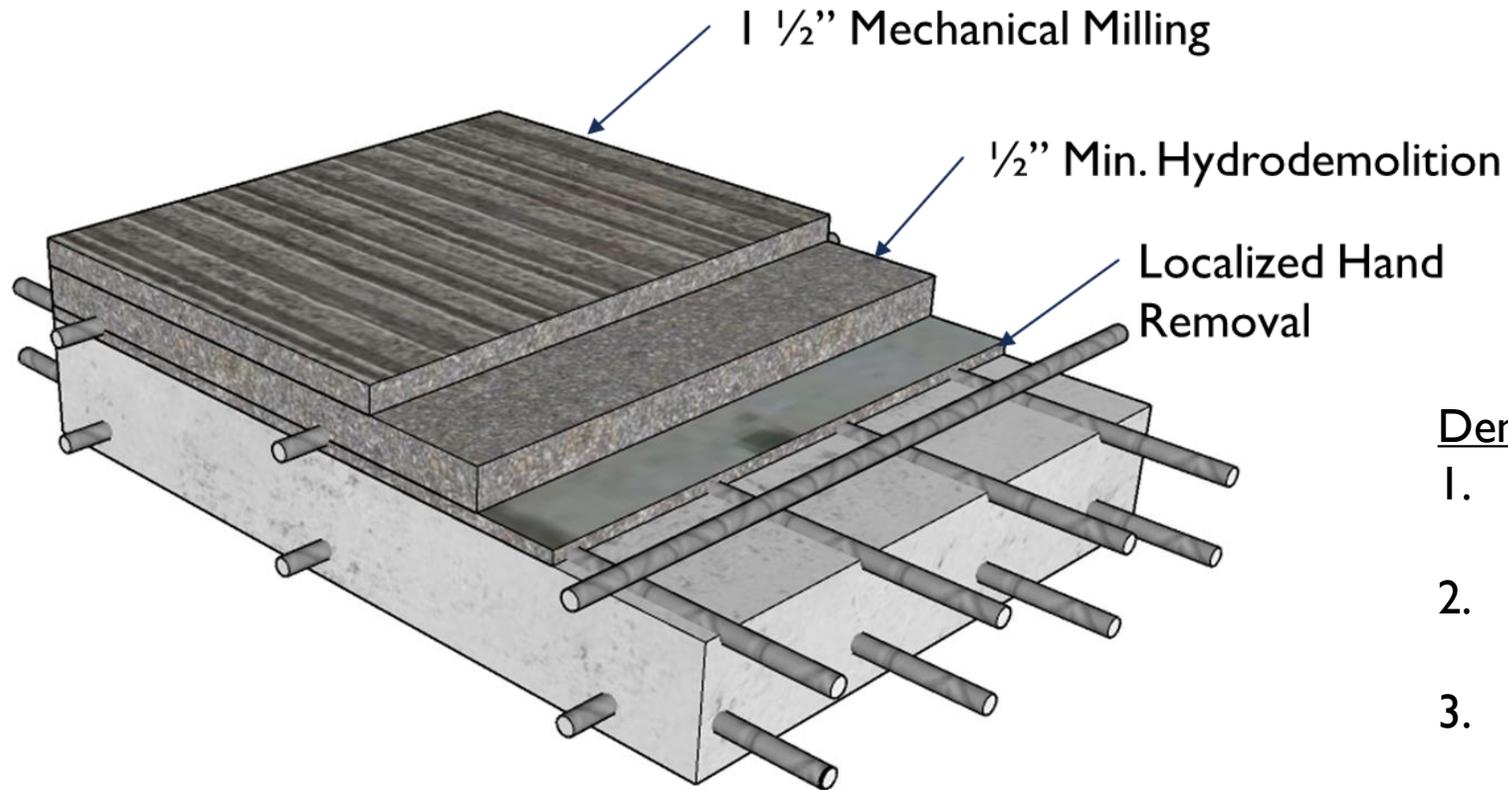
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- Originally bid to perform overlay work in fall 2019 and again in fall 2020
 - Could only pour LMC between May 1 – November 30
 - No long-term closure of Lane 1 until October 1 and removed by April 15
 - About 30 Working Days for LMC Placement
- Wagman was directed to accelerate the schedule by combining and condensing the schedule to complete all LMC during one construction season
- All construction activities were scheduled during nightly full bridge closures or short daily lane closures (less than four hours)



Construction Process

Deck Removal Process:



Demolition Process:

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

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Construction Process

- LMC Overlay – Mechanical Grinding (Scarification):
- Plans 1"-1½" Mechanical, and or ½" – 1" hydro.
 - 1½" - 2½" was the overall intent, but we ended up averaging a 3 ½" overall depth
- It was advantageous to scarify as deep as possible without damaging rebar, since scarification is much faster than hydrodemolition.



Construction Process

LMC Overlay – Hydrodemolition:

- Average Hydro-Demolition Depth of 1”
- Optimal Results Achieved with:
 - Constant monitoring / required to avoid blowout
 - Completed Initial Pass to achieve desired Removal

Desired Surface Profile



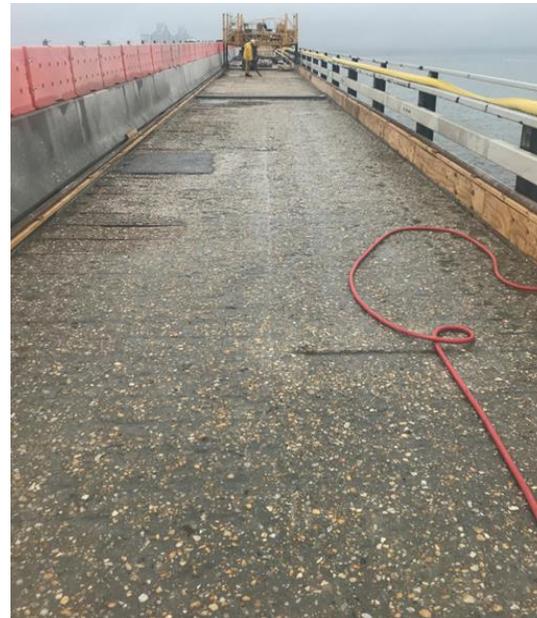
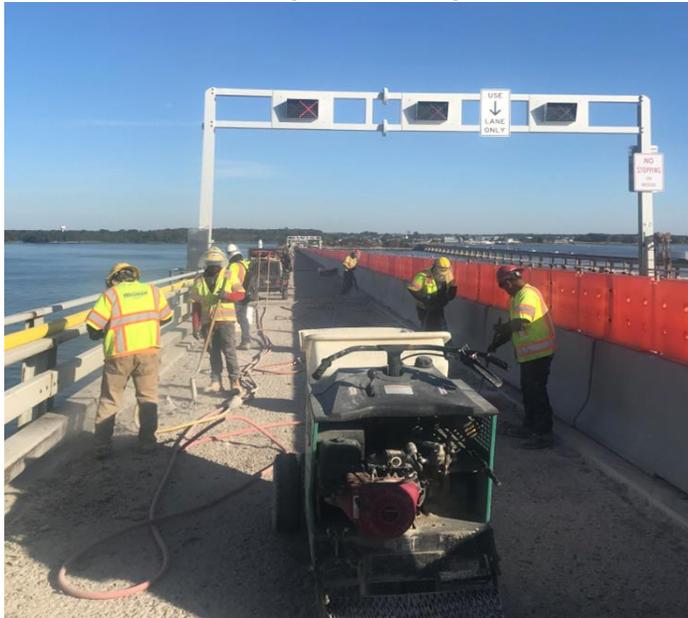
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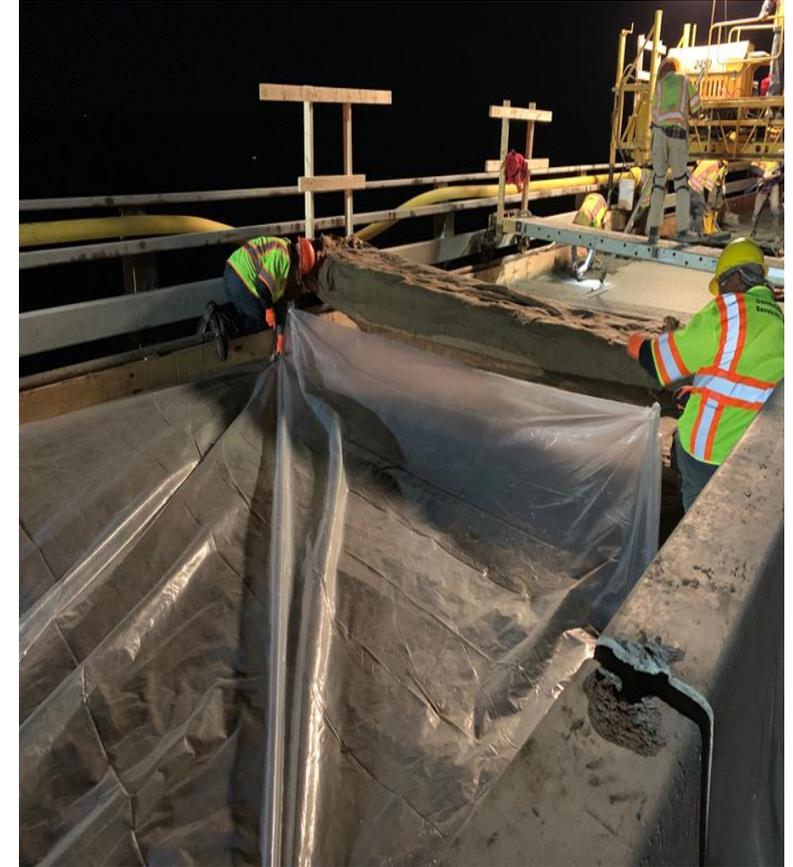
Construction Process

LMC Overlay – Hand Removal and Final Surface Preparation:

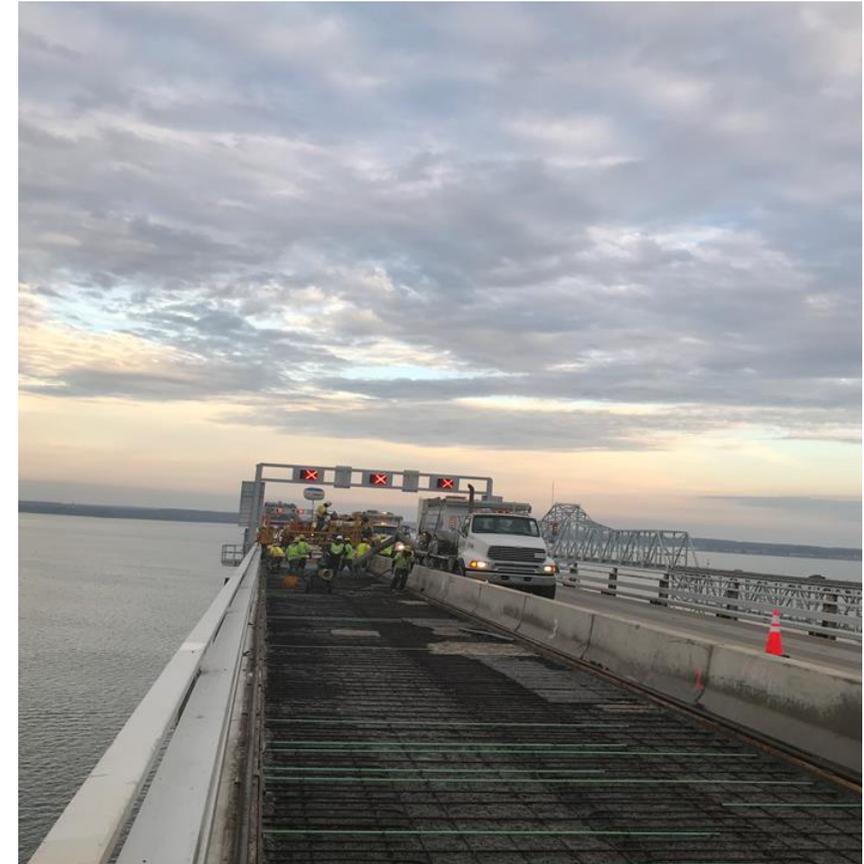
- Hand Removal of Areas Inaccessible
- Remaining This Layer of Bonded Micro-Silica - 100% Removal
- Power washing Deck Surface
- Surface Prep is key to a strong bond between LMC and existing substrate



- 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.



- Specification Modifications
 - Not being able to pour with temps below 45 degrees was lifted and revised to not placing LMC if air temps were to be below 32 degrees within the five-day cure period
 - Innovative methods of winter protection included thermal insulating blankets, ground heaters to provide the required 50 degree cure temps
- MDTA allowed Wagman to take temporary lane closures during daytime hours to service hydro, pour LMC and service artificial heat system





- Nearly five miles of 4" temporary hose were installed on existing bridge safety rail to supply clean water for hydro operation and pump wastewater to frac tanks
- Trucks were mobilized on the bridge each shift and staged in adjacent temporary lane closures to pour from the closed lane. Averaging 400 LF x 12' width
- No equipment allowed on deck after hydro was complete
- Ground Heaters





- Significant deterioration in localized areas
- Larger scale patching and partial deck replacement
- Access while maintaining lanes and staying off of the hydro surface.
- Wind / Weather / receiving lane closures

Challenges



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- 2.2 million gallons of water used
- 26,000 Linear Feet of 4" Lay flat Hose
- 15,169 Linear Feet of Temporary Traffic Barrier
- 858 LF of expansion joints replaced
- 1,669 CY of LMC Placed
- Average Depth of Pours 3.5 Inches
 - Existing deck thickness was ~6 ½ - 7"
- 8 – 6K SF Ground Heaters
- 128,000 SF of Concrete Blankets
- 750,000 SF of Silane Sealant

Construction Facts



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“This project was envisioned as taking two construction seasons to complete. But our dedicated employees and contractors, working to serve their neighbors and all those who use this bridge, have completed it in just over seven months – record time by any measure,” Governor Hogan added. “The men and women who have accomplished this task inspire me, and will forever have my appreciation.”

– Maryland Governor Larry Hogan



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