

# Eastbound Wilson Boulevard over Arlington Boulevard (Route 50)

*Accelerated Bridge  
Superstructure Replacement*

by:

Asst. District Structure and Bridge Engineer: Edmund Okerchiri, PE  
Virginia Department of Transportation

Lead Design Engineer: Kelly Guild, PE  
WSP USA



# Project Location

- EB Wilson Boulevard bridge is in Falls Church at the Seven Corners interchange. It crosses over Route 50 with 50,000 vehicles per day.
- Seven Corners interchange marks the junction of five major roadways.



# Existing Bridge Conditions

- Existing bridge built in 1958.
- Deck condition rated 4 out of 9 makes it structurally deficient. Qualifies for SGR funding.



# Superstructure Replacement

## **Deck replacement and staged construction ruled out:**

- Would cripple interchange for several months, causing mobility problems and extensive disruption to the community.

## **Precast deck replacement option was unacceptable:**

- Non-uniform existing beam layout and inadequate structural capacity of fascia beams (originally designed for sidewalk loads)

## **Full superstructure replacement utilizing Accelerated Bridge Construction (ABC) was the only option to address structural deficiencies and increase the useful life of the bridge.**

- Superstructure built offsite.
- Constructed in a much shorter time period.
- Reduces construction time and minimizes traffic delays.

# VDOT Task Order



- Superstructure replacement using ABC methods per agreement between VDOT Traffic & Structure/Bridge
  - WSP tasked to provide design, construction plans, specifications, and construction support for superstructure replacement of EB Wilson Boulevard over Route 50.
  - New bridge superstructure built offsite.
  - Demolish existing bridge superstructure and replace during a **SINGLE WEEKEND** in August.

# Design Considerations

## *Existing Abutment Rehabilitation*

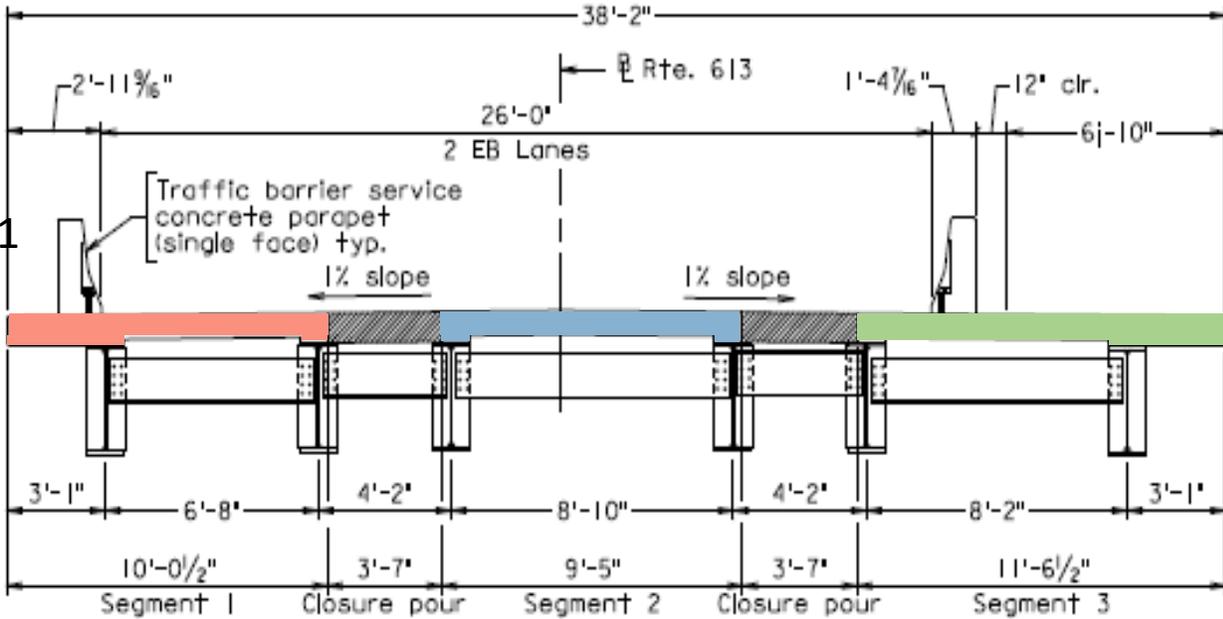
- Allowed for ABC superstructure replacement.
- Noted areas of localized cracking, spalling, and delamination.
- All defects repaired under VDOT's standard items "Concrete Substructure Surface Repair" and "Crack Repair Type B."
- Galvanic anodes were incorporated in concrete repairs to protect reinforcing steel.
- Constructed ahead of weekend closure.



# Design Considerations

## *Preconstructed Composite Units (PCUs)*

Ability to transport and lift new superstructure into place was the primary design consideration.

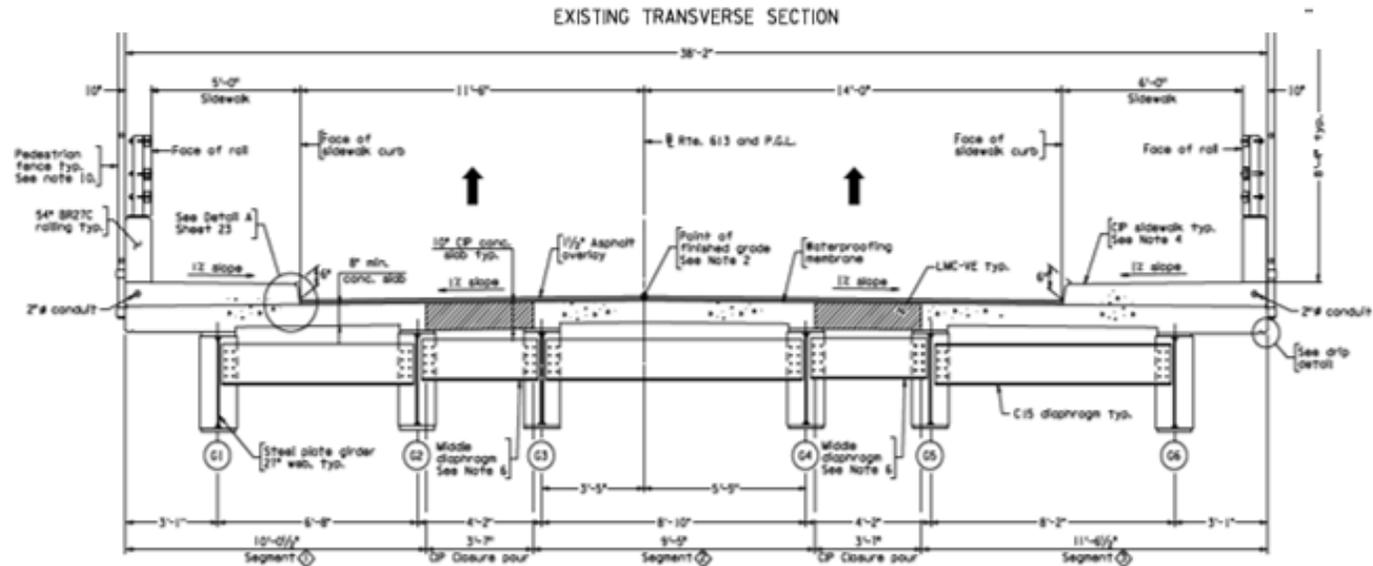
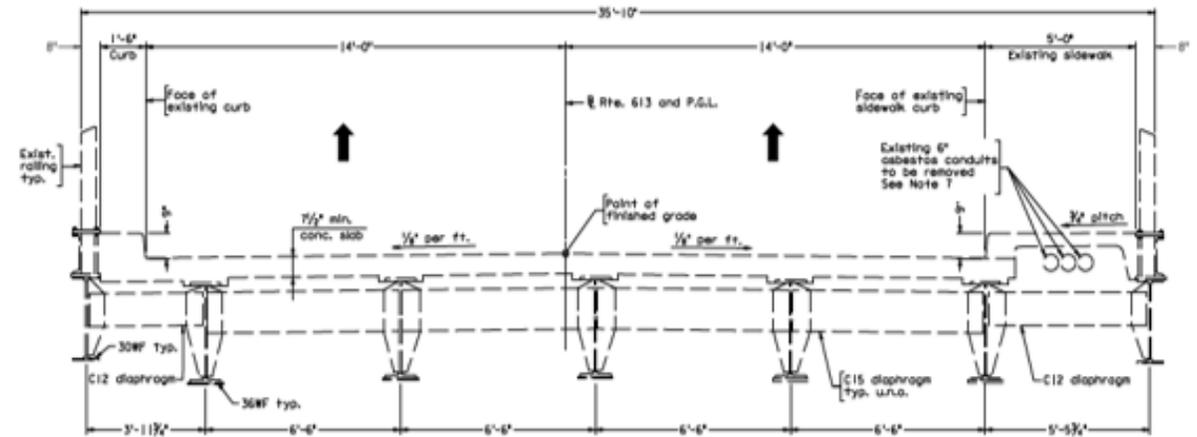


Estimated Segment Weight - Light Weight vs. Normal Weight Concrete

	Segment 1		Segment 2		Segment 3		TOTAL	
Segment width	10.04 ft		9.42 ft		11.54 ft		31.00 ft	
Concrete unit weight	150 pcf	116 pcf	150 pcf	116 ocf	150 pcf	116 ocf	150 pcf	116 ocf
Total weight	72.6 Tons	60.0 Tons	62.6 Tons	52.2 Tons	78.8 Tons	64.7 Tons	209.2 Tons	173.3 Tons
Savings	12.6 Tons		10.4 Tons		14.1 Tons		35.9 Tons	

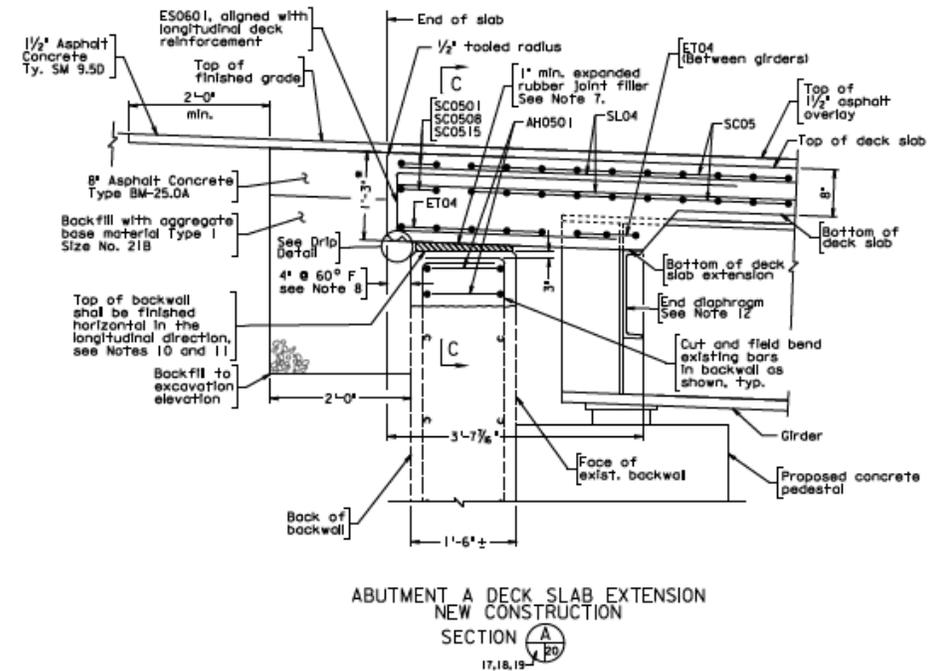
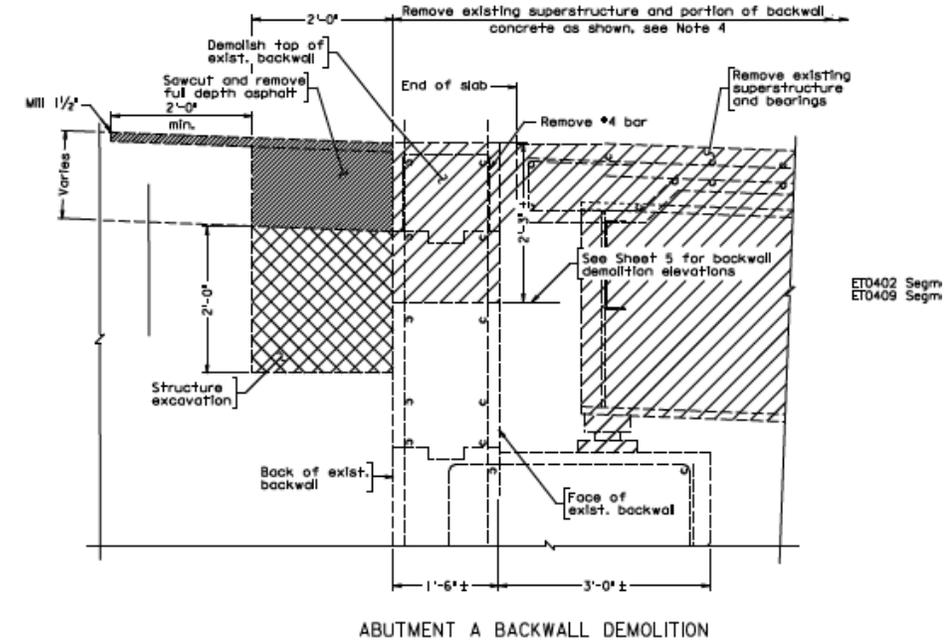
# Design Considerations

- Located 6 new girders between 7 existing girders.
- Allowed for construction of new bearing pedestals and bearings prior to weekend closure.



# Design Considerations Deck Slab Extension and Backwall Modifications

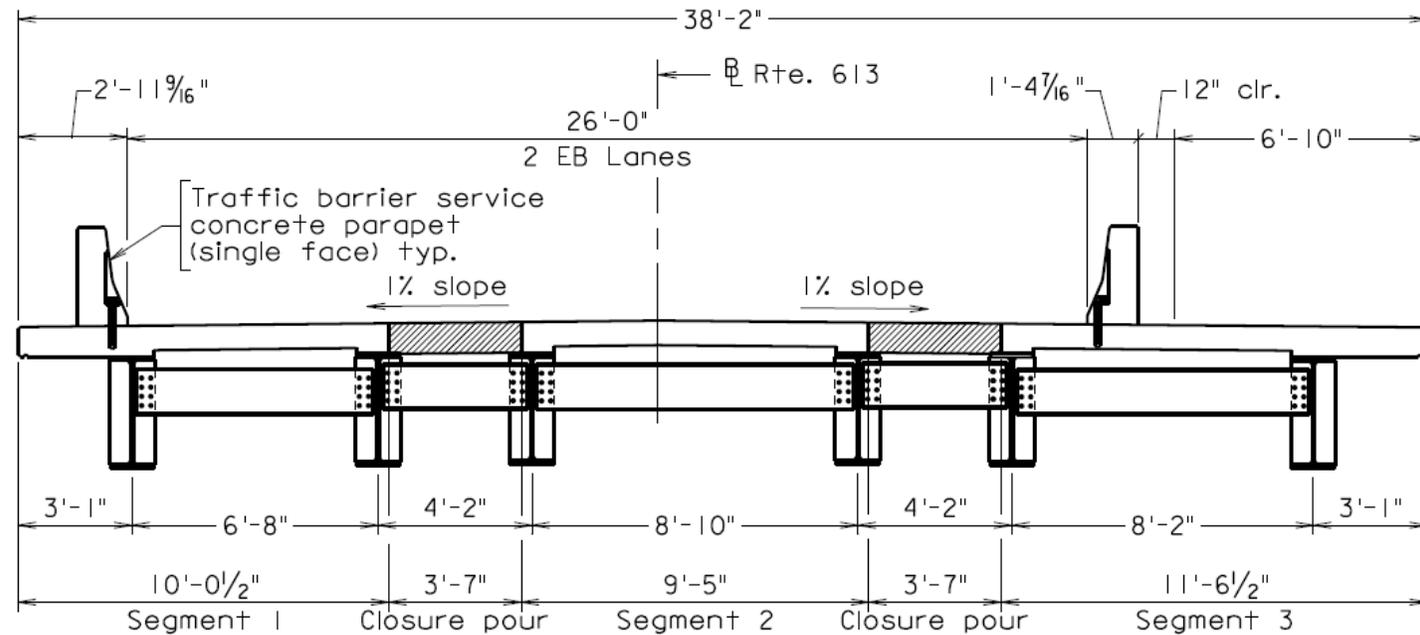
- Demolish and reconstruct top portion of existing backwall to make room for deck slab extension.
- Crucial to construct an accurate interface between deck slab extension and top of backwall.
- Challenge to construct new backwall (at bridge location) to match underside of PCU deck slab extension (constructed offsite).
- Design plan was to modify backwall during weekend closure prior to segment lift.
- Contractor requested to place PCU's first.



# Design Considerations

## Deck Closure Pours

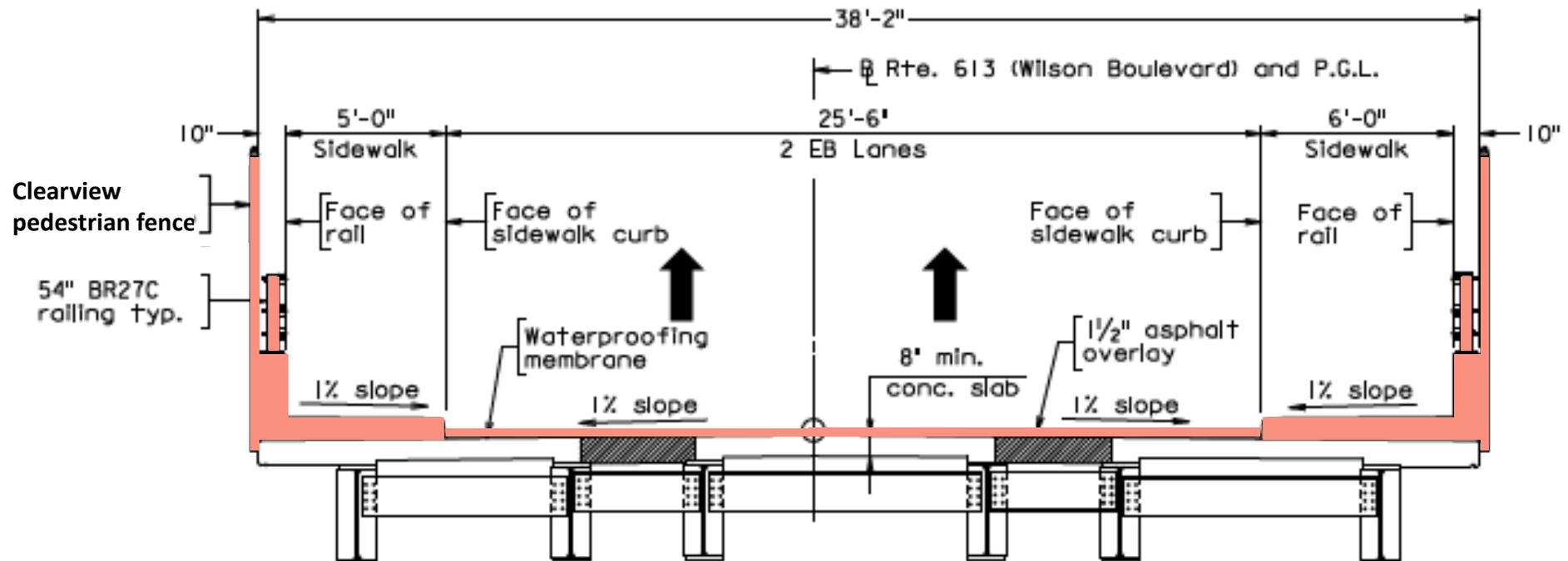
- Two 3'-7" deck closure pours designed to provide a continuous deck.
- Material needed an accelerated cure to meet tight weekend schedule.
- Constructed using Latex Modified Concrete, Very Early Strength (LMC-VE) per VDOT Materials.
- Met compressive strength requirements in 4 hours!



# Design Considerations

## *Post-weekend Closure Design Elements*

- New BR27 railings, sidewalks, pedestrian fences, and asphalt overlay on bridge.
- New sidewalk, curb, and retaining wall at bridge approaches.



# Accelerated Superstructure Construction Award and Schedule Constraints

- ABC superstructure replacement project awarded to Martins Construction on March 4, 2019
- Fabricate superstructure off-site in segments, transport and install
- Pick one of three weekends to replace the bridge: 8/3, 8/10, 8/17
- Detour allowed from 10 PM Friday to 5 AM Monday; **ONLY 55 HOURS**
- Substructure work including new beam seat construction to be performed prior to weekend closure
- Parapets, sidewalks, fence and asphalt overlay constructed after weekend closure

12

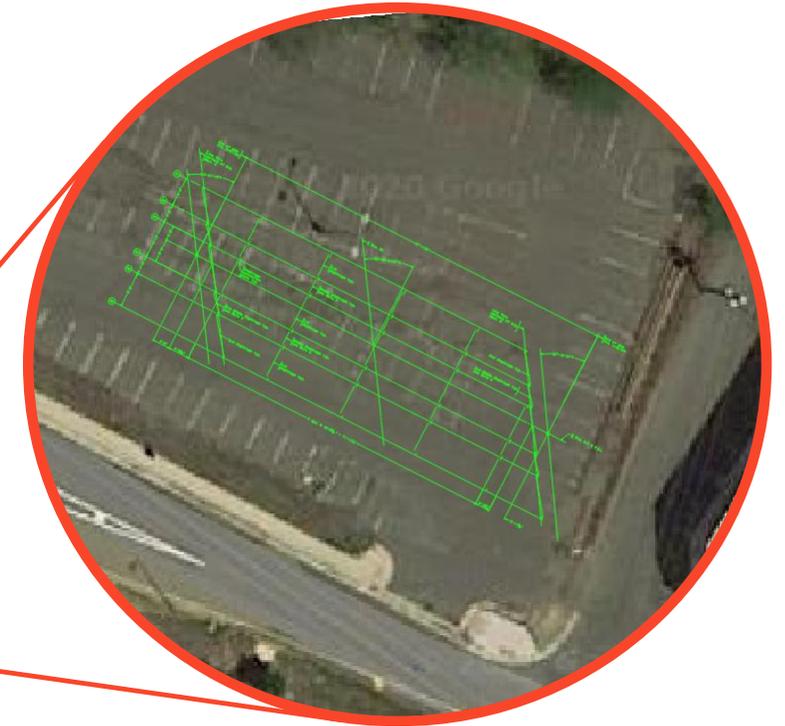


# Accelerated Superstructure Construction

## *Offsite Construction*

- Transport and survey constraints resulted in pursuit of leasing close by casting yard
  - 8 ton weight restriction on Route 50
  - Ability to perform repeated surveys of substructure modifications and superstructure segments
- Section of yard with favorable cross-slope similar to final position

13



# Accelerated Superstructure Construction *Offsite Construction*

- Plate girder layout **June 19, 2019.**
  - Design plan requirement to shop assemble first.



# Accelerated Superstructure Construction *Offsite Construction*

- Deck reinforcement placement **July 9, 2019.**



15

VDOT

WSP

MARTINS  
CONSTRUCTION

# Accelerated Superstructure Construction *Offsite Construction*

- Deck pour **July 10, 2019.**
  - 10 continuous concrete trucks, 80CY concrete total



# Accelerated Superstructure Construction *Preconstructed Composite Units (PCUs)*



17



# Accelerated Superstructure Construction

## *PCU Loading and Transport*

- Loaded and Staged Prior to Weekend Closure - **August 1, 2019**
- Maintain line and grade / prevent turn and twist:
  - Super-duty turn buckles during lifting
  - Specialized stretchable trailers with self-adjusting hydraulic axles

18



# ABC WEEKEND CLOSURE

**AUGUST 2 - AUGUST 5  
2019**

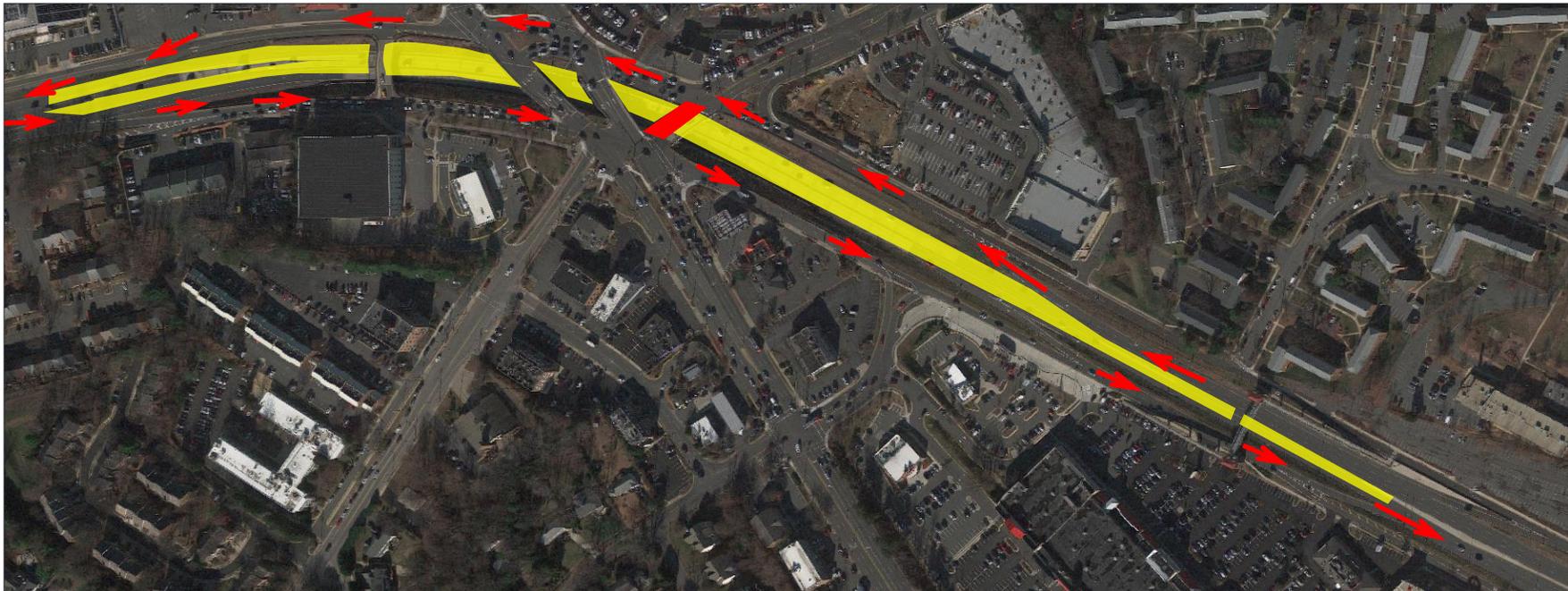
19



# Maintenance of Traffic (MOT)

## *Weekend Closure of Route 50*

- Complete closure of Wilson Boulevard bridge (shown in red).
- Complete closure of Route 50 (shown in yellow).
- Route 50 detour onto existing ramps (red arrows).



# Weekend Closure - Demolition

21

Friday	10:00 PM
	11:00 PM
Saturday	12:00 AM
	2:00 AM
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Sunday	8:00 PM
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Monday	1:00 AM
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# Weekend Closure – Debris Removal and Substructure Demo/Formwork

22

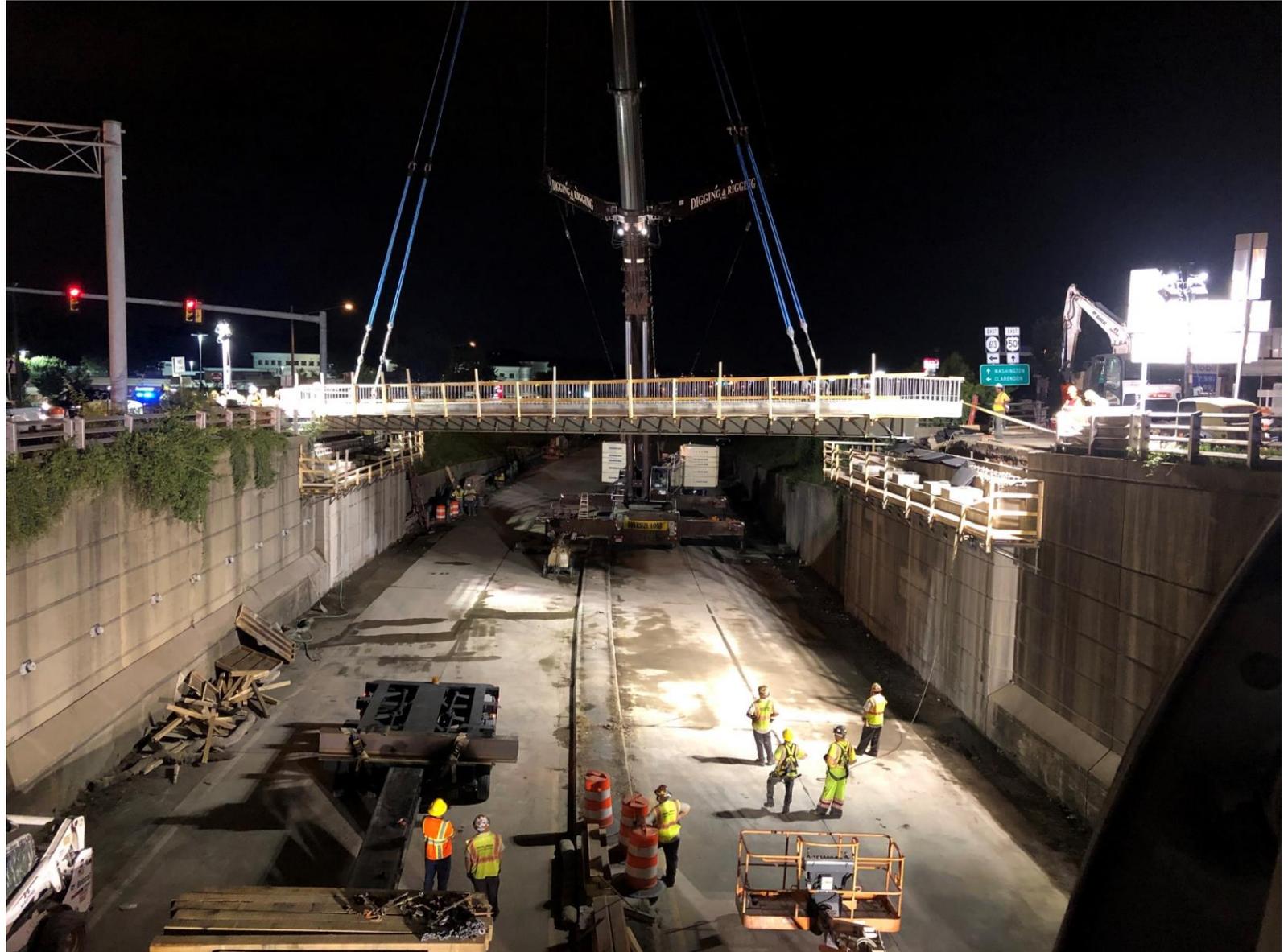
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Monday	8:00 PM
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# Weekend Closure - PCU Installation - Segment 1

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Friday	10:00 PM
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Saturday	12:00 AM
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# Weekend Closure - PCU Installation - Segment 2

24

Friday	10:00 PM
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# Weekend Closure - PCU Installation - Segment 3

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Friday	10:00 PM
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# Weekend Closure - Installation of Closure Pour Formwork and Reinforcing

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# Weekend Closure - Backwall Pours (Concurrent with Closure Forming)

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Friday	10:00 PM	
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- VDOT required LMC-VE for backwall pour.
- Contractor requested to cast backwalls AFTER segments were in place.
- Closure openings were utilized to funnel concrete into forms.
- Perfect interface at overhang.
- Change saved hours in construction schedule.

# Weekend Closure - Closure Pours

- Modified Mix Design with Plasticizers and Retarders to extend cure time from 20 minutes to 40 minutes
- Offset Trucks Along Skew and Synchronized Truck Movement to reduce differential deflections
- Both measures resulted in quality deck concrete and closure pours **without cracking.**

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# Weekend Closure – Cleanup and Bridge Opening

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Saturday 6:00 PM

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Sunday 10:00 AM

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Monday 12:00 AM

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4:00 AM

5:00 AM

- Curing of closure pours
- Installation and bolting of barriers
- Clean-Up
- Removal of MOT Devices and Signs
- Route 50 : **OPENED TO TRAFFIC AT 2:30 AM**
- Wilson Blvd.: **OPENED TO TRAFFIC AT 4:20 AM**
- Total Time to Replace Superstructure: **ONLY 54 HOURS**



# Before & After



Before



After

# Public Information

## BEFORE

- Project Website
- News Release
- Tweets
- News Stories

## AFTER

- Time Lapse Video (Twitter, Facebook, Reddit, LinkedIn, YouTube)
- Impressions: 63, 835; Views: 46,300; Likes: 1,967; Comments: 193; Shares: 168
- News Stories, including Popular Science



# Notable Public Approval

Amazing!! 🌟

2:37 PM · Aug 5, 2019 · [Twitter Web App](#)

Fantastic. I drove over the new bridge at lunchtime today. Bravo!

6:18 PM · Aug 5, 2019 · [Twitter Web App](#)

Yay VDOTNOVA .....the best! We're so lucky here 😊

7:09 PM · Aug 5, 2019 · [Twitter for Android](#)

Amazing work @VaDOTNOVA

11:42 PM · Aug 5, 2019 from [Arlington, VA](#) · [Twitter for Android](#)

Me: feels like I need to take a ride down the road and see the new addition to the neighborhood! Thank you for the hustle @VaDOTNOVA!

6:27 AM · Aug 6, 2019 · [Twitter for Android](#)

Thank you for the hard work 👍

7:27 AM · Aug 6, 2019 · [Twitter for iPhone](#)

Well done, everyone!

1:18 PM · Aug 6, 2019 · [Twitter for Android](#)

I'm going to show my dad!

6:03 PM · Aug 6, 2019 · [Twitter for iPhone](#)

Impressive. We appreciate you!

8:40 PM · Aug 6, 2019 · [Twitter for iPhone](#)

TooEZ\_OL56 [Fairfax County](#) 200 points · 5 months ago

This is what I can appreciate my tax dollars working for.

Shervivor 42 points · 5 months ago

This is an awesome video! I was seriously surprised by the limited disruption this work caused. It wasn't near the hell I was expecting!

austri [Fairfax County](#) 6 points · 5 months ago

That's cool, and congrats on getting it done so quickly.

I drove through there (Route 7) this weekend and traffic was not terrible, thankfully.

breredit 3 points · 5 months ago

Congrats to the chief engineer. If life were fair they would give an Oscar to a Chief engineer. Whoever you are Mr or Mrs Chief Engineer, that will never happen, but it would if it were up to me!!!

zamora23 2 points · 5 months ago

The power of competent people!

SrirachaPeass 5 points · 5 months ago

Sometimes I think that these huge trucks and huge building materials just poofs out of nowhere and fixes things.

[vadotnova](#) 9 points · 5 months ago

Like The Infrastructure Fairy?

[donmeanathing](#) 9 points · 5 months ago · *edited 5 months ago*

Didn't some of the funding come from federal sources? I thought I read somewhere that this was part of an initiative to fix decrepit bridges.

[vadotnova](#) 9 points · 5 months ago

"Decrepit" just sounds... hurtful for some reason.

# Award Winning Project!

- Awarded the ACEC Metro-Washington chapter's "Engineering Excellence Honor" and "Best Local Project" Awards



# Acknowledgements

- Many thanks to VDOT, WSP, and Martins Construction for the successful superstructure replacement in Seven Corners!

34



# Time Lapse Video

35



Questions?  
Thank you!