

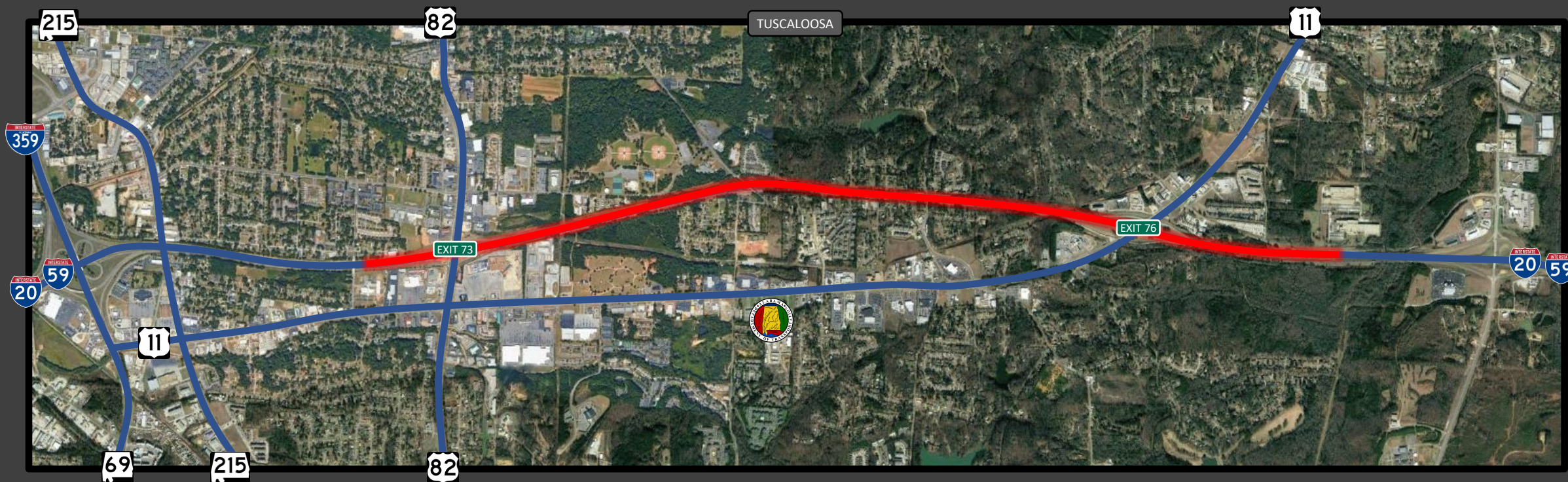
CONSTRUCTION OF ALABAMA'S FIRST SINGLE POINT URBAN INTERCHANGE (SPUI)

Wallace McAdory, III, PE
Region Engineer
ALDOT West Central Region



Project Overview

- Owner: ALDOT
- General Contractor: Brasfield & Gorrie
- Engineer: AECOM
- Contract Amount: \$83,409,790.11
- Contract Completion: December 18, 2020
- I-20/59 ADT: 60,004 (2017) & 98,323 (2037)
- ≈ 4.2 miles of interstate widening
- 2 Bridge Replacements
- Decorative Lighting

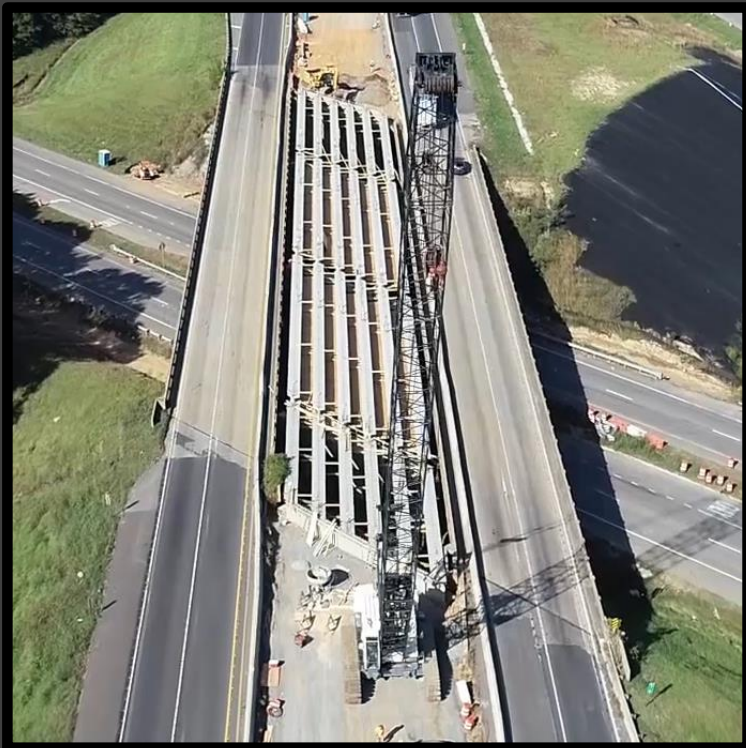


Additional Lanes



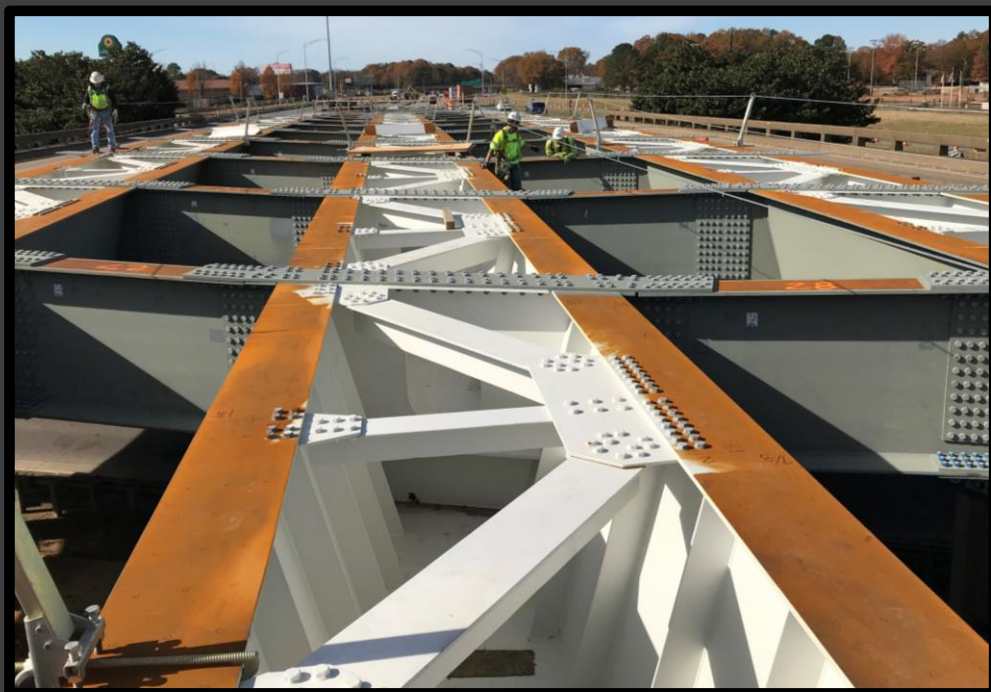
Bridge Replacement: Skyland Blvd

- Foundation
 - 284 – 12” deep foundation H-Piles
 - estimated 7,245 LF of piling
- 4 Spans For A Total Length Over 350’
 - 3 intermediate bents
 - 27 – 36” round columns
- Girders
 - 68 – BT-54 girders
 - 55’ to 105’ in length



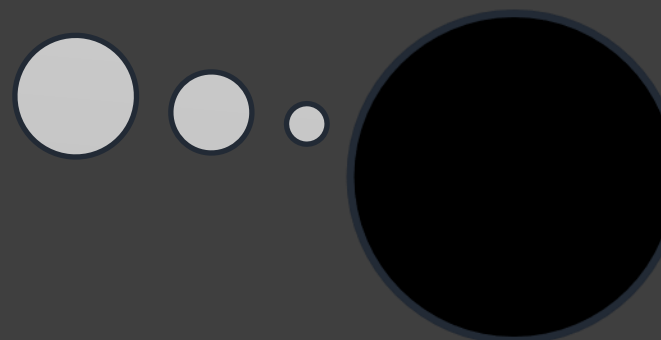
Bridge Replacement: McFarland Blvd

- Foundation
 - 30 – 54” diameter drilled Shaft foundations
- Mass Concrete Abutments/Thrust Blocks
- Single Span of 256’-10 ¼”
- Girders
 - 7 steel tub girders
 - 6’ tall
- 2 Independent Steel Arches
 - 13 – 2⁵/₈” steel cables per side



Why...

- a Single Point Urban Interchange (SPUI)?
- an arch suspension bridge?



Existing Interchange

- Conventional Diamond Interchange
 - 2 sets of signals, 1 on each side
 - Congestion causing miscues up and downstream
- Poor Level of Service
 - LOS F, 113 second delay
- Urban Area, Limited ROW



Analysis, Design, & Selection

- Modeled New Intersection Designs
- Evaluated Simulations
- Single Point Urban Interchange (SPUI)
 - Requires fewer traffic signals.
 - Improves safety.
 - Increases efficiency.
 - Improves travel time.
 - Accommodates large vehicles.
 - Level of service improvements.



Traffic Control

Automatic Optimization

Number: 7
 Intersection: SPUI
 Control Type: Signalized
 Analysis Method: HCM 6b-Edison

Approach: Northbound, Southbound, Eastbound

Lane Configuration: 3 lanes, 3 lanes, 2 lanes

Turning Movement	Left	Thru	Right	Left	Thru	Right	Left	Thru	Right
Base Volume Input [veh/h]	254	1273	130	441	1561	425	280	0	471
Total Analysis Volume [veh/h]	254	1273	79	441	1561	225	280	0	275

Intersection Settings

Priority Scheme: Major, Major, Minor

Analyze Intersection?

Analysis Period: 1 hour

Located in CBO

Controller ID: 1

Signal Coordination Group: -

Cycle Length [s]: 100

Coordination Type: Time of Day Pattern Coordinated

Actuation Type: Fixed time

Offset [s]: 0.0

Offset Reference: LeadGreen

Permissive Mode: SingleBand

Lead time [s]: 0.00

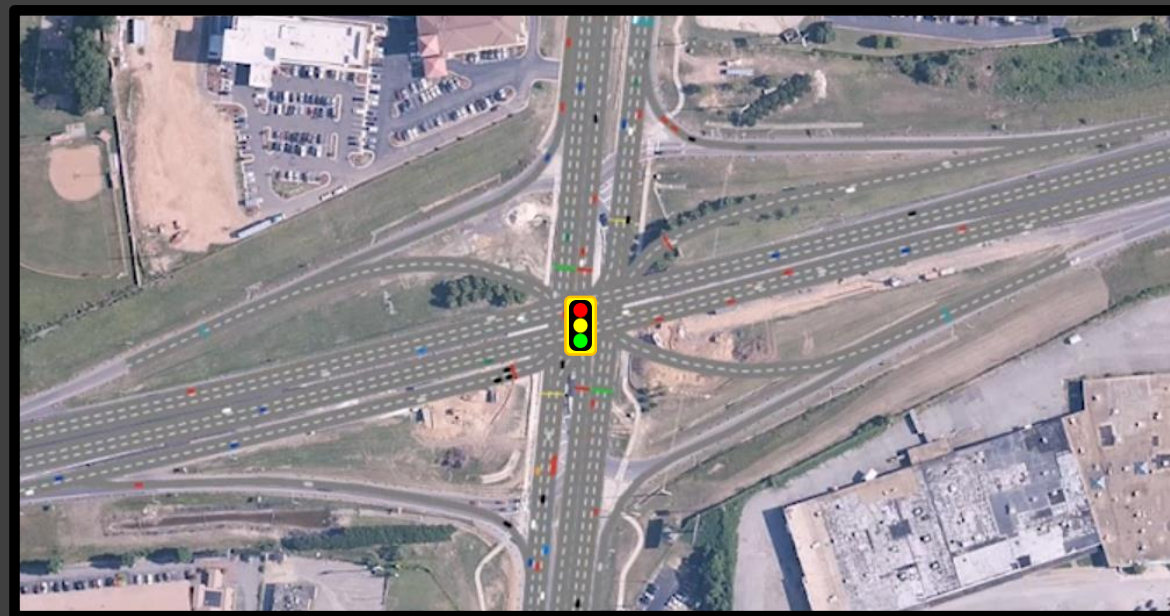
Pedestrian Walking Speed [ft/s]: 3.10

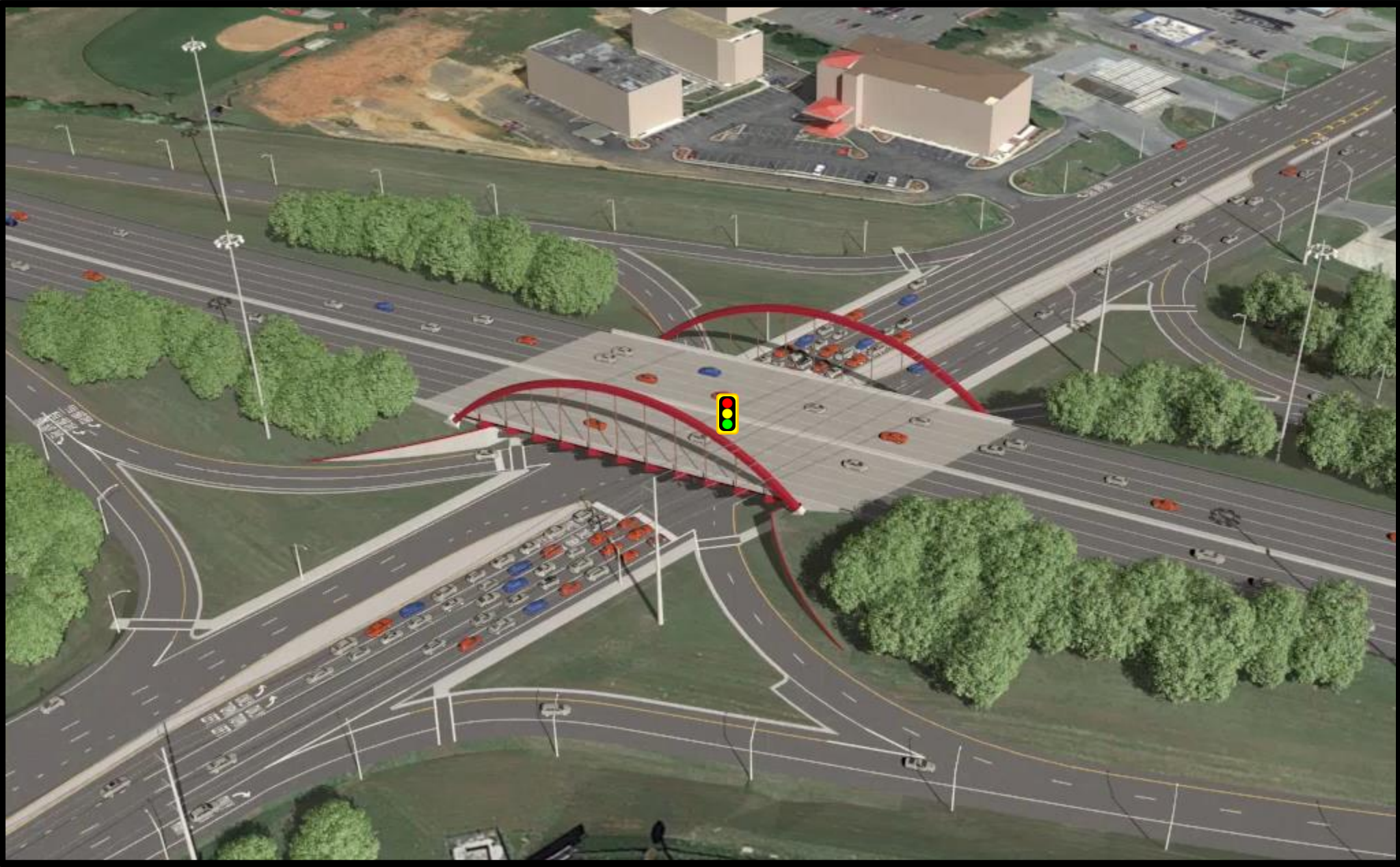
Phasing & Timing

Control Type	Protected	Permissive	Permissive	Protected	Permissive	Permissive	Protected	Permissive	Permissive
Allow Lead/Lag Optimization	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Signal Group	1	6	0	5	2	0	3	0	0
Auxiliary Signal Groups									
Lead / Lag	Lead			Lead			Lead		

Sequences

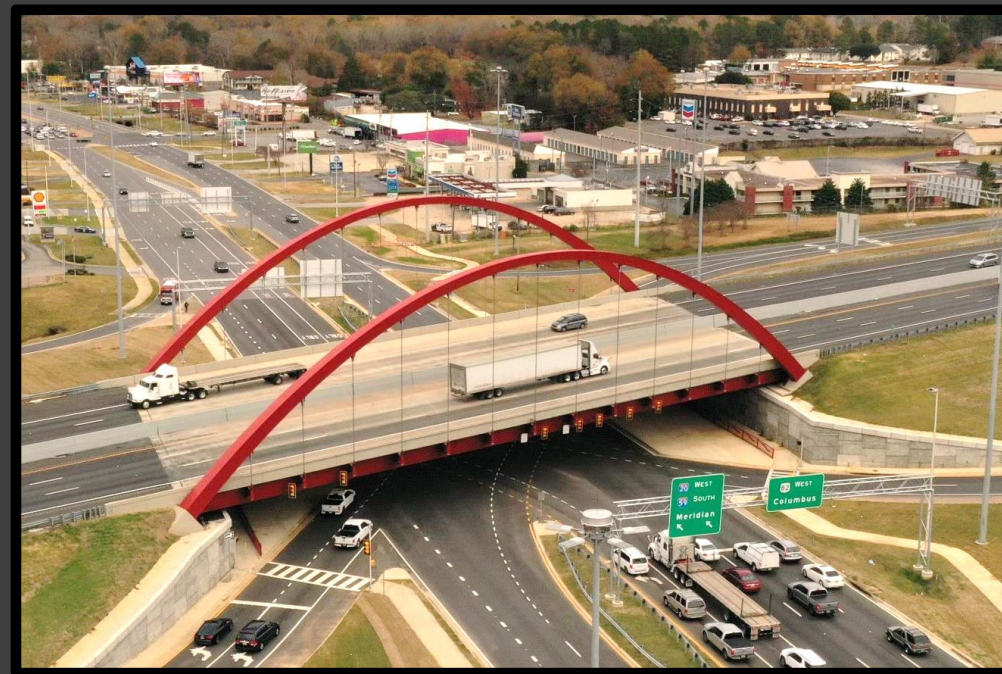
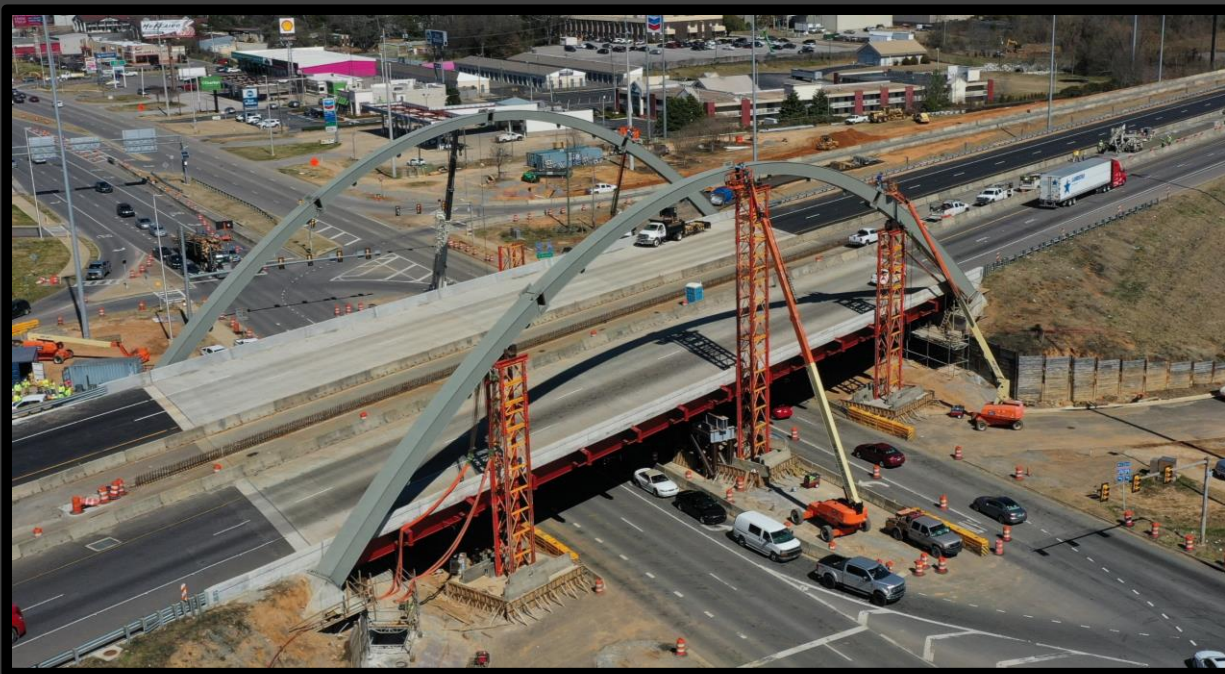
Ring	1	2	3	4	5	6	7	8	9	10
Ring 1	-	-	-	-	-	-	-	-	-	-
Ring 2	-	-	-	-	-	-	-	-	-	-
Ring 3	-	-	-	-	-	-	-	-	-	-
Ring 4	-	-	-	-	-	-	-	-	-	-





SPUI & McFarland Blvd Bridge Construction

- Ramp Geometry Changes
- Simplified Construction Phases – Stages
- Foundation Installation
- Temporary Bent Construction
- Girder Installation
- Bridge Demolition
- Arch Erection
- Ribs & Welding
- Cable Installation
- Cable Tensioning & Temporary Bent Removal
- Decorative Paint Color
- Decorative Lighting
- Comparisons

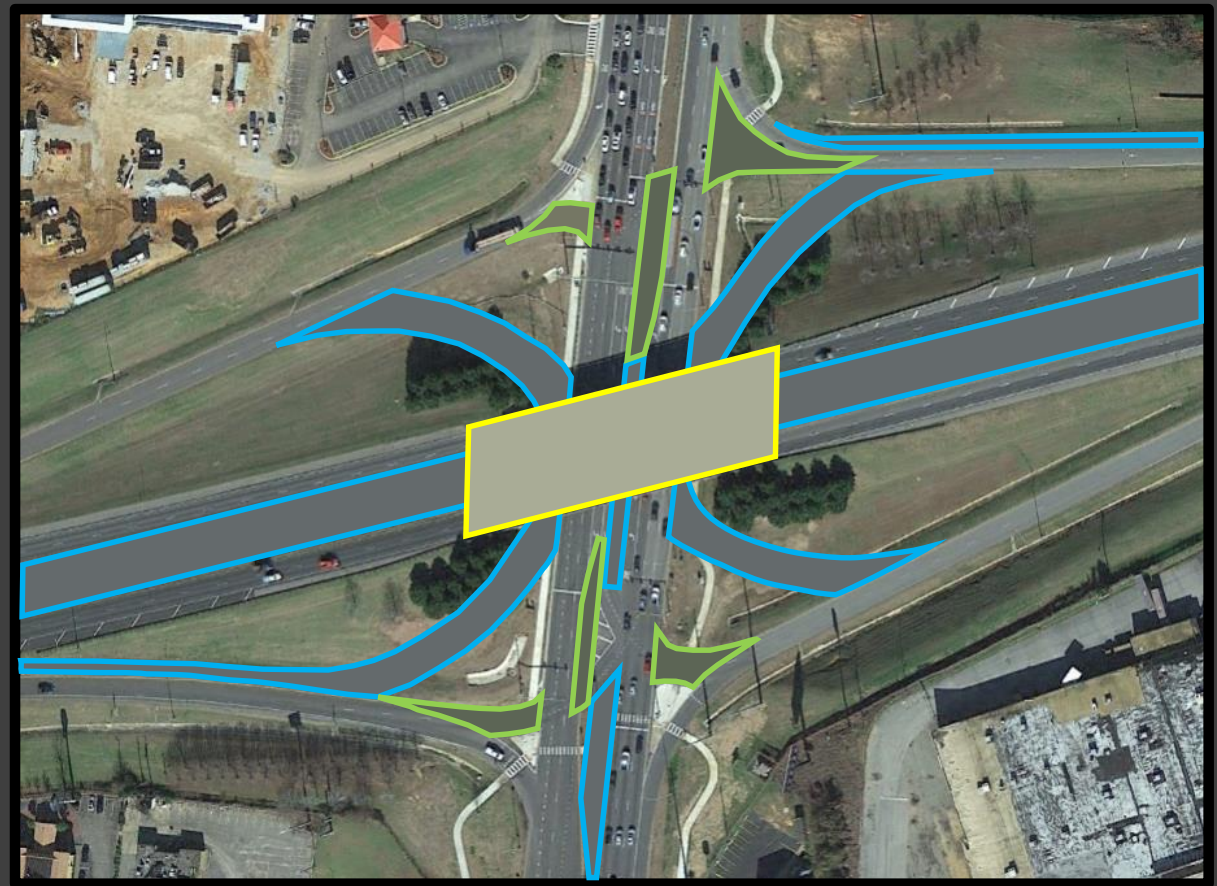


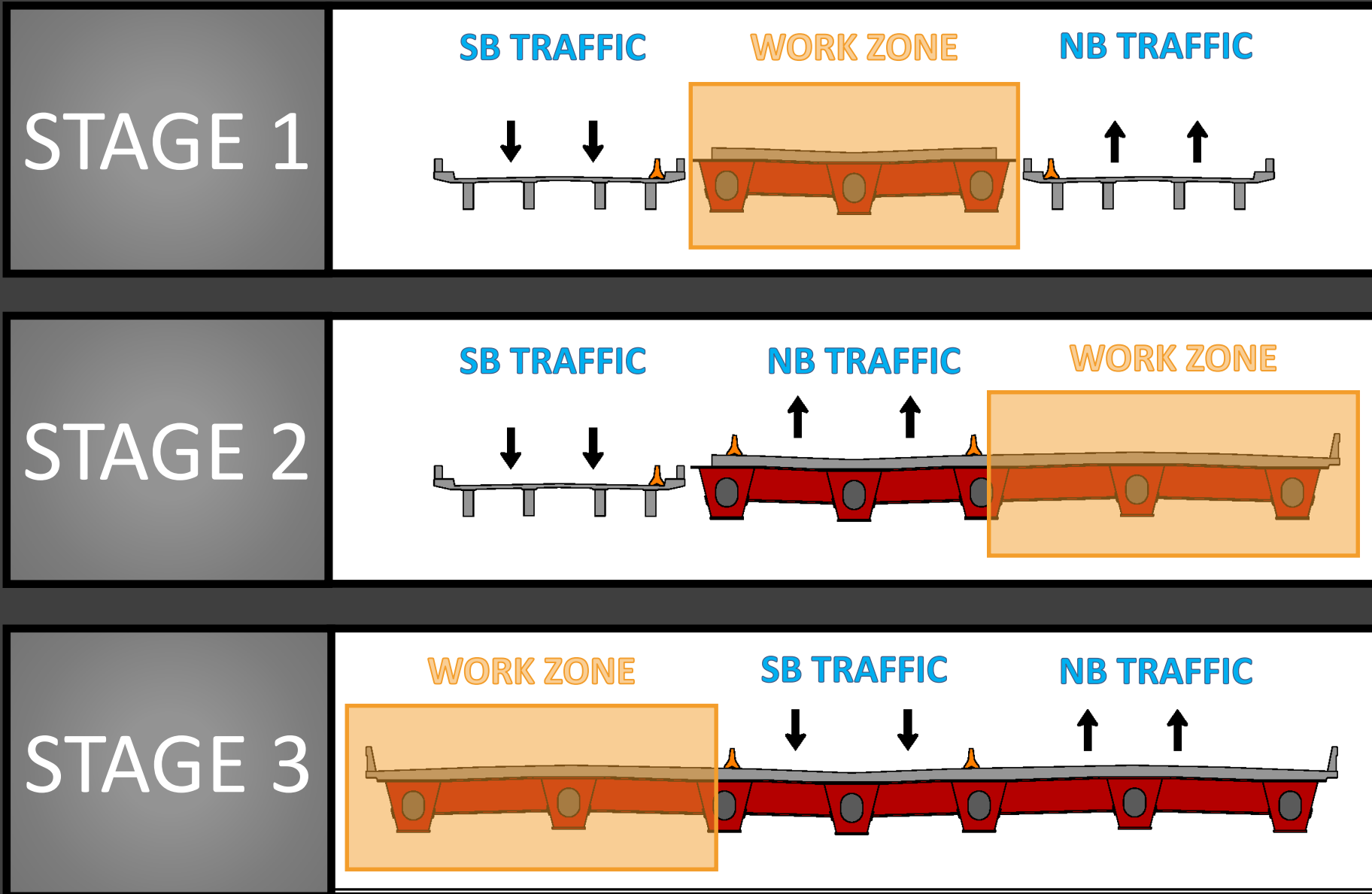
Ramp Geometry Changes

- Existing



- Changes





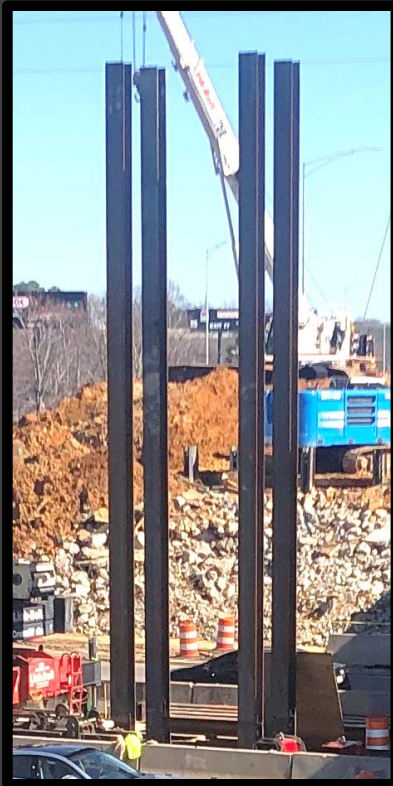
Foundation Installation

- 30 – 54” Diameter Drilled Shafts
- 545,300 lbs Steel Reinforcement
- 1,177 cy Bridge Substructure Concrete
- 3,420 lbs Structural Steel
- 2,384,860 lbs Structural Steel Superstructure (including arch ribs approx.)



Temporary Bent Construction

- Designed By the Contractor
- HP14x17 Driven Pile Foundation
- Double W35x232 For Bent Cap
- Welded structure
- Utilized Shim Plates
- Removed After Final Arch Installation



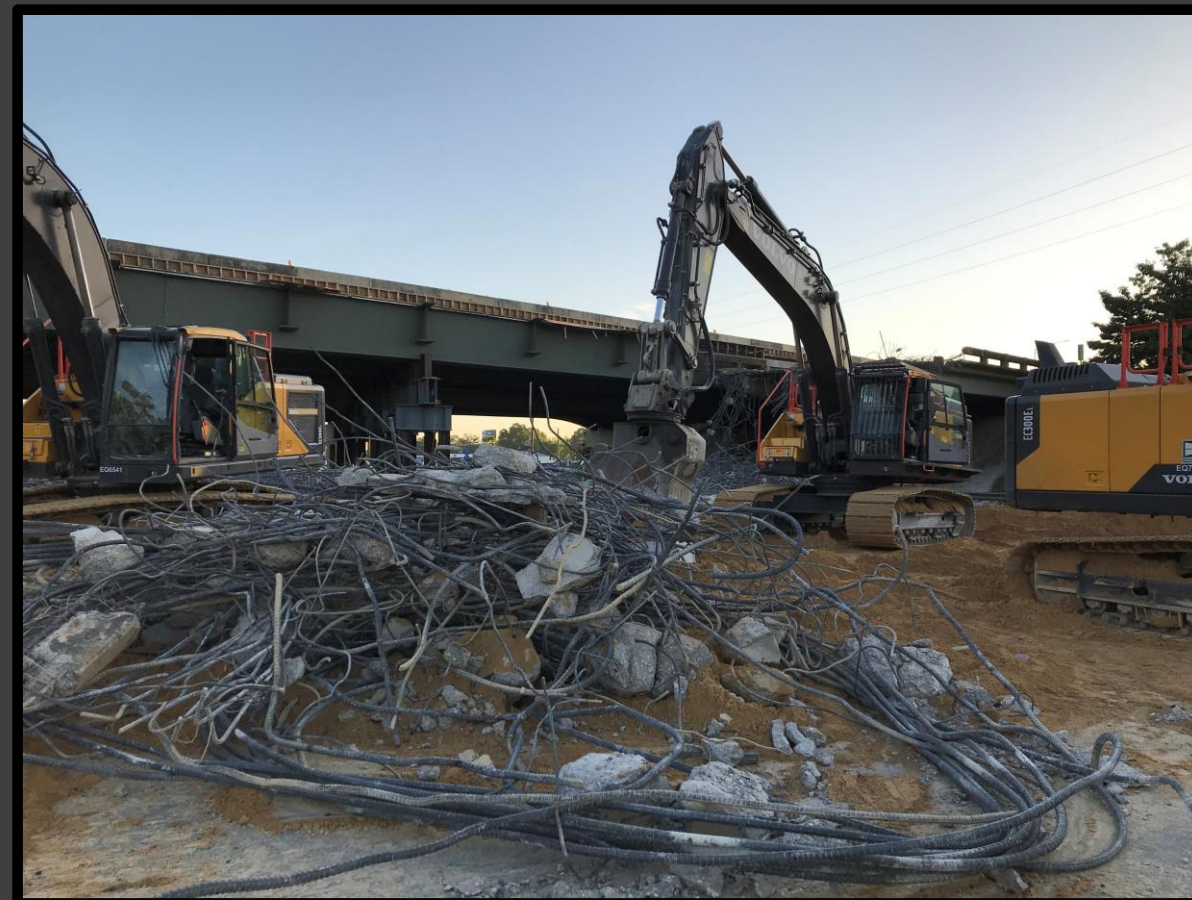
Girder Installation

- Detailed Erection Plan and Pickup Points
- 20-min Rolling Roadblocks On Interstate
- 54-hour Shutdown Window
 - complete shutdown of McFarland
 - interstate to remain open



Bridge Demolition

- 54-hour Shut Down Window
- Removal of superstructure, substructure, and debris
- Developed Engineered Demolition Plan
 - avoid impacts to newly constructed bridge
 - controlled collapse of bridge focusing on “attach zones”
- 2-ft Layer of Sand To Protect Roadway





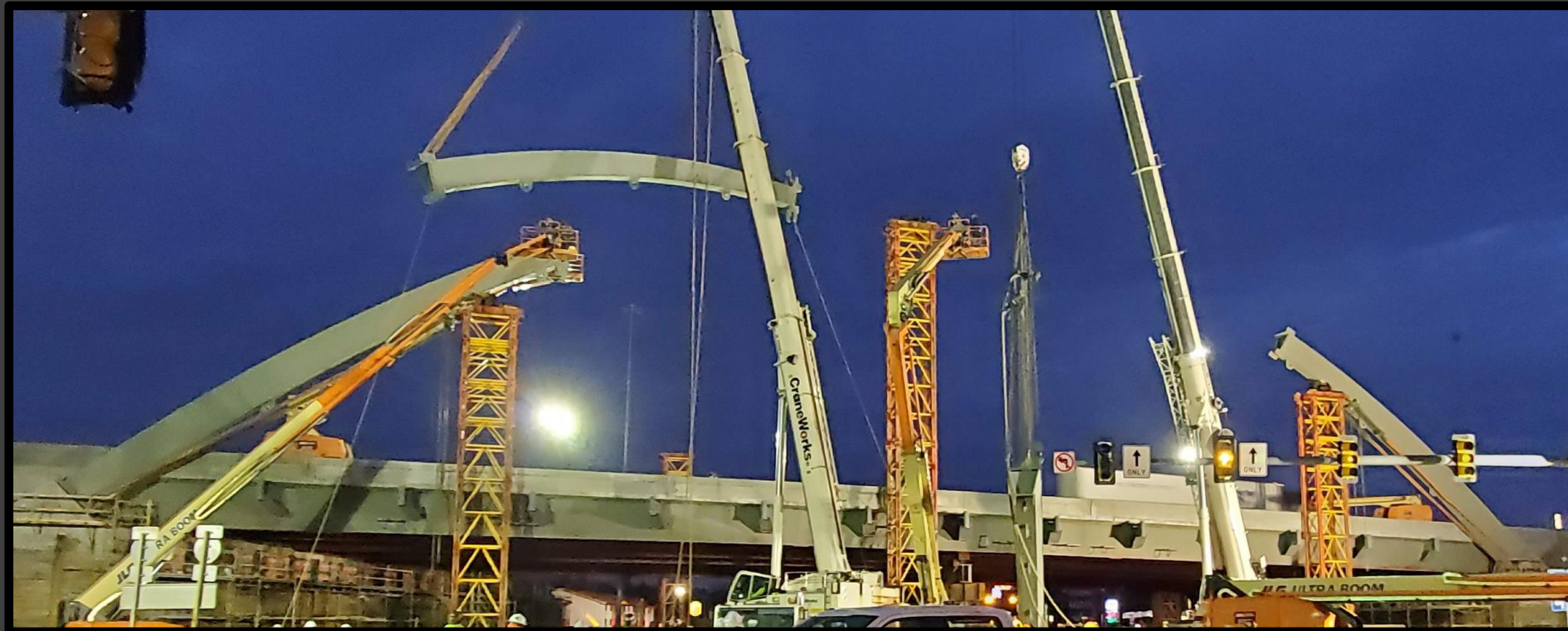
Arch Erection

- Temporary Erection Towers

- 3 towers per side
- 2 months to construct 6 footings,
 - 4 located in shoulder & 2 in median

- Erection Scheme

- Weekday, daytime lane closures
- Weekend, 54-hour shutdown window



Ribs & Welding

- Arch Segments Secured Via Ribs
- Weld Sections Together
- Welding Time Frame: \approx 5.5 weeks
- Ribs Removed After Welding



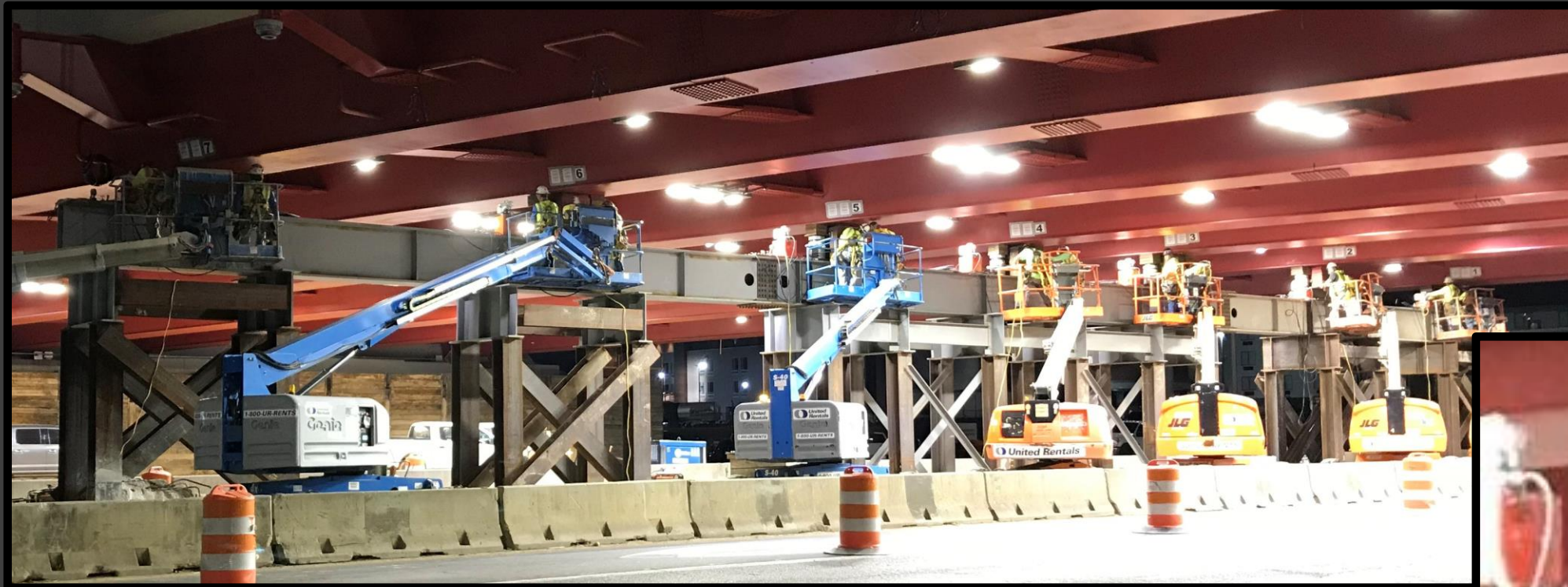
Cable Installation

- Transfers Load To Arch
- 26 – 2 ⁵/₈” ASTM A586 Steel Cables
 - 13 each side
- Hanger Length: 12.5ft – 55.5 ft
- Avg. Max Ultimate Design Load: 367 kips



Cable Tensioning & Temporary Bent Removal

- Utilized Jacks To Remove Shims
- Estimated Max Deflection: $\approx 3''$



Decorative Paint Color

- Consulted with the University of Alabama's to color match their Crimson.
- Painted over 2 weekends.



Federal Standard 595
25488 "Crimson"





Decorative Lighting

- Consultant
 - HLB Lighting Design



• 6 Preprogrammed Lighting Schemes

- 1) TRAFFIC
- 2) HIGH FIVE
- 3) ROLL TIDE
- 4) SOLEMN HOLIDAY
- 5) DECEMBER HOLIDAYS
- 6) FIRE WORKS

JANUARY						
S	M	T	W	R	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

FEBRUARY						
S	M	T	W	R	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28				

MARCH						
S	M	T	W	R	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30	31	

APRIL						
S	M	T	W	R	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30						

MAY						
S	M	T	W	R	F	S
	1	2	3	4	5	6
7	8	9	10	11	12	13
14	15	16	17	18	19	20
21	22	23	24	25	26	27
28	29	30	31			

JUNE						
S	M	T	W	R	F	S
				1	2	3
4	5	6	7	8	9	10
11	12	13	14	15	16	17
18	19	20	21	22	23	24
25	26	27	28	29	30	

JULY						
S	M	T	W	R	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

AUGUST						
S	M	T	W	R	F	S
		1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31		

SEPTEMBER						
S	M	T	W	R	F	S
					1	2
3	4	5	6	7	8	9
10	11	12	13	14	15	16
17	18	19	20	21	22	23
24	25	26	27	28	29	30

OCTOBER						
S	M	T	W	R	F	S
1	2	3	4	5	6	7
8	9	10	11	12	13	14
15	16	17	18	19	20	21
22	23	24	25	26	27	28
29	30	31				

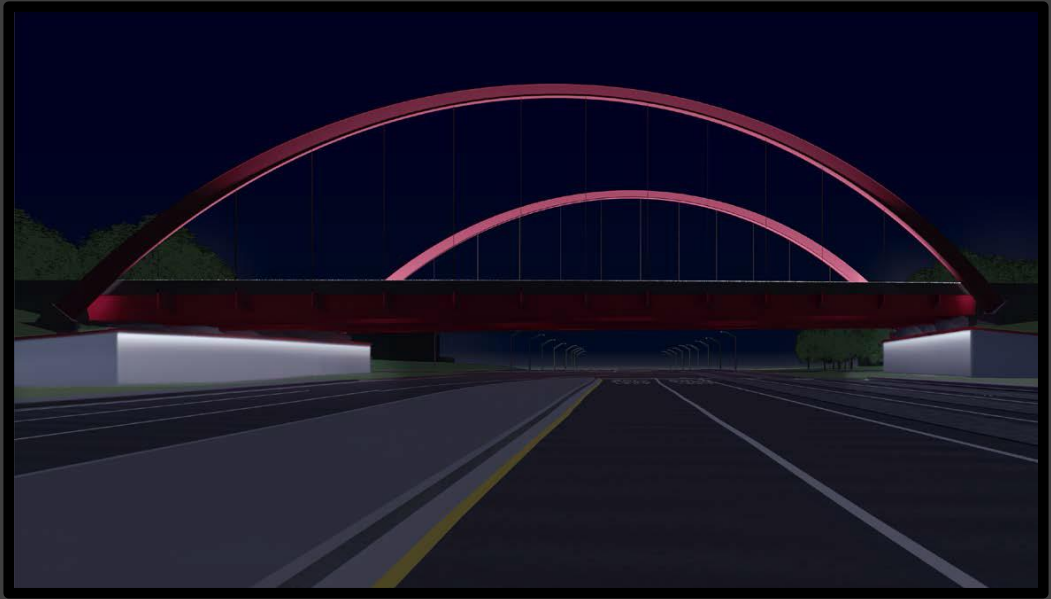
NOVEMBER						
S	M	T	W	R	F	S
			1	2	3	4
5	6	7	8	9	10	11
12	13	14	15	16	17	18
19	20	21	22	23	24	25
26	27	28	29	30		

DECEMBER						
S	M	T	W	R	F	S
						1
2	3	4	5	6	7	8
9	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31					

Comparisons



Comparisons



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Any questions?



Thank you!