TRANSFORM I-66 OUTSIDE THE BELTWAY:
I-66/NUTLEY STREET INTERCHANGE

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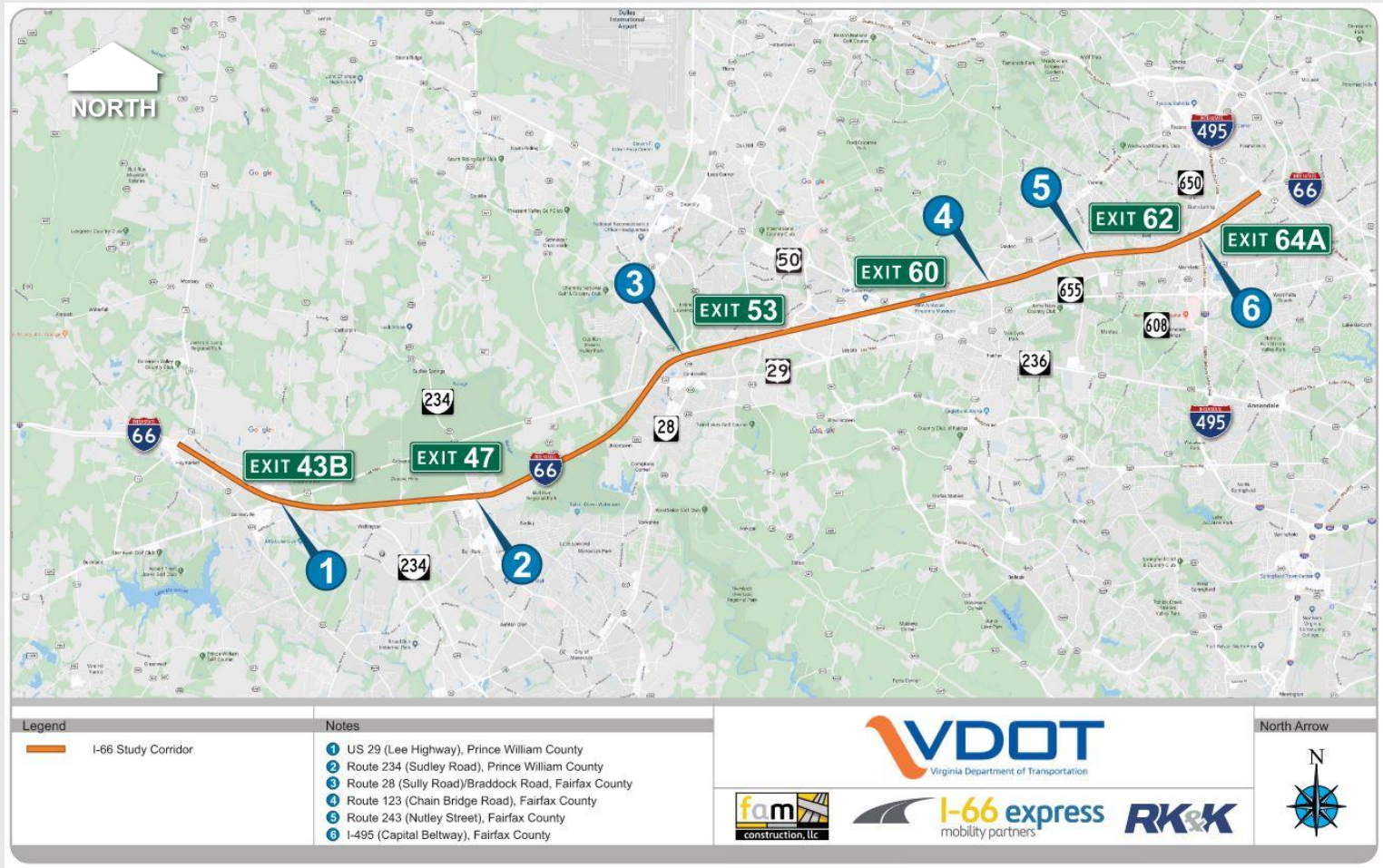
RK&K

PROJECT INTRODUCTION & BACKGROUND

- Transform I-66 Outside the Beltway P3 project – 23 Miles
  - 18 Miles of shared-use-path
  - 4000+ Park-and-Ride spaces
  - Up to 12 interchanges rebuilt/modified
  - Approximately $3.7-billion
- Original IJR in 2016
- Developers IJR in 2019
- Supplemental IJR in 2021

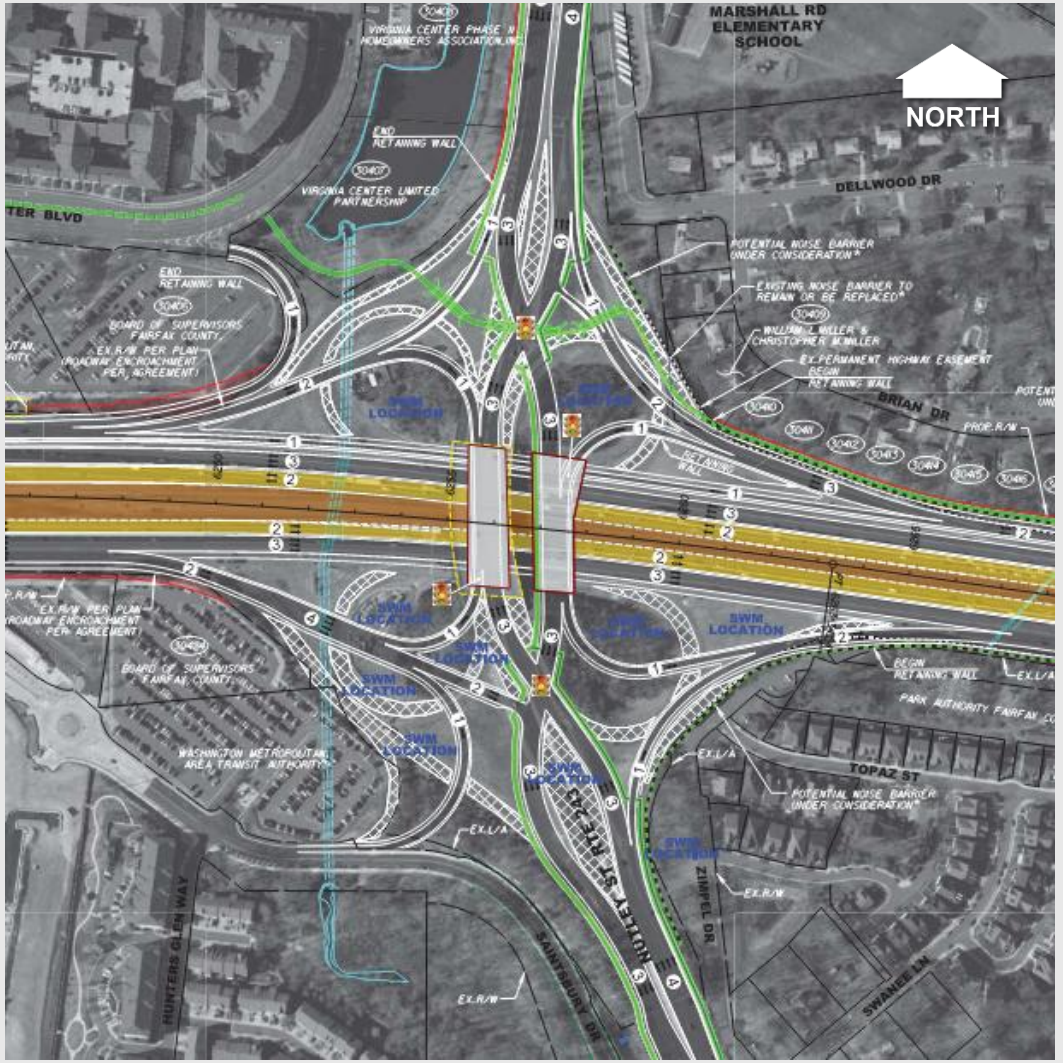


PROJECT INTRODUCTION & BACKGROUND / cont'd

I-66 at Nutley Street RFP Concept Plan:

Diverging Diamond Interchange (DDI)

- Nationally recognized to improve safety and efficiency at an interchange
- Accommodates heavy left-turning volumes (>600+ vph)
- Two phase signals reduce overall delay compared to traditional signalized interchange designs
- ***Reconstruct the existing bridge***
- ***Requires additional bridge over I-66 and the WMATA Orange Line tracks***
- ***Adds two new traffic signals***



ALTERNATIVE DESIGN

Partial Cloverleaf with Roundabouts

- Reuses existing bridge
- Eliminates the need for a second bridge
- Does not add traffic signals
- Less ROW impacts
- Less impervious area
- Can maintain cell tower in Northwest quadrant

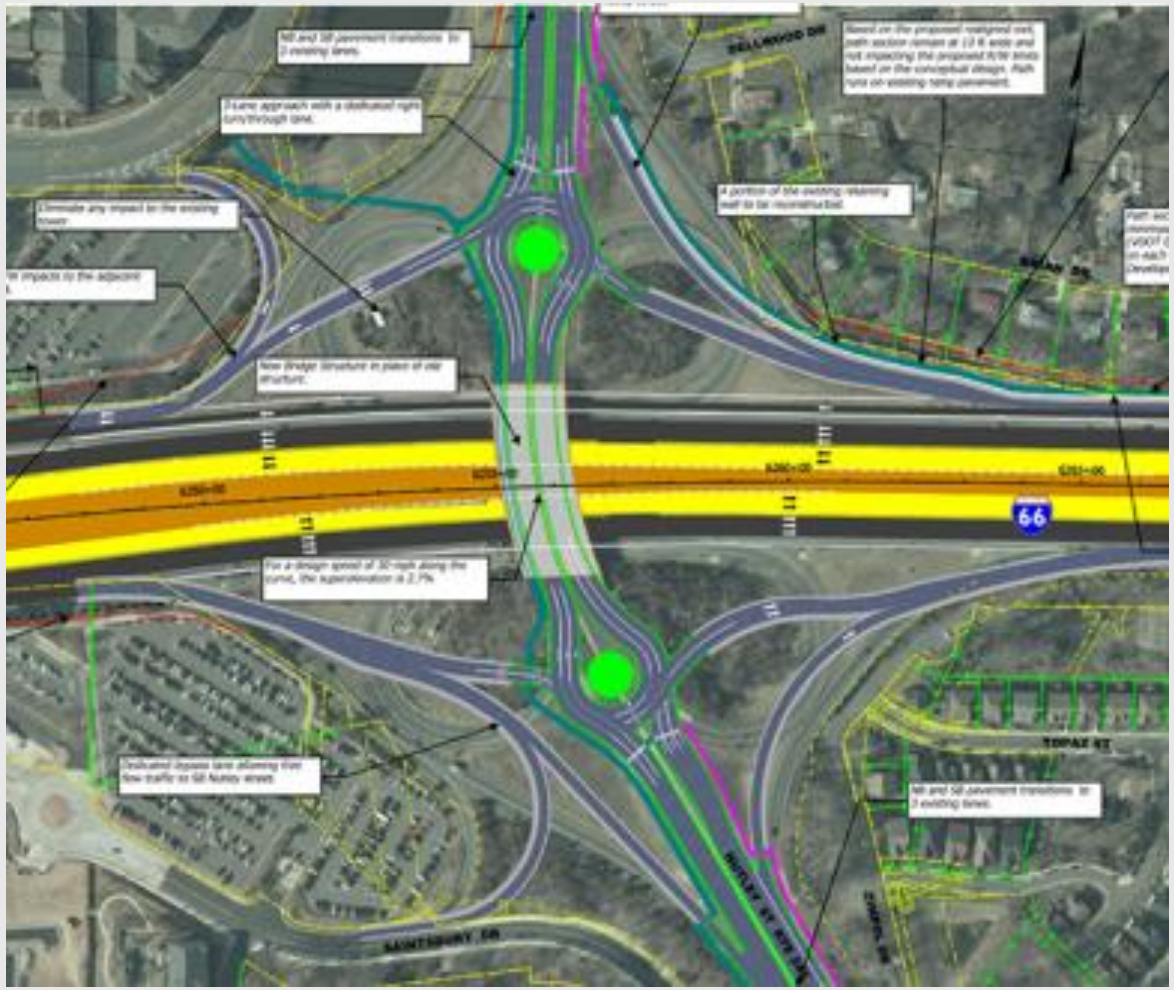
- But will it work?

ALTERNATIVE DESIGN

Multi-lane double roundabout interchange proposed by EMP during the procurement process (ATC #6)

Rejected by VDOT

- The ATC presents a design configuration that leads to lane choice confusion
- Pedestrian and bike crossing connections to the roundabout present unresolved conflict points
- The ATC presents a design configuration which demonstrates lane imbalance, resulting in an increase in conflict points at the exit curves

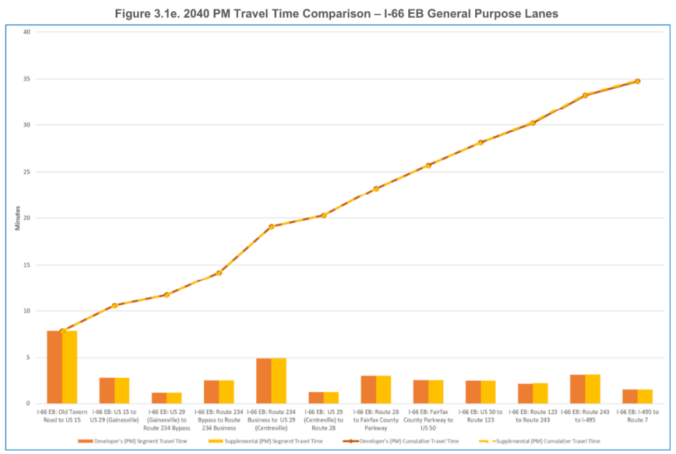


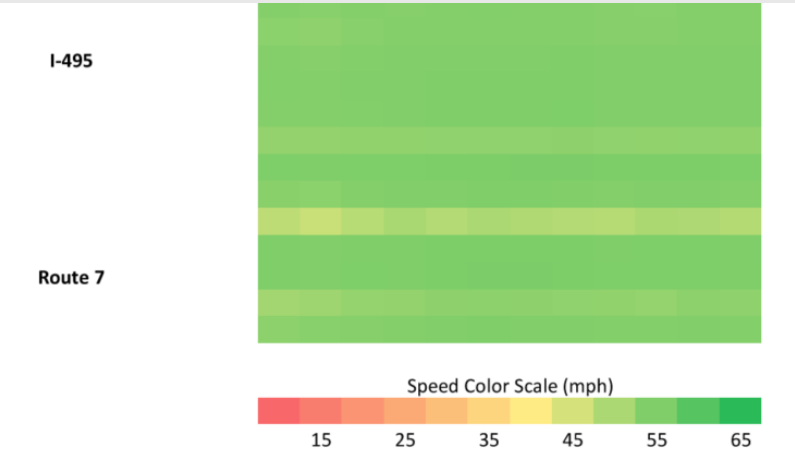
CURRENT DESIGN & BENEFITS

- Double Teardrop Roundabouts with Bypass lanes
  - Provides directional ramps in all quadrants
  - *Added bypass lanes to accommodate free-flow movements for all I-66 bound traffic, removing the need for lane changes between ramp terminals*
  - *Reduced vehicle conflict points*
  - Grade separated the SUP throughout the interchange and provided connectivity to the I-66 Parallel Trail
  - *Fewer pedestrian crossings (3 crosswalks) compared to DDI design (9 crosswalks)*

OPERATIONAL ANALYSIS - METHODOLOGY

- VISSIM 5.4
- Vehicular routing
  - By vehicle class
  - Origin – Destination
- Measures of Effectiveness (MOEs)
  - Travel Time
  - Volumes
  - Freeway Density
  - Speed
  - Delay & Queue Length (Intersections)

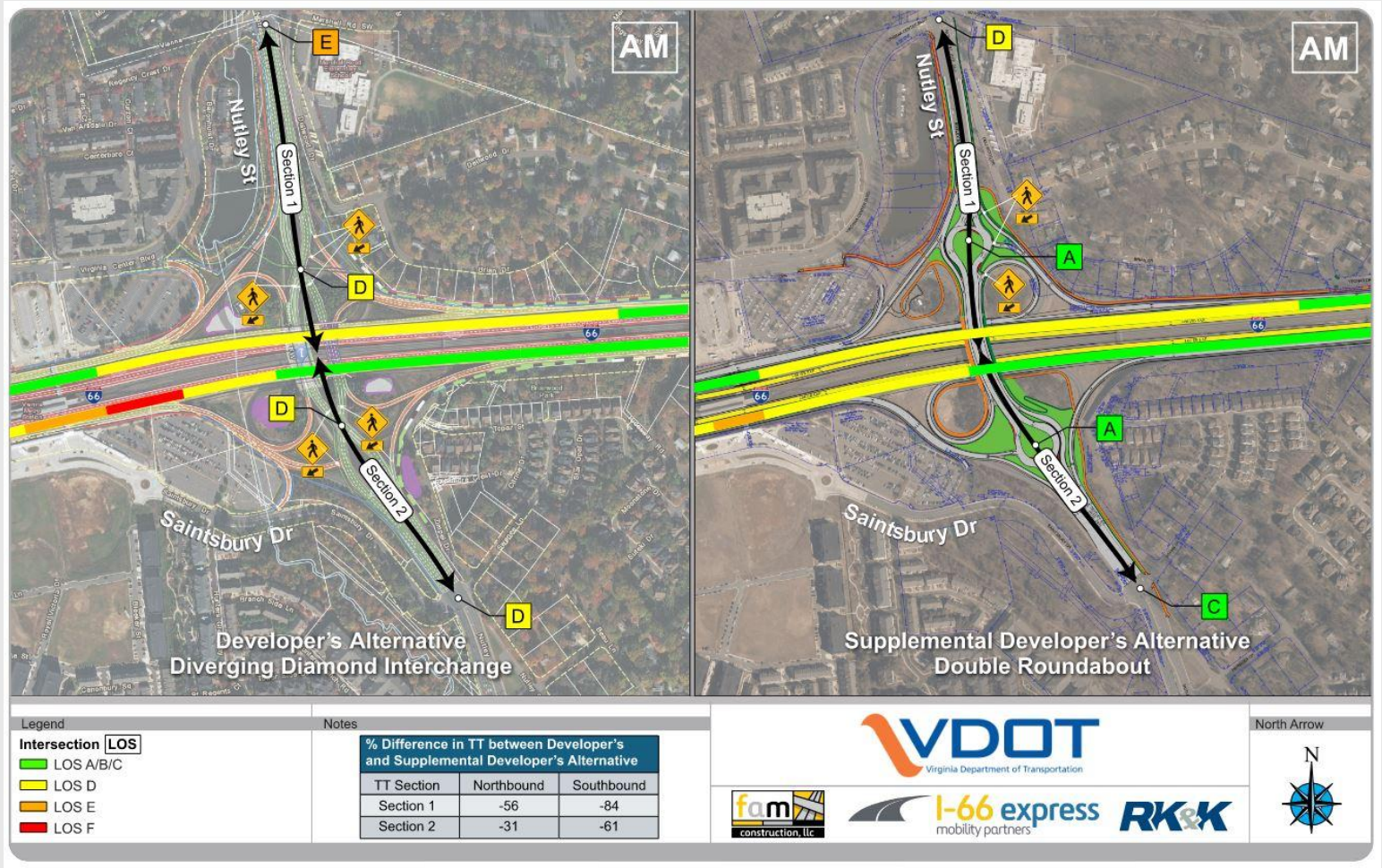




Description	Type	Developer's Alternative - AM				Supplemental Alternative- AM			
		# Lanes	Volume (vph)	Density (veh/mi/ln)	Speed (mph)	# Lanes	Volume (vph)	Density (veh/mi/ln)	Speed (mph)
I-66 EB, Between Route 123 & Route 243	Basic	4	7,336	34.5	53	4	7,359	34.2	54
	Basic	4	7,327	38.5	49	4	7,364	36.0	52
I-66 EB, Off-Ramp to Route 243	Diverge	4	7,162	39.7	47	4	7,201	34.1	53
	Diverge	4	7,293	46.8	42	5	7,330	32.6	47
I-66 EB, Upstream of Route 243SB On-Ramp	Basic	3	4,534	27.8	54	3	4,548	27.7	55
I-66 EB, On-Ramp Merge from Route 243SB	Merge	5	5,622	20.4	55	4	5,130	24.0	53
I-66 EB, On-Ramp Merge from Route 243NB	Merge	N/A				5	5,828	21.2	54
I-66 EB, East of Route 243 Ramps	Basic	4	5,631	25.7	55	4	5,832	26.6	55
I-66 EB, East of Route 243 Ramps	Basic	4	5,636	25.7	55	4	5,821	26.6	55
I-66 EB, Off-Ramp to I-66 EB EL	Diverge	5	5,645	20.6	55	5	5,833	21.4	55

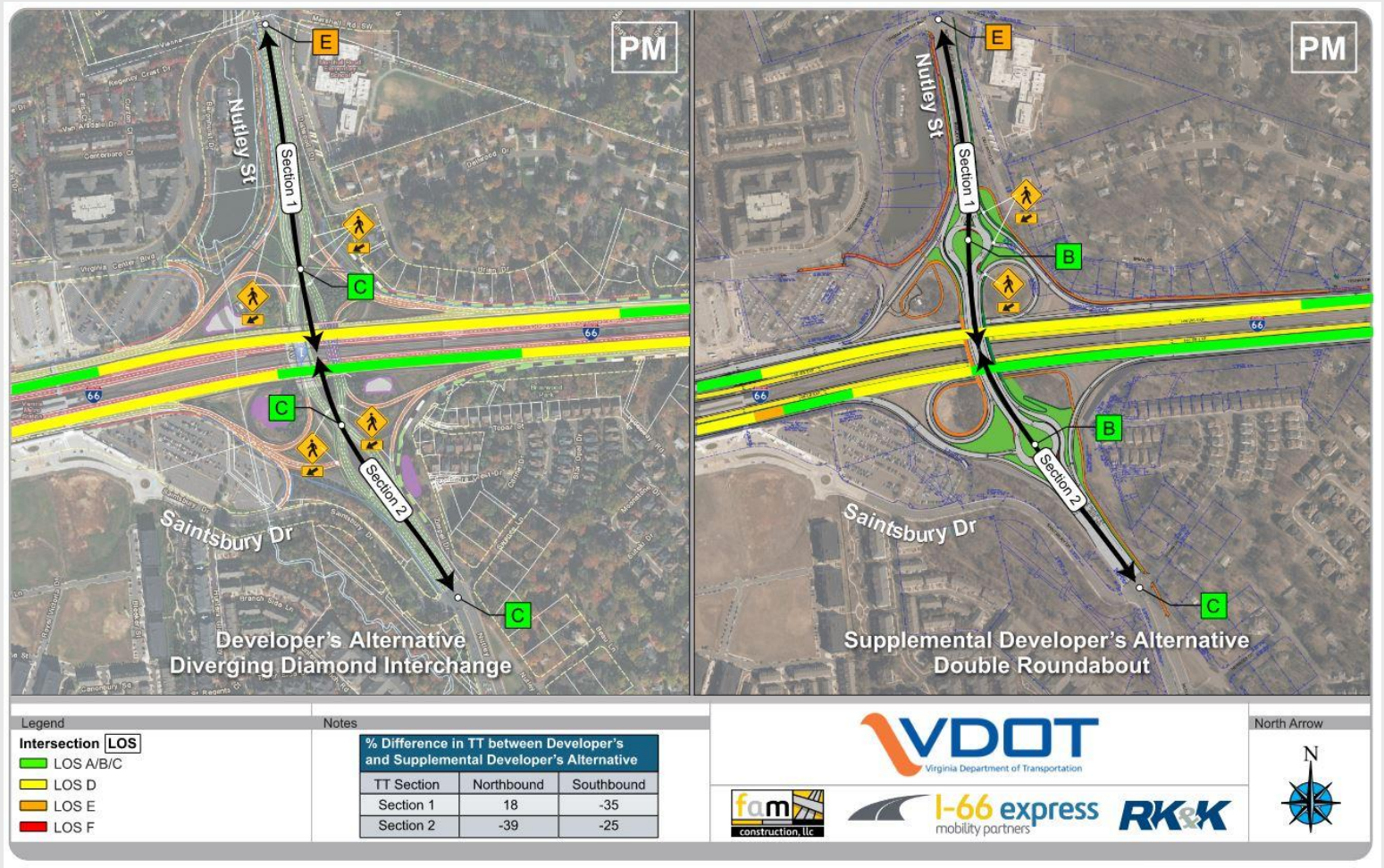
BENEFITS – OPERATIONS – 2040 AM

- Intersection Operations
  - Improves from LOS D to LOS C or better
- Travel Times
  - Section 1: 55-85% reduction
  - Section 2: 30-60% reduction
- Mainline I-66 Operations
  - EB: Improves from LOS E/F to LOS D or better
    - Increased speeds up to 6MPH
    - Nearly identical throughput
  - WB: Diverge section similar or better
    - Short (~500-feet) diverge section LOS E of F
    - Overall speeds remain similar
    - Nearly identical throughput



BENEFITS – OPERATIONS – 2040 PM

- Intersection Operations
  - LOS similar or better
- Travel Times
  - Section 1: ~12% reduction overall
  - Section 2: 25-39% reduction
- Mainline I-66 Operations
  - Nearly identical LOS, speeds, throughput

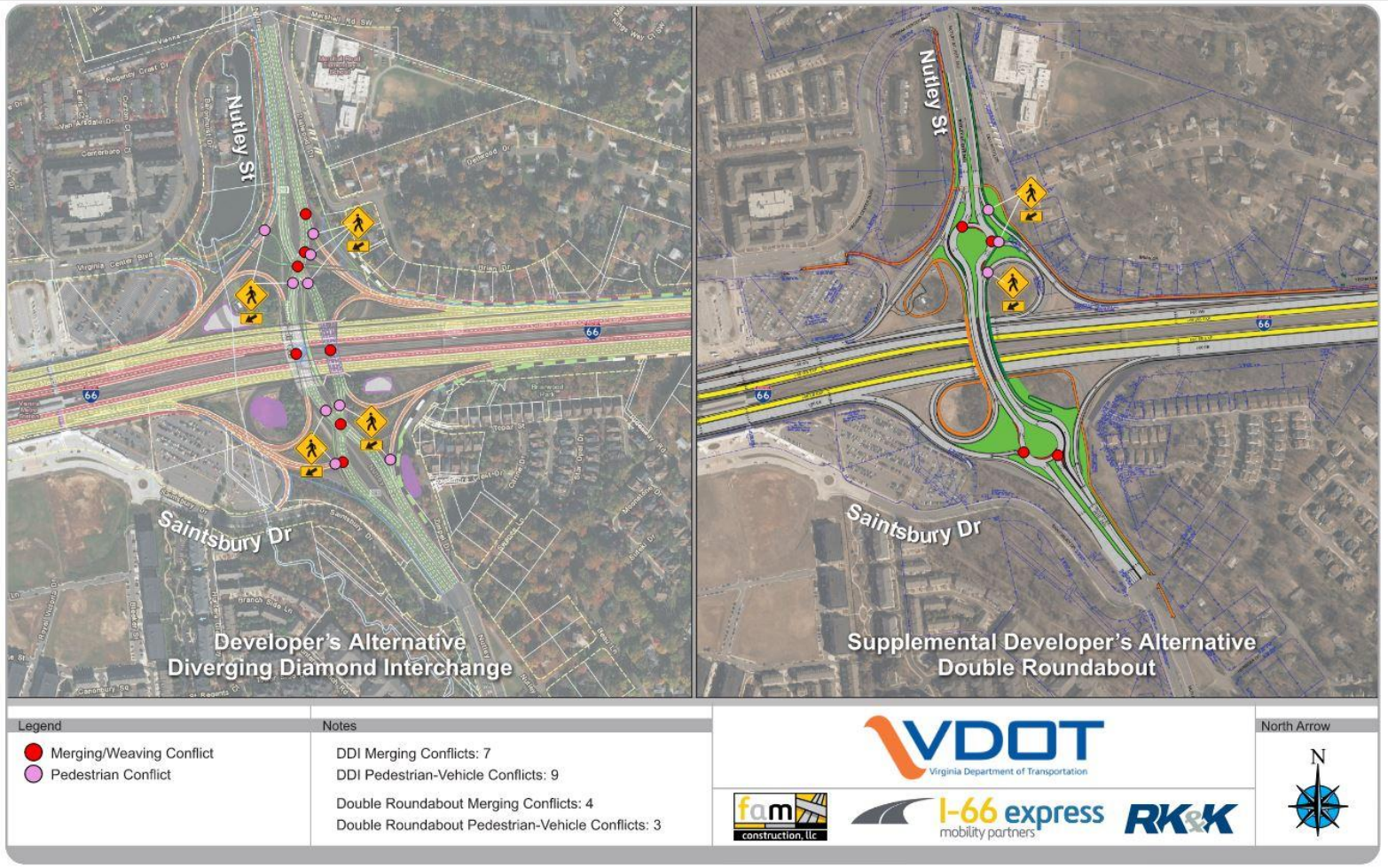


BENEFITS – SAFETY

- Fewer vehicle-vehicle (3) and vehicle-pedestrian (6) conflict points
- Fewer stops for 66-bound traffic
- Signal → Roundabouts
  - CMF: 0.33-0.52

ISATe – I-66 Predicted Crashes/Year

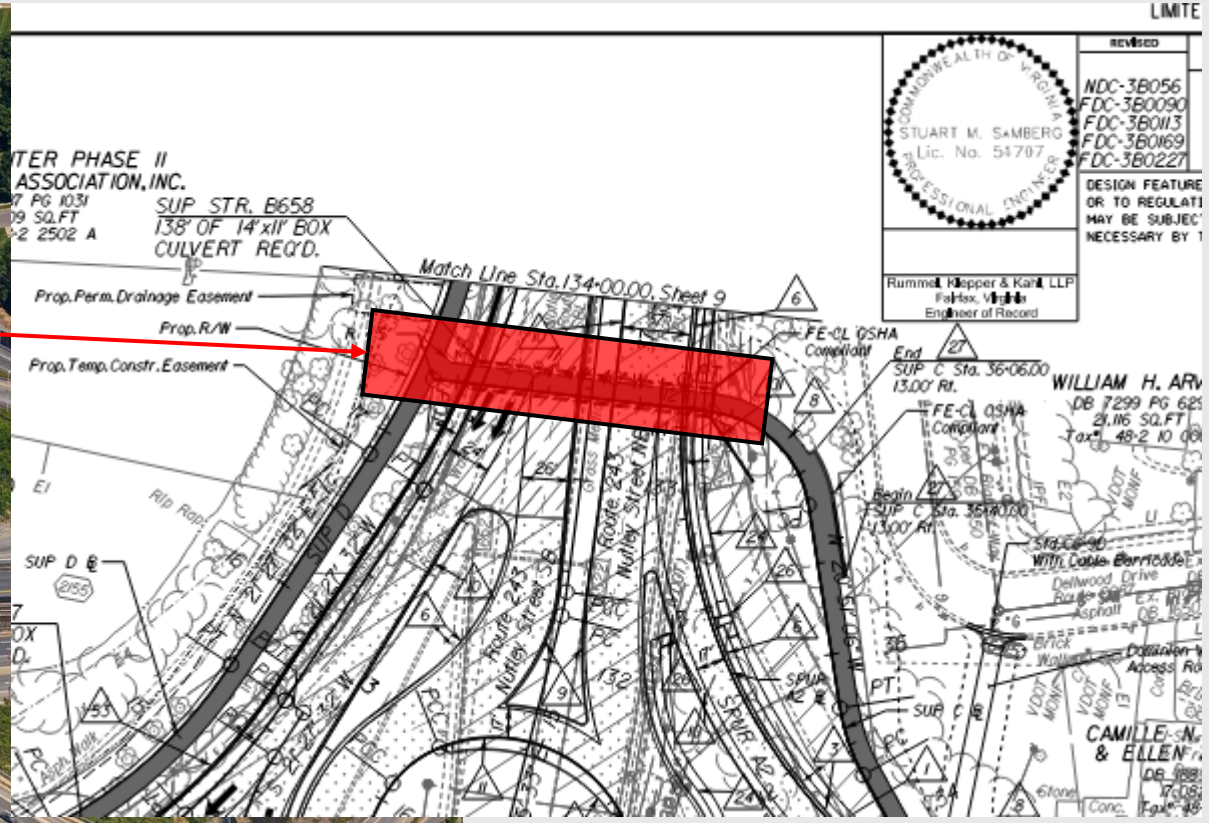
Crash Severity	*Developer's*	*Supplemental*
Fatal	0.4	0.5
Injury	43.8	44.5
PDO	107.1	108.9
Total	151.3	153.9



MAINTENANCE OF TRAFFIC (MOT) ANALYSIS

- VISSIM 5.4, Synchro, SIDRA, HCS
- Streetlight
- Transit and detour routing analyses
- Temporary traffic signal timings
  - Temporary clearance interval calculations
  - Timing plans using Synchro
  - Semi-actuated / Video detection
  - Actuated pedestrian signals
  - Coordination with adjacent intersections

CONSTRUCTABILITY CHALLENGES – PED CULVERT



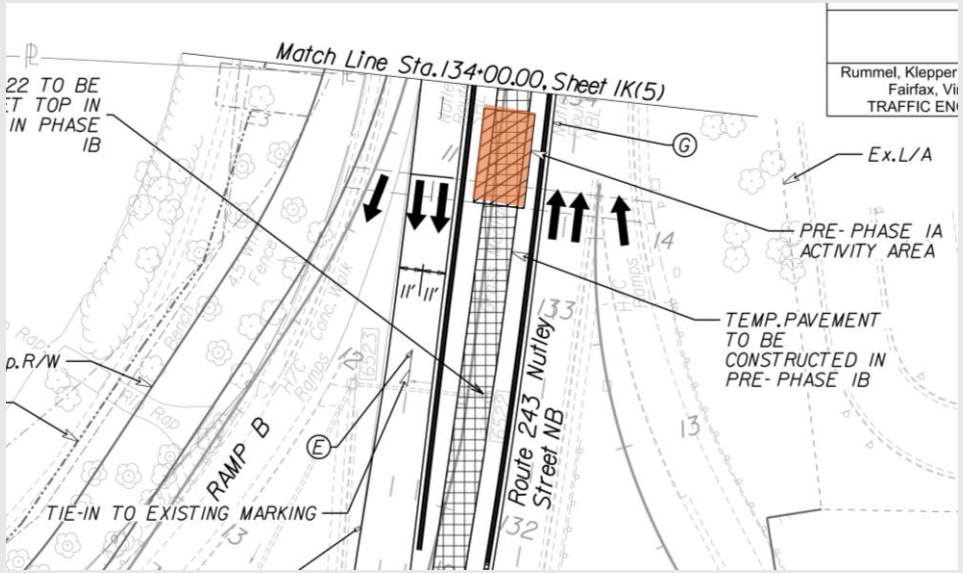
How do you install a culvert under an active roadway?

CONSTRUCTABILITY CHALLENGES – PED CULVERT

- Planned a series of weekend long lane closures as the first phase of the interchange reconstruction

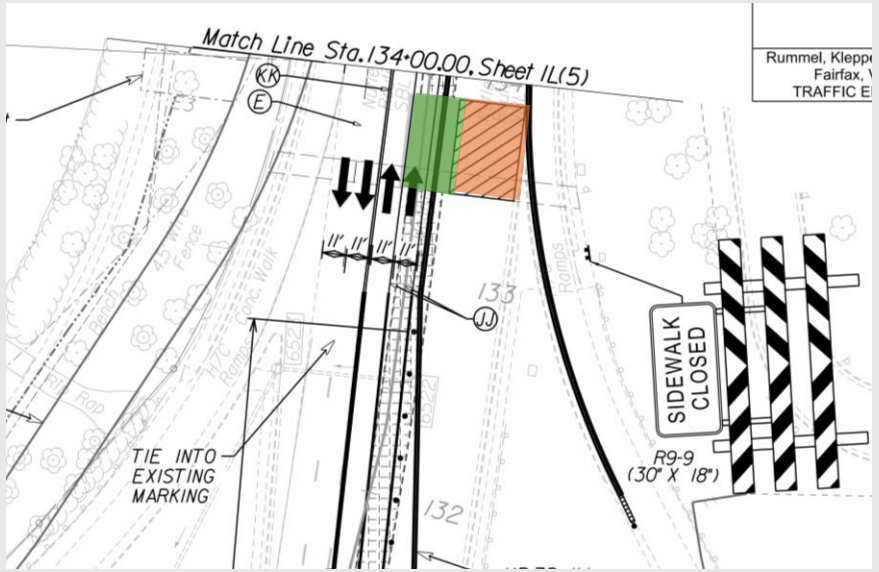
Weekend 1: lane closure in each direction (3 to 2):

- Install the middle, in the median
- Temp pave over the median



Weekend 2: lane closure in each direction (3 to 2):

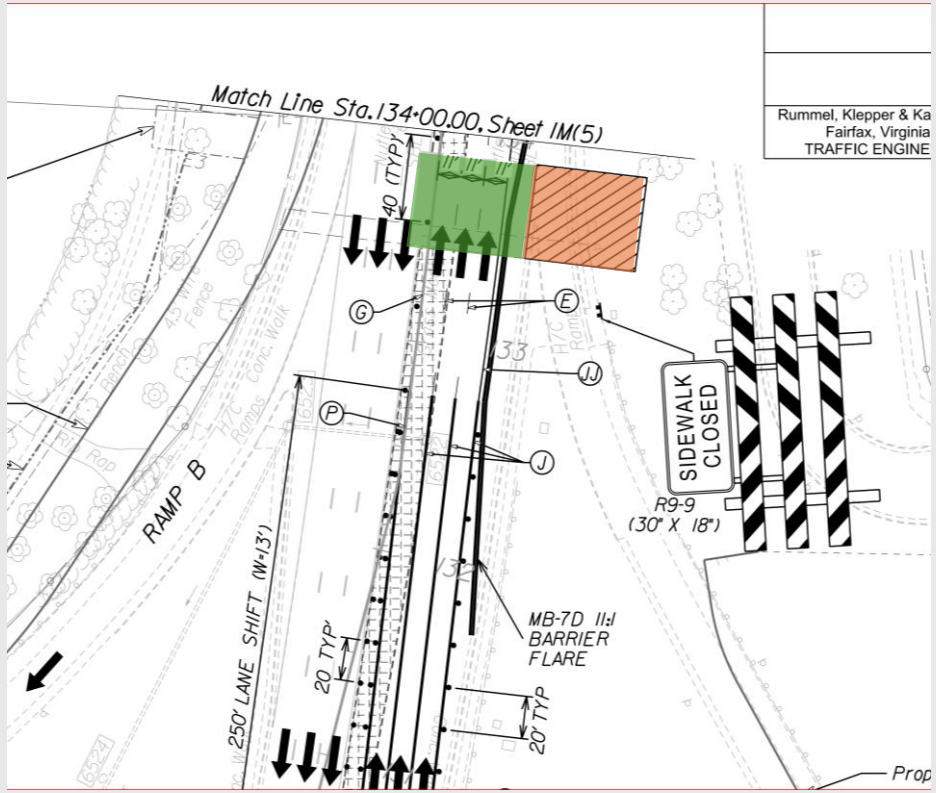
- Cross NB traffic over median
- Install mid-east piece (directional ramp open)



CONSTRUCTABILITY CHALLENGES – PED CULVERT

Weekend 3:

- Detour ramp traffic thru ex. cloverleaf
- Install the easternmost piece of culvert



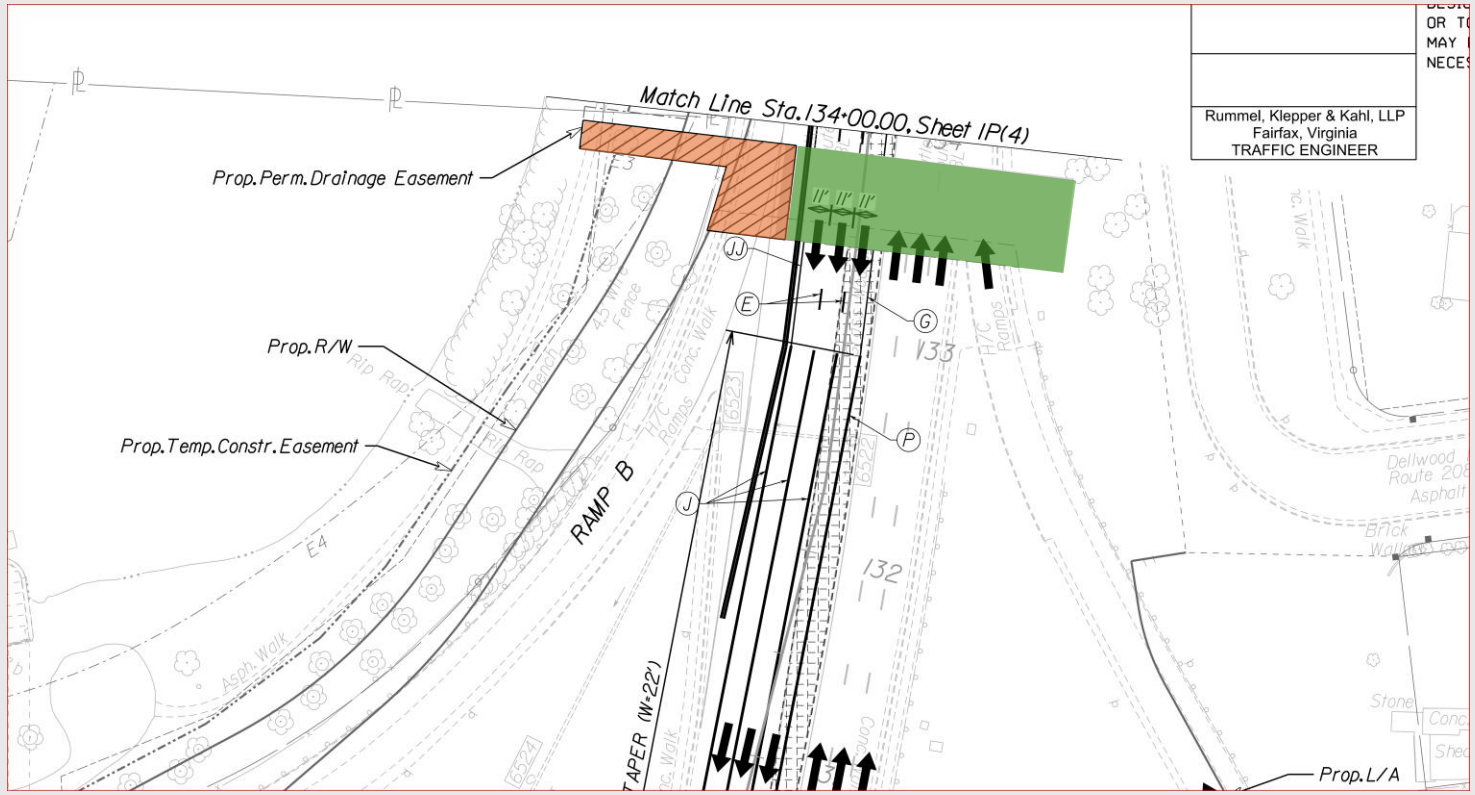
Weekend 4: lane closure each direction (3 to 2):

- Cross SB traffic over median
- Install mid-west piece (directional ramp open)

CONSTRUCTABILITY CHALLENGES – PED CULVERT

Weekend 5:

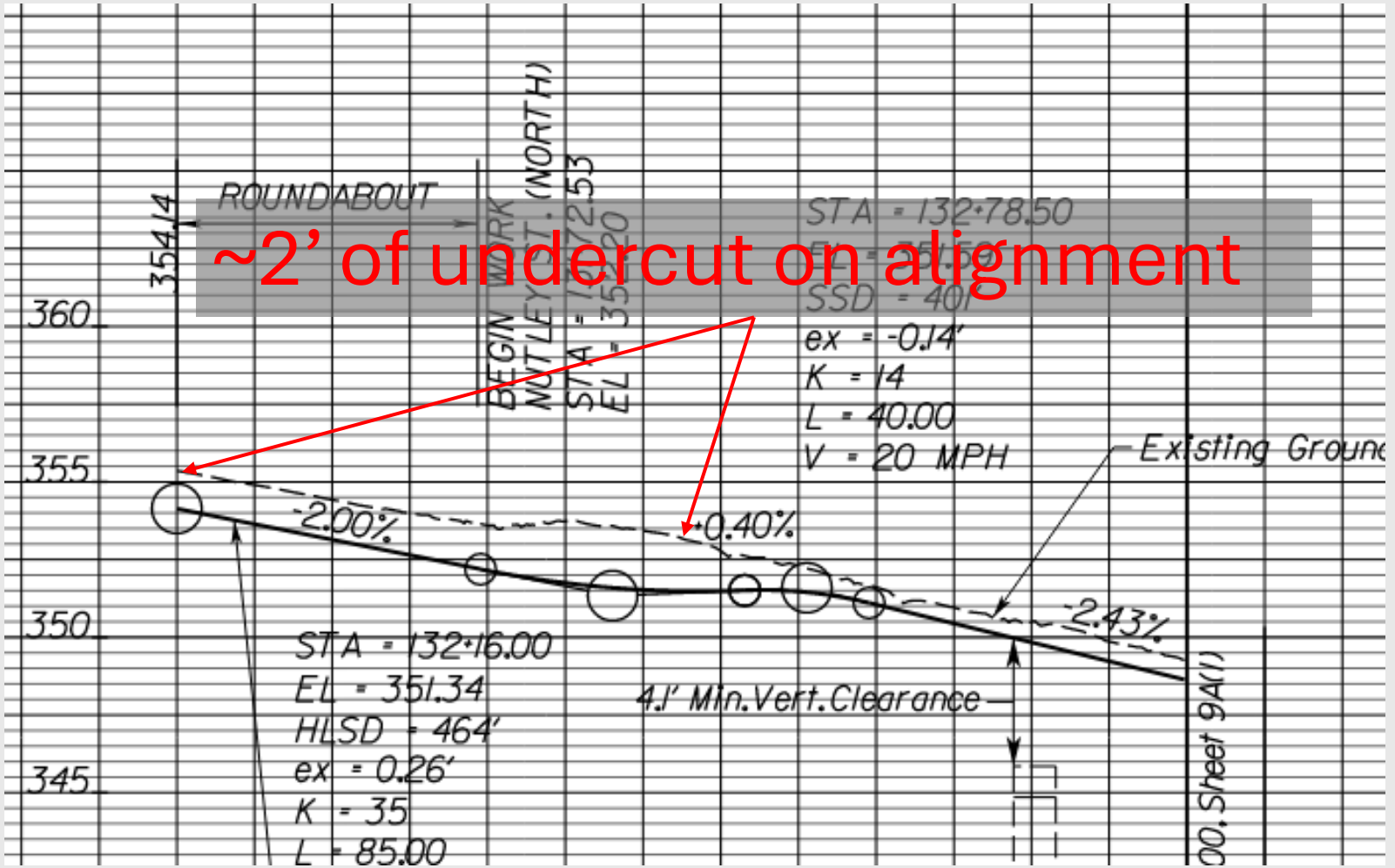
- Detour ramp traffic thru ex. cloverleaf
- Install the westernmost piece of culvert



CONSTRUCTABILITY CHALLENGES – PED CULVERT

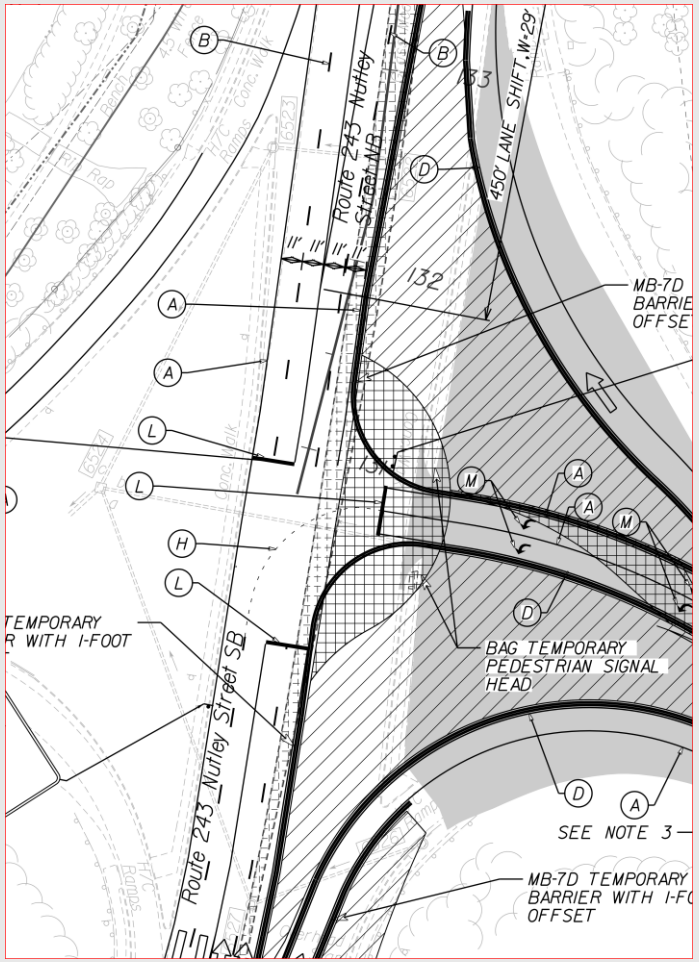
- Contractor delayed start of ped culvert work
  - Initially much more complicated but was simplified by reduced volumes due to COVID – able to reduce Nutley to 2 lanes in each direction

CONSTRUCTABILITY CHALLENGES – ROUNDABOUT PROFILE



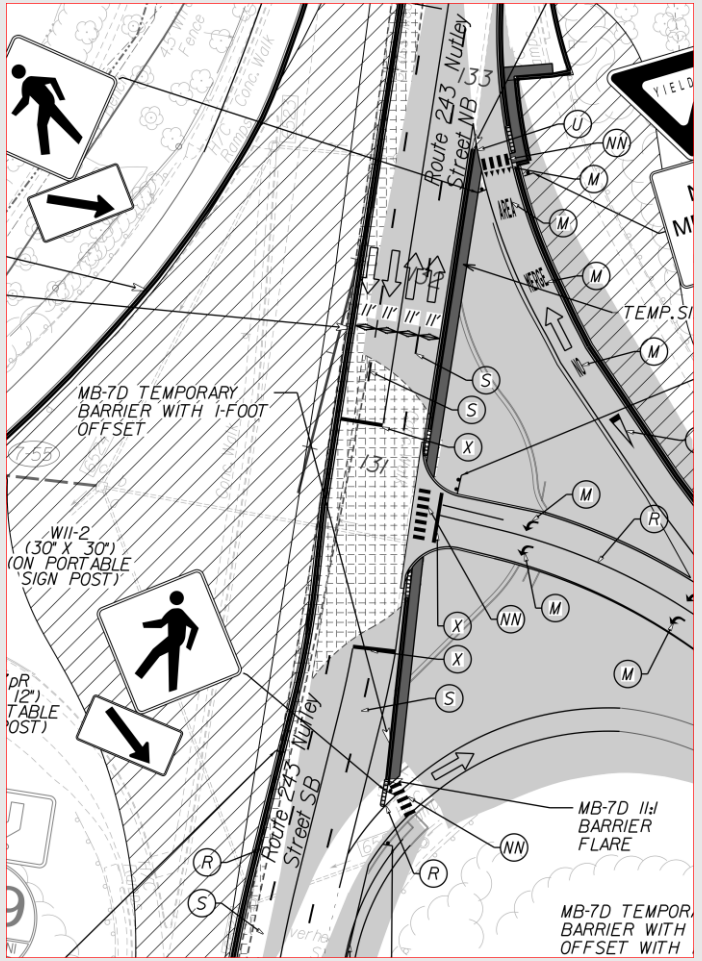
CONSTRUCTABILITY CHALLENGES – ROUNDABOUT PROFILE

- Temporary pave the center island
- Build temporary ramps
- Utilize temporary signals
- Shift traffic all the way west



CONSTRUCTABILITY CHALLENGES – ROUNDABOUT PROFILE

- Adjust ramps
- Shifts heads on span wires
- Shift traffic all the way east



CONSTRUCTABILITY CHALLENGES – PED CULVERT UNDER SB TO WB RAMP

- Contractor was allowed to shift the SB to WB movement onto the NB to WB loop ramp using a connector at the existing temporary signal
- Allowed for construction of the pedestrian culvert and the western half of the roundabout

CONSTRUCTABILITY CHALLENGES – FINISHING THE ROUNDABOUTS

- Converted the temporary signals to continuous green-T intersections
  - Traffic on Nutley was introduced to the roundabout geometry
  - Provided workspace to build the bottoms of the tear-drops

INNOVATIVE TRAFFIC DESIGN – RRFBS WITH PASSIVE PEDESTRIAN DETECTION

- How?
  - Thermal sensor programmed detection zone
  - Call to controller activates both beacons

INNOVATIVE TRAFFIC DESIGN – PASSIVE PEDESTRIAN DETECTION

- Why?
  - Improved accessibility – no need to worry about PROWAG reach requirements
  - More accommodating – does not rely on a physical input by the user
  - Can dynamically adjust crossing times for slower user
- Why not?
  - More $$$
  - May present a challenge to blind/visually impaired users

CONCLUSION

- Double Roundabout Parclo Interchange Design with Bypass Lanes
  - Enhances mobility within the interchange and improves overall operations
  - Provides free-flow access from both directions of Nutley Street to both directions of I-66
  - Reduces total number of vehicular conflict points compared to DDI
  - Fewer crossings reduce vehicular-pedestrian conflicts while providing better connectivity for pedestrians and cyclists
  - Nearly 1 acre less ROW and eliminated ROW acquisition from 3 parcels
  - Reduced the impervious area by more than 1 acre compared to the DDI
  - Helped to avoid impacts to a privately owned pond in the northwest quadrant
  - Allowed the existing cell tower to remain in the northwest quadrant
  - Reduced coordination with and impacts to WMATA
  - Reduced construction costs
  - **Most importantly, the reduced scope allowed FAM to focus work on completing I-66 and opening the Express Lanes ahead of schedule**

Concept to completion in 5 years!