



Modular Roundabouts

February 16, 2023



Presented to:



Overview

- Background
- Modular Roundabouts
- JMT Design Approach
- Selected/Candidate Intersections
- Implemented Roundabouts
- Lessons Learned
- Q&A



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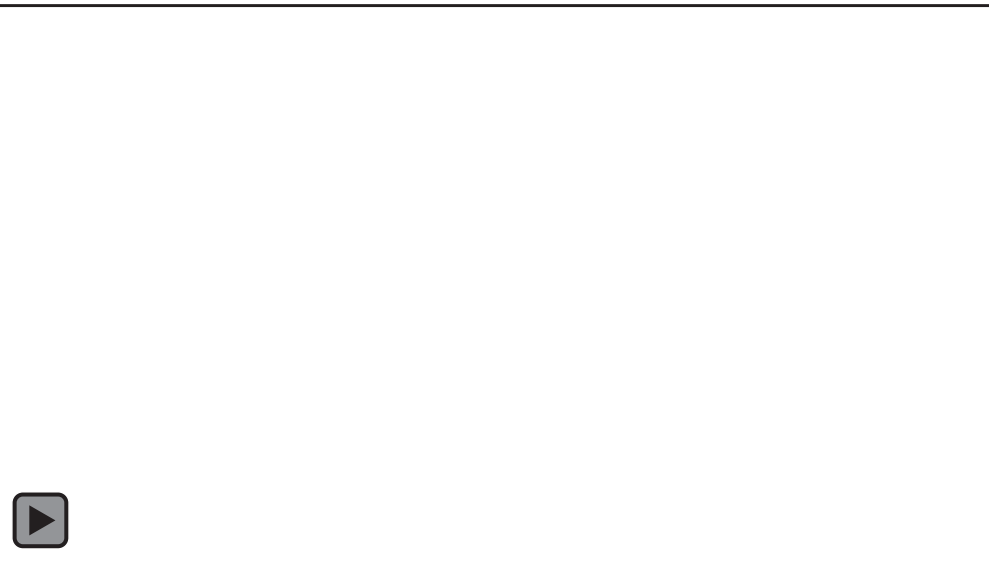
JOHN RILEY, PE, PTOE
JMT Richmond Traffic
Section Head

Roundabouts

- Why Roundabouts?
 - Enhance safety
 - Better traffic performance
 - Long-term cost effective
- Cons of Roundabouts
 - Right of Way
 - Utility relocation
 - Higher construction cost
 - Time consuming
- Alternatives
 - Modular Roundabouts

Modular Roundabouts

- Small blocks
 - Custom made
 - Bolted to existing pavement
- Environment friendly
 - Recycled plastic material
- Less construction cost/time
- Traffic can be maintained during construction



Modular vs. Traditional Roundabouts

- Same functionality (slower speeds & improved safety)
- Quicker to implement (~1 mo. vs. ~1-2+ yr.)
- Cost effective (~\$200-\$400K vs. \$1M-\$2M+)
- No ROW (\$\$\$ & time)
- No utility relocation (\$\$\$ & time)
- Easy to maintain (few hours)
- Easily modified (flexibility)
- No/minimal survey?



Limitations

- Durability
 - Weather/Snow
 - Design life
 - Heavy vehicle impact
- Aesthetics
- Driver compliance
- Lack of past performance/experience
- One Vendor
 - Pricing
 - Mass production
 - Procurement (proprietary)

ZKxKZ LLC

vortex

Colors

- Variety of colors and patterns are available



Snow

- January 2022



Intersection Selection

- Project selection (VDOT Richmond District TE)
 - Larger (pavement) intersections
 - Multi-lane approaches
 - Existing crash issues
 - Angle crashes - considered roundabouts
 - Operational issues
- Original list of 18 candidate locations
 - Narrowed to six in three counties
 - Hanover, Chesterfield, and Goochland
 - Pilot project
 - Build template for future work
- Three potential intersections
 - Buildable within existing intersection

Intersection Selection

- Stafford County
- VDOT Fredricksburg District TE
 - Larger (pavement) intersections
 - Multi-lane approaches
 - Existing safety issues

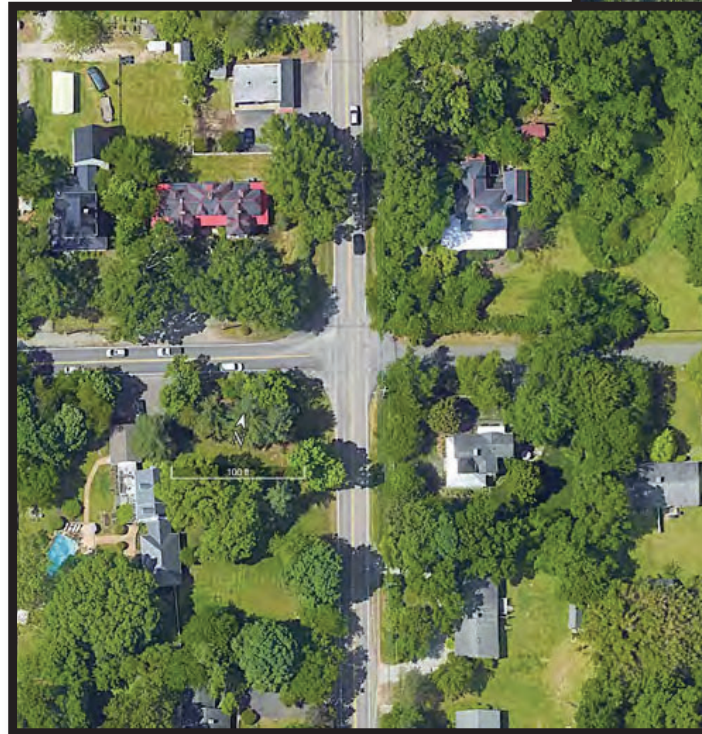


Intersection Selection

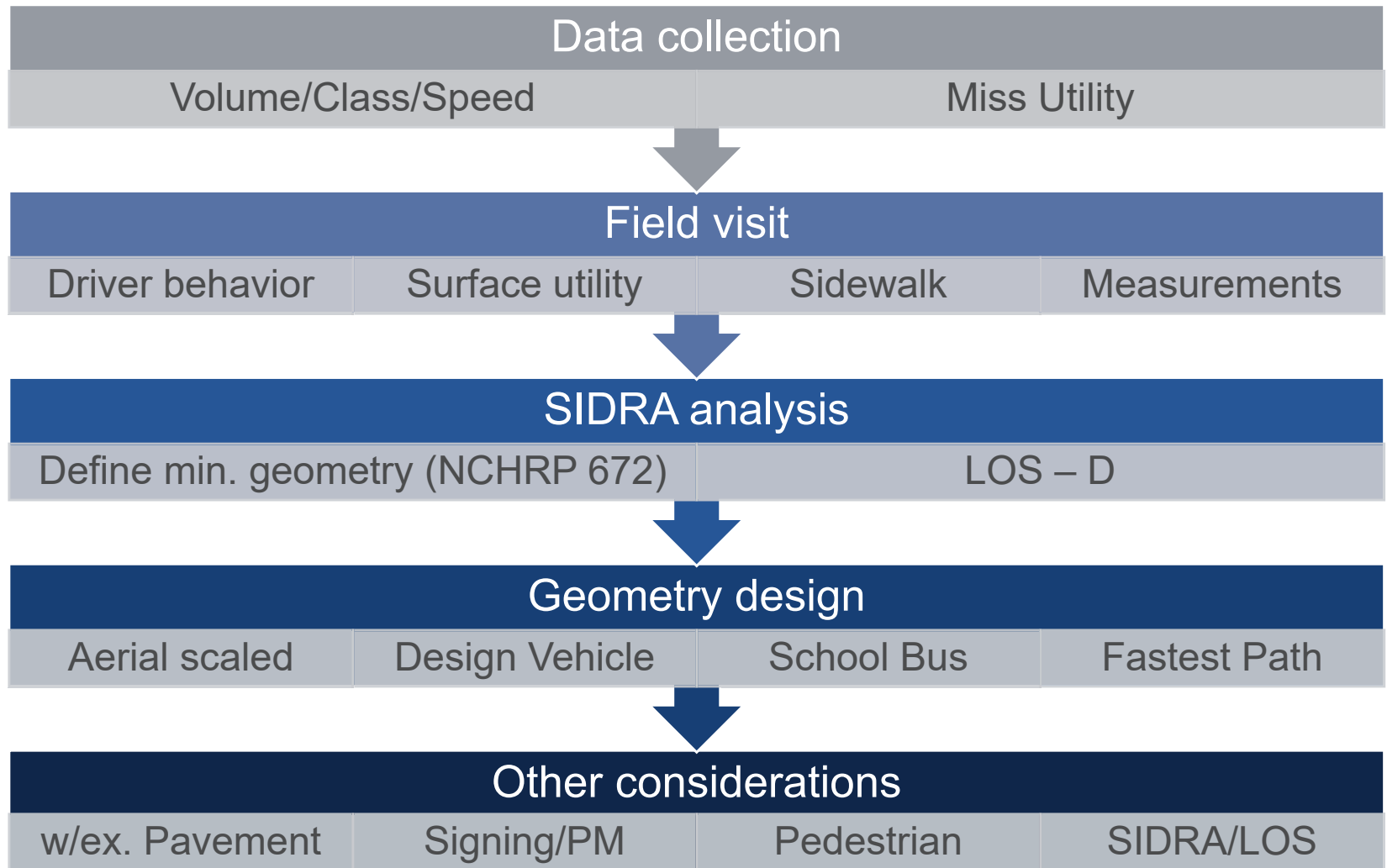
- Project selection (VDOT Richmond District TE)
 - Larger (pavement) intersections
 - Multi-lane approaches
 - Existing safety issues



- **Smaller** intersection
 - Safety issues
 - Operational issues
 - Does not warrant AWSC



Design Approach



Intersection #1 - Safety (PSI)

- 18 Crashes in 3 years
 - 15 angle crashes
 - 7 injuries



Proposed Roundabout #1

- Within existing pavement
- Inscribed \emptyset 100 ft.



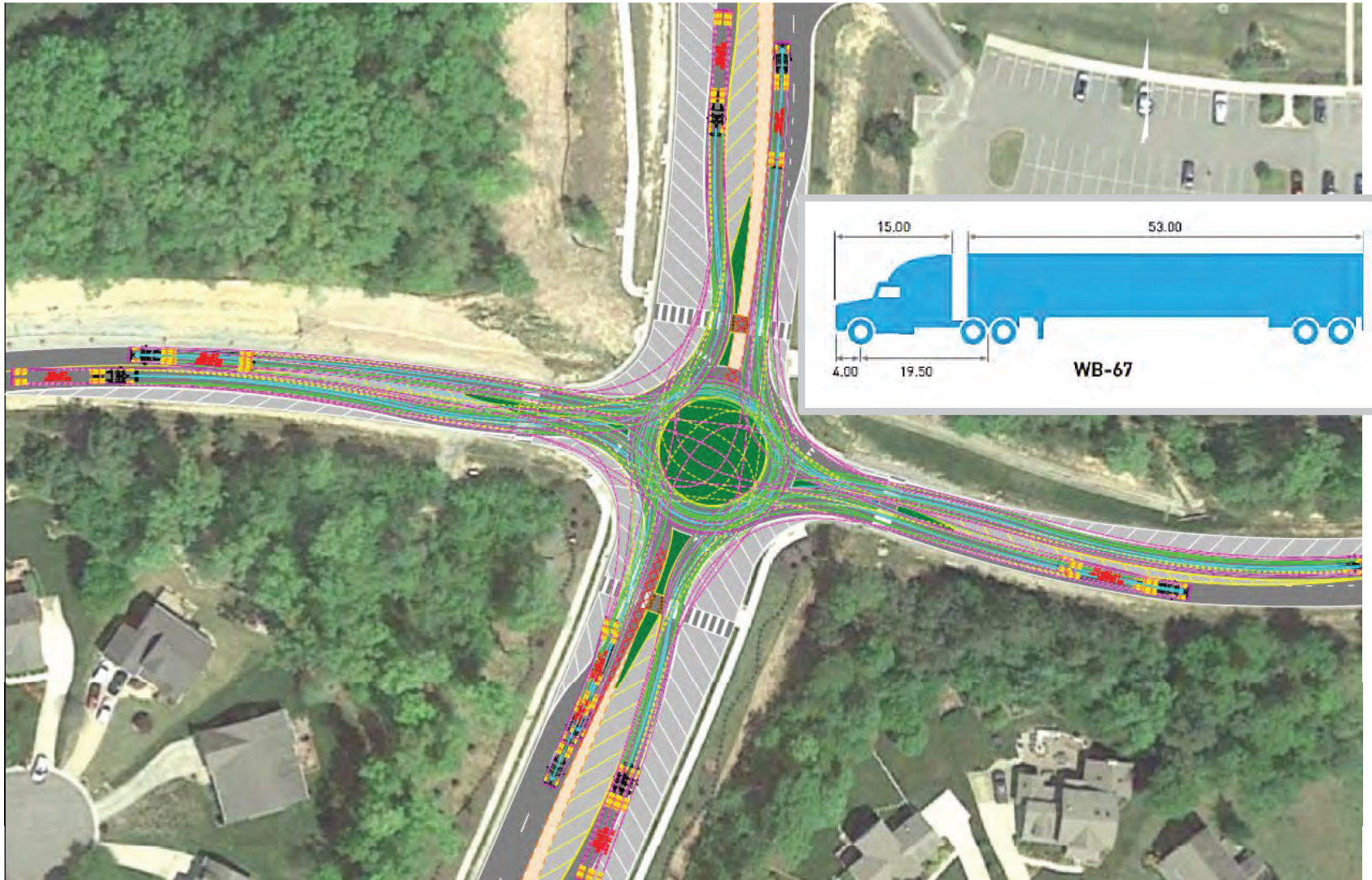
Operational Analysis



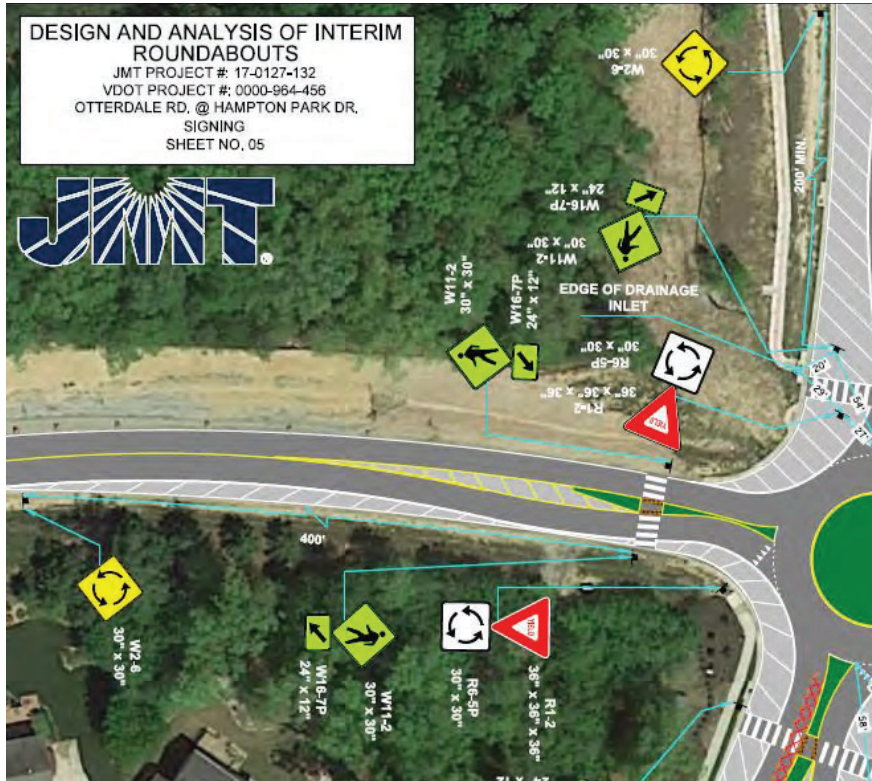
School Bus



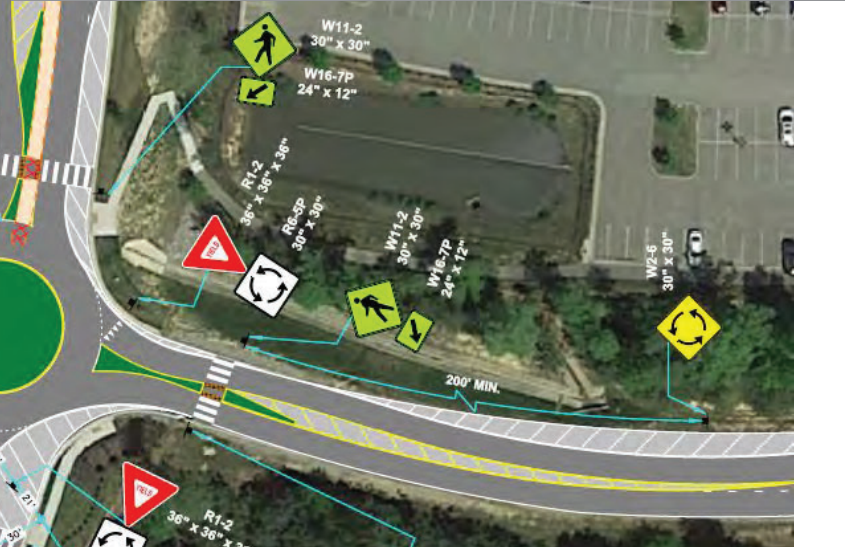
Trucks Accommodated



Construction Cost



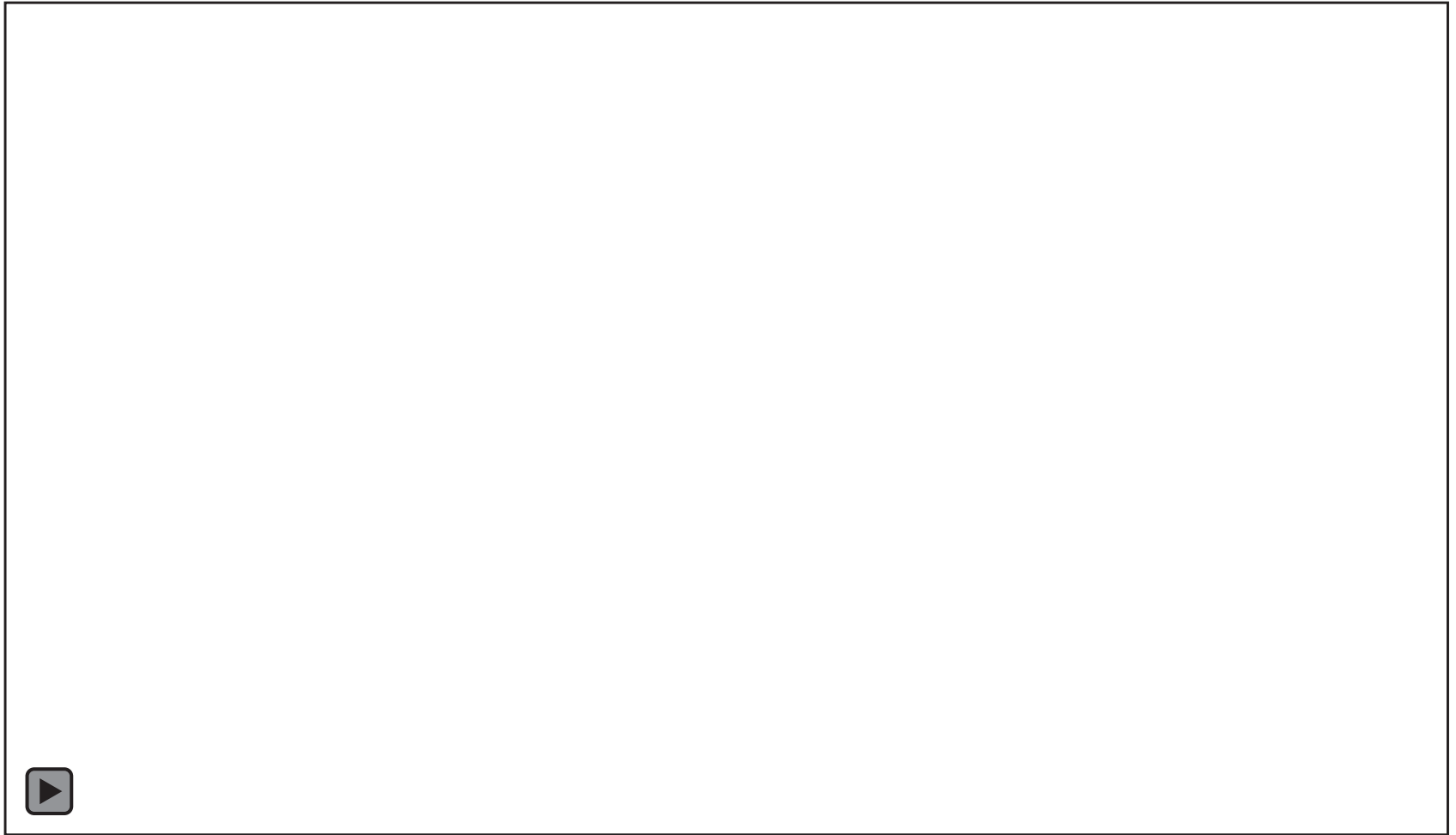
OTTERDALE RD. AT HAMPTON PARK DR.	
CONSTRUCTION	\$ 225,164
ENGINEERING	\$ 45,033
CONTINGENCIES	\$ 20,808
TOTAL	\$ 291,005



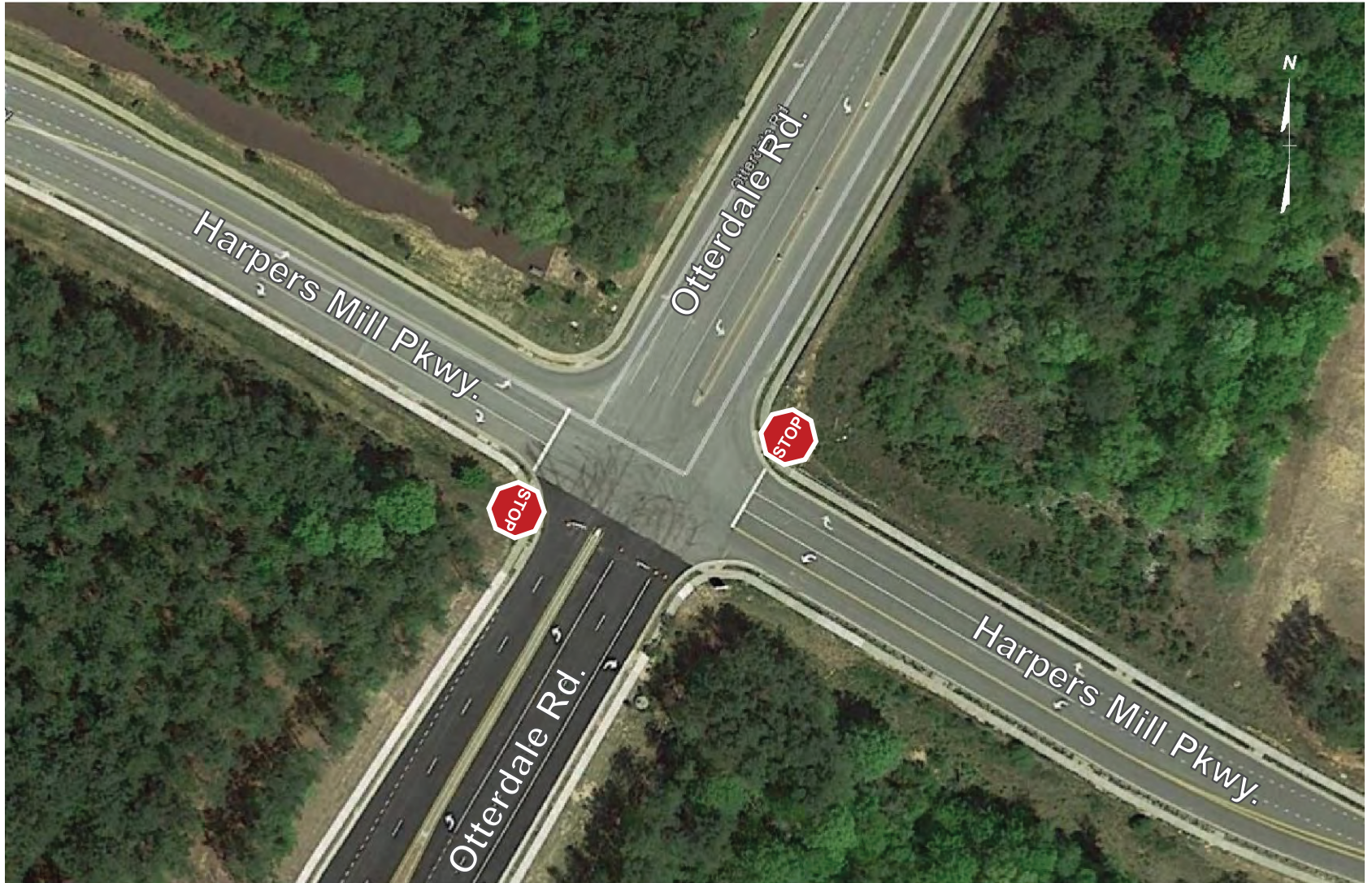
STEP 4 :: B/C RATIO (Compute the B/C ratio for specific combinations of CMFs)

Proposed Improvement	Include in Analysis? (Yes/No)	Present Value of Benefit	Present Value of Cost	B/C by CMF	B/C Ratio	Annual Estimated Lives		Other Notes
						Saved	Injuries Prevented	
Interim roundabout	Yes	\$394,909	\$292,500	1.35	1.35	1	1. VDOT District and Central Office personnel charge review and administration time to project managed by localities. Safety Projects not managed by VDOT shall include a minimum of \$5,000 for VDOT PE costs.	
	Yes	\$0	\$0	#DIV/0!		0		
	Yes	\$0	\$0	#DIV/0!		0		

Roundabout #1



Intersection #2



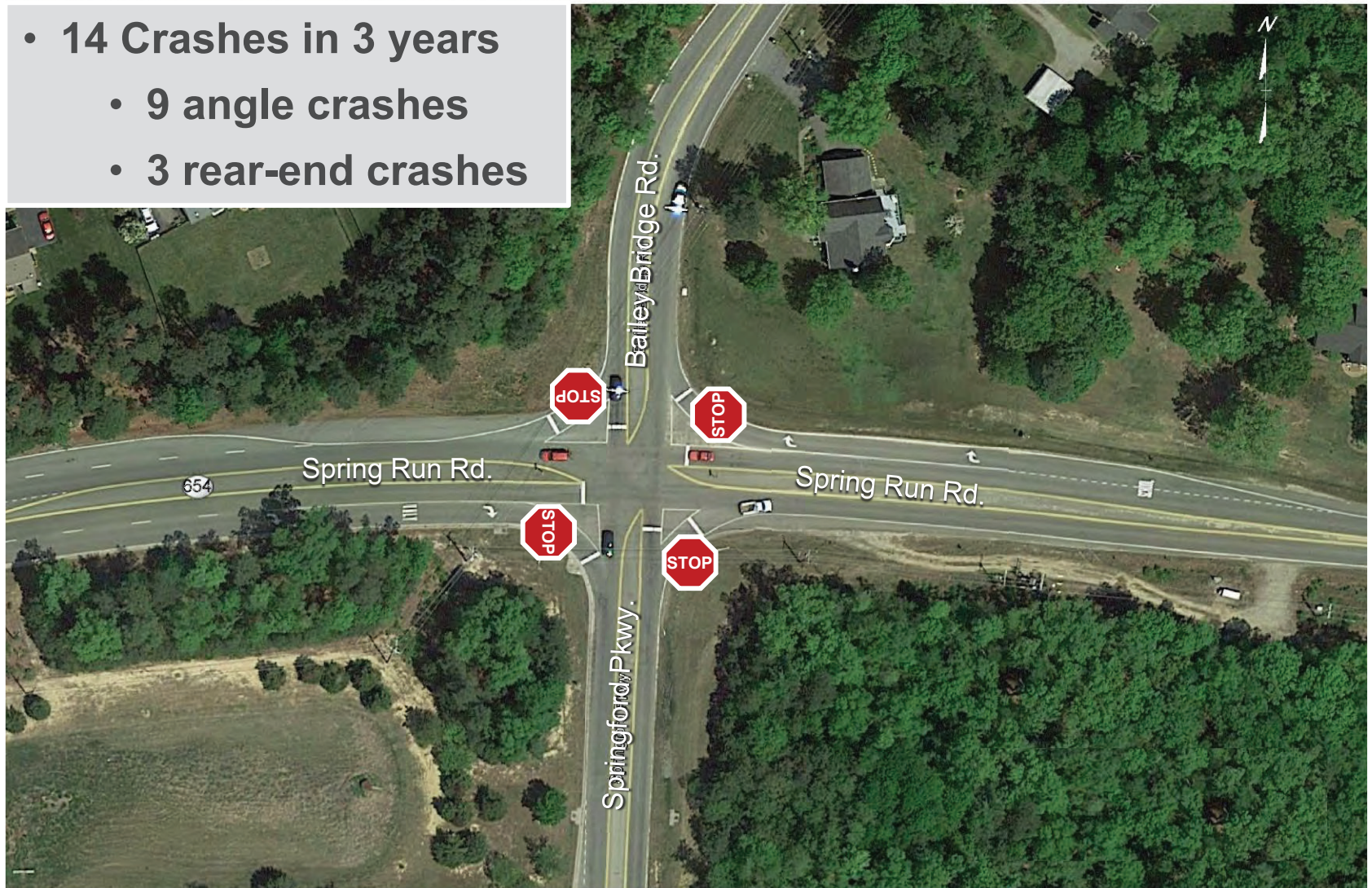
Intersection #2

- Within existing pavement
- Pedestrians accommodated
- Inscribed \emptyset 112 ft.



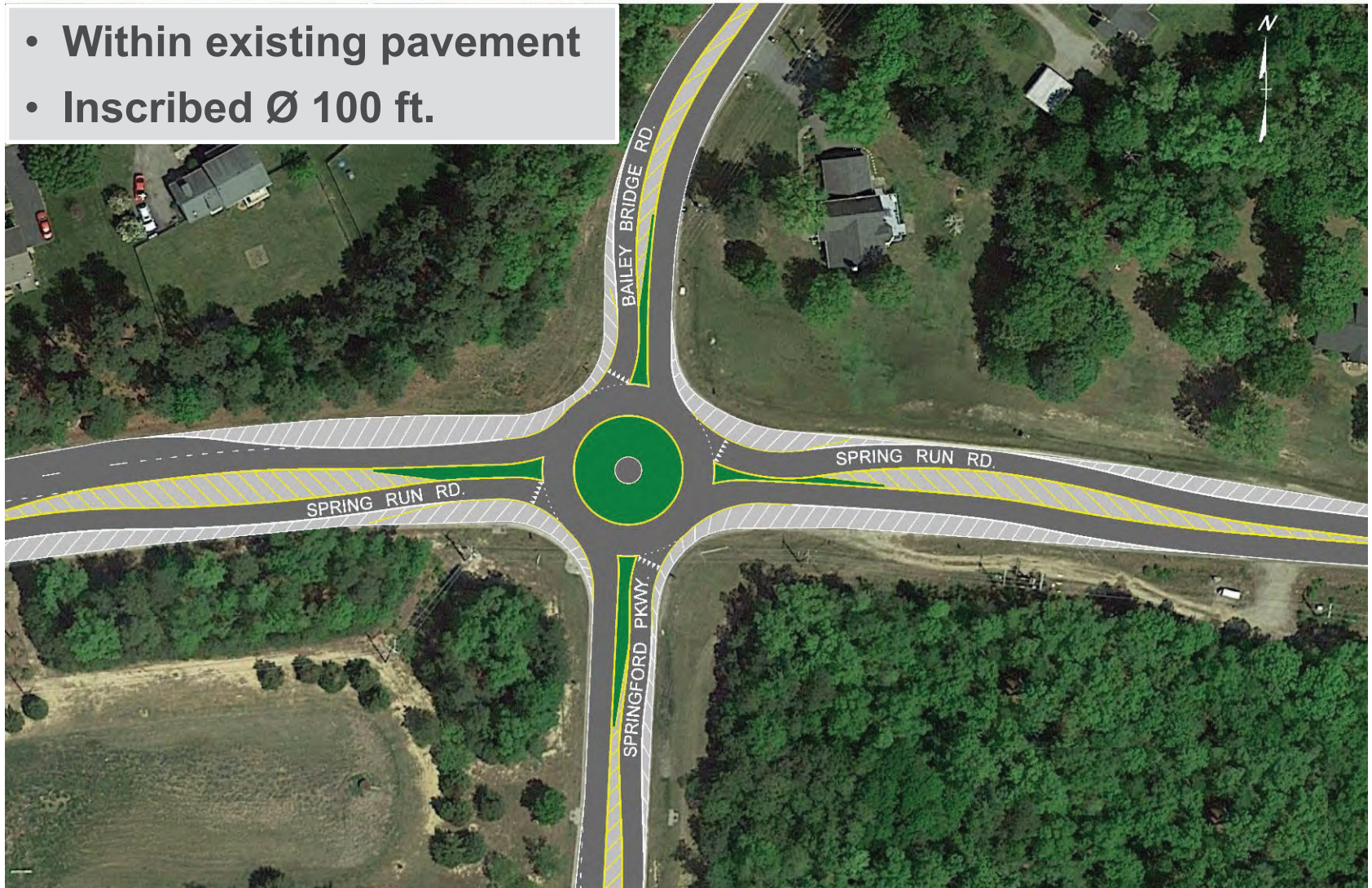
Intersection #3

- 14 Crashes in 3 years
 - 9 angle crashes
 - 3 rear-end crashes

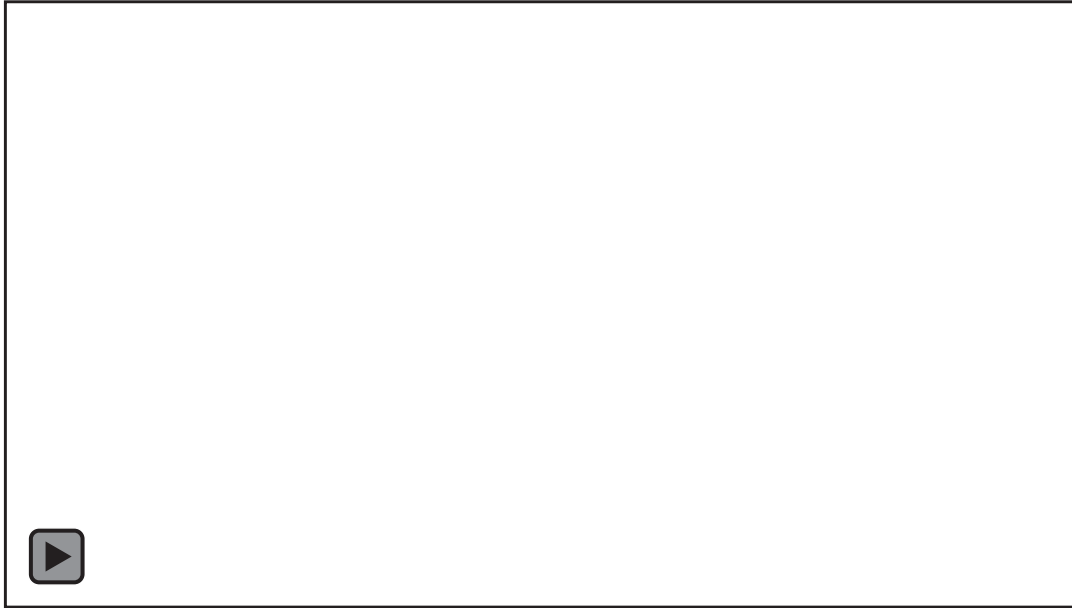


Proposed Roundabout #3

- Within existing pavement
- Inscribed \emptyset 100 ft.



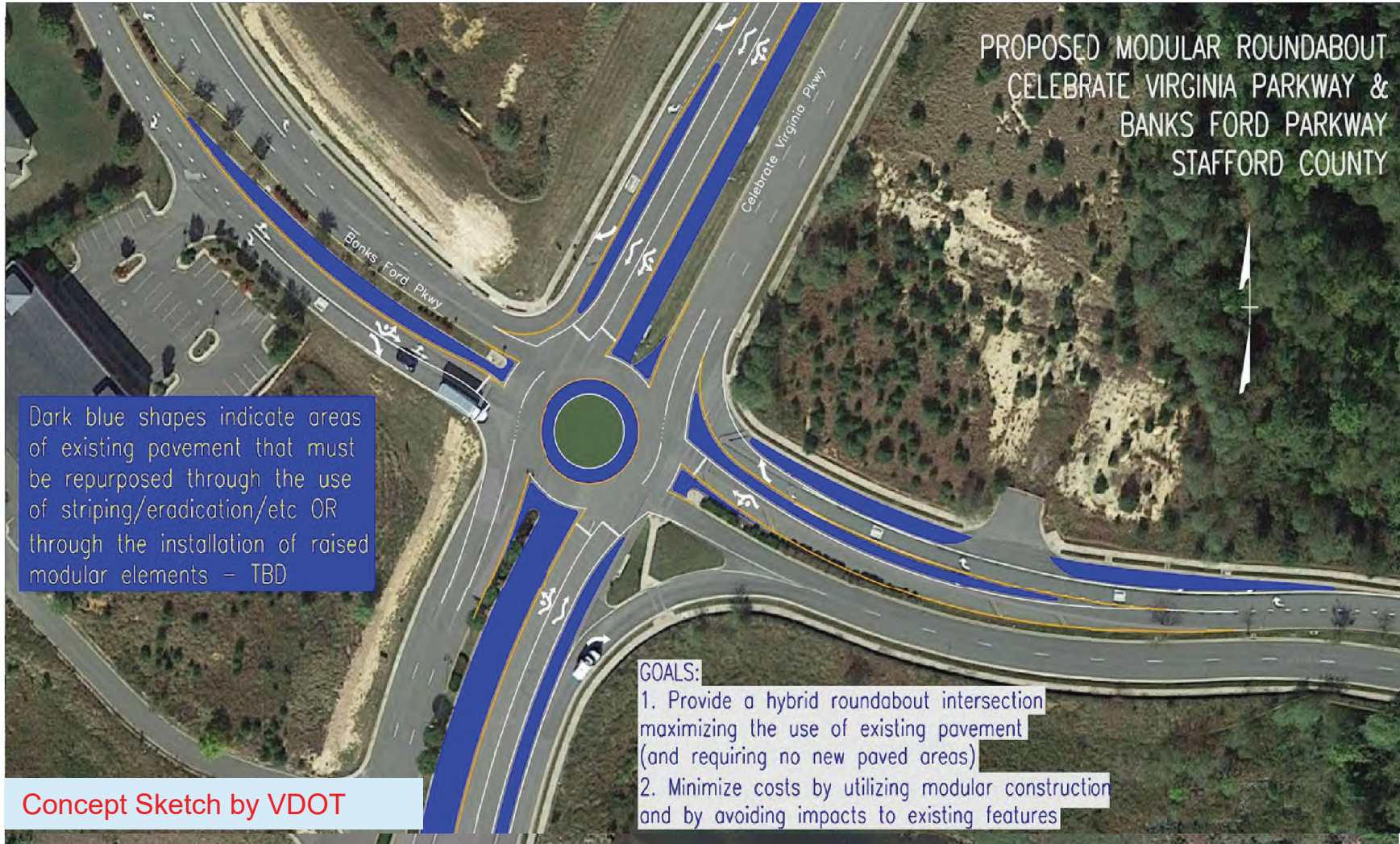
Roundabouts #2 & #3



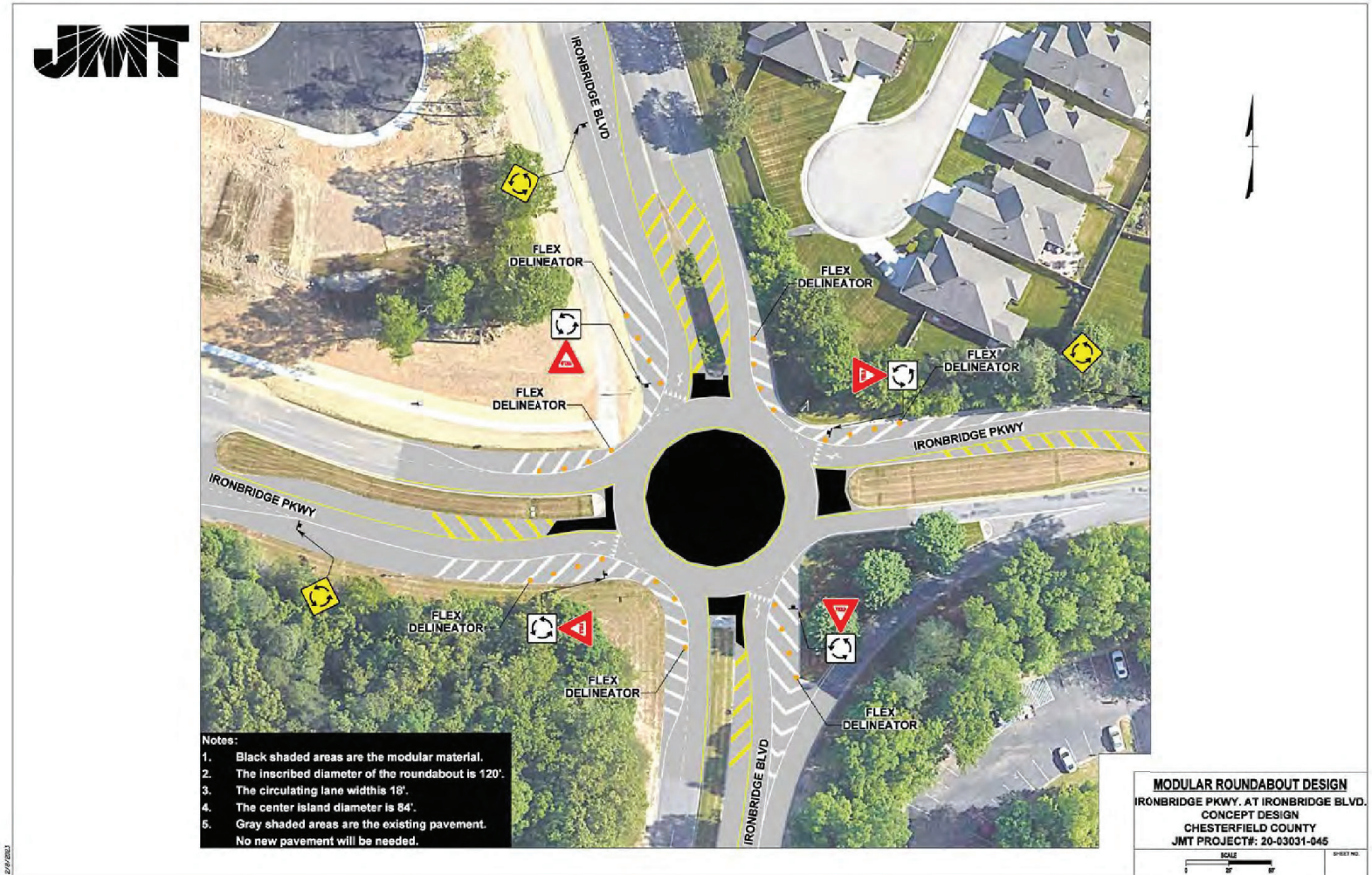
ACEC Grand Award Winner 2023



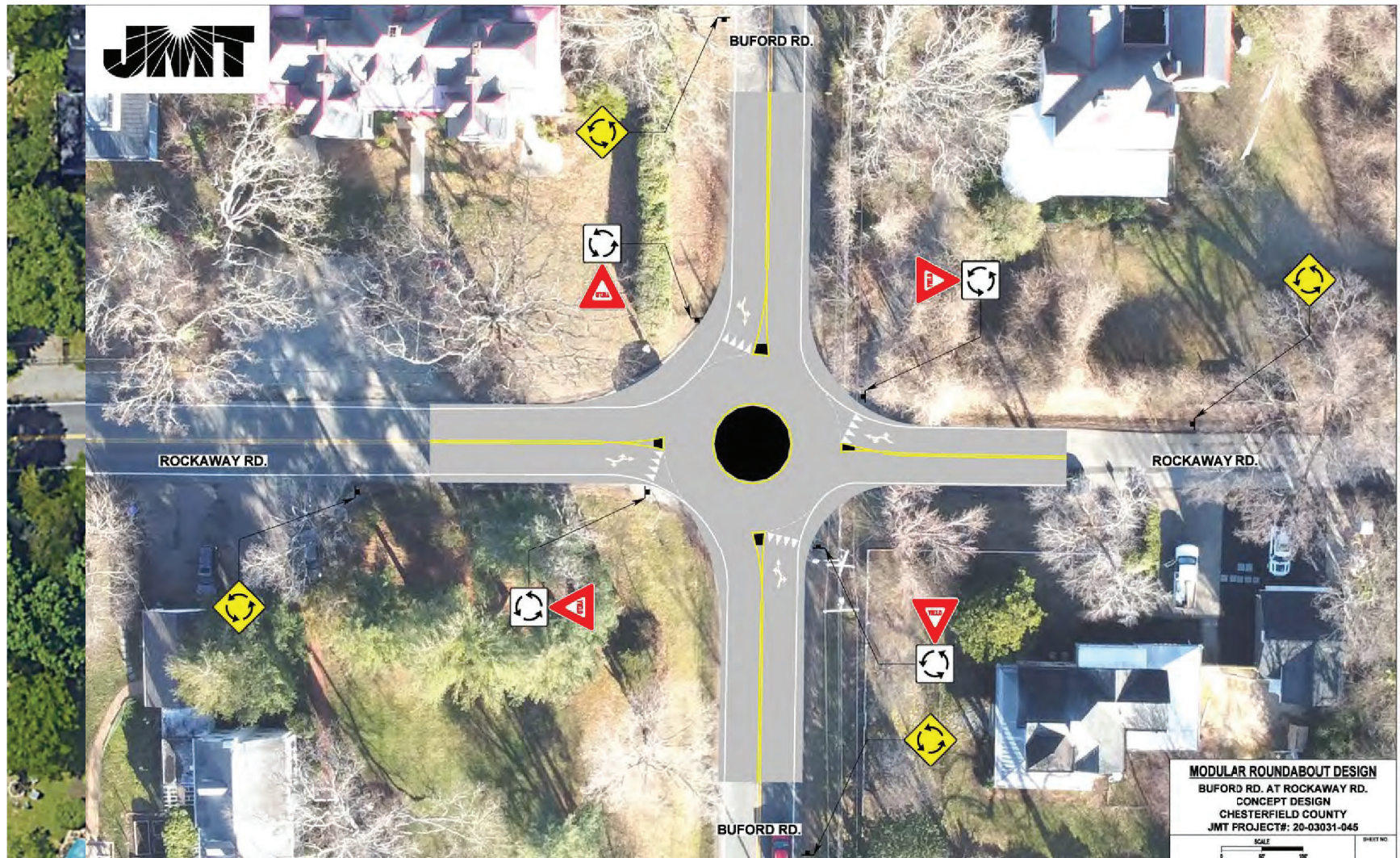
Roundabout #4



Roundabout #5



Roundabout #6



Construction Details (first 3 built)

- VDOT Survey group layout design
- Installation by VDOT crew
- First location with Vendor
- Construction support by JMT – Design details
- Pavement marking by VDOT on-call contractor



Cost and Duration

- Cost for each
 - Some of the overall cost was for these three roundabouts that were not installed
- Roundabout installation from start to end (including PE)
 - \$462,000 average cost per location
- Construction completed October 2020

Since then.....

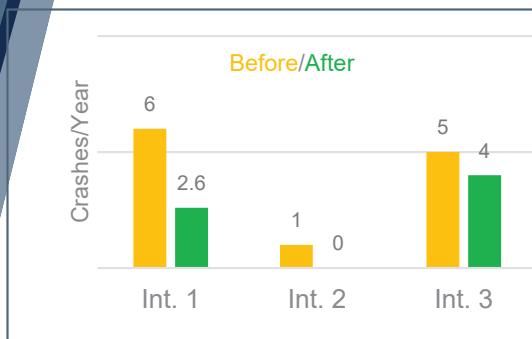
Acceptance

- Complaints from public?
 - Initial concern – safety of roundabout
 - Evolved into concerns over aesthetics
 - Not fans of Black/Yellow



Safety Performance (as of May 2022)

- Roundabout #1 (Otterdale/Hampton Park)
 - Before = 18 crashes/3 years
 - 15 angle, 7 injury
 - After = 4 crashes (All PDO)/~1.5 years
- Roundabout #2 (Otterdale/Harpers Mill)
 - Intersection fully opened in late 2017
 - Before = 1 crashes/1 year (angle)
 - After = 0 crashes/~1.5 years
- Roundabout #3 (Spring Run/Bailey Bridge)
 - Before = 14 crashes/3 years
 - 9 angle, 1 injury
 - After = 6 crashes (4 PDOs+ A injury +B injury)/~1.5 years



Performance

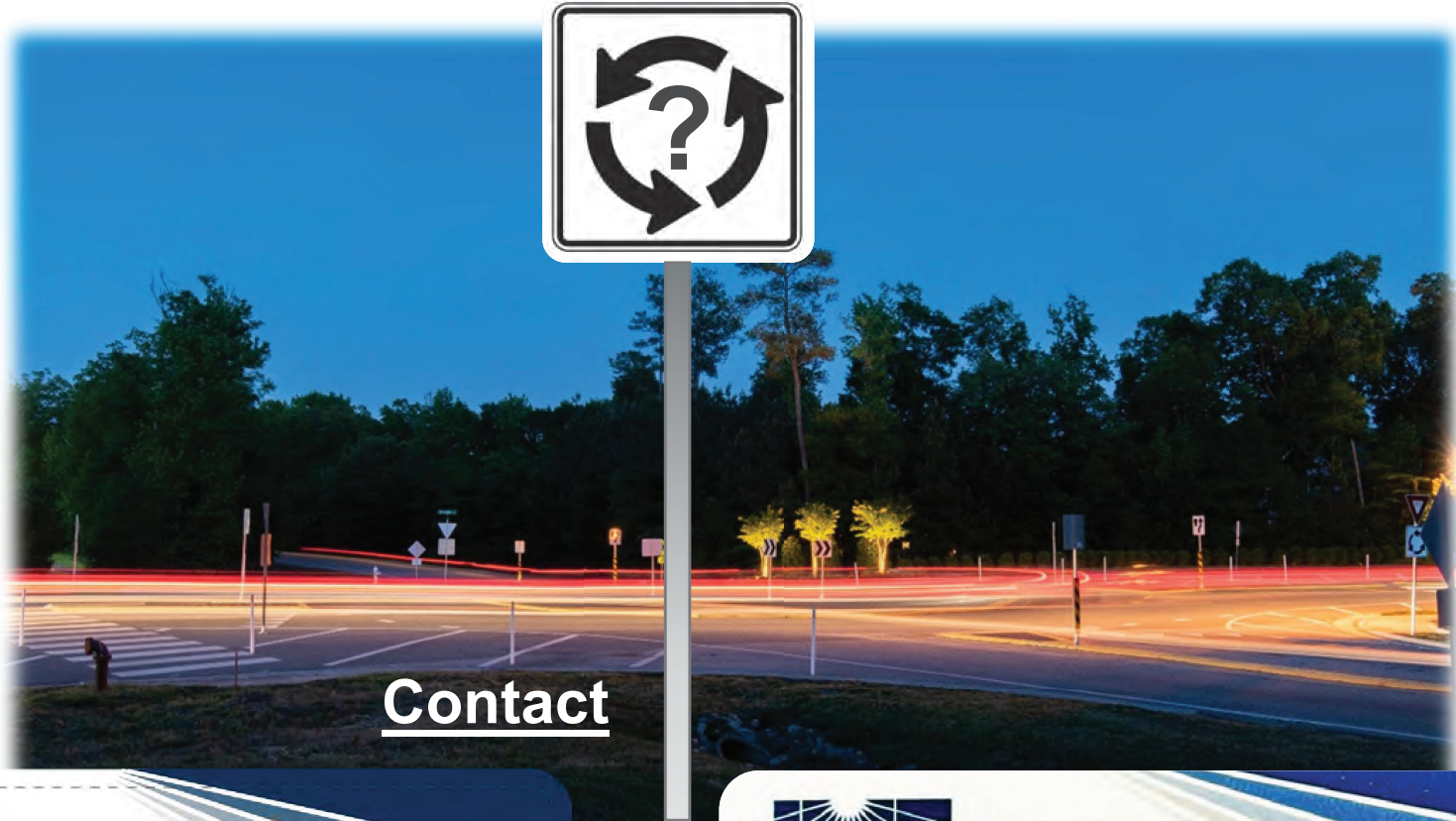
- Overall performance
 - No operational issues to date
- Maintenance
 - Some issues with ground water (used epoxy vs. mortar)
 - Performed well during Winter
 - Visible in 5"-6" of snow
 - multiple winter storms and plow cycles
- Next steps
 - For these intersections
 - Other plans for future modular RABs

Lessons Learned

- Public input is key
 - Especially in areas with HOAs
- No survey vs. survey?
 - Recommend getting some to facilitate layout
- Install by local forces or contractor?
 - Based on cost and availability of crews
- Criteria for candidate locations?
 - Selection criteria used:
 - Larger intersection with multiple approach lanes
 - A roundabout needed to fit within existing pavement
 - Crash issues or high potential
- Other
 - Consider changes to pedestrian access
 - Client's understanding of cost savings



THANK YOU!



Contact



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