SMART SCALE

Funding the Right Transportation Projects in Virginia

SMART SCALE & Performance Based Planning

Land Use Forum - May 2018

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Office of Intermodal Planning and Investment

Overview

SMART SCALE
Funding the Right Transportation Projects in Virginia

- Performance based programming
  - SMART SCALE
  - SGR
  - HSIP
- Performance Based Planning/Project Development
  - Philosophy
  - Rethinking how to solve transportation problems

Success here depends on...

effort here.

Performance Based Programming

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- Performance measures are driving the project selection and funding allocation processes
  - SMART SCALE
  - SGR
  - HSIP
- Scoring and *selection based on metrics* (eg. asset condition) and assessing expected benefits (eg. reduction in crashes, repair vs replace $, reduction in delay, etc)
- Project *cost is important* variable

Needs → Solutions

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- Where do the projects that get evaluated in the performance based programming process come from?
- Shouldn't the process of developing and planning the solution be performance driven - to improve success in getting project funded?
- How can we feed better, more cost effective solutions into the project evaluation process?
- Are there existing projects that need to be re-examined or re-scoped?

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Performance Based Planning/Project Development

Rethinking the Solutions

Performance Based Planning

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- If it ain't broke don't fix it… establish a need/problem
- If you can, prevent breakage from occurring… preserve/protect assets
- If it's broke, can you fix what you have…
  - Operational improvements
  - Innovative intersection treatments
  - Travel Demand Management
- If you have exhausted all options to improve what you have, then consider a new one (build more)

Performance Based Planning

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Does this decision tree make sense?

New Engine

New Car

Performance Based Planning

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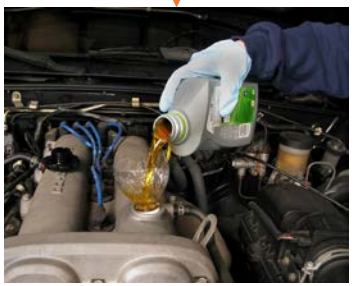
Or is this more logical...

Understand the problem

Develop/Test Solutions



Rethinking how we solve transportation problems

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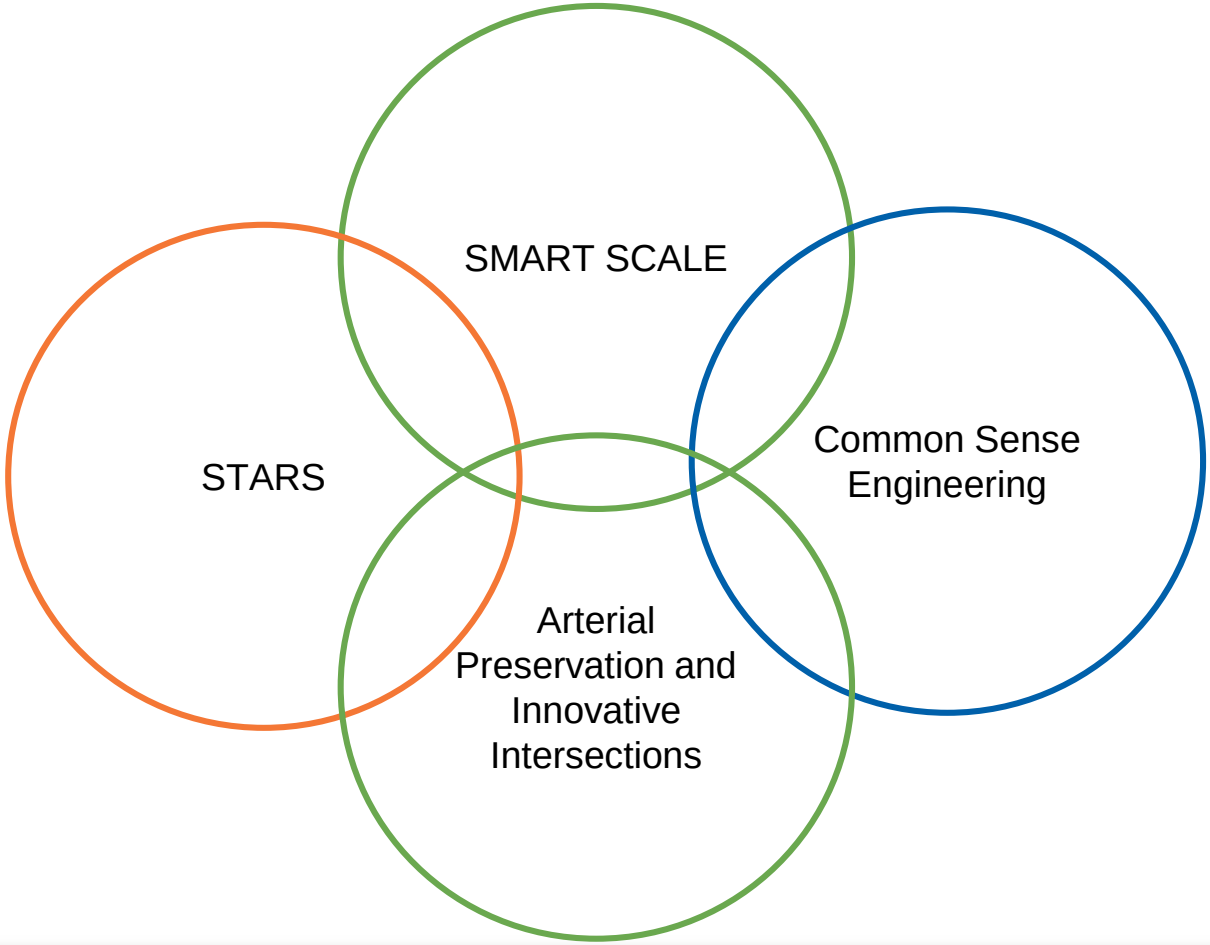

Common Thread

Focused
Cost Effective
Solutions

Why Cost Effectiveness Matters
Opportunity Costs

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Scenario Comparison

Objective: Reduce congestion and improve safety along corridor with 10 signalized intersections

Strategy 1	Strategy 2
Widen corridor by one lane in each direction for $90,000,000	Convert corridor to Superstreet and install adaptive signal controllers and transit signal priority for $30,000,000

Transportation as a System

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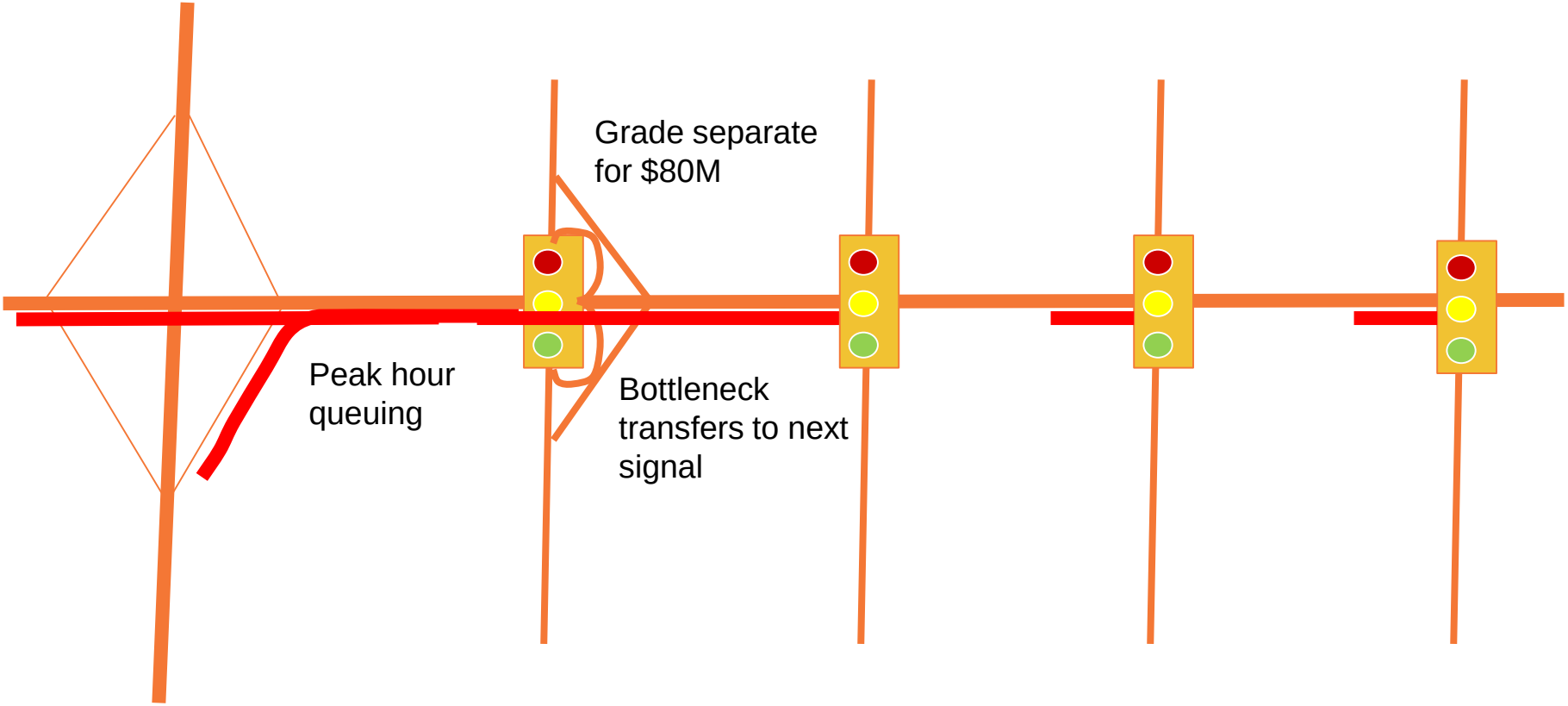

Transportation as a System

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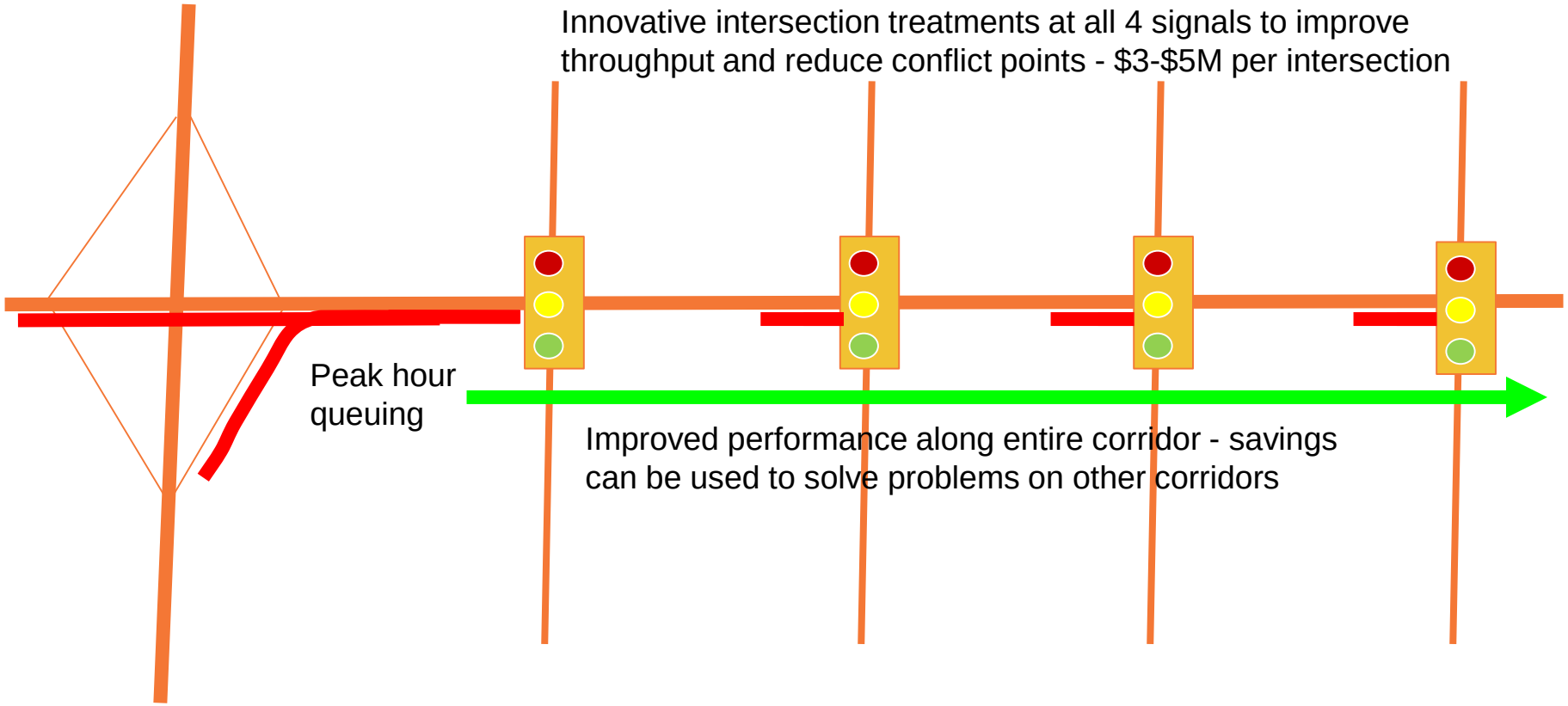

Rethinking Solutions

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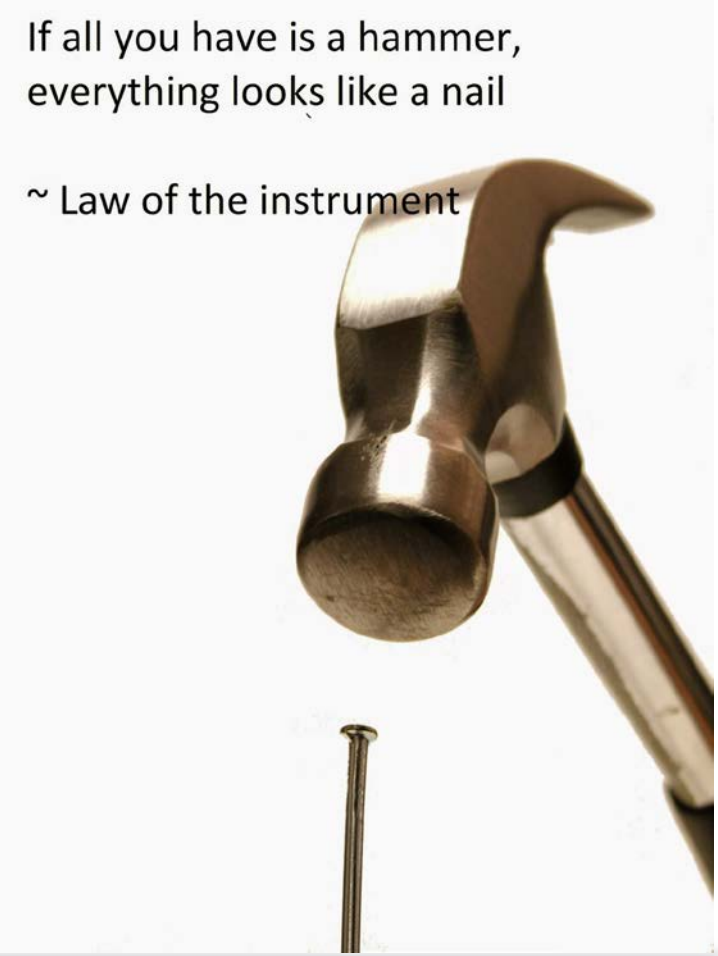
Expanding the Toolbox of Solutions

Current Toolbox

- Traffic Signalization
- Major Capacity increase if existing facilities
- New facilities



Rethinking Solutions

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Expanding the Toolbox of Solutions

- Access Management/Signal Reduction
  - Improve safety
  - Improve traffic flow
- New Technologies
  - **Adaptive controllers**
- Travel Demand Management
- **<u>Innovative Intersections</u>**
  - Improve *capacity*
  - Improve *safety*

Rethinking Solutions

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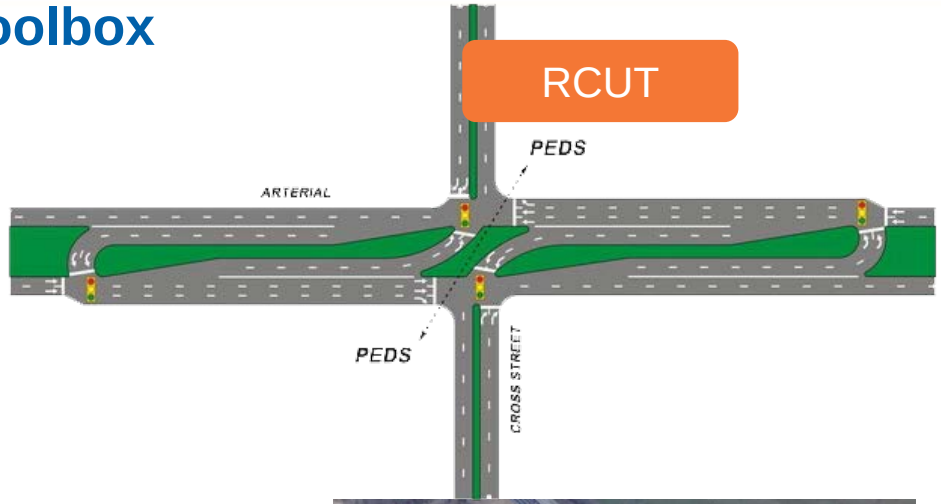
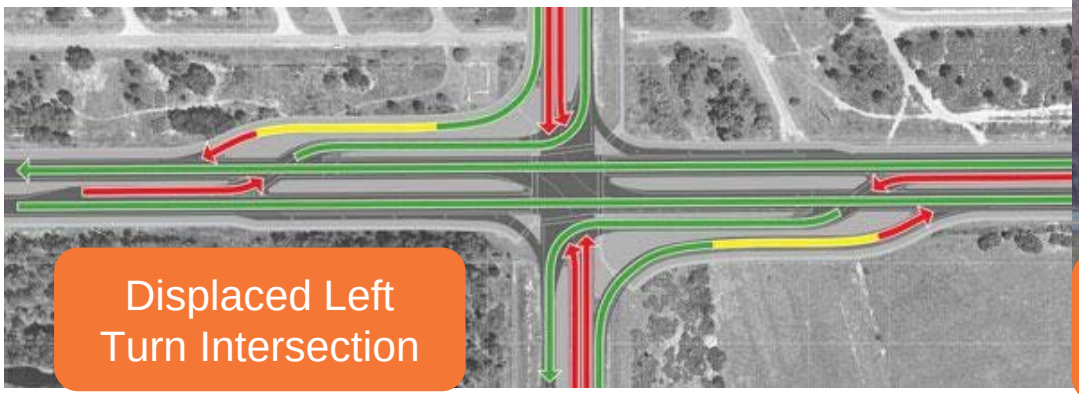
Innovative Intersection Toolbox

Divergent Diamond



RCUT



Displaced Left Turn Intersection

Quadrant Roadway Intersection

Reducing Conflict Points and Signal Phases

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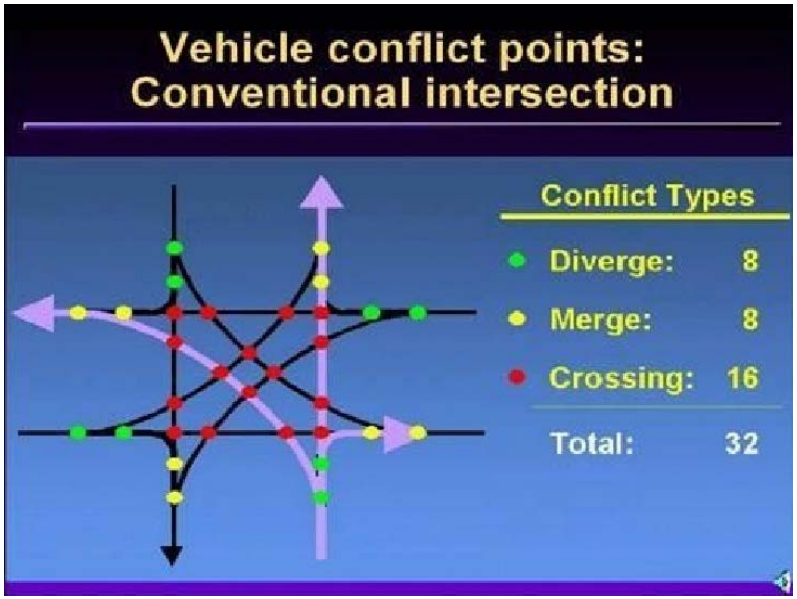
Benefits of Alternative Intersections

- **Safety**
  - Fewer conflict points
  - Significant before/after crash reductions
- **Mobility**
  - Reduced delay
  - Reduced congestion
- **Value**
  - Less right-of-way needed
  - Lower construction costs
  - Quicker project delivery



Urban Application
US 281 in San Antonio, TX

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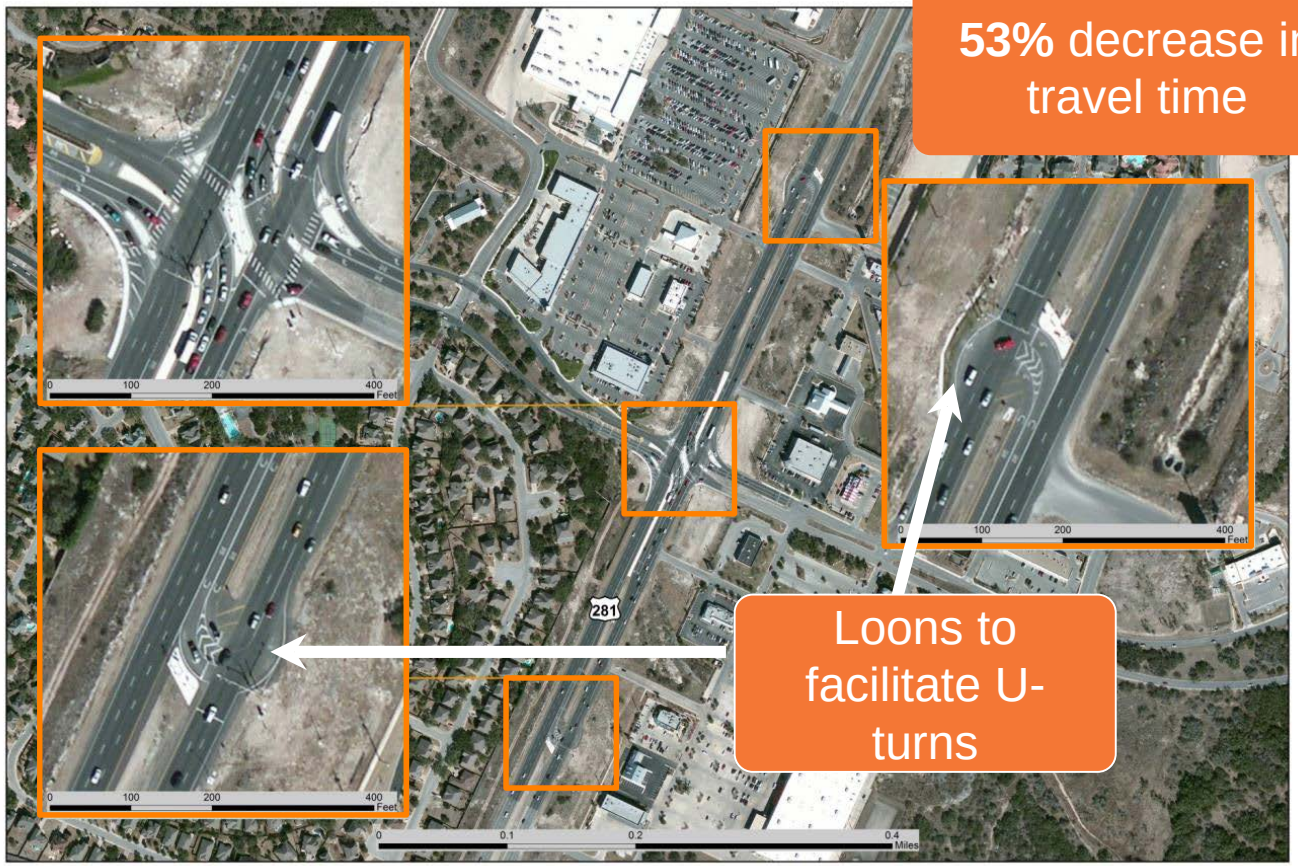

53% decrease in travel time

Loons to facilitate U-turns

Rural Application
US 17 in Leland, NC

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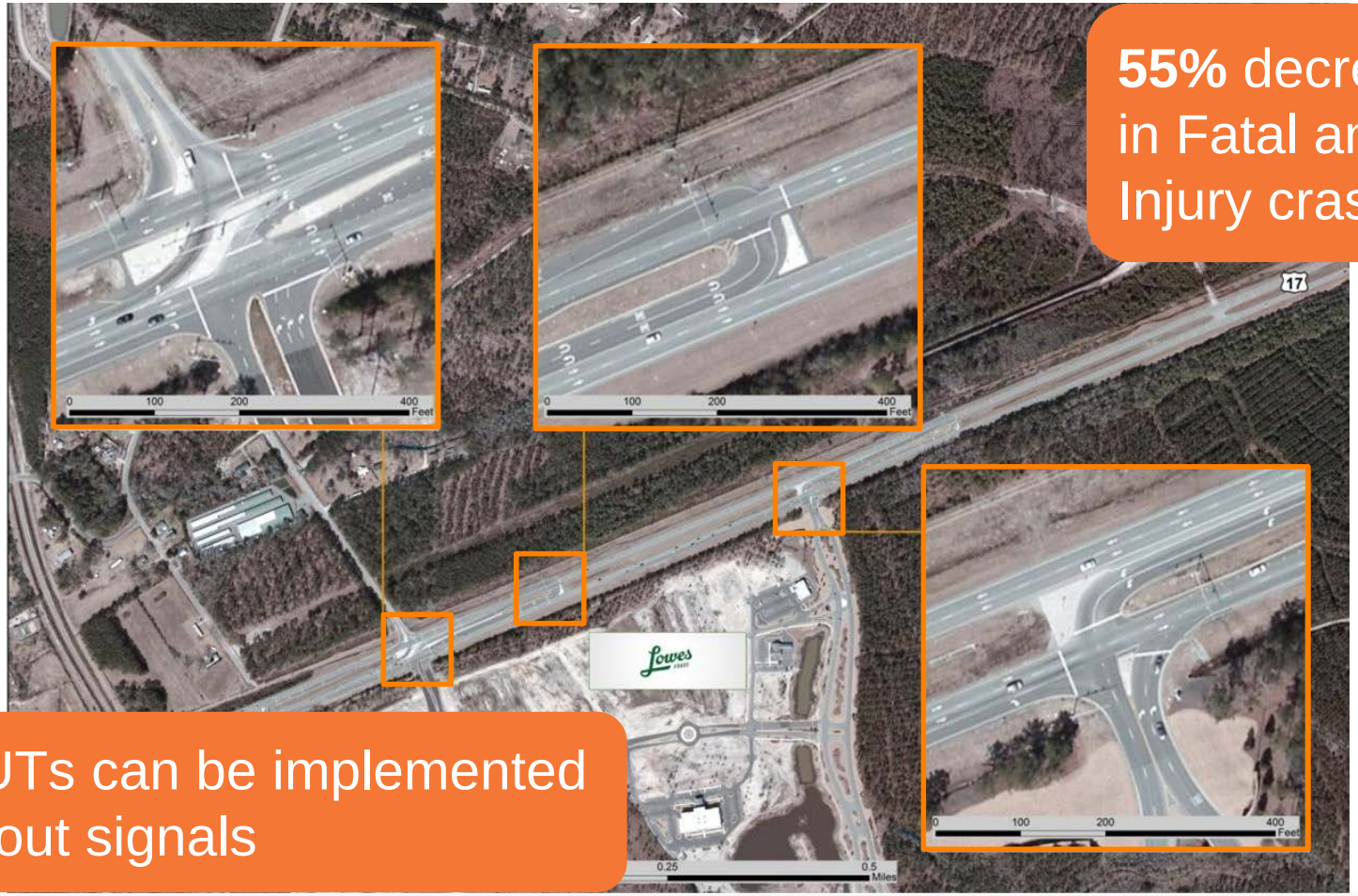

55% decrease in Fatal and Injury crashes

RCUTs can be implemented without signals

I know what you are thinking...

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I know what you are thinking...

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- *"Innovative intersections aren't pixie dust that can solve every problem - to think otherwise is a fairytale."*
- *"Sometimes common sense means spending some stinking money on a big solution to a big problem."*

How many of you have felt this way?

If you raised your hand...

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- You are 100% correct
- Specific treatments or engineering solutions are not by themself innovative - application in the wrong situation = bad outcome = bad solution
- Innovation is the result of a process, a way of working and thinking
- Doing the same thing over and over because "that's the way it is done" <> innovation
- Doing something different just to be different <> innovation
- Innovation rarely comes out of ample time and resources - it comes out of necessity or is a conscious deliberate effort

Necessity → Innovation

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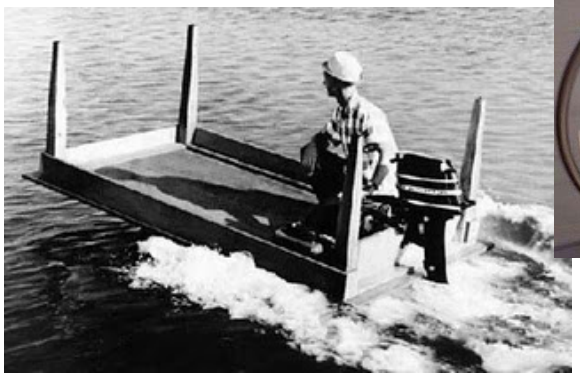

Warrenton Southern Interchange

Necessary innovation

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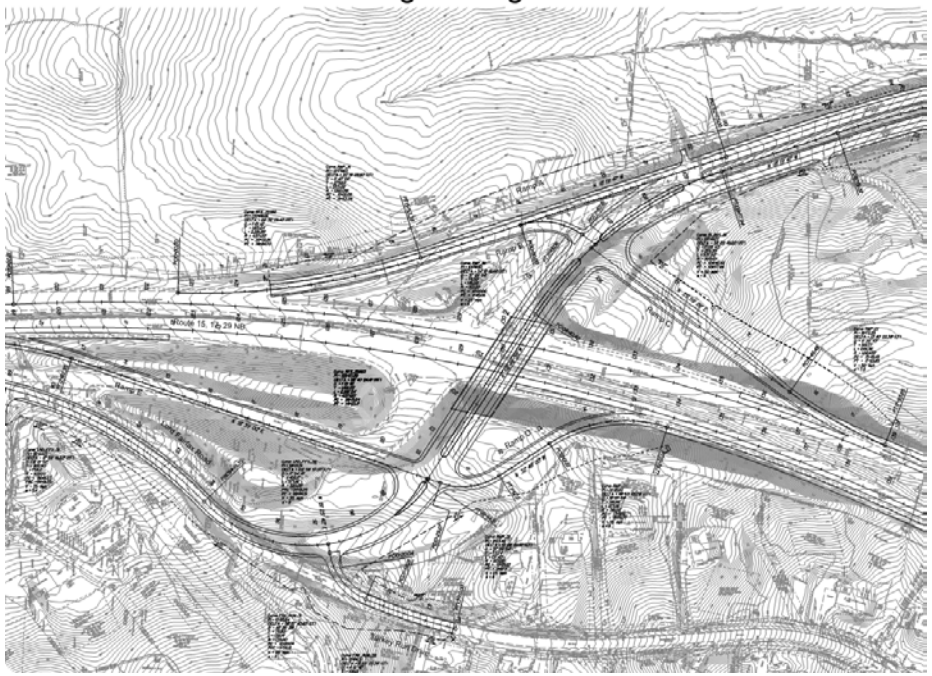
Case Study

- Initial project:
  - Full interchange
  - >$45M estimate
- Significant Bridge Costs (5 Lane)
- Significant Width Ramps to accommodate volumes
- Top priority for the Culpeper District
- Project selected in Round 1
- Non-engineer estimate reduced to $27M
- District was directed to make it work

Warrenton Final Interchange Design

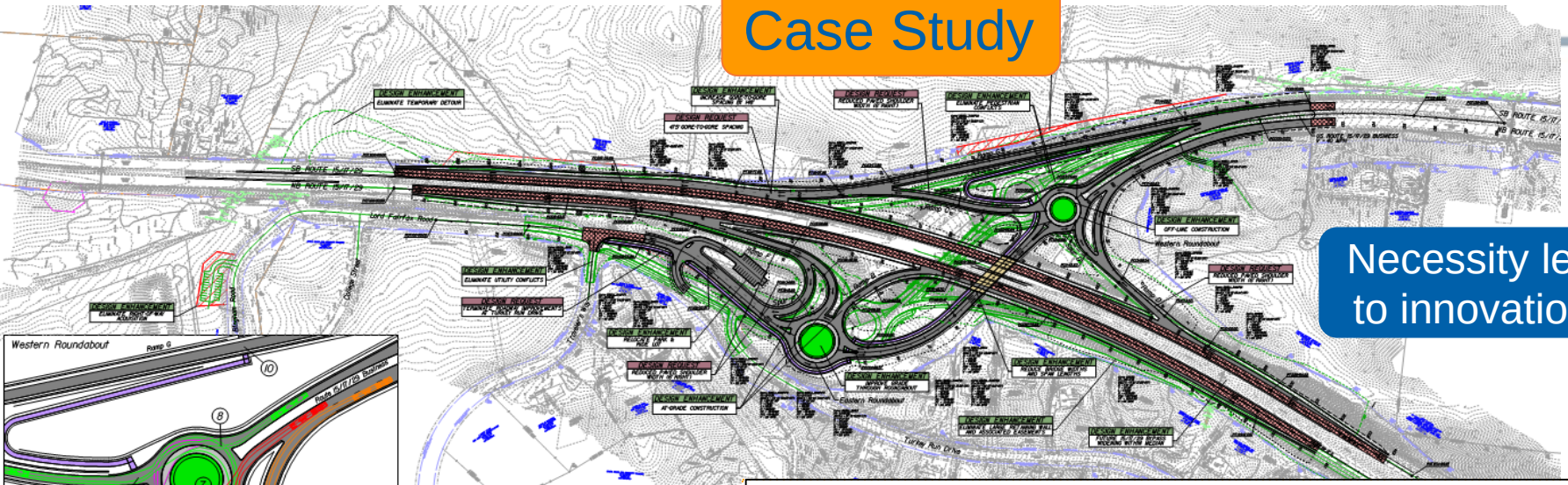


Warrenton Southern Interchange

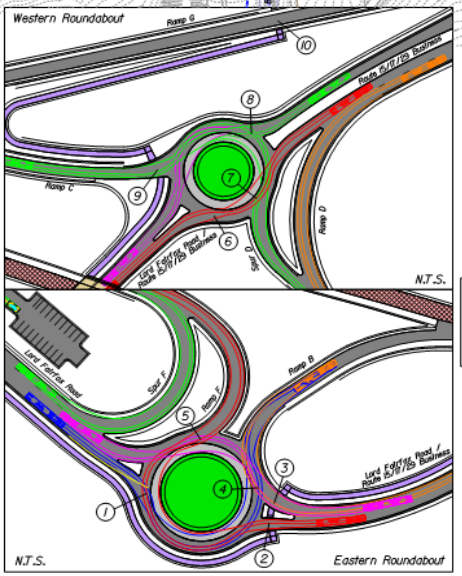
Barbell Design Option

SMART SCALE — *Funding the Right Transportation Projects in Virginia*

Case Study



Necessity led to innovation



Eastern Roundabout	Western Roundabout
Level of Service, Delay (sec.)	Level of Service, Delay (sec.)
AM Peak: B, 11.4	AM Peak: A, 6.5
PM Peak: A, 7.5	PM Peak: A, 4.4
SAT Peak: A, 9.6	SAT Peak: A, 4.7

(See Operational Analysis Technical Memorandum)

- (X) Denotes Conflict Points
- Denotes Proposed Full Depth Pavement
- Denotes Proposed Bridge
- Denotes Proposed Truck Apron
- Denotes Proposed Central Island
- Denotes Proposed Milling and Overlay or Variable Depth Overlay
- Denotes Proposed Shared Use Path
- Denotes Area of ROW Reduction
- Denotes RFP Concept Plan
- Denotes RFP Concept Plan Proposed Right-Of-Way
- C Denotes Construction Limits In Cuts
- F Denotes Construction Limits In Fills

SHIRLEY CONTRACTING COMPANY, LLC

Warrenton Southern Interchange US 15/17/29
ATC 001 Modified Barbell Interchange Concept

Dewberry

Date 10/25/2017 — NOT FOR CONSTRUCTION

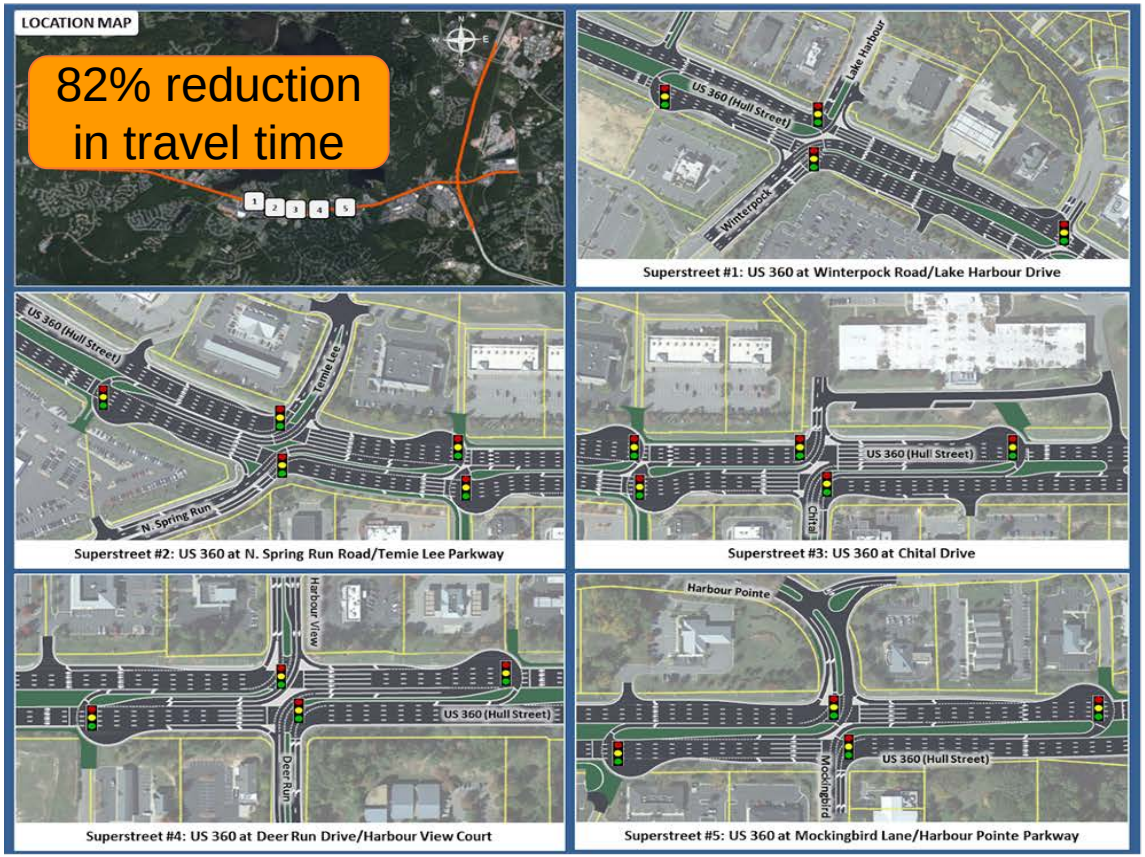
Scale 1" = 100'

SCALE 0 100' 200'

- Project team sharpened pencils
- Roundabout terminals reduced bridge to 2 lanes, reduced grading for ramps and provided:
  - better long term level-of-service
  - improved safety and reduced maintenance costs - less pavement, no signals, smaller deck
- Final design-build proposal being awarded to Shirley-Dewberry for <u>$19.8 million</u>
- <u>CEI and overhead likely add $3-5M</u>
- <u>$47M → $27M → $23-25M</u>

US 360, Chesterfield County - Superstreet

Improvement 7 – Construct Five Superstreet Intersections along US 360 Corridor



VDOT US 360/ROUTE 288 INTERCHANGE AREA STUDY

PROJECT DESCRIPTION

- The proposed improvements include modifying five existing intersections to a superstreet configuration to accommodate large future side street and US 360 traffic volumes.
- The superstreet configuration requires all side street traffic to turn right. Left-turn and through movements from the side street are required to make U-turns downstream at the signalized median crossovers.
- Expanded paved aprons or loons were assumed at the U-turn crossovers to provide additional space to facilitate larger turning paths of commercial vehicles.

Planning Level Cost Estimate	2021 Dollars Six Year Improvement Program Cycle = FY16 – 21			
	per Superstreet		Total for 5 Superstreets	
	Low Estimate	High Estimate	Low Estimate	High Estimate
Preliminary Engineering	$600,000	$900,000	$3,100,000	$4,500,000
ROW and Utility Relocation	$2,800,000	$3,500,000	$14,200,000	$17,400,000
Construction	$4,300,000	$6,400,000	$21,700,000	$31,900,000
Total Cost =	**$7,700,000**	**$10,800,000**	**$39,000,000**	**$53,800,000**

PROJECT BENEFITS

Safety Measures	
Total Crashes^ (2008 – 2013)	101
Crash Reduction Factor	56% (all crash types, all severities)
20-Year Safety Savings	$15,300,000

^ Number of crashes within a 500 foot radius of intersection

Traffic Operations Measures	
2040 No Build Delay*	4,579 hours
2040 Build Delay*	838 hours
Δ Travel Time (% Reduction)	-3,741 hours (-82%)
20-Year Operations Savings	$333,300,000

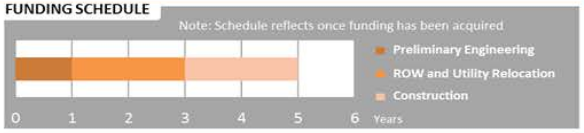
* Weekday total AM and PM intersection delay

- The proposed superstreet corridor would improve throughput on US 360 west of Brad McNeer Parkway.
- The proposed configuration would improve progression on US 360 by allowing more green time and improve safety by reducing the number of conflict points.
- Economical solution to providing increased capacity and can be implemented with minimal impact to right-of-way and schedule.

Benefit/Cost Ratio: 7.5

Benefit/Cost calculated using the midpoint of the cost estimate range

FUNDING SCHEDULE



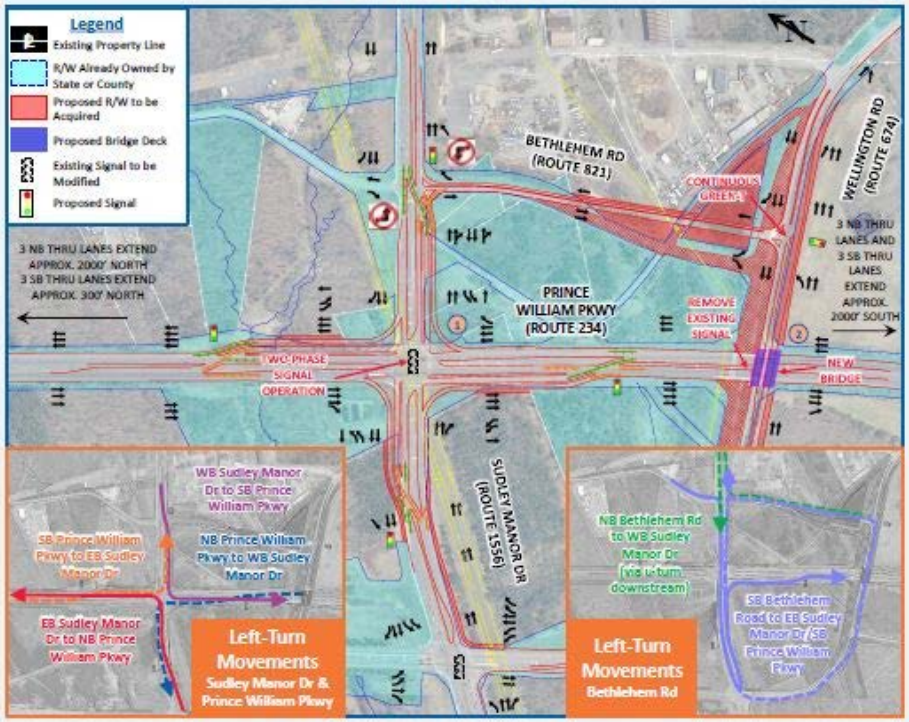
Route 234, Prince William County

Almost 40% reduction in cost over grade separation
70-80% reduction in delay NB vs B

PRINCE WILLIAM PARKWAY AND SUDLEY MANOR DRIVE/WELLINGTON ROA

PREFERRED ALTERNATIVE: CONTINUOUS-FLOW INTERSECTION

Conceptual Design Layout



Project Description

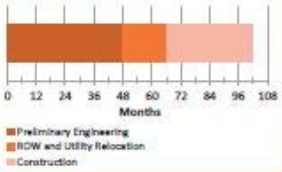
This project improves operations on Prince William Parkway at Sudley Manor Drive and Wellington Road by converting the intersection of Prince William Parkway and Sudley Manor Drive to a full continuous-flow intersection and constructing a bridge to grade separate Prince William Parkway and Wellington Road. At the continuous-flow intersection, all left-turn movements cross to the opposite side of the street at a signalized crossover before reaching the main intersection, allowing protected left turns and opposing through movements to occur simultaneously at the main intersection. The new bridge eliminates delay on Prince William Parkway and Wellington Road. The eliminated turning movements between Prince William Parkway and Wellington Road can be accommodated by the Sudley Manor Drive/Prince William Parkway intersection.

Planning Level Cost Estimate

Phase	Cost Estimate
Preliminary Engineering	$8,121,000
ROW and Utility Relocation	$12,719,000
Construction	$59,513,000
Total Cost =	$80,353,000

Note: Cost estimates reported in 2017 dollars

Project Schedule



Project Benefits

Traffic Operations Benefits

	AM Peak Hour	PM Peak Hour
1 Prince William Parkway Through Delay		
2040 No Build	128.6 sec/veh	192.5 sec/veh
2040 Build	40.9 sec/veh	38.3 sec/veh
Δ Delay	-87.7 sec/veh	-154.2 sec/veh
2 Prince William Parkway Through Delay		
2040 No Build	191.5 sec/veh	136.8 sec/veh
2040 Build	0 sec/veh	0 sec/veh
Δ Delay	-191.5 sec/veh	-136.8 sec/veh

Note: Prince William Parkway through delay reported for peak direction

Safety Benefits

- Reduces conflict points at the continuous-flow intersection
- Grade separation removes all crossing conflict points
- Increases share of mainline green time, which results in reduced delay/stops and potentially mitigates rear-end crashes

PRINCE WILLIAM PARKWAY INTERSECTION ALTERNATIVES STUDY

STARS VDOT

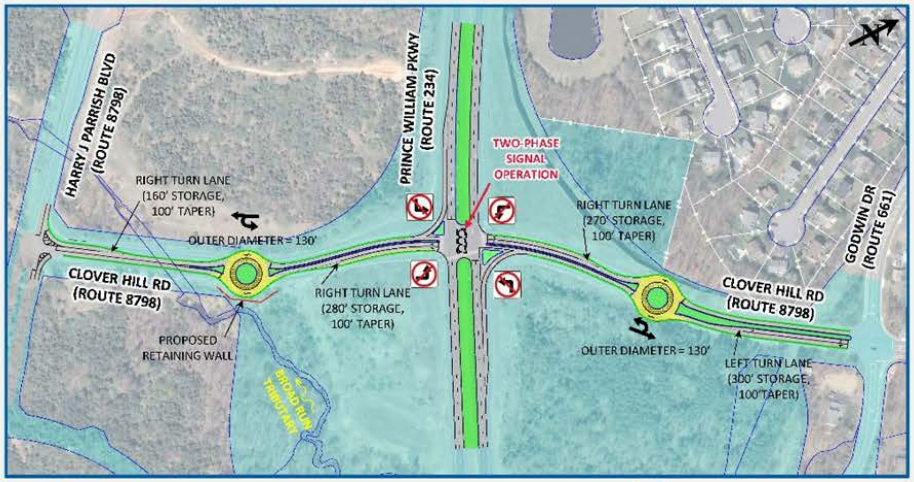
Route 234, Prince William County

32-40% reduction in delay NB vs B

PRINCE WILLIAM PARKWAY AND CLOVER HILL ROAD

PREFERRED ALTERNATIVE: BOWTIE INTERSECTION

Conceptual Design Layout



Left-Turn Movements

Legend

- Existing Pavement
- Proposed Pavement
- Proposed Raised Median
- Proposed Truck Apron
- R/W Already Owned by State or County
- Existing Property Line
- Existing Signal to be Modified

Project Description

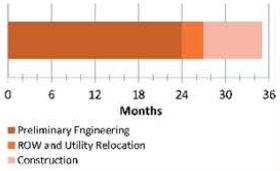
This project improves operations on Prince William Parkway at Clover Hill Road by converting the existing conventional intersection to a bowtie intersection. Left turns are not permitted at the main intersection and vehicles must turn right or continue straight and use downstream roundabouts to complete left-turn movements. Removing left-turns from the main intersection allows the intersection to operate under two-phase signal control, which increases green time on Prince William Parkway by 50% and reduces delay for mainline through vehicles as well as the overall intersection. The roundabouts are designed to accommodate large trucks and are spaced to provide appropriate queue storage.

Planning Level Cost Estimate

Phase	Cost Estimate
Preliminary Engineering	$3,131,000
ROW and Utility Relocation	$140,000
Construction	$11,090,000
Total Cost =	**$14,361,000**

Note: Cost estimates reported in 2017 dollars

Project Schedule



Project Benefits

Traffic Operations Benefits

	AM Peak	PM Peak
Overall Intersection Delay		
2040 No Build	49.6 sec/veh	68.3 sec/veh
2040 Build	33.7 sec/veh	41.2 sec/veh
Δ Delay	**-15.9 sec/veh**	**-27.1 sec/veh**
Prince William Parkway Through Delay		
2040 No Build	69.4 sec/veh	78.5 sec/veh
2040 Build	39.3 sec/veh	18.9 sec/veh
Δ Delay	**-30.1 sec/veh**	**-59.6 sec/veh**

Note: Prince William Parkway through delay reported for peak direction

Safety Benefits

- Reduces conflict points at the intersection
- Removes left-turn movements across high-speed mainline corridor
- Increases share of mainline green time, which results in reduced delay/stops and potentially mitigates rear-end crashes

PRINCE WILLIAM PARKWAY INTERSECTION ALTERNATIVES STUDY

STARS VDOT

Project Applications

Success in Leveraging the Expanded Toolbox

- **Adaptive Signal Control**
  - US 220 – Roanoke / Roanoke County (Funded HB2 FY17)
  - Norfolk (Funded HB2 FY17)
  - Alexandria (Funded HB2 FY17 and SMART SCALE FY18)
  - Route 419 and Route 221 – Roanoke County (Funded SMART SCALE FY18)
  - Winchester (Submitted Revenue Sharing FY18)
  - Graves Mill Road – Lynchburg (Submitted HSIP FY19)
- **Innovative Intersections**
  - Route 10 Signalized RCUT – Chesterfield County (Funded HB2 FY17)
  - North Main RCUT – Blacksburg (Funded HB2 FY17)
  - US 13 RCUT – Accomack County (Submitted HSIP FY19)
  - US 220 Continuous Green-T – Franklin County (Submitted Revenue Sharing FY18)

Innovation by choice... by default

SMART SCALE
Funding the Right Transportation Projects in Virginia

- Approach every transportation problem as a personal challenge to find the most cost-effective solution to the identified problem(s)
- Commonwealth cannot submit projects for SMART SCALE
- Easy for local/regional decision makers or public to see innovation as:
  - Settling for a less than optimal project
  - Getting less for less
  - Bubblegum, Baling Wire, and Bandaids

Translation → For innovative solutions to be submitted and funded, VDOT and DRPT must engage and educate decision makers and the public

Resources

SMART SCALE
Funding the Right Transportation Projects in Virginia

- SMART SCALE website - http://smartscale.org
- Policy Guide and Technical Guide - http://smartscale.org/resources/default.asp
- SMART Portal - https://smartportal.virginiahb2.org
- VTrans - www.vtrans.org
- STARS mapping - https://app.box.com/v/VDOTSTARS
  - Includes layers for congestion, safety reliability, etc
- Innovative Intersections - www.virginiadot.org/innovativeintersections
- Warrenton interchange - Culpeper District points of contact
  - Hal Jones, Nathan Umberger, or Will Stowe