An Application of the New Synchronized Interchange Design

Bradley Reynolds, PE and Elizabeth Harris, PhD, PE

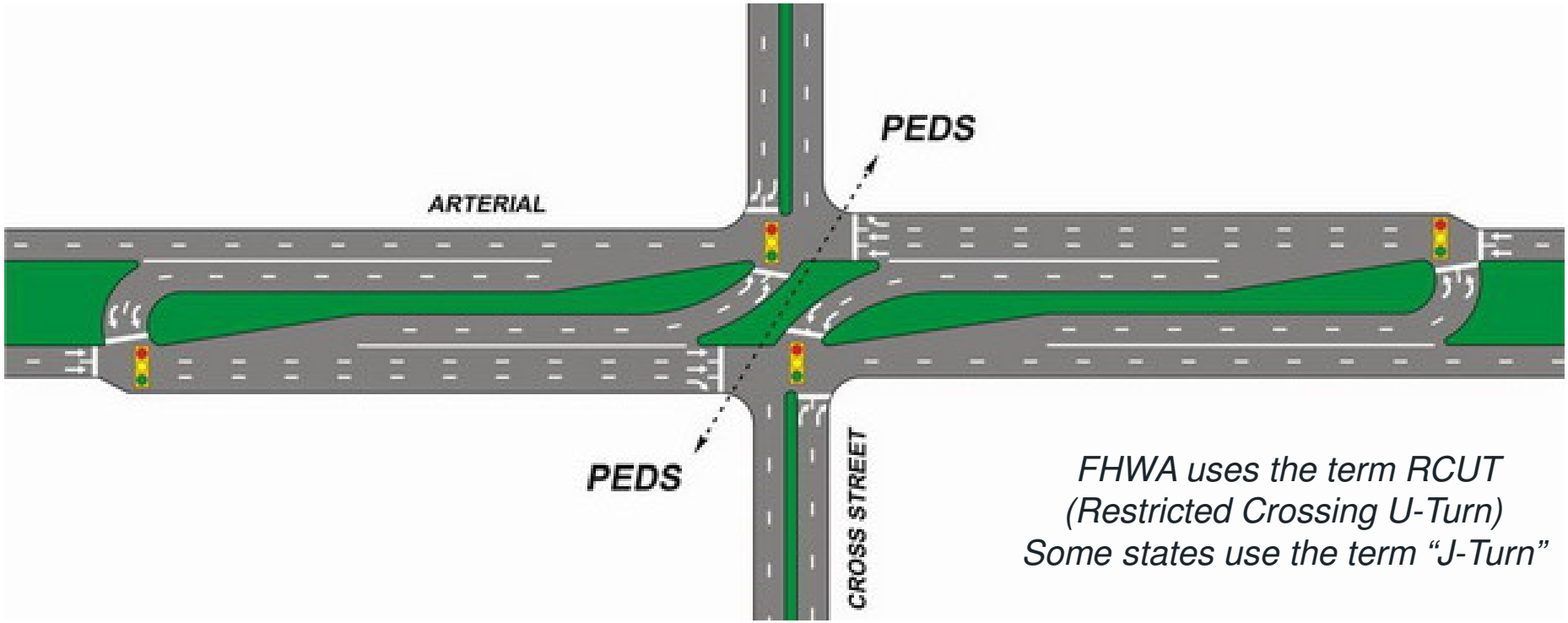
May 22, 2017

HNTB

Introduction

- Synchronized Interchange Overview
- I-26 Widening Project Overview
- I-26 / US 25 Interchange
  - Interchange Form Analysis
  - Synchronized Interchange Application
  - Measures of Effectiveness
  - Considerations and Challenges
- Next steps

Superstreet (Synchronized Streets)

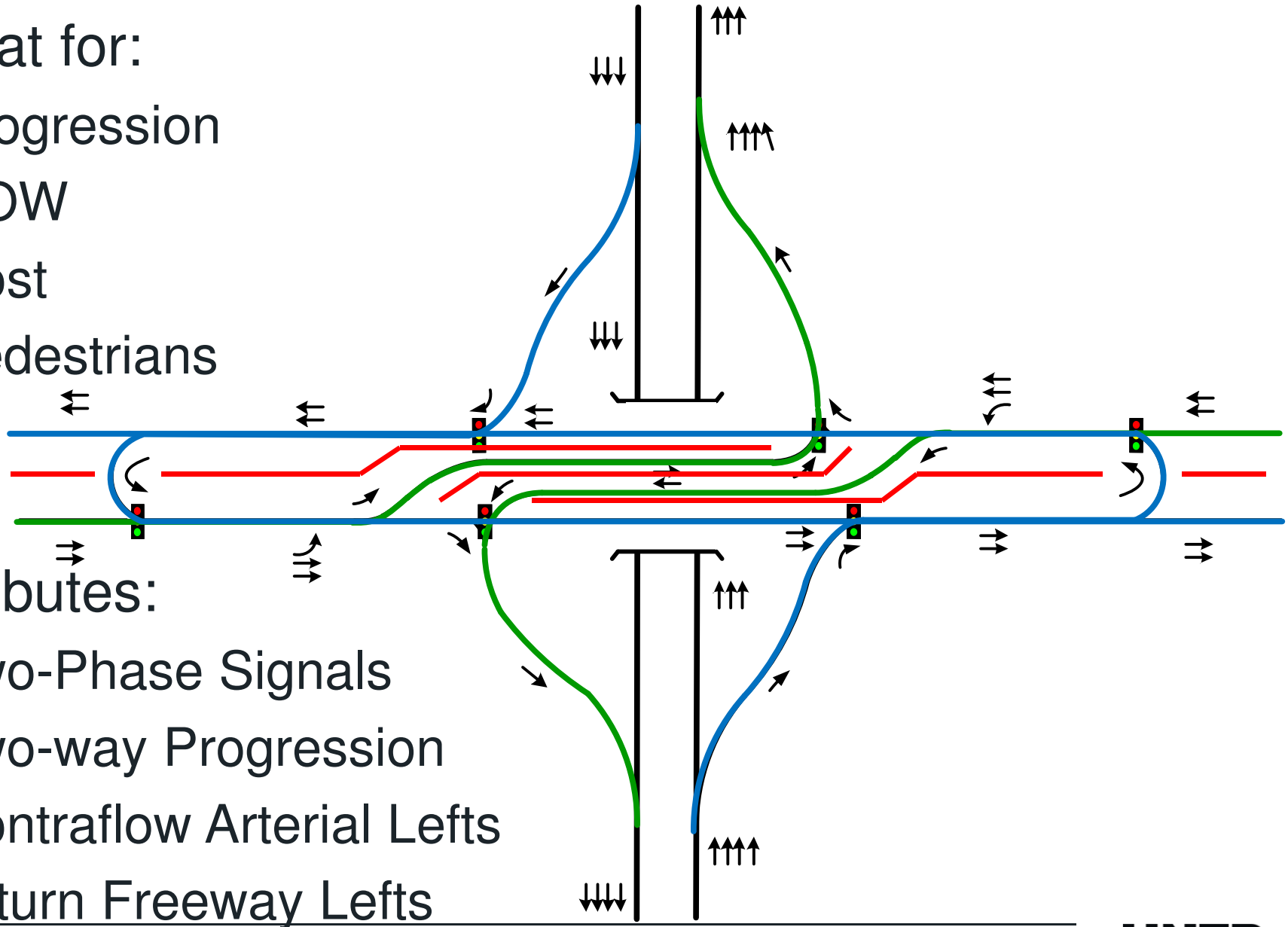


FHWA uses the term RCUT (Restricted Crossing U-Turn) Some states use the term "J-Turn"

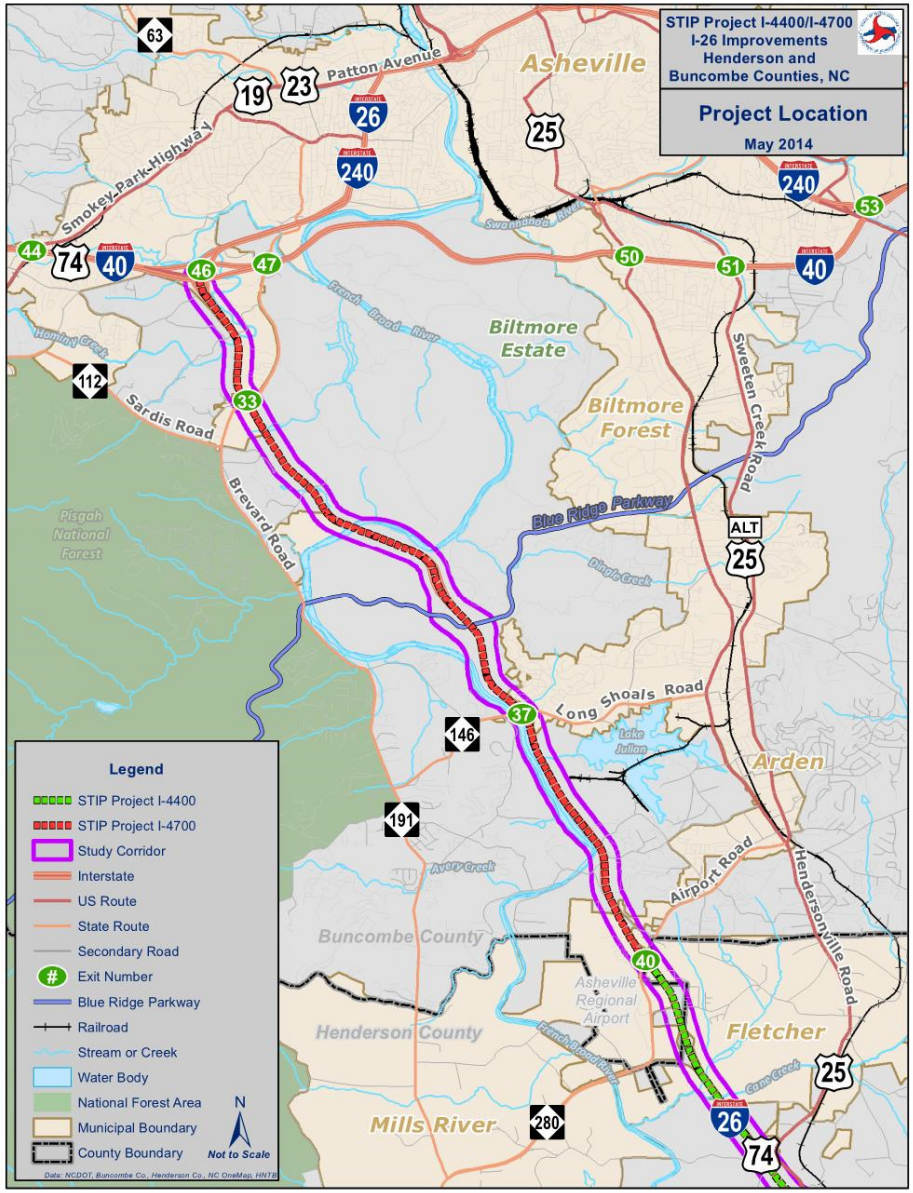
- Benefits
  - Improved safety
  - Travel time savings
  - Increased capacity
  - Improved traffic flow
  - Access management
  - Land use and corridor protection

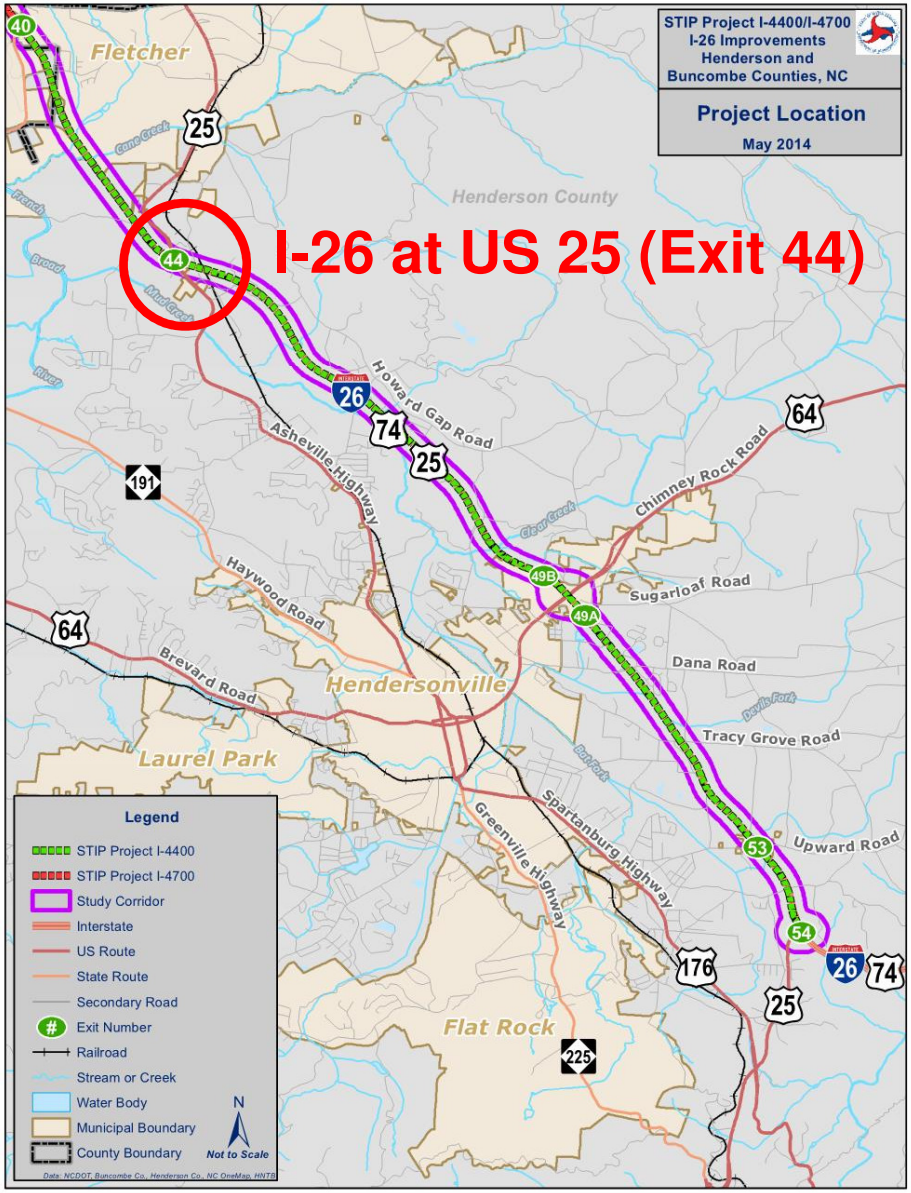
Synchronized Interchange

- Great for:
  - Progression
  - ROW
  - Cost
  - Pedestrians
- Attributes:
  - Two-Phase Signals
  - Two-way Progression
  - Contraflow Arterial Lefts
  - U-turn Freeway Lefts



STIP Projects I-4400 / I-4700 (I-26 Widening)



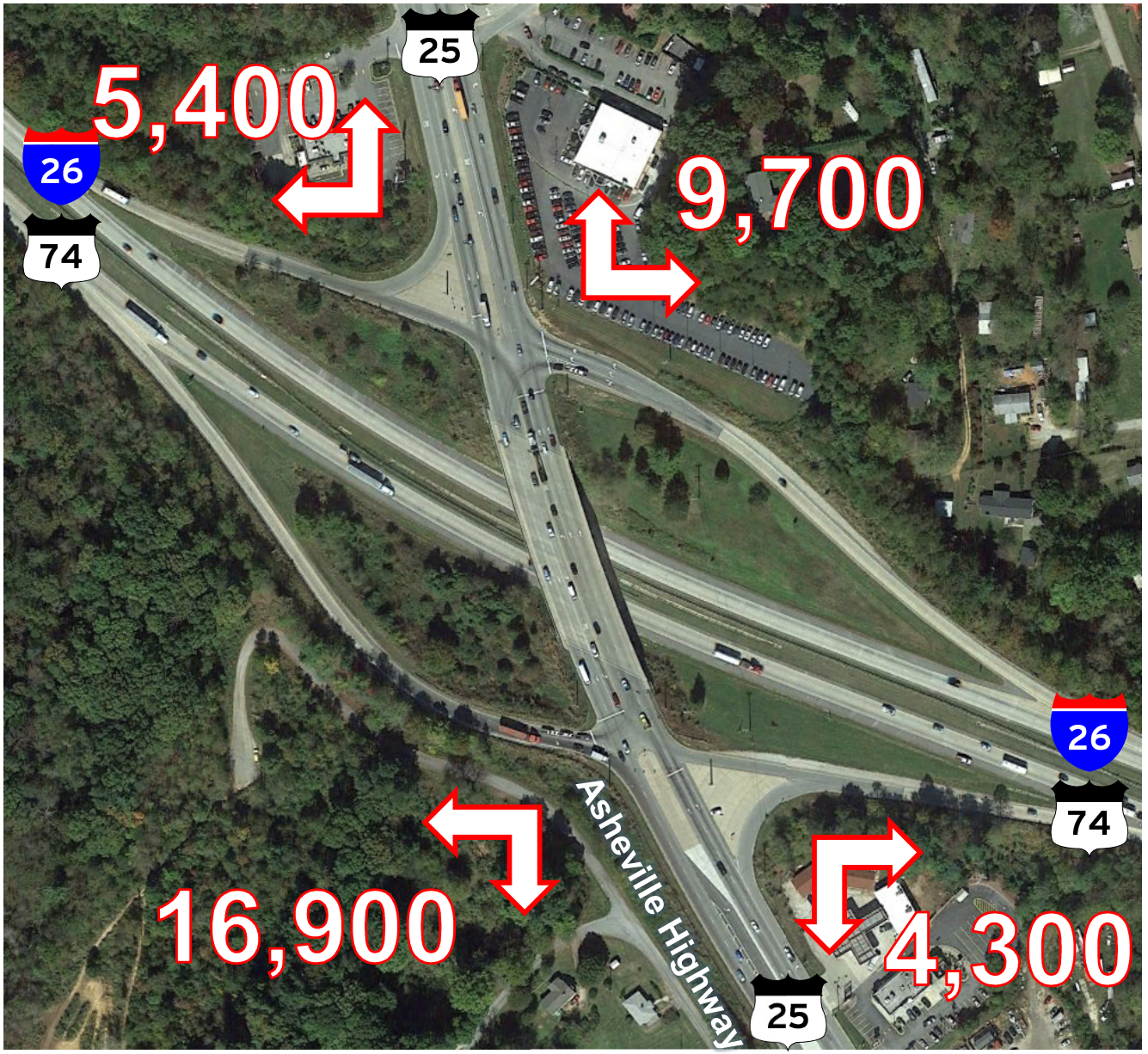


Case Study: I-26 at US 25, Hendersonville, NC

Existing Diamond Interchange

US 25

- Five-Lane Section
- Six-Lane Bridge
- 45 mph Posted
- Signalized Ramp Terminals
- 2040 AADT – 33,900 to 40,000
- Poor Existing and Future Intersection LOS



HNTB

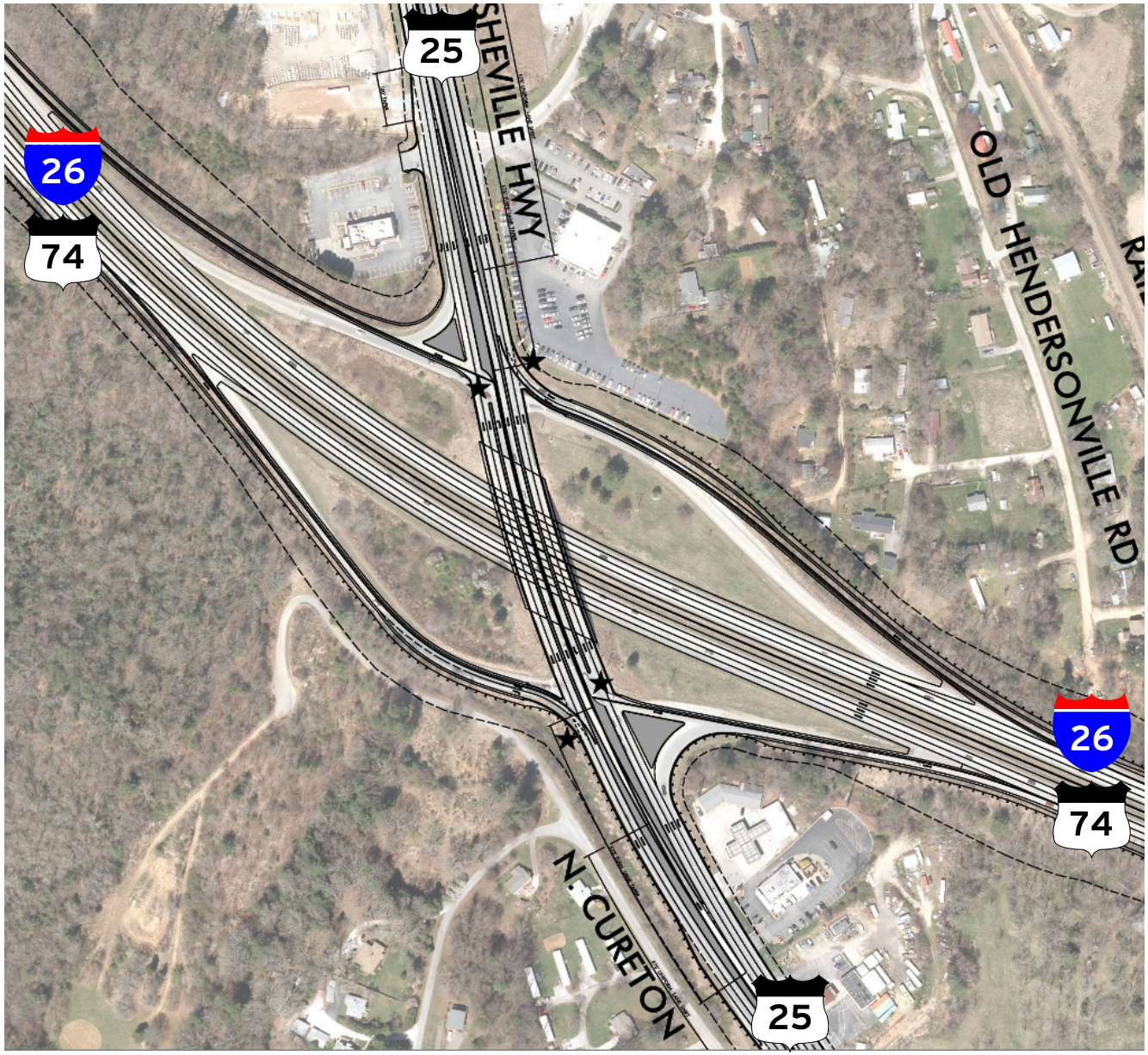
Alternative Interchange Concepts

Case Study: I-26 at US 25, Hendersonville, NC

Synchronized Interchange Design

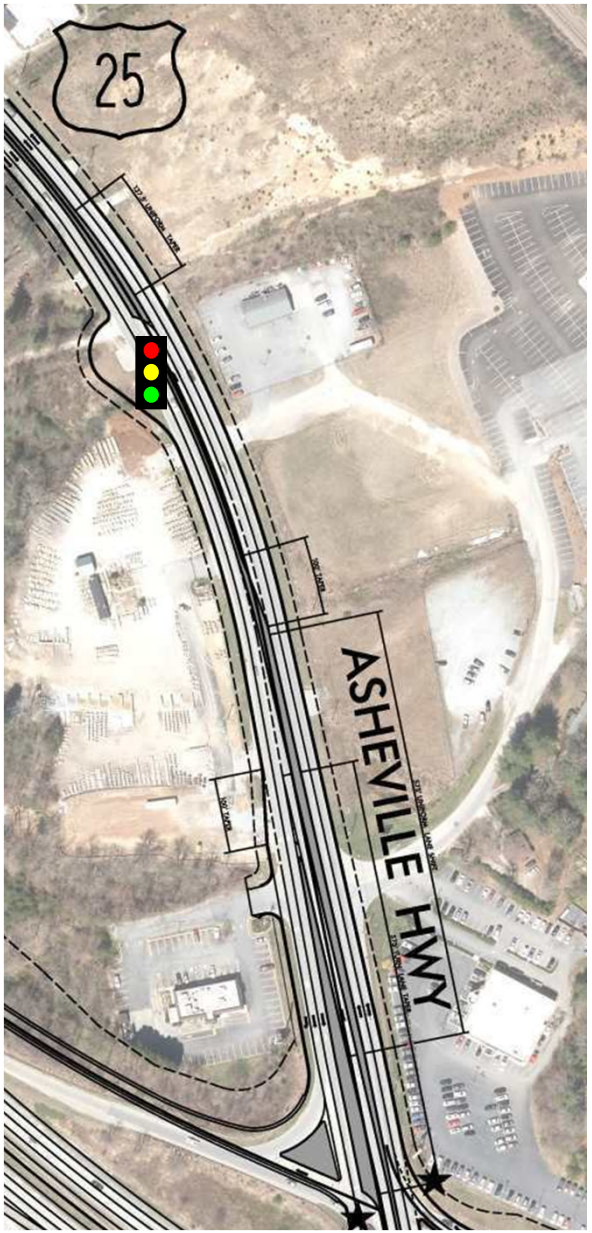
Why Here?

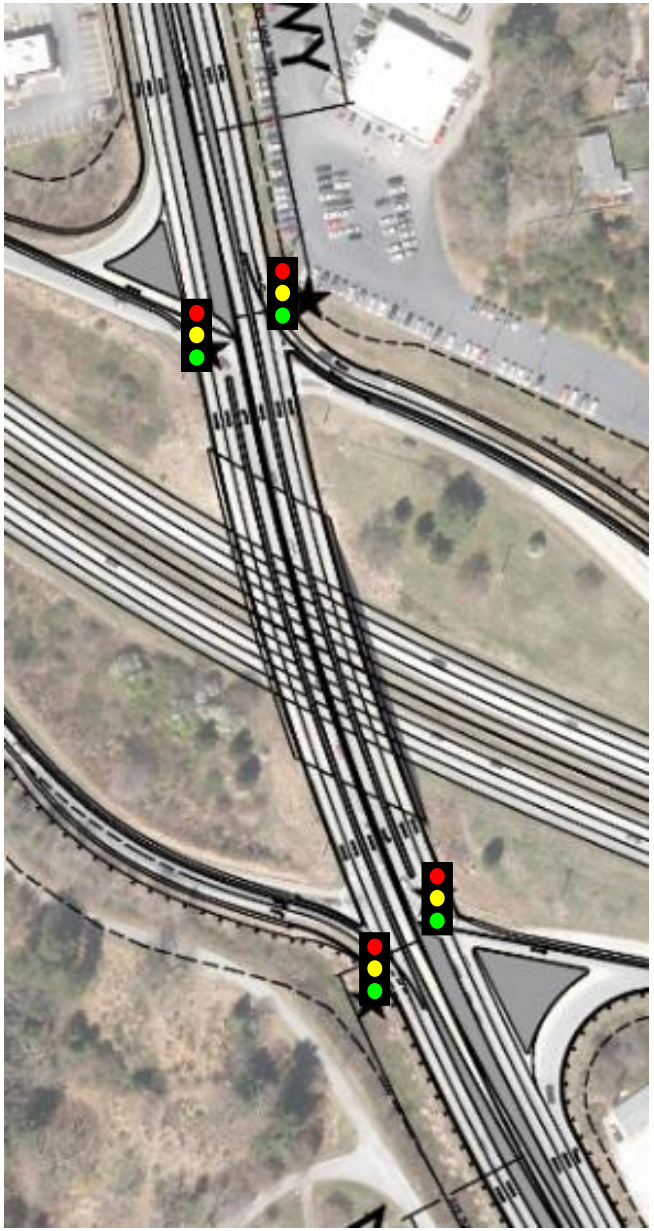
- Value Engineering
- Impacts
- Operations
- Roadway Network
- Volumes

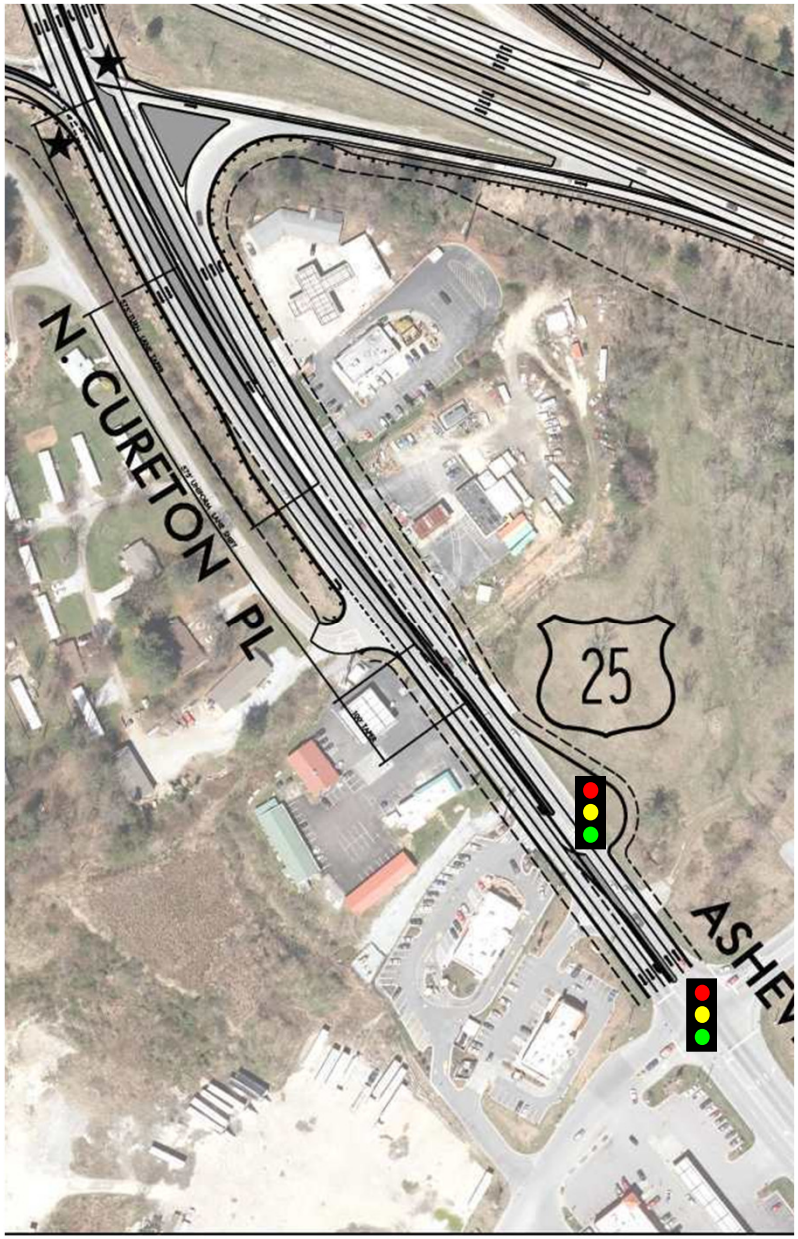


HNTB

Case Study: I-26 at US 25, Hendersonville, NC

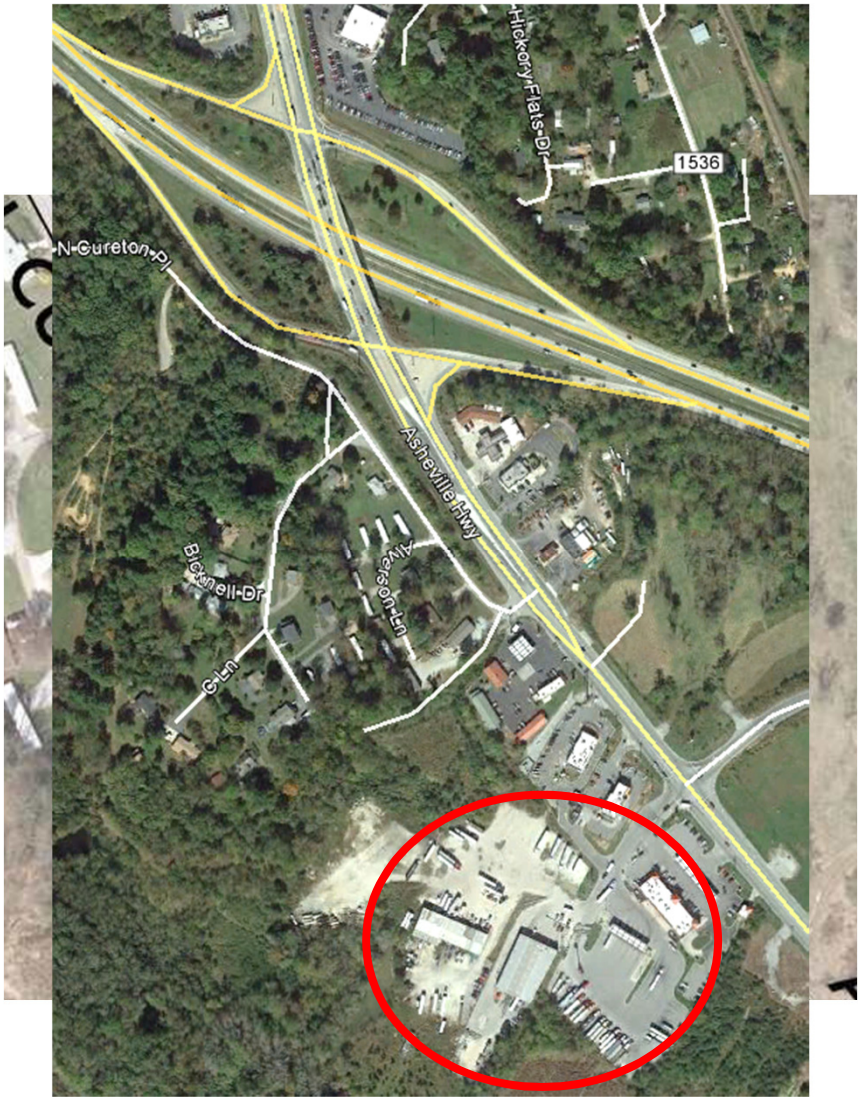






Considerations and Challenges

- New Interchange Form
- Modifies Existing Access
- U-turn Locations
- Nearby Roadways
- Local Land Uses
  - Truck Stop



Network Measures of Effectiveness

Alternative Scenario	MOE							
	Vehicle Miles Traveled (VMT)		Vehicle Hours Traveled (VHT)		Mean System Speed (mph)		Total System Delay (Hours)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
No-Build (Diamond)	7233.0	7805.1	2303.5	2052.6	5.0	5.8	2186.7	1928.1
DDI	13888.0	13854.2	540.1	549.7	28.5	27.9	325.0	335.1
DLT	14253.2	14345.5	348.6	318.6	41.7	45.8	129.0	97.8
Partial Cloverleaf	14860.0	14853.7	309.2	310.6	48.9	48.7	74.6	75.8
Partial Cloverleaf (Design Exception)	14660.3	14656.8	305.9	303.5	48.8	49.1	74.0	71.7
Synchronized	14778.2	14716.0	329.0	335.5	45.7	44.7	95.5	103.1

Alternative Scenario	2040 Future Year Percent Improvement over Syncronized Intersection							
	Vehicle Miles Traveled (VMT)		Vehicle Hours Traveled (VHT)		Mean System Speed (mph)		Total System Delay (Hours)	
	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak	AM Peak	PM Peak
No-Build (Diamond)	-51%	-47%	600%	512%	-89%	-87%	2189%	1770%
DDI	-6%	-6%	64%	64%	-38%	-38%	240%	225%
DLT	-4%	-3%	6%	**-5%**	-9%	**2%**	35%	**-5%**
Partial Cloverleaf	**1%**	**1%**	**-6%**	**-7%**	**7%**	**9%**	**-22%**	**-26%**
Partial Cloverleaf (Design Exception)	-1%	0%	**-7%**	**-10%**	**7%**	**10%**	**-23%**	**-30%**

HNTB

Corridor Measures of Effectiveness

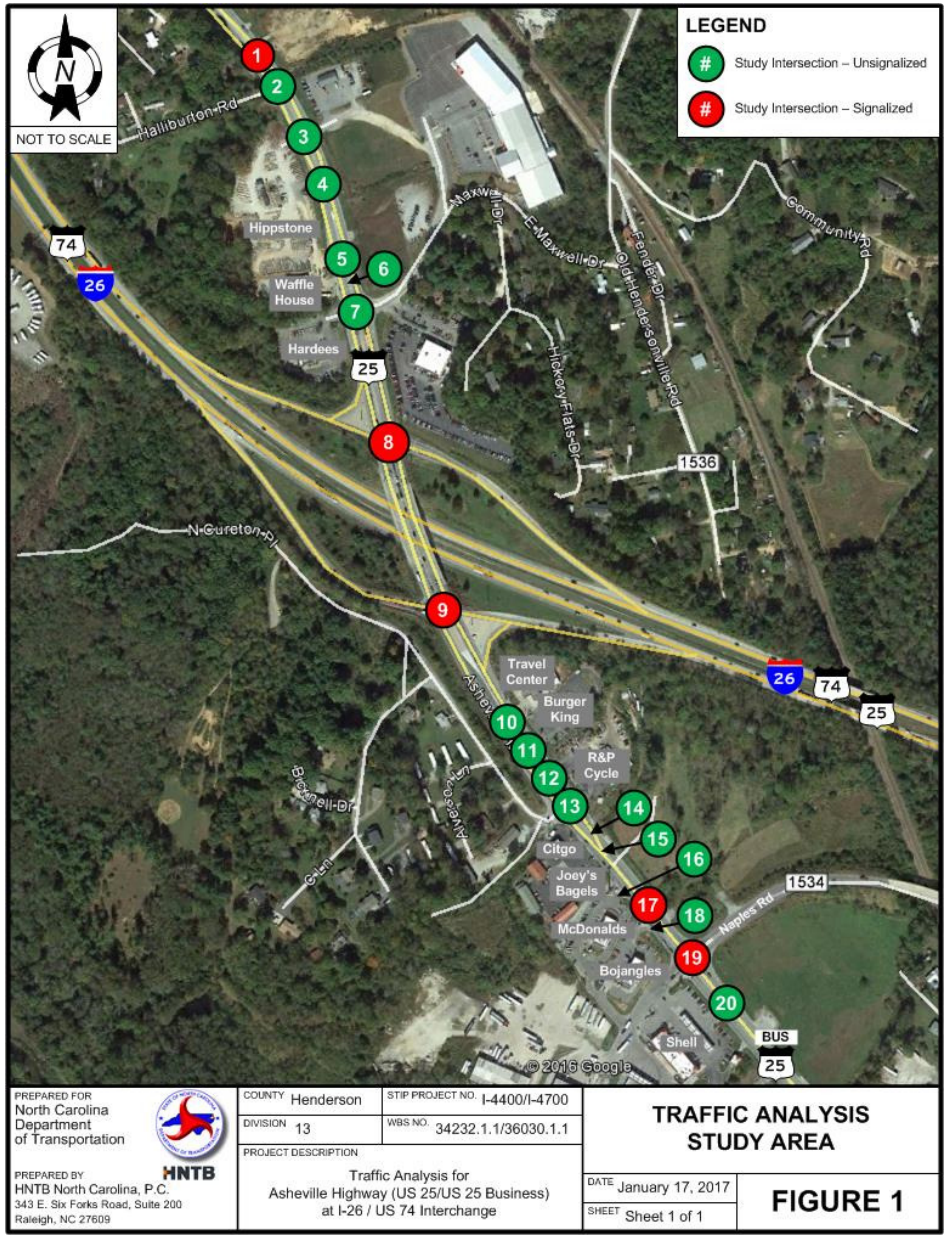
Alternative Scenario		MOE			
		Travel Time (min)		Trips	
		AM Peak	PM Peak	AM Peak	PM Peak
No-Build	NB	4.01	3.56	293	354
	SB	3.57	4.21	390	334
DDI	NB	3.35	2.79	393	479
	SB	3.14	3.70	427	346
DLT	NB	1.26	1.51	431	558
	SB	3.28	2.00	498	428
Partial Cloverleaf	NB	1.16	1.16	454	566
	SB				
Partial Cloverleaf (Design Exception)	NB				
	SB				
Synchronized	NB				
	SB				

Alternative Scenario		2040 Percent Improvement over Synchronized Interchange			
		Travel Time (min)		Trips	
		AM Peak	PM Peak	AM Peak	PM Peak
No-Build (Diamond)	NB	233%	231%	-35%	-37%
	SB	207%	193%	-31%	-24%
DDI	NB	179%	160%	-12%	-15%
	SB	170%	158%	-24%	-21%
DLT	NB	4%	40%	-4%	-1%
	SB	182%	39%	-11%	-2%
Partial Cloverleaf	NB	**-3%**	8%	**1%**	**1%**
	SB	19%	**-12%**	-1%	**1%**
Partial Cloverleaf (Design Exception)	NB	**-7%**	1%	0%	**1%**
	SB	17%	**-15%**	0%	0%

HNTB

Next Steps

- Detailed Evaluation
- Selection of Preferred Alternative
- More to Come!!!



Questions?

Bradley Reynolds (breynolds@hntb.com)
Elizabeth Harris (eaharris@hntb.com)

HNTB