DIVERGING DIAMOND INTERCHANGES

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2009 ACEC-KY/FHWA/KYTC Partnering Conference

Project Management Team

Federal Highways Administration

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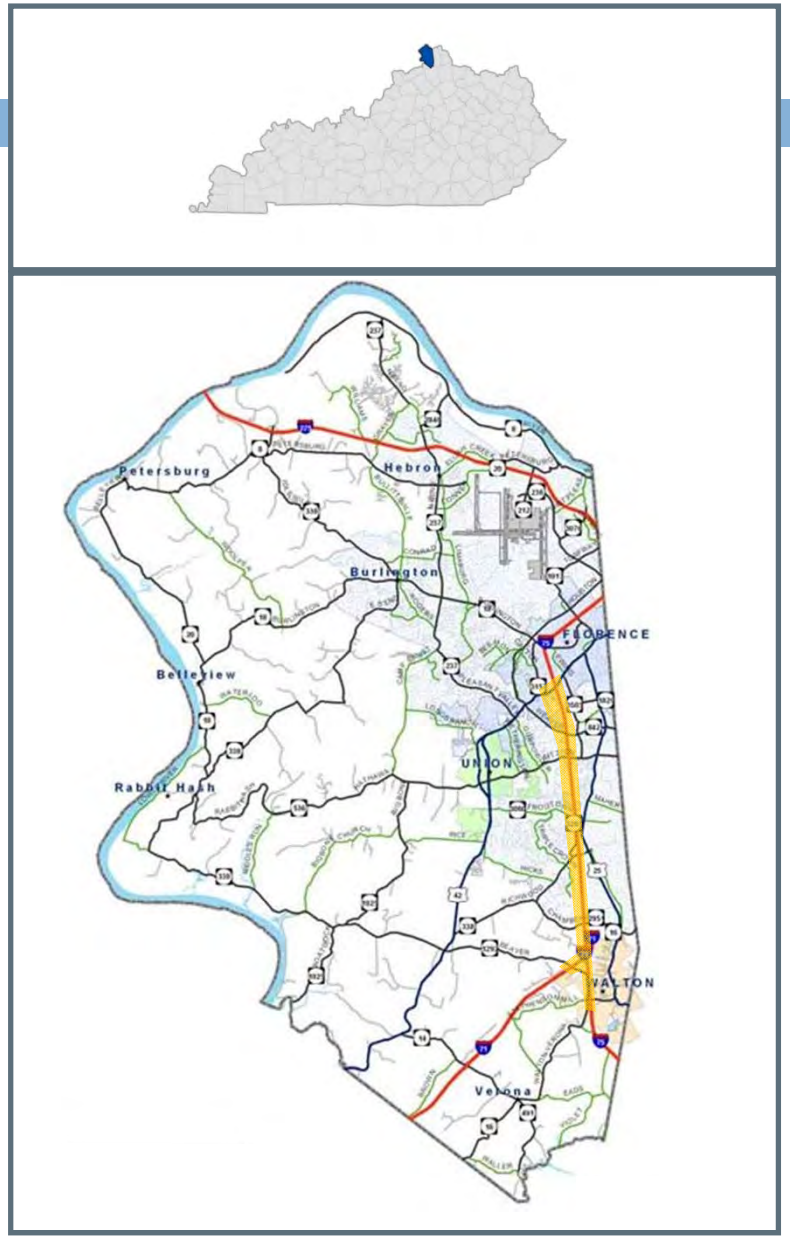
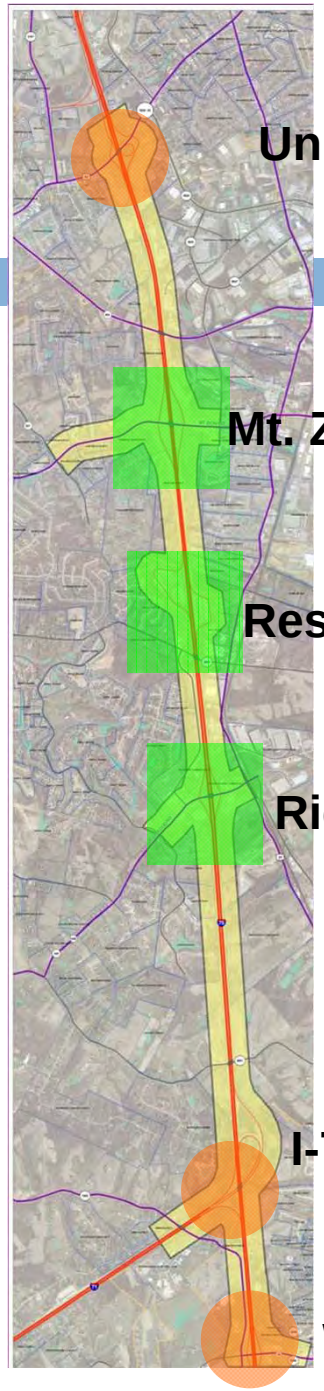
Study Area





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History

- Mt. Zion at I-75 interchange opened in 1994.
- Original traffic projections in 1994 on I-75 were 88,000 for year 2007.
- Within 5 years, traffic exceeded 88,000 ADT on I-75.
- 2006: 104,000 ADT on I-75
- 2006: 24,174 ADT on KY 536 (Mt. Zion Road)

Existing Geometry

Description	I-71/I-75 Mainline	KY 536 (Mt. Zion Road)
Functional Classification	Urban Interstate	Urban Arterial
Number of Lanes	3-4 in each direction	4
Posted Speed	70 mph	35-45 mph
Lane Width	12’	11-12’
Shoulder Width	14’-8”	6’-8’
Maximum Grade	2.75%	4.00%
Non-Passing Sight Distance	689’	537’

Land Use

Table 1. Existing (2007) Land Use within the Study Area

Land Use	Approximate percentage	Approximate Acreage
Agricultural	19%	412
Commercial	2%	48
Industrial	6%	129
Public/Institutional	<1%	3
Recreational	<1%	10
Residential	21%	468
Transportation	47%	1,057
Woodlands	4%	86

Table 2. Future (2030) Land Use within the Study Area

Land Use	Approximate percentage	Approximate Acreage
Commercial	4%	77
Developmentally sensitive*	1%	23
Industrial	17%	389
Public/Institutional	<1%	3
Recreational	<1%	7
Residential	44%	977
Rural land**	<1%	2
Transportation	33%	735

* can include areas with an existing slope which limits urban development
**can include wooded, agricultural, recreation or low density residential areas

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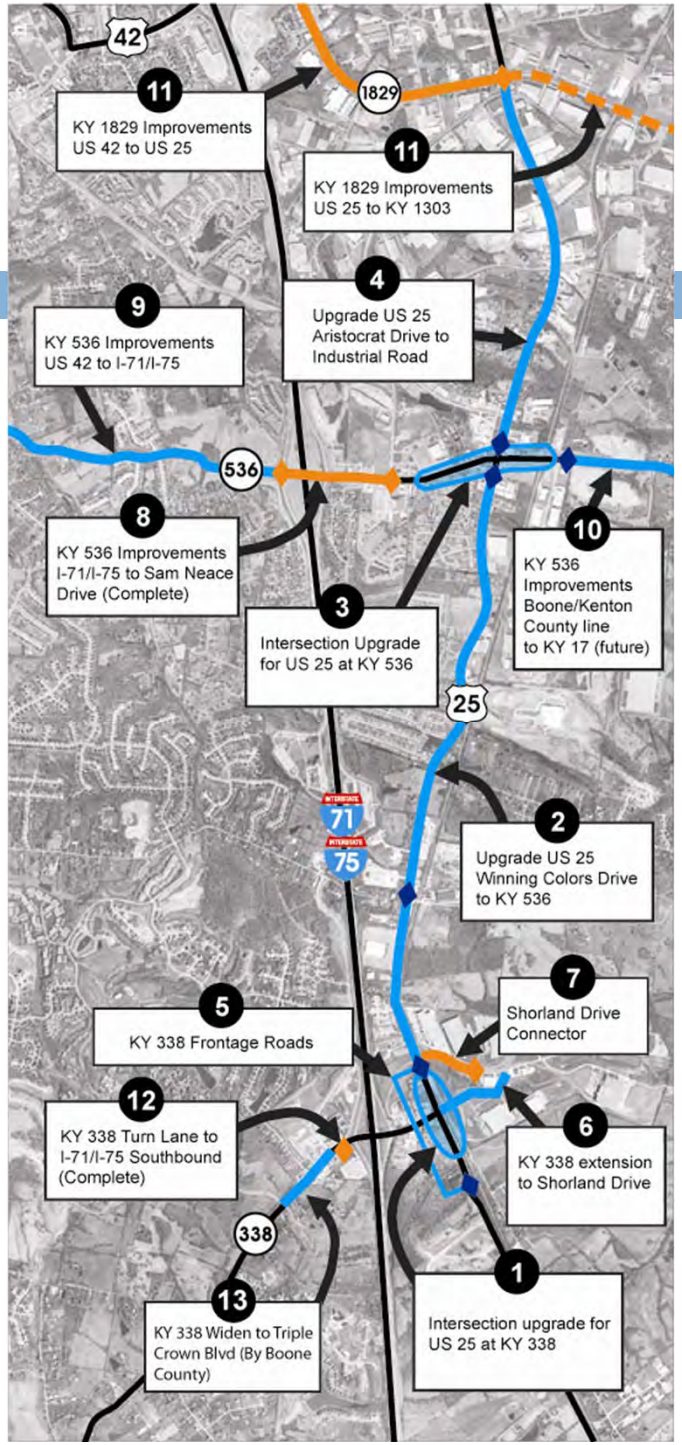
Related Projects/Studies



Ongoing Construction/
Recently Completed

Future Construction

In Design

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Public Involvement

- The project team held 3 Stakeholder Advisory Council (SAC) Meetings consisting of:
  - Federal Highway Administration (FHWA)
  - Kentucky Transportation Cabinet (KYTC)
  - Northern Kentucky Area Planning Commission
  - Northern Kentucky Chamber of Commerce
  - Northern Kentucky Tri-County Economic Development Corporation
  - Ohio-Kentucky-Indiana Regional Council of Governments (OKI)
  - Transit Authority of Northern Kentucky (TANK)
  - Boone County Administration
  - Office of Judge Executive
  - Boone County Planning Commission
  - Boone County Public Works
  - City of Florence
  - City of Union
  - City of Walton
  - Norfolk Southern Corporation
  - Local Citizens and Business Leaders

Traffic - Existing Conditions

- 24 hour tube counts
- Turning movements at Peak Hours
- Existing signal timing
- Crash Data
- Evaluation using
  - HCS: capacity
  - Synchro: signal timing
  - Paramics: micro-simulation and visualization

Traffic Projections

- 3 Sources
  - OKI Travel Demand Model
  - Boone County Transportation Plan
  - Other design documents
- Result: annual growth rate=3.5%

Alternatives

No Build

1 – Additional Lanes to Existing Diamond

2 – Eastbound/Northbound Loop Ramp

3 – Eastbound/Northbound & Southbound/ Eastbound Loop Ramps

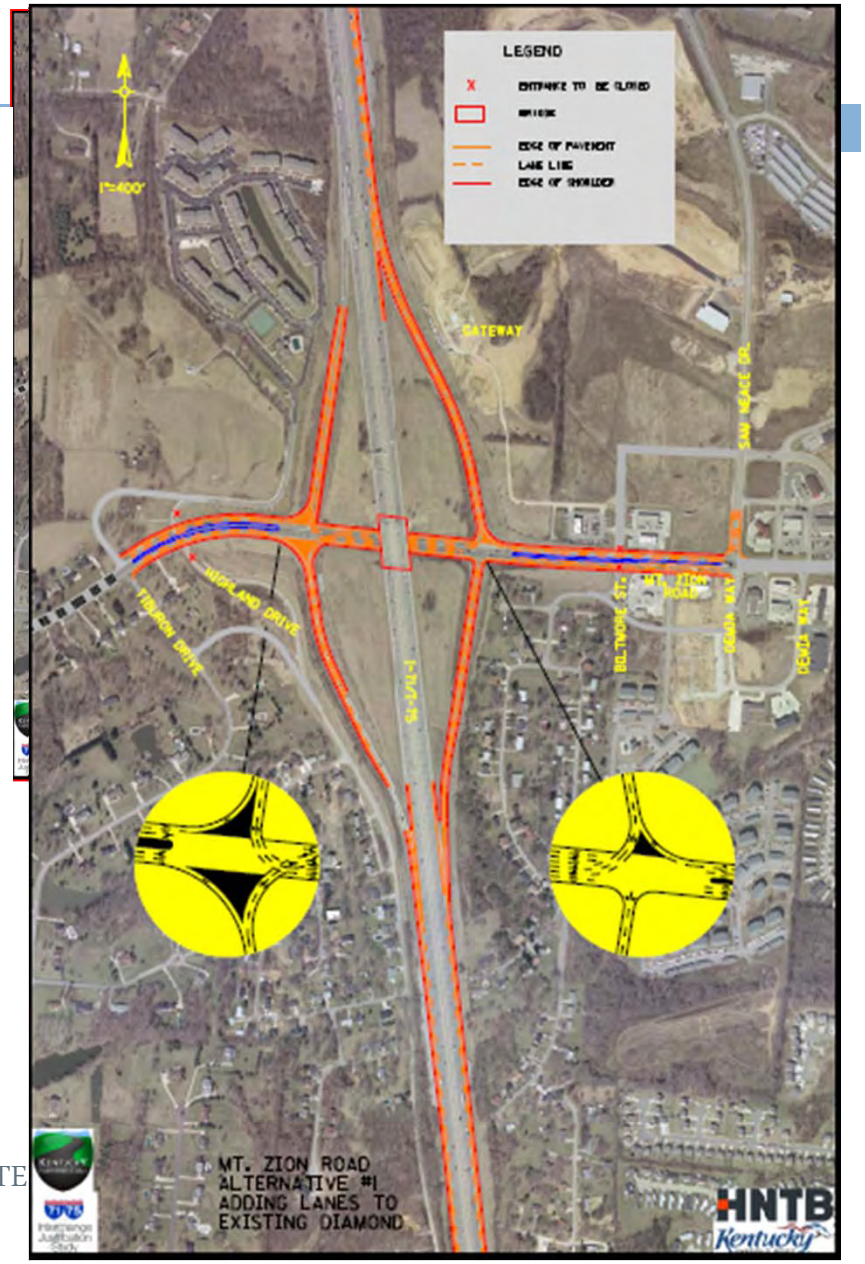
4 – Partial Cloverleaf

5 – Diverging Diamond Interchange (DDI)

6 – Single Point Urban Interchange (SPUI)

7 – Double Roundabout

8 – Directional Fly-Over



Evaluation Criteria

Financial Measures
Construction Costs
Right of Way Costs
Safety Benefits
Improvements to High Accident Locations
Acceleration
Conflict Points
Improves Incident Management
Levels of Service/ Mobility
Improves Travel Time (Capacity Constraints)
Freeway LOS & V/C
Local LOS & V/C
Suitable Local and Interstate Truck Access

Design
Efficient with Heavy Truck Volumes
Meets Current Design Standards
Provides for Pedestrians
Socioeconomic - Environmental
Relocations
Access to/from Community Facilities
Access to/from Businesses
Natural Areas
Noise/Air Quality
Access to Public Transportation

Equity (Environmental Justice)
Equitable Distribution of Benefits
Equitable Distribution of Impacts
Implementation
Schedule
Maintain Traffic on KY 536
Maintain Traffic on I-75

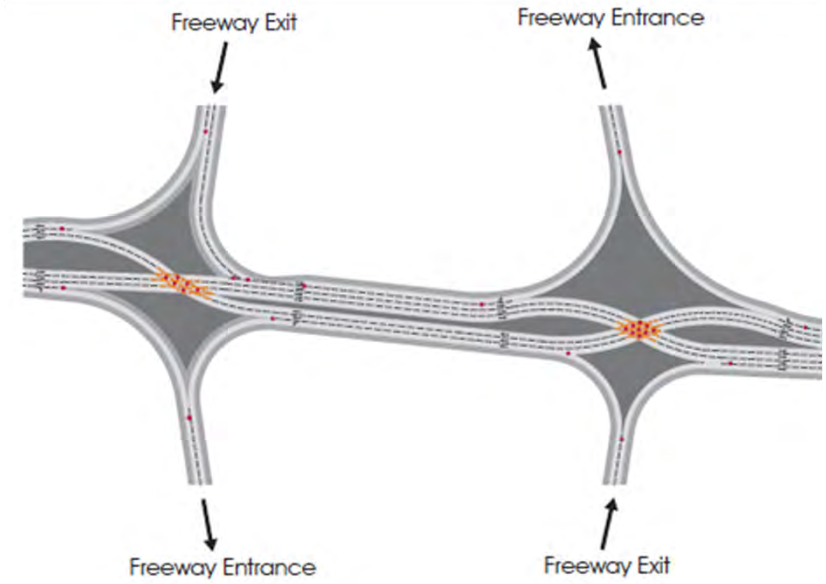
Traffic Comparison

- LOS C = Desired
- LOS D = Minimum Acceptable
- Targeting a V/C< 1.0

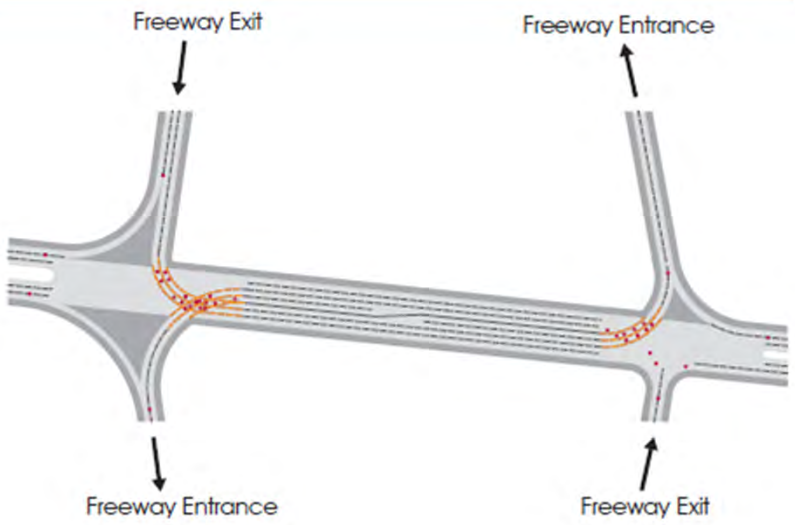
		Traditional Widening (9 lanes)		Diverging Diamond Interchange (8 lanes)	
		West	East	West	East
Mt. Zion	AM	C	B	B	B
MT. Zion	PM	C	B	B	B

Safety Comparison

Diverging Diamond - 29 Conflict Points



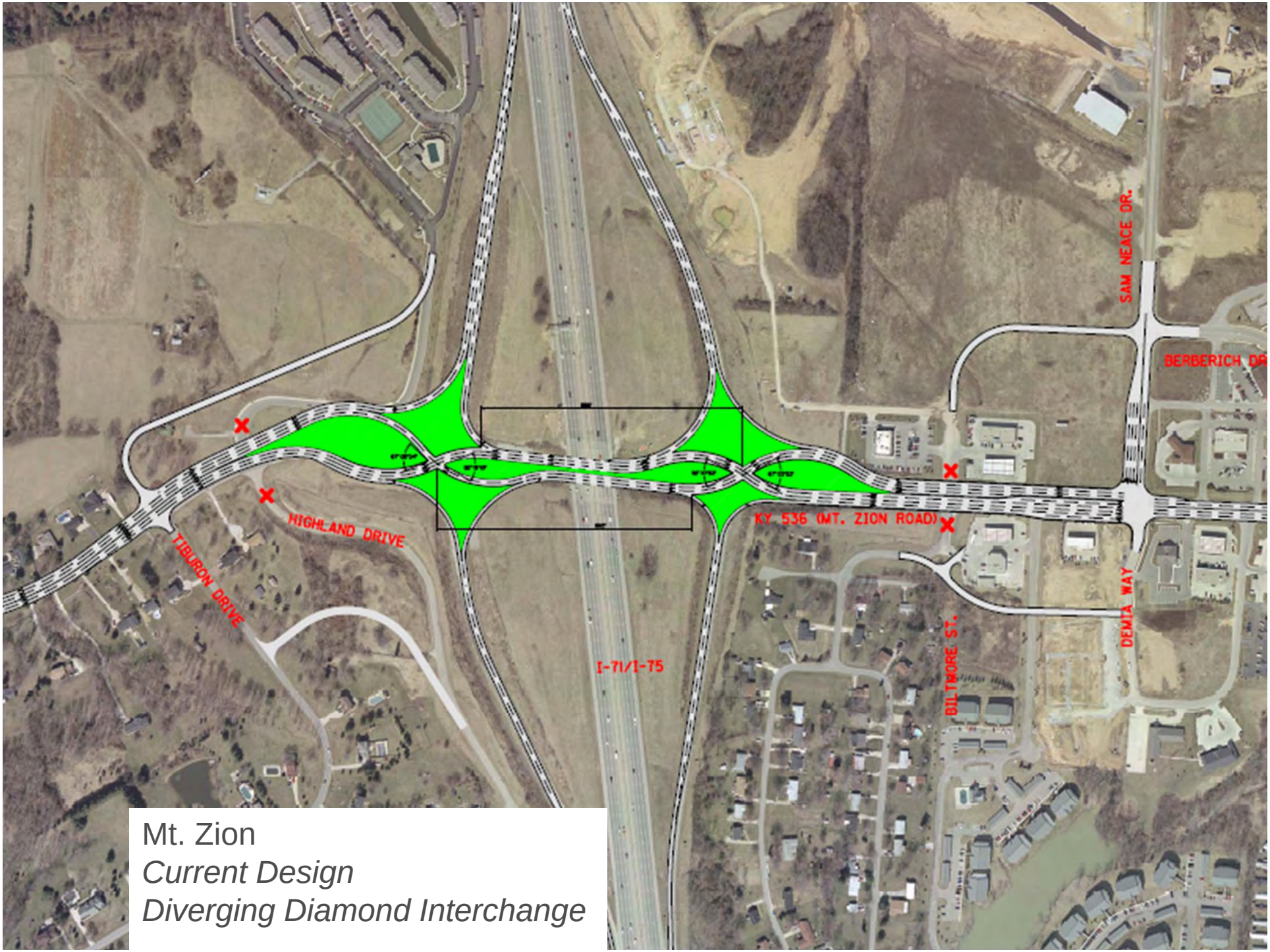
Traditional Widening – 36 Conflict Points



Construction Cost

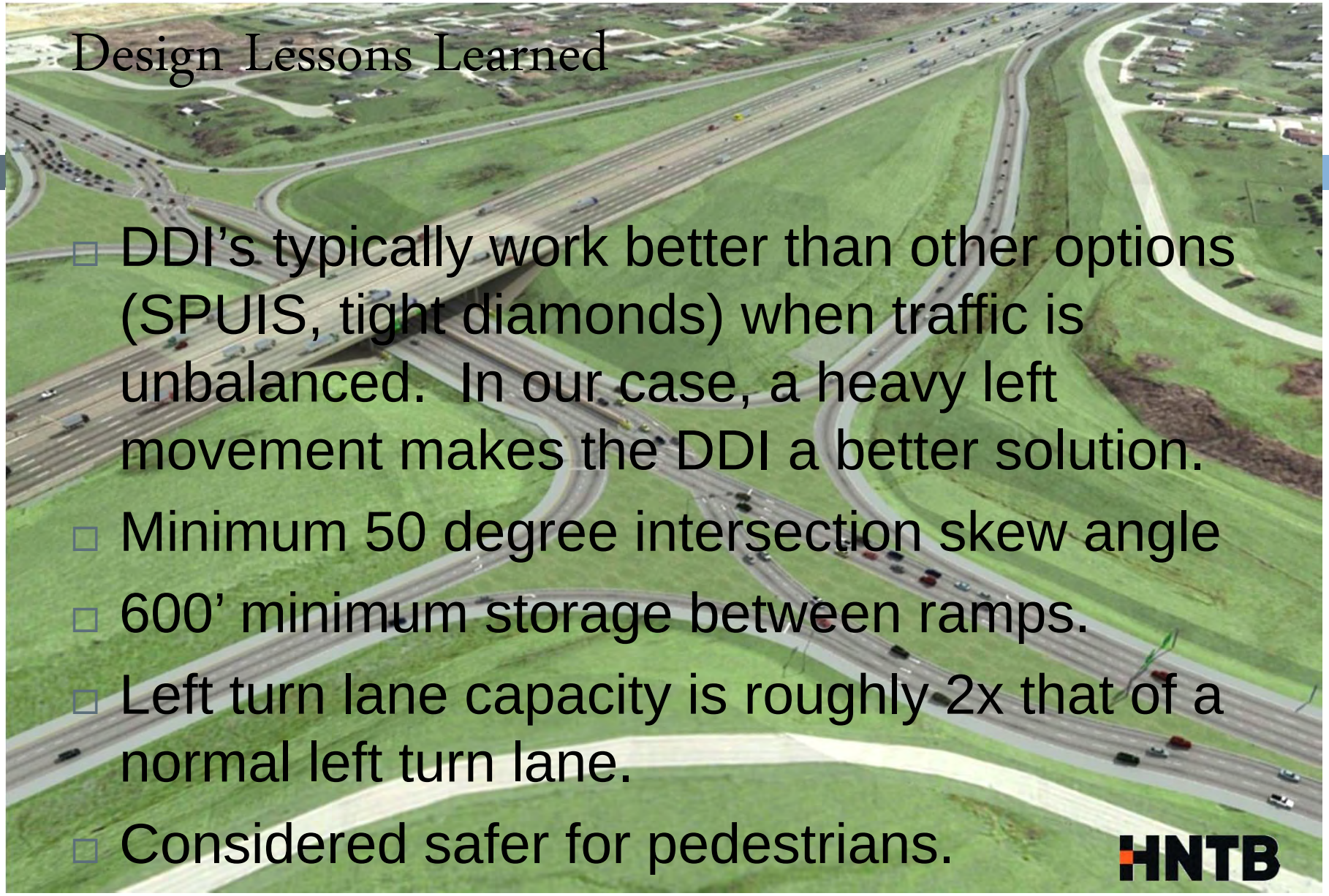
- Traditional Widening
  - Construction = $23M
  - ROW = $2.9M
  - Utilities = $1.8M
- Diverging Diamond
  - Construction = $16M
  - ROW = $2.9M
  - Utilities = $1.8M

Cost Difference = $7M



Mt. Zion
Current Design
Diverging Diamond Interchange

Design Lessons Learned



- DDI's typically work better than other options (SPUIS, tight diamonds) when traffic is unbalanced. In our case, a heavy left movement makes the DDI a better solution.
- Minimum 50 degree intersection skew angle
- 600' minimum storage between ramps.
- Left turn lane capacity is roughly 2x that of a normal left turn lane.
- Considered safer for pedestrians.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Thank you