


US16/US16B/Catron Boulevard Intersection Evaluation and Screening Process

- 
- **Step 1:** Intersection type: SPI Build Options vs. DLT Build Options
 - **Step 2:** Sub-option review to determine if any can be screened out
 - **Step 3:** US16 northbound/southbound right turn treatment at US16B/Catron Boulevard:

Consultant Recommendation: technical recommendation of Build Option to carry forward into the NEPA process (environmental study)

The self-paced slides highlight key findings throughout process to provide an overarching summary of the process used to develop the Consultant Recommendation. Please reach out to a study representative if you are interested in discussing these items in greater detail.

Step 1: *Safety*

Predictive Safety Analysis – predicted reduction in crashes by implementing the proposed Build Option improvements.

Fatal & Injury Crashes

Addison & Tucker Access	1. SPI	2. DLT	No-Build
Closed	30-33% reduction	-	Baseline (355 crashes)
Open	-	18% reduction	

Total Crashes

Addison & Tucker Access	1. SPI	2. DLT	No-Build
Closed	24-27% reduction	-	Baseline (965 crashes)
Open	-	9-11% reduction	

Step 1: *Safety*

Findings:

- SPI: 1.5 to 2x greater reduction in expected crashes than DLT Build Options
- SPI: 1 to 2 fewer Fatal & Injury crashes per year than DLT Build Options

SPI Key Safety Features:

- US16 NB/SB free movement over single point intersection
- US16 merge/diverge points instead of crossing conflicts
- Reduces high severity right-angle conflicts
- Addresses weather-related safety concerns associated with fog, ice, and downgrade into a signalized intersection
- High-capacity interchange provides a safe and efficient means to distribute high volumes of traffic throughout area

Step 1: **US16/US16B/Catron Blvd Intersection Operations**

Overall Intersection Delay and LOS – average delay (sec) of all vehicles entering the intersection/interchange based on forecasted Year 2050 traffic volumes.

Overall Intersection Delay

US16 NB/SB Right Turn Treatment	1. SPI AM / PM	2. DLT AM / PM	No Build AM / PM
Free Right Turns	22 / 18 B / B	29 / 32 C / C	75 / 137 E / F
Signalized Dual Right Turns	24 / 27 B / B	32 / 37 C / D	

Step 1: *US16/US16B/Catron Blvd Intersection Operations*

Findings:

- SPI: 7 to 13+ seconds less intersection delay per vehicle than DLT Build Options
 - SPI best manages high traffic volumes (PM peak hour, seasonal fluctuations, etc.)
- DLT: near or exceeding study delay threshold of acceptability by Year 2050
 - DLT 2.2 and 2.3 exceeds threshold by Year 2050

SPI Key Intersection Operations Features:

- US16 NB/SB free movements over single point intersection
 - Zero (0) delay for high-volume US16 through traffic
 - Improves functionality and operation of a signalized, single point intersection
 - US16 diverge/merge locations to/from ramps for turning US16 traffic

Step 1: **US16 Corridor Travel Time**

Corridor Travel Time – average travel time (sec) of all vehicles traversing a US16 segment based on forecasted Year 2050 traffic volumes.

US16 Corridor Travel Time

US16 Segment	1. SPI	2. DLT
Moon Meadows Dr to Promise Rd	120 – 133 sec	139 – 158 sec

Findings and Key Differentiating Features:

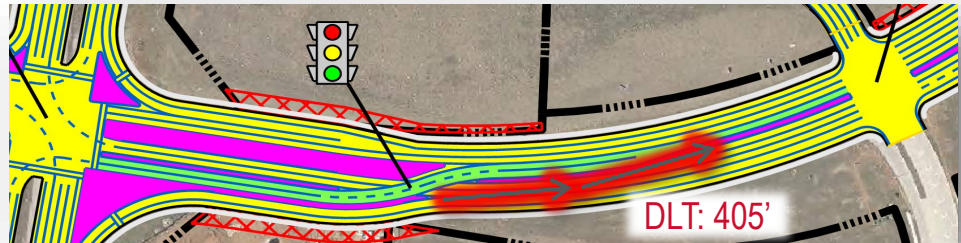
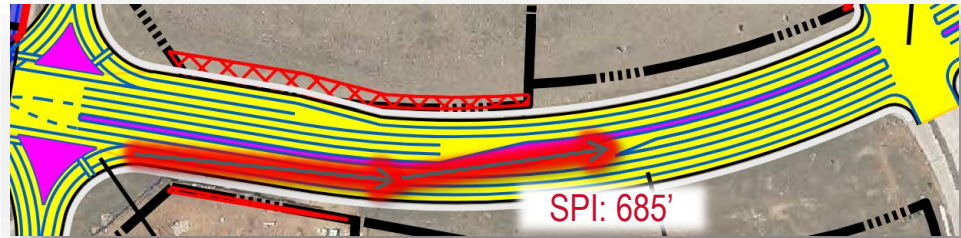
- SPI: provides least travel time for high-volume US16 northbound/southbound traffic
- DLT: additional travel time directly correlates to US16 delay at the DLT intersection
 - As DLT intersection congestion increases, delay for US16 travel increases

Step 1: *Closely Spaced Intersection Impacts*

US16 NB/SB right turn to downstream
Catron Blvd left turn weave conflicts

- NB US16 right turn to EB Catron Blvd
left turn weave distance
 - SPI: 685'
 - DLT: 405'

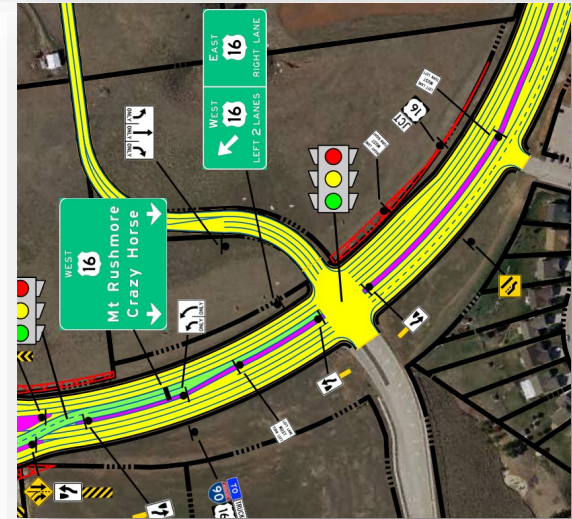
- DLT short weave distance impacts:
 - Traffic stops on 'free' right turn lane
 - Traffic turbulence during weave area
 - Signalizing dual right turn lanes does not
meet study goals for intersection delay



Step 1: *Closely Spaced Intersection Impacts*

During high volumes, traffic congestion expected to spill back through DLT closely spaced intersections

- Westbound crossover queues extend back to Healing Way intersection
 - Requires crossover 'turn lane' extended east of Healing Way
 - Results in an overlap of intersection lane change areas
- Westbound guide (green) sign placement conflicts
 - East of Healing Way, violates driver expectancy with an interim major intersection
 - West of Healing Way (shown in figure), short lane change distance with queued traffic conflicts

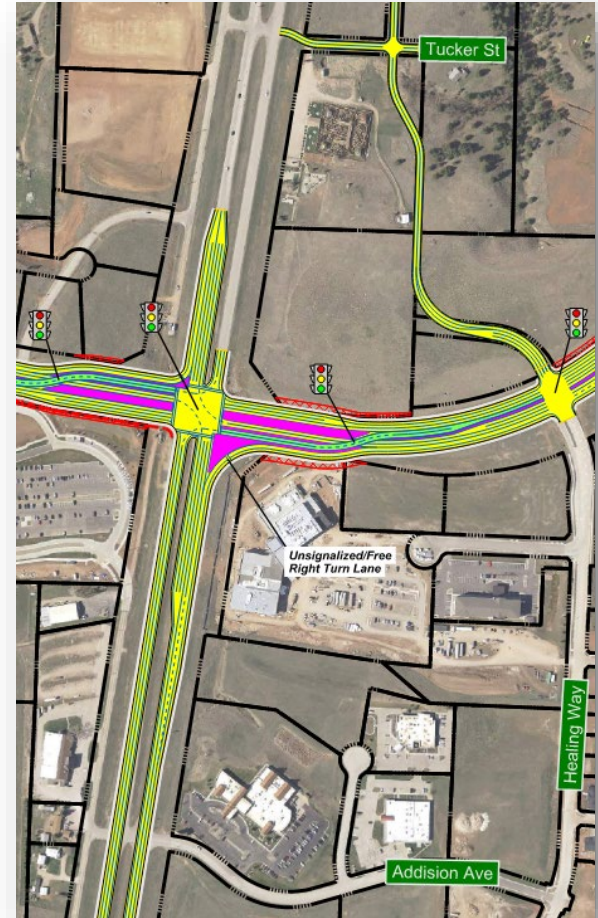


Step 1: **US16 Access**

DLT Build Options provide an opportunity to maintain access at Tucker St and Addison Ave. SPI ramps require closure of these access points.

Safety impacts of maintaining US16 access points

- SPI with access closures provides best overall safety performance
 - Turn and stopping conflicts removed from US16 mainline
- DLT scenarios evaluated with differing levels of access at Addison Ave and Tucker St
 - Closed: best DLT safety performance; considerably lower than SPI
 - Partial (left turn restrictions): middle DLT safety performance
 - Signalized: worst DLT safety performance



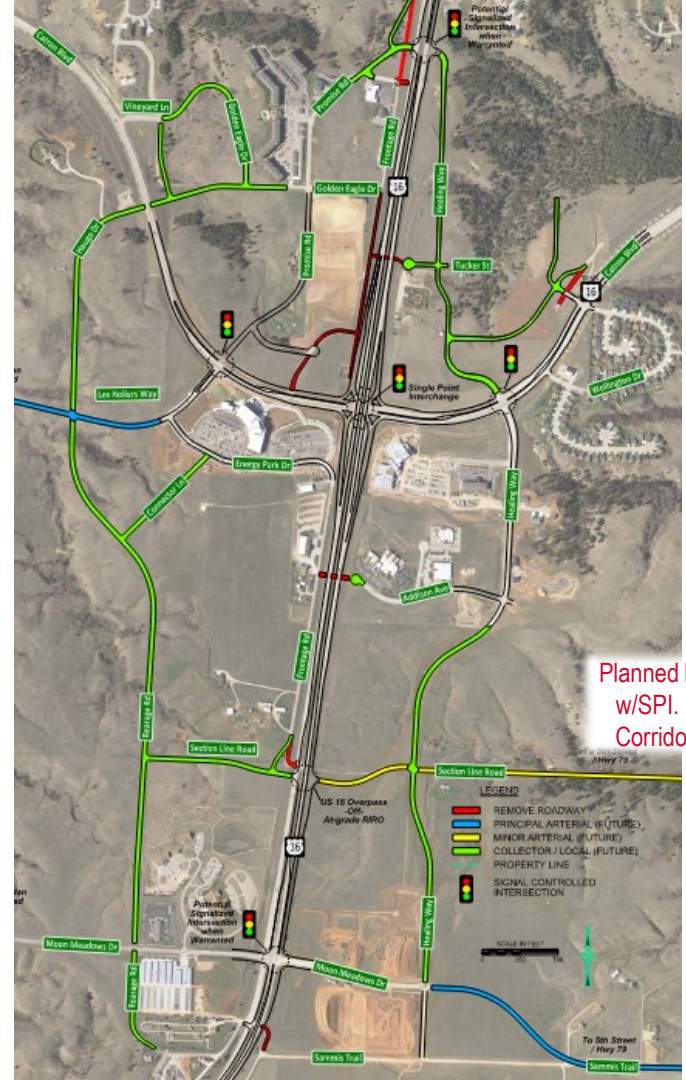
Step 1: *US16 Access*

Addison Avenue: US16 service road spacing with US16

- Existing spacing: 85'
- Design guideline: minimum 150' and desired 250'
- Potential future impacts of existing spacing:
 - Degraded US16 traffic operations and safety
 - Difficult to sign and control traffic

Leverage local network benefits and purpose

- Planned local network provides convenient, safe, and efficient connectivity.
- SPI provides key capacity and safety benefits to facilitate high turn volumes throughout area.

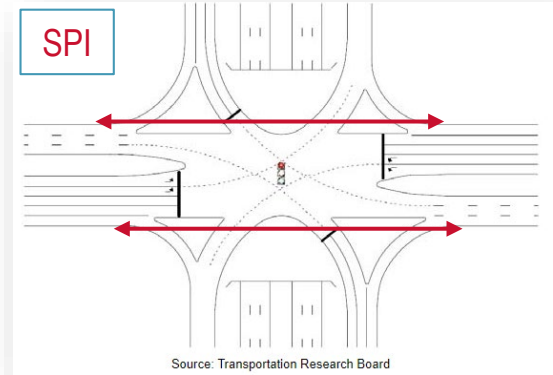


Planned local network w/SPI. See Urban Corridor for layout.

Step 1: *Bicycle and Pedestrian Considerations*

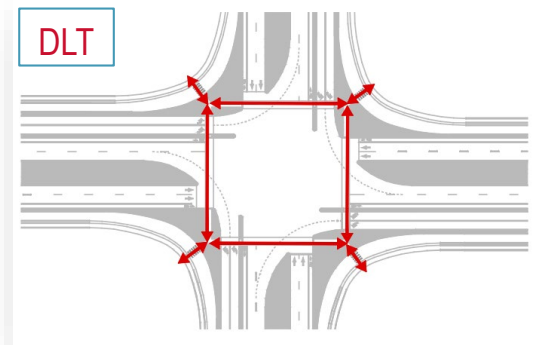
SPI

- Benefit: short crossing distances
 - Less exposure to pedestrians and minimal impact to signal timing
- Drawback: north/south crossings rerouted to Healing Way or Les Hollers Way intersections



DLT

- Benefit: main intersections provides for all crossing movements
- Drawback: long crossing distances
 - Greater exposure to pedestrians in crosswalk
 - Pedestrian-actuated 'WALK' indication will disrupt signal coordination with adjacent intersections
 - *Potential operational issues for several minutes during peak hours while traffic signal coordination synchs between DLT and adjacent intersections*



FHWA

Step 1: *Maintenance and Operations*

▪ Winter Maintenance

- DLT: Utah DOT experience notes similar to 2x as long as traditional intersection

▪ Traffic Signal Timing Maintenance

- SPI: fewer signals, less complex timing plans
- DLT: additional signals, very complex timing plans, maintaining coordination is imperative
 - Many agencies with DLTs designate dedicated staff for DLT maintenance
 - SDDOT and City of Rapid City do not currently have resources or staff to maintain signal timings at this type of complex intersection

▪ Roadway Maintenance

- SPI: includes additional infrastructure, but this cost was negligible in overall Benefit-Cost analysis
- DLT: More complex maintenance of traffic during lane closures and other maintenance activities

Step 1: **Construction Costs and Benefit-Cost Analysis**

A Benefit-Cost Analysis (BCA) was conducted using the same methodology as BUILD Discretionary Grant applications. A BCA attempts to monetize benefits to the greatest extent possible to assess feasibility (B/C ratio > 1.0) of a Project. Qualitative and quantitative analyses are also important components in the evaluation of Build Options.

Measure	1. SPI	2. DLT
Construction Cost *	\$31.1M – 32.4M	\$18.5M – 20.3M
Benefit – Cost Ratio *	1.32	1.34

** Note: SPI includes 0.75 miles additional US16 corridor reconstruction than DLT. With planned future reconstruction of US16 corridor, DLT savings in this estimate would lead to higher costs in the future corridor project.*

Step 1: *Conclusions*

SPI Build Option best meets the Project Purpose and Need

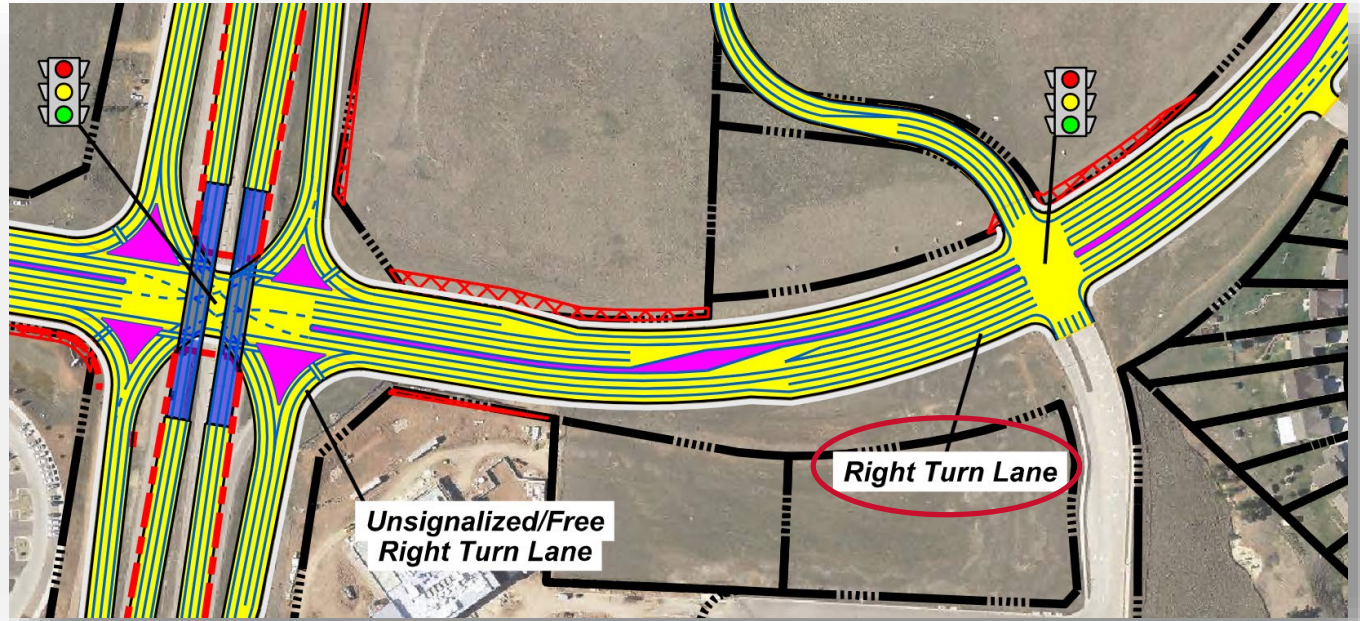
- **Best predicted safety performance**
 - Greatest reduction in predicted crashes, particularly high-severity Fatal & Injury crashes

- **Best traffic operations performance (with ties to safety)**
 - Least overall 'intersection' delay
 - Shortest and most reliable corridor travel time on both US16 and US16B/Catron Boulevard corridors
 - Best addresses closely-spaced intersection weave and queue spillback concerns
 - Provides familiarity for: driver expectancy, construction, maintenance, and operations.

- **Best accommodates urbanizing land use**
 - Provides the greatest long-term capacity to accommodate growing traffic volumes and seasonal fluctuations.

Step 2: *Sub-Option Review*

- Focus: SPI 1.1b
 - SPI 1.1a + EB right turn lane at Healing Way



Conclusion: Eliminate SPI 1.1b from further consideration due to

- Right turn lane not required for intersection operations
- Weave movement and lane change conflicts

Step 3: *US16 NB/SB Right Turn Lane Treatment*

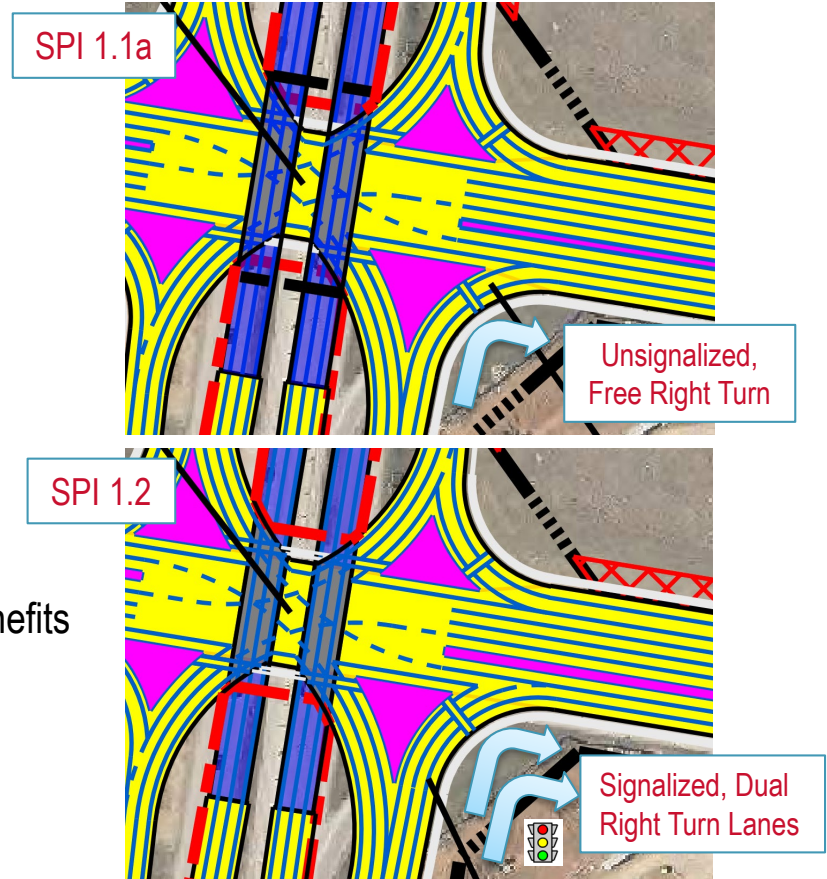
Focus:

- SPI 1.1a: free right turns
- SPI 1.2: dual, signalized right turns

Considerations

- SPI 1.1a provides best long-term traffic operations
- However, towards Year 2050...
 - Increased stops and delay on free right turn lanes
 - Dual right turn lanes provide operational and safety benefits

Consultant Recommendation...



Consultant Recommendation

SPI 1.1a with off-ramp grading/
pavement width to
accommodate dual
right turn lanes
shown in SPI 1.2.

Figure reflects
Consultant
Recommendation layout
and other
considerations. See
US16 Urban Area
section for discussion
on Promise Road and
Section Line Road.

