

# PROJECT BACKGROUND AND PROCESS

The Gore Hill Interchange has long been an concern to the Great Falls community due to issues with operations, geometrics, safety, and access. A high percentage of truck traffic uses the interchange due to the presence of multiple truck stops, the airport, the Montana Air National Guard, and other heavy use commercial and industrial areas. The intersections at the interchange are closely spaced and do not adequately accommodate queuing and large truck movements. Additionally, the interchange is spaced closely to the 10th Avenue South Interchange to the north which results in congested merge/diverge conditions. These issues are projected to compound in the future due to new development and increasing traffic volumes.



## I-15 Corridor Planning Study

The study identified recommendations to address the transportation needs of I-15 through Great Falls. Among the recommended improvement options were the addition of a southbound auxiliary lane between the 10th Ave S and Gore Hill Interchanges, and intersection improvements to the four intersections at the Gore Hill Interchange.

## Existing and Projected Conditions

A detailed analysis of existing physical features, land use, geometric conditions, safety concerns, and traffic characteristics was conducted to gain an understanding of the study area. Historic and projected conditions were then evaluated to help forecast future conditions and identify operational and safety needs through the year 2041.

## Recommended Improvements

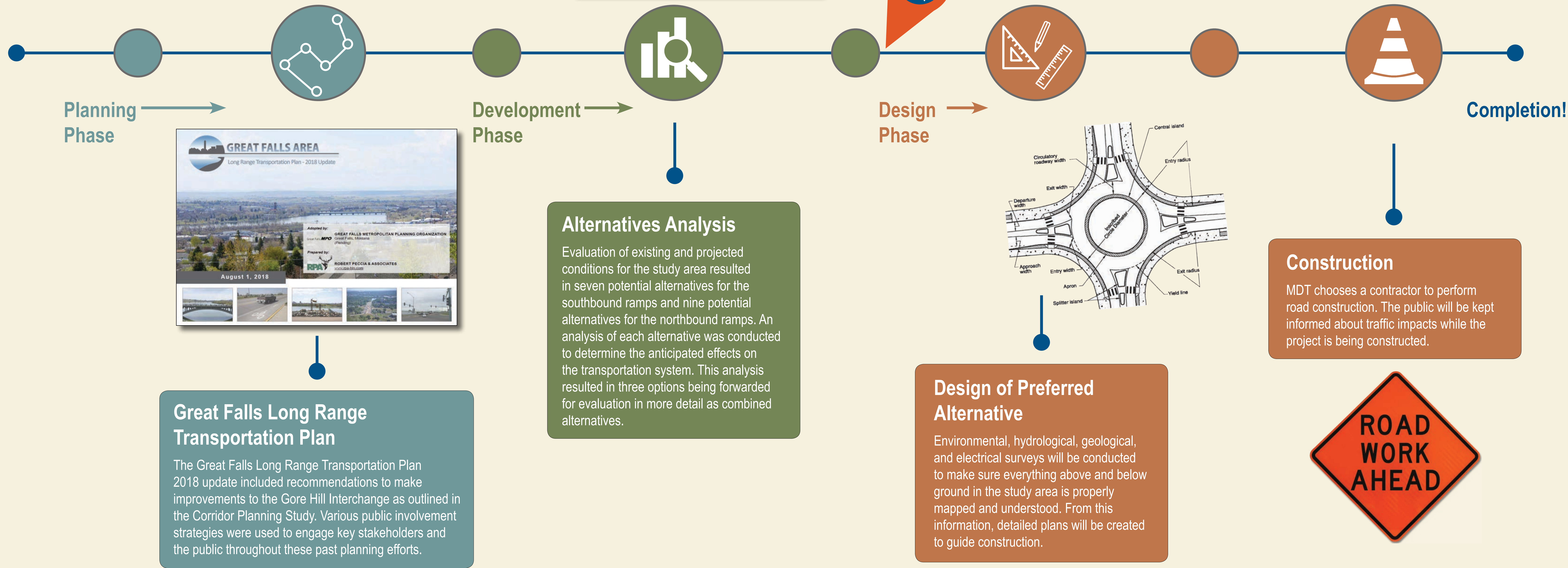
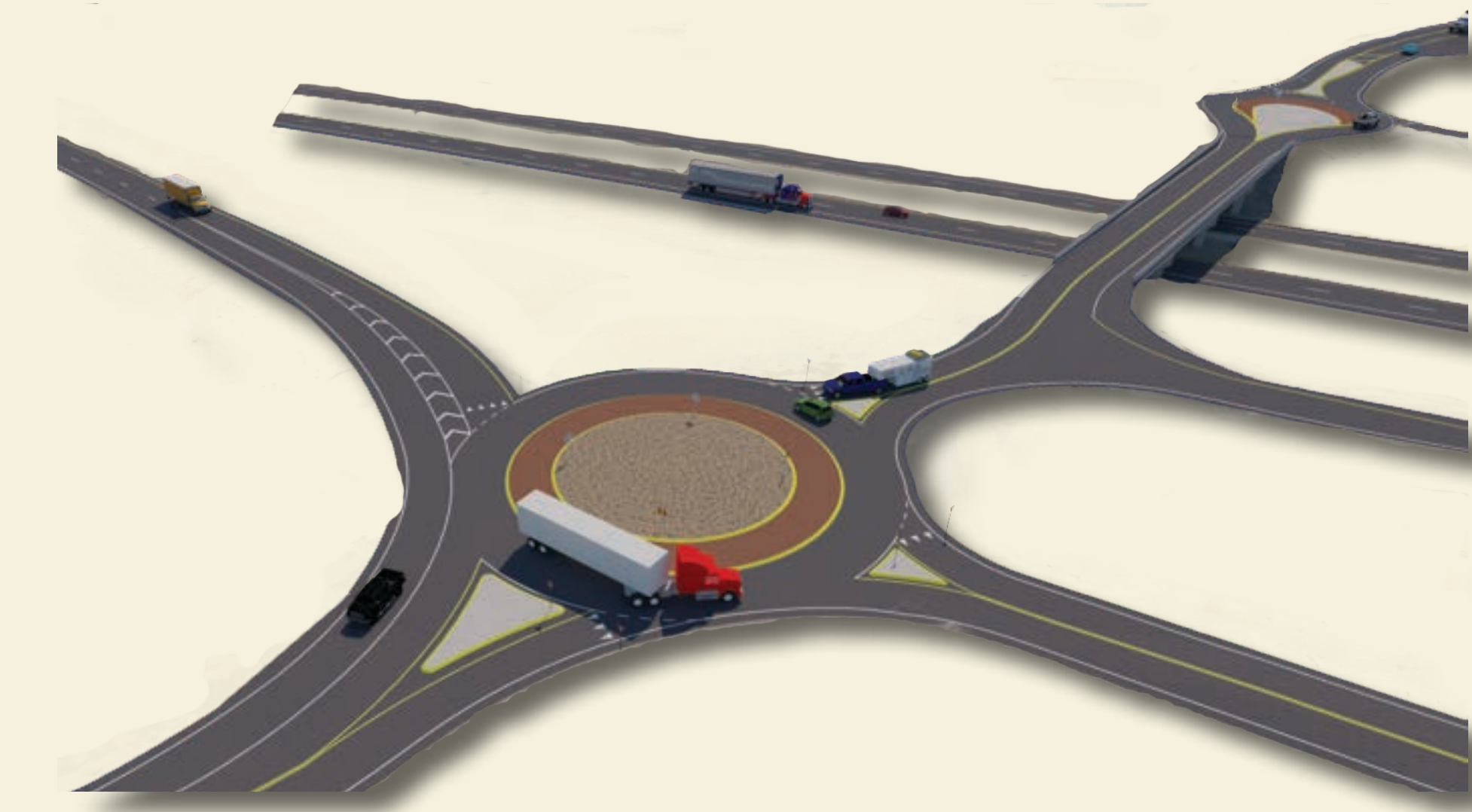
After thorough evaluation of feasible options, the Single-lane Roundabouts option was identified as the preferred alternative. It is also recommended that an auxiliary lane be constructed between the 10th Avenue South and Gore Hill Interchanges. These improvements are shown to address the operational and safety needs of the interchange while limiting costs and impacts.

## Right of Way

After detailed plans have been developed, MDT determines the amount of space required to build the right facility and amenities. MDT will apply for appropriate permits and finalize design plans.

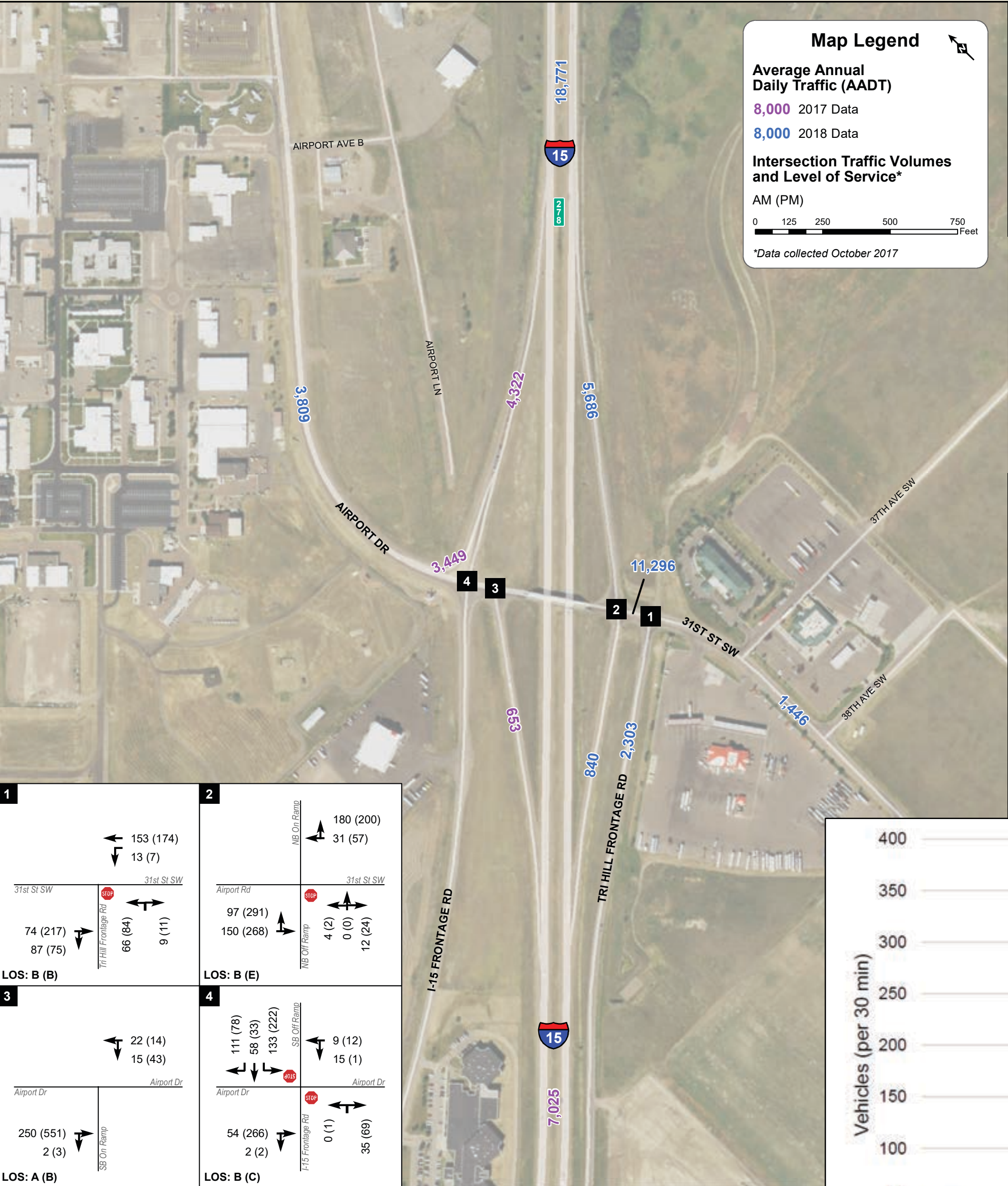
Option	NORTHBOUND RAMP			
	Intersection LOS (AM/PM)			
	I-15 NB Ramps/ 31st St SW	2017	2041	31st St SW/ Tri Hill Frontage Rd
NB-1: No Action	B/E	C/F	B/B	B/C
NB-2a: Eastbound Left-turn Lane on Bridge	B/E	C/F	B/B	B/C
NB-2b: Eastbound Left-turn Bay and Westbound Right-turn Slip Lane	B/D	C/F	B/B	B/C
NB-3a: Southbound Left-turn Lane on Bridge with Signal Control	A/A	A/A	B/B	B/C
NB-3b: Traffic Signal with Frontage Road Re-routed to South	A/A	A/A	B/B	B/C
NB-4a: Four-leg Roundabout with Frontage Road in Place	A/A	A/B	B/B	B/C
NB-4b: Four-leg Roundabout with Frontage Road Re-routed to South	A/A	A/B	B/B	B/C
NB-4c: Dual Lane Four-leg Roundabout with Frontage Road Rerouted to South	A/A	A/A	B/B	B/C
NB-5: Five-leg Roundabout	A/A	A/C	--	--

Option	SOUTHBOUND RAMP			
	Intersection LOS (AM/PM)			
	I-15 SB Off Frontage Rd/ Airport Dr	2017	2041	I-15 SB On Airport Rd
SB-1: No Action	B/D	B/F	A/B	A/B
SB-2a: Two-lane Exit with Stop Control	B/D	B/F	A/B	A/B
SB-2b: Two-lane Exit and Two-Lane Airport Drive with Stop Control	B/C	B/F	A/B	A/B
SB-3: Traffic Signal	B/B	B/D	A/B	A/B
SB-4a: Four-leg Roundabout	A/A	A/C	A/B	A/B
SB-4b: Dual Lane Four-leg Roundabout	A/A	A/A	A/B	A/B
SB-5: Five-leg Roundabout	A/A	A/C	--	--





EXISTING CONDITIONS

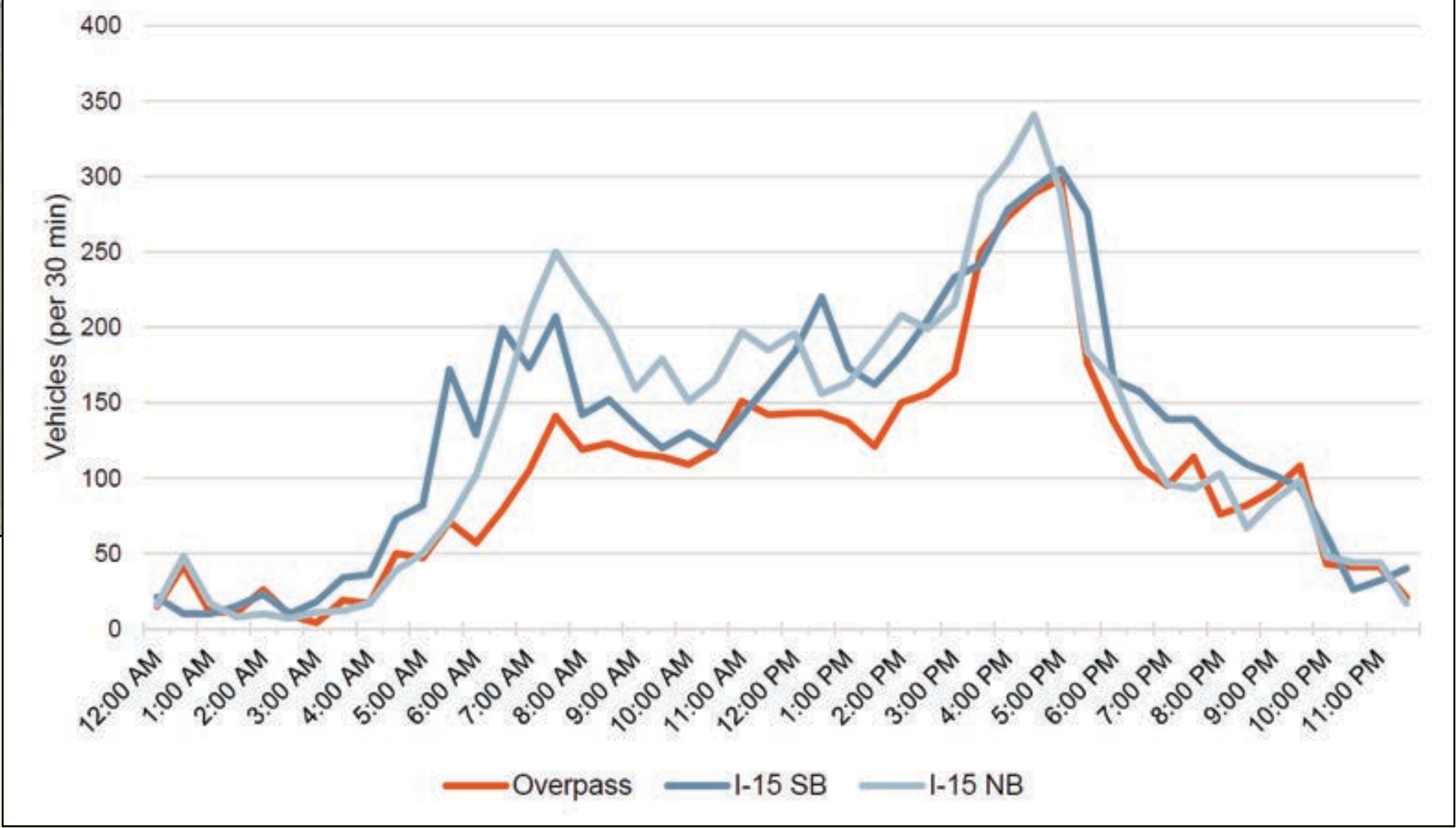


EXISTING TRAFFIC CONDITIONS

EXISTING INTERSECTION OPERATIONS (2017)

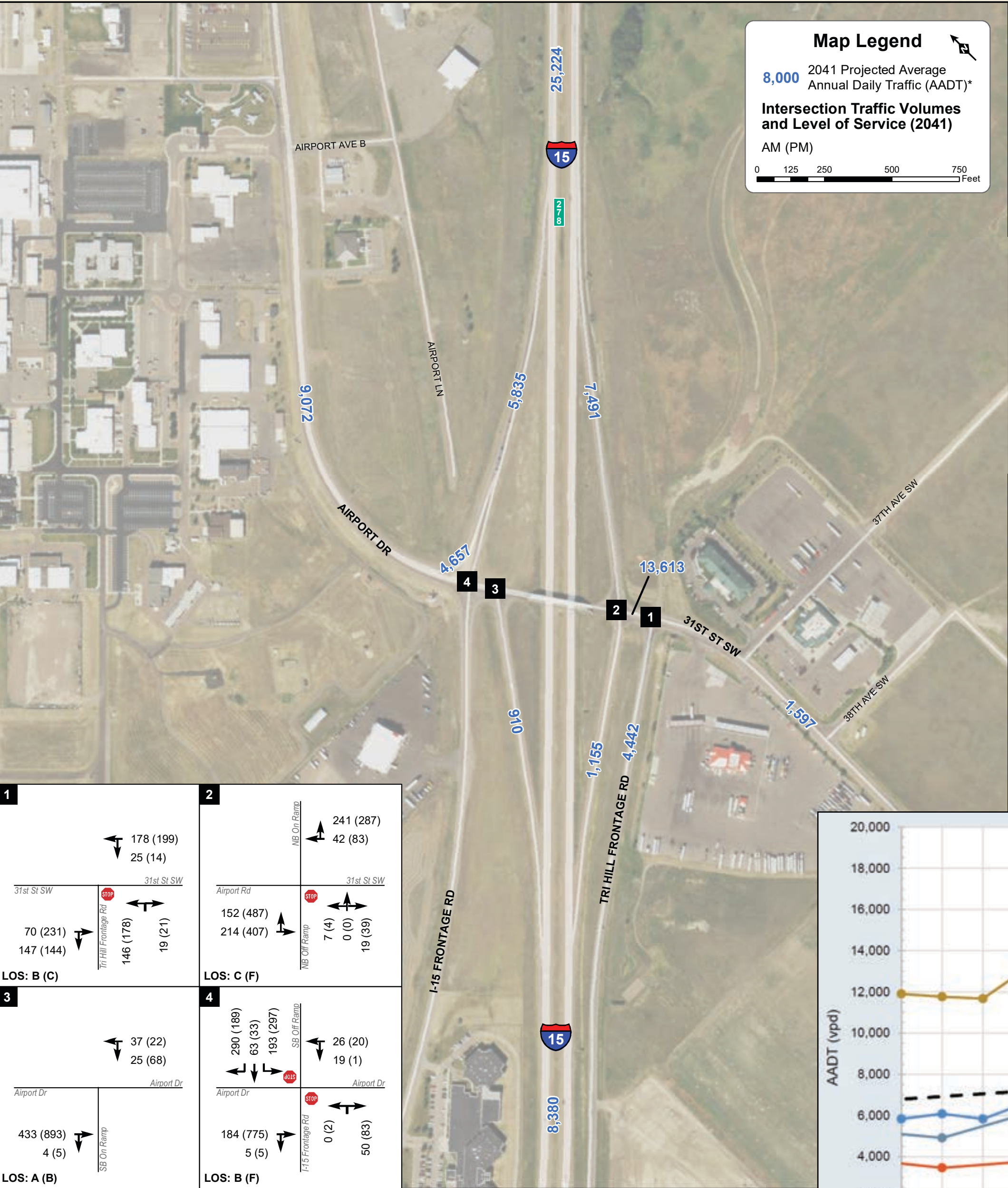
Intersection	AM Peak Hour			PM Peak Hour		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
1 Tri Hill Frontage/31 <sup>st</sup> St SW	11.3	0.11	B	12.9	0.16	B
1 Northeast bound	11.3	0.11	B	12.9	0.16	B
1 Northwest bound	7.8	0.01	B	8.1	0.01	A
1 Southeast bound	0.0	0.00	A	0.0	0.00	A
2 31 <sup>st</sup> St SW/I-15 NB On/Off	14.8	0.00	B	38.4	0.02	E
2 Northeast bound	14.8	0.02	B	38.4	0.05	E
2 Northwest bound	0.0	0.00	A	0.0	0.00	A
2 Southeast bound	8.1	0.08	A	8.9	0.27	A
3 Airport Drive/I-15 SB On	8.9	0.02	A	10.2	0.07	B
3 Northwest bound	8.9	0.02	A	10.2	0.07	B
3 Southeast bound	0.0	0.00	A	0.0	0.00	A
4 Airport Drive/I-15 Frontage Rd/I-15 SB Off	11.2	0.23	B	19.6	0.51	C
4 Northeast bound	10.9	0.05	B	12.4	0.11	B
4 Southwest bound	11.2	0.23	B	19.6	0.51	C
4 Northwest bound	7.4	0.01	A	7.9	0.00	A

24-HOUR TRAFFIC DISTRIBUTION



The northbound ramps intersection is shown to operate at a failing level of service, particularly during the PM peak hour. The intersection with the southbound off-ramp experiences delay and operates at a LOS C during the PM peak. The poor operations are a result of limited gaps available for turning vehicles due to high volumes of vehicles traveling along Airport Drive/31st Street Southwest.

PROJECTED CONDITIONS

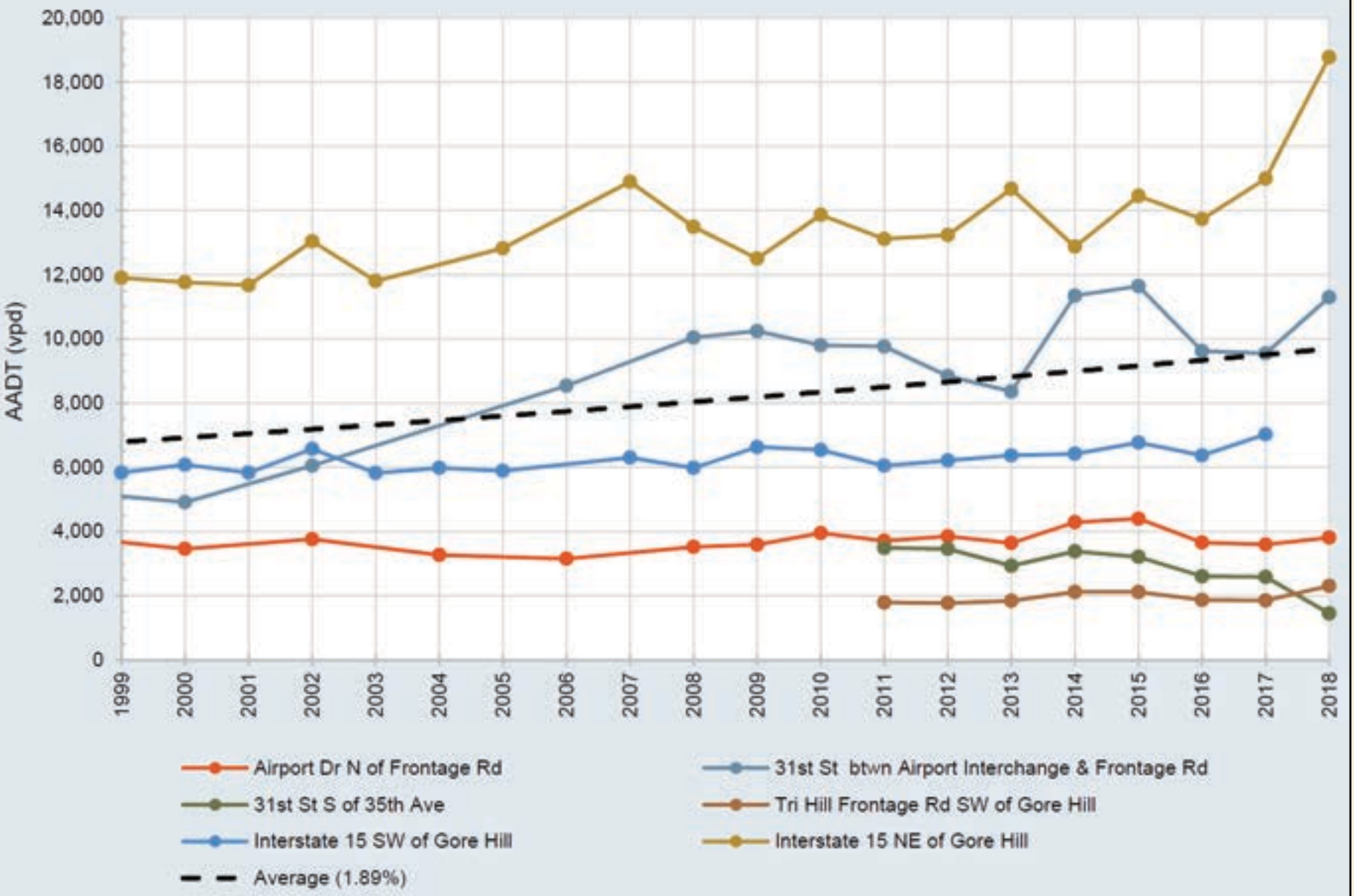


PROJECTED TRAFFIC CONDITIONS

PROJECTED INTERSECTION OPERATIONS (2041)

Intersection	AM Peak Hour			PM Peak Hour		
	Delay (s)	v/c	LOS	Delay (s)	v/c	LOS
1 Tri Hill Frontage/31 <sup>st</sup> St SW	12.9	0.24	B	16.4	0.35	C
1 Northeast bound	12.9	0.24	B	16.4	0.35	C
1 Northwest bound	7.9	0.02	A	8.3	0.01	A
1 Southeast bound	0.0	0.00	A	0.0	0.00	A
2 31 <sup>st</sup> St SW/I-15 NB On/Off	18.4	0.00	C	95.2	0.00	F
2 Northeast bound	18.4	0.03	C	95.2	0.08	F
2 Northwest bound	0.0	0.00	A	0.0	0.00	A
2 Southeast bound	8.3	0.12	A	10.1	0.41	B
3 Airport Drive/I-15 SB On	9.5	0.03	A	12.0	0.18	B
3 Northwest bound	9.5	0.03	A	12.0	0.12	B
3 Southeast bound	0.0	0.00	A	0.0	0.00	A
4 Airport Drive/I-15 Frontage Rd/I-15 SB Off	13.4	0.31	B	265.5	1.44	F
4 Northeast bound	13.4	0.06	B	23.8	0.22	C
4 Southwest bound	13.4	0.31	B	265.5	1.44	F
4 Northwest bound	7.7	0.01	A	9.3	0.00	A

HISTORIC TRAFFIC VOLUMES



The study area has historically experienced slow and steady traffic growth. In recent years, there has been a mixture of new commercial and some residential development in the area. The airport and surrounding area in particular have experienced growth and new development over the past few years. The study area is expected to continue to grow over the foreseeable future due to a mixture of residential and employment growth. With this growth, traffic patterns and volumes will change in the future.

SAFETY



\*Note: Crash locations are approximate.

AT GORE HILL INTERCHANGE

**21** Crashes occurred at the Gore Hill Interchange (on ramps, overpass or intersections)



**8** Rear End Crashes

**7** Right Angle Crashes



**71%**

Occurred during daylight hours

**43%**

Occurred when roads were snowy, icy, or wet

BETWEEN 10TH AVE S AND GORE HILL INTERCHANGES

**6** S **12** N

18 Crashes occurred between the interchanges, 6 in the southbound direction, 12 in the northbound direction.



**6** Wild Animal Crashes



**6** Fixed Object Crashes



**5** Rollover Crashes

AT 10TH AVE S INTERCHANGE

**3** Crashes - All Fixed Object Crashes

**66%**

Occurred when roads were snowy, icy, or wet



**33%** of crashes between the interchanges occurred on snowy, wet, or icy roads



**33%** of crashes occurred during daylight hours



# RECOMMENDED INTERCHANGE IMPROVEMENTS



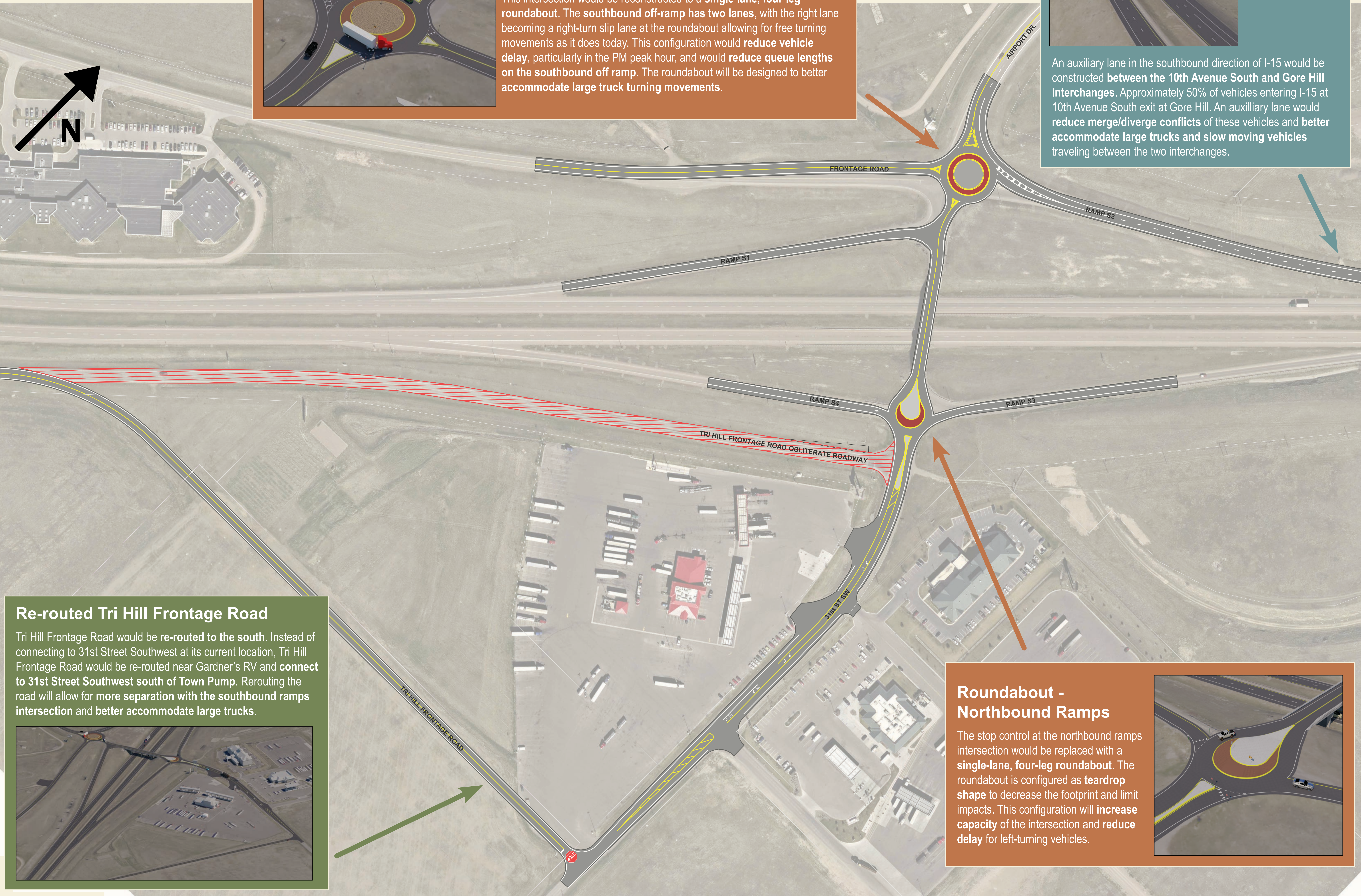
## Roundabout - Southbound Ramps

This intersection would be reconstructed to a **single-lane, four-leg roundabout**. The **southbound off-ramp has two lanes**, with the right lane becoming a right-turn slip lane at the roundabout allowing for free turning movements as it does today. This configuration would **reduce vehicle delay**, particularly in the PM peak hour, and would **reduce queue lengths on the southbound off ramp**. The roundabout will be designed to better **accommodate large truck turning movements**.



## Southbound Auxiliary Lane

An auxiliary lane in the southbound direction of I-15 would be constructed **between the 10th Avenue South and Gore Hill Interchanges**. Approximately 50% of vehicles entering I-15 at 10th Avenue South exit at Gore Hill. An auxiliary lane would **reduce merge/diverge conflicts** of these vehicles and **better accommodate large trucks and slow moving vehicles** traveling between the two interchanges.



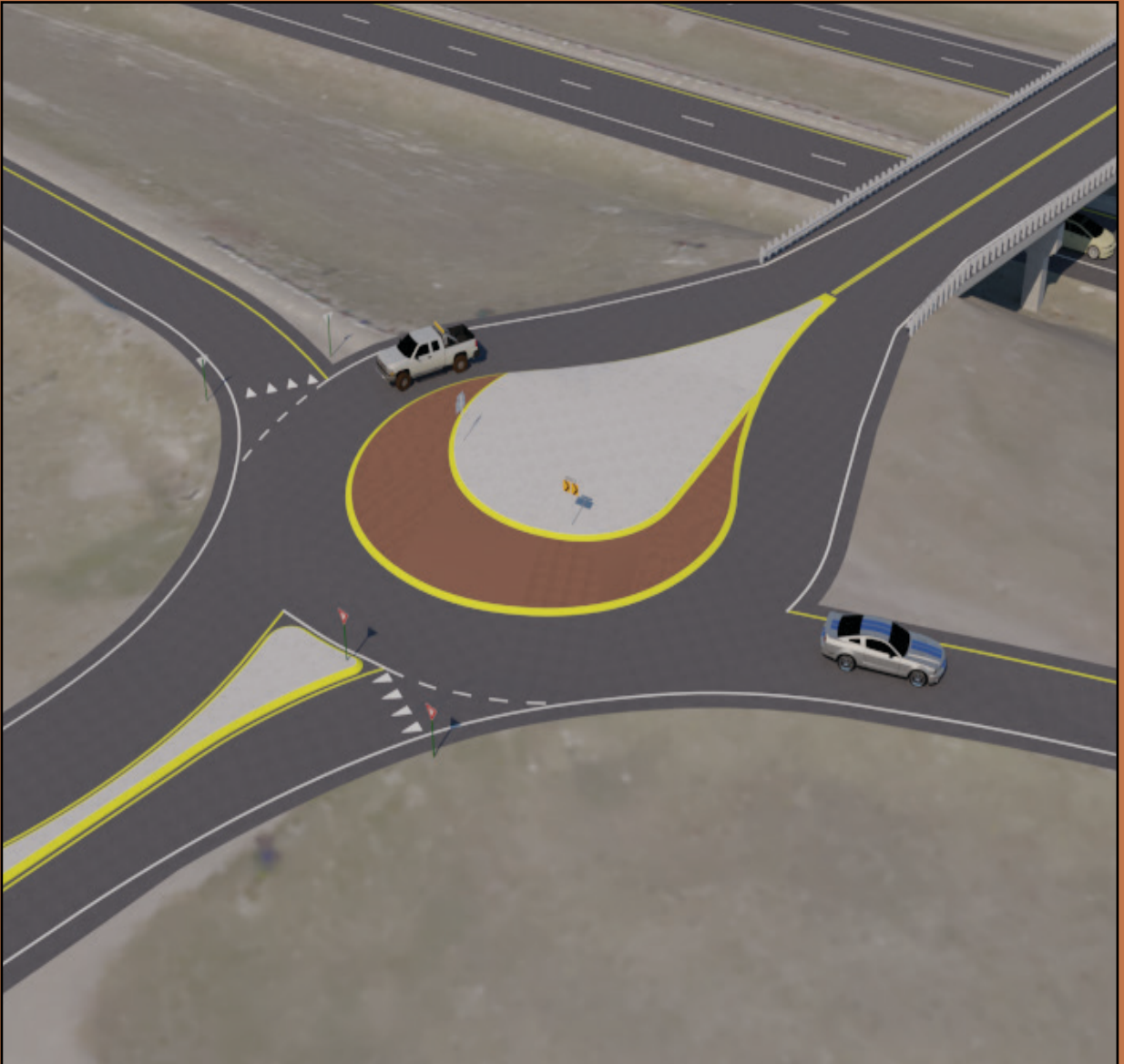
## Re-routed Tri Hill Frontage Road

Tri Hill Frontage Road would be **re-routed to the south**. Instead of connecting to 31st Street Southwest at its current location, Tri Hill Frontage Road would be re-routed near Gardner's RV and **connect to 31st Street Southwest south of Town Pump**. Rerouting the road will allow for **more separation with the southbound ramps intersection** and **better accommodate large trucks**.



## Roundabout - Northbound Ramps

The stop control at the northbound ramps intersection would be replaced with a **single-lane, four-leg roundabout**. The roundabout is configured as **teardrop shape** to decrease the footprint and limit impacts. This configuration will **increase capacity** of the intersection and **reduce delay** for left-turning vehicles.

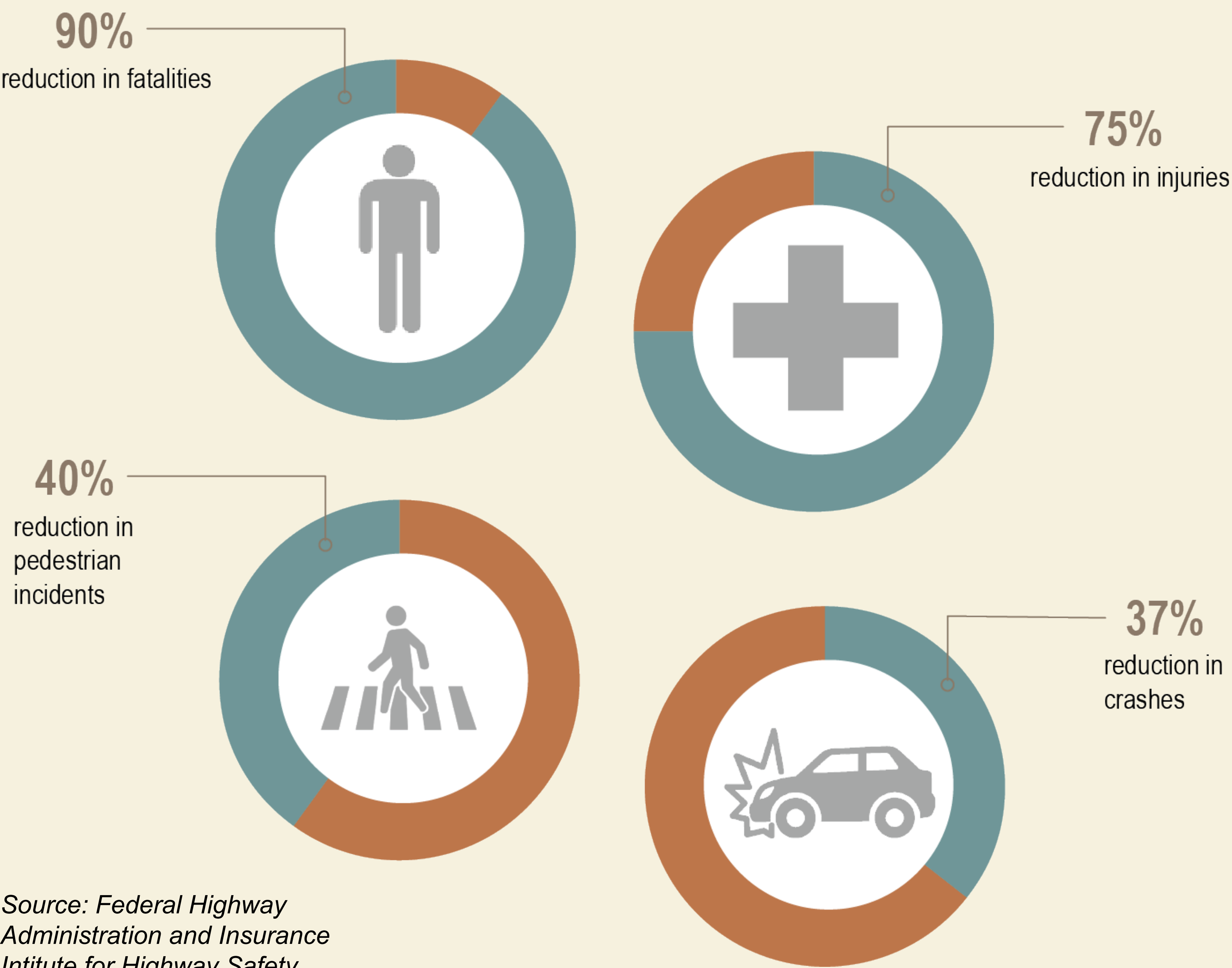




# WHY ROUNDABOUTS?

## ROUNDABOUTS ARE SAFER THAN TRADITIONAL INTERSECTIONS

The statistics prove it! Driver's must slow down to yield to other vehicles before entering the roundabout. Driver's must also slow to navigate the roundabout. Slower speeds help reduce the likelihood and severity of accidents.



Source: Federal Highway Administration and Insurance Intitute for Highway Safety (FHWA and IIHS).

## REDUCED DELAY AND IMPROVED TRAFFIC FLOW

Roundabouts promote a continous flow of traffic. Unlike intersections with traffic signals, driver's don't have to wait for a green light at a roundabout to get through the intersection. Since traffic is only required to yield, not stop, the intersection can handle more traffic in the same amount of time.



## ROUNDABOUTS ARE LESS EXPENSIVE LONG TERM

The cost of building a roundabout and a traffic signal are often comparable. But when the costs of maintenance, cost to society, and cost to the environment are concerned, roundabouts are less expensive than traffic signals.

### The Cost of Crashes to Society is Substantial

Source: National Safety Council "Estimating the Costs of Unintentional Injuries".

- \$1,542,000 Fatality
- \$90,000 Serious Injury
- \$26,000 Minor Injury
- \$21,400 Possible Injury
- \$11,400 Non-Injury

### Building and Maintenance Costs



Eliminate the costs to install and repair signal equipment.

Provide a 25-year service life with no equipment to break down.

Reduce road electricity and maintenance costs by an average of \$5,000 per year.

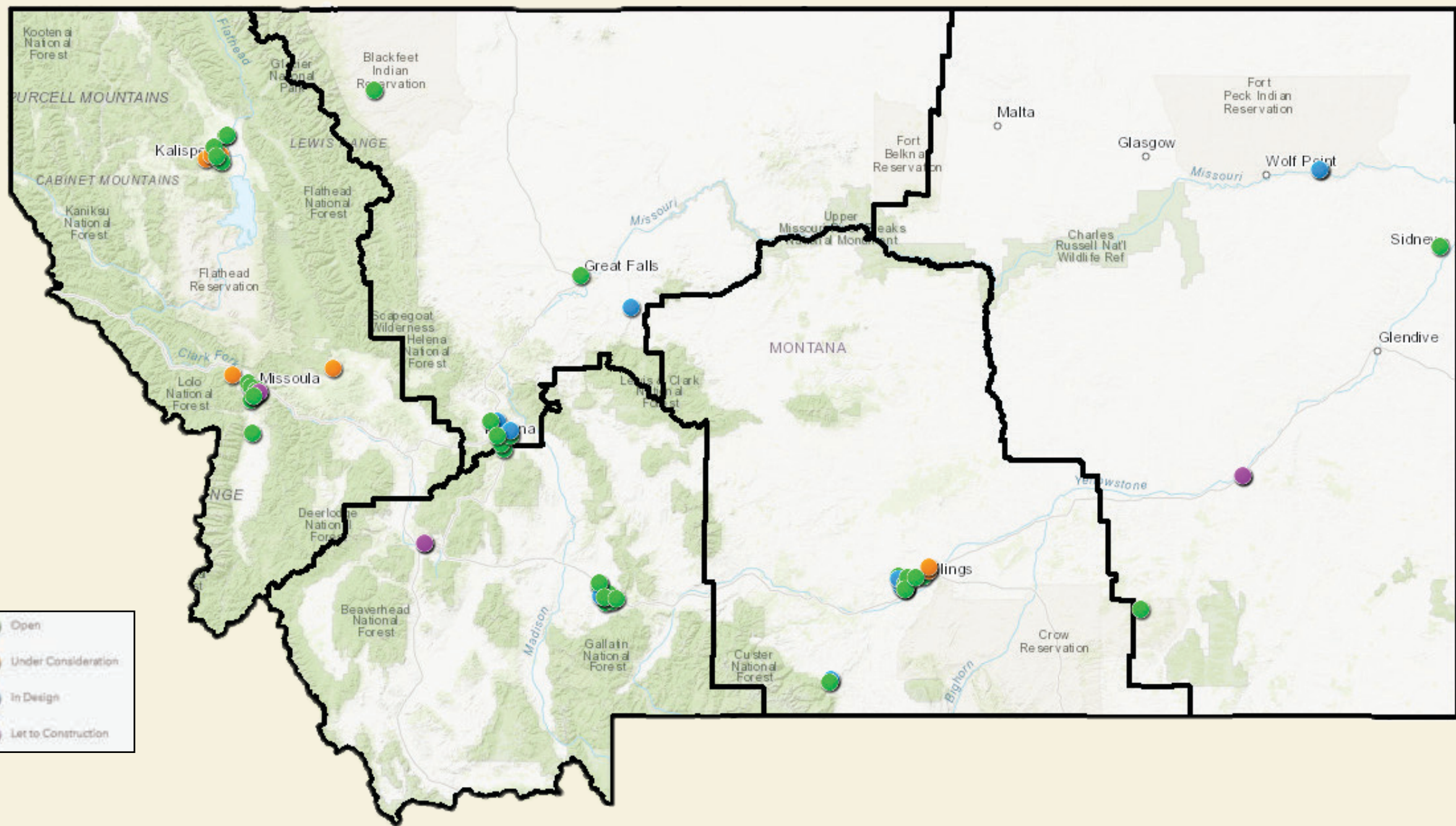


### Environmental Costs

Roundabouts decrease fuel consumption and carbon emissions by reducing vehicle delay and stops compared to signalized intersections.

## DID YOU KNOW?

Montana already has over 50 roundabouts already constructed with many more planned or under development.



## COMPARE ROUNDABOUTS TO OTHER INTERSECTION TYPES

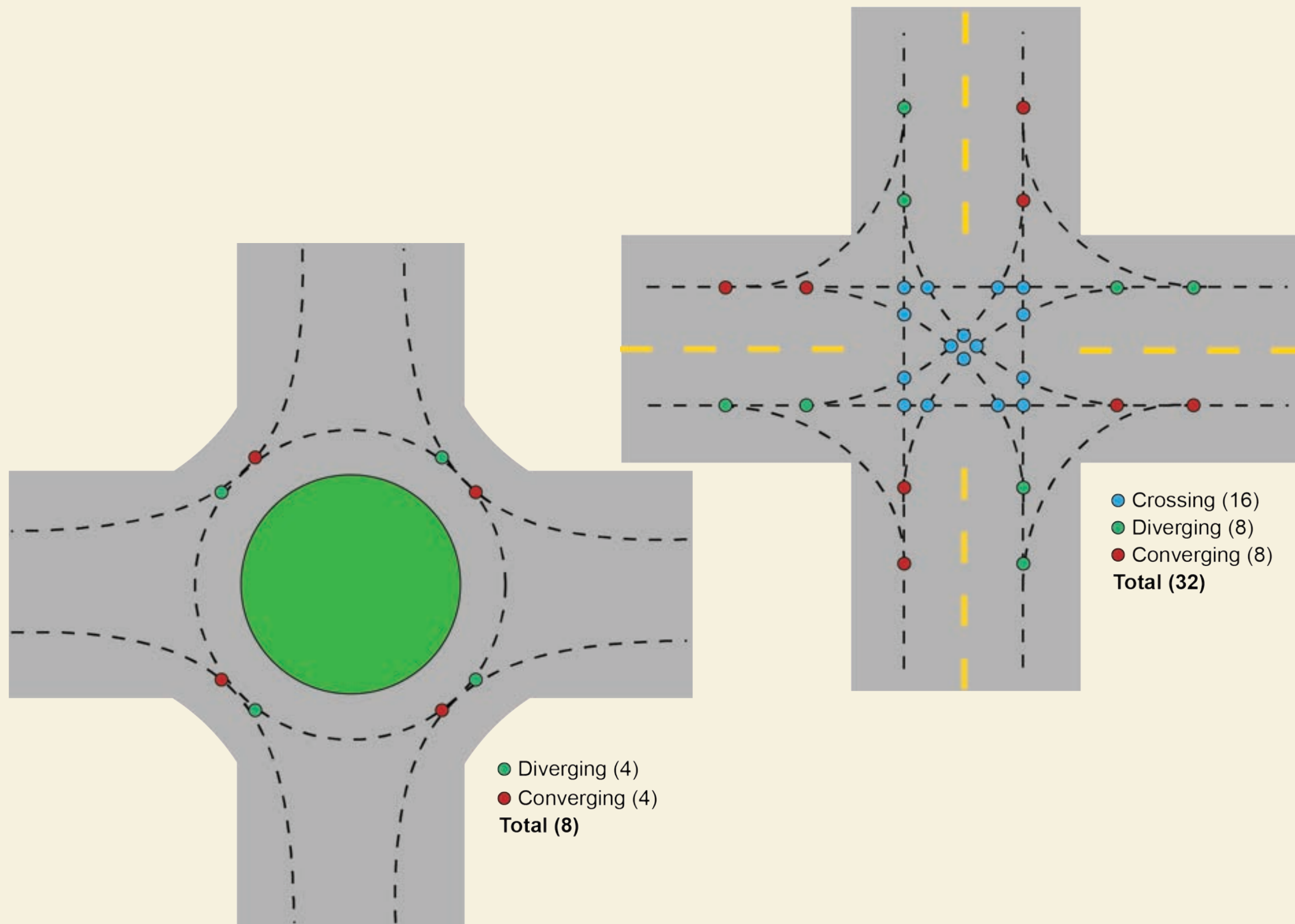
All intersection types have benefits and drawbacks, compare them here.

	Roundabout	Traffic Signal	Two-way Stop	
				Drawback No Difference Benefit
PEDESTRIANS				
Crossing Length	2 lanes	2-3 lanes	2 lanes (1 at a time)	
Speed of adjacent traffic (relative)	HIGH	HIGH	LOW	
Crossing regulation	Right-of-way rule	Protected signal phase	Right-of-way rule	
Risk related to driver compliance	HIGH; Visibility, right-of-way confusion	MEDIUM; Red-light running, right-turn on red	LOW; Good visibility and decision point distribution	
BICYCLES				
Comfort/convenience	MEDIUM; Stop required on minor approaches, multiple conflict points, right-of-way confusion	MEDIUM; Stop often required, need to ride adjacent to and across multiple lanes of traffic	MEDIUM; no stop required, can ride in single traffic stream, intimidating	
Speed of adjacent traffic (relative)	HIGH	HIGH	MEDIUM	
AUTOS				
Peak hour delay (relative)	HIGH	LOW	LOW	
Off-peak delay (relative)	MEDIUM	MEDIUM	LOW	
Travel speed	HIGH	HIGH	LOW	
Convenience	LOW; Highest peak hour delays, stop always required on minor approaches	MEDIUM; Some induced delay	HIGH; Lowest delays, stop not required	
Collision potential (relative)	HIGH	HIGH	LOW	
Collision severity (relative)	HIGH	HIGH	LOW	
HEAVY TRUCKS				
Maneuvers	Limited, difficult from minor approaches	Accommodated and protected	Accommodated with apron	
GENERAL				
Safety	LOW	LOW	HIGH	
Sight distance required	HIGH	HIGH	LOW	
Right-of-way required	LOW	MEDIUM	HIGH	

## THERE ARE FEWER VEHICLE COLLISION POINTS

Traditional intersections have 32 collision points while roundabouts have only 8. The curved roads and one-way travel around the roundabout eliminate the possibility for T-bone and head-on collisions. The likelihood of a severe crash is decreased.

TRADITIONAL INTERSECTION CRASH  
ROUNDABOUT INTERSECTION CRASH





# WERE OTHER OPTIONS CONSIDERED?

YES!

7 potential options for the southbound ramps and 9 potential options for the northbound ramps were identified and analyzed for effects on the transportation system. This analysis resulted in 3 options being forwarded for evaluation in more detail as combined options. Ultimately, Single-Lane Roundabouts were identified as the preferred alternative.

Check out which options were analyzed:



## WHY NOT TRAFFIC SIGNALS?

### SIGNAL WARRANTS ARE NOT MET

Traffic signal warrants are not currently met at the intersections and are unlikely to be met under projected conditions. If warrants aren't met, a traffic signal cannot be built.

### MORE EXPENSIVE/IMPACTS TO BRIDGE

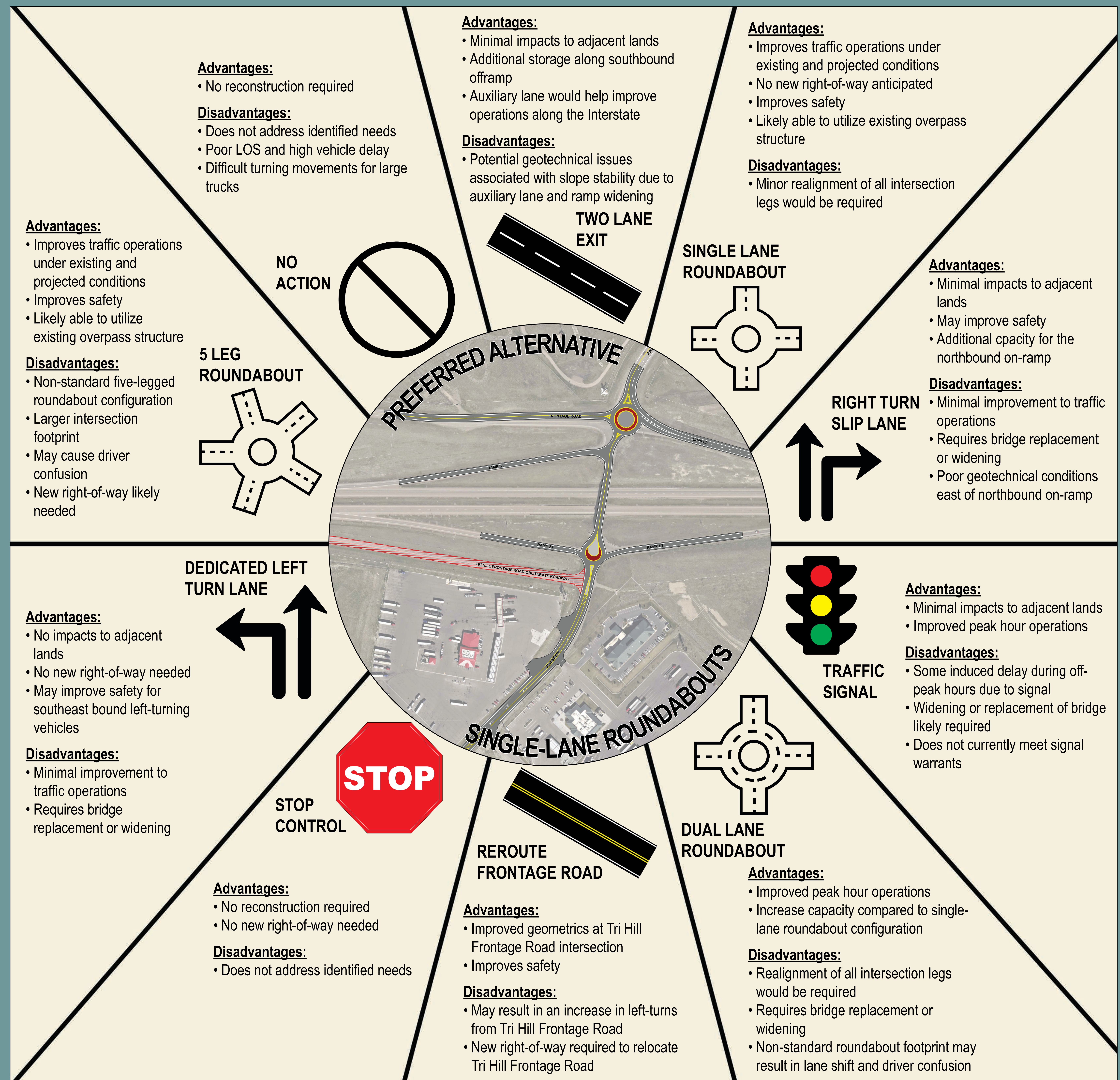
In order to provide enough capacity for projected traffic volumes additional turn lanes will be needed. This would require widening or replacing the bridge overpass structure which would be costly.

### TRAFFIC SIGNALS INDUCE DELAY

Traffic signals introduce delay during off-peak periods. Roundabouts promote continuous flow during all travel times.

### SAFETY IS A CONCERN

Safety is a concern with traffic signals because there are more conflict points and drivers often try to "beat the light". The likelihood of head on, right angle, and rear end crashes is increased at signalized intersections versus roundabouts.





# WHAT ABOUT LARGE TRUCKS?

A high percentage of truck traffic uses the interchange due to the presence of multiple truck stops, the airport, the Montana Air National Guard, and other heavy use commercial and industrial areas. The importance of the Gore Hill Interchange to the trucking industry is well understood by the project team. In order to ensure the proposed design for the interchange best accommodates the needs of large loads, MDT will partner with members of the local trucking community.

BEFORE IMPROVEMENTS

## UNSAFE & CONGESTED MERGE/DIVERGE CONDITIONS



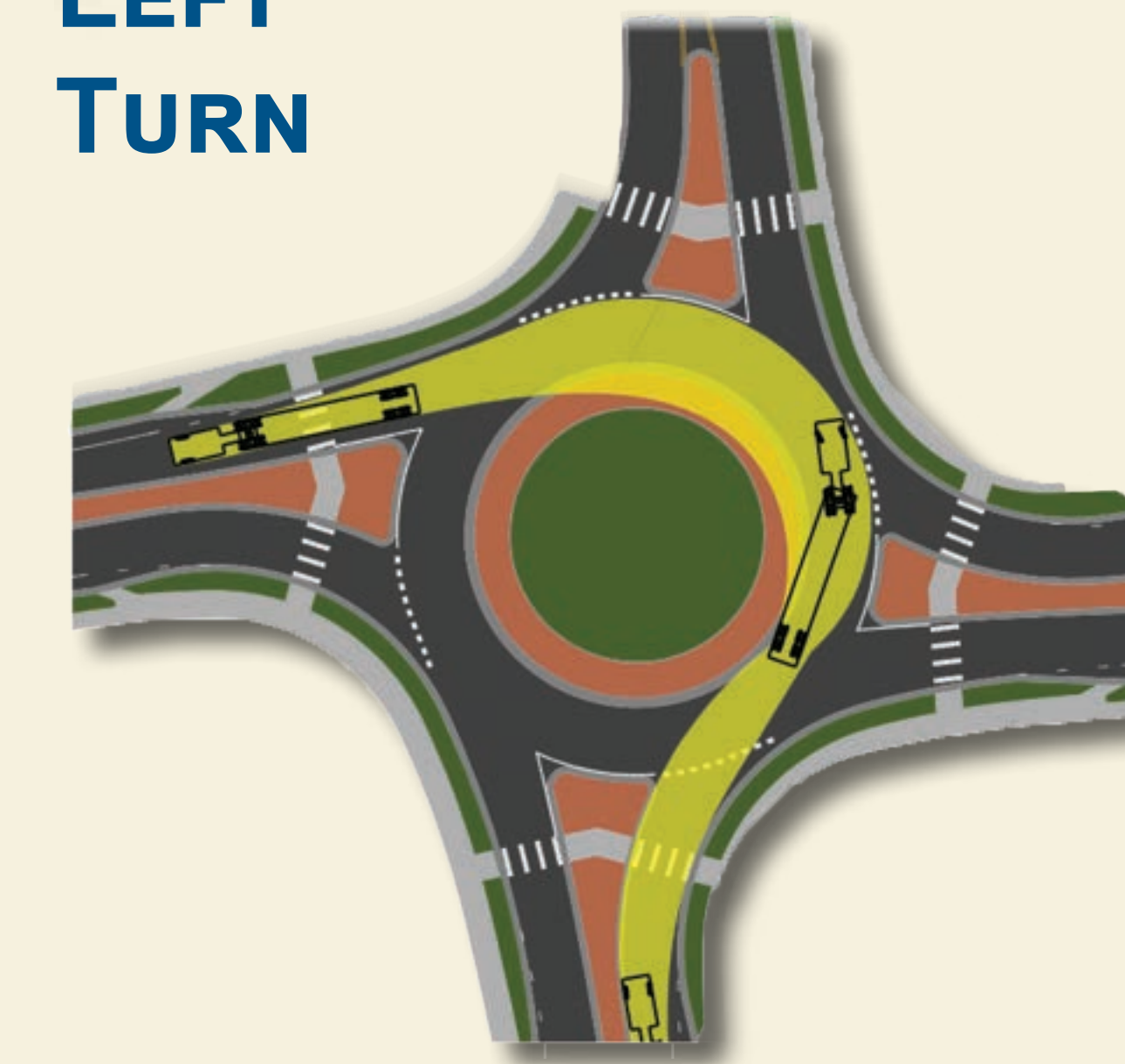
High volumes of traffic travel between the 10th Ave S and Gore Hill Interchanges with a large percentage of that traffic being heavy trucks. The steep grade between the interchanges, combined with a mixture of vehicle types, results in a wide range of vehicle speeds. These conditions have created safety issues and congested merge/diverge conditions.

## POOR GEOMETRICS



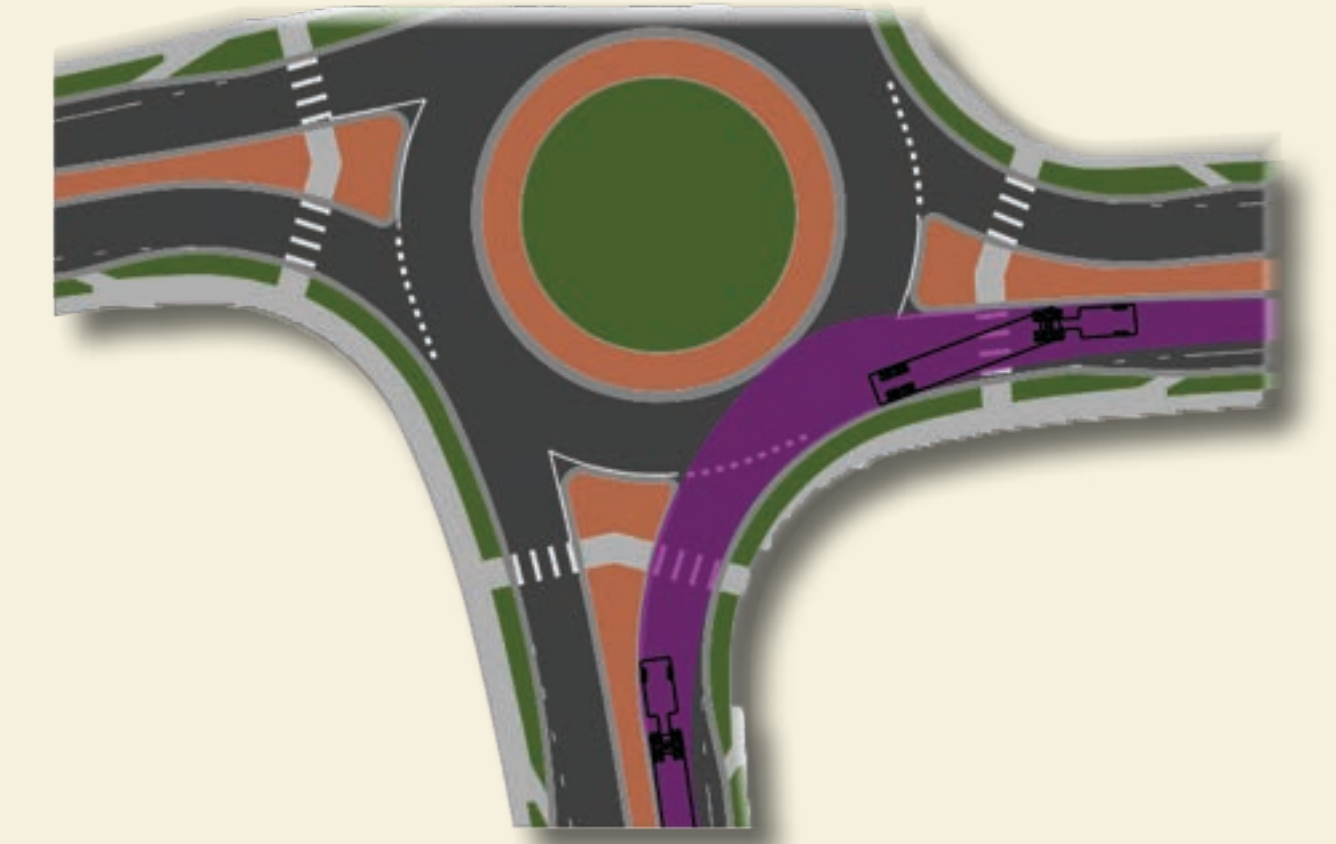
The intersections at the current interchange are closely spaced and do not adequately accommodate queuing and large truck movements.

LEFT  
TURN

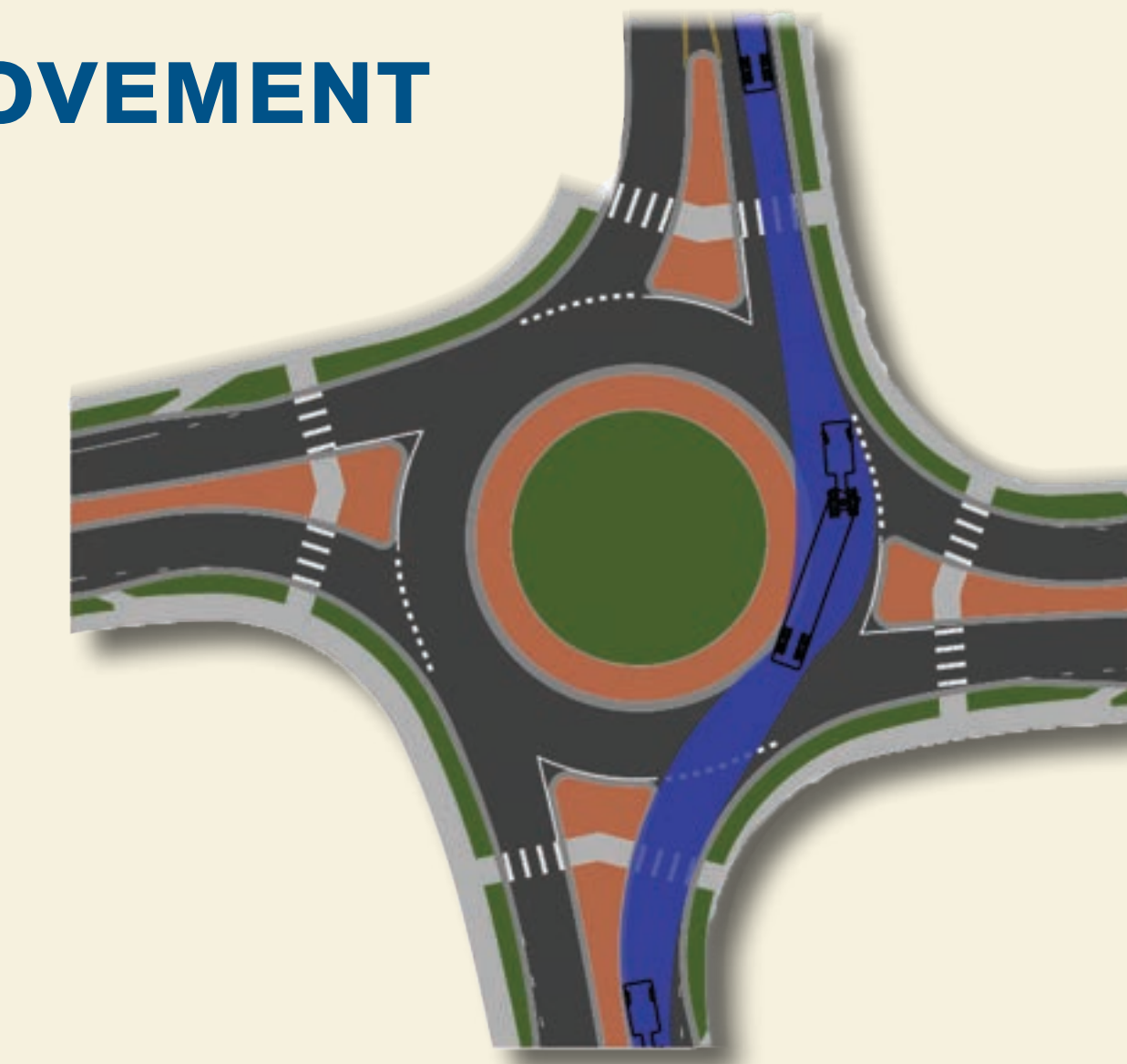


ROUNDBABOUTS ARE  
EASILY NAVIGABLE  
BY LARGE TRUCKS

RIGHT TURN



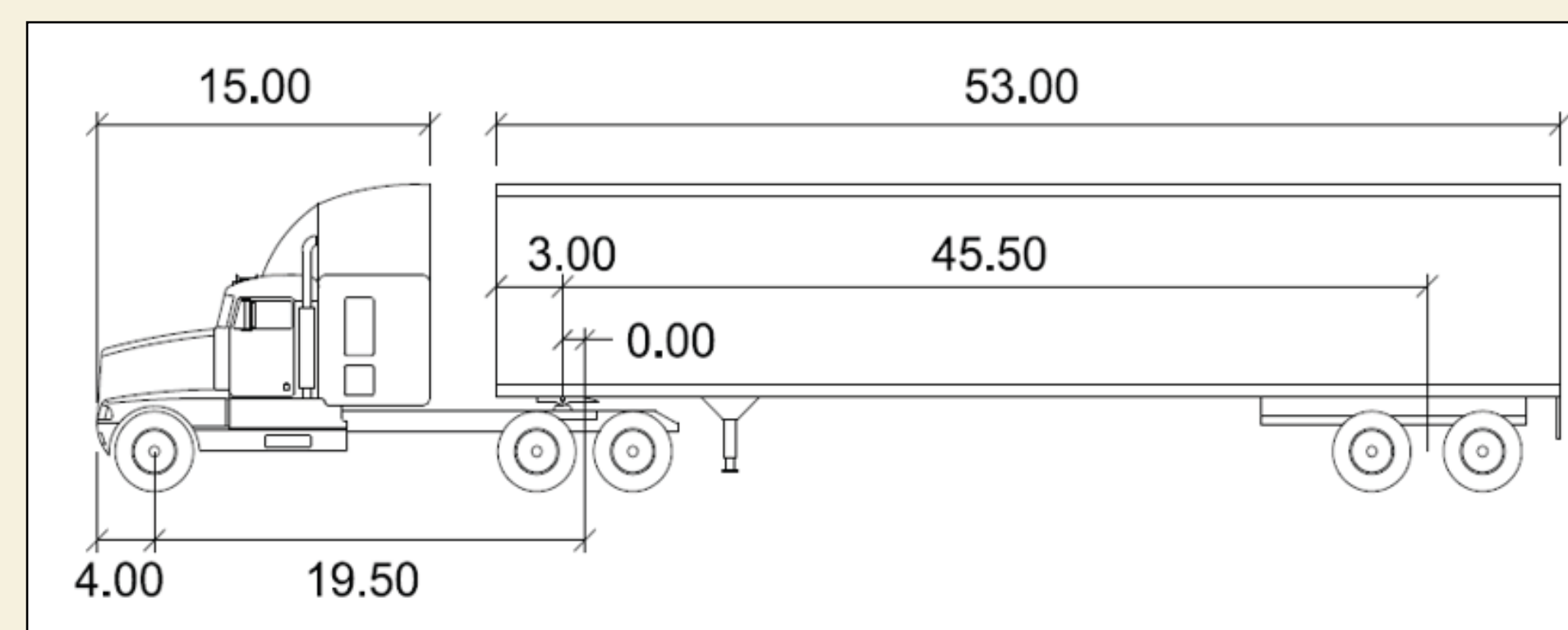
THROUGH  
MOVEMENT



AFTER PROPOSED IMPROVEMENTS

## OVER SIZED OVER WEIGHT

The medians of the roundabouts are designed to be easily traversable by oversized and overweight loads. Light poles are placed outside the travel path and signs can be removed to allow passage.



## Did You Know?

Roundabouts are designed to accommodate over sized and over weight loads.



## CLIMBING LANE

The addition of an auxiliary lane will allow trucks to travel at a slower speed while climbing the steep grade. A dual lane exit on the Gore Hill southbound off ramp will allow for safer travel between the two interchanges.



## APPROPRIATELY SIZED

The proposed improvements will condense the number of intersections, alleviating the need to make closely spaced turns. Roundabouts are also designed to make large truck turning movements safe and easily executed.



Mountable  
truck apron.

## TRUCK APRON

The roundabouts will have mountable truck aprons designed with a flat slope and low height to accommodate vehicles with low clearance.

## Example Truck Apron Curb

