Chapter 4: Transportation Systems

4.1 INTRODUCTION

This chapter evaluates the transportation benefits and impacts of the Preferred Alternative on the existing transportation system (No-Action Alternative). Table 4-1 summarizes the transportation benefits and impacts associated with the Preferred Alternative. Transportation benefits are discussed in detail in Chapter 5: Comparison of Alternatives.

Table 4- 1: Transportation Benefits and Impacts of the Preferred Alternative

Benefits	Impacts
Mobility	
- Improved transit ridership through improved reliability and reduced transit travel time - Improved regional mobility through improved connectivity for autos from Interstate 15 (I-15) to Orem and Provo (Phase II) and improved transit connections to and from FrontRunner commuter rail - Improved corridor mobility through increased travel capacity and decreased travel times for autos and transit (corridor-wide)	Increase in auto travel time on one segment of University Parkway
Travel Patterns and Accessibility	
Improved accessibility for autos, transit, pedestrians, and cyclists across I-15 (Phase II)	- Left turn movements would be prohibited along 900 East, 700 North, and University Avenue in Provo - Traffic volumes would increase on some local roads near the 800 South interchange - 1370 West in Orem would dead end at 800 South
Pedestrian and Cyclist Considerations	
- Improved accessibility for autos, transit, pedestrians, and cyclists across I-15 (Phase II) - Improved pedestrian accessibility at stations along the corridor	N/A
Safety	
Improved safety from elimination of one at-grade railroad crossing at 800 South and I-15	N/A
Parking	
Reduced need for parking by approx. 9 acres	Some on-street parking would be eliminated on University Avenue in Provo

4.2 METHODOLOGY

The transit and traffic data used in this chapter are derived from the Mountainland Association of Governments (MAG) Regional Travel Demand Model (Version 6.1) and traffic counts conducted by the project team, Provo City, and Orem City. The MAG Regional Travel Demand Model uses projected population, employment, travel behavior, and transit and roadway network information to forecast future regional travel demand and impacts.

Analysis was completed by estimating current traffic conditions and future projected conditions in the year 2030, thereby determining the existing and future intersection level of service (LOS) based on vehicle delay. The year 2030 was used as a planning horizon to be consistent with the MAG Regional Transportation Plan and the associated 2030 Regional Travel Demand Model. The opening year for Phase I improvements is expected to be 2014, assuming funds become available. Additional information on opening year conditions is included in the Provo-Orem Rapid Transit Alternatives Analysis (AA) report to be consistent with FTA Small Starts requirements. Detailed operational analysis was completed using the analysis tool VISSIM. VISSIM uses micro-simulation to measure delay at intersections. Additional tools used for analysis and their uses are described below.

MAG Regional Travel Demand Model (Version 6.1):

- Ridership forecasting
- Corridor-wide travel time
- Volume-to-capacity (V/C) ratios for roadway links
- Vehicle miles traveled analysis
- Regional impacts of 800 South interchange
- Neighborhood impacts of 800 South interchange

VISSIM micro-simulation (Versions 4.3 and 5.2):

- Segment-specific travel time for select portions of the corridor
- Localized traffic impacts for select portions of the corridor

Synchro (Version 6):

- Localized traffic impacts of the Orem Intermodal Center access to Geneva Road

Field data was also gathered for pedestrian infrastructure at intersections, including crosswalk facilities, pedestrian push buttons, median refuges, curb ramps, and pedestrian signal heads. The Preferred Alternative was then reviewed to assess how it would impact or improve bicycle and pedestrian mobility along the corridor.

4.3 TRANSIT RIDERSHIP

Transit projects are measured by their ability to show benefits of the Preferred Alternative over the Enhanced Bus Alternative (as described in Section 2.2 of this Environmental Assessment (EA)). The transit benefits to regional and local travel for the two alternatives are shown in Table 4-2: 2030 Transit Ridership. Additional transit benefits are discussed in Chapter 5. For this EA, the Enhanced Bus Alternative is similar to the No-Action Alternative. However, it assumes improved

transit service characteristics and Transportation Systems Management (TSM) strategies, such as signal timing improvements, traffic engineering actions, and bus route restructuring.

The No-Action Alternative and the Enhanced Bus Alternative perform similarly in terms of ridership. Although there would be a slight increase in ridership with the Enhanced Bus Alternative, the regional travel demand model does not capture an increase that small.

Table 4- 2: 2030 Transit Ridership

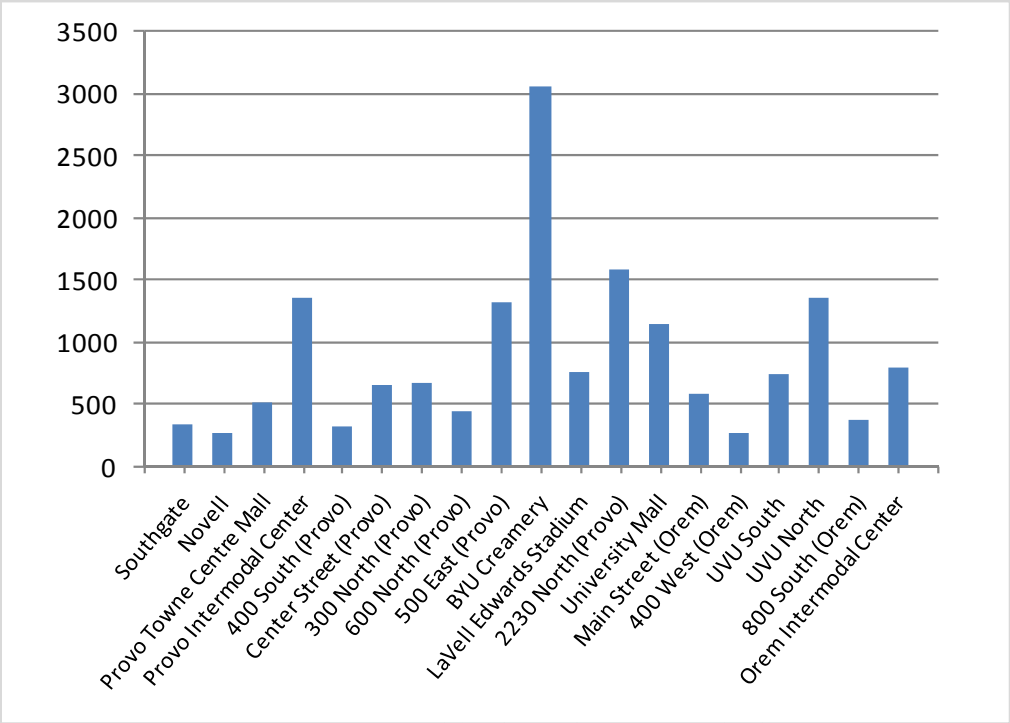
Measure	No-Action/ Enhanced Bus	Preferred Alternative (Phase II)
Total Linked Transit Trips for Wasatch Front Region	225,900	232,000
Route Ridership (riders/day, 2030)	8,400	16,400
Route Ridership Opening Day (riders/day, 2014)	6,800	12,900
Study Area Transit Capture[1]	2.2%	2.9%
Net New Riders to Local System (based on linked trips)	-	6,100
Home-Based College Transit Trips, Study Area	7,800	11,000
Home-Based Work Transit Trips, Study Area	8,900	10,600
Corridor Mode Split, Peak Hour (persons on transit/persons in autos)[2]	10% / 90%	33% / 67%
Reliability	84%	Estimated at more than 95%
Auto Trips Eliminated Over the No-Action Alternative (trips/day)[3]	0	3,600

1. Transit Capture is the percent of all trips (auto, non-motorized, etc.) that involve transit.
2. Peak Hour Person-Throughput and Mode Split are an average of persons in transit and persons in autos taken at select intersections on University Parkway and University Avenue. (Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010)
3. Auto Trips Eliminated is presented for the study area.

Sources: MAG Travel Demand Model, Version 6.1; WCEC Engineers 2010

Route ridership is the summation of the boardings for each station. Figure 4-1 shows the 2030 station-level boardings for the Preferred Alternative. The two university stations, particularly Brigham Young University (BYU), would be the busiest stations along the corridor. Two regional malls, particularly the University Mall in Orem, would also draw numerous riders. Ridership is projected to be higher at the University Mall station than the Provo Towne Centre mall station because the University Mall station would also be a transfer point for regional north/south bus routes.

Figure 4-1: Station-Level Daily Boardings for the Preferred Alternative (Phase II, 2030)



The Preferred Alternative would stop at the Orem Intermodal Center and the Provo Intermodal Center, which will also serve FrontRunner commuter rail from Salt Lake. Commuter rail ridership projections were based on the assumption that a connection to bus rapid transit (BRT) would be provided (as reflected in the MAG 2030 Regional Transportation Plan). As expected, ridership will be substantial at the two commuter rail stations. Projected commuter rail ridership at these locations is shown in Table 4-3: Projected Commuter Rail Boardings, as reported in the *Provo to Salt Lake FrontRunner Final Environmental Study Report* (October 2007).

Table 4- 3: Projected Commuter Rail Boardings

Station	2010 Daily Boardings			2030 Daily Boardings		
	Southbound	Northbound	Total	Southbound	Northbound	Total
Provo	0	1,357	1,357	0	1,633	1,633
Orem	166	1,088	1,255	172	1,466	1,637
Source: Provo to Salt Lake FrontRunner Final Environmental Study Report, October 2007						

4.4 REGIONAL MOBILITY

The Preferred Alternative would improve regional mobility through improved connectivity for autos from I-15 to Orem and Provo (Phase II) and improved transit connections to and from the FrontRunner commuter rail.

Improved Transit Connections to and from FrontRunner Commuter Rail

The Preferred Alternative would improve travel time for trips involving FrontRunner commuter rail. For a typical transit trip from downtown Salt Lake City to BYU, the Preferred Alternative would reduce the travel time from 1 hour 20 minutes to 1 hour 7 minutes (Phase I) and 1 hour 9 minutes (Phase II).

Regional Effects of the 800 South High-Occupancy/Toll Interchange Overpass

The addition of the 800 South high-occupancy/toll (HOT) interchange overpass would increase mobility by providing a new connection from I-15 to Provo and Orem. The University Parkway Single Point Urban Interchange is approximately a half mile south of the proposed interchange and is projected to be 50 percent over capacity in 2030. It is used to access Utah Valley University (UVU) and the commercial corridor of Orem. It is also a major corridor to Provo and BYU.

Under the Preferred Alternative, the 800 South interchange would serve between 18,000 and 22,000 daily auto trips in 2030, which would improve operations at the University Parkway interchange, as shown in Table 4-4: University Parkway Interchange Traffic Volumes 2030. The Preferred Alternative would reduce volumes on the University Parkway interchange southbound off-ramp, one of the more critical movements, by approximately 12 percent during the peak hour. The proposed interchange would reduce congestion directly east and west of I-15 along University Parkway.

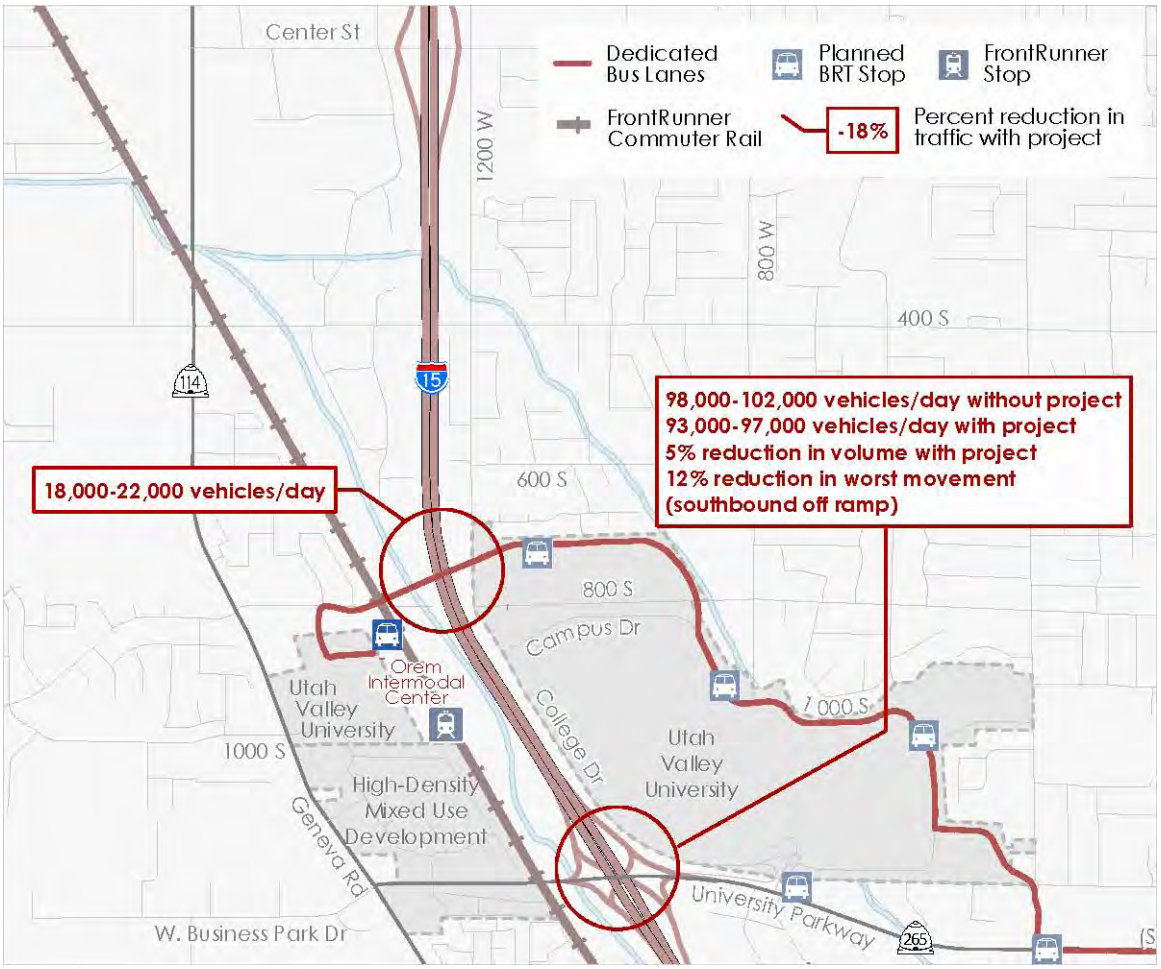
The new interchange would connect existing residential and commercial uses to a regional transit system at the Orem Intermodal Center, improving accessibility region-wide. The addition of the exclusive BRT bus lanes on 800 South and the direct connection to the Orem Intermodal Center would also improve transit reliability for the Preferred Alternative. Buses would no longer have to wait in traffic on University Parkway.

Table 4- 4: University Parkway Interchange Traffic Volumes 2030

	No-Action (2030)	Preferred Alternative (2030)	% Change
Daily Total Entering Volume	98,000 – 102,000	93,000 – 97,000	Approx. -5%
Daily Volume East Side	82,000 – 86,000	78,600 – 82,600	Approx. -4%
Daily Volume West Side	35,000 – 39,000	31,700 – 35,700	Approx. -9%
Peak Hour on Southbound Off-Ramp	2,500 – 2,900	2,200 – 2,600	Approx. -12%
Peak Hour on Westbound to Southbound On-Ramp	1,500 – 1,900	1,300 – 1,700	Approx. -8%
Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010			

Figure 4-2 shows traffic conditions that would be relieved by the addition of the 800 South HOT interchange.

Figure 4-2: Traffic Conditions Relieved by 800 South HOT Interchange (2030)



4.5 CORRIDOR MOBILITY

Travel Time

Table 4-5 shows a p.m. peak hour travel time comparison between auto, bus, and BRT modes for the No-Action Alternative and the Preferred Alternative. Existing auto travel time was collected using Global Positioning System (GPS). The GPS travel time was used to validate the VISSIM model against actual traffic operations. The corridor-wide travel time was calculated using the MAG Travel Demand Model. A limitation of the MAG Travel Demand Model is that it does not fully account for traffic operations at the signalized intersection or the effect of transit signal priority (TSP). All other segment travel times were calculated from the micro-simulation analysis that was performed using VISSIM. VISSIM is able to account for complex traffic operations, but was not completed for the entire corridor. Further, the VISSIM modeling indicated that these segments would operate under highly congested, unstable conditions in 2030.

Table 4- 5: PM Peak Hour Travel Time Comparison

Path	Existing Auto	2030 No-Action Auto	2030 No-Action Bus	2030 Preferred Alternative (Phase II) Auto	2030 Preferred Alternative (Phase II) BRT
Total Corridor[4]	35:00[1]	40:30[3]	56:42[3]	39:00[3]	36:30[3]
University Parkway: 400 West to 800 East	3:00[1]	5:24[2]	7:36[3]	6:30[2]	1:54[2]
University Parkway: 2230 North to University Avenue	1:30[1]	4:06[2]	5:42[3]	3:48[2]	2:24[2]
University Avenue: 700 North to 300 South	2:30[1]	4:18[2]	6:00[3]	3:54[2]	4:48[2]

1. Travel time measured using GPS technology
2. Travel time estimated from VISSIM simulation model
3. Travel time estimated from travel demand model
4. Overall corridor estimates prepared using MAG Travel Demand Model and will not be the sum of the individual segments analyzed with GPS and VISSIM technology

Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010

Not all of the projected traffic demand was able to be served during the analysis period. The travel time measurements were from stop-bar to stop-bar and did not include travel time entering the network. Due to the limitations of these available tools, the results from both tools are presented below. Since these results came from two different methodologies, they are not entirely compatible and limited conclusions can be drawn from comparisons between the results. The segments analyzed using VISSIM account for 3.1 miles of the 10.5-mile project, or 29.5 percent of the total travel corridor. These three study segments include 21 of the 38 signalized intersections, or 55 percent of all the traffic signals on the Preferred Alternative alignment.

Under the 2030 Preferred Alternative, automobile travel time would decrease when compared to the No-Action Alternative. The reduction in auto travel time is the result of signal operations to accommodate BRT that favor the through-movement, and the new general purpose lanes on University Parkway from State Street to University Avenue.

On University Parkway between 400 West and 800 East, the following conditions result in a 1 minute 6 second increase in travel time for autos: construction of an exclusive BRT lane, TSP, a new traffic signal to provide pedestrian access between the University Mall and the BRT station, and new traffic signals to provide left-turn access to existing parcels.

The segments shown in Table 4-5: PM Peak Hour Travel Time Comparison represent the most congested 3.1 miles of the BRT corridor. BRT travel times would decrease more than 10 minutes over the No-Action Alternative on these segments, which represents approximately 50 percent of the BRT travel time savings for the total corridor. The increase to auto travel time is less than 3 percent.

Corridor Capacity

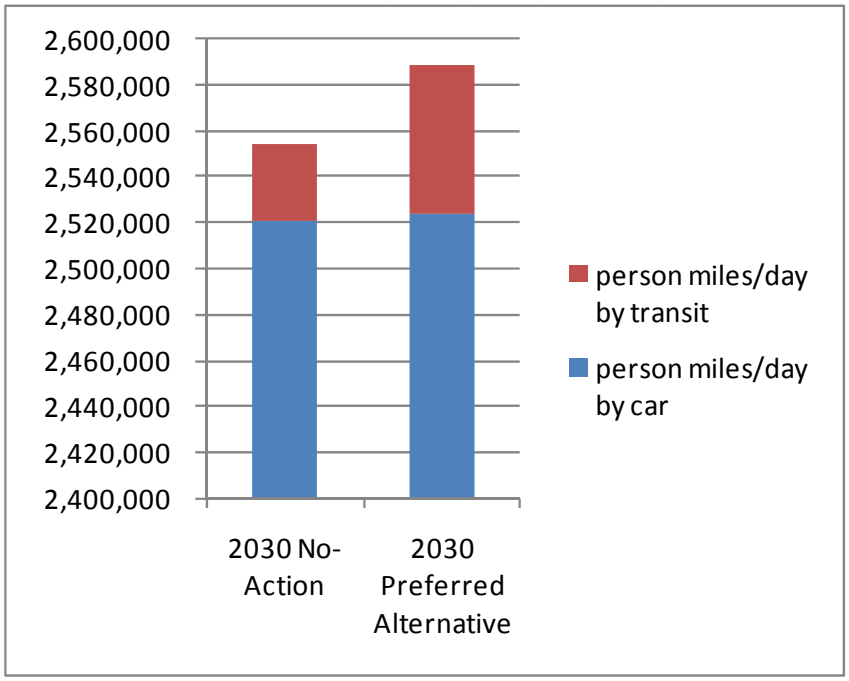
Vehicle Miles Traveled

Table 4-6 shows a comparison of the vehicle miles traveled between the No-Action Alternative and the Preferred Alternative. The table shows that the vehicle miles traveled increases slightly within the study area, but that from a countywide perspective, vehicle miles traveled remains basically the same. Increases in vehicle miles traveled in the study area are from lane widening on University Parkway and the addition of the 800 South interchange. Some drivers will drive slightly farther at freeway speeds to avoid more congested arterials. The ratio of miles traveled via transit and auto is estimated to increase. Figure 4-3: Miles Traveled by Mode within the Study Area shows person miles traveled by BRT and by auto.

Table 4- 6: Vehicle Miles Traveled Comparison

Alternative	Study Area Vehicle Miles Traveled	Countywide Vehicle Miles Traveled
No-Action Alternative	1,938,900	20,094,200
Preferred Alternative (Phase II, 2030)	1,960,400	20,119,700
Percentage Difference	**1.11%**	**0.13%**
Source: MAG Travel Demand Model, Version 6.1; WCEC Engineers 2010		

Figure 4- 3: Miles Traveled by Mode within the Study Area (Phase II)



Corridor Throughput

The Preferred Alternative would increase person-throughput (people in cars and people on transit) in the p.m. peak hour on the Preferred Alternative corridor by up to 25 percent in some locations (see Table 4-7: Person-Throughput in the PM Peak Hour, and Figure 4-4: Person-Throughput in the PM Peak Hour). The increase in travel capacity calculated at the four locations shown in Table 4-7 is due entirely to the transit improvements.

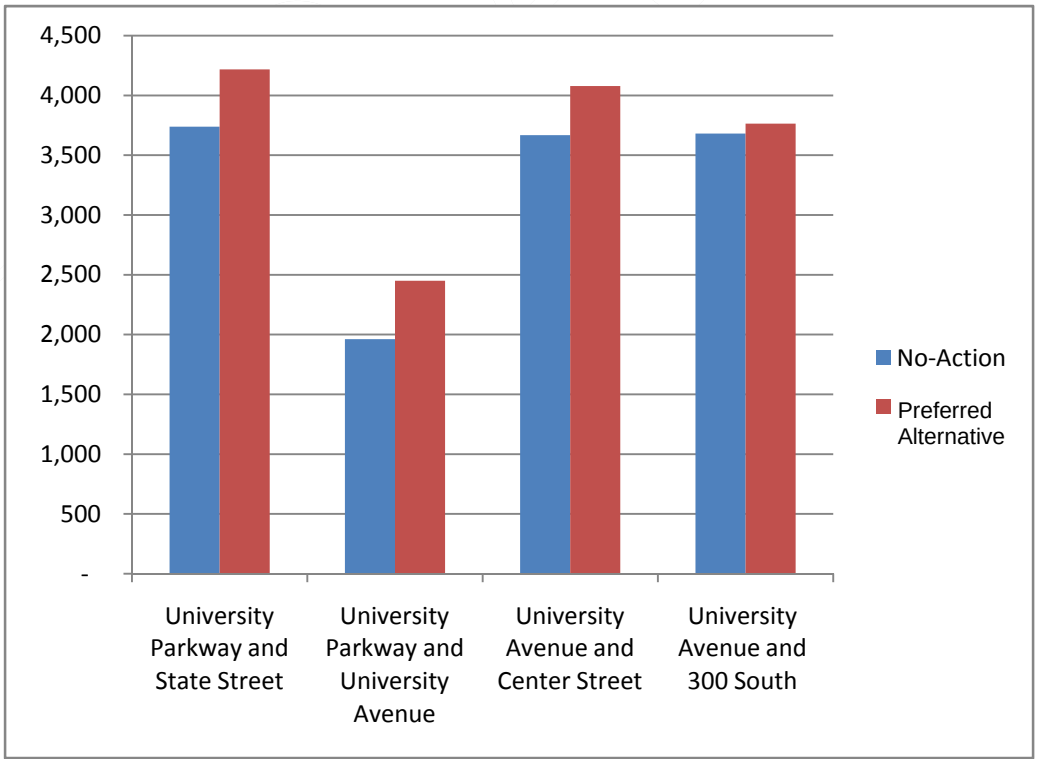
Table 4- 7: Person-Throughput in the PM Peak Hour (Persons/Hour)

Intersection	No-Action (persons/hour)	Preferred Alternative (persons/hour)	% Increase
University Parkway and State Street	3,739	4,218	13%
University Parkway and University Avenue	1,962	2,450	25%
University Avenue and Center Street	3,668	4,078	11%
University Avenue and 300 South	3,681	3,765	2%

Notes:
1. *Person-throughput is for the p.m. peak hour, and summed for both directions in the through-direction only.*
2. *Transit ridership in the p.m. peak hour is based on the travel demand model.*
3. *Autos Served is based on VISSIM modeling.*

Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010

Figure 4-4: Person-Throughput in the PM Peak Hour



The general purpose lanes on the segment of University Parkway would also increase travel capacity for autos for a discrete segment of the corridor. The Preferred Alternative includes expanding University Parkway from two lanes in each direction to three lanes in each direction from State Street to University Avenue. This would give University Parkway a consistent eight-lane cross-section (three general purpose lanes and one BRT lane in each direction) from I-15 in Orem to University Avenue in Provo.

Transit capacity is estimated to increase from 164 (seated) to 220 (with standing capacity) persons per hour (one direction) for the current Bus Route 830 (or 250 to 330 persons per hour for the Enhanced Bus Alternative) to 720 to 960 persons per hour. According to the MAG Travel Demand Model, transit demand in the peak hour is estimated to be more than 550 persons per hour in 2030.

4.6 LOCALIZED TRAFFIC IMPACTS AND ACCESSIBILITY

Several areas throughout the project corridor were analyzed to determine the level of traffic impacts associated with the Preferred Alternative. The analysis consisted of two levels: a preliminary planning level analysis and a detailed operational analysis. The results of these analyses are presented in this section.

LOS is a term that describes the operating performance of an intersection or roadway. LOS is measured quantitatively and reported on a scale from A to F, with A representing the best performance and F the worst. Table 4-8: LOS Descriptions provides a brief description of each LOS letter designation and an accompanying average delay per vehicle for both signalized and unsignalized intersections.

Table 4- 8: LOS Descriptions

LOS	Description of Traffic Conditions	Signalized Intersections	Unsignalized Intersections
		Average Delay[1] (sec/vehicle)	Delay[2] (sec/vehicle)
A	*Free Flow/Insignificant Delay* Extremely favorable progression. Individual users are virtually unaffected by others in the traffic stream.	0 to 10	0 to 10
B	*Stable Operations/Minimum Delays* Good progression. The presence of other users in the traffic stream becomes noticeable.	> 10 to 20	> 10 to 15
C	*Stable Operations/Acceptable Delays* Fair progression. The operation of individual users is affected by interactions with others in the traffic stream.	> 20 to 35	> 15 to 25
D	*Approaching Unstable Flows/Tolerable Delays* Marginal progression. Operating conditions are noticeably more constrained.	> 35 to 55	> 25 to 35
E	*Unstable Operations/Significant Delays Can Occur* Poor progression. Operating conditions are at or near capacity.	> 55 to 80	> 35 to 50
F	*Forced, Unpredictable Flows/Excessive Delays* Unacceptable progression with forced or breakdown of operating conditions.	> 80	> 50

1. Overall intersection LOS and average delay (sec/vehicle) for all approaches
2. Worst approach LOS and delay (sec/vehicle) only

Source: Fehr & Peers descriptions based on Highway Capacity Manual, 2000 Methodology (Transportation Research Board)

The Highway Capacity Manual 2000 (HCM 2000) methodology was used in this study to remain consistent with "state-of-the-practice" professional standards. This methodology has different quantitative evaluations for signalized and unsignalized intersections. For signalized intersections, LOS is provided for the overall intersection (weighted average of all approach delays). For unsignalized intersections, LOS is reported based on the worst approach.

Traffic Impacts of the Preferred Alternative

Table 4-9: Future (2030) PM Peak Hour LOS presents the LOS comparison of existing conditions, 2030 No-Action conditions, and 2030 Preferred Alternative conditions. The overall impact of the Preferred Alternative on traffic operations is minor. Most of the intersections on University Parkway would be congested under 2030 No-Action and Preferred Alternative conditions. Existing and projected traffic volumes are shown on Figure 4-5: Provo-Orem BRT Traffic Volumes (located at the end of the chapter).

Table 4- 9: Future (2030) PM Peak Hour LOS

Intersection	Existing	2030 No-Action	2030 Preferred Alternative
University Parkway / 400 West	C	E/F[1]	E/F[1,4]
University Parkway / 200 West	B/C[1]	B/D[5]	D/E[1]
University Parkway / Main Street	D	E	F
University Parkway / 100 East	A	A	A
University Parkway / 200 East	C	D	E[1]
University Parkway / 300 East	A	A	A/B[1]
University Parkway / State Street	D	E	E/F[1]
University Parkway / 800 East	D	F	E/F[1]
University Parkway / 2230 North	D	D/E[1]	D/E[1]
University Parkway / Freedom Boulevard	C	D	D/E[1]
University Parkway / University Avenue[1]	C	E	E/F[1]
University Avenue / 700 North	C/D[1]	E/F	E/F[1]
University Avenue / 600 North	N/A[3]	N/A[3]	B
University Avenue / 500 North	C/D[1]	E/F[1]	E/F[1]
University Avenue / 100 North	D/E[1]	E/F[1]	F
University Avenue / Provo Center	C	E/F[1]	E
University Avenue / 100 South	C	E/F[1]	E
University Avenue / 300 South	C/D[1]	E/F[1]	F

1. Intersection is within one standard deviation of either LOS.
2. Unsignalized LOS is based on delay at worst approach.
3. New signalized intersection not analyzed in Existing or 2030 No-Action scenarios
4. Based on Phase II configuration
5. Intersection experiences high level of variability due to its proximity to unstable conditions at 400 West.
Note: Intersections were analyzed with a calibrated stochastic simulation model using VISSIM software.

Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010

For 2030 No-Action conditions, the following assumptions were used:

- Widening of I-15 in Utah County was complete (assuming the existing interchange configuration for University Parkway).
- FrontRunner commuter rail was constructed from Salt Lake City to Provo.
- The intersection at University Parkway/800 East was widened to include dual eastbound left turn lanes.
- Geneva Road was widened from Provo to Pleasant Grove.
- The northbound and southbound left turns at 700 North/University Avenue were converted to protected/permitted phasing.
- Orem and Provo Intermodal Centers were constructed.

For future (2030) Preferred Alternative conditions, the following additional assumptions were used:

- The transit line would be center-running with exclusive lanes in the downtown Orem and Provo areas.
- A new interchange exists at 800 South and I-15.
- A new signalized intersection was added between State Street and 800 East in Orem. This new intersection serves pedestrian access to the proposed station at that location, as well as a primary access for the University Mall.
- Northbound and southbound left turns are prohibited on University Avenue at:
    - 600 North
    - 400 North
    - 300 North
    - Provo Center Street
    - 200 South
    - 400 South
- Additional pedestrian crosswalks and signals added at 600 North, 300 North, and 500 South on University Avenue. Only the 600 North added crosswalk is included in the detailed traffic analysis of University Avenue, however similar results are expected at the other locations. At the 500 South location, southbound vehicles will also be required to stop to allow BRT vehicles to exit the exclusive lanes. This will be accomplished through the use of the pedestrian signal at this location.
- All southbound and northbound left turning movements along 900 East in Provo were prohibited except the southbound left turning movement at Heritage Drive.
- Signal timing plans were developed for the study intersections based on projected travel times. For the purpose of this analysis, it was assumed that the 2030 No-Action and 2030 Preferred Alternative would operate with similar timing plans (same splits, cycle lengths, and offsets). This was done to make a fair comparison between the No-Action and the Preferred Alternative. The Utah Department of Transportation (UDOT), Orem City, and Provo City may make further adjustments to the corridor timing plans in order to adjust for the impact of TSP on side-street delay.

- The BRT was simulated with TSP at most intersections with the following exceptions:
    - State Street / University Parkway
    - 800 East / University Parkway
    - 2230 North / University Parkway
    - Freedom Boulevard / University Parkway
    - University Avenue / University Parkway
    - University Avenue / 700 North

TSP is an Intelligent Transportation Systems treatment that allows the transit vehicle to communicate with the traffic operations signals, providing priority to the transit line. While TSP does not guarantee a green light for the transit vehicle, it increases the probability that the transit vehicle will get a green light by giving the approach an early or extended green signal. TSP works best when the bus is moving in the predominate direction (coordinated direction), and can create additional delays to conflicting traffic. When this conflicting traffic consists of high volumes, this delay can become excessive. The above-mentioned locations had higher conflicting traffic volumes, and were therefore analyzed without TSP in place.

Traffic Volumes

The interchange at 800 South would result in increased traffic volumes on some local roads. Impacts to neighborhoods east of the new interchange were analyzed on a roadway link basis, using volumes estimated and distributed from the travel demand model. Table 4-10 shows the difference between No-Action and Preferred Alternative volumes on selected roadway links in the 800 South neighborhood for opening day (2014).

Table 4- 10: Neighborhood Impacts of the 800 South HOT Interchange – 2030 Peak Hour

Location	No-Action	Preferred Alternative (Phase II)
800 South at Interchange	0	1,400
1200 West, North of 800 South	1,550	1,450 – 1,650
New 800 South, West of Roundabout	0	1,550
Old 800 South, West of Roundabout	500	400 – 500
800 South, Directly West of 800 West[1]	800	1,000 – 1,650
800 West, North of 800 South	400	450 – 650
800 South: 800 West to 400 West	650	800 – 1,300
800 South, East of 400 West	1,050	1,100 – 1,350
400 West, South of 800 South	950	950 – 1,100
University Parkway, East of 400 West	6,000	6,100 – 6,250

1. *This segment would have traffic calming features and would have the biggest change in traffic diverting from it, and therefore the largest range in volumes of any of the roadway segments. All the other roads would have an increase due to traffic diverting to them, but traffic would get dispersed so each road only gets a portion of what comes off 800 South.*

Source: Fehr & Peers, Traffic Analysis Memorandums, November 2010

Accessibility

The Preferred Alternative would impact accessibility in a few locations and could change travel patterns. The new interchange would require 1370 West in Orem to dead end. Currently it connects directly to 800 South. However, because 800 South would be elevated under the Preferred Alternative, residents on 1370 West could access 800 South through 1420 West. Currently there is no development on the property north of 800 South between the railroad and I-15; this property is currently accessed via an at-grade railroad crossing on 800 South. If an agreement is in place for the current property to access 800 South, the access agreement would be maintained. Access would still be provided off the new 800 South; however, 800 South at this location will be elevated.

Along the Preferred Alternative corridor, unprotected left turns would be prohibited. This is discussed in more detail in the Traffic Impacts of the Preferred Alternative section above and in Section 4.8: Safety.

4.7 MOBILITY FOR PEDESTRIANS AND CYCLISTS

Existing Pedestrian Facilities

Existing pedestrian facilities throughout the corridor are outlined below.

- 800 South: 4-foot-wide sidewalk on both sides of the street
- Campus/College Drive: 4-foot-wide sidewalk on the west side of the street
- Willy Way: 6-foot-wide sidewalk on the south side of the street
- 400 West: 4-foot-wide sidewalk on the east side of the street
- University Parkway, 400 West to State Street: 6-foot-wide sidewalk on both sides of the street
- University Parkway, State Street to 800 East: 12-foot-wide College Connector Trail (open to bicycles and pedestrians) along the north side of University Parkway
- University Parkway, 800 East to approximately 750 West: 12-foot-wide College Connector Trail along the north side of the street
- University Parkway, 750 West to Freedom Boulevard: 12-foot-wide College Connector Trail along the north side of the street
- University Parkway, Freedom Boulevard to University Avenue: 12-foot-wide College Connector Trail along the north side of the street
- University Parkway, University Avenue to 900 East: 6-foot-wide sidewalk on both sides of the street
- University Parkway, 900 East to 700 North: varies from 4- to 8-foot-wide sidewalk on both sides of the street
- 700 North, 900 East to University Avenue: 4-foot-wide sidewalk on both sides of the street
- University Avenue: 4-foot-wide sidewalk on both sides of the street
- Freedom Boulevard, Intermodal Center to Novell Campus: 6-foot-wide sidewalk on both sides of Freedom Boulevard
- Novell Campus: 4-foot-wide sidewalk around campus

Overall, most locations throughout the corridor have pedestrian facilities on both sides of the street. The College Connector Trail connects BYU to UVU and provides a non-motorized transportation option for both bicyclists and pedestrians in the area. Data for pedestrian crossing

facilities at intersections was also gathered and is summarized for the intersections closest to proposed BRT stations in Table 4-11: Station Intersection Existing Pedestrian Facilities.

Table 4- 11: Station Intersection Existing Pedestrian Facilities

Intersection	Intersection Control	Pavement Treatment	Other Crossing Amenities
University Parkway / Sandhill Road	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons, countdown timers, audible signals
University Parkway / Main Street	Signalized	Parallel line crosswalk	Pedestrian signal heads, push buttons
University Parkway / State Street	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons
University Parkway / 2230 North	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons
University Parkway / Canyon Road	Signalized	Parallel line crosswalk	Pedestrian signal heads, push buttons
Campus Drive, east of 450 East	Grade-separated	Pedestrian bridge over Campus/College Drive	None
East Campus Drive, south of Heritage Drive	Grade-separated	Pedestrian bridge over Campus/College Drive	None
University Avenue / 600 North	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons
University Avenue / 300 North	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons
University Avenue / Provo Center Street	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons
University Avenue / 400 South	Signalized	Parallel line crosswalk, pedestrian refuge	Pedestrian signal heads, push buttons

Planned Pedestrian Facilities

The MAG 2030 Regional Transportation Plan identifies planned pedestrian facilities and improvements for Utah County. According to the plan, several facilities are planned in the study area, including the following:

- The Provo River Parkway Trail will extend from 3700 North to 2230 North in Provo, along the Provo River. The facility will be a 10-foot-wide asphalt trail and will not intersect the Preferred Alternative.
- The Orem 800 East Pathway will extend from 1600 North to University Parkway in Orem, and will be a 10-foot-wide concrete trail. The trail's southern terminus will be near the Preferred Alternative along University Parkway. However, BRT stations are not planned at 800 East, and interaction between BRT riders and the Orem 800 East Pathway will be minimal.
- Geneva Road will be widened to four lanes from 1600 North in Orem to Center Street in Provo. The project will also include a 10-foot-wide asphalt trail along Geneva Road,

including the section contained within the BRT alignment (from 800 South to University Parkway). The Geneva Road project will utilize already-available funds, and should occur during Phase I of the Regional Transportation Plan (2007 – 2015).

In addition to those pedestrian facilities identified in the MAG Regional Transportation Plan, the Carterville Multi-Use Path was identified as a pedestrian facility in coordination with Orem City. The Carterville Multi-Use Path will be a 10- to 12-foot-wide paved trail following Carterville Road north from University Parkway in Orem. Planned bicycle facilities, including bike lanes and routes, are discussed in Section 3.9: Parks and Recreation Resources.

Existing Bicycle Facilities

Existing bicycle facilities throughout the corridor are outlined below.

- 800 South Bike Lane (Orem) – Existing bike lane running from College Drive to 400 West in Orem.
- College Drive Bike Lane (Orem) – Existing bike lane runs from College Drive between Willy Way and 800 South in Orem.
- 1200 West Bike Lane (Orem) – Existing bike lane runs from 800 South along 1200 West in Orem.
- 900 East Bike Route – North (Provo) – Existing bike route runs along 900 East between University Parkway and Temple View Drive in Provo.
- Freedom Boulevard Bike Lane (Provo) – Existing bike lane runs from 300 South to Towne Center Boulevard in Provo.
- 800 North Bike Lane (Provo) – Designated bike lane on both sides of 800 North in Provo between 700 East and Geneva Road.
- 700 North Bike Lane (Provo) – Designated bike lane on both sides of 700 North from University Avenue to Seven Peaks Boulevard in Provo. It is approximately 8 feet wide and includes striping.
- 500 North Bike Lane (Provo) – Existing bike lane runs along 500 North in Provo.
- Center Street Bike Lane (Provo) – Located on Center Street between 200 East and 900 East in Provo. There is an existing pedestrian plaza between approximately 300 East and 500 West on Center Street.

Planned Bicycle Facilities

Bicycle master plans for the cities of Provo and Orem as well as the MAG 2030 Regional Transportation Plan identified the following planned bicycle facilities:

- University Avenue Bike Lane (Provo) – Bike lane will be located on both sides of University Avenue and will run between 500 North and 2230 North in Provo.
- 100 West Bike Route (Provo) – Bike route will run along 100 West in Provo.
- 400 West Bike Route (Provo) – Bike route will run along 400 West in Provo.
- 900 East Bike Route (Provo) – Bike route will follow 900 East south of University Parkway in Provo.
- 1860 South Bike Route (Provo) – Bike route will run along 1860 South from East Bay Boulevard east to South State Street in Provo.
- 100 South Bike Lane (Provo) – Bike lane will run along 100 South in Provo.

Mobility Benefits to Bicycles and Pedestrians

Adding the Preferred Alternative along the corridor would improve pedestrian and bicycle conditions in several locations, primarily at intersections. These improved locations are detailed below.

Pedestrian Benefits

UVU Station(s)

Currently, pedestrians are forced to cross major and minor roadways at dispersed locations to access campus. Stations planned for the UVU campus would funnel high volume pedestrian traffic to a single location where pedestrian treatments can be implemented.

University Mall Station

The Preferred Alternative includes a new signalized access to the University Mall east of State Street, including a BRT station. Riders would unload from BRT at the intersection and use crosswalks to cross the street while traffic is stopped. The Preferred Alternative would enhance pedestrian mobility by relocating the transit stop closer to the University Mall destination and improve pedestrian safety by reducing exposure to the State Street free right turns.

The University Mall is expected to be a major generator of ridership for the BRT line (see Figure 4-1). This station may require mitigation measures, such as additional pedestrian staging areas at the northern corners of the proposed intersection, to adequately accommodate the pedestrian traffic. In addition, the College Connector Trail parallels University Parkway's north side and will intersect the sidewalks at the proposed University Mall access. Sidewalks in both directions should be widened to accommodate the additional trail and BRT pedestrian traffic.

BYU Creamery Station

The proposed BYU Creamery station at Heritage Drive and 900 East would eliminate the northbound left turn movements from this intersection, creating a safer crossing for pedestrians at the intersection. The station would also create a mid-block pedestrian refuge, which would allow pedestrians to access the transit line. This refuge would not require pedestrians to cross in two phases. The amenities that would be built with the station would improve the pedestrian linkage to campus. The Preferred Alternative would also require the elimination of the unsignalized pedestrian crossings along 900 East, consolidating the pedestrian activity to the signals at Heritage Drive and University Parkway. It is recommended that the pedestrian environment from Heritage Drive to the center of campus be improved; however, this project will not be responsible for those amenities.

Stations without Changes to Pedestrian Conditions

Several locations throughout the corridor would see neither mobility benefits nor negative impacts due to the Preferred Alternative. Some stations would change pedestrian crossing patterns due to a center-running transit alignment instead of side-running transit, but this would not change overall pedestrian exposure to traffic. Stations where pedestrian conditions do not noticeably change include the Orem Intermodal Center, Center Street, and the Provo Intermodal Center.

Bicycle Benefits

800 South Interchange and Access to UVU

A bike lane is planned for the interchange at 800 South, which would provide improved access between eastern and western neighborhoods, as well as improve the safety conditions for cyclists who were forced to use University Parkway in the absence of another alternative (see discussion in Section 3.9: Parks and Recreation Resources).

BRT Vehicles

Utah Transit Authority (UTA) buses currently include exterior bicycle racks on the front of the vehicles. As part of the proposed project, UTA plans to explore the feasibility of including bicycle racks/storage areas within BRT vehicles. This would help improve mobility within the project study area by providing more convenient multi-modal transportation options.

Impacts on Pedestrian Facilities

While the Preferred Alternative would improve pedestrian mobility in some locations, it would negatively impact pedestrian mobility in other locations. This section discusses the pedestrian impacts and identifies needed mitigation actions.

University Mall Station

The University Mall station would provide mobility benefits to pedestrians and other users of the Preferred Alternative. However, the proposed University Mall access would also result in a new intersection crossing for users of the College Connector Trail. Trail users would have to navigate around pedestrians unloading from the BRT system and traffic accessing the University Mall through the new ingress/egress. Mitigation of these impacts should include signage that warns trail users of the upcoming crossing and signage that alerts drivers to the presence of the trail.

2230 North Station

The 2230 North/University Parkway intersection has several pedestrian amenities, as shown in Table 4-11 (see page 4-15). Pedestrian refuge areas within University Parkway are designed to accommodate pedestrians utilizing the two-phase crossing over the parkway. However, the Preferred Alternative would be center-running in this location and would likely utilize the space currently used for refuge areas. This would negatively affect pedestrians by reducing or eliminating the waiting space needed during the two-phase crossing. Mitigation measures may include preservation of needed space for the two-phase crossing or a longer pedestrian signal phase that requires pedestrians to cross University Parkway in one attempt.

In addition, curb ramps are present at intersection corners, but do not always connect to crosswalks. As a result, wheelchair users must detour from the curb ramp through the intersection to access the crosswalk. This curb alignment also provides poor guidance for the visually impaired who rely on curb ramp direction to indicate crosswalk placement and the desired direction of travel across the intersection. In addition, University Parkway does not have sidewalks due to the presence of the College Connector Trail. Therefore, sidewalks along 2230 North stop abruptly at its intersection with University Parkway. Furthermore, 2230 North lacks sidewalks on its south side east of University Parkway, though sidewalk is present on the north side of the street. Recommended mitigation measures include reconstructing curb ramps at 90-degree angles rather than 45-degree angles and extending sidewalk eastward along the south side of 2230 North to 400 West.

LaVell Edwards Stadium Station

The LaVell Edwards Stadium station is located at the intersection of University Parkway and Canyon Road and has marked crosswalks, pedestrian push buttons, and pedestrian signal heads. The Preferred Alternative would likely have large numbers of BRT riders unloading at this intersection before and after special events at the stadium. Sidewalk widths surrounding the stadium are currently 10 feet. However, pedestrian staging areas at the northeast corner of the University Parkway/Canyon Road intersection may be inadequately sized to accommodate special event riders unloading from the BRT system. A potential mitigation measure would be an expansion of those staging areas.

Impacts on Bicycle Facilities

This section discusses the impacts to bicycle facilities resulting from the Preferred Alternative.

700 North Bike Lane

The existing 8-foot shoulder along 700 North would be reduced to 4 feet. The bike lane in this location would be restriped.

900 East Bike Route

If an exclusive BRT lane is constructed on 900 East in the future, the existing 2-foot shoulder will need to be removed. Therefore, no additional space will be available for the proposed bike route.

4.8 SAFETY

Left Turns

Left turns that are unprotected are among the most dangerous traffic movements. With BRT running in the median through much of the corridor, left turns from the major streets to side streets at signalized intersections would either be protected only, or would be eliminated, depending on the location. The use of protected left turns may decrease accidents, as left turns would only be allowed at green arrows. Along University Avenue in Provo, some unprotected left turns would be eliminated, thus decreasing the number of conflict points at each intersection, and lowering the likelihood of accidents. By prohibiting unprotected left turns along the BRT corridor, the result is generally higher delays for vehicles turning left. This delay is included in the summary of the results in Section 4.6: Localized Traffic Impacts and Accessibility, above.

Pedestrian Safety

In the No-Action Alternative, transit patrons would board and alight all buses from the roadside. On the exclusive guideway sections in the Preferred Alternative, transit patrons would board and alight from stations in the median. Pedestrian safety would be addressed at station locations by ensuring signalized pedestrian crossings to access stations. Median stations would have railings and landscape buffers, where appropriate, to lower the risk of auto-pedestrian conflicts. Where the BRT runs mixed-flow, auto-pedestrian conflicts would be avoided by passengers alighting directly from the curb stations, similar to how they do today, and how they would in the No-Action Alternative.

Railroad Crossings

There is one existing crossing and one proposed crossing of the Union Pacific Railroad line along the project corridor. The Preferred Alternative would cross the Union Pacific Railroad at an

existing, grade-separated railroad crossing on University Avenue near 600 South in Provo. A proposed, grade-separated railroad crossing at 800 South west of I-15 in Orem is proposed as part of the Preferred Alternative. In both cases, crossings are grade-separated, resulting in negligible impacts to the railroad. The interchange at 800 South in Orem would eliminate one at-grade railroad crossing at 800 South, improving safety.

4.9 EFFECTS ON PARKING

The Preferred Alternative would impact on-street parking along 800 South (west side of I-15) in Orem due to the addition of bike lanes, and along University Avenue in Provo. In downtown Provo, there is adequate parking through private parking and on-street parking on adjacent streets. There are currently approximately 175 on-street parking spaces on University Avenue between 300 South and 500 North. The Preferred Alternative would reduce the on-street parking spaces to approximately 85 (loss of 95 spaces), based on the conceptual design (Lochner 2010a and 2010c). From Center Street to 300 North, there are currently 61 spaces, and the Preferred Alternative would reduce parking to 47 spaces (a loss of 14 spaces). The Preferred Alternative would also reduce the need for more than 200 parking spaces (2 acres) by increasing transit ridership to downtown. The actual number of on-street parking spaces would be determined during final design.

Commercial properties along a portion of University Parkway in Orem may lose some parking in lots adjacent to the parkway; however, these impacts are likely to be minimal given the size of the commercial lots.

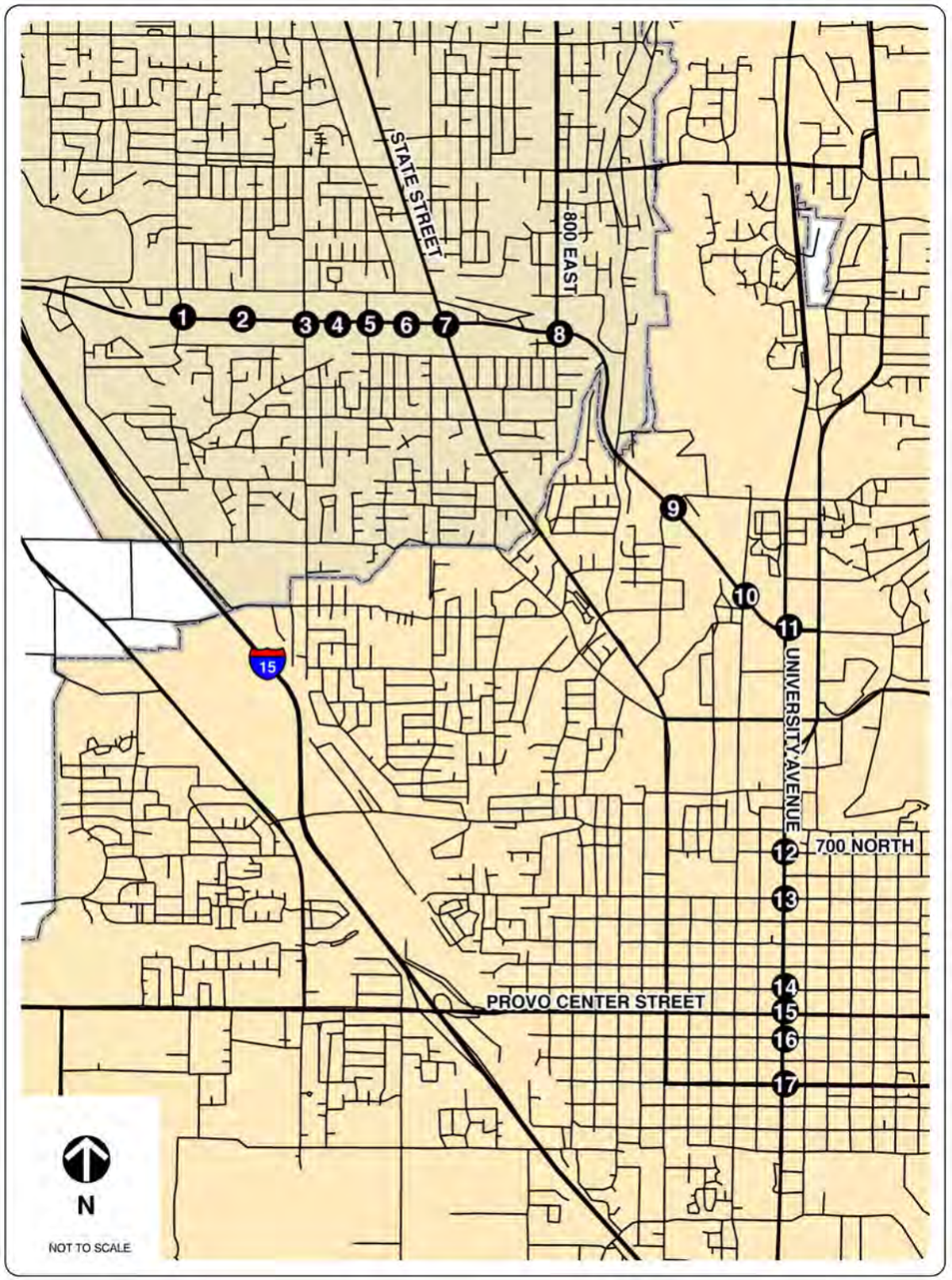
The Preferred Alternative would reduce the need for approximately 7 acres (over 800 spaces) of parking at the university campuses.

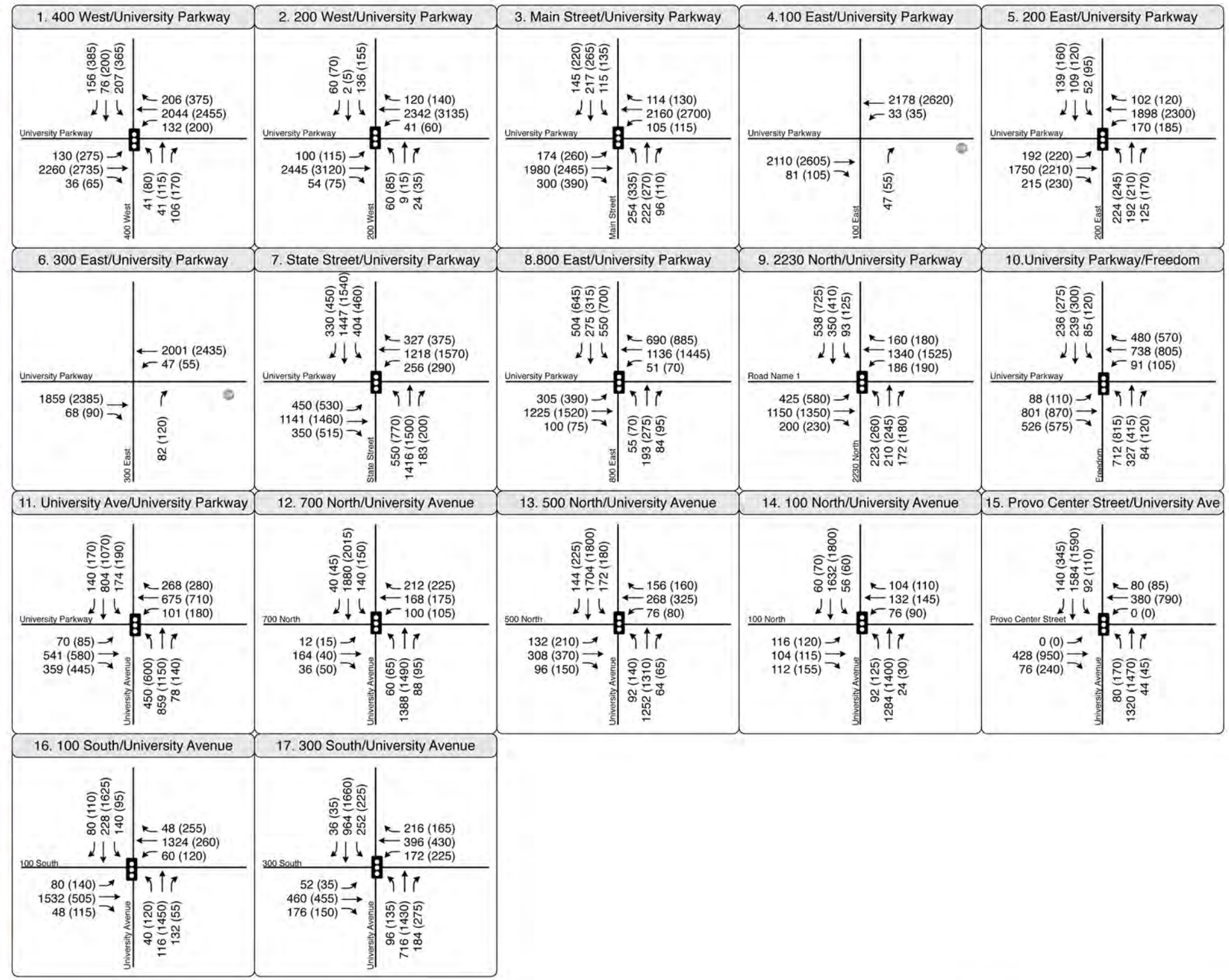
No parking would be provided at the BRT stations; however, approximately 965 stalls and nearly 500 stalls will be provided at the Provo and Orem Intermodal Centers, respectively.

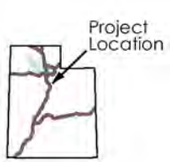
4.10 CONSTRUCTION IMPACTS ON TRAFFIC

University Parkway, University Avenue in Provo, and 700 North in Provo would be most affected by construction because these are the roadways where the majority of the exclusive right-of-way is planned.

Traffic operations on roadways would be reasonably maintained during construction. Strategies to minimize impacts to roadways include off-peak and night construction; construction phasing; providing detours, temporary roadways, alignment shifts, and expansions in construction areas to maintain capacity; use of variable message signs; and transportation demand management programs. A traffic maintenance program would be developed and coordinated with city staff during final design prior to commencement of construction activities.







LEGEND

- Turn Lane
- Study Intersection
- Traffic Signal
- Stop Sign

Existing (2030) Peak Hour Traffic Volume

Figure 4-5

Provo-Orem

BRT Traffic Volumes

Bus Rapid Transit Environmental Assessment