

TRANSIT IMPROVEMENTS ASSESSMENT FOR THE **JACKSON-WILSON ROAD (SNAKE RIVER BRIDGE)**

Draft Final Report



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Prepared for



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1. STUDY BACKGROUND AND PURPOSES

STUDY BACKGROUND

Southern Teton Area Rapid Transit (START) is the transit provider to the Town of Jackson and Teton County, Wyoming. START originated in 1987 as a ski shuttle and has incrementally expanded service over the last 25 years. It now operates year-round service on five fixed routes, which can be grouped into three service types based on the operating structure, fare type, and markets being served:

- Commuter Routes – Longer routes that primarily serve those who work in Jackson, Teton Village, or other areas of Teton County, but live outside of the County (Star Valley and Teton Valley routes).
- Corridor Routes – Medium-distance routes that operate along high travel corridors connecting towns, communities, and other destinations within Teton County (Teton Village route).
- Circulator Routes – Short-distance routes that make frequent stops within a single town or community to provide local circulation and connections to corridor and commuter routes (Town Shuttle).



WYOMING ROUTE 22 AND WYOMING ROUTE 390

Transit Enhancements

Previous studies and plans, such as the Jackson/Teton County Integrated Transportation Plan (ITP) have proposed enhanced transit service between Teton Village and Jackson, including high-frequency bus rapid transit (BRT) (Route 20—Teton Village) along Wyoming Route 390 (WYO 390) and Wyoming Route 22 (WYO 22), as shown in **Figure 1**. The Route 30—Teton Valley commuter route also shares part of Route 20's alignment on WYO 22 and operates between the Town of Jackson and Wilson.

Roadway Enhancements

The Wyoming Department of Transportation (WYDOT) has programmed a bridge replacement of the Snake River Bridge on WYO 22 (Draft Wyoming 2020 State Improvement Program). The WYO 22/WYO 390 intersection, which is in close proximity to the Snake River Bridge will also be improved to accommodate future traffic volumes. The programmed improvements (CN 2000058, Jackson-Wilson Road, Bridge Over Snake River, Teton County) consist of bridge replacement over the Snake River, WYO 22/WYO 390 intersection modifications, and roadway widening to 4-lanes. WYDOT has initiated planning of the improvements. Final design will be completed in 2021, and construction is programmed for 2023.

STUDY PURPOSES

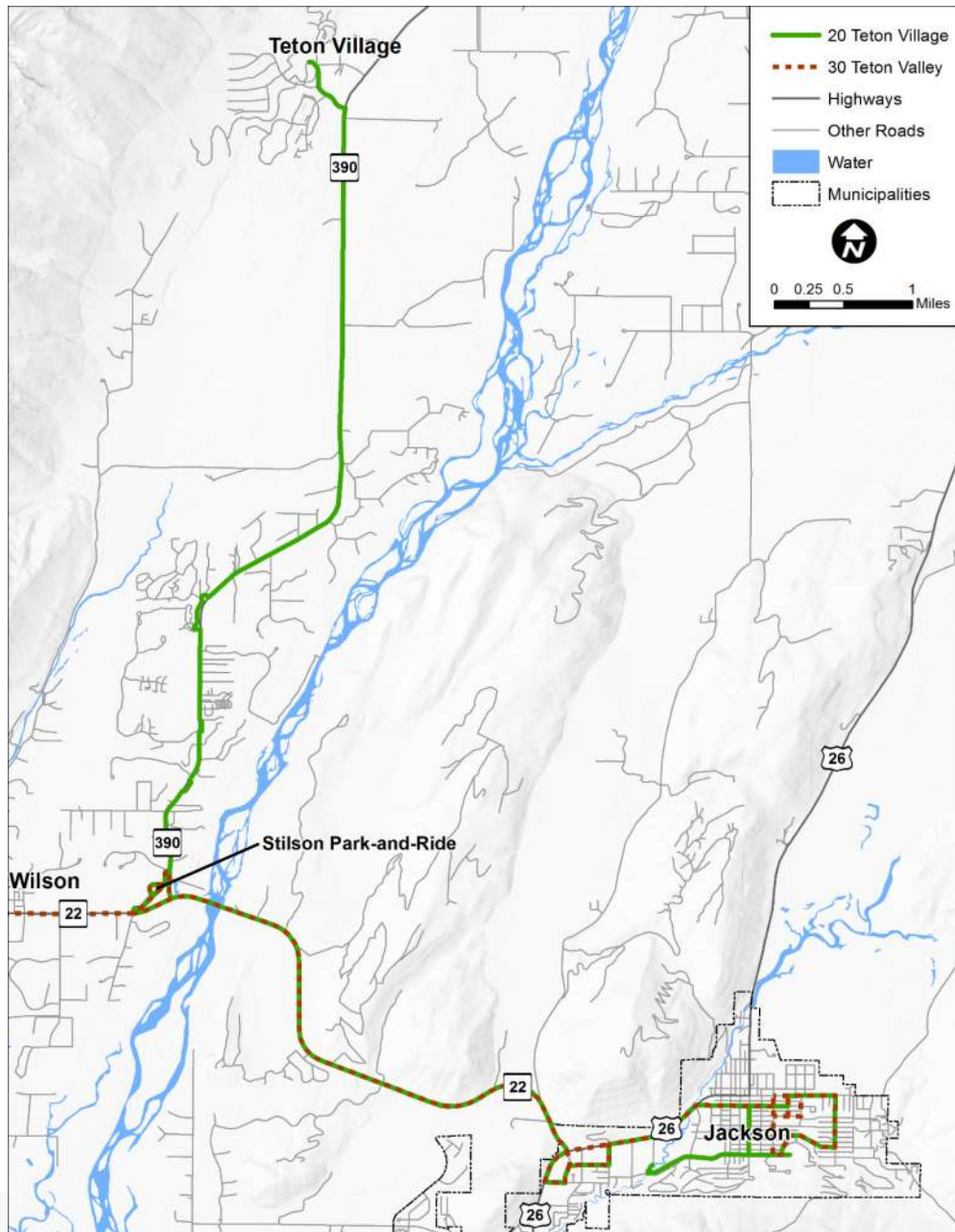
The WYO 22/WYO 390 intersection was identified in the Planning and Environmental Linkages Study (PELS) as a major intersection in which motorists encounter delays. The PELS listed the intersection and the Snake River Bridge as a high priority improvement project.

To inform the improvements planning and design, WYDOT has initiated this Transit Assessment to identify what transit improvements, if any, should be incorporated into the WYO 22/WYO 390 and Snake River Bridge improvements. The purposes of this study are:

1. Review corridor recommendations from previous studies related to transit/BRT and roadway improvements on WYO 22 and WYO 390 between Jackson and Teton Village

2. Review proposed improvements to WYO 22/WYO 390 (Jackson-Wilson Road, Snake River Bridge, Teton County)
3. Assess the need for improvements to accommodate BRT. Evaluate the compatibility of the proposed WYO 22/WYO 390 improvements with implementation of future transit/BRT improvements.
4. Recommend modifications to the WYO 22/WYO 390 (Jackson-Wilson Road, Snake River Bridge, Teton County) improvement plans to accommodate future BRT. The purposes of the BRT improvements are to:
 - Improve the capacity and reliability of the transit service between Jackson and Teton Village
 - Reduce transit travel times
 - Increase transit ridership, which will reduce vehicle demand on the WYO 22 and WYO 390 corridors
5. Obtain stakeholder and public input on the alternatives to identify a set of recommended alternatives.

Figure 1: Study Area



2. PREVIOUS PLANNING EFFORTS

A number of plans have identified a need for traffic congestion management and enhanced transit within the WYO 390 and WYO 22 corridors. Recently completed planning efforts include:

- Wyoming Highways 22 and 390 Planning and Environmental Linkages (PEL) Study
- Jackson/Teton County Integrated Transportation Plan (ITP)
- Teton Village/Jackson Hole Mountain Resort Transportation Demand Management Program Plan

Details on pertinent recommendations from these plans are provided in the subsequent subsections.

WYOMING HIGHWAYS 22 AND 390 PEL STUDY

WYDOT initiated a PEL study in 2012 to develop a vision for the WYO 22 and WYO 390 corridors between the Town of Jackson, the Jackson Hole Ski Resort at Teton Village, and southern Teton County. A PEL approach to transportation decision making considers environmental, community, and economic goals early in the planning process and uses the resulting information as inputs into future environmental review processes along the corridor.

The PEL identified the following corridor (WYO 390/WYO 22) needs:

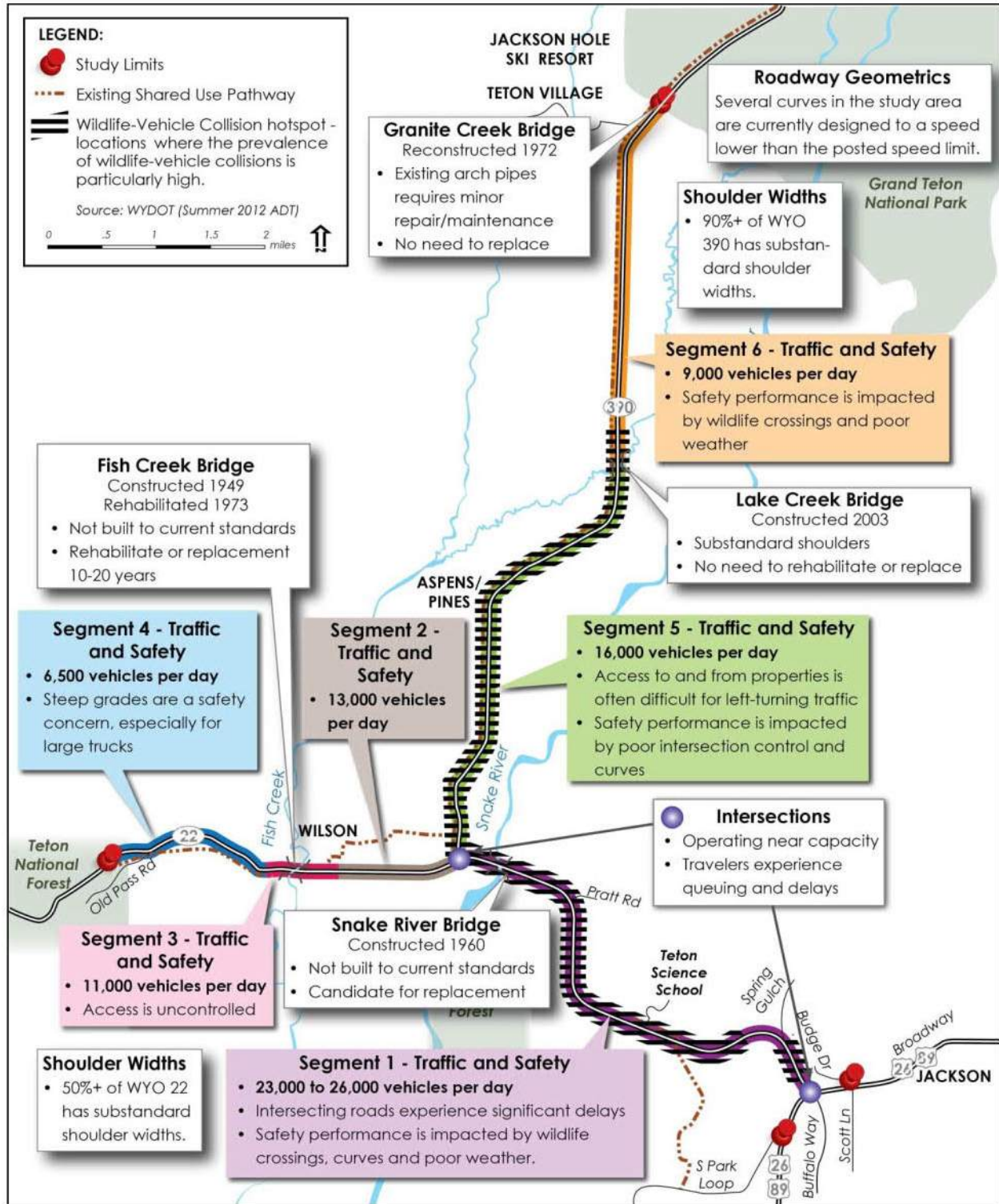
- Mobility – Congestion during peak periods in the summer and winter seasons impairs mobility and access for all users. Traffic conditions result in long platoons of vehicles in steady traffic streams on the two-lane highways. This condition makes access to and from the highways difficult and results in queueing and delay.
- Transit – Buses can experience slow travel times due to congestion. Travel delay is often experienced at the intersections of WYO 22 with Broadway, Spring Gulch, and WYO 390. To attract riders, buses need to maintain a competitive travel time with automobiles.

Figure 2 depicts existing corridor conditions as identified in the PEL study. The PEL identified and screened five potential intersection design alternatives for the WYO 22/WYO 390 intersection. Alternatives are shown in **Figure 3**. The PEL recommended considering queue jumps and transit signal priorities at major intersections:

- WYO 22/Broadway
- WYO 22/WYO 390
- WYO 22/Spring Gulch Road

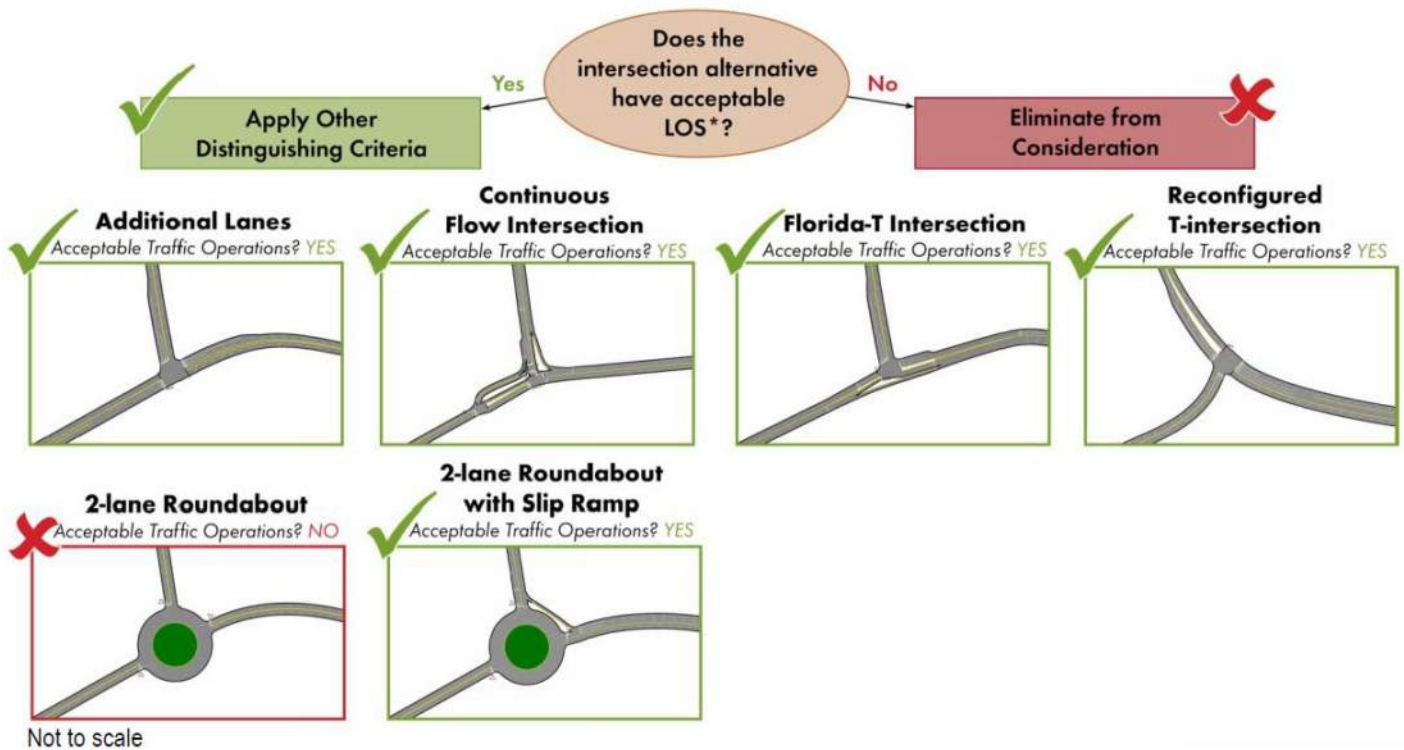
The PEL also identified an opportunity for dedicated bus lanes or bus pullouts as well as queue jump lanes on WYO 390 between WYO 22 and Lake Creek. The PEL recommended that WYDOT, in partnership with START and Teton County, consider locating an additional park-and-ride along the corridor, although further evaluation of the concept is needed to identify an appropriate location.

Figure 2: Existing Corridor Conditions Identified in the PEL Study



Source: Wyoming Highways 22 and 390 Planning and Environmental Linkages Study (2012)

Figure 3: Intersection Alternatives for WYO 22/WYO 390 Intersection



Source: Wyoming Highways 22 and 390 Planning and Environmental Linkages Study (2012)

JACKSON/TETON COUNTY INTEGRATED TRANSPORTATION PLAN

The Jackson/Teton County Integrated Transportation Plan (ITP) was developed in 2015 as a guidance document to help implement the policies, goals, and objectives that were identified in the 2012 Town and County Comprehensive Plan. The ITP was developed to be implemented over a 20-year horizon, with actions identified in three timeframes—immediate actions (to be implemented within three years); high-priority actions (to be implemented within 10 years); and benchmarked, or long-range actions (to be implemented by 2035).

All actions were developed under the guiding principles from the Comprehensive Plan, including:

- Meeting future transportation demand by using alternative modes
- Creating a safe, efficient, interconnected, and multimodal transportation network
- Coordinating land use and transportation planning

The ITP considered key needs and identified recommendations related to providing transit service between Jackson and Teton Village. A key recommendation in the ITP was to implement BRT between Jackson and Teton Village. The BRT route, as identified in the Jackson/Teton County Integrated Transportation Plan, is shown in **Figure 4**, with the implementation including:

- Addition of a bus/high-occupancy vehicle (HOV) lane along WYO 22
- Implementation of traffic signal and/or lane prioritization for buses at the WYO 22 'Y-intersection' (WYO 22 and Broadway in Jackson) and the WYO 22/WYO 390 intersection
- Streamlining the route alignment to prioritize use of the highway along the route and eliminate detours
- Improved service levels by increasing both the frequency of the service and the hours of operation
- Enhanced viability of a new BRT system through specific branding
- Implementation a system for off-board fare collection at major stops to reduce dwell times

The ITP recommended increasing transit service on the Teton Village route during the summer by utilizing excess fleet capacity from the winter fleet. The goal of this increase in service is to grow ridership for the route during a season when the county population and traffic volumes can be more than double those of other seasons.

The ITP recommended working with local employers to develop and implement transportation demand management (TDM) strategies that would incentivize using the bus for commuting trips to increase commuter ridership and reduce commuter-related vehicular traffic on the route.

Planning and design coordination for BRT-related capital recommendations (providing a dedicated bus/HOV lane and intersection reconfigurations at the WYO 22 ‘Y-intersection’ and WYO 22/WYO 390 intersection) were identified in the ITP as immediate actions to be taken within three years of the plan’s adoption, although the construction of these projects is recognized to be within the high-priority (10-year) timeframe.

TETON VILLAGE/JACKSON HOLE MOUNTAIN RESORT TDM PROGRAM

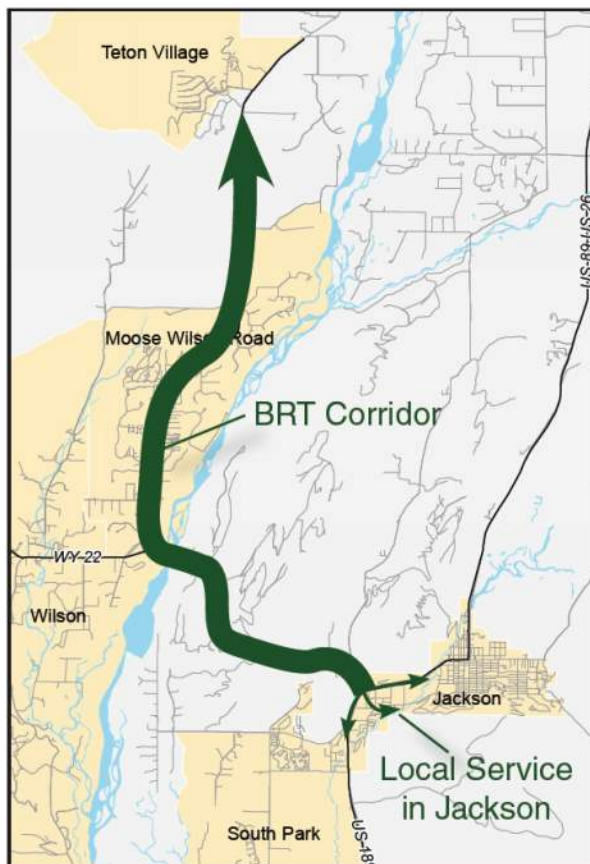
In 1998 Teton County approved new development limits for Teton Village that provided the framework for the area to grow from its 1998 levels , of 618 Average Number of People Housed at Peak Occupancy (APO) and 4,957 skiers, to a build out of 5,240 APO and 7,690 skiers.

As a condition of approval, Teton Village Association and Jackson Hole Mountain Resort implemented a multifaceted TDM program to encourage travel by alternate modes and ensure that vehicle traffic from the expanded ski resort would not overwhelm the road system. Elements included:

- Encourage expansion of transit service
- Construct the Stilson Park-and-Ride and provide a free shuttle to Teton Village
- Provide incentives for using transit and carpooling for resort employees
- Implement parking fees at Teton Village for personal automobiles
- Expand the number of accommodations and on-site restaurant and retail options for guests at Teton Village to reduce the need for visitors to leave the resort for lodging or other services
- Provide improved traveler information for transit and alternative modes to visitors and residents
- Provide a comprehensive system of pedestrian and bicycle facilities that offer connections within Teton Village and to the regional trail system and provide bicycles for residents and visitors to use

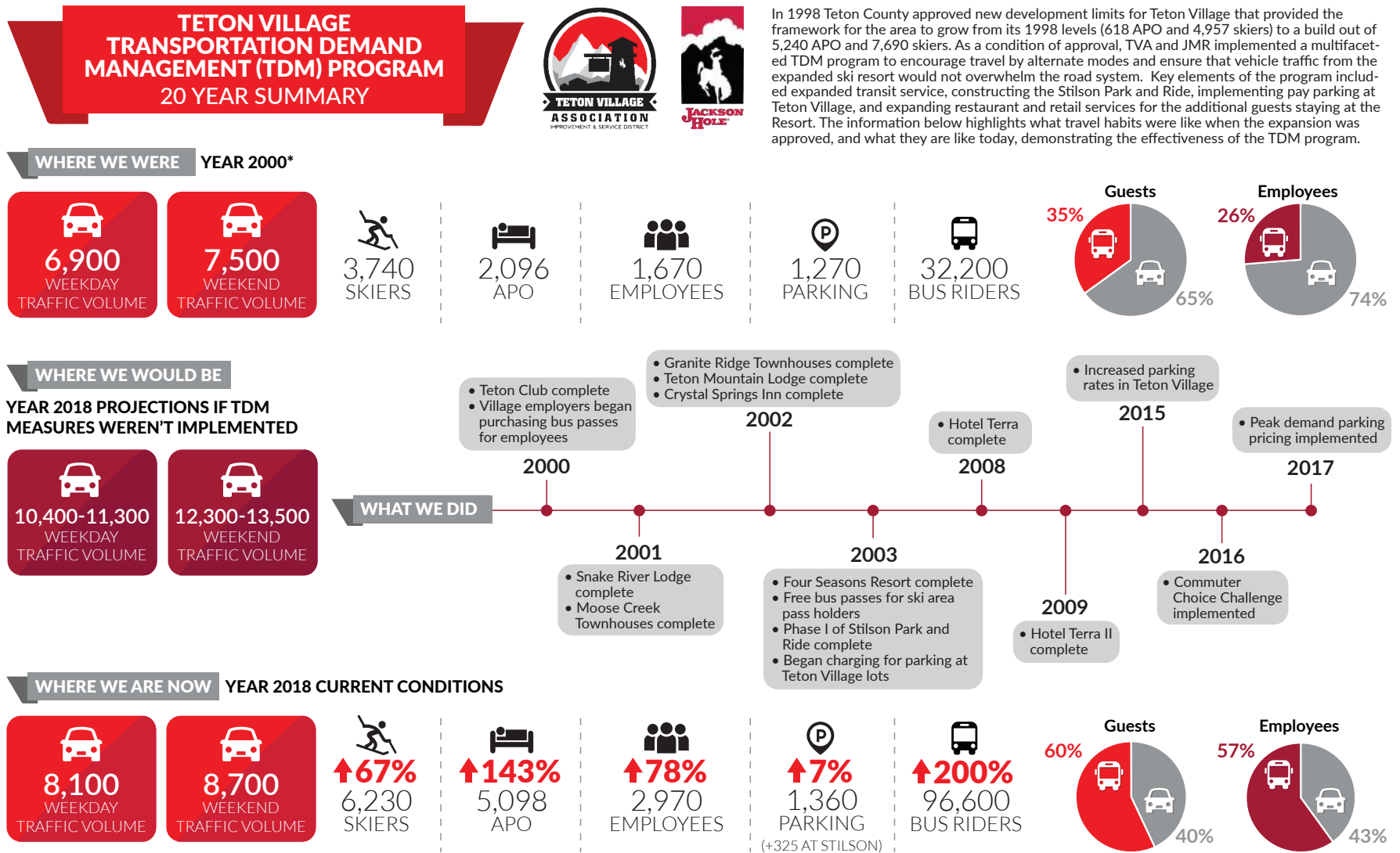
Part of the TDM program was a requirement to monitor and report on progress of specific TDM measures. **Figure 5** shows the 20-year success of the TDM program. The resort has expanded and accommodates more visitors and employees without experiencing a corresponding level of increase in vehicular traffic to and from the resort. In 2018, approximately 60% of guests and just under 60% of employees reported using the bus to reach the resort instead of driving personal automobiles.

Figure 4: BRT Alignment Identified in the Jackson/Teton ITP



Source: Jackson/Teton Integrated Transportation Plan (2015)

Figure 5: Teton Village TDM Program Summary of Results



*Program began in 1998, however 2000 was the first year of data monitoring
Data shown is for February 2000 and February 2018

Source: <https://tetonvillagewy.org/2019/03/12/20-year-transportation-demand-management/>

3. CURRENT ROADWAY AND TRAFFIC CHARACTERISTICS

ROADWAY CHARACTERISTICS

WYO 22

WYO 22 is a rural highway connecting the Town of Jackson to the unincorporated community of Wilson and continues west to Idaho. WYO 22 is mainly a two-lane roadway, apart from a ¼-mile segment west of Broadway (US 26) in Jackson which has a four-lane cross section. Left- and right-turn lanes exist at most intersections along the corridor. In the two-lane segment, WYO 22 is typically 38 feet in width, with two 12-foot travel lanes and a seven-foot shoulder on each side. The speed limit is variable along the corridor:

- 45 mph between WYO 390 and approximately Walton Ranch Road
- 55 mph between Walton Ranch Road and approximately Spring Gulch Road
- 40 mph between Spring Gulch Road and just west of US 26
- 30 mph approaching US 26

Unique Considerations

The Snake River Bridge is located on WYO 22 approximately ¼-mile east of the intersection with WYO 390. The bridge is approximately 890 feet in length and 38 feet wide, carrying one lane of traffic in each direction. The shoulders do not provide width for vehicles to pull out of the travel lanes or for emergency response vehicles to bypass traffic on the bridge. The bridge was constructed in 1960 and the deck is reaching the end of its functional life, with frequent maintenance required. WYDOT has programmed a bridge replacement of the Snake River Bridge (Draft Wyoming 2020 State Improvement Program).

WYO 390

WYO 390 is a rural highway connecting WYO 22 to the Teton Village area and other points to the north. From WYO 22 to Teton Village, WYO 390 is two lanes with isolated segments of a center turn lane. Most intersections do not have turn lanes. The roadway is typically 32 feet in width, with two 12-foot travel lanes and a four-foot shoulder on each side. The speed limit on WYO 390 is 45 mph between WYO 22 and approximately John Dodge Road, and 55 mph between John Dodge Road and Teton Village Road.

Unique Considerations

Shared-use paths are adjacent to both WYO 22 and WYO 390 for the length of the study area. On WYO 22, the shared-use path runs along the south side of the roadway between Broadway and Mallard Road. The shared-use path then crosses to the north side of WYO 22 and continues to Snake River. To the west of the Snake River Bridge, the shared-use path separates from the roadway to cross the Snake River on a pedestrian/bicycle bridge. After crossing, the shared-use path crosses under WYO 390 to connect to a shared-use path on the west side of WYO 390. The shared-use path along WYO 390 continues along the west side of the roadway the entire length between WYO 22 and Teton Village Road.

WYO 22/WYO 390 INTERSECTION

The intersection of WYO 22 and WYO 390 is located approximately 1.5 miles east of Wilson and ¼-mile west of the Snake River. The intersection is a signalized 'T' intersection, with a southbound, eastbound, and westbound approach. The southbound approach has separate left- and right-turn lanes. The eastbound approach has separate left- and through-lanes. The westbound approach is one lane with a westbound right-turn bypass lane that allows westbound traffic to turn onto WYO 390 without stopping.

Figure 7 shows the existing configuration of the WYO 22/WYO 390 intersection.

Figure 7: Existing WYO 22/WYO 390 Intersection



TRAFFIC CHARACTERISTICS

Seasonal Traffic Volumes

Traffic volume data were obtained from WYDOT from three automatic vehicle classifier (AVC) count stations on WYO 22 and WYO 390:

- WYO 22 east of WYO 390
- WYO 22 west of WYO 390
- WYO 390 north of WYO 22

Table 1 shows average traffic volumes by month for the most recent count data available. The highest observed volumes occurred in July, which are approximately 35% higher than the average annual volumes. The lowest observed volumes occurred in November.

Table 1: Average Daily Traffic Volumes

Month (Year)	WYO 22 (E of WYO 390)	WYO 22 (W of WYO 390)	WYO 390 (N of WYO 22)
January (2019)	17,299	Not available	11,978
February (2019)	16,968	9,421	11,910
March (2019)	17,617	10,278	12,044
April (2019)	12,896	9,145	7,399
May (2019)	15,662	11,104	9,709
June (2019)	20,799	14,116	13,848
July (2019)	23,283	15,810	15,173
August (2018)	22,086	14,698	Not available
September (2018)	19,889	13,371	12,369

Month (Year)	WYO 22 (E of WYO 390)	WYO 22 (W of WYO 390)	WYO 390 (N of WYO 22)
October (2018)	15,640	10,944	9,509
November (2018)	12,630	8,797	7,737
December (2018)	16,329	10,222	11,171
Average	17,577	11,606	11,211

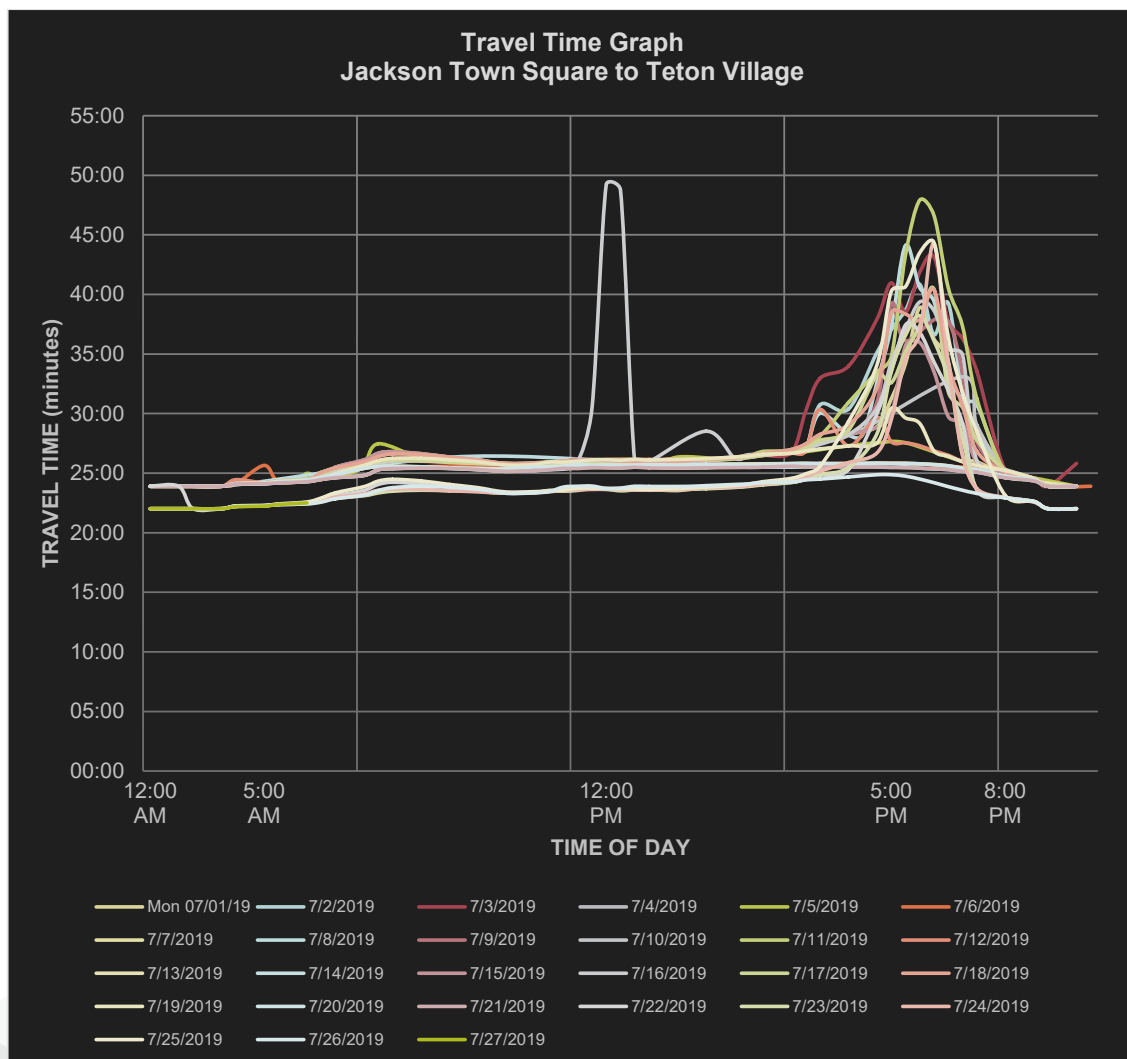
Corridor Travel Time

Kimley-Horn’s Traction software was used to collect and analyze vehicle travel time data on the WYO 22/ WYO 390 corridor for the month of July 2019. Traction utilizes anonymized cell phone data to track trips and obtain travel times for designated routes. Vehicle travel time for this study were collected directionally for Jackson Town Square to Teton Village and Teton Village to Jackson Town Square.

Jackson Town Square to Teton Village

Travel times from Jackson Town Square to Teton Village are approximately 25 minutes with no traffic congestion. Observed travel times for Town Square to Teton Village are shown in **Figure 8**. Travel times stay consistent most of the day with peaks between 5:00 pm and 6:00 pm, where travel times increase to 35 to 40 minutes.

Figure 8: Jackson Town Square to Teton Village Travel Times

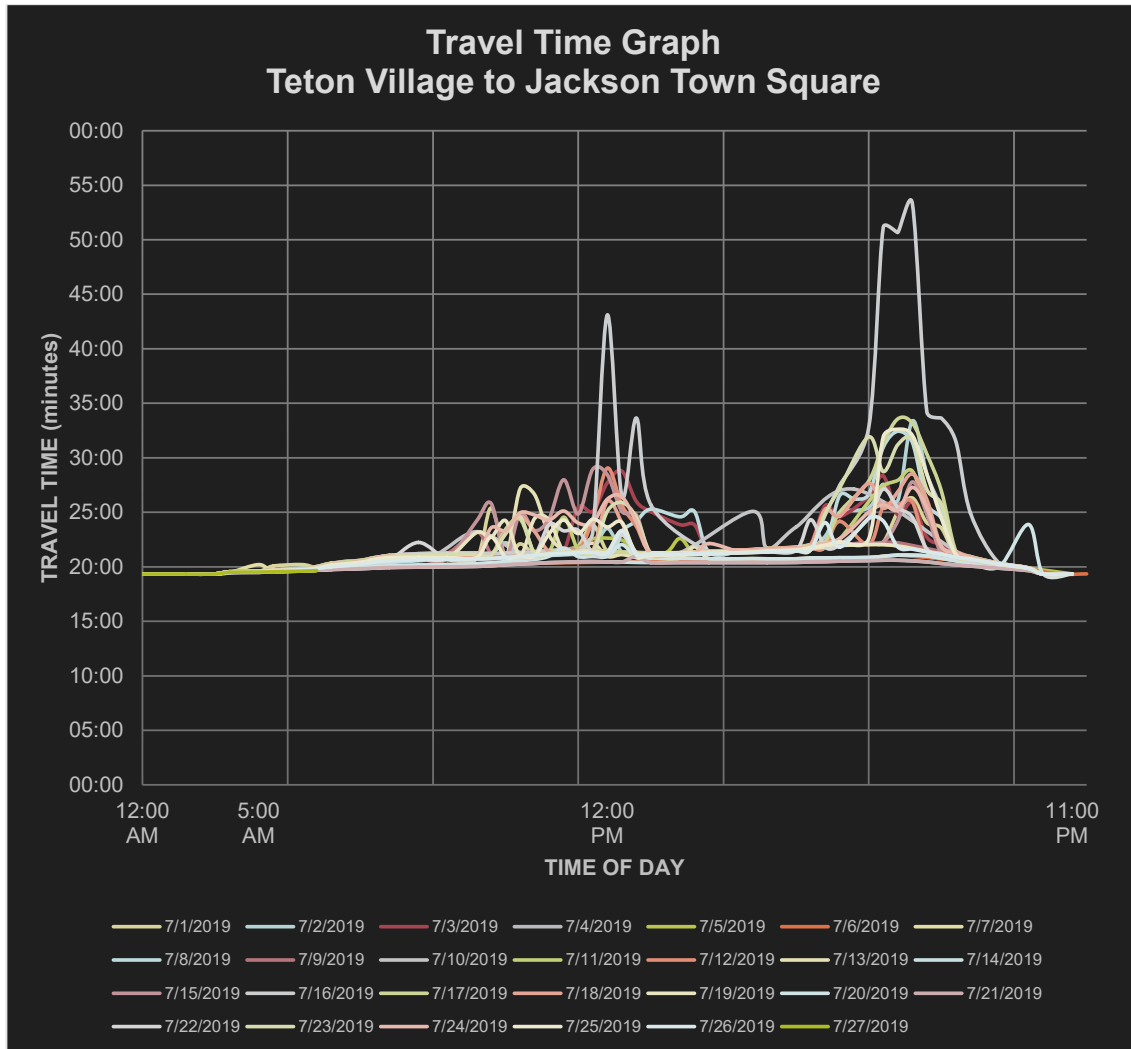


Teton Village to Jackson Town Square

Travel times from Teton Village to Jackson Town Square are approximately 19-20 minutes without traffic congestion. Observed travel times for Teton Village to Jackson Town Square are shown in **Figure 9**.

Travel time delay in the eastbound direction (Teton Village to Jackson Town Square) is experienced during more times of the day, but the peak periods are less severe than in the westbound direction. An increase in travel times was observed in the late morning hours (10:00 am–12:00 pm) as well as during the evening commuter peak (5:00 pm–6:30 pm). Average travel times during the peak period increased to approximately 31-33 minutes. There is an outlier on July 16, 2019 where travel times increased to 53 minutes. This is likely due to a crash on Highway 89 north of Jackson that directed traffic onto Highway 390.

Figure 9: Teton Village to Jackson Town Square Travel Times



Current And Future Traffic Volumes

Current Traffic Volumes

Current condition turning movement counts at the WYO 22/WYO 390 intersection are provided in **Figure 10**. Turning movement counts (2018) show several movements with traffic volumes that exceed 500 vehicles per hour (vph).

AM Peak Period

- Eastbound through movement
- Westbound to northbound right-turn movement

PM Peak Period

- Westbound through movement
- Southbound to eastbound left-turn movement

Future Traffic Volumes

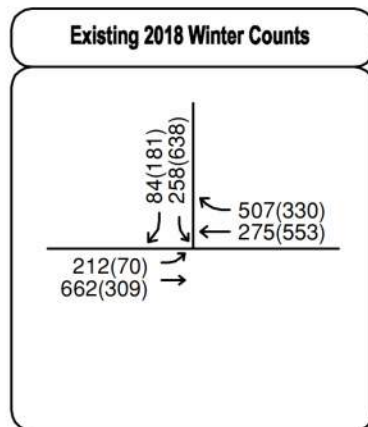
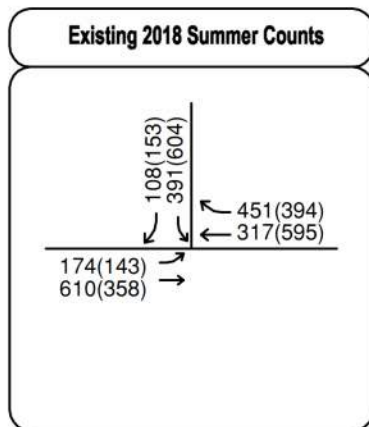
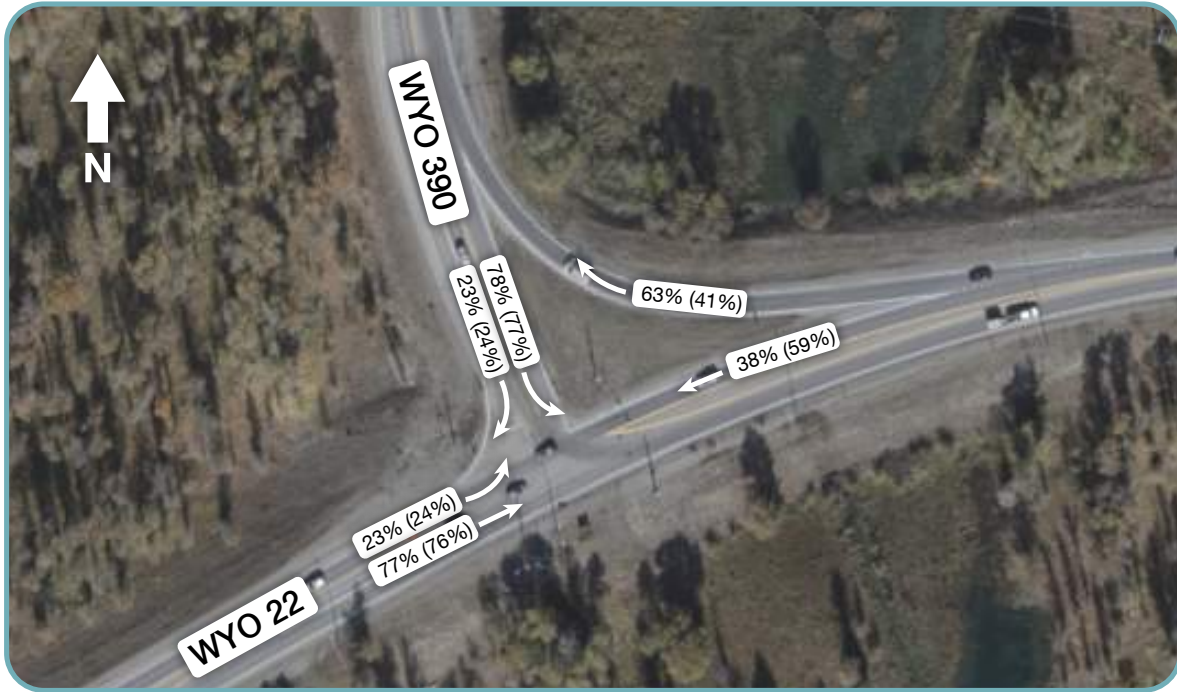
The Wyoming Highways 22 and 390 PEL Study forecasted future volumes on WYO 22 and WYO 390. **Figure 11** shows the forecasted average daily traffic volumes on the study area corridors. The PEL study projected traffic volumes will increase from 23,000 vehicles per day (2018) to 35,000 vehicles per day in 2035, an annual growth rate of 2.06%.

The segment of WYO 390 between WYO 22 and Indian Creek is projected to increase from 16,000 vehicles per day to 23,000 vehicles per day in 2035, an annual growth rate of 1.3%.

The segment of WYO 390 between Indian Creek and Teton Village Road is anticipated to increase from 9,000 vehicles per day to 15,000 vehicles per day in 2035, an annual growth rate of 2.15%.

2035 and 2040 projections show that overall peak-hour intersection volume is anticipated to grow from approximately 2,300 vehicles (August 2018 PM volume) to 3,600 vehicles in 2035 and 4,000 vehicles in 2040, an annual growth rate of over 2.5%.

Figure 10: WYO 22/WYO 390 Intersection Turning Movement Counts, Forecasts, and Directional Splits



LEGEND	
← XX(XX)	AM (PM) PEAK HOUR VEHICLE VOLUMES
← XX%	AVERAGE AM (PM) DIRECTIONAL SPLIT

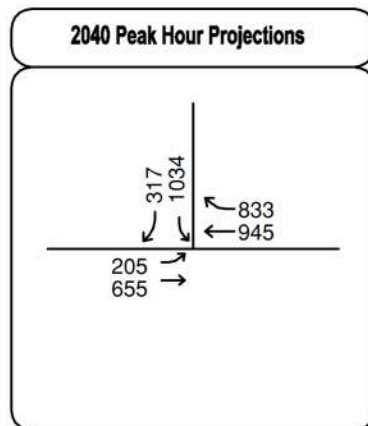
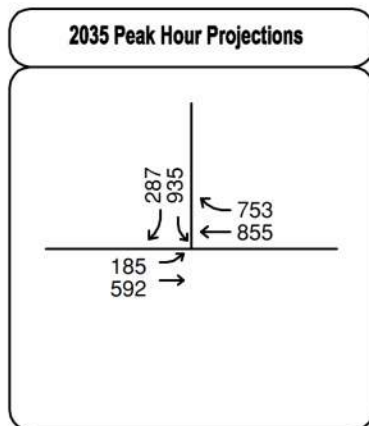
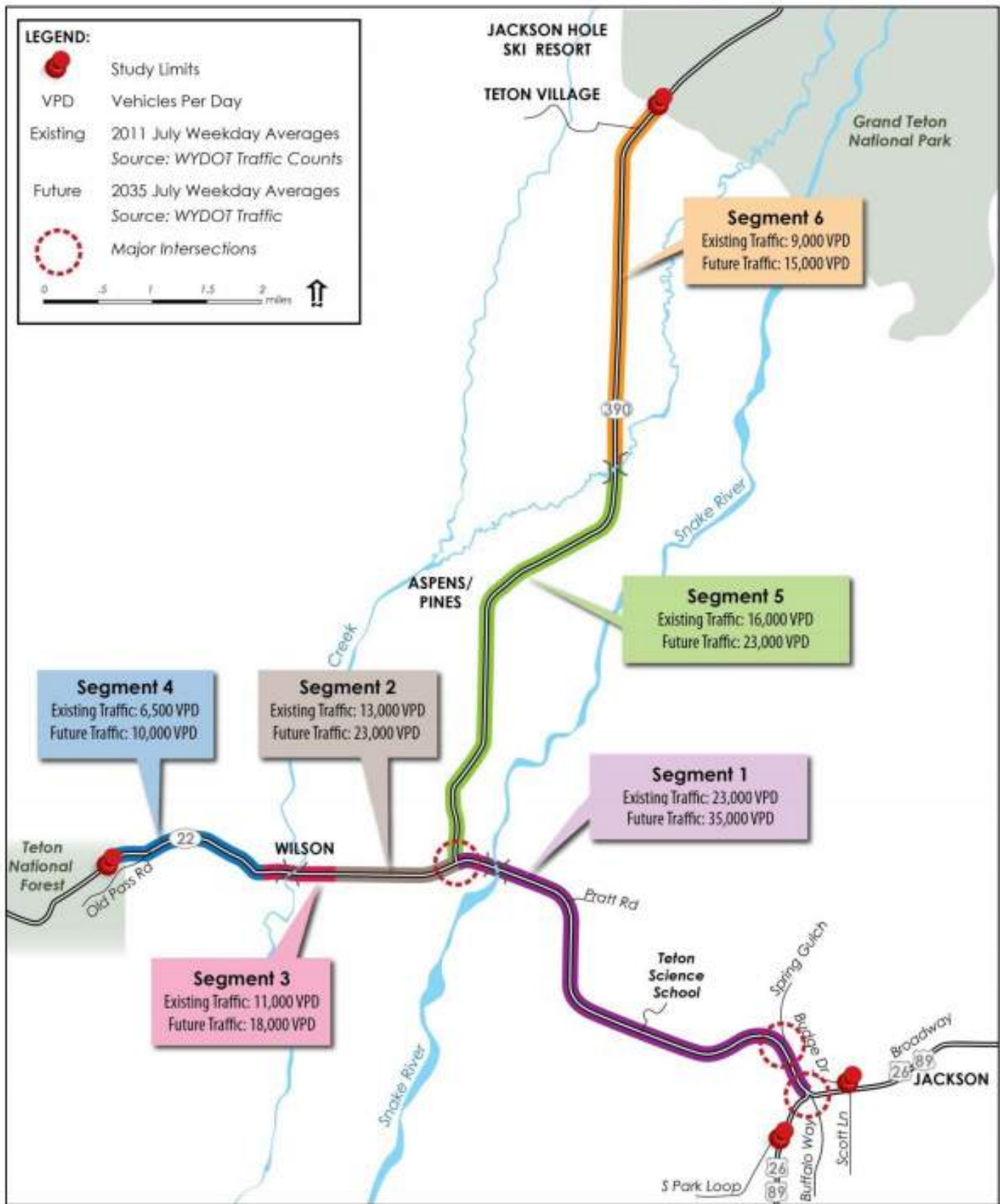


Figure 11: Wyoming Highways 22 and 390 PEL Study Traffic Forecasts



Source: Wyoming Highways 22 and 390 Planning and Environmental Linkages Study (2012)

Current Conditions

The existing WYO 22/WYO 390 intersection was modeled in VISSIM. The results, shown in **Table 2**, show delay and queueing for the eastbound left-turn movement, the westbound through movement, and the southbound left-turn movement.

Table 2: Current (2019) Summer Conditions PM Peak Period VISSIM Model

Intersection	Direction	Movement	2019 Current Conditions - PM Peak					
			Average Delay (sec/veh)	LOS	Approach Delay (sec/veh)	Approach LOS	Avg. Queue (ft)	Max. Queue (ft)
WYO 22/ WYO 390	EB	Left	47.7	D	30.1	C	25	260
		Through	22.8	C			50	480
	WB	Through	55.0	E	42.3	D	780	1665
		Right	23.7	C			5	210
	SB	Left	52.1	D	57.1	D	395	1425
		Right	27.1	C			15	135
	Intersection			41.1	D	-	-	-

Future Conditions

WYDOT’s 2020 State Transportation Improvement Program includes funding for Snake River Bridge replacement and WYO 22/WYO 390 intersection improvements (Jackson-Wilson Road, Snake River Bridge, Teton County). The improvements consist of intersection modifications, roadway widening, and bridge expansion over the Snake River.

The WYO 22/WYO 390 intersection will be reconstructed to a ‘Florida-T’ configuration, as shown in **Figure 12**. Design features include:

1. Adding a second southbound left-turn lane
2. Adding a second westbound through-lane
3. Adding an eastbound bypass lane so that eastbound traffic does not have to stop at the intersection
4. Reconstructing the Snake River bridge to a four-lane cross-section
5. Widening and improving shoulders

Figure 12: Proposed WYO 22/WYO 390 Intersection Improvements



The build-configuration (Florida-T) intersection was modeled in VISSIM traffic simulation software for the 2019 and 2040 PM peak periods.

2019 Build-Configuration Level of Service

Table 3 demonstrates that the build-configuration (Florida-T), under current (2019) traffic volumes, will operate at LOS B. All movements will operate at LOS C or better.

Table 3: 2019 Build-Configuration PM Period VISSIM Model

Intersection	Direction	Movement	2019 Build-Configuration - PM Peak					
			Average Delay (sec/veh)	LOS	Approach Delay (sec/veh)	Approach LOS	Avg. Queue (ft)	Max. Queue (ft)
WYO 22/ WYO 390	EB	Left	21.2	C	6.8	A	15	155
		Through	1.5	A			0	0
	WB	Through	18.7	B	11.4	B	25	190
		Right	1.3	A			0	0
	SB	Left	18.3	B	15.9	B	35	205
		Right	6.3	A			5	105
	Intersection			11.9	B	-	-	-

2040 Build-Configuration Level of Service

Table 4 shows that the build-configuration (Florida-T), under future (2040) traffic volumes, will operate at LOS C:

- The eastbound left is anticipated to degrade from a LOS C to a LOS F in 2040, with an average modeled delay of over 100 seconds per vehicle. All other movements are anticipated to operate at a LOS C or better.
- The overall intersection is expected to operate at a LOS C, with an average delay of 25.1 seconds per vehicle, and an increase from 11.9 seconds per vehicle in the 2019 build-condition analysis.
- The average vehicle queue in the westbound direction is estimated at 75', or approximately 3-4 vehicles. The maximum modeled queue is 355', or approximately 18 vehicles.
- The average vehicle queue in the southbound left direction is estimated at 225', or approximately 10 vehicles. The maximum modeled queue is 1530'.

Table 4: 2040 Build-Configuration PM Period VISSIM Model

Intersection	Direction	Movement	2040 Build-Configuration - PM Peak						
			Average Delay (sec/veh)	LOS	Approach Delay (sec/veh)	Approach LOS	Avg. Queue (ft)	Max. Queue (ft)	
WYO 22/ WYO 390	EB	Left	100+	F	29.4	C	190	700	
		Through	6.8	A			56	330	
	WB	Through	32.6	C	18.9	B	75	355	
		Right	3.4	A			0	0	
	SB	Left	32.9	C	29.0	C	225	1,530	
		Right	16.3	B			20	235	
	Intersection			25.1	C	-	-	-	-

TRANSIT CHARACTERISTICS

Bus Routes

Two START bus routes run on WYO 22 between US 26 and WYO 390: Route 20 – Teton Village and Route 30 – Teton Valley. Only one route (Route 20 – Teton Village) runs on WYO 390.

Route 20 – Teton Village currently operates with approximately 30-minute headways (Summer 2019 schedule). From Jackson to Teton Village, operating hours are 5:00 am through 11:30 pm. From Teton Village to Jackson, operating hours are 6:00 am through 12:00 am. There are approximately 35 trips per day in each direction.

Route 30 – Teton Valley is a commuter-oriented service with four buses per weekday in each direction. Buses only travel from Driggs, ID to Jackson (eastbound on the WYO 22) in the morning, with the first bus leaving Driggs at 5:40 am and the last bus leaving Driggs at 7:40 am. The service provides a return trip (westbound on the WYO 22 corridor) in the afternoon/evening hours, with the first bus leaving Jackson at 3:45 pm and the last bus leaving Jackson at 7:30 pm.

BUS STOPS

Bus stops on WYO 390 in proximity to the WYO 22/WYO 390 intersection are shown in **Figure 14**. Between US 26 and WYO 390, there are no bus stops along WYO 22. The Stilson Park-and-Ride is the only transfer point outside of Jackson between Route 20 – Teton Village and Route 30 – Teton Valley.

The four bus stops on WYO 390 between WYO 22 and Teton Village Road are served by the Route 20 – Teton Village.

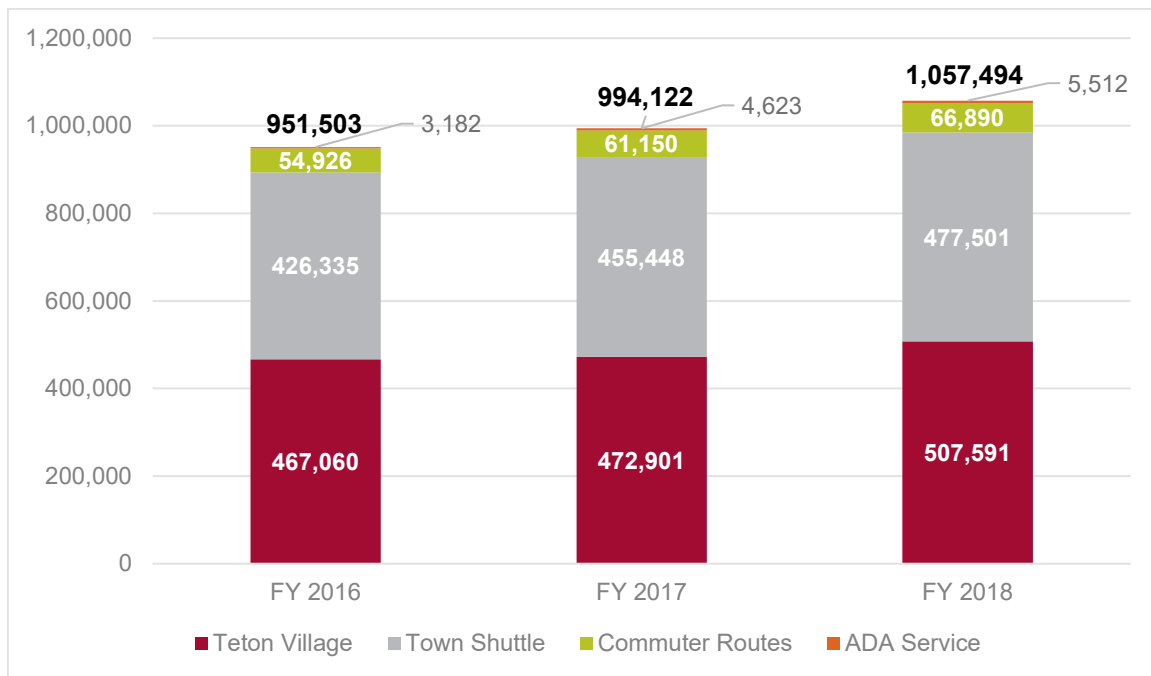
Both the Teton Science School Residence and Calico Pizza/Q Roadhouse stops are located on small loop roads on the east side of WYO 390. Buses traveling southbound make left turns from and back onto WYO 390. Both stops have bus shelters but do not have marked crosswalks to cross WYO 390.

The Westbank Center and The Aspens bus stops are located on Pines Way, a small roadway parallel to and west of WYO 390. Southbound buses make a right turn from WYO 390; northbound buses make a left turn onto Pines Way off to stop at these two bus stops and the make their way back onto WYO 390.

CURRENT TRANSIT RIDERSHIP

Ridership on the Teton Village route has grown in recent years, as has overall ridership on the START system. In FY 2018, annual ridership was 507,591. **Figure 13** shows ridership between 2016 and 2018 on the START system. The Teton Village route accounts for approximately 48% of overall ridership for the system.

Figure 13: Annual START Ridership



BUSES NEEDED TO MITIGATE ROADWAY WIDENING NEED

WYO 22 between Jackson and the Snake River Bridge is a two-lane highway. Improving WYO 22 to four lanes (two lanes in each direction) is not programmed. By 2040, WYO 22 is projected to carry 35,000 vehicles per day and nearly 1,800 vehicles in each direction during the peak hour, which would exceed the capacity for a two-lane highway.

- An analysis (using Highway Capacity Software HCS7 Two-Lane Highway) was conducted to estimate the number of buses required to mitigate or eliminate the need to widen WYO 22 to four lanes

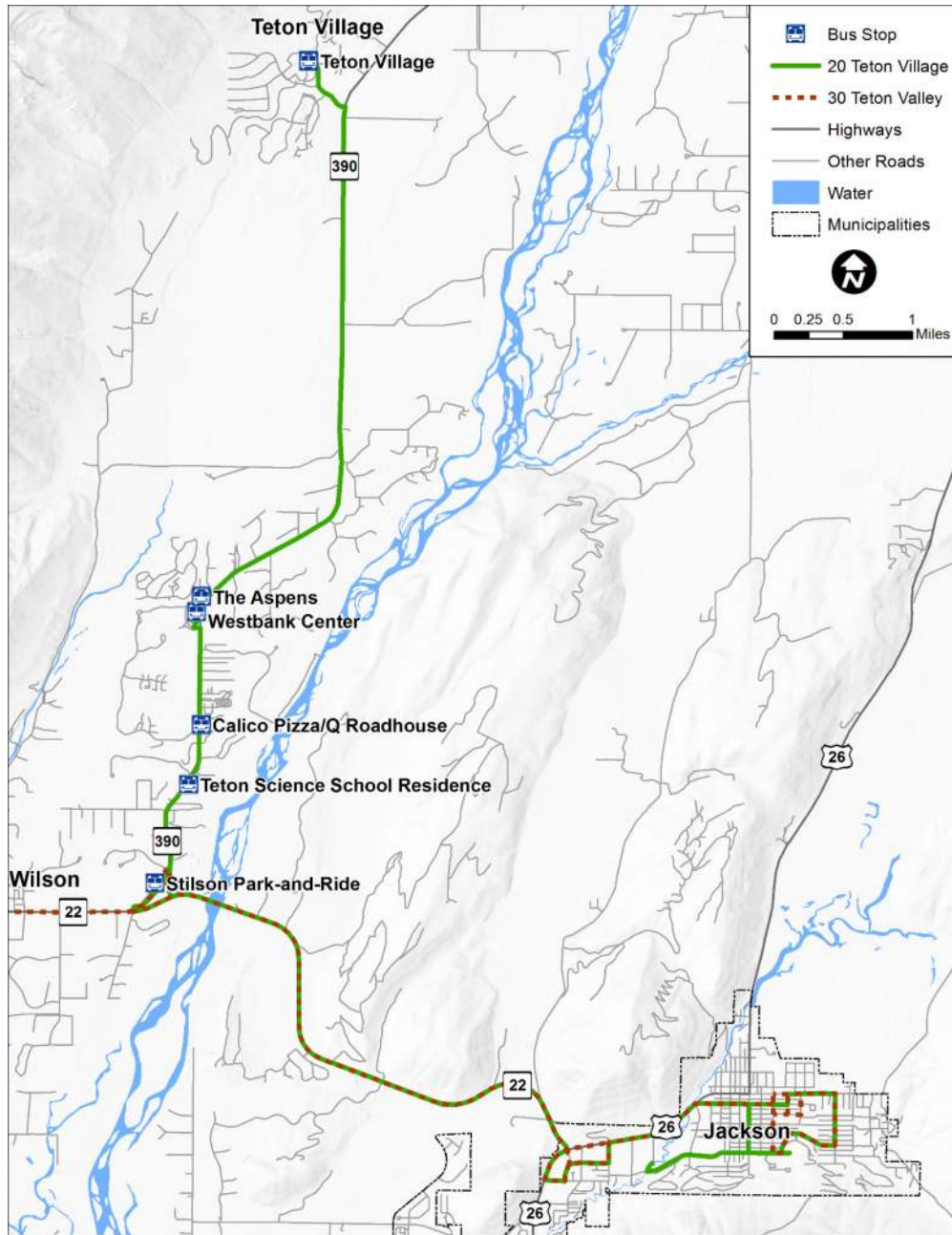
between the Snake River Bridge and Broadway Road in Jackson. The analysis assumed the following:

- Summer vehicle occupancy = 2.5 persons per vehicle
- Bus capacity = 47 passengers per bus
- 2040 directional volume = 1,780 vehicles per hour (peak hour)
- Peak hour factor = 0.9

The analysis yielded the following:

- LOS D threshold directional volume for a two-lane highway = 680 vehicles per hour
- Number of vehicles required to be reduced on WYO 22 to eliminate need for widening (achieve LOS D) = 1,100 (2,750 persons), or 59 buses during the peak hour.

Figure 14: Bus Stop Locations



4. PROJECT NEEDS, OBJECTIVES, AND STRATEGIES

PROJECT NEEDS, OBJECTIVES, AND STRATEGIES

Needs were identified from the review of previous studies, and existing roadway, traffic, and transit characteristics and are summarized in **Table 5**. **Table 5** also recommends proposed objectives and strategies to address the needs.

Table 5: Identified Project Needs, Objectives, and Potential Strategies

Need	Objectives	Potential Strategies
Strategies specific to WYO 22/WYO 390 Intersection and Snake River Bridge Improvements		
Improve transit travel times and reliability ahead of expected growth and development	Reduce transit travel time along the corridor	<ul style="list-style-type: none"> Utilize roadway shoulders as transit-only lanes Improve ability of bus to make left turns from Stilson Park-and-Ride, or eliminate the need to make a left turn
	Reduce transit travel time at intersections	<ul style="list-style-type: none"> Implement TSP at signalized intersections (see description of Typical Elements to Improve Transit Operations and Efficiency on next page) Add queue jump lanes at signalized intersections
The following strategies can be considered and further evaluated by START but will not be evaluated further within this study:		
Increase the accessibility and utility of the Teton Village route	Adjust the Teton Village schedule	<ul style="list-style-type: none"> Decrease summer headways, using excess vehicles from the winter service, to reduce wait times Implement timed transfers between the Teton Village and Teton Valley routes at the Stilson Park-and-Ride
	Develop a marketing strategy for the BRT service	<ul style="list-style-type: none"> Develop branding for the Teton Village route to make it easily identifiable to tourists and commuters <ul style="list-style-type: none"> Implement this new branding on the buses through wraps or specialized buses Utilize branding on enhanced bus stop facilities
	Implement tools to make riding easier and more understandable	<ul style="list-style-type: none"> Partner with other agencies (WYDOT, Teton County) or ride-sharing companies to develop an application that includes comparative costs and travel times of different modes Implement real-time arrival information at bus stops Implement off-board fare collection; on-board fare payment is often the largest source of transit delay
	Improve the accessibility of the Teton Village route	<ul style="list-style-type: none"> Review stop locations along the WYO 390 and WYO 22 corridors to ensure they provide reasonable access to surrounding land uses Consider stop amenities including near-level boarding at future stations Provide safe crossings across WYO 390 to capture ridership from both sides of the highway
	Make the Teton Village Route usable for all trip purposes	<ul style="list-style-type: none"> Ensure buses have proper equipment to store bicycles for residents and commuters Ensure buses can safely store ski equipment and other luggage for tourists Work with local employers to provide reduced fares or other benefits for daily commuters

Need	Objectives	Potential Strategies
Collect data for future planning needs	Collect data to ensure future planning efforts can support continued growth of transit ridership	<ul style="list-style-type: none"> • Collect boarding and alighting data using Automatic Passenger Counting (APC) technology • Quantify on-time performance and travel delay using AVL technology

PROJECT EVALUATION CRITERIA

Potential transit strategies were evaluated following the process shown in **Figure 15**, to identify the most beneficial strategies.

Level 1 Screening Criteria evaluates performance benefits to bus travel time and operations. The highest-performing strategies are advanced to Level 2 Screening Criteria, which evaluates the impacts of the highest-performing strategies.

A preferred strategy is then identified from the Level 2 screening. Screening criteria are described in **Table 6**.

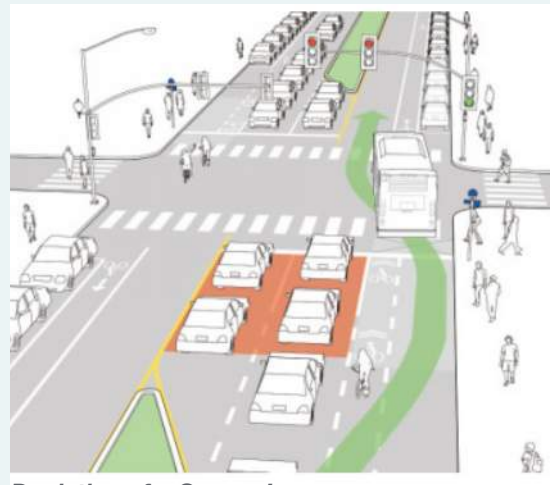
TYPICAL ELEMENTS TO IMPROVE TRANSIT OPERATIONS AND EFFICIENCY

Queue Jump Lanes – In mixed traffic, buses experience the same delay as private vehicles at traffic signals. Queue jump lanes provide buses with access to a separate lane (such as a right-turn lane or a dedicated bus-only lane) that will bring them to the front of the queue at a signal. Transit signal priority is offered to the buses allows the bus to proceed through the intersection before the other vehicles in the queue. This can improve travel times and reliability of transit.

Traffic Signal Prioritization (TSP) – Buses are detected by the traffic signal, which gives an early green signal to the bus or holds a green signal longer to allow the bus to pass through the intersection faster. The intention is to reduce the delay for buses at intersections.

Off-Board Fare Collection – One of the delays experienced by passengers is purchasing their fares on the bus. While this delay may seem insignificant, this delay can compound increasing the dwell time at each stop along a route. There are technology-based solutions for this issue, such as providing passengers the ability to pay in advance of riding (e.g., contactless/tap ticketing)

Dedicated Travel Lanes – These lanes allow buses to bypass congestion and improve travel times and reliability. Dedicated lanes can be flexible, meaning they turn into bus-only lanes during the peak commute times, while at other times they turn back to a typical travel lane for all traffic or used as a shoulder.



Depiction of a Queue Jump

Source: *Transit Street Design Guide*, NACTO

Figure 15: Project Refinement Process

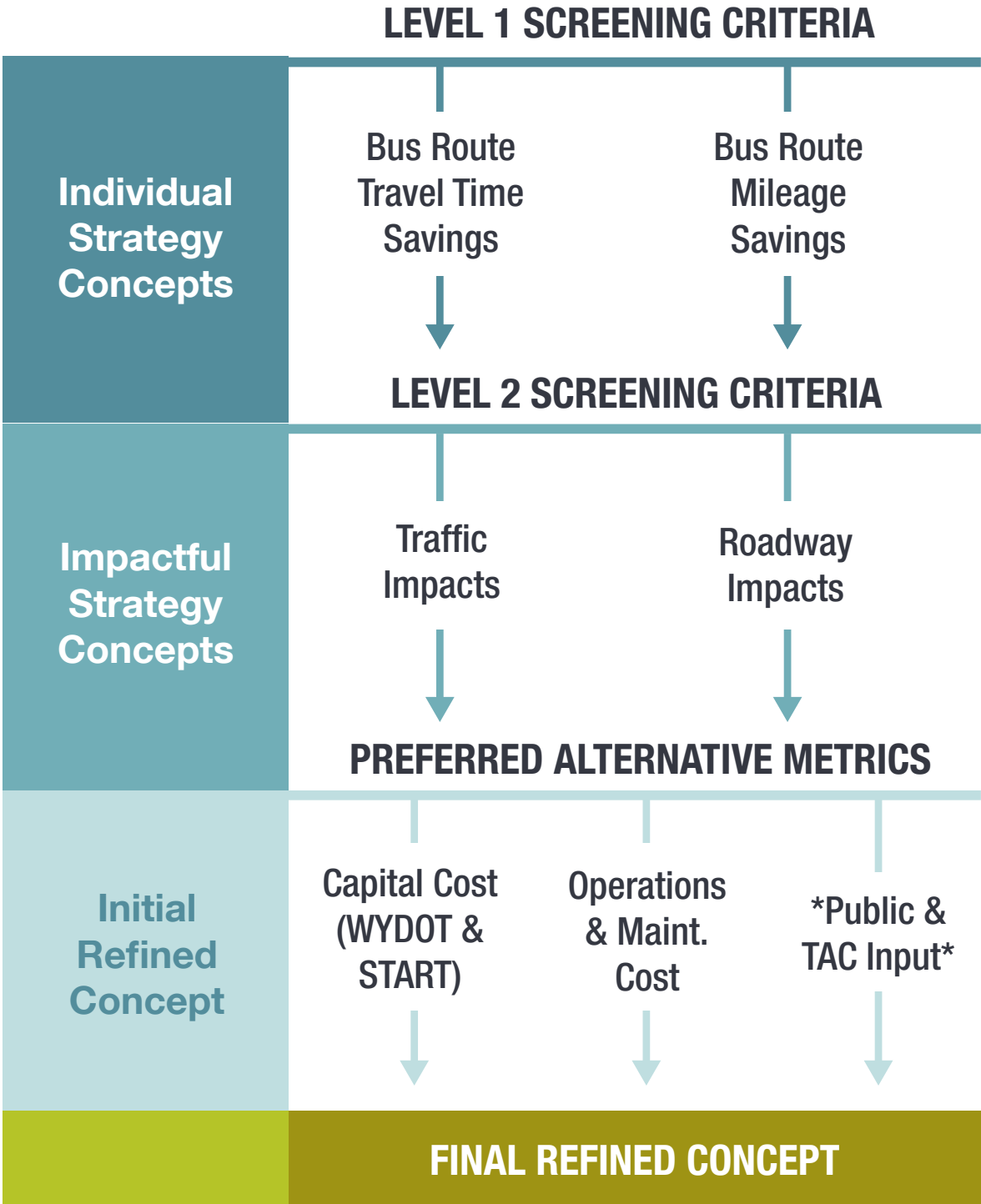
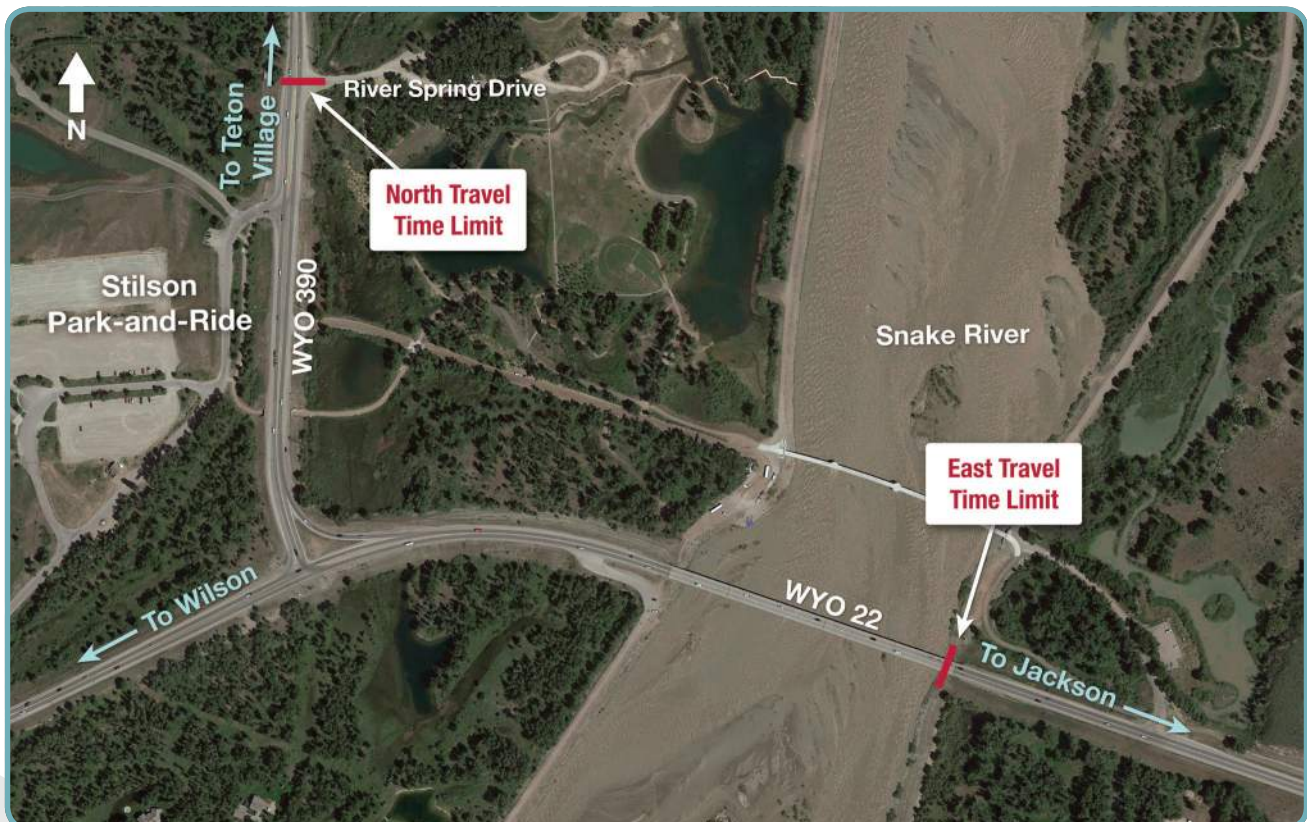


Table 6: Screening Criteria

SCREENING CRITERIA	
Level 1	<ul style="list-style-type: none"> Bus route travel time savings: Quantify the improvement in bus travel times based on VISSIM modeling.
	<ul style="list-style-type: none"> Bus route mileage savings: Utilize geographic information systems (GIS) to determine the impacts of the different alternatives on the length of the Teton Village and Teton Valley routes.
Level 2	<ul style="list-style-type: none"> Traffic impacts: Utilize VISSIM modeling to identify negative impacts to vehicular delay or mobility due to the proposed transit improvements.
	<ul style="list-style-type: none"> Roadway impacts: Determine whether each improvement would expand the environmental limits required for the proposed 'Florida-T' intersection design as well as if the concept would require WYDOT to acquire additional right-of-way.
Preferred Alternative	<ul style="list-style-type: none"> Project capital cost: Relative costs to WYDOT or START.
	<ul style="list-style-type: none"> Operations and maintenance cost: Relative costs to WYDOT or START.
	<ul style="list-style-type: none"> Public and TAC input: Feedback on the initial refined concept will be sought from the Public Transit Subcommittee as well as from the public through a public meeting.

*Note 1: Bus route travel time savings are calculated from the VISSIM model; bus travel times are measured between limits consistent across model runs, providing an equivalent travel time comparison even with changes to bus routing within scenarios. The bus travel time limits designated are at the intersection of WYO 390 and River Spring Drive north of the alternative limits and the east end of the WYO 22 Snake River Bridge. The travel time limits are shown in **Figure 16**. Impacts to bus route mileage are calculated using ArcGIS, a GIS software.*

Figure 16: Bus Route Travel Time Limits



5. STRATEGY CONCEPTS AND SCREENING

STRATEGY CONCEPTS

Eight strategy concepts were identified that have the potential to improve transit operations within and around the WYO 22/WYO 390 intersection. These concepts are described in **Table 7**. Each concept is illustrated in **Figure 17** through **Figure 24**.

Table 7: Strategy Concepts

Strategy Concept	WESTBOUND WYO 22	
1.	Construct a westbound queue jump approach lane at the intersection	<ul style="list-style-type: none"> Queue jump lane within channelized westbound right-turn island to accommodate buses traveling westbound through the intersection
2.	Construct a westbound queue jump receiving merge lane west of WYO 390	<ul style="list-style-type: none"> Merge lane west of the intersection; westbound buses merge into the outside lane west of the intersection
3.	Implement TSP at the intersection	<ul style="list-style-type: none"> TSP to prioritize transit through the intersection
WYO 390		
4.	Construct a southbound queue jump lane at the WYO 22/ WYO 390 intersection	<ul style="list-style-type: none"> Transit-only lane between outside southbound left-turn and right-turn lanes to accommodate buses making the southbound left-turn at the intersection
5.	Implement transit-only signal on WYO 390	<ul style="list-style-type: none"> Separate, transit-only egress from Stilson Park-and-Ride, 700' north of WYO 22 with a signal activated by buses exiting the park-and-ride
6.	Construct a northbound left-turn lane on WYO 390 at the new transit-only signal	<ul style="list-style-type: none"> Northbound left-turn lane to accommodate northbound bus left-in movements to the Stilson Park-and-Ride at the new signal
7.	Move the Teton Village bus stops to WYO 390	<ul style="list-style-type: none"> On-street bus stops on WYO 390 north of WYO 22
8.	Construct a new traffic signal on WYO 390 at Stilson Ranch Road	<ul style="list-style-type: none"> New signal to facilitate egress from Stilson Park-and-Ride; signal would be used by buses and vehicles

Concepts Not Advanced

The need to accommodate shoulder-running buses, east of the WYO 22 / WYO 390 intersection between the bridge and the intersection was initially considered. The VISSIM analysis indicates that there is not a need to consider shoulder-running operations westbound across the bridge because of the limited queueing at the WYO 22/WYO 390 intersection anticipated in the future after reconstruction to the 'Florida-T' configuration. Evaluation of shoulder running transit between WYO 22 / WYO 390 intersection and the "Y" would require additional analysis, and expansion of the traffic modeling utilized for this analysis.

Figure 17: Concept 1, Westbound Queue Jump Lane



Figure 18: Concept 2, Westbound Queue Jump with Receiving Lane



Figure 19: Concept 3, TSP at the Intersection

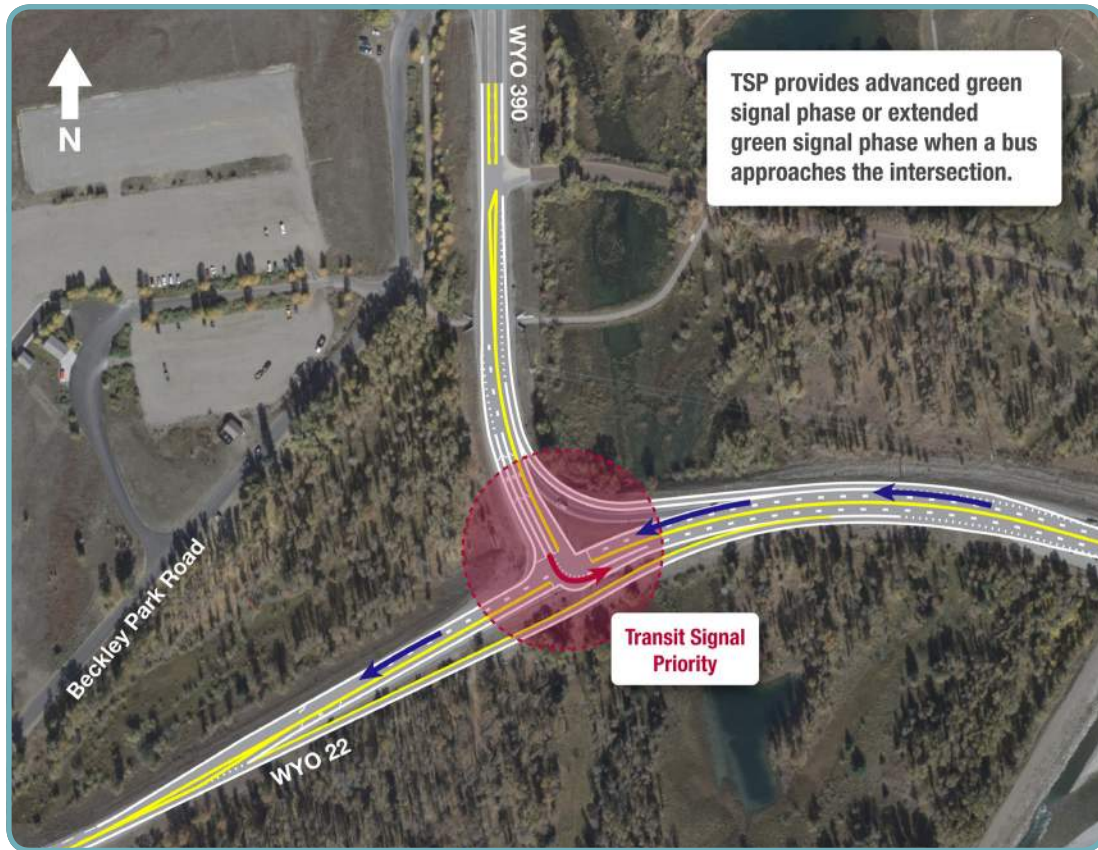


Figure 20: Concept 4, Southbound Queue Jump Lane



Figure 21: Concept 5, Traffic Signal with Bus-Only Access



Figure 22: Concept 6, Traffic Signal with Northbound Left-Turn Lane on WYO 390



Figure 23: Concept 7, Bus Stops on WYO 390



Figure 24: Concept 8, New Traffic Signal at Existing Stilson Ranch Road



LEVEL 1 SCREENING RESULTS

Level 1 screening results for the eight concept elements are reported in **Table 8**.

The results show the following:

- Strategies 1-4 include queue jump lanes on WYO 22 and WYO 390. The modeling shows that under the 2040 Florida-T configuration, queue jump lanes do not provide a significant benefit to START bus travel time. The 2040 projected vehicle queues, with the Florida-T construction are relatively modest. Without significant queues to bypass, the benefit of a queue jump lane to START buses is modest, ranging from nine to 15 seconds.

The most beneficial concepts relate to reducing START bus delay entering, routing through, and exiting the Stilson Park-and-Ride lot:

- Strategy 7, relocating Teton Village route bus stops from the Stilson Park-and-Ride lot to WYO 390, provides the highest benefit.
- Strategy 6, constructing a new transit-only signal on WYO 390 north of WYO 22 with a northbound left-turn lane to allow westbound buses to access the Stilson Park-and-Ride, reduces bus travel time by nearly two minutes.
- Strategy 5, constructing a new transit-only signal on WYO 390 north of WYO 22 provides some positive travel time benefits without adding the northbound left-turn lane (present in Strategy 6).
- Strategy 8, constructing a standard traffic signal at the intersection of WYO 390 and Stilson Ranch Road, provides positive travel time benefits to START operations without widening WYO 390 or adding a new transit-only approach.

Table 8: Level 1 Screening Results

Transit Strategy Concept	Description	Bus Route Travel Times (min:sec)		Bus Route Travel Time Savings (min:sec)		Bus Route Mileage Savings (mi.)
		Jackson to Teton Village	Teton Village to Jackson	Jackson to Teton Village	Teton Village to Jackson	
-	2040 baseline	4:40	3:19	-	-	-
1	WB queue jump	4:25	3:19	0:15	0:00	0
2	WB queue jump and receiving lane	4:24	3:19	0:16	0:00	0
3	TSP at WYO 22/390 intersection	4:31	3:01	0:09	0:18	0
4	SB queue jump	4:40	2:58	0:00	0:21	0
5	Transit-only signal	3:38	3:04	1:02	0:15	0.10
6	Transit-only signal and NB left-turn lane	2:48	3:00	1:52	0:19	0.27
7	Move bus stops to WYO 390	1:24	1:59	3:16	1:20	1.18
8	Traffic signal at Stilson Ranch Road	3:04	3:19	1:36	0:00	0.05

Strategies 1, 2, and 4, the alternatives comprised of queue jump lanes, provide the least benefit to bus travel times and do not reduce the mileage of the Teton Village route. Therefore, these alternatives have been removed from further consideration and will not be advanced to Level 2 screening.

Strategy 3, implementing TSP at the WYO 22/WYO 390 intersection, does not provide a significant benefit to bus travel times, but if implemented at a system-wide level along the majority or entirety of the Teton Village route may have a substantial benefit. However, the system-wide benefits cannot be quantified as a part of this study. Therefore, Strategy 3 will not be advanced to Level 2 screening, but implementation at a system-wide level is a long-term recommendation as the Teton Village route is converted to BRT.

LEVEL 2 SCREENING RESULTS

The highest-performing strategies from the Level 1 screening were advanced to Level 2, in terms of their potential to provide bus travel time savings.

- Strategy 5: Transit-only signal on WYO 390
- Strategy 6: Northbound left-turn lane on WYO 390 at the new traffic signal
- Strategy 7: Move the Teton Village bus stop to WYO 390
- Strategy 8: New traffic signal at WYO 390 and Beckley Park Way

Level 2 screening criteria are traffic impacts and roadway impacts. Traffic impacts are measured in delay for all vehicles at the WYO 22/WYO 390 intersection as provided by the VISSIM models. Roadway impacts are measured in square footage of new pavement required to implement the alternatives. The Level 2 VISSIM results and roadway impact results are provided in **Table 9**.

Table 9: Level 2 Screening Results

Transit Strategy Concept	Intersection LOS (Delay [sec/veh] (LOS))							Additional Pavement (sq. ft.)
	Overall	EBL	EBT	WBT	WBR	SBL	SBR	
Baseline	22.4 (C)	92.9 (F)	4.7 (A)	32.4 (C)	3.5 (A)	25.9 (C)	20.6 (C)	-
5	25.4 (C)	100 (F)	3.0 (A)	33.7 (C)	3.0 (A)	33.1 (C)	20.0 (B)	4,050
6	24.4 (C)	100 (F)	4.2 (A)	33.3 (C)	3.6 (A)	30.9 (C)	19.0 (B)	4,050
7	23.5 (C)	100 (F)	4.1 (A)	34.0 (C)	3.6 (A)	25.8 (C)	18.9 (B)	6,120
8	24.0 (C)	96.7 (F)	2.3 (A)	33.1 (C)	3.1 (A)	32.2 (C)	18.7 (B)	0

None of the alternatives analyzed in Level 2 screening had a substantive negative impact on intersection operations. Alternative 5 had the greatest overall impacts of adding an additional three seconds per vehicle, but the LOS remains a C.

Strategy 7 requires the most additional pavement of the Strategies due to the widening required to create the bus pull-outs, new curb and gutter, as well as the sidewalk required to connect the bus pull-outs to the existing shared-use path.

Strategies 5 and 6 require the same amount of new pavement for the transit-only approach to the new signalized intersection. The northbound left-turn lane included in Strategy 6 does not require any additional widening outside of what is already proposed to reconfigure the WYO 22/WYO 390 intersection to the Florida-T configuration.

Strategy 8 does not require any widening; the existing pavement at the WYO 390/Stilson Ranch Road intersection is adequate to accommodate signalization.

6. RECOMMENDATIONS

The following recommendations are provided based on the Level 1 and Level 2 screening (**Table 10**). Recommendation 1A and 1B are alternatives (both would not be constructed). Recommendations 2 and 3 can both be implemented.

Table 10: Recommendations Summary

	Recommendation	Timeframe
1A	Construct a traffic signal on WYO 390 at the existing boat launch access road along with a transit-only access roadway to Beckley Park Way with a northbound left-turn lane for buses only (Strategy 6)	The traffic signal should be constructed when delay experienced by buses making a left turn from Beckley Park Way to northbound WYO 390 significantly impacts on-time bus performance or poses a safety risk.
	OR	
1B	Construct a traffic signal at the existing intersection of WYO 390 and Stilson Ranch Road (Strategy 8)	It should be noted that a traffic signal at Beckley Park Way that is open to general traffic would likely not meet traffic signal warrants as specified in the Manual on Uniform Traffic Control Devices (MUTCD).
2	Relocate transit stops to WYO 390 consistent with the Stilson Master Plan (Strategy 7).	Relocation of bus stops to WYO 390 provides significant travel time savings and reduces bus route distance. However, the bus stops should only be relocated upon redevelopment of the Stilson Park-and-Ride. Pedestrian improvements are required for both northbound and southbound WYO 390 between the park-and-ride and the bus stops.
3	Implement system-wide TSP	Implement TSP at WYO 22/WYO 390 when system-wide BRT implemented is on the Teton Village route. At that time, TSP should also be implemented at all major signals along the route.

Estimates of capital costs and operations and maintenance costs (Level 3 performance metrics) are provided in **Table 11**. Capital costs were based on a conceptual design of each of the recommended alternatives.

Annual operations and maintenance costs were developed using the travel time savings calculated during Level 1 screening and operating expenses per vehicle revenue hour reported by START to the National Transit Database (NTD). The 2016 reported operating expense per vehicle revenue hour (latest available) is \$148.27. The current summer schedule, as well as schedules from past seasons, were utilized to determine the number of round trips per year on the Teton Village route.

Table 11: Criteria Screening Results

	Recommendation	Capital Cost	Annual Operations/Maintenance Savings
1A	Construct a traffic signal on WYO 390 at the existing boat launch access road along with a transit-only access roadway to Stilson Ranch Road/Beckley Park Way with a northbound left-turn lane for buses only (Strategy 6)	\$300,000	\$87,500
	OR		
1B	Construct a traffic signal at the existing intersection of WYO 390 and Stilson Ranch Road/Beckley Park Way (Strategy 8)	\$210,000	\$64,200
2	Relocate transit stops to WYO 390 consistent with the Stilson Master Plan	\$165,000	\$184,700
3	Implement system-wide TSP*	N/A*	\$18,100**

* Cost depends on the number of signals where TSP is implemented as well as the number of buses where communication devices are installed; therefore, a system-wide cost cannot be estimated at this time.

**Savings as a result of implementing TSP could only be calculated for the WYO 22/WYO 390 intersection. Implementation across the whole Teton Village route would result in a higher corridor travel time and operations/maintenance benefit.