Main Street Alternatives Analysis Report

City of Ketchum

Ketchum, Idaho

December 5, 2022

Executive Summary

The City of Ketchum, Idaho (City) *Master Transportation Plan* (2020)[1] identified the opportunity to reduce the number of vehicle travel lanes on Main Street (State Highway 75 [SH-75]) from four lanes to three lanes, with a travel lane in each direction and a center median lane that can provide dedicated left-turn pockets. This configuration has the potential to reduce pedestrian vehicle conflicts and expand the sidewalks. As noted in the *Master Transportation Plan,* some potential drawbacks to the lane reconfiguration could include reduced roadway capacity for general vehicular traffic, emergency vehicles, mail trucks, and transit vehicles. These vehicles may be delayed with increased traffic volumes in the single through lane, left-turn lanes may be hard to access during high demand periods, and it may create some issues with snow removal.

The goals of this project are to improve vehicle progression on the corridor without shifting traffic to local streets, improve pedestrian and bike facilities and crossings, and enhance the streetscape and pedestrian realm. The purpose of this report is to document the alternatives analysis and the decision-making process that led to a recommended alternative.

Existing Conditions

The Main Street corridor is within the Downtown Core neighborhood and the Community Core – specifically Retail Core – Districts within the Ketchum zoning map. These designations match the land uses on the ground, which is evident by a thriving main street corridor. The City's *2014 Comprehensive Plan*[2] identifies potential gateways to the City located at River Street and 6th Street along Main Street.

Of the six blocks that make up the Main Street corridor, some blocks are more successful at providing a public realm that supports the walkable, vibrant downtown feel associated with Ketchum than others. For instance, the blocks along Main Street from 4th to 6th Streets have a strong public realm supporting pedestrians with amenities such as identity and wayfinding signage, landscaping, larger sidewalks, benches, and bike racks. However, moving north or south, the amenities along the blocks oscillate between having a less comfortable and safe public realm and providing certain desirable elements.

The project team analyzed crashes between 2016 and 2020 to assess the safety of the corridor. There were 25 crashes at intersections on Main Street. The most frequent crash type was rear end (13 crashes), and the most frequent contributing circumstance was following too close (8 crashes). Most of the crashes were property damage only (PDO) (15 crashes), with two suspected serious injury (A Injury) crashes, four minor injury (B Injury), and four possible injury (C injury) crashes.

During the 5-year study period, there were 18 non-intersection related crashes on Main Street. The most frequent crash type was rear end (9 crashes), and the most frequent contributing circumstance was following too close (4 crashes). Most of the crashes were PDO (11 crashes),

[1] City of Ketchum, Master Transportation Plan. March 15, 2021.
[2] City of Ketchum. 2014 Comprehensive Plan. February 18, 2014. Available online: https://www.ketchumidaho.org/planning-building/page/comprehensive-plan

with two suspected serious injury (A Injury) crashes, and five possible injury crashes (C Crashes).

Corridor intersection traffic operations are operating at a level of service (LOS) D or better in both the AM and PM peak hours. During the summer peak travel periods, some intersections experience longer delays; however, the LOS remains above LOS D for all intersections. The following are existing inefficiencies identified on the corridor:

- Movements experience long queue lengths that may back up several blocks.
- The Sun Valley Road intersection is currently split phased on the north-south (Main Street) movements, meaning the movements occur separately from each other and are not timed concurrently. This impedes two-way progression on the corridor and increases the cycle length at the intersection, which in turn, increases delays.
- The pedestrian scramble at Sun Valley Road increases the signal cycle length. At the pedestrian clearance, time is calculated using the diagonal distance across the intersection instead of the shorter distance on the legs of the intersection.
- The signals on the corridor are not interconnected, which does not allow for implementing a coordinated signal timing plan. This limits vehicle progression through the corridor as green bands are unlikely to line up.
- The southbound travel lanes must merge from two lanes to one lane between River Street and 1st Street. Drivers were observed getting into the continuous left lane before 1st Street to avoid having to perform the merge maneuver before River Street. This creates an underutilization of lanes at the 1st Street intersection, degrading operations and capacity at the intersection.
- The “split” of Main Street at the 6th Street intersection causes some confusion due to the lack of proper pavement markings and way finding signage in advance of the intersection.

Initial Future Conditions Analysis

HDR calculated a 1.44 percent historical growth rate to represent traffic volume growth based on historical data from Idaho Transportation Department’s (ITD) Automated Traffic Recorders (ATRs) on SH-75. The project team selected 2042 as the design year for the purposes of this analysis and LOS D was set for the target LOS threshold based on ITD’s requirements in their *Roadway Design Manual*[3]. HDR initially analyzed the following four scenarios.

[3] Idaho Transportation Department. Roadway Design Manual. August 2013. Available online: https://apps.itd.idaho.gov/apps/manuals/roadwaydesign/files/Roadwaydesignprintable.pdf

No.	Volumes Used	Scenario	Main Street Cross Section	Signal Operations	Peak Hour Factor
1	2042 Average	No-Build	Two lanes in each direction, no dedicated turn lanes at intersections	Existing signal timing parameters	0.92
2	2042 Summer				
3	2042 Average	Build	One lane in each direction, dedicated left-turn lane at each intersection on Main Street	100 second cycle length, flashing yellow arrows (FYA) for left turns	
4	2042 Summer				

In the No-Build scenarios 1 and 2, the corridor is expected to operate poorly as queue lengths at Sun Valley Road begin to approach 600 feet. Northbound traffic at Sun Valley Road is expected to exceed capacity and experience delays.

At first glance, reducing the number of lanes from four to three and adding flashing yellow arrows (FYAs) for left turns, analyzed in scenarios 3 and 4, appears to improve the LOS along the corridor. For example, the Sun Valley Road/Main Street intersection operations improve from a LOS F in the PM peak hour to LOS C with these improvements. However, the estimated queue lengths at the intersections can exceed 1,000 feet in some cases with the reconfigured cross section. These excessive queues are significantly longer than those estimated under the No-Build scenarios and would back up from one signal through the upstream signalized intersections, causing significant congestion and potential gridlock.

Side street queue lengths also increase from the No-build to the Build scenarios under average conditions and get even worse under summer conditions. Short city block lengths, on-street parking, and a single lane in each direction limit the amount of storage available on the side streets. Overall, these results indicate that there is significant operational improvement by removing the split phasing at Sun Valley Road and installing left-turn lanes with FYAs. The closely spaced intersections prevent the large volume of traffic from being stored, ultimately creating congestion.

The project team then analyzed three additional scenarios using 2042 summer volumes.

- Scenario 5: Add left-turn lanes on Main Street at Sun valley Road, removing split phasing and pedestrian scramble.
- Scenario 6: Prohibit left-turn movements from Main Street, except at Sun Valley Road, where left-turn lanes are added.
- Scenario 7: Install a five-lane section along Main Street with left-turn lanes at each intersection.

When compared to the No-Build or three-lane scenarios, scenarios 5, 6, and 7 decrease congestion on the corridor and reduce travel times. Each alternative provides better LOS, less congestion/gridlock, and better progression and travel time for vehicles and pedestrians. The shorter cycle lengths with these scenarios would shorten the wait times for pedestrians at intersections. Scenario 7 achieves vehicle progression goals; however, it's adverse impacts include removing parking along the corridor and limiting opportunities to install curb extensions on Main Street to shorten the pedestrian crossings.

Initial Recommendations and Limitations of the Analysis

HDR presented the findings of the deterministic analysis to the City Council on April 11, 2022. HDR recommended against pursuing the three-lane section due to the significant impacts to motorized vehicle flow and travel time. Congestion on Main Street could cause traffic to use adjacent streets to get through town, increasing volumes, congestion, and conflicts on local streets. Instead, HDR recommended the City pursue adding left-turn lanes at the Sun Valley Road Intersection (Scenario 5).

The City Council asked for a visual representation of the corridor operations to understand the potential impacts of the different lane reconfiguration scenarios. HDR explained the limitations of the macroscopic methodologies and recommended a microsimulation analysis to improve the confidence of the analysis and provide videos of the operations.

Interim Improvements

At the City's request, HDR and the project team implemented short-term solutions to enhance the corridor operations in the interim period.

- The project team coordinated with ITD to interconnect the signals in order to implement a coordinated signal timing plan.
- The City and ITD agreed to remove the pedestrian scramble.
- HDR developed signal timing plans for the AM and PM peak hours to reduce the number of stops and increase progression during the peak hours. Additionally, HDR recalculated the pedestrian clearance intervals to increase pedestrian safety.
- ITD is currently designing a project south of Ketchum that is scheduled to be built before improvements on Main Street and would provide an opportunity to revise the location of the merge taper between 1st Street and River Street to be south of River Street.

Microsimulation Analysis

Based on the City Council feedback, the project team developed specific alternatives to analyze with Vissim software:

- Existing conditions
- Alternative 1: No-Build
- Alternative 2: Adding left-turn lanes at Sun Valley Road
- Alternative 3: Three-lane section

Comparing the Alternatives

Alternative 3 provides many benefits to the pedestrian and public realms, but at a significant cost to traffic flow. This alternative would increase vehicle congestion and would not serve all traffic during the peak periods. This level of congestion could push traffic onto neighboring streets, increasing conflicts and negating large safety benefits from the potential lane reconfiguration. This alternative also would not meet ITD's LOS D threshold for state highways.

Although the three-lane section could decrease the number of lanes pedestrians need to cross the roadway, vehicle congestion would be likely to reduce gaps pedestrians have to cross at unsignalized intersections. Side streets would be expected to see large increases in vehicle queue lengths as vehicles are unable to enter the Main Street due to a lack of gaps.

Alternative 2, which removes parking for two blocks to add turn lanes at the Sun Valley Road intersection, would serve all estimated traffic during the design year. Estimated travel times for future vehicles would be similar to existing conditions. By removing the split phasing, the bottle neck at Sun Valley Road would be removed and all other intersections on the corridor could increase operational efficiency for both pedestrians and vehicles. The safety benefits of Alternative 2 may not be as great as for Alternative 3; however, the remaining intersections could still see improvements to the pedestrian and public realms with bulb-outs and wider sidewalks.

Recommendation and Costs

Alternative 2 is recommended over the Alternative 3 (three-lane configuration). Alternative 2 best serves vehicular traffic and improves traffic operations, it meets ITD's LOS D threshold, and provides excess capacity. Excess capacity allows some contingency for performance i.e., suggesting that if Ketchum sees a greater increase in vehicle traffic than estimated, this alternative would best be able to handle that increase. Although the opportunity to widen the pedestrian space is not as great as with Alternative 3, there would still be opportunities to enhance the public realm, improve the placemaking feel of Ketchum's Main Street, and further enhance the corridor's safety performance. Final conceptual exhibits are presented in **Appendix F**.

The project team developed an opinion of probable cost based upon the conceptual exhibits. The costs assume complete sidewalk replacement, signal upgrades, tree cells, ADA ramp improvements and bulb-outs. Alternative 2 probable costs are summarized in the table below. ITD has programed a project to resurface Main Street in the near future and the costs assume that ITD will pay for the resurfacing, including base material. The budget for their work is $7,322,000, according to ITD's STIP. Those costs include new pavement, aggregate, ADA ramp improvements and signal upgrades from River Street to Club House Drive. There will be some overlap in the costs assumed for this project, so cost sharing with ITD to the financial impact to the City and costs should be negotiated.

Cost	Amount
Engineering Fee:	$353,000
Construction Costs:	$3,880,000
Right-of-way Costs:	$10,000
Total Project Costs:	$4,243,000

Next Steps

The City should coordinate with ITD to get approval for the recommended Alternative 2. Additionally, the City should coordinate the improvement designs to align with an upcoming ITD maintenance project on SH-75. Coordination will decrease the amount of mobilization required to improve the roadway and reduce the impacts to the public. The curb extensions and a raised intersection will need to be evaluated in coordination with ITD during design to evaluate truck turning movements and stormwater needs in detail.

The City should also pursue grant opportunities to fund the improvements. Outreach for stakeholder participation in the grant pursuits should occur, including with Mountain Rides, Blaine County School District, and the Ketchum Urban Renewal Agency.

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Acronyms/Abbreviations

Acronyms and abbreviations used more than once in the report text.

AADT	annual average daily traffic
ADA	Americans with Disabilities Act
ATR	automated traffic recorders
City	City of Ketchum
CMF	crash modification factor
EPDO	equivalent property damage only
FYA	flashing yellow arrow
HCM	Highway Capacity Manual
ITD	Idaho Transportation Department
LHTAC	Local Highway Technical Assistance Council
LOS	level of service
LPI	leading pedestrian interval
MP	mile post
mph	miles per hour
NACTO	National Association of City Transportation Officials
PDO	property damage only
PHB	pedestrian hybrid beacon
PROWAG	Public Rights-of-Way Accessibility Guidelines
RRFB	rectangular rapid flashing beacon
SH-75	State Highway 75
v/c	volume to capacity ratio
vpd	vehicles per day

1 Introduction

1.1 Background and Purpose

The City of Ketchum, Idaho (City) *Master Transportation Plan* (2020)[4] identified the opportunity to reconfigure Main Street (State Highway 75 [SH-75]) to reduce the number of vehicle travel lanes from the existing four lanes to three, with a travel lane in each direction and a center median lane that can provide dedicated left-turn pockets. This configuration has the potential to reduce pedestrian/vehicle conflicts and expand the sidewalks. As noted in the *Master Transportation Plan,* some potential drawbacks to the lane reconfiguration could include reduced roadway capacity for vehicular traffic; mail trucks and transit vehicles may stop traffic in the single through lane; left-turn lanes may be hard to access during high demand periods; and it may create some issues with snow removal.

The goals of this project are to improve vehicle progression on the corridor without shifting traffic to local streets, improve pedestrian and bike facilities and crossings, and enhance the streetscape and pedestrian realm. The purpose of this report is to document the alternatives analysis and the decision-making process that led to a recommended alternative that balances the need for improved public environment with the future traffic volume demand on Main Street.

1.2 Study Area

The study area (shown in Figure 1) begins at the intersection of Main Street and River Street and continues six blocks north to the 6th Street intersection where Main Street splits into Warm Springs Road to the northwest and Main Street to the northeast. Main Street runs through the core of Downtown Ketchum. The adjacent land use is zoned as Retail Core, featuring several small businesses, restaurants, and hotels. Main Street is also known as SH-75 and is owned by the Idaho Transportation Department (ITD). The highway connects southern Idaho to the Sawtooth Valley in central Idaho and serves as a commuter route for individuals working in Ketchum or Sun Valley communities. Ketchum is a

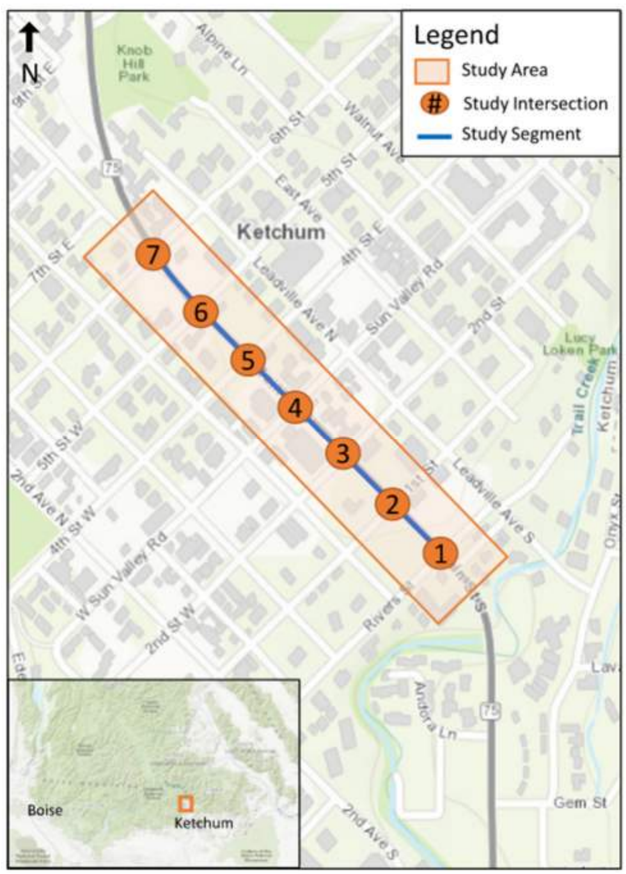

Figure 1. Study Area

[4] City of Ketchum, Master Transportation Plan. March 15, 2021.

resort, destination city with regional traffic generators, including two ski hills and outdoor recreational locations to the north and south.

1.3 Study Process

The study process followed the general procedure outlined in Figure 2. The project team performed an initial evaluation of existing conditions in the study area that considered existing traffic operations using deterministic methodologies, determined safety issues and needs, and examined the public realm needs. In coordination with ITD, the project team identified short-term improvements that could be implemented during the study to improve operations until a larger project could be completed. Signal timing improvements were analyzed and implemented in coordination with ITD under a separate project for the City.

Next, the project team analyzed different scenarios using a deterministic methodology to identify potential alternatives along the corridor. After consulting with the City Council, the team advanced three alternatives to a microsimulation analysis and presented the results of the microsimulation and additional safety opportunities at a public meeting where residents could evaluate the alternatives, ask questions, and provide feedback. An online survey accompanied the public meeting for those unable to attend the in-person meeting. Finally, the project team revised the alternatives, as necessary, prepared a final report, and presented it to the City Council for adoption.

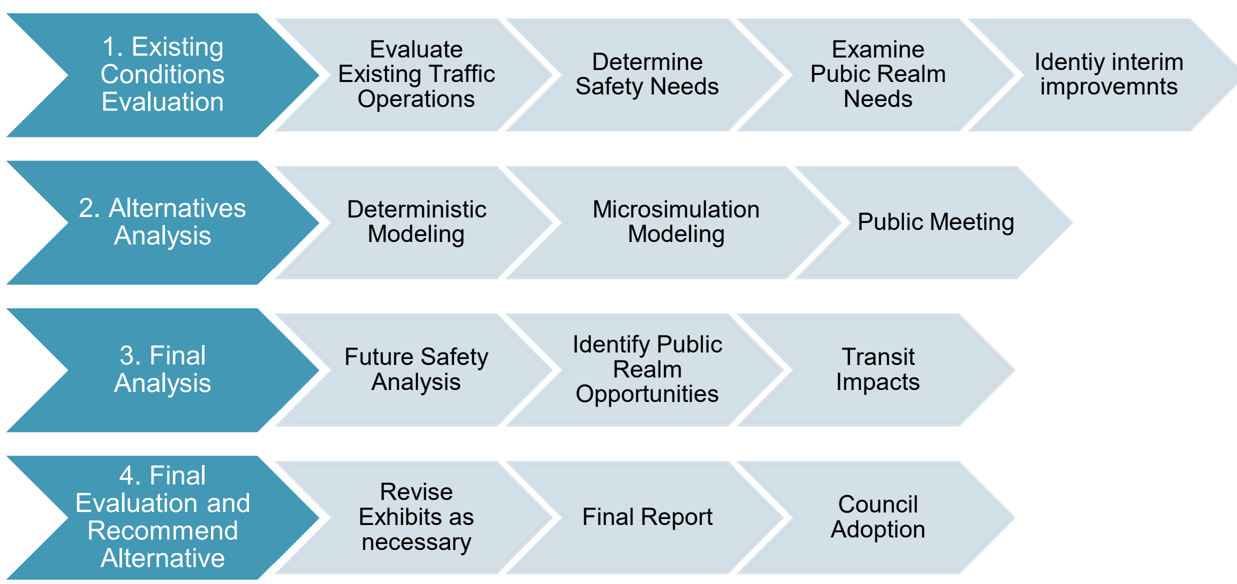

Figure 2. Study Process

1.4 Organization of Report

Following the introduction in Section 1, this report is also organized following the general structure of the study process shown in Figure 2.

- Section 2 describes existing conditions and determines needs;
- Section 3 presents the forecasted travel models and presents the deterministic modeling results;
- Section 4 describes the interim improvements;
- Section 5 discusses the microsimulation analysis;
- Section 6 details the safety evaluation and presents safety recommendations for each alternative;
- Section 7 summarizes the public meeting; and
- Section 8 compares alternatives, recommends a preferred alternative, presents a cost estimate, and discusses next steps.

2 Existing Conditions Evaluation

2.1 Land Use

The Main Street corridor is entirely within the Downtown Core neighborhood and the Community Core – specifically Retail Core – districts within the Ketchum zoning map. These designations match the land uses on the ground, as evident by a thriving main street corridor. The City's *2014 Comprehensive Plan*[5] identifies potential gateways to the city located at River Street and 6th Street along Main Street that are intended to let travelers to know they are entering an important part of Ketchum. Though it is evident that a traveler is entering a special district as a result of the walkable, Main Street land uses, no specific gateway elements exist. This stretch of town is a major part of the heart of Ketchum, supporting small businesses, restaurants, tourist destinations, and local life.

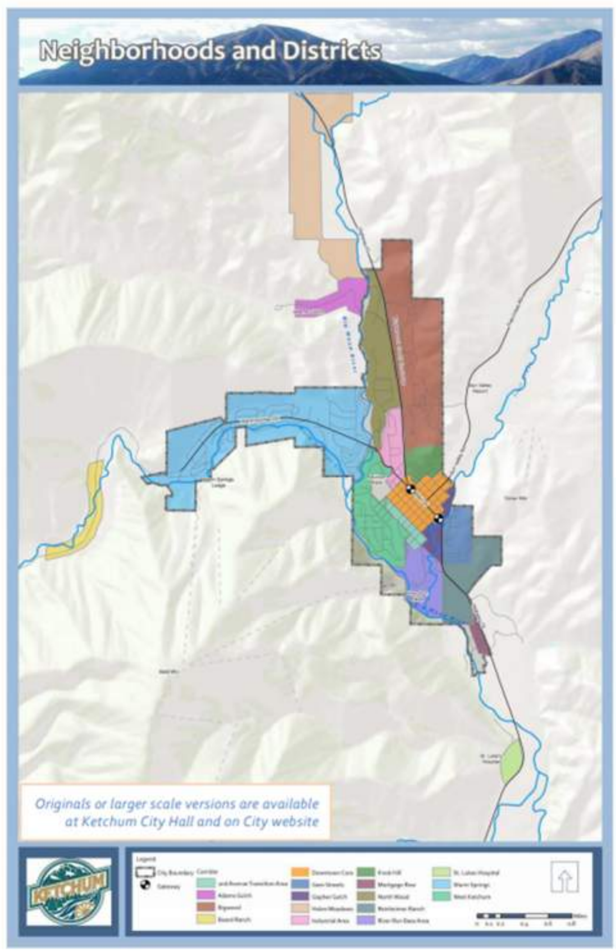

Figure 3. Ketchum Neighborhoods and Districts

This corridor is expected to continue with commercial land uses in the future as it provides a core identity to the town. The

[5] City of Ketchum. 2014 Comprehensive Plan. February 18, 2014. Available online: https://www.ketchumidaho.org/planning-building/page/comprehensive-plan

2014 Comprehensive Plan points to a slight differentiation in land uses along this stretch, with a specific focus on the portion between 1st and 5th Streets acting as the Retail Core. The areas bookending that segment are designated as either Commercial Employment or Mixed-Use Commercial, indicating a slightly decreased focus in the Main Street retail environment but a continuation of the diverse mix of uses that comprise much of the rest of downtown. With the construction of the mixed-use building on the south side of Main Street between River and 1st Streets, and the potential development diagonally across the intersection east of River Street, this distinction is not likely evident to most users. Similar change is possible west of 5th Street as well. As a result, the larger stretch between River and 6th Streets largely feels like one place type.

2.2 Public Realm

Of the six blocks that make up the Main Street corridor between River and 6th Streets, some blocks are more successful than others at providing a public realm that supports the walkable, vibrant downtown feel associated with Ketchum. However, more challenging than the success of any given block is the inconsistency of the public realm along the stretch. For instance, the blocks along Main Street from 4th to 6th Streets have a strong public realm supporting pedestrians with amenities such as identity and wayfinding signage, landscaping, larger sidewalks, benches, and bike racks. This stretch feels consistent and promotes a cohesive feel to the corridor (Figure 4). However, moving north or south, the amenities along the blocks oscillate between having a less comfortable and safe public realm and providing certain desirable elements (Figure 5).

Figure 4. Successful Public Realm

Figure 5. Challenged Public Realm

Areas with an inadequate public realm along the corridor currently consists of small, attached sidewalks that share limited space with retail shops, either making walking uncomfortable or lending to a cramped feeling for the adjacent establishments. Many areas along the corridor have limited or no amenities such as trash receptables or benches, as well as limited or no landscaping or tree canopy. The investment in a consistent tree canopy is one of the most successful methods of creating a desirable and safe walking environment. This public realm inconsistency from block to block prevents the downtown core from being unified from a pedestrian point of view and creates smaller segments of the street, rather than one combined corridor. Even the stronger segments of the corridor are limited in their space and amenities, pointing to an opportunity to reconsider the entire corridor's streetscape in the future. A potential reconfiguration of the roadway may provide a rare opportunity to attempt a larger overhaul.

2.3 Transit Facilities

Mountain Rides is the local transit authority maintaining bus routes throughout the City. Main Street serves as one of the main connection points for the bus system with several different lines running along the roadway. Stops are present in both directions at the 4th Street intersection near the Wells Fargo and at the 1st Street intersection near the Limelight Hotel and Kentwood Lodges. A single Mountain Rides sign delineates the stops but the stops themselves do not feature shelters, safety lighting, or other enhancements.

In conversations with Mountain Rides, the merge taper between 1st Street and River Street makes it difficult for busses to merge back into traffic after picking up passengers.

2.4 Existing Traffic Operations

2.4.1 Existing Intersection Control

The Main Street corridor features a variety of intersection controls along the six blocks. Sun Valley Road, 1st Street, and 5th Street are all signal controlled. 2nd Street and River Street are two-way stop controlled (TWSC) on the side streets and uncontrolled on Main Street. 4th Street is a right out on the side streets with a pedestrian hybrid beacon (PHB) or high intensity activated crosswalk (HAWK) beacon to stop traffic on Main Street for pedestrian crossings.

The Sun Valley Road intersection with Main Street is currently split phased on the north-south (Main Street) movements, meaning these movements occur separately from each other and are not timed concurrently. The east and west (Sun Valley Road) movements feature dedicated left-turn lanes with three section green-arrow signal heads allowing for a protected left-turn phase to occur. Until recently, no pedestrian movements were allowed at Sun Valley Road during vehicular movements but pedestrians were allowed to cross in any direction, even diagonally, during an exclusive pedestrian phase. This pedestrian phase is known as a "pedestrian scramble" or "barn dance" where all vehicles are stopped while pedestrians cross the intersection. As noted in Section 4 of this report, the pedestrian scramble was decommissioned as part of the interim improvements.

The 1st and 5th Street intersections with Main Street are two-phase intersections, meaning the northbound and southbound traffic (Main Street traffic) has a green light to proceed and then the east and westbound traffic proceeds. No exclusive left-turn phases exist and the pedestrian phases occur with the corresponding vehicle through movements. The 4th Street PHB is timed to operate twice during the Sun Valley Road cycle; however, poor compliance is observed with both pedestrians and vehicles, and this causes additional delay and queuing along Main Street.

2.4.2 Existing Volume Development

The project team took traffic counts on August 31, 2021 and identified an AM peak hour beginning at 8:00am and a PM peak hour beginning at 4:15pm. In the AM peak, the northbound movements are the largest traffic volumes throughout the corridor. Conversely, the PM peak is characterized by commuters traveling southbound, with larger volumes at the southern end of the corridor. Additionally, in the PM peak hour, the number of vehicles taking the westbound left turn at Sun Valley Road increases by a factor of approximately 2.5 times the volume in the AM peak. Traffic counts are provided in **Appendix A**.

The City is a resort destination community with travel patterns that vary throughout the year. The City does not have any automated traffic recorder (ATR) stations of their own, but ITD has two ATRs at the following locations to estimate seasonal variations on SH-75 near Ketchum:

- ATR #28 – SH-75 @ mile post (MP) 135.95 (7.6 miles north of the SH-75 Spur junction)
- ATR #68 – SH-75 @ MP 119.4 (2.9 miles north of Bullion Street in Hailey, ID)

Using data from the ATRs, the project team analyzed traffic volumes on SH-75 for fluctuations throughout a given year. The highest traffic volumes were observed in the summer months, averaging over 15,000 vehicles per day (vpd) in June, July, and August at ATR #68 and around 2,400 vpd at ATR #28. The lowest traffic volumes were observed in the winter months of December, January, and February with volumes less than 12,000 vpd at ATR #68 and less than 900 vpd at ART #28. There is a significant drop in volume on the highway from north and south of Ketchum. Table 1 shows the average monthly seasonal factors determined from the historical ATR data. Volumes from 2020 are not included in the analysis due to the Covid-19 pandemic and associated shutdowns.

Table 1. Monthly Seasonal Factors (MSFs)

	Jan	Feb	Mar	Apr	May	Jun	Jul	Aug	Sep	Oct	Nov	Dec
Avg MSF	0.90	0.94	0.88	0.85	0.93	1.11	1.24	1.19	1.08	1.03	0.88	0.98
w/o 2020	**0.89**	**0.93**	**0.89**	**0.89**	**0.94**	**1.11**	**1.24**	**1.18**	**1.06**	**1.02**	**0.88**	**0.97**

The seasonal adjustments results are calculated by dividing the August 2021 count by a factor of 1.18. This represents an 18 percent decrease in volumes to represent a typical day. Figure 6 details the results of the volume adjustments.

Figure 6. Main Street AM and PM Peak Hour Turning Movement Counts

2.4.3 Capacity and Level of Service

Capacity is defined as the maximum rate at which vehicles can pass through a given point in an hour under prevailing conditions. Intersection capacity is measured by evaluating the critical lane groups that experience the most delay for stop-controlled intersections. A volume to capacity (v/c) ratio less than 0.85 generally indicates that adequate capacity is available, and vehicles are not expected to experience significant queues or delays. As the v/c ratio approaches 1.0, traffic flow may become unstable and significant delay and queuing conditions may occur. Once the demand exceeds capacity, defined as a v/c ratio greater than 1.0, traffic flow is unstable and excessive delay and queuing is expected. The concept of level of service (LOS) was developed to correlate numerical traffic operational data to subjective descriptions of traffic performance at intersections. LOS is defined as the system of six designated ranges, from "A" (best) to "F" (worst), used to evaluate performance. Table 2 presents the Highway

Capacity Manual (HCM)[6] thresholds based on delay at stop-controlled and signalized intersections.

Table 2. LOS Thresholds for Motor Vehicles at Intersections

LOS	Stop Control Intersection Control Delay (seconds/vehicle)	Signalized Intersection Control Delay (seconds/vehicle)
A	≤ 10	≤ 10
B	10 – 15	10 – 20
C	15 – 25	20 - 35
D	25 – 35	35 - 55
E	35 – 50	55 - 80
F	> 50	> 80

Source: National Academies Press. Highway Capacity Manual, 6th Ed. A Guide for Multimodal Mobility Analysis.

The project team used Synchro 11 software to model and analyze study area intersections under existing conditions, and HCM 6th Edition and HCM 2000 analysis methods to produce the analysis reports.

2.4.4 Existing Corridor Inefficiencies

The corridor had several operational inefficiencies that affect intersection performance that were modeled in the initial deterministic analysis. A separate signal timing update occurred parallel to this analysis and HDR worked with City staff and ITD to implement some mitigation measures, described in Section 4. The inefficiencies include:

- The Sun Valley Road intersection is currently split phased on the north-south (Main Street) movements, meaning the movements occur separately from each other and are not timed concurrently. This impedes two-way progression on the corridor and increases the cycle length at the intersection, which intern increases delay;
- The pedestrian scramble at Sun Valley Road increases the signal cycle length. At the pedestrian clearance, time is calculated using the diagonal distance across the intersection instead of the shorter distance on the legs of the intersection;
- Although the signals along the corridor are closely spaced, they are not interconnected, which does not allow for a coordinated signal timing plan to be implemented. This limits vehicle progression through the corridor as green bands are unlikely to line up;
- The southbound travel lanes must merge from two lanes to one lane between River Street and 1st Street. Drivers were observed getting into the continuous left lane before 1st Street to avoid having to perform the merge maneuver before River Street. This creates an underutilization of lanes at the 1st Street intersection, degrading operations and capacity at the intersection; and

[6] National Academies Press. Highway Capacity Manual, Sixth Edition: A Guide for Multimodal Mobility Analysis.

- The "split" of Main Street at the 6th Street intersection causes some confusion due to the lack of proper pavement markings and way finding signage in advance of the intersection.

2.4.5 Summer Peak Existing Traffic Operations

Given the large variability of traffic volumes during the summer months compared to other months, the project team analyzed the intersections with the unadjusted August volumes for comparison with the seasonally adjusted volumes.

Table 3. Summer Peak Existing Traffic Operations

Intersection	Overall Intersection LOS	Movement				
		Lane Group	Delay (s)	LOS	95th Percentile Queue Length (feet)	V/C Ratio
1, River / Main	C (D)	NET/L/R	18.1 (24.7)	C (C)	4.4 (15.4)	0.072 (0.199)
		SWT/L/R	23.4 (28.9)	C (D)	2.2 (4.4)	0.033 (0.053)
		NWT/L/R	8.2 (10.5)	A (B)	2.2 (2.2)	0.032 (0.022)
		SET/L/R	0 (8.4)	A (A)	0 (0)	0 (0.004)
2, First / Main	A (A)	NET/L/R	16.7 (15.1)	B (B)	15.4 (50.6)	0.19 (0.34)
		SET/L	3.2 (7.7)	A (A)	13.2 (77)	0.16 (0.39)
		SET/R	3.2 (7.7)	A (A)	13.2 (72.6)	0.17 (0.42)
		NWT/L	4.7 (6.6)	A (A)	46.2 (50.6)	0.40 (0.26)
		NWT/R	4.7 (6.6)	A (A)	44 (44)	0.44 (0.29)
		SWT/L/R	17 (16.8)	B (B)	22 (99)	0.26 (0.58)
3, Second / Main	C (B)	NET/L/R	16.6 (14)	C (B)	4.4 (4.4)	0.052 (0.087)
		SWT/L/R	19.3 (14)	C (B)	2.2 (2.2)	0.044 (0.049)
		SET/L	9.1 (8.2)	A (A)	0 (0)	0.005 (0.004)
		SET/R	0 (0)	A (A)	0 (0)	0 (0)
		NWT/L	8 (9.1)	A (A)	2.2 (2.2)	0.025 (0.024)
		NWT/R	0.1 (0.1)	A (A)	0.1 (0)	0 (0)
4, Sun Valley / Main*	D (D)	NWT/L/R	57.6 (52.4)	E (D)	#345 (#250)	0.95 (0.83)
		NEL	47.3 (51.1)	D (D)	48 (66)	0.43 (0.44)
		NET/R	43.8 (48.5	D (D)	88 (122)	0.42 (0.52
		SWL	48.8 (50.2)	D (D)	90 (199)	0.37 (0.41)
		SWT/R	43.2 (44.7)	D (D)	95 (153)	0.37 (0.41)
		SET/L/R	28.3 (41.5)	C (D)	138 (281)	0.41 (0.73)

Intersection	Overall Intersection LOS	Movement				
		Lane Group	Delay (s)	LOS	95th Percentile Queue Length (feet)	V/C Ratio
5, Fourth / Main*	A (A)	SET/L/R	0.1 (0.2)	A (A)	0 (0)	0.14 (0.21)
		NWT/L/R	0.1 (0.1)	A (A)	0 (0)	0.19 (0.14)
		NER	0 (0)	A (A)	0 (0)	0.01 (0.01)
		SWR	0 (0)	A (A)	0 (0)	0.03 (0.04)
6, Fifth / Main	A (A)	NET/L/R	19.5 (19.2)	B (B)	72 (61.6)	0.43 (0.45)
		NWT/L	3.9 (4)	A (A)	33 (26.4)	0.27 (0.19)
		NWT/R	4 (4.1)	A (A)	33 (24.2)	0.28 (0.21)
		SET/L	3.7 (4.9)	A (A)	24.2 (50.6)	0.23 (0.35)
		SET/R	3.8 (5.2)	A (A)	26.4 (50.6)	0.24 (0.37)
		SWT/L/R	18.5 (19.5)	B (B)	31 (63.8)	0.22 (0.51)
7, Sixth / Main	B (B)	NEL	10.2 (10.9)	B (B)	2.2 (2.2)	0.023 (0.036)
		SWL	10.2 (9.8)	B (A)	2.2 (4.4)	0.03 (0.051)

AM (PM) results
= 95th percentile volume exceeds capacity, queue may be longer
*Indicates that HCM 2000 was used due to pedestrian phase methodology not being supported

Table 3 represents the overall operations of intersections during the month of August, which is projected to see higher than average traffic due to tourism in the Ketchum region. Overall, the intersections operate well during each peak hour under existing conditions with some left-turning movements that have longer than desirable delays. The intersection of Main Street and Sun Valley Road operates poorly during the PM peak hour as the existing pedestrian scramble phase causes added delay to the intersection. In addition, the Main Street and Sun Valley Road intersection had significant delay of over 50 seconds for the NWT and left-turn movements onto Main Street in the AM and PM peaks. The NWT AM peak had the longest delay of 57.6 seconds at LOS E. The overall for this intersection is LOS D. The River and Main Street intersection also experienced high delays for the NEL and SWL movements. The delay for these movements was about 21 seconds in the AM and 26 seconds in the PM. The intersection has an overall LOS C for the AM peak and LOS D for the PM peak. Several queue lengths from intersections are estimated to be long and impact adjacent intersections. Detailed reports are provided in **Appendix B**.

2.4.6 Seasonally-Adjusted Traffic Operations

Table 4. Seasonally Adjusted Traffic Operations

Intersection	Overall Intersection LOS	Movement				
		Lane Group	Delay (s)	LOS	95th Percentile Queue Length (feet)	V/C Ratio
1, River / Main	C (C)	NET/L/R	14.6 (19.5)	B (C)	2.2 (11)	0.045 (0.136)
		SWT/L/R	19.7 (22.3)	C (C)	2.2 (2.2)	0.022 (0.034)
		NWT/L/R	8 (9.7)	A (A)	2.2 (2.2)	0.026 (0.016)
		SET/L/R	0 (8.2)	A (A)	0 (0)	0 (0.003)
2, First / Main	A (A)	NET/L/R	16.7 (15.4)	B (B)	13.2 (41.8)	0.17 (0.31)
		SET/L	2.9 (6.1)	A (A)	11 (55)	0.13 (0.32)
		SET/R	3 (6.4)	A (A)	11 (50.6)	0.14 (0.34)
		NWT/L	3.9 (5.4)	A (A)	33 (33)	0.34 (0.22)
		NWT/R	4.3 (5.6)	A (A)	33 (30.8)	0.37 (0.24)
		SWT/L/R	16.9 (16.8)	B (B)	19.8 (81.4)	0.13 (0.54)
3, Second / Main	C (B)	NET/L/R	14.4 (12.5)	B (B)	2.2 (4.4)	0.038 (0.063)
		SWT/L/R	15.7 (12.4)	C (B)	2.2 (4.4)	0.028 (0.054)
		SET/L	8.7 (8)	A (A)	0 (0)	0.003 (0.003)
		SET/R	0 (0)	A (A)	0 (0)	0 (0)
		NWT/L	7.9 (8.7)	A (A)	2.2 (4.4)	0.021 (0.019)
		NWT/R	0 (0.1)	A (A)	0 (0)	0 (0)
4, Sun Valley / Main*	D (D)	NWT/L/R	46.4 (47)	D (D)	#252 (178)	0.39 (0.43)
		NEL	56.2 (51.9)	E (D)	43 (58)	0.57 (0.49)
		NET/R	46.4 (47)	D (D)	76 (105)	0.39 (0.43)
		SWL	47.1 (50.4)	D (D)	78 (168)	0.55 (0.68)
		SWT/R	42.4 (44.2)	D (D)	81 (129)	0.30 (0.36)
		SET/L/R	26.3 (36.1)	C (D)	113 (229)	0.33 (0.59)
5, Fourth / Main*	A (A)	SET/L/R	0.1 (0.1)	A (A)	0 (0)	0.11 (0.18)
		NWT/L/R	0.1 (0.1)	A (A)	0 (0)	0.16 (0.11)
		NER	0 (0)	A (A)	0 (0)	0.01 (0.01)
		SWR	0 (0)	A (A)	0 (0)	0.02 (0.04)
6, Fifth / Main	A (A)	NET/L/R	19.6 (19.2)	B (B)	63 (72)	0.39 (0.41)
		NWT/L	3.3 (4.4)	A (A)	24.2 (11)	0.20 (0.16)
		NWT/R	3.5 (3.6)	A (A)	24.2 (11)	0.23 (0.17)

Intersection	Overall Intersection LOS	Movement				
		Lane Group	Delay (s)	LOS	95th Percentile Queue Length (feet)	V/C Ratio
		SET/L	3.2 (4.2)	A (A)	17.6 (19.8)	0.19 (0.29)
		SET/R	3.3 (4.4)	A (A)	17.6 (19.8)	0.20 (0.31)
		SWT/L/R	18.7 (19.5)	B (B)	29 (59)	0.21 (0.47)
7, Sixth / Main	A (A)	NEL	9.9 (10.4)	A (B)	2.2 (2.2)	0.018 (0.028)
		SWL	9.9 (9.6)	A (A)	2.2 (2.2)	0.024 (0.04)

The seasonal adjusted volume operations reduced the overall delay times (Table 4); however, the Sun Valley Road and Main Street intersection still has significant delays for the NET movement in both the AM and PM peak hours. The intersection has an overall LOS D as generally the queues clear during one signal cycle. All other intersections operate with a LOS C or better during both AM and PM peak hours. Detailed reports are provided in **Appendix B.**

2.5 Crash History & Evaluation

2.5.1 Annual Average Daily Traffic Volume

The project team converted PM peak hour traffic volume data to annual average daily traffic (AADT) by using a conversion factor of 8.70. This factor was developed by comparing the AADT values on Main Street between 4th Street and 5th Street and between 2nd Street and Sun Valley Road to the related PM peak volume. The AADTs were divided by the PM peak hour traffic volumes to estimate a conversion factor from peak to AADT volumes on the corridor. The calculated factors were 8.72 for the segment between 2nd Street and Sun Valley Road and 8.68 for the segment between 4th Street and 5th Street. The average of these two values (8.70) was applied throughout the corridor.

2.5.2 Crash Costs and EPDO Weighting Factor

Average crash costs by severity are used in the existing conditions equivalent property damage only (EPDO) crash analysis. Average crash costs, shown in Table 5, are taken from ITD's 2020 traffic crash resource[7]. The costs are economic costs reflecting the tangible (e.g., medical bills, car repairs, towing, legal, loss of productivity, etc.) cost of crashes. The EPDO weighting factors in Table 5 are calculated relative to property damage only (PDO) crash costs (i.e., fatal crash cost of $10,322,433 divided by PDO crash cost of $3,430 equals a weighting factor of 2,968).

[7] Idaho Traffic Crashes 2020 ; https://apps.itd.idaho.gov/Apps/OHS/Crash/20/Analysis.pdf

Table 5. Economical Crash Costs

Crash Severity	Economic Crash Costs	EPDO Weighting Factor
K - Fatal	$ 10,322,433	2,968
A – Suspected Serious Injury	$ 493,671	142
B – Suspected Minor Injury	$ 134,460	39
C – Possible Injury	$ 68,660	20
Property Damage Only (PDO)	$ 3,478	1

The project team conducted a crash analysis on Main Street for the intersections and the blocks (or segments) between the intersections. Crashes are considered intersection crashes if coded as so in the Local Highway Technical Assistance Council (LHTAC) data; otherwise, the crashes are considered segment crashes. Crashes are summarized by frequency, type, and severity.

In addition, the project team ranked intersections and segments separately using a combined ranking of crash frequency, crash rate, and EPDO. EPDO assigns the weighting factors from Table 5 to crashes, by severity, to develop a score that reflects frequency and severity. The combined rank is developed by ranking the intersections and segments three times; according to 1) crash frequency (the number of crashes), 2) crash rate and 3) EPDO. The intersection crash rate is calculated by dividing the crash frequency by the total entering traffic volume from 2016 to 2020. The rankings are summed for each location and the location with the lowest score has the highest potential for safety improvement.

2.5.3 Intersection Crashes

During the 5-year study period (2016-2020) there were 25 crashes at intersections on Main Street between River Street and 6th Street. The most frequent crash type was rear end (13 crashes), and the most frequent contributing circumstance was following too close (8 crashes). Most of the crashes were PDO (15 crashes), with two suspected serious injury (A Injury) crashes, four minor injury (B Injury), and four possible injury (C injury) crashes. Most of the crashes occurred in daylight conditions (21 crashes) and on dry roads (17 crashes).

These types of crash patterns are consistent with congested signalized corridors and poor vehicular progression. The congestion increases the likelihood drivers are following too close and will rear-end another vehicle. Poor vehicular progression also increases the number rear end crashes as drivers behave in a stop-and-go pattern, instead of a consistent flow.

Figure 7 shows the number and severity of crashes at the study intersections. Table 6 shows the crash types at the study intersections, and Table 7 shows most frequent crash contributing circumstances.

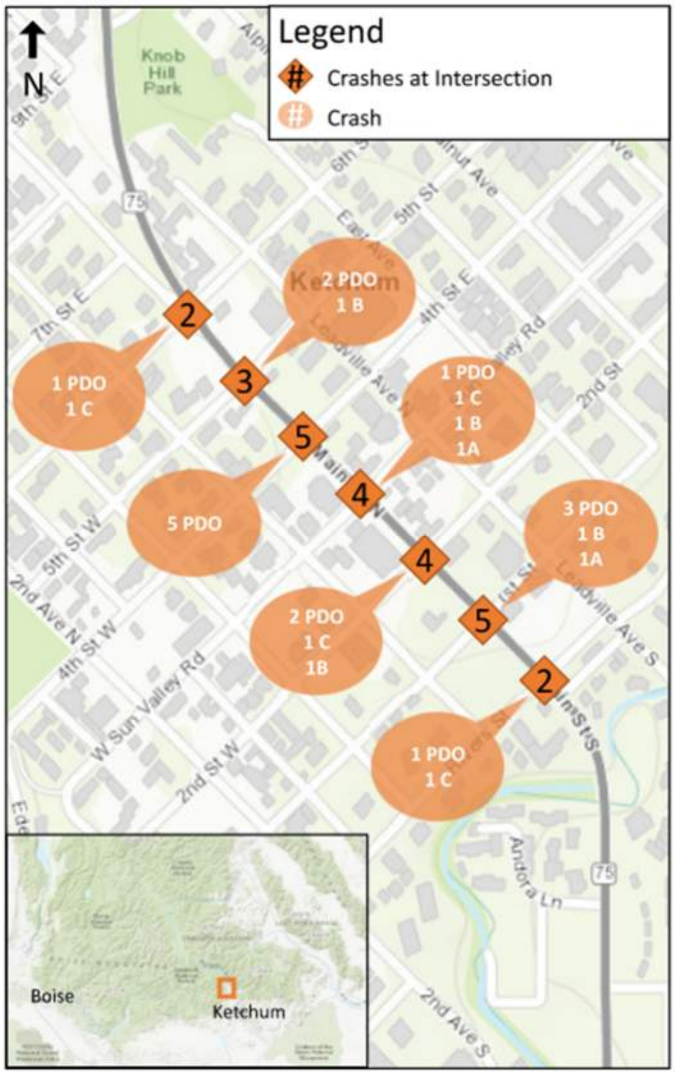

Figure 7. Intersection Crashes by Location and Severity (2016-2020)

Table 6. Intersection Crash Types (2016-2020)

Intersection	Total	Crash Types					
		Rear-end	Side Swipe	Angle	Pedestrian / Pedalcycle	Head on Turning	Road Departure
E River Street / Main Street*	2	1	1				
1st Street / Main Street**	5	1		2	1	1	
2nd Street / Main Street*	4	2	1		1		
Sun Valley Road / Main Street**	4	3	1				
4th Street / Main Street***	5	3	1				1

Intersection	Total	Crash Types					
		Rear-end	Side Swipe	Angle	Pedestrian / Pedalcycle	Head on Turning	Road Departure
5th Street / Main Street**	3	1	2				
6th Street / Main Street****	2	2					
Total	**25**	**13**	**6**	**2**	**2**	**1**	**1**

* Two-way stop-controlled intersection
** Signalized intersection
*** Two-way stop-controlled with rectangular rapid flashing beacon (RRFB) intersection
**** Five-way intersection with two-way stop-controlled

Table 7. Intersection Contributing Circumstances (2016-2020)

Intersection	Total	Circumstances						
		Following Too Close	Failed to Yield	None / Other	Failed to Maintain Lane	Failed to Obey Signal	Inattention	Too Fast for Conditions
E River Street / Main Street*	2	1			1			
1st Street / Main Street**	5	1	1			2	1	
2nd Street / Main Street*	4	2	1	1				
Sun Valley Road / Main Street**	4			2	1			1
4th Street / Main Street***	5	2	1	1	1			
5th Street / Main Street**	3	1	1				1	
6th Street / Main Street****	2	1		1				
Total	**25**	**8**	**4**	**5**	**3**	**2**	**2**	**1**

* Two-way stop-controlled intersection
** Signalized intersection
*** Two-way stop-controlled with rectangular rapid flashing beacon (RRFB) intersection
**** Five-way intersection with two-way stop-controlled

Table 8 shows the frequency, crash rate and EPDO scores for each of the study intersections, and Table 9 shows the resulting ranking and potential for safety improvement. The 1st Street and Sun Valley Road intersections ranked first and second, respectively. They each have experienced one suspected major injury (A injury) crash and rank in the top half of crash frequency.

Table 8. Intersections – Frequency, Crash Rate, EPDO Score (2016-2020)

Intersection	Crash Frequency (Total Crashes from 2016-2020)	Crash Rate (Crashes per Million Entering Vehicles (MEV))	EPDO Score
E River Street / Main Street	2	0.12	21
1st Street / Main Street	5	0.28	184
2nd Street / Main Street	4	0.28	61
Sun Valley Road / Main Street	2	0.25	202
4th Street / Main Street	4	0.37	5
5th Street / Main Street	5	0.18	41
6th Street / Main Street	3	0.13	21

EPDO = equivalent property damage only

Table 9. Intersection - Potential for Safety Improvement (2016-2020)

Intersection	Crash Frequency Rank	Crash Rate Rank	EPDO Score Rank	Combined Score
1st Street / Main Street	1	2	2	5
Sun Valley Road / Main Street	3	4	1	8
2nd Street / Main Street	3	3	3	9
4th Street / Main Street	1	1	7	9
5th Street / Main Street	5	5	4	14
6th Street / Main Street	6	6	5	17
E River Street / Main Street	6	7	5	18

EPDO = equivalent property damage only

2.5.4 Segment Crashes

During the 5-year study period, there were 18 non-intersection related crashes on Main Street between E River Street and 6th Street. The most frequent crash type was rear end (9 crashes), and the most frequent contributing circumstance was following too close (4 crashes). Most of the crashes were PDO (11 crashes), with two suspected serious injury (A Injury) crashes, and five possible injury crashes (C Crashes). Most of the crashes occurred in daylight conditions (17 crashes) and clear sky (17 crashes).

Figure 8 shows the number and severity of crashes at the study segments. Table 10 shows the crash types on each segment, and Table 11 shows most frequent crash contributing circumstances. As with the intersection crashes, these types of crash patterns are consistent with congested signalized corridors and poor vehicular progression. The congestion increases the likelihood drivers are following too close and will rear-end another vehicle. Poor vehicular progression also increases the number rear end crashes as drivers behave in a stop-and-go pattern, instead of a consistent flow.

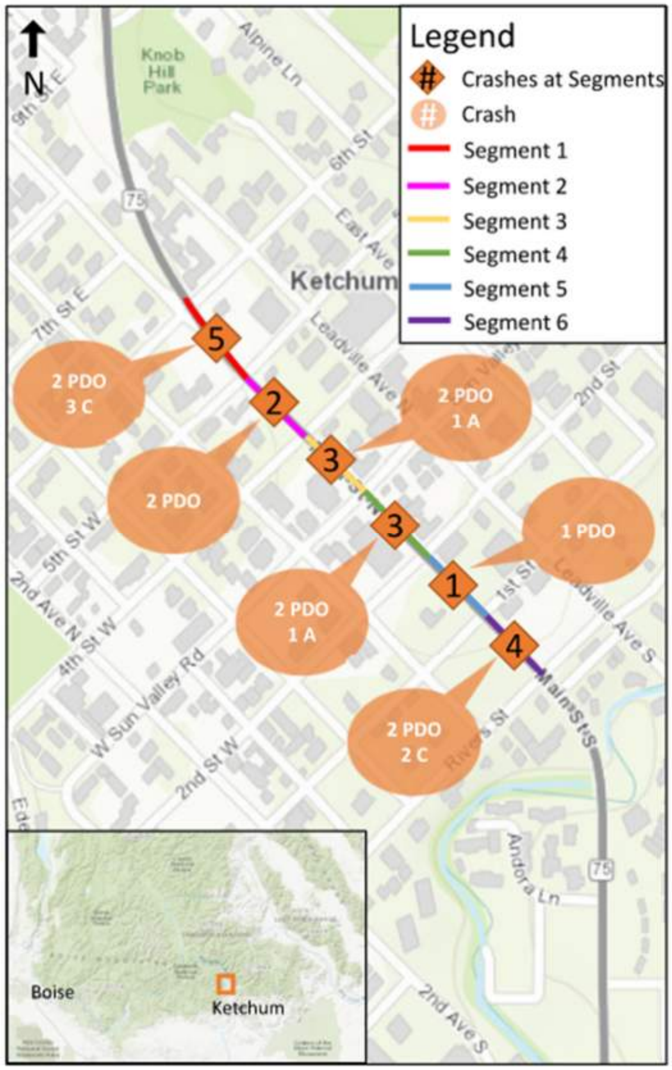

Figure 8. Segment related crashes by location and severity

Table 10. Segment Crash Types (2016-2020)

Intersection	Total	Crash Types							
		Rear-end	Side Swipe Same Direction	Parked Car	Pedestrian / Pedalcycle	Overturn	Same Direction Turning	Backed into	Angle
E River Street to 1st Street	4	3		1					
1st Street to 2nd Street	1	1							
2nd Street to Sun Valley Road	3	3							
Sun Valley Road to 4th Street	3				1			1	1
4th Street to 5th Street	2	1		1					
5th Street to 6th Street	5	1	2			1	1		
Total	**18**	**9**	**2**	**2**	**1**	**1**	**1**	**1**	**1**

Table 11. Segment Contributing Circumstances (2016-2020)

Intersection	Total	Circumstances								
		Following Too Close	None / other	Inattention	Failed to Maintain Lane	Alcohol Impaired	Distraction	Foot Slipped Off or Caught on Pedal	Improper Turn	Failed to Signal
E River Street to 1st Street	4	2		2						
1st Street to 2nd Street	1							1		
2nd Street to Sun Valley Road	3	1	1				1			
Sun Valley Road to 4th Street	3		1			2				
4th Street to 5th Street	2	1	1							
5th Street to 6th Street	5		1		2				1	1
Total	**18**	**4**	**4**	**2**	**2**	**2**	**1**	**1**	**1**	**1**

Table 12 shows the frequency, crash rate and EPDO scores for each of the study segments and Table 14 shows the resulting ranking and potential for safety improvement. Table 13 shows the crash rates and the related critical crash rates using a level of confidence of .95 (K=1.645). Idaho's 2020 crash rate for local roads was 1.653[8]. Critical crash rate was calculated by adding

[8] Idaho Traffic Crashes 2020 ; https://apps.itd.idaho.gov/Apps/OHS/Crash/20/Analysis.pdf

1.653 (Idaho's 2020 crash rate for local roads) to K*(1.653/MVM)$^{1/2}$ +.5/MVMT. Million vehicle miles (MVM) was specific to each segment. Critical crash rates were calculated since the segment lengths are only .05 miles each. The highest ranking for segment crashes is between 5th Street and 6th Street, and it is the only segment to be over the critical crash rate. In addition, the crash rate for the entire Main Street segment is over the calculated critical crash rate.

Table 12. Segment – Frequency, Crash Rate, EPDO Score (2016-2020)

Segment	Crash Frequency (Total Crashes from 2016-2020)	Crash Rate (Crashes per MVM)	EPDO Score
E River Street to 1st Street	4	3.45	42
1st Street to 2nd Street	1	1.09	1
2nd Street to Sun Valley Road	3	3.37	144
Sun Valley Road to 4th Street	3	3.91	144
4th Street to 5th Street	2	2.44	2
5th Street to 6th Street	5	5.26	62

MVM = million vehicle miles; EPDO = equivalent property damage only

Table 13. Segment – Crash rate vs Critical Crash Rate (2016-2020)

Segment	Crash Rate (Crashes per MVM)	Critical Crash Rate (Crashes per MVM)	Over or under Critical Crash Rate
E River Street to 1st Street	3.45	4.05	Under
1st Street to 2nd Street	1.09	4.41	Under
2nd Street to Sun Valley Road	3.37	4.46	Under
Sun Valley Road to 4th Street	3.91	4.72	Under
4th Street to 5th Street	2.44	4.60	Under
5th Street to 6th Street	5.26	4.35	Over
Entire Segment	3.27	2.65	Over

MVM = million vehicle miles

Table 14. Segment - Potential for Safety Improvement (2016-2020)

Segment	Crash Frequency Rank	Crash Rate Rank	EPDO Score Rank	Combined Score
5th Street to 6th Street	1	1	3	5
Sun Valley Road to 4th Street	3	2	1	6
2nd Street to Sun Valley Road	3	4	1	8
E River Street to 1st Street	2	3	4	9
4th Street to 5th Street	5	5	6	15
1st Street to 2nd Street	6	6	5	18

EPDO = equivalent property damage only

2.5.5 Additional Qualitative Safety Issues

The project team learned of safety concerns with the corridor from conversations with City staff, the public at public involvement meetings, and with the City Council. These concerns may not be directly contributing to crashes within the study area, but they do increase the amount of stress that pedestrians, bicyclists, and motorists feel when navigating the area.

Several intersections have multiple approaches to single parcels or long vehicle approaches that could be consolidated. For example, at 1st Street, the access to the Village Market is very long and close to the intersection, which creates more turning conflicts with pedestrians than necessary if the access was consolidated. Additionally, the Veltex property has two access points less than 10 feet away from the intersection, which cause confusion at the intersection. City staff noted that some individuals use the two approaches to avoid the intersection by cutting through the Veltex parking lot. Figure 9 and Figure 10 show the existing conditions at these locations.

Figure 9. Large Access and Lack of ADA/PROWAG Complaint Facilities at 1St Street

Figure 10. Multiple Approaches Close to the 5th Street Intersection

The Main Street Corridor also is lacking facilities that are compliant with the Americans with Disabilities Act (ADA) and Public Rights-of-Way Accessibility Guidelines (PROWAG). Most of the curb ramps do not have truncated domes or wheelchair-accessible pedestrian pushbuttons. This increases the likelihood that visually impaired and wheelchair-dependent users may enter the intersection during a conflicting vehicle movement. Figure 11 shows a non-compliant corner on the corridor.

Figure 11. ADA/PROWAG Noncompliant Corner at Sun Valley Road and Main Street

In conversations with City staff, and during a walking tour, concerns were raised about the ability of northbound traffic seeing pedestrians crossing at the River Street intersection. Vehicular traffic is traversing up a hill and the crosswalk markings on the north side of the intersection are difficult to see. With two new hotels expected to redevelop adjacent lots on the corner, there is concern for an increase in pedestrians and that drivers may not be able to stop in time when a pedestrian is crossing. Figure 12 shows the existing conditions at the River Street Intersection.

Figure 12. River Street Intersection View from the South.

3 Future Conditions and Initial Alternatives

3.1 Study Year and Target LOS

For the purposes of this study, the project team identified year 2042 as the design year for the improvements. Per section A.15 of ITD's *Roadway Design Manual*[9] LOS D is "applicable for Federal-aid construction on State and local highway excluding highways on the National Highway System." Since ITD owns Main Street, the project team set a target LOS D for the operations analysis.

3.2 Forecasted Traffic Patterns

The City of Ketchum does not lie within boundaries of a Municipal Planning Organization (MPO) that would produce a travel demand model that projects trip generation out into the future. Therefore, the project team calculated an average growth rate to represent traffic volume growth.

Traffic volumes on SH-75 were analyzed using historical data from ITD's ATRs to see how they have grown between 1990 and 2019. Due to the Covid 19 pandemic shutdowns, 2020 data was

[9] Idaho Transportation Department (ITD). Roadway Design manual. 2012

again excluded. Historical data from the ATR stations show patterns of steady and rapid growth on SH-75 up to the early 2000s, followed by a steep decline that coincides with the Great Recession. Traffic volumes started increasing again around 2012 and have steadily increased each year approaching the highest volumes seen before the Great Recession. Using the ATR data, the project team calculated a historical annual average growth rate of 1.44 percent for SH-75 and applied it as a regional growth factor for the City of Ketchum. Figure 13 and Figure 14 show the historical patterns of the AADT along SH-75.

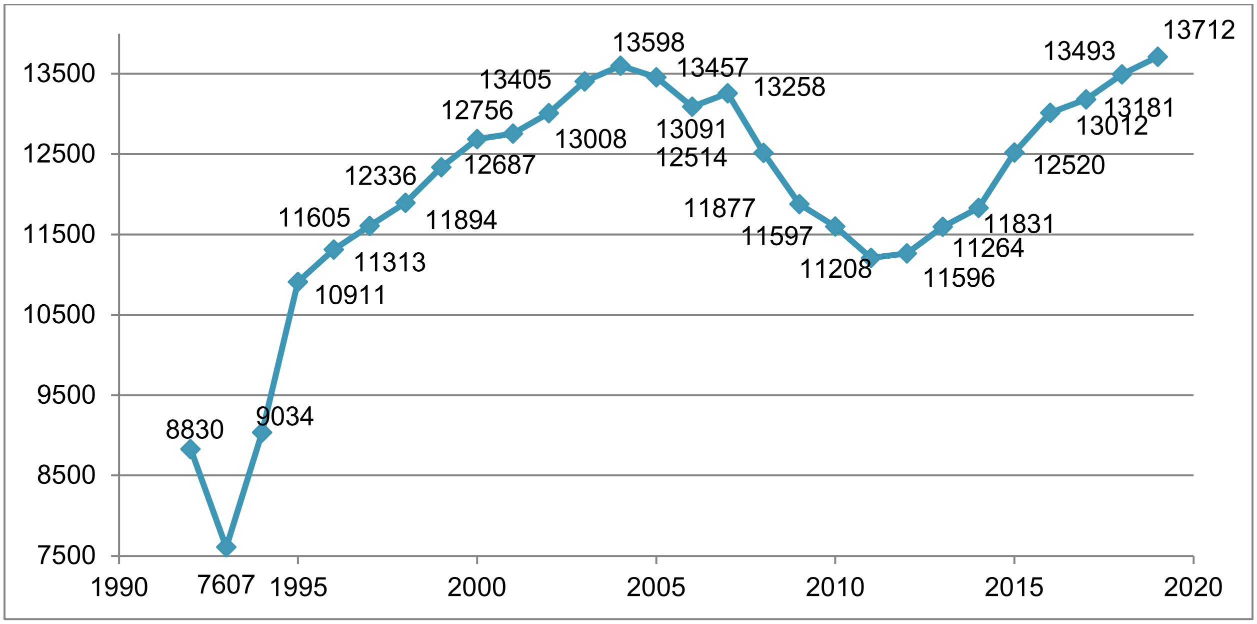

Figure 13. ATR #68 Historic AADT

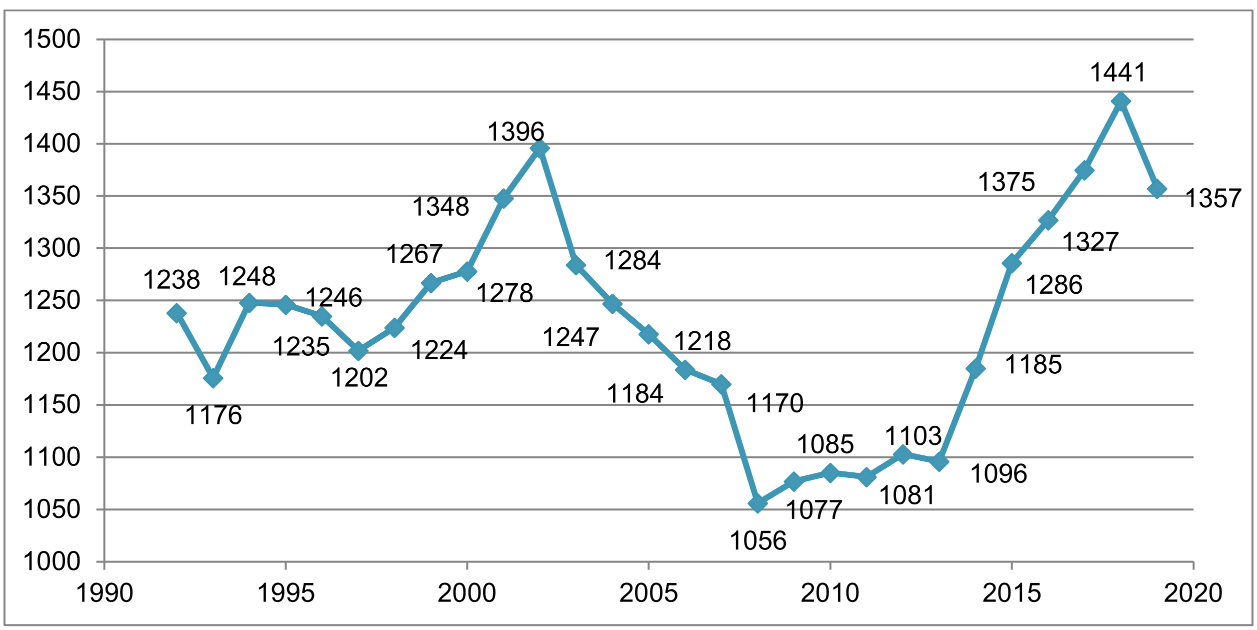

Figure 14. ATR #28 Historic AADT

The project team developed two separate volume scenarios for this study: 1) applying the growth rate to the unadjusted August counts, called the summer volumes, and 2) applying the growth rate to the adjusted counts, called the average volumes. Forecasted traffic volumes for the AM and PM peak hours are provided in Figure 15 and Figure 16.

Figure 15. Average Main Street 2042 Volumes

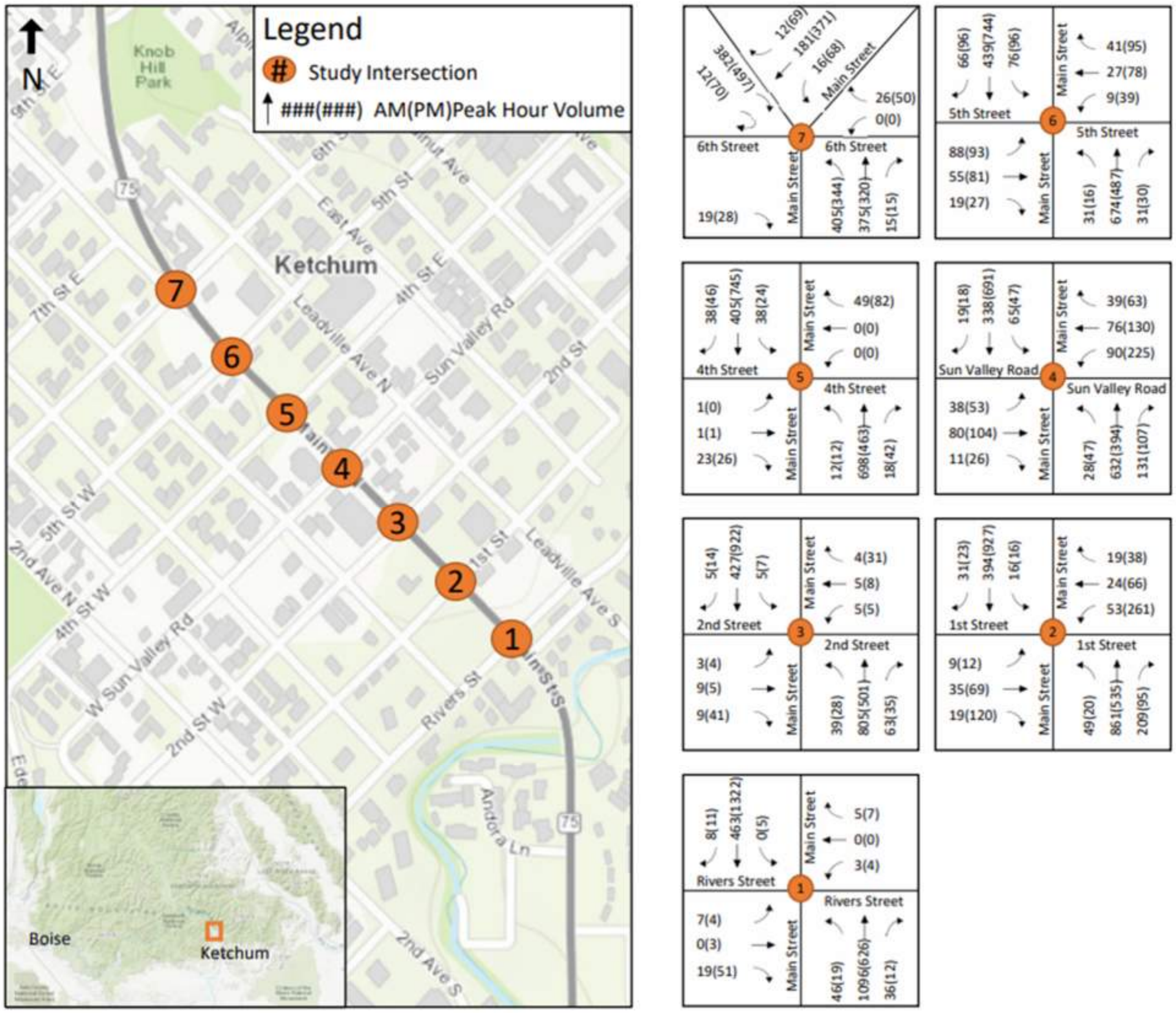

Figure 16. Summer Main Street 2042 Volumes

3.3 Future Scenario Evaluation

The project team developed two scenarios (No-Build and Build 3-lane configuration) along Main Street for both the average and summer volumes conditions for a total of four analysis scenarios (AM and PM peak for each). Table 15 summarizes different analysis scenarios. The analysis results of each are discussed in detail in **Appendix C** – Draft Future Conditions Memo.

Table 15. Main Street Analysis Scenarios

No.	Volumes Used	Scenario	Main Street Cross Section	Signal Operations	Peak Hour Factor
1	2042 Average	No-Build	Two lanes in each direction, no dedicated turn lanes at intersections	Existing signal timing parameters	0.92
2	2042 Summer				
3	2042 Average	Build	One lane in each direction, dedicated left-turn lane at each intersection on Main Street	100 second cycle length, flashing yellow arrows (FYA) for left turns	
4	2042 Summer				

3.3.1 Main Street Scenario 1

The first scenario on Main Street evaluates the existing four-lane section and timing parameters with the 2042 average volumes. Only the Sun Valley Road intersection and River Street intersection perform below ITD's recommended LOS D threshold. Sun Valley Road is estimated to operate at LOS F during the AM peak hour and LOS E during the PM peak hour, largely due to the split phasing of Main Street traffic.

Side street traffic at River Street looking to turn onto Main Street becomes overwhelmed by the large PM peak volumes of southbound traffic and cannot find a gap to turn left. This reduces River Street to an estimated LOS F. The remaining intersections are estimated to operate at an LOS C or better in the AM and PM peak hours. The average speed through the corridor is expected to be 14 miles per hour (mph) in the AM peak and 10 mph in the PM peak.

3.3.2 Main Street Scenario 2

Like the first scenario, the second scenario evaluates the existing four-lane section and timing parameters but with the summer 2042 volumes. Again, the Sun Valley Road and River Street intersections operate below ITD's recommended LOS D threshold. Sun Valley Road is estimated to operate at LOS F in both peak hours with northbound queues approaching 600 feet in the AM peak hour. The northbound traffic is expected to exceed the capacity of the intersection in both the AM and PM peak hours and the southbound traffic is expected to exceed capacity in the PM peak.

River Street continues to operate at LOS F in the PM peak hour, with the remaining intersections operating at an estimated LOS D or better in both peak hours.

The average speed through the corridor is expected to be approximately 8 mph in the morning and 7 mph in the evening peak. The capacity of the corridor is exceeded and over 200 vehicles are estimated to not be served during the peak hours.

3.3.3 Main Street Scenario 3

In scenario three, the 2042 average volumes are analyzed with a three-lane section, one lane in each direction with dedicated left-turn lanes at each intersection along Main Street. Side streets will remain in their existing configurations. The signalized intersections were evaluated with 100-second cycle lengths and flashing yellow arrow (FYA) left-turn operations. Pedestrian clearance times were reduced due to the smaller crossing distances expected. Sun Valley Road's split phasing and pedestrian scramble phase were replaced with a standard signal phasing.

Overall, the intersections through the corridor are expected to operate at a better LOS in 2042, with the Sun Valley Road intersection experiencing the largest improvement to LOS B in both peak hours.

In terms of the corridor's performance, the average speed through the corridor is expected to be 14 mph in the morning peak and 10 mph in the evening peak. However, the corridor's capacity is exceeded in the evening and 28 vehicles will not be served.

Unfortunately, the LOS and delay benefits expected at the intersections may not be fully realized due to excessive queue lengths. For example, the southbound queue lengths at 1st Street are expected to exceed 330 feet, which would back up traffic through the 2nd Street intersection. 5th Street's estimated queue lengths are also large in the evening peak with southbound traffic backing up nearly 370 feet, which would clog the 6th Street intersection. The HCM's methodology analyzes intersections in isolation and does not consider queue spillback. It's expected that these large queue lengths would interfere with upstream intersection operations, degrading their LOS. Therefore, reported LOS and delay benefits should be read with caution and within the context of the queue lengths.

3.3.4 Main Street Scenario 4

The final scenario on Main Street analyzes the same roadway cross section as Scenario 3, but with the 2042 summer volumes. Signal operations, pedestrian clearances, and phasing are also the same as in Scenario 3.

With the increase in volumes in the summer months, River Street, 1st Street, and 2nd Street are expected to operate at LOS E or LOS F during the peak hours. The traffic at River Street and 2nd Street, both stop-controlled intersections, struggle to find a gap to turn left onto Main Street, increasing delays. In the case of the signalized operations at 1st Street, it is estimated to operate at LOS E in the PM peak hour with the southbound movements experiencing LOS F. The remaining intersections are expected to operate at an acceptable LOS.

As with Scenario 3, the LOS and delay benefits experienced at the intersection may not be fully realized due to excessive queue lengths. For example, at 1st Street, the PM peak southbound traffic experiences an estimated queue length of 1,309 feet. This long of a queue would back traffic up nearly to 6th Street, blocking the other intersections on the corridor. Similarly, the queued northbound traffic at 1st Street in the morning is expected to back up 721 feet, extending beyond River Street.

3.3.5 Main Street Initial Scenarios Comparison

At first glance, reducing the number of lanes from four to three and adding FYA for left turns, analyzed in scenarios 3 and 4, appears to improve the LOS along the corridor. For example, the Sun Valley Road/Main Street intersection operations improve from an LOS F in the PM peak hour to an LOS C with these improvements. However, when looking at the estimated queue lengths at the intersections, they can exceed 1,000 feet in some cases with the reconfigured cross section. These excessive queues are significantly longer than those estimated under the No-Build scenarios and would back up from one signal through the upstream signalized intersections, causing significant congestion and potential gridlock.

The HCM capacity analysis methodology and the reported measures of effectiveness (MOE) generally do not consider how closely spaced signals interact with one another. Long queue lengths from one signalized intersection would interfere with another's operations, ultimately increasing delay and reducing LOS. By separating the left-turn traffic from the through traffic and adding FYA left-turn operations along Main Street in the 2042 Build scenario, traffic flow tends to improve, but there simply is not enough room on Main Street to store the queued traffic without blocking adjacent intersections.

Side street queue lengths also increase from the No-Build to the Build alternatives under average conditions and get even worse under summer conditions. Short city block lengths, on-street parking, and a single lane in each direction limit the amount of storage available on the side streets. Operations at the stop-controlled intersections are not expected to improve in the Build scenario and delays are expected to increase during the summer peak.

Overall, these results indicate that there is significant operational improvement by removing the split phasing at Sun Valley Road and installing left-turn lanes with FYA. The closely spaced intersections prevent the large volume of traffic from being stored, ultimately creating congestion.

3.4 Additional Scenarios

In consultation with City staff, the project team evaluated the following three additional scenarios, using 2042 summer volumes, to quantify the potential benefits and trade-offs to improve the corridor

- Scenario 5: Add left-turn lanes on Main Street at Sun Valley Road, removing split phasing and pedestrian scramble.
- Scenario 6: Prohibit left-turn movements from Main Street, except at Sun Valley Road where left-turn lanes are added.
- Scenario 7: Install a five-lane section along Main Street with left-turn lanes at each intersection.

Scenario results are summarized below. Summary tables and detailed reports are provided in **Appendix C**.

3.4.1 Main Street Scenario 5 – Add Left-Turn Lanes at Sun Valley Road

In this scenario, parking is removed along two blocks at the Sun Valley Road intersection to add a left-turn lane in each direction on Main Street. The split phasing and pedestrian scramble are removed creating an intersection with traditional phasing. The results show a marked decrease in queue lengths, with queue lengths at Sun Valley Road at less than 65 feet.

3.4.2 Main Street Scenario 6 – Add Left Turns at Sun Valley Road and Prohibit at Other Intersections

This scenario is similar to Scenario 5 in that it adds turn lanes on Main Street at the Sun Valley Road intersection, but it also prohibits left turns at the 1st and 5th street intersections. This pushes all left-turning traffic from Main Street to the Sun Valley Road intersection. This scenario also decreases queue lengths along the corridor, but slightly increases travel times as compared to Scenario 5.

3.4.3 Main Street Scenario 7 – Create a 5-lane Section along Main Street

The final scenario removes parking along the entirety of Main Street to add left-turn lanes at each intersection. The configuration removes the split phasing and pedestrian scramble at the Sun Valley Road intersection. It improves operations to LOS A at 1st Street, Sun Valley Road and 5th Street in the AM peak hour. In the PM peak hour, Sun Valley Road and 5th Street are expected to operate at an LOS B, while 1st Street operates at an LOS C. Travel times for this scenario are expected to be higher than scenarios 5 and 6, but less than the three-lane scenario.

3.4.4 Comparing Additional Scenarios

When compared to the No-Build or three-lane scenarios, scenarios 5, 6, and 7 decrease congestion on the corridor and reduce travel times. Each scenario provides better LOS, less congestion/gridlock, and better progression and travel time for vehicles and pedestrians. The shorter cycle lengths with these scenarios will shorten the wait times for pedestrians at intersections. Scenario 7 achieves vehicle progression goals; however, it produces the greatest impact by removing parking along the corridor. The Scenario 7 configuration may also limit opportunities to install curb extensions on Main Street to shorten the pedestrian crossings.

Figure 17 shows a comparison of the travel times between the three-lane scenario and the other scenarios. During the PM peak hour, the three-lane configuration southbound travel time is nearly double the other alternatives. Adding the left turns at Sun Valley Road reduces the travel times the most. Scenarios 6 and 7 also reduce travel times; however, they have a greater impact on the public in turn restrictions or removing more parking than Scenario 5. Average speeds, shown in Figure 18, are lowest in the three-lane scenario due to the increase in congestion and limited capacity of the roadway.

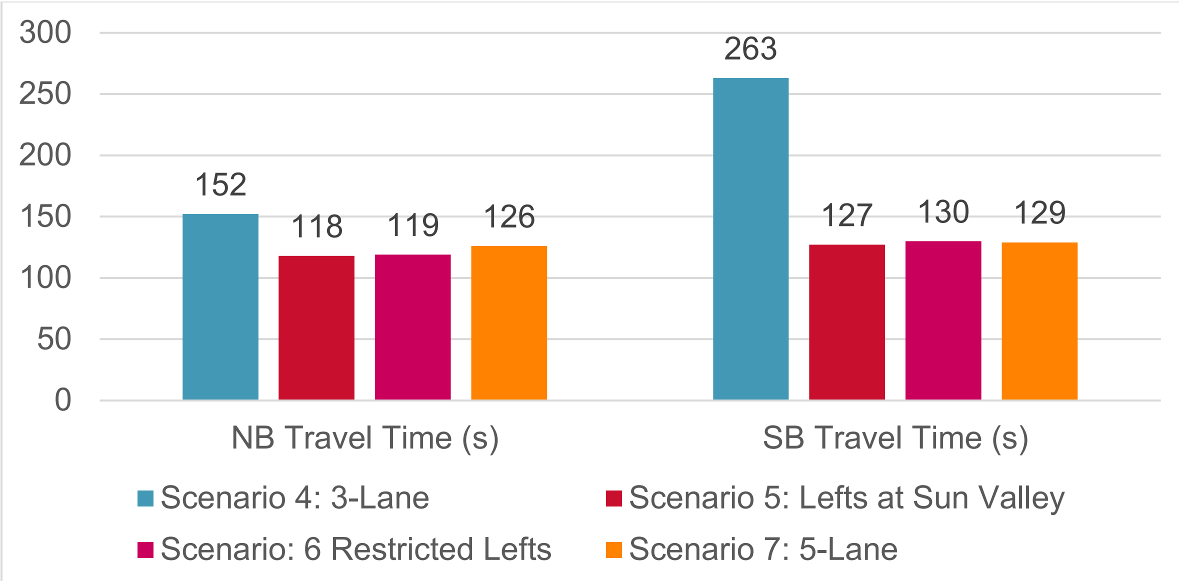

Figure 17. PM Peak Travel Time Comparison of Additional Scenarios

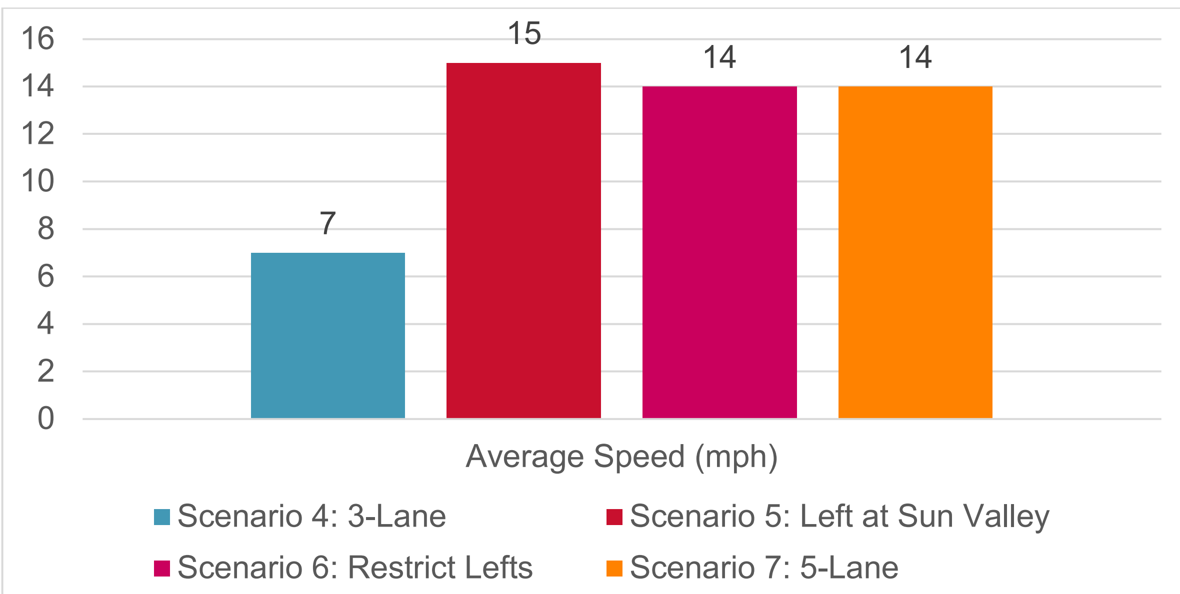

Figure 18. PM Peak Average Speed Comparison of Additional Scenarios

3.5 Initial Recommendation and Limitations of the Analysis

HDR presented the findings of the deterministic analysis to the City Council on April 11, 2022. HDR recommended against pursuing the three-lane section due to the significant impacts to motorized vehicle flow and travel time. Congestion on Main Street could cause traffic to use adjacent streets to get through town, increasing volumes, congestion, and conflicts on local streets. Instead, HDR recommended the City pursue adding left-turn lanes at the Sun Valley Road Intersection, similar to scenario 5, and HDR provided a conceptual rendering, shown in Figure 19.

Figure 19. Conceptual Rendering of Adding Left Turns at Sun Valley Road

The above results were performed using HCM methodologies, which are deterministic in nature. The methodologies use parameters, including volume, saturation flow rates, signal timing settings, and others to estimate a statistical model representing traffic. This methodology, employed in Synchro, is usually accurate enough for basic projects, but generally does not consider the immediate influences of adjacent intersection or impacts to individual drivers. Deterministic analysis also does not produce a visual representation of the operations.

The City Council asked for a visual representation of the corridor operations to understand the potential impacts of the different lane reconfiguration scenarios. HDR explained the limitations of the macroscope methodologies and recommended performing a microsimulation analysis to improve the confidence of the analysis and provide videos of the operations.

4 Interim Improvements

At the City's request, HDR and the project team implemented short-term solutions to enhance the corridor operations in the interim period. These improvements were in response to inefficiencies previously identified in Section 2.4.4.

- The project team coordinated with ITD to interconnect the signals to implement a coordinated signal timing plan.

- The City and ITD agreed to remove the pedestrian scramble. While good in its intentions to provide more opportunities for pedestrians to cross Main Street, the scramble added undo delay to vehicles along the corridor.
- HDR developed signal timing plans for the AM and PM peak hours to reduce the number of stops and increase progression during the peak hours. Additionally, HDR recalculated the pedestrian clearance intervals to increase pedestrian safety.
- ITD is currently designing a project south of Ketchum that is scheduled to be built before improvements on Main Street and would provide an opportunity to revise the location of the merge taper between 1st Street and River Street to be south of River Street. This would allow drivers to stay in their lanes for a longer period of time before merging and reduce the impact of the merge on the 1st Street signal. Figure 20 below shows the existing merge taper and proposed merge taper for this area.

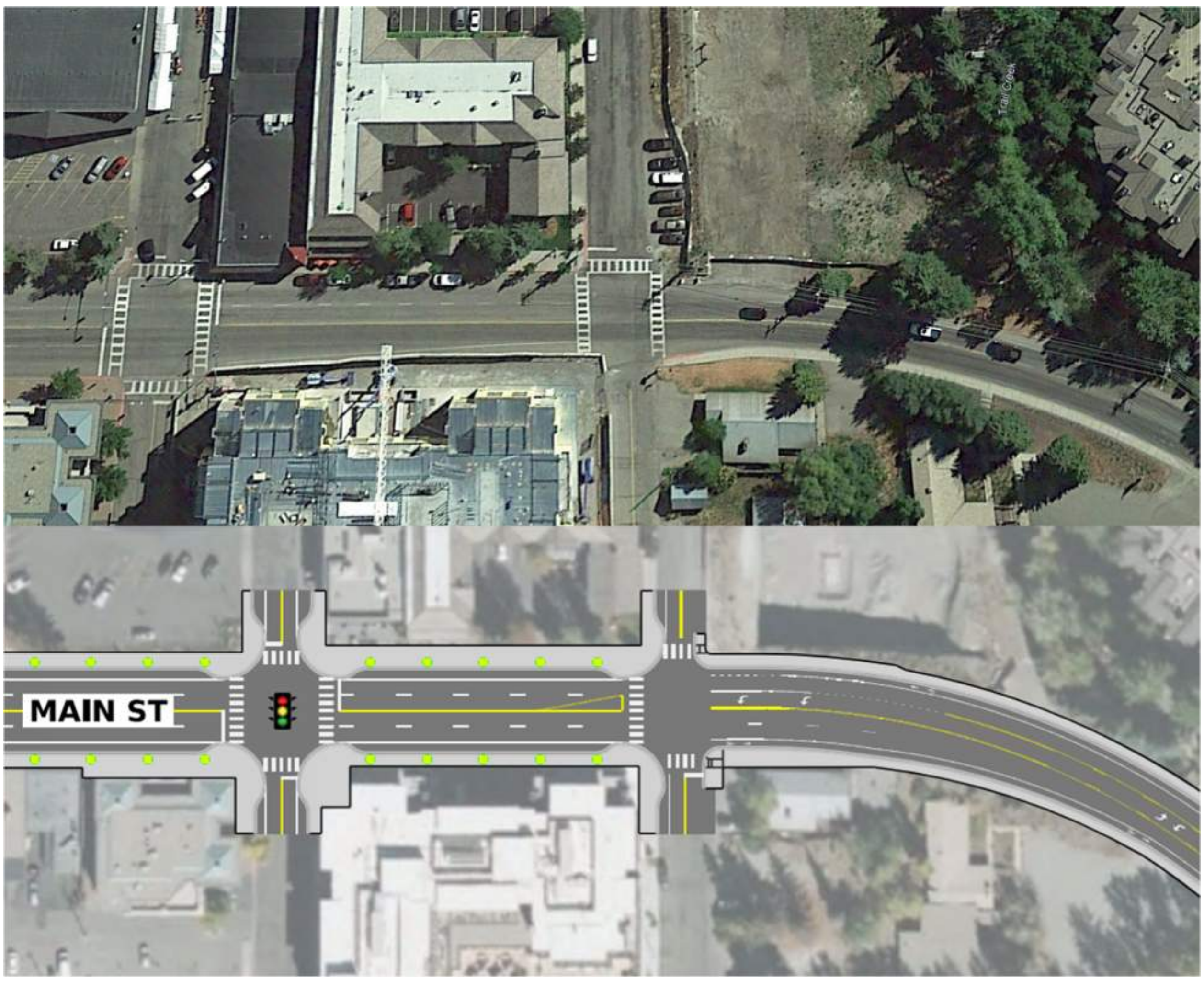

Figure 20. Existing Merge Between 1st and River (Top) and Proposed Merge South of River (Bottom)

5 Microsimulation Analysis

The project team performed a microsimulation analysis using Vissim software. The microsimulation is a higher-grade analysis than the previously described deterministic analysis that treats vehicles individually instead of in flow relationship equations. This level of analysis creates a higher confidence in vehicle-to-vehicle interaction and a visual example of estimated operations can be produced. The project team analyzed the following specific alternatives:

- Existing Conditions
- Alternative 1: No-Build
- Alternative 2: Adding Main Street left-turn lanes at Sun Valley Road
- Alternative 3: Three-lane section

The Existing Conditions alternative and Alternative 1 were developed under the following assumptions:

- the pedestrian scramble was removed,
- the new signal timing plans were implemented,
- the merge taper was moved south of River Street, and
- Left turns were protected only and FYA's were not used.

Each alternative evaluated August 2042 volumes grown by the 1.44 percent average annual growth rate and no seasonal adjustments were made to traffic volumes.

In Vissim, the intersection LOS is computed from a microsimulation analysis that is reported as an "estimated LOS." Vissim quantifies overall intersection delays more realistically than typical equation based HCM methods because it models the entire network and how operations at one intersection influences adjacent intersection as it tracks individual vehicle movements and interactions. The estimated LOS for existing conditions is based on HCM criteria and thresholds for signalized and unsignalized intersections. The overall intersection delay and LOS for signalized intersections is based on the total control delay of all movements. The overall intersection delay and LOS for unsignalized intersections is based on the worst stop-controlled movement per HCM standards. Detailed measures of effectiveness tables for individual movements are provided in **Appendix D**. Unlike in the deterministic analysis, FYAs were not considered for left-turn lanes.

5.1 Existing Conditions Alternative

Like the earlier analysis, the existing conditions are modeled using August 2022 volumes with results shown in Table 16. Each intersection is operating at an estimated LOS C or better in the AM peak hour. The average delay at the Sun Valley Road intersection is at 31 seconds with northbound and southbound queue lengths at approximately 240 feet, or nearly the entire block. In the PM peak hour, each intersection operates at LOS D or better with 40 seconds of average vehicle delay at the Sun Valley Road intersection. At 1st Street and Sun Valley Road, the queue lengths are estimated to be at or exceeding 300 feet both westbound and southbound.

Table 16. Existing Conditions Microsimulation Results

Intersection	Traffic Control	AM Peak		PM Peak	
		Delay (sec/veh)	Estimated LOS	Delay (sec/veh)	Estimated LOS
SH-75 and 6th St	Unsignalized	6.5	A	7.4	A
SH-75 and 5th St	Signalized	9.3	A	9.9	A
SH-75 and 4th St	Unsignalized	15.5	C	15.4	C
SH-75 and Sun Valley Rd	Signalized	31.4	C	38.2	D
SH-75 and 2nd St	Unsignalized	12.0	B	13.1	B
SH-75 and 1st St	Signalized	7.0	A	18.2	B
SH-75 and River Rd	Unsignalized	16.2	C	24.8	C

sec/veh = seconds per vehicle; LOS = level of service

5.2 Alternative 1: No-Build

In the 2042 No-Build conditions, each intersection operates at an LOS C or better in the AM peak with delays at Sun Valley Road approaching 31.3 seconds. The 6th Street intersection performs the worst in the PM peak with an average delay of 146.7 seconds and an LOS F. Although the average delay at the Sun Valley Road intersection is only 47.4 seconds per vehicle, the westbound left turn is estimated to experience delays exceeding 80 seconds at LOS F and queue lengths approaching 590 feet. The 1st Street intersection is expected to have queue lengths exceed 500 feet in the PM peak hour. Table 17 shows a LOS summary for each of the intersections.

Table 17. Alternative 1: No-Build Microsimulation Results

Intersection	Traffic Control	AM Peak		PM Peak	
		Delay (sec/veh)	Estimated LOS	Delay (sec/veh)	Estimated LOS
SH-75 and 6th St	Unsignalized	7.1	A	146.7	F
SH-75 and 5th St	Signalized	11.3	B	24.6	C
SH-75 and 4th St	Unsignalized	15.7	C	48.2	E
SH-75 and Sun Valley Rd	Signalized	33.9	C	47.4	D
SH-75 and 2nd St	Unsignalized	19.4	C	16.9	C
SH-75 and 1st St	Signalized	9.3	A	20.3	C
SH-75 and River Rd	Unsignalized	30.8	D	28.7	D

sec/veh = seconds per vehicle; LOS = level of service

5.45.3 Alternative 2: Install Left-Turn Lanes at Sun Valley

In Alternative 2, the 2042 volumes are analyzed with left-turn lanes added at the Sun Valley Road intersection. During the AM peak hour, each intersection performs above ITD's LOS D threshold, with River Street performing the worst at LOS D and 31.0 seconds of average delay. In the PM peak hour, each intersection performs at an LOS C or better with River Street again operating the worst at LOS D with 32.2 seconds of delay. The westbound left-turn lane at Sun Valley Road has a queue length of 413 feet in the PM peak hour, but only experiences an average delay of 49.1 seconds. Queue lengths for the 1st Street westbound movements again exceed 500 feet. Table 18 shows a LOS summary for each intersection.

Table 18. Alternative 2: Install Left-Turn Lanes at Sun Valley Microsimulation Results

Intersection	Traffic Control	AM Peak		PM Peak	
		Delay (sec/veh)	Estimated LOS	Delay (sec/veh)	Estimated LOS
SH-75 and 6th St	Unsignalized	7.1	A	9.1	A
SH-75 and 5th St	Signalized	10.6	B	12.6	B
SH-75 and 4th St	Unsignalized	7.5	A	16.6	C
SH-75 and Sun Valley Rd	Signalized	22.9	C	28.1	C
SH-75 and 2nd St	Unsignalized	15.8	C	13.8	B
SH-75 and 1st St	Signalized	8.1	A	16.3	B
SH-75 and River Rd	Unsignalized	31.0	D	32.2	D

sec/veh = seconds per vehicle; LOS = level of service

5.55.4 Alternative 3: Three-Lane Section

In Alternative 3, the 2042 volumes are analyzed with the roadway lanes configured into one lane in each direction and left-turn lanes at each of the intersections. During the AM peak hour, the River Street intersection operates at an LOS F with 69.7 seconds of delay. The remaining intersections operate at LOS D or better. In the PM peak hour, the operations at the 6th Street intersection severely degrade. Delay is expected to exceed 11 minutes at this intersection. Main Street splits at 6th Street with SH-75 going northeast and Warm Springs Road going northwest. In the PM peak hour, these two lanes must merge down to one between 6th Street and 5th Street; however, there is such a large number of vehicles that this merge causes a more severe delay at the intersection.

Table 19. Alternative 3: Three-Lane Section Microsimulation Results

Intersection	Traffic Control	AM Peak		PM Peak	
		Delay (sec/veh)	Estimated LOS	Delay (sec/veh)	Estimated LOS
SH-75 and 6th St	Unsignalized	7.5	A	668.3	F
SH-75 and 5th St	Signalized	22.5	C	52.2	D
SH-75 and 4th St	Unsignalized	18.8	C	27.4	D
SH-75 and Sun Valley Rd	Signalized	26.5	C	37.4	D
SH-75 and 2nd St	Unsignalized	41.5	E	46.8	E
SH-75 and 1st St	Signalized	16.3	B	36.2	D
SH-75 and River Rd	Unsignalized	82.5	F	45.3	E

sec/veh = seconds per vehicle; LOS = level of service

Unlike the other three alternatives, the three-lane section does not fully serve the forecasted vehicle demand. In the VISSIM simulations, the model only serves about 81 to 89 percent of the forecasted vehicle traffic. This is due to both no room for vehicles to turn onto Main Street and the long wait north of 6th Street. Figure 21 and Figure 22 show the long queue lengths and congestion.

Figure 21. Alternative 3 Long Queue Lengths – South End

Figure 22. Alternative 3 Long Queue Lengths - North End

~~5.6~~5.5 Travel Times and Average Speeds

Figure 23 and Figure 24 summarize the estimated travel times of each alternative under 2042 conditions and the existing conditions (2022) model. The travel time segments are assumed to begin and end 500 feet north of 6th Street and 500 feet south of River Street.

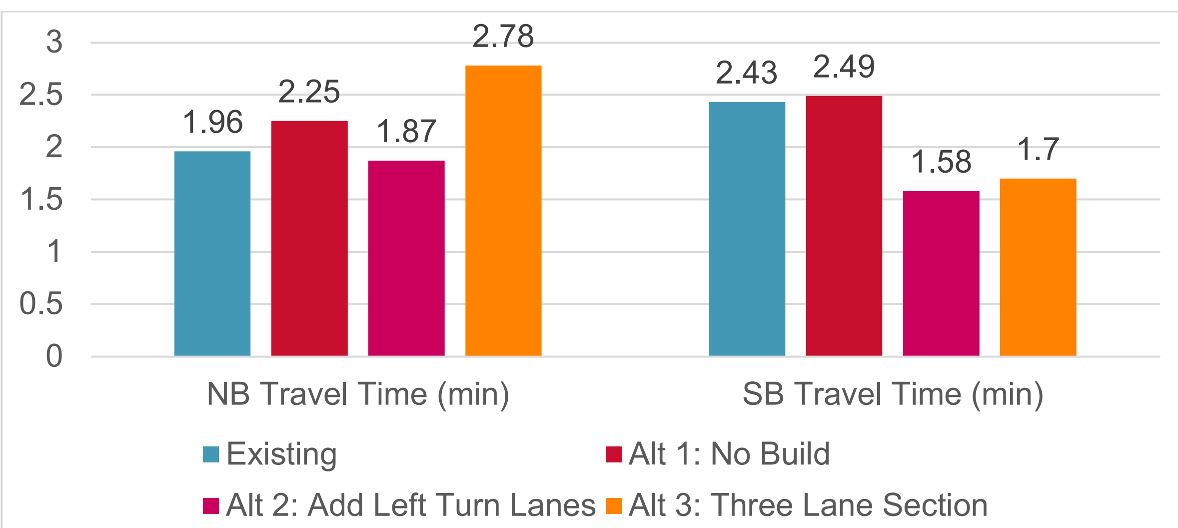

Figure 23. AM Peak Microsimulation Travel Time Comparison

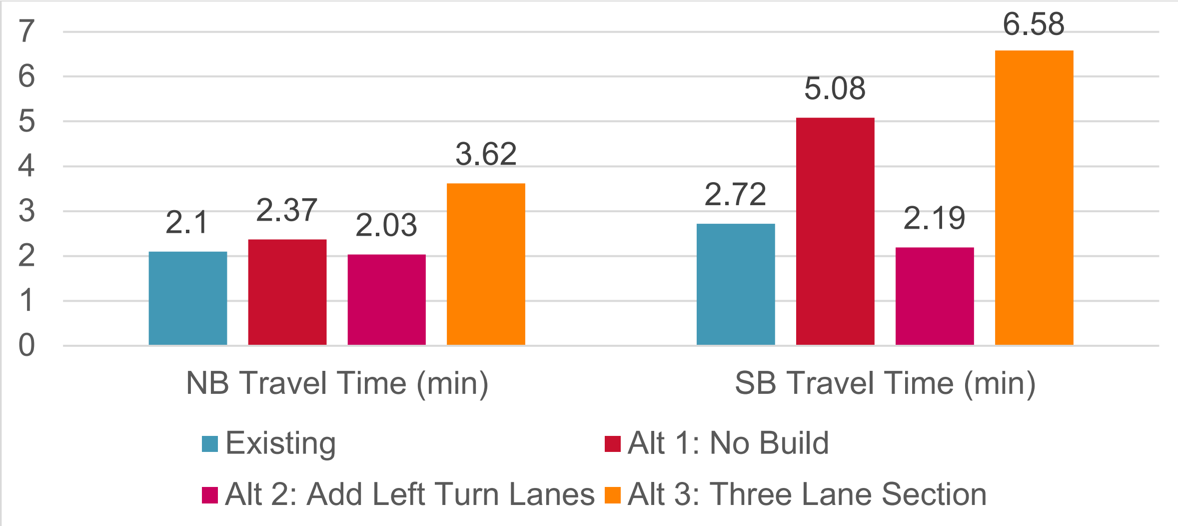

Figure 24. PM Peak Microsimulation Travel Time Comparison

Table 20 outlines the differences in travel times between the alternatives. Alterative 2 decreases the total travel time when compared to the other alternatives.

Table 20. Microsimulation Travel Time Comparison

Travel Time Segments		Difference (minutes)			
Peak Hour	Direction	Alt 1: No-Build vs Existing	Alt 2: Add Left-Turn Lanes vs Alt 1: No-Build	Alt 3: Three-Lane Section vs Alt 1: No-Build	Alt 2: Add Left Turns vs Alt 3: Three-Lane Section
AM	NB	0.29	-0.37	0.54	-0.91
	SB	0.06	-0.91	-0.79	-0.12
PM	NB	0.27	-0.34	1.25	-1.59
	SB	2.36	-2.88	1.51	-4.39

Figure 25 and Figure 26 present the average vehicle speed through the corridor. In both the AM and PM peaks, the average speed is highest in Alternative 2, although still below the posted speed limit. The added left-turn lanes allow for removing the split phasing, which provides better two-way progression. In turn, more vehicles can proceed through the corridor without stopping. The three-lane section is considerably slower than other alternatives in the PM peak hour, nearly slowing vehicles to a crawl in the southbound direction.

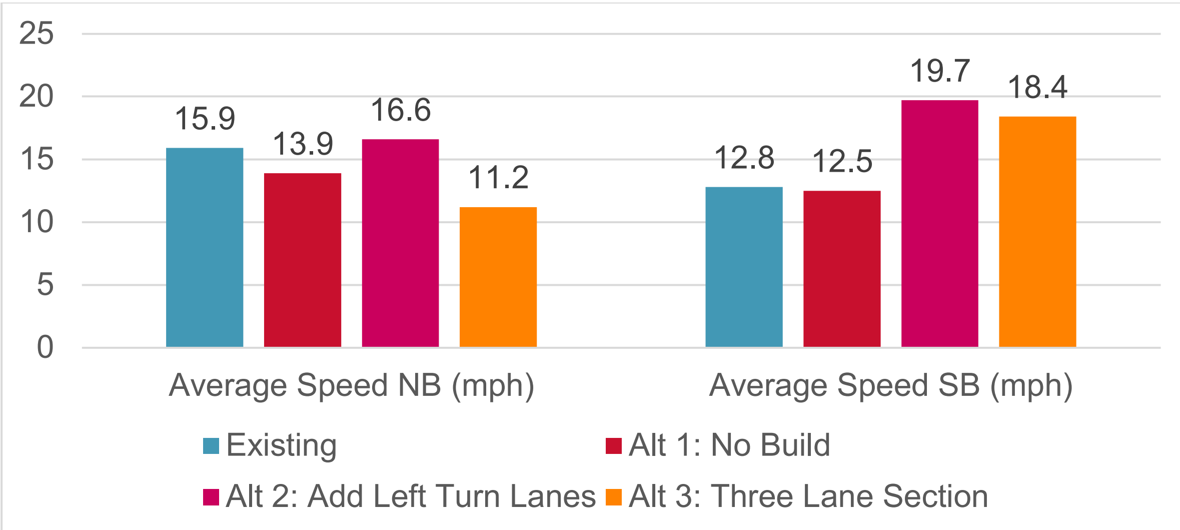

Figure 25. Microsimulation AM Peak Average Speed Comparison

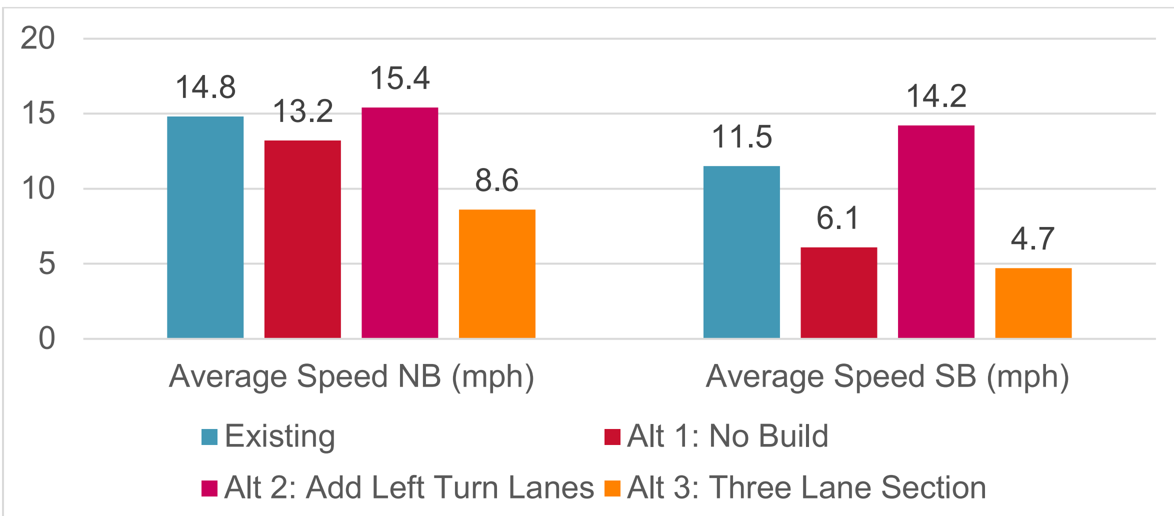

Figure 26. Microsimulation PM Peak Average Speed Comparison

6 Safety and Public Realm Enhancements

6.1 Safety and Public Realm Enhancements

The project team evaluated the corridor for recommendations that could be applied to either Alternative 2 or Alternative 3 to further enhance corridor safety. Following are the recommended treatments as part of the project.

6.1.1 Narrow the Travel Lanes from 12 Feet to 11 Feet

The existing travel lanes are 12 feet wide. These could reasonably be reduced to 11 feet, thereby providing 4 feet to increase the pedestrian space (2 feet on each side). Reducing the parking lane width from 8.5 feet to 8 feet from the face to curb would give an additional half-foot to the pedestrian realm on each side of the roadway. Figure 27 and Figure 28 are conceptual drawings of the increased pedestrian space. The reduced travel lane width would reinforce slower speeds and calm traffic through the corridor.

Figure 27. Additional Sidewalk Concept

Figure 28. Additional Sidewalk Concept

6.1.2 Provide Bulb-Outs at Intersections

Bulb-outs, also known as curb extensions, shorten the pedestrian crossing distance by extending the curb out into the adjacent parking lane. Bulb-outs increase pedestrian safety by increasing their visibility as they are no longer hidden to drivers behind adjacent parked vehicles. Figure 29 is a National Association of City Transportation Officials (NACTO) rendering of a bulb-out. The extra curb space can be used to provide placemaking signs or landscaping along the corridor to enhance the public realm. As shown in Figure 30, there are bulb-outs presently at the 4th Street intersection. Similar bulb-outs could be implemented with minimal impacts to parking along the rest of the corridor.

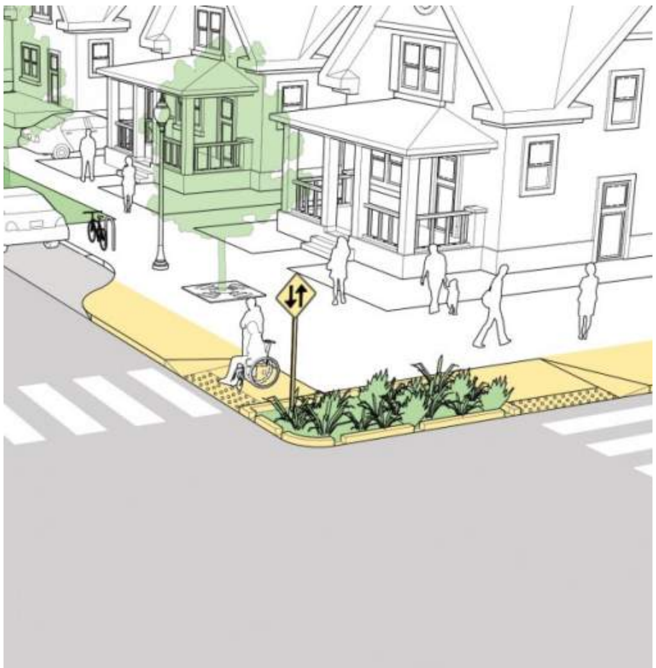

Figure 29. NACTO Bulb-out Rendering

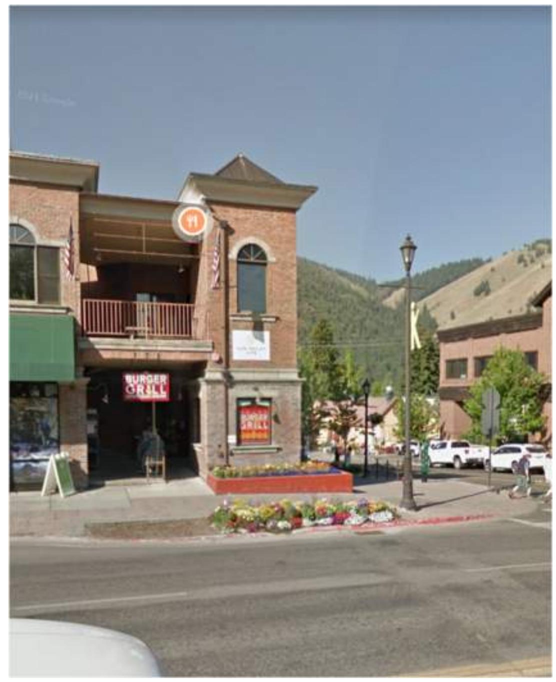

Figure 30. Existing Bulb-out at 4th Street

6.1.3 Public Realm Improvements

The extra space afforded by narrowing the lanes and providing bulb-outs where applicable, may allow the City to install public realm improvements that would provide a place-making feel and redefine the downtown area. These can include specialty landscaping, identifying signage, banner poles, artwork and sculpture, tree-lined street, and enhancing seating options. Some examples are shown below in Figure 31.

Figure 31. Example Public Realm Improvements

6.1.4 Raised Intersection at Sun Valley Road

A raised intersection may be explored at Sun Valley Road to improve the pedestrian experience along the corridor (Figure 32). According to the NACTO *Urban Street Design Guide*[10], "Raised intersections create a safe, slow-speed crossing and public space…they reinforce slow speeds and encourage motorist to yield to pedestrians at the crosswalk." This type of intersection treatment may keep speeds low along the Main Street corridor, helping facilitate a calmer presence along the corridor.

The Sun Valley Road intersection features corners without truncated domes and curb ramps with steep grades, making the intersection out of compliance with ADA/PROWAG guidelines. The intersection is also likely to prove challenging to bring into compliance because the building entrances and sidewalk height on the northeast corner are higher above the roadway than is typical. Installing ramps may prove challenging as the grades and tight corner do not allow much flexibility. However, a raised intersection could be feasible because instead of lowering the pedestrian to the level of the roadway, the roadway would rise to the pedestrian. Then, the sidewalk would not need to ramp down with unnecessarily steep grades and long pedestrian ramp runs can potentially be avoided.

This intersection treatment would need to be evaluated in coordination with ITD during design to ensure that the design vehicles can safely traverse the intersection. Additionally, drainage may be an issue as the raised intersection would change the drainage patterns of the intersection.

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[10] National Association of City Transportation Officials. 2013. *Urban Street Design Guide*.

Figure 32. NACTO Raised Intersection Rendering

6.1.5 Leading Pedestrian Interval

According to the NACTO's *Urban Street Design Guide,* "A leading pedestrian interval (LPI) typically gives pedestrians a 3-7 second head start when entering an intersection with a corresponding green signal in the same direction of travel." The LPI enhances pedestrian visibility as they establish their presence in the crosswalk prior to the vehicles getting a green. This can be implemented with any of the alternatives and would need to be evaluated in coordination with ITD when programing the signal timing.

6.2 Future Safety Evaluation

The project team used the Federal Highway Administration's (FHWA's) Crash Modification Factor (CMF) Clearinghouse[11] to identify the potential change in crash frequency or severity associated with the possible intersection changes and/or changes to the number of lanes on Main Street. CMFs were selected based on study similarities to Main Street's roadway conditions and star rating (i.e., minimum of three stars). Each CMF also needed to include all crash types and crash severities. When there were no CMFs available for the specific situation, a qualitative discussion is provided.

[11] FHWA CMF Clearinghouse, http://www.cmfclearinghouse.org/index.cfm

6.2.1 Alternative 1: No-Build

Few opportunities existing within the No-Build alternative. The City and ITD could implement a LPI, which according to CFM ID 9910 (5 stars) shows a 16 percent decrease in crashes when LPIs are used on either all crossings or only across the minor roadway.

6.2.2 Alternative 2: Adding Left-Turn Lanes

The following CMFs can be applied to Alternative 2:

- CMF ID 153 (3 stars) shows a 20 percent decrease in crashes when prohibiting on-street parking.
- CFM ID 9910 (5 stars) shows a 16 percent decrease in crashes when LPI are used on either all crossings or only across the minor roadway.
- Installing a raised intersection at the Sun Valley Road intersection may help keep Main Street's speeds low.
- Bulb-outs have been shown to increase safety by decreasing the pedestrian crossing distance, reducing speeds caused by a decreased roadway width, and increasing pedestrian visibility to drivers.
- Install a rectangular rapid flashing beacon (RRFB) at the River Street intersection and disallow crossings on the south side of the intersection. This would enhance the visibility of pedestrians at the intersection and help alleviate the issues caused by the steep grade on the south side of the intersection as described in Section 2.5.5 and Figure 12.

6.2.3 Alternative 3: Three-Lane Section

The following CMFs can be applied to Alternative 3:

- CMF ID 2841 (5 stars) estimates a 47 percent reduction in crashes when converting the existing four-lane roadway to a three-lane roadway.
- CFM ID 9910 (5 stars) shows a 16 percent decrease in crashes when LPIs are used on either all crossings or only across the minor roadway.
- Installing a raised intersection at the Sun Valley Road intersection may help keep Main Street speeds low.
- Bulb-outs have been shown to increase safety by decreasing the pedestrian crossing distance, reducing speeds caused by a decreased roadway width, and increasing pedestrian visibility to drivers.
- Install a rectangular rapid flashing beacon (RRFB) at the River Street intersection and disallow crossings on the south side of the intersection. This would enhance the visibility of pedestrians at the intersection and help alleviate the issues caused by the steep grade on the south side of the intersection as described in Section 2.5.5 and Figure 12.

6.3 Future Transit Impact

6.3.1 Alternative 1: No-Build

Alternative 1 would provide no or minimal benefit to the transit network. There are no dedicated bus lanes on Main Street and congestion is shown to get worse in the design year; therefore, the decrease in travel times along the corridor would negatively impact the headways of Mountain Rides. Additionally, with the pedestrian realm and sidewalk remaining unchanged, there is little opportunity to enhance the bus stops.

6.3.2 Alternative 2: Adding Left-Turn Lanes at Sun Valley

Alternative 2 would improve the transit operations on Main Street. Travel times along the corridor in the design year are expected to be similar to today's travel times, meaning Mountain Ride's headways are expected to improve or not be impacted by the change. The changes proposed to the public realm would allow an opportunity to enhance bus stops along the corridor and improve the ridership experience.

6.3.3 Alternative 3: Three-lane Section

Alternative 3 would be mixed in its impact to transit. The potential narrowing of the roadway may allow for more room on the sidewalk to enhance bus stops like Alternative 2. The drastic increase in congestion would negatively impact transit operations along the corridor. As congestion and travel times increase, bus headways would increase as they may be stuck in long queues of vehicles. Without another direct alternative route through town, busses would need to travel either across or through Main Street likely preventing an alternate bus route from being effective.

7 Public Meeting Summary

A public meeting was held on October 3, 2022, followed by 2-week online public comment period. The public meeting consisted of three separate presentations (one each in the morning, mid-day, and evening) that outlined the results of the microsimulation analysis, showed videos of the estimated operations for each alternative, and presented the benefits and draw backs of each alternative. For individuals who could not attend the meetings in person, an online form was made available to provide feedback. Additionally, the public meeting included a presentation and survey on a concept study project concerning the Lewis Street and 10th Street intersections on Warm Springs Road.

No every person at the in person public meeting answered every question. The results of the in person public meetings were as follows:

- When asked if the city should choose the "No Build" alternative, 33 percent (4 of 12 attendees) said "yes", 8% were neutral (1 of 12), and 58 percent (7 of 12) said "No"
- When asked if the city should explore the "Left turn Lanes" alternative: Sixty-three percent (7 of 11) said "yes", 18 percent (2 of 11) were neutral and 18 percent (2 of 11) said "No"

- When asked if the city should explore the “lane reconfiguration” alternative: 18 percent (2 of 12) said “yes”, 25 percent (4 of 12) were neutral and 58 percent (7 of 12) said “No”

A total of 151 respondents filled out the online survey and not every respondent answered every question. The online results were as follows:

- When asked if the city should explore the “No Build” alternative, 44 percent (41 of 93) said “yes”, 23 percent (21 of 93) were neutral, 31 percent (29 of 93) said “No”, and 2% (2 of 93) responded other.
- When asked if the city should explore the “Left turn Lanes” alternative, 42 percent (39 of 93) said “yes”, 15 percent (14 of 93) were neutral, 39% (36 of 93) said “No”, and 4% (4 of 93) responded other.
- When asked if the city should explore the “Lane Reconfiguration” alternative, 22 percent (20 of 93) said “yes”, 16 percent (15 of 93) were neutral, 61 percent (57 of 93) said “No”, and 1 percent (1 of 93) responded other.

A summary of the public involvement results is provided in **Appendix E**.

8 Recommendations and Additional Opportunities

8.1 Comparing the Alternatives

Alternative 3 provides many benefits to the pedestrian and public realms, but at a significant cost to vehicle traffic flow. Based on historical growth rates, this alternative produces congestion and does not serve all traffic during future peak periods. This level of congestion could push traffic onto neighboring streets, increasing conflicts and negating large safety benefits from the potential lane reconfiguration. This alterative also does not meet ITD’s LOS D threshold.

Although the three-lane section may decrease the number of lanes pedestrians need to cross the roadway, vehicle congestion is likely to reduce gaps pedestrians will have to cross at unsignalized intersections. Side streets are expected to see large increases in vehicle queue lengths as vehicles are unable to enter Main Street due to a lack of gaps. The 6th Street intersection is especially problematic with delays exceeding 11 minutes.

Alternative 2, which removes parking for two blocks to add turn lanes at the Sun Valley Road intersection, serves all estimated traffic during the design year. Estimated travel times for future vehicles are similar to existing conditions. By removing the split phasing, the bottle neck at Sun Valley Road is removed and all other intersections on the corridor are able to increase operational efficiency for both pedestrians and vehicles. The safety benefits of Alternative 2 may not be as great as for Alternative 3; however, many safety improvements discussed in Section 6 can be implemented along the corridor to enhance pedestrian and multi-modal safety. The remaining intersections could still see improvements to the pedestrian and public realms with bulb-outs and wider sidewalks.

8.2 Recommendation

Alternative 2 is recommended over Alternative 3. Alternative 2 serves vehicular traffic and improves traffic operations; it meets ITD's LOS D threshold for improvements on a state highway; and provides excess capacity. Excess capacity allows some contingency for performance i.e., suggesting that if Ketchum sees a greater increase in vehicle traffic than estimated, this alternative would best be able to handle that increase. Although the opportunity to widen the pedestrian space is not as great as with Alternative 3, there are still opportunities to enhance the public realm, improve the placemaking feel of Ketchum's Main Street, and further enhance corridor safety performance. Final conceptual exhibits are provided in **Appendix F**. During design, the city should implement enhancements discussed in Section 6 of this report.

8.3 Opinion of Probable Costs

8.3.1 Opinion of the Probable Cost of the Recommended Alternative

The project team developed an opinion of probable cost based upon the conceptual exhibits. The costs assume complete sidewalk replacement, signal upgrades, tree cells, ADA ramp improvements and bulb-outs. ITD has programed a project to resurface Main Street in the near future and the Alternative 2 costs assume that ITD will pay for the resurfacing, including base material. The budget for their work is $7,322,000, according to ITD's STIP. Those costs include new pavement, aggregate, ADA ramp improvements and signal upgrades from River Street to Club House Drive. There will be some overlap in the costs assumed for this project, so cost sharing with ITD to the financial impact to the City and costs should be negotiated.

Three costs are estimated: engineering fee, construction costs, and right-of-way costs. The Alternative 2 probable costs are summarized in Table 21.

Table 21. Opinion Of Probable Costs

Cost	Amount
Engineering Fee:	$353,000
Construction Costs:	$3,880,000
Right-of-way Costs:	$10,000
Total Project Costs:	$4,243,000

The costs assume the following:

- All costs are in current (2022 dollars)
- Curb, gutter, and sidewalk will be removed and replaced along the length of the corridor.

- The pedestrian realm will be expanded by narrowing the travel lanes to 11 feet and the extra space given to the sidewalk.
- Tree cells will be installed to improve the tree canopy and provide a sustainable option for stormwater treatment.
- The traffic signal at the Sun Valley Road intersection will be completely rebuilt and no signal materials will be salvaged.
- The traffic signals at 1st Street and 5th Street as well as the PHB at 4th Street will be removed and reset as needed as their components are likely to be able to be reused.
- Bulb-outs will be installed at every intersection except at Sun Valley Road where vehicle turning movements may preclude their installation.
- ITD will pay for the raised intersection at Sun Valley Road as part of their improvements.
- 20 percent of the construction costs are assumed for contingency items that may arise.
- 10 percent of the construction costs are assumed for the engineer fee to complete the City's portion of the work.
- The right-of-way costs are estimated for the unlikely event of an easement or other access to a private property require complete construction.

8.3.2 Opportunities to Reduce Costs

As previously stated, the cost to construct the preferred alternative includes replacing sidewalk and installing bulb-outs at each intersection. This substantially increases project costs; however, the City may reduce total project costs by limiting the number of bulb-outs installed and not narrowing the travel lanes. This would decrease the benefits to the public realm and pedestrians.

The tree cell system is estimated to improve the tree canopy on Main Street; however, drainage benefits may be redundant with the existing storm sewer system in place. Excavation and material costs can be reduced by eliminating the tree cells from the concept.

8.4 Additional Opportunities

The following minor opportunities exist to enhance the corridor and provide longevity to the recommended improvements.

- Install mast arms long enough to add future dedicated left-turn lanes at 1st Street. Although the analysis indicates that future queue lengths and delays are acceptable, if the City experiences more growth than estimated, the longer mast arms would decrease costs associated with adding left-turn lanes on 1st Street.
- The City should look at controlling access at businesses along the corridor to mitigate conflicts and reduce confusion at the intersections. Coordination with the Village Market and the Valtrex property will be necessary.

- Enhance the wayfinding in advance of the 6th Street intersection to help non-locals identify which lane they need to be in before Main Street splits. This could be accomplished with new signage before intersection.

8.5 Next Steps

City staff should review this report for completeness and provide any comments. HDR will revise and resubmit the report for adoption by the City Council. After adoption, the City should pursue grant opportunities to fund the improvements. Outreach for stakeholder participation in the grant pursuits should occur, including with Mountain Rides, Blaine County School District, and the Ketchum Urban Renewal Agency.

The City should coordinate with ITD to get approval for the preferred alternative. ITD owns Main Street and will have final say on the implementation of any chosen alternative. Additionally, the City should coordinate design improvements to align with an upcoming maintenance project on SH-75. Coordination will decrease the amount of mobilization required to improve the roadway and reduce impacts to the public. The curb extensions and raised intersection will need to be evaluated in coordination with ITD during design to evaluate truck turning movements and stormwater needs in detail.