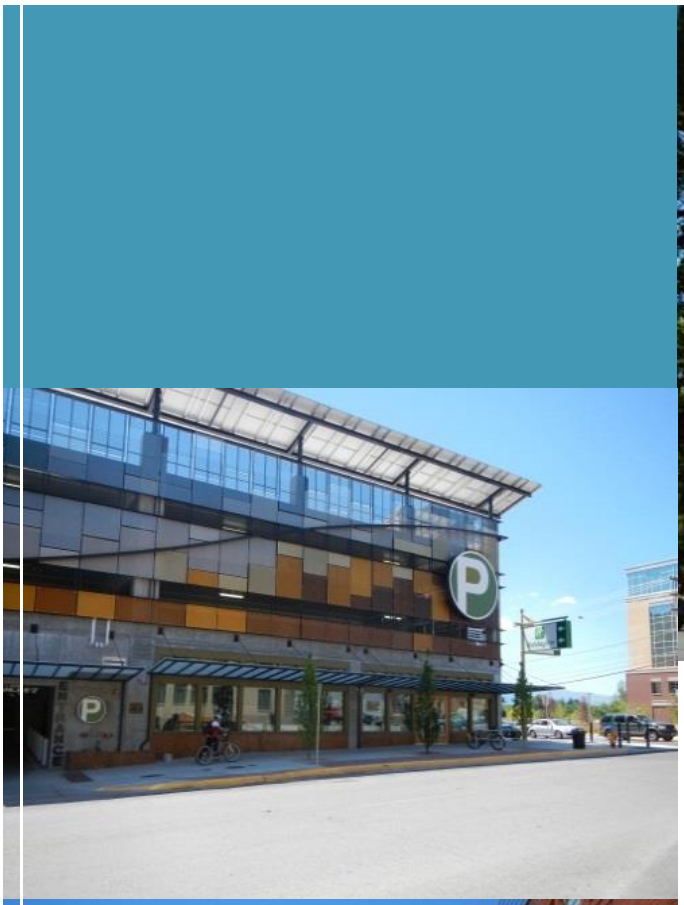

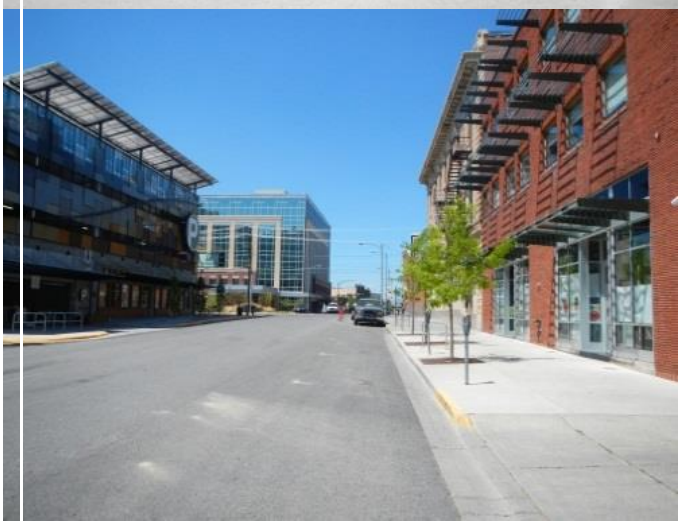

Front Street/Main Street Two-Way Conversion Feasibility Study

Draft Final Report

Missoula, MT

March 2015

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Acronyms and Abbreviations

ADA	Americans with Disabilities Act
ADT	Average Daily Traffic
AWSC	All-way stop controlled
CDBG	Community Development Block Grants
CMAQ	Congestion Mitigation and Air Quality
CO	Carbon Monoxide
EC	Elemental Carbon
EPA	Environmental Protection Agency
FHWA	Federal Highway Administration
GPM	Gasoline Particulate Matter
HUD	Housing and Urban Development
lbs	Pounds
LOS	Level of Service
LRTP	Long Range Transportation Plan
MDT	Montana Department of Transportation
MOVES	Motor Vehicle Emission Simulator
mph	Miles per Hour
MPO	Metropolitan Planning Organization
MRA	Missoula Redevelopment Agency
NHS	National Highway System
NN	Peak Hour-Noon
OC	Diesel Organic Carbon
OWSC	One-way Stop Controlled
PAC	Project Advisory Committee
PBR	Brake Particulate Matter
PM10	Particulate Matter <10 Microns
PTI	Tire Wear Particulate
SF	Square Footage
Sharrow	Shared Lane Traffic Marking
SID	Special Improvement District
STP	Surface Transportation Program
Synchro	Brand name of computer software used to simulate traffic
TA	Transportation Alternatives Program
TIP	Transportation Improvement Program
TSEP	Treasure State Endowment Program
TWSC	Two-way Stop Controlled
VMT	Vehicle Miles Traveled
WE	Weekend Peak Hour

Executive Summary

Project Summary

In 2014, the Missoula Redevelopment Agency (MRA) commissioned a study to examine the feasibility of converting the Front Street and Main Street one-way couplet in Downtown Missoula back to two-way traffic operations. The purpose of the study was to compare the existing one-way operation with proposed alternatives for two-way operation of Front and Main streets between Orange and Madison streets (study area). Feasibility of the two-way conversion was determined largely by the successful operations of the proposed redesign of the major intersections at Orange Street, Higgins Avenue, and Madison Street. An operational analysis using the traffic simulation software, Synchro, was conducted for the two-way alternatives to assess the operations of the proposed design against existing levels of service (LOS). Evaluation criteria were used to evaluate the proposed designs relative to motorized and non-motorized users' safety and mobility, traffic flows and operations, parking impacts, and right-of-way requirements. Recommended alternatives were developed that best met the goals of the study and included a proposed design for the major intersections within the study area as well as a proposed cross section for the different road segments of Front and Main streets within the study area. Finally, the study provided a planning-level cost estimate and potential funding mechanisms for the recommended improvements.

Background

Refer to **Chapter 2** of this report for the project background.

The conversion of the Front and Main streets one-way couplet to two-way traffic was identified as a top priority project in the 2009 *Greater Missoula Downtown Master Plan* as a means to improve overall circulation, pedestrian and bicycle safety, and economic vitality in Downtown Missoula. The MRA has identified the downtown business district as a priority area for improvements to safety for all forms of transportation, including pedestrians and bicyclists, business climate enrichment, long-term residential livability, and general aesthetic enhancements. Similar projects across the country are demonstrating that a conversion to two-way traffic can positively impact downtown businesses and spur new retail and residential development.

Methods

Chapter 3 includes information on the study methodology.

The feasibility of the proposed two-way conversion was assessed through conducting a traffic impact analysis measuring vehicle operations and queuing at the major study area intersections. Synchro was used to model the two-way conversion with current traffic volumes. The traffic analysis considered existing intersection traffic controls. At currently unsignalized intersections (i.e., stop sign controlled) approaching or at a failing LOS, a traffic signal was modeled to assess the effectiveness of a signalized intersection and measure its improvement to the functionality of the intersection.

Several criteria were established to evaluate and screen the build alternatives. Criteria were developed through coordination and input received from the public, stakeholders, and the project advisory committee (PAC). Criteria include:

- **Enhanced safety for both motorized and non-motorized users**: The proposed design should provide measures for increased safety between pedestrian, cyclists, and motorized traffic through reduced speeds, increased visibility, and improved pedestrian crossings.

- **Traffic flows and Level of Service**: The proposed design should, at a minimum, not have an adverse effect on current operations or result in a decrease in LOS over the existing condition.
- **Parking availability**: The proposed design should minimize impacts to available on-street parking spaces.
- **Right-of-way requirements**: The proposed design should minimize the need for acquisition of right-of-way. The proposed design should involve intersection and/or roadway reconfigurations within the existing rights-of-way to the greatest extent practicable.

Existing Conditions Analysis

Chapter 4 includes an analysis of existing conditions.

Existing conditions were examined for the roadway and transit system, traffic operations and parking, bicycle and pedestrian environment, crash history, and the economic conditions within the study area. Existing conditions information was gathered through field reviews, review of traffic data, and review of other publically available information. Information on existing conditions in the study area was also gathered through input from the public, stakeholders, and the PAC.

Improvement Options

Chapter 5 includes a detailed description of the alternative improvement options.

Alternative intersection configurations were developed for the major intersections, and the operational characteristics for vehicles and bicycles/pedestrians for each option were reviewed to assess its effectiveness in meeting project goals. The conceptual intersection configurations were then modeled within Synchro to determine if the design met the minimum criteria established by the project team. Table ES- 1 describes the improvement options developed for the study.

American Disabilities Act (ADA)

Sidewalk and intersection improvements that move forward would be required to be in compliance with the current PROWAG and MUTCD requirements for the American’s with Disabilities Act (ADA) facilities. These improvements could consist of updating pedestrian ramp slopes, truncated domes, width, orientation, color, and texture. Specific ADA-compliant features would be developed in the design phase for any forwarded project.

Table ES- 1. Description of Improvement Options

Improvement Option		Description/Changes	Bike/Pedestrian Improvements	Parking Impacts[1]	Recommended Option?
ORANGE STREET	**Option 1**	▪ Front St. operates as primary street ▪ Main St. hooks into Front St. at new intersection	▪ Curb extensions to reduce crossing distances ▪ Bike box on southbound Orange St. to increase bike visibility ▪ No dedicated bike lanes; utilizes "sharrows" on Front St. and Main St. ▪ Southbound bikes on Orange St. would make left turn with vehicles	Under 10 spaces lost	NO
	Option 2	▪ Main St. operates as primary street ▪ Front St. hooks into Main St. at new intersection ▪ Consistent with *Downtown Master Plan* concept	▪ Curb extensions to reduce crossing distances ▪ Southbound bikes on Orange St. use a two-step maneuver with launch pad for left turns ▪ New bike lanes on Front St. between Orange St. and Higgins Ave.	20 to 25 spaces added	**YES**
HIGGINS AVENUE	**Option 1**	▪ Four lane configuration ▪ Western leg of Front St. includes bike lanes and parallel parking	▪ Curb extensions to reduce crossing distances ▪ New bike lanes on Front St. between Orange St. and Higgins Ave.	20 to 25 spaces lost	**YES**
	Option 2	▪ Three lane configuration ▪ Dedicated left turn lanes at intersections ▪ Center turn lane for mid-block alley access	▪ Curb extensions to reduce crossing distances ▪ Buffered bike lanes ▪ New bike lanes on Front St.	Under 10 spaces lost	NO
	Option 3	▪ Three lane configuration ▪ Similar configuration as North Higgins Ave.	▪ Curb extensions to reduce crossing distances ▪ Elevated cycle tracks behind parked cars ▪ Includes bike launch pads for 2-step left turn onto Front St.	Under 10 spaces lost	NO
MADISON STREET	**Option 1**	▪ Proposed new signal at Adams St./Broadway St. for through traffic ▪ Intersections at Front St./Main St. are right-in/right-out only, existing left-in at Main St. is eliminated	▪ New north-south crosswalks on Front St./Main St. ▪ Improved east-west crosswalk across Madison St. at Front St. ▪ Improved bike lanes on Madison St. ▪ No real bike access improvement – northbound bikes on Madison St. turning west on Front St. would use pedestrian crosswalk	Under 10 spaces lost	NO
	Option 2	▪ Proposed new fully signalized intersection at Front St./Madison St. ▪ Front St./Madison St. allow for all movements ▪ Main St./Madison St. allow for right-in/right-out only ▪ Frontage road eliminated, replaced with green buffer and right turn lane	▪ New north-south crosswalks on Front St./Main St. ▪ Improved signalized east-west crosswalk across Madison St. on north side of Front St. ▪ New signalized east-west crosswalk across Madison St. on south side of Front St. ▪ Improved bike lanes on Madison St. ▪ Bike access for northbound bikes turning left on Front St. accommodated through launch pad	Under 10 spaces lost	**YES**

Notes 1. Parking impacts do not include potential areas where on-street parking could be introduced or improved. See Chapter 5 for more information.

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Feasibility Analysis Results

Chapter 6 includes the feasibility analysis results for the preferred alternative.

Feasibility of the two-way conversion was determined primarily by the ability of the proposed design to accommodate two-way operations while not negatively affecting the existing LOS at the major intersections. The study area traffic volumes were also examined to determine the projected changes in number of vehicles on each of the study area road segments.

Traffic Results

Results of the two-way conditions LOS analysis show that nearly all study area intersections are not expected to experience a negative impact to LOS over the existing condition. Table ES- 2 provides a comparison for the PM peak period for the two-way conversion versus the current one-way condition.

Table ES- 2. 2014 Two-Way vs. One-Way PM Peak Hour Summary

Intersection	Control Type[1]	PM Peak Hour			
		Two-Way Traffic (proposed)		*One-way Traffic (existing)*	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	48.1	D	50.7	D
Orange St./Front St.	Signal	37.5	D	35.2	D
Broadway St./Higgins Ave.	Signal	19.1	B	20.1	C
Main St./Higgins Ave.	Signal	14.3	B	14.8	B
Front St./Higgins Ave.	Signal	18.9	B	20.4	C
Broadway St./Adams St.	TWSC	14.5	B	13.6	B
Main St./Adams St.	TWSC	10.8	B	10.8	B
Front St./Adams St.	OWSC	10.3	B	9.8	A
Broadway St./Madison St.	Signal	33.5	C	35.1	D
Main St./Madison St.	OWSC	12.2	B	10.2	B
Front St./Madison St.	TWSC	**>110**	**F**	**>110**	**F**
Front St./Madison St.	Signal	7.7	A	-	-
Front St./Main St.	OWSC	17.6	C	-	-
Front St./Main St.	Signal	20.3	C	-	-

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

There were only a few instances in the peak hour periods where the intersection delay increased by a few seconds over existing conditions and one intersection that went from a LOS B to LOS C during the weekend peak hour (Orange and Front streets). Similarly, there are a few instances where the proposed two-way conversion would positively affect LOS. The intersection of Front and Madison streets under existing one-way conditions (one-way stop controlled intersection) operates at a LOS F and would

continue operating at a failing level under two-way conditions without a traffic signal. By implementing a signal at this intersection, the LOS would improve to LOS A.

Changes in traffic volumes for the two-way conversion are projected to vary depending on the time of day and the street segment. Overall, the study area is projected to experience a 13% increase in the average daily traffic volumes under the proposed two-way traffic operations. It is important to note that increased traffic levels are a desirable result as it may indirectly have a positive impact on downtown businesses. Main Street, from Orange Street to Higgins Avenue, is projected to experience an increase in traffic volumes; however, the remainder of Main Street is expected to see no change or a reduction in average daily traffic volumes. Front Street, from Higgins Avenue to Madison Street, is expected to see an increase in daily traffic, whereas the segment from Orange Street to Higgins Avenue is expected to see a small reduction in traffic.

Anticipated Economic Benefits

The two-way conversion is anticipated to have a beneficial outcome to downtown businesses. The assessment is based on insights and implications from conversion projects in other jurisdictions. Over the short-term, an increase in sales of about 10% to 13% for local retail, restaurants, and other food establishments could be a reasonable estimate based on the projected increase in daily traffic and the likely increase in the number of pedestrians and bicyclists downtown due to the improved environment. In the long-term, the impact of the street conversion project may be more significant, especially when coupled with the planned redevelopment projects in areas adjacent to the study area (e.g., Fox Site, Old Sawmill, Silver Park). When completed, these projects may provide new trips and visits to the area which are necessary to stimulate growth.

Air Quality

Projected total air emissions from the two-way conversion for the year 2040 were modeled using the U.S. Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator model (MOVES 2010a). Results show a 1.2% increase in the projected amount of Carbon Monoxide (CO) emissions for the year 2040 over the one-way condition. Overall, the increase in CO levels is negligible, is well within the emissions budgeted for the Missoula area, and passes the CO conformity determination. Particulate Matter <10 Microns (PM10) projections for the 2040 two-way conversion show a 6.6% reduction in total particulates over the one-way condition. Again, the projected PM10 levels are well below the budgeted levels for the Missoula area and pass the conformity determination.

RECOMMENDED IMPROVEMENTS

Chapter 7 includes a detailed description of the recommended improvement options.

Overall, the Preferred Alternative provides a conceptual design that meets the goals of the project. The conceptual intersection configurations forwarded as the Preferred Alternative include:

- Orange Street Option 2
- Higgins Avenue Option 1
- Madison Street Option 2

Additionally, an intersection concept for Ryman and Front streets was developed to improve pedestrian and bicycle movements at this location. Many of the recommended improvements are aimed at enhancing safety for both motorized and non-motorized users. They are designed to improve access to and circulation throughout the study area for people arriving on foot, bicycle, or bus; increase visibility of

pedestrians and bicyclists for safety and comfort; reduce vehicle speeds to support a walkable downtown environment; and facilitate the movement of pedestrians by improving street crossings.

The recommendations include the following key interventions:

- Reconfigure intersections at Orange and Madison streets to accommodate two-way traffic as well as improve pedestrian and bicycle access to the study area and create opportunities for aesthetic enhancements of these gateways into downtown;
- Improve and shorten pedestrian crossings where possible to increase safety and comfort of pedestrians throughout the study area; and
- Add bike lanes on Front Street to enhance the bikeway system by creating logical connections to the Higgins Avenue Bridge and the Riverfront Trail North.

In addition to the conceptual designs developed, several general recommendations are offered to enhance pedestrian, bicycle, and transit facilities within the study area except on state maintained facilities in accordance with MDT standards.

Improved Crosswalks: The use of continental type crosswalk markings, as opposed to transverse lines, is recommended throughout the study area.

Curb Extensions: Where possible, curb extensions at intersections are strongly recommended to reduce crossing distances and increase visibility of pedestrians.

Streetscape Improvements: To provide shade and visual interest, the addition of street trees is recommended where feasible. Other recommended streetscape improvements include bike racks, bus shelters, pedestrian scale street lighting, and benches and other furnishings ideally coordinated in style and color theme to reinforce a cohesive aesthetic for downtown. In addition, some control of signage size, especially regarding A-frame signs, would be beneficial to the aesthetic appeal of the sidewalks.

Consolidated Curb Cuts: The proposed two-way circulation provides opportunities to consolidate or eliminate redundant driveway curb cuts without placing undue burden on individual properties. As redevelopment occurs, efforts should be made to consolidate driveway cuts, reduce the width of driveways, and utilize the existing alleys to a greater degree.

Improved Bike Facilities: In order to improve bicycle access to the study area and create a stronger connection between the regional bicycle system and the downtown, the introduction of “launch pads” at key intersections is recommended. Where launch pads are present, right on red movements would no longer be permitted. To facilitate regional bike connectivity between areas west of downtown and the University of Montana as well as neighborhoods south of the Clark Fork River, bike lanes along Front Street between Orange and Washington streets are recommended.

Transit Circulation: The three fixed transit routes that are currently operating within the study area could be maintained with Front and Main streets operating as two-way streets. However, some modifications could be made to enhance circulation, such as:

- Reverse direction of Route 1 to travel westbound on Front Street, northbound on Ryman Street, southbound on Pattee Street, and eastbound on Main Street.
- Move Route 12 to travel westbound on Front Street and maintain travel northbound on Ryman Street.
- Move Route 7 to travel eastbound on Main Street and maintain northbound travel on Ryman Street.

With Main Street operating as the primary route on the west end of the study area and Front Street being the primary route on the east end, Ryman or Pattee streets could be used as transition streets moving buses between Front and Main streets. Mountain Line currently operates Route 6 on Higgins Avenue so utilizing the nearby Ryman and Pattee Street would not require additional left turns at signalized intersections.

Planning-Level Cost Estimate

The improvements within the study area that would be required with the two-way conversion are shown in Table ES- 3. It should be noted that the costs presented are for planning purposes only and do not include design-level of effort. Additional information on construction costs and potential funding sources can be found in **Chapters 7 and 9**.

Table ES- 3. Study Area Improvements for Two-way Conversion

Intersection	Item	Amount	Intersection Total	Investment	
				State	Local
Orange Street & Front Street/ Main Street	Sidewalk Bulbouts	$ 12,000	$1,279,000	$ 961,000	$ 318,000
	Front St. Realignment	$700,000			
	Utilities [1]	$300,000			
	Traffic Signal	$250,000			
	Drainage Modifications	$11,000			
Ryman Street & Front Street	Sidewalk Bulbouts	$32,000	$ 43,000	-	$ 43,000
	Drainage Modifications	$11,000			
Higgins Avenue & Front Street	Sidewalk Bulbouts	$23,000	$284,000	$284,000	--
	Traffic Signal	$250,000			
	Drainage Modifications	$11,000			
	Sidewalk Bulbouts	$34,000	$295,000	$295,000	--
	Traffic Signal	$250,000			
	Drainage Modifications	$11,000			
Madison Street & Front Street	Sidewalk Bulbouts	$18,000	$1,073,500	$1,073,500	--
	Madison St. Improvements	$700,000			
	Utilities [1]	$100,000			
	Traffic Signal	$250,000			
	Drainage Modifications	$5,500			
Madison Street & Main Street	Sidewalk Bulbouts	$13,000	$18,500	$18,500	--
	Drainage Modifications	$5,500			

Intersection	Item	Amount	Intersection Total	Investment	
				State	Local
Additional Improvements Throughout Study Area					
Pavement Rehabilitation - Front Street & Main Street		$1,200,000	$1,551,000	$1,240,800	$310,200
Signing and Striping		$101,000			
Street Lighting [2]		$250,000			
TOTALS			**$4,538,000**	**$3,172,800**	**$1,365,200**

Notes: The costs shown above are approximate and do not include design-stage detail. Further examination is required.
1. Utility costs are approximate and depend on existing conditions at the time of construction. Costs are also associated with the funding source and utility owner. Further examination is required.
2. Street Lighting cost estimated at an average of $175,000 per urban mile of road.

Conclusions

The feasibility study began with establishing several criteria that required consideration in advance of making a recommendation. Those criteria included advancing safety for all forms of transportation, maintaining the current LOS at all intersections with federal aid routes, and minimizing parking and right-of-way impacts. Through the feasibility analyses of the proposed two-way conversion, the following conclusions were determined:

- The traffic analysis demonstrated that **operations and LOS will not be negatively impacted at any of the study area intersections**. Impacts to Broadway Street intersections adjacent the study area were also determined to be negligible.
- The economic analysis determined that **a short-term benefit in sales of approximately 10% to 13% for downtown retailers could be expected** from the conversion.
- The **air quality analysis** demonstrated that the conversion to two-way traffic operations would not have an appreciable effect on regional emission levels.
- The parking analysis found that **less than 10% of parking spaces would be impacted by the recommended improvements**. Options to gain parking in select locations should be examined during final design.
- The recommended improvements can be made with **minimal impact to private property**.
- The recommended improvements would **greatly enhance safety for pedestrians and bicyclists** through increased visibility at intersections and shortening crossing distances.
- The recommended improvements would **enhance the bikeway system** by creating logical connections to and throughout the downtown area.

Overall, the study shows that a two-way conversion is a feasible option for Front and Main streets in downtown Missoula. The cost estimates provide an “order of magnitude” estimate for the various components of the improvement options, which could be implemented in a phased approach depending on funding availability.

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1. INTRODUCTION

The conversion of Front and Main streets back to two-way traffic has been identified as a top priority project in the 2009 *Greater Missoula Downtown Master Plan* as well as a means to improve overall circulation, pedestrian and bicycle safety, and economic vitality in downtown Missoula. The Missoula Redevelopment Agency (MRA), in cooperation with the Montana Department of Transportation (MDT) and the City of Missoula, conducted a feasibility study to analyze alternatives for modifying the downtown traffic patterns from their current one-way pattern back to two-way operations.

The MRA has identified the downtown business district as a priority area for improvements to safety for all forms of transportation, including pedestrians and bicyclists, business climate enrichment, long-term residential livability, and general aesthetic enhancements. This feasibility study will focus on determining if these goals can be met by converting the current one-way couplet to a pair of two-way streets, while having an acceptable impact on current traffic flows. The study will forecast the operational, economic, and aesthetic impacts that might result from such a conversion to provide a sound decision-making basis.

The Front Street/Main Street Two-Way Conversion Feasibility Study will:

- Document existing conditions regarding traffic operations, pedestrian and bicycle facilities, transit, parking, and safety;
- Summarize the operational analysis and anticipated levels of service (LOS) resulting from the two-way conversion as well as assess the effect on local economy, residential areas, motorized and non-motorized traffic flow, streetscape aesthetics, safety, parking, public transit, and air quality; and
- Provide recommendations and planning level cost estimates for recommended improvements as well as potential funding sources for these modifications.

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2. PROJECT BACKGROUND

History of One-way Conversion

Front and Main streets were converted to one-way traffic in the 1950s to reduce traffic congestion in the downtown area and efficiently process vehicular traffic in and out of downtown during peak hours. Concerns of the Cold War era made it desirable to move people out of town quickly in the event of a military incident. The one-way street system lent itself to solving traffic congestion and efficiently processing peak hour traffic because it allowed for signal synchronization and reduced travel times. Air pollutants were coming into the spotlight at this time as well, and it was felt that one-way streets with fewer stops aided in the reduction of vehicular emissions.

The popularity of the one-way street system has changed as downtown areas around the country have slowly become more important as residential, economic, and cultural centers of the community. The desire for revitalization, as well as the need to balance traffic movement with other objectives such as business retention, pedestrian convenience, and a visitor friendly transportation system, is leading many urban areas back toward two-way configurations. The need for ease of access for all forms of travel, reduced traffic speeds, and increased business visibility is driving the reversal in hundreds of cities across the United States.

One-way to Two-way Conversion in Missoula

The conversion of Front and Main streets to two-way traffic was identified as part of a larger system of catalyst projects within the 2009 *Downtown Master Plan*. The current and future circulation needs of downtown Missoula were presented in the *Downtown Master Plan* and included changes that would directly impact both Front and Main streets. From pedestrian and bicycle traffic to the future addition of a street car route, the vision for downtown Missoula is centered around the concept of this one-way to two-way street conversion.

Study Area

The study area includes the existing Front Street/Main Street one-way couplet between Orange and Madison streets in downtown Missoula (Figure 1). The study area includes the main intersections of Orange and Front/Main streets on the west side, both the Front and Main streets intersections with North Higgins Avenue, and the Madison Street/Front Street intersection on the eastern boundary, including a portion of Madison Street in between the Madison Street Bridge and West Broadway Street. See Appendix A for additional figures depicting existing conditions in the study area.

Two-way operations exist west of the study area at the Orange Street intersection. East of this intersection, Main Street operates as a westbound, one-way street until it tees into Madison Street at the east end of the project area. Front Street operates as an eastbound, one-way street between Orange and Madison streets except for one city block between Ryman Street and North Higgins Avenue. Front Street operates as a two-way street for this short stretch, which provides access to Caras Park on Ryman Street. At the intersection of Front and Madison streets, eastbound traffic on Front Street must either turn left to continue on the Madison Street frontage road to access Main Street or vehicles must turn right and merge onto southbound Madison Street. Traffic on Front Street cannot continue eastbound on Front Street through Madison Street. In the current intersection configuration, both northbound and southbound vehicles on Madison Street can access Main Street for westbound travel towards downtown Missoula. The north-south streets within the study area operate as two-way facilities except Washington Street. Between Front and Main streets, Washington Street is one-way for northbound traffic, allowing additional on-street parking near the Missoula Public Library.

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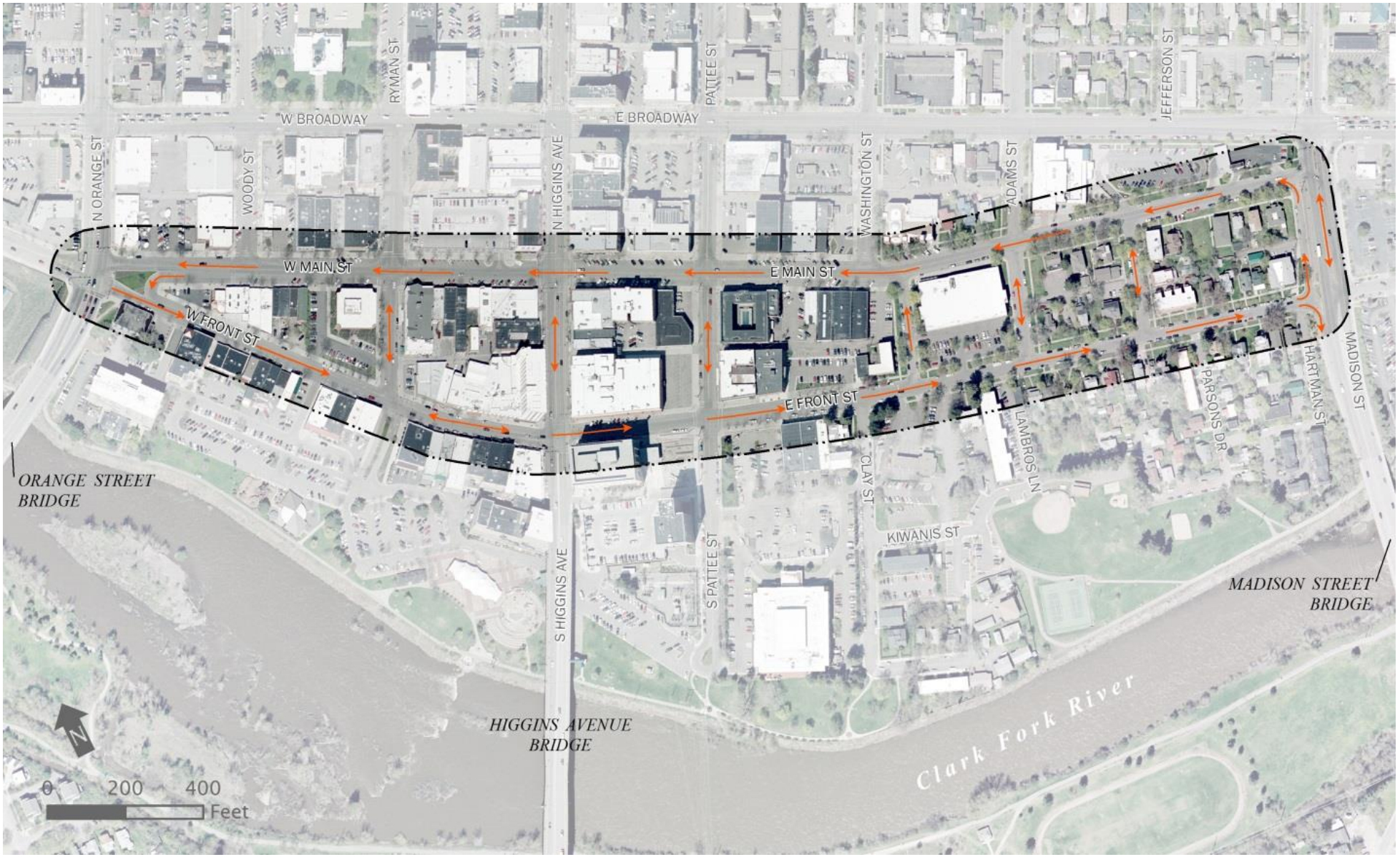

Figure 1. Study Area

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3. METHODOLOGY

The following section describes the methods used to determine the traffic conditions within the study area and assumptions used for the feasibility analysis. This report presents the results of the transportation impact analysis conducted for the proposed two-way operations of Front and Main streets in downtown Missoula. An operations and queue analysis of key intersections within the study area was conducted for the intersections listed in the following section.

Traffic Model

The traffic simulation software, Synchro, was used to model the two-way conversion with current traffic volumes. A system-wide model for downtown Missoula was initially provided to HDR by MDT and was used as the base network. Modifications to the model were made to reflect the two-way traffic conversion and conceptual intersection treatments being proposed. Refer to Appendix B for more information on the traffic analysis methodology.

The traffic analysis included operational analyses at intersections both within and immediately adjacent to the study area. While the focus of the study is centered on the major intersections within the study area, the traffic model required examining a broader area that includes several intersections located outside the study area. The following list includes the intersections examined in the traffic model and their associated traffic control:

- Orange Street and Broadway Street – Signalized
- Orange Street and Front Street – Signalized
- Main Street and Front Street (future intersection) – Signalized or one-way stop controlled
- Broadway Street and Higgins Avenue – Signalized
- Main Street and Higgins Avenue – Signalized
- Front Street and Higgins Avenue – Signalized
- Broadway Street and Adams Street – Two-way stop controlled
- Main Street and Adams Street – Two-way stop controlled
- Front Street and Adams Street – One-way stop controlled
- Broadway Street and Madison Street (US 12) – Signalized
- Main Street and Madison Street (US 12) – One-way stop controlled
- Front Street and Madison Street (US 12) – Signalized or two-way stop controlled

Build Alternative Evaluation Criteria

Several criteria have been established to evaluate and screen build alternatives. Criteria were developed through coordination and input received from the public, stakeholders, and the project advisory committee (PAC). Criteria include:

- **Enhanced safety for both motorized and non-motorized users**: The proposed design should provide measures for increased safety between pedestrian, cyclists, and motorized traffic through reduced speeds, increased visibility, and improved pedestrian crossings.
- **Traffic flows and Level of Service**: The proposed design should, at a minimum, not have an adverse effect on current operations or result in a decrease in LOS over the existing condition.
- **Parking availability**: The proposed design should minimize impacts to available on-street parking spaces.
- **Right-of-way requirements**: The proposed design should minimize the need for acquisition of right-of-way. The proposed design should involve intersection and/or roadway reconfigurations within the existing rights-of-way to the greatest extent practicable.

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4. EXISTING CONDITIONS ANALYSIS

The following sections provide a summary of the existing conditions for the roadway and transit system, bicycle and pedestrian environment, and the economic conditions within the study area. Existing conditions information was gathered through field investigations, review of traffic data, and review of other publically available information. Information on existing conditions in the study area was also gathered through input from the public, stakeholders, and the PAC.

Existing Roadway Network

The study area includes the commercial areas and residential neighborhoods along Front and Main streets between Orange and Madison streets. These streets are described below.

Main Street

Main Street runs east-west and is the existing westbound, one-way street of the downtown couplet. The roadway is classified as a local road and has a speed limit of 25 miles per hour (mph). The typical section is two lanes with angled parking on both sides between Orange and Washington streets. There is parallel parking on both sides between Washington and Madison streets. The existing curb-to-curb distance on Main Street at its intersection with Orange Street is approximately 38 feet. The street widens to a 66-foot width at its intersection with Woody Street. Main Street maintains this width until reaching Washington Street, where it decreases to approximately 50 feet from curb-to-curb. The existing right-of-way along Main Street within the study area is approximately 97 feet.

Front Street

Front Street runs east-west and is the existing eastbound, one-way street of the downtown couplet. The roadway is classified as a major collector and has a speed limit of 25 mph. The typical section is primarily two lanes with parallel parking on both sides. There is a third eastbound lane between Orange and Ryman streets that turns into a left-only lane at the intersection with Ryman Street. Between Ryman Street and Higgins Avenue, there are two eastbound lanes and one westbound lane along with parallel parking. Between Higgins Avenue and Pattee Street, there is angled parking on the north side of Front Street. The existing curb-to-curb width on Front Street between Orange and Pattee streets is approximately 52 feet. The width decreases within the residential area between Pattee and Madison streets to approximately 38 feet.

Orange Street

Orange Street runs north-south and is the designated US-93 business route. The roadway is classified as a principal arterial and has a speed limit of 30 mph. The typical section is two lanes in both directions, bike lanes, and left turn pockets at Front and Broadway streets. There is no parking on either side within the study area. The Orange Street Bridge, which is located south of the project area, provides one of the three main river crossings within downtown Missoula. The north-south traffic signal movements are coordinated along Orange Street.

North Higgins Avenue

Higgins Avenue runs north-south, is classified as a minor arterial, and has a speed limit of 25 mph. The typical section is two lanes in each direction. There are no dedicated left turn pockets within the study area. Parallel parking is present on both sides of the roadway. There are protected bike lanes on Higgins Avenue north of the study area, between Alder and Broadway streets. Standard bike lanes continue south of Broadway Street between the on-street parallel parking and the through lane. Signals are located at both the Front Street and Main Street intersections with Higgins Avenue. Stairs on both sides of the

Higgins Avenue Bridge, located just one block south of the intersection with Front Street, provide pedestrian access to Caras Park and the Riverfront Trail located on the north side of the Clark Fork River.

Madison Street

Madison Street runs north-south and is designated US-12. The roadway is classified as a principal arterial and has a speed limit of 30 mph. The typical section is two lanes in both directions with left turn lanes at Broadway and Front streets. There is no parking on either side within the study area. Madison Street provides access to the University of Montana, located just south of project area. The existing Madison Street Bridge includes a pedestrian and bicycle undercrossing that provides additional pedestrian and bicycle access to downtown and the surrounding areas. The northbound, left turn pocket just south of Broadway Street allows for lefts to both Broadway and Main streets. In the northbound direction, the outside lane becomes a right turn only lane north of Front Street.

Existing Major Intersections

The study area includes the following six major intersections that were examined in detail:

1. Orange Street and Front Street/Main Street
2. Higgins Avenue and Main Street
3. Higgins Avenue and Front Street
4. Madison Street and Main Street
5. Madison Street and Front Street
6. Front Street and Ryman Street

These six intersections represent the major design challenges when considering a two-way traffic conversion due to existing traffic volumes, configuration, and traffic control type. More information regarding the existing roadway and traffic conditions for these intersections is provided in the following sections.

Orange Street & Front Street/Main Street

The Orange Street intersection with Front and Main streets consists of a five-legged intersection that functions as the western gateway into the study area (Figure 2). It is a fully signalized intersection. Main Street merges into Front Street on the west side of the intersection, making Front Street a two-way street. There is a turnaround for westbound traffic located on Main Street to access eastbound Front Street, creating a landscaped triangle dividing Front and Main streets on the east approach. The existing condition does not include bike lanes on Front or Main streets. The private property located between Front and Main streets, east of the intersection with Orange Street, includes 10 private parking spaces. The signalized intersection of Orange and Broadway streets is located one block north, which requires signal coordination between the intersections to help move traffic through the area. The intersection has left turn pockets on the northbound, southbound, and eastbound approaches. All of the left turn movements are permissive except for the westbound approach, which has a protected/permissive movement. There are crosswalks on each approach.

Figure 2. Orange Street Intersection – Existing Condition

Higgins Avenue - Main Street & Front Street Intersections

Higgins Avenue is the major north-south route that crosses the Clark Fork River between Orange and Madison streets (Figure 3). There are two lanes in the northbound and southbound directions. There are no dedicated left turn pockets along Higgins Avenue at Main and Front streets. There is a raised median located south of Front Street. There is parallel parking and a bike lane on each of the northbound and southbound directions. The north-south traffic signal movements are coordinated along Higgins Avenue. There are crosswalks on each intersection approach. The west approach of Front Street is made up of two lanes: one shared through/left lane and one right turn lane. There is parallel parking on both sides of the street. The east approach of Front Street has two receiving lanes, parallel parking on the south side, and angled parking on the north side. The east approach of Main Street is made up of two lanes: one shared through/left lane and one shared through/right lane. The west approach of Main Street has two receiving lanes. Each of the east and west approaches has angled parking on both sides of the street.

Figure 3. Higgins Avenue - Existing Conditions

Ryman Street / Front Street Intersection

The Ryman Street intersection with Front Street is a four-legged intersection controlled with stop signs on three of four approaches (Figure 4). The eastbound movement along Front Street is uncontrolled, and vehicles only stop when there are pedestrians using the crosswalk. The other three approaches have crosswalks as well. There is parallel parking along the east and west approach of Front Street and the north approach of Ryman Street. The south approach of the intersection provides access to the nearby Caras Park and public parking.

Figure 4. Front and Ryman Streets (Entrance to Caras Park) – Existing Conditions

Madison Street - Main Street & Front Street Intersections

Madison Street/US 12 is the eastern terminus of the study area (Figure 5). The four lane route crosses the Clark Fork River just south of Front Street. A raised median restricts turning movements from Front Street onto Madison Street. Eastbound traffic is restricted to a right turn only onto Madison Street. A median break allows southbound traffic on Madison Street to turn left onto the Front Street, where it operates as a two-way street. Southbound traffic on Madison Street can exit to the right and enter westbound Main Street. The intersection of Madison and East Broadway streets is currently signalized. The east and west approaches are split phased. The northbound left movement is permissive only and the northbound right has an overlap phase that runs concurrently with the westbound phase. There are crosswalks on each approach.

Figure 5. Madison Street - Existing Conditions

Existing Traffic Volumes and Level of Service (LOS)

Traffic data for the study area was obtained from field observations as well as published data available from MDT and the Missoula Urban Traffic count program. Turning movement volumes for the signalized intersections were provided by MDT within their Synchro traffic model for 2010 and included AM, midday (NN), PM, and weekend peak (WE) hour volumes. Turning movement counts were collected in the field between April 17 and April 26, 2014 for the unsignalized intersections. An adjustment factor would typically need to be applied to the traffic model to adjust 2010 volumes to current levels; however, the 5-year traffic growth rate between 2009 and 2012 within the study area was negative, and no growth was assumed within the study area. Therefore, the 2010 volume provided at signalized intersections remained the same within the existing 2014 analysis. The 5-year average daily traffic (ADT) and percent change is provided in Table 1.

Table 1. 5-Year Traffic Counts and Growth within the Study Area, 2009-2013

Station ID	Description	2009	2010	2011	2012	2013	5-Year Growth
32-3A-211	Main St. between Ryman & Woody St.	4,730	5,000	4,980	4,940	4,050	-14.4%
32-3A-212	Ryman St. between Main & Front St.	2,860	3,030	3,020	2,990	2,830	-1.0%
32-3A-213	Front St. between Ryman St. & Higgins Ave.	5,250	5,560	5,540	5,490	5,480	4.4%
32-3A-214	Higgins Ave between Main & Front St.	13,680	12,390	12,650	12,460	12,390	-9.4%
32-3A-215	Front St. between Pattee & Washington St.	3,210	3,400	3,390	3,740	3,020	-5.9%
32-3A-216	Main St. between Pattee & Washington St.	4,490	4,750	4,730	4,690	3,160	-29.6%
32-3A-217	Front St. between Jefferson & Madison St.	1,390	1,470	1,530	1,170	1,280	-7.9%

Source: MDT, 2015; HDR, 2015

An LOS analysis was performed at the study intersections for each of the four peak hours. LOS refers to the degree of congestion on a roadway or at an intersection, measured in average delay, and based on the methodologies provided in the Highway Capacity Manual. LOS A represents free-flow conditions (i.e., motorists experience little or no delay and traffic levels are well below roadway capacity), LOS F represents forced-flow conditions (i.e., motorists experience very long delays and traffic levels exceed roadway capacity), and LOS B to E represent decreasing desirable conditions.

For both signalized and unsignalized intersections within the study area, Synchro was used to determine LOS. The LOS reported for unsignalized intersections is the worst case among all of the calculated movements (usually one of the stop-controlled approaches). The LOS at unsignalized intersections applies only to the capacity of the worst movement, and is not a valid indicator of overall traffic operations at an intersection.

Results of the existing conditions LOS analysis are summarized in Table 2 and Table 3.

Table 2. Existing AM and Midday Peak Hour Summary

Intersection	Control Type[1]	Existing Conditions			
		AM Peak Hour		NN Peak Hour	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	29.4	C	33.9	C
Orange St./Front St.	Signal	16.4	B	22.0	C
Broadway St./Higgins Ave.	Signal	10.8	B	14.2	B
Main St./Higgins Ave.	Signal	10.0	B	12.9	B
Front St./Higgins Ave.	Signal	15.1	B	16.9	B
Broadway St./Adams St.	TWSC	10.9	B	10.6	B
Main St./Adams St.	TWSC	10.1	B	10.5	B
Front St./Adams St.	OWSC	8.8	A	9.7	A
Broadway St./Madison St.	Signal	28.7	C	28.9	C
Main St./Madison St.	OWSC	9.5	A	9.5	A
Front St./Madison St.	TWSC	**41.9**	**E**	**90.1**	**F**

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

Table 3. Existing PM and Weekend Peak Hour Summary

Intersection	Control Type[1]	Existing Conditions			
		PM Peak Hour		WE Peak Hour	
		Control Delay/ Veh[2]	LOS[3]	Control Delay/ Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	50.7	D	30.4	C
Orange St./Front St.	Signal	35.2	D	14.9	B
Broadway St./Higgins Ave.	Signal	20.1	C	20.9	C
Main St./Higgins Ave.	Signal	14.8	B	18.1	B
Front St./Higgins Ave.	Signal	20.4	C	25.4	C
Broadway St./Adams St.	TWSC	13.6	B	17.4	C
Main St./Adams St.	TWSC	10.8	B	10.3	B

Intersection	Control Type[1]	Existing Conditions			
		PM Peak Hour		WE Peak Hour	
		Control Delay/ Veh[2]	LOS[3]	Control Delay/ Veh[2]	LOS[3]
Front St./Adams St.	OWSC	9.8	A	9.3	A
Broadway St./Madison St.	Signal	35.1	D	30.7	C
Main St./Madison St.	OWSC	10.2	B	9.3	A
Front St./Madison St.	TWSC	**>110**	**F**	**67.1**	**F**

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

Existing Conditions for Pedestrian and Bicyclists

The study area presents several challenges related to pedestrian access and circulation, gaps between bicycle amenities, and safety issues due to long crossing distances and a lack of adequate crosswalks or signals. The following sections describe the existing conditions for pedestrian, bicyclist, and transit riders within the study area. Existing conditions for non-motorized and transit users were inventoried through field observations and review of existing documentation and maps. More information can be found in Appendices A and C.

Main Street at Orange Street Looking East

Pedestrian Access to the Study Area

Front Street west of Orange Street ties into the Riverfront Triangle, slated for redevelopment with high-density residential and employment uses. While the intersection is signalized, it is perceived as uninviting and risky to cross due to the traffic volumes and speeds on Orange Street, the lack of pedestrian refuges, permitted right turns on red, and long crossing distances across five lanes of traffic. Furthermore, the curb-adjacent sidewalks lack any amenities that generally provide pedestrian comfort, such as boulevards that buffer pedestrians from moving vehicles, or street trees that provide shade and shelter.

Pedestrians Crossing Front Street at Higgins Avenue

Higgins Avenue bisects the study area and provides access from the north and south. All intersections with Higgins Avenue—Front, Main, and Broadway streets—are signalized, ensuring generally good east-west connectivity. The street width of approximately 70 feet, however, results in a relatively long walk time across the intersection.

Two intersections at Madison Street constitute the eastern gateways into the study area. A crosswalk on the north side of Front Street provides a notional east-west pedestrian connection across Madison Street;

however, the absence of a signal in combination with high traffic volumes and speeds make the crossing of Madison Street a daunting undertaking. The crossing distance is substantial and includes the five lane arterial section of Madison Street as well as the northbound frontage road along its western edge, resulting in an overall crossing distance of approximately 120 feet.

The intersection of Main and Madison streets is closely tied to the intersection of Broadway and Madison streets, less than 100 feet to the north. The Broadway Street/Madison Street intersection is signalized and provides east-west and north-south pedestrian connections to and from the study area. However, the east end of Main Street is challenging for pedestrians due to cars entering from three directions without traffic controls.

Table 4 provides approximate street widths and walk times for the major intersections located within the study area.

Table 4. Intersection Crossing Distances and Walk Times

Intersection	Crossing Direction	Crossing Distance (feet)	Approximate Walk Time (seconds)
Orange Street	East-West	85	21
Higgins Avenue	East-West	70	18
Madison Street (including frontage lane)	East-West	120	30
Front Street (West of Washington St.)	North-South	50	13
Front Street (East of Washington St.)	North-South	38	10
Main Street (West of Washington St.)	North-South	66	17
Main Street (East of Washington St.)	North-South	50	13

Source: HDR, 2014

Pedestrian Circulation throughout the Study Area

Clay and Washington streets subdivide the study area into two fairly distinct subareas. Generally, everything west of Washington Street is commercial in character, whereas the area east of Washington Street is predominantly residential, with the Missoula Public Library as a linchpin connecting the two, and the Children's Theatre as a buffer to the busy Broadway Street. Accordingly, there is a range of sidewalk widths in the study area. East of Washington Street, sidewalks generally are around 5 feet and typically separated from the roadway by landscaped boulevards, some quite substantial in width. West of Washington Street, sidewalks are generally curb-adjacent and range in width from around 10 to 12 feet along much of Front Street, to about 15 feet and greater along much of Main Street. Roadway widths and crossing distances for pedestrians also differ on Front and Main streets throughout the study area (see Table 4).

Typical Sidewalk East of Washington Street

Other than the signals at the Higgins Avenue intersections, none of the crosswalks within the study area are signalized. The crosswalks west of Washington Street are generally marked, while crosswalks to the east are not. In addition to the crossings at intersections, there is one marked mid-block crosswalk near the west end of Front Street that includes retrofitted floating curb extensions to reduce the crossing distance and increase pedestrian visibility.

Mid-Block Crosswalk with Floating Curb Extensions

Crosswalks in the study area are generally perpendicular to the roadway, with two notable exceptions. Washington Street is misaligned at its intersection with Main Street, and the roadway width of Main Street changes at Washington Street, causing the crosswalks to be angled to connect the sidewalks. Similarly, the crosswalks at the intersection of Ryman and Front streets, which includes the busy driveway access to the Caras Park parking lot, are acutely angled. As a result, southbound pedestrians crossing Front Street cannot easily see oncoming eastbound traffic on Front Street. In addition, visibility at the driveway is impacted by large shrubs and is of some concern for pedestrian safety.

Other than some of the above mentioned crosswalk issues, the major safety concern for pedestrians is the frequency of driveway curb cuts, particularly west of Ryman Street, but also around the Main Street/Pattee Street intersection and along the Main Street frontage of the Missoula Children's Theater. There are several instances of adjacent driveways within close proximity and others of substantial width. In addition, a few parking lots directly abut the sidewalk without any landscape buffer. While there are several driveway cuts along the south side of Front Street east of Washington Street, these tend to be low volume residential driveways with a lesser conflict potential.

Bicycle Access to the Study Area

Striped bike lanes on three major north-south routes in the downtown area provide access to the study area: Orange Street, Higgins Avenue, and Madison Street. The bicycle lanes are basic 5-foot striped lanes without any protective buffers. There are no provisions to facilitate left turn movements from southbound Orange Street or northbound Madison Street into the study area, so bicyclists either have to merge into travel lanes or utilize pedestrian crossings to enter the study area.

Main Street at Higgins Avenue

The Madison Street under-bridge allows for easy bicycle access to the downtown area from the University of Montana campus and the larger bicycle network south of the Clark Fork River via the Riverfront Trail North. The trail enables bicycle access to the study area at numerous points, including Ryman Street, Pattee Street, Clay Street, Parsons Drive, and Kiwanis Park; however, all of these access points are rather incidental and none provide a direct route or a clear gateway.

Striped bike lanes on Broadway Street west of Orange Street provide bicycle access from the west and tie into the larger trail system via the Shady Grove Trail and the California Street Bridge, which provides a connection to the Riverfront Trail South. The *Downtown Master Plan* proposes a protected bi-directional bikeway along the south side of Broadway Street east of Orange Street, which would significantly improve east-west connectivity and access to the study area from the north.

Bicycle Circulation throughout the Study Area

There are no dedicated bicycle facilities in the study area besides the striped bike lanes on Orange Street, Higgins Avenue, and Madison Street. Bicyclists ride in the travel lanes, and there are painted "sharrow" markings along Main Street indicating the shared nature of the facility. Almost all destinations within the study area are within a couple of blocks of a north-south bike facility on an arterial street, or within a couple of blocks of the Riverfront Trail North. However, the actual riding distance may be greater due to the one-way street system. Anecdotal observations and stakeholder feedback also suggest that bicyclists utilize sidewalks to ride against the flow of traffic, particularly on Front Street.

"Sharrows" on Main Street indicate shared travel lanes

Bicycle parking in the study area is limited to several inverted U type racks located on sidewalks west of Washington Street. In addition, there are two larger bike parking areas associated with the Missoula Public Library and the Missoula Children's Theatre.

Existing Transit Services

Mountain Line provides public transit service in the greater Missoula area. The study area is served by a number of fix-route bus lines (refer to the Bus Route and Bus Stop Locations Map in Appendix A). Three bus routes operate on portions of the Front Street/Main Street couplet (Routes 1, 7 and 12), another route bisects the study area on Higgins Avenue (Route 6). All four routes terminate at the transfer center a couple of blocks north of the study area on Pine Street, between Woody and Ryman streets, and provide connections to destinations south of the Clark Fork River, including the University of Montana, the county fairgrounds, and Southgate Mall.

Mountain Line Route 1, shown at a bus stop on Main Street

An additional five routes operate on portions of Broadway Street along the northern study area boundary and provide connections to destinations to the north, west, and east, including the Missoula International Airport (Route 11).

While the area is well served by a variety of bus routes providing connections to much of the city, service frequency is limited during off-peak hours and on Saturdays. There is no bus service on Sundays and major holidays. Route 1 (named the Bolt!) provides the most frequent service within the study area with peak headways of 15 minutes, whereas Routes 7 and 12 have peak headways of 30 minutes. In between peak service, frequency typically drops to 60 minute headways.

There are ten bus stop locations within the study area, and another five just beyond the boundary on Broadway Street and Higgins Avenue. Most of the bus stops in and around the study area consist of simple signs. Only a few bus stops have benches, and there are no shelters, ticket vending machines, light fixtures, trash receptacles, route maps, or any other amenities at these transit stops.

Effective January 5, 2015, the Mountain Line began a three year "zero fare" demonstration project in an effort to increase ridership by 45% to a target ridership of 400,000. During this time, Mountain Line's fixed route and door-to-door services operate at zero-fare.

Existing Parking Operations

Parking within the study area is a precious commodity and is typically in high demand. The need to improve or maintain public parking within the project area was a common topic during public outreach and meetings with the PAC. There are currently two public parking structures within the study area. Central Park Garage is located on the north side of Main Street between Ryman Street and Higgins Avenue. This structure offers both paid public parking and lease parking during the day and is open to the public, free of charge, on the evenings, weekends, and holidays. The second parking structure, the Park Place Structure, is located on the southeast corner of Front and Pattee streets. Park Place also offers paid public parking and leased spaces during business hours, with free parking available in the evenings, weekends, and holidays. In addition to these two structures, there is additional parking located on the southeast corner of Higgins Avenue and Front Street (Bank Street Garage), south of Front Street at Caras Park, and off of Front Street behind the Missoula Public Library. Metered on-street parking can also be found on the west side of the study area, within the commercial development area. The residential area, located east of Washington Street, also offers free on-street parallel parking. All together, the study area offers over 350 on-street parking spaces. A number of private businesses also have private parking throughout the area for customer use.

Study Area Crash History

Downtown Missoula experiences a high number of accidents involving vehicle-vehicle incidents and, to a larger degree, accidents involving bicyclists and pedestrians. Crash analyses reported in the 2012 Missoula Long Range Transportation Plan (LRTP) show that the study area intersections of Front Street/Higgins Avenue and Main Street/Higgins Avenue are among the top 25 intersection crash locations (ranked 18 and 23, respectively) by total cost (2007-2009 data). The Front Street/Higgins Avenue and Main Street/Higgins Avenue intersections experience some of the highest rates of crashes involving pedestrians within the City of Missoula. It is pointed out in the LRTP that this statistic doesn't necessarily make downtown Missoula more dangerous to pedestrians as compared to other parts of town, but is indicative of the nature of Higgins Avenue as the street with greatest number of pedestrians in Missoula.

Crash data were obtained from the MDT Traffic and Safety Bureau for the study area. HDR reviewed crash data over a 5-year period—from January 1, 2009 to December 31, 2013—for the following locations in the study area:

- On Broadway Street from Russell Street to Van Buren Street
- On Higgins Avenue from 3rd Street south to Spruce Street
- On Madison Avenue from Front Street to Spruce Street
- On Orange Street from 3rd Street to Spruce Street

None of the study intersections had more than 50 crashes during the time frame. There were no fatalities within the study area during the study period. The crashes at the Front Street/Higgins Avenue and Main Street/Higgins Avenue intersections were reviewed in more detail. There were no visible crash patterns at these two intersections. There were several bicycle crashes at the intersection of Higgins Avenue and Front Street, but they were due to disregarding the traffic signs and sun glare. In addition, there were no visible collisions involving wrong-way drivers.

Existing Economic Conditions

This section provides an overview of existing economic conditions, plans, and forecasts relevant for and affecting the study area. This includes the discussions of specific situations and plans in the study area. Refer to Appendix C for more information.

Downtown Business Inventory

Table 5 below shows the downtown business statistics by broad sector of activity in terms of the number of establishments, square footage (SF) of their premises, annual sales, and employment. Table 5 shows that over half of all establishments present in downtown are various consumer service businesses that include professional services, personal services, hotels, medical offices, etc. They also occupied nearly half of all SF. Retail and food and beverage establishments accounted jointly for over one quarter of all establishments and over 16% of SF. Government and non-profit organizations accounted for about 10% of all establishments but occupied over 25% of the space. Downtown vacancy is estimated at 70 establishments with over 300,000 SF, accounting for about 9% of all establishments and nearly 13% of total space. Employment in downtown amounts to about 4,200 jobs. In general, average employment per establishment is rather small with less than 10 employees.

Table 5. Downtown Business Statistics by Sector

Sector	Total Square Footage (SF)	Number of Est.	Average SF/Est.	Annual Sales/ Revenues	Number of Emp.	Sales per Est.	Emp. per Est.	Percentage of Total			
								Square Footage	Number of Est.	Sales	Emp.
Consumer Services	1,177,107	412	2,857	$301,543,933	2,631	$731,903	6.4	49.2%	53.8%	46.4%	62.1%
Retail	270,541	133	2,034	$31,278,766	235	$235,179	1.8	11.3%	17.4%	4.8%	5.5%
Food and Beverage	120,162	72	1,669	$50,383,870	268	$699,776	3.7	5.0%	9.4%	7.7%	6.3%
Government	325,854	30	10,862	$182,215,416	787	$6,073,847	26.2	13.6%	3.9%	28.0%	18.6%
Non-Profit	194,386	49	3,967	$85,093,623	316	$1,736,605	6.4	8.1%	6.4%	13.1%	7.5%
Vacant	306,271	70	4,375	-	-	-	-	12.8%	9.1%	-	-
Total	**2,394,321**	**766**		**$650,515,608**	**4,237**						

Source: “Missoula Downtown Building and Business Inventory”, Missoula Downtown Association, May 25, 2012.

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Study Area Business Inventory

An inventory of businesses within the study area was conducted through a windshield survey with assistance from Google Street View (accessed February 2014). It should be acknowledged that this source may not be exhaustive and fully accurate. In particular, it may not capture all tenants in larger structures such as office buildings with rental office space, or shops that have just recently closed down or moved. However, it should provide a good sense of the overall conditions and the type of businesses on the ground level fronting the streets within the study area.

Each business was classified into the following sectors:

- **Retail:** various types of retail trade businesses, including clothing, shoes, specialty stores, second hand stores, pawn stores, etc.
- **Restaurant/Bar:** various types of eating places, including restaurants, bars, bistros, and coffee shops.
- **Financial:** establishments offering financial services in the area of banking, financial planning and management, insurance, etc.
- **Professional Services:** establishments offering various types of professional services and consulting in areas such as engineering, law, and architecture.
- **Other:** all other establishments, including private and public/government organizations such as personal care services, repair services, educational services, not-for-profit organizations, etc.

The literature on conversion of one-way streets to two-ways points out that one-way street networks may be confusing to visitors or infrequent users who, because of the one way of traffic direction, have some difficulty in navigating through the area. As a result, they may not be able to notice some establishments that could be of interest to them. In addition, on a one-way street, ground businesses are exposed only to traffic travelling in one direction, and even that exposure may be reduced due to higher speeds on one-way streets. Available literature also suggests that businesses that are most likely to benefit the two-way traffic conversions are businesses that depend to a large extent on pass-by traffic or spontaneous and casual customer visits. The businesses deemed to depend substantially on spontaneous visits include retail stores, personal care, bars, and restaurants, particularly if they are relatively small and/or not widely known in the community. Based on this information, each business was marked as to whether or not it depends substantially on casual customer visits.

This exercise was performed for Front and Main streets as well as Higgins Avenue (the section between Front and Spruce streets) for a comparison. Table 6 shows the results for the number of businesses by category as well as the number and percentage of businesses deemed dependent on spontaneous visits.

Table 6. Inventory of Businesses in the Study Area

Sector	Number of Establishments	Share
FRONT STREET AND MAIN STREET		
Retail	8	13.1%
Restaurant/Bar	14	23.0%
Financial	6	9.8%
Professional Services	6	9.8%
Other	27	44.3%
TOTAL FRONT & MAIN STREETS	**61**	
Businesses Dependent on Spontaneous Trips	24	39.3%
HIGGINS AVENUE (FRONT TO SPRUCE STREETS)		
Retail	19	43.2%
Restaurant/Bar	12	27.3%
Financial	3	6.8%
Professional Services	1	2.3%
Other	9	20.5%
TOTAL HIGGINS AVENUE	**44**	
Businesses Dependent on Spontaneous Trips	32	72.7%

Source: HDR, 2014 based on examination of Google maps (February 2014)

Based on the inventory, 44% fell into the category of “Other.” Some of the organizations included in this category were Missoula Library, Days Inn Hotel, Missoula Parking Commission, Missoula Downtown Association, a fitness club, and a dance studio. On the other hand, there were just eight retail stores and 14 restaurants or bars, accounting for 13% and 23% of all businesses, respectively. In total, businesses deemed dependent on spontaneous trips accounted for 39% of the total.

For comparison, 44 businesses were identified on Higgins Avenue in its downtown core section (between Front and Spruce streets). Nineteen of these businesses were retail stores and 12 were restaurants (43% and 27% of the total, respectively). In total, businesses deemed dependent on spontaneous trips accounted for nearly 73% of the total.

This analysis suggests that the number of businesses that are likely to experience significant and quick benefits from the conversion to two-way traffic is relatively small, smaller than on other streets in this retail hotspot of the downtown area but higher than the entire downtown on average (based on data on downtown businesses shown in Table 6).

However, it should be noted that the business structure that we currently observe is likely a result of adjustments to the overall existing conditions, including traffic circulation. Over time, as the traffic pattern changes, the business structure may change, with more businesses dependent on pass-by traffic locating along Front and Main streets. At a minimum, new specialty retail stores and restaurants could open in vacant spaces. This will contribute to the increase in overall business and vitality of Missoula’s downtown.

Development Plans and Proposals Affecting the Study Area

Conversion of Front and Main streets from one-way to two-way operations was envisioned as one element of the 2009 *Downtown Master Plan,* a strategy for strengthening and expanding downtown's role in the community. The *Downtown Master Plan* outlined the vision for the downtown area in terms of the functions and activities that should be supported and strived for to achieve the desired mix of uses and level of activities. The *Downtown Master Plan* also outlined the traffic circulation framework as well as more specific development and redevelopment projects that would best support its vision.

The *Downtown Master Plan* forecasted significant growth in the downtown area over 25 years, specifically the following additional development in terms of SF occupied:

- Retail: 220,000 SF;
- Office: 677,000 SF;
- Commercial: 376,000 SF;
- Government: 82,000 SF;
- Arts and Entertainment: 178,000 SF;
- Parks and Open Spaces: 1,232,000 SF;
- Public Parking: 1,915 Spaces;
- Private Parking: 5,490 Spaces;
- Residential: 2,840 Units; and
- Hotel: 280 Rooms.

Some of these projects were forecasted specifically for Front and Main streets, which in the plan are in the center of the downtown commercial core referred to as the "Retail Hotspot." These projects—seen as catalysts of development—included the following:[1]

- **Front Street Parking Structure:** A new parking structure adjacent to (now former) Macy's building and First Interstate Bank.
- **139 East Main Street Mixed-Use Project:** New and renovated retail/ restaurant, hotel, and condominiums complex.
- **Orange and Main Retail Anchor:** New retail anchor and housing on the west end of the Retail Hot Spot.
- **Front Street Realignment:** New Front Street realignment and utility relocations needed to assemble a site for the Orange and Main Retail Anchor.
- **Orange and Main Parking Structure:** A new parking structure opposite the Riverfront Triangle as well as the Orange and Main Retail Anchor.

The parking structure on Front Street has recently been completed. Regarding the property on 139 East Main Street, the City of Missoula obtained an application from Ryan Montgomery for development of a microdistillery with a tasting room in 2011. The application was approved; however, the facility opened in September 2012 in a different location on 129 Front Street. Regarding other development and redevelopment projects, no published references could be found regarding their progress or planning status.

It is noted, however, that the amount of vacant space (in vacant establishments) amounting to 306,271 SF (see Table 5) exceeds the additional future retail space requirements, or accounts for 45% of future commercial space requirements forecasted in the 2009 *Downtown Master Plan*. Therefore, the downtown business community may have sufficient capacity available for expansion or redevelopment in the near term.

1 The plan also included Macy's improvements with renovations, remodeling, and expansion of the store. These became inconsequential after the store closure.

The City of Missoula initiated redevelopment of a portion of Riverfront Triangle Urban Renewal District known as the Fox Site. The Fox Site is located along the north shore of the Clark Fork River at the southwest corner of the intersection of Orange and Front streets. The Fox Site is envisioned to accommodate multi-use development, which would form the anchor of the west entrance to the downtown core and the east entry to the West Broadway corridor. Current plans call for the conversion of the 6-acre area into a hotel and convention center with the possibility of housing, offices, restaurants, and retail. The hotel study was completed in 2012. Recently, Mayor John Engen asked the developers to work on a much larger scheme, including re-working of parking in the area in conjunction with St. Patrick Hospital. In January 2014, the developer obtained one additional year to finalize plans with a new deadline in 2015. Although the timing and exact layout of the development is uncertain, it likely will have an effect on traffic patterns on the west end of the study area.

Recently, plans were announced for a 500-bed University of Montana student housing project to be located on the corner of Front and Clay streets, at the site of the former First Interstate Bank. In addition to several onsite amenities, the development will include retail space along Front Street and a parking garage and visitor parking spaces. The project is expected to be ready for occupancy by May 2017.

5. DEVELOPMENT OF IMPROVEMENT OPTIONS

This section presents a summary of the conceptual build alternatives developed for the major intersections within the study area. Alternative intersection configurations were developed for the major intersections, and the operational characteristics for vehicles and bicycles/pedestrians for each option were reviewed to assess its effectiveness in meeting the goals of the project. The conceptual intersection configurations were then modeled within Synchro to determine if the design met the minimum criteria established by the project team. Options that met the minimum criteria were then forwarded for further consideration based on the operational analysis results and input from the PAC. The options forwarded for recommendation were then assessed in detail to determine their feasibility for two-way conversion, as described in Chapter 6.

The improvement options are described from west to east, starting with the Orange Street intersection and ending with the two Madison Street intersections. During the initial development of alternatives, the circulation for both bicycles/pedestrians and vehicles were examined. The project team wanted to examine how each of the streets would accommodate all modes of traffic while minimizing the disturbances to commercial developments and private residences.

Orange Street Intersection

Two general concepts were developed for the reconfiguration of the Orange Street intersection, as described below. Both concepts include removing either Front or Main streets at the Orange Street intersection to create a new four-legged intersection.

Orange Street Option 1

Traffic/Geometric Configuration: Orange Street Option 1 (Figure 6) shows Front Street operating as the primary roadway with Main Street hooking into Front Street at a new intersection. Front Street includes left turn storage for both northwest and southeast bound traffic. No modifications would be required to the existing west approach of the intersection. The westbound/southbound traffic on Main Street would be stop controlled at Front Street, and advanced signing would be required to ensure traffic is in the correct travel lane prior to the intersection.

Pedestrian/Bicycle Considerations: Pedestrian and bicycle improvements include curb extensions on Front Street to reduce pedestrian crossing distances; advance stop bars at all legs of the intersection and a bike box on southbound Orange Street to increase bike visibility; and shared lane pavement markings, known as “sharrows,” to accommodate bicyclists. Southbound bikes on Orange Street would turn left along with vehicles. This concept includes a green space on the north side of the intersection.

Parking Considerations: This concept maintains the parallel parking along the south side of Front Street but removes parking on the north side of Front Street. Parallel parking would continue along Front Street. Main Street would maintain the angled parking configuration but would lose several spaces near the new intersection with Front Street. Option 1 also includes a large landscaped area where the existing Main Street approaches Orange Street. This area blocks the main entrance to the parking lot located between Orange and Woody streets on Main Street. This would force the main entrance of the parking lot to be from the alley access off of Woody Street. This concept also shows the new Main Street/Front Street intersection, impacting the private parking lot located on the east side of the new intersection.

Figure 6. Orange Street Option 1

Orange Street Option 2

Traffic/Geometric Configuration: Orange Street Option 2 (Figure 7) shows Main Street operating as the primary roadway with Front Street hooking into Main Street at a new intersection. This concept is consistent with the 2009 *Downtown Master Plan* concept. The westbound/northbound traffic on Front Street would be stopped controlled. Depending on future developments to the Fox Site and the property on the southeast corner of Orange and Main streets, additional public parking or property access could be examined.

Pedestrian/Bicycle Considerations: Curb extensions on Front and Main streets are provided to reduce pedestrian crossing distances and provide additional visibility. Advance stop bars at all legs of the intersection and bike boxes to increase bike visibility as well as "sharrows" are included on Main Street. Front Street provides new bike lanes. Southbound bikes on Orange Street use a two-step maneuver with a launch pad for left turns. This concept includes a greenspace on the south side of the intersection.

Parking Considerations: This concept maintains the parallel parking along both sides of Front Street. Main Street would maintain angled parking east of Woody Street and replace some of the existing parallel parking spaces between Woody and Orange streets with angled parking. A few spaces would be lost near the new intersection with Front Street. Private parking access is maintained on the north end of Main Street between Orange and Woody streets and east of the new intersection of Main and Front streets.

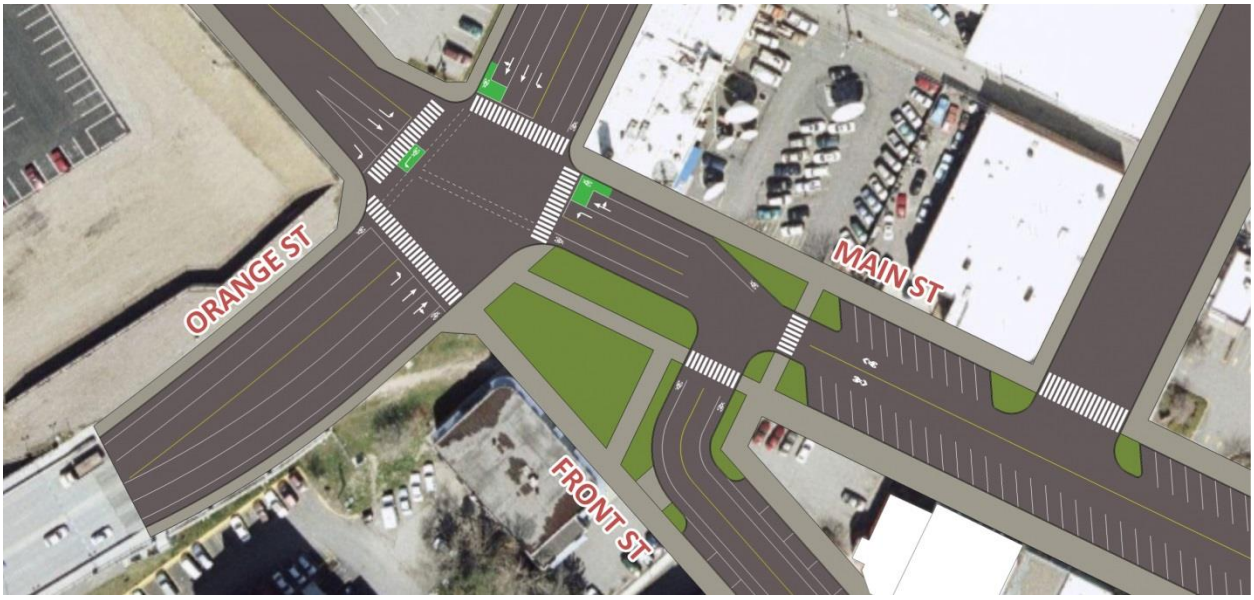

Figure 7. Orange Street Option 2

Ryman Street / Front Street Intersection

Ryman Street and Front Street Proposed Improvements

Traffic/Geometric Configuration: The Ryman Street Proposed Improvements (Figure 8) include squaring up the crosswalks on all four approaches and introducing curb extensions for improved visibility. The north and south approach to the intersection would be stopped controlled and allow the eastbound and westbound traffic to flow freely through the intersection. Ryman Street could be used as a transition street, moving the through traffic from Main Street to Front Street prior to the signalized intersections at Higgins Avenue. Mountain Line currently uses this route for public transit, specifically for Route 7. Future improvements to the Caras Park entrance have been discussed and any modifications would need to be examined prior to moving forward with this option. Preliminary plans included shifting the driving lanes to the west to increase the width of the sidewalk on the east.

Pedestrian/Bicycle Considerations: Curb extensions on all four approaches are provided to reduce pedestrian crossing distances and provide additional visibility. The raised median on the south approach is revised to accommodate a pedestrian refuge and increase the visibility of oncoming traffic for the northbound stopped traffic. Front Street provides new bike lanes.

Parking Considerations: The Ryman Street concept maintains parallel parking along both sides of Front and Ryman streets. A few metered parking spaces on Front Street are lost due to the new alignment of the crosswalks and the use of curb extensions.

Figure 8. Ryman and Front Streets Intersection

Higgins Avenue

Higgins Avenue Option 1

Traffic/Geometric Configuration: Higgins Avenue Option 1 (Figure 9) is a four lane configuration. Curb extensions were introduced on all four corners of the two Higgins Avenue intersections. Traffic signals would need to be modified to accommodate the two-way traffic. The existing condition at Higgins Avenue and Front Street prohibits the southbound left turning movement between 4:00-6:00 PM and does not allow northbound left turns at any time. The proposed traffic analysis was conservative and did not prohibit left turns during any of the peak periods. There are no turn lanes present on Main Street with this option.

Pedestrian/Bicycle Considerations: Higgins Avenue Option 1 is a modification of existing conditions and is limited to adding curb extensions and improved crosswalks. The western leg of Front Street includes bike lanes. This concept provides for bike lanes on Front Street between Orange Street and Higgins Avenue. To maintain angled parking on the north side of Front Street, the bike lanes end at Higgins Avenue and “sharrows” are introduced east of Higgins Avenue on Front Street. The “sharrows” on Main Street continue through the intersection.

Parking Considerations: Higgins Avenue Option 1 maintains the current parking layout along both Front and Main streets as well as Higgins Avenue. Wider travel lanes and no dedicated turn lanes on either Front or Main streets help maintain the current configuration.

Figure 9. Higgins Avenue Option 1

Higgins Avenue Option 2

Traffic/Geometric Configuration: Higgins Avenue Option 2 (Figure 10) is shown as a three lane section, rather than the current four lanes, with relatively narrow lane widths. A dedicated left turn lane is introduced prior to the intersection for northbound and southbound traffic on Higgins Avenue. Front and Main streets do not include left or right turn lanes with this option. The existing traffic signal would need to be modified to accommodate the two-way traffic on Front Street.

Pedestrian/Bicycle Considerations: This option provides buffered bike lanes; provides slightly wider travel lanes; and allows for dedicated left turn lanes at the intersections, with a center turn lane for mid-block driveway or alley access. The eastern leg of Front Street is shown with bike lanes and parallel parking, as an alternative to the configuration shown in Option 1.

Parking Considerations: Higgins Avenue Option 2 maintains parallel parking along both sides of Front Street west of Higgins Avenue. Angled parking is replaced with parallel parking on the east side of the intersection to accommodate bike lanes. Angled parking is maintained along Main Street and there are no parking impacts on Higgins Avenue.

Figure 10. Higgins Avenue Option 2

Higgins Avenue Option 3

Traffic/Geometric Configuration: Higgins Avenue Option 3 (Figure 11) is shown as a three lane section and is basically an extension of the Higgins Avenue treatment that currently exists north of Broadway Street. A dedicated left turn lane is introduced prior to the intersection for northbound and southbound traffic on Higgins Avenue. Front and Main streets do not include left or right turn lanes with this option. The existing traffic signal would need to be modified to accommodate the two-way traffic on Front Street.

Pedestrian/Bicycle Considerations: Higgins Avenue Option 3 includes elevated cycle tracks behind parked cars that weave in and out at the intersections. The treatment is shown as an alternative to Option 2 with buffered bike lanes. This concept also provides launch pads to facilitate two-step bike left turns on Front Street.

Parking Considerations: Higgins Avenue Option 3 maintains parallel parking along both sides of Front Street west of Higgins Avenue. Angled parking is replaced with parallel parking on the east side of the intersection to accommodate bike lanes. Angled parking is maintained along Main Street and there are no parking impacts on Higgins Avenue.

Figure 11. Higgins Avenue Option 3

Madison Street Intersections

Madison Street Option 1

Traffic/Geometric Configuration: Madison Street Option 1 (Figure 12) utilizes a new proposed signal at Adams and Broadway streets for through traffic and minimizes through traffic in the easternmost portion of downtown. Both intersections at Front and Main streets are right-in/right-out only, and the existing left-in at Main Street is eliminated. The frontage road along the west side of Madison Street is eliminated and replaced with a green buffer and a right turn lane.

Pedestrian/Bicycle Considerations: Madison Street Option 1 provides new north-south crosswalks on Front and Main streets and an improved east-west crosswalk across Madison Street on Front Street. Option 1 provides improved bike lanes on Madison Street to increase visibility and reduce conflicts with turning vehicles. This option provides no real bike access improvement. Northbound bikes wanting to turn left onto Front Street would have to use the pedestrian crosswalk.

Parking Considerations: Madison Street Option 1 maintains parallel parking along both sides of Front and Main streets west of Madison Street. The residential parallel parking spaces located on the existing frontage road between Front and Main streets are lost. Parallel parking could be introduced along the west side of Madison Street if approved during design.

Figure 12. Madison Street Option 1

Madison Street Option 2

Traffic/Geometric Configuration: Madison Street Option 2 (Figure 13) proposes a fully signalized intersection at Front and Madison streets, allowing for all movements at this intersection. Main Street to/from Madison Street allows for right-in/right-out only. The frontage road along the west side of Madison Street is eliminated and replaced with a green buffer and southbound right turn lane. There is also a right turn lane for eastbound traffic on Front Street.

Pedestrian/Bicycle Considerations: Madison Street Option 2 provides new north-south crosswalks on Front and Main streets. This option includes an improved signalized east-west crosswalk across Madison Street on the north side of Front Street and a new signalized east-west crosswalk on the south side of Front Street. It provides improved bike lanes on Madison Street to increase visibility and reduce conflicts with turning vehicles. Bike access for northbound bicyclists turning left are accommodated through a launch pad on Front Street where bikes go straight through the northbound signal and wait at the launch pad for a westbound green light.

Parking Considerations: Similar to the previous option, parallel parking is maintained along both sides of Front and Main streets west of Madison Street. A few on-street parking spaces are lost on the south side of Front Street to accommodate the eastbound right turn lane. The residential parallel parking spaces located on the existing frontage road between Front and Main streets are also lost.

Figure 13. Madison Street Option 2

Selected Improvement Options

The following section describes the improvement options that were selected as preferred alternatives and carried forward as recommended improvements. The options were selected based on overall performance results from the traffic analysis as well their effectiveness in meeting the goals of the project.

Orange Street

The Orange Street **Option 2** was selected as the preferred alternative. This option resulted in minimal right-of-way impacts as well as maintained private parking and property access. Main Street operates as the primary route on the west side of the study area with this option. Front Street hooks into Main Street and is stop controlled, which did not present a problem with current traffic volumes during the traffic analysis. The current volumes are close to the thresholds for meeting traffic signal warrants for volume. No other channelization changes were assumed between the existing and future conditions. The queue length between the signalized intersection of Front, Main, and Orange streets is equal to the link length for the northwest left movement at Orange Street. This is true for existing volumes whether the new intersection remains unsignalized or if a traffic signal is installed. There are several variables though that will have an effect on this queue length. The final roadway design between the two intersections may be adjusted. During the traffic signal design, the signal interconnect between Orange Street and the new intersection will be designed. The traffic distributions were done conservatively. Fewer vehicles could make the northwest left movement. If a traffic signal is installed, while the traffic signal is being designed, the signal cycle length, phases and offsets will need to be established so that they are coordinated with the north-south traffic signal system along Orange Street. The northwest left movement at Orange Street should empty the queue before westbound vehicles from Main Street have their green phase. With this emphasis during the design phase, the new traffic signal will have a positive effect on queue lengths between the intersections. Orange Street Option 2 is further described in the following sections.

Higgins Avenue

The Higgins Avenue **Option 1** was selected as the preferred alternative due to results from the traffic modeling. The Synchro traffic analysis conducted for Higgins Avenue Options 2 and 3 (three lane configurations) resulted in a negative impact to intersection LOS, which declined from the existing condition. Due to this degradation in traffic operations, Higgins Avenue Options 2 and 3 were removed from further analysis. Option 1 was then analyzed in closer detail and it was determined that left turn pockets on both Front and Main streets approaching Higgins Avenue were required as to not result in a decline in LOS. Chapter 7, Recommended Improvements, describes the recommended Higgins Avenue Option 1 and additional refinements made to improve operations.

Madison Street

The Madison Street **Option 2** was selected as the preferred alternative. This option offered improved access to the future University of Montana East Campus that will be located on Broadway Street, east of Madison. The new traffic signal located at the Madison and Front streets intersection improves pedestrian accessibility to the study area. By coordinating the signal timing at this intersection with the nearby Broadway Street intersection, traffic will not be adversely affected. This option also uses Front Street as the primary route on the east side of the study area. The intersection with Main Street is limited to right-in and right-out only access. Option 1 introduced a new signal at Broadway and Adams streets, which was not favored by the PAC. The following sections include additional information about the preferred alternative.

6. TWO-WAY CONVERSION FEASIBILITY ASSESSMENT

Feasibility of the two-way conversion was determined largely by the successful operations of the proposed redesign of the major intersections at Orange Street, Higgins Avenue, and Madison Street. An operational analysis using Synchro was conducted for the two-way alternatives to assess the operations of the proposed design against existing LOS.

Intersection Analysis

For the two-way conversion, intermediate Sychro modeling was completed for each option but only the preferred option will be reported. For the volume redistribution, a conservative approach was used to ensure that Broadway Street operations would not degrade past existing LOS. This was completed by:

- Diverting 30% of the vehicles turning left from the southbound Orange Street to Main Street (19 PM vehicles) to turn left onto Broadway Street for access into the study area, leading to right turns at Woody and Ryman streets.
- Diverting 30% of the vehicles turning right onto Orange from Main Street (37 vehicles) to alternatively access Orange Street from Broadway Street; vehicles would gain access to Broadway Street from Woody and Ryman streets.
- The vehicles accessing Front and Main streets were evenly distributed with the two-way conversion. If 56 vehicles were entering the study area from southbound to westbound from Higgins Avenue, 28 would use Main Street and 28 would use Front Street.
- Diverting 30% of the vehicles that would have previously entered the study area at Main and Madison streets to Broadway Street. These vehicles would enter the study area by turning left at Adams and Pattee streets. The remaining southbound vehicles that previously turned right at Main Street would be evenly split between Main and Front streets.

Results of the two-way conditions LOS analysis are summarized in Table 7 and Table 8. The LOS calculations are provided in Appendix B. For each of the peak hours, the same intersection at Front and Madison streets operates below LOS D. The analysis strove to ensure that none of the MDT intersections had a LOS degradation with the two-way conversion. When comparing these results with the one-way results reported in Chapter 4, there were only a few instances where the intersection delay increased by a few seconds and one intersection that went from a control delay of 14.9 seconds and LOS B to a control delay of 23.9 seconds and LOS C during the weekend peak hour (Orange and Front streets). Bold values represent failing intersections. For the new intersections at Front, Main, and Madison streets, both unsignalized and signalized alternatives were analyzed.

The current volumes are close to the thresholds for meeting traffic signal warrants for volume. No other channelization changes were assumed between the existing and future conditions. The queue length between the signalized intersection of Front, Main, and Orange streets is equal to the link length for the northwest left movement at Orange Street. This is true for existing volumes whether the new intersection remains unsignalized or if a traffic signal is installed. There are several variables though that will have an effect on this queue length. The final roadway design between the two intersections may be adjusted. During the traffic signal design, the signal interconnect between Orange Street and the new intersection will be designed. The traffic distributions were done conservatively. Fewer vehicles could make the northwest left movement. If a traffic signal is installed, while the traffic signal is being designed, the signal cycle length, phases and offsets will need to be established so that they are coordinated with the north-south traffic signal system along Orange Street. The northwest left movement at Orange Street should empty the queue before westbound vehicles from Main Street have their green phase. With this emphasis during the design phase, the new traffic signal will have a positive effect on queue lengths between the intersections.

Table 7. 2014 Two-Way AM and Midday Peak Hour Summary

Intersection	Control Type[1]	Two-Way Conditions			
		AM Peak Hour		NN Peak Hour	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	27.7	C	33.4	C
Orange St./Front St.	Signal	15.7	B	24.1	C
Broadway St./Higgins Ave.	Signal	10.7	B	14.1	B
Main St./Higgins Ave.	Signal	9.7	A	12.1	B
Front St./Higgins Ave.	Signal	13.5	B	16.0	B
Broadway St./Adams St.	TWSC	11.3	B	10.7	B
Main St./Adams St.	TWSC	9.7	A	10.4	B
Front St./Adams St.	OWSC	9.0	A	9.6	A
Broadway St./Madison St.	Signal	28.4	C	29.0	C
Main St./Madison St.	OWSC	14.2	B	11.5	B
Front St./Madison St.	OWSC	**54.5**	**F**	**109.7**	**F**
Front St./Madison St.	Signal	10.6	B	11.4	B
Front St./Main St.	OWSC	11.1	B	17.2	C
Front St./Main St.	Signal	6.6	A	17.1	B

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

Table 8. 2014 Two-Way PM and Weekend Peak Hour Summary

Intersection	Control Type[1]	Two-Way Conditions			
		PM Peak Hour		WE Peak Hour	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	48.1	D	28.2	C
Orange St./Front St.	Signal	37.5	D	23.9	C
Broadway St./Higgins Ave.	Signal	19.1	B	23.0	C
Main St./Higgins Ave.	Signal	14.3	B	15.0	B
Front St./Higgins Ave.	Signal	18.9	B	18.4	B
Broadway St./Adams St.	TWSC	14.5	B	18.4	C
Main St./Adams St.	TWSC	10.8	B	10.1	B
Front St./Adams St.	OWSC	10.3	B	8.9	A
Broadway St./Madison St.	Signal	33.5	C	30.9	C
Main St./Madison St.	OWSC	12.2	B	10.7	B
Front St./Madison St.	TWSC	**>110**	**F**	**76.1**	**F**
Front St./Madison St.	Signal	7.7	A	9.1	A
Front St./Main St.	OWSC	17.6	C	15.8	C
Front St./Main St.	Signal	20.3	C	12.5	B

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

Traffic Volumes

Main Street from Orange Street to Higgins Avenue is forecasted to experience an increase in traffic volumes throughout the day as well as on weekends (Table 9). However, the remainder of Main Street is expected to see no change or a reduction in traffic (except for AM peak hours on the section from Higgins Avenue to Adams Street). On the other hand, Front Street from Higgins Avenue to Adams Street and from Adams to Madison streets is forecasted to see an increase in traffic (except for AM peak hours on the section from Higgins Avenue to Adams Street). The section of Front Street from Orange Street to Higgins Avenue is forecasted to see a general reduction in traffic (except for mid-day peak hour, which is expected to generate a small increase).

Table 9. Study Area Traffic Volumes, Current and After Conversion (at 2010 Traffic Levels)

Street Section	Current (One-way)	After Conversion (Two-way)	Change (# of vehicles)	Percent Change
Main St. (Orange St. to Higgins Ave.)				
AM Peak Hour	240	320	80	33.3%
Mid-Day Peak	400	460	60	15.0%
PM Peak Hour	390	470	80	20.5%
Weekend Peak	390	440	50	12.8%
Daily (ADT)	3,900	4,700	800	20.5%
Main St. (Higgins Ave. to Adams St.)				
AM Peak Hour	190	270	80	42.1%
Mid-Day Peak	400	380	-20	-5.0%
PM Peak Hour	440	380	-60	-13.6%
Weekend Peak	450	380	-70	-15.6%
Daily (ADT)	4,400	3,800	-600	-13.6%
Main St. (Adams St. to Madison St.)				
AM Peak Hour	180	150	-30	-16.7%
Mid-Day Peak	190	190	0	0.0%
PM Peak Hour	280	200	-80	-28.6%
Weekend Peak	160	140	-20	-12.5%
Daily (ADT)	2,800	2,000	-800	-28.6%
Front St. (Orange St. to Higgins Ave.)				
AM Peak Hour	420	340	-80	-19.0%
Mid-Day Peak	420	430	10	2.4%
PM Peak Hour	450	430	-20	-4.4%
Weekend Peak	420	410	-10	-2.4%
Daily (ADT)	4,500	4,300	-200	-4.4%
Front St. (Higgins Ave. to Adams St.)				
AM Peak Hour	350	270	-80	-22.9%
Mid-Day Peak	350	420	70	20.0%
PM Peak Hour	310	420	110	35.5%
Weekend Peak	290	370	80	27.6%

Street Section	Current (One-way)	After Conversion (Two-way)	Change (# of vehicles)	Percent Change
Daily (ADT)	3,100	4,400	1,300	41.9%
Front St. (Adams St. to Madison St.)				
AM Peak Hour	110	180	70	63.6%
Mid-Day Peak	160	310	150	93.8%
PM Peak Hour	150	360	210	140.0%
Weekend Peak	110	160	50	45.5%
Daily (ADT)	1,500	3,600	2,100	140.0%
TOTAL SUM OF ALL PEAKS	**7,250**	**7,880**	**630**	**8.7%**
SUM OF WEEK DAY PEAKS	**5,430**	**5,980**	**550**	**10.1%**
SUM OF DAILY TRAFFIC (ADT)	**20,200**	**22,800**	**2,600**	**12.9%**
SUM OF WEEKEND PEAKS	**1,820**	**1,900**	**80**	**4.4%**

Potential Economic Changes in the Study Area due to Street Conversion

This section provides a discussion of changes in the study area that may occur as a result of the proposed conversion to two-way traffic. The overall assessment is based on putting together insights and implications from two components: (1) experience with street traffic conversion projects in other jurisdictions, and (2) changes in traffic volumes resulting from one-way to two-way traffic conversion as well as other changes that impact flow of vehicles, pedestrians, and bicyclists.

Experience with Street Conversion Projects in Other Jurisdictions

Business communities tend to favor two-way street designs to one-way and believe that the former is generally better for business than the latter. As an example, a survey of businesses conducted for a proposed conversion from two-way to one-way couplets in Kelowna, British Columbia, revealed that 50% of businesses believed that the conversion would have a negative impact on their property or business. The remaining 50% were almost equally split between positive impact and no significant impact responses (23% and 27%, respectively).[2] Similarly, a survey of businesses in Westbank (on the other side of Lake Okanagan across from Kelowna) regarding their views on the existing street network (that also included one-way couplets) indicated that 56% of businesses thought that location on a one-way street was bad. The main reason for the beliefs regarding the negative impact of a one-way street network was the impact on accessibility by car and customers arriving by car.

Consistent with these surveys, many analyses of conversions from one-way to two-way streets report overall success and satisfaction from the outcomes. However, it should be pointed out that many street conversion projects were conducted in conjunction with other measures and elements of a wider plan of revitalization and redevelopment. Other elements of such plans often included changes in traffic flow, improvements in intersections and traffic lights, relocation of railroad tracks, and a general street beautification. In many cases, conversion was taking place when some redevelopment activities in the

[2] See City of Kelowna and Downtown Kelowna Association, "One Way Couplets Impact Analysis", Final Report July 2003, Section 6.4.

impact area were already noticeable as emerging trends. In these cases, the street conversion played a role of an additional catalyst.

Table 10 provides an overview of a sample of street conversions and general results from literature reviews conducted in other studies.

Table 10. Impacts of Street Conversion Projects in Other Jurisdictions

No.	City, Scope of Project and Year[1]	Reported Impacts
1	Des Moines, Iowa: Court Avenue, Walnut Avenue, Locust Street, 2006	• $2.75 billion invested in public and private capital projects. • Addition of over 520,000 square feet of new office space. • Increase in office vacancy rate from 6.2% to 7.5% due to the large increase in the amount of office supply (also implies that much of the new space was rented).
2	Fort Collins, Colorado: Mason: and Howe Streets, 2012	• Catalyst to development and redevelopment of downtown area; redevelopment through higher density, infill condominium projects. • 11 residential construction projects completed by mid-2000s and additional projects considered for the Mason Street Bus Rapid Transit Corridor (MAX). • Retail space projected to increase over the period of 10 years following conversion by 600%. Property taxes are projected to increase by 885%.
3	Lafayette, Indiana: Main Street, 1994	• "Very big plus to retail," particularly specialty stores. New specialty retail stores attracted after conversion completed. • $25 million, three building complex with retail/ residential. • Condominium building with 18,500 square feet of retail space, 36 residences, and 140,000 square feet of office space.
4	Austin, Texas: Cesar Chavez Street, 2008	• Significant new development in the area starting from 2004, including a new Austin City Hall, a residential project with 294 apartments, 185 condominiums, 22,000 square feet of retail, 11,000 square feet of office, a restaurant, and another high rise residential with 258 rental units and ground floor retail space.
5	Vancouver, Washington: Broadway, Main and "C" Streets, 2007	• Increase in retail sale of 10% to 20% since street's conversion to two-way. • 71,000 square feet of mixed use commercial complex with 21 luxury condominiums and a 267-space public parking structure. • Several other commercial projects actively planned for the area.
6	West Palm Beach: Clematis Street, 1996	• Substantial increase in new retail shops, restaurants, and residential use.
7	Toledo, Ohio	• Catalyst for redevelopment: long time vacant buildings occupied or sold to developers for new shops and restaurants.
8	Lafayette, Indiana: Main Street, 1994	• Increase in traffic and sales.
9	Hickory North	• Change in city's image to more "user friendly."

No.	City, Scope of Project and Year[1]	Reported Impacts
	Carolina: Main Street and two other major streets in downtown	• Businesses were satisfied with conversions.
10	New Haven, Connecticut: Chapel Street and College Street, late 1990s to early 2000s	• Well received by businesses and the general public. • More "user-friendly" for visitors.
11	Lubbock, Texas: Main Street	• Consensus that the conversion was beneficial; downtown started experiencing growth after years of decline.

Notes 1. Results based on literature reviews in the following studies: (1) Conversion of NP Avenue and 1st Avenue in Downtown Fargo. Economic Impact Chapter, September 13, 2010, and (2) City of Kelowna and Downtown Kelowna Association, "One Way Couplets Impact Analysis," Final Report July 2003.

Systematic studies attempting to disentangle the various influences on street conversion projects and quantify the net impacts are lacking. The study for Kelowna for a conversion from two-way to one-way couplets (therefore, an opposite project) concluded that the impact of such conversions will be significant for main historic and commercial corridors of a city. However, for streets that are not major commercial streets, the impact will be limited. Also, office type tenants or businesses such as bank branches, real estate offices, or dental offices are not expected to be affected. This is because these businesses face little or no competition in the local market. They are major destinations that customers will drive or walk to regardless of the configuration of the local road network.

For the specific conversion project of three streets in downtown Kelowna, the study concluded that on two of the streets the expected impact on sales of ground floor businesses deemed sensitive to traffic flow configuration is expected to be negative but low in the range of 5% to 10%. This was because on balance the daily traffic on these streets was expected to remain unchanged, and projected loss of parking was not expected to affect these businesses directly. On the other hand, the impact on many ground floor businesses on the third street considered for conversion was assessed as negative in the medium range of 10% to 20%. This was because the proposed one-way couplet and other street reconfiguration were expected to significantly reduce daily traffic on that street.

Key Features and Forecasted Traffic Outcomes of Two-way Conversion and Its Implications for Economic Conditions in the Study Area

Changes in street configurations can be expected to affect the choice of a precise travel route through an area; therefore impacting the amount of traffic in the various streets within that area. The results of the traffic model simulations for traffic volumes by street section and time of day before and after conversion are shown in Table 9 above.[3] The table does display some redistribution of traffic in the study area after

[3] It should be emphasized that the results presented in Table 9 are purely "mechanical" changes influenced by the practicality and convenience of travel on a given street when traveling to a certain destination. In the longer term, further changes in traffic flows may occur depending on the attractiveness of travel on a certain street influenced by factors such as presence of stores, restaurants, and other destination points. This requires more intensive modeling which could not be completed within the scope of this study.

the two-way street conversion. Some street sections are forecasted to experience an increase in traffic in certain times of the day and other street sections are forecasted to experience a reduction.

Overall, when summing across the street sections, peak traffic in the study area is expected to increase by almost 9% on a week day and 4% on a weekend. Over the entire day, traffic in the study area is expected to increase by nearly 13%.

Regarding the economic impact of increased vehicle traffic on local businesses, it should be noted that available literature does not offer many insights on buying behavior of drivers and how—and in what magnitude—the increased traffic could translate into increased sales in the areas that they pass. As argued earlier under the general context of impacts of street conversion from one-way to two-way traffic, some increase in sales could be expected because more vehicles passing through an area will increase business exposure of local stores. Assuming that each vehicle passing a store has a similar probability of making a stop there, increased traffic on a street can be expected to lead to increased sales in some proportion to the increased traffic. These increased sales could represent entirely new sales attracted by more convenient access, but also likely would be some redistribution from areas and street sections where traffic declined or from outside of the study area.

In addition to changing the flow of vehicle traffic on Front and Main streets, this conversion project also proposes a range of street improvements in the study area to enhance pedestrian safety, facilitate access and flow of bicyclists to and through the area, and improve the flow of vehicles. These include the following (some changes/installations may not apply to some alternatives considered or to the entire street length):

- Curb extensions at crosswalks to reduce the crossing time for pedestrians and increase pedestrian visibility;
- Bicycle lanes (new or improved), separated on-road or off-road;
- Turning lanes; and
- Changes to some intersection layouts to improve flow and turning conditions for vehicles.

Pedestrian and bicycle traffic was not explicitly estimated in this study. However, the above installations may be expected to encourage more walking and bicycling in or through the study area due to increased safety and user comfort. Increased pedestrian and bicycle traffic may then also have some economic benefits and benefit local businesses because they may represent potential new customers. Studies indicate that retailers tend to over-estimate the number of customers who are arriving by car and underestimate those customers who are walking or using a bicycle to get to the store.[4] Those customers may also be valuable. For example, a study of Toronto's Bloor Street found that people who arrive to the local stores by transit, bicycle, or foot spend more on a monthly basis than those who arrive by car.[5] These study results provided support for street improvement projects involving allocation of a greater share of space to sidewalks and bike lanes (at the expense of parking) as such a change would be unlikely to negatively impact sales of local merchants. The project could actually increase retail sales as well as generate benefits to a large pool of pedestrians and bike users.

At the same time, studies also show that street improvements involving increased accessibility; connectivity; safety to bicyclists, transit users, pedestrians; and an increase in quality of the surrounding public/pedestrian space can help improve the sales performance of the businesses on the affected

[4] As an example, see discussion in "Good for Business. The benefits of making streets more walking and cycling friendly." Discussion paper, The Heart Foundation, November 22, 2011.
[5] "Bike Lanes, On-Street Parking, and Business", Year 2 Report: A Study of Bloor Street in Toronto's Bloor West Village, Clean Air Partnership, 2010.

streets. In other words, increased pedestrian and bicycle traffic after the improvements may also bring new sales. For example, a recent study of a mix of these types of improvements on selected streets in New York City shows that retail sales on most of those improved streets on average increased more than the average sales in the entire borough and more than sales on many other streets in the neighborhood analyzed for a comparison.[6] The specific results varied widely from a few percentage points above the borough and/or comparison streets to as much as 30% to 40%.

Summary of Likely Changes in the Study Area

The analysis presented above leads to a conclusion that in the short-term, the economic impacts of the conversion of Front and Main streets from one-way to two-way traffic can be expected to be rather modest. The key influencing factors are:

- A relatively small number of businesses have been deemed sensitive to traffic flow and are dependent on spontaneous customer visits and discretionary expenditure from pass-by traffic. Therefore, most businesses are unlikely to see a significant increase in revenue.
- Higgins Avenue is one of the key shopping streets in the downtown core and at the same time one of the key arterials through downtown with much larger traffic than Front and Main streets. Traffic model simulations indicate that the conversion of Front and Main streets is not expected to affect traffic flow on Higgins Avenue. Therefore, Higgins Avenue may be expected to remain one of the key downtown shopping streets, possibly competing with Front and Main streets.
- There have been cautious economic forecasts and some uncertainty regarding the effects of the announced cuts in the public sector in Missoula. This may limit growth in consumer expenditures, which will not be favorable to the general business conditions under which the various businesses operate.

Overall, a short-term increase in sales of about 10% to 13% for local retail, restaurants, and other food establishments could be a reasonable estimate based on the following two considerations:

1. Increased daily vehicle traffic can be expected to increase sales by about 10%. This is based on experience in Vancouver, Washington (lower range of the reported increase in retail sales, see Table 10) and assessment conducted for Kelowna, British Columbia (an impact of 10% corresponding to upper level assessed impact on streets with no change in traffic and a lower range of assessed impact on street with a significant reduction in traffic).
2. Improved environment for pedestrians and bicyclists can be expected to increase sales by another 3%. This is based on experience in New York City where similar street improvements were reported to generate some increase in retail sales in many instances with a lower range around a few percentage points.

It should be noted that since there is no local sales tax in Missoula, the city is unlikely to see a fiscal benefit of the proposed street conversion in the short-term.

In the long-term, the impact of the street conversion project may be more significant. This could be possible given that some redevelopment projects in areas adjacent to the study area are now starting to take place (e.g., Fox Site, Old Sawmill, Silver Park). When completed, these projects may provide new trips and visits to the area that are necessary to stimulate growth. Initial improved conditions and growing sales may then provide an incentive to lease vacant spaces, or change the profile of some existing businesses to generate higher revenues.

6 “The Economic Benefits of Sustainable Streets,” New York City Department of Transportation.

The success of the initial projects may then provide an incentive to pursue other projects downtown, perhaps even redevelopment of other existing street sections (e.g., to multi-use structures with retail on the ground floor and office or residential on the upper floors).

Summary of Air Quality Impacts

Projected total air emissions from the two-way conversion for the year 2040 were modeled using the U.S. Environmental Protection Agency's (EPA) Motor Vehicle Emission Simulator model (MOVES 2010a) (Table 11 and Table 12). A more current MOVES model is available; however, the air emission projections presented in the 2012 Missoula LRTP Air Quality Conformity Analysis utilized the MOVES 2010a model and it was determined that the same model version should be used to obtain results that are directly comparable to the 2040 projections published in the 2012 Missoula LRTP. The air quality conformity analysis was conducted using the Metropolitan Planning Organization (MPO) TransCAD model inputs for the two-way conversion scenario. Results have been incorporated into the conformity determination tables as presented in the 2012 Missoula LRTP (Tables 8-1 and 8-2 of the LRTP) to provide a comparison of 2040 projections for the existing one-way condition versus the proposed two-way condition.

The two-way conversion results in a minor increase in Seasonal Vehicle Miles Traveled (VMT) for both the Carbon Monoxide (CO) and Particulate Matter <10 Microns (PM10) modeled areas. Results from the MOVES 2010a model show a minor increase in the projected amount of CO emissions for the year 2040. The 2040 projections for the two-way conversion result in an increase of 529 pounds/day (0.26 tons/day), or a 1.2% increase, of CO emissions over the one-way condition. Overall, the projected CO levels are within the emissions budgeted for the Missoula area and pass the CO conformity determination.

PM10 projections for the 2040 two-way conversion show a decrease in total particulates over the one-way condition. While total tailpipe particulates increase by 3.3%, the total particulates (tailpipe and road dust combined) show a 6.6% reduction over the one-way condition. Again, the projected PM10 levels are well below the budgeted levels for the Missoula area and pass the conformity determination.

Table 11. CO Emission Projections for 2040, One-Way to Two-Way Conversion

Year	*2012 LRTP Results*				*2014 Two-Way Conversion Results*		
	2010	2020	2030	2040	2040 Two-way Conversion	Change in 2040 One-way to 2040 Two-way	2040 % Change
Budget (tons/day)	43.22	42.67	42.67	42.67	42.67	NA	NA
Seasonal VMT	991,962	1,193,691	1,395,420	1,597,149	1,635,148	37,999	2.4
Projection (pounds/day)	72,808	51,591	43,827	42,505	43,034	529	1.2
Projection (tons/day)	36.40	25.80	21.91	21.25	21.52	0.26	1.2
Conformity (Projection < Budget?)	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**		

Table 12. PM10 Emission Projections for 2040, One-Way to Two Way Conversion

Year	*2012 LRTP Results*				*2014 Two-Way Conversion Results*		
	2010	2020	2030	2040	2040 Two-way Conversion	Change in 2040 One-way to 2040 Two-way	2040 % Change
Budget (pounds/day)[1]	16,119	16,119	16,119	16,119	16,119	NA	NA
Seasonal VMT	860,118	1,025,386	1,190,653	1,355,921	1,400,925	45,004	3.3
Road Dust rate (grams/mile)	5.0310	5.0526	5.0682	4.8540	4.3545	0	-10.3
Projection: Tailpipe Particulates (pounds/day)							
Gpm (gasoline particulates)	2	2	2	2	2	0	0.0
Ec (diesel elemental carbon)	368	73	38	30	31	1	3.3
Oc (diesel organic carbon)	582	198	166	178	184	6	3.4
Pbr (brake particulates)	513	615	720	826	853	27	3.3
Pti (tire wear particulates)	20	24	28	32	33	1	3.1
Total Tailpipe Particulates (pounds/day)	**1,485**	**912**	**954**	**1,068**	**1,103**	**35**	**3.3**
Projection: Road Dust Particulates (pounds/day)[2]							
Deicer Areas	5,305	6,274	7,242	8,211	9,509	1,299	15.8
Washed Sand Area	1,858	2,313	2,769	4,425	3,570	-856	-19.3
Unwashed Sand Area	2,379	2,837	3,296	1,877	373	-1,504	-80.1
Total Road dust Particulates (pounds/day)	9,542	11,424	13,306	14,513	13,452	-1,061	-7.3
Total Parcticulates (pounds/day)	11,027	12,336	14,260	15,581	14,555	-1,026	-6.6
Conformity (Projection < Budget?)	**Pass**	**Pass**	**Pass**	**Pass**	**Pass**		

Notes VMT = Vehicle Miles Traveled

1. Includes road dust, elemental carbon, organic carbon, gasoline exhaust particulates, tire wear, and brake wear
2. Projection= Emission Rate x Seasonal VMT, then divide by 453.5 to convert to pounds

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7. RECOMMENDED IMPROVEMENTS

The following chapter describes the recommended improvements for the study area. The options carried forward from the alternatives selection were further refined to address certain areas of concern and the concepts. The recommendations include a description of proposed specific recommended intersection improvements as well as general improvements that may enhance both motorized and non-motorized facilities throughout the study area. Sidewalk and intersection improvements that move forward would be required to be in compliance with the current PROWAG and MUTCD requirements for the American's with Disabilities Act (ADA) facilities. These improvements could consist of updating pedestrian ramp slopes, truncated domes, width, orientation, color, and texture. Specific ADA-compliant features would be developed in the design phase for any forwarded project.

Recommended Intersection Improvements

From the options described in Chapter 5, one option was forwarded for further consideration based on the results from operational analyses and input from the PAC. The advanced intersection configurations were then further refined based on stakeholder and PAC input, and the final recommended concepts are provided within this section. Note that for the Front Street/Ryman Street intersection, only one alternative was developed, and is described in detail within this section.

Orange Street Option 2

Major modifications are recommended for the existing five-legged Orange Street/Front Street/Main Street intersection (Figure 14). The recommended design includes a simplified four-legged intersection with Main Street as the primary east-west route. Front Street is envisioned as a secondary route that ties into Main Street at a T-intersection some distance from Orange Street. As a result, operations of the Main Street/Orange Street intersection are simpler and easier to navigate for pedestrians and bicyclists. While the east-west crossing distances are largely unchanged, the north-south crossing distance on the east side of the intersection is significantly shortened. A launch pad is recommended to facilitate two-step left turns for southbound bikes on Orange Street accessing the study area.

The realignment of Front Street allows for a highly visible civic park space. A combination of shade trees, ornamental landscape, benches, and public art are recommended to create an attractive western gateway into the downtown core. A walkway connection aligned with the existing sidewalk along the southern edge of Front Street continues to provide direct pedestrian access from Orange Street to Front Street. The sidewalks on both sides of Main Street include landscaped boulevards with street trees, providing a more comfortable and inviting pedestrian environment.

The new T-intersection of Main and Front streets is designed to minimize pedestrian crossing distances. The stretch of Front Street that "hooks" into Main Street is limited in width to travel and bike lanes, with no on-street parking to minimize the east-west crossing distance. Curb extensions on Main Street minimize the north-south crossing distance.

The reconfigured intersection is designed to accommodate turning movements of city buses and emergency vehicles without those larger vehicles having to swing into the opposing lanes.

The Orange Street Option 2 was determined to be the favorable option based on several factors, such as: minimal right-of-way impacts, maintained private property access and private parking, and increased redevelopment potential on the southeast corner of the intersection. Several modifications were made to the concept to address the concerns identified by the PAC. The result included the following modifications:

- Provides access to private property located at the southeast corner of the new intersection of Front and Main streets, and maintains the current number of private parking spaces.
- Realigned south crosswalk to tie into Main Street (decreases distance between the stop bar and Main Street on the south approach).
- Bulb-out/decreased crosswalk distance at Woody Street.
- Maintain access to private property and parking located on the north side of Main Street.

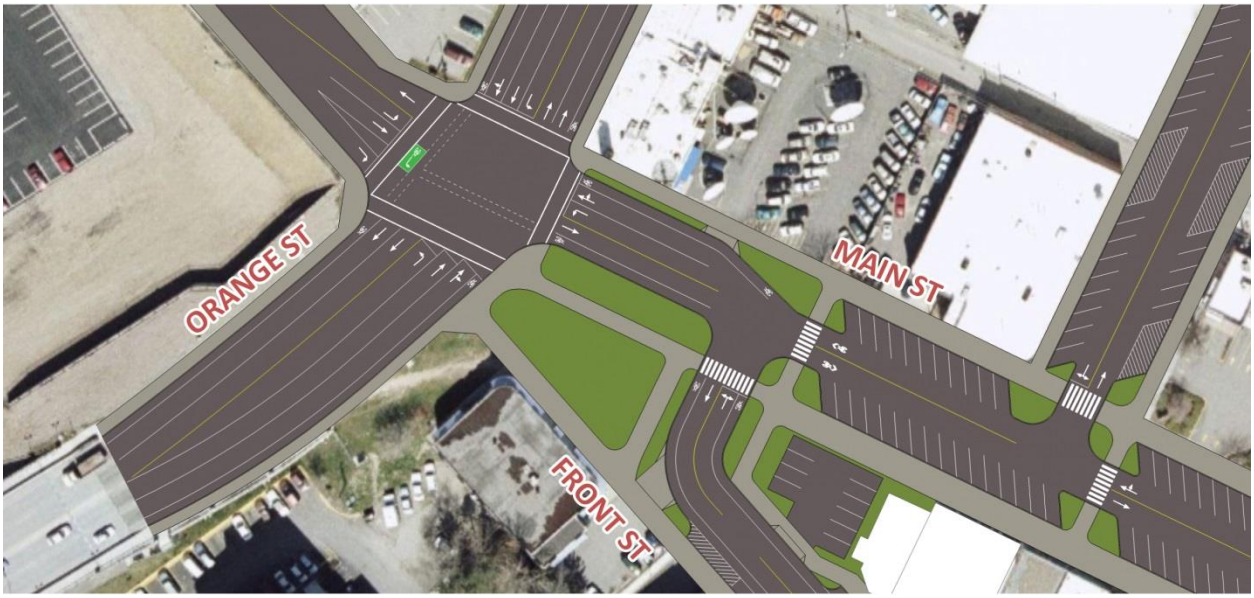

Figure 14. Orange Street Option 2 - Refined

Front Street at Ryman Street

The intersection of Front and Ryman streets, including the slightly offset driveway accessing the Caras Park parking lot, is recommended to be reconfigured to improve operations and pedestrian safety (Figure 15). New curb extensions and realigned, perpendicular crosswalks significantly reduce crossing distances and improve pedestrian visibility.

The Caras Park driveway is now designed to look like a street intersection, rather than a driveway apron. This design better reflects its traffic volume and eliminates the false perception of safety pedestrians may have when walking across an area with sidewalk pavement. The new east-west crosswalk clearly identifies a crossing of a roadway, while the median provides a refuge and reduces the crossing distance.

Only one option was developed at this location to maintain the existing accessibility to Caras Park as well as to minimize impacts to surrounding properties and on-street parking. Plans for future modifications are currently being considered at this intersection independent of this study to improve the pedestrian access to the park.

Figure 15. Ryman Street and Front Street Intersection

Higgins Avenue Option 1

To reduce crossing distances at the intersections of Higgins Avenue with Front and Main streets, curb extensions are recommended where feasible. The intersections are designed to accommodate turning movements of city buses and emergency vehicles without those larger vehicles having to swing into the opposing lanes. The curb extensions that were originally included in Option 1 were revised to accommodate the right turning movement of these larger vehicles. Orange Street and Madison Street are all considered National Highway System Non-Interstate Routes. State maintained routes do not allow curb extensions with mountable curbs due to safety concerns. The curb extensions were revised to keep larger vehicles from encroaching into oncoming traffic or curb returns.

Launch pads are recommended to facilitate left turns for bikes accessing the study area from the bike lanes along Higgins Avenue.

Figure 16 and Figure 17 present the revised Higgins Avenue Option 1 at a larger scale.

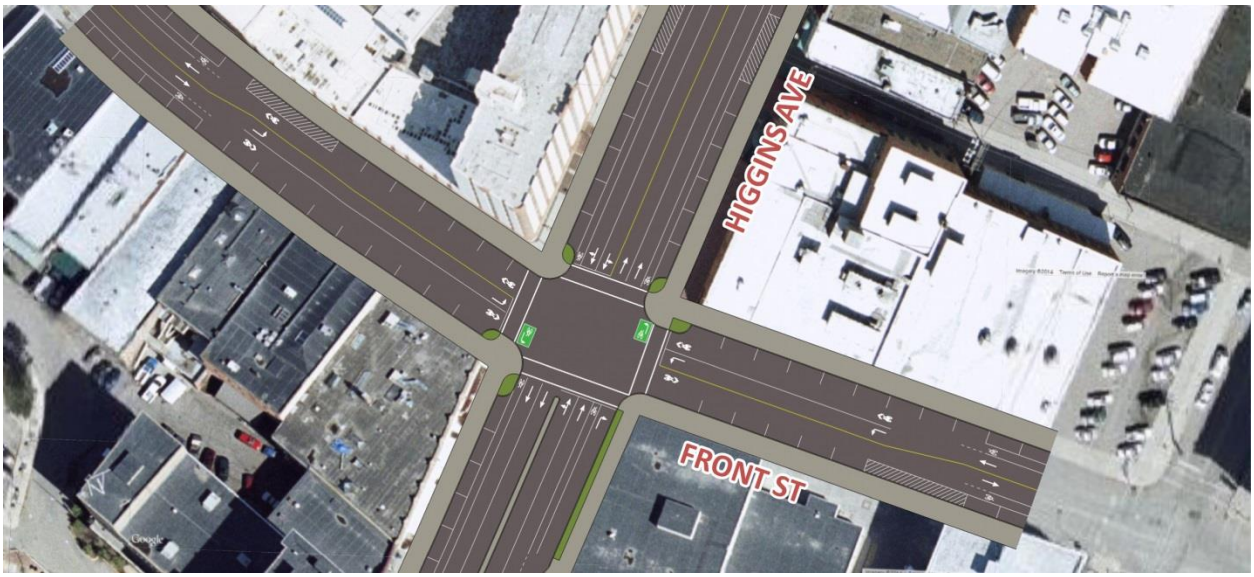

Figure 16. Higgins Avenue Option 1 – Refined, Front Street Intersection

Additional modifications made to the Higgins Avenue intersection at Front Street include:

- **Front Street west of Higgins**: Assuming the bike lanes will have to be dropped mid-block and merge into shared lanes in order to accommodate the 200-foot left turn pocket. Parallel parking is assumed on both sides of Front Street. No loss of parking compared to status quo.
- **Front Street east of Higgins**: Assuming the angled parking on the north side of Front Street will need to be replaced with parallel parking to accommodate the 150-foot left turn pocket while the parallel parking on the south side of the street is maintained. An estimated eight parking spaces would be lost compared to the status quo.

Figure 17. Higgins Avenue Option 1 - Refined, Main Street Intersection

Additional modifications made to the Higgins Avenue intersection at Main Street include:

- **Main Street west of Higgins**: Assuming the diagonal parking on the north side of Main Street will need to be replaced with parallel parking for about two-thirds of the block length to accommodate a 200-foot left turn lane. The existing driveway cuts for the parking structure will be maintained, and on-street parking in front of the parking structure is not as critical for the surrounding businesses. An estimated 10 parking spaces would be lost compared to the status quo.
- **Main Street east of Higgins**: Assuming the diagonal parking on the north side of Main Street will need to be replaced with parallel parking for about half of the block length to accommodate a 150-foot left turn lane. The existing alley access will be maintained and an estimated six parking spaces would be lost compared to the status quo.

Figure 18 and Figure 19 provide a conceptual cross section view from Higgins Avenue of the proposed improvements on Front and Main streets, respectively.

Figure 18. Higgins Avenue Option 1 Street Section at Front Street

Figure 19. Higgins Avenue Option 1 Street Section at Main Street

Madison Street Option 2

Major modifications are recommended for the Main Street/Front Street intersections with Madison Street, including the closure of the existing frontage road along Madison Street that currently connects Front and Main streets. In place of the frontage road, a generous green buffer along Madison Street provides increased pedestrian comfort and allows for design and landscaping opportunities for an eastern gateway treatment into the downtown core. In addition, the green buffer provides opportunities to reduce noise and light impacts on the residences abutting Madison Street.

Striped bike lanes along Madison Street are recommended to provide designated bike routes for north and southbound traffic.

Front Street at Madison Street

Significant changes to traffic operations are recommended. A new full traffic signal at the Front Street/Madison Street intersection provides full vehicular access as well as significantly improved bike and pedestrian access. While there is an existing unsignalized crosswalk on the north side of Front Street, the new design provides signalized crossings on both the north and south side, in addition to new north-south crossings. Compared to the existing crosswalk, the crossing distance of Madison Street on the north side of Front Street is somewhat reduced, while the new crosswalk on the south side provides a more significant pedestrian refuge and overall shorter crossing distance.

The reconfigured intersection also provides greater distance between Madison and Hartman streets, located just west of Madison Street. This adds pedestrian safety and comfort and allows for a north-south crosswalk to align with the sidewalk to the north.

A launch pad is recommended to facilitate two-step left turns for northbound bikes on Madison Street accessing the study area.

The intersection is designed to accommodate turning movements of city buses and emergency vehicles without those larger vehicles having to swing into the opposing lanes.

Main Street at Madison Street

The proposed intersection design greatly reduces the number of conflicts and significantly increases pedestrian safety. The new configuration eliminates the frontage road and the northbound left turns from Madison Street and only permits right-in and right-out traffic. Main Street is designed with a curb extension on the south side, providing a shorter crossing distance. While not signalized, pedestrians only have to cross a conventional two lane street. The sidewalks along Madison Street north and south of Main Street are now aligned, and the sidewalk along Madison Street between Main and Broadway streets is no longer curb-adjacent but separated by a landscaped boulevard, providing pedestrian comfort.

The intersection is designed to accommodate turning movements of city buses and emergency vehicles without those larger vehicles having to swing into the opposing lanes.

The Madison Street intersection concepts were presented to the PAC, and Option 2 was determined to be the favorable option based on several factors, including pedestrian safety and improved access to developing areas such as the University of Montana's East Campus. By closing the frontage road between Front and Main streets, approximately seven on-street parking spaces are lost. Parking could be added along the west side of Madison Street if approved during the design process.

Several modifications were made to the concept to address the concerns identified by the PAC. The result included the following modifications:

- Modified bike lane transition from green to preferred white dashed markings
- Removal of green bike launch pad on NB Madison at Front
- Additional access provided from Front and Main streets
- Removing the raised median on Main Street in order to accommodate bike lanes

Figure 20 and Figure 21 present the refined Madison Street Option 2 at a larger scale.

Figure 20. Madison Street Option 2 – Refined, Main Street Intersection

Figure 21. Madison Street Option 2 - Refined, Front Street Intersection

Figure 22 and Figure 23 provide a conceptual cross section view from Madison Street of the proposed improvements on Main and Front streets, respectively.

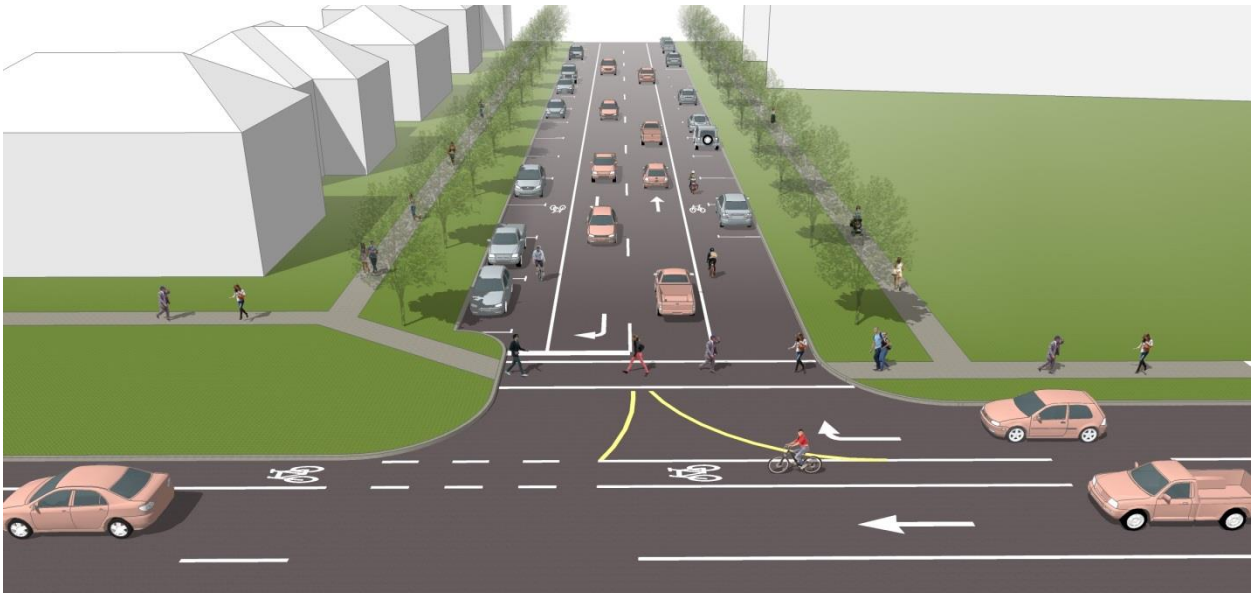

Figure 22. Madison Street Option 2 Street Section at Main Street

Figure 23. Madison Street Option 2 Street Section at Front Street

Cost Summary

The costs associated with the recommended options are summarized in Table 13. Potential funding sources are also discussed in Chapter 9.

Table 13. Planning-Level Cost Estimates for Recommended Improvement Options

Intersection	Item	Amount	Intersection Total
Orange St. & Front St./Main St.	Sidewalk Bulbouts	$ 12,000	$1,279,000
	Front Street Realignment	$700,000	
	Utilities[1]	$300,000	
	Traffic Signal	$250,000	
	Drainage Modifications	$11,000	
Ryman St. & Front St.	Sidewalk Bulbouts	$32,000	$ 43,000
	Drainage Modifications	$11,000	
Higgins Ave. & Front St.	Sidewalk Bulbouts	$23,000	$284,000
	Traffic Signal	$250,000	
	Drainage Modifications	$11,000	
Higgins Ave. & Main St.	Sidewalk Bulbouts	$34,000	$295,000
	Traffic Signal	$250,000	
	Drainage Modifications	$11,000	
Madison St. & Front St.	Sidewalk Bulbouts	$18,000	$1,073,500
	Madison Street Improvements	$700,000	
	Utilities[1]	$100,000	
	Traffic Signal	$250,000	
	Drainage Modifications	$5,500	
Madison St. & Main St.	Sidewalk Bulbouts	$13,000	$18,500
	Drainage Modifications	$5,500	
Additional Improvements Throughout Study Area			
Pavement Rehabilitation - Front Street & Main Street		$1,200,000	$1,551,000
Signing and Striping		$101,000	
Street Lighting[2]		$250,000	
TOTALS			**$4,538,000**

Notes: The costs shown above are approximate and do not include design-stage detail. Further examination is required.
1. Utility costs are approximate and depend on existing conditions at the time of construction. Costs are also associated with the funding source and utility owner. Further examination is required.
2. Street Lighting cost estimated at an average cost of $175,000 per urban mile of road.

Recommended Improvements to Pedestrian, Bicycle, and Transit Facilities

Many of the recommended improvements are aimed at enhancing safety for both motorized and non-motorized users, as established in the Build Alternative Evaluation Criteria and included in the final recommended intersection configurations described above. The following measures were designed to improve access to and circulation throughout the study area for people arriving on foot, bicycle, or bus; increase visibility of pedestrians and bicyclists for safety and comfort; reduce vehicle speeds to support a walkable downtown environment; and facilitate the movement of pedestrians by improving street crossings.

The recommendations include the following key interventions:

- Reconfigure intersections at Orange and Madison streets to improve pedestrian and bicycle access to the study area and create opportunities for aesthetic enhancements of these gateways into downtown;
- Improve and shorten pedestrian crossings where possible to increase safety and comfort of pedestrians throughout the study area; and
- Add bike lanes on Front Street to enhance the bikeway system by creating logical connections to the Higgins Avenue Bridge and the Riverfront Trail North.

The recommended improvements can be categorized as follows:

- **Minor modifications:** Repaving and restriping within the existing roadway width and sidewalk modifications not affecting curb and gutter;
- **Limited scope:** Curb modifications to create sidewalk extensions at intersections; and
- **Significant modifications:** Realigned roadways as well as reconfigured intersections and traffic signal layout at key locations.

The more costly interventions should be limited in scope and focus on areas where the biggest benefits can be expected. For example, while moving the curb location, increasing the sidewalk width may be desirable. Reducing the crossing distance at an intersection through focused curb-extensions provides a greater benefit to pedestrian safety at a fraction of the cost.

General Recommendations

Curb Extensions:

Where possible curb extensions at intersections are strongly recommended to reduce crossing distances and increase visibility of pedestrians. Curb extensions are also recommended at signalized intersections, even though the signal provides some level of pedestrian protection. However, pedestrians are particularly vulnerable to right on red movements, making increased visibility all the more important. In addition, a reduction in crossing time can be significant to pedestrian comfort and perceived safety. Furthermore, curb extensions can contribute to reduced travel speeds by visually narrowing the perceived roadway width.

Streetscape Improvements:

To provide shade and visual interest, the addition of street trees is recommended where feasible. Where sidewalk widths are constrained, placing trees in the parking lane may be an option, although it would reduce the available street parking to a degree. Trees should be of a species with high canopies and

sufficiently transparent foliage to not obscure storefronts and signage and should not produce excessive amounts of debris.

Other recommended streetscape improvements include bike racks, bus shelters, pedestrian scale street lighting, benches, and other furnishings ideally coordinated in style and color theme to reinforce a cohesive aesthetic for the downtown. In addition, some control of signage size, especially regarding A-frame signs, would be beneficial to the aesthetic appeal of the sidewalks.

Consolidated Curb Cuts:
The proposed two-way circulation provides opportunities to consolidate or eliminate redundant driveway curb cuts without placing undue burden on individual properties. Curb cuts generate conflicts between vehicle traffic and pedestrians and bicyclists, as well as automobile traffic on adjacent roads. A reduction in the number of curb cuts thus increases the safety for all modes. As redevelopment occurs, efforts should be made to consolidate driveway cuts, reduce the width of driveways, and utilize the existing alleys to a greater degree. There are several parking lots with two or more access points. Because of easier circulation through the conversion to two-way traffic, a number of driveways could be immediately closed without causing any adverse operational impacts to the parking lots.

Improved Bike Facilities:
To improve bicycle access to the study area as well as create a stronger connection between the regional bicycle system and downtown, the introduction of “launch pads” at key intersections is recommended. Launch pads are marked boxes that facilitate two-step left turns for bikes to safely and comfortably access Front or Main streets. Rather than merging into travel lanes to reach the left turn lane, bicyclists riding on Orange, Higgins or Madison streets stay in the bike lane, go straight through the intersection, and safely wait at the launch pad for the next signal phase. Where launch pads are present, right on red movements are no longer permitted.

Introducing two-way operations on Front Street significantly changes the pattern of bicycle circulation in the downtown. Now every street connecting the Riverfront Trail North with Front Street provides good bike access to the study area. For most cyclists, sharing the roadway with vehicle traffic on slow, urban streets is acceptable. In addition, with two-way circulation every destination in the study area is within a couple of blocks of a bike lane or trail, making the downtown comfortably accessible even to less experienced cyclists.

To facilitate regional bike connectivity between areas west of downtown and the University of Montana as well as neighborhoods south of the Clark Fork River, bike lanes along Front Street between Orange and Washington streets are recommended. The bike lanes provide a logical route to access the Higgins Avenue Bridge as well as the Riverfront Trail North connecting to the Madison Street under-bridge. With the proposed two-way circulation, Front Street mostly accommodates parallel parking, which generally is preferred for bike safety.

Bike lanes are also recommended along Main Street east of Washington Street to provide convenient bicycle access to the Missoula Public Library and the Children’s Theatre as well as to connect the study area with the Rattlesnake neighborhood and Greenough Park just north of Interstate 90 via Madison Street and Greenough Drive.

Transit Circulation:
The three fixed routes that are currently operating within the study area could be maintained with Front and Main streets operating as two-way streets. However, some modifications could be made to enhance circulation, such as:

- Reverse direction of Route 1 to travel westbound on Front Street, northbound on Ryman Street, southbound on Pattee Street, and eastbound on Main Street.
- Move Route 12 to travel westbound on Front Street and maintain northbound travel on Ryman Street.
- Move Route 7 to travel eastbound on Main and maintain northbound travel on Ryman Street.

With Main Street operating as the primary route on the west end of the study area and Front Street being the primary route on the east end, Ryman or Pattee streets could be used as transition streets moving buses between Front and Main streets. Mountain Line currently operates Route 6 on Higgins Avenue so utilizing the nearby Ryman and Pattee streets would not require additional left turns at signalized intersections.

In addition to the current Mountain Line bus route and schedules, the Missoula Urban Transportation District recently evaluated the addition of an urban streetcar in downtown Missoula. The study, dated December 2012, identified three potential street car routes that would link St. Patrick Hospital and the University to downtown via Front and Main streets. All three potential street car alignments would circulate through the study area along Front and Main from Ryman to Madison streets. The two-way conversion would still allow a street car operating within the same lane as other vehicular traffic along Front and Main streets. This would also be favorable use of the preferred rubber-tired circulator discussed in the Streetcar Study.

Recommended Front Street Improvements

Front Street west of Washington Street:

The typical cross section of Front Street in the commercial core consists of one travel lane and one bike lane in each direction with parallel on-street parking on both sides of the street (Figure 24). Recommended improvements also include the addition of street trees where possible. Where feasible, curb extensions at intersections and continental style crosswalk markings provide improved and shortened pedestrian crossings.

Figure 24. Front Street West of Washington Street (Looking West)

At the approaches to the Higgins Avenue intersection, the cross section changes to accommodate left turn pockets. Bike and through travel lanes merge and are marked with “sharrow” symbols to indicate the shared nature of the lanes.

At the approach to the Orange Street/Main Street intersection, on-street parking is omitted and the street section narrows to one travel lane and one bike lane in each direction.

Front Street east of Washington Street:

East of Washington Street the character of Front Street is predominantly residential, and the street width is narrower (Figure 25). The typical cross section consists of one travel lane in each direction with parallel on-street parking on both sides of the street. Bike traffic is accommodated in shared travel lanes that are marked with “sharrow” symbols. Where feasible, curb extensions at intersections and continental style crosswalk markings provide improved and shortened pedestrian crossings.

Figure 25. Front Street East of Washington Street (Looking West)

At the approach to the Madison Street intersection, the cross section changes. On-street parking on the south side of the street is omitted to accommodate a right turn lane.

Recommended Main Street Improvements

Main Street West of Washington Street:

The typical cross section of Main Street in the commercial core consists of one travel lane in each direction with diagonal on-street parking on both sides of the street (Figure 26). Bike traffic is accommodated in shared travel lanes that are marked with “sharrow” symbols. Recommended improvements also include the addition of street trees where possible. Where feasible, curb extensions at intersections and continental style crosswalk markings provide improved and shortened pedestrian crossings.

Figure 26. Main Street West of Washington Street (Looking West)

At the approaches to the Higgins Avenue intersection, the cross section changes to accommodate left turn pockets. This is achieved by replacing diagonal parking on the north side of the street with parallel parking.

Main Street East of Washington Street:

East of Washington Street, Main Street is lined with a mix of residential and civic uses, including the Missoula Public Library and the Missoula Children's Theater (Figure **27**). The typical cross section consists of one travel lane in each direction with a bicycle lane and parallel on-street parking on both sides of the street. This configuration reflects the mostly residential and civic character of the eastern end of Main Street, compared with the commercial character west of Washington Street. Where feasible, curb extensions at intersections and continental style crosswalk markings provide improved and shortened pedestrian crossings.

Figure 27. Main Street East of Washington Street (Looking West)

Other Recommended Improvements

To improve pedestrian and bicycle access to the study area from the downtown areas north of Broadway Street, it is recommended to investigate the potential for crosswalk improvements along Broadway Street, including adding curb extensions, adding additional crosswalks, adding flashers, and adding pedestrian/bicyclist activated signals.

The total net loss of on-street parking spaces that would be impacted with the recommended improvements is approximately 24 spaces. In order to maintain or increase the number of on-street parking spaces in the commercial areas of downtown, some streets currently offering parallel parking could be converted to angled spaces with limited roadway modifications. For example, extra wide sidewalks are located on both sides of Pattee Street from Broadway Street to Front Street ranging from 12 feet to 15 feet. By reducing the sidewalk to a more standard width and widening the paved roadway, angled parking could be accommodated on one side of the road. This and other options to increase the overall number of parking spaces within the study area, including a proposed new parking lot on Front Street near its intersection with Orange Street, are listed in Table 14These parking modifications would need to be coordinated with pedestrian and bicycle improvements as well as nearby developments during design.

Table 14. Parking Improvements

Block	Recommended Parking Improvements	Approximate Number of Additional Spaces
300 W Front Street	West of new Front Street Alignment – New Public Parking Lot	16
200 E Front Street	Replace parallel parking on north side of Front St. with angled parking	10
300 to 500 E Front Street	Remove parking on the south side and add angled parking on north side	30
400 to 500 E Main Street	Remove parking on the south side and add angled parking on north side	20
100 N Pattee Street	Decrease sidewalk width on west side and replace parallel parking with angled parking	14
Total		90

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8. FUTURE CONDITION TRAFFIC FORECASTING

The Missoula travel demand model data banks were used to calculate a growth rate to apply to the existing traffic volume. The growth rate was calculated by determining the amount of entering vehicles in the study area using each of the AM and PM existing and 2040 data banks. The worst case growth rate was 39%, which was then applied to the existing volumes. If calculated using a compound annual growth over 30 years, the percentage would be 1.1% per year growth. Results of the two-way conditions LOS analysis are summarized in **Error! Reference source not found.** and Table 16. The LOS calculations re provided in Appendix B. Bold values represent failing intersections. For the new intersections at Front and Main streets and at Madison Street, both unsignalized and signalized alternatives were analyzed. By 2040, both new intersections will most likely be signalized because of the increased traffic volumes. No other channelization changes were assumed between the existing and future conditions.

Table 15. 2040 Two-Way AM and Midday Peak Hour Summary

Intersection	Control Type[1]	Two-Way Conditions (2040)			
		AM Peak Hour		NN Peak Hour	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	**>110**	**F**	**80.8**	**F**
Orange St./Front St.	Signal	**63.4**	**E**	49.6	D
Broadway St./Higgins Ave.	Signal	14.5	B	26.2	C
Main St./Higgins Ave.	Signal	11.1	B	14.5	B
Front St./Higgins Ave.	Signal	15.7	B	19.6	B
Broadway St./Adams St.	TWSC	13.9	B	12.1	B
Main St./Adams St.	TWSC	10.1	B	11.4	B
Front St./Adams St.	OWSC	9.2	A	10.3	B
Broadway St./Madison St.	Signal	58.4	E	52.4	D
Main St./Madison St.	OWSC	19.8	C	13.7	B
Front St./Madison St.	TWSC	**>110**	**F**	**>110**	**F**
Front St./Madison St.	Signal	8.3	A	12.6	B
Front St./Main St.	OWSC	13.1	B	**44.9**	**E**
Front St./Main St.	Signal	21.4	C	19.9	B

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections

Table 16. 2040 Two-Way PM and Weekend Peak Hour Summary

Intersection	Control Type[1]	Two-Way Conditions (2040)			
		PM Peak Hour		WE Peak Hour	
		Control Delay/Veh[2]	LOS[3]	Control Delay/Veh[2]	LOS[3]
Orange St./Broadway St.	Signal	**>110**	**F**	**75.9**	**E**
Orange St./Front St.	Signal	**105.1**	**F**	28.4	C
Broadway St./Higgins Ave.	Signal	**89.3**	**F**	**64.6**	**E**
Main St./Higgins Ave.	Signal	25.0	C	19.4	B
Front St./Higgins Ave.	Signal	37.4	D	22.3	C
Broadway St./Adams St.	TWSC	24.8	C	32.6	D
Main St./Adams St.	TWSC	11.8	B	10.9	B
Front St./Adams St.	OWSC	10.5	B	9.2	A
Broadway St./Madison St.	Signal	**79.9**	**E**	**62.4**	**E**
Main St./Madison St.	OWSC	15.3	C	12.2	B
Front St./Madison St.	TWSC	**>110**	**F**	**>110**	**F**
Front St./Madison St.	Signal	11.2	B	10.4	B
Front St./Main St.	OWSC	**43.6**	**E**	30.7	D
Front St./Main St.	Signal	22.5	C	13.2	B

Notes
1. OWSC = One-way stop controlled intersection. TWSC = Two-way stop controlled intersection. AWSC = All-way stop controlled intersection. Signal = Signalized intersection. Yield = Yield controlled intersection. Unsignalized and signalized intersections were analyzed using Synchro.
2. Control delay, measured in seconds per vehicle, is a measure of all the delay contributable to traffic control measures, such as traffic signals or stop signs.
3. LOS is the level of service, a concept based on the 2000 Highway Capacity Manual for unsignalized and signalized intersections.

9. FUNDING SOURCES

A variety of funding mechanisms were identified that may be available to assist with the costs associated with the conversion from one-way to two-way streets. Potential funding sources exist at the federal level down to the local level and are described below. Depending on the scope of the project and location, the funding sources identified below may be available to fund all or part of these improvements.

Federal Funds

Because both Front and Main streets are routes that are partially included in the State's urban highway system, they are eligible, at least in part, for federal funding. The use of federal aid funds in any metropolitan area (i.e., population greater than 50,000) requires that the project be approved by the MPO, and the project must be included in the Transportation Plan and Transportation Improvement Program (TIP). North Orange Street (US 93 Business), North Higgins Avenue, and Madison Street (US 12) are all federal aid-eligible routes and the intersections of these routes with Front and Main streets are eligible for federal aid funding. Front Street between Ryman and Madison streets (and further east to Van Buren Street) is designated an Urban Route and is eligible for federal aid funding. Additionally, Main Street between Orange and Jefferson streets, is also included in the federal aid urban system and eligible for federal aid funding.

National Highway Performance Program (NHPP)

The National Highway Performance Program (NHPP) provides funding for the National Highway System, including the Interstate System and National Highways system roads and bridges. The purpose of the National Highway System (NHS) is to provide an interconnected system of principal arterial routes which will serve major population centers, international border crossings, intermodal transportation facilities and other major travel destinations; meet national defense requirement; and serve interstate and interregional travel. The National Highway System includes all Interstate routes, a large percentage of urban and rural principal arterials, the defense strategic highway network, and strategic highway connectors.

Allocations and Matching Requirements

NHPP funds are Federally-apportioned to Montana and allocated to Districts by the Montana Transportation Commission (MTC) based on system performance. The MTC establishes priorities for the use of NHPP funds.

Eligibility and Planning Considerations

Activities eligible for the National Highway System funding include construction, reconstruction, resurfacing, restoration, and rehabilitation of segments of the NHS roadway; construction, replacement, rehabilitation, preservation and protection of bridges on the National Highway System; and projects or part of a program supporting national goals for improving infrastructure condition, safety, mobility, or freight movements on the National Highway System. Operational improvements as well as highway safety improvements are also eligible. Other miscellaneous activities that may qualify for NHS funding include bikeways and pedestrian walkways, environmental mitigation, restoration and pollution control, infrastructure based intelligent transportation systems, traffic and traveler monitoring and control, and construction of intra or inter-city bus terminals serving the National Highway System. The Transportation Commission establishes priorities for the use of National Highway Performance Program funds and projects are let through a competitive bidding process.

The Federal share for non-Interstate NHS projects is 86.58% and the State is responsible for the remaining 13.42%. The State share is funded through the Highway State Special Revenue Account.

North Orange Street (US 93 Business) and Madison Street (US 12) are NHS routes. Given the estimated planning-level costs for Missoula District National Highway System priorities already under development, NHPP funding for improvements in this study is unlikely over the short term.

Surface Transportation Program (STP)

Surface Transportation Program (STP) funds are Federally-apportioned to Montana and allocated by the Montana Transportation Commission to various programs including the Surface Transportation Program Primary Highways (STPP)*, Surface Transportation Program Secondary Highways (STPS)* and the Surface Transportation Program Urban Highways (STPU).* The Federal share for these projects is 86.58% with the non-Federal share typically funded through Highway State Special Revenue (HSSR).

**State funding programs developed to distribute Federal funding within Montana.*

Urban Highway System (STPU)

The Federal and state funds available under this program are used to finance transportation projects on Montana's Urban Highway System, as per MCA 60-3-211. STPU allocations are based on a per capita distribution and are recalculated each decade following the census. STPU funds are primarily used for resurfacing, rehabilitation or reconstruction of existing facilities; operational improvements; bicycle facilities; pedestrian walkways and carpool projects.

Allocations and Matching Requirements

State law guides the allocation of Urban funds to projects on the Urban Highway System in Montana's urban areas (population of 5,000 or greater) through a statutory formula based on each area's population compared to the total population in all urban areas. Of the total received, 86.58% is Federal and 13.42% is non-Federal match typically provided from the Special State Revenue Account for highway projects.

Montana's urban areas are as follows:

Anaconda	Columbia Falls	Helena	Miles City
Belgrade	Glendive	Kalispell	Missoula
Billings	Great Falls	Laurel	Sidney
Bozeman	Hamilton	Lewistown	Whitefish
Butte	Havre	Livingston	

Eligibility and Planning Considerations

Urban funds are used primarily for major street construction, reconstruction, and traffic operation projects on the 430 miles on the State-designated Urban Highway System, but can also be used for any project that is eligible for STP under Title 23 U.S. C. Priorities for the use of Urban funds are established at the local level through local planning processes with final approval by the Transportation Commission.

Higgins Avenue as well as portions of Front Street and Main Street are designated as urban routes. It should be noted Missoula's STPU funds are prioritized until the completion of Russell Street.

Congestion Mitigation and Air Quality Program (CMAQ)

Federal funds available under this program are used to finance transportation projects and programs to help improve air quality and meet the requirements of the Clean Air Act. Montana's air pollution problems are attributed to carbon monoxide (CO) and particulate matter (PM10 and PM2.5).

Allocations and Matching Requirements

CMAQ funds are Federally-apportioned to Montana and allocated to various eligible programs by formula and by the Commission. As a minimum apportionment state a Federally-required distribution of CMAQ

funds goes to projects in Missoula since it was Montana's only designated and classified air quality non-attainment area. The remaining, non-formula funds, referred to as "flexible CMAQ" is primarily directed to areas of the state with emerging air quality issues through various state programs. The Transportation Commission approves and awards both formula and non-formula projects on MDT right-of-way. Infrastructure and capital equipment projects are let through a competitive bidding process. Of the total funding received, 86.58% is Federal and 13.42% is non-Federal match provided by the state for projects on state highways and local governments for local projects.

Eligibility and Planning Considerations
In general, eligible activities include transit improvements, traffic signal synchronization, bicycle pedestrian projects, intersection improvements, travel demand management strategies, traffic flow improvements, air quality equipment purchases, and public fleet conversions to cleaner fuels. At the project level, the use of CMAQ funds is not constrained to a particular system (i.e. Primary, Urban, and NHS). A requirement for the use of these funds is the estimation of the reduction in pollutants resulting from implementing the program/project. These estimates are reported yearly to FHWA.

CMAQ (formula) – Mandatory CMAQ funds that come to Montana based on a Federal formula and are directed to Missoula, Montana's only classified, moderate CO non-attainment area. Projects are prioritized through the Missoula Metropolitan planning process.

Transportation Alternatives Program (TA)

The Transportation Alternatives Program (TA) requires MDT to obligate 50% of the funds within the state based on population, using a competitive process, while the other 50% may be obligated in any area of the state. The Federal share for these projects is 86.58, with the non-Federal share funded by the project sponsor through the HSSR.

- Funds may be obligated for projects submitted by:
- Local governments
- Transit agencies
- Natural resource or public land agencies
- School district, schools, or local education authority
- Tribal governments
- Other local government entities with responsibility for recreational trails for eligible use of these funds.

Eligibility and Planning Considerations
Eligible categories include:

- On-road and off-road trail facilities for pedestrians and bicyclists, including ADA improvements;
- Historic Preservation and rehabilitation of transportation facilities;
- Archeological activities relating to impacts for a transportation project;
- Any environmental mitigation activity, including prevention and abatement to address highway related stormwater runoff and to reduce vehicle/animal collisions including habitat connectivity;
- Turnouts, overlooks, and viewing areas;
- Conversion/use of abandoned railroad corridors for trails for non-motorized users;
- Inventory, control, and removal of outdoor advertising;
- Vegetation management in transportation right of way for safety, erosion control, and controlling invasive species;
- Construction, maintenance, and restoration of trails and development and rehabilitation of trailside and trailhead facilities;

- Development and dissemination of publications and operation of trail safety and trail environmental protection programs;
- Educations funds for publications, monitoring, and patrol programs and for trail-related training;
- Planning, design, and construction of projects that will substantially improve the ability of students to walk and bicycle to school; and
- Non-infrastructure-related activities to encourage walking and bicycling to school, including public awareness campaigns, outreach to press and community leaders, traffic education and enforcement school vicinities, student sessions on bicycle and pedestrian safety, health, and environment, and funding for training.

Competitive Process

The State and any Metropolitan Planning Organizations required to obligate Transportation Alternative funds must develop a competitive process to allow eligible applicants an opportunity to submit projects for funding. MDT's process emphasizes safety, ADA, relationships to State and community planning efforts, existing community facilities, and project readiness.

Congressional Directed or Discretionary Funds

Congressionally Directed funds may be received through either highway program authorization or annual appropriations processes. These funds are generally described as "demonstration" or "earmark" funds. Discretionary funds are typically awarded through a Federal application process or Congressional direction. If a local sponsored project receives these types of funds, MDT will administer the funds in accordance with the Montana Transportation Commission Policy #5 – "Policy resolution regarding Congressionally directed funding: including Demonstration Projects, High Priority Projects, and Project Earmarks."

Community Development Block Grants

Community Development Block Grants (CDBG) grants are funds that come from the U.S. Department of Housing and Urban Development (HUD) for the purpose of community revitalization through housing, economic development, and infrastructure improvement programs that serve the interests of low income or moderate income people.

State Funds

Treasure State Endowment Program (TSEP)

The Treasure State Endowment Program (TSEP) is a state funded program overseen by the Montana Department of Commerce with a goal of assisting local governments with lowering the cost of constructing public improvement and infrastructure projects. This program allocates roughly $25 million annually in funding for construction and preliminary engineering grants to communities. Improvements to storm sewer systems are among the types of projects eligible for funding under this program. Construction grants are limited to a maximum of $750,000 and a one-to-one match is required (matching funds can be public or private). This funding source may be an option to assist funding storm inlet upgrades within the study area.

State Gas Tax Allocations

All fuel sold in Montana and used on the public roadways is taxed $0.27 per gallon. The tax is collected by MDT, and a portion of the funds are distributed to counties, cities and towns, and consolidated city-county governments using a formula based on road mileage, population, and land area (MCA 15-70-101). The City of Missoula in Fiscal Year 2015 will receive $982,213 in the distribution. These funds are designated for construction, maintenance, and repair of city streets or alleys.

State of Montana Grants

The 2015 Legislative session will be reviewing funding legislation aimed at improving infrastructure. The Governor has proposed a $300 million infrastructure program aimed at producing jobs, improving the economy, and helping communities improve their aging infrastructure. It is likely that street improvements, sidewalks, signals, and signage will be included in that legislation.

Local Funds

Local funding options could include funds from the City of Missoula, Missoula County, or private sources, as described below.

Special Improvement Districts

Special Improvement Districts (SIDs) are created by action of the City Council. The city governing body has the authority (MCA 7-12-4102) to create SIDs for the construction of roads, hydraulic features, sidewalks, plantings, and parking facilities. The city government has the authority (MCA 7-12-4301) to also create SIDs for the purpose of lighting projects on streets or public highways.

Debt Financing

Various types of debt financing are available to meet the needs of the roadways and include general obligation bonds, revenue bonds, or special improvement district bonds. The purpose of debt financing is to allow infrastructure improvements to be done using a future revenue stream that might come from user fees, special assessments, or identified sources of future revenue. Debt financing often allows the entity to take advantage of low interest rates, low construction or materials costs for needs that require immediate attention.

Grants

Department of Commerce grants, including Economic Development Grants, are aimed at supporting local government efforts to partner with private industry and attract private investment to revitalize regions and local communities. These grants require an application process and are awarded on a competitive basis.

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10. SUMMARY AND CONCLUSIONS

The feasibility study began with establishing several criteria that required consideration in advance of making a recommendation. Those criteria included advancing safety for all forms of transportation, maintaining the current LOS at all intersections with MDT routes, and minimizing parking and right-of-way impacts. Through the feasibility analyses of the proposed two-way conversion, the following conclusions were determined:

- The traffic analysis demonstrated that **operations and LOS will not be negatively impacted at any of the study area intersections**. Impacts to Broadway Street intersections adjacent to the study area were also determined to be negligible.
- The economic analysis determined that **a short-term benefit in sales of approximately 10% to 13% for downtown retailers could be expected** from the conversion.
- The **air quality analysis** demonstrated that the conversion to two-way traffic operations would not have an appreciable effect on regional emission levels.
- The parking analysis found that **only a minor amount of parking spaces would be impacted by the recommended improvements**. Options to gain parking in select locations should be examined during final design.
- The recommended improvements can be made with **minimal impact to private property**.
- The recommended improvements would **greatly enhance safety for pedestrians and bicyclists** through increased visibility at intersections and shortening crossing distances.
- The recommended improvements would **enhance the bikeway system** by creating logical connections to and throughout the downtown area.

Overall, the study shows that a two-way conversion is a feasible option for Front and Main streets in downtown Missoula. The cost estimates provide an “order of magnitude” estimate for the various components of the improvement options, which could be implemented in a phased approach depending on funding availability.

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