

Executive Summary

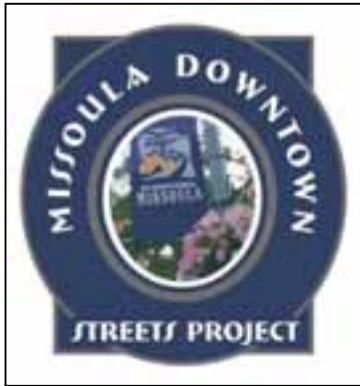
MISSOULA DOWNTOWN STREETS PROJECT

PLANNING CIVIC INFRASTRUCTURE FOR A VITAL DOWNTOWN



March 2005





PART I – LONG TERM PLAN AND RECOMMENDATIONS

The Downtown Streets Project plan will facilitate improvements downtown by providing improved pedestrian-oriented street lighting and pedestrian amenities, revised traffic patterns that improve access and circulation, and additional on-street

parking through reorganization. Revising the antiquated traffic pattern downtown will improve access and convenience for customers. Of major consequence to the project is the community's desire to eliminate the one-way streets on Front and Main that restrict circulation and cause significant out-of-the-way travel. Converting these streets back to two-way streets and opening up both ends will improve access to downtown businesses. The major objectives of the plan include:

- Providing a high-quality pedestrian environment
- Improving traffic flow, access, and circulation to downtown
- Providing additional on-street parking
- Creating an inviting streetscape and festival atmosphere
- Establishing downtown as a high-quality place, inviting additional investment in redevelopment

This plan provides a template for redevelopment of the street front, as well as an analysis of the traffic flow and circulation downtown. The plan includes a strategy for implementing revisions to the traffic flow and the streetscape. In addition, the plan seeks to brand downtown as an inviting streetscape and festival atmosphere, attractive to local residents and tourists alike.

Recommendations

Although current street infrastructure downtown is adequate, enhancement opportunities are desired by the community and the feedback helped to identify and prioritize the enhancements. Implementation will be a long-term process, with an on-going community discussion of funding and priorities.

Traffic Circulation Plan

This plan shows the importance of Front Street in accommodating circulation to central downtown along the river. To fully recognize the benefits of this plan, Front Street should provide two-way traffic flow. This necessitates eliminating the one-way couplet that currently exists on Front and Main Street. This configuration greatly facilitates access to the downtown from the University of Montana, a major trip generator for the downtown.

Street Width Guidelines

The plan provides guidelines for street widths downtown. Parking configuration and lane usage is determined by existing street classification and curb-to-curb width. Bike lanes are provided, where possible, on collector and arterial streets. Maximizing on-street parking is critical. Parking streets can have either diagonal or parallel parking, depending on curb-to-curb width, with care taken not to compromise sidewalk width to accommodate diagonal parking. Parking, which creates site obstructions for pedestrians, can be mitigated with bulb outs at the corners.

Sidewalk Width Guidelines

Required sidewalk width downtown is governed by the adjacent land use and the potential uses on the sidewalk. Existing sidewalks are 12 to 16 feet wide. New sidewalks should be as wide as possible to accommodate intended uses. Urban sidewalks generally have three zones. The Building Frontage Zone, beginning at the building wall, needs to be wide enough to accommodate intended uses. If sidewalk tables are desired, this zone should be a minimum 6 to 8 feet wide for a single row of tables. Cover the zone with awnings or overhead structures for protection against weather and to create a room on the sidewalk. The Pedestrian Travel Zone should be a minimum of 6 feet wide, with a preferred width of 8 feet. It should be free of obstructions that hinder pedestrians walking side by side. The travel zone can be partially covered to accommodate pedestrian comfort. The Fixtures/Planting Zone, or curbside zone, should be wide enough to accommodate parking meters, trees and landscaping, seating areas, bus stops, and bicycle parking, where necessary.

Streetscaping Elements

The public expressed a strong desire to see streetscaping elements incorporated into the downtown. In general, simplicity and functionality are desirable outcomes. Recommended streetscaping elements include:

- Pedestrian scale lighting
- Corner bulb outs
- Bollards
- Benches
- Street Trees
- Pots for seasonal flowers and plants
- Interesting and unique Paving surfaces and materials

Ideally, the entire downtown will be reconstructed with these elements to create a uniquely enticing and attractive environment. A high-quality downtown environment will encourage future reinvestment.

Street Lighting

New street lighting for the sidewalks and streets is critical for rejuvenating downtown. The Public expressed a strong desire for historic streetlights that are "night sky" friendly—optics in the fixture project light downward, reducing light spill over and broadcast. The existing streetlights, which are likely over 40 years old, are leased from the power company, with charges assessed to downtown land owners. The assessments include operation and maintenance costs. Although it varies by district, the lease charge constitutes approximately 55 percent of the monthly charge. The lights on Higgins light the street well but do a poor job of lighting the sidewalks. Many other streets are very poorly lit. This is an important issue and recommendation for public safety. The City should embark on enhancing the lighting downtown.

Identified Projects

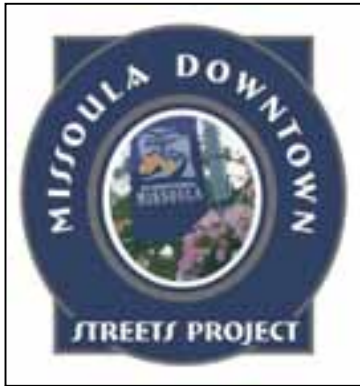
Extensive public involvement resulted in a list of priority projects chosen by the community for implementation. The first two are the community's highest priority projects. The remaining projects are not listed in any particular order.

1 Streetscape Higgins North of Broadway

The Missoula community identified the area on Higgins north of Broadway as a desirable location to stimulate existing businesses. In addition, revisions to existing traffic lanes will provide 30 to 40 new parking spaces in this three-block area.

2 Convert Front and Main to Two-Way Streets

The existing one-way street configuration on Front and Main significantly hinders access to many businesses on these streets. The community recommends converting these streets back to two-way streets. This change would have a positive impact on access and circulation downtown. The change would require modifications at the Madison Street and Orange Street intersections to accommodate two-way traffic flow. In modifying the lane configurations on Front Street, it is possible to eliminate one lane of traffic to convert to diagonal parking. The increase in diagonal parking can enhance adjacent retail and commercial uses on Front Street. Conversion should include bulb outs in residential areas to improve pedestrian safety.



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Pine Street Art Walk

Create a streetscape along Pine Street, connecting the Art Museum with the Transit Center. Establish a linked series of public

art pieces along this route.

Streetscape “Hip Strip” Neighborhood

Streetscape the Hip Strip neighborhood on Higgins Avenue south of the river. Remove the existing median and reconfigure the 3rd Street intersection to accommodate full access. To accomplish this, it is necessary to modify the sidewalk and rail on the south end of the Higgins Avenue Bridge to provide adequate stopping site distance for entering vehicles.

Create a Blues Alley Entertainment District

The alley behind the Florence Building presents a unique opportunity to create a beneficial enhancement to the downtown as a quality entertainment district. The existing cluster of land uses in and adjacent to this alley provides the opportunity. Lighting, seating areas, planters, and screening will enhance the alley as a place to walk and spend time. This concept, coined “Blues Alley,” was presented as an idea by the landowners. To implement this idea, a special zoning overlay can be created to accommodate alcohol usage, vehicle access, and law enforcement.

Create a Gateway to Caras Park

The driveway access to Caras Park parking on Front Street can be enhanced to create a gateway to the park. The gateway can include elements from the Carousel (ponies) to provide a visual way-finding cue to visitors as the entrance to the park. The gateway becomes public art and part of the streetscape.

Residential Neighborhood Enhancements

The residential role of downtown is vital and should be acknowledged and encouraged. Infrastructure enhancements in the residential areas should include streetscaping elements to improve walking conditions. Pedestrian-scale lighting should be provided to enhance safety and aesthetics. The lighting should be sensitive to the historic context of these neighborhoods, as well as designed to reduce light intrusion and glare into residential windows by providing photometrics that project light down the sidewalk.

Alder Street Access Enhancement & Streetscape

Alder Street in the north of downtown has good potential for continued redevelopment. It is recommended that a left-turn lane be added on Orange Street to accommodate left turns into Alder from southbound Orange Street.

Bicycle Parking

Bike parking is generally accommodated with the City’s standard bicycle rack. Historically racks were placed in the 3-foot curbside zone, which proved too close to the curb where parked vehicles frequently damaged bikes. The bike racks were moved away from the curbside zone and now often encroach on the walking area. This net reduction in walking zone is undesirable. Standard streetscaping should provide a minimum 5-foot curbside zone where possible. This allows bike parking appropriately in the curbside zone with room to prevent damage from vehicle overhang. On-street parking for bikes should be included where applicable. On-street bike parking can be accommodated easily when incorporated adjacent to corner bulb outs.

Bike Lanes

City of Missoula guidelines provide for on-street bike lanes on arterial and collector streets when the width accommodates the lanes. Bikes ride with traffic on residential and parking streets where vehicle speeds and volumes are low. The same guidelines hold true downtown. Under this plan, bike lanes should be provided on Spruce and Front Streets, the east-west collector streets. When these streets are reconfigured, include bike lanes where the width accommodates the addition.

Bus Stops

Bus Stops downtown should be easily identifiable with a minimum of signing. Patron accommodations should include, at a minimum, a bench and an unobstructed loading area that accommodates ADA requirements for accessibility. Higher use stop locations should include a shelter, if space exists. Shelters can be functional sculpture to contribute to a unique and interesting streetscape. In general, locate bus stops at the far (departure) side of signalized intersections in the core downtown area. The signal stops traffic periodically, allowing the bus time to stop and pull back into traffic. Where two lanes of traffic in one direction are available on the street, the bus stop can be configured to allow the bus to stop traffic in the outside lane while loading. Where one lane of traffic is provided, adequate width should be provided to allow the stop to occur without stopping traffic.

Diagonal Parking

Much community discussion occurred on the subject of on-street diagonal parking in downtown. Diagonal parking is convenient and provides twice the number of parking spaces when compared to parallel parking. Where the street width allows, parallel spaces can be converted to diagonal spaces with very little impact to adjacent properties. However, diagonal spaces restrict visibility to the pedestrian attempting to cross at the intersection. This results in a less pedestrian friendly environment, which is counter to the intent of this plan. It is recommended that bulb outs be required with the conversion of parallel parking to diagonal parking. Bulb outs shorten the pedestrian crossing distance and provide the pedestrian and motorist with improved visibility.

The public suggested back-in diagonal parking as a way to improve safety for bicyclists and motorists. Benefits and experiences with diagonal parking were researched as part of the study. The information was presented to the public for comment and discussion. People clearly see the advantages of improved visibility and passenger loading. Numerous individuals expressed concern about the ability of drivers to back into the parking space. The community should continue to explore this idea by accommodating both pull-in and back in parking until such a time as the community is ready for a change to back in diagonal parking. The authority to affect this change ultimately lies with the parking commission with input from the City.

Three Lanes vs. Four Lanes

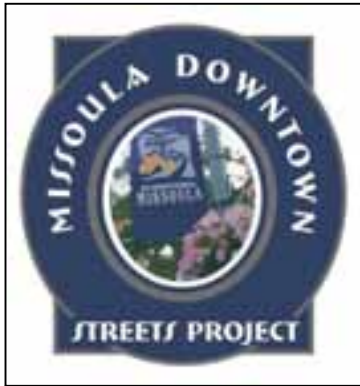
The discussion of three-lane and four-lane streets was extensive during the public involvement for this project. The community developed strong opinions about this because of a perceived reduction in capacity with a conversion from four lanes to three lanes.

Connect the Riverfront Trail

The public expressed a strong desire to see connections between the riverfront trail system and the street system in downtown. Connections should be explored at Madison Street on both sides of the river to accommodate this connection. The trail system should also be connected to Front Street along the Owen Street right of way at the old Fox Theater site. Connections to Orange Street can facilitate pedestrian movement to the trail.

Higgins Ave. Bridge Rail, Walkway, & Lights

Improve the existing walkway on the Higgins Avenue Bridge with wider sidewalks, new lights, and a new, aesthetic and safe bridge rail.



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Structured Parking

Additional, strategically placed, structured parking will increase the supply and reduce the demand for surface parking spaces. This will encourage redevelopment of existing downtown surface lots. The locations of structured parking should be dispersed throughout downtown. The existing parking structures provide good

support for the core downtown area along Higgins Avenue. Providing public structure parking at the Riverfront Triangle site will support redevelopment of that area. The City should also work on a long-term plan to develop a parking structure on the north side. This structure should be within 1,000 feet (walking distance) of the core retail area of North Higgins. The issue of parking south of the river was brought up several times in public discussions. This area is currently not included in the downtown parking district. The City should consider working with this neighborhood to evaluate the support for expanding the downtown district to include this area.

Parking Signing

The community perception of a shortage of parking downtown is likely based on a lack of awareness of parking locations and availability rather than on supply. The Parking Commission should consider a parking signage program to place simple, easy to understand signs guiding shoppers and visitors to parking.

Enhance Traffic Signals

The least sexy recommendation is to enhance the downtown traffic signals by installing vehicle and pedestrian detection equipment and pedestrian countdown timers. While lackluster at first blush, our traffic modeling shows dramatic improvement in traffic operations downtown by installing traffic detection.

Pedestrian Traffic Signal Enhancements

The countdown timer on the corner of Higgins and Spruce received positive feedback from the community. Incorporate countdown timers on all signals as a benefit to pedestrians. Community feedback identified the pedestrian crossings and the operation of the traffic signals on Higgins Avenue south of the river as being pedestrian unfriendly. It is recommended that all signals in the downtown be operated with a pedestrian recall phase. This means that the "Walk" indication comes on concurrently with the green light indication on the roadway, regardless of whether a pedestrian pushed the signal button. Incorporating the pedestrian recall phase will enhance the pedestrian service level at the signalized intersections in downtown.

Implementation

MRA URD I Sunset.

The Missoula Redevelopment Agency (MRA) has expressed a desire to leave the downtown with a small streetscaping project to serve as an example for future projects. The North Higgins project was selected as providing the best project to enhance existing businesses, encourage continued redevelopment, and provide a substantial increase in on-street parking.

Parking Commission Participation

The addition of on-street parking in the downtown is a real benefit to existing business and encouragement to redevelopment. A continued partnership with the Parking Commission is a key component to implementation of this plan. The Parking Commission may want to consider a series of on-going projects to provide bulb outs and streetscaping, as required, to convert existing parallel spaces to diagonal parking spaces with a net gain in parking of nearly two-to-one.

Redevelopment Projects

As the downtown continues to redevelop, businesses are encouraged to consider streetscaping their frontage to create and enhance the downtown market place. The frontage improvements are an investment that will provide a return in increased occupancy and reduced occupant turnover. The enhanced appearance of the street will encourage additional investment in redevelopment, which will benefit long-term lease rates.

Special Improvement Districts

One method of funding for these projects is for a group of landowners to get together and form a special improvement district (SID, as allowed by state law. Costs of the improvements are distributed to the property owners and an assessment is made to the property. The assessment can be paid up front or over a period of 12 to 20 years, depending on the bonds used to finance the improvements. Market interest rates for the financing have typically been about six percent (2005). Rates will vary with current market interest rates.

City Sidewalk Assessment Program

The City has a sidewalk assessment program for replacement of sidewalks and sidewalk safety improvements. Many streetscaping elements are clearly pedestrian safety enhancements and could be eligible for this program. This methodology allows individual properties to provide for improvements without forming a district or requiring neighbors to participate.

Street Lighting Districts

The downtown street lights are likely 30 to 40 years old. The existing poles are leased from Northwestern Energy Company, with lease costs paid by property owners through a Street Lighting District assessment. Maintenance and operation of the lights are also paid for by the assessment. New streetlights could be placed downtown and paid for through a 20-year SID. A new street lighting district could be formed for the maintenance and operation of the lights. This financing would allow for the eventual payoff of the capital cost of the lights, eliminating the perpetual lease.

Regulatory Support

Providing the infrastructure to support the desired outcomes is a first important step to revitalizing the downtown. Additional work is required to provide regulatory support for the proposals contained in this report. Done well, the regulatory environment can be structured in a way to create incentives and encourage these desirable outcomes.

Private Use of Public Right of Way

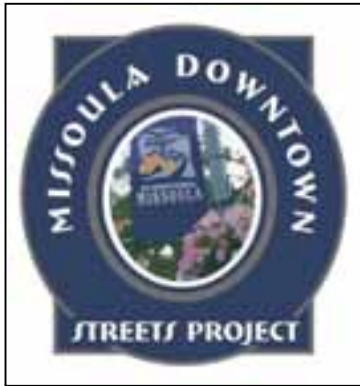
Private use of the public right of way is not generally allowed or encouraged in the City of Missoula. Missoula's downtown, however, should be considered a unique exception. In general, the downtown buildings have no setback from the property line and, therefore, no "front yard." To encourage activity on the sidewalk downtown, it is desirable to allow retail and dining to occur on the sidewalk. It is recommended that the City undertake a simple permitting process to formalize these uses. Permitting should allow for placement of semi-fixed (removable) barriers that provide a positive separation of sidewalk business uses from sidewalk walking zones.

Accommodate Sidewalk Dinning

Sidewalk dinning is a highly desirable activity that should be encouraged downtown. To facilitate this, the City could provide assistance to businesses wishing to expand the use of their Cabaret or Liquor license to the sidewalk. The State of Montana is ultimately responsible for this licensing activity. The City can establish a program to assist businesses with this licensing process.

Blues Alley Special Overlay

A special overlay can be created to accommodate the Blues Alley concept outlined in this plan. An overlay establishes hours of use for deliveries, and vehicle access restrictions. Noise and law enforcement issues, as well as open container and liquor license issues can also be addressed.



PART II – STREETSCAPING GUIDELINES

The purpose of these guidelines is to help coordinate improvements downtown by providing opportunity and color for our downtown public spaces, streets, sidewalks, building facades, and landscaping. The guidelines provide a design context for consistency, as well as variation, in creating successful community spaces. As Missoula grows and changes, it becomes increasingly apparent that design guidelines are needed to allow the streetscape to adapt appropriately for the community, while at the same time promoting a mix of uses, including pedestrian, bicycle, automobile, and public transit. It is intended that implementation of these designs will serve to increase the appeal and viability of downtown Missoula by improving public safety, vitality, encouraging business growth and tax base, aesthetics, pride of place, community expression, and civic involvement.

Universal Principles

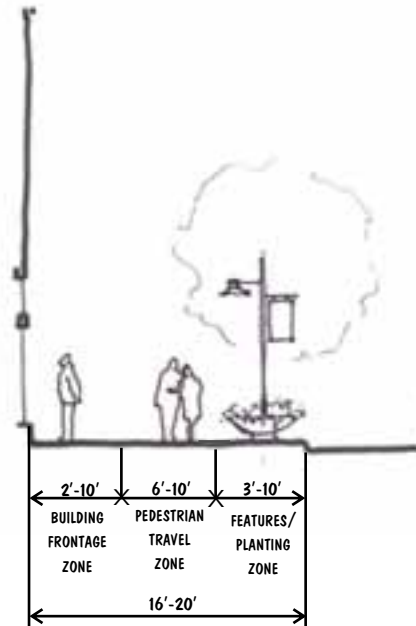
A study of the best streets in healthy, vibrant cities reveals numerous design principles common to nearly all.

Sidewalk Width

The sidewalk, a public right of way, is what makes the city accessible to all. The width and layout should allow people of all ages and abilities to move comfortably and safely at their own pace. If the typical Missoula sidewalk width of 16 feet were extended several feet, pedestrians, food carts, outdoor tables, benches, and trees could fit at intervals within that space and still allow comfortable pedestrian movement and flow. In addition, wider sidewalks encourage sidewalk dining. Restaurants that expand their boundaries by moving out to the street add tremendously to a vibrant outdoor scene downtown.

Downtown sidewalks should be wide enough to accommodate anticipated uses in each sidewalk zone. For comfortable activity, the Pedestrian Travel Zone should generally have a clear walking path 8 to 10 feet wide, with about 8 feet of height clearance. This imaginary pedestrian channel can weave in and out around activities on the sidewalk. An additional 2 feet minimum should be provided immediately adjacent to store windows to allow for viewing and sandwich-board signage, or an additional 4 feet minimum for dining tables. This is the Building Frontage Zone. The Features/Planting Zone, the space from the street trees to the curb for edge definition and separation from traffic, should be from

3 to 10 feet. These distances are provided as a guideline. Cross slopes meeting Americans with Disabilities Act (ADA) requirements are 2 percent, or 2½ inches in 10 feet.



Use of the Public Right-of Way

The use of city sidewalks for private purposes is a benefit to adjacent businesses and patrons, and contributes to the vibrancy downtown. Sidewalk cafes provide opportunities for watching people. The plan encourages outdoor dining and sidewalk cafes where appropriate.



Psychological/Physical Separation from Traffic

Separation of pedestrians from traffic is for safety and peace of mind. People are reluctant to use the sidewalk if they feel uncomfortable or unsafe. Visual or physical cues create a sense of security for pedestrians. Separation ideas include: changing materials and texture at the curb, parked cars, a line of street trees, plantings, large planter pots/urns, benches, bollards, and light poles/banners.

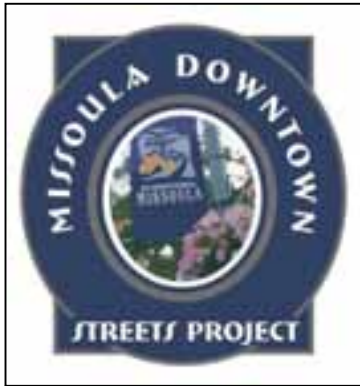


Define the Edges

Define the street's edges or boundaries to define the sidewalk space. Use the building line, the building height, walls, screens, trees, hedges, and sculptural elements. An appropriate ratio of street width to building wall height gives the street volume, definition, and a human scale. Along 100-foot-wide Higgins Avenue, a comfortable proportion allows for building heights between 30 and 80 feet. A strong tree line can provide edge definition when the height-to-width ratio is too small. Large gaps in the street wall, such as at-surface parking lots, can be remedied with a tree line.

Provide Texture, Variety, Light, and Shadow

Building surfaces contribute to visual appeal. However, when considering sidewalk surfaces only, trees, pots, benches, signage, lighting, and varying materials can also achieve a variety of depths, textures, and colors. Variety in this context is often more important than consistency. Again, street trees can provide considerable benefit for relatively little investment. The variegation in leaves, color, shape, shadow, movement, depth, and richness are impossible to duplicate with any man-made element.



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Occupy the Upper Floors

Although usually an economic consideration beyond the scope of the streetscape designer, the active and visible habitation of the floors above street level adds substantially to the positive social atmosphere of the street. Occupied

windows in apartments, hotels, and offices add eyes to the street, create a visual connection between people, and contribute to the safety, liveliness, and vitality of downtown. People living downtown dramatically change the feel of the street, making it safer, busier, and more comfortable. A street becomes successful when people support it. A critical mass of density is required to support a vibrant community. Increasing residential use is critical to a successful downtown. A residential downtown augments other uses and creates a twenty-four hour environment.

Building Transparency at the Street

The importance of transparency in the street-front façade cannot be over emphasized. Without visual connection between pedestrian and interior space, sidewalks seem cold and lifeless. People do not spend time on streets with blank walls, small punched window openings, or dark or mirrored glass where there is no connection between indoors and outdoors.

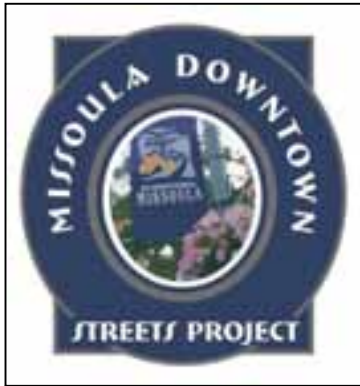


Design Guidelines

Design Guidelines are provided for:

- **Sidewalks**, including width, zone use, crossing distances, bulb outs, snow removal, bike parking accommodation, fixtures, and sidewalk materials and surfaces
- **Planting**, including trees, tree species, tree grates and trunk protectors, hanging baskets, planting materials, at-grade plantings, planting containers, trellises, buffer plantings, and watering
- **Seating**, including location, orientation, and style
- **Outdoor Tables**, including outdoor dining, location, enclosures, and overhead protection.
- **Sidewalk Lighting**, including lighting specifications and multiple functions
- **Public art**, including type and incorporation
- **Signage**, including informational and commercial
- **Bollards**, including purpose, type, and specifications
- **Bike Parking**, including racks, location, and on-street parking





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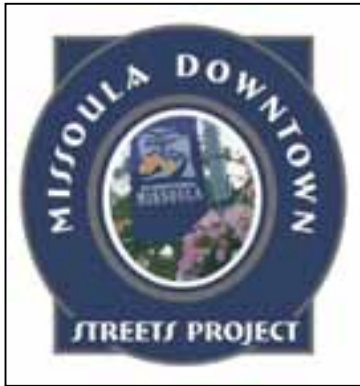


Streetscape Maintenance

Consider streetscaping projects in terms of future maintenance and care, as well as implementation. Materials need to be able to withstand weather and constant wear. A successful maintenance program is critical to the success of improvements. Maintenance includes the concrete and plant elements within the public right-of-way, from the curb inward to the building wall. This includes repair and maintenance of curbs and gutters, sidewalks, signage, furnishings, sidewalk lighting, and the planting, cultivating, and maintenance of trees and plantings.

Sidewalks must be cleaned regularly. Tripping hazards must be identified and repaired promptly. Conformity to ADA requirements must be maintained. Consider the impact of cleaning methods. Many materials and laying methods require time to cure and pavements to become impervious. Maintenance and upkeep of includes tree trimming, fertilizing, weeding, watering, plant care, and irrigation system repair and maintenance. Plantings must be monitored on a weekly basis for health, damage, cleaning, and correct watering. Irrigation must be adjusted according to weather variations and plant needs. Seasonal fertilization, pruning, and mulching are important to the vigor of the plantings. Hanging baskets without the installation of drip systems will require hand watering. Hose bibs should be located approximately every 100 feet along the sidewalks. Irrigation start-up and winterization will be required. Irrigation requires ongoing monitoring and adjustment. The visibility and energy of the crews are a reminder of the community's commitment to the Missoula downtown.





PART III – TRANSPORTATION PLANNING AND ANALYSIS

Traffic Study

Efficient and effective traffic operations are essential to access, circulation, and safety downtown. The Downtown Streets Traffic Study examines traffic operations and

travel in downtown Missoula to determine the conditions of traffic movements at various times, in various locations, and in conjunction with various alternatives. If downtown Missoula is to remain vibrant, adequate travel and circulation must be available. Traffic circulation in the downtown study area was analyzed in terms of the impact of various alternatives on current and future patterns.



Downtown Study Area

The area for the traffic study includes Higgins Avenue from Spruce to Brooks; Front Street from Orange to Madison; and Main Street from Orange to Madison. This area encompasses all streets for which improvements are under consideration.

Traffic Analysis

The traffic analysis of the study area addresses traffic volumes, vehicle routes, vehicle delay, intersection capacity and level of service, and traffic crashes. Pedestrian volumes at intersections and parking maneuvers near intersections, though not discussed in detail in this report, were taken into consideration in the analysis. Traffic conditions in the study area were analyzed, simulated, and animated through the use of a traffic model created specifically for this study. Synchro/SimTraffic software was used for the creation of this model.

Traffic Counts

Manual counts of traffic volume in the study area were completed in March 2004. During that time, the University of Montana was in session. Counts were conducted during the AM Peak Period, 7:00 to 9:00 AM, during which traffic volumes and delays are at their highest levels of the morning, and during the PM Peak Period, 4:00 to 6:00 PM, during which traffic volume and delays are at their highest levels of the afternoon/evening. Within each AM and PM Peak Period is a one-hour period of time when traffic volume and delay is highest, commonly referred to as the rush hour. The study area traffic counts were analyzed to determine the peak-hour traffic volume for both AM and PM periods at each intersection. A review of existing traffic volumes and conditions found the PM peak-hour traffic more critical, in terms of traffic operations, than the AM peak-hour traffic. Therefore, this study focuses on the PM peak-hour analysis.

Street Network Inventory

An inventory of the existing street network was conducted. The inventory includes the number of lanes and lane assignment at each intersection, the width of each lane, areas of allowed parking, traffic signal equipment and operations, and pertinent traffic control devices.

Measures of Effectiveness

Measures of Effectiveness (MOEs), various measurements used to compare traffic operations, including average vehicle speed, vehicle stops, delays, vehicle-hours of travel, vehicle-miles of travel, fuel consumption, and pollutant emissions, provide insight into the effects on the traffic stream of the applied improvement strategy. The MOEs used in the traffic study alternative analysis summary tables are defined as follows:

Number of Intersections

The number of key intersections analyzed in the street network, not necessarily the total number of intersections in the study area.

Cycle Length

The time it takes, in seconds, to complete one cycle of a traffic signal. Cycle length is equal to the sum of all the phase durations of a traffic signal. Although traffic signal phase durations may vary, the cycle length in each traffic analysis scenario is the same.

Total Delay per Vehicle

The average amount of time lost, as a result of traffic signals, stop signs, traffic queues, reduced traffic speeds, etc., by a vehicle driving through the street network. The lower the value, the better the network is operating.

Total Delay in the System

The combined total of “delay per vehicle” for all vehicles traveling in the street network during the entire analysis period (the PM peak hour). The lower the value, the better the network is operating.

Stops

The total number of times a vehicle has to stop, for example, at a stop sign, traffic signal, and for a queue, in the entire network during the analysis period (the PM peak hour). The lower the value, the better the network is operating.

Average Speed

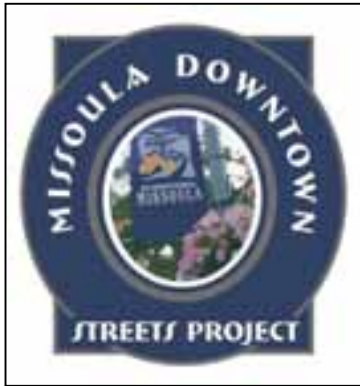
The average speed of a vehicle traveling in the street network. Speed includes time spent idling when stopped. Values near or slightly below the signed speed limit indicate good network operations.

Fuel Consumed

The total amount of fuel consumed by all vehicles in the street network during the analysis period (one hour). The lower the value, the more efficiently the network is operating.

CO Emissions

The amount of carbon monoxide emitted by vehicles in the entire network during the analysis period (one hour). The lower the value, the better the network is operating.



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Unserved Vehicles

The total number of vehicles in the network not served upon arrival by the first green phase of the traffic signal. Unserved vehicles wait through one or more green and red phases. The lower the value, the better the network is operating.

Performance Index (PI)

A quantitative measure of overall network performance. PI is a value derived from combining vehicle stop and delay values. The lower the PI, the better the network is operating.

Crash Analysis

Traffic crash data was reviewed to identify high-crash locations within the study area. The crash data was used to calculate crash rates for each signalized intersection. Crash rates above 3 or 4 are greater than the norm. The calculated rates at the Higgins Avenue intersections with Front, Main, Pine, and Spruce are significantly higher than the norm. Improvements to these locations will take into account the number and types of accidents that have occurred, and provide design solutions that improve intersection safety. The accident history at the Higgins Avenue intersections with Spruce, Pine, Front, and Main includes more than one pedestrian or bicycle related incident, accounting for six to ten percent of all accidents at these locations. Channelization and sidewalk improvements will improve pedestrian safety at these locations.

TRAFFIC CRASH RATES

Intersection Description	2004 PM Peak Hour Total Intersection Approach Volume	Calculated Intersection ADT	Average Accidents Per Year	Accidents Per Million Entering Vehicles
Brooks and Higgins	541	5410	6.8	3.4
6th and Higgins	569	5690	8.8	4.2
5th and Higgins	507	5070	7.0	3.8
4th and Higgins	422	4220	8.2	5.3
3rd and Higgins	381	3810	2.0	1.4
Front and Higgins	429	4290	13.6	8.7
Main and Higgins	309	3090	9.4	8.3
Broadway and Higgins	450	4500	7.4	4.5
Pine and Higgins	183	1830	4.2	6.3
Spruce and Higgins	215	2150	5.8	7.4
Orange/Front/Main	520	5200	9.2	4.8

Traffic Growth: A 20-Year Perspective

To confirm that all street configuration alternatives under consideration would continue to function effectively in the future, they were tested against traffic volume projections twenty years beyond an anticipated construction completion date. Based on an anticipated implementation date of 2005; traffic analyses for the years 2005 and 2025 were completed.

Traffic volume growth rates, developed for each street within the study area, were used to project traffic volumes for the years 2005 and 2025. Growth rates are based on information obtained from historic traffic counts dating back ten years, the transportation planning model developed by the Montana Department of Transportation (MDT) for the latest Missoula Transportation Plan Update, and local understanding of traffic trends in downtown Missoula. The resulting growth rates range from 0.4 to 2.0 percent per year, with an average growth of 0.8 percent per year.

In addition, traffic diversions, or deviations from current traffic patterns, were estimated for each street improvement scenario that added or restricted traffic movements at intersections. This resulted in a unique set of study area traffic volumes for each traffic analysis scenario.

Alternatives Analysis

A traffic analysis was conducted to determine the impact of a number of street improvement alternatives on traffic operations in downtown Missoula. The alternatives, described in detail in Part 1, include:

- No Action Alternative
- Optimized Signal Timing Alternative
- Three-Lane Higgins Alternative
- Three-Lane Higgins North of Broadway Alternative
- Two-Way Front & Main and Three-Lane Higgins Alternative
- Two-Way Front & Main and Three-Lane Higgins North of Broadway Alternative (Preferred Alternative)

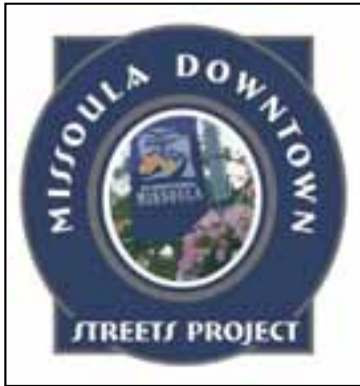
Each street improvement alternative was subjected to a detailed traffic analysis. An overview of each alternative analysis follows.

No-Action Alternative

These are the conditions that will exist if nothing is done to the existing street network and traffic grows at the rates anticipated by this study. A no-action alternative, meaning no improvements to the street network or traffic-signal timing are made, provides a benchmark against which the improvement alternatives can be compared.

Existing Streets with Optimized Signal-Timing Alternative

For this alternative, the phase lengths, or allocation of green signal time, at signalized intersections, and the offset between intersections (the time from one signal turning green to the next signal turning green in a coordinated signal system), were optimized to determine if the network traffic signals could



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operate more effectively without changing signal equipment or the signal phasing pattern. By comparing this alternative to the No-Build Alternative, and observing the Performance Index in particular, it is evident that significant improvements to overall traffic operations can be achieved through signal-timing optimization. For example, the LOS at the intersection of Higgins Avenue and Brooks Street can be dramatically improved in the 2005 PM peak hour from LOS D to LOS B.

Three-Lane Higgins Alternative

This alternative converts Higgins Avenue to three-lanes from north of 5th Street to Spruce Street (see Figure 3-4 for street lanage details). The existing turning restrictions at Higgins Avenue signalized intersections are eliminated, with the exception of the southbound left turn at 6th Street. Traffic signal equipment is upgraded at the Higgins Avenue intersections north of the river to allow for pedestrian- and traffic-actuated operation of the signals. These signals currently operate on a fixed-time routine. Comparison of this analysis to the No-Build Alternative analysis shows that moderate improvements in the MOEs would be realized in 2005, and that by 2025, there would be significant improvements over the no-action scenario.

Three-Lane Higgins North of Broadway Alternative

This alternative converts Higgins Avenue to a three-lane street from Broadway Avenue to Spruce Street. The rest of the study area is left unchanged (see Figure 3-4). Traffic signal equipment is upgraded at the Higgins Avenue intersections, from Broadway north to Spruce, to allow for pedestrian- and traffic-actuated operation of the signals. These signals currently operate on a fixed-time routine. Comparison of this analysis to the No-Build Alternative analysis demonstrates that significant improvements in the MOEs would be realized in both the 2005 and 2025 traffic scenarios. This alternative would also operate noticeably better than the Three-Lane Higgins Alternative.

Two-Way Front & Main plus Three-Lane Higgins Alternative

This alternative converts both Front Street and Main Street to two-way traffic from Orange to Madison. Traffic is still prohibited from entering the Orange Street intersection from Front Street. Higgins is converted to three-lanes without intersection turning movement restrictions from 5th Street to Spruce Street. Traffic signal equipment is upgraded at the Higgins Avenue intersections from Broadway to Spruce to allow for pedestrian- and traffic-actuated operation of the signals. These signals currently operate on a fixed-time routine. This alternative dramatically improves access in the downtown area and reduces out-of-direction travel caused by the current one-way system on Front and Main. Comparison of this alternative to the No-Build Alternative indicates very little difference in the traffic operations MOEs in 2005, but significant improvement in 2025, even with the reduced lanage and improved access.

Two-Way Front & Main plus Three-Lane Higgins North of Broadway Alternative (Preferred)

This alternative converts Front Street and Main Street to two-way traffic from Orange to Madison. Traffic is still prohibited from entering the Orange Street intersection from Front Street. Higgins is converted to three-lanes from Broadway to Spruce. Left-turn restrictions remain in effect on Higgins at Front and Main. Traffic signal equipment is upgraded at the Higgins Avenue intersections from Broadway to Spruce to allow for pedestrian- and traffic-actuated operation of the signals. These signals currently operate on a fixed-time routine. This alternative dramatically improves access in the downtown area and reduces out-of-direction travel caused by the current one-way system of Front and Main Streets. However, access and circulation improvements are not as significant as in the Two-Way

Front and Main plus Three-Lane Higgins North of 5th Street Alternative because of the remaining left-turn restrictions on Higgins at Front and Main. While delay in the total system is not reduced as dramatically as with other alternatives, this option achieves a desirable balance of improved accessibility and acceptable system operation. **This is the recommended alternative for the long-term street network in the downtown.**

ALTERNATIVES: 2005 PM PEAK HOUR

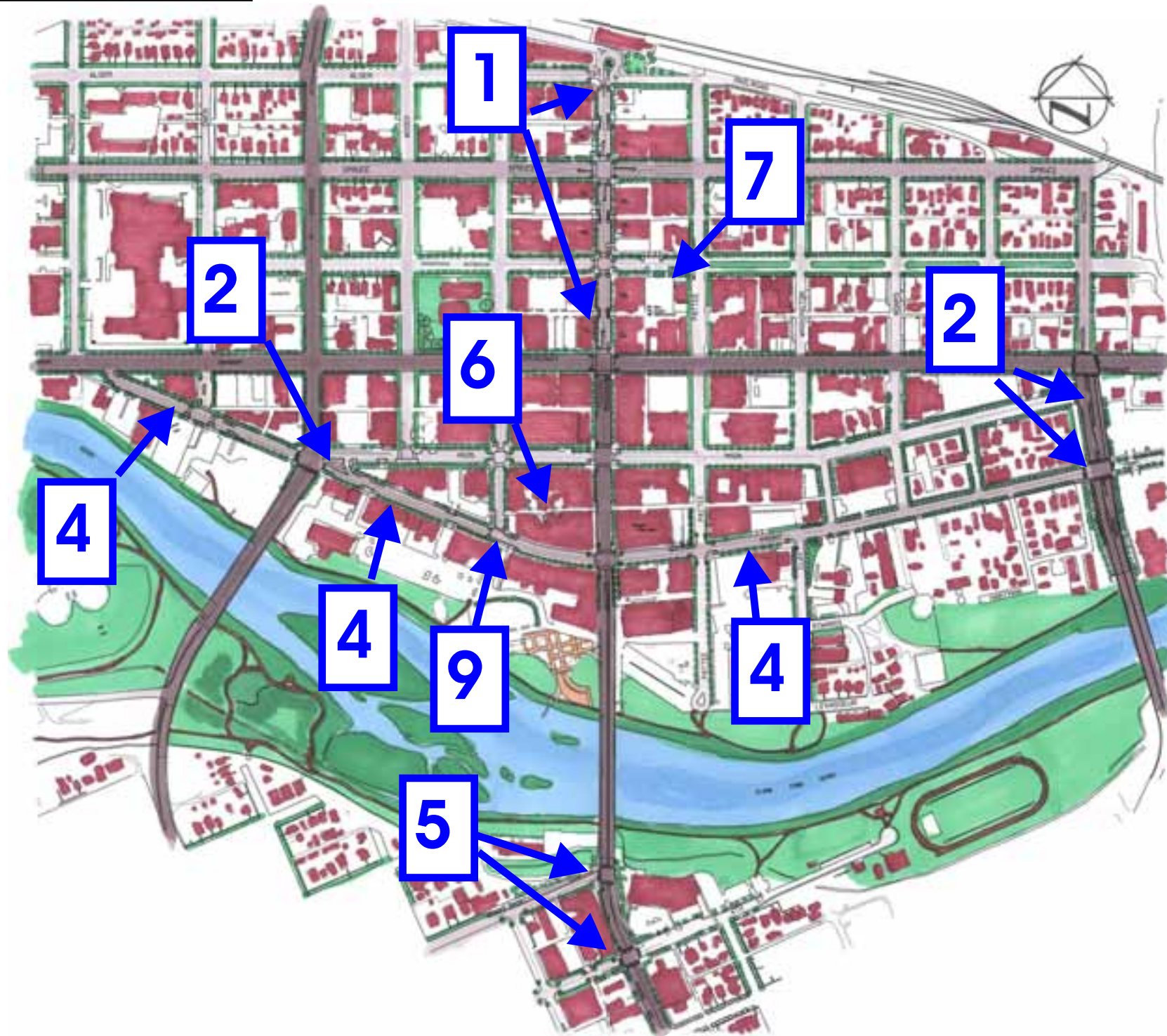
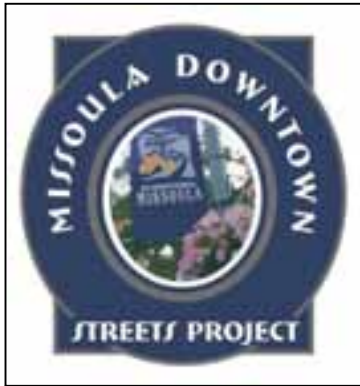
	No-Action	Existing Streets w/Optimized Signal Timing	3-Lane Higgins	3-Lane Higgins North of Broadway	Two-Way Front & Main + 3-Lane Higgins North of 5th Street	Two-Way Front & Main + 3-Lane Higgins North of Broadway
Number of Intersections	15	15	15	15	16	19
Cycle Length	90	90	90	90	90	90
Total Delay/Vehicle (sec/veh)	16	11	13	11	13	11
Total Delay in System (hours)	108	78	93	77	101	80
Stops	10958	10369	11168	10012	11108	10385
Average Speed (mph)	13	15	14	15	14	16
Fuel Consumed (gal)	256	231	246	229	255	236
CO Emissions (kg)	17.87	16.16	17.18	16.01	17.86	16.52
Unserviced Vehicles	0	0	0	0	0	0
Performance Index	138.7	106.8	124.2	104.9	132.0	109.1

ALTERNATIVES: 2025 PM PEAK HOUR

	No-Action	Existing Streets w/Optimized Signal Timing	3-Lane Higgins	3-Lane Higgins North of Broadway	Two-Way Front & Main + 3-Lane Higgins North of 5th Street	Two-Way Front & Main + 3-Lane Higgins North of Broadway
Number of Intersections	15	15	15	15	16	16
Cycle Length	90	90	90	90	90	90
Total Delay/Vehicle (sec/veh)	38	14	21	14	27	23
Total Delay in System (hours)	313	113	170	118	239	206
Stops	14992	13232	14619	13501	13594	12953
Average Speed (mph)	8	14	11	14	9	10
Fuel Consumed (gal)	441	288	335	294	385	358
CO Emissions (kg)	30.84	20.15	23.42	20.55	26.89	25.06
Unserviced Vehicles	0	0	0	0	19	0
Performance Index	354.5	150.2	210.4	155.1	276.5	241.6

Conclusion

The traffic analyses illustrate that each of the improvement alternatives will operate at least as well as, and in several instances significantly better than, the existing condition when measured by the network-wide MOEs. Traffic circulation and commercial access can be improved by converting Front and Main Streets to two-way traffic. While this conversion results in deterioration in some network-wide MOEs, the overall effect is an improvement over the existing condition. Crash rates on Higgins Avenue north of the Clark Fork River are almost two times higher than expected at urban signalized intersections. In addition, the proposed plan, when fully implemented, reduces congestion by 47% over the long term (20 year projection).



Plan Recommendations

- 1** **North Higgins Streetscape** - Add approximately 20 diagonal parking spaces.
- 2** **Two-way Front & Main Street Traffic Flow** - Revise Orange/Front/Main & Madison Front Intersections.
- 3** **New Street & Pedestrian Lights** - Everywhere! Replace Over Time.
- 4** **Add Diagonal Parking on Front Street** - As needed at several locations.
- 5** **Streetscape Hip Strip** - Open Up 3rd Street Intersection at Higgins. Add Diag. Parking on 4th.
- 6** **Create "Blues Alley" Entertainment District** - Outdoor seating areas, improved lighting.
- 7** **Streetscape Pine Street** - Create Public Art Walk connecting to Missoula Art Museum.
- 8** **Upgrade Traffic Signals** - Add pedestrian push buttons, countdown timers & traffic detection equipment throughout Downtown.
- 9** **Create Carousel "Gateway" on Front Street**
- 10** **Additional Streetscaping & Bulb-outs** through redevelopment & individual projects.