6.1 COMPLETE STREET GUIDELINES

A complete street is one that is designed and operated to safely accommodate all users, including but not limited to: motorists, pedestrians, bicyclists, transit, and people of all ages and abilities. A complete streets philosophy causes transportation agencies to design and operate the entire right of way to encompass users of all types and to promote safe access and travel for the users. Complete streets ensure that the streets are safe for motorists, transit, pedestrians, bicyclists, children, the elderly, people with disabilities, and all users.

A complete street is comprised of many different elements; these elements may include, but are not limited to: sidewalks, bike lanes, crosswalks, wide shoulders, medians, bus pullouts, special bus lanes, raised crosswalks, audible pedestrian signals, sidewalk bulb-outs, and more. The elements that are used can vary from project to project, but the end result is still to achieve a connected network that is safe and effective for all modes of travel. A Complete Street accommodates the needs of all modes and users.

6.1.1 Elements of Complete Streets

Complete streets contain standard elements that together, create an effective and adoptable facility that benefits all transportation system users. Complete street guidelines contribute to a comprehensive, integrated, and connected network. A complete street concept also recognizes the need for flexibility: that all streets are different and user needs should be balanced. Any exceptions to complete street implementation must be clearly and specifically stated within the guideline and require high-level approvals so that there is no confusion what type of design is required. The design must fit in with the context of the community while using the latest and best standards.

Standards within the guidelines must be put in place to ensure that an effective guideline is created. The guideline must create a network that is complete and connected while still allowing for flexibility within the design. All streets are unique and require different levels of attention, so the guideline must be flexible enough to accommodate all types of roads and be adoptable by every agency.

Major street improvements are not a requirement through maintenance activities and should not be expected. Maintenance activities do present some opportunities that can improve the environment for other roadway users. While the construction of a sidewalk is not appropriate as part of maintenance activities, facilities such as improved crosswalks, or bike lanes, or a shoulder stripe may be included in a routine re-stripe of a roadway if adequate space exists and the facility is designated to have such facilities in the Bozeman Area Transportation Plan. For additional examples of improvements that could be associated with various roadway maintenance activities, see **Section 6.6**.

6.1.2 Recommendation

It is recommended that the City of Bozeman and Gallatin County adopt the following complete streets guidelines:

> The City of Bozeman and Gallatin County will plan for, design, construct, operate, and maintain appropriate facilities for pedestrians, bicyclists, transit vehicles and riders, children, the elderly, and people with disabilities in all new construction, maintenance activities, and retrofit or reconstruction projects subject to the exceptions contained herein.
>
> These jurisdictions will incorporate Complete Streets principles into: The Greater Bozeman Area Transportation Plan, the Bozeman 2020 Community Plan, the Parks Recreation Open Space Trails (PROST) Plan, the Unified Development Ordinance (UDO), Gallatin County Subdivision Regulations, the Gallatin County Trails Plan, Gallatin County Growth Policy, Gallatin County Community/Neighborhood Plans and other plans manuals, rules, regulations and programs as appropriate.
>
> Complete Streets principles will be applied on single projects, privately funded development, and incrementally through a series of smaller improvements, operations and maintenance activities over time. All sources of transportation funding, public and private, should be drawn upon to implement Complete Streets within the Gallatin Valley. The City of Bozeman and Gallatin County believe that maximum financial flexibility is important to implement Complete Streets principles.
>
> Complete Streets principles will be applied in street construction, retrofit, reconstruction and maintenance projects except in unusual or extraordinary circumstances contained herein:
>
> 1. Bicyclists and pedestrians are prohibited by law from using the facility. In this case, alternative facilities and accommodations shall be provided within the same transportation corridor.
> 2. Where the existing right-of-way does not allow for the accommodation of all users. In this case alternatives shall be explored such as the use of revised travel lane configurations, paved shoulders, signage, traffic calming, education or enforcement to accommodate pedestrians, cyclists, transit, and persons with disabilities.
> 3. The cost of establishing bikeways or walkways or other accommodations would be disproportionate to the need, particularly if alternative facilities are available within a reasonable walking and/or bicycling distance.
> 4. Where there is no need, including future need.
> 5. Where application of Complete Streets principles is unnecessary or inappropriate because it would be contrary to public safety.
> 6. When routine maintenance is being performed.
>
> Any project that does not include complete streets principles based on the above exceptions should have said determination confirmed and filed with the City or County Commission for review.

6.1.3 Next Steps

After adoption, effective implementation of the complete streets guidelines requires additional steps to ensure success. City of Bozeman and Gallatin County will need to review their procedures and, if necessary, restructure them, to accommodate all users on every project. In addition, applicable changes to design manuals or public works standards may need to be made to fully encompass the safety and needs of all users by employing the latest in design standards and innovation. Periodic education and training of planners and engineers is also recommended to ensure the latest techniques in balancing the needs of roadway users are being applied. Finally, existing data sources and projects can be tapped to track how well the streets are serving all users.

6.2 CONTEXT SENSITIVE DESIGN / CONTEXT SENSITIVE SOLUTIONS GUIDANCE

6.2.1 History and Definition

The Institute of Transportation Engineers defines context sensitive solutions as a "…process of balancing the competing needs of many stakeholders starting in the earliest stages of project development. It is also flexible in the application of design controls, guidelines, and standards to design a facility that is safe for all users regardless of the mode of travel they choose."

The initial principals of Context Sensitive Solutions (CSS) came about in 1998 at the "Thinking Beyond the Pavement Conference" in Maryland. The key component to CSS is that it brings all of the stakeholders and the public together in the earliest phases of the project. Context sensitive designs incorporate a multidisciplinary design team. Residents, business owners, local institutions, city officials, and designers all have a part in the design and implementation of CSS. Addressing these needs in the early stages can save valuable time and money in the development process and can help to achieve a widely accepted product.

A Context Sensitive Design (CSD) is one that balances safety, mobility, community, and environmental goals. The idea is to achieve a design that works for all of the users and for the area. A CSD focuses not only on moving traffic, but also on pedestrians, bicycles, transit, and aesthetic issues. A properly constructed road will be safe for all users, regardless of their mode of travel which allows flexibility for its users when choosing their travel type.

A CSD should also encourage "smart growth" within the area. This refers to a type of city center growth that discourages urban sprawl by creating an area where pedestrians, bikes, transit, and vehicles can function in harmony within the network. Mixed-use development is also used in the area to allow for a variety of activities to take place. Another purpose of a CSD is to give users flexibility in the design process of transportation elements. All projects are different and should be treated as such. It is appropriate for some areas to incorporate 12′ travel lanes, for example, while others may benefit more from smaller 10′ lanes. Roads cannot be designed simply based on their functional classification or traffic volumes.

6.2.2 The Makeup of CSS

CSS designed roads are built with every user in mind. All users' needs are balanced when designing a road based on this approach. Moving traffic of all kinds safely and efficiently is of primary concern. Pedestrian and bicycle traffic are of just as much concern as vehicular traffic with this design. Walking and riding bikes is encouraged by using designated bike lanes and sidewalks. Road lane widths are generally decreased to promote slower traveling speeds for vehicles and to create safer crossings for pedestrians. Medians are also commonly used to make protected turning lanes for motorists and to limit unregulated turning movements.

CSS combines mixed land use with compact development to help create areas where mixed activity can be used. Mixed activity areas create a greater need for more adequate and safer pedestrian and bicycle networks. The networks should be created using a circular approach which creates connectivity to all areas within the network.

Under CSS, projects would also be designed with the context of the area in mind. Areas with historical value would see projects that utilize aesthetic touches to help preserve the historic feel and look. Areas with dense foliage would have the same types of trees and bushes planted in the area. Design flexibility is another key component to CSS designs. Road designers are allowed to have flexibility in their design which can be tailored to the specific context. CSS designs help blend roadways and networks into the area giving them a more natural appeal.

Below is an example of CSS being applied to Lyndale Avenue on US Highway 12 in Helena. The before photo shows a deteriorating roadway with a raised median, sidewalk, limited shoulder space, and poor aesthetic appeal. The after photo shows a context sensitive roadway that implements a landscaped raised median, larger shoulder area, sidewalk, updated guardrail, bicycle and pedestrian underpass, and updated lighting. This roadway now adds greater aesthetic value to the Great Northern Town Center area of Helena.

It should be noted that promoting slower traveling speeds, which is a common CSS attribute, does have an effect on the capacity of the roadway. A discussion on the relationship between speed and capacity can be found in **Chapter 4**.

Before

After

Photos courtesy of MDT

6.2.3 Recommendation

It is recommended the CSS principles and procedures be considered in all transportation projects. This complements the aforementioned concept of Complete Streets. Direct, honest, and meaningful dialogue at the beginning of a transportation project can lead to a successful end product and serve to build consensus going forward as the community grows.

6.3 MDT Current Practices

The following is MDT's policy on context sensitive solutions:

- **Start early –** Making context-sensitive solutions part of our culture means beginning early in the project selection process and continuing on through design, construction and maintenance with consideration for community and customer values and needs.

- **Involve local government and citizens –** To help the process get off to the best possible start, remember to include all affected parties (e.g. local government) and those with a partnership interest (e.g. Federal Highway Administration.) In fact, to make this concept work, local government and citizens must be a genuine part of the process and feel they have been heard…otherwise we are just offering lip service.

- **Balance wants, needs, money and the law –** Since the availability of transportation funds will also continue to be a major factor affecting decision-making during the project development process, balancing the needs of the community with safety/mobility and multiple project needs will certainly challenge the transportation designers of the future. And, of course, any context-sensitive solution must be accomplished within the parameters of existing laws, rules and regulations.

- **Think "outside the box"– innovation is key –** No "cookie cutter" approach is available on exactly how to approach context-sensitive solutions.

- **Listen and keep an open mind –** Be willing to listen to our customers – some of our best solutions come from them. Individuals and communities will have different ideas on what constitutes the ideal context sensitive solution in any given situation. The fact that there are differences does not mean there is a "right" or "wrong" outcome.

- **Support, teamwork and communication –** To make this policy work at MDT, all staff need to support context-sensitive solutions, recognize the physical and financial limitations involved, and communicate as a team to make the best possible decision.

6.3.1 Examples of Montana Based CSS Projects

The picture below shows North Main Street located in Helena. This road was previously a two-lane country road with no median, no sidewalks, and limited shoulders. The context sensitive design is complete with four travel lanes, a landscaped raised median, curb and gutter, and sidewalks.

Photo courtesy of MDT

The following is an example located on Main Street in Boulder Montana. This context sensitive design of the roadway included a raised landscaped median, sidewalks, curb and gutter, and shoulder area.

Photo courtesy of MDT

The project shown below is located on Woodward Avenue in Absorkee and received an award from the *AASHTO Center for Environmental Excellence* for "Best Practices in Context Sensitive Solutions". The award stated that, "…the Woodward Avenue Project represents an absolutely remarkable example of a transportation agency going the extra mile to address the needs of a small community…"

Photo courtesy of MDT

The following project is located on US Highway 92 between Evaro and Polson. The design for the corridor was said to be a "hallmark of context sensitive design" by the Federal Highway Administration and won a national award in June, 2008.

Photo courtesy of MDT

Main Street in Bozeman is another example of a context sensitive design. In the beginning phases of this project, a number of design features were proposed to help alleviate traffic congestion and increase safety. MDT proposed a three-lane configuration with raised median and limited left turns. At the request of the community and by vote of the Bozeman City Commission, it was determined that this corridor would be left as a four-lane configuration. A raised median and limited left turns were also not incorporated in this project due to community response. Features that were included in this project were the addition of count-down walk/don't walk signs, the addition of colored pedestrian crossings, and the replacement of traffic signals.

Photo courtesy of MDT

6.3.2 Other Programs and Policies

MDT has a number of other programs and policies that are in place to aid in the design and funding process that helps to encourage multimodal transportation. One of these programs is MDT's Community Transportation Enhancement Program (CTEP). This program is defined by MDT as "…a Montana program that funds transportation related projects designed to strengthen the cultural, aesthetic, and environmental aspects of Montana's intermodal transportation system." CTEP funds are sub-allocated to local and tribal governments based on population. Since CTEP was established in 1992, local and tribal officials have directed about half of all CTEP funds have been directed to bicycle and pedestrian projects.

Montana also has a multimodal transportation policy plan called TranPlan 21. TranPlan 21 was created in 1995 with an update occurring in 2002. A recent amendment occurred in March 2008 to update the plan to meet current requirements. TranPlan 21 is a long-range transportation policy plan intended to identify transportation issues, identify needs and priorities (both of the public and stakeholder), and establish programs and policies. The plan serves as a guide for MDT for the development and management of multimodal transportation.

In addition to CTEP funding and the multimodal transportation policy plan TransPlan 21, MDT also manages several transit programs, the state Safe Routes to School Program, and sponsors courses in bicyclist and pedestrian accommodation design.

Projects developed on routes under MDT's jurisdiction within the City of Bozeman and Gallatin County must comply with applicable National Environmental Policy Act (NEPA) / Montana Environmental Policy Act (MEPA) provisions as a condition of receiving federal and state funding. In short, the NEPA/MEPA process requires that proposed projects: be developed in response to an identified purpose and need; give consideration to viable alternatives where applicable; undergo an evaluation for potential environmental effects; and be duly coordinated with the public and involved agencies. As part of the required project coordination activities for these environmental compliance processes, local policies and plans will be considered during the project development phase.

6.4 LEVEL OF SERVICE GUIDELINES

Level of service (LOS) is a qualitative measure developed by the transportation profession to quantify driver perception for such elements as travel time, number of stops, total amount of stopped delay, and impediments caused by other vehicles. It provides a scale that is intended to match the perception by motorists of the operation of the intersection. LOS provides a means for identifying intersections that are experiencing operational difficulties, as well as providing a scale to compare intersections with each other. The LOS scale represents the full range of operating conditions. The scale is based on the ability of an intersection or street segment to accommodate the amount of traffic using it. LOS values range from an "A" which is the best performing value and has free flow characteristics, to an "F" which represents the worst performing value and has traffic that flows at extremely slow speeds and is considered to be in a forced or breakdown state.

6.4.1 Roadway LOS vs. Intersection LOS

Roadway LOS:

In order to calculate the LOS of a roadway, a number of characteristics must be looked at. Factors such as lane widths, lateral clearances, access frequency, terrain, heavy vehicle traffic, and driver population characteristics are used to establish base conditions for a roadway. Once these factors are determined, the free-flow speed can be determined. The free-flow speed is the mean speed of traffic on the road when the flow rates are low. After the free-flow speed is determined, the flow rate can be calculated. To determine the flow rate, the highest volume in a 24-hour period (peak-hour volume) is used, with adjustments being made for hourly variation, heavy vehicle traffic, and driver characteristics. Once these parameters are defined, the LOS for the roadway can be calculated using an additional set of calculated factors.

The primary factor for calculating roadway LOS is *percent time delay*. *Percent time delay* is defined as the average percent of the total travel time that all motorists are delayed while

traveling in platoons due to the inability to pass. Multi-lane highways have a demand for passing that increases as the traffic volume increases. However, the opportunities for passing decrease as the traffic volume increases. This effect causes the LOS to decrease as the traffic levels increase. The secondary factors that go into LOS calculations are *average travel speed* and *capacity utilization*. *Average travel speed* is used to determine the mobility of the roadway. *Capacity utilization* represents accessibility to the roadway and is defined as the ratio of the demand flow rate to the capacity of the facility. Other factors that go into LOS calculations include *terrain type*, *lane and shoulder widths*, *heavy vehicle traffic*, and the *peak hour factor*. All of these parameters are used to calculate a single LOS that is used to represent the overall characteristic of the roadway.

The *Highway Capacity Manual – 2000* defines the LOS categories for roadways as follows:

- **LOS A** represents free flow. Individual users are virtually unaffected by the presence of others in the traffic stream. Freedom to select desired speeds and to maneuver within the traffic stream is extremely high. The general level of comfort and convenience provided to the motorist, passenger, or pedestrian is excellent. **(Free flow)**

- **LOS B** is in the range of stable flow, but the presence of other users in the traffic stream begins to be noticeable. Freedom to select desire speeds is relatively unaffected, but there is a slight decline in the freedom to maneuver within the traffic stream from LOS A. The level of comfort and convenience provided is somewhat less than at LOS A, because the presence of others in the traffic stream begins to affect individual behavior. **(Reasonably free flow)**

- **LOS C** is in the range of stable flow, but marks the beginning of the range of flow in which the operation of individual users becomes significantly affected by interactions with others in the traffic stream. The selection of speed is now affected by the presence of others, and maneuvering within the traffic stream requires substantial vigilance on the part of the user. The general level of comfort and convenience declines noticeably at this level. **(Stable flow)**

- **LOS D** represents high-density, but stable, flow. Speed and freedom to maneuver are severely restricted, and the driver or pedestrian experiences a generally poor level of comfort and convenience. Small increases in traffic flow will generally cause operational problems at this level. **(Approaching unstable flow)**

- **LOS E** represents operating conditions at or near the capacity level. All speeds are reduced to a low, but relatively uniform value. Freedom to maneuver within the traffic stream is extremely difficult, and it is generally accomplished by forcing a vehicle or pedestrian to "give way" to accommodate such maneuvers. Comfort and convenience levels are extremely poor, and driver or pedestrian frustration is generally high. Operations at this level are usually unstable, because even small increases in flow or minor perturbations within the traffic stream will cause breakdowns. **(Unstable flow)**

- **LOS F** is used to define forced or breakdown flow. This condition exists wherever the amount of traffic approaching a point exceeds the amount which can traverse it and queues begin to form. Operations within the queue are characterized by stopping and starting. Over and over, vehicles may progress at reasonable speeds for several hundred feet or more, then be required to stop. Level-of-service F is used to describe operating conditions within the queue, as well as the point of the breakdown. It should be noted, however, that in many cases once free of the queue, traffic may resume to normal conditions quite rapidly. **(Forced or breakdown flow)**

Intersection LOS:

The current practice to analyze intersection LOS is to use average vehicle delay to determine the LOS of the intersection as a whole. Individual LOS values can also be determined for each approach leg and turning lane for intersections based on the average vehicle delay on that lane. There are multiple types of intersections, all of which receive a LOS value based on vehicle delay.

Signalized intersections are considered to be ones that have a signal control for every leg of the intersection. This type of intersection takes an average of the delay for each vehicle that uses the intersection and determines the LOS based on that average vehicle delay. An unsignalized intersection is one that does not have traffic signal control at the intersection. These intersections use the average vehicle delay for the entire intersection to determine the LOS (for four-way stop-controlled). Two-way stop-controlled (TWSC) intersections utilize stop control on the minor legs of the intersection while allowing free flow characteristics on the major legs. TWSC intersections take the average vehicle delay experienced on the most constrained approach, rather than the average vehicle delay for the entire intersection, to determine the LOS of the intersection. This can cause problems at intersections with high volumes of traffic along the uncontrolled major legs. Left turns off of the minor approach legs may be difficult at these intersections, which may cause high delay values and poor levels of service. The LOS for this type of intersection is based on the LOS for the worst case minor approach leg. Under these traffic conditions the worst case minor approach leg can easily have a high delay from a low number of vehicles wanting to make a left-turn onto the major approach; this may result in a poor LOS for the entire intersection.

A description and average delay range for each LOS value for signalized and unsignalized intersections, as defined by the *Highway Capacity Manual (HCM) 2000*, is found in **Table 6-1** on the following page.

An intersection that has a roundabout also has a LOS value associated with it. The LOS for these types of intersections is more difficult to determine than that of a standard intersection. While programs such as *SIDRA, RODEL,* and *ARCADY* exist to help analyze roundabouts, the results from these programs can vary greatly. These programs generally use a form of average vehicle delay as their main component for LOS determination. The variance between the different programs lies in how each program calculates the capacity of the intersection, which is a factor used in conjunction with others to determine the average vehicle delay.

The average vehicle delay at a roundabout is comprised of two components: *queuing delay* and *geometric delay*. *Queuing delay* is the delay a vehicle experiences while outside of the roundabout waiting to enter. This type of delay is similar to the delay experienced by vehicles in unsignalized and signalized intersections. Queuing delay represents the delay experienced by the driver waiting to enter the intersection.

Geometric delay is the delay experienced while negotiating through the roundabout. This type of delay is generally very small, especially at small roundabouts. However, the geometric delay can play a big part in LOS determination at intersections with roundabouts

installed at locations with high speed approaches and a large center island. This type of intersection requires a driver to drastically slow down to maneuver through the roundabout resulting in increased geometric delay times. Combining queuing delay and geometric delay gives a total average vehicle delay which is used to determine the LOS of the intersection.

Table 6-1
Intersection Level of Service (LOS) Criteria

LOS	Unsignalized Intersections		Signalized Intersections	
	Description	Average Delay (sec/veh)	Description	Average Delay (sec/veh)
A	Little or no conflicting traffic for minor street approach.	< 10	Uncongested operations; all queues clear in a single cycle.	< 10
B	Minor street approach begins to notice presence of available gaps.	10 – 15	Very light congestion; an occasional phase is fully utilized.	10 – 20
C	Minor street approach begins experiencing delay while waiting for available gaps.	15 – 25	Light congestion; occasional queues on approaches.	20 – 35
D	Minor street approach experiences queuing due to a reduction in available gaps.	25 – 35	Significant congestion on critical approaches, but intersection is functional.	35 – 55
E	Extensive minor street queuing due to insufficient gaps.	35 – 50	Severe congestion with some longstanding queues on critical approaches.	55 - 80
F	Insufficient gaps of sufficient size to allow minor street traffic to safely cross through major traffic stream.	> 50	Total breakdown, stop-and-go operation.	> 80

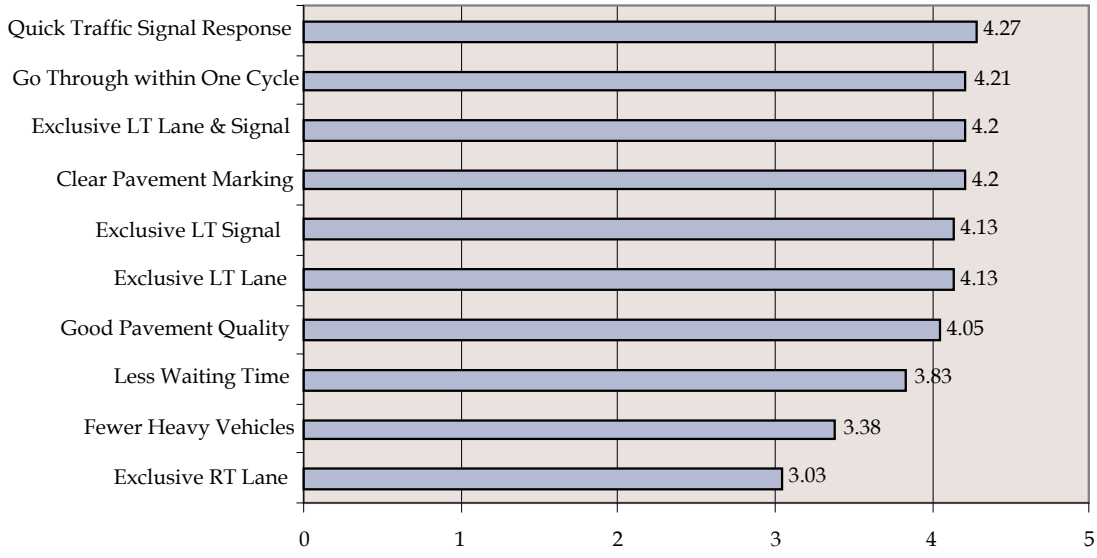
6.4.2 User Perceived LOS

The LOS of a roadway or intersection is intended to serve as a qualitative measure of the performance level of a roadway or intersection that represents driver perception. LOS is determined solely from the average vehicle delay at an intersection. While delay may be a part of determining user perceived LOS, it may not be the primary factor for a driver's perception of the intersection's performance. Multiple traffic and non-traffic related factors may go into a drivers perceived LOS for an intersection. These factors include traffic signal efficiency, pavement conditions, left-turn treatment, delay, and overall safety of the intersection. A study done by the University of Hawaii at Manoa found that safety was stated to be "three to six times more important than delay" when evaluating LOS. A ranking of driver importance factors determined from this study can be found in **Figure 6-1**.

Under the current HCM, all intersections of the same type (i.e. signalized, unsignalized…) that have the same average vehicle delay, would receive the same LOS ranking, independent of other factors found to be important to driver perceived LOS. While LOS values are intended to represent a driver's perception of the intersection's overall performance level, delay is the only tool used to determine the LOS. Delay is, however, based on a number of factors. Changes to intersection geometry, including addition or deletion of turn-lanes or protected turn phases, can affect the average vehicle delay, and therefore the LOS of that intersection. While protected left-turn signals and designated turn-lanes change average vehicle delay values, these factors may affect driver perceived LOS values more

dramatically. Two intersections that have the same average vehicle delay, and therefore the same LOS, associated with them may have a significantly different driver perceived LOS.

Figure 6-1
Driver Perceived Intersection Importance Levels



- "User Perceptions of Signalized Intersection Level of Service", Zhang & Prevedouros

6.4.3 Bozeman's Current LOS Standard

Bozeman's *Unified Development Ordinance (UDO)* defines a basic set of rules for land development and subdividing in Bozeman. The *UDO* specifies street improvement standards that must be met by the developer. The level of service standard as defined by the *UDO* is stated below:

> *"Streets and intersection level of service "C" shall be the design and operational objective, and under no conditions will less than level of service "D" be accepted. All arterial and collector streets, and movements on intersection approach legs designated as arterial or collector streets, shall operate at a minimum level of service "C". The design year for necessary improvements shall be a minimum of fifteen years following construction of said improvements."*
>
> *- Bozeman Unified Development Ordinance, Section 18.44.060.D*

The current application of the Bozeman UDO has been subject to interpretation. In practice, the UDO is interpreted by City staff under two different scenarios as described below:

Scenario 1: Existing intersection operation is a LOS D or better and development traffic impact continues the LOS at a D or better, then no mitigation is being required.

Scenario 2: Pre-development or post-development analysis shows intersection operations below LOS D, then intersection mitigation (i.e. improvements) must achieve a LOS of C over the next fifteen years.

6.4.4 Recommended Revised LOS Standard

A revised LOS standard for development in Bozeman is suggested and defined in this section. These revised standards should be used to determine if there are sufficient transportation improvements being made to meet the requirements for proposed developments. LOS values shall be determined by using the methods defined by the *Highway Capacity Manual – 2000*. A development shall be approved only if the LOS requirements are met by the developer through mitigation measures. A list of revised LOS standards is listed below:

- Signalized intersections shall have a minimum acceptable LOS of "C" for the intersection as a whole; individual movement and approach leg LOS lower than "C" shall be allowed such that the total intersection LOS is a "C" or higher.

- Unsignalized intersections shall have a minimum acceptable LOS of "C" for the intersection as a whole for four-way stop controlled; individual movement and approach leg LOS lower than "C" shall be allowed such that the total intersection LOS is a "C" or higher.

- Two-way stop-controlled (TWSC) intersections shall have a minimum acceptable LOS of "C" or higher for the stop-controlled, minor legs.

- An intersection with a roundabout shall have a minimum acceptable LOS of "C" or higher for the intersection as a whole.

It is recommended that the entire intersection LOS be the controlling factor in determining if an intersection performs at a proper level for all intersections except a "two-way, stop-controlled (TWSC)" intersection. In the TWSC scenario, the intersection LOS should be for the stop-controlled, minor legs.

It is recommended, however, that individual movement and approach LOS still be calculated and presented in the various traffic impact studies to determine if the network as a whole functions properly and if additional steps need be looked at.

6.4.5 Bicycle Level of Service

There are two established tools available for estimating the compatibility of roads for bicycling: the first, developed by Alex Sorton and others at the Northwestern University's Traffic Institute in the 1980's, is called the "Bicycle Stress Level" analysis (hereafter referred to as "Sorton"). The second, called the "Bicycle Compatibility Index", (BCI) was developed for the FHWA by David Harkey and others at the University of North Carolina's Highway Safety Research Center, and became available in late 1998.

Both models are based on many years of careful research and surveying of bicyclists under simulated bicycling conditions, and can produce worthwhile results. More often, unfortunately, transportation planners are presented with at least two significant barriers to implementation. First, both the Sorton and the BCI are expressly intended for urban and

suburban application, and are therefore of very limited utility for use in rural areas. Second, many agencies that wish to estimate bicycle compatibility on their roads do not possess the rather extensive data required for employing the BCI model.

Sorton

The Sorton model is significantly simpler than the BCI in that it measures only three parameters: curb lane volume, curb lane width, and motor vehicle speed. The following table relates each parameter's measurement with a corresponding stress level, with 1 being low stress (safe) and 5 being high stress (unsafe).

Variable	Quantitative Value	Stress Analysis
Curb Lane Volume (vehicles/hr)	≤ 50	1
	150	2
	250	3
	350	4
	≥ 450	5
Curb Lane Width (m)	≤ 4.6	1
	4.3	2
	4	3
	3.7	4
	≥ 3.3	5
Motor Vehicle Speed (km/hr)	≤ 40	1
	50	2
	60	3
	65	4
	≥ 75	5

Source: University of North Carolina Highway Safety Research Center

Bicycle Compatibility Index

The BCI considers the following parameters:

1. Number of lanes (in one direction)
2. Width of the curb lane (ft)
3. Bicycle lane width (ft)
4. Paved shoulder width (ft)
5. Residential development (y/n)
6. Speed limit (mi/h)
7. 85th percentile speed (mi/h)
8. ADT
9. Large truck % (HV)
10. Right turn % (R)
11. Parking lane (y/n)
12. Occupancy (%)
13. Parking time limit (minutes)

These thirteen parameters are converted into data that are then entered into a formula. The outputs of this formula, normally ranging from about 1 to 6, are converted to letter grades ranging from level of service 'A' (extremely high compatibility; low output values) to 'F' (extremely low compatibility; high output values).

The Sorton method and the BCI are similar but differ in some important respects:

1. Number of parameters: The Sorton model requires fewer variables: volume, width and speed are the primary ones, and driveways, percent trucks and parking turnover are added in a non-mathematical fashion. The BCI treats nine primary variables and allows for three additional (mathematical) adjustment factors.
2. Weighting of variables: The Sorton model treats all variables equally; that is, there is no weighting. The BCI weights each parameter in relation to the others.
3. Slope / Grade: A revision of the Sorton model allows for the inclusion of slope (or grade) in the model, whereas the BCI discounts this variable.

Although the BCI provides a more sophisticated system for evaluating the compatibility of roads for bicycling, its data requirements – as mentioned – are frequently beyond the bounds of the average agency's budget and time constraints. The Sorton method is far more practical in this respect, but it is limited to urban and suburban applications.

6.5 PEDESTRIAN AND BICYCLE PROGRAM & POLICY RECOMMENDATIONS

The following education and outreach programs are designed to raise awareness of walking and bicycling; connect current and future cyclists to existing resources; educate them about their rights and responsibilities; and encourage residents to walk and bicycle more often. Key target audiences include drivers; current and potential (interested) cyclists; students, children and families; school personnel; and employees (through employer programs).

The following education and outreach programs have basic cost estimates associated with them. Since the cost to implement such programs can vary considerably depending on the availability of volunteer (versus professional) resources and available funding, an estimated range is provided according to the following ranges.

$	= Minimal to $500	Volunteer effort and low funding required
$$	= $500 to $2,500	Low amounts of funding required
$$$	= $2,500 to $10,000	Moderate amounts of funding required
$$$$	= $10,000 to $50,000	High amounts of funding required
$$$$$	= $50,000+	Very high amounts of funding required

6.5.1 Education Program Recommendations

Bike Buddy Campaign	
Target	New cyclists who are interested in using a bicycle for transportation
Primary agency	City of Bozeman
Partners	Bozeman Area Bicycle Advisory Board, Gallatin County
Key elements	Less-experienced cyclists are paired with a trained cycling mentor who assists them in route selection, training rides, reading bike maps, and gear questions in order to lower the barriers to using a bicycle for transportation.
Time frame	Spring, on-going
Cost	$ - $$ (depends on scope of program)
Potential funding sources	Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs; businesses interested in increasing the number of employees who ride bicycles
Sample programs	http://www.bicyclealliance.org/commute/bikebuddy.html
	http://www.sfbike.org/?bikebuddy
	http://bicycling.511.org/buddy.htm

Bike Rodeos	
Target	Children and youth
Primary agency	City of Bozeman
Partners	Bozeman Police and/or Fire Department, Bozeman Area Bicycle Advisory Board, Safe Routes to School Taskforce
Key elements	Drop-in event aimed at teaching kids basic skills and safety rules. Often organized by Police or Fire Bureaus. Can include free or low-cost helmet distribution.
Time frame	Fall and spring, annually
Cost	$$-$$$ (depending on size and organization)
Potential funding sources	Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs; hospitals and insurance companies
Sample programs	http://www.bicyclinglife.com/SafetySkills/BicycleRodeo.htm
	http://www.saferoutestoschools.org/pdfs/lessonplans/RodeoManualJune2006.pdf
	Guide to Bicycle Rodeos, by John Williams and Dan Burden. Available from the Adventure Cycling Association, PO Box 8308-Z5, Missoula, MT 59807, 800-721-8719, M-F, 8-5 Mountain time. Price $5.00.

Police Education Courses	
Target	Law enforcement agencies
Primary agency	Bozeman Police Department, Gallatin County Sheriff's Department, MSU Police Department
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Pedestrian and Bicycle Law Enforcement Training Course includes a How Pedestrian and Bicycle Crashes Happen, Education on Pedestrian Laws and Bicycle Laws, and Crash Investigation and Reporting. The course can be open to all law enforcement entities for a fee, which covers instruction and materials.
Time frame	Spring, annually
Cost	$ - $$
Potential funding sources	Federal and state safety grant funding
Sample programs	http://www.bicyclinginfo.org/enforcement/training.cfm
	http://www.massbike.org/police/

Women on Bikes Program	
Target	Women who ride bicycles
Primary agency	City of Bozeman, Bozeman Area Bicycle Advisory Board
Partners	Local Bicycle Shops
Key elements	Women-only clinics, workshops, and rides, designed to be welcoming and supportive for participants at any stage of comfort. Topics may include maintenance basics, bike cleaning, riding in the rain and dark, shopping by bike, or commute tips. Rides are themed (e.g. historic houses, heritage trees, ice cream shops, rain gardens), and are low-mileage.
Time frame	Spring and summer, annually
Cost	$ - $$
Potential funding sources	Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs;
Sample programs	http://www.portlandonline.com/transportation/index.cfm?c=44100
	http://www.toronto.ca/cycling/canbike/canbike_cffw.htm

Technical/Professional Training	
Target	Planners and traffic engineers
Primary agency	Gallatin County, City of Bozeman, Western Transportation Institute, MDT
Partners	Montana Department of Transportation, Local Engineering, Architecture, and Planning Firms.
Key elements	Agency planners and traffic engineers receive training on how to plan and build facilities to accommodate bicycles and pedestrians. Courses can be taught by experts brought in or electronically via webinars.
Time frame	As needed, annually
Cost	$-$$$ (ranging from webinar to visiting expert)
Potential funding sources	Federal and state funding
Sample programs	Federal Highway Administration's Designing Streets for Pedestrian Safety:
	http://www.fhwa.dot.gov/resourcecenter/teams/safety/0608pedsafety.pdf

Create Bike and Walking Maps	
Target	Current and potential cyclists and walkers
Primary agency	City of Bozeman – Bozeman Area Bicycle Advisory Board
Partners	Gallatin County
Key elements	Clear symbology, designations and services attractive for cyclists and walkers, good selection of routes. Continue with current map production with periodic updates, Consider map encompassing Gallatin County in the future.
Time frame	regular updates; every 3 years, or as needed.
Cost	$$ - $$$
Potential funding sources	City of Bozeman, Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs; hospitals and insurance companies
Sample programs	http://www.sfbike.org/download/map.pdf
	http://www.cityofchicago.org/Transportation/bikemap/keymap.html
	http://www.nycbikemaps.com/

One of the most effective ways of encouraging people to bike and walk is through the use of maps and guides showing that the infrastructure exists, to demonstrate how easy it is to access different parts of the city by bike or on foot, and to highlight unique areas, shopping districts or recreational areas. Bicycling and walking maps can be used to promote tourism, encourage residents to walk, or promote local business districts. Maps can be citywide, district-specific, or neighborhood/family-friendly maps.

Diversion Class	
Target	Motorists, cyclists, and pedestrians
Primary agency	Bozeman Police Department, Gallatin County Sheriff's Department, MSU Police Department
Partners	Bozeman Area Bicycle Advisory Board
Key elements	A Share the Road class is tailored to first-time offenders of certain bicycle and pedestrian-related traffic violations, including running a stop sign/light on a bike. In lieu of the citation, cyclists, motorists and pedestrians can take the class instead. Interested citizens can take the class even if they did not receive a ticket.
Time frame	Anytime; on-going
Cost	$$ -$$$
Potential funding sources	Federal and state traffic safety funding
Sample programs	http://www.marinbike.org/Campaigns/ShareTheRoad/Index.shtml#StreetSkills
	http://www.legacyhealth.org/body.cfm?id=1928

Bozeman Bike Central Website	
Target	Current and potential cyclists
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Resources, maps and map orders, safety, events, groups. This website becomes the starting point for any bicycling related query linking to other local cycling groups and activities. This website becomes the informational clearinghouse for any bicycle or pedestrian related program/activity and is essential for Bike Week activities in May.
Time frame	Ongoing
Cost	$ - $$ (depending on design and scope)
Potential funding sources	Low cost; may not require outside funding
Sample programs	Vélo Québec website: http://www.velo.qc.ca/english/home.lasso

Bozeman already has numerous resources for cyclists, and more services and resources are planned for the future. Many cyclists or potential cyclists do not know where to turn to find out about laws, events, maps, tips, and biking groups. The City of Bozeman should develop a "one stop shopping" website aimed at bicyclists. A potential name is Bozeman Bike Central, though other names could be used.

The Bozeman Bike Central website should contain:

- A list of all **bicycling groups**, including clubs, racing teams, and advocacy groups
- Information about the Bozeman Area Bicycle Advisory Board (how to get involved, meeting times and dates, agendas and minutes)
- Information about **current projects and how to get involved** (e.g. public meetings, comment periods)
- **Maps and brochures** (links to online maps and brochures, where to find in person, and how to request mailed materials)
- Links to **laws and statutes** relating to bicycling

- Information about **cycling events** (rides, classes, volunteer opportunities)
- A list of **local bike shops**, including phone number and address
- Relevant **phone numbers** (hotlines for pothole repair, parking enforcement, bike rack installation request, etc.)

The website may also feature:

- Events calendar
- Request form for route planning assistance
- Message boards
- Blog featuring stories and news
- Photo galleries from events and submitted by readers
- Popular ride routes
- Maintenance requests for bicycle facilities

Note that these additional features may increase the cost to set up and maintain the website. A one-stop bike website will not be difficult to set up, but it will only be successful if the site is both easy to use and updated regularly. Corners should not be cut in either design or in maintenance of the site and its information. All Bike Central website content should be reviewed annually for accuracy.

The bicycle community can assist in keeping the site up to date. The Bozeman Area Bicycle Advisory Board should consider adding a standing agenda item for the BAC to discuss the Bike Central website in order to hear about new content that should be added or out-of-date content that should be updated or removed.

"Lights On" Campaign	
Target	Cyclists (especially students and low-income bicycle commuters)
Primary agency	Varies
Partners	Area law enforcement, Montana State University, Bozeman Area Bicycle Advisory Board, Gallatin County
Key elements	Media outreach, enforcement, bike light giveaways or subsidies
Time frame	Fall, annually
Cost	$$ - $$$ (depends on scope of program)
Potential funding sources	Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs; hospitals and insurance companies
Sample programs	Portland's "See & Be Seen" campaign: http://www.portlandonline.com/transportation/index.cfm?&c=deibb&a=bebfjh
	Dutch "Lights On" campaign: http://www.fietslichtaan.nl/

While Montana state law requires bicyclists to use lights at night, cyclists riding without lights are common in the Bozeman area. Many cyclists, especially students, are unaware that lights are required by law, or they have simply not taken the trouble to purchase or repair lights. Research shows that cyclists who do not use lights at night are at much greater risk of being involved in bike-car crashes. For these reasons, increasing bicycle light usage is a top priority for Bozeman, and a successful effort will reduce crash risk for bicyclists.

Every fall in the Netherlands, as days get shorter, a national "lights on" campaign reminds cyclists to use bicycle lights. This "lights on" campaign focuses several complementary strategies into a short time frame for maximum impact, pairing media messages (ads, posters, radio spots, and TV ads) with police enforcement of 'fix it' tickets.

A similar Lights On campaign is recommended for Bozeman. This multi-pronged outreach effort should take place every September, as the days are getting shorter and as kids and university students are returning to school.

- This poster from Portland, OR uses simple graphics to communicate the importance of using bicycle lights

The *Bozeman Lights On* campaign should include the following elements:

- Well-designed **graphic ads**, to be placed on transit benches, transit vehicles, and local newspapers, as well as around MSU. Ad space may be purchased or donated. Small-format ads can be placed on bike handlebars as well if desired.

- Police **enforcement of bike light laws**. This enforcement will be most likely to result in behavior change if the cyclist is able to avoid penalty if they obtain a bike light. Ideally, the police would give a warning, explain the law, and then install a bike light on the spot. If this is not possible, the cyclist should receive a 'fix it ticket' along with a coupon for a free or discounted light at a local bike shop; once the cyclist shows proof that they have purchased a bike light, their fine will be waived.

- Every fall, Dutch cyclists receive many messages to use lights, including these bike hangers

- **Partnership with local cycling groups** to get the word out to their members and partners. These groups can be counted as campaign partners at no cost to them, enhancing the campaign's credibility and community exposure. Groups should be supplied with key campaign messages to distribute with their constituents along with coupons for free or discounted bike lights.

- **Earned media outreach**: The City of Bozeman should distribute media releases with statistics about the importance of using bike lights, relevant legal statutes, and the campaign's goal, timing, activities, and partners. If possible, a meeting with local media editorial boards should be sought.

Depending on partners, volunteer capacity and interest, the *Bozeman Lights On* campaign may also include the following:

- **In-school presentations** about bike lights, including reflective material giveaways
- A **community bike light parade** with prizes
- **Discounts on bike lights** and reflective gear at local bike shops during September (publicized through the campaign outreach)
- Volunteers stationed at key intersections, trails, and on the MSU campus **who thank bicyclists using bike lights** and reward them with a small gift

"Drive Less, Live More" Campaign	
Target	Drive-alone commuters
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board, Pedestrian Traffic Safety Committee
Key elements	Media marketing campaign and website around commute options
Time frame	On-going
Cost	$$ - $$$$ (depending on advertising strategy)
Potential funding sources	Bike shops (in-kind donations); transit agencies and local news outlets (donated ad space); traffic safety foundations and grant programs; hospitals and insurance companies
Sample programs	Drivelesslivemore.org
	Drivelesslivemore.com
	Drivelesssavemore.com

The "Drive Less, Live More" campaign website would include transit tips, facts and tools, including a commute cost calculator, trip planning assistance, links to transit and bike maps, transit schedules and updates, and bicycle trip planning information.

6.5.2 Commuting Program Recommendations

Bike to Work Week or Month	
Target	Current and potential cyclists
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Publicize Bike to Work Month in May. Offer classes, rides and events.
Time frame	May, annually
Cost	$$ - $$$ (depending on scope and length of program)
Potential funding sources	Local businesses and bike shops (in-kind or cash support); hospitals and insurance companies; City of Bozeman
Sample programs	Bay Area Bike to Work Day: http://www.bayareabikes.org/btwd/index.php
	Bike Commute Challenge (Oregon): http://www.bikecommutechallenge.com/

Many local groups and agencies currently collaborate on the area Bike to Work Week in May. Many of the programs and activities outlined in this section would be appropriate for inclusion as an activity under the Bike to Work Week organization structure. Based on the large number of potential activities it is recommended that Bike to Work Week transition to Bike Month coinciding with 'National Bike Month' in May of each year. Spreading out the activities keeps the focus on non-motorized transportation for an entire month and helps spread out volunteer resources to avoid burnout.

MSU Bike Program	
Target	Montana State University students, faculty and staff
Primary agency	MSU Planning
Partners	Student groups
Key elements	Tools and stands; mechanic services; clinics. Tie into 'Bozeman Bike Central' website.
Time frame	Ongoing
Cost	$$$
Potential funding sources	MSU parking fees
Sample programs	UC Davis Bicycle Program: http://www.taps.ucdavis.edu/bicycle/

Commuter Calculator	
Target	Commuters and Transportation Demand Management Organizations
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Cost calculator on monthly and annual commuting costs based on one's mode of transportation.
Time frame	One-time with ongoing website maintenance
Cost	$
Potential funding sources	Health agencies, pollution mitigation funds
Sample programs	Missoula In Motion commuter calculator: http://missoulainmotion.com/commuter_calculator.php

6.5.3 Enforcement Program Recommendations

Speed Limit Enforcement	
Target	Speeding motorists
Primary agency	City of Bozeman and Bozeman Police Department
Partners	Schools and community organizations
Key elements	Work with police to do targeted enforcement of speed limits on designated bikeways, near schools, and in response to cyclist/pedestrian complaints
Time frame	Anytime; on-going
Cost	$-$$$$ (depending on scale or necessity of officer overtime pay)
Potential funding sources	Federal and state traffic safety funding
Sample programs	Federal Highway Administration "A Resident's Guide for Creating Safe and Walkable Communities:
	http://transportation.stanford.edu/alt_transportation/BikingAtStanford.shtml

Radar Speed Sign Deployment	
Target	Speeding motorists
Primary agency	Bozeman Police Department and the City of Bozeman
Partners	Schools and community organizations
Key elements	Schools and community organizations request a radar speed sign from the City of Bozeman. The sign is deployed to key locations (schools, community centers, etc) and reminds motorists to follow the designated speed limit.
Time frame	Anytime, on-going
Cost	$$
Potential funding sources	Federal and state traffic safety funds and Safe Routes to School funding
Sample programs	Issaquah, Washington:
	http://www.ci.issaquah.wa.us/Page.asp?NavID=309

Bicycle Patrol Unit	
Target	N/A
Primary agency	Bozeman Police Department, Gallatin County Sheriff's Department
Partners	Community organizations
Key elements	On-bike officers are an excellent tool for community and neighborhood and special event policing.
Time frame	One-time setup, ongoing maintenance and training
Cost	$-$$$ (depending on existing equipment inventory)
Potential funding sources	Crime prevention funding
Sample programs	Central Point, Oregon:
	http://www.bta4bikes.org/btablog/2008/01/30/alice-award-nominee-chief-jon-zeliff/

6.5.4 Encouragement Program Recommendations

MSU Bike Orientation	
Target	MSU students, especially incoming freshmen
Primary agency	City of Bozeman and MSU
Partners	MSU Cycling Team
Key elements	Bicycle safety & promotion orientation for incoming freshmen and returning students. Classes & clinics, materials, social events, rides.
Time frame	September, annually
Cost	$-$$
Potential funding sources	MSU parking fees, TDM funding sources
Sample programs	Stanford University Bike Program: http://transportation.stanford.edu/alt_transportation/BikingAtStanford.shtml

University students are ideal candidates for bicycling outreach programs; many students live near campus and may not own a car or choose to drive. The City of Bozeman should partner with Montana State University to promote bicycling to students at the beginning of the school year.

The MSU Bike Orientation should include:

- **Bike maps and information** provided to incoming and returning students at the beginning of the year through school information packets
- **Flat clinics, bike legal clinics, and guided rides**, advertised through flyers, email and bulletin boards, and campus newspaper
- **Information tabling** at campus events and prominent locations (e.g. bookstore, quad) during the first few weeks of school
- A **Bikes at MSU web page** with links and more information
- At-cost or low-cost **bike lights** sold at tabling events and through the campus bookstore
- If desired, a "bike buddy" program may be implemented to match current cycling students with interested students. This can be a simple program where bicyclists wear a sticker that says "I bike to MSU, ask me how," or a more elaborate program that matches bike buddies with interested students who live in their neighborhood for mentoring. A bike buddy program would increase the cost of the program. This could be set up through the existing campus rideshare website.

6.5.5 Policy Recommendations

Bozeman Area Bicycle Advisory Board	
Target	Citizen advocates
Primary agency	Continuation of Regular meetings of the Bozeman Area Bicycle Advisory Board to advise the City of Bozeman on bicycle technical issues.
Partners	City of Bozeman, bicycle advocacy groups, health organizations, etc
Key elements	Regular meetings of the Bicycle Advisory Committee to advice the City of Bozeman on technical issues. Gallatin County may also explore the concept in the future if the need arises.
Time frame	Ongoing
Cost	$
Potential funding sources	City of Bozeman
Sample programs	UC Davis Bicycle Program: http://www.taps.ucdavis.edu/bicycle/

Complete Streets	
Target	Planners and engineers
Primary agency	City of Bozeman, Gallatin County,
Partners	Montana State University
Key elements	Policy language that creates streets to work for all users, including drivers, freight, walkers, cyclists and transit riders. Recommended Guidelines can be found in **Section 6.1** of this Plan.
Time frame	One-time; can happen at any time
Cost	$
Potential funding sources	N/A
Sample programs	http://www.completestreets.org/ contains sample policies and real-life examples

Perform Annual Bicycle and Pedestrian Counts	
Target	N/A
Primary agency	Gallatin County, City of Bozeman
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Annual bicycle user counts and surveys at set locations to provide for evaluation over time.
Time frame	Annually
Cost	$$-$$$
Potential funding sources	General Funds, Private Donations
Sample programs	National Bicycle & Pedestrian Documentation Project
	(http://www.fhwa.dot.gov/environment/bikeped/study/)

Many jurisdictions do not perform regular bicycle user counts. As a result, they do not have a mechanism for tracking ridership trends over time, or for evaluating the impact of projects, policies, and programs.

It is recommended that the City of Bozeman and Gallatin County perform and/or coordinate annual counts of bicyclists (and pedestrians if desired) according to national practices. The

National Bicycle and Pedestrian Documentation Project has developed a recommended methodology, survey and count forms, and reporting forms, and can be modified to serve the needs and interests of individual jurisdictions.

If desired, further bicycle and pedestrian data collection opportunities may be pursued as well, including:

- Include before-and-after bicycle/pedestrian/vehicle data collection on priority roadway projects
- Insert bicycle/pedestrian survey questions into any existing travel mode or city audit survey instrument
- Require counting of bicyclists/pedestrians in all traffic studies
- Purchase National Household Travel Survey add-on

Bicycle Parking Guidelines	
Target	City & County planners and engineers
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Adopt Bicycle Parking Design Guidelines and parking requirements contained in the Bozeman Area Transportation Plan (Chapter 5.4.5)
Time frame	One-time
Cost	$
Potential funding sources	N/A
Sample programs	Association of Pedestrian and Bicycle Professionals:
	http://www.bfbc.org/issues/parking/apbp-bikeparking.pdf

Request a Bike Rack Program	
Target	City & County planners and engineers
Primary agency	City of Bozeman, Gallatin County
Partners	Bozeman Area Bicycle Advisory Board, Downtown Bozeman Association
Key elements	Provide a system by which a business can request additional bicycle parking be installed to meet high demand by bicyclists
Time frame	On-going
Cost	$$-$$$ per year
Potential funding sources	Bozeman Area Bicycle Advisory Board. Private Donations
Sample programs	City of Chicago:
	http://www.chicagobikes.org/forms/bikerackrequest.php

Crash Reporting Methodology	
Target	Law enforcement agencies
Primary agency	County 911, Bozeman Police Department
Partners	Bozeman Area Bicycle Advisory Board
Key elements	Adopt a uniform methodology for reporting crash data for pedestrian and bicycle crashes. Training for law enforcement agencies on crash reporting is incorporated in the police education courses on pedestrian and bicycle awareness. Ensure accurate accounting of bicycle and pedestrian crashes. Separate out bicycle crashes from motorcycle crashes
Time frame	One-time with on-going training
Cost	$
Potential funding sources	Federal and state traffic safety funds
Sample programs	Wisconsin Department of Transportation:
	http://www.dot.state.wi.us/library/research/docs/finalreports/05-18bicycle-f.pdf

Fund and Staff a Pedestrian/Bicycle Coordinator Position	
Target	N/A
Primary agency	City of Bozeman and/or Gallatin County
Partners	Bozeman Area Bicycle Advisory Board, health organizations, etc
Key elements	Staff position charged with managing bicycle-related policies, programs, and projects. Could be a shared position with Gallatin County.
Time frame	Ongoing
Cost	$-$$$
Potential funding sources	General funds
Sample programs	Portland Office of Transportation
	Chicago Department of Transportation

To take full advantage of bicycle planning efforts in the Bozeman, and to assist with implementation of the many projects and programs recommended in this Plan, the City of Bozeman may wish to consider filling this position. The job duties for this staff person may include:

- Work with community partners
- Monitor the design and construction of on-street bikeways and shared use paths, including those constructed in conjunction with private development projects
- Ensure bicycle facilities identified in planning documents, development applications and/or as mitigation measures are designed appropriately and constructed expediently
- Coordinate implementation of the recommended projects and programs listed in this Plan
- Identify new projects that would improve the region's access for bicyclists

6.6 NON-MOTORIZED MAINTENANCE CONSIDERATIONS

Pedestrians and cyclists are more sensitive to conditions within the roadway right-of-way than motorists. Any roadway maintenance activities to be undertaken should not degrade the user experience of pedestrians and cyclists and should be seen as an opportunity to make some simple changes that can enhance conditions usually at minimal, or no cost to the City of Bozeman, Gallatin County or MDT. A healthy maintenance program is necessary to ensure bikeway and walkway facilities are usable to the public to the greatest extent possible.

6.6.1 Overlay / Resurfacing Projects

Roadway surfacing projects create an opportunity to make improvements for bicyclists or pedestrians at minimal cost. If resurfacing activities are scheduled, the bikeway and pedestrian project recommendations in Chapter 5 should be referenced to determine if some projects might be completed as part of the job.

Rural Overlay Projects

On uncurbed roads with wide, stable gravel shoulders, there are often opportunities to widen shoulders without major grading. If the shoulders are paved prior to a resurfacing project, the ensuing overlay provides seamless shoulders and a roadway that is safer for all users.

Some sections of roadway may require minor grading to provide additional width; this can be justified on roads with high or potentially high bicycle use (see **Chapter 5** for roads recommended for shoulder expansion).

Other Areas

In areas where widening isn't possible because of existing curbs and sidewalks or a constrained right-of-way by natural features such as ditches or other major changes in grade, the most effective way to provide non-motorized facilities is by reconfiguring lanes after paving if there is adequate width. This saves the expense and inconvenience of removing existing stripes. In many cases no additional right-of-way is required for adding bicycle facilities as adequate width may already exist.

Chip Sealing

Chip seals are useful maintenance tools for prolonging pavement life for vehicles, but present significant obstacles to bicyclists. Chip seals typically leave the shoulder or pavement edge covered in debris and present a rough riding surface that can increase the chance of flat tires for bicyclists.

Chip Seal Recommendations:

- Do not cover part of the shoulder or bike lane leaving a 'lip' for cyclists to contend with.
- Use a fine textured material: 3/8"-10 or ¼"-10 aggregate; and
- After chip sealing, thoroughly sweep the shoulder area of debris

6.6.2 Utility Cuts

Utility cuts can leave rough transitions for cyclists if they are not filled properly.

Utility Cut Recommendations:

- If possible, perform pavement cuts in locations that will not interfere with bicycle travel;
- When resurfacing, back fill cuts in bikeways flush with the surface as bicycles will not carry sufficient force to pack down a hump;
- Ensure that cuts parallel to bicycle traffic do not leave a ridge or groove in the bicycle track; and
- Back fill cuts in concrete sidewalks or shared use paths with concrete flush with the finished sidewalk grade.

6.6.3 Snow Removal

In the Bozeman area, increasing numbers of cyclists and pedestrians are choosing to travel by these modes year-round. Snow stored on bike lanes or sidewalks presents a significant impediment and disincentive to bicycling and walking in the winter.

Snow Removal Recommendations:

- Bike Lanes and roadway shoulders can offer additional snow storage capacity following a large snow event. Snow plow operators should always attempt to clear roadways from curb-to-curb barring prohibitive accumulations.
- If roadway snow removal operations obstruct publicly maintained sidewalks the sidewalks should be cleared following roadway clearing operations.

6.6.4 Bikeway and Walkway Maintenance During Construction Activities

The summer months constitute the bulk of roadway maintenance and construction activities in the Bozeman area. Cyclists and pedestrians frequently have to contend with narrowed roadways, temporary closures of bikeways and sidewalks, and debris on bikeways and sidewalks. The following recommendations provide for improved conditions for bicyclists and pedestrians during construction activities.

Construction Activity Recommendations:

- Pedestrians do not have the patience to tolerate long detours around construction sites and typically ignore signs or trespass on site. It is preferable to create passages that allow pedestrians to proceed as close to their normal route as possible. Barricades or traffic cones should be utilized within the travel way if space permits to create temporary facilities. If possible, temporary ramps can be installed from wood or steel that can provide access to the disabled;
- Intersections and crosswalks should be kept open if possible. Temporary crosswalks can be marked if they need to be relocated;
- Bicycle access should also be maintained. Bicyclists can share the lane with vehicles for a short distance, 15 mph construction zone speed limits can help keep vehicle speeds down. For longer projects a wide outside lane or temporary bike lane is

preferred. Bicyclists should not be directed to ride on sidewalks through construction zones;

- Construction debris in bike lanes and sidewalks can present an uncomfortable and potentially dangerous situation and should be cleared routinely during construction activities; and
- A final sweeping of bicycle and pedestrian facilities should be undertaken following completion of any construction activity.