Marysville has many assets. These include an historic downtown, as shown in the two top photos. Marysville's natural environment includes two rivers (third photo above), Ellis Lake (at bottom), and neighborhood parks.

Recommendations

Guiding principles
Overall project recommendations
Site-specific recommendations

Guiding Principles

The public process in this and previous planning efforts suggested a strategy based on three guiding principles: building on Marysville's assets; corridor beautification; and providing safe connections for all users (pedestrians, cyclists, and motorists).

1) Assets: Build on Marysville's existing assets

Marysville has many assets that provide a foundation for the future and this plan. These include a historic downtown, a desirable natural environment, a grid for a street network, and numerous revitalization opportunities. The historic downtown includes a variety of restaurants, retail businesses, historic points of interest, and civic functions. The large variety of diverse destinations makes the historic downtown an attractive walking destination.

Marysville is closely connected to the natural environment by the Feather and Yuba Rivers, which define two edges of the city. Riverfront Park provides open space and trails along the Feather River. Marysville has several city parks and open spaces in its central district, including Veteran's, Motor and Yuba. Ellis Lake dominates the center of the city, with its parkland and adjacent Bryant Field. The state highways form two sides of the Ellis Lake park.

Marysville's traditional street grid with short blocks helps distribute motorists and provides frequent pedestrian crossings. The grid pattern allows easy access to tourists who wish to leave or enter and provides multiple opportunities to attract visitors from the heavily traveled highways. It is an asset to be treasured and preserved. See the discussion of "Connectivity" on page 9 for some additional benefits of a grid system.

The state highway rights-of-way are spacious. This offers the flexibility to redistribute space within the existing cross sections to better balance the needs of pedestrians, cyclists, and motorists. In general, unnecessarily wide lanes promote higher speeds, especially when traffic is light. Slower speeds give drivers more time to react to pedestrians and cyclists. If a vehicle does hit a pedestrian or cyclist, lower speeds reduce the impact. Lower speeds means lowered risk of a fatal crash. Eliminating underused lanes and narrowing the remaining ones reduces the crossing distance for pedestrians and cyclists. Shorter crossings improve real and perceived safety for these users.

Marysville offers numerous revitalization opportunities. For example, many historic buildings line E Street. Currently vacant properties could be preserved and restored to maintain the neighborhood's character. The Downtown Economic Development Strategic Plan identified two sites, the State Theater and Marysville Hotel, as "Catalytic Opportunities." Charrette participants also expressed a desire to preserve historic buildings and encourage their use for pedestrian-compatible commerce. Many alleys provide access to downtown properties, allowing parking and loading in the rear. Numerous side streets provide additional on-street parking. Another potential revitalization site is the vacant lot on B Street near 14th Street. Development here could help connect to Ellis Lake and the rest of Marysville.

Photos above show an alley and State Theater. Marysville has mature trees and street landscaping on some streets, as shown below. Charrette participants envisioned similar beautification of the state highways.

2) Beautify: Add more street trees and landscaping

Charrette participants strongly endorsed beautification of the corridors, especially provision of street trees. Marysville already has some trees and landscaping, but participants believed that more plantings would be a simple, effective way to beautify the corridors. Caltrans recognizes the benefits of street landscaping,

US 395, Carson City, NV, shown on the left, has about the same amount of traffic as E Street north of 3rd Street. It features landscaped edges and raised center medians. Note the maintenance worker in this photo. Maintenance requirements vary depending on the type of landscaping selected.

"Street landscaping makes downtowns more livable, beautiful, and unique to the town. Quality landscaping along the roadway, close to the highway or in medians can increase driver awareness of the immediate environment and may alter driver behavior, resulting in slower speeds and a safer main street." Caltrans
The photos above demonstrate these principles.

The photo below shows a recent beautification effort on Marysville's D Street.

as described in its publication *Main Streets: Flexibility in Design and Operations:*

> Street landscaping makes downtowns more livable, beautiful, and unique to the town. Quality landscaping along the roadway, close to the highway or in medians can increase driver awareness of the immediate environment and may alter driver behavior, resulting in slower speeds and a safer main street. A row of trees may calm traffic by making the road appear narrower. Street trees add an attractive canopy over the main street and may increase comfort for pedestrians. They create comfortable spaces and soften lighting. They cool streets in the summer, and provide a windbreak in the winter. Trees also create distinctive identity and seasonal interest.

Research suggests that sidewalk trees create street environments that are well-defined, comfortable, safe feeling, and inviting to pedestrians. Closely planted trees at the sidewalk edge create a "transparent fence" that helps protects pedestrians, psychologically and physically, from traffic on the street. (Jacobs et al 2002). Closely planted deciduous street trees also play a major role in contributing to the year round physical comfort of pedestrians. They provide shade on hot, sunny days, and some protection from rain. Recent public health research suggests that environmental factors can increase or decrease physical activity. Pedestrians and cyclists are more likely to travel when and where they feel safest and most comfortable.[1, 2, 3] Policies limiting or restricting the location of street trees also limits the perceived and actual pedestrian safety and comfort. Except for certain situations, use of street trees should not be restricted.[4]

Beautification of public spaces is a simple way to enhance the overall image of the community. Sidewalks, streets, squares, and parks are public spaces that can encourage walking and other forms of physical activity. Research suggests that a beautified environment provides psychological health benefits to residents and visitors. http://www.uctc.net/papers/768.pdf.

3) Connections: Provide safe connections for all users — motorized and non-motorized

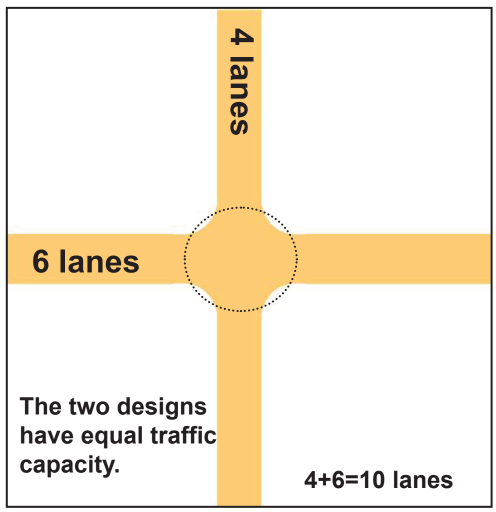
All users share common travel goals. For example, all users want the most comfortable, convenient, and direct route. They also want easy access to destinations and want to avoid delays. Good, safe connections mean balancing the sometimes conflicting interests of motorists, pedestrians, and cyclists. Balancing these needs was one criterion used to evaluate potential design treatments. Recommendations in this report consider the needs of all potential users.

The directness of a route determines its level of connectivity. Motorists prefer direct connections that do not require going out of their way. Direct connections for other users have not been a priority. For example, at some intersections pedestrians are barred from crossing at one or more quardrants. This forces pedestrians to go out of their way to cross the street and can expose them to three times the number of conflicts. An intersection like this provides low pedestrian connectivity.

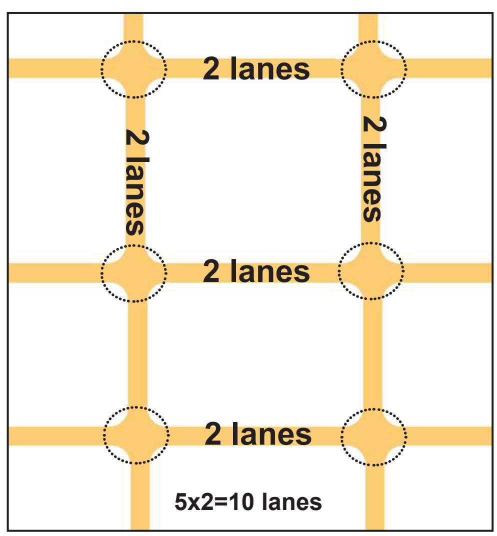
Connectivity

Walkability depends on connectivity to make this mode an appealing and useful choice. Connectivity gives greater options for vehicle movements as well. The two diagrams on the right show each have the same traffic capacity: four total lanes north and south, six lanes east and west. All intersections in the diagrams are signalized. In the upper diagram, all lanes intersect at a single point, requiring longer wait times to accommodate all vehicle and pedestrian movements. Pedestrians need more time to cross all four or six lanes.

The lower diagram shows a grid system like Marysville's. Six smaller intersections distribute an equal amount of traffic over a wider area. Because users have numerous choices for turning instead of just one, wait times at each intersection are much shorter. Pedestrians can choose when and where to cross and have shorter crossing distances.



One single intersection must handle all through traffic volume, turning movements, and pedestrian crossings.



Six intersections distribute traffic and pedestrian volume, turning movements and crossings, making signal wait time and crossings shorter. In this situation, signals may not be needed at all intersections, due to the lower volumes at each.

Overall project recommendations

Throughout the study area, the corridor requires improvements in four major areas: street markings; pedestrian countdown clocks at signalized intersections; signal timing; and accessibility for users of all abilities.

Provide high-visibility crosswalk markings at all signal-controlled intersections.

Marysville should mark crosswalks on every leg of all signalized intersections, except at 9th and E Street, where crossing E Street to the south is prohibited. Markings should use stop bars and high visibility ladder-style markings. The ladder-style marking illustrated in the image below is more visible to both drivers and pedestrians with low vision. Using a staggered pattern reduces wear by placing markings between tire tracks.

Except as noted, all legs of signalized intersections should be available for pedestrian crossings. When one crossing leg is closed, some pedestrians must cross three legs of the intersection to reach their destination. This increases their exposure to traffic and risk of crash. When closing one crossing leg to pedestrians cannot be avoided, careful compliance with Americans with Disabilities (ADA) guidance will help visually impaired pedestrians recognize the closure.

Above, left: Pedestrian view of existing E Street crossing. All signalized intersections should have high-contrast "ladder-style" crosswalks, like those shown in the photo simulation to the right.

The motorist's view of the same intersection and simulated crosswalk markings. High-contrast markings alert drivers to watch out for pedestrians. Ladder-style markings are spaced so that vehicle tires travel between crossbars, instead of over them. This reduces wear and maintenance of crosswalk markings.

Install pedestrian countdown signals at all signalized intersections

Some intersections in Marysville already have pedestrian countdown signals. At these signals, a standard WALK symbol is displayed during the walk interval, which is the period of time during which pedestrians may enter the crosswalk. When the WALK interval closes, it is followed by a clearance interval, during which time pedestrians can complete their crossing, but may not enter the crosswalk. At a countdown signal, the number of seconds remaining in the clearance interval is displayed. Preliminary research shows most pedestrians understand the countdown display more clearly than signals which do not display the remaining seconds. Some pedestrians still start to cross during the clearance phase, but fewer pedestrians start crossing late in the clearance phase. The results are that pedestrians are out of the crosswalk by the steady "don't walk" phase. Despite fears that drivers would cue from the countdown signal and accelerate to beat the light, preliminary research indicates this is not happening.

Pedestrian countdown signals.

Signal timing changes

Set minor street pedestrian signals to rest in WALK when the main line signals are resting in green. This allows pedestrians to proceed without pausing to push the button, as long as an adequate WALK interval remains. Some engineers hold a belief that requiring pedestrians to push a button before crossing the street makes them more "aware" of their crossing and thereby increases their safety. This is a reasonable assumption in theory. But the reality is that when many pedestrians walk along a major street, they simply don't bother pushing the button to cross the minor streets. They observe and cross with the adjacent green interval. Making signalized intersections more convenient for pedestrians results in better pedestrian behavior and encourages the appropriate use of pedestrian signals. WALK signals that are automatic, shorter wait times before the signal turns to WALK, and conveniently-placed pushbuttons (when truly needed) are three primary features that make signalized intersections more convenient for pedestrians.

High-contrast, ladder-style crosswalk markings are much more visible to motorists, as shown above. The top photo is the existing intersection, while the bottom is a simulation.

The WALK interval, which is the period during which pedestrians may enter the crosswalk, should be at least seven seconds long at all traffic signals. The current minimum in the Manual on Uniform Traffic Control Devices (MUTCD) is 4 seconds. Caltrans timing varies from 4 to 7 seconds. The clearance interval, which is the amount of time allowed for pedestrians to complete their crossing after entering the crosswalk, should be calculated based on a walking speed of 3.5 ft per second, curb to curb. Caltrans and the current edition of the MUTCD calculates clearance intervals based on a walking speed of 4 ft per second. These changes to increase the minimum time for pedestrians to enter the crosswalk and reach the opposite curb may become requirements in the 2009 MUTCD.

All pedestrian crossings of major streets should incorporate Leading Pedestrian Intervals (LPIs). Leading Pedestrian Intervals give pedestrians a two to five second head start over motorists. LPIs provide a brief, exclusive phase for pedestrians, allowing them to step into the crosswalk before turning drivers receive a green light. This increases pedestrian visibility and reduces conflicts with turning vehicles.

Typically about 37% of pedestrian injury crashes and 20% of fatal pedestrian crashes occur at intersections. A study of LPIs at urban intersections showed they reduced conflicts between turning motorists and pedestrians. The high volume of turning movements from side streets onto E Street conflicts with pedestrians crossing E Street. Installing LPIs here can increase safety by reducing conflicts without slowing traffic.[5]

Within the study area, most of the traffic from minor streets turns right or left onto the major street. Most of the side streets have simple signal phase timing, without a protected left turn signal phase. Turning vehicles conflict with the concurrent pedestrians crossing the major street. Because the main streets are wide, they take longer to walk across. The estimated crossing time is called the Pedestrian Clearance Interval (PCI). On E Street, for example, the PCI is 22 seconds (at 3.5 feet per second). Together with the recommended 7 second walk interval, side streets have a pedestrian actuated 29 second cycle. Even during peak hours, the green time is more than long enough to serve the vehicle queue on the side street. Holding the side street traffic for two to five seconds would not delay motorists on the major street, such as E Street.

Preemption for emergency service providers

Marysville should investigate the benefits of implementing an Emergency Vehicle Preemption system. Emergency Vehicle Preemption (EVP) systems allow drivers of fire and emergency medical response vehicles to change red lights to green. EVP can reduce driver confusion, reduce conflicts and crashes involving emergency vehicles, and improve emergency response times. EVP technologies include light-based, infrared-based, sound-based, and radio-based emitter/detector systems.[6] Impacts of preemption systems on traffic flow differ based on the frequency of calls, but could result in delays. In one study in Plano, TX, traffic during peak periods took 10 to 20 minutes to return to normal flow after a signal interruption.[7] The safety benefits must be weighed against the potential for increased traffic delay.

This well-designed downtown Marysville crosswalk illustrates how aesthetic treatments and the need for a smooth crossing can be compatible.

Incorporate Americans with Disabilities Act (ADA) Recommendations

All improvements in the study area should provide access to users of all abilities, as described in the 2005 Revised Draft Guidelines for Accessible Public Rights-of-Way. This is the most recent guideline issued by the U. S. Access Board. The current draft revision of this guideline offers excellent information and recommendations for providing equal access to people with disabilities. Marysville should rely on the recommendations in this draft until they are superseded. The following accessible design features should be incorporated throughout the study area:

- Smooth surface on all walkways and crossings
- Five foot minimum unobstructed walkway.
- Pedestrian push buttons with audible and vibratory signals located per guidelines.
- Each corner needs two curb ramps, each aligned with its respective cross walk. A four foot level landing area is called for at the top of each curb ramp.
- Warnings detectable to the visually impaired at curb ramps, landings, and blended transitions. For example, truncated domes on curb ramps signal the edge of the crossing.

This sidewalk next to Ellis Lake is separated from traffic, making it a more pleasant walk. Better connections to the street and way-finding signs would enhance this asset.

The sidewalk in the top photo is not wide enough to pass comfortably. The next photo shows a sidewalk wide enough to accommodate passing and groups.

Ellis Lake is an important city asset. Along State Routes 70/20 this is the only sidewalk provided on the Ellis Lake side. It serves both recreational walkers and destination-oriented people who are walking for transportation. Connections between the street and walkway at the lake should be as direct as possible. The walking route should be obvious to visitors who may not be familiar with the area, keeping in mind that people who are blind or have impaired vision need audible or tactile information to help them find their way.[8]

Sidewalks and sidewalk zones

Sidewalks can be organized in zones to accommodate a wide range of uses while minimizing potentially hazardous obstacles or obstructions. In addition to providing a clear travel route for pedestrians of all abilities, sidewalks are expected to provide zones for amenities like transit stops, landscaping, and bike racks.

Starting at the street, the first zone is the curb zone, as shown on the next page. Flat-faced curbs are best to define the edge of the vehicle boundary. Next to the curb is a furniture zone, or buffer zone, that separates the walkway from the roadway. Fire hydrants, benches, transit stops, trees, bike racks, signs, poles, newspaper racks, public phones, and other street elements are usually in this zone. The furniture zone on major streets should be at least five to six feet wide.[4] Next to the buffer zone is the pedestrian zone, an accessible pathway free of obstacles, protruding objects, and vertical obstructions. This area should have a smooth surface for safe and comfortable use by individuals with personal assistance devices, such as walkers, wheelchairs, or strollers. Marysville may have to adopt local ordinances to protect the pedestrian zone from signs, other temporary street fixtures, sidewalk cafes, etc.

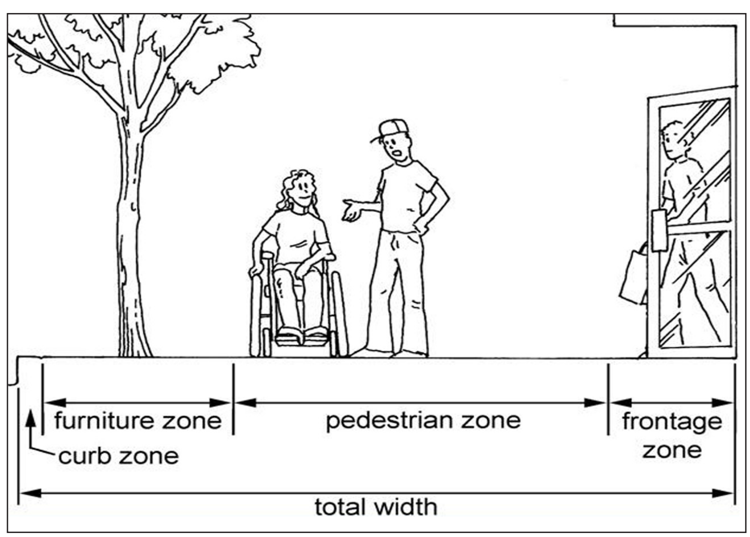
Between the pedestrian zone and any buildings adjacent to the sidewalk is the frontage zone. It marks the edge of the public right-of-way. Sidewalk users generally avoid the frontage zone if they can. For one reason, some ground floor doors open out, and people may exit buildings at any time. Most people don't feel comfortable walking or rolling very close to buildings, fences, or other structures at the edge of the right-of-way.

Bikeways

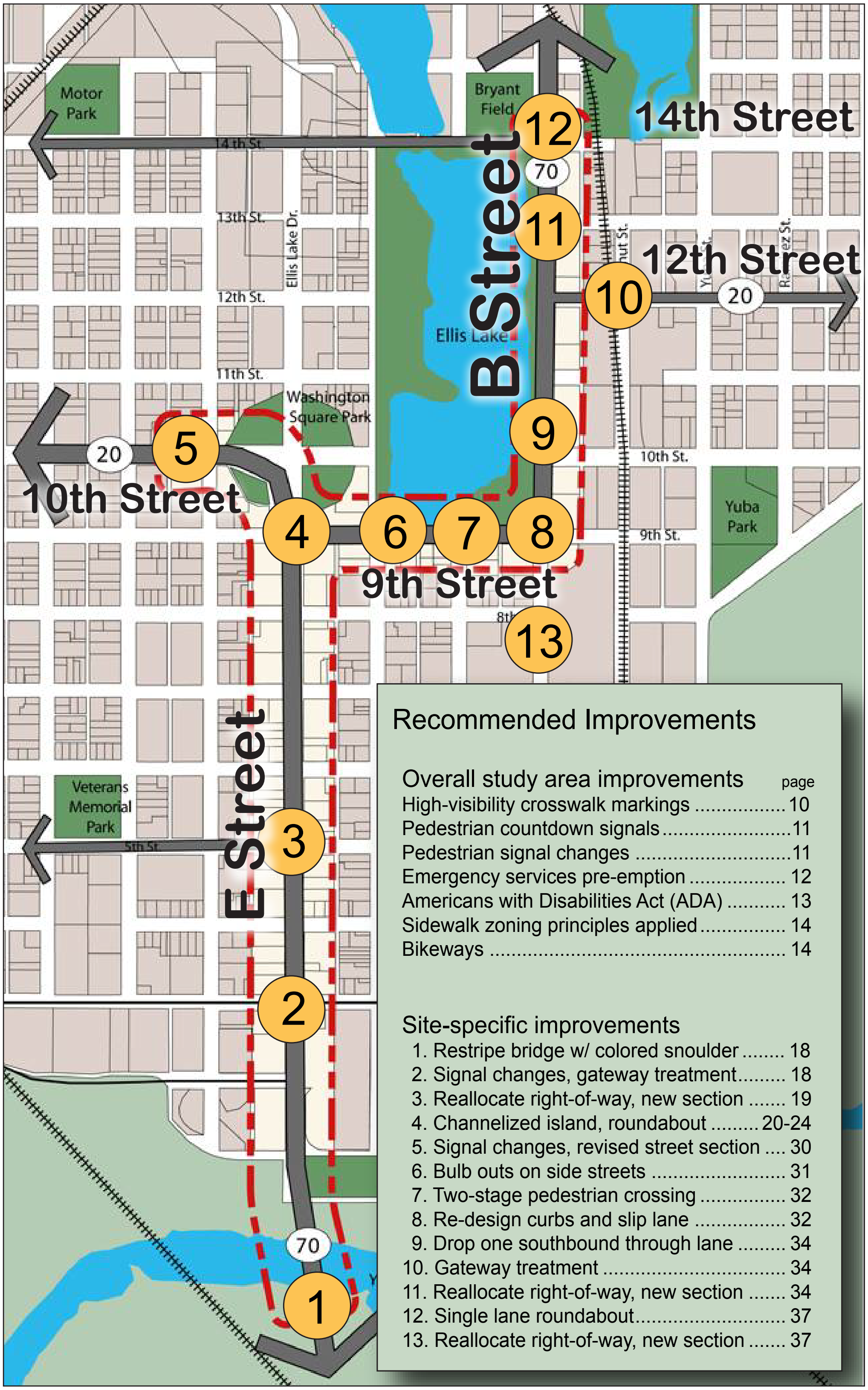
Many bicyclists were observed riding on sidewalks in Marysville. Bicyclists riding on sidewalks are twice as likely to be involved in a vehicle-bike crash as those riding on a designated bikeway. This is due to the conflicts at intersections and driveways, where motorists may not be expecting a bicyclist. Riding facing the oncoming traffic, whether on a sidewalk or in the street, also increases the likelihood of a conflict.

A detailed Master Plan should be developed to create a network of bikeways in Marysville. The Yuba County Bicycle and Trails Plan includes a planned bikeway around the outskirts of Marysville, but this loop does not provide a network that serves all types of bicyclists within the City. Several bicyclists were observed riding on the sidewalks in Marysville, which is unsafe and prohibited in the City, but is an indicator of the need for safe bicycle routes.

Bikeways include both on-street and off-street facilities. Many bicyclists prefer to ride in the street and follow the same rules followed by motorists because they are not delayed by waiting at pedestrian crossing areas. Others prefer to use off-road shared use trails because they are uncomfortable on the street. Both types of facilities are important. A systematic approach to identifying locations for on-street and off-street facilities is recommended. These facilities should be linked together to create continuous routes throughout the community that serve bicyclists in much the same way motorists are served by street networks. Constraints such as railroad crossings or narrow bridges and tunnels should be addressed. The master plan should also consider other elements that influence bicycling. For example, well designed bike racks located in safe, secure locations where bikes can be "watched over" are a necessary part of a system. Another example is angled parking. Many communities choose not to stripe bike lanes on streets with angled parking. Some California communities, including San Francisco, sign streets where bicycle lanes cannot be provided with the message, "Bicyclists may use full lane." These and other issues require a planning process that focuses on bicyclist needs.



The photo above and sketch below demonstrate the concept of sidewalk zones.



Recommended Improvements

Overall study area improvements

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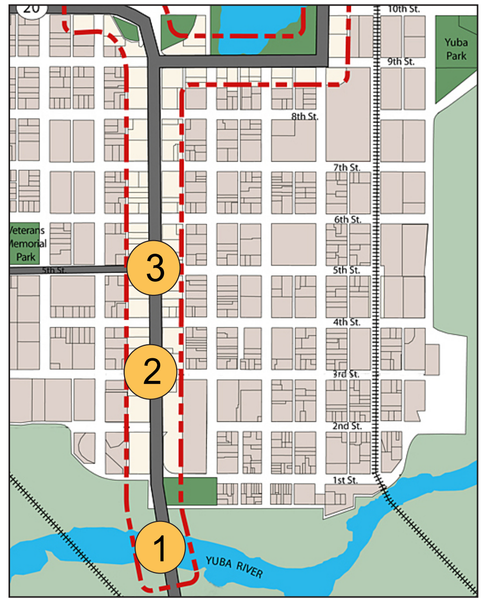
Site-specific street recommendations

E Street (State Route 70)

E Street is one of Marysville's major north-south thoroughfares for vehicular traffic. From the city's southern boundary to 9th Street, it is designated State Route 70. Over the Yuba River, south of Marysville, the route is a limited access, high speed roadway. According to Caltrans (2006), E Street carried 49,500 vehicles per day, traveling both directions, near the Yuba River bridge. As it enters the city, the street gives direct access to adjacent commercial properties. E Street also connects to minor streets that lead to nearby commercial and residential districts. Some traffic turns on to side streets as E Street continues north. Near 9th Street, the average daily vehicle count is only 32,000. (Caltrans, 2006) Since this portion of E Street is a state highway, it naturally carries a lot of truck traffic. Most trucks do not turn on to side streets. Due to fairly tight corner radii, any turning trucks have to reduce speed considerably.

The state highway section of E Street has three key intersections: 3rd, 5th, and 9th Streets. Signal cycles at these intersections range from 80 seconds to 120 seconds. Signals are programmed with five different cycles, each one ten seconds longer. These traffic signal cycles are designed to vary with the actual traffic volume, not by certain times of the day. Wire loops embedded in the roadway detect volume and queue length at intersections. When traffic volume increases and more vehicles queue for each intersection, signal cycles are lengthened. Northbound and southbound traffic signal cycles are the same. Signal programming does not favor peak traffic in only one direction. Northbound traffic can back up at the intersection of 9th and E Street during peak hours. Because southbound traffic moves during two of the signal cycles, traffic in this direction keeps flowing even during peak hours.

Pedestrians trying to cross E Street face some serious challenges. Due to longer signal cycles during high traffic periods, pedestrians may have to wait up to 2 minutes to cross E Street. While intersections with the highest pedestrian traffic have crosswalks, smaller intersections do not. Pedestrian WALK intervals occur simultaneously with the permissive green for side street traffic, creating a conflict between pedestrians and turning traffic.



1. Restripe bridge w/ colored shoulder
2. Signal changes, gateway treatment
3. Reallocate right-of-way, new section

The upper photo shows a practically deserted E Street looking north. The lower photo shows peak hour conditions. Northbound congestion will decrease somewhat after improvements at 5th Street.

Pedestrian signals for crossing side streets along E Street rest in DON'T WALK during the green phase on E Street until a pedestrian pushes a button to get a WALK interval. If enough time remains in the signal cycle, the pedestrian receives an immediate walk interval. All left turns off E Street to the minor streets are dedicated only, which benefits pedestrians by removing conflicts with left turning traffic.

Overall recommendations discussed in the previous section apply to E Street as well. Additional specific recommendations apply to particular sites along E Street. These are listed below, starting from the south.

1. Restripe bridge w/ colored shoulder

State Route 70 entrance to Marysville at Yuba River bridge

1 The bridge carrying E Street across the Yuba River has 70 feet of available right-of-way. This is enough room to provide 6 foot paved shoulders on both sides, which could help buffer pedestrians and bicyclists from motorized traffic. Solid colored or pigmented shoulders can help distinguish this buffer zone. In Europe, colored shoulders have helped calm traffic and protect pedestrians and cyclists for decades. U.S. cities, including Chino Hills, Petaluma, and Sunnyvale, CA, have also adopted this strategy. Studies show that colored shoulders make roads seem narrower to drivers, helping reduce speed. Studies also show that vehicles are more likely to stay out of colored shoulders than unmarked shoulders or even striped shoulders. Keeping adequate separation between motorists and cyclists decreases bicycle-vehicle conflicts.

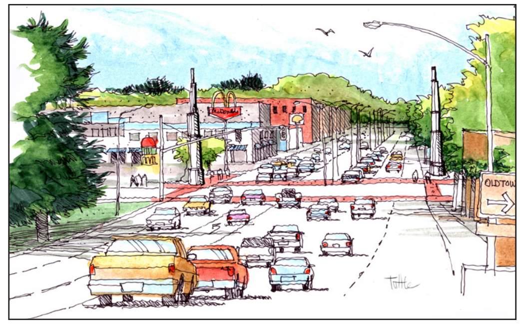
When roadway resurfacing includes colored shoulders, dyed asphalt is better than other materials because of installation ease, high durability, and low maintenance requirements. If the road is not scheduled for resurfacing in the near future, shoulders can be colored using thermoplastic/epoxy coatings or tennis court paint.

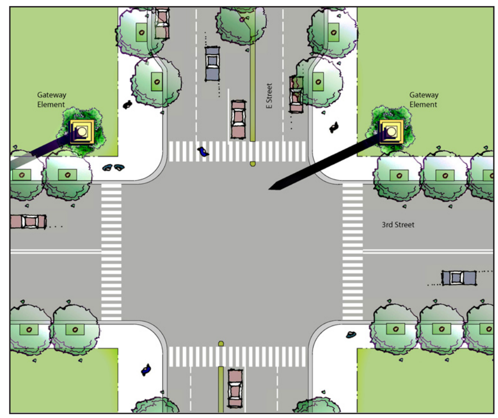
2. Signal changes, gateway treatment

E Street at 3rd Street

2 Northbound, the intersection of E and 3rd Streets includes double left turn lanes and a right turn pocket. At the time of the study, its signal timing was unusual because the cross street was only served every other cycle, without regard to time of day. Recent discussions with Caltrans engineers indicate that the signal timing has been changed to be consistent with other intersections on E Street. This is a significant improvement for pedestrians since it decreases the potential delay that pedestrians experience to cross E Street.

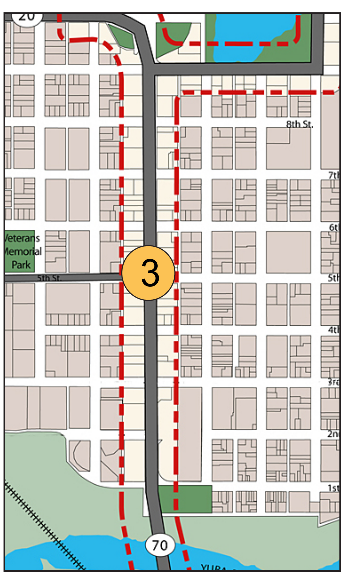
To enhance walkability at E and 3rd Streets, the crosswalk on the south leg should be opened. Crosswalks are marked on the other three legs of the intersection, but the crosswalk on the south side of the intersection is currently signed as closed. Considering that the Mervyn's Department store is a fairly high pedestrian-generating use, a crosswalk on this leg is important. Closing this leg of the intersection to pedestrians is not necessary or useful. Users who want to cross E Street on the south side of 3rd Street must travel around three sides of the intersection. When crossing these three legs of the intersections, pedestrians experience many conflicts with turning vehicles, including all of the turning movements that they would conflict with if crossing on the currently closed south leg of the intersection. Rather than crossing all 3 legs, pedestrians are very likely to simply cross the south leg anyway, thereby reducing overall pedestrian safety. This crosswalk is likely closed in order to improve vehicle capacity. Opening the crosswalk would only negatively impact vehicle capacity during cycles when pedestrians push the button to cross the street here. Pedestrian volumes are low enough that these crosswalks will only be used during a fraction of the signal cycles each day. If the crosswalk on the south side of the intersection remains closed, it needs an ADA-compliant barrier blocking the crosswalk instead of just a sign.





Proposed intersection improvements at E and 3rd Streets. Gateway features on the north side of the intersection would mark the entrance to downtown.

A gateway feature at 3rd Street is recommended, as shown at the right, serving to mark the southern entrance to the city. Gateways help signal to drivers to expect lower speeds, more turns, and pedestrians.



E and 5th Streets

3 During peak hours, the northbound left turn lane at 5th Street backs up into the through travel lanes. This causes additional traffic congestion, which can lead drivers to take dangerous risks. Caltrans plans to add an additional left turn lane.

3. Reallocate right-of-way, new section

E and 5th Streets, looking south towards the bridge.

4. Reallocate right-of-way, restripe, channelized island, roundabout.

E and 9th Street is a busy, large intersection. Note the dogleg crosswalk. Also notice how far pedestrians have to cross.

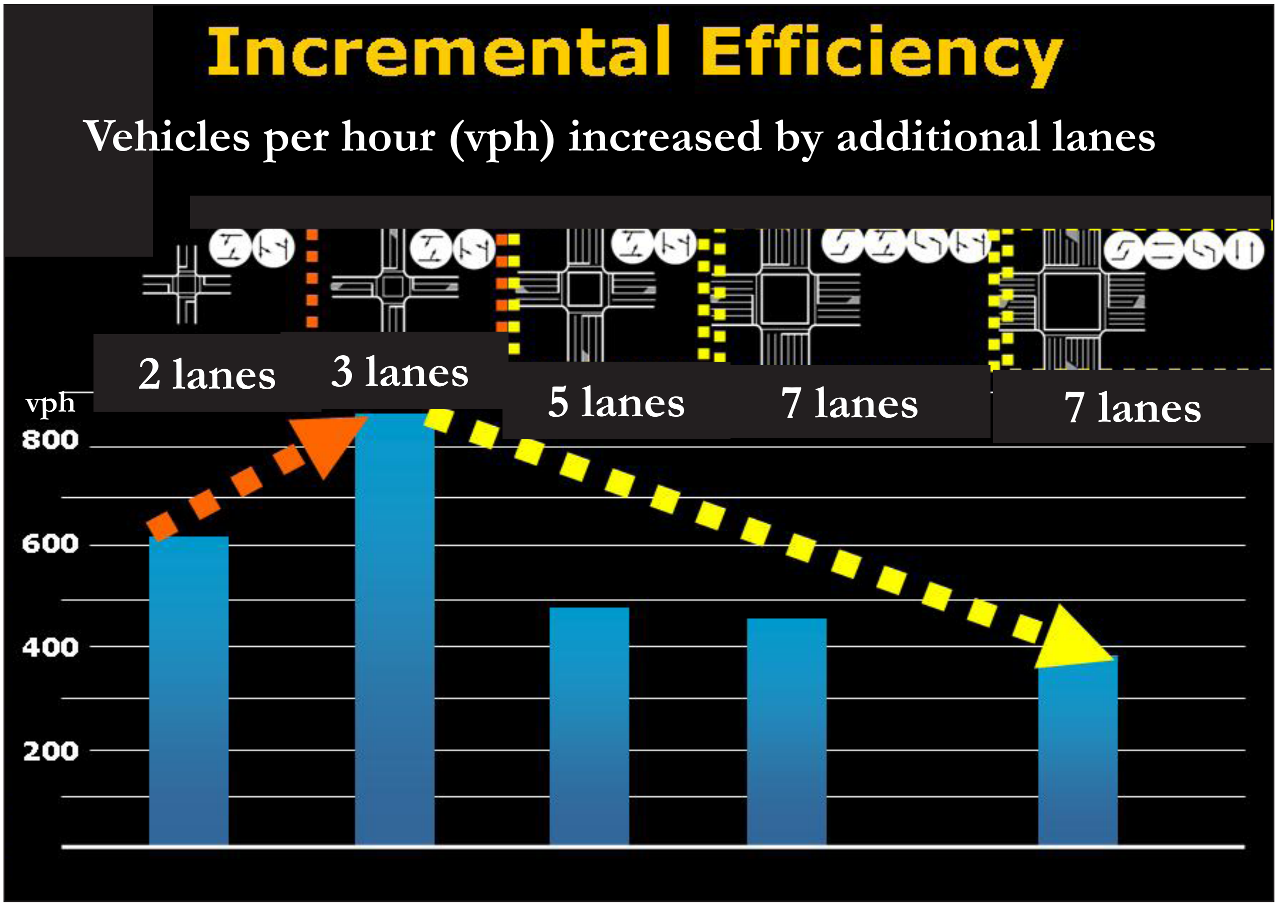
E Street at 9th Street

4 Highways 70 and 20 meet at this key intersection. Northbound, a lot of traffic turns right onto 9th Street, where the two highways merge for several blocks around Ellis Lake. Heavy eastbound traffic on Highway 20 must turn left onto 9th Street. Heavy southbound traffic on Highway 70 travels west on 9th Street and turns left onto E Street. The large number of vehicles turning at this intersection increases congestion and the risk of potential conflicts and crashes, both motorized and non-motorized. As at 3rd Street, there is a sign prohibiting pedestrians from crossing E Street on the south side of the intersection. The E Street crossing on the north side of the intersection includes an angled section. This intersection allows motorists to proceed straight through during two of the signal phases. Turning traffic only has one signal phase.

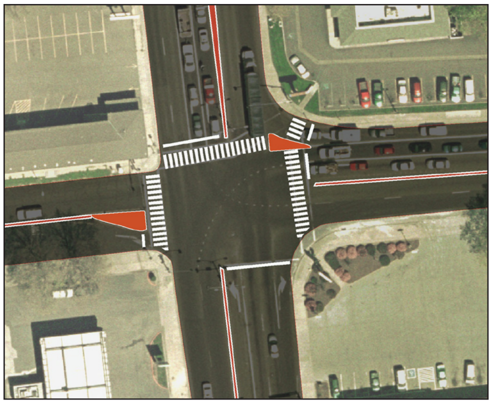
The heavy turning traffic reduces the capacity of the E Street and 9th Street intersection, since turning vehicles take longer. Charrette participants reported large trucks frequently back up on 9th Street, waiting to turn at E Street. They can block D Street, forcing motorists trying to enter 9th Street to wait through additional signal cycles.

Also, whether motorists continue on their original state highway or turn on to the intersecting one, they must turn up to four times while traveling through Marysville. The capacity of E Street is greatest at the southern end, where higher speeds are feasible in the freeway transition area on the bridge. North of 3rd Street, speeds are much lower and signalized intersections further slow motorists. Speeds decrease and congestion increases approaching 9th Street. After passing this intersection, congestion decreases again. The number of vehicles that can pass through the E and 9th Streets intersection limits the traffic capacity of the entire SR70/20 corridor.

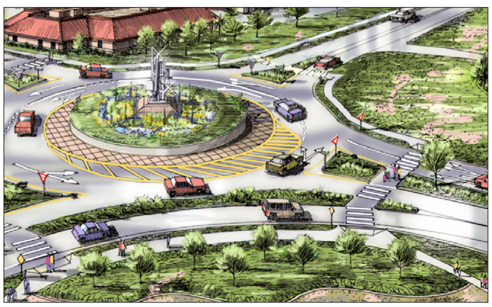
Caltrans has discussed expanding E Street to six lanes to alleviate congestion. While further detailed analyses may be necessary, the preliminary analysis reveals that unless the capacity of this intersection is increased, additional lanes on E Street will not make a substantial difference in traffic flow. The added lanes will, however, reduce accessibility for non-motorized users. Additional lanes contribute to longer crossing distances, higher speeds, and higher traffic volume, all of which increase risk to non-motorized users. As the population ages, more people will rely on devices such as motorized wheelchairs and electric



The illustration above shows how the capacity of each additional lane diminishes as more lanes are added due to constraints at signalized intersections. As shown, per lane capacity is greatest when a single turn lane is added to a street with one lane in each direction. The capacity per lane drops substantially as more lanes are added. See the Appendix for details. In the case of E Street, capacity is constrained at the intersection of E Street and 9th Street. Unless additional lanes on E Street will continue through the intersection, so the benefit is limited. Adding lanes increases pedestrian crossing distances and exposure to traffic. The Institute of Transportation Engineers (ITE) Journal (2003), illustrates this concept. See details in the Appendix.



Proposed slow speed, right turn slip lanes at 9th and E Streets.



The roundabout in the illustration is under construction in Reno, NV. Note how single and dual lanes are combined with right-turn slip lanes.

scooters to retain their mobility and independence. Other non-motorized users include children riding their bikes or scooters, young mothers with strollers, joggers, shoppers, and tourists exploring the downtown on foot.

The illustration on the left shows improvements to the crosswalks at 9th and E Streets. A right-turn slow speed slip lane on the northeast corner helps align the crosswalk. (see page 24) STAA turning templates will need to be used when designing the slip lane, as per the Caltrans Highway Design Manual. Without major changes, congestion and signal timing at this intersection prevent the opening of the southern leg for pedestrian crossings.

Increasing the traffic capacity at this intersection will require a new design. Such improvements will likely require land use changes in adjoining properties. Since any substantial improvement in intersection capacity will require additional right-of-way, a roundabout should be one of the alternatives considered to improve operations at E and 9th Streets.

A preliminary analysis shows that a roundabout with two lanes north and south of E Street and a single entry lane with a slip lane on 9th Street would provide a better level of service for traffic than a signalized intersection. It would also allow full access to all legs of the intersection. The analysis compares the roundabout to a signalized intersection with 12 entry lanes, 50 percent more lanes than the roundabout. The results forecast longer vehicle queues at the signalized intersection than at the roundabout. It may be necessary to re-time signals near the roundabout to prevent queues from backing up into the roundabout during peak traffic periods. See the appendix for the analysis.

This family is running to get across all the lanes in time.

Roundabouts

Roundabouts are un-signalized intersections in which traffic circulates counterclockwise around a raised center island. In the proper setting, well-designed roundabouts have far fewer crashes than signalized intersections. Roundabouts have 76% fewer injury crashes and 30-40% fewer pedestrian crashes than signalized intersections. The most severe intersection crashes, often caused by red light running, are eliminated at roundabouts.

Well-designed roundabouts also increase roadway capacity to reduce delays, without adding more lanes. As a result, roundabouts reduce vehicles' speed differentials within the intersection, while reducing congestion. Elimination of stop and go driving by the roundabout lowers vehicle emissions and noise. Vehicles in the roundabout have the right-of-way over entering traffic. Drivers of cars, pickups, vans, SUVs, and motorcycles slow down as they approach the intersection, yielding to any pedestrians in the crosswalk. The yielding driver looks left, waiting if necessary for a gap in the traffic flow before merging into the roundabout. Once inside the roundabout, drivers signal and turn right at their exit.

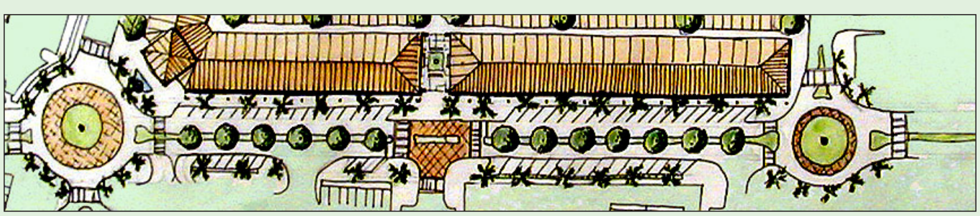
Pedestrians cross roundabouts at designated crosswalks. There are no signals for pedestrians. They cross one direction of traffic, wait in the refuge island to be sure a driver is going to yield, then complete their crossing. People with visual impairments rely on sound to determine when it is safe to cross. At roundabouts it may be difficult for them to determine when traffic has stopped to wait for them. Experienced bicyclists can proceed through the roundabout in a traffic lane, following the same rules as other vehicles. Cyclists may also use sidewalks and pedestrian crossings.

Large trucks and long fire engines drive over the curb on the truck apron in the middle to make the tightest turns. The truck apron surrounding the center island uses contrasting paving and slopes slightly up toward the middle. Normal vehicles stay off the truck apron.

Roundabout size is dependent upon the volume and type of traffic that will pass through the intersection. Roundabouts can be designed to accommodate the largest trucks.

Roundabouts can increase intersection capacity 30-50%. They reduce delays, reduce pollution, save fuel, reduce the need for storage lanes, and improve traffic flow at intersections with frequent left turns. Roundabouts save signal maintenance and power costs. Cost comparisons between roundabouts and signalized intersections show that roundabouts can cost less over their life-times. The service life of a roundabout is 25 years, versus the 10-year service life of signal equipment.

While roundabouts are safer and offer beautification opportunities, they are not the right choice in every circumstance. Roundabouts often require more right-of-way than a signalized intersection. At 9th and E Street, the roundabout central island diameter would be approximately 120 feet, with a circulating width of about 34 feet. A total of approximately 218 feet would be needed when sidewalks, buffers, and curb area are added. A right-of-way study was not conducted, but space required for the roundabout would most likely be triangular sections on all four corners. More detailed analysis is needed to know precise measurements and additional right-of-way requirements.



This sketch illustrates how roundabouts are often used in pairs. Note how in this drawing the building is located near the sidewalk and parking is behind the building.

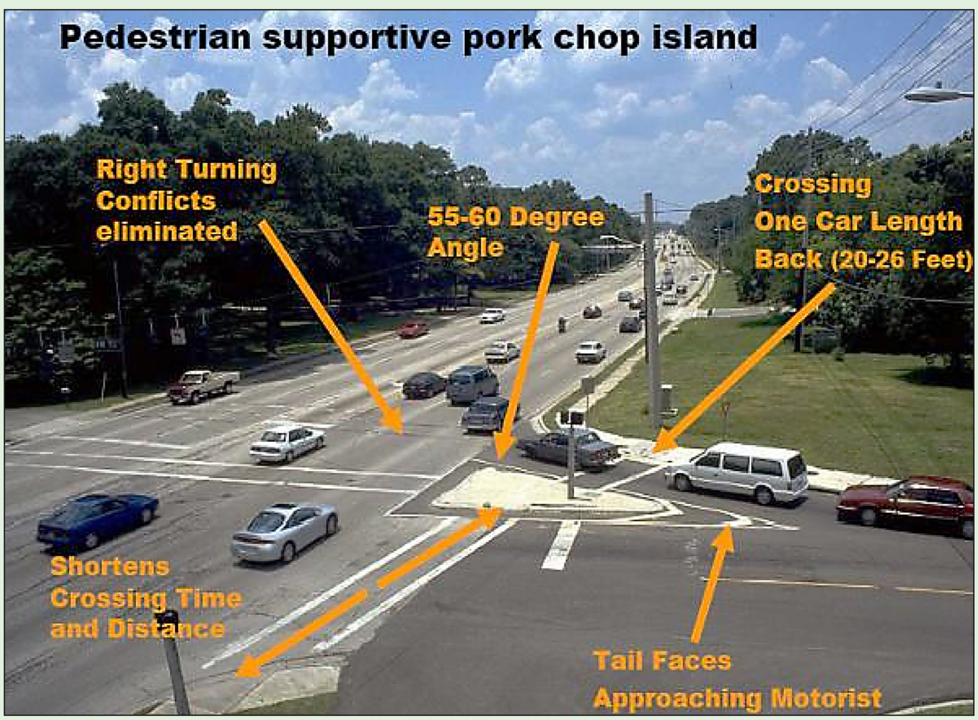
Right-Turn Slip Lane Design

A right-turn slip lane is a vehicle lane dedicated to right turning motorists. They are not usually controlled by a signal unless there are two right turn lanes. When they are not controlled by signals, motorists pull forward and wait for a gap to enter the traffic stream. On many arterial street intersections, pedestrians have difficulty crossing due to right-turn movements and wide crossing distances. The addition of well-designed right-turn slip lanes provide pedestrian crossing islands within the intersection and a right-turn lane that optimizes the right-turning motorist's view of the pedestrian and of vehicles to his or her left.

Pedestrians are able to cross the unsignalized right-turn lane and wait on the refuge island, or "pork chop island," for their walk signal. Since the traffic signal is timed based on a shorter crossing, the pedestrian crossing time has a much smaller influence on the timing of the signal.

The problem for pedestrians is that many slip lanes are designed for unimpeded vehicular movement. The design of corner islands, lane width, and curb radii of right-turn slip lanes should discourage high-speed turns, while accommodating large trucks and buses. The triangular "pork chop" corner island that results should have the "tail" pointing to approaching traffic.

This design has an additional advantage for the pedestrian; the crosswalk is located in an area where the driver is still looking ahead. Older designs place the crosswalk too far down, where the driver is already looking left for a break in the traffic.



Proposed E Street Sections

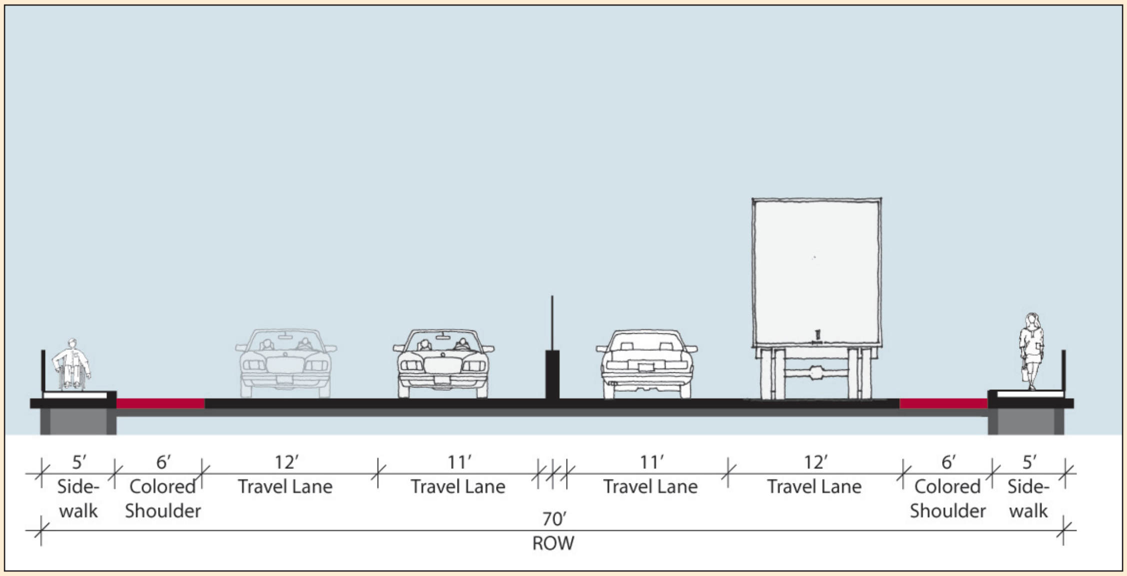
E Street Sections

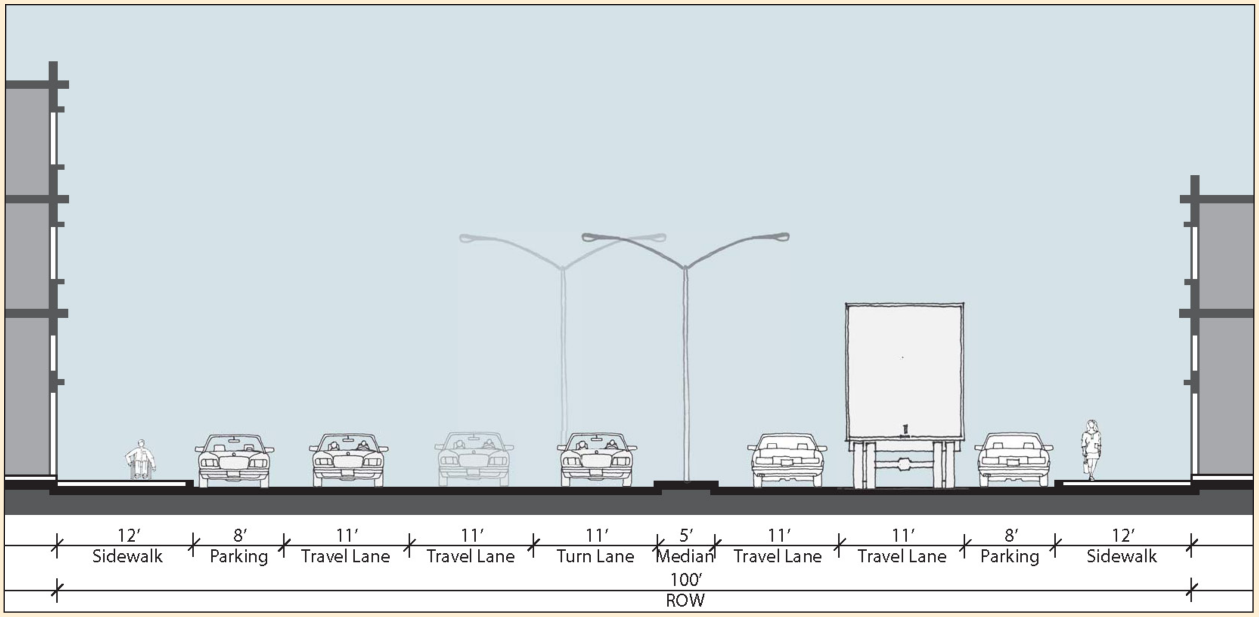
The right-of-way for all streets can be divided into sections, starting at the center line and proceeding to the edge of the right-of-way. At a minimum, streets have one or more travel lanes for vehicles and possibly, sidewalks. Other features found in the street cross section could include a raised median, right or left turn lanes, bicycle lanes, parking spaces, curbs, and sidewalks.

Many potential alternate street sections were studied during the charrette. Participants emphasized incorporating features that build on Marysville's assets and enhance its historic character. Participants also urged beautification of E Street by providing more landscaping. These considerations, along with other suggestions, have been incorporated in recommendations whenever possible and practical.

E Street sections vary. New sections proposed by charrette participants are shown in this section. The illustrations show how existing right-of-way could be reallocated. Starting at the south on the bridge, the proposed street section is shown first. This inside travel lane is reduced to 11 feet while the outside travel lane is 12 feet. This leaves enough room for a six foot colored shoulder, as shown below.

On the right are photos of the existing bridge conditions (left) and simulated colored lane (right). The proposed E Street section on the bridge is below.





The existing E Street section is shown above.

Between the bridge and 3rd Street, the E Street section would remain mostly unchanged, though lane widths could require adjustment to transition between higher and lower speed segments. The existing right of way between the bridge and 3rd Street is not adequate for wider sidewalks or other improvements recommended north of 3rd.

The recommended cross section for E Street north of 3rd Street reflects input from charrette participants, as well as current best practices. The proposed section better balances the needs of motorists with the needs of other users, including pedestrians and bicyclists. People who work, shop, or live on E Street, as well as motorists, would benefit from beautification efforts such as additional landscaping.

The recommended plan reduces the amount of uniform dark asphalt on E Street. Brick pavers on the edges of sidewalks would strengthen connections to the historic brick downtown. Smooth pavers, stamped asphalt, and/or colorizing would demarcate parking bays and buffer zones. Adding these design details will rebalance the character of E Street. The makeover will invite people downtown, to shop, dine, walk, cycle, work, or visit.

When black asphalt is used only for travel and turn lanes, the perceived width of the street narrows considerably. Distinguishing travel lanes from other zones helps separate traffic traveling at different speeds, which increases safety. Right-of-way zones designated for other uses, such as parking and buffer zones, are accentuated by using textured and colored surfaces. Such design details would improve both the function and beauty of E Street, while harmonizing with Marysville's existing character.

The upper photo shows the existing E Street condition. The middle photo simulates stamped, ADA acessible pavers, accented curbs, stamped, colorized parking bays, and other recommended features. The bottom simulation suggests how the streets could develop.

The proposed E Street section adds zones to the existing street section, without changing total right-of-way width. Starting in the center of E Street, the plan calls for a left turn lane, then two 11-foot travel lanes in each direction. Next to the travel lanes on both sides is a two foot buffer zone and parking spaces next to the curb. Small groups of parking spaces would be separated by eight foot curb extensions. The curb extensions help visually narrow the street and calm traffic.

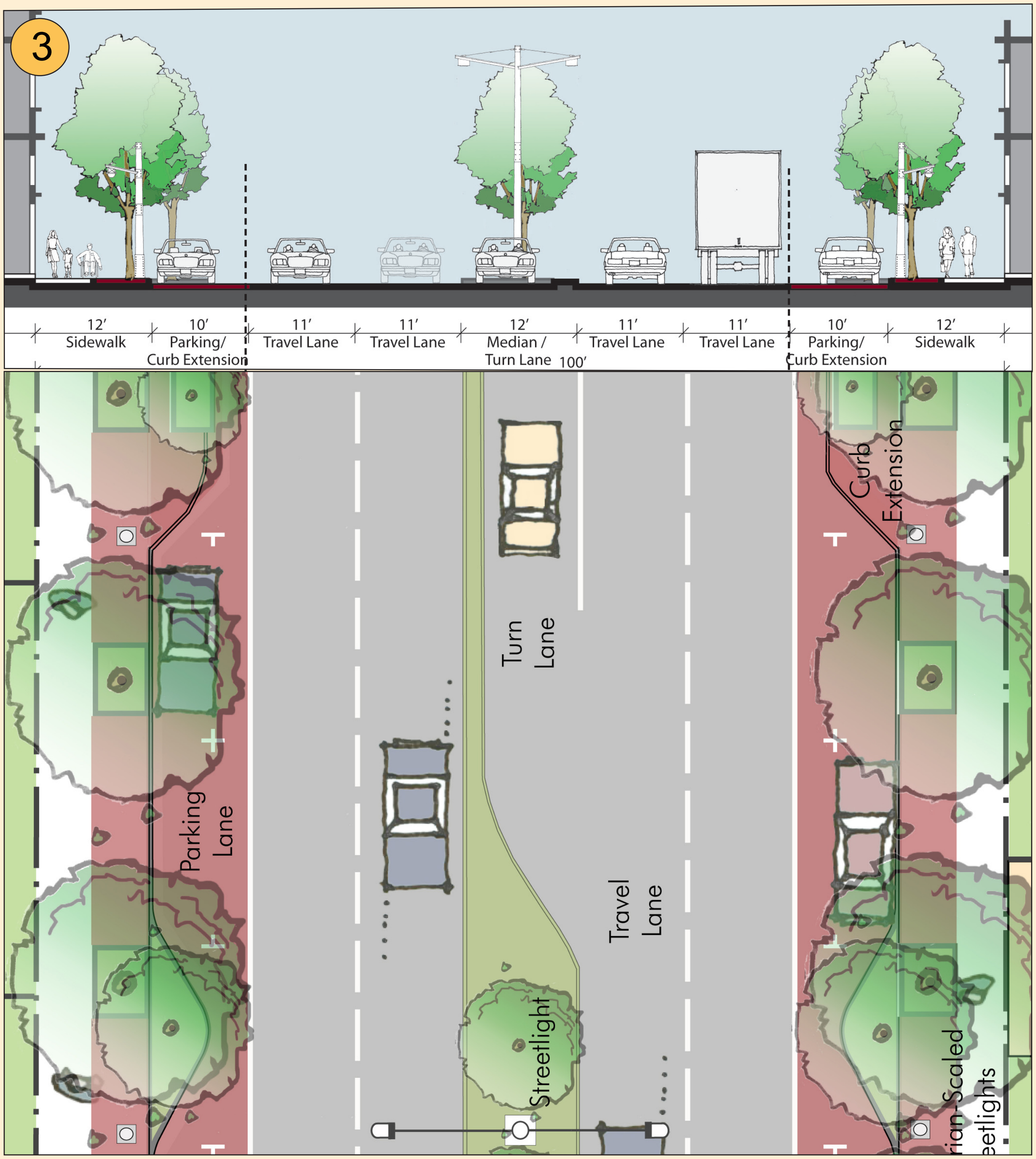
AASHTO guidance also discusses the benefits of narrower lanes on streets with speeds under 45 mph and “interrupted-flow operating conditions.” On E Street the signalized intersections cause “interrupted-flow conditions.” Benefits include shortened pedestrian crossing times.

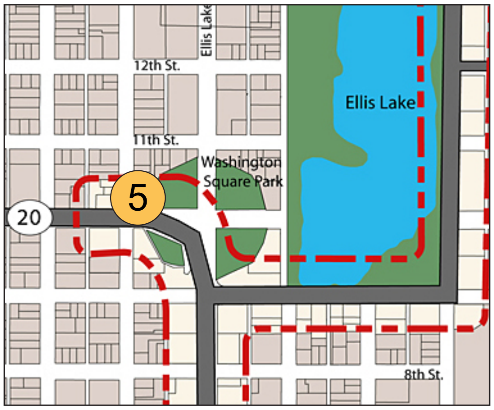
Existing lane widths in the study area vary from 11 to 12 feet. Though AASHTO allows ten foot lanes, they were not recommended in the study area because of substantial truck traffic on this street. The plan’s proposed section makes eleven feet the standard for all travel and turn lanes on E Street.

Travel Lane Widths

According to Caltrans’ *Main Streets: Flexibility in Design and Operations*, (2005), 12 foot lanes are standard on state highways outside downtown areas, where exceptions can be made. The American Association of State Highway and Transportation Officials’ (AASHTO) *Geometric Design of Highways and Streets* advises urban arterials should have 10-12 foot lanes. Lane widths of less than 12 feet may be appropriate on main street highways.

Proposed E Street section is shown below, at street level and from overhead. Note that trees in the median are only feasible where left turn lanes do not require the entire block. Trees cannot be planted adjacent to the left turn pocket and should be planted a minimum of 2 ft. behind the curb. Refer to Section 500 of the Caltrans Encroachment Permits Manual. This section only appies to E Street north of 5th Street due to the future addition of a second northbound left turn lane onto 5th Street.





5. Signal changes, revised street section.

10th Street at the curve north of E Street. Note the vehicle in the right turn lane. The right "trap lane" drops before the bridge. During field observations, few vehicles turned right from the lane. Most merged into through traffic lanes to cross the bridge. This movement is sometimes erratic. Conflicts are created as drivers attempt to pass as many cars on the right as they can before entering the traffic stream.

10th Street (State Route 20)

5 10th Street has 6 lanes and a wide raised median. Annual Average Daily Traffic (AADT) is 36,000, comparable to E Street traffic volume. The highway divides residential and commercial areas. Some children must walk across 10th Street to attend Covillaud Elementary School.

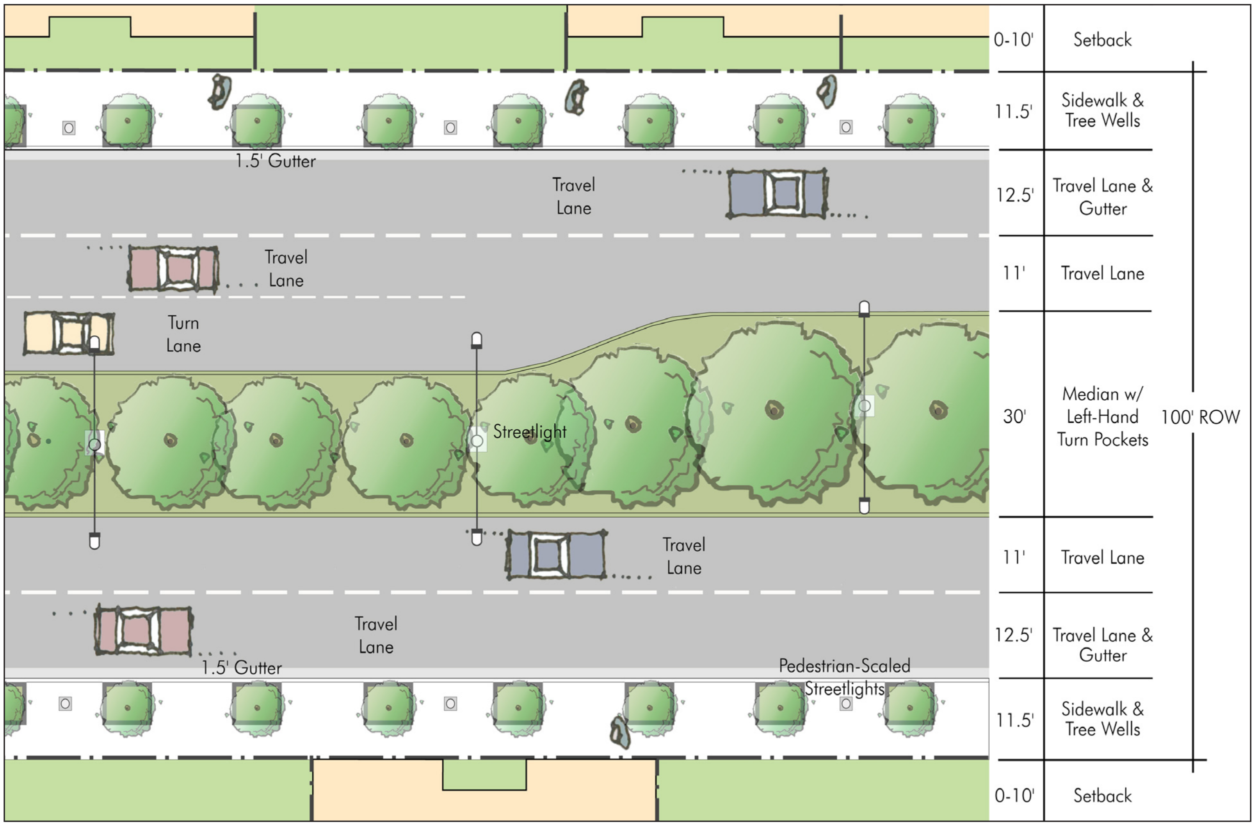
Caltrans has studied West 10th Street and proposed some spot improvements. In its *Project Study Report/Project Report, Marysville Operational Improvements,* Caltrans recommends

1. Remove outside westbound lane, which is not being used as intended.
2. Remove raised medians between F and H Streets. Instead, provide left turn lanes eastbound and westbound at G Street, and eastbound at F Street.
3. Prohibit westbound left turns at F Street (turning south on F Street)
4. Convert signals from 3-phase operation to 5-phase operation with permissive green movements northbound and southbound.
5. Retain left turn prohibition at H Street.
6. Remove on/off ramps and traffic island at I Street and convert the westbound "trap" lane into a lane that merges before the bridge structure.

This proposal increases capacity by eliminating the existing split phase timing, allowing more green time to move east and west bound traffic. Additional capacity is gained from the signal improvements. Caltrans' should definitely move forward with the recommended signal upgrades. However, losing the landscaped medians would make the street less pedestrian-friendly. The capacity improvements provide an opportunity for options that preserve landscaping space while minimizing pedestrian exposure to traffic.

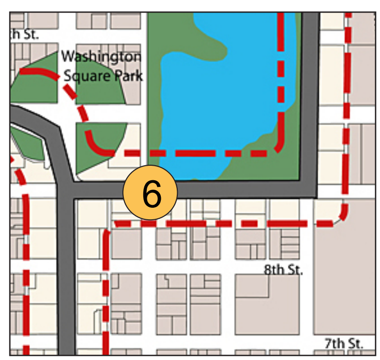
During the charrette, a more pedestrian-friendly street design emerged that deserves consideration, as well as Caltrans' proposal. The alternate design calls for converting the leftmost through lanes at F and G Streets to left-turn-only lanes, and possibly one left-turn lane at H Street. The left-turn lane would extend back from each intersection for most of a block, but would be tapered out (by widening the median) at the beginning of each block. This design requires using protected left-turn-only phasing. Permissive left-turns would be unsafe. A queue of oncoming left-turning vehicles can block the view of through travel lanes. Protected phasing also reduces risk to pedestrians and other users crossing the street. After the capacity of this design has been verified, further planning could lead to a longer-term project. Rebuilding the entire road could include widening sidewalks and/or buffer areas along the sidewalks with rows of trees.

The plan view below shows the street section recommended for west 10th near E Street. Design exceptions will be needed for this section: Lane width - Plan recommends 11 ft.; Design standard is 12 ft. Shoulder/Gutter width - Plan recommends 1.5 ft.; Design standard is 4 ft.



East 9th Street (State Routes 70/20)

6 D Street is an important gateway into the downtown area. The images on the next page illustrate how adding bulb-out curb extensions on D Street would shorten the crossing distance for pedestrians, and make them more visible to motorists. The bulb-outs also enhance the intersection by replacing asphalt with sidewalks and landscaping. To maintain the right turn lanes on the approaches to 9th Street, bulbouts on the northwest and southeast corners were not recommended. The bulb-out on the northwest corner also would have conflicted with an existing driveway that is unusually close to the intersection.



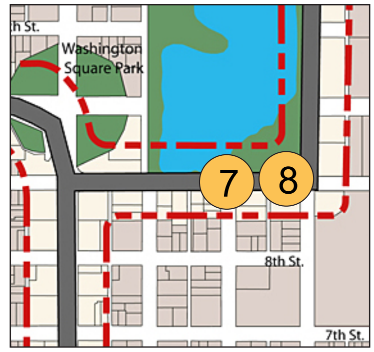
6. Bulbouts on side streets.

Access management of driveways can benefit non-motorized users. This can be done over time, as land uses change. Limiting the width and number of driveways along the street lowers risk to all users. Pedestrians reduce their risk by lowering their exposure to vehicles exiting and entering driveways. Access management lowers motorists' risk by reducing the number of vehicles entering and exiting the roadway.

The upper photo shows the existing 9th and D Street intersection. The bottom photo simulates recommended improvements.

New commercial development on 9th Street provides additional pedestrian destinations. However, crossing to the new businesses can be a problem, as the pedestrian in the lower photo found.

9th and C Streets



7. Two-stage pedestrian crossing.
8. Re-design curb and slip lane.

7 Connectivity across 9th Street is poor for pedestrians and other users. South of 9th Street lie the downtown and civic center area. Ellis Lake and commercial areas are north of 9th Street. The pedestrian in the bottom, left image is crossing at the C Street intersection, which is a legal, though unmarked, crosswalk. Past improvements at this site included the island the pedestrian is standing on, but the intention was for pedestrians to cross at B or D Streets. New commercial development has changed the desire line for pedestrians, making it unrealistic to expect them to travel to B and D Streets to access businesses. Today many pedestrians cross at or near C Street, towards Ellis Lake and the commercial destinations that line 9th Street. This location is well suited for a two-stage pedestrian crossing because existing turn restrictions and the existing median allow adequate room. The north side of 9th Street needs a new sidewalk connection to give direct pedestrian access to destinations on that side, including the lake and commercial destinations.

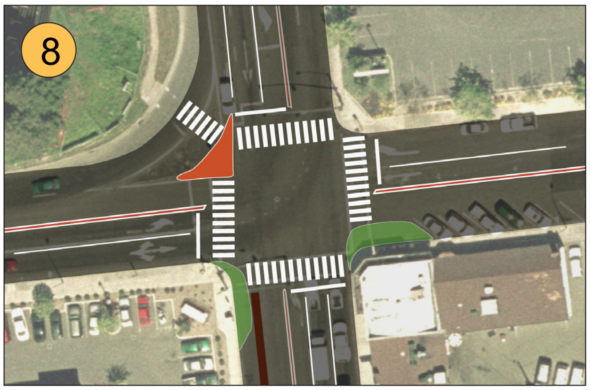
9th and B Streets

8 Most traffic at this intersection follows State Route 70 (north and south) State Route 20 (east and west). This requires turning at 9th and B Streets for most vehicles. New commercial development on the northwest corner hosts a variety of eateries and has become a neighborhood destination for all users. The north leg of the intersection is closed to pedestrians.

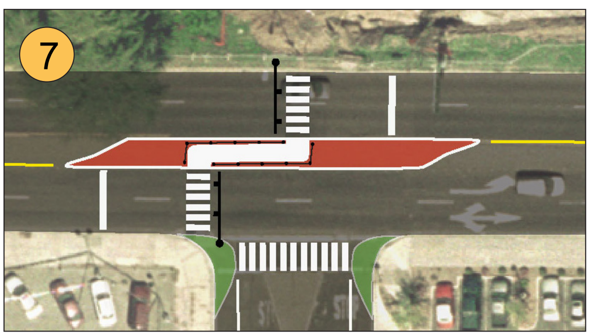
The right-turn slip lane and the curb line on the northwest corner

Looking north toward 9th Street. To reach retail destinations pedestrians must cross the state highway.

should be modified to slow right-turning traffic and encourage turning drivers to yield to pedestrians. (see slip lane information on page 24.) Since most traffic turns here, two southbound through lanes are not necessary. One southbound through lane should be dropped at this intersection. This would leave one right-turn lane, one through lane, and one left turn lane. All four legs of the intersection should be marked with crosswalks. Bulb-outs on the south side of the intersection would reduce pedestrian crossing distance and hold back parking at the southeast corner so drivers do not accidentally enter the crosswalk.



Above are the suggested intersection improvements for 9th and B Streets. The simulation below shows proposed crossing improvements at 9th and C Streets.

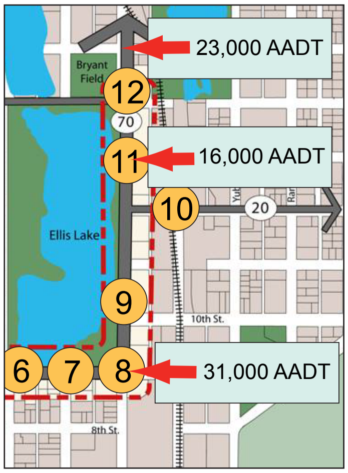


Two-stage pedestrian crossings

Two-stage crossings reduce pedestrian risk while minimizing interruptions in the traffic flow. Pedestrians push the button, wait for the "walk" interval (which is on their side of the street only); walk to the median island; push the next button, and cross during the "walk" interval. Ideally, pedestrians do not have to wait long for a "walk" interval. If wait times are long, pedestrians may cross during a gap in traffic and cars may be stopped when pedestrians are no longer present.

The offset in the island turns pedestrians towards oncoming traffic before proceeding across the second half of the street. This helps raise awareness of oncoming traffic. Pedestrian warrants in the Manual on Uniform Traffic Control Devices are expected to change in the near future, making it easier to meet warrants at locations like 9th and C Street.

The photo above shows a two-stage pedestrian crossing. After the first stage, crossing to the center island, pedestrians must walk to face traffic before completing the second stage. A signal, as shown above, is not required for two-stage pedestrian crossings.



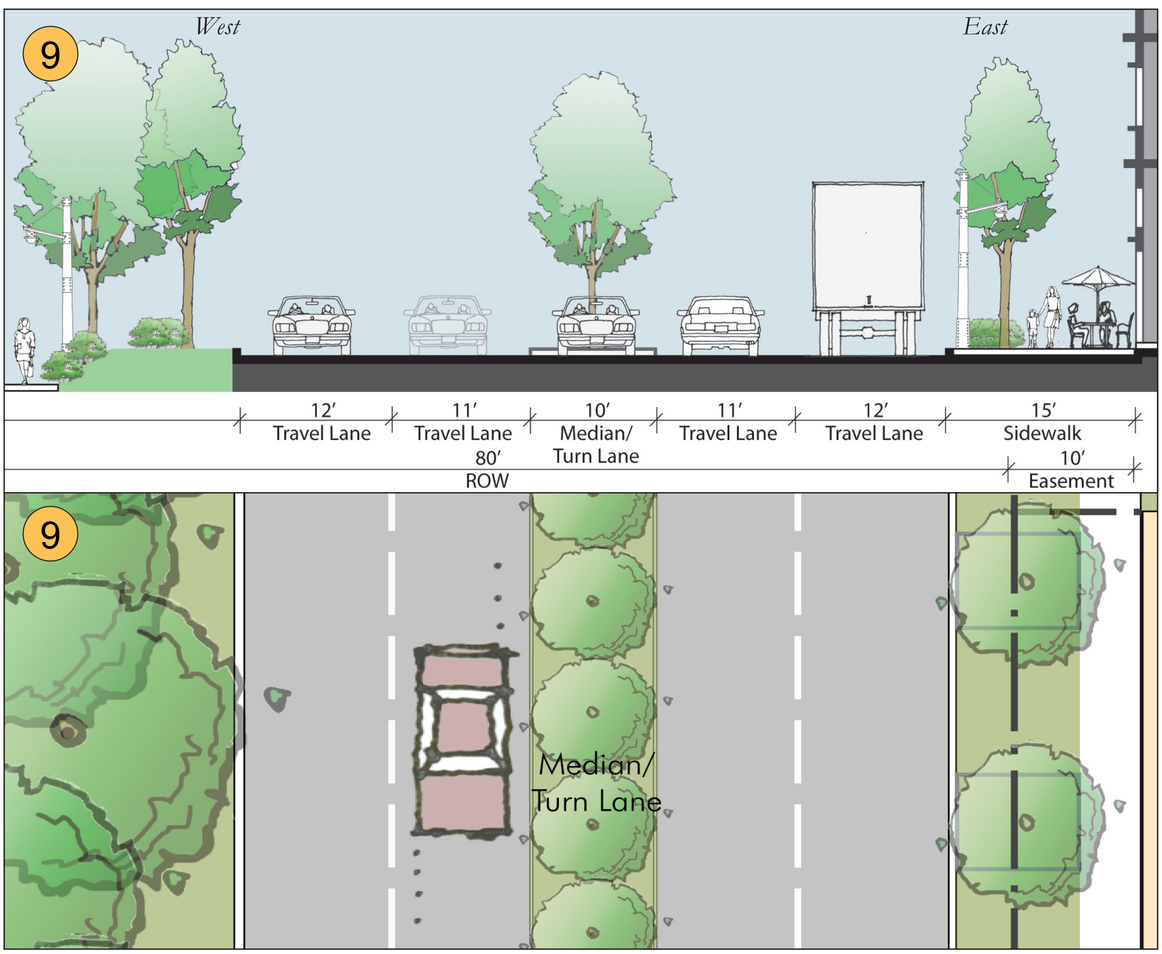
9. Drop one southbound through lane.

10. Gateway treatment.

11. Reallocate right-of-way, new section.

B Street (State Route 70/20)

9 B Street is designated as State Route 70/20 north of 9th Street. Traffic volume is substantially higher between 9th and 12th than in other segments of B Street. The recommended section for this segment has 4 travel lanes and a raised median, with turn pockets at selected locations between 10th and 12th Streets. The sidewalk zone on the east side of the street is 15 feet wide, with landscaping between the sidewalk and street to buffer pedestrians from the high volume of traffic. As shown in the section drawing on the next page, accommodating a wider sidewalk on the east side of the street would require setting buildings back 10 feet and working with property owners to obtain a sidewalk easement. Trees in the buffer area and raised median will help achieve City beautification objectives and make the area more comfortable for pedestrians. The sidewalk on the west side of B Street is at lake level.



Top: Proposed B Street section between 9th-12th Streets. A median is only feasible between 10th and 12th Streets, north of the left-turn pocket. Bottom: Plan view of street.

North of 12th Street

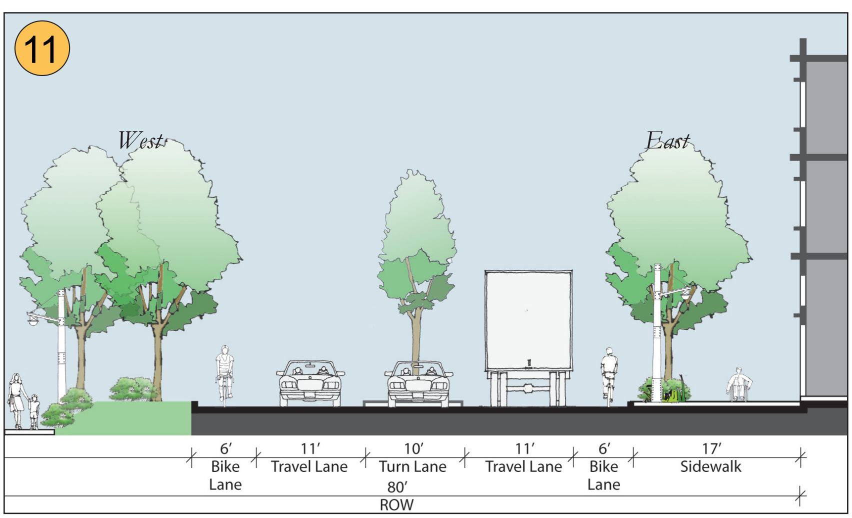
11 Between 12th and 14th Street, traffic volume on B drops substantially, then increases again on the two-lane segment north of 14th Street. There is a vacant parcel due for revitalization near the intersection of B and 14th Street.

Participants expressed a desire to strengthen connections to Ellis Lake as future development occurs. Numerous ideas for connecting the vacant parcel to the lake were considered. The cost to relocate B Street is prohibitive. Reallocating roadway space between 12th and 14th, however, would help the street environment complement the lake and better suit pedestrian-oriented business. Three options emerged from the discussions. However, the most feasible option of the three shows one 11 foot travel lane in each direction, a sidewalk with a landscaped buffer on the east side of the street, on-street bike lanes, and a raised median and left turn lanes where needed. The east side sidewalk is 11 feet wide and there is no sidewalk along the Lake Ellis side at street level. Bike lanes or delineated shoulders on both sides of the street keep traffic six feet further from the sidewalks.

This will still provide adequate capacity to carry current traffic volumes. A roundabout at the intersection of 14th Street is recommended to add traffic capacity, which would encourage revitalization of the intersection's southeast corner. The roundabout is discussed on pages 23 and 37. Reducing the number of lanes will increase connectivity to the lake. Pedestrians can cross easily and safely at the roundabout.

B Street parallels Ellis Lake. Pedestrian access to the lake is limited to the signalized crossings. There is no on-street parking near the lake.

The railroad bridge on Highway 20 just east of Ellis Lake is an ideal gateway sign location.



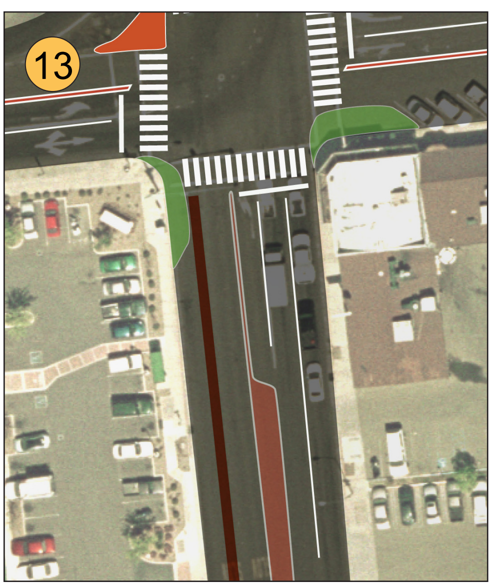
Proposed B Street section between 12th-14th Streets.

Bike lanes are shown in this section north of 12th Street. However, there is no room for bike lanes between 9th and 12th Street at this time. Until space is available in that segment, areas depicted as bike lanes should be delineated with an edge line, but should not be marked or signed as a bike lane. Whether marked as bike lanes or simply delineated as space not for driver use, this shoulder area creates a buffer between pedestrians and traffic and provides space for drivers to pull over for emergency vehicles. This area also provides space for officers to pull over errant motorists and for emergency parking if a vehicle is disabled.

As B Street develops, more pedestrian crossings may be needed. If the distance between intersection crossings is great, and people are crossing midblock, consideration should be given to installing a midblock crossing. Its location would be dependent upon land uses and proximity to other crossings. For example, if an ice-cream shop opened midway between 12th and 14th, pedestrians might cross frequently to the lake to enjoy their treat. A convenient crossing may be needed. A cut-through in the raised median similar to the one shown above allows pedestrians to cross one direction of travel at a time. This increases the number of gaps available for crossing and improves safety.

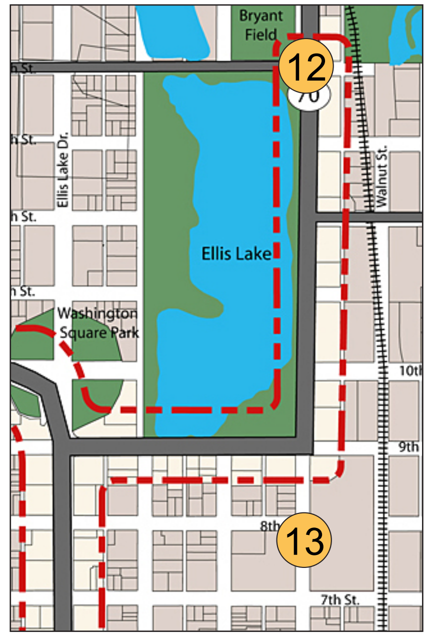
Example of a midblock crossing in Olympia, WA.

The photo above simulates an overhead view of the roundabout recommended for B and 14th Street. The drawing below provides a conceptual vision of a roundabout at this intersection.



B and 14th Street

12 A single-lane roundabout is recommended at B and 14th Streets to provide maximum capacity and smooth traffic flow through the intersection. See page 23 for more information.



12. Single-lane roundabout.
13. Rallocate right-of-way, new section.

B Street south of 9th

13 Although outside the formal study area, the consultant team observed the role that the southern portion of B Street plays in moving regional and local traffic. Traffic volumes drop substantially and the character of B Street changes south of 9th Street. There is a mix of uses in this segment, including commercial, Caltrans offices, the County Court House and residential. The street connects to the downtown grid and ultimately merges into 1st Street. First Street passes through the historic Chinese district and connects to E Street via a cloverleaf ramp on the west side near the end of the bridge. It is an attractive cut-through for drivers seeking less congested alternatives to highways 70/20, but it would be incompatible with the guiding principles of this plan to encourage through traffic to use this travel route. Therefore, one lane in each direction, turn pockets at intersections, on-street parking, and bike lanes should be considered for B Street south of 9th. However, due to the traffic movements, and to maintain the capacity of the intersection at 9th and B, the City may want to keep two northbound lanes, with turn pockets at intersections, between 6th and 9th Streets. See 4 to 3 Lane Conversions in the Appendix for additional information.

The simulation on the left shows improvements recommended for B Street south of 9th. To manage traffic speeds and cut through travel, the segment of B Street only needs one through lane in each direction.

Implementation

The plan recommends numerous improvements. This section lists improvements and the approximate implementation timeline.

Short-term projects could begin right away, with completion accomplished by the end of twenty-four months. Focusing first on these projects will benefit pedestrian safety and comfort while providing visible changes. For example, striping high-visibility crosswalks at all signalized intersections is a noticeable improvement. This affirms the message that Marysville is serious about becoming a more walkable community and responding to citizen input.

Some short-term recommendations, such as using the Zone System and the most recent ADA publications to guide development of new sidewalks, will require changes in procedures and/or standard drawings. Although it is feasible to draft and adopt the new requirements within a year, the results will not be visible until new projects are constructed. Changes such as these are important to include in short-term efforts so opportunities for improvements are not lost as redevelopment and ADA upgrades occur in Marysville.

Some short-term improvements, including signal timing changes, may require additional analysis before implementation. This process should begin as soon as possible.

Mid-term projects are those that could take 3 to 10 years to complete. Factors that influence the timeline include the need for collaboration with Caltrans, funding sources, and priorities. Some mid-term projects are less complex, and may merit a higher priority than those with more construction impacts. For example, it may be feasible to construct the right-slip-lane at E & 9th Streets more quickly than the signalized two-stage pedestrian crossing at 9th and C Streets. Since most of the recommended projects are on State right-of-way, Caltrans' input in selecting priorities is essential.

Long-term projects are those expected to take longer than 10 years to complete. In some cases, the long-term project timeline could be shortened if driven by development opportunities. For example, redevelopment is anticipated on the southwest corner of 9th and E Streets. That development may provide an opportunity for improving the intersection sooner than expected.

The Guiding Principles affect all implementation efforts. Community leaders should consider compatibility with the principles during the decision-making process. ***Principle 1, Taking Advantage of Marysville's Assets***, requires carefully considering projects to ensure they enhance existing assets. Many of the improvement can incorporate ***Principle 2, Beautify***, by adding landscaping and aesthetic features. ***Principle 3, Connections for all users***, is equally important. Marysville must assess each project in the community to make sure it improves the current level of connectivity for nonmotorized users, as well as preserving existing connectivity for vehicles.

Implementation Schedule	1 - 24 months	3 - 10 years	10 years or more
Overall Recommendations			
High visibility crosswalk markings	x		
Pedestrian countdown signals		x	
Pedestrian signal changes	x		
Preemption for emergency service providers			x
Sidewalks: Guidance/standards for Zone System and ADA	x		
Bikeway master plan		x	
E Street			
Restripe bridge w/colored shoulder		x	
Signal timing changes	x		
Open or barricade crosswalk, south leg of E & 3rd	x		
Gateway at 3rd		x	
Additional left turn lane at E & 5th	x		
Slip lane w/island at E & 9th		x	
Roundabout or additional lanes at E & 9th			x
Restripe travel, turn, and parking lanes	x		
Construct and landscape medians		x	
Rebuild sidewalks w/brick paver edges		x	
Rebuild parking lanes with bulb outs and textured material		x	
10th Street			
Signal improvements as proposed by Caltrans		x	
Convert leftmost lanes to turn lanes		x	
Sidewalk and landscaping improvements			x
9th Street			
at D Street, side street curb extensions		x	
at C Street, two-stage pedestrian crossing, signalized		x	
at B Street, geometric changes per illustration		x	
B Street			
Restripe between 9th and 12th; drop one southbound thru lane	x		
Between 9th and 12th, widen sidewalks and add landscaping as easements are granted		x	x
Restripe north of 12th	x		
Colorize bike lanes when a continuous route can be provided			x
Roundabout at 14th			x
If needed, add midblock pedestrian crossing with island			x
South of 9th Street, restripe to one through lane each direction, bike lanes and center two-way left turn	x		

Pedestrian Infrastructure

MTC Pedestrian and Bicycle Toolkit. http://www.mtc.ca.gov/planning/bicyclespedestrians/index.htr

● High
⊖ Medium
(Low

Item	Description	Qty.	Unit	Low Unit $	High Unit $	Effective-ness	Notes & Assumptions[1,2]
Crossings							
1.0	Audible Pedestrian Crossing Cues at Intersection		LS	$10,400	$10,400	⊖	Per intersection. Assumes one at each corner of intersection (8 per intersection or $10,400 per intersection)
1.1	Automatic Pedestrian Detection		EA	$500	$1,000	⊖	A surface treatement that senses the weight of pedestrian
1.2	Bulbout (LF curb, sf Concrete, wheelchair access, demo)		EA	$15,000.00	$25,000.00	●	Costs increases with infrastructure implications. Based on lump sum cost for 6' wide bulbout extension, and 20' length
1.3	Crosswalk Countdowns		LS	$2,400	$6,400	●	Per intersection (assumes 8 signals). Cost is $300 - $800 for one countdown signal
1.4	Crosswalk: Lighted Flashing (In Pavement Flashers)		LS	$100,000	$120,000	⊖	Lights adhered to pavement in crosswalk. Per interesection.
1.5	Crosswalk: Raised above grade		EA	$5,000	$5,000	⊖	
1.6	Crosswalk: Striping (Standard and High Visibility)		LF	$3	$6	⊖	Low end: standard and zebra stripping; High end: high visibility floursescent
1.7	Pedestrian Push Button Treatments		EA	$1,300	$1,300	⊖	
1.8	Pedestrian Refuge Island		EA	$8,000	$15,000	⊖	Assumes curb and median approximately 6' wide
1.9	Signage (Standard vs. High Visibility)		EA	$300	$400	●	Assumes new post is needed in sidewalk and installation
1.10	Signalized Interesctions		LS	$125,000	$250,000	●	Per intersection. Estimate depends on size of street, type of signal and complexity of intersection
1.11	Wheelchair Ramps (w/ warning surface half domes)		EA	$2,600	$3,000	●	Includes demolition costs and repaving asphalt at cuts
1.12	Yield Lines (Advanced Limit Lines or Back Lines)		LS	$200	$500	●	Per intersection
Enforcement							
1.13	Radar Speed Display Sign		EA	$13,000	$16,000	●	
1.14	Rat Box		LS	$400	$400	⊖	Per intersection. Rat box indicates when signal has changed. Requires 4 per intersection(or $100 each)
1.15	Traffic Cameras		LS	$75,000	$125,000	●	Infrared cameras that photograph autos running redlights. Per intersection.
Materials							
1.16	Asphaltic Concrete		SF	$9	$9	(	Roadway asphalt
1.17	Concrete Paving Sidewalk (scored)		SF	$8	$10	●	Square foot cost of concrete for interior of sidewalk only
Sidewalks and Lighting							
1.18	Concrete Curb and Gutter Installation		LF	$30	$40	●	
1.19	Concrete Curb and Gutter Remove and Replace		LF	$60	$60	●	
1.20	Concrete Sidewalks Removal and Replacement		SF	$20	$20	●	Crosswalk includes concrete treatment
1.21	Pedestrian-Level Street Lights		EA	$3,000	$5,000	●	
1.22	Standard Street Light (Cobra Head)		EA	$10,000	$10,000	(	
1.23	Widened Sidewalks		LF	$80	$80	●	Includes demolition cost for curb removal, replacement and concrete for 3 SF of sidewalk

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● High
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Item	Description	Qty.	Unit	Low Unit $	High Unit $	Effectiveness	Notes & Assumptions[1,2]
Traffic Calming							
1.24	Chicanes		LS	$15,000	$35,000	●	A significantly bermed median between two lanes of traffic
1.25	Speedbumps		EA	$3,000	$4,500	●	
1.26	Stop Signs		EA	$300	$300	⊖	Including new post and cost of installation
1.27	Traffic Calming Circles		EA	$8,000	$12,000	●	Small circle barrier in typical intersection and landscaped
Pedestrian Amenities							
2.0	24" Box Trees		EA	$1,820	$1,820	●	Includes irrigation, trenching and water barrier
2.1	60 Day Maintenance		LS	$3,000	$4,000	⊖	Estimate based on square footage of landscape area and tree maintenance of costs over 1/2 mile of road
2.2	Bench (6' Wide)		EA	$1,500	$3,000	⊖	
2.3	Bike Racks		EA	$600	$1,200	⊖	Includes installation
2.4	Bollards		EA	$500	$750	⊖	
2.5	Bus Shelter		EA	$5,000	$10,000	●	
2.6	Bus Concrete Pad		EA	$6,500	$6,500	(	
2.7	Crosswalk: Permeable Paving- Brick		SF	$13	$13	(	Includes demo of existing asphaltic concrete and aggregate base
2.8	Crosswalk: Scored Concrete		SF	$8	$12	(	Includes demo of existing asphaltic concrete and aggregate base
2.9	Crosswalk: Stamped Colored Concrete		SF	$10	$15	(	Includes demo of existing asphaltic concrete and aggregate base
2.10	Gateway Features		EA	$12,000	$24,000	●	
2.11	Grade Separated Crossing (Pedestrian Bridge)		EA	$500,000	$4,000,000	(	Costs increases with size and approach of crossing
2.12	Information Kiosks		EA	$1,500	$3,000	⊖	
2.13	Landscaped Median		LF	$200	$400	⊖	
2.14	Newsracks		EA	$4,000	$6,000	(	Includes a bank of 4-6 newspaper racks.
2.15	Orange Safety Flags at Corner Intersections		EA	$100	$100	(	Per set for one side of street; 8 sets required for complete set.
2.16	Planting at Bulb-outs		SF	$9	$9	⊖	
2.17	Seat Wall		LF	$185	$225	(	
2.18	Street Pole Banners		EA	$400	$600	⊖	Assumes standard street light pole already installed cost includes brackets and 2 banners.
2.19	Trash Cans		EA	$800	$1,500	(	
2.20	Tree Grates includes frame (4'x4')		EA	$680	$750	⊖	
2.21	Tree Guards (Powder Coated)		EA	$325	$670	(	
2.22	Tree Well		EA	$500	$500	●	Includes saw cut of 5' x5' hole, 2.5 cy amended soil, and concrete demo and hauling
2.23	Water Fountain		EA	$15,000	$50,000	(	Assumes water source is already available at site.

References

1. Giles-Corti, B., Donovan, R.J. (2003) Increasing Walking: Relative Influences of Individual, Social Environmental, and Physical Environmental Correlates of Walking, American Journal of Public Health, 93(9), 1583-1589.

2. Frank, Lawrence, and Peter Engelke. 2001. The Built Environment and Human Activity Patterns: Exploring the Impacts of Urban Form on Public Health. Journal of Planning Literature 16, 2: 202-18

3. Humpel N, Owen N, Leslie. 2002. Environmental factors associated with adults' participation in physical activity: a review. Am J Prev Med, 22:188-99

4. Jacobs et al, 2002

5. Field Evaluation of a Leading Pedestrian Interval Signal Phase at Three Urban Intersections. Van Houten, Retting, and Farmer. Transportation Research Board.

6. Traffic Signal Preemption for Emergency Vehicles. US Department of Transportation. Publication FHWA-JPO-05-010.

-7. Intelligent Transportation Systems, U.S. Department of Transportation, Benefits of EVP, http://www.itsdocs.fhwa.dot.gov/JPODOCS/REPTS_TE/14097_files/section_6.htm

7. Draft Public Rights-of-Way. http://www.access-board.gov/prowac/index.htm

8. Guide for the Planning, Design, and Operation of Pedestrian Facilities. American Association of State Highway and Transportation Officials (AASHTO). July, 2004.