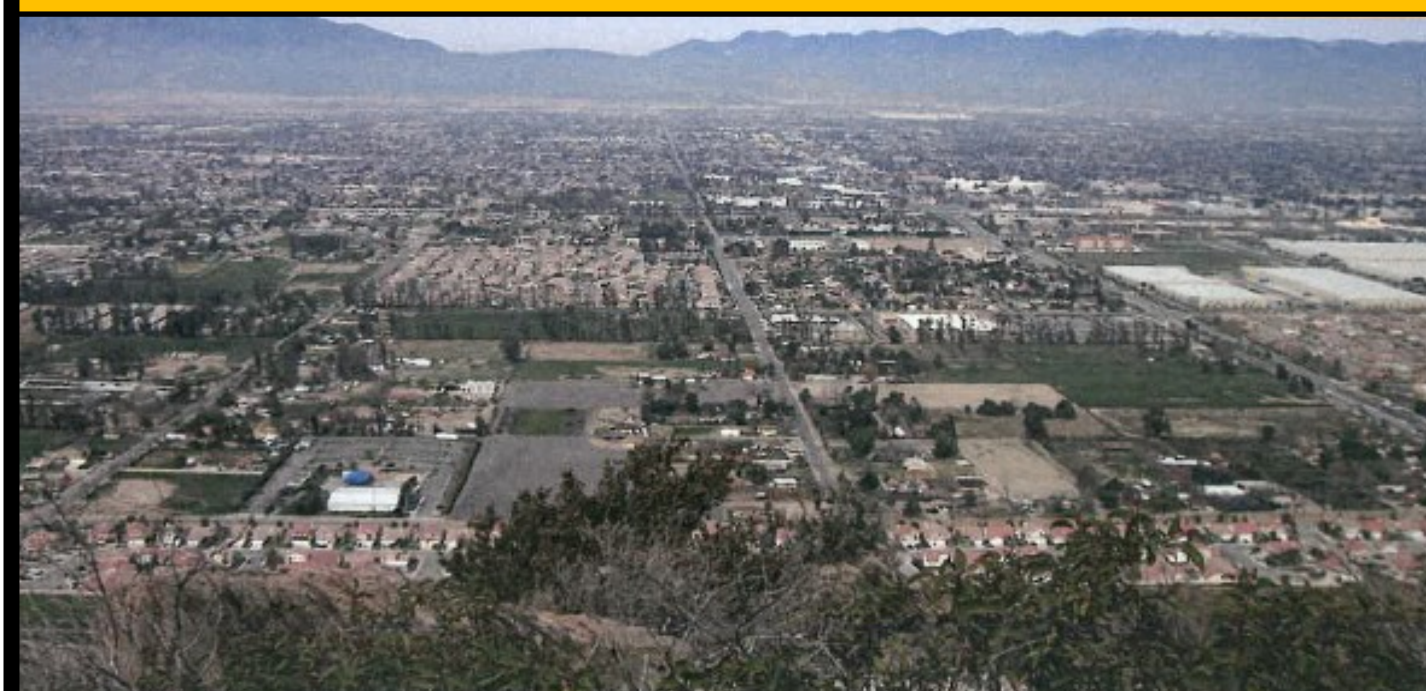
Fontana Forward
FONTANA GENERAL PLAN UPDATE 2015-2035

Mobility Best Practices White Paper

APPENDIX TWO



Transportation and Connectivity Best Practices White Paper

Fontana General Plan

Stantec

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City of Fontana

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May 17, 2016

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1.0 CHANGING APPROACHES TO TRANSPORTATION

Like many sectors of planning and development, transportation is going through a paradigm shift in the 21st century. For most of the 20th century, transportation analysis focused on roadway vehicle capacity, automobile volumes, and delay—each combined in a measure called Level of Service (LOS)—as an indicator of the environmental impact of a given project. The LOS system of performance indicators rate service quality from "A" (lowest congestion) to "F" (highest congestion). Traditionally, jurisdictions set an acceptable target roadway or intersection LOS, often C or D, based on vehicle volume/capacity ratios or average vehicle delay, below which roadways are considered deficient and thus, require improvement. This system gives precedence to motorized vehicles over all other transportation modes. It can lead to wider and wider roads which expand capacity and reduce delay for cars in the short term. However, studies have shown that increasing capacity induces demand that eventually increases congestion. (Duranton, 2011) Moreover, wider roadways become less and less friendly for pedestrians and bicyclists. As the conventional impact analysis process ignores these negative side effects and the phenomenon of induced demand, planning decisions based on LOS favor cars by default, reducing access to alternative modes of transportation. SB 743, discussed in Section 2.3 is intended to address these shortcomings of the traditional approach to roadway analysis.

Level of Service		Flow Conditions	V/C	Delay	Service Rating
A		Highest quality of service. Free traffic flow, low volumes and densities. Little or no restriction on maneuverability or speed.	0.01 – 0.60	None	Good
B		Stable traffic flow, speed becoming slightly restricted. Low restriction on maneuverability.	0.61 – 0.70	None	Good
C		Stable traffic flow, but less freedom to select speed, change lanes, or pass. Density of the number of vehicles increasing.	0.71 – 0.80	Minimal	Adequate
D		Approaching unstable flow. Speeds tolerable but subject to sudden and considerable variation. Less maneuverability and driver comfort.	0.81 – 0.90	Minimal	Adequate
E		Unstable traffic flow with rapidly fluctuating speeds and flow rates. Short headways, low maneuverability and low driver comfort.	0.91 – 1.00	Significant	Poor
F		Forced traffic flow. Speed and flow may drop to zero with high densities.	Above 1.00	Considerable	Poor

Source: Highway Capacity Manual 2010, Transportation Research Board, National Research Council.

Figure 1-1 Roadway Level of Service Descriptions (Source: HCM 2010)

Today, transportation planners and designers are focusing on a variety of ways to integrate multiple modes of travel—not just motorized vehicles—with land use decision making. These approaches are designed to provide transportation choice, reduce air pollution and other environmental impacts, enhance public health, and support amenities. Unlike previous auto-centric developments that favored speed and convenience, planners are focusing on "people-centric" development that favors creating places where people want to live, work, and play. Alongside traditional transportation by car, new developments are rediscovering multi-modal transportation by improving transit, pedestrian, and bike systems that lead to amenity-rich, walkable and sustainable communities.

Multi-modal transportation choices can include travel by foot, bicycle, transit (train, bus, trolleys/trams), two-wheelers, three-wheelers, neighborhood electric vehicles (NEVs), and cars, including hybrid and electric cars. An infrastructure network that supports a combination of these choices serves people who live, work, play, and learn and allows them to access the variety of land uses in different ways. Multi-modal transportation choices are becoming the norm in many parts of the world and many Southern California communities are adding new multimodal networks to the region's system of freeways, arterial and local roads. Millennials, the generation born between 1980 and 2000, are less car-focused than previous generations: a smaller percentage has a driver's license and is buying cars, and they wait longer to get a license. (Cortright, 2016)

Figure 1-2 MMLOS Graphic Table (Source: Florida DOT 2013 Quality/Level of Service Handbook)

A multi-modal approach to transportation systems includes the following benefits:

- **Reduction in the growth rate of congestion.** Studies have revealed that increasing the capacity of roadways, such as by adding lanes, does not reduce congestion. When road capacity goes up so does the total vehicle miles travelled, a phenomenon referred to as "induced demand". (Duranton, 2011) On the contrary, a well-planned and convenient public transportation system can help slow the increase of congestion.

- **Economic development.** Communities with multi-modal systems are attracting businesses and the workforce.

- **Community connection and cohesion.** Successful multi-modal systems are contiguous, uninterrupted, and connected to destinations. As interconnected networks, they are interdependent. This connectivity and network character creates amenities and places that enrich community life.

- **Improvement in health and well-being.** Non-motorized travel modes are often called "alternative transportation" or "active transportation." Opportunities for safe walking and bicycling enhance physical health, especially in communities like Fontana with public health challenges such as obesity and diabetes.

- **Reduce greenhouse gases.** An in-depth comparison of CO_2 emissions of bicycling versus other modes found the CO_2 per passenger per mile traveled by bicycle is far lower. (ECF, 2011)

This paper summarizes best practices in multi-modal transportation planning. This includes the physical infrastructure as well as various evaluation techniques. The following information can be used as a guide throughout the Fontana General Plan update effort. Recent legislative bills that affect the California transportation planning and environmental analysis process are also documented in this paper.

2.0 LEGISLATION: CALIFORNIA FRAMEWORK FOR TRANSPORTATION

Legislation and government funding play an important role in shaping communities. Several bills focusing on active transportation, multi-modalism and newer evaluation methods have been signed into law in California. These are helping in the transformation of our transportation network to balance the emphasis on all major modes of transportation – auto, transit, bicycle and pedestrian. The section below provides the summaries of the following legislation:

- SB 375/AB 32 – The Sustainable Communities and Climate Protection Act
- AB 1358 – The California Complete Streets Act
- SB 743 – VMT as a Traffic Impact Analysis Criterion

2.1 SENATE BILL (SB) 375/ASSEMBLY BILL 32 (AB32): THE SUSTAINABLE COMMUNITIES AND CLIMATE PROTECTION ACT

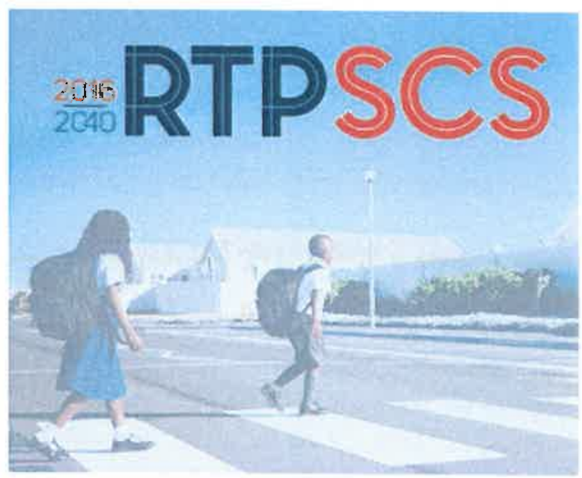

Figure 2-1 RTP SCS (Source: rtpscs.scag.ca.gov)

Signed into law on September 30, 2008, SB 375 set goals for the reduction of greenhouse gas (GHG) emissions across the state. Also known as the Sustainable Communities and Climate Protection Act of 2008, SB 375 set regional targets for GHG emissions reductions from transportation. These targets were initially established by the California Air Resources Board (ARB) in 2010 for horizon years of 2020 and 2035 and will be periodically reviewed and updated. In accordance with SB 375, each California metropolitan planning organization (MPO) must prepare a Sustainable Communities Strategy (SCS) as part of its regional transportation plan (RTP). The SCS is a newly required element of the Regional Transportation Plan (RTP). The SCS will integrate land use and transportation strategies to achieve ARB's emissions reduction targets (ARB, 2008).

Fontana is included in the Southern California Association of Governments (SCAG's) SCS. An SCS includes integrated land use, transportation, housing, and other policies designed to allow the region in question to meet its GHG emissions reduction targets. Together with the RTP, the SCS guides future investments, planning, and policies in transportation. However, if the ARB determines that the combined initiatives in a given SCS would not meet regional GHG targets if implemented, the MPO in question is then required to prepare a separate alternative planning strategy (APS) in order to meet the targets. Finally, as an incentive for implementing regional SCS and APS initiatives, developers and local government can be exempted from certain California Environmental Quality Act (CEQA) requirements if each project is consistent with a regional SCS or APS that meets the targets. The Southern California Association of Governments (SCAG) implemented their first local RTP/SCS for Southern California in 2012, and recently adopted the 2016-2040 RTP/SCS update. The Southern California region is expected to add nearly four million people in the next 25 years. SCAG estimates Fontana's population in 2040 as 280,900 people in 74,000 households. The 2016 RTP/SCS lays out a vision for accommodating that growth, while at the same time maintaining quality of life and protecting our environment (SCAG, 2016).

The 2016 RTP/SCS states that integrating transportation and land use planning is the key to achieving the plan's goals. The plan's transportation/land use strategies include:

- Transit-Oriented Development: Focus new growth around transit
- Livable Corridors: Plan for growth around livable corridors—revitalize commercial strips with mixed use development and enhanced multi-modal mobility
- Neighborhood Mobility Areas: Provide more transportation options through alternative modes for short trips (less than three miles)

2.2 AB 1358: THE CALIFORNIA COMPLETE STREETS ACT

As defined by Caltrans, a complete street is "a transportation facility that is planned, designed, operated, and maintained to provide safe mobility for all users, including bicyclists, pedestrians, transit vehicles, truckers, and motorists, appropriate to the function and context of the facility" (CA-DOT, 2008). Since AB 1338 took effect in January 2011, the California Complete Streets Act has required local governments to include consideration of complete streets in their local planning initiatives. Signed into law on September 30, 2008, the California Complete Streets Act requires cities and counties to include changes for the promotion of complete streets whenever substantive revisions to the circulation element of their general plan are made. The Complete Streets Act made California the first state in the nation to mandate that the planning documents of local agencies consider the needs of pedestrians, transit riders, and bicyclists as well as drivers. Since then, more than 700 agencies in the United States have committed to a complete streets policy (CA-OPR, 2010).

The California Complete Streets Act requires cities and counties to include changes for the promotion of complete streets whenever substantive revisions to the circulation element of their general plan are made.

The National Complete Streets Coalition recently completed a survey of local departments of transportation and public works across the counties that have implemented a complete streets project. Their research found that complete streets projects tend to improve safety for everyone, increase biking and walking, and can result in either an increase or a decrease in automobile traffic. As shown in the following graphics, a complete streets project can significantly reduce the number of collisions, as well as result in an increase in walking and biking trips (NCSC, 2015).

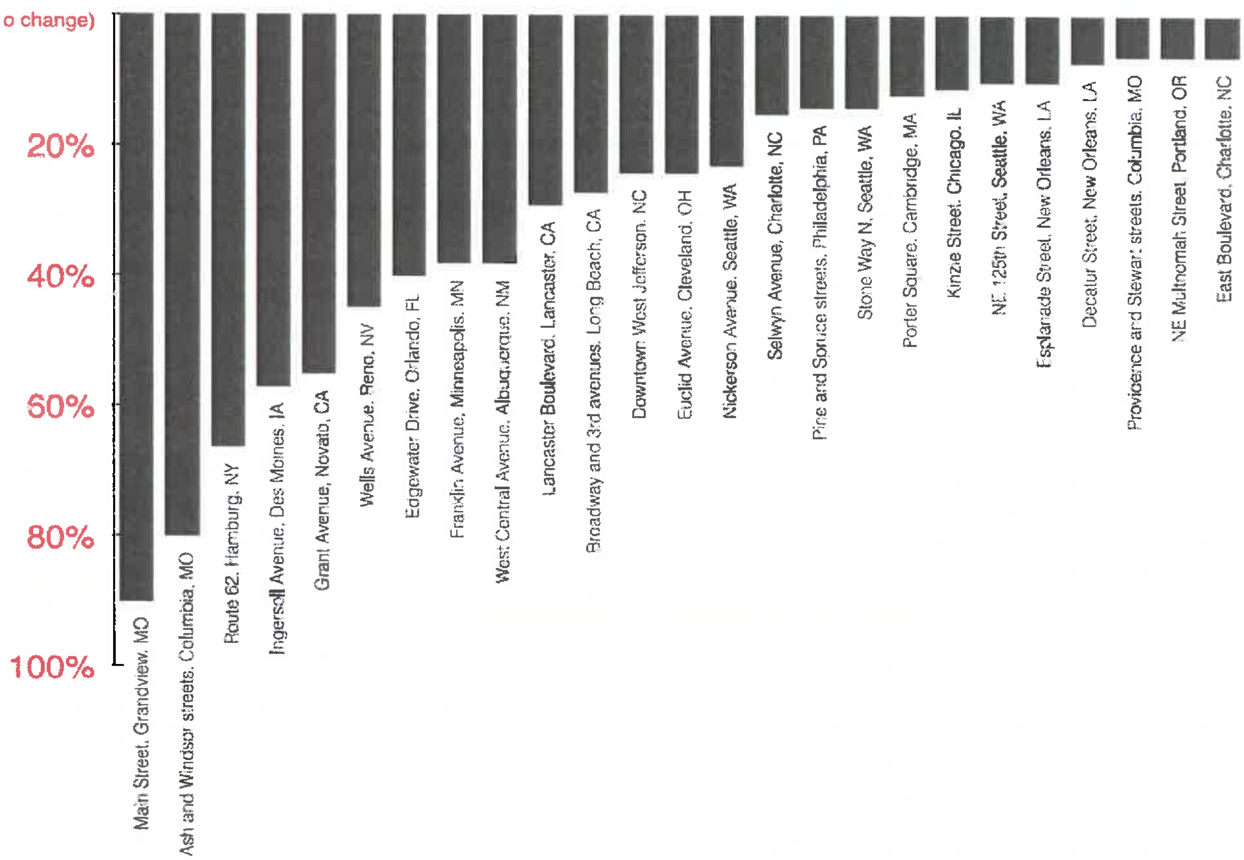

Figure 2-2 Reduction in Collisions after Complete Street Improvements (NCSC, 2015)

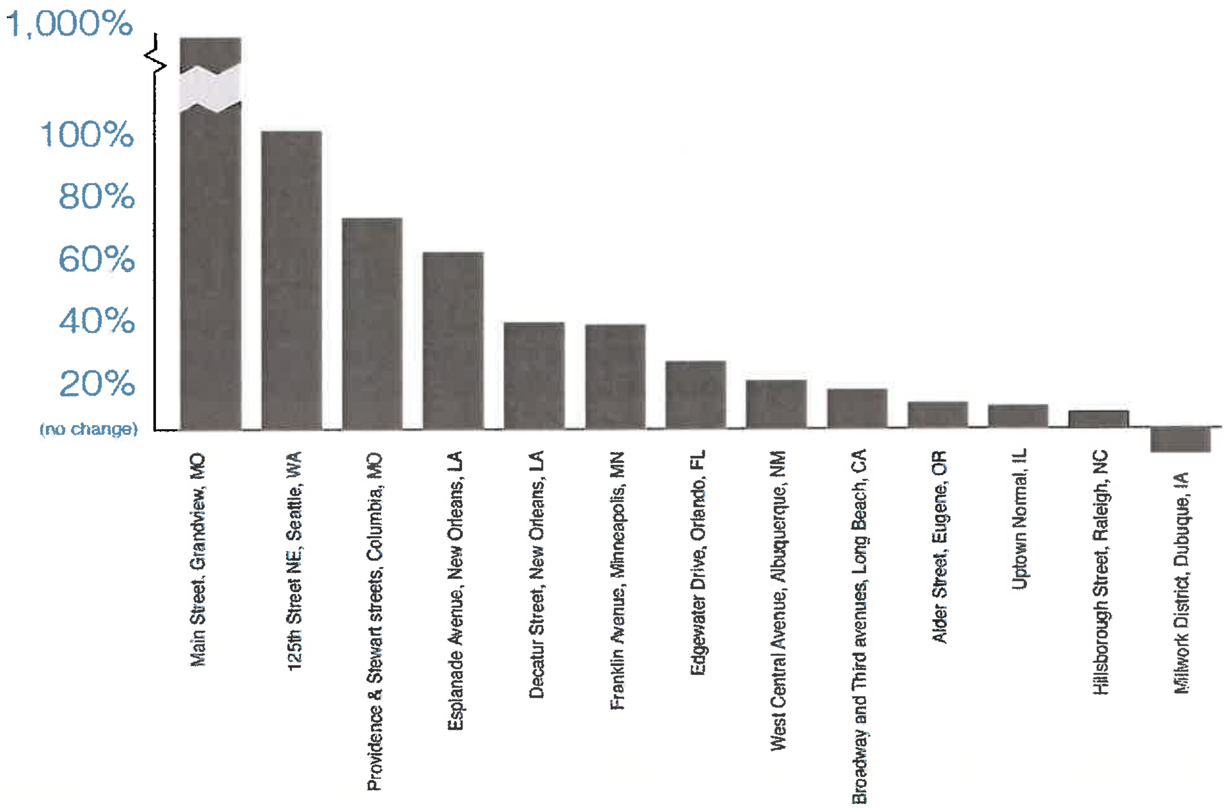

Figure 2-3 More Walking Trips after Complete Street Improvements (NCSC, 2015)

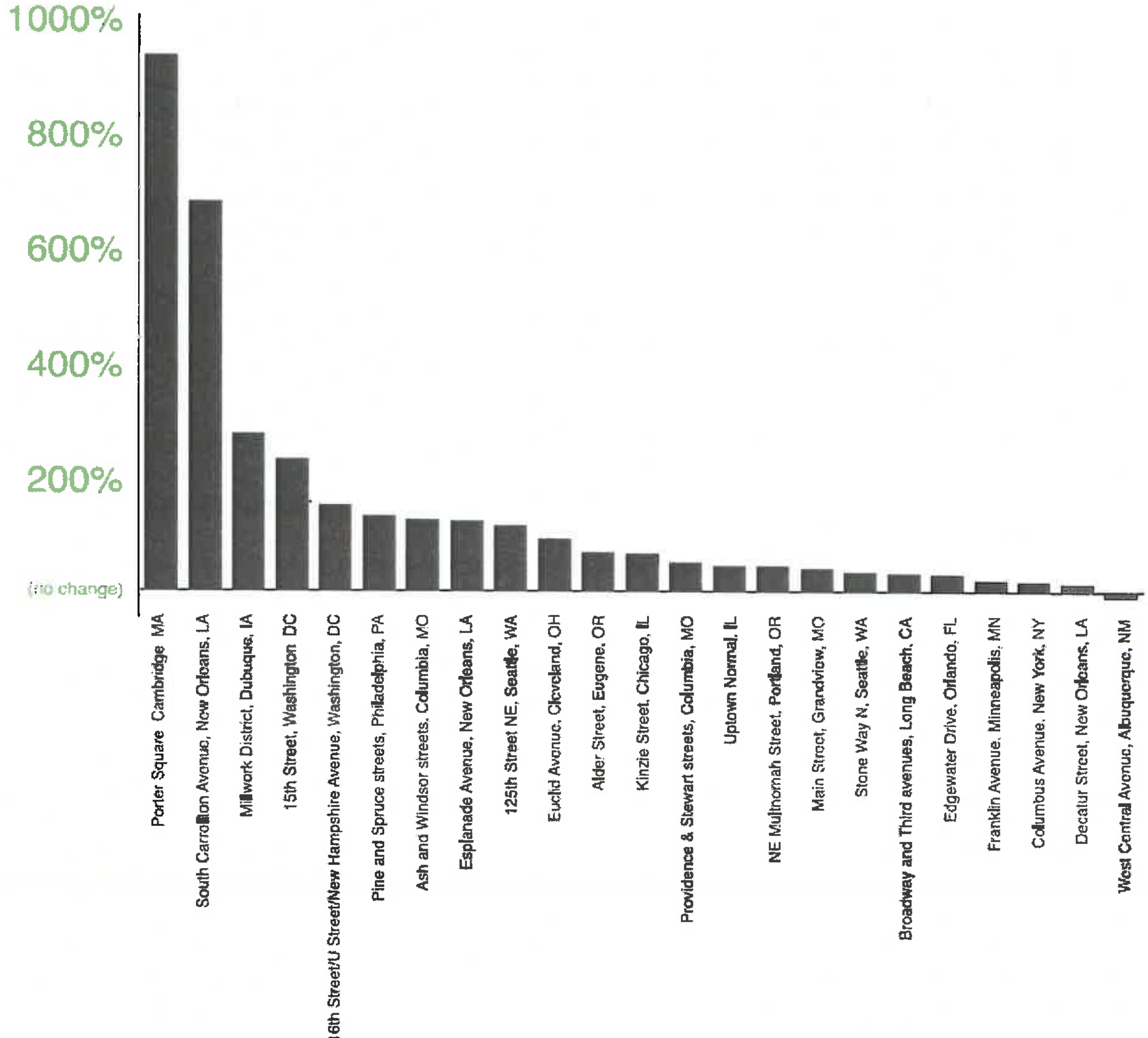

Figure 2-4 More Biking Trips after Complete Street Improvements (NCSC, 2015)

2.3 SB 743: VEHICLE MILES TRAVELED (VMT) AS A TRAFFIC IMPACT ANALYSIS CRITERION

Signed into law on September 27, 2013, SB 743 replaces level of service (LOS) analysis with vehicle miles travelled (VMT) as the primary benchmark in the transportation impact analysis process required for California Environmental Quality Act (CEQA) compliance. Moreover, parking will no longer be considered a significant impact on the environment for residential mixed use or employment center developments on infill sites—though local authorities may still consider it under local discretionary powers.

SB 743 streamlines the environmental review process for employment center projects and mixed use projects (some combination of residential, commercial and retail, office building, transit station, and/or schools) by expanding existing CEQA exemptions for projects that are within one-half mile of a major transit stop and are consistent with both a specific plan certified through the environmental impact report (EIR) process as well as a SCS enacted by the MPO. In accordance with state and local goals related to climate change, this policy shift removes impediments to infill development, transit, and active transportation projects by promoting a more holistic approach to transportation impact analysis. Furthermore, SB 743 provides the option to apply the new guidelines to all projects statewide, which is the approach being pursued by the State as of this time.

Prior to SB 743, the CEQA process primarily analyzed projects' increases in traffic volumes and resulting vehicle delay. SB 743 is intended to balance traffic management concerns with statewide efforts to reduce greenhouse gas (GHG) emissions, develop multimodal transportation networks, encourage a diversity of land uses, and promote public health. The changes are expected to come into effect in 2017 following periods of public comment and research at the Governor's Office of Planning and Research (OPR), a "rulemaking" process at state agencies, followed by an implementation buffer period of up to two years for local and regional agencies to update their guidance before full implementation is required. In August, 2014, OPR released a preliminary discussion draft of changes to the CEQA guidelines that outlined the proposed new methodology for CEQA traffic analysis.

Numerous comments on the draft were received, both in favor and opposing the change. Major themes that emerged in support were:

- Removes a serious impediment to infill development, transit and active (bicycle and pedestrian) projects.
- Advances climate goals, consistent with SB 375.
- Allows for flexibility in local control of transportation planning.
- Creates greater options for mitigation.

Major themes that emerged as concerns include the following:

- The public may view traffic congestion as a quality of life issue, even if it is not considered an environmental issue under CEQA.
- Level of service requirements are already embedded in general plans and local fee programs.
- The public is not familiar with vehicle miles traveled as a measure of impact.
- Changes in CEQA analysis may become an issue in future litigation.

Additional comments focused on models and data availability. OPR released a revised draft of the guidelines and a technical advisory in January, 2016, for further review and comment. Legislative adoption of the guidelines is expected in 2017 with a currently proposed two-year horizon for local agencies to implement.

3.0 MULTIMODALISM

3.1 MULTIMODAL LEVEL OF SERVICE SYSTEM

In light of state, regional, and local efforts to promote more holistic, sustainable transportation planning, exemplified by state legislation as well as local efforts, transportation planners and engineers have been looking for ways to evaluate the transportation service of roadways from a multimodal, rather than auto-centric perspective, by measuring the level of service for transit, pedestrian, and bicycle users as well as cars. The Transportation Research Board (TRB) provides the only recognized and well-documented methodology for analyzing multimodal level of service (MMLOS) in their Highway Capacity Manual (HCM) published in 2010.

The TRB MMLOS methodology explained in the 2010 HCM analyzes criteria specific to each of four modes of transportation, Auto, Transit, Bicycle, and Pedestrian, and measures the degree to which the urban street designs and operations meet the needs of each major mode's users. For example, Pedestrian LOS includes variables such as pedestrian density, bicycle-pedestrian conflicts, width of shoulder, width of outside lane, on-street parking occupancy, presence of trees, and sidewalk width. Similarly, the variables for transit include access to transit, wait for transit, and travel time.

Florida's "2013 Quality/Level of Service Handbook", summarizes this system in the diagram depicted below and emphasizes the interdependency of these modes. For example transit is dependent on pedestrian facilities to allow bus riders to access the bus. The handbook also provides an illustration of LOS for each mode for urban roadways. The result is calculating LOS for each mode on scale of A to F, instead of one combined LOS. Multimodal Level of Service indicators can be used for modeling, for performance standards, and for targets.

Other methodologies to evaluate complete streets include use of a mode-specific index to emphasize improving a specific mode. For example, the San Francisco Department of Public Health developed the Pedestrian Environmental Quality Index (PEQI) as a tool to prioritize improvements in pedestrian infrastructure during the planning process. Another example is "Low-Stress Bicycling and Network Connectivity", by Mineta Transportation Institute that has developed measures to evaluate and guide bicycle network planning. However, these methods are mode specific and they do not address the transportation network as a whole. Hence, at this time the MMLOS is the best available method for evaluating the entire transportation network.

Communities in California are starting to transition from traditional LOS to a MMLOS assessment of the circulation system's performance for all modes of travel. Some examples are the cities of Pasadena, San Francisco and San Pablo.

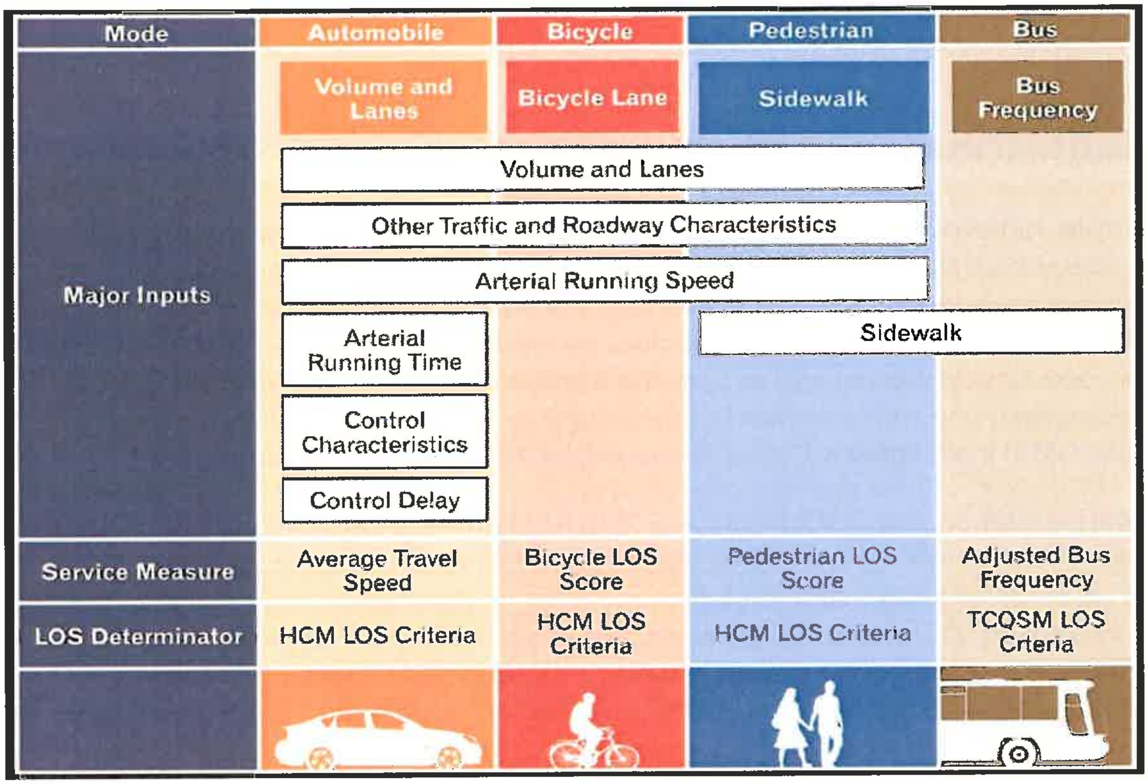

Figure 3-1 MMLOS Indicators (Source: Florida DOT 2013 Quality/Level of Service Handbook)

Regardless of methodology, local policies can be adjusted to ensure that the needs of all users are taken into consideration in designing transportation improvements and during the transportation impact analysis process. By performing a combined evaluation of auto, pedestrian, bike, and transit modes, communities and agencies can ensure that the transportation planning process protects all users and reflects local and regional priorities.

3.2 RELATED TOOLS AND METRICS

3.2.1 Mixed-Use Development (MXD) Trip Generation

Figure 3-2 Mixed Use Development (Source: Stantec)

Trip generation is a forecast of the number of vehicle trips that will be generated by a specific land use, based upon the size and type of use. Trip generation is generally based upon studies and analyses contained in the *Trip Generation Manual* produced by the Institute of Transportation Engineers (ITE). (ITE, 2012) The manual reports daily and peak period traffic generation rates for a wide variety of uses that commonly occur based upon national experience.

However, these trip generation rates are studied for each individual land use and do not consider mixed use developments (MXD). Mixed use developments often generate significantly less traffic than single use developments. This is because many of the trips can be avoided if uses are combined. Most mixed use developments are walkable and bike-able, and many are served by transit facilities leading to fewer auto trips. In addition, traditional trip-generating estimates do not consider the combined impact of multiple development projects.

The federal Environmental Protection Agency (EPA), in cooperation with ITE, worked to develop new data and methods to estimate the trip-generation impacts of mixed-use developments. EPA analyzed six metropolitan regions, merging data from household travel surveys, GIS databases, and other sources to create consistent land use and travel measures. The resulting linked models estimate internal capture of trips within mixed-use developments as well as walking and transit use for trips starting or ending in mixed-use developments. (EPA, 2014)

The Mixed-Use Method consists of four steps to achieve an estimate of daily vehicle trips generated by the mixed-use development on roadways. The four steps and outputs are:

1. Compute daily trip estimates using standard rates or equations from an external source (raw trips). These estimates do not assume any internalization, and only minimal trips made by walking and/or transit modes.

2. Compute the probability of a trip staying internal to the mixed-use development.

3. Compute the probability an external trip will be made by walking or bicycling.

4. Compute the probability an external trip will be made by transit.

In California, the San Diego Association of Governments (SANDAG) approved the MXD method for use region-wide for estimating trip generation of mixed use developments.

3.2.2 Walk Score

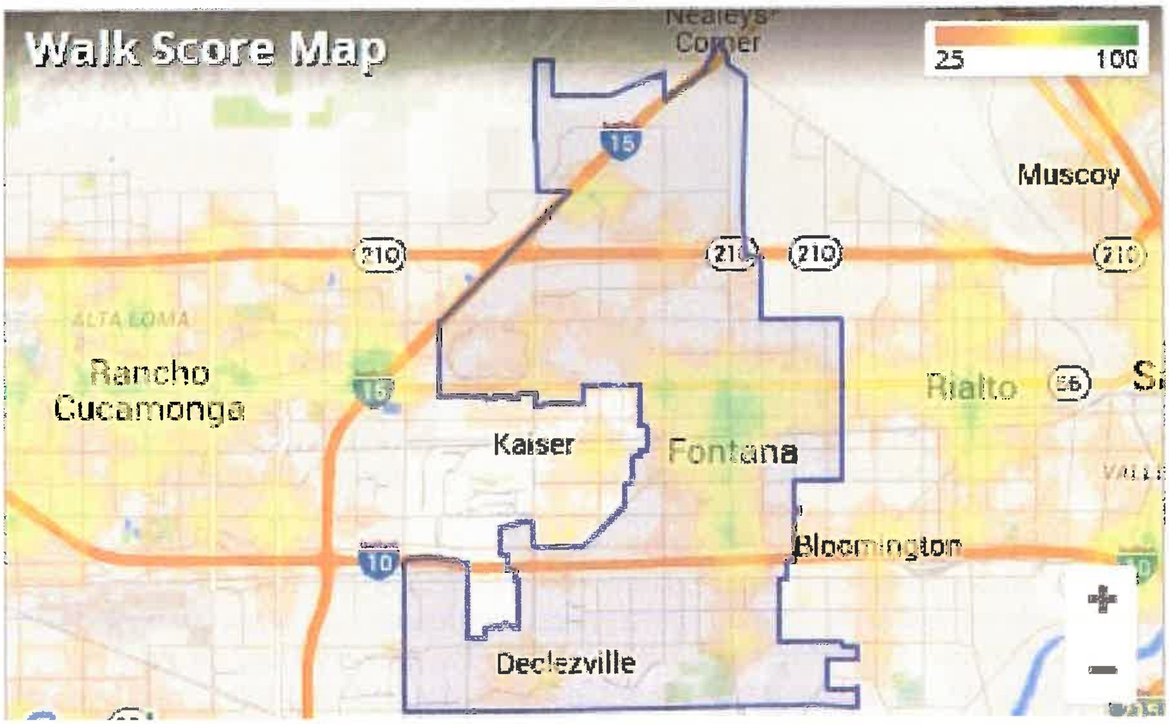

Figure 3-3 Walk Score (Source: walkscore.com)

New tools like Walk Score and Strava heat maps provide spatial data and metrics useful to understanding walkability and accessibility. (WalkScore, 2016), (STRAVA, 2015) Walk Score provides metrics for walkability, transit accessibility, and bike accessibility on a 0-100 scale. The Walk Score metric is based on population density, average block length, route directness, and the concentration of destinations such as schools, parks, and retail. The Walk Score for Fontana as a whole is 32. Walk scores vary significantly within a community such as Fontana, which scores very favorably in the downtown area, but is car-dependent in the newer, northern subdivisions. The similar Bike Score metric measures bicycling accessibility based on bicycle infrastructure, topography, road connectivity, and comparable destination information. The Transit Score metric captures similar factors as well as closest stop, route type, and route frequency information. Each of these metrics can be compared on a block by block, neighborhood by neighborhood, or city by city basis to better understand the components of walkability, areas that need the most improvement, and related questions. Similarly, Strava provides a heat map of movement logged through their mobile app that can provide additional insights about locations where people are running and biking and where runners and bicyclists are absent.

Both services provide basic information online for free and more comprehensive data can be requested and/or purchased.

4.0 BEST PRACTICES

4.1 PEDESTRIAN FACILITIES

Walking is the most basic form of transportation. Creating an attractive and safe pedestrian environment is a critical part of developing more livable communities. Pedestrian facilities should be safe, accessible to all types of users, connect to places where people want to go, encourage interaction, be attractive and of pedestrian scale, easy to use, economical to build and easily mantainable. The main forms of pedestrian facilities are sidewalks and trails including street crossings. Enhancements include curb ramps, pedestrian signals (including countdown signals and lights embedded in crosswalks), raised crosswalks, and street furniture, lighting and landscaping

4.1.1 Pedestrian Trails

Trails are off-street pedestrian facilities that offer opportunities not provided by the road system. Some trails are single use and can only be used for walking, cycling, neighborhood electrical vehicles, or horse riding. Others can be used by multiple users. However, it is important to separate users of vastly varying speeds such as walking and horse riding. Most trails in the US are multi-use trails and are used for walking and biking including users on skates and skateboards. (A number of cities have banned Segways and bicycles from sidewalks because they can go much faster than pedestrians.) Many multi-use trails also have separated pedestrian ways. These are much safer but are higher cost and need more space.

It is desirable to have a four feet minimum of clear usable space for walking/hiking trails and eight feet for multi-use trails (bike and pedestrian). In addition, a clear vertical space of eight feet is desirable for these trails.

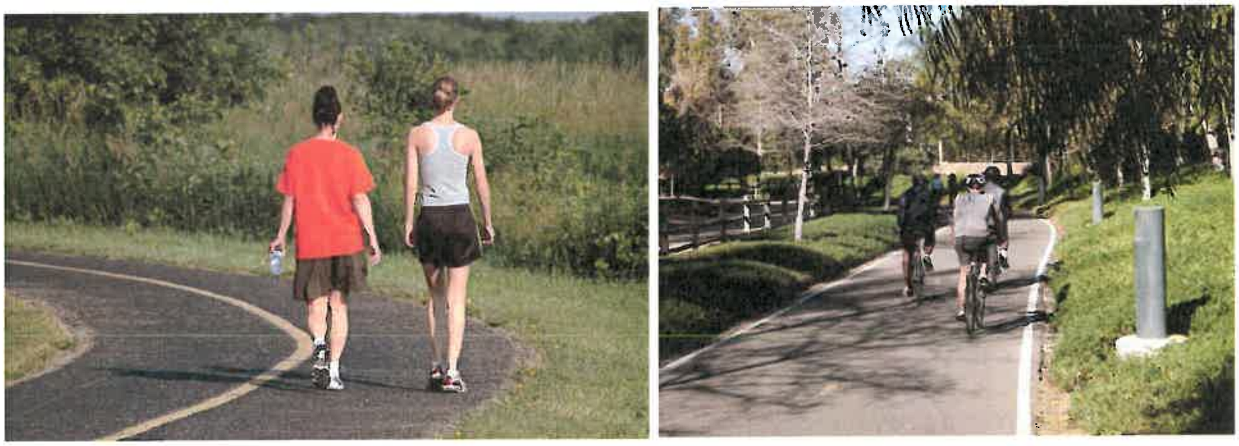

Figure 4-1 Pedestrian Trails (Source: pedbikeinfo.org, Stantec)

4.1.2 Sidewalks

Paved sidewalks are constructed alongside motorized vehicle travel ways with the intent of providing a safe, attractive environment for walking, separated from motor vehicles. Americans with Disabilities Act (ADA) provisions such as avoidance of sidewalk obstructions and abrupt changes in cross-slope facilitate their use by the mobility disadvantaged and the general public.

The California Highway Design Manual (CALTRANS, 2012) indicates that the minimum width of a sidewalk should be 8 feet between a curb and a building when in commercial districts like urban and rural main streets. For all other locations the minimum width of sidewalk should be 6 feet when contiguous to a curb or 5 feet when separated from the street by a planting strip. Sidewalk width does not include curbs. Street furniture, buildings, utility poles, light fixtures and areas where people congregate, such as window displays and bus stops, can reduce the effective width of sidewalks, so it is important to provide sufficient space for walking.

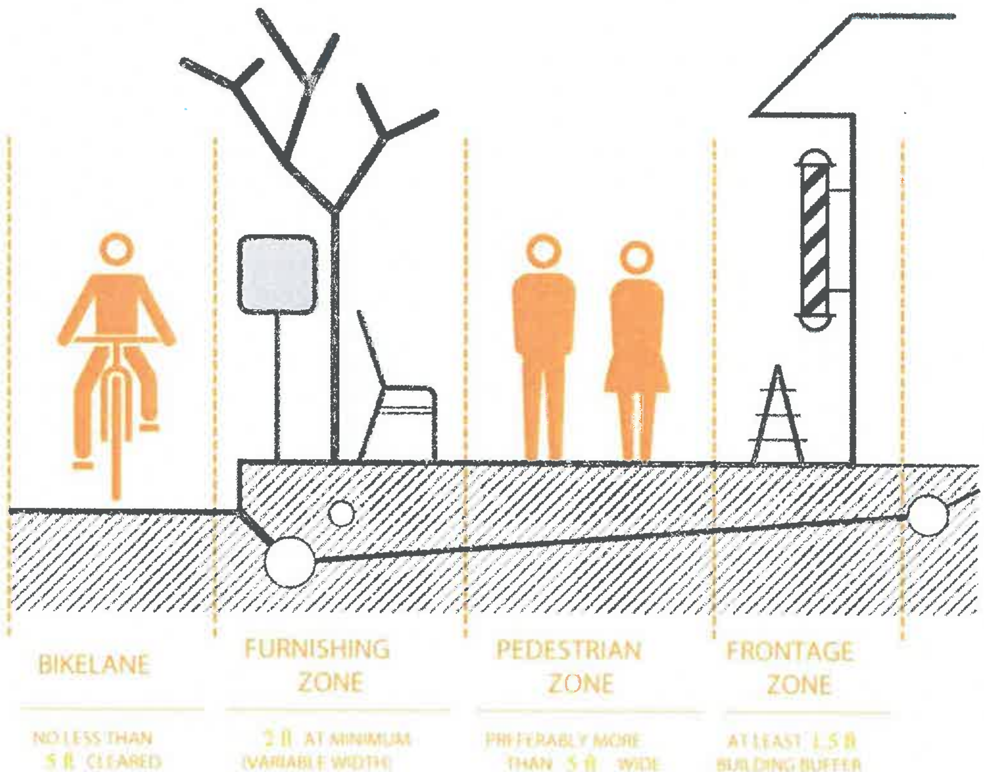

Figure 4-2 Streetscape (source EMBARQ/WRI Ross Center for Sustainable Cities)

4.1.3 Curb Ramps

Curb ramps are an important part of making sidewalks, street crossings, and the other pedestrian routes accessible to people using wheelchairs, walkers, scooters and people with strollers. Title II of the ADA requires state and local governments to make pedestrian crossings accessible to people with disabilities by providing curb ramps either using ADA Standards for Accessible Design (ADA Standards) or the Uniform Federal Accessibility Standards (UFAS). The most common type of curb ramp is the perpendicular curb ramp, which intersects the curb at a 90-degree angle. Curb ramps must have flared sides if people are required to walk across them. When pedestrians are not required to walk across the ramp, such as where there is a non-walking surface (grass, for example) or obstructions on both sides of a curb ramp, curb ramps are allowed to have returned curbs. The Standards also require that curb ramps include features called "detectable warnings." Detectable warnings consist of a series of small truncated domes that contrast in color with the surrounding sidewalk or street. (ADA, 2008)

Figure 4-3 Curb Ramps (Source: Stantec)

4.1.4 Roadway Crossings

4.1.4.1 At-grade Crossings

At-grade crosswalks are a critical part of the pedestrian network. Marked crosswalks are most effective when they can be identified easily by motorists as well as pedestrians. They should provide visual contrast with the surface of the street. Curb extensions can be effective in reducing crossing times and increasing visibility between pedestrians and motorists. Crosswalk and related pavement markings, signs, warning beacons, and traffic signals, as well as crossing-related traffic calming, can help make crossing streets at grade less of a barrier for pedestrians.

Pedestrian-actuated traffic controls require the user to push a button to activate a walk signal. These signals are often inaccessible to people with limited mobility and visual impairment. In order to overcome this issue, traffic controls need to be located as close as possible to the curb ramp without reducing the width of the path. They also need to be mounted low enough to permit people in wheelchairs to reach the buttons. When pedestrian change intervals are over seven seconds long, countdown timers are provided to indicate the time remaining to cross. To accommodate visually impaired pedestrians, pedestrian signals may include audio cues such as recorded speech instructions or tones. These acoustic features of *accessible pedestrian signals* are still the subject of ongoing standards development and are not yet required at all pedestrian signal locations. Special crosswalk treatments such as flashing beacons can also enhance pedestrian travel and safety.

4.1.4.2 Decorative Crosswalk

Decorative crosswalks provide for the crosswalk to be painted with specialty markings, or created from special materials (typically bricks or other specialty paving). They make the crosswalk more visible to on-coming traffic. The cost starts at approximately $5 per square foot for lower cost applications.

Figure 4-4 Decorative Cross walk (Source: Stantec)

4.1.4.3 Raised Crosswalks

In addition to decorative treatments, raised crosswalks provide make pedestrians more visible to on-coming traffic, in addition to serving as a speed reduction facility for vehicles due to the horizontal deflection of the roadway. The elevation of the crosswalk serves to reduce speeds almost like a speed hump and the textured material (typically long enough for an entire wheelbase) draws attention to the roadway.

Raised crosswalks are considered a high cost measure, and can cost approximately $25,000 per location.

Figure 4-5 Raised Crosswalk (Source: www.pedbikeimages.org / Dan Burden)

4.1.4.4 Lighted Crosswalks

Crosswalks can be lighted in two ways – via in-ground flashers or overhead flashing lights. In-ground lights are installed in the pavement along the entire length of both crosswalk lines, and the lights blink when activated by a pedestrian (either through pedestrian push-button or motion activation). Overhead flashing lights are yellow lights located above the crosswalk. Both have flashing yellow lights which are intended to increase motorists' awareness of pedestrian crossings.

Lighted crosswalks are considered high cost measure, and can cost approximately $20,000 to $30,000 for in roadway and approximately $15,000 for a Rectangular Rapid Flashing Beacon (RRFB) System.

Figure 4-6 At-grade Crossing (Source: Stantec)

4.1.4.5 Curb Extensions (Bulb-Outs)

Curb extensions are locations where the curb is extended into the roadway, providing for narrower travel lanes and easier pedestrian crossing. This can be done by eliminating non-travel space (such as parking areas along the outside of a roadway), by reducing the number of travel lanes in each direction from two lanes to one lane, or by reducing the total number of travel lanes from two lanes (one per direction) to one lane (such as a one-lane bridge)

Figure 4-7 Curb Extensions (Source: commons.wikimedia.org,wikipedia)

4.1.4.6 Midblock Crossings

Midblock crossings are pedestrian crossing points that do not occur at intersections. They are often installed in areas with heavy pedestrian traffic to provide more frequent crossing opportunities. They can also be installed in areas with large neighborhood blocks. Since it is difficult for visually impaired people to detect mid-block crossings, an audible or vibrating alerting system is desirable. Just like at-grade crossing at intersections, these crossings should be highly visible and should provide visual contrast with the surface of the street.

Figure 4-8 Midblock Crossing (Source: www.pedbikeimages.org / Dan Burden)

4.1.4.7 Grade-Separated Crossings

Grade separated crossings fall into two categories

1. Overpasses - bridges, elevated walkways, and skywalks or skyways

2. Underpasses - pedestrian tunnels and below-grade pedestrian networks

Grade-separated crossings can reduce pedestrian-vehicle conflicts and potential accidents while limiting vehicle delay and increasing roadway capacity. They provide great benefit for pedestrians and bicyclists who must cross heavily traveled roadways. However they can cause inconvenience by increasing travel distance for pedestrians traversing ramps, if they are not in-line with an established travel way and if too constrained or not properly lighted. They are typically not viewed as pleasant routes. Their use can be facilitated with elevators, which are often required to make the facilities handicap-accessible. Maintenance and security can become problems if overpasses and underpasses are not well-maintained, well-lit, and designed with security in mind. Generally speaking, overpasses and underpasses should be avoided unless necessary cross significant barriers.

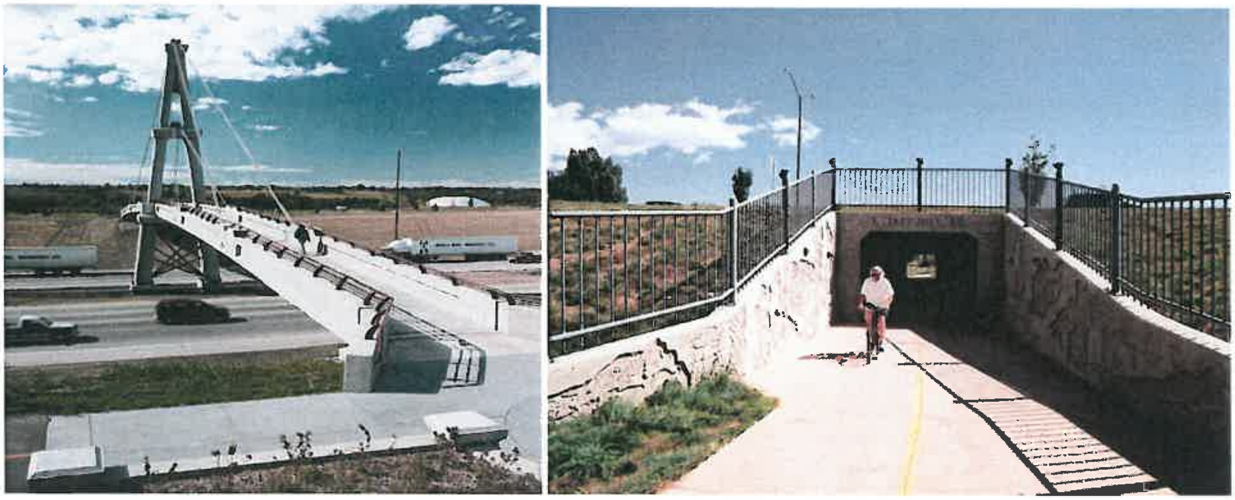

Figure 4-9 Pedestrian/Bike Overpass and Underpass (Source: Stantec)

4.1.5 Medians and Islands

A median is the portion of the roadway separating opposing directions of the roadway, or local lanes from through travel lanes. Medians may be depressed, raised, or flush with the road surface. Medians are generally linear and continuous through a block. An island is defined as an area between traffic lanes used for control of traffic movements. Because they are continuous along a block, medians generally allow vehicles to travel at increased speeds. They can also encourage pedestrians to cross away from crosswalks. From a pedestrian safety point of view, refuges at established crosswalks are preferable to medians.

According to a report on the FHWA safety program website (FHWA, 2013), providing raised medians or pedestrian refuge areas at pedestrian crossings at marked crosswalks has demonstrated a 46 percent reduction in pedestrian/vehicle crashes. At unmarked crosswalk locations, pedestrian crashes have been reduced by 39 percent. Installing raised pedestrian refuge islands on the approaches to unsignalized intersections has had the most impact reducing pedestrian crashes.

4.1.6 Sight Distances

Sight distance is defined as "the distance a person can see along an unobstructed line of sight." Adequate sight distances between pedestrians and motorists increase pedestrian safety. Sidewalk design should take line of sight into consideration while planning for landscaping, signage, bollards and lighting.

4.2 BICYCLE FACILITIES

Caltrans has defined classes of bikeways which are used throughout the state for project description, design standards, and other purposes. Traditionally bikeways were divided into three classes, but a fourth class, known as cycle tracks, separated bikeways, or protected bikeways, was recently created by a new State law (CALTRANS, 2012).

4.2.1 Class I Bikeways – Separated Bikeways

Figure 4-10 Class I Bikeways (Source: Stantec, commons.wikimedia.org)

Class I Bikeways provide a paved right-of-way that is physically separated and independent from the street or highway. The Pacific Electric Trail (PET) in Fontana is the city's only Class I bikeway. Bikeways provide recreational and commuter bicycling opportunities as well as a path for walkers and joggers. Class I Bikeways are commonly found along rivers, ocean fronts, canals, utility rights-of-way, adjacent to railroad rights-of-way, and on abandoned railroad rights-of-way (like the PET, which is a "rail trail"). Class I facilities can also close gaps in a bicycle network caused by the construction of freeways or the existence of natural barriers (rivers, hills, and mountains). Class I Bikeways typically prohibit motorized traffic but are often shared with pedestrians and other non-motorized users.

4.2.2 Class II Bicycle Lanes – Marked Bike Lanes

Figure 4-11 Class II Bike Lanes (Source: Stantec, modestogov.com)

Class II facilities are on-street bicycle lanes delineated by traffic striping and marking to create separate portions of the roadway available to bicyclists and motorists, providing for more predictable movements by each. Class II facilities include a striped lane that allows for one-way bicycle travel normally on the right side of a street or highway. Class II facilities are located adjacent to the curb or they can provide for a parking lane or right turn lane to the right of the bicycle lane.

Recently, agencies have started providing special paving or color treatments to make bicycle lanes more visible to motorists. This can be done by using colored pigment in the asphalt mix, applying a surface coloring to the entire lane, solidly coloring part of the lane, or adding colored stripes within the lane. While the cost of colored lanes is higher compared to striping, it is far more effective in terms of actual and perceived safety of using these paths and is critical to maximizing the use of these facilities.

Another treatment to provide greater separation between bicyclists and the adjacent general purpose lane is the buffered bike lane. A buffered bike lane is a Class II bike lane that is paired with a buffer space delineated by normal white pavement markings that separate the bicyclists from the adjacent vehicle traffic or parked cars without raised barriers or pavement markers.

Figure 4-12 Class II Bike Lanes - Buffered (Source: nacto.org)

4.2.3 Class III Bicycle Routes – Shared Streets

Class III facilities are designated routes that provide for shared use with motor vehicle traffic and are identified by signage, but do not provide a designated area for bicycles and non-motorized users. These facilities can provide continuity to other bicycle facilities or to designate preferred routes through high-demand corridors. Bike routes are established by placement of "Bicycle Route" guide signs. Some Class III facilities are supplemented by bicycle "sharrow" markings which indicate that travel lanes are intended for the shared use of both bicycles and motor vehicles. Sharrows are a visual reminder for cyclists and cars to share the road and may be used where there is insufficient width to add a bike lane. The sharrow, when implemented correctly, shows the rider where to travel to increase maximum visibility of the cyclist and move the cyclist out of the "door zone" of parked cars. Sharrow markings and signs may be applied to class III bike routes to inform motorists that cyclists are allowed and to share the road. They can also be supplemented by additional signs indicating "Bicycles May Use Full Lane."

Figure 4-13 Class III Bike Routes (Source: Stantec, nacto.org)

4.2.4 Class IV Bikeways – Cycle Tracks

In addition to the standard class I, II, and III bike facilities, an additional bicycle treatment is now being implemented in select bicycle-friendly cities across the country. Class IV Bikeways, also known as cycle tracks, separated bikeways, or protected bikeways are similar to class I facilities in that they feature a dedicated bicycle right-of-way. Rather than being independent from a street or highway, class IV facilities are located inside the road right-of-way. Cyclists are typically separated from motor vehicles by a barrier such as a curb, delineator posts, a lane of parked cars, or median. A variation is a parking protected bike lane where the bike path is situated alongside the curb and the parking spaces are moved over to serve as a barrier between cyclers and automobile traffic.

The Protected Bikeways Act of 2014 (Assembly Bill 1193 – Ting, Chapter 495) established Class IV bikeways and tasked Caltrans to prepare design criteria for their proper development. This law also allows for use of design criteria in the Urban Bikeway Design Guide, published by the National Association of City Transportation Officials (NACTO, 2013). Elements of Class IV facilities were formerly considered to be contrary to State design standards until the passage of this law. They are now permitted and are encouraged where feasible by Caltrans.

Cycle tracks are also safer for users as they are protected by a physical barrier and reduce overall confusion and tension for all users of the road. A study conducted by the National Institute for Transportation and Communities that examined protected bicycle lanes in 5 cities including San Francisco, observed an increase in ridership on all facilities after the installation of the protected cycling facilities, ranging from +21 percent to +171 percent. Buffers constructed using flexible posts received very high ratings even though they provide little actual physical protection from vehicle intrusions— because cyclists perceive them as an effective means of positive separation (NTIC, 2014).

Cycle Tracks can provide opportunities for aesthetic improvements in addition to mobility improvements. They can provide opportunities for landscaping or other decorative features in the roadway. Drainage should be maintained on both sides of the cycle track. Examples of Class IV Bikeways in California include cycle tracks in Temple City, Long Beach, Redondo Beach, Santa Monica, Carlsbad, and San Francisco. They are being implemented in major cities throughout the U.S., often following the criteria found in the Urban Street Design Guide (NACTO, 2013). FHWA has recently published a Planning and Design Guide for separated bike lanes (FHWA, Seperated Bile lane Planning Design Guide, 2015), that reflects encouragement of their use by the Federal Government.

Figure 4-14 Class IV Cycle Tracks (Source: Stantec, modestogov.com)

4.2.5 Additional Enhanced Bicycle Treatments

4.2.5.1 Bicycle Boulevards

Bicycle boulevards, also known as neighborhood bikeways or greenways, are low-speed streets that have been optimized for bicycle traffic. They provide safer and more comfortable bicycling environments than facilities such as striped bike lanes on major streets and they are often located to provide routes parallel to collector or arterial streets. Bicycle boulevards typically provide traffic devices that are also used for neighborhood traffic calming, such as speed humps, medians, landscaped bulb-outs, roundabouts, and other measures that discourage non-local traffic and reduce motor vehicle speeds to 15 mph while allowing uninterrupted bicycle speeds of 15 mph. Also referred to as neighborhood greenways, bicycle boulevards can combine green infrastructure and stormwater management with bicycle boulevard treatments. The net effect of either improvement is to transform a street into a facility where bicyclists have equal or priority use of the street with motorists. The Neighborhood Greenways Assessment Report recommends the following operational performance guidelines for neighborhood greenways (PBOT, 2015):

- Vehicle speeds of 20 mph at the 85th percentile
- Automobile volume target of 1,000 ADT, with 1,500 ADT acceptable and 2,000 ADT maximum
- Bicycle and pedestrian crossing opportunities, measured as a minimum of 50 crossing opportunities per hour, with 100 crossing opportunities per hour the preferred level of service

Figure 4-15 Bicycle Boulevard with Diverter Islands (Source: B.I.K.A.S https://labikas.wordpress.com)

4.2.5.2 Elevated or Raised Bike Lanes

Another treatment that provides additional protection from motor vehicles is elevating the bike lane from the grade of the roadway. Slightly elevating the bike lane from the travel lane can provide additional visibility, a clearer demarcation of the space as dedicated for bicyclists, and a slight physical barrier in contrast to a typical bike lane into which motorists may stray haphazardly when making right turns. Typical treatments include raising the bike lane only slightly over the pavement or to the same level as the sidewalk. This treatment is relatively new in the United States and is not yet widely accepted. It is being tested now in San Francisco, and other agencies are considering the treatment.

Figure 4-16 Raised Bike Lanes (Source: bayviewcompass.com, nacto.org)

4.2.5.3 Colored Bike Lanes

Figure 4-17 Colored Bike Lanes (Source: nacto.org)

Recently, agencies have started providing special paving or color treatments on striped bike lanes to make them more visible to motorists. Colored treatment can be applied to the entire width of the bike lane for the entirety of the facility or before and after critical conflict zones where bicyclists and motorists must yield to one another—typically at intersections where motorists may turn right across the bicycle lane.

Green, blue, and red are among the colors that have been tested across the world for this purpose. Because these colored pavements are intended to regulate, warn, or guide traffic (motorists and bicyclists) and thus are serving as more than just an aesthetic treatment, they are considered to be traffic control devices. In United States, green has been the only color that has received official FHWA approval for colored pavement experiments on bicycle facilities as blue and red are used for different purposes. Green colored pavement can be used in marked bicycle lanes by any jurisdiction that requests and obtains interim approval from the FHWA (FHWA, 2011).

4.2.5.4 Bicycle Boxes

A bicycle box is the extension of the bike lane into the intersection itself. Bike boxes are designed to prevent bicycle and car collisions, especially between drivers turning right and bicyclists traveling straight or turning left. It is intended to make cyclists more visible and to give cyclists a head start when turning. A striped box with a white bicycle symbol inside is painted on the road before a stop light or sign. The boxes include the bicycle lanes approaching the box. Bicyclists stop in the bike box to be most visible to motorists while they wait for the signal.

The use of bicycle boxes is currently experimental under the FHWA. Along with other requirements such as setbacks, pavement marking, full-time turn on red prohibition, FHWA requires that pedestrian countdown signals must be present or installed for the contiguous crosswalk movement if the bicycle box is installed laterally across more than one approach lane. Active official experiments in California are being performed at Davis and Santa Monica (FHWA, 2015).

Figure 4-18 Bicycle box (Source: nacto.org, Stantec)

4.2.5.5 Dedicated Bicycle Signals and Signal Phases

Providing a dedicated bicycle signal can move bicyclists through an intersection safely, before allowing motor vehicles to create a potential conflict. Alternatively, traffic signals can be timed to allow priority for bicycles or pedestrians encouraging these non-motorized uses and improving safety. A signal phase is defined as the signal cycle length allocated to a traffic movement at an intersection receiving the right-of-way, or to any combination of traffic movements receiving the right of way simultaneously. The combination of all phases is equal to one cycle length. Providing dedicated signal phases for bicycles and/or pedestrians separates them from automobile traffic. This reduces potentially dangerous conflicts and makes bicycling a less stressful and more welcoming alternative to driving. Although rare in the U.S., they have been approved for usage in the U.S and in California at this time. They exist in Davis, Long Beach, and Redondo Beach, and additional cities are considering their use.

Figure 4-19 Dedicated bicycle Signals (Source: portlandoregon.gov, www.billandnancy.com, www.sa.gov.au)

4.2.5.6 Grade Separation

Grade separation removes any potential for conflict between bicycles and motor vehicles. Replacing an at-grade street crossing with a bicycle overpass or underpass can reduce conflicts with automobiles while allowing bicyclists to maintain momentum by eliminating the need to stop. However, such an improvement can come at a very high cost if existing infrastructure is not already in place.


Figure 4-20 Grade Separation (Source: Stantec)

4.3 TRANSIT SYSTEMS

Transit systems can include fixed-route systems, such as subways, light rail, and Bus Rapid Transit (BRT) with dedicated rights-of-way, and variable route systems served by buses, BRT without dedicated lanes, paratransit, community circulators and so on. People will use transit if it is frequent and reliable, convenient, and comfortable, The Inland Empire was developed with transportation by car as the model, and the very dispersed employment profile of cities like Fontana makes transit challenging. However, at a minimum every community includes people who cannot drive (including youth under 16 and some elderly people) and others who do not have cars and need to reach jobs. While the City of Fontana does not control the regional transit systems that serve the city, it has a role to play in the implementation of SCAG's 2016-2040 RTP/SCS. The City can make land use decisions that support transit and can advocate for service that best meets the needs of Fontanans.

Heavy rail. A recent study by researchers at the University of California-Berkeley found that the most successful fixed-route systems connect areas that are dense in both population and jobs and have expensive parking. (TRB, 2014) Fontana is connected to downtown Los Angeles by the Metrolink commuter rail system, a fixed-route system. Downtown Los Angeles qualifies as job-dense with expensive parking and the suburban route is designed to capture a regional population that works in downtown LA. In Fontana, however, less than 10% of employed residents currently work there. Because Fontana's Metrolink station is downtown, there are opportunities to enhance its value as a regional transportation link through additional transportation-oriented development, with opportunities to reduce the growth of congestion on regional freeways.

Light rail. There is no light-rail system in Fontana or the region and there are no plans to establish light rail within the time horizon of the General Plan Update. The Transportation Research Board's Urban Public Transportation Glossary defines Light Rail Transit as "A metropolitan electric railway system characterized by its ability to operate single cars or short trains along exclusive rights-of-way at ground level, on aerial structures, in subways, or occasionally, in streets and to board and discharge passengers at track or car floor level" (TRB, 1978). In the more distant future, if the Inland Empire becomes more population- and job-dense, light rail systems may become feasible.

Bus service. The regional Omnitrans bus system currently operates in Fontana. Best practices for bus systems include reorganizing routes and schedules to provide more frequent and convenient service on the routes with the most riders, rather than providing equally infrequent and inconvenient service to cover all areas, including those with few riders. Better service on the routes that most people want to use often increases ridership, with the potential to take some cars off the road and relieve some congestion.

Bus Rapid Transit (BRT). The West Valley Connector is a BRT system without a dedicated lane currently expected to have a route starting at Kaiser Hospital in Fontana, going up Sierra Avenue to Foothill Boulevard and then going west along Foothill and through Ontario, Rancho Cucamonga, Upland and ending in Pomona, with destinations including the regional airport and retail. The purpose of the BRT is to provide frequent, convenient and comfortable service. Best practice characteristics include a limited number of stops, frequent headways (the amount of time between service), transit signal priority (timed signals to give crossing priority to transit and minimizing stopping), enhanced stations and security, and arrival information at stops.

Land use integration with transit. The amount of system investment in transit routes and stops determines the likelihood of transit-oriented development. The permanence of dedicated rights-of-way and transit stations attracts development. BRT without dedicated lanes is somewhat less permanent, but still includes a level of investment in stations that can be the foundation of transit-oriented development. Conventional bus routes and stops can be easily changed and for that reason do not readily attract the investment needed for centers of transit-oriented development.

Medium-sized cities such as Fontana can work with transit agencies so that land use and economic development policies are consistent with efficient public transportation opportunities. Vanpool, paratransit (on demand service for disabled persons), and community circulators can also be well suited for communities such as Fontana.

Figure 4-21 Light Rail Transit System (Source: Stantec)

4.3.1 Bus Rapid Transit

The Institute for Transportation and Development Policy (ITDP) identifies Bus Rapid Transit (BRT) as a "high-quality bus-based transit system that delivers fast, comfortable, and cost-effective services at metro-level capacities. It does this through the provision of dedicated lanes, with busways and iconic stations typically aligned to the center of the road, off-board fare collection, and fast and frequent operations" (ITDP, 2016). BRT generally improves speed by 10% to 15%. BRT-style buses that provide service on limited-stop routes with without dedicated lanes—sometimes referred to as "BRT 'Lite'"—is a variant of full BRT. The West Valley Connector planned for Fontana is currently expected to be service without a dedicated lane. A BRT corridor is a section of road or contiguous roads with a minimum length of 1.9 miles that has dedicated bus lanes. According to ITDP, the five essential features that define full BRT are:

- **Dedicated Right-of-Way:** Bus-only lanes make for faster travel and ensure that buses are never delayed due to mixed traffic congestion.
- **Busway Alignment:** Center of roadway or bus-only corridor keeps buses away from the busy curbside where cars are parking, standing, and turning
- **Off-board Fare Collection:** Fare payment at the station, instead of on the bus, eliminates the delay caused by passengers waiting to pay on board
- **Intersection Treatments:** Prohibiting turns for traffic across the bus lane reduces delays caused to buses by turning traffic. Prohibiting such turns is the most important measure for moving buses through intersections – more important even than signal priority.
- **Platform-level Boarding:** The station should be at level with the bus for quick and easy boarding. This also makes it fully accessible for wheelchairs, disabled passengers, strollers and carts with minimal delays.

Other important characteristics for successful BRT are common to transit modes that have permanent stops or stations:

Station Location: Stations should be well designed, well located and provide convenient and easy access. They should interact with other modes of travel and be ADA accessible.

Station and Facility Design: A station should be well integrated into the surrounding areas, well designed, easily accessed, attractive, comfortable, and safe. Amenities such as real-time passenger information systems, route maps, transfer connection information, and ticket machines are needed at the station.

Specialized Branding/Marketing: Attractive branding and marketing materials, including maps, can significantly increase ridership and should be carefully crafted to cater to the taste of the targeted population

Figure 4-22 Bus Rapid Transit System (Source: Stantec)

4.3.2 Local Bus Service

Most cities are served by a local bus system often operated by local transit authorities, Omnitrans in the case of Fontana. While the City does not operate the system, it can advocate for practices that have been shown to improve service and attract more ridership and collaborate with the transit authority to help improve bus speeds through providing changes to signal timing, providing signal priority, queue jump lanes and similar efforts.

A recent report by the Transportation Research Board, *Commonsense Approaches for Improving Transit Bus Speeds* [TCRP Synthesis 110, 2013], based on a survey of 31 transit agencies and review of practices, identified a number of practices that can improve bus speeds, which is a major issue for riders. In addition, as noted earlier, many transit agencies have reconfigured routes and service to provide more frequent service to the routes most in demand, rather than focusing on providing coverage.

- **Adjust schedules**: Adjusting running time, recovery times (the time spent turning the bus), and more flexible headway schedules improve on-time performance reliability for riders, and reduce the need for buses to sit if they are running early.
- **Consolidate stops:** More than half of the agencies surveyed have consolidated stops, either by focusing on specific corridors or by gradual policy changes. Moving stops to the far side of intersections at stop lights and physical changes to allow faster boarding, such as longer bus stops or bulbouts, also improve speed.
- **Streamline routes:** Straightening out routes, trimming deviations, eliminating duplication, and shortening routes can simplify and speed up service.
- **Stop design:** A safe, clean, comfortable, and ADA-accessible bus stop/shelter should provide some shade and seating, at a minimum.
- **Signal timing:** Synchronized stoplights along transit routes can make sure that buses face more green lights than red, but only have a mild impact on operating speeds.
- **Transit signal priority:** Signal priority changes stop lights for approaching buses to help increase bus speeds.
- **Fare policy**: In the survey, one agency established a system to collect fares before passengers board, and to allow them to board at both bus doors. This change decreased bus running times by 9 percent.
- **Vehicle changes:** Low-floor buses reduce loading times, and ramps can speed loading for wheelchairs and bicycles.
- **Bus lanes:** Dedicated lanes on wide arterial streets moderately improve speeds.

Figure 4-23 Local Buses – off street bus stop with a shelter with seating and shade (Source: Stantec)

4.3.3 Urban Streetcars and Trolleys

Streetcars are local public transportation that uses electric vehicles running on rails. Streetcars are generally designed to provide short-trip urban circulation, and the vehicles and infrastructure are optimized accordingly. The streetcar alignment can be located in shared traffic lanes or on a segregated right-of-way if one is available. Vehicles typically consist of a single unit, ranging from restored heritage cars to modern multi-section articulated designs. Streetcar projects are typically driven by a combination of transit demand and the desire to rejuvenate urban public spaces. They are best suited for short trips in an urban environment; usually around five miles though streetcars serving longer and shorter distances also exist.

Variations include trackless trolleys without rails but connected to above-ground wires, and circulators (such as the downtown trolleys in many cities) that are often called trolleys but are really rubber-tired buses designed to resemble historic streetcars.

Streetcars can operate on mixed right- of-way, street level operation or exclusive lane if available. Many choices of streetcar vehicles ranging from replica heritage cars (vintage/heritage trolley) to modern streetcars are available and the choice of a particular car design should be personalized to the community it serves. Modern vehicles vary between 60 feet to 100 feet long and carry 100 to 175 people. Historic cars are usually shorter, from 40 feet up to 60 feet with capacities of 50 to 60 people.

All the best practices for bus systems are also true for the streetcar system.

Figure 4-24 Urban Street Cars (Source: Stantec)

4.4 GOLF CARTS AND LOW SPEED ELECTRIC VEHICLES

Although some people use walking and biking as modes of travel to work or for recreational purposes, the majority of the population will use these modes to perform daily activities only if they are in a comfortable range of 0.5 - 1 miles for walking and 1-3 miles for biking. These modes also require a person to be relatively physically fit. Seniors or physically challenged people need other modes that can cover short distances safely. Hence, there is a growing trend in transportation for the use of vehicles such as golf carts and low-speed vehicles or Neighborhood Electric Vehicles (NEV). Apart from providing mobility to people residing in the community, these vehicles have other advantages over the use of cars:

- They do not have gas engines and run on electricity providing significant emission reductions.
- They generally don't go over 25 miles per hour and hence reduce chances of serious injuries.
- The infrastructure they require can be used by cyclists, skaters, and joggers.
- Their parking spaces are one-third the size of those of cars, thereby reducing the size of parking lots.
- Relieves congestion by reducing the need for a car for shorter trips.

According to the California Vehicle Code (CVC), a golf cart is "a motor vehicle having not less than three wheels in contact with the ground, having an unladen weight less than 1,300 pounds, which is designed to be and is operated at not more than 15 miles per hour and designed to carry golf equipment and not more than two persons, including the driver". The use of a golf cart does not require a California driver's license or registration with the California Department of Motor Vehicles.

On the other hand, a low-speed vehicle or a NEV is "a motor vehicle that meets all of the following requirements: (1) has four wheels, (2) can attain a speed, in one mile, of more than 20 miles per hour and not more than 25 miles per hour, on a level paved surface, and (3) has a gross vehicle weight rating of less than 3,000 pounds. The CVC also states that the driver of a low-speed vehicle must have a valid California driver's license and the low-speed vehicle must be registered with the California Department of Motor Vehicles prior to any use on public roadways or shopping centers.

Many communities allow the use of a golf cart on existing multi-use trails. However, it is best to provide a separate trail for their use so they don't interfere with pedestrian and bicycle users and to intern minimize accidents. On the other hand, NEVs in California are allowed to drive on streets with posted speed limit below 25 miles per hour.

5.0 TRAFFIC CALMING MEASURES

This section of the report discusses various measures which can be used to reduce speeding and discourage through traffic in neighborhoods. Safer neighborhood streets in turn encourage pedestrian and bicycle trips, and sometimes transit usage. These traffic calming measures are divided into low cost options (0 - $5,000), medium cost ($5,000 - $15,000) and high cost improvements (over $15,000).

5.1 FOCUSED ENFORCEMENT

Police enforcement can be a very important tool in neighborhood traffic calming and can often result in a 3 mph average speed reduction across the board of speed ranges. However, the effect is often temporary, especially if enforcement is sporadic. Enforcement is most effective under a systematic program or in conjunction with a change in traffic conditions.

The National Highway Traffic Safety Administration (NHTSA) provides guidelines for developing a speed enforcement program, and discusses designating specific areas as enforcement zones. In addition to police enforcement, NHTSA discusses using neighborhood committees to assist with enforcement activity and to raise public awareness (NHTSA, 2008).

Focused enforcement would be considered a low cost measure. The cost can run approximately $500 per day. The cost can be offset by income from fines, but total fine income will not be increased unless traffic manpower is increased. Issues of enforcement and staff deployment are challenging for a local police department trying to address a variety of public safety concerns. Therefore, increased or focused enforcement is not likely a long-term solution.

5.2 RADAR SPEED TRAILERS

Radar speed trailers can be placed at the sides of the roadway in the street right of way if there is adequate width so as to not impede traffic, or directly adjacent to the roadway (on the parkway or another area if available). These trailers show the posted speed limit and also "your speed." The trailer's radar detects vehicles' speeds and shows the speed at which they are traveling.

These trailers come with a variety of features. Many units are lightweight and can be moved throughout the neighborhood. Others can flash "Slow Down" or have flashing red and blue lights when the speed detected is too high and the driver does not slow to the posted speed limit.

Radar speed trailers are considered a low cost measure, and often require the City to move existing equipment to a specified location. Purchase of actual radar equipment could be more expensive, with prices ranging from $5,000 to $15,000.

In addition to radar speed trailers, permanent signs can be posted on existing street signs or new poles. They show the same information as the trailers including two lines of text (typically "YOUR SPEED" or "SLOW DOWN") and the vehicle's speed. They can be a lower-cost than the trailers, but also offer less visibility.

These options have been tried in many locations, with mixed success. Speed reduction is typically high when first implemented, but effectiveness often reduces over time. Therefore, they are not recommended as a long-term solution.

5.3 ROADWAY SIGNS AND MARKINGS

Roadway signs and markings are some of the lowest cost options for traffic calming. There are a variety of traffic signs that can be used in conjunction with traffic calming. Many relevant traffic-calming signs are shown in Figure 5-1.

Speed limit signs can have some limited effectiveness, but alone, they rarely result in compliance or speed reductions. It is appropriate to post a 25 mph limit as a reminder to residents, but this action alone will not likely change the speed of most vehicles. Stop signs, used in isolation, are rarely effective for speed control as motorists do not see an obvious reason to stop at a stop sign.

Marked and signed crosswalks can be effective for reducing speeds, especially in high pedestrian or school areas. Pavement markings on the street can also serve as traffic control devices. Pavement markings can include edge lines painted to designate the parking area from the travel area, bicycle lanes, and median centerline stripes. All of these serve to visually narrow the roadway and therefore have a tendency to slow traffic.

Roadway signs and markings are considered low cost measures. Signs typically cost under $200 per location/sign for installation. Markings typically cost $500 to $1000 per site.

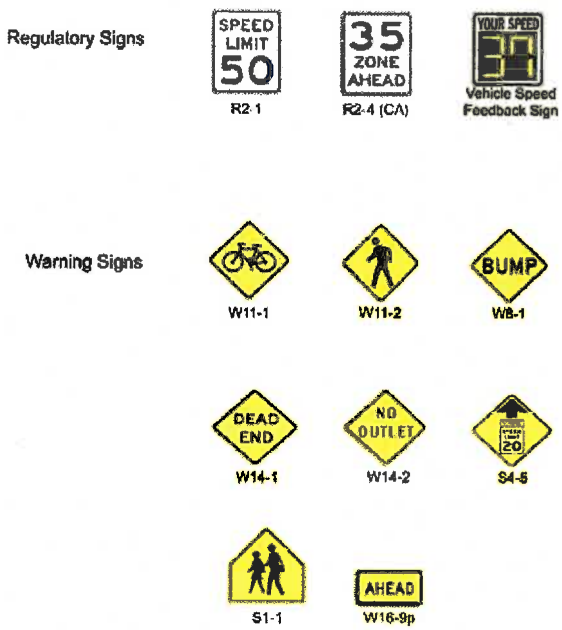

Figure 5-1 Potential Traffic Calming Signs

5.4 ROADWAY MODIFICATIONS

5.4.1 Narrow Streets

Narrowing the width of a street, or more specifically narrowing the traveled way for vehicles, will result in lower vehicular speeds. The following are common treatments used to narrow the traveled way for traffic calming purposes.

5.4.1.1 Curb Extensions and Bulb-outs

Curb extensions are locations where the curb is extended into the roadway, providing for narrower travel lanes. This can be done by eliminating non-travel space (such as parking areas along the outside of a roadway), by reducing the number of travel lanes in each direction from two lanes to one lane, or by reducing the total number of travel lanes from two lanes (one per direction) to one lane (such as a one-lane bridge).

Curb extensions normally result in a loss of parking in order to narrow the street and provide landscaping. The parking loss can be reduced if the roadway is narrowed at areas that already include driveways, but driveway access will be lost while the curb extension is being constructed. Also landscape opportunities are greatly reduced if driveways are provided within the curb extensions. The curb extensions must be carefully planned and designed to work with the existing driveway locations, and the function of existing drainage and street sweeping systems.

Figure 5-2 Curb Extensions (Source: nacto.org)

Intersection bulb-outs are curb extensions located specifically at intersection locations that extend the curb line into the roadway, providing for narrower travel lanes and pedestrian crossing areas. This can be done by eliminating non-travel space (such as parking areas along the edge of a roadway), by reducing the number of travel lanes in each direction from two lanes to one lane, or by reducing the total number of travel lanes from two lanes (one per direction) to one lane (such as a one-lane bridge).

These improvements have an estimated cost of $20,000 or more per intersection ($5,000 per corner).

5.4.1.2 Chicanes

Chicanes are created when curb extensions alternate from one side of the street to the other, essentially creating S-curves. On lower volume streets, however, chicanes can create traffic deviating out of the appropriate lane if they are not designed very carefully.

Curb extensions, including both chicanes and standard curb extensions, are high cost improvements, and typically cost approximately $20,000 per location.

There are bolt-on options available for a lower cost; however, they have some restrictions. There are two main types of bolt-on curbs, namely rubber curbing and doweled cement. These are less costly because they are installed over the existing roadway and do not require modifications to any existing paving. The limitations however, include that the existing drainage must not be disrupted and no irrigation is typically available. Landscaping must be very drought-tolerant or cannot be provided. Bolt-on treatments typically cost closer to $5,000 per application site, or $10,000 in pairs to create curb extensions or chicanes.

Figure 5-3 Chicanes (Source: nacto.org)

5.4.2 Raised Intersections

Similar to raised crosswalks, an entire intersection can be raised slightly, including the crosswalks and the central intersection area. Special treatments, such as simulated brick, are often used in the central area. Similar to speed humps and other vertical speed control elements, they reinforce slow speeds and encourage motorists to yield to pedestrians at the crosswalk. Raised intersections are a high cost alternative at approximately $20,000 or more per location.

Figure 5-4 Raised Intersections (Source: nacto.org)

5.4.3 Speed Humps

Speed humps can serve to slow traffic on residential roadways to more appropriate levels. However, they can be discouraged by Fire Departments due to potential reductions in response times, and they can result in community backlash when encountered too frequently. Some communities have specific guidelines for speed hump implementation, such as, the roadway must not have more than a 5% grade or the roadway is not identified as an emergency response route, that its installation will not shift or divert traffic to other streets, and that it is agreed to by a specified percentage of the affected residents. While speed humps are effective at reducing speed at the location of the hump itself, vehicles tend to speed up between the hump, reducing their overall effectiveness. Noise impacts can also be a factor when implemented due to an increase in noise from the vehicles passing over the humps as well as the additional noise from vehicles braking in advance of the humps and accelerating after the humps.

Figure 5-5 Speed Humps (Source: nacto.org)

5.4.4 Roundabouts

A roundabout provides a central island at an intersection, requiring traffic to drive around in a counterclockwise direction. Roundabouts are an extremely safe form of traffic control as the potential for perpendicular crashes are eliminated and speeds are typically reduced from normal intersections. There is heightened interest in roundabouts throughout the U.S. because of their safety record compared to traffic signals and stop sign applications. They also can provide better traffic performance than other intersection control types, since traffic is slowed but not stopped.

Many bicyclists also prefer roundabouts, since a properly designed roundabout will slow car traffic to around 18-25 miles per hour and the need to come to a complete stop occurs less frequently. However, bike lanes are not striped through roundabout intersections, even on Class II roadways. Therefore, it is recommended that the sidewalks adjacent to the roundabout provide additional width, to allow for a multi-use segment, so bicycles can choose to use the sidewalk if they are uncomfortable riding travel lane without bike lanes.

Properly designed roundabouts normally require more area than is available at a residential tee intersection. As such, they are most often provided at 4-leg intersections. They are also often favored in traffic calming plans because of the many benefits of landscaping in the central island. These include aesthetics, traffic speed reduction, effect on cross streets, and visual effect upon speed when viewed from a distance. Roundabouts are an extremely high-cost alternative, with costs of approximately $100,000 per location.

Figure 5-6 Roundabouts (Source: Stantec)

5.4.5 Traffic Calming Circles and Mini-Roundabouts

While roundabouts may not be practical within the residential area of the neighborhood, a similar but smaller treatment may be appropriate. Traffic calming circles are smaller than roundabouts and can fit within the area available for area intersections. But due to the reduced area, long vehicles may be required to turn left in front of the circle, essentially traveling against traffic. This is normally not a significant problem if the cross street is lightly used.

When left turn traffic is heavier, an alternative solution is a mini-roundabout. The primary difference between a circle and a mini-roundabout is that with the mini-roundabout the central area must be traversable by long vehicles and cannot be landscaped. Instead, it is often raised slightly and paved with a special treatment to discourage traffic. Automobiles will generally circulate properly around the mini roundabout, while trucks will turn over the raised area slowly.

Curb extensions are not required with traffic circles and mini roundabouts, but they can increase the effectiveness of the treatment especially if on-street parking is lightly used. They prevent vehicles from drifting to the right to avoid the speed reducing effect caused by the circle. They also offer landscaping opportunities. Traffic calming circles and mini-roundabouts cost approximately $20,000 per location.

Figure 5-7 Mini-roundabout (Source: nacto.org)

5.4.6 Median Islands

Median islands provide for an island in the middle of the roadway, typically with landscaping for aesthetic reasons. They can be provided at community gateways or entrances to neighborhoods, and serve as an aesthetic entrance, in addition to a reminder that the vehicle is entering a residential community that has been traffic calmed. They are effective in reducing speeds at the site of the island.

Median islands are a medium-cost alternative, costing approximately $10,000 per location or more, with landscaping costs. Bolt-on options can also be provided (as described in the curb extensions discussion above) for a lower cost, of approximately $5000 per location; however, landscaping may not be feasible.

Figure 5-8 Median Island (Source: Wikipedia)

5.4.7 Road Diets

When an existing roadway has excess capacity, a "road diet" can be implemented to reduce the number of vehicle through lanes in order to provide other roadway features, such as on-street parking and bike lanes, without the need to physically widen the roadway. Road diets are most commonly utilized on four-lane roadways without medians, by removing one lane in each direction and adding a two-way-left-turn lane in the center of the road. The additional space that is gained can then be utilized for parking or bike lanes. A road diet is generally feasible when daily traffic volumes are 18,000 ADT or less, but have been implemented on roadways with as much as 22,000 ADT in certain conditions.

Figure 5-9 Road Diets (Source: FHWA,)

5.4.8 Roadway Diversions / Closures

Full roadway closures or one-way diversions can restrict through traffic, either totally, or by limiting traffic to enter or exit a neighborhood at certain locations. Due to the higher potential for inconveniencing travelers, great caution should be exercised when recommending roadway diversions and closures. Gated neighborhoods and developments with perimeter walls have a similar effect.

Figure 5-10 Roadway Diversions / Closures (Source: fhwa.dot.gov, pedbikesafe.org)

5.4.9 Channelizers

Channelizers can be used, often at a lower cost, to simulate curb extensions and median islands. They are not widely used, however, as they do not look as nice as permanent treatments and the lack of mass reduces their effectiveness. They are effective in discouraging the crossing of lanes, such as restricting left turns.

Channelizers are a very low cost solution, with an approximate cost of $30, per post. They can present a maintenance problem, but typically provide less of a barrier to nearby driveway access.

6.0 NEIGHBORHOOD CHARACTERISTICS

In 2009, EPA, the U.S. Department of Housing and Urban Development (HUD), and the U.S. Department of Transportation (DOT) formed the Partnership for Sustainable Communities to help communities improve access to affordable housing and transportation while protecting the environment. Six guiding principles were developed (HUD-DOT-EPA, 2009).

1. **Provide more transportation choices:** Develop safe, reliable and economical transportation choices to decrease household transportation costs, reduce our nation's dependence on foreign oil, improve air quality, reduce greenhouse gas emissions and promote public health.

2. **Promote equitable, affordable housing:** Expand location- and energy-efficient housing choices for people of all ages, incomes, races and ethnicities to increase mobility and lower the combined cost of housing and transportation.

3. **Enhance economic competitiveness:** Improve economic competitiveness through reliable and timely access to employment centers, educational opportunities, services and other basic needs by workers as well as expanded business access to markets.

4. **Support existing communities:** Target federal funding toward existing communities—through such strategies as transit-oriented, mixed-use development and land recycling—to increase community revitalization, improve the efficiency of public works investments, and safeguard rural landscapes.

5. **Coordinate policies and leverage investment:** Align federal policies and funding to remove barriers to collaboration, leverage funding and increase the accountability and effectiveness of all levels of government to plan for future growth, including making smart energy choices such as locally generated renewable energy.

6. **Value communities and neighborhoods:** Enhance the unique characteristics of all communities by investing in healthy, safe, and walkable neighborhoods—rural, urban, or suburban.

Federal transportation funding is guided by these livability principles.

6.1 MIXTURE OF USES

Neighborhoods and districts with a variety of uses have significantly more pedestrians than those that do not. Simply put, a mix of uses ensures that residents and visitors alike have places to walk to. For example, residents of traditional suburban developments often have few services available within a short walk, while residents of a mixed-use neighborhood can often accomplish many of their daily tasks without getting in their cars. Residents of a mixed-use neighborhood can often pick up coffee, drop off their laundry, get groceries, see a doctor, and even go to work all within a short walk.

Figure 6-1 Mixed Use Development (Source: Stantec)

6.2 PEDESTRIAN SCALE STREET FRONTAGE

The non-vehicular (bike and pedestrian) experience is defined in part by the sense of enclosure and activity that we need to feel comfortable. In other words, it matters what pedestrians are walking past. Open storefronts, building faces with lots of street level doors and windows, restaurants, bars, and cafes with outdoor seating or seating that faces the street is much more engaging than the blank wall of a building or a surface parking lot. In fact, studies have shown that distances actually feel shorter when there is more going on at street level, and when distances feel shorter people are more likely to walk.

Figure 6-2 Pedestrian Scale Frontage (Source: pedbikeinfo.org)

6.3 LANDSCAPING AND SHADE

Provisions for shade and landscaping provide the sense of enclosure that we get from well executed street frontage. Street trees help provide a welcoming environment by providing a psychological barrier between pedestrians and motorists while also proving shade in the summer months. Tree-lined streets also tend to moderate vehicle speeds. Deciduous trees have the added benefit of losing their leaves and allowing more sunshine in the cooler months. When combined with other landscaping like bio-swales and planters, these features can provide a park-like environment encouraging more people to walk while simultaneously reducing storm water pollution, providing natural cooling, and even reducing air conditioning costs in the surrounding buildings. Given the severity of the statewide drought, landscaping efforts should feature low water use and native plants whenever possible. Architectural treatments can provide shade and wind protection without water requirements.

6.4 STREET FURNISHINGS

In addition to landscaping and active street frontages, high quality street furnishings such as benches, lighting, bus shelters, bike racks, trash cans, etc. can improve the pedestrian experience by making them more inviting to different types of users under different circumstances. For example, provision of benches and parklets--small sidewalk extensions installed in parking lanes that provide more space and amenities for people using the street, give pedestrians a place to rest and gather. Lighting is important for a sense of security and bus shelters provide shade and protection in inclement weather. Bike racks and parking complement bike infrastructure to allow bicyclists to secure their bikes when shopping or moving to a different transportation mode, such as commuter rail. Adequate trash cans reduce the occurrence of unsightly litter, also improving the pedestrian experience. Public art, street banners, and similar interventions reinforce the human scale and identity of places to provide pedestrian- and bicycle-friendly environments that are comfortable and interesting.

Figure 6-3 Landscaping and Shade (Source: nacto.org)

Figure 6-4 Street Furniture (Source: Stantec)

6.5 OPTIMIZE PARKING

Right-sizing parking requires balancing the number of spaces, cost of parking, and timed parking. Ample free or inexpensive parking can induce demand for driving. According to a document published by the Seattle Department of transportation, "the most effective parking strategies are cost based or pricing measures that link parking rates more directly to demand or provide financial incentives and/or prime parking spaces to preferred markets such as carpools, vanpools and short term parkers" (SDOT(a), 2008). Some cost based as well as other strategies are listed below.

- Setting variable parking rates that fluctuate with demand
- Separately sold or leased parking
- Imposing parking taxes
- Providing employer based incentives for lower parking use
- Sharing parking spaces or lots based on parking demand (example offices in the morning and afternoons and restaurants in the evening)
- Installing electronic parking guidance systems to direct motorists to parking facilities with available spaces
- Limiting number of parking spaces to be provided at new developments through off-street parking requirements
- Developing park-and-ride lots
- Parking enforcement and education

6.6 MULTI-MODAL CONNECTIVITY

Figure 6-5 Multi-modal Connectivity (Source: Stantec)

In order for a community to be less dependent on automobiles, other modes of travel should be well integrated with each other (including automobile transportation) as well land uses it serves. The Florida Department of Transportation has developed criteria for designation of areas as multimodal districts. The criteria are divided in 3 categories--Land use, Interconnected Street System, and Design--and their characteristics are listed below (FDOT, 2013).

Land use

- Inclusion of complementary land uses which promote alternative mode usage, including medium/high density residential
- Appropriate densities and intensities of development to support transit
- Appropriate organization of land uses, focusing on central core and multimodal supportive development along major corridors
- Recommended minimum 5,000 in residential population, and 2 to 1 population to jobs ratio
- Special considerations given to schools and their multimodal needs to provide a safe, amenable environment for students

Interconnected Street System,

- Adequate levels of service for all modes
- Appropriate numbers of connections within the street network
- Connected pedestrian and bicycle systems
- Convenient modal connections
- Convenient connections to regional transportation

Design

- Adequate access for pedestrians and cyclists to transit
- Transit oriented development within the area
- Shorter block length providing easier access and better quality pedestrian environment

6.7 INVESTMENT IN KEY LOCATIONS

As resources are limited, an initial focus on key districts, main streets, and key corridors linking community destinations, and integration of these investments with appropriate land uses and other improvements will create pilot sites to show the benefits of multimodal transportation.

SCAG's 2016-2040 RPT/SCS outlines a strategy that integrates land use planning with transportation planning to realize the vision of a more compact and connected region. The RPT/SCS includes strategies to facilitate and improve short-distance, as well as longer distance commuter travel.

A key feature of this strategy is the Neighborhood Mobility Areas (NMA) concept, which facilitates the use of non-vehicular modes of travel for short trips within the neighborhood. NMAs are conducive to pedestrian and bicycling trips and are centered upon a "Complete Streets" approach to roadway improvements. The ideal location for an NMA is where there is a high intersection density, low to moderate traffic speeds and robust residential-retail connections. Approximately 38 percent of all trips in the SCAG region are three miles in length or less, which is a short enough distance that can be covered by walking and biking. (SCAG, 2016) The NMA strategy represents a set of policies to encourage the use of non-automobile modes of transportation for these short trips.

Much of the suburban development pattern found throughout southern California, including Fontana, is characterized by long arterial corridors. SCAG's approach to these arterials is the Livable Corridors Strategy, which encourages development along these corridors that crisscross the region. These corridors serve as major travel routes, as well as destinations in their own right. Infill development along the Livable Corridors makes the provision of high quality, high frequency transit feasible, and facilitates its use. The Livable Corridor Strategy specifically advises local jurisdictions to plan and zone for increased density at key nodes along the corridor and the replacement of single-story under-performing strip retail with well-designed higher density housing and employment centers.

Figure 6-6 Example of a Neighborhood Mobility Area (Source: SCAG/NACTO)

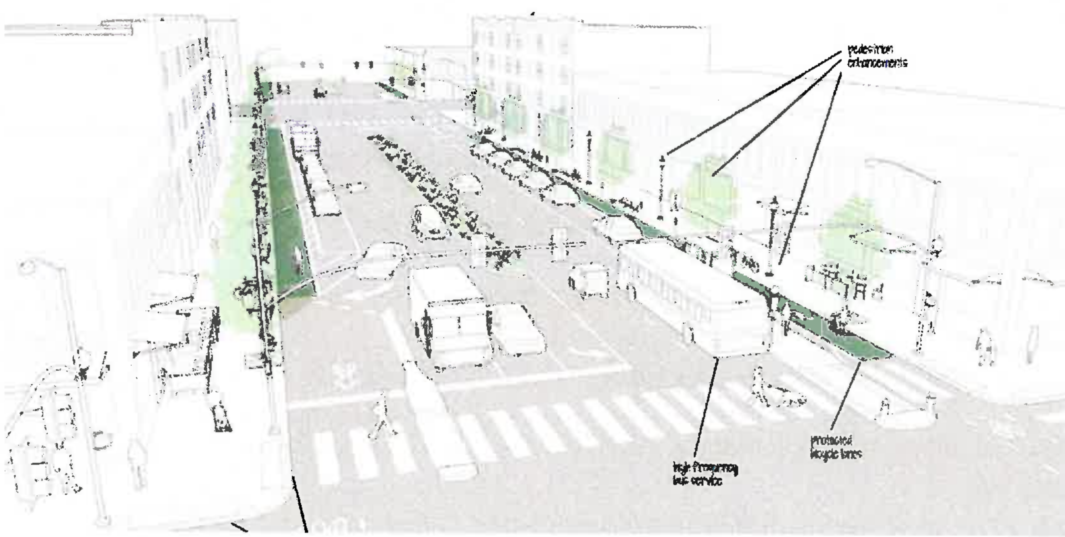

Figure 6-7 Example of a Livable Corridor (Source: SCAG/NACTO)

7.0 RESOURCES

The following documents and websites can serve as useful resources when implementing the practices and concepts outlined in this report.

- *Smart Growth Trip Generation and Parking Study*, San Diego Association of Governments (SANDAG), 2010 (http:// www.sandag.org/tripgeneration)
- *Main Street California, A Guide for Improving Community and Transportation Vitality*, Caltrans, 2013
- *Urban Street Design Guide*, National Association of City Transportation Officials (NACTO)
- *Urban Bikeway Design Guide*, NACTO
- *Transit Street Design Guide*, NACTO
- *PEDSAFE – Pedestrian Safety Guide and Countermeasure Selection System*, FHWA (http://www.pedbikesafe.org/PEDSAFE)
- TDM Encyclopedia, Victoria Transport Policy Institute (VTPI), 2014 (http://www.vtpi.org/tdm/index.php)
- *Complete Intersections: A Guide to Reconstructing Intersections and Interchanges for Bicyclists and Pedestrians*, Caltrans, 2010

8.0 REFERENCES

ADA. (2008, 10). *Curb Ramps and Pedestrian Crossings*. Retrieved 04 04, 2016, from ADA Best Practices Tool Kit for State and Local Governments : http://www.ada.gov/pcatoolkit/chap6toolkit.htm

ARB, C. (2008). *CEPA ARB*. Retrieved 03 23, 2016, from Air Resource Board.

CA-DOT. (2008, October). *California Department of Transportation*. Retrieved 03 25, 2016, from Complete Streets -Integrating the Transportation System: http://www.dot.ca.gov/hq/LocalPrograms/bike/DD-64-R1_Signed.pdf

CALTRANS. (2012, Dec). *Highway Design Manual.* Retrieved 04 04, 2016, from California Department of Transportation: http://www.dot.ca.gov/hq/oppd/hdm/pdf/english/HDM_Complete_30Dec2015.pdf

CA-OPR. (2010). *Update to the General Plan Guidelines: Complete Streets and the Circulation Element*. Retrieved 3 25, 2016, from Governor's office of Planning and Research, California: https://www.opr.ca.gov/docs/Update_GP_Guidelines_Complete_Streets.pdf

Cortright, J. (2016, April 25). *On the road again?* Retrieved April 25, 2016, from City Observatory Web site: http://cityobservatory.org/on-the-road-again-2/

Duranton, G. a. (2011). The Fundamental Law of Road Congestion: Evidence from US Cities. *The American Economic Review, 101(6)*, 2616-2652.

ECF. (2011, November). *Cycle more Often 2 cool down the planet !* Retrieved 3 25, 2016, from ASBL, European Cyclists' Federation: https://ecf.com/sites/ecf.com/files/co2%20study.pdf

EPA. (2014). *Mixed-Use Trip Generation Model.* Retrieved December 16, 2015, from EPA Web site: https://www.epa.gov/smartgrowth/mixed-use-trip-generation-model

FDOT. (2013, Nov). *Multimodal Transportation Districts and Areawide Quality of Service Handbook.* Retrieved 04 04, 2016, from Reconnecting America: http://www.reconnectingamerica.org/assets/Uploads/bestpractice098.pdf

FHWA. (2009, 12). *Manual of Uniform Traffic Control Devices.* Retrieved 04 04, 2016, from US DOT Federal Highway Administration: http://mutcd.fhwa.dot.gov/htm/2009/html_index.htm

FHWA. (2011, 04 15). *Memorandum- Intrim Approval.* Retrieved 04 04, 2016, from USDOT Federal Highway Administration: http://mutcd.fhwa.dot.gov/resources/interim_approval/ia14/ia14grnpmbiketlanes.pdf

FHWA. (2013). *Safety Benefi ts of Raised Medians and Pedestrian Refuge Areas.*

FHWA. (2015, 09 24). *Bicycle Facilities and the Manual on Uniform Traffic Control Devices.* Retrieved 04 04, 2016, from Bicycle & Pedestrian Program: https://www.fhwa.dot.gov/environment/bicycle_pedestrian/guidance/mutcd/bicycle_box.cfm

FHWA. (2015, may). *Seperated Bile lane Planning Design Guide.* Retrieved 3 25, 2016, from UA DOT, Federal Highway Administration: https://www.fhwa.dot.gov/environment/bicycle_pedestrian/publications/separated_bikelane_pdg/page00.cfm

HUD-DOT-EPA. (2009). *HUD-DOT-EPA Partnership for Sustainable Communities.* Retrieved 04 04, 2016, from EPA United States Environmental Protection Agency: https://www.epa.gov/smartgrowth/hud-dot-epa-partnership-sustainable-communities#Livability_Principles

ITDP. (2016). *What is BRT?* Retrieved 03 30, 2016, from Institute For Transportation and Development Policy: https://www.itdp.org/library/standards-and-guides/the-bus-rapid-transit-standard/what-is-brt/

ITE. (2012). *Trip Generatinon Manual, 9th Edition.* Washington, DC: Institute of Transportation Engineers.

NACTO. (2007). *LRT.* Retrieved 03 30, 2016, from Light Rail Transit Service Guidelines: http://nacto.org/docs/usdg/lrtserviceguidelines_vta.pdf

NACTO. (2013, October). *Urban Bikeways Design Guide*. Retrieved march 4, 2016, from National Association of City Transportation Officials: http://nacto.org/publication/urban-bikeway-design-guide/

NCSC, S. (2015, March). *National Complete Streets Coalition, Smart Growth America*. Retrieved 03 25, 2016, from Safer Streets, Stronger Economics- Complete Streets Project Outcomes From Across the Country: http://www.smartgrowthamerica.org/documents/safer-streets-stronger-economies.pdf

NHTSA. (2008). *Speed Enforcement Guidelines.* National Highway Traffic Safety Administration .

NTIC. (2014, June). *Lessons from the Green Lanes: Evaluating Protected Bike Lanes in the U.S.* Retrieved 3 24, 2016, from National Institute for Transportation and Communities: http://bikeportland.org/wp-content/uploads/2014/06/NITC-RR-583_ProtectedLanes_FinalReportb.pdf

PBOT. (2015). *Portland Neighborhood Greenways Assessment.* Retrieved 04 04, 2016, from Portland Bureau of Transportation: https://www.portlandoregon.gov/transportation/50518

SCAG. (2016). *2016/2040 RTP SCS*. Retrieved 3 23, 2016, from Southern California Association of Governments: http://scagrtpscs.net/Pages/default.aspx

SDOT. (2008). *7 Best Practices in Transportation Demand Management.*

SDOT. (2008). *Seattle Urban Mobility Plan- 9 Best Practices in Transit.* Seattle Department of Transportation.

STRAVA. (2015). *Strava*. Retrieved December 16, 2015, from Strava: https://www.strava.com/

TGM. (2013). *Transit in Small Cities.* Oregon Transportation and Growth Management Program.

TRB. (1978). *TRB Special Report 179: Glossary of Urban Public Transportation Terms* .

TRB. (2014). *Making Effective Fixed-Guideway Transit Investments: Indicators of Success, (Report 167).*

WalkScore. (2016). *Living in Fontana*. Retrieved May 11, 2016, from Walk Score: https://www.walkscore.com/CA/Fontana