Community-Based Planning to Create a Walkable/Bikeable Treasure Island
San Francisco Department of Public Health & The San Francisco Bicyle Coalition
Bicycle Environmental Quality Index Design

Street Design	Presence of a marked area for bicycle traffic	Bike Lane w/ Parking Adjacent to Right	With more and more people using bikes for transportation, the need to make room on the streets for bicycling is clearly visible. The addition of bike lanes to roadways helps define road space for both vehicle traffic and bicyclists. Bike lanes provide safety for bicyclist by organizing the flow of traffic, which encourages bicyclists to ride in the correct direction and reduces the chance of vehicles will stray in to a bicyclists. A study (Maritz, 1996) revealed that serious bicycle injuries occur on streets without bike lanes and the addition of bicycle lanes in Davis, CA reduced accidents by 31% (FHA, 1995). In addition to bike lanes, shared lane pavement markings can also have a positive impact on motorist and cyclist behavior, positions, and safety (Alta Planning and Design, 2004).	Dashed markings should be used 1) where intersections are offset by about 7' to 30' 2) where there are more than four intersection legs 3) there is a need to assist vehicles through an intersection 4) where there are significant grades, especially where visibility is compromised 5) in large, wide intersections and 6) at intersections with especially high bicycle crosstraffic.
		Bike Lane w/ Sidewalk Adjacent to Right (without parking)		
		Bike Lane w/ HOV or Public Transit Adjacent to Right		
		Bike Lane w/ Traffic Lane Adjacent to Right		
		Shared Traffic Lane With Sharrow (or Painted Bike Marking on pavement)		
		Combined Bike Lane/Parking		
		Bike Path		
		None		
Street Design	Width of Bike Lane	< 5ft	Bicycle lane width is an important issue because it increases the level of service for bicyclist and provides define space. The proposed minimum width varies by report, but typically no less than 4 feet for a bicycle lane with no curb and gutter. In most cases, it is recommended that bicycle lane should be 5 feet, leaving room for a 1-2 foot gutter which would allow at least 3 feet for the bicycle lane. If there is parallel parking on the street, the optimal bicycle width is 5 feet. The width of the bicycle lane should be at least 12 feet In situation where there is parallel parking with no marked parking stripes, and 13-14 feet if there is high parking volume and/or turnover (AASHTO, 19990).	Bike lanes alongside parking lanes shall be at least 5' wide. They may be widened to 6' if space is available and the parking lane has been widened to 9'. Bike lanes alongside curbs shall be at least 4' wide, with 3' minimum from gutter joint to the bike lane stripe. Curbside bike lanes should be 5' wide, and may be wider if necessary and space is available.
		5 - 6 ft		
		> 6 Ft		
Street Design	Bicycle Lane Markings	One Stripe Left Side of Bike Lane	The presence of a double stripped bike lane allows enough room for parked motor vehicles to exit the vehicle without contacting a bicyclist (Hunter, 1999). A study (Landis B., 1997) explains that lane stripping increases the quality of service for bicyclists by 31%. Dashing the bike lane stripe at busy driveways is also recommended, not only to alert a motorist that a bicyclist may be approaching because of the presence of the bike lane but also to alert a bicyclist that a motoris may be emerging from the driveway adjacent to the dashed stripe" (Hunter, 1999)	
		Stripes on Both Sides of Bike Lane		
		None		
Street Design	Connectivity of bicycle lanes	Yes	In order for bicycle lanes to be effective, the lane should be continuous from street to street, displaying connectivity throughout the bicycle route (NCDOT). In order for bicycists to have a high level of comfort on the road, a bicycle network should be implemented for bicyclists to be abel to travel between destinations and residential neighborhoods. Bicycle routes should be interconnected and not end suddenly with barriers (AASHTO Handbook).	Recommended improvements to the existing bicycle network are located throughout the city but more specifically throughout neighborhoods such as the Financial District, Marina, Hayse Valley, Golden Gate Park, and North Beach. There are several recommened study areas and streets for new bicycle
		No		
Street Design	Pavement Type/Condition	Smooth Surface	It is desired to have a smooth and uniform width pavement surface to increase bicycle safety. A bicycle can lose control if wide cracks, joints, or drop-offs along the edge of a bicycle lane are present. In addition, potholes or bumps in the road surface can could bicyclists to swerve and/or merge into traffic (AASHTO, 1999). Street paving is prioritized in San francisco by three surface features: cracking, raveling (erosion), and motor vehicle ride quality (SF Bike Plan, 06). Pavement conditions, especially major obstruction such as Potholes, should be addressed especially if the roadway is a bicycle network. Bicyclists are negatively affected when pavement conditions change suddenly, especially with no forwarning (ASSHTO Handbook).	DPW uses a Pavement Management and Mapping System (PMMS) to prioritize street paving based upon a point system. The PMMS uses a numeric "Pavement Condition Score" based on a field inspection of three surface features: cracking, raveling (erosion) and motor vehicle ride quality. The highest priority to fix streets might not be the streets in the worst conditions. Streets that don't need complete reconstrcution will have higher priority to prolong the "street life" and have lower costs. Pavement base shall be portland cement
		Few Obstructions (eg., Cracks)		
		Large Obstructions (e.g, Potholes or Bumps)		
Street Design	Street Grade	No Grade	Bicyclists prefer street grade at five percent or less because most riders find it difficult going up hill and are uncomfortable with increased speeds associated with downhill grades. It is recommended with grades larger than five percent a maximum distance of the grade be associated with it. For example, the grade should be no more than 50 feet with an 11% grade or 200 feet with a nine percent	If a street is greater than 15%, alternate bicycle routes are chosen with a lower grade. Although the standard is less than 15%, the lowest possible grade is always a priority.
		<5%		
		5% - 10%		

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		10% - 15%	grade (AASHTO, 1999).	
Street Design	Bicycle Lane Slope	No Slope 1% - 16% >16%	The recommended maximum slope for bicycle lane width is 1:6 (AASHTO,1999). Crossing slopes must be minimal to avoid bicyclist being thrown to the curb if it's too excessive. (Williams, 1998).	
Street Design	Driveway Cuts	More than 5 Few (less than 5) None	A high number of bicycle-motor vehicle conflicts occur when motor vehicles are exiting and entering driveways (Hunter, 1999). The number of driveways should be limited on each street due to pedestrian/vehicle collisions where the driveway and sidewalk intersect (Vancouver NTMP, 2002).	
Intersection Design	Left turn bicycle lane	Yes No		This treatment shows a standard-width bicycle lane adjacent (right) to the left-hand turn lane in order to reduce conflicts with turning vehicles.
Intersection Design	Dashed Intersection Bicycle Lane:	Yes No	It is not recommended to continue a bicycle lane through an intersection. It is acceptable to use a dashed bicycle lane if there is a complex intersection. Proper signing and striping is encouraged to decrease the number of vehicle/bicycle conflicts at intersections. At intersections where there are high volumes of right turns made by vehicles, a separate right -turn lane should in incorporated, where the bicycle lane would continue straight and to the left of the turn lane (AASHTO, 1999).	Bike lanes associated with busy intersection can have dashed marking to guide bicyclist and motorist through an intersection.
Vehicle Traffic	Posted Speed Limit	Less than 20 MPH 20-30 MPH 30-40 MPH More than 40 MPH	Bicyclists feel more comfortable and have less stress when the speed limit is lower. (Harkey, D L; Reinfurt, D W; Knuiman, M, 1998). There is a correlation with vehicle speed and bicycle level of service and safety. Reducing vehicle speeds will increase pedestrian safety and slightly increase a pedestrian's response time if encountered with a vehicle conflict. If the speed limit is 25 mph or lower, the drivers line of sight is more clear and will notice the street edge where pedestrians (walkers and bicyclists) are present (Vancouver NTMP, 2002).	
Vehicle Traffic	Vehicle LOS	A B C D E F	Bicycle use on streets is affected by the Level of Service of the street and how smooth the traffic flows. Level of Service included multiple variables, such as average daily traffic volumes, peak hour volumes, number of lanes, and factors affecting speed and capacity (City of Auburn, 1998). The Vehicle LOS will determine the bicyclists level of comfort and safety and include carrying capacity affected by annual average daily traffic, number of signalized intersections and travel lanes, effective green time at signalized intersections, directional distribution of traffic flow, and peak-hour traffic volumes (Dixon, 1996).	
Vehicle Traffic	Traffic Volume: Average Number of Vehicles Per Day	Less than 1000 1000 - 5000 5000 - 10000 10000 +	Bicyclists feel more comfortable and have less stress when there is a lower traffic volume. (Harkey, D L; Reinfurt, D W; Knuiman, M, 1998). Streets with higher traffic volume are more likely to have a collision with bicyclists or other vehicles (SFDPT, 2004). There is a correlation with traffic volume and bicycle level of service and safety (Landis, 1997). Decreased traffic volume will result in an effective safety measure of bicyclists. Most bicyclists will choose a street with less traffic volume. (NCDOT).	The Bicycle Route Network directs bicyclists to the flattest streets with low traffic volumes or slow motor vehicle speeds, where possible, as well as connecting major attractors and neighborhoods. Diversions or restrictions that force traffic volumes onto residential street, bicycle routes, or transit routes should be avoided. It is recommended that bicycle lanes be greater than five feet when there are high traffic
Vehicle Traffic	Percentage of Heavy Vehicle	Less than 5% 5% - 10%	Bicyclist usually don't choose streets that have high traffic volume, especially commercial truck, and high speed limits (Landis, 1997). The width of commercials truck, along with high speed, cause problems for bicyclists and their safety. It is recommended that additional shoulder space be provided for bicycle	

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		10% - 20%	safety. It is recommended that additional shoulder space be provided for bicycle lanes if the street has a high volume of trucks, buses, or recreational vehicles (AASHTO, 1999).	
		Greater than 20%		
Vehicle Traffic	Parallel Parking Adjacent to Bike Lane/Route	Yes	Motor vehicles exiting or entering on-street parking or parallel parking spaces have a high risk of being involved in a bicycle- motor vehicle collision, either hitting the bicyclist or causing them to swerve into the adjacent lane or on the sidewalk (Hunter, 1999). A bicyclist's level of comfort riding on street with on-street parking will be lower do to vehicles frequently moving in and out of the spaces. Presence of on-street parking ranks as one of the highest factors in terms of street being compatible with bicycle lanes and use (Bicycle Compatibility Index, 1998).	It is recommended to avoid diagonal parking configurations adjacent to bike routes. Also, parallel parking should only be on one side of the street, where the bicycle lane could be located on the opposite side. This is only feasible if the street is not a high traffic volume /bus route area. As long as there is adequate space (5 plus feet) between parallel parking markings and bicyle lane marking, the two can remain on the
		No		
Vehicle Traffic	Traffic Calming Features Streets	No Features	Motor vehicle driver's behaviors at non-signalized intersections found that speed-reducing measurements, such as speed bumps, elevated bicycle crossings and stop signs, help drivers to recognize bicyclists early and properly (Summala et al., 1996). A recent study (Jacobsen, 2003) explains that traffic calming is intended to lower motor vehicle speed, reducing bicycle-motor vehicle collisions, which reduced more head injuries than any other injury. Decreasing the actual or apparent size of a street will help reduce vehicle speed and therefore, increase the drivers vision and notice the street border where pedestrians and bicyclist are located. Multiple factors can influence and slow down vehicle speed including round-abouts or traffic circles, speed bumps, crosswalk treatments, narrow streets, and extended curbs at intersections (bulb-outs). Reducing vehicle speeds will increase pedestrian safety and slightly increase a pedestrian's response time if encountered with a vehicle conflict. Most pedestrian fatalities involving vehicles happen at speeds over 25 mph (Vancouver NTMP, 2002).	There are cetain taffic calming features that are not acceptable for certain street types. Arterial streets should not have rumble strips in commercial or residential areas, speed humps, chicanes, traffic cirlcles on most streets, and diverters/forced turns and street closers. Commercial streets shouldn't have rumber strips and diverters/forced turns and street closers. Local area tracks and school trachs shouldn't have rumble strips. Pavement and crosswalk treatments, speed table and raised crosswalks, commercial/local/school speed humps, and angled parking all need specific field testing for each area to determine acceptablity.
		Two TCFs		
		Four TCFs		
		More than Four TCFs		
Safety/Other	Presence of Bicycle Lane Sign:	Yes	Motor vehicle drivers are not hesitant to use or cross over a bike when exiting a building or turning at an intersection. A "yield to bicyclists" sign will inform the driver to slow down and be cautious of bicyclists (Hunter, 1999). In addition to having a bicycle lane sign present, it is recommended to have an "Ahead" sign mounted right below the bicycle lane sign before the bicycle lane begins. The same is true for an "End" sign before the bicycle lane ends. To remind motorist to lookout for bicyclists, a "Share the Road" sign can be mounted below the bicycle lane sign. (USDOT, 2004).	There are a few standard bicycle signs used in San Francisco that are recommended but not approved by the Manual of Uniform Traffic Control Devices. These include Local Bicycle Route Sign, Cross Town Bicycle Route Sign, and Bicycle Route Detour Sign. There is also bicycle-specific signals which inform bicyclists which streets are appropriate to ride on (red, yellow, or green bicycists) and a track crossing warning sign may be used to inform bicyclist of train/trolley tracks coming up ahead. It is good not to overuse these signs because too many signs can decrease the effectiveness, as well as the street asthetics.
		No		
Safety/Other	Presence of Other Bicyclists	Few	Collisions between a motorist and a bicyclist decreases where more people are bicycling (Jacobsen PL, 2003).	
		Many		
		None		
Streetscape	Presence of Trees	Few	Street lined trees are a traffic calming feature, reducing the speed of motor vehicles by giving a sense that the road is more narrow than it appears (Massachusetts Highway Department, 2006).	Street trees are recommended and acceptable traffic calming feature for all newly constructed and reconstructed streets including arterial streets, commercial streets, local streets tracks, and school area tracks.
		Many		
		None		

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Streetscape	Bicycle/Pedestrian Scale Lighting	Yes No	Presence of lighting provides necessary visibility and safety for bicyclist by allowing to see obstacles and faults in the pavement which could cause a collision. Lighting standards should be set at a pedestrian level compared to street lighting for vehicles, and have horizontal illumination levels of 5 lux to 22 lux. Levels should be raised if there is a safety issue at certain areas or intersections, as well as underpasses or tunnels (AASHTO, 1999). Bicycle Pedestrian lighting is an important component to a bicycle network. Many indiviudal's only mode of transportation is a bicycle and are forced to ride at night. Unlit street can be damgerous because there is a potentail that motorists will not see the bicyclist , which could result in a collision and/or injury. Even with bike headlights and flashers, the motorist can not always see this until they are very close (AASHTO Handbook).	
Streetscape	Line of Sight	Line of Sight Obstructed or Compromised Adequate Distance Clear Line of Sight	Bicycle safety is improved if the bicyclist has a long view of oncoming traffic (City of Auburn, 1998). Motor vehicle stopping sight distances are usually measured and can be used and are appropriate for bicycle stopping distances as well. The stopping sight distance depends on the grade of the street and the speed limit. For example, if the speed limit 25 mph with a zero percent grade, the stopping distance would be 155 feet. As the speed increases, the stopping sight distance will increase as well. If traveling uphill, the distance will decrease and increase for downgrades (Massachusetts Highway Department, 2006).	
Adjacent Land Use	Bicycle Parking	Yes No	A main reason bicycling is chosen as a main mode of transportation is the presence of bicycle parking. It important to locate bicycle parking on sidewalks wide enough, not to get in the walk id pedestrian walking. It is recommended to put bicycle parking on sidewalks 10 feet or wider (City of Chicago, 2007). Over 1.5 million bicycles are reported stolen in the united States each year and is associated will safe and convenience bicycle parking (Pedestrian and Bicycle Information Center, 2007).	The Planning Code requires bicycle parking in buildings with 10 or more automobile parking spaces; and requires parking for employees and visitors for new and renovated commercial buildings based on square footage. More specifically, if there is up to 120 vehcile parking garge spaced there must be six bicycle parking spaces. If there is more than 500 vehcile spaces in a parking garage there must be 25 bicycle spaces plus one bicycle space per every 40 auto spaces, up to a maximum of 50 bicycle spaces. There is currently no specific bicycle parking requirement for residential developments in San Francisco, other than the requirement that applies to all developments of one bicycle parking space for every twenty auto spaces
Adjacent Land Use	Retail Use	Many One within Five blocks None in Area	Mixed-use land zoning is said to promote more walking and bicycling (Metropolitan Area Planning Council). According to the draft Prop K 5-Year Prioritization Program (06), bicycle facilities are favored if they are inra- or inter-connected to neighborhoods close to retail shopping, access to transit, and open space. Retail and commercial areas are more likely to attract bicyclists and should be concidered throughout as bicycle demand analysis (AASHTO Handbook).	