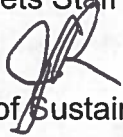




MEMORANDUM

TO: Sustainable Streets Staff

FROM: Jerry Robbins 
Interim Director of Sustainable Streets

DATE: May 29, 2014

SUBJECT: SFMTA Crosswalk Guidelines

This memorandum is an update to the SFMTA Crosswalk Guidelines approved in January 2012. The update includes a revision of the section entitled Decorative Crosswalk Paving on page 17 of this document.

The changes include:

- Clarification of the types of decorative treatments that are acceptable, based on FHWA guidance;
- Clarification of the use of continental crosswalk markings with decorative pavement per the SFMTA's marked crosswalk policies; and,
- Clarification of the SFMTA's responsibility for crosswalk maintenance where decorative crosswalks are installed.

The original memorandum distributed in January 2012 provides guidelines for design and installation of crosswalks within San Francisco. These guidelines document desired practice, subject to engineering judgment on a case-by-case basis. They are not meant to supplant the California Manual on Uniform Traffic Control Devices (CA MUTCD), which should also be consulted by practitioners involved in the installation of crosswalks. These guidelines were prepared by the Livable Streets and Transportation Engineering subdivisions of the SFMTA Sustainable Streets division and are based in part on the research referenced at the end of this memo.

The guidelines are divided into three general areas:

1. Overview (page 2)
2. Where to Mark Crosswalks and use Additional Treatments (page 4)
3. How to Mark Crosswalks (page 15)

1. OVERVIEW

Crosswalks exist at all non-alley¹ intersections that meet at approximately right angles, whether marked or unmarked, except where pedestrian crossing is specifically prohibited. Marked crosswalks serve to alert road users to expect crossing pedestrians and to direct pedestrians to desirable crossing locations.

At mid-block locations, crosswalks only exist where marked. At these non-intersection locations, it is the crosswalk markings that legally establish the crosswalk.

The following guidelines cover where and how to mark crosswalks, including the following topics:

- Marking crosswalks at controlled intersection locations
- Marking crosswalks at uncontrolled intersection locations
- Marking crosswalks at mid-block locations
- Marking crosswalks within school areas
- Crosswalk closures
- Crosswalk marking patterns
- Additional crosswalk safety treatments

These guidelines are consistent with Section 3B.17 of the 2009 MUTCD, which at this time is pending official adoption by California. These guidelines are not meant to be rigid standards, but rather to provide additional guidance subject to engineering judgment on a case-by-case basis.

The following legal definitions and right-of-way control excerpts are from the California Vehicle Code (CVC).

CVC Section 275. Crosswalk is either:

- (a) That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at intersection where the intersecting roadways meet at approximately right angles, except the prolongation of such lines from an alley across a street.
- (b) Any portion of a roadway distinctly indicated for pedestrian crossing by lines or other markings on the surface. Notwithstanding the foregoing provisions of this section, there shall not be a crosswalk where local authorities have placed signs indicating no crossing.

CVC Section 21950. Right-of-Way at Crosswalks:

¹Per the California Vehicle Code Section 110, alleys are generally minor streets that are 25 feet or narrower in width.

- (a) The driver of a vehicle shall yield the right-of-way to a pedestrian crossing the roadway within any marked crosswalk or within any unmarked crosswalk at an intersection, except as otherwise provided in this chapter.
- (b) The provisions of this section shall not relieve a pedestrian from the duty of using due care for his or her safety. No pedestrian shall suddenly leave a curb or other place of safety and walk or run into the path of a vehicle which is so close as to constitute an immediate hazard. No pedestrian shall unnecessarily stop or delay traffic while in a marked or unmarked crosswalk.

2. WHERE TO MARK CROSSWALKS AND USE ADDITIONAL TREATMENTS

The CA MUTCD provides the following guidance on where to mark crosswalks (Section 3B.17):

“In general, crosswalks should not be marked at intersections unless they are intended to channelize pedestrians. Emphasis is placed on the use of marked crosswalks as a channelization device.

The following factors may be considered in determining whether a marked crosswalk should be used:

- *Vehicular approach speeds from both directions.*
- *Vehicular volume and density.*
- *Vehicular turning movements.*
- *Pedestrian volumes.*
- *Roadway width.*
- *Day and night visibility by both pedestrians and motorists.*
- *Channelization is desirable to clarify pedestrian routes for sighted or sight impaired pedestrians.*
- *Discouragement of pedestrian use of undesirable routes.*
- *Consistency with markings at adjacent intersections or within the same intersection.”*

The decision making processes for marking crosswalks is different depending on whether the location is controlled or uncontrolled. Much of the following guidance on where to mark crosswalks is dedicated to uncontrolled locations.

MARKING CROSSWALKS AT CONTROLLED INTERSECTION LOCATIONS

In San Francisco, unless pedestrian crossing is prohibited, marked crosswalks should be provided at all intersection approaches controlled by traffic signals. Intersection approaches controlled by STOP signs can be recommended for marked crosswalks if any of the following conditions apply:

- The crosswalk is located in a school area;
OR,
- Elderly or disabled pedestrian volumes of 20 or more are expected during the peak hour of pedestrian demand;
OR,
- Pedestrian volumes of 60 or more are expected during the peak hour of pedestrian demand and vehicular daily volumes of 6,000 or more are expected to cross over the crosswalk²;

² Many of the guidelines reviewed from other municipalities recommend marking crosswalks either at all approaches controlled by STOP signs or when pedestrian volumes of 20 or more are expected during the peak hour of pedestrian demand. However, San Francisco has many STOP sign controlled intersections with relatively low traffic volumes that would make these thresholds impractical.

- OR,
- Safety or efficiency reasons dictate directing pedestrians to a particular leg of the intersection;
- OR,
- STOP sign approaches are on a Minor Arterial or Major Arterial.

MARKING CROSSWALKS AT UNCONTROLLED INTERSECTION LOCATIONS

At uncontrolled intersection approaches, crosswalks should only be marked if the following conditions apply:

- There is sufficient demand (see Demand section below);
- AND,
- The location is more than 300 feet from a controlled crossing location³;
- AND,
- Adequate stopping sight distance exists between approaching motorists and pedestrians starting to cross the street at the crosswalk;
- AND,
- The location has street lighting adjacent to the crosswalk;
- AND,
- Safety considerations arising from roadway configuration, vehicle volumes or vehicle speeds do not preclude marking a crosswalk (see Roadway Configuration, Motor Vehicle Volume and Speed section below).

Demand

At uncontrolled intersection approaches, crosswalks should be considered for marking only if there is sufficient demand according to the following criteria:

- The crosswalk is located in a school area;
- OR,
- Pedestrian volumes of 15 or more per hour are expected during multiple hours throughout the day;
- OR,
- Pedestrian volumes of 20 or more are expected during the peak hour of pedestrian demand;
- AND,
- Pedestrians have fewer than five gaps in traffic per five-minute period.⁴

MARKING CROSSWALKS AT MID-BLOCK LOCATIONS

Mid-block crosswalks only exist if marked and must be established by a SFMTA Board of Directors' resolution. Because pedestrian crossings may not be expected by motorists at mid-block locations, additional measures such as signage and parking restrictions are recommended. Bulbouts are another desirable feature to improve

³ This guideline is used by several other municipalities including Sacramento, Stockton, Boulder, Virginia DOT and more.

⁴ This guideline is used by several other municipalities including Palo Alto, Boulder, Sacramento, Stockton, San Leandro, Virginia DOT and more.

visibility for both pedestrians and motorists but typically require special funding sources due to their relatively high cost. Curb ramps are required. On higher volume and speed streets a traffic signal may be required.

Mid-block crosswalks should only be established if the following conditions apply:

- There is sufficient demand (see Demand section below);
AND,
- The location is more than 300 feet from a controlled crossing location⁵;
AND,
- Adequate stopping sight distance exists between approaching motorists and pedestrians starting to cross the street at the proposed crosswalk;
AND,
- The location has adequate street lighting to illuminate the proposed crosswalk;
AND,
- Safety considerations arising from roadway configuration, vehicle volumes or vehicle speeds do not preclude establishing a crosswalk (see Roadway Configuration, Motor Vehicle Volume and Speed section below).

Demand

Mid-block crosswalks should be considered only if there is a sufficient demand according to the following criteria:

- Pedestrian volumes of 40 or more are expected during the peak hour of pedestrian demand;
OR,
- Significant pedestrian trip generators (such as a school, park, or commercial building) are on both sides of the street between controlled intersections.⁶

ROADWAY CONFIGURATION, MOTOR VEHICLE VOLUME AND SPEED

The table provided in the Appendix is from the Federal Highway Administration study *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations* and can be used as a reference when deciding whether to mark a crosswalk at an uncontrolled location. For different roadway configurations, the table identifies ranges of vehicle speeds and volumes where crosswalks can be marked without additional treatments (C), where additional treatments should be considered along with crosswalk markings (P), and where crosswalks should not be marked without additional treatments (N).

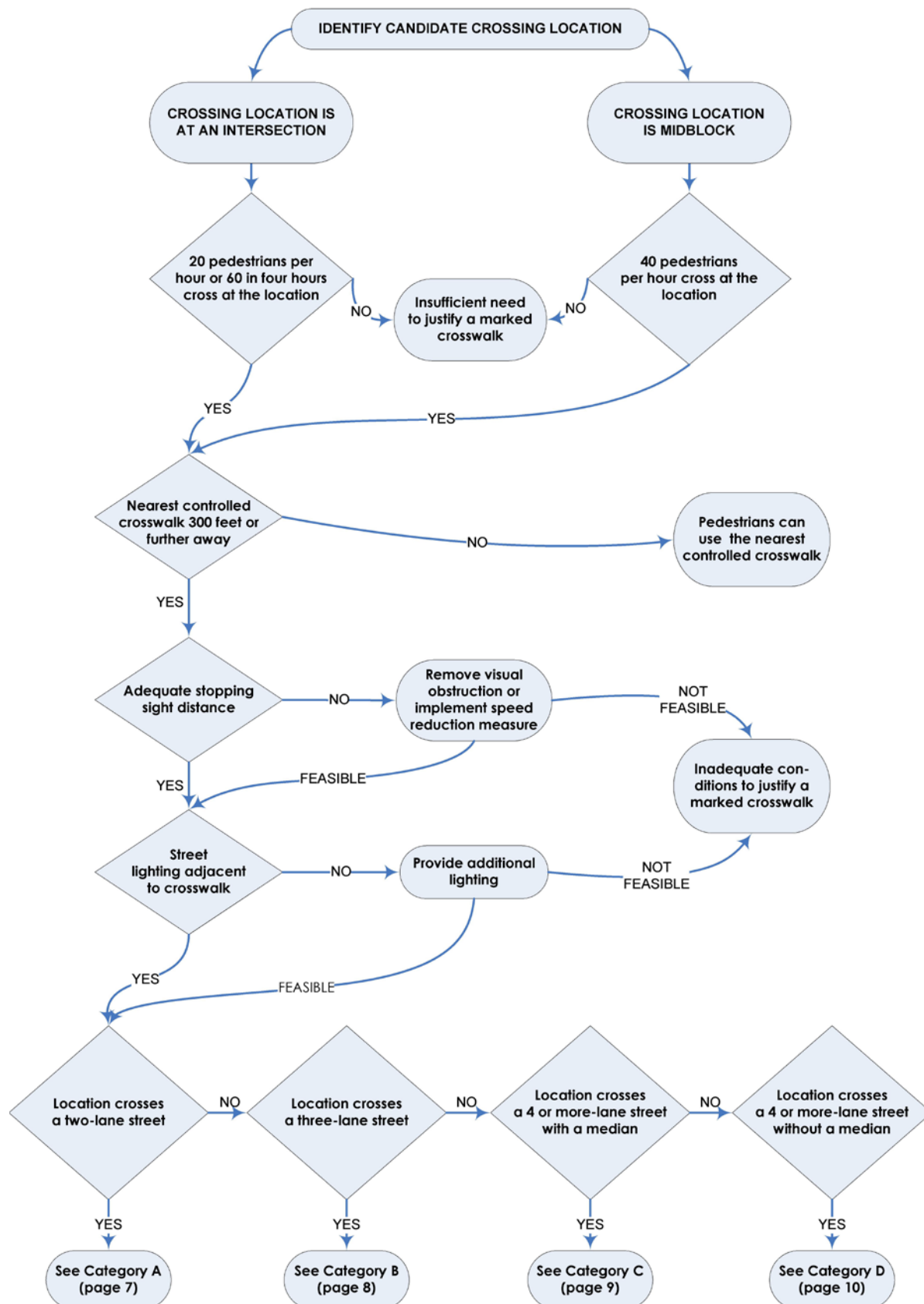
Below is a flowchart offering further assistance with the decision of whether or not to mark a crosswalk at an uncontrolled location, and what, if any, additional treatments should be considered. The flowchart and accompanying tables do not apply to crosswalks within school areas (see School Area Crosswalks section on page 14).

⁵ This guideline is used by several other municipalities including Sacramento, Stockton, Boulder, Virginia DOT and more.

⁶ These demand guidelines are used by several other municipalities including San Leandro, Palo Alto Boulder, Sacramento, Stockton, Virginia DOT and more.

Where safety concerns persist even with special treatments (extreme cases of category “N” above), traffic signal warrants established in the most current CA MUTCD should be followed to determine whether the crossing warrants a traffic signal. Pedestrian crossing distance alone is not a sufficient reason to consider new traffic signals. If a traffic signal is determined to be unwarranted or infeasible, other pedestrian treatments such as medians and bulbouts should be considered.

CROSSWALK MARKING FLOWCHART FOR UNCONTROLLED LOCATIONS



CATEGORY A: TWO LANE STREETS**(Meeting requirements of flowchart on page 6)**

TRAFFIC VOLUME (ADT)	POSTED SPEED		
	30 MPH or less	35 MPH	40 MPH or more
Up to 12,000 vehicles per day	Consider Level 1 device (see page 11)	Consider Level 1 device (see page 11)	Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)
12,000 vehicles or more per day	Consider Level 1 device (see page 11)	Marked X-walk and additional Level 1 device (see page 11).	Marked X-walk plus additional Level 1 and/or Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)

CATEGORY B: THREE LANE STREETS
(Meeting requirements of flowchart on page 6)

TRAFFIC VOLUME (ADT)	POSTED SPEED		
	30 MPH or less	35 MPH	40 MPH or more
9,000 vehicles or fewer per day	Consider Level 1 device (see page 11)	Consider Level 1 device (see page 11)	Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)
9,000-12,000 vehicles per day	Consider Level 1 device (see page 11)	Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)	
12,000-15,000 vehicles per day	Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)		Marked X-walk plus additional Level 1 and/or Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)
15,000 vehicles or more per day		Marked X-walk plus additional Level 1 and consider Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)	

CATEGORY C: FOUR OR MORE LANES WITH A RAISED MEDIAN
(Meeting requirements of flowchart on page 6)

TRAFFIC VOLUME (ADT)	POSTED SPEED		
	30 MPH or less	35 MPH	40 MPH or more
9,000 vehicles or fewer per day	Consider Level 1 device (see page 11)	Consider Level 1 device (see page 11)	Marked X-walk plus additional Level 1 and/or Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)
9,000-12,000 vehicles per day		Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)	
12,000-15,000 vehicles per day	Marked X-walk plus additional Level 1 device and consider Level 2 device (see page 11)	Marked X-walk plus additional Level 1 and consider Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)	
15,000 vehicles or more per day	Marked X-walk plus additional Level 1 and consider Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)		

CATEGORY D: FOUR OR MORE LANES WITHOUT A RAISED MEDIAN
(Meeting requirements of flowchart on page 6)

TRAFFIC VOLUME (ADT)	POSTED SPEED		
	30 MPH or less	35 MPH	40 MPH or more
9,000 vehicles or fewer per day	Consider Level 1 device (see page 11)	Marked X-walk and additional Level 1 device (see page 11).	Marked X-walk plus additional Level 1 and/or Level 2 devices. Evaluate the location for a traffic signal (Level 3 device) using CA MUTCD warrants (see page 11)
9,000-12,000 vehicles per day	Marked X-walk and additional Level 1 device (see page 11).	Marked X-walk and additional Level 1 device (see page 11).	
12,000 vehicles or more per day	Evaluate the location for a pedestrian signal. If the location does not meet the warrant, install marked X-walk plus additional Level 1 and 2 devices (see page 11)	Evaluate the location for a pedestrian signal. If the location does not meet the warrant, install marked X-walk plus additional Level 1 and 2 devices (see page 11)	Evaluate the location for a pedestrian signal. If the location does not meet the warrant, install marked X-walk plus additional Level 1 and 2 devices (see page 11)

ADDITIONAL TREATMENTS FOR CROSSWALKS AT UNCONTROLLED LOCATIONS

A partial list of additional treatments to be considered for crosswalks at uncontrolled locations is provided below. Specific circumstances will call for flexibility in application, and a combination of treatments may be appropriate.

Level One (lower cost traffic control devices)

- **Signage**, including the “Yield Here to Pedestrians”, “Yield to Pedestrians in Crosswalk” metal and pop-up signs, and “Pedestrian Warning”, as discussed in the CA MUTCD;
- **Advance Stop and Yield Lines** (see discussion on page 14);
- **Raised pedestrian refuge islands**;
- **PED XING pavement markings** installed on the approaches to the crosswalk;
- **Parking prohibitions** or red zones at the crosswalk; and,
- **Speed limit signs or changes** in conformance with an engineering study and CVC regulations.

Level Two (higher cost traffic control devices and street changes)

- **Flashing beacons** used alone or in conjunction with overhead signs as approved for general use by the CA MUTCD;
- **In-roadway warning lights** as approved for general use by the CA MUTCD;
- **Curb extensions or bulbouts**;
- **Road diets** or other traffic lane changes to reduce number of approach lanes or allow the installation of pedestrian refuge islands or medians;
- **Traffic calming** or other appropriate engineering measures to reduce roadway speeds;
- **Pedestrian Hybrid Beacons (HAWK)** as approved for general use by the CA MUTCD; and,
- **Rectangular Rapid Flash Beacon** following guidelines set forth in the FHWA’s interim approval for optional use.

Level Three (traffic signalization)

- **Traffic signals** should be used where other treatments are infeasible or ineffective and current CA MUTCD traffic signal warrants are met.

REMOVING CROSSWALK MARKINGS

These guidelines should not be used to justify removal of existing crosswalk markings. In most circumstances additional measures should be considered prior to removal of crosswalk markings. In exceptional cases crosswalk markings can be recommended for deletion while leaving a crosswalk open, such as when an engineering evaluation indicates that other measures have not been effective and there are significant safety advantages to not marking the crosswalk. Removing a marked crosswalk requires a public hearing under the Pedestrian Safety Act of 2000 (AB 2522). Consult CVC Section 21950.5 for more details about the 30-day minimum public notification requirements.

CROSSWALK CLOSURES

Closures of existing crosswalks should be avoided, and existing closed crosswalks should be evaluated for opening, which may necessitate additional safety measures such as traffic signal timing or signage changes.

In exceptional cases, closing a crosswalk or keeping a crosswalk closed may be justified even if a crosswalk meets the guidelines outlined elsewhere in these guidelines. Where crosswalk closures are required, only one leg of an intersection should be closed. Closing a crosswalk with signs and barriers may be justified by such factors as heavy turn volumes, poor sight distance, or very low pedestrian demand. The extent of inconvenience for pedestrians must be considered in these decisions. Closing a crosswalk requires a public hearing and a SFMTA Board of Directors' resolution.

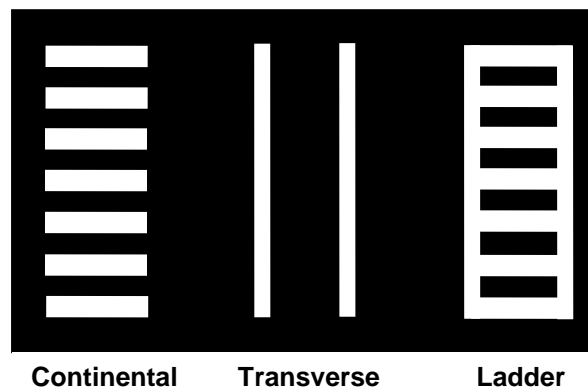
3. HOW TO MARK CROSSWALKS

All marked crosswalks other than designated school area crosswalks shall be white. All crosswalks should be marked using thermoplastic treated with retroreflective glass beads upon installation. The width of a crosswalk should generally conform to sidewalk width, but can be wider in locations with high pedestrian demand or narrow sidewalks. The minimum recommended crosswalk width is 10 feet.

CROSSWALK MARKING PATTERNS

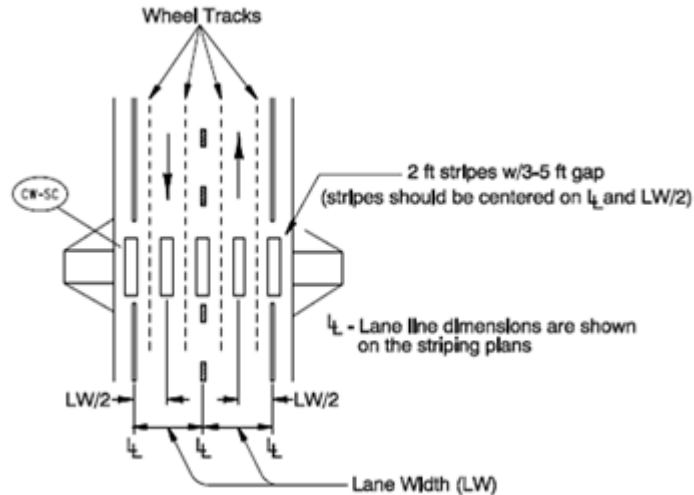
Various crosswalk marking patterns exist in San Francisco, including continental, transverse, and ladder, as shown in Figure I below. Until recently, San Francisco only used continental markings at mid-block and school area crosswalks. It is now the goal of the Sustainable Streets Division to gradually have all crosswalk markings be converted to the continental marking pattern. Existing transverse markings should be prioritized for conversion to continental markings as resources allow; recognizing resource limitations, this policy will be implemented slowly over time. When transverse markings are converted to continental markings, the side stripes may remain, since removal is costly, but the side stripes should not be maintained.

FIGURE I: Crosswalk Marking Patterns



Continental stripes should be two feet wide and should be painted parallel to the curb. The minimum spacing between continental stripes is two feet, although this spacing may be consistent or staggered. Staggered continental stripes may be used to avoid wheel paths as shown in Figure II on page 14. Because of their potential to reduce long-term maintenance, staggered continental stripes are the preferred continental marking pattern and should be used at new installations and after roadway repaving. For staggered continental details, see Striping Drawing STR 7821.

FIGURE II: Staggered Continental Crosswalk Layout



SCHOOL AREA CROSSWALKS

Crosswalks marked in locations directly adjoining Kindergarten through 12th grade schools in California are considered school area crosswalks and must be marked in yellow. When one crosswalk is marked in yellow, all crosswalks at the same intersection must be marked in yellow. CVC Section 21368 regulates which crosswalk locations not directly adjoining schools can be considered school area crosswalks to be marked in yellow. Yellow school area crosswalks at uncontrolled approaches must be accompanied by SLOW SCHOOL XING pavement markings in each approaching lane and appropriate signage. Refer to Chapter 7 of the CA MUTCD and CVC Section 21368 for additional guidance.

ADVANCE STOP AND YIELD LINES

Advance stop and yield lines can be a tool for improving pedestrian safety on streets with multiple threat scenarios.⁷ Advance yield lines are not typically used for single lane approaches unless justified by unique conditions. Guidelines for advance stop and yield lines can be found under Section 3B.16 of the CA MUTCD, which allows for their use from 4 to 50 feet in advance of crosswalks, depending upon location-specific variables.

Advance stop lines are solid white lines typically 2 feet wide, extending across all approach lanes to indicate where vehicles must stop in compliance with a crosswalk, stop sign or traffic signal (per the requirements of CVC Section 377). White lane lines between an advance stop line and a crosswalk should be removed or not repainted. Advance stop lines may be placed in advance of a stop- or traffic signal-controlled marked crosswalk location to mitigate poor crosswalk visibility, poor driver compliance, and non-standard geometrics.

⁷A multiple threat scenario exists when one vehicle stops for a pedestrian in a marked crosswalk, but a vehicle in the neighboring lane continues to proceed through. The pedestrian often will not be able to see the approaching vehicle in time to avoid being hit, and likewise the motorist can't see the pedestrian.

Advance yield lines consist of a single row of white triangles, extending across all approach lanes to indicate where vehicles must yield in advance of an uncontrolled marked crosswalk location. Advance yield lines used at uncontrolled multi-lane crosswalks shall be used in conjunction with the R1-5 series or “Yield Here to Pedestrians” sign and located 20 to 50 feet in advance of the crosswalk adjacent to the advance yield line (preferably 25 feet). Where R1-5 series signs are added, any existing R1-6 signs should be removed and no new R1-6 signs added. White lane lines between the advance yield lines and the crosswalk should be removed or not repainted. Parking should be prohibited in the area between the advance yield line and the crosswalk. See the CA MUTCD Sections 2B.08 – 2B.11 and 3B.16 for a discussion of yield lines and associated signage.

DECORATIVE CROSSWALK PAVING

Decorative paving treatments, including colored and/or textured concrete, asphalt or pavers, Street Print, Duratherm, or other similar treatments should not be considered a safety or traffic control measure. Decorative crosswalk treatments are not a substitute for, and should not detract from, transverse or continental crosswalk markings. Furthermore, decorative treatments between transverse crosswalk markings are not a substitute for continental markings, which should be used for any new or upgraded marked crosswalks.

For both continental and transverse crosswalks, the decorative markings must contrast with the visibility of the crosswalk markings and must be devoid of retroreflective properties. The FHWA Memorandum “MUTCD - Official Ruling 3(09)-24(I) – Application of Colored Pavement” dated August 15, 2013 provides the following clarification on acceptable decorative treatment at marked crosswalks:

“Examples of acceptable treatments include brick lattice patterns, paving bricks, paving stones, setts, cobbles, or other resources designed to simulate such paving. Acceptable colors for these materials would be red, rust, brown, burgundy, clay, tan or similar earth tone equivalents. All elements of pattern and color for these treatments are to be uniform, consistent, repetitive, and expected so as not to be a source of distraction. No element of the aesthetic interior treatment is to be random or unsystematic. No element of the aesthetic interior treatment can implement pictographs, symbols, multiple color arrangements, etc., or can otherwise attempt to communicate with any roadway user.”

When used, decorative crosswalk paving treatments should consist of durable, skid-resistant materials that do not cause discomfort to those who use wheelchairs and other assistive mobility devices. When decorative crosswalk treatments supplement continental crosswalks, the underlying pavement material should be asphalt or another similar material that thermoplastic crosswalk markings adhere well to. All decorative crosswalk markings will be reviewed on a case-by-case basis. See also Chapter 3G of the California MUTCD for further guidance on the use of colored paving materials at crosswalks. The SFMTA will maintain crosswalk markings and other traffic control devices but assumes no responsibility for maintaining decorative crosswalks.

REFERENCES

State of California, Department of Transportation, Division of Traffic Operations; 2010; *California Manual on Uniform Traffic Control Devices*. CADOT.

http://www.dot.ca.gov/hq/traffops/signtech/mutcdsupp/ca_mutcd2010.htm

US Department of Transportation, Federal Highway Administration. 2009. *2009 Manual on Uniform Control Devices*, FHWA http://mutcd.fhwa.dot.gov/kno_2009.htm

Ron Van Houton, 2000. *Advance Yield Markings Reduce Vehicle/Pedestrian Conflicts at Multilane Crosswalks with an Uncontrolled Approach*. Mount Saint Vincent University, Center for Education and Research in Safety, Halifax. <http://www.cers-safety.com/images/advanceyieldmarkings.pdf>

Charles Zegeer, J. Richard Stewart et al. 2005; *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Locations*; FHWA.

<http://www.fhwa.dot.gov/publications/research/safety/04100/index.cfm>

Pedestrian Facilities Users Guide — *Providing Safety and Mobility (Appendix C, Recommended Guidelines for Crosswalk Installation)*, FHWA 2002

http://katana.hsrrc.unc.edu/cms/downloads/PedFacility_UserGuide2002.pdf

City of Boulder Transportation Division, 2006. *Pedestrian Crossing Treatment Installation Guidelines*. Prepared by Fox Higgins Transportation Group.

http://www.bouldercolorado.gov/files/Transportation/Projects/Pedestrian%20Crossing%20Treatment/pctig_jan2006_final.pdf

City of Sacramento, Public Works Department, Traffic Engineering Division. 2003. *Pedestrian Safety Guidelines*. Prepared by Fehr and Peers.

http://www.cityofsacramento.org/transportation/dot_media/engineer_media/pdf/PedSafety.pdf

City of San Leandro, 2004. *Bicycle and Pedestrian Master Plan*. Prepared by Fehr and Peers.

<http://www.sanleandro.org/civica/filebank/blobload.asp?BlobID=3635>

City of Stockton, Public Works Department, Engineering Division. 2003. *Pedestrian Safety and Crosswalk Guidelines*. Prepared by Fehr and Peers.

<http://www.stocktongov.com/publicworks/publications/pedguidelines.pdf>

Virginia Department of Transportation, Traffic Engineering Division, 2005. *Guidelines for the Installation of Marked Crosswalks*. http://www.virginiadot.org/business/resources/Marked_20Crosswalks_20Final_20Guidelines_2012-14-05.pdf

City of Palo Alto, 2000. *Warrants for Marked Crosswalk at Uncontrolled Intersections and Mid-block Crosswalk Guidelines*.

http://www.cityofpaloalto.org/depts/pln/transportation/traffic_operations/default.asp

San Francisco Municipal Transportation Agency, 2008. *SFMTA High Visibility Crosswalk TETAP Study*. Prepared by Fehr & Peers. http://www.westernite.org/annualmeetings/sanfran10/Papers/Session%207_Papers/ITE%20Paper_7C-Feldman_Manzi.pdf

TCRP Report 112/NCHRP Report 562, 2006. *Improving Pedestrian Safety at Unsignalized Crossings*.

APPENDIX

Recommendations for installing marked crosswalks and other needed pedestrian improvements at uncontrolled locations*

Source: *Safety Effects of Marked vs. Unmarked Crosswalks at Uncontrolled Crossing Locations*, FHWA, 2005.

Roadway Type (Number of Travel Lanes and Median Type)	Vehicle ADT < 9,000			Vehicle ADT > 9000 - 12,000			Vehicle ADT < 12,000 - 15,000			Vehicle ADT > 15,000		
	Speed Limit**											
	<30 mph	35 mph	40 mph	<30 mph	35 mph	40 mph	<30 mph	35 mph	40 mph	<30 mph	35 mph	40 mph
2-Lanes	C	C	P	C	C	P	C	C	N	C	P	N
3-Lanes	C	C	P	C	P	P	P	P	N	P	N	N
Multi-Lane (4 or More Lanes) With Raised Median***	C	C	P	C	P	N	P	P	N	N	N	N
Multi-Lane (4 or More Lanes) Without Raised Median	C	P	N	P	P	N	N	N	N	N	N	N

C: Candidate sites for marked crosswalks. Marked crosswalks must be installed carefully and selectively. Before installing new marked crosswalks, an engineering study is needed to show whether the location is suitable for a marked crosswalk. For an engineering study, a site review may be sufficient at some locations, while a more in-depth study of pedestrian volumes, vehicle speeds, sight distance, vehicle mix, etc. may be needed at other sites. It is recommended that a minimum of 20 pedestrian crossings per peak hour (or 15 or more elderly and/or child pedestrians) exist at a location before placing a high priority on the installation of a marked crosswalk alone.

P: Possible increase in pedestrian crash risk may occur if crosswalks are added without other pedestrian facility enhancements. These locations should be closely monitored and enhanced with other pedestrian crossing improvements, if necessary, before adding a marked crosswalk.

N: Marked crosswalks alone are not recommended, since pedestrian crash risk may be increased with marked crosswalks. Consider using other treatments, such as traffic signals with pedestrian signals to improve crossing safety for pedestrians.

* These guidelines include intersection and midblock locations with no traffic signals or stop sign on the approach to the crossing. **They do not apply to school crossings.** A two-way center turn lane is not considered a median. Crosswalks should not be installed at locations which could present an increased safety risk to pedestrians, such as where there is poor sight distance, complex or confusing designs, substantial volumes of heavy trucks, or other dangers, without first providing adequate design features and/or traffic control devices. Adding crosswalks alone will not make crossings safer, nor necessarily result in more vehicles stopping for pedestrians. Whether marked crosswalks are installed, it is important to consider other pedestrian facility enhancements, as needed, to improve the safety of the crossing (e.g., raised median, traffic signal, roadway narrowing, enhanced overhead lighting, traffic calming measures, curb extensions). These are general recommendations; good engineering judgment should be used in individual cases for deciding where to install crosswalks.

** Where speed limit exceeds 40 mph, marked crosswalks alone should not be used at unsignalized locations.

*** The raised median or crossing island must be at least 4 ft wide and 6 ft long to adequately serve as a refuge area for pedestrians in accordance with MUTCD and AASHTO guidelines. 6 feet is preferable and consistent with the U.S. Access Board's Proposed Right of Way Accessibility Guidelines.