City of Piedmont
COUNCIL AGENDA REPORT

DATE: December 4, 2017

TO: Mayor and Council

FROM: Paul Benoit, City Administrator

SUBJECT: Consideration of a Policy for the Installation of Stop Signs, Yield Signs and Crosswalk Markings

RECOMMENDATION

Approve the attached Policy for the Installation of Stop and Yield Signs, and Crosswalk Markings dated April 2017.

BACKGROUND

Staff receives numerous requests from the public for the installation of stop signs, yield signs and crosswalk markings. While the Police Chief, Director of Public Works, and City Engineer review these requests using accepted traffic industry standards, the establishment of written policies for the installation of stop signs, yield signs and crosswalk markings would ensure uniform practice and transparency to the public.

In December 2014, the City Council adopted the Pedestrian and Bicycle Master Plan (PBMP). Part of the PBMP recommended needed policies that the Council should consider establishing and adopting. Section 5 states the following:

…the City should develop a policy describing the process through which it reviews requests for new crosswalks and stop signs. The policy would describe the conditions under which new crosswalks and stop signs would be approved. Decisions would be informed by sound traffic engineering considerations such as traffic speeds and volumes on the streets involved; street grades, widths and other physical characteristics; amount of foot traffic; pedestrian travel paths and crossing patterns; and adequacy of sight lines and stopping sight distances.

Typically, staff relies on State-adopted policies and procedures for these type of facilities. The California Manual on Uniform Traffic Control Devices (MUTCD) is the document widely used by most agencies. Revision 2, adopted in April 2017, of the 2014 MUTCD does not establish criteria for these types of installations, but does provide standards for multi-way stop intersections, as well as general applications for stop and yield signs. Also, the State criteria, being standardized, does not sufficiently address the many unique conditions experienced on local streets.

For these reasons, Staff and the City Engineer have drafted a policy for installation of stop and yield signs, as well as crosswalk markings. The policy provides a consistent methodology and approach to guide Staff in responding to requests received. In developing the policy, Staff reviewed existing stop and yield sign installation policies implemented by other cities, evaluated the MUTCD guidelines and their applicability to conditions within the City of Piedmont, and developed the criteria for the installation of stop signs, yield signs and for crosswalk markings. The draft policy is attached as Exhibit A.

Additionally, the policy has been reviewed by Kittelson & Associates, the primary traffic engineering firm used by the City, to ensure consistency with industry practices and sound traffic engineering. Adoption of this policy will allow staff to consistently and objectively consider the requests per the criteria set forth in this document.

CITY ATTORNEY REVIEW

The City Attorney has reviewed and approved the Policy.

By: Chester Nakahara, Director of Public Works
John Wanger, City Engineer

City of Piedmont

Policy for the Installation of Stop Signs, Yield Signs and Crosswalk Markings

DRAFT

April - 2017

In December 2014, the City Council of Piedmont adopted the Pedestrian and Bicycle Master Plan (hereinafter referred to as "PBMP".) Part of the PBMP recommended needed policies that should consider establishing and adopting. Specifically, in Section 5 (Policies) of the Action Plan portion of the PBMP, it states:

> *As part of the needs assessment process for the PBMP, many people requested new crosswalks and stop signs, to make it easier to cross the street and slow down traffic. However, crosswalks and stop signs are often not the right solution and can create more problems than they solve. "Unwarranted" crosswalks (at unexpected or unconventional locations) might be even more dangerous than unmarked crossings; they can give pedestrians a false sense of security, leading them to be less careful when they cross the street. Unwarranted stop signs can also lead to accidents if they are in unexpected locations and also can result in unnecessary traffic delays.*
>
> *To address pedestrians' concerns, the PBMP recommends high visibility crosswalks and enforcement efforts. At the same time, the City should develop a policy describing the process through which it reviews requests for new crosswalks and stop signs. The policy would describe the conditions under which new crosswalks and stop signs would be approved. Decisions would be informed by sound traffic engineering considerations such as traffic speeds and volumes on the streets involved; street grades, widths and other physical characteristics; amount of foot traffic; pedestrian travel paths and crossing patterns; and adequacy of sight lines and stopping sight distances.*

Per this recommendation in the PBMP, the intent of this document is to provide a policy for the installation of stop and yield signs and crosswalks within the City.

STOP AND YIELD SIGNS

One of the most widely accepted documents providing some guidelines for the installation of stop signs is the State of California Department of Transportation Manual on Uniform Traffic Control Devices (hereinafter referred to as "MUTCD".) The MUTCD provides recommended criteria for the installation of 2-way and 4-way stop signs at intersections as well as general applications for stop and yield signs; however, it does not establish specific criteria for the installation of single-stop signs, 2-way stop signs on minor streets, and stop signs or yield signs for T-intersections. All-way stops are commonly installed at the intersections of streets with similar traffic volumes or where justified by other criteria.

In addition to the MUTCD, another guiding document is the California Vehicle Code (hereinafter referred to as "CVC".) Specifically, Section 21100 of the CVC provides for the following the following guidance to local agencies for installation of traffic control devices (signage):

> *"21100. Local authorities may adopt rules and regulations by ordinance or resolution regarding all of the following matters:…*
>
> *(d) Regulating traffic by means of official traffic control devices meeting the requirements of Section 21400"*

Furthermore, several other sections of the CVC establish the criteria and authority that local agencies have with respect to placement of signs and installation of traffic control devices. Specifically:

> *21400. (a) (1) The Department of Transportation shall, after consultation with local agencies and public hearings, adopt rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to this code, including, but not limited to, stop signs, yield right-of-way signs, speed restriction signs, railroad warning approach signs, street name signs, lines and markings on the roadway, and stock crossing signs placed pursuant to Section 21364.*
> *(2) The Department of Transportation shall, after notice and public hearing, determine and publicize the specifications for uniform types of warning signs, lights, and devices to be placed upon a highway by a*

person engaged in performing work that interferes with or endangers the safe movement of traffic upon that highway.
(3) Only those signs, lights, and devices as are provided for in this section shall be placed upon a highway to warn traffic of work that is being performed on the highway.
(4) Control devices or markings installed upon traffic barriers on or after January 1, 1984, shall conform to the uniform standards and specifications required by this section.

21351. Local authorities in their respective jurisdictions shall place and maintain or cause to be placed and maintained such traffic signs, signals and other traffic control devices upon streets and highways as required hereunder, and may place and maintain or cause to be placed and maintained, such appropriate signs, signals or other traffic control devices as may be authorized hereunder or as may be necessary properly to indicate and to carry out the provisions of this code or local traffic ordinances or to warn or guide traffic.

21354. Subject to the provisions of Section 21353, a local authority may designate any highway under its jurisdiction as a through highway and may erect stop signs at entrances thereto or may designate any intersection under its exclusive jurisdiction as a stop intersection and erect stop signs at one or more entrances thereto.

21356. The Department of Transportation or local authorities, with respect to highways under their respective jurisdictions, may erect yield right-of-way signs at the entrances to intersections or highways. Such yield right-of-way signs shall not be erected upon the approaches to more than one of the intersecting streets. Yield right-of-way signs shall be located at or near the entrance to the intersection or highway where motorists are required to yield the right-of-way.

The purpose of stop signs is to control the right-of-way assignment at intersections, give preference to major traffic movements and to reduce the potential for some types of accidents. Stop signs are not installed for speed control purposes, but the speed of approaching vehicles is an important consideration relative to the sight distance and conflicting traffic movements at an intersection. The purpose of a yield sign is to control right-of-way assignments at intersections where control is advisable and a stop sign is not warranted or is unreasonably restrictive. Stop and yield sign installations should be consistent with the magnitude of traffic conflicts; their indiscriminate use results in unnecessary delay and energy usage.

CROSSWALKS

In addition to a policy for the installation of stop and yield signs, the adopted PBMP also recommends that the City desires to adopt a policy for the installation of crosswalks. The intent of establishing a policy for installation of crosswalks is to ensure pedestrian safety. Section 275 of the CVC defines a crosswalk as follows:

"*Crosswalk is either: (a) That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at intersections 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*."

Furthermore, the CVC addresses certain specific local authority to establish crosswalks warrants to be used as guidelines for installing crosswalks near schools. Specifically, Section 21372 of the CVC states:

21372. The Department of Transportation and local authorities shall, with respect to highways under their respective jurisdictions, establish and promulgate warrants to be used as guidelines for the placement of traffic control devices near schools for the purpose of protecting students going to and from

school. Such devices may include flashing signals. Such warrants shall be based upon, but need not be limited to, the following items: pedestrian volumes, vehicle volumes, width of the roadway, physical terrain, speed of vehicle traffic, horizontal and vertical alignment of the roadway, the distance to existing traffic control devices, proximity to the school, and the degree of urban or rural environment of the area.

Crosswalk markings are intended to provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops. In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways at locations that are not controlled by traffic control signals or stop or yield signs. At non-intersection locations, crosswalk markings legally establish the crosswalk.

POLICY

GENERAL:

Only those intersections meeting certain criteria as specified in the MUTCD and this policy should be considered for stop or yield signs. The criteria contained herein have general national acceptance as factors to be analyzed to determine where stop or yield signs should be installed. In special situations, stop signs may not be advisable because of the adverse effect they could cause in a total area traffic pattern despite other justifying factors.

It is the policy of the City Council of the City of Piedmont that the installation of stop and yield signs shall be made using engineering judgment and safety considerations based upon the following criteria, and that such analyses, measurements, and computations as may be required in determining the appropriate traffic controls shall be the responsibility of the City Engineer, the Police Chief, the Public Works Director or their respective designee.

Warrants provide specific conditions where stop and yield signs should be considered. One or more of the following warrants are to be met to qualify for the installation of a stop sign. The satisfaction of a warrant does not mandate the installation of a stop or yield sign, nor does the non-satisfaction of a warrant prevent such installations, but should be used in conjunction with engineering judgement and safety when considering a location for installation of a stop sign.

The following outlines the proposed criteria for the installation of all-way stop signs, 3 stop signs at T-intersections, 2-way stop signs on minor streets, and single-stop locations. Stop sign installations may be considered if ANY of the following conditions exist:

A. STOP SIGNS

1. **Traffic and Pedestrian Volumes**

   a. The minimum hourly average (for any eight hours) vehicular volume entering the intersection from all approaches on an average day and the vehicular volume entering the intersection from the minor street or streets for the same eight hours must meet the following criterion:

	Minimum Hourly Average (vehicles per hour) [1]	**Vehicular Volume from Minor Street(s) (fraction of total volume per hour minimum)**
All-Way Stop Signs	300	1/3

3-Way Stop Signs on T-Intersections	225	1/4
2-Way Stop Signs on Minor Streets	300	1/5
Single-Stop Signs on Minor Streets	225	1/4

1. The minimum hourly average is for any eight hours, consecutive or non-consecutive.

b. The minimum hourly average (for any eight hours) vehicular volume entering the intersection on the major approach and the pedestrian volume per hour crossing during the same eight hours must meet the following criterion:

	Minimum Hourly Average (vehicles per hour)	**Pedestrian Volume (pedestrians per hour)**
All-Way Stop Signs	150	75 crossing the major approach
3-Way Stop Signs on T-Intersections	60	30 crossing the major approach
2-Way Stop Signs on Minor Streets	40	30 crossing the minor approach
Single-Stop Signs	100	30 crossing the minor approach

2. Sight Distances

The visibility warrant establishes the criteria for determining if an intersection has inadequate visibility to maintain safe traffic operations. Providing the appropriate stopping sight distance reduces the likelihood of a collision at an intersection caused by a driver on the minor street crossing or entering the major street in the presence of oncoming traffic. The straight line sight distance (the length of roadway in a straight line that is visible to the driver) of one or more approaches of the major street for vehicles or pedestrians crossing the intersection is less than 150 feet, or if the stopping sight distance (the distance traveled when a vehicle driver is required to stop) for roadways with approach grades of +/- 3% for vehicles on one or more approaches of the major street does not meet the American Association of State Highway and Transportation Officials' (AASHTO) *A Policy on Geometric Design and Highways and Streets.*

Speed (mph)	**15**	**20**	**25**	**30**	**35**	**40**	**45**
Stopping Distance (ft)	80	115	155	200	250	305	360

Source: Exhibit 9-55: Design Intersection Sight Distance – Case B1 – Left Turn from Stop
These design speeds and design stopping distances are for roadways with grades between -3% and 3%, but guidelines for roadways on steeper grade are also included in AASHTO and can be calculated by adjusting the time gap for the design vehicle and the resulting intersection site distance.

For approach grades steeper than +/- 3%, the following table provides adjustment factors with respect to the appropriate approach grade.

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	Speed (mph)						
Approach Grade (%)	**15**	**20**	**25**	**30**	**35**	**40**	**45**
-6	1	1.1	1.1	1.1	1.1	1.1	1.1
-5	1	1.0	1.1	1.1	1.1	1.1	1.1
-4	1	1.0	1.0	1.1	1.1	1.1	1.1
-3 to +3	1	1.0	1.0	1.0	1.0	1.0	1.0
+4	1	1.0	1.0	1.0	1.0	0.9	0.9
+5	1	1.0	1.0	1.0	0.9	0.9	0.9
+6	1	1.0	0.9	0.9	0.9	0.9	0.9

Source: Exhibit 9-53: Adjustment Factors for Sight Distance Based on Approach Grade
Note: Based on ratio of stopping sight distance on specified approach grade to stopping sight distance on level terrain

Additional Considerations

When determining whether to install a stop sign, there are a number of additional engineering considerations that may be considered in the evaluation. These factors include:

- **Accident History** – When evaluating the installation of a stop sign, 3 or more types susceptible to correction by stop signs within a 12-month period.
- **In Vicinity of High-Pedestrian Generator** – Installation of a stop sign may justified at an intersection where any facility adjacent to that study intersection generates an unusually high concentration of pedestrian traffic. This may include the use of the intersection by school-aged children, the elderly or physically challenged pedestrians; or the presence of a facility such as a school, playground, park, shopping center, fire station, etc. The installation of a crosswalk may be considered with the installation of stop signs when near an identified high-pedestrian generator.
- **Unusual Intersection Geometrics** – Installation of a stop sign may be justified where unusual intersection design or geometrics (horizontal and/or vertical curves, or intersection offsets) require the installation of a stop sign.
- **Visible Signs of Issues** – Installation of a stop sign may be justified where visible signs of potential traffic problems exist, such as, skid marks, evidence of fixed object collisions, etc.
- **Volume Equilibrium** – Installation of a stop sign may be justified if the intersection approach volumes for the minor/major legs are reach equilibrium (45%/55% of the total intersection volume).

B. YIELD SIGNS

Yield signs should control the minor flow of traffic at an intersection. Yield signs should not be installed where there are stop signs on one or more approaches, except under special circumstances, to provide minor movement control within a complex intersection.

A yield sign may be warranted:

1. On a minor street entrance to an intersection where it is necessary to assign right-of-way to the major street where a stop is not necessary at all times and the safe approach speed on the minor street exceeds 10 mph; or
2. Where there is a separate or channelized right-turn lane, without an adequate acceleration lane.

C. CROSSWALKS

It is the policy of the City Council of the City of Piedmont that the installation of crosswalks shall be made using engineering judgment and safety considerations based upon the following criteria, and that such analyses, measurements, and computations as may be required in determining the appropriate traffic controls shall be the responsibility of the City Engineer, the Police Chief, the Public Works Director or their respective designee.

Crosswalks should be provided as required to delineate paths on approaches to and within signalized intersections and on approaches to other intersections where traffic stops. At non-controlled intersections and "mid-block crossings", crosswalk markings legally establish the crosswalks and shall be used in conjunction with signs and other warning measures per the MUTCD.

At locations controlled by traffic control signals or on approaches controlled by stop or yield signs, crosswalk lines should be installed where engineering and safety judgment indicates they are needed to direct pedestrians to the proper crossing path(s). Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location away from a traffic control signal or an approach controlled by a stop or yield sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

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

A. Vehicular approach speeds from both directions.
B. Vehicular volume and density.
C. Vehicular turning movements.
D. Pedestrian volumes.
E. Roadway width.
F. Day and night visibility by both pedestrians and road users.
G. Channelization is desirable to clarify pedestrian routes for sighted or sight impaired pedestrians.
H. Discouragement of pedestrian use of undesirable routes.
I. Consistency with markings at adjacent intersections or within the same intersection.

Crosswalk markings may be established between intersections (mid-block) in accordance with CVC 21106(a). Mid-block pedestrian crossings are generally unexpected by the motorist and should be discouraged unless, in the opinion of the City Engineer, Public Works Director or Police Chief, there is strong justification in favor of such installation. Particular attention should be given to roadways with two or more traffic lanes in one direction as a pedestrian may be hidden from view by a vehicle yielding the right-of-way to a pedestrian.

When it has been determined that a crosswalk is necessary, crosswalks shall be installed per the MUTCD Section 3B.18 and City Standards. Yellow markings shall be used near schools per CVC 21368 as follows:

> Whenever a marked pedestrian crosswalk has been established in a street contiguous to a school building or the grounds thereof, it shall be painted or marked in yellow, as shall be all the marked pedestrian crosswalks at an intersection in case any one of the crosswalks is required to be marked in yellow. Other established marked pedestrian crosswalks may be painted or marked in yellow if either (a) the nearest point of the crosswalk is not more than 600 feet from a school building or the grounds thereof, or (b) the nearest point of the crosswalk is not more than 2,800 feet from a school building or the grounds thereof, there are no intervening crosswalks other than those contiguous to the school grounds, and it appears that

the facts and circumstances require special painting or marking of the crosswalks for the protection and safety of persons attending the school. There shall be painted or marked in yellow on each side of the street in the lane or lanes leading to all yellow marked crosswalks the following words: "SLOW SCHOOL XING", except that such words shall not be painted or marked in any lane leading to a crosswalk at an intersection controlled by stop signs, traffic signals, or yield right-of-way signs.

New marked crosswalks across uncontrolled roadways should include other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and the roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater. Because non-intersection pedestrian crossings are generally unexpected by the road user, warning signs (per MUTCD) should be installed for all marked crosswalks at non-intersection locations and adequate visibility should be provided by parking prohibitions.

ALTERNATIVE PROCESS:

Notwithstanding other provisions of this Policy, signs may be installed by this Alternative Process. If an intersection is found to not satisfy the criteria established above upon an initial evaluation, then the following process may be used:

1. Any resident of the City, business owner within the City, or community organization may request a re-evaluation, bringing forth any additional information that may cause the intersection to satisfy the criteria. The City Engineer, Public Works Director, Police Chief or their designee shall then re-evaluate the intersection based on this request, notify the requesting party of the results, and install the sign(s) if the criteria are satisfied.
2. If the criteria are not satisfied upon the re-evaluation, then the person or community organization may request consideration by the City Council. The City Engineer, Public Works Director and/or the Police Chief shall submit a report to the City Council discussing why the sign(s) is(are) not recommended. The City Council may subsequently adopt a resolution authorizing the installation of the sign(s) at the intersection.
3. Signs may also be removed by following the steps of this process. Stop signs installed by City Council resolution may only be removed by a subsequent resolution.
4. For signs installed or removed by City Council resolution, the City Engineer or designee shall submit a report analyzing traffic conditions at the location for the first year after the change.

DRAFT

City of Piedmont
California

Date: December 1, 2017

To: City Council &
Paul Benoit, City Administrator

From: Chester G. Nakahara
Public Works Director

Subject: Stop Sign Policy
Item 7 of the 12-4-2017 Council Agenda

An earlier version of the Stop Sign Policy was inadvertently attached to the Staff Report for this item. Attached to this memo is the updated, correct iteration, dated October 2017. Please use this when considering your decision.

City of Piedmont

Policy for the Installation of Stop, Yield Signs And Crosswalk Markings

October 2017

In December 2014, the City Council of Piedmont adopted the Pedestrian and Bicycle Master Plan (hereinafter referred to as "PBMP".) Part of the PBMP recommended needed policies that should consider establishing and adopting. Specifically, in Section 5 (Policies) of the Action Plan portion of the PBMP, it states:

> *As part of the needs assessment process for the PBMP, many people requested new crosswalks and stop signs, to make it easier to cross the street and slow down traffic. However, crosswalks and stop signs are often not the right solution and can create more problems than they solve. "Unwarranted" crosswalks (at unexpected or unconventional locations) might be even more dangerous than unmarked crossings; they can give pedestrians a false sense of security, leading them to be less careful when they cross the street. Unwarranted stop signs can also lead to accidents if they are in unexpected locations and also can result in unnecessary traffic delays.*
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> *To address pedestrians' concerns, the PBMP recommends high visibility crosswalks and enforcement efforts. At the same time, the City should develop a policy describing the process through which it reviews requests for new crosswalks and stop signs. The policy would describe the conditions under which new crosswalks and stop signs would be approved. Decisions would be informed by sound traffic engineering considerations such as traffic speeds and volumes on the streets involved; street grades, widths and other physical characteristics; amount of foot traffic; pedestrian travel paths and crossing patterns; and adequacy of sight lines and stopping sight distances.*

Per this recommendation in the PBMP, he intent of this document is to provide a policy for the installation of stop and yield signs and crosswalk markings within the City.

STOP AND YIELD SIGNS

One of the most widely accepted documents providing some guidelines for the installation of stop signs is the State of California Department of Transportation Manual on Uniform Traffic Control Devices (hereinafter referred to as "MUTCD".) The MUTCD provides recommended criteria for the installation of 2-way and 4-way stop signs at intersections as well as general applications for stop and yield signs; however it does not establish specific criteria for the installation of single-stop signs, 2-way stop signs on minor streets, and stop signs or yield signs for T-intersections. Given that Piedmont is in an urban area, it is recommended that stop signs should be placed at the minor street approaches at intersections. Accordingly, this would address single stop signs, 2-way stop signs and stop signs at T-intersections. All-way stops are commonly installed at the intersections of streets with similar traffic volumes or where justified by other criteria.

In addition to the MUTCD, another guiding document is the California Vehicle Code (hereinafter referred to as "CVC".) Specifically, Section 21100 of the CVC provides for the following the following guidance to local agencies for installation of traffic control devices (signage):

> *"21100. Local authorities may adopt rules and regulations by ordinance or resolution regarding all of the following matters:*
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> *(d) Regulating traffic by means of official traffic control devices meeting the requirements of Section 21400"*

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> *21400. (a) (1) The Department of Transportation shall, after consultation with local agencies and public hearings, adopt rules and regulations prescribing uniform standards and specifications for all official traffic control devices placed pursuant to this code, including, but not limited to, stop signs, yield right-of-way signs, speed restriction signs, railroad warning approach signs, street name signs, lines and markings on the roadway, and stock crossing signs placed pursuant to Section 21364.*

(2) The Department of Transportation shall, after notice and public hearing, determine and publicize the specifications for uniform types of warning signs, lights, and devices to be placed upon a highway by a person engaged in performing work that interferes with or endangers the safe movement of traffic upon that highway.
(3) Only those signs, lights, and devices as are provided for in this section shall be placed upon a highway to warn traffic of work that is being performed on the highway.
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21351. Local authorities in their respective jurisdictions shall place and maintain or cause to be placed and maintained such traffic signs, signals and other traffic control devices upon streets and highways as required hereunder, and may place and maintain or cause to be placed and maintained, such appropriate signs, signals or other traffic control devices as may be authorized hereunder or as may be necessary properly to indicate and to carry out the provisions of this code or local traffic ordinances or to warn or guide traffic.

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The purpose of stop signs is to control the right-of-way assignment at intersections, give preference to major traffic movements and to reduce the potential for some types of accidents. Stop signs are not installed for speed control purposes, but the speed of approaching vehicles is an important consideration relative to the sight distance and conflicting traffic movements at an intersection. The purpose of a yield sign is to control right-of-way assignments at intersections where control is advisable and a stop sign is not warranted or is unreasonably restrictive. Stop and yield sign installations should be consistent with the magnitude of traffic conflicts; their indiscriminate use results in unnecessary delay and energy usage.

CROSSWALK MARKINGS

In addition to a policy for the installation of stop and yield signs, the adopted PBMP also recommends that the City desires to adopt a policy for the installation of crosswalk markings. The intent of establishing a policy for installation of crosswalk markings is to ensure pedestrian safety. Section 275 of the CVC defines a crosswalk marking as follows:

"*Crosswalk is either: (a) That portion of a roadway included within the prolongation or connection of the boundary lines of sidewalks at intersections 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.*"

Furthermore, the CVC addresses certain specific local authority to establish crosswalk markings warrants to be used as guidelines for installing crosswalk markings near schools. Specifically, Section 21372 of the CVC states:

21372. The Department of Transportation and local authorities shall, with respect to highways under their respective jurisdictions, establish and promulgate warrants to be used as guidelines for the placement of traffic control devices near schools for the purpose of protecting students going to and from school. Such devices may include flashing signals. Such warrants shall be based upon, but need not be limited to, the following items: pedestrian volumes, vehicle volumes, width of the roadway, physical terrain, speed of vehicle traffic, horizontal and vertical alignment of the roadway, the distance to existing traffic control devices, proximity to the school, and the degree of urban or rural environment of the area.

Crosswalk markings are intended to provide guidance for pedestrians who are crossing roadways by defining and delineating paths on approaches to and within signalized intersections, and on approaches to other intersections where traffic stops. In conjunction with signs and other measures, crosswalk markings help to alert road users of a designated pedestrian crossing point across roadways at locations that are not controlled by traffic control signals or stop or yield signs. At non-intersection locations, crosswalk markings legally establish the crosswalk.

POLICY

GENERAL:

Only those intersections meeting certain criteria as specified in the MUTCD and this policy should be considered for stop or yield signs. The criteria contained herein have general national acceptance as factors to be analyzed to determine where stop or yield signs should be installed. In special situations, stop signs may not be advisable because of the adverse effect they could cause in a total area traffic pattern despite other justifying factors.

It is the policy of the City Council of the City of Piedmont that the installation of stop and yield signs shall be made using engineering judgment and safety considerations based upon the following criteria, and that such analyses, measurements, and computations as may be required in determining the appropriate traffic controls shall be the responsibility of the City Engineer, the Police Chief, the Public Works Director or their respective designee.

Warrants provide specific conditions where stop and yield signs should be considered. One or more of the following warrants are to be met to qualify for the installation of a stop sign. The satisfaction of a warrant does not mandate the installation of a stop or yield sign, nor does the non-satisfaction of a warrant prevent such installations, but should be used in conjunction with engineering judgement and safety when considering a location for installation of a stop sign.

The following outlines the proposed criteria for the installation of all-way stop signs, 3 stop signs at T-intersections, 2-way stop signs on minor streets, and single-stop locations. Stop sign installations may be considered if ANY of the following conditions exist:

A. STOP SIGNS

1. **Traffic Volume**

The minimum hourly average (for any eight hours) vehicular volume entering the intersection from all approaches on an average day and the vehicular volume entering the intersection from the minor street or streets for the same eight hours must meet the following criterion:

	Minimum Hourly Average from Major Street Approaches (vehicles per hour) [1]	Minimum Vehicular Volume from Minor Street(s) (fraction of total volume per hour minimum) including Vehicular, Pedestrian and Bicycle (combined)
All-Way Stop Signs	300	200 [2]
3-Way Stop Signs on T-Intersections	300	200

1. The minimum hourly average is for any eight hours, consecutive or non-consecutive.
2. Side street delay for the worst hour must equal 30 seconds or more

2. **Traffic and Pedestrian Volumes**

The minimum hourly average (for any eight hours) vehicular volume entering the intersection on the major approach and the pedestrian volume per hour crossing during the same eight hours must meet the following criterion:

	Minimum Hourly Average for the Major Approach (vehicles per hour)	Pedestrian Volume (pedestrians per hour)
All-Way Stop Signs	650	75 crossing the major approach
3-Way Stop Signs on T-Intersections	650	75 crossing the major approach

3. **Sight Distances**

The visibility warrant establishes the criteria for determining if an intersection has inadequate visibility to maintain safe traffic operations. Providing appropriate stopping sight distance reduces the likelihood of a collision at an intersection caused by a driver on the minor street crossing or entering the major street in the presence of oncoming traffic. An all-way stop controlled intersection would be warranted if one of more approaches provides less than 150 feet of sight distance upstream and downstream of the intersection on roadways with design speeds of less than 25 mph. For roadways with 25 mph design speeds or greater and approach grades of +/- 3%, an all-way stop controlled intersection would be warranted if one or more approaches have sight distances less than the stopping sight distance required in the American Association of State Highway and Transportation Officials' (AASHTO) *A Policy on Geometric Design and Highways and Streets*. The required stopping sight distance shall be:

Speed (mph)	**25**	**30**	**35**	**40**	**45**
Stopping Distance (ft)	155	200	250	305	360

Source: Exhibit 9-55: Design Intersection Sight Distance – Case B1 – Left Turn from Stop
These design speeds and design stopping distances are for roadways with grades between -3% and 3%, but guidelines for roadways on steeper grade are also included in AASHTO and can be calculated by adjusting the time gap for the design vehicle and the resulting intersection site distance.

For approach grades steeper than +/- 3%, the following adjustment factors shall be applied:

	Speed (mph)				
Approach Grade (%)	**25**	**30**	**35**	**40**	**45**
-6	1.1	1.1	1.1	1.1	1.1
-5	1.1	1.1	1.1	1.1	1.1
-4	1.0	1.1	1.1	1.1	1.1
-3 to +3	1.0	1.0	1.0	1.0	1.0
+4	1.0	1.0	1.0	0.9	0.9
+5	1.0	1.0	0.9	0.9	0.9
+6	0.9	0.9	0.9	0.9	0.9

Source: Exhibit 9-53: Adjustment Factors for Sight Distance Based on Approach Grade
Note: Based on ratio of stopping sight distance on specified approach grade to stopping sight distance on level terrain

4. **Collision History –** Five or more reported crashes in a 12-month period that are susceptible to correction by a multi-way stop installation. Such crashes include right-turn and left-turn collisions as well as right-angle collisions.

Additional Considerations
When determining whether to install a stop sign, there are a number of additional engineering considerations that may be considered in the evaluation. These factors include:

- **In Vicinity of High-Pedestrian Generator** – Installation of a stop sign may be justified at an intersection where any facility adjacent to that study intersection generates an unusually high concentration of pedestrian traffic. This may include the use of the intersection by school-aged children, the elderly or physically challenged pedestrians, or the presence of a facility such as a school, playground, park, shopping center, fire station, etc. The installation of a crosswalk marking may be considered with the installation of stop signs when near an identified high-pedestrian generator.
- **Unusual Intersection Geometrics** – Installation of a stop sign may be justified where unusual intersection design or geometrics (horizontal and/or vertical curves, or intersection offsets) exist.
- **Visible Signs of Issues** – Installation of a stop sign may be justified where visible signs of potential traffic problems exist, such as, skid marks, evidence of fixed object collisions, etc.
- **Volume Equilibrium** – Installation of a stop sign may be justified if the intersection approach volumes for the minor/major legs are nearly equivalent (e.g. 45%/55% of the total intersection volume).
- **Different Sight Distance Constraints** – Installation of a stop sign may be justified for intersections that have more than the required stopping sight distance, but less that the corner sight distance.

B. YIELD SIGNS

Yield signs should control the minor flow of traffic at an intersection. Yield signs should not be installed where there are stop signs on one or more approaches, except under special circumstances, to provide minor movement control within a complex intersection.

A yield sign may be warranted:

1. On a minor street entrance to an intersection where it is necessary to assign right-of-way to the major street where a stop is not necessary at all times and the safe approach speed on the minor street exceeds 10 mph; or
2. Where there is a separate or channelized right-turn lane, without an adequate acceleration lane.

C. CROSSWALK MARKINGS

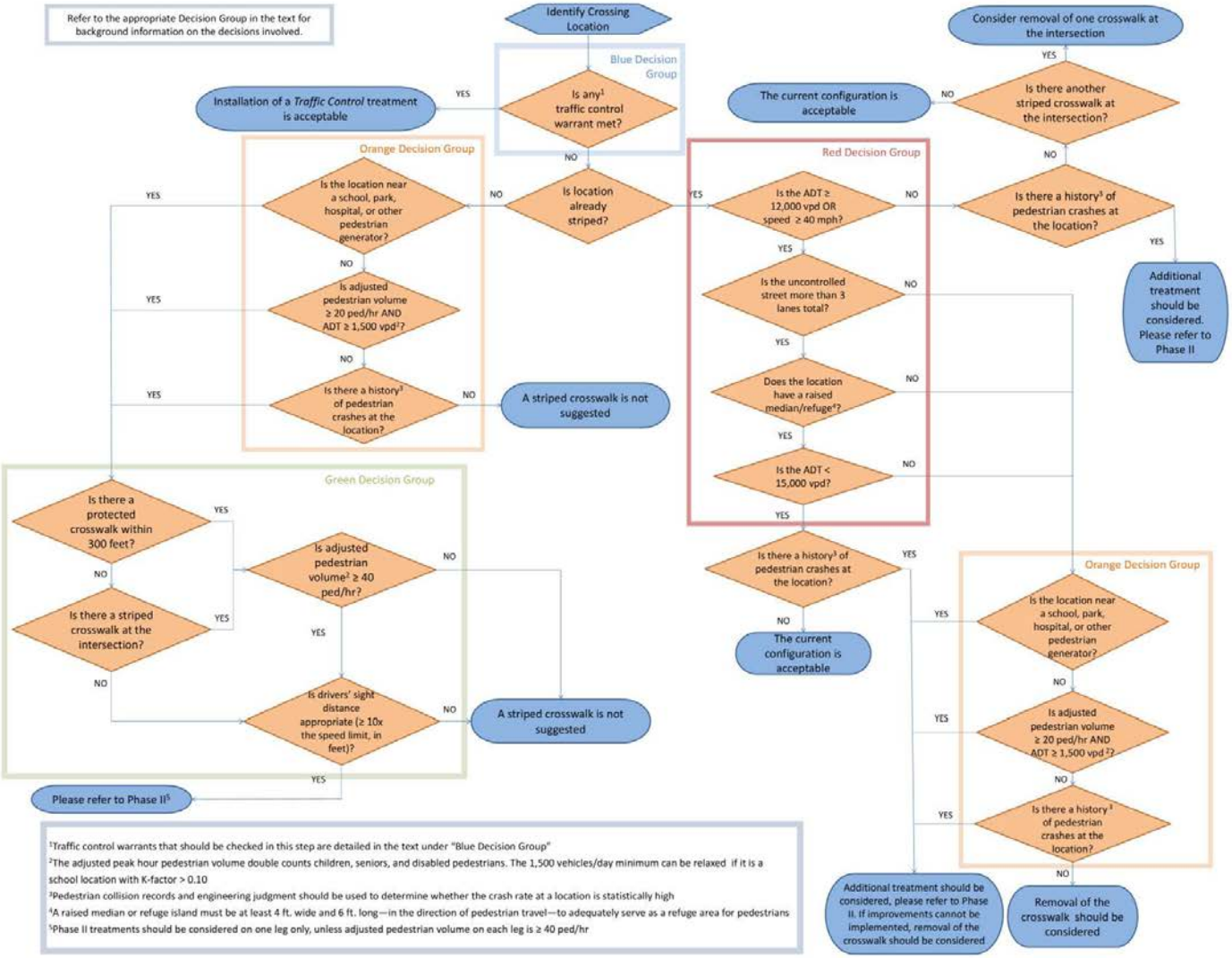
It is the policy of the City Council of the City of Piedmont that the installation of crosswalk markings shall be made using engineering judgment and safety considerations based upon the following criteria, and that such analyses, measurements, and computations as may be required in determining the appropriate traffic controls shall be the responsibility of the City Engineer, the Police Chief, the Public Works Director or their respective designees.

Crosswalk markings should be provided as required to delineate paths on approaches to and within signalized intersections and on approaches to other intersections where traffic stops. At "mid-block crossings", crosswalk markings legally establish the crosswalks and shall be used in conjunction with signs and other warning measures per the MUTCD.

At locations controlled by traffic control signals or on approaches controlled by stop or yield signs, crosswalk lines should be installed where engineering and safety judgment indicates they are needed to direct pedestrians to the proper crossing path(s). Crosswalk lines should not be used indiscriminately. An engineering study should be performed before a marked crosswalk is installed at a location that is not controlled by an existing traffic signal, stop sign or yield sign. The engineering study should consider the number of lanes, the presence of a median, the distance from adjacent signalized intersections, the pedestrian volumes and delays, the average daily traffic (ADT), the posted or statutory speed limit or 85th-percentile speed, the geometry of the location, the possible consolidation of multiple crossing points, the availability of street lighting, and other appropriate factors.

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

Piedmont Stop Sign and Crosswalk Policy



[1]Traffic control warrants that should be checked in this step are detailed in the text under "Blue Decision Group"

[2]The adjusted peak hour pedestrian volume double counts children, seniors, and disabled pedestrians. The 1,500 vehicles/day minimum can be relaxed if it is a school location with K-factor > 0.10

[3]Pedestrian collision records and engineering judgment should be used to determine whether the crash rate at a location is statistically high

[4]A raised median or refuge island must be at least 4 ft. wide and 6 ft. long—in the direction of pedestrian travel—to adequately serve as a refuge area for pedestrians

[5]Phase II treatments should be considered on one leg only, unless adjusted pedestrian volume on each leg is ≥ 40 ped/hr

When it has been determined that a crosswalk is necessary, crosswalk markings shall be installed per the MUTCD Section 3B.18 and City Standards. Yellow markings shall be used near schools per CVC 21368 as follows:

> Whenever a marked pedestrian crosswalk marking has been established in a street contiguous to a school building or the grounds thereof, it shall be painted or marked in yellow, as shall be all the marked pedestrian crosswalk markings at an intersection in case any one of the crosswalk markings is required to be marked in yellow. Other established marked pedestrian crosswalk markings may be painted or marked in yellow if either (a) the nearest point of the crosswalk marking is not more than 600 feet from a school building or the grounds thereof, or (b) the nearest point of the crosswalk marking is not more than 2,800 feet from a school building or the grounds thereof, there are no intervening crosswalk markings other than those contiguous to the school grounds, and it appears that the facts and circumstances require special painting or marking of the crosswalk markings for the protection and safety of persons attending the school. There shall be painted or marked in yellow on each side of the street in the lane or lanes leading to all yellow marked crosswalks the following words: "SLOW SCHOOL XING", except that such words shall not be painted or marked in any lane leading to a crosswalk marking at an intersection controlled by stop signs, traffic signals, or yield right-of-way signs.

New marked crosswalks across uncontrolled roadways should include other measures designed to reduce traffic speeds, shorten crossing distances, enhance driver awareness of the crossing, and/or provide active warning of pedestrian presence, and marked crosswalks should not be installed across uncontrolled roadways where the speed limit exceeds 40 mph and the roadway has four or more lanes of travel without a raised median or pedestrian refuge island and an ADT of 12,000 vehicles per day or greater. Because non-intersection pedestrian crossings are generally unexpected by the road user, warning signs (per MUTCD) should be installed for all marked crosswalks at non-intersection locations and adequate visibility should be provided by parking prohibitions.

ALTERNATIVE PROCESS:

Notwithstanding other provisions of this Policy, signs may be installed by this Alternative Process. If an intersection is found to not satisfy the criteria established above upon an initial evaluation, then the following process may be used:

1. Any resident of the City, business owner within the City, or community organization may request a re-evaluation, bringing forth any additional information that may cause the intersection to satisfy the criteria. The City Engineer, Public Works Director, Police Chief or their designee shall then re-evaluate the intersection based on this request, notify the requesting party of the results, and install the sign(s) if the criteria are satisfied.
2. If the criteria are not satisfied upon the re-evaluation, then the person or community organization may request consideration by the City Council. The City Engineer, Public Works Director and/or the Police Chief shall submit a report to the City Council discussing why the sign(s) is(are) not recommended. The City Council may subsequently adopt a resolution overriding the recommendations from the report and authorize the installation of the sign(s) at the intersection.
3. Signs may also be removed. Stop sign removal requests should follow steps 1 and 2 (above.) Stop signs installed by City Council resolution may only be removed by a subsequent resolution.
4. For signs installed or removed by City Council resolution, the City Engineer or designee shall submit a report analyzing traffic conditions at the location for the first year after the change.