DATE: March 30, 2022

TO: Bicycle/Pedestrian Advisory Committee

FROM: Priyoti Ahmed, Transportation Planner
              Ria Hutabarat Lo, Transportation Manager

SUBJECT: **Vision Zero Action Plan/Local Road Safety Plan**

RECOMMENDATION

Receive and review a report on the integrated Vision Zero Action Plan and Local Road Safety Plan and provide feedback on:

1.   The proposed Local Road Safety Plan countermeasures and Vision Zero Action Plan actions; and

2.   The prioritization framework for the Local Road Safety Plan.

BACKGROUND

On December 10, 2019, City Council adopted a Vision Zero Policy. Policy deliberation was supported by Vision Zero analysis, which examined crash data to identify the City's High Injury Network (HIN), key crash contributing factors, and other issues related to fatal and severe injury crashes (KSI). At the December 10, 2019 meeting, Council also received information on existing, recent, and proposed actions that might be included in a Vision Zero Action Plan (see Attachment 1). These actions include the 7Es: engineering, education, encouragement, engagement, emergency response, evaluation, and enforcement.

City staff is now developing an integrated Vision Zero Action Plan (VZAP) and Local Road Safety Plan (LRSP). This plan is a living document that provides a framework for identifying, analyzing, and prioritizing roadway safety improvements on local roads.

Based on Caltrans' direction, the LRSP approach utilizes a systemic safety analysis to identify engineering improvements that may be implemented at locations with similar characteristics to where respective KSI collisions have occurred. On January 27, 2021, the Bicycle/Pedestrian Advisory Committee (B/PAC) reviewed and provided feedback on the analysis of KSI crash data

from 2014 to 2019. This analysis identified primary collision factors, vulnerable users, and roadway characteristics associated with fatal and severe injury crashes.

ANALYSIS

In 2020, the City hired a consultant to prepare an integrated VZAP and LRSP. VZAPs typically use a multi-pronged hot spot approach to transportation safety by addressing key factors in behaviors (such as DUI, speeding, and encroaching in pedestrian rights-of-way) and improving corridors on the HIN using the 7Es. By comparison, LRSPs use a systemic infrastructure approach to transportation safety by identifying locations with similar characteristics or movements to where KSI collisions have occurred and treating these locations with engineering countermeasures. Key steps in developing an LRSP include:

- Identification of roadway and land use factors associated with KSI crashes;

- Systemic analysis of locations featuring these roadway and land use factors;

- Compilation of proven safety countermeasures and conditions under which these countermeasures would be applied;

- Development of prioritization criteria; and

- Prioritization of projects identified by applying countermeasures to locations.

Identification of Roadway and Land Use Factors

The LRSP process is an iterative process that produces systemwide recommendations based on the types of traffic crashes that occurred within a certain geographic area and time period. In this case, the systemic safety analysis included all crashes that occurred on roadways in Mountain View between 2014 and 2019. The crash data was obtained from the Transportation Injury Mapping System (TIMS), which is maintained by UC Berkeley, and typically has a time lag of approximately three years. This time lag reflects the considerable time that it takes to complete Police investigations, determine primary collision factors, submit local information to the Statewide system, compile information at the State level, and process data into a complete geocoded database.

Based on the crash data analysis from 2014 to 2019, the following roadway and land use factors were associated with a higher than average incidence of KSI collisions in the City:

- Streets with a posted speed of 35 mph or above (20% of streets in Mountain View, 73% of KSI crashes);

- Intersections of 35 mph streets with 25 mph streets (50% of KSI crashes);

- Signalized intersections (30% of KSI crashes);

- Two-way, stop-controlled intersections (18% of all KSI crashes, 45% of KSI crashes involving people walking); and

- Commercial areas and Precise Plan areas, including downtown Mountain View (60% of crashes, about 40% of land area).

Table 1 identifies the specific segments of the City's network that have the highest KSI crash rate per mile, along with roadway and land use factors, and common crash types.

Table 1: High Crash Street Segment (Ranked by KSI Crash per Mile) (2014-2019)

Location	Ped/Bike Crashes	KSI Crashes	KSI Crashes per Mile	Roadway and Land Use Factors	Common Crash Types
East El Camino Real (east of Grant Road)	61	9	10.04	• 40 mph • Commercial/ Precise Plan area	• Driver right turn with pedestrian • Driver left turn (motor vehicle only)
Ellis Street	16	4	5.68	• 40 mph • Commercial/ Precise Plan area	• Driver ran off road • Motorcycle involved
North Rengstorff Avenue (Central Expressway to Middlefield Road)	45	3	4.69	• 35 mph • Commercial/ Precise Plan area	• Driver left turn with bicyclist or pedestrian • Pedestrian crossing between intersections
Amphitheatre Parkway	23	3	4.45	• 35 mph	• Driver proceeding straight with bicyclist
North Shoreline Boulevard (Central	33	3	4.42	• 35 mph • Commercial/ Precise Plan area	• Driver ran off road • Driver left turn with a bicyclist

Location	Ped/Bike Crashes	KSI Crashes	KSI Crashes per Mile	Roadway and Land Use Factors	Common Crash Types
Expressway to Middlefield Road)					
El Monte Avenue	13	2	4.34	• 35 mph • Commercial/ Precise Plan area	• Driver proceeding straight with pedestrian crossing crosswalk
California Street (Rengstorff Avenue to Shoreline Boulevard)	34	4	4.31	• 35 mph	• Driver and bicyclist involved
South Rengstorff Avenue (El Camino Real to Central Expressway)	44	2	3.55	• 35 mph • Commercial/ Precise Plan area	• Driver and bicyclist involved
San Antonio Road	30	2	3.48	• 35 mph • Commercial/ Precise Plan area	• Driver collides with bicycle or pedestrian at a signalized intersection
Castro Street	54	4	3.46	• Commercial/ Precise Plan area	• Driver collides with pedestrian crossing between intersections

Roadway and Land Use Factors for Crashes involving People Walking and Biking

Both the Vision Zero crash analysis and LRSP systemic analysis found that people walking and biking are disproportionately affected by fatal and severe injury crashes. The location of crashes involving pedestrians and bicyclists during the study period are displayed in Figure 1.

Figure 1: Crash Locations for Walking and Biking, 2014-2019

As shown in Table 2, key factors associated with higher-crash intersections for people walking and biking include intersections between higher- and lower-speed roads and intersections in commercial or precise plan areas. The Sylvan Avenue/El Camino Real intersection had two KSI crashes involving someone walking or biking while nearly all the other listed intersections had one KSI in the 2014-2019 study. The intersection of Shoreline Boulevard/Villa Street, which had the highest number of crashes involving pedestrians and bicycles, currently has a pedestrian/bicycle improvement project under construction funded by the State Transportation Development Act (TDA3) and Federal Highway Safety Improvement Program (HSIP) grants.

Table 2: High-Crash Intersections for People Walking and Biking, 2014-2019

Location	Ped/Bike Crashes	KSI Crashes	Roadway and Land Use Factors	Common Crash Types
Shoreline Boulevard and Villa Street	9	0	• Signalized • 35 mph with 30 mph	• Driver left turn with bicyclist or pedestrian crossing crosswalk.
Showers Drive and Latham Street	6	1	• Two-way Stop • 35 mph with 25 mph • Commercial/ Precise Plan area	• Driver and bike proceeding straight (broadside). • Driver left turn or proceeding straight with a pedestrian crossing crosswalk.
Rengstorff Avenue and Latham Street	5	1	• Signalized • 35 mph with 25 mph	• Driver left turn with pedestrian crossing crosswalk.
Charleston Road and Huff Avenue	5	1	• Signalized • 35 mph with 25 mph • Commercial/ Precise Plan area	• Driver left turn with pedestrian crossing crosswalk.
El Monte Avenue and Marich Way	4	1	• Two-way Stop • 35 mph with 25 mph	• Driver collides with pedestrian crossing in a crosswalk.
El Camino Real and Dale Avenue	3	1	• Two-way Stop • 30 mph with 40 mph • Commercial/ Precise Plan area	• Driver right turn with pedestrian crossing crosswalk.

Location	Ped/Bike Crashes	KSI Crashes	Roadway and Land Use Factors	Common Crash Types
Sylvan Avenue/The Americana and El Camino Real	3	2	• Signalized • 40 mph with 25 mph • Commercial/Precise Plan area	• Driver right turn with bicyclist proceeding straight.
San Antonio Road and Fayette Drive	3	1	• Signalized • 35 mph with 25 mph • Commercial/ Precise Plan area	• Driver collides with bicyclist.
Ortega Avenue and Latham Street	3	1	• Commercial/Precise Plan area	• Driver left turn with pedestrian crossing crosswalk.

Roadway and Land Use Factors for Crashes involving Motorists

High-crash intersections for motor vehicles include all intersections where a crash resulted in a fatality or severe injury; as well as all intersections with more than seven motor-vehicle-only crashes in the 2014-2019 analysis period.

Table 3: High-Crash Intersections for Motor Vehicles (2014-2019)

Location	Total Motor Vehicle Crashes	Motor Vehicle KSI Crashes	Roadway and Land Use Factors	Common Crash Types
Middlefield Road and State Route 237 on-/off-ramps	43	2	• Signalized • 35 mph with 35 mph	• Broadside • Signal violation
Franklin Street and California Street	10	0	• Two-way stop • 35 mph with 25 mph	• Broadside • ROW violation
El Camino Real and Shoreline Boulevard	10	0	• Signalized • 25 mph with 35 mph	• Broadside • Signal violation
Plymouth Avenue and Joaquin Road	8	0	• Two-way stop • 25 mph with 25 mph	• Broadside • ROW violation

Location	Total Motor Vehicle Crashes	Motor Vehicle KSI Crashes	Roadway and Land Use Factors	Common Crash Types
West El Camino Real and Phyllis Avenue	8	0	• Signalized • 30 mph with 25 mph	• Unsafe speed/Rear end • Signal violation/Broadside
Moffett Boulevard and Central Avenue	6	1	• Signalized • 35 mph with 25 mph	• Broadside • Signal or ROW violation
Rengstorff Avenue and Old Middlefield Way	5	1	• Signalized • 35 mph with 35 mph	• Broadside • Signal violation
Moffett Boulevard and State Route 85 ramp	3	1	• Signalized • 40 mph with 20 mph	• Broadside • Signal violation
Chiquita Avenue and California Street	2	1	• Two-way stop • 25 mph with 35 mph	• Broadside • ROW violation
Castro Street and El Camino Real	1	1	• Signalized • 30 mph with 35 mph	
Ellis Street and Fairchild Drive	1	1	• Two-way stop • 40 mph with 25 mph	• Wrong side of the road

Systemic Analysis of Locations Featuring Roadway and Land Use Factors

Based on the roadway and land use factors identified above, other locations throughout the City that share these characteristics have been identified as mapped in Figure 2.

Figure 2: Locations with Key Roadway and Land Use Factors

Toolbox of Proven Safety Countermeasure

To reduce fatal and severe injury crashes, the Federal Highway Administration (FHWA) developed a list of infrastructure-oriented safety treatments with proven effectiveness and benefits. The FHWA recently updated the list of Proven Safety Countermeasures in 2021, with a crash reduction factor (CRF) identified for each strategy. The CRF is the percentage of crash reduction that might be expected after implementing a given countermeasure.

The table below summarizes the proven safety countermeasures best suited to address fatal and severe injury crashes in Mountain View. All countermeasures are already implemented or planned in certain areas of the City.

Table 4: Proven Countermeasures

Countermeasure	Description	Benefit
Leading Pedestrian Interval (LPI)[1]	Provides pedestrians a 3 to 10 second head start when entering a signalized crossing, by presenting the "walk" sign while vehicle traffic has a red light in all directions.	• Reduces crashes by 13%. • Increases visibility. • Reduces conflicts between drivers and pedestrians.
Protected Left Turn[2]	Separates vehicle and pedestrian movements by providing separate signal phases for pedestrians and left-turning motorists.	• Reduces crashes by 99%. • Increases visibility. • Reduces conflicts between drivers and pedestrians.
Curb Radius Reduction	Reduces curb radius at corners, which requires motorists to reduce vehicle speed by making sharper turns.	• Reduces vehicle turn speed. • Aligns curb ramps with crosswalk.
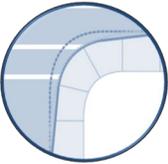
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[1] Federal Highway Administration (FHWA). Leading Pedestrian Interval (LPI) Countermeasure Tech Sheet. Safe Transportation for Every Pedestrian. October 2019. FHWA-SA-19-040.

[2] FHWA. 2008. Toolbox of Countermeasures and Their Potential Effectiveness for Pedestrian Crashes. https://safety.fhwa.dot.gov/ped_bike/tools_solve/ped_tctpepc/

Countermeasure	Description	Benefit
Curb Extensions	Narrows the roadway or intersection and creates more space for pedestrians to wait and a shorter crossing distance.	• Increases visibility. • Reduces vehicle speed. • Encourages crossing at designated locations. • Shortens crossing distance. • Prevents drivers from parking at corners.
High-Visibility Crosswalks[3]	Provides high-visibility elements such as striped crosswalk markings, pavement markings, lighting, and advanced or in-street warning signage.	• Reduces crashes by 23-48%. • Increases visibility. • Increases driver awareness.
Medians and Pedestrian Crossing Islands[4]	Provide areas between opposing lanes of traffic to separate pedestrians and bicyclists from oncoming motorists and limit exposure to moving vehicles.	• Reduces crashes 46% at medians or 56% at islands. • Increases visibility. • Encourages crossing at designated locations. • Reduces crossing distance. • Increases driver awareness.
Rectangular Rapid Flash Beacons (RRFB) [5]	When activated by pedestrians or bicyclists, provide high-visibility LED strobe-like warning to drivers when pedestrians and bicyclists use a crosswalk at mid-block crossings or unsignalized intersections.	• Reduces crashes by 47% at major streets. • Increases visibility. • Increases driver awareness. • Encourages crossing at designated locations.

[3] FHWA. 2018. Crosswalk Visibility Enhancements.
https://safety.fhwa.dot.gov/ped_bike/step/docs/TechSheet_VizEnhancemt_508compliant.pdf
[4] FHWA. 2018. Pedestrian Refuge Island.
https://safety.fhwa.dot.gov/ped_bike/step/docs/techSheet_PedRefugeIsland2018.pdf
[5] Rectangular Rapid-Flashing Beacon (RRFB). 2017.
http://pedbikesafe.org/PEDSAFE/countermeasures_detail.cfm?CM_NUM=54

Countermeasure	Description	Benefit
Pedestrian Hybrid Beacon (PHB)	A traffic control device activated by pedestrians and bicyclists that makes drivers aware of pedestrians crossing the street at uncontrolled marked crosswalk locations.	• Reduces crashes by 29%, 55% for pedestrians, 15% for KSI.[6] • Increases visibility. • Increases driver awareness. • Encourages crossing at designated locations.
Bike Signal Phase	Provides separate signal phase for bicycle movements at intersections.	• Reduces right-hook conflicts between turning vehicles and bicyclists traveling straight. • Increases bicyclist visibility.
Bike Box Treatments at Intersections	Designates space at the head of a traffic lane at a signalized intersection to provide bicyclists with visible space ahead of queuing traffic and tailpipe emissions during the red signal phase, or space to wait during two-stage left turns.	• Increases bicyclist visibility. • Provides designated space for bicyclists to wait. • Increases driver awareness of bicyclists.
Protected Intersection	Keeps bicycles separated from motor vehicles up until the intersection, providing a high degree of comfort and safety for people of all ages and abilities.	• Reduces vehicle turning speed. • Improves sight lines. • Reduces conflict points and bicyclist exposure
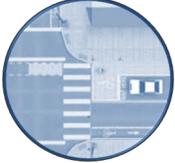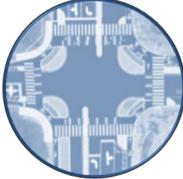
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[6] FHWA. 2018. Pedestrian Hybrid Beacon.
https://safety.fhwa.dot.gov/provencountermeasures/pdf/17_Pedestrian%20Hybrid%20Beacons_508.pdf

Countermeasure	Description	Benefit
Class IV Protected Bikeways	Provides a physical separation between bicyclists and motor vehicle traffic using on-street parking, curbs, delineators, or landscaping. Protected bike lanes may be one-way or two-way and are sometimes referred to as cycle tracks.	• Reduces crashes by 49% on four-lane roads and 30% on two-lane roads.[7] • Improves bicyclist visibility and comfort. • Increases driver awareness of people walking or biking. • Reduces conflict points between drivers and bicyclists.
Road Diet	Reallocates roadway space to accommodate traffic volumes and users in fewer mixed-purpose motor vehicle lanes, i.e., reducing the number of through lanes, while maintaining intersection quality of service for all modes.	• Crash reduction of 19% to 47%. • Increases spaces of sustainable modes, such as bicyclist, pedestrian, and transit. • Reduces speed.
Bicycle Boulevard	Provides shared lane markings, wayfinding signs, traffic calming and diverters on streets with low volume and speeds to reduce through traffic, reduce vehicle speeds and prioritize vulnerable road users.	• Reduces vehicle speeds. • Reduces traffic volumes. • Increases driver awareness of bicyclists. • Improves bicycle connectivity.

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[7] FHWA. 2018. Bicycle Lane. https://safety.fhwa.dot.gov/provencountermeasures/pdf/PSC_New_Bicycle%20Lanes.pdf

| Countermeasure		Description	Benefit
Access Management		Consolidates driveways or employs medians to restrict access to right-in/right-out turning movements at driveways or intersections	• Reduces the frequency and magnitude of conflict points at intersections and driveways.
Improved Intersection Lighting, Extension Lines, and Signage		Includes intersection lighting, extension lines for turning vehicles and roadway signage to enhance visibility of medians, crosswalks, and other vehicles at intersections.	• Increases visibility. • Directs drivers for different lanes and direction.
Impaired Driving Policies		Coordinates local, regional, and State partners for policy and education action and implements strategies such as place of last drink (POLD) survey to provide data for interventions.	• Reduces crashes due to DUIs, which represent 40% of all traffic fatalities in California.
Reduce Speed Limit by 5 mph		Employs the option of reducing posted speed by 5 mph relative to the 85th percentile speed near schools or senior centers per California Manual of Uniform Traffic Control Devices (CA MUTCD).	• Reduces speed where applicable. • Increases pedestrian and bicyclist comfort.
25 mph Business and Residential District		Sets prima facie speed limit to 25 mph in school zones, business and residential areas, and areas near senior centers in conjunction with traffic calming per CA MUTCD 2B.13.	• Implements slow speed where applicable. • Increases pedestrian and bicyclist comfort.

| Countermeasure	Description	Benefit
Traffic Calming	Reduces average vehicle speed and eliminates high vehicle speeds using vertical and horizontal deflections, including speed humps, traffic circles, and raised intersections on local and collector residential streets.	• Reduces speed where applicable. • Increases pedestrian and bicyclist comfort. • Increases driver's awareness of people walking or biking.

Application of Countermeasures to Various Crash Types

Common crash types in Mountain View could be addressed through countermeasures as indicated in Table 5. Based on the systemic safety analysis, these strategies will be applied to specific locations in order develop a list of priority projects for the Local Road Safety Plan. These projects will be supplemented with targeted 7Es approaches to develop an integrated Vision Zero Action Plan and Local Road Safety Plan.

**Table 5: Summary of the Most Common Fatal and
Severe Crash Types and Potential Countermeasures**

Crash Types	Illustration	Potential Countermeasures
Driver making left turn and pedestrian crossing in a crosswalk at a signalized intersection		• Pedestrian signal improvements (leading pedestrian interval and decreased walking speed) • Protected left turn • Curb radius reduction or curb extension • High-visibility crosswalk • Median and crossing island • Protected intersection

Crash Types	Illustration	Potential Countermeasures
Driver proceeding straight and pedestrian in a crosswalk at a two-way, stop-controlled intersection		• Curb radius reduction or curb extensions • High-visibility crosswalk • Median and crossing island • Rectangular Rapid Flashing Beacon • Pedestrian hybrid beacon
Driver proceeding straight and pedestrian crossing between intersections		• New or improved midblock crossing • Curb extensions • High-visibility crosswalk • Rectangular Rapid Flashing Beacon • Pedestrian hybrid beacon
Bicyclist proceeding straight broadsided by a driver at a signalized intersection		• Protected left turn • Median and crossing island • Bike signal phase • Bike treatments at intersections • Protected intersection
Bicyclist involved between intersections		• Class IV protected bike lanes • Road diet • Bicycle boulevard • Access management
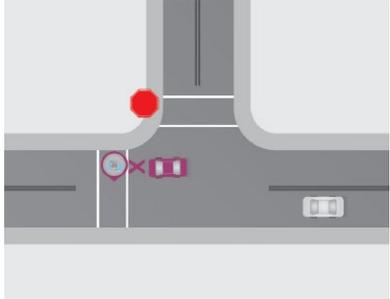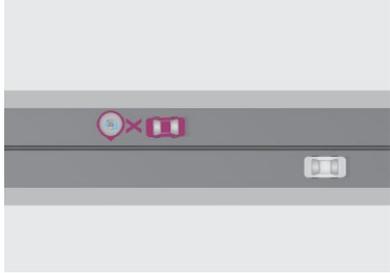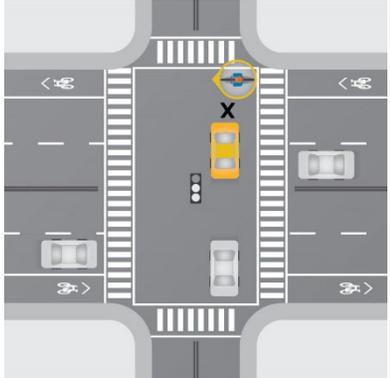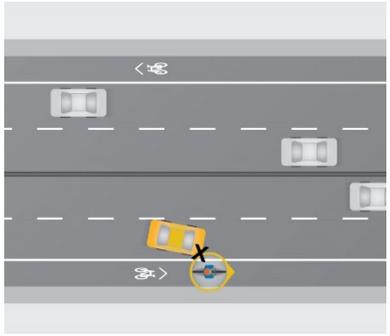
Crash Types	Illustration	Potential Countermeasures
Driver Turning Right, Bicyclist Crossing (right hook)		• Curb radius reduction or curb extensions • Leading pedestrian interval and decreased walking speed • Bike signal phase • Bike treatments at intersections • No Right Turn on Red (NRTOR) signs
Motor vehicle broadside between intersections (assumed to be at driveways)		• Road diet • Access management
Drivers runs off road and/or the wrong side of the road		• Enhanced delineation • Improved Intersection Lighting, Extension Lines, and Signage
Alcohol or drug intoxication		• Impaired Driving Policies
Speed Management		• Curb radius reduction or curb extensions • Road diet • Bicycle boulevards • Reduce Speed Limits by 5 mph • 25 mph business or residential district • Traffic calming measures
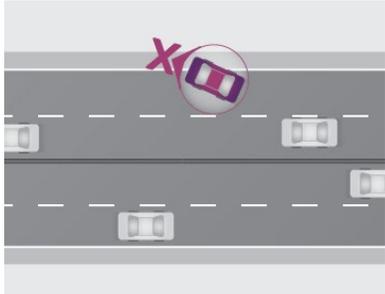
Project Prioritization Criteria

Based on the systemic safety analysis and historic crash analysis, the countermeasures will be applied to specific locations to develop a list of projects. The project list will include historic KSI crash locations as well as other location(s) identified through the systemic safety analysis process. This approach will help the City to proactively implement improvements that enhance safety.

The project prioritization criteria will be used to evaluate the project list and recommend five grant-ready (detailed project scope, project completion cost estimates, and implementation schedule and funding strategy) projects. Suggested project prioritization criteria include:

1. Severity of Crashes–This category includes the severity of crashes from the historical crash analysis. This criterion is consistent with City's Vision Zero policy and Caltrans Local Road Safety Plan goals and metrics.

2. Proven Effectiveness–This category includes cost and benefits analysis for different safety improvements. FHWA has different proven effectiveness for different countermeasures. Through this criterion, there will be a determination of what is the planning-level cost of implementation versus its proven effectiveness.

3. Equity–This goal is consistent with City's General Plan related to improving equity throughout the City. The metrics associated with equity are income and vulnerable road users (i.e., bicyclists, pedestrians, seniors, youth, and people with disabilities).

4. Proximity to Key Destinations–This category improves accessibility to destinations that are pedestrian and bicyclist attractors and locations that should be accessible for all modes of transportation. Key destinations include schools, parks/open spaces, commercial centers, senior centers, senior living communities, healthcare facilities, and libraries.

5. Implementation–This category includes the implementation feasibility of different safety improvements. The metric includes the potential to leverage ongoing City efforts such as planned CIPs, development projects, or ongoing maintenance efforts, project completion time frame, and degree of agency coordination.

Table 6: Project Prioritization Criteria

Priority Criteria	Metric
Severity of Crash	• Fatal • Severe Injury • Minor Injury
Proven Effectiveness	• Crash reduction factor • Planning-level cost
Equity	• Median Household Income • Vulnerable Road Users–Bicycle and Pedestrian
Proximity to Key Destinations	• Schools • Parks/Open Spaces • Commercial centers • Senior centers and senior living communities • Health-care facilities • Libraries
Ease of Implementation	• Potential to Leverage Planned CIPs or Ongoing Development Projects • Project Time Frame • Degree of Agency Coordination

DISCUSSION

Staff seeks B/PAC input on the following key questions:

1. Are there any other Local Road Safety Plan (LRSP) countermeasures (Table 4) or Vision Zero Action Plan (VZAP) actions (Attachment 1) suggested for staff to evaluate to address the different crash types in Mountain View?

2. Does the B/PAC concur with the prioritization criteria for the LRSP?

NEXT STEPS

City staff will evaluate and incorporate community feedback and B/PAC feedback on the countermeasures and the prioritization criteria. In the upcoming months, staff will develop a list of projects and apply the revised prioritization criteria to recommend and provide details for five

grant-ready projects for this study. Staff will return with an updated project list in July to seek feedback from the community and B/PAC.

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Attachment: 1.   Initial Vision Zero Action Plan Items