

Memorandum

From: Staff
To: Rail Expanded Community Advisory Panel (XCAP)
Date: April 16, 2020
Subject: Staff Update: Follow Up to XCAP Criteria Questions

The XCAP created small [working groups](#) to discuss various parts of their work to be most efficient in their research to meet the original April 30, 2020 deadline set by the City Council. One working group, the Existing Policies working group, also focused on the City Council Adopted Criteria (explained below).

The XCAP Existing Policies working group brainstormed how they would like to approach the criteria to help the XCAP in the recommendation-making process. The group considered trying to add weights to each criterion but decided not to do that. The group also considered compiling XCAP suggestions to take to City Council to get the criteria updated, but were concerned that such a process would not align with the overall XCAP timeframe. Thus, the working group decided not to pursue that option and instead presented criteria-related questions to staff in January 2020. Staff responded to those questions (link: <https://connectingpaloalto.com/wp-content/uploads/2020/01/SharedatMeeting-Measurable-Criteria-Questions-with-staff-responses-jan.15.20.pdf>).

As a follow up to staff's responses, the XCAP wanted to know if there were metrics or measurements in existing plans, such as the City's 2030 Comprehensive Plan, or collected by the City in the normal course of business that the group could use in their analysis. They requested that staff do this work for them.

Staff researched this information and found that there is very limited information responsive to this request. Some of the data requested was collected for specific projects at a certain point in time and not collected on an ongoing basis as a part of regular city business, as suggested. Other information requested is simply not applicable to the task of rail grade separation. Staff's findings are explained in this memo.

Background on City Council-Adopted Criteria:

The City Council adopted evaluation criteria in September 2017. The criteria are shown below. The 2017 staff report: <https://www.cityofpaloalto.org/civicax/filebank/documents/61108> explains how the City Council determined the evaluation criteria. The criteria have been used consistently since adoption by the City Council to guide the evaluation of alternatives. Specifically, the Council-Adopted criteria has been used in the evaluation matrices related to each of the alternatives still under [consideration as shown in the Fact Sheets \(link: https://connectingpaloalto.com/fact-sheets/\)](#) and the Summary of Evaluation Fact Sheet.

Tier 1 Criteria: Most Important

Technical

Financial

- East-West connectivity: facilitate movement across the corridor for all modes of transportation
- Traffic congestion: reduce delay and congestion for automobile traffic at rail crossings
- Ped/Bike circulation: provide clear and safe routes for pedestrians and bicyclists seeking to cross the rail corridor, separate from automobile traffic
- Rail operations: support continued rail operations and Caltrain service improvements
- Cost: finance with feasible funding sources

Tier 2 Criteria: Also Important

Property

Construction

- Environmental impacts: reduce rail noise and vibration along the corridor
- Environmental impacts: minimize visual changes along the rail corridor
- Local access: maintain or improve access to neighborhoods, parks, schools and other destinations along the corridor while reducing regional traffic on neighborhood streets
- Cost: minimize right-of-way acquisition by eminent domain
- Construction: minimize disruption and the duration of construction



Findings:

The material provided in this brief memorandum summarizes what staff could find as general guidance from the 2030 Comprehensive Plan, the 2012 Pedestrian and Bicycle Transportation Plan, or other recent plans that seem relevant. Overall, there are not many known metrics from which the XCAP can rely. As stated above, some of the data was collected for specific projects at a certain point in time and not collected on an ongoing basis as a part of regular city business or the information is simply not applicable to the task of rail grade separation.

Items covered in this memo and the City Council-Adopted criteria to which they relate:

Measurement	Related City Council-Adopted Criteria
Level of Service (LOS)	A: Facilitate movement across the corridor for all modes of transportation. B: Reduce delay and congestion for vehicular traffic at rail crossings. C: Provide clear, safe routes for pedestrians and cyclists crossing the rail corridor, separate from vehicles. H: Maintain access to neighborhoods, parks, and schools along the corridor, while reducing regional traffic on neighborhood streets.
Noise	G: Reduce rail noise and vibration. I: Minimize visual changes along the corridor. J: Minimize disruption and duration of construction.
Construction Noise	J: Minimize disruption and duration of construction.
Scenic Routes	I: Minimize visual changes along the corridor.

Level of Service:

Level of Service, or LOS, is a qualitative measure used to relate the quality of motor vehicle traffic service. LOS is used to analyze roadways and intersections by categorizing traffic flow

and assigning quality levels of traffic based on performance measures like vehicle speed, density, congestion, etc. Motor vehicle LOS is a way of measuring traffic congestion based on average control delay per vehicle, and in some analyses, based on the ratio of the volume of traffic to the capacity of the road. LOS A is a free-flowing condition for cars and LOS F is an extreme congestion condition, with traffic volumes at or over capacity. LOS definitions for signalized intersections are shown in the 2030 Comprehensive Plan Table T-1 (also copied below). Policies in the Comprehensive Plan Transportation Element ensure that the City will continue to use vehicular LOS at local intersections when evaluating development applications, including a project’s potential contribution to cumulative LOS.

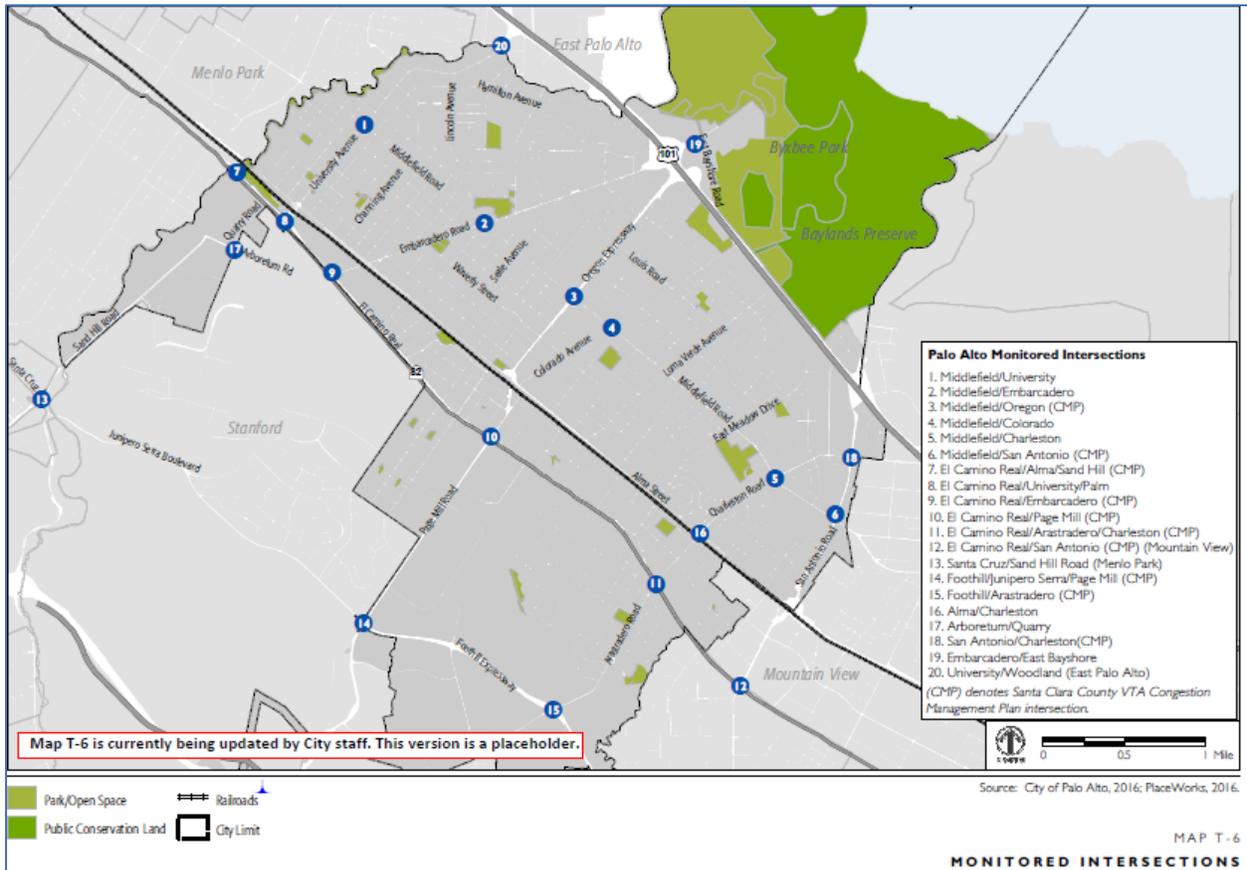
TABLE T-1 SIGNALIZED INTERSECTION LOS DEFINITIONS BASED ON AVERAGE DELAY	
LOS	Average Control Delay Per Vehicle (Seconds)
A	10.0 or less
B	10.1 to 20.0
C	20.1 to 35.0
D	35.1 to 55.0
E	55.1 to 80.0
F	Greater than 80.0

Source: Transportation Research Board, 2000 Highway Capacity Manual. Washington, D.C. 2000.

Source: 2030 Comprehensive Plan

The City collects LOS regularly at 22 intersections to understand the general traffic flow in the community and plan necessary improvements. The 2030 Comprehensive Plan (pages 70-71) states the following in Policy T-1.24 related to City Council-Rail Adopted Criteria A, B, C (bikes), and H:

Monitor and publicly report on the level of service at critical intersections (as shown on Map T-5) on a regular basis and consider additional intersections to add to this list to monitor the effectiveness of the City's growth management policies. Also monitor multi-modal level of service for arterials and residential arterials.



Source: 2030 Comprehensive Plan

Outside of the traditional LOS collection at these intersections, the City collects traffic data as well as bicycle data for specific projects as those projects come up. An example is the traffic data collected for the Castilleja School Project. The table below from the Castilleja School Project Draft Environmental Impact Report (EIR) shows LOS definitions and the following table shows the LOS at nearby intersections at key times in the day.

LOS Example: Castilleja School Project Draft EIR LOS Definitions:

**Table 7-2
Level of Service Definitions and Roadway Conditions**

LOS	Signalized Intersection	Two-Way Stop-Controlled Intersection
A	Uncongested operations, all queues clear in a single-signal cycle. Delay of less than 10.1 seconds	Little or no delay. Gaps in traffic are readily available for drivers exiting the minor street Delay of 0 to 10 seconds
B	Uncongested operations, all queues clear in a single cycle.	Free flow, presence of other vehicles noticeable. Gaps in traffic are somewhat less readily available than with LOS A, but no queuing occurs on the minor street. Delay of 10 to 15 seconds
	LOS B+ Delay between 10.1 and 12.0 seconds	
	LOS B Delay between 12.1 and 18.0 seconds	
	LOS B- Delay between 18.1 and 20.0 seconds	
C	Light congestion, occasional backups on critical approaches.	Average traffic delays. Ability to maneuver and select operating speed affected. Delay of 15 to 25 seconds
	LOS C+ Delay between 10.1 and 12.0 seconds	
	LOS C Delay between 12.1 and 18.0 seconds	
	LOS C- Delay between 18.1 and 20.0 seconds	
D	Significant congestion of critical approaches but intersection functional. Cars required to wait through more than one cycle during short peaks. No long queues formed.	Long traffic delays. Unstable flow, speeds and ability to maneuver restricted. There are fewer acceptable gaps in traffic, and side streets may experience queues of one or two vehicles. Delay of 25 to 35 seconds
	LOS D+ Delay between 35.1 and 39.0 seconds	
	LOS D Delay between 39.1 and 51.0 seconds	
	LOS D- Delay between 51.1 and 55.0 seconds	
E	Severe congestion with some long standing queues on critical approaches. Blockage of intersection may occur if traffic signal does not provide for protected turning movements. Traffic queue may block nearby intersection(s) upstream of critical approach(es).	Very long traffic delays with intersection at or near capacity. Few acceptable gaps in traffic are available and longer queues may form on the side street. Delay of 35 to 50 seconds
	LOS E+ Delay between 55.1 and 60.0 seconds	
	LOS E Delay between 60.1 and 75.0 seconds	
	LOS E- Delay between 75.1 and 80.0 seconds	
F	Total breakdown, stop-and-go operation. Delay greater than 80.0 seconds	Drivers may wait for long periods before there is an acceptable gap in traffic for exiting the side streets, creating long queues. Delay of more than 50 seconds

Source: Appendix E

LOS Example: Castilleja School Project Draft EIR Existing LOS at Key Intersections

**Table 7-3
Existing Peak Hour Intersection Levels of Service**

Intersection <i>Approach</i>	Control Type	AM Peak		School PM Peak		PM Peak	
		Delay	LOS	Delay	LOS	Delay	LOS
El Camino Real/ Embarcadero Rd	Signal	39.9	D	41.2	D	42.6	D
Embarcadero Rd Spur/ Alma St	TWSC	2.2	A	1.0	A	0.8	A
<i>Westbound (Embarcadero)</i>		54.5	F	20.4	C	25.3	C
Alma St/Kingsley Ave	TWSC	1.4	A	1.3	A	4.3	A
<i>Westbound (Kingsley)</i>		70.5	F	43.2	E	**	F
Embarcadero Rd/ Emerson St	TWSC	0.6	A	0.4	A	0.6	A
<i>Northbound (Emerson)</i>		14.7	B	13.8	B	13.4	B
Embarcadero Rd/ Bryant St	Signal	13.1	B	12.0	B+	11.5	B+
Middlefield Rd/ Embarcadero Rd	Signal	38.5	D+	35.4	D+	39.7	D
Melville Ave/ Emerson St	TWSC	3.2	A	3.6	A	3.0	A
<i>Westbound (Melville)</i>		9.7	A	9.6	A	9.4	A
Melville Ave/Alma St	TWSC	0.3	A	0.3	A	0.1	A
<i>Westbound (Melville) Approach</i>		21.3	C	16.0	C	15.0	C
Kellogg Ave/Emerson St	TWSC	5.1	A	6.3	A	5.4	A
<i>North & Southbound (Emerson)</i>		10.1	B	9.5	A	9.3	A
Churchill Ave/Emerson St	AWSC	7.6	A	7.9	A	7.7	A
Churchill Ave/Alma St	Signal	24.9	C	28.8	C	32.4	C

Notes:

Delay is measured in average seconds per vehicle

TWSC = two-way stop-controlled

LOS = Level of Service

Results for minor approaches to two-way stop-controlled intersections are indicated in *italics*.

** = delay greater than 120 seconds

Bold text = deficient operation

Source: Appendix E

Noise, Visual Impacts, and Construction Noise:

There have been questions and comments about noise, visual impacts, and construction related to the City Council-Adopted Criteria. The relevant City Council-Adopted Criteria for noise, visual impacts, and construction noise are Criteria G, I, and J. The existing documents do not provide specific quantitative guidance as to thresholds for these. More details are below by topic area. On a broader level related to rail, the 2030 Comprehensive Plan (page 89) states the following in Policy T-3.18 related to City Council-Adopted Criteria G, I, and J:

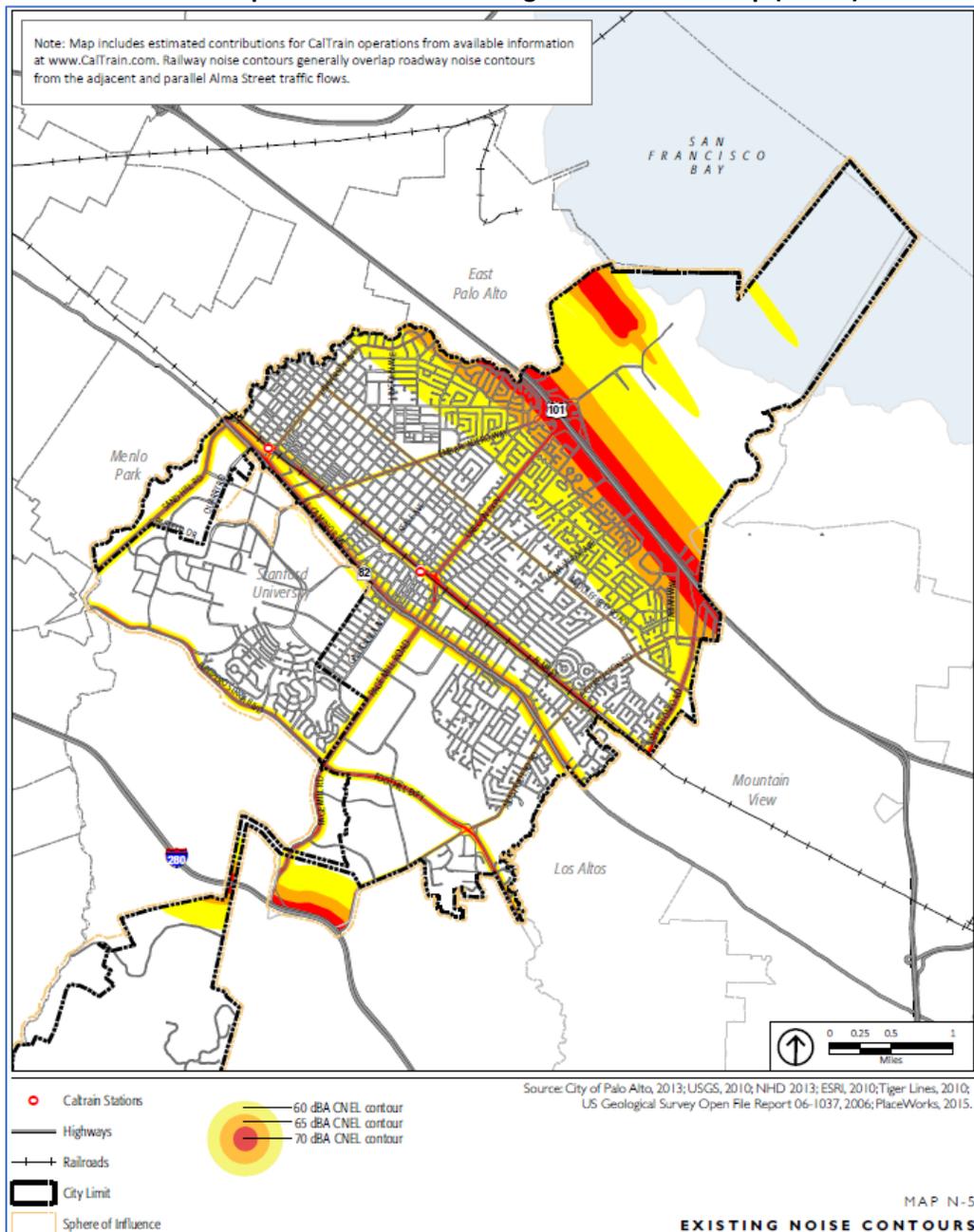
Improve safety and minimize adverse noise, vibrations and visual impacts of operations in the Caltrain rail corridor on adjoining districts, public facilities, schools and neighborhoods with or without the addition of High Speed Rail.

Noise:

In short, the 2030 Comprehensive Plan does not set specific noise levels related to rail though it tried to anticipate the impact of High Speed rail. The 2030 Comprehensive Plan (pages 106-108) states the following about noise as an explanation of the noise contour maps included in the Comprehensive Plan:

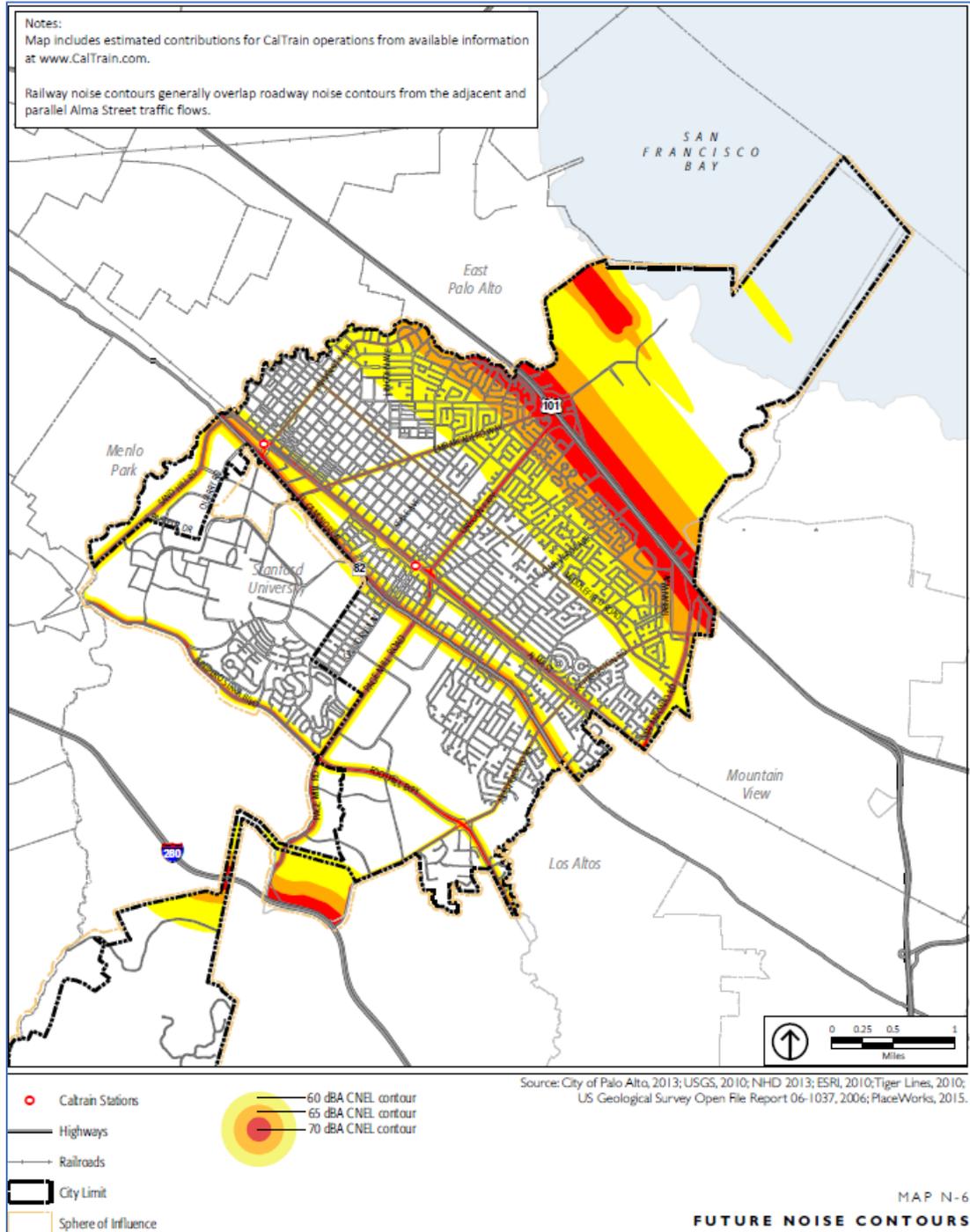
Palo Alto's bustling urban environment generates noise from traffic, trains, airports, construction and yard maintenance, among other sources. Existing and future noise contours within Palo Alto are shown on Maps N-5 and N-6, respectively. The Comprehensive Plan addresses these diverse noise sources and provides the policy foundation for much more rigorous requirements established in the City's Noise Ordinance.

From Comprehensive Plan: Existing Noise Contour Map (~2015)



Source: 2030 Comprehensive Plan

From Comprehensive Plan: Future Noise Contour Map (~2015)



Source: 2030 Comprehensive Plan

These noise contour maps were a snapshot in time and the projected future noise levels are more related to future development in the City and are less focused on rail noise specifically. The 2030 Comprehensive Plan (page 128) states the following suggestions for policies related to City Council-Adopted Criteria G for rail noise.

Rail Noise:

Policy N-6.13 Minimize noise spillover from rail related activities into adjacent residential or noise-sensitive areas.

Program N6.13.1 Encourage the Peninsula Corridors Joint Powers Board to pursue technologies and grade separations that would reduce or eliminate the need for train horns/whistles in communities served by rail service.

Program N6.13.2 Evaluate changing at-grade rail crossings so that they qualify as Quiet Zones based on Federal Railroad Administration (FRA) rules and guidelines in order to mitigate the effects of train horn noise without adversely affecting safety at railroad crossings.

Program N6.13.3 Participate in future environmental review of the California High-Speed Rail (HSR) Project, planned to utilize existing Caltrain track through Palo Alto, to ensure that it adheres to noise and vibration mitigation measures.

Policy N-6.14 Reduce impacts from noise and ground borne vibrations associated with rail operations by requiring that future habitable buildings use necessary design elements such as setbacks, landscaped berms and soundwalls to keep interior noise levels below 45 dBA _{L_{dn}} and ground-borne vibration levels below 72 _vdB.

These policy recommendations align with grade separation goals to separate the rail and road in order to reduce current rail sounds (horns, gates, etc.) but it provides very few measurements to use as a guide. The one measurement mentioned in Policy N-6.14 references sound measurements from inside future buildings instead of emphasis on the sound of the rail itself or for existing buildings. It does note noise mitigations for the rail which are being studied as part of the grade separation alternatives currently under review.

Construction Noise:

The 2030 Comprehensive Plan also does not set specific measurements related to construction noise and duration outside of reference to the noise ordinance. The Plan (page 127) provides a list of things for large projects to follow to minimize construction impacts. The information related to construction noise is as follows (this is related to City Council-Adopted Criteria J):

Policy N-6.11 Continue to prioritize construction noise limits around sensitive receptors, including through limiting construction hours and individual and cumulative noise from construction equipment.

Program N6.11.1 For larger development projects that demand intensive construction periods and/or use equipment that could create vibration impacts, such as the Stanford University Medical Center or major grade separation projects, require a vibration impact analysis, as well as formal, ongoing monitoring and reporting of noise levels throughout the entire construction process pertinent to industry standards. The monitoring plan should identify hours of operation and could include information on the monitoring locations, durations and regularity, the instrumentation to be used and appropriate noise control measures to ensure compliance with the noise ordinance.

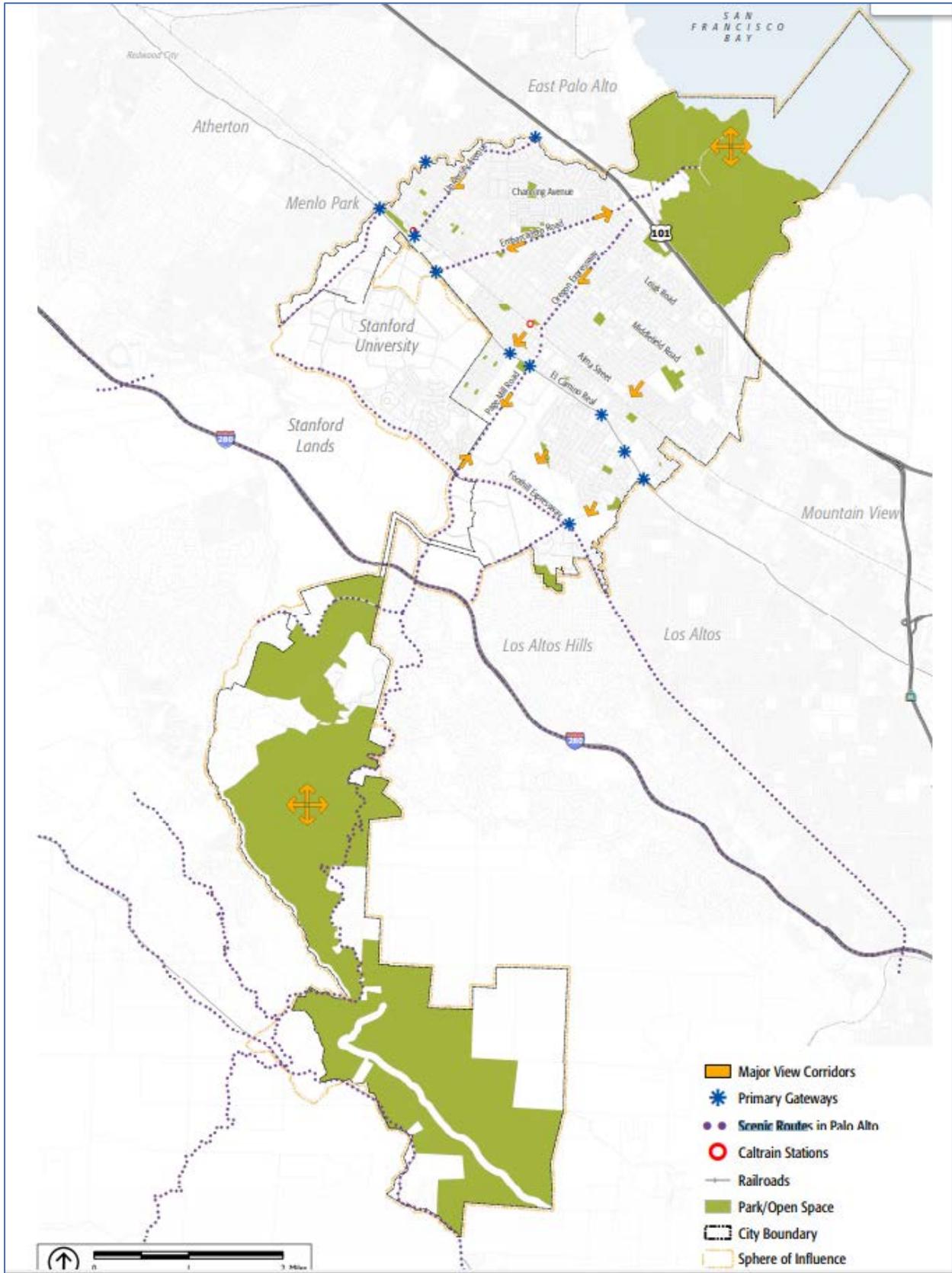
Scenic Roadways:

The City Council-Adopted Criteria 'I' states that the project should minimize visual impacts to the corridor. The 2030 Comprehensive Plan (Map L-4 and pages 50-51) provides some guidance on scenic roadways in Palo Alto but does not state how visual impact should be measured. Specifically, the Plan identifies Embarcadero Road from Stanford to the Baylands as a scenic roadway. It also identifies Embarcadero Road facing west from around Middlefield as a major view corridor. Lastly, the Plan shows that the corridor facing west along Meadow near Alma as a major view corridor as well. These designations can be seen in the map below (Map L-4 from the Comprehensive Plan). The Plan did not provide any specifics around these designations.

Policy L-9.1 Recognize Sand Hill Road, University Avenue between Middlefield Road and San Francisquito Creek, Embarcadero Road, Page Mill Road, Oregon Expressway, Interstate 280, Arastradero Road (west of Foothill Expressway), Junipero Serra Boulevard/Foothill Expressway and Skyline Boulevard as scenic routes and preserve their scenic qualities.

Policy L-9.7 Strengthen the identity of important community-wide gateways, including the entrances to the City at Highway 101, El Camino Real and Middlefield Road; the Caltrain stations; entries to commercial districts; Embarcadero Road at El Camino Real and between Palo Alto and Stanford.

From Comprehensive Plan: Map L-4 Scenic Roadways Map (~2015)



Source: 2030 Comprehensive Plan