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# 1.0 Methods Used to Understand Alternatives

## 1.1 Introduction

Per XCAP's Guiding Principles, XCAP duties state:

The [XCAP](#) was created as a temporary community panel to review technical information and present preferred alternatives to the City Council by April 30, 2020 [per Larry Klein amendment] and to help with the extended community outreach related to the rail grade separation [Connecting Palo Alto](#) process. In addition, the XCAP shall, as requested by the City Council or the City Manager (or designee), provide advice on relevant matters pertaining to rail grade separation affecting the City aligned with City Council-guided parameters.

Therefore, XCAP has been guiding the City Staff and [AECOM](#) on researching existing and new alternatives, reviewing them, providing a forum for the presentation of ongoing work, providing an opportunity for the public to provide comments on the work, and identifying additional work that needs to be done.

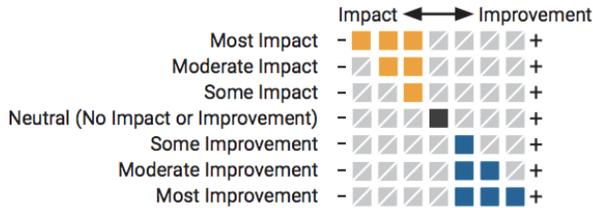
In October 2019, an opportunity was provided for the group and the public to propose any new ideas on grade crossings. After presentations and a vote on the existing 5 ideas, 3 new ideas were advanced for further consideration and research by XCAP.

At the end of this process, XCAP will produce recommendations for each intersection from researching and reviewing technical information on each of the remaining alternatives. This may result in more than one alternative recommended for each intersection, and also potentially with caveats and constraints based on information that is incomplete at the time of XCAP's production of final recommendations. Please note that these XCAP recommendations will help the City Council to reach the final decisions.

## 1.2 Methodology

### 1.2.1 Criteria Matrix

A [matrix](#) containing criteria provided by City Council was created in an attempt to compare grade separation alternatives with each other. In most instances, only a qualitative ranking was deployed using color to gauge relative positive(*improvement*) and negative(*impact*) aspects of a given criteria for a particular option:



The evaluation criteria given by City Council were:

- 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
- D. Support continued rail operations and Caltrain service improvements
- E. Finance with feasible funding sources
- F. Minimize right-of-way acquisition
- G. Reduce rail noise and vibration
- H. Maintain access to neighborhoods, parks, and schools along the corridor, while reducing regional traffic on neighborhood streets
- I. Minimize visual changes along the corridor
- J. Minimize disruption and duration of construction
- K. Order of Magnitude Cost

Through XCAP deliberations, the evaluation criteria was expanded to include additional engineering challenges criteria.

Engineering challenges as evaluation criteria were:

- L. Creek/Drainage Impacts
- M. Long-Term Maintenance
- N. Utility Relocations
- O. Railroad Operations Impacts during Construction
- P. Local Street Circulation Impacts during Construction
- Q. Caltrain Right of Way Impact
- R. Caltrain Design Exceptions Needed

### 1.2.2.1 Technical Working Group

In November 2019, the XCAP Technical Working Group was formed with members; Keith Reckdahl, Phil Burton, and Tony Carrasco, with Chairperson Naia Naik listening in. Retired civil

engineers from the community would also be asked to help out with this group. They would review AECOM engineering work and provide feedback when needed.

### 1.2.2.2 Resident Proposals

In November 2019, a process was initiated to leverage community ideas and expertise to generate ideas for grade crossing solutions at the intersections. This would be an attempt to make sure we had not missed any potential solutions which could be better than what was under consideration already.

### 1.2.2.3 AECOM Explorations and Presentations

Palo Alto's rail consultants, [AECOM](#), would provide the bulk of engineering resources to generate engineering explorations on any grade crossing ideas, as well as providing further work as deemed necessary by XCAP and City Staff. We would be leveraging their expertise in technical feasibility, constraints, and costs. Deliverables would include technical drawings, presentations, renderings, and feedback.

## 1.2.3 Traffic Impact Study

Traffic analyses were performed to further our understanding of what happens to vehicular, pedestrian, and bicycle traffic patterns both before and after a grade separation option were implemented.

The first group to perform traffic analyses was [TJKM](#). Their analysis was presented on August 7, 2019 (see [Draft Traffic Impact Study Report Churchill Avenue Closure, dated 8/7/2019](#)).

TJKM was later replaced by [Hexagon](#). Their initial analysis can be found in [Traffic Analysis of Potential Closure of Churchill Ave at Alma Street, dated 11/26/2019](#). Subsequently, XCAP asked Hexagon to return with more analyses on traffic at Churchill, Meadow and Charleston Road intersections, and their report can be found in [Churchill, Meadow and Charleston Grade Separation Traffic Analysis, dated 5/5/2020](#).

Every analysis leveraged data collected previously. Analysis was done at existing condition traffic levels and those projected in 2030. Mitigations were also proposed by each group at important intersections related to a given grade crossing.

Results were delivered as follows, as described in the Hexagon May 5, 2020 report:

Traffic conditions at the study intersections were evaluated using level of service (LOS). Level of service is a qualitative description of operating conditions ranging from LOS A, or free-flow conditions with little or no delay, to LOS F, or jammed conditions with excessive delays. The acceptable LOS in the City of Palo Alto is LOS D or better for signalized and unsignalized intersections.

## 1.2.4 Environmental

### 1.2.4.1 Sound

Noise and vibration studies were done by AECOM.

Per their [Final Draft Noise and Vibration Comparative Analysis Report, dated July 10, 2020](#):

The existing condition noise survey included a combination of Short-term (15 to 60 minutes) and Long-term (24 hour) measurements at a total of 18 locations. These were conducted between March 10 through March 12, 2020. The noise measurements were conducted in three general areas within the larger project area, near existing grade crossings at Palo Alto Ave., Churchill Ave., and Meadow Dr./Charleston Rd.

Various noise sources under consideration are train noise sources (horn and crossing bell, propulsion/engine noise, wheel/rail noise) and non-train noise sources (road traffic, aircraft overflight, other community noise).

### 1.2.4.2 Visual

Visual aspects were also considered for each alternative. Visual aspects include:

View of the skyline and sky

Visibility and aesthetics of structures

Aesthetics of surroundings after construction, ie. landscaping, fencing, etc.

Methods to evaluate visual impact were:

Qualitative - feedback from XCAP members and community members on what their take on visual impacts were.

3D Renderings by AECOM - Our consultants provided both still and video renderings of the alternatives which could give some indication of visual impacts.

Engineering drawings by AECOM - Engineering drawings provided by AECOM deliver some possible proposals on design options for rail structures. Visual impacts can be inferred from the drawings.

#### 1.2.4.3 Trees

Some trees are regulated in Palo Alto. Summarized from [Regulated Trees on the City of Palo Alto site](#):

Regulated trees are specific species and categories of trees identified in our ordinance, [Title 8, Palo Alto Municipal Code](#), that are protected. All public trees are regulated. Public or street trees are all trees growing within the street right-of-way, on public property such as parks, and outside private property. Protected trees include trees of specific species or distinctive character, public or private. Individual species of trees that are protected are all Coast Live Oaks, Valley Oaks (greater than 11.5 inches in diameter), and Coast Redwood (greater than 18 inches in diameter). Heritage Trees are also protected. Heritage trees are individual trees of any size or species or historical significance that are deemed as such by City Council. Property owners may also nominate a tree for Heritage Tree status if it has characteristics that are distinctive. Designated trees are all trees (public and private), when associated with a development project, that are specifically designated by the City to be saved and protected on public and private property which is subject to discretionary development review. Trees that are under or near power lines are regulated. The State of [California Public Utilities Commission \(CPUC\)](#) requires all utilities in the state to maintain vegetation clearance from their electric conductors and related equipment.

Therefore, in the construction of grade separation options, it is possible that trees could be affected and that some of them would have to go through a review to determine whether trees can be altered or removed. Depending on the circumstances, preservation of trees may be a major factor in determining the feasibility of a given grade separation.

#### 1.2.4.4 Ground water, creeks, storm water

##### **Ground Water**

From [Groundwater.org](#):

Groundwater is the water found underground in the cracks and spaces in soil, sand and rock. It is stored in and moves slowly through geologic formations of soil, sand and rocks called aquifers.

The water table “indicates the level below which soil and rock are saturated with water.” [\[Source\]](#) If a grade separation option results in construction and structures below the water table, then flooding is a certainty and continuous pumping operations are required to keep those structures water-free.

## **Creeks**

There are several creeks that exist in Palo Alto. Preserving the creeks is not only important from a conservation point of view but also to reduce the risk of water issues as the water still needs to go somewhere.

## **Storm Water**

Storm water refers to water that results from a weather event such as rain or snow. Storm water will collect on the ground and needs to be removed or else flooding will occur. This means drainage must be provided, and depending on the situation, there may need to be pumps to move water. The construction and maintenance of pumps and pumping stations will increase costs, and introduce risk that flooding can happen if pumps fail.

### 1.2.4.5 Historical Landmarks and Structures

There could be historic structures that are affected by grade separation options. These include structures such as the [El Palo Alto redwood tree](#), the [San Francisquito Creek railroad bridge](#). The [bridge over the Embarcadero underpass at Alma](#) may also be affected although it is not officially designated as an official historic structure. Preservation of historic structures and sites may affect our recommendation of grade separation options.

### 1.2.4.6 Climate Change Events

Climate change has greatly increased the risk of more variable and intense weather, shortened and warmer winters, and hotter and longer summers. With it comes the potential also for rising seas. The risk of flooding rises either from more severe rain storms or from a water table that is rising due to rising seas. The risk presented by climate change events may be considered in the final recommendations for grade separation options.

## 1.2.5 Other considerations

### 1.2.5.1 Cost

In our preliminary design work, we asked AECOM to provide cost estimates for each grade separation option. Generally these result in ranges as without the final design work done, more accurate cost estimates are not available at this time. However, they are useful for our consideration when comparing between options and their cost relative to each other and gives us insight into what kinds of funds would be needed and where they would need to come from.

XCAP will note the different methods of obtaining funds and their relative difficulty in accessing them. XCAP will take into consideration the hypothetical difficulty of obtaining funds for a given grade separation option when making recommendations.

### 1.2.5.2 Community Feedback

During XCAP meetings, the public was invited to comment on our presentations and deliberations. Public comments will factor somewhat into our determination of recommendations.

XCAP also invited the public to engage in brainstorming of any other possible grade separation options that may have been missed. These resulted in some additional options that were explored and under consideration by XCAP.

### 1.2.5.3 Community Meetings

The City held some community meetings during our deliberations period. Community meetings were a combination of presentation and opportunity for the public to comment and to interact with some of the City Staff and consultants.

XCAP had little to no role in community meeting organization, other than much of the information we generated was often used in the presentations. We gave no feedback on the presentations themselves.

We may take some of the community feedback heard into consideration for our recommendations.

Community meeting materials can be found in the [Community Meetings tab of the Presentations and Reports page](#).

#### 1.2.5.4 Town Hall Meetings

The City held some town hall meetings during our deliberations period. Town halls were an opportunity to inform the public of the status of the grade separation project. However, there was little or no opportunity for the public to make comments or interact with Staff and consultants.

Like the community meetings, XCAP had little to no role in town hall organization, other than much of the information we generated was often used in the presentations. We gave no feedback on the presentations themselves.

We may take any feedback heard into consideration for our recommendations.

Town hall materials can be found in the [Community Meetings tab of the Presentations and Reports page](#).

#### 1.2.5.5 Safety

Safety of vehicles, pedestrians, and cyclists will all be considered in our recommendations. Please see the section on Safety for more discussion.

## 1.3 Alternatives

This section describes all the grade separation alternatives at each intersection that were explored during XCAP's deliberations. These alternatives are briefly described below. Note that each alternative has a Fact Sheet which expands on their descriptions.

This section is divided into two. The first section, Existing Alternatives, refers to the grade separation alternatives that existed at the time XCAP began deliberations and pre-date XCAP's creation. The second section, New Alternatives, refers to grade separation alternatives that emerged during a brainstorming opportunity in October 2019.

At the time of the end of XCAP's meetings, the resulting designs are not final and require more work to bring them to full reality before construction. It is highly likely that more work will need to be done before City Council can finalize their decisions. Therefore, XCAP's recommendations

will be based on information available at the time of deliberations on the final recommendations. Incomplete information will be noted.

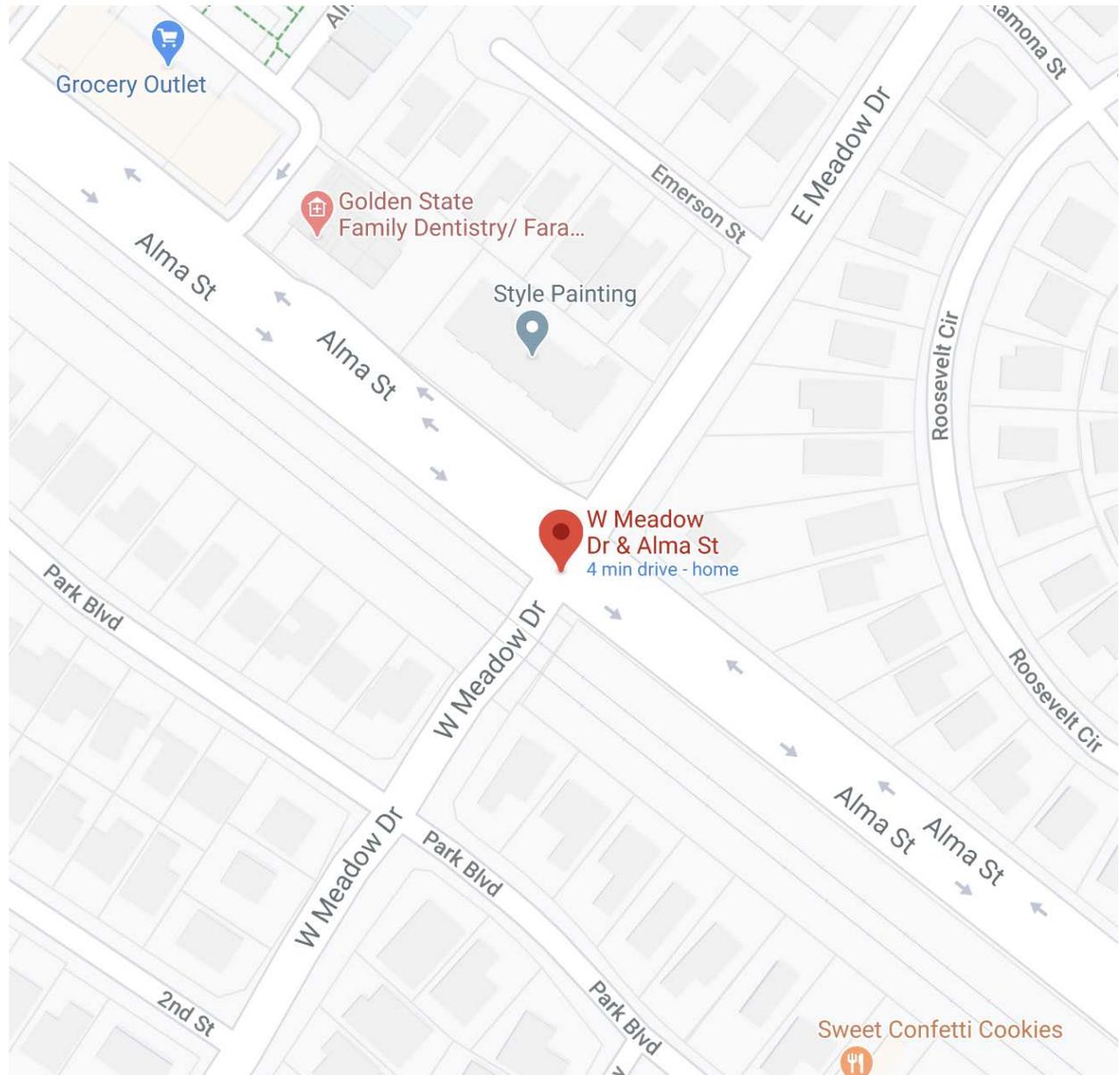
Fact sheets for all alternatives are available on the Connecting Palo Alto website:  
<https://connectingpaloalto.com/fact-sheets/>

### 1.3.1 Existing Alternatives

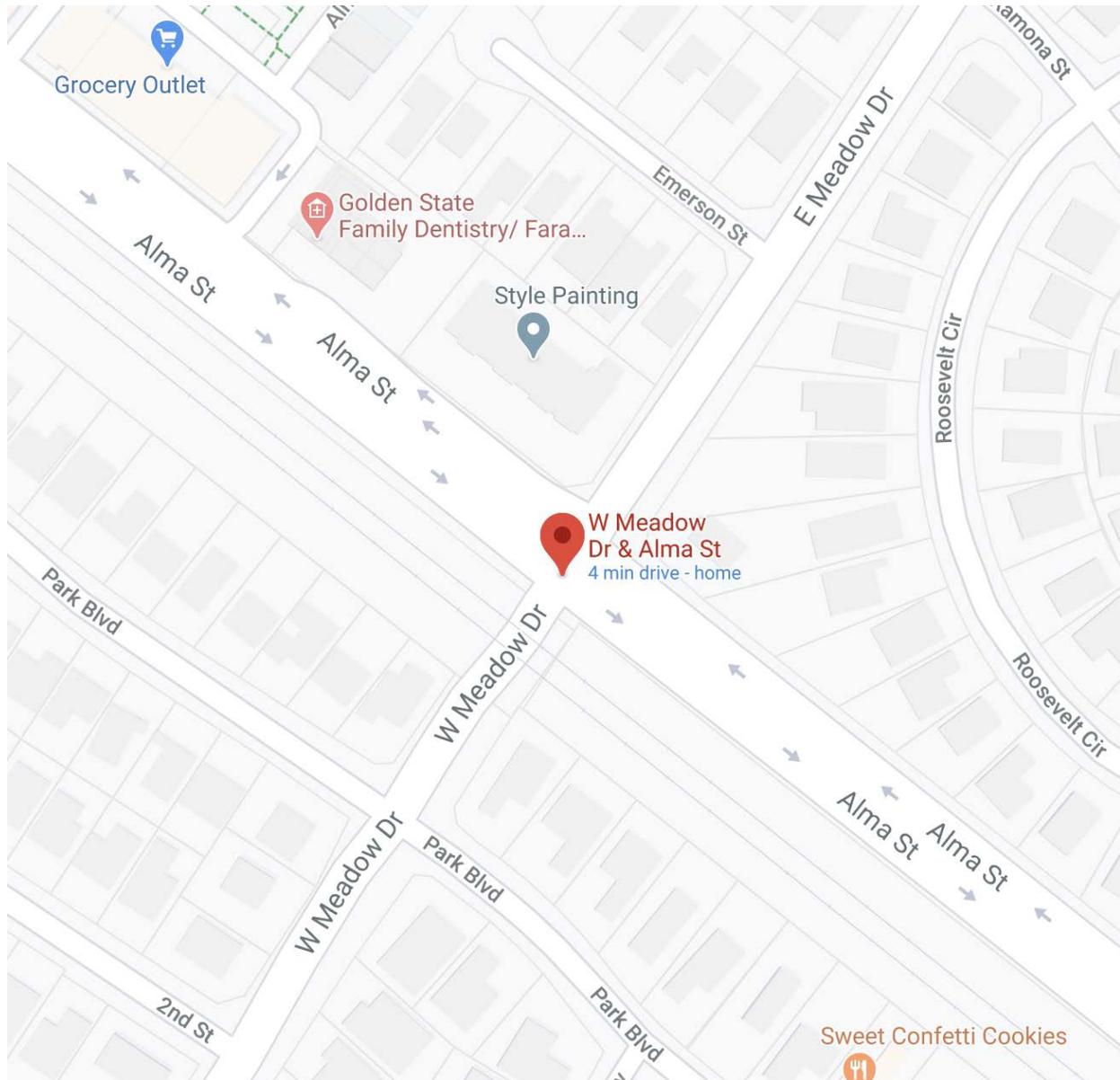
These alternatives were the result of a 2+ year effort by the City, involving Staff, City Council, the (now defunct) Rail Committee, the Committee of the Whole (what the Rail Committee became), and community input. Some of this work also had its origins in the California High Speed Rail Project.

South Palo Alto: Meadow Road and Charleston Road

In South Palo Alto, there are two Caltrain at-grade crossings. The first is at Meadow Drive and Alma Street::



The second is at Charleston Road and Alma Street:



For much of the work, we considered the same design would be deployed at both intersections. Some inquiry was made into whether different designs could be used for each intersection versus the same for both. In the memo, [Mixing of Underpass and Hybrid Grade Separation Alternatives at Charleston Road and Meadow Drive](#), the summary states:

The preliminary evaluation indicates that roadway improvements can be accommodated for the two alternatives at each grade separation location independently, however, it may require adjustment of railroad grade at both locations i.e. Meadow and Charleston, depending on how high the rail is raised at the other location. Therefore, additional design efforts and construction measures will be required to accommodate these improvements.

### 1.3.1.1 Meadow/Charleston Trench

#### **Introduction**

Lowering the train into the ground creates advantages in noise reduction, and enabling at-grade crossings over the train tracks for vehicles, pedestrians, and cyclists. The train will also be hidden from view between the ramps entering and exiting the trench area, thereby improving the visual aspects of the neighborhood.

#### **Description**

From the [Meadow-Charleston Trench Fact Sheet](#):

For the trench alternative, the railroad tracks will be lowered in an U-shaped box below Meadow Drive and Charleston Road. The new electrified railroad tracks will be built at the same location as the existing railroad tracks and will begin lowering south of Loma Verde Avenue, remain lowered under Meadow Drive and Charleston Road, and return to the existing elevation north of the San Antonio Station.

The roadways at Meadow Drive and Charleston Road will remain at their existing grade on a bridge over the railroad tracks. The roadway will have a similar configuration to what exists today with the addition of Class II buffered bike lanes on Charleston Road. This will require expanding the width of the road to maintain bike lanes through the overpass of the railroad.

### 1.3.1.2 Meadow/Charleston Hybrid

#### **Introduction**

The classic grade separation technique involves putting one road above the other. A hybrid involves raising one road and lowering another, so that the depth and rise are not as severe. In doing so, it may be possible to reduce property impacts when compared to only raising or lowering one of the roads while keeping the other at-grade.

#### **Description**

From the [Meadow-Charleston Hybrid Fact Sheet](#):

For the hybrid alternative, the railroad tracks will be raised above Meadow Drive and Charleston Road. The new electrified railroad tracks will be built at the same location as the existing

railroad tracks and will begin rising near El Verano Avenue, remain raised above Meadow Drive and Charleston Road, and return to the existing elevation north of the Ferne Avenue.

Between Park Boulevard and Alma Street, the roadways at Meadow Drive and Charleston Road will be lowered and will have a similar configuration that exists today, with the addition of Class II buffered bike lanes on Charleston Road. This will require expanding the width of the road to maintain bike lanes through the underpass of the railroad and to accommodate the new column supporting the railroad structure.

#### 1.3.1.4 Meadow/Charleston Viaduct

##### **Introduction**

Viaducts raise the train tracks above the ground. This allows vehicular and cyclist traffic, along with pedestrians, to pass freely under the tracks. This may also allow the use of land that is under the train tracks.

##### **Description**

From the [Meadow-Charleston Viaduct Fact Sheet](#):

For the viaduct alternative, the railroad tracks will be elevated on a structure over Meadow Drive and Charleston Road. The new electrified railroad tracks will be built between the existing railroad tracks and Alma Street (east side) and will begin rising north of Loma Verde Avenue, remain elevated over Meadow Drive and Charleston Road, and return to the existing elevation south of Ferne Avenue.

The roadways at Meadow Drive and Charleston Road will remain at their existing grade and have a similar configuration to what exists today, with the addition of Class II buffered bike lanes on Charleston Road. This addition will require expanding the width of the road to maintain bike lanes through the underpass of the railroad and to accommodate the new column supporting the railroad structure.

#### 1.3.1.5 South Palo Alto Tunnel - Passenger and Freight

##### **Introduction**

Tunnels take the train underground and any issues along with it. The desire is to remove noise and visual impacts as well as reclaim the ability to use land previously occupied by the train at grade. The cost of creating a Palo Alto wide tunnel was explored but rejected prior to XCAP by City Council due to cost concerns among other aspects. One design option was to put both the

passenger and freight train into a tunnel which runs under only Charleston Road and Meadow Drive instead of across the entirety of Palo Alto.

## **Description**

From the [South Palo Alto Tunnel - Passenger and Freight Fact Sheet](#):

For the tunnel alternative, the railroad tracks will be lowered in a trench south of Oregon Expressway to approximately Loma Verde Avenue. The twin bore tunnel will begin near Loma Verde Avenue and extend to just south of Charleston Road. The railroad tracks will then be raised in trench to approximately Ferne Avenue. The new electrified southbound railroad tracks will be built at the same horizontal location as the existing railroad track, however, the northbound track will be moved to the east within the limits of the tunnel to accommodate the spacing required between the twin bores. The railroad tracks will carry both passenger and freight trains as it does today.

The roadways at Meadow Drive and Charleston Road remain at their existing grade and will have a similar configuration that exists today with the addition of Class II buffered bike lanes on Charleston Road. This will require expanding the width of the road to maintain bike lanes through the overpass of the railroad.

### 1.3.1.6 South Palo Alto Tunnel with At-Grade Freight

## **Introduction**

Tunnels take the train underground and any issues along with it. The desire is to remove noise and visual impacts as well as reclaim the ability to use land previously occupied by the train at grade. The cost of creating a Palo Alto wide tunnel was explored but rejected prior to XCAP by City Council due to cost concerns among other aspects. This led to considering a a tunnel which runs under only Charleston Road and Meadow Drive instead of across the entirety of Palo Alto. One design option was to put the passenger train into the tunnel but leaving the tracks at grade so that the freight trains would run at night at grade. By leaving the freight at grade, it was hypothesized that the engineering requirements for the tunnels could be more advantageous, running only passenger trains in it instead of both passenger and freight.

## **Description**

From the [South Palo Alto Tunnel with At-Grade Freight Fact Sheet](#):

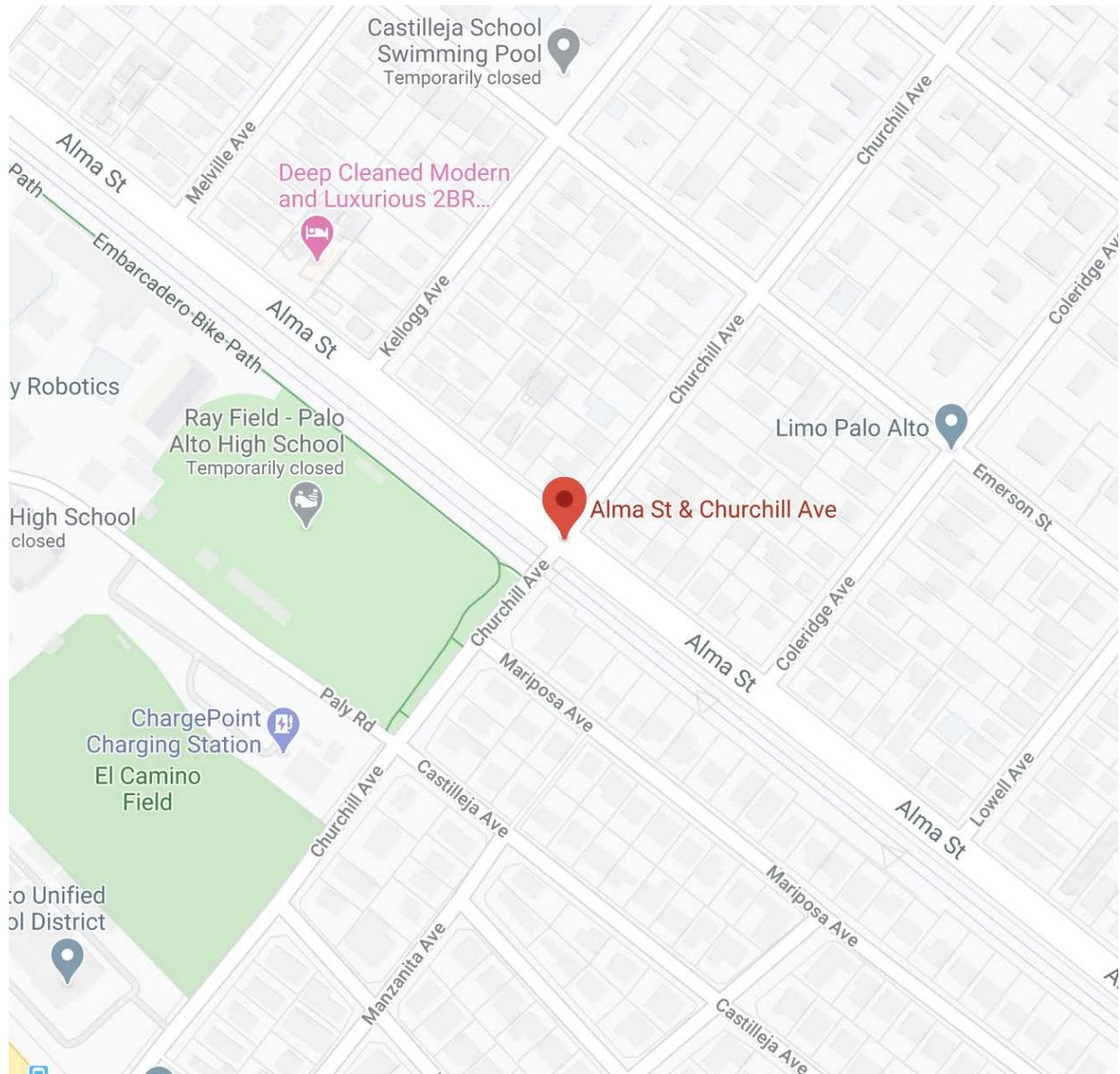
For the tunnel alternative, the railroad tracks will be lowered in a trench south of Oregon Expressway to approximately Loma Verde Avenue. The twin bore tunnel will begin near Loma Verde Avenue and extend to just south of Charleston Road. The railroad tracks will then be

raised in trench to approximately Ferne Avenue. The new electrified southbound railroad tracks will be built at the same horizontal location as the existing railroad track, however, the northbound track will be moved to the east within the limits of the tunnel to accommodate the spacing required between the twin bores. The railroad tracks in the trench and tunnel will carry only passenger trains. The freight trains will remain at-grade.

The roadways at Meadow Drive and Charleston Road remain at their existing grade and will have a similar configuration that exists today with the addition of Class II buffered bike lanes on Charleston Road. This will require expanding the width of the road to maintain bike lanes through the overpass of the railroad.

#### Churchill Ave

The train tracks cross Churchill Avenue near Alma Street:



### 1.3.1.7 Churchill Ave Closure with Mitigations

#### **Introduction**

Churchill Ave is a residential street which runs through Old Palo Alto from Embarcadero to Alma, and then from Alma and El Camino in Southgate. It is narrow and one lane each way with many stop signs. Because it is one of the few places on Alma Street where a left turn can be safely made due to the traffic light, it commands a lot of vehicular traffic. This is in addition to nonoptimal sections of road on Embarcadero, between Alma and El Camino, as well as on Oregon Expressway, between Alma and El Camino, both of which drive some traffic to cross to El Camino through Southgate.

Running next to Palo Alto High School, Churchill Ave is a major crossing point for students on bicycles going to and from school.

In the interest of cost, it was proposed to simply close Churchill to vehicular traffic, and introduce mitigations at Embarcadero Road and Oregon Expressway to enable diverted traffic to flow better there. Additional mitigations would be provided for pedestrians and cyclists to still cross Alma at Churchill, enabling access to Palo Alto High, Stanford University, and points beyond.

## **Description**

From the [Churchill Ave Closure with Mitigations Fact Sheet](#):

For the Churchill closure alternative, the railroad tracks will remain at their existing location and elevation (as is). Churchill Avenue will become a T-intersection with Alma Street on the east side and will end at Mariposa Avenue on the west side. A pedestrian/bike only undercrossing will be constructed. Two options are proposed: one crosses under the railroad tracks only (Option 1) and the other crosses under both the railroad tracks and Alma Street (Option 2). Ramps and stairs in varying configurations will provide access to the undercrossing for pedestrians and cyclists.

There are several intersection improvements associated with the Churchill Avenue closure to mitigate the anticipated diversion in traffic. These improvements will include:

- Embarcadero Road/Alma Street: constructing a pedestrian/bike overcrossing at Embarcadero Road, widening Alma Street on the Embarcadero underpass, adding a right turn lane from eastbound Embarcadero Road and left turn lane from southbound Alma Street, and installing a new signal at Embarcadero Road/Kingsley Avenue/High Street. Two options are proposed: one that provides full connectivity to/from High Street (Option A) and the other that keeps the movements to/from High Street as they are today (Option B).
- El Camino Real/Embarcadero Road: optimizing signal timing and installing an additional westbound left turn lane and northbound right turn lane.
- Alma Street/Oregon Expressway: signalizing both on/off ramps.
- El Camino Real/Oregon Expressway-Page Mill Road: optimizing signal timing and installing a westbound right turn lane and northbound right turn lane from Oregon Expressway to El Camino Real Road.

### 1.3.1.8 Churchill Ave Vicinity Viaduct

## **Introduction**

There was a desire to explore options which keep Churchill Ave open to Alma Street from El Camino. The first of these options involves building a viaduct to raise the train tracks above the ground and enable vehicular traffic, as well as pedestrians and cyclists, to pass underneath.

## **Description**

From the [Churchill Ave Vicinity Viaduct Fact Sheet](#):

For the viaduct alternative, the railroad tracks will be elevated on a structure over Churchill Avenue. The new electrified railroad tracks will be built at the same location as the existing railroad tracks and will begin rising near Homer Avenue, remain elevated over Churchill Avenue, and return to the existing track elevation near the California Avenue Station. Stanford game day station will be eliminated. The roadway at Churchill Avenue will remain at its existing grade and have a similar configuration to what exists today. This will require expanding the width of the road through the underpass of the railroad to accommodate the new column supporting the railroad structure.

### 1.3.2. New Alternatives

There was a desire by XCAP and the community to further explore options and to see if any more options might result in a better solution than the ones provided. In November 2019, the community was asked to provide proposals for other solutions. These options were presented, discussed, and then voted on for further exploration by the City and consultants.

#### 1.3.2.1 Churchill Ave Partial Underpass

## **Introduction**

As there were concerns about the existing alternatives being problematic for various constituencies, especially the tension between either closing Churchill or elevating the tracks on a viaduct, this alternative was proposed to maintain traffic flow without elevating the tracks.

## **Description**

See also: [Churchill Partial Underpass Factsheet \[DRAFT\]](#)

The partial underpass alternative will grade separate Churchill Avenue from the current Caltrain tracks via an underpass; however, there will no longer be through traffic on Churchill Avenue at the intersection with Alma Street.

Traffic on eastbound Churchill Avenue from the Paly Road/Castilleja Avenue intersection will descend and pass under the railroad and terminate at a lowered, signal-controlled, T-intersection at Alma Street where vehicles can make a left turn onto northbound Alma Street or a right turn onto southbound Alma Street; then ascend and return to grade along Alma Street.

Traffic on westbound Churchill Avenue from Emerson Street will terminate at Alma Street. Right turns only (onto northbound Alma Street) will be permitted. Similarly, westbound traffic on Kellogg Avenue and Coleridge Avenue approaching Alma Street will be permitted to make right turns only onto northbound Alma Street.

Traffic on southbound Alma Street will operate as it does today except left turns onto Kellogg Avenue, Churchill Avenue and Coleridge Avenue will not be permitted. The Caltrain tracks will be supported on a new rail bridge spanning across a lowered Churchill Avenue at approximately its current location. A separate pedestrian/bicycle crossing will be provided at Kellogg Avenue. From westbound Kellogg Avenue, a 10-foot wide path will descend at the center of the road, at which point widens to 20 feet and crosses under both Alma Street and the Caltrain tracks and conforms at the Embarcadero Bike Path adjacent to Palo Alto High School.

#### 1.3.2.2. Meadow/Charleston Underpass

### **Introduction**

With increasing concerns around the underground options, as well as concerns about elevating the tracks, the XCAP sought alternatives that would keep the tracks at grade and lower the roads under the tracks. Because of the proximity of the tracks to the major corridor Alma Street, going under the tracks requires also going under Alma. This alternative presents a potential pass through under both while retaining as many of the turning options as possible.

### **Description**

See also: [Meadow-Charleston Underpass Factsheet \[DRAFT\]](#)

The underpass alternative retains the Caltrain tracks at the current grade and lowers Meadow Drive and Charleston Road under the tracks and under Alma Street for through traffic. Alma Street will retain four lanes of traffic, two northbound and two southbound, supported on a new road bridge spanning the intersecting road. Turning movements to and from Alma Street will be facilitated by ramps for key traffic flow directions and controlled by traffic signals. On the east side of Alma Street, the new road profile will begin descending just west of the Emerson Street for Meadow Drive, and just west of Wright Place on Charleston Road and will return to grade on the west side of the tracks, just west of Park Boulevard. Turning movements from various side streets will be limited.

The Caltrain tracks will be supported on a new rail bridge that spans the width of the intersecting road and the pedestrian/bike ramp while remaining on its current alignment. The pedestrian/bike ramp will provide a crossing for cyclists and foot traffic of both Alma Street and the railroad. This pedestrian/bike crossing is separate and at a different grade from both the rail and the road, providing both the benefits of a safer route and less traffic interference resulting in better traffic flow.

The on-ramp and off-ramp connecting Meadow Drive to Alma Street will be limited to northbound and southbound traffic, respectively. Through traffic on Park Boulevard will no longer be possible. The connection from the south side of Park Boulevard to Meadow Drive will no longer be possible and will end in a cul-de-sac, while the north side of Park Boulevard will have driveway modifications but turning movements will be retained.

With connection ramps only to East Charleston Road, movement to and from Alma Street will be facilitated via a roundabout on East Charleston Road just west of Mumford Place. Right of way acquisition from private property will be required to accommodate this alternative. As with Meadow Drive, through traffic on Park Boulevard will no longer be possible, however, a bridge will be constructed just west of the tracks to provide north/south pedestrian/bike connectivity at Park Boulevard. Ely Place intersection with Alma Street will only facilitate an exit onto northbound Alma Street. Entrance from southbound Alma Street into Ely Place will be prohibited.

#### 1.3.2.3. Other Alternatives Considered

This section describes other alternatives that were considered by XCAP during the opportunity for our group and the public to come up with additional alternatives in November 2019. These were alternatives that were not advanced to further exploration and consideration.

#### 1.3.2.4. Alternative Tunnel Proposal

See this [Tunnel Proposal information document](#).

### **Introduction**

As an alternative to the proposed tunnels for South Palo Alto, a citizen proposed some alternative standards and considerations that could make the tunnel more viable.

### **Description**

The proposal would put passenger trains underground with freight trains running at grade. However, what differs from his proposal than the original tunnel proposals is to use smaller

tunnel diameters which would enable shallower and shorter ramps down to the tunnel entrances. The narrower diameter tunnels would also theoretically impact creeks and utilities less. He also proposed that costs would be dramatically less, providing some comparative costs from Europe.

#### 1.3.2.5. Roundabout at Embarcadero/Alma Intersection

See this Roundabout Proposal information document.

### **Introduction**

The proposal to close Churchill requires workarounds at Alma and Embarcadero, an interchange that is antiquated and poorly designed. Furthermore, there are higher volumes of traffic along Embarcadero than ever before, and the traffic and congestion already on Embarcadero is a perennial complaint from residents. Adding traffic to that corridor by closing Churchill is a concern that many on the XCAP held and was echoed by numerous public speakers.

Architect Tony Carrasco designed a conceptual proposal for addressing the exchange at Embarcadero and Alma in such a way that addressed not only the additional traffic diverted from Churchill, but also improved the flow of traffic along Embarcadero. Many on XCAP appreciated the design and were interested, but we were advised that the additional work required to address Embarcadero was out of scope for the XCAP to consider and should therefore be considered through other channels, if staff or Council so desired.

### **Description**

Remove the old bridge at Alma over Embarcadero, and re-fill Embarcadero to grade to eliminate the underpass. At that interchange now will be a large roundabout at grade with Alma Street, providing access to all directions. The train tracks would be elevated on a viaduct with support posts in and around the roundabout such that traffic could flow freely on the level ground underneath. Bike lanes and pedestrian sidewalks would be available based on a model intersection from the Netherlands, and encourage connection on all modes from south to north of Embarcadero. This design has the benefit of being easier to traverse for bikes and pedestrians, easier to see and less dangerous for car drivers, and more beautiful and open for a currently awkward and troublesome interchange.

#### 1.3.2.6. Alternative Proposal for Churchill Ave Underpass

Find details on this proposal in the [Meeting Summary document for XCAP meeting November 13, 2019](#).

## **Introduction**

It was noted that in the initial hybrid or underpass proposals at Churchill Ave, that no one had specifically asked for design proposals which did not involve property takings. This proposal had no formal presentation and was proposed verbally during the call for ideas.

## **Description**

The concept would be to reopen exploration on the Churchill Ave intersection with an underpass or hybrid underpass, with a specific direction to the consultants to provide design solutions which specifically do not have property takings, or to minimize them.