What is an Underpass?
The underpass alternative retains the Caltrain tracks at the current grade and lowers the 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 crossing is separate and at a different grade from the road underpass, and is thus a true multimodal separation.
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 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.

By the numbers
• Meadow Drive and Charleston Road are designed for 25 miles per hour.
• Alma Street is designed for 35 miles per hour.
• Maximum grade for the roadway is 12% on Meadow Drive, and 9% on Park Boulevard.
• Maximum grade for the roadway is 12% on Charleston Road, and 12% on Park Boulevard.
• Travel lanes are 10 to 12 feet wide.
• Pedestrian/bike ramp width is 20 feet.
• Construction period is approximately 3.5 to 4 years.

Engineering Challenges
• For access to the construction site, construction traffic will be diverted to other areas.
• Lowering of the roadways will require a pump station.
• Increased cost of long-term maintenance and risk of flooding due to pump station.
• Major utility relocations will be required for the lowered roadways.

Neighborhood Considerations
• The rail crossing at Meadow Drive and Charleston Road will need to be closed for most of the construction period.
• Excavation work and construction of the new road bridge will require or reduction of the number of lanes on Alma Street for a significant portion of the construction period.
• Vertical clearance of Meadow Drive and Charleston Road under the railroad will be 15.5 feet.
• With the grade separation at Meadow Drive and Charleston Road and restricted turning movements, traffic at nearby intersections is expected to improve.
• Significant excavation and construction work will take place adjacent to residences.

Cost Breakdown

<table>
<thead>
<tr>
<th>Item</th>
<th>Cost</th>
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</thead>
<tbody>
<tr>
<td>Roadway &amp; Railroad Items</td>
<td>$140M to $180M</td>
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<tr>
<td>Structure Items</td>
<td>$15M to $25M</td>
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<td>Right-of-way &amp; Utilities</td>
<td>$80M to $100M</td>
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<tr>
<td>Support Costs</td>
<td>$65M to $80M</td>
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<td>Escalation from 2018 to 2025 dollars</td>
<td>$50M to $65M</td>
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<tr>
<td><strong>TOTAL PROJECT COSTS</strong></td>
<td><strong>$350M to $450M</strong></td>
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</tbody>
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Preliminary and subject to change. Maintenance costs and relocation of fiber optic lines not included. Intersection improvements included.
Evaluation with City Council-Adopted Criteria:

- **Facilitate movements across the corridor for all modes of transportation**
  Meadow Drive and Charleston Road will be grade separated from the railroad for all modes and will remain open, allowing access in all directions but resulting in a longer route.

- **Reduce delay and congestion for vehicular traffic at rail crossings**
  With construction of the grade separation, the railroad crossing gates and warning lights at Meadow Drive and Charleston Road will be removed. Thus, the traffic will not be interrupted by gates coming down. Pedestrian and cyclist mode separation will also help reduce intersection congestion.

- **Provide clear, safe routes that are separated from vehicles for pedestrians and cyclists crossing the rail corridor.**
  Pedestrians and cyclists will be completely separated from train and vehicular traffic. Full pedestrian and cyclist movement is maintained.

- **Support continued rail operation and Caltrain service improvements**
  During construction, a temporary railroad track is likely to be required unless an alternate construction methodology and sequencing is acceptable to Caltrain.

- **Finance with feasible funding sources**
  The underpasses would require low levels of local funding, and a substantial portion of the capital costs would be covered by regional, state and federal sources.

- **Reduce rail noise and vibration**
  Train horn noise and warning bells will be eliminated by the replacement of the at-grade crossings with grade separations. The use of electric motors rather than diesel engines will also reduce noise. Train wheel noise may increase at the bridge location, depending on structure type; however, this noise can be mitigated.

- **Minimize visual change along the corridor**
  Railroad tracks will remain at-grade. East Charleston Road neighborhoods will experience visual changes with the addition of the traffic roundabout and removal of the planting strip on both sides of the road. The planting strip on the east side of Alma Street between East Charleston Road and Ely Place will also be removed.

- **Maintain access to neighborhoods, parks, and schools along the corridor while reducing regional traffic on neighborhood streets**
  Regional traffic will be diverted due to the restricted turning movements; however, travel in all directions will be possible, but may require a longer route and take more time. Pedestrian and cyclist access will significantly improve due to mode separation.

- **Minimize right-of-way acquisition**
  Multiple private property acquisitions are required, and driveway modifications are also likely to be required. There is also encroachment into Caltrain’s right of way, especially during construction.

- **Minimize disruption and duration of construction**
  Construction will require extended lane reductions at Alma Street. Closure of all intersection roads during construction is expected. Construction would last for approximately 3.5 to 4 years.

- **Facilitate movements across the corridor for all modes of transportation**
  Meadow Drive and Charleston Road will be grade separated from the railroad for all modes and will remain open, allowing access in all directions but resulting in a longer route.

- **Reduce delay and congestion for vehicular traffic at rail crossings**
  With construction of the grade separation, the railroad crossing gates and warning lights at Meadow Drive and Charleston Road will be removed. Thus, the traffic will not be interrupted by gates coming down. Pedestrian and cyclist mode separation will also help reduce intersection congestion.

- **Provide clear, safe routes that are separated from vehicles for pedestrians and cyclists crossing the rail corridor.**
  Pedestrians and cyclists will be completely separated from train and vehicular traffic. Full pedestrian and cyclist movement is maintained.

- **Support continued rail operation and Caltrain service improvements**
  During construction, a temporary railroad track is likely to be required unless an alternate construction methodology and sequencing is acceptable to Caltrain.

- **Finance with feasible funding sources**
  The underpasses would require low levels of local funding, and a substantial portion of the capital costs would be covered by regional, state and federal sources.

Example Section - Underpass at Meadow Drive and Charleston Road

Caltrain Right-of-way
Approx. 75 – 100 ft. (TYP.)

Existing Tracks
Pedestrian/Bike Ramp

Alma Street
Approximately 60 ft. (TYP.)

Connection Ramp
Alma Street through Traffic
Connection Ramp

Westbound
Eastbound

For more renderings, plans and animations visit: https://connectingpaloalto.com/renderings-plans-and-animations/
What is a Partial Underpass?

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 onto northbound Alma Street or a right 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 northbound Alma Street will be split near Coleridge Avenue:

- Vehicles bearing right will remain at grade and continue on northbound Alma Street. This traffic will be permitted to make right turns onto all connecting streets (Coleridge Avenue, Churchill Avenue, Kellogg Avenue, etc.) approaching Emerson Street.
- Vehicles bearing left will descend to the T-intersection with Churchill Avenue and be permitted to make left turns (under the railroad) onto westbound Churchill Avenue approaching Paly Road/Castilleja Avenue and El Camino Real.

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, cross under both Alma Street and the Caltrain tracks and daylight at the Embarcadero Bike Path adjacent to Palo Alto High School.
By the numbers

- Churchill Avenue is designed for 25 mph and Alma Street is designed for 35 mph.
- Maximum grade on the roadway is 11% for Churchill Avenue, and 7% for Alma Street.
- Travel lanes are 10 to 12 feet wide.
- Pedestrian undercrossing widths range from 10 to 20 feet.
- Construction period is approximately 2.5 to 3 years.

Engineering Challenges

- For access to the construction site, construction traffic will be diverted to other areas.
- Lowering of the roadway will require a pump station.
- Increased cost of long-term maintenance and risk of flooding due to pump stations.
- Major utility relocations will be required for the railroad for all modes and will remain open. A pedestrian/bike undercrossing will be provided at Kellogg Avenue.

Cost Breakdown

<table>
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<tr>
<th>Item</th>
<th>Cost Breakdown</th>
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<tr>
<td>Roadway &amp; Railroad Items</td>
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<tr>
<td>Structure Items</td>
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<td>Escalation from 2020 to 2025</td>
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<td>Total Project Cost</td>
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Preliminary and subject to change. Maintenance costs and relocation of fiber optic lines not included. Intersection improvements included.

Evaluation with City Council-Adopted Criteria:

- Facilitate movements across the corridor for all modes of transportation
- Church Avenue will be grade separated from the railroad for all modes and will remain open. A pedestrian/bike undercrossing will be provided at Kellogg Avenue.
- Reduce delay and congestion for vehicular traffic at rail crossings
- With the grade separation at Churchill Avenue and the restricted turning movements, traffic at nearby intersections is expected to improve.
- Significant excavation and construction work will take place adjacent to residences.
- Accessibility to the Churchill Avenue crossing and the Embarcadero bike path will be limited during construction, which will impact Pedestrian and Bicycle routes heading to Palo Alto High School.

Neighborhood Considerations

- Churchill Avenue between Alma Street and Mariposa Avenue will likely be closed for an extended length of time (18+ months) during construction. In addition, Alma Street will be one-way northbound for 6 months. Local traffic will be diverted to other neighborhood roads during construction.
- Vertical clearance of Churchill Avenue under the railroad will be 15.5 feet.
- With the grade separation at Churchill Avenue and the restricted turning movements, traffic at nearby intersections is expected to improve.
- Significant excavation and construction work will take place adjacent to residences.
- Access to the Churchill Avenue crossing and the Embarcadero bike path will be limited during construction, which will impact Pedestrian and Bicycle routes heading to Palo Alto High School.

Support continued rail operation and Caltrain service improvements

During construction however, a temporary railroad track is likely to be required unless an alternate construction methodology and sequencing is acceptable to Caltrain.

Provide clear, safe routes that are separated from vehicles for pedestrians and cyclists crossing the rail corridor

Pedestrians and cyclists will be completely separated from train and vehicular traffic. Full Pedestrian and cyclist movement is maintained with the crossing relocated to Kellogg Avenue.

Reduce rail noise and vibration

Train horn noise and warning bells will be eliminated by the replacement of the at-grade crossings with grade separations. The use of electric motors rather than diesel engines will also reduce noise. Train wheel noise at the bridge location can be mitigated.

Minimize visual changes along the corridor

The railroad tracks and the northbound lanes of Alma Street will remain at-grade, and the east side of Churchill Avenue will remain unchanged. Mature trees and overhead power poles within the Alma Street planting strip, from just north of Kellogg Avenue to just south of Colderidge Avenue, will be removed.

Minimize right-of-way acquisition

Driveway modifications are likely to be required due to the removal of planter strips along Alma Street. Some (sliver) acquisition of the high school and/or residential property fronting Churchill Avenue on the west side of the tracks will be required. Some of the proposed improvements require encroachment inside Caltrain’s right-of-way, especially during construction.

Minimize disruption and duration of construction

Construction will require extended lane reductions at Alma Street. Closure of Churchill Avenue between Alma Street and Castilleja Avenue is expected for majority of the construction. The construction would last for approximately 2.5 to 3 years.

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