TO: HONORABLE COUNCIL COMMITTEE OF THE WHOLE

FROM: ED SHIKADA, CITY MANAGER

DATE: MARCH 18, 2019

SUBJECT: AGENDA ITEM NUMBER 1 – Connecting Palo Alto Schedule and Criteria Update

Staff inadvertently left out Attachments A and B for the Connecting Palo Alto Grade Separation agenda item for the March 18th Council Committee of the Whole. The attachments are attached to this memo (Attachment A: Redlined Version of Evaluation Criteria from September 11, 2017; and Attachment B: Example of Evaluation Criteria Usage in the Evaluation Matrix).

In addition to the aforementioned attachments, staff also wanted to share recent documents related to Connecting Palo Alto Grade Separation. The documents include:

1. A Letter from City Manager Ed Shikada to the Valley Transportation Authority (VTA) regarding grade separation funding; and
2. The PowerPoint presentation from the March 13, 2019 Rail Community Advisory Panel (CAP) meeting which details traffic mitigation information related to Churchill Avenue. The PowerPoint also includes the full animation for the citywide tunnel (https://vimeo.com/ursci/review/322224263/53a894a056) and some finance updates.

Ed Shikada
City Manager

Attachments
Connecting Palo Alto: Problem Statement, Objectives, and Evaluation Criteria
September 2017 Draft for City Council Discussion Purposes

Connecting Palo Alto: Suggested Evaluation Criteria

The following evaluation criteria are suggested as a starting place to support the development and evaluation of alternatives. These can be modified or supplemented with performance measures or metrics based on community input and technical analyses.

Tier 1 Criteria: Most Important

- 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

- 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 & finance with available funding sources
- Construction: minimize disruption and the duration of construction

Tier 3 Criteria: Somewhat Important

- Construction: minimize disruption and the duration of construction activities at any single location
- Cost: minimize right-of-way acquisition & finance with available funding sources
Attachment B: Example of Evaluation Criteria Usage in the Evaluation Matrix

Evaluation Matrix as of December 2018:

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Trench (MCT)</th>
<th>Hybrid (MCL)</th>
<th>Viaduct (MCV)</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A. Improve East-West Connectivity</td>
<td></td>
<td></td>
<td></td>
<td>Same connectivity for all three final configuration</td>
</tr>
<tr>
<td>B. Reduce traffic congestion and delays</td>
<td></td>
<td></td>
<td></td>
<td>Same traffic improvements for all three final configuration</td>
</tr>
<tr>
<td>C. Provide clear, safe routes for pedestrians and bikes</td>
<td></td>
<td></td>
<td></td>
<td>Reduced conflicts for bikes/peds for all three final configuration</td>
</tr>
<tr>
<td>D. Support continued rail operations</td>
<td></td>
<td></td>
<td></td>
<td>Viaduct can be built without a temporary railroad diversion (chef):</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Viaduct and hybrid do not increase long-term maintenance or risk to operations</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Trench will have high maintenance costs and risks to rail operations</td>
</tr>
<tr>
<td>E. Finance with feasible funding sources</td>
<td></td>
<td></td>
<td></td>
<td>Based on estimated range of construction costs (K)</td>
</tr>
<tr>
<td>F. Minimize right-of-way acquisition</td>
<td></td>
<td></td>
<td></td>
<td>Trench requires subsurface acquisition for structural elements and impairs to cranes will require right of way to construct pumps.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hybrid requires driveway modifications.</td>
</tr>
<tr>
<td>G. Reduce rail noise and vibration</td>
<td></td>
<td></td>
<td></td>
<td>All alternatives eliminate train horn noise and warning bells.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>All options have some degree of noise impact/Improvement, such as:</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>1) in a trench, noise could reflect off walls and impact properties farther away can be mitigated</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>2) in a viaduct and hybrid, wind noise could reflect off walls can be mitigated</td>
</tr>
<tr>
<td>H. Maintain or improve local access</td>
<td></td>
<td></td>
<td></td>
<td>Same improvements for all three final configuration</td>
</tr>
<tr>
<td>I. Minimize visual changes along the corridor</td>
<td></td>
<td></td>
<td></td>
<td>Trench has train below grade - landscaping option limited to bishes or shrubs with shadow root systems</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hybrid has train above grade 15 feet above grade - landscaping with trees for screening feasible.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Viaduct has train approximately 20 feet above grade - landscaping with trees for screening feasible.</td>
</tr>
<tr>
<td>J. Minimize disruption and duration of construction</td>
<td>6 years</td>
<td>4 years</td>
<td>2 years</td>
<td>Trench has extended road closures at Meadow and Charleston during construction.</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Hybrid has extended road reductions at Ault, Meadow and Charleston during construction.</td>
</tr>
</tbody>
</table>
| K. Order of Magnitude Cost                    | $800M to 950M* | $200M to 250M* | $400M to 500M* | Total Preliminary Construction Costs in 2018 dollars **Includes land. **

*Note: The order of magnitude cost is an estimate and may vary.

**Note: The total preliminary construction costs include land acquisition and other related expenses.**
March 13, 2019

Nuria Fernandez
General Manager
Santa Clara Valley Transportation Authority
3331 North First Street
San Jose, CA 95134-1906

Re: Request for Measure B Grade Separation Funding

Dear General Manager Fernandez,

It is our understanding that VTA is currently developing your multiyear capital budget, and our staff learned last week that the unallocated portion of the $7.0 million that was earmarked for the FY 2018-19 biennium period will be carried over to the FY 2020-21 biennium budget. The purpose of this letter is to request an allocation of $4 million from these funds in FY 2020/21 to support grade separation planning in the City of Palo Alto. I am addressing this request to your office, as there does not yet appear to be a system for handling requests of this nature.

An extensive community engagement process to select a preferred alternative is drawing toward completion, with the City then proceeding with Project Approval / Environmental Document (PA/ED) preparation later this calendar year. The estimated cost for the PA/ED phase ranges between $3 million and $6 million. As such we would like to request a minimum of $3 million to support PA/ED for project development at three of our four existing at-grade rail crossings at Churchill Avenue, Charleston Road, and Meadow Drive.

VTA staff has indicated that the Authority has allocated $500,000 from the $7.0 million, for the contractual services required to develop the Implementation Plan. The remaining balance of $6.5 million remains unallocated. Since the City of Mountain View has completed its preparation of environmental documents, the Cities of Palo Alto and Sunnyvale are the only eligible applicants for the allocation of these funds. VTA staff has indicated that any unused funds in a biennium budget cycle will automatically be carried over to the next biennium budget cycle.

As you know, VTA staff is recommending that $31 million be included in the second FY biennium budget cycle (FY 20/21) for the design of the two eligible projects in Mountain View in order to keep moving these projects forward. The design of the Rengstroff Avenue project would be allocated $24 million and the design of the Castro Street project allocated $7 million.
To account for the possibility that either or both the projects in Palo Alto and Sunnyvale would move into the design stage during the FY 20/21 Biennium cycle, we support the position taken at today's meeting of the VTA Technical Advisory Committee that any funding for FY 20/21 not be allocated until the Implementation Plan is adopted by VTA.

The City's fourth eligible project, the rail crossing at Palo Alto Avenue is part of a comprehensive land use/transportation planning process to commence in 2019 with a preferred alternative selected in 2020. The preparation of an EIR for that project is expected to commence in 2020 or 2021. While the cost of environmental clearance is unknown at this time, the Coordinated Area Plan specified under the Palo Alto Municipal Code is expected to be a multimillion dollar effort. We are seeking funds for this effort from several sources, so are requesting $1 million from VTA to develop a preferred alternative for the Palo Alto Avenue existing at-grade crossing.

Please ask your appropriate staff to contact me at ed.shikada@cityofpaloalto.org or Chantal Cotton Gaines at Chantal.gaines@cityofpaloalto.org or (650) 329-2280 to discuss any follow-up information needed and next steps, as well as if you have any questions or would like to discuss this issue further. I look forward to our staff continuing to work together on this important program.

Sincerely,

[Signature]

Ed Shikada
City Manager

Cc: Chantal Cotton Gaines, Assistant to the City Manager, City of Palo Alto
    Wayne Tanda, Consultant, City of Palo Alto
    Jason Kim, Senior Transit Planner, Santa Clara Valley Transportation Authority
Community Advisory Panel Meeting # 7

03.13.19
Welcome and Introductions
Community Conversations
Financial Update
Traffic Analysis for Churchill Closure
Citywide Tunnel Alternative
Churchill Pedestrian/Bike Crossing Alternatives
Overview of March 27th Community Meeting Agenda
Summary of Action Items
Adjourn & Thank you
Community Conversations

- CAP Community Interactions
- Emails to the City
Finance and Funding

Outline

- Gross Receipt Tax
- Per Employee Tax
- Comparable Grade Separation Projects in Nearby Cities
## Finance and Funding

### Matrix of taxes by city ($ million)

<table>
<thead>
<tr>
<th></th>
<th>San Francisco</th>
<th>Mountain View</th>
<th>Cupertino</th>
</tr>
</thead>
<tbody>
<tr>
<td>Gross Receipt Tax</td>
<td>$1180</td>
<td>$0</td>
<td>$0</td>
</tr>
<tr>
<td>Per Employee Tax</td>
<td>$0</td>
<td>$6</td>
<td>$10</td>
</tr>
</tbody>
</table>
Gross receipts refers to the total amount of money received from doing business in San Francisco and includes amounts derived from sales, services, dealings in property, interest, rent, royalties, dividends, licensing fees, other fees, commissions and distributed amounts from other business entities.”
San Francisco

______________
Gross Receipt Tax & Business Registration Fee Ordinance (Proposition E)

**Finance and Funding**

**When?**
April, 2014

**Purpose**
The tiered rate structure better distributes the tax burden.
A diversified tax base increases revenue stability.

**Who?**
Business with Gross Receipts > $1,120,000
Business with Payroll expenses > $300,000

**Estimate**
Approximately $880 million*

*Overall gross receipts tax was to be revenue neutral and phase out the payroll expense tax.
San Francisco

Homeless Services
Gross Receipts Tax
(Proposition C)

**Finance and Funding**

**When?**
November, 2018

**Purpose**
Support services for homeless people and prevent homelessness
- Housing ≈ 50%
- Mental health services ≈ 25%
- Residential shelters and hygiene ≈ 10%
- Homelessness prevention ≈ 15%

**Estimate**
Additional $250 - $300 million annually

**Who?**
- For businesses that pay a gross receipts tax, additional 0.175% - 0.690% on those gross revenues over $50 million.
- For businesses that pay the administrative office tax, an additional tax of 1.5 percent of their payroll expense.
“A per-employee tax is a progressive tax system under which larger companies pay higher rates than small businesses.
Mountain View
___________
Per-Employee Business Tax
(Measure P)

**Finance and Funding**

**When?**
November, 2018

**Purpose**
Fund critical City needs (reducing traffic congestion, enhancing bicycle/pedestrian friendly routes, housing affordable)

**Estimate**
Additional $6 million annually of which Google pays $3.3 million

**Who?**
A progressive tax system with larger companies paying higher rates than small businesses.

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>Business License Tax</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>$75</td>
</tr>
<tr>
<td>2-25</td>
<td>$75 + $5/per employee over 1</td>
</tr>
<tr>
<td>26-50</td>
<td>$195 + $10/per employee over 25</td>
</tr>
<tr>
<td>51-500</td>
<td>$445 + $75/per employee over 50</td>
</tr>
<tr>
<td>501-1,000</td>
<td>$34,195 + $100/per employee over 500</td>
</tr>
<tr>
<td>1,001-5,000</td>
<td>$84,195 + $125/per employee over 1,000</td>
</tr>
<tr>
<td>5,001 +</td>
<td>$584,195 + $150/per employee over 5,000</td>
</tr>
</tbody>
</table>
When?  
November, 2020

Purpose  
Improve the City’s transportation infrastructure and alleviate local traffic congestion

Estimate  
Additional $8 - $10 million annually of which Apple would pay $7-9 million

Who?  
A progressive tax system with larger companies paying higher rates than small businesses.

### Per-Employee Business Tax

<table>
<thead>
<tr>
<th>Number of Employees</th>
<th>Base Rate</th>
<th>Employee Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-9</td>
<td>$150</td>
<td>$-</td>
</tr>
<tr>
<td>10-49</td>
<td>$250</td>
<td>$-</td>
</tr>
<tr>
<td>50-99</td>
<td>$500</td>
<td>$50.00</td>
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<tr>
<td>100-249</td>
<td>$500</td>
<td>$75.00</td>
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<td>250-499</td>
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<td>$500</td>
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</tr>
<tr>
<td>1,000-4,999</td>
<td>$500</td>
<td>$150.00</td>
</tr>
<tr>
<td>5,000+</td>
<td>$500</td>
<td>$-</td>
</tr>
</tbody>
</table>
Other examples of headcount taxes

- City of Sunnyvale
- Redwood City
- San Jose
Examples of funding sources obtained or proposed for projects in the region

Comparable Grade Separation Projects in Nearby Cities

Projects Completed
- San Bruno

Projects in Construction
- San Mateo

Projects in Planning
- Burlingame
- Mountain View
- Menlo Park
Comparable Grade Separation Projects in Nearby Cities

San Bruno
funding sources obtained

**Project Summary:**
- Elevate Caltrain tracks above three crossings; three pedestrian underpasses; new elevated Caltrain station
- Project cost of $155 million
- Completed in 2014

**Funding Summary:**
- Regional funds - $92.4 million
  - San Mateo County Transportation Authority (Measure A)
- State funds - $55.9 million
  - High Speed Rail / Proposition 1B / Statewide Transportation Improvement Program / Caltrans+CPUC Section 190
- Federal funds - $6.6 million
  - Federal Transit Administration
Comparable Grade Separation Projects in Nearby Cities

San Mateo

Project Summary:
- Hybrid approach: Raise tracks; lowering of the road grade; allow for east-west street connections; new elevated Caltrain station
- Project cost of $180 million
- Estimated completion date of 2020

Funding Summary:
- Local Funds - $12 million
  - City of San Mateo Transportation Impact Fees
- Regional funds - $74 million
  - San Mateo County Transportation Authority (Measure A)
- State funds - $94 million
  - High Speed Rail Proposition 1A ($84 million)
  - Caltrans/CPUC Section 190 ($10 million)
Comparable Grade Separation Projects in Nearby Cities

**Burlingame**
- Estimated project alternative costs range from $250 to $910 million
- Preferred alternative was $250 million
- Preliminary design expected to be complete by end of 2019

**Mountain View**
- Estimated project cost of $120 million (in 2014)
- Entering preliminary environmental review and engineering phase

**Menlo Park**
- Estimate project cost for three crossings is $390 million while single crossing was estimated at $200 million, former preferred by City
- Draft project study report released at end of 2018

**Across projects similar funding concepts:**
- Regional: San Mateo County Measure A / Santa Clara County Measure B
- State: Caltrans/CPUC Section 190
- Local: Transportation impact fees and value capture approaches
Comparable Grade Separation Projects in Nearby Cities

Summary findings of funding strategies

- Federal funds have been limited for projects completed or under construction.

- High speed rail funds have been critical for projects completed or under construction, but this will likely be an unreliable source of future funds.

- Regional transportation measure funds have been and will continue to be a critical funding source for projects.

- Local funding sources such as transportation impact fees have been used / are proposed for use, but have yet to be a large contributor comparative to total project costs.

- Total project costs for similar projects were $250 million or less, which makes it challenging to identify a percentage share from different funding sources given the larger price tag of project.
Traffic Study Review

Topics 2/13/19 CAP

- Data Collection
- Evaluation of Existing Traffic Conditions

Topics for today (3/13/19 CAP)

- Evaluation of Year 2030 Traffic Conditions with Churchill Closure
- Mitigations for Impacted Intersections
Existing Traffic Volume at Alma Street/Churchill Avenue

**Total Trips Diverted due to Churchill Ave Closure**
- **AM Peak (8:00 a.m. - 9:00 a.m.)** = 706 vehicles
- **PM Peak (5:15 p.m. - 6:15 p.m.)** = 776 vehicles
Trip Distribution

1. XX% - AM Trip Distribution
2. (XX%) - PM Trip Distribution
3. XX – AM Trip Volume
4. (XX) – PM Trip Volume
Intersections Mitigated as a Group
- #3 - Alma Street/Lincoln Avenue
- #4 - Alma Street/Embarcadero Road
- #8 - Alma Street/Kingsley Avenue

CMP Intersections
- #19 - El Camino Real/Embarcadero Road
- #24 - Oregon Expressway/Middlefield Road
- #21 - El Camino Real/Oregon Expressway-Page Mill Road

Intersections Mitigated Individually
- #22a/#22b - Alma Street/Oregon Expressway
- #15 - Embarcadero Road/Cowper Street
Intersections
Intersections Mitigated as a Group

#3: Alma Street/Lincoln Avenue

#4: Alma Street/Embarcadero Road

#8: Alma Street/Kingsley Avenue

Existing Plus Project

Year 2030 Plus Project
Operating at LOS F in AM and PM Peak for:
- Existing
- Year 2030
- Year 2030 Plus Project

Westbound left turns at the 3 intersections are experiencing highest delay (LOS F)

Alma Street/Kingsley Avenue meets Peak Hour Traffic Signal Warrant for Year 2030 Plus Project scenario
Existing Geometry and Mitigation for Intersection 3, 4, and 8

- Individual mitigations for each intersection did not show as much benefit as mitigating as a group
- Right in/out at Alma St/Lincoln Ave

**Existing Layout**

- Divert left turning vehicles at Lincoln Ave and add left-turn lane on Embarcadero Rd for vehicles turning onto Alma St (removal of parking)
- Signalize Alma St/Embarcadero Rd and Alma St/Kingsley Ave with one controller

**Proposed Layout**
## Resulting LOS for Intersection 3, 4, and 8

<table>
<thead>
<tr>
<th>#</th>
<th>Int.</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030</th>
<th>Year 2030 Plus Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without Mitigation</td>
<td>With Mitigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td>Alma St/Lincoln Ave</td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>With Mitigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Alma St/Embarcadero Rd</td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td></td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>D</td>
</tr>
<tr>
<td></td>
<td>Alma St/Kingsley Ave</td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>D</td>
</tr>
</tbody>
</table>
Concept – Near Term
Intersection 19 - El Camino Real/Embarcadero Road

CMP intersection
Operating at LOS F in AM and PM
Peak for:
  – Year 2030 (PM Peak Only)
  – Year 2030 Plus Project
Existing Geometry and Mitigation for El Camino Real/Embarcadero Road

- Install additional westbound left turn lane and northbound right turn lane
- Optimize signal timings

**Existing Layout**

**Proposed Layout**
<table>
<thead>
<tr>
<th>#</th>
<th>Intersection</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030</th>
<th>Year 2030 Plus Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without Mitigation</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>With Mitigation</td>
</tr>
<tr>
<td>19</td>
<td>El Camino Real/Embarcadero Rd</td>
<td>AM</td>
<td>E</td>
<td>E</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td>E</td>
</tr>
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<td></td>
<td>PM</td>
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<td>F</td>
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<td></td>
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<td></td>
<td></td>
<td></td>
<td>E</td>
</tr>
</tbody>
</table>
CMP Intersection
Operating at LOS F in AM and PM Peak for:
  – Year 2030 (AM Peak Only)
  – Year 2030 Plus Project
Existing Geometry and Mitigation for El Camino Real/Oregon Expressway-Page Mill Road

- Install westbound right turn lane from Oregon Expressway to El Camino Real
- Optimize signal timing

**Existing Layout**

**Proposed Layout**
<table>
<thead>
<tr>
<th>#</th>
<th>Intersection</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030</th>
<th>Year 2030 Plus Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>El Camino Real/Oregon Expressway</td>
<td>AM</td>
<td>E</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM</td>
<td>E</td>
<td>E</td>
<td>F</td>
</tr>
</tbody>
</table>
Intersection 24 – Oregon Expressway/Middlefield Road

CMP Intersection
Operating at LOS F in AM and PM
Peak for:
  – Year 2030
  – Year 2030 Plus Project

Existing Plus Project

Year 2030 Plus Project
Existing Geometry and Mitigation for Oregon Expressway/Middlefield Road

- Remove southbound thru/right lane and install exclusive right turn lane
- Modify signal phasing to include overlaps for SB right turn and EB right turn
- Convert northbound right turn lane into shared thru/right turn lane
- Add an additional northbound receiving lane

**Existing Layout**

**Proposed Layout**
### Intersection #24
Middlefield Rd. / Oregon Exp'y.

<table>
<thead>
<tr>
<th>#</th>
<th>Intersection</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030</th>
<th>Year 2030 Plus Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Oregon Expressway/ Middlefield Rd</td>
<td>AM</td>
<td>E</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM</td>
<td>E</td>
<td>F</td>
<td>F</td>
</tr>
</tbody>
</table>
Operating at LOS F in AM and PM Peak for both on/off ramps in:
- Existing
- Year 2030
- Year 2030 Plus Project

Alma St/Oregon Expressway EB Ramp meets peak hour signal warrant for all scenarios
Existing Geometry and Mitigation Alma Street/Oregon Expressway

- Signalize both on/off ramps with one controller
## Resulting LOS for Alma Street/Oregon Expressway

<table>
<thead>
<tr>
<th>#</th>
<th>Int.</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030 Without Mitigation</th>
<th>Year 2030 Plus Project Without Mitigation</th>
<th>Year 2030 Plus Project With Mitigation</th>
</tr>
</thead>
<tbody>
<tr>
<td>22a</td>
<td>Alma St/ Oregon Ave</td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>A</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>A</td>
</tr>
<tr>
<td>22b</td>
<td>Alma St/ Oregon Expy EB</td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td>Off Ramp</td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>F</td>
<td>C</td>
</tr>
</tbody>
</table>
Operating at LOS F in AM and PM Peak for:

- Existing
- Year 2030
- Year 2030 Plus Project

Northbound and Southbound movements experiencing highest delay (LOS F and E, respectively)
Existing Geometry and Mitigation for Embarcadero Road/Cowper Street

- Right in/out for Cowper St in NB and SB direction

- Divert NB left/NB through and SB left/SB through movements to Embarcadero Rd / Waverly St

**Existing Layout**

**Proposed Layout**
<table>
<thead>
<tr>
<th>#</th>
<th>Int.</th>
<th>Peak hour</th>
<th>Existing</th>
<th>Year 2030</th>
<th>Year 2030 Plus Project</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td></td>
<td>Without Mitigation</td>
<td>With Mitigation</td>
</tr>
<tr>
<td>15</td>
<td>Embarcadero Rd/Cowper St</td>
<td>AM</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM</td>
<td>F</td>
<td>F</td>
<td>F</td>
</tr>
<tr>
<td>16</td>
<td>Embarcadero Rd/Waverly St</td>
<td>AM</td>
<td>C</td>
<td>C</td>
<td>C</td>
</tr>
<tr>
<td></td>
<td></td>
<td>PM</td>
<td>D</td>
<td>C</td>
<td>C</td>
</tr>
</tbody>
</table>
Traffic Infusion on Residential Environment (TIRE)

- Measure of traffic impact on residents along a roadway
- Based on daily average conditions and uses average daily traffic (ADT) volumes to determine amount of daily traffic that could be added to a roadway before residents would perceive the increase in traffic

2 segments will see an impact due to the closure of Churchill Avenue during Existing Plus Project and Year 2030 Plus Project scenarios

- Emerson Street, from Channing Avenue to Addison Avenue
- Emerson Street, from Lincoln Avenue to Kingsley Avenue
TIRE Analysis
Summary of Traffic Mitigations

#3 - Alma Street/Lincoln Avenue
- Restrict left turn and provide right turn only for Lincoln Ave

#4 - Alma Street/Embarcadero Road
- Add left turn lane and signalize

#8 - Alma Street/Kingsley Avenue
- Signalize intersection

#19 - El Camino Real/Embarcadero Road
- Add additional WBL turn and NBR turn lane
- Optimize signal timings

#24 - Oregon Expressway/Middlefield Road
- Install SBR turn lane and modify signal phasing to include NBR and SBR turn overlaps

#21 - El Camino Real/Oregon Expressway-Page Mill Road
- Install WBR turn lane and optimize signal timing

#22a/#22b - Alma Street/Oregon Expressway
- Signalize intersections

#15 - Embarcadero Road/Cowper Street
- Restrict left turn and through movements for NB and SB at Cowper, reroute trips to Embarcadero/Waverly
Current List of Grade Separation Alternatives

- **Citywide Tunnel**
  - Lower the railroad below the roadways in a tunnel

- **Churchill Ave. Closure**
  - At-grade crossing to be fully or partially closed at Churchill Ave with a grade separation for Bike/Ped connectivity

- **South Palo Alto Tunnel**
  - Tunnel south of Oregon Expressway under Meadow and Charleston

- **Meadow / Charleston Trench**
  - Lower the railroad below the roadways at Meadow and Charleston

- **Meadow / Charleston Hybrid**
  - Partially lower the roads and partially elevate the tracks at Meadow and Charleston

- **Meadow / Charleston Viaduct**
  - Raise the railroad above the roadways at Meadow and Charleston on structure

List as of January 22, 2019 City Council Meeting
Twin Bore Tunnel Design Assumptions

- 22-foot vertical clearance from the track top-of-rail to the contact wire resulting in a 34-foot outside diameter tunnel.
- 15-foot minimum clearance between the twin bores at the portals resulting in a 49-foot track spacing.
- 34 feet of clearance between the twin bores at locations beyond the portals.
- 10-foot minimum distance between the top of the tunnel and the ground surface at the portals.
- Minimum distance of 34 feet between the top of the tunnel and the ground surface at locations beyond the portals.
- The bore pit for launching the Tunnel Boring Machines is a minimum 100 feet wide by 44 feet deep.
- Track slope is 2% for portal approach tracks.
- Minimum track slope of 0.3% for tunnel drainage.
- Pump station will be located at the tunnel low point to drain the seepage flows and firewater in the event of a fire.
- The underground station will be mined with individual openings to the surface for vent shafts, stairways and elevators.
Tunnel Example Section - Twin Bore Tunnel
DISCLAIMER:
The following animation is a Concept for Discussion Only. It is not a specific proposal.
Tunnel Animation
### Citywide Tunnel Evaluation Matrix

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Citywide Tunnel</th>
<th>Comments</th>
</tr>
</thead>
<tbody>
<tr>
<td>A</td>
<td>Improve East-West Connectivity</td>
<td>&lt;ul&gt;&lt;li&gt;All at-grade crossings fully separated (Meadow, Charleston, Churchill)&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>B</td>
<td>Reduce traffic congestion and delays</td>
<td>&lt;ul&gt;&lt;li&gt;All at-grade crossings fully separated (Meadow, Charleston, Churchill)&lt;/li&gt;&lt;li&gt;Alma St permanently narrowed from 4 to 2 lanes in the areas of the north portal. For the south portal area, Alma St will be permanently narrowed from 5 to 3 lanes.&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>C</td>
<td>Provide clear, safe routes for pedestrians and bikes</td>
<td>&lt;ul&gt;&lt;li&gt;Reduced conflicts for bikes/peds with railroad&lt;/li&gt;&lt;li&gt;Reduced lanes on Alma Street near north and south portal&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>D</td>
<td>Support continued rail operations</td>
<td>&lt;ul&gt;&lt;li&gt;A temporary railroad track (shoofly) required near the north and south portals.&lt;/li&gt;&lt;li&gt;Tunnel will have high maintenance costs and risks to train operations&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>E</td>
<td>Finance with feasible funding sources</td>
<td>&lt;ul&gt;&lt;li&gt;Based on estimated range of construction costs (K)&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>F</td>
<td>Minimize right-of-way acquisition</td>
<td>&lt;ul&gt;&lt;li&gt;Tunnel requires subsurface acquisition for structural elements&lt;/li&gt;&lt;li&gt;Significant right-of-way impacts for construction of the temporary track near the north and south portals.&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>G</td>
<td>Reduce rail noise and vibration</td>
<td>&lt;ul&gt;&lt;li&gt;Tunnel eliminates train horn noise and warning bells&lt;/li&gt;&lt;li&gt;Potential noise impact related to ventilation system, pump station, and generators.&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>H</td>
<td>Maintain or improve local access</td>
<td>&lt;ul&gt;&lt;li&gt;Stanford Station game day service eliminated&lt;/li&gt;&lt;li&gt;Embarcadero undercrossing will need to be re-built&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>I</td>
<td>Minimize visual changes along the corridor</td>
<td>&lt;ul&gt;&lt;li&gt;Tunnel has train below grade – landscaping option limited to bushes or plants with shallow root systems&lt;/li&gt;&lt;/ul&gt;</td>
</tr>
<tr>
<td>J</td>
<td>Minimize disruption and duration of construction</td>
<td>7+ years</td>
</tr>
</tbody>
</table>
| K | Order of Magnitude Cost | $2,500M to 3,800M* | <ul><li>Does not include costs associated with rebuilding Embarcadero and reconfiguring Adobe Creek.</li><li>* Total Preliminary Construction Costs in 2018 dollars (Subject to Change)</li></ul>
### Tunnel Engineering Impacts

<table>
<thead>
<tr>
<th>L</th>
<th>Creek/Drainage/ Groundwater Impacts</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Requires diversion of Adobe creeks resulting in the need for pump stations</td>
</tr>
<tr>
<td>-</td>
<td>Numerous regulatory agency approvals required for creek diversion</td>
</tr>
<tr>
<td>-</td>
<td>Groundwater impacts include disruption to natural flow and potential to disperse existing contamination</td>
</tr>
<tr>
<td>-</td>
<td>Pump stations also required to dewater the tunnel</td>
</tr>
<tr>
<td>-</td>
<td>Increased risk of flooding due to pump stations</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>M</th>
<th>Long Term Maintenance</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Increased maintenance costs due to:</td>
</tr>
<tr>
<td>-</td>
<td>Pump stations for creek diversions</td>
</tr>
<tr>
<td>-</td>
<td>Pump stations for tunnel dewatering</td>
</tr>
<tr>
<td>-</td>
<td>Below ground railroad alignment</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>N</th>
<th>Utility Relocations</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Major utility relocations for Alma Street</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>O</th>
<th>Railroad Operations Impacts during Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Temporary track (shoofly) is required at north and south portals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>P</th>
<th>Local Street Circulation Impacts during Construction</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>Alma St closed near north and south portals</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Q</th>
<th>Caltrain Design Exceptions Needed</th>
</tr>
</thead>
<tbody>
<tr>
<td>-</td>
<td>2% grade on track required. Maximum allowed by Caltrain is 1%.</td>
</tr>
</tbody>
</table>
Churchill Ave Ped/Bike Undercrossing - Option 1
Churchill Ave Ped/Bike Undercrossing - Option 1
Churchill Ave Ped/Bike Undercrossing - Option 2
Churchill Ave Ped/Bike Undercrossing - Option 2
<table>
<thead>
<tr>
<th>Criteria</th>
<th>Option 1</th>
<th>Option 2</th>
<th>Comments</th>
</tr>
</thead>
</table>
| A Improve East-West Connectivity             | ✅        | ✅        | □ Both options close Churchill to through traffic  
□ Option 1 ped/bikes crosses underneath the railroad tracks only  
□ Option 2 ped/bikes crosses underneath the railroad tracks and Alma St |
| B Reduce traffic congestion and delays       | ✅        | ✅        | □ Both options close Churchill to through traffic; however, impacted intersections can be mitigated.  
□ Pedestrian phase for traffic signal no longer needed at Alma Street for Option 2. |
| C Provide clear, safe routes for pedestrians and bikes | ✅        | ✅        | □ Option 1 reduces conflicts for ped/bikes at railroad  
□ Option 2 reduces conflicts for ped/bikes at railroad and Alma St  
□ Option 1 will have shorter ramps, stairs, and undercrossing than Option 2 |
| D Support continued rail operations          | ✅        | ✅        | □ Option 1 and 2 can be built with similar construction staging with limited single track operations at night and on weekends. |
| E Finance with feasible funding sources      | ✅        | ✅        | □ Based on estimated range of construction costs (K) |
| F Minimize right-of-way acquisition          | ✅        | ✅        | □ Option 1 may impact High School property and ramp proposed within Caltrain right-of-way  
□ Option 2 has no right-of-way impacts; however, there will be some loss of parking on the east side of Churchill |
| G Reduce rail noise and vibration            | ✅        | ✅        | □ Both options eliminate train horn noise and warning bells with closure of Churchill |
| H Maintain or improve local access           | ✅        | ✅        | □ Both options close Churchill to through traffic  
□ Option 1 ped/bikes crosses underneath the railroad tracks only  
□ Option 2 ped/bikes crosses underneath the railroad tracks and Alma St |
| I Minimize visual changes along the corridor | ✅        | ✅        | □ Both options have opportunities for additional landscaping areas |
| J Minimize disruption and duration of construction | 1 year    | 2 years  | □ Construction period is relatively short |
| K Order of Magnitude Cost                    | $12M to $15M* | $16M to $20M* | * Total Preliminary Construction Costs in 2018 dollars (Subject to Change)
## Churchill Ped/Bike Undercrossing Engineering Impacts

<table>
<thead>
<tr>
<th>Engineering Impacts</th>
<th>Option 1</th>
<th>Option 2</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>L</strong> Creek/Drainage Impacts</td>
<td>□ Pump station required for lowered pedestrian/bike way.</td>
<td>□ Pump stations required for lowered pedestrian/bike way.</td>
</tr>
<tr>
<td></td>
<td>□ Increased risk of flooding due to pump stations.</td>
<td>□ Increased risk of flooding due to pump stations.</td>
</tr>
<tr>
<td><strong>M</strong> Long Term Maintenance</td>
<td>□ Increased maintenance costs due to:</td>
<td>□ Increased maintenance costs due to:</td>
</tr>
<tr>
<td></td>
<td>• Pump stations for undercrossing dewatering</td>
<td>• Pump stations for undercrossing dewatering</td>
</tr>
<tr>
<td><strong>N</strong> Utility Relocations</td>
<td>□ Minimal impacts to utilities</td>
<td>□ Potential utility relocations in Alma St and Churchill</td>
</tr>
<tr>
<td><strong>O</strong> Railroad Operations Impacts during Construction</td>
<td>□ No shoofly required, only single tracking during nights and weekends</td>
<td>□ No shoofly required, only single tracking during nights and weekends</td>
</tr>
<tr>
<td><strong>P</strong> Local Street Circulation Impacts during Construction</td>
<td>□ Path along High School will impacted temporary during construction</td>
<td>□ Temporary closure night and weekend closures of lanes on Alma St and Churchill</td>
</tr>
<tr>
<td><strong>Q</strong> Caltrain Design Exceptions Needed</td>
<td>None required.</td>
<td>None required.</td>
</tr>
</tbody>
</table>
Please select your preferred alternative for the Meadow/Charleston location

☐ TRENCH: Lower the railroad below the roadways at Meadow and Charleston

☐ HYBRID: Partially lower the roads and partially elevate the tracks at Meadow and Charleston

☐ VIADUCT: Raise the railroad above the roadways at Meadow and Charleston on structure

Please select your preferred option for the Churchill Pedestrian/Bike Crossing options.

☐ OPTION 1: At-grade crossing (railroad) to be fully closed at Churchill Ave with a grade separation for ped/bike connectivity

☐ OPTION 2: At-grade crossing (railroad and Alma St) to be fully closed at Churchill Ave and railroad with a grade separation for ped/bike connectivity

Please select your preference for direction the Citywide Tunnel should take.

☐ Continue to study this alternative

☐ Eliminate this alternative
THANK YOU for your participation!

Materials from this meeting will be posted to:
www.cityofpaloalto.org/ConnectingPaloAlto

Wednesday
March 27, 2019
6:00 - 8:00 pm

Railroad crossing ideas to be discussed:
• Churchill Avenue
• Citywide Tunnel
Thank you
Criteria of Significance

**Signalized Intersections:** Per City of Palo Alto Standards, a project generated increase in motor vehicle traffic is considered to have significant impact:

- If intersection degrades from LOS D or better to unacceptable LOS E or F; or
- If critical delay increases by more than four seconds and the volume-to-capacity (V/C) ratio increases by 0.01 or more at intersections with unacceptable LOS E or F

**Unsignalized Intersections:** Per City of Palo Alto Standards, LOS D is minimum acceptable LOS. A project is considered to have significant impact:

- If intersection degrades from LOS E or F from acceptable operations and the intersection satisfies the peak hour signal warrant from CA MUTCD
Per CMP (Congestion Management Program), a project-generated increase in traffic is considered to have significant impact:

- If intersection operations degrade from an acceptable LOS E or better to unacceptable LOS F; or
- If the critical delay increase by more than four seconds and the V/C ratio increases by 0.01 or more at intersection with unacceptable operations (LOS F)
Churchill Ave Ped/Bike Undercrossing - Option 2