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Subject	ECR BRT Phasing Plan – Detailed 2020 Concept Evaluation Memo	

1 Introduction

This memo presents the detailed evaluation for Phase 1 ECR service concepts (i.e., those with an implementation year of 2020, thus nine service concepts including Concept 1 – 2020 Base Case). The evaluation is both a quantitative and qualitative analysis that has been adapted from the initial detailed framework presented in the September 23, 2013 *ECR BRT Phasing Plan – Proposed Evaluation Framework*. Data evaluated as part of this analysis is based on future 2020 service concepts and key operating statistics presented in the following memos:

- August 31, 2014 *Operating Plan Memo – Draft v1*
- September 13, 2014 *ECR BRT Phasing Plan – Capital Costs Memo*
- September 13, 2014 *ECR BRT Phasing Plan – O&M Costs Memo*
- October 1, 2014 *ECR BRT Phasing Plan – Ridership and Productivity Memo*

It is noted that statistics for Concept 10 – 2040 Full BRT are included for comparison purposes only. Concept 10 performance is not considered in the ranking of 2020 concepts.

2 Initial Evaluation Metrics

An initial detailed evaluation framework was presented in September 23, 2013 *ECR BRT Phasing Plan – Proposed Evaluation Framework* and is shown in Table 1. This framework was developed after project inception.

Table 1: Initial Detailed Evaluation Framework

Goal	Objective	Evaluation Criteria	Source(s)
1. Increase bus ridership along the El Camino Corridor by improving service for existing customers and attracting new customers	1.1. Increase ridership	<ul style="list-style-type: none"> • Increase in corridor ridership • Increase in ridership along key segments of corridor • Increase in system ridership • Increase in new riders • Boardings per revenue hour 	<ul style="list-style-type: none"> • VTA Model • Operating plan
	1.2. Improve passenger experience	<ul style="list-style-type: none"> • Improve station experience and security (station infrastructure for Full BRT only) • Improve in-vehicle experience • Create unique service branding/identity • Legible and easy to understand routing and service 	<ul style="list-style-type: none"> • Physical plan (qualitative assessment) • Operating plan
2. Complement the Grand Boulevard Initiative’s vision of realizing El Camino Real as a “grand boulevard of meaningful destinations” by building consensus on transit improvements that promote livability and commercial vitality	2.1. Improve pedestrian safety	<ul style="list-style-type: none"> ▪ Pedestrian safety assessment (bulbouts, medians, sidewalks, crossing opportunities) 	<ul style="list-style-type: none"> • Physical plan (qualitative assessment)
	2.2. Increase access to households, employment and retail opportunities	<ul style="list-style-type: none"> • # of households accessible within a 15-minute walk from a station • # of jobs accessible within a 15-minute walk from a station • Convenient and direct pedestrian/bicycle access between stations and adjacent land uses 	<ul style="list-style-type: none"> • Operating plan • VTA Model/2040 Plan Bay Area (GIS) • Physical plan (qualitative assessment)
	2.3. Support planned growth in corridor	<ul style="list-style-type: none"> • Serve key commercial and residential growth areas 	<ul style="list-style-type: none"> • Operating plan • VTA Model/2040 Plan Bay Area (GIS) •
3. Minimize system capital and operating cost increases and operational impacts by developing a conceptual bus operating plan that optimizes local, Rapid and Full BRT services along the corridor	3.1. Provide cost-effective service	<ul style="list-style-type: none"> • Capital cost • Operating and Maintenance (O&M) cost per revenue hour • O&M cost per unlinked passenger trip 	<ul style="list-style-type: none"> • VTA Model • Operating plan • Physical plan • SamTrans cost model
	3.2. Minimize ECR operating impacts	<ul style="list-style-type: none"> • Minimize operating demands for peak vehicles • Reliability (travel time variability) 	<ul style="list-style-type: none"> • Operating plan • VTA Model
4. Minimize corridor traffic and parking impacts while maximizing the benefits of Rapid and Full BRT services	4.1. Minimize traffic impacts	<ul style="list-style-type: none"> • Volume-to-Capacity (LOS) at key segments (effect of BRT physical improvements and Intelligent Transportation Systems (ITS) measures) 	<ul style="list-style-type: none"> • VTA Model •
	4.2. Minimize physical changes to corridor infrastructure	<ul style="list-style-type: none"> • Net change in on-street parking • Extent of new turn restrictions 	<ul style="list-style-type: none"> • Physical Plan

Source: *September 23, 2013 ECR BRT Phasing Plan – Proposed Evaluation Framework.*

3 Refinement of Evaluation Metrics

In light of project developments over the last year (including the outputs and results of the ridership forecasts from the VTA Model), the evaluation metrics presented in Table 1 were refined as shown in Table 2. Key changes to the evaluation frameworks are described in the table notes. It is noted that overall project goals and objectives did not change – only the detailed evaluation metrics.

Table 2: Refined Evaluation Framework (Light Gray Shading = Qualitative Metric)

Goal	Objective	Metric	Evaluation Criteria	Type of Metric	Explanation of Metric	
1. Increase bus ridership along the El Camino Corridor by improving service for existing customers and attracting new customers	1.1. Increase ridership ^{A, B}	1.1A	Increase in corridor-level boardings	Quantitative	<ul style="list-style-type: none"> Measures the increase in corridor-level boardings (including all SamTrans routes operating on the El Camino Real corridor) compared to Concept 1 (2020 Base Case). Higher corridor-level boardings generate more corridor revenues. 	
		1.1B	Increase in system-level boardings	Quantitative	<ul style="list-style-type: none"> Measures the increase in system-level boardings (including all SamTrans routes operating in the system) compared to Concept 1 (2020 Base Case). Higher system-level boardings generate higher total fare revenues for SamTrans. 	
		1.1C	Corridor boardings per RVH	Quantitative	<ul style="list-style-type: none"> Measures corridor boarding productivity (boardintags/RVH) for all SamTrans routes on the El Camino Real corridor. Boardings/RVH is an indicator of service productivity. 	
	1.2. Improve passenger experience		1.2A	Improve station experience and security	Quantitative	<ul style="list-style-type: none"> Measures the extent to which a service concept improves the customer experience at the stop/station (based on the number of enhanced stops or BRT stations in one direction). More satisfied customers may translate into higher ridership.
			1.2B	Improve in-vehicle experience	Qualitative	<ul style="list-style-type: none"> Measures the extent to which a service concept improves in-vehicle experience (based on average travel speed of the Rapid or Hybrid service (i.e., the non-ECR service). Average travel speed acts as a proxy for in-vehicle time, thus faster travel speeds likely means shorter in-vehicle time and a better experience and possibly higher ridership.
			1.2C	Create unique service branding/identity	Qualitative	<ul style="list-style-type: none"> Measures how well a service concept creates a unique service and branded identify, separate from the existing SamTrans ECR. A more unique brand identity helps eliminate confusion for riders and may attract riders looking for an enhanced service beyond ECR.
			1.2D	Legible and easy to understand routing and service	Qualitative	<ul style="list-style-type: none"> Measures how easy and intuitive the routing and service pattern is for a given service concept against the current situation. A more legible and understandable service is convenient and easier to use for riders.
2. Complement the Grand Boulevard Initiative's vision of realizing El Camino Real as a "grand boulevard of meaningful destinations" by building consensus on transit improvements	2.1. Improve pedestrian safety ^C	2.1A	Pedestrian safety assessment	Qualitative	<ul style="list-style-type: none"> Measure intended to assess scale of pedestrian improvements including bulbouts, medians, sidewalks, and safer crossing opportunities. Not applicable for the 2020 evaluation as specific design details for service concepts were not developed. 	
	2.2. Maintain or improve access to households, employment and retail opportunities ^{D, E}	2.2A	# of households and jobs accessible within a 15-minute walk from a station	Quantitative & Qualitative	<ul style="list-style-type: none"> Measures the extent to which a service concept maintains or improves access to households and employment. This metric measures the relative accessibility to jobs and housing provided by each service concept. Concepts with more households and jobs within the walking catchment area may generate higher ridership. 	
		2.2B	Convenient and direct pedestrian/bicycle access between stations and adjacent land uses	Qualitative	<ul style="list-style-type: none"> Measure intended to assess how well a service concept facilitates cycling. Not applicable for the 2020 evaluation as specific design details for service concepts were not developed. 	

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Goal	Objective	Metric	Evaluation Criteria	Type of Metric	Explanation of Metric
that promote livability and commercial vitality	2.3. Support planned growth in corridor	2.3A	Serve key commercial and residential growth areas	Qualitative	<ul style="list-style-type: none"> Measures the extent to which a service concept serves key commercial and residential growth areas along the corridor. Service to key commercial and residential growth areas is necessary to generate sustainable levels of ridership.
3. Minimize system capital and operating cost increases and operational impacts by developing a conceptual bus operating plan that optimizes local, Rapid and Full BRT services along the corridor	3.1. Provide cost-effective service ^{F, G, H}	3.1A	Capital cost	Quantitative	<ul style="list-style-type: none"> Measures total capital costs (inclusive of infrastructure and vehicle costs). Higher total costs may mean more difficult in securing funding, local commitments, and ultimately implementation.
		3.1B	Capital cost per mile	Quantitative	<ul style="list-style-type: none"> Measures average capital cost per route mile (inclusive of infrastructure and vehicle costs). This is intended to provide another capital cost metric – for instance, a service concept may have a lower overall capital costs, but may be implemented on only a portion of the corridor. This metric better captures such projects and gives a better sense of “return on investment” than the straight comparison of capital costs. Higher average costs may mean more difficulty in securing funds and local commitments.
		3.1D	Subsidy per boarding (corridor-level)	Quantitative	<ul style="list-style-type: none"> Measures corridor subsidy per boarding, which indicates the amount of public funding necessary to “generate” one boarding (subsidy is the difference between total O&M costs and fare revenue). This metric can also serve as a proxy for productivity, farebox recovery (although normalized by boarding instead of at a corridor level), and general “return on investment”.
		3.1E	Incremental O&M cost per new boarding (corridor-level)	Quantitative	<ul style="list-style-type: none"> Measures the additional O&M costs required in the corridor to serve one new boarding above the costs O&M costs for Concept 1 – 2020 Base Case. Thus, additional (or marginal) O&M costs are estimated by subtracting O&M costs for a given service concept by the Concept 1 O&M costs. Higher incremental costs per boarding imply a less productive service.
	3.2. Minimize ECR operating impacts	3.2A	Minimize operating demands for peak vehicles	Quantitative	<ul style="list-style-type: none"> Measures the number of vehicles required to provide peak service. The more peak vehicles required, the higher the chance that new vehicles must be procured and thus additional capital costs will be required.
		3.2B	Reliability	Qualitative	<ul style="list-style-type: none"> Measures the expected reliability of the service based on the length of the corridor operated and the number of Rapid or Hybrid stops served. This serves as a proxy for on-time performance. Concepts with poorer reliability may require additional vehicles or corrective measures to ensure that schedules are being met. Note – the VTA model is unable to estimate reliability of travel times.
	4. Minimize corridor traffic and parking impacts while maximizing the benefits of Rapid and Full BRT services	4.1. Minimize traffic impacts	4.1A	Length of segments operating at LOS E or F	Quantitative
4.2. Minimize physical changes to corridor infrastructure		4.2A	Net change in on-street parking	Quantitative	<ul style="list-style-type: none"> Measure intended to assess the loss of curbside parking and thus the relative impact on the business community from inconvenience and possible lost business. Not applicable for the 2020 evaluation as no changes to on-street parking provision are proposed.
		4.2B	Extent of new turn	Qualitative	<ul style="list-style-type: none"> Measure intended to assess the implementation of new turn restrictions and thus the

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Goal	Objective	Metric	Evaluation Criteria	Type of Metric	Explanation of Metric
			restrictions		extent to which traffic is negatively impacted. <ul style="list-style-type: none"> Not applicable for the 2020 evaluation as no changes to turning restrictions are proposed.

^A Increase in ridership along key segments of the corridor is no longer part of the evaluation. Increase in corridor and system ridership are perceived as better overall metrics.

^B Increase in new riders is no longer part of the evaluation. This is already effectively measured by: (i) increase in corridor ridership; and (ii) increase in system ridership.

^C The qualitative assessment of pedestrian safety has been removed from the 2020 analysis as detailed urban design treatments were not developed as part of the ECR Phasing Plan.

^D The volume of households and jobs accessible within a 15-minute walk from a stop/station has been combined into a single metric.

^E The qualitative analysis of convenient and direct pedestrian/bicycle access between stops/stations and adjacent land uses has been removed from the 2020 analysis as detailed urban design and land use integration treatments were not developed as part of the ECR Phasing Plan.

^F Capital costs per route mile were added to provide another indicator of capital cost investment required.

^G O&M cost per revenue vehicle hour (RVH) has been removed from the analysis, as operating costs are originally built on an assumed figure of \$210/RVH for an articulated, 60' bus.

^H Subsidy per boarding has been added to the analysis an indicator of how productivity and farebox recovery.

4 Performance and Scoring by Evaluation Criteria

This sections presents the results of the quantitative and qualitative analyses for each service concept. Performance among service concepts is then ranked on a scale of 1-to-5 for each evaluation criteria. The scores are then summed up for all evaluation criteria to generate a composite score for each service concept.

4.1 Quantitative Analysis

4.1.1 Raw Data

The raw data for the quantitative analysis is presented in Table 3 (as noted, qualitative metrics will be discussed in Section 4.3). This data was collected and generated through various study activities and highlighted in the following documents:

- August 31, 2014 *Operating Plan Memo – Draft v1*
- September 13, 2014 *ECR BRT Phasing Plan – Capital Costs Memo*
- September 13, 2014 *ECR BRT Phasing Plan – O&M Costs Memo*
- October 1, 2014 *ECR BRT Phasing Plan – Ridership and Productivity Memo*

Service concepts are then scored/ranked on a 1-to-5 point scale for each quantitative evaluation criteria, with 1 being the concept with the lowest performance and 5 being the concept with the highest performance. Performance vis-à-vis each evaluation criteria is presented in each individual memos noted above and will not be reviewed in any detailed fashion for this memo.

4.1.2 Quantitative Scoring Methodology

There are several scoring methodologies that could have been employed – for instance:

- **Ordinal Ranking** – Gives a score based on the relative position of the service concept (in ascending or descending order). For instance, of the nine service concepts, the top scoring one could have been given a score of 9, the next one an 8, etc.)
- **Comparative Ranking (Quartiles, Quintiles, etc.)** – This is similar to ordinal ranking, except scoring (in this case 1-to-5) would be assigned by “quintiles” (divided into five different ranges). For instance, of the nine service concepts, those scoring the highest and second highest would be in the “top” quintile and would receive a score of 5. Those receiving the eighth and ninth highest scores would fall into the “bottom” quintile and would receive a score of 1.
- **Standard Score Ranking (Using Mean and Standard Deviation (SD))** – This ranks service concepts in terms of the number of SDs above or below the mean. For example, a service concept scoring over two SD above the mean would be given a score of 5. A concept scoring between one and two SDs above the mean would be given a score of 4. A concept scoring

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within one SD of the mean would be given a score of 3. This is similar to a bell curve used to grade students.

In order to better capture the changes in magnitude between service concepts, the standard score ranking was selected. The scoring methodology is as follows:

Type of Metric	Bounds	Score				
		1	2	3	4	5
Ascending Metric (Highest Value = Best)	Lower Bound	0	Mean – 2 SD	Mean – 1 SD	Mean + 1 SD	Mean + 2 SD
	Upper Bound	Mean – 2 SD	Mean - 1 SD	Mean + 1 SD	Mean + 2 SD	∞
Descending Metric (Lowest Value = Best)	Lower Bound	∞	Mean + 2 SD	Mean + 1 SD	Mean – 1 SD	Mean – 2 SD
	Upper Bound	Mean + 2 SD	Mean + 1 SD	Mean – 1 SD	Mean – 2 SD	0

Note: SD = Standard Deviation

The scoring framework is designed to differentiate high performing concepts from low performing concepts.

4.2 Qualitative Analysis

Table 4 also presents the results of the qualitative analysis for the nine qualitative evaluation criteria as well as rationale for this scoring. Service concepts are scored/ranked on a 1-to-5 point scale for each criteria, with 1 being the concept with the lowest performance, and 5 being the concept with the highest performance. Some concepts may receive the same score. Color shading indicates relative performance, with dark green representing the highest performing concept, and red representing the lowest performing concept.

Table 3: Quantitative Performance by Service Concept

Goal	Objective	Metric	Evaluation Criteria	Type	Ascending or Descending	Concept 1: 2020 Base Case	Concept 2: 2020 Full Rapid	Concept 3: 2020 Truncated Rapid (DC-RC)	Concept 4: 2020 Truncated Rapid (SB-RC)	Concept 5: 2020 Hybrid A (76 Stops - 12 Min)	Concept 6: 2020 Hybrid B (50 Stops - 12 Min)	Concept 7: 2020 Peak Rapid	Concept 8: 2020 Hybrid A (76 Stops - 10 Min)	Concept 9: 2020 Hybrid B (50 Stops - 7.5 Min)	Concept 10: 2040 Full BRT	Mean	SD	
1. Increase bus ridership along the El Camino Corridor by improving service for existing customers and attracting new customers	1.1. Increase ridership	1.1A	Increase in corridor-level boardings	Quantitative	Ascending	0	5,606	4,558	3,088	2,915	1,077	3,607	4,640	5,870	17,134	3,485	1,859	
		1.1B	Increase in system-level boardings	Quantitative	Ascending	0	7,362	6,570	5,539	1,156	1,220	5,730	2,607	4,713	33,355	3,877	2,525	
		1.1C	Corridor boardings per RVH	Quantitative	Ascending	49.4	41.3	42.1	43.5	49.3	48.5	44.7	47.5	44.3	67.8	46	3	
	1.2. Improve passenger experience	1.2A	Improve station experience and security (based on # of enhanced stops)	Quantitative	Ascending	0	37	32	23	37	37	37	37	37	37	37	31	12
		1.2B	Improve in-vehicle experience (based on average operating speed of the Rapid/Hybrid service)	Quantitative	Ascending	11.0	14.2	14.0	14.2	11.9	13.0	14.2	11.9	13.0	18.0	13.0	1.1	
		1.2C	Create unique service branding/identity	Qualitative	Ascending	Presented in the Qualitative Analysis												
1.2D	Legible and easy to understand routing and service	Qualitative	Ascending															
2. Complement the Grand Boulevard Initiative's vision of realizing El Camino Real as a "grand boulevard of meaningful destinations" by building consensus on transit improvements that promote livability and commercial vitality	2.1. Improve pedestrian safety	2.1A	Pedestrian safety assessment (bulbouts, medians, sidewalks, crossing opportunities)	Qualitative	Ascending	Presented in the Qualitative Analysis												
	2.2. Maintain or improve access to households, employment and retail opportunities	2.2A	# of households and jobs accessible within a 15-minute walk from a station	Qualitative (Quantitative)	Ascending													
		2.2B	Convenient and direct pedestrian/bicycle access between stations and adjacent land uses	Qualitative	Ascending													
2.3. Support planned growth in corridor	2.3A	Serve key commercial and residential growth areas	Qualitative	Ascending														
3. Minimize system capital and operating cost increases and operational impacts by developing a conceptual bus operating plan that optimizes local, Rapid and Full BRT services along the corridor	3.1. Provide cost-effective service	3.1A	Capital cost	Quantitative	Descending	\$0	\$41,975,000	\$35,249,000	\$25,545,000	\$21,025,000	\$16,464,000	\$41,975,000	\$29,268,000	\$39,544,000	\$176,850,000	\$27,893,889	\$13,121,977	
		3.1B	Capital cost per mile	Quantitative	Descending	\$0	\$1,635,616	\$1,694,005	\$1,719,587	\$819,269	\$641,543	\$1,635,616	\$1,140,469	\$1,540,888	\$6,891,212	\$1,202,999	\$568,627	
		3.1C	Subsidy per boarding (corridor-level)	Quantitative	Descending	\$2.89	\$3.69	\$3.64	\$3.51	\$2.87	\$2.94	\$3.32	\$3.01	\$3.38	\$1.69	\$3.25	\$0.31	
		3.1D	Incremental O&M cost per new boarding (corridor-level)	Quantitative	Descending	\$0.00	\$7.49	\$7.68	\$8.10	\$4.12	\$5.57	\$6.65	\$4.96	\$6.13	\$1.93	\$5.63	\$2.34	
	3.2. Minimize ECR operating impacts	3.2A	Minimize operating demands for peak vehicles (based on # of peak vehicles required)	Quantitative	Descending	22	39	36	32	25	23	39	30	37	36	31	6	
		3.2B	Reliability (based on the length of corridor and number of stops served by the Rapid/Hybrid service)	Qualitative	Ascending	Presented in the Qualitative Analysis												
4. Minimize corridor traffic and parking impacts while maximizing the benefits of Rapid and Full BRT services	4.1. Minimize traffic impacts	4.1A	Length of segments operating at LOS E or F	Quantitative	Descending	29.76	29.96	30.07	29.54	30.1	30.26	30.53	30.39	30.4	30.53	30.11	0.30	
	4.2. Minimize physical changes to corridor infrastructure	4.2A	Net change in on-street parking	Qualitative	Descending	Presented in the Qualitative Analysis												
		4.2B	Extent of new turn restrictions	Qualitative	Descending													

Source: Various SamTrans ECR Phasing Plan memos.

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Table 4: Scoring for Quantitative and Qualitative Evaluation Criteria by 2020 Service Concept (Dark Green = Best Performing; Red = Worst Performing)

Goal	Objective	Metric	Evaluation Criteria	Type	1	2	3	4	5	6	7	8	9	Rationale for Scoring and Other Comments	
					Concept 1: 2020 Base Case	Concept 2: 2020 Full Rapid	Concept 3: 2020 Truncated Rapid (DC-RC)	Concept 4: 2020 Truncated Rapid (SB-RC)	Concept 5: 2020 Hybrid A (76 Stops - 12 Min)	Concept 6: 2020 Hybrid B (50 Stops - 12 Min)	Concept 7: 2020 Peak Rapid	Concept 8: 2020 Hybrid A (76 Stops - 10 Min)	Concept 9: 2020 Hybrid B (50 Stops - 7.5 Min)		
1. Increase bus ridership along the El Camino Corridor by improving service for existing customers and attracting new customers	1.1. Increase ridership	1.1A	Increase in corridor-level boardings	Quantitative	1	4	3	3	3	2	3	3	4	<ul style="list-style-type: none"> Concepts with larger increases in corridor boardings score higher. Rapid concepts operating along the entire corridor generate larger increases in corridor boardings and score higher than Rapid concepts operating on truncated segments of the corridor. Hybrid concepts serving more stops generate larger increases in corridor boardings and are thus scored higher than those Hybrid concepts serving fewer stops. 	
		1.1B	Increase in system-level boardings	Quantitative	1	4	4	3	1	2	3	3	3	<ul style="list-style-type: none"> Concepts with larger increases in system-level boardings score higher. Rapid concepts operating along the entire corridor generate larger increases in system boardings and score higher than Rapid concepts operating on truncated segments of the corridor. Hybrid concepts serving more stops generate larger increases in system boardings and are thus scored higher than those Hybrid concepts serving fewer stops. 	
		1.1C	Corridor boardings per RVH	Quantitative	4	2	2	3	4	3	3	3	3	3	<ul style="list-style-type: none"> Concepts with higher productivity score higher. Hybrid concepts generate the highest productivity and score higher than Rapid concepts. Rapid concepts operating for portions of the day or on portions of the corridor generate better productivity than the full-day/corridor Rapid service.
	1.2. Improve passenger experience	1.2A	Improve station experience and security (based on # of enhanced stops)	Quantitative	1	3	3	3	3	3	3	3	3	3	<ul style="list-style-type: none"> Concepts with a larger number of enhanced stations (or BRT stations) score higher than those with fewer. All Hybrid and full-corridor Rapid concepts each serve 37 enhanced stops in one direction. Truncated Rapid concepts serve fewer than 37 enhanced stops in one direction.
		1.2B	Improve in-vehicle experience (based on average operating speed of the Rapid/Hybrid service)	Quantitative	2	4	3	4	3	3	3	4	3	3	<ul style="list-style-type: none"> Concepts that more significantly improve the in-vehicle experience score higher (i.e., those with faster operating speeds for the Rapid or Hybrid). Rapid concepts serve fewer stops and operate faster than Hybrid concepts, thus scoring higher. Hybrid concepts that serve fewer stops operate faster and score higher than those that serve more stops.
		1.2C	Create unique service branding/identity	Qualitative	1	5	4	3	2	3	3	4	2	3	<ul style="list-style-type: none"> Concepts creating a premium service that is distinct from current ECR service score higher than those that are similar to the existing ECR service. Rapid options are unique branded products that are different from and complement the existing ECR. Those Rapid options serving the entire corridor score higher than those that are truncated. Hybrid options are similar to the ECR, except have fewer stops and are thus less "unique", serving essentially as a "limited stop" ECR. Those with fewer stops score higher than those with more stops.
		1.2D	Legible and easy to understand routing and service	Qualitative	5	3	2	1	4	3	3	2	4	3	<ul style="list-style-type: none"> Concepts with simpler routing and service patterns (where passengers do not need to think about where the bus stops) score higher than those with multiple, possibly confusing routings. The 2020 Base Case is scored the highest as a single route (ECR) operates on the entire corridor. Hybrid options are also scored high because only one route operates on the corridor, although Hybrid options do not serve all ECR stops (thus they perform slightly worse than the 2020 Base Case). Rapid concepts score lower because multiple routes operate in the ECR corridor, which may be confusing. Those Rapid concepts serving the entire corridor score higher than those serving truncated portions of it.
	2. Complement the Grand Boulevard Initiative's vision of realizing El Camino Real as a "grand boulevard of meaningful destinations" by building consensus on transit improvements that promote livability and commercial vitality	2.1. Improve pedestrian safety	2.1A	Pedestrian safety assessment (bulbouts, medians, sidewalks, crossing opportunities)	Qualitative	Not applicable to the 2020 Evaluation									
2.2. Maintain or improve access to households, employment and retail opportunities		2.2A	# of households and jobs accessible within a 15-minute walk from a station (parentheses represent the # of households and jobs within the catchment zone from GIS analysis)	Qualitative / Quantitative	3 (536,000)	5 (536,000)	4 (536,000)	3 (536,000)	2 (436,000)	1 (325,000)	3 (536,000)	3 (436,000)	2 (325,000)	<ul style="list-style-type: none"> This analysis is both qualitative and quantitative. An initial quantitative analysis was undertaken to estimate the total number of jobs and households within a 15 minute walk from a bus stop (indicated in parentheses). The 2020 Base Case is given score of 3 as a baseline with ECR-only service. Rapid concepts operate both Rapid and ECR service, with Rapid services providing an enhanced level of access over the ECR. Thus, Rapid concepts score higher than the 2020 Base Case. Rapid service concepts (with both Rapid and ECR services) serve the highest number of jobs and households (and thus score higher than Hybrid concepts that only serve a subset of the stops). Hybrid concepts serving more stops score higher than those serving fewer stops. Also, Hybrid concepts providing more frequent service score higher. 	
		2.2B	Convenient and direct pedestrian/bicycle access between stations and adjacent land uses	Qualitative	Not applicable to the 2020 Evaluation										
2.3. Support planned growth in corridor	2.3A	Serve key commercial and residential growth areas	Qualitative	3	5	4	3	3	2	4	3	2	<ul style="list-style-type: none"> The 2020 Base Case is given a score of 3 as a baseline. All proposed service concepts will serve key commercial and residential growth areas, although they differ according to the level of access provided to these areas. Rapid service improve access to key areas in addition to the access provided by the ECR and score higher. 		

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					1	2	3	4	5	6	7	8	9	
Goal	Objective	Metric	Evaluation Criteria	Type	Concept 1: 2020 Base Case	Concept 2: 2020 Full Rapid	Concept 3: 2020 Truncated Rapid (DC-RC)	Concept 4: 2020 Truncated Rapid (SB-RC)	Concept 5: 2020 Hybrid A (76 Stops - 12 Min)	Concept 6: 2020 Hybrid B (50 Stops - 12 Min)	Concept 7: 2020 Peak Rapid	Concept 8: 2020 Hybrid A (76 Stops - 10 Min)	Concept 9: 2020 Hybrid B (50 Stops - 7.5 Min)	Rationale for Scoring and Other Comments
														<ul style="list-style-type: none"> Hybrid concepts also serve key commercial and residential growth areas, although there is a slight loss of access due to the reduced number of stops. Hybrid A performs better than Hybrid B as it makes more stops which increases overall accessibility.
3. Minimize system capital and operating cost increases and operational impacts by developing a conceptual bus operating plan that optimizes local, Rapid and Full BRT services along the corridor	3.1. Provide cost-effective service	3.1A	Capital cost	Quantitative	5	2	3	3	3	3	2	3	3	<ul style="list-style-type: none"> Concepts with lower capital costs score higher than those with higher capital costs. Hybrid concepts generate lower capital costs than most Rapid options due to the number of additional vehicles that must be procured to provide peak service. Rapid services operating on truncated portions of the corridor also generate lower capital costs than Rapid concepts operating along the entire corridor (and require fewer peak vehicles).
		3.1B	Capital cost per mile	Quantitative	5	2	2	2	4	4	2	3	2	<ul style="list-style-type: none"> Concepts with lower average capital costs/mile score higher than those with higher average costs. Hybrid concepts generate the lowest capital costs/route mile due to fewer additional peak vehicles that must be procured. Those Hybrid services serving fewer stops score the highest. Rapid concepts that serve truncated segments of the corridor generate lower capital costs per mile than those operating along the entire corridor.
		3.1C	Subsidy per boarding (corridor-level)	Quantitative	4	2	2	2	4	4	3	4	3	<ul style="list-style-type: none"> Concepts with lower average subsidy per boarding score higher than those with higher rates. Hybrid concepts score higher since they generate lower operating costs than the Rapid concepts (which has both Rapid and ECR service), yet generate similar volumes of fare revenues.
		3.1D	Incremental O&M cost per new boarding (corridor-level)	Quantitative	5	2	2	2	4	3	3	3	3	3
	3.2. Minimize ECR operating impacts	3.2A	Minimize operating demands for peak vehicles (based on # of peak vehicles required)	Quantitative	4	2	2	3	4	4	2	3	2	<ul style="list-style-type: none"> Concepts with lower peak vehicle requirements score higher than those with higher requirements. Hybrid concepts require the fewest vehicles due to faster operating speeds and fewer stops, and thus score higher than Rapid concepts. Rapid concepts operating on truncated portions of the corridor require fewer vehicles than those concepts operating along the entire corridor.
		3.2B	Reliability (based on the length of corridor and number of stops served by the Rapid/Hybrid service)	Qualitative	1	4	5	5	2	3	4	2	3	<ul style="list-style-type: none"> Concepts with better perceived reliability score higher than those with lower perceived reliability. Rapid concepts serve fewer stops and are perceived as being more reliable and thus score higher. Rapid concepts serving truncated segments are perceived to be more reliable than those serving the entire corridor. Hybrid concepts that serve fewer stops are perceived to be more reliable than those serving more stops. Perceived reliability for the 2020 Base Case is based on the current ECR, which operates on the whole corridor and would stop more frequently than any of the proposed Rapid or Hybrid service concepts (and thus scores the lowest).
4. Minimize corridor traffic and parking impacts while maximizing the benefits of Rapid and Full BRT services	4.1. Minimize traffic impacts	4.1A	Length of segments operating at LOS E or F	Quantitative	4	4	3	5	3	3	2	2	2	<ul style="list-style-type: none"> Concepts with shorter cumulative LOS E or F segments score higher than those with longer LOS E or F cumulative segments.
	4.2. Minimize physical changes to corridor infrastructure	4.2A	Net change in on-street parking	Qualitative	<i>Not applicable to the 2020 Evaluation</i>									
		4.2B	Extent of new turn restrictions	Qualitative										

2020 Composite Score (Quantitative Score Only):	36	31	29	33	36	34	30	33	31
Relative Ranking (Quantitative Score Only):	1	6	9	4	1	3	8	4	6
2020 Composite Score (Qualitative Score Only):	13	22	19	15	13	12	17	14	13
Relative Ranking (Qualitative Score Only):	6	1	2	4	6	9	3	5	6
2020 Composite Score (Combined):	49	53	48	48	49	46	47	47	44
Relative Ranking (Combined):	2	1	4	4	2	8	6	6	9

4.3 Key 2020 Findings

4.3.1 Key Quantitative Findings

Table 4 presents the quantitative scoring for each evaluation criteria by service concept (with dark green representing the highest performing concept, and red representing the lowest performing concept). Key findings are as follows:

- Qualitative scores by service concepts range from 31 to 36 for the 11 evaluation criteria.
- The highest performing service concepts are Concept 1 - 2020 Base Case) and Concept 5 - 2020 Hybrid A (76 Stops – 12 Min), each with 36 points.
- In general, Hybrid concepts (and the 2020 Base Case) perform better due to lower operating and capital cost requirements (in terms of the number of additional peak vehicles required).
- Concepts operating both Rapid and ECR services may perform well for ridership-based metrics, however, they perform poorly overall due to higher associated operating and capital costs (from higher peak vehicle requirements) than Hybrid concepts.

4.3.2 Key Qualitative Findings

Key findings are as follows:

- Qualitative scores by service concepts range from 12 to 22.
- The highest performing service concepts are Concept 2 - 2020 Full Rapid) and Concept 3 - 2020 Truncated Rapid (DC-RC)), with 22 and 19 points, respectively.
- In general, concepts with Rapid and ECR service perform better qualitatively in that these concepts both maintain a high level of access (as the ECR still provides local service), while providing a faster, more reliable, and brand-distinguished overlay service (the Rapid). Rapid concepts that serve the entire corridor score higher as they are more intuitive to use and less confusing than those that serve truncated portions of the corridor.
- Hybrid concepts provide a high level of service, but provide reduced access to jobs and housing along the corridor, since a significant number of stops are eliminated from service – and thus score lower than Rapid concepts.

4.3.3 Overall Composite Findings

Table 5 and Figure 1 present the overall composite score, which is calculated by adding the quantitative and qualitative scores of each service concept. Key findings are as follows:

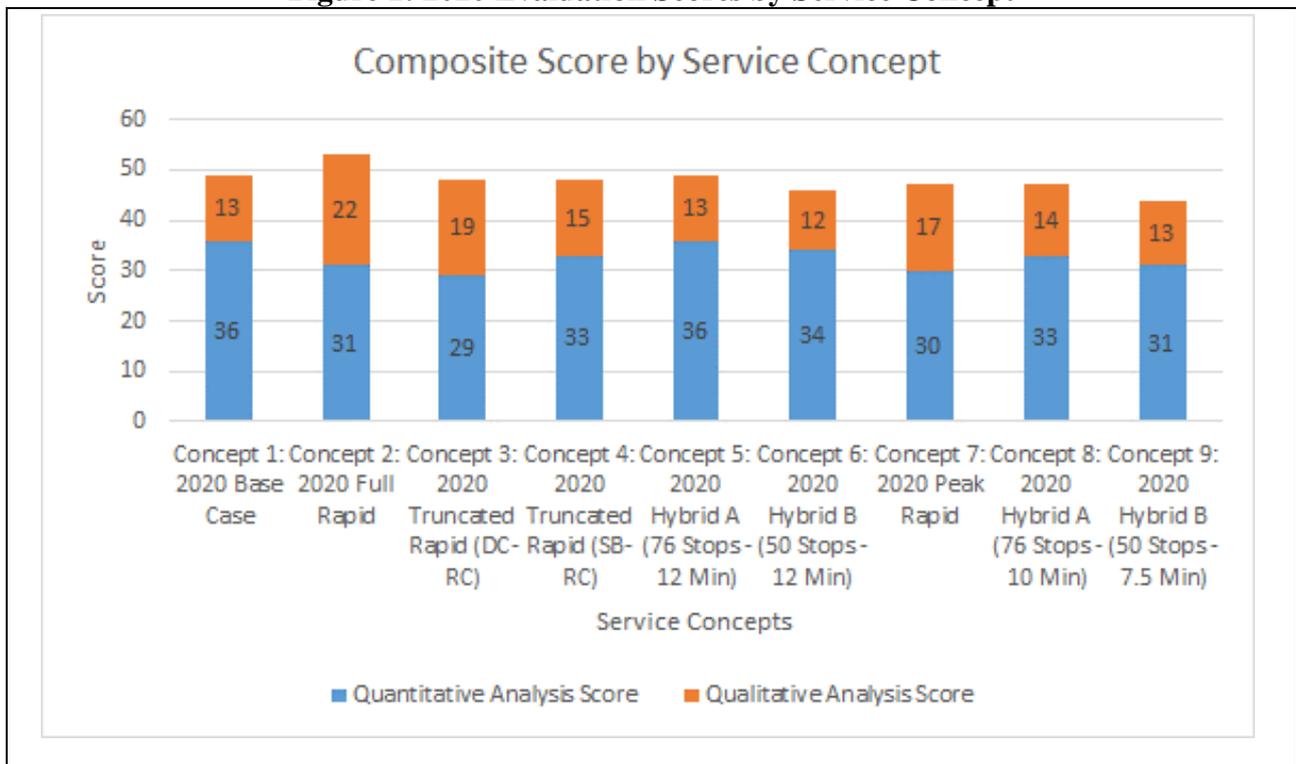
- **Concept 2 Performs the Best** - Concept 2 - 2020 Full Rapid generates a composite score of 53, which represents the best performance of the nine 2020 concepts. As noted, Concept 2 is extremely strong in its qualitative analysis, which makes up for its average performance in the quantitative analysis.
- **Concept 1 and 5 Are the Next Best Performers** – Concept 1 – 2020 Base Case and Concept 5 – 2020 Hybrid A (76 Stops – 12 Min) both have composite scores of 49, to finish second to Concept 2. Both Concepts 1 and 5 perform well in the quantitative analysis, buoyed by high ratings in cost-related categories. Both of these concepts have lower than average qualitative scores - this indicates, at least for Concept 5, that perceived service levels may not be improved significantly compared to the 2020 Base Case with ECR-only service.
- **Combined Rapid and ECR Concepts Perform Better than Hybrid Concepts** – Overall, concepts with combined Rapid and ECR service seem to perform better than Hybrid concepts. The reason is likely that access is a key element in the concept evaluation – thus loss of access by eliminating stops (as is done for all Hybrid concepts) has a significant negative impact on the evaluation and the perceived level of service.
- **If Improvements Are Implemented, Concepts 2 and 5 Can Be Strong Options, But Each Brings Different Benefits** – As noted, the top scoring “build” alternatives (i.e., those where changes and modifications are made) are Concept 2 – 2020 Full Rapid, Concept 5 – 2020 Hybrid A (76 Stops – 12 Min). There are key differences between each service concept, however, with different implications for the future scope/extent of BRT service and infrastructure:
 - **Concept 2 – 2020 Full BRT** - While Concept 2 performs the best and offers the most robust enhancement to customer service and access with the full-corridor overlay Rapid service, it is more expensive overall in terms of both operating costs (as the number of RVH is significantly higher than the 2020 Base Case) and capital costs (due to the high number of additional peak vehicles required). Overlay Rapid service in Concept 2 is a natural precursor to more significant investment in a future fixed guideway system with dedicated bus lanes and more robust bus stations (i.e., Bus Rapid Transit). There are some shortcomings of Concept 2, in particular, higher costs may preclude enhancements if adequate budget is not available or allocated for other purposes.
 - **Concept 5 – 2020 Hybrid A (76 Stops – 12 Min)** - Concept 5 on the other hand, may score lower in customer service and access, but has much lower O&M and capital cost (as it requires minimal increases in RVH and thus O&M costs, and does not require a significant number of new peak vehicles to be acquired). Concept 5, with its cheaper price, may be easier to garner political support and eventual implementation and can likely be implemented faster. Taking a long-term perspective, however, Concept 5 represents a minor change to existing ECR service – essentially creating a “limited stop” ECR. Concept 5 does not align well with plans for a future BRT system with dedicated bus lanes and more robust bus stations, which would have both local and BRT service running in parallel (as Concept 5

would in the short-term cut local service, that would eventually be restored in the future for the BRT, which would be confusing and send conflicting messages to the public and policymakers).

Table 5: Composite Score and Ranking by Service Concept

Concept	Quantitative Analysis Score	Qualitative Analysis Score	Composite Score	Rank
Concept 1: 2020 Base Case	36	13	49	2
Concept 2: 2020 Full Rapid	31	22	53	1
Concept 3: 2020 Truncated Rapid (DC-RC)	29	19	48	4
Concept 4: 2020 Truncated Rapid (SB-RC)	33	15	48	4
Concept 5: 2020 Hybrid A (76 Stops - 12 Min)	36	13	49	2
Concept 6: 2020 Hybrid B (50 Stops - 12 Min)	34	12	46	8
Concept 7: 2020 Peak Rapid	30	17	47	6
Concept 8: 2020 Hybrid A (76 Stops - 10 Min)	33	14	47	6
Concept 9: 2020 Hybrid B (50 Stops - 7.5 Min)	31	13	44	9

Figure 1: 2020 Evaluation Scores by Service Concept



5 Next Steps

Findings from this memo will be further analyzed in terms of the potential for implementation and funding, as well as transition to a future BRT system in 2040.