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San Francisco Bay Crossings Study Update – June 2013

Executive Summary

The purpose of this executive summary is to provide a synopsis of the findings of the San Francisco Bay Crossings Study Update (2012) (herein referred to as the "Updated Study") effort and a review of the top ranked highway approach alternatives, which was conducted in 2013. The Updated Study is an update of the 2000 San Francisco Bay Crossings Study (herein referred to as the "2000 Study") and provides an update of current and forecast transbay travel conditions, examines previously identified improvements, develops new conceptual alternatives, and determines if transbay travel demand merits additional investments in capacity, based on Year 2010 and forecast Year 2035 traffic volumes, and Year 2010 cost estimates. The review of top ranked highway approach alternatives utilizes current (Year 2013) traffic volumes and cost estimates to update and re-evaluate the top ranked highway approach improvement alternatives identified in the Updated Study.

The San Francisco Bay Crossings study area, generally defined as the area of the San Francisco Bay between the Bay Bridge and State Route (SR) 237, is crossed by three primary travel corridors. These include the Bay Bridge, San Mateo Bridge, and Dumbarton Bridge corridors.

Current and Projected Conditions

Current Conditions

The total number of daily crossings of the San Francisco Bay was approximately 15 percent less in 2010 than in 2000. The decrease in average weekday daily person-trips can largely be attributed to the economic conditions at that time. Historical traffic volume data from 2006 to 2010 shows an annual decrease in vehicle-trips throughout the San Francisco Bay Area. Additionally, there has been an observed decrease in transbay carpool usage since the introduction of the $2.50 carpool charge and lane usage enforcement in 2010, and a decrease in the observed average vehicle occupancy rates. The combination of these factors – lower traffic volumes, lower rates of carpool usage, and lower rates of vehicle occupancy – results in a reduction in total person-trips crossing the bridge corridors in 2010 compared to 2000.

Projected Conditions

Future Year 2035 travel demand forecasts for all transbay travel modes were developed using a model scenario of the Sustainable Communities Strategy/Regional Transportation Plan developed by the Metropolitan Transportation Commission (MTC). This model scenario reflects the Association of Bay Area Governments' (ABAG) Projections 2011 and the MTC's 2035 Transportation Plan network. The previous ridership/demand volumes presented in the 2000 Study were Year 2025 projections from a model scenario that included ABAG Projections 2002 and MTC's 2001 Regional Transportation Plan network.

The same combination of factors – lower traffic volumes, lower rates of carpool usage, and lower rates of vehicle occupancy – results in a reduction in the projected number of person-trips crossing the bridge corridors in 2035 (the Updated Study horizon year) compared to 2025 (the 2000 Study horizon year). In general, the 2025 projections were higher than the 2035 projections. The number of daily person-trips crossing the Bay Bridge and San Mateo Bridge corridors is projected to be approximately 17 percent and 26 percent less, respectively, in 2035 than was projected in 2025. For the Dumbarton Bridge, the 2035 projections are 16 percent higher than the 2025 projections. The projected increase in person-trips on the Dumbarton Bridge in 2035 compared to 2025 can be partially attributed to the completion of Dumbarton

Rail, which is expected to be fully operational by 2035. The total number of daily person-trips crossing the three corridors is projected to be approximately 155,800 less in 2035 than was projected in 2025.

Based on the Year 2035 forecasts, the number of daily person-trips crossing the Bay Bridge, San Mateo Bridge, and Dumbarton Bridge corridors is expected to increase by approximately 33 percent, 22 percent, and 41 percent, respectively, between 2010 and 2035. The projected increase in transbay travel demand and ridership between 2010 and 2035 is expected to result in the following:

- Peak hour demand on the existing bridges will exceed capacity by more than 20 percent by 2035;
- Significant delay will occur at the bridge approaches (the approaches constrain bridge capacity);
- Bay Area Rapid Transit (BART) ridership will exceed transbay tube capacity by 2025; and,
- Bus ridership will be constrained by inefficient routes and redundant service.

Summary of Alternatives Evaluation

Previously Identified Alternatives

Alternatives identified in the following studies were updated and re-assessed for feasibility and effectiveness as part of the Updated Study:

- 1991 San Francisco Bay Crossings Study;
- 2000 San Francisco Bay Crossings Study;
- 2000 Regional Airport System Plan;
- Bay Area Regional Rail Plan (2007);
- California High-Speed Rail Authority (Authority) Bay Area to Central Valley Program Environmental Impact Report/Environmental Impact Statement (EIR/EIS);
- Water Emergency Transportation Authority (WETA) Final Transition Plan (2009); and,
- Bay Bridge Corridor Congestion Study (2011).

The previously identified alternatives include auto (single-occupancy vehicle [SOV] and high-occupancy vehicle [HOV]), transit (rail, bus, and ferry), and bicycle/pedestrian improvements. The alternatives range from low cost improvements, such as an on-ramp HOV lane conversion, to mega-improvements, such as a new rail tunnel/BART tube.

Based on factors including current project status, updated regulatory framework, updated costs, and updated ridership/demand projections, the feasibility of the alternatives was assessed. Travel demand forecast volumes were updated to Year 2035 projections for three improvement scenarios:

- New Midbay Crossing;
- San Mateo Bridge Widening; and,
- Dumbarton Bridge Approach Improvements.

Due to reduced travel demand projections, reduced tolling revenue, and increased environmental/construction costs, none of the updated alternatives from the previous studies were recommended for further evaluation.

New BART Crossing Alternatives

With demand approaching the capacity of the transbay tube, and the recognition of the considerable impacts that a temporary or extended closure of the transbay tube would have on travel in the region, additional San Francisco Bay crossings for the BART system were considered. The previously-developed BART crossings were reviewed, pointing to three potential alignments for a new Bay crossing for BART.

- Northern Crossing: This alignment would facilitate an airport-to-airport connector between SFO and Oakland Airport (OAK);

- Midway Crossing: This alignment would cross south of the airports and north of Bay Fair Station, where the Dublin/Pleasanton Line branches from the Fremont Line. This alignment could also serve an airport-to-airport connection; and,
- Southern Crossing: This alignment would connect between Millbrae and Union City Stations, crossing relatively adjacent to the San Mateo Bridge (SR 92).

While providing convenience for air travelers transferring between the Bay Area's two busiest airports, an airport-to-airport connection via the Northern or Midway Crossings would facilitate few transbay trips. BART passengers at any existing East Bay station would have to use the future Oakland Airport Connector and transfer twice to reach San Francisco and Peninsula stations via the new crossing, resulting in longer travel times. The Midway and Southern Crossings, interlining with the Fremont Line, would provide much greater utility for the BART system than an airport-to-airport connector. The Midway Crossing would have the greatest ridership potential and could potentially shift trips from both the Dublin/Pleasanton and Fremont/San Jose branches to the new crossing – reducing transbay tube demand by up to 22 percent in 2035.

A conceptual operating plan was developed for the Midway Crossing. Based on the proposed operating plan, trips between San Mateo County and many stations in the East Bay, generally Bay Fair and stations south and east, would have shorter travel times. However, other trips – particularly those between downtown San Francisco and Bay Fair and stations south and east – would have longer travel times, either due to a less direct routing via the new crossing, or introduction of a forced transfer. Overall, the Midway Crossing would introduce a net loss of approximately 3,700 daily person hours among BART's 2035 ridership. Considering the cost of construction, right-of-way acquisition, program and project management, engineering, bonds and insurances and environmental mitigation, the overall cost of the Midway Crossing is estimated at $9.1 billion (2011).

While a new BART Bay Crossing offers potential relief for the transbay tube and would add redundancy to the BART System, these potential BART crossings would be costly, and would introduce forced transfers and increase travel time for most BART passengers. Therefore these BART crossing alternatives were not recommended for further evaluation and it was determined that additional BART transbay capacity would be most effective in the Bay Bridge corridor.

Transit Improvement Alternatives

The following four transit improvement alternatives were identified and recommended for further study and potential implementation:

- BART Downtown Station Capacity Enhancements;
- BART Skip-Stops;
- East Bay Bus Terminal; and,
- Bus Service Expansions.

In November 2012, BART released conceptual plans for implementation of the BART Metro plan. Based on projected ridership expansion, the constraint for transbay BART trips is not the transbay tube itself, but the stations on either end of the tube. BART metro capacity improvements include station capacity enhancements and introduction of a skip-stop configuration. Station capacity enhancements would consist of side platform tunnel ("Saddlebags") and vertical circulation improvements at Embarcadero and Montgomery Stations. Skip-stop configurations are under consideration for the East Bay and the West Bay.

Expansion and modification of the Embarcadero and Montgomery Stations to incorporate platform screen doors and/or side platforms and vertical circulation elements, such as new emergency stairways, escalators, and elevators, would improve the operations of those stations and optimize the capacity of the transbay tube. The additional elements would be accommodated by expanded subway boxes constructed

on the sides of the existing stations and would expand each station's circulation area. These elements would allow trains to be boarded form both sides and would increase the number of passengers each station is able to process. The additional platform space would improve boarding/alighting conditions for BART patrons and could potentially reduce dwell times and headways.

Skip-stop is a service pattern which reduces travel times and increases capacity by not requiring vehicles to make all designated stops along a given route. A new alignment within San Francisco would increase the service capacity within the Market Street corridor and provide additional BART stations within a new San Francisco corridor. A parallel track and side platform could be constructed at the Montgomery Station and allow for transfers between trains without causing delay. This would essentially function as a skip-stop at Embarcadero Station, the main constraint point, while providing a new BART route. To relieve the East Bay transbay tube constraint point at West Oakland Station, a skip-stop schedule could be introduced whereby not all trains would be required to stop at the West Oakland Station. Alternatively, an additional mainline track could be constructed, allowing trains to bypass the West Oakland Station. Skip-stopping stations in the East Bay (i.e. West Oakland station) and the West Bay would reduce transbay travel times and could potentially reduce transbay headways. These capacity improvements will be necessary once daily system wide ridership reaches 500,000 passengers (expected by 2025).

The recommended bus improvements include the re-routing of East Bay bus lines to a new bus terminal with potential for cross-platform transfers and frequent point-to-point service to the Transbay Terminal, and the expansion/extension of Alameda-Contra Costa Transit (AC Transit) transbay bus lines to additional destinations within San Francisco.

AC Transit currently operates more than 25 routes between the East Bay and the Transbay Terminal in San Francisco. Within the East Bay, the comprehensive service extends between San Pablo on the north and Fremont on the south. Many of the routes are redundant between the East Bay and San Francisco, presenting an opportunity to more efficiently use resources. AC Transit buses could be rerouted to an East Bay Bus Terminal and passengers could be shuttled between the East Bay Bus Terminal and the Transbay Terminal in San Francisco. Trip time and travel distance for individual transbay routes would be reduced. Reduced run times could translate to higher service frequency and/or increased service coverage. Additionally, this concept would likely reduce the number of buses crossing the Bay Bridge during peak hours while increasing capacity utilization on each bus.

AC Transit transbay service is currently limited to the Transbay Terminal within San Francisco. Passengers utilizing AC Transit to cross the Bay Bridge must transfer to another transit service to reach their destination, unless within walking distance. The forced transfer is a deterrent for potential AC Transit passengers. To increase service coverage in San Francisco, AC Transit buses could be rerouted to destinations beyond the Transbay Terminal. Increasing service coverage would likely result in an increase in ridership on AC Transit transbay routes.

Highway Approach Improvement Alternatives

For the Updated Study, a benefit/cost analysis was conducted for 19 potential highway approach improvement alternatives identified through discussions with Bay Area Toll Authority (BATA) and California Department of Transportation (Caltrans). The Updated Study was completed in June 2012. An update of the top ranked highway improvement alternatives was conducted in May 2013 at the request of BATA staff. The seven top ranked alternatives located in the vicinity of the Bay Bridge corridor were updated and reviewed to determine if current (Year 2013) transbay travel conditions or costs would result in materially different benefits or costs. The two open road tolling improvements (San Mateo Bridge and Dumbarton Bridge) were not included in the review. A ranked summary of the total capital cost of the improvement, estimated time savings benefit, and benefit/cost ratio for each alternative are presented in

Table 1.

Table 1: Top Ranked Highway Approach Alternatives Summary

Rank	#	Alternative	Cost of Improvement[(1)]	Time Savings Benefit[(2)]	Benefit / Cost Ratio
1	5	Powell Street/I-80 Ramps Intersection – HOV Improvement	$1.29	$7.14	5.53
2	2	MacArthur Boulevard Bus Ramp	$11.50	$4.02	0.35
3	11	Cesar Chavez Street to US 101 HOV Lane Addition	$37.70	$8.87	0.24
4	10	US 101 to Cesar Chavez Street HOV Lane Addition	$71.80	$14.60	0.20
5	9	Bay Bridge to US 101 Lane Addition	$137.80	$21.28	0.15
6	8	Fourth Street On-Ramp/Ninth Street Off-Ramp Braid	$51.20	$7.26	0.14
7	1	Mandela Parkway Bus Ramp	$47.70	$4.01	0.08

Source: AECOM, 2013.
Notes:
(1) Cost estimate in fiscal year 2013 dollars.
(2) Time Savings Benefit assumes a value of time of $16.03/person-hour for autos and transit, and $26.24/person-hour for trucks and a 30-year benefit life cycle.

As shown in **Table 1**, the Powell Street/I-80 Ramps Intersection – HOV Improvement is the top ranked alternative with a benefit/cost ratio of 5.53. During periods when queuing from the Bay Bridge extends beyond the westbound I-80 Powell Street ramps, HOVs and buses experience significant delays as they approach the Toll Plaza. To reduce the travel time between the westbound I-80 Powell Street ramps and the Bay Bridge for HOVs and buses, this alternative proposes the addition of a dedicated HOV left-turn lane to the Powell Street diagonal westbound on-ramp. This improvement would allow HOVs and buses traveling westbound on Powell Street to enter westbound I-80 via the Powell Street diagonal westbound on-ramp and would reduce the distance HOVs and buses travel with mixed-flow vehicles before continuing to the westbound I-80 HOV flyover. These vehicles would enter the mainline approximately 0.5 miles downstream of the Powell Street loop westbound on-ramp. Significant reductions in travel time could be expected with the implementation of a dedicated HOV left-turn lane from westbound Powell Street to the Powell Street diagonal westbound on-ramp.

The Mandela Parkway Bus Ramp and MacArthur Boulevard Bus Ramp alternatives would yield benefit/cost ratios of 0.35 and 0.08, respectively. The Mandela Parkway Bus Ramp and MacArthur Boulevard Bus Ramp improvements would accomplish similar goals in that they would decrease the travel time for AC Transit lines C, CB, and F. Regardless, these alternatives would each provide transit operators with the opportunity to realign service routes by providing multiple access points. Likewise, the Powell Street/I-80 Ramps Intersection – HOV Improvement would also reduce travel time for AC Transit lines C, CB, F, J, and Z, however, the majority of the benefit would be for HOVs.

The Cesar Chavez Street to US 101 HOV Lane Addition and the US 101 to Cesar Chavez Street HOV Lane Addition alternatives would yield benefit/cost ratios of 0.24 and 0.20, respectively. Benefit/cost ratio lower than 1.00 indicates that the cost of the alternative outweighs the benefit. The Cesar Chavez Street to US 101 HOV Lane Addition and the US 101 to Cesar Chavez Street HOV Lane Addition propose to widen US 101 from three mixed-flow lanes to four lanes, providing one HOV lane and three mixed-flow lanes. The mixed-flow lanes would shift with a standard taper and a designated HOV lane would be added to the median. The HOV lanes would merge with mixed-flow traffic at the HOV lane terminus. This would reduce the benefit of the HOV lane. The effectiveness of the widening is a direct function of the level of utilization by motorists, which may be significantly lower than a continuous through lane. Both of these alternatives would be more effective if they were continued beyond the currently proposed extents.

The Fourth Street On-Ramp/Ninth Street Off-Ramp Braid and the Bay Bridge to US 101 Lane Addition alternatives would yield benefit/cost ratios of 0.14 and 0.15, respectively. The Fourth Street On-Ramp/Ninth Street Off-Ramp Braid and the Bay Bridge to US 101 Lane Addition alternatives would both alleviate congestion caused by the weave on westbound I-80, between the Fourth Street On-Ramp and Ninth Street Off-Ramp. The combination of these alternatives would be less beneficial if both were constructed. Logically, only one of each improvement combination should be pursued at a particular location.

Conclusion

The Updated Study provides an update of current and forecast transbay travel conditions, examines previously identified improvements, develops new conceptual alternatives, and determines if transbay travel demand merits additional investments in capacity. An update to this study would be warranted if there are significant changes to transbay travel demand or travel conditions within the study area, including, but not limited to:

- Travel patterns;
- Traffic conditions for passengers and freight, e.g., volumes, travel time, and reliability;
- Transit service levels, ridership, travel time, and reliability;
- Socio-economic conditions;
- Regulatory framework; or,
- Funded and proposed transportation improvements based on state, regional, and county transportation plans, including ports and airport capital improvement plans.

A detailed future-year analysis is recommended to provide a more detailed and accurate assessment of the benefits of the Powell Street/I-80 Ramps Intersection – HOV Improvement alternative to determine whether it should be considered for implementation in the short term.

Transit improvements recommended for potential implementation include BART station capacity enhancements (i.e., “saddlebags” and improved vertical circulation elements at Embarcadero and Montgomery Stations), construction of an East Bay Bus Terminal, and expansion of AC Transit bus service to additional destinations within San Francisco. BART station capacity enhancements would be required when daily system ridership reaches 500,000 passengers (expected in 2025). Construction of an East Bay Bus Terminal and expansion of AC Transit bus service to additional destinations within San Francisco would provide immediate benefit and should be considered for implementation in the short term.