Sustainable Systems Research, LLC
27276 Meadowbrook Dr.
Davis, CA 95618
May 15, 2013

Sandra Spelliscy
Executive Director
Resources Legacy Fund
555 Capitol Mall, Suite 1095
Sacramento, CA 95814

Richard Marcantonio
Managing Attorney
Public Advocates, Inc.
131 Steuart Street, Suite 300
San Francisco, CA 94105

Dear Ms. Spelliscy and Mr. Marcantonio:

As requested, we have completed our review of the Draft Environmental Impact Report (DEIR) for *Plan Bay Area.* Attached please find: 1) curricula vitae for the SSR personnel involved in the review, and 2) a memorandum that addresses the technical questions related to the DEIR posed by Public Advocates, Inc.

Please contact me if you have any questions.

Sincerely,

Alex Karner, PhD
Principal
Sustainable Systems Research, LLC

Enclosures:

Curricula Vitae for Deb Niemeier, Alex Karner, and Melody Eldridge
Technical Memorandum: Review of the Draft Environmental Impact Report for *Plan Bay Area* (FINAL)

DEB NIEMEIER

DEB@SUSTAINABLESYSTEMSRESEARCH.NET

EDUCATION

Ph.D., **University of Washington**, Civil and Environmental Engineering, 1994.

M.S., **University of Maine**, Civil and Environmental Engineering, 1991.

B.S., **University of Texas**, Civil Engineering, 1982.

EXPERIENCE

Professor. Department of Civil and Environmental Engineering, University of California, Davis, 1994-Present
Principal. Sustainable Systems Research, LLC, 2012-2013
Recent Consulting.
- Save Our Creek, *Review of the Summerhill Homes/Magee Ranch Draft EIR,* 2013
- Save Our Creek, *Danville General Plan Review,* 2012
- Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR,* 2012
- Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin,* 2012
- East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR,* 2012
- Natural Resources Defense Council, *Ports and Air Quality: Moving Toward Clean Cargo,* 2012
- TransForm, *Looking Deeper: A detailed review of the project performance assessment being used to develop OneBayArea,* 2011-2012
- Resources Legacy Foundation, *Complete Streets in California: Challenges and Opportunities*, 2011
- City of Davis, *GHG Inventory*, 2010

Transportation Project Manager. T.Y. Lin International, Falmouth, Maine, 1991-1994
Traffic Engineer. City of San Marcos, Texas, 1985-1987
Engineer. Texas Department of Highways, Austin, Texas, 1978-1987

PROFESSIONAL APPOINTMENTS

Editor-in-Chief, Transportation Research, Part A, 2007-Present
Editorial Advisory Board, Transportation Research, Part B, 2003-Present
MARs Corp, Sustainable Science Board, 2009-Present
National Academy of Science, Board on Energy and Environmental Systems, 2011-Present
Elected, Member-at-large, AAAS Section on Engineering, 2007-2012

SELECTED PUBLICATIONS

Heres Del Valle, D., Niemeier, D. (2011). CO_2 emissions: Are land-use changes enough for California to reduce VMT? Specification of a two-part model with instrumental variables. *Transportation Research, Part B*, 45(1):150-161.

Niemeier, D., Bai, S., Handy, S. (2011). The impact of residential growth patterns on vehicle travel and pollutant emissions. *Journal of Transport and Land Use*, 4(3):65-80.

Lee, A., Niemeier, D. (2011). Environmental justice and transportation, *A Dictionary of Transport Analysis*. Button and Nijkamp *(eds)*, Pergamon.

Gao, O., Niemeier, D. (2011). Mobile emissions, *A Dictionary of Transport Analysis*. Button and Nijkamp (*eds)*, Pergamon.

Rowan, D. Karner, A., Niemeier, D. (2010). Miles per gallon illusions and CAFE distortions: When even the transport experts have trouble. *Transportation Research Record,* 2191:8-15.

Karner, A., Eisinger, D., Niemeier, D. (2010). Near roadway air quality: Synthesizing the findings from real-world data. *Environmental Science and Technology*, 44(10):5334-5344.

Torres, R., Nelson, V., Momsen, J., Niemeier, D. (2010). Experiment or transition? Revisiting food distribution in Cuban agromercados from the "special period". *Journal of Latin American Geography*, 9:1-12.

Timoshek, A., Eisinger, D., Bai, S., Niemeier, D. (2010) Mobile source air toxic emissions: Sensitivity to traffic volume, fleet composition, and average speed. *Transportation Research Record*, 2158:77-85.

Hixson, M., Mahmud A., Hu, J., Bai, S., Niemeier, D., Handy, S., Gao, S., Lund, J., Sullivan, D., Kleeman, M. (2009). Influence of development policies and clean technology adoption on future air pollution exposure. *Atmospheric Environment,* 37(36):5047-5068.

Silvis, J., Niemeier, D. (2009). Social networks and dwelling characteristics that influence ridesharing behavior of seniors. *Transportation Research Record*, 2118:47-54.

Rowan, D., Niemeier, D. (2009). From kiosks to megastores: The evolving carbon market. *California Agriculture,* 63(2):96–103.

Gould, G., Niemeier, D. (2009). Review of regional locomotive emission modeling and the constraints posed by activity data. *Transportation Research Record*, 2117:24-32.

Chen, H., Bai, S., Eisinger, D., Niemeier, D., Claggett, M. (2009), Predicting near-road $PM_{2.5}$ concentrations: Comparative assessment of CALINE4, CAL3QHC, and AERMOD. *Transportation Research Record*, 2123:26-37.

Karner, A., Eisinger, D., Bai, S., Niemeier, D. (2009) Mitigating diesel truck impacts in environmental justice communities. *Transportation Research Record*, 2125:1-8.

Van Houtte, J., Niemeier, D. (2008). A critical review of the effectiveness of I/M programs for monitoring PM emissions from heavy duty vehicles. *Environmental Science and Technology,* 42(21):7856-7865.

Niemeier, D., Gould, G., Karner, A., Hixson, M., Bachmann, B., Okma, C., Lang, Z., Heres Del Valle, D. (2008). Rethinking downstream regulation: California's opportunity to engage households in reducing greenhouse gases. *Energy Policy*, 38:3436-3447.

Gao, H., Niemeier, D. (2008). Using functional data analysis of diurnal ozone and NO_X cycles to inform transportation emissions control. *Transportation Research, Part D*, 13(4):221-238.

Lin, J., C. Chen, Niemeier, D. (2008). An Analysis on Long-Term Emission Benefits of a Government Vehicle Fleet Replacement Plan in Northern Illinois, *Transportation*, 35(2):1572-9435.

Kear, T., Eisenger, D, Niemeier, D., Brady, M. (2008). US vehicle emissions: Creating a common currency to avoid model comparison problems. *Transportation Research, Part D*, 13(3):168-176.

Hendren, P., Niemeier, D. (2008*)* Identifying Peer States for Transportation System and Policy Analysis. *Transportation*, 35:445-465.

Niemeier, D., Mannering, F. (2007) Bridging research and practice: A synthesis of best practices in travel demand modeling. *Special Issue (eds), Transportation Research, Part A,* 41:365-366.

Bai, S., Nie, Y., Niemeier, D. (2007). The impact of speed post-processing methods on regional mobile emissions estimation. *Transportation Research, Part D,* 12: 307-324.

Yura, E., Kear, T., Niemeier, D. (2007). Using CALINE dispersion to assess vehicular $PM_{2.5}$ emissions. *Atmospheric Environment,* 41(38): p. 8747-8757.

ALEX KARNER
ALEX@SUSTAINABLESYSTEMSRESEARCH.NET

EDUCATION

Ph.D., **University of California, Davis**, Civil and Environmental Engineering, 2012.
M.S., **University of California, Davis**, Civil and Environmental Engineering, 2008.
B.A.Sc., **University of Toronto**, Civil Engineering, 2002.

EXPERIENCE

Principal. Sustainable Systems Research, LLC, 2012-2013
Recent Consulting.
- Save Our Creek, *Review of the Summerhill Homes/Magee Ranch Draft EIR,* 2013
- Save Our Creek, *Danville General Plan Review,* 2012
- Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR,* 2012
- Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin,* 2012
- East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR,* 2012
- Natural Resources Defense Council, *Ports and Air Quality: Moving Toward Clean Cargo,* 2012
- TransForm, *Looking Deeper: A detailed review of the project performance assessment being used to develop OneBayArea,* 2011-2012

Graduate Student Researcher. Department of Civil and Environmental Engineering, University of California, Davis, 2006-2012
Teaching Assistant. Department of Civil and Environmental Engineering, University of California, Davis, 2011
Transportation Modeling Intern. Sacramento Area Council of Governments, 2009

PUBLICATIONS

London, J., Karner, A., Sze, J., Rowan, D., Gambirazzio, G., Niemeier, D. Racing Climate Change: Collaboration and Conflict in California's Global Climate Change Policy Arena. In press. *Global Environmental Change.*

Karner, A., Multimodal Dreamin': California transportation planning, 1967-1977. In press. *Journal of Transport History.*

Karner, A., Urrutia, A., Niemeier, D. (2012). US public transit fantasies: Performance and economic stimulus. *International Journal of Transport Economics,* 34(1):39-55.

Karner, A., Eisinger, D., Niemeier, D. (2010). Near-roadway air quality: Synthesizing the findings from real-world data. *Environmental Science and Technology*, 44(14):5334-5344.

Rowan, D., Karner, A., Niemeier, D. (2010). Miles per gallon illusions and Corporate Average Fuel Economy distortions: When even the transport experts have trouble. *Transportation Research Record,* 2191:8-15.

Gould, G., Karner, A. (2009). Modeling bicycle facility operation: A cellular automaton approach. *Transportation Research Record,* 2140:157-164.

Karner, A., Eisinger, D., Bai, S., Niemeier, D. (2009). Mitigating diesel truck impacts in environmental justice communities. *Transportation Research Record,* 2125:1-8.

Sze, J., Gambirazzio, G., Karner, A., Rowan, D., London, J., Niemeier, D. (2009). Best in show? Climate and environmental justice policy in California. *Environmental Justice,* 2(4):179-184.

Niemeier, D., Gould, G., Karner, A., Hixson, M., Bachmann, B., Okma, C., Lang, Z., Heres Del Valle, D. (2008). Rethinking downstream regulation: California's opportunity to engage households in reducing greenhouse gases. *Energy Policy*, 38:3436-3447.

PRESENTATIONS

Karner, A., Niemeier, D. A review of civil rights guidance and equity analysis methods for regional transportation plans. Submitted for presentation at the 92nd Annual Meeting of the Transportation Research Board. Washington, DC, January 13-17, 2013.

Karner, A., Niemeier., D. Innovations in the equity analysis of regional transportation plans. Submitted for presentation at the 92nd Annual Meeting of the Transportation Research Board. Washington, DC. January 13-17, 2013.

Karner, A., (2012). Innovations in regional transportation equity analysis. Paper accepted for presentation at the International Conference on Inequality and Sustainability. Medford, MA, November 9-10, 2012.

Karner, A., (2012). Transportation equity analysis for activity-based travel demand models. Poster presentation at the University of California Transportation Center Student Conference. Davis, CA, April 20, 2012.

Karner, A., (2012). Evaluating public participation in California's Global Warming Solutions Act. Paper presented at the 2nd Annual Dimensions of Political Ecology Conference. Lexington, KY, April 13-15, 2012.

Karner, A., Niemeier, D. (2012). The region or the state? California transportation planning, 1967-1977. Transportation History, Session 303. Paper presented at the 91st Annual Meeting of the Transportation Research Board. Washington, DC, January 22-26, 2012.

Rowan, D., Karner, A. (2011). Moving toward equity: The ongoing struggle for environmental justice in California. Session co-organizer and moderator. Interdisciplinary Graduate and Professional Symposium, UC Davis, Davis, CA. April 23, 2011.

Karner, A., Niemeier, D. (2011). Translating policy to practice: An interdisciplinary investigation of transportation planning. Paper presented at the 13th Transportation Research Board National Planning Applications Conference. Reno, NV, May 8-12, 2011.

Karner, A., Niemeier, D., (2011). Transportation spending under the American Recovery and Reinvestment Act in California. Taxation and Finance, Session 561. Paper presented at the 90th Annual Meeting of the Transportation Research Board. Washington, DC, January 23-27, 2011.

Karner, A., Eisinger, D., Niemeier, D. (2010). Near-road air quality: Findings from real world data. Paper presented at the Coordinating Research Council Mobile Source Air Toxics Workshop. Sacramento, CA. November 30-December 2, 2010.

Karner, A., Eisinger, D., Niemeier, D. (2010). Near-road air quality: Findings from real world data. Paper presented at the Air & Waste Management Association Symposium on Air Quality Measurement Methods and Technology. Los Angeles, CA, November 2-4, 2010.

.

MELODY ELDRIDGE
MELODY@SUSTAINABLESYSTEMSRESEARCH.NET

EDUCATION

B.S., **University of California, Davis**, Civil and Environmental Engineering, 2011.

EXPERIENCE

Principal. Sustainable Systems Research, LLC, 2012-2013
Recent Consulting.
Save Our Creek, *Review of the Summerhill Homes/Magee Ranch Draft EIR,* 2013
Save Our Creek, *Danville General Plan Review,* 2012
Natural Resources Defense Council, *Review of Southern California International Gateway Project Recirculated Draft EIR,* 2012
Natural Resources Defense Council, *Coal Dust and Rail: Impacts of Coal Transport from the Powder River Basin,* 2012
East Yard Communities for Environmental Justice and Natural Resources Defense Council, *Review of the Transportation and Air Quality Analysis in the I-710 Draft EIR,* 2012
Natural Resources Defense Council, *Ports and Air Quality: Moving Toward Clean Cargo,* 2012
Sustainability and Planning Intern. City of Davis Department of Community Development and Sustainability, 2012
Junior Research Specialist. Department of Civil and Environmental Engineering, University of California Davis, 2011
Research Assistant. Dr. Deb Niemeier, Department of Civil and Environmental Engineering, University of California, Davis, 2008-2011
Engineering Intern. Engineering Development Associates, San Luis Obispo, CA, 2008

LICENSE

E.I.T., October, 2010.

PUBLICATIONS

Rowan, D., Eldridge, M., Niemeier. D., (Submitted to *Energy Policy*, March 2012). Incorporating regional growth into forecasts of greenhouse gas emissions from project-level residential and commercial development.

Technical Memorandum: Review of the Draft Environmental Impact Report for *Plan Bay Area*

MAY 15, 2013

FINAL

PREPARED FOR:
RESOURCES LEGACY FUND
PUBLIC ADVOCATES, INC.

PREPARED BY:
SUSTAINABLE SYSTEMS RESEARCH, LLC

Disclaimer

The views expressed in this review are those of the authors. They do not represent the opinions of the University of California Davis, Resources Legacy Fund, Public Advocates, Inc., or any other organization with which the authors or recipients are affiliated. The analyses contained in this report are based on the documents available to its authors at the time it was prepared.

CONTENTS

1. Overview

In April, 2013, Sustainable Systems Research, LLC was commissioned by Resources Legacy Fund to provide technical assistance to Public Advocates, Inc. during their review of the Draft Environmental Impact Report conducted for *Plan Bay Area* (DEIR). *Plan Bay Area* is the 2013 regional transportation plan/sustainable communities strategy (RTP/SCS) prepared jointly by the Metropolitan Transportation Commission (MTC), the metropolitan planning organization (MPO) for the nine-county Bay Area, and the Association of Bay Area Governments (ABAG), the regional council of governments (COG). Our assistance focused on assessing the performance analyses, travel demand modeling, and land use modeling conducted to support the DEIR. In this report, we address the questions posed by Public Advocates, Inc. including:

1. To what extent are the travel demand and land use modeling methods employed in the preparation of the DEIR likely to affect the relative performance of the Proposed Plan and Equity, Environment, and Jobs (EEJ) Alternatives?
2. Are the modeling methods employed consistent with the RTP Guidelines promulgated by the California Transportation Commission?
3. Were the full capabilities of the land use model used to consider gentrification and displacement?
4. How much would additional funds dedicated to the maintenance of Local Streets and Roads in the EEJ Alternative contribute to improved pavement conditions in the region relative to the Proposed Plan Alternative?
5. How do transit service improvements differ by mode in the Proposed Plan and EEJ Alternatives?
6. Is BART operating at or near capacity during the peak period in the Proposed Plan or EEJ Alternative?
7. To what extent do reported performance measures differ in absolute terms between the Proposed Plan and EEJ Alternatives, and what is the significance of those differences?

To address this list, we examined the quantitative results presented in the DEIR and related documents, as well as travel demand modeling data provided by MTC.

2. Agency materials reviewed

The following documents related to the DEIR have been consulted to support our analysis, and are referenced using the abbreviations indicated. References not related to the project are cited in footnotes.

- **Plan:** Draft Plan Bay Area. Prepared by MTC and ABAG. March 2013.
- **DEIR**: Draft Plan Bay Area Environmental Impact Report. State Clearinghouse No. 2012062029. April 2013.

- **Summary of Predicted Land Use Responses**: Draft Plan Bay Area Draft Summary of Predicted Land Use Responses. Prepared by MTC and ABAG. April 2013.
- **Summary of Predicted Traveler Responses**: Draft Plan Bay Area Draft Summary of Predicted Traveler Responses. Prepared by MTC and ABAG. March 2013.
- **Performance Assessment Report**: Draft Plan Bay Area Draft Performance Assessment Report. Prepared by MTC and ABAG. March 2013.
- **Equity Analysis Report**: Draft Plan Bay Area Draft Equity Analysis Report. Prepared by MTC and ABAG. March 2013.
- **Appendices to Equity Analysis:** Draft Plan Bay Area Appendices to Draft Equity Analysis Report. Prepared by MTC and ABAG. March 2013.
- **Local Streets and Roads Appendix:** Draft Plan Bay Area Local Street and Road Needs and Revenue Assessment. Prepared by MTC and ABAG. March 2013.
- **Summary of Funding Shifts Table**: Funding Adjustments for EEJ Alternative Compared to Preferred Transportation Investment Strategy. Document received via email from Richard Marcantonio, May 13, 2013. The origin of the document is with MTC staff. Because it is not readily available it is included in Appendix A.
- **Transit Frequency Increases Table:** Bus/Light Rail Routes Slated for Frequency Improvements in Plan Bay Area EIR Alternative #5 (DRAFT). Document received via email from Richard Marcantonio, May 13, 2013. The origin of the document is with MTC staff and it is dated 8/27/2012. Because it is not readily available it is included in Appendix A.
- **MTC Model Inputs & Outputs:** MTC provided travel demand model inputs and outputs for the base year (2010) and forecast year scenarios for 2020 and 2040. These were obtained from MTC and are referenced in text as appropriate.

3. REVIEW OF MODELING METHODS

The predicted location of future housing units in the Bay Area directly affects the performance of alternative transportation and land use scenarios on greenhouse gas emissions, vehicle-miles traveled, and housing and transportation affordability, among other indicators. There are key differences in how the forecasted housing distributions were generated for the Proposed Plan and Equity, Environment, and Jobs (EEJ) Alternatives. These differences are likely to have affected their relative performance. Specifically, if the projected housing distribution had been spatially allocated using the same methods for both scenarios, EEJ would show improved performance relative to the Proposed Plan above what is currently demonstrated in the Draft Environmental Impact Report (DEIR) prepared for *Plan Bay Area*.

After a review of the technical documentation and a request for clarification from modeling staff at MTC and ABAG, the exact steps used to create the housing distribution in the Proposed Plan Alternative remain unclear. However, it is clear that the method used to distribute housing in the EEJ alternative and two other alternatives (the No Project and the Transit Priority Alternatives) was not the same method used in the Proposed Plan Alternative.

The UrbanSim model was used to allocate housing to varying degrees for all alternatives. UrbanSim is an agent-based land use model that predicts the locations of businesses and households based on a spatial representation of the housing and commercial development markets and the decisions of individual actors – families, businesses, and real estate developers [1]. UrbanSim takes current and allowable land uses and demographics at the parcel level as input. The model also requires the user to input estimates of future jobs and population (known as "control totals") that are subsequently allocated spatially to parcels. Measures of transportation accessibility, which are outputted from a travel demand model, are also used as an input to UrbanSim. Including accessibility ensures that modeled agents are sensitive to the travel time changes engendered by transportation investments. UrbanSim outputs annual estimates of housing and business locations and the demographics of household residents.

UrbanSim is sensitive to both market dynamics and policy instruments. Policy instruments can include urban growth boundaries and developer subsidies[1] that incentivize the construction of housing types that would otherwise not appear profitable. Specifically, "UrbanSim simulates land use outcomes (i.e. buildings and their occupants) on individual parcels of land. As such, the native units describing the land use outcomes for the No Project, Transit Priority, and EEJ Alternatives are parcels. There are about 2 million parcels in the nine county Bay Area" (Summary of Predicted Land Use Responses, Appendix A, p. 10).

For the EEJ alternative and the two other alternatives, housing was distributed using UrbanSim to "simulate the impact of land use and transportation projects/policies on land use outcomes. It is the sole method used to determine the land use distribution for these three alternatives" (Summary of Predicted Land Use Responses, Appendix A, p. 8). In other words, "land use outcomes" – the number, type, location, and residents of housing and commercial developments at the parcel level – in the EEJ Alternative were generated using only the UrbanSim economic forecasting model. UrbanSim's underlying methods allocate new housing developments only where it determines that such developments on specific parcels would be profitable to a simulated developer. In order to encourage housing in designated infill zones, subsidies can be entered into the developer's financial (rate of return) equation for each parcel, and various types of housing tested, until profitable projects are found. Subsidies were a key policy tool used to encourage the development of affordable housing near jobs in UrbanSim's modeling of the EEJ Alternative. Employing subsidies for infill in UrbanSim brings more of this type of housing into the "profitable" realm for simulated developers.

On the other hand, for the Proposed Plan Alternative, the use of UrbanSim was restricted to only filling "in land use details not available through the methodology developed for the

[1] Note that subsidies need not be conceptualized as direct outlays from the public to developers. They could represent policies that are not currently well-modeled by UrbanSim. Stated differently, the land use outcomes realized with a total amount of subsidy could be realized by alternative policy instruments not currently represented in the model including deed-restricted housing and inclusionary zoning.

Jobs/Housing Connection, including detailed land uses, densities, and intensities outside of PDAs" (Summary of Predicted Land Use Responses, Appendix A, p. 8). More specifically,

> for the proposed Plan, the *Jobs/Housing Connection* provides land use outcomes, including jobs and population, for PDAs, where applicable, as well as travel analysis zones (TAZs, which are geographies used by the travel model and identical to Census tracts for most of the Bay Area). (emphasis added, Summary of Predicted Land Use Responses, Appendix A, p. 10).

In other words, in the Proposed Plan Alternative, the number of housing units was fixed in each PDA according to the housing distribution set forth in the *Jobs/Housing Connection*.[2] The *Jobs/Housing Connection* specified not only the number of housing units and households in each city in the region in 2040, but also the percentage of housing units located in PDAs in that year. Since TAZs and PDAs are much larger than parcels, an allocation method must be employed to distribute land use outcomes by parcel. The approach used by staff adjusted

> UrbanSim … via calibration techniques to simulate a future in which the outcomes, when measured across collections of PDAs or TAZs, adequately re-create the results of the Proposed Plan … This process generated parcel-level results for the Proposed Plan … which can then be used for detailed analyses. (Summary of Predicted Land Use Responses, Appendix A, p. 10).

The technical documentation does not explain the "calibration techniques" employed to obtain this result. However, it does give some hints, explaining that, in the Proposed Plan Alternative

> For parcels within PDAs, the UrbanSim results are scaled up or down to match the PDA results from the *Jobs/Housing Connection* methods … For parcels outside of PDAs, the UrbanSim results are scaled up or down to match the TAZ results from the *Jobs/Housing Connection* methods. (Summary of Predicted Land Use Responses, Appendix A, p. 13).

To be clear, staff are indicating that the approach used for the Proposed Alternative

> explicitly assumes that the PDA- and TAZ-scale data from the *Jobs/Housing Connection* methods more accurately reflect the Proposed Plan Alternative than the UrbanSim results. Said another way: UrbanSim only informs the distribution of land use outcomes *within* TAZs or *within* PDAs. The *Jobs/Housing Connection* methods inform the distribution of land use outcomes *across* TAZs and *across* PDAs and the total amounts of population, jobs and housing within each PDA." (emphasis added, Summary of Predicted Land Use Responses, Appendix A, p. 13).

---

[2] Although the DEIR does not say so explicitly, we assume this refers to the housing allocation data in the Appendix entitled "Jobs-Housing Connection Scenario (Draft, Revised: March 9, 2012)," available at http://www.onebayarea.org/pdf/SCS_Preferred_Scenario_Jobs_Housing_Connection_3-9-12.pdf.

It should also be noted that different types and magnitudes of subsidies appear to have been applied during the modeling of the Proposed Plan and EEJ Alternatives.[3] Specifically, subsidies were employed only partially within UrbanSim to incentivize the desired number of housing units within PDAs in the Preferred Alternative. Additionally, the number of buildings and occupants were *scaled* (i.e. multiplied by a constant factor) to ensure that the sum of all parcels within PDAs and TAZs matched totals described in the *Jobs/Housing Connection.* Scaling in this manner circumvents the simulation of developer profitability since it simply asserts that more or less housing is constructed on a parcel.

The net result of the above discussion is that the land use outcomes under the Proposed Plan Alternative are forced to match targets defined in the *Jobs/Housing Connection* using unspecified "calibration techniques" which likely include a combination of a fixed amount of subsidy combined with scaling. In contrast, the Transit Priority and EEJ Alternatives are being modeled completely with UrbanSim, with subsidies being applied at the parcel level to incentivize the construction of housing units in specific zones. Rather than allocating housing to specific cities and PDAs, the EEJ Alternative must match only total jobs and housing at a regional level (control totals are listed in Summary of Predicted Land Use Responses, Appendix A, Table 1, p. 6).

The critical philosophical distinction between these two approaches is that the land use assumptions used to evaluate the Proposed Plan Alternative reflect regional land use planning *goals*, while the evaluation of the EEJ Alternative is based on the expected outcomes of policies that strive to achieve regional planning goals (i.e. the outcomes of a free market in which subsidies must be applied). This difference in assumptions means that arguments proffered in the DEIR regarding the relative subsidies required to realize each alternative are not meaningful (see, e.g., Summary of Predicted Land Use Responses, p. 27).[4] A consistent land use modeling approach would have set zoning at the parcel level, applied land use policies (e.g., urban growth boundaries) to each alternative as appropriate, and executed UrbanSim for each. If subsidies were required to match regional goals, they should have been applied to the evaluation of each alternative, as required, rather than mixing the application of scaling and subsidization for one alternative but not another.

---

[3] In a table summarizing the policy measures employed by each alternative, the DEIR indicates that "Subsidies for PDA/TPP Opportunity Areas" were employed in the EEJ alternative but "Subsidies for PDA Growth" were applied in the Proposed Plan Alternative (DEIR, Table 3.1-1, p. 3.1-9). Modeling for the Proposed Plan Alternative employed "a subsidy similar in magnitude to the Bay Area's former redevelopment program to support development in PDAs where the market is weak" (Draft Technical Appendix: Predicted Land Use Patterns, p. 27). The difference seems to be that for the Proposed Plan Alternative, the subsidy amount was fixed in advance and supplemented with scaling whereas for the EEJ Alternative, increasing subsidy levels were modeled to approximate the desired regional outcomes.

[4] An additional inconsistency in land use modeling approach is evident for another DEIR scenario, the Enhanced Alternative (or Network of Communities). It used a development fee to discourage non-infill development that was used to offset some of the subsidies used for infill parcels. As a result, the reported subsidies are not the gross subsidies, but are net subsidies after subtracting development fees. For this reason, the Enhanced Alternative cannot be compared to the other alternatives, in terms of level of subsidies.

The inconsistencies in land use modeling approaches are likely to substantially affect the magnitude and direction of the Proposed Plan Alternative's environmental impacts. Correspondence with ABAG[5] staff indicates that the total amount of subsidy required to realize the Proposed Plan Alternative is approximately $819 million. The corresponding amount for the EEJ alterative is $2.4 billion. The difference in the magnitude of subsidy required to realize each plan may be driven mostly by the approach to modeling land use rather than substantive differences between the alternatives. Specifically, the Proposed Plan Alternative relied on the setting of regional planning goals as key policy tools. Regional planning goals are important policy tools, but real estate markets will continue to operate in the context of these goals. These goals may not be achieved without additional policies. In requiring subsidies to realize regional development goals and employing UrbanSim on all parcels, the EEJ alternative provides a more realistic accounting of development in the forecast year than the Proposed Plan Alternative.

If the lower level of subsidies employed in the Proposed Plan Alternative relative to EEJ were maintained, but UrbanSim was executed on all parcels without calibrating to the *Jobs/Housing Connection* PDA/TAZ totals, the resultant predictions for the Proposed Plan Alternative would likely place less housing near transit; if such development had been profitable in the Proposed Plan Alternative, it would have been undertaken without scaling. Without additional subsidies or other stated policies to support the housing allocation described in the *Jobs/Housing Connection*, land use outcomes for the Proposed Plan Alternative would move closer to the No Project Alternative which assumes no change in current zoning. The No Project Alternative allocates 24% of housing growth to PDAs compared to 77% for the Proposed Plan and 57% for the EEJ Alternatives (DEIR, p. 3.1-15). With relatively less housing near to transit in a free market version of the Proposed Plan Alternative, its performance on the key metrics of greenhouse gas emissions and vehicle-miles traveled would be likely to decrease.

4. Consistency with California Transportation Commission recommendations

The California Transportation Commission (CTC) promulgates guidance to be used by MPOs as they prepare regional transportation plans (RTPs). This guidance includes best practices for the use of travel demand and land use models in the planning process. In early 2010, the CTC adopted revisions to their guidelines to address changes in planning and modeling practice prompted by the passage of Senate Bill 375 [2]. According to the introductory letter by then-CTC chair James Earp,

> the revisions were prepared through the work of an Advisory Committee representing MPOs, RTPAs, federal, state and local governments, organizations knowledgeable in the creation and use of travel

[5] Email from Mike Reilly, April 29, 2013.

> demand models, and organizations concerned with the impacts of transportation investments on communities and the environment. [ref. 2, introductory letter, p. 1]

The CTC guidelines are intended to synthesize relevant federal and state requirements for transportation planning and to promote consistency in transportation planning throughout California, among other goals [2, p. 3]. The DEIR notes that the CTC guidelines regarding validation and sensitivity analysis were followed (DEIR, p. 2.1-21). However, Chapter 3 of the CTC document contains other provisions related to the integration of travel demand and land use models and scenario consistency that appear to not have been followed in the DEIR. Failing to follow the guidance set forth by the CTC puts the DEIR modeling at variance with best practices.

The CTC recommends that California's largest MPOs transition to integrated travel demand-land use models which "allow planners to study the interactions between land use and the transportation system" [2, p. 47]. Specifically, "Land use models should be sensitive to transportation scenarios such that the effects of land use and transportation policies can interact with feedback in an integrated transportation and land use model" [2, p. 50]. Transportation investments are likely to increase accessibilities in parts of the region proximate to them, increasing their attractiveness for development. Prior to the use of integrated models, this relationship was not captured.

As noted above, MTC and ABAG have transitioned to an integrated modeling framework, but the differences in modeling approaches between the Proposed Plan Alternative and the EEJ Alternative noted above mean that the degree to which the models are truly integrated, and therefore the degree of influence land use and transportation outcomes are able to exert on each other differs by scenario. By taking land use outcomes from the *Jobs/Housing Connection* (as described in the previous section), the Proposed Plan Alternative does not fully allow regional transportation investments to affect the relative attractiveness of parcels for development. On the other hand, the EEJ Alternative is illustrative of a fuller integration between the travel demand and land use models. In the latter scenario, decisions regarding development on particular parcels are based solely on the market faced by a developer, including the relative accessibility of an area. By not consistently integrating travel demand and land use models across alternatives, the DEIR violates CTC modeling guidelines.

Another relevant CTC guideline relates to consistency between modeled alternatives. It states that,

> The same land use model used in the RTP modeling should be used in the impact assessment for the No Action alternative, the Proposed Plan alternative, and the Environmentally Preferable Alternative. Only in this way will all of the outputs in the RTP and EIR be comparable. [ref. 2, p. 51].

By employing UrbanSim differently between the Proposed Plan Alternative and the EEJ alternative as described in the previous section, MTC and ABAG effectively applied different land use modeling methods to assess the Proposed Plan Alternative and the environmentally preferable EEJ Alternative.[6] This modeling decision violates the CTC guidelines and limits the utility of comparing the performance of each alternative.

In the next RTP/SCS update, MTC and ABAG should use the same population and employment projections and the same urban growth boundaries for all scenarios. They should also use UrbanSim to fully model all of the scenarios, using only developer subsidies in the model to get the desired levels of infill in designated zones so that officials and citizens can compare the scenarios on a consistent basis. There should be no manual assignment of households or employees to smaller scale zones, especially for some scenarios and not others.

5. CONSIDERATION OF GENTRIFICATION AND DISPLACEMENT

One major benefit of employing an integrated simulation of land use and travel behavior is that zonal demographics and land uses are not assumed to equal a pre-determined value in the future, as was the case in historic analyses that ran a travel model in isolation. As a result, UrbanSim has been used to predict demographic changes including gentrification and displacement expected in response to transportation investments. In one example, Joshi et al. [3] studied the gentrifying and displacing effects of the Phoenix-area light rail and supportive transit-oriented development (TOD) measures including upzoning and mixed-use development near stations. Their results showed that the low-income, high-accessibility areas near Arizona State University in Tempe gradually gentrified. In the build scenario, these areas had lower housing densities, higher average incomes, and higher proportions of white residents than a no-build scenario. Importantly, their results demonstrate that projections of future racial and ethnic demographics are possible.[7]

Joshi et al. [3] did not link their results dynamically to a travel model, but instead assumed arbitrary light rail mode share increases; they also did not represent policies designed to mitigate gentrification. Linking UrbanSim to a travel model and representing policies designed to mitigate gentrification are vital to truly understanding the link between gentrification, displacement, TOD, equity, and mitigation options.

Instead of conducting an analysis of demographic changes expected in response to *Plan Bay Area*, the Equity Analysis Report employs a static indicator of "potential for displacement" which overlays

> concentrations of today's households spending more than half their incomes on rent (and who are thus considered already overburdened by housing costs considered high relative to their household incomes) with locations of more intensive planned housing growth by 2040 (defined as an 30% or

---

[6] The EEJ Alternative was identified as the environmentally superior alternative as defined by CEQA in the DEIR (DEIR, p. 3.1-146).

[7] Although a race and ethnicity variable could be associated with simulated individuals in both the travel demand and land use models used in *Plan Bay Area*, modeling staff have so far not included one, for reasons discussed elsewhere [see, e.g., ref. 4].

greater increase in housing units relative to today, slightly above the regional average of 27% growth. (Equity Analysis Report, p. 4-18).

The resultant indicators are presented as a percentage of overburdened households located in high growth areas for two subsets of the Bay Area – communities of concern and (for comparison) the remainder of the region. Communities of concern were defined using overlapping geographic thresholds at the TAZ-level including proportion of minority and low-income residents, and proportion of elderly residents, among others (see Equity Analysis Report, pp. 2-4 – 2-7, for additional details). The results of this analysis show that communities of concern contain higher proportions of overburdened renter households in high growth areas than the remainder of the region under all *Plan Bay Area Alternatives* (Equity Analysis Report, Table 4-10, p. 4-19). This result highlights the region-wide need for policies that mitigate displacement; however, it does not provide information regarding the actual responses of individuals and families to changing market conditions and transportation investments.[8] Future analyses of gentrification and displacement should take full advantage of the UrbanSim model outputs to summarize demographic changes over time. This type of analysis would identify changing demographics across the region in response to transportation investments and land use policies rather than simply identifying the areas that are expected to experience a risk of such changes.

6. Effect of additional Local Streets and Roads Funding

The EEJ Alternative would allocate an additional $3.4 billion for Local Streets and Roads Maintenance relative to the Proposed Plan Alternative (Summary of Funding Shifts Table). An approximation of the total number of additional lane-miles that can be maintained using this funding can be determined using data from the Local Streets and Roads Appendix.

There are 42,500 lane-miles classified as Local Streets and Roads in the Bay Area (Local Streets and Roads Appendix , p. 3). Maintaining these lane-miles in a state of good repair will cost $45 billion over the *Plan Bay Area* period. To maintain the region's current pavement condition index (a measure of pavement quality) would require $32.5 billion over the same time period. Inferring an average per mile maintenance cost for each scenario results in an estimate of the number of additional lane miles that would be improved in the EEJ Alternative relative to the Proposed Plan Alternative:

[8] The potential for displacement indicator was designed prior to the DEIR process based on discussions with the "Regional Equity Working Group" (Equity Analysis Report, p. 1-9). UrbanSim was only introduced for the DEIR analysis. Updating the equity analysis methods to take full advantage of the possibilities of the land use model would have afforded additional analytical possibilities.

- $\$3.4 \cdot (10^9) / \$45 \cdot (10^9) / 42.5 \cdot (10^3)$ lane-miles = **3,200** additional lane-miles (or 7.5% of total local streets and road lane miles) maintained in a state of good repair in the EEJ Alternative relative to the Proposed Plan Alternative
- $\$3.4 \cdot (10^9) / \$32.5 \cdot (10^9) / 42.5 \cdot (10^3)$ lane-miles = **4,400** additional lane-miles (or 10.4% of total local streets and road lane miles) maintained to the current pavement condition index in the EEJ Alternative relative to the Proposed Plan Alternative

7. TRANSIT SERVICE IMPROVEMENTS

The DEIR reports the capacity of the regional transit system by mode in daily seat-miles (DEIR, Table 3.1-7, p. 3.1-8) for the base year and 2040 for each alternative. Table 1 reproduces i) the capacity in 2010 and 2040 for each major transit mode, ii) the capacity increase within each mode from 2010 to 2040, and iii) the proportion of the total increase in transit capacity that is attributable to each mode. For example, capacity on local bus measured in daily seat-miles increases by 9.72% from 2010 to 2040 under the Proposed Plan Alternative. That capacity increase accounts for 10.8% of the total growth in transit seat-miles expected from 2010 to 2040.

Table 1 provides important insights related to the relative proportions of capacity increases accounted for by modes typically associated with "choice" rides (i.e. transit users who have the option of driving) and "transit dependents" for whom transit is the only option [see, e.g, ref. 5]. Here we consider choice modes to consist of heavy rail, commuter rail, and ferry and dependent modes to consist of local bus and light rail. The Proposed Plan and EEJ Alternatives allocate 75.8% and 64.8% of their total capacity increases to choice modes, respectively.[9] The Proposed Plan Alternative allocates 19.4% of its capacity increases to transit dependent modes and the EEJ alternative allocates 28.8% of its capacity increases to same.[10] These percentage allocations translate into a 101% increase in seat-miles of service on transit dependent modes for the EEJ Alternative relative to the Proposed Plan Alternative.[11] Thus, the EEJ Alternative effectively doubles the increase in service for modes used by transit dependent individuals relative to the Proposed Plan Alternative.

Table 2 shows the expected transit ridership in 2040 for the Proposed Plan and EEJ Alternatives by mode and major operator. Increases in local bus and light rail ridership in the EEJ Alternative translate into increased ridership on those modes relative to the Preferred Plan Alternative in 2040.

[9] Summing the percent increases for heavy rail, commuter rail, and ferry.
[10] Summing the percent increases for local bus and light rail.
[11] (41,887,000 – 34,477,000 + 12,814,000 – 8,114,000) - (37,828,000 – 34,477,000 + 10,781,000 – 8,114,000) = 6,092,000 additional seat-miles of service on transit dependent modes in the EEJ Alternative. The Proposed Plan Alternative has 6,018,000 seat-miles of transit dependent service, resulting in an increase of 101% for the EEJ Alternative relative to the Proposed Plan Alternative on this metric.

Table 1. Transit system capacity (daily seat-miles) in the base year (2010), Proposed Plan Alternative (2040), and EEJ Alternative (2040). Source: DEIR, Table 3.1-7, p. 3.1-8.

Mode	2010 Capacity (1,000 seat-miles)	Proposed Plan Alternative			EEJ Alternative		
		2040 Capacity (1,000 seat-miles)	Increase from 2010	Share of overall transit capacity increase	2040 Capacity (1,000 seat-miles)	Increase from 2010	Share of overall transit capacity increase
Transit Dependent Modes							
Local bus	34,477	37,828	9.7%	10.8%	41,887	21.5%	17.6%
Light rail	8,114	10,781	32.9%	8.6%	12,814	57.9%	11.2%
Choice Modes							
Heavy rail	44,134	56,743	28.6%	40.7%	60,499	37.1%	39.0%
Commuter rail	14,463	22,842	57.9%	27.0%	22,842	57.9%	19.9%
Ferry	4,612	7,099	53.9%	8.0%	7,099	53.9%	5.9%
Other							
Express bus	7,560	9,050	19.7%	4.8%	10,232	35.3%	6.4%
Total	113,360	144,343	27.3%	100.0%	155,373	37.1%	100.0%

Table 2. Summary of 2040 transit ridership for the Proposed Plan and EEJ Alternatives by mode and major operator. Source: MTC Travel model data.

	Proposed Plan Alternative (2040)		EEJ Alternative (2040)		Difference (EEJ – PP)	
Mode	Boardings per Day	% Share	Boardings per Day	% Share	Absolute	Percent
Local	1,668,103	55%	1,779,367	56%	111,264	7%
Express	206,646	7%	201,043	6%	-5,603	-3%
Ferry	25,528	1%	21,265	1%	-4,263	-17%
Light Rail	503,210	17%	554,155	17%	50,945	10%
Heavy Rail[1]	536,760	18%	553,657	17%	16,897	3%
Commuter Rail	83,743	3%	82,424	3%	-1,319	-2%
Total	3,023,990	100%	3,191,911	100%	167,921	6%
Major operator						
AC Transit	374,222	12%	455,484	14%	81,262	22%
VTA	617,166	20%	701,659	22%	84,493	14%
SamTrans	103,227	3%	153,958	5%	50,731	49%
BART[1]	536,364	18%	553,497	17%	17,133	3%
MUNI	984,855	33%	921,335	29%	-63,520	-6%
Total	2,615,834	87%	2,785,933	87%	170,099	7%

[1]Note that heavy rail boardings do not equal BART boardings because the Oakland Airport Connector was included in the travel demand model in 2040 as a separate “operator” but was grouped under the heavy rail mode.

8. BART CAPACITY ANALYSIS

To investigate whether BART is expected to operate at or near capacity in the forecast year, we aggregated the loaded transit network data using MTC's travel model outputs for both the Proposed Plan and EEJ Alternatives. These data included total boardings per day, total boardings by mode (local bus, express bus, ferry, light rail, heavy rail, and commuter rail), and total boardings by major operator (AC Transit, VTA, SamTrans, BART, and MUNI) for each modeled time period.

BART capacity during the AM peak period (6 – 10 AM) was estimated using these data and the following approach. A maximum number of passenger seats at any given point on a line was calculated using information from BART: a maximum of 60 seats per car in current car models[12] and 10 cars per train due to station platform limitations.[13] The current number of cars owned by BART does not allow for all trains to have 10 cars simultaneously. The passenger seat information was then used to calculate the total seat-mile capacity for the line during the morning peak. Percent utilization was calculated for each line using passenger-mile totals from the MTC model outputs.

As an example, the Bay Point – SFO line has 15 minute headways in the AM peak period and its route is 53 miles in length. Morning seat-mile capacity is thus:

(60 minutes/hour)/(15 minutes/train) x 4 hours x 60 seats/car x 10 cars/train x 53 miles = 510,720 seat-miles.

The passenger-miles given by the model outputs indicate that demand is 528,005 passenger-miles over the morning period. Utilization for the Bay Point – SFO line is thus:

528,005/510,720 = 103%

Results are summarized in Table 3.[14] Those lines with utilization rates greater than 80% were considered critical per the DEIR guideline that "an exceedance [in transit capacity] is defined as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators" (DEIR, Table ES-2). Note that the passenger-miles are spread out over the length of each line; in the cases where demand imbalances exist (i.e. boardings increase with proximity to urban centers) the actual number of passengers on board the train would exceed capacity more readily.

In an attempt to describe capacity during the worst transit crowding conditions, a 15-minute peak estimate was also calculated. This number was calculated using a conservative peak hour

---

[12] http://www.bart.gov/about/history/cars.aspx

[13] http://www.bart.gov/news/articles/2008/news20080924a.aspx

[14] It is important to note that while the total boardings taken from the model outputs (as reported in DEIR Table 3.1-8) match the boardings reported in Table 3, the daily percent utilization rates from the DEIR do not reflect the model's output passenger-mile values (as reported in DEIR Table 3.1-13). This may reflect an unspecified weighting of travel times and peak hours. This weighting factor should not affect the results presented in Table 3 because our calculations do not use the DEIR percent utilization rates.

factor of 0.8[15] and results in a significantly higher utilization rate than for the four hour AM peak period. Overall, we estimate a high risk that four lines will be operating at or near peak capacity for portions of the AM peak period (Richmond – Millbrae, Bay Point – SFO, Dublin/Pleasanton – Civic Center, and Santa Clara – Daly City) in the Proposed Plan Alternative in 2040.

The results of a similar capacity analysis for the EEJ Alternative are summarized in Table 4. Since the EEJ Alternative allocates an additional $3.2 billion in BART operating funding, peak period headways are reduced on some routes.[16] Accordingly, the risk of meeting or exceeding capacity is reduced relative to the Proposed Plan Alternative. No routes operate at 80% of capacity over the entire AM peak, while three operate above 80% of capacity during the peak 15 minute period.

9. ABSOLUTE PERFORMANCE MEASURES ANALYSIS

In order to better interpret the DEIR performance indicators, we used several data sources to convert their reported percentage changes into absolute values. The sources included the Plan itself, the DEIR, the Equity Analysis Report, the Summaries of Predicted Land Use/ Traveler Responses, and the Performance Assessment Report. In the case of region-wide coarse particulate emissions, a BAAQMD document [7] was used to help establish the baseline emissions; for all other metrics the *Plan Bay Area* documentation was enough to estimate absolute metric values. Two tables summarizing the absolute performance of the EEJ alternative relative to the Proposed Plan Alternative are included in Appendix B.

These tables summarize the performance of the EEJ Alternative relative to the Proposed Plan Alternative, demonstrating the EEJ Alternative's superiority on a number of important metrics. Specifically, the EEJ Alternative performs best on combined housing and transportation cost, a critical equity indicator. It also shows the largest increase in non-auto mode share. This indicator is very important in a long-term analysis. The benefits of increasing non-auto mode share will compound over time, as land uses will follow ridership, creating a virtuous cycle.

Resolving key differences in model inputs between the EEJ and Proposed Plan Alternatives would also have been likely to further improve EEJ's performance. The Proposed Plan Alternative allocated 100% of new households into designated infill zones (PDAs and transit

---

[15] A peak hour factor (PHF) accounts for fluctuations in ridership during the peak period. A PHF of 0.8 assumes that the peak hour ridership will only be 80% of the peak 15-minute ridership multiplied by four (rather than 100%). Our calculations conservatively assumed that all morning hours would have equal ridership, and then calculated the peak 15-minute period from the averaged hour-long period. The PHF of 0.8 was taken from the *Transit Capacity and Quality of Service Manual* [ref. 6, Exhibit 5-8] and represents a conservative value among those presented in that publication.

[16] Contradictory statements taken from the DEIR seem to indicate that BART capacity was not increased. E.g., "[The EEJ] alternative seeks to strengthen public transit by significantly boosting service frequencies in most suburban and urban areas, other than on Muni, BART or Caltrain" (DEIR, p. 3.1-8). Despite this statement, capacity increases on BART appear to have been modeled for the EEJ Alternative. Route-specific increases for local bus were provided by MTC staff (Transit Frequency Increases Table).

priority project zones) while the EEJ Alternative only allocated 93% (Draft Predicted Land Use Responses Report, Table 7, p. 33). The percentage of new households placed into the infill zones is a strong predictor of lower VMT per capita. If the EEJ scenario had been modeled as the Proposed Plan Alternative had (with all housing units assigned to the infill zones), performance results would have improved on most measures. Another difference in the modeling of alternative scenarios was the treatment of California Environmental Quality Act (CEQA) streamlining. In the modeling of the Proposed Plan Alternative, developers received cost savings related to CEQA streamlining if they constructed high density housing in designated infill zones. This was not the case in the EEJ Alternative (DEIR, p. 3.1-7 – 3.1-8). If the EEJ Alternative would have included CEQA streamlining its performance results would have improved on travel-related metrics.

10. TRANSPORTATION PROJECTS AND SEA LEVEL RISE

Transportation projects within the Mid-Century Sea Level Rise Zone and the Mid-Century Low-Lying Zone which were included in the Proposed Plan Alternative but not in the EEJ Alternative were aggregated based on the information in DEIR Tables 3.1-30, 3.1-31. Information in the DEIR, Appendix C was used to assign a cost estimate to each of these projects and create a sum total cost for the projects with future flood risk. These projects are shown in Table 5.

Table 3. Proposed Plan Alternative AM BART/Heavy Rail Ridership, 2040. Dark blue shading indicates AM peak route utilization over 80%, while light blue indicates those routes which do not near capacity over the entire morning period but have a peak 15-minute utilization over 80%.

Line	Sum of Passenger Miles	Headway (Min.)	Line Distance (Miles)	Vehicle Revenue Miles	Calculated Max Occupancy	Line % Utilization[1]	Est. Peak 15-Min % Utilization[2]	Sum of Boardings	Avg Boardings /Train
Millbrae – Richmond	201,749	15	38	608	364,800	55%	69%	16,826	1,052
Richmond – Millbrae	313,531	15	38	608	364,800	86%	107%	22,602	1,413
Richmond - Santa Clara	343,148	12	58	1,150	690,000	50%	78%	18,685	934
Santa Clara – Richmond	259,337	12	58	1,150	690,000	38%	59%	17,679	884
SFO - Bay Point	195,949	15	53	851	510,720	38%	48%	15,749	984
Bay Point – SFO	528,005	15	53	851	510,720	103%	129%	27,345	1,709
Pleasant Hill - Civic Center	144,872	15	26	413	247,680	58%	73%	10,783	674
Civic Center - Pleasant Hill	31,959	15	26	413	247,680	13%	16%	2,932	183
Civic Center - Dublin/Pleasanton	53,843	15	32	518	311,040	17%	22%	3,820	239
Dublin/Pleasanton - Civic Center	245,098	15	32	518	311,040	79%	98%	14,373	898
Daly City - Santa Clara	209,476	12	60	1,204	722,400	29%	45%	15,330	767
Santa Clara - Daly City	582,621	12	60	1,204	722,400	81%	126%	28,449	1,422
Oakland Airport Connector (Outbound)	396	4	3	192	115,200	0%	2%	124	2
Oakland Airport Connector (Return)	19	4	3	192	115,200	0%	0%	6	0
Grand Total	3,110,003	N/A	N/A	9,873	5,923,680	53%	75%	194,703	N/A

Maximum number of Seats Available Per Line[3]	600

[1]Note that the DEIR defines capacity exceedance as "as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators" (DEIR, Table ES-2).
[2]A conservative peak hour factor of 0.8 was used to calculate peak 15-minute ridership. See the discussion in text for additional details.
[3]With standing room, approximately 200 people can fit per car, for a maximum train ridership of 2,000 at any given time.

Table 4. EEJ Alternative AM BART/Heavy Rail Ridership, 2040. Light blue shading indicates those routes which do not near capacity over the entire morning period but have a peak 15-minute utilization over 80%.

Line	Sum of Passenger Miles	Headway (Min.)	Line Distance (Miles)	Vehicle Revenue Miles	Calculated Max Occupancy	Line % Utilization[1]	Est. Peak 15-Min % Utilization[2]	Sum of Boardings	Avg. Boardings /Train
Millbrae – Richmond	253,300	12	38	760	456,000	56%	69%	19,913	996
Richmond - Millbrae	254,072	12	38	760	456,000	56%	70%	18,929	946
Richmond - Santa Clara	414,112	12	58	1,150	690,000	60%	75%	21,906	1,095
Santa Clara – Richmond	215,613	12	58	1,150	690,000	31%	39%	15,382	769
SFO - Bay Point	244,931	12	53	1,064	638,400	38%	48%	18,564	928
Bay Point – SFO	433,879	12	53	1,064	638,400	68%	85%	23,965	1,198
Pleasant Hill - Daly City	129,001	15	32	518	311,040	41%	52%	9,546	597
Daly City - Pleasant Hill	65,607	15	32	518	311,040	21%	26%	6,437	402
24th St - Santa Clara	161,119	12	56	1,112	667,200	24%	30%	11,164	558
Santa Clara - 24th St	513,426	12	56	1,112	667,200	77%	96%	23,981	1,199
Daly City - South Hayward	19,667	30	32	254	152,640	13%	16%	2,153	269
South Hayward - Daly City	68,111	30	32	254	152,640	45%	56%	4,783	598
Daly City - Dublin/Pleasanton	78,507	12	39	780	468,000	17%	21%	7,094	355
Dublin/Pleasanton – Daly City	344,069	12	39	780	468,000	74%	92%	19,080	954
Oakland Airport Connector (Outbound)	178	4	3	192	115,200	0%	0%	56	1
Oakland Airport Connector (Return)	0	4	3	192	115,200	0%	0%	0	0
Grand Total	3,195,592	N/A	N/A	11,662	6,996,960	46%	67%	202,953	N/A

Maximum number of Seats Available Per Line[3]	600

[1]Note that the DEIR defines capacity exceedance as "as passenger seat-mile demand for any transit technology being greater than 80 percent of passenger seat-miles supplied by transit operators" (DEIR, Table ES-2).
[2]A conservative peak hour factor of 0.8 was used to calculate peak 15-minute ridership. See the discussion in text for additional details.
[3]With standing room, approximately 200 people can fit per car, for a maximum train ridership of 2,000 at any given time.

Table 5. Transportation projects subject to risks from sea level rise in the Proposed Plan Alternative but not in the EEJ Alternative. Source: DEIR, Table 3.1-30 and Appendix C.

Project ID	County	Description	Total Cost (Millions)
230668	Bay Area Region / Multi-County	Convert I-880 HOV lanes to express lanes between Hengenberger Road and Route 237 southbound, and Hacienda Drive to 237 northbound	$58
230685	Bay Area Region / Multi-County	Express Lanes on I-680: Widen I-680 northbound for express lane from Rudgear to North Main; Convert HOV lanes to express lanes between Benicia Bridge and Alcosta Boulevard in each direction	$24
230686	Bay Area Region / Multi-County	Widen I-680 in each direction for express lanes between Martinez Bridge to I-80	$335
240587	Bay Area Region / Multi-County	Widen I-680 northbound for express lanes from Marina Vista Avenue to North Main Street	$93
240581	Bay Area Region / Multi-County	Widen I-80 in each direction for express lanes from Air Base Parkway to I-505	$139
240691	Marin	Marin Sonoma Narrows HOV Lane and corridor improvements	$119
21325	Marin	Improve U.S. 101 Greenbrae/Twin Cities Corridor (includes modifying access ramps, new bus stops, improving transit stops and facilities, and adding pedestrian/bicycle facilities)	$155
21613	San Mateo	Widen Route 92 between San Mateo-Hayward Bridge to I-280, includes uphill passing lane from U.S. 101 to I-280	$35
240060	San Mateo	Modify existing lanes on U.S. 101 from Whipple to County line to accommodate HOV/T lane	$117
240436	Santa Clara	Improve southbound U.S. 101 between San Antonio Road to Carleston Road/Rengstorff Avenue	$51
240441	Santa Clara	Improve interchange at U.S. 101/ Oregon Expressway/ Embarcadero Road	$128
Total for Sea Level Rise Zone (11 Projects)			$1,254

11. REFERENCES

1. Waddell, P., A. Borning, M. Noth, N. Freier, M. Becke, and G. Ulfarsson, *Microsimulation of Urban Development and Location Choices: Design and Implementation of UrbanSim.* Networks and Spatial Economics, 2003. **3**(1): 43-67.
2. CTC, *2010 California Regional Transportation Plan Guidelines*. 2010, California Transportation Commission: Sacramento, CA.
3. Joshi, H., S. Guhathakurta, G. Konjevod, J. Crittenden, and K. Li, *Simulating the Effect of Light Rail on Urban Growth in Phoenix: An Application of the UrbanSim Modeling Environment.* Journal of Urban Technology, 2006. **13**(2): 91-111.
4. Karner, A. and D. Niemeier, *A Review of Civil Rights Guidance and Equity Analysis Methods for Regional Transportation Plans,* 92nd Annual Meeting of the Transportation Research Board. 2013: Washington, DC.
5. Garrett, M. and B.D. Taylor, *Reconsidering Social Equity in Public Transit.* Berkeley Planning Journal, 1999. **13**: 6-27.
6. Kittelson & Associates Inc., KFH Group Inc., Parsons Brinckerhoff Quade & Douglas Inc., and K. Hunter-Zaworski, *Transit Capacity and Quality of Service Manual, Second Edition*. 2003, Transit Cooperative Research Program, Transportation Research Board.
7. BAAQMD, *Bay Area Air Quality Management District Base Year 2005 Emission Inventory Summary Report*. 2008.

Appendix A

FUNDING ADJUSTMENTS FOR EEJ ALTERNATIVE *compared to Preferred Transportation Investment Strategy*	Equity Advocates' Initial Estimate *July 23, 2012*	MTC DRAFT Alt. #5 *August 30, 2012*
NEW REVENUES + COST SAVINGS FROM SPENDING CUTS		
VMT Tax	**$5.3 billion**	**$7.9 billion**
Increased Bay Bridge Tolls	**$1.0 billion**	**$1.1 billion**
Canceled Road Projects (uncommitted funds)*	**$7.1 billion**	**$5.4 billion**
Canceled Express Lane Network*	**$0.9 billion**	**$0.6 billion**
TOTAL	**$14.3 billion**	**$15.0 billion**
FUNDING INCREASES		
BART Metro	**$3.0 billion**	**$3.2 billion**
Bus Frequency Improvements (capital + operating)	**$6.3 billion**	**$6.7 billion**
AC Transit	$2.3 billion	$2.2 billion
VTA	$2.3 billion	$2.2 billion
SamTrans	$1.3 billion	$1.3 billion
Marin Transit	$0.1 billion	$0.2 billion
Golden Gate Transit	$0.1 billion	$0.2 billion
LAVTA	$0.1 billion	$0.2 billion
County Connection	$0.1 billion	$0.2 billion
Santa Rosa CityBus	$0.1 billion	$0.1 billion
Sonoma County Transit	--	$0.1 billion
Regional Youth Bus Pass	**$1.0 billion**	**$1.8 billion**
LSR Maintenance (via OBAG)	**$4.1 billion**	**$3.4 billion**
TOTAL	**$14.3 billion**	**$15.0 billion**

* = in general, uncommitted funds had to be shifted through OBAG to make them flexible for spending on transit operations

Operator	Route	Service Type	Alternative 2 (Project) Peak Frequency	Alternative 5 (EEJ) Peak Frequency	Alternative 2 (Project) Midday Frequency	Alternative 5 (EEJ) Midday Frequency	Alternative 2 (Project) Evening Frequency	Alternative 5 (EEJ) Evening Frequency
AC Transit	72R	Rapid	11	8	11	8	n/a	n/a
AC Transit	40	Urban Trunk	18	10	18	15	18	18
AC Transit	57	Urban Trunk	13	8	13	10	18	12
AC Transit	51A	Urban Trunk	9	5	10	7	18	9
AC Transit	51B	Urban Trunk	9	5	10	7	18	9
AC Transit	11	Local	30	15	30	30	n/a	n/a
AC Transit	12	Local	20	15	30	30	30	30
AC Transit	14	Local	15	12	30	15	30	15
AC Transit	18	Local	13	10	13	10	22	15
AC Transit	20	Local	30	15	30	30	30	30
AC Transit	21	Local	30	15	30	30	30	30
AC Transit	22	Local	30	15	30	15	30	15
AC Transit	25	Local	40	30	40	30	240	240
AC Transit	31	Local	30	15	30	30	30	30
AC Transit	45	Local	20	15	30	15	30	15
AC Transit	46	Local	60	30	60	30	n/a	n/a
AC Transit	49	Local	30	15	30	15	240	240
AC Transit	52	Local	15	10	35	20	30	20
AC Transit	54	Local	12	10	15	12	40	20
AC Transit	62	Local	20	15	20	15	30	20
AC Transit	65	Local	30	20	30	20	90	90
AC Transit	67	Local	40	30	40	30	120	120
AC Transit	73	Local	15	10	15	12	22	15
AC Transit	74	Local	35	20	35	20	35	20
AC Transit	76	Local	30	15	30	20	n/a	n/a
AC Transit	85	Local	60	30	60	30	240	240
AC Transit	86	Local	30	30	30	30	240	60
AC Transit	97	Local	20	15	20	15	20	15
AC Transit	98	Local	20	15	30	15	30	15
AC Transit	99	Local	30	20	30	20	60	20
AC Transit	210	Local	30	20	30	20	30	20
AC Transit	O	Regional All-Day	15	7	60	20	60	20
AC Transit	FS	Regional Commute	60	20	n/a	n/a	n/a	n/a
AC Transit	J	Regional Commute	30	15	n/a	n/a	n/a	n/a
AC Transit	OX	Regional Commute	15	10	n/a	n/a	n/a	n/a
AC Transit	P	Regional Commute	30	15	n/a	n/a	n/a	n/a
AC Transit	SB	Regional Commute	40	15	n/a	n/a	n/a	n/a
AC Transit	U	Regional Commute	45	20	n/a	n/a	n/a	n/a
AC Transit	V	Regional Commute	20	10	n/a	n/a	n/a	n/a
AC Transit	W	Regional Commute	20	10	n/a	n/a	n/a	n/a
VTA	900	Urban Truck	13	8	13	10	13	13
VTA	901	Urban Truck	13	8	13	10	13	13
VTA	902	Urban Truck	13	8	13	10	13	13
VTA	25	Local Network	30	10	30	15	60	30
VTA	26	Local Network	30	15	30	20	60	60
VTA	40	Local Network	30	20	30	20	60	60
VTA	46	Local Network	30	20	60	30	n/a	n/a
VTA	51	Local Network	60	30	60	45	n/a	n/a
VTA	52	Local Network	30	15	30	20	n/a	n/a
VTA	53	Local Network	60	30	60	45	n/a	n/a
VTA	54	Local Network	30	15	30	30	240	240
VTA	55	Local Network	20	10	30	20	60	60
VTA	66	Local Network	15	10	20	10	60	60

Operator	Route	Service Type	Alternative 2 (Project) Peak Frequency	Alternative 5 (EEJ) Peak Frequency	Alternative 2 (Project) Midday Frequency	Alternative 5 (EEJ) Midday Frequency	Alternative 2 (Project) Evening Frequency	Alternative 5 (EEJ) Evening Frequency
VTA	70	Local Network	15	10	15	10	60	30
VTA	71	Local Network	15	10	30	20	60	60
VTA	72	Local Network	15	10	20	15	60	30
VTA	73	Local Network	15	10	20	15	60	60
VTA	201	First/Last Mile	10	7.5	15	10	n/a	n/a
SamTrans	KX	Regional All-Day	60	10	60	15	60	30
SamTrans	292	Urban Truck	27	7	27	10	54	30
SamTrans	110	Local Network	60	15	60	30	60	60
SamTrans	120	Local Network	10	7	20	10	30	20
SamTrans	121	Local Network	30	15	30	20	60	60
SamTrans	122	Local Network	20	10	30	15	30	30
SamTrans	130	Local Network	20	10	30	20	60	60
SamTrans	250	Local Network	30	15	30	20	60	60
SamTrans	260	Local Network	30	15	60	30	n/a	n/a
SamTrans	296	Local Network	30	10	30	10	60	30
Marin Transit	36	First/Last Mile	25	20	240	240	n/a	n/a
Marin Transit	17	Community Bus	30	20	60	60	120	120
Marin Transit	22	Community Bus	30	20	60	30	90	90
Marin Transit	23	Community Bus	60	30	60	60	60	60
Marin Transit	29	Community Bus	60	30	60	60	240	240
Marin Transit	35	Community Bus	20	7.5	30	15	30	30
Marin Transit	71	Community Bus	45	30	60	45	n/a	n/a
LAVTA	70	Regional Commute	45	30	n/a	60	n/a	n/a
LAVTA	10	Local Network	30	10	30	15	120	60
LAVTA	8	Community Bus	30	15	60	60	240	240
LAVTA	12	Community Bus	45	15	45	20	90	60
LAVTA	14	Community Bus	30	20	30	30	120	120
LAVTA	15	Community Bus	30	20	30	30	60	60
County Connection	6	Local Network	40	30	120	60	n/a	n/a
County Connection	1	Community Bus	60	30	60	60	n/a	n/a
County Connection	4	Community Bus	15	10	15	10	n/a	30
County Connection	10	Community Bus	30	15	30	30	60	30
County Connection	11	Community Bus	45	30	90	60	n/a	n/a
County Connection	14	Community Bus	40	15	40	30	40	40
County Connection	15	Community Bus	60	30	60	40	n/a	n/a
County Connection	17	Community Bus	45	30	75	75	n/a	n/a
County Connection	20	Community Bus	30	15	30	15	30	30
Golden Gate	70	Regional All-Day	45	15	60	60	60	60
Santa Rosa CB	1	Local Network	29	15	29	15	n/a	n/a
Santa Rosa CB	9	Local Network	29	15	29	15	228	228
Santa Rosa CB	10	Local Network	29	15	29	15	228	228
Santa Rosa CB	14	Local Network	29	15	29	15	228	228
Sonoma Cty. Tr.	44/48	Urban Trunk	43	30	43	30	114	114
Sonoma Cty. Tr.	20	Urban Trunk	76	45	114	60	n/a	n/a
Sonoma Cty. Tr.	30	Urban Trunk	114	60	114	114	n/a	n/a
Sonoma Cty. Tr.	62	Community Bus	95	45	95	45	n/a	n/a

[green] ***= indicates frequency improvement in comparison to Alternative 2 (Project/Preferred Transit Network)***

Routes with no frequency changes from the Preferred Transit Network are not shown; all frequencies are shown as minutes between successive arrivals of a bus at a given stop.

n/a indicates that a route is not in service during a given timeperiod.

Appendix B

Sustainable Systems Research, LLC

Summary comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios

Source	Category		Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040[a]	Units
Draft Plan pg 116. Table 4: Target Analysis: Plan Bay Area EIR Alternatives for Year 2040	Reduce per–capita CO2 emissions from cars and light–duty trucks		-1,900	*TOTAL Regional CO2 Emissions From Passenger Vehicles: Tons/Day*
	Reduce premature deaths from exposure to fine particulates (PM 2.5)		-2	Deaths/Year
	Reduce coarse particulate emissions (PM 10)		-2.1	Tons/Day
			-624	Tons/Year[b]
	Reduce the number of injuries and fatalities from all collisions		-760	People/Year
	Increase the average daily time walking or biking per person for transportation		0.3	Minutes/Person/Day
			251	*Regional aggregate hours active transportation per day*
	Decrease the share of low–income and lower–middle income residents' household income consumed by transportation and housing	HOUSING ONLY		
		< $38K ($)	-$70	Dollars/Month
			-$79,202,000	*Regional Aggregate dollars per month for low income households*
		< $38K (%)	-4%	% Income
		$38K to $76K ($)	-$1	Dollars/Month
			-$13,838,000	*Regional Aggregate dollars per month for lower-middle income households*
		$38K to $76K (%)	0%	% Income
		HOUSING + TRANSPORTATION		
		< $38K ($)	-$28	Dollars/Month
			-$41,747,000	*Regional Aggregate dollars per month for low income households*
		< $38K (%)	-1%	% Income
	Increase non–auto mode share		1%	Percent of Trips
			107,970	Daily Non-Auto Person-Trips
	Decrease automobile vehicle miles traveled (VMT) per capita		-3,460,000	*TOTAL Regional Vehicle Miles Travelled*
Draft Plan page 117. Table 5: Results of Plan Bay Area Equity Analysis for EIR Alternatives, 2010-2040	Potential for Displacement: Share of today's overburdened-renter households located in high-growth areas	Communities of Concern	-12,696	NUMBER of today's overburdened-renter households located in high-growth areas
		Remainder of Region	-3,117	
		Total	-15,812	
Draft EIR	Total Per Capita Energy Use (Direct and Indirect, Land Use and Transportation)		-1,476	BTU/ Person/ Day
			-67,915,818,000	*Regional Aggregate BTU per Day*
	Vehicles In Use		-83,536	Total Vehicles in Region
	TRANSIT			
	Transit Seat Miles		11,030,000	Seat-miles per day
	Daily Transit Boardings		165,000	Boardings/Day
	Transit Commute Trips[c]		65,184	Regional Trips/Day
	Transit Commute Travel Time[d]		-0.4	Minutes/Trip
			-507,003	*Regional Aggregate Minutes per day*
	Transit Non-Commute Trips[e]		-10,304	Regional Trips/Day
	Transit Non-Commute Travel Time		-0.2	Minutes/Trip
			-190,496	*Regional Aggregate Minutes per day*
	WALKING			
	Walking Commute Trips[c]		14,176	Regional Trips/Day
	Walking Commute Travel Time[d]		0.1	Minutes/Trip
			24,502	*Regional Aggregate Minutes per day*
	EMISSIONS			
	Transportation Emissions Estimates for Criteria Pollutants	ROG	-0.7	Tons/Day
			-210	Tons/Year[b]
		CO	-4.3	Tons/Day
			-1,290	Tons/Year[b]
		PM10	-0.7	Tons/Day
			-210	Tons/Year[b]
		PM2.5	-0.1	Tons/Day
			-30	Tons/Year[b]
		NOx (Summertime)	-0.9	Tons/Day
		NOx (Wintertime)	-0.9	Tons/Day
		NOx Avg. Annual	-270	Tons/Year[b]
		Total	-7	Tons/Day
			-2,010	Tons/Year
	Transportation Emissions Estimates for Toxic Air Contaminants	Diesel PM	-15.6	Kilograms/Day
		1,3 Butadiene	-0.8	Kilograms/Day
		Benzene	-3.1	Kilograms/Day
		Total	-19.5	Kilograms/Day
			-6.4	Tons/Year[b]
	Total Regional GHG Emissions		-568,000	Metric Tons CO2e / Year
	FLOODING RISK			
	Number of Proposed Transportation Projects Within the Mid-Century Sea Level Rise Inundation Zone		-11	Number of Projects
			$ -1.25 Billion	*Estimated Value of (11) Fewer Projects*
	Number of Proposed Transportation Projects Within the Mid-Century Low-Lying Zone		-6	Number of Projects
			$ -1.28 Billion	*Estimated Value of (6) Fewer Projects*
	Residents within the Mid-Century Sea Rise Inundation Zone		-12,220	People
	Residents within the Mid-Century Low-Lying Zone		-17,900	People
	Employment within the Mid-Century Sea Rise Inundation Zone		-13,360	Jobs
	Employment within the Mid-Century Low-Lying Zone		-15,660	Jobs

[a]Negative values indicate that a given metric is *lower* in the EEJ scenario than the Proposed Plan.
[b]All conversion of emissions from "per day" to "per year" assume a multiplier of 300 to maintain consistency with the Draft EIR, as specified in DEIR Table 2.5-5.
[c]Number of commute trips was calculated as twice the number of commute tours by mode (either all transit modes or walk).
[d]Changes in regional aggregate minutes per day were calculated using the EEJ scenario's number of trips/day, but scenario-specific values of travel time.
[e]Number of non-commute trips was calculated as the number of trips whose purpose was not work.

Date: 4/29/2013

Detailed comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios

Category			Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040[a]	Units	2005 Value	2040											Source
						No Project (Alt. 1)			Proposed Plan (Alt. 2)			EEJ (Alt. 5)					
						Value	Change From 2005	% Change from 2005	Value	Change From 2005	% Change from 2005	Value	Change From 2005	% Change from 2005	Change from Alt. 2	% Difference from Alt. 2	
Draft Plan pg 116. Table 4: Target Analysis: Plan Bay Area EIR Alternatives for Year 2040	Reduce per–capita CO2 emissions from cars and light–duty trucks		-1,900	*TOTAL Regional CO2 Emissions From Passenger Vehicles: Tons/Day*					77,100			75,200			-1,900	-2%	DEIR Table 3.1-28
	Reduce premature deaths from exposure to fine particulates (PM 2.5)		-2	Deaths/Year	224	65	-159	-71%	65	-159	-71%	63	-161	-72%	-2	-3%	Draft Plan pg. 99 & Table 4
	Reduce coarse particulate emissions (PM 10)		-2.1	Tons/Day	208	174.72	-33.28	-16%	172.6	-35.4	-17%	170.56	-37.44	-18%	-2.1	-1%	BAAQMD 2005 Emission Inventory Table 3
			-624	Tons/Year[b]													
	Reduce the number of injuries and fatalities from all collisions		-760	People/Year	39,000	46,020	7,020	18%	46,000	7,000	18%	45,240	6,240	16%	-760	-2%	Draft Plan pg. 99 & Table 4
	Increase the average daily time walking or biking per person for transportation		0.3	Minutes/Person/Day	8.8	9.9	1.1	12%	10.3	1.5	17%	10.6	1.8	20%	0.3	3%	Draft Plan pg. 100 & Table 4
			251	*Regional aggregate hours active transportation per day*					94,326,088			94,341,176			15,088	0%	Population: DEIR Table 3.1-12
	Decrease the share of low–income and lower–middle income residents' household income consumed by transportation and housing	HOUSING			Base Year 2005-2009 / 2010												Appendices to Draft Equity Analysis Report Tables D-1 and D-2. Total number of low-income households for 2040 derived from Draft Summary of Predicted Land Use Responses pg. 16 and Appendix Table 4. Note that money saved due to there being fewer households in Alt. 4 was not included.
		< $38K ($)	-$70	Dollars / Month	$818	$871	$53	6%	$810	-$8	-1%	$740	-$78	-10%	-$70	-9%	
		< $38K ($)	-$79,202,000	*Regional Aggregate dollars per month for low income households for EEJ Population*					828,881,100			749,679,200			-79,201,900	-10%	
		< $38K (%)	-4%	% Income	46%	49%	3%	N/A	46%	0%	N/A	42%	-4%	N/A	-4%	N/A	
		$38K to $76K ($)	-$1	Dollars / Month	$1,814	$1,951	$137	8%	$1,807	-$7	0%	$1,806	-$8	0%	-$1	0%	
		$38K to $76K ($)	-$13,838,000	*Regional Aggregate dollars per month for low income households for EEJ Population*					1,312,279,540			1,298,441,760			-13,837,780	-1%	
		$38K to $76K (%)	0%	% Income	37%	40%	3%	N/A	37%	0%	N/A	37%	0%	N/A	0%	N/A	
		TRANSPORTATION			Base Year 2005-2009 / 2010												
		< $38K ($)	$42	Dollars / Month	$470	$555	$85	18%	$498	$28	6%	$540	$70	15%	$42	8%	
		< $38K ($)	$37,455,000	*Regional Aggregate dollars per month for low income households*					509,608,380			547,063,200			37,454,820	7%	
		< $38K (%)	3%	% Income	26%	31%	5%	N/A	28%	2%	N/A	31%	5%	N/A	3%	N/A	
		$38K to $76K ($)	$32	Dollars / Month	$844	$952	$108	13%	$900	$56	7%	$932	$88	10%	$32	4%	
		$38K to $76K ($)	$16,473,000	*Regional Aggregate dollars per month for lower-middle income households*					653,598,000			670,070,720			16,472,720	3%	
		$38K to $76K (%)	1%	% Income	17%	20%	3%	N/A	18%	1%	N/A	19%	2%	N/A	1%	N/A	
		H+T			Base Year 2005-2009 / 2010												
		< $38K ($)	-$28	Dollars / Month	$1,288	$1,426	$138	11%	$1,308	$20	2%	$1,280	-$8	-1%	-$28	-2%	
		< $38K ($)	-$41,747,000	*Regional Aggregate dollars per month for low income households*					1,338,489,480			1,296,742,400			-41,747,080	-3%	
		< $38K (%)	-1%	% Income	72%	80%	8%	N/A	74%	2%	N/A	73%	1%	N/A	-1%	N/A	
		$38K to $76K ($)	$31	Dollars / Month	$2,658	$2,903	$245	9%	$2,707	$49	2%	$2,738	$80	3%	$31	1%	
		$38K to $76K ($)	$2,635,000	*Regional Aggregate dollars per month for lower-middle income households*					1,965,877,540			1,968,512,480			2,634,940	0%	
		$38K to $76K (%)	1%	% Income	54%	60%	6%	N/A	55%	1%	N/A	56%	2%	N/A	1%	N/A	
	Increase non–auto mode share		1%	Percent of Trips	16.0%	19%	3%	N/A	20%	4%	N/A	21%	5%	N/A	1%	N/A	DEIR Tables 3.1-8 and 2.1-13
			107,970	Daily Non-Auto Person-Trips	N/A	5,392,770	N/A	N/A	5,973,000	N/A	N/A	6,080,970	N/A	N/A	107,970	1.8%	
	Decrease automobile vehicle miles traveled (VMT) per capita		-3,460,000	*TOTAL Regional Vehicle Miles Travelled*					179,408,000			175,948,000			-3,460,000	-2%	DEIR TABLE 3.1-12

[a]Negative values indicate that a given metric is *lower* in the EEJ scenario than the Proposed Plan.

[b]All conversion of emissions from "per day" to "per year" assume a multiplier of 300 to maintain consistency with the Draft EIR, as specified in DEIR Table 2.5-5.

Date: 4/29/2013

Detailed comparison of Plan Bay Area performance metrics for EEJ and Proposed Plan scenarios (cont'd)

Category			Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040[a]	Units	2040								Source
					No Project (Alt. 1)		Proposed Plan (Alt. 2)		EEJ (Alt. 5)				
					Number HHs	% of Today's overburdened Renter HHs	Number HHs	% of Today's overburdened Renter HHs	Number HHs	% of Today's overburdened Renter HHs	Change from Alt. 2	% Difference from Alt. 2	
Draft Plan page 117. Table 5: Results of Plan Bay Area Equity Analysis for EIR Alternatives, 2010-2040	Potential for Displacement: Share of today's overburdened-renter households located in high-growth areas	Communities of Concern	-12,696	NUMBER of today's overburdened-renter households located in high-growth area	17,774	21%	30,469	36%	17,774	21%	-12,696	-42%	Appendices to Draft Equity Analysis Report Table D-4
		Remainder of Region	-3,117		7,791	5%	12,466	8%	9,350	6%	-3,117	-25%	
		Total	-15,812		25,565	11%	42,935	18%	27,123	11%	-15,812	-37%	

Category			Difference Between EEJ (Alt. 5) and Proposed Plan (Alt. 2) in 2040[a]	Units	2010	2040											Source
						No Project (Alt. 1)			Proposed Plan (Alt. 2)			EEJ (Alt. 5)					
					Value	Value	Change From 2010	% Change from 2010	Value	Change From 2010	% Change from 2010	Value	Change From 2010	% Change from 2010	Change from Proposed Plan	% Difference from Alt. 2	
Draft EIR	Total Per Capita Energy Use (Direct and Indirect, Land Use and Transportation)		-1,476	BTU/ person/ day	268,716	240,163	-28,553	-10.6%	241,254	-27,462	-10.2%	239,778	-28,938	-10.8%	-1,476	-0.6%	DEIR Table 3.1-27
			-67,915,818,000	*Regional Aggregate BTU per day*					2,204,337,798,000			2,136,421,980,000			-67,915,818,000		Population: DEIR Table 3.1-12
	Vehicles In Use		-83,536	Total Vehicles in Region	4,608,722	5,493,962	885,240	19%	5,463,760	855,038	19%	5,380,224	771,502	17%	-83,536	-2%	DEIR Table 3.1-14
	TRANSIT																
	Transit Seat Miles		11,030,000	Seat-miles per day	113,361,000	129,359,000	15,998,000	14%	144,344,000	30,983,000	27%	155,374,000	42,013,000	37%	11,030,000	8%	DEIR Table 3.1-7
	Daily Transit Boardings		165,000	Boardings/Day	1,581,000	2,426,000	845,000	53%	3,054,000	1,473,000	93%	3,219,000	1,638,000	104%	165,000	5%	DEIR Table 3.1-8
	Transit Commute Trips[b]		65,184	Regional Trips/Day	694,262				1,202,324			1,267,508	573,246	83%	65,184	5%	MTC Travel Model One
	Transit Commute Travel Time[c]		-0.4	Minutes/Trip	44	46.3	2.3	5%	44.3	0.3	1%	43.9	-0.1	0%	-0.4	-1%	DEIR Table 3.1-9
			-507,003	*Regional Aggregate Minutes per day*	55,770,352				56,150,604			55,643,601	-126,751	0%	-507,003	-1%	MTC Travel Model One
	Transit Non-Commute Trips[d]		-10,304	Regional Trips/Day	505,870				962,784			952,480	446,610	88%	-10,304	-1%	
	Transit Non-Commute Travel Time[c]		-0.2	Minutes/Trip	36.2	36.3	0.1	0%	35.5	-0.7	-2%	35.3	-0.9	-2%	-0.2	-1%	DEIR Table 3.1-10
			-190,496	*Regional Aggregate Minutes per day*	34,479,776				33,813,040			33,622,544	-857,232	-2%	-190,496	-1%	MTC Travel Model One
	WALKING																
	Walking Commute Trips[b]		14,176	Regional Trips/Day	140,756				230,840			245,016			14,176	6%	MTC Travel Model One
	Walking Commute Travel Time[c]		0.1	Minutes/Trip	19.5	19.5	0	0%	19.3	-0.2	-1%	19.4	-0.1	-1%	0.1	1%	DEIR Table 3.1-9
			24,502	*Regional Aggregate Minutes per day*	4,777,812				4,728,809			4,753,310			24,502	1%	MTC Travel Model One
	EMISSIONS																
	Emissions Estimates for Criteria Pollutants	ROG	-0.7	Tons/Day	93.7	36.5	-57.2	-61%	36.5	-57.2	-61%	35.8	-57.9	-62%	-0.7	-2%	DEIR Table 3.1-15
		CO	-4.3	Tons/Day	879.9	268.5	-611.4	-69%	266.5	-613.4	-70%	262.2	-617.7	-70%	-4.3	-2%	DEIR Table 3.1-15
		PM10	-0.7	Tons/Day	36.4	41.3	4.9	13%	41	4.6	13%	40.3	3.9	11%	-0.7	-2%	DEIR Table 3.1-15
		PM2.5	-0.1	Tons/Day	10.4	10	-0.4	-4%	9.9	-0.5	-5%	9.8	-0.6	-6%	-0.1	-1%	DEIR Table 3.1-15
		NOx (Summertime)	-0.9	Tons/Day	164.3	48.7	-115.6	-70%	48.5	-115.8	-70%	47.6	-116.7	-71%	-0.9	-2%	DEIR Table 3.1-15
		NOx (Wintertime)	-0.9	Tons/Day	185.3	53.9	-131.4	-71%	53.7	-131.6	-71%	52.8	-132.5	-72%	-0.9	-2%	DEIR Table 3.1-15
	Emissions Estimates for Toxic Air Contaminants	Diesel PM	-15.6	Kilograms/Day	2,599.60	758.1	-1841.5	-71%	755.9	-1843.7	-71%	740.3	-1859.3	-72%	-15.6	-2%	DEIR Table 3.1-16
		1,3 Butadiene	-0.8	Kilograms/Day	162.4	49.1	-113.3	-70%	48.2	-114.2	-70%	47.4	-115	-71%	-0.8	-2%	DEIR Table 3.1-16
		Benzene	-3.1	Kilograms/Day	731.2	224.2	-507	-69%	219.3	-511.9	-70%	216.2	-515	-70%	-3.1	-1%	DEIR Table 3.1-16
	Total Regional GHG Emissions		-568,000	Metric Tons CO2e per Year	48,846,000	42,895,000	-5951000	-12%	41,344,000	-7502000	-15%	40776000	-8070000	-17%	-568000	-1%	DEIR Table 3.1-29
	FLOODING RISK																
	Number of Proposed Transportation Projects Within the Mid-Century Sea Level Rise Inundation Zone		-11	Number of Projects	N/A	15	N/A	N/A	32	N/A	N/A	21	N/A	N/A	-11	-34%	DEIR pg 3.1-64
			$ 1.25 Billion	*Estimated Value of (11) Fewer Projects*					$1,254	million dollars		0			-$1,254		DEIR Appendix C
	Number of Proposed Transportation Projects Within the Mid-Century Low-Lying Zone		-6	Number of Projects	N/A	10	N/A	N/A	21	N/A	N/A	15	N/A	N/A	-6	-29%	DEIR Table 3.1-31
			$ 1.28 Billion	*Estimated Value of (6) Fewer Projects*					$1,284	million dollars		0			-$1,284		DEIR Appendix C
	Rise Inundation Zone		-12,220	People	78,340	95,720	17380	22%	104,090	25750	33%	91,870	13530	17%	-12220	-12%	DEIR Table 3.1-34
	Lying Zone		-17,900	People	31,940	47,870	15930	50%	58,630	26690	84%	40,730	8790	28%	-17900	-31%	DEIR Table 3.1-37
	Rise Inundation Zone		-13,360	Jobs	80,920	104,820	23900	30%	108,790	27870	34%	95,430	14510	18%	-13360	-12%	DEIR Table 3.1-40
	Lying Zone		-15,660	Jobs	32,060	42,180	10120	32%	48,400	16340	51%	32,740	680	2%	-15660	-32%	DEIR Table 3.1-43

[a]Negative values indicate that a given metric is *lower* in the EEJ scenario than the Proposed Plan.

[b]Number of commute trips was calculated as twice the number of commute tours by mode (either all transit or walk).

[c]Changes in regional aggregate minutes per day were calculated using the EEJ scenario's number of trips/day, but scenario-specific values of travel time.

[d]Number of non-commute trips was calculated as the number of trips whose purpose was not work.

Date: 4/29/2013