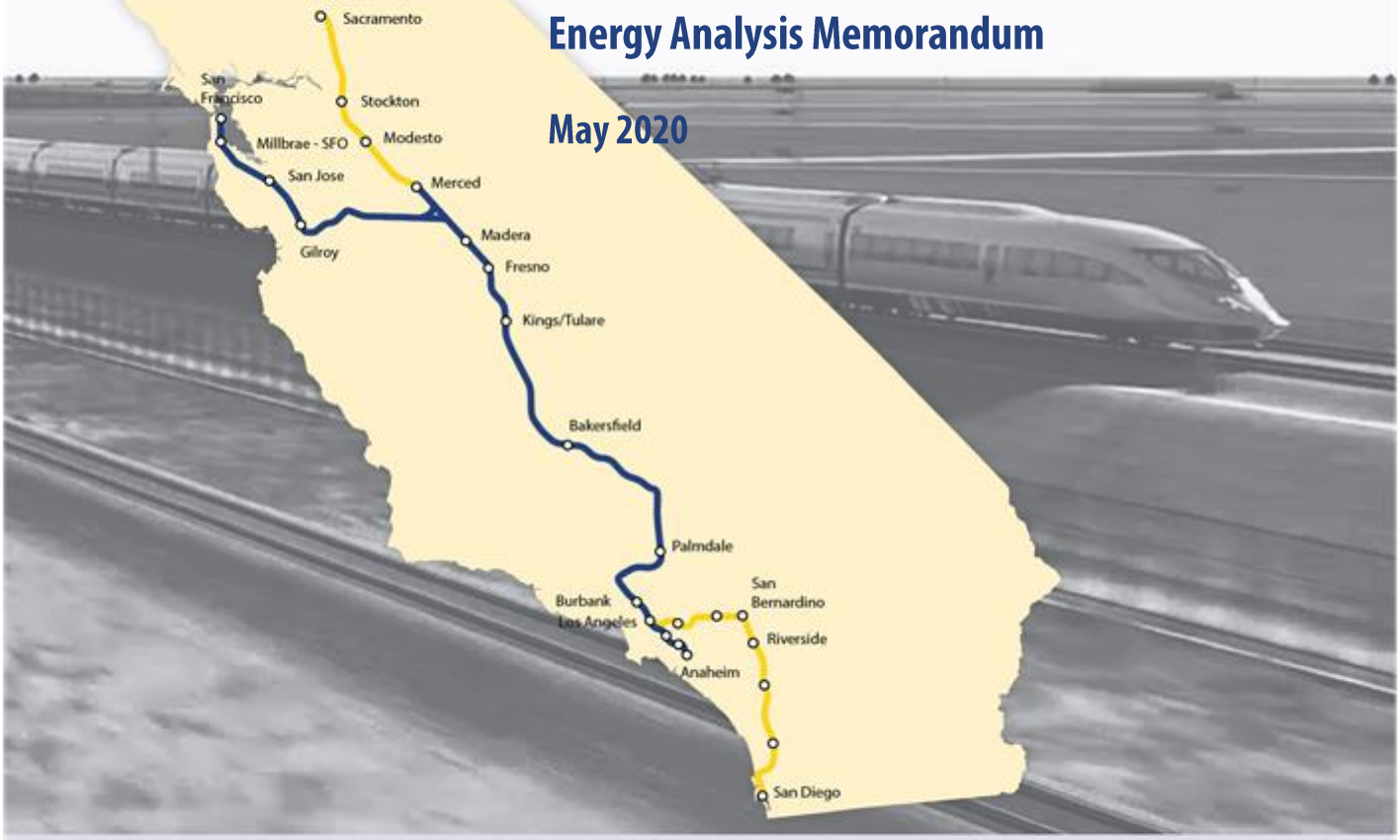
California High-Speed Rail Authority

Burbank to Los Angeles Project Section

Draft Project Environmental Impact Report/Environmental Impact Statement

Appendix 3.6-A: California High-Speed Rail Statewide Criteria Pollutant, GHG, and Energy Analysis Memorandum

May 2020



CALIFORNIA High-Speed Rail Authority

The environmental review, consultation, and other actions required by applicable Federal environmental laws for this project are being or have been carried out by the State of California pursuant to 23 U.S.C. 327 and a Memorandum of Understanding dated July 23, 2019, and executed by the Federal Railroad Administration and the State of California.

This page intentionally left blank

Memorandum

DATE: Issued: November 16, 2016
Rev.#1: November 23, 2017
Rev.#2: March 27, 2017

TO: Authority and Regional Consultant Environmental Staff

FROM: Alice Lovegrove and Eddie Tadross, WSP Parsons Brinckerhoff

CC: Lisa Nungesser and Bryan Porter

SUBJECT: California High-Speed Rail Statewide Criteria Pollutant, GHG and Energy Analysis

---

This revised version of the memo includes a discussion of statewide energy consumption for on-road vehicles, aircraft, and electrical energy that would change with future operation of the project. In addition, the statewide Excel spreadsheet summaries that accompany this memo have also been updated. Should you have any questions, please contact Alice Lovegrove at Lovegrove@pbworld.com or Eddie Tadross at Tadross@pbworld.com.

Overview

This memo describes the calculation of statewide criteria pollutant and greenhouse gas (GHG) emission levels associated with future operation of the California High-Speed Rail Project. This memo is meant to accompany Excel spreadsheet files with statewide summary emission data for the following high-speed rail (HSR) sections: San Francisco to San Jose, San Jose to Merced, Bakersfield to Palmdale, Palmdale to Burbank, Burbank to Los Angeles, and Los Angeles to Anaheim. An earlier analysis of emission levels for the Merced to Fresno and Fresno to Bakersfield HSR sections was completed several years ago.

The spreadsheets consist of multiple tables. The list below explains what is included as part of each spreadsheet file.

- MED - EX(2015) & EX+PROJ = Medium Alternative 2015 (Existing & Existing Plus Project)
- MED - 2029 NB&BD = Medium Alternative 2029 (No Build & Build)
- MED - 2040 NB&BD = Medium Alternative 2040 (No Build & Build)
- MED EXT - EX(2015) & EX+PROJ = Medium Extended Alternative 2015 (Existing & Existing Plus Project)
- MED EXT - 2029 NB&BD = Medium Extended Alternative 2029 (No Build & Build)
- MED EXT - 2040 NB&BD = Medium Extended Alternative 2040 (No Build & Build)
- HIGH - EX(2015) & EX+PROJ = High Alternative 2015 (Existing & Existing Plus Project)
- HIGH - 2029 NB&BD = High Alternative 2029 (No Build & Build)
- HIGH - 2040 NB&BD = High Alternative 2040 (No Build & Build)

Provided below is a description of the emission calculations. You can also use this text in preparing the air quality section for your HSR section environmental impact report/environmental impact statement (EIR/EIS).

Statewide and Regional Operational Emissions Calculations

The emission burden analysis of a project determines a project's overall impact on air quality levels. The project section would affect long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The HSR system would also affect electrical demand throughout the state. Analysts calculated criteria pollutant and GHG operational emissions for three ridership scenarios: a medium ridership scenario of the Silicon Valley to Central Valley line (from San Jose to North of Bakersfield), a medium ridership scenario of an extended Silicon Valley to Central Valley line (from San Francisco to Bakersfield), and a high ridership scenario of the Silicon Valley to Central Valley line for Existing (2015) and Phase 1 of Statewide High-Speed Rail Build Out (2040) years. All applicable scenarios are based on the level of ridership as presented in the Authority's *2016 Business Plan* (Authority 2016). The tables in the effects analysis therefore present three values for operational emissions for each pollutant, corresponding to these three scenarios.

On-Road Vehicles

Analysts evaluated on-road vehicle emissions using average daily VMT estimates and associated average daily speed estimates for each affected county. Analysts estimated emission factors using the emission factors using the California Air Resources Board (CARB) emission factor program, EMission FACtors 2014 (EMFAC2014), which accounts for existing regulations that would reduce emissions, such as the Pavley Clean Car Standards. Parameters were set in the program for each individual county to reflect conditions within each county and statewide parameters to reflect travel through each county. The analysis was conducted for the following modeling years:

- Existing (Year 2015)
- Opening Year (Year 2029)
- Horizon Year (Year 2040)

To determine overall pollutant burdens generated by on-road vehicles, analysts multiplied the estimated VMT by the applicable pollutant's emission factors, which are based on speed, vehicle mix, and analysis year.

Aircraft

Analysts used the Federal Aviation Administration's Aviation Environmental Design Tool (AEDT) to estimate aircraft emissions. This tool estimates the emissions generated from specified numbers of landing and take-off cycles. Along with emissions from the aircraft themselves, emissions generated from associated ground maintenance requirements are included. Analysts calculated average aircraft emissions based on the profile of aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the HSR using the results of the travel demand modeling analyses conducted for the project section, based on the ridership estimates presented in the California High-Speed Rail Authority's *2016 Business Plan* (Authority 2016).

Power Plants

Analysts conservatively estimated the electrical demands caused by propulsion of the trains and the trains at terminal stations and in storage depots and maintenance facilities as part of the project section design. Analysts derived average emission factors for each kilowatt-hour required from CARB statewide emission inventories of electrical and cogeneration facilities data along with USEPA eGRID2012 (released 10/2015) electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

The HSR system is currently analyzed as if it would be powered by the state's current electric grid. This is a conservative assumption because of the state requirement that an increasing fraction of electricity (50 percent by 2030) generated for the state's power portfolio come from renewable energy sources. As such, the emissions generated for the HSR system are expected to be lower in the future than the emissions estimated for this analysis. Furthermore, under the 2013 Policy Directive POLI-PLAN-03, the Authority has adopted a goal to purchase 100 percent of the HSR system's power from renewable energy sources.

Greenhouse Gas Analysis

As discussed in Section XX [of the EIR/EIS], Definition of Resource Study Area, the project section would reduce long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The project section would also affect electricity demand throughout the state. These elements would affect GHG emissions in both the statewide and regional study areas. The methodology for estimating GHG emissions associated with operations of the project section is discussed below.

On-road Vehicle Emissions

Analysts conducted the on-road vehicle GHG emission analysis using the same methods and RSAs as described for air quality emission calculations in Section X, On-Road Vehicles.

Aircraft Emissions

Analysts calculated aircraft emissions by using the fuel consumption factors and emission factors from the CARB's 2000–2014 *Greenhouse Gas Emissions Inventory Technical Support Document* and the accompanying technical support document. The emission factor includes both landing and take-off and cruise operations (formula: aircraft emissions per flight = fuel consumption × emission factor; aircraft emissions = flights removed × aircraft emissions per flight). Analysts calculated average aircraft GHG emissions based on the profile of intrastate aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the project section through the travel demand modeling analysis conducted for the project section, based on the ridership estimates presented in the Authority's *2016 Business Plan* (Authority 2016).

Power Plant Emissions

The electrical demands due to propulsion of the trains, stations, storage depots and maintenance facilities were calculated as part of the project design. Average GHG emission factors for each kilowatt-hour required were derived from USEPA eGRID2012 electrical generation data. The energy estimates used in this analysis for the propulsion of the HSR include the use of regenerative brake power.

In addition, because of the state requirement that an increasing fraction (50 percent by 2030) of electricity generated for the state's power portfolio come from renewable energy sources, the emissions generated for the HSR system are expected to be lower in the future when compared to emissions estimated for this analysis.

Energy Analysis

As discussed in Section XX [of the EIR/EIS], Definition of Resource Study Area, the project section would reduce long-distance, city-to-city travel along freeways and highways throughout the state, as well as long-distance, city-to-city aircraft takeoffs and landings. The project section would also affect electricity demand throughout the state. These elements would affect energy in both the statewide and regional study areas. The methodology for estimating energy associated with operation of the project section is discussed below.

On-road Vehicle Energy Usage

Analysts conducted the on-road vehicle energy analysis using the same inputs and RSAs as described for air quality emission calculations in Section X, Energy rates were determined through the use of carbon balance equations as recommended by CARB.

Aircraft Energy Usage

Analysts calculated aircraft energy use by using the fuel consumption factors from the CARB's 2000–2014 *Greenhouse Gas Emissions Inventory Technical Support Document* and the accompanying technical support document. The energy use includes both landing and take-off and cruise operations (formula: aircraft energy per flight = fuel consumption × btu/gallon of fuel; aircraft energy = flights removed × aircraft energy per flight). Analysts calculated average aircraft energy based on the profile of intrastate aircraft currently servicing the San Francisco to Los Angeles corridor. Analysts estimated the number of air trips removed attributable to the project section through the travel demand modeling analysis conducted for the project section, based on the ridership estimates presented in the Authority's *2016 Business Plan* (Authority 2016).

Energy Usage

The electrical demands due to propulsion of the trains, stations, storage depots and maintenance facilities were calculated as part of the project design. Analysts estimated the energy use based on the ridership estimates and train operating characteristics as presented in the Authority's *2016 Business Plan* (Authority 2016).