

GREENHOUSE GAS EMISSIONS /  
GLOBAL CLIMATE CHANGE

FOOTHILL TRANSPORTATION CORRIDOR - SOUTH

PREPARED FOR  
TRANSPORTATION CORRIDOR AGENCY

LSA

December 20, 2007

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## FOOTHILL TRANSPORTATION CORRIDOR – SOUTH GREENHOUSE GAS EMISSIONS/CARBON FOOTPRINT

### I. INTRODUCTION

The Coastal Commission staff report (page 22) requested an evaluation of the project's contribution to global warming and greenhouse gas (GHG) emissions, including calculation of and mitigation for both construction and operation emissions. Information regarding the project's contribution to global climate change (GCC) was included in the April submittal to the California Coastal Commission (CCC). As requested, additional information is included herein regarding the evaluation of GHG emissions from both project construction and operation for the life of the project and the measures that will be employed to further reduce GHG emissions. The operation of the proposed project improves travel speeds and reduces vehicle hours traveled (VHT) compared to future conditions without the implementation of the project. The reduced congestion and improved travel speeds yield a net decrease in carbon dioxide (CO<sub>2</sub>) emissions.

### II. REGULATORY SETTING

As described in the April 2007 CCC submittal, there have been several actions taken at the State level to address GHG emissions. These are summarized below.

- Executive Order (EO) S-3-05, signed by Governor Arnold Schwarzenegger on June 1, 2005, requires that the State of California reduce GHG emissions to 2000 levels by 2010, to 1990 levels by 2020, and to 80 percent below 1990 levels by 2050.
- The California Global Warming Solutions Act, Assembly Bill (AB) 32, was passed by the State legislature on August 31, 2006, and approved by the Governor on September 27, 2006. AB 32 requires the California Air Resources Board (ARB) to adopt regulations to require reporting and evaluation of statewide GHG emissions, and then to create a program and emission caps to limit statewide emissions to 1990 levels. This program is to be adopted by 2012 and implemented in a manner achieving emissions compliance by 2020.
- Senate Bill (SB) 97, which was approved by the California Governor on August 21, 2007, requires: (1) the Office of Planning and Research (OPR) to prepare and develop California Environmental Quality Act (CEQA) guidelines "for the mitigation of GHG emissions or the effects of GHG emissions" by July 1, 2009; (2) the Resource Agency to adopt those CEQA guidelines by January 1, 2010; and (3) OPR and the Resource Agency to periodically update the guidelines. It also removes climate change analysis as a cause of action under CEQA for certain State-financed infrastructure projects.

### III. METHODOLOGY

Direct impacts on climate change from a roadway are difficult to determine because infrastructure does not constitute a separate source of GHG emissions distinct from overall emissions in the area. In addition, it is difficult to measure or predict the magnitude of GHG emissions that might be associated with a particular project due to the indirect relationship between infrastructure and GHG production. As a result, project-specific contributions to global warming cannot be discerned with a high degree of certainty. However, the following discussion conservatively analyzes the FTC-S project construction phase impacts and long-term and operational impacts relative to GHG emissions in response to a question by California Coastal Commission staff. This document: 1) calculates, to the extent feasible, the project's GHG emissions; 2) lists the Project Design Features (PDFs) incorporated into the project to avoid, minimize, and reduce GHG emissions; and; 3) describes mitigation measures to further reduce GHG emissions.

Information previously provided to the CCC identified the operational GHG emissions that result from traffic in the future (2025) both with and without the implementation of the proposed Foothill Transportation Corridor – South (FTC-S) project. The information below restates the operational analysis for the project, and also includes, as requested by the staff report, an analysis of construction emissions.

GHGs include water vapor, CO<sub>2</sub>, methane (CH<sub>4</sub>), nitrous oxide (N<sub>2</sub>O), hydrochlorofluorocarbons (HCFCs), perfluorinated carbons (PFCs), ozone (O<sub>3</sub>), and hydrofluorocarbons (HFCs). The proposed project is a transportation infrastructure project. Vehicular emissions include CO<sub>2</sub> and water vapor; however, only CO<sub>2</sub> emissions are included in the Emission Factors (EMFAC) air quality model. Since there is no established methodology for calculating water vapor emissions for the FTC-S project, project emissions of water vapor have not been estimated. CO<sub>2</sub> emissions can be calculated using the EMFAC model and are provided below. Emissions of O<sub>3</sub> precursors, nitrogen oxides (NO<sub>x</sub>) and volatile organic compounds (VOCs), have also been estimated for the project and are included in the air quality analyses in the Final Supplemental Environmental Impact Report (SEIR) (December, 2005). O<sub>3</sub> is relatively short-lived in the troposphere and therefore is not global in nature. There is insufficient information at this time to make an accurate determination of the contribution of O<sub>3</sub> precursors to global warming; therefore, emissions of O<sub>3</sub> precursors are not addressed further in this analysis.

HCFCs, O<sub>3</sub>, PFCs, and HFCs are found in consumer products such as older refrigeration units, older vehicular air conditioning units, and aerosol propellants. These fluorocarbons are not tailpipe emissions. Similarly, CH<sub>4</sub> is not a vehicular tailpipe emission and is more typically associated with dairy farms (fermentation of manure) and decaying organic materials occurring naturally such as in natural gas fields, or as a result of landfills. N<sub>2</sub>O is produced by microbial processes in soil and water, including reactions that occur in fertilizer containing nitrogen. Therefore, N<sub>2</sub>O emissions are associated with agricultural sources, some industrial processes that use fossil fuels, and in engines that use it as an aerosol spray propellant. The FTC-S project will not result in emissions of fluorocarbons, CH<sub>4</sub>, or N<sub>2</sub>O.

CO<sub>2</sub> emissions associated with the vehicular traffic that will use the proposed project were calculated using the EMFAC air quality model. CO<sub>2</sub> within the project region was calculated using the traffic data from Appendix B of the Traffic and Circulation Technical Report (Austin-Foust Associates, Inc., December 2003) and the EMFAC2007 emission factor model. The average vehicle speed within the

region was calculated for each alternative and each baseline condition by dividing the VMT by the VHT. The average vehicle speed for the baseline and with project conditions for the FTC-S project is shown in Table A. These average vehicle speeds, along with the VMT and the EMFAC2007 CO<sub>2</sub> emission rates, were used to calculate the regionwide CO<sub>2</sub> emissions.

**Table A: CO<sub>2</sub> Emissions for the FTC-S Project in Comparison to Baseline Emissions**

	Baseline	FTC-S Project
VMT	421,794,107	421,795,693
VHT	12,805,181	12,773,601
Average Speed	32.94	33.02
CO <sub>2</sub> Rate	446.18	445.57
Emissions (lbs/day)	414,907,294.25	414,338,744.64
CO <sub>2</sub> Increase		-568,549.60
% CO <sub>2</sub> Reduction		0.137

CO<sub>2</sub> = carbon dioxide  
lbs/day = pounds per day

VHT = vehicle hours traveled  
VMT = vehicle miles traveled

#### IV. CARBON FOOTPRINT ASSESSMENT

The information below includes, as requested by the staff report, an analysis of GHG emissions associated with project construction, specifically the production and application of concrete and asphalt to construct the roadway and associated features such as bridges. Operational emissions and growth-inducing considerations are also included as presented in the earlier April 2007 report to the CCC and as expanded to address the September, 2007, CCC Staff Report.

##### Short-Term Construction Impacts

The FTC-S project will result in short-term emissions during construction. Air pollutants, including GHGs, will be emitted by construction equipment. As discussed below, the FTC-S project incorporates mitigation measures that require compliance with Air Quality Management District rules and policies (including Rules 401, 402, and 403), and grading code and construction air quality policies. These mitigation measures will limit idling and construction equipment emissions, require the use of ARB-certified equipment with post-combustion controls, and compliance with State construction vehicle emission standards. Other measures require the use of and proper maintenance of low-emission mobile construction equipment and require that work crews shut off equipment when not in use to reduce emissions.

The Staff Report chose to calculate the GHG emissions from road construction, and it states that the estimated 100,000 tons of cement required to construct the proposed facility would generate 100,000 tons of CO<sub>2</sub>. However, contrary to Commission staff's assumptions, the majority of the proposed facility would be paved using asphalt (with the exception of bridge structures and other specific features). The production of asphalt results in higher emissions of GHG than the production of cement. Production of the estimated 400,000 cubic yards of asphalt required to pave the facility

would generate 266,300 tons of CO<sub>2</sub><sup>1</sup> over the course of the construction period. Production of the estimated 192,515 cubic yards of concrete required to construct bridge structures and other specific features would generate an additional 2,170 tons of CO<sub>2</sub> over the course of the construction period.

The second source of GHG emissions during construction is the tail pipe emissions from construction equipment. The CO<sub>2</sub> emissions generated by the construction equipment were estimated using the emission rates from URBEMIS2007. It is projected that the equipment required for the 42-month construction schedule would generate up to 58,200 tons of CO<sub>2</sub>.

When combined with paving-related emissions, project construction will generate 326,670 tons of CO<sub>2</sub>. After completion of the proposed project, the GHG emissions reductions from the operational improvements (see below) would offset the construction emissions in less than 5 years.

### Long-Term Emissions

The CCC staff report (page 208) notes that Section 30253 of the Coastal Act provides that new development shall minimize energy consumption and VMT. The following discussion analyzes the proposed project's potential long-term operational impacts on GHG emissions. The primary source of GHG emissions resulting from a transportation project is vehicle emissions. Therefore, the following analysis discusses the change in VMT as well as VHT and CO<sub>2</sub> emissions resulting from operation of the FTC-S project.

As part of the traffic analysis for the proposed project, the changes in the 2025 regionwide VMT and VHT produced by the FTC-S project compared to the No Action Alternative were estimated (Table A). The changes in systemwide VMT for the FTC-S project were found to be relatively low, which is an indication that the average length of vehicle trips does not change substantially, in terms of distance, between the No Action Alternative and the FTC-S project. Also, there was little change in VMT among the Build Alternatives, including the VMT for the AIO Alternative (improvements to existing arterial streets), the Interstate 5 (I-5) widening alternative, and the proposed project/Preferred Alternative. Therefore, the primary opportunity for savings in energy consumption as a result of the project is in the form of reduced VHT because tailpipe emissions of GHG per mile decrease with improved speeds and reduced congestion.

The VHT statistic is an indicator of the travel time savings produced due to the traffic congestion relief provided by the FTC-S project. This travel time savings statistic is expressed as total hours of reduced vehicle travel time per day. With the FTC-S project, vehicle travel time will be reduced by 32,000 hours per day.

The FTC-S project results in more vehicles traveling at a higher speed than with the corresponding No Action Alternatives. The increase in the VMT increases vehicle emissions by a negligible amount; however, reduction of congestion and an increase in traveling speed decreases vehicle emissions. The combination of these two factors results in a reduction in CO<sub>2</sub> emissions anticipated during the long-term operation of the FTC-S project. As shown in Table A, the FTC-S project is anticipated to result in a decrease in CO<sub>2</sub> emissions generated within the region, compared with baseline conditions

<sup>1</sup> California Energy Commission, Optimization of Product Life Cycles to Reduce Greenhouse Gas Emissions in California, August 2005.

(future conditions without the project). The net reduction is relatively small as a percentage of emissions generated within the region (0.137 percent) compared with baseline conditions; however, the actual emissions reduction of over 568,000 pounds per day (lbs/day) is a notable benefit.

Implementation of the FTC-S (Preferred Alternative) is projected to increase the daily VMT in the subregion by 1,586 miles per day. This increase is less than a 0.0004 percent change in no-build daily VMT of 421,794,107 miles. The increase in VMT is negligible; therefore, the project would not result in any substantial growth in daily VMT. At the same time, project implementation will reduce congestion on I-5 and arterial streets, resulting in better traffic flow and improved traffic speeds that would reduce the daily VHT by 31,580 hours. This reduction in VHT corresponds with a reduction in CO<sub>2</sub> emissions in the subregion by approximately 569,000 lbs/day (even with consideration of the slight increase in VMT).

Therefore, the project will result in a CO<sub>2</sub> emissions reduction of approximately 2,284,535,000 pounds (1,142,268 tons) between opening year 2014 and project planning horizon 2025 (569,000 pounds x 365 days per year x 11 years = 2,284,535,000 pounds). In addition, the project will result in a CO<sub>2</sub> emissions reduction of approximately 8,307,400,000 pounds (4,153,700 tons) between the project opening year 2014 and the life of the project 2054 (569,000 pounds x 365 days per year x 40 years = 8,307,400,000 pounds). As demonstrated, the project will result in a reduction in GHG emissions, even when construction emissions are taken into account. After completion of the proposed project, the GHG emissions reductions from the operational improvements would offset the construction emissions in less than 5 years.

In sum, although the Staff Report (page 219) has chosen to focus on VMT as a near-single indicator of GHG emission, there are in fact other considerations as well. The proposed project does not impede the efforts of the counties and regional agencies, including the San Diego Association of Governments, Southern California Association of Governments, the County of Orange, and the Orange County Transportation Authority from pursuing land use patterns and transit services that will reduce VMT and support efforts to reduce GHG emissions. As explained in the growth inducement section below, the proposed FTC-S will not alter established and approved development patterns in south Orange County and will result in improved traffic flow and reduced GHG emissions.

The Staff Report includes information regarding the link between GCC and the rise in sea level. As noted above, the proposed project results in no net impact (net reduction) in GHG emissions and therefore does not contribute to GCC and associated effects such as sea level changes.

### **Growth Inducement**

The Staff Report also makes erroneous conclusions about growth inducement, suggesting it would be caused by FTC-S. Significantly and dispositive of this issue, the project clearly would not be the slightest growth inducing in the Coastal Zone, and the Staff Report makes no argument to the contrary. Thus, the issue of growth inducement is irrelevant here. In any event, FTC-S has been identified on local and regional plans for over 25 years. The development patterns of Orange County are well established, and the County and study area are largely built out. The Growth Section of the SOCTIIP Final SEIR explains that: (1) the majority of the study area that is not committed to permanent open space is already developed or in the process of developing and approaching the approved build out; (2) any growth-facilitating effects of the project would occur within the overall

distribution and intensity of development allowed under adopted General Plans, Specific Plans, and other regional forecasts; and (3) since the Ranch Plan was approved for development (in November 2004), it is highly unlikely that completion of State Route 241 (SR-241) would influence the location and density of development, because development locations and intensity levels were set by the County and through a Settlement Agreement with groups opposed to the Ranch Plan (i.e., Endangered Habitats League, Natural Resources Defense Council, Sea and Sage Audubon Society, Laguna Greenbelt, Inc., and Sierra Club). Thus, the project would not influence the total amount of growth in the study area or induce growth beyond what would otherwise be expected under the adopted regional growth forecasts in the foreseeable future, and therefore would not be growth inducing. The Final EIR for the Ranch Plan concluded that the Ranch Plan project could be built with or without implementation of the FTC-S project; however, if SR-241 is not completed, then the Ranch Plan would need to implement additional roadway improvements.

In summary, the staff reference to the project encouraging continued growth is incorrect. There is no evidence that the project would be growth inducing within the Coastal Zone or anywhere else.

## V. PROJECT GHG EMISSIONS REDUCTION STRATEGIES

### Greenhouse Gas Project Reductions

In addition to the GHG emissions benefits resulting from the reduced congestion and improved travel speeds in the region, the Transportation Corridor Agencies (TCA) have committed to implementing a number of measures in addition to those identified in the Final SEIR in order to further reduce GHG emissions. These commitments include:

- Solar panels at toll plazas and booths.
- Utilization of green construction practices and materials when feasible
  - All diesel-powered construction equipment will have the latest emission control devices (e.g., diesel oxidation catalysts and diesel particulate filters verified by the ARB to reduce emission of diesel soot and particulate matter, smog-forming NO<sub>x</sub>, and GHGs).
  - Construction equipment operators will be required to turn off equipment engines when not in use to reduce emissions of particulates, nitrogen oxides, and GHGs released while engines are idling.
  - Construction equipment operators to be required to use cleaner diesel or diesel alternative fuels such as biodiesel, low sulfur diesel, ultra-low sulfur diesel, or emulsified diesel.
  - Any concrete or asphalt removed during project construction will be recycled.
  - Use of environmentally friendly concrete and asphalt alternatives and practices will be employed as feasible, such as:
    - Use of recycled tires as an asphalt component
    - Minimizing the use of Portland cement and maximizing the use of supplementary cementitious materials
    - Minimizing the use of natural rocks and sand as aggregates
    - Maximizing the use of recycled and non-potable water as a concrete mix
    - Designing for a service life of 100 to 150 years

## Project-Specific Mitigation and Design Features

The proposed project will have a beneficial cumulative effect on reducing GHG emissions. Although no further mitigation measures are necessary, the following mitigation measures and project design features were incorporated into the proposed project as described in the Final SEIR and comply with the strategies presented in the *Climate Action Team Report to Governor Schwarzenegger and the Legislature*.

- Compliance with outdoor lighting codes designed to reduce energy and output:
  - Measure AS-3 requires that lighting be installed per Caltrans policies and procedures as set forth in the Caltrans Traffic Manual. The mainline corridor will not be continuously lit, which will reduce energy and output.
  - Measure AS-4 specifies that light will be applied as effectively as possible to minimize both the glare of any light source and the spillover of light onto areas outside of the corridor right-of-way.
  - PDF 18-1 specifies that the FTC-S project will include pole-mounted lighting at the toll plazas, ramps, and other locations as required by Caltrans standards. Lighting in areas away from the toll plazas, ramps, and other locations as required by Caltrans standards will be minimized to avoid unnecessary light effects in more rural areas adjacent to the corridor. In addition, all lighting along the corridors will be shielded and directed to focus the light on the corridor and its facilities to minimize light leakage outside the corridor limits.
- Water conservation measures, including incorporation of drought-resistant landscaping materials:
  - Measure WV-7 specifies that the landscaping along the corridor in open space (nonurban) areas will be a mix of native, noninvasive, drought-tolerant plant species from the scrub, grassland, and chaparral communities.
  - Measure WV-7 also specifies that during plant establishment, temporary low-volume irrigation systems using reclaimed water (where available) shall be included in the final design of the selected alternative.
  - PDF 8-2 specifies that the FTC-S project will include landscaping for unpaved areas within the corridor rights-of-way. Landscaping will focus on native plant species, particularly in areas adjacent to undeveloped land with native plant species.
- Preparation and implementation of Transportation Management Plans:
  - Measure CT-1 includes preparation and implementation of a Construction Traffic Management Plan to reduce construction vehicle traffic and to minimize traffic flow interference from construction activities.
  - Compliance with Air Quality Management District rules and policies (including Rules 401, 402, and 403) and grading code and construction air quality policies designed to limit idling and limit construction equipment emissions, including ozone precursor emission controls, preparation of diesel emission reduction plans, requirements for the use of ARB-certified equipment of post-combustion controls, and compliance with state construction vehicle emission standards.

- Measures AQ-1, AQ-2, and AQ-5 require compliance with Air Quality Management District rules and policies (including Rules 401, 402, and 403) and grading code and construction air quality policies designed to limit idling and limit construction equipment emissions, including ozone precursor emission controls, requirements for the use of ARB-certified equipment, and compliance with State construction vehicle emission standards.
- Measure AQ-5 requires the use of and proper maintenance of low-emission mobile construction equipment to reduce emissions. This measure also requires that work crews shut off equipment when not in use.
- Measure AQ-5 requires that the contractor support incentives for ridesharing and transit use by the construction crew.

## **VI. CONCLUSION**

Implementation of FTC-S will result in a reduction in emissions of CO<sub>2</sub>, largely as a result of improved travel speeds in the region. This reduction in emissions of CO<sub>2</sub>, a GHG, is consistent with the objectives of AB 32 to reduce GHG emissions in California. Further, the proposed project includes design features to require energy efficient lighting, conserve water, and reduce construction equipment emissions. As demonstrated, the project will result in a reduction in GHG emissions, even when construction emissions are taken into account. The GHG emissions reductions resulting from the operation of FTC-S will offset the construction emissions in less than 5 years.