TECHNICAL EVALUATION: GREENHOUSE GAS EMISSIONS (CLIMATE CHANGE)

Climate change is an important national and global concern. While the earth has gone through many natural changes in climate in its history, there is general agreement that the earth's climate is currently changing at an accelerated rate and will continue to do so for the foreseeable future. Anthropogenic (human-caused) greenhouse gas (GHG) emissions contribute to this rapid change. Carbon dioxide (CO_2) makes up the largest component of these GHG emissions. Other prominent transportation GHGs include methane (CH_4) and nitrous oxide (N_2O). CO_2 equivalents (CO_2e) is a measure used to compare the emissions of the various greenhouse gases based upon their global warming potential.

Many GHGs occur naturally. Water vapor is the most abundant GHG and makes up approximately two thirds of the natural greenhouse effect. However, the burning of fossil fuels and other human activities are adding to the concentration of GHGs in the atmosphere. Many GHGs remain in the atmosphere for time periods ranging from decades to centuries. GHGs trap heat in the earth's atmosphere. Because atmospheric concentration of GHGs continues to climb, our planet will continue to experience climate-related phenomena. For example, warmer global temperatures can cause changes in precipitation and sea levels.

To date, no national standards have been established regarding GHGs, nor has EPA established criteria or thresholds for ambient GHG emissions pursuant to its authority to establish motor vehicle emission standards for CO_2 under the Clean Air Act. However, there is a considerable body of scientific literature addressing the sources of GHG emissions and their adverse effects on climate, including reports from the Intergovernmental Panel on Climate Change, the U.S. National Academy of Sciences, and EPA and other Federal agencies. GHGs are different from other air pollutants evaluated in Federal environmental reviews because their impacts are not localized or regional due to their rapid dispersion into the global atmosphere, which is characteristic of these gases. The *affected environment* for CO_2 and other GHG emissions is the entire planet. In addition, from a quantitative perspective, global climate change is the cumulative result of numerous and varied emissions sources (in terms of both absolute numbers and types), each of which makes a relatively small addition to global atmospheric GHG concentrations. In contrast to broad scale actions such as actions involving an entire industry sector or very large geographic areas, it is difficult to isolate and understand the GHG emissions impacts for a particular transportation project. Furthermore, presently there is no scientific methodology for attributing specific climatological changes to a particular transportation project's emissions.

Under NEPA, detailed environmental analysis should be focused on issues that are significant and meaningful to decision-making.[1] FHWA has concluded, based on the nature of GHG emissions and the exceedingly small potential GHG impacts of the proposed action (as examined in the following and documented Table 2) that the GHG emissions from the proposed action will not result in "reasonably foreseeable significant adverse impacts on the human environment" (40 CFR 1502.22(b)). The GHG emissions from the project Build Alternate will be insignificant, and will not play a meaningful role in a determination of the environmentally preferable alternative or the selection of the preferred alternative. More detailed information on GHG emissions "is not essential to a reasoned choice among reasonable alternatives" (40 CFR 1502.22(a)) or to making a decision in the best overall public interest based on a balanced consideration of transportation, economic, social, and environmental needs and impacts (23 CFR 771.105(b)). Nevertheless, an alternatives-level GHG analysis has been performed for this project, and the results are presented in Table 1.

[1] *See* 40 CFR 1500.1(b), 1500.2(b), 1500.4(g), and 1501.7

Table 1. GHG Emissions for Each Project Alternative.

Analysis Year	Alternative	GHG Emissions, MMT	
		CO_2	CO_2e
2010	No Build	1.5	1.5
2018	No Build	1.6	1.6
	Build	1.6	1.6
2035	No Build	1.8	1.8
	Build	1.8	1.8

MMT = million metric tons

The context in which the emissions from the proposed project will occur, together with the expected GHG emissions contribution from the project, illustrate why the project's GHG emissions will not be significant and will not be a substantial factor in the decision-making. The transportation sector is the second largest source of total GHG emissions in the U.S., behind electricity generation. The transportation sector was responsible for approximately 27 percent of all anthropogenic (human caused) GHG emissions in the U.S. in 2009.[2] The majority of transportation GHG emissions are the result of fossil fuel combustion. CO_2 makes up the largest component of these GHG emissions. U.S. CO_2 emissions from the consumption of energy accounted for about 18 percent of worldwide energy consumption CO_2 emissions in 2009.[3] U.S. transportation CO_2 emissions accounted for about 6 percent of worldwide CO_2 emissions.[4]

While the contribution of GHGs from transportation in the U.S. as a whole is a large component of U.S. GHG emissions, as the scale of analysis is reduced the GHG contributions become quite small. Using CO_2 because of its predominant role in GHG emissions, Table 2 presents the relationship between current and projected Georgia highway CO_2 emissions and total global CO_2 emissions, as well as information on the scale of the project relative to statewide travel activity.

Based on emissions estimates from EPA's Motor Vehicle Emissions Simulator (MOVES) model[5], and global CO_2 estimates and projections from the Energy Information Administration, CO_2 emissions from motor vehicles in the entire state of Georgia contributed less than two tenths of one percent of global

[2] Calculated from data in U.S. Environmental Protection Agency, Inventory of Greenhouse Gas Emissions and Sinks, 1990-2009.

[3] Calculated from data in U.S. Energy Information Administration International Energy Statistics, Total Carbon Dioxide Emissions from the Consumption of Energy, http://www.eia.gov/cfapps/ipdbproject/IEDIndex3.cfm?tid=90&pid=44&aid=8, accessed 9/12/11.

[4] Calculated from data in EIA figure 104: http://205.254.135.24/oiaf/ieo/graphic_data_emissions.html and EPA table ES-3: http://epa.gov/climatechange/emissions/downloads11/US-GHG-Inventory-2011-Executive-Summary.pdf

[5] http://www.epa.gov/otaq/models/moves/index.htm. EPA's MOVES model can be used to estimate vehicle exhaust emissions of carbon dioxide (CO_2) and other GHGs. CO_2 is frequently used as an indicator of overall transportation GHG emissions because the quantity of these emissions is much larger than that of all other transportation GHGs combined, and because CO_2 accounts for 90-95% of the

Table 2. Statewide and Project Emissions Potential, Relative to Global Totals.

Analysis Year	Global CO_2 emissions, MMT[6]	Georgia motor vehicle CO_2 emissions, MMT[7]	Georgia motor vehicle emissions, % of global total	Project VMT, % of statewide VMT	% change in statewide VMT due to project
2010 (Base Case)	31,000	58	0.19%	2.3%	(None)
2035 (Future Case)	44,000	74	0.17%	1.9%	0.058%

Notes: Global emissions estimates are from International Energy Outlook 2013, data for Figure 140. Georgia emissions and statewide VMT estimates are from MOVES2010b. Project VMT data come from information compiled for the Technical Evaluation: Mobile Source Air Toxics (MSAT) Analysis for the affected transportation network; estimates reflect the alternative with the highest VMT (i.e., the Build Alternate).

overall climate impact from transportation sources. MOVES includes estimates of both emissions rates and VMT, and these were used to estimate the Georgia statewide highway emissions in Table 2.

[6] These estimates are from the EIA's *International Energy Outlook 2013*, and are considered the best-available projections of CO_2 emissions from fossil fuel combustion. These totals do not include other sources of emissions, such as cement production, deforestation, or natural sources; however, reliable future projections for these emissions sources are not available.

[7] MOVES projections suggest that Georgia motor vehicle CO_2 emissions may increase by 27% between 2010 and 2035. MOVES2010b predicts that statewide VMT will increase by 54% between 2010 and 2035; the increase in emissions is smaller than the increase in VMT because improved fuel economy in the vehicle fleet (as characterized in MOVES) helps offset much of the emissions increase that would otherwise occur.

emissions in 2010 (0.19%), and are projected to contribute an even smaller fraction (0.17%) in 2035[8]. Vehicle miles traveled (VMT) on the transportation network affected by the project represents 2.3% of total Georgia travel activity; and the project itself would increase statewide VMT by less than one tenth of one percent. (Note that the affected transportation network, as defined for the MSAT analysis, includes travel on many other roadways in addition to the proposed project.) As a result, based on the alternative with the highest VMT (i.e., the Build Alternate), FHWA estimates that the proposed project could result in a potential increase in global CO_2 emissions in 2035 of 0.000099% (less than one thousandth of one percent). This very small change in global emissions is well within the range of uncertainty associated with future emissions estimates.[9, 10]

Mitigation for Global GHG Emissions

To help address the global issue of climate change, U.S. DOT is committed to reducing GHG emissions from vehicles traveling on our nation's highways. U.S. DOT and EPA are working together to reduce these emissions by substantially improving vehicle efficiency and shifting toward lower carbon-intensive fuels. The agencies have jointly established new, more stringent fuel economy and first-ever GHG emissions standards for model year 2012 to 2025 cars and light trucks, with an ultimate fuel economy standard of 54.5 miles per gallon for cars and light trucks by model year 2025. Further, on September 15, 2011, the agencies jointly published the first-ever fuel economy and GHG emissions standards for heavy-duty trucks and buses, and has since initiated efforts to tighten these standards. Increasing use of technological innovations that can improve fuel economy, such as gasoline- and diesel-electric hybrid vehicles, will improve air quality and reduce CO_2 emissions in future years.

Consistent with its view that broad-scale efforts hold the greatest promise for meaningfully addressing the global climate change problem, FHWA is engaged in developing strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. In an effort to assist States and metropolitan planning organizations in performing GHG analyses, FHWA has developed a Handbook for Estimating Transportation GHG Emissions for Integration into the Planning Process. The handbook presents methodologies reflecting

[8] Georgia emissions represent a smaller share of global emissions in 2035 because global emissions increase at a faster rate.

[9] For example, Figure 114 of the Energy Information Administration's *International Energy Outlook 2010* shows that future emissions projections can vary by almost 20%, depending on which scenario for future economic growth proves to be most accurate.

[10] When an agency is evaluating reasonably foreseeable significant adverse effects on the human environment in an environmental impact statement and there is incomplete or unavailable information, the agency is required make clear that such information is lacking (40 CFR 1502.22). The methodologies for forecasting GHG emissions from transportation projects continue to evolve and the data provided should be considered in light of the constraints affecting the currently available methodologies. As previously stated, tools such as EPA's MOVES model can be used to estimate vehicle exhaust emissions of CO_2 and other GHGs. However, only rudimentary information is available regarding the GHG emissions impacts of highway construction and maintenance. Estimation of GHG emissions from vehicle exhaust is subject to the same types of uncertainty affecting other types of air quality analysis, including imprecise information about current and future estimates of vehicle miles traveled, vehicle travel speeds, and the effectiveness of vehicle emissions control technology. Finally, there presently is no scientific methodology that can identify causal connections between individual source emissions and specific climate impacts at a particular location.

good practices for the evaluation of GHG emissions at the transportation program level, and demonstrates how such an evaluation may be integrated into the transportation planning process. FHWA has also developed a tool for use at the statewide level to model a large number of GHG reduction scenarios and alternatives for use in transportation planning, climate action plans, scenario planning exercises, and in meeting state GHG reduction targets and goals. To assist states and metropolitan planning organizations in assessing the climate change vulnerabilities of their transportation networks, FHWA has developed a vulnerability and risk assessment conceptual model and has piloted the model in several locations.

There are several programs underway in Georgia to address GHG emissions. Georgia is a member of the Climate Registry, a nationwide voluntary effort to quantify GHG emissions from all sources and lay the foundation for potential future carbon emissions trading and mitigation efforts.

Summary

This document does not incorporate an analysis of the GHG emissions or climate change effects of each of the alternatives because the potential change in GHG emissions is very small in the context of the affected environment. Because of the insignificance of the GHG impacts, those impacts will not be meaningful to a decision on the environmentally preferable alternative or to a choice among alternatives. As outlined above, FHWA is working to develop strategies to reduce transportation's contribution to GHGs—particularly CO_2 emissions—and to assess the risks to transportation systems and services from climate change. FHWA will continue to pursue these efforts as productive steps to address this important issue.