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Developing a Framework for a Toolkit for Carbon Footprint that Integrates Transit (CFIT)

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Final Report



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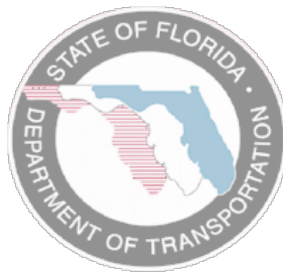


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Developing a Framework for a Toolkit for Carbon Footprint that Integrates Transit (CFIT)

FDOT BDK85 Task Work Order #977-10

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Final Report
November 2010

Disclaimer

The opinions, findings, and conclusions expressed in this publication are those of the authors and not necessarily those of the State of Florida Department of Transportation.

Metric Conversion Table

Symbol	When you know	Multiply by	To find	Symbol
Length				
mi	miles	1.61	kilometers	km
km	kilometers	0.621	miles	mi
Volume				
gal	gallons	3.785	liters	L
L	liters	0.264	gallons	gal
Mass				
oz	ounces	28.35	grams	g
g	grams	0.035	ounces	oz
lb	pounds	0.454	kilograms	kg
kg	kilograms	2.202	pounds	lb
T	Short tons (2000 lb)	0.907	Megagrams (or "metric ton")	Mg (or "t")
Mg (or "t")	Megagrams (or "metric ton")	1.103	Short tons (2000 lb)	T

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16. Abstract The purpose of this research was to evaluate five transportation planning processes used in Florida to determine how greenhouse gas (GHG) emissions considerations can be incorporated into the processes. These included the federal metropolitan planning organization long range transportation planning process (MPO LRTP) and transportation improvement programming (TIP) with application of federal Clean Air Act (CAA) air quality conformity analysis; the National Environmental Policy Act (NEPA) environmental review process with application of CAA air quality conformity analysis; the Florida local government comprehensive planning process; and the Florida development of regional impact review process. The research included a review of GHG emissions calculation tools and their applicability to each planning process. The research also included four case studies from the states of New York, California, Washington and Massachusetts, featuring proposed transportation improvement projects and programming of varying scales and how GHG emissions were calculated and were figured into decision making. The study also included the development of a scenario of a public bus transit improvement project that was used in calculating an estimate of generated GHG emissions. The results of the study provided recommendations for the selection and use of GHG calculation tools as part of transportation planning processes, discussed the limitations and uncertainties of the tools, and provided recommendations for incorporating GHG emissions into planning processes.			
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Executive Summary

Problem and Research Objectives

Sustained attention at the state and national level to the effects of climate change and the contribution of the transportation sector to carbon footprint has provided a renewed focus of public transit's potential contribution to reduce greenhouse gas (GHG) emissions. In light of the shift in public policy toward addressing climate impacts from the transportation sector, this research project has been undertaken to develop a framework for calculating GHG emissions from proposed transportation projects and to recommend ways to incorporate this framework into five transportation planning processes used in Florida. A detailed description of these processes within the context of GHG emissions analysis is provided in Appendix B, with conclusions and recommendations for each.

The following is a description of how the three study objectives were accomplished, with referenced page numbers.

- 1) Develop a framework for analyzing GHG emissions within the present planning processes

Planning processes were assessed for their current suitability to encompass GHG analysis, and at what stage in these processes GHG calculations could possibly be conducted, and what existing tools are appropriate to use. The results are summarized in **Section 5** with a more detailed discussion in **Appendix B**.

- 2) Illustrate how the framework might be applied in an instance of a plan to expand bus transportation in an area

An evaluation of existing GHG emissions calculation tools was summarized (**pp. 12-16**), the development of a bus transit improvement scenario was described (**pp. 16-17**), the method used for calculating direct on-road GHG emissions, using available data from a local travel demand model, was described and illustrated (**pp. 17-21**), and the results of the calculations were presented for three sub-scenarios representing different mode shift assumptions (**pp. 23**).

- 3) Identify major uncertainties and gaps in data, analytical tools, and planning processes, to be addressed in Phase II

The difficulties in using available data for project level bus transit GHG emissions analysis are found in mapping the data to the needed scale and format. These conclusions are drawn from and illustrated by the worked example and described in Section 2 (**pp. 3-5**). Conclusions are also drawn from the case studies, summarized in Section 4 (**pp. 24-33**).

Findings and Conclusions

This study included a review of existing methods and models for calculating GHG emissions. Example calculations were also performed for a bus rapid transit project scenario to illustrate GHG calculations for transit projects, to identify uncertainties and limitations, and to identify data and guidance needs. An activity-based approach to computing GHG emissions was used because it was found that fuel usage data at the project (or metropolitan area) scale are not reliable. Simplified default GHG emissions estimation methods outlined by the American Public Transportation Association (APTA) may be appropriate for many transit project purposes. For calculation of emissions for the transit project scenario, simplified emissions estimation methods outlined by the American Public Transportation Association (APTA) were applied based on corridor transportation activity data from the local travel demand model. Additionally, the Motor Vehicle Emissions Simulator (MOVES), developed by the EPA Office of Transportation and Air Quality for calculating emissions from transportation, was also investigated. Findings indicate that mode shift, congestion mitigation, and land-use effects (induced/reduced demand) may provide significant emissions credits (decreases) associated with transit improvements. However, there is uncertainty associated with these effects, and the range of uncertainty can determine whether the project leads to a net emissions increase or decrease. More locally-specific research and data on these effects are needed. Additionally, running MOVES to calculate emissions requires a significant amount of input data that are not directly available from the local travel demand model and that local governments and MPOs are not likely to currently have available. While data will be developed by MPOs for MOVES in response to changing air quality conformity requirements, these data sets are not the same as those needed for small-scale analysis. MOVES also represents a change in the structure of data inputs, run-time decisions, and emissions calculations from the previous on-road emission factor generator (e.g. MOBILE6).

Case studies from four leading states also were developed as part of this research study, to provide examples that could inform a future approach in Florida to use transportation planning processes to reduce GHG emissions. A summary of findings is included in this report and the complete write-ups of the case studies are found in Appendix A. It was found that differences among the states' approaches to consider GHG emissions included differences in the emissions estimation methodologies, the sources of emissions considered, the spatial scale of the traffic modeling, and the types of GHGs considered. Analysis of the case studies reveals the importance of strong state level leadership and legislation for incorporating climate change into transportation planning processes. Conclusions about the case studies stress the importance of estimating cumulative emissions, and also of paying more attention to methods of estimating emissions from the construction phase of projects. Evidence from two case studies suggests these emissions are of significant quantity. Where a transit or road project involves capital construction, the emissions from construction should be estimated during the cost estimation phase of its associated Project Development & Environment (PD&E) study, which is part of its required NEPA review; it is at this stage that the computations can probably be accomplished with the least additional work. The standard tool for estimating emissions from highway construction, developed in California, needs to be updated, to reflect changes in construction technology, and changes in technology for producing construction materials, that have occurred since the model was developed in

the early 1970s. As part of such an update, the model's scope should be expanded to handle capital construction for transit projects in the same way that it calculates emissions from road construction. Until an updated, expanded model for construction emissions becomes available, APTA's methodology should be used to estimate construction emissions for transit projects. Where possible, construction emissions should be used as part of an estimate of a project's lifetime emissions. When alternatives are being compared, construction emissions should be included in all alternatives.

It is concluded that it may be more appropriate to make decisions about GHGs from transportation at a larger scale, such as in the MPO LRTP process or the local government comprehensive planning process. Such analyses could examine strategies to reduce GHG emissions, and the effect of proposed packages of projects on emissions. From the perspective of limiting emissions, individual projects would be approved as part of an area budget, similar to conformity analysis, and then allowed to proceed as long as they are consistent with the LRTP or LGCP and the analysis on which it is based. Another advantage of analyzing and mitigating emissions at the comprehensive plan or LRTP level is the ability to integrate transportation with other strategic planning concerns that have GHG emissions implications, such as land use and economic development. Mitigation and emissions reductions have the greatest potential if these planning sectors are working in concert, rather than pursuing different goals. The more holistic and system level planning and analysis at the plan rather than the project level seems to be the most cost-effective approach that can result in greater GHG emissions mitigation from transportation at a greater scale.

Research Benefits

The benefits of this research are its contributions toward better delineating the available tools for calculating GHG emissions, establishing their applicability and strengths for analysis at different scales, identifying the types of data that are needed but not yet available for performing more accurate calculations, identifying the uncertainties introduced by the necessity to make assumptions about future conditions, and detailing ways to strengthen existing transportation planning processes to incorporate GHG emissions reduction considerations. These findings provide the framework for implementation in a CFIT Phase II study that would develop a set of guidelines accompanied by supporting tools to perform GHG emissions calculations as useful inputs to Florida's transportation planning processes. The resulting benefit will be to enable transportation planners to more effectively weigh climate change considerations in response to proposed transportation improvement funding allocations.

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List of Acronyms

AA	Alternatives Analysis
AADT	Average Annual Daily Traffic
AASHTO	American Association of State Highway and Transportation Officials
AB	Assembly Bill
ADA	Application for Development Approval
AN	Advance Notification
APTA	American Public Transportation Association
AQPP	Air Quality Post Processor
ARB	Air Resources Board (California)
BRT	Bus Rapid Transit
CAA	Clean Air Act
Caltrans	California State Department of Transportation
CBSA	Core-based Statistical Area
CDR	Conformity Determination Report
CE	Categorical Exclusion
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act (California)
CFIT	Carbon Footprint that Integrates Transit
CH ₄	Methane
CIP	Capital Improvements Program
CLIP	Climate Leadership in Parks Tool
CMAQ	Congestion Mitigation and Air Quality
CO	Carbon Monoxide
CO ₂	Carbon Dioxide
CO ₂ e	Carbon Dioxide Equivalent
COA	Class of Action
CRC	Columbia River Crossing (Oregon/Washington)
CTG	Control Technique Guidelines
CTPS	Central Transportation Planning Staff (Massachusetts)
DCA	Department of Community Affairs
DEIS	Draft Environmental Impact Statement
DEP	Department of Environmental Protection
DO	Development Order
DOT	Department of Transportation
DRI	Development of Regional Impact
DULA	Dense Urban Land Area
EA	Environmental Assessment
EAR	Evaluation and Appraisal Report

ECO	Energy Conservation Overlay
EF	Emissions Factor
EFC	Excess Fuel Consumed
EIIP	Emission Inventory Improvement Program
EIR	Environmental Impact Report
EIS	Environmental Impact Statement
EMIS	Emission Interference Program
EPA	Environmental Protection Agency
EST	Environmental Screening Tool
ETAT	Environmental Technical Advisory Team
ETC	Estimated Time of Completion
ETDM	Efficient Transportation Decision Making
FAAR	Final Alternatives Analysis Report
FAC	Florida Administrative Code
FDAR	Final Definition of Alternatives Report
FDOT	Florida Department of Transportation
FDEP	Florida Department of Environmental Protection
FEIS	Final Environmental Impact Statement
FHWA	Federal Highway Administration
FIHS	Florida Intrastate Highway System
FMVCP	Federal Motor Vehicle Control Program
FONSI	Finding of No Significant Impact
FPSR	Final Programming Summary Report
FQD	Florida Quality Development
FS	Florida Statute
FSUTMS	Florida Standard Urban Transportation Modeling Structure
FTA	Federal Transit Administration
FTE	Full-Time Equivalent
FTP	Florida Transportation Plan
GHG	Greenhouse Gas
GIS	Geographic Information System
GREET	Greenhouse Gases, Regulated Emissions, and Energy Use in Transportation Model
GTM	Goethals Transportation Model (New York)
HART	Hillsborough Area Regional Transit Authority
HB	House Bill
HCM	Highway Capacity Manual
HERS	Highway Economic Requirements System
HPMS	Highway Performance Monitoring System
IDAS	Intelligent Transportation Systems Deployment Analysis System
ITE	Institute of Transportation Engineers

ITS	Intelligent Transportation Systems
LEM	Life Cycle Emissions Model
LGCP	Local Government Comprehensive Plan
LOS	Level of Service
LOSPLAN	LOS Planning Software
LPA	Locally Preferred Alternative
L RTP	Long Range Transportation Plan
LUM	Land Use Multiplier
MEPA	Massachusetts Environmental Policy Act (Massachusetts)
MMTD	Multimodal Transportation District
MOVES	Motor Vehicle Emissions Simulator
MPA	Metropolitan Planning Area
MPG	Miles per Gallon
MPO	Metropolitan Planning Organization
MSF	Mode Shift Factor
MTC	Metropolitan Transportation Commission (California)
MTF	Model Task Force
MUTS	Manual on Uniform Traffic Studies
MVEB	Motor Vehicle Emissions Budgets
NAAQS	National Ambient Air Quality Standards
NCTR	National Center for Transit Research
NEMS	National Energy Modeling System
NEPA	National Environmental Policy Act
NH ₃	Ammonia
NHTS	National Household Travel Survey
N ₂ O	Nitrous Oxide
NO _x	Nitrogen Oxides
NOA	Notice of Availability
NOI	Notice of Intent
NOPC	Notice of Proposed Changes
NSR	New Source Review
NYSDOT	New York State Department of Transportation
OPR	Office of Planning and Research (California)
PDA	Preliminary Development Agreement
PD&E	Project Development & Environment
PDSR	Project Development Summary Report
PE	Preliminary Engineering
PM	Particulate Matter
PPB	Parts per Billion
PSR	Programming Summary Report

Q/LOS	Quality/Level of Service
RACT	Reasonably Available Control Technologies
RDEIR	Revised Draft Environmental Impact Report
ROD	Record of Decision
RPC	Regional Planning Council
RVP	Reid Vapor Pressure
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act – A Legacy for Users
SAGE	Systems for the Analysis of Global Energy Markets
SCC	Social Cost Calculator
SCC	Source Classification Code
SCS	Sustainable Communities Strategy (California)
SEP	State Energy Plan (New York)
SEPA	State Environmental Policy Act (Washington)
SEQR	State Environmental Quality Review (New York)
SHS	State Highway System
SIP	State Implementation Plan
SIPT	State Inventory Protection Tool
SIS	Strategic Intermodal System
SIT	State Inventory Tool
SMITE-ML	Spreadsheet Model for Induced Travel Estimation—Managed Lanes
SO ₂	Sulfur Dioxide
SOV	Single Occupant Vehicle
SPASM	Sketch Planning Analysis Spreadsheet Model
STEAM	Surface Transportation Efficiency Analysis Model
STIP	State Transportation Improvement Program
TAZ	Traffic Analysis Zone
TBEST	Transit Boarding Estimation and Simulation Tool
TBRPM	Tampa Bay Regional Planning Model
TCEA	Transportation Concurrency Exception Area
TCM	Transportation Control Measures
TCMA	Traffic Congestion Management Area
TCMS	Traffic Congestion Management System
TCR	Transportation Conformity Rule
TDM	Transportation Demand Management
TDMAP	Transportation Demand Management Assessment Procedure
TDP	Transit Development Plan
TEA-21	Transportation Equity Act for the 21 st Century
TEM	World Energy Protection System Transportation Energy Model
TJ	Terajoule
TIP	Transportation Improvement Program

TLOS	Transit Level of Service
TMA	Transportation Management Area
TPD	Tons per Day
TPO	Transportation Planning Organization
TPT	Transit Passenger Trip
TRIMMS	Trip Reduction Impacts of Mobility Management Strategies
TRIP	Transportation Regional Incentive Program
TSM	Transportation System Management
TTF	Transportation Task Force
TTI UMR	Texas Transportation Institute <i>Urban Mobility Report</i>
UPT	Unlinked Passenger Trip
US	United States
USC	United States Code
USDOT	United States Department of Transportation
USEPA	United States Environmental Protection Agency
UMR	<i>Urban Mobility Report</i> of the Texas Transportation Institute
VMT	Vehicle Miles Travelled
VOC	Volatile Organic Compound

Section 1: Introduction

Mounting evidence of the relationship between activities that generate greenhouse gas (GHG) and global warming has brought about consensus in the international scientific community that action should be taken to reduce GHG emissions.¹ This has become a topic of great interest to both the private sector and public sector, including government at all levels, from international coordinating bodies to national and state governments, regional entities as well as municipalities. The transportation sector is a major contributor of GHG emissions, primarily as a byproduct from the operation of internal combustion engines of motor vehicles. In 2008, on-road vehicles made up the largest proportion of the total GHG emissions from transportation, approximately 85 percent of CO₂e.² Presently there are no federal air quality standards for the primary greenhouse gas (GHG), CO₂. However, some states are forging ahead with consideration for figuring GHG emissions into transportation planning processes. It is also anticipated that the next federal transportation reauthorization bill will address issues relating to climate change. It is increasingly clear that future transportation planning in the state of Florida will need to analyze, estimate, and consider GHG emissions resulting from transportation system development and operations.

The purpose of this research project is to provide information, guidance, and an analytical tool to support transportation decision making at the system, land development, and project levels. There are three objectives of Phase I of this research project.

- 1) Develop a framework for analyzing GHG emissions within the present planning processes
- 2) Illustrate how the framework might be applied in an instance of a plan to expand bus transportation in an area
- 3) Identify major uncertainties and gaps in data, analytical tools, and planning processes to be addressed in Phase II

The tasks undertaken to accomplish these objectives included the completion of a literature review, coordination with other concurrent research efforts, identification of four states that are leaders in climate change analysis and documentation of their approaches used to include GHG emissions in their transportation planning processes. Tasks also included the documentation of the existing transportation planning and analysis processes used in Florida, the construction of a case study scenario of a bus transit

¹ IPCC, *Climate Change 2007: Synthesis Report. Contribution of Working Groups I, II, and III to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change*, [Core Writing Team, Pachauri, R. K. and Reisinger, A. (eds.)], IPCC, Geneva, Switzerland, 2007, 104 pp. Available:

http://www.ipcc.ch/publications_and_data/ar4/syr/en/contents.html [October 7, 2010]

² U.S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2008*, U.S. EPA # 430-R-10-006, April 2010. Computed from data provided in Table 2-15, p. 2-21. Available:

http://epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_Chapter2-Trends.pdf [10/2010] Trends.pdf http://epa.gov/climatechange/emissions/downloads10/US-GHG-Inventory-2010_Chapter2-Trends.pdf [October 7, 2010]

service expansion in a corridor, and the development of worked examples from the scenario to demonstrate how GHG emissions can be calculated.

Section 2: Results of CFIT Framework Development

From the standpoint of reducing greenhouse gas (GHG) emissions from passenger transportation, the largest source is motor vehicle travel. This study addresses managing the demand for travel through transportation planning processes. The purpose of this research study is to develop a framework for incorporating GHG emissions and carbon footprints from transportation activities and services into five major transportation planning processes in the state of Florida. This study was sponsored by the Florida Department of Transportation (FDOT) under a grant from the National Center for Transit Research.

Addressing a carbon footprint criterion, the ability of a bus service improvement at a project or corridor level to compete favorably with an alternative proposed addition of highway lane capacity depends upon a demonstration that the bus service improvement will effectively reduce GHG emissions. Bus service can do so by converting enough car drivers who use the congested facility to bus passengers. Then, vehicle trips and vehicle miles traveled can be reduced, thereby also reducing GHG. Additionally, by reducing passenger car vehicle trips, bus service can make a positive difference in the operating level of service of the segment and corridor. However, decreased congestion also has the potential to spur increased vehicle trips on the corridor, which could offset gains made by conversion of car drivers to bus passengers.

Beyond AASHTO's 2006 review of available GHG calculation tools,³ this Final Report identifies seven other models. No one model is recommended as appropriate for all types of analyses because the tools address different specific applications foci, different levels of inclusion of the breadth of GHGs and production activities, and varying levels of complexity and disaggregation. Some tools are not sensitive to the effects of small transportation projects, which is a problem considered in the design of the CFIT framework.

The methods and results presented in Section 3 provide an example of calculating GHG emissions from a local transit project. The process of doing these calculations provides insights into limitations and needed data and is further discussed. Recommendations for the use of methods and tools for each of the state planning processes are provided as the framework for a Florida toolkit for transit GHG emissions calculations.

This research study pursued an activity-based approach to computing GHG emissions from transportation to estimate vehicle miles traveled (VMT), traffic volumes, and vehicle speeds necessary

³ ICF Consulting, *Assessment of Greenhouse Gas Analysis Techniques for Transportation Projects*, prepared for American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Environment as part of National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 17, Transportation Research Board, National Research Council, Washington, D.C., May 2006.

for the calculation of on-road emissions. The analysis relied primarily on data from a local travel demand model, the Tampa Bay Regional Planning Model (TBRPM), used as an example. There are some important difficulties and limitations in using this data for project level transit GHG emissions analyses, particularly in mapping this data to a scale and format needed for emissions analyses.

Data Disaggregation by Vehicle Type and Speed

First, data disaggregation by detailed vehicle type would be useful as emissions rates are expected to change by vehicle type. This is especially true for transit buses and truck classes, as their fuel economy can be significantly less than for personal autos. Additionally, their speeds can be different, especially, for example, in the case of bus rapid transit (BRT), if signalization priority is used. If possible, it will be helpful to disaggregate speed for the buses from the general traffic, as signalization priority may allow less acceleration/deceleration of buses, and hence reduced emissions. This is not accounted for in the TBRPM data. The Motor Vehicle Emissions Simulator (MOVES) emissions model that was developed by the United States Environmental Protection Agency (USEPA) is currently the most sophisticated model for calculating emissions rates and inventories. It has several vehicle classes. In order to translate the volume data from the TBRPM (which is disaggregated into personal autos, shared autos, and trucks) to MOVES, a mapping scheme that provides local VMT distributions by detailed (MOVES or the Highway Performance Monitoring System (HPMS)) vehicle class would be useful. It is unlikely that these distributions would be specific to a given corridor for a project level analysis, but could be specific to the county and maintained by the FDOT district or Metropolitan Planning Organization (MPO).

Data that Represents a Full Year Distribution

The TBRPM only provides data for specific conditions (congested versus uncongested) during the peak season, with no information on the distribution of congested versus uncongested conditions. Nor is there data in the model regarding the representativeness or translation of this data to other time periods (or annually). For GHG calculations, estimation of annual emissions is needed. Guidance (based on local traffic count data, for example) is needed on how data from the travel demand model can be translated to a full year distribution. Improvements in travel demand modeling that increase the temporal scope of the modeling to be more aligned with GHG emissions calculation needs would be helpful.

Transportation Modeling Refinements

A proposed BRT service along Fletcher Avenue in Hillsborough County was used as the scenario, in which a single model run of the TBRPM was employed to ensure that only the addition of BRT affected the results and not differences in economic and other TBRPM input data. A second model run, specifically simulated under BRT conditions, with all other input conditions the same would also be useful for such an analysis. Alternatively, a corridor simulation transportation model could be applied to estimate transportation activity data for the project. This latter approach would likely provide data more appropriate for input to the project level structure in the USEPA MOVES emissions estimator, which requires link level data on vehicle processes and speeds. However, both of these approaches would require allocating time and resources for transportation modeling to calculate GHG emissions for the

project. Hence, it would be best to modify the transportation modeling processes to perform these estimates during routine use of the model for other planning purposes, either using the TBRPM or a corridor model.

Guidance on MOVES and Need for Default Data

Overall, guidance is needed on how to apply MOVES (selection of domain level, run specifications, and input data sources) in different types of analyses. Furthermore, guidance is needed on how to translate results output by typical transportation models (e.g. TBRPM or corridor level simulators) to MOVES transportation activity input data (VMT, traffic volumes, speeds, processes). Default MOVES input data resolved to the county level is also needed when the data are not available through a transportation model. For example, fuel type distributions are needed to run MOVES. Default data on fuel type distributions for the county that have been vetted and recommended, would be useful.

Mode Shift Assumption

Mode shift was a significant uncertainty in the results found here, as the impact of the project on GHG emissions could vary substantially based on the mode shift factor assumption. This is largely because of the resultant impact of the mode shift factor on congestion mitigation credits. Congestion mitigation credits were calculated here by scaling local fuel savings data from Texas Transportation Institute's (TTI) *Urban Mobility Report*. This approach appears to substantially overestimate congestion mitigation benefits. Part of the reason for this overestimation could be because the default APTA mode shift factor is a system average that does not attempt to attribute changes to specific actions by the agency.

Impact of Congestion Mitigation on Truck VMT

Furthermore, the timescale in which the congestion mitigation benefits occur is unclear. Overall, more data and analyses are needed on the impacts, over both short and long timescales, of different types of transit on mode shift, congestion, and land use. Data specific to the local area would be best, but will probably require detailed local research studies over multiple years. Knowledge on impacts for different vehicle types would also be useful. Although not considered here, the impact of congestion mitigation on truck VMT is particularly important, as trucks typically have higher emission rates. If road widening (and decreased congestion) occurs, such that commercial trucks are more likely to use the route, this could increase GHG emissions.

Data on Construction Emissions

As noted in the scenario analysis results described in Section 3, construction emissions were not calculated due to lack of appropriate data. However, it is likely that data in the form needed for GHG estimation (total steel, cement, asphalt, and vehicle purchases) could be relatively easily produced during a routine project cost analysis. Hence, it is recommended that such aggregated estimates be requested during these analyses (e.g., a PD&E). Most of the other types of emissions not calculated here are expected to be small, except in the case of electrified transit projects for which emissions from electricity use should be calculated. However, when appropriate data are available for calculating and

allocating electricity use, stationary source fuel use, and maintenance emissions, they could be added to a project level analysis.

Analysis of Cumulative Impacts

Finally, it is noted that the temporal resolution and domain chosen for calculating emissions was the year. As GHG impacts are long-term in nature, analysis of cumulative impacts over a time domain of multiple years would be most appropriate. However, such an analysis would only be valuable if annual changes in emissions due to changes in economic factors, weather, etc. are calculated. These changes are difficult to predict as long-term dynamics between economics, transportation activity, mode shift and land use change are not well understood. Furthermore, transportation models do not currently handle these dynamics internally. Additionally, calculation over multiple years (with dynamic changes) would significantly increase the complexity of the analysis. Nonetheless, to capture the benefits of transit, such cumulative analyses should be a goal. Additional work should strive to develop an analytical approach for estimating emissions over a project's lifetime that strikes a balance among detail, credibility, and the organizational resources required for such an analysis.

Section 3: Greenhouse Gas Emissions Calculation Framework

A variety of tools are available for calculating GHG emissions from transportation planning activities. The appropriateness of a given tool will depend on the type and level of project being analyzed, the GHG producing activities involved, and the GHG pollutant types involved in these activities. In this section, the fundamental methods for emissions calculations for different types of GHG pollutants and transportation activities are reviewed. This is followed by a discussion of available tools for calculating GHG emissions from transportation. For both of these reviews, the focus is on the applicability of the tools for transit. Next, a case scenario is discussed that was constructed to demonstrate the calculation of GHG emissions from a transit improvement. Methods, results, data, and uncertainties are discussed.

Fundamentals of Methods Used for Calculating GHG Emissions from Transportation

Methods for calculating emissions differ from pollutant to pollutant and depend, in part, on both the specific emissions sources and the availability of necessary data. Following is a discussion of the fundamental basis of available methods.

Direct Emissions

Fuel usage based activity method for calculating direct CO₂ combustion emissions

Carbon dioxide is the largest contributor to global warming and, hence, is the most important pollutant to quantify. Direct emissions from transportation come primarily from fuel combustion. As CO₂ is the main product of combustion, with almost all carbon in the fuel oxidized to CO₂, high-level emissions inventory methodologies recommend basing CO₂ emissions on *fuel usage*, disaggregated by fuel type. Using this methodology, CO₂ emissions can be calculated as the following.⁴

$$\text{Emissions (kg CO}_2\text{)} = \text{fuel use (TJ)} \times \text{EF (kg CO}_2\text{/TJ)}$$

Where EF is the emissions factor and depends on the carbon content of the fuel. TJ is terajoule, or one trillion joules, a measure of energy. It can be calculated as follows.

$$\text{EF (kg CO}_2\text{/TJ)} = \text{fuel carbon content (kg C/TJ)} \times 44/12 \text{ (kg CO}_2\text{/kg C)}$$

The 44/12 ratio is a conversion factor for the molecular weight of CO₂ to carbon.

The advantage of using this approach is that it is directly related to the emissions source (fuel combustion). It also accounts for all carbon emitted from combustion (whether it is emitted as carbon dioxide, methane, non-methane volatile organic compounds, or particulate matter).

⁴ Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, prepared by the National Greenhouse Gas Inventories Programme, Eggleston, H.S., Buendia, L., Miwa, K., Ngara, T., and Tanabe, K. (eds.), Institute for Global Environmental Strategies, Japan, 2006. Available: <http://www.ipcc-nggip.iges.or.jp> [October 7, 2010]

For transportation agencies, combustion emissions of GHGs come from both stationary sources (boilers, furnaces, and on-site electricity generation) and mobile combustion (fuel combustion by vehicles.) For stationary combustion, a fuel-based method typically is used and, for the purposes of GHG inventories, it is determined from fuel consumption, based on meter reading, fuel purchase receipts, and changes in fuel stocks.⁵ For project planning purposes, estimation would require predictive attribution of stationary source fuel use to the project.

For mobile source combustion, fuel usage numbers are also difficult to obtain. Hence, calculations in higher-level (international, national, and state) inventories are often based on fuel sold, which can have uncertainties if fuel stockpiling or losses occur. For lower-level analyses, such as the transportation project level, data that can isolate the effects of a specific project directly on fuel usage by private vehicles would be needed. Calculations for such projects often rely on fuel economy data (miles per gallon), as the fundamental activity unit available is vehicle miles traveled (VMT), discussed below.

Travel activity based method for calculating direct mobile combustion emission of multiple GHGs

A second approach for estimation of mobile combustion emissions is based on *travel activity*, such as VMT. The approach is very similar to that used for conventional air pollutants emitted from transportation (such as CO and NO_x). In this approach, pollutant emissions are quantified as follows.

$$\text{Emissions (kg)} = \text{VMT (miles)} \times \text{EF (kg/ mile)}$$

VMT is the number of vehicles multiplied by the number of miles each travels on the roadway. The emissions factor (EF) will depend on many variables, including the fuel type, vehicle type and age, vehicle control technologies, vehicle maintenance, vehicle operating conditions, roadway characteristics, climate and environmental characteristics, and pollutant of interest. Vehicle speed often is used as one variable that attempts to capture some of the effects of operating conditions on emissions. To these calculated running emissions, cold start emissions (which can be large) are generally added, based on the number of cold starts expected per vehicle per year. Emissions factors, at a variety of levels of disaggregation by the above variables, can be calculated using emissions or emission factor models, such as USEPA's MOVES model (or the previous MOBILE6 model⁶). Emission factor values and algorithms in these models are based largely on empirical data recording emissions measured under a variety of conditions, and on theoretical mass balance calculations. These models take as their input transportation activity data on VMT and vehicle speeds from transportation modeling output. Vehicle class and age data, maintenance policies, fuel types, and other environmental input data are usually

⁵ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

⁶ U.S. Environmental Protection Agency, Office of Transportation and Air Quality, *MOBILE6 Vehicle Emission Modeling Software*, web site last updated May 10, 2010. Available: <http://www.epa.gov/OTAQ/m6.htm> [October 7, 2010]

based on state and local transportation and environmental databases, although USEPA provides guidance for default values, and Florida uses some of these.⁷

For CO₂, the calculation is often a hybrid of fuel activity and travel activity methods, where emissions are calculated by converting travel activity (e.g., VMT) to fuel usage using fuel economy values that depend on many of the same variables affecting conventional pollutant emissions factors. For CH₄ and N₂O, a travel activity approach is the only direct method available, though conversion factors have been applied to CO₂ emissions to estimate total GHG emissions. The calculation is very similar to the approach used for traditionally regulated pollutants emitted from transportation sources, and it relies upon data on transportation activity parameters available from transportation models.⁸ Hence, for project level calculations, this is the preferred approach for all three pollutants. However, an important issue with this approach is that, depending on the tool used, emissions factors can be either oversimplified or highly parameterized, and require a lot of input data. Many of the tools that use this method do not capture well the effects of accelerations (such as stop-and-go traffic) that increase fuel consumption (and CO₂ emissions).⁹ Improvements in the MOVES model, which allow calculation of emissions for specific transportation process activities at much higher disaggregation (e.g., such as speeds), are being designed to improve the calculation of emissions within a framework similar to the conventional methods.¹⁰

Fugitive and Indirect Emissions

CO₂ from catalytic converters of diesel vehicles

Emissions of CO₂ produced in the catalytic converters of diesel vehicles can be calculated as follows.¹¹

$$\text{Emissions (g)} = \text{urea additive consumed (g)} \times P \text{ (g/g)} \times 44/60 \text{ (g CO}_2\text{/g urea)}$$

Here, P is the mass fraction of urea (used as a chemical reducing agent), in the additive (purity). The amount of urea additive consumed is about one to three percent of the diesel fuel combustion. The default purity for national inventories is 32.5 percent. As the total emissions are a very small portion of

⁷ Wong, R., Florida Department of Environmental Protection, instructor comment in a training class on Air Quality Conformity Analysis, January 27-29, 2009.

⁸ ICF Consulting, *Assessment of Greenhouse Gas Analysis Techniques for Transportation Projects*, prepared for American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Environment as part of National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 17, Transportation Research Board, National Research Council, Washington, D.C., May 2006.

⁹ Transport Research Laboratory, *Methodology for Calculating Transport Emissions and Energy Consumption*, Project Report SE/491/98, 1999.

¹⁰ U.S. Environmental Protection Agency, Office of Transportation and Air Quality, *MOVES (Motor Vehicle Emission Simulator)*, web site last updated September 27, 2010. Available: <http://www.epa.gov/otag/models/moves/index.htm> [October 7, 2010]

¹¹ Intergovernmental Panel on Climate Change, *2006 IPCC Guidelines for National Greenhouse Gas Inventories*, prepared by the National Greenhouse Gas Inventories Programme, Eggleston, H.S., Buendia, L., Miwa, K., Ngara, T., and Tanabe, K. (eds.), Institute for Global Environmental Strategies, Japan, 2006. Found at <http://www.ipcc-nggip.iges.or.jp> [October 7, 2010]

the emissions from transportation,¹² these emissions can generally be omitted from smaller scale analyses.

HFC (and PFC) evaporative emissions

Hydrofluorocarbons (HFCs) and perfluorocarbons (PFCs) are emitted due to their use in mobile air conditioning systems. Leaked emissions can be calculated based on the number of vehicles with air conditioning technology using a specific compound multiplied by an emissions factor. Alternatively, consumption data for specific compounds can be used. Indirect emissions from empty containers that are off-gassing, air conditioning system charging activities, and end-of-life issues also must be added. Overall, these emissions typically make up a small portion of GHG emissions from transportation and often are quantified with simplified assumptions, because the data needed to estimate them can be extensive.

Indirect emissions from electricity use

GHG emissions from transportation agency activities can also be due to electricity, heating, cooling, and steam purchases. For inventory purposes, GHG emissions usually are calculated from monthly purchase billing and meter records. Such use often makes up less than five percent of the total emissions for a transit agency¹³ and is not usually relevant for project level analyses. However, as use of hybrid and electric vehicles increases, this may become a relatively more important contribution.

Other activities and effects

Construction and maintenance activities

In addition to direct emissions from vehicles, GHGs also can be emitted during construction and maintenance activities for transportation projects. The USEPA estimates that construction and maintenance equipment contributed 1.7 and 4.3 percent of N₂O and CH₄, respectively, of emissions from mobile combustion in the United States (US) in 2007.¹⁴

If calculated, the American Public Transportation Association (APTA) recommends using material-specific default emission factors with the metric tonnage of materials used. They provide default emissions factors for steel, cement, and asphalt use and revenue vehicles purchased. Combustion emissions during construction and maintenance can be calculated from fuel usage and emissions factors, similarly to the way emissions from on-road vehicles are calculated. However, the emissions factors are less well developed than for on-road vehicles, and APTA does not recommend including them in emissions inventories. If calculated, APTA specifies that construction emissions should be included for the year construction occurs, rather than amortizing the capital improvement emissions over multiple years. In part, this is because determination of the appropriate timescale of amortization

¹² According to the *USEPA Greenhouse Gas Emissions Inventory for 2007*, CO₂ emissions due to urea consumption from all non-fertilizer activities was 0.2 percent of transportation CO₂ emissions from fuel combustion.

¹³ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

¹⁴ U. S. Environmental Protection Agency, *Inventory of U.S. Greenhouse Gas Emissions and Sinks: 1990-2007*, Washington DC, 2009.

is complex. Because construction and maintenance account for small proportions of total emissions, they are often not considered in transportation project analyses. This omission may not always be justified. In the two case studies discussed in Section 4 that reported construction emissions, these were a sixth or more of the projects' lifetime total emissions. However, much of what was attributed to construction emissions was actually from the production of cement and other materials used in construction (i.e., life cycle emissions). A recent study has found that for transit, infrastructure contributes a larger share of project lifetime emissions, even though the total may be lower than for highway construction projects.¹⁵

Mode shift, congestion mitigation, and land use change

Transportation activities, including transit improvements, can have important impacts on emissions by causing changes in the choice of travel mode (driving, transit), by mitigating congestion, and by inducing or reducing demand through land use changes. Since these are not direct emissions, they are an optional calculation for GHG inventories. However, for transit activities, these effects often provide the GHG emissions credits (i.e., lead to emissions reductions), whereas direct emissions are debits (i.e., activities lead to emissions). Hence, to understand the benefits of transit, it is important to account for these in GHG emissions analysis. APTA provides recommended methods for calculating these effects for transit activities.¹⁶

The mode shift effects of transit can be estimated in a few different ways, including using a regional travel demand model, using data from natural experiments in which transit service was halted, or by application of a mode shift factor. Use of a regional travel demand model requires a model that dynamically captures mode shift (rather than one that inputs the mode distribution) and is calibrated appropriately for large changes in mode availability, which may not be available. Additionally, results of natural experiments are rarely applicable to other localities and do not capture long-term impacts. Hence, APTA recommends using a mode shift factor to estimate the VMT displaced due to the transit improvement. It is important to note that when estimating the change in emissions that result when people shift from driving to transit, it is necessary to consider two kinds of shifts between travel modes. One is the change in mode split between driving and transit, expressed as the proportions of trips made by the two modes in the area affected by the project. These changes might involve only a few percentage points (for example, a shift from 80 percent driving and two percent transit to 78 percent and four percent, respectively). The second is the mileage displaced by such shifts. The APTA guidelines use a mode shift factor to refer to the displacement of auto vehicle miles with transit passenger miles (it is the ratio of these quantities). A value less than 1.0 accounts for "transit-dependent" riders who would forego trips if transit were not available, and riders who would use modes other than driving or transit. To calculate VMT displacement by an improvement in transit, the mode shift factor is applied to the additional transit passenger mile activity created by the transit improvement. APTA outlines the use of

¹⁵ Chester, M. and A. Horvath, "Environmental assessment of passenger transportation should include infrastructure and supply chains," *Environmental Research Letters*, Vol. 4, 2009, pp. 1–8.

¹⁶ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

travel demand models, survey data, or default values (based on area size and population) to specify the relevant mode shift factor. Once the VMT displacement is known, the GHG emissions debit of this displacement can be calculated using the travel-activity-based method.

Transit improvements also are expected to impact emissions by mitigating congestion. Conceptually, as more people choose riding transit versus driving a personal vehicle, traffic volumes can decrease and vehicles may spend less time idling in traffic. Hence, less fuel will be consumed and less GHG emissions released. Based on previous work indicating that as traffic volumes increase, congestion increases exponentially, APTA discusses developing and extrapolating an exponential fit equation of the dependence of fuel consumption on traffic density. Alternatively, use of a travel demand model is suggested (if applicable, as discussed above). The exponential equation can be based on historical data from a given metropolitan area from TTI's *Urban Mobility Report* or based on local transportation data. Once the equation has been established, values of VMT displaced by transit (from the mode shift calculations, discussed above), can be used to calculate the effect of the transit improvement on traffic density (VMT per lane mile), the effect on fuel consumption (using the exponential equation), and ultimately, the effect on CO₂ emissions (using fuel-based emissions factors). If no data for a particular area is available from the *Urban Mobility Report*, APTA provides a method for using default data. It must be noted that the long term congestion effects of transportation improvements, including transit, are debated. As congestion decreases in the short term and people spend less time in congested traffic, this can lead to increased travel distances. With increased travel distances, more fuel will be consumed and emissions gains can be offset. In addition, decreased congestion could lead to less mode shift away from private vehicles, and a negative feedback cycle toward a similar equilibrium congestion level. The degree and timescales of these effects are unknown at this time.

Finally, transportation and transit improvements can have impacts on land use patterns that induce or reduce travel demand (in terms of distance traveled). Transportation improvements, such as road widening and highway infrastructure, historically have occurred concurrently with (and likely led to) decreased travel times, longer travel distances, changes in land use patterns in which daily activities are located farther from one another, and overall continued increases in VMT. Conversely, transit improvements have been found to likely induce more compact land use patterns and reduce travel demand as VMT. In tandem, effects include reduced trip lengths, trip chaining, increased use of human powered (bicycle and pedestrian) modes of travel, and reduced vehicle ownership. The interactions are complex, however, and the degree and timescale of impact depend both on the existing local to regional land use pattern and on the overall connectivity in the transit system. APTA suggests using a land use multiplier (the ratio of the emissions reduction from the land use effect to that due to VMT replacement). Land use multipliers can be estimated from complex, locally-specific analysis, or a default value can be used. APTA suggests two approaches for choosing a land-use multiplier, but only after noting: "...methodologies to measure the land use impacts of transit are evolving and local variables

strongly influence how to measure these impacts.”¹⁷ APTA recommends Methodology 1 below if possible, Methodology 2 otherwise.

Methodology 1: Locally Specific Analysis

An agency with sufficient capacity can undertake an analysis using a number of tools which disentangle the relationship between transit service and land use patterns, based on the Mixed Comparative approach employed by MTA [Municipal Transportation Authority, San Francisco]. These tools include the use of a four step model, statistical evaluation, and other types of GIS modeling ...

Methodology 2: Default Approach Using National Data

An agency without the capacity to run a regional study as described in Methodology 1 may use the national default multiplier of 1.9 calculated by the ICF study...^[18] This approach should be used only for sketch-planning applications or where there is another clear justification. This default should be considered a placeholder, pending future work to develop default emission factors that are disaggregated by size and type of region and transit system (for example, through further structural equation modeling work or a Delphi panel of expert opinions).¹⁹

Land use multipliers in previous studies have been found to range from about 1.3 to 9, with a default value of 1.9. However, there remains much uncertainty in these effects. Appropriate estimation methods are still in development.

Product life cycles

In addition to emissions during transportation activities, GHGs can be emitted during upstream and downstream activities throughout the life cycle of products and processes used in those transportation activities. These include emissions during the transportation fuel cycle (during drilling, exploration, production, and retail distribution) and emissions during a vehicle life cycle (during raw materials extraction, processing, transport, parts manufacturing, distribution, retail, maintenance, and disposal). Transportation decisions that affect fuel selection and vehicle ownership, therefore, can have important impacts on life cycle GHG emissions. These decisions are made at multiple levels, including those made by individuals in the purchase of private vehicles, and those made by transit agencies, government, and private companies in fleet management. Transportation decisions are also influenced by the fuel mix that is available to the region in response to requirements of the State Implementation Plan. Analyses of these emissions generally involve identifying and diagramming all the activities involved in the life cycle of a product (or process), preparing an inventory of materials and energy inputs and outputs

¹⁷ APTA Climate Change Standards Working Group, *Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 14, 2009, p. 46.

¹⁸ Bailey, L., P.L. Mokhtarian, et al., *The Broader Connection Between Public Transportation, Energy Conservation, and Greenhouse Gas Reduction*, ICF International, Fairfax, 2008.

¹⁹ APTA Climate Change Standards Working Group, *Recommended Practice for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 14, 2009, p. 50.

through individual activities and the system, and assessing the impacts of the inventory.²⁰ Although previous assessments have estimated that life cycle activities constitute a significant fraction of GHG emissions for transportation (upstream activities have been estimated at 18-43 percent of direct GHG emissions),²¹ performance of life cycle assessments is very data intensive and methods are still in development. Hence, assessment of life cycle effects is not yet a routine part of GHG transportation impact analyses.

Calculation Tools

AASHTO commissioned a review of available GHG calculation tools.²² The outcomes and recommendations from that review that are relevant to Florida processes are reviewed here. In addition, the review identified seven other models.

The AASHTO review categorizes available tools into three categories: 1) transportation GHG calculation tools, 2) transportation and emissions strategy analysis tools, and 3) energy and economic forecasting tools. All rely in some way on the above methods' fundamentals, but with different specific applications foci, different levels of inclusion of the breadth of GHGs and production activities, and varying levels of complexity and disaggregation. No one model is recommended by AASHTO as appropriate for all types of analyses. However, for different levels (from state to project) and types of analyses, specific tools are recommended. Hence, these models are further grouped based on the level of analysis, as categorized below.

Tools for forecasting national and international energy demand and consumption based on economic factors.

This category includes four of the models, the National Energy Modeling System (NEMS), VISION, the Systems for the Analysis of Global Energy Markets (SAGE), and the World Energy Protection System Transportation Energy Model (TEM). These were identified by ICF Consulting in a review for the American Association of State Highway and Transportation Officials (AASHTO). These are not applicable to the metropolitan regional and project level transportation analyses that CFIT will work with. These will not be considered further for CFIT.

²⁰ D.T. Allen and D.R. Shonnard, *Green Engineering: Environmentally Conscious Design of Chemical Processes*. Prentice-Hall, Inc.: Upper Saddle River, NJ, 2002.

²¹ ICF Consulting, *Assessment of Greenhouse Gas Analysis Techniques for Transportation Projects*, prepared for American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Environment as part of National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 17, Transportation Research Board, National Research Council, Washington, D.C., May 2006.

²² ICF Consulting, *Assessment of Greenhouse Gas Analysis Techniques for Transportation Projects*, prepared for American Association of State Highway and Transportation Officials (AASHTO) Standing Committee on Environment as part of National Cooperative Highway Research Program (NCHRP) Project 25-25, Task 17, Transportation Research Board, National Research Council, Washington, D.C., May 2006.

Tools for preparing state level inventories of GHG emissions, and forecasting future state-level emissions

Two of the models that ICF identified, the State Inventory Tool (SIT) and the State Inventory Protection Tool (SIPT) were designed for these purposes. These are not applicable to the kinds of analyses that CFIT will work with, and will not be considered further for CFIT.

Tools designed to calculate emissions from different kinds of transportation and fuel systems (such as comparing emissions from petroleum fuels, biofuels, and battery-powered vehicles)

This category includes two of the models that ICF identified, the Greenhouse Gases, Regulated Emission, and Energy Use in Transportation Model (GREET) and the Life cycle Emissions Model (LEM). The results of these models have potential applicability within a CFIT analysis, but the models are not designed for metropolitan regional and project level analyses and are complicated to run. Although alternative fuel cycles and vehicle types are important, these tools are not likely to be relevant for the scale considered here.

Tools for direct emissions estimation from project and regional-level transportation activities

This group includes APTA's GHG guidelines²³ and six models identified by ICF Consulting. These are MOBILE6, EMFAC, MOVES, NONROAD, the Climate Leadership in Parks Tool (CLIP), and draft guidance from the New York State Department of Transportation (NYSDOT). MOBILE6, EMFAC, and MOVES are related models that focus primarily on estimating emissions (or providing emissions factors) for on-road vehicular traffic in support of air quality regulations and are applicable to a broad range of transportation projects. MOBILE6 is a well-established emissions factor model developed by the USEPA and used for regulatory air quality analyses for transportation. It primarily estimates emissions factors for criteria pollutants, but has simplified capabilities for CO₂. NONROAD is the complementary USEPA model for non-road sources (excluding marine vessels, trains, and aircraft). EMFAC is California's version of MOBILE6, with detailed data relevant to California. MOVES is the new USEPA model that replaces MOBILE6 and is being developed to replace NONROAD. It eventually will incorporate both on-road and non-road sources, enhanced capabilities for GHG emissions, and some life cycle emissions. The draft NYSDOT guidance provides guidance and spreadsheet table data for similar calculations. CLIP is designed for analyzing transportation in national parks, but includes emissions from off-road and non-road vehicles and from non-transportation activities (such as park lodging). The APTA guidelines are most applicable for estimating an emissions inventory for an entire transit agency, rather than for a specific transit project. However, many of the methods they recommend can be adapted to the project level. In addition, the APTA guidelines have not been designed to compare emissions from transit with those from other kinds of transportation investments, and no tool has been built to implement the APTA guidelines.

²³ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

All of these models differ somewhat in their level of detail about vehicle technology and operating conditions, both of which are important in determining GHG emissions. Only the APTA guidelines (which are limited to transit) attempt to represent second-order effects of transportation investments, such as induced demand or land use changes likely to occur as a result of the investment and likely to affect use of the investment. All except CLIP, the draft NYSDOT guidance, and the default direct emissions methods in the APTA guidelines require significant investment in data and trained personnel to run the models. In part, the complexity is a result of detailed data and assumptions needed about vehicle operations and their effects on emissions. The ICF Consulting review considers MOVES the most capable of the models it reviewed, although many of the capabilities in MOVES were still in development at the time of their review. All of these tools have potential relevance to the design and implementation of CFIT.

Tools to estimate changes in travel and emissions from various transportation strategies

This group includes three tools, the EPA Commuter Model, the Intelligent Transportation Systems Deployment Analysis System (IDAS), and Trip Reduction Impacts of Mobility Strategies (TRIMMS®).²⁴ IDAS was designed for project level analysis to estimate changes in emissions resulting from installation of Intelligent Transportation Systems (ITS) technology (such as improved coordination of traffic signals). The EPA Commuter Model was designed for project level analysis to estimate changes in traffic and emissions resulting from efforts to manage commuting travel to worksites. TRIMMS® can accomplish both project level and regional analysis and was designed to estimate changes in commuter traffic and emissions resulting from the implementation of work site transportation demand management (TDM) strategies. TRIMMS® was developed under a previous project of the National Center for Transit Research (NCTR) and funded under FDOT. All three tools make greatly simplifying assumptions about vehicle technologies and operations, and their effects on emissions. Again, these models have potential relevance to the design and implementation of CFIT, in terms of estimating the effects of different project designs and implementations on emissions.

Tools to conduct cost-benefit or social-cost analyses

This group includes six models. These are the Surface Transportation Efficiency Analysis Model (STEAM),²⁵ the Spreadsheet Model for Induced Travel Estimation—Managed Lanes (SMITE-ML),²⁶ the Highway Economic Requirements System (HERS),²⁷ IMPACTS,²⁸ the Sketch Planning Analysis Spreadsheet

²⁴ Concas, S., and P. Winters, *Quantifying the Net Social Benefits of Vehicle Trip Reductions: Guidance for Customizing the TRIMMS® Model*, Final Draft Report, prepared for the Florida Department of Transportation by the Center for Urban Transportation Research, University of South Florida, Tampa, April 2009.

²⁵ DeCorla-Souza, P., "Using STEAM for Benefit-Cost Analysis of Transportation Alternatives," Paper No. 98-0083, *Transportation Research Record* 1649, 1998. See also DeCorla-Souza, P., "A Review of Applications of STEAM in Evaluating Transportation Alternatives", *ITE Journal*, February 1999, p.12.

²⁶ DeCorla-Souza, P., "Evaluation of Toll Options Using Quick-Response Analysis Tools: A Case Study of the Capital Beltway," prepared for presentation at the Annual Meeting of the Transportation Research Board, National Research Council. Washington, D.C., January 2003.

²⁷ DeCorla-Souza, P., "Evaluation of Toll Options Using Quick-Response Analysis Tools: A Case Study of the Capital Beltway," prepared for presentation at the Annual Meeting of the Transportation Research Board, National Research Council. Washington, D.C., January 2003.

Model (SPASM),²⁹ and the Social Cost Calculator (SCC).³⁰ The first five of these were developed by the Federal Highway Administration to estimate the effects of various factors, such as induced demand and multimodal transportation investments, on the benefit-cost ratios of proposed transportation alternatives. SCC was developed at the University of California—Davis to make a full accounting of the social costs of transportation investments and use. All models use greatly simplified assumptions about vehicle stock and technologies for reducing emissions. Indeed, some, such as SCC, require estimates of emissions as inputs and then calculate their costs. Others, such as STEAM, are not sensitive to the effects of small projects,³¹ and, hence, may not be appropriate for CFIT. Some use estimates of motor vehicle traffic volumes or transit use from other models, such as the typical four-step transportation planning model, and then either adjust the estimates to account for variables that the four-step models exclude, or apply cost coefficients to the inputs and sum the costs. Some of the adjustments, such as that for induced demand, are relevant to CFIT. In addition, from the perspective of providing a toolkit that is reasonably easy to use when comparing different kinds of projects, some of these models, such as IMPACTS, provide potentially useful examples to consider when designing the toolkit's user interface.

The carbon footprint calculators discussed here typically are used to measure GHG emissions for alternative transportation scenarios on a regional scale. Measuring the carbon footprint of proposed transportation improvements on a microscale is difficult because of issues related to defining the boundaries of the impact from small-scale improvements. The impacts of a transportation improvement on the larger community and vice versa (the impacts of community context on the functioning of the transportation improvement) are not separable. As a result, in long range transportation planning, individual transportation improvements are identified and developed to work together as a whole, based upon outputs from regional travel demand models. Ideally, the individual transportation improvements that are identified as needed are those that support the long range vision of the overall efficient system. However, the development of the vision for the ideal transportation system does not have the benefit of knowing how land development will actually occur.

While the local government comprehensive planning process includes the creation of a land use element that maps out where land development should take place and at what maximum defined densities and intensities, the market at the time of development determines what actually gets built and the location of these developments. The rezoning process causes land development (and the resulting needed transportation improvements to support that development) to stray from the original plan. Actual future growth is less than predictable, and the public demand for specific transportation

²⁸ DeCorla-Souza, P., *IMPACTS: Spreadsheet Software Documentation*, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., revised June 1999.

²⁹ DeCorla-Souza, P., *IMPACTS: Spreadsheet Software Documentation*, Federal Highway Administration, U.S. Department of Transportation, Washington, D.C., revised June 1999.

³⁰ Delucchi, M., *The Social Cost Calculator (SCC): Documentation of Methods and Data, and Case Study of Sacramento*, Institute of Transportation Studies, University of California—Davis, 2005.

³¹ Luebbbers, M., and E. Gabler, "Benefit-Cost Analysis in MPO Transportation Planning," presented to the Ohio-Kentucky-Indiana Regional Council of Governments and the Federal Highway Administration, November 8, 2007.

improvements arises within the political environment based upon perceptions of what is needed right now to address traffic congestion, in response to the needs generated by individual developments.

Example Application to a Bus Rapid Transit Project

To demonstrate and explore the use of GHG calculations for transit-related transportation planning, the methods and tools discussed above were applied to an example project. This section discusses: 1) the objectives addressed with this example, 2) a description of the example transit expansion case, 3) the calculation methods used, and 4) the results comparing GHG emissions with and without the project, and limitations revealed.

Objectives

The objectives of this example calculation were to:

- 1) demonstrate how GHG emissions can be calculated for a transit project,
- 2) identify analytical tools for the calculation,
- 3) identify data needs and limitations, and
- 4) identify limitations in approaches and methods available.

To make the example as relevant as possible to planning processes in Florida, the focus was on using data that would be routinely available to planners.

Case description: Fletcher BRT

To examine the calculation of GHG emissions from a transit project, a case study project was first selected for analysis. Selection was done through review of the Cost Affordable projects of the Hillsborough County (Florida) Metropolitan Planning Organization's (MPO) 2035 Long Range Transportation Plan (L RTP), through consultation with MPO staff and through discussions with the FDOT District 7 staff and its consultants who are responsible for running the Tampa Bay Regional Planning Model (TBRPM). Ultimately, the project chosen for the example calculations is the implementation of bus rapid transit (BRT) along Fletcher Avenue between Nebraska Avenue and I-75 (which will be part of a larger "North/South" BRT corridor running from downtown Tampa to I-75). In 2007, the Fletcher Avenue corridor had annual average daily traffic flows of nearly 58,000 at its west end near Nebraska Avenue, declining to nearly 40,000 at its east end near I-75.³²

The selected BRT project is part of the Cost Affordable 2035 LTRP. It has been approved for implementation by 2015,³³ and it is described in engineering design documents.³⁴ Specifically, the

³² Hillsborough County Department of Planning and Growth Management, 2007 Average Annual Daily Traffic Counts (A.A.D.T.), Available: <https://www.hillsboroughcounty.org/pgm/transportation/resources/publications/maps/trafficcountsmmap.pdf> [October 7, 2010]

³³ Metropolitan Planning Organization for Transportation, Newsletter of the Hillsborough County MPO, Issue 45, Fall 2009.

³⁴ HDR Transportation Consulting Group, *North/South Corridor BRT Project Development and Environment Study (PD&E) Preliminary Engineering Report, Final*, prepared for Hillsborough County. October 2009.

design includes BRT stations at eight intersections along Fletcher Avenue, the construction of a few bus bays and other roadway improvements, and installation of transit signal priority equipment at 12 intersections along Fletcher. The overall North/South corridor BRT system (including the Nebraska Avenue and downtown components) is planned to have service every ten minutes during peak hours and every 15 minutes otherwise from 5:30 am to 7:30 pm, with 14 BRT vehicles in operation at a time. Using transportation data available from the TBRPM, the analysis in the example considers the change in on-road GHG emissions per year from the corridor with BRT implemented, relative to the corridor without BRT.

It should be noted that a road widening project planned along the Fletcher corridor (the addition of two lanes from 30th Street to Morris Bridge Road) initially was considered for inclusion in the example. However, the widening project is currently unfunded, and its inclusion would make it more difficult to discern the impact of the BRT versus the road widening on GHG emissions (which could offset one another). Additionally, road widening was not included in the TBRPM runs available for this analysis. Therefore, the BRT project is the only one considered in the calculation, but the possible impact of road widening will be discussed in the discussion section.

Description of methods used

For the calculation of on-road GHG emissions effects of the BRT case study, we used an approach combining transportation activity data with emissions calculations by activity. For a project level analysis we used and adapted the methods presented in the APTA Guidelines.³⁵ The change in GHG emissions was calculated for the implementation of the BRT project along the Fletcher corridor.

On-road emissions

To the degree possible, corridor specific transportation data were obtained from TBRPM model run results provided by FDOT District 7 via their consultants. Data were provided from the 2006 Base run of the TBRPM, which is based on 2006 economic conditions and the existing transportation network. This provides the transportation activity data prior to the implementation of the BRT. Data provided for the Fletcher corridor (in both directions) include link by link data on link length, uncongested and congested travel times and speeds, and daily traffic volume by vehicle type. The vehicle distribution in the TBRPM is limited to light-duty vehicles (drive-alone and shared ride passenger cars and trucks) and heavy-duty vehicles (commercial trucks). It is noted that TBRPM assumes peak season (March) weekday conditions. No TBRPM model run results were available for which the BRT is included in the network, but with other economic and network infrastructure remaining the same as in the 2006 case. The lack of comparative model runs is not unusual for small projects such as this. Therefore, in order to investigate the impact of BRT implementation alone on GHG emissions, travel activity data from the 2006 TBRPM model run were instead adjusted to account for the addition of BRT and the reduction of passenger car VMT associated with mode shift.

³⁵ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

Daily vehicle miles traveled (VMT) for vehicle type i , (passenger autos versus trucks) on the corridor was first calculated using link lengths (L_l) and traffic volumes (V) by vehicle type i and link l from the TBRPM as follows.

$$VMT_i = \sum_l L_l V_{il}$$

Current (pre-BRT) and BRT bus VMT were calculated based on data in the Project Development and Environment (PD&E) study for the project.³⁶ Specifically, transit bus VMT was estimated as follows.

$$VMT_{bus} = (\text{No. of buses per day in each direction}) \times 2(\text{corridor length in miles})$$

A factor of two is used to account for travel in both directions. The number of buses per day in each direction was estimated as follows.

$$\text{No. of buses per day} = (\text{duration of service, hrs/day}) \times (\text{No. of buses per hour})$$

The PD&E study³⁷ for the project indicates that current bus service occurs 14 hrs/day, with service every 15 minutes (4 buses per hour in each direction). After implementation of the BRT, BRT service will occur approximately every 10-15 minutes (or about 4.5 buses per hour in each direction) and the headway for non-BRT bus service on the overlapping route will be doubled (number of buses halved). Two times the length of the Fletcher Ave. corridor (i.e., including both directions) is 11.66 miles. Annual VMT was calculated by multiplying by a factor of 365 for autos and trucks, and 260 for buses (assuming weekday service only).

Average vehicle speed on the Fletcher corridor was calculated from the TBRPM link data, by first calculating the average speed (corridor length divided by total travel time) for both congested and uncongested conditions, and then averaging the congested and uncongested speeds. It is important to note that the BRT system may have effects on vehicle speeds, which will impact emissions factors and, hence, estimated GHG emissions. Vehicle speeds could be impacted through congestion mitigation and the signalization priority system planned for the BRT. However, no data were available to estimate the impacts of such a system on vehicle speeds. Thus, no adjustments were made here for these effects.

Using the above annual VMT data, on-road emissions from the BRT project on the corridor were calculated by applying emission factors as recommended by APTA. The CO₂ emission factor (kg/mile) was calculated by estimating the fuel economy on the corridor based on the average corridor speed (resulting in 17.2 mpg), and using that to convert the default (kg/gallon) emission factor. Default emission factors and mass conversion factors (for CO₂e) were used for methane and nitrous oxide. Emissions of CO₂, N₂O, CH₄, and CO₂e were calculated by vehicle type (and total) prior to BRT implementation, for the BRT scenario, and the difference between the two.

³⁶ HDR Transportation Consulting Group, *North/South Corridor BRT Project Development and Environment Study (PD&E) Preliminary Engineering Report, Final*, prepared for Hillsborough County. October 2009.

³⁷ HDR Transportation Consulting Group, *North/South Corridor BRT Project Development and Environment Study (PD&E) Preliminary Engineering Report, Final*, prepared for Hillsborough County. October 2009.

On-road emissions credits due to mode shift

It should be noted that there are a few factors that are expected to impact the on-road GHG emission changes due to a BRT implementation. First, the additional buses will tend to increase GHG emissions since fuel usage per mile and hence emission rates are typically higher for heavy buses than for passenger cars (though this can depend on the bus engine technology and fuel used, and is not captured with the emissions factor methods used here). However, if bus service leads to sufficient replacement of passenger car VMT (mode shift), GHG emissions can be reduced.

Although quite important to estimating the effect of BRT on GHG emissions, there is large uncertainty about the magnitude of the mode shift to be expected. Information about the impact of BRT service on mode shift is limited to a few case studies of short term impacts, but indicates a short term impact of one to two percent reduction in VMT on a corridor. Additionally, a one percent increase in transit frequency has been found to lead to approximately 0.5 percent increase in transit ridership.³⁸ Most estimates of the impacts of BRT systems in the US have examined upgrades of regular bus transit systems to incorporate various elements of BRT, including some separation of the bus right-of-way from regular vehicle lanes. For cases such as the Fletcher Avenue BRT, which will be new service over part of its length, and which will operate in regular traffic lanes but with some priority at traffic signals, the most comparable system seems to be with routes in Phoenix, where the average daily boarding on three BRT routes range between 435 and 607.³⁹ Finally, it is expected that the degree of congestion on the roadway may impact the amount of mode shift, with higher congestion leading to higher shift toward modes that circumvent some of the congestion (such as BRT with signal priority). Projects that decrease congestion (such as road widening) are expected to decrease mode shift to BRT. However, the amount of this effect on mode shift is not well documented.

To account for mode shift effects, three sub-scenarios were studied here to study the range of impacts. For an upper limit, we assumed full buses with all passengers shifting from single-passenger vehicles (i.e., a mode shift factor of 1). The number of passenger auto VMT displaced was therefore estimated as follows.

$$VMT_{displacement} = (\text{No. of buses per day}) \times (\text{No. of spaces per bus}) \times 2(\text{corridor length in miles})$$

For the second subscenario, we assumed a short term mode shift effect of 1 percent, or $VMT_{displacement}$ of $0.01 \times VMT$ (i.e., a mode shift factor of 0.01 if the buses are full). For an area type and population like Tampa-St. Petersburg, APTA recommends a default mode shift value (0.47), which falls between these extremes. This default value was used for the third scenario. Note that all scenarios assume that the buses are full, since expected usage is uncertain. The adjustment factor used here can also be used to represent the product of an occupancy factor (spaces occupied divided by spaces available) and the true

³⁸ Dierkers, G., E. Silsbe, S. Stott, S. Winkelman, and M. Wubben. *CCAP Transportation Emissions Guidebook, Part One: Land Use, Transit & Travel Demand Management*, Center for Clean Air Policy. (n.d.), Available: http://www.ccap.org/safe/guidebook/guide_complete.html [October 7, 2010]

³⁹ Hinebaugh, D., *Characteristics of Bus Rapid Transit for Decision-Making (CBRT)*, Federal Transit Administration, Office of Research, Demonstration and Innovation, Washington, D.C., 2009.

mode shift factor (vehicle miles displaced divided by transit passenger miles added). Hence, the range of values studied can be used to represent the uncertainty in both these factors.

Other Indirect GHG Emissions Credits

To investigate the potential effects of the BRT improvement project on GHG emissions through congestion mitigation and the land use multiplier, simple methods outlined by the APTA guidelines were used to calculate impacts on CO₂ emissions. As noted earlier, results from the TBRPM were available only for conditions on Fletcher without the BRT Project. If results had been available from comparable runs of the TBRPM including the BRT project, the APTA guidelines specify using them to estimate emission reductions attributable to congestion reduction. However, when such results are not available, APTA guidelines provide options for using simpler but lower-quality methods. APTA does not recommend emissions calculations for CH₄ and N₂O, resulting from congestion mitigation or land use multipliers, because these are only sketch estimates. For congestion mitigation, CO₂ emissions credits were estimated from TTI's *Urban Mobility Report* (UMR) data as follows.

$$\text{CO}_2 \text{ (metric tons)} = (\text{EFC}/\text{UPT}) \times \text{TPT} \times \text{MSF}/\text{MSF}' \times \text{EF} / 1000$$

Here EFC is the excess fuel consumed due to congestion and UPT are the unlinked passenger trip values for the Tampa-St. Petersburg area from the UMR data for 2006 (39 million gallons and 24.9 million trips, respectively). TPT is the number of passenger trips added by the transit project. MSF is the mode shift factor for the area and MSF' is the mode shift factor used to calculate the EFC in the UMR data (0.8). EF is the default emissions factor of 8.81 kg CO₂ per gallon of fuel consumed. 1000 converts kg to metric tons.

To estimate the land use multiplier effect the APTA default approach was adapted to use the VMT displacement for each mode shift scenario. For this, emissions credits were estimated as follows.

$$\text{CO}_2 \text{ (metric tons)} = \text{VMT}_{\text{displaced}} \times \text{EF} \times \text{LUM}/1000$$

EF is the emissions per vehicle mile (calculated from vehicle speed, as discussed above). LUM is the land use multiplier (default 1.9). 1000 converts kg to metric tons.

Other Emissions

It is important to note that construction emissions were not calculated due to lack of appropriate data. APTA recommends estimating these based on the metric tonnages of materials used for the construction of the BRT improvements and transit bus purchases. These activity values can then be multiplied by the default APTA emissions factors (1.06, 0.99, 0.03, and 42, where the first three factors are metric tons of CO₂e per metric ton of steel, cement, and asphalt used, and the fourth is the metric tons of CO₂e per bus purchased) to calculate GHG emissions. This approach is similar to that used in the methodology developed by the California State Department of Transportation (Caltrans) and is used in two of the case studies in Section 4. However, the Caltrans methodology also estimates fuel

consumption by equipment in constructing the improvement, and uses what is probably older data.⁴⁰ The PD&E study provides cost estimates for construction that include estimates of materials needed. However, these data are highly disaggregated and cannot be directly used for this estimate. For projects in which a GHG estimate is required, it is recommended that aggregate materials data be calculated during the PD&E calculation of construction costs.

Finally, it is noted that no emissions estimations were made regarding maintenance activities, stationary source fuel use, electricity usage, or evaporative coolants. These emissions are expected to be small (or not applicable) for the project chosen here. However, emissions from electricity use could be important for electrified transit projects.

Results: project GHG emissions

Table 1 provides the overall impacts of the project on GHG emissions, for the three different assumptions of mode shift factor (MSF). This includes the change in on-road emissions from buses (including BRT), mode shift emissions credits from auto VMT displacement, congestion mitigation, and land use credits. Note that most of the emissions changes are credits (emissions reductions). For a MSF of one percent, CO₂ and CO₂e emissions are reduced, but emissions of N₂O and CH₄ are slightly increased (because emissions credits due to congestion mitigation and land use effects are not calculated for these latter pollutants). However, the changes are very small and represent less than one percent of the total on-road emissions from the corridor prior to the implementation of the BRT (42,874 metric tons/yr). Using the MSF recommended by APTA, the overall reduction is approximately 36 percent, and for the maximum MSF scenario, the reduction is approximately 77 percent of the total on-road emissions from the corridor prior to the implementation of BRT. These high proportions are due to very large credits from mode shift, congestion mitigation, and land use effects, and suggest that the high mode shift scenarios may be overestimates. It is important to note that construction emissions would provide emissions debits and, depending on their scale, could balance the credits calculated here.

Table 1 - Total GHG Emissions Changes (metric tons/yr) Associated with the BRT Project*

Pollutant	MSF = 0.01	MSF = 0.47	MSF = 1.0
CO ₂	(276)	(15,445)	(32,922)
N ₂ O as CO ₂ e	0.068	(7.24)	(15.66)
CH ₄ as CO ₂ e	0.010	(1.04)	(2.26)
Total CO ₂ e	(275)	(15,453)	(32,940)

* Values in parentheses are estimated reductions

⁴⁰ California Department of Transportation, *Energy and Transportation Systems*. Division of Engineering Services, Office of Transportation Laboratory. Sacramento, California, 1983, 350 pp.

Table 2 shows the change in total GHG emissions associated with different categories of emissions. On-road bus emissions provide the only emission debit (increase) due to the project, while the changes in emissions from other categories are credits. Mode shift credits alone overwhelm these debits for all but the lowest mode shift scenario. Land use credits are approximately twice as high as mode shift credits (due to the land use multiplier of 1.9). As a comparison, a land use credit of 4,426 metric tons/year is estimated if APTA default values for average vehicle occupancy (1.39 passengers/vehicle) and CO₂ emissions factor (0.436 kg/mi) are used, rather than locally specific values and scenario MSFs. The congestion mitigation credits are the largest credits; however, there is much uncertainty in this estimate.⁴¹

Table 2 - Total CO₂e Emissions Changes (metric tons/yr) Associated with the BRT Project for Each Type of Emissions

	On-Road Bus/BRT	Mode shift	Congestion Mitigation	Land Use*
MSF = 0.01	54.46	(38.1)	(220)	(72)
MSF = 0.47		(1,792)	(10,328)	(3,388)
MSF = 1.0		(3,812)	(21,975)	(7,208)

* Values in parentheses are estimated reductions

Table 3 provides insights into the scale of the mode shift (and resultant) credits. The bus and BRT VMT is very low compared with the total VMT on the corridor and less than the auto VMT displacement for all but the low mode shift (one percent) scenario. Overall, these data suggest that the implementation of the BRT may likely result in GHG emissions credits, even without considering the project's estimated effects on congestion or land use, which are highly uncertain. However, construction emissions could mitigate this credit, particularly if the project is estimated to have a low rate of displacing automobile VMT (APTA's mode shift factor). In that case, emissions from the additional bus VMT would exceed the effects of decreases in car VMT.

⁴¹ The results reported here for congestion mitigation are based on APTA's "Tier C" method. APTA's "Tier B" method, which it recommends over "Tier C", calculated even larger emission reductions from congestion mitigation, which are considered unrealistically large.

Table 3 - Annual Vehicle Miles Travelled for Different Scenarios on the Fletcher Study Corridor

VMT	Bus/BRT VMT	Auto VMT displacement	Total VMT on corridor
Pre-BRT scenario	169,738	-	83,523,904
BRT scenarios			
MSF = 0.01	275,824	(74,260)	83,555,730
MSF = 0.47		(3,490,229)	80,139,762
MSF = 1.0		(7,426,019)	76,203,972

Section 4: Case Studies from Other States

The states that are leading the way in incorporating climate change and GHG emissions into the transportation planning process were reviewed. Four case studies were prepared for this study. These case studies included two major bridge replacement projects, illustrated by the Columbia River Crossing (CRC) project in Washington and Oregon and the Goethals Bridge Replacement project in New York. The case studies also included a major urban transit project illustrated by The Urban Ring in Boston, Massachusetts, and a long range transportation plan (LRTP) for the San Francisco Bay Area, California. A complete write-up of each case study is included in Appendix A. The case studies varied in many dimensions, including:

- When, how, and why GHG emissions were introduced into the transportation planning process,
- Emissions modeling methodologies and assumptions, and
- The effect of GHG emissions analysis on decision making (which was often unclear).

The CRC project introduced GHG emissions analysis fairly early into the transportation planning process, based upon a determination that climate change was a cumulative impact and therefore needed to be addressed under the National Environmental Policy Act (NEPA).

The Goethals Bridge Replacement project of New York State included GHG emissions in its Draft Environmental Impact Statement (DEIS), but not in preliminary screening of alternatives. GHG emissions were included based upon criteria resulting from New York's 2002 State Energy Plan (SEP) that required GHG analysis for LRTPs, Transportation Improvement Programs (TIP), and regionally significant transportation projects. Currently, New York requires that its MPOs include GHG evaluation in its LRTPs and project level evaluation of regionally significant transportation projects. New York is also the only state to have developed a methodology for quantifying GHG emissions in transportation projects that enables this evaluation. GHG evaluations also are required in the State Environmental Quality Review (SEQR) process, New York State's version of NEPA.⁴²

The Urban Ring Project of Boston, Massachusetts compared GHG emissions only for the locally preferred alternative (LPA) and no-build scenarios in its DEIS, due to requirements under MEPA, Massachusetts' state version of NEPA, to evaluate GHG emissions and energy usage,⁴³ as well as requirements under the "Small Starts" program.

The San Francisco Bay Area's LRTP, Transportation 2035, considered GHG emissions from very early on in the planning process, as reduction in GHG emissions was one of the eight overarching goals guiding

⁴² New York State Department of Environmental Conservation, *Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements*, Draft, March 11, 2009. Available: http://www.dec.ny.gov/docs/administration_pdf/eisghgpolicy.pdf [October 7, 2010]

⁴³ Massachusetts Executive Office of Energy and Environmental Affairs, *Smart Growth/Smart Energy Toolkit, State Policies and Initiatives*. Available: http://www.mass.gov/envir/smart_growth_toolkit/pages/state-policy.html [October 7, 2010]

plan development. This stems from the aggressive GHG emissions reduction goals established in California's Assembly Bill (AB) 32.

Fuel-Based Versus Travel Activity-Based Estimation Tool

The main difference in emissions estimation methodology was the use of a fuel use-based versus a travel activity-based estimation tool. Fuel use estimations base their calculations upon long term energy consumption rates and the CO₂ byproduct of that consumption. Travel activity-based estimation tools add additional functions to existing tools, such as MOBILE, EMFAC, or MOVES, established to measure CO and other criteria air pollutants. Among the four case studies analyzed here, the CRC and Goethals Bridge Replacement made their emission estimates based on fuel use; while the Urban Ring and Bay Area LRTP based their estimates on travel activity. Each type of emission estimating tool has its own advantages, disadvantages, and level of data requirements, which will be discussed further.

Source of Emissions

Another methodological difference between the studies considered was the source of emissions considered in the analysis. The CRC and Goethals Bridge projects considered emissions from operations, construction, and maintenance; while the Bay Area LRTP and Urban Ring projects only considered emissions from operations. This could possibly be explained by the larger scales of the two latter analyses, as the Bay Area LRTP Environmental Impact Statement (EIS) stated that they did not feel confident estimating total construction emissions from the entire LRTP, but expected each major project to do so in its own environmental analysis.

Changes in Vehicle Technology

All of the cases examined made some effort to account for changes in vehicle technology during the lifetime of the projects, primarily by projecting changes in vehicle fuel economy based on applicable regulations. The applicable regulations varied, with Washington, Oregon, and California all using California's aggressive fuel economy standards, and New York's emission factors assuming little effort to improve vehicle fuel economy.

Spatial Scale of Traffic Analysis

The spatial scale of traffic modeling also varied slightly among the four case studies, as the CRC project only analyzed traffic on the two bridges affected by the project, while the other three studies analyzed regional traffic from existing or newly developed traffic models. The CRC project was also the only one to use micro-simulation tools to capture the effects of tolling and other detailed analysis. The selection of an appropriate scale of traffic analysis is an important and complex issue in GHG emissions analysis, as drawing the boundaries of a project can greatly influence both total emissions and changes in emissions generated by the project in question.

GHG Types

The last major methodological variant was which types of GHGs were considered in the emissions analysis. The CRC and Bay Area LRTP projects used conversion factors applied to CO₂ to estimate CO₂e

emissions of all GHGs, while the Goethals Bridge and Urban Ring projects only considered CO₂ emissions. Table 4 compares methodological and other features of the four projects.

It was often unclear what, if any, effect that the GHG emissions estimations had upon the selection of alternatives in the transportation planning processes. Each of the chosen locally preferred alternatives (LPA) had lower GHG emissions than the no-build scenario, but the Bay Area's LRTP was the only project that explicitly evaluated GHG emissions reductions when considering alternatives. Many of the other projects' goals and benchmarks would result in GHG emissions reductions, such as reduced congestion and VMT, or improved alternative transportation. This speaks to the synergistic effects of GHG mitigation strategies, and the possibilities inherent in multi-criteria or multi-pollutant based transportation planning strategies.

Table 4 – Case Study Features

Project	State	Year	Project Level	Year for evaluating project emissions	Modeling/ Estimation	Avg. Light-Duty MPG in project year	GHGs Considered	Types of Emissions	Adaptation Considered?	Change in GHG Emissions
Columbia River Crossing	WA & OR	Draft EIS 2008	Single Project	2030	Fuel use	2005:24.2 2030: 39.2	Used factor of 1.05 on CO ₂ to get CO ₂ e	Operations, Construction, Maintenance	Yes	2030 build -2 to +7% change from 2030 no-build (as presented in DEIS), +15-+17% (as estimated by CFIT project team)
Goethals Bridge	NY	Draft EIS 2009	Single Project	2034	Fuel use	2009: 19.33 2034: 20.73	CO ₂	Operations, Construction, Maintenance	No	2034 build 49-53% more than 2034 no-build
Bay Area LRTP	CA	Final EIS 2009	Regional Transportation Plan	2035	Travel activity	2006: 17.5 2035: 17.9-27.3	Used factor of 1.02 on CO ₂ to get CO ₂ e	Operations	Yes	2035 build 2% less than 2035 no-build
Urban Ring	MA	Draft EIS 2008	Regional Transit Improvement	2035	Travel activity	Values unclear, did not vary	CO ₂	Operations	No	2030 build 3% less than 2030 no-build

Estimated changes in emissions are highly dependent upon the assumptions made about regulatory based technological change. For the New York Goethals Bridge Replacement Project, the year 2006 estimated background conditions were estimated at 91.4 thousand tons per day of CO₂e emissions. The full project build-out at 2035 with no Pavley rules in place would result in a 27 percent increase in emissions; the Pavley Level 1 rules being in effect would cause the 2035 build-out to reduce emissions by six percent from the baseline conditions; and the Pavley Level 1 and 2 rules being in effect would cause the 2035 build out to reduce emissions by 16 percent from the baseline conditions.⁴⁴ Regardless

⁴⁴ Dyett and Bhatia Urban and Regional Planners, *Change in Motion, Transportation 2035 Plan for the San Francisco Bay Area, Environmental Impact Report*, Draft, State Clearinghouse No. 2008022101, prepared for the Metropolitan Transportation Commission, December 2008. Available: http://www.mtc.ca.gov/planning/2035_plan/EIR/draft/T2035Plan_EIR-Draft_Complete.pdf [October 7, 2010]

of the level of technological change, the 2035 project reduced emissions by two percent from the 2035 no project scenario, due to investments in transit and improved operations. Estimated emissions changes are summarized in Table 5.

Table 5 – Estimated Emissions Changes (in 000s of tons CO₂e/day)

Proposed Goethals Bridge Replacement, New York						
	<i>Standards</i>	<i>2006</i>	<i>2035 No Project</i>	<i>2035 Project</i>	<i>Change from 2006 to 2035 Project</i>	<i>Project change from No Project</i>
CO ₂ e Emissions	Pavley 1 & 2	91.4	78.6	77.1	-16%	-2%
CO ₂ e Emissions	Pavley 1 Only	91.4	87.3	85.6	-6%	-2%
CO ₂ e Emissions	No Pavley	91.4	118.3	115.9	27%	-2%

For the Urban Ring Project in Boston, changes in emissions were very small, even when comparing the 2000 baseline conditions and the 2030 projected conditions for the project and no project alternatives. Emissions were projected to increase by 9.5 percent from the background emissions if the project was not built and 9.1 percent if the LPA was built. Basically, even though the decrease in CO₂ emissions is approximately 378,000 pounds per day when comparing 2030 projections for the LPA versus no-build scenarios, this is less than one percent of regional emissions (approximately 0.3 percent, or 69,000 tons per year).

Conclusions

Several conclusions are drawn from the set of case studies.

Motivation for considering climate change

The state policy environment was important. Three of the four case studies incorporated climate change considerations into their transportation planning processes due to aggressive state level requirements, while the CRC Project based theirs upon interpretation of national standards that have been interpreted differently elsewhere. Strong state level leadership and legislation appears to be the best method for incorporating climate change into the transportation planning process regardless of the project and planning level. Washington's revisions to its SEPA requirements, made after the CRC analysis, would probably require GHG emissions to be considered if the same analysis were begun now.

While the four states reviewed here have taken strong leadership positions on GHG/climate change, it is understandable why many others have not. Many states and MPOs have taken a "wait and see" approach, anticipating federal requirements for GHG analysis and mitigation.^{45,46} The four states

⁴⁵ Volpe National Transportation Systems Center, *Integration of Climate Change Considerations in Statewide and Regional Transportation Planning Processes*, July 2009.

⁴⁶ Resource Systems Group, Inc., Summary Report, MPO Peer Workshop on Planning for Climate Change, n.d.

reviewed here, along with other States and MPOs incorporating GHGs into their transportation planning processes have approached the problem differently and developed a wide range of strategies and policies to mitigate and adapt to climate change. Federal regulatory actions would require these states and MPOs that are waiting for guidance to incorporate GHG emissions mitigation into their transportation planning processes while also standardizing requirements for those who have already done so. Such federal action would also serve to better integrate the global nature of climate change issues with the scope of regulatory requirements.⁴⁷ NEPA or Clean Air Act revisions are two possible mechanisms for implementing such a federal requirement. While strong federal leadership is recommended to address the global problem of climate change, some level of local flexibility also needs to remain present to allow states and municipalities to meet GHG emissions reduction goals according to local conditions and concerns. Federal guidelines also should be quickly updatable as climate change science and GHG emissions estimation methodology evolve.

Cumulative impacts vs. cumulative emissions

In several of the case studies, analysis of GHG emissions was motivated by a requirement either in NEPA or in state laws modeled on NEPA to consider cumulative impacts. Within the context of NEPA and similar state requirements, this refers to the need to consider the impacts of a project in the context of impacts from past actions and possible future actions. The impact of one project may appear small in isolation, but viewed in conjunction with other projects, the effect of all projects taken together may be large enough that it needs to be mitigated or avoided. The question then becomes whether the potential impacts of the project, considered with impacts of other projects and activities, are themselves large enough to warrant consideration under analyses of cumulative impacts. California's guidance for analyses under the state's CEQA law does not provide thresholds for making this determination for climate change and GHG emissions.⁴⁸ The revisions to Washington's SEPA do not do so either,⁴⁹ but allow individual agencies to set thresholds if they wish. Massachusetts' revised MEPA GHG emissions policy and protocol do not include significance thresholds, but are eventually expected to do so.⁵⁰ The

⁴⁷ Plumeau, P. and S. Law, "Meeting the Challenge of Institutional Fragmentation in Addressing Climate Change in Transportation Planning and Investment," *Journal of the Transportation Research Board*, No. 2139, National Research Council, Washington, D.C., 2009, pp 81-87.

⁴⁸ Text of the California Environmental Quality Act (CEQA) GHG Guidelines Amendments, December 30, 2009. Available:

http://ceres.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf [October 7, 2010] Discussion of the Guidelines by the California Association of Environmental Professionals notes the absence of thresholds. Hendrix, M. et al., *Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents*. Final, California Association of Environmental Professionals, June 29, 2007, 25 pp. Available: http://www.counties.org/images/public/Advocacy/ag_natres/AEP_Global_Climate_Change_June_29_Final%5B1%5D.pdf [October 7, 2010]

⁴⁹ State of Washington Department of Ecology, *Guidance: SEPA and GHG Emissions, Part 8, Significance Determination*, n.d. Available: http://www.ecy.wa.gov/climatechange/sepa_significance.htm [October 7, 2010]

⁵⁰ Commonwealth of Massachusetts, Executive Office of Energy and Environmental Affairs, *Revised MEPA GHG Emissions Policy and Protocol*. Effective Date May, 5, 2010, 17 pp., found at <http://www.env.state.ma.us/mepa/downloads/GHG%20Policy%20FINAL.pdf> [October 7, 2010]

Federal NEPA GHG Draft Guidelines designated 25,000 metric tons of direct CO₂e emissions annually as a “useful indicator” of when a project may have significant emissions. This threshold is based upon the Clean Air Act threshold for stationary emitters of GHG emissions.⁵¹ Canadian thresholds for inclusion of GHG emissions in their environmental assessment documents is based on industry or jurisdictional profiles,⁵² a promising approach that ties significance to the particular sector contributing emissions rather than a blanket national significance threshold.

In the context of climate change, cumulative emissions also refers to the lifetime emissions of a project or action, because most GHGs remain in the atmosphere for many years rather than washing out or fading away immediately (like conventional criteria air pollutants). Each year’s emissions add to the amounts accumulated from previous years, so that the impact of the project at the end of, for example, 20 years depends not just on the amount emitted in the 20th year, but also on the amount that has been emitted each year since it was implemented (including emissions to construct the project). Thus, for example, considering three projects that have the same annual emissions in their 20th year, a project “A” whose annual emissions increase slowly for 20 years has lower lifetime emissions than a project “B” whose annual emissions increase rapidly at first and then level off. However, project “A” will have higher emissions than a project “C” whose annual emissions increase slowly at first and then rapidly later.

None of the four case studies reported cumulative traffic emissions over a 20- to 30-year lifetime of the project, alternative, or plan being analyzed, although the Goethals Bridge analysis did report cumulative emissions from construction and maintenance. Otherwise, what the analyses reported were snapshots (one-year emissions calculated for one to three specific years). For example, the emissions for the Urban Ring Project of Boston was reported for a snapshot, with 2030 used as the year for which future conditions are estimated and year 2000 was used as the baseline conditions with which they are compared.

It is unclear whether any of the analysis teams was aware of the importance of cumulative emissions over the lifetime of the project, when considering climate change. Even if they had been, estimating the lifetime emissions would have required additional effort.

Limited tools to estimate emissions from construction and maintenance

Two of the case studies (Washington/Oregon and New York) reported estimates of the emissions that would result from constructing the projects being analyzed. The cumulative construction and maintenance emissions reported in the Goethals Bridge analysis, when averaged over the project

⁵¹ Sutley, N., Chair, Council on Environmental Quality, *Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions*, Memorandum for Heads of Federal Departments and Agencies, February 18, 2010. Available: <http://www.whitehouse.gov/sites/default/files/microsites/ceq/20100218-nepa-consideration-effects-ghg-draft-guidance.pdf> [October 7, 2010]

⁵² Canadian Environmental Assessment Agency: *Incorporating Climate Change Considerations in Environmental Assessment: General Guidance for Practitioners*, web site last modified September 10, 2010. Available: <http://www.ceaa-acee.gc.ca/default.asp?lang=En&n=A41F45C5-1&offset=3&toc=show#s21> [October 7, 2010]

lifetime, were roughly 40-50 percent of the final annual emissions of the project. From results presented in the CRC analysis, it is estimated that the comparable percentage may be roughly 15-17 percent for that project. However, without an emissions profile for traffic emissions throughout the lifetime of the project, it is hard to estimate what share of either project's cumulative emissions is attributable to construction. At the same time, the emissions from traffic on the CRC project differed by only a few percentage points among the alternatives analyzed for each project (reductions of two percent to increases of six to seven percent, relative to doing nothing, depending on the alternative); the Goethals Bridge analysis assumed that emissions from traffic would not differ among the alternatives, and the Massachusetts Urban Ring did not report emissions for the different alternatives. The small variation among alternatives suggests that more attention needs to be paid to estimating emissions from the construction phase of projects. Because the type of infrastructure and construction activities required for dedicated separate rail and BRT guide-ways are similar to those required to build roads and bridges, this suggests that construction emissions need similar attention when comparing proposals to construct transit right-of-way with proposals to construct highway facilities.

Both of the analyses that reported construction emissions used a model that Caltrans developed in the early 1970's, using data describing construction practices of that time.⁵³ Part of the existing (outdated) Caltrans methodology uses input-output coefficients that, in effect, say "if you spend \$X on this activity, you have Y impact", which, if updated, could be useful in estimating GHG emissions from construction. It is likely that construction practices have become more efficient since then,⁵⁴ and production of construction materials may also have become more efficient. If this is the case, then the standard tool probably overestimates emissions from construction. This would make the estimates—that 50 percent and 15-17 percent of emissions for the projects were from construction and maintenance—too high, although we cannot say by how much. An update of the Caltrans model and supporting data seems warranted.⁵⁵

The cost estimation phase would be the best time to make estimates of construction emissions because this is when the data needed to make such estimates will be collected. This is the phase during which

⁵³ California Department of Transportation, *Energy and Transportation Systems*. California Department of Transportation, Division of Engineering Services, Office of Transportation Laboratory. Sacramento, California, 1983.

⁵⁴ McGourty, K., E. Beirborn, and K. Dunlap, January 2009, *Columbia River Crossing Greenhouse Gas Emission Analysis Expert Review Panel Report*, prepared for the Washington State Department of Transportation and Oregon Department of Transportation, January 2009, p. 15. Available: http://www.columbiarivercrossing.org/FileLibrary/TechnicalReports/GHG_PanelReport_010809.pdf [October 7, 2010]

⁵⁵ During the course of our analysis, we became aware of a proposed NCHRP project to deal with the related problem of estimating construction vulnerability to increases in fuel prices. The NCHRP study will calculate the coefficients of \$X on highway construction activity Z that means Y gallons of petroleum. We contacted the TRB project officer to suggest a slight broadening of the project that would also update the data for the Caltrans model. The project officer replied that the panel that prepared the request for proposals was aware that the effort could have been made useful to a wider range of problems, but that the project scope was constrained by the budget available for the primary objective. Personal communication with Ed Harrigan, Senior Staff Officer, NCHRP, October 12, 2009.

estimates for quantities of materials, amount of earth-moving, hours of use of construction equipment (and its associated fuel consumption) are most likely to be available. Even if the analysis uses very general estimates (cost/paving one lane mile), one should be able to back out an estimate of materials, operational hours, etc. for this.

Regarding use of recycled materials for construction, given the age of the data in the Caltrans methodology, it is suspected that it does not have data on recycled materials per se. But an updated version ought to consider this. One of the things that has happened to the US steel industry since the early 1980s is that the US has switched from being a primary steel producer to a steel recycler. When the large old steelmaking plants were shut down, they were replaced by “mini-mills” that (1) generally are more energy efficient and (2) are that way because they tend to use scrap as a resource feedstock, rather than iron ore. Updated coefficients and data in the Caltrans model should capture this shift to recycled steel.

The American Public Transportation Association (APTA) has developed guidelines for estimating emissions from construction of infrastructure for rail or bus rapid transit projects.⁵⁶ However, these only include emissions from construction materials such as steel, asphalt, and cement, all of which require large amounts of energy to produce. The guidelines specifically exclude emissions from the operation of construction equipment, from construction-induced traffic congestion, and the transportation and disposal of construction waste. The guidelines also do not mention transportation of materials to the construction site. The APTA guidelines also specify that when construction emissions are reported, they are to be reported in the beginning year of the project rather than amortized over the life of the project, and the guidelines do not include calculation of a project’s cumulative lifetime emissions. An updated Caltrans-type model would include emissions from operations of construction equipment. Any updating of the Caltrans model needs to accommodate transit infrastructure construction as well as road construction.

Recent changes in federal fuel economy standards, and in the availability of transit buses that are more fuel-efficient than standard buses, give some urgency to the need to update the data and method used to estimate construction emissions. As vehicle fuel economy improves, emissions calculated using the existing Caltrans tool will become a relatively larger percentage of a project’s estimated lifetime emissions, when in fact construction efficiency might be improving at a comparable rate.

Scale for analysis and decision making

Although analysis of the CRC project between Washington and Oregon was motivated to consider GHG emissions through NEPA’s provisions for cumulative impacts, this is an uncertain foundation for such analysis. The Caltrans guidance under its state version of NEPA is that, with respect to climate change, the emissions differences between alternatives of a single project are small enough as to be

⁵⁶ American Public Transportation Association, Climate Change Standards Working Group, *Recommended Practices for Quantifying Greenhouse Gas Emissions from Transit*, APTA CC-RP-001-09, August 2009.

insignificant, and that program level emissions analysis and mitigation is the way to achieve results.⁵⁷ Equivalent processes in Washington and Massachusetts do not set thresholds. States may still require accounting for GHG emissions in the analysis of individual projects, but such analysis might not affect the record of decision.

The appropriate level of planning at which GHG emissions should be considered is a difficult question that the states have approached differently. Evaluations at the project level and at the wider level of a municipal comprehensive plan, regional plan or vision, or MPO LRTP each have their advantages and disadvantages.

The main advantage of project level analysis is the increased level of precision in estimating emissions. Unfortunately, this also leads to the main disadvantage for project level analyses, which is the increased amount of data necessary to achieve that level of precision. Data requirements for project level analyses and the difficulties involved in their attainment are discussed in greater detail in Section 3. These data requirements are related to the increased cost associated with evaluating each significant transportation project individually, something that may be difficult in times of economic downturn and reduced state and municipal budgets.

In the larger context of climate change, differences in the emissions for different individual project alternatives—even for something as large as the CRC—really may be too small. It may be more appropriate to make decisions about GHGs from transportation at a larger scale, either in the comprehensive planning process or in the development of the LRTP. Such analyses could examine strategies to reduce GHG emissions, and the effects of proposed packages of projects on emissions. From the perspective of limiting GHG emissions, individual projects would be approved as part of an area budget, similar to conformity analysis, and then allowed to proceed as long as they are consistent with the plan and the analysis on which it is based.

While program level emissions analyses are less precise than those at the project level, they do offer the advantage of being able to mitigate GHG emissions at a greater scale. If the transportation plans and policies of a MPO, region, state, or even the nation as a whole are designed to result in transportation projects with reduced GHG emissions, the necessity to evaluate emissions at a project level would seem to be eliminated. An example policy would be the shift in transportation planning from reducing congestion to reducing VMT discussed in Section 5. The concern associated with this type of larger level of planning and policy is whether or not project level decisions are made consistently with the goals and policies of the larger plan, something that would have to be monitored and enforced closely. One possible way to deal with this issue is to include compliance with municipal or regional GHG goals and policies as part of the review of each individual project under national or state environmental review processes.

⁵⁷ California Department of Transportation, *Environmental Impact Report/Environmental Assessment Annotated Outline*, Revised May 2010, 152 pp. Available: http://www.dot.ca.gov/ser/downloads/templates/ao/eir_ea.doc#Climate_Change [October 7, 2010]

Another advantage of analyzing and mitigating emissions at the comprehensive plan or LRTP level is the ability to integrate transportation with other strategic planning concerns that have GHG emissions implications, such as land use and economic development. Mitigation and emissions reductions have the greatest potential if these planning sectors are working in concert, rather than pursuing different goals.⁵⁸ The more holistic and system level planning and analysis at the plan rather than the project level seems to be the most cost-effective approach that can result in greater GHG emissions mitigation from transportation at a greater scale.

⁵⁸ California Air Pollution Control Officers Association: *Model Policies for Greenhouse Gases in General Plans, A Resource for Local Governments to Incorporate General Plan Policies to Reduce Greenhouse Gas Emissions*, June 2009, 250 pp. Available: http://www.ca-ilg.org/sites/ilgbackup.org/files/resources/CAPCOA_Model_Policies_for_Greenhouse_Gases_in_General_Plans_-_June_2009.pdf [October 7, 2010]

Section 5: Recommendations for Use of Methods and Tools in Florida Transportation Planning Processes

It was concluded in Section 4 that strong state leadership appears to create the most favorable conditions for incorporating climate change considerations into the transportation planning process. The Florida Transportation Plan (FTP) is currently undergoing review and update for the issuance of the FTP 2060. This is an important opportunity to incorporate GHG emissions reduction goals into the FTP. Furthermore, any land development must be consistent with the state and regional policy plans; therefore, in order for transit to be considered in land development, including Florida developments of regional impact (DRI), the state and regional policy plans should establish the role of transit service in meeting goals and objectives.

The analysis of case studies in Section 4 identified actions that other states have taken to reduce GHG emissions. Some ideas that may be considered from the Washington, New York, Massachusetts and California case studies for strengthening GHG emissions considerations for Florida statewide transportation planning include the following:

- Consider making GHG emissions reduction and mitigation a state funding criterion.
- Set statewide reduction goals for vehicle miles traveled (VMT) on a per capita basis for light-duty vehicles.
- FDOT should maintain a leadership position in reducing GHG emissions from transportation, strengthened by education and outreach programs on environmental responsibility and sustainability.

A review of five transportation planning processes used in Florida was conducted for this research study. These included the federal metropolitan planning organization long range transportation planning process (MPO LRTP) and transportation improvement programming (TIP) with application of federal Clean Air Act (CAA) air quality conformity analysis; the National Environmental Policy Act (NEPA) environmental review process with application of CAA air quality conformity analysis; the Florida local government comprehensive planning (LGCP) process; and the Florida development of regional impact (DRI) review process. A summary of recommendations is included below. Complete documentation of each planning process is included in Appendix B.

Florida's Development of Regional Impact Review Process

None of the states examined as part of case study review have a similar development of regional impact review process. Florida's DRI review process is designed to ensure that affected local governments communicate and coordinate efforts in determining the anticipated nature, magnitude, and location of proposed land development impacts. As a result of the DRI process, the host local government determines and assigns mitigation activities as part of a development order, as well as calculates and imposes fees to cover the costs of public facilities impacts from the development.

Challenges of the DRI Review Process

In a discussion of incorporating GHG emissions considerations into Florida planning processes, the DRI process holds the least potential, due to the scale of a single land development and due to limited process applicability.

Recommendations for Engaging the Florida DRI Review Process

Provided below are recommendations for maximizing consideration of VMT reduction and GHG emissions reduction through the DRI review process.

In the law, while highway capacity is discussed as transportation service, public transit is mentioned as mitigation and as a means to connect low-income persons with jobs while providing a DRI incentive to build more residential units. It is suggested that in the effort to develop a multimodal system, public transit as well as non-motorized modes also be considered primarily as transportation service.

While level of service (LOS) is defined by Rule as a qualitative assessment of a roadway's operating conditions or the average driver's perception of the quality of traffic flow, it is measured quantitatively as a measure of capacity. In the application for a binding letter, the pre-application conference checklist, the ADA application, and the Transportation Uniform Standard Rule, transportation service is defined in terms of highway capacity and congestion mitigation. Other elements of service quality are not considered. Much recent attention has been devoted to Quality/Level of Service (Q/LOS) measures to guide the development of a multimodal system. However, the DCA DRI evaluative instruments do not yet reflect this and should be updated.

The issuance of the FDOT *Transportation Impact Handbook* is a giant leap forward in incorporating multimodal options in DRIs, thereby providing the ground work for VMT and GHG emissions reductions. For the future, some further advances toward supporting multimodal options will include the suggestion in the *Transportation Impact Handbook* ADA Review Checklist that public transit improvements include not only site access improvements but also contributions toward off-site operational improvements in transit service itself, in much the same way developers commonly are asked to contribute to off-site roadway and intersection improvements. It will also help, when after local governments adopt level of service standards for bicycle, pedestrian, and transit service based upon quality as perceived by the traveler (instead of a capacity measure), that the *Transportation Impact Handbook* Checklists (ADA Review, DO Review, Project Monitoring & Report Review) will reflect the expectation of achieving and maintaining these QLOSs in much the same way that roadway LOS is expected to be maintained.

NEPA Reviews and Air Quality Conformity

Challenges from Project-Specific Evaluation

From this study of the NEPA review process as it relates to reducing GHG emissions, some observations can be made regarding the challenges of incorporating GHG emissions considerations into NEPA reviews. Unlike the MPO LRTP process, the NEPA review process is more limited in the way in which considerations for GHG emissions reductions can be incorporated, primarily due to the uncertainty introduced into GHG calculations that examine project level transportation improvements. This

uncertainty deals with the issue of defining spatial boundaries, as discussed more in Section 4. Despite these uncertainties, the President's Council on Environmental Quality (CEQ) is moving forward with draft guidelines on determining whether a proposed transportation improvement project should be evaluated for GHG emissions, based upon an emissions threshold. Recognizing potentially significant impacts from cumulative emissions, all four states that were reviewed as case studies have considered GHG emissions in their state level environmental reviews.

NEPA reviews are meant to be project-specific. As a result, air quality impacts of a proposed transportation alternative are evaluated based on the air pollutants generated by that alternative and their impact on the immediate area surrounding the project. Unlike the NAAQS criteria pollutants, the measure of interest for GHG emissions is not concentration but total emissions resulting from an alternative. If the draft CEQ guidance is adopted as is, then on a project scale, the impact of these total emissions, due to the project, would have to be 25,000 metric tons of CO₂e or greater annually in order for it to be considered potentially significant and worth evaluating.

However, GHG emissions impacts are not localized, which makes it difficult to quantify the global warming impact of the particular transportation improvement alternative on the neighboring social, economic and physical environment. The air quality impacts of anything larger than a project would not be evaluated through NEPA air quality conformity but through MPO LRTP conformity. For criteria pollutants that are regulated under National Ambient Air Quality Standards (NAAQS), the impacts of concern result from concentrations of the pollutant in the air as they affect the immediate geographic area surrounding the proposed transportation project. The Final Programming Summary Report that results from the Efficient Transportation Decision Making (ETDM) process recommends project alternatives. Presently, the ETDM process evaluates CO concentrations only.

Using the CRC case study as an illustration, some NEPA reviews define transportation improvement alternatives as various highway improvements combined with a transit option. Consequently, a direct comparison of the merits of a highway-only alternative with a transit-only alternative cannot be conducted. Also, the differences in one defined alternative from another, such as variations in alignment, can be so minor from a traffic flow standpoint that the calculated differences in GHG emissions among the alternatives may be smaller than the margins of error in the models used.

Recommendations for Engaging the NEPA Review Process

The outcomes of the MPO LRTP early planning screening analysis from the ETDM process play a major role in the definition of transportation improvement alternatives evaluated in the NEPA review. If the transportation alternatives to be reviewed are modally distinct, then it is possible to calculate the differences in GHG emissions from the modal alternatives.

The definition of a modal alternative in the wording of the NEPA Purpose and Need statement for the transportation improvement is critical to what alternatives would be considered. For example, if the need is to improve highway LOS and capacity, then a transit option is unlikely. It is recommended that particular care be exercised in the development of the Need and Purpose statement.

Depending upon the definition of those alternatives, the recommended GHG emissions calculation tools to apply may include MOVES if the data are available, IDAS for testing ITS strategies, and TRIMMS© as part of the ETDM programming screening.

GHG emissions considerations should be analyzed and included as part of construction, maintenance, and operations impacts using an updated version of the 1973 Caltrans methodology (Input/Output approach), discussed more in Section 4, as well as in mitigation options.

It is recommended that a GHG expert panel review the findings of a carbon footprint analysis of the candidate transportation improvement alternatives and that the analysis be prepared in a separate technical study appended to the Environmental Impact Statement (EIS) document. Such independent panel reviews could take place until the expertise for conducting such analyses can be provided by the resource agencies involved in conducting the ETDM programming screening.

MPO LRTP and Air Quality Conformity

Air quality conformity as presently conducted, concentrates on maintaining the NAAQS for criteria pollutants to protect public health. The results of the conformity analysis are reflected in transportation improvements that get prioritized in the MPO LRTP and TIP. GHGs are not criteria pollutants but the air quality conformity framework, in which states develop state implementation plans that stay within a budget designated by USEPA, could possibly be applied similarly to GHG reduction.

In the future, there is the possibility that federal law will require GHG emissions reduction as part of the metropolitan planning process and air quality conformity. For example, the discussion draft of a “climate change bill” called the American Power Act would provide performance grants to MPOs that are in compliance with the Act. As national attention continues to deliberate the best means to reduce GHG emissions through USEPA regulation or by changes to federal law, FDOT should continue to monitor these new developments and weigh in on the discussion as these are likely to change requirements at the state level.

Relevance of Available GHG Emissions Calculation Tools

The above review in Section 3 provided a comprehensive inventory and discussion of the available GHG emissions calculation tools. The tools that stand out as having the most advantages and applicability to the MPO LRTP process include the MOVES model that continues to be refined, and can be applied at the regional, jurisdictional and project levels. The primary limitation of MOVES is the need for extensive detailed data and the staff resources to collect and maintain such data, in order to use the calculation power of the MOVES model.

As part of the transportation studies that are undertaken in the development of the MPO LRTP, including modal systems, sub-area and corridor level studies, IDAS also is recommended for application in estimating changes in GHG emissions from ITS applications.

TRIMMS© can be applied to project level applications, areawide and corridor level studies to evaluate changes in commuter travel from worksite transportation demand management strategies. TRIMMS©

is an example of an off-model methodology that is a practitioner-oriented sketch planning tool, which quantifies net social benefits to society from the implementation of transportation demand management (TDM) strategies. These benefits include reductions in fuel consumption and emissions, global climate change impacts and congestion.⁵⁹ TRIMMS© evaluates employer-based program support strategies that affect access and travel times, such as TDM program support, alternative work schedules and work site amenities. TRIMMS© also evaluates strategies directly affecting the cost of travel, such as public transportation subsidies and other financial incentives provided to employees by their employers. Travel price and travel time elasticity are at the core of the TRIMMS© trip demand function and it estimates changes in travel behavior, such as change in mode share and VMT. TRIMMS© allows input customization and the ability to clearly differentiate between analysis at the regional and employer site levels. The regional level is either area-wide or multi-employer analysis that defines a scope where the number of travelers being affected by the policy under evaluation is represented by the total regional employment population or a specific target population, respectively. Model inputs for regional analysis include number of employers operating in the area and average employer size by major industrial sector. For TRIMMS©, the time of analysis is represented by the implementation duration of the TDM strategy. TRIMMS© uses output tables from MOBILE6 and is likely to use output tables from MOVES when MOVES becomes fully operational. These output tables provide emission factors specific to the geographic areas analyzed by TRIMMS©.

The main disadvantage of both IDAS and TRIMMS© is their use of greatly simplified assumptions about vehicle technology and operating conditions. With these caveats in mind, these tools could be applied as part of the ETDM early planning screening and again in the overall assessment of traffic operations and GHG emissions generation at the network level for various combinations of transportation improvements. For example, to evaluate the effects of new signalization on emissions, MOVES could be used but if ease of use is a priority, then IDAS could be substituted in exchange for less precision and detail.

With regard to the use of TRIMMS© for a regional analysis of the impact of TDM strategies on commute trips, this requires an ability to forecast the magnitude and geographic distribution of changes in travel patterns likely to result from more aggressive TDM programs. It also requires an ability to estimate the effect these changes will have on delay, speed, and travel time throughout affected corridors. For a research project recently completed for the Washington State Department of Transportation, the Transportation Demand Management Assessment Procedure (TDMAP) was developed as a sketch planning modeling approach to incorporate TDM into WSDOT's travel demand model. TDMAP does so by (1) extracting mode split tables from the model, (2) processing them to be compatible with TRIMMS©, (3) running the tables through TRIMMS©, and then (4) processing them back into the four-step model for distribution over the transportation network. The study resulted in the development of a

⁵⁹ Concas, S. and P. Winters. *Quantifying the Net Social Benefits of Vehicle Trip Reductions: Guidance for Customizing the TRIMMS© Model*, Draft Final Report, prepared for the Florida Department of Transportation, prepared at the Center for Urban Transportation Research, University of South Florida, Tampa, April 2009.

low cost method to help WSDOT plan TDM strategies as part of its overall transportation planning process.⁶⁰

A new proposed research project under the National Center for Transit Research (NCTR) has since been submitted to FDOT. The objective of this research is to extend the evaluation of transit emission reduction strategies to account for a broad spectrum of emission pollutants. The range of pollutants will include carbon dioxide (CO₂), carbon monoxide (CO), volatile organic compounds (VOCs), nitrogen oxide (NO_x), sulphur oxide (SO_x), and particulate matter (PM). This objective will be accomplished by extending the TRIMMS© model.⁶¹ It should be noted that the TRIMMS© model addresses impact of TDM strategies upon commute trips. For evaluation of alternative transportation improvements upon all trips, other tools would be necessary. This gap could be filled with the CFIT Toolkit.

Project Level Analysis

It is important to stress that measuring the carbon footprint of proposed transportation improvements on a microscale is difficult because of issues related to defining the boundaries of the impact from small scale improvements. The impacts of a transportation improvement on the larger community and vice versa (the impacts of community context on the functioning of the transportation improvement) are not separable. As a result, in long range transportation planning, individual transportation improvements are identified and developed to work together as a whole, based upon outputs from regional travel demand models. Ideally, the individual transportation improvements that are identified as needed are those that support the long range vision of the overall efficient system.

It is not recommended to evaluate bus transit service compared to a highway widening project at the scale of a highway segment or corridor. Shifting enough single occupant vehicle (SOV) travelers in a corridor to bus transit is unlikely in the short term and would unfairly discredit the potential for bus service to reduce GHG emissions. Bus service may achieve GHG emissions reductions that are higher than those reductions from highway widening, at the corridor or highway segment scale, only when the transit network is funded at higher levels and developed to achieve better system-wide service.

Cumulative Emissions

It is important to remember that the MPO LRTP represents emissions from a single year, including the base year, one or more intermediate analysis years, and the horizon year. Single year emissions calculations do not account for the cumulative effects of GHG emissions. Therefore, this is a limitation of the MPO LRTP process as presently conducted in accounting for carbon footprint.

⁶⁰ Winters, P., E. Hillsman, C. Lee, and N. Georggi, *Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model*, prepared for Washington State Department of Transportation, prepared at the Center for Urban Transportation Research, University of South Florida, Tampa, March 2010.

⁶¹ Concas, S., "Estimating Costs and Benefits of Emissions Reduction Strategies for Transit by Extending the TRIMMS© Model," proposal prepared for the Florida Department of Transportation, August 13, 2010.

Useful Ideas from Case Studies

Some ideas from the Washington, New York, Massachusetts and California case studies that might be considered for strengthening GHG emissions considerations in the Florida MPO LRTP process include the following:

1. As was done with the Columbia River Crossing NEPA review, assemble a GHG emissions expert panel within each MPO as part of the resource agencies and staff engaged in the ETDM process, to oversee the evaluation of proposed transportation improvement scenarios that are candidates for the LRTP. This independent review function could remain until the MPOs developed the in-house staff expertise to conduct such analyses.
2. Require MPOs to include GHG evaluation (Florida state law presently encourages only) in the LRTP process, set GHG emissions reduction targets and tie these targets to the LRTP/TIP. Make GHG reduction an overarching goal in the LRTP so that it directs transportation improvement scenario development right from the beginning of the process. Establish VMT reduction as a performance objective in the LRTP.
3. Require MPOs to develop a sustainable communities' strategy element in the MPO LRTP to reach the GHG reduction targets. The element would incorporate policies to establish land use development patterns supportive of GHG emissions reduction. Such policies would introduce land use planning on a regional scale.
4. Encourage MPOs to allocate a larger overall proportion of total transportation funding toward public transit projects. For example, San Francisco's Transportation 2035 LRTP allocated almost two thirds of its transportation funding toward public transit, approximately 30 percent to maintenance projects, and five percent to roadway expansion projects.
5. Encourage MPOs to devise transportation system improvement scenarios based upon a combined emphasis of climate protection, growth management and pricing.

Recommendations for Engaging the MPO LRTP Process

For MPOs that have the resources and staff to collect and organize into a database the necessary inputs required by the USEPA MOVES air emissions model, such as fuel mix data, acceleration/deceleration data, and more specific data on vehicle fleet mix, this could be incorporated into the Environmental Screening Tool (EST) of the Efficient Transportation Decision Making process. The results would provide calculations for GHG emissions that represent those produced by transportation improvement alternatives.

Whenever possible, MPOs should make use of travel demand model features that account for travel time, transit transfer time, and cost to calculate and incorporate changes in mode share. This will

ensure that mode share reflects conditions that support change. The travel model should also be run to reflect changes in travel due to congestion pricing and parking policies.

The MPO LRTP process sets the stage for NEPA reviews. LRTPs should contain strong transit-supportive goals for GHG emissions reduction through VMT reduction and policies for advancing multimodalism. Transportation control measures to be funded through LRTPs should advance public transit to decrease VMT with resulting decreases in GHG emissions. In the MPO LRTP process, planning studies can select a mode to consider later in a NEPA review.

Rather than solely reducing traffic congestion to reduce GHG emissions, the planning focus should be reducing VMT. For example, VMT-based user fees could influence location decisions and raise funds for public transit improvements. While it is argued that a VMT metric ignores the potential benefits of operations strategies and technologies,⁶² it is still essential to reduce VMT even if the rate of reduction of GHG emissions from VMT reduction decreases. This is because of the anticipated high rate of population growth in Florida over the next 30 years. VMT growth may outpace technology improvements.

In nonattainment and maintenance areas, the TIP also describes the progress in implementing required transportation control measures (TCM). This is a point in the process where calculation of carbon footprint from proposed transportation projects would be a useful criterion. Where projects can be shown to reduce the carbon footprint, this is likely the result of progress in implementing TCMs.

Florida's Local Government Comprehensive Planning Process

It may be more appropriate to make decisions about GHGs from transportation at a larger scale, in the comprehensive planning process, than at the level of individual projects, such as in NEPA reviews or DRIs. The LGCP process may hold the greatest promise in incorporating GHG emissions reduction considerations if a municipality-wide GHG emissions budget were established. The future proposed land development and the transportation improvements to support it could be evaluated for their long term impacts within the context of its consistency with and contribution to the overall growth management goals of the municipality.

In regard to the use of the LGCP process to advance the goals of reducing GHG emissions, the 2008 House Bill (HB) 697 amendments to comprehensive planning law are a positive start. Local governments that are preparing LGCPs are recognizing the necessity to address GHG emissions by reducing VMT. LGCPs generally contain numerous goals, objectives, and policies that are on target for reducing VMT by encouraging a balanced multimodal system that includes public bus transit.

Planning Expertise and Data Requirements

There remain several barriers to introducing explicit consideration of GHG reduction as a specific goal within comprehensive transportation planning. These barriers include lack of expertise in many planning

⁶² Policy Mechanisms for Integrating GHG Objectives into Transportation Decision Making, Results of NCHRP Project 20-24 (64), ICF International, webinar, May 18, 2010, slide 12.

agencies and lack of data regarding GHG emissions from transportation. The case studies of other states have found that efforts are underway elsewhere to incorporate GHG considerations into comprehensive planning. This includes the California Office of Planning and Research that is addressing climate change in their General Plan Guidelines.

Recommendations for Engaging the Florida LGCP Process

Provided below are recommendations for strengthening the LGCP process to support a shift in mode share to public transit, support VMT reduction, and decrease GHG emissions from transportation sources as a result.

Planning analyses could examine strategies to reduce GHG emissions, and the effects of proposed packages of projects on emissions. From the perspective of limiting GHG emissions, individual projects should be approved as part of an area budget, similar to conformity analysis, and then allowed to proceed as long as they are consistent with the plan and the analysis on which it is based. This could work if it were more difficult to amend LGCPs. Proposed land development projects should be designed to conform to the LGCP, and not the other way around.

Because GHG emissions are cumulative, it is recommended that the time horizon for a LGCP be longer, perhaps up to 60 years, to incorporate a meaningful jurisdiction-wide GHG emissions budget that encompasses the time required to stabilize the cumulative amount.

The consideration of GHG emissions reduction should be incorporated at the very beginning of the LGCP process, in the development of vision, goals, objectives and policies. GHG emissions should be an explicit overarching goal in the transportation, land use, natural resources, and intergovernmental coordination elements. The land use element should coordinate and be consistent with proposed regional land use policy planning efforts of the MPO. Plan objectives should include GHG emissions reduction targets.

It is recommended that the emphasis on congestion reduction should be changed to an emphasis on VMT reduction, thereby reducing GHG emissions. Increased transit investments should be combined with allowing highway congestion to occur, combined with parking controls. Hillsborough County provides an example of the development of a public transit LOS (TLOS) measure. High TLOS corridors may be designated along roadways operating at a deficient LOS. A greater level of transit service may offer an alternative and where mode shift may begin to occur. Lowering the roadway LOS standard to 120 percent of LOS E recognizes the use of congestion as a condition that supports mode shift to public transit and VMT reduction.

The results of this CFIT study conclude that achieving GHG emissions reduction through greater public transit use (VMT reduction) depends upon a LGCP that is more prescriptive with regard to physical planning and design, more detail-oriented, sets a GHG emissions budget to guide long term transportation investments, and discourages piecemeal plan amendments for accommodating land development proposals. If the comprehensive plan already achieves a high degree of internal integrity, then it is critical that community growth decisions abide by the plan.

Conclusions and Recommendations for Further Research

The benefits of this research are its contributions toward better delineating the available tools for calculating GHG emissions, establishing their applicability and strengths for analysis of different scales, identifying the types of data that are needed but not available for performing more accurate calculations, identifying the uncertainties introduced by the necessity to make assumptions about future conditions, and detailing ways to strengthen existing transportation planning processes to incorporate GHG emissions reduction considerations. These findings provide the framework for the next steps in a CFIT Phase II study that would develop information, guidance, and supporting tools, based upon the findings of CFIT Phase I. A series of spreadsheets for each of the planning processes would be adapted for consistency with those travel demand and emissions models identified as suitable from Phase I. The Toolkit will also include an “envelope” that relates the spreadsheets together for efficient data input, and a guidance manual for planning practitioners. Guidance would include default and example input databases for Florida counties and project types, specification of locally-specific input data files and factors for MOVES and guidance on the use of data output from typically used transportation models, such as the Tampa Bay Regional Planning Model and corridor simulators. A CFIT Phase II draft scope is included in Appendix C. The development of guidance currently underway for estimating emissions of conventional pollutants associated with transportation conformity in non-attainment areas could be leveraged to achieve this.

APPENDIX A: Case Studies from Other States

Introduction

Individual states have taken a range of actions to reduce GHG emissions and mitigate climate change from transportation, including:

- adopting numerical targets for reducing emissions (generally by governor's executive order or by legislation),
- inventorying GHG emissions,
- developing state climate action plans (33 completed and 3 under way⁶³),
- identifying transportation actions to be taken as part of efforts to reduce GHG emissions and meet the state targets, and
- incorporating GHG emissions considerations into the transportation planning process.

State departments of environmental protection and energy, not state DOTs, generally have led these efforts, although state DOTs have participated. Leading states in the effort to control GHG emissions from transportation include Washington, New York, Massachusetts, and California.

This section examines cases in each of these four states where GHG emissions were analyzed as part of the transportation planning process. These cases range in scope from the single project level in the Columbia River Crossing between Washington and Oregon, and the Goethals Bridge Replacement in New York, to a regional transit improvement in the Urban Ring Project in Boston, to a Long Range Transportation Plan for the Bay Area region of California. Each of these cases involved transportation planning processes that are analogous to one of the five Florida transportation planning processes discussed in Section 4. There is also a wide variation in the methods used to quantify emissions, while the reason that they were considered in all four scenarios was strong state level leadership and legislation on climate change. A common set of questions is used in reviewing all four cases to keep the review focused on issues important to the C-FIT project.

Washington/Oregon: Columbia River Project

Washington State is focusing on reducing transportation's impacts on climate change. The state's efforts have been directed towards both improving vehicle and fuel efficiencies and reducing vehicle miles travelled.⁶⁴ Although development of the state's original Climate Action Plan was led by the Department of Environmental Quality, the Washington DOT participated in that process and has co-chaired some subsequent efforts. It is heavily involved in interagency climate change programs statewide. The DOT

⁶³ Pew Center on Global Climate Change, Map of State Climate Action Plans. Found at http://www.pewclimate.org/what_s_being_done/in_the_states/action_plan_map.cfm.

⁶⁴ State of Washington, The Washington Transportation Plan 2007-2026 Part II: The Plan for the Future Section B: The Challenge, found at <http://www.wsdot.wa.gov/NR/rdonlyres/083D185B-7B1F-49F5-B865-C0A21D0DCE32/0/FinalWTP111406.pdf/>

secretary is the chairman of the AASHTO Climate Change Steering Committee. Washington also requires any transportation project that requires an EIS to consider GHG emissions and possible mitigation strategies. This includes both direct emissions from use of the roadway as well as indirect construction emissions.⁶⁵ Washington's governor has directed that climate change impacts and mitigation efforts become a funding criterion for all state disbursement by 2010.⁶⁶ In 2008, Washington became the first state to set statewide reduction goals for vehicles miles traveled (VMT) on a per capita basis for light-duty vehicles.⁶⁷

Describe the situation being analyzed.

This project is a proposed replacement for an existing Interstate Highway bridge across the Columbia River between Portland, Oregon, and Vancouver, Washington. The bridge currently carries over 135,000 vehicles per day and is projected to be congested for 15 hours a day in 2030 if no action is taken.⁶⁸ Seismic standards also are not met by the current bridge. Alternatives analyzed include No Build, Build with BRT, Build with Light Rail, and With and Without Tolling (but only for the Build alternatives; it is unclear why tolling the existing bridge, without expansion, was not considered). These were analyzed within the context of completely replacing the existing bridge or supplementing the existing bridge with an additional parallel bridge. There have been issues of inter-jurisdictional cooperation at both the state and local levels.⁶⁹

Following preparation of the draft EIS (DEIS), an expert panel was convened to review the analysis of the project's modeling of transportation demand. The review concluded that this modeling had been valid and comprehensive. Following the expert panel's review, the project has stalled, partly because of organized opposition to the project and partly because of the project's cost and the effects of the economic recession on tax revenues in both states.

Does the state in which the project occurs have a state-level planning process that serves the same purpose as a local government's comprehensive planning process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

As this project encompasses both the states of Washington and Oregon, both are considered here for discussion. The two states both have strong comprehensive planning and growth management statutes in place. Oregon has 19 overarching state planning goals, with which local government comprehensive

⁶⁵ Washington Department of Transportation, June 2008, Environmental Procedures Manual Chapter 440: Energy, found at <http://www.wsdot.wa.gov/publications/manuals/fulltext/M31-11/440.pdf>

⁶⁶ Washington State Department of Transportation, 2009, Summary Climate Change & Transportation Related Impacts by 2009 Legislation & Governor's Climate Change Executive Order 09-05, found at http://www.wsdot.wa.gov/NR/rdonlyres/CB205DC5-8AEF-4C24-87E5-12C35075F916/0/2009_Leg_Session_and_EO_Summary.pdf

⁶⁷ NCHRP Project 08-36 (94), Integrated State and Local Government Policy Approaches to Transportation and Climate Change: Summary of the Executive Peer Exchange.

⁶⁸ Columbia River Crossing Project Website, Background Section, found at <http://www.columbiarivercrossing.org/Background/AboutTheBridge.aspx>

⁶⁹ "Portland, Vancouver Political leaders Say New I-5 Bridge Plan Unacceptable" Oregon Live Website, January 2010, found at http://www.oregonlive.com/portland/index.ssf/2010/01/portland_vancouver_political.html

plans must be consistent before they are “acknowledged.”⁷⁰ Included in these 19 goals are transportation, energy conservation, and air quality.⁷¹ Similar to Oregon, Washington has 14 overarching state planning goals with which local government comprehensive plans must be consistent.⁷² Included in these state planning goals are: regional transportation, environmental protection, sprawl reduction, and concentrated urban growth.⁷³ Washington also is considering how to assist local governments in mitigating climate change through land use and transportation planning under its growth management act.⁷⁴

Does the state have a review process similar to Florida’s Development of Regional Impact (DRI) process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

There is no DRI-type review process in Oregon. Although one initially was included in the Land Use Planning Act, it was never used and was later deleted from the statute.⁷⁵ Washington also lacks a DRI process similar to that of Florida.

What documentation is available for review?

Project website is at <http://www.columbiarivercrossing.org/>. It includes the following:

- DEIS and supporting documentation
- Materials provided to the independent expert review panel and the report of the panel on the DEIS analysis of travel demand
- Selected press coverage from Internet sources

Is there any information on why climate change/GHG emissions were considered (advocacy groups, existing or anticipated legal requirements, etc.)?

Interestingly, the project description does not mention environmental benefits among its project benefits. The interpretation was that NEPA and court rulings did not require consideration of climate change, but that NEPA does require analysis of cumulative impacts and climate change is a cumulative impact. Following submission of the DEIS, Washington has adopted draft guidelines that require GHG emissions to be considered under the Washington State Environmental Policy Act (SEPA)⁷⁶ (its state version of NEPA).

⁷⁰ Oregon Department of Land Conservation and Development: Statewide Planning Goals, found at <http://www.lcd.state.or.us/LCD/goals.shtml>

⁷¹ *Ibid.*

⁷² Municipal Research and Service Center of Washington: Comprehensive Planning/Growth Management, found at <http://www.mrsc.org/Subjects/Planning/compplan.aspx>

⁷³ *Ibid.*

⁷⁴ State of Washington Department of Ecology: Climate Change Mitigation through the Growth Management Act, found at <http://www.ecy.wa.gov/climatechange/growthmgt.htm>

⁷⁵ Personal communication, Bob Cortright, Oregon Department of Land Conservation and Development, May 26, 2010.

⁷⁶ State of Washington Department of Ecology: SEPA Guidance on GHG Emissions, found at <http://www.ecy.wa.gov/climatechange/sepa.htm>

How were climate change/GHG emissions considered in the analysis—integrated from the beginning, added later, mitigation, adaptation, construction, operations?

It is unclear how early climate change/GHG emissions were included, but most likely from fairly early in the process and definitely as part of the DEIS under cumulative impacts. The DEIS considered the impacts of construction and operations on GHG emissions and mitigation of emissions.

Adaptation also was considered briefly, using the year 2030 as a basis for analysis.⁷⁷ Modeling revealed that increased winter rains (replacing snows) from global climate change processes could increase the height of the Columbia River in 2030 by five feet in the winter season in the project area, in a worst case scenario. Potential adaptation measures identified included raising the height of the crossing, ensuring that the design and materials of the crossing could withstand major storms and droughts, and avoiding or minimizing construction on 100-year and 500-year floodplains. The DEIS drew upon analyses that modeled future flows in the Columbia River for 50- and 100-year periods.

How was technological change considered (especially changes in vehicle technology/fuel consumption/emission regulations)?

Consideration of technological change is unclear and seems to have been collapsed into vehicle operating costs, which the review panel deemed reasonable even though model results are not particularly sensitive, even to fairly large differences (\$0.05-\$0.13 per mile). Baseline conditions in the analysis reflected regional and national averages, and future conditions were based on the “worst case” (high cost) projections made by the U.S. Energy Information Administration for 2030. Vehicle fuel efficiency for the 2030 analysis assumed implementation of the California Pavley standards,⁷⁸ which the two states adopted and were the basis of the recent changes in federal fuel economy standards. Full turnover of the light-duty vehicle fleet was estimated to yield an average of 39.2 miles per gallon (MPG).⁷⁹ Analysts used historical data on bus fuel consumption rates from the Tri-County Metropolitan Transportation District of Oregon (TriMet) to extrapolate bus fuel efficiency in 2030. No changes were assumed in construction/maintenance technology, and the report did note that this probably overestimated emissions from construction.

What modeling was done to estimate changes in vehicle- or person-trips or to estimate changes in emissions? In particular, how was VMT estimated? Describe the analytical approach and modeling, assumptions, shortcuts.

For operations (traffic) analysis, the analysis used the Portland Metro area’s four-step model (EMME/2), which includes car, transit, biking, and walking. The modeling includes fuel costs as part of vehicle operating costs, which affect mode split but not destination choice. The analysis assumed a real

⁷⁷ Interstate 5 Columbia River Crossing: Cumulative Impacts Technical Report, pp. 5-6 through 5-7, found at http://www.columbiarivercrossing.org/FileLibrary/TechnicalReports/Cumulative_Effects_TechnicalReport.pdf

⁷⁸ California Assembly Bill 1493, Chapter 200. Found at http://www.climatechange.ca.gov/publications/legislation/ab_1493_bill_20020722_chaptered.pdf

⁷⁹ Fuel Cost Assumptions within Metro Travel Demand Model, Tables 2-3, pp. 5-6, part of briefing package provided to the Travel Demand Review Panel that reviewed the methods used to estimate travel demand for the DEIS, found at http://www.columbiarivercrossing.org/FileLibrary/TechnicalReports/TravelDemandModelReview_PanelReport.pdf

(inflation-adjusted) increase in future vehicle operating costs of 32 percent. GHGs were modeled as fuel consumption to compute CO₂, and then multiplied by 100/95 to compute CO₂e. This is a simplification that EPA has used and appears to recommend, based upon the assumption that CO₂ comprises 95 percent of the warming potential of GHG emissions from passenger vehicles, on average.⁸⁰ Traffic projections in the analysis were based on the adopted land use plans for the target years (out to 2030); the 2030 network is based on the financially-constrained Long Range Transportation Plan, so the 2030 No-Build analysis includes projects within this alternative that are outside the Columbia River Crossing (CRC) study area. For detailed analysis, VISUM (a software system for travel demand modeling and network data management) and VISSIM (a microscopic simulation model of multimodal traffic flows) were used, the latter to analyze tolls, speeds, density, and throughput. Because all of the Build alternatives (but not the No-Build alternative) included tolling, the analysis included the existing bridge on I-205 that parallels the I-5 corridor, in order to account for diversion of vehicle traffic seeking to avoid the tolls.

To estimate emissions from vehicle operations, the analysis focused on how changes in traffic volumes and speeds on the two bridges affect fuel consumption and thus emissions, rather than considering changes in volume and speed in the larger regions served by the bridge. The analysts took this narrow spatial focus for the following reasons:

- Travel demand forecasts are relative in nature and emphasis should be put on changes in travel demand as opposed to absolute nominal values,
- The most pronounced change in travel demand, which identifies differences in project alternatives, was the difference across the I-5 and I-205 bridge crossings,
- The differences in total VMT for each alternative were miniscule, therefore not adequately illustrating the effects of each project alternative, and
- Estimating energy consumption as a function of VMT does not appropriately account for the operational benefits (i.e., increased speeds) of the project alternatives, which affects the amount of energy consumed.

The second and third of these reasons might not hold true in other kinds of projects and settings (for example, where traffic flows are not constrained to use one of a small number of bridges, or comparing the effects of tolling a bridge vs. not tolling it).

For emissions from construction, a 1973 methodology of the California Department of Transportation (Caltrans), the “Caltrans methodology” was used to estimate energy consumed in construction and then applied emission factors to the energy to estimate GHGs, including factors for primary energy used to generate electricity. The general approach is to estimate expenditures, then apply factors for energy consumption per dollar of expenditure of different types, and a factor to convert 1973 dollars (because the energy consumption per dollar is in 1973 dollars) to 2007 dollars (the nominal year for the NEPA analysis). This is the Input/Output approach, as opposed to the much more complex (but also much

⁸⁰ USEPA, 2005a, Emission Facts: Greenhouse Gas Emissions from a Typical Passenger Vehicle, EPA420-F-05-004, <http://www.epa.gov/otaq/climate/420f05004.htm#key>.

more accurate) process approach, which analyzes each segment of construction separately for energy consumption. This Input/Output methodology probably overestimates construction energy and emissions, since almost certainly there have been technological changes and energy efficiency improvements in the past 37 years, both in direct construction practices and in the production of construction materials such as cement, steel and asphalt. A presentation by the project staff draws a similar conclusion, noting also that the No-Build alternative estimate does not include emissions from maintenance.⁸¹

Another possible underestimation of project benefits resultant from GHG emissions reductions stems from the No-Build analysis not including two primary sources of congestion – bridge lifts and collisions. The four Build alternatives would eliminate bridge lifts and increase traffic safety on the replacement bridge, resulting in reduced congestion and GHG emissions not captured in the DEIS.⁸²

Additional inputs and a wider scope of highway emissions analysis are planned for the Final EIS (FEIS).⁸³

What was the spatial scale of traffic modeling?

Operations-related GHG emissions for highway traffic were estimated for the 0.9 mile river crossings at I-5 and I-205. I-205 was included to capture emissions from diverted traffic from the tolling system incorporated in the project. Traffic analysis in the DEIS showed that the alternatives analyzed did not have a large effect upon traffic volumes and speeds outside these two corridors, so the GHG expert review panel concluded that this limited traffic emissions modeling was acceptable, although they recommended expanding the spatial area being modeled to provide a more comprehensive and concise GHG emissions estimate in the FEIS.⁸⁴ Transit emissions were estimated from all transit in the regional system, which could explain why transit emissions were higher than highway emissions for the project. The GHG expert review panel recommended that this difference in spatial scale for highway and transit operations be emphasized in the FEIS to explain these differences.⁸⁵

Are the emissions reported for a snapshot, for the life of the project, or both?

Emissions from operations (vehicles) are presented only for snapshots of existing conditions (2005 base year) and a future year (2030). Emission estimates from construction are reported in a similar manner.

How large were the estimated changes in emissions relative to the estimated background conditions?

The current bridges were estimated to have 280,470 vehicles per day in 2005; the No-Build alternative, 394,000 in 2030; and the Build alternatives between 384,000 and 391,000 in 2030. The Build

⁸¹ Columbia River Crossing: Powerpoint Presentation to Expert Review Panel. Found at <http://www.columbiarivercrossing.org/FileLibrary/GeneralProjectDocs/PowerpointPresentationGHGpanel.pdf>

⁸² McGourty, K., E. Beirborn, and K. Dunlap, January 2009, Columbia River Crossing Greenhouse Gas Emission Analysis Expert Review Panel Report, found at http://www.columbiarivercrossing.org/FileLibrary/TechnicalReports/GHG_PanelReport_010809.pdf

⁸³ *Ibid.*

⁸⁴ *Ibid.*

⁸⁵ *Ibid.*

alternatives were estimated to have lower volumes because of tolling, increased transit, including light rail (LR) or BRT across the bridge, and general increases in high-capacity transit. Light rail was estimated to yield very slightly lower emissions than BRT (490.7 tons per day vs. 493.7) for the Supplemental Bridge option, but slightly higher emissions than BRT (452.4 tons per day vs. 452.3) for the Replacement Bridge option. The No-Build option would have 463.3 tons per day, and current emissions were estimated at 342.5 tons per day. These emissions estimates for the Build alternatives, all with tolling, are summarized in Table 1. These results are for vehicle operations only.

Table A1 - CRC Alternatives Emissions Estimates

<i>Alternative</i>	<i>CO₂e Emissions (tons per day)</i>	<i>Change from Existing</i>	<i>Change from 2030 No Build</i>
Existing	342.5		
2030 Alternative 1 (No Build)	463.3	+35%	
2030 Alternative 2 (Replacement, BRT)	452.3	+32%	-2%
2030 Alternative 3 (Replacement, LR)	452.4	+32%	-2%
2030 Alternative 4 (Supplemental, BRT)	493.7	+44%	+7%
2030 Alternative 5 (Supplemental, LR)	490.7	+43%	+6%

Because of the higher volumes, the No-Build alternative would have lower speeds and higher emissions. The higher emissions from the Supplemental Bridge options relative to the Replacement Bridge are almost entirely the result of conventional bus traffic for the supplemental bridge options. The difference in bus traffic on the bridge during the peak periods is modest between the two sets of alternatives, but the energy report indicates that the Supplemental alternative would include substantial additional local, feeder, and express bus service to serve the high-capacity transit (LRT or BRT) in this alternative, but not in the Replacement alternative.⁸⁶ The No-Build alternative, unlike the two Build alternatives, does not include tolling. However, an analysis of system-level choices suggests that tolling may reduce emissions of GHG by 1.8 – 3.3 percent; the larger reduction, if applicable to the No-Build alternative, might yield lower GHG emissions than any of the Build alternatives.

The DEIS did not attempt to combine construction emissions with emissions from vehicle operations, and it does not provide estimates of emissions from vehicle operations for years between 2005 and 2030. However, if we make the simplifying assumption that annual emissions from vehicle operations increase linearly throughout the life of the project from 2005 to 2030, and assume a 25-year project lifetime, then we can estimate a total lifetime emissions for the No-Build and alternatives. This yields Table 2. This indicates that including the construction emissions probably outweighs the projected reduction in emissions from vehicle operations. Increases in traffic under the No-Build option would increase emissions by 17.6%, but building any of the alternatives would increase emissions by roughly 35-38%, even after allowing for changes in the emissions from vehicle operations during the project

⁸⁶ Interstate 5 Columbia River Crossing: Energy Technical Report, pp. 1-5, found at http://www.columbiarivercrossing.org/FileLibrary/TechnicalReports/Energy_TechnicalReport.pdf

lifetime. Compared to the No-Build alternative, any of the build alternatives would increase emissions over the life of the project by roughly 15-17%. These conclusions must be viewed with some caution, because the model used to estimate construction emissions probably overestimates them, and the chance that our assumption of a linear increase in emissions from vehicle operations over the life of the project might underestimate the total. This does not consider some of the more detailed analyses of specific project options presented in the DEIS. But this does indicate that emissions from construction need to be considered, as do emissions over the whole life of the project. The assumed lifetime of the project is important. Assuming a 20-year lifetime would make construction's share of project emissions higher, while assuming a longer lifetime would reduce it (but increase total emissions from vehicle operations).

Table A2 - CRC Alternatives Emissions Estimates (estimated by C-FIT authors)

	<i>Construction CO₂e tons</i>	<i>Vehicle operations daily CO₂e tons</i>	<i>25-year total CO₂e tons</i>	<i>% change in total over 2005</i>	<i>% change in total over No- Build</i>
base 2005	0	342.5	3,125,313	0.0%	0.0%
No Build	0	463.3	3,676,463	17.6%	0.0%
Alternative 2 (with 16th Street Tunnel)	590,178.3	452.3	4,216,453	34.9%	14.7%
Alternative 2 (with McLoughlin Tunnel)	585,536.1	452.3	4,211,811	34.8%	14.6%
Alternative 3 (with 16th Street Tunnel)	608,224.0	452.4	4,234,955	35.5%	15.2%
Alternative 3 (with McLoughlin Tunnel)	603,472.0	452.4	4,230,203	35.4%	15.1%
Alternative 4	494,010.0	493.7	4,309,173	37.9%	17.2%
Alternative 5	509,171.2	490.7	4,310,646	37.9%	17.2%

What, if any, recommendations were made about how to conduct similar/future analyses?

The use of an expert review panel was recommended to facilitate analysis of GHG emissions for future transportation projects.

What, if any, effect did consideration of climate change/GHG emissions have in the decision making?

The Locally Preferred Alternative (LPA) for the project, a replacement bridge with light rail, had the lowest estimated GHG emissions of the five bridge alternatives. The LPA also had the largest improvement in traffic, transit, bicycle, and pedestrian safety and the least congestion and improved river navigation. This makes it possible that GHG emissions were factored into the selection of the LPA, along with other more traditional criteria.

New York: Goethals Bridge Replacement

New York is among the leaders in states that are working to reduce GHG emissions from transportation. In large part, this is due to energy supply and efficiency concerns that prompted development of a New York State Energy Plan (SEP) in 2002. One of the recommendations in the SEP was to include GHG considerations in transportation planning. Currently, New York requires that its MPOs include GHG evaluation in its Long Range Transportation Plans and project-level evaluation of regionally significant transportation projects. New York is also the only state to have developed a methodology for quantifying GHG emissions in transportation projects that enables this evaluation. GHG evaluations also are required in the State Environmental Quality Review (SEQR) process, New York State's version of NEPA.⁸⁷

How large were the estimated changes in emissions, relative to the estimated background conditions?

Estimated changes in emissions are highly dependent upon the assumptions made about regulatory based technological change. The year 2006 estimated background conditions were estimated at 91.4 thousand tons per day of CO₂e emissions. The full project build-out at 2035 with no Pavley rules in place would result in a 27 percent increase in emissions; the Pavley Level 1 rules being in effect would cause the 2035 build-out to reduce emissions by 6 percent from the baseline conditions; and the Pavley Level 1 and 2 rules being in effect would cause the 2035 build out to reduce emissions by 16 percent from the baseline conditions.⁸⁸ Regardless of the level of technological change, the 2035 project reduced emissions by 2 percent from the 2035 no project scenario, due to investments in transit and improved operations. Estimated emissions changes are summarized in Table 3.

⁸⁷ New York State Department of Environmental Conservation: Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements, March 11, 2009, Draft, found at http://www.dec.ny.gov/docs/administration_pdf/eisghgpolicy.pdf

⁸⁸ Dyett and Bhatia, December 2008, Transportation 2035 Plan: Draft Environmental Impact Report, found at http://www.mtc.ca.gov/planning/2035_plan/EIR/draft/T2035Plan_EIR-Draft_Complete.pdf

Table A3 – Estimated Emissions Changes (in 000s of tons CO₂e/day)

	<i>Standards</i>	<i>2006</i>	<i>2035 No Project</i>	<i>2035 Project</i>	<i>Change from 2006 to 2035 Project</i>	<i>Project change from No Project</i>
CO ₂ e Emissions	Pavley 1 & 2	91.4	78.6	77.1	-16%	-2%
CO ₂ e Emissions	Pavley 1 Only	91.4	87.3	85.6	-6%	-2%
CO ₂ e Emissions	No Pavley	91.4	118.3	115.9	27%	-2%

New York is among the leaders in states that are working to reduce GHG emissions from transportation. In large part, this is due to energy supply and efficiency concerns that prompted development of a New York State Energy Plan (SEP) in 2002. One of the recommendations in the SEP was to include GHG considerations in transportation planning. Currently, New York requires that its MPOs include GHG evaluation in its Long Range Transportation Plans and project-level evaluation of regionally significant transportation projects. New York is also the only state to have developed a methodology for quantifying GHG emissions in transportation projects that enables this evaluation. GHG evaluations also are required in the State Environmental Quality Review (SEQR) process, New York State's version of NEPA.⁸⁹

Describe the situation being analyzed.

The Goethals Bridge spans the Arthur Kill, a tidal strait between Staten Island, New York, and Elizabeth, New Jersey. It provides direct connections between the Staten Island Expressway/West Shore Expressway to the east, and the New Jersey Turnpike and US Routes 1 and 9 to the west. The Goethals Bridge corridor is an important link in the [regional transportation network](#).⁹⁰ The current bridge is 81 years old and has become functionally obsolete, necessitating a replacement. The Port Authority of NY & NJ is the project sponsor, and the U.S. Coast Guard is the lead agency for the EIS. The proposed replacement has bicycle and pedestrian facilities and opportunities for managed lanes and does not preclude the addition of a transit facility as a future project. The four Build alternatives for the project are Replacement North of Existing Bridge, Replacement South of Existing Bridge, Supplement North of Existing Bridge, and Supplement South of Existing Bridge.

⁸⁹ New York State Department of Environmental Conservation: Assessing Energy Use and Greenhouse Gas Emissions in Environmental Impact Statements, March 11, 2009, Draft, found at http://www.dec.ny.gov/docs/administration_pdf/eisghgpolicy.pdf

⁹⁰ Goethals Bridge Replacement Project Website: EIS Overview, found at http://www.goethalseis.com/eis/pdf/location_map.pdf.

Does the state in which the project occurs have a state-level planning process that serves the same purpose as a local government’s comprehensive planning process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

New York has a comprehensive planning process similar to Florida’s, although it appears to be less strict than that of Florida and some of the other states discussed in this section. State and local environmental reviews assess whether the action in question is in concert with the adopted comprehensive plan.⁹¹

Does the state have a review process similar to Florida’s DRI process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

New York does not have a review process similar to Florida’s DRI process.

What documentation is available for review?

The project Web site at <http://www.goethalseis.com> contains documents including:

- scoping process
- DEIS
- public comments
- public hearing transcripts

Is there any information on why climate change/GHG emissions were considered (advocacy groups, existing or anticipated legal requirements, etc.)?

The 2002 New York SEP is the legislative background for the inclusion of GHG emissions in project and plan analysis in New York. The SEP set goals for emissions five percent below 1990 levels by 2010 and 10 percent below 1990 levels by 2020. One of the measures identified to enable the meeting of these goals was the inclusion of energy and CO₂ analysis in the New York State Environmental Quality Review Act (SEQRA) process for LRTPs, TIPs/STIPs, and regionally significant transportation projects.

How were climate change/GHG emissions considered in the analysis—integrated from the beginning, added later, mitigation, adaptation?

It appears that climate change considerations were not integrated from the beginning, as they were not included in the alternatives screening analysis. Mobility concerns that affect GHG emissions were included in the alternatives screening, such as VMT reduction and reduction in SOV trips. GHG analysis was considered in the DEIS, however. Construction, maintenance, and operation impacts were considered along with mitigation options, but not adaptation. New York City and the State of New York are both currently evaluating potential climate change impacts and planning potential adaptation measures.^{92,93}

⁹¹ New York State General Counsel, Legal Memorandum LU09, “Defining a Community Through the Plan,” found at <http://www.nyupstateplanning.org/PlannersCorner/PDFsDOCs/CompPlanning/LegalMemorandumLU09.pdf>

⁹² State of New York Department of Environmental Conservation: Sea Level Rise Task Force, found at <http://www.dec.ny.gov/energy/45202.html>

⁹³ City of New York Department of Environmental Protection: Climate Change Program Assessment and Action Plan, found at http://www.nyc.gov/html/dep/html/news/climate_change_report_05-08.shtml

How was technological change considered (especially changes in vehicle technology/fuel consumption/emission regulations)?

Vehicle fuel efficiency for traffic operations was estimated following the state's Draft Energy Analysis Guidelines, dated 2003. These contain tables of fuel efficiency for different classes of vehicle, by year, through 2035, based on historical data through approximately 2002, U.S. Energy Information Administration projections through 2025, and extrapolations for 2026-2035. These predate efforts since 2003 to improve fuel economy standards and show an estimate of the average MPG of light duty vehicles at 20.73 in 2034 (the final year of analysis for the Goethals Bridge DEIS).

What modeling was done to estimate changes in vehicle- or person-trips or to estimate changes in emissions? In particular, how was VMT estimated? Describe analytical approach and modeling, data, assumptions, shortcuts.

A regional transportation model, the Goethals Transportation Model (GTM), was developed using both the New York Metropolitan Transportation Council's model and the New Jersey Regional Travel Model. Transportation improvements and major land use developments assumed to be in place by the forecast year also were included in the GTM.

Direct energy analysis was performed using the Urban Fuel Consumption Method, the preferred method advanced in the New York State DOT's Draft Greenhouse Gases Emissions Estimate Guidelines for Project-Level Analysis.⁹⁴ This method incorporates vehicle miles traveled, vehicle hours traveled, and the resulting speeds. The resultant fuel consumption figures were then used to estimate CO₂ emissions; 99 percent oxidation was assumed; therefore, this was used as a conversion factor. The New York DOT's guidelines do not include calculation of emissions of trace GHGs such as methane or nitrous oxide.

Construction emissions were estimated using the Input/Output approach from the 1973 Caltrans methodology, which assigns an energy-to-dollar ratio for construction activities, the same methodology used by the CRC study to estimate construction emissions. This approach is much simpler than a process approach, where every material and operational step in construction is assigned an energy value, but is much less accurate. The age of the methodology is also probably a source of inaccuracy, as construction vehicles and processes have increased their efficiency since 1973.

Maintenance emissions for the four Build and one No Build alternatives were estimated using a lane-mile approach based upon the 1973 Caltrans methodology, which is probably also outdated and an overestimation due to increases in efficiency.

When a preferred build alternative is selected, detailed quantitative CO₂ analysis will be performed, including mitigation options. This analysis will be documented in the FEIS.

⁹⁴ State of New York Department of Transportation, November 2003, Draft Greenhouse Gases Emissions Estimation Guidelines for Project-Level Analysis.

New York DOT is moving towards using the new MOVES model to replace its 2003 Draft GHG Emissions Estimate Guidelines.⁹⁵

What was the spatial scale of traffic modeling?

As previously discussed, a regional transportation model for affected areas in New York and New Jersey was developed from existing models in both states. This regional model resulted in a composite system with 3,685 traffic analysis zones.

Are the emissions reported for a snapshot, for the life of the project, or both?

The DEIS concluded that traffic volumes for the four Build alternatives would not vary among them, so it reported identical direct emissions (from vehicle operations) for each alternative. The report included estimates for the years 2014 (estimated time of completion, ETC), 2024 (ETC + 10), and 2034 (ETC + 20). The DEIS reported indirect emissions (from construction and maintenance) cumulatively for the entire 21-year period from the estimated start of construction (2009) to the final year of the regional LRTP (2030). It also annualized these. The construction and maintenance emissions were estimated to differ among the alternatives.

How large were the estimated changes in emissions, relative to the estimated background conditions?

The bridge replacement was estimated to reduce CO₂ emissions by 0.4 percent in 2014, 1.6 percent in 2024, and 4.6 percent in 2034, compared to the No-Build alternative when considering only direct emissions (all four Build alternatives were assumed to have the same effect upon bridge operations). When considering total (direct and indirect) emissions, bridge replacement options were projected to increase CO₂ emissions between 59 and 64 percent in 2014, between 55 and 60 percent in 2024, and between 49 and 53 percent in 2034 (the replacement bridges had greater construction emissions than the supplemental bridges). Most of the overall change in emissions was based upon construction of a new or supplemental bridge, which would be balanced out over time by decreases in operational emissions. Also, as mentioned previously, it is important to remember that the methodology for estimating construction and maintenance emissions was outdated and probably overestimated these emissions.

What, if any, recommendations were made about how to conduct similar/future analyses?

No recommendations were found about how to conduct similar analyses in the future.

What, if any, effect did consideration of climate change/GHG emissions have in the decision-making?

Consideration of climate change/GHG emissions did not seem to have any effect, which makes sense, as the only difference found was in construction impacts of the four Build alternatives, which varied by only seven percent. The No-Build option was not really an option, as the bridge was judged to be too operationally inefficient to not receive some sort of update. However, earlier alternative analysis did

⁹⁵ New York Department of Transportation: Comments on the Draft NEPA GHG Guidance, found at <http://www.whitehouse.gov/sites/default/files/webform/NY%20DOT.pdf>

not consider GHG emissions, which might have made a difference when considering transit alternatives. Traffic modeling revealed that there would not be enough riders to warrant a dedicated BRT lane or light rail on a replacement bridge with six lanes, and that dedicating a lane strictly to buses would result in unacceptable traffic volumes in the remaining lanes. However, conceptual designs for the bridge-replacement alternatives being studied in detail in the DEIS will not preclude the ability to include some form of transit in the future, if demand for such a system develops.

California: Transportation 2035 Plan, San Francisco Bay Area

California has determined that transportation accounts for 39 percent of its GHG emissions, and it has developed specific strategies to reduce these GHG emissions resulting from transportation activities. California is also the third largest consumer of gasoline in the world, behind the United States and China. While the state's strategies focus upon fuel/vehicle efficiencies, there also are directives in smart growth/land use planning and intelligent transportation systems that seek to reduce GHG emissions in California from transportation by reducing the number of vehicle miles traveled.⁹⁶ California also developed plans to include GHG emissions in the California Environmental Quality Act (CEQA), its state environmental review process, which was enacted on March 18, 2010.⁹⁷ Major transportation projects in California are required to analyze their GHG emissions, but most point to the climate change impacts of a single project as insignificant and emphasize the uncertainty and assumptions present in the current emissions estimation methodologies.^{98,99,100} The Environmental Impact Report (EIR) template developed by Caltrans actually contains boilerplate language dismissing the impacts of individual projects as insignificant,¹⁰¹ based upon the California Association of Environmental Professionals interim recommendations for addressing climate change under CEQA.¹⁰² Some California regional governing and planning agencies, including the San Francisco Bay Area, are addressing climate change more aggressively through the development of their Long Range Transportation Plans (LRTPs).

Describe the situation being analyzed.

Transportation 2035 is the LRTP for the nine-county San Francisco Bay region, developed by the Metropolitan Transportation Commission (MTC) that is the regional MPO, with extensive public and private consultation. It specifies the distribution of approximately \$218 billion in federal, state, and local transportation funds over the next 25 years. Analysis of the planned distribution of revenue by transportation mode for Transportation 2035 shows that almost two-thirds will be committed to public transit operations, maintenance, and expansion. Thirty percent is committed to street, road, and

⁹⁶ California Department of Transportation Business, Transportation, and Housing Agency, December 2006, Climate Action Programs at Caltrans, found at <http://www.dot.ca.gov/docs/ClimateReport.pdf>

⁹⁷ California Governor's Office of Planning and Research: CEQA Guidelines and Greenhouse Gases, found at <http://www.opr.ca.gov:80/index.php?a=ceqa/index.html>

⁹⁸ The Port of Long Beach and The State of California Department of Transportation, January 2010, Revised Draft EIR/EIS Gerald Desmond Bridge Replacement, http://www.dot.ca.gov/dist07/resources/envdocs/docs/Gerald_Desmond_Final_redraft_Feb2010.pdf.

⁹⁹ California Department of Transportation, November 2009, Final Environmental Impact Report, State Road 74 Lower Ortega Highway Widening, found at http://www.dot.ca.gov/dist12/docs/Lower74_FEIR/Chapter_2/2.5_Climate_Change.pdf

¹⁰⁰ California Department of Transportation, August 2008, Final Program EIR/Phase One EIS State Route 11 and the Otay Mesa East Point of Entry, found at <http://www.dot.ca.gov/dist11/sr-11/SR-11Final.pdf>

¹⁰¹ California Department of Transportation: Environmental Impact Report/Environmental Assessment Annotated Outline, found at http://www.dot.ca.gov/ser/downloads/templates/ao/eir_ea.doc#Climate_Change

¹⁰² California Association of Environmental Professionals, June 2007, Alternative Approaches to Analyzing Greenhouse Gas Emissions and Global Climate Change in CEQA Documents, found at http://www.counties.org/images/public/Advocacy/ag_natres/AEP_Global_Climate_Change_June_29_Final%5B1%5D.pdf

highway maintenance, with the remaining five percent dedicated to roadway expansion.¹⁰³ Transportation 2035 also commits \$400 million to a multi-agency Transportation Climate Action Campaign, focusing on education and outreach to reduce the carbon footprint of the region's transportation system.

It was estimated in 2007 that 40 percent of the Bay Area's GHG emissions resulted from transportation, the largest contributing category. The Bay Area was also the second most congested area in the United States, according to the Texas Transportation Institute.¹⁰⁴

Four alternatives to the Transportation 2035 Plan were analyzed, although GHG emissions estimates were developed for only the 2035 Plan and no project options. Alternatives included No Project, Heavy Maintenance/Climate Protection Emphasis (2035 Plan), Heavy Maintenance/Climate Protection Emphasis and Pricing, and Heavy Maintenance/Climate Protection Emphasis and Land Use options. Interestingly, the Heavy Maintenance/Climate Protection Emphasis and Pricing, and Heavy Maintenance/Climate Protection Emphasis and Land Use options were judged to be superior to the 2035 Plan overall (including in terms of GHG emissions reductions), but the regional agencies felt that they did not have the statutory authority to enforce these plan alternatives. It is also unclear why a combination of both pricing and land-use strategies was not considered as an option.

Does the state in which the project occurs have a state-level planning process that serves the same purpose as a local government's comprehensive planning process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

California has a local government planning process similar to Florida's. General Plans in California have seven required elements that guide local planning decisions, including land use, circulation (transportation), and conservation.¹⁰⁵ California's Office of Planning and Research is in the process of updating the General Plan Guidelines, including the addition of new guidance on addressing climate change.¹⁰⁶

Does the state have a review process similar to Florida's DRI process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

California does not have in place a review process similar to Florida's DRI process.¹⁰⁷

¹⁰³ Transportation 2035 Website, Metropolitan Transportation Commission, found at http://www.mtc.ca.gov/planning/2035_plan/

¹⁰⁴ *Ibid.*

¹⁰⁵ Governor's Office of Planning and Research, State of California, December 2005. California Planning Guide: An Introduction to Planning in California, found at http://www.opr.ca.gov/planning/publications/California_Planning_Guide_2005.pdf

¹⁰⁶ NCHRP Project 08-36 (94), Integrated State and Local Government Policy Approaches to Transportation and Climate Change: Summary of the Executive Peer Exchange.

¹⁰⁷ Governor's Office of Planning and Research, State of California, December 2005, California Planning Guide: An Introduction to Planning in California, found at http://www.opr.ca.gov/planning/publications/California_Planning_Guide_2005.pdf

What documentation is available for review?

The plan Web site at http://www.mtc.ca.gov/planning/2035_plan/ includes:

- Transportation 2035 Plan for the San Francisco Bay Area (April, 2009)
- Draft (December 2008) and Final (April 2009) EIRs for the 2035 Plan
- Performance Assessment Report for the 2035 Plan (December 2008)
- Travel Forecast Data Summary for the 2035 Plan (December 2008)

Is there any information on why climate change/GHG emissions were considered (advocacy groups, existing or anticipated legal requirements, etc.)?

GHG emissions were considered as a cumulative impact under CEQA, California's state version of NEPA. In 2007, SB 97 passed the California Legislature, requiring the Office of Planning and Research (OPR) to develop guidelines for the analysis and mitigation of GHG emissions in CEQA documents. An interim informal guidance was released in June 2008,¹⁰⁸ while the formal CEQA guidelines amendments were adopted on December 30, 2009.¹⁰⁹

Two other important pieces of California legislation also influenced the inclusion of GHG emissions in this analysis. The first is AB 32 (The California Global Warming Solutions Act, 2006), that required statewide reduction of GHG emissions to 1990 levels by 2020. SB 375, enacted in 2008, established a process for AB 32 to be implemented, requiring regional emissions targets by sector to be established by 2010. MPOs are required to develop a Sustainable Communities Strategy (SCS) element in their long-range plans to reach the GHG emissions reduction targets. The SCS adds three new elements to the plan: a land-use component, a resource and farmland protection component, and a demonstration of how the development pattern and the transportation network can work together to reduce GHG emissions.¹¹⁰ While these requirements will apply to the next Long Range Transportation Plan adopted after Transportation 2035, work has already begun on the region's SCS.¹¹¹ The SCS process might be a very promising method to reduce GHG emissions, as many MPOs have stated that they have little potential for GHG mitigation due to their lack of control over land use patterns.^{112,113}

How were climate change/GHG emissions considered in the analysis—integrated from the beginning, added later, mitigation, adaptation?

Climate change/GHG emissions were considered from the beginning of the long range transportation planning process as one of the eight overarching goals for the entire plan. Target 3 in the performance

¹⁰⁸ Governor's Office of Planning and Research, State of California, June 2008, Technical Advisory: CEQA and Climate Change, found at <http://www.climatechange.ca.gov/publications/agencies/OPR-1000-2008-018.pdf>

¹⁰⁹ California Department of Natural Resources: CEQA Guidelines Amendments, December 30, 2009, found at http://ceres.ca.gov/ceqa/docs/Adopted_and_Transmitted_Text_of_SB97_CEQA_Guidelines_Amendments.pdf

¹¹⁰ Metropolitan Transportation Commission: Planning and Climate Change, found at <http://www.mtc.ca.gov/planning/climate/>

¹¹¹ One Bay Area Project Website, found at <http://onebayarea.org/>

¹¹² Volpe National Transportation Systems Center, July 2009, Integration of Climate Change Considerations in Statewide and Regional Transportation Planning Processes.

¹¹³ Resource Systems Group, Inc., Summary Report, MPO Peer Workshop on Planning for Climate Change.

objectives for the plan called for reduction of GHG emissions to 40 percent below 1990 levels by 2035.¹¹⁴ Reduced VMT was also a performance objective for the 2035 Plan.

Adaptation was also a component of mitigation measures included in the Draft EIR. Engineering designs for new transportation projects were required to demonstrate that they were budgeting for and incorporating mitigation measures to adapt to projected sea level rise and increased storm surges where applicable.

How was technological change considered (especially changes in vehicle technology/fuel consumption/emission regulations)?

Regulation based technological change was considered by evaluating 2035 emissions (the full build-out of the plan) at three different levels of regulated technological change. These levels were No Pavley Standards, Pavley Level 1 Only, and Pavley Levels 1 and 2. Pavley Levels refer to Assembly Bill (AB) 1493 of 2002, which required regulations to achieve maximum feasible reduction of GHG emissions from transportation vehicles in California. Level 1 would set near-term emissions standards from 2009 to 2012 and mid-term standards from 2013 to 2016, while Level 2 would set long-term standards from 2017 to 2020, all for motor vehicles manufactured in the 2009 or later model year. The California Air Resources Board (ARB) calculated that in calendar year 2016, the Pavley Level 1 rules would reduce California's GHG emissions by 16.4 million metric tons of CO₂e, and by 2020, Pavley Level 2 would reduce emissions by 31.7 million metric tons.¹¹⁵

For the 2035 analyses developed in the Draft EIR, Pavley Level 1 standards reduced CO₂e emissions by 26 percent, while Pavley Levels 1 and 2 standards reduced emissions by 34 percent.

What modeling was done to estimate changes in vehicle- or person-trips or to estimate changes in emissions? In particular, how was VMT estimated? Describe analytical approach and modeling, data, assumptions, shortcuts.

MTC generated the vehicle activity data from its travel demand forecasting models, which move beyond traditional four-step travel demand models by also incorporating auto ownership models, working household models, and time of day models. Key model outputs included total daily vehicle trips, VMT, and distribution of VMT by speed.

Key assumptions that were made in travel demand modeling included the following: the price of gas was \$7.47 per gallon in 2035, using 2008 dollars; the average fleet fuel economy for the Pavley Level 1 and 2

¹¹⁴ Metropolitan Transportation Commission, December 2008, Transportation 2035 Plan for the San Francisco Bay Area: Performance Assessment Report, found at http://www.mtc.ca.gov/planning/2035_plan/Supplementary/T2035Plan-Perf_AssessmentReport.pdf

¹¹⁵ Dyett and Bhatia, December 2008, Transportation 2035 Plan, Draft Environmental Impact Report, found at http://www.mtc.ca.gov/planning/2035_plan/EIR/draft/T2035Plan_EIR-Draft_Complete.pdf
Fuel economy under the Pavley Standards would be similar to the revised federal fuel economy standards adopted in 2009-2010.

scenarios was 33.2 miles per gallon in 2035; and the average roadway speed on all regional roadways was 29 miles per hour in 2035.¹¹⁶

The latest ARB emissions model, EMFAC2007, was used to estimate CO₂ emissions. The technological change analysis was completed by using ARB spreadsheet models, as EMFAC does not yet incorporate the proposed new regulations for improved vehicle fuel economy and emissions. The spreadsheet model adjusts the emissions factors by model year, yielding factors adjusted by the age of the fleet. As EMFAC only provides CO₂ emissions, CO₂e emissions were estimated by multiplying CO₂ emissions by a factor of 1.02 to capture CH₄ and N₂O emissions from transportation in the bay area, as recommended by the Bay Area Air Quality Management District. This is similar to the process used in the CRC study, although a slightly different conversion factor was used (1.05 versus 1.02).

MTC has acknowledged the necessity for improved data and tools to better model and track GHG emissions in the future.¹¹⁷

Indirect construction-related GHG emissions were analyzed qualitatively, assuming that construction emissions would be quantified in detail and mitigation measures developed during the environmental review at the project level. This was based upon determinations that MTC had insufficient information to evaluate construction related GHG emissions at the program level. Maintenance emissions were not analyzed.

What was the spatial scale of traffic modeling?

The MTC's travel model for the San Francisco Bay Area region incorporates 1,454 regional TAZs in a region of 7,149 square miles.¹¹⁸ This system does not consider how transportation system improvements and resulting traffic patterns in the Bay Area affect traffic outside of the Bay Area.

Are the emissions reported for a snapshot, for the life of the project, or both?

Emissions are reported for the full build-out year of the LRTP 2035, and compared with baseline conditions from 2006. There is a very brief qualitative discussion of interim years, based upon the phase-in of the Pavley standards.

How large were the estimated changes in emissions, relative to the estimated background conditions?

Estimated changes in emissions are highly dependent upon the assumptions made about regulatory based technological change. The year 2006 estimated background conditions were estimated at 91.4 thousand tons per day of CO₂e emissions. The full project build-out at 2035 with no Pavley rules in place would result in a 27 percent increase in emissions; the Pavley Level 1 rules being in effect would cause

¹¹⁶ Metropolitan Transportation Commission, December 2008, Transportation 2035 Plan for the San Francisco Bay Area: Travel Forecast Data Summary, found at http://www.mtc.ca.gov/planning/2035_plan/Supplementary/T2035-Travel_Forecast_Data_Summary.pdf

¹¹⁷ Metropolitan Transportation Commission, September 2009, Transportation, Land Uses and Greenhouse Gases: A Bay Area Resource Guide.

¹¹⁸ *Ibid.*

the 2035 build-out to reduce emissions by 6 percent from the baseline conditions; and the Pavley Level 1 and 2 rules being in effect would cause the 2035 build out to reduce emissions by 16 percent from the baseline conditions.¹¹⁹ Regardless of the level of technological change, the 2035 project reduced emissions by 2 percent from the 2035 no project scenario, due to investments in transit and improved operations. Estimated emissions changes are summarized in Table 4.

Table A4 – Estimated Emissions Changes (in 000s of tons CO₂e/day)

	<i>Standards</i>	<i>2006</i>	<i>2035 No Project</i>	<i>2035 Project</i>	<i>Change from 2006 to 2035 Project</i>	<i>Project change from No Project</i>
CO ₂ e Emissions	Pavley 1 & 2	91.4	78.6	77.1	-16%	-2%
CO ₂ e Emissions	Pavley 1 Only	91.4	87.3	85.6	-6%	-2%
CO ₂ e Emissions	No Pavley	91.4	118.3	115.9	27%	-2%

What, if any, recommendations were made about how to conduct similar/future analyses?

No recommendations were found about how to conduct similar analyses in the future.

What, if any, effect did consideration of climate change/GHG emissions have in the decision-making?

The MTC adopted a significance criterion, based on guidance from the California Air Pollution Control Officers Association,¹²⁰ that the plan would have a potentially significant adverse impact if it would result in an increase in CO₂ emissions relative to existing (2006) conditions. Under this criterion, the EIR for Transportation 2035 found that the project’s “contribution to the significant cumulative impact of global climate change is not cumulatively considerable.” This is based upon full implementation of the plan with enforcement of Pavley Level 1 and 2 emissions standards, resulting in reduced emissions in 2035 from the baseline levels in 2006. The EIR states that increases in VMT are due to regional population growth (estimated at 26%) and employment growth (estimated at 50%) over the length of the plan, rather than the structure of the transportation system. This is supported by their modeling that shows that the 2035 project scenario compared to the no project scenario has about 2 percent fewer emissions, due to increased investments in transit and other alternative modes.

¹¹⁹ Dyett and Bhatia, December 2008, Transportation 2035 Plan: Draft Environmental Impact Report, found at http://www.mtc.ca.gov/planning/2035_plan/EIR/draft/T2035Plan_EIR-Draft_Complete.pdf

¹²⁰ California Air Pollution Control Officers Association: CEQA & Climate Change: Evaluating and Addressing Greenhouse Gas Emissions from Projects Subject to the California Environmental Quality Act, found at <http://www.climatechange.ca.gov/publications/others/CAPCOA-1000-2008-010.pdf>

Massachusetts: Urban Ring Project, Boston

Massachusetts is another leader among states mitigating transportation's effects on climate change. Like New York, Massachusetts requires large projects undergoing environmental review through the state process to quantify GHG emissions and identify measures to avoid, minimize, or mitigate such emissions.¹²¹

Massachusetts' Climate Protection Plan also established specific policies to achieve emissions reductions from the transportation sector. The policies include various smart growth and transportation demand strategies to reduce the amount of VMT in Massachusetts as well as the incorporation of energy use and GHG emissions as criteria in transportation planning decisions.¹²²

On June 2, 2010, Massachusetts' DOT launched "GreenDOT," a comprehensive environmental responsibility and sustainability initiative. The three guiding principles behind this program are reducing GHG emissions; promoting the healthy transportation options of walking, biking, and public transport; and supporting smart growth development.¹²³ GreenDOT's initial goal is to reduce the emissions of transportation GHGs to 7.3 percent below 1990 levels by 2020, which would be almost 30 percent below a "business as usual" scenario.

Describe the situation being analyzed.

The Urban Ring is a proposed major new BRT system that has been discussed since the 1970s that would run in a roughly circular corridor, serving Boston, Brookline, Cambridge, Chelsea, Everett, Medford, and Somerville. The project is divided into three phases. The project is currently in Phase 2, in the development of BRT service. Four preliminary Build alternatives are being analyzed: surface BRT routes (the locally-preferred alternative, or LPA), surface BRT routes with increased busway/buslane separations, short tunnel segments in highly congested areas, and longer tunnel segments.¹²⁴ It is estimated that the LPA would have 184,000 weekday daily riders in 2030 (an increase of 37,700 riders), which would divert 24,200 auto trips.

Does the state in which the project occurs have a state-level planning process that serves the same purpose as a local government's comprehensive planning process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

Massachusetts requires any city or town to have a Master Plan that includes elements such as circulation and land use.¹²⁵ All development and zoning must be consistent with the Master Plan. The process seems to be less developed and stringent than that of Florida, as updates and improvements of

¹²¹ Massachusetts Executive Office of Energy and Environmental Affairs: Smart Growth/Smart Energy Toolkit, found at http://www.mass.gov/envir/smart_growth_toolkit/pages/state-policy.html

¹²² The Commonwealth of Massachusetts: 2004. Climate Protection Plan, 54 pp.

¹²³ "Patrick-Murray Administration Announces GreenDOT Comprehensive Sustainable Transportation Initiative," Massachusetts Bay Transportation Authority website, press release, June 2, 2010, found at http://www.mbta.com/about_the_mbta/news_events/?id=19491&month=&year=

¹²⁴ Urban Ring Project Website, Urban Ring Facts, found at <http://www.theurbanring.com/urbanfacts.asp>

¹²⁵ General Laws of Massachusetts, Part 1, Title VII, CH 41: Improved Method of Municipal Planning. Found at <http://www.mass.gov/legis/laws/mgl/41-81d.htm>.

these plans are left to the discretion of local planning boards. The Urban Ring project cooperated with the seven local governments in its planning area to ensure that it was consistent with their Master Plans and also took into account relevant Institutional Master Plans required by the City of Boston for major medical and educational institutions.

Does the state have a review process similar to Florida's DRI process? If so, describe. If not, are any elements of such a process in place (describe any that are)?

Massachusetts does not have a statewide review process similar to Florida's DRI process. Interestingly, the Cape Cod Commission, the regional planning entity for Cape Cod, has its own DRI process in place.¹²⁶

What documentation is available for review?

The project website, <http://www.theurbanring.com/>, includes the following.

- Major Investment Study (MIS)
- Revised Draft EIR
- Technical reports
- Public comments
- Citizens Advisory Committee (CAC) meeting minutes

Is there any information on why climate change/GHG emissions were considered (advocacy groups, existing or anticipated legal requirements, etc.)?

GHG emissions were considered due to the requirements of MEPA, Massachusetts' "little NEPA." GHG emissions were ruled to be "damage to the environment," so large projects undergoing review were required to quantify their GHG emissions and identify mitigation measures.¹²⁷ Massachusetts recently revised its detailed guidelines for this type of analysis on May 5, 2010,¹²⁸ after completion of the draft EIR. In addition, estimated emissions of GHGs (CO₂ and methane) were determined for the LPA, as required in the FTA Final Rule for Major Capital Investment Projects ("New Starts").¹²⁹

How were climate change/GHG emissions considered in the analysis—integrated from the beginning, added later, mitigation, adaptation?

It is unclear exactly how early climate change and GHG were considered in the analysis. They are incorporated into the comparisons of the LPA and the "No Project" scenario in both the draft and revised EIR. Discussion of climate change appears in the section on energy consumption, but emissions of CO₂ are reported with emissions of criteria pollutants and not discussed separately even there. Adaptation is not considered in this project.

¹²⁶ Cape Cod Commission: DTI Brochure, found at <http://www.capecodcommission.org/regulatory/DRIbrochure.pdf>

¹²⁷ Massachusetts Executive Office of Energy and Environmental Affairs: Smart Growth/Smart Energy Toolkit, State Policies and Initiatives, found at http://www.mass.gov/envir/smart_growth_toolkit/pages/state-policy.html

¹²⁸ Massachusetts Executive Office of Energy and Environmental Affairs: MEPA Website, found at <http://www.env.state.ma.us/mepa/ghg.aspx>

¹²⁹ *Federal Register*, December 7, 2000, 49 CFR Part 611 Major Capital Investment, Final Rule, Appendix A, found at <http://frwebgate5.access.gpo.gov/cgi-bin/PDFgate.cgi?WAISdocID=010602401367+11+2+0&WAIAction=retrieve>

How was technological change considered (especially changes in vehicle technology/fuel consumption/emission regulations)?

Technological change was not considered in modeling analyses. There is discussion in the Revised DEIS about technology choice for the BRT buses, with choices eventually being made between emission-controlled diesels, compressed natural gas, or hybrid electric engine types once the project is further developed. There is no discussion of technological change for the light vehicular fleet away from which the BRT buses will be diverting trips.

What modeling was done? To estimate changes in vehicle- or person-trips? To estimate changes in emissions? In particular, how was VMT estimated? Describe the analytical approach and modeling, data, assumptions, shortcuts.

Travel demand modeling was done using a traditional four-step model in the EMME/2 software package. The modeled area encompasses 164 cities and towns in eastern Massachusetts, which include the 101 Boston Region MPO cities and towns and 63 communities outside of the MPO region. The mesoscale study area was developed in cooperation with the traffic engineers and data provided by Central Transportation Planning Staff (CTPS) for the project area. Total emissions were calculated for each study case/year.

Based on the regional extent of the project, CTPS provided comprehensive traffic data to reflect how each of the cities and towns and the Boston MPO would be impacted by the project. For each, calculations were performed using CTPS' regional model on a link-by-link basis by assigned volume, congested speed, and functional class for all significant roadways in eastern Massachusetts. The USEPA MOBILE 6.2.039 computer program was used by CTPS to estimate CO₂ emission factors from motor vehicles on roadways. Emission factors calculated by the model were based on typical motor vehicle operations as provided by the USEPA and Massachusetts Department of Environmental Protection (DEP).

Emissions analyses were estimated only for existing conditions, the No-Build scenario, a "baseline alternative" (a term used by FTA for a lower-cost alternative against which the benefits of the LPA can be compared), and the LPA (surface BRT routes). The DEIS did not analyze construction and maintenance emissions.

What was the spatial scale of traffic modeling?

The modeled area encompasses 164 cities and towns in eastern Massachusetts, which include the 101 Boston Region MPO cities and towns, and 63 communities outside of the MPO region. This area is divided into 2,727 traffic analysis zones (TAZ), with 101 external stations around its periphery that allow for travel outside of the model.¹³⁰

¹³⁰ Central Transportation Planning Staff, November 2008, Regional Travel Demand Modeling Methodology and Assumptions.

Are the emissions reported for a project snapshot, for the life of the project, or both?

Emissions are reported for a snapshot, with 2030 used as the year for which future conditions are estimated and 2000 used as the baseline conditions which they are compared with.

How large were the estimated changes in emissions relative to the estimated background conditions?

Changes in emissions were very small, even when comparing the 2000 baseline conditions and the 2030 projected conditions for the project and no project alternatives. Emissions were projected to increase by 9.5 percent from the background emissions if the project was not built and 9.1 percent if the LPA was built. Basically, even though the decrease in CO₂ emissions is approximately 378,000 pounds per day when comparing 2030 projections for the LPA versus No Build scenarios, this is less than one percent of regional emissions (approximately 0.3 percent, or 69,000 tons per year).

What, if any, recommendations were made about how to conduct similar/future analyses?

No recommendations were found about how to conduct similar analyses in the future.

What, if any, effect did consideration of climate change/GHG emissions have in the decision-making?

GHG emissions may have played a small part in the decision making process. Although the changes in emissions were small when comparing alternatives, the project was designed to reduce congestion and improve air quality and mobility, all of which are heavily associated with reducing GHG emissions and mitigating climate change.

APPENDIX B: Florida Transportation Planning Processes

Long Range Metropolitan Transportation Planning Process and Air Quality Conformity

Introduction

FDOT, like other state DOTs throughout the nation, depend on federal funding to build regional transportation infrastructure. Within urban areas, Metropolitan Planning Organizations (MPOs) are charged by federal law to undertake a long range transportation planning (LTRP) and transportation improvement programming (TIP) process. Complying with the prescribed planning and programming process is required in order to receive federal funding. The MPO process is required to demonstrate that transportation facilities built with federal funding will not contribute to air quality degradation. This demonstration of compliance with federal law is known as air quality conformity.

State highways that are part of Florida's Strategic Intermodal System (SIS) and other state roads of regional significance run through metropolitan areas. Non-state roads of regional significance connect to state roads. As a result, the outcome of the metropolitan planning process has a profound influence on the functioning of the state road system in metropolitan areas. In addition to FDOT's role as manager of the state transportation system and provider of funds for construction, operation, and maintenance, it also plays key roles in the MPO planning process, including serving as provider of the travel demand modeling software and technical support, planning process oversight and liaison with the federal government. According to federal law, if a federal-aid highway of regional significance is deemed to need improvements, then FDOT undertakes design, engineering, environmental, and construction phases in consultation with the MPO, the public transit provider, and other agencies. In this discussion of the MPO long range transportation planning process, the geographic area of interest is the urbanized areas that are served by state roads and public bus systems.

Under what circumstances would it be better to develop a public bus transit alternative along a state road than to widen the road? This project looks at GHG as one criterion to evaluate a bus rapid transit (BRT) alternative. In some cases, a public bus transit alternative might be a good option from a state department of transportation's point of view. For example, if some portion of urban area single-occupant vehicle local trips are shifted off state roads and onto bus transit service, this may free some state highway capacity for regional and interstate passenger and freight trips. Such an outcome would enable FDOT to better allocate its scarce resources to develop and maintain a more effective and efficient overall state highway system. This potential outcome, combined with the possibility of reducing GHG emissions by a switch from private auto travel to public bus travel, would contribute to an incorporation of transportation strategies that address GHG emissions from the transportation sector.

This is required by changes to the Florida local government comprehensive planning process made in 2008, as well as encouraged by Florida state law regarding the role of the MPO.¹³¹

The following discussion identifies the body of laws that govern metropolitan transportation planning and air quality conformity. It describes the existing processes and analysis methods. The discussion identifies the point in the processes where alternative transportation solutions are considered, developed, and evaluated, including air quality merits of alternative scenarios. The discussion evaluates the adequacy of the existing planning process and analysis methods to consider GHG emissions as a criterion for selecting alternative transportation solutions. Recommendations are given for incorporating GHG emissions considerations into the planning and analysis processes. These recommendations include shifting the long range transportation planning focus away from reducing traffic congestion, which encourages quick fixes at the expense of long term improvements. A focus that will yield GHG emissions reduction, provide better mobility and a decrease in congestion in the long term, is efforts to reduce VMT. It is not recommended to evaluate public transit improvements at the project level because the full benefits of public transit will not be captured where a strong transit service network is not already in place. The application of strategies to reduce traffic congestion, such as public transit planning and TDM and operational management strategies, such as pricing and parking controls, should be evaluated in combination, as these strategies reinforce each other.

Federal Law Overview

There are four primary federal laws that provide the legal underpinning for metropolitan transportation planning and air quality conformity. The first two laws in the United States Code (USC) define the kinds of transportation projects eligible for federal funding. These two laws are 23 USC Chapter 1, Federal-Aid Highways and 49 USC Chapter 53, Public Transportation. Proposed transportation projects in a metropolitan area that meet those eligibility requirements become those projects identified in the LRTP and TIP of an MPO. Many federal programs are in place, and some are limited to only one mode or facility type. In this way, the availability of appropriate federal funds can influence the way transportation systems in metropolitan areas are developed. The most recent federal transportation funding reauthorization was the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU), signed into law on August 10, 2005. SAFETEA-LU expired on September 30th, 2009. However, most of the existing programs were temporarily extended by Congress at their current levels through December 31, 2010.

The second two laws specify the process that must be undertaken by states and MPOs to align their proposed transportation projects with federal requirements. The first is 23 USC Chapter 1, §134, Metropolitan Transportation Planning, which establishes the required process of long range transportation planning and short-term transportation improvement programming. The second law is the Clean Air Act as amended in 1990 (CAA), which is statutorily held in 42 USC §§7401 *et seq.*, and

¹³¹ Chap. 163.3177(6)(b) and 163.3177(6)(j)10, F.S., and Chap. 339.175(1), F.S.

which contains the requirements for ensuring protection of air quality as part of the transportation planning process.¹³²

Federal Requirements for Metropolitan Transportation Planning

Title 23 USC §134 provides for the requirements of metropolitan transportation planning, including purpose, definitions, and required contents of the LRTP and TIP. Metropolitan transportation planning must provide for both passenger and freight travel and consider eight factors: economic development; safety and security; access and mobility; environmental protection, including minimizing fuel consumption and air pollution; providing intermodal connectivity; striving for efficient system management; and system preservation. The law is summarized below.

¹³² 23 U.S.C. §109(j) provides a cross reference to the Clean Air Act, requiring that highways constructed under Title 23 must maintain National Ambient Air Quality Standards and must be consistent with any maintenance plan established for the area.

Federal Requirements for Metropolitan Transportation Planning—An Overview

The 3Cs. The planning process undertaken by the MPO must be cooperative, continuing and comprehensive and must satisfy consideration of eight planning factors for developing a transportation system. These factors include economic vitality; safety and security; mobility and access for people and freight; intermodal connectivity; efficient system operation, management, and preservation; consistency with local and state plans for growth; energy conservation; and environmental protection, which includes air quality.

Areas that must be served. The metropolitan planning process must be conducted in urbanized areas of more than 50,000 people. If an urbanized area has a population over 200,000, it is called a transportation management area and the transportation planning process must include travel demand reduction strategies and operational management strategies as part of a congestion management process.

Metropolitan planning area boundaries. An MPO must plan for all of the land area contained in Census Bureau-defined urbanized areas (UZAs), plus the land area expected to become urbanized over the next twenty years.

Coordination. MPOs must demonstrate that they are coordinating with other planning entities, which can be aided by the execution of interlocal agreements. There is usually a technical advisory committee composed of staff from the various planning entities. These planning entities include the regional transit authority and commuter assistance program.

Public participation. The MPO must prepare a public participation plan that provides for a reasonable opportunity to comment on the draft long range transportation plan (LRTP) and the transportation improvement program (TIP) prior to key decision points. The plan must be made available by publication and electronically. There may also be a citizen advisory committee that reviews and comments on the plan.

Planning time period. The metropolitan planning process must cover at least a 20-year forecast time period.

Cost affordable. All projects included in the LRTP and five-year TIP must have available funding. The LRTP and TIP identify realistically available funding sources for transportation improvements, including local, state, federal, private and other sources.

Updates. The LRTP must be updated every 5 years. In air quality nonattainment areas and maintenance areas, the LRTP must be updated every 4 years.

Long Range Transportation Plan (LRTP) contents. The LRTP must be multimodal and must describe the goals of the transportation facilities provided within the plan, including protecting and enhancing the environment. There must be a discussion of environmental mitigation. In areas that are not in compliance with National Ambient Air Quality Standards (NAAQS), called nonattainment areas, there must be provisions for developing transportation control measures that reduce air pollution.

MPO certification. The MPO, state DOT, FHWA, and FTA jointly certify that the metropolitan planning process has followed all the requirements of the law. If the MPO is not certified, federal funding can be withheld.

Facilities for single occupant vehicles. In transportation management areas classified as nonattainment areas for ozone or carbon monoxide pursuant to the Clean Air Act, federal funds cannot be advanced for any highway project that will increase the carrying capacity of the facility for single occupant vehicles ***unless the project goes through a congestion management process.***

Transportation Improvement Program (TIP). The TIP is a priority list of federal-aid projects to be implemented within the next five years and for which funding sources are identified and available. TIP projects are eligible for federal funding under Titles 49 USC and 23 USC. TIP projects are a subset of the LRTP. SAFETEA-LU Sections 1107 and 6001, respectively, require that the LRTP and the TIP remain as separate

Federal Requirements for Air Quality Conformity

The Clean Air Act, as amended in 1990 (42 USC Chapter 85), contains the requirements for ensuring protection of air quality as part of the transportation planning process and is summarized below.

Federal Clean Air Act Requirements for Air Quality Conformity—An Overview

State responsibility. Each state has primary responsibility for assuring air quality in urbanized areas.

Air quality standards. National Ambient Air Quality Standards (NAAQS) are established for six criteria pollutants as specified in 40 CFR Part 50. These are ozone (and ozone precursors, oxides of nitrogen and volatile organic compounds), particulate matter, carbon monoxide, sulfur dioxide and lead. The violation of any standard in an air shed causes all metropolitan planning areas within that air shed to be designated by USEPA as a nonattainment area. There are both primary and secondary standards. Primary standards protect public health, such as reduction in cases of asthma. Secondary standards protect public welfare, such as reduction in damage to vegetation and crops.

State implementation plans. Each state is required to prepare a state implementation plan (SIP) that demonstrates how activities in each region, for both stationary and mobile sources of emissions, including transportation, will be controlled to prevent air quality deterioration beyond a pollutant emissions budget as designated by USEPA. There are emissions budgets for the state as a whole as well as emissions budgets for each MPO within the state.

Conformity. The federal government cannot financially support transportation improvements for a region that does not conform to its state implementation plan. SAFETEA-LU Section 6011 changed the frequency of air quality conformity determinations to every 4 years, unless the MPO revises the TIP more frequently.

Nonattainment areas. The law establishes plan requirements with general and specific provisions for nonattainment areas to work toward meeting the NAAQS, including milestones and achievement dates.

Transportation control measures. The law enumerates specific transportation control measures that provide reductions in air pollutants from mobile sources.

Maintenance plan. The law establishes requirements for the development of a maintenance plan for nonattainment areas that have reestablished the NAAQS, and have been officially redesignated as attainment areas. The maintenance plan establishes actions for maintaining air quality standards, and is incorporated into the state implementation plan.

Conformity time horizons. Under SAFETEA-LU, Section 6011, conformity time horizons were also changed under certain circumstances to a 10-year horizon to provide more flexibility.

Florida Laws that Implement the Federal Metropolitan Planning Rule and the Transportation Conformity Rule

State requirements for metropolitan transportation planning pursuant to Title 23 USC §134, and 23 CFR 450.200 “Metropolitan Transportation Planning and Programming,” are found in Chapter 339.175, Florida Statutes. Florida State law largely reiterates Federal law with regard to metropolitan transportation planning and air quality conformity, with the addition of due dates for planning products to ensure expeditious review by state agencies.

Role of Florida Public Transit Agencies in MPO Decision Making

The first six sections of Ch. 339.175, F.S. provide for the requirements of MPO establishment, organization and authority.¹³³ The voting members of MPOs are elected officials of general purpose local governments within the MPA, except that the MPO may choose (or not) to include an official of an independent agency that operates or administers a major mode of transportation.¹³⁴ Nonvoting advisors also may be appointed, such as representatives of various multimodal forms of transportation not otherwise represented by voting members of the MPO.¹³⁵ MPOs conduct activities necessary to be eligible for federal transportation funds. Interestingly, the duties of the MPOs in Florida are described thus:

Each MPO shall perform all acts required by federal or state laws or rules, now and subsequently applicable, which are necessary to qualify for federal aid. It is the intent of this section that each MPO shall be involved in the planning and programming of transportation facilities, including, but not limited to airports, intercity and high-speed rail lines, seaports, and intermodal facilities, to the extent permitted by state or federal law.¹³⁶

The transportation planning activities explicitly listed above do not include highways, public bus transit, or intra-urban light rail. However, the transportation system in Florida and nationwide is largely a highway system; therefore, inclusion of highway planning is understood. This is not so for public bus transit or intra-urban rail; these qualify as regionally-significant transportation facilities found primarily in urbanized areas. Regional public transit lacks institutional power in the MPO decision making process for identifying and prioritizing needed transportation facilities, unless local government elected officials, particularly county commissioners, who must comprise not less than one third of the MPO membership, are supportive of a shift in emphasis toward public transit. As a result, while the development of the

¹³³ State law regarding metropolitan planning organizations is implemented by the Florida Administrative Code. Chapter 35-1.001-35-2.001, F.A.C. implements state laws Ch. 339.175, F.S. and Ch. 330.177, F.S. These administrative procedures focus primarily on the principles of organizing MPOs and not on long range transportation planning.

¹³⁴ Ch. 339.175(3)(a), F.S. Many transit systems are operated by a county or municipality. In these cases, a separate representative cannot be appointed since the system is deemed to be represented by the elected officials serving on the MPO.

¹³⁵ Ch. 339.175(4)(a), F.S.

¹³⁶ Ch. 339.175(6), F.S.

MPO LRTP is guided by detailed procedures carried out by state and local transportation agencies to assure a rational process, the LRTP is strongly influenced by the political process.

Florida Transportation Management Programs

State law provides for the development of six different transportation management programs. FDOT districts, in cooperation with affected local government entities and MPOs, are directed to “... develop and implement a separate and distinct system for managing each of the following program areas: highway pavement, bridges, highway safety, **traffic congestion** [bold emphasis added], public transportation facilities and equipment, and intermodal transportation facilities and equipment.”¹³⁷ The traffic congestion management system planning required by the State also addresses the requirements of federal law for congestion management planning in air quality nonattainment areas.

Florida Enforcement of Air Quality Standards

State law gives the Florida Department of Environmental Protection (FDEP) the authority to enforce federal air quality standards per Chap. 403, F.S. The Florida Administrative Code, Chap. 62-204, F.A.C. provides the procedures to implement state law, including adoption of ambient air quality standards, designation of air quality attainment, nonattainment and maintenance areas, and public hearing requirements for revisions to the State Implementation Plan (SIP) that establishes air pollution emissions limits for the state. The Florida Administrative Code (Chap. 62-204, F.A.C.) is included by reference in the federal code that contains requirements for SIPs.¹³⁸

¹³⁷ Ch. 339.177(1), F.S. There is no state administrative code that provides procedures to implement Ch. 339.177, F.S.

¹³⁸ 40 CFR Part 51.

Table B1 – Thumbnail Summary of Air Quality Conformity Process within the MPO LRTP and TIP

Why?	NAAQS enforcement pursuant to CAA as amended in 1990.
Who?	USEPA Region 4 Office, FHWA Florida Division Office, FTA Region 4 Office, FDOT Office of Policy Planning, FDOT Systems Planning Office, FDEP Bureau of Air Monitoring and Mobile Sources, MPOs, local EPAs, transit agency, expressway authority, citizen’s advisory committee, transportation disadvantaged committee, coordinating committees that demonstrate a consultation process.
Where?	Airsheds for individual pollutants are areas where emissions interact via topographical and meteorological conditions to produce elevated pollutant concentrations. Nonattainment areas and maintenance areas are officially designated areas that contribute to the violation of a NAAQS (or previous violation for a maintenance area). They can be multi-jurisdictional (multiple counties, parts of counties, parts of multiple states).
What?	Based upon VMT on regionally-significant roads, generated by a regional travel demand model and input into an EPA-approved air emissions model, an air quality conformity determination report (CDR) reflecting the proposed projects in the LRTP and the TIP is prepared by the MPO. The CDR must demonstrate that the emissions generated by the LRTP do not exceed the emissions budget for that region as established in the State Implementation Plan (SIP). For nonattainment areas, there must be an air quality maintenance plan that is then incorporated into the SIP. The STIP is the State Transportation Improvement Program, which are the combined TIPs in the state that gets submitted to USDOT.
When?	Air quality conformity is conducted with each LRTP update every 5 years for MPAs that have always been in attainment, and every 4 years for nonattainment or maintenance areas. The conformity determination covers the first 3 years of the TIP. Future analysis years of the LRTP sets the horizon year at 20 years out.
How?	An EPA-approved SIP allocates an emissions budget for each county for the purpose of maintaining the NAAQS. The LRTP must conform to the budget.

Details of the Federal Metropolitan Transportation Planning Process

The preceding discussion provided an overview of the federal and Florida state legislative mandates for metropolitan transportation planning and air quality conformity. The discussion below delves further into the specific elements of the planning process, particularly those that have a bearing on GHG emissions reduction.

The Metropolitan Planning Rule¹³⁹ specifies federal requirements for metropolitan transportation planning. The MPO LRTP represents the culmination of a process of identifying and evaluating the merits of alternative transportation improvements to meet future needs. The result is a vision for the region and a set of cost-feasible projects eligible to receive federal funding.

MPO Planning Process Time Frames

Authorization for the allocation and release of federal transportation funding to MPOs begins each October 1, the beginning of the federal fiscal year. The yearly planning activity of the MPOs and the

¹³⁹ 23 CFR Part 450 Subpart C.

State, culminating in a demonstration of compliance with federal law and approvals by the Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA), is timed to be in place by October 1 to be eligible for the next release of federal funds. As with all federal programs, planning funds are issued to states and MPOs on a reimbursement basis.

Metropolitan Planning Area Boundaries

There is not a one-to-one relationship between a metropolitan planning area (MPA) and an MPO. In Florida, it is particularly pronounced to have more than one MPO covering a single MPA. This occurs in the Tampa Bay area, where the Tampa-St. Petersburg-Clearwater Urbanized Area MPA is planned by the Pinellas MPO, Hillsborough MPO, Pasco MPO, and the Hernando MPO. In addition, the Zephyrhills MPA is planned by the Pasco MPO. The Brooksville MPA is covered by the Hernando MPO.¹⁴⁰ For MPOs that serve an urbanized area designated as nonattainment for ozone or carbon monoxide after August 10, 2005, the boundaries may be redrawn to coincide with the designated boundaries of the ozone and/or carbon monoxide nonattainment area.¹⁴¹ MPOs primarily have been concerned with the attainment and maintenance of NAAQS standards (the ozone standard, in particular), which represent pollutant concentration limits in air that are protective of public health and welfare. On the other hand, no NAAQS currently exist for GHGs (such as CO₂), since effects on public health and welfare are not directly associated with a local air concentration level, and current law does not extend to pollutants that do not cause local impacts. However for regulatory and planning purposes, the emissions rate (amount emitted per time) and measurement standards for GHGs usually mimic those used for pollutants covered by NAAQS.

GHG emission rates can be estimated from activity rates and factors quantifying the emissions amount per activity level. Typically, either fuel consumption or vehicle miles traveled (VMT) are the activities used to estimate the bulk of emissions from transportation. Within the boundary of an MPA or for a particular transportation project, it is difficult to determine the amount of fuel consumed that an MPA is responsible for due to the great amount of extra-jurisdictional travel into and out of the MPA. Fuel purchase within the MPA may be consumed and emissions released somewhere outside the MPA and vice versa. Therefore, for planning purposes, GHG emissions are usually based on VMT and other activities that are often mapped to VMT (such as idling), though more detailed specific activity-based emissions estimation is becoming available through the MOVES model, discussed in Section 3.

It is important to note that GHG emission rates are not sensitive to pollutant movement and reaction in air (due to weather and topography) as are concentration of ozone in air. Within the context of a multi-pollutant reduction strategy, this suggests that the boundaries used for the calculation of GHG emissions for area-wide planning could defer to the boundaries drawn for ozone (and do not need to be redrawn). However, at the corridor or project level of transportation planning, the definition of boundaries for GHG becomes more problematic. In attempting to place a boundary on the corridor or project in question, the purpose of computing GHG emissions would be to determine the amount of emissions for

¹⁴⁰ Alexander Bond, USF Center for Urban Transportation Research, email conversation, July 14, 2010.

¹⁴¹ 23 CFR §450.312(b).

which the project alternative is responsible. A corridor or highway segment usually does not represent the complete trip of those traveling by it, and a transportation improvement alternative might cause changes in travel along other routes. Therefore, emission estimation may require running the travel model for a larger network to calculate the effect of the improvement or project on the total network activity.

Intergovernmental Coordination

Intergovernmental and interagency coordination is recognized as critical in the MPO planning process because of its focus on regionally significant facilities within urbanized areas. This presents a dichotomy in the MPO planning process because it deals with the connection and interplay between two distinct systems. The first system is the urban transportation network that, in concept, serves trips within the urban area (local trips). It is composed of county and municipal roads and public bus transit, where the goal is providing access. The second system is the State Highway System, of which the SIS highways and their intermodal connections are the priority focus. The SIS serves regional, interstate, and international trips. The goal of the SIS is mobility and economic development. In general, thriving and growing economies generate growing travel demand. Urban travelers use SIS highways where these facilities traverse the urban area. Local trips now congest SIS facilities and connections to the SIS. FDOT seeks ways to preserve capacity on SIS highways through SIS highway capacity expansion where there are no constraints. FDOT also funds and provides technical support to public bus transit agencies and commuter assistance programs to better serve local travel. This is to remove local trips from SIS highways. FDOT also funds the Transportation Regional Incentive Program (TRIP), which provides a State match to local governments and other entities seeking to provide capacity improvements on regionally-significant roads or public transportation. FDOT also considers providing support to local governments to improve capacity of parallel local roads to remove local trips from the SIS.

If State support results in expanding capacity within urban areas, it also slows the transition toward greater use of public transit because the motivation to travel by public transit (by saving costs and travel time in comparison) is then removed. FDOT should continue to pursue ways to separate local traffic from regional traffic within urbanized areas, including studying the designation of more State roads as toll facilities. Keeping in mind that there is federal policy requiring alternatives to toll facilities, there is potential to using open road tolling on new state highways. This is worth further study.

Early in the MPO planning process, written agreements are put in place to guide interagency and intergovernmental coordination, establishing roles, responsibilities and coordination efforts for consistent data collection, analysis, and planning assumptions among the following entities:¹⁴²

- The State, MPO and the public transportation authority
- Adjacent or nearby MPOs
- Metropolitan planning areas where the air quality planning agency is not the MPO
- MPOs that serve portions of the same urbanized area

¹⁴² 23 CFR §450.314.

- MPOs representing urbanized areas that extend across two or more states
- MPOs in which the transportation management area of one overlaps with the MPA of another

The result is that consistency requires that all parties may have to agree to use similar travel demand model refinements and data of the same level of detail. Different MPOs may have varying levels of staff resources to support the application of something new, such as MOVES2010. The new EPA MOVES air emissions model can be used to calculate GHG emissions from county transportation networks, corridors and projects, given appropriate data on network infrastructure, transportation activities, vehicle fleet and fuel-type distributions, speed distributions or drive cycles, local meteorology, and vehicle maintenance programs. FDOT is currently developing an air quality post processor for its travel demand model that incorporates MOVES emissions rate outputs for the county with travel demand model output for calculating on-road running emissions relevant to criteria pollutants. This could be supplemented to also calculate GHG emissions. However, much of the data needed to fully use the features of MOVES (e.g. fuel-type distributions) is not routinely used by MPOs and has not yet been developed for Florida planning (and must rely on national default information). Doing so will require staff training, staff time and more resources.

Development of Vision, Goals, Objectives and Policies

MPOs in Florida are in the process of updating their LRTPs with a horizon year of 2035. This study presents the Hillsborough MPO LRTP as an example for two reasons. First, the proposed transportation improvement scenario examined in this study, the Bus Rapid Transit North/South Corridor, is located in Hillsborough County. Second, the Hillsborough MPO adopted its LRTP 2035 update in December 2009, incorporating the latest State law amendments encouraging GHG emissions reduction strategies to be considered in the MPO LRTP process.

Initial efforts in the LRTP process also include the development of a public participation plan as required by federal law. Florida law requires the participation of citizen advisory committees and committees for the transportation disadvantaged. These committees, as well as others, such as bicycle and pedestrian advisory committees and technical advisory committees, also participate in the development of vision, goals, objectives and policies to address the eight required federal planning factors. This is an early opportunity to reflect support for local pollution control efforts, address air quality, and articulate objectives to reduce GHG emissions.

For example, the Hillsborough MPO presented in its LRTP 2035 several Goals, Objectives and Policies of relevance to GHG emissions reduction and improvement of public bus transit service, presented below with bold added to emphasize certain points. The last objective, Objective 4.1B regarding lowering highway LOS standards on non-SIS roadways, is of particular interest to a later discussion regarding congestion mitigation. Development of the vision, goals, objectives and policies provides the urban community a common direction for the future and an early opportunity to incorporate GHG emissions reduction into the MPO LRTP process. Policies guiding land use to make urban areas more compact would help separate local trips from regional trips and reduce VMT and GHG emissions.

The next steps are determining what plans are currently under implementation and what is known about the social, economic, and environmental characteristics of an urban area that should inform planning decisions.

Selected Goals, Objectives and Policies, Hillsborough MPO LRTP Update 2035

Goal I Improve the quality of life, promote energy conservation, and enhance the environment, while minimizing transportation related fuel consumption, **air pollution and greenhouse gas emissions**.

Objective 1.2 Minimize the use of fossil fuels and **improve air quality**.

Policy 1.2A: Give incentives to use **transit**, biking, walking, and transportation demand management (TDM) practices such as carpooling and telecommuting to reduce fuel consumption.

Policy 1.2B: Promote the use of alternative fuels and technologies in motor vehicles, fleet, and transit application to **reduce greenhouse gas emissions**.

Policy 1.2D: Comply with all federal and state air quality standards, and pursue strategies to **reduce greenhouse gas emissions from transportation sources** in Hillsborough County and the Tampa Bay region.

Goal II: Support economic vitality to foster the global competitiveness, productivity and efficiency of local and regional businesses.

Objective 2.2 Relieve congestion and improve traffic flow.

Policy 2.2A: Identify and promote multi-modal improvements in congested corridors to **reduce vehicle miles traveled (VMT), including bus service, rapid transit**, bicycle/pedestrian facilities and managed lanes (e.g. **High Occupancy Vehicle (HOV)** or High Occupancy Toll (HOT) lanes).

Goal III: Promote accessibility and mobility by increasing and improving multimodal transportation choices, and the connectivity across and between modes, for people and freight.

Objective 3.2 **Decrease reliance on single-occupancy vehicles**.

Policy 3.2A: Plan for and develop a **“transit-friendly”** transportation system providing appealing choices that are more competitive with automobile travel

Policy 3.2B: Increase the percentage of persons using **alternative modes**, especially during peak hours, through planning implementable multimodal projects, and connections between them.

Goal IV Assure that transportation improvements coordinate closely with comprehensive land use plans and support anticipated growth and development patterns.

Objective 4.1B: **Allow lower highway LOS standards** on Non-SIS roadways with acceptable transit services, particularly in urbanized areas.

Plan Review

The initial assessment of transportation needs within an MPA includes a survey of existing local government and state plans and studies, in which proposed transportation improvements have been previously identified and considered. These include modal plans, such as plans for the development of bicycle and pedestrian facilities networks. As a result, the MPO planning process does not always start from scratch but builds upon the “memory” of proposed transportation alternatives from previous LRTP updates. This is important to note because political support may boost alternatives favored by some. In

addition, the LRTP acknowledges with its 20-year planning horizon that major transportation projects can take decades to complete. Multi-year, multi-phase transportation projects presently under way carry much forward momentum and committed investment, so there is high motivation to finish what has been started. As a result, the ultimate contents of an updated LRTP will likely include many older projects begun under a previous LRTP. This provides the needed continuity for plan achievement, such as the development of bicycle and pedestrian networks. But many of these older projects tend to fit into and support a particular transportation system framework, specifically, a highway-dominant system built over the last 40 years, and societal expectations for its continued functioning and expansion. This has translated into an urban transportation planning process that largely reacts to the location of traffic congestion with incremental capacity improvements. In conclusion, past planning decisions exert powerful influence upon the direction of future planning decisions.

As part of the initial needs assessment, the MPO reviews existing state and local government comprehensive plans. The LRTP process is required to coordinate with the comprehensive planning of member local governments within the MPA and reflect those comprehensive plans to the maximum extent feasible. This means that the desired transportation improvements of local governments have a high degree of priority in the initial needs assessment and the resulting LRTP. The MPO receives lists of priority projects from local government as well as from committees, such as the pedestrian and bicycle committees. Private citizens can submit suggestions for needed transportation improvements.

Many municipalities in Florida do not have densely-populated downtowns, and local trip making is decentralized and dispersed, with trips going from one end of a municipality to another. The fastest way to make such a trip is by a state highway or regionally significant facility. Therefore, local governments are strongly motivated to advance highway capacity expansion projects. Due to sprawling land development patterns of the past 50+ years, public bus transit systems cannot serve such decentralized trips efficiently, given historical patterns of underfunding compared to highway funding.

The public transit agency is an intergovernmental partner that participates in the LRTP process. The Metropolitan Planning Rule requires that the preparation of the multi-year regional public transit development plan (TDP) is consistent and coordinated with the metropolitan planning process. The TDP is usually drafted by the local public transit authority. The recommendations contained in the TDP are incorporated into the list of transit projects identified in the needs assessment in the LRTP.

It is important to note that proposed transit improvements in the TDP do not focus primarily upon alleviating traffic congestion. Instead, they emphasize serving its existing ridership, a different market from the motoring public. Subsequently, the identified transit needs in the TDP will not primarily address congestion as do proposed highway capacity improvements. Therefore, substituting bus service enhancements for additional lane capacity would be highly unusual under existing conditions in which private vehicle travel and bus travel represent separate and parallel systems. Additional bus passenger service might not serve the SOV trips causing the congestion. A major shift in transportation planning focus would have to occur in order for bus service to substitute for highway capacity improvements. It is not recommended to evaluate bus transit service compared to a highway widening project at the scale

of a highway segment or corridor. Shifting enough SOV travelers in a corridor to bus transit is unlikely in the short term and would unfairly discredit the potential for bus service to reduce GHG emissions. Bus service will achieve GHG emissions reductions that are higher than those reductions from highway widening, at the corridor or highway segment scale, only when the transit network is funded at higher levels and developed to achieve better system-wide service. Increased transit investments should be combined with allowing highway congestion to occur, combined with parking controls.

More dialogue should be initiated among the public transit agencies and FDOT, MPOs, and local governments to identify public bus service configurations that would move local SOV trips onto public transit and other high-occupancy vehicles, such as carpools and vanpools. Where high numbers of trip origins and destinations are located along the same corridor, bus service should be provided. Where major destinations are located along a corridor, such as large employment sites, TDM strategies narrowly targeted to the needs of each individual employer should be funded to organize carpooling and vanpooling where trip origins are dispersed. To reduce VMT and GHG emissions, more emphasis should be placed upon commuter assistance programs, especially those that support telework and other alternative work arrangements.

Transportation Studies

In addition to plans, the MPO also reviews existing studies for information, including updated socio-demographic data for the area. The forecast magnitude of future population and employment and their location will determine corridors of future travel demand. Transportation planning decisions will tend to address issues that are studied the most. The predominant transportation funding and MPO planning focus as emphasized by both state and federal planning processes is highway congestion management, as opposed to some other focus such as equity, economic competitiveness, or environmental and financial sustainability.¹⁴³ These alternative foci are studied but not often operationalized in the form of projects and programs to address them. For example, "... Although most MPOs discussed freight and economic competitiveness, few gave the issue detailed consideration."¹⁴⁴ Since congestion management system planning is an ongoing process of extensive data collection and analysis, transportation improvement solutions addressing congestion will get the greater emphasis due to the planning documentation to back them up.

Congestion Management Planning

Each MPO in Florida takes the lead on developing and implementing a traffic congestion management system (TCMS). The State TCMS is developed to be reflective of the individual systems developed by the MPOs. The purpose of these systems is to provide the information needed to make informed decisions

¹⁴³ For example, "The statewide twenty-year funding shortfall increased by an inflation-adjusted 46 percent to reach \$62.5 billion." The 2008 Review of Florida's MPO Long Range Transportation Plans, prepared for FDOT and the Florida MPO Advisory Council, prepared by Jeff Kramer and Alexander Bond, Center for Urban Transportation Research, University of South Florida, October 2008, p. ii.

¹⁴⁴ The 2008 Review of Florida's MPO Long Range Transportation Plans, prepared for FDOT and the Florida MPO Advisory Council, prepared by Jeff Kramer and Alexander Bond, Center for Urban Transportation Research, University of South Florida, October 2008, p. 8.

regarding the proper allocation of transportation resources. Each system uses state and local data to define problems, identify needs, analyze alternatives, and measure effectiveness.¹⁴⁵ The work undertaken to develop an MPO congestion management system per State requirements also helps satisfy federal requirements in air quality nonattainment areas. Large (over 200k) MPOs must draft a Congestion Management Process, which is a distinct document from the LRTP. Congestion management planning emphasizes short term low cost strategy identification, which does not work in favor of public transit improvements in urban areas where an increment of public transit improvement is not adding to an already strong transit network.

For transportation management areas (urbanized areas with population over 200,000) in air quality nonattainment areas, federal law requires a cooperative multimodal Congestion Management Process by the MPO to provide information for monitoring traffic congestion within the transportation network and for evaluating alternatives to address that congestion. For multiple MPOs that cover a single MPO, coordinating committees, such as the West Central Florida Chairs Coordinating Committee (WCFCCC) in the Tampa Bay region provide programmatic consistency. The Southeast Florida Transportation Executive Council (SFTC) serves a similar role for the Palm Beach County MPO, the Broward MPO, and the Miami-Dade MPO. These groups adopt a single Congestion Management Process, and work on air quality issues if needed.¹⁴⁶ The law's emphasis on congestion management implies that congestion causes air quality problems, not the amount and mode of travel activity itself.

The Congestion Management Planning Process must include the following steps

- Monitoring and evaluation to identify the sources of recurring and nonrecurring congestion
- Identification and evaluation of alternative strategies, examples of which are transportation demand management, growth management, congestion pricing, traffic operational improvements, Intelligent Transportation Systems (ITS) technologies, and **public transportation improvements**
- Where necessary, evaluation of building additional system capacity
- Coordinated data collection and evaluation of effectiveness of implemented strategies
- Development of an implementation schedule
- Assignment of responsibilities
- Identification of possible funding sources
- Periodic assessment of success based upon the selected performance measures

However, federal regulation acknowledges the connection between highway widening and air quality degradation:

In a TMA designated as a nonattainment area for ozone or carbon monoxide pursuant to the Clean Air Act, Federal funds may not be programmed for any project that will

¹⁴⁵ Ch. 339.177(2) and (3), F.S.; and Ch. 339.175(6)(c)1., F.S.

¹⁴⁶ Alexander Bond, USF Center for Urban Transportation Research, email conversation, July 14, 2010.

result in a significant increase in the carrying capacity for SOV's (i.e., a new general purpose highway on a new location or adding general purpose lanes, with the exception of safety improvements or the elimination of bottlenecks), unless the project is addressed through a congestion management process meeting the requirements of this section.¹⁴⁷

Note here that as long as the process is served, highway capacity expansion can still be accomplished. Process requirements include the following:

The congestion management process must provide an appropriate analysis of reasonable (including multimodal) travel demand reduction and operation management strategies for the corridor [in question]. If the analysis demonstrates that travel demand reduction and operational management strategies cannot fully satisfy the need for additional capacity in the corridor and additional SOV capacity is warranted, then the congestion management process shall identify all reasonable strategies to manage the SOV facility safely and effectively.¹⁴⁸

Where the addition of general purpose lanes is determined to be an appropriate congestion management strategy, explicit consideration is to be given to the incorporation of appropriate features into the SOV project to facilitate future demand management strategies and operational improvements that will maintain the functional integrity and safety of those lanes.¹⁴⁹

While an increase in SOV VMT is recognized by federal law as the main culprit to air quality degradation, it is congestion reduction that is emphasized instead of VMT reduction. In general, analyses of "reasonable" multimodal travel demand reduction might not demonstrate full satisfaction of the demand for additional travel capacity because the bus transit system and supporting bicycle and pedestrian networks are underdeveloped. The effectiveness of a highway facility to satisfy travel demand would never be evaluated if the facility were still under construction. TDM strategies are neither funded on a large enough scale nor bundled adequately as a complete program of incentives and disincentives that reinforce each other. Instead, TDM strategies tend to be analyzed in isolation. Alternative strategies such as travel demand reduction and operational management strategies that are evaluated through the congestion management process should be evaluated as sets of combined strategies that reinforce each other.

In response to federal congestion management planning process requirements, Florida MPOs have reduced criteria air pollutant emissions, primarily those of ozone precursors, by reducing delay on roadways, as measured by the ratio of vehicle volume to maximum service volume for each highway

¹⁴⁷ 23 CFR §450.320(d).

¹⁴⁸ 23 CFR §450.320(e).

¹⁴⁹ 23 CFR §450.320(b).

segment. Delay reduction has been accomplished by adding lane capacity to corridor segments that are functioning as bottlenecks. This strategy has served double duty in Florida counties and municipalities by maintaining the adopted highway motor vehicle level of service (LOS) standards required for state roads¹⁵⁰ as well as those established in local government comprehensive plans under Chap. 163.3177, F.S.

The V/C LOS standard is not a federal requirement. Federal law provides requirements for the process but allows a state to select its own performance measures. Other system performance measures are not enforced by state law. Rather than solely reducing traffic congestion to reduce GHG emissions, the planning focus should be reducing VMT. For example, VMT-based user fees could influence location decisions and raise funds for public transit improvements.

It is noteworthy that in the Hillsborough MPO LRTP Update 2035, to assure that transportation improvements coordinate closely with comprehensive land use plans and support anticipated growth and development patterns, an objective to support this is to allow lower highway LOS standards on non-SIS roadways with acceptable public transit services, particularly in urbanized areas. This is an example of using congestion as a tool to increase public transit mode share. In conjunction with the objective to increase the prioritization of bus transit improvements, MPO LRTPs should consider incorporating the objective to lower highway LOS standards on non-SIS roadways, as the Hillsborough MPO LRTP Update 2035 has done.

Corridor and Sub-Area Studies

As part of the metropolitan planning process, the State, MPO, or public transit authority may conduct multimodal systems-level, corridor, or subarea planning studies. To the extent possible, these studies must coordinate with the public transit authority. These studies may result in a proposed transportation project that includes identification of the travel corridor, mode definition (highway, transit, or highway/transit combination), preliminary screening of alternatives and elimination of unreasonable alternatives, preliminary identification of environmental impacts, and preliminary identification of environmental mitigation.¹⁵¹

Given the information foundation provided by MPO staff members who conduct traffic congestion management system planning, transportation improvement concepts can then be identified. Those selected for a closer examination become part of corridor or sub-area transportation studies or Project Development & Environment (PD&E) studies, as they are called in Florida, which evaluate the alternatives. The results of these studies may become part of the review process under the National Environmental Policy Act (NEPA) Environmental Assessments and Environmental Impact Statements,

¹⁵⁰ Chap. 14-94.003, F.A.C.

¹⁵¹ 23 CFR §450.318(a).

discussed later in this report.¹⁵² The results of these efforts are proposed projects in the LRTP and the TIP.

Another factor in the development of transportation improvement alternatives for the LRTP is public input regarding locations where there are routine traffic jams. Ultimately, the selection of an alternative transportation facility improvement for inclusion in the LRTP and TIP depends upon the availability of funds to complete the project.

Efficient Transportation Decision Making

As part of corridor and sub-area studies to evaluate transportation improvement concepts, FDOT uses the Efficient Transportation Decision Making (ETDM) process to screen for environmental impacts. The ETDM was developed by FDOT in coordination with state, local, and federal agencies, in response to federal Transportation Equity Act for the 21st Century (TEA-21) legislation (Section 1309) that provided incentives to states to streamline transportation project review and permitting processes. First implemented in Florida in 2003, the ETDM process provides agencies early access to transportation project concepts during long range planning, specifically the corridor and subarea studies discussed above. The ETDM process provides a systematic approach to integrating land use, social, economic, environmental and transportation considerations, including review time frames for specific agencies and performance standards, as provided in interagency memoranda of understanding and agreements. Each FDOT district has its own ETDM team that includes an environmental technical advisory team (ETAT) of federal, state and MPO agency representatives. The ETDM team also includes a community liaison officer, an FDOT ETDM coordinator, and an MPO ETDM coordinator.

The ETAT team uses an Environmental Screening Tool (EST) to evaluate transportation projects, which includes data collection from various Florida databases and GIS analysis of the data. Agencies and the public review the analysis results and provide recommendations. A summary report is compiled that includes conclusions on the degree of effect of a proposed transportation project on resources and recommendations for technical studies that should be done as part of transportation project development and prioritization. The EST considers 17 environmental factors, including air quality. The EST allows consideration of secondary and cumulative effects on a system-wide basis. The EST is applied during the earliest planning screen and again during a later programming screen, the results of which form the basis for NEPA reviews. The ETDM currently does not address GHG emissions, but if the necessary data were available, the EST would be the place in the MPO planning process to consider GHG emissions from alternative transportation improvements. For MPOs that have the resources and staff to collect and organize into a database the necessary inputs required by the USEPA MOVES air emissions model, such as fuel mix data, acceleration/deceleration data, and more specific data on vehicle fleet mix, this could be incorporated into the Environmental Screening Tool (EST) of the ETDM process. The results would provide calculations for GHG emissions that represent those produced by transportation improvement alternatives.

¹⁵² Pursuant to 40 CFR §1502.20, subarea studies as part of the metropolitan planning process may be incorporated into NEPA draft Environmental Assessments and draft Environmental Impact Statements.

Long Range Transportation Plan Content

The effective date of the LRTP is the date of MPO adoption of the plan. In air quality nonattainment and maintenance areas, the effective date of the LRTP is the date at which FHWA and FTA determine conformity of the plan. The box below summarizes the required contents of LRTPs.

The Long Range Transportation Plan must include the following.

- All planning assumptions, for interagency and public review
- Projected transportation demand in the metropolitan planning area over the forecasted time period
- Implementation of the public participation plan, including making the draft LRTP readily accessible through publication and posting electronically, and providing reasonable opportunity for the public to comment
- A description of future transportation policies, services and activities, including intermodal activities that advance the planning considerations required by the Metropolitan Planning Rule, **including protecting air quality**
- A security element that addresses disaster preparedness
- Operational and management strategies to optimize performance of the existing system
- The results of the congestion management planning process, **including identification of SOV facilities that resulted from the congestion management process in nonattainment areas**
- Existing and proposed multimodal transportation facilities, emphasizing those that serve national and regional transportation functions
- Identification and adoption of the locally preferred alternative from an Alternatives Analysis, under the FTA's Capital Investment Grant Program
- Inventory of pedestrian walkways and bicycle facilities
- Transportation and transit enhancement activities, including potential bicycle and pedestrian improvements
- Consultation with State and local agencies responsible for natural resource management, environmental protection and historic preservation, regarding LRTP development
- Policies and programs constituting environmental mitigation for the LRTP
- Design concept and scope descriptions of all existing and proposed facilities for the purpose of developing cost estimates **and determining air quality conformity in nonattainment and maintenance areas**
- **In nonattainment and maintenance areas, air quality conformity determinations must be made by the MPO, FTA and FHWA on any LRTP update and any amended LRTP, presented in a companion document, the Conformity Determination Report (CDR)**
- Capital investment strategies that preserve existing and future transportation infrastructure
- A financial plan demonstrating LRTP feasibility from reasonably expected funding sources, applying an inflation rate reflecting "year of expenditure dollars". **In nonattainment and maintenance areas, the financial plan must include the cost of implementing transportation control measures (TCM)**

Using the recently-adopted Hillsborough MPO LRTP 2035 update as an example, there are several ways in which alternative transportation improvements are identified. The availability of funding and the conditions for the receipt and use of funding is an important influence upon the MPO Board in the identification of proposed transportation improvements.¹⁵³ The Hillsborough LRTP 2035 developed the 20-year cost affordable plan, first, by understanding the availability of different federal, state and local funding sources and identifying those proposed transportation projects that would qualify as eligible for those funds. In this respect, federal policy drives, to some extent, the development of urban transportation systems in the U.S. SAFETEA-LU's congestion management emphasis is an example of this influence. SAFETEA-LU funded highway and transit projects by a ratio of 4 to 1.

The state can also influence the development of proposed transportation projects. For example, Section 339.2819, F.S. establishes the Transportation Regional Incentive Program (TRIP), which was created to provide funding to improve regionally significant transportation facilities in regional transportation areas created pursuant to Section 399.155, F.S. The projects to be funded by this program must be transportation facilities that serve national, statewide, or regional functions and function as an integrated regional transportation system. The project must be consistent with the SIS plan and with the Florida Transportation Plan. FDOT will pay 50 percent of the non-federal share to improve a facility of regional transportation significance and up to 100 percent of the non-federal match for public transportation facilities. The FDOT LOS standard established by Rule 14-94, F.A.C. then applies to roads that receive TRIP funding. TRIP funds are allocated by formula to the FDOT Districts and the District Offices will determine what projects to fund. The TRIP program is currently funded at low levels.

MPOs should work with their local governments to increase funding sources for all forms of public transit. FDOT should emphasize consideration of TRIP applications for public transportation improvements to regionally significant facilities. In a future federal transportation reauthorization, if there are funding sources that provide flexibility in their use, such as the current Surface Transportation Program, or there is a continuation of the CMAQ program, then MPOs should maximize the use of these funding sources toward public transit improvements.

The political process also influences what gets into the LRTP. For example, the Hillsborough County-sponsored Transportation Task Force (TTF) that worked over a period of two years to provide recommendations to the Hillsborough County Board of Commissioners developed a series of recommendations for projects, divided into a Phase I and a Phase 2. To build consensus, Phase I included short-term projects to increase capacity along roadway segments that were most congested. Phase 2 included the projects that were most desired by the member jurisdictions. In the LRTP 2035 list of projects, after the listing of the projects already "in progress," the TTF-recommended projects were listed second.

The Hillsborough MPO staff and advisory committees had also engaged in a public participation process for citizen input and a technical evaluation process to rate identified potential projects. This evaluation

¹⁵³ Financial Plan & Prioritization of Needs, Draft 2035 Long Range Transportation Plan, Chapter 9, p. 9-13.

process was based upon the identification of 10 weighted performance criteria applied to each of the proposed transportation improvements and evaluated by technical staff. The performance criteria and their weights were established by the MPO's committees. The evaluated transportation improvements included highway, transit, bicycle and pedestrian projects, as well as ITS, TSM and TDM programs. The 10 performance criteria, listed by greatest to least weighting were:

1. Safety/reducing crashes
2. Reducing traffic congestion
3. Alternatives to driving alone
4. Improve access to activity centers
5. Making regional connections
6. Support community plans & minimize community impacts
7. Impacts on natural, historic, cultural or archeological resources, which included air quality and GHG emissions
8. Enhance goods movement
9. Maintain/support existing corridors/facilities
10. Improve emergency evacuation

According to the list, crash reduction was given the greatest priority with a weight of 17, and improving emergency evacuation, with a weight of 5, was the least greatest priority, although a priority nonetheless. Criteria 5 and 6 were assigned an equal weight of 8. Criteria 7, 8, and 9 were all given the weight of 7. The types of projects that rated "best" for Criterion 7, which included air quality preservation and GHG emissions reduction, were local and regional bus service improvements, paratransit, travel demand management programs, and trails. However, these same types of projects tended to be rated "average" for traffic congestion reduction. The projects that rated "best" for traffic congestion reduction tended to be highway widening projects. Interestingly, when the performance criteria were applied to all projects listed in the 2035 LRTP, many of the projects did not necessarily achieve the highest rated overall project scores from the rational evaluation process, which demonstrates the power of the politics to circumvent the process. FDOT Districts should encourage and monitor MPOs to place greater emphasis on the established and documented evaluation processes for developing transportation improvements, giving greater weight to reducing GHG emissions.

Historically, public bus transit and travel reduction strategies have been advanced in addition to road widening but usually not instead of road widening. Road widening has been a primary congestion reduction solution for MPOs. However, that may be changing due to corridor constraints. For example, the Hillsborough MPO LRTP cites that public transportation is vital because a highway-only transportation system will not be able to adequately serve the anticipated growth through 2035. The Plan is considered to be a "policy-constrained" plan because, in addition to proposing new roads and widening existing roads, the Plan proposed enhancement projects that increase capacity without adding through lanes for roads that cannot be widened due to cost, neighborhood impacts, or policy constraints.

The Transportation Improvement Program (TIP)

The TIP is consistent with and is a subset of the LRTP. The TIP of an MPO is the document that is used to initiate federal-aid transportation improvements as well as other facilities, such as transit and rail projects funded by the State Transportation Trust Fund. MPO staff members prepare the TIP for the MPO in cooperation with the State and all affected public transit authorities. The TIP must demonstrate consistency with the capital improvements program of the comprehensive plan of all member local governments. The first year of an approved TIP constitutes the agreed upon list of projects that can be selected for immediate implementation.

The TIP includes all regionally significant capital and non-capital surface transportation projects that fall into the following categories:

- Projects proposed for funding under 23 USC and 49 USC Chapter 53
- Projects requiring some action by FHWA or FTA
- For conformity purposes, projects to be funded with federal funds other than those administered by FHWA and FTA
- For conformity purposes, projects to be funded with non-federal funds

TIPs in Florida must be five years in length, and updated on an annual cycle that matches the State TIP.

The TIP must be cost feasible and include the development of a financing plan. The information describing the transportation projects in the TIP must be specific enough to allow a reasonably accurate estimate of project costs. Projects are typically broken down into phases. For each project or phase of a project the TIP must provide the following:¹⁵⁴

- Type of work, termini, length
- Estimated total project cost
- Amount of federal funds proposed to be obligated each program year for each project or phase
- Agencies responsible for carrying out the project or phase
- In nonattainment or maintenance areas, identification of those projects which are identified as transportation control measures (TCM) in the state implementation plan
- In nonattainment or maintenance areas, projects are described in sufficient detail, including design concept and scope, for an air quality analysis to determine conformity

In nonattainment or maintenance areas, the first two years of the TIP can include only projects for which funds are available or committed, and the TIP must give priority to eligible TCMs identified in the approved State Implementation Plan. In nonattainment and maintenance areas, the first three years of the TIP are subject to air quality conformity requirements and must be found in conformity by FHWA and FTA before it can be included in the STIP.

¹⁵⁴ 23 CFR §450.324.

As a management tool for monitoring progress in implementing the LRTP, the TIP identifies the criteria and process for prioritizing implementation of transportation plan elements, for inclusion in the TIP. In nonattainment and maintenance areas, the TIP also describes the progress in implementing required TCMs. This is a point in the process where calculation of carbon footprint from proposed transportation projects would be a useful criterion. Where projects can be shown to reduce the carbon footprint, this is likely the result of progress in implementing TCMs.

All amended and updated TIPs also must go through a conformity determination. In nonattainment and maintenance areas, if a TIP amendment involves projects that are not exempt from air quality conformity (exempt projects include transportation improvements such as landscaping and sidewalks; a complete list is provided in 40 CFR Part 93) or is replaced with an updated TIP, a new conformity determination of the TIP must be made by the MPO, FHWA, and FTA. The TIP expires when the FHWA/FTA approval of the STIP expires.

Factors Influencing the Prioritization of Transportation Improvements in the LRTP and TIP

In the development of the LRTP, as they are required to be multimodal plans, the method for including transportation improvements for multiple modes is done by identifying desired projects for each mode, independently of the other modes. Transportation improvements are usually conceived as separate facilities contained within parallel modal systems, and are planned and function as such. The separate and parallel modal planning is reinforced by the separation of funding sources, institutional authority, user groups, and even professional training, along the lines of transportation mode.

Separate modal planning is changing as questions arise regarding the need for methods to evaluate tradeoffs among modes and, most urgently, to determine the point at which public transit is expanded instead of highway capacity expansion. It is unusual for a proposed highway widening project to be replaced by a capacity improvement from an alternative mode, unless widening cannot be done due to prohibitive costs, neighborhood impacts, or policy constraints. For example, Portland, Oregon, is known for its decision not to build a major cross-town expressway but to fund public transit instead. Planners must now deal with funding constraints and limited land upon which to expand the transportation system.¹⁵⁵

In the meantime, while multimodal integration of transportation planning is conventionally understood as necessary and desirable, the current state of practice is to develop the LRTP as an amalgam of separate modal facility improvements.

In summary, the factors that influence the identification of transportation improvements in the LRTP and the TIP include the following:

¹⁵⁵ In the Hillsborough MPO LRTP 2035, in the case of a highway corridor with right-of-way constraints, "... the 2035 LRTP emphasizes preserving right-of-way for rapid transit by reducing the number of lanes for the proposed widening" (LRTP 2035 Chap 2 p. 2-37). This is a departure from the recommendations of the Hillsborough County Comprehensive Plan Capital Improvements Program, which calls for an additional highway lane in each direction.

- Availability of federal funds for particular projects. MPOs will identify eligible projects to take advantage of the funding availability.
- Public input about highway congestion in specific places and the political process, including constituent pressure brought to bear upon local elected officials to push for specific roadway improvements.
- The existence of older project concepts from previous LRTPs.
- Transportation improvement projects and programs already under way.
- Projects identified through the TDP and other modal plans, such as bicycle and pedestrian plans.
- Projects identified through congestion management systems planning.
- Results from corridor studies or sub-area studies.
- The application of a rational method with weighted criteria to evaluate and prioritize improvement alternatives.

Details of the Federal Clean Air Act Air Quality Conformity Process and Analysis and its Application to Metropolitan Transportation Planning

The air quality conformity process and analysis is defined by the planning processes to which it applies, including the MPO LRTP and TIP and the NEPA EA/EIS process. A discussion of the air quality conformity process is presented here as part of the discussion of the transportation planning processes.

In geographic areas designated by USEPA as air quality nonattainment or maintenance areas, a finding of air quality conformity is a prerequisite to the adoption of the MPO LRTP and the TIP. This means that all proposed transportation projects that are sought to be built using federal funds, including highway and transit projects located in these areas, must be part of a conforming MPO LRTP and TIP before acceptance by FHWA and FTA.

The Transportation Conformity Rule (Title 40 CFR Part 93 §§100-160) implements the Clean Air Act (CAA), as amended in 1990.¹⁵⁶ The Transportation Conformity Rule also supplements requirements of other laws and regulations governing the content of transportation plans, such as the Metropolitan Planning Rule.

For all transportation plans, programs, and projects that require some federal action, such as approval or funding, this Rule provides policy, criteria, and procedures for demonstrating the conformity of transportation activities to an SIP developed pursuant to the CAA, for all areas that are designated as nonattainment or that have achieved attainment and have maintenance plans. Transportation activities that enable attainment and maintenance of the NAAQS must be given approval priority by FHWA and FTA. In this way, highway widening projects that can achieve congestion reduction can win approval priority.

The chronology of the air quality conformity determination process of the LRTP and TIP proceeds as follows:

1. MPO develops the LRTP and TIP.
2. MPO prepares a conformity determination report, finding the LRTP and the TIP to be in conformity.
3. FHWA and FTA consult with USEPA regarding conformity of LRTP and TIP.
4. FHWA and FTA make a finding of conformity.
5. MPO adopts the LRTP and the TIP.
6. Projects are selected from the LRTP for inclusion in the TIP.
7. Projects in the MPO TIP are incorporated into the STIP.
8. Transportation projects in the STIP are discussed in the SIP.

¹⁵⁶ The complete reference is Title 40: Protection of Environment, Part 93—Determining Conformity of Federal Actions to State or Federal Implementation Plans, Subpart A—Conformity to State or Federal Implementation Plans of Transportation Plans, Programs, and Projects Developed, Funded or Approved Under Title 23 USC, Highways or Under Title 49 USC, Federal Transit Laws.

A determination of conformity includes the finding that the MPO LRTP and TIP have developed a plan and program that stays within an air pollutant emissions budget specified for that MPA by its SIP. The USEPA provides to the states information on air quality criteria and air pollution control techniques to assist in the development of their SIPs.

The Metropolitan Planning Rule also establishes integration of long range transportation planning with air quality conformity to the NAAQS. For example, transportation plan conformity determinations are required every four years for the TIP update in nonattainment and maintenance areas to make sure that the results continue to be valid and consistent with current and forecasted transportation and land use trends and conditions. FDOT elected to update and conduct TIP conformity determinations every 3 years, as federal law allows.¹⁵⁷

State Implementation Plan

To understand the air quality conformity process for MPAs, it is helpful to provide a brief overview of air quality conformity at the state level. Each state that contains air quality nonattainment or maintenance areas must prepare an SIP. The purpose of the SIP is to:

... eliminate or reduce the severity and number of violations of the national ambient air quality standards (NAAQS) and to achieve expeditious attainment of the NAAQS, ensuring that such activities will not:

- cause or contribute to any new violation of any standard in any area;
- increase the frequency or severity of any existing violation of any standard in any area; or
- delay timely implementation of any standard or any required interim emission reductions or other milestone in any area.¹⁵⁸

The SIP contains a Memorandum of Agreement regarding conformity criteria and procedures that are applied in the state. Each SIP must demonstrate that the strategies, rules, and regulations contained in it are adequate to provide for the timely attainment and maintenance of the national standards that it implements.¹⁵⁹ For those criteria pollutant control strategies selected for inclusion in the SIP, the SIP must also specify how the control strategies will be monitored and enforced for compliance.

FDEP is the state agency that is responsible for ensuring state compliance with the Federal Clean Air Act and that develops and updates the Florida State Implementation Plan (SIP). The SIP contains the emissions budget for the entire state for each criteria pollutant that is in violation of the NAAQS. The SIP provides the allocation of allowed emissions across both stationary and mobile sources within the state, including stationary point sources, stationary areas, biogenic sources, non-road mobile sources,

¹⁵⁷ As described in Part 1 of the MPO Administrative Manual, Chap. 5, "Transportation Improvement Program, Topic No. 525-010-025, and as described in the FDOT District Review of Conformity Determinations, Triennial Plan Update Process, 525-010-014-g. Office of Policy Planning, effective July 9, 1998.

¹⁵⁸ 42 USC §7506(c)(1).

¹⁵⁹ 40 CFR §51.112.

and on-road mobile sources of interest to this study. For on-road emissions sources, this includes the motor vehicle emissions budgets (MVEB) from transportation sources for each MPA.

Any time the SIP is revised, there must be a redetermination of conformity of the LRTP and the TIP. The SIP may be revised:

- If there is a change by USEPA in the air emissions budget allocated to the Florida SIP.
- If there are changes in Florida's allocation of emissions budget to on-road mobile sources.
- In response to the results of a new regional emissions inventory.
- If there are changes to the maintenance plan of the SIP.

Emissions Inventory and Reporting

To satisfy requirements of the SIP, states are required to inventory emissions sources for the entire state, with the exception of tribal lands, and report it to the USEPA. These include emissions from mobile sources, listed by source classification code (SCC), such as on-road mobile sources, and non-road mobile sources. The pollutants that must be measured and reported for NAAQS management are sulfur dioxide (SO₂), volatile organic compounds (VOC), nitrogen oxides (NO_x), carbon monoxide (CO), lead and lead compounds, particulate matter (Primary PM_{2.5} and Primary PM₁₀), and ammonia (NH₃).

States must report 12-month emissions for all sources to USEPA every 3 years (a Three-Year Cycle Inventory), including summer day emissions for VOC and emissions from NO_x for the 5-month ozone season.

The USEPA provides the Emission Inventory Improvement Program (EIIP), which provides and ranks estimating procedures based upon degrees of uncertainty for each pollutant measured. These procedures enable standardization across states for comparison purposes.¹⁶⁰

Nonattainment Areas

The USEPA NAAQS for ozone is presently 75 parts per billion (ppb), 8-hour. The USEPA is scheduled to announce its final ruling regarding lowering the ozone NAAQS on August 31, 2010.¹⁶¹ If the NAAQS for ozone is decreased to as low as 60 ppb, 8-hour, then 37 counties representing 21 MPOs in Florida could be designated as nonattainment.¹⁶²

States having ozone nonattainment areas, as Florida will likely have, must submit control strategy SIPs. These control strategy SIPs are referred to as "reasonable further progress SIPs," "attainment demonstration SIPs," or "maintenance plans," depending upon the degree of progress toward air quality conformity.

¹⁶⁰ The EIIP can be found at <http://www.epa.gov/ttn/chief/eiip>.

¹⁶¹ More information will be posted at <http://www.epa.gov/climatechange/emissions>

¹⁶² Transportation and Air Quality Conformity is Coming! Florida Department of Environmental Protection, Tom Rogers and Robert Wong, Powerpoint presentation slide 5. Presented at the 2009 Model Task Force Meeting, Orlando, November 10, 2009. Found at http://www.fsutmsonline.net/images/uploads/mtf-files/Air_Quality_DEP_Tom_Rogers_Robert_Wong.pdf

The CAA sets forth different requirements for SIPs for areas designated as Marginal, Moderate, Serious, Severe, and Extreme Nonattainment Areas.¹⁶³ SIPs must include a date by which standards are to be attained. Florida would be affected by the ozone reduction requirements for Marginal and Moderate Nonattainment Areas.

For all areas newly designated as nonattainment, FDEP must develop an SIP with emissions budgets for each nonattainment area to come into conformity with NAAQS no later than five years from the time the areas are officially designated as nonattainment. If an urbanized area demonstrates conformity with NAAQS for three consecutive years, then the State can apply for an attainment designation for that urban area.

These SIPs establish MVEBs, measured in tons per day (tpd) for each of the criteria pollutants and/or their precursors to address pollution from cars and trucks. The MVEBs are the portion of the total allowable emissions that is allocated to highway and transit vehicle use and emissions. The MVEBs serve as a ceiling on emissions from an area's planned transportation system so that total emissions do not exceed the 1990 attainment year (base year) emissions. The SIP provides an MVEB for intermediate milestone years and an attainment year for a MPA that is in nonattainment and is implementing TCMs. Milestones are emissions levels and the date that the emissions levels must be achieved in order to demonstrate "reasonable further progress" toward attainment. The SIP also contains emissions estimates for the current year and future years.¹⁶⁴

For Marginal Nonattainment Areas, the SIP and successive SIP revisions must include an inventory of emissions from all sources. The State must submit another inventory at the end of each three-year period until the area is redesignated to attainment. The SIP must include use of "reasonably available control technologies" (RACT), which includes TCMs referenced below, as part of a means to achieve "reasonable further progress" and ultimate attainment of the standard. For Moderate Nonattainment Areas to achieve reasonable further progress, the SIP must contain all elements as those for Marginal Areas, plus provide for actions that will achieve specific annual reductions in VOC and NO_x to attain the primary NAAQS for ozone by an attainment date set by USEPA. These include a system for gasoline vapor recovery of emissions from the fueling of motor vehicles at fueling stations that sell over a certain amount of gasoline per month. The SIP must satisfy provisions for motor vehicle inspection and maintenance. The SIP also must contain a specific schedule for implementing a vehicle emission control inspection and maintenance program per guidance provided by USEPA.

For Marginal Nonattainment Areas, the SIP must satisfy an emissions offset requirement. The ratio of total emissions reduction of VOC to total increase must be at least 1.1 to 1. For Moderate Nonattainment Areas, the ratio of total emissions reduction of VOC to total increase must be at least 1.15 to 1.

¹⁶³ CAA §182 (42 USC Chapter 85, Section 7511a).

¹⁶⁴ The MVEB is explained in the preamble to the Nov 24, 1993 Transportation Conformity Rule, published in 58 FR 62188. It describes how MVEBs are established and revised in SIPs.

Transportation Control Measures

In MPAs that are in nonattainment for ozone or carbon monoxide, the MPO must coordinate the development of the LRTP with the process for developing TCMs as part of the SIP.

A conformity determination for plans or projects in nonattainment or maintenance areas requires a demonstration of the timely implementation of any TCMs identified in the SIP. This includes a demonstration that implementation is on schedule, an identification of obstacles to timely implementation and how they are being overcome, a demonstration that maximum funding and approval priority is being given to TCM projects over other projects and that funding for previously programmed TCMs have not been diverted to other projects.

There are presently no required TCMs in the Florida SIP; however, “TCM-type” projects historically have been proposed and funded by MPOs as part of the overall strategy to reduce emissions. These TCM-type projects include bike lanes, sidewalks, Intelligent Transportation Systems (ITS) freeway management, intersection improvements, and commuter assistance programs. A recent study resulted in the compilation of a list of ozone-reduction strategies that transit agencies can implement or that affect transit agencies.¹⁶⁵ CAA Section 108(f) lists examples of TCMs, including improvements to public transit (bold emphasis added below) and other strategies that reduce VMT.¹⁶⁶

¹⁶⁵ Transit Ozone-Reduction Strategies Toolbox, prepared by Tindale-Oliver & Associates, Inc., sponsored by Florida Department of Transportation, March 2010.

¹⁶⁶ 42 USC Chapter 85 Section 7408 (CAA 108(f))

Examples of Transportation Control Measures Provided by Law

42 USC Chapter 85 Section 7408 (CAA 108(f))

- **Programs for improved public transit.**
- Restriction of certain roads or lanes to, or construction of such roads or lanes for use by, passenger buses or high occupancy vehicles.
- Employer-based transportation management plans, including incentives.
- Trip-reduction ordinances.
- Traffic flow improvement programs that achieve emission reductions.
- Fringe and transportation corridor parking facilities serving multiple occupancy vehicle programs or transit service.
- Programs to limit or restrict vehicle use in downtown areas or other areas of emission concentration particularly during periods of peak use.
- Programs for the provision of all forms of high occupancy, shared-ride services.
- Programs to limit portions of road surfaces or certain sections of the metropolitan area to the use of non-motorized vehicles or pedestrian use, both as to time and place.
- Programs for secure bicycle storage facilities and other facilities, including bicycle lanes, for the convenience and protection of bicyclists, in both public and private areas.
- Programs to control extended idling of vehicles.
- Programs to reduce motor vehicle emissions, consistent with subchapter II of this chapter, which are caused by extreme cold start conditions.
- Employer-sponsored programs to permit flexible work schedules.
- Programs and ordinances to facilitate non-automobile travel, **provision and utilization of mass transit**, and to generally reduce the need for single-occupant vehicle travel, as part of transportation planning and development efforts of a locality, including programs and ordinances applicable to new shopping centers, special events, and other centers of vehicle activity.
- Programs for new construction and major reconstruction of paths, tracks or areas solely for the use by pedestrian or other non-motorized means of transportation when economically feasible and in the public interest. For purposes of this clause, the Administrator shall also consult with the Secretary of the Interior.
- Programs to encourage the voluntary removal from use and the marketplace of pre-1980 model year light duty vehicles and pre-1980 model light duty trucks.

Air quality models are used to demonstrate the effectiveness of a TCM. Federal guidelines specify the appropriate selection of air quality models and data requirements for determining TCM effectiveness.¹⁶⁷ With approval of USEPA, air quality models may be modified or substituted, for a specific State program or on a case-by-case basis. To demonstrate that a TCM is effective, the SIP must include the following:

1. A summary of the computations, assumptions, and judgments used to determine the degree of reduction of emissions (or reductions in the growth of emissions) that will result from the implementation of the control strategy.
2. A presentation of emissions levels expected to result from implementation of each measure of the control strategy.

¹⁶⁷ 40 CFR, Part 51, Appendix W, "Guideline on Air Quality Models"

3. A presentation of the air quality levels expected to result from implementation of the overall control strategy presented either in tabular form or as an isopleth map showing expected maximum pollutant concentrations.
4. A description of the dispersion models used to project air quality and to evaluate control strategies.
5. For interstate regions, the analysis from each constituent State must, where practicable, be based upon the same regional emission inventory and air quality baseline.¹⁶⁸

TCMs also must be monitored for effectiveness, which requires data collection. The SIP must contain procedures for obtaining and maintaining data on actual emissions reductions achieved as a result of implementing TCMs. In the case of TCMs based on traffic flow changes or reductions in vehicle use, the data must include observed changes in VMT and average speeds. The data must be maintained in such a way as to facilitate comparison of the planned and actual efficacy of the TCMs.¹⁶⁹

Maintenance Plans

When a state submits a request to USEPA for a redesignation of a nonattainment area for any air pollutant to the status of attainment of the NAAQS, then it must submit a control strategy implementation plan revision which constitutes a maintenance plan for maintaining the NAAQS for at least 10 years after redesignation. Even though GHG emissions from transportation are not yet regulated, the requirements of the federal NAAQS have engaged Florida MPOs for the past 20 years to ensure air quality standards are met through the transportation planning process. For example, there are three air quality maintenance areas for ozone in Florida: the Tampa Bay metropolitan area; the Southeast area of Miami-Dade, Broward and Palm Beach Counties; and the Jacksonville metropolitan area.

USEPA uses the following minimum criteria by which it finds an MVEB in a submitted maintenance plan to be adequate for conformity purposes:

- The MVEB must be consistent with the emissions inventory and TCMs that are part of the maintenance plan.
- The budget must be precisely quantified and, when considered together with all other emissions sources, also must be consistent with the requirements for achieving the relevant goal (reasonable further progress, attainment or maintenance).
- If it is a revision to a previously-submitted SIP or maintenance plan, then explanations must be provided for any changes to the budget or to the TCMs, including changes to emissions factors or estimates of vehicle miles traveled, anticipated impacts to emissions, and any changes to the

¹⁶⁸ 40 CFR §51.112.

¹⁶⁹ 40 CFR §51.213.

amount by which the total projected emissions for a pollutant differs from the standard known as the safety margin.¹⁷⁰

The maintenance plan includes the 1990 base year emissions inventory, the motor vehicle emissions budget for the region, and an enforceable contingency plan of TCMs that are to be implemented if a future violation occurs. Control measures currently contained in the Florida Ozone Maintenance Plans include VOC Reasonably Available Control Technology (RACT), the Federal Motor Vehicle Control Program (FMVCP), and Reid Vapor Pressure (RVP). In case of a violation of the ozone NAAQS, the plans contain a contingency to implement additional control measures. These include reinstatement of New Source Review (NSR), less volatile or reformulated gasoline, expansion of control strategies to adjacent counties for VOC and/or NO_x and two new control technique guidelines (CTG) categories, NO_x RACT, Stage II Vapor Recovery, and an enhanced vehicle emissions inspection program. These contingency plans do not appear to contain transportation control measures that relate to modifying travel behavior and reducing vehicle miles traveled.

The maintenance plan in an SIP must have satisfied all applicable consultation and documentation processes, and it must be endorsed by the Governor after a state public hearing. In reviewing an SIP for adequacy, there is a public comment period, after which the USEPA responds to public comments on its Web site, then informs the State of its findings and publishes the findings in the *Federal Register*. The effective date of the approved SIP is 15 days after publication in the *Federal Register*.

Reducing ozone and ozone precursors can be accomplished in the same way as for GHG emissions from motor vehicle travel, by reducing the amount of travel, such as the number of trips and length of those trips, measured as VMT, which are addressed by transportation demand management (TDM) and by providing transportation alternatives. GHG emissions also can be decreased by reducing motor vehicle idling, reducing accelerations and decelerations, and maintaining an optimum travel speed, which are addressed by congestion reduction strategies. However, the optimum speed can be dependent on pollutant, fuel type, and engine technology.

For all MPOs in nonattainment or maintenance areas, the regional emissions analysis representing the combined emissions generated by all transportation improvements contained in the MPO LRTP must indicate that less emissions are produced than that budgeted for that region by the SIP for each planning year represented by the LRTP and that the emissions will not cause or contribute to the violation of any standard or to the delay in achieving a standard.

A Conformity Determination Report (CDR), prepared by the MPO, demonstrates that the MPO LRTP is in compliance with the SIP and with CAA as amended in 1990.

¹⁷⁰ Conformity Guidance on Implementation of March 2, 1999, Conformity Court Decision” by EPA, May 14, 1999. This was incorporated into “Transportation Conformity Rule Amendments: Response to Court Decision and Additional Rule Changes” by EPA, 68 FR38974, June 30, 2003.

Interagency Review

A large part of conformity determination is a consultation process required by law among key agencies, including FDOT and local transportation and land use agencies, FDEP, MPO/TPO, state and local air quality agencies, regional EPA, FHWA and FTA, and RPCs.

The State must develop interagency coordination processes that are used prior to conformity determinations. These processes are included in the SIP. These processes include public participation, conflict resolution, and interagency consultation. Public involvement processes are developed in accordance with 23 CFR Part 450. Interagency consultation processes and procedures include establishing the following:

- The roles and responsibilities of each agency, at each stage in the process for developing the implementation plan, LRTP, and TIP.
- Within agencies, the level of staff at which there must be regular consultation.
- Determination of which transportation projects are “regionally significant.”
- Development of the regional transportation model and conduct of research and data collection efforts.
- Evaluation and selection of models, methods, and assumptions for regional emissions analysis and hot spot analysis, where CO concentrations accumulate.
- Consultation on emissions analysis for projects that cross MPO borders or nonattainment areas.
- Development of TCMs for inclusion in the implementation plan.
- Evaluation of progress of TCM implementation or the selection of new TCMs.
- Determination when events trigger a new conformity determination, including when a project has changed in design concept and scope that would trigger an amendment to the LRTP and TIP.
- Evaluation of projects that qualify for exemption from conformity.

The FDOT District Review of Conformity Determinations is provided in FDOT Directive 525-010-014-g.¹⁷¹ This directive is applied to the Triennial LRTP Plan Update Process (occurring every three years). It describes the duties of FDOT districts, the FDOT Systems Planning Office, and the FDOT Office of Policy Planning in reviewing and transmitting conformity determinations by MPOs in air quality maintenance areas. The Office of Policy Planning of the FDOT Central Office develops guidance to assist in the review and approval of conformity determinations between districts, MPOs, and federal agencies. The FDOT Systems Planning Office of the Central Office assists districts and MPOs in conducting modeling for conformity determinations. FDOT Districts provide technical assistance to MPOs and their consultants in conducting the required regional analysis for determining conformity. The FDOT District also assists the MPO in drafting a scope of services for the LRTP update, if a consultant is retained. The scope of

¹⁷¹ FDOT District Review of Conformity Determinations, Directive 525-010-014-g, effective July 9, 1998, updated August 20, 1998.

services defines the roles of the FDOT District and the MPO. These roles must be consistent with the Metropolitan Planning Rule 23 CFR 450 Part C and the joint participation agreement between the FDOT District and the MPO.

Timing and Scope of Conformity Determinations

Conformity determinations of the LRTP must be no less frequent than every four years. FDOT elected to update and conduct LRTP conformity determinations every 3 years, as federal law allows.¹⁷² Any revisions of an LRTP also require a new conformity determination. Revisions include a change in design concept and scope of a transportation project, adding or deleting a regionally significant project, shifting project phasing, changing planning assumptions, or anything else that might change the emissions from the original projections.

Conformity determinations are required prior to the adoption of LRTPs and major LRTP amendments, as well as TIPs and major TIP amendments. The transportation network is developed based upon an official street map of the county and the existing public transit system. Proposed regionally significant changes to the highway and transit system are described. These include additions and modifications to intersections and highway segments, as well as completely new facilities to be added to the existing transportation network that would be operational by the planning horizon year. These proposed transportation improvements must be a reasonable planning response to anticipated future land development patterns. These proposed transportation improvements include FHWA/FTA projects and non-FHWA/FTA projects, and these must be included in the regional emissions analysis of the LRTP and TIP.

The conformity determination process starts with a review of the results of the LRTP update. The LRTP uses the most recent estimates of future population, employment, travel, and congestion¹⁷³ to forecast resulting land use changes, as guided by the land use element policies contained in the comprehensive plans of local governments in the region. These data and forecasts form the basis for the forecast future regional demand for transportation facilities and services. Estimates and forecasts for population, employment, school enrollment and hotel/motel rooms are made by planning staff, based upon the assumption that planning policies that direct growth and redevelopment will be implemented.

The LRTP must include a determination of the impact of the changes upon route choice between traffic analysis zones, as a result of the selected proposed transportation projects or policies, such as changes in pricing. The design concept and scope for each new highway segment must be described to enable prediction of travel times for various traffic volumes, using modeling methods consistent with that used for the area-wide transportation analysis by the MPO. Future transit ridership also must be predicted, taking account of described design concept, scope and operating policies of planned new transit

¹⁷² As described in Part 1 of the MPO Administrative Manual, Chap. 5, "Transportation Improvement Program, Topic No. 525-010-025, and as described in the FDOT District Review of Conformity Determinations, Triennial Plan Update Process, 525-010-014-g. Office of Policy Planning, effective July 9, 1998.

¹⁷³ Required planning data is described in the U.S. Code of Federal Regulations, 40 CFR 93.110 and 23 CFR 450.322(a).

facilities and services. Assumptions are made regarding increases in transit fares and road tolls. An inflation rate adjustment is applied.

Conformity determinations also are required prior to the approval, funding and implementation of the following types of projects:

- FHWA/FTA projects from a conforming LRTP and TIP
- FHWA/FTA projects not from a conforming LRTP or TIP (such as an alternative scenario under review)
- Regionally significant projects that are not FHWA/FTA projects

The law specifies highway and transit projects that are exempt from inclusion in the conformity determination. These include projects that do not increase capacity, such as highway modifications to improve safety, signalization, resurfacing, ITS strategies, TDM strategies, and purchase of replacement transit vehicles.¹⁷⁴ The law does not list transportation control measures explicitly, but does include the continuation of ridesharing and vanpooling promotion activities at current levels, and bicycle and pedestrian facilities.

Analysis and Horizon Years

Within two years of EPA's finding that MVEBs contained in an initial or revised SIP are adequate to achieve conformity, the LRTP and the TIP must undergo a conformity determination to determine their compliance with the SIP. The estimated motor vehicle emissions that represent all projects in the LRTP, the TIP, and from FHWA/FTA projects not included in the LRTP or TIP must not exceed the budget in the approved SIP for the last year represented in the LRTP (the horizon year) and for intermediate years in the LRTP such that consistency determinations can be demonstrated for analysis years that are not more than 10 years apart.

The Transportation Conformity Rule provides stipulations for the selection of planning horizon years that provide the timeframes for describing future planned transportation facilities in enough detail that determinations of conformity to NAAQS can be made. For example, the first horizon year may be no more than 10 years from the base year used to validate the transportation demand planning model. Horizon years may be no more than 10 years apart. The last year of the transportation plan's forecast period must be a horizon year, and the timeframe for conformity determination must be through the last year of the transportation plan's forecast period.

For MPAs that are in attainment and have an approved air quality maintenance plan in the SIP, the MPO may choose, in coordination with other agencies, to shorten the timeframe of the LRTP and TIP conformity determination to extend through the last year of the maintenance plan. For areas that do not have an approved maintenance plan, the MPO also may choose to shorten the timeframe of the

¹⁷⁴ 40 CFR 93.126

LRTP and TIP conformity determination but must extend it to whichever one of the following three is the latest:

- The latest year for which an approved MVEB in the implementation plan can be applied.
- The year after a regionally significant project in the TIP is completed.
- The 10th year of the LRTP.

Planning Assumptions

All conformity determinations require a finding that the latest planning assumptions were used, the latest emissions model specified by USEPA was used, and that the appropriate consultation and coordination processes were correctly followed.¹⁷⁵ The planning assumptions include the latest estimates of current and future population, employment, travel, and congestion that have been developed by the MPO or authorized authority. The conformity determination for each LRTP and TIP must discuss how transit operating policies, such as fares and service levels, and ridership have changed since the last conformity determination, including reasonable assumptions about future transit service, transit fare increases, and bridge and road toll increases.

Inputs to Regional Travel Demand Model

The growth projections, planning assumptions, and proposed transportation facilities that become operational and in use by each analysis year are entered into the regional travel demand model. This is to develop traffic volumes by highway segment for the analysis years and the horizon year, based upon a number of scenarios describing different combinations of existing and planned highway and transit facilities, services and activities. The LRTP and the CDR provide lists of these proposed facilities by analysis year. The scenarios also include ongoing TDM and TSM programs, and any TCMs that are part of the LRTP.

The Travel Demand Model Calculates VMT

Population and employment forecasts, as well as land development pattern forecasts based upon growth management policy, are provided as inputs to a travel demand model. In Florida, the Florida Standard Urban Transportation Modeling Structure (FSUTMS) is available for use by MPOs. MPOs sometimes perform modeling in conjunction with neighboring MPOs, and in some cases an entire FDOT District operates a single model. Also known as the Florida Standard Model, FSUTMS is the traffic demand model that simulates human behavior while traveling. The computer model simulations are calibrated to match actual observed traffic for a given point in time. Once this is accomplished, the models then are used as a tool to project future traffic. The transportation modeling and planning community in Florida relies heavily on travel survey data to develop, calibrate, and validate travel demand forecasting models, to evaluate alternatives, assess impacts of policies and multimodal plans, and quantify travel demand by purpose, time, location, and mode.

¹⁷⁵ Including those specified in 40 CFR 93 Subpart A (Transportation Conformity Rule), 23 CFR 450 (Metropolitan Planning Rule) and the state implementation plan.

Regions use variations of FSUTMS. In the case of the Hillsborough MPO, this is the Tampa Bay Regional Planning Model (TBRPM), which encompasses five counties. The travel demand model simulates the generation of trips according to land use, and distributes those trips across origin-destination pairs of traffic analysis zones (TAZs). Assumptions about modal split are input, and the model is run. The result is the assignment of trips upon the facilities within a transportation network that is described by existing conditions as well as a network augmented by the proposed transportation improvements in the LRTP. Assignment of a mode split has been historically modest, but over time, should reflect an increased mode split for bus transit, based upon the impact of land development policies to place greater densities of employment and residential development closer to transit service. Some travel models account for travel time, transit transfer time, and cost to calculate and incorporate changes in mode share. MPOs should exercise care in assumptions about mode split in the travel demand model, as the model outputs might continue to reflect status quo conditions instead of supporting change. The travel model should also be run to reflect changes in travel due to congestion pricing and parking policies. The travel demand model outputs of traffic volumes (and post-processed VMT), vehicle type distributions, travel speeds, and facility type (along with other data) can be used as input to air pollutant emissions models (including the new EPA MOVES model) to generate estimates of criteria air pollutant emissions.

Based upon the results of the travel demand model, alternative scenarios of transportation improvements are run iteratively until results show that the combination of transportation improvements ultimately proposed within the LRTP are cost affordable and provide adequate transportation service to meet forecast travel demand 20 years out. The results also must show that air pollutant emissions resulting from the projects within the LRTP will not violate air quality standards.

Members of the Florida Model Task Force (MTF) met in a workshop in November 2009, where they identified priorities for the improvement of travel demand modeling in Florida, including the development of standards for transit data collection from surveys and counts, for the purpose of meeting requirements of the FTA New Starts program. Ridership forecasts for transit development plans and planning studies for FTA's New Starts and Small Starts programs are supported by FDOT's Transit Boardings Estimation and Simulation Tool (TBEST). TBEST provides immediate results and cost efficiency to local governments and transit agencies that cannot be met by long range travel demand models. TBEST simulates transit travel demand at the individual stop level and takes into consideration several elements, including the distinction between direct and transfer boardings, time-of-day analysis, pedestrian access to transit as informed by socioeconomic characteristics, network connectivity and accessibility, competing and complementary system effects, and other planning factors.¹⁷⁶ TBEST is being assessed by FDOT for its model outputs compared to the data requirements of FTA.

The MTF also is interested in using the latest National Household Travel Survey (NHTS) data for use in Activity Based Models and in the next cycle of MPO LRTP updates. The FDOT Systems Planning Office plans to use the new NHTS data to examine a number of travel characteristics, including use of different

¹⁷⁶ Florida Transportation Modeling Newsletter, FDOT Systems Planning Office, October 2009, p. 4.

transportation modes. Analysis will include assessing the explanatory power of various independent variables, including mode splits, as they relate to the generation of person trips by trip purpose.

Application of Air Pollutant Emissions Model

The USEPA must approve the air pollutant emissions model that uses the outputs from the regional travel demand model to estimate pollutant emissions. The currently approved model for SIP inventories and transportation conformity is MOVES. The air quality analysis must demonstrate that the regional emissions predicted for each analysis year within an MPA are less than or equal to the emissions predicted in the 1990 base year inventory and MVEB.

VMT also must be adjusted to convert peak season VMT (January through March) to peak ozone season (June through August). FDOT provides Average Annual Daily Traffic (AADT), traffic characteristics, and regional roadway characteristics to FHWA as part of the national highway database known as the Highway Performance Monitoring System (HPMS). The HPMS VMT adjustment factor is developed for this purpose and is used to calibrate the EMIS module for FSUTMS. The adjusted VMT is used to calculate emissions for comparison with the SIP budget. The MOVES air quality emissions model and the EMIS module, an FDOT custom utility program, are then used within the FSUTMS framework. EMIS is used as an interface program to link the travel model and the emissions analysis model. EMIS applies the MOVES output emissions factors to the VMT output from FSUTMS. While using EMIS, an adjustment factor of the Highway Performance Monitoring System (HPMS) is applied. EMISFAC adjusts the 1990 FSUTMS model-produced VMT such that VOC or NO_x calculated from the VMT is equal to or less than the 1990 inventory amounts.

The FDOT Systems Planning Office provides information and guidance on the use of the required models to the FDOT districts and MPOs. This includes control files containing updated FSUTMS input values that are used for long range transportation planning to determine VMT generated by the regional network as a result of transportation improvement projects represented in the LRTP and the TIP. The VMT calculation is then used in performing the regional emissions analysis. The FDOT Districts advise their respective MPOs. Required inputs for MOVES vary by the criteria pollutant under analysis. For ozone, variables include the high and low temperatures provided by FDOT Systems Planning and the Reid Vapor Pressure for the peak ozone season provided by USEPA.

The MTF also has prioritized the development of model application and post-processing tools for air quality evaluation in the FSUTMS framework, in anticipation of newly designated air quality nonattainment areas in Florida. Based upon the 2007-2009 ozone monitoring data and the least stringent standard of 70 parts per billion (ppb), 8-hour, there are several core-based statistical areas (CBSA) that are likely to be designated as nonattainment areas, including:

- Pensacola—Ferry Pass—Brent
- Panama City—Lynn Haven
- Tampa—St. Petersburg—Clearwater
- Bradenton—Sarasota—Venice

- Orlando—Kissimmee
- Lakeland—Winter Haven¹⁷⁷

USEPA is expected to designate new ozone nonattainment areas by July 2011 with MPO conformity determinations of L RTPs and T IPs due one year after designation. The FDOT Systems Planning Office has made progress on the air quality post processor (AQPP) within FSUTMS/Cube Voyager to calculate ozone and GHG emissions. This tool can be used to compare emissions at the regional level and to compare study alternatives. In preparation of demonstrating conformity, the FDOT Systems Planning Office recommends establishing regional interagency committees to discuss data, methods and assumptions and to consider integrating the FSUTMS AQPP framework into the FSUTMS travel demand model, using MOVES2010 emissions factors to calculate ozone and GHG emissions.¹⁷⁸

The FDOT Systems Planning Central Office and FDOT Districts also assist MPOs in calculating emissions reductions from CMAQ-funded projects as well as ITS, TDM, and TSM strategies, exempt projects, and other projects that can demonstrate emissions benefits, such as TCMs and TCM-like strategies, and contingency measures that are part of maintenance plans. These projects are not accounted for in the model and so are accounted for using “off-model methodologies.”

There are various models in existence that aim to calculate impacts based upon selected values for identified variables. An example of an off-model methodology is the model Trip Reduction Impacts of Mobility Management Strategies (TRIMMS®), a practitioner-oriented sketch planning tool that quantifies net social benefits to society from the implementation of transportation demand management (TDM) strategies. These benefits include reductions in fuel consumption and emissions, global climate change impacts and congestion.¹⁷⁹ TRIMMS® evaluates strategies directly affecting the cost of travel, such as public transportation subsidies and other financial incentives provided to employees by their employers. TRIMMS® also evaluates employer-based program support strategies that affect access and travel times, such as TDM program support, alternative work schedules and work site amenities. Travel price and travel time elasticity are at the core of the TRIMMS® trip demand function and it estimates changes in travel behavior, such as change in mode share and VMT. TRIMMS® allows input customization and the ability to clearly differentiate between analysis at the regional and employer-site levels. The regional level is either area-wide or multi-employer analysis that defines a scope where the number of travelers being affected by the policy under evaluation is represented by the total regional employment population or a specific target population, respectively. Model inputs for regional analysis include number of employers operating in the area and average employer size by major industrial sector. For TRIMMS®, the time of analysis is represented by the implementation duration of the TDM strategy. TRIMMS® uses output tables from MOBILE6 and is likely to use output tables from

¹⁷⁷ Florida Transportation Modeling Newsletter, FDOT Systems Planning Office, March/April 2010, p. 3.

¹⁷⁸ Florida Transportation Modeling Newsletter, FDOT Systems Planning Office, March/April 2010, p. 3.

¹⁷⁹ Concas, Sisinnio and Philip Winters. 2009. “Quantifying the Net Social Benefits of Vehicle Trip Reductions: Guidance for Customizing the TRIMMS® Model.” Final Draft Report. Prepared for the Florida Department of Transportation. Prepared at the Center for Urban Transportation Research, University of South Florida, Tampa, April.

MOVES when MOVES becomes fully operational. These output tables provide emission factors specific to the geographical areas used by TRIMMS®.¹⁸⁰

With regard to the use of TRIMMS 2.0© for a regional analysis of the impact of TDM strategies, this requires an ability to forecast the magnitude and geographic distribution of changes in travel patterns likely to result from more aggressive TDM programs. It also requires an ability to estimate the effect these changes will have on delay, speed, and travel time throughout affected corridors. For a research project recently completed for the Washington State Department of Transportation, the Transportation Demand Management Assessment Procedure (TDMAP) was developed as a sketch planning modeling approach to incorporate TDM into WSDOT's travel demand model. TDMAP does so by (1) extracting mode split tables from the model; (2) processing them to be compatible with TRIMMS® 2.0; (3) running the tables through TRIMMS® 2.0; and then (4) processing them back into the four-step model for distribution over the transportation network. The study resulted in the development of a low cost method to help WSDOT plan TDM strategies as part of its overall transportation planning process.¹⁸¹

Conclusions

Tipping the scale toward achieving GHG emissions reductions through local public bus transit on the scale of a highway segment or corridor would require a shift by sufficient numbers of private vehicle travelers to bus service to reduce VMT from local trips at the transportation system network level and offset additional emissions from buses. To better serve local trips, preserve SIS highway capacity, support the long term shift to multimodalism, and reduce GHG emissions through an increase in public transit ridership, there are several recommendations for planning and implementation, as listed below.

1. It is not recommended to evaluate bus transit service compared to a highway widening project at the scale of a highway segment or corridor. Shifting enough SOV travelers in a corridor to bus transit is unlikely in the short term and would unfairly discredit the potential for bus service to reduce GHG emissions. Bus service will achieve GHG emissions reductions that are higher than those reductions from highway widening, at the corridor or highway segment scale, only when the transit network is funded at higher levels and developed to achieve better system-wide service. Increased transit investments should be combined with allowing highway congestion to occur, combined with parking controls.
2. In conjunction with the objective to increase the rational weighting of bus transit improvements, MPOs should consider incorporating the objective to reducing highway LOS standards on non-SIS roadways, as the Hillsborough MPO LRTP Update 2035 has done.
3. MPOs should work with their local governments to increase funding sources for all forms of public transit. FDOT should emphasize consideration of TRIP applications for public transportation improvements to regionally significant facilities. In a future federal

¹⁸⁰ Concas, Sisinnio. 2009. Email communication. June 24.

¹⁸¹ Winters, Philip L., Edward L. Hillsman, Chanyoung Lee, and Nevine Labib Georggi, "Incorporating Assumptions for TDM Impacts in a Regional Travel Demand Model," prepared for Washington State Department of Transportation, prepared at the Center for Urban Transportation Research, University of South Florida, Tampa, March 2010.

transportation reauthorization, if there are funding sources that provide flexibility in their use, such as the current Surface Transportation Program, or there is a continuation of the CMAQ program, then MPOs should maximize the use of these funding sources toward public transit improvements.

4. FDOT Districts should encourage and monitor MPOs to place greater emphasis on the established and documented evaluation processes for identifying and developing transportation improvements.
5. Alternative strategies such as travel demand reduction and operational management strategies that are evaluated through the congestion management process should be evaluated as sets of combined strategies that reinforce each other.
6. Rather than solely reducing traffic congestion to reduce GHG emissions, the planning focus should be reducing VMT. For example, VMT-based user fees could influence location decisions and raise funds for public transit improvements.
7. For MPOs that have the resources and staff to collect and organize into a database the necessary inputs required by the USEPA MOVES air emissions model, such as fuel mix data, acceleration/deceleration data, and more specific data on vehicle fleet mix, this could be incorporated into the Environmental Screening Tool (EST) of the Efficient Transportation Decision Making process. The results would provide calculations for GHG emissions that represent those produced by transportation improvement alternatives.
8. FDOT should continue to pursue ways to separate local traffic from regional traffic within urbanized areas, including studying the designation of more State roads as toll facilities. Keeping in mind that there is federal policy requiring alternatives to toll facilities, there is potential to using open road tolling on new state highways. This is worth further study.
9. Development of the MPO LRTP vision, goals, objectives, and policies provides the urban community a common direction for the future and an early opportunity to incorporate GHG emissions reduction into the MPO LRTP process. Policies guiding land use to make urban areas more compact would further help to separate local trips from regional trips and reduce VMT and GHG emissions.
10. More dialogue should be initiated among the public transit agencies and FDOT, MPOs, and local governments to identify public bus service configurations that would move local SOV trips onto public transit and other high-occupancy vehicles, such as carpools and vanpools. Where high numbers of trip origins and destinations are located along the same corridor, bus service should be provided. Where major destinations are located along a corridor, such as large employment

sites, TDM strategies narrowly targeted to the needs of each individual employer should be funded to organize carpooling and vanpooling where trip origins are dispersed.

11. To reduce VMT and GHG emissions, more emphasis should be placed upon commuter assistance programs, especially those that support telework and other alternative work arrangements.
12. MPOs should make use of travel demand model features that account for travel time, transit transfer time, and cost to calculate and incorporate changes in mode share. This will ensure that mode share reflects conditions that support change. The travel model should also be run to reflect changes in travel due to congestion pricing and parking policies.
13. In nonattainment and maintenance areas, the TIP also describes the progress in implementing required TCMs. This is a point in the process where calculation of carbon footprint from proposed transportation projects would be a useful criterion. Where projects can be shown to reduce the carbon footprint, this is likely the result of progress in implementing TCMs.

Potential Changes to Federal Law

In the future, there is the possibility that federal law will require GHG emissions reduction as part of the metropolitan planning process and air quality conformity. For example, the discussion draft of a “climate change bill” called the American Power Act would provide performance grants to MPOs that are in compliance with the Act. This bill was issued by U.S. Senators Kerry and Lieberman in Spring 2010 during the 111th Congress, 2nd Session. This discussion draft bill proposed addressing GHG emissions generated from the transportation sector and included carbon emissions in the MPO planning process. Intended to reflect the latest thinking on GHG emissions reduction through transportation planning, the American Power Act would amend the Clean Air Act by authorizing the EPA administrator, in consultation with the USDOT Secretary, to establish national transportation-related GHG emissions reduction goals. It would establish the following.

- Data collection methods and standardized emission models,
- Methods to be used by states and MPOs, for establishing:
 - Targets,
 - Projecting emissions resulting from state and regional transportation plans,
 - Establishing baseline emissions levels, and
 - Measuring actual emissions resulting from implementing the plans.

The USDOT Secretary would be charged with updating regulations to improve transportation planning models and tools to assess GHG emissions and to assess projected travel activity and transportation strategies from state and regional transportation plans.

To accomplish the above, the EPA administrator and USDOT secretary would promulgate regulations within 18 months after passage of the Act. Every six years thereafter, EPA and USDOT would assess progress toward achieving the GHG emissions reduction targets, including progress due to reductions in vehicle miles traveled and success of transportation demand management strategies. The American Power Act also would amend parts of federal law pertaining to MPOs. This includes requiring MPOs within an MPA serving a transportation management area to establish GHG emissions reduction targets and strategies to meet those targets within two years after EPA promulgates regulations for the reduction of GHG emissions.

MPO plans would have to be developed to demonstrate progress in achieving the reduction targets through analysis of different strategy scenarios, including increasing public transit ridership, increasing travel by other forms of alternative transportation and increasing use of TDM programs. MPO plans determined to be in compliance with the Act would be eligible for performance grants. This draft took the place of the earlier S. 1733, which was introduced to Congress in September 2009. Other earlier climate change bills introduced to the 111th Congress in Spring 2009 that proposed changes to the transportation planning process included the Clean, Low-Emission, Affordable, New Transportation Efficiency Act, H.R. 1329 and its companion bill, S. 575; and the Smart Planning for Smart Growth Act of 2009, H.R. 1780. These bills were referred to committee for review.

As national attention continues to deliberate the best means to reduce GHG emissions through EPA regulation or by changes to federal law, FDOT should continue to monitor these new developments and weigh in on the discussion as these are likely to change requirements at the state level.

Environmental Impact Statements and Air Quality Conformity

Introduction

Within the context of a discussion of transportation, the goal of an Environmental Impact Statement (EIS) is to identify the reasonable alternatives or variations of a proposed transportation improvement that both meets an identified need and minimizes adverse effects.

The National Environmental Policy Act (NEPA) of 1969, as amended (42 USC §§4321-4347), establishes a decision making process to consider environmental impacts of proposed projects, legislation, and policy decisions that are supported by federal funding. This includes the requirement to study and document the social, economic, and environmental impacts of proposed transportation projects, through the preparation of an Environmental Impact Statement (EIS). The Federal Highway Administration (FHWA) and the Federal Transit Administration (FTA) jointly are responsible for managing the NEPA process, and these federal lead agencies ultimately are responsible for the completion and content of the EIS. This section discusses the Air Quality Conformity process within the context of the environmental review process.

When the impact of a proposed transportation project is uncertain, an Environmental Assessment (EA) is conducted first to provide sufficient evidence regarding whether the preparation of the more in-depth EIS is necessary. The EA includes brief discussions of the need for the project, a description of the alternatives under analysis, a discussion of the environmental impacts of all alternatives that were found as part of environmental impact analysis and interagency review, and a listing of the agencies and persons consulted. If it is concluded through the conduct of the EA that there is no evidence of potential impacts, then the FHWA will issue a Finding of No Significant Impact (FONSI). If at any point in the process it becomes clear that there are significant impacts, then an EIS is immediately begun.

The main findings of this section relate to the scope of the NEPA review. NEPA reviews are meant to be project specific, looking at localized impacts of the project upon a specifically defined study area. This poses challenges for incorporating GHG emissions impacts into the NEPA process, as these impacts go beyond the study area. A NEPA review for proposed highway alternatives differs in several respects from a NEPA review for public transit alternatives. As a result, decisions made early in the review process are key to the inclusion of transit alternatives for consideration. The MPO LRTP process sets the stage for NEPA reviews, and studies conducted as part of the MPO LRTP process can define the proposed transportation by mode as well as influence the identification of project alternatives based upon the wording of the Purpose and Need statement.

Contents of an EIS

The Code of Federal Regulation provides the procedures that FHWA and FTA must use in the preparation of the EA/EIS.¹⁸² Several major required sections are contained in the EIS. The EIS must

¹⁸² 23 CFR §771 describes policies and procedures for FHWA and FTA to implement NEPA. 49 CFR §622.101 provides the FTA cross reference to procedures for complying with NEPA. The implementation of NEPA also is supported by regulations issued by the President's Council on Environmental Quality, 40 CFR §§1501-1508.

include a summary of all studies, reviews, consultations, and coordination required by federal law or Executive Orders. The EIS must describe the need and purpose of the major federal action. Based upon the need and purpose of the project, a set of alternative project concepts, including transit alternatives, is identified that could reasonably meet the need and purpose. An “Alternatives” section in the EIS describes the process that was used to develop, analyze, evaluate, and eliminate potential alternatives.¹⁸³ The EIS explains how the remaining alternatives better meet the need for the project and how they avoid or minimize environmental harm. An “Environmental Consequences” section describes and compares the impacts of these project alternatives on the environment and documents the methodologies used for evaluating these impacts. There is also a detailed description of potential mitigation actions that can be taken, including avoidance, minimization, mitigation, and compensation.

Importantly, the Council on Environmental Quality (CEQ), which is part of the Executive Office of the President and is charged with ensuring that the requirements of NEPA are met, requires agencies also to include reasonable alternatives that may not be within the jurisdiction of the lead agency, which, in the case of highway projects, is FHWA.¹⁸⁴ For example, public transit options could be considered even when they are outside FHWA's funding authority. Transportation Systems Management (TSM) and Transportation Demand Management (TDM) strategies also could be evaluated as potential design alternatives, such as high-occupancy vehicle lanes, ridesharing, and signal synchronization.

Key Coordination and Decision Points in the NEPA Review Process
SAFETEA-LU Environmental Review Process Final Guidance
FHWA/FTA, 2006, p. 33

1. Notice of Intent (NOI) publication and scoping activities.
2. Development of purpose and need.
3. Identification of range of alternatives.
4. Collaboration and consensus on selected methodologies and level of detail.
5. Selection of preferred alternative.
6. Completion of Draft Environmental Impact Statement (DEIS).
7. Completion of Final Environmental Impact Statement (FEIS).
8. Completion of Record of Decision (ROD).
9. Completion of permits, licenses, or approvals after ROD.

¹⁸³ 23 CFR §771.123(c).

¹⁸⁴ 40 CFR §1502.14.

Addressing GHG Emissions in EISs

The CEQ issued draft guidance in February 2010 on how the effects of GHG emissions resulting from federal actions should be addressed within the existing framework of NEPA reviews.¹⁸⁵ A public comment period ended in May 2010 but no date for final issuance of the guidance has been announced. The draft guidance advises federal agencies to determine, during the NEPA scoping process, whether the proposed action can be anticipated to generate direct emissions of 25,000 metric tons or more of CO₂e GHG emissions annually. This reference point is intended to be used as an indicator for further evaluation for reporting emissions under the Clean Air Act, rather than as an indicator of significant environmental impacts. The 25,000 metric tons of CO₂e threshold has been used before for the disclosure of GHG emissions.¹⁸⁶

This threshold is used in Clean Air Act rule-makings because it provides comprehensive coverage of emissions with a reasonable number of reporters, thereby creating an important data set useful in quantitative analyses of GHG policies, programs and regulations.¹⁸⁷

In assessing direct emissions, the draft guidance advises federal agencies to evaluate the consequences of actions over which they have direct control. For those actions associated with energy use, agencies also are advised to evaluate cumulative GHG emissions and mitigation opportunities as part of the comparison of study alternatives. “Cumulative impact” is defined as the “...impact on the environment that results from the incremental impact of the action when added to past, present, and reasonably foreseeable future actions.”¹⁸⁸

With regard to cumulative impacts, “The relevant cumulative effects typically result from human activities with effects that accumulate within the temporal and geographic boundaries of the effects of the proposed action...The purpose of cumulative effects analysis is to document agency consideration of the context and intensity of the effects of a proposal for agency action, particularly whether the action is related to other actions with individually insignificant but cumulatively significant impacts...Federal actions may cause effects on the human environment that are not significant environmental effects, in isolation, but that are significant in the aggregate or that will lead to significant effects. CEQ construes the phrase ‘major Federal actions significantly affecting the quality of the human environment’ as

¹⁸⁵ “Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, Memorandum for Heads of Federal Departments and Agencies, issued by Nancy H. Sutley, Chair, Council on Environmental Quality, February 18, 2010.

¹⁸⁶ Mandatory Reporting of Greenhouse Gases Final Rule, USEPA, 4 FR 56260, October 30, 2009.

¹⁸⁷ “Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, Memorandum for Heads of Federal Departments and Agencies, issued by Nancy H. Sutley, Chair, Council on Environmental Quality, February 18, 2010, p. 3. See also 74 FR 56272.

¹⁸⁸ 40 CFR 1508.7

requiring the consideration of the ‘overall, cumulative impact of the action proposed (and of further actions contemplated)’.”¹⁸⁹

Furthermore, the draft guidance instructs that “...an agency may decide that it would be useful to describe GHG emissions in aggregate, as part of a programmatic analysis of agency activities that can be incorporated by reference into subsequent NEPA analyses for individual agency actions. In addition, federal programs that affect emissions or sinks and proposals regarding long range energy, transportation, and resource management programs lend themselves to a programmatic approach.”¹⁹⁰ It would seem that quantifying GHG emissions in aggregate from a long range transportation management program would be comparable to the MPO LRTP process.

Connection Between EIS and the MPO Long Range Transportation Planning Process

A purposeful connection exists between the MPO LRTP and NEPA review that is intended to do three things: improve process efficiency and avoid duplication of effort, make use of MPO information and process outcomes, and comply with the law.

Process Efficiency

With regard to the MPO LRTP, “... Over the years, the Congress has refined and strengthened the transportation planning process as the foundation for project decisions, emphasizing public involvement, consideration of environmental and other factors, and a federal role that oversees the transportation planning process but does not second-guess the content of transportation plans and programs.”¹⁹¹ The purpose of linking the MPO LRTP process and the NEPA EA/EIS process is to prevent duplication of effort and avoid delays through early and continuous participation by environmental, regulatory, and resource agencies. Generally, modal systems-level, corridor and sub-area studies conducted for the MPO LRTP process are less detailed than the analysis required for the NEPA EA/EIS, but they set the context. In furtherance of such process refinement, in 2006, SAFETEA-LU Sec. 6001 strengthened consultation and collaboration requirements with resource agencies in the LRTP process. As a result, if done properly, the MPO LRTP process provides a strong foundation for the NEPA review of proposed transportation projects.

The MPO LRTP process usually includes one or more studies at the modal systems level, sub-area, or corridor level. The NEPA EA/EIS process can be linked to the MPO LRTP process at the point at which a modal systems-level, sub-area, or corridor study is conducted, which generates any of the following that can be used as a basis for the EA/EIS:

¹⁸⁹ “Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, Memorandum for Heads of Federal Departments and Agencies, issued by Nancy H. Sutley, Chair, Council on Environmental Quality, February 18, 2010, p. 10. See also 40 CFR 1508.27(b)(7).

¹⁹⁰ “Draft NEPA Guidance on Consideration of the Effects of Climate Change and Greenhouse Gas Emissions, Memorandum for Heads of Federal Departments and Agencies, issued by Nancy H. Sutley, Chair, Council on Environmental Quality, February 18, 2010, p. 5.

¹⁹¹ 23 CFR Appendix to §450.

1. Basic description of the environmental setting, especially identifying sensitive or fragile areas.
2. Establishment of a needs statement for a transportation improvement.
3. Determination of a purpose statement or goals and objectives that the proposed improvement should accomplish.
4. General travel corridor definition.
5. General mode definition (e.g., highway, transit, or a highway/transit combination).
6. Preliminary identification and screening of alternatives and elimination of clearly unreasonable alternatives.
7. Preliminary identification of environmental impacts and environmental mitigation.¹⁹²

MPO LRTP Source Materials

The MPO long range transportation planning process also results in source materials that can be referenced in NEPA documents, if the lead NEPA agencies (FHWA and FTA and the direct recipient of federal funds, such as the State DOT, local government, or public transit agency) agree that the source materials can aid in the establishment of the need for the federal action or can identify transportation alternatives, impacts, or ways to mitigate those impacts. For the LRTP source material to be allowed to be included in the NEPA EA/EIS, it must also meet requirements of interagency involvement and public participation and provide agencies and the public a reasonable opportunity to review the information during the modal systems-level, sub-area, or corridor study that informs the scoping process (issue identification) for the NEPA EA/EIS.¹⁹³ The LRTP source material is more likely to be included in the NEPA EA/EIS if there was a strong process for identification of issues and an early coordination process that provides explanations for how the purpose and need for the transportation improvement was developed, the information and analysis used, and how a design concept and scope was determined. MPO LRTP source materials can be incorporated into NEPA documents as an appendix or by reference. The planning level data and analysis of the MPO LRTP process about land use, population, and employment can provide the basis for the required NEPA review of indirect and cumulative impacts. For MPO LRTP data and analysis to be used in NEPA review of indirect and cumulative impacts, the planning study information needs to be "... sufficiently detailed that differences in consequences of alternatives can be readily identified."¹⁹⁴

The Importance of Need and Purpose

The basis for the need and purpose of a proposed transportation improvement under NEPA review also can be the achievement of goals and objectives of the MPO LRTP. Transportation needs have included such things as meeting transportation demand, improving safety, carrying out legislative direction, increasing urban transportation plan consistency, enhancing modal interrelationships, completing system linkages, and improving the condition of an existing facility.¹⁹⁵

¹⁹² 40 CFR §450.318(a)(1)-(5).

¹⁹³ 40 CFR §450.320(b).

¹⁹⁴ 23 CFR Appendix to Part 450, question 14.

¹⁹⁵ 23 CFR Appendix to Part 450.

In the MPO LRTP process, planning studies can eliminate some alternatives from consideration in the EA/EIS by the manner in which the planning studies shape the need and purpose of the project, as well as study results that demonstrate that certain alternatives are unfeasible.

The articulation of project purpose and need is important because it drives the development of the range of identified alternatives.¹⁹⁶ For example, planning studies that define a corridor or select a mode can eliminate some alternatives from consideration. Consistent with NEPA,

... the Purpose and Need statement should be a statement of a transportation problem, not a specific solution. However, the purpose and need statement should be specific enough to generate alternatives that may potentially yield real solutions to the problem at-hand. A purpose and need statement that yields only one alternative may indicate a purpose and need that is too narrowly defined.¹⁹⁷

For example, “the lack of highway lane capacity” or “the lack of bus service” is not a need statement; however, “slowing global warming” or “reducing consumption of fossil fuels” could be. Including the reduction of GHG emissions in the MPO LRTP goals and objectives can shape the purpose and need for proposed transportation improvement alternatives.

The Purpose and Need statement also can be informed by the data collected and analyzed for the MPO LRTP as part of the transportation management programs required by state law. This includes Florida’s Congestion Management System maintained for the purpose of improving mobility and congestion management planning required by federal law for transportation management areas (populations greater than 200,000).

Procedurally, an environmental review could be initiated in conjunction with a MPO LRTP sub-area or corridor study when FHWA/FTA publishes a Notice of Intent (NOI) in the *Federal Register* announcing the start of a NEPA review. Public transit agencies seeking federal New Starts or Small Starts funding can conduct the required Alternatives Analysis (AA) for funding eligibility under the FTA Capital Investment Grant Program and combine the AA as part of a draft EIS. The MPO LRTP process can coincide with a “Tier 1” EIS that evaluates general travel corridors, modes, and/or packages of projects at a planning level of detail. Completion of Tier 1 leads to a design concept and scope for the “Tier 2” EIS review.

When a major candidate transportation improvement project is initially identified by FDOT and the MPO during the LRTP update process, the Efficient Transportation Decision Making (ETDM) process can be applied. Described earlier in the summary of the MPO LRTP process, at this stage it is referred to as the

¹⁹⁶ U.S. Department of Transportation, Federal Highway Administration, Technical Advisory T6640.8A, October 30, 1987, <http://www.fhwa.dot.gov/legregs/directives/techadvs/t664008a.htm>

¹⁹⁷ 23 CFR §450 Appendix A to Part 450—Linking the Transportation Planning and NEPA Processes, II. Substantive Issues.

Planning Screening of the ETDM process and is applied on a maximum three-year cycle for LRTP updates in nonattainment and maintenance areas and on a maximum five-year cycle for LRTP updates in all other areas. “The natural resource issues that should be evaluated include, but are not limited to, the following: ... Air Quality: Assess the potential for air quality effects caused by the proposed project. Used in nonattainment and maintenance areas for ozone or particulate matter....”¹⁹⁸ The planning screening would be an appropriate point in the process to measure annual direct emissions from the proposed improvement, based upon CEQ guidance.

Compliance with Air Quality Conformity

Not only does the MPO LRTP process provide a head start to the NEPA review through source materials, studies, data, and LRTP process outcomes, FHWA also requires project consistency with regard to federal Clean Air Act (CAA) air quality conformity. First, no new project-level conformity determinations may be made until conformity of the transportation plan and TIP has been determined by the MPO and USDOT. A NEPA approval for FHWA/FTA actions requires that a conforming LRTP and TIP be in place at the time of approval.¹⁹⁹

For air quality nonattainment and maintenance areas, the proposed transportation project under NEPA review must be part of a conforming MPO LRTP and TIP (and also must be consistent with the transportation element of the Local Government Comprehensive Plan and the local Capital Improvements Program) before FHWA will approve an environmental document.²⁰⁰ It is important to note that the EIS review process results in the identification of alternatives, some of which might not be included in the MPO LRTP and TIP. However, according to Federal Code that describes the relationship between the LRTP/TIP and the NEPA process, the proposed transportation improvements that comprise a specific travel network tested in the regional air quality modeling does not prevent consideration of other project alternatives developed during the NEPA process or for other project development studies not represented in the LRTP/TIP.²⁰¹ If the NEPA process results in a project with a design concept and scope that is significantly different from that in the LRTP and TIP, then the project must meet the conformity criteria for “projects not from a TIP” before NEPA completion.²⁰²

Initial Steps Leading to the EIS

Project concepts resulting from the MPO LRTP planning studies, for which federal funding is sought, are then evaluated through a NEPA review. The lead agencies of the NEPA review issue an Advance Notification (AN) to all interested parties and the public, announcing that preparations are under way to start a NEPA review. The AN provides general information about the proposed project.

¹⁹⁸ 650-000-002 ETDM Manual, Chapter Four, Planning Phase, Florida Department of Transportation, March 2006, p. 4-7.

¹⁹⁹ 40 CFR §93.104(e).

²⁰⁰ PD&E Part 2, Analysis and Documentation, Chapter 5, Purpose and Need for Action, Florida Department of Transportation, January 28, 2003, p. 4.

²⁰¹ 40 CFR §93.107.

²⁰² 40 CFR §§93.109-119.

The NEPA technical review begins when the MPO or FDOT enters information about a proposed transportation project into the ETDM process Environmental Screening Tool (EST). Then, the information for the project is accessed by members of the Environmental Technical Advisory Team (ETAT), who correspond to the participating resource agencies and stakeholder agencies in a NEPA review. A step beyond the earlier ETDM planning screening, this begins what is called the programming screening by the resource agencies to evaluate direct, indirect, and cumulative impacts from proposed transportation project alternatives, including the degree of effect (enhanced, none or minimal, moderate, substantial, dispute).

The result of the programming screening is a Programming Summary Report (PSR) that identifies issues (scoping) that need to be addressed in the Project Development & Environment Study (PD&E), so named in Florida as the study that meets all requirements of NEPA.²⁰³ The PSR includes a recommendation for the Class of Action (COA), which is the determination of whether the proposed project is a Categorical Exclusion, must undergo an EA, or requires the preparation of an EIS. The PSR also contains a recommendation for the Purpose and Need statement that will be finalized and approved by the lead agencies. The Purpose and Need is the basis for the PD&E. The PSR also may evaluate corridors in addition to specific projects. The Final Programming Summary Report (FPSR) recommends the alternatives that should be further evaluated in the PD&E, which is prepared to satisfy all federal and state NEPA requirements for an EIS. If the FPSR does not include a recommendation for a transit alternative, then a transit alternative likely will not be evaluated in the EA or EIS. The consideration of public transit to satisfy the Purpose and Need and the definition of alternatives happens very early in the process. Whether public transit is included as an alternative depends strongly upon the Purpose and Need statement.

PD&E/EIS

An EA or EIS begins with a review of the PSR. The lead agencies ultimately are responsible for defining the transportation project's Purpose and Need statement. As established by the President's Council on Environmental Quality, the project purpose is supposed to include a clear statement of what the project would accomplish by addressing the defined need. The project is supposed to support growth management objectives from applicable comprehensive plans, support objectives in the MPO LRTP, and serve other national objectives. SAFETEA-LU's emphasis on congestion management has influenced the need and purpose of many EISs.

The EA/EIS process addresses project-level transportation proposals, although projects can vary greatly in size, from an interchange improvement to the development of a new rail service. With regard to spatial scale, FHWA guidance describes three principles used, as laid out in federal law, to determine the boundaries of a project. To ensure meaningful evaluation of alternatives and to avoid commitments to transportation improvements before they are fully evaluated, the action evaluated in each EIS should:

²⁰³ Chap. 339.155, F.S., Chap. 334.044, F.S., and Chap. 334.048(3), F.S.

1. Connect logical termini and be of sufficient length to address environmental matters on a broad scope.
2. Have independent utility or independent significance, (i.e., be usable and be a reasonable expenditure even if no additional transportation improvements in the area are made).
3. Not restrict consideration of alternatives for other reasonably foreseeable transportation improvements.²⁰⁴

Proposed transportation project alternatives are defined by general location and the identification of other federal approvals required through planning studies conducted as part of the MPO LRTP process. The defining of project alternatives should result from consultations with resource agencies, such as the local government environmental planning commission. It also should result through consistency with State and local growth plans, from discussion of potential environmental mitigation activities with adherence to public participation plans to promote stakeholder involvement and through the use of visualization strategies of the proposed alternatives.²⁰⁵

Once FHWA approves the COA that has been recommended by the local lead agency, the FHWA Division Administrator (and FTA Regional Administrator, if public transit alternatives are being evaluated) provides a Notice of Intent (NOI) to start the environmental review process, to be published in the *Federal Register*, with a time frame for beginning the draft EIS (DEIS).

Lead Agency Selection

Lead agencies jointly decide which agency is to prepare the DEIS. For public transit projects, the local transit agency typically prepares the DEIS under the direction of FTA. For example, the PD&E for the Bus Rapid Transit North/South Corridor project in Tampa was prepared by the Hillsborough Area Regional Transit Authority (HART).²⁰⁶ In the selection of an agency to prepare the DEIS, it would seem that if a local transit agency were selected, then at that point in the process, various public transit alternatives will be considered and a transit option will be chosen as the LPA. Likewise, if a local government public works or traffic department were selected, it is less likely that a transit alternative will ultimately be chosen as the LPA.

Lead agencies jointly determine who to invite as participating agencies in the NEPA review. Nongovernmental agencies and private entities are not permitted to be participating agencies. The identification of appropriate participating agencies is partly an iterative process, as the identification of the proposed transportation alternatives will partly determine what agencies will be stakeholders, and the participation of stakeholders will contribute to the scoping process that includes determination of need and purpose of the transportation improvement and refinement of the project alternatives. The opportunity for involvement must be extended to participating agencies prior to the finalization of the

²⁰⁴ 23 CFR §771.111(f). See also FHWA/FTA SAFETEA-LU Environmental Review Process Final Guidance, November 15, 2006. <http://www.fhwa.dot.gov/hep/section6002/>.

²⁰⁵ SAFETEA-LU Sec. 3005, 3006, and 6001.

²⁰⁶ The HART PD&E for the Bus Rapid Transit project can be found at http://www.gohart.org/departments/marketing/brt/metro_rapid_final_per_nov_09.html

range of alternatives. The regulations governing the development of the EA/EIS provide defined time periods for the various stages of the process. In general, an EA/EIS process takes about 18 months. SAFETEA-LU Sec. 6002 (23 USC §139) expedites transportation improvement projects that address congestion. It established a new environmental review process for highways, transit, and multi-modal projects that is mandatory for all EISs. It requires earlier and expedited review and environmental screening "... and provides guidance on developing coordination plans and schedules, concurrent reviews, identifying and resolving issues of concern, ensuring compliance with mitigation commitments, adopting and using environmental documents, and providing or receiving funding for activities related to the environmental review process." Environmental streamlining requires transportation and natural, cultural, and historic resource agencies to establish realistic timeframes to develop and review projects, and then to work cooperatively to adhere to those timeframes. Lead agencies schedule early and open scoping meetings, which provide all participants with the opportunity to identify and address all issues. This input from participating agencies informs the later selection of methodologies. Participating agencies are responsible for providing timely input on potential project impacts and participate in the resolution of issues that may delay the project or deny the granting of a necessary permit.

Coordination on Key Decisions

The lead agencies develop a plan for coordination with participating agencies and participation by the public throughout the development of the DEIS, including opportunities prior to key decision points, such as the definition of purpose and need for the transportation improvement and the identification of the range of alternatives. The coordination plan includes a realistic schedule for decision making for each agency approval and provides for 30-day public comment periods prior to each major decision point and a 60-day public comment period after issuance of the DEIS.

The lead agencies collaborate with participating agencies in the determination of methodologies and on the appropriate level of detail needed for the analysis of alternatives. Lead agencies then decide on the appropriate methodologies to use and the level of detail warranted, and then document and communicate their rationale to participating agencies. Each identified alternative is evaluated to a similar level of detail that allows an informed choice with regard to a preferred alternative. The level of detail should provide sufficient information for each alternative regarding how the alternative can avoid, minimize, or mitigate adverse impacts and comply with other environmental laws such as the Clean Air Act.

Identification of Alternatives

With input from participating agencies, through a cooperative and interactive process, the lead agencies identify the range of alternatives. In the development of proposed alternatives, they must be specified according to established standards of design and methodologies, such as the *Manual on Uniform Traffic Studies (MUTS)*²⁰⁷, the *FDOT Quality/Level of Service Handbook* and software, the *Transit Capacity and*

²⁰⁷ Topic #750-020-007, FDOT.

Quality of Service Manual, the Transit Corridor Program,²⁰⁸ the Project Traffic Forecasting Procedure,²⁰⁹ and the *Highway Capacity Manual* (HCM).

Prior to the finalized and refined definition of alternatives for review in the EIS, if the lead agency is FHWA, then it is implicitly determined that the selected project alternative will be a highway project. The alternatives considered include a No-Build or No-Project alternative, a transportation systems management alternative that represents the lowest cost alternative to meet the Purpose and Need, a multimodal alternative where there is a need or opportunity for it, and construction alternatives. The alternatives identified must include all proposed alternative modes, including public transit, which can feasibly provide transportation service to meet the need, even though such a modal alternative is not within the funding authority of FHWA. Where such a combined joint highway/public transit alternative exists, FHWA must coordinate with FTA as early as possible in alternatives development.²¹⁰ A future horizon year is selected as the design year for analysis, which may be 20 years or the expected useful life of the facility. Alternatives might include rehabilitation of the existing transportation facility, such as resurfacing, rehabilitation plus widening, or complete replacement of the existing facility. The analysis must recognize the unique travel characteristics of facility users, including peak hour travel conditions.

Operational Analysis of Alternatives

An operational analysis is conducted for each alternative to evaluate how well it meets the Purpose and Need and reviews both temporary and permanent impacts in sufficient detail to determine costs and benefits of each. The operational analysis can include impact on level of service and congestion and reduced travel time. If the Purpose and Need for a proposed transportation project is improved capacity and highway level of service, then the alternatives that satisfy that need are those that can demonstrate that the resulting level of service is equal to or better than the accepted standard for that facility.²¹¹

As part of the analysis, environmental technical studies are prepared to respond to social, economic, and environmental issues that were identified in the FPSR, such as wetlands and wildlife habitat studies. An air quality report also may be prepared.

Preferred Alternative Identification

The EIS review process ends with the preparation of a Project Development Summary Report (PDSR) that identifies a preferred alternative, documents the study process used to evaluate and eliminate alternate corridors or modes, documents resolutions to any controversial issues, explains all decisions made, including the decision making process, and provides information to prepare a Design Scope of

²⁰⁸ FDOT Procedure #725-030-003.

²⁰⁹ FDOT Procedure #525-030-120-g.

²¹⁰ PD&E Part 2, Analysis and Documentation, Chapter 6, Alternatives, Florida Department of Transportation, January 12, 2000, p. 6-5.

²¹¹ PD&E Part 2, Analysis and Documentation, Chapter 5, Purpose and Need for Action, Florida Department of Transportation, January 28, 2003, p. 6.

Services or a Work Plan for in-house design. The PDSR constitutes the DEIS, the primary contents of which are listed in the text box below.²¹²

Primary Contents of a Project Development Summary Report

1. Location and needs summary
2. Identification and description of alternatives
3. Selection of methodologies
4. Description of the affected environment
5. Evaluation of the alternatives
6. Selection and description of a preferred alternative that includes for a highway project:
 - a. Horizontal and vertical alignment
 - b. Typical section(s)
 - c. Drainage plan
 - d. Bridge analysis, if applicable
 - e. Design traffic volumes
 - f. Intersection concepts and signal analysis
 - g. Access management designation
 - h. Pedestrian and bicycle facilities
 - i. Right-of-way requirements and relocations
 - j. Utilities and lighting, including a maintenance agreement
 - k. Aesthetics and landscaping
 - l. Special features, such as noise barriers and retaining walls
 - m. Preliminary traffic management plan
 - n. Value engineering summary
 - o. Preliminary engineering costs
 - p. Right-of-way costs
 - q. Construction costs
7. Summary of environmental impacts
8. Summary of permits and mitigation
9. Summary of public involvement
10. Commitments and recommendations
11. Appendices, including references to environmental technical studies conducted, such as an air quality report

²¹² PD&E Part 1 Process and Administration, Chapter 4 Project Development, Florida Department of Transportation, May 20, 2008, p. 4-27.

An EIS for a Public Transit Alternative

If an EIS is evaluating transit alternatives, the process and satisfaction of federal laws and requirements are different from that of highway alternatives. The LRTP process identifies public transit projects to satisfy mobility needs. Especially in air quality nonattainment and maintenance areas, the LRTP may emphasize the development of public transit services; however, highway capacity improvement projects often are advanced on the grounds that they will improve air quality, especially for carbon monoxide, due to congestion reduction.

The NEPA review process for a transit project begins with a decision by state or local agencies to seek federal funding for it. FTA administers a New Starts Program and a Small Starts Program. Eligible projects for New Starts funding include but are not limited to heavy rail, light rail, commuter rail, automated fixed guideway systems (such as a people mover), bus rapid transit, and other high occupancy vehicle facilities, or the extension of these systems.²¹³ The Small Starts Program is smaller in size and scope than the New Starts Program. A project eligible for Small Starts funding is one for which the total capital cost is less than \$250 million and can include fixed guideway for at least 50 percent of the project and/or that it is a corridor-based bus system with minimum required elements such as substantial transit stations, signal priority/pre-emption, low floors, special service branding, frequent service, and service offered for a minimum of 14 hours per day.²¹⁴

The New Starts and Small Starts evaluations are separate from the EIS. FTA serves as the lead agency for those proposed transit projects requiring FTA approval. The local public transit agency serves as a co-leading agency. All FTA-funded projects must follow the PD&E process.

Alternatives Analysis

A study called an Alternatives Analysis (AA) identifies potential alternative transportation solutions within a corridor. The AA is roughly equivalent to the Programming Summary Report (PSR) conducted for proposed highway projects. The transit alternatives must include a No Build Alternative. They must also include a Baseline (non-guideway) Alternative that corresponds to a TSM Alternative for highway project evaluations, representing low-cost transit improvements that can meet the Purpose and Need. FTA must approve how the Baseline Alternative is defined in the AA. The alternatives also can include one or more fixed guideway options. The result of the AA is a determination of a locally-selected preferred mode, such as light rail or bus rapid transit, and a general alignment. This is known as the Locally Preferred Alternative (LPA). Per the recommendations of the AA, FTA reviews and makes a final determination on the Class of Action (COA) (Categorical Exclusion (CE), Environmental Assessment, (EA) or Environmental Impact Statement (EIS)).

²¹³ PD&E Part 1 Process and Administration, Chapter 14 Federal Transit Administration (FTA) Environmental Process, Florida Department of Transportation, July 10, 2008, p. 14-2.

²¹⁴ *Ibid.*

FTA must approve the scope and content of the PD&E. The findings of the AA are the basis for the PD&E and preliminary engineering and can be conducted prior to the PD&E or concurrent with it. Whether the AA and PD&E are done sequentially or concurrently depends largely on the timing of available funds for the studies. Local officials adopt a financing plan for the LPA, and FTA then provides its approval to begin a PD&E. The LPA may differ from the alternative later identified through the PD&E process that considers a range of alternatives and alignments and determines which alternative both meets the Purpose and Need and can minimize environmental impacts.

The AA includes four sequential steps: a study initiation, the development of alternatives and methodologies, analysis and evaluation, and LPA determination. During study initiation, the issues to be addressed are identified, baseline conditions and assumptions are agreed upon, an inventory of available data and models is conducted, roles and responsibilities of participating agencies are defined, and a public participation plan is developed. If the AA is being conducted at the same time as the PD&E, then these activities are the same as the scoping phase of the PD&E.

A Purpose and Need statement is developed that will be used in the PD&E and which must be approved by FTA. If the AA is being conducted prior to the PD&E, then this statement of need is developed as a “Making the Case” document. It establishes the problem, serves as the foundation for goals, objectives, and evaluation, and is the yardstick against which the alternatives are judged as being reasonable options to meet the need or solve the problem.

The second step in the AA is the development and refinement of the alternatives to be evaluated. The development of the alternatives may yield numerous options, in which case an iterative screening is undertaken to eliminate less promising options early in the process. Interim products may be generated during this step, such as the preparation of a Definition of Alternatives Report. The candidate alternatives that remain through the initial screening are further refined with the inclusion of operating plans and policies, design features, user costs, and parking. The results of the Final Definition of Alternatives Report (FDAR) become part of the AA.

After the alternatives are defined, methodologies are developed that document for each topic of analysis (i.e., wildlife, wetlands, air quality) the assumptions, initial data collection, and evaluation method applied to each alternative. Consultation on methodologies is conducted to gain agreement among all participating agencies before the start of the evaluation as to how the evaluation will proceed. The methodologies are then applied, which results in technical studies and memoranda for each topic.

Apart from the NEPA review process, the FTA New Starts AA process also reviews, as part of its evaluation criteria of New Starts projects, environmental benefits of the alternatives, as part of a justification rating. In 2000, FTA guidance initially required a quantification of emissions: “The forecast change in criteria pollutant emissions and in greenhouse gas emissions, ascribable to the proposed new investment, calculated in terms of annual tons for each criteria pollutant or gas (forecast

year), compared to the baseline alternative;...”²¹⁵ Later guidance specified a calculation of “...Net Change in Greenhouse Gas Emissions. This measure is defined as the net change in emissions of the primary transportation-related greenhouse gas (carbon dioxide) in the forecast year. The measure is expressed as the difference (in tons) in the annual emissions of carbon dioxide from transportation sources in the metropolitan region, comparing conditions under the Section 5309 New Start investment first to the no-build conditions and then to conditions under the TSM alternative.”²¹⁶

However, updated FTA guidance has eliminated the submission of environmental benefits measures quantifying CO₂. This is because FTA found that comparisons among transit alternatives yielded very small changes in CO₂. FTA also found that these measures “...do not distinguish, in any meaningful way, the differences between projects...Until measures can be developed that provide salient information for the environmental benefits criterion that better differentiates the characteristics of projects, grantee submission of the information is not required...At this time, however, FTA will continue to use its current evaluation measure of the Environmental Protection Agency’s ambient air quality rating.”²¹⁷ The ambient air quality rating constitutes the environmental benefits criterion. It is weighted at 10% of the total project justification rating.²¹⁸ New Starts projects must meet both NEPA review requirements and CAA requirements and conform to the state implementation plan.²¹⁹ FTA provides that projects in CAA air quality nonattainment areas for any transportation-related air pollutants receive a “High” rating for environmental benefits, while projects in attainment areas receive a “Medium” rating.²²⁰

In the meantime, FTA is testing alternative methods and measures to evaluate and compare transit alternatives for environmental benefits, by applying them to projects currently being considered for New Starts funding. FTA is searching for preferably simple, quantitative measures that are based upon readily available existing data, that are applicable to different transit technologies, and that can distinguish the relative merits of alternative projects. A recent Colloquium considered measures for GHG emissions under the category of energy use. This was one of four broad categories to measure environmental benefits. The panelists of the Colloquium suggested proposed measures, including CO

²¹⁵ *Federal Register*, Vol. 65, No. 236, p. 76884, 49 CFR Part 611, Major Capital Investment Projects; Final Rule, Federal Transit Administration, December 7, 2000, Appendix A to Part 611—Description of Measures Used for Project Evaluation. Project Justification, (b) Environmental Benefits. (1).

²¹⁶ Advancing Major Transit Investments through Planning and Project Development, Appendix B—New Starts Evaluation and Rating Process, IV Project Justification Rating, D. Environmental Benefits. January 2003, Found at http://www.fta.dot.gov/planning/newstarts/planning_environment_2595.html

²¹⁷ Final Guidance on New Starts/Small Starts Policies and Procedures and Notice of Availability of Updated Reporting Instructions, Docket Number FTA-2007-27172, June 4, 2007. Found at http://www.fta.dot.gov/planning/newstarts/planning_environment_9070.html#1a_Operating_Efficiencies_and_Environmental_Benefits

²¹⁸ *Federal Register*, Vol. 74, No. 144, p. 37766, Final Guidance on New Starts/Small Starts Policies and Procedures, July 29, 2009. Found at http://www.fta.dot.gov/planning/newstarts/planning_environment_9727.html#Summary

²¹⁹ 23 CFR 771, Environmental Impact and Related Procedures, as amended, effective date, April 23, 2009. Found at http://www.fta.dot.gov/planning/planning_environment_5222.html

²²⁰ Legal Research Digest 30, Legal Handbook for the New Starts Process, Transit Cooperative Research Program, prepared under TCRP Project J-5, TRB Counsel for Legal Research Projects, ed., prepared by Daniel Duff and Edward J. Gill, Jr., February 2010, p. 9.

emissions per passenger mile traveled or revenue mile traveled. The panelists discussed the difficulty of measuring VMT, energy use and GHG emissions due to the lack of disaggregated energy use information to enable energy savings to be attributable to a specific project. It was also noted that for measures of air quality, air quality models are based upon travel forecasting models that are on a regional scale. The change in emissions from one transit project is small when analyzed on a regional scale, and it is generally smaller than the error in the models.²²¹

The result of the analysis is the Final Alternatives Analysis Report (FAAR), which is reviewed by FTA and forms the basis for FTA approval to proceed to the preliminary engineering (PE) stage. If undertaken concurrently with a PD&E, the FAAR becomes the DEIS. If the AA is conducted prior to the PD&E, then the results contained in the Final Alternatives Analysis Report are used as the basis for the PD&E.

The contents of the Draft Environmental Impact Statement (DEIS) are summarized in the box below.²²² It indicates where in the DEIS an evaluation of air quality impacts are found and the contents of an air quality evaluation. FTA uses the NAAQS impact criteria but may use different air pollutant models than FHWA. After the DEIS is prepared, FTA places a Notice of Availability (NOA) in the *Federal Register* and in newspapers and circulates it to stakeholders of interest. A public hearing is held, after which the preparation of the FEIS is begun.

The non-federal lead agency, such as a transit authority, may submit a letter of request to develop the LPA to a higher level of detail during the time period between the issuance of the DEIS for review, public comment and agency response to comments, and the completion of the final EIS (FEIS). The lead agencies may concur that the LPA should be further developed to a higher level of detail in order to further develop mitigation measures or facilitate compliance with other environmental laws. This higher level of detail for the preferred alternative, before the overall completion of the NEPA review, must not prejudice the lead agencies from fairly considering the other alternatives or lead the public to perceive that the FEIS had a predetermined outcome.

After the FEIS is complete, FTA evaluates the results of the FEIS for compliance with NEPA and issues a Record of Decision (ROD) on the identification of the alternative that both meets the Purpose and Need and also can minimize environmental impacts. This alternative may or may not be the LPA presented in the AA. The ROD includes the basis for FTA's decision to approve the LPA and describes any mitigation measures that are required.

The FEIS contains responses to written comments and public testimony. FTA also requires the FEIS to contain the New Starts or Small Starts evaluation of the AA as well as the PD&E. Apart from the results of the PD&E, the New Starts or Small Starts evaluation processes yield a rating based upon a number of criteria that evaluate the likelihood of project success from a transportation service standpoint. The

²²¹ Comparing the Environmental Benefits of Transit Projects; Proceedings from a Colloquium—October 28 & 29, 2008, prepared for the Federal Transit Administration by the John A. Volpe National Transportation Systems Center, pp. 9 and 12.

²²² *Ibid.*, p. 14-18, 14-19, 14-20.

rating must be good enough (“medium”) for the lead agency to be permitted to proceed with the LPA to final design and obtain a Full Funding Grant Agreement. The FEIS presents the LPA, commitments to mitigate adverse impacts, evidence of compliance with all applicable environmental laws, and a description of any changes to the project since the DEIS was published. After the FEIS is approved by FTA, it is filed with USEPA for publication in the *Federal Register*.

Major Contents of the Draft Environmental Impact Statement (DEIS)

1. Purpose and Need for the Proposed Action Description of Affected Environment
2. Alternatives Identified Rationale for Selection of Methodologies Social Effects
3. Environmental Effects, including
 - Air Quality Technical Memorandum
 - Legal and Regulatory Context
 - Methodology
 - Existing Conditions
 - Long-term effects
 - Short-term construction effects
 - Mitigation
4. Economic Effects
5. Transportation Effects
6. Section 4(f) and 6(f) Evaluation
7. Financial Analysis
8. Secondary and Cumulative Effects
9. Evaluation of Alternatives Carried Forward
10. Public Involvement
11. Appendices

Requirements for Discussion of Impacts

Federal law provides very specific requirements regarding the content of discussion on the impacts of proposed alternatives in an EIS, summarized as follows:²²³

- The environmental impacts of the alternatives including the proposed action, including direct, indirect and cumulative project effects and their significance.
- Any adverse environmental effects which cannot be avoided should the proposal be implemented.
- The relationship between short-term effects of the project upon the social, economic, and environmental resources versus the overall long-term benefits of the project.
- The maintenance and enhancement of long-term productivity.
- Any irreversible or irretrievable commitments or resources that would be involved in the proposal should it be implemented.
- Possible conflicts between the proposed action and the objectives of federal, regional, state and local land use plans, policies, and controls for the area.
- Energy, natural or depletable resource requirements and conservation potential of various alternatives and mitigation measures.
- Urban quality, historic and cultural resources, and the design of the built environment, including the reuse and conservation potential of various alternatives and mitigation measures.
- Means to mitigate adverse environmental impacts.

Air Quality Discussion

Both the Clean Air Act and NEPA require that air quality be addressed in environmental documents. The level of analysis may vary according to the size of the transportation project and existing air quality conditions. The air quality analysis addresses only those pollutants that would be directly generated by the project and the discussion usually includes the results of a screening level analysis for all alternatives. Of all the criteria pollutants, project-level analysis is required only for carbon monoxide and at all intersections within the project corridor in an EIS.²²⁴

According to FHWA guidance, air quality impacts from proposed transportation alternatives are divided into mesoscale (regional) concerns and microscale (project-level) concerns.²²⁵ Air pollutants of regional concern include ozone, hydrocarbons, and oxides of nitrogen. The planning phase of the ETDM, as applied to the MPO LRTP, assesses area-wide impacts on air quality. If these pollutants are an issue, the transportation alternatives are dealt with in the MPO LRTP process. It is referenced in its relationship to the State Implementation Plan (SIP) and whether the project is in an area with approved transportation control measures. The criteria pollutant of primary concern in Florida is ozone; however, because ozone

²²³ 42 USC §4332 and PD&E Part 2, Analysis and Documentation, Chapter 8, Environmental Consequences or Impacts, Florida Department of Transportation, January 16, 2008, p. 8-2.

²²⁴ Part 2, Analysis and Documentation, Chapter 16, Air Quality Analysis, Florida Department of Transportation, September 13, 2006, p. 16-8.

²²⁵ U.S. Department of Transportation, Federal Highway Administration, Technical Advisory T6640.8A, October 30, 1987, <http://www.fhwa.dot.gov/legisregs/directives/techadvs/t664008a.htm>.

is considered an area-wide pollutant, it is "... evaluated in system wide planning efforts only [LRTP air quality conformity] within areas designated non-attainment or maintenance. It is not practical, nor a requirement, that an evaluation be performed to evaluate the effect of an individual project on regional ozone analysis."²²⁶

For proposed transportation improvements located in air quality nonattainment and maintenance areas, the air quality technical memorandum identifies the LRTP/TIP and date in which the project is included, the project identification number, and the date that the conformity determination for the LRTP/TIP was approved.²²⁷

The ETDM Final Programming Summary Report (FPSR), conducted at the project level, would include an air quality screening, the results of which would be available to the PD&E process. The later PD&E assesses carbon monoxide only, and the air quality study results likely will demonstrate an improvement in air quality as a result of the highway capacity expansion. "In most circumstances, the build alternatives will indicate an improvement in carbon monoxide concentrations."²²⁸ The identified air pollutant of project-level concern is carbon monoxide and must be evaluated according to a detailed procedure. If an intersection fails a screening test, then a microscale dispersion analysis is performed on that intersection using USEPA's latest models. While particulate matter from a proposed project does not need to be addressed in environmental documents, short-term dust control due to construction must be addressed through the FDOT Standard Specifications for Road and Bridge Construction.

"NEPA process completion," for purposes of the Transportation Conformity Rule and with respect to FHWA and FTA, means the point at which there is a specific action to make a determination that a project is:

1. categorically excluded,
2. determined to make a Finding of No Significant Impact, and
3. issued an ROD on an FEIS under NEPA.

Transportation project concepts often change. According to §93.104(d), FHWA/FTA projects must be found to conform before they are adopted, accepted, approved, or funded. Conformity must be re-determined for any FHWA/FTA project if one of the following occurs:

1. A significant change in the project's design concept and scope.
2. A three-year lapse since the most recent major step to advance the project (major steps include NEPA process completion, start of final design, acquisition of a significant portion of the right-of-way, and construction (including federal approval of plans, specification and estimates).

²²⁶ Part 2, Analysis and Documentation, Chapter 16, Air Quality Analysis, Florida Department of Transportation, September 13, 2006, p. 16-7.

²²⁷ Part 2, Analysis and Documentation, Chapter 16, Air Quality Analysis, Florida Department of Transportation, September 13, 2006, p. 16-9.

²²⁸ *Ibid.*, p. 16-6.

3. Initiation of a supplemental environmental document for air quality purposes.

Conclusions from a Review of the NEPA Review Process

From this review of the NEPA review process as it relates to reducing GHG emissions, some observations can be made.

NEPA reviews are meant to be project-specific. As a result, air quality impacts of a proposed transportation alternative are evaluated based on the air pollutants generated by that alternative and their impact on the immediate area surrounding the project. However, GHG emissions impacts are not localized, which makes it difficult to quantify the global warming impact of the particular transportation improvement alternative on the neighboring social, economic and physical environment. The air quality impacts of anything larger than a project would not be evaluated through NEPA air quality conformity but through MPO LRTP conformity.

As with the NAAQS criteria pollutants, the impacts of concern result from concentrations of the pollutant in the air as they affect the immediate geographic area surrounding the proposed transportation project. The Final Programming Summary Report that results from the ETDM process recommends project alternatives. Presently, the ETDM process evaluates CO concentrations only. Unlike the NAAQS criteria pollutants, the measure of interest for GHG emissions is not concentration but total emissions resulting from an alternative. If the draft CEQ guidance is adopted as is, then on a project scale, the impact of these total emissions, due to the project, would have to be 25,000 metric tons of CO₂e or greater annually in order for it to be considered potentially significant and worth evaluating.

Although Federal Code requires a lead agency to consider project alternatives that may not be within their jurisdiction (such as FHWA including a transit alternative in an EIS), and NEPA allows reviews of alternatives not initially included in a conforming MPO LRTP/TIP, the process and satisfaction of federal laws and requirements for NEPA review are different for a highway project than for a transit project. As a consequence, the selection of the type of federal funding sought for the transportation improvement project, the selection of a lead agency, the selection of an agency to prepare the DEIS, and the selection of an evaluation process, all accomplished at the beginning of NEPA review, would appear to set the range of alternatives on a particular modal course. The definition of a modal alternative in the wording of the NEPA Purpose and Need statement for the transportation improvement is critical to what alternatives would be considered. If the need is to improve highway LOS and capacity, then a transit option is unlikely.

SAFETEA-LU has emphasized congestion management and has expedited congestion management projects, which would appear to tip the balance toward highway project alternatives. The MPO LRTP process sets the stage for NEPA reviews. LRTPs should contain strong transit-supportive goals for GHG emissions reduction through VMT reduction and policies for advancing multimodalism. Transportation control measures to be funded through LRTPs should advance public transit to decrease VMT with resulting decreases in GHG emissions. In the MPO LRTP process, planning studies can select a mode. If

congestion management is the big issue, then the purpose of studies at the modal systems, sub-area and corridor levels should be defined as those that support strategies for reducing VMT. For consistency, the LGCP should contain growth management goals and objectives that support denser, more compact urban areas.

The discussion of environmental sensitivities of the study area under NEPA review should be expanded to include current and anticipated global warming impacts, such as anticipated sea level rise in coastal counties, sea acidification and warming impacts on fisheries and resulting economic impacts to communities, and climatological impacts on agriculture, flora and fauna in Florida.

Other elements that influence identification of transit alternatives is input from environmental resource agencies, public support for transit, clearly apparent environmental liabilities from highway alternatives or environmental benefits from transit alternatives, the relative effectiveness and cost of potential mitigation of the transit alternative, and the appeal wrought by visualization strategies.

Local Government Comprehensive Planning

Introduction

The purpose of this study is to evaluate how the calculation of greenhouse gas (GHG) emissions from transportation can be incorporated into five Florida transportation planning processes, specifically looking at an instance in which alternatives are evaluated for a corridor- or project-level transportation improvement. The focus is the development of the state's transportation system (state roads) as they relate to the consideration of public transit (bus) as an alternative. Therefore, within the discussion of local government comprehensive planning, the geographic areas of interest are counties and municipalities that are served by state roads and public bus systems.

Florida state law establishes requirements that local governments develop and implement comprehensive plans. There are no federal laws that require this. While the state law provides the framework for topics to be addressed and the process for developing and amending comprehensive plans, the intent of the law is to provide local governments with the power to envision their communities as they see fit and make plans accordingly, protecting and enhancing the unique attributes of each community. Comprehensive planning gives local governments the power and responsibility to guide and control future development. Two primary motivations behind the state legislature's decision to pass a growth management law was, first, to make sure that the necessary public facilities to serve new development were adequate and in place to serve it when first occupied. Second, the law makes sure that the local government can demonstrate that adequate funding exists to construct the needed public facilities prior to government approval of development orders, permits, and enforceable agreements between the local government and the developer.

The name of the law, the Local Government Comprehensive Planning and Land Development Regulation Act,²²⁹ was enacted in 1975²³⁰ and encompasses two processes. The first is that the local government engages a process by which the citizenry develops an overall direction and policies for growth management that are used as guidance by government agencies in the construction of capital facilities. The second process described by the second part of the Act's name, the "Land Development Regulation Act,"²³¹ addresses the fact that much infrastructure development in a county or municipality is completed by private sector land developers who build residential subdivisions, office parks, retail malls, etc., on available land parcels in response to market opportunities. Most of this infrastructure is privately owned on private property, but the use of those properties relies on public infrastructure such as transportation facilities. The Act lays out a process by which local governments interact with land developers to ensure that the costs associated with the use of public capital facilities by land development are recouped. This is accomplished through enforceable development agreements. Additionally, the Local Government Comprehensive Plan (LGCP) is carried out by ordinances that

²²⁹ s. 163.3161, F.S.

²³⁰ "...In conformity with, and in furtherance of, the purpose of the Florida Environmental Land and Water Management Act of 1972, Chapter 380, F.S.," which established the Development of Regional Impact review process, s. 163.3161(2), F.S., discussed later in this report.

²³¹ As implemented in accordance with s. 163.3220-3243, F.S.

regulate where and how land development takes place to ensure orderly community growth. No public or private development is permitted except that which conforms to the comprehensive plan.²³² However, the implementation of the comprehensive plan must recognize constitutionally-protected private property rights.²³³

The law calls for innovative planning and development strategies that address the urbanization of Florida and protect the environment.²³⁴ The law also calls for LGCPs and the local land development regulations that implement them to “maximize the use of existing facilities and services through redevelopment, urban infill development, and other strategies for urban revitalization.”²³⁵ The Florida Administrative Code (F.A.C.), which provides detailed guidance about how to carry out state law, explicitly states, “The purpose of the transportation element [of the LGCP] shall be for a multimodal transportation system that places emphasis on public transportation systems.”²³⁶

Internal and External Consistency of the LGCP with Other Plans and Jurisdictions

LGCPs must be consistent with the Florida State Comprehensive Plan,²³⁷ the Florida Transportation Plan,²³⁸ and the regional policy plan, all of which are general policy documents. The LGCP also must be coordinated with the comprehensive plans of adjacent municipalities, the County, adjacent counties, and the regional strategic plan, as well as the selection and application of transportation analysis methodologies.²³⁹ The LGCP must be coordinated and consistent with the FDOT Adopted Work Program,²⁴⁰ including the “establishment of strategies to facilitate local traffic to use alternatives to the Florida Intrastate Highway System to protect its interregional and intrastate functions.”²⁴¹ For a community located within a metropolitan planning area, its LGCP must be consistent with the MPO’s LRTP.²⁴² The LGCP capital improvements program (CIP) must be consistent with the MPO with a schedule that must “include transportation improvements included in the applicable metropolitan planning organization’s transportation improvement program [TIP] adopted pursuant to s. 339.175(7), F.S. to the extent that such improvements are relied upon to ensure concurrency and financial feasibility.”²⁴³

²³² s. 163.3161(5), F.S.

²³³ s. 163.3161(9), F.S.

²³⁴ s. 163.3177(11)(a), F.S.

²³⁵ s. 163.3177(11)(c), F.S.

²³⁶ Chap. 9J-5.019(1), F.A.C.

²³⁷ s. 187.201 F.S.

²³⁸ As required by s. 339.155, F.S.

²³⁹ s. 163.3177(4)(a), F.S.

²⁴⁰ Chap. 9J-5.019(3)(g) and (4)((b)3., F.A.C.

²⁴¹ Chap 9J-5.019(4)(c)13., F.A.C.

²⁴² Pursuant to s. 339.175(6), F.S.

²⁴³ s. 163.3177(3)(a)6, F.S.

Definition of “Consistency”

s. 163.3177(10)(a), F.S.

“The Legislature finds that in order for the department [FL Department of Community Affairs] to review local comprehensive plans, it is necessary to define the term “consistency.” Therefore, for the purpose of determining whether local comprehensive plans are consistent with the state comprehensive plan and the appropriate regional policy plan, a local plan shall be consistent with such plans if the local plan is “compatible with” and “furthers” such plans. The term “compatible with” means that the local plan is not in conflict with the state comprehensive plan or appropriate regional policy plan. The term “furthers” means to take action in the direction of realizing goals or policies of the state or regional plan. For the purposes of determining consistency of the local plan with the state comprehensive plan or the appropriate regional policy plan, the state or regional plan shall be construed as a whole and no specific goal and policy shall be construed or applied in isolation from the other goals and policies in the plans.”

Furthermore, public transit agencies in Florida that seek to receive state Public Transit Block Grant funding must develop a TDP. The TDP must present a 10-year financial and operating plan for the development of the public transit system. The TDP is updated every five years, with minor annual updates.²⁴⁴ State law requires the TDP to be consistent with the LGCP.²⁴⁵

The LGCP comprises several elements as specified by law.²⁴⁶ It includes a capital improvements element or program (the CIP), which must represent a financially feasible plan for the construction of capital facilities for at least a five-year period. It spans the range of public facilities, including public schools, libraries, and parks, as well as transportation facilities, and these elements must be internally consistent with each other. A required intergovernmental coordination element must identify any interlocal transportation service agreements.²⁴⁷

While internal and external consistency is fundamentally important, a possible disadvantage is the potential difficulty and/or resistance a local government might encounter upon suggesting something new, such as a different methodology or use of a different performance indicator. How is it ensured that consistency does not stifle innovation? Innovation may be difficult if coordinating partners are not in agreement.

²⁴⁴ s. 341.052, F.S.

²⁴⁵ s. 341.071, F.S.

²⁴⁶ s. 163.3177, F.S.

²⁴⁷ s. 163.3177(6)(h)6.a., F.S.

Contents of the LGCP

The LGCP must cover at least two planning periods: a 5-year period after the plan's adoption and a 10-year period thereafter. The LGCP must contain goals and objectives based upon appropriate data²⁴⁸ and policies that describe how the LGCP will be implemented. Transportation is required to be addressed in the LGCP as a separate element. Conservation is also a required element, which would contain one or more objectives for the protection of natural resources, including air quality.²⁴⁹

For small municipalities not within an urbanized area, a traffic circulation element is required that describes the types, locations, and extent of existing and proposed major thoroughfares and transportation routes, including bicycle and pedestrian ways. Transportation corridors may be designated, and an ordinance for the preservation and management of the corridor can be adopted.²⁵⁰

For municipalities that have a population greater than 50,000 and counties that have a population greater than 75,000, a transportation element must be adopted that provides more detail and requires more in-depth planning. It must include, either as part of the traffic circulation element or as separate elements, a separate plan for the development of public transit and a separate plan for ports and/or aviation.²⁵¹

For local governments located within a metropolitan planning area of an MPO, State law specifies the contents of the transportation element, including traffic circulation; identification of alternative modes including public transit; parking facilities; airport development; rail, seaport, and intermodal facilities; compatibility of transportation facilities to serve land uses; hurricane evacuation capabilities; programs to support greater land use densities to encourage public transportation; and identification of transportation corridors for future facilities.²⁵²

Compliance by local governments to carry out comprehensive planning as prescribed by State law is determined by Chap. 9-J5, F.A.C., the Minimum Criteria for Review of Local Government Comprehensive Plans and Determination of Compliance of the Department of Community Affairs,²⁵³ which specifies the transportation-related data that are required to be collected and presented in the traffic circulation element or the transportation element of a LGCP.

Transportation elements include four main sections:

1. A description of each modal system (roads, public transit, bicycle, pedestrian, port, airport, rail, intermodal facilities) based on an inventory of different types of data that is specified to be collected.
2. A transportation analysis of both existing and future conditions.

²⁴⁸ s. 163.3177(10)(e), F.S.

²⁴⁹ s. 163.3177(6)(d), F.S. and Chap. 9J-5.013(2)(b)1., F.A.C.

²⁵⁰ s. 163.3177 (6)(b), F.S.

²⁵¹ s. 163.3177(6)(i), F.S.

²⁵² s. 163.3177(6)(j), F.S.

²⁵³ s. 163.3177(10)

3. Goals, objectives, and policies.
4. A future transportation map or map series.

Analysis includes an assessment of growth trends and travel patterns, as well as existing conditions described by modal split, average daily and peak hour vehicle trips, vehicle occupancy rates, peak direction levels of service for roads and transit routes, ridership by route, peak hour capacities and headways, and the characteristics of major trip generators and attractors. The need for new facilities and expansion of alternative transportation modes to provide a safe and efficient transportation network and enhance mobility must be addressed. The methodologies, assumptions, modeling applications, and alternatives considered must be included. The analysis should show how the local government will maintain its adopted level of service (LOS) standards for roads and transit facilities within its jurisdiction.²⁵⁴

It is noted that in transportation studies, importance has been placed upon improving conditions of the peak hour of travel, when the largest number of motorists are using the roadway at the same time and during which the highest levels of congestion are experienced by motorists. The peak hour accounts for only about 10 percent of all trips in a 24-hour period, but the emphasis is on adequately serving those trips. On the other hand, transit headways during the same peak hour represent the best possible service conditions experienced by transit riders. If planners were to concentrate on improving transit service during those times when transit service is at its worst LOS, then they might be studying Sunday afternoon or late evening and applying the transit LOS standard to those times. Although an argument could be made that it would be unreasonable to provide more transit service during those times when fewer people might be traveling, an example from Portland TriMet demonstrates that by providing a high level of service all day every day on designated corridors, this has created a service reliability that has increased ridership.²⁵⁵ In an effort to create a balanced multimodal system in which transit provides service that is competitive with private automobile travel, effort should be made to evaluate planning processes to ensure that the applied transit LOS standards are comparable or equivalent to highway LOS standards.

LGCP Updates and Evaluation

Measurable objectives must be included in LGCP elements to be used in the monitoring and evaluation process for plan implementation.²⁵⁶ At least seven years from the time of LGCP adoption, the local government must prepare an Evaluation and Appraisal Report (EAR) that assesses the progress in implementing the elements of the LGCP.²⁵⁷ With regard to transportation for those local governments that have adopted a transportation concurrency exception area (TCEA), a transportation concurrency management area (TCMA), or a multimodal transportation district (MMTD) pursuant to concurrency law

²⁵⁴ Chap. 9J-5.019(3)(f) and (g), F.A.C.

²⁵⁵ <http://www.trimet.org/about/ridership.htm> The portion of weekday riders served by Frequent Service lines has increased from 17 percent in 1998 to 57 percent in FY 2009.

²⁵⁶ s. 163.3177(8)(e), F.S.

²⁵⁷ s. 163.3191, F.S.

established in s. 163.3180, F.S., the EAR must include the extent to which these strategies have achieved their purposes.²⁵⁸ The law also requires an evaluation “of the extent to which changes are needed to develop a common methodology for measuring impacts on transportation facilities for the purpose of implementing its concurrency management system in coordination with the municipalities and counties.”²⁵⁹ After the EAR is prepared, the local government adopts it and submits it to the Florida Department of Community Affairs (DCA) for review. DCA reviews the EAR for sufficiency in its fulfillment of evaluation requirements and contents listed in s. 163.3191(2), F.S. Upon a determination of sufficiency, the local government updates its LGCP according to the findings and recommendations in the EAR.

Local governments must establish the ways in which public services are measured for adequacy and must set LOS standards in their LGCP for public facilities. Development orders and permits are issued in accordance with maintaining those standards.²⁶⁰ The construction and provision of public facilities and services must be consistent with what is included in the CIP, and development can be constructed in phases that match the degree to which public facilities and services are available.²⁶¹

Changes to Local Government Comprehensive Planning that Require GHG Considerations

In 2008, the State legislature amended the growth management law (HB 697) by requiring traffic circulation elements to “incorporate transportation strategies to address reduction in greenhouse gas emissions from the transportation sector.” Amendments also require transportation elements to include “the incorporation of transportation strategies to address reduction in greenhouse gas emissions from the transportation sector.” The conservation element must include “factors that affect energy conservation.” The land use element must include “the discouragement of urban sprawl; ... greenhouse gas reduction strategies,”²⁶²

DCA has held workshops, the last on April 23, 2010, to receive public and agency input on draft rulemaking for implementing the incorporation of GHG considerations into the LGCP process. DCA also held a workshop on June 23, 2010, on the implementation of HB 360 and HB 697. The draft Rules, dated September 2010, propose to include the following statement in the Application and Purpose of the transportation element: “All local governments shall adopt strategies to reduce greenhouse gas emissions from the transportation sector and support energy efficient land use patterns.” It adds explicit consideration of public transit and bicycle and pedestrian modes for which an analysis should demonstrate integration and coordination among the various modes of transportation. It replaces analysis requirements for identifying land uses and transportation management programs necessary to promote and support a “public transportation system in designated public transportation corridors” with analysis requirements to identify land uses and transportation management programs necessary to promote and support a “multimodal transportation system to reduce vehicle miles traveled and

²⁵⁸ s. 163.3191(2)(o), F.S.

²⁵⁹ s. 163.3191(2)(p), F.S.

²⁶⁰ s. 163.3177(10)(f), F.S.

²⁶¹ s. 163.3177(10)(h), F.S.

²⁶² House Bill 697, amending s. 163.3177(6)(a), (b), (d), and (j), F.S.

greenhouse gas emissions.” In addition, the proposed Third Draft Rules for implementing HB 697 call for a land use analysis of urban sprawl and the identification of land use strategies to reduce greenhouse gas emissions. It also call for one or more specific objectives and supporting policies to achieve energy efficient land use patterns that reduce per capita greenhouse gas emission.²⁶³

A public hearing on the Proposed Rule change was last held October 25, 2010 in Tallahassee.²⁶⁴ In the meantime, local governments are responding to the requirements of the law. For example, Seminole County’s growth management plan calls for future growth policies that promote primarily redevelopment, infill, and an emphasis on mixed land uses. However, one stumbling block is cited: roadway concurrency. Planning efforts have resulted in the designation of four mobility areas, with strategies tailored to municipalities based upon the degree of transit readiness. Currently, there are transit headways of 60 minutes. Once a trigger percentage of seats has been filled during peak periods, service will progress to 30-minute headways. There also has been a shift in the sidewalk program from an emphasis on serving schools to an emphasis on serving SunRail stations and LYNX bus stops. A next step is to link residential areas by bicycle trails to LYNX and SunRail bus stops. In response to HB 697, the Seminole County Energy Conservation Overlay (ECO) was developed to encompass unincorporated properties ¼ mile from either side of current and proposed transit corridors and within ½ mile of major intersections and SunRail stations. The ECO is within the Seminole County DULA. For the purpose of reducing VMT and GHG emissions, the energy strategy applies only to major transit corridors, centers, and SunRail stations in the unincorporated County and is not a land use change but offers performance standards and incentives to encourage redevelopment of energy inefficient land use patterns.²⁶⁵

The above has summarized the LGCP process. However, the most important part of comprehensive planning with ramifications for reducing GHG emissions through public transit is transportation concurrency, which applies standards that are enforced by law.

Concurrency

The cornerstone of Florida growth management and comprehensive planning is the concept of concurrency. Known in some other states as adequate public facilities ordinances, “concurrency means that the necessary public facilities and services to maintain the adopted level of service standards are available when the impacts of development occur.”²⁶⁶ In Florida, this applies not only to sanitary sewer, solid waste, drainage, potable water, parks and recreation, and public schools but also to transportation. Transportation concurrency applies to both state and local transportation facilities.²⁶⁷

²⁶³ Third Draft Rules for HB 697 September 2010, Florida Department of Community Affairs.

²⁶⁴ At such time as DCA takes the next step in the rule development process, there will be a notice in the Florida Administrative Weekly and information posted on the DCA Web site at <http://www.dca.state.fl.us/fdcp/dcp/EnergyGHG/index.cfm#RD>.

²⁶⁵ “A Bridge to the Future, Seminole County’s Mobility and Energy Strategy,” Seminole County Growth Management Department, PowerPoint presentation given by Sheryl Stolzenberg at the Department of Community Affairs 2010 Growth Management Implementation Workshop, Orlando, June 23, 2010.

²⁶⁶ 9J-5.003(25), F.A.C.

²⁶⁷ s. 163.3180(4)(a), F.S.

Each local government must adopt LOS standards for public facilities within its boundaries, including local roads and public transit, to ensure that adequate public facility capacity will be provided for future development and for purposes of issuing development orders or development permits. The LOS standard must be set for each individual facility or facility type and not on a system-wide basis,²⁶⁸ and there must be standards for the peak hour for both roads and public transit.²⁶⁹ These LOS standards must be upheld through “a schedule of capital improvements which maintains adopted level of service standards and meets the existing and future capital facility needs.”²⁷⁰ By Code, LOS is “an indicator of the extent or degree of service provided by, or proposed to be provided by, a facility based on and related to the operational characteristics of the facility. Level of service shall indicate the capacity per unit of demand for each public facility.”²⁷¹ This definition of LOS as a measure of capacity presents problems that multimodal LOS measures attempt to address, as further discussed below.

Local governments must adopt the transportation LOS standards established by FDOT for FIHS facilities within their jurisdictions.²⁷² However, there is much overlap between the FIHS and state highways that are part of the SIS. Local governments must adopt the transportation LOS standards established by FDOT for SIS facilities within their jurisdiction, except that the recent Community Renewal Act exempted the use of FDOT LOS standards on SIS facilities located within designated transportation concurrency exception areas, described below. For all other roads that are part of the SHS, the local government can establish LOS standards in coordination with adjacent jurisdictions that do not have to be consistent with the LOS standards of FDOT, but FDOT must be in agreement.²⁷³

Local governments receive technical assistance from FDOT and DCA in the application of a multi-modal LOS analysis for automobiles, bicycles, pedestrian facilities, transit, and trucks. These techniques may be used to evaluate increased accessibility by multiple modes and reduction in VMT in an area.²⁷⁴ Transportation facilities needed to serve new development must be in place or under actual construction within three years after the local government approves a building permit that results in traffic generation.²⁷⁵ Since its inception in 1993, Florida’s concurrency law has undergone an evolution process through 10 amendments, including the addition of several options to satisfy transportation concurrency. Part of these changes were due to the recognition that transportation concurrency was implemented in a way that discouraged infill development and encouraged sprawl because it was more expensive for the developer to ensure a transportation LOS in a more urbanized area. These options include TCMAs, TCEAs, TCMS, and MMTDs. These strategies address the experience of local

²⁶⁸ 9J-5.005(3), F.A.C.

²⁶⁹ 9J-5.019(4)(c)1., F.A.C

²⁷⁰ 9J-5.016(3)(b)3., F.A.C.

²⁷¹ 9J-5.003(62), F.A.C.

²⁷² 9J-5.019(4)(c)1., F.A.C.

²⁷³ s. 163.3180(10), F.S. as specified by Chap. 9J-5.015(3)(b)3., F.A.C. The Community Renewal Act of 2008 (SB 360) amended s. 163.3180, F.S. to establish the exemption from FDOT LOS standards for SIS facilities within TCEAs. Also, Chap. 9J-5.019(4)(c)1., F.A.C.

²⁷⁴ s. 163.3180(1)(b), F.S.

²⁷⁵ s. 163.3180(2)(c), F.S.

governments that financial, physical, and policy constraints might prevent transportation facilities from being constructed.

Transportation Concurrency Management Areas (TCMAs)

One or more TCMAs can be designated by a LGCP. A TCMA is “a compact geographic area with an existing network of roads where multiple, viable alternative travel paths or modes are available for common trips.”²⁷⁶ An area-wide LOS standard is applied to the TCMA rather than the specification of a LOS standard street link-by-link. This allowance releases the local government from the prohibition in 9J-5.005(3) F.A.C. from using area-wide LOS standards. The area-wide LOS standard is very important because it recognizes that congestion on one segment can be relieved by travelers altering their route choice. However, the local government must meet with FDOT regarding maintaining the LOS standards for all SIS highways within the TCMA and provide for the mitigation of any impacts.

Transportation Concurrency Management Systems (TCMS)

Another option is for a local government to establish a long-term TCMS as part of the LGCP. A TCMS authority can be established to set up a special taxing district to raise revenues for transportation improvements. The system would apply to a designated area where there are backlogged roadways. Backlogged roadways are those where the adopted LOS standard is exceeded by the existing trips plus additional projected background trips from general area-wide growth that is not attributable to a land development project under review.²⁷⁷ The TCMS is closely tied to the schedule of capital improvements in the CIP for up to 10 years as a basis for issuing development orders and may set a tiered schedule of interim LOS standards that must be designed to correct existing capacity deficiencies. A TCMS also may adopt multimodal LOS standards for transportation facilities, using the FDOT methodology for multimodal LOS standards.²⁷⁸ (Multimodal LOS standards are described further under Multimodal Transportation Districts below.) The TCMS also must set priorities for addressing the backlogged roads.²⁷⁹ Where there is sufficient cause and justification, DCA may grant the local government up to a 15-year plan horizon to remedy existing deficiencies. Despite the existence of backlogged roadways, the TCMS allows local governments to avoid moratoria on land development. In turn, the land developer contributes a proportionate fair-share contribution that may be directed toward one or more specific transportation improvements reasonably associated with the travel demand that will be generated by the new development. The proportionate fair-share contribution can go toward one or more modes of travel.²⁸⁰

The TCMS is important because it releases the local government from having to achieve LOS standards immediately and allows multimodal Quality/Level of Service (Q/LOS) standards. These changes give recognition that transitioning to a multimodal system will require tolerance of some congestion over time.

²⁷⁶ s. 163.3180(7), F.S.

²⁷⁷ s. 163.3180(16)(i), F.S. as defined in HB 1021, 2009.

²⁷⁸ Chap. 9J-5.0055(2)(b)., F.A.C.

²⁷⁹ s. 163.3180(9)(a), F.S. as implemented by Chap. 9J-5.0055, F.A.C.

²⁸⁰ s. 163.3180(16)(b)(2)c., F.S.

Multimodal Transportation Districts (MMTDs)

In the LGCP process, local governments can choose to employ the designation of MMTDs to address transportation concurrency through community design and by prioritizing the needs of the pedestrian over the needs of motor vehicle travel. LGCP guidance for the MMTD must specify the geographic boundaries of the MMTD and include objectives for providing a safe, comfortable, and attractive pedestrian environment with convenient connections to public transit. The LGCP must result from an analysis that demonstrates that the MMTD will reduce VMT through community design elements and will support an integrated, multimodal transportation system that maintains adopted LOS standards for roads and transit facilities. Within MMTDs, those LOS standards can be specified using FDOT's development of multimodal Q/LOS measures, described further below.²⁸¹ These Q/LOS measures and standards include those set for public transit and are based upon the traveler's experience and level of satisfaction with the service, rather than a measure of capacity in the strictest sense (i.e., number of transit bus seats available during the peak travel hour), as defined in the Florida Code. Policies for MMTDs must include support for the development of an interconnected network of streets and sidewalks within the MMTD and provide for convenient street crossings, close proximity of transit service to origins and destinations within the MMTD, and provisions for bicycles on roadways.²⁸²

Once approved, an MMTD is incorporated as an amendment into the LGCP, and land development regulations are amended accordingly to support the MMTD. One challenge to the establishment of an MMTD is that, initially, many of the community design elements are missing and are to be put in place as part of redevelopment projects. If land developers balk at the proposed MMTD requirements because they are seen as too expensive, a local government may be reluctant to approve an MMTD if there is concern that the MMTD would scare away new land redevelopment investments.²⁸³

Transportation Concurrency Exception Areas (TCEAs)

TCEAs are those areas where the LOS standards for highway segments have been eliminated. A local government can designate as a TCEA an area that promotes public transportation or is designated as urban infill development, urban redevelopment, or downtown revitalization. For TCEAs, the LGCP must contain long-term strategies that demonstrate support and fund mobility within the area, including alternative modes of transportation. Data and analysis must support the TCEA boundary designation, and strategies must address urban design, appropriate land use mixes, development intensity and density. The local government must meet with FDOT to determine how LOS on the SIS and regional facilities will be affected and provide a mitigation plan that may include access management, parallel reliever roads, and transportation demand management.

In 2009, the State Legislature found that "in urban centers, transportation cannot be effectively managed and mobility cannot be improved solely through the expansion of roadway capacity, that the expansion of roadway capacity is not always physically or financially possible, and that a range of

²⁸¹ s. 163.3180(15)(c), F.S.

²⁸² Chaps. 9J-5.019(3)(k), 9J-5.019(4)(b)10., and 9J-5.019(4)(c)22., F.A.C.

²⁸³ Conversation with Thomas Locke, General Manager, University Mall, and Board member of the University Community Area Redevelopment Corporation, Inc., February 2010.

transportation alternatives is essential to satisfy mobility needs, reduce congestion, and achieve healthy, vibrant centers.”²⁸⁴ As a result of this recognition, the legislature passed SB 360, the Community Renewal Act,²⁸⁵ which amended the growth management law. The Act eliminated the requirement that local governments meet highway LOS standards by allowing “dense urban land areas” (DULAs, areas with a population density greater than 1,000 persons per square mile) to be designated as TCEAs. There are 238 municipalities that qualify as DULAs for purposes of TCEA designation. Counties that qualify as DULAs include Miami-Dade County, the transportation concurrency districts in Broward County, and the areas within urban service areas or urban growth boundaries designated prior to July 1, 2009, in six other counties.²⁸⁶ With 67 counties and 411 municipalities in Florida, this means that 59 counties and 173 municipalities must continue to implement transportation concurrency as it was originally designed. The qualifying DULA governments can either choose to exercise their home rule power and keep the existing transportation concurrency requirements in effect, or pursue the TCEA designation by amending their LGCPs and implementing ordinances. Within two years of designation as a TCEA, the LGCP must include adopted land use and transportation strategies to support and fund long-term mobility within the exception area, including alternative modes of transportation.

Presently, there is little guidance on the development of transportation and land use strategies that would fulfill the requirements of TCEAs as established pursuant to SB 360. However, some municipalities such as the City of Gainesville are moving forward with plan development. In response to SB 360 and HB 697, the City of Gainesville adopted an amendment to its Concurrency Management Element in December 2009.²⁸⁷ Gainesville’s TCEA originally was created as a redevelopment TCEA, and that emphasis remains. The most recent amendment expanded the number of specific zones within the TCEA from three to six. Each zone specifies transportation mobility requirements of land developers in the form of a menu of options or “multimodal standards” that are “projects or methods to mitigate trip impacts or support mobility (payments or construction) based on average daily trip generation.”²⁸⁸ The greater the trip generation estimated for the new development, the more options would be required of the developer to complete. The requirements are higher for zones that are farther from the urban center.

The expansion of the application of the TCEA designation is an indication that the original method of demonstrating transportation concurrency through maintaining highway segment-by-segment LOS standards is working poorly for many local governments, especially the larger ones. In response, the Community Renewal Act also directed DCA and FDOT to complete studies on a mobility fee concept as a

²⁸⁴ s. 163.3180(5)(a), F.S.

²⁸⁵ Section 13, Chapter 2009-96, Laws of Florida, s. 163.3164, F.S.

²⁸⁶ 2009 List of Local Governments Qualifying as Dense Urban Land Areas, Florida Department of Community Affairs, found at <http://www.dca.state.fl.us/fdcp/dcp/Legislation/2009/CountiesMunicipalities.cfm>.

²⁸⁷ Concurrency Management Element, Goals, Objectives & Policies, City of Gainesville, Revised by Ord. 0090184, 12/17/09.

²⁸⁸ City of Gainesville TCEA Amendment Package, PowerPoint presentation given by Onelia Lazzari, Concurrency Management Planner, at the Department of Community Affairs 2010 Growth Management Implementation Workshop, Orlando, June 23, 2010, slide 10.

potential replacement to the existing transportation concurrency system, while continuing to ensure that adequate transportation facilities and services are in place to support new development.

Mobility Fee

A mobility fee is “a charge on all new development to provide mitigation for its impact on the transportation system.”²⁸⁹ As part of local government comprehensive planning, a mobility fee is a growth management strategy that would raise sufficient funds to provide for the additional travel demand generated by new development. The mobility fee concept is intended to address the issue that the previous transportation concurrency system allowed initial development to take place with no transportation capacity improvements required, where no LOS standards were violated, largely on the suburban outskirts; those wishing to develop property after roadways began functioning below LOS standards suddenly had to pay for the impact of the development to maintain the LOS standard. The mobility fee also is intended to provide a reconciliation between the desired creation of thriving urban centers (i.e., congested) through greater development and the challenges that urban centers encounter in providing adequate transportation facilities.

The objectives of a mobility fee are to support the development of multimodal transportation systems and promote compact development and, by doing so, reduce GHG emissions. The mobility fee, as proposed by FDOT and DCA, would apply on at least a countywide basis and possibly on a regional basis. The mobility fee would vary by location of the new development. The mobility fee would fund multimodal improvements, including transit capital and operating costs. It could provide a charge for recouping a new development’s share of transit operating costs for a short term period. The raised funds would be distributed among all government entities responsible for maintaining the impacted transportation facilities. The mobility fee is intended to replace both proportionate-share payments applied to DRIs and proportionate fair-share payments that are applied to developments not subject to DRI review.

The fee would be applied to pay for transportation facilities and services in a planned schedule of improvements as identified and prioritized by the responsible government entities in their LGCPs and CIPs. Developers would be charged the mobility fee commensurate with the transportation services consumed by the new development. This approach also acknowledges that congestion is a characteristic typical of thriving urban areas, and an LOS measure other than peak hour highway LOS should be used. The mobility fee approach calls for multimodal measures of the LOS that address network performance, and that includes highway, transit, bicycling and walking modes combined. The system would be unique to each county or multi-county area and would be established through an interlocal agreement among FDOT, the MPO, public transit agencies, and local governments.²⁹⁰

A mobility fee calculation could be either improvements-based, which charges the developer a portion of the costs of specific improvements necessary to accommodate future growth proportionate to the

²⁸⁹ “Joint Report on the Mobility Fee Methodology Study,” prepared by Florida Department of Transportation and the Florida Department of Community Affairs, December 1, 2009, p 19.

²⁹⁰ *Ibid.*, pp. 20-22.

development impact, or consumption-based, which charges the new development the value of transportation services needed by the new development based upon generated vehicle miles or person miles of travel. The premise is that the fee would be less for development locations closer to the urban core because VMT generated by such a development is anticipated to be less.²⁹¹ A challenge for a consumption-based mobility fee based upon VMT might be, at least initially, that in more decentralized urban areas in Florida, average VMT in urban centers might not be much less than for locations in the suburban fringe. The mobility fee is considered to be paired with a transportation utility fee or user fee to address existing backlogs and deficiencies.²⁹² DCA has begun the process of developing guidance as part of 9J-5, F.A.C. for the development of transportation and land use strategies within newly-designated TCEAs qualifying under SB 360. Those adopted by a local government would become the legal basis for the mobility plan and mobility fee.²⁹³

If a mobility fee system is adopted, DCA would revise Chapter 9J-5, F.A.C. to evaluate LOS standards for all transportation facilities.²⁹⁴ As of June 2010, there are no 9J-5 mobility fee requirements. The mobility fee concept shows promise for providing an incentive to develop land that generates less VMT and reduces GHG emissions.

FDOT Quality/LOS Handbook

Over the years, considerable national and statewide attention has focused on the development of LOS measures and standards for transportation of different modes. One of the outcomes of that effort is the *FDOT Quality/Level of Service Handbook*, which has implications for GHG emissions reduction through public transit. “The methods ... provide the first successful multimodal approach unifying the nation’s leading automobile, bicycle, pedestrian, and bus Q/LOS evaluation techniques into a common transportation analysis at the facility and segment levels. With these professionally accepted techniques, analysts can now easily evaluate roadways from a multimodal perspective, which result in better multimodal decisions for projects in the planning and preliminary engineering phases.”²⁹⁵ It is anticipated that FDOT’s analytical approach as presented in the handbook will correspond to the 2010 update of the *Highway Capacity Manual*.²⁹⁶

The handbook provides the professionally-accepted tools and accompanying software for transportation engineers and planners to quantify multimodal transportation service within the roadway environment. It can be used for two levels of analysis: (1) generalized planning, for which Generalized Service Volume Tables were developed for computing a planning-level estimate of the capacity and LOS needed;²⁹⁷ this would correspond to the development of a LGCP (as well as the MPO LRTP) and better support the development of public transit; and (2) the more detailed preliminary engineering, which supports

²⁹¹ *Ibid.*, pp. 23-24.

²⁹² *Ibid.*, p. 29.

²⁹³ *Ibid.*, p. 12.

²⁹⁴ *Ibid.*, p. 7.

²⁹⁵ *2009 Quality/Level of Service Handbook*, Florida Department of Transportation, 2009, p. 8.

²⁹⁶ *Ibid.*, p. 25.

²⁹⁷ *Ibid.*, p. 9.

decisions relating to design concept and scope of a transportation improvement project;²⁹⁸ this would correspond to the DRI review process and NEPA review. For preliminary engineering, the handbook provides ARTPLAN, FREEPLAN, and HIGHPLAN, which comprise Florida's LOS planning software (LOSPLAN) and are based upon the *Highway Capacity Manual*,²⁹⁹ the *Transit Capacity and Quality of Service Manual*³⁰⁰ that is supplemented by FDOT's Transit Level of Service (TLOS) software, the Bicycle LOS Model,³⁰¹ and the Pedestrian LOS Model.³⁰²

The handbook focuses on two dimensions of mobility: the quality of travel, which is traveler perception and satisfaction with a facility or service, and capacity utilization. Motorized vehicle capacity is "the maximum hourly volume that can reasonably be expected to pass a point under prevailing conditions."³⁰³ LOS is different from capacity in that LOS is a quantitative stratification of the degree of user satisfaction. The motor vehicle LOS measure is average travel speed.³⁰⁴ Bicycle LOS and pedestrian LOS is not based upon speed. Motor vehicle speed, and therefore LOS, is affected by more than capacity utilization, such as signal progression and other elements that may affect operating speed of the facility.³⁰⁵ However, the capacity and LOS concepts do intersect in a discussion of motor vehicle LOS in that LOS E corresponds to the maximum service volume or capacity of a highway segment or facility, in which motorists experience heavily congested stop-and-go conditions. Capacity utilization is a less useful measure for bus transit, pedestrians, and bicyclists than for private motor vehicle travel.

An important innovation of the Q/LOS methodology is that ARTPLAN links and simultaneously calculates separate LOS measures for each highway mode – private motorists, bus passengers, truck drivers, bicyclists, and pedestrians – under a defined set of highway conditions. This acknowledges that the modes of travel are interactive and that if, for example, LOS for motorists increases, the LOS for other users, such as pedestrians, may decrease.³⁰⁶ This effect highlights the necessity of transportation policy and decision makers that, in the development of any transportation facility or service, trade-offs must be made. In the LGCP process, as in the MPO LRTP process, rarely do the plans explicitly acknowledge this issue through guidance for making such trade-off decisions, especially where the accomplishment of two or more objectives may come into conflict.

The use of simplifying assumptions in the analysis procedures is necessary to keep the analysis process from becoming too cumbersome and so that the level of precision corresponds to the level of accuracy of a planning analysis. "Planning level analyses make extensive use of default values and simplifying assumptions to the operational models on which they are based."³⁰⁷ "For transit analysis planning

²⁹⁸ *Ibid.*

²⁹⁹ *Highway Capacity Manual*, Transportation Research Board, 2000.

³⁰⁰ *Ibid.*, TRB, 2003.

³⁰¹ *Bicycle LOS Model*, Landis, 1997.

³⁰² *Pedestrian LOS Model*, Landis, 2001.

³⁰³ *2009 FDOT Quality/Level of Service Handbook*, p. 13.

³⁰⁴ *Ibid.*, Figure 1-4, p. 22.

³⁰⁵ *Ibid.*, p. 14.

³⁰⁶ *Ibid.*, Figure 1-4, p. 22.

³⁰⁷ *Ibid.*, p. 30.

purposes, the most significant assumption is that bus frequency is the single most important factor in determining the Q/LOS to transit users along a transit route segment or roadway facility.”³⁰⁸

For planning level analysis, the service measure for public bus transit is “the number of scheduled fixed route buses which have a potential to stop on a given roadway segment in one direction of flow in a one hour time period.”³⁰⁹ The frequency is adjusted according to the degree of sidewalk coverage along a facility as the factor for pedestrian access to transit.

At the preliminary engineering level, the adjusted bus frequency determinations are computed as an average, weighted by segment lengths of the facility under analysis, and adjusted according to pedestrian LOS, roadway crossing difficulty, and obstacles to bus stops.³¹⁰ For an analysis of daily transportation service, bus span of service also is taken into account, which is the number of hours in a day of scheduled fixed route bus service; “span of service becomes a relevant factor for any given hour if the transit service is not available for the return, or originating, trip.”³¹¹ To address this, multiplicative factors in ARTPLAN are applied to daily analyses of bus service. For all Generalized Service Volume Tables in the handbook regarding bus service, “all numbers are shown in terms of buses per hour only for the peak hour in the single direction of higher traffic flow.”³¹² It is important to note that the traffic volume shown representing the standard at each level of service is the lower boundary for each standard. In other words, using the tables below as an example, for a Class III undivided roadway facility that provides one lane in each direction, the number of motor vehicles traveling during the peak hour to achieve a level of service C can be no more than 270. At LOS C, driving conditions will never get worse than that during the peak hour or for that matter, for the rest of the day. During the peak hour, driving conditions will be better in the reverse direction of peak flow. However, for bus service, for example, where the street system provides <85% sidewalk coverage, the number of buses per hour on a facility is 4-5. That represents the best level of service at LOS C during the peak hour. Level of service will be worse than this in the reverse direction of peak flow and level of service will be worse for the remainder of the day.

³⁰⁸ *Ibid.*, p. 33.

³⁰⁹ *Ibid.*, p. 73.

³¹⁰ *Ibid.*, pp. 30 and 39.

³¹¹ *Ibid.*, p. 73.

³¹² *Ibid.*, p. 93.

**Table B2 - Excerpt from “Generalized Peak Hour Directional Volumes for Florida’s Urbanized Areas”,
 9/4/09**

Class III/IV (more than 4.50 signalized intersections per mile)*					
Lanes	Median	B	C	D	E
1	Undivided	**	270	630	790
2	Divided	**	670	1,500	1,700
3	Divided	**	1,050	2,330	2,570
4	Divided	**	1,440	3,170	3,450

*TABLE 7, 2009 FDOT Quality/Level of Service Handbook

**Table B3 – Excerpt from “Generalized Peak Hour Directional Volumes for Florida’s Urbanized Areas”,
 9/4/09**

BUS MODE (Scheduled Fixed Route)*				
Buses in peak hour in peak direction				
Sidewalk coverage	B	C	D	E
0-84%	>5	≥4	≥3	≥2
85-100%	>4	≥3	≥2	≥1

*TABLES 1, 4 and 7, 2009 FDOT Quality/Level of Service Handbook

Local governments are beginning to apply the principles of Q/LOS measures. For example, to meet current state requirements for public transit LOS standards to be defined according to capacity, Hillsborough County’s standard describes the number of transit seats available at peak hour as “Levels of Service for Mass Transit facilities shall be a peak hour load factor not to exceed 1.2.”³¹³ However, Hillsborough County also is moving toward the use of a quality of service standard, reflecting the experience and perspective of the transit patron. The quality of service measure for transit, or TLOS,

³¹³ Future of Hillsborough, Comprehensive Plan for Unincorporated Hillsborough County Florida, Capital Improvements, Effective Date August 26, 2008, Policy 1.C.1.g., p. 14.

incorporates the criterion of transit frequency and was calculated for each route as a weighted average of the frequency LOS scores for regular hours, peak hours, and evening hours.³¹⁴

$$\text{Average Frequency LOS} = [(2 \times \text{mid-day span score}) + (2 \times \text{peak hour span score}) + (\text{evening span score})] / 5$$

The quality of service measure also incorporates the criterion of transit service span, or the number of hours of transit service provided in a day. The Average LOS for Span of Service Hours was calculated for each route as a weighted average of the span LOS scores for weekdays and weekend days.³¹⁵

$$\text{Average Span LOS} = [(5 \times \text{weekday span score}) + (\text{Saturday span score}) + (\text{Sunday span score})] / 7$$

The final LOS score for each route is a simple average of the frequency and span scores.

Area coverage is also a criterion for setting TLOS and is defined as a simple ¼-mile walking buffer around each local route and a 1- to 5-mile driving radius around each park-and-ride lot. “The standard for future transit service will be based on the percent of the desired service area, percent of the population, or percent of target corridor miles that are served by transit at a desired quality level.”³¹⁶ Transit has also been designated to supplement the capacity of transportation corridors that are constrained and are operating at a poor highway LOS. Bus corridors that operate at a TLOS of D or better are High TLOS Corridors, in which buses operate at least 12 hours per day and arrive every 30 minutes or less on average and supplement an existing constrained or deficient roadway. County roadways that are designated as High TLOS Corridors are those roadways generally parallel to and within ¼ mile of a High TLOS roadway. Arterials and collectors are assigned a LOS E standard and constrained or deficient roadways that are along a High TLOS Corridor are assigned as 120 percent of LOS E. In this way, public transit supplements the transportation service along the facility, but also the roadway LOS standard is allowed to be lower than regular arterials and collectors within the urban service area (LOS D).³¹⁷

Figure 1-2 of the Handbook, “Examples of LOS by Mode for Urban Roadways,” illustrates through photographs what each LOS looks like for each mode.³¹⁸ The modes, automobile, bicycle, pedestrian, and bus are shown by column so that, for example, the LOS A for each mode is shown in the same row. It is assumed that the figure does not suggest that automobile service of LOS A/B is comparable in quality to bus service of LOS A/B. To do so would be like comparing “apples to oranges”; however, LGCP and MPO LRTP goals and objectives include VMT reduction and a shift in mode share from automobile to transit. In this case, comparability is important. While the bus service frequency measure is the single most important factor in determining Q/LOS to transit users, based on Q/LOS performance

³¹⁴ *Ibid.*, p. 31.

³¹⁵ *Ibid.*, p. 33.

³¹⁶ *Ibid.*, p. 36.

³¹⁷ *Ibid.*, Policy 1.C.1.g., p. 8.

³¹⁸ 2009 FDOT Quality/Level of Service Handbook, p. 15.

measures, a question arises regarding whether such a measure is sufficient to describe bus service that might constitute, for example, a LOS A that is comparable to automobile service of LOS A. Bus service that is LOS A provides more than four buses per hour during the peak hour only at a designated stop along the facility or segment of interest. Such bus service also provides excellent pedestrian access. However, to provide bus service to accomplish any one particular trip will necessitate the existence of an extensive network of connecting and coordinated routes. Additionally, during the other 23 non-peak hours of travel, automobile LOS likely will have improved, while bus transit service likely will have decreased.

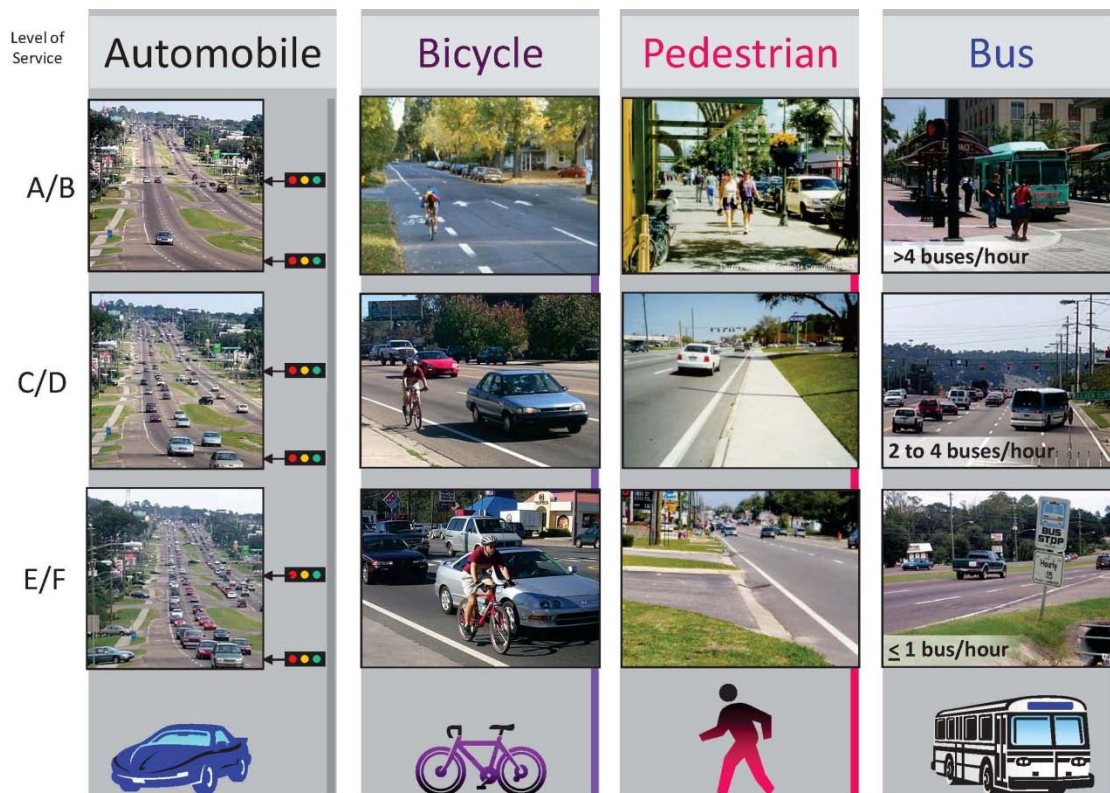


Figure B1 – Reproduction of Figure 1-2 from the FDOT 2009 Quality/Level of Service Handbook

In comparison, while average travel speed for automobile travel is just one service measure, incorporating several simplifying assumptions,³¹⁹ it represents well the motorist's experience in the LOS analysis because all the other elements necessary for effective automobile travel are already in place. For example, the roadway network already exists to enable a motorist to travel to any desired destination from any origin, to select the shortest path, and not have to switch modes. The motorist can choose any time of day or night to travel. Physical access to one's automobile always is available because one owns and has exclusive use of the automobile and because the built environment provides parking for almost every origin and destination. These essential elements already exist because local, state, and federal governments have made the necessary infrastructure investments over the past

³¹⁹ *Ibid.*, pp. 30-32.

several decades, and motorists currently spend, on average, over \$8,091 annually on vehicle ownership expenses. Households that earn less than \$20,000 per year and own automobiles spend almost 25 percent of their annual incomes on automobile expenses.³²⁰ The system for automobile travel is highly developed and maintained.

It is suggested that adjusted bus frequency does not capture all the necessary elements of bus service to elevate it to a viable and reasonable travel choice. For example, another issue is personal safety, which is not a function of service duration or frequency. If the goal is reducing VMT, then the measure of service for bus travel must comprise all those elements that would actually make it competitive with auto travel. This assertion is supported by other research on the existence of a hierarchy of transportation needs, common to all modes, based upon which people will make a certain mode choice that best satisfies a psychological need hierarchy.³²¹

The policy issue of importance to this study is to what degree more travelers would travel by bus than by private motor vehicle if more bus service were provided and, at the same time, the continued expansion of private motor vehicle service was altered to a slower schedule for completion. However, the handbook does not address analysis issues relating to latent demand (better addressed by logit models). It does acknowledge that, in decisions whether to devote more resources to the development of alternative modes, such as bus transit, bicycle facilities, and pedestrian facilities, the estimate of potential users (quantity, or demand for travel) of alternative modes becomes the main guide. "Frequently, especially for the non-automobile modes, an analysis addressing the quantity (demand) of potential users is **more important** [emphasis added] in the decision making process than the quality of service provided to the users."³²² This statement makes the crossover from analysis methodology to reflect issues of policy and how policy makers have made such decisions up to now. Implicit in this statement is that policy makers have decided that it would be fiscally unreasonable to allocate scarce resources to build a facility for use by travel populations (bus riders, bicyclists, pedestrians) smaller in numbers than the population of private motorists.

Under the financially-constrained conditions that comprehensive and long range planning are practiced, the real dilemma is whether to invest scarce resources in alternative modes at the expense of the heavily-used highway mode to effect a shift in travel from private motor vehicles to bus, pedestrian, and bicycle. Where highway congestion always is reduced by expansion projects, the motivation to consider public transit is removed. While the goal to reduce VMT, shift travelers to alternative modes, and create a balanced multimodal system is common among local governments and MPOs, it rarely is

³²⁰ U.S. Bureau of Labor Statistics, Report 1023, Consumer Expenditures in 2008, March 2010, pp. 2 and 9.

³²¹ "Assessing Level of Service Equally Across Modes," FDOT BC-353-15, prepared by Philip L. Winters, Francis Cleland, Edward Mierzejewski, Ph.D., P.E. and Lisa Tucker, Center for Urban Transportation Research, University of South Florida, sponsored by Florida Department of Transportation, December 2001. See also "Assessing Hierarchy of Needs in Levels of Service," Final Report, FDOT BD 549-1, prepared by Jennifer S. Perone, Center for Urban Transportation Research, University of South Florida, sponsored by Florida Department of Transportation, funded under the National Center for Transit Research, October 2005. Found at <http://www.nctr.usf.edu/pdf/527-08.pdf>

³²² 2009 FDOT Quality/Level of Service Handbook, p. 14.

acknowledged that providing all the travel “choices,” including highway expansion projects for congestion reduction to maintain the LOS standard, is counterproductive to reducing VMT and increasing transit mode share.

Local Government Development Review

When a land developer wishes to begin the local government transportation review process regarding a particular land development proposal, a major process outcome of concern is how much the developer will have to pay to cover the transportation impacts of the development. The transportation impacts must be quantified first. Typically, a land developer either has on staff or hires a transportation engineering consultant to conduct a traffic impact analysis. An early meeting between the consultant and the local government staff takes place, during which it is decided what transportation impact analysis methodology will be applied. The FDOT *Transportation Impact Handbook*³²³ is a recently issued re-write of the *Site Impact Handbook* of 1997. It is a major reference that is used by local government transportation review staff for evaluating development proposals because it is considered to be a professionally-accepted methodology, as required by law. Its methodology meets the analysis requirements for determining the traffic impact of a proposed new development on the SHS. The *Transportation Impact Handbook* was revised to include more support for the growth management goals of Florida.³²⁴ Not only does the *Transportation Impact Handbook* provide the recommended methodological framework for site impact analysis, comprehensive plan review, and DRI review, it also provides detailed guidance for staff on the its role in the process and expectations for document content. It provides a comprehensive discussion of the legislative history and background, as well as Rule requirements, links to studies and manuals, appendices providing useful references, review checklists, and a separate chapter on mitigation strategies. Mitigation strategies include discussions of the application of transportation systems management, transportation demand management, access management and other topics. The *Transportation Impact Handbook* reflects ongoing efforts to develop a methodology that reflects and supports multimodal solutions to transportation demand.

A land development proposal might be exempted from transportation concurrency if, for example, it qualifies as an “infill” development or is small enough to qualify as a *de minimus* exception. Otherwise, a detailed traffic analysis quantifies the traffic impact of the new development, including the magnitude of the impact, the timing of the impact, the modal impact, and the particular transportation facilities affected. Once quantified, that impact is compared to the local government’s inventory of the remaining capacity on the transportation facilities that is available for new development before LOS standards are violated. If the analysis indicates that there will be a violation of LOS standards on particular facilities, then a discussion begins regarding what transportation improvements will need to be provided and how much these improvements that directly remedy the impact of the new development will cost.

³²³ *Transportation Impact Handbook: Estimating the Transportation Impacts of Growth*, Florida Department of Transportation, Systems Planning Office, Tallahassee, August 2010.

³²⁴ *State Planning and Research (SPR) Program Part I*, Florida Department of Transportation, July 1, 2008 – June 30, 2009 SPR-PL-1 (46) Program Plan, 12/1/09 Revised Version, Systems Planning Activities, p. 21.

SB 360 amended Florida concurrency in 2005, creating the proportionate fair-share payment option for non-DRI developments. Also described as “pay-and-go,” it allows new development to be constructed even though directly adjacent facilities would continue to operate under LOS-deficient and constrained conditions despite transportation improvements from the developer. The proportionate fair-share payment is directed toward some other needed transportation improvement that is in the CIP and is consistent with the goals and objectives of the LGCP. The magnitude of the payment must be in proportion to the impact of the new development. The proportionate fair-share payment can go toward one or more modes of travel, including public transit.³²⁵

In this case, an early meeting takes place to discuss analysis methodology and possible transportation mitigation options that would be candidate projects for a proportionate fair-share payment. The developer’s consultant then prepares and submits a traffic analysis and proportionate fair-share calculations for local government staff review. Once accepted, the appropriate transportation improvement projects are identified. After consensus is reached between the developer and the local government, a proportionate fair-share agreement is prepared.

The formula for computing proportionate fair-share is significant because it is not based on maintaining Q/LOS (a measure of traveler satisfaction) but, rather, is a measure of capacity. The capacity measure is not person trips but “the cumulative number of trips from the proposed development expected to reach roadways during the peak hour from the complete build-out of a stage or phase being approved, divided by the change in the peak hour maximum service volume of roadways resulting from construction of an improvement necessary to maintain the adopted LOS, multiplied by the construction cost, of the improvement necessary to maintain the adopted LOS.”³²⁶

OR

$$\text{Proportionate Fair-Share} = \sum \left[\left(\frac{\text{Development Trips}_i}{\text{SV Increase}_i} \right) \times \text{Cost}_i \right]$$

Where:

Development Trips_i = Those trips from the stage or phase of development under review that are assigned to roadway segment “i” and have triggered a deficiency per the CMS;

SV Increase_i = Service volume increase provided by the eligible improvement to roadway segment “i” per section E;

Cost_i = Adjusted cost of the improvement to segment “i”. Cost shall include all improvements and associated costs, such as design, right-of-way acquisition, planning, engineering, inspection, and physical development costs directly associated with construction at the anticipated cost in the year it will be incurred.

³²⁵ s. 163.3180(16)(c), F.S.

³²⁶ s. 163.3180(12)(a)4, F.S.

It addresses maintaining a motor vehicle LOS defined by average travel speed by calculating the cost of improvements that would supply more capacity to maintain the average travel speed.

Site Impact Analysis

In a standard traffic impact analysis, there are basic steps that include an initial survey of existing transportation facilities and travel behavior. Then, the number of motor vehicle trips that would be generated by the proposed new development is estimated. Next, a determination is made where traveler trip origins and destinations are located relative to the proposed development site (trip distribution). A mode split is estimated, traffic is assigned to the transportation network, and impacts from that new development are calculated.

There are problems associated with the methodology of site impact analysis that are rooted in the definitions used as well as the assumptions. A trip or trip end is defined as “a single or one-direction vehicle movement with either the origin or destination (exiting or entering) inside a study site.”³²⁷ The *Transportation Impact Handbook* recognizes limitations of the trip generation data from the Institute of Transportation Engineers (ITE): “Most data collected for ITE’s *Trip Generation* were collected in suburban locations with free parking and little or no transit service.”³²⁸ In addition, the ITE *Trip Generation* also reflects conditions of free parking, which will increase motor vehicle trip rates. Donald Shoup found that “...ITE’s method of collecting data skews observations toward sites with high parking and trip generation rates. Larger samples might solve the problem of statistical insignificance, but a basic problem with parking and trip generation rates remain: they measure the peak parking demand and the number of vehicle trips at suburban sites with ample free parking. This situation is troubling, because ITE rates greatly influence the outcome of transportation and land-use planning, ultimately contributing to decisions that result in more traffic, lower density, and more urban sprawl.”³²⁹

A most promising revision reflected in the *Transportation Impact Handbook* is the discussion of determining mode split. In the prior *Site Impact Handbook*, mode split was “the amount of travel that uses modes other than automobiles...” and “...is estimated using regional and local guidelines based on existing transit usage. Typically 3 to 5 percent is considered a maximum realistic share of travel for modes other than automobiles.”³³⁰ This was troublesome because existing conditions was the basis

³²⁷ *Trip Generation: An ITE Information Report, User’s Guide*, Institute of Transportation Engineers, 8th Ed., Vol. 1 of 3, p. 9.

³²⁸ *Transportation Impact Handbook: Estimating the Transportation Impacts of Growth*, Florida Department of Transportation, Systems Planning Office, Tallahassee, August 12, 2010, pp.44-45. This limitation is a caveat explained in *Trip Generation: An ITE Informational Report*, 8th Edition, which warns that care must be exercised in the application of the data for estimating trip generation. “ITE informational reports are prepared for informational purposes only. They do not include ITE recommendations on the best course of action or the preferred application of the data.” (p.ix) Further information on the cautions and limitations of the data is presented in Chapter 4, “Description of the Database,” of *Trip Generation*, pp. 11-12.

³²⁹ “Truth in Transportation Planning,” *Journal of Transportation and Statistics*, Donald C. Shoup, University of California, Los Angeles, Vol. 6, N. 1, 2003, p. 9.

³³⁰ *Site Impact Handbook*, Florida Department of Transportation, Systems Planning Office, Office of Policy Planning, and District Site Impact Coordinators, Tallahassee, April 1997, p. 31.

upon which future travel characteristics were predicted. The determination of proposed transportation improvements were in response to those future travel characteristics. This means of decision making created a closed loop that prevented the orchestration of change in the types of transportation improvements provided and the ways in which people travel. Growth management in Florida attempts to encourage the development and use of a balanced multimodal system. The new *Transportation Impact Handbook* reflects this by recognizing that “In many instances, the Mode Split portion of the typical four-step modeling process will not be sufficient for corridor or site specific transit forecasting.”³³¹ FDOT’s Public Transit Office developed the transit analysis tool TBEST (The Transit Boardings Estimation and Simulation Tool), which simulates transit ridership in a way that allows it to provide detailed information regarding ridership estimates at individual stops. It is also recognized that care must be exercised in the use of mode split data from travel models. Some travel demand models account for travel time, transit transfer time, and cost due to congestion pricing and parking policies, to calculate and incorporate changes in mode share. This will ensure that mode share reflects conditions that support change.

Conclusions

In regard to the use of the LGCP process to advance the goals of reducing GHG emissions, the new HB 697 amendments to comprehensive planning law are a positive start. Local governments that are preparing LGCPs are recognizing the necessity to address GHG emissions by reducing VMT. LGCPs generally contain numerous goals, objectives, and policies that are on target for reducing VMT by encouraging a balanced multimodal system that includes public bus transit. Provided below are recommendations for changing the planning processes to support a shift in mode share to public transit, support VMT reduction, and decrease GHG emissions from transportation sources.

Providing Transportation Choices, As Implemented by Many Local Governments

The Florida Administrative Code requires a multimodal system, but determining how much of each mode is enough is up to the discretion of local governments. Financial constraints, as well as physical, legal, and environmental constraints, do not allow that adequate facility capacity will be provided to serve existing and future travel demand at the LOS standards for roadways and also have enough resources left over to build and maintain networks for other modes that provide a comparable LOS. However, LGCPs commonly describe providing transportation “choices” by not only developing some public bus transit, pedestrian facilities, and bicycle facilities, but also continuing to expand roadway capacity and devoting a majority of the funding to it. Continuing to add highway capacity removes the traffic congestion and an important motivation source to use public bus transit. Highway capacity expansion does not recognize the role that traffic congestion plays in balancing mode share. Fueled by regional air quality concerns, highway widening to reduce traffic congestion is an effective short-term fix with long-term ill effects upon the goal to develop a balanced multimodal system. The emphasis on congestion reduction should be changed to an emphasis on VMT reduction.

³³¹ *Transportation Impact Handbook, Estimating the Transportation Impacts of Growth*, Florida Department of Transportation, Systems Planning Office, Tallahassee, August 12, 2010, pp. 64-65.

Hillsborough County provides an example of the development of a public transit LOS (TLOS) measure. High TLOS corridors may be designated along roadways operating at a deficient LOS. A greater level of transit service may offer an alternative and where mode shift may begin to occur. Lowering the roadway LOS standard to 120 percent of LOS E recognizes the use of congestion as a condition that supports mode shift to public transit and VMT reduction.

Preserving Capacity of the SIS

By law, the LGCP must protect the capacity of the highways in the SIS in non-TCEA areas. This presents challenges because the SIS and the rest of the SHS are intertwined with the transportation network of a local government. Maintaining LOS on the SHS likely will require capacity enhancements to non-state roads. Congestion relief improvements tend to run counter to shifting mode share to public transit. As discussed more in the section on the MPO LRTP process, it is recommended that more attention be placed on creating some separation between the SHS and the local government transportation system (as well as the transportation system of the metropolitan planning area), by way of tolls, access controls, or other strategies.

Site Impact Analysis Methodology

The site impact methodology contained in FDOT's new *Transportation Impact Handbook* reflects improvements to incorporate multimodal considerations. Efforts should continue to refine the site impact methodology to support change in the transportation system.

LOS Measures and Standard Setting

The effort to redefine LOS from a capacity measure to a measure of user satisfaction is a critical step toward supporting VMT and GHG emissions reduction. Adoption of multimodal LOS standards is also an important step in the right direction. It is important that, as LOS measures are being redefined, these measures capture all the necessary elements that are sufficient to provide transportation service quality. Certainly an LOS measure should not be overly complex, but should the measure incorporate other aspects of transportation service, such as network connectivity? It is also important that a public bus transit LOS A, from the traveler perspective, should be as equivalent as possible to an automobile LOS A, transit LOS B should be equivalent to auto LOS B, etc., to establish conditions in which public transit service is truly competitive with the private automobile experience.

Using the Peak Hour as Measure for Transit LOS is Problematic

The requirement to use the transportation LOS for travel conditions associated with the peak hour of travel continues to place emphasis on LOS as a measure of capacity. Requiring the peak hour to be used as the timeframe against which travel conditions are compared to LOS standards is most advantageous for automobile travel but the worst possible time frame for evaluating public bus transit. This is because peak hour conditions are that time of the day when automobile LOS will be at its worst, and standards for automobile LOS are set based upon maintaining acceptable LOS even during the most congested time of the day for travel. It is the opposite for public transit. While the public bus transit LOS standard is compared against bus service provided during the peak hour of traffic congestion, this also is the time during which the best possible bus service is usually provided. Opposite to the auto LOS standard, the

public transit standard measures the best LOS that is possible during the day, not what LOS is provided during the worst conditions for transit travel (i.e., weekday late night, Sunday afternoon). This method of standard setting for public transit puts public transit at a great disadvantage.

Consistency Requirements Also Create Problems

The MPO LRTP process lends direction to and a jumping off point for the comprehensive planning process. As existing transportation facilities are inventoried and mapped as part of the long range transportation planning process, highway segments identified as regionally significant facilities that are operating at or beyond capacity (LOS E or F) are identified on existing conditions maps, and for consistency purposes, also are identified on LGCP maps. The MPO LRTP process seeks to maximize receipt of federal funds for transportation improvement projects. SAFETEA-LU prioritizes congestion reduction, and for every available federal dollar for public transit improvements, there are four federal dollars for highway improvements. As a result, more highway improvement projects will be prioritized.

In the LGCP, there are many goals and objectives that are consistent with each other, but there is no clear guidance on which goals and objectives take priority. Is Goal #1 the most important goal? During LGCP implementation, the accomplishment of one objective may consistently be prioritized over the accomplishment of others without any explicit recognition of that fact. Goals, objectives, and policies in LGCPs should be explicitly prioritized, with funding allocations supporting those priorities accordingly.

There are consistency requirements across jurisdictions as well as consistency requirements across the planning processes, including the LGCP process, the MPO LRTP process, the NEPA review, and the DRI review. Changing methods of one process may require changing that method as used by the others. Such changes may be neither easy nor quick.

Local Governments Should Exercise Their Powers to Incorporate Multimodal Improvements into Land Development Order Conditions

Regardless of whether a proposed land development lies within a TCEA or not, land development orders should specify a higher degree of public transit, bicycle, and pedestrian service improvements to be paid for by the development, and this is within the power of local governments to require.

Adhere to Accomplishing the Public Transit, Pedestrian and Bicycle Improvements of the Comprehensive Plan

It is recommended that the comprehensive planning process develop a plan focused upon the implementation of multimodal transportation facility and service improvements, and that development orders be conditioned upon a proportionate cost improvement that adheres to and supports the comprehensive plan. The land use and transportation strategies developed as part of the mobility plan that must be in place for local governments containing DULAs designated as TCEAs would be a part of that comprehensive plan.

LOS Measures and Standards Should Accomplish Emphasis of the Law

Although a great deal of research and complex analysis has gone into the development of highway LOS standards over the years, the LOS standard is essentially an expectation for a level of highway motor

vehicle travel freedom that the local government is required by State law to provide and maintain within the context of continuing population growth, urban land development, and the increasing demand for travel and traffic that results. While goals, objectives, and policies of LGCPs for multimodalism are periodically evaluated in the EAR, this process does not lend the same weight and motivation to accomplish them as the legally-enforced highway LOS standards. Indeed, violations of concurrency standards can cause moratoria on local land development. But, since “the purpose of the transportation element [of the LGCP] is for a multimodal transportation system that places emphasis on public transportation systems,” as explicitly stated by 9J-5, F.A.C., then the Q/LOS measures and standards should be tailored to accomplish that emphasis. Currently, the LOS measures and standards used by many local governments do not emphasize public transportation systems despite the fact that there may be one or more goals and objectives in support of a multimodal transportation system.

Mobility Plans for TCEAs Provide an Opportunity

The land use and transportation strategies developed for TCEAs to provide for mobility may provide a foundation upon which to establish alternative LOS measures and standards.

Infill Development Incentives Could Reinforce the Mobility Fee Concept

Closer to urban centers, where conditions to develop a multimodal system are already somewhat better, incentives should be put in place for development to add transit service improvements where they would be more cost effective. This could reinforce the mobility fee concept, in which calculated fees are higher as the development location is farther from the urban center, but the type of transportation service that is provided within the MPA should be multimodal and actually meet some standard of service.

Florida's Development of Regional Impact (DRI) Process

Introduction

This section describes Florida's DRI process as it relates to transportation and air quality impacts resulting from land development that impacts the SHS and how GHG emissions reduction can be incorporated into the DRI process. DRIs are a subset of proposed land developments but are regulated under the Florida Environmental Land and Water Management Act of 1972, Sections 380.012 through 380.08, F.S. A DRI is defined as "any development which, because of its character, magnitude, or location, would have a substantial effect on the health, safety, or welfare of citizens of more than one county."³³² The purpose of the DRI review process is to allow the identification of multijurisdictional issues early in the development review process so any impacts to state and regional resources and facilities can be addressed. The DRI review process is aided by technical expertise from the State and from the area's Regional Planning Council (RPC).

Although recent changes to concurrency law exempt urbanized areas from the DRI review process, there is still a large portion of Florida that must continue to apply it, primarily non-urban areas that are less likely to have fixed route public transit. This poses challenges to using the DRI review process to support the development of a multimodal transportation system. However, this summary continues to apply the premise that GHG emissions reductions can be reduced through Florida transportation planning processes, including the DRI review process, by concentrating upon reducing VMT through development of public transit systems and the non-motorized modes that support use of public transit.

Exemptions from the DRI Review Process

In 2009, the Florida Legislature passed amendments to the concurrency law that exempted proposed developments from the DRI review process if they are located in a dense urban land area (DULA), defined as:

- A municipality that has an average of at least 1,000 people per square mile of land area and a minimum total population of at least 5,000.
- A county, including municipalities located therein, which has an average of at least 1,000 people per square miles of land area.
- A county, including the municipalities located therein, which has a population of at least 1 million.³³³

Additionally, local governments may choose to amend their LGCPs to create a TCEA on land that is designated within a DULA. This means that strategies of a mobility plan designated for the TCEA must be advanced by the proposed development instead of abiding by highway LOS standards. Currently, many local governments that have chosen to designate TCEAs do not yet have mobility plans in place. These must be in place within two years of the LGCP amendment adopting the TCEA.

³³² s. 380.06(1), F.S.

³³³ s. 163.3180(5), F.S.

SB 360 also amended concurrency law to exempt local governments from adopting FDOT LOS standards for SIS facilities in TCEAs.

Furthermore, local governments may exempt from the DRI process areas in their comprehensive plan that are outside DULAs but are urban infill, community redevelopment areas, downtown revitalization areas, and areas that are within an urban service boundary, as defined in s. 163.3164, F.S.

Due to these amendments to concurrency law, 59 counties and 173 municipalities do not qualify as DULAs and must continue to implement transportation concurrency as it was originally designed. As a result, the DRI review process presently applies to proposed development that would be located generally in non-urban areas.

Major Elements of the DRI Process

The law and supporting sections of the Florida Administrative Code (F.A.C.)³³⁴ specify the major elements characterizing the DRI process, including:

- Roadways of state and regional significance to which the DRI review process applies.
- Identification of affected jurisdictions.
- Criteria for establishing whether a development must undergo DRI review.
- Guidelines and standards that implement the criteria and define numerical thresholds for specified different land uses in establishing the requirement for DRI review.
- Chronological process of DRI review.
- Roles played by the various governmental entities.
- Entities that must be given notice during each stage of the process.
- Agencies that are permitted to participate if they choose.
- Circumstances under which an approved DRI requires a new review.
- Circumstances under which changes are made to a developer's vested rights.
- When public hearings are required.
- Entity that has final decision authority.
- When an appeal can be pursued and the procedures for doing so.

Primary Written Instruments of the DRI Process

The DRI law also establishes the written instruments that represent the decisions, results of negotiations, and agreements throughout the DRI review process. These include:

- A **binding letter of interpretation** issued by DCA that determines whether a proposed development must undergo a DRI review, issued at the request of the development only in cases where it is unclear whether the development qualifies as a DRI.

³³⁴ Chapter 28-24, F.A.C.

- **Binding written agreements** resulting from the pre-application conference regarding established assumptions and methodology for impact analysis.
- **Notices of Recommendation** from a conceptual agency review process, filed by permitting agencies such as the water management district regarding required permits for construction and operation activities. These include such activities as dredge/fill and storm-water retention. The recommendations from the permitting agencies can either be an approval, a denial, or approval with conditions.
- An **Application for Development Approval (ADA)** submitted by the developer that establishes that the development is a DRI. The ADA provides information necessary for affected jurisdictions and agencies to identify regional impacts.
- A **regional report**, issued by the area RPC, after the information provided in the ADA has been determined to be sufficient. The regional report contains the RPC determination whether the DRI will have favorable or unfavorable impacts on state or regional resources and public facilities.
- A **Preliminary Development Agreement (PDA)**, sometimes issued in advance of a development order, which allows a portion of a DRI to be allowed to proceed into construction if that portion is shown to have no adverse impact on public facilities.
- A **Development Order (DO)**, issued by the host local government after completion of the DRI review. The DO provides the conditions under which the DRI is allowed to proceed.
- **Monitoring and status reports**, submitted periodically by the developer, that demonstrate compliance with the conditions in the DO.

Timeframes

The DRI law specifies minimum and maximum time periods for each step of the process to ensure a balance between ensuring the developer's business need for the review process to be executed efficiently and ensuring that the state's requirements and process for review are followed. The DRI review process generally takes no less than 12 months to complete. Typically, development proposals are planned in multiple phases, and developers will request one or more revisions to a DRI in response to changing market conditions. This triggers subsequent reviews for each development phase, which can take place over a period of years and makes the DRI review an ongoing process. Development orders typically stipulate vested development rights for a period of 20 years. If the DRI as proposed is approved by the host local government, then the developer receives a Development Order. State or regional permits necessary to proceed with DRI construction are valid for five years after permit issuance. An administrative appeal or judicial review may occur, which may extend the time of permit validity by starting the running time at the date of final action. An application for a state or regional permit must be filed within five years of issuance of a final Development Order and will not be effective for more than eight years after issuance of a final development order.

Transportation Facilities to Which a DRI Applies

There are a variety of roadway designations in Florida, including:

- local roads
- state roads that are designated part of the Florida Intrastate Highway System (FIHS)
- state roads that are designated part of the Strategic Intermodal System (SIS)
- state roads that are neither part of the FIHS nor part of the SIS

The DRI review of transportation impact applies only to a state or regionally-significant transportation facility. For a roadway to be under consideration as state or regionally-significant, it must be paved and have one or more of the following characteristics:

- cross local government jurisdictional boundaries
- be a component of the SIS/FIHS
- connect components of the SIS
- provide access to a regional center
- be a hurricane evacuation route

If it is at least one of the above, then, based upon recommendations from FDOT, the roadway may be determined by DCA to be of state or regional significance. If it is part of the FIHS, then it must be considered state and regionally-significant.

The Transportation Uniform Standard Rule governs how DCA evaluates transportation in the review of applications for binding letters, DRI ADAs, and local government DOs.³³⁵ This Rule also applies to other transportation-related issues, such as air quality, right-of-way protection, railroad crossing safety, hurricane preparedness, project access to state highways, State subsidies in high-hazard coastal and barrier island areas, or consistency with an LGCP. A state and regionally-significant roadway segment is considered “significantly impacted” by the proposed development if, at a minimum, the traffic projected to be generated at the end of any stage or phase of the proposed development, cumulatively with previous stages or phases, will consume five percent or more of the adopted peak hour LOS maximum service volume of the roadway. If a transportation facility significant impact threshold of less than five percent is specifically adopted by a LGCP, then this lower significant impact threshold will be used to establish the impact area.

Developments that Qualify as DRIs

Per the amendments to concurrency law in 2009, only those developments that are not within DULAs and are not urban infill, a community redevelopment area, a downtown revitalization area, or located within an urban service area or within an urban service boundary may qualify as a DRI. In addition, there are statewide guidelines and standards for determining whether a particular development will

³³⁵ Rule 9J-2.045, F.A.C.

undergo DRI review. In establishing the guidelines and standards, the Administration Commission (the Governor and Cabinet) is guided by the:

- extent to which the development would create or alleviate environmental problems such as air pollution
- amount of pedestrian or vehicular traffic likely to be generated by the development
- number of persons likely to be residents, employees, or otherwise present at the development
- size of the site to be occupied
- likelihood that additional or subsidiary development will be generated
- extent to which the development would create an additional demand for, or additional use of, energy, including the energy requirements of subsidiary developments
- unique qualities of particular areas of the state

Chap. 28-24, F.A.C. provides a detailed list and definitions for land development types and provides size thresholds for developments presumed to be of regional impact. These are given in units, such as the number of full-time-equivalent (FTE) students for schools, number of beds for hospitals, number of dwelling units for residential developments, acreage size for industrial development, and square feet of gross floor area or number of parking spaces for office and retail development. According to Section 380.06(2)(c), F.S., the numerical thresholds that are applied to a particular development are those that were in effect at the time the developer received authorization from the local government to begin development. Meeting these thresholds trigger the requirement for a DRI review.

A development that is below 100 percent of *all* numerical thresholds in the guidelines and standards is not required to undergo DRI review. When a development exceeds a standard between 100 and 120 percent, it is presumed that a development must undergo DRI review unless there is compelling evidence that it should not; this is known as the rebuttable presumption. A development that is at or above 120 percent of *any* numerical threshold is required to undergo DRI review.

For certain kinds of land development and development locations, the threshold requiring DRI review is raised. Thresholds requiring DRI review can be increased by 50-150 percent, making DRI review less likely under certain circumstances for developments in urban central business districts, in regional activity centers, and in rural areas of critical economic concern. For developments that meet certain criteria for job creation and are at 100 percent of a threshold, a DRI review is not required.

Many DRIs are multi-use developments and, therefore, are subject to different thresholds. Chap. 28-24, F.A.C. further defines the threshold conditions under which a multi-use development must be considered a DRI. These conditions apply as long as the threshold for any individual land use in the proposed development is not met. If any proposed development has two or more land uses, where the sum of the percentages of the appropriate thresholds for each land use in the development is equal to or greater than 145 percent, then it is identified as a DRI. Furthermore, if a development has three or more land uses, one of which is residential and contains 100 dwelling units or 15 percent of the applicable residential threshold, whichever is greater, where the sum of the percentages of the

appropriate thresholds for each land use in the development is equal to or greater than 160 percent, then it is also a DRI. DRI residential thresholds are updated annually based upon county population estimates. The thresholds range from 250 residential units for the most rural counties to 3,000 residential units for the most populated counties.

DRI Review Process Chronology

The basic requirements for the DRI review process, as specified by Section 380.06, F.S. and the implementing procedures of Rule 9J-2, F.A.C., include numerous steps as summarized below.

1. A determination is made that a proposed development must undergo the DRI review process.
2. A pre-application meeting is held between the developer and the staff of affected jurisdictions to determine review methods and identify early concerns. Usually, a traffic methodology meeting is held before the pre-application meeting so that transportation issues and methods are already identified and a course of action is generally agreed upon.
3. The developer prepares and submits an Application for Development Approval (ADA) to the host local government, with copies to the RPC and DCA.
4. The RPC, the local governments, and other agencies review the ADA to determine whether it contains sufficient information.
5. The developer responds with any needed supplementary information in an ADA re-submittal.
6. The ADA receives final review.
7. The RPC prepares a regional report containing any findings of regional impacts and distributes it to local governments, the developer, and all affected agencies.
8. A public hearing is held.
9. The host local government prepares a Development Order (DO) that specifies the conditions under which the development may proceed. The DO is reviewed by the developer, DCA, and the RPC.
10. The developer submits biannual reports to the host local government, DCA, the RPC, and any affected permitting agencies describing the progress of the development and demonstrating compliance with conditions in the DO.

Throughout the DRI review process, transportation issues are considered at significant junctures:

1. When it is unclear whether a proposed development will have regional traffic impacts, the developer prepares and submits an application for a binding letter of interpretation. The application requires transportation-related information that must be reviewed.
2. Once it is determined that the proposed development is a DRI, then an initial traffic methodology meeting between the developer applicant and reviewing agencies is held prior to the pre-application conference.
3. Transportation staff members of affected agencies and jurisdictions attend the pre-application conference where agreements on traffic assumptions and methodology are formalized.

4. Prior to the developer's preparation of the ADA, the developer receives agency comments and a list of early identified issues, compiled and provided by the RPC. Transportation staff can submit comments.
5. After the ADA is submitted, transportation agencies have the opportunity to conduct a preliminary review of the ADA for sufficiency of transportation-related information.
6. After the RPC has judged that the revised ADA contains sufficient information, there is a final review opportunity of the ADA.
7. Recommendations for transportation-related conditions can be offered to the host local government for insertion into the development order.
8. Transportation agencies can review the biannual reports submitted by the developer as construction proceeds.

FDOT's involvement in a DRI review is guided by the nature of the land development proposal and if transportation is defined early in the process as a regional issue. FDOT assesses the impact of proposed developments that affect the SHS and any other element of the State transportation system. FDOT provides recommendations for appropriate mitigation measures. When those mitigation measures turn to transit, the negotiations require the agreements from FDOT and the local transit agency. FDOT's role in the DRI review process is statutorily limited to the following steps:

- Review of petitions to change numerical thresholds in the statewide guidelines and standards.
- Participation in a traffic methodology meeting between the applicant and reviewing agencies.
- Participation in the formal pre-application conference for a DRI, at the request of the RPC or DCA, where traffic methodology and assumptions are decided.
- Review of proposed LGCP amendments.
- Review of ADAs for specific proposed developments.
- Conceptual agency review.
- Provision of recommendations to the RPC.

FDOT's role outside the DRI law can affect the outcome of DRIs. This includes the development and designation of the SHS and applicable LOS standards and the development and adoption of the Florida Transportation Plan, including the Transit Element, which is part of the State Comprehensive Plan. Local governments must abide by LGCPs that are consistent with the State Comprehensive Plan.

Binding Letter of Interpretation of DRI Status

In cases where it is unclear if the DRI process applies to a proposed development, it is the responsibility of the applicant (land developer or his/her representative) to initiate an inquiry to determine whether a land development must undergo DRI review. In response to the inquiry, a binding letter is issued by DCA that provides a decision that must be adhered to by the state, regional, and local governments as well as the developer. If a proposed development has anticipated impacts that are between 100-120 percent of the presumptive numerical threshold in the guidelines and standards, then DCA or the local government may require a developer to obtain a binding letter of interpretation to decide whether the development

must undergo DRI review. A binding letter also is issued by DCA to clarify any change in vested rights of a developer as a result of changing the nature of a previously-approved DRI. Every binding letter that determines that a proposed development is not a DRI will expire within three years unless the development has begun. Binding letters can be extended by mutual agreement.

DCA provides an application form for a binding letter that contains a section on describing the potential impacts on transportation facilities.³³⁶ The developer's consultant applies a professionally-accepted methodology and definitions to the analysis that is usually similar methodology as that used by FDOT. Transportation service is characterized as roadway LOS, and the focus of the transportation analysis is upon maintaining roadway LOS standards. Since developments located in DULAs, per SB 360 of 2009, are exempt from DRI review, this means that the remaining DRIs are in non-urban areas where the availability of public transit service is less likely.

Once it is determined that a DRI review is necessary, such that the application for a binding letter indicates potential LOS violations on state or regionally-significant roads, then DCA issues the binding letter with a determination that a DRI review is necessary.

Pre-Application Conference

A proposed development that must undergo a DRI review must submit an ADA to the local government having jurisdiction. Prior to submitting an ADA, the applicant meets with the RPC, the host local government, and other state permitting agencies, including FDOT, as part of a pre-application conference. The minimum transportation-related information that the applicant must provide at least 10 days prior to the pre-application conference is a map of the proposed study area that indicates the functional classification and number of lanes of all roadways in the study areas except residential streets.³³⁷ The FDOT *Transportation Impact Handbook* provides a comprehensive DRI Pre-Application Checklist and Methodology Meeting Checklist.³³⁸ Two critical decisions are made with respect to transportation during the pre-application conference. First, it is decided which issues will be addressed in the ADA. Various questions in the ADA can be eliminated if it is agreed that the issue does not apply to the proposed development. At this point, it is formally decided whether transportation is a regional issue of concern and whether it will be included in the ADA. Second, decisions are made with regard to the underlying assumptions used and the methodology that will be used to determine the estimated impact of the proposed development upon the transportation system. These decisions constitute a binding agreement between the applicant and the participating agencies and host local government.

Conceptual Agency Review

A developer may decide to request a conceptual agency review if the DRI review begins. The conceptual agency review would occur either at the same time as the DRI review and LGCP amendment or after the

³³⁶ Form-RPM-BSP-BLID-1, established under s. 380.06, F.S., and s. 120.57, F.S. (the Administrative Procedure Act).

³³⁷ Pre-Application Conference Document and Information, FORM-RPM-BSP-PREAPP INFO-1, Florida Department of Community Affairs, Division of Community Planning, p. 2.

³³⁸ *Transportation Impact Handbook: Estimating the Transportation Impacts of Growth*, Florida Department of Transportation, Systems Planning Office, Tallahassee, August 12, 2010, pp. 156-162.

pre-application conference. The conceptual agency review is a general review of the proposed location, densities, intensity of use, character, and major design features of the proposed development. This information is used to coordinate the required issuance of permits from FDEP, the water management district, or other agencies that require construction or operating permits for activities such as dredging, filling, and storm water retention. Each participating agency is required to cooperate with DCA to standardize review procedures, data requirements, and data collection methodologies among all participating agencies.

Application for Development Approval and Concurrent Plan Amendments

The applicant uses a specific ADA form supplied by DCA.³³⁹ In addition, the FDOT *Transportation Impact Handbook* provides a detailed ADA Review Checklist.³⁴⁰ The ADA must state that the development is a DRI. Sometimes, the approval of a DRI is contingent upon changes to the LGCP that enables the DRI to be built. LGCP amendments can be initiated by a developer or a local planning agency. The developer can request a LGCP amendment no later than the pre-application conference or at a submission for a substantial deviation. A substantial deviation occurs when a developer of an already-approved DRI seeks changes to it that will create additional impacts that have not been considered. The agencies that are notified include the regional planning agency, the local government, and DCA.

DRI Application for Development Approval, Question 21–Transportation

The ADA form consists of 38 questions, each of which concerns a specific topic of DRI review. Question 21 consists of a nine-part procedure for estimating transportation impacts. The most recent procedures from the Transportation Research Board and FDOT define the methodology for appraising transportation LOS. The Florida Standard Urban Transportation Model Structure (FSUTMS) and trip generation rates from the Institute of Transportation Engineers also are used unless, by agreement, other sources are selected. If another procedure is to be used, then it must be agreed upon at the pre-application conference meeting. The step-by-step procedure for estimating and documenting transportation impacts from the proposed development follows the methods in FDOT's *Transportation Impact Handbook*. Transit service, bicycling, and walking, addressed in ADA Question 21-I: "What provisions, including but not limited to, sidewalks, bicycle paths, internal shuttles, ridesharing, and public transit, will be made for the movement of people by means other than private automobile? Refer to internal design, site planning, parking provisions, location, etc." corresponds to the FDOT *Transportation Impact Handbook* ADA Review Checklist that provides a detailed Multimodal Supplement for the description of existing conditions. This calls for a description of existing public transit location, level of service, span and frequency of service, coverage, connectivity, loading reliability, ridership, transit/auto travel time ratio, and whether the local government or transit agency has adopted transit LOS standards. Similar detail is evaluated for bicycle and pedestrian facilities as well as other alternative travel modes, TDM strategies and land use mix, intensity/density and connectivity. However, further into the ADA Review Checklist where proposed transportation improvements are outlined in Section F.

³³⁹ Form Number RPM-BSP-ADA-1 as required by Rule 9J-2.010, F.A.C.

³⁴⁰ *Transportation Impact Handbook: Estimating the Transportation Impacts of Growth*, Florida Department of Transportation, Systems Planning Office, Tallahassee, August 12, 2010, pp. 166-170.

Recommended Road and Intersection Improvements, and in J. Multimodal Access to Surrounding Community (transit, bicycle, and pedestrian), Section J.(F) requests, “Identify specific transit-related facilities needed to provide access to existing or planned transit service.” The emphasis is on facilities and providing access to transit from the development site. This is important but the wording appears to leave out the provision of transit service itself.

DRI Application for Development Approval Question 22 – Air

The air quality analysis for a DRI requires several steps, including documenting what steps will be taken to control fugitive dust resulting from construction activities. The documentation also includes a specification of what structural or operational measures will be implemented, consistent with those identified in Question 21, to minimize air quality impacts, “e.g., road widening and other traffic flow improvements on existing roadways, etc.”³⁴¹ Next, it must be determined if air quality monitoring for carbon monoxide (CO) must be undertaken for any intersections and parking facilities affected by the proposed development. If detailed modeling is required, it should be completed in conjunction with the traffic analysis for the project. Estimates are to be made for the worst case one-hour CO concentrations expected for each phase of the development through build-out, using methodology approved by DEP. If there are NAAQS violations anticipated, then the ADA must identify appropriate mitigation measures and the modeling to demonstrate that such measures will ensure maintenance of air quality standards.

Submission of Application for Development Approval

An ADA must be filed with a local government and copies must be sent to the appropriate regional planning agency and DCA. The local government then gives notice and holds a public hearing after the receipt of a sufficiency notification³⁴² that the ADA contains all the sufficient information to conduct a review from the RPC. Regional reports are required within 50 days after receipt of the notice of public hearing. This regional report expresses whether the development will have a favorable or unfavorable impact on state or regional resources or facilities identified in the state and regional plans.

Local Government Issues Development Order

Within 30 days after the hearing, the local government issues a DO that includes a legal description of the property. FDOT reviews the DO using a checklist from the *Transportation Impact Handbook*.³⁴³ If the conditions of a DO require that the developer contribute land for a public facility or construct, expand, or pay for land acquisition or construction or expansion of a public facility, the need to construct new facilities or add to the present system of public facilities must be reasonably attributable to the proposed development. Any contribution of funds, land, or public facilities required from the

³⁴¹ Development of Regional Impact Application for Development Approval Under Section 380.06, Florida Statutes, Florida Department of Community Affairs, Division of Community Planning, FORM RPM-BSP-ADA-1 Question 22 – Air, Part B., p. 28.

³⁴² The FDOT *Transportation Impact Handbook*, referenced earlier, contains an ADA Sufficiency Review Checklist, p. 164.

³⁴³ The FDOT *Transportation Impact Handbook*, referenced earlier, contains the DO Review Checklist, p. 172. This reference manual also provides comprehensive Checklists for Project Monitoring & Report Review, pp. 174-175; Conceptual Site Access Review, p. 176; and a Checklist for evaluating Notice of Proposed Changes/Substantial Deviation Determination, p. 178.

developer must be comparable to the amount of funds, land, or public facilities that the state or local government would reasonably expect to provide to mitigate the impacts that have been reasonably attributed to the proposed development.

Preliminary Development Agreement

Developments that are subject to DRI review cannot be undertaken without issuance of a DRI Development Order unless authorized by a Preliminary Development Agreement (PDA). This allows the developer to proceed with a limited amount of the total proposed development. A PDA may authorize development that is less than 100 percent of any applicable thresholds, provided that the development is limited to lands that DCA agrees are suitable for development. Another condition for a PDA is that existing public infrastructure will accommodate the new development. The development also must neither adversely impact existing resources nor existing and planned facilities.

Affordable Housing and Public Transit

While discussion of DRI impacts on transportation center upon the amount of roadway capacity used by the DRI and whether LOS standards are maintained or violated, public transit has been linked to DRIs relative to the amount and co-location of affordable housing in proximity to public transit. The 2006 law provided the incentive to a developer to allow up to a 50 percent increase in residential units to a DRI as long as at least 15 percent of the units are dedicated to workforce housing.³⁴⁴ In other words, the numerical threshold for the number of residential units of a proposed development is raised with regard to required DRI review if it includes enough affordable housing. This issue has links to transit, not through the administrative rules governing participation of FDOT, but rather for DCA. Rule 9J-2.048, F.A.C., Adequate Housing Uniform Standard Rule, establishes how DCA evaluates adequate housing issues for DRIs and describes mitigation of significant adequate housing impacts:

As an incentive to promote the co-location of adequate housing in close proximity with employment, and in recognition that such co-location reduces impacts to transportation, air quality, and energy usage, ... credits against the mitigation requirements for the adequate housing need of this section shall be given for the developer provision of adequate housing units based on the distance of these units from the development site and the availability of direct mass transit facilities....³⁴⁵

In other words, the number of units of affordable housing required to be provided are reduced if they are located closer to mass transit. While this law provides an incentive to the developer to build more affordable housing, the law also raised the threshold for residential units, making it easier to avoid the DRI review process.

Most Recent Legislative Changes to Transportation Concurrency

Concurrency is a growth management concept intended to ensure that the necessary public facilities and services are available concurrent with the impacts of development, including DRIs. Described in the

³⁴⁴ Chap. 2006-220, Laws of Florida.

³⁴⁵ Rule 9J-2.048(8)(c), F.A.C.

previous section on the LGCP process, changes to the application of concurrency were established by SB 360 in 2009. In DULAs, a TCEA is allowed to be established by LGCP amendment. Once the TCEA is established, this eliminates the requirement to comply with transportation LOS standards applied on a highway segment-by-segment basis. However, there must be a mobility plan in place within two years from the designation of the TCEA. This law also exempts developments located within DULAs from DRI review. DRI reviews still hold in non-DULA areas that are likely more suburban or rural in nature. These areas are less likely to have public transit service.

Approved Transportation Mitigation Measures

The following measures can be used to mitigate transportation impacts and reasonably assure that transportation facilities will be constructed and made available when needed to accommodate the impacts of the proposed development:

- Scheduling of facility improvements.
- Alternative concurrency provisions.
- Proportionate share payments for roadway improvements based upon peak hour roadway trips generated.
- LOS monitoring with binding commitments for needed improvements.
- A combination of the above mitigation measures OR the provision for capital facilities for mass transportation OR the provision for programs that provide alternatives to single occupancy vehicle travel.³⁴⁶

Payments as Mitigation for Impacts

The 2005 amendments to Florida's growth management legislation directed local governments to enact concurrency management ordinances by December 1, 2006, that allow for "proportionate share" contributions from developers toward concurrency requirements.³⁴⁷ The intent of the proportionate share option is to provide applicants for development an opportunity to proceed under certain conditions, notwithstanding the failure of transportation concurrency, by contributing their share of the cost of improving the impacted transportation facility.

A multiuse DRI may satisfy the transportation concurrency requirements of the local comprehensive plan, the local government's concurrency requirements of the local comprehensive plan, the local government's concurrency management system, and Section 380.06, F.S., by payment of a proportionate-share contribution for local and regionally-significant traffic impacts if, among other things, the development contains an integrated mix of land uses and is designed to encourage pedestrian and other non-automotive modes of transportation.³⁴⁸

Under this subsection, the proportionate-share contribution is calculated in terms of automobile trips and highway level of service, based on the:

³⁴⁶ Rule 9J-2.045(7)(a)1-5, F.A.C.

³⁴⁷ s. 163.3180(16), F.S.

³⁴⁸ s. 163.3180(12), F.S.

...cumulative number of trips from the proposed development expected to reach the roadways during the peak hour from the complete build-out of a stage or phase being approved, divided by the change in the peak hour maximum service volume of roadways resulting from construction of an improvement necessary to maintain the adopted level of service, multiplied by the construction cost, at the time of the developer payment, of the improvement necessary to maintain the adopted level of service.³⁴⁹

Proportionate share mitigation can include private funds and, separately or collectively, contributions of land, construction and facilities.

Substantial Deviations—When a Development Concept Changes Mid-Process

A previously-approved development for which the developer proposes a change that may cause a regional impact is subject to further DRI review. These proposed changes are reviewed both individually and cumulatively with other previously granted changes to determine if they exceed any of 16 specific criteria stated by law. As it relates to transportation and air quality impacts, these criteria include the following:

- Changes in the number of parking spaces or number of spectators at an attraction or recreation facility, increases in the capacity, storage, land uses or square footage of a facility.
- Changes in the combinations of land uses within a multi-use development.
- Increases in acreage.
- Increases in the number of vehicle trips generated.
- An extension of the date of build-out of the development by seven or more years.

The developer must submit to DCA a request for the proposed changes in a Notice of Proposed Changes (NOPC), the regional planning agency, and the local government for a finding of no substantial deviation. The process of reviewing and approving such a request has time limits for both the developer and the reviewing agencies. A public hearing must be held within 90 days of the developers' submittal. No later than 45 days after the developer's submittal, DCA and the regional planning agency must submit a response to the local government whether it objects to the proposed change and the reasons for the objection.

At the public hearing, the local government determines whether the proposed change is a substantial deviation requiring further DRI review. In its review, the local government considers the statewide guidelines, standards, and thresholds; whether the proposed development is eligible for increased thresholds due to its status as a designated rural area of critical economic concern; whether the proposed changes benefit the area's economy, raise employment, increase wages, and promote higher skill levels³⁵⁰; and if there is any addition of land not previously reviewed. If the local government

³⁴⁹ s. 163.3180(12)(e), F.S.

³⁵⁰ Per criteria in Section 403.973, F.S.

determines that the proposed change is not a substantial deviation and does not require further DRI review, then it will issue an amendment to the DO incorporating the approved change and conditions of approval relating to the change. There is also an appeals process after the local government makes its determination.

Variations of DRIs

Area-wide DRI

There are other options to a standard DRI. A developer may petition for authorization to submit a plan for an area-wide DRI. An area-wide DRI provides that all development within a defined planning area must conform to an approved area-wide development plan and the DO. This type of plan integrates a CIP for transportation and other public facilities to ensure development staging contingent on the availability of facilities and services.

Optional Sector Plan

A local government also can initiate the establishment of an optional sector plan upon written agreement with DCA. An optional sector plan is an alternative to the DRI process that applies to areas bigger than 5,000 acres. It combines the purposes of Chapters 163 and 380, F.S. by emphasizing urban form, including a conceptual long-term build-out overlay and one or more detailed specific area plans that implement the overlay and authorize DOs. The optional sector plan also emphasizes protection of regional resources and facilities. The optional sector plan identifies regionally significant public facilities and the public facilities necessary for the short term, including developer contributions in a financially feasible five-year capital improvements schedule. The local government must monitor and enforce the requirements of the specific area plans and submit an annual report to DCA and the RPC.³⁵¹ There are presently optional sector plans in Bay County, Orange County and the City of Bartow.

Florida Quality Developments

The Florida Quality Development (FQD), established by law, is another alternative to a DRI and assures the developer a more expeditious and timely review of development proposals in exchange for a binding commitment to donate a fee sufficient to protect natural attributes in perpetuity, including wetlands, water bodies, beaches, dunes, archaeological sites, and habitats important to the survival of endangered species. The FQD must achieve a higher quality of life for its residents, including planning and design features for public transit. However, for purposes of off-site transportation impacts, the developer must comply with the provisions of the DRI Transportation Uniform Standard Rule for evaluating transportation facilities for highway LOS and abide by the regional policy plan and the LGCP.³⁵²

Conclusions

The above has provided a summary of the DRI review process. Despite the designation of DULAs and TCEAs, there is still a large part of Florida that is subject to the DRI process, perhaps crucially because these areas are on the suburban fringe. While developers prefer to avoid the DRI process, it still may be

³⁵¹ s. 163.3245, F.S.

³⁵² s. 380.061, F.S.

less expensive to build in suburban fringe areas where highway capacity is still available. These areas are not usually set up to offer public transit. Small towns grow by building highway networks until they are large and have allowed dispersed development. Not until a municipality has a population greater than 50,000 and a county has a population greater than 75,000 must a local government begin to plan for the development of public transit. Laying the groundwork for public transit needs to start earlier in small town and rural planning. Furthermore, public transit systems often do not cross jurisdictional boundaries and so, for the significant number of trips that cross jurisdictional boundaries on state and regionally significant facilities, public transit cannot serve those trips. An important role is played by regional public transit authorities, such as the Tampa Bay Area Regional Transportation Authority, to put regional public transit service in place. Such service can begin to address the challenges of maintaining motor vehicle LOS standards on SIS highways.

Often, the allowance of a DRI to receive a Development Order requires amendments to the LGCP. A closer evaluation should be undertaken of the circumstances under which an LGCP is amended to conform to a proposed development, rather than the proposed development conforming to the LGCP. If the LGCP is properly developed, then each incremental change to the plan has the potential to undermine its integrity.

Proportionate share payments from the developer to mitigate the impacts may satisfy transportation concurrency for multiuse DRIs if they have an integrated mix of uses that encourages pedestrian and non-motorized transportation. Here, the law focuses on the land use. A proportionate share contribution to transit is calculated in terms of automobile trips representing an increment of highway capacity and is restricted toward mass transit capital facilities. A developer wants to pay once and be done with it, and contributions toward capital facilities allow that. However, restricting the use of the funds disallows paying for operating costs, where public transit needs it the most.

In the law, while highway capacity is discussed as transportation service, public transit is mentioned as mitigation and as a means to connect low-income persons with jobs while providing a DRI incentive to build more residential units. It is suggested that in the effort to develop a multimodal system, public transit as well as non-motorized modes also be discussed primarily as transportation service.

While LOS is defined by Rule as a qualitative assessment of a roadway's operating conditions or the average driver's perception of the quality of traffic flow, it is measured quantitatively as a measure of capacity. Other elements of service quality are not considered. Much recent attention has been devoted to Q/LOS measures to guide the development of a multimodal system. However, the DCA DRI evaluative instruments do not yet reflect this. In the application for a binding letter, the pre-application conference checklist, the ADA application, and the Transportation Uniform Standard Rule, transportation service is defined in terms of highway capacity and congestion management. It is recommended that the transportation concurrency process support LOS indicators that measure other attributes of mobility.

It is recommended that Questions 21 and 22 in the ADA be updated to reflect the application of multimodal level of service measures. In the ADA Question 22 – Air, the use of roadway widening is provided as an explicit example of a structural or operational measure to minimize air quality impacts. This may be true in the short term, especially for carbon monoxide concentrations, but other examples, such as VMT reductions that address long-term air quality preservation, should also be listed.

The issuance of the FDOT *Transportation Impact Handbook* is a giant leap forward in incorporating multimodal options in DRIs, thereby providing the ground work for VMT and GHG emissions reductions. For the future, some further advances toward supporting multimodal options will include the suggestion in the *Transportation Impact Handbook* ADA Review Checklist that public transit improvements include not only site access improvements but also contributions toward off-site operational improvements in transit service itself, in much the same way developers commonly are asked to contribute to off-site roadway and intersection improvements. It will also help, when after local governments adopt level of service standards for bicycle, pedestrian, and transit service based upon quality as perceived by the traveler (instead of a capacity measure), that the *Transportation Impact Handbook* Checklists (ADA Review, DO Review, Project Monitoring & Report Review) will reflect the expectation of achieving and maintaining these QLOSs in much the same way that roadway LOS is expected to be maintained.

Appendix C: CFIT Phase II Draft Scope of Work

Exhibit "A"

Scope of Service

Phase II

Toolkit for Carbon Footprint that Integrates Transit (C-FIT)

Submitted to

The Florida Department of Transportation
Research Center
605 Suwannee Street, MS 30
Tallahassee, FL 32399

c/o Amy Datz, Project Manager

Submitted by

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Draft

August 24, 2009

Toolkit for Carbon Footprint that Integrates Transit (C-FIT)—Phase II

Research Purpose

It is increasingly clear that future transportation planning in the state of Florida will need to analyze, estimate, and consider greenhouse gas emissions resulting from transportation system development and operations. The purpose of this research project is to provide information, guidance, and an analytical tool to support transportation decision making at the system, land development, and project levels. The result of this research will be to enable transportation planners to more effectively weigh air quality considerations in response to proposed transportation funding allocations. The premise of this study is that the overall increase or decrease in the amount of greenhouse gas emissions may vary considerably across proposed transportation project alternatives, including modes. A process to generate comparative information on GHG emissions for bus transit alternatives can aid in the funding prioritization and decision making process for developing transit service.

Background (Review and Summary of Phase I)

This proposed project begins with the results of Phase I, which is a framework for incorporating greenhouse gas (GHG) emissions and carbon footprints from transportation activities and services into five major transportation planning processes in the state of Florida. The Phase I framework focused on incorporating bus transit alternatives into transportation planning, including guidelines and formulas for estimating emissions.

In Florida, the planning processes of interest include Florida's **Local Government Comprehensive Planning** (LGCP) process, which creates and implements local transportation and land development policies that are enforceable by code, and the Florida **Development of Regional Impact** (DRI) review process that is applied to individual land development projects. Both of these processes steer later building decisions related to land development and transportation services and facilities. Federal processes include **Environmental Assessments and Environmental Impact Statements** (EA/EIS) required by the National Environmental Policy Act (NEPA) and air quality **Conformity Analysis** required through the Clean Air Act. Regarding Florida's attainment status, measured levels of ozone in several counties currently exceed the new NAAQS, which was made more restrictive by EPA in the Spring of 2008. The federal government also requires urbanized areas to establish metropolitan planning organizations (MPO) that are charged with identifying and prioritizing transportation improvements. These improvements are those that qualify for federal transportation funding and are identified in the **MPO long range transportation planning** (LRTP) process, and prioritized in the **Transportation Improvement Program** (TIP) and the **State Implementation Plan** (SIP).

Proposed Study Parameters

1. As a complement to measuring the carbon footprint of transit use globally, and of the operations of a transit property as a whole, which is the focus of a study currently underway at FSU, this study will look at how to consider estimates of GHG when analyzing and evaluating the merits of alternative transportation modes for the NEPA, DRI, LGCP, LRTP and Conformity Analysis planning processes. This focus on how to incorporate GHG emissions into transportation planning, distinguishes this study from two others now being sponsored by FDOT: Conserve by Transit and an FSU study that is developing an analysis method that quantifies a baseline carbon footprint from transit operation, to be used in a cap and trade market. Apart from these two FDOT-sponsored studies, there is a third project underway, TCRP Project J-7, Synthesis Topic SH-09, which will present the state-of-the-practice on what transit agencies, state, and local governments are already doing to reduce GHG emissions in the transportation sector. The results of these three studies will be considered for incorporation, where appropriate, into the framework of the C-FIT Toolkit.
2. This scope represents Phase II of a multi-phase study Phase I that is currently underway is focusing upon evaluating how existing/emerging methodologies for measuring GHG emissions can be applied to the five specifically identified planning processes, to identify limitations and gaps in analytical needs and data, and to develop recommendations for an approach and framework for measuring GHG emissions that provide useful inputs to the five planning processes. Implementation of that approach and framework, in a set of guidelines accompanied by supporting tools, will fall within this scope for Phase II.

This scope will address GHG emissions generated from the provision of bus transit as a transportation modal alternative. As a result of the selection of a bus service alternative during the planning process, the emissions of interest are those avoided due to a mode shift of travelers from private motor vehicle to use of bus transit plus the increased emissions resulting from the provision of any additional transit service to meet demand. The calculation will also include anything that the public transit agency does to reduce emissions resulting from the additional service, such as use of alternative fuel buses, the construction, operations, and maintenance of off-site transit infrastructure used to provide additional service, etc. This study will not include GHG emissions generated from bus transit agency overhead functions, such as administrative support, employee work commute mode, bus maintenance and fueling station activity, vehicle procurement, etc.

3. This scope is focused upon GHG emissions measurement only and not other issues relating to sustainability of public transit, i.e., paper recycling, water use, soil erosion mitigation practices, etc.

4. While the current Phase I study focuses upon comparing proposed highway alternatives to bus transit alternatives only, this proposed Phase II study will include consideration of other public transit modes that, like additional highway capacity, require emission of GHG to produce infrastructure and materials for infrastructure, as well as emissions to move persons and vehicles on existing infrastructure.

Objectives and Supporting Tasks for Phase II

There are three objectives of this research.

- 4) Refine the C-FIT framework into specific spreadsheet tools and guidance, based upon the results of the Phase I assessment
- 5) Secure participation of representative government transportation planning agency units and apply the CFIT Toolkit to a case study project for each of the five identified planning processes
- 6) Evaluate the results of the Toolkit application and make adjustments to the CFIT Toolkit as necessary

Work not included in this scope of service is not to be performed and will not be subject to compensation by the Department.

The following are the anticipated tasks necessary to achieve the above objectives.

Task 1 Kick-Off Meeting and Project Management

A net conference kick-off meeting will be scheduled to occur before any work begins. At a minimum, the project manager and the principal investigator will attend. The Research Center staff will be advised of the meeting and given the option to attend, in person or via net conference. Other parties may be invited, as appropriate. The subject of the meeting will be to review and discuss the project's tasks, schedule, milestones, deliverables, reporting requirements, and deployment plan. Task 1 will also include project management, including preparation of quarterly progress reports and internal review.

Task 2 Monitor New Legislation, Rule Making, and Continue Coordination with Other Research Efforts

Policies affecting transportation, local planning, and greenhouse gas emissions are likely to change during the period of work for Phase II. For example, at present there are no federal air quality standards or other regulations for the primary greenhouse gas, CO₂. Ongoing rulemaking and legislative processes may change this. The 2009 session of the Florida legislature made major changes in the state's growth management practices, and there has been discussion of modifying some of these in the 2010 session. The next federal transportation authorization bill is likely to address issues related to climate change and may change other aspects of transportation planning. Staff will monitor these developments and adapt the CFIT Toolkit as needed.

Staff will continue to coordinate with other government agencies, including FHWA, the Florida Department of Environmental Protection and the Florida Department of Community Affairs, as well as coordination with continuing related research efforts, including a study on transportation control

measures by Tindale Oliver & Associates, Inc., the final outcome of the Conserve by Transit study by Florida State University, and the results from the study on recommended practices for measuring greenhouse gas emissions from transit by the American Public Transportation Association. Coordination will take place by email communication, telephone calls and up to three telephone conferences.

Task 3 Develop the Toolkit

Based upon the preceding results and recommendations from Phase I, staff will refine and implement the CFIT Toolkit framework developed in Phase I for application to case studies. Based on the work accomplished to date in Phase I, we anticipate that the Toolkit will consist of a series of spreadsheets for each of the planning processes, adapted for consistency with those travel demand and emissions models identified as suitable from Phase I. The Toolkit will also include an “envelope” that relates the spreadsheets together for efficient data input, and a guidance manual for planning practitioners. The Toolkit will also incorporate other forms of transit (rail, bus rapid transit) and other modes, including walking, bicycling, vanpooling.

Task 4 Apply CFIT Toolkit to Case Study Locations

Concurrently with the development of the Toolkit in Task 3, staff will seek the participation of representative units of government, including an MPO, regional planning council, and local government in Florida to apply the C-FIT Toolkit to each of the following planning processes.

- An MPO LRTP update and TIP update
- An air quality conformity analysis
- An EA/EIS
- A DRI
- A LGCP update

Upon finding interested planning agencies willing to participate by assisting with identifying representative projects for test evaluation and data sharing, staff will apply the CFIT Toolkit spreadsheets to the five case studies at the appropriate identified points within the planning processes. The intent of this task is to determine the suitability of the toolkit, not to inform the decisions being made in the case study situations. It is likely that some of the case studies will use data collected for decisions that have already been made.

Task 5 Evaluation and Documentation of the CFIT Toolkit

Staff will prepare a final draft report summarizing the results of applying the CFIT Toolkit to the five case studies and demonstrating how reducing GHG emissions can weigh into the identification and selection of alternatives for transportation service and infrastructure. The results will include an evaluation or “reality check” with regard to the efficacy of the Toolkit. Based on the experience gained in the case studies, staff will prepare documentation and guidance for using the Toolkit. Recommendations will be

made regarding appropriate application and distribution of the Toolkit. A netconference with coordinating partners will be held to discuss the results of the case study test of the Toolkit.

Task 6 Deliverable: Draft Final Report -- Toolkit for Carbon Footprint that Integrates Transit (C-FIT)

The draft final report will be submitted 90 days prior to the end date of the contract. FDOT will have a 30-day review period before providing recommendations, then an additional 15 days for a second review before final approval of the draft report.

Task 7 Deliverable: Final Report – Toolkit for Carbon Footprint that Integrates Transit (C-FIT) Upon FDOT approval, the final report will be finalized and a PowerPoint presentation will be prepared and transmitted in electronic format to FDOT offices in Tallahassee.

Use of Graduate Student(s) and other Research Assistants

Graduate students will assist in monitoring new legislation and rulemaking as it applies to the development and application of the CFIT Toolkit (Task 2). Graduate students will assist with spreadsheet development and drafting guidance materials (Task 3). Graduate students will assist with the information and data collection characterizing the five case study projects to be tested under the CFIT Toolkit (Task 4), and with preparing documentation of the Toolkit software (Task 5). Graduate students will also assist with preparation of the final report draft Tasks 6 and 7).

Equipment

No equipment will be needed.

Travel

It is anticipated that face to face meetings will be needed in the solicitation of transportation planning government agency participation, information sharing and test application of the CFIT Toolkit. To the extent feasible, attempts will be made to secure case study examples within the Tampa Bay region to incur vicinity mileage and parking charges only. If attempts to secure local case studies are not successful, staff may have to attempt to secure participation from government agencies just beyond the Tampa Bay region.

All travel must be in accordance with Section 112.061, Florida Statutes. FDOT employees may not travel on research contracts.

Net Conferences

Per Task 1, one net conference will be conducted for the kick-off meeting. Per Task 5, a net conference will be held with coordinating partners to discuss the results of the application of the CFIT Toolkit to the

five transportation planning processes. A total of two net conferences will be held as a part of this project.

Deliverables

Progress Reports CUTR will submit quarterly progress reports to the Research Center. The first report will cover the activity that occurred in the 90 days following the issuance of the Task Work Order.

Reports will be submitted within 30 days of the end of the reporting period. CUTR will submit reports even if little or no progress has occurred (in which case, the report would explain delays and/or lack of progress). Progress reports will be sent in MS Word to Sandra Bell, Sandra.bell@dot.state.fl.us.

Progress reports will contain the following information:

1. Contract Number, Task Work Order Number, and Title
2. Work performed during the period being reported
3. Work to be performed in the following period
4. Anticipated modifications (i.e., to funding, schedule, or scope). This section is for reporting/informational purposes, not for officially requesting an amendment.
Note: To request an amendment to a contract, CUTR will provide the project manager with the appropriate information (i.e., what is being requested with justification) in the required format. If the project manager concurs with the request, he/she shall forward it with his/her approval and commentary, as appropriate, to the Research Center for administrative review and processing (pending available funds, etc.)
5. A Progress Schedule (Figures A, B, and C) updated to reflect activities for the period being reported.

Failure to submit progress reports in a timely manner may result in termination of the work order.

Draft Final Report – Toolkit for Carbon Footprint that Integrates Transit (C-FIT)

The draft final report will be submitted to Sandra Bell, Sandra.bell@dot.state.fl.us. The draft final report will also be submitted to other state agencies, as appropriate, with an invitation for their review and comment. It will be edited for technical accuracy, grammar, clarity, organization, and format prior to submission to the Department for technical approval. The Research Center expects contractors to be able to provide well-written, high-quality report that address the objectives defined by the scope of service. Draft final reports will be prepared in accordance with the Guidelines for Preparing Draft Final and Final Reports, found at [http://www.dot.state.fl.us/research%2Dcenter/Program Information/Guidelines%20for%20Pr](http://www.dot.state.fl.us/research%2Dcenter/Program%20Information/Guidelines%20for%20Pr)

[eparating%20a%20Final%20Report%2012-07.pdf](#)) and in plain language according to the Governor's initiative. This document provides information on all report requirements, including format requirements, the technical report documentation form, disclaimer language, and so forth.

Final Report – Toolkit for Carbon Footprint that Integrates Transit (C-FIT)

Once the draft final report has been approved, the university shall prepare the final report and one PowerPoint presentation. The university will deliver eight (8) copies of the final report in MS Word on CD no later than the end date of the task work order, to the attention of Sandra Bell at

The Florida Department of Transportation
Research Center, MS30
605 Suwannee Street
Tallahassee, FL 32399-0450

Each copy will be provided on a CD or DVD (i.e., for a total of eight disks). If the project manager requires additional copies, such provision must be indicated in the scope.

Project Certification The Sponsored Research office or appropriate authority will submit as a final deliverable a project certification prepared according to university compliance standards.

Budget

The proposed budget for this research project is \$100,000.

Description of Research Roles on the Project

Sara Hendricks will serve as the primary contact for the project and will be responsible for project administration (Task 1). Ms. Hendricks will arrange coordination meetings and be responsible for the preparation and submittal of all deliverables (Tasks 2, 6 and 7). Ms. Hendricks will lead the effort to solicit and arrange for the participation of transportation planning agencies and in the application of the CFIT Toolkit to case study projects (Task 4). Ms. Hendricks will provide support to Drs. Hillsman and Stuart in the refinement of the CFIT-Toolkit products (Task 3) and in the evaluation of case study results (Task 5).

Ed Hillsman will provide input at the kick-off meeting (Task 1), participate in project coordination (Task 2), and provide recommendations on case study projects (Task 4). Dr. Hillsman will lead jointly with Dr. Amy Stuart in the refinement and development of the CFIT toolkit in Task 3 and with Ms. Hendricks and Dr. Stuart in the application of the CFIT Toolkit in Task 4. Dr. Hillsman will take the lead on the evaluation of the CFIT Toolkit in Task 5 and draft appropriate sections of the final draft report and final report in Tasks 6 and 7, based upon his expertise.

Amy Stuart will provide input at the kick-off meeting (Task 1), participate in project coordination (Task 2), and lead jointly with Dr. Hillsman in the refinement and development of the CFIT Toolkit in Task 3. Dr. Stuart will provide recommendations on case study selection in Task 4 and provide input on the evaluation of the CFIT Toolkit in Task 5. Dr. Stuart will draft appropriate sections of the final draft report and final report, based upon her expertise (Tasks 6 and 7).

Phil Winters and Joel Volinski will provide internal review of technical memoranda and the draft final report.

Jennifer Iley will provide assistance with contract administration, help with the set-up of net conferences, and assist with the preparation of the draft final report.

A graduate student will assist in monitoring new legislation and rulemaking as it applies to the development and application of the CFIT Toolkit (Task 2). The graduate student will assist with the information and data collection characterizing the five case study projects to be tested under the CFIT Toolkit (Task 4) , and with preparing documentation of the Toolkit software (Task 5). The graduate student will also assist with preparation of the final report draft Tasks 6 and 7).

A second graduate student will assist with spreadsheet development and drafting guidance materials for their use (Task 3). The graduate student will also assist with preparation of the final report draft (Task 6).

Patricia Ball will provide technical editing of the draft final report.

Contact Information

The following are the three Co-Principal Investigators for this research.

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