

Comparing the Environmental Benefits of Transit Projects

Proceedings from a Colloquium – October 28 & 29, 2008



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Acronyms

APTA	American Public Transportation Association
CEQ	Council on Environmental Quality
CEQA	California Environmental Quality Act
CH ₄	Methane
CNT	Center for Neighborhood Technology
CO	Carbon monoxide
CO ₂	Carbon dioxide
DOT	Department of Transportation
EMS	Environmental Management System
EPA	U.S. Environmental Protection Agency
FTA	Federal Transit Administration
FY	Fiscal Year
GAO	General Accountability Office
GHG	Greenhouse gas
GIS	Geographic Information System
H ₂ O	Water Vapor
ISTEA	Intermodal Surface Transportation Efficiency Act of 1991
LEED	Leadership in Energy and Environmental Design
MOVES	Motor Vehicle Emission Simulator
MPO	Metropolitan Planning Organization
NEPA	National Environmental Policy Act
NO _x	Nitrogen oxides
N ₂ O	Nitrous oxide
PM ₁₀	Particulate Matter with a diameter of 10 microns or less
SACOG	Sacramento Area Council of Governments
SAFETEA-LU	Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users
TSM	Transportation system management
TTI	Texas Transportation Institute
TxDOT	Texas Department of Transportation
USACE	U.S. Army Corps of Engineers
USDHHS	U.S. Department of Health and Human Services
VMT	Vehicle miles traveled
VOCs	Volatile organic compounds

Executive Summary

On October 28 and 29, 2008, the Volpe National Transportation Systems Center (Volpe Center) convened a panel of 10 individuals with expertise in transportation and environmental policy for a one-and-a-half day Colloquium to identify numerous environmental indicators that could meaningfully compare the environmental benefits of transit projects competing for Federal Transit Administration (FTA) New Starts funds (see the Agenda in Appendix A). The meeting provided a forum for panelists to discuss issues and opportunities associated with identifying meaningful environmental benefit measures and to brainstorm possible methods and measures for evaluating and comparing these environmental benefits. The purpose of this report is to present ideas generated in the Colloquium that FTA could consider when developing proposed regulations and guidance.

During the Colloquium, the panel identified four primary categories to measure the environmental benefits of proposed transit projects. The four categories include:

Energy use. Energy savings and reduction in related greenhouse gas emissions of the proposed New Starts project compared to the baseline condition or alternative.

Air quality. Decrease in growth of air pollution emissions that have local and regional impacts from the proposed transit project as compared to the baseline condition or alternative.

Land use. Environmental benefits from the land use impacts of the proposed New Starts project compared to the baseline condition or alternative.

Physical activity. Proportional increase in physical activity and associated health benefits resulting from the proposed New Starts project as compared to the baseline condition or alternative.

The panel briefly discussed alternative baselines against which the project's environmental benefits would be measured. Baseline options include existing conditions, future no-build conditions (e.g., continuation of auto-oriented land use and mode shares driven by continued highway development to meet demand), or the New Starts baseline alternative used in evaluating the other statutory New Starts criteria.¹

In addition, participants discussed methodologies for evaluating the environmental benefits of transit projects. Possible methods identified include:

A warrants approach. Similar to the approach used in the Very Small Starts program, a warrants approach to measuring the environmental benefits of transit projects would outline certain minimum criteria that a project must meet to achieve a certain rating level. This approach provides a simplified method for promoting projects that have desired criteria or project setting characteristics.

¹ For the other criteria used in the New Starts evaluation, the baseline typically represents the best that can be done to improve transit service in a corridor without major capital investment in new infrastructure.

Indexing. The indexing approach involves the scaling and weighing of a number of evaluation measures to produce a single number. The approach requires that a consistent group of individuals evaluate and rate the proposed projects.

A checklist. The approach would require FTA to develop a list of attributes that an environmentally beneficial transit project would possess. Each candidate project would be compared against the checklist and receive an environmental benefit rating based on the number of attributes attained.

A “Making the Case” document. Project sponsors would document substantive arguments on the environmental benefits of the transit project. An agency could use the “Making the Case” document to justify a project primarily based on quantitative but also qualitative non-transportation benefits and impacts that might not otherwise be captured from other New Starts evaluation metrics.

The Colloquium was intended to generate ideas on how to evaluate the environmental benefits of proposed transit projects. The panelists were not asked to reach consensus regarding any of the measures and methods identified in this report. Once initial environmental measures have been identified, FTA will test the suitability of the proposed measures by applying them to the projects in the current New Starts pipeline to determine their usefulness in comparing the environmental benefits of transit projects.

Introduction

On October 28 and 29, 2008, the Volpe National Transportation Systems Center (Volpe Center) convened a panel of 10 individuals with expertise in transportation and environmental policy for a one-and-a-half day Colloquium to identify numerous indicators that can meaningfully compare the environmental benefits of competing New Starts projects (see the Agenda in Appendix A). The purpose of the meeting was for panelists to discuss issues and opportunities associated with identifying meaningful environmental benefit measures and to brainstorm possible methods for evaluating the environmental benefits of transit projects.

Many ideas were generated during the duration of this Colloquium. This discussion was the beginning of the larger effort and evaluation needed to develop and fully assess the best methods by which the Federal Transit Administration (FTA) should measure and compare the environmental benefits of transit projects. FTA will further develop proposed measures and will subsequently present them to the general public for review and comment.

The backgrounds of the Colloquium panelists represented a range of subject area expertise and employment sectors (Panel members' biographies are presented in Appendix B). Panel members included:

- Dennis King, University of Maryland and King and Associates;
- Judy Krueger, Center for Disease Control and Prevention;
- David L. Mieger, Los Angeles County Metropolitan Transit Authority;
- Anthony Perl, Simon Fraser University;
- Naomi Renek, New York State Metropolitan Transportation Authority;
- Michael Replogle, Environmental Defense;
- Anne Richman, San Francisco Metropolitan Transportation Commission;
- Elena Safirova, Resources for the Future;
- Steve Winkelman, Center for Clean Air Policy; and
- Joe Zietsman, Texas Transportation Institute.

In addition to the panelists, staff from FTA, the General Accountability Office (GAO), and the American Public Transportation Association (APTA) also attended as observers. A complete list of Colloquium attendees is included in Appendix C.

This report summarizes the Colloquium discussion on proposed metrics and methodologies to measure the environmental benefits of transit. The report is a summary of the general themes discussed by the panel on which no consensus was attempted or achieved. Members of the panel have individually reviewed this report to assure that the main ideas discussed during the

Colloquium are presented accurately. The Colloquium panel members often held differing opinions; those differences are captured throughout this report.

The report covers the following topics:

Background. Provides background to the statutory requirements of New Starts project evaluation and outlines FTA's objectives for the Colloquium.

Proposed measures and metrics. Presents the four primary categories of measures of environmental benefits of transit projects developed by the panel during the Colloquium.

Proposed methodologies. Presents four methods panelists discussed to evaluate the environmental benefits of transit.

Next Steps. Presents potential next steps FTA could take in both the short- and long-term in order to develop methods and measures for evaluating the environmental benefits of transit projects.

Background

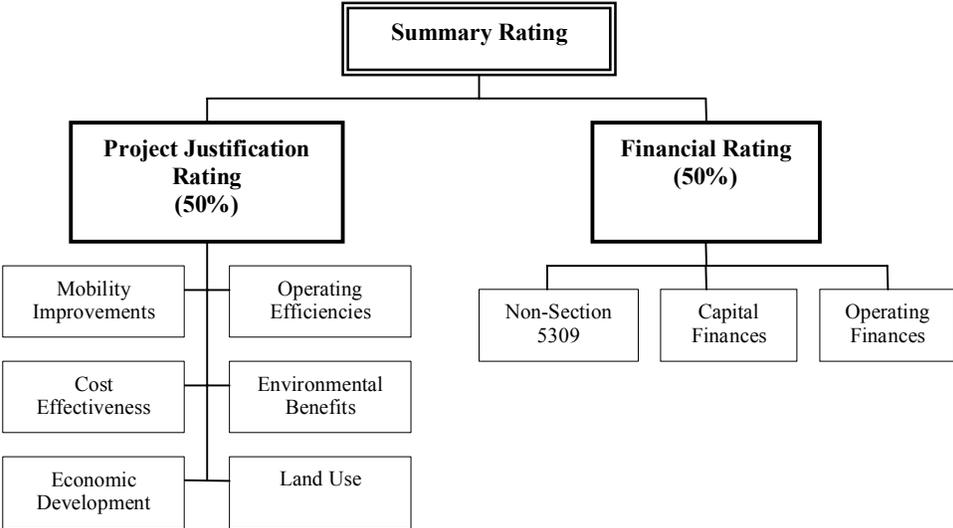
Statutory Requirements of New Starts Project Evaluation

The New Starts program is the Federal Government’s primary discretionary financial resource for capital investment in new public transportation. FTA is required by law to evaluate and rate projects and to identify the projects most meritorious of Federal funding in an annual report to Congress. The New Starts program provides funding for new fixed-guideway transit projects, including heavy rail, light rail, commuter rail, streetcars, ferries, and corridor-based bus projects.

Title 49, United States Code, Chapter 53 (Federal Transit Law), directs FTA to prioritize projects for funding by evaluating, rating, and recommending projects based on specific financial and project justification criteria (see Figure 1). The project justification criteria include:

- Mobility improvements;
- Environmental benefits;
- Operating efficiencies;
- Cost effectiveness;
- Economic development; and,
- Transit supportive land use policies and future patterns.

Figure 1: FTA’s New Starts Evaluation and Rating Framework



Federal Transit Law also mandates that a proposed New Starts project receive FTA approval to advance into the preliminary engineering phase and then into the final design phase. FTA's approval to advance is based on an evaluation of the proposed project using the New Starts project justification criteria and an assessment of the sponsor's financial plans and local financial commitment. Proposed projects must achieve an overall rating of at least medium (based on a five-level scale of high, medium-high, medium, medium-low, and low) in order to advance into each phase of project development.

Although all project justification factors are to be considered in rating a project, currently FTA assigns a weight of 50 percent each to cost effectiveness and land use when calculating a project justification rating. FTA considers information on environmental benefits, mobility improvements, and economic development; but these criteria are not currently used to develop a project's New Starts rating because the information submitted in support of these measures does not help to distinguish between projects in any meaningful way. For example, in its evaluation of the environmental benefits of a proposed transit project, FTA currently considers the U.S. Environmental Protection Agency's (EPA's) air quality designation for the worst transportation pollutant in the project area. However, FTA has realized that this information does not meaningfully distinguish environmental differences among competing New Starts projects. As a result, FTA reports the information submitted by project sponsors on environmental benefits in the *Annual Report on Funding Recommendations*, but it does not formally incorporate this measure in the overall rating of New Starts projects.

In the SAFETEA-LU Technical Corrections Act of 2008¹, Congress directed that “comparable, but not necessarily equal, numerical weight [be given] to each project justification criteria in calculating the overall project rating.” FTA plans to publish proposed interim Guidance on New Starts/Small Starts Policies and Procedures in early 2009, assigning numerical weights to each project justification criteria. Final policy guidance is anticipated to be issued sometime in the spring of 2009.

Federal Transit Law further directs FTA to consider factors such as air pollution, noise pollution, energy consumption, associated ancillary and mitigation costs, reductions in local infrastructure costs achieved through compact land use development, and the cost of suburban sprawl when developing a project-justification rating.²

FTA's Objectives

In 2008, in response to the Congressional mandate from the SAFETEA-LU Technical Corrections Act to utilize each project justification criteria in calculating the overall project rating, FTA initiated an effort to develop more robust environmental measures that meet the statutory requirements and provide a practical and useful way to distinguish the relative merits of candidate projects and to help identify the most worthy projects from around the nation from an environmental standpoint.

¹ SAFETEA-LU Technical Corrections Act of 2008. Available at <http://thomas.loc.gov/cgi-bin/query/D?c110:7:./temp/~c110nlNsez:>

² 49 USC 5309(d)(3)

The goal of the Colloquium was to provide a forum for panelists to discuss issues and opportunities associated with identifying environmental benefit measures or indicators. The Colloquium did not address the weight to be assigned to environmental benefits relative to the other statutory New Starts criteria (i.e., mobility improvements, cost effectiveness, operating efficiencies, economic development effects, and public transportation supportive land use policies and future patterns).

For the purposes of this work, FTA assumes a definition of “environment” that is based on the President’s Council on Environmental Quality’s (CEQ) National Environmental Policy Act (NEPA) implementing regulations. According to the CEQ definition, “environment” means the human environment shall be interpreted comprehensively to include the natural and physical environment and the relationship of people with that environment. The term, therefore, encompasses the built environment (i.e., urban design and historic preservation) and the natural environment (air quality, wetlands, wildlife, parks, etc.).

For the other project justification criteria used in the New Starts evaluation, the baseline typically represents the best that can be done to improve transit service in a corridor without major capital investment in new infrastructure (known as the transportation system management (TSM) baseline)³. For the purposes of the environmental benefits measure, in addition to the TSM baseline, additional alternative baselines were considered, including existing conditions and future no-build conditions. In what follows, the term “baseline” is used generically and does not necessarily imply the TSM baseline unless that more descriptive terminology is used explicitly.

FTA offered the following considerations related to the development of environmental benefit measures or indicators:

- To the extent possible, the measures or indicators of environmental benefits should be based on existing data readily available to metropolitan planning organizations (MPO), state departments of transportation, transit agencies, and state or regional air quality agencies;
- A quantitative measure of an environmental benefit would be preferable to a qualitative indicator;
- The indicators of environmental benefits must be applicable to transit projects using different technologies (e.g., heavy rail, light rail, commuter rail, ferry, streetcar, and bus rapid transit) and different project lengths in different metropolitan areas;
- Scaling of the indicators may be necessary to account for the size of the project or investment;
- Simple measures are better. Measures that are intuitive and transparent will help public and political understanding and acceptance of the FTA ratings of environmental benefits. Simple measures are also beneficial because project sponsors will be asked to assess the environmental benefits of a proposed project many times during project development as the project changes and information is updated as the project advances;

³ In some rare cases, the New Starts baseline alternative is the future no-build condition (e.g., continuation of auto-oriented land use and mode shares driven by continued highway development to meet demand).

- To avoid double counting of benefits, the indicators of environmental benefits should be independent of the other New Starts criteria as much as possible. For example, “transit supportive land use policies and future patterns” is a separate criterion; the measures and indicators of environmental benefits should not overlap with the transit-supportive land use measures. Overlap would result in double counting of the associated benefits;
- The statute refers to “environmental benefits.” A project’s environmental disbenefits (if, for example, a project requires the filling of wetlands or the demolition of historic buildings) could also be taken into account in rating the “environmental benefits” of the project;
- Multiple indicators (e.g., separate indicators related to air quality, wetlands, historic preservation, parks, endangered species, noise, etc.) may be rolled into a single environmental benefit rating of the project; and,
- The indicators of environmental benefits will not be useful to FTA if all transit projects receive the same environmental benefit rating. As applied, the indicators must distinguish between projects that are environmentally beneficial and those that are less so or more so.

Previous Environmental Benefit Measures

The inclusion of environmental benefits as a New Starts project justification measure was first established in the Intermodal Surface Transportation Efficiency Act of 1991 (ISTEA). Since then, FTA has considered various methods to measure the environmental benefits of transit projects. The following describes approaches that FTA has used in the past.

Emission reductions

For a number of years, FTA employed a quantitative approach that was based on a 20-year forecast of the change in vehicle miles of travel (VMT) for the proposed New Starts project versus the New Starts baseline alternative.⁴ The regional VMT was multiplied by a regional average emission factor generated by the EPA MOBILE model to calculate the differences in carbon monoxide (CO), nitrogen oxides (NO_x), volatile organic compounds (VOCs), particulate matter with a diameter of 10 microns or less (PM₁₀), and carbon dioxide (CO₂), between the New Starts project and the baseline alternative. An estimate of energy use based on the same VMT and a regional average miles-per-gallon was also made. The results proved unsatisfactory from many perspectives. The differences in emissions from the proposed New Starts project and the New Starts baseline were insignificant due to the fact that a single transit project generally has only a very minor impact on total regional emissions. In addition, comparing projects’ emissions reductions does not take into account the varying severity of air quality problems in metropolitan areas across the country and the varying number of people exposed. Furthermore, it was difficult

⁴ In most instances the New Starts baseline alternative is a low-cost project that relies primarily on TSM activities to address the identified transportation needs in the New Starts project’s service area. There are rare instances when the New Starts baseline is the future no-build alternative.

to determine if a given project had higher levels of benefits compared to any other project. Thus, FTA determined that this was not a reliable measure to rate a project's environmental benefits.

Air Quality Designation

In recent years, each proposed project was given an environmental benefit rating based solely on the EPA air quality designation of its project area. The ratings were determined as follows:

High. Projects in non-attainment areas for any transportation-related pollutants that demonstrate a reduction in that pollutant;

Medium. Projects in attainment areas that demonstrate a reduction in any transportation-related pollutant; and,

Low. All other projects.

FTA determined that this approach did not meaningfully distinguish the environmental merits of competing New Starts projects. Since transit projects typically result in small reductions in air pollutants, every project received a rating of medium or high. In addition, the rating was based on an area's nonattainment status, which has little to do with the performance of a proposed transit project. Finally, this measure did not reflect the positive (or negative) environmental impacts of the Federal investment.

Proposed Measures and Metrics

During the course of the Colloquium, the panel identified four primary categories to measure the environmental benefits of proposed transit projects. The four categories are: 1) energy use, 2) air quality, 3) land use, and 4) physical activity. The discussion of each of the four categories, including proposed metrics and considerations, is summarized below.

Energy Use Measure

The amount of energy consumed by the transportation system represents 28 percent of the nation's total energy consumption, which is second only to the industrial sector.⁵ One of the main perceived environmental benefits of public transportation is energy savings. Panelists agreed that the energy use displaced by transit through a mode shift from private automobiles or from less energy efficient transit operations is an appropriate environmental benefit for use in New Starts project justification criteria. In addition, panelists noted that an energy use measure could be a surrogate for measuring greenhouse gas (GHG) emissions.

Proposed Metrics

Panelists suggested metrics or indicators to evaluate the energy use of a proposed New Starts project compared to a baseline condition or alternative. Panelists proposed direct metrics of energy use as well as surrogates that can serve as indicators of energy use. The proposed metrics include:

Direct Measures of Energy Use:

- Energy used per vehicle, passenger, or per revenue mile traveled; and
- Energy consumption for transportation per household in project area or transit service area.

Proxy Measures for Energy Use:

- CO₂ emissions per passenger mile traveled (or revenue mile) traveled;
- Change in VMT per household within one half or one quarter mile of the transit project's service area or corridor. A change in VMT can be used to estimate changes in energy consumption;
- Change in VMT per household (or per capita) region-wide;
- Change in private vehicle ownership within the project area as a proxy for VMT;
- Change in the number of parking spaces within the project area as a proxy for VMT; and,

⁵ Energy Information Administration. Annual Energy Review 2007.

- How well the project supports regional plans and policies to encourage better environmental planning, such as climate action plans and growth management plans.

Considerations

Panelists noted the difficulty in accurately measuring energy use and GHG emissions because disaggregate energy use information is not usually available, making it difficult to attribute energy savings to an individual project. Similarly, current travel forecasting models, which are scaled to the regional level, limit the ability to determine changes resulting from an individual project. In addition, current travel forecasting models lack a reliable means to calculate vehicle speed, which is a necessary component in correctly measuring energy use.

While panelists agreed that current travel forecasting models are limited, the group also noted several modeling developments that may provide insight into how to measure energy use, including:

- Several panelists noted that the EPA Office of Transportation and Air Quality is developing an emissions modeling system called the Motor Vehicles Emission Simulator (MOVES). The MOVES model will estimate emission factors for on-road and non-road transportation sources, cover a broad range of pollutants, and allow multiple scale analysis from fine-scale analysis to national inventory estimation.⁶ The MOVES model is designed to produce more credible emission calculations, including those for CO₂. However, the MOVES model, like its predecessor MOBILE model, produces emission factors and still relies on travel demand models to estimate the future travel volumes against which the MOVES emission factors are applied.
- Numerous panelists commented on the difficulty in measuring VMT. In response, one panelist referenced a VMT data collection method employed by the Center for Neighborhood Technology (CNT).⁷ In one study, CNT measured VMT per vehicle from odometer readings recorded when owners take their vehicles for emissions system inspections. VMT is determined by subtracting each vehicle's odometer reading from its previous year's reading. The average VMT per household is calculated as the VMT per vehicle times the number of vehicles per household for the project area.
- One panelist recommended that agencies use I-PLACE3S, a software tool for analyzing land use and transportation data at a parcel-level scale. I-PLACE3S is used for scenario planning, whereby several land use options are considered and evaluated against quantifiable criteria. The I-PLACE3S model was used by the Sacramento Area Council of Governments (SACOG) in developing the land use allocations for its Metropolitan Transportation Plan 2035.⁸
- One participant suggested an activity based modeling approach. Such an approach entails surveying a statistically significant sample of the population in the project area and using the resulting activity data to forecast each individual's travel behavior and energy consumption with and without the project.

⁶ US EPA. Modeling and Inventories. *MOVES (Motor Vehicle Emission Simulator)*. Retrieved on November 14, 2008 from <http://www.epa.gov/OMS/ngm.htm>.

⁷ CNT website: <http://www.cnt.org/>

⁸ Sacramento Area Council of Governments. *I-PLACE3S*. Retrieved on November 14, 2008 from <http://www.sacog.org/services/I-PLACE3S/>.

Panelists noted that modeling limitations might make measuring energy use a challenge in the short term and that it may be more realistic as a long term goal.

Several panelists noted that VMT does not necessarily serve as a good indicator for energy use in areas with an existing high transit mode share because the energy use by the transportation sector is not likely to change markedly with additional transit capacity. For example, in New York City, additional transit investments would not induce a modal shift to the same degree as in areas with little transit service. In response, several panelists recommended using a density or land use threshold that does not use VMT change. Another panelist suggested that a scenario analysis--a process of analyzing possible future events by considering alternative possible outcomes--could be run to predict where individuals and businesses would locate in the absence of the new transit project.

Additional concerns and questions raised by panelists in regard to the energy use measure include:

- For a passenger trip that uses both an existing transit line and the new line, what percent of the energy savings should be attributed to the new line?
- How should transit agencies quantify the energy consumed when different energy types are involved? Because there are many different energy sources (electric, compressed natural gas, diesel, coal, etc.) used to fuel both vehicles and power plants, it may be difficult to quantify the value of the change in energy consumption between a baseline and a proposed transit project.
- How to measure a project's impact on regional energy use when a transit agency is one of a dozen agencies operating in the region.
- Whether to normalize energy use by passenger mile or by revenue mile. Normalizing by passenger mile inherently makes commuter rail projects look more attractive because they tend to be longer projects.
- Whether the energy use measure should focus solely on operating energy use or whether it should also include the energy consumed during construction. One panelist noted that for transit projects that require intensive energy use during construction, such as projects involving tunnels, it may take decades to recover the energy expended during construction through energy-efficient operations.
- One panelist argued that the energy use criteria take into account a project's fuel source because energy consumed from non-renewable fuel sources has different environmental impacts than energy consumed from renewable fuel sources.

Finally, a number of panelists noted that any GHG indicator used as part of the New Starts criteria should be synergistic with any reporting requirements that might accompany future climate-related legislation. For example, if legislation requires that specific data be collected or a specific methodology be used to calculate GHG emissions, the New Starts criteria should mirror those requirements. Similarly, several panelists mentioned that the American Public Transportation Association (APTA) Climate Change Standards Working Group is currently developing guidance on a standard methodology for transit agencies to use to quantify their GHG emissions, including both emissions generated by transit and the potential reduction of emissions through mode shifts to transit decreased vehicular congestion, resulting in freer-flowing conditions and more compact land use, which encourages non-motorized and transit trips. The

methodology would ensure that transit agencies are able to gain credit for emission reductions and for carbon avoidance (i.e. lower emissions due to dense transit-dependent land use). This information would be recorded with the various climate exchange registries and eventually would be utilized to sell credits or offsets in a carbon market.

Air Quality Measure

Surface transportation generates global, regional, and local air pollution, including emissions of CO, NO_x, PM of various dimensions, VOC, and GHG, including CO₂, water vapor (H₂O), methane (CH₄), and nitrous oxide (N₂O). Transit projects can reduce growth in air pollutants and GHG emissions by facilitating a mode shift to public transportation from private automobiles. Travel by public transportation generally produces fewer emissions per trip per person than travel by private vehicle. Panelists agreed that a transit project's contribution to reducing air pollutant and GHG emissions is an appropriate environmental benefit to measure as part of the New Starts project justification criteria.

In discussing the use of emissions as a potential environmental benefit measure, panelists noted the possibility that, in the future, states, MPOs, and other regional bodies may need to set goals for reducing GHG emissions from the transportation sector. Panelists highlighted recent efforts by states to reduce GHG emissions, including the Regional Greenhouse Gas Initiative (RGGI), California's Global Warming Solutions Act of 2006, and the recently passed California SB 375, which ties transportation funding with carbon reduction strategies.

Proposed Metrics

Panelists suggested several metrics or indicators to measure the air quality impacts of a proposed New Starts project. These would be based on the incremental difference in emissions between a baseline and the proposed transit project. Proposed metrics include:

Direct Measure of Air Quality:

- Emissions of NO_x, VOC, and PM emitted per mile per passenger (or normalized by cost);
- CO₂ emissions per mile per passenger (or normalized by cost). Panelists noted that CO₂ accounts for 95 percent of transportation GHG emissions; and,
- Reduction of criteria pollutant area wide and locally in non-attainment areas.

Proxy Measures for Air Quality:

- Change in VMT in project area;
- Impact of a transit project on air pollution hot spots, a location where emissions from specific sources may expose the adjacent population to elevated risks of adverse health effects; and,
- How well a project supports a regional air quality attainment plan.

Considerations

The panelists identified a number of issues related to the air quality measures. Many air quality models, which are based on travel forecasting models, are scaled to the regional level. A number of panelists noted that the change in emissions associated with one transit project is relatively small when it is analyzed on a regional scale; it is generally smaller than the error in the models. Therefore, it is difficult to quantify the air quality benefits of a specific project and relate those benefits to the performance of the project. However, another panelist noted that emission modeling is moving toward producing improved project-level impact analysis. This panelist noted that EPA's forthcoming MOVES model allows multi-scale analysis from a fine-scale analysis to national inventory estimation. In addition, the MOVES model will be more accurate than current models and will provide more robust emission data, including CO₂ levels.

One panelist noted that concerns regarding particular pollutants vary from location to location throughout the country; and, therefore, the air quality measure should take into account the context of the project location. This panelist noted that if the air quality measure is tied solely to emission quantities, it ignores the variation in the severity of air quality problems in different regions. For example, two projects that result in identical emission reductions may have very different health impacts if the two project areas have very different annual numbers of days exceeding the EPA air quality standard and the size of the exposed population in each area differs. To address this issue, another panelist suggested that the air quality measure focus on environmental services; i.e., the beneficial outcome of the function. For air quality, one environmental service is human health. Under this system, a project's environmental benefit rating would not be based solely on emission quantities but rather would be based on how its emission levels impact the health of the project area population.

Similarly, one panelist pointed out that transit projects in markets with an existing high transit usage will not typically result in significant emissions reductions. The objective of such projects is to relieve transit congestion in order to maintain ridership levels and avoid mode shift to automobile.

Finally, one panelist noted the limitations of current air pollution hot spot⁹ monitoring. This panelist noted that many air pollution monitors are not located near highways and, therefore, do not capture localized increases in air pollution associated with vehicle emissions. The panelist noted that if the monitor is not accurately capturing air pollution associated with vehicle travel, then analysis of the proposed transit project might not capture a decrease in pollution in the hot spot.

Land Use Measure

Transit supportive land use plans and policies that promote compact development patterns have a number of environmental benefits, including a decreased reliance on private vehicles and a reduction in the rate of suburbanization of natural and agricultural areas on the fringe of

⁹ A hot spot is a very localized exceedance of an air quality standard. A project that reduces emissions region wide may, nevertheless, concentrate vehicular activity at a single location where a hot spot occurs.

metropolitan areas. Panelists proposed that the environmental benefits stemming from the secondary impacts of transit projects be included in the New Starts criteria. One such benefit highlighted by panelists is transit's role in inducing infill development (development on unused and underutilized lands within existing urban areas). Infill development is energy efficient because it uses existing infrastructure, such as sewer systems and utilities, and leaves open space at the edge of urban areas undeveloped. As one participant noted, "Where you avoid building is just as important as where you do build." In addition, one panelist noted that the land use measure should take into account impacts on wildlife habitat connectivity and water quality.

Proposed Metrics

Panelists recommended that the environmental benefits rating take into account a project's existing transit supportive land use, as well as the land use changes resulting from the proposed New Starts project. Suggested approaches included both qualitative and quantitative metrics. Proposed metrics include:

- Percentage of project located in an area for which the VMT is lower than the average annual regional VMT. This measure serves as an indirect indicator for the level of infill development. Infill development is the process of developing vacant or under-used parcels within existing urban areas that are already largely developed rather than developing along the fringe of an urban area;
- The percent or portion of the project that is located within an existing right-of-way;
- The pedestrian/bicycle friendliness of the area. Projects located in areas that are easily accessible to pedestrians and bicyclists maximize transit use. The pedestrian shed could be defined as an area within one-half mile of a bus or transit stop, while the bicycle shed could be defined as within one-and-one-half miles from a stop. Panelists recommended the following metrics to measure pedestrian/bicycle friendliness:
 - *Sidewalk amenities*: elements that contribute to the attractiveness or convenience of sidewalks, including benches, lighting, street pedestrian crossings, planters and trees;
 - *Street connectivity*: a system of streets with multiple routes and connections serving the same origins and destinations;
- Change in the percentage of impervious surface in the project area from which stormwater runoff degrades the water quality of receiving waters;
- Mix of shopping, residential, and work locations in proximity to transit stations. Projects located in mixed land use areas generally have high transit use and less VMT;
- Station area population density in a base year or current project planning year, as well as in a forecast year. Projects located in high density areas tend to have high transit use and less VMT. Considering a base year instead of a distant forecast year eliminates the need for projecting changes in land use, which can be speculative;
- Station area employment density in the base year or on opening day and in the forecast year. Transit services with a high density of trip generations and destinations generally have high transit use and less VMT;
- Floor to area ratio (i.e., density level): the ratio of the total floor area of buildings in an area to the size of the land in that area, as an indicator of development density. Transit projects in densely developed areas generally produce high transit use and less VMT;

- Opening day ridership;
- Area parking supply and policies that support the goals of transit-oriented development; and,
- Attributes outlined in the U.S. Green Building Council's Leadership in Environmental and Energy Design (LEED) for Neighborhood Development Rating System.¹⁰

Panelists acknowledged overlap between the environmental benefits measure and the existing land use measure. Because some of the proposed land use measures are already collected as part of the existing land use criteria, panelist suggested that data collected for the land use criteria could be analyzed with a new perspective focused on environmental benefits. One panelist suggested that in the short term the land use and environmental benefit measures could be combined.

Considerations

Similar to the modeling limitations associated with energy use, current transportation models are limited in their ability to accurately account for transportation impacts of land use changes. In particular, panelists questioned the ability of models to accurately capture non-motorized trips. For example, Portland, Oregon, used a model to evaluate the land use impacts of transportation policies and investments. The model demonstrated how various neighborhood indicators, such as street connectivity and density, affect VMT. However, one panelist noted that the Portland model does not model changes in pedestrian friendliness. Instead, the modelers developed a pedestrian sensitivity factor. If a similar model was to be used on a national scale, FTA would need to develop standards for the pedestrian sensitivity.

Another issue raised is that many New Starts projects, particularly commuter rail projects, serve both urban and rural areas. As a result, the pedestrian and bicycle friendliness, as well as population and employment density, vary substantially from one station to the next. A measure of the environmental benefits of land use impacts would need to take this variability within a project into account.

Finally, one panelist noted that environmental benefits derived from land use are not necessarily the result of a particular transit project. In addition, in many parts of the country regional land use planning is not the norm, and transit agencies do not have control over local land use policies; instead, such policies are typically the responsibility of local government. In response, several panelists pointed out that local land use decisions by private and public entities are influenced a great deal by the characteristics of local transit projects and that this linkage is strongly supported in both practical and academic research. One individual noted that, since the tools for examining shifting land use patterns with and without certain transit projects are readily available, it is imprudent to exclude these important indirect and induced environmental impacts from the environmental benefit analysis. Conversely, another panelist noted that it is very difficult to accurately forecast changes in land use, regardless of whether they are attributable to transit.

¹⁰ LEED is a third-party certification program and nationally accepted benchmark for the design, construction and operation of high performance green buildings. The LEED for Neighborhood Development integrates the principles of smart growth, urbanism and green building. More information is available at <http://www.usgbc.org/DisplayPage.aspx?CMSPageID=148>

Physical Activity Measure

Panelists recommended that transit-based physical activity be used as a potential measure of the environmental benefits of transit. In a recent evidence-based review conducted by the U.S. Department of Health and Human Services (USDHHS), *2008 Physical Activity Guidelines for Americans (Guidelines)*, a panel of experts found that physically active people have lower all-cause mortality rates, higher levels of functional health, and lower medical expenditures.¹¹ According to the report, substantial health benefits occur with at least 150 minutes a week of moderate-intensity aerobic physical activity that should be performed in episodes of at least 10 minutes spread throughout the week. The *Guidelines* also found that low levels of activity are clearly preferable to an inactive lifestyle and suggest that 30 minutes of physical activity at least one to three times a week to be significant for lowering risk.

Public transportation can play a role in increasing physical activity because many transit trips begin and end with individuals walking or bicycling to transit stations or bus stops. Research has shown that individuals who use transit spend a median of 19 minutes daily walking to and from transit.¹² Panelists noted that transit has additional impacts on physical activity by inducing compact land development that enables walk- or bicycle-only trips. However, transit projects with large park-and-ride lots that rely heavily on auto access do not provide these benefits.

Proposed Metrics

Panelists provided a number of suggestions on metrics to measure the proportional increase in physical activity from proposed New Starts projects. Proposed metrics include:

Direct Measures of Physical Activity:

- Percentage of the area's population who meet the recommended amount of weekly physical activity;
- Change in the number of bicycle and pedestrian trips; and
- Mode shift from private vehicle to walking, bicycling, and transit.

Proxy Measures for Physical Activity:

- Pedestrian and bicycle accessibility to the stations, including quality of access. Panelists recommended the following metrics to measure pedestrian/bicycle friendliness:
 - Number of transit/bus stations and/or frequency of stops along a line as an indicator of transit accessibility;
 - Existing bicycle and pedestrian plans, including bicycle parking availability;
 - Area parking supply and policies because the availability and cost of parking shapes travel behavior;

¹¹ U.S. Department of Health and Human Services. *2008 Physical Activity Guidelines for Americans*.

¹² Besser, L and A. Dannenberg. 2005. *Walking to Public Transit: Steps to Help Meet Physical Activity Recommendations*.

- Station area density because high density increases travel by walking and bicycling;
- Mix of shopping, residential, and work locations in proximity to transit stations and bus stops because high density, mixed use land areas promote travel by walking and bicycling; and
- Number of pedestrian or bicyclists injured per mile traveled to indicate safety of non-motorized travel.

Considerations

Panelists noted that the physical activity measure is closely tied to the land use measure. As such, the modeling limitations highlighted in the land use section, especially the limitations of current models to accurately capture walk- and bike-only trips, also pertain to the physical activity measures. In addition, one panelist observed that the distance individuals are willing to walk or bike is a function of distance and quality of the access route and the transit service. The panelist suggested that the distance most people are willing to walk or bike to transit stations can be measured using geographic information systems (GIS) or self-reported surveys. The quality of the access route or service is more difficult to measure and may require the use of a standardized environmental audit.

Panelists noted several potential data sources for the transit-based physical activity (leisure time physical activity or walking or biking for transportation). Potential sources include the U.S. Census, the National Health Interview Survey, the National Health and Nutrition Examination Survey, and the Behavioral Risk Factor Surveillance System.

Additional Discussion Points

Baseline Comparison

For the other New Starts project justification criteria used in the New Starts evaluation, the baseline typically represents the best that can be done to improve transit service in a corridor without major capital investment in new infrastructure known as the transportation system management (TSM) baseline. During the Colloquium, panelists raised alternative definitions for a baseline to use in measuring the environmental benefits of transit projects. Suggested baseline alternatives included existing conditions, future no-build conditions (in many cases continuation of auto-oriented land use and mode shares driven by continued highway development to meet demand), or continuing to use the TSM baseline that is used in evaluating other statutory New Starts criteria.

Scale of Measures

Several panelists suggested that the New Starts environmental benefits rating should be based on the performance of the transit system instead of the one proposed project. Many of the measures identified by panelists, such as air emissions and land density, are not significantly affected by a single project. In such cases, the regional transit system may be a more reasonable basis for evaluation. In addition, one panelist noted that it is counterproductive to promote one project if it operates within a dysfunctional system that is not reaching its overall goals. It was also suggested that transit agencies that implement Environmental Management Systems (EMS) receive credit for their commitment in promoting environmental stewardship. EMS is a set of procedures to

ensure that an organization's daily operations comply with environmental regulations and support environmental objectives such as energy conservation, efficient water use, vehicle emission reduction, and management of hazardous materials.

Adverse Environmental Impacts

Panelists discussed whether the New Starts environmental benefits project justification criteria should include a project's adverse environmental impacts (i.e. disbenefits). Participants noted that environmental impacts are highlighted and evaluated during the NEPA process. Since the New Starts evaluation process begins before the NEPA review is completed, it would be difficult to incorporate information on a project's adverse impacts into the New Starts rating process. In addition, one panelist noted that including adverse impacts within the environmental benefits rating could bias New Starts funding towards one part of the country. For example, projects in the northwest region nearly always affect wetlands because of the region's geology. As a result, projects located in this region may have more inherent environmental impacts than other regions. However, one panelist stated that instead of excluding consideration of adverse environmental impacts due to regional inconsistencies, the environmental benefits measure should be used to illuminate the variation in adverse impacts from different types and locations of transit projects.

Cost Effectiveness Rating

In addition to discussing new measures of the environmental benefits of transit projects, the group also briefly discussed the role that the existing cost effectiveness measure plays in the environmental benefits of transit projects. The current cost effectiveness measure creates a disincentive for transit agencies to include environmental mitigation measures in their proposed projects because doing so typically increases the total cost of the project, thereby decreasing the project's overall cost effectiveness rating. For example, an agency may choose a fuel source that is more polluting but less costly in order to stay under a certain cost effectiveness threshold. Some panelists suggested that the cost effectiveness measure not include costs associated with environmental mitigation. However, one panelist noted that including environmental mitigation costs within the cost effectiveness rating may encourage agencies to avoid adverse environmental impacts. By removing those costs, agencies may be more willing to adversely impact environmental resources and use mitigation, which is always imperfect, rather than avoiding the impacts outright.

One panelist suggested a "triple bottom line" accounting approach as a more appropriate method for evaluating the cost effectiveness of proposed transit projects. The "triple bottom line" method considers social and environmental performance in addition to financial results. This panelist noted that the triple bottom line approach would enhance the overall consideration of the social and environmental benefits and costs of projects.

Proposed Methodologies

Participants discussed methodologies for evaluating the environmental benefits of transit projects. Possible methods identified include:

- A warrants approach;
- Indexing;
- A checklist; and
- A “Making the Case” document.

The discussion of each of the four methods is summarized below.

Warrants Approach

FTA currently uses a warrants approach to evaluate project criteria in its Very Small Starts Program¹³. A warrants-based approach uses minimum performance standards and criteria that must be met to warrant a medium rating. In order to receive a medium rating, a Very Small Starts project must meet specific thresholds for cost, ridership, system characteristics, and performance. For the New Starts environmental benefits measure, a warrant approach could outline certain minimum criteria or performance characteristics that a project must meet to achieve a medium rating. Similar to this approach, one panelist suggested a tiered analysis that also requires that minimum criteria or benchmarks be established but differs in that, if a project does not meet the minimum criteria, it would have an opportunity to demonstrate its environmental benefits through other means.

Several panelists with experience working with the New Starts Program agreed that exploring a warrants-based approach would be a worthwhile effort. Such an approach would provide transit agencies with a clear understanding of what project elements are necessary to achieve a medium environmental benefits rating and would reduce the workload for both the sponsor and FTA. However, another panelist pointed out that such an approach could result in many or all projects receiving a medium rating.

Panelists gave examples of criteria that could be used for this approach. For example, a number of panelists observed that projects within an area that meets a minimum population or employment density should automatically receive a high environmental benefits rating because transit investments in such areas would contribute to maintaining the existing energy-efficient density. Projects that fall outside the development density threshold would be required to provide additional data for evaluation of their environmental performance.

¹³ Project category within the Section 5309 Capital Investment Grant program for simple, low-risk projects that qualify for a highly simplified project evaluation and rating process by FTA.

Indexing Approach

A number of panelists proposed an indexing approach to measure the environmental benefits of transit. These panelists highlighted two examples of programs using this approach: 1) the U.S. Army Corps of Engineers (USACE) used an indexing approach in developing wetland indicators to guide national and regional wetland mitigation programs; and 2) the Texas Transportation Institute (TTI) used an indexing approach in its work with the Texas Department of Transportation (TxDOT) to develop a performance-measurement-based methodology for addressing environmental and sustainability concerns.

The concept of an index can be appealing as it provides a single number that is based on a set of criteria or factors that one wishes to examine. The first step is to develop a set of measures that serve as the evaluation criteria. Next, a scale is developed to express the value of the quantified measure. For example, a scale of 1-5 is developed to demonstrate the magnitude and/or certainty of the measure. Next, weights are assigned to reflect the relative importance of each measure. Finally, the scaled measures are aggregated according to their respective weights to calculate a final index. An indexing approach is useful for both quantitative and qualitative measures, as well as ones for which data cannot be easily obtained. For example, for each measure identified in the first step, general information can be used to determine whether a project has a positive, neutral, or negative environmental impact based on the more general information.

One panelist noted that multi-attribute scoring is helpful but also presents a challenge in deciding the weight to assign to each measure. The panelist noted that FTA would have a difficult time developing a system that worked for all constituents and that such a system leaves room for political input. Another panelist suggested that FTA could appoint a working group that included industry representatives to develop the weighting system. While an indexing approach would not place a large burden on New Starts applicants, it would require FTA to organize a consistent group of individuals responsible for evaluating and rating all projects.

Checklist Approach

A checklist approach to evaluating the environmental benefits of proposed transit projects would involve developing a list of attributes that an environmentally beneficial transit project would contain. A project would receive an environmental benefit rating based on the number of attributes attained, which could include both quantitative and qualitative features. For example, out of a list of 100 attributes, a medium-high rating may require 80 attributes; a medium rating may require 60 attributes and so on. The U.S. Green Building Council's LEED rating system and California's Environmental Quality Act (CEQA) checkbox system currently use checklists for evaluation.

Supporters of the checklist approach felt that it provided a simplified way for transit agencies to provide data throughout the course of the New Starts application process. However, a number of panel members expressed concern with using a checklist approach to evaluate the environmental benefits of transit projects. One panelist cautioned that agencies may do the bare minimum in order to "check a box." In such a system, it would be difficult to determine if the agency was meeting the intent of the criteria or just merely trying to do the minimum necessary to check a box. Another panelist noted that if a checklist method were selected, it would be important to be rigorous in how the attributes are defined.

“Making the Case” Document Approach

Beginning several years ago, FTA required all applicants to the New Starts program to submit a “Making the Case” document. The purpose of the document is for project sponsors to present a compelling narrative based on quantitative data on how the proposed investment would meet the goals and specific needs of an area. In addition, it provides project sponsors with the opportunity to provide information on the “other factors” that make a project worthy of funding that may not be captured within the existing evaluation criteria.

A few panelists suggested that adding an environmental benefits section to the existing “Making the Case” document could provide a means for FTA to evaluate the environmental benefits of transit projects in the short term before the measures and data are finalized. These panelists noted that this system would be much less labor intensive for transit agencies compared with other rating systems and could greatly simplify the evaluation process.

A number of panelists expressed concern in taking this approach to evaluating the environmental benefits of transit projects. The critics noted that such a document is highly subjective. Without clear expectations of what is to be included in the document, it often turns into a public relations piece that does not provide any substantive information for project evaluation.

Next Steps

During the Colloquium, participants generated many ideas, including identifying possible metrics to measure the environmental benefits of transit, as well as possible methods for evaluating those benefits. This initial discussion is part of a larger effort that is needed to fully assess the best methods for FTA to use to measure and evaluate the environmental benefits of proposed New Starts projects. The following are possible next steps FTA could take in both the short and long term in order to develop methods and measures for evaluating the environmental benefits of transit projects.

Short Term (6 to 18 months)

- Review existing literature regarding the use of environmental indicators to inform the development of the environmental benefits measure. Existing models to review include:
 - The Centre for Sustainable Transportation's work on Sustainable Transportation Performance Indicators¹⁴;
 - U.S. Army Corps of Engineers development of wetland indicators to guide national and regional wetland mitigation programs;
 - Texas Transportation Institute's performance-measurement based methodology for addressing environmental and sustainability concerns; and
 - Leadership in Environmental and Energy Design (LEED) for Neighborhood Development Rating System.
- Identify state-of-the-art models being used by transportation agencies that produce information regarding the environmental benefits of transit projects.
- Identify initial measures and a baseline alternative against which to measure environmental benefits for further discussion and development. Convene a workshop that uses case studies to evaluate how the initial measures and baseline alternative could be applied to New Starts projects. The purpose of the workshop would be to further refine the measures and identify any limitations, including data availability and technical capacity of New Starts applicants.
- Support the Transportation Research Board with the 2009 Transit Cooperative Research Program topic on developing a Methodology for Comparing the Environmental Benefits of Transit Projects.

Long Term (18 months to 5 years)

- Fund research and model development work to advance the state of the practice of producing reliable data regarding the environmental impacts of proposed transit projects.

¹⁴ The Centre for Sustainable Transportation (December 2002). *Sustainable Transportation Performance Indicators*. Available at <http://cst.uwinnipeg.ca/documents/STPI%20Phase%203%20report.pdf>.

To accurately capture the full range of environmental benefits, models should calculate changes in energy use and VMT, as well as capture non-motorized trips.

- Fund the development of trip surveys in selected regions to test whether the approach can be used to inform regional models.
- Target selected projects in the New Starts pipeline as example projects to test the proposed methodology and metrics to determine effectiveness of proposed metrics and methodologies with comparing the environmental benefits of New Starts projects.
- Establish data collection procedures to evaluate the environmental impacts of projects that receive New Starts funding. Collected data can be used as inputs into travel models.

Appendix A: Agenda

Day 1: Tuesday, October 28

- 12:00** **Arrival and working lunch for panelists and invited guests**
- 12:10** **Welcome and Introductions (FTA)**
- 12:30** **Overview (Volpe Center)**
- a. Objectives for this Colloquium
 - b. Colloquium agenda
- 12:40** **Background and Environmental Measures Considered (FTA)**
- a. New Starts project evaluation process
 - b. Statutory language on transit environmental benefits
 - c. Measures or indicators of transit environmental benefits used in the past
 - d. Additional measures and indicators that have been considered
 - e. Review of current projects
 - f. Review of FTA's preferences for criteria
 - g. Questions and answers
- Break (2:00)**
- 2:15** **Participant Discussion**
- What are possible alternative definitions or approaches to environmental benefits that could be most useful for FTA and the New Starts Applicants?
- Individual thoughts (5-10 minutes each)
- 3:30** Discuss pros and cons of the identified approaches
- What are the similarities and contrasts?
 - Do the approaches fit the criteria? Data needed?
 - Any hybrid approach after this discussion?
- 4:30** Identify initial metrics for further discussion
- 5:00** **Wrap up (Volpe Center)**
- Set tomorrow's objectives

Day 2: Wednesday, October 29

8:00 **Arrival, coffee and pastries for all attendees**

8:30 **Review of today's objectives, agenda (Volpe Center)**

8:40 **Further discussion of potential metrics (Participants)**

Based on the discussion so far what issues and challenges remain with the measurements such as:

- a. Data limitations
- b. Computational complexity/simplicity of various approaches
- c. Scaling for project size
- d. Organizational issues and technical capacity of New Starts applicants and their state and local partners
- e. Appropriate size of area of project influence or value
- f. If FTA adopted these measures, what further work would need to be accomplished to implement them into the New Starts Program?

10:00 **Break**

10:15 **Continued discussion of potential metrics**

11:40 **Lunch**

1:00 **Identification of short term and long term metrics (Participants and FTA)**

- a. Metrics applicable for FY2011 New Starts guidance
- b. Identify specific research needed

2:45 **Break**

3:00 **Wrap-up (FTA)**

- a. DOT Recap of what we have heard
- b. Next steps (including development of Colloquium white paper)
- c. Follow-up teleconference discussions

4:00 **Adjourn**

Appendix B: Panelist Biographies

Dennis King is a Research Professor at the University of Maryland, Center for Environmental Science, and Research Director at King and Associates, Inc., an environmental economics consulting firm. He has over 30 years of research and consulting experience in matters related to transportation and land use changes, environmental valuation, comparisons of costs/risks/benefits of ecosystem restoration alternatives, and the "scoring" of environmental trades and environmental offset and mitigation projects. Dr. King is the author of over 100 reports, papers, and book chapters dealing mostly with assessments of ecological/economic linkages related to economic, business, and trade policy decisions and has been a project manager on over 50 interdisciplinary science/policy research projects dealing with complex scientific/engineering/economic issues. He developed and pioneered practical applications of widely used ecosystem valuation methods and economic tools to assess and compare environmental restoration and mitigation projects, invasive species problems, and coastal fishing-oil industry conflicts and developed "scoring" methods to compare environmentally beneficial uses of dredged material and to facilitate market-based solutions to problems related to wetlands, greenhouse gases, and water quality.

Judy Kruger, Ph.D., is an epidemiologist in the Physical Activity and Health Branch, Division of Nutrition, Physical Activity, and Obesity, Centers for Disease Control and Prevention, in Atlanta. She is a co-investigator on two projects involving tracking and evaluating trail, open space, and park physical activity legislative policies. Ms Kruger's research focus is on surveillance of physical activity behavior, environmental influences of physical activity, health behavior and chronic disease prevention, and dissemination of evidence-based research. She is an advisory committee member to the Environmental Protection Agency's National Recognition Program to promote smart growth and active aging and on the advisory group for the Atlanta Regional Commission's Fifty Forward Demography and Diversity. She earned her Ph.D. in Public Health and her Master's degree in Exercise Sciences from the University of Illinois at Chicago and a Bachelor's degree in Health Sciences from the University of Waterloo, Canada.

David L. Mieger is the Deputy Executive Officer for Westside Planning at the Los Angeles County Metropolitan Transportation Authority (Metro). He is presently serving as Project Manager for the Westside Extension of the Metro Red Line/Metro Purple Line subway project and supervises a staff of nine planners. He coordinates Metro capital planning projects in the Westside of Los Angeles County; including the cities of Los Angeles (Hollywood and West Los Angeles), Beverly Hills, Culver City, Malibu, Santa Monica, and West Hollywood. Among his responsibilities are the management of major transit capital projects from inception through preliminary engineering and environmental clearance. These studies are generally undertaken by a multi-disciplinary team of Metro staff and consultants in coordination with responsible public agencies and elected bodies.

Anthony Perl is a Professor of Urban Studies and Political Science and Director of the Urban Studies Program at Simon Fraser University. Prior to his current position, Dr. Perl worked at the City University of New York, the University of Calgary, and the Universite Lumiere in Lyon, France. His research crosses disciplinary and national boundaries to explore the policy decisions that affect transportation system performance. He has advised governments in Australia, Belgium, Canada, France, and the United States on transportation and environmental research and policy development. Dr. Perl currently chairs the committee on Intercity Rail Passenger Systems of the U.S. Transportation Research Board, is Vice-Chair of Canada's Centre for Sustainable Transportation, and is the Director of VIA Rail Canada. He received an undergraduate honors

degree in Government from Harvard University and an M.A. specializing in Public Administration and a Ph.D. in Political Science from the University of Toronto.

Naomi Renek is Assistant Director of Grant Management at the New York State Metropolitan Transportation Authority (MTA). Ms. Renek has eight years of experience with FTA's New Starts process and was responsible for preparing the New Starts submissions for MTA's Second Avenue Subway and East Side Access projects, both of which recently received Full Funding Grant Agreements. She works closely with staff throughout the MTA to ensure compliance with Federal regulations and to review environmental documents for projects seeking formula funds. Ms. Renek also helps develop formal comments on proposed rules, guidance, and circulars that affect the MTA. Prior to her current position at MTA Headquarters, Ms. Renek worked at MTA New York City Transit in the Operations Planning unit where her responsibilities included managing the development and review of the Second Avenue Subway environmental impact statement and conducting analyses on long-term subway service changes. She is active with the American Public Transit Association's Policy and Planning Committee and holds an M.A. in Public Administration from New York University and a B.A. in Political Science from the University of California at Los Angeles.

Michael Replogle manages Environmental Defense's initiatives to link transportation, land use, and natural resource plans and programs to enhance public health, equity, and environmental quality. He is an expert on Federal transportation law and policy, transportation impact analysis, and strategies to reduce traffic and pollution through incentives, smart growth, marketing, and improved accountability. Mr. Replogle works with Federal and state agencies, Congress, local officials, business, and activists to promote reform. He has worked extensively in metropolitan Washington/Baltimore, New York, Atlanta, Denver, Portland, and other regions. His work in Atlanta helped redirect \$300 million from sprawl-inducing roads to transit and safety projects. Mr. Replogle received a Master's degree in Civil and Urban Engineering and a Bachelor's degree in Civil and Urban Engineering and Sociology, all from the University of Pennsylvania.

Anne Richman is a Senior Planner/Policy Analyst with the San Francisco Metropolitan Transportation Commission, the Metropolitan Planning Organization for the nine-county San Francisco Bay Area. Ms. Richman has over 15 years of experience in transportation and environmental policy. Currently, she is responsible for planning and fund programming for transit capital activities in the region, covering a wide variety of transit expansion, maintenance, and related land-use projects. Ms. Richman works extensively with local, state, and Federal agencies on advocacy and funding strategies to implement transit projects, including the region's two New Starts projects. Her prior experience includes work for a major urban transit system, as well as work with the U.S. Department of Transportation, the airline industry, and consulting on environmental compliance and policy issues. She holds a Bachelors degree from the University of California, Berkeley, and a Masters in Public Policy from Harvard's Kennedy School of Government.

Elena Safirova is a fellow at Resources for the Future. In her current research, she focuses on economic modeling and policy analysis related to transportation and urban land use. In particular, Dr. Safirova is analyzing transportation policy alternatives with respect to outcomes for transportation demand, location decisions, urban sprawl, and interaction with other policies, as well as the effects on economic welfare and environmental quality. She also is interested in the impacts of technological change on urban spatial structure, labor markets, industrial organization, and the environment. Dr. Safirova received a Ph.D. in Economics from the State University of New York at Buffalo and a B.A. in Economics from the Moscow State University.

Steve Winkelman is the Director of the Transportation and Adaptation Programs with the Center for Clean Air Policy (CCAP). Mr. Winkelman has more than 15 years of experience in the transportation, energy and environmental fields. He is a co-author of the book, [*Growing Cooler: The Evidence on Urban Development and Climate Change*](#), published in 2008 by the Urban Land Institute. Mr. Winkelman directs CCAP's VMT and Climate Policy Dialogue, which engages top decision makers and leading experts on integrating transportation and climate change policies. He has successfully focused the attention of key policy makers on the importance of slowing growth in VMT for reducing transportation sector GHG emissions and has testified to two Congressional committees on the subject. Mr. Winkelman developed the CCAP Transportation Emissions Guidebook with tools for quantifying greenhouse gas savings from 40 transportation policies and measures, including feebates, biofuels, smart growth, pricing strategies, and intermodal freight. He is an active member of the National Academy of Sciences' Transportation Research Board Sustainability Committee. Mr. Winkelman holds a B.S. in Physics from the University of Michigan and an M.A. in Public Policy from the University of Minnesota.

Joe Zietsman is the Director of the Center for Air Quality Studies at the Texas Transportation Institute (TTI). He has 20 years of professional experience in the field of transportation engineering. Since joining TTI in the spring of 1998, Dr. Zietsman has been principal investigator of several research projects covering the areas of air quality, sustainable transportation, performance measurement, and transportation planning. Prior to joining TTI in 1998, he was the manager of transportation planning for a large metropolitan area in South Africa. Dr. Zietsman is an active member of the Transportation Research Board where he chairs a subcommittee and serves as a member of the Performance Measurement and the Sustainable Transportation committees. He received a Ph.D. in Civil Engineering from Texas A&M University and a Master's degree in Transportation Engineering and a Bachelor's degree in Construction Project Management and Civil Engineering from the University of Pretoria, South Africa.

Appendix C: Additional Colloquium Attendees

C1: PRESENTERS AND DISCUSSANTS

- Carl Bausch, Office of Planning and Environment, Federal Transit Administration
- Susan Borinsky, Associate Administrator for Planning & Environment, Federal Transit Administration
- Joe Ossi, Office of Planning and Environment, Federal Transit Administration
- Robert Padgette, American Public Transportation Association
- Dwayne Weeks, Office of Planning and Environment, Federal Transit Administration
- Elizabeth Zelasko, Office of Planning and Environment, Federal Transit Administration

C2: FACILITATOR AND RECORDERS

- Jeff Bryan, Volpe National Transportation Systems Center
- Gina Filosa, Cambridge Systematics
- Julianne Siegel, Volpe National Transportation Systems Center

C3: OBSERVERS

- Julie Atkins, Office of Planning and Environment, Federal Transit Administration
- Jim Barr, Office of Planning and Environment, Federal Transit Administration
- Kyle Browning, Government Accountability Office
- Steve Lewis-Workman, Office of Planning and Environment, Federal Transit Administration
- Katherine Mattice, Office of Program Management, Federal Transit Administration
- Camille Mittelholtz, Office of the Secretary, U.S. Department of Transportation
- David Ory, Office of Planning and Environment, Federal Transit Administration
- Chris VanWyk, Office of Chief Counsel, Federal Transit Administration

C4: ADDITIONAL INVITEES

- House Transportation and Infrastructure staff
- Senate Banking Committee staff
- Office of Management and Budget