Development of Evaluation Measures for Major Capital Projects

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Evaluation measures can play an integral role in the *GO TO 2040* planning process, providing a basis for assessing the relative merits of alternative transportation capital investments to support the region's vision for its future development. As a first step in identifying measures and the process that CMAP can apply in long-range regional planning, the Volpe Center has reviewed the project evaluation practices of selected Metropolitan Planning Organizations (MPOs) and other transportation agencies across the United States. The review is summarized in this paper, and will be followed later by draft measures and methods that CMAP can apply in evaluating potential capital projects. Additionally, we have included here initial thoughts about how CMAP might use evaluation practices in the context of short-term projects being considered within the Federal Economic Recovery Package. The Volpe Center will work with CMAP to expand upon these initial thoughts to develop a process for reviewing and screening candidate projects for the proposed new federal funding.

Nationwide Scan

The Volpe Center initially conducted a scan of selected national peers to determine the range of practices throughout the country and then to select those with the greatest relevance to the *GOTO 2040* process. The search focused on the development of long-range transportation plans and regional plans, such as growth management plans with a transportation component. The following criteria guided the selection of transportation agencies and planning processes for inclusion in the review:

- MPOs with strong records of accomplishment in long-range planning, as reflected in Federal Certification and peer reviews;
- Major metropolitan areas; and
- Geographic cross-section, including the Midwest.

The Volpe Center considered a total of 17 prospective regional planning/MPO best practice examples. The metropolitan areas ranged from Seattle to Atlanta and included most of the country's regions with major cities, including Detroit, Cleveland, and Minneapolis in the Midwest. The scan also included smaller metropolitan areas – Harrisburg, PA, Albany, NY and Charlotte, NC - based on related positive results of metropolitan planning reviews conducted during Federal planning oversight. Analysis focused on the following types of information:

- Use of defined measures or criteria for comparative evaluation of capital projects, independently or as part of long-range planning scenarios;
- Multi-modal perspective;
- Inclusion of environmental, land use, and community impacts;
- Linkage to long-range transportation and growth plans, i.e., a specific process for assessing relative merit of proposals in relation to plan goals and objectives.

The scope of the review included the overall evaluation strategy as well as identification of specific evaluation measures. This context is important not only to illustrate how the measures are used, but also to show how some of the major issues inherent to plan evaluation have been addressed, such as how to assign priorities to different evaluation criteria and how to address

investments in different modes. For example, some of the best practices rely on scenario-based evaluation, in which scenarios composed of multiple projects are evaluated, rather than individual projects. The specific evaluation measures used in this approach generally can also be applied to individual projects, particularly when the projects are large in scale. In addition, this approach reflects the reality that the cumulative impact of an array of different projects often can be more – or less – than the sum of the component parts. These issues also are explored in the Volpe Center's previous report for CMAP, *Innovative Applications of Transportation Performance Measures by Peer Agencies*, July 2008.

The results of the scan are discussed below and presented in more detail in Appendix A of this memorandum.

The scan also considered large metropolitan transit agencies for possible measures that could be applied to transit or possibly adapted to a multi-modal context: BART (San Francisco), MBTA (Boston), MTA (New York City), SEPTA (Philadelphia), and WMATA (Washington, DC). While all of these agencies have standards that they apply for service evaluation purposes, the scope of their evaluations does not match the long-range regional planning processes conducted by CMAP and the MPOs researched for this study. The transit agencies' evaluation measures generally are of three kinds: 1) operations-based service standards governing ridership, adherence to schedule, reliability (e.g., distance between failures), accessibility, comfort, safety, security, cost-effectiveness; (2) organization-based measures such as financial stability and workforce effectiveness; and (3) in some cases, broadly-defined social goals such as sustainability, but without corresponding performance or evaluation measures.

The evaluation process and measures applied by five MPOs emerged as the best examples of overall effective practice with immediate relevance to the *GOTO 2040* planning effort:

- Baltimore
- Boston
- Los Angeles
- Portland, OR
- San Francisco

The following section presents a review of the evaluation measures and processes applied in these five metropolitan areas and, at CMAP's request, Wisconsin and Missouri.

Baltimore

Development of Baltimore's *Transportation Outlook 2035*, the regional long-range metropolitan transportation plan, included an investment prioritization process for individual transportation projects. The process consisted of two components, each of which included a separate set of criteria and scoring procedure: (1) policy evaluation and (2) technical analysis.

Policy Evaluation

The *Policy Evaluation* component of the evaluation process accounted for 60 percent of the total score for each project. Seven categories of criteria were considered, as follows, each of which includes from two to five component criteria and accounts for 20 points, with a total maximum of 140 points:

- Safety
- Maximize System Operations
- Accessibility
- Environmental Quality
- Improves System Security
- Link Transportation Planning with Land Use and Economic Development
- Foster Inter-jurisdictional Participation and Cooperation

The policies conform to priorities of the Baltimore Metropolitan Council's member jurisdictions. Some criteria within each of the categories are subject to objective, quantitative measurements, e.g., "Improves safety by reducing fatalities and injuries" under the "Safety" category, but most of the criteria are qualitative, e.g.,"Enhance safety by improving intersections," in that staff judgment is the basis for assigning quantitative scores on scales that range from 0 – 2 to 0 – 10 for different criteria. For example, "Improves safety by reducing fatalities and injuries" is scored on a 0 - 5 point scale, as is "Promotes preservation of natural and cultural resources, rural areas and sensitive lands," in the "Environmental Quality" category, whereas "Contributes to short and long term achievement of air quality targets," also in the "Environmental Quality" category, is scored on a 0 – 8 point scale and "Promotes efficient use of energy sources" is scored on a 0 -2 point scale. The differences in scale serve the function of weighting the different criteria within categories. The individual criteria and corresponding point values are shown in Appendix B.

Technical Analysis

The *Technical Analysis* evaluation component, accounting for 40 percent of a project's total score, consists entirely of quantitative measures. Highways, rail transit, and non-motorized transportation projects were each evaluated according to different sets of criteria on a 100-point scale. Highway evaluation measures are divided into seven categories, each of which includes one or two quantitative measures worth points ranging from 0-3 to 1-10 points, as follows:

- Safety (20 points) – Crash Frequency and Crash Severity
- Congestion (15 points) – Measure of peak congestion per day based on travel demand model results
- Demand (15 Points) – Peak one-hour volume per lane
- Accessibility (10 points) – Travel time savings
- Cost Effectiveness (15 points) – Capital Cost Effectiveness and Operating and Maintenance Cost Effectiveness
- Connectivity (10 points) – Roadway and Transit
- Environment (15 points) – Air Quality Benefit and Natural Resources

For example, as noted above, the "Safety" category includes two criteria: "Crash Frequency," measured in terms of the rate of total crashes per vehicle miles traveled (VMT) and log miles, and "Crash Severity," a measure of the rate of injuries and fatalities per VMT and log miles. Each of these criteria was scored on a scale of 1 to 10. Another example of a highway evaluation category is "Accessibility," measured in terms of the amount of travel time projected to be saved as a result of project implementation, and also scored on a 0 to 10 point scale. "Environment," another evaluation category, includes two criteria: "Air Quality Benefit," scored on a 1 to 10 point scale, and "Natural Resources," worth a total of five points with a perfect score. The "Natural Resources" score was based on staff analysis of impacts, such as is required under the National Environmental Protection Act (NEPA) process.

Rail Transit projects were evaluated according to seven categories of criteria that closely parallel the highway criteria, although the distribution of points among the categories differs:

- Safety (5 points) – impact on roadway, transit, pedestrian, and bicycle safety as determined though staff analysis
- Congestion (10 points) – impact on traffic flows based on traffic model forecasts
- Demand (15 points) – Riders per mile
- Accessibility (25 points) – Job Accessibility and Modal Shift
- Cost Effectiveness (15 points) – Capital Cost Effectiveness and Operating and Maintenance Cost Effectiveness
- Connectivity (25 points) – Intraregional and Interregional Transit (two criteria)
- Environment (5 points) – Air Quality Benefit and Natural Resources.

A crucial difference between the scoring of highway and transit projects is that Accessibility and Connectivity are weighted far more heavily in the case of transit projects, whereas the scoring for highways is more evenly weighted among the seven evaluation categories. Each project gets a total point score combining the weighted *Policy Evaluation* and *Technical Analysis*. The distribution of funding for individual projects among the modes depends not only on projects' point scores but on restrictions associated with specific funding sources, e.g., highway versus Surface Transportation Program funds.

Reference URLs:

http://www.baltometro.org/content/view/808/534/

http://www.baltometro.org/downloadables/Outlook2035/TO2035-Prioritization_Technical.pdf

Observations

Baltimore's evaluation process is notable in that the potential for quantitative measurement is extensively developed at the same time that inherently qualitative and subjective outcomes of the planning process are accorded balanced consideration. The process also relates individual projects to policies in the *Policy Evaluation* element, giving ample weight to the role of participation by the public and Council officials in determining the region's transportation and

development future, rather than over-emphasizing technical analysis. The evaluation measures incorporate most of the Federal metropolitan planning factors[1].

Boston

The Central Transportation Planning Staff (CTPS) serving the Boston MPO rated projects quantitatively for the *Journey to 2030* metropolitan transportation plan, as part of a broader evaluation process that integrated project ratings with the results of public participation and consultation with environmental resource agencies, both of which contributed to forming a regional vision and policies. Highway and transit projects were rated quantitatively, according to two separate sets of policy-based categories of criteria.

The following criteria were used to rate highway projects:

- System preservation, modernization, and efficiency – Preserves Existing System
- Mobility – Improves Connections/Access to System; Improves Public Transit Service, Expands System Capacity, Provides Bike and Pedestrian Facilities, Addresses Suburban Transit Needs, Better Access for Target Populations, Improves Freight Mobility
- Environment – Improves Air Quality, Protects Water, Open Space, Wildlife, etc., Preserves Natural/Cultural Resources
- Safety and Security – Enhance Safety of Infrastructure for Users, Component of Safety/Security Initiative
- Regional equity/Environmental Justice[2] – Improves Mobility for Environmental Justice Residents, Addresses Environmental Justice Issues
- Land Use and Economic Development - Considers Land Use and Economic Plans, Supports Sustainable Development, Serves Existing Centers of Activity, Provides Links for Economic Activities

Highway projects were rated on a -3 to +3 scale for each criterion, with total scores calculated for each category. Quantitative performance measures were used only when the impacts of project implementation could be captured readily, as in the number of crashes per year and per mile in the case of "Safety and Security." Most of the criteria were evaluated largely on a qualitative basis by the planning staff.

Transit projects were rated on a three-point qualitative scale – High, Medium, or Low – in terms of 35 performance measures in the seven categories shown below.

- Utilization
- Mobility

[1] SAFETEA-LU identified eight metropolitan transportation planning factors: Economic activity; safety; security; accessibility and mobility; environment, energy conservation, quality of life; integration, connectivity across modes people and freight; efficient system management and operations; and preservation of the existing system.
[2] Environmental Justice refers to the distribution of environmental benefits and burdens with respect to traditionally underserved segments of the population, including low-income and minority communities.

- Cost-effectiveness
- Air Quality
- Service Quality
- Economic and land use impacts
- Environmental Justice

An overall project rating was determined on the basis of the ratings in each of the seven categories.

http://www.ctps.org/bostonmpo/3_programs/1_transportation_plan/2030plan_ch3.pdf

http://www.ctps.org/bostonmpo/3_programs/1_transportation_plan/2030plan_appC.pdf

Observations

Evaluation measures play a role in the selection of projects but primarily as a systematic means of organizing and communicating vital information about the relative contribution of each project toward achieving policy goals and objectives. The measures themselves are derived largely on the basis of qualitative judgment and are not used to produce an overall numerical ranking or scoring of projects that determines project selection. It is notable that the number of performance measures is far greater for transit than highway projects, while the ratings are less quantitative.

Los Angeles

The Southern California Association of Governments (SCAG) evaluated the performance of the entire 2035 Los Angeles metropolitan transportation plan as a unified whole, rather than in terms of individual projects. The analysis consisted of a comparison of plan outcomes – following implementation of all proposed projects – with two alternatives that represent a no-build condition, the Base Year (2003) and a Baseline for 2035, which includes none of the new projects proposed in the plan.

SCAG used ten "performance outcomes" to evaluate the impacts of the plan, all of which correspond to seven broad goals that address the transportation system and its effect on the region's quality of life, including the environment and land use. Specific quantitative performance measures were used to assess outcomes, as follows:

- Mobility - Speed (systemwide), Delays (total system and per capita)
- Accessibility – Percentage of population that can travel between work and home within 45 minutes during peak travel times
- Reliability – Standard deviation of travel times divided by average trip times, measured over many days and weeks
- Productivity – percent (systemwide) utilization during peak travel periods

- Safety – Fatalities Per Million Persons, Injuries Per Million Persons, Property Damage Per Million Persons
- Sustainability – Total Inflation-Adjusted Cost Per Capita to Maintain Overall System Performance at Current Condition
- Preservation – Percentage of Roadways and Bridge Requiring Rehabilitation
- Cost-Effectiveness – Benefit/Cost calculation derived from monetary valuation of benefits associated with Delay Savings, Safety Improvements, Air Quality Improvements, and Reduction in Vehicle Operating Costs divided by incremental plan implementation cost (versus Base Year and Baseline)
- Air Quality – Regional Emissions Analysis per Conformity Requirements
- Environmental Justice – (for target populations) Accessibility to Employment Services z(by mode), Accessibility to Parks, Distribution of Expenditures, Taxes Paid, Auto Travel Time Savings, Auto Travel Distance Reductions, Environmental Impacts (Air Pollutant Emissions and Noise)
- Economy – Jobs (resulting from innovative finance of transportation infrastructure)

http://www.scag.ca.gov/rtp2008/pdfs/finalrtp/f2008RTP_Chapter5.pdf

Observations

Los Angeles presents an alternative approach to the evaluation process, as a model of scenario-based analysis, rather than evaluation of individual projects. This approach is combined with exclusive reliance on objective, quantitative evaluation measures. An advantage of the overall evaluation method is that the need for scoring and weighting is obviated. The obvious disadvantage is that the effects of individual projects are not addressed, although it would be possible to model additional scenarios in which major projects or groups of projects are excluded, allowing the incremental results of those projects to be distinguished.

Portland, Oregon

Portland's Metro Council analyzed five scenarios to test different transportation policy and investment strategies in relation to the region's long-term growth vision, the *2040 Growth Concept*:

- Reference scenario: Extension of currently adopted plans and policies
- Connectivity scenario: Increased street connectivity
- High capacity transit scenario: New rail, bus rapid transit, and streetcar lines supported by expanded bus service
- Throughways scenario: Substantial expansion of highway capacity
- Management scenario: Use of pricing strategies to manage travel behavior and promote more efficient usage of transportation system.

The scenarios were composed of specific projects and in some cases, adjustments in the travel forecasting models to account for expected changes in mode-specific characteristics, such as

transit travel time reductions resulting from providing commuter rail connections to all regional centers. The effects of the scenarios were analyzed using both the regional travel model and the MetroScope model, the latter of which forecasts the distribution of housing and jobs throughout the region.[3] The following evaluation measures were used to analyze different scenario outcomes:

- Cost: Transportation System Cost, Transportation and Housing Cost Per Household (disaggregated by income level)
- Land Development: New Households in Centers and Corridors, Land Developed in Future Urban Growth Boundary (UGB) Expansion Areas, Future UGB Undeveloped by 2035, Average One-Way Commute Distance, New Households Total Daily Commute Length
- Housing Distribution: Housing Density and Location
- Job Distribution: Job Density and Location
- Air Quality and Greenhouse Emissions: Carbon Monoxide and Greenhouse Gas Emissions
- Travel Behavior: Daily Transit Ridership, Daily VMT, VMT Per Person,
- Mobility: Peak Period System Delay (Freeways, Arterials). Mid-Day Regional Freight System Delay, Annual Cost of Mid-Day Delay on Regional Freight System

While Portland's evaluation addressed scenarios, the evaluation measures used – possibly with some modification – may be applicable to specific capital projects or investments.

http://www.oregonmetro.gov/files/planning/08475_rtp_discussion_guideweb.pdf

Observations

As with Los Angeles, Portland's evaluation process addresses impacts of complex, multi-project scenarios or strategies, rather than individual projects. In Portland, this approach is extended to the evaluation of multiple scenarios, however, which capture a variety of critical transportation policy differences, providing the opportunity to assess the impacts of shifts in investments among highways, street infrastructure, and rail, as well the potential efficiency benefits of user charges. While all the best practice examples address transportation-related impacts on the environment and land use, Portland 's emphasis on the linkage between transportation and growth management is most explicit and quantified, as reflected in the use of the MetroScope model to supplement the results of the regional travel model. The extent of technical land use forecasting capabilities – and the accuracy of available models - is a key factor affecting the feasibility of applying some of Portland's land use-related evaluation measures to other metropolitan areas, whether to entire scenarios or individual projects.

San Francisco

The Metropolitan Transportation Commission (MTC) used a two-part performance evaluation in developing the *Transportation 2030* plan for the San Francisco region: (1) evaluation of the extent to which potential projects address needs-based plan objectives and (2) corridor benefits

[3] http://tmip.fhwa.dot.gov/discussions/webinars/archive/09202007_lum/conder/conder.pdf

assessment in which the impacts of groups of projects on corridor transportation conditions were estimated. The latter is a more focused assessment of transportation impacts based on standard results of travel forecasting models: changes in average travel times, VMT, emissions, and monetary value of travel time savings. The first component of the performance evaluation corresponds to the broader goals, objectives, and policies that the long-range metropolitan transportation plan is intended to address, beyond improvements in travel conditions.

MTC subjected only larger projects with regional impacts and policy implications to detailed performance evaluation according to the broader needs-based methodology (i.e., first part of the two-part evaluation). Following are the performance measures or criteria used to evaluate individual projects, organized according to the 13 objectives to which they correspond:

(1) Accommodate Growth in Person and Freight travel through Operational Efficiency: Roadways – AM peak period volume to capacity (V/C) ratio; Transit – AM peak period ridership, capacity and utilization (i.e., passengers load factor)
(2) Improve System Reliability: Roadways – AM peak period V/C ratio (in consideration of crowding); Transit – bus speeds, number of daily trains (for future forecasts)
(3) Accommodate Growth in Person and Freight Travel through Strategic Capacity Expansion: same measures as with objective 1 above, but focus on capacity availability
(4) Improve System Connectivity: Qualitative assessment of gaps (e.g., highway linkages/interchanges, transit access); Roadways – daily vehicle volumes on interchange ramps; Transit – Transit vehicles per day at transit hubs
(5) Improve Access to the Regional Transportation System: Roadways: Growth in population and jobs in area served by project (i.e., need for improved access); Transit – Number of daily passengers entering or exiting a transit hub
(6) Improve Access to Seaports and Airports: Growth in airport passengers of air cargo (i.e., need for improved access)
(7) Promote Community Vitality and Implement Smart Growth Objectives: Adding or improving transit, pedestrian, and/or bicycle facilities and improving linkage between modal alternatives and activity nodes (qualitative assessment); Population and employment density in area where project is located.
(8) Promote Equity for System Users: Location in designated community of concern; Lifeline transportation route (qualitative assessment)
(9) Improve Safety Through Collision Reduction and Improved Security: inclusion of identified features (e.g., traffic signal, pedestrian crossing improvement, sidewalk or bicycle lane) to improve safety
(10) Improve Seismic Safety: Daily passengers or vehicles at risk (at location where safety feature/project would be implemented); Included on Caltrans Lifeline System (state highways only)
(11) Improve Air Quality: Designation of project as Transportation Control Measure; Daily vehicle emissions (reactive organic gases, nitrogen oxide, particulate matter)
(12) Reduce Transportation-Related Noise: Includes characteristics that reduce noise
(13) Maintain the System: Project addresses maintenance on segment of system weighted in terms of vehicle miles/vehicle plus passenger miles per vehicle for transit and total and truck vehicle miles traveled.

While quantitative data were used to generate many of the performance measures, all were assigned qualitative high-to-low ratings for purposes of relative evaluation. For example, in the case of the first objective, *Accommodate Growth . . .through Operational Efficiency*, numerical calculations represented in the measures identified above were translated into High (>1.0), Medium (.0.8 – 0.99), or Low (0.8) ratings. Measures corresponding to other objectives were rated on a five-point scale that includes High/Medium and Medium/Low categories.

The measures were not used to assign numerical scores to individual projects but to differentiate those projects that strongly support the *Transportation 2035 Plan* performance objectives and goals from those that do not. Results of the performance evaluation guided MTC in choosing projects but as part of a broader decision-making process that considered the priorities of transportation partners and stakeholders, in addition to policy initiatives such as lifeline and bicycle transportation and climate protection.

http://www.mtc.ca.gov/planning/2030_plan/downloads/PPER/5-Detailed_Methodology.pdf

Observations

San Francisco's performance evaluation methods have been honed over several cycles of long-range plan development to reflect practical experience in dealing with technical challenges, such as constraints on data availability and accuracy, as well as the difficulty of assigning precise numerical values to attributes that are significantly qualitative in nature or ranking priorities among different goals and objectives. A key advantage of the San Francisco approach is that the evaluation measures can be derived readily from the standard output of travel forecasting models or inherent project characteristics, e.g., presence of bicycle facilities or safety features such as traffic signals. The evaluation measures are relatively limited in scope, however, focusing largely on transportation attributes. Land use and growth factors are given relatively limited consideration in conjunction with the *Promote Community Vitality and Implement Smart Growth Objectives* set of measures, which focus on modal connections and density. Another disadvantage is that the effort involved in quantifying most of the measures is not reflected in resulting High to Low ordinal rankings and the rankings are sufficiently precise only to distinguish major differences in relative project benefits.

Milwaukee

The Southeastern Wisconsin Regional Planning Commission evaluated three different scenarios in developing *A Regional Transportation System Plan for Southeastern Wisconsin 2035*:

- Transportation System Management (TSM) scenario
- TSM Plus arterial street and highway expansion
- No-build or baseline alternative

The TSM scenario included no roadway system expansion, consisting of Transportation Demand Management (TDM), Bicycle and Pedestrian System, Public Transit, and roadway operational or

TSM elements. The No-Build included no improvement or expansion of any mode, providing only for operating, maintaining and reconstructing the existing year 2005 transportation system. The scenarios were then compared in terms of the following measures:

- number of person trips by mode
- vehicle trips by trip and vehicle type
- traffic congestion throughout the regional network

These scenarios also were analyzed in terms of the following evaluation measures, which correspond to standards derived from transportation plan objectives and corresponding principles:

- transportation plan consistency with the regional land use plan – accessibility measured in terms of travel time between each subarea and all jobs in the region
- transportation plan capital and annual operating and maintenance costs,
- level of transportation service provided – transit service area (in relation to jobs and major activity generators); population and employment served by transit; service hours and frequency; ratio of transit to auto travel times for trips to jobs and activity generators, roadway congestion (mileage by county at different levels of congestion)
- the convenient and efficient movement of people and goods – travel times to jobs and activity generators by transit and private vehicle, roadway speeds
- impacts on the built and natural environment – total land acquisition; necessary acquisition of residences; commercial and industrial buildings; governmental and institutional buildings; historic buildings and sites; park lands; primary and secondary environmental corridors and isolated natural resource areas; wetlands; natural areas; critical species habitat areas; geological and archeological areas; Wisconsin Department of Natural Resources managed lands and legacy locations; land trust and conservancy lands; prime agricultural lands
- travel safety – property damage, injuries and fatalities based upon the amount of highway and transit travel and the degree of freeway traffic congestion
- energy consumption.

http://www.sewrpc.org/publications/pr/pr-049_regional_transportation_system_plan_for_se_wi_2035.pdf

Observations

As in the case of Los Angeles and Portland, the Milwaukee evaluation is scenario-based. The analysis is intended to demonstrate the impacts of investment in expansion of transit, demand management, and non-motorized transportation versus and the further impact of investment in highway capacity expansion projects. Highway capacity expansion projects are not considered without transit and other non-highway expansion projects. The measures are not as comprehensive as in the other metropolitan areas included as best practice examples, although some of the individual measures, like accessibility, may have advantages that merit consideration for application by CMAP.

Missouri DOT

Missouri's *Tracker* comprises 18 categories of performance measures intended to monitor the progress of the DOT in fulfilling its mission and value statements. Unlike the other best practice examples, these measures were not applied to development of a long-range transportation plan, but as a basis for continuing progress reporting on the DOT's entire program, including capital investments, operating and maintenance activities, and policies.

The 18 performance measure categories are as follows:

- Uninterrupted Traffic Flow
- Safe Transportation System
- Roadway Visibility
- Personal, Fast, Courteous & Understandable Response to Customer Requests
- Partner with Others to Deliver Transportation Services
- Leverage Transportation to Advance Economic Development
- Innovative Transportation Solutions
- Fast Projects That Are of Great Value
- Environmentally Responsible
- Efficient Movement of Goods
- Easily Accessible Modal Choices
- Customer Involvement in Transportation Decision-Making
- Convenient, Clean & Safe Roadside Accommodations
- Best Value for Every Dollar Spent
- Attractive Roadsides
- Advocate for Transportation Issues
- Accurate, Timely, Understandable & Proactive Transportation Information

The results of the measures are published quarterly.

http://www.modot.org/about/general_info/Tracker.htm

Observations

While the performance measures are not used specifically in the context of long-range planning or selection of capital projects, some of them may be applicable to these purposes. For example, *Easily Accessible Modal Choices* includes measures based on tabulating the number of passengers and amount of service provided by different modes. The advantage of these measures is that they are relatively straightforward to calculate and they are objective and quantitative. The overall framework has limited relevance to the *GO TO 2040* planning process, but individual measures may be applicable and merit consideration, in combination with an overall approach more closely matching one or more of the other examples considered.

Summary and Conclusions

The best practices summarized in this paper illustrate important considerations concerning the role of project evaluation in developing long-range regional transportation and development plans:

- Linkage to goals, objectives, and policies
- Reconciliation of technical analysis results with participation of the public, officials, and other stakeholders in the planning process;
- Relative emphasis on objective, quantitative analysis;
- Scenario-based versus project evaluation;
- Technical difficulty/data availability;
- Modeling capabilities;
- Number and types of projects evaluated; and
- Specific evaluation measures.

A close tie between evaluation measures and plan goals, objectives, and policies is common to all the examples of best practice. This linkage is essential, as the evaluation is based on the extent to which the components of the plan address its fundamental purposes. As concerns the second consideration noted above, reconciliation of technical analysis with value-based community preferences and priorities, all of the best practices integrate objective evaluation in the larger planning process. The degree of influence on decision-making and the means by which the evaluation results are taken into account in the evaluation of capital investments vary. Baltimore represents the only example of a quantitative project scoring and weighting system, illustrating how a highly technical approach can effectively accommodate policy considerations and qualitative project impacts. In contrast, the other best practices use the evaluation process either to quantify the impacts of entire scenarios or to distinguish the relative degree of benefits for specific projects, i.e., to single out those projects with major benefits in relation to plan purposes from others with lesser benefits.

A key difference among the best practice examples is the evaluation of entire multi-project scenarios versus individual projects. In part, the use of scenarios as a basis for evaluation is a response to concerns about the role of the evaluation process in prioritizing projects. Subjective factors can be incorporated with greater flexibility in constructing scenarios than in a project scoring process. The evaluation of entire scenarios can then be based solely or primarily on objective measures like levels of congestion, air pollution, concentration of new development, and acres of open space.

The examples presented herein offer two alternative variations of the scenario approach – in Los Angeles a single preferred scenario is compared to existing conditions and a future baseline to determine how proposed investments will respond to objectives, while Portland illustrates the use of multiple scenarios to demonstrate the broader implications of investments in modal and strategic alternatives. The specific evaluation measures used in these examples could potentially be adapted to the evaluation of individual projects. In addition, scenario-based evaluation could supplement the evaluation of individual projects in a two-phase evaluation process, to identify synergistic impacts after the benefits of individual projects are identified.

The scenario-based evaluation model also is related to the question of technical capabilities, including the precision and accuracy of forecasting models and the availability of data necessary to construct individual evaluation measures. While Portland's use of scenarios avoids precision issues associated with forecasting project-specific impacts, for example, the emphasis on land use imposes a different set of technical requirements that necessitate special modeling capabilities. Generally, the choice of evaluation measures must take into account the technical feasibility and time requirements associated with generating those measures, particularly in relation to their value in the evaluation. If the evaluation measures are to be used only as a general guide to project selection, for example, or if the measures are to be translated into qualitative rankings, the resources devoted to generating quantitative measures should not be disproportionate.

There also are alternative approaches to the selection of projects to be evaluated. In San Francisco, evaluation measurement was applied only to large-scale projects with the potential to generate regional-level impacts. This represents a practical strategy for avoiding the unproductive allocation of resources for analysis to projects with low levels of impact. Another possibility is that specific projects may be undefined, but represented instead in terms of lump-sum funding. In that case, the ability to model the impacts of the funding is the key to determining the most effective evaluation method. If the funding levels can be translated into changes in capacity or travel times, as Portland did in forecasting the impact of some new commuter rail connections, impacts can be quantified as with most other projects. For example, if lump-sum funding can be translated into miles of dedicated bicycle lanes, it may be possible to estimate travel time savings and mode shifts to bicycles. If the funding cannot be translated into illustrative projects, qualitative measures of benefit, such as "improving bicycle facilities" or "improving safety or access to transit" can be used, based on assessment of relative impact on a 0 -10 point scale.

The best practice examples provide a broad range of candidate evaluation measures that could be considered for adaptation to CMAP's planning process. All of the examples demonstrate substantial consideration of the Federal metropolitan transportation planning factors, as reflected in the use of such criteria as safety and security, accessibility, connectivity, and system preservation. Conspicuously absent from the best practice examples are significant measures of economic activity, although Boston and Los Angeles both address economic impacts to a limited degree. Among the three examples that illustrate explicit project-specific evaluation, two - Baltimore and Boston - apply somewhat different measures for highways and transit, while a single set of measures is applied uniformly across modes in San Francisco. Tailoring the measures to individual modes becomes more practical when criteria are more detailed and numerous.

The considerations noted above should be addressed as a next step in developing evaluation measures for the CMAP *GOTO 2040 Regional Vision*. To summarize crucial questions:

- What are the goals, objectives, and policies to be addressed by the measures? What is the range of impacts to be considered?

- How will the outcomes of the evaluation process be integrated in the broader planning process to prioritize projects, particularly with the results of participatory planning by the public and local officials?
- To what degree and how will measures be quantified?
- Will the evaluation be based only on analysis of specific projects or broader scenarios?
- Will the evaluation be limited to selected projects or include all projects, regardless of size and anticipated levels of impacts?
- How can the results of available travel forecasting models be incorporated into the measures?
- What additional data and technical analysis are required? Are resources and time sufficient to satisfy these requirements?
- What are the specific evaluation measures to be used?

In responding to these questions, CMAP, with the support of the Volpe Center, can adopt one of the best practice models presented herein or extract and combine elements of different models to create an approach uniquely crafted for the *GOTO 2040 Regional Vision*.

Appendix A
Summary of Nationwide Scan

Metropolitan Area	Description of Project Evaluation	Scoring OR Systematic Method for Applying Measures	Scope of Measures
Albany	"Planning and investment" principles guide development of 4 alternative future development scenarios; use of CMS performance measures for expressway projects; broad criteria and highway performance for "big ticket" items	No	VMT, speeds, delay, etc. for 4 scenarios
Atlanta	Broad, qualitative evaluation in terms of regional goals and objectives, use of CMS	No	CMS
Baltimore	Transportation-based quantitative performance measures used to test scenarios used to test scenarios	Yes	Highways and Transit performance, land use (greenfield acres consumed)
Boston, MA	Highway projects evaluated on 6 measures, transit projects on 35 individual measures in 7 categories	Yes	Highway and transit projects
Charlotte, NC	No evidence of systematic performance evaluation (inclusion based on Certification Commendation)	No	NA
Cleveland	Governing Board's Regional Transportation Investment Policy is based on project status (e.g., advanced state of planning); projects considered in terms of how they affect goals/strategies, but not systematic evaluation; modeled plan-wide impacts on accessibility by highway vs. transit	No	NA
Dallas	Evaluates highway system performance in terms of specific measures (e.g., VMT, capacity, delay); LOS on individual hwy. segments	No	NA
Detroit	Corridor-based scoring in terms of needs, based on transportation criteria	Yes, but limited	Highway emphasis
Denver	Evaluation not tied to goals, objectives, policies; promised evaluation in future Metropolitan Transportation Plan updates	TIP	NA
Harrisburg	Projects evaluated in 10-step process based on needs, identifies projects with environmental impacts (inclusion based on Certification Commendation).	No	NA

Los Angeles	Recommended plan compared to future Baseline and Existing Conditions, in terms of performance criteria:	No	Limited range: mobility – speed, delay; accessibility - % of people who can travel between home and work in 45 minutes; air quality conformity, planning. factors
Miami	Needs plan development based on multimodal modeling analysis	NA	NA
Minneapolis	No evidence of systematic project evaluation	No	NA
Portland , OR	Analysis of 4 scenarios based on modeling	No	Transportation LOS and growth management criteria
Seattle	Impacts of plans measured post-implementation	No	Emphasis on multi-county planning policies, impact measurement
San Francisco	Comprehensive	Yes	Multi-modal
Washington, DC	Plan includes system performance measures but not linked to policies or projects	No	NA

Appendix B

Baltimore's *Transportation Outlook 2035* Evaluation Criteria and Point Values[4]

2007 Prioritization Checklist for Policy Factors
Category Criteria Point Range

1. Safety
Improves safety by reducing fatalities and injuries 0 -5
Improves safety by enhancing mobility/reducing congestion 0 -5
Enhance safety by improving intersections 0 - 5
Improve safety for pedestrians and bicyclists 0 - 5

Total Points 20 max

2. Maximize System Operations
Increases efficiency, performance, reliability of existing system 0 – 10
Increases availability of real-time information to transportation system operators and travelers 0 – 10

Total Points 20 max

3. Accessibility
Contributes to an accessible, balanced, integrated regional transportation network 0 – 4

Enhances mobility for special needs populations – young, elderly, poor, disabled, unemployed 0 – 4

Increases the number and quality of transportation choices for both work and non-work travel 0 – 4

Improves access to key tourist attractions or recreational Destinations 0 – 4

Improves access, connectivity, and efficient movement of freight 0 – 4

Total Points 20 max

4. Environmental Quality
Contributes to short and long term achievement of air quality targets 0 – 8

[4] *Source: Baltimore Metropolitan Council, Transportation Outlook 2035 http://www.baltometro.org/content/view/808/534/*

Helps sustain/clean up the Chesapeake Bay 0 – 5
Promotes efficient use of energy resources 0 – 2
Promotes preservation of natural and cultural resources, rural areas and sensitive lands 0 – 5

Total Points 20 max

5. Improves System Security
Promotes coordination between transportation and nontransportation response agencies 0-6

Improves security of critical transportation infrastructure, systems, and data 0-7

Improves operation of the transportation system in the event of an Emergency 0-7

Total Points 20 max

6. Link Transportation Planning with Land Use and Economic Development
Contributes to integrated land development patterns which support alternatives to driving alone (e.g., bike/ped facilities, TOD) 0 – 4

Preserves/enhances infrastructure in designated Priority Funding Areas 0 – 8

Preserves/enhances unique characteristics of existing communities 0 – 2
Improves access to business and employment opportunities 0 - 2

Contributes to community revitalization by retaining / expanding Businesses 0 – 2
Helps expand regional market for labor and goods 0 – 2

Total Points 20 max

7. Foster Inter-jurisdictional Participation and Cooperation
Supports regional needs and priorities 0 - 7
Reflects local needs and priorities (per latest comprehensive plan) 0 - 10
Reflects consensus opinion of key (local) interest groups and private Sector 0 - 3
Total Points 20 max

Total Checklist Points - 140 max

Technical Analysis

HIGHWAYS & INTERCHANGES

Safety - 20 Points

1a - Crash Frequency - Measure the rate of total crashes according to VMT and log miles - SHA Crash Records 0-10

1b - Crash Severity - Measures the rate of injuries and fatalities according to VMT and log miles - SHA Crash Records 0-10

Congestion - 15 Points

2 - Congestion Index - Measures peak congestion per day - Output of BMC Travel Demand Model (2000 and 2035 no build) 0-15

Demand - 15 Points

3 - Peak Demand - Measures peak one-hour volume per through lane - Output of BMC Travel Demand Model (2000 and 2035 build) 0-15

Accessibility - 10 Points

4 Travel Time Savings - Measures amount of travel time projected to be saved by implementing the project Output of BMC Travel Demand Model
(2035 no build vs. build networks) 0-10

Cost Effectiveness - 15 Points

5a Capital Cost Effectiveness - Assesses cost per person mile of travel (PMT) 0-8
• BMC Travel Demand Model (2035)
• Costing Methodology

5b Operating and Maintenance Cost Effectiveness - Assesses operating and maintenance cost per person mile of travel (PMT)
BMC Travel Demand Model (2035) 0-7

Connectivity - 10 Points

6a Roadway - Assesses connectivity of project to National Highway System and project's ability to improve freight mobility - BMC Staff Analysis 0-7

6b Transit - Assesses connectivity of project to improve transit mobility - BMC Staff Analysis - 0-3

Environment - 15 Points

7a Air Quality Benefit - Assess impact of TDM component of project on air quality 0-10

- BMC Travel Demand Model (2035)
- BMC Staff Analysis

7b Natural Resources - Assess impact of project on natural resources - BMC Staff Analysis 0-5

Total Maximum Points: 100

Brief Explanation of Method

1: **Safety** (20 points)

1a - Crash Frequency: Calculate the average number of total crashes per year based on available crash data for the years 2003-2005. Divide average by 2005 VMT and rank results. Divide average by log miles and rank results. Add results and score. Note: For new roads, an existing parallel facility is used. (Also applies to Crash Severity criteria.)

1b - Crash Severity: Calculate the average number of crashes resulting in either injury or fatality per year based on crash data for the years 2003-2005. Divide average by 2005 VMT and rank results. Divide average by log miles and rank results. Add results and score.

2. **Congestion** (15 points)

Determine the maximum hourly volume/capacity (V/C) ratio of the 5 time periods year 2035. Projects with the highest V/C will score the maximum number of points. Projects will be ranked and scored on a relative scale based on percentile rank.

3. **Demand** (15 points)

Calculate peak hour traffic in the peak direction on a facility for year 2035 build alternative. Divide by the number of available through lanes of roadway. Rank projects according to the peak hour volume per through lane, and score.

4. **Accessibility** (10 points)

Calculate differences in delay between no build and build alternatives for year 2035. A greater travel time savings equals greater points.

5. **Cost Effectiveness** (15 points)

5a & 5b - Calculate VMT for each project. Convert VMT to person miles of travel (PMT). Calculate capital cost and operating costs for each project using costing methodology. Divide cost by PMT. Lowest cost per PMT receives the highest points.

6. **Connectivity** (10 points)

6a - Roadway: Award project 7, 5, 3, or 0 points based upon it's relevance to NHS and freight movement.

6b - Transit: Award 0, 1.5, or 3 points for a project's ability to provide bus or rail service in a corridor or provides improved service to existing transit stations or routes.

7. **Environment** (15 points)

7a - Air Quality Benefit: Assess impact of TDM component (HOV facility, park-&-ride, ITS, roundabout, ramp metering, reversible lanes, bike/ped) of project on air quality. (0-10 points)

7b – Natural Resources: Assess project relationship to ecologically significant lands (i.e., GreenPrint program) (0-5 points)

TRANSIT

1: **Safety** (5 points)

Assess impact of project on safety by assigning 2 points for every safety feature to a maximum of five points: dedicated right-of-way, double tracking, grade separation, etc.

2. **Congestion** (10 Points)

Assess impact of candidate project in reducing AM Peak congestion. Refer to ridership per mile, 2035 level of service congestion maps, and Skycomp data. Rank and score. Project with higher demand receives higher points.

3. **Demand** (15 points)

Forecast average number of daily riders per mile on candidate facility for 2035. Rank and score. Projects with higher numbers of riders receive higher points.

4. **Accessibility** (25 points)

Job Accessibility: Estimate increased number of jobs accessible as a result of the project.

Modal Shift: Estimate number of trips shifted from highway to transit as a result of project. Refer to 2035 level of service congestion maps and Skycomp data.

5. **Cost Effectiveness** (15 points)

5a – Capital Cost Effectiveness (10 points): Forecast average number of daily riders on candidate facility for 2035. Divide by estimated capital cost. Rank and score. Projects with higher rider/cost ratio receive higher points.

5b - Operating and Maintenance Cost Effectiveness (5 points): Forecast average number of daily riders on candidate facility for 2035. Divide by estimated operating and maintenance cost. Rank and score. Projects with higher rider/cost ratio receive higher points.

6. **Connectivity** (25 points)

6a - Intraregional Transit (15 points): Award 1 point for every intraregional transit Rail line directly served and ½ point for every Local Bus line directly served.

6b - Interregional Transit (10 points): Award 2 points each for direct service to AMTRAK or BWI and 1 point for every MARC station.

7. **Environment** (5 points)

7a - Air Quality (3 points): Assess impact of project on air quality. Use transit ridership to establish order of magnitude benefits.

7b - Natural Resources (2 points): Assess proximity of project to established boundaries for sensitive areas (i.e., GreenPrint program, drinking water reservoir watersheds).

Total Maximum Points: 100