

Appendix C: Literature Review and Best Practices



TransAction Technical Report

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1 Overview

In November 2012, the Northern Virginia Transportation Authority (NVTA) adopted TransAction 2040, the long range transportation plan for Northern Virginia. Although the plan is traditionally revised and amended every five years, two recent changes make the current update particularly notable:

- 1) In 2012, when TransAction 2040 was adopted, Northern Virginia was facing a funding crisis with insufficient resources to address critical mobility needs and challenges. In 2013, the Virginia Legislature passed HB 2313 which provided substantial financial resources to fund regional priorities; and
- 2) Transportation technology and networks have innovated and evolved rapidly over the past few years. This trend is accelerating. These innovations disrupt many former assumptions and forecasts for future travel demands and levels of congestion and the traditional evaluation of projects, operations, and investments.

For these reasons and others, the NVTA has embraced reevaluation of the methodology for project evaluation, selection, and prioritization at this time.

In embarking on this update, the NVTA looks to leading research, best practices, and exceptional peers. While the Authority is unique in many respects, the challenges faced by Northern Virginia, and the quality of life outcomes desired by the residents and stakeholders of the region, are shared by many. Best practices selected for review include research scans across the industry encompassing a diversity of practices and approaches used by leading peers. Peers were chosen for both innovation and model practices, as well as comparability with the Northern Virginia region and applicability to the challenges and requirements faced by the Authority.

1.1 Purpose

The TransAction Update is a data-based, outcome-oriented plan to strategically invest the NVTA's regional revenues. The intent of the literature review and case studies is to examine the state of the practice and learn from peer jurisdictions.

A variety of transportation agencies and authorities have developed approaches to managing auto traffic, including integration with transit, non-motorized modes, freight delivery, and land use. Some of these agencies have developed new performance measures and evaluation techniques that measure the potential benefits of these approaches in order to make better informed decisions about investments. The intent of this review is to highlight the best available practices to advise the NVTA in reevaluation of its project review and selection process and clarification of plan goals and objectives.

1.2 Guidelines for Performance-Based Planning

Much has been written about goals for transportation investments, implementation of performance-driven planning, specific metrics for consideration, and how dynamic innovation can be incorporated into the planning process.

FHWA's recently developed guidebook "*Model Long-Range Transportation Plans: A Guide for Incorporating Performance-Based Planning*"¹ defines performance-based planning as, "a data-driven, strategic approach, providing for public and stakeholder involvement and accountability, in order to make investment and policy decisions to attain desired performance outcomes for the multimodal transportation system."

Comprehensive performance-based planning is much more than just the process of selecting and applying performance measures. The process includes setting a strategic direction ("where do we want to go?") built on a foundation of data from monitoring and evaluation of system performance ("where are we now?"), followed by analysis of how the region will move toward achieving its goals through investments and policies ("how are we going to get there?").

A comprehensive performance-based plan includes the following elements:

- Baseline data about the transportation system
- A statement of goals and objectives
- A set of performance measures to compare alternative strategies and track progress over time
- Desired trends or targets (that is, the intended direction of change or a specific numerical target)
- Forecasts of future conditions or needs
- Policies, strategies, and investments that will support attaining the desired trends or targets
- Understanding of financial strategy for implementation

TransAction is a performance-based planning effort oriented around a number of objectives and desired outcomes, and the previous version of the plan included most (if not all) of the elements listed above, with a particular focus on the evaluation of projects against specific performance criteria. As part of the TransAction Update, this structure should be enhanced wherever possible as the evaluation process is finalized.

1.3 Background: TransAction's Performance-Based Approach

In 1999, TransAction established and adopted its original vision:

In the 21st century, Northern Virginia will develop and sustain a multimodal transportation system that supports our economy and quality of life. It will be fiscally sustainable, promote areas of concentrated growth, manage both demand and capacity, and employ the best technology, joining rail, roadway, bus, air, water, pedestrian and bicycle facilities into an interconnected network.

The vision has endured over time and reflects many of the same themes common across other urbanized area transportation planning bodies – themes that speak to economic and community vitality, coordination with land use, intermodal systems, and efficiently functioning networks.

The seven TransAction goals further articulate this vision. These goals have remained constant in both TransAction 2030 (adopted in 2006) and TransAction 2040 (adopted in 2012).

¹ "Model Long-Range Transportation Plans: A Guide for Incorporating Performance-Based Planning," August, 2014, FHWA-HEP-14-046, FHWA website, accessed 10/2/15:
http://www.fhwa.dot.gov/planning/performance_based_planning/mlrtp_guidebook/.

- 1) Provide an integrated, multimodal transportation system.
- 2) Provide responsive transportation service to customers.
- 3) Respect historical and environmental factors.
- 4) Maximized community connectivity by addressing transportation and land use together.
- 5) Incorporate the benefits of technology.
- 6) Identify funding and legislative initiatives needed to implement the Plan.
- 7) Enhance Northern Virginia relationships among jurisdictions, agencies, the public and the business community.

Additionally, TransAction 2040 applied a selection of system-level measures of effectiveness to test performance of the system as a whole with and without the package of proposed projects. These measures included:

- Daily vehicle-miles of travel (VMT) – normalized by population;
- Daily person-miles of travel (PMT);
- Work trip length;
- Work trip mode share;
- Job accessibility (number of jobs accessible within a 60 minute trip);
- Screenline analysis (volume to capacity ratio – V/C); and
- Levels of service (highway LOS, transit service coverage, and rail transit crowding).

Three scenarios were defined to evaluate the package of proposed projects: current conditions, baseline conditions (projected growth plus already programmed transportation improvements but without the benefit of proposed TransAction projects), and an initial “Build” scenario to test the proposed package of TransAction projects. A subsequent scenario, Build 2, was developed to address deficiencies identified in the initial Build scenario.

To prioritize among the projects under consideration, each proposed project was evaluated individually based on a number of performance evaluation criteria (PEC). These are, in essence, objectives related to each of the plan goals. In total, six of the seven goals had PECs assigned to them (relationships among jurisdictions did not) for a total of 15 PECs:

- | | |
|--|---|
| • Freight movement (capacity and reliability) | • Environmental sensitivity (minimal impact) |
| • Improved bicycle and pedestrian travel options | • Activity center connections |
| • Multimodal choices (transit capacity, non-SOV) | • Land use support (Comprehensive Plan support) |
| • Urgency (addresses <i>existing</i> LOS deficiencies or maintenance concerns) | • Management and operations (use of technology) |
| • Project readiness (phase of design, clearance) | • Cost sharing (private or outside funding) |
| • Reduced vehicle miles traveled (VMT) | |
| • Safety | |
| • Person throughput (person miles traveled) | |
| • Reduced roadway congestion | |
| • Reduced time spent traveling | |

Performance measures were then assigned to each PEC. While many qualitative measures were carried over from TransAction 2030, TransAction 2040 introduced several quantitative measures for a total of nineteen. Each of the PECs was weighted equally (a weighting factor of 6.67). Where PECs had two measures associated with them, each measure was weighted at 3.33. Across the six goals, provision of a responsive transportation system was weighted the most heavily (47 percent of project scoring) with the other five goals splitting the balance.

1.4 Case Studies

To inform the development of the necessary evaluation components for the TransAction Update, a number of leading peers were examined. These case studies specifically explored five broad areas of interest:

- Goals and objectives. Many transportation plans share a similar vision. What distinguishes individual plans are the goals which reflect the values of a region, and the objectives - the specific actionable focus of investment. Measurements and evaluation criteria are derived from adopted goals and objectives, however these relationships are not always clearly defined or universally understood by all stakeholders. For example, congestion reduction is a key objective for Northern Virginia, but “addressing congestion” may mean something different to each of the participating jurisdictions.
- Targets, criteria, and metrics. We achieve what we measure. A number of different measures may be used to assess objectives. For example, congestion reduction may be measured by total travel time, travel time reliability, vehicle throughput, or person throughput – each of which relates to a subtly different understanding of the desired objective. MAP-21 requires a more performance-based planning approach that sets metrics and targets for transportation investment priorities. Peer case studies examine the diversity of metrics chosen to reflect the goals and objectives and assess performance in achieving specific outcomes.
- Evaluation and assessment. Equally important is how measures are used in the evaluation of an overall regional program and selection of projects. The case studies and research review examines how projects are evaluated at the various phases of program development and across multiple modes and project types. This included a review of the tools used to assist in development, evaluation, and prioritization of alternatives.
- Performance and outcomes. Planning is largely focused on assessing projects and programs against a desired future state, generally using forecasts of expected outcomes. Performance measurement, however, is empirical observation of actual outcomes. While still conceptual in many regions, processes and protocols for post-investment performance measurement and feedback loops back into program evaluation criteria are recognized as a desired practice to assess and calibrate the metrics and tools used for project evaluation and selection.
- Public engagement. Effective stakeholder engagement can be difficult in large planning processes. Some case studies modeled effective strategies for engaging stakeholders in a meaningful and accessible way to participate in the crafting of goals, objectives, priorities, and targets. Others used visualization tools, public dashboards, and other data reports to provide the

public with timely and engaging information on performance measures and progress against stated targets.

- Transportation innovation. Transportation technology and services are rapidly evolving. A number of these changes could have profound impact on transportation demand and the efficacy of certain infrastructure projects. As with performance measurement and post-project assessment, anticipation of disruptive innovations in transportation and incorporation of this eventuality into the project/program evaluation and selection process remains an emerging practice, however a handful of case studies provide real world examples.

Research surveys and industry papers were reviewed as resources on best practices overall. Leading peers were those who demonstrate best practices in one or more of the areas above.

While the NVTA is a fairly unique entity, there are a number of regions, transportation agencies, and states with experience and innovative approaches that are immediately relevant to the TransAction Update. Best practice examples draw from metropolitan planning organizations, transportation agencies, and international best practices that have similar qualities to the NVTA. Factors considered in selecting peers included:

- Multi-Jurisdictional (MJ). The NVTA is responsible for planning across four counties (Arlington, Fairfax, Loudoun, and Prince William), and five cities (Alexandria, Fairfax, Falls Church, Manassas, and Manassas Park). Case studies sought out similar multi-jurisdictional entities.
- Diverse land use context (LU): The Northern Virginia area includes a transect of land uses from urban to rural. Case studies with similar diversity of context were preferred.
- Multimodal (MM): The NVTA invests in projects for all modes including roadway networks, transit services, bicycle and pedestrian facilities, and technology systems and services. Ideal peers also had responsibility for multimodal investments.
- Organizational Structure (OS). The NVTA was created by the Virginia General Assembly in 2002 and is governed by a 17-member board, including state elected officials, state transportation officials, citizens who reside in the service area, and the nine cities and counties that comprise the region. The literature review will highlight how the organizational structure of transportation agencies is reflected in their project prioritization procedures and performance goals.
- Independent Funding (IF). When HB 2313 was passed by the General Assembly in 2013, it provided a source of revenue for the NVTA to program transportation projects in Northern Virginia. The Authority is a funding authority independent from the mandates of either the Virginia Department of Transportation (VDOT) or the Metropolitan Washington Council of Governments (MWCOC). While the NVTA coordinates closely with both, it may deviate from the adopted goals or priorities of either body in order to serve the best interests and needs of its member jurisdictions.

A number of candidate peer agencies were initially considered. All represent aspects of model practices in one of the six areas of interest, and all share at least some common characteristics with the NVTA (**Table 1-1**). A subset of these was selected for detailed examination and summary. An annotated summary of research and case studies is included in Appendix A.

Table 1-1: Case Studies

Entity	Distinctive Goals and Objectives	Quantifiable Metrics and Measures	Evaluation in Project Selection	Post-investment Perform. Measurmt.	Transport Innovation	Public Engagement
Arizona Department of Transportation Scottsdale, AZ LU, IF	X		X			X
San Diego Association of Governments San Diego, CA MJ, LU, MM, OS		X				
Alameda County Transportation Commission, CA MM, IF	X		X			
Metropolitan Transportation Commission (MTC) San Francisco, CA MJ, LU, MM, OS, IF			X	X		X
Denver Regional Transportation District Denver, CO LU, IF					X	
District Department of Transportation Washington, DC MM	X	X		X		X
Atlanta Regional Commission Atlanta, GA MJ, LU, MM, OS, IF	X				X	
Chicago Metropolitan Agency for Planning Chicago, IL MJ, LU, MM, OS		X				X
North Shore Council of Mayors Chicago, IL MJ, LU, MM, OS, IF			X			
Boston Department of Transportation Boston, MA MM					X	X
Mid-Ohio Regional Planning Commission Columbus, OH MJ, LU, MM, OS		X				
Northeast Ohio Regional Planning Commission Cleveland, OH MJ, LU, MM, OS		X				
Delaware Valley Regional Planning Commission (DVRPC) Philadelphia, PA MJ, LU, MM, OS	X		X	X		X
North Central Pennsylvania Regional Planning & Development Commission Ridgeway, PA MJ, LU			X			
Wasatch Front Regional Council Salt Lake City, UT MJ, LU, MM, OS	X	X				
Utah Department of Transportation Salt Lake City, UT IF				X		
Puget Sound Regional Council Seattle, WA MJ, LU, MM, OS			X			
Washington State Department of Transportation Olympia, WA IF				X		
TransLink Vancouver, Canada LU, MM	X		X			
City of Toronto, Canada LU, MM	X	X				

Characteristic Codes: MJ=Multi-Jurisdictional, LU=Diverse land uses, MM=Multimodal, OS=Organizational Structure, IF=Independent Funding

2 Goals and Objectives

2.1 Survey of Peers

States, regions, counties, and cities across the country share many of the same goals and objectives for transportation investments and improvements. These locations share a commitment to deliver a safe, well maintained transportation system; reduce congestion and travel time uncertainty; support economic development and land use visions; and preserve the environment. A number of case study examples are provided in Appendix B. A sampling of goals and objectives from a diverse group of peers is summarized in **Table 2-1**.

Table 2-1: Goals and Objectives

Toronto Congestion Management (2013)	GoBoston 2030	Vancouver TransLink Regional Transportation Strategy (2013)	DVRPC Connections 2040 Plan for Greater Philadelphia
Maximize system efficiency & reliability <ul style="list-style-type: none"> • Increase throughput • Reduce delays • Reduce travel time variability • Reduce vehicle operational costs Improve safety of the network <ul style="list-style-type: none"> • Reduce traffic collisions • Reduce collision severity Improve response to incidents, events and traffic conditions <ul style="list-style-type: none"> • Reduce duration of traffic incidents and events through detection, response and clearance Improve availability & reliability of information <ul style="list-style-type: none"> • Reduce traveler frustration • Increase use of all modes Reduce impact of transportation on the environment <ul style="list-style-type: none"> • Reduce GHG emissions • Increase fuel savings 	Accessible <ul style="list-style-type: none"> • Many travel choices • Cross-town connections • Accessible for 8 to 80 • Job access Safe <ul style="list-style-type: none"> • Maintenance • Service • Safety over speed Reliable <ul style="list-style-type: none"> • Consistent on-time service • Predictable • Reliable information • Options for travel Experientially oriented <ul style="list-style-type: none"> • Welcoming and respectful • Fun and vibrant • Clean and comfortable Innovative <ul style="list-style-type: none"> • Anticipate disruptive technologies • Innovate • Build in smart energy • Crowd-source knowledge Affordable <ul style="list-style-type: none"> • Protect affordable housing • Make transport affordable • Invest fairly Sustainable and resilient <ul style="list-style-type: none"> • Reduce emissions • Resilient to adverse events • Protect infrastructure Inclusively governed <ul style="list-style-type: none"> • Prioritize people over cars • Strengthen partnerships • Improve without displacing • Broad participation Healthy <ul style="list-style-type: none"> • Reduce emissions • Improve access to care • Connect residents to green 	Invest strategically to maintain and grow <ul style="list-style-type: none"> • Maintain what is needed • Make early investments in walk and bike networks • Invest in roadway safety, access and goods movement • Make ridership investments in transit • Ensure coverage in low-demand neighbourhoods Manage the system for efficiency & user-focus <ul style="list-style-type: none"> • Make travel safe and secure for all users • Make travel easy and attractive for all users • Optimize roads and transit for efficiency, safety and reliability • Use integrated mobility pricing • Manage parking Partner to make it happen <ul style="list-style-type: none"> • Support regional land use objectives • Ensure effective coordination • Establish funding that is stable, sufficient, appropriate and influences travel choices • Monitor progress towards desired outcomes 	Manage growth and protect the environment <ul style="list-style-type: none"> • Preserve open space • Manage stormwater and water quality • Reduce GHG • Plan for climate change • Improve air quality • Increase local food production and distribution • Preserve historic & cultural resources Create livable communities <ul style="list-style-type: none"> • Invest in centers • Promote affordable, accessible housing • Enhance • Promote green infrastructure • Invest in parks Build the Economy <ul style="list-style-type: none"> • More energy-efficient economy • Support key sectors • Enhance business growth • Foster the workforce and education • Increase innovation • Expand connections to global economy Modern multimodal transportation system <ul style="list-style-type: none"> • Invest in long-range plan goals • Rebuild and maintain infrastructure • Increase safety • Increase security • Increase accessibility and mobility • Reduce congestion • Limit impacts on environment • Improve operations • Multimodal system

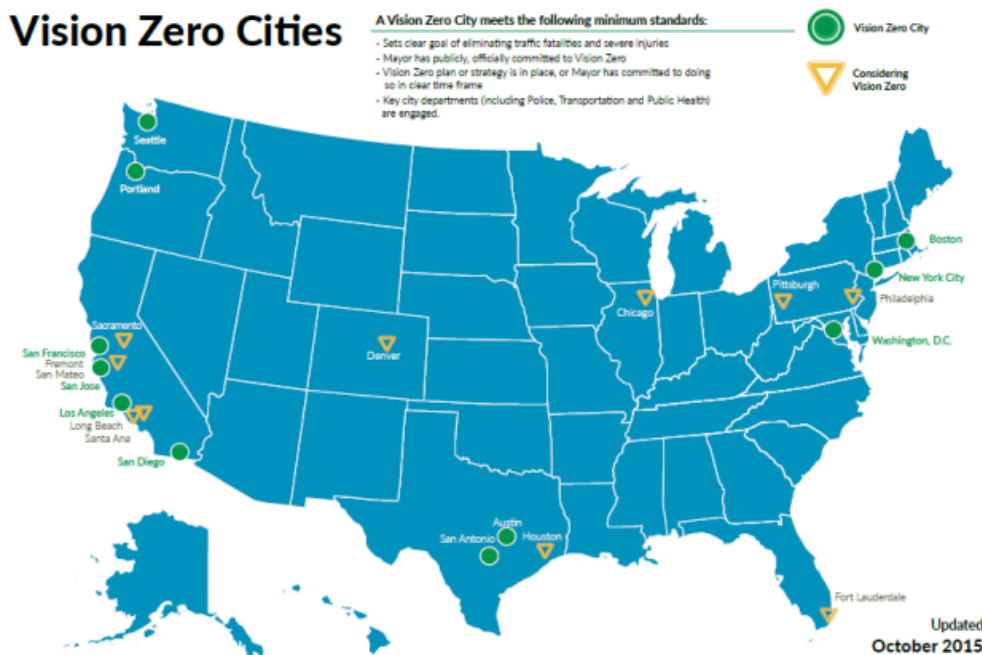
2.2 Goals and Objectives Considerations

The TransAction goals were established over a decade ago. Many of the goals reflect time-honored values of transportation planning – providing multimodal travel options, making responsive and prudent investments, and coordinating with land use visions. Some of the goals – notably the attention to technology innovations – were visionary at the time and remain at the leading edge today as compared to many peers.

The particular emphasis or prominence of certain transportation values, however, have changed and risen over the years. A key focus of the NVTa is congestion reduction in the Northern Virginia region. Additionally, the Authority is constrained in what it may invest in, for example there are limitations on the ability to invest in maintenance and operations. Although many goals of best practice peers are incorporated within the TransAction goals or PECs, some are fairly marginalized as compared to the weight given by peer agencies in part due to the afore mentioned constraints:

- Safety:** Safety is often the first concern of any transportation provider and is reflected within the “responsive transportation service” goal of TransAction. Nationally there has been tremendous attention to safety via “Vision Zero” strategies at both the city and state (Washington and Montana) levels. In addition to preserving human life and protecting property, prioritizing improvements in safety and the commensurate reduction in collisions and traffic incidents can bring major benefits to other categories of transportation objectives, such as reducing congestion and improving reliable operations. The equal weighting of each of TransAction 2040’s PECs resulted in a relatively low weight on safety (6.67 percent) that does not align with the emphasis observed in peer agencies.

Figure 2-1: Cities with Vision Zero Programs



- Fix it first/Optimize Use:** Limited transportation spending at the federal level combined with economic changes and volatile fuel prices² has reduced the level of transportation funds available to states, regions, and localities. Many were faced with prioritizing between strategies that built new facilities and expanded capacity or improvements to existing facilities to improve operations. Peer agencies highlight the desire to leverage past investments by optimizing the use of existing

² Higher fuel prices reduced driving in many states and with it, reduced fuel purchases and associated gas tax revenues.

facilities. As with safety, this is considered in the current TransAction goals, but with even less weight (3.33 percent).

- **Reliability and Congestion:** The goals of many peers emphasize travel time reliability over other measures of congestion. Travel time variability, as with other factors, can have dramatic implications for transportation costs (i.e. estimating fuel usage) and economic performance (on-time arrival of staff). While reliability was measured indirectly in some measures of system-level efficiency, it is not currently a stated goal for the Northern Virginia region.
- **Accessibility:** Nearly every transportation plan makes reference to coordinating transportation decision-making with land use planning and/or transportation with local economic development priorities, but many are vague as to what this actually means. For most members of the public and business community, the real objective is access – access to jobs, markets, and the daily necessities of life (schools, parks, groceries, healthcare and other professional services, etc.). With aging Baby Boomers (born between 1946 and 1964), rising demands from persons with disabilities, and the changing mobility preferences of Millennials (born between 1980 and 2000), accessibility is also interpreted by many peers to mean a breadth of viable choices for a wide spectrum of age and ability. In TransAction, accessibility is implied in the “community connectivity” goal, and job access is a system-efficiency measure, but improved access to goods, services, and opportunities is not an explicitly stated goal as seen among many peers. The varied needs and demands of diverse ages and abilities of people throughout the region goes largely unmentioned.
- **Air Quality, Climate Change and Resiliency:** Compared to peers, the TransAction goals largely ignore considerations of air quality, climatic events, and resiliency. The regional air quality conformity model confirms that the Washington metropolitan region remains in compliance with federal air quality standards, but many regions have gone above and beyond to proactively prioritize greenhouse gas reductions. As events of recent years have demonstrated, flooding, major snow events, and even earthquakes can occur in Northern Virginia and have caused major disruptions to transportation systems. Without resilient systems, regions can suffer major human and economic losses.
- **Affordability:** Affordable transportation is gaining awareness today as affordable housing becomes an ever more critical concern in booming regions like metropolitan Washington. Maintaining affordability and lowering the combined housing and transportation cost for households is recognized by many best practices as a cornerstone to economic competitiveness and long term vitality as a region. Household transportation cost factors are not reflected in existing TransAction goals or PECs.

One other distinction to note is the lack of stated objectives in TransAction 2040. Peer agencies identified in this review generally all articulate a vision, goals, and objectives. While the distinctions are subtle, each is an important component in providing an actionable, measurable plan:

- **Vision:** The vision statement is generally aspirational, articulating a preferred idealized state.
- **Goals:** Goals are generally a limited number of distinct priorities, purposes, and/or outcomes the region desires to move toward. They generally represent components of a vision.
- **Objectives:** Objectives are measurable and targeted actions that result in incremental but tangible advancement toward the stated goals. Criteria and metrics for evaluating potential performance of

the network and/or individual projects should be derived from stated objectives. Objectives can and should change over time as the region progresses and diverse aspects of goals become more pronounced in response to contemporary issues or understanding.

The current TransAction goals are a mixture of goals, objectives, and generally expected requirements for transportation projects in the region. At the same time, many PECs appear to represent “objectives” as defined in many best practice examples, although some – like “project readiness” – are really a factor of project selection and phasing or programming. The TransAction Update could be strengthened and become more legible and compelling to the public through more clearly defined goals, objectives, and measures that are clearly tied together.

3 Measures and evaluation

Goals are an articulation of the values and priorities of a region, and it is important that the TransAction Update accurately reflect those for Northern Virginia. It is equally important that these goals and their associated objectives be accurately and meaningfully measured so that the region and member jurisdictions can evaluate how well transportation projects achieve the stated objectives, and how the overall program works to achieve the stated vision. This section discusses how leading peers define and measure goals held in common with Northern Virginia.

Evaluation measures can be used at a variety of scales – to compare overall network performance, to compare alternative approaches to corridor improvements, and/or to compare between alternative projects. Some evaluation measures can compare and help rank the potential beneficial performance of an array of projects in different areas or corridors of a region.

The desired trend/direction of performance is also important (e.g. reduction in VMT, increase in non-auto mode share, not to exceed current hours of person-delay). Best practices often set targets either articulated within a goal, as specific objectives, or associated with performance measures (see Appendix B).

3.1 Definition of measures

The best practice review and survey of industry literature provide examples of a wide variety of metrics and measures used across North America for evaluating project and program performance. Below is a brief summary; more detailed information is provided in detailed case studies in Appendix C.

Congestion: Congestion is a key concern in Northern Virginia, and the measures chosen to evaluate congestion can result in dramatically different evaluations of project performance. It is critical therefore, that the NVTA clearly articulate the problematic outcomes resulting from congestion so that meaningful measures can be appropriately selected. Due to the complexity associated with measuring congestion, as well as the variety of impacts, peers often use a suite of congestion measures, instead of using just one. For example, the Chicago Metropolitan Association of Planning (CMAP) measures congestion in a number of different ways explicitly so as to better capture the different causes and consequences of delay and to not weight any particular measure too heavily. As part of the HB 599 evaluation process, five measures were used to measure the congestion reduction potential of each project, accounting for a range of effects to both highway and transit facilities.

More than a dozen different measures were found that measure aspects of congestion, ranging from traditional (i.e. volume to capacity ratio, level of service, passenger load factors) to less common measures designed to capture specific effects of congestion. Of particular interest is an increased use of measures related to reliability, such as the Planning Time Index or Buffer Index which quantify the variability of travel time. Congestion severity, congestion duration, and the amount of delay (or the economic cost of that delay), are also possible options used by peer agencies.

Another important consideration is the threshold set for determining congestion. For example, the San Francisco Metropolitan Transportation Commission (MTC) defines “congestion delay” as that which occurs when freeway speeds drop below 35 mph. Speeds below posted limits are captured in “total delay” calculations. The Delaware Valley Regional Planning Commission (DVRPC) classifies congestion as periods when traffic flows at rates below 70 percent of the posted speed limit. VDOT’s HB 599

evaluation process defined “severe congestion” as corridors with peak hour travel time ratios (congested travel time / free flow travel time) greater than 3 for traffic or transit load factor of > 1.3 passengers per seat for local bus (>1.1 for express bus or commuter rail) or > 120 passengers per car for Metrorail.

Safety: Safety is commonly reported in absolute terms – the number of crashes, injuries, and/or fatalities over a given timeframe. This can often be misleading. While absolute numbers is the preferred measure where fatalities are concerned (zero traffic fatalities being the goal) in most other instances safety rates are generally more informative. For example, an increase from 15 crashes involving bicyclists to 20 is generally perceived as an unfavorable trend, but this perception would change if it were associated with a fourfold increase in the number of bicyclists (resulting in decreasing the *rate* of crashes from 15 crashes per 100 to just four crashes per 100).

As with measures of congestion, many peers use a number of different safety measures to evaluate safety improvements, as some projects may improve safety for some users and have a detrimental impact on others. For example, Boston includes four measures under the safety goal:

1. Eliminate traffic fatalities
2. Reduce pedestrian and bicycle related collisions by 30 percent
3. Provide a protected bicycle facility of shared use path within a five minute walk of all homes
4. Lower default speed limit to 25 MPH (from 30 MPH)

Accessibility: As previously mentioned, accessibility is often a key factor in supporting economic development or preserving/enhancing household opportunities and quality of life. Accessibility may be measured in a number of ways, depending on the vision and goals set for the region. For example, MTC in the Bay Area defines equitable access as “the share of low-income and lower-middle income residents’ household income consumed by transportation and housing.” In Atlanta, the ARC defines an “Accessibility Ratio” as the proportion of all trips that originate from or are destined to a designated major activity center. Finally, in Chicago, CMAP measures accessibility as the proportion of residents and jobs that are accessible by transit.

3.2 Targets

Targets focus and inspire action. They provide an attainable goal and a fixed point against which to measure progress. The most recent transportation funding bill - Moving Ahead for Progress in the 21st Century Act (MAP-21) – emphasizes target setting in determining transportation investment priorities. Although MAP-21 has not yet established firm national targets, many agencies are already adopting performance-based planning and identifying local goals and targets to compliment the national ones.

Many peers have articulated targets to aspire toward and to measure incremental progress periodically. Common targets include reducing average commute distances and travel times or increasing transit access across the region. Targets are generally established as a meaningful representative of desired goals, but they may also help to set reasonable expectations – for example, in rapidly growing regions, reducing certain measures of congestion may not be realistic and so their targets may be to keep congestion from getting worse than existing levels. Sample targets include:

- MTC goal of “equitable access” aims to decrease by 10 percent the share of low-income and lower-middle income residents’ household income consumed by transportation and housing.

- TransLink in Vancouver, British Columbia has set a target that by 2034 total annual vehicle kilometers traveled (VKT) not increase above 2012 levels. This represents a one-third reduction from current conditions. Further they have set a target of 15% cycling mode share for all trips under 8 km (by 2040) and to achieve an 80% reduction in regional greenhouse gas emissions below 2007 levels by 2050.
- moveDC, the long range transportation vision plan for the District of Columbia, has set a target of 75 percent non-auto mode share for all commute trips within the District.
- CMAP's GO TO 2040 Plan sets a number of specific targets for the three overarching goals. Among these are to increase efficiencies in the highway network to maintain no more than the current level of congestion today (1.8 million congested hours) even with 2.4 million more residents by 2040.
- GoBoston 2030, underway by the Boston Department of Transportation, has set targets to decrease average commute time by 10% (from the current 28.8 minutes to 25.8 minutes), achieve a consistent average travel time for vehicle traffic on major arterials during peak hours every day, and reduce regional VMT by 5.5% below 2005 levels by 2020.
- Toronto, Ontario has committed to reduce greenhouse gas emissions to 30% below 1990 levels by 2020.

Targets are also useful in driving project development and assessing and prioritizing projects. The District Department of Transportation (DDOT), borrowing from the Portland Bureau of Transportation (PBOT), set a policy to, “make bicycling and walking the *mode of choice* for trips under 3 miles and 1 mile respectively.” TransLink has quantified this goal in a target that by 2040, 15 percent of all trips under 8 km will be made by bicycle. It is important to note that most targets also include a targeted date for achieving a specific outcome. In this way, achievable targets can be set for short-term and long-term outcomes and they can be revised based on changes in regional trends, and observation of actual performance of improvements.

4 Program Development and Assessment

Just as important as what is measured and why, is how measurements are used in the evaluation of the network, proposed program, and individual projects. Case studies demonstrated the use of many different evaluation techniques. Common among them is the use of scenario planning.

4.1.1 Scenario Planning

Scenario planning is a common approach among many peers and an approach familiar to the Washington region. Scenario planning assesses possible futures or strategic choices by incorporating both the “knowns” of today as well as the unknowns (such as disruptive technologies) and considers multiple futures. Scenarios evaluated are often then combined into a single preferred program that incorporates the performance demonstrated across uncertain futures or in relation to tested priorities. The TransAction Update includes extensive scenario planning efforts to address both uncertain futures and potential strategies to deal with those futures.

In the development of the moveDC plan, DDOT crafted three distinct scenarios, each with a different focus: Approach 1: “Stay the Course” emphasized state of good repair and enhanced operations to make better use of existing resources. Approach 2: “Get to the Center” focused on downtown congestion and commuter trips. Approach 3: “Connect the Neighborhoods” focused on shorter distance trips to address community livability needs. Each approach included a package of potential projects serving the primary objective. The approaches were modeled and evaluated against the predetermined common performance criteria such as commute mode share, access to mobility options, miles of facilities, and person capacity of the network.

MWCOG’s Regional Mobility and Accessibility Study (2006) and subsequent efforts utilized scenario planning to assess the consequences of different regional growth trends. Scenarios considered the outcomes if growth was concentrated in the inner areas of the region, disproportionately in the outer areas of the region, fairly equitably distributed across the region (inner and outer, east and west), or concentrated in transit-rich areas. The outcomes of this assessment helped regional jurisdictions understand the consequences of their land use policies and the likely value of various transportation programs and investments.

DVRPC created investment scenarios to see how various funding situations would affect their performance. Investment scenarios look at options to see how spending money in different ways impacts transportation performance. For their investment scenarios, DVRPC reviewed future financial options. Current funding levels were projected to determine the medium baseline; the high scenario was built on potential preMAP-21 projected funding amounts; the low scenario was based on forecasted gas tax receipts in the Highway Trust Fund that were being discussed on the Federal level at the time.

Arizona DOT's transportation plan examined scenarios called "alternative investment choices" or AICs. AIC A had a "highway focus", reflecting a preservation-oriented investment approach with limited system expansion. AIC B was an "expanded travel choices" alternative, shifting funding from preservation to expansion, including to non-highway investments such as transit, rail, aviation, and other modes. Based on their implications on performance outcomes, the state ultimately blended the two scenarios which were then translated into prioritization measures used to select projects.

4.2 Evaluation and Prioritization Methods

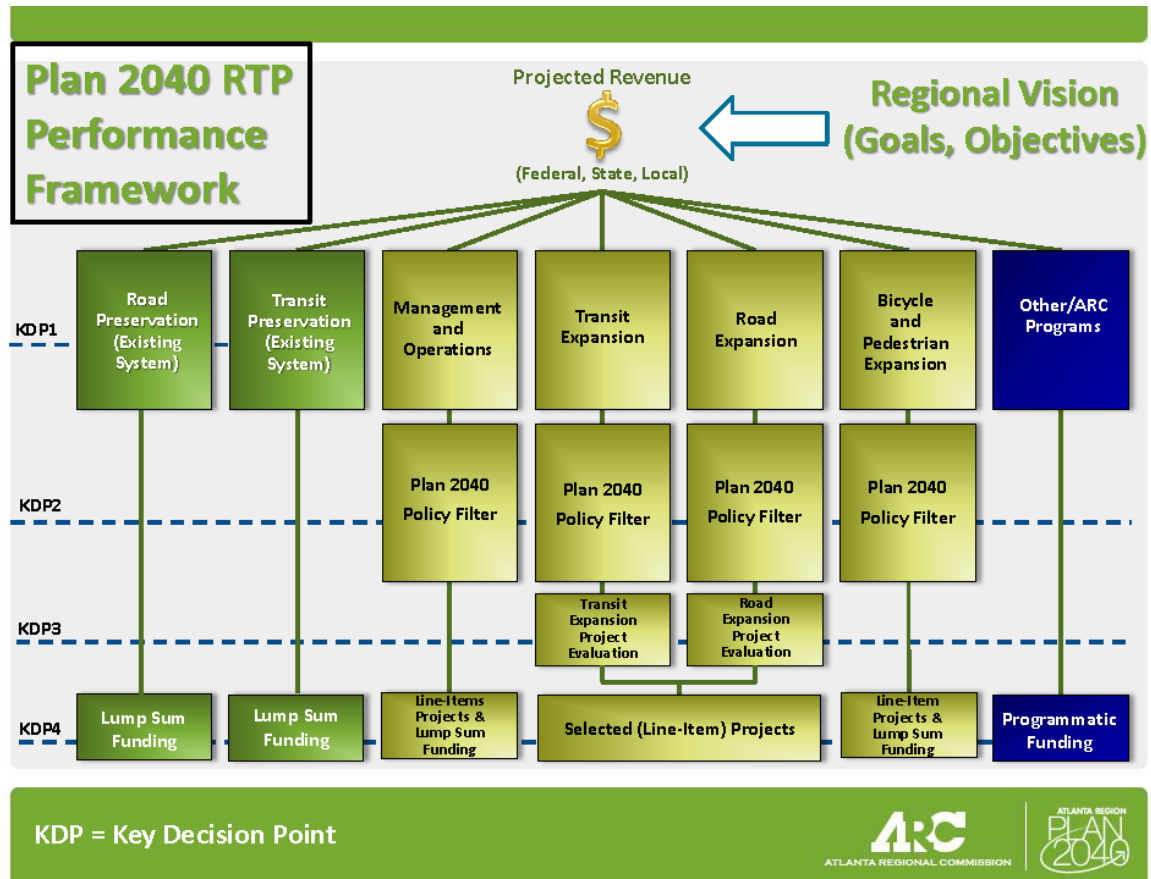
Several transportation (and other) agencies employ the use of various evaluation tools to assist in weighing competing factors and examining the potential trade-offs inherent in performance or programming choices.

Decision Lens is one such tool employed by several organizations including DVRPC, WMATA, Pennsylvania DOT, North Central Pennsylvania Planning and Development Commission, and dDOT, to name a few. VDOT used this tool to develop weights for the different performance measures used in the HB 599 analysis process. Tools such as these help participants to both weigh in on priorities as well as to visualize different outcomes. These database tools can quickly model “what if?” analysis, demonstrate changes to a program resulting from slight increases or decreases in funding, and compare outcomes of various choices. It can dynamically demonstrate how projects would rank, and an overall program assembled, if a factor were weighted higher or prioritized differently.

Benefit-Cost Analysis (BCA) or a variation is used by several agencies, accounting for benefits including a range of community values and goals. Translink, MTC, and Arizona DOT all use this approach, and TransAction 2040 included a cost-benefit analysis to inform efficient programming choices.

Some case studies demonstrated unique decision-making models. The Atlanta Regional Commission has a four-step process, as shown in Figure 4-1. The proposed program is filtered through four key decision points (KDPs). This begins with an assessment against the top level goals and objectives for the plan (KDP1) after which projects are assessed through the policy filter associated with one or more of the goal areas (KDP2) before a project-level evaluation is completed including both quantitative and qualitative performance measures (KDP3). If a project progresses that far, programmatic decisions about funding and phasing are made (KDP4). This is not dissimilar from the decision model graphically illustrated for the TransAction Update, or from the two-tiered approach (Project Selection followed by Project Evaluation) used by VDOT in conducting the HB 599 evaluations.

Figure 4-1: ARC Decision Support Model



5 Public engagement

5.1 Web-based Visualizations and Role Playing

Communicating information about scenarios, project performance evaluations, and progress toward targets to policymakers and the public can have significant impacts on the success of performance-based planning efforts. Peer agencies are using a variety of innovative tools and strategies to engage the public in the process as well as to communicate the tradeoffs between different investment scenarios.

For example, CMAP has created a highly graphic and interactive [website](#) to help members of the public understand and visualize complex datasets relating to metropolitan Chicago's transportation system. Interactive maps are provided specifically for congestion, road condition and ride quality, bridge conditions, transit access and ridership, and freight rail crossing delay.

The North Carolina Department of Transportation (NCDOT) developed an interactive spreadsheet-based tool that allows stakeholders and the public to develop different funding scenarios given a budget constraint. The tool estimates the impacts of these funding scenarios on the transportation system's level of service, and compares these results to current conditions and desired targets. NCDOT uses the input developed in these "Investment Strategy Summits" to allocate funds across program areas.

This type of role playing tool is similar to "build your own transit system" tools used by various transit authorities to evaluate the benefits of investment options on the values established through the planning process. Some examples include the Ohio Transit Survey (ohiotransitsurvey.com/demo.html) and Washtenaw County Transit Master Plan in southeast Michigan (<http://visuals.sdgworld.net/temp/annarborgame/>).

DVRPC won an award from US DOT for their public involvement process. Launched in October 2013, Choices & Voices serves as a way for members of the public to share their preferences for future development patterns, transportation projects, and approaches to funding them. At the same time, it contains an educational component that offers users a better understanding of the linkages between land use and transportation, the considerable basic maintenance and repair issues of the transportation network, and the consequences of failing to invest in transportation.

5.2 Crowd-sourced Input and Information

The broad accessibility of the internet and ever increasing "literacy" among the public with electronic media has increased the ability for transportation and other agencies to gather information from a wide cross-section of the public. Examples include:

- Boston DOT's "[Question Campaign](#)" that gathered more than 5,000 ideas for the future of Boston. These ideas were coded by geographic area of origin and thematic focus. Input was then analyzed to gauge issues and priorities across diverse stakeholders and within unique geographic areas.
- Combination of "WikiMap" and public survey to determine priorities and areas of concern to update the comprehensive plan for Sandy Springs, GA in the Atlanta metropolitan region (<http://thenext10.org/engage/>).
- DDOT pioneered and has now made wide use of "pop up" meetings. These meetings take the issues to the street – literally – holding meetings at the top of Metro escalators, on busy street

corners, or at parks with food trucks. These meetings do not require that participants have any advance notice of the process or the event and engage stakeholders in the course of their daily lives.

6 Considerations for TransAction

Leading peers and national research findings provide a number of lessons learned and specific actions for consideration in development of the TransAction Update.

6.1 Use Performance-based Planning with a Purpose

Performance-based planning is a data-driven, analytical process that allows agencies to compare and weigh the tradeoffs between competing packages of transportation investments. It allows policies and goals to be expressed in quantifiable terms and creates an analytical framework to determine the degree to which different investment packages meet the policies and goals. This approach is intended to lead to a more systematic and analytical selection process for investment priorities. It also allows for ongoing monitoring of the performance of investments to inform future decision-making and to enable adjustments to be made as necessary over time as the plan is updated every five years.

At the same time, the nature of performance-based planning typically requires a relatively robust set of analytical tools and models. Developing and applying such tools takes time, resources, and requires a series of assumptions about background conditions. Many of the best practice case studies profiled here were—like TransAction—large, multi-year undertakings that resulted in evaluation of each investment individually to determine its performance on all of the selected measures. However, some agencies have limited their analysis to only certain types of projects (for example, highway capacity expansion) while others have used different measures to evaluate different types of projects (such as state of good repair for highways versus transit projects). TransAction is the kind of large, multi-year planning process that can take full advantage of a performance-based planning approach.

Potential Actions:

- Task 5 Performance Measures – Develop measures that lend themselves to periodic reassessment as well as use during the current project evaluation; *ongoing refinements to the Goals, Objectives, Performance Evaluation Criteria are documented under separate cover as part of Task 5*
- Task 6 Develop Scenarios – Track the assumptions made for scenario development over time
- Task 7 Modeling – Design the models to facilitate use over time

6.2 Use the Vision Statement to Set Specific Goals and Objectives

The NVTa TransAction vision statement is strong and persuasive. The goals, however, are more nuanced compared to many of the best practices developed by peers, whose goals provide more specificity in the outcomes. Missing from TransAction 2040 are specifically articulated objectives, although they are captured to some extent in the Performance Evaluation Criteria (PECs).

Recasting the goals and PECs as clearly articulated goals and actionable objectives will make TransAction more legible and compelling to the public. This process will also help build consensus among the many regional stakeholders about the most important outcomes of the plan.

Potential Actions:

- Task 5 Performance Measures – Refine TransAction goals in light of the specific measures to be applied; *ongoing refinements to the Goals, Objectives, Performance Evaluation Criteria are documented under separate cover as part of Task 5*
- Task 5 Performance Measures – Introduce objectives that are specific and measurable; objectives provide the rationale for use of detailed measures, or PECs.
- Task 5 Performance Measures - Recommendations for consideration in specific objectives include:
 - Congestion
 - Travel time variability measures such as planning time index
 - Duration of congested periods
 - Severity of congestion
 - Number of people affected by congestion
 - Safety
 - Crash rates
 - Crash severity
 - Incident frequency
 - Accessibility
 - Household access to jobs within 60 minutes (all modes)
 - Activity center access to workforce within 60 minutes
 - Household access to multiple transportation modes (pedestrian networks, bicycle facilities, high frequency transit services, arterials, etc.)
 - Network redundancy
 - Network conditions
 - State of good repair
 - Regional significance
 - Person-capacity
 - Number of project sponsors

6.3 Select Meaningful Measures

Goals, objectives, and performance measures need to be nuanced and flexible enough to reflect changing and uncertain conditions in the real world, while at the same time being simple and reliable enough to be consistently evaluated with the data and tools available. In addition, they must be readily understood by stakeholders and decision-makers. Many agencies choose performance measures such that they meet certain basic criteria, such as:

- Can the measure be clearly explained and understood?
- Are data and tools available now and in the future to calculate this measure?
- Does the measure clearly relate to one or more of the plan's goals?

Every agency will have different goals and objectives, and the performance measures selected will reflect those differences. For example, in the Bay Area where the focus is on expanding transit availability and making transit service more productive, MTC has selected performance measures that track items like the

change in transit service hours, transit mode share, and fare box recovery ratio. In Chicago, on the other hand, where the focus is on reducing congestion, CMAP uses multiple metrics measuring road congestion throughout the system. As the TransAction plan update process continues, the NVTa should consider how the plan goals relate to the project prioritization and performance measures tracked over time.

Potential Actions:

- Task 5 Performance Measures – Clarify measures and simplify the overall list of measures for the formal evaluation process; there will be secondary measures for use by the study team, but the primary measures should be easily explained and understood
- Task 5 Performance Measures – PECs are technical, therefore the process for refining measures relates more to the analytical effort of TransAction; the process is interactive and collaborative, but goals and objectives are better statements for broad discussion

6.4 Identify Targets and Track Performance

When individual performance measures are used to compare the effects of investment strategies, the question becomes, “Which investment strategy produces a larger effect on this performance measure?” Ideally, in addition to using performance measures for comparative purposes, a performance-based plan will also establish desired targets for each measure.

Defining targets allows decision-makers to evaluate their decisions in relation to a desired end state, and clarifies progress made toward that end state in each successive update of the plan. There are several examples of transportation plans that set targets or desired trends. MTC’s Plan Bay Area set a numerical target for each of its performance measures and reported on whether the final plan achieved or fell short of each target. Similarly, CMAP in Chicago provides a robust interactive visualization tool to see how the region is performing. NVTa has the opportunity to use performance management to drive a conversation throughout the region about transportation system conditions and funding by making the data real for residents.

Setting aggressive long-term targets can galvanize and focus action in the region. These targets should be ambitious in order to inspire action and energy, however near-term milestones should also be established for interim targets.

Targets should relate directly to the goals and objectives that allow for the tracking of progress over time. Targets and performance measures do not need to be identical, as one is observed while the other is projected, they are likely to be closely related. Setting and tracking targets over time can also help to determine if improvements are having the same type and scale of impacts that is predicted by the analysis methodology.

Example targets for consideration include:

- a. Do not exceed 2015 average periods of congestion (e.g. duration of congested periods)
- b. Reduce regional vehicle miles traveled by 10% (from 2015 levels) by 2040 even while the number of jobs and households grow
- c. Reduce greenhouse gas emissions by 10% (from 2015 levels) by 2040

- d. Achieve XX% non-SOV mode share for commute to work by 2040
- e. Achieve average household transportation costs less than 15% of household income
- f. Increase person-capacity of the regionally significant network by 50% by 2040
- g. Achieve zero traffic fatalities on the regional network by 2040
- h. Achieve XX% of households accessible to YY% of NVTA jobs within a reliable 60 minute commute travel time

Potential Actions:

- Task 5 Performance Measures – Select performance measures that allow for application of near-term and longer-term targets
- Task 6 Develop Scenarios – Consider the measurable targets to be articulated in Task 5 in development of scenarios;
- Task 6 Develop Scenarios – Use the scenario development and evaluation process to highlight the ability to meet targets; the selected package of improvements will likely be a hybrid among the various alternatives but scenarios permit a better understanding of objectives, trade-offs, and performance
- Task 7 Modeling – Model outputs presented in relation to the targets to facilitate understanding of how close the region is to attaining the targets

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