TASK 2: NEEDS ASSESSMENT AND PRIORITIZATION PROCESS RECOMMENDATIONS

Prepared for Roanoke Valley Transportation Planning Organization

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TASK 2: DRAFT NEEDS ASSESSMENT AND PRIORITIZATION PROCESS RECOMMENDATIONS

ACKNOWLEDGMENTS

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ABOUT GAP-TA

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TASK 2: DRAFT NEEDS ASSESSMENT AND PRIORITIZATION PROCESS RECOMMENDATIONS

Introduction

This memorandum summarizes draft recommendations for the Roanoke Valley Transportation Planning Organization's (RVTPO) regional transportation needs assessment and prioritization processes. The recommendations' purpose is to improve reliance on data and align with statewide needs assessment processes while remaining attuned to local processes and priorities.

Recommendations are not intended to be implemented in the 2045 plan's version of the regional needs, but rather to be considered for incorporation into the process used to generate future versions of the needs and priorities. Continued consultation with the Transportation Technical Committee (TTC) and the RVTPO Policy Board will remain important in determining the recommendations to implement just as they have shaped the 2045 plan's needs assessment and prioritization processes.

The consultant team depended on the following documents to understand the needs assessment and needs prioritization processes.

- **Needs Assessment Process:** Roanoke Valley Transportation Planning Organization (2021). Roanoke Valley Transportation Needs Assessment. Approved April 22, 2021.
- **Needs Prioritization Process:** Roanoke Valley Transportation Planning Organization (2022). Needs Prioritization Methodology. TTC Special-Called Meeting. January 5, 2022. Staff Report..
- **Needs Prioritization Tool:** Roanoke Valley Transportation Planning Organization (2022). RVTPO Transportation Needs Prioritization Calculator & Results. Spreadsheet tool.
- **Prioritized Needs:** Roanoke Valley Transportation Planning Organization (2022). RVTP Needs Prioritization. Retrieved from https://experience.arcgis.com/experience/3600baf1a508452ca12fcf93e61e5e51.

The recommendations can also be understood as belonging to just a few categories of recommendations, which are to:

1. Strengthen the role of performance data analysis, particularly for identifying needs that are less visible to the public,
2. Increase clarity and precision in metrics used for needs prioritization,
3. Increase the objectivity and replicability of measures used for needs prioritization, and
4. Make other miscellaneous improvements to accelerate processing, increase responses, or increase precision.

The recommendations are organized according to the steps in the needs assessment and prioritization processes.

Needs Assessment Recommendations

1. Incorporate data for less visible needs categories into the process.

- **Justification:**
  The 2045 plan's needs assessment process relies highly on public input along with several other data sources including prior plans and studies, the travel demand model for the RVTPO area, and historical crashes. Use of public input has advantages for identifying needs that residents perceive and for identifying needs at locations that lack transportation performance data, such as roads with lower functional classifications, as well as identifying perceived needs that data would not highlight. Public participation tends to put more emphasis on visible needs categories like safety and congestion while omitting less visible needs that affect other stakeholders (e.g., those who maintain the system), such as asset management.

- **Recommendation Details:**
  Some potential needs categories such as asset management can be assessed using performance or condition data to identify problem areas where measures exceed allowed thresholds. This approach was taken in OIPI's VTrans process. Selecting enduring and regularly updated data sources can simplify performance analysis and make analytical steps more easily replicable, assuming that the data sources have adequate network coverage and spatial precision for regional and local needs analysis. Use of these data sources can also minimize local and regional responsibility for updating data by leaning on state and national programs. Potential sources include the U.S. Census Bureau's websites, [1,2] Pathways for Planning,[3] Virginia Roads,[4] Interact VTrans,[5] and RITIS data.[6] Table 2 shows data sources that can serve as a foundation for assessing needs that are not very visible to the public.

Table 2: Potential Data Sources

Need Category	Potential Data Sources
System Management – Bridge Condition	Virginia Department of Transportation (2022). Bridges and Culverts. Virginia Roads. Retrieved from https://www.virginiaroads.org/datasets/vdotbridgesculverts-ec/explore?location=37.984084%2C-79.491842%2C8.28
System Management – Pavement Condition	Virginia Department of Transportation. Pathways for Planning. Retrieved from https://vdotp4p.com/.[7]
Vulnerability to Inland Riverine Flooding	Office of Intermodal Planning and Investment (2022). Interact VTrans. Retrieved from https://vtrans.org/interactvtrans/map-explorer.

[1] Data.Census.gov

[2] U.S. Census Bureau (n.d.). Longitudinal Employer-Household Dynamics. Retrieved from https://lehd.ces.census.gov/data/.

[3] Virginia Department of Transportation (n.d.). Pathways of Planning. Retrieved from https://vdotp4p.com/.

[4] Virginia Department of Transportation (n.d.). Virginia Roads. Retrieved from https://www.virginiaroads.org/.

[5] Office of Intermodal Planning and Investment (n.d.). Interact VTrans. Retrieved from https://vtrans.org/interactvtrans/map-explorer.

[6] INRIX XD data is available without charge to Virginia MPOs through membership in the Eastern Transportation Coalition (https://tetcoalition.org).

[7] Includes pavement condition data for Roanoke, Bedford, and Botetourt Counties. Data for the cities of Salem and Roanoke are not included in VDOT data and may need to be requested directly through the cities.

2. Include additional information about collected data in the needs assessment.

- **Justification:**
  a. Not all the needs provided by the public are mappable. For instance, some needs related to transit system management are not mappable and are fully described in the individual plans. Thus, those needs can be included in a format different than the maps.
  b. Having non-mappable needs ensures that the needs assessment covers all the transportation-related needs even if they are not categorized in the surveys.

- **Recommendation Details:**
  a. Provide an accompanying document with a list of unmappable needs.
  b. It is possible to include the additional comments the public left at the end of the survey in the needs assessment since 71% (33 comments) of those were transportation-related.

3. Ask about transportation problems rather than projects in surveys.

- **Justification:**
  The surveys' final goal is to provide a list of needs (i.e., problems) across the network, not a list of solutions or projects.

- **Recommendation Details:**
  In surveys, don't ask "What other transportation projects would you like us to consider?" Instead, ask "What other transportation problem do you have?"

4. Focus data analysis and roadway needs assessments on shorter road segments to better define needs and potential areas for projects or further study.

- **Justification:**
  Long segments can obscure where a need really starts and stops by losing spatial granularity.

- **Recommendation Details:**
  Chop up long stretches of road into logical segments. Do not use long stretches; if a need applies to a big area or a long stretch (e.g., speeding on I-81), consider designating it "unmappable" or systemic.

5. Separate automobile needs and all other travel needs.

- **Justification:**
  Justification: RVTPO observed the need for this change while processing needs.

- **Recommendation Details:**
  Use need categories that separate modes.

6. Use multiple geometry types (e.g., points, lines, polylines, polygons) to signify needs, allowing the geometry that best matches each need to be used.

- **Justification:**
  Having multiple geometry types can reduce ambiguity as much as possible about where a need is located.

- **Recommendation Details:**
  In the needs assessment process, use lines, dots, and polygons to match the geometry of the need. Do not try to "make" polygons with lines or try to represent an area with a single dot. This has since been accomplished in the needs prioritization process.

3. Split needs that are generated by the same comment but are at different locations.

- **Justification:**
  Needs in different locations may need to be analyzed separately or receive different priorities regardless of the data or comment that resulted in their designation.

- **Recommendation Details:**
  Split up different locations clearly and change names to reflect the locations, for example if a comment says "this is a problem on all major Vinton corridors" create separate records for each Vinton corridor and name each location with the name of each road rather than naming all "major Vinton corridors."

Needs Prioritization Recommendations

Spatial Calculations Steps

Consider refining the process for overlapping needs' catchment area with prioritization criteria to convert binary assignment to an area share-based assignment for some criteria.

- **Justification:** The proportional overlap approach suggests that the full prioritization metric score is given to the need if there is an overlap greater than 50%. A binary overlap between needs and the metrics' geography loses data about the proximity between the need and the metric. Although not important for all criteria, for some criteria that proximity matters, and losing it degrades the level of data available. For details about the proportional overlap calculation, please see the Needs Prioritization Methodology, including Figure 2.[8]
- **Recommendation Details:** In some cases, combining the percentage overlap with the scoring of criteria (listed in Table 1 of the Needs Prioritization Methodology document)[9] can provide a better distribution of scores for prioritization. This implies treating an overlap as a continuous rather than a binary variable. Rather than assigning the metric fully to a need whose catchment area is 50% or more within the buffer and not at all to a need whose catchment area is less than 50% within the buffer, a percentage of the metric can be assigned to the percentage overlap between the metric and the need catchment area. Criteria for which this may be important to include those that are assigned based on a pre-existing area's geography such as multimodal centers and districts, equity emphasis areas, development priority locations, and urban development areas.

Table 3: Continuous Variables Proposed for Use in Prioritization

Needs Criteria	Needs Metric	Continuous Metric Proposed for Use
Throughput	Priority Corridor	Planning Time Index (PTI)
Safety	VTrans Safety Need	VTrans Safety Need Priority (where a Very High priority need equals 4, High equals 3, Medium equals 2, and Low equals 1). Safety Need
Safety	Pedestrian Safety Action Plan (PSAP) Priority Needs	PSAP Index
Environmental Justice	Equity Emphasis Area (EEA)	EEA Index

Needs Metrics Steps

Make as many metrics as possible use continuous rather than binary or categorical variables.

- **Justification:** Converting a continuous variable to a binary or categorical variable loses data compared with the original categorical variable.
- **Recommendation Details:** Rather than treating the criteria for Throughput, Safety, and Environmental Justice, as binary, consider using the continuous value behind the criteria. This creates greater variation in the values and reflects the severity of the underlying criteria rather than just presence or absence. When a continuous variable is substituted for a binary variable, then the continuous variable would be multiplied by the share of the overlap between the metric and the needs' catchment area (see spatial calculation recommendation above) before either normalizing so that the resulting value is still between 0 and 1 or calculating deciles as was done for the VMT Change metric. Table 3 shows the continuous metrics that are proposed.

Combining Results Steps

No recommendations.

[8] Roanoke Valley Transportation Planning Organization (2022). *Needs Prioritization Methodology*. TTC Special-Called Meeting. January 5, 2022. Staff Report.

[9] Roanoke Valley Transportation Planning Organization (2022). *Needs Prioritization Methodology*. TTC Special-Called Meeting. January 5, 2022. Staff Report.

Applying Scores and Weights Steps

1. Move subjective metrics for access needs prioritization toward objective processes.

- **Justification:**
  Subjective assessments are not as replicable across people or over time as more objective processes. Additionally, depending on the process, subjective assessments can be more time-consuming to complete since they require an analyst to collect, analyze, and weigh details of each individual need.

- **Recommendation Details:**
  a. Access needs scoring is currently subjective. Moving to a more structured scoring approach will allow the scoring to be replicated in the future and will reduce the variability in scoring that emerge when different people follow the process independently. Objective scoring can be achieved by combining available access-related scores including Walk Score, Bike Score, and Transit Score. These three measures are expected to become available for free on Interact VTrans[10] in the first quarter of 2022. Although data on compliance with the Americans with Disabilities Act (ADA) at the city level is sparse, an ADA compliance criterion can in theory be added to evaluate needs related to disabled pedestrians needing ADA accommodation.
  b. Where subjective measures remain, attempt to improve inter-rater reliability by creating guidance for analysts and if possible, by having several analysts score each need and take an average of their scores.

2. Develop a needs prioritization tool based on GIS and scripts.

- **Justification:**
  a. In general, tools help in documenting processes and establishing a systematic way of applying those processes.
  b. The current needs prioritization tool is Excel-based, which requires a separate spatial process of the needs and metrics prior to using the tool.
  c. Programmed GIS-based tools ease testing the prioritization methodology assumptions. They allow the developer to easily apply sensitivity analysis to test the impact of the various needs criteria, metrics and assumptions.

- **Recommendation Details:**
  a. GIS-based tools can be programmed using scripts such as R and ArcPy to run through all the needs prioritization process steps starting with the proportional overlap spatial process of the various needs criteria and ending with the prioritized list of needs in one tool. While these tools take an upfront investment of time and effort to develop, their advantage is that they automate most of the prioritization process, allowing it to be easily rerun with different needs, updated data, and/or different criteria weights now or in the future. The tool allows weights for goal areas and measures to be adjusted with final scores automatically recalculated. These types of tools can also automate calculation of measures used to prioritize based on raw data. This tool served to prioritize projects, although conceptually it is the same as one that would prioritize needs.
  b. Scripts give the flexibility to incorporate non-mappable needs if a separate non-spatial prioritization process is developed to address those needs. This non-spatial data can be included as part of the same GIS-based tools as an attribute table.

[10] https://vtrans.org/interactvtrans/map-explorer.

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Task 2: Needs Assessment
and Prioritization Process Recommendations

TASK 3:
PROCESS FOR DEVELOPING OBJECTIVES AND PERFORMANCE MEASURES

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TASK 3: PROCESS FOR DEVELOPING OBJECTIVES AND PERFORMANCE MEASURES

PROCESS OUTLINE

The following document gives a general outline of the process for developing objectives and performance measures as part of the long-range transportation planning process. It is broken into two parts: the process for developing objectives and the process for developing performance measures. The chart below shows the elements in the Roanoke Valley transportation planning process. It outlines all the steps in the performance-based planning process used to develop the transportation plan. However, these are not arranged in the sequence in which they occur. The chart at the end of the document shows the general sequence of these steps and tasks in the order in which they occur.

OBJECTIVES DEVELOPMENT PROCESS

The process of developing objectives consists of three parts. The first part involves brainstorming objective statements for consideration. It includes examples and other selection sources to help think of ideas. It also includes reviewing federal or state required performance measures and how they relate in a quantitative way to objectives. The second part involves evaluating and refining the objectives. While Part One helps generate draft objectives, Part Two establishes criteria for evaluating draft objectives. Part Three lists a series of example and potential draft objectives.

DEFINITIONS OF TERMS

To avoid ambiguity, it is necessary to clearly define the terminology used in these processes. Clear, detailed terms and definitions provided below clarify each step and its outcomes.

Needs – Transportation problem or issue identified in the community currently

Future Factors – Potential future need or consideration

Vision – Describes the desired future state

Goals – Broad statement of desired results, given an understanding of the needs

Objectives – A specific desired result, as it relates to making progress toward a goal, that may be accomplished by multiple strategies/solutions.

Projects/Services – The preferred means to address a transportation need and achieve an objective. These are identified in the constrained list of projects, and the vision list of projects

Solution/Strategy – Idea of how the region can achieve desired results.

Performance Measures – The quantitative link to objectives, performance measures assess the degree to which past investments have addressed transportation needs and meet acceptable thresholds. Performance measures guide strategies/solutions and selection of projects/services to best address transportation needs and meet objectives. Measures are not the same as prioritization criteria used for prioritizing needs, solutions, or projects though they may be related or similar in some cases.

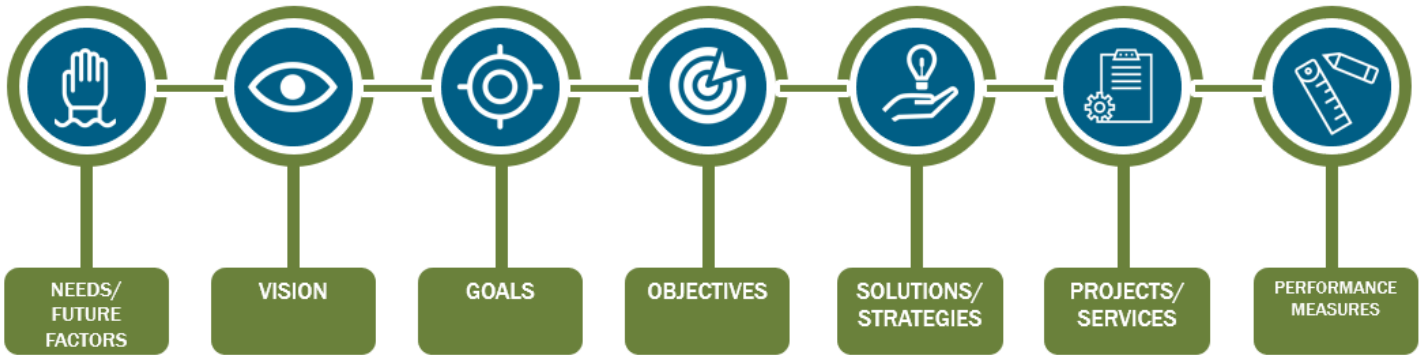

Figure 1: Chart of the basic elements in the performance-based planning process of the Roanoke Valley Transportation Plan

GUIDELINES FOR DEVELOPING OBJECTIVES

The following guidelines for developing clear and measurable objectives are based on the FHWA "Performance-Based Planning and Programming Guidebook."

- Objectives should support local goals, but also be informed by objectives established by federal and state programs
- Objectives must be attainable, measurable, and flexible with multiple possible ways to accomplish the objective.
- Objectives should be as specific as possible, and if possible, attainable within a working timeframe.
- Objectives are accomplished by outlining strategies/ solutions (general plans of action) then determining appropriate projects/services (how the solution will be executed) for the preferred solution.
- Solutions should not be included in the objective as there might be more than one possible solution to address the objective.

PART 1: DEVELOPING DRAFT OBJECTIVES

Part One is about idea generation. It provides a process for developing objective themes and basic ideas for evaluation in consideration of priority needs. Steps in this process include the following.

1. Identify themes based on priority needs under each Goal: Under each goal, list the priority needs that are related to the attainment of a goal. For example, under the overall goal of safety, different themes of priority needs could include reducing pedestrian crashes or reducing auto crashes at intersections.

2. Translate themes into candidate objectives: Turn each identified theme into a candidate objective using the SMART framework (i.e. that objectives should be Specific, Measurable, Agreed Upon, Realistic, and Time-Bound). For example, the theme of reducing pedestrian crashes could be turned into a draft objective that is measurable and realistic such as "reduce the number of non-motorized fatalities and serious injuries." "Increase the number of pedestrian-activated signalized intersections in the region by an average of five percent per year."

3. Compare candidate objectives to Need Prioritization methods: The candidate objectives in the Roanoke Region should be compared to the regional Needs and the methods used to prioritize Needs. Some of the objectives (such as those related to safety or reliability) may have a more direct relationship to the Needs Prioritization Criteria than others. While it is not necessary that every objective be correlated to one of the Need Prioritization Criteria, they should not conflict with one another. For example, if the Environmental Justice criterion for Need Prioritization is based on presence of low income, elderly, and disadvantaged populations, the objectives for Equity should not use a completely different set of indicators.

4. Apply additional refinement criteria to candidate objectives: This process can filter candidate objectives through several other criteria, such as:

a. Relationship to the SMART framework (i.e. that objectives should be Specific, Measurable, Agreeable, Relevant, and Time-Bound),

b. Relevant state and federal programs (including:

i. VTrans objectives

ii. Smart Scale evaluation factors

iii. U.S. DOT federal planning factors and performance measures)

5. Develop refined objectives: The final step involves detailing all the parts of the SMART criteria elements for the objectives defined to be more specific, measurable, and time-bound (e.g., reduce the person hours of total delay on highways and major arterials associated with traffic incidents by X percent over Y years.). As objectives are refined, they should also be linked with specific sources of data that will be used to measure performance of each objective. Although selecting performance measures is a related step in the process, each objective should have an identified set of data and potential measures that can be used to gauge performance over time.

PART 2: VETTING THE DRAFT OBJECTIVES

Part Two describes the process for vetting the candidate objectives with stakeholders to be able to affirm the final set of objectives for the planning process. The primary stakeholders in this process are the Technical Committee (TTC) and the Policy Board. Public involvement was conducted during the Needs process and the public will be brought back in to review the final Goals, Objectives, Measures, etc. when the Plan is in draft form. Steps in this process include:

1. Briefing for TTC on the definitions of Needs, Goals, Objectives, and Measures: The TTC's involvement will help to validate the candidate objectives. This involvement should begin with developing their understanding of key terms in the process.

2. Homework for the TTC: Following the initial briefing on key terms and definitions, the TTC should be given a homework assignment to review the list of candidate objectives. The TTC will have the opportunity to mark up the draft objectives and metrics. The TTC should have meaningful involvement in this step, evaluating each objective and providing thorough input electronically or through an online survey.

3. TTC meetings or work session: A work session should be conducted with the TTC to review the results of their evaluation and affirm the final preferred objectives. This coordination should end with a recommendation on the final objectives to the Policy Board.

4. Policy Board: As the decision-making body, the Policy Board will have authority for final approval of the Goals, Objectives, Measures framework and results. This process should also reinforce building support, to validate the final Roanoke Valley Transportation Plan.

PART 3: EXAMPLE OBJECTIVES

Based on the process above and the parameters in the FHWA Performance-Based Planning and Programming Guidebook, a list of potential draft objectives for consideration has been included at the end of this document. The sample objectives were identified through various sources including VTrans objectives, objectives from other MPO plans and from the RVAMPO 2035 transportation plan. However, it should be noted that some objectives from the RVAMPO 2035 Plan may not be appropriate as potential objectives since they do not fit the "SMART" criteria for defining objectives. They have been included for reference and as potential candidate ideas for Solutions or Projects. Likewise, other potential objectives may be vague and require additional detail to make them obtainable.

PERFORMANCE MEASURES DEVELOPMENT PROCESS

TYPES OF PERFORMANCE MEASURES

The process of developing performance measures can occur at two points in the performance-based planning process:

1. Federal performance measures - Federal FAST Act provisions mandate system performance measures and targets. The performance measures and targets defined through federal guidance were adopted by state DOTs and MPOs, including the RVTPO, in the past few years.

2. Regional performance measures – Additional performance measured adopted by the RVTPO that are not federally required. These measures quantitatively assess progress towards meeting objectives and through them the region's goals and vision.

Note: Prioritization criteria for needs, solutions or projects - these are not performance measures, rather they are criteria developed for selecting or prioritizing needs, solutions or projects. The criteria are typically developed at the MPO or regional level to ensure that needs prioritization, solution evaluation, and project selection occur in a fair and transparent process. These criteria may be closely aligned with some performance measures.

The purpose of utilizing federal or developing additional unique regional performance measures is to have a way to track the changes in the transportation system over time and progress toward achieving the region's vision, goals and objectives.

Performance measures are the quantitative counterpart to objectives. Thus, ideally performance measures should be aligned with both goals and objectives, and they should show progress toward meeting the region's transportation goals by several means, including addressing the region's transportation needs. The intent is to have a set of system performance measures corresponding with each objective so that progress toward the objectives can be measurable.

RELATIONSHIP TO FEDERAL MEASURES

USDOT requires that MPOs track a set of performance measures, as defined on page 24 of the Regional Transportation Improvement Program: https://rvarc.org/wp-content/uploads/2021/08/FY21-24TIP-083121.pdf

These measures allow the RVTPO to track progress toward some of the region's goals and objectives, but not all the regional goals have federal performance measures associated with them. The following table compares the RVTPO regional goals with the federally required performance measures. As shown in the table, there is not a direct correspondence between some of the goals and the federal performance measures.

This is to be expected since the federal performance measures are only intended to track system performance, whereas local or regional goals may relate to other priorities that are not directly related to the state of the system, such as economic development or

environmental sustainability.

However, as objectives are developed, there can be a closer correspondence between the objectives and the federal performance measures. For the objectives that do not have a federally required performance measure, the RVTPO should select a performance measure that it can track every year to monitor progress toward achieving the objective.

Table 1: Relationship to Federal Measures

RVTPO Goals	Applicable Federally Required Performance Measures
1. Provide a safe and secure transportation system	Safety and Public Transit Agency Safety Plan
2. Enable reliable mobility	Highway System Performance
3. Ensure convenient and affordable access to destinations	N/A
4. Foster environmental sustainability	N/A
5. Maintain and operate an efficient and resilient transportation system	Pavement and Bridge, and Transit Asset Management
6. Support economic vitality	N/A
7. Promote equitable transportation investments	N/A

PROCESS FOR DEVELOPING REGIONAL PERFORMANCE MEASURES

The process of developing additional regional performance measures follows logically from the process of identifying objectives and consists of a similar sequence of steps-developing candidate measures, selecting criteria to refine them, and vetting the measures with stakeholders.

1. Refine and finalize objectives

Performance measures need to be directly tied to the objectives. It may be necessary to refine the list of objectives to ensure that each of the federally mandated performance measures has a measurable objective linked to it.

2. Identifying gaps in performance measures

Identify gaps where no federally required performance measure corresponds to an objective.

3. Developing candidate performance measures

This step involves brainstorming a list of candidate regional performance measures to go with each objective.

Candidate performance measures can be derived from sources such as:

- The list of performance measures that the RVTPO tracked up until 2017. These performance measure reports are available at: https://rvarc.org/transportation/mpo_urban_transportation/performance_measures
- VTrans system performance measures - these include the surrogate performance measures aligned with each VTrans goal, which are available on page 23 of the VTrans draft policy guide: https://vtrans.org/resources/DRAFT_VTrans_Policy_Guide_2021.pdf
- Performance measures that have been developed by other MPOs. Virginia examples include those developed by the Hampton Roads TPO, the Central Virginia MPO and others.

4. Evaluating performance measures

The next step involves evaluating performance measures and refining draft performance measures based on objective standards. One source of standards for refining performance measures is the Roanoke Valley TPO Transportation Performance Management Technical Assistance Recommendations Report, prepared by Transportation for America. Although that report focused on project prioritization criteria, some of its guidelines for selecting good criteria are applicable to selection of system performance measures as well, including:

a. Work toward a small number of performance measures that directly support the identified goals and objectives.

b. Keep the number of performance measures small to make them easier to track and digest, increasing the likelihood that the performance measures will be used meaningfully.

c. Ensure that the data for the performance measure is available. Data must be available or be able to be made

available for the performance measure to be tracked each year.

d. Ensure that the performance measure is easy to understand.

In addition to the above recommendations, other considerations should be reviewed when refining and evaluating the candidate performance measures, such as:

- Is the desired direction of the measure clear? If not, it can be hard to know whether progress is being made. Each performance measure should have a desired direction (e.g. increase in values or decrease in values).

- Can the RVTPO directly influence the performance measure through its work, including through its project selection? Some performance measures may be important for the region but too broad for the RVTPO to influence through its transportation work. If measures cannot be influenced directly or indirectly, the RVTPO will be evaluating itself on performance measures over which it has no influence.

4. Vetting the draft performance measures

The process for vetting the draft performance measures is essentially the same as the process for vetting the candidate objectives as described above. Steps in this process include:

a. Recap for TTC on the process of defining Needs, Goals, Objectives, and Measures: The TTC may need a brief recap of how performance measures fit into the overall cycle of performance-based planning in the transportation plan.

b. Homework for the TTC: Following the initial briefing on the overall process, the TTC should be given a homework assignment to review the list of draft performance measures. The TTC will have the opportunity to mark up the draft performance measures with input provided electronically or through an online survey.

c. TTC meetings or work session: A work session should be conducted with the TTC to review the results of their evaluation and affirm the final preferred performance measures. This coordination should end with a recommendation on the final objectives and any new regional performance measures to the Policy Board.

d. Policy Board Review: As the decision-making body, the Policy Board will have authority for final approval of the Goals, Objectives, Performance Measures framework and results. This process should also reinforce building support, to validate the final Roanoke Valley Transportation Plan.

OVERALL PROCESS CHART

The following flowchart depicts how the various elements of the process connect. It is based on the RVTPO's framework for prioritization originally approved in 2017. The identified regional Needs start the process and shape the Goals, which inform the prospective objectives. The prioritized Needs report and objectives work together to form possible Solutions and Strategies. The preferred Solutions are developed into specific Projects or Services, and these are prioritized as well as measured to ensure that their performance relates back to the original Goal and Objective.

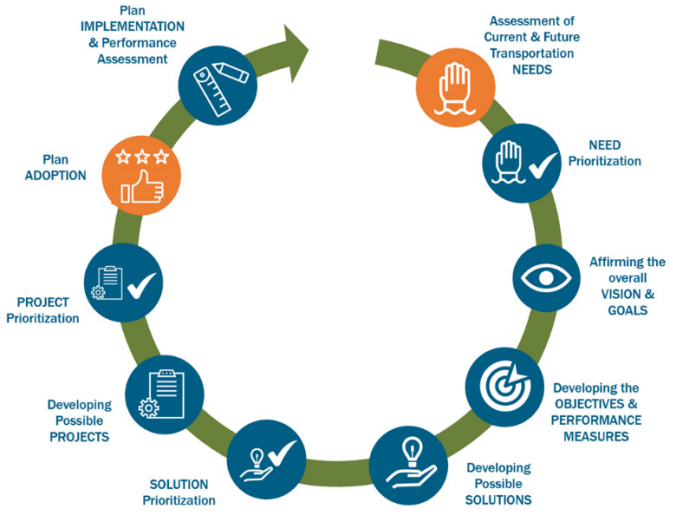

Figure 2: Chart showing how objectives fit within the overall Roanoke Valley Transportation Plan process

APPENDIX A: EXAMPLE OBJECTIVES

Table 2: Potential Objectives for Consideration

2045 Draft LRTP Goals	Potential Objectives	Idea Source
1. Provide a safe and secure transportation system	Reduce vehicle crash rate (EPDO/KAs) and frequency	VDOT safety measure
	Maintain state of good repair	RVTPO Needs Assessment references pedestrian/ADA facilities as poor
	Reduce injuries and fatalities along the region's multi-modal transportation system	Other MPO examples
	Improve the security of the transportation system's users through the coordination of agencies, responders, and departments (transportation and non-transportation).	Other MPO examples
	Reconfigure, restripe, and/or resurface urban collectors and arterials to include bicycle lanes, sidewalks, or pedestrian paths in accordance with local comprehensive plans and local design guidelines.	RVAMPO CLRTP 2035 Objective
	Use data analysis to identify top regional accident locations on a vehicle miles traveled, entering volume, or other standard measure.	RVAMPO CLRTP 2035 Objective
	Identify regionally significant right of way or human factors that have the potential to lead to accidents in anticipated projects listed in this plan.	RVAMPO CLRTP 2035 Objective
	Promote educational safety programs	Other MPO examples
	Reduce the number and rate of motorized fatalities and serious injuries	**VTrans**
	Reduce the number of non-motorized fatalities and serious injuries	**VTrans**
	Provide a safe and secure environment for the traveling public, addressing roadway hazards, pedestrian and bicycle safety, and transit security.	**Other MPO example (Maricopa Association of Gov'ts)**
	Increase safety with an adaptive transportation system for all users, including minimizing conflicts between motorized and non-motorized modes.	Other MPO examples (HRTPO)
	Ensure the security of the region's transportation infrastructure and its users.	Other MPO examples (HRTPO)

2045 Draft LRTP Goals	Potential Objectives	Idea Source
2. Enable reliable mobility	Improve system reliability	VDOT measure
	Reduce traffic congestion on primary travel corridors within the region.	Other MPO Examples
	Maintain reliability and performance for freight, transit, bike and pedestrian modes of travel.	Other MPO Examples
	Integrate technologies, techniques, and programs to maximize the efficiency of the existing system.	Other MPO Examples
	Maintain regional vehicle hours of delay at present level.	Other MPO Examples
	Increase performance and awareness of Travel Demand Management (TDM) program	RVAMPO CLRTP 2035 Objective
	Consider corridor improvements as a combination of a series of intersection or bottleneck improvements coupled with appropriate safety and accessibility.	RVAMPO CLRTP 2035 Objective
	Target future areas that are projected to have a concentration of "carless households" in retirement age ranges.	RVAMPO CLRTP 2035 Objective
	Investigate daily bus service between Roanoke Valley and Smith Mountain Lake to connect retired lake residents with regional airport and other transportation connections.	RVAMPO CLRTP 2035 Objective
	Emphasize capacity management through low-cost investments - prioritize projects that focus on lower cost operations and management type improvements such as intersection improvements, transit priority, and complete street solutions.	Other MPO Examples
	Improve reliability on key corridors for all modes	VTrans
	Maintain an acceptable and reliable level of service on transportation and mobility systems serving the region, taking into account performance by mode and facility type.	Other MPO example (Maricopa Association of Gov'ts)

NOTE: Some Objectives from the RVAMPO 2035 Plan may (in orange font) may not be appropriate as potential objectives since they do not fit the "SMART" criteria for defining objectives. They have been included for reference and as potential candidate ideas for Solutions or Projects. Likewise, other potential objectives may be vague and require additional detail to make them obtainable.

2045 Draft LRTP Goals	Potential Objectives	Idea Source
3. Ensure convenient and affordable access to destinations	Increase destinations accessible by transit	RVTPO Needs Assessment
	Incorporate and coordinate transportation improvements with existing and planned future land uses to minimize infrastructure cost.	Other MPO Examples
	Provide safe, reliable, and affordable connections to employment, education, healthcare, and other essential services.	Other MPO Examples
	Improve and enhance regional and long-distance transit usage and coverage within the region.	Other MPO Examples
	Improve and enhance bicycle and pedestrian facilities within the region.	Other MPO Examples
	Preserve needed future transportation corridors early in the planning process.	Other MPO Examples
	Plan for non-interstate park and ride lots by including construction costs or private sector partnership costs in the Financially Constrained List of Transportation Projects.	RVAMPO CLRTP 2035 Objective
	Provide bicycle accommodations on key commute corridors.	RVAMPO CLRTP 2035 Objective
	Increase pedestrian access and safety on collector and arterial roads.	RVAMPO CLRTP 2035 Objective
	Construct "Roanoke River Greenway" as defined in "2007 Update to the Roanoke Valley Conceptual Greenway Plan" by end of CLRTP 2035 time horizon.	RVAMPO CLRTP 2035 Objective
	Develop at least 10 active or completed Safe Routes to Schools (SRTS) plans or projects by the end of the CLRTP 2035 time horizon.	RVAMPO CLRTP 2035 Objective
	Provide residents of the region with access to jobs, shopping, educational, cultural, and recreational opportunities and provide employers with reasonable access to the workforce in the region.	Other MPO example (Maricopa Association of Gov'ts)
	Reduce delay and improve travel efficiency.	Other MPO example (HRTPO)

2045 Draft LRTP Goals	Potential Objectives	Idea Source
	Increase the coordination of the transportation system, across and between modes, for people and goods.	Other MPO Examples
	Provide a variety of transportation options that accommodates all users.	Other MPO example (HRTPO)

NOTE: Some Objectives from the RVAMPO 2035 Plan may (in orange font) may not be appropriate as potential objectives since they do not fit the "SMART" criteria for defining objectives. They have been included for reference and as potential candidate ideas for Solutions or Projects. Likewise, other potential objectives may be vague and require additional detail to make them obtainable.

2045 Draft LRTP Goals	Potential Objectives	Idea Source
4. Foster environmental sustainability	Reduction in air pollution	RRTPO Regional Prioritization
	Improve air quality through the reduction of emissions.	Other MPO Examples
	Promote coordination of planning to avoid disturbance of sensitive natural areas and historical properties while minimizing transportation impacts on neighborhoods.	Other MPO Examples
	Build arterial and collector streets as "complete streets", accommodating automobiles, bikes, buses and sidewalks.	Other MPO Examples
	Implement projects and policies that help reduce the growth of VMT to be more consistent with the rate of population growth.	Other MPO Examples
	Maintain a planning process that integrates and coordinates transportation planning with land use, water and natural resource conservation.	Other MPO Examples
	Reduce per-capita vehicle miles traveled	VTrans
	Reduce transportation related NOX, VOC, PM, and CO emissions	VTrans
	Minimize the environmental impact of future growth and transportation.	Other MPO example (HRTPO)
	Promote compatibility between transportation improvements and planned land use and economic development patterns.	Other MPO example (HRTPO)

2045 Draft LRTP Goals	Potential Objectives	Idea Source
5. Maintain and operate an efficient and resilient transportation system	Increase system resiliency to existing and future climate and extreme weather impacts.	Other MPO Examples
	Maximize useful life of assets through prioritized infrastructure repair and maintenance.	Other MPO Examples
	Ensure safe travel along the region's multimodal transportation system through a properly preserved system.	Other MPO Examples
	Manage access to major facilities to maintain throughput adn encourage compatible land uses.	Other MPO Examples
	Consult local government design guidelines and neighborhood plans to more accurately develop project cost estimates for candidate LRTP 2035 projects.	RVAMPO CLRTP 2035 Objective
	Provide funds for signal timing coordination and synchronization plans and studies on key regional corridors.	RVAMPO CLRTP 2035 Objective
	Provide for the continuing preservation and maintenance needs of transportation facilities and services in the region, eliminating maintenance backlogs.	Other MPO example (Maricopa Association of Gov'ts)
	Make investments to improve flood resiliency.	Other MPO example (HRTPO)

NOTE: Some Objectives from the RVAMPO 2035 Plan may (in orange font) may not be appropriate as potential objectives since they do not fit the "SMART" criteria for defining objectives. They have been included for reference and as potential candidate ideas for Solutions or Projects. Likewise, other potential objectives may be vague and require additional detail to make them obtainable.

2045 Draft LRTP Goals	Potential Objectives	Idea Source
6. Support economic vitality	Increase work accessibility	SMART SCALE measure
	Provide for the efficient movement of goods by rail and truck and improve connections to global markets.	Other MPO Examples
	Enhance travel and tourism connectivity to regionally and nationally significant resources.	Other MPO Examples
	Assure adequate transportation connectivity between Downtown Roanoke and Biomedical Center Complex on Reserve Ave.	RVAMPO CLRTP 2035 Objective
	Develop telework as a complement to existing commuting patterns and as an inter-regional transportation option for those living in the RVAMPO area and teleworking to larger metropolitan areas.	RVAMPO CLRTP 2035 Objective
	Continue to investigate an increased role for rail, both intermodal freight and a possible re-establishment of passenger rail service.	RVAMPO CLRTP 2035 Objective
	Respond to mobility needs of the workforce population	Other MPO Examples
	Prioritize transportation investments that serve residential, commercial, and logistics development sites and other priority places identify in MPO's plan.	Other MPO Examples
	Address regional freight first and last mile connections.	Other MPO Examples
	Reduce the amount of travel that takes place in severe congestion	VTrans
	Reduce the number and severity of freight bottlenecks	VTrans
	Maintain a reasonable and reliable travel time for moving freight into, through and within the region, as well as providing high-quality access between intercity freight transportation corridors and freight terminal locations, including intermodal facilities for air, rail, and truck cargo.	Other MPO example (Maricopa Association of Gov'ts)
	Support efficient freight movement.	Other MPO example (HRTPO)

2045 Draft LRTP Goals	Potential Objectives	Idea Source
	Support accessibility for tourism.	Other MPO example (HRTPO)
	Support regional growth and productivity.	Other MPO example (HRTPO)

NOTE: Some Objectives from the RVAMPO 2035 Plan may (in orange font) may not be appropriate as potential objectives since they do not fit the "SMART" criteria for defining objectives. They have been included for reference and as potential candidate ideas for Solutions or Projects. Likewise, other potential objectives may be vague and require additional detail to make them obtainable.

2045 Draft LRTP Goals	Potential Objectives	Idea Source
7. Promote equitable transportation investments	Increase destinations accessible by underserved communities	RRTPO Regional Prioritization
	Prioritize MPO investments that benefit equity populations	Other MPO Examples
	Minimize potential harmful environmental, health and safety effects of MPO funded projects for all equity populations	Other MPO Examples
	Promote investments that are accessible to all people regardless of ability	Other MPO Examples
	Improve access from equity emphasis areas (EEAs) to jobs	Loosely derived from VTrans data
	Improve access to activity centers	Loosely derived from VTrans data
	Address the needs of the elderly and other population groups that may have special transportation needs, such as non-drivers or those with disabilities.	Other MPO example (Maricopa Association of Gov'ts)
	Ensure that mobility benefits positively affect low-income residents.	Other MPO example (HRTPO)
	Engage a diverse public in the development of the region's transportation system.	Other MPO example (HRTPO)

APPENDIX B: RVTPO FEDERAL PERFORMANCE MEASURES

Rule and effective date(s)	Performance Measures
Safety Final Rule published 1/15/16. Effective date 1/14/16. RVTPO adopted PM targets 1/25/18.	• Number of fatalities • Fatality rate (per 100 million VMT) • Number of serious injuries • Serious injury rate (per 100 million VMT) • Number of non-motorized fatalities and serious injuries
Pavement and Bridge Final Rule published 1/18/17. Effective date 5/20/17. RVTPO adopted PM targets 10/25/18.	• % of pavements on the Interstate system in good condition • % of pavements on the Interstate system in poor condition • % of pavements on the non-Interstate NHS in good condition • % of pavements on the non-Interstate NHS in poor condition • % of NHS bridges classified as in good condition • % of NHS bridges classified as in poor condition
Highway System Performance Final Rule published 1/18/17. Effective date 5/20/17. RVTPO adopted PM targets 10/25/18.	• % of person miles traveled on the Interstate system that are reliable • % of person miles traveled on the non-Interstate NHS that are reliable • % of Interstate system mileage providing for reliable truck travel times (Truck Travel Time Reliability)
Transit Asset Management Final Rule published 7/26/16. Effective date 10/1/16. RVTPO adopted PM targets 10/25/18	• % of revenue vehicles that have met or exceeded their useful life benchmark • % of non-revenue vehicles that have met or exceeded their useful life benchmark • Percentage of track segments with performance restrictions • Percentage of facilities rated in poor condition
Public Transit Agency Safety Plan Final Rule published 7/19/18. Effective date 7/19/19. RVTPO adopted PM targets 1/28/21.	• Fatalities (total number of reportable fatalities per year) • Fatalities (rate per total vehicle revenue miles by mode) • Injuries (total number of reportable injuries per year) • Injuries (rate per total vehicle revenue miles by mode) • Safety events (total number of safety events per year) • Safety events (rate per total vehicle revenue miles by mode) • System Reliability: Distance between Major Failures • System Reliability: Distance between Minor Failures

Beginning in the fall of 2017, the RVTPO has coordinated with VDOT, DRPT, Valley Metro, RADAR, the Federal Highway Administration, and the Federal Transit Administration to set and adopt performance measure targets. The target establishment dates vary based on the effective date of the federal Final Rule, the establishment of state targets by VDOT (no later than one year following effective date of Final Rule), and the development or acceptance of VDOT targets by the MPO (no later than 180 days after VDOT target is set).

Roanoke Valley Transportation PLANNING ORGANIZATION
Staffed by the REGIONAL commission

TASK 4:
PROCESS FOR IDENTIFYING AND EVALUATING SOLUTIONS TO TRANSPORTATION NEEDS

Prepared for Roanoke Valley Transportation Planning Organization

AUGUST 2022

TASK 4: PROCESS FOR IDENTIFYING AND EVALUATING SOLUTIONS TO TRANSPORTATION NEEDS

ACKNOWLEDGMENTS

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ABOUT GAP-TA

The Growth and Accessibility Planning Technical Assistance (GAP-TA) program supports Virginia localities in planning and developing multimodal transportation opportunities. The program has four components, and each component has differences in eligible applicants, eligible activities, expected outcomes, and application evaluation criteria. Component 1 involves conducting multi-modal planning within existing or planned Urban Development Areas or Growth Areas. Component 2 involves developing or evaluating strategies to address emerging planning issues. Component 3 involves developing an accessibility planning process, Finally, Component 4 involves conducting multi-modal planning outside urbanized areas. Visit vtrans.org/about/GAP-TA for more information about the GAP-TA program.

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Roanoke Valley Transportation PLANNING ORGANIZATION
Staffed by the REGIONAL commission

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TASK 4: PROCESS FOR IDENTIFYING AND EVALUATING SOLUTIONS TO TRANSPORTATION NEEDS

Solutions Development Process

The process for identifying and evaluating solutions to transportation needs is intended to be implemented as part of the Roanoke Valley Transportation Plan (RVTP) development process after the identification of objectives and system performance measures (task 3). It directly precedes the identification and prioritization of projects (task 5). This process is intended to allow for the identification and prioritization of infrastructure and policy solutions and to account for new solutions that have not historically been implemented in the region non-transportation solutions to transportation problems. The process combines different kinds of inputs ranging from historical projects to best practices research and stakeholder involvement to capture the breadth of possible solutions and their areas of appropriate application.

The process was developed by considering national best practices in light of the Roanoke Valley Transportation Planning Organization's (RVTPO) intent for the process and the data that is likely to be available for process execution. The process synthesizes elements of four primary approaches, namely stakeholder involvement, analysis of existing and committed projects, engineering and planning judgment, and automation to generate recommendations.

The proposed process has three phases, each comprised of multiple steps as summarized in Figure 1. Phase I defines common transportation solutions that could support the region's goals and objectives. Phase II takes the prioritized transportation needs and recently completed, existing, and committed projects to identify needs without a solution in progress (gap needs) and potential solutions. Finally, phase III evaluates the potential solutions to prioritize them and select a preferred solution for each need evaluated based on several criteria that are used to evaluate infrastructure and policy solutions. The following sections detail each of these phases.

Definitions of Terms

There are several terms that are important for understanding the proposed process. These terms are defined below.

Need – Transportation problem or issue identified in the community currently. As described in the Roanoke Valley Transportation Needs Assessment, a transportation need "states a problem, not a specific solution, and could be solved by multiple possible solutions."[1]

Gap Need – A need without a funded project or service.

Addressed Need – A need with a recently funded solution to be reviewed for performance outcomes prior to any further solutions identification, if needed.

Solution – An idea of how the region can achieve desired results. Solutions address specific transportation needs and contribute to the realization of a regional objective. Some transportation solutions may be simple enough to lead directly to a project whereas others may require further study/analysis.

Project – A specific scope of work describing how the solution will be implemented including start/end points, length, and cost.

Study/Analysis – Additional work required to identify possible solutions or derive a project from a solution.

Solutions Identification – The development of a universe of possible solutions (including non-transportation solutions) that can respond to a transportation need.

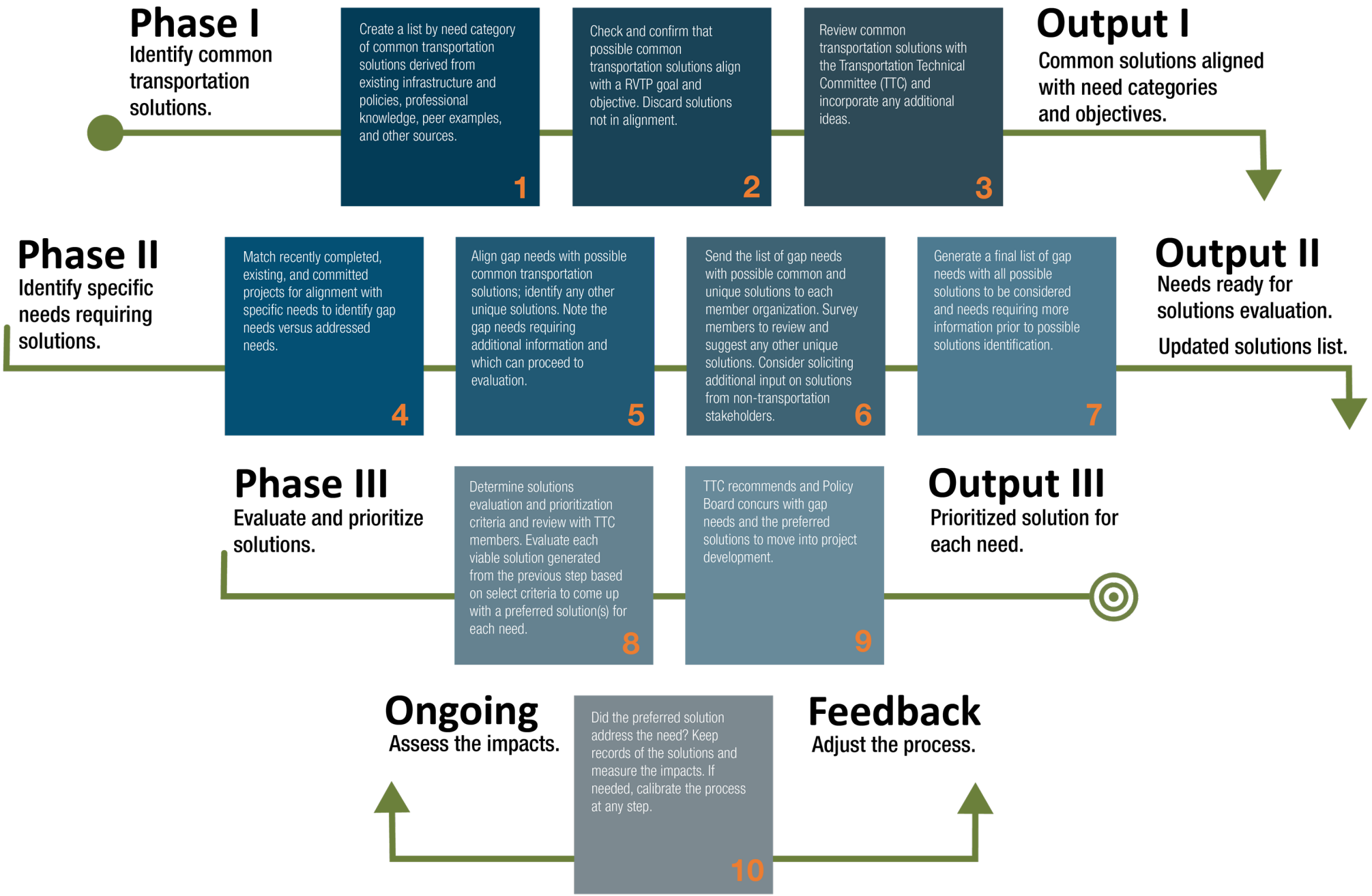
Solutions Evaluation – The prioritization and winnowing of solutions in response to a particular need. This evaluation may be a function of location-specific, organizational, and/or regional characteristics.

Common Solution – A transportation solution deriving from sources that are not related to the context of a particular need, such as past projects, peers, and best practices. It contrasts with unique solutions, which derive from a particular need's context.

Unique Solution – A solution deriving from the context of a particular need, in contrast to a common solution, which derives from past projects, peers, or best practices before being applied to a particular need. Unique solutions may be transportation or non-transportation solutions.

[1]RVTPO (2021). Roanoke Valley Transportation Needs Assessment. Approved April 22, 2021.

Figure 1: Solutions Identification and Evaluation Process Flow Chart



Phase I: Identifying Common Transportation Solutions

Phase I determines the options for addressing the region's transportation needs by defining common transportation solutions. Infrastructure solutions are drawn from recently completed, current, and historical project lists, professional knowledge, peers, and other sources (step 1). These solutions are aligned with RVTPO goals and objectives to ensure that each solution supports the future that the region has envisioned (step 2) before soliciting feedback from the Transportation Technical Committee (TTC) (step 3). The following subsections describe the inputs and deliverables from the process, along with each of the three steps.

Phase I Inputs

The following inputs are needed for execution of phase I.

a. **Projects from Transportation Improvement Program (TIP) for fiscal years 2021-2024:** https://rvarc.org/transportation/mpo-urban-transportation/tip/.

b. **Projects from Vision 2040:** Roanoke Valley Transportation Plan (2017). https://rvarc.org/transportation/mpo-urban-transportation/long-range-plan/.

c. **Project features**: List of project features presented by the Office of Intermodal Planning and Investment (OIPI).[2]

d. **Plans/studies:** These state, regional and local plans and studies are intended to provide solutions to populate the solutions list. Plans and studies to be examined are included in Appendix A along with any other studies underway.

e. **Prioritized needs:** The transportation needs refer to the needs derived from the Roanoke Valley Transportation Needs Assessment that was approved on April 22, 2021.

f. **Final goals and objectives:** The final objectives are identified using the process defined in Task 3. The goals refer to the transportation plan goals, which were identified in May 2021.

g. **Research material:** Sources for researching best practices and/or access to peers.

h. **Future factors summary:** The *Roanoke Valley Transportation Plan – Future Factors* summary document dated July 28, 2021.

i. **Feedback** from Transportation Technical Committee (TTC).

Phase I Deliverables

The output of phase I is a table listing common solutions that are typically implemented in response to each transportation needs category and those solutions' alignment with regional objectives. Appendix B includes a template of the table to be populated (Table 2).

Step 1: Develop List of Common Transportation Solutions

The RVTPO's staff or consultant team will review projects from the current transportation plan, from one or more previous transportation improvement programs (TIPs), or other known improvements. The intent is to identify common solutions implemented through similar elements of projects based on the project descriptions and / or scopes. Common solutions are those that derive from past projects, peers, best practices, and other sources that do not consider a particular need's context in defining the solution. The solutions derived in this step are a first draft of possible solutions to transportation needs. Appendix C shows a list of example solutions derived from the fiscal year (FY) 2021-2024 TIP.

Searching project scopes or descriptions by key word such as "widening," "new lane," "auxiliary lane," and "roundabout" is recommended to automate the categorization of project elements into common solutions. The key words and their association with possible solutions will be developed through exploratory analysis. A project may address more than one need, and the possible solutions are intended to be precise enough to guide eventual project development while allowing for the specific project details to be selected based on more detailed analysis and site conditions. It is not necessary to analyze all possible solutions, as long as a large and representative sample is examined.

The RVTPO's staff or consultant team executing the RVTP will supplement these draft common solutions with other sources to flesh out the list for new project types that have not previously been implemented in the Roanoke Valley. The purpose is to derive potential transportation

[2]Office of Intermodal Planning and Investment (2021). SMART SCALE. Presentation by Brooke Jackson to the RRTPO Technical Advisory Committee. November 8, 2021. Retrieved from https://youtu.be/p1QJMby966E?t=2840.

solutions from peers, best practices, and studies. One such source is the list of project features that OIPI uses for some SMART SCALE processes, which provides a fairly comprehensive set of common transportation solutions. A screenshot from a Virginia Office of Intermodal Planning and Investment (OIPI) presentation is in Appendix D. Additionally, RVTPO / consultant staff will review best practices, other plans and studies, and peers to complete the list of common transportation solutions.

Best practices: Potential sources for best practices research include the following:

1. Transportation Research Board presentations
2. Publications by the Transportation Research Board (TRB), including National Cooperative Highway Research Program (NCHRP), National Cooperative Transit Research Program (NCTRP), National Cooperative Railroad Research Program (NCRRP), and National Cooperative Freight Research Program (NCFRP) reports
3. Transportation journals
4. Publications by organizations such as the Lincoln Institute of Land Policy and the American Planning Association (APA)

Plans and studies: Many existing regional and local plans and studies define solutions or provide recommendations from which more generalized solutions can be derived. These studies are listed in Appendix A.

Peer Research: If possible, a handful of peer metropolitan planning organizations (MPOs) can be examined through plan reviews and interviews to assess any innovative or creative solutions that they have considered and/or used. It is recommended to select MPOs that vary by size and location to create variety in the solutions that they use.

Future Factors: While the future factors related to technology, society, economy, sustainability, and funding & finance do not dictate solutions, they do provide context for where the region is going and for the breadth of solutions that may be required in the future. The future factors should be consulted while developing lists of common solutions to make sure that at least some of the solutions identified will help the region prepare for these future factors. If very few of the solutions would help the region prepare for future factors, then the future factors may merit special attention in the development of unique solutions in phase II. Appendix E lists the future factors.

At this point, it is not necessary to evaluate the RVTPO's level of influence over implementing the solution since the purpose is to define a broad set of potential solutions to each problem. The output from this step is a list of common transportation solutions to transportation needs.

Step 2: Check Alignment between Common Transportation Solutions, and Goals and Objectives

Each common transportation solution is assessed to ensure that realization of the solution will promote one or more of the regional objectives as described in the RVTP. Solutions that do not promote achievement of at least one objective are removed. Implementation of solutions should uniformly advance the region toward its goals and objectives, although there may be trade offs among objectives. Additionally, at this step the solutions are aligned with the needs categories such that it is possible to say for each category which transportation solutions could be considered to resolve it. Solutions can be aligned with more than one need category.

Step 3: Review Common Transportation Solutions List with Transportation Technical Committee (TTC)

The TTC reviews the common transportation solutions list to provide feedback or add other solutions. Feedback may include new solutions to consider, changes to the way in which solutions are categorized or described, changes to the needs or objective alignment, or elimination of solutions that are unlikely to be useful. Questions to ask the TTC that may generate helpful feedback include the following.

1. Are there other solutions that should be included?
2. Do any of these solutions appear infeasible in our region, even over the long term?
3. Do any solutions appear unrelated to the resolution of the need that they are aligned to? If so, this could indicate either a problem with how the solution is explained or an error in its alignment to the need.

Phase II: Identify Specific Needs Requiring Solutions

The purpose of phase II is to identify gap needs, assign common solutions to gap needs, and identify unique solutions to gap needs. Needs are matched to relevant recently completed, existing, and committed projects to identify addressed needs and reveal gap needs (step 4). At this point, common transportation solutions are assigned to priority gap needs, and unique solutions for these needs are identified (step 5). Gap needs and their common and unique solutions are shared with each locality to review and identify any other possible unique transportation or non-transportation solutions to consider for that particular need (step 6). This produces a list of gap needs with matched common and unique solutions (step 7). The following subsections detail the phase II inputs and deliverables, along with each step.

Phase II Inputs

The following inputs support phase II execution.

a. **Phase I deliverable**: The table that aligns potential solutions with needs categories and regional objectives.

b. **Prioritized transportation needs:** As derived from the Roanoke Valley Transportation Needs Assessment that was approved on April 22, 2021 and subsequent needs prioritization methodology.

c. **Recently completed, existing and committed projects:** Projects which have been recently completed, for which construction has begun, or for which funds have been committed, as listed in the fiscally constrained TIP and the RVTPO Annual List of Federally Obligated Transportation Funds.

d. **Plans and studies:** Select plans and studies to examine are listed in Appendix A along with any others underway.

e. **Stakeholder feedback:** Localities are consulted to generate unique solutions for particular needs.

f. **Feedback** from the Transportation Technical Committee (TTC).

Phase II Deliverable

Phase II produces a list of gap needs requiring a solution with all potential solutions to each gap need. Depending on the quantity of gap needs, it is possible to focus on priority gap needs and continue matching lower priority gap needs with solutions in subsequent years. Appendix F includes a template of the final product. The second phase II deliverable is a revised solutions list to include the unique solutions generated through stakeholder input in phase II.

Step 4: Match Needs with Recently Completed, and Existing and Committed Projects to Identify Gap Needs

Projects are matched to needs based on their ability to solve a specific need. Projects are overlaid with needs via geographic information systems (GIS) analysis to determine which projects may resolve a given need, and then each project is assessed for its ability to fully or partially resolve the needs that they overlap. Projects often spatially overlap needs to resolve them, though not always, such as congestion or reliability needs where a project at one location can resolve issues downstream or safety needs where routing travelers to an alternate route was determined to be the preferred solution. Additionally, non-spatial needs should be reviewed to assess if and how existing and committed projects will address them.

The RVTPO staff / consultant team will use recently completed, existing and committed projects to identify addressed needs. Addressed needs are those needs for which a project that is recently completed, currently underway, or programmed for construction is expected to cover the need.

All other needs without recently completed, existing or committed projects will be considered “gap needs”. Gap needs could be covered by other planned projects, for example, projects in the fiscally constrained Vision 2040 plan, vision list projects, or other recommendations from recent plans or planning studies. Gap needs also may have no recent planning or project development activity, representing an opportunity for assessing possible solutions.

The result of this step is the distinction between gap and addressed needs.

Step 5: Align Gap Needs with Possible Common Transportation Solutions

In this step, RVTPO/consultant staff align gap needs with possible common transportation solutions and identify any other possible unique transportation or non-transportation solutions. Some needs can be addressed through policies, such as how enforcement measures can remedy some safety needs, while others might be addressed through non transportation factors such as land use and development-related policies. Below are some examples of transportation needs that may be solved through non-transportation solutions.

- A need for access to a given service can be provided by moving all or portions of the service online or to one or more geographically central locations.
- A perceived need for motorist/pedestrian safety around a homeless shelter can be addressed by improving housing access or improving shelter conditions.

The RVTPO/consultant staff will also brainstorm unique transportation and non-transportation solutions for each need. In some cases, the gap need may require more information to better understand the need before progressing to solutions evaluation. In some cases it may be determined that the need is not a regional transportation need and may be referred to another agency.

Step 6: Send List of Gap Needs with Possible Solutions to Member Organizations

This step elicits feedback from member organizations about any other unique or non-transportation solutions to consider.

Unique transportation solutions: RVTPO / consultant staff will share a list of the gap needs and their potential solutions with each member organization to allow them to consider where other unique solutions might exist. Additionally, member organizations may be requested to provide feedback on their preferred solutions and on unique solutions via a survey or at a meeting with RVTPO staff.

As time allows, RVTPO / consultant staff may moderate a workshop with the localities to identify the needs where other unique solutions may exist and to jointly describe these solutions. Future factors may be discussed at this workshop so that participants consider not only where the region is today but also the conditions that the solutions may need to respond to in the future. Localities' preferences will inform designation of a preferred solution. If there are a lot of needs with unique solutions in each locality, then it is best to host separate workshops or meetings for each locality. If the number of needs is small, then holding a common workshop for all or several localities may generate more creative solutions through the dialog among localities and the facilitators.

Unique non-transportation solutions: Non transportation stakeholders may participate in the workshops and may be consulted to generate unique non-transportation solutions to priority gap needs and to assess stakeholders' support for these solutions, their feasibility, and potential implementation roles.

There are three substeps in consulting non-transportation stakeholders.

1. Identify additional stakeholders in local and state government that might have insights into unique solutions regardless of whether the stakeholder might have any responsibility for implementing the eventual solution. Potential stakeholders may include local planning departments, local police, housing authorities, social services, libraries, and parks and recreation.
2. Contact these stakeholders to explain the work, request their involvement, and describe how their involvement may improve the region. When possible, relate the request to the organization's mission and possibilities to help achieve their mission through the connections resulting from their involvement since this may increase buy-in and likelihood of participation.[3]
3. Invite these stakeholders to the workshop with locality staff or organize a separate workshop to convene participants from these stakeholders to discuss transportation needs to which a non-transportation solution may be possible. It may help to prime discussion by describing categories of needs and having maps or photos illustrating the needs. Begin discussion with brainstorming about potential solutions without immediately narrowing the list by feasibility or responsibility for implementation to generate as large

[3]In future version of the RVTP, including select non-transportation stakeholders in RVTP committees may increase buy-in to the solution and garner feedback about areas of synthesis with non-transportation functions for other parts of the plan.

a list as possible. As the workshop continues, it can be helpful to focus on better defining the solutions, assessing feasibility, and potential implementation roles. If the solution is mutually beneficial to the participants' organization and the RVTPO, this information is important to point out. When possible, record the participants' preferred solution.

Step 7: Generate Final List of Potential Solutions Aligned with Gap Needs

RVTPO / consultant staff consolidates the output of the prior steps in this phase into a single list of priority gap needs with a set of potential solutions assigned to each. The list should include a unique identifier for each need that can be used to join the solutions to a specific point or line in a spatial file such as a shapefile or geodatabase of prioritized needs. Note that not all needs are spatial, so some needs and their solutions may not include spatial data. Appendix F includes a template for the final product. At this step, needs requiring more information prior to possible solutions identification are flagged.

Phase III: Evaluate and Prioritize Solutions

Phase III uses the phase II deliverables to evaluate and prioritize solutions. The solutions for each need are evaluated (step 8), allowing staff to recommend a preferred solution for each need for TTC recommendation and Policy Board Concurrence (step 9). The following subsections details the phase III data inputs, deliverables, and steps.

Phase III Inputs

Phase III requires the following inputs–

a. **Phase II deliverable:** The list of gap needs requiring a solution with potential solutions assigned to each.

b. **Stakeholder feedback:** Stakeholders are consulted about solutions' appropriateness for resolving specific needs.

c. **RVTP goals, objectives, and performance measures:** The final RVTP goals, objectives, performance measures and supporting data sources to inform solution ratings.

d. **Future factors summary:** The *Roanoke Valley Transportation Plan – Future Factors* summary document dated July 28, 2021.

e. **TTC review:** Feedback from the TTC on goal and criteria weights, and on preferred solutions.

Phase III Deliverables

Phase III produces the following deliverables–

a. List of needs referred for further study before a preferred solution is selected.

b. A preferred solution for needs. In some cases, this may include a short-term and a long-term solution.

c. List of needs with a preferred solution to be further developed into a project.

Step 8: Determine Solutions Evaluation/ Prioritization Criteria, Prioritize Solutions, and Identify Preferred Solutions

RVTPO / consultant staff draft solutions evaluation criteria and finalize with input from the TTC. Using the criteria, RVTPO / consultant staff evaluate the solutions applied to the gap needs and meet with locality staff to review resulting priorities and adjust as necessary. Given the feedback, RVTPO / consultant staff note a preferred solution for each need for TTC review, revision, and / or recommendation to the Policy Board for progression to the project phase.

The remainder of this section details the process for evaluating solutions and selecting preferred solutions. The process is described with two example criteria shown in Table 1, one related to the solution's efficacy and another related to its potential to generate unintended new needs. Each solution is rated for its efficacy in advancing the region toward its objectives. The better the solution promotes regional objectives that are relevant to the need that it resolves, the higher its score. Each solution is also rated on its likelihood to produce unintended new needs through its implementation within each of the region's goals. The more likely a solution is to produce unintentional new needs or exacerbate existing needs, the lower its score. These objective and goal ratings are then weighted, summarized, and combined as described in the following sections to produce a single score for each solution that can be used to compare it with other solutions for the same need.[4] Consider documenting the rationale for the rating given for future reference.

1. **Criterion on Efficacy:** The efficacy criterion refers to the ability of the proposed solution to effectively achieve the objectives by addressing the transportation need. The following steps should be followed for each solution to calculate an efficacy score.

   1.1. Score each objective that is relevant to the need that it solves from 0 (No Effect) to 3 (Highly Effective) for its ability to advance the objective. The score could be derived quantitatively based on a solution's potential impact on the objectives' performance measure. or it can be based on planning or engineering judgment supported by research.

   1.2. Sum the scores within each goal area and divide by the maximum score possible, which is the product of 3 by the number of objectives within the goal.

   1.3. Weight the goal-level score by goal weights. This can be done by multiplying the output for the previous step by the goal weight. Guidance for determining goal weights is provided in the following section.

   1.4. Sum the result of the previous step across the RVTP goals to produce an efficacy score.

2. **Criterion on Potential to Generate Unintended Needs:** Identify the negative effects that the proposed solution may have in the future and determine the degree to which the solution may generate unintended new needs or exacerbate other existing needs related to each RVTP goal. The unintended needs scoring process may involve the following considerations for each solution:

   2.1. Score each objective from 0 (Certain) to 3 (Highly Unlikely).

   2.2. Divide the score from the previous step by the maximum score possible (which is 3) to normalize.

   2.3. Multiply the scores from the previous step by goal weights by multiplying the two numbers together. Use the same goal weights as for the efficacy criterion.

   2.4. Sum the result of the previous step across the RVTP goals to produce a score for the criterion.

Table 1: Example Evaluation Criteria

Criteria	Rating	Considerations
Efficacy	Highly Effective (3), Moderately Effective (2), Somewhat Effective (1), or No Effect (0).	How effective is the solution expected to be at advancing the region toward its objectives?
Potential to Generate Unintended New Needs	Highly Unlikely (3), Unlikely (2), Likely (1), Certain (0)	What is the likelihood that this solution would exacerbate or create another problem or need?

Goal Weights

It is recommended to weight each goal area so that the goals that are more important to the TTC and the Policy Board influence solutions' criteria scores more than those that are less important. Weights should sum to 100%. Goal weights may be assigned in multiple ways:

1. RVTPO and consultant staff may consider the goals against each other and propose weights for each that sum to 100%. This method is appropriate if consensus can be achieved about goals' relative importance. As a starting point, the group might consider weights used for SMART SCALE.[5]

2. There may be cases where discussion does not lead to consensus about the overall weights but there is consensus about how each goal relates to the other goals individually. In this case, pairwise comparison among goals can allow overall weights to be derived. Analytical Hierarchy Processing (AHP) provides one such scale and calculations for assessing importance.[6]

3. A final option is to assign equal weights to all goal areas, which may be done if there is not consensus about the relative importance of goals. The decision to assign equal weights to goals should be taken explicitly rather than done by default.

[4]Roanoke Valley Transportation Planning Organization (2022). TTC Special-Called Meeting, Staff Report. January 5, 2022. Pages 17-21. Retrieved from https://rvarc.org/wp-content/uploads/2022/01/RVTP-Staff-Report-2.pdf

Combined Scores

The next step of the solutions rating process is combine each solution's scores across the criteria to generate a single score for each solution. Weights for the criteria may be determined similarly to goal weights. The team may discuss the criteria's importance and select weights that reflect their relative importance. The criteria may also be given equal weight if the criteria are deemed to be equally important. Weights should sum to 100%. Whichever methods are selected, RVTPO and/or consultant staff will derive weights and the TTC will provide feedback before the weights are finalized.

Combined scores are produced by summing the product of the criteria weights and scores across the two criteria.

Future Factors

RVTPO has identified future factors related to technology, society, the economy, sustainability, and funding and finance. These factors may impact the appropriateness of certain transportation solutions. For instance, transportation solutions that help the region adapt to one or more future factors would help the region beyond meeting the need(s) that they are selected to address.

Future factors may be considered in the solutions process by multiplying the combined score by a future factor adjustment. The score can be raised by 5% or another amount selected by the TTC for each future factor theme for which the solution helps prepare the region. If 5% were used as the multiplier, solutions could receive up to a 25% bonus if they helped the region respond to all future factors. Appendix E lists the future factors.

Final Scores

Final scores are the combined scores plus the adjustment for future factors. They are used to identify the solution with the highest overall score. In cases where solutions' scores are similar or where locality staff disagree about the preferred solution, the RVTPO / consultant team should gather stakeholder feedback and / or TTC input for assistance. The solution that most comprehensively meets the criteria is the recommended solution for the need.

A solutions evaluation template is provided in Appendix G.

Selection of Multiple Solutions for a Given Need

It may be appropriate to pair the preferred solution with one or more high-scoring solutions to address the need fully or address it over short and long timeframes. Each potential solution should also be assessed for its ability to resolve the need(s) with which it is paired. This step takes place after scoring solutions because the intent is not to score solutions but to identify when multiple high-scoring solutions should be pursued in tandem to resolve a need. When the preferred solution is inadequate to address the entirety of the need, one or more additional high-scoring solutions may be retained to also address the need such that some needs may have more than one solution assigned to them. Solutions can be evaluated for their ability to resolve the entirety of the need on the example scale listed below.

- Solution is likely to resolve the entirety of the need (3 points)
- Solution may resolve the entirety of the need when pair with one or more other solutions (2 points)
- Solution may not resolve the entirety of the need even when paired with other solutions (1 point)
- Solution does not resolve the need (0 points)

Following the example scale, solutions receiving zero points should be discarded, preferred solutions receiving 3 points should be retained without any other solutions on the same time horizon, while preferred solutions assigned either 1 or 2 points may be paired with other high-scoring solutions to the same need. The pairing should ideally be done such that solutions that are paired address different aspects of the need. For instance, a congestion need may be caused in part by freight traffic and in part by passenger traffic. A solution involving travel demand management might address the passenger traffic component of the needs and be paired with a solution involving freight rail, which might address the rail component of the need.

Additionally, it may be desirable to retain two high-scoring solutions for a given need when the two solutions are on a very different timeframe. In this case, there can be a preferred short-term solution that can be pursued during the next five years between transportation plan

[5]Office for Intermodal Planning and Investment (2022). "SMART SCALE - How to Works." Retrieved from http://smartscale.org/how_it_works/default.asp.

[6]Coyle, G. (2004). Practical strategy, open access material. AHP. Retrieved from https://training.fws.gov/courses/references/tutorials/geospatial/CSP7306/Readings/AHP-Technique.pdf.

updates and a long-term solution that would involve a longer pursuit period to more completely resolve the need over a longer time horizon. Most needs are not expected to have a short-term and long-term solution, with the option of two solutions remaining open for a minority of needs where the highest-scoring and/or most effective solution will take many years to implement. For instance, a congestion need might be partially resolved in the short term with additional roadway capacity while over the long term a more effective solution given expected population and employment growth might be coordination between land use and transportation.

Step 9: RVTPO Decision

The TTC considers the preferred solutions identified along with any additional high-scoring solutions retained. In many cases, the preferred solution will be the one ultimately recommended by the TTC to the RVTPO Policy Board, although sometimes there may be location-specific considerations that make the solution that has been designated as the preferred solution different from the one ultimately chosen. If the TTC is not comfortable making a recommendation and believes that additional study is required, it can also refer a need for ad hoc analysis or a formal transportation study.

Once a course of action is selected, RVTPO staff and/or the consultant team should ensure solution follow-up. For transportation solutions, follow-up will occur at least in part through the project identification and prioritization process. Implementation of policy solutions may require coordination with the RVTPO Policy Board or coordination between consultant or RVTPO staff with policy branches in stakeholder organizations. Implementation of non-transportation solutions will likely depend heavily on partnership with stakeholders, many of which may have been involved in the identification of non-transportation solutions. It would build momentum to begin implementation with non-transportation solutions for which stakeholders have indicated high buy-in and the potential to take an ownership role. After these quick-wins have been realized, consultant or RVTPO staff can pursue meetings with other stakeholders that may play a role in implementation.

Ongoing Activity

Step 10: Ongoing Assessment and Feedback

When the TTC recommends and the Policy Board selects a preferred solution that is different from the one recommended by the evaluation criteria, RVTPO / consultant staff should record these decisions and use them to adjust the evaluation criteria and/or criteria weights in future iterations. Additionally, data about how well the selected solution resolved the need should be collected to refine the solutions evaluation criteria and weights.

Other refinements may be made to the process as time allows. One such refinement to consider is the establishment of decision guidelines to assess common solutions' viability for a given need before scoring the need through evaluation criteria. Steps to develop decision guidelines are provided in Appendix H.

APPENDIX A: RELEVANT PLANS AND STUDIES

Plan	Locality	Year
419 Town Center Plan	Roanoke County	2019
Hollins Center Plan	Roanoke County	2021
Oak Grove Plan	Roanoke County	2021
Hollins Area Plan	Roanoke County	2008
Glenvar Community Plan	Roanoke County	2012
Roanoke County Community Strategic Plan	Roanoke County	2016
Roanoke County Comprehensive Plan	Roanoke County	2005
419 Town Center Plan	Roanoke County	2019
Explore Park Adventure Plan	Roanoke County, Bedford County	2016
Vinton Area Corridors Plan	Vinton	2010
Vinton Comprehensive Plan	Vinton	2004
Vinton Urban Development Areas	Vinton	2016
City Plan 2040	Roanoke City	2020
Senior Quality of Life Survey	Roanoke City	2018
City of Roanoke Downtown Plan	Roanoke City	2017
Downtown Intermodal Study	Roanoke City	2015
Age Friendly Community AARP Survey	Roanoke City	2019

Plan	Locality	Year
Melrose Avenue Bus Stop Improvement	Roanoke City	2016
Exit 150 Market Study	Botetourt	2015
Botetourt Comprehensive Plan	Botetourt	2017
Gateway Crossing Area Plan	Botetourt	2016
Salem Downtown Plan	Salem	2016
Salem Comprehensive Plan	Salem	2015
Vision 2040: Roanoke Valley Transportation Plan	Regional	2017
Community Health Assessment	Regional	2018
I-81 Corridor Improvement Plan	Regional	2018
81 & 581 Auxiliary Lane Study	Regional	2016
Route 11/460 Corridor Study	Regional	2013
Route 419 Corridor Study	Regional	2010
Route 460 Operational Improvement Study	Regional	In progress
Bus Stop Accessibility Study	Regional	2013
RADAR Transit Development Plan	Regional	2018
Valley Metro Transit Development Plan	Regional	2018
Valley Metro Comprehensive Operations Analysis	Regional	2018
Regional Transit Vision Plan	Regional	2016

Plan	Locality	Year
Coordinated Human Services Mobility Plan	Regional	2013
Roanoke Valley Greenways Plan	Regional	2018
Regional Bikeway Plan	Regional	2012
Regional Pedestrian Vision Plan	Regional	2015
Traffic Congestion Management Process	Regional	2020
Roanoke Valley Regional Transportation Safety Study	Regional	2019
2019 Travel Demand Model	Regional	2021

APPENDIX B: TEMPLATE FOR ALIGNING NEEDS, SOLUTIONS, AND OBJECTIVES

Table 2: Phase I Deliverable – Table Aligning Need Categories, Common Solutions, and Regional Objectives

Need Category	Common Solutions	Objective
System Management (Assets)	Improve/replace existing bridge(s)	Maintain state of good repair.
Congestion	Add New Through Lane(s)	Reduce traffic congestion on primary travel corridors within the region.
Safety (Ped)	Improve Bike/Pedestrian Crossing (At Grade)	Reduce the number and rate of non-motorized fatalities and serious injuries.
Safety (Bike)	Add/Construct Bike Lane	Reduce the number and rate of non-motorized fatalities and serious injuries.
Safety (Auto)	Rumble Strip Installation	Provide a safe and secure environment for the traveling public.
Access (All Modes)	Develop properties to be multimodal-accessible	Provide safe, reliable, and affordable connections to employment, education, healthcare, and other essential services.

Note: This table is populated with example needs, possible common transportation solutions, and objectives.

APPENDIX C: ILLUSTRATION OF COMMON SOLUTIONS DERIVED FROM TIP

Table 3 illustrates how draft common solutions derived from the FY 2021 to 2024 Transportation Improvement Program (TIP). Common solutions are derived primarily by examining the project name and description to deduce the work that has been completed with as much precision about the type of work as possible. Some project names and descriptions are not detailed enough about the type of work completed to permit for a detailed solution to be identified. When the project name and description do not specify the project details, the common solution will need to be derived from other sources described in step 1.

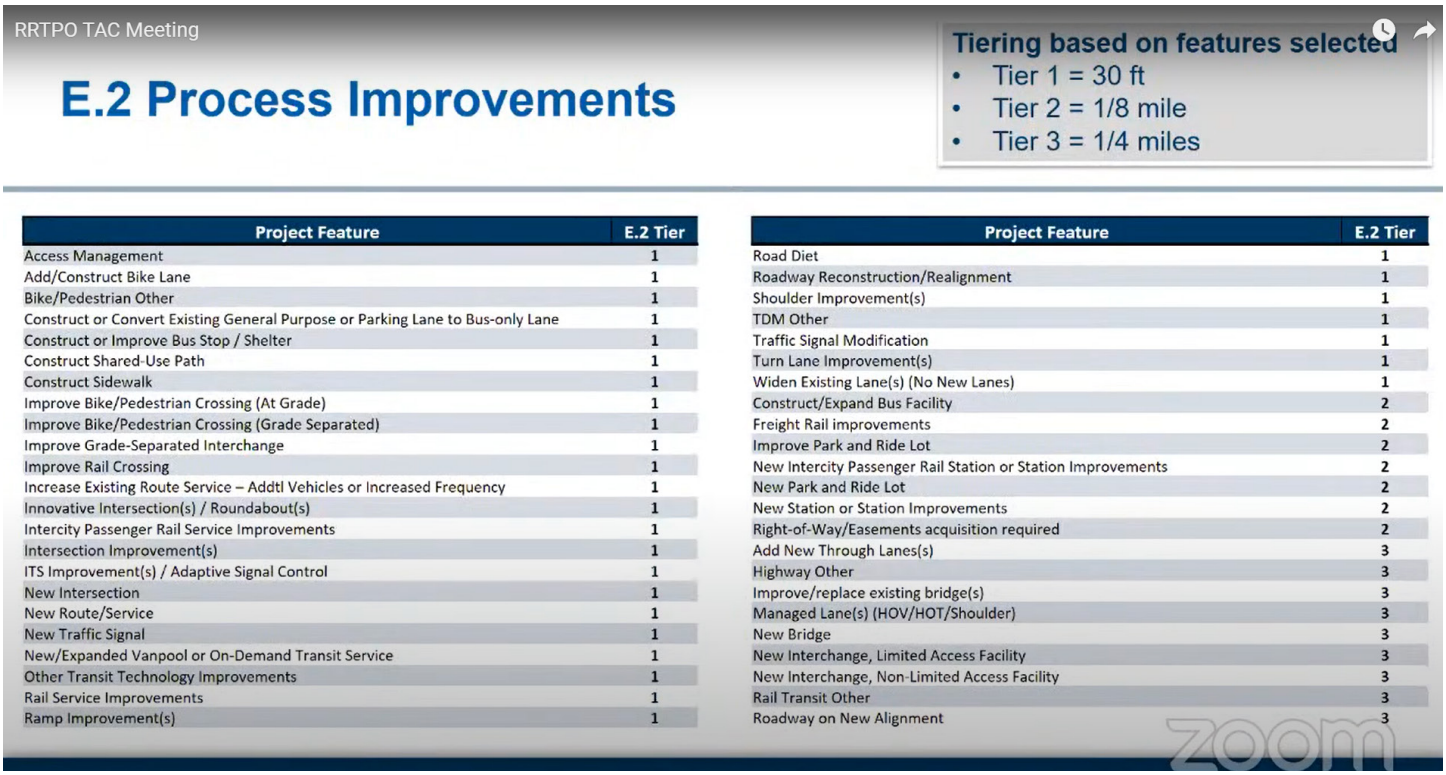
Table 3: Example Solutions Derived from FY 2021 to 2024 TIP

UPC	Project Name	Description	Solution Category	Common Solution
107061	Rte. 419 Safety Improvements at Tanglewood	From: 0.45 Mile South of Int. of Route 11 & Route 117 To: Int. of Route 11 & Route 117 (2017 HB2/SMART SCALE project)	Safety Countermeasures	Not specified
116203	#I-81 - MM136 to MM139 adding lane in each direction	From: I-81 Exit 137 Interchange To: Red Ln. Overpass	Highway Capacity Expansion	Add New Through Lane(s)
113173	I-81 Exit 137 SB Safety Improvements	From: Beginning of I-81 Exit 137 SB Off-Ramp To: End of I-81 Exit 137 SB Off-Ramp	Safety Countermeasures	Not specified
108906	I-81 NB Auxiliary Lane from Exit 141 to 143	Add one lane on I-81 NB - From: 0.026 Mi. West of Int. SBL I-81 Entrance Ramp To: I-81 (2017 HB2/SMART SCALE project)	Highway Capacity Expansion	Auxiliary Lanes
119462	Route 419 Streetscape Improvements, Phase 2	Improvements between Ogden & Starkey Rds. include converting north and south shoulders to shared through/right turn lanes, sidewalks and bicycle lanes on the north and south sides, and pedestrian signals w/crosswalks at the Starkey Rd. intersection.	Pedestrian Improvements (Sidewalks) Pedestrian Improvements Bicycle Improvements Intersection Improvements	Construct Sidewalk Improve Bike/Pedestrian Crossing (At Grade) Add/Construct Bike Lane Turn Lane Improvements

Source: Projects extracted from the fiscal year (FY) 2021-2024 Transportation Improvement Program (TIP). Retrieved from https://rvarc.org/wp-content/uploads/2021/08/FY21-24TIP-083121.pdf.

APPENDIX D: PROJECT FEATURES USED IN SMART SCALE

Figure 2: Screenshot Showing Project Features Used in SMART SCALE



Project Feature	E.2 Tier
Access Management	1
Add/Construct Bike Lane	1
Bike/Pedestrian Other	1
Construct or Convert Existing General Purpose or Parking Lane to Bus-only Lane	1
Construct or Improve Bus Stop / Shelter	1
Construct Shared-Use Path	1
Construct Sidewalk	1
Improve Bike/Pedestrian Crossing (At Grade)	1
Improve Bike/Pedestrian Crossing (Grade Separated)	1
Improve Grade-Separated Interchange	1
Improve Rail Crossing	1
Increase Existing Route Service – Addtl Vehicles or Increased Frequency	1
Innovative Intersection(s) / Roundabout(s)	1
Intercity Passenger Rail Service Improvements	1
Intersection Improvement(s)	1
ITS Improvement(s) / Adaptive Signal Control	1
New Intersection	1
New Route/Service	1
New Traffic Signal	1
New/Expanded Vanpool or On-Demand Transit Service	1
Other Transit Technology Improvements	1
Rail Service Improvements	1
Ramp Improvement(s)	1

Project Feature	E.2 Tier
Road Diet	1
Roadway Reconstruction/Realignment	1
Shoulder Improvement(s)	1
TDM Other	1
Traffic Signal Modification	1
Turn Lane Improvement(s)	1
Widen Existing Lane(s) (No New Lanes)	1
Construct/Expand Bus Facility	2
Freight Rail improvements	2
Improve Park and Ride Lot	2
New Intercity Passenger Rail Station or Station Improvements	2
New Park and Ride Lot	2
New Station or Station Improvements	2
Right-of-Way/Easements acquisition required	2
Add New Through Lanes(s)	3
Highway Other	3
Improve/replace existing bridge(s)	3
Managed Lane(s) (HOV/HOT/Shoulder)	3
New Bridge	3
New Interchange, Limited Access Facility	3
New Interchange, Non-Limited Access Facility	3
Rail Transit Other	3
Roadway on New Alignment	3

Source: Office of Intermodal Planning and Investment (2021). SMART SCALE. Presentation by Brooke Jackson to the RRTPO Technical Advisory Committee. November 8, 2021. Retrieved from https://youtu.be/p1QJMby966E?t=2840.

APPENDIX E: FUTURE FACTORS

Theme 1: Technology	Theme 2: Society	Theme 3: Economy	Theme 4: Sustainability	Theme 5: Funding & Finance
Connected & Automated Vehicles (CAV)	Aging Society	Labor Force	Climate Change	Revenue Sources
Drone / Automated Vehicle deliveries	Equity	Job Types and Skills	Electrification	Pricing
Broadband	Increased Reliance on Remote Services	High-Tech Startups and Entrepreneurial Regional	Alternative Energy	Costs
On-Demand Transit	Transportation Impact of the COVID-19 pandemic	Fewer "Brick and Mortar" Retailers	Natural Resources	
Mobility as a Service		Tourism	Alternatives to Single Occupant Vehicles	

Source: Roanoke Valley Transportation Planning Organization (RVTPO). *Roanoke Valley Transportation Plan – Future Factors*. July 28, 2021.

APPENDIX F: TEMPLATE FOR POTENTIAL SOLUTIONS

Table 4 provides a template for aligning potential solutions with gap needs. The need IDs are unique identifiers that can be created to match the table with a spatial file showing each needs' location in a geographic information system (GIS)-compatible format. All the potential solutions are listed as columns in this table, allowing for a check mark or 'X' to indicate when a solution may be applied to a given need.

Table 4: Phase II Deliverable – Potential Solutions Assigned to Prioritized Needs by Need Category

Need ID	Simple Location	Detailed Location	Need	Need Priority	Solution #1	Solution #2	Solution #3	Solution Summary
1					x		x	**Solution 1, Solution 3**
2								
3								
4								
5								
6								

APPENDIX G: EXAMPLE SOLUTIONS EVALUATION TEMPLATE

Instructions:

- Fill in goal weights.
- Fill in efficacy criterion with rating for each objective that is relevant to the solution.
- Fill in the potential to generate unintended needs criterion for each goal area where a solution may generate an unintended need.

Goal Weights	Goal	Objective	Efficacy Criterion	Potential to Generate Unintended Needs Criterion.
	Goal 1: Provide a safe and secure transportation system	a. Eliminate fatalities and reduce injuries on the multimodal transportation system.		
	Goal 2: Enable reliable mobility	a. Maintain vehicle travel time reliability on priority corridors.		
		b. Maintain transit and passenger rail on-time performance (OTP).		
	Goal 3: Enable convenient and affordable access to destinations	a. Provide motorized access to inaccessible properties identified for future development.		
		b. Increase accessibility to key destinations by transit.		
		c. Increase transportation connections to markets outside the region, including across Virginia and the U.S.		
		d. Increase transit, bicycle, and pedestrian connections for all users within multimodal centers and districts.		

Source: Roanoke Valley Transportation Planning Organization (2022). TTC Special-Called Meeting, Staff Report. January 5, 2022. Pages 17-21. Retrieved from https://rvarc.org/wp-content/uploads/2022/01/RVTP-Staff-Report-2.pdf

Goal Weights	Goal	Objective	Efficacy Criterion	Potential to Generate Unintended Needs Criterion.
	Goal 4: Foster environmental sustainability	a. Minimize emissions from motorized on-road transportation.		
		b. Minimize / mitigate new impervious surfaces created by transportation infrastructure.		
	Goal 5: Maintain and operate an efficient and resilient transportation system	a. Maintain state and national standards for infrastructure and asset condition.		
	Goal 6: Support economic vitality	a. Ensure redevelopment and new developments in designated growth areas and multimodal centers/ districts are supported by more than one mode of transportation infrastructure.		
		b. Maintain truck travel time reliability.		
		c. Maintain acceptable levels of congestion during peak travel periods on priority corridors.		
	Goal 7: Promote equitable transportation investments	a. Assess planning-level benefits or disproportionate adverse effects of transportation projects included in this plan on Equity Emphasis Areas and identify mitigation strategies.		
		b. Ensure that non-drive alone mobility investments create opportunities for people in Equity Emphasis Areas.		
		c. Eliminate fatalities and reduce serious injuries in Equity Emphasis Areas.		
		d. Maintain state and national standards for infrastructure condition in Equity Emphasis Areas.		
100%	**TOTAL**			

APPENDIX H: DEVELOPMENT OF DECISION GUIDELINES

Decision guidelines can filter solutions before scoring them along criteria by assessing their viability for resolving a particular need. Solutions that are not viable to resolve a given need based on the sites' characteristics can be excluded from later evaluation. Developing decision guidelines is intended to save the staff time by filtering solutions through research- or practice-informed network or performance criteria and to ensure that only solutions that are viable based on the sites' characteristics are selected as a preferred solution to a given need.

Decision guidelines are derived from existing and accepted tools and regulations insofar as possible (primarily be for infrastructure solutions). When these tools and regulations are inadequate, planning and infrastructure staff at the VDOT Salem district office, RVTPO staff, and planning and engineering experts in peer regions can be interviewed to identify appropriate guidance for applying each solution. Finally, the RVTPO staff's and consultant team's planning and engineering judgment—informed by research—provide the final source for the decision guidance.

The decision guidance is manually formed into a 'decision tree' for each needs category that says when a certain solution is the appropriate based on sequentially examined criteria. A decision tree is composed of a set of hierarchical criteria for which the answers progressively lead to one or more viable solutions to the need. There are generally two decision trees for each needs category: one for infrastructure solutions and another for policy solutions (both transportation and non transportation).

One decision tree may refer the user to another decision tree, such as when a non-recurring congestion problem may have an operational or a safety solution. Decision trees can be created by hand or in any software such as MS PowerPoint that allows for the criteria and connections among criteria depending on the answers to be inserted. Figure 3 and Figure 4 show example decision trees.

The most important part of constructing a decision tree is identification of the proper criteria and the actions taken depending on the answer to the criteria. It is recommended to constitute these criteria through the following sequential steps.

a. **Existing tools and regulations:** Examine tools and regulations with embedded decision trees or prioritization guidance. These may be found in documentation for MPO or state solution selection processes. A list of already identified tools is in Table 5, along with the data inputs that are needed. The list of tools in Table 5 is not exhaustive but rather shows the tools that are likely most appropriate for use based on widespread acceptance (in Virginia when possible or nationwide otherwise), their low cost or lack of cost, and their close alignment with the need categories.

Figure 3: Example Decision Tree for Congestion Needs

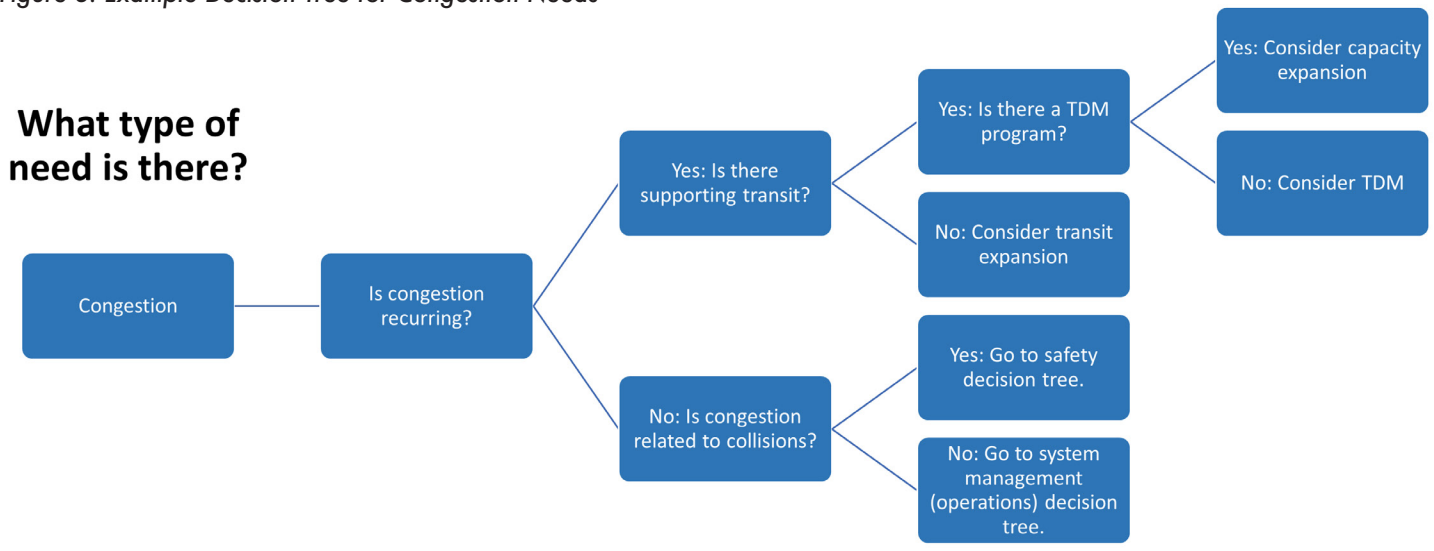


Figure 4: Example Decision Trees for Safety and Bridge Asset Management Needs

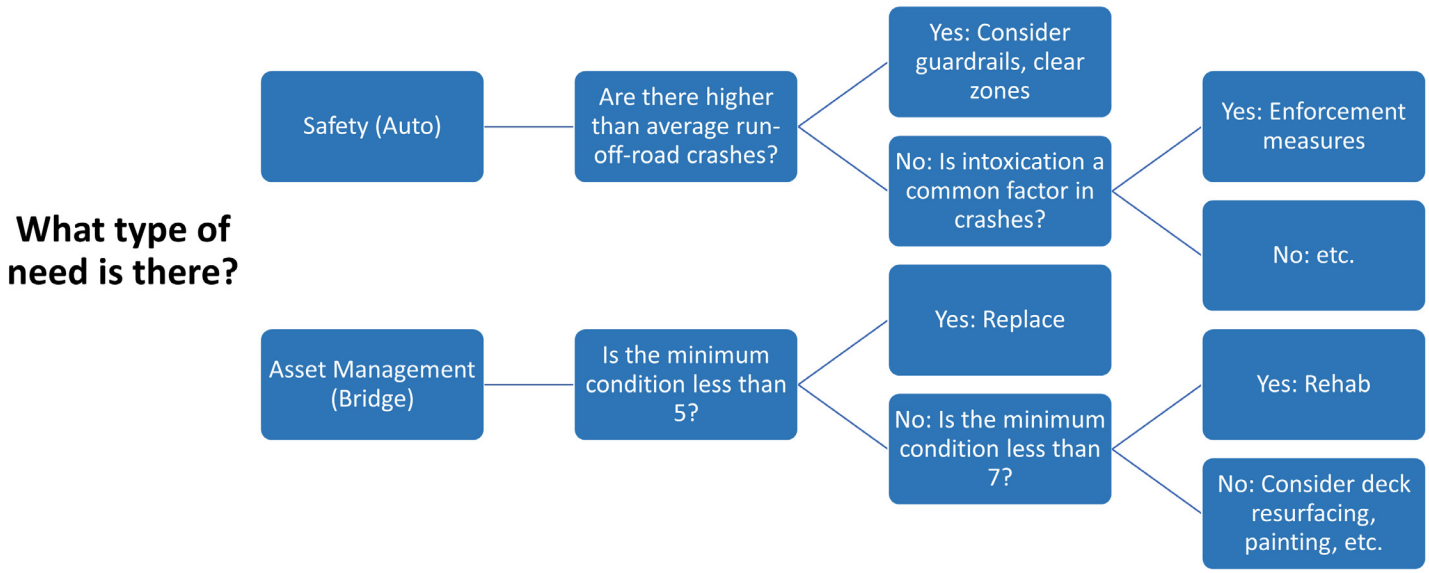


Table 5: Sample of Tools and Regulations with Decision Trees and Decision Guidance (Primarily for Infrastructure Solutions)

Needs Category	Tool(s) or Research that are Sources for Decision Trees	Inputs
Safety (auto)	Safety Performance for Intersection Control Evaluation (SPICE) Tool	Intersection Type, Analysis Year, Opening Year, Design Year, Facility Type, Facility Secondary Type (For Roundabouts Only), Number of Legs, Opening Year – Major Road AADT, Opening Year – Minor Road AADT, Number of Approaches with Left-Turn Lanes, Number of Approaches with Right-Turn Lanes, Number of Uncontrolled Approaches with Left-Turn Lanes, Number of Uncontrolled Approaches with Right-Turn Lanes + A group of optional inputs for calibration
Safety (ped)	PEDSAFE: Pedestrian Safety Guide and Countermeasure Selection System	Performance objective, Crash type of interest (ex: bus-related, turning vehicle, dart/dash, etc.), Area type (rural/urban), Road functional class, ADT, Speed limit, Number of through lanes, Traffic signal presence (with an indication of whether addition/ removal is an option), Location description (intersection/ midblock), Special location features (transit route, school zone, work zone, railroad crossing)
Safety (bike)	BIKESAFE: Bicycle Countermeasure Selection System	Performance objective, Crash type of interest (ex: bus-related, turning vehicle, dart/dash, etc.), Area type (rural/urban), Road functional class, ADT, Speed limit, Number of through lanes, Traffic signal presence (with an indication of whether addition/ removal is an option), Location description (intersection/ midblock), Location description (on-road/off-road), On-road bike facility type

Safety (transit)	PEDSAFE has some transit-related safety countermeasure [Transit Stop Improvements, Access to Transit, Bus Bulb Outs]	Performance objective, Crash type of interest (ex: bus-related, turning vehicle, dart/dash, etc.), Area type (rural/urban), Road functional class, ADT, Speed limit, Number of through lanes, Traffic signal presence (with an indication of whether addition/ removal is an option), Location description (intersection/ midblock), Special location features (transit route, school zone, work zone, railroad crossing)
Congestion	Capacity Analysis for Planning of Junctions (CAP-X) Tool	Number of legs at the intersection, number of lanes for each movement in each leg, Major street direction, turning movements volumes, Adjustment factors for turning movements, percentage of heavy trucks per leg, Volume growth percentage by leg, Truck to PCE factor, Multimodal activity level, Critical lane volume sum limits, Number of ped crossings at the intersection, Number of lanes crossed by ped for each crossing, Vehicle speed at the crossing, Number of bicycle crossing segments at the intersection, Number of segments per intersection, Type of bike lane by segment, Vehicle speed
	VDOT Junction Screening Tool – VJuST	Number of through lanes for each leg, turning movements volumes, Adjustment factors for turning movements, Percentage of heavy trucks per leg, Truck to PCE factor
System Management (operations, assets)	*None identified*	*Not available*
System Management (transit)	Transit Signal Priority Recommendation Tool	Dedicated Right-of-Way, Number of Lanes per Direction, Vertical Alignment, Bus Schedule Adherence, Transit Frequency, Number of Passengers, Transit Level of Service, the percent of buses operating in the corridor that have GPS/AVL, Bus Stop Placement, walk score, Transit-Dependent Population, Intersection Control Delay, Signal Control System, Signal Coordination
Access (all modes)	VDOT TransCAD Accessibility model	Point of interest and network data from HERE Technologies, transit networks based on General Transit Feed Specification (GTFS), and land use forecasts

To illustrate the tools' use with a hypothetical safety need, if a pedestrian safety need exists at a certain location, the PEDSAFE tool can be used to provide a list of appropriate countermeasures. The tool allows the user to answer a series of questions related to the location's geometric and operational characteristic, such as the number of through lanes and functional classification. The output of this tool is a list of countermeasures that can address the need, such as curb extension and pedestrian crossing island installation in the case of pedestrian safety needs.

b. **Interviews:** Interview MPO and DOT staff about selection criteria that are not featured in documentation to fill in gaps. This step may be especially important for establishing viability of non-infrastructure and non-transportation policies and strategies.

c. **Research-Informed Judgment:** Use research and engineering/planning judgement to fill gaps in the criteria left from the previous two sources. This will be especially important for new solutions that have not been implemented in the past and for non-infrastructure/non-transportation policies.

For policy solutions, supplemental research about each policy solution will be conducted to assess the circumstances in which it may be useful. Research can be found in examining sources that include the following list for studies that relate to the solution.

i. TRB reports (including NCHRP, NCTRP, NCRRP, and NCFRP)
ii. Academic articles found on Google Scholar or Microsoft Academic Search
iii. Think tanks and research centers (e.g., Smart Growth America, Voorhees Transportation Center, Urban Institute)
iv. Professional associations and advocacy groups (e.g., Institute of Transportation Engineers, American Planning Association, Association of Metropolitan Planning Organizations, Virginia Bicycling Federation, The League of American Bicyclists)
v. Government Organizations (e.g., Vole Center)

After decision trees are formed for infrastructure and non infrastructure transportation solutions under each needs category, they are applied to the needs resulting from phase II to identify one or more viable infrastructure and non infrastructure solutions for each need.

Prepared for Roanoke Valley Transportation Planning Organization

Task 4: PROCESS FOR IDENTIFYING AND
EVALUATING SOLUTIONS TO TRANSPORTATION NEEDS

TASK 5:
PROCESS FOR IDENTIFYING AND PRIORITIZING PROJECTS

Prepared for Roanoke Valley Transportation Planning Organization

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TASK 5: PROCESS FOR IDENTIFYING AND PRIORITIZING PROJECTS

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ABOUT GAP-TA

The Growth and Accessibility Planning Technical Assistance (GAP-TA) program supports Virginia localities in planning and developing multimodal transportation opportunities. The program has four components, and each component has differences in eligible applicants, eligible activities, expected outcomes, and application evaluation criteria. Component 1 involves conducting multi-modal planning within existing or planned Urban Development Areas or Growth Areas. Component 2 involves developing or evaluating strategies to address emerging planning issues. Component 3 involves developing an accessibility planning process, Finally, Component 4 involves conducting multi-modal planning outside urbanized areas. Visit vtrans.org/about/GAP-TA for more information about the GAP-TA program. Visit vtrans.org/about/GAP-TA for information about the Growth and Accessibility Planning Technical Assistance program.

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Staffed by the REGIONALcommission

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TASK 5: PROCESS FOR IDENTIFYING AND PRIORITIZING PROJECTS

Project Development Process

The process for identifying and evaluating projects is intended to be implemented as part of the Roanoke Valley Transportation Plan (RVTP) after the identification and evaluation of solutions (Task 4). In this stage of the plan, all preferred solutions identified in the region will be translated into projects, which in turn will be categorized and ranked to determine which will be pursued for funding.

The process described in this task includes four major phases:

- **Phase I** refines every preferred solution identified in the previous task into a project or service.
- **Phase II** is a benefit evaluation. It is intended to measure the extent to which the benefits provided by a proposed project or service would advance the region's transportation goals and objectives and help meet performance measure targets.
- **Phase III** is a viability evaluation. This phase evaluates the high-benefit projects and services identified in Phase II and determines the extent to which they are ready to move into funding pursuit.
- **Phase IV** briefly considers the ways that the Roanoke Valley Transportation Planning Organization (RVTPO), localities, and other public agencies can use the prioritized project list to pursue funding for transportation improvements in the Roanoke Valley region.

Definitions of Terms

There are several terms that are important for understanding the proposed process. These terms are defined below.

Need – Transportation problem or issue identified in the community currently. As described in the Roanoke Valley Transportation Needs Assessment, a transportation need "states a problem, not a specific solution, and could be solved by multiple possible solutions."[1]

Gap Need – A need without a funded project or service.

Addressed Need – A need with a recently funded solution to be reviewed for performance outcomes prior to any further solutions identification, if needed.

Solution – An idea of how the region can achieve desired results. Solutions address specific transportation needs and contribute to the realization of a regional objective. Some transportation solutions may be simple enough to lead directly to a project whereas others may require further study/analysis.

Project – A specific scope of work describing how the solution will be implemented including start/end points, length, and cost.

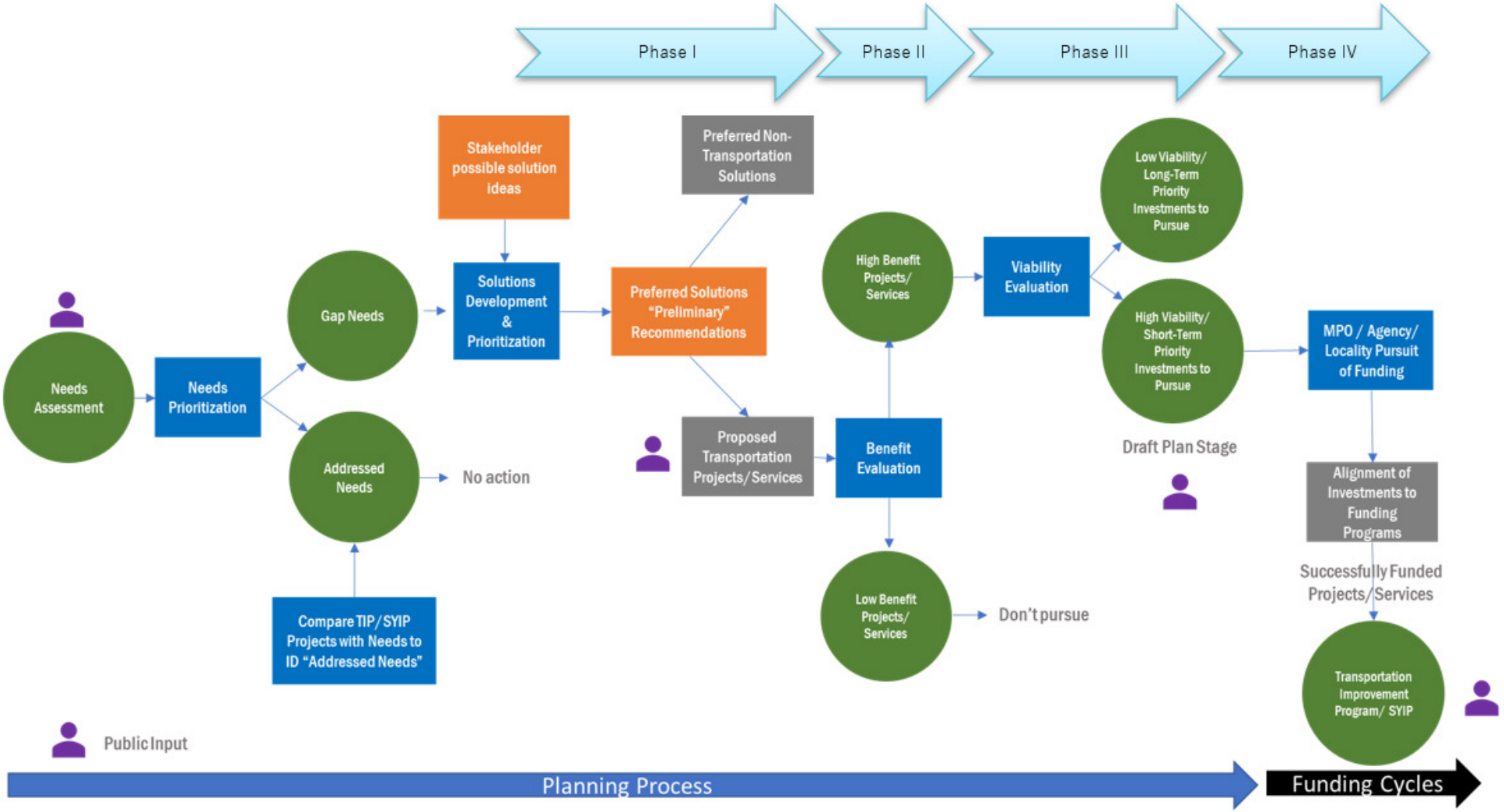
Study/Analysis – Additional work required to identify possible solutions or derive a project from a solution.

Common Solution – A transportation solution deriving from sources that are not related to the context of a particular need, such as past projects, peers, and best practices. It contrasts with unique solutions, which derive from a particular need's context.

Unique Solution – A solution deriving from the context of a particular need, in contrast to a common solution, which derives from past projects, peers, or best practices before being applied to a particular need. Unique solutions may be transportation or non-transportation solutions.

[1] *RVTPO (2021). Roanoke Valley Transportation Needs Assessment. Approved April 22, 2021.*

Figure 1: Project Identification and Prioritization Process Flow Chart



Phase I: Definition of Projects and Services

Phase I uses the preferred solutions for priority gap needs identified in Task 4 to develop a list of proposed transportation projects and services (Step 1). This list will be reviewed by stakeholders and the public, with amendments made as necessary (Step 2).

Phase I Inputs

The following inputs are needed for execution of Phase I:

a) Complete List of Preferred Solutions

Phase I Deliverables

At the conclusion of Phase I, every preferred solution will be assigned a corresponding project or service that will be evaluated in later phases.

Step 1: Assemble List of Proposed Transportation Projects and Services

The final output of the Solutions Identification and Evaluation process (Task 4) was the assignment of a preferred solution to every gap need in the region. Figure 1 illustrates the process that was used to advance from RVTP's needs assessment to the identification of preferred solutions. This process is described in more detail in the Task 4 memo.

In Step 1 of this process, every preferred solution will be assigned a proposed project or service. Non-transportation solutions will be recommended to the appropriate agencies or services. The focus of the process described in this document, however, is the preferred solutions that evolve into a transportation project or service.

The transportation project or service can be defined based on a prior recommendation at that location, or as a newly proposed project. At a minimum, every proposed transportation project or service will be assigned a scope of work that identifies:

- Project Title
- The facility or service name
- The project location and limits or service element that is new or will be improved
- The project or service jurisdiction
- Description of need(s) being addressed and need type(s)
- The preferred solution(s) corresponding with the project or service
- A project category (i.e. Transit or Highway/Bicycle/Pedestrian)
- A general project or service description

The assigned need category should correspond to those defined by the RVTPO's Needs Evaluation and Solutions Tool (NEST).[2]

Step 2: Public Review of Proposed Projects and Services

After a project or service has been defined for each preferred solution in Step 1, the public and stakeholders will review the complete list of proposed transportation projects and services.

If a party reviewing the list would like to submit a new or additional project or service for consideration, the RVTPO can enter the recommendation into the process as a Common or Unique Solution. This Solution will be evaluated and prioritized using the process described in the Task 4 memo. If the recommendation is determined to qualify as a preferred solution, it can then be translated into a project or service and added to the list of proposed projects and services.

Phase II: Benefit Evaluation

Phase II begins by establishing scoring thresholds that will be used to rate the benefits provided by each project or service in relation to the RVTPO's goals, objectives, and performance measures (Step 3). The resulting scoring categories will be used to determine the benefit score of each project or service (Step 4), which in turn will be used to identify the region's high-benefit projects and services that will be advanced for further evaluation (Step 5).

Phase II Inputs

The following inputs are needed for execution of Phase II:

a) Complete List of Projects and Services

b) RVTP Goals, Objectives, and Performance Measures

c) Goal and Objective Weights

Phase II Deliverables

At the conclusion of Phase II, every proposed transportation project or service will be assigned a benefit score. These scores will be used to select a sub-group of High Benefit Projects and Services that will be advanced for further evaluation.

Step 3: Establish Benefit Scoring Criteria

Every proposed project or service will be evaluated for its ability to generate benefits that advance the region's transportation goals and objectives, which are listed in Appendix A.

[2] *RVTP Needs Evaluation and Solutions Tool: https://experience.arcgis.com/experience/7c2b2fb55b1b42c58954799c2156b922*

Benefit scoring criteria will utilize the performance measures that the RVTPO has selected for each of its objectives. It is important to note, however, that project or service benefits are not based on the existing conditions measured at a location. Benefits are instead based on the anticipated changes to each performance measure brought about by the project or service. For example, the safety benefit of a redesigned intersection would not be measured by the total number of crashes that occur at the intersection, but rather by the anticipated reduction in crashes that would occur at the intersection because of the new design.

For each performance measure, four scoring categories (0, 1, 2, or 3) will be established that capture the full range of potential impacts that a project or service could have on a performance measure. A project that provides no benefit to the objective's performance measure will receive a score of 0, while a project that provides the highest level of benefit will receive a score 3.

The first step in this phase, then, will be for the RVTPO to establish the measurement thresholds defining the benefit scores for each performance measure. Where performance measures have not yet been adopted related to an objective, a qualitative measure will be used.

Figure 2: Sample Benefit Scoring Criteria (For Illustrative Purpose Only)

Objective 1A: Eliminate fatalities and reduce injuries on the multimodal transportation system.	
Performance Measure: Number of motorized fatalities per 100 million vehicle miles traveled.	
Benefit Score	**Anticipated Change in Performance Measure**
No Benefit (0 Points)	No Reduction/ Anticipated Increase in Motorized Fatalities
Low Benefit (1 Point)	Reduction of 0-1 fatalities per 100 million VMT
Medium Benefit (2 points)	Reduction of 1-3 fatalities per 100 million VMT
High Benefit (3 Points)	Reduction of 3 or more fatalities per 100 million VMT

The criteria used in the scoring of each objective could be derived quantitatively based on a project or service's potential impact on the objectives' performance measure, or it can be based on planning or engineering judgment supported by research. Appendix B offers examples of benefit scoring measures and criteria. These would need to be adapted to correspond directly with the performance measures selected by the RVTPO, but are intended offer instructive ideas and guidance for measuring project benefits.

Step 4: Calculate Benefit Scores

The following steps should be followed for each project or service to calculate a benefit score:

1) Assign the project or service a score for each objective from 0 (No Benefit) to 3 (High Benefit) for its ability to advance the objective.

2) Sum the scores within each goal area and divide by the maximum score possible, which is the product of 3 by the number of objectives within the goal.

3) Weight the goal-level score by goal weights. This can be done by multiplying the output for the previous step by the goal weight. Utilize the same goal weights that were determined in the Solutions Development process of Task 4.

4) Sum the result of the previous step across the RVTP goals to produce a benefit score.

Step 5: Establish High Benefit Threshold

Once benefit scores have been calculated for every proposed project or service, RVTPO staff or consultants should receive input from the TTC members for guidance on a preferred threshold for "high benefit" projects and services based on the calculated benefit scores.

The high benefit threshold can be defined in multiple ways. One approach is to establish a score that a project or service must equal or exceed to be considered "high benefit."

Alternatively, the RVTPO could choose to select a particular number of the highest scoring projects (overall, by locality, or within each project category) to be designated as high benefit projects.

Only projects and services that are categorized as "high benefit" will advance to Phase III for viability evaluation.

Phase III: Viability Evaluation

Phase III evaluates the viability of the high benefit projects or services identified in Phase I to determine which are the best candidates to submit for funding consideration. This phase begins with the selection of the criteria that will be used to evaluate the viability of each project or service (Step 6). These criteria will then be applied to all high benefit projects and services to separate them into high and low viability categories (Step 7). The results of this exercise will be used to create a draft RVTP project list that will be reviewed by the TTC and Policy Board (Step 8) and then shared with the public (Step 9).

Phase III Inputs

The following inputs support Phase III:

a) Selected List of High Benefit Projects and Services

b) Prior Transportation Studies and Plans

c) Official Cost Estimates

Phase III Deliverable

Phase III produces the RVTP's draft project list, which will be divided between priority and vision projects and services. Once formally approved, this project list will be used in Phase III for the selection of projects and services that will be advanced for funding applications.

Step 6: Select Viability Evaluation Criteria

The initial step of Phase II will be the selection of the criteria that a project or service must satisfy to be considered a viable project or service. A "viable" project or service is one that has been studied and developed to the level of detail that is required for competitive funding applications.

Examples of Viability Criteria include:

- Project Readiness
- Availability of Detailed Cost Estimate
- Right of Way Sufficiency
- Likelihood of Local, State, or Federal Funding
- Implementation Timeframe
- Coordination with Other Projects
- Regional and Local Support

The RVTPO staff can also select other viability criteria to respond to specific interests or concerns of the TTC or Policy Board.

Step 7: Determine Viability Ratings

After the project viability criteria are selected in Step 6, staff or consultants will apply the criteria to all high benefit projects and solutions identified in Phase II. Scoring can be performed using a binary yes/no outcome for every criteria, or with a graduated 0-3 point scale corresponding to Not Viable/Low Viability/ Medium Viability/High Viability outcomes. Regardless of the scoring method, a total scoring threshold will then be established to separate "High Viability" projects and services from "Low Viability" projects and services.

Step 8: Review Project List with TTC and Policy Board

After the completion of Step 7, the RVTPO staff will be able to create a draft RVTP project list.

"Low Viability" projects and services will be assigned to the RVTP Vision List. This list will include projects and services that are likely to generate a high level of benefit for the region but may need to be studied in greater detail before they can be submitted for funding consideration.

"High Viability" projects and services will be included on the RVTP Priority List. Projects and Services on the Priority List can be ranked in order of Benefit Score to determine the order in which the projects or services should be pursued for funding. Alternatively, a cost/benefit score can be calculated for projects and services included on the Priority List using the benefit score calculated in Step 4 and detailed cost estimates. The RVTPO can choose to rank the Priority List using this cost-benefit score to prioritize projects that offer the most benefit per dollar spent.

After this draft RVTP Project List has been created, it should be presented to the TTC and Policy Board for review.

Step 9: Present Draft Plan for Public Review

After the TTC and Policy Board have reviewed the Project List in Step 8, the draft project list will be presented to the public for review and comment.

Phase IV: Funding Acquisition

The final phase of the project identification and prioritization process involves the pursuit and acquisition of funding for the priority projects and services identified in Phase III. Projects and services are selected for funding applications in their priority ranking order (Step 10). Those projects and services that are successful in their respective grant programs and are slated to receive funding are then confirmed by the Policy Board through approval and inclusion in the region's Transportation Improvement Program (TIP). These projects and services are also reflected in the Commonwealth Transportation Board's Six-Year Improvement Program (SYIP) (Step 11).

Phase IV Inputs

Phase IV requires the following inputs:

a) RVTP Priority List Projects and Services

b) Funding Program Applications

Phase IV Deliverables

At the conclusion of Phase IV, the RVTPO will receive the funding acceptance or denial decisions for projects and services that the RVTPO and regional stakeholders have submitted for funding consideration.

Step 10: Submission of Projects and Services for Funding Consideration

Once it has been completed and approved, the RVTPO and regional stakeholders will be able to refer to the priority list of projects and services to determine which projects or services should be selected for funding applications.

The overall order of priority should correspond with the ranking of the project or services on the Priority List. In instances where funding is limited to specific kinds of projects only, the Priority List can be filtered according to the project category identified in Step 1. The top-ranking project or service within that project category can then be selected for the funding application.

Step 11: Addition of Successfully Funded Projects and Services to TIP/SYIP

Projects and services that the state chooses to fund will be considered by the Policy Board for inclusion in the region's Transportation Improvement Program and also reflected in the Six-Year Improvement Program. The RVTPO staff should closely track all submitted funding applications and present successful projects to the Policy Board, moving the project from the Roanoke Valley Transportation Plan to the Transportation Improvement Program.

APPENDIX A: RVTPO GOALS AND OBJECTIVES

Goals	Objectives
Goal 1: Provide a safe and secure transportation system	a. Eliminate fatalities and reduce injuries on the multimodal transportation system.
Goal 2: Enable reliable mobility	a. Maintain vehicle travel time reliability on priority corridors.
	b. Maintain transit and passenger rail on-time performance (OTP).
Goal 3: Enable convenient and affordable access to destinations	a. Provide motorized access to inaccessible properties identified for future development.
	b. Increase accessibility to key destinations by transit.
	c. Increase transportation connections to markets outside the region, including across Virginia and the U.S.
	d. Increase transit, bicycle, and pedestrian connections for all users within multimodal centers and districts.
Goal 4: Foster environmental sustainability	a. Minimize emissions from motorized on-road transportation.
	b. Minimize/mitigate new impervious surfaces created by transportation infrastructure.
Goal 5: Maintain and operate an efficient and resilient transportation system.	a. Maintain state and national standards for infrastructure and asset condition.
Goal 6: Support economic vitality	a. Ensure redevelopment and new developments in designated growth areas and multimodal centers/districts are supported by more than one mode of transportation infrastructure.
	b. Maintain truck travel time reliability.
	c. Maintain acceptable levels of congestion during peak travel periods on priority corridors.

Goals	Objectives
Goal 7: Promote equitable transportation investments.	a. Assess planning-level benefits or disproportionate adverse effects of transportation projects included in this plan on Equity Emphasis Areas and identify mitigation strategies.
	b. Ensure that non-drive alone mobility investments create opportunities for people in Equity Emphasis Areas.
	c. Eliminate fatalities and reduce serious injuries in Equity Emphasis Areas.
	d. Maintain state and national standards for infrastructure condition in Equity Emphasis Areas.

APPENDIX B: POTENTIAL BENEFIT EVALUATION CRITERIA

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 1: Provide a safe and secure transportation system	a. Eliminate fatalities and reduce injuries on the multimodal transportation system.	Expected Crash Reduction (EPDO) - Number	Anticipated crash prevention from the project	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs[3]
		Expected Crash Reduction (EPDO) per Vehicle Miles Traveled (VMT)	Focuses on crashes per million miles rather than overall number of crashes. Allows for better comparison between projects on routes with different traffic volumes.	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs[4]
Goal 2: Enable reliable mobility	a. Maintain vehicle travel time reliability on priority corridors.	Reduction in Person-Hours of Delay	Estimated peak hour travel time savings (peak volume, average occupancy)	SMART SCALE
		Improvement in auto travel speed in corridor	Compares no-build to build scenarios to determine project improvement.	SPS data, 2045 AADT Projections, E+C network modeling
		Decrease in number of person hours of delay	Projected travel time during analysis period minus the theoretical travel time at free-flow speed. Compare build vs no build scenarios.	Travel Demand Model, E+C Network Model
		Improvement in Travel Time Reliability	Statistically correlate LOTTR with TTI. Then use volume-delay function to estimate changes to TTI as a function of project changes to peak-hour traffic or capacity.	INRIX or NPMRDS

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 1: Provide a safe and secure transportation system	a. Eliminate fatalities and reduce injuries on the multimodal transportation system.	Expected Crash Reduction (EPDO) - Number	Anticipated crash prevention from the project	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs
		Expected Crash Reduction (EPDO) per Vehicle Miles Traveled (VMT)	Focuses on crashes per million miles rather than overall number of crashes. Allows for better comparison between projects on routes with different traffic volumes.	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs
Goal 2: Enable reliable mobility	a. Maintain vehicle travel time reliability on priority corridors.	Reduction in Person-Hours of Delay	Estimated peak hour travel time savings (peak volume, average occupancy)	SMART SCALE
		Improvement in auto travel speed in corridor	Compares no-build to build scenarios to determine project improvement.	SPS data, 2045 AADT Projections, E+C network modeling
		Decrease in number of person hours of delay	Projected travel time during analysis period minus the theoretical travel time at free-flow speed. Compare build vs no build scenarios.	Travel Demand Model, E+C Network Model
		Improvement in Travel Time Reliability	Statistically correlate LOTTR with TTI. Then use volume-delay function to estimate changes to TTI as a function of project changes to peak-hour traffic or capacity.	INRIX or NPMRDS
Goal 3: Enable convenient and affordable access to destinations	a. Provide motorized access to inaccessible properties identified for future development.	Improvement of access to otherwise inaccessible properties identified for future development	Can be binary (1 if yes, 0 if no), or categorized by number of properties affected	Future land development locations

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 3: Enable convenient and affordable access to destinations	b. Increase accessibility to key destinations by transit.	Level of improved access to Activity Centers	Using VTrans-defined activity centers	Interact VTrans
		Change in number of VTrans activity centers (or other destination type) served by transit.		Transit Stops posted on Interact VTrans[5] and transit agency GTFS feeds[6], VTrans Activity Centers posted on Interact VTrans[7]
Goal 3: Enable convenient and affordable access to destinations	c. Increase transportation connections to markets outside the region, including across Virginia and the U.S.	Does the project increase transportation connections to markets outside the region?	Binary yes/no response	*No additional data required*
Goal 3: Enable convenient and affordable access to destinations	d. Increase transit, bicycle, and pedestrian connections for all users within multimodal centers and districts.	Increase in Connections to Other Modes	Determine the number of other mode types (bus stops, train stations, sidewalks, trail, park & ride lots) that are within 1 mile [.5 mile/ .25 mile] of the project	GIS Analysis Bus stops[8] Train stations[9] Sidewalks[10] Park and ride lots[11]
Goal 4: Foster environmental sustainability	a. Minimize emissions from motorized on-road transportation.	Expected Emissions Reduction	Estimated reduction in GHG emissions and criteria pollutants from project	CMAQ emissions reduction estimation tool[12] OR TDM output
Goal 4: Foster environmental sustainability	b. Minimize/mitigate new impervious surfaces created by transportation infrastructure.	Estimated amount or area of impervious surfaces created by project	Estimated based on facility type and project description	

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 5: Maintain and operate an efficient and resilient transportation system.	a. Maintain state and national standards for infrastructure and asset condition.	Does the project improve the condition of a bridge or a road that is currently in "poor" condition?		Road (pavement[13]) /Bridge[14] Conditions
		Change in deck area-weighted average bridge condition (0-9 NBI scale) due to project		Likely requires bridge management system
		Change in lane mile-weighted average pavement condition due to project		*Likely requires pavement management system*
Goal 6: Support economic vitality	a. Ensure redevelopment and new developments in designated growth areas and multimodal centers/ districts are supported by more than one mode of transportation infrastructure.	Number of New Non-Work Destinations Accessible by Walking	Proximity calculation (buffer)/ network analysis for greater accuracy*Non-Work Destinations would need to be defined (hospitals, schools, community centers, retail businesses)	SMART SCALE/ GIS Analysis for areas without existing calculation
		Increase in average job access for all populations/ travel modes	Increase in number of people with contiguous access to employment centers (access defined as within ten miles by auto; three miles by bicycle; one mile by walking or transit).	2045 horizon year total employment, existing & committed project (E+C) network model, bicycle or pedestrian system shapefiles

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 6: Support economic vitality	c. Maintain acceptable levels of congestion during peak travel periods on priority corridors	Change in number of hours with TTI over 1.25		Travel Demand Model, E+C network model
Goal 7: Promote equitable transportation investments.	a. Assess planning-level benefits or disproportionate adverse effects of transportation projects included in this plan on Equity Emphasis Areas and identify mitigation strategies.	Does project adversely affect Equity Emphasis Area?	Adverse effects may include increases in congestion, pollution, noise, or crash risk.	Equity Emphasis Areas on Interact VTrans[15]
Goal 7: Promote equitable transportation investments.	b. Ensure that non-drive alone mobility investments create opportunities for people in Equity Emphasis Areas.	Increase in average job access for residents in Equity Emphasis Areas	Increase in number of people living in Equity Emphasis Areas with contiguous access to employment centers (access defined as within ten miles by auto; three miles by bicycle; one mile by walking or transit).	2045 horizon year total employment, E+C network model, bicycle[16] or pedestrian system shapefiles, Equity Emphasis Areas on Interact VTrans[17]
		Increase in average non-work destinations for residents in Equity Emphasis Areas	Increase in number of people living in Equity Emphasis Areas with contiguous access to non-work destinations (access defined as within ten miles by auto; three miles by bicycle; one mile by walking or transit).	Non-Work Destinations, E+C network model, bicycle[18] or pedestrian system shapefiles, Equity Emphasis Areas on Interact VTrans[19]

Goal	Objective	Candidate Measure	Measure Details	Likely Data Source
Goal 7: Promote equitable transportation investments.	c. Eliminate fatalities and reduce serious injuries in Equity Emphasis Areas.	Expected Crash Reduction (EPDO) - Number, for projects in EEA	Anticipated crash prevention from the project	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs[20]
		Expected Crash Reduction (EPDO) per Vehicle Miles Traveled (VMT)- for project in EEA	Focuses on crashes per million miles rather than overall number of crashes. Allows for better comparison between projects on routes with different traffic volumes.	Virginia-approved Crash Modification Factors (CMFs), SMART SCALE Planning Level CMFs[21]
Goal 7: Promote equitable transportation investments.	d. Maintain state and national standards for infrastructure condition in Equity Emphasis Areas.	Does the project improve the condition of a bridge or a road in an EEA that is currently in "poor" condition?		Road (pavement[22]) /Bridge[23] Conditions
Goal 7: Promote equitable transportation investments.	d. Maintain state and national standards for infrastructure condition in Equity Emphasis Areas.	Change in deck area-weighted average bridge condition in an EEA (0-9 NBI scale) due to project		Likely requires bridge management system
		Change in lane mile-weighted average pavement condition for a corridor in an EEA due to project		Likely requires pavement management system

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[4] OIPI (2022). SMART SCALE Planning Level CMFs. http://smartscale.org/documents/cmf-list-smart-scale-rd4_fy2022.pdf.

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[13] VDOT (n.d.). Pathways for Planning. https://vdotp4p.com/.

[14] VDOT (2022). VDOT Bridges and Culverts. https://www.virginiaroads.org/datasets/vdotbridgesculverts-ec/explore.

[15] OIPI (2022). Interact VTrans. Equity Emphasis Area (EEA) Index. https://vtrans.org/interactvtrans/map-explorer?layer=Equity%20Emphasis%20Area%20(EEA)%20Index&field=Equity%20Emphasis%20Area%20Index&center=-79.42091791156685%2C38.0180314177667 14&zoom=8.

[16] OIPI (2022). Interact VTrans. Bicycle Facilities. https://vtrans.org/interactvtrans/map-explorer?layer=Bicycle%20Facilities&field=VDOT%20Bicycle%20Facility%20Type&center=-79.42091791156685%2C38.0180314177667 14&zoom=8.

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[18] OIPI (2022). Interact VTrans. Bicycle Facilities. https://vtrans.org/interactvtrans/map-explorer?layer=Bicycle%20Facilities&field=VDOT%20Bicycle%20Facility%20Type&center=-79.42091791156685%2C38.0180314177667 14&zoom=8.

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PLANNING ORGANIZATION
Staffed by the REGIONAL commission