

# **NORTHEAST CORRIDOR MOBILITY STUDY**

## **TRANSPORTATION EVALUATION METHODOLOGY MEMORANDUM**

*April 30, 2009*

**PREPARED FOR:  
NASHVILLE AREA METROPOLITAN PLANNING ORGANIZATION**

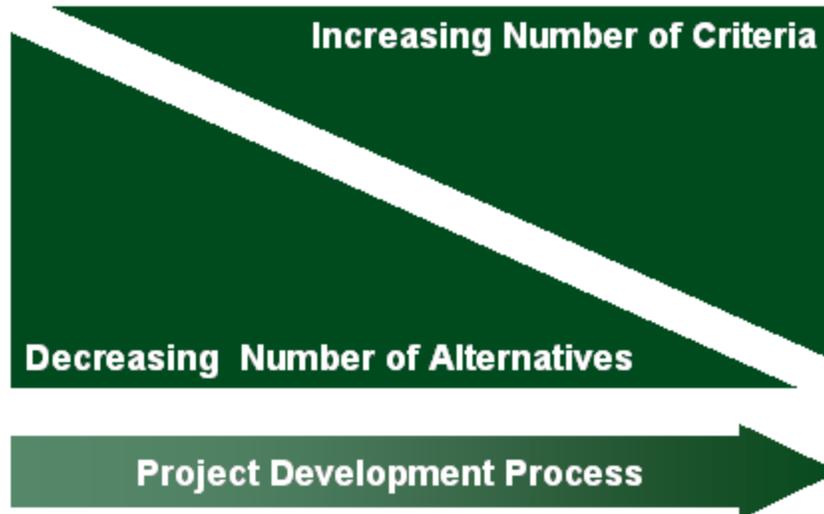
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## 1.0 INTRODUCTION

This basis for evaluation allows the benefits and impacts of each alternative to be measured with an objective set of criteria that relate to the specific needs for this project. As the evaluation progresses with respect to these criteria, the most suitable options will emerge for more detailed analysis, traditionally leading to the adoption of the Locally Preferred Alternative (LPA) by local transportation decision makers. While the methodology offers an objective procedure for comparing potential transit solutions in this specific corridor, it also takes into consideration FTA's criteria for evaluating transit projects competing for New Starts funding to facilitate fully informed decision making.

Typically the evaluation methodology for an AA is a three-step process, whereas increasingly detailed and comprehensive criteria and measures of effectiveness (MOEs) are applied to a decreasing number of alternatives. Each step in the evaluation process is thus designed to focus the analysis on progressively fewer alternatives with higher levels of scrutiny.

**FIGURE 1 ALTERNATIVES ANALYSIS PROCESS**



As the AA phase progresses more quantitative and less qualitative measures are implemented. Although each of the alternatives will be evaluated using the same criteria, all are not equally significant. Traditionally, the temptation has been to translate the qualitative and quantitative data into a ratio scale that can be arithmetically calculated and thus provide one number which can be used to compare the alternatives. However, this approach is not recommended because one must progressively weight the more significant criteria, which tends to become more subjective and less defensible.

Instead it is recommended to present the quantitative measures in numerical form and summarize the qualitative measures by comparison to one another. By translating the qualitative outcomes into an ordinal scale rating (i.e., Favorable, Neutral, Unfavorable), it allows for less precise judgments, and in this case recognizes positive and negative impacts. For ease of reference, key weaknesses which justify the elimination of alternatives are highlighted. The rationale being that the alternatives advance unless there are compelling reasons to eliminate them.

A narrative will be provided in the screening report(s) which will provide the detailed findings of the measures applied in each step, together with a discussion of the key differentiators.

Ultimately, the purpose of this methodology memo is to describe the two-step process proposed to evaluate the transportation alternatives for the Northeast Corridor Mobility Study. This methodology is intended to achieve a balance between the economic, land use and transportation analysis in terms of project budgeting. The two step process primarily consists of:

1. Preliminary screening of the alternatives
2. Detailed evaluation of alternatives

Although the Northeast Corridor Mobility Study is not specifically oriented toward the identification of a Locally Preferred Alternative and/or a New Starts project, the planning process is intended to follow FTA guidelines to the extent feasible within the project's scope so as not to preclude the eventuality of a New Starts Project. With this in mind, we do recommend notifying the FTA of the project and providing them with periodical updates in order to avoid delays should the MPO decide to apply for New Starts funding in the future. Details of the proposed screening methods and associated criteria are provided below.

## **2.0 TWO STEP SCREENING PROCESS**

### **2.1 Step One: Preliminary Screening of the Alternatives**

#### ***2.1.1 Preliminary Technology Screening***

The Universe of Alternatives begins with a wide range of alternatives which may or may not be appropriate to satisfy the needs of the corridor. At the pre-screening, transit modes may be eliminated for several reasons, including lack of demonstrated success in the US, high capital cost per mile, or clearly does not meet the project purpose and need. These determinations are made based upon the knowledge and experience of the consultant team, taking into account the distinctive requirements of the Northeast Corridor. The purpose of the pre-screening of transit technologies is to make an efficient use of study time and resources, and to avoid spending large amounts of time analyzing transit technologies that will clearly not be feasible or competitive in later stages of the alternative screening process.

Six criteria are proposed to determine the suitability and applicability of each technology in the corridor. Each technology is rated based on these criteria with a positive (+) rating by comparison, a neutral (o) rating by comparison, or a negative (-) rating by comparison. A qualitative narrative will be prepared together with a summary table as shown in Table 1.

TABLE 1: STEP 1A – PRELIMINARY TECHNOLOGY SCREENING

Criteria	Measure	Alternatives			
		1	2	3	4
<b>Suitability</b>					
Average Operating Speed	+ / o / -				
Average Station Spacing	+ / o / -				
Compatibility with Transportation System	+ / o / -				
Satisfies Study Purpose and Need	+ / o / -				
Order of Magnitude Capital Costs	+ / o / -				
<b>Applicability</b>					
Proven Revenue Service in US	+ / o / -				
<b>RESULT</b>	Advance/ Do Not Advance	Advance	Do Not Advance	Advance	Advance

**Qualitative Ratings by Comparison**

- + Favorable
- o Neutral
- Unfavorable

Indicates a Cause for Elimination by Comparison

In addition, a list of local circulator solutions will be provided. A brief narrative will describe and discuss the suitability of various local circulator options. The narrative will explain that different modes may be appropriate for local circulators, but not appropriate for the entire length of the Northeast Corridor.

TABLE 2: LOCAL CIRCULATOR OPTIONS

Local Circulator Options				
1	2	3	4	5

**2.1.2 Preliminary Definitions and Screening of Alternatives**

The next step is to identify existing corridors within the study area and to combine the remaining technologies with suitable corridors. The pairing of technologies and corridors is a subjective process and a brief narrative will be provided to explain the rationale. Simple maps will be provided to illustrate the alignments and preliminary station locations. Station locations should not be considered as “final,” but rather as provisional and solely for the purpose of preliminary screening. Route variations/deviations and feeder services will not be addressed in this step. The detailed criteria employed during preliminary screening are discussed in the paragraphs below, organized by the five project goals.

**Goal #1 – Improving Alternative Transportation Options**

The first goal of the project is to improve access and mobility within the study area through identifying mobility solutions and providing alternative transportation options on the corridor. Four quantitative criteria will be used to evaluate this goal:

- o End to end travel time (order-of-magnitude)
- o Number of major activity centers (within 1/2 mile)
- o Forecast year 2035 population within 1/2 mile of station
- o Forecast year 2035 employment within 1/2 mile of station

End to end travel time will be estimated based upon the route length and the average speed for the transit technology. The other criteria will be analyzed based upon GIS maps incorporating population and employment forecasts from the MPO and information

on current major activity centers. The result will be a table that will illustrate the overall suitability of different alternatives for improving access and providing mobility solutions in the corridor.

### **Goal #2 – Serve Transit Dependent Populations**

The second goal of the project is to ensure adequate service is offered to accommodate zero-car households and other transit-dependent populations. Three quantitative criteria will be used to evaluate this goal:

- Number of zero-car households within 1/2 mile of stations
- Number of low income households within 1/2 mile of stations
- Number of minority households within 1/2 mile of stations

These data will be derived based upon the latest geocoded US Census information available and proposed alternative routes and stations. The result will be a table that will illustrate the overall suitability of different alternatives in providing service to transit-dependent populations.

### **Goal #3 – Promote Environmental Sustainability**

The third goal of the project is to promote environmental sustainability through appropriate development patterns while integrating transportation and land use to reduce auto and truck trips, and to reduce pollutant emissions to minimize impact on attainment status. Two quantitative and two qualitative criteria will be used to evaluate this goal:

- Potential for promoting or connecting to TOD developments (qualitative)
- Qualitative assessment of potential impacts to environmentally sensitive sites, infrastructure, and private property (qualitative)
- Number of negatively affected parks, wetlands, historic sites, cemeteries, and religious properties within 500 feet (if GIS data is available)\*
- Number of disrupted or impacted residences, schools, businesses, or churches within 500 feet (if GIS data is available)\*

*\*Only if existing GIS data is available and of adequate quality; data on such sites will not be gathered by the consultant team*

These data will be derived based upon GIS information provided by local governments or the MPO and information about each of the proposed alternative's routes. The potential for promoting and connecting to TOD (transit-oriented) development will be based upon the subjective evaluation of the planning and economic development consultants. The consultant team will evaluate the feasibility of the proposed station locations for TOD development for each alternative. This analysis will take into account market potential, availability of land, local jurisdictional planning efforts, and existing development patterns in the area. The assessment of potential impacts to the environment and infrastructure will be based upon the transportation planner's subjective assessment of different routes and their disruption potential, taking into account each route's intersection with known environmental or infrastructure features. All qualitative assessments will be categories as positive (+), neutral (o), or negative (-). The result of each of these analyses will be a table that will illustrate the overall suitability of different alternatives in promoting environmental sustainability and fostering transit-oriented development patterns.

### **Goal #4 – Steward Transportation Funds**

The fourth goal of the project is to steward transportation funds to incorporate market and economic analysis for a realistic plan, determine development potential, and

recommend incentives for desired development patterns. Two quantitative criteria will be used to evaluate this goal:

- Average capital cost range based upon national comparisons and route length
- Acres of densely/intensely zoned land within 1/2 mile of stations

Average capital costs will be provided as a range based upon national comparisons and route length. This will provide a rough basis for estimating costs differences between alternatives and can be a potential basis for eliminating some alternatives, as the stewardship of transportation funds is a major stakeholder concern. Development potential is grossly estimated by the number of acres that are intensively zoned within ½ mile of proposed station locations. This will be analyzed by gathering zoning information in GIS form from local governments. Each zoning category will be identified as either densely/intensively zoned or not. Any single family zoning land will be considered as not densely/intensively zoned. The result of each of these analyses will be a table that will illustrate the overall suitability of different alternatives in stewarding transportation funds and capitalizing on development potential.

It should be noted that one of the goals of the study is to help shape local government land use policy, including potential rezonings and/or overlays after a preferred alternative is identified.

#### **Goal #5 - Safety**

The fifth goal of the project is to improve safety and security in the corridor while considering the transit/pedestrian/auto interface. No criteria have been developed for evaluating alternatives, because safety is more dependent upon the specific design and engineering solutions developed for each alternative in the engineer phase of the project, rather than on generic mode and/or route selection.

This preliminary screening of alternatives provides an appropriate level of analysis as a basis for comparing alternatives without engaging in the more time-consuming and expensive methodologies employed in the later detailed evaluation of alternatives. Quantitative measures are employed wherever feasible in order to develop a more objective preliminary screening process. However at the end of the process alternatives must be eliminated, and there is no objective method for ranking the various alternatives across numerous criteria. In some cases, particular alternatives will have clear inherent weaknesses (by comparison), and they will be identified as the key reasons to dismiss the alternatives from further evaluation as shown in the table below. A narrative will be provided to explain which alternatives are eliminated, which were the criteria on which they “failed,” and which alternatives should advance to the next phase of screening. See Table 3 below for an example of the summary table to be provided.

Having met the fundamental criteria listed in Table 3, three build alternatives (with some potential limited route variations) will likely advance to Step 2 which employs more rigorous criteria and analytic evaluation methods.

**TABLE 3: STEP 1B – PRELIMINARY ALTERNATIVE SCREENING**  
**Screen 1 Evaluation Criteria**

Criteria	Measure	Alternatives						
		1	2	3	4	5	6	7
<b>Goal 1: Improve access and mobility within the study area through identifying mobility solutions and providing alternative transportation options on the corridor.</b>								
End to end travel time (order-of-magnitude)	travel time							
Number to Major Activity Centers (within 1/2 mile)	number							
Forecast year 2035 population within 1/2 mile of station	population							
Forecast year 2035 employment within 1/2 mile of station	employment							
<b>Goal 2: Ensure adequate service is offered to accommodate zero-car households and other transit-dependent populations</b>								
Number of zero-car households within 1/2 mile of stations	households							
Number of low income households within 1/2 mile of stations	households							
Number of minority households within 1/2 mile of stations	households							
<b>Goal 3: Promote environmental sustainability through appropriate development patterns while integrating transportation and land use to reduce auto and truck trips. Additionally, attempt to reduce pollutant emissions to minimize impact on attainment status.</b>								
Potential for promoting or connecting to TOD developments	+ / o / -							
Qualitative assessment of potential impacts to environmentally sensitive sites, infrastructure, and private property	+ / o / -							
Acres of negatively affected parks and wetlands within 500 feet.*	acres							
Number of negatively affected historic sites and cemeteries within 500 feet.*	number							
Number of disrupted or impacted residences, schools, businesses, or religious facilities within 500 feet*	number							
<b>Goal 4: Steward transportation funds to incorporate market and economic analysis for a realistic plan, determine development potential, and recommend incentives for desired development patterns.</b>								
Average capital cost range based upon national comparisons and route length	dollars							
Acres of densely/intensely zoned land within 1/2 mile of stations	acres							
<b>Goal 5: Improve safety and security in the corridor while considering the transit/pedestrian/auto interface.</b>								
No criteria	N/A							
<b>RESULT</b>	Advance/ Do Not Advance	<b>Do Not Advance</b>	<b>Do Not Advance</b>	Advance	Advance	<b>Do Not Advance</b>	Advance	<b>Do Not Advance</b>

**Qualitative Ratings by Comparison**

- + Favorable
- o Neutral
- Unfavorable

**Indicates a Cause for Elimination by Comparison**

\*Only if existing GIS data is available and of adequate quality; data on such sites will not be gathered by the consultant team

## **2.2 Step Two: Detailed Evaluation of the Alternatives**

Step 2 will consist of a detailed, mostly quantitative analysis inclusive of cost estimating and travel demand forecasting. To conduct a thorough evaluation, each of the alternatives will need to be well defined in terms of operating plans, concept drawings, and a written description of the physical characteristics. The definitions would also include specific modifications to the underlying bus network to eliminate competing service and/or to provide complementary feeder service as warranted.

In addition to the build alternatives, a No-build and a TSM (Baseline) alternative will need to be defined and evaluated. The No-build alternative is traditionally comprised of the existing and committed (E+C) transportation network. The committed projects are traditionally defined as being “fiscally constrained” or likely to be implemented and are typically listed in the regional transportation plan.

The Baseline Alternative is a “low cost” alternative intended to satisfy the purpose and need of the project and is used in the New Starts evaluation process to help determine the cost-effectiveness of proposed projects. The New Starts Baseline Alternative must be defined so that comparisons with the New Starts project isolate the costs and benefits of the proposed major transit capital investment. It is important to understand that the Baseline alternative is also viewed as a potentially viable alternative by the FTA and needs to be developed and analyzed accordingly.

From FTA guidance,

*...the New Starts Baseline Alternative should represent the "best that can be done" to improve transit service in the corridor without major capital investment in new infrastructure. At a minimum, the New Starts baseline must include in the project corridor all reasonable cost-effective transit improvements short of the major capital investment often required for a New Starts project. The New Starts baseline should be designed to address identified transportation needs in the New Start project's service area and demonstrate the extent to which these problems can be solved without a proposed major capital investment such as a New Starts fixed guideway transit project. However, it is important to note that in some cases the New Starts Baseline Alternative may still result in substantial capital and operating costs, particularly in complex study areas with significant transportation problems.*

In Step 2, the more fully defined alternatives are subjected to almost entirely quantitative measures. This provides a method of clearly differentiating the alternatives via an objective comparison. Again, the key reasons for the elimination of particular alternatives will be highlighted for ease of reference and to focus the attention on the key project drivers.

The Step 2 criteria are categorized under four general headings: Transportation, Environmental, Financial and Public/Stakeholder Involvement.

The travel demand model (TDM) will be used to generate about half of the data used to evaluate the transportation impacts of each alternative including vehicle miles traveled, vehicle hours traveled, ridership and travel time savings. The approximate number of on-street parking spaces and the number of traffic impediments will be quantified manually and based on the concept design and operations. Finally, a qualitative assessment will be made regarding the impacts the project will have on traffic and the expected LOS on the arterial roadways and highways in the corridor.

Under the Environmental heading, the socio-economic criteria and analysis will be derived from Geographical Information Systems (GIS) technology. Likely sources of information will be the 2000 U.S. Census Block Group shape files (geospatial data files) and demographic tables, in addition to the TAZ (traffic analysis zone) shape files. Projections for the horizon year (2035) will be used where data is available. The catchment area for the statistics will be based on a ¼ mile radius centered about the stations. Where park-and-rides are provided, a 3 mile radius will be used. These buffered areas represent the distances most riders are willing to walk or drive to and from the transit stations. Application of these criteria will help to compare the potential size and profile of the markets being served for the various alternatives.

Potential 4f and cultural environmental impacts will be evaluated by conducting a windshield survey of the known subject areas. Sites adjacent to the project alignment with likely right-of-way impacts will be quantified. This analysis is intended to differentiate one alternative from another, based on “known” or likely impacts. Literature review and NEPA level environmental analysis will not be conducted in this study.

Likely right-of-way impacts will be based on concept level planning and engineering documents. Quantification of the potential residential and commercial displacements will be determined by referencing aerial photography, auditor’s maps and field observation. Because of the conceptual level of engineering at this stage of project development, it is recommended to present the quantities in order-of-magnitude context. This approach is intended to weed-out the alternatives with unacceptable or intolerable displacements prior to more detailed project development and analysis.

Within the financial criteria, a capital cost estimate for each alternative will be prepared and will be based on the sum of the total prices for the major items of construction work and will include additional costs for complexity. The capital cost estimates will include the development of route feet or linear foot direct costs for various typical design cross-sections, as well as direct costs for other special line items unique to each of the project alignments under study. Unit costs and quantities will be based on the best information available and the level of design completed for each alternative. At this stage, many items will be treated as lump sum allowances and/or proportions of quantified items. Appropriate contingencies for unknown factors and professional services will be applied.

Operating and maintenance costs will be based on the number of new stations and guideways together with the route miles of proposed new service. For the purposes of alternatives analysis, costs for items that are driven by mode (e.g., train-hours, bus-hours, BRT-hours) may be aggregated to arrive at a single unit cost per mode-hour. Operating hours, spans of service, frequencies and travel time will be taken into account.

The annualized capital cost and operating cost for each alternative will then be factored with the annual travel time savings (user benefits) to make an early determination of the cost-effectiveness of the projects. Cost-effectiveness is a key efficiency criteria used by the FTA to help determine if a project is eligible to advance in the New Starts process and ultimately qualify for a Full Funding Grant Agreement (FFGA).

Safety and security issues will be addressed qualitatively. Areas with unusually high crash rates will be identified for each alternative and discussed in terms of how the proposed build alternatives may or may not influence those particular areas. The capital improvements associated with each alternative will also be discussed in terms of safety

and security at a broad level (e.g., traffic calming features, pedestrian improvements and controlled access for traffic).

Lastly in Step 2, the public and stakeholder outreach response will be summarized and accounted for in the screening process. Strong opposition or support for a particular alternative may influence the decisions made in regard to which alternatives advance to the next level. Furthermore, the public and stakeholder input are invaluable in regard to the refinement of advancing alternatives.

Because the development and analysis of alternatives is an evolutionary process, variations of each alternative will likely continue to be defined and redefined throughout subsequent project development phases.

**TABLE 4: STEP 2 – DETAILED ALTERNATIVES EVALUATION CRITERIA**

**Screen 2 Evaluation Criteria**

Criteria	Measure	No-Build	TSM	Build Alternatives		
				1	2	3
<b>Goal 1: Improve access and mobility within the study area through identifying mobility solutions and providing alternative transportation options on the corridor.</b>						
Total Population Served	Total #					
Total Employment Served	Total #					
Total Households Served (HH)	Total #					
Regional Vehicle Hours Traveled (VHT)	Total #					
# of New Traffic Impedements	Total #					
Estimated Impacts to Level of Service	+ / o / -					
Annual Transit Boardings on New Service	Total #					
Ave. Annual User Benefits	Total #					
<b>Goal 2: Ensure adequate service is offered to accommodate zero-car households and other transit-dependent populations</b>						
Percentage of 0-Car Households	% of Total					
Percent of Low Income Households	% of Total					
Percentage of Minority Population	% of Total					
<b>Goal 3: Promote environmental sustainability through appropriate development patterns while integrating transportation and land use to reduce auto and truck trips. Additionally, attempt to reduce pollutant emissions to minimize impact on attainment status.</b>						
Estimated Regional Emission Reduction	Total #					
Regional Vehicle Miles Traveled (VMT)	Total #					
# of On-Street Parking Spaces Displaced	Total #					
# of Parks and Recreation Areas w/ Likely Impacts	Total #					
# of Wildlife and Waterfowl Habitats w/ Likely Impacts	Total #					
# of Historic and Archeological Sites w/ Likely Impacts	Total #					
# of Residential Units Displaced	Total #					
# of Commercial Units Displaced	Total #					
<b>Goal 4: Steward transportation funds to incorporate market and economic analysis for a realistic plan, determine development potential, and recommend incentives for desired development patterns.</b>						
Total Capital Cost	Total \$					
Annual Operating Cost	Total \$					
Total Annualized Cost	Total \$					
Cost-Effectiveness (Cost/User Benefit)	Total \$					
<b>Goal 5: Improve safety and security in the corridor while considering the transit/pedestrian/auto interface.</b>						
Estimated Impacts to Safety	+ / o / -					
<b>Public/Stakeholder Involvement</b>						
Public and Stakeholder Preference	+ / o / -					
<b>RESULT</b>	Advance/ Do Not Advance	<b>Do Not Advance</b>	<b>Do Not Advance</b>	<b>Advance</b>	<b>Do Not Advance</b>	<b>Do Not Advance</b>

**Qualitative Ratings by Comparison**

- + Favorable
- o Neutral
- Unfavorable

**Indicates a Cause for Elimination by Comparison**