TAPPAN ZEE BRIDGE/I-287
ENVIRONMENTAL REVIEW

New York State Thruway Authority
Metropolitan Transportation Authority
Metro-North Railroad

TECHNICAL MEMORANDUM

Alternatives Screening Procedures

Level 1 Screening Criteria

(Level 2 Criteria to be added in subsequent drafts)

Tappan Zee Bridge/I-287 Corridor

Environmental Review

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Task – 3F.1010
Alternatives Definition and Screening

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Thruway Authority

Metro-North Railroad

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1 INTRODUCTION

A wide range of alternatives is being considered to address the goals of the Tappan Zee Bridge/I-287 Corridor Study. The alternative elements fall into four broad categories, as follows:

- Transportation demand management/system management (TDM/TSM) options,
- Improvements to existing transit services,
- River crossing improvements, and
- Corridor-wide roadway and transit solutions.

The Stage 1 Alternatives Analysis (AA) phase of the project will employ a two-level screening process to successively narrow the number of alternatives to be assessed in greater detail as part of the Stage 2 EIS process. These processes are referred to as "Level 1" and "Level 2" screening. This technical memorandum provides details of the proposed screening procedures to be utilized during both Level 1 and Level 2 screening in the Stage 1 Alternatives Analysis (AA). The memo presents the project's goals and objectives, the proposed evaluation criteria linked to the goals and objectives, and a suggested screening methodology.

2 PURPOSE OF SCREENING

The primary purpose of alternatives screening is to narrow the large number of options so that the most promising ones are carried forward into the more detailed EIS process. During the AA, screening will be carried out by comparative evaluation, assessing options against a Baseline or No Build alternative, using a consistent set of screening criteria.

Two stages of alternatives screening will be undertaken, as follows:

- Level 1 Screening: A "long list" of alternative elements, falling into the four broad categories previously described, will be narrowed to identify those that would clearly not meet the project's goals and objectives. The objective of this process is to eliminate from further consideration those alternatives that appear to have little promise. While the primary basis of comparison will be to the No Build alternative, the process will also allow judgments to be made about the relative performance among the alternatives within individual categories. The primary basis for elimination will be little or no benefit compared to the No Build alternative in relationship to associated costs and impacts. Another significant factor will be major unavoidable impacts that are judged to make an alternative extremely difficult to implement. The first level of screening will be general, with fewer and/or simpler criteria and a simpler rating system than the Level 2 screening process that follows.
- Level 2 Screening: Alternatives that survive Level 1 screening will be combined into multi-modal, corridor-wide alternatives. These corridor-wide alternatives will be defined

further for Level 2 screening. Level 2 screening will then reduce the corridor-wide alternatives to a limited number for detailed examination in the EIS to follow. The Level 2 Screening process will include more criteria and more detailed measures than the broad-based Level 1 criteria.

3 PURPOSE AND NEED

The purpose of the Project is to address the mobility needs in the Tappan Zee Bridge/I-287 Corridor. The Project will also address the structural needs of the Tappan Zee Bridge, the Corridor's most important infrastructure element, and other existing Thruway infrastructure in the Corridor. The specific needs to be addressed by the Project include:

Growing Traffic Congestion and Delay: The Tappan Zee Bridge/I-287 Corridor experiences varying levels of traffic congestion throughout its 30-mile length. The steady increase in traffic demand over the years, together with only limited increases in roadway capacity and paucity of east-west modal alternatives, have resulted in a continual increase in travel time and delay. These problems are most acute in the vicinity of the Tappan Zee Bridge itself during the eastbound morning and westbound evening peak periods.

Lack of Modal Alternatives: Other than bus services operated in mixed traffic, which suffer the same congestion as all other traffic, no other east to west modal alternatives exist in the Corridor. The existing commuter rail lines provide service only north and south from Orange and Rockland Counties into New Jersey and from Westchester, Putnam and Dutchess Counties to Grand Central Terminal in Manhattan. MNR's lines east of the Hudson River are orientated to the Manhattan commuter travel market, while the lines west of the river are underutilized since they require a transfer and result in long travel times for trips in the primary travel markets. The nearest exclusive transit crossings of the Hudson River are located to the south in New York City: the Lincoln Tunnel bus lanes that serve the Port Authority Bus Terminal and the Northeast Corridor rail services that connect to New York Penn Station. As a result, a number of potential transit markets are not served by a dedicated transit system. These transit markets include: trips from origins west of the Hudson to Midtown Manhattan; travel wholly within the Corridor among Rockland and Westchester origins and destinations; and travel through the Corridor with either an origin or destination in Orange, Putnam or Fairfield counties.

Lifeline Structure: The Tappan Zee Bridge provides the principal Hudson River crossing between the George Washington Bridge (I-95) and the Newburgh Beacon Bridge (I-84), a distance of 46 miles. (The Bear Mountain Bridge, between I-287 and I-84, because of its location in a less urbanized area as well as its indirect east-west connections carries significantly less traffic.) With interstate connections at both ends (I-287/I-87 at Suffern at the west end and I-287/I-95 at Port Chester at the east end), I-287 is a vital link in the regional and national transportation network. If the bridge were to become unserviceable through an act of nature or man, it would be devastating both to the regional and local transportation network.

Safety and Vulnerability to Minor Incidents: The Tappan Zee Bridge has substandard lane widths (11 feet 8 inches) and no shoulders. Without shoulders, vehicle breakdowns and minor

traffic accidents can cause severe congestion in both directions. In turn, this frequent congestion impacts emergency response times and minor incidents can become major problems.

Support for Local and Regional Economic Well-Being: The Tappan Zee Bridge and the entire I-287 Corridor are vital to the economic vitality of the Hudson River Valley. Background growth and development in the area are projected to produce increases in travel demand of 20 to 30 percent over the next 20 years, and traffic impacts are expected to be significant without mobility improvements in the Corridor. In turn, these traffic impacts could impede the region's economic health and adversely affect the quality of life in Corridor communities.

Structural Condition of the Tappan Zee Bridge: The Tappan Zee Bridge has been in service since December of 1955. In addition to the usual problems from normal wear and tear to be expected on a 47-year old bridge, parts of the structure are nearing or are at the end of their useful life. This state of deterioration is in part due to the location of the structure in a harsh environment. Also contributing to the deterioration of the bridge is the increase in vehicle and truck traffic over the years. As the result of a robust and continuous program of heavy maintenance, the condition of the bridge does not pose any danger to the traveling public. In the year 2000, the costs of complete rehabilitation and retrofitting to current seismic design standards were estimated at approximately $1.1 billion.

Seismic Vulnerability: The Tappan Zee Bridge is located in a seismically active zone, but has not been designed to withstand possible seismic events. The seismic vulnerability of the Bridge is of vital concern.

4 GOALS AND OBJECTIVES

The *Scoping Information Packet* (December 2002) contains six primary goals, with associated objectives, to guide the development and evaluation of Level 1 and Level 2 alternatives. The goals and associated objectives are as follows:

Goal 1: Improve the mobility and accessibility of people, goods and services for the travel markets served by the Tappan Zee Bridge/I-287 Corridor.

- Reduce traffic congestion levels.
- Improve travel times for local trips.
- Improve travel times for regional trips.
- Provide modal travel alternative(s) not subject to roadway congestion.
- Increase the share of travel demand accommodated by transit and ridesharing.
- Provide a non-motorized means of travel, such as bicycle and pedestrian, across the Hudson River.

Goal 2: Maximize the flexibility and adaptability of new transportation infrastructure to accommodate changing long-term travel demand.

- Maximize ability to accommodate increases in travel demand.
- Minimize constraints to serving future travel patterns and markets.

Goal 3: Maintain and preserve vital elements of the transportation infrastructure.

- Assure that the Corridor's transportation infrastructure meets applicable standards for structural design and integrity.
- Assure that the Corridor's infrastructure meets applicable seismic design standards.

Goal 4: Improve the safety and security of the transportation system.

- Reduce motor vehicle accident severity and rates.
- Improve roadway geometrics to applicable standards.
- Improve the likelihood that the River Crossing would survive a severe natural or manmade event.

Goal 5: Avoid, minimize, and/or mitigate any significant adverse environmental impacts caused by Corridor improvements.

- Comply with state and federal standards and/or procedures such as those for air quality, noise, surface and ground water quality, stormwater management, ecosystems, environmental justice, energy consumption, hazardous materials, and river navigation.
- Minimize community disruption, displacements, and relocations; as well as adverse impacts to public parks, historic resources, and visual resources and aesthetics resulting from mobility improvements in the Corridor.

Goal 6: Develop feasible, cost effective solutions that can be implemented within a reasonable time horizon.

- Include improvements that to the extent practical can be implemented quickly to address existing problems, as well as long-term improvements.
- Foster capital and operating cost effectiveness.
- Minimize disruptions to the regional transportation system.
- Maximize use of the region's existing and committed transportation infrastructure.

5 LEVEL 1 SCREENING CRITERIA

Tables 1, 2 and 3 summarize the criteria to be used for Level 1 screening. The criteria to be used for screening the Transportation Demand Management/Transportation Systems Management (TDM/TSM) and Transit Service Improvements are shown in Table 1, Table 2 contains the criteria proposed for the Corridor-wide alternative elements and Table 3 the criteria to be used for the River Crossing alternatives. Separate screening procedures are proposed for the various improvement categories, since many of the impact criteria are unique to a given category. As an example Structural Integrity and Seismic Standards relate primarily to the River Crossing alternatives.

For Level 1 screening detailed design, cost, ridership and impact information will not be available. Thus, many of the Level 1 criteria will be surrogate measures or qualitative, professional judgments. The information will be presented in several ways, depending on the measurement method as follows:

- Some assessments will provide numerical results. For example, travel time would be summarized by the number of minutes for typical trips.
- Some assessments will result in a "pass/fail" result. For example, the river crossing alternatives either will or will not include a pedestrian/bicycle facility.
- Many assessments will result in a "level of impact/effectiveness" rating. For example, level of parklands and 4(f)/6(f) resource impacts will be presented using a simple, qualitative statement as to the judged degree of potential impacts.

Since the purpose of the Level 1 screening is to provide a basis to delete or modify ineffective or high impact alternatives, the number of criteria to be used during this high-level evaluation need not be exhaustive. The letter codes for "type" of rating in the tables refer to the following:

- **Q** = Qualitative rating based on judgment (for example, a visual impact rating);
- **Q(M)** = Qualitative rating informed by surrogate or approximate measure (for example, rating air quality impacts based on a change in regional vehicle miles of travel, or rating parkland impacts based on an inexact right-of-way footprint);
- **M** = Direct Measurement (for example, auto speed on selected roadway links which is a direct output of the Best Practices Method model; or, total cost).

The accompanying tables also indicate the relationship of each of the screening criteria to the previously discussed goals and objectives. The appendix to this technical memorandum provides a more detailed discussion of the methods that will be used to develop performance open each of the screening criteria.

Table 1 – TDM/TSM and Improvements to Existing Transit Services
Level 1 Screening Criteria

Criteria	Measurement Method	Type	Units/Rating System	Related Goal(s)
Traffic Operations	Potential to reduce congestion and/or incrementally increase vehicular capacity	Q	Rating Poor/Neutral/ Fair/Good	1
Transit Ridership	Potential to increase transit ridership	Q	Rating Poor/Neutral/ Fair/Good	1
Auto Occupancy	Potential to increase ridesharing	Q	Rating Poor/Neutral/ Fair/Good	1
Peak Period Vehicle Trip Reduction	Potential to reduce peak period vehicle trips	Q	Rating Poor/Neutral/ Fair/Good	1
Socio-economic Impacts	Potential for disproportionate impacts to low income and/or minority populations	Q	Yes/No	5
Air Quality Impacts	Potential change in air quality as a result of changes in travel conditions	Q	Rating Degradation/ Neutral/ Improvement	5
Other Significant Adverse Impacts	Significant adverse impacts to other environmental resources, as appropriate given the characteristic of the improvement	Q	Rating Nature and Degree of Impact	5
Implementation Issues	Judgment based on legislative needs, jurisdictional issues, and public controversy with action	Q	Rating Poor/Neutral/ Fair/Good	6
Cost Effectiveness	Rating on anticipated benefits in relation to costs	Q	Rating Poor/Neutral/ Fair/Good	6

Table 2a – Corridor Wide Improvements
Level 1 Transportation Performance Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Travel Time	Highway: AM peak period/peak direction travel times for selected pairs of origin and destinations	M	Average travel time in minutes	1
	Transit: AM peak period/peak direction travel times for selected pairs of origins and destinations	M	Average travel time in minutes	1
AM Peak Period Peak Direction Mode Split	Reduction in SOV crossing Hudson River screenline	M	Number of vehicles	1
	Increase in transit share for selected travel markets	M	Percentage	1
Transit Ridership	Increase in transit ridership crossing the Hudson River	M	Number of passengers	1
	Increase in regional transit ridership	M	Number of passengers	1
AM Peak Period Reserve Capacity	Year 2020 reserve peak period/peak direction highway person-capacity at selected screenlines	M	People/hour	1, 2
	Year 2020 reserve peak period/peak direction transit person-capacity at selected screenlines	M	People/hour	1, 2
Transportation System Integration	Ease of integration with existing roadway network	Q	Rating Poor/ Fair/Good	2, 6
	Ease of integration with existing transit infrastructure	Q	Rating Poor/ Fair/Good	2, 6
Freight	Potential to accommodate rail freight	Q	Rating Low/Medium/ High	1, 2, 6
Alternative Mode(s) Not in Mixed Traffic	Inclusion of alternative mode(s) operating on roadway/guideway not subject to highway congestion	Q	Yes/No	1, 2, 6

Table 2b – Corridor Wide Improvements
Level 1 Environmental Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Potential for Existing Land Use Impacts	Potential consistency with existing land use	Q	Rating Low/Medium/ High	5
Potential for Future Land Use Impacts	Potential consistency with adopted land use plans and policies	Q	Rating Low/Medium/ High/Variable	5
Potential Change in Air Quality	Year 2020 potential change in air quality	Q	Rating Slight Deterioration/ None/ Slight Improvement	5
Acquisitions, Displacements and Relocations	Potential extent of acquisitions, displacements and relocations	Q	Rating Low/Medium/ High	5
Historic and Archaeological Resources	Potential to impact resources listed on or eligible for listing on the National or State Register of Historic Places	Q	Rating Low/Medium/ High	5
Parklands and Section 4(f)/6(f)	Potential to impact parklands and 4(f)/6(f) resources	Q	Rating Low/Medium/ High	5
Potential Impacts on Upland Ecosystems and Water Resources	Potential impacts to ecosystems and water resources	Q	Rating Low/Medium/ High/Severe	5
Construction Impacts	Construction impact severity	Q	Rating Low/Medium/ High	5, 6
	Construction impact duration	Q	Rating Short/Medium/ Long	5, 6

Table 2c – Corridor Wide Improvements
Level 1 Cost Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Capital Cost	Estimated capital cost order-of-magnitude range in $2003	M	$ 2003	6

Table 3a – River Crossing Improvements
Level 1 Transportation Performance Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Travel Time	AM peak period/peak direction travel time change by mode	M	Average travel time in minutes	1
Traffic Operations and Safety	Potential changes in traffic operations and overall traffic safety based on roadway configuration and geometrics	Q	Rating Negative/ Neutral/Low/ Medium/ High	1, 4
AM Peak Period Reserve Capacity	Year 2020 reserve peak period/peak direction highway person-capacity	M	People/hour	1, 2
	Year 2020 reserve peak period/peak direction transit person-capacity	M	People/hour	1, 2
Transportation System Integration	Ease of integration with existing roadway network	Q	Rating Poor/ Fair/Good	2, 6
	Ease of integration with existing transit infrastructure	Q	Rating Poor/ Fair/Good	2, 6
Freight	Potential to accommodate rail freight	Q	Rating Low/Medium/ High	1, 2, 6
Structural Integrity	Structural sufficiency rating, based on degree to which river crossing is brought into compliance with current structural standards	Q	Rating Poor/Fair/Good	3
Seismic Standards	Seismic sufficiency rating, based on degree to which river crossing is brought into compliance with current seismic standards	Q	Rating Poor/Fair/Good	3
Vulnerability	Assessment based on type and characteristics of structure(s)	Q	Rating Poor/Fair/Good	4
Alternative Mode(s) Not in Mixed Traffic	Inclusion of alternative mode(s) operating on roadway/guideway not subject to highway congestion	Q	Yes/No	1, 2, 6
Non-Vehicular Travel	Inclusion of pedestrian and bicycle facilities	Q	Yes/No	1, 2

Table 3b – River Crossing Improvements
Level 1 Environmental Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Potential for Existing Land Use Impacts	Potential consistency with existing land use	Q	Rating Low/Medium/ High	5
Potential for Future Land Use Impacts	Potential consistency with adopted land use plans and policies	Q	Rating Low/Medium/ High/Variable	5
Potential Change in Air Quality	Year 2020 potential change in air quality	Q	Rating Slight Deterioration/ None/ Slight Improvement	5
Acquisitions, Displacements and Relocations	Potential extent of acquisitions, displacements and relocations	Q	Rating Low/Medium/ High	5
Historic and Archaeological Resources	Potential to impact resources listed on or eligible for listing on the National or State Register of Historic Places	Q	Rating Low/Medium/ High	5
Parklands and Section 4(f)/6(f)	Potential to impact parklands and 4(f)/6(f) resources	Q	Rating Low/Medium/ High	5
Potential Impacts on Hudson River Ecosystems and Water Resources	Potential impacts to ecosystems and water resources	Q	Rating Low/Medium/ High/Severe	5
Construction Impacts	Construction impact severity	Q	Rating Low/Medium/ High	5, 6
	Construction impact duration	Q	Rating Short/Medium/ Long	5, 6

Table 3c – Corridor Wide Improvements
Level 1 Cost Screening Criteria

Criteria	Measurement Methods	Type	Units/Rating System	Related Goal(s)
Capital Cost	Estimated capital cost order-of-magnitude range in $2003	M	$ 2003	6

6 LEVEL 2 SCREENING CRITERIA

(This section will be developed following completion of the Level 1 screening process.)

7 EVALUATION METHODOLOGY

Once the detailed evaluation results are compiled a procedure for synthesizing the evaluation and making decisions is needed. The first step for both Level 1 and Level 2 screening will be to summarize the results. The next step will be to review the results, compare alternatives and select and/or modify those to continue to the next phase. However, the sheer number of alternatives, criteria and measurement could present difficulties in easily understanding the results. Therefore, a methodology is needed to focus attention on key results and define differences among alternatives.

7.1 LEVEL 1 METHODOLOGY

For Level 1 the screening criteria assessments will be simpler than those ultimately used in later phases, but the number of alternatives will be quite large. As a result, the findings will be summarized into four separate matrices that correspond to each of the alternative categories:

- TDM/TSM programs
- Transit service improvements
- Corridor-level transit and roadway improvements
- River crossing alternatives

The process in Level 1 will then focus on screening the alternatives within each of the categories. Comparisons across or among categories will not be made at Level 1. Each alternative element will be rated and compared to the alternatives within its respective category. The alternatives that perform poor overall will be candidates for elimination. As determined appropriate, modifications and/or mitigation measures will be identified that may improve performance, reduce costs and/or reduce environmental impacts for those alternatives that are to be carried forward. The remaining alternatives from each category, including any modifications/mitigation measures, will be combined to form comprehensive corridor-wide solutions to be assessed in Level 2.

Given the number of criteria (far fewer than for Level 2 screening) and the nature of the screening process (focusing primarily on eliminating poorly performing alternatives), the screening information could be presented as a mix of quantitative information and qualitative ratings (both “pass/fail” and “low/medium/high”). In other words, each alternative would show a mix of numbers, such as a cost estimate, and qualitative ratings, such as an impact on an environmental resource. Alternatively, it may be desirable in some cases and for some audiences to convert the findings for all of the criteria to a common qualitative scale. This could be done by taking the quantitative information, such as transit ridership or costs, normalize the data and convert them to a common scale. At this time, weighting the criteria is not recommended.

The actual process of developing the recommendations for eliminating alternative elements and selecting those to go forward could occur through a collaborative technical work session involving the entire the study team. The results of this technical work session would then be carried forward for public review during the second round of public workshops. The suggested approach to the study team technical work sessions include the following:

1. Prior to the study team work session, the screening assessment results for all categories of alternatives would be circulated to participants in summary matrix format.

2. At the work session, the technical discipline leads would present the results of each assessment and provide the rationale for the ratings.

3. Once the ratings were finalized, each alternative would be compared to the results for the No Build or baseline alternative. Those alternatives that perform worse overall than the No Build, or provide questionable benefits in relation to their cost, or have serious impacts that appear to unavoidable and not possible to mitigate would be recommended for elimination.

4. After the No Build comparisons are completed, the alternatives would be compared to each other in order to identify those that perform better than others. The work session participants would then rank the alternatives within each improvement category.

5. The work session participants would then discuss the rankings and develop recommendations on those alternatives to be dropped from further review and those to be carried forward.

6. The participants would identify any potential modification/mitigation to the remaining alternatives that could improve performance, reduce cost and/or reduce environmental impacts to make them more attractive. For example, a route alignment could be modified to avoid a significant cultural resource. This information would be carried forward into Level 2 Alternative Definition.

Finally, after the completion of public review, the screening results, and the rationale behind decisions to drop, maintain or enhance Level 1 alternatives would be documented in a screening report.

7.2 LEVEL 2 METHODOLOGY

(This section will be developed following completion of the Level 1 screening process.)

APPENDIX: Criteria Rating Methodology

A-1 CRITERIA FOR TDM/TSM AND TRANSIT ALTERNATIVES

During Level 1 screening, the TDM/TSM and existing transit service improvement alternatives will be evaluated on an individual basis and therefore, specific criteria have been proposed to assess them. However, during Level 2, the most promising actions will be incorporated into an overall corridor strategy. Therefore, during Level 2 screening, TDM/TSM programs and improvements to existing transit services will be an integral part of each alternative and will be evaluated using the criteria and ratings proposed in Section A.2 of this appendix. (It should be noted that this would not preclude implementing TDM/TSM measures separately.)

A-1.1 TRANSPORTATION PERFORMANCE CRITERIA

7.2.1 Traffic Operations

In Level 1 screening, specific actions will be evaluated on their expected effectiveness in improving traffic operations within the study corridor, by reducing congestion and/or incrementally increasing vehicular capacity at key bottlenecks. This is proposed to be a qualitative rating, based on judgment informed by experience with the measures contemplated.

7.2.2 Transit Ridership

The degree of mode shift from SOV to transit due to individual transit service improvements will probably be substantially less than that resulting from higher-cost alternatives such as implementation of a new, corridor-wide commuter or light rail transit line. However, it is anticipated that some improvements to existing transit services will result in incrementally higher transit ridership at specific critical locations within the corridor. This is proposed to be a qualitative rating, based on judgment informed by experience with the measures contemplated.

7.2.3 Auto Occupancy

Some TDM and TSM actions/programs can serve to increase ridesharing. Alternatives will qualitatively rated on their ability to incrementally increase average auto occupancy in the corridor.

7.2.4 Peak Period Vehicle Trip Reduction

Individual TDM actions will be qualitatively rated on their expected effectiveness in reducing vehicle trips during peak periods within the study corridor. This rating would be informed by existing program effectiveness/saturation, the specific travel markets in the study area, as well as experience elsewhere.

A-1.2 ENVIRONMENTAL IMPACT CRITERIA

Only very minor physical impacts are expected with any individual TDM/TSM and transit service improvement option, related to impacts at specific facility sites (for example, the impacts associated with installing changeable message signs or increasing the frequency of bus service on a specific route). These types of impacts require details of facilities and services that will not be available during the AA phase of the project. Air quality and environmental justice are two areas of possible impact associated with TDM/TSM actions/programs and will be included.

7.2.5 Socio-economic Impacts

It is anticipated that some TSM actions, such as pricing or toll structures could have a disproportionate impact on lower-income populations. During Level 1 screening alternatives will be rated "yes/no" on whether they could negatively impact minority and/or low-income populations.

7.2.6 Air Quality

During Level 1 screening, alternatives will be qualitatively rated on their relative potential to reduce or possibly increase motor vehicle related air emissions in the I-287 corridor. This will be a qualitative rating based on the potential change in vehicle trips and roadway congestion associated with a specific TDM/TSM/transit service improvement.

A-1.3 COST EFFECTIVENESS CRITERIA

7.2.7 Cost Effectiveness

TDM/TSM and transit service improvements are relatively low-cost alternatives, so their total costs are not as important as their anticipated cost effectiveness. During Level 1 screening, both individual transit service improvements and TDM/TSM actions will be qualitatively assessed on their anticipated effectiveness in reducing peak period vehicle travel, in relation to their anticipated investment level.

A-2 RATINGS FOR CORRIDOR AND RIVER CROSSING ALTERNATIVES

A-2.1 TRANSPORTATION PERFORMANCE CRITERIA

7.2.8 Travel Time

The BPM model has several direct outputs that will be helpful in assessing the transportation performance of various alternatives under consideration. One such output is estimated average travel time. The project team will select a series of representative auto and transit trips utilizing the corridor. The BPM model will be used to estimate the average AM peak period/peak direction trip times for these trips, and will produce a weighted average for each improvement

alternative based on number of trips. The change in this weighted average trip time will be compared to the No Build model run, and the alternatives rated on their ability to reduce the 2020 AM peak period average trip time. Because travel time is a corridor level measure it will be used as a screening criteria only for the Corridor Improvement alternatives and not the River Crossings.

Possible representative trips are as follows:

- From Suffern to White Plains
- From Harriman to Yonkers
- From Stamford, CT to White Plains
- From White Plains to Montvale, NJ
- From New City to Midtown Manhattan
- From New City to Nyack

7.2.9 Mode Split

A direct output of the BPM model is mode choice, the total number of person trips using various transportation modes available in the region during a specified time period. This output can be analyzed to calculate the shift from the Single Occupant Vehicle (SOV) mode to other modes. Alternatives will be rated on the forecasted percent shift from the SOV mode to other modes, at selected screenlines. Because mode split is a corridor level measure it will be used as a screening criteria only for the Corridor Improvement alternatives and not the River Crossings.

The proposed AM peak period analysis will include the following:

- Estimated reduction in SOV volumes crossing the Hudson River Screenline, and
- Increase in the percentage of travel by transit for a selected sample of the travel market in the corridor.

7.2.10 Transit Ridership

In addition to the shift from SOV, it will be possible to calculate the number of new daily transit riders at key screenlines for each alternative using the BPM model results, compared to the No Build condition. This criterion will provide an indication of how well each alternative alters mode choices. Alternatives will be rated on their ability to increase AM peak period transit ridership. Because transit ridership is a corridor level measure it will be used as a screening criteria only for the Corridor Improvement alternatives and not the River Crossings. Two measures of transit ridership will be developed, as follows:

- Estimated increase in transit ridership crossing the Hudson River, and
- Total estimated increase in regional transit ridership.

7.2.11 Reserve Capacity

This criterion will measure an alternative's ability to handle travel growth beyond the 2020 forecast horizon. Unused, or "reserve" year 2020 person-capacity for all modes during the AM peak period at critical screenlines will be calculated. The proposed locations for this analysis include the Hudson River Crossing and other key locations in Rockland and Westchester Counties as determined by the transportation modeling.

For transit services, person-capacity will be estimated based on vehicle capacities and peak hour operating schedules. Alternatives with greater person-capacity will be rated higher. For roadways, person-capacity will be measured based on a theoretical maximum highway lane capacity of 1,900 vehicles per hour (as defined by the Highway Capacity Manual), and the 2020 average auto occupancy within the corridor. Those alternatives with higher reserve capacity will be rated better than those with lower reserve capacity.

7.2.12 Traffic Operations and Safety

This criterion will be based on a qualitative judgment as to the impact that the various River Crossing alternatives on overall traffic operations, traffic safety and emergency response times. This judgment will be based on the proposed lane configuration and geometrics of the roadway facilities. During Level 1 screening this criterion will be applied to the River Crossings only and not to the Corridor Improvements.

7.2.13 Transportation System Integration

Both the Corridor Improvement and River Crossing alternatives will be evaluated based on qualitative assessments of their potential to interconnect with other elements of the existing and proposed highway and transit systems within the corridor. The assessment will also include a qualitative judgment on the alternative's level of impact and/or effectiveness with respect to transportation service and performance related to the No Build alternative as well as the relative performance among alternatives within individual categories. Ratings of Good, Fair or Poor will be used, as follows

- A good rating will be applied if the alternative connects directly with, and could be integrated into the transportation system without any negative service or performance impacts, and was judged to have a positive effect on the system's transportation performance. A good rating would also be applied if the alternative provided new service or improved existing service for a comparatively longer distance within the corridor than other alternatives within the same improvement category.

- A fair rating will be applied if the alternative is judged to have only a minor positive effect on the system's performance, or if the integration into the system could cause minor negative impacts, minor service disruptions, or minor interference with the performance of the transportation system. A fair rating was applied if the alternative serviced only a portion of the corridor, or if most of its service benefits are provided outside of the Corridor.

A poor rating will be applied if the alternative creates the potential for disruption of a transportation service; reduction or removal of access to sections of the system; or significant interference with modal operations. The alternative would warrant a poor rating if the service provided duplicates or replaces an existing service or system without appreciable service benefits or performance enhancements.

7.2.14 Potential to Accommodate Rail Freight

This criterion will be used to identify those alternatives that have the potential to accommodate for rail freight service both in the Corridor and the River Crossing. High, medium and low ratings will be applied based on a qualitative assessment of the ability of the alternatives to accommodate rail freight from an operational and engineering standpoint. A high rating will be applied to those alternatives that could accommodate rail freight service with only minimal or modest change. A low rating, on the other hand, would suggest that the introduction of freight to a commuter rail alternative would require an additional major capital investment to meet the grade and clearance requirements. It would also indicate that the fright service could have a limited window of operation to avoid interference with the commuter rail requirements.

7.2.15 Alternative Modes Not in Mixed Traffic

This criterion indicates the presence of modes not subject to roadway congestion at key locations in the corridor. The presence of modes will be determined with a "yes/no" type of rating at the Hudson River crossing and other key locations in Rockland and Westchester Counties to be determined as a result of the travel forecasting work.

7.2.16 Non-Vehicular Travel

This criterion will be rated on the presence of pedestrian and cyclist facilities across the Hudson River. For Level 1 screening, alternatives will be rated as "yes" (including bicycle and pedestrian facilities) or "no" (not including bicycle and pedestrian facilities). Only the River Crossing alternatives will be rated during Level 1.

7.2.17 Structural Integrity and Seismic Design Standards

These two criteria relate to the ability of the River Crossing alternatives to meet current structural and seismic design standards. Alternatives will be qualitatively rated based on the degree to which they could be brought into compliance with current standards. In general, alternatives that include new crossings (which can be designed to meet or exceed current standards) would be rated higher than those that only provide for rehabilitation of the existing bridge (which may not result in meeting existing design standards). Alternatives that only provide for maintenance of the existing bridge will be rated lowest, as there would be no opportunity to meet current standards

7.2.18 River Crossing Vulnerability

Any Hudson River crossing structure could be vulnerable to major natural events (earthquakes, floods) or man-made events (ship collisions, terrorist acts). However, some river crossing alternatives would have less or more vulnerability than others, for example:

- Alternatives with new construction may be less vulnerable than those involving rehabilitation or maintenance of the existing bridge crossing, since the former would be designed to meet or exceed current design standards.
- A long-span bridge with a limited number of piers within the river would be less vulnerable to collision.
- Twin tube tunnels or separate bridge structures would be less vulnerable to impacts caused by damage than a single structure due to their redundancy.
- A tunnel would not be vulnerable to a ship collision, but would be more susceptible to roadway collisions and related fires.
- Some tunnel locations may be less vulnerable to earthquakes depending on their associated soil conditions.

Each river-crossing alternative will be qualitatively rated on its ability to withstand both natural and man-made events, depending primarily on crossing type, redundancy and location.

A-2.3 ENVIRONMENTAL IMPACT CRITERIA

Environmental impacts for corridor-wide improvement alternatives are often more difficult to rate quantitatively since impacts tend to be localized to specific locations, and different degrees of impact can result due to the varying sensitivity of environmental resources. These characteristics make it difficult to develop a summary corridor-wide rating based on quantitative analysis. In addition, very little detailed design information will be available during the AA phase – information upon which many environmental impact analyses typically rely. Therefore, during the AA phase, most environmental criteria will be assessed qualitatively, informed by limited quantitative analysis and by relatively generalized design information.

During the AA stage, only direct and long-term environmental impacts will be assessed (unless noted otherwise). The alternatives will be assessed at Level 1 assuming no major mitigation actions are in place (excluding those required by current design standards or regulations, such as typical stormwater treatment/control actions).

7.2.19 Land Use Impacts

Two land use impact assessments are proposed for Level 1 screening. Each will employ judgments using a low, medium, high or no impact scale for the following:

- Consistency with existing land use. Alternatives will be qualitatively assessed on their level of compatibility with existing land uses. In general, alternatives that don't require

additional right-of-way, change major corridor access points or which avoid impacts on developed areas would have the least impact on existing land uses.

- Consistency with adopted land use plans. Alternatives will be qualitatively assessed on their level of support to or conformity with current adopted local and regional land use/growth plans and policies. In general, alternatives that add significant person-capacity to the study corridor, either through widening or development of new highway and/or transit routes, or alternatives that significantly change corridor access, would have the greatest impacts. Alternatives will be assessed on whether this impact is consistent, or inconsistent with current land use/growth plans.

7.2.20 Acquisitions, Displacements & Relocations

At this stage alternatives will be described in terms of centerline alignments and typical cross sections of facilities. Only an approximation of the required right-of-way (ROW) footprint can be developed, since more detailed design information relating to features such as cut/fill slopes, retaining walls, stormwater facility requirements, and mitigation elements will be unknown. Consequently, specific acquisitions, displacements and relocations cannot be identified with certainty at the AA phase of project development.

For Level 1 screening, alternatives will be qualitatively rated on their level of potential displacements. Judgments will be based on knowledge of land uses and a general understanding of the implications of particular alternatives. Alternatives with lower potential to cause displacements will be rated higher.

7.2.21 Historic Architectural and Archaeological Resource Impacts

This criterion will be assessed in much the same way as that for Acquisitions, Displacements and Relocations. For Level 1 screening, a qualitative rating will be developed based on the potential level of historic architectural and archeological resource impacts. This assessment will use a low, medium, high, or no impact scale.

7.2.22 Parklands & Section 4(f)/6(f) Impacts

For Level 1 screening, given the limited information available, alternatives will be qualitatively rated on their potential to require parkland (parks, recreation areas, wildlife areas, wild and scenic rivers, natural trails, natural landmarks, etc.). This assessment will use a low, medium, high, or no impact scale.

7.2.23 Air Quality Impacts

During Level 1 screening, this criterion will be qualitatively assessed for highway modes using the likely change in regional VMT projected by the BPM model. The ratings will include assessments of whether the alternatives have the potential for improvement, no impact, or decline in air quality.

7.2.24 Ecosystems and Water Resources Impacts

For Level 1 screening, given the limited information available, alternatives will be qualitatively rated on their potential to impact ecosystems and water resources. This assessment will use a low, medium, high, or severe impact scale.

7.2.25 Construction Impacts

The alternatives will be qualitatively rated on both construction impact severity and construction duration. The ratings will be based on experience with similar types of construction elsewhere and knowledge of the specific locations and configurations in the corridor. Impacts to mobility, as well as other environmental impacts will be considered. Those alternatives with fewer expected disruptions and impacts for shorter periods of time would be rated higher. Construction severity will use a rating scale of low, medium or high. Construction impact durations will be rated on a scale from short to medium to long.

A-2.3 COST EFFECTIVENESS CRITERIA

7.2.26 Capital Costs

Establishing orders of magnitude and, when possible, relative costs among alternatives are key aspects of the screening process. Expectations of accuracy for the probable construction costs must, however, be consistent with the level of definition provided for the various alternatives. At the Level 1 screening stage, alternatives may be defined as simply as lines on a map. For this study, development of capital costs will be based on indicative unit costs applied to quantity approximations.

The unit cost values and quantities used at each screening level will be established using:

- Estimates of indicative quantities calculated from the definition of the alternative
- Cost data from Means *Costworks* Cost Data for Heavy Construction
- Comparison to compiled data - quantities and unit costs - of similar construction projects from around the world adjusted to the local material and wage rates

Soft Costs, a component of project costs encompassing project management, design, permits, construction administration and inspections, will range from 30 to 40 percent of the construction costs.

To account for the design and construction unknowns inherent to this early stage in the study process, a contingency will be applied to all costs. This contingency is expressed as a percent 'mark-up'. The percentage will gradually decrease through the study, as the definitions of alternatives are refined.

When attempting to establish probable costs the study team will recognize risks and opportunities within an alternative. What physical, technical, and operational unknowns could add to the costs? Likewise, what physical, political and operational savings might become

available as an alternative's design, construction and use are finalized? To capture these risks and opportunities, the costs will be reported in ranges.

Many alternatives at Level 1 definitions will only be described in words without benefit of any design. Others will be represented as lines on maps. These simple descriptions do not lend themselves to accuracy in establishing probable costs. To be consistent with these broad-brush descriptions, the Level 1 screening will seek to place alternatives within a project range – an order of magnitude. Parameters to establish quantities for the Level 1 Alternatives will include:

- Number of lanes and lane miles
- Tunnel diameters
- Number of tracks and track miles
- Bridge costs on a square foot basis
- Number and size of ancillary facilities
- Quantity and dispersion of ITS facilities
- Number of New Stations

Contingency in the estimates to cover the myriad of unknowns will be applied to the total of the construction and soft costs at a rate of 40 to 50% depending on the level of definition for a given alternative.