TAPPAN ZEE BRIDGE/I-287 ENVIRONMENTAL REVIEW

New York State Department of Transportation
New York State Thruway Authority
Metropolitan Transportation Authority/Metro-North Railroad

Tappan Zee Bridge/I-287
Environmental Review

Draft
Transit Mode Selection Report

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Thruway Authority

New York State Department of Transportation

Metro-North Railroad

Executive Summary

The purpose of this *Transit Mode Selection Report* is to document the in-depth analysis, evaluation, and public and agency participation conducted to date for the Tappan Zee Bridge/I-287 Environmental Review and to make a transit mode recommendation that best meets the project's purpose and need, goals, and long-term public interest. Transit is needed in this corridor to address mobility and travel demand needs within the study area through 2035, principally focusing on accommodating both the cross-corridor and New York City metropolitan area travel markets. For example, as demonstrated in the *Alternatives Analysis*, peak-period traffic in the already-congested corridor is projected to increase by 30 percent over a 30-year period. It was also demonstrated that the daily Vehicle Miles Traveled (VMT) would increase significantly over the same period, especially in the fast-growing counties of Orange (85 percent increase), Rockland (54 percent increase), and, to a lesser degree, Westchester (29 percent increase).

The need for this project and transit is demonstrated based on the forecasted population and employment growth in the region and corridor, and its resulting projected increase in travel. Based on the New York Metropolitan Transportation Council (NYMTC) Consensus Forecasts and Best Practice Model, the need for transit in this corridor to meet present and future travel demand needs is well documented. As noted in Chapter 5, between 2005 and 2035, population growth in Rockland County is expected to be 28 percent, and, in Orange County, 51 percent. The Westchester County population is expected to be more stable – growing by only 6 percent. All three counties are expected to exceed the forecasted regional employment growth of 20 percent: employment in Westchester will grow by 26 percent, in Rockland by 31 percent, and in Orange by 44 percent[1]. Without major transit investments, already-unacceptable levels of congestion are forecasted to occur in the corridor far into the future. It is the purpose of this document to present an analysis of which transit modes will best meet present and future needs. This report summarizes the results of the evaluation and analysis required to recommend a transit solution that will meet travel demand needs, minimize environmental impacts (to man made and natural environments), contribute to sustainable transportation and land use, and enhance quality of life in an energy-efficient and cost-effective manner.

S.1 Development of Preliminary Alternatives/Options

The Alternatives Analysis (AA) process for the Tappan Zee Bridge/I-287 Environmental Review ended with the selection of six preliminary alternatives for analysis in the draft environmental impact statement (DEIS):

- Alternative 1 – No build.
- Alternative 2 – Rehabilitated bridge with transportation demand management/transportation system management (TDM/TSM) measures.
- Alternative 3 – Full-corridor bus rapid transit (BRT).
- Alternatives 4A, 4B, and 4C – Commuter rail transit (CRT) in Rockland and either CRT, light rail transit (LRT), or BRT in Westchester.

In the course of evaluating the six DEIS alternatives that had been developed in the AA process, several variations were developed during the scoping update process. Thus, the range of alternatives/options evaluated in this report is as follows[2] (Figure S-1):

- No Build – Alternative 1 is used as the baseline to measure impacts, where appropriate.
- Option 3A (Alternative 3 with enhanced service plan). Buses would use the high-occupancy vehicle/high-occupancy toll (HOV/HOT) lanes in Rockland County, and exclusive bus lanes integrated into the existing bus system and dedicated busway east of White Plains in Westchester County.
- Option 3B (Alternative 3 with enhanced service plan and full-corridor busway). Buses would use the HOV/HOT lanes in Rockland County and exclusive busway in the I-287 right-of-way (ROW) in Westchester County.
- Option 4D (Option 3A plus CRT in Rockland).
- Alternatives 4A, 4B, and 4C as developed in the AA process.
- Option 4A-X (4A without a Hudson Line connection) and cross-corridor LRT.

With such a wide scope of alternatives/options, this transit mode selection report was prepared to select a feasible transit mode or modes to carry forward into the DEIS. These analyses (1) enabled comparisons among the alternatives/options based on selective criteria; (2) determined whether there were significant differentiators among them; and (3) ascertained whether there were any major issues associated with any alternative/option.

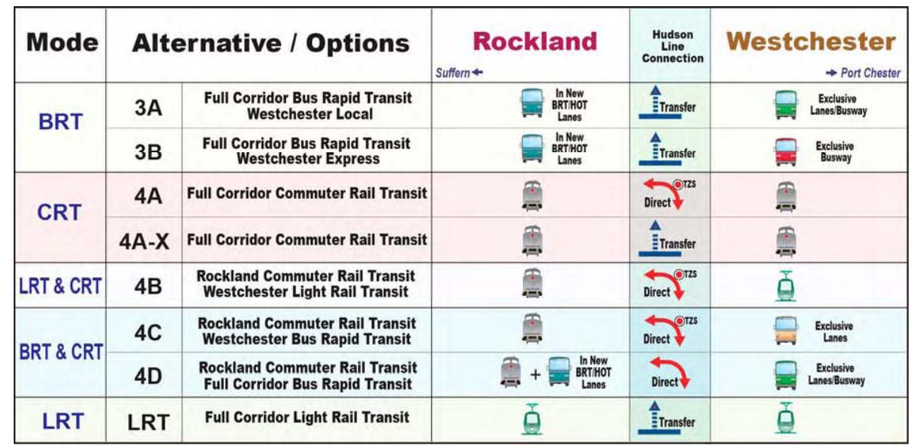

Figure S-1 Description of Alternatives/Options

S.2 Project Study Area

The study area consists of a linear 30-mile corridor that extends from the I-87/I-287 Interchange in Rockland County to the I-287/I-95 Interchange in Westchester County and includes the Tappan Zee Bridge (Figure S-2). The corridor is an important part of a regional transportation system, and transportation implications extend beyond the immediate roadway system to Poughkeepsie in Dutchess County to the north, Stamford, Connecticut to the east, the five New York City boroughs to the south, and parts of Orange County, New York, and Bergen County, New Jersey to the west.

[1] These population and employment projections will be updated in the Fall of 2008, when the NYMTC releases its new consensus forecasts as part of its long-range plan.

[2] Alternatives 1 and 2 have no transit component. However, while Alternative 2 has no transit component, and is thus not included in the analyses presented here, it should be noted that bridge rehabilitation concepts have been advanced that provide transit functionality comparable to that of replacement bridges. Thus, the analyses presented in this report are independent of whether the Tappan Zee Bridge is replaced or rehabilitated. The subject of whether to rehabilitate or replace the bridge is the subject of a separate report (*Alternatives Analysis, Rehabilitation or Replacement of the Tappan Zee Bridge Report*), the recommendations of which will be included in the Scoping Summary Report for the project.

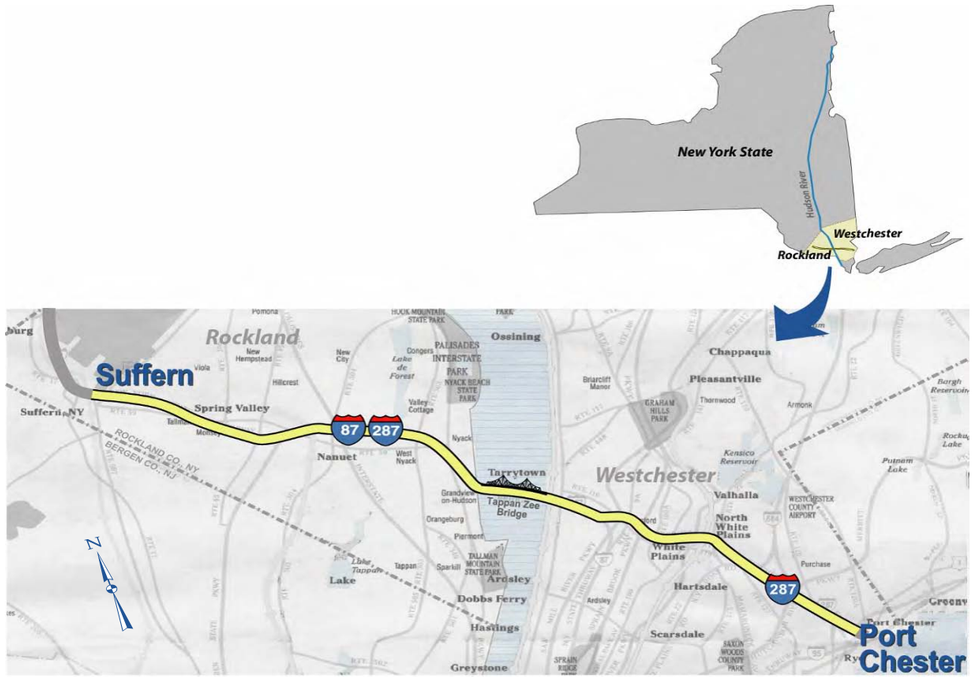

Figure S-2 Tappan Zee Bridge- I-287 Corridor

S.3 Purpose and Need

Studies have shown that several transportation improvements, including mobility, transit options, and safety, are needed in order to meet the growing travel demands of the corridor. The corridor experiences significant delays due to congestion and is often operating at or near capacity, particularly in the vicinity of the Tappan Zee Bridge. Rockland County is one of the fastest-growing communities in the Metropolitan Region and Westchester County is experiencing employment growth in areas around White Plains and the Platinum Mile. The Tappan Zee Bridge and the corridor provide an important link between these communities as well as to the overall regional transportation network. In addition to the capacity constraints of the corridor, the Tappan Zee Bridge is aging and in need of a regular and extensive maintenance program. As the region grows, travel demand will increase on an already-strained roadway network. Thus, the following needs have been identified for the corridor:

- Preserve the existing river crossing as a vital link in the regional and national transportation network.
- Provide a river crossing that has structural integrity, meets current design criteria and standards, and accommodates transit.
- Improve highway safety, mobility, and capacity throughout the corridor.
- Improve transit mobility and capacity throughout the corridor and travel connections to the existing north-south and east-west transit network.

In order to meet project needs, five goals have been established to address the bridge, highway and transit needs of the corridor:

- Improve the mobility of people, goods and services for travel markets served by the Tappan Zee Bridge/I-287 Corridor.
- Maximize the flexibility and adaptability of new transportation infrastructure to accommodate changing long-term demand.
- Maintain and preserve vital elements of the transportation infrastructure.
- Improve the safety and security of the transportation system.
- Avoid, minimize, and/or mitigate any significant adverse environmental impacts caused by feasible and prudent corridor improvements.

S.4 Criteria Evaluated

Transportation, environmental, and cost criteria were developed in order to assist in making the transit mode decision. These criteria were derived from the evaluation criteria developed in the AA process. The criteria were presented at the scoping update meetings in February 2008 and at a number of Stakeholder Advisory Working Group (SAWG) meetings. Four transportation evaluation criteria were used in the evaluation of the transit modes:

- Transit ridership
- Capacity
- Transit travel time
- Roadway congestion

Eight environmental evaluation criteria were used in the evaluation of the transit modes:

- Consistency with land use plans
- Transit-oriented development potential
- Parklands and recreational areas
- Hudson River habitat disturbance
- Wetlands
- Residential and commercial acquisitions and displacements
- Historic and archaeological resources
- Air quality and energy

Five cost evaluation criteria were used in the evaluation of the transit modes:

- Capital costs
- Annual operating costs
- Fare revenue
- Costs/net costs per passenger and per passenger mile
- Transit travel-time benefits

Many of the criteria used in the evaluation turned out not to be differentiators – that is, they were not sufficiently different among the alternatives/options to be used as a basis for choosing one mode over another. While all of them are important criteria for full evaluation in the DEIS, their importance to the analyses of a particular transit mode was minimal. Regional roadway congestion, for example, is not a differentiator among transit modes, as all of the transit

alternatives/options result in lower total VMT than under the No Build conditions, but the range is between one and two percent.

S.5 Analysis Results

The results of the analyses are summarized in Table S-1. In general, environmental factors were not differentiators, costs were greater for modes that included CRT, and cost-effectiveness was better for those modes that included BRT. Travel-time savings were most dramatic in those modes that provided a means of avoiding congestion for the greatest number of travelers, whether rail or bus. Travel-time savings across the corridor were generally greater than were time savings to Manhattan.

The transit mode analyses concluded that:

- **Option 3A** (Full-Corridor BRT Enhanced) had the lowest capital cost, the lowest operating cost, the lowest net annual transit cost, the lowest net cost per passenger, and the lowest net cost per passenger-mile. However, Option 3A also had the lowest annual passenger miles and was in the bottom third for weekday daily ridership compared to the rail alternatives, with the exception of the LRT alternative.

- **Option 3B** (Variation of Option 3A) closely trailed Option 3A in all categories, having slightly higher costs (capital and operating, overall project, and transit only), fewer passengers or passenger miles, and a higher net cost per passenger and per passenger-mile. Option 3B is, however, significantly ahead of the other alternatives/options on these measures. As with Option 3A, Option 3B provides far fewer ridership or passenger-mile benefits than the other transit alternatives.

- **Alternative 4A** (Full-Corridor CRT) had the highest cost of the alternatives in terms of capital costs, operating costs, and annual project costs and annual transit costs, while delivering the most passenger miles and ridership benefits in the upper range of all alternatives/options. The cost per passenger was high (second-highest of all alternatives) but the net cost per passenger-mile was in the mid range of the alternatives/options.

- **Option 4A-X** (Full-Corridor CRT without a Hudson Line Connection) was the second-most costly alternative after Alternative 4A in terms of capital costs, but was substantially lower cost in terms of operating costs, coming in the bottom third of the range on project and transit operating costs. It had the highest net cost per net passenger and the highest cost per passenger-mile. It also had the lowest number of new riders and total riders and the second lowest number of diverted riders, the second-lowest travel time benefits, and the fewest annual passenger miles on new facilities.

- **Alternative 4B** (Manhattan-Bound CRT with LRT in Westchester County) was mid-range in capital cost measures but was in the upper third on operating costs. Alternative 4B was in the mid range on weekday daily ridership and on the high end of the range for passenger-miles. Alternative 4B was in the mid range on net cost per passenger and per passenger-mile.

- **Alternative 4C** (Manhattan-Bound CRT with BRT in Westchester County) was in the mid range in capital cost measures but had the third-highest operating cost. It had the highest annual passenger miles on existing facilities of the alternatives. It also had the second-highest daily ridership, the third-highest annual passenger-miles, and was tied with Alternative 4B for the most annual passenger miles on existing facilities. In terms of the net cost per passenger and the net cost per passenger-mile, Alternative 4C was in the bottom third.

Table S-1

Cost Criteria – Transit Costs

Criterion	Mode by Alternative/Option							
	BRT		CRT		LRT/CRT	BRT/CRT		LRT
	3A Full-Corridor BRT Enhanced	**3B** Full-Corridor BRT HOT Lanes in Rockland, Busway in Westchester	**4A** Full-Corridor CRT with Hudson Line (HL) Connection	**4A-X** Full-Corridor CRT without HL Connection	**4B** CRT in Rockland, HL Connection, LRT in Westchester	**4C** CRT in Rockland, HL Connection, BRT in Westchester	**4D** CRT in Rockland, HL Connection, Full-Corridor BRT (3A)	Full-Corridor LRT
Annual Transit Costs ($ Millions)	140	266	1,389	1,105	974	901	911	483
Fare Revenue ($ Millions)	40	39	105	34	98	113	127	27
Net Annual Transit Costs ($ Millions)	100	227	1,284	1,071	876	788	784	456
Travel-Time Benefits ($ Millions)	110	112	184	97	154	149	202	95
Weekday Daily Ridership								
New	23,400	23,800	21,800	13,800	21,000	21,400	31,200	16,900
Diverted From Other Transit Routes	30,600	29,800	40,100	23,100	32,200	44,800	48,700	21,400
Total	54,000	53,600	61,900	36,900	53,200	66,200	79,900	38,300
Annual Passenger-Miles (Millions)								
In Corridor	100	90	190	80	160	176	207	90
On Existing Facilities Beyond Corridor	40	60	360	120	340	346	332	100
Total	140	150	550	200	500	522	539	190
Cost per Passenger	$8.92	$17.03	$77.16	$103.23	$62.87	$46.68	$39.08	$43.51
Net Cost per Passenger	$6.39	$14.55	$71.36	$100.13	$56.52	$40.81	$33.66	$41.13
Cost per Passenger-Mile*	$1.00	$1.77	$2.53	$5.52	$1.95	$1.73	$1.69	$2.54
Net Cost per Passenger-Mile	$0.72	$1.51	$2.34	$5.36	$1.75	$1.51	$1.45	$2.40

*Notes: Based on Year 2012 dollars. Net cost per passenger-mile is calculated based on total passenger-miles (in-corridor and on existing facilities beyond corridor).

- **Option 4D** (Variation of Alternative 4C) was in the mid-range for all costs, both capital and operating. It was highest in travel-time benefits, fare revenue, new ridership, and total riders. It was second-highest in total annual passenger miles and had the most annual passenger-miles on new facilities of all the alternatives/options. Option 4D's net cost per passenger was the third lowest and its net cost per passenger-mile the second lowest of all the alternatives/options.

- **Full-Corridor LRT** was in the bottom third of the alternatives/options in terms of capital costs. Its operating costs were the second lowest of the alternatives. It had the lowest fare revenue and lowest travel-time benefits of all the alternatives, the second-lowest total weekday daily ridership, and was among the lowest in annual passenger-miles (on new facilities, on existing facilities, and total). Full-corridor LRT had a mid-range net cost per passenger and was the second highest in net cost per passenger-mile.

S.6 Transit Mode Recommendation

The recommendation of a transit mode has been developed within the context of the goals adopted for this study in the Scoping Process:

- **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. *All modes improve personal mobility – to differing degrees.*

- **Goal 2:** Maximize the flexibility and adaptability of new transportation infrastructure to accommodate changing long-term travel demand. *BRT is the most flexible mode, preserving CRT options provides maximum ability to meet changing demand.*

- **Goal 3:** Maintain and preserve vital elements of the transportation infrastructure. *Utilization of existing infrastructure enhances its preservation (e.g., Hudson and Port Jervis Lines).*

- **Goal 4:** Improve the safety and security of the transportation system. *CRT is the safest mode, followed by LRT and BRT. It has been established that CRT is the safest surface transportation mode (Federal Transit Administration, Commuter Rail Safety Study, November 2006), by virtue of its minimal interaction with other surface transportation modes and pedestrians.*

- **Goal 5:** Avoid, minimize, and/or mitigate any significant adverse environmental impacts caused by corridor improvements. *Initial environmental analysis indicated that none of the modes have significant unmitigatable environmental impacts and that environmental factors are not differentiators among the modes. (A more detailed environmental impacts analysis will be performed in the Environmental Impact Statement [EIS].)*

- **Goal 6**: Develop feasible, cost-effective solutions that can be implemented within a reasonable time horizon. *Starting with BRT, while preserving the options for CRT, best meets this goal.*

Table S-2 assigns a performance rating to each of the measures presented in the analysis to arrive at an overall recommendation. The solid circles represent the highest-rated performers, while the three-quarters-hollow circles represent the lowest-rated performers. Ratings for quantitative measures were derived by applying the Quartiles method to the numerical results from the analysis. Ratings for the qualitative measures were derived by comparing the modes' performance to the elements within each goal.

The largest differences in the performance of the modes came in the financial measures, with the BRT mode able to be implemented and operated for far less of an investment than the rail modes. However, the BRT mode was also much lower on the revenue side. The combination of BRT/CRT was a consistently high-performing mode. When all the factors are considered, the summary rating indicated combined BRT/CRT and BRT alone were the highest-rated performers, followed by CRT and then LRT.

Table S-2

Summary Performance Ratings

Mode	BRT		CRT		LRT & CRT	BRT & CRT		LRT
Alternative/Option No.	3A	3B	4A	4A-X	4B	4C	4D	Full LRT
Goal 1: *Improve Mobility*	◕	◕	●	◔	◑	◕	●	◑
Goal 2: *Flexibility and Adaptability*	●	●	◕	◔	◑	◕	●	◑
Goal 3: *Vital Elements of the Transportation Infrastructure*	◕	◕	●	◑	◑	◕	◕	◑
Goal 4: *Improve Safety and Security*	◑	◑	●	◑	◑	●	●	◑
Goal 5: *Environmental Impacts*	◕	◕	◑	◑	◑	◕	◕	◑
Goal 6: *Feasible Cost - effective Alternatives*	●	◕	◑	◔	◑	◕	◕	◔
Daily Transit Trips for Selected Markets	◑	◑	◑	◑	◑	◑	◕	◑
Daily Transit Ridership on New Service	◑	◑	◕	◔	◑	◕	◕	◔
Capital Cost Estimate	●	◕	◔	◔	◔	◑	◑	◕
Cost/Passenger Mile	●	◕	◑	◔	◔	◑	◕	◔
Aggregate travel-time savings	◑	◑	◕	◔	◕	◕	●	◔
Summary Rating	◕	◕	◑	◔	◑	◕	◕	◑

Legend Very Good ● Good ◕ Fair ◑ Poor ◔

BRT better serves the circumferential movements, as it has the flexibility to reach destinations within and outside of the corridor. The CRT functions best when it uses existing infrastructure (Hudson Line) to reach Manhattan destinations. The combined BRT/CRT mode takes advantage of both. The LRT mode is less effective than BRT for cross-corridor movements and less effective than the other modes in serving Manhattan. All of the modes take advantage of the existing I-287 ROWs in Rockland County.

The transit mode selection analyses, therefore, conclude that the BRT mode offers the best opportunity to improve transit service and ridership in the corridor at the lowest cost. Implementing the combined BRT/CRT modes was also shown to offer significant benefits. The CRT mode alone was less effective than when complemented by BRT, while the LRT mode did not provide sufficient benefits to warrant further consideration.

Full-corridor BRT in combination with CRT is recommended because it best meets present and future travel demand and mobility needs. BRT/CRT provides the most flexibility to accommodate many markets and both the cross-corridor and New York City travel markets. The BRT/CRT recommendation is the transit solution that will fulfill the goals of this study by:

- Meeting corridor travel demand needs.
- Minimizing environmental impacts.
- Contributing to sustainable transportation and land use.
- Providing a flexible and adaptable transportation system with excess capacity to meet changing needs in the corridor.
- Enhancing quality of life in an energy-efficient and cost-effective manner.

S.7 Transit Components to be Studied in the DEIS

Based on the previous analyses, full-corridor BRT from Suffern to Port Chester and CRT from Orange/Rockland to Grand Central Terminal will be studied in the DEIS. As the Tappan Zee Bridge/I-287 Corridor project is multimodal in nature with proposed bridge, highway, and transit improvements, the EIS will be conducted using a tiered analysis approach to allow each project component to advance at its own appropriate pace. Thus, two levels of analysis will be conducted in the DEIS:

- The study of **transit at a Tier 1 level** will be performed at a planning level of detail, providing transportation and environmental analyses appropriate to a planning study and related decisions regarding transit mode(s), transit alignments, and logical termini. While proposed station locations are identified in this report, and will be analyzed at a planning level in the DEIS, it is important to note that these will form the basis for a corridor-level decision and, together with supportive infrastructure, will be subject to further studies as part of the Tier 2 transit analysis.

- The study of **highway and bridge at a Tier 2 level** will be based on detailed engineering for those components of the project and will provide transportation and environmental analyses so that a decision can be made on preferred highway and bridge alternatives. The highway and bridge engineering will include appropriate accommodations for the transit mode, alignments, termini, and stations identified in Tier 1 transit.

This tiered process will allow the project to focus the environmental review process and progress work that has been conducted to date. Following this EIS/Record of Decision (ROD) there will be a Tier 2 transit phase in which details of transit alternatives will be further studied in separate environmental document(s) and be consistent with the Tier 1 transit and Tier 2 highway/bridge studies and decisions.

The DEIS analysis will include a range of reasonable alternatives likely to include the following components:

- **Bus Rapid Transit**
  - BRT/HOV Lanes in I-287 median, from Suffern and across the Tappan Zee Bridge.
  - BRT in exclusive guideway in I-287 ROW in Rockland.
  - BRT integrated into existing street system in Westchester.
  - BRT in exclusive guideway in Westchester.

- **Commuter Rail Transit**
  - CRT in I-287 median; from Suffern and across the Tappan Zee Bridge connecting to the Hudson Line.
  - CRT on south side of I-287 ROW; from Suffern and across the Tappan Zee Bridge connecting to the Hudson Line.

BRT

LRT

CRT