Tappan Zee Bridge Repair Project

Connecting New York’s Westchester and Rockland Counties
Congressional Districts: 17 and 18
Urban Area Project
Funding Request: $160,000,000

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Tappan Zee Bridge Repair Project

Project Description

Open to traffic on December 15, 1955, the 3.03-mile Governor Malcolm Wilson Tappan Zee Bridge (Tappan Zee) carries the New York State Thruway’s mainline (I-87/I-287) across the Hudson River, connecting Westchester and Rockland Counties approximately 13 miles north of New York City. The bridge provides the principal Hudson River crossing between the George Washington Bridge (I-95) and the Newburgh Beacon Bridge (I-84), 46 miles to the North. (The Bear Mountain Bridge, between I-287 and I-84, carries significantly less traffic because of its location in a less urbanized area as well as its indirect, non-interstate, east-west connections.) The Tappan Zee is a vital link in the regional and national transportation network for both commercial and passenger traffic, and is an evacuation route for the nearby Indian Point nuclear power plant. If the bridge were to become unserviceable the consequences would be devastating to both the regional and local transportation network and economies. It is important to note, during the hours and days immediately following the September 11th terrorist attacks, the Tappan Zee Bridge was the only crossing in the New York metropolitan region that remained open. The Tappan Zee was used extensively to transport emergency services personnel, goods and people in and out of New York City.

When the bridge opened to traffic in 1955, it carried an average of 18,000 vehicles daily during its first year of operation. Today, approximately 140,000 vehicles cross the bridge on an average weekday, with volumes as high as 170,000 vehicles on some peak days. During the past 20 years (beginning in the mid-1980’s), due to growth in population and jobs as well as changing inter-corridor commute patterns, traffic volumes have grown significantly in the corridor – more than 50 percent in the I-287 corridor and more than 70 percent on the bridge. Since 1990, traffic crossing the Tappan Zee Bridge has grown from 100,000 daily trips to nearly 140,000 daily trips, driven by the opening of I-287 in New Jersey. This is a 40 percent increase over 15 years and a nearly eight-fold increase from the time of opening.

Tappan Zee Structural Segments
The 16,600-foot-long bridge is comprised of 198 spans that are divided into five distinct structural segments: the west trestle, west deck truss, main spans, east deck truss, and east trestle. Seven lanes of traffic are carried by the bridge, with a movable barrier in the middle that is adjusted daily to provide four lanes in the peak direction. The southbound direction of the bridge is tolled, with variable pricing for commercial vehicles, and collection occurring at the southern end of the bridge.

In addition to the usual problems from normal wear and tear to be expected on a 50-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 passenger vehicle and truck traffic over the years.

The overall bridge condition rating resulting from a 2008 inspection was 3.71 on a NYSDOT scale of 1-9, indicating that the bridge was safe for traffic but that repairs were required. Typically, a rating of at least 5 would be expected for a bridge in good condition, and a rating of 3 or below would indicate that deterioration was affecting the structural functioning of the bridge and would be unacceptable. The 3.71 rating was a reduction from a rating of 5 in the 2000 inspection.

A previous condition rating decrease from 5 to 4 in the late 1980’s resulted in increased expenditure by the Authority in a series of repair contracts through the 1990s. Repairs included steelwork and substructure concrete refurbishment contracts, planned and emergency contracts to install a new deck on the east deck truss, and removal and replacement of the asphalt overlay and waterproofing for the remainder of the bridge deck. The result was a return to a 5 rating in the late 1990s.

As the result of a robust and continuous program of heavy maintenance, the original condition of the bridge does not pose any danger to the traveling public. However, as the deck continues to deteriorate, failures in the original deck will occur at an ever-increasing rate, and the maintenance regimen and its impact on traffic will have to escalate accordingly.

Due to the high cost of repairs, this next series of repairs will be done in multiple project stages over a number of years, with the Authority currently completing contract 1 of the necessary redecking work. Contract 1 replaced the existing deck for four of the seven lanes on the bridge from Nyack to the east end of the Main Span, approximately 590,000 square feet of deck, 42% of the total bridge deck, and 54% of the original remaining deck. However, until the requested proposed project, replacing approximately 410,000 square feet of deck, 30% of the entire decking and 83% of the remaining original deck, is completed, interim on-demand work by maintenance forces will continue to lead to lane closures, added traffic delays, and a decrease in bridge reliability. As one recent

1 Note: There is an ongoing multi-agency study, the Tappan Zee Bridge/I-287 Environmental Review, investigating options for replacing the Tappan Zee Bridge. However, the “no build” option used in the study includes the repairs and maintenance detailed in this application, which are required to keep the bridge functioning at an acceptable service level.
example, at 5:15 a.m. on August 26, 2009, a hole in the bridge deck led to the closure of two southbound lanes for less than two hours, and caused a more than ten mile backup. (Appendix A)

Commuters have come to expect and adjust their schedules for daily congestion, but they cannot adjust for unexpected delays caused by unanticipated deck failure and resulting emergency lane closures. Commercial transportation in the use of just-in-time manufacturing also depends on reliable travel times, with the dependence of companies on the simultaneous delivery of multiple components in order to take advantage of lower costs and increased productivity.
GEOSPATIAL MAPS
LOCATION

The Tappan Zee Bridge provides access to two interstate highways, I-87/I-287 at the west end and I-87/I-287/I-95 at the east end, each serving distinct functions. I-87, the main route through the Hudson Valley, connects New York City and Canada extending between I-278/Triboro Bridge and Champlain, New York. I-287 is used as a circumferential route serving the New York and New Jersey metropolitan area. It serves suburb-to-suburb trips in addition to long distance trips (i.e., from New Jersey and points west to New England) enabling passenger and commercial vehicles to bypass New York City and its congestion.

In addition to linking Westchester and Rockland Counties, the Tappan Zee provides the primary access between those portions of the New York City metropolitan area east of the Hudson River and the northern suburbs west of the Hudson, primarily Orange County. The bridge also serves as a major route for traffic traveling between New England and areas to the south and west.

URBAN AREA NEEDS

The New York metropolitan region covers a large geographic area and is considered a global center of finance, commerce, culture, and entertainment. The decade of the 1950s saw the completion of the Palisades Interstate Parkway and the New York State Thruway and the opening of the Tappan Zee Bridge. This new accessibility transformed the county first into a “bedroom suburb” that has tripled its population since 1950, and more recently into a diverse economy with services, trade, government, and manufacturing as its leading industries. Pharmaceuticals are a major manufacturing sector, with firms such as Par, Wyeth-Ayerst, and Novartus located in Rockland County.

A trend of locating corporate headquarters outside of New York City began in 1923 in Westchester and continued after World War II, when major firms started to take advantage of improved transportation and communication infrastructures, lower taxes, and suburban lifestyles. Toward this end, Westchester County was found to be particularly attractive. General Foods and Nestle relocated to White Plains in the 1950s and IBM and Texaco built large headquarters in Armonk and Harrison, respectively, along with many others. Also in the 1950s, Westchester became a retail center, with construction of the Cross-County Shopping Center and commercial districts on heavily trafficked stretches of roads in White Plains, New Rochelle, and Yonkers.

The Tappan Zee and the entire transportation network are vital to the economic vitality of the Hudson River Valley and have been an integral part of the region’s economic success. The background growth and development in the area are projected to produce increases in travel demand of 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.
Continued population and employment growth in the region has created, and will continue to create, more travel demand, placing greater burdens on the existing transportation infrastructure. Regional mobility has proven to be a critical factor in relocation decisions made by companies. The provision of safe, efficient, cost effective, and environmentally sound transportation will continue to attract and retain businesses by linking the skilled and highly educated labor force living in its suburbs with jobs in both the suburban centers and New York City.

TRANSPORTATION CHALLENGES

The New York State Thruway Authority (Authority) follows a very stringent and thorough Bridge Inspection Program, as mandated by current Federal and State guidelines. Every two years, the Tappan Zee undergoes an inspection. In addition, interim inspections are conducted to ensure that the bridge is maintained and operated safely and efficiently.

In addition to the Federal and State inspection guidelines, the Authority conducts hands-on inspections, has an 80-member crew dedicated to Tappan Zee maintenance and has installed sensors to monitor the stresses in wind bracings as related to wind speed and temperature.

The maintenance crew, headed by a Professional Engineer, performs inspections and preventive maintenance of the Tappan Zee on a daily basis. The work addresses the ongoing needs of the bridge, which includes painting, deck repairs, substructure concrete repairs and steel repairs. The crew also addresses deficiencies found during the biennial inspection. Since most of the Bridge is over water, tug boats, work boats, barges and several pieces of lift equipment facilitate inspection and maintenance operations. The Authority furnishes its own personnel and equipment to handle emergency breakdowns of vehicles crossing the Bridge. Disabled vehicles are towed to special parking areas on either side of the Bridge, where Authority truck operators work 24 hours a day, 365 days a year.

PROJECT DETAILS

Major rehabilitation projects necessary to maintain and/or improve service conditions on the Tappan Zee include:

1. Replace remaining original existing superstructure (structural deck and supporting stringers) from the Nyack Abutment to the east end of the Main Span. This would encompass the replacement of: 3.98 lane miles (12,640 linear feet) of the West Trestle roadway lanes; 1.00 lane mile (5250 linear feet) of the West Deck Truss roadway lanes, and 1.37 lane miles (7250 linear feet) of the Main Span’s roadway lanes. This replacement would equal 410,100 square feet of roadway deck.

The proposed work would address the current condition of the deck by restoring it to a level of new condition thereby extending the service life of the superstructure for a minimum of 15 years. If this work item were not completed, maintenance forces would
address any issues that would arise on the original deck and any punch-throughs that occur would require multiple lane closures. The existing asphalt overlay would remain, thereby requiring a future mill and inlay and future deck repairs.

- Main Span $35,000,000
- West Truss $30,000,000
- West Trestle $100,000,000

Estimated Cost: $165,000,000

2. Mill and Repave 55,700 square feet of the West Truss’s Lane 3: The existing asphalt overlay was originally installed in 1996-97 on the installed Inverset superstructure units. This overlay will need to be removed and repaved to match up to the new superstructure units.

Estimated Cost: $1,000,000

3. Relocate Fiber Optic Line: The Thruway’s current fiber backbone crosses the Tappan Zee. In the causeway section, the line is located under the original remaining deck and the line will need to be relocated.

Estimated Cost: $3,000,000

4. Moveable Barrier System: The barrier system is in need of repair/replacement as maintenance forces have been replacing a limited number of failed concrete sections with steel.

Estimated Cost: $12,000,000

5. Main Span Painting: Paint on the floor beams and wind bracing under the deck has failed. This would equal approximately 275,000 square feet.

Estimated Cost: $11,000,000

6. Main Span Steel Repairs: Wind bracing connections and locations on the floor beams require repair.

Estimated Cost: $13,000,000

7. Electrical: The Tappan Zee is not completely grounded for lightning strikes and equipment on the bridge has shorted out. Currently, the speed limit is not posted on the bridge due to inoperable speed signs which would be replaced, and necklace lighting would be rewired to address continual shortages.

Estimated Cost: $5,000,000

8. Repairs to the East Truss Deck Panels: Grid deck panels were installed on the East Truss from 1998-2000. During the past year, it has been noted by maintenance forces that
grid panels adjacent to the expansion joints have become loose, with movement occurring. The movement has caused the anchor elements (grid deck grouting used to install the panels and clips) to fail. Maintenance forces have done interim patches to the grid deck grouting. No long term repairs have been done. Retrofit details have been developed and could be systematically implemented.

Estimated Cost: $10,000,000

9. Construction Inspection: Estimated Cost: $19,540,000

**Total construction and inspection funding needed: $ 239,540,000**

**RELEVANT DATA**

**Traffic Volumes**

Traffic crossing the Tappan Zee has grown from 100,000 daily trips to nearly 140,000 daily trips since 1990. This growth is projected to continue in the future, based on New York Metropolitan Transportation Council projections of economic growth in Rockland and Orange Counties, in particular. The capacity increase resulting from creation of the reversible lane on the bridge is already being fully utilized in the peak hours, and the length of the peak period will increase as traffic grows.

Southbound passenger and commercial toll data, since tolls are only collected one-way on the bridge, for 2007 and 2008 show the following volumes:

<table>
<thead>
<tr>
<th></th>
<th>2007</th>
<th>2008</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Passenger</strong></td>
<td>23,767,450</td>
<td>23,025,716</td>
</tr>
<tr>
<td><strong>Commercial</strong></td>
<td>1,491,025</td>
<td>1,394,781</td>
</tr>
<tr>
<td><strong>Total Yearly Traffic</strong></td>
<td>25,258,475</td>
<td>24,420,497</td>
</tr>
</tbody>
</table>

**Tappan Zee Bridge Yearly Traffic**
In the Cross Harbor Freight Movement DEIS (a study conducted by the New York City Economic Development Corporation for a new tunnel under the Hudson River between New Jersey and New York City to carry freight trains), freight volume (tonnage) in the region is forecast to increase by 70 percent between 2000 and 2025, and 79 percent of this increase would be carried by trucks. This would translate to thousands of additional trucks on roadways in and around New York City, including the Tappan Zee corridor.

Existing Bridge Conditions

The bridge sufficiency rating formula is a method of evaluating factors which indicate a bridge’s sufficiency to remain in service. The result of the formula is a percentage in which 100 percent represents an entirely sufficient bridge and zero (0) percent represents an entirely insufficient or deficient bridge. States annually submit to the Federal Highway Administration (FHWA) all of the required information for each bridge, then the FHWA uses these numbers to determine the sufficiency rating. The rating uses multiple factors such as Structural Adequacy, Safety, Serviceability, Functional Obsolescence and Essentiality for Public Use. Structural Adequacy and Safety account for 55% of this score. The Tappan Zee 2008 sufficiency score was 49.1.

Using the New York State Department of Transportation’s Bridge Condition Rating Scale, the 2008 overall Biennial Bridge Inspection rating of the Tappan Zee was 3.71. By definition, a rating of 3 would indicate serious deterioration, or not functioning as originally designed, and a rating of 5 would indicate minor deterioration but functioning as originally designed.

There are also many components on the bridge rated independently in the inspection. These individual ratings are used on a weighted scale to calculate the overall condition rating shown above.

DECK: of the 198 spans of the bridge, 39 spans have a rating of 4, and 7 spans have a rating of 3. The remaining spans were rated 5.

DECK ELEMENTS: This includes components such as wearing surface, curbs, fascia and railings. For these items, 4 spans were rated a 12, and 24 spans rated 3 (the remaining spans were given a rating of 5.)

PRIMARY STRUCTURAL MEMBERS: 28 of the 198 spans were rated 4, the remaining spans maintained a rating of 5.

JOINTS: All spans were rated 4 or less (9 spans rated 3). Although a contract currently in place is addressing many bridge joint concerns starting at the end of the West Trestle to the end of the Main Span, the interior lanes of the West Trestle are not being addressed.

SUBSTRUCTURE ELEMENTS: 61 spans rated 4, 45 spans rated 3, the remaining spans were rated a 5.
**Congestion Levels**

The Tappan Zee Bridge Southbound is typically congested during the weekday morning peak hours (6 AM to 9 AM) with an existing level of service (LOS) “F”. Northbound, the same situation occurs during afternoon periods (4 PM to 7 PM) with an existing level of service (LOS) "F". The weekend congested period is generally 11 AM to 7 PM with the worst conditions Sunday nights in the southbound direction. As traffic volumes increase, the congestion levels on the bridge will cause a decreased level of service on the roadways leading to and surrounding the Tappan Zee.

**Safety**

The fatality rate along the Thruway is significantly below the national average as calculated by the National Center for Statistics and Analysis (NCSA) of the National Highway Traffic Safety Administration. According to NCSA, the United States had more than 41,000 fatalities in 2007 that resulted in a fatality rate of 1.36 fatalities per 100 million vehicle miles (MVM). In New York State there were more than 1,300 fatalities in 2007 that resulted in a fatality rate of 0.97 fatalities per 100 MVM. In 2008, there were 28 fatal accidents on the Thruway resulting in 33 deaths, reflecting a fatality rate of 0.32, the third lowest rate in Thruway history.

In 2007, the accident rate on the New York State Thruway was 1.1161 per MVM, lower than the New York State accident rate of approximately 2.36. The accident rate on the Tappan Zee was more than twice the Thruway rate, at 2.4250 per million vehicle miles.
Project Parties

The Thruway Authority ("Authority") is a public corporation organized and existing pursuant to Article 2, Title 9 of the New York State Public Authorities Law for the purpose of financing, constructing, reconstructing, improving, developing, maintaining and operating a highway system known as the Governor Thomas E. Dewey Thruway. The powers of the Authority are vested in and exercised by a seven-member Board appointed by the Governor and confirmed by the State Senate.

The Thruway is a 570-mile superhighway system crossing the State. It is the longest toll superhighway system in the United States. The Thruway route from the New York City line to the Pennsylvania line at Ripley is 496 miles long and includes the 426-mile mainline connecting the State’s two largest cities, New York City and Buffalo. Other Thruway sections make direct connections with the Connecticut and Massachusetts Turnpikes, New Jersey Garden State Parkway and other major expressways that lead to New England, Canada, the Midwest and the South. In 1991, the Cross-Westchester Expressway and in 1992, I-84 were added to the Thruway System. The Authority operated and maintained I-84 through October 2007 at the Authority’s expense. In October 2007, the Authority returned responsibility for I-84 to the New York State Department of Transportation ("NYSDOT"). However, pursuant to an agreement between the Authority and NYSDOT, the Authority currently continues to perform operation and maintenance of I-84 on behalf of NYSDOT at NYSDOT’s expense. In all, the Thruway (without I-84) is comprised of 2,818 lane miles of roadway, 806 bridges, more than 350 office and maintenance buildings, 27 travel plazas, 275 toll booths, nearly 120 water services, 18 water waste treatment plants and 26 motor fueling stations for Authority vehicles and equipment. Operationally, the Authority is segmented into four regional divisions – Albany, Buffalo, Syracuse and Suffern (referred to as New York Division) – with Administrative Headquarters located in Albany.

In 1992, legislation was enacted that transferred jurisdiction over the New York State Canal System from the NYSDOT to the Authority. This legislation also created the New York State Canal Corporation ("Corporation"), a subsidiary of the Authority, charged with operating, maintaining, constructing, reconstructing, improving, developing, financing and promoting the Canal System. This System consists of 524 miles of connected, navigable waterways encompassing: the Erie Canal (338 miles, east to west), the Champlain Canal (60 miles, south to north), the Oswego Canal (24 miles south-east to north-west, between Lake Ontario and the Erie Canal), and the Cayuga-Seneca Canal (12 miles, southwest to north-east linking the Erie Canal with Cayuga and Seneca Lakes). There are also 90 miles of navigable channel through Cayuga Lake to Ithaca and Seneca Lake to Watkins Glen, respectively. Comprised of both “canalized” natural rivers and dug channel, the Canal System’s 57 locks and 16 lift bridges facilitate navigation as part of a larger network of navigable waterways in New York State extending south to Florida, north to Canada, and west to the Great Lakes and the Mississippi River.
Grant Funds and Sources and Uses of Project Funds
(in millions of dollars)

<table>
<thead>
<tr>
<th></th>
<th>TIGER funds (requested)</th>
<th>TIGER % (requested)</th>
<th>NYSTA Toll Funds</th>
<th>NYSTA %</th>
<th>Total Funds</th>
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<tbody>
<tr>
<td>Project Approval/Environmental Document</td>
<td></td>
<td>$0.06</td>
<td>100 %</td>
<td></td>
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<tr>
<td>Plans, Specifications &amp; Estimate</td>
<td></td>
<td>$1.4</td>
<td>100%</td>
<td></td>
<td>$1.4</td>
</tr>
<tr>
<td>Construction (capital and support)</td>
<td>$160</td>
<td>66.8 %</td>
<td>$79.54</td>
<td>33.2%</td>
<td>$239.54</td>
</tr>
<tr>
<td>Total</td>
<td>$160</td>
<td>66.4 %</td>
<td>$81</td>
<td>33.6%</td>
<td>$241</td>
</tr>
</tbody>
</table>
Primary Selection Criteria

LONG TERM OUTCOMES

State of Good Repair

The Tappan Zee Bridge deck experienced an average of 56 deck failures, identified as punch-throughs, per year in 2000, 2003, and 2004. In 2002, the Thruway initiated services to perform a ground penetrating radar (GPR) assessment and underside sounding of the existing deck condition. The results indicated that approximately 473,000 square feet of the 1,065,000 square feet comprising the West Trestle, West Deck Truss and Main Span have been denoted as deficient (defined as imminent spalling or hollow sounding). An initial deck repair contract was bid in December 2005, which replaced 4 of the 7 lanes from the West abutment of the bridge to the end of the Main Span of the bridge. This deck replacement contract addressed an estimated 70% of the forecasted 960 punch-through locations as determined by the results of the GPR survey. The remaining 3 interior lanes, while not subjected to the level of truck traffic as the exterior lanes, is forecasted to continue deteriorating on an accelerated rate to an estimated 130 punch-throughs annually by 2020. Closures related to repairs of the increasing number of punch-throughs are expected to escalate to 2.2 million vehicle-hours of delay by 2030, cumulatively costing users approximately $642 million (discounted at 3%) between 2010 and 2030.

In 2005, the Authority contracted HDR Engineering, Inc. to analyze the user delay costs on the Tappan Zee related to closures associated with bridge deck repair. The following analysis is from that report. (See Appendix B for the full draft report)

When a hole develops, maintenance crews temporarily cover it with a steel plate until a scheduled deck repair procedure can be performed. During both the plating and repair operations, lanes are closed, temporarily reducing the bridge’s traffic-carrying capacity. The delay forecast has two key components; the frequency/duration of lane closures over time (i.e. capacity), and the growth of traffic volumes over time (i.e. demand).

The following figure charts the location and size of bridge-deck holes from 2002 to 2004. The number of scheduled repair operations was less than the number of holes because most repairs addressed more than one hole (1.63 holes per repair on average).
HDR linearly extrapolated the recent historical experience with punch-throughs to forecast the expected number and size of holes through the year 2020. The following figure illustrates these forecasts, as well as the expected annual number of repair operations (based on the historical ratio of 1.63 holes per repair operation). The forecast is based on totals from 2000, 2003, and 2004.

Both the emergency plating operations and the deck repair operations result in lane closures on the bridge. To forecast delays associated with these closures, the following assumptions were used:

• **Emergency Plating:** Once a hole is discovered, maintenance crews are dispatched as quickly as possible to apply the temporary plating. This process is estimated to take three hours on average (including closing the lanes, installing the plating, and reopening the lanes). It is assumed that the incidence of punch-throughs is a random event; therefore, the day and start time for the emergency plating procedure are also treated as random for the purposes of this analysis. Note that every punch-through is assumed to result in a unique emergency-plating lane closure (unlike scheduled repairs, as reiterated below). Closures are assumed to always leave two (and only two) lanes available to traffic in the direction of the closure.

• **Scheduled Deck Repairs:** Repairs occur on weekdays during Maintenance Shift 2 (8:30 a.m. to 4:30 p.m.). As mentioned earlier, some repair operations address multiple holes. Repair records from 2002/2003 indicate that repair durations varied from four to eight hours in length. Like the emergency plating operations, the repair operations are assumed to occur randomly throughout the year. Unlike the plating procedures, the repairs have a known start time but an unknown duration (from a forecasting standpoint). For the purposes of this analysis, it was assumed that all repairs start at the beginning of Shift 2. Based on an examination of repair records, the repair duration was divided into three categories – short (4 hours), medium (6 hours), and long (8 hours) – and the relative frequency of each of these durations was determined (30%, 15%, 55% respectively). As with the plating procedures, repair-based closures are assumed to leave two (and only two) lanes available to traffic in the direction of the closure.

The above assumptions were used to develop “closure profiles”: hourly graphs indicating the available capacity per direction for each potential closure event. When all lanes are open, the capacity of the bridge is 1,850 vehicles per hour per lane (vphpl). On Monday,
February 28, 2005, an incident occurred that allows the examination of capacity during lane closure events. In the southbound direction, Lanes 1 and 2 (the outside lanes) were closed from about 6:45 a.m. until about 8:00 a.m. Lanes 3 and 4 remained open to southbound traffic. Based on data from this event, HDR derived a capacity of 1,650 vphpl for the closure scenario – a decrease related primarily to “rubbernecking”.

HDR was able to develop typical 2004 hourly volume profiles for each direction on the bridge. For each direction and season, both weekday and weekend profiles were developed.

To forecast future traffic, a compounding growth factor of 1.8 percent per year, developed for previous studies, was applied to each of the profiles. Thus, it was possible to develop a set of hourly profiles for each future year between 2005 and 2020.

Delay forecasts were developed for each year from 2005 to 2020. This number was reduced from a potentially larger total by completing detailed calculations for even-numbered years only, and interpolating the results for odd-numbered years.

The basic process used to calculate the total 15-year delay (2005 through 2020) was to (1) compute the delay associated with each volume/closure combination, (2) multiply that delay by the number of times the volume/closure combination would be expected each year, and (3) sum the results for all years.

• Delays for Volume/Closure Combinations: To derive delay values for possible combinations, the procedures of elementary queueing theory (deterministic fluid approximation), supplemented by basic shockwave theory, were employed. When the volume is greater than the capacity, congestion and queueing develop. The queue is derived essentially in two parts: (1) the basic queue, which is equal to the cumulative amount of vehicle “arrivals” at a given point in time minus the cumulative amount of vehicle “departures”; and (2) the shockwave-based queue, which accounts for the fact that the queue will “telescope” because vehicles in queue will displace other vehicles that “wanted” to occupy that space during that hour. The total delay for all vehicles during the congested period is equal to the area under the queue curve. The telescoping effect of shockwave theory, when left unconstrained, can result in massive queue buildups that motorists would not be reasonably expected to endure if alternative routes were available. Therefore, for the purposes of this analysis, some diversion of traffic was assumed when queues stretched so far back that they affected vehicles forecasted to be on the bridge two or more hours in the future.

Expected Closures per Year: To compute the total annual delay associated with continued maintenance closure events, HDR multiplied the expected number of closures (by type) per year by the delay associated with each closure. Some assumptions underlay this calculation:
- Punch-throughs would be distributed evenly over the year (42% January–May; 25% June–August, 33% September–December).
- Punch-throughs would be distributed evenly by direction (50% northbound, 50% southbound).
- Punch-throughs would be distributed evenly throughout the week (71% weekdays, 29% weekends).
- The duration of scheduled repairs would be distributed as 30% short, 15% medium, 55% long.

*Delay Results*

The result of the analysis shows that roughly 109 million vehicle-hours of delay would be attributed to closures between 2005 and 2020. Scheduled repairs constitute over two-thirds of the forecasted total delay. [The above analysis was completed prior to the first Tappan Zee redecking project, which reduced the predicted vehicle-hours of delay. The Benefit Cost Analysis completed for this application does reflect the first project and contains current information]

Note that the traffic volume on the bridge was forecasted to exceed its capacity - regardless of closures - by 2008 in the southbound direction during the a.m. peak hour, and by 2014 in the northbound direction during the p.m. peak hour. This delay was excluded from the closure delay totals – therefore, the delays presented are above and beyond any delays associated with basic capacity constraints. The delay and queue projections were also spot-checked using a CORSIM (microsimulation) model of bridge closure conditions. The CORSIM model was adjusted to reflect the constrained and unconstrained capacities of the bridge as appropriate.

*Economic Competitiveness*

Prolonged congestion could impede the future economic and job growth that is projected in the Tappan Zee area. Crashes, vehicular breakdowns, summer and holiday travel, and construction and maintenance activities affect the reliability of the transportation system. These delays routinely account for about 50 percent of all delays in the corridor. Commerce depends on a work force that has reasonable access to business locations and affordable housing. Without these basics, there is no work force. Businesses without a work force from which to draw and a viable infrastructure would go elsewhere, resulting in significant economic impact to the area.

Employment growth rates are expected to be highest in the outlying counties of the region, so that Rockland will experience higher growth rates in all categories than Westchester, and Orange County will see even higher growth. All three counties are expected to exceed the forecasted regional employment growth of 17 percent: Westchester will grow by 19 percent, Rockland by 29 percent, and Orange by 35 percent. (NYMTC 2003 Socioeconomic forecasts)
The Tappan Zee project will improve long-term efficiency, reliability, and congestion, and improve cost competitiveness in the movement of works and goods. Mobility is measured not only by how many people can be moved on a transportation system, but also by how well. Predictable and regular travel times in 2025 will be even more important than they are today.

Livability

The Tappan Zee project is consistent with local and regional efforts to maintain transportation facilities. From the New York Metropolitan Transportation Council (NYMTC) Congestion Management Process Report, available on the website, [www.nymtc.org](http://www.nymtc.org), “The NYMTC planning area has the advantage of an extensive system of transportation facilities and services, which is critical to current mobility and future growth. Ensuring its day-to-day operations and maintenance and achieving and maintaining a State-of-Good-Repair for all of its components is an overall emphasis of NYMTC’s 2010-2035 Plan.”

Significant growth is predicted for the Tappan Zee corridor, in and around Westchester, Rockland, and Orange Counties, which will exacerbate the existing transportation situation. Between the 2000 Census and 2025, regional household population is expected to grow by 12 percent, with Rockland expected to grow by 18 percent and Orange County 27 percent. (Westchester population is expected to be more stable – growing by 4 percent). Additionally, there is no local alternative to the Tappan Zee Bridge to cross the Hudson River – it, in and of itself, is a local bottleneck.
Sustainability

In this scenario, vehicular emission costs are dependant on idling and speed changes due to queuing. Emission consumption values were produced using Mobile 6 and take into account future regulations and trends. Per-unit costs for each emission were then applied to the consumption rates to determine the monetized value on emissions. There are five types of emissions being measured; sulfur dioxide (SO2), particulate matter (PM), volatile organic compounds (VOC), NOx (nitrogen oxides) and carbon dioxide (CO2). Table 6 depicts the reduction in emissions volumes at different times in the analysis period. Throughout the twenty year study period, the emission reduction savings accrue to over $0.7 million. (Appendix C)

Safety

Congestion levels are strong indicators of the likelihood of accidents and the congestion impacts of punch-through incidents would increase the likelihood of accidents over normal operations. Reduction in potential congestion due to lane closures will have a direct effect of reducing the likelihood of accidents on the bridge. For the purpose of this analysis, three categories of accidents were modeled: Property Damage Only (PDO); personal injury; and fatality. The accident cost savings from the Tappan Zee Project are estimated to be about $4.6 million. (Appendix D)

JOB CREATION AND ECONOMIC STIMULUS

Short term job creation is estimated based on the Project construction cost between 2010 and 2012. The IMPLAN Group’s input-output model for the State of New York is used to estimate direct, indirect and induced employment, associated output, value added and

Population Growth by Zone, 1996-2025
labor income. The cumulative value from the Tappan Zee project is estimated at $160.5 million.

Direct, indirect, and induced employment by industry and estimated social benefit were calculated using annual wage estimates for the New York-White Plains-Wayne, NY-NJ Metropolitan Division from the Bureau of Labor Statistics. The total estimated benefit from the project is $105.27 million. (Appendix E)

**Project Construction Schedule**

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**Environmental Approvals**

Section 106 of the National Historic Preservation Act  
Section 4(f) FHWA coordination  
Federal consistency review by the New York State Department of State  
United State Coast Guard authorization  
Section 7 Endangered Species Act Consultation

**Legislative Approvals**

The Authority has been authorized to charge tolls on the Tappan Zee Bridge since it was built in 1955. No additional legislative approvals are necessary for the Project to proceed with construction, or for the bridge to be operated and maintained as intended. The Tappan Zee is recognized as a vital component in the New York transportation system and the repair project has the support of State and local officials including Senator Gillibrand, Congresswoman Lowey, and Congressman Engel. (Appendix F)

**State and Local Planning**

The Tappan Zee Bridge rehabilitation project is on the NYMTC Transportation Improvement Program (TIP) available at [www.nymtc.org](http://www.nymtc.org).
Technical Feasibility

The proposed project is currently in the Plans, Specifications and Estimate phase (PS&E) which is expected to be completed by November, 2009. The Authority has received signoff approvals from NYS Office of Parks, Recreation and Historic Preservation (SHPO), NYC Department of Environmental Protection, and the US Coast Guard. Metro North railroad approval is anticipated by the completion of PS&E for miscellaneous steel work and fiber optic relocation for the span over the tracks. Once PS&E is complete, it will be advertised at the beginning of 2010 and there will be a pre-bid meeting.

Financial Feasibility

The design phase of the Tappan Zee project is complete, and has been funded by the Authority. Construction of the project is programmed in the Authority’s Capital Plan, and will be fully funded, including contingency reserve.

While the Authority has never received a Federal grant in the amount requested, the agency has successfully utilized funds from a variety of federal sources such as high priority funding in ISTEA and TEA-21, earmarks in several yearly appropriations bills, and a share of New York State’s Interstate Maintenance and Enhancement funding. Additionally, the Authority is currently managing a $2.1 billion multi-year Capital Program and has experience in the delivery of large scale projects such as the I-84/I-87 Interchange 17 Reconstruction ($120 million).

BENEFIT/COST ANALYSIS

Based on monetized values of all the benefit categories described above, the re-decking effort for the bridge will generate substantially more benefits over the analysis period than the cost incurred. At a 7% discount rate, a $158 million project cost will result in over $419 million in net benefits, with benefit to cost ratio of about 2.65 and a net present value of $261 million. At a discount rate of 3%, a $167 million project cost will result in over $743 million in net benefits with a benefit-cost ratio of about 4.44 and a net present value exceeding $576 million. The results indicate that $351 million out of $419 million in benefits are due to the travel time savings for the drivers – a majority of which is during the peak periods of congestion. This is a typical outcome for repairs on already congested corridors. (Appendix G)
Secondary Selection Criteria

INNOVATION

In June 2005, the Authority hosted an Accelerated Construction Technology Transfer (ACTT) workshop for the Tappan Zee Bridge Partial Superstructure Replacement Project. At the workshop, ACTT experts in construction/contracting, structures, traffic/safety/ITS, and public relations reviewed proposed alternatives and made suggestions which were integrated 2005 Tappan Zee Bridge repair contract and will be used for the proposed upcoming Tappan Zee Bridge Repair project. (Workshop details in Appendix H) The first project won two American Council of Engineering Companies (ACEC) awards, the 2009 New York Platinum Award for Structural Systems and the 2009 Lower Hudson Valley Tappan Zee Award for Project of the Year. The Authority intends to meet the principles behind FHWA’s ACTT and Highways for LIFE programs for the proposed Tappan Zee project by pursuing the following recommendations:

Innovative Construction/Contracting

- Hold a mandatory pre-bid orientation meeting with potential bidders at the project site,
- Continue use of disincentives and incentives,
- Enter into confidentiality agreements with bidders since this is a lifeline structure.

Structures

- Prefabricated superstructure concept allowing off-site fabrication,
- Minimize on-site grouting and concrete pouring,
- Use galvanized steel girders to minimize future maintenance.

Traffic/Safety/ITS

- Utilize Highway Advisory Radio (HAR) and Dynamic Message Signs (DMS),
- Use enforcement techniques to identify traffic trends and remind motorists of the speed limit in work zones,
- Adhere to Authority lane closure requirements for all contracts,
- Provide the public with real-time information via the Authority’s website, the traffic management center and press releases,
- Provide project information to trucking and other industries through Authority operations and press releases,
- Utilize TRANSMIT detectors to obtain real-time speed and travel times, then broadcast times on HAR and lighted signs for construction periods,
- Provide good field lighting,
- Plan for job site delivery of materials and supplies,
- Provide worker buffer areas.
Public Relations
- Give public accurate and timely information to gain buy-in for the project,
- Integrate messages about the project with plans for future work in the area,
- Inform patrons of scheduled work via press releases, E-ZPass mailings, informational pamphlets at toll plazas, DMV mailings, etc,
- Provide notification to commercial carriers, including other states and Canada, via HAR or other means,
- Use dedicated staff to provide accurate outreach,
- Have a dedicated project web page with a link from the Authority home page.

PARTNERSHIP

The Authority is currently the only provider of funding for the Tappan Zee project; however State and Local transportation groups, as well as elected representatives of the area do support the additional infrastructure investments. Without the TIGER funding, the Authority will fund and complete the necessary portions of the Project, but the work will be completed over a longer timeframe, as there are currently no other funding sources available.
Federal Wage Rate Requirement Certification

The Thruway Authority will comply with all Federal requirements, including subchapter IV of chapter 31 of title 40 USC. (Appendix I)

NEPA Details

The project is classified as a Class II Action under the National Environmental Policy Act as implemented in 23 CFR 771. The FHWA would be the NEPA lead agency. The project is NEPA Programmatic Categorical Exclusion on the basis that significant environmental effects will not result from the project. The Categorical Exclusion Checklist can be found in Appendix J

Environmentally Related Actions

This Tappan Zee project is expected to meet all of the prerequisite criteria to be classified as a Type II project under the New York State Environmental Quality Review Act (SEQRA) in accordance with 6 NYCRR Part 617. The project is considered a bridge rehabilitation involving no significant changes or expansions to the existing structure.

In 2003, the Tappan Zee Bridge was identified as eligible for listing on the National Register of Historic Places. In New York’s State Historic Preservation Office’s (SHPO’s) opinion, the Tappan Zee Bridge is significant in the areas of transportation and engineering as one of the state’s most important bridges. Consequently, work performed on the bridge is subject to Section 106 of the National Historic Preservation Act if federal funds are being used. The SHPO has reviewed the project in accordance with Section 106 and issued a No Adverse Effect determination dated February 13, 2009. (Appendix K)

Because the Bridge is a National Register eligible structure, the bridge is also considered a Section 4(f) resource. In light of the “No Adverse Effect” determination from the SHPO, the Authority will coordinate as necessary with the Federal Highway Administration and the SHPO. It is anticipated that the FHWA will determine that the proposed project will have de minimis impacts to this Section 4(f) resource in accordance with Section 6009(a) of the Safe, Accountable, Flexible, Efficient Transportation Equity Act: A Legacy for Users (SAFETEA-LU).

The project is located within the New York State Coastal Zone. The project would therefore require Federal consistency review by the New York State Department of State as a result of Federal funding. Since the project will maintain the bridge and assure its continued functioning, it is anticipated that the coastal consistency review will be accomplished in a timely manner. Several communities in the vicinity of the bridge have approved Local Waterfront Revitalization Plans filed with the New York State Department of State. Given the scope of the project and the fact that the project is
anticipated to qualify as a SEQRA Type II action, a State consistency review by the Authority is not anticipated to be required.

The project will not involve any impacts to Waters of the United States. Section 10/404 permit will therefore not be required for the project. A U.S. Coast Guard (USCG) Section 9 Permit is not required for this project. The Coast Guard has reviewed the general plans and has no objections to the work. For work on, over, near or affecting the waterway, the project will comply with the stipulations provided in the General Construction Requirements and Floating Equipment Notification Form, supplied by the USCG. Prior to the commencement of work, written authorization from the USCG will be secured. (Appendix L)

No disturbance of the river is anticipated during construction and therefore, an Article 15 permit from the New York State Department of Environmental Conservation (NYSDEC) will not be required. The Authority is not required to obtain individual permits for projects regulated by the Environmental Conservation Law Article 15 Protection of Waters. However, the Authority ensures all projects comply with Article 15.

No adverse impacts are anticipated by the proposed project to any of the endangered or threatened species identified, or to the critical habitat areas.

The Tappan Zee Bridge is home to the New York State Endangered Peregrine Falcons (Falco peregrinus) who reside year-round on the bridge. The Authority has worked in cooperation with the New York State Department of Environmental Conservation (NYS DEC) and New York City Department of Environmental Protection (NYCDEP) since 1988 protecting the nesting falcons. Currently there is a nest box located on the northbound side of the bridge (Main Towers). The boxes are located on the third panel point approximately 23 meters above the roadway surface. The Bridge and the falcons have a symbiotic relationship: The nesting boxes provide falcons with a high perch and the falcons keep pigeons away from the bridge. Pigeon droppings are detrimental to the paint, and consequently, the steel on the Bridge. The Authority has coordinated closely with the NYS DEC Endangered Species Unit and the NYCDEP to ensure safety of the birds and employees particularly during nesting season when the birds may become extremely territorial. A special note (Appendix M) has been developed to carefully direct the contractors as to what coordination is required and what special conditions must be met to ensure the birds, as well as contractors working on the bridge.
Appendix A: LoHud.com Article

August 27, 2009

Pothole snarls traffic on Tappan Zee Bridge

Khurram Saeed and Leslie Korngold
ksaeed@lohud.com

A pothole on the Tappan Zee Bridge closed two Westchester-bound lanes yesterday morning and brought traffic to a crawl for several miles during rush hour.

The two left lanes on the bridge's west deck were closed for about two hours for emergency repairs, officials said.

The pothole, measuring 2 feet by 1 foot, was reported in the bridge's center lane at 5:15 a.m., said Ted Nadratowski, the state Thruway Authority division director for the Hudson Valley region.

Road crews were sent out and covered the large pothole with metal plates, Nadratowski said.

Both lanes were reopened by 7 a.m. but by then, traffic had backed up more than 10 miles past the Palisades Interstate Parkway interchange at Exit 13 in Nanuet, state police reported.

Valley Cottage resident Phil DeLorenzo, who works in the Bronx, was driving across the bridge shortly after 6 a.m. but said he didn't experience terribly long delays.

"I got nailed for maybe 10 minutes," he said. "I got lucky."

Nadratowski said crews routinely go out looking out at potential problem areas and scheduled work prior to the road failing.

"What happened (yesterday) morning was something that we didn't catch," Nadratowski said.

That section of road, and other places, will be chipped out and replaced with concrete during the day this week, he said.

Potholes and punch-throughs - a hole in which the Hudson River can be seen through the steel reinforcement - are common occurrences on the aging bridge, which handles more traffic than it was designed for decades earlier.

The pothole - Nadratowski wasn't sure if it actually was a punch-through - occurred in a lane on a part of the bridge deck that will eventually be replaced.

An $171 million deck replacement project has replaced the two outer lanes on the 53-year-old bridge in both directions from the Rockland shore to the eastern side of the main span.
Plans call for a new bridge to take the place of the Tappan Zee Bridge in the coming decade. Environmental studies are continuing, and key federal decisions are expected next year.

Project officials have said construction could begin in 2013, but there is still no money to pay for the span.
Appendix B: HDR, Inc. User Delay Cost Report
Appendix C: Reduction in Environmental Emissions

In this scenario, vehicular emission costs are dependant on idling and speed changes due to queuing. The emission consumption values were produced using Mobile 6 and take into account future regulations and trends. Per-unit costs for each emission were then applied to the consumption rates to determine the monetized value on emissions. There are five types of emissions being measured; sulfur dioxide (SO2), particulate matter (PM), volatile organic compounds (VOC), NOx (nitrogen oxides) and carbon dioxide (CO2). Table 6 depicts the reduction in emissions volumes at different times in the analysis period. Throughout the study period, the emission reduction savings accrue to over $0.7 million.

Table 6: Annual Emissions Reduction

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The emission rates were estimated by type of emission as a function of vehicle operating conditions. Table 7 below shows the rate of emissions per vehicle in 2010 as a function of average speed and year. For simplicity, emission rates for 2010 are reported here, however, the analysis makes use of emission rates that vary across the lifecycle of the project.

Table 7: Emission Rates 2010 (grams per mile)

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<th>10</th>
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<th>20</th>
<th>25</th>
<th>30</th>
<th>35</th>
<th>40</th>
<th>45</th>
<th>50</th>
<th>55</th>
<th>60</th>
<th>65</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO2</td>
<td>0.0067</td>
<td>0.0067</td>
<td>0.0067</td>
<td>0.0067</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td>0.0068</td>
<td></td>
</tr>
<tr>
<td>PM</td>
<td>0.0114</td>
<td>0.0114</td>
<td>0.0114</td>
<td>0.0114</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td>0.0113</td>
<td></td>
</tr>
<tr>
<td>VOC</td>
<td>2.1950</td>
<td>1.1745</td>
<td>0.9180</td>
<td>0.8160</td>
<td>0.7660</td>
<td>0.7330</td>
<td>0.7025</td>
<td>0.6840</td>
<td>0.6675</td>
<td>0.6510</td>
<td>0.6370</td>
<td>0.6245</td>
<td>0.6235</td>
</tr>
<tr>
<td>NOx</td>
<td>0.9535</td>
<td>0.6945</td>
<td>0.5640</td>
<td>0.5590</td>
<td>0.5645</td>
<td>0.5680</td>
<td>0.5680</td>
<td>0.5775</td>
<td>0.5905</td>
<td>0.6035</td>
<td>0.6180</td>
<td>0.6325</td>
<td>0.6345</td>
</tr>
<tr>
<td>CO2</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
<td>368.10</td>
</tr>
</tbody>
</table>

The product between emission rates (on a ton per mile basis) and the annual punch-through rates determines annual emission volume. The difference between the Build scenario emission volume and No-Build scenario emission volume shows the reduction in emissions volume due to re-decking of the bridge. The product of the reduction in emissions volume and emission costs per ton determines the monetized value of emission savings. Table 8 shows the values used in the analysis and according to the TIGER grant application guidelines.
### Table 8: Emission Costs

<table>
<thead>
<tr>
<th>Emission</th>
<th>Emission Cost ($2009 per ton)</th>
</tr>
</thead>
<tbody>
<tr>
<td>SO2</td>
<td>16,447</td>
</tr>
<tr>
<td>PM</td>
<td>172,697</td>
</tr>
<tr>
<td>VOC</td>
<td>1,748</td>
</tr>
<tr>
<td>NOx</td>
<td>4,112</td>
</tr>
<tr>
<td>CO2</td>
<td>34</td>
</tr>
</tbody>
</table>
Appendix D: Reduced Accident Costs

Reduction in potential congestion due to lane closures will have a direct effect of reducing the likelihood of accidents on the bridge. For the purpose of this analysis, three categories of accidents were modeled: (i) Property Damage Only (PDO); (ii) personal injury; and (iii) fatality. Table 9 shows the reduction in number of estimated accidents at different times during the analysis period. The accident cost savings are estimated to be about $4.6 million.

**Table 9: Annual Accident Reduction**

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2022</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual Reduction in Number of Accidents</td>
<td>3</td>
<td>6</td>
<td>11</td>
</tr>
</tbody>
</table>

Congestion levels are strong indicators of likelihood of accidents. The congestion impacts of punch-through incidents would increase the likelihood of accidents over the normal operations. The volume-to-capacity ratio is used as a determinant of traffic congestion. Table 10 shows the rates of accidents used in the analysis.

It is to be noted here that the accident rate reduction shown are only the ones directly attributable to the lane closure events resulting from punch-through incidents. It is not indicative of all possible improvements in traffic flow patterns resulting from redecking.

**Table 10: Accident Rates with respect to volume-to-capacity ratios**

<table>
<thead>
<tr>
<th>Peak Period</th>
<th>Volume-to-Capacity Ratio</th>
<th>PDO</th>
<th>Injury</th>
<th>Fatality</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>0.03</td>
<td>0.0093</td>
<td>0.0092</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>0.05</td>
<td>0.0187</td>
<td>0.0184</td>
<td>0.0001</td>
</tr>
<tr>
<td></td>
<td>0.08</td>
<td>0.0278</td>
<td>0.0275</td>
<td>0.0002</td>
</tr>
<tr>
<td></td>
<td>0.10</td>
<td>0.0371</td>
<td>0.0366</td>
<td>0.0003</td>
</tr>
<tr>
<td></td>
<td>0.13</td>
<td>0.0464</td>
<td>0.0458</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>0.15</td>
<td>0.0556</td>
<td>0.0549</td>
<td>0.0004</td>
</tr>
<tr>
<td></td>
<td>0.18</td>
<td>0.0649</td>
<td>0.0641</td>
<td>0.0005</td>
</tr>
<tr>
<td></td>
<td>0.20</td>
<td>0.0731</td>
<td>0.0721</td>
<td>0.0006</td>
</tr>
<tr>
<td></td>
<td>0.30</td>
<td>0.1096</td>
<td>0.1081</td>
<td>0.0008</td>
</tr>
<tr>
<td></td>
<td>0.40</td>
<td>0.1461</td>
<td>0.1442</td>
<td>0.0011</td>
</tr>
</tbody>
</table>
The difference between accident rates in Build scenario and accident rates in the No-Build scenario determine the annual reduction in number of accidents on the bridge. The savings due to accident reduction are monetized according to the specifications in the TIGER application guidelines. Table 11 shows the values used in the analysis.

Table 11: Accident Costs

<table>
<thead>
<tr>
<th>Accident Type</th>
<th>Accident Cost ($ 2009 per accident)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Property Damage Only (PDO)</td>
<td>42,146</td>
</tr>
<tr>
<td>Injury</td>
<td>65,790</td>
</tr>
<tr>
<td>Fatality</td>
<td>6,000,000</td>
</tr>
</tbody>
</table>
Appendix E: Short and Long Term Employment Output and Income

Short term job creation is estimated based on the project construction cost between 2010 and 2012. The IMPLAN Group’s input-output model for the State of New York is used to estimate direct, indirect and induced employment, associated output, value added and labor income. Employment represents full time and part time jobs created for a full year. Value added represents total business sales (output) minus the cost of purchasing intermediate products which is roughly equivalent to gross regional/domestic product. Labor income consists of employee compensation (wage and salary payments, health and life insurance, retirement payments, and any other non-cash compensation) and proprietary income (payments received by self-employed individuals as income). Table 4 provides short term job creation, income and value added due to the project.

Table 4: Short Term Job Creation, Income and Value Added

<table>
<thead>
<tr>
<th>Period</th>
<th>Employment</th>
<th>Total</th>
<th>Labor Income</th>
<th>Cumulative Income</th>
<th>Value Added</th>
<th>Cumulative Value Added</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td></td>
<td></td>
<td>($million)</td>
<td>($million)</td>
<td>($million)</td>
<td>($million)</td>
</tr>
<tr>
<td>2010 - Q1</td>
<td>263</td>
<td>263</td>
<td>$19.10</td>
<td>$19.10</td>
<td>$23.80</td>
<td>$23.8</td>
</tr>
<tr>
<td>2010 - Q2</td>
<td>119</td>
<td>382</td>
<td>$7.90</td>
<td>$27.0</td>
<td>$10.1</td>
<td>$33.9</td>
</tr>
<tr>
<td>2010 - Q3</td>
<td>71</td>
<td>453</td>
<td>$4.90</td>
<td>$31.9</td>
<td>$6.2</td>
<td>$40.0</td>
</tr>
<tr>
<td>2010 - Q4</td>
<td>313</td>
<td>766</td>
<td>$19.70</td>
<td>$51.6</td>
<td>$25.4</td>
<td>$65.4</td>
</tr>
<tr>
<td>2011 - Q1</td>
<td>233</td>
<td>999</td>
<td>$14.80</td>
<td>$66.4</td>
<td>$19.0</td>
<td>$84.4</td>
</tr>
<tr>
<td>2011 - Q2</td>
<td>343</td>
<td>1,342</td>
<td>$21.20</td>
<td>$87.6</td>
<td>$27.5</td>
<td>$111.9</td>
</tr>
<tr>
<td>2011 - Q3</td>
<td>375</td>
<td>1,718</td>
<td>$23.10</td>
<td>$110.7</td>
<td>$29.9</td>
<td>$141.8</td>
</tr>
<tr>
<td>2011 - Q4</td>
<td>164</td>
<td>1,882</td>
<td>$10.10</td>
<td>$120.8</td>
<td>$13.1</td>
<td>$154.9</td>
</tr>
<tr>
<td>2012 - Q1</td>
<td>65</td>
<td>1,947</td>
<td>$4.00</td>
<td>$124.7</td>
<td>$5.2</td>
<td>$160.1</td>
</tr>
<tr>
<td>2012 – Q2</td>
<td>5</td>
<td>1,952</td>
<td>$0.30</td>
<td>$125.0</td>
<td>$0.4</td>
<td>$160.5</td>
</tr>
</tbody>
</table>

Table 5 provides employment by industry, which are aggregated by 2-digit at the 2-digit NAICS\(^2\) level. Total benefits for each of these industries are calculated using annual wage estimates for the New York-White Plains-Wayne, NY-NJ Metropolitan Division from the Bureau of Labor Statistics.

Table 5: Direct, Indirect, and Induced Employment by Industry and Estimated Social Benefit

<table>
<thead>
<tr>
<th>Industry</th>
<th>Job Years</th>
<th>Total Benefit ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farming, Fishing, and Forestry Occupations</td>
<td>1.0</td>
<td>$0.04</td>
</tr>
<tr>
<td>All Occupations – Mining</td>
<td>1.4</td>
<td>$0.06</td>
</tr>
<tr>
<td>Electrical and Electronic Equipment Assemblers</td>
<td>2.5</td>
<td>$0.07</td>
</tr>
</tbody>
</table>

\(^2\) North American Industry Classification System
## Industry

<table>
<thead>
<tr>
<th>Industry</th>
<th>Job Years</th>
<th>Total Benefit ($ million)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Construction and Extraction Occupations</td>
<td>1,261.3</td>
<td>$73.03</td>
</tr>
<tr>
<td>Production Occupations</td>
<td>17.4</td>
<td>$0.48</td>
</tr>
<tr>
<td>Sales Representatives, Wholesale and Manufacturing Except Technical and Scientific Products</td>
<td>31.3</td>
<td>$1.82</td>
</tr>
<tr>
<td>Transportation and Material Moving Occupations</td>
<td>13.2</td>
<td>$0.43</td>
</tr>
<tr>
<td>Retail Salesperson</td>
<td>106.1</td>
<td>$2.33</td>
</tr>
<tr>
<td>Computer and Mathematical Science Occupations</td>
<td>7.3</td>
<td>$0.59</td>
</tr>
<tr>
<td>Business and Financial Operations Occupations</td>
<td>28.1</td>
<td>$2.06</td>
</tr>
<tr>
<td>Real Estate Sales Agent</td>
<td>26.9</td>
<td>$1.87</td>
</tr>
<tr>
<td>Life, Physical, and Social Science Occupations</td>
<td>203.9</td>
<td>$13.01</td>
</tr>
<tr>
<td>Management Occupations</td>
<td>2.4</td>
<td>$0.29</td>
</tr>
<tr>
<td>Office and Administrative Support Occupations</td>
<td>33.1</td>
<td>$1.16</td>
</tr>
<tr>
<td>Educational, Training, and Library Occupations</td>
<td>22.9</td>
<td>$1.23</td>
</tr>
<tr>
<td>Community and Social Service Occupations</td>
<td>91.5</td>
<td>$3.87</td>
</tr>
<tr>
<td>Arts, Design, Entertainment, Sports, and Media Occupations</td>
<td>12.8</td>
<td>$0.76</td>
</tr>
<tr>
<td>Food Preparation and Serving Related Occuplications</td>
<td>35.6</td>
<td>$0.79</td>
</tr>
<tr>
<td>Personal Care and Service Occupations</td>
<td>46.7</td>
<td>$1.12</td>
</tr>
<tr>
<td>Community and Social Service Occupations</td>
<td>6.1</td>
<td>$0.26</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>1,952</strong></td>
<td><strong>$105.27</strong></td>
</tr>
</tbody>
</table>

Although in typical benefit cost analysis, the local and regional benefits from short-term employment are not considered, the current economic environment and the value of triggering productive economic activity warrants the inclusion of benefits from this economic stimulus. New York is one of the cities that have experienced major job losses during this recession.
Appendix F: Letters of Support
Appendix G: Benefit Cost and Economic Impact Analysis

This document supports New York State Thruway Authority’s (NYSTA) application for TIGER grant funds towards re-decking of the inside lanes of the Tappan Zee bridge. It describes the framework, methodology, and results of the Benefit-Cost Analysis (BCA) for the project.

Framework

The project determines the impact of the Thruway Authority’s initiative to re-deck the inside lanes on Tappan Zee Bridge. It is expected that re-decking of the lanes would reduce delays associated with the incidence of punch-throughs on Tappan Zee Bridge. The BCA framework is structured around a fundamental relationship between the demand for travel and the costs associated with travel. Though each project benefit is estimated separately, the BCA assumes a relationship between the number of trips, the cost of travel to travelers and the benefits to existing travelers as a result of the project.

The diagram below presents this general framework. The blue area represents the benefit of reduced travel cost accruing to roadway users. The objective of the BCA is to compare the Build Scenario (re-decking of inside lanes on Tappan Zee bridge) to the No-Build Scenario (do nothing). It allows stakeholders to weigh the long-term benefits of re-decking the bridge against the construction, operating and maintenance costs.

Within this framework, the BCA estimates lifecycle benefits and costs specifically accruing to roadway users, such as travel time savings and accident cost savings. Additional benefits include emissions reductions and short-term job creation.
• The benefits stemming from the implementation of the roadway improvement are measured in terms of the improvement over the No-Build scenario. For instance, the travel time in the Build scenario is compared with the travel time in the No-Build scenario to estimate the travel time savings potential of the project.

• All benefits and costs are estimated in 2009 dollars. The non-pecuniary benefits are monetized according to the specifications set forth by the TIGER grant application guidelines. The different components of time, for instance, are monetized by using a “value of time” that is assumed to be equivalent to the user’s willingness to pay for travel time savings. These, as with all other parameter values used in the analysis are taken from the United States Department of Transportation (USDOT) guidance on the preparation of TIGER applications.

• Annual costs and benefits are computed over a long-run planning horizon and summarized through a lifecycle cost analysis. The project is assumed to have a useful life of at least 20 years, which is used as the time horizon of the analysis. Benefits from the re-decking of Tappan Zee Bridge accrue during the entire lifecycle of the project.

• As peak hour traffic dynamics vary from off-peak hour travel dynamics, each benefit is estimated for travel during peak hours as well as travel during off-peak hours. These individual benefits are then summed up to determine full project benefits.

• The opportunity cost associated with the delayed consumption of benefits and the alternative uses of the capital for the implementation of the project is accounted for using a discount rate. All benefits and costs are discounted to reflect the opportunity costs of committing resources to the project. A 7 percent real discount rate is used in the analysis, with a sensitivity test at 3 percent.

Measurement, Data and Assumptions

This section describes the measurement approach for each category of benefit estimated in this analysis and provides an overview of the data and assumptions used in the analysis.

Redecking of the Tappan Zee Bridge is expected to eliminate the occurrence of frequent punch-through damages to the bridge. These damages result in lane closures for extended periods of time causing severe congestion on this vital roadway segment. Redecking is expected to generate significant travel time savings to the travelers, particularly during peak hour. This in turn results in reducing emissions and improving safety. In addition, the project will reduce the costs due to constant repairs of the deck.

Table 1 below lists each of the benefits considered in this analysis.
Table 1: Benefits and Description by Evaluation Criteria

<table>
<thead>
<tr>
<th>Criteria</th>
<th>Benefit(s)</th>
<th>Description</th>
</tr>
</thead>
<tbody>
<tr>
<td>State of Good Repair</td>
<td>Operation &amp; Maintenance Cost Savings</td>
<td>Reductions in operation and maintenance costs due to reduction in incidence of punch-throughs</td>
</tr>
<tr>
<td></td>
<td>Travel Time Savings</td>
<td>Time savings to roadway users due to reduction in punch-throughs and consequent reduction in lane closures</td>
</tr>
<tr>
<td>Economic Competitiveness</td>
<td>Short Term Employment</td>
<td>Value of new short-term jobs created as a result of re-decking</td>
</tr>
<tr>
<td>Sustainability</td>
<td>Emissions Reductions</td>
<td>Reductions in emissions due to lesser idling and stop-and-go vehicle operation on the bridge</td>
</tr>
<tr>
<td>Safety</td>
<td>Accident Reduction</td>
<td>Reductions in property damages, injuries and fatalities due to Potential traffic accidents</td>
</tr>
</tbody>
</table>

Operation & Maintenance Savings

Currently the bridge deck is subjected to punch-throughs at the rate of 73 punch-throughs per year, projected forward from a rate of 56 punch-throughs per year in 2004. Engineering estimates indicate that the state of infrastructure and the increasing level of traffic will increase this to about 130 punch-throughs per year by 2020 unless a re-decking effort is undertaken. Table 2 shows the possible schedule of maintenance expenses at various times in the analysis period under a No-Build scenario.

Table 2: Annual Operation and Maintenance Savings

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2022</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Operation &amp; Maintenance Savings ($ 2009)</td>
<td>$657,328</td>
<td>$1,112,702</td>
<td>$1,695,340</td>
</tr>
<tr>
<td>Operation &amp; Maintenance Savings ($ 2009) (discounted at 7%)</td>
<td>$536,575</td>
<td>$461,732</td>
<td>$409,447</td>
</tr>
</tbody>
</table>

If the re-decking investment is made, the ongoing maintenance cost over the study period is negligible, thus resulting in discounted savings exceeding $10.8 million.

Travel Time Savings

Travel time savings accrue to roadway users on Tappan Zee Bridge and are the most significant benefit of the project. If the project is implemented, fewer lane closures would be needed to repair punch-throughs. As a result, roadway users would face fewer delays.
at the Tappan Zee Bridge. The reduction in Vehicle Hours Traveled (VHT) as a result of the re-decking is multiplied with the value of time to determine the travel time savings. The travel time savings for vehicle drivers are presented in Table 3. Throughout the study period, the time savings accrue to over 266 million.

Table 3: Annual Vehicle Hours Traveled (VHT) Reduction

<table>
<thead>
<tr>
<th></th>
<th>2012</th>
<th>2022</th>
<th>2030</th>
</tr>
</thead>
<tbody>
<tr>
<td>Annual VHT Reduced</td>
<td>172,916</td>
<td>713,459</td>
<td>2,218,183</td>
</tr>
</tbody>
</table>

Travel times are calculated using the BPR speed-flow relationship given below:

$$\text{Speed} = \frac{\text{Free Flow Speed}}{(1+0.15(v/c)^4)}$$

This relationship is shown in Figure 2. Current peak hour conditions at Tappan Zee Bridge show average speed of 49 mph during congestion. This is consistent with the traffic flow observations. A lane closure event for deck repair would increase the congestion level significantly reducing speeds to as low as 26 mph.

Figure 1: BPR Speed-Flow Curve

Assuming a free-flow speed of 60 mph, speed during congestion was calculated using the volume-to-capacity ratio and applying the BPR equation. Once speed-flows were determined, the vehicle hours traveled (VHT) during lane closure were estimated. The product of VHT per punch-through incident and annual rate of punch-throughs in the No-Build scenario determines the annual VHT without re-decking. It is assumed that the annual rate of punch-throughs with re-decking will be zero in the first 20 years, therefore there is no delay arising from punch-throughs in the project Build scenario. The annual

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3 Singh. 1999. *Improved Speed-Flow Relationships: Application to Transportation Planning Models*
hours of delay saved are then multiplied by the passenger value of time ($ per hour) to obtain a monetized value for travel time savings.

The monetary value of time used in the analysis is $14.11 per hour in 2009 dollars for all travel purposes. These are based on values recommended by the TIGER grant application guidelines. The value of time in peak hours is adjusted using a mark-up factor of 2.5, as recommended by the National Cooperative Highway Research Program (NCHRP) Report 431.

Table 12 below summarizes the BCA findings based on monetized values of all the benefit categories described above. As shown in the table, the re-decking effort for the bridge generates substantially more benefits over the analysis period than the cost incurred. At a 7% discount rate, a $158 million project cost results in over $419 million net benefits and with benefit to cost ratio of about 2.65 and a net present value of $261 million. At a discount rate of 3%, a $167 million project cost results in over $743 million in net benefits with a benefit-cost ratio of about 4.44 and a net present value exceeding $576 million.

Table 12: Summary of Benefit-Cost Analysis (BCA) Results

<table>
<thead>
<tr>
<th>Summary of Primary Selection Criteria - Long Term Outcomes</th>
<th>7% Discount Rate</th>
<th>3% Discount Rate</th>
</tr>
</thead>
<tbody>
<tr>
<td>State of Good Repair</td>
<td></td>
<td></td>
</tr>
<tr>
<td>O&amp;M Savings ($ millions)</td>
<td>10.8</td>
<td>17.2</td>
</tr>
<tr>
<td>Economic Competitiveness</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Short-Term Employment (Job-Years)</td>
<td>1,952</td>
<td></td>
</tr>
<tr>
<td>Direct Employment</td>
<td>1,360</td>
<td></td>
</tr>
<tr>
<td>Indirect Employment</td>
<td>233</td>
<td></td>
</tr>
<tr>
<td>Induced Employment</td>
<td>359</td>
<td></td>
</tr>
<tr>
<td>Benefits of Short-term Employment ($ millions)</td>
<td>$ 51.6</td>
<td>$ 75.3</td>
</tr>
<tr>
<td>Travel Time Savings ($ millions)</td>
<td>$ 351</td>
<td>$ 642</td>
</tr>
<tr>
<td>Sustainability</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Reduced Emissions (grams)</td>
<td>163 million</td>
<td></td>
</tr>
<tr>
<td>Emissions Savings ($ millions)</td>
<td>$ 0.7</td>
<td>$ 0.8</td>
</tr>
<tr>
<td>Safety</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Accident Cost Savings ($ millions)</td>
<td>$ 4.6</td>
<td>$ 7.5</td>
</tr>
</tbody>
</table>

4 These values for time are based on the suggested in the US DOT memorandum titled “Revised Departmental Guidelines for Valuation of Time in Economic Analysis.” The memo specified $21.20 for business and $11.20 for aggregated all travel in 2000 dollars.

### Tappan Zee Bridge Repair Project

<table>
<thead>
<tr>
<th>Total Discounted Benefits ($ millions)</th>
<th>$ 419</th>
<th>$ 743</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total Discounted Costs ($ millions)</td>
<td>$ 158</td>
<td>$ 167</td>
</tr>
<tr>
<td>Benefit - Cost Ratio</td>
<td>2.65</td>
<td>4.44</td>
</tr>
<tr>
<td>Net Present Value ($ millions)</td>
<td>$ 261</td>
<td>$ 576</td>
</tr>
</tbody>
</table>

The results indicate that $351 million out of $419 million in benefits are due to the travel time savings for the drivers – a majority of which is during the peak periods of congestion. This is a typical outcome for repairs on already congested corridors.
Appendix H: ACCT Workshop Details
Appendix I: Federal Wage Rate Requirement Certification
Appendix J: NEPA Categorical Exclusion Checklist

NEPA ASSESSMENT CHECKLIST

Answer the following questions by checking YES or NO.

I. THRESHOLD QUESTION

YES NO

1. Does the project involve unusual circumstances as described in 23 CFR §771.117(b)?
   ___
   X

M If YES, the project does not qualify as a Categorical Exclusion and an EA or EIS is required. You may STOP COMPLETING THE CHECKLIST.

M If NO, go on.

II. AUTOMATIC CATEGORICAL EXCLUSION

YES NO

2. Is the project an action listed as an Automatic Categorical Exclusion in 23 CFR §771.117(c) (C List) and/or is the project an element-specific project classified by FHWA as a Categorical Exclusion on July 22, 1996?
   ___
   X

M If YES to question 2, the project qualifies for a C List Categorical Exclusion. You may STOP COMPLETING THE CHECKLIST. The checklist should be included in the appendix of the Final Design Report (or Scope Summary Memorandum/Final Design Report). The CATEGORICAL EXCLUSION DETERMINATION memo is to be sent to the appropriate Main Office Design liaison unit with a copy of the Final Design Report (or Scope Summary Memorandum/Final Design Report). A copy of the CATEGORICAL EXCLUSION DETERMINATION memo must also be sent to the Office of Budget and Finance, Project and Letting Management, and others (see sample DETERMINATION memo attached).

(Note - Even if YES to question 2, there may be specific environmental issues that still require an action such as an EO 11990 Wetland Finding or a determination of effect on cultural resources. The project is still an Automatic Categorical Exclusion but the necessary action must be taken, such as obtaining FHWA's signature on the wetland finding. Refer to the appropriate section of the Environmental Procedures Manual for guidance.)

M If NO to question 2, go on.
Appendix K: New York's State Historic Preservation Office
Opinion Letter

New York State Office of Parks,
Recreation and Historic Preservation

Historic Preservation Field Services Bureau • Peebles Island, PO Box 189, Waterford, New York 12188-0189
518-237-8643
www.nysparks.com

February 13, 2009

Re: FHWA/NYSTA
Tappan Zee Bridge-phase 2
(cast side repairs)
South Nyack, Rockland County
09PR00542

Dear Mr. Curtis:

Thank you for requesting the comments of the State Historic Preservation Office (SHPO). We have reviewed the project in accordance with Section 106 of the National Historic Preservation Act of 1966. These comments are those of the SHPO and relate only to Historic/Cultural resources. They do not include potential environmental impacts to New York State Parkland and may be involved in or near your project. Such impacts must be considered as part of the environmental review of the project pursuant to the National Environmental Policy Act and/or the State Environmental Quality Review Act (New York Environmental Conservation Law Article 8).

Based upon our review, it is the SHPO’s opinion that the project will have No Adverse Effect upon properties in or eligible for inclusion in the National Register of Historic Places.

If you have any questions regarding this letter or your project, please feel free to contact me. Ext. 3273.

Sincerely,

Kenneth Markunas
Historic Sites
Restoration Coordinator
Appendix L: Coast Guard Communication

U.S. Department of Homeland Security

United States Coast Guard

Commander
First Coast Guard District

Battery Park Bldg.
1 South Street
New York, NY 10004-5073
Staff Symbol: 090
Phone: (212) 668-7000
Fax: (212) 668-7080
Email: jrm.arca@uscg.mil

16594/27.001//
Hudson R/NY/
February 12, 2009

Mr. David J. Curtis, P.E.
Director, Environmental Services Group
New York State Thruway Authority/Canal Corp.
200 Southern Blvd.
P.O. Box 189
Albany, NY 12201-0189

Dear Mr. Curtis:

We have reviewed the general plans submitted with your letter dated 2 February 2009, concerning Phase II of superstructure repair at the Tappan Zee Bridge across Hudson River. We have no objection to the work as described in your plan. To facilitate your planning, the stipulations in the attached Enclosure (1) and (2) entitled “General Construction Requirements” and “Floating Equipment Notification Form” must be adhered to that apply for work on, over, near or affecting the waterway. These stipulations are based on the facts presently before us and additional requirements may be imposed if the contractor submits an approach or action not anticipated by this office. Upon receipt and review of plans submitted pursuant paragraph (3) of enclosure (1), authorization to work over the waterway will be issued by this office.

If you have any further questions, please contact me at the above number.

Sincerely,

J.M. Arca
Deputy Chief, Bridge Branch
First Coast Guard District
By direction of the District Commander

Encl: 1) General Construction Requirements
2) Floating Equipment Notification Form

Copy: Commander-SecNY - Waterway Oversight Branch
Appendix M: Endangered Peregrine Falcon Note

Peregrine Falcons

The Tappan Zee Bridge is home to the New York State Endangered Peregrine Falcons (*Falco peregrinus*) who reside year round on the bridge. The New York State Thruway Authority has worked in cooperation with the NYSDEC and NYCDEP since 1988 protecting the nesting falcons. Currently there is a nest box located on the northbound side of both Pier 175 and 176 (Main Towers). The boxes are located on the third panel point approximately 23 meters above the roadway surface.

The annual nesting season for the falcon is from February through August. During this time the birds are extremely aggressive. For the duration of the nesting season, no construction activity is to occur within 30 meters of each pier at a height of 8 meters or greater above the roadway surface.

Additionally, considerations for construction activities in the vicinity of the nests and worker safety precautions will be discussed at the pre-construction meeting. It will be the Contractor’s responsibility to provide adequate protection for its workers without intentionally harming the falcons.

A coordination meeting between the Contractor, Authority, and NYCDEP/NYSDEC should be scheduled 2 months prior to any work on the main span to discuss issues related to the falcon nests.

NYCDEP/NYSDEC shall be contacted 1 week prior to any access of the towers (Pier 175 and 176).

Equipment brought to the site that can be used by the falcons as a landing point (i.e. apex of cranes, etc.) or equipment that utilizes petroleum or chemical products at or near the apex of such equipment shall be equipped with a flag or some other non-harmful deterrent used to discourage the falcons to use as a landing location.

The contacts for this project:

Christopher Nadasinski  
New York City Department of Environmental Protection, Wildlife Studies  
465 Columbus Avenue  
Valhalla, NY 10595-1336  
Phone: 914-773-4472  
Pager: (914) 445-1572  
Email: cnadasinski@dep.nyc.gov

or

Barbara Allen Loucks  
New York State Department of Environmental Conservation  
Endangered Species Unit