Chapter 4: Transportation

4-1 INTRODUCTION

This chapter evaluates the potential benefits and impacts of the Tappan Zee Hudson River Crossing Project on transportation. The analysis addresses regional transportation issues, local highway traffic operations, and accident history. This chapter also describes the new mobility options for pedestrians and cyclists as well as the project's potential impacts on transit service and marine transport.

Interstate 87/287, including the Tappan Zee Bridge, is prone to frequent and heavy congestion. The Replacement Bridge Alternative would not generate additional traffic volumes across the Tappan Zee crossing as compared to the No Build Alternative (see **Appendix B**). The capacity of the bridge is controlled by several factors, including a reduction in the number of travel lanes west of Interchange 11, and weaving maneuvers at interchanges in Westchester and Rockland Counties. .While it would not address the capacity constraints along the Interstate 87/287 corridor, the Replacement Bridge Alternative would implement six important improvements at the Tappan Zee Hudson River crossing:

- The eight-lane configuration of the Replacement Bridge Alternative would be sufficient to meet the projected increase in traffic volumes on the bridge without the need for a reversible lane;
- The Replacement Bridge Alternative would include 12-foot lanes and left and right shoulders, which would improve safety conditions and reduce the delays associated with traffic incidents and accidents;
- The Replacement Bridge Alternative would include extra-wide left shoulders that would serve for dedicated emergency access, which would substantially improve response times to incidents and accidents;
- The Replacement Bridge Alternative would reduce the grades on the bridge, which presently contribute to a high number of accidents resulting from poor sight distances and excessive speed differentials;
- The Replacement Bridge Alternative would not preclude future transit service at the Tappan Zee Hudson River crossing; and
- The Replacement Bridge Alternative would include pedestrian and bicycle accommodations, which are not available on the existing bridge.

4-2 REGULATORY CONTEXT

The design, operations, safety, and security of the Tappan Zee Bridge and adjacent highways are regulated by a variety of agencies, including the New York State Department of Transportation (NYSDOT), the New York State Thruway Authority

(NYSTA), and the Federal Highway Administration (FHWA). Other national organizations are involved in establishing design and operational guidelines and standards widely used for transportation projects, including the American Association of State Highway and Transportation Officials (AASHTO) and the Transportation Research Board (TRB).

The Tappan Zee Hudson River Crossing Project is a part of the transportation planning process in the New York metropolitan area. With FHWA as federal lead agency, it must be a part of the Continuing Comprehensive Coordinated process defined in federal planning regulations. Those regulations mandate that the Metropolitan Planning Organization (MPO), the New York Metropolitan Transportation Council (NYMTC) in this case, manage the transportation planning process, including the adoption of the Tappan Zee Hudson River Crossing Project's travel demand forecasting models into its regional transportation model (i.e., Best Practices Model; BPM).

4-3 METHODOLOGY

4-3-1 TRAVEL DEMAND MODELING

The methodology for the traffic analysis focused on forecasting the future demand on the Tappan Zee Bridge and determining the ability of the replacement bridge alternative to satisfy that demand. Forecasting future demand required a detailed regional travel demand modeling effort involving the NYMTC BPM and a local microsimulation analysis utilizing Paramics.

Due to the limitations of the freeway methodology in the Highway Capacity Manual, a traditional Level of Service analysis was not conducted as part of the traffic analysis. As stated in the Highway Capacity Manual, the basic freeway facility methodology experiences limitations under conditions where downstream congestion results in blockages and queuing on the freeway segment. The Highway Capacity Manual also identifies limitations to the methodology when analyzing extended bridge segments, segments near toll plazas and system-wide oversaturated flow conditions. All of which are experienced with the project limits of the Tappan Zee Bridge.

NYMTC is a regional council of governments and serves as the MPO for New York City, Long Island, and the lower Hudson Valley. NYMTC has developed the BPM to meet the federal requirements for long-range planning, including conformity (air quality), sub-regional, and corridor-level analyses. The BPM incorporates transportation behavior and relationships and has been developed with an extensive set of data that includes a travel survey of households in the region, land-use inventories, socioeconomic data, traffic and transit counts, and travel times. The BPM served as the forecasting tool to identify the future transportation demand on the Tappan Zee Hudson River crossing.

The BPM is a regional transportation model and is not designed or suitable for the analysis of particular roadway segments. Therefore, the travel demand forecasts of the BPM were entered into a Paramics microsimulation model to predict volumes at the Tappan Zee crossing and on adjacent roadways. The Paramics model was developed for the previous project from the BPM highway network, and it was enhanced based on field conditions for the 2010 (Existing Conditions), 2017 (Estimated Time of Completion, or ETC) and 2047 (ETC+30) analysis years. The initial data collection program was conducted in 2005 and served as the baseline for calibration of the Paramics model. The Paramics model was recalibrated and validated in 2007, 2010, and 2011.

4-3-2 ACCIDENT ANALYSIS

The purpose of the accident analysis is to evaluate safety conditions on the Tappan Zee Bridge by studying and quantifying accidents in terms of rates, frequencies, and severity. The analysis provides insight into the accidents by isolating and identifying contributing circumstances that suggest specific patterns and/or clusters of accidents.

In accordance with the NYSDOT Safety Investigation Procedure Manual (2002), accident records for a three-year period (January 1, 2008 through December 31, 2010) were obtained from NYSTA. The accident rate for each segment of the bridge is calculated in 3/10-mile increments and compared with the statewide average for comparable roadway segments. Consistent with NYSDOT methodology, the accident data do not include non-reportable accidents.

The accident investigation was limited to all accidents on the Tappan Zee Bridge and immediate approaches, an approximate 3½-mile segment, and did not include adjacent interchanges or the toll barrier. In the westbound direction, the study area extended from milepost 12.9 to milepost 16.6. In the eastbound direction, the study area extended from milepost 16.6 to milepost 13.1. The difference in the milepost limits for the eastbound direction reflects the exclusion of the toll plaza (milepost 13.07) from the study area. The cluster of accidents experienced less than 1/10 of a mile from the toll plaza was excluded to maintain a focus on accident conditions on the bridge and immediate approaches.

4-4 AFFECTED ENVIRONMENT

The Tappan Zee Bridge provides the only interstate highway crossing of the Hudson River for the 48-mile stretch between the George Washington Bridge (Interstate 95) and the Newburgh-Beacon Bridge (Interstate 84). It is a vital link between the population and employment centers of Rockland and Westchester Counties and a major route for freight movement in the region.

The Tappan Zee Bridge is a part of the New York State Thruway system and identified as both I-87 and I-287. The directional orientation of I-87 is north-south and I-287 is orientated as east-west in direction. For consistency, this report will present all traffic discussions in the east-west direction (with eastbound traffic corresponding to the southbound direction as designated on I-87).

4-4-1 VEHICULAR TRAFFIC

The Tappan Zee Bridge was originally designed with six lanes. In 1992, NYSTA began using the median as a seventh lane to address the peak period traffic demands. A movable barrier system reverses the additional lane, so four lanes are available in the peak hour direction. Typically, four lanes are provided in the eastbound direction until mid-afternoon, typically around 3 PM, when the lane is reversed to provide an additional travel lane in the westbound direction. The reversible lane is typically returned to the eastbound direction around 7 PM. Although the reversible lane provides much-needed capacity, it removes the bridge’s shoulders and median area and reduces lane widths in some segments.

In 2010, the Tappan Zee Bridge carried over 134,000 vehicles per day. Volumes are highest during the peak weekday commuter hours in the morning (eastbound direction) and evening (westbound direction), but the bridge is prone to severe congestion in non-commuter periods as well. On a typical weekday, the Tappan Zee Bridge carries a two-way volume between 5,000 and 8,000 vehicles per hour between 6 AM and 7 PM.

NYMTC forecasts continued growth to 2035 for both population and employment, which were assumed to hold constant until 2047. The populations of Rockland and Westchester Counties are expected to increase between 2010 and 2047 by 50,000 and 134,000 residents, respectively. Employment is projected to increase by 47,000 jobs in Rockland County and by 160,000 jobs in Westchester County during this timeframe. This growth in population and employment will increase daily volumes across the Tappan Zee Bridge for the next several decades.

4-4-1-1 VOLUMES AND TRAVEL PATTERNS

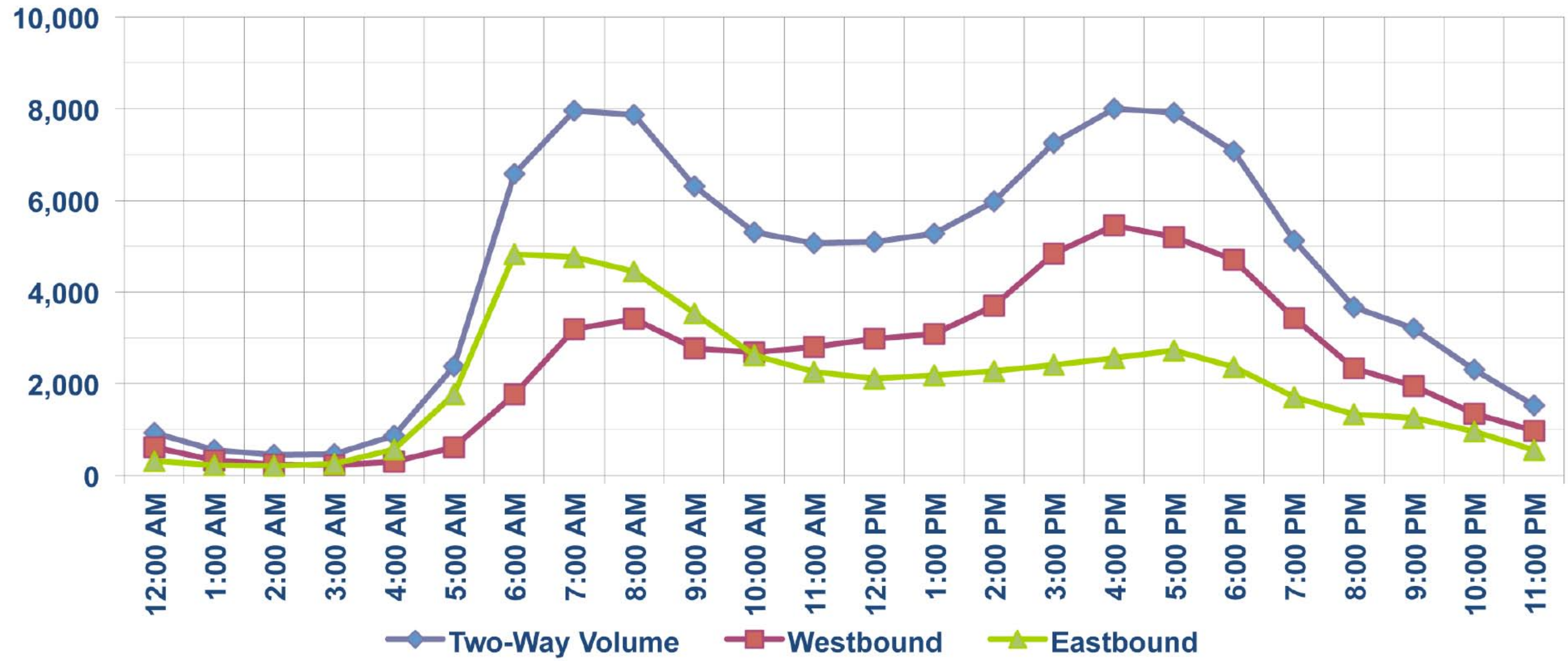
Traffic volumes in the corridor as measured at the Tappan Zee Bridge grew at an average annual rate of roughly 4 percent over the 1960 to 2000 period. This rapid rise reflects population and job growth along the corridor, completion of the Cross Westchester Expressway (Interstate 287) from Interstate 87 to Interstate 95 (New England Thruway) in 1960, and the Interstate 87 connection to Interstate 287 at Interchange 15 in 1994.

As shown in **Figure 4-1**, traffic growth has been very modest since 2000. In 2010, the bridge experienced an average annual daily traffic (AADT) of approximately 134,900 vehicles as compared with 2000 when the bridge volume was 134,200 vehicles, an increase of 700 vehicles. However, the bridge did experience a higher volume of vehicles per day in 2007.

Figure 4-2 presents a typical 2010 hourly traffic volume profile for a weekday in the fall at a continuous count location adjacent to the Tappan Zee Bridge. The fall period was selected since it represents a normal commuter period not typically impacted by weather, holidays, or school vacations. As shown on the figure, the Tappan Zee Bridge carries peak hour traffic volumes of approximately 8,000 vehicles during the weekday morning and evening peak hours. The weekday morning peak hour is typically 7 to 8 AM when approximately 4,800 vehicles, or 60 percent of the total traffic, are traveling in the eastbound direction and 3,200 vehicles, or 40 percent, in the westbound direction. The trend is reversed during the evening peak hour, typically 4 to 5 PM, when approximately 5,500 vehicles, or 69 percent, cross the bridge in the westbound direction and 2,600 vehicles, or 31 percent, in the eastbound direction.

Commercial truck volumes on the Tappan Zee Bridge are approximately 5,000 trucks per day, or roughly 5 percent of the total traffic. Commercial traffic follows a more level profile with truck volumes building up as early as 5 AM, peaking around 10 AM or 11 AM at 380 trucks per hour, and slowly tapering off until 5 PM, when volumes drop to fewer than 200 trucks per hour. It is interesting to note how truck volumes decrease during the 6:00 AM to 9:00 AM time period, likely to avoid congestion due to the peak commuter period. The percentage of trucks as compared with total traffic ranges between 3 and 4 percent during the peak commuter hours, around 7 percent during the midday period, and greater than 20 percent during the late overnight hours. Hourly truck volumes for a typical weekday in fall 2010 are summarized in **Figure 4-3**.

Figure 4-1
Tappan Zee Bridge
Average Annual Daily Traffic Volumes



0 1 2 MILES

SCALE

Figure 4-2

Tappan Zee Bridge

2010 Average Weekday Traffic Volumes

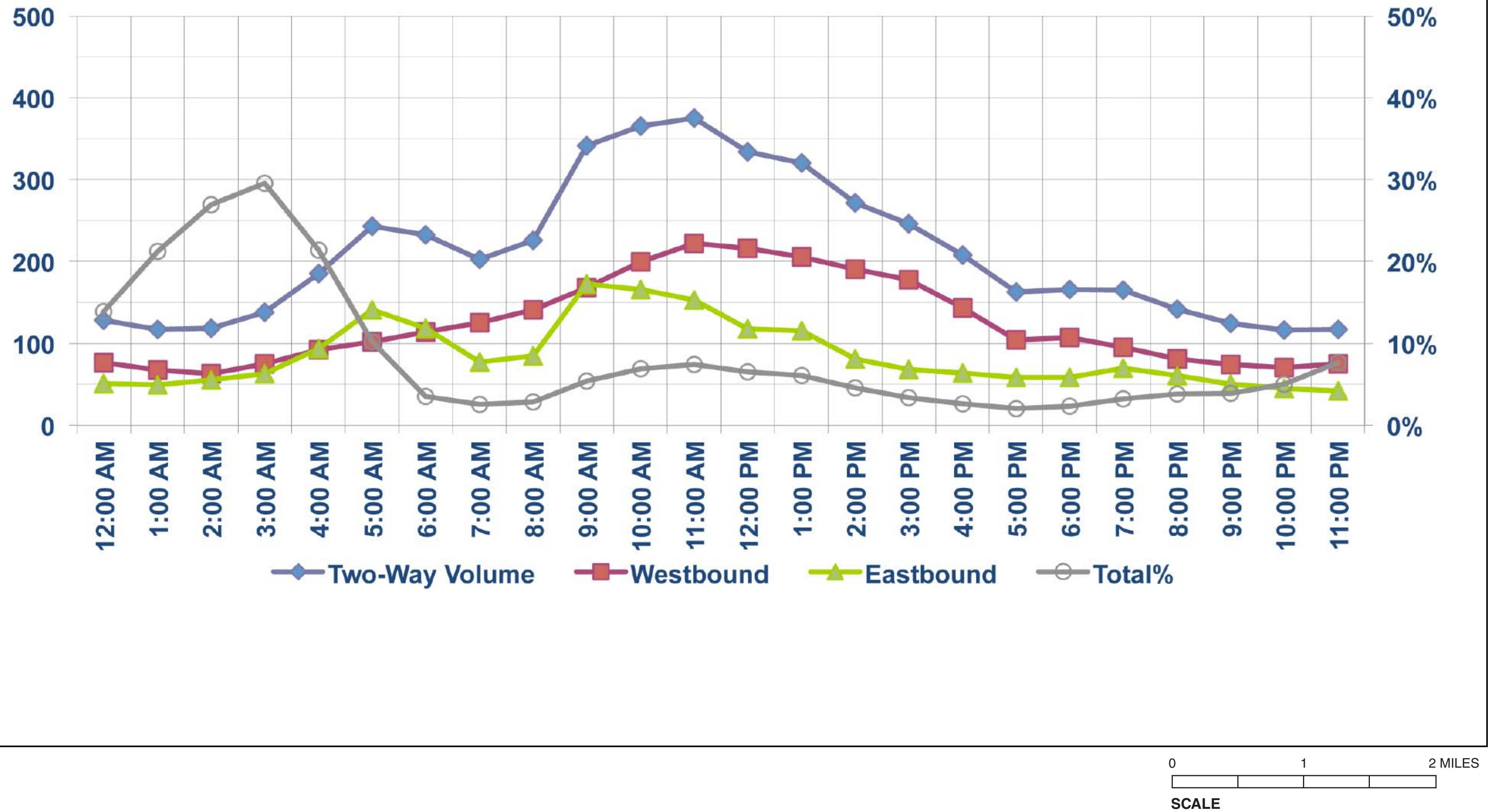


Figure 4-3

Tappan Zee Bridge
2011 Typical Weekday Truck Volumes

The Tappan Zee Bridge collects tolls in the eastbound direction at the toll barrier located in Tarrytown, Westchester County. The Tappan Zee toll barrier provides 10 collection lanes within the toll barrier itself, generally operating as 4 dedicated E-ZPass lanes and 6 cash or cash/E-ZPass lanes. The E-ZPass lanes within the toll barrier process up to 900 vehicles per hour (VPH) per lane, while the cash or cash/E-Z Pass lanes process roughly 250 VPH per lane. There are also two higher-speed E-ZPass lanes on the left-hand side of the barrier, which can process approximately 1,100 to 1,200 VPH per lane. The higher speed E-ZPass lanes post a speed limit of 35 miles per hour. NYSTA adjusts the mix of lanes in response to travel demand patterns, and not all lanes are generally open during off-peak periods. On the right hand side of the toll barrier, dedicated E-ZPass lanes are also available to serve patrons destined for Interchange 9 (Route 9), just to the east of the toll barrier.

In the weekday morning peak periods, the toll plaza generally handles the flow of traffic with minimum delay, given that nearly 90 percent of the drivers have an E-ZPass. The greater challenge is on weekends. Although traffic volumes are lower, E-ZPass usage is less than 60 percent. As such, weekend queues of cash-paying drivers block access to the E-ZPass lanes and occasionally queue back onto the bridge, creating traffic delays.

4-4-1-2 SAFETY AND ACCIDENT HISTORY

The following section describes the recent accident history for the Tappan Zee Bridge. Based on a review of this analysis, the following conclusions can be made:

- The study area exceeds the NYSDOT statewide average accident rate for comparable roadway segments for nearly all locations in the eastbound direction and most segments in the westbound direction (accident rate calculations are presented in **Appendix B-2**);
- The accident conditions include a high percentage of “property damage only” accidents with causes attributed to vehicles following too closely, which is characteristic of a high-volume congested corridor; and
- Two major accident clusters were identified on the Tappan Zee Bridge. In the westbound direction, the accident rate ranges from 2.8 to 3.7 times the average statewide accident rate between mileposts 13.7 and 14.2.
- In the eastbound direction, the accident rate is greater than 5.2 times the statewide average between mileposts 14.2 and 13.8. This highway segment is of interest because the bridge’s main span extends from milepost 13.8 to milepost 14.2. At the approaches to the man span, the roadway grade increase by more than 3 percent. This steep grade reduces sight distances as well as the speeds of trucks. At both approaches, impatient drivers behind slower moving trucks, aggressively attempt to pass and often find a lack of available gaps in traffic to execute the pass. This results in weaving movements that create a greater potential for conflicts and an increase in accidents. Other contributing factors include sun glare in the early morning and braking and weaving maneuvers as vehicles approach the toll plaza at milepost 13.07.

In the three-year period of analysis (2008 to 2010), a total of 464 and 784 accidents were reported in the westbound and eastbound directions, respectively. During this period, the Tappan Zee Bridge experienced an average of 155 and 261 accidents per year in the westbound and eastbound directions, respectively. The steep grade on the bridge, sun glare and weaving maneuvers appear to be the cause of the higher rate for eastbound vehicles.

Overall accident severity is categorized as being one of four classifications:

- Fatality—any accident that result in a fatality;
- Personal Injury)—any accident that result in injuries of any type except for a fatality;
- Property Damage Only—any accident resulting in damages exceeding a threshold value of $1,000 and no injuries or fatalities; and
- Non-reportable—any accident that caused less than $1,000 of property damage and no injuries or fatalities.

In the eastbound direction, 593 accidents (76 percent) of the 784 reported involved property damage only and 177 accidents (22 percent) involved personal injuries. The remaining 2 percent were unidentified. Of the 464 accidents reported in the westbound direction, 372 accidents (80 percent) involved property damage only, and 79 accidents (17 percent) involved personal injuries. The remaining 3 percent were unidentified. No fatalities were reported during this period.

Accident conditions such as weather, light, and road surface conditions were investigated for each accident to determine apparent contributing factors.

- **Weather Conditions.** In the eastbound direction, of the total 784 accidents reported 479 accidents (61 percent) were reported under clear weather conditions and 198 accidents (25 percent) were reported under cloudy conditions. The remaining 107 accidents (14 percent) were reported during fog, rain, snow, or other precipitation. Of the total 464 accidents reported in the westbound direction, 315 accidents (68 percent), were reported under clear weather conditions and 109 accidents (24 percent) were reported under cloudy conditions. The remaining 40 accidents (9 percent) were reported during fog, rain, snow, or other precipitation.
- **Light Conditions.** In the eastbound direction, of the total 784 accidents reported 622 accidents, or 79 percent, were reported during daylight hours and 92 accidents, or 12 percent, were reported in darkness with the roadway lighted. The remaining 70 accidents, or 9 percent, were reported during dusk, dawn, or other conditions. Of the total 464 accidents reported in the westbound direction, 346 accidents, or 75 percent, were reported during daylight hours and 87 accidents, or 19 percent, were reported in darkness with the roadway lighted. The remaining 31 accidents, or 6 percent, were reported during dusk, dawn, or other conditions. A contributing factor that is difficult to quantify but often experienced by motorists is limited visibility on the bridge due to sun glare during the early morning hours in the eastbound direction.
- **Road Surface Conditions.** Of the total 464 accidents reported in the westbound direction, 410 accidents, or 88 percent, were reported under dry roadway conditions and 52 accidents, or 11 percent, were reported on wet roadway conditions. The remaining 2 accidents, or 1 percent, were reported during snow, ice, slush, or other road surface conditions. In the westbound direction, of the total 784 accidents

reported 641 accidents, or 82 percent, were reported under dry roadway conditions and 133 accidents, or 17 percent, were reported on wet roadway conditions. The remaining 10 accidents, or 1 percent, were reported during snow, ice, slush, or other road surface conditions.

Accident rates vary greatly depending on the type of facility, and among similar facilities depending on factors like traffic congestion, local road use patterns, and terrain/ roadway characteristics. For a highway section, the accident rate calculated as the number of accidents divided by the product of traffic volume (in millions of vehicles per year) times the section length (in miles), or accidents per million vehicle miles (accidents per million-vehicle-miles). The accident rates were calculated based on the designated mileposts by direction in 3/10-mile increments, as each designated milepost is spaced 1/10-mile apart. The accident rate is a statistically meaningful index in the context of accident analysis.

The accident rates for several roadway segments on the Tappan Zee Bridge substantially exceed the NYSDOT statewide average rate for comparable highway segments. A comparison of the Tappan Zee Bridge accident rates for total accidents with the NYSDOT average for comparable highways is presented in the **Table 4-1**.

Over 85 percent of all accidents experienced on the Tappan Zee Bridge can be classified within the following causes:

- Rear-end: Vehicle following too closely (52 percent);
- Overtaking: Unsafe lane change or lane use and/or unsafe speed (22 percent); and
- Obstruction and/or debris in roadway (13 percent).

Typically, rear-end accidents result from vehicles following too closely and inattention. Overtaking accidents can result from unsafe lane changes and speeding. These accident causes are typical in congested environments, often involve nonstandard geometric design, and result in frequent traffic delays.

It is important to note that the discussion to this point has been limited to an analysis of accident data. The accident records do not include non-reportable accidents and only capture accidents involving significant property damage (sufficient to warrant a police report) and/or personal injury. These data represent only a minor percent of the overall number of roadway “traffic incidents” that contribute to congestion and frequent user delay experienced on the Tappan Zee Bridge (see **Figure 4-4**).

Traffic incidents are defined by the Federal Highway Administration as nonrecurring events that cause a reduction of roadway capacity or an abnormal increase in demand. Accidents are a subclass of traffic incidents, and studies have estimated that they consist of approximately 10 to 20 percent of the total traffic incidents experienced by drivers. Other subclasses of traffic incidents include: disabled vehicles or breakdowns; truck overturns or spills; lane closures; rubbernecking; special events; severe weather conditions; roadway maintenance; and non-reportable accidents (those resulting in less than $1,000 in damage and/or a motor accident report is not filed).

Of all the subclasses of traffic incidents, disabled vehicles are estimated to occur in the greatest frequency and consist of approximately 60 to 80 percent of all traffic incidents.

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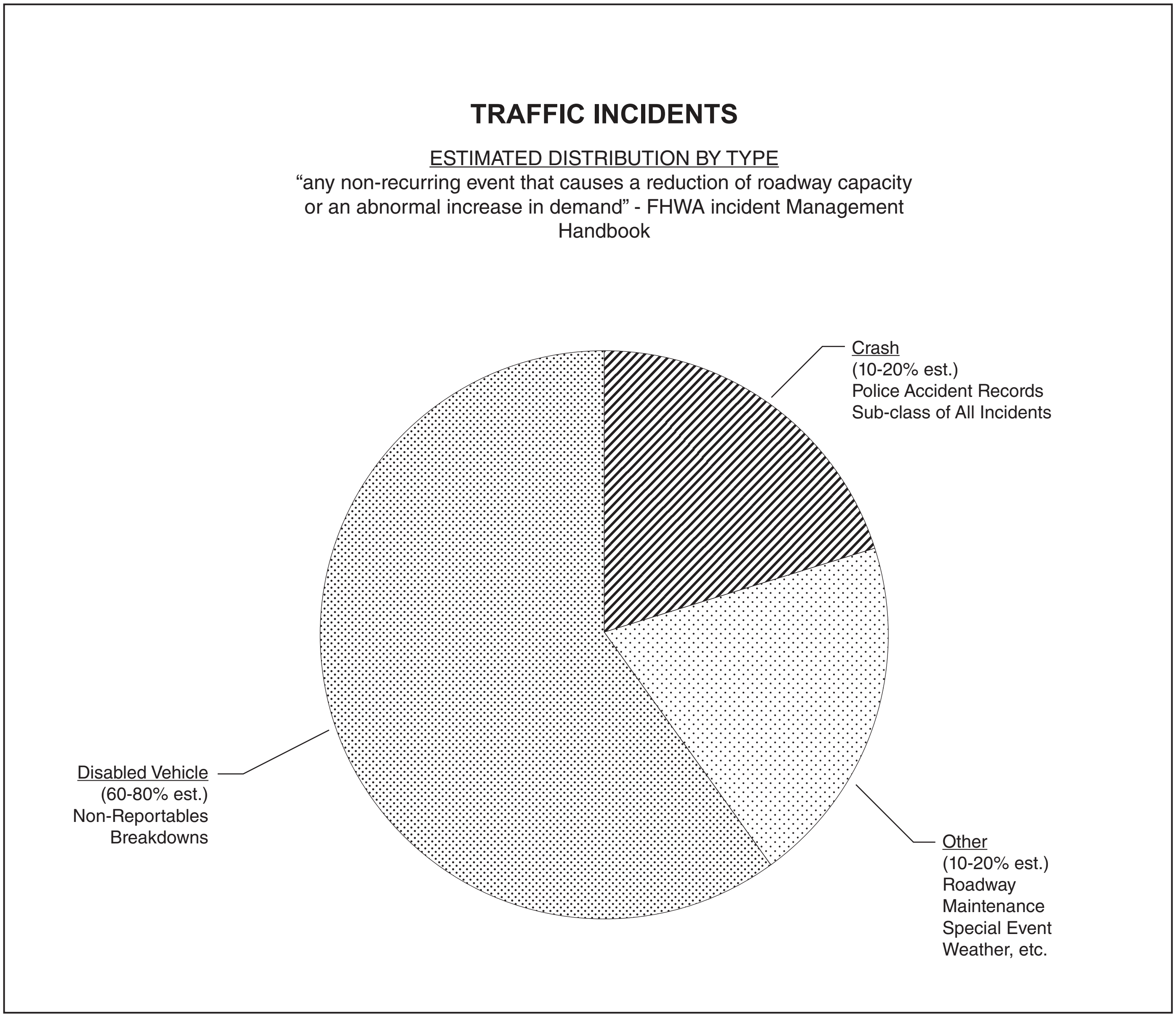

Figure 4-4
Traffic Incidents

Table 4-1
Accident Rates for the Tappan Zee Bridge and New York State (2008 to 2010)

Westbound						Eastbound					
MP	MP	Total Accidents	TZB Rate (acc/1 M VM)	NYS Rate (acc/1 M VM)	Ratio (TZB / NYS)	MP	MP	Total Accidents	TZB Rate (acc/1 M VM)	NYS Rate (acc/1 M VM)	Ratio (TZB / NYS)
12.9	13.1	91	4.15	1.16	3.58	16.6	16.4	93	4.24	1.16	3.66
13.0	13.2	67	3.06	1.16	2.63	16.5	16.3	99	4.51	1.16	3.89
13.1	13.3	34	1.55	1.16	1.34	16.4	16.2	82	3.74	1.16	3.22
13.2	13.4	20	0.91	1.16	0.79	16.3	16.1	72	3.28	1.16	2.83
13.3	13.5	25	1.14	1.16	0.98	16.2	16.0	67	3.06	1.16	2.63
13.4	13.6	29	1.32	1.16	1.14	16.1	15.9	47	2.14	1.16	1.85
13.5	13.7	25	1.14	1.16	0.98	16.0	15.8	30	1.37	1.16	1.18
13.6	13.8	24	1.09	1.16	0.94	15.9	15.7	20	0.91	1.16	0.79
13.7	13.9	47	2.14	1.16	1.85	15.8	15.6	11	0.50	1.16	0.43
13.8	14.0	95	4.33	1.16	3.73	15.7	15.5	21	0.96	1.16	0.83
13.9	14.1	93	4.24	1.16	3.66	15.6	15.4	26	1.19	1.16	1.02
14.0	14.2	72	3.28	1.16	2.83	15.5	15.3	38	1.73	1.16	1.49
14.1	14.3	23	1.05	1.16	0.90	15.4	15.2	35	1.60	1.16	1.38
14.2	14.4	16	0.73	1.16	0.63	15.3	15.1	34	1.55	1.16	1.34
14.3	14.5	26	1.19	1.16	1.02	15.2	15.0	55	2.51	1.16	2.16
14.4	14.6	34	1.55	1.16	1.34	15.1	14.9	56	2.55	1.16	2.20
14.5	14.7	40	1.82	1.16	1.57	15.0	14.8	54	2.46	1.16	2.12
14.6	14.8	26	1.19	1.16	1.02	14.9	14.7	32	1.46	1.16	1.26
14.7	14.9	19	0.87	1.16	0.75	14.8	14.6	40	1.82	1.16	1.57
14.8	15.0	44	2.01	1.16	1.73	14.7	14.5	80	3.65	1.16	3.14
14.9	15.1	43	1.96	1.16	1.69	14.6	14.4	84	3.83	1.16	3.30
15.0	15.2	44	2.01	1.16	1.73	14.5	14.3	85	3.88	1.16	3.34
15.1	15.3	14	0.64	1.16	0.55	14.4	14.2	61	2.79	1.16	2.40
15.2	15.4	19	0.87	1.16	0.75	14.3	14.1	69	3.15	1.16	2.71
15.3	15.5	25	1.14	1.16	0.98	14.2	14.0	132	6.02	1.16	5.19
15.4	15.6	26	1.19	1.16	1.02	14.1	13.9	145	6.61	1.16	5.70
15.5	15.7	25	1.14	1.16	0.98	14.0	13.8	146	6.66	1.16	5.74
15.6	15.8	18	0.82	1.16	0.71	13.9	13.7	109	4.97	1.16	4.28
15.7	15.9	18	0.82	1.16	0.71	13.8	13.6	102	4.65	1.16	4.01
15.8	16.0	29	1.32	1.16	1.14	13.7	13.5	99	4.51	1.16	3.89
15.9	16.1	32	1.46	1.16	1.26	13.6	13.4	64	2.92	1.16	2.52
16.0	16.2	38	1.73	1.16	1.49	13.5	13.3	46	2.10	1.16	1.81
16.1	16.3	26	1.19	1.16	1.02	13.4	13.2	40	1.82	1.16	1.57
16.2	16.4	29	1.32	1.16	1.14	13.3	13.1	47	2.14	1.16	1.85
16.3	16.5	21	0.96	1.16	0.83						
16.4	16.6	19	0.87	1.16	0.75						

Notes: Shading indicates limits of the bridge's main span (mileposts 13.8 to 14.2).
MP = milepost
acc/1M = Accidents per 1,000,000 vehicle miles of travel

Analysis was conducted to determine the frequency of traffic incidents that occur during the peak travel time periods on the Tappan Zee Bridge. Accident data were summarized by day of week and time of day for each of the three years studied (see **Table 4-2**). To account for the potentially extensive delays that incidents and accidents can cause during peak travel times, this accident analysis considered two-hour peak periods. The peak travel time periods for this accident analysis were identified as weekdays from 7 AM to 9 AM in the eastbound direction and 4 PM to 6 PM in the westbound direction.

Table 4-2
Traffic Incident Frequency of Occurence on the Tappan Zee Bridge

	Eastbound Direction AM Commuter Peak			Westbound Direction PM Commuter Peak		
Year	AM Peak Period Accidents	Estimated Total Traffic Incidents	Average Frequency of Occurrence	PM Peak Periods Accidents	Estimated Total Traffic Incidents	Average Frequency of Occurrence
2008	59	177	1 per 1.5 days	32	96	1 per 2.7 days
2009	54	162	1 per 1.6 days	32	96	1 per 2.7 days
2010	40	120	1 per 2.2 days	33	99	1 per 2.6 days

Notes:
(1) The AM commuter peak in is identified as 7 to 9 AM in the eastbound direction.
(2) The PM commuter peak is identified as 3 to 5 PM in the westbound direction.
(3) It is assumed accidents comprise approximately 33 percent of all traffic incidents (a more conservative estimate than the FHA study which identified a 10 to 20 percent range).
(4) The frequency of occurrence assumes the average number of traffic incidents experienced over 260 days (52 weeks x 5 work days).

A summary of the accident data is provided as follows for the peak travel times:

- In the eastbound direction, a total of 59 accidents in 2008, 54 in 2009, and 40 accidents in 2010 were reported on weekdays between 7 AM and 9 AM, resulting in an average of one incident or accident every 2 days during the morning peak commuter period.
- In the westbound direction, a total of 32 accidents in 2008 and 2009 and 33 accidents in 2010 were reported on weekdays between 3 PM and 5 PM. Once again, assuming 260 weekdays per year, resulting in an average of one incident or accident every 2 to 3 days during the evening peak commuter period.

These findings demonstrate the magnitude and extent that accidents and incidents contribute to reduced throughput and routine delays for drivers on the Tappan Zee Bridge during the peak commuter periods.

4-4-2 MARINE TRANSPORT

The Hudson River is navigable from the New York Harbor to north of Albany and serves both recreational and commercial boaters. At the Tappan Zee Bridge, the existing shipping channel is 600 feet wide with a vertical clearance of 139 feet at mean high water. The bridge provides a clear span of 1,000 feet over the shipping channel to give adequate buffer between its piers and fenders and the navigation route.

Smaller vessels (i.e., smaller commercial craft, sailboats, power boats, and kayaks) can use the backspan channels beneath the Tappan Zee Bridge approaches to navigate this crossing. The backspan channels are adjacent to the shipping channel and provide for 480 feet of horizontal clearance and 123 feet of vertical clearance.

Between 2000 and 2008, annual vessel traffic under the Tappan Zee Bridge ranged from 8,000 to 16,000 vessel movements per year (excluding small recreational boats, as no data are available). **Table 4-3** provides a description of some of the larger vessels that travel along the Hudson River shipping channel, as reported by Hudson River Pilots, who operate many of these vessels. These data are based on vessel movements recorded between January 2005 and October 2006.

Table 4-3
Ship and Barge Movements on the Hudson River

Displacement (tons)	# of Ships	# of Barges*	Length Min/Max (feet)	Beam Min/Max (feet)	Draft Min/Max (feet)	Air Draft Min/Max (feet)
0-10,000	46		3,00/400	40/70	15/20	60/150
10,001-20,000	132	20	120,/565	64/75	15/27	100/120
20,001-40,000	248	57	500/600	75/90	16/31	111/140
40,001-60,000	233		600/730	76/106	21/33	117/140
60,001-80,000	9		623/811	100/106	21/33	129/140
80,000+	8		735/805	106/137	27/33	129/140

Notes: *This table only reflects the number of vessels operated by Hudson River Pilots. Total barge movements are estimated to be approximately 2,800-3,000 per year.
Sources: Hudson River Pilots, Jan. 2005 – Oct. 2006

Materials shipped via the Hudson River vary from construction materials to oil. The majority of imports passing through the Port of Albany (approximately 95 percent) comprise oil. Cargo typically exported from Albany includes grain, scrap metal, project cargo (e.g., industrial cargo from General Electric in Schenectady), heavy lift cargo, and cement. Several other marine terminals are located in the Hudson River Valley, including Newburgh, which supports marine terminals that accommodate oil barges; and Yonkers, in which Refined Sugars operates a marine terminal.[1]

The Hudson River is also used by sail boaters, power boaters, and other personal water craft users for recreational purposes. The crossing is also within the Hudson River Greenway Water Trail (see Chapter 7, “Parklands and Recreational Resources”).

4-4-3 TRANSIT

Two bus lines use the Tappan Zee Bridge:

- TZ Express is managed by the Rockland County Department of Public Transportation, and operates seven days a week between Suffern and White Plains, with direct connections to the Tarrytown Metro-North Railroad (MNR) Station.

[1] Personal communication with Hudson River Pilots, December 6, 2006.

- Orange-Westchester Link (OWL) is managed by Coach USA Short Lines and operates seven days a week between Middletown in Orange County, through Rockland County and across the Tappan Zee Bridge to White Plains.

The Bee Line system of Westchester County operates three routes through the study area: 1T (The Bronx to Tarrytown); 1W (The Bronx to White Plains); and 13 (Ossining-Tarrytown-Port Chester). Routes 1W and 13 travel on Interstate 87/287 east of Interchange 9 (Route 9).

Transport of Rockland operates two routes through the study area in Nyack: Route 91 and Route 92. These routes do not travel on Interstate 87/287.

The MNR Hudson Line operates along the Hudson River in Westchester County. Trains serve the Tarrytown Station within the study area on their route between Poughkeepsie and Grand Central Terminal in New York City.

4-4-4 BICYCLES AND PEDESTRIANS

In Rockland County, the closest bicycle and pedestrian trail is the Raymond G. Esposito Memorial Trail in South Nyack. In Westchester County, the Old Croton Aqueduct State Trailway runs along the Old Croton Aqueduct from Croton Dam Road in Cortlandt to Yonkers. It diverges onto roads in several locations, including at the Interstate 87/287 overpass in Tarrytown. In addition, the Westchester RiverWalk runs along portions of the Hudson River from New York City to the Bear Mountain Bridge. A segment of this trail is planned to cross underneath the Tappan Zee Bridge in Tarrytown.

Pedestrians and cyclists are not permitted on interstate highways without special accommodations, and therefore, are prohibited on the Tappan Zee Bridge. The nearest Hudson River crossings for cyclists and pedestrians are the George Washington Bridge, 15 miles to the south, and the Bear Mountain Bridge, 18 miles to the north.

4-5 ENVIRONMENTAL EFFECTS

4-5-1 NO BUILD ALTERNATIVE

4-5-1-1 TRAFFIC

For the traffic analysis, the No Build Alternative is assessed for the project’s completion year 2017 (ETC) and for a long-term, horizon year 2047 (ETC+30). Under the No Build Alternative, the Tappan Zee Bridge would retain its current, seven-lane configuration. NYSTA estimates that it would spend $1.3 billion to maintain and repair the bridge over the next decade. Major work activities would include seismic upgrades to portions of the bridge, navigational safety improvements, steel and concrete repairs, and other miscellaneous work to continue to keep the bridge safe for the traveling public.

The background transportation network assumed to be in place for 2017 and 2047 also reflects transportation improvements included within NYMTC’s Fiscal Year 2008-2012 Transportation Improvement Program (TIP). These improvements include signal timing modifications in the Town of Orangetown (Rockland County) and the Village of Tarrytown (Westchester County) as well as reconstruction of Route 9/Route 119 (Executive Boulevard) as a four-lane divided roadway with left-turn bays and new sidewalks. These projects would improve conditions on local roadways but would have limited, if any, effect on the operations of the Tappan Zee Bridge.

By 2017, NYSDOT will complete its improvements on the Cross Westchester Expressway (Interstate 287) in Westchester County. These improvements include reconstruction of Interchange 7 (Central Westchester Parkway), including a westbound frontage road, an eastbound auxiliary lane between the Central Westchester Parkway and Interchange 8W (Westchester Avenue/Route 119), the already completed reconstruction of Interchange 8 (Westchester Avenue/Route 119), and the addition and removal of various bridges along the corridor. Pavement, signage, and lighting upgrading; installation of a concrete center median; shoulder-lane widening; and drainage upgrades are also scheduled. These improvements were included as part of the No Build Alternative because of their potential to increase the traffic demand on the bridge in the westbound direction and improve the processing ability of the highway network in the eastbound direction after traffic departs the Tappan Zee toll barrier.

Future traffic volumes for the No Build and Replacement Bridge Alternatives are a function of the regional travel demand and the highway network that support the Tappan Zee crossing in Rockland and Westchester Counties. Using the BPM projections and the Paramics microsimulation analysis, the future traffic demand was identified for the Tappan Zee Bridge. There were two important findings of this analysis:

- The unconstrained maximum capacity of the Tappan Zee Bridge in the No Build Alternative is approximately 8,000 vehicles per hour in the peak direction and 6,000 vehicles per hour in the off-peak direction (2,000 vehicles per lane); and
- Demand on the Tappan Zee Bridge would not reach capacity under the 2047 No Build Alternative because of the capacity constraints on the adjacent highway segments, including the reduction from four to three lanes and steep grades in Rockland County and merges and weaving associated with entering and exiting vehicles in Westchester County. These adjacent highway segments in Rockland and Westchester Counties have a maximum capacity that is less than that of the Tappan Zee Bridge, and the capacities of these adjacent roadways would be reached before 2047. As a result, traffic on the Tappan Zee Bridge would be controlled by the more limited processing capacity of the adjacent highway segments. Any improvements to address these constraints are not foreseeable at this time, and their implementation would require a separate and independent environmental review process when and if they are identified and financing is available.

Table 4-4 presents the projected peak hour (8AM to 9AM and 4PM to 5PM) traffic volumes to the Tappan Zee Bridge. As shown, total traffic volumes (in both directions) for the weekday AM peak hour are projected to increase from 11,050 vehicles in 2005, to 11,657 vehicles in 2017, and to 12,909 vehicles in 2047. This reflects an average annual growth rate of 0.8 percent between 2005 and 2017 and 0.3 percent from 2017 to 2047. Similar traffic growth is projected in for the weekday PM peak hour. Total traffic volumes for the weekday PM peak hour are projected to increase from 9,810 vehicles in 2005, to 11,753 vehicles in 2017, and 12,672 vehicles in 2047. This reflects an average annual growth rate of 2.6 percent between 2005 and 2017 and 0.3 percent from 2017 to 2047. The 2005 data was utilized for this comparison because it served as the baseline condition for the traffic analysis. Recent traffic data on the bridge reflects the recovery from the recent economic downturn and are lower than the 2005 volumes. As noted above, the 7-lane bridge would have adequate capacity to meet this future demand.

The volumes presented in **Table 4-4** are a measure of the projected throughput of the bridge and take into consideration the capacity of the bridge and the capacity constraints of the highway segments at the approach to and departure from the bridge. For example, **Table 4-4** identifies no growth (or slightly negative growth) for the PM peak hour in the westbound direction between 2017 and 2047. This negative growth rate results from the highway capacity constraint in Rockland County (i.e., steep grades and the reduction in travel lanes west of Interchange 11). Because the adjacent highway segments would reach capacity by 2047, motorists in this corridor would either seek alternative routes of travel or would travel at times outside of the peak hour (i.e., preceding and following peak hours). The result would be increased congestion on the alternative roadways and higher traffic volumes on the Tappan Zee Bridge during more hours of the day.

The No Build Alternative would not correct nonstandard highway features of the Tappan Zee Bridge. The bridge would continue to operate with a movable median barrier and no shoulders, and therefore, there would be no improvements in incident and accident management and response as compared to existing conditions. At the same time, traffic volumes would grow and are likely to result in an increase in the number of incidents and accidents on the bridge. With more incidents and accidents and no improvement in the means to respond to them, the frequency and severity of traffic delays across the bridge would grow in the No Build Alternative.

Table 4-4
Projected Peak Hour Traffic Volumes and Average Annual Growth Rates for the Tappan Zee Bridge

Peak Hour/ Direction	Capacity (vehicles per hour)	2005	2017 (ETC)	Annual Growth 2010-2017	2047 (ETC+30)	Annual Growth 2017-2047
AM Peak Hour						
Eastbound	8,000	7,380	7,402	0.1%	7,668	0.1%
Westbound	6,000	3,670	4,255	2.1%	5,241	0.7%
Total	14,000	11,050	11,657	0.8%	12,909	0.3%
PM Peak Hour						
Eastbound	6,000	3,800	4,664	3.0%	5,753	0.7%
Westbound	8,000	6,010	7,089	2.4%	6,919	-0.1%
Total	14,000	9,810	11,753	2.6%	12,672	0.3%

Notes:

The capacity data reflects a maximum flow rate of 2,000 vehicles per lane per hour (during the AM peak this reflects four lanes in the eastbound direction and 3 lanes in the westbound direction and the reverse configuration in the PM peak hour).

The Year 2005 volumes represent actual traffic volume counts conducted on the bridge as part of the original data collection effort. It should be noted current volumes on the bridge reflect the recovery from the recent economic downturn and are lower than the 2005 volumes.

The Year 2017 (ETC) and 2047 (ETC+30) peak hour volume represents forecasted volumes.

4-5-1-2 MARINE TRANSPORT

The No Build Alternative would not alter the vertical or horizontal clearance of the shipping or side channels at the Tappan Zee Bridge. Therefore, it would not impact marine transport on the Hudson River.

4-5-1-3 TRANSIT

There are two projects listed in NYMTC's 2008-2012 TIP that may increase bus service across the Tappan Zee Bridge. The Rockland County Department of Transportation is studying an expansion of the Tappan Zee Express system, which may result in higher frequencies on existing routes as well as new routes between Rockland County and points east via the Tappan Zee Bridge. NYSDOT is study new Orange-Westchester Link (OWL) bus service between Route 17 (I-86) and Westchester County with connections to other services (Tappan Zee Express, I-bus & local service).

These new or expanded services would increase transit ridership across the Tappan Zee Bridge. These buses would use general traffic lanes and be subject to the same safety and mobility constraints as private vehicles and trucks.

4-5-1-4 BICYCLES AND PEDESTRIANS

The 2008-2012 TIP includes a project to establish one mile of trail to link the Lyndhurst and Sunnyside historic sites in the Town of Greenburgh, Westchester County. While there would continue to be a system of trails on both sides of the Hudson River, pedestrian and bicycle access would continue to be prohibited on the Tappan Zee Bridge.

4-5-2 REPLACEMENT BRIDGE ALTERNATIVE

4-5-2-1 TRAFFIC

The traffic growth projections for the Replacement Bridge Alternative are the same as for the No Build Alternative. Both design options for the Replacement Bridge Alternative would provide the same highway elements in terms of the number of lanes (eight total lanes) and their design, including shoulders, lane widths, medians, and grade. As such, the replacement bridge's traffic-carrying capacity would be identical under the Short Span and Long Span Options.

The Replacement Bridge Alternative would expand the cross section of the bridge from seven lanes to eight lanes, making an additional lane available to support traffic flow in the off-peak direction. The transportation analysis, using output from the BPM and Paramics models, forecasted the vehicle volumes and analyzed the impacts of adding an additional lane in the off-peak direction.

As described in Section 4-5-1 above, a seven-lane bridge (four lanes in the peak direction and three lanes in the off-peak direction) would have adequate capacity to meet demand in both 2017 and 2047. As there would be no change in volume between no build and build conditions, the eight-lane Replacement Bridge Alternative would also have adequate capacity to meet demand.

As stated in Section 4-5-1 above, future volumes on the bridge are controlled by the constrained highway network in Rockland and Westchester Counties (i.e., lane reductions and grades in Rockland County and weaving and merging at interchanges in

Westchester County) and not the throughput of the bridge itself. The Replacement Bridge Alternative would not alter the highway features that constrain the bridge's capacity for growth. Thus, the addition of a travel lane on the bridge would not induce vehicle trips along this corridor, and the capacity of the adjacent highway segments in Rockland and Westchester Counties would continue to control volumes on the bridge. (**Appendix B** provides further information regarding the modeling and analysis of 2017 and 2047 no build and build conditions at the Tappan Zee Hudson River crossing.)

The Replacement Bridge Alternative would provide a number of enhancements over the No Build Alternative, including left and right shoulders, 12-foot travel lanes, reductions in grade, and highway speed E-ZPass lanes. With the provision of left and right shoulders, drivers would have more decision space and could use the shoulders to exit the general traffic lanes for incidents (e.g., flat tire) and accidents. The availability of an extra-wide, inside shoulder would provide dedicated access for emergency vehicles and would substantially reduce the response time for police, fire, and NYSTA Roadside Assistance. The relatively steep grade on the existing bridge would be reduced with the Replacement Bridge Alternative, which would improve sight distances and consistency of speed between passenger cars and commercial vehicles. These measures, along with pavement, signage, and lighting improvements would reduce the accident rates identified above as well as the time to respond to and address accidents and incidents. The Replacement Bridge Alternative's improvements in the ability to avoid and respond to incidents and accidents would reduce delays for motorists. The Replacement Bridge Alternative would change the two, higher-speed E-ZPass lanes at the Tappan Zee toll barrier to three highway-speed E-ZPass lanes. The highway speed lanes would improve speeds and reduce delays through the toll plaza for E-ZPass users.

Overall, the Replacement Bridge Alternative would not result in adverse impacts on vehicular traffic.

4-5-2-2 MARINE TRANSPORT

Both approach span (Long Span and Short Span) and main span options (Arch and Cable-stayed) for the Replacement Bridge Alternative would maintain the 600-foot-wide shipping channel with a vertical clearance of at least 139 feet at mean high water. As with the existing bridge, both options for the Replacement Bridge Alternative would provide approximately 1,042 feet of horizontal clearance over the river to give adequate buffer space between the piers and fenders and the shipping channel.

With the Long Span Option, the backspan channels would provide a horizontal clearance of 380 feet and a vertical clearance of 123 feet. With the Short Span Option, the backspan channels would provide a horizontal clearance of 180 feet and a vertical clearance of 123 feet.

The Replacement Bridge Alternative's horizontal and vertical clearance of the shipping channel would be the same as today, the backspan channels would be narrower. The backspan channels would continue to serve recreational and commercial vessels, but some larger boats may need to use the main shipping channel to traverse the bridge. Overall, the clearances of the new bridge would accommodate the same dimensions of vessels that cross beneath the existing Tappan Zee Bridge, and the Replacement Bridge Alternative would not adversely impact maritime transport.

4-5-2-3 TRANSIT

As described above, the Replacement Bridge Alternative would correct nonstandard features of the existing Tappan Zee Hudson River crossing and would substantially enhance incident management, responses to accidents, and resultant vehicle delays. The bus services that use the Tappan Zee Bridge would benefit from these safety and operational improvements. At the same time, the Replacement Bridge Alternative would not preclude future bus rapid transit or commuter rail service at the Tappan Zee Hudson River crossing, but such a proposal would be subject to a separate environmental review and approval process at the time that it is foreseeable and financing is available (see Chapter 2, "Project Alternatives," and **Appendix A**). Therefore, the Replacement Bridge Alternative would not adversely impact transit services.

4-5-2-4 PEDESTRIANS AND CYCLISTS

A shared-use (bicycle and pedestrian) path would be provided along the northern edge of the Replacement Bridge Alternative's north structure. In Rockland County, the shared-use path would connect to the Esposito Trail via the South Broadway Bridge in South Nyack. In Westchester County, the shared-use path would be connected to Route 9 (South Broadway). The shared-use path would increase the public's access to trail systems and bicycle routes on both sides of the Hudson River and would substantially enhance mobility of cyclists and pedestrians. Therefore, the Replacement Bridge Alternative would not adversely impact pedestrian or bicycle circulation.

4-6 MITIGATION

The Replacement Bridge Alternative would not result in adverse impacts on vehicular traffic, marine transport, transit services, or pedestrian and bicycle circulation. Therefore, no mitigation measures are required.