

Appendix B: Transportation

B-10 Toll Plaza Analysis

TRAFFIC-DESIGN STUDIES TZB TOLL PLAZA ANALYSES STUDY ASSUMPTIONS

Study Goal:

- Provide assessment of current design concept for toll plaza operations under HOV/HOT (H/H) lane and busway alternatives.
- Based on modeling results, define potential design or operational adjustments to address identified problems.

Study Process

- Base on present BODR Design with and Without H/H lane.
- Utilize focused Paramics model (from Interchange 12 to Interchange 8).
- Run for 2017 and test growth cases (+10% and 5% increments up to 25%) to assess potential weak points in design.
- H/H lane option assesses operations with and without overpass connection from EB H/H lane to Ex. 9.

Key Assumptions for Toll Plaza and H/H Lane Design and Operation

- **Bridge lanes approaching the plaza:** 4 EB bridge lanes separate into 2 lanes leading to 3 High Speed EZPass and 2 lanes heading to the EZPass/Cash toll plaza.
- **Total EB demand volume in 2017 (peak AM hour):** 7,400 vph in AM peak hour
- **Restrictions on Access to Exit 9:**
 - Vehicles using the high-speed EZPass lanes cannot use Exit 9 – must use the toll plaza lanes.
 - Two options for H/H lane users:
 - flyover ramp provides connection from H/H lane to Exit 9; and
 - no ramp connection – same options as high-speed EZPass lane users.
- **AM Peak EZPass usage:** 88%.
- **Toll Plaza Configuration:** 7 lanes:
 - 4 cash – 300 vph/lane = 1,200 vph capacity (optimal);
 - 3 EZPass – 900 vph/lane = 2,700 vph capacity (optimal);
 - 2 right-hand lanes in toll plaza principally used by those destined for Exit 9.
- **High Speed EZPass:** 3 lanes
 - Max. capacity of 1,800 vph/lane – potential of 5,400 vph (optimal);
 - 2-lane entrance to high-speed lanes limits capacity to ~ 3,600 vph (optimal);
 - Speed set at 55 mph (current speed is 35mph).

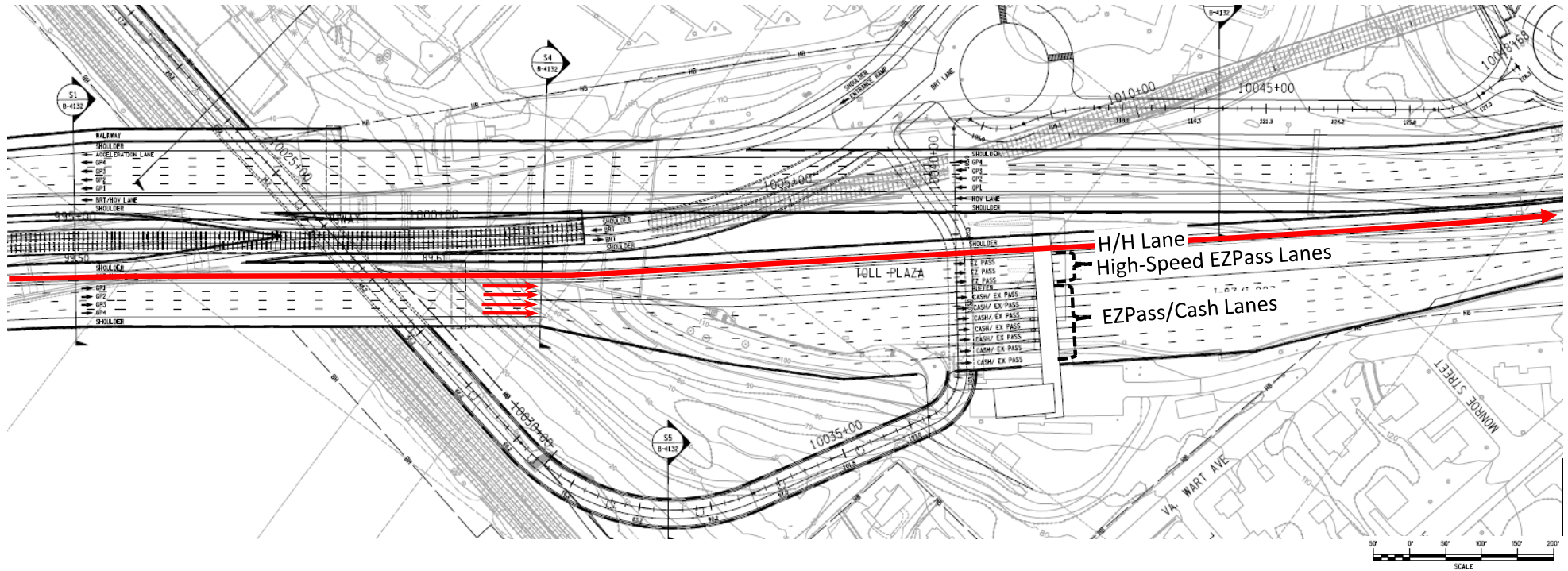
H/H Lane Design/Operating Assumptions

- **H/H lane Capacity:** 1,500 vph through the toll plaza, posted at 65 mph but and remain at 45+ mph+ speeds through toll plaza area.
- **Source of H/H Lane vehicles:**
 - ~ 400 EZPass using Exit 9 (*assuming overpass connection*);
 - ~1,100 EZPass from the High-Speed Lanes.
- **High Speed Lanes:** test with 2-lane entrance constraint – 3,600 vph capacity (optimal).

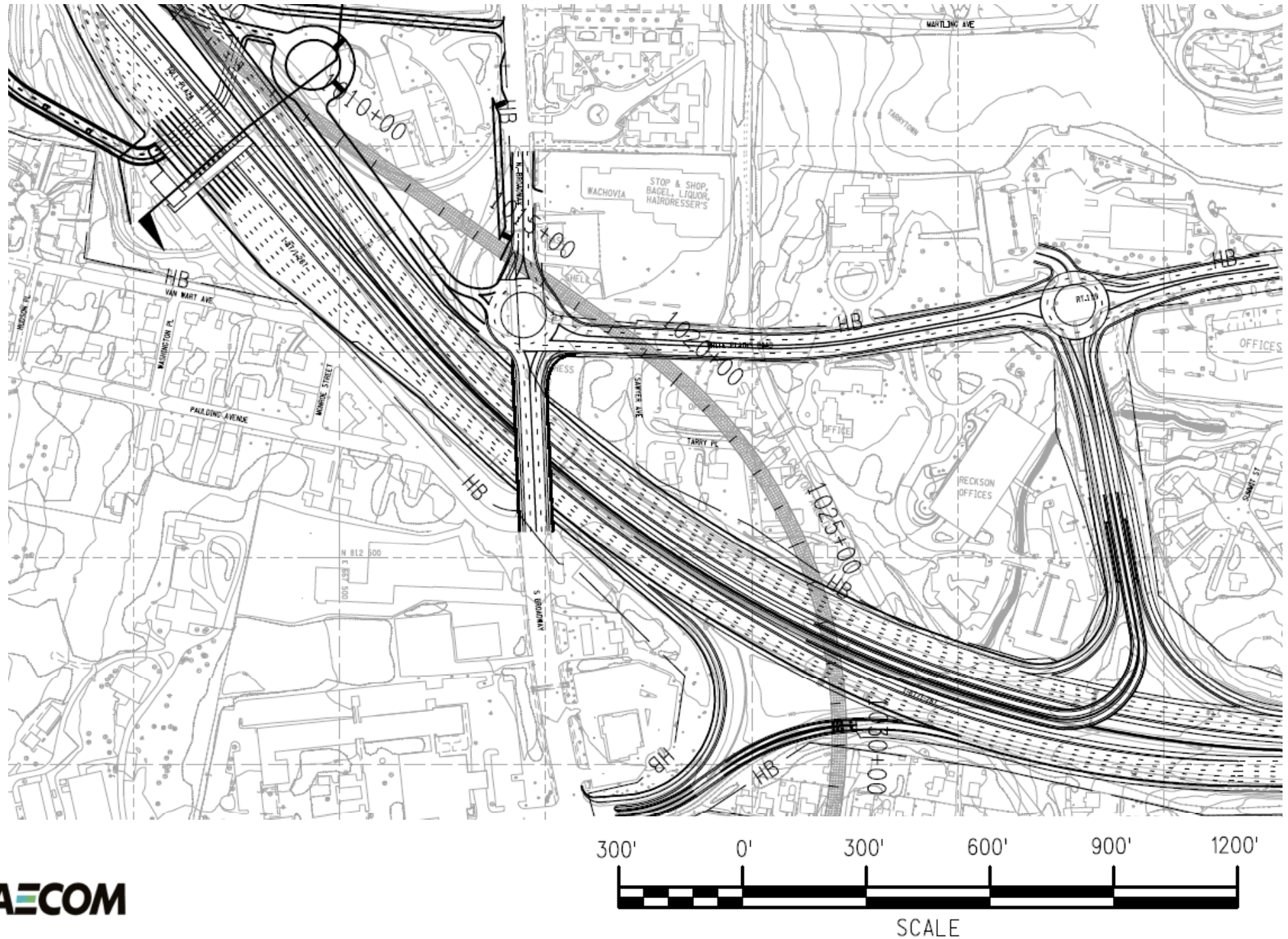
Initial Analysis Results

- **Limitation of Two-Lane approach to High-Speed Lanes:**
 - Potential high-speed demand = 5,400 vph
 - 2-lane “choke point” limits capacity to 3,600 vph (optimal)
- **2017 Analysis Results:** extensive queuing – spillback reaches Int. 10
- **Initial Proposed Design Change: 5-Lane EB Transition Zone Approaching Toll Plaza**
 - Same Assumptions as Arup design (without H/H lane)
 - 1,000-ft. 5-lane transition added west of the separation point between High Speed EZPass and regular toll plaza lanes;
 - 3 lanes lead to High Speed EZPass lanes -- capacity expanded to 5,400 vph (optimal);
 - 2 lanes lead to toll plaza

Toll Plaza Design Concept (W/ H/H Lane)



Toll Plaza – Int. 9 Design Concept (With H/H Lane and Flyover to Int. 9)





TAPPAN ZEE BRIDGE/I-287
ENVIRONMENTAL REVIEW
ENVIRONMENTAL REVIEW

MEMORANDUM
TOLL PLAZA AND ROCKLAND INTERCHANGE MODELS ANALYSIS
June 22, 2010 Update

This memo describes the results and observations found to date from the toll Plaza and Rockland Interchange Paramics model analyses.

TOLL PLAZA MODEL - WEEKDAY

AM – 2017

ARUP DESIGN: BODR DESIGN – BUSWAY ALT.

- **Design:** Plaza Layout: 3 High-Speed EZPass & 7 Toll Lanes (3 EZPass, 4 Cash)
- **EZPass Penetration: 89%**
- **Simulation Results:** Significant congestion on I-287 and the Bridge in the EB direction, affecting Interchange 10 and (to a lesser extent) 11
- **Design/Operational Problem Areas:** 2-lane access to High Speed EZpass lanes limits capacity to ~3,600 vph vs. full 3-lane capacity of ~5,400 vph
- **Impact on Speeds:** EB Travel speeds for upstream highway sections:
 - Interchange 12 to Interchange 11: 44 mph
 - Interchange 11 to Interchange 10: 27 mph
 - Interchange 10 to Toll Plaza: 22 mph

PROPOSED TOLL PLAZA DESIGN CHANGE: IMPROVED TRANSITION

DESIGN: 1,000-foot transition leading up to 3 High Speed EZPass lanes

- **Simulation Results:** No congestion is observed
- **Impact on Speeds:** EB Travel speeds for upstream highway sections:
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 57 mph
 - Interchange 10 to Toll Plaza: 56 mph

AM – 2017 + 10% (With Improved Design)

- **Simulation Results:** Moderate Congestion in the EB direction on the Bridge
- **Design/Operational Problem Areas:** demand is approaching overall capacity of the toll plaza and the 4-lane bridge
- **Impact on Speeds:** EB Travel speeds for upstream highway sections:
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 50 mph
 - Interchange 10 to Toll Plaza: 33 mph

AM – 2017 + 15% (With Improved Design)

- **Simulation Results:** Moderate Congestion in the EB direction on I-287, but now extending back to have a somewhat greater effect on Interchange 12 to 10.
- **Design/Operational Problem Areas:** demand is approaching overall capacity of the 4-lane bridge, which impacts upstream highway and interchange operations
- **Impact on Speeds** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 24 mph
 - Interchange 11 to Interchange 10: 25 mph
 - Interchange 10 to Toll Plaza: 31 mph

ARUP DESIGN: BODR DESIGN WITH HOV/HOT LANE & IMPROVED TRANSITION

AM – 2017

- **Simulation Results:** No Congestion observed
- **Design/Operational Problem Areas:**
- **Impact on Speeds** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 58 mph
 - Interchange 11 to Interchange 10: 57 mph
 - Interchange 10 to Toll Plaza: 56 mph
 - Interchange 9 to Interchange 8: 54 mph

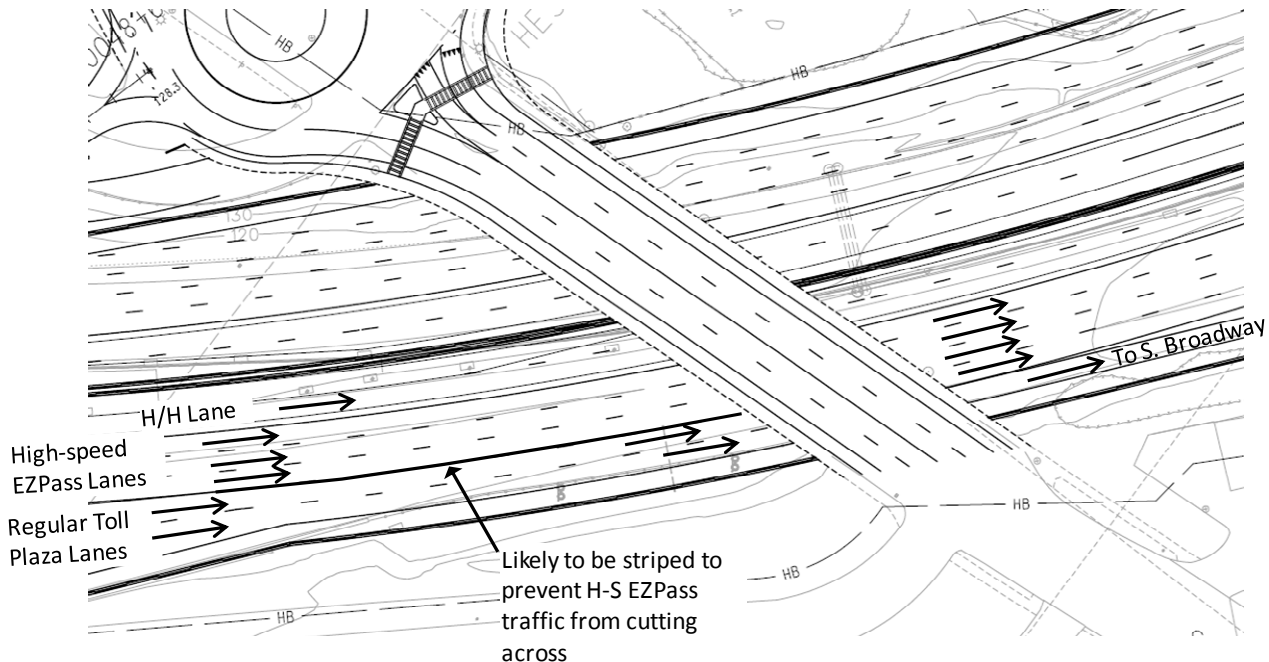
AM – 2017 + 10%

- **Simulation Results:** Congestion observed on EB 287 between interchanges 9 and 8.
- **Design/Operational Problem Areas:** With the addition of the HOV/HOT lane the bridge and toll plaza capacity increase but the downstream area between interchanges 9 and 8 are not designed to handle the extra volume.
- **Impact on Speeds** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 58 mph
 - Interchange 11 to Interchange 10: 57 mph
 - Interchange 10 to Toll Plaza: 51 mph
 - Interchange 9 to Interchange 8: 19 mph

AM – 2017 + 15%

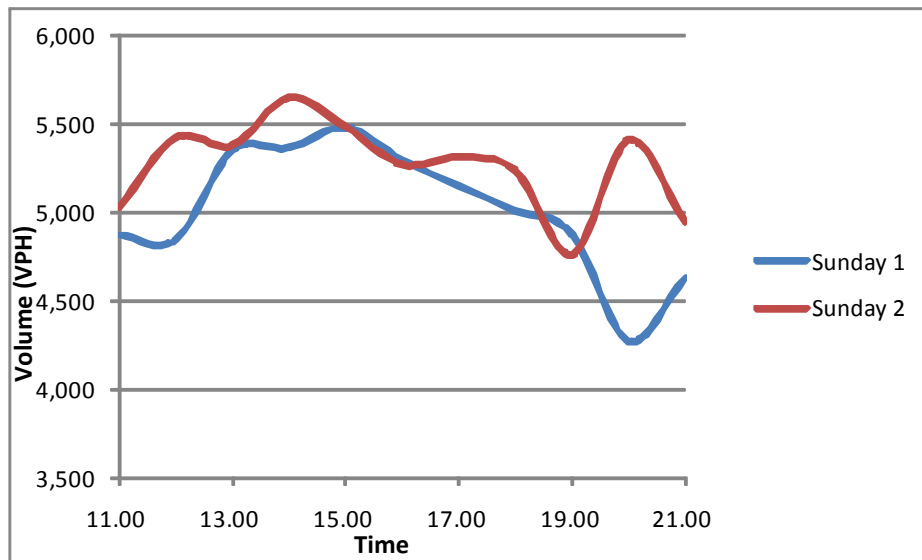
- **Simulation Results:** Increased congestion on the bridge, at the plaza and between Interchanges 9 and 8.
- **Design/Operational Problem Areas:** The capacity of various facilities (bridge, toll plaza) being reached. Two main areas with insufficient capacity are (1) at Interchange 8, and (2) merging of departing toll plaza traffic back to EB highway. The present design of exit from the plaza for regular (vs. high-speed EZPass) lanes only provides one lane for vehicles wanting to go beyond Int. 9 (see figure).
- **Impact on Speeds** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 58 mph

- Interchange 11 to Interchange 10: 56 mph
- Interchange 10 to Toll Plaza: 20 mph
- Interchange 9 to Interchange 8: 27 mph



TOLL PLAZA MODEL – WEEKEND (WITH IMPROVED TRASITION DESIGN – NO HOV/HOT LANE

- **Nature of Weekend Peak (see chart of two sample 2017 weekend travel patterns):**
 - peak starts at about 11:00 am and goes to about 9:00 pm.
 - Hourly plaza volume varies from 4,800 to 5,600, but lower EZPass penetration (<60%) the capacity of the plaza is much lower.
- **Operational Assumptions & EZPass Penetration Rates:**
 - Preliminary simulation indicated that to avoid plaza breakdown 6 of 7 lanes in regular toll plaza must be cash lanes, with 1 EZPass lane.
 - The EZPass penetrations being tested are 60% (roughly existing rate), 65%, 70% and 75%
 - Also test 5 cash/2 EZPass at high penetration rates



- NOTE: 2017 +15% still only represents a peak weekend demand of 6,300 vph.

Weekend – 2017 60% EZPass Usage

- Simulation Results:** Significant congestion is observed on the EB I-287 sections of this model, with speed reductions back to Interchange 11
- Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 56 mph
 - Interchange 11 to Interchange 10: 33 mph
 - Interchange 10 to Toll Plaza: 12 mph

Weekend – 2017 70% EZPass Usage

- Simulation Results:** Dramatic improvement over 60%. No real congestion is observed on the EB I-287 sections of this model
- Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 58 mph
 - Interchange 11 to Interchange 10: 58 mph
 - Interchange 10 to Toll Plaza: 57 mph

Weekend – 2017 +10% -- 60% EZPass Usage

- Simulation Results:** Significant congestion is observed on the EB I-287 sections of this model, with significant speed reductions back to Interchange 12 and beyond.
- Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 12 mph
 - Interchange 11 to Interchange 10: 11 mph
 - Interchange 10 to Toll Plaza: 11 mph

Weekend – 2017 +10% -- 70% EZPass Usage

- **Simulation Results:** Minor congestion is observed on the EB I-287 sections of this model, but with delays limited to the bridge.
- **Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 58 mph
 - Interchange 10 to Toll Plaza: 30 mph

Weekend – 2017 +15% -- 60% EZPass Usage

- **Simulation Results:** Complete failure, data collected does not show the true picture

Weekend – 2017 +15% -- 70% EZPass Usage

- **Simulation Results:** More significant congestion seen on the EB Bridge, spill back goes to Interchange 10
- **Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 50 mph
 - Interchange 10 to Toll Plaza: 21 mph

TESTS OF HIGHER (76%-80%) PENETRAION RATES & 2 EZPASS LANES

Weekend – 2017 +15% -- 75% EZPass Usage

- **Simulation Results:** No significant congestion seen – significant gain over 70%
- **Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 58 mph
 - Interchange 10 to Toll Plaza: 56 mph

Weekend – 2017 +15% -- 75% EZPass Usage (5 cash lanes + 2 EZpass)

- **Simulation Results:** Significant congestion seen on the EB Bridge, spill back past Interchange 10 but does not go all the way to interchange 11
- **Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 38 mph
 - Interchange 10 to Toll Plaza: 18 mph

Weekend – 2017 +15% -- 80% EZPass Usage (5 cash lanes +2 EZpass)

- **Simulation Results:** Minor Congestion at the cash lanes of the toll plaza. Queuing doesn't not go back beyond the General/High Speed lanes split.
- **Impact on Speeds:** EB Travel speeds for the sections go are as follows
 - Interchange 12 to Interchange 11: 57 mph
 - Interchange 11 to Interchange 10: 58 mph

Preliminary: For Discussion Only

Areas East of TZB Toll Plaza Under HOV/HOT Alternatives



Toll Plaza Operation

Figure 4-13 shows the proposed toll plaza for the replacement bridge. The toll plaza would have 10 lanes, including 3 regular E-ZPass, 4 cash, and 3 high-speed E-ZPass lanes. The replacement bridge approach would be designed to provide five-lanes leading up to the toll plaza area, with three lanes feeding directly into the high-speed E-ZPass lanes to maximize their capacity. The HOV/HOT lane included across the bridge under Alternative D (HOV/Busway) and Alternative E (HOV/Bus Lanes) would have its own high-speed E-ZPass lane.

The proposed toll plaza design assumes a traditional stop-and-pay toll collection system. However, it is more likely that an open road tolling (ORT) type operation would be utilized in the future, with a combination of transponder-based collection (like E-ZPass) and license-plate recognition for other vehicles. This would effectively eliminate toll-collection delays and reduce the amount of space needed for toll collection. Nonetheless, a traffic analysis was completed under the more traditional design to ensure that sufficient space was provided for an enhanced stop-and-pay collection toll plaza that could meet projected demand.

The conclusions of this traffic analysis indicated the following for peak weekday operations:

- Under all build alternatives in 2017, the toll plaza could handle peak traffic volumes without any substantial delays;
- Under Alternative B (Corridor Busway) and Alternative C (Busway/Bus Lanes) in 2047, there would be some delays at the toll plaza and between the toll plaza and Interchange 9, as vehicles maneuver to get off at Interchange 9 or continue east on the highway; and
- Under Alternative D (HOV/Busway) and Alternative E (HOV/Bus Lanes) in 2047, the added vehicles in the HOV/HOT lane (up to 1,400 under peak conditions) would create delays when they merge into the highway east of Interchange 9, with the slowdown spilling back, lowering speeds, and causing traffic flow instability across the bridge and into Rockland County.

For weekend operations, overall volumes would be considerably lower than on weekdays. However, the E-ZPass utilization of approximately 60 to 65 percent

on weekends versus 90 percent on weekday peak periods would create cash-lane back-ups that would impact overall toll plaza operations. An increase to the 70 to 75 percent range for E-ZPass usage would substantially reduce weekend toll plaza congestion.

Highway Travel Times and Mobility

Table 4-8 and Table 4-9 show how the volume and speed patterns represent changes in travel times, PMTs, and overall mobility under the build alternatives in 2017 and 2047, respectively. Travel times, PMTs, and mobility indices are presented for selected segments within Rockland and Westchester Counties

in both the eastbound and westbound directions. Comparative information for the No Build Alternative was previously presented in Table 4-6.

Overall mobility gains in Rockland County would be relatively modest in 2017, with slight increases in the two peak periods – eastbound in the morning and westbound in the evening. In the peak travel directions, PMTs would increase by 11 percent to 15 percent with the HOV/HOT lanes under Alternative D (HOV/Busway) and Alternative E (HOV/Bus Lanes) over No Build levels. Somewhat smaller growth would be realized when comparing the No Build Alternative to the common Highway Elements under

Figure 4-13 Proposed Toll Plaza for Replacement Bridge

