Appendix H: Construction Impacts

H-2 Transportation

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Memorandum

To	Robert Conway
CC	Donald Tone
Subject	Tappan Zee Bridge EIS Construction Impact Assessment
From	William Crowell, Atman Sookram, Jean Michel
Date	October 19, 2011

Introduction and Overview

This memo summarizes the assessment of impacts of the following actions proposed during the construction of a new Tappan Zee Bridge:

A. Closure of the entrance ramp from S. Broadway to the westbound Thruway at Interchange 9 in Tarrytown;

B. Closure of the S. Broadway Avenue Bridge over I-287 at Interchange 10 in South Nyack;

C. Creation of an eastbound off-ramp and a westbound on-ramp to and from River Road in South Nyack to provide access for construction vehicles to the proposed waterfront construction staging area at that location. The existing and proposed merges and diverges will create a ramp-weave condition on eastbound and westbound I-287.

LOS Criteria

LOS D, the minimum LOS design standard for the project setting per NYSDOT design criteria, will be the target for components of proposed roadway facilities (e.g. weaves at Interchange 10) to which construction related volumes were added. Improvement measures were considered for existing facilities (e.g. signalized intersection movements) that deteriorated to LOS F with the addition of the rerouted traffic volumes. As such, results shown in the LOS tables reflect the proposed improvements. Facilities that remained at LOS F will be further discussed.

Analysis and Results

- **Tarrytown (Interchange 9)**

Access to westbound I-287 at Interchange 9 is provided by two entrance ramps: one from South Broadway, another located approximately 2200 feet to the east. With a closure of the entrance ramp from South Broadway, traffic volumes were rerouted to the other entrance ramp through the jughandle at the intersection of South Broadway (US 9) and White Plains Road (NY119), and through the eastbound NY119 right-turn lane at the intersection of NY119 and the entrance and exit ramps to and from westbound I-287. It was projected that during the peak construction period, conservatively assumed to occur in 2017, 216 and 464 vehicles would be rerouted during the AM and PM peak hours, respectively.

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Traffic Volumes:

The construction period volumes used for these analyses were based on the following components:

- 2017 volumes at intersections (from October 2011 counts)
- Projected rerouting patterns (see Traffic Rerouting Map and Volumes) due to the closure of the westbound entrance ramp from South Broadway
- 2017 No-Build Thruway volumes for I-287 mainline and Interchange 9 westbound ramps (from TZB EIS)

Figures and Tables (attached):

- Figures 1A and 1B: 2011 Peak Hour Volumes
- Figure 2: Traffic Rerouting
- Figures 3A and 3B: 2017 Construction Volumes
- Tables 1 and 2: LOS Results
- Tables 3-1 and 3-2: Future Construction Volumes (Intersections)

NY119/ US9 Intersection Analysis

With an increase of the maximum green time for the jughandle phase by 5 seconds, the jughandle approach would operate at LOS D and E during the AM and the PM peak hours, respectively without degrading the LOS of other movements and approaches.

NY119/ Interchange 9 Ramps Intersection Analysis

The eastbound NY119 approach features a right-turn lane where RTOR maneuvers were observed. The right-turn lane is projected to operate at LOS A and E during the AM and the PM peak hours, respectively without degrading the LOS of other movements and approaches.

Entrance Ramp to WB I-287 Analysis

The entrance ramp is projected to operate at LOS A and E during the AM and the PM peak hours.

- **South Nyack (Interchange 10)**

Actions generated the analyses are the proposed new/expanded Entrance and Exit Ramps to River Road construction staging area, and the temporary closure of South Broadway Bridge.

Analysis Locations:

- New weaves on eastbound and westbound I-287 between existing Interchange 10 on- and off-ramps and proposed ramps to and from the construction staging area at River Road. (Weaving Length: Approx. 1500 feet)
- Four (4) Unsignalized Intersections to assess diversions from closure of the S. Broadway Bridge
  - Cornelison Avenue/ South Broadway Avenue
  - South Broadway Avenue/ Hillside Ave
  - Hillside Avenue/ Old Mountain Road (CR 28)
  - Hillside Avenue/ Shadyside Avenue

Traffic Volumes:

- Analysis volumes include the following components:
  - 2017 volumes at intersections (from October 2011 counts)
  - Projected traffic rerouting (see Traffic Rerouting Map and Volumes) due to the closure of South Broadway Bridge

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- 2017 No-Build Thruway volumes for I-287 mainline and ramps
- Construction incremental volumes for TZB and landing construction (Ref. staging area at Int. 12)
  [Rockland Daily 140 HV, 350 PCEs, See Table for Peak Hour Breakdown]

Key volume findings:

- Broadway Bridge Average Daily Traffic (ADT): 2040 veh/day (1285 NB, 755 SB)
- Non-Thruway Traffic rerouting : Mainly through Hillside Avenue and Shadyside Avenue (See Figure 5 map)
- Differential Running Time for Emergency Vehicle Access with Rerouting: preliminary analysis were completed of potential travel time increases between police, fire and hospital facilities adjacent to [police] or north of Interchange 10 for properties along South Broadway. These travel time estimates, based on projected rerouting patterns, show that response times would be approximately 1-2 minutes greater during the bridge closure, depending on a property's location along South Broadway. Further details on this analysis can be provided if necessary.

Figures and Tables (attached):

- Figures 4A and 4B: 2011 Peak Hour Volumes
- Figure 5: Traffic Rerouting
- Figure 6: Construction Trip Increments
- Figures 7A and 7B: 2017 Construction Volumes
- Tables 1 and 2: LOS Results
- Tables 3-3 and 3-4: Future Construction Volumes (Intersections)
- Table 4: Determination of Construction Trip Increments

Analysis Results:

Thruway Weaves:

- Eastbound I-287: AM LOS D, PM LOS B
- Westbound I-287: AM LOS B, PM LOS D

Ramp Termini at River Road: Design of ramp turning radii and selection of type of control at River Road to be determined during project's design phase.

Unsignalized Intersections:

Three unsignalized intersections operated at LOS C or better with traffic rerouting

- Cornelison Avenue/ South Broadway Avenue
- Hillside Avenue/ Old Mountain Road (CR 28)
- Hillside Avenue/ Shadyside Avenue

At a fourth intersection -- South Broadway Avenue and Hillside Avenue – the existing LOS F on the southbound South Broadway Avenue approach to Hillside Avenue is projected to continue, along with safety concerns at this location related to the intersection's poor geometry. Appropriate traffic control type and possible geometric improvements can be further analyzed during the design phase.

Conclusions

Tarrytown (Ramp Closure):

- Acceptable operations are projected for the three analysis locations in Tarrytown.

South Nyack (Construction Ramp and S. Broadway Bridge Closure):

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- The intersection of South Broadway Avenue and Hillside Avenue would experience operational and safety deficiencies. Appropriate countermeasures (traffic control type and possible geometric improvements) to be defined during the project's design phase.

- LOS D target is met for the new weaves on I-287 at Interchange 10 due to construction ramps.

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Table 1
Year 2017 Construction Conditions
LOS Analysis Results

Intersection	Approach	Movement	Weekday AM Peak Hour (8:00 to 9:00 AM)			Weekday PM Peak Hour (5:00 to 6:00 PM)		
			v/c	Delay (sec/veh)	LOS	v/c	Delay (sec/veh)	LOS
Signalized Intersections (Tarrytown)								
White Plains Rd (NY119)/ South Broadway (US 9)	EB	T	0.66	45.8	D	0.92	57.5	**E**
	WB	L	0.93	55.7	**E**	0.57	39.0	D
		R	0.93	69.3	**E**	0.59	40.5	D
	NB	T	0.85	40.5	D	0.61	32.5	C
		R	0.81	16.6	B	0.44	9.7	A
	SB	T	0.61	31.3	C	0.69	34.5	C
	Overall			**39.4**	**D**		**37.2**	**D**
White Plains Rd (NY119)/ I-287 Int 9 Thruway Ramps	EB	L	0.60	51.3	D	0.04	26.7	C
		T	0.60	18.5	B	0.29	18.1	B
		R	0.46	6.3	A	**1.02**	56.9	**E**
	WB	L	0.59	50.2	D	0.90	55.3	**E**
		TR	0.41	16.3	B	0.41	19.1	B
	NB	L	**0.99**	66.5	**E**	0.84	61.6	**E**
		LT	**0.98**	62.7	**E**	0.82	57.3	**E**
		R	0.29	17.1	B	0.12	16.8	B
	SB	LTR	0.26	37.4	D	0.39	42.1	D
	Overall			**37.4**	**D**		**41.7**	**D**
Unsignalized Intersections (S. Nyack)								
Cornelison Ave/ South Broadway Ave	WB	TR	0.16	10.9	B	0.06	10.1	B
	SB	LR	0.03	7.5	A	0.06	7.6	A
Hillside Ave/ South Broadway	SB	LT	0.01	10.5	B	0.05	9.2	A
	WB	L	**0.97**	160.7	**F**	**1.17**	382.5	**F**
Hillside Ave/ Old Mountain Rd (CR28)	NB	LT	0.01	9.5	A	0.05	12.3	B
	EB	LR	0.07	15.5	C	0.06	16.5	C
Shadyside Ave/ Hillside Ave	EB	LR	0.14	11.0	B	0.17	11.5	B

v/c = volume-to-capacity ratio, LOS = Level-of-Service
NB = Northbound; SB = Southbound; EB = Eastbound; WB = Westbound
L = left-turn, R = right-turn, T = through movement,
LTR = left/through/right, TR = through/right-turn, LT = left-turn/through, LR = left-turn/right-turn

Table 2
HCS Freeway LOS Analysis
2017 Thruway Construction Conditions

Location	Weekday AM Peak Hour			Weekday PM Peak Hour		
	Speed (mph)	Density (pc/mi/ln)	LOS	Speed (mph)	Density (pc/mi/ln)	LOS
WB I-287 Merge from NY119 (Int. 9)	58.7	11.4	B	57.3	22.3	C
EB I-287 Weave to River Rd. Constr. Staging Area (Int. 10)	53.0	33.1	D	59.8	18.3	B
WB I-287 Weave from River Rd. Constr. Staging Area (Int. 10)	60.4	16.5	B	51.6	32.5	D

Table 3-1
TZB Only EIS
Future Construction Volumes (Intersections)

10/10/2011

Base Year (Y_0)	2011
Peak Construction Year	2017
? ETC	2018

Growth Rate Thru ETC	0.5%
GF (Peak Construction Year)	1.0300

Weekday AM Peak Hour (8:15 AM - 9:15 AM) - Tarrytown - Thruway Int. 9

Locations	Movement	2011 Base Volumes	2017 Expanded Volumes	2017 Diverted Volumes	2017 Workers Volumes	2017 Construction Volumes
White Plains Rd (NY119)/I-287 Ramps/ Office Driveway	**Med**					
NY119	EBL	25	26			26
	EBT	670	690			690
	EBR	105	108	216		324
NY119	WBL	30	31			31
	WBT	310	319			319
	WBR	0	0			0
I-287 Off-Ramp	NBL	900	927			927
	NBT	15	15			15
	NBR	130	134			134
Med Office Driveway	SBL	5	5			5
	SBT	5	5			5
	SBR	0	0			0
White Plains Rd (NY119)/S. Broadway (U.S. 9)						
Jughandle (from S. Broadway)	EBL		0			0
	EBT	170	175	216		391
	EBR		0			0
NY119	WBL	720	742			742
	WBT		0			0
	WBR	470	484			484
S. Broadway	NBL		0			0
	NBT	810	834			834
	NBR	630	649			649
S. Broadway	SBL		0			0
	SBT	565	582			582
	SBR		0			0
On-Ramp to WB I-287 from S. Broadway (U.S. 9)						
SB	WBR	210	216	-216		0
Int. 9 On-Ramp to WB I-287 from NY119						
	WBR	140	144	216		361
Int. 9 Off-Ramp from WB I-287 to NY119						
	WBR	1,045	1076			1076

Table 3-2
TZB Only EIS
Future Construction Volumes

10/10/2011

Base Year (Y_0)	2011
Peak Construction Year	2017
? ETC	2018

Growth Rate Thru ETC	0.5%
GF (Peak Construction Year)	1.0300

Weekday PM Peak Hour (5:00 PM - 6:00 PM) - Tarrytown - Thruway Int. 9

Locations	Movement	2011 Base Volumes	2017 Expanded Volumes	2017 Diverted Volumes	2017 Workers Volumes	2017 Construction Volumes
White Plains Rd (NY119)/I-287 Ramps/ Office Driveway	**Med**					
NY119	EBL	10	10			10
	EBT	345	355			355
	EBR	305	314	464		778
NY119	WBL	305	314			314
	WBT	465	479			479
	WBR	0	0			0
I-287 Off-Ramp	NBL	325	335			335
	NBT	5	5			5
	NBR	55	57			57
Med Office Driveway	SBL	5	5			5
	SBT	5	5			5
	SBR	15	15			15
White Plains Rd (NY119)/S. Broadway (U.S. 9)						
Jughandle (from S. Broadway)	EBL		0			0
	EBT	275	283	464		747
	EBR		0			0
NY119	WBL	465	479			479
	WBT		0			0
	WBR	305	314			314
S. Broadway	NBL		0			0
	NBT	620	639			639
	NBR	385	397			397
S. Broadway	SBL		0			0
	SBT	705	726			726
	SBR		0			0
On-Ramp to WB I-287 from S. Broadway (U.S. 9)						
SB	WBR	450	464	-464		0
Int. 9 On-Ramp to WB I-287 from NY119						
	WBR	615	633	464		1097
Int. 9 Off-Ramp from WB I-287 to NY119						
	WBR	385	397			397

Table 3-3
TZB Only EIS
Future Construction Volumes

10/12/2011

Base Year (Y_0)	2011
Peak Construction Year	2017
? ETC	2018

Growth Rate Thru ETC	0.5%
GF (Peak Construction Year)	1.0300

Weekday AM Peak Hour (8:00 AM - 9:00 AM) - S. Nyack - Thruway Int. 10

Locations	Movement	2011 Base Volumes	2017 Expanded Volumes	2017 Diverted Volumes	2017 Workers Volumes	2017 Construction Volumes
Cornelison Ave/S. Broadway Ave						
Cornelison Ave	WBL	5	5	-5		0
	WBT	35	36			36
	WBR	40	41	5		46
S. Broadway Ave	NBL	10	10	-10		0
	NBT	65	67	-67		0
	NBR	15	15	-15		0
S. Broadway Ave	SBL	35	36			36
	SBT	30	31	-31		0
	SBR	250	258			258
S. Broadway Ave/ Hillside Ave (US 9W)						
S. Broadway Ave	WBL		0			0
	WBT	50	52	26		77
	WBR		0			0
Hillside Ave	NBL		0			0
	NBT	900	927	28		955
	NBR	30	31	-28		3
Hillside Ave	SBL	5	5	0		5
	SBT	585	603	36		639
	SBR		0			0
Old Mountain Rd (CR 28) & Hillside Ave (US 9W)						
CR 28	EBL	5	5			5
	EBT		0			0
	EBR	10	10			10
Hillside Ave	NBL	5	5			5
	NBT	925	953			953
	NBR	30	31			31
Hillside Ave	SBL	5	5			5
	SBT	595	613			613
	SBR	40	41	62		103
Shadyside Ave & Hillside Ave (US 9W)						
Shadyside Ave	EBL					0
	EBT	10	10	62		72
	EBR	10	10			10
Hillside Ave	SBL		0			0
	SBT	180	185	36		221
	SBR	55	57			57

Table 3-3
TZB Only EIS
Future Construction Volumes

10/12/2011

Base Year (Y_0)	2011
Peak Construction Year	2017
? ETC	2018

Growth Rate Thru ETC	0.5%
GF (Peak Construction Year)	1.0300

Weekday AM Peak Hour (8:00 AM - 9:00 AM) - S. Nyack - Thruway Int. 10

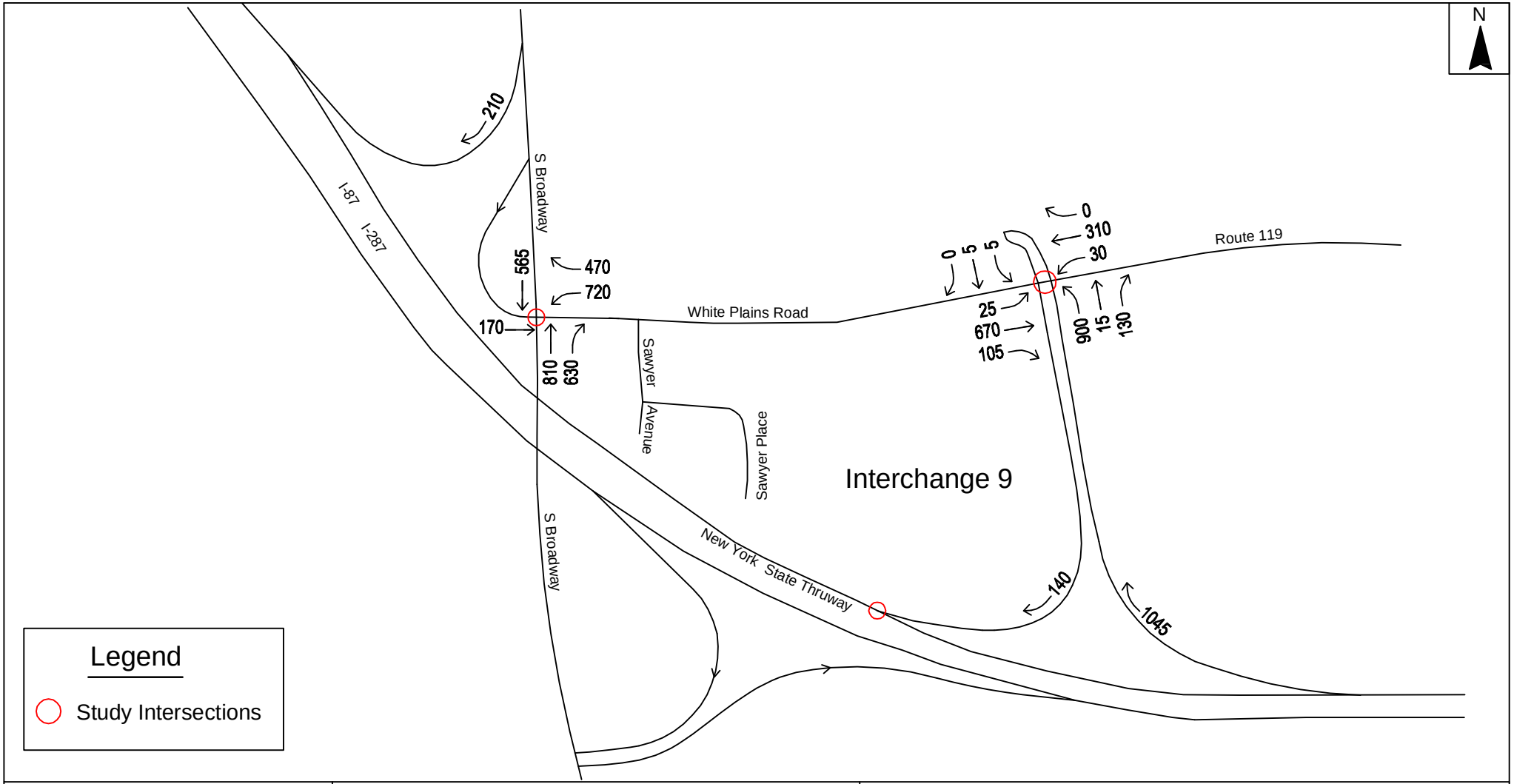
Locations	Movement	2011 Base Volumes	2017 Expanded Volumes	2017 Diverted Volumes	2017 Workers Volumes	2017 Construction Volumes
Cornelison Ave/S. Broadway Ave						
Cornelison Ave	WBL	5	5	-5		0
	WBT	35	36			36
	WBR	40	41	5		46
S. Broadway Ave	NBL	10	10	-10		0
	NBT	65	67	-67		0
	NBR	15	15	-15		0
S. Broadway Ave	SBL	35	36			36
	SBT	30	31	-31		0
	SBR	250	258			258
S. Broadway Ave/ Hillside Ave (US 9W)						
S. Broadway Ave	WBL		0			0
	WBT	50	52	26		77
	WBR		0			0
Hillside Ave	NBL		0			0
	NBT	900	927	28		955
	NBR	30	31	-28		3
Hillside Ave	SBL	5	5	0		5
	SBT	585	603	36		639
	SBR		0			0
Old Mountain Rd (CR 28) & Hillside Ave (US 9W)						
CR 28	EBL	5	5			5
	EBT		0			0
	EBR	10	10			10
Hillside Ave	NBL	5	5			5
	NBT	925	953			953
	NBR	30	31			31
Hillside Ave	SBL	5	5			5
	SBT	595	613			613
	SBR	40	41	62		103
Shadyside Ave & Hillside Ave (US 9W)						
Shadyside Ave	EBL					0
	EBT	10	10	62		72
	EBR	10	10			10
Hillside Ave	SBL		0			0
	SBT	180	185	36		221
	SBR	55	57			57

Table 4
TZB Only EIS
Determination of Peak-Hour Construction Trips Increment
Bridge and Landing Construction - Base Staging Area at Interchange 12 Facility

	Daily Trips		AM Peak Hour Distribution		PM Peak Hour Distribution		AM Peak Hour (8-9)				PM Peak Hour (5-6)			
	Rockland (Int. 10)	Westchester (Int. 9)	From Int 12	To Int 12	From Int 12	To Int 12	Int 12 to Int 10	Int 10 to Int 12	Int 12 to Int 9	Int 9 to Int 12	Int 12 to Int 10	Int 10 to Int 12	Int 12 to Int 9	Int 9 to Int 12
1. Concrete Trucks (6 and 9 yd^3 avg)	47	10	20%	10%	10%	30%	9	5	2	1	5	14	1	3
2. Equipment Movements	74	36	40%	10%	10%	50%	30	7	14	4	7	37	4	18
3. Bus Trips	19	12	40%	20%	20%	60%	8	4	5	2	4	11	2	7
Total	140	58					47	16	21	7	16	62	7	28

Peak Hour Incremental Volumes in PCE's *

	Daily Trips		AM Peak Hour		PM Peak Hour		AM Peak Hour (8-9)				PM Peak Hour (5-6)			
	Rockland (Int. 10)	Westchester (Int. 9)	From Int 12	To Int 12	From Int 12	To Int 12	Int 12 to Int 10	Int 10 to Int 12	Int 12 to Int 9	Int 9 to Int 12	Int 12 to Int 10	Int 10 to Int 12	Int 12 to Int 9	Int 9 to Int 12
1. Concrete Trucks (6 and 9 yd^3 avg)	118	25	20%	10%	10%	30%	24	12	5	3	12	35	3	8
2. Equipment Movements	185	90	40%	10%	10%	50%	74	19	36	9	19	93	9	45
3. Bus Trips	48	30	40%	20%	20%	60%	19	10	12	6	10	29	6	18
Total	350	145					117	40	53	18	40	155	18	71



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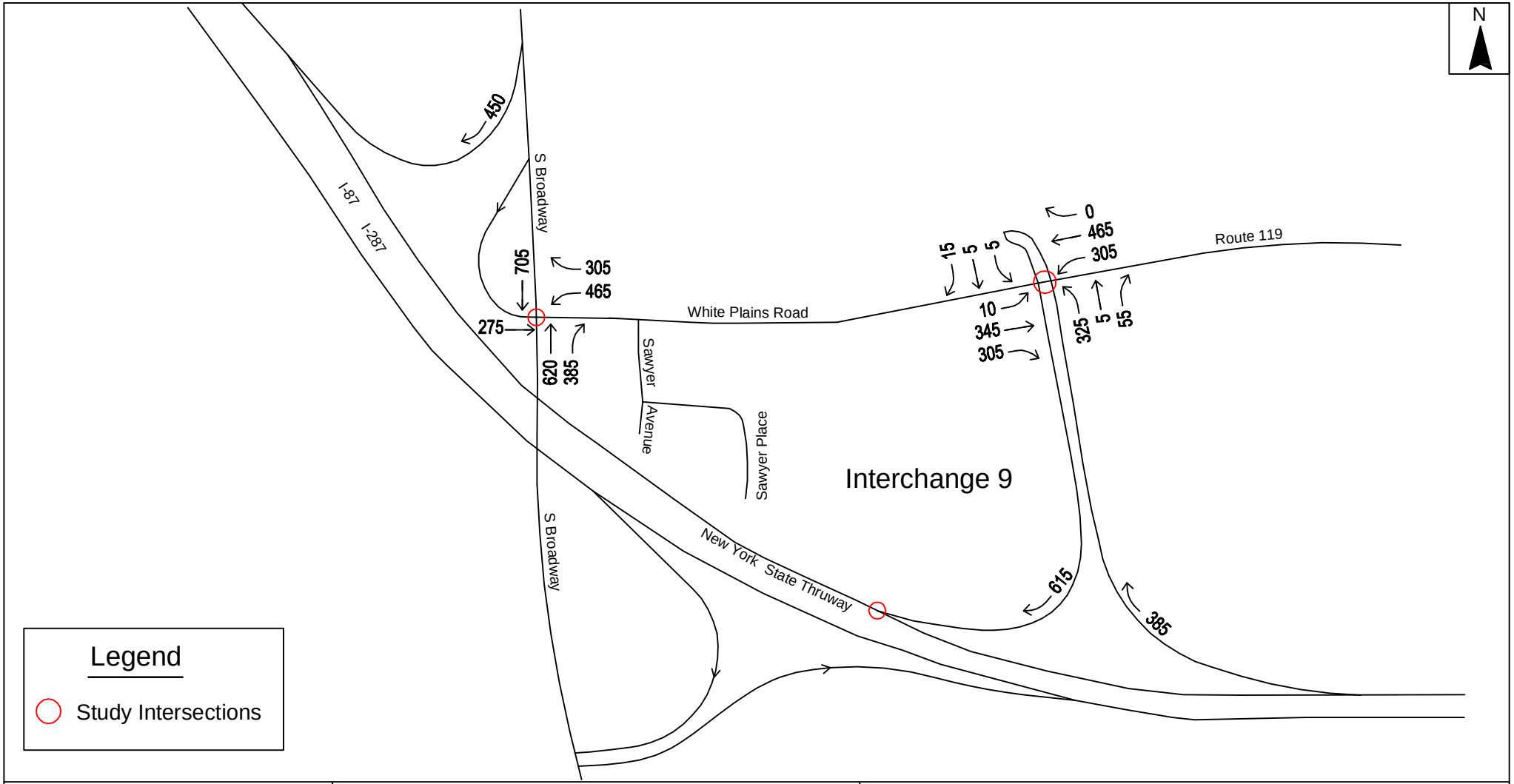
Tappan Zee Bridge EIS

Tarrytown, NY

2011 Existing Volumes

Weekday 8:00-9:00 AM Peak Hour

Figure 1A



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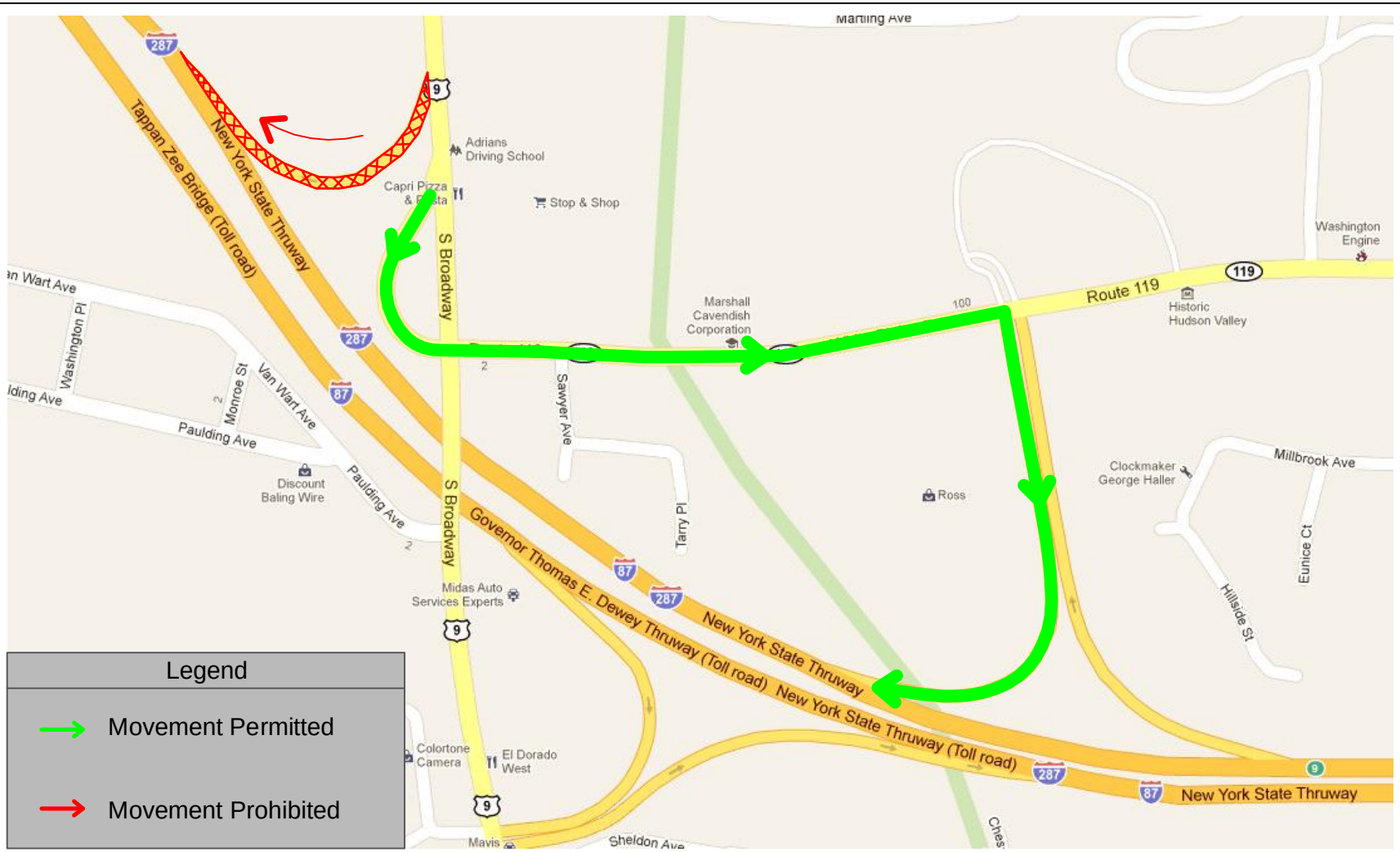
Tappan Zee Bridge EIS

Tarrytown, NY

2011 Existing Volumes

Weekday 5:00-6:00 PM Peak Hour

Figure 1B



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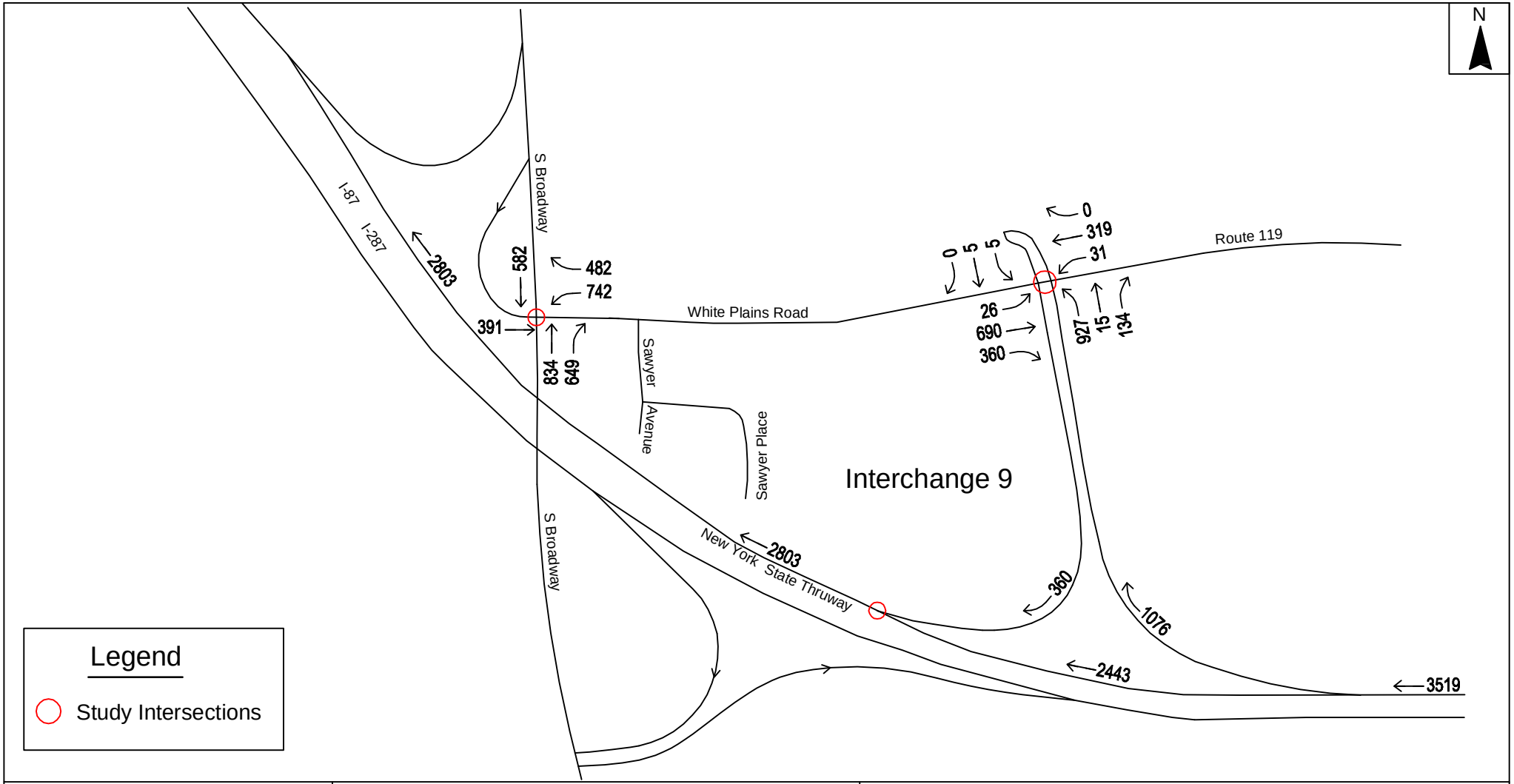
Tappan Zee Bridge EIS

Tarrytown, NY

Closure of on-ramp to I-287 from S Broadway

Figure 2



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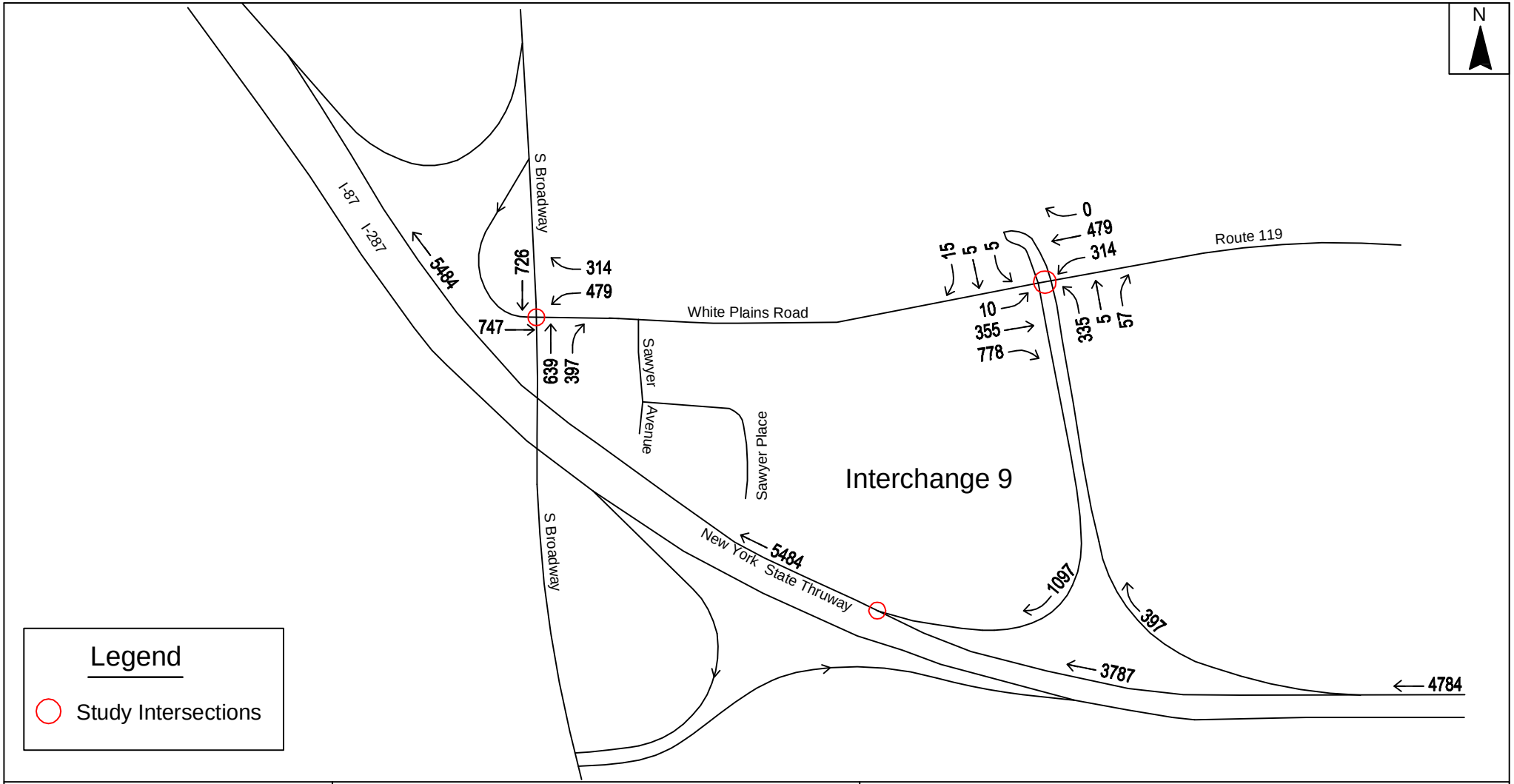
Tappan Zee Bridge EIS

Tarrytown, NY

2017 Construction Volumes

Weekday 8:00-9:00 AM Peak Hour

Figure 3A



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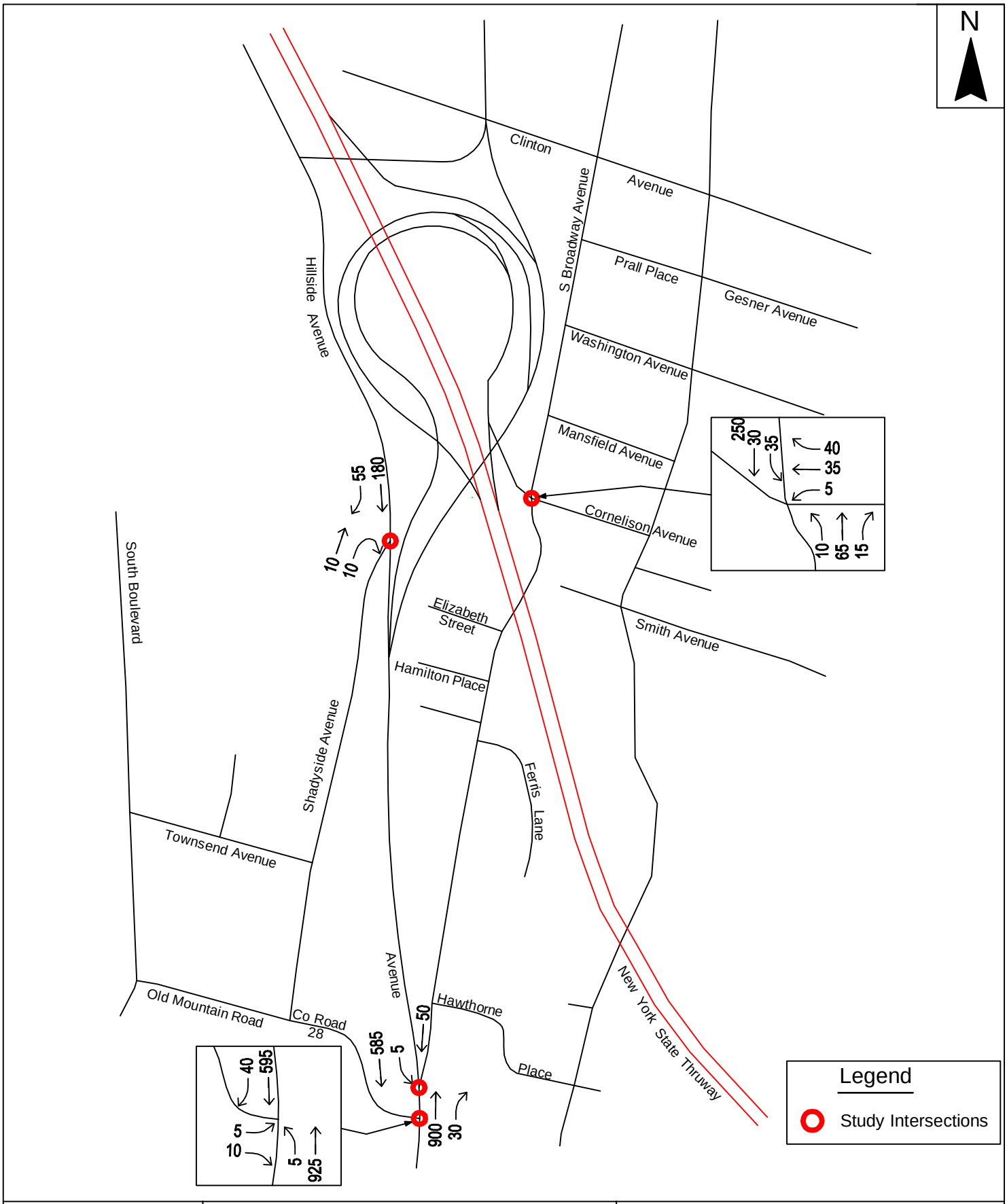
Tappan Zee Bridge EIS

Tarrytown, NY

2017 Construction Volumes

Weekday 5:00-6:00 PM Peak Hour

Figure 3B



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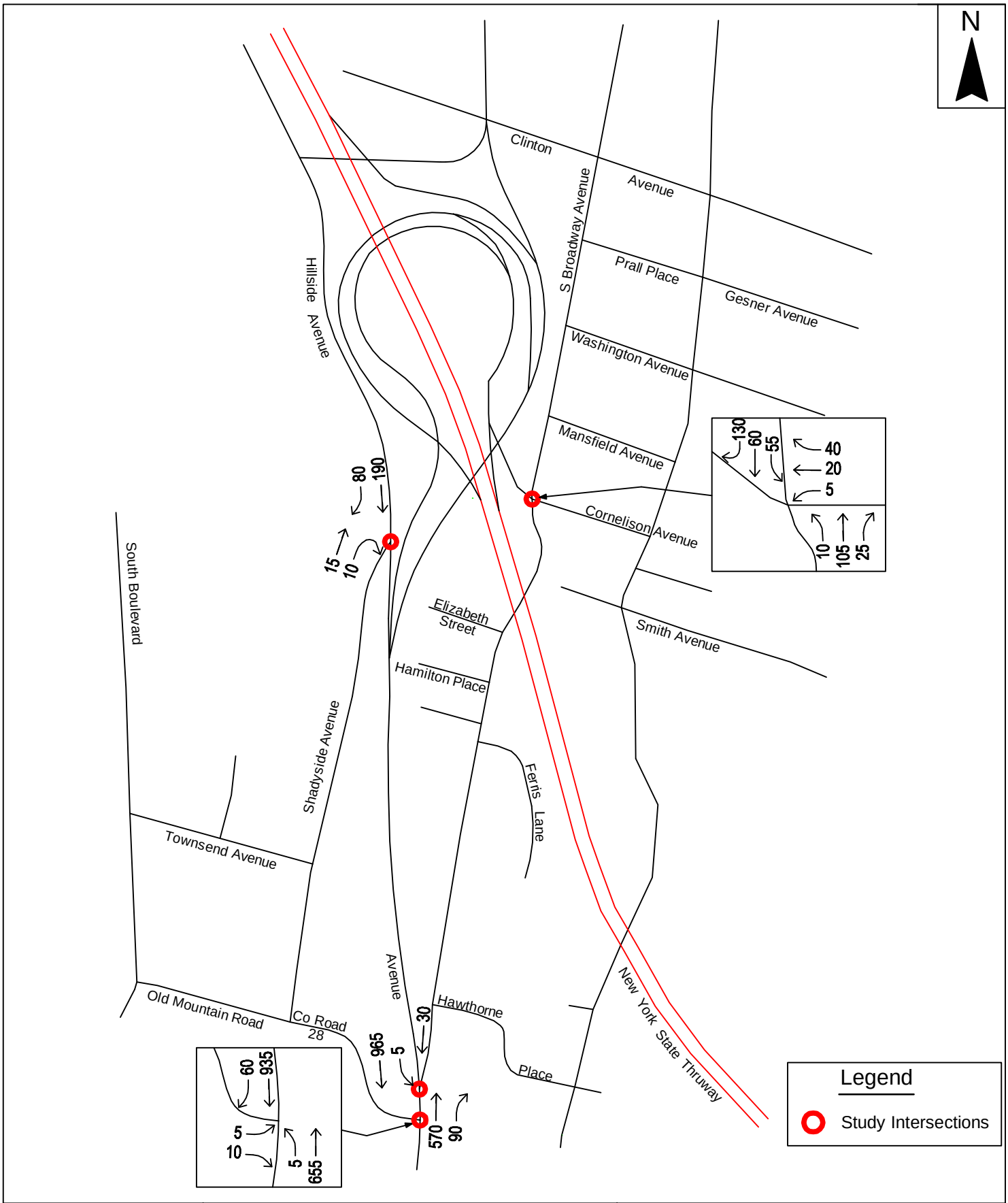
Tappan Zee Bridge EIS

South Nyack, NY

Year 2011 Existing Traffic Volumes
Weekday 8:00-9:00 AM Peak Hour

Figure 4A



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Tappan Zee Bridge EIS

South Nyack, NY

Year 2011 Existing Traffic Volumes

Weekday 5:00-6:00 PM Peak Hour

Figure 4B

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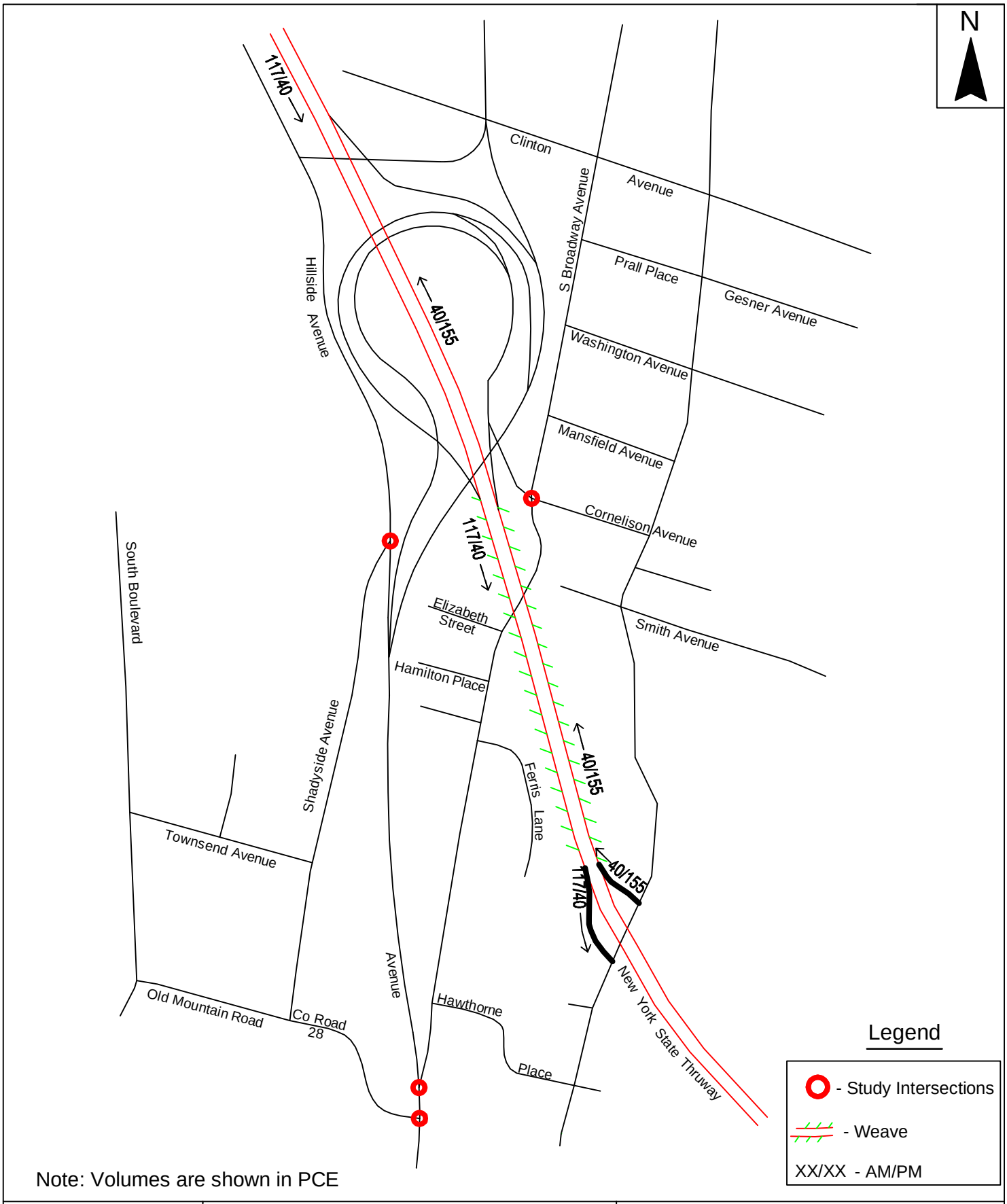
Tappan Zee Bridge EIS
South Nyack, NY

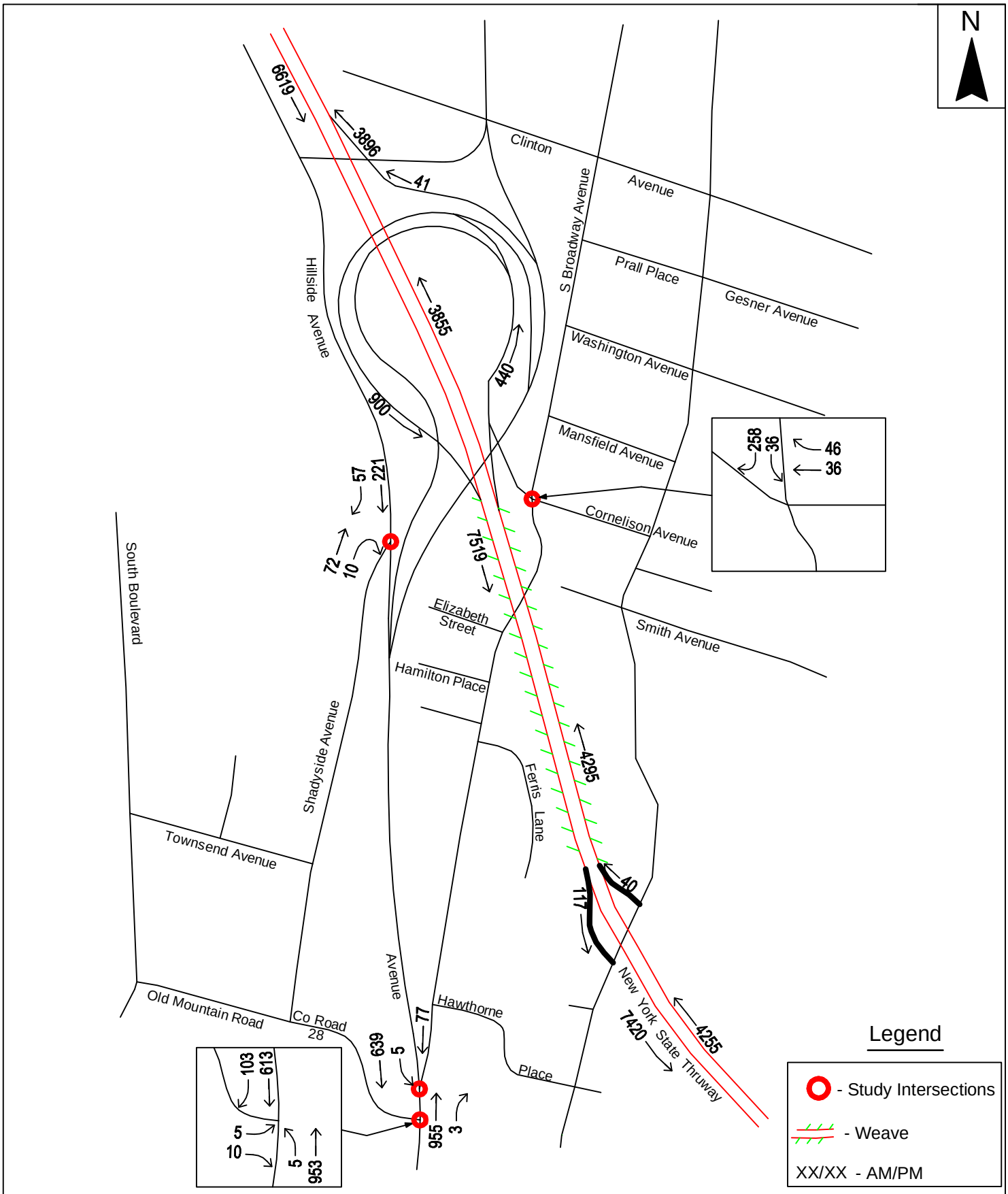
Closure of South Broadway Bridge
Traffic Rerouting

Figure 5



Note: Volumes are shown in PCE

AECOM	Tappan Zee Bridge EIS South Nyack, NY	Construction Trip Increment On Thruway Figure 6



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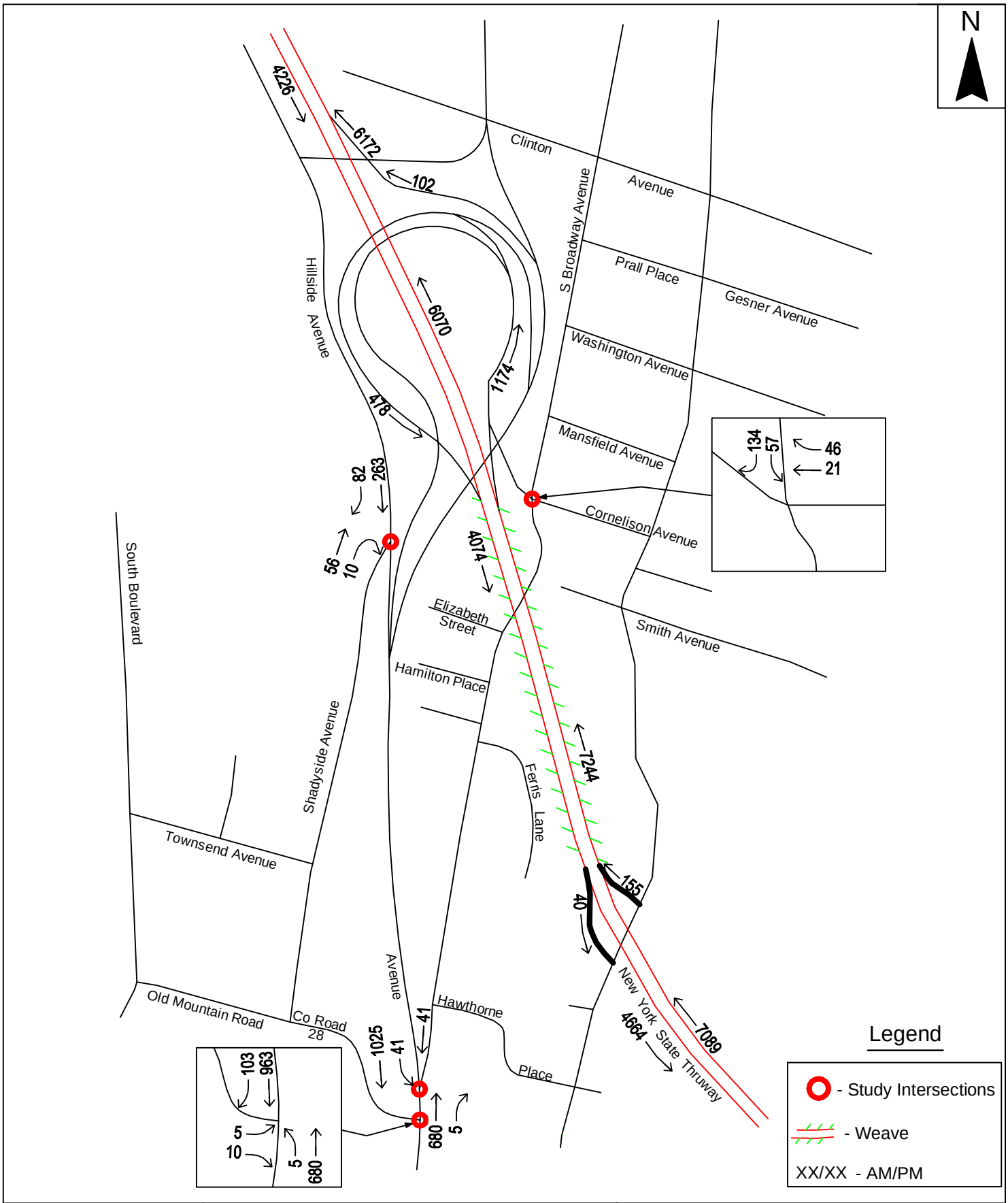
Tappan Zee Bridge EIS

South Nyack, NY

2017 Construction Volumes

Weekday 8:00-9:00 AM Peak Hour

Figure 7A



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Tappan Zee Bridge EIS

South Nyack, NY

2017 Construction Volumes

Weekday 5:00-6:00 PM Peak Hour

Figure 7B