Appendix I
Traffic Analysis

The traffic analysis for the project was conducted using the Bow-Concord Traffic Microsimulation Model prepared specifically for the project. The details of the microsimulation model are described in the *Bow-Concord Traffic Analysis Volume Documentation* memo dated March 28, 2017 prepared by RSG, which is included in this appendix. This memo describes the steps undertaken to develop the model and how the model was used to evaluate project concepts and alternatives.

The memo includes the testing of several build "scenarios" made up of combinations of concepts developed for the four project segments. These scenarios were assembled to ensure those concepts viewed as reasonable would be evaluated and that different configurations of I-93 would also be evaluated. The memo contains three build scenarios as described below:

Scenario A

- Auxiliary lanes between all interchanges along I-93 except southbound between I-89 and Exit 12.
- I-89 Area Concept C
- Exit 12 Area Concept F
- Exit 13 Area Concept A
- Exit 14/15 Area Concept D

Scenario B

- Auxiliary lanes between all interchanges along I-93 except northbound and southbound between Exit 12 and Exit 13.
- I-89 Area Concept K
- Exit 12 Area Concept F
- Exit 13 Area Concept B
- Exit 14/15 Area Concept C

Scenario C

- Auxiliary lanes between all interchanges along I-93 except southbound between Exit 14 and Exit 15 because Concept O eliminated the weaving segment.
- I-89 Area Concept P
- Exit 12 Area Concept E
- Exit 13 Area Concept B
- Exit 14/15 Area Concept O

The results of the above scenario model runs were used in the determination of the Project Preferred Alternative. Once the Preferred Alternative was recommended, it was modeled using the microsimulation model as Scenario D. The results of the modeling for the Preferred Alternative, Scenario D, are also included in this appendix. Scenario D is described below:

Scenario D (Preferred Alternative)

- Auxiliary lanes between all interchanges along I-93 except northbound between Exit 14 and Exit 15 as there is no need without the Exit 14 entrance ramp.
- I-89 Area Concept K
- Exit 12 Area Concept F
- Exit 13 Area Concept B
- Exit 14/15 Area Concept F2

A summary of the local intersection operations for all four modeled scenarios is included at the end of this appendix as well.

Bow-Concord Traffic Analysis Volume Documentation

March 28, 2017

Prepared by RSG

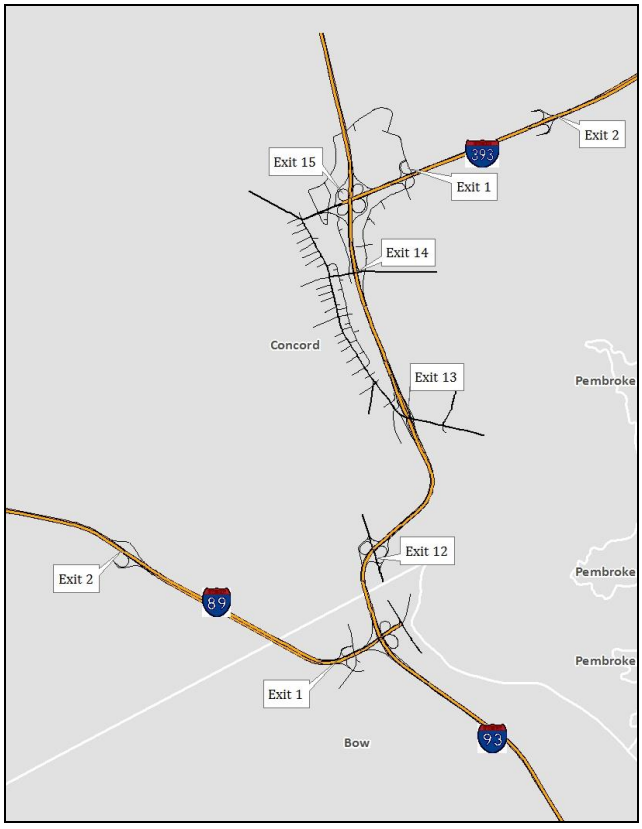
MEMO

TO:	Gene McCarthy, PE
FROM:	Ben Swanson; Erica Wygonik, PE/PhD
DATE:	March 28, 2017
SUBJECT:	Bow-Concord Traffic Analysis Volume Documentation

1.0 INTRODUCTION

The Bow-Concord Traffic Microsimulation Model has been developed to support a comprehensive assessment of the traffic implications associated with highway and interchange design alternatives developed for the I-93 corridor in central New Hampshire. The study corridor extends from south of I-89 to north of I-393 and includes interchanges along I-93, I-89, and I-393, as well as surface streets proximate to the study corridor (Figure 1). The microsimulation model is calibrated to weekday AM and PM peak design hour conditions and is developed in the TransModeler software program.

FIGURE 1: TRAFFIC MICROSIMULATION MODEL EXTENT



The Bow-Concord Traffic Microsimulation Model has been developed in parallel with a regional transportation demand model of the Central New Hampshire Regional Planning Commission (CNHRPC) region[1] (Figure 2). The regional model, which is developed in the TransCAD software platform, is calibrated to daily traffic conditions and provides insights into regional traffic patterns.

The roadway network and Traffic Analysis Zone (TAZ) structure for the regional model was established concurrently with the construction of the microsimulation model. By knowing the level of detail required by the microsimulation model during construction of the regional model, additional details beyond what would typically be necessary for a regional travel demand model could be added to the regional model in the microsimulation study area to enhance the correspondence between the two models.

The microsimulation model was developed based on a subarea extraction of the regional model network, the extent of which is shown in the expanded graphic below. Roadways and zones within the microsimulation model share common identification numbers and attributes with the regional model, to facilitate integration and cooperative analysis between the regional model and microsimulation model.

FIGURE 2: REGIONAL MODEL EXTENT (LEFT) AND MICROSIMULATION MODEL EXTENT (RIGHT)

2.0 MICROSIMULATION MODEL CALIBRATION

The Bow-Concord Traffic Microsimulation Model includes detailed information on roadway classification, speeds, geometrics, intersection controls, signal timings, and traffic volumes. Model traffic demand on the roadway network occurs between 93 unique TAZs using origin/destination (O/D) matrices for the weekday AM and PM peak hours. This model traffic is represented by the cumulative demand from over 8,000 potential unique origin/destination pairs. The peak hour O/D matrices were developed to match intersection turning movement counts at 39 intersections and 18 highway and ramp

[1] In addition to CNHRPC towns, the regional model includes the Town of Weare in order to keep a regular geometric shape to the model and to ensure all roadways used between CNHRPC towns are included in the model.

counts, and were informed by highway origin/destination data collected with Bluetooth monitoring devices installed along the I-93 corridor in 2014.

TARGET TRAFFIC VOLUME DATA

Intersection turning movement counts were obtained from the City of Concord and the CNHRPC, and additional count data were collected by RSG in 2014. Figure 3 and Figure 4 present lists of intersection turning movement count locations and highway and ramp count locations, respectively. Count data for the weekday AM and PM peak hours were adjusted to represent design hour conditions based on seasonal adjustment factors obtained from NHDOT continuous count stations 099012 and 099011 on I-93 between exits 12 and 13. Design hour adjustments increase raw count data by up to 11% depending on the count date.

FIGURE 3: TURNING MOVEMENT COUNT INTERSECTION LIST

#	Intersection	#	Intersection
1	US 3/US 202 and Bouton St	21	Main St/Ferry St
2	Commercial St/US 202	22	Main St/Pitman St
3	I-93/I-393 Interchange	23	Main St/Storrs St
4	College Drive/I-393 WB Ramps	24	Main St/Park St
5	College Drive/I-393 EB Ramps	25	Main St/Capitol St
6	US 202/Loudon Road/Centre Street	26	Main St/School St
7	Loudon Rd/Stickney Ave and Bridge St	27	Main St/Phenix St
8	Loudon Rd/I-93 SB ramps	28	Main St/Warren St
9	Loudon Rd/I-93 NB on ramp	29	Main St/Depot St
10	Loudon Rd/Fort Eddy Rd	30	N Main St/Pleasant St
11	I-93 SB off ramp and Hall St/Manchester St	31	Storrs St/Pleasant St Ext
12	I-93 (SPUI)/Manchester St	32	Main St/Hills Ave
13	Manchester St/Old Turnpike	33	Main St/Fayette St
14	I-93 Exit 12/South Main Street	34	Main St/Thompson St
15	South Street/I-89 Exit 1 NB Ramps	35	Main St/Theatre St
16	South Street/I-89 Exit 1 SB Ramps	36	Main St/Concord St
17	I-93/I-89	37	Main St/Thorndike St
18	NH-3A/I-89 and Hall St	38	S Main St/Storrs St/Perley St
19	Main St/Franklin St	39	Water St/S Main St
20	Main St/Ferry St		

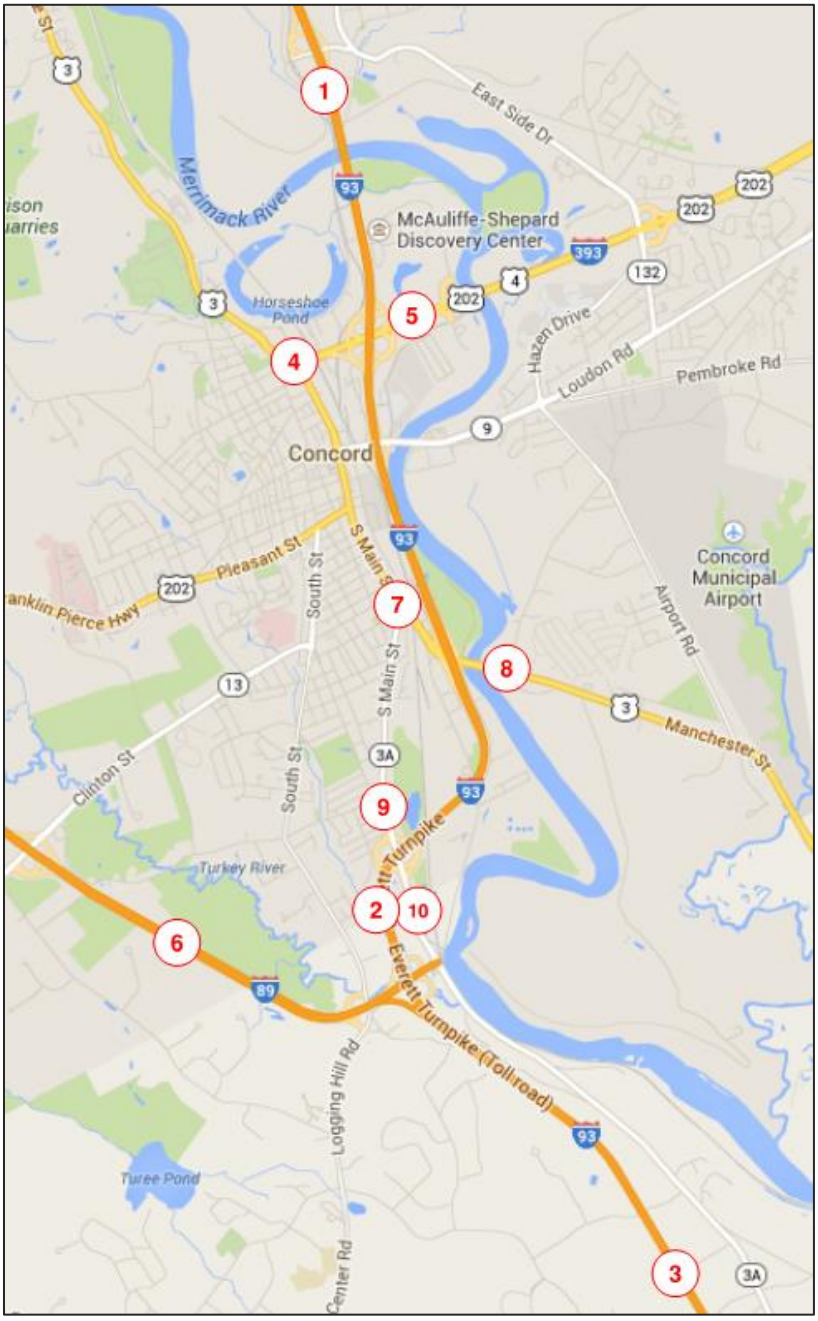
FIGURE 4: HIGHWAY SEGMENT COUNT LIST

#	Highway Count
1	I-93 NB between Exits 15 and 16
2	I-93 SB between Exits 15 and 16
3	I-93 NB between Exits 12 and 13
4	I-93 SB between Exits 12 and 13
5	I-93 NB at Hookset Toll Plaza
6	I-93 SB at Hookset Toll Plaza
7	I-89 NB between Exits 1 and 2
8	I-89 SB between Exits 1 and 2
9	I-393 EB over the Merrimack River
10	I-393 WB over the Merrimack River
11	I-393 Exit 2 EB Off-Ramp
12	I-393 Exit 2 EB On-Ramp
13	I-393 Exit 2 WB Off-Ramp
14	I-393 Exit 2 WB On-Ramp
15	I-89 Exit 2 EB Off-Ramp
16	I-89 Exit 2 EB On-Ramp
17	I-89 Exit 2 WB Off-Ramp
18	I-89 Exit 2 WB On-Ramp

BLUETOOTH COUNT LOCATIONS

In addition to target traffic volumes, origin/destination data was collected along the I-93 corridor at the 10 locations shown below in Figure 5, from April 30, 2014 through May 7, 2014. Unique and anonymous media access control identification numbers associated with passing Bluetooth devices were recorded at the Bluetooth monitoring stations shown below and are used to inform the distribution of traffic origin/destination pairs between interchanges.

FIGURE 5: BLUETOOTH MONITORING LOCATIONS



DEVELOPMENT OF AM AND PM PEAK HOUR TRIP TABLES

An important step in the model calibration process is the estimation of an origin-destination trip matrix ("O/D matrix"). The O/D matrix represents the zone-to-zone vehicle trips during the analysis peak hours. Including external TAZs, the model has 93 TAZs, which generates a 93 by 93 matrix of vehicle trips (i.e. 8,556 origin/destination pairs).

The calibration process involves assigning an estimated O/D matrix to the roadway network and comparing the simulated vehicle travel paths against the calibration count set. Every left, through, and right turn estimated in the model is compared against the actual number of left turns, through movements, and right turns within the calibrated count set, and the estimation process is repeated until satisfactory calibration targets between simulated and actual traffic volumes are met.

Calibration involves the iterative process of estimating the O/D matrix and comparing results with target volumes. For the Bow-Concord model there are several sources of information that are used to constrain the O/D estimation process, including:

- Bluetooth origin/destination flows along the I-93 corridor,
- Land-use information on model TAZs including type and size of specific land-uses,
- relative amount of available parking, and
- Zone-specific traffic counts that allow for the estimation process to constrain the vehicle origins and destinations for specific TAZs.

An iterative proportional fitting (IPF) process developed within the Python programming language was used to generate the AM and PM peak hour origin/destination trip tables.

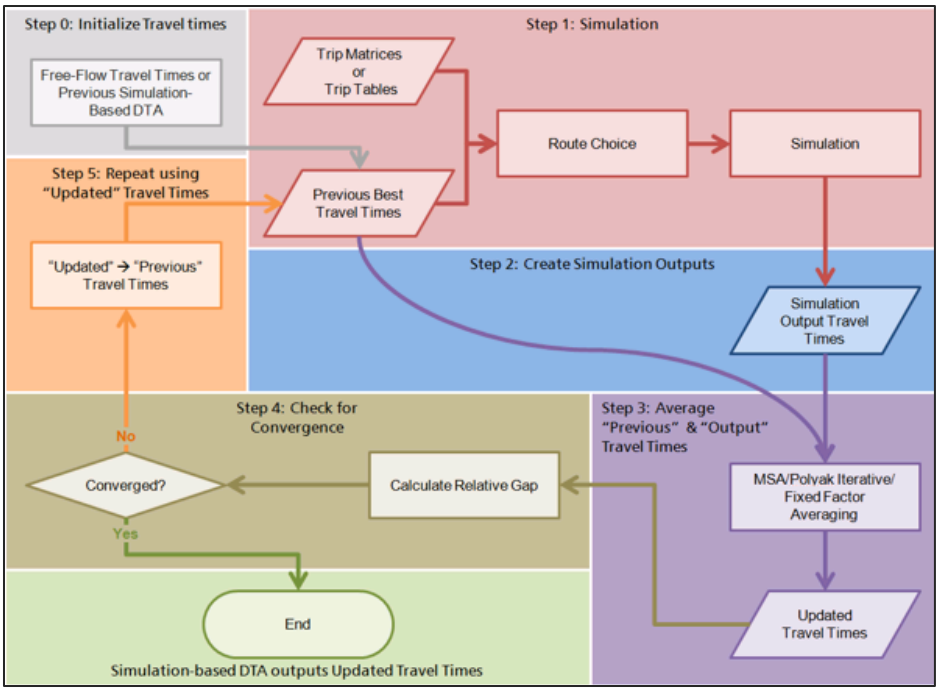
The IPF process works by repeatedly adjusting O/D path volume estimates to match the target volumes. Each path volume is adjusted multiple times, but each time it is adjusted the change is smaller. After iterating, the adjustments drop to zero. For this project, there were approximately 15,000 paths and 400 targets, and the IPF process converged after approximately 10 iterations. Comparing the results to the target volumes and the Bluetooth data showed the final estimate was well calibrated to actual volume measurements.

After completing the IPF process, we used the resulting O/D matrices to run the TransModeler microsimulation model. After completing the trip assignment process (described below) and simulating traffic through the microsimulation model, we compared the resulting model volumes with target volumes using statistical measures of fit (described below) to quantify the level of calibration. When the calibration thresholds are met, the calibration process is considered complete and the resulting model is considered valid for planning purposes.

TRIP ASSIGNMENT

Dynamic Traffic Assignment (DTA) is the process by which traffic between origin and destination pairs is distributed to all potential route paths within the microsimulation model. The DTA process starts by conducting a series of simulation runs from which travel times and turning delays are recorded for all links and turning movements within the model. For each simulation run, travel times and delays are compared with travel times and delays from previous simulation runs. With each iteration, subsequent simulation runs slightly modify the route choices and repeat the comparison of new travel times and delays with previous averages. The DTA process is considered complete when the iterative fluctuations in route choice no longer create significant changes to the overall travel times and delays. The goal of the DTA process is to arrive at a set of stable travel times and delays that route traffic between origin/destination pairs with the least amount of overall delay possible. Figure 6 presents a flow chart of the DTA process.

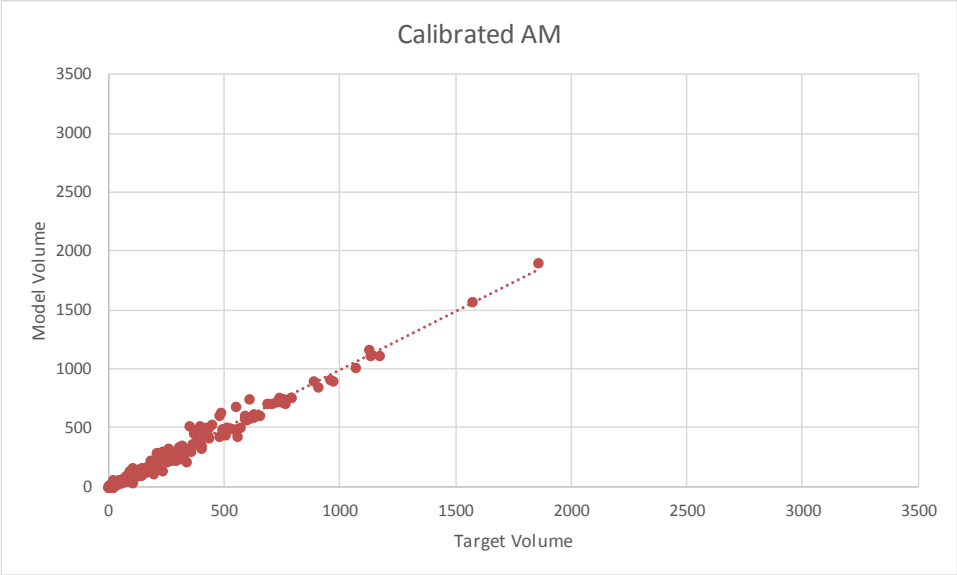
FIGURE 6: DYNAMIC TRAFFIC ASSIGNMENT PROCESS FLOW CHART[2]



CALIBRATION PERFORMANCE

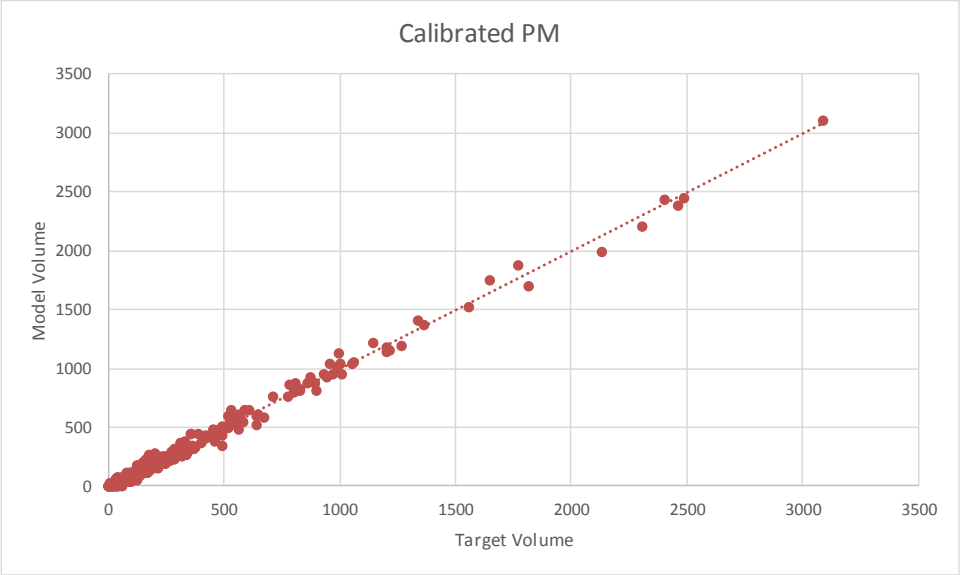
Figure 7 and Figure 8 below show the distribution of model output compared to target traffic count volumes during the AM and PM peak hours, respectively. A 45-degree line represents a perfect correlation of model output and target volumes. As can be seen below, the regression lines shown in the figures are nearly at a 45-degree angle, indicating the model volumes are in very good correlation with the target volumes.

FIGURE 7: TARGET VOLUMES VS. MODEL VOLUMES – AM PEAK HOUR



[2] Image courtesy Caliper Corporation

FIGURE 8: TARGET VOLUMES VS. MODEL VOLUMES – PM PEAK HOUR



The model has been compared to two calibration standards. The first calibration threshold relates to the standards conventionally applied to regional travel demand models. These standards have been developed by the Federal Highway Administration (FHWA) to provide an overall threshold of quality for transportation models used for regional transportation planning and are shown below in Figure 9.

FIGURE 9: CALIBRATION RELATIVE TO RECOMMENDED THRESHOLDS FOR REGIONAL MODELS

	Target	AM Model	PM Model
Root Mean Squared Error	<40%	14.0%	11.5%
Coefficient of Correlation (r)	>= 0.88	0.98	0.99
Percent Error (Region)	+/- 5%	-0.3%	0.1%

Additional standards have been developed specifically for microsimulation travel models. These standards were first published in 2004 by FHWA.[3] These standards rely upon the GEH statistic, which is an empirical measure of fit used to compare errors across roadways with largely different traffic flows. The GEH statistic is computed as in Equation 1.

EQUATION 1: GEH STATISTIC

$$GEH = \sqrt{\frac{(ModelVolume - CountVolume)^2}{0.5 * (ModelVolume + CountVolume)}}$$

In practice, a GEH value less than 5 indicates the model volume is a good fit with the target. A GEH between 5 and 10 indicates potential errors or a lack in model accuracy at the subject count area, and a GEH greater than 10 indicates an unacceptable level of correlation.

[3] "Traffic Analysis Toolbox Volume III: Guidelines for Applying Traffic Microsimulation Software". FHWA-HRT-04-040. July 2004.

Figure 10 presents the performance of the Bow-Concord microsimulation model relative to the turning movement calibration targets for the GEH statistic.

FIGURE 10: MICROSIMULATION CALIBRATION METRIC COMPARISON

	Target	AM Model	PM Model
GEH <=5, by movement	>85%	94.5%	93.6%
5<GEH<=10, by movements	<=15%	5.5%	6.4%
GEH >10, by movement	0%	0.0%	0.0%

3.0 BASELINE NETWORK IMPROVEMENTS

At the time of model construction, the City of Concord was actively undertaking a major improvement project on Main Street in downtown Concord. This project adds streetscaping and increases sidewalk and public spaces while reducing the roadway cross-section from 4 lanes to 2 lanes between Loudon Road and Storrs Street. Roadway configurations at major intersections remain unchanged and the overall vehicle capacity of Main Street is not expected to have changed significantly with these improvements. However, this overall project does represent a relatively major change to the study area road network. For all future-year, 2035, scenario testing, we assume these Main Street "road diet" improvements are in place in all scenarios.

4.0 TRIP ASSIGNMENT FOR ALTERNATIVE TESTING

As the Bow-Concord project progresses, alternatives have been developed for various interchange, ramp access, and freeway configurations along the I-93 corridor. These alternatives are being tested for impacts and benefits to traffic operations using the traffic microsimulation model described above. To the extent that proposed improvements offer new or alternative connections to study area roadways, the model DTA process is used to reallocate traffic demand, considering these new or altered route paths.

5.0 FUTURE YEAR ANALYSIS

Future year traffic volumes for the 2035 microsimulation analysis year rely on growth projections developed by the Central New Hampshire Regional Planning Commission (CNHRPC) for the regional travel demand model. These projections are consistent with historical traffic trends within the project study area.

MODEL GROWTH

The regional model differs from the microsimulation model in that regional model network traffic is generated directly from population, household, and employment numbers, rather than a fixed matrix of OD demand. The CNHRPC regional model base year (2010) population, household, and employment numbers have been assigned to the model zones with data obtained from the US Census, New Hampshire Employment Security (NHES)[4], and the Longitudinal Employer-Household Dynamics

[4] http://www.nhes.nh.gov/elmi/products/documents/planning-regions.pdf

(LEHD) program.[5] Growth projections from these datasets were generated for the CNHRPC by Applied Economic Research, Inc. and indicate approximately 28% growth in employment and 9% growth in population by 2035. Actual traffic changes in the regional model vary based on the assigned locations of projected residential and employment growth at the zone level.

Land-use changes at the individual TAZ level, were developed by CNHRPC in consultation with representatives from member towns, to ensure projected growth was allocated where local experts anticipate it is most likely. Figure 11 and Figure 12 present the relative distribution of anticipated growth in regional employment and households by 2035.

FIGURE 11: PROJECTED INCREASES IN CNHRPC EMPLOYMENT

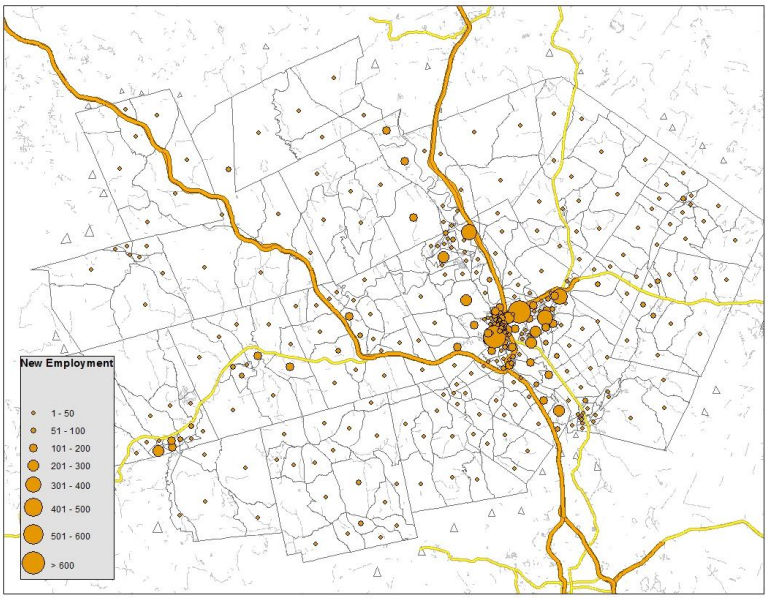


FIGURE 12: PROJECTED INCREASES IN CNHRPC HOUSEHOLDS

[5] http://lehd.ces.census.gov/

To identify projected growth within the microsimulation model study area, a subarea analysis was performed on the calibrated baseline regional model and again on the projected 2035 regional model. This process generates OD matrices based on the regional model baseline and future year travel demand, which are structured similarly to the calibrated microsimulation model's OD matrix. The future year and base year subarea analysis OD matrices and the calibrated baseline microsimulation model OD matrix were then all compared and subjected to an 8-case pivoting process to determine the projected growth for each OD pair. For each OD pair the projected traffic growth is dependent on the values in the regional model baseline and future year OD matrices and in the baseline microsimulation OD matrix. Where normal growth is expected and all three matrices have non-zero inputs, the projected growth is the rate of growth observed between the baseline and future year regional model matrices. Where any one of the three matrices has a zero entry for a given OD pair, or where extreme growth is projected by the proportional scaling method, one of seven other methods is applied. This pivoting process is described well in a paper by RAND Europe from 2011.[6] Figure 13, from the RAND study, illustrates the 8 growth cases addressed by this methodology.

FIGURE 13: EIGHT CASES OF TRAVEL DEMAND MODEL GROWTH[6]

Base (B)	Synthetic Base (S_b)	Synthetic Future (S_f)	Predicted (P)		Cell Type
0	0	0	0		1
0	0	>0	S_f		2
0	>0	0	0		3
0	>0	>0	Normal growth	0	4
			Extreme growth	$S_f - X_1$	
>0	0	0	B		5
>0	0	>0	$B + S_f$		6
>0	>0	0	0		7
>0	>0	>0	Normal growth	$B.S_f / S_b$	8
			Extreme growth	$B.X_2 / S_b + (S_f - X_2)$	

$$X_1 = k_2.Sb$$

$$X_2 = k_1.Sb + k_2.Sb.\max\left[\frac{Sb}{B}, \frac{k_1}{k_2}\right]$$

Overall, this method results in a projected traffic volume increase of approximately 18% during the weekday AM peak hour and approximately 12% during the weekday PM peak hour, by the 2035 future year.

HISTORICAL TRAFFIC TRENDS

We have also examined historic growth trends at three continuous traffic counter (CTC) stations in Concord. As shown in Figure 14, two CTC stations are on I-93 (between exits 12 and 13 and between exits 16 and 17) and one CTC station is on I-393 immediately east of Exit 1 over the Merrimack River.

Using data collected at these three NHDOT count stations since 1993, we have calculated historic growth trends over the past 10, 15, and 20 years of data, and have done so independently for the: 1) highest traffic hour of the year, 2) the annual average daily traffic volume (AADT), and 3) the 30th highest traffic hour of the year (which is typically regarded as representative of design hour conditions).

[6] A. Daly, J. Fox, and B. Patruni, RAND Europe. *Pivoting in Travel Demand Models.* Association for European Transport and Contributors, 2011.

FIGURE 14: NHDOT CONTINUOUS TRAFFIC COUNT (CTC) STATION LOCATIONS

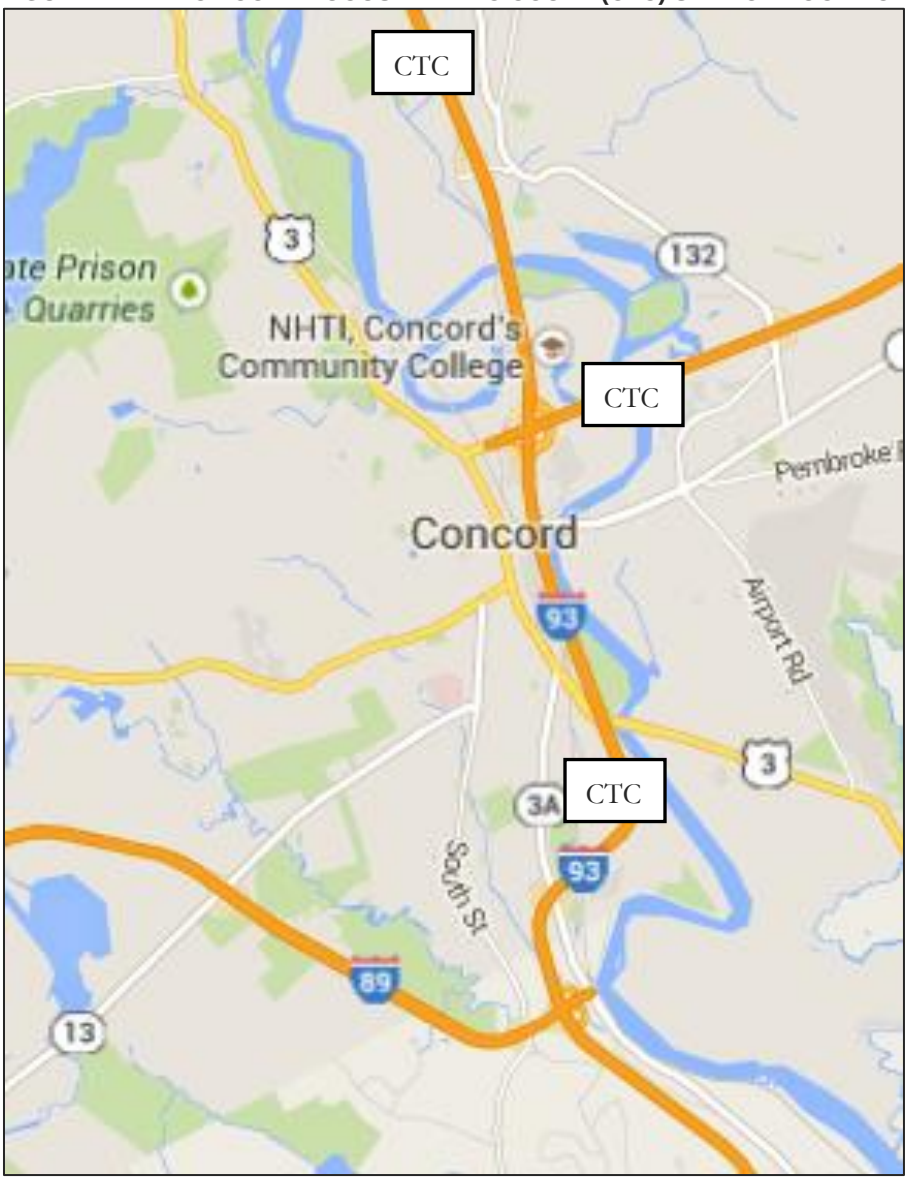


Figure 15 through Figure 17 present plots of these three sets of historic traffic data and include trend lines from the 20-year period and from the most recent 10-year period. As can be seen in these figures, the 20-year historic growth trends at all three count stations indicate continued growth. However, over the past 10 years, traffic volumes have declined at all three count stations and across all three datasets.

FIGURE 15: HIGHEST HOUR HISTORIC TRAFFIC TRENDS

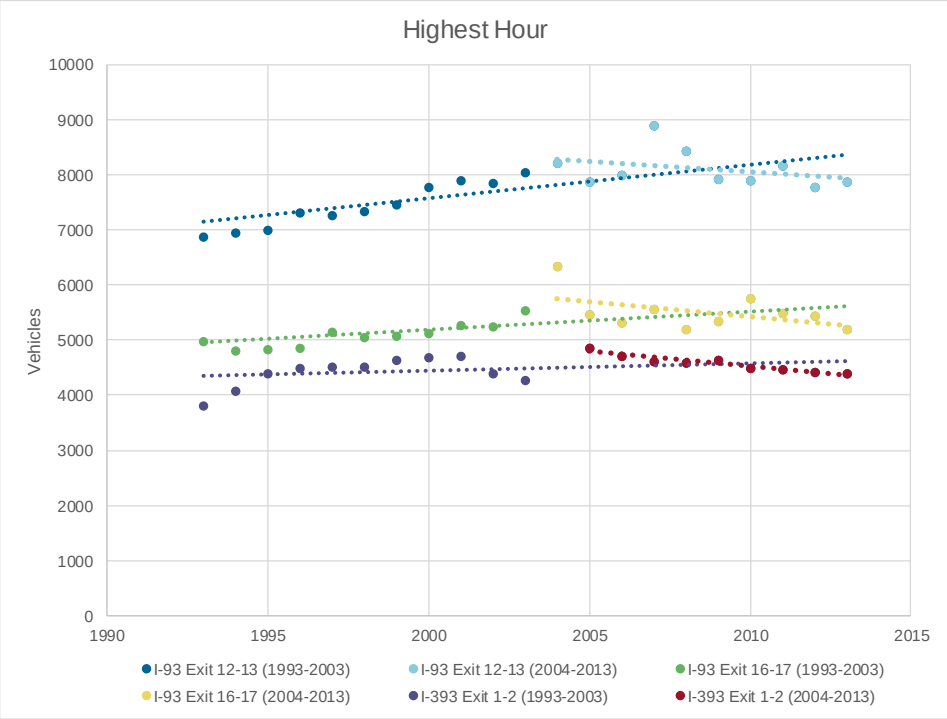


FIGURE 16: AADT HISTORIC TRAFFIC TRENDS

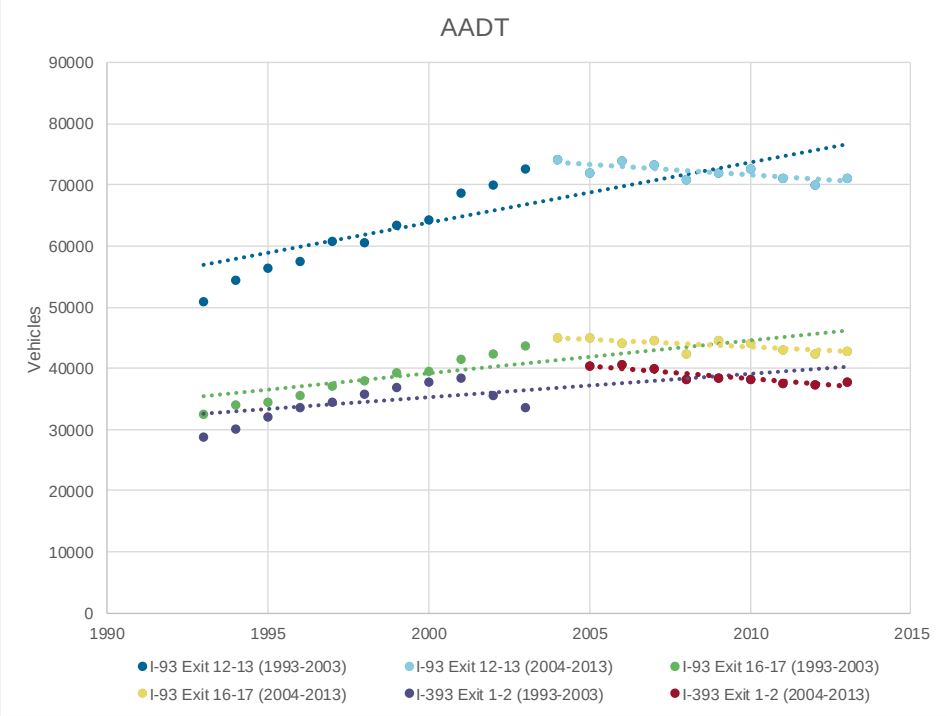


FIGURE 17: 30TH HIGHEST HOUR TRAFFIC TRENDS

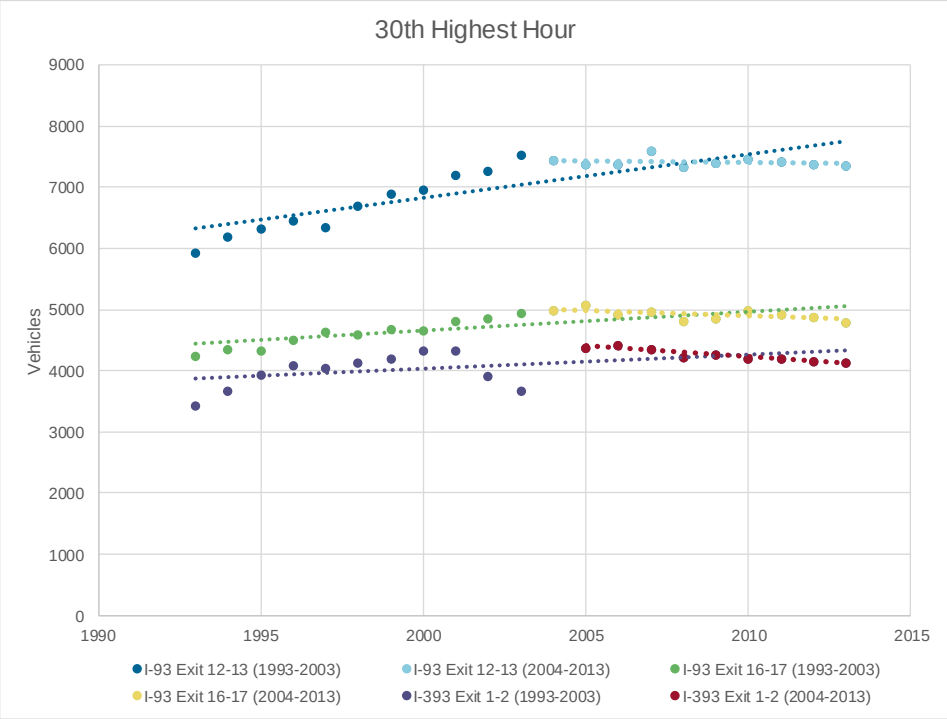


Figure 18 presents the overall projected percentage increase in traffic volumes out to the 2035 design year, based on the three datasets and calculated from 20-year, 15-year, and 10-year regression analyses. As evidenced by the plots above, the 20- and 15-year regression analyses indicate continued growth while the 10-year trends indicate a decline in traffic volumes. Additionally, the highest hours and 30th highest hours of traffic have grown less over 20 years than the AADT, indicating a sizable portion of daily traffic growth has occurred in off-peak hours (likely some portion related to peak spreading).

Taking an average of the projected increase to 2035 conditions across the three count locations, and based on the most conservative 20-year projections and considering the 30th highest hour dataset, which is typically regarded to represent design hour conditions, we calculate an average growth adjustment of approximately 14% overall to 2035 conditions, based on historic count trends.

FIGURE 18: GROWTH PROJECTION ADJUSTMENT TO 2035 ANALYSIS YEAR

	I-93 Between Exits 12-13 2014 - 2035 Growth			**I-93 Between Exits 16-17 2014 - 2035 Growth**			**I-393 over Merrimack River 2014 - 2035 Growth**		
	10 Yrs	15 Yrs	20 Yrs	10 Yrs	15 Yrs	20 Yrs	10 Yrs	15 Yrs	20 Yrs
#1 Highest Hour	-10%	5%	14%	-22%	4%	12%	-26%	-5%	6%
#30 Highest Hour	**-2%**	**7%**	**18%**	**-8%**	**4%**	**12%**	**-18%**	**1%**	**11%**
AADT	-10%	10%	24%	-13%	9%	24%	-24%	5%	20%

	Average Highway Growth 2014 - 2035 Growth		
	10 Yrs	15 Yrs	20 Yrs
#1 Highest Hour	-19%	1%	11%
#30 Highest Hour	**-9%**	**4%**	**14%**
AADT	-16%	8%	23%

Traffic projections based on historic count data are consistent with the model projected growth of ~12% during the weekday AM peak hour and ~18% during the weekday PM peak hour. Growth derived from the regional model process is used to test all scenarios in this analysis.

6.0 SCENARIO TESTING

The Bow-Concord Traffic Microsimulation Model has been developed to support a comprehensive assessment of the traffic implications associated with highway and interchange design alternatives developed for the I-93 corridor in central New Hampshire.

SCENARIOS

Within the project limits there are seven (7) full access interchanges including two freeway-to-freeway interchanges, I-93/I-89 and I-93/I-393. Because there is limited space between some of the interchanges, the project has been separated into four segments for the purposes of alternatives development. The four segments are as follows:

- I-89 Area, which includes I-93/I-89 and Exit 1 on I-89
- Exit 12
- Exit 13
- Exit 14-15, which also includes Exit 1 on I-393

MJ has developed several design concepts for each segment listed above, as well as the freeway segments between the interchanges. Segment concepts have been assembled as corridor scenarios for the purposes of modeling. These scenarios have been tested with the microsimulation model and refined iteratively to obtain the scenarios listed below. All scenarios include expanding I-93 from 2 lanes per direction to 3 lanes as a starting point. The number and design of merge, diverge, and weave areas differ by scenario. The scenarios were developed specifically to determine how differences in weaves, auxiliary lanes, merges, and access affect overall corridor operations.

Conceptual designs provided by MJ for each scenario are included as an attachment with this memorandum and are outlined below:

Scenario A

- **I-89 Area**: (MJ Concept C)
  - Maintains the existing interchange intersection configurations,
  - Reconstructs on- and off-ramps to increase weave distance between I-89 Exit 1 and the I-93/I-89 interchange
- **Exit 12**: (MJ Concept F)
  - Relocates southbound and northbound off-ramps downstream of NH-3A,
  - Converts four-way intersections to three-way intersections at the ramp terminals,
  - Constructs roundabouts at ramp terminals
- **Exit 13:** (MJ Concept A)
  - Signalize northbound right-turn and provide an overlap phase for this movement.
- **Exit 14-15:** (MJ Concept D)
  - Single Point Urban Interchange (SPUI) at Exit 14
  - Retains full cloverleaf at Exit 15

Scenario B

- **I-89 Area**: (MJ Concept K)
  - New roadway connecting NH-3A and South Street at the I-89 Exit 1 NB Ramp intersection,
  - Elimination of the direct I-89 connection to NH-3A,
  - New ramps from I-93 northbound to I-89 northbound and from I-89 southbound to I-93 southbound, which eliminate weaves between I-89 Exit 1 and the I-93/I-89 interchange
- **Exit 12**: (MJ Concept F)
  - Relocates southbound and northbound off-ramps downstream of NH-3A,
  - Converts four-way intersections to three-way intersections at the ramp terminals,
  - Constructs roundabouts at ramp terminals
- **Exit 13:** (MJ Concept B)
  - Signalize northbound right-turn and provide an overlap phase for this movement.
  - Widens northbound right-turn lane to two lanes.
- **Exit 14-15:** (MJ Concept C)
  - Single Point Urban Interchange (SPUI) at Exit 14,
  - New northbound and southbound collector-distributor roads between Exit 14 and Exit 15,
  - Retains full cloverleaf at Exit 15, but with collector-distributor roads extending through the cloverleaf.

Scenario C

- **I-89 Area**: (MJ Concept P)
  - New roadway connecting NH-3A and South Street at the I-89 Exit 1 NB Ramp intersection,
  - Elimination of the direct I-89 connection to NH-3A,
  - New ramps between I-93 and I-89 create a fully directional interchange,
  - Eliminates northbound and southbound weaves on I-89 between Exit 1 and I-93
  - Eliminates the northbound I-93 connector-distributor road weave.
- **Exit 12**: (MJ Concept E)
  - Relocates southbound and northbound off-ramps downstream of NH-3A,
  - Converts four-way intersections to three-way intersections at the ramp terminals,
  - Constructs signals at ramp terminals
- **Exit 13:** (MJ Concept B)
  - Signalize northbound right-turn and provide an overlap phase for this movement.
  - Widens northbound right-turn lane to two lanes.

- **Exit 14-15:** (MJ Concept O)
  - Reconfigures Exit 14 to eliminate southbound ramps at Loudon Road and to reconstruct the northbound on-ramp to be a loop ramp exiting south of Loudon Road,
  - Constructs a new local road between Stickney Avenue and Fort Eddy Road and adds southbound ramp connections to Stickney Avenue,
  - Reconfigures Exit 15 with relocated on-ramps to eliminate all weaves.

Auxiliary lanes between interchanges vary in these three scenarios. Figure 19 presents a summary of where full auxiliary lanes are assumed in each of the scenario packages. Locations marked are marked with "n/a" where previous weaves have been eliminated by the reconfigured design.

FIGURE 19: SUMMARY OF FULL AUXILIARY LANE LOCATIONS BY SCENARIO

	I-89 between Exit 1 and I-93/I-89	I-93 between I-93/I-89 and Exit 12	I-93 between Exit 12 and Exit 13	I-93 between Exit 13 and Exit 14	I-93 between Exit 14 and Exit 15	I-93 within Exit 15 Cloverleaf	I-393 between I-93/I-393 and Exit 1
Scenario A	NB, SB	NB	NB, SB	NB, SB	NB, SB	NB, SB	EB, WB
Scenario B	n/a	NB, SB		NB, SB	NB, SB	NB, SB	EB, WB
Scenario C	n/a	NB, SB	NB, SB	NB, SB	NB, n/a	n/a	EB, WB

2035 VOLUME MAPS

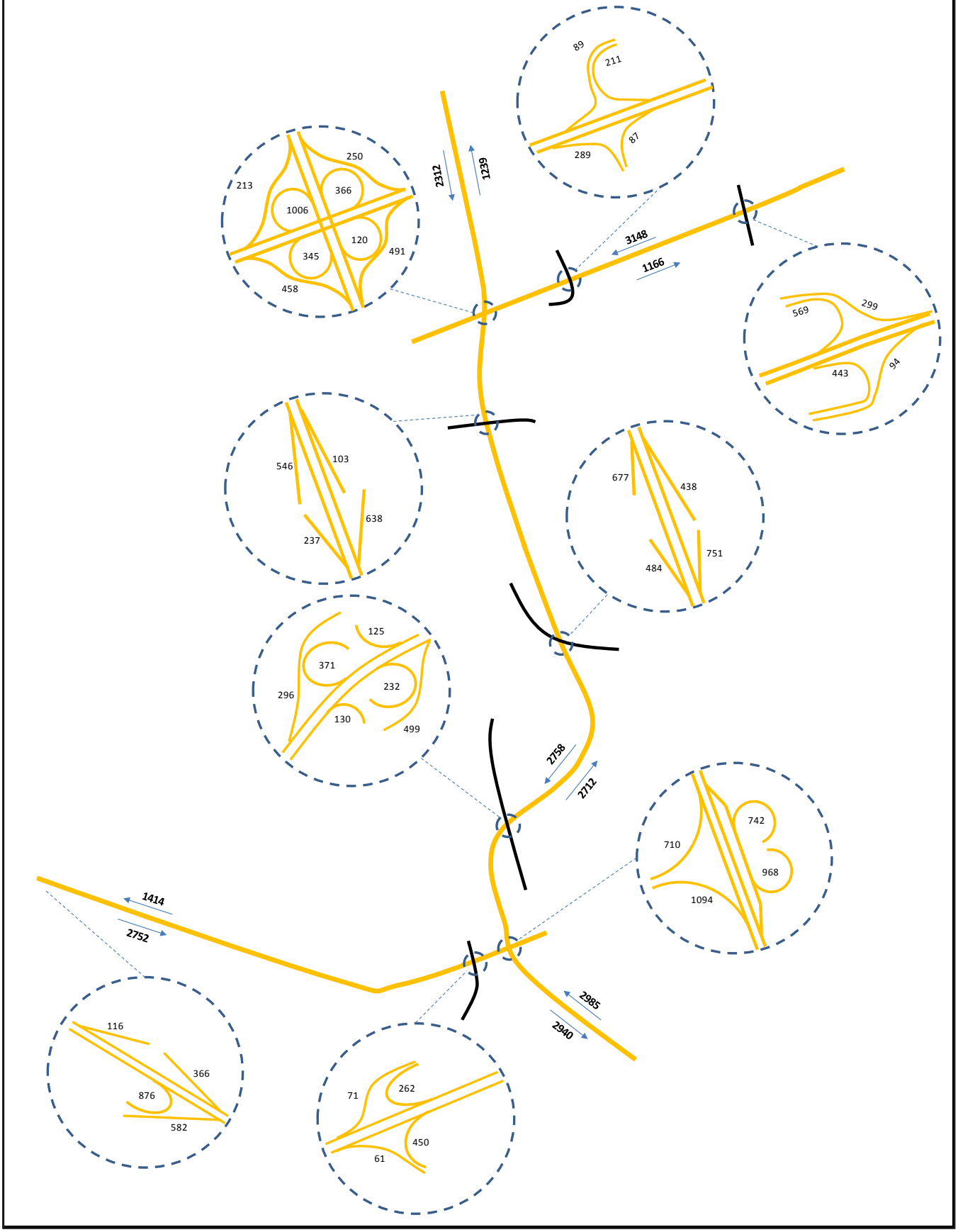
The maps below present the scenario traffic volumes for the No Build condition and the three alternatives listed above, during the 2035 weekday AM and PM peak hours. Highway and ramp volume maps are presented first, followed by interchange turning movement volume maps.[7]

With adjusted roadway network geometries and new/altered route paths, the model DTA process is used to re-distribute traffic demand to the new routes made available by the updated roadway network. The volume maps below present the model traffic processed for each scenario (Throughput). Volumes vary by scenario due to the relative attractiveness of various routes between scenarios.

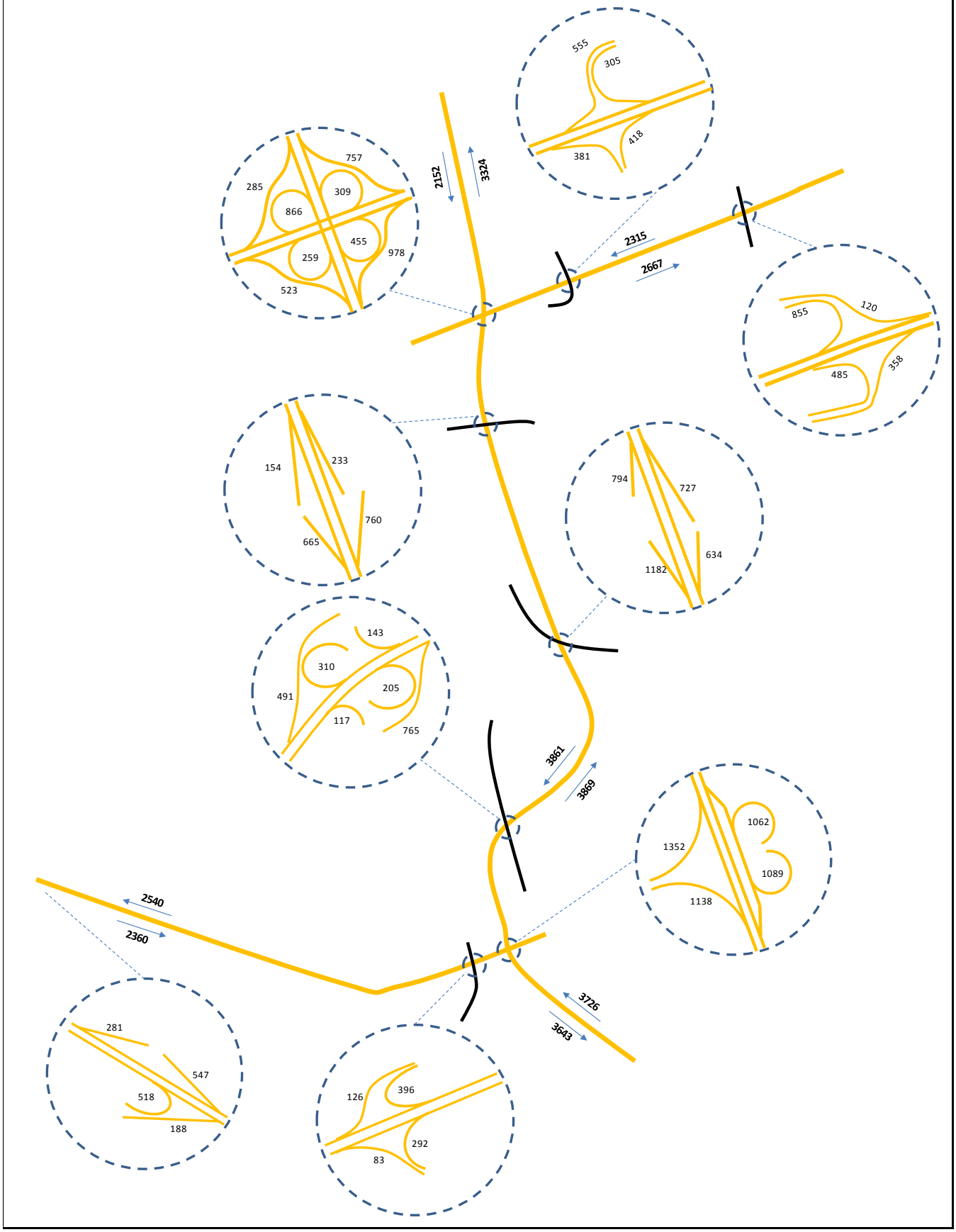
Because of constrained conditions in the 2035 No Build scenarios, the full demand is not served in the No Build simulation hours (significant queues persist at the end of the simulation hour). To present a more complete picture of No Build demand, we have also run the No Build AM and PM peak hour simulations with an additional simulation hour to process all vehicles in queue at the end of the peak hour. These figures (Demand) show the actual No Build demand, not just that which is processed in the peak hour.

[7] Because intersection volumes are recorded at a different location than ramp volumes, volumes presented for ramps may differ slightly from the total volume approaching or departing the corresponding interchange intersection. This is because some vehicles may have past the ramp count location and not the intersection count location (or vice versa) at the end of the simulation hour.

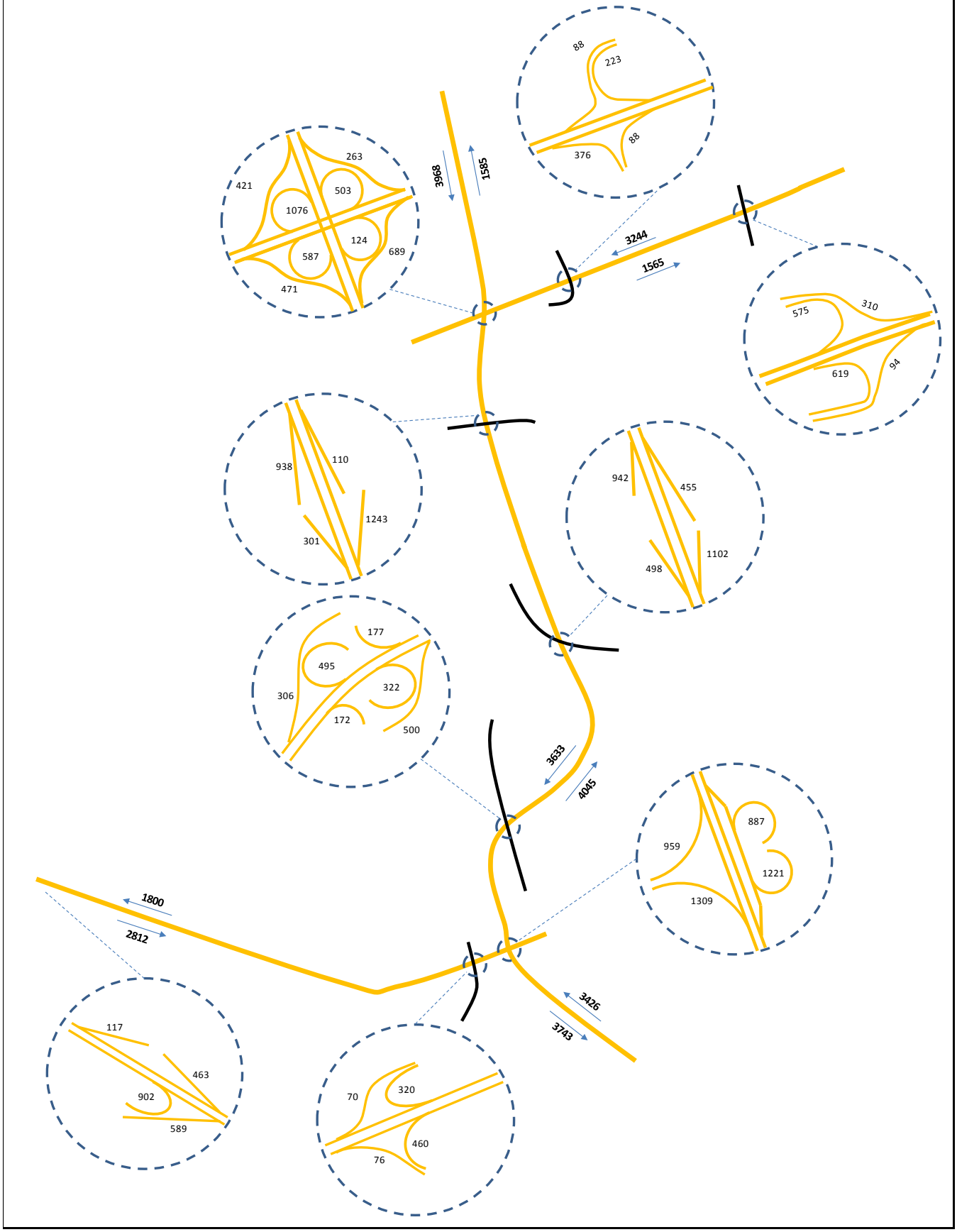
Highway & Ramp 2035 AM Peak Hour Traffic Volumes - Model Throughput



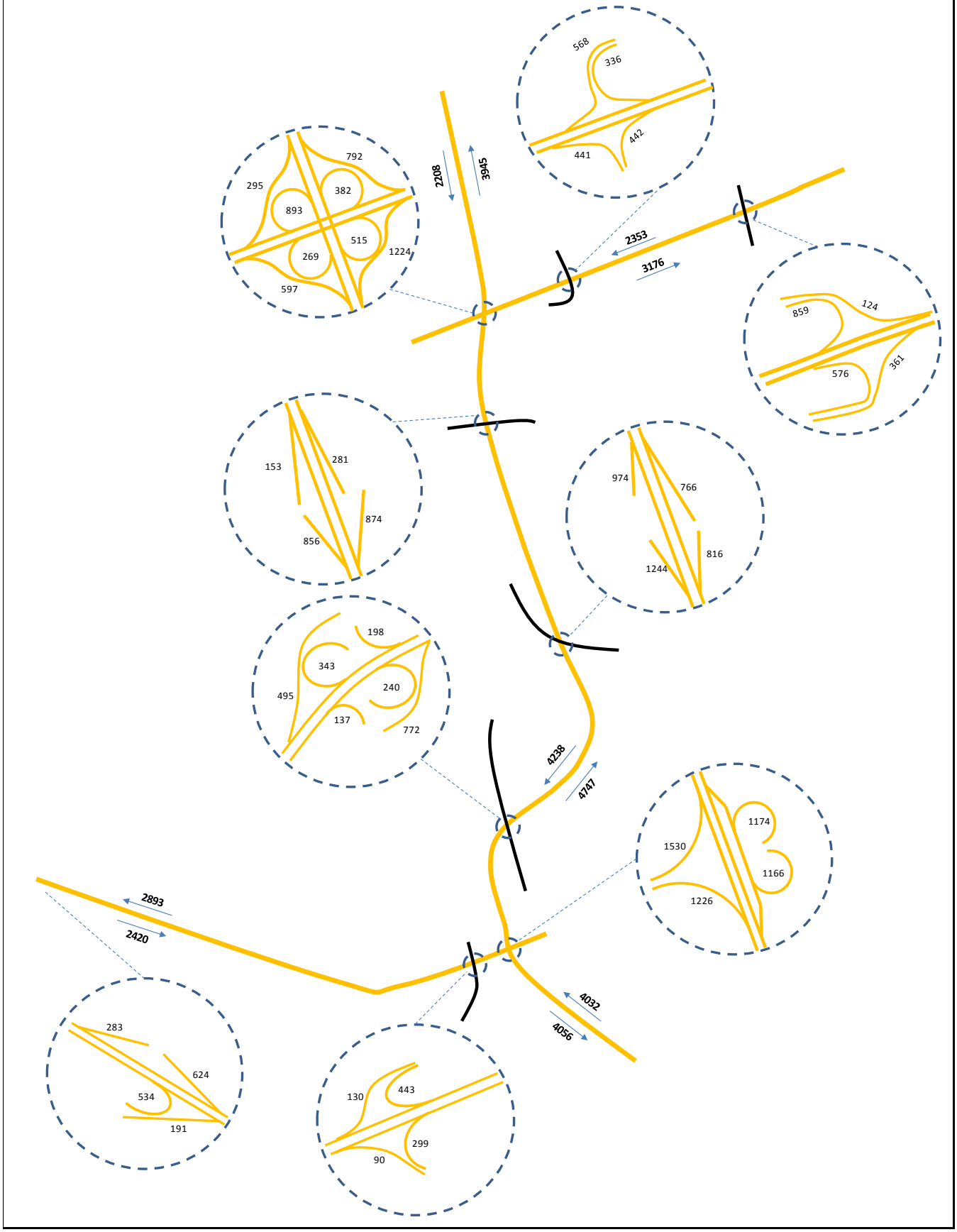
Highway & Ramp 2035 PM Peak Hour Traffic Volumes - Model Throughput



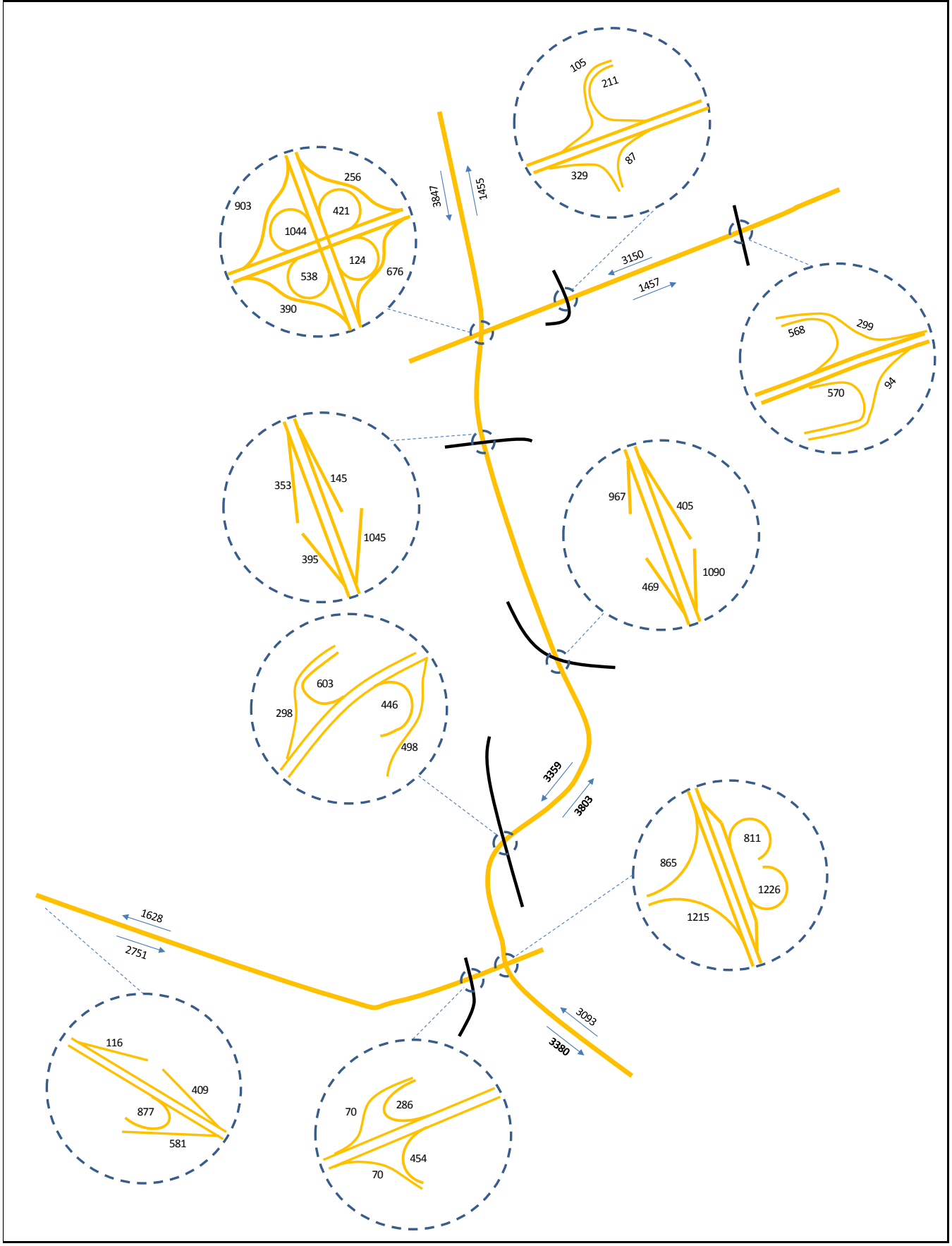
Highway & Ramp 2035 AM Peak Hour Traffic Volumes - Model Demand



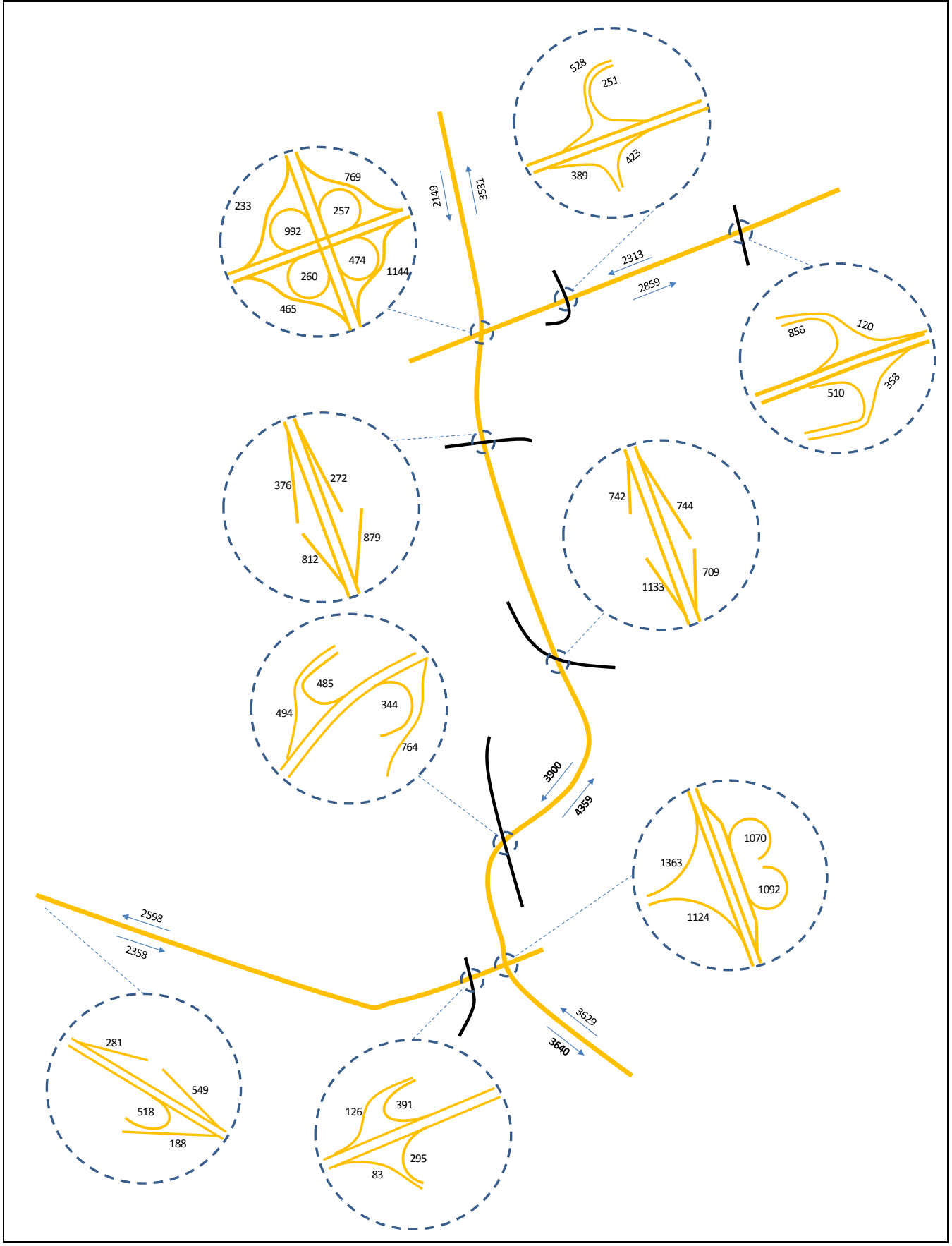
Highway & Ramp 2035 PM Peak Hour Traffic Volumes - Model Demand



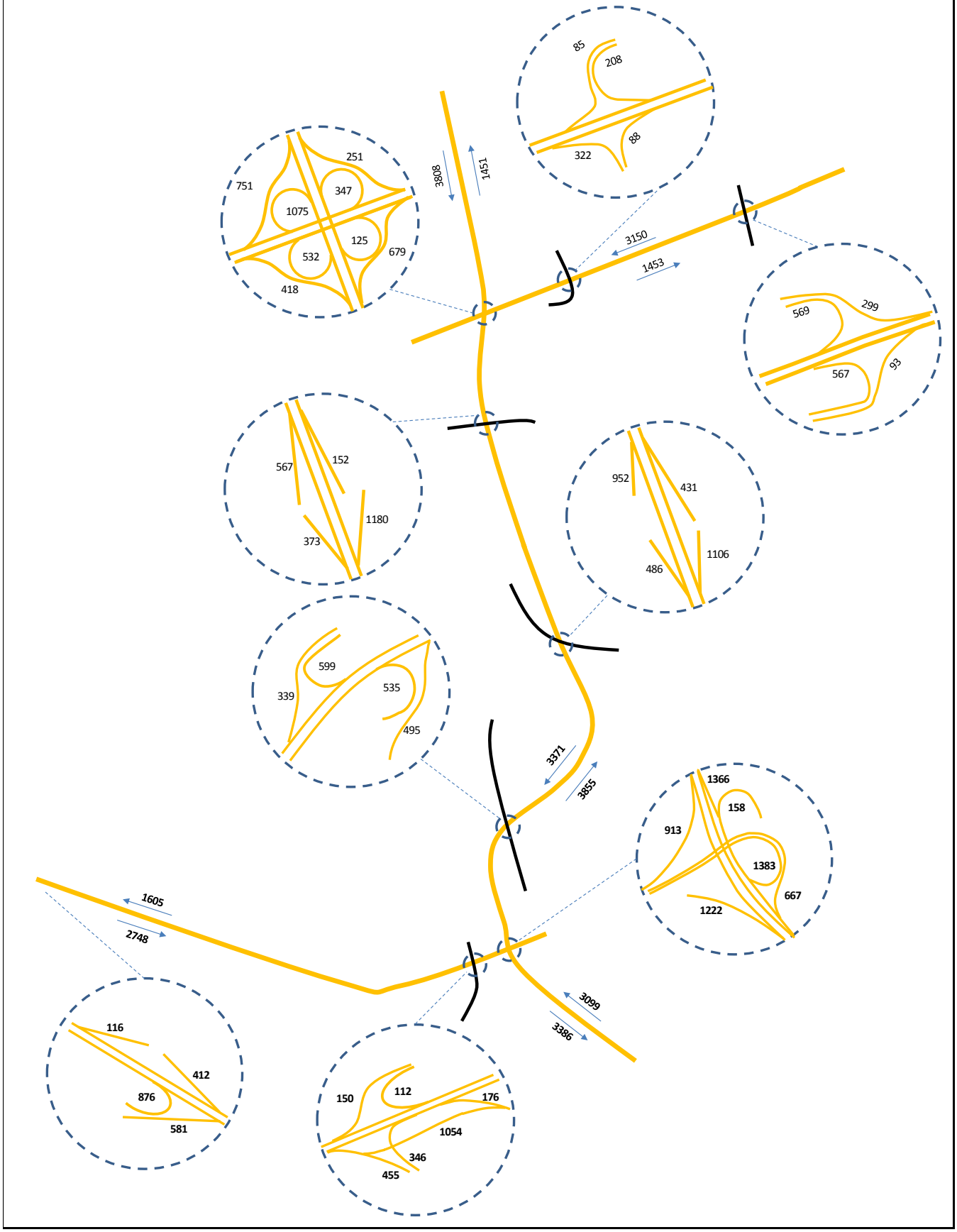
Scenario A - 2035 AM Peak Hour Traffic Volumes - Model Throughput



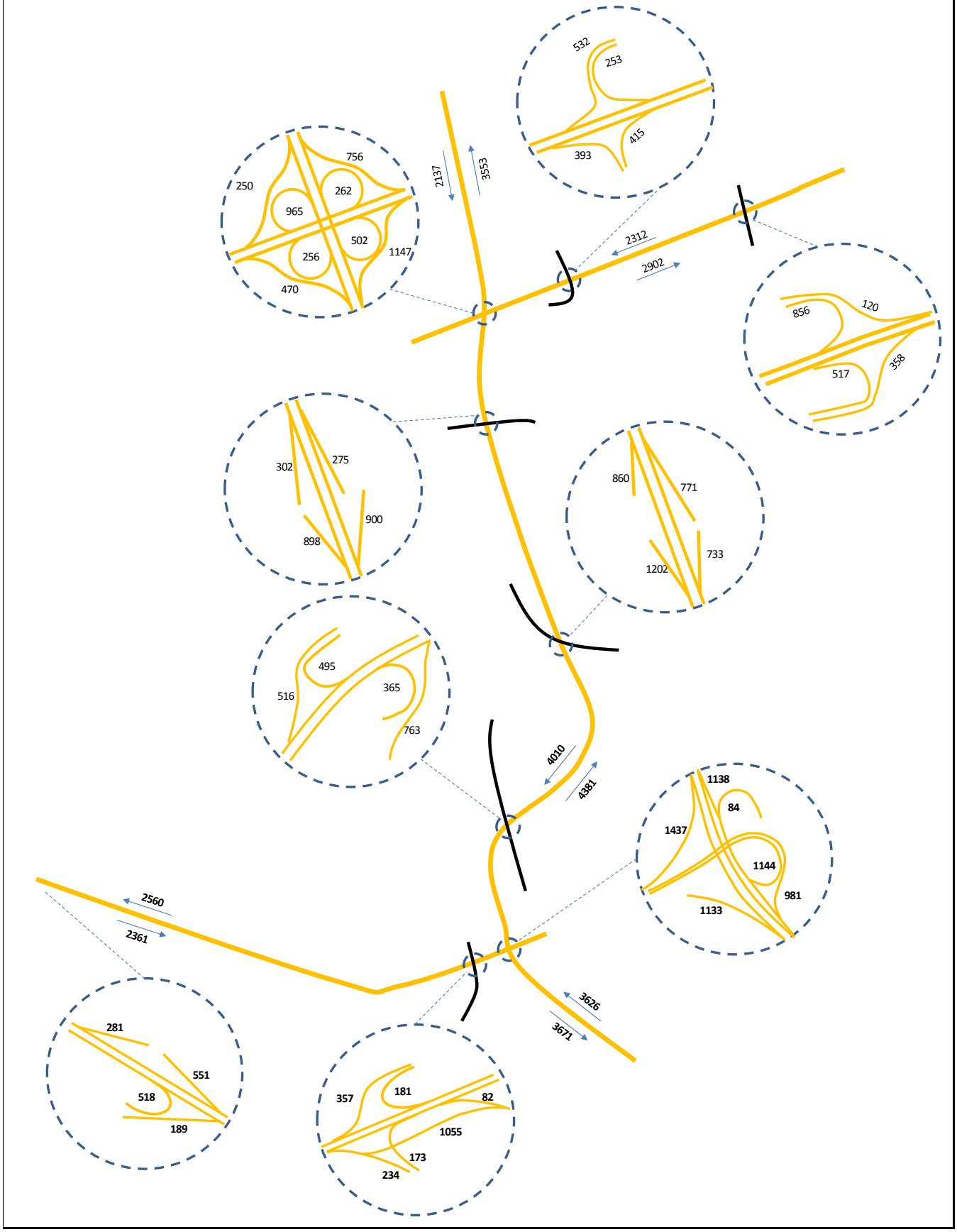
Scenario A - 2035 PM Peak Hour Traffic Volumes - Model Throughput



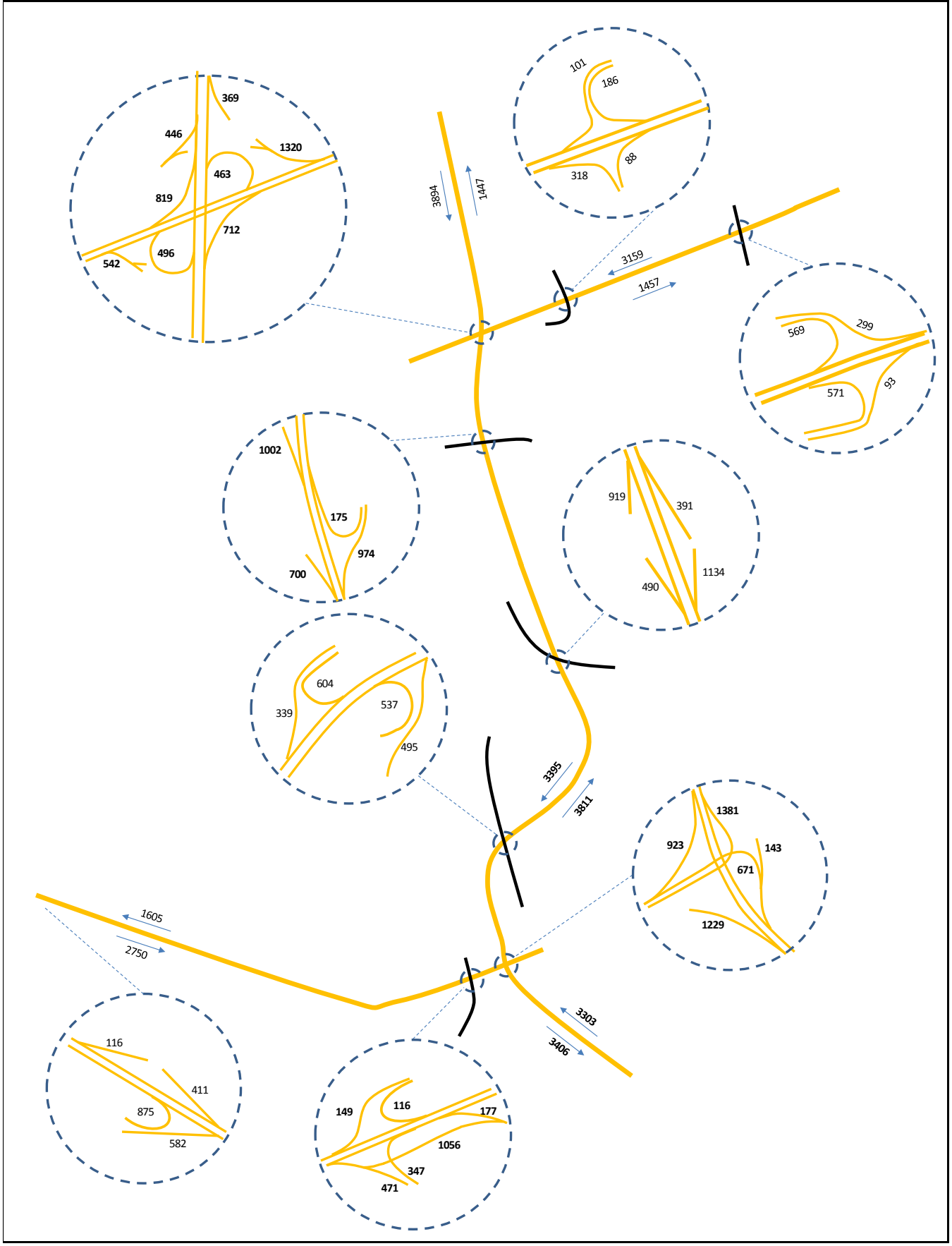
Scenario B - 2035 AM Peak Hour Traffic Volumes - Model Throughput



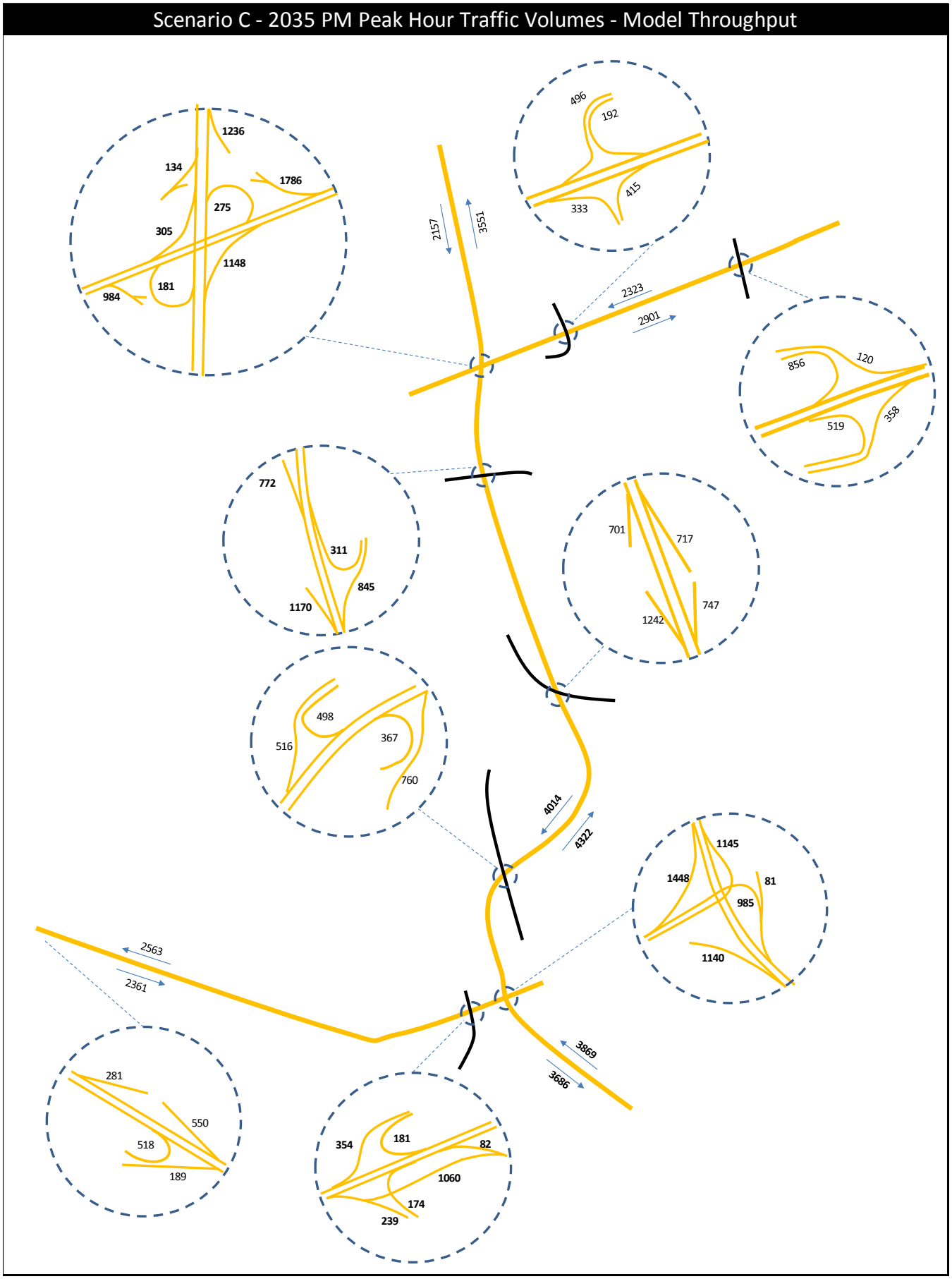
Scenario B - 2035 PM Peak Hour Traffic Volumes - Model Throughput



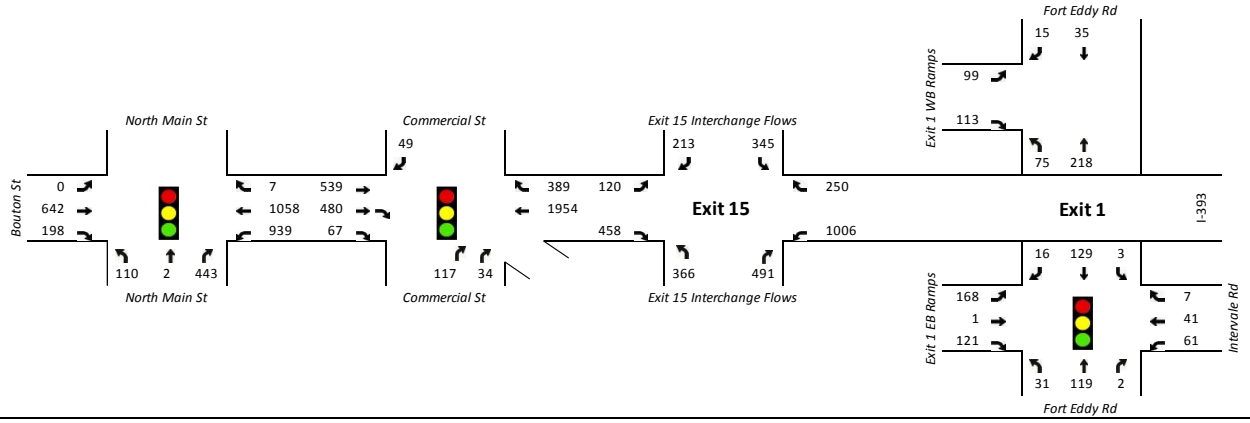
Scenario C - 2035 AM Peak Hour Traffic Volumes - Model Throughput

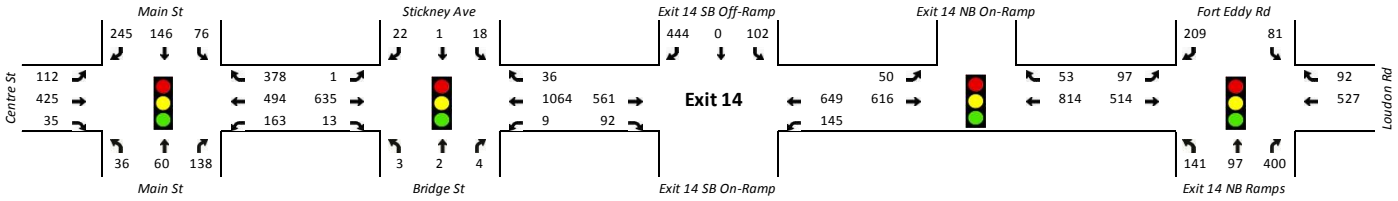


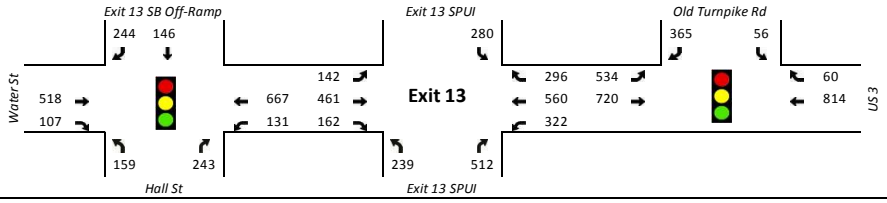
Scenario C - 2035 PM Peak Hour Traffic Volumes - Model Throughput

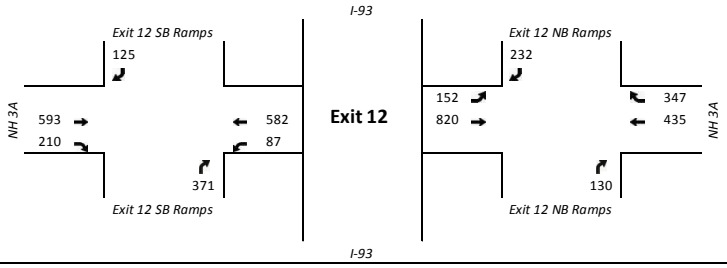


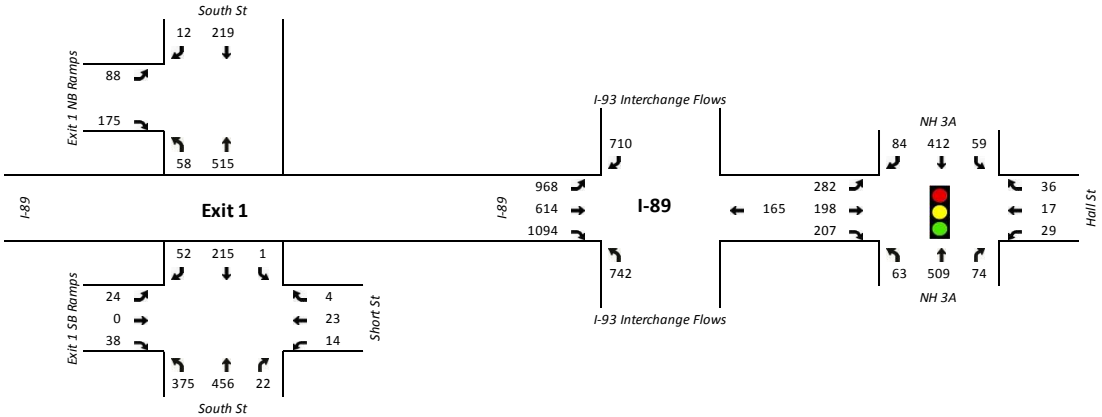
No Build - 2035 AM Peak Hour Model Throughput



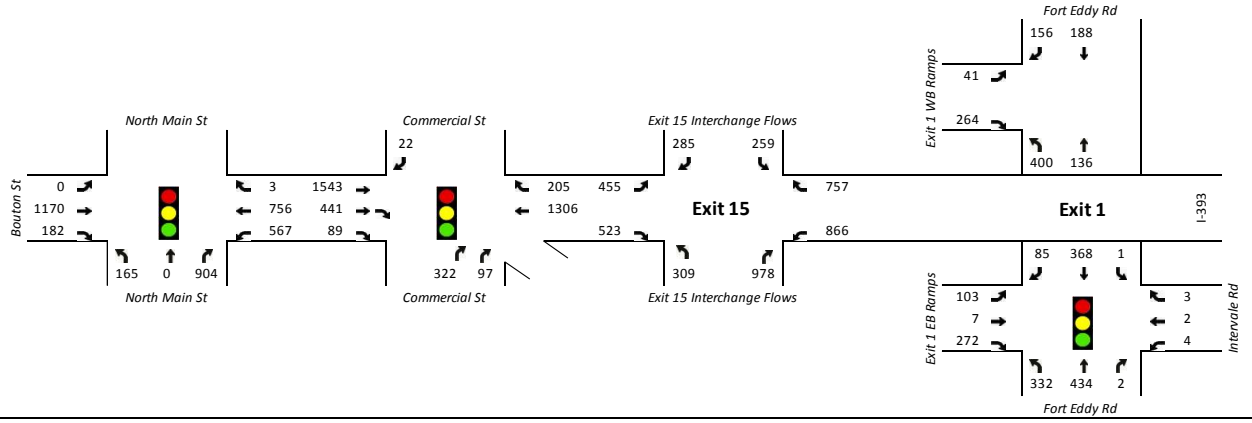


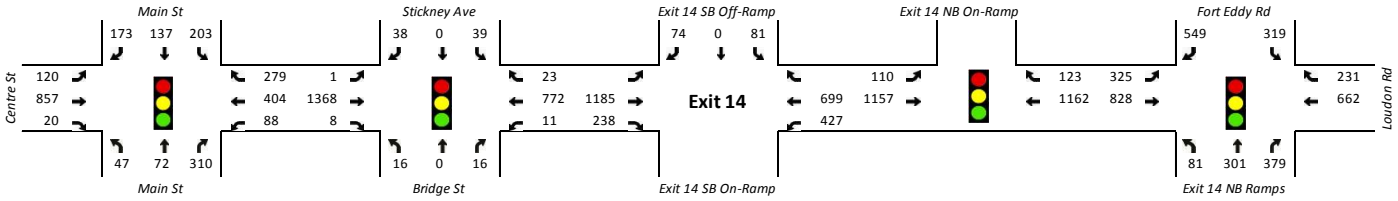


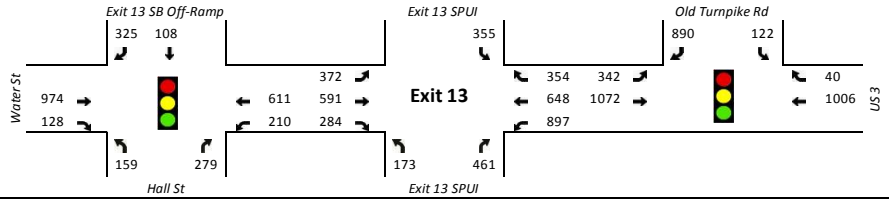


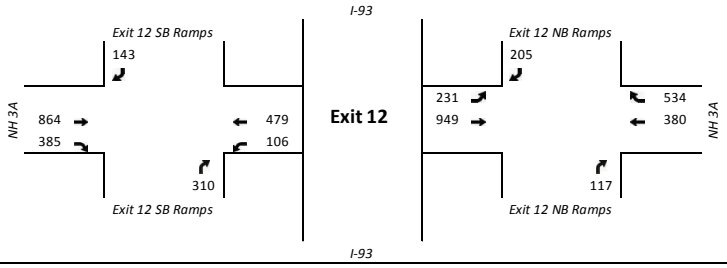


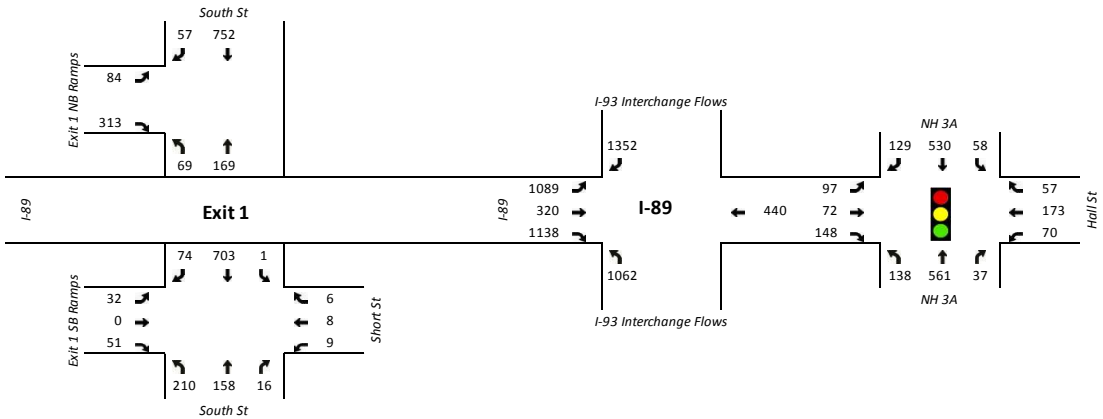
No Build - 2035 PM Peak Hour Model Throughput



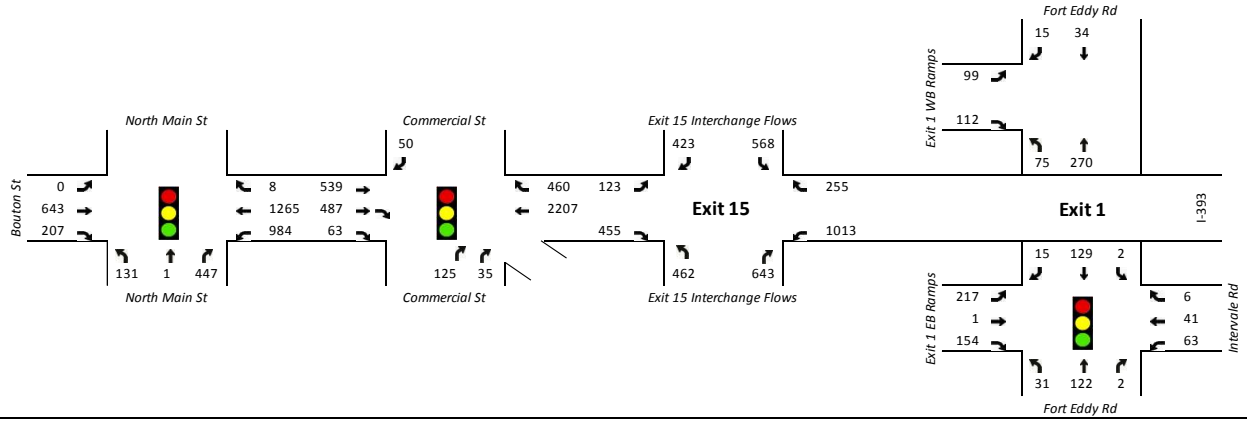


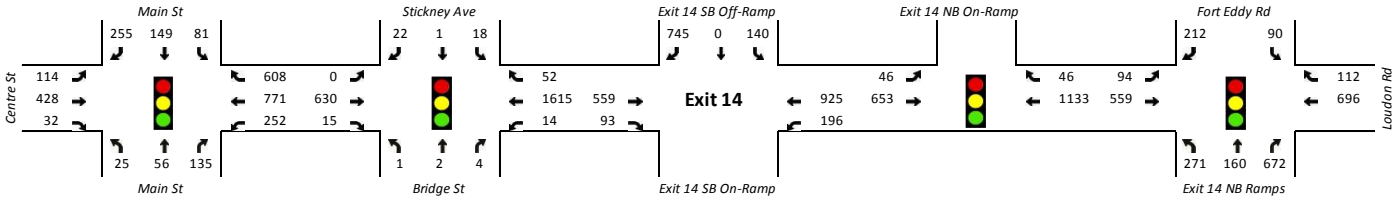


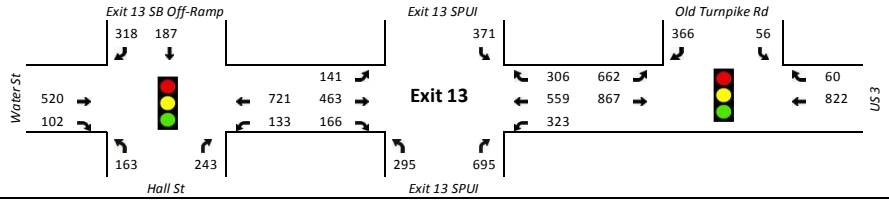


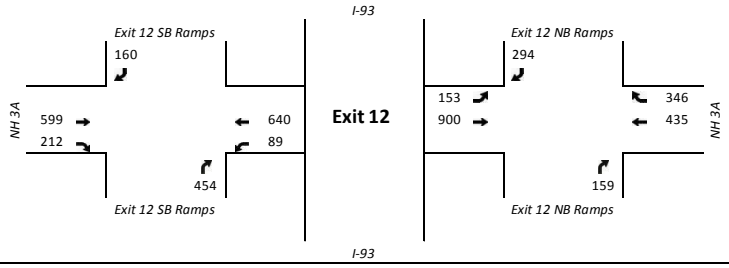


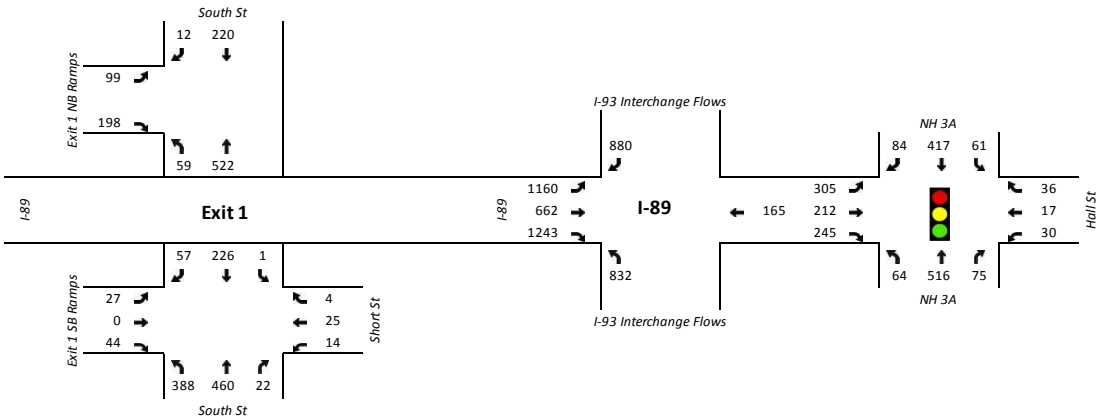
No Build - 2035 AM Peak Hour Model Demand



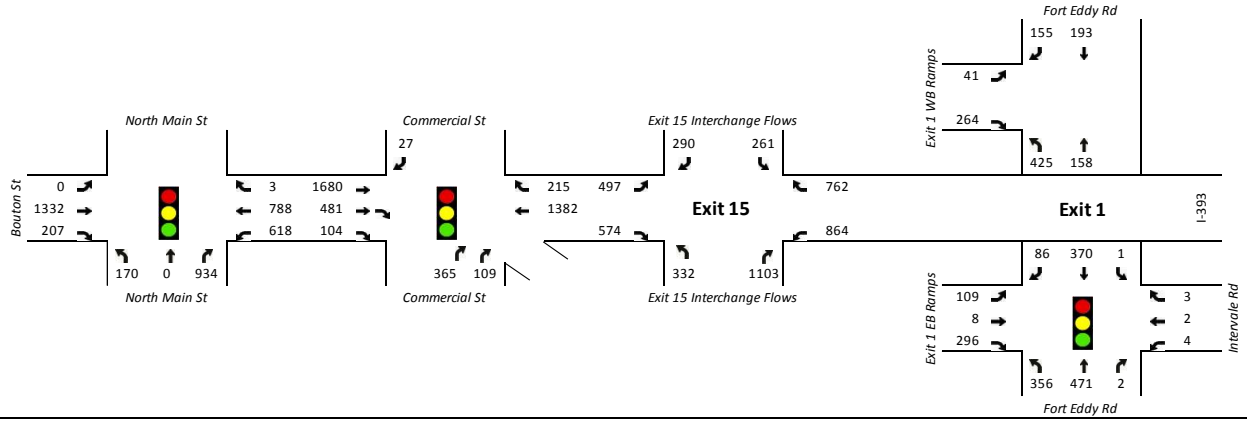


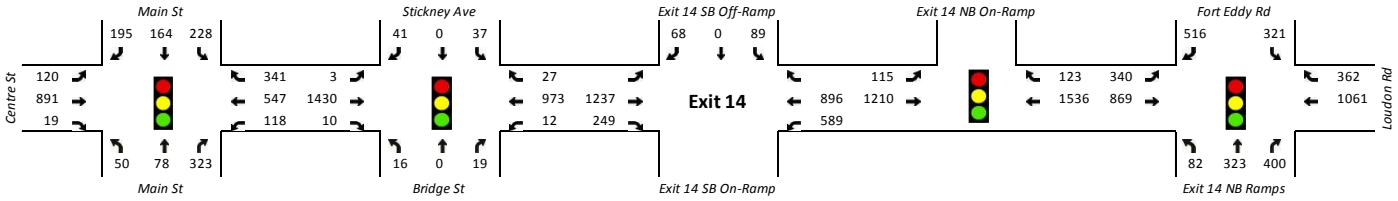


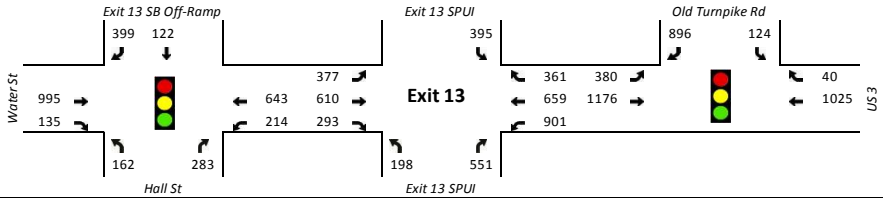


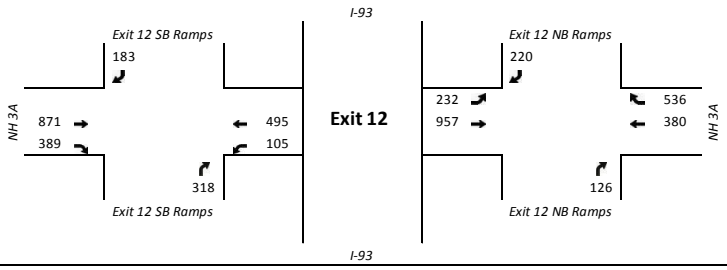


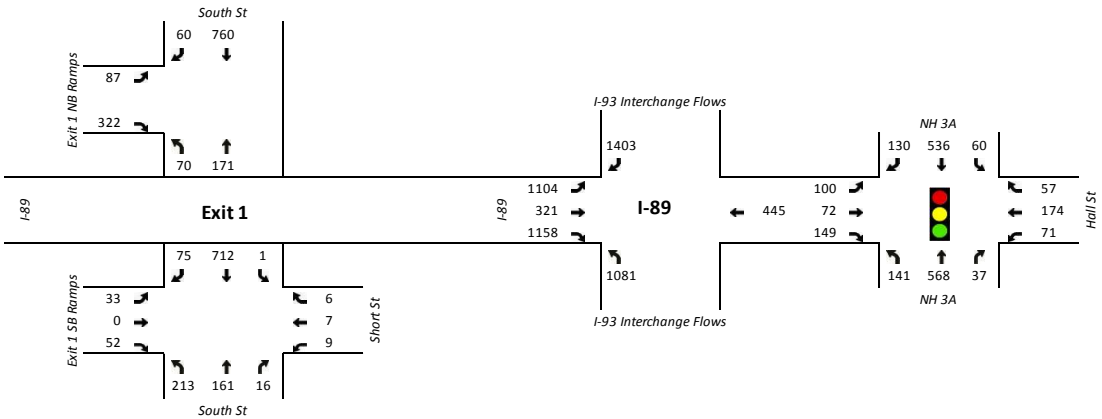
No Build - 2035 PM Peak Hour Model Demand



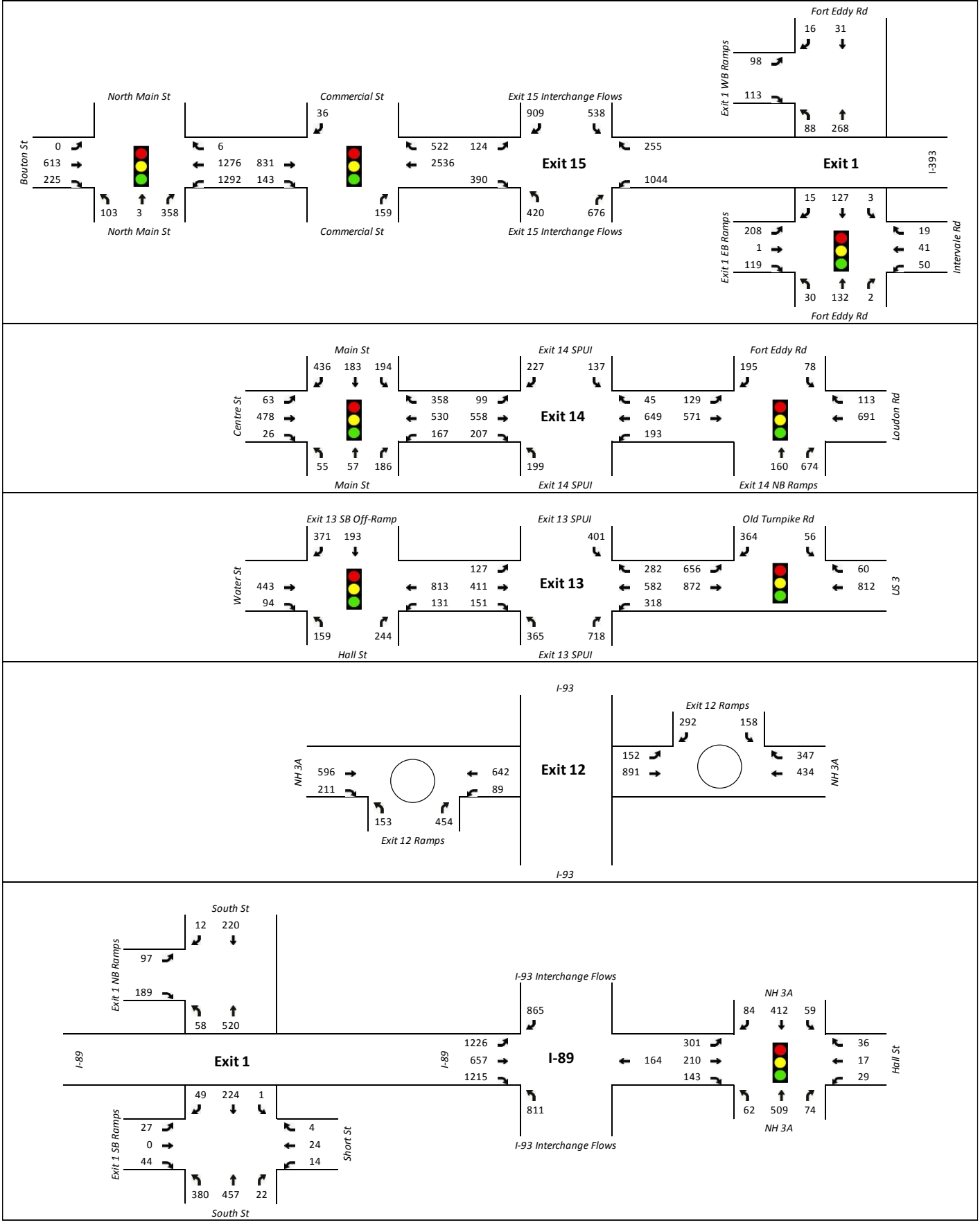




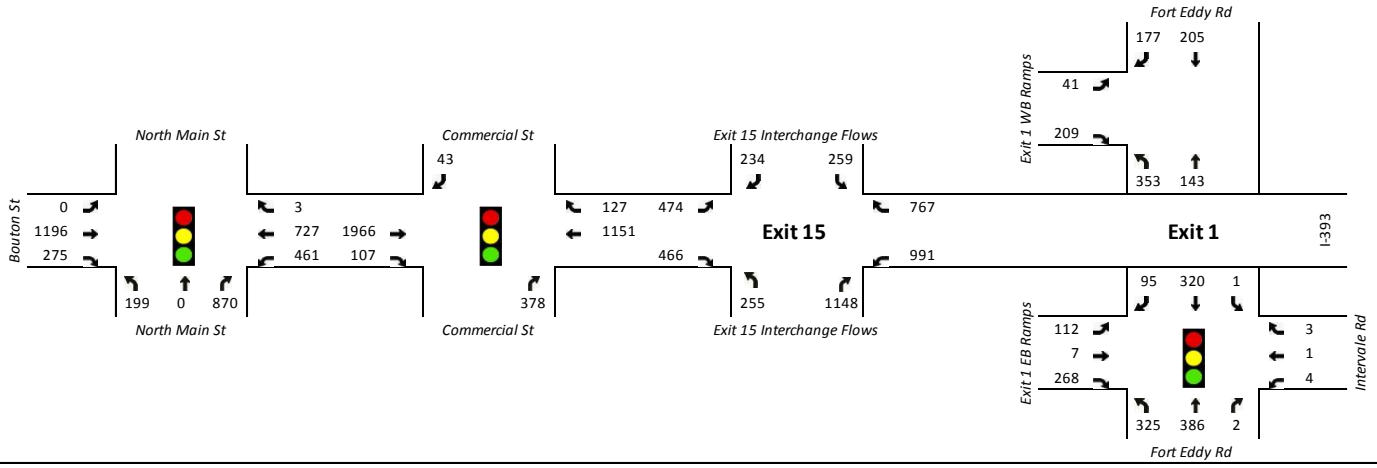


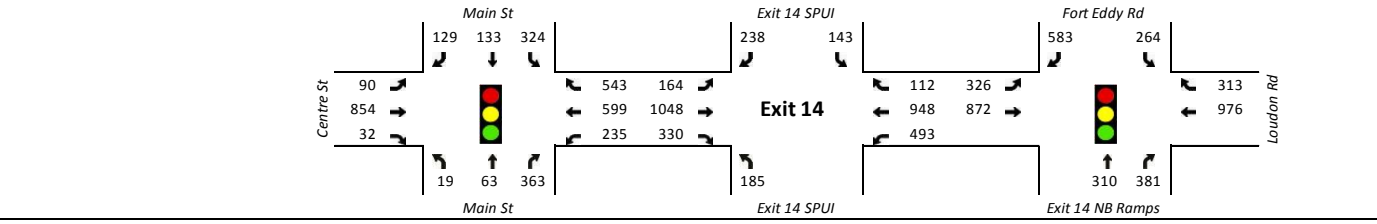


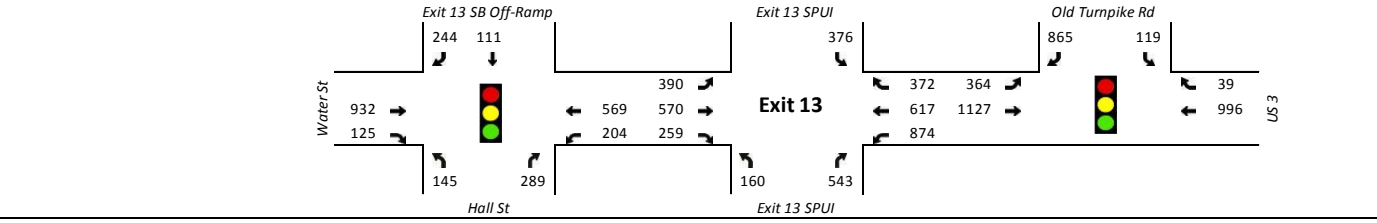
Scenario A - 2035 AM Peak Hour Model Throughput

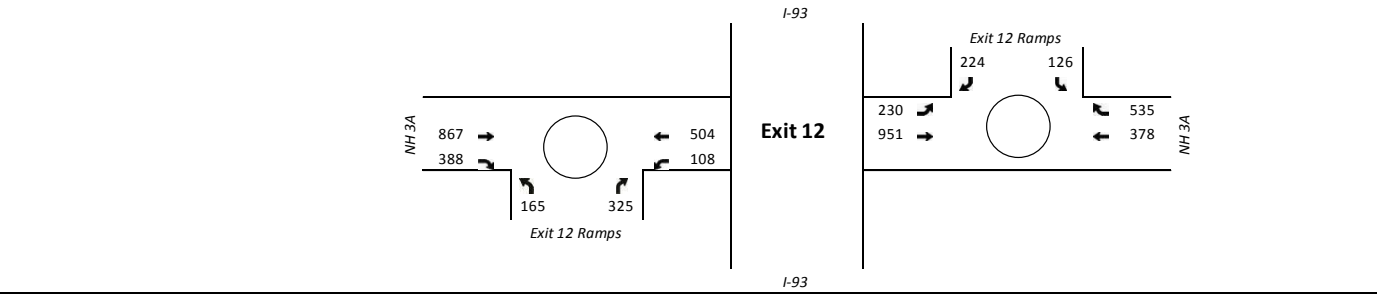


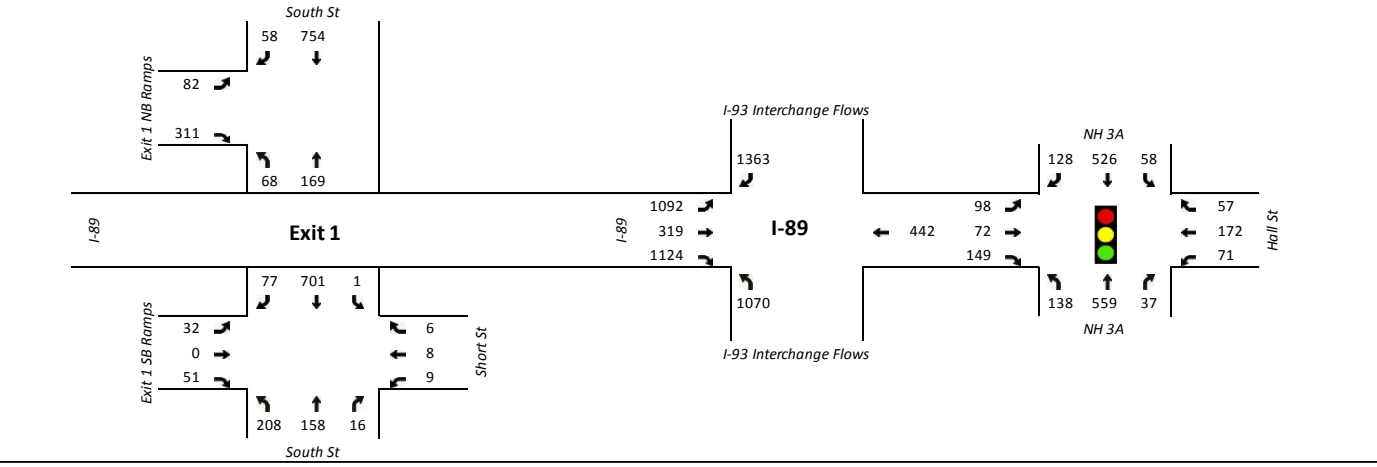
Scenario A - 2035 PM Peak Hour Model Throughput



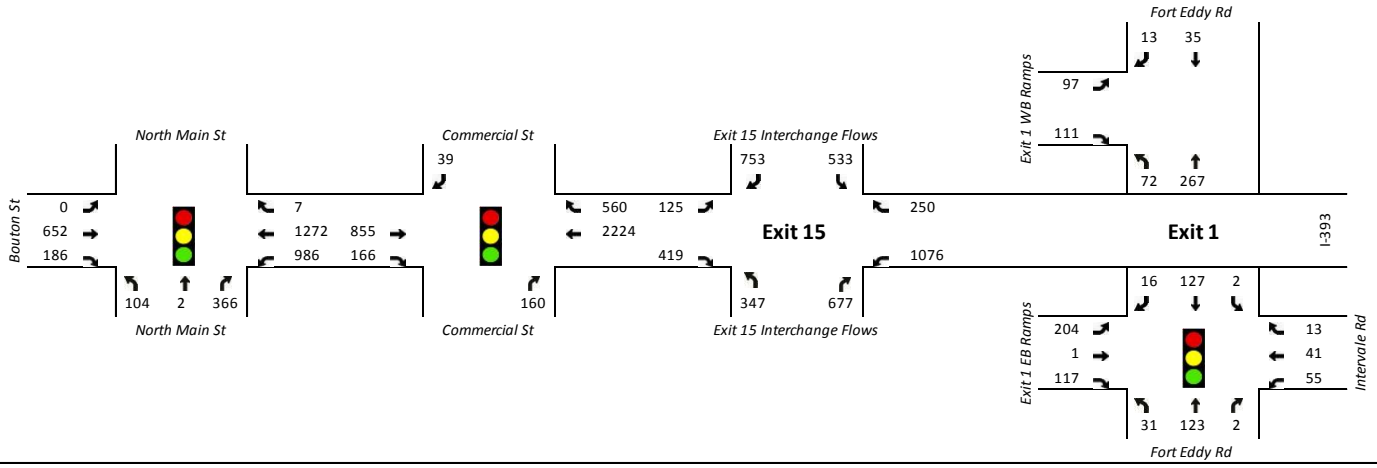


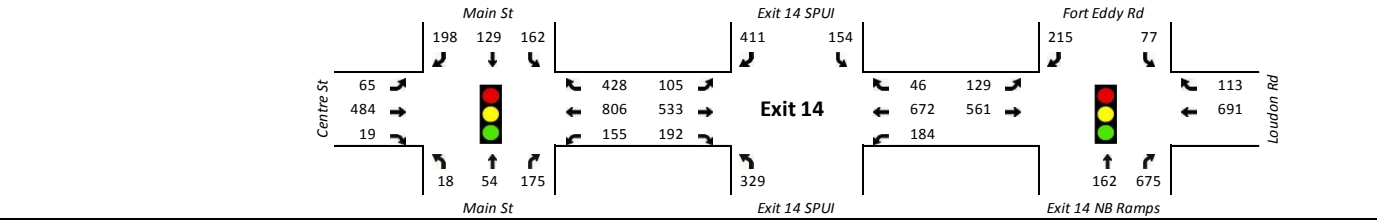


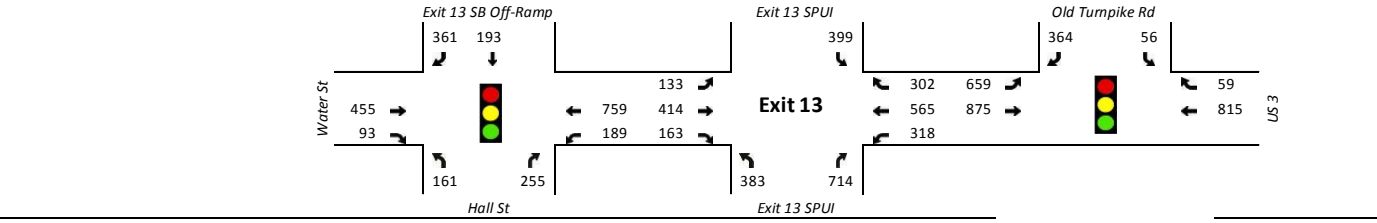


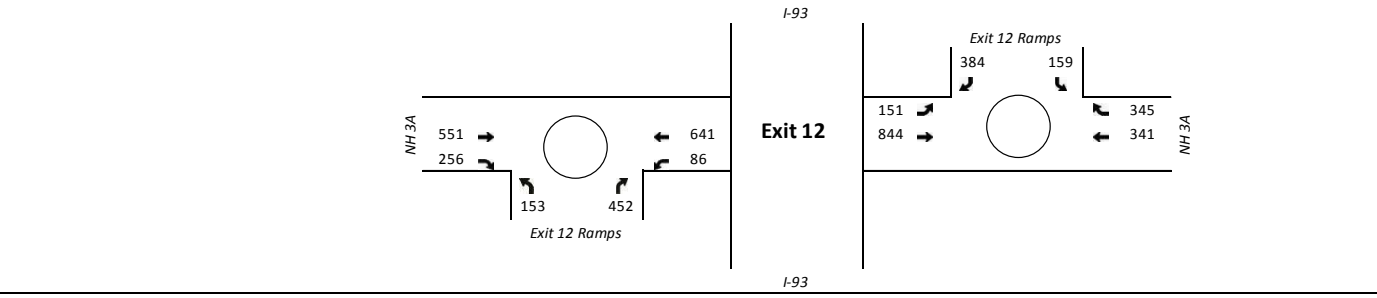


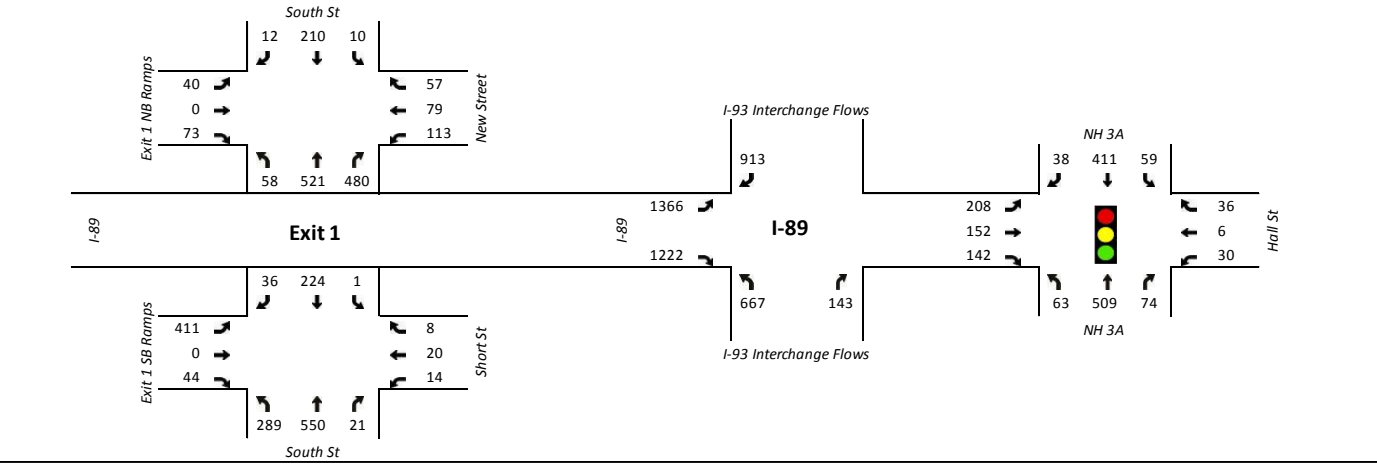
Scenario B - 2035 AM Peak Hour Model Throughput



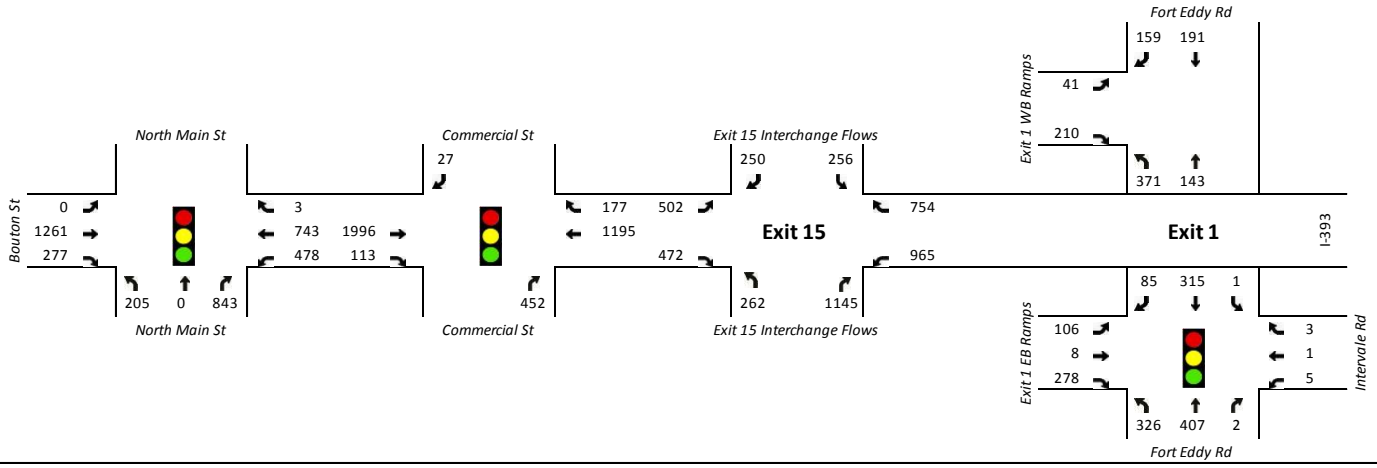


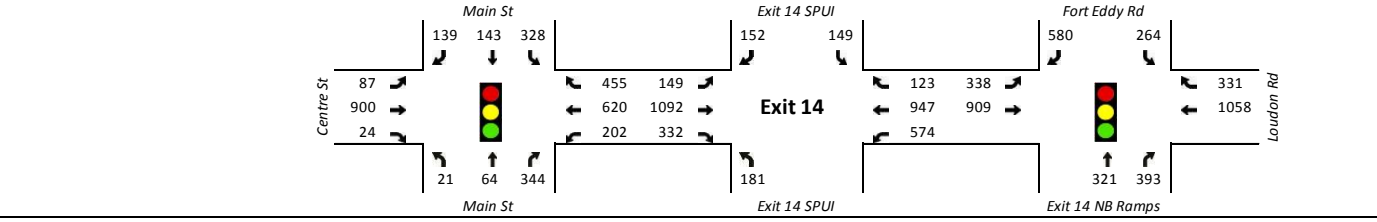


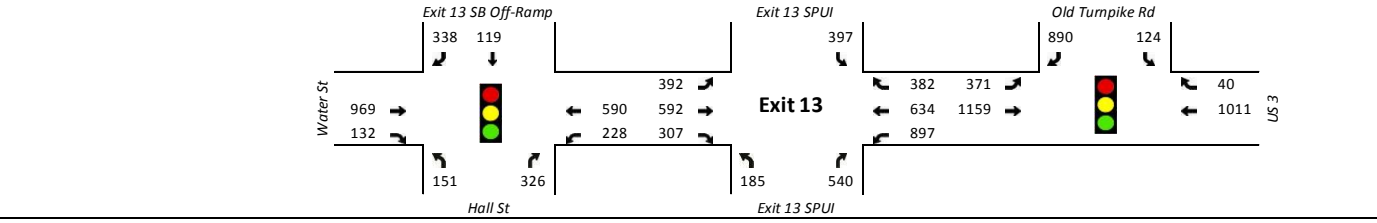


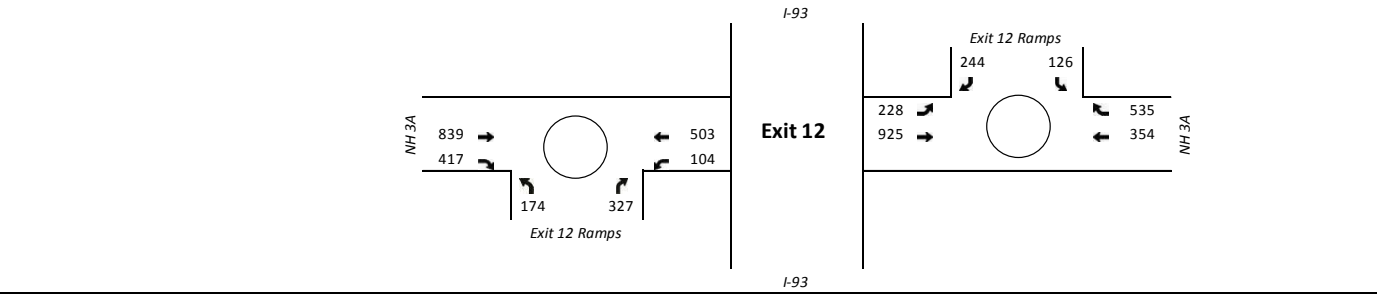


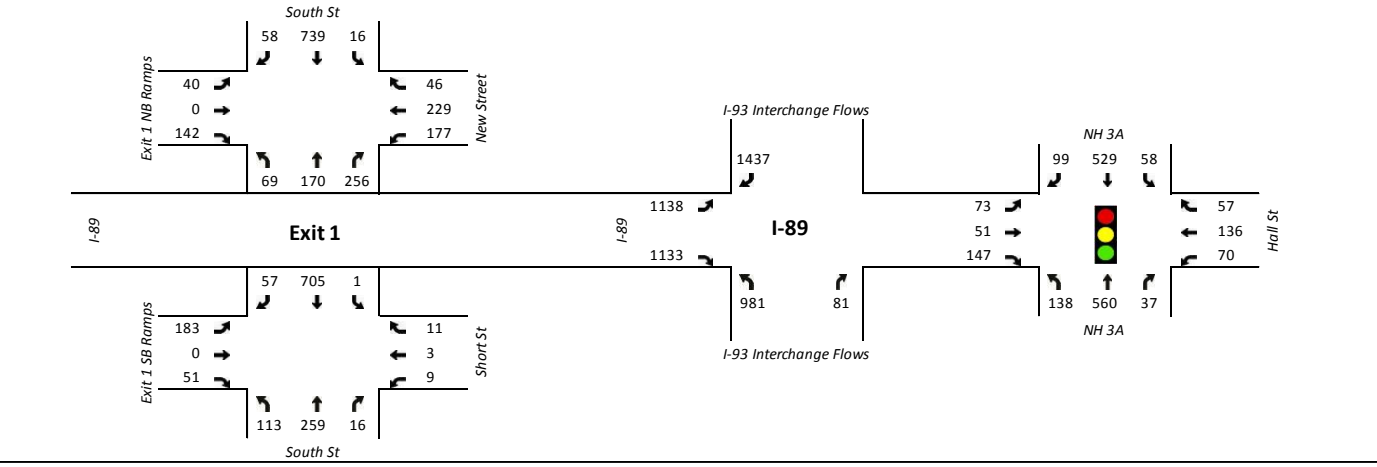
Scenario B - 2035 PM Peak Hour Model Throughput



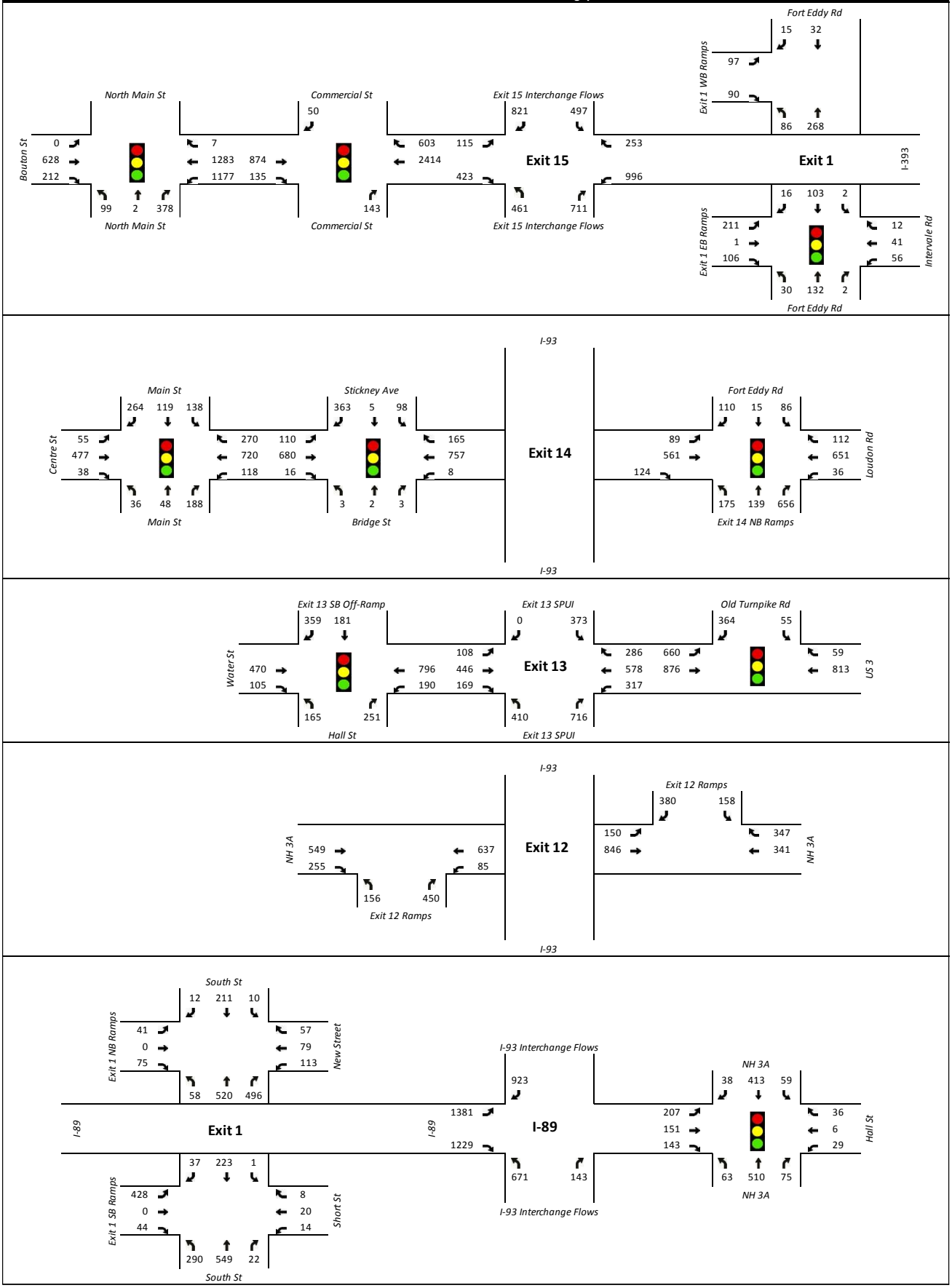




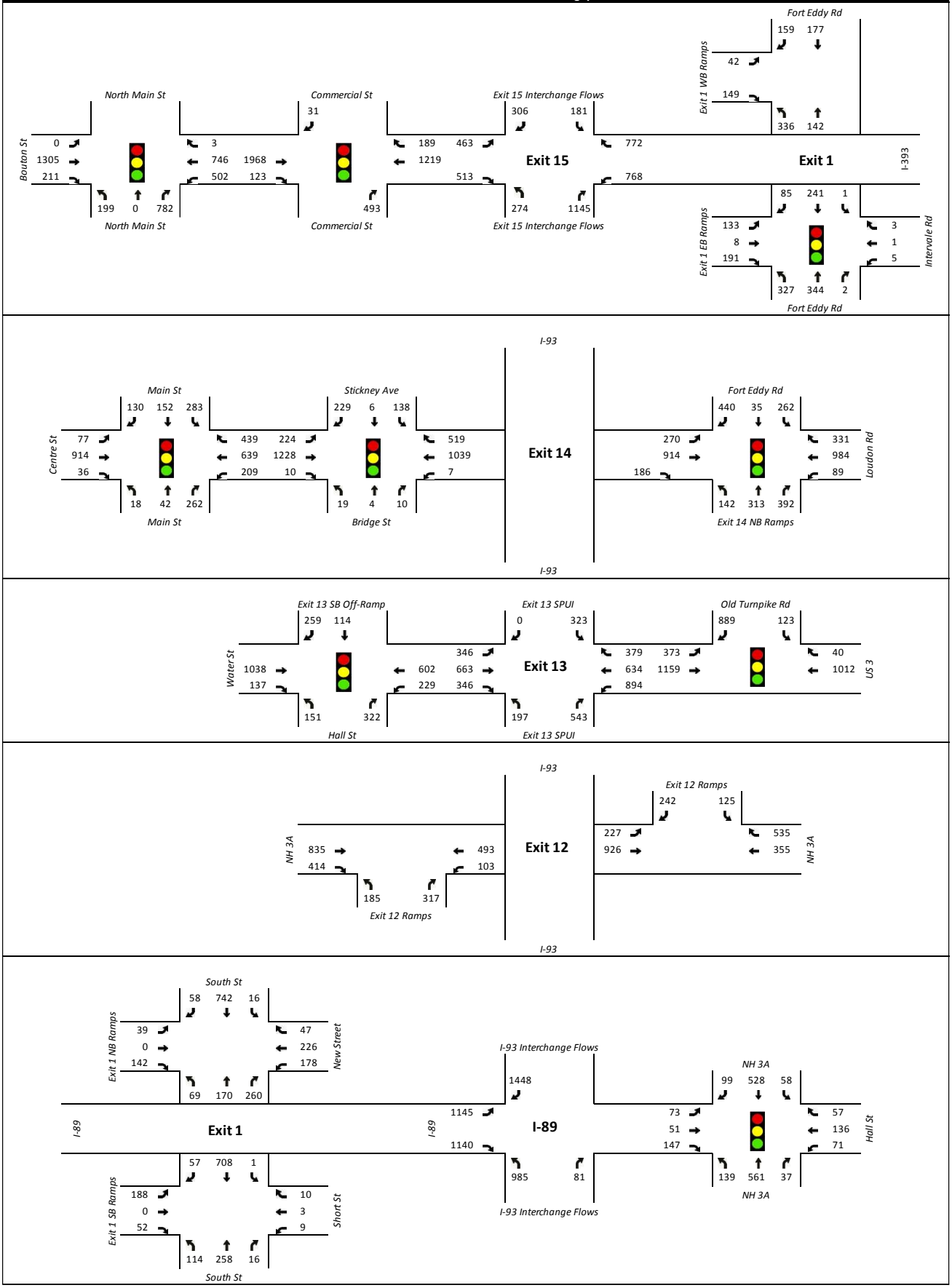




Scenario C - 2035 AM Peak Hour Model Throughput



Scenario C - 2035 PM Peak Hour Model Throughput



7.0 FREEWAY ANALYSIS

To assess the relative benefits provided by each design alternative, freeway densities and levels of service are calculated for the study area segments in each scenario. Level of Service (LOS) is a qualitative measure describing the operating conditions as perceived by motorists. LOS definitions and calculation procedures are outlined in the 2010 Highway Capacity Manual (HCM 2010).

The HCM 2010 defines six qualitative grades to describe the LOS for freeway segments. LOS is based on the vehicle density. Figure 20 shows the various LOS grades and descriptions for basic, weave, merge, and diverge segments.

FIGURE 20: LOS CRITERIA FOR FREEWAY SEGMENTS

		DENSITY (PC/MI/LN)	
LOS	CHARACTERISTICS	BASIC	WEAVE/MERGE/DIVERGE
A	Free-flow operations	≤ 11	≤ 10
B	Reasonably free-flow	>11-18	>10-20
C	Speeds near free-flow	>18-26	>20-28
D	Speeds decline with	>26-35	>28-35
E	Operation at capacity	>35-45	>35
F	Breakdown/unstable flow	>45	Demand Exceeds Capacity

The figures below present the freeway LOS results for each of the design alternatives and for the No Build condition.

No Build					2035 AM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	Mainline North of Exit 15	Basic	146	10	F
			Exit 15 SB Off-Ramp	Diverge	140	10	F
			Mainline between Exit 15 Off/On -Ramps	Basic	46	28	F
			Exit 15 Weave	Weaving	61	32	F
			Mainline between Exit 15 Off/On-Ramps	Basic	39	43	E
			Exit 15 to Exit 14 Weave	Weaving	49	42	F
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	29	54	D
			Exit 14 SB On-Ramp	Merge	30	52	D
			Mainline between Exit 14 and Exit 13	Diverge	33	53	D
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	24	55	C
			Exit 13 SB On-Ramp	Merge	29	50	D
			Mainline between Exit 13 and Exit 12	Diverge	30	52	D
		Exit 12	Exit 12 SB Off-Ramp to Rte 3A SB	Diverge	33	48	D
			Mainline between Exit 12 Off/On-Ramps	Basic	25	55	C
			Mainline between Exit 12 On-Ramp and I-93 Off-Ramp to I-89 NB	Merge	14	56	B
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	12	59	B
			I-93 On-Ramp from I-89 SB	Merge	10	66	B
			Mainline South of I-89 SB On-Ramp	Basic	18	63	C
	Northbound	Exit 15	Mainline North of Exit 15	Basic	12	58	B
			Exit 15 NB On-Ramp	Merge	11	59	B
			Mainline between Exit 15 On/Off -Ramps	Basic	10	59	A
			Exit 15 Weave	Weaving	17	49	B
			Mainline between Exit 15 Off/On-Ramps	Basic	12	57	B
			Exit 14 to Exit 15 Weave	Weaving	20	53	B
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	18	54	B
			Mainline between Exit 13 and Exit 14	Diverge	109	13	F
		Exit 13	Exit 13 NB On-Ramp	Merge	104	11	F
			Mainline between Exit 13 Off/On-Ramps	Basic	70	19	F
			Mainline between Exit 12 and Exit 13	Diverge	111	16	F
		Exit 12	Exit 12 NB On-Ramp	Merge	111	12	F
			Mainline between Exit 12 Off/On-Ramps	Basic	125	13	F
			Exit 12 NB Off-Ramp to Rte 3A NB	Diverge	112	15	F
			Exit 12 NB Off-Ramp to Rte 3A SB	Diverge	113	16	F
		I-89	I-89 SB On-Ramp to I-93 NB	Merge	112	11	F
			Mainline between Off/On Ramps to I-89	Basic	81	16	F
			Mainline South of I-89 NB Off-Ramp	Diverge	32	61	D
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	97	11	F
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	27	63	D
			Exit 2 SB Off-Ramp	Diverge	26	56	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	63	C
			Exit 2 SB On-Ramp	Merge	55	53	F
			Mainline between Exit 2 and Exit 1	Basic	51	33	F
		Exit 1	Exit 1 SB Off-Ramp	Diverge	66	19	F
			Mainline between Exit 1 Off/On-Ramps	Basic	84	17	F
			Exit 1 SB On-Ramp to I-93 SB Off-Ramp Weave	Weaving	80	22	F
			I-89 SB Off-Ramp to I-93 NB	Diverge	72	14	F
	Northbound	Exit 2	Mainline North of Exit 2	Basic	10	68	A
			Exit 2 NB On-Ramp	Merge	9	67	A
			Mainline between Exit 2 Off/On-Ramps	Basic	9	68	A
			Mainline between Exit 1 and Exit 2	Diverge	13	66	B
		Exit 1	Exit 1 SB On-Ramp	Merge	12	69	B
			Mainline between Exit 1 Off/On-Ramps	Basic	12	64	B
			I-93 SB On-Ramp to Exit 1 SB Off-Ramp Weave	Weaving	19	50	B
			I-93 NB On-Ramp to I-93 SB On-Ramp	Merge	10	51	B
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	8	50	A
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	9	57	A
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	10	55	A
			Mainline between Exit 1 Off/On-Ramps	Basic	11	56	B
			Exit 1 On-Ramp	Merge	12	56	B
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	13	56	B
			Exit 2 Off-Ramp	Diverge	12	54	B
			Mainline Between Exit 2 Off/On-Ramps	Basic	7	59	A
			Exit 2 On-Ramp	Merge	8	60	A
			Mainline East of Exit 2	Basic	8	58	A
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	33	38	D
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	38	44	E
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	27	45	C
			Mainline between Exit 1 Off/On-Ramps	Basic	40	43	E
			Exit 1 Off-Ramp	Diverge	32	49	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	36	50	E
			Exit 2 On-Ramp	Merge	35	40	D
			Mainline Between Exit 2 On/Off-Ramps	Basic	30	50	D
			Exit 2 Off-Ramp	Diverge	32	54	D

	Baseline				2035 PM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	Mainline North of Exit 15	Basic	22	56	C
			Exit 15 SB Off-Ramp	Diverge	23	54	C
			Mainline between Exit 15 Off/On -Ramps	Basic	21	51	C
			Exit 15 Weave	Weaving	41	42	E
			Mainline between Exit 15 Off/On-Ramps	Basic	28	51	D
			Exit 15 to Exit 14 Weave	Weaving	34	52	D
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	30	54	D
			Exit 14 SB On-Ramp	Merge	39	42	E
			Mainline between Exit 14 and Exit 13	Diverge	40	49	E
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	29	52	D
			Exit 13 SB On-Ramp	Merge	56	28	F
			Mainline between Exit 13 and Exit 12	Diverge	47	42	F
		Exit 12	Exit 12 SB Off-Ramp to Rte 3A SB	Diverge	47	46	F
			Mainline between Exit 12 Off/On-Ramps	Basic	38	52	E
			Mainline between Exit 12 On-Ramp and I-93 Off-Ramp to I-89 NB	Merge	27	52	C
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	16	59	B
			I-93 On-Ramp from I-89 SB	Merge	13	66	B
			Mainline South of I-89 SB On-Ramp	Basic	22	62	C
	Northbound	Exit 15	Mainline North of Exit 15	Basic	36	52	E
			Exit 15 NB On-Ramp	Merge	34	50	D
			Mainline between Exit 15 On/Off -Ramps	Basic	28	54	D
			Exit 15 Weave	Weaving	37	46	E
			Mainline between Exit 15 Off/On-Ramps	Basic	27	52	D
			Exit 14 to Exit 15 Weave	Weaving	42	48	E
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	36	52	E
			Mainline between Exit 13 and Exit 14	Diverge	58	35	F
		Exit 13	Exit 13 NB On-Ramp	Merge	73	19	F
			Mainline between Exit 13 Off/On-Ramps	Basic	81	24	F
			Mainline between Exit 12 and Exit 13	Diverge	61	35	F
		Exit 12	Exit 12 NB On-Ramp	Merge	73	22	F
			Mainline between Exit 12 Off/On-Ramps	Basic	88	23	F
			Exit 12 NB Off-Ramp to Rte 3A NB	Diverge	76	27	F
			Exit 12 NB Off-Ramp to Rte 3A SB	Diverge	85	26	F
		I-89	I-89 SB On-Ramp to I-93 NB	Merge	84	17	F
			Mainline between Off/On Ramps to I-89	Basic	47	34	F
			Mainline South of I-89 NB Off-Ramp	Diverge	24	63	C
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	54	25	F
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	23	65	C
			Exit 2 SB Off-Ramp	Diverge	22	60	C
			Mainline between Exit 2 Off/On-Ramps	Basic	19	63	C
			Exit 2 SB On-Ramp	Merge	31	56	D
			Mainline between Exit 2 and Exit 1	Basic	27	49	D
		Exit 1	Exit 1 SB Off-Ramp	Diverge	33	34	D
			Mainline between Exit 1 Off/On-Ramps	Basic	38	35	E
			Exit 1 SB On-Ramp to I-93 SB Off-Ramp Weave	Weaving	39	37	E
			I-89 SB Off-Ramp to I-93 NB	Diverge	20	41	C
	Northbound	Exit 2	Mainline North of Exit 2	Basic	20	65	C
			Exit 2 NB On-Ramp	Merge	19	63	B
			Mainline between Exit 2 Off/On-Ramps	Basic	18	66	B
			Mainline between Exit 1 and Exit 2	Diverge	23	65	C
		Exit 1	Exit 1 SB On-Ramp	Merge	22	66	C
			Mainline between Exit 1 Off/On-Ramps	Basic	24	58	C
			I-93 SB On-Ramp to Exit 1 SB Off-Ramp Weave	Weaving	42	40	E
			I-93 NB On-Ramp to I-93 SB On-Ramp	Merge	19	46	B
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	17	48	B
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	18	56	B
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	21	51	C
			Mainline between Exit 1 Off/On-Ramps	Basic	25	53	C
			Exit 1 On-Ramp	Merge	28	48	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	29	53	D
			Exit 2 Off-Ramp	Diverge	29	53	D
			Mainline Between Exit 2 Off/On-Ramps	Basic	23	55	C
			Exit 2 On-Ramp	Merge	25	54	C
			Mainline East of Exit 2	Basic	27	53	D
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	21	40	C
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	21	50	C
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	21	46	C
			Mainline between Exit 1 Off/On-Ramps	Basic	24	48	C
			Exit 1 Off-Ramp	Diverge	24	51	C
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	27	47	D
			Exit 2 On-Ramp	Merge	27	37	C
			Mainline Between Exit 2 On/Off-Ramps	Basic	16	52	B
			Exit 2 Off-Ramp	Diverge	16	57	B

Scenario A

	Direction	Locaton	Description	Type	2035 AM Segment Density (veh/mi/ln)	2035 AM Speed (mph)	2035 AM LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	71	32	F
			3-Lane Mainline North of Exit 15	Diverge	30	51	D
			Mainline between Exit 15 Off/On -Ramps	Basic	21	54	C
			Exit 15 Weave	Weaving	27	43	C
			Mainline between Exit 15 Off/On-Ramps	Basic	27	53	D
			Exit 15 to Exit 14 Weave	Weaving	23	52	C
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	25	54	C
			Mainline between Exit 14 and Exit 13	Weaving	21	55	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	21	54	C
			Exit 13 SB On-Ramp	Merge	17	55	B
			Mainline Between Exit 13 and Exit 12	Basic	18	56	B
		Exit 12	Exit 12 SB Off-Ramp	Diverge	18	53	B
			Mainline between Exit 12 Off/On-Ramps	Basic	22	54	C
			Exit 12 SB On-Ramp	Merge	22	52	C
			Mainline between Exit 12 and I-89	Diverge	24	53	C
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	15	58	B
			I-93 On-Ramp from I-89 SB	Merge	14	66	B
			Mainline South of I-89 SB On-Ramp	Basic	21	62	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	15	57	B
			Exit 15 NB On-Ramp	Merge	11	58	B
			Mainline between Exit 15 On/Off -Ramps	Basic	8	60	A
			Exit 15 Weave	Weaving	9	52	A
			Mainline between Exit 15 Off/On-Ramps	Basic	10	57	A
			Exit 14 to Exit 15 Weave	Weaving	12	53	B
		Exit 14	Mainline between Exit 14 Off/On Ramps	Basic	15	53	B
			Mainline between Exit 13 and Exit 14	Weaving	17	53	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	21	51	C
			Exit 13 NB Off-Ramp	Diverge	23	53	C
			Mainline Between Exit 12 and Exit 13	Basic	22	54	C
		Exit 12	Exit 12 NB On-Ramp	Merge	22	54	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	53	C
			Mainline between I-89 and Exit 12	Weaving	21	52	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	18	54	B
			I-93 NB Off-Ramp to I-89NB	Diverge	25	63	C
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	45	30	E
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	27	63	D
			Exit 2 SB Off-Ramp	Diverge	26	56	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	63	C
			Exit 2 SB On-Ramp	Merge	37	50	E
			Mainline between Exit 2 and Exit 1	Basic	31	51	D
		Exit 1	Exit 1 SB Off-Ramp	Diverge	43	34	E
			Mainline between Exit 1 Off/On-Ramps	Basic	42	38	E
			Exit 1 SB On-Ramp to I-93 SB On-Ramp Weave	Weaving	32	40	D
			I-89 SB Off-Ramp to I-93 NB	Diverge	28	40	C
	Northbound	Exit 2	Mainline North of Exit 2	Basic	11	68	B
			Exit 2 NB On-Ramp	Merge	10	69	B
			Mainline between Exit 2 Off/On-Ramps	Basic	10	68	A
			Mainline between Exit 1 and Exit 2	Diverge	15	65	B
		Exit 1	Exit 1 NB On-Ramp	Merge	13	66	B
			Mainline between Exit 1 Off/On-Ramps	Basic	14	66	B
			I-93 SB Off-Ramp to Exit 1 NB Off-Ramp Weave	Weaving	12	61	B
			I-93 NB Off-Ramp to I-89 NB	Merge	11	54	B
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	9	49	A
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	11	57	A
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	12	55	B
			Mainline between Exit 1 Off/On-Ramps	Basic	15	55	B
			Exit 1 On-Ramp	Merge	15	54	B
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	15	55	B
			Exit 2 Off-Ramp	Diverge	16	53	B
			Mainline Between Exit 2 Off/On-Ramps	Basic	9	59	A
			Exit 2 On-Ramp	Merge	9	60	A
			Mainline East of Exit 2	Basic	10	58	A
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	33	39	D
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	38	44	E
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	26	46	C
			Mainline between Exit 1 Off/On-Ramps	Basic	39	45	E
			Exit 1 Off-Ramp	Diverge	33	50	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	37	48	E
			Exit 2 On-Ramp	Merge	36	39	E
			Mainline Between Exit 2 On/Off-Ramps	Basic	30	50	D
			Exit 2 Off-Ramp	Diverge	32	54	D

Scenario A

	Direction	Locaton	Description	Type	2035 PM Segment Density (veh/mi/ln)	2035 PM Speed (mph)	2035 PM LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	22	56	C
			3-Lane Mainline North of Exit 15	Diverge	14	56	B
			Mainline between Exit 15 Off/On -Ramps	Basic	13	56	B
			Exit 15 Weave	Weaving	18	48	B
			Mainline between Exit 15 Off/On-Ramps	Basic	19	55	C
			Exit 15 to Exit 14 Weave	Weaving	18	54	B
		Exit 14	Mainline between Exit 14 On/Off Ramps	Basic	18	56	C
			Mainline between Exit 14 and Exit 13	Weaving	19	54	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	20	54	C
			Exit 13 SB On-Ramp	Merge	22	52	C
			Mainline Between Exit 13 and Exit 12	Basic	21	53	C
		Exit 12	Exit 12 SB Off-Ramp	Diverge	21	52	C
			Mainline between Exit 12 Off/On-Ramps	Basic	29	49	D
			Exit 12 SB On-Ramp	Merge	32	45	D
			Mainline between Exit 12 and I-89	Diverge	34	50	D
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	17	58	B
			I-93 On-Ramp from I-89 SB	Merge	15	65	B
			Mainline South of I-89 SB On-Ramp	Basic	22	62	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	40	49	E
			Exit 15 NB On-Ramp	Merge	32	51	D
			Mainline between Exit 15 On/Off -Ramps	Basic	18	56	C
			Exit 15 Weave	Weaving	17	54	B
			Mainline between Exit 15 Off/On-Ramps	Basic	19	56	C
			Exit 14 to Exit 15 Weave	Weaving	24	49	C
		Exit 14	Mainline between Exit 14 Off/On Ramps	Basic	26	52	C
			Mainline between Exit 13 and Exit 14	Weaving	28	49	D
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	27	51	D
			Exit 13 NB Off-Ramp	Diverge	21	54	C
			Mainline Between Exit 12 and Exit 13	Basic	24	55	C
		Exit 12	Exit 12 NB On-Ramp	Merge	21	54	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	53	D
			Mainline between I-89 and Exit 12	Weaving	21	53	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	20	55	C
			I-93 NB Off-Ramp to I-89NB	Diverge	29	62	D
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	47	28	F
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	23	65	C
			Exit 2 SB Off-Ramp	Diverge	21	60	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	63	C
			Exit 2 SB On-Ramp	Merge	30	55	D
			Mainline between Exit 2 and Exit 1	Basic	26	51	D
		Exit 1	Exit 1 SB Off-Ramp	Diverge	35	35	E
			Mainline between Exit 1 Off/On-Ramps	Basic	35	37	E
			Exit 1 SB On-Ramp to I-93 SB On-Ramp Weave	Weaving	25	41	C
			I-89 SB Off-Ramp to I-93 NB	Diverge	20	40	C
	Northbound	Exit 2	Mainline North of Exit 2	Basic	20	65	C
			Exit 2 NB On-Ramp	Merge	19	64	B
			Mainline between Exit 2 Off/On-Ramps	Basic	18	66	B
			Mainline between Exit 1 and Exit 2	Diverge	24	63	C
		Exit 1	Exit 1 NB On-Ramp	Merge	20	63	C
			Mainline between Exit 1 Off/On-Ramps	Basic	22	64	C
			I-93 SB Off-Ramp to Exit 1 NB Off-Ramp Weave	Weaving	19	58	B
			I-93 NB Off-Ramp to I-89 NB	Merge	16	55	B
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	17	49	B
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	18	56	B
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	20	53	C
			Mainline between Exit 1 Off/On-Ramps	Basic	27	53	D
			Exit 1 On-Ramp	Merge	30	46	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	30	52	D
			Exit 2 Off-Ramp	Diverge	31	52	D
			Mainline Between Exit 2 Off/On-Ramps	Basic	24	55	C
			Exit 2 On-Ramp	Merge	26	53	C
			Mainline East of Exit 2	Basic	29	53	D
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	22	39	C
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	23	48	C
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	21	48	C
			Mainline between Exit 1 Off/On-Ramps	Basic	25	48	C
			Exit 1 Off-Ramp	Diverge	24	50	C
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	28	46	D
			Exit 2 On-Ramp	Merge	28	36	C
			Mainline Between Exit 2 On/Off-Ramps	Basic	16	52	B
			Exit 2 Off-Ramp	Diverge	16	57	B

Scenario B					2035 AM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	75	30	F
			3-Lane Mainline North of Exit 15	Diverge	28	54	C
			Mainline adjacent to CD Road at Exit 15	Basic	22	55	C
		Exit 14	CD Road/Mainline Merge	Merge	22	53	C
			Mainline between CD Road Merge and Exit 14 SB On-Ramp	Basic	26	53	D
			Exit 14 SB On-Ramp to Exit 13 SB Off-Ramp Weave	Weaving	21	55	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	20	55	C
			Exit 13 SB On-Ramp	Merge	26	50	C
			Mainline Between Exit 13 and Exit 12	Basic	25	52	C
		Exit 12	Exit 12 SB Off-Ramp	Diverge	17	54	B
			Mainline between Exit 12 SB Off/On-Ramps	Basic	21	55	C
			Exit 12 SB On-Ramp to I-93 SB Off-Ramp to I-89 NB Weave	Weaving	16	55	B
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	15	58	B
			I-93 On-Ramp from I-89 SB	Merge	14	65	B
			Mainline South of I-89 SB On-Ramp	Basic	21	62	C
	Northbound	Exit 15	3-Lane Mainline North of Exit 15	Basic	10	58	A
			CD Road/Mainline Merge	Merge	9	58	A
			Mainline adjacent to CD Road at Exit 15	Basic	8	58	A
		Exit 14	Mainline between Exit 14 NB Off-Ramp and CD Road	Diverge	17	56	B
			Exit 13 NB On-Ramp to Exit 14 NB Off-Ramp Weave	Weaving	18	52	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	19	54	C
			Exit 13 SB Off-Ramp	Diverge	40	45	E
			Mainline Between Exit 13 and Exit 12	Basic	36	42	E
		Exit 12	Exit 12 NB On-Ramp	Merge	36	44	E
			Mainline between Exit 12 Off/On-Ramps	Basic	27	50	D
			Exit 12 NB Off-Ramp	Weaving	22	53	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	17	55	B
			Mainline South of I-89 NB Off-Ramp	Diverge	25	63	C
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	29	34	D
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	28	63	D
			Exit 2 SB Off-Ramp	Diverge	26	56	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	64	C
			Exit 2 SB On-Ramp	Merge	30	53	D
			Mainline between Exit 1 and Exit 2	Basic	30	52	D
		Exit 1	Exit 1 SB Off-Ramp to CD Road	Diverge	31	47	D
			CD Road between Exit 1 Off/On-Ramps	Basic	39	37	E
			I-89 SB to I-93 NB On-Ramp	Merge	30	35	D
	Northbound	Exit 2	Mainline North of Exit 2	Basic	11	67	B
			Exit 2 NB On-Ramp	Merge	11	67	B
			Mainline between Exit 2 Off/On-Ramps	Basic	11	67	A
			Mainline between Exit 1 and Exit 2	Diverge	15	64	B
		Exit 1	CD Road On-Ramp	Merge	14	57	B
			2-Lane Mainline from I-93 NB off-Ramp to I-89 NB	Basic	6	67	A
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	9	49	A
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	11	57	A
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	12	56	B
			Mainline between Exit 1 Off/On-Ramps	Basic	15	55	B
			Exit 1 On-Ramp	Merge	15	54	B
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	15	55	B
			Exit 2 Off-Ramp	Diverge	16	53	B
			Mainline Between Exit 2 Off/On-Ramps	Basic	9	59	A
			Exit 2 On-Ramp	Merge	9	60	A
			Mainline East of Exit 2	Basic	10	58	A
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	32	39	D
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	38	44	E
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	27	44	C
			Mainline between Exit 1 Off/On-Ramps	Basic	42	41	E
			Exit 1 Off-Ramp	Diverge	33	48	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	38	48	E
			Exit 2 On-Ramp	Merge	37	38	E
			Mainline Between Exit 2 On/Off-Ramps	Basic	30	50	D
			Exit 2 Off-Ramp	Diverge	33	54	D
I-93 CD	Southbound	Exit 14 & 15	Off-Ramp to CD Road	Diverge	21	49	C
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	11	51	A
			Exit 15 Weave	Weaving	20	41	C
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	17	54	B
			Exit 15 SB On-Ramp to Exit 14 SB Off-Ramp Weave	Weaving	14	54	B
			CD Road Between Exit 14 Off/On-Ramps	Basic	14	57	B
	Northbound	Exit 14 & 15	CD Road between Exit 15 NB On-Ramp and I-93 NB	Merge	7	58	A
			CD Road Exit 15 NB Off-Ramp to Exit 15 NB On-Ramp	Basic	4	60	A
			Exit 15 Weave	Weaving	7	47	A
			CD Road Exit 15 NB Off-Ramp to Exit 15 NB On-Ramp	Basic	7	58	A
			Exit 14 NB On-Ramp to Exit 15 NB Off-Ramp Weave	Weaving	10	53	A
			CD Road Between Exit 14 Off/On-Ramps	Basic	13	53	B
I-89 CD	Northbound	Exit 1	I-89 NB CD Road to Mainline	Merge	16	55	B
			CD Road between Exit 1 Off/On-Ramps	Basic	17	55	B
			CD Road between I-93 SB Off-Ramp and Exit 1 Off-Ramp	Diverge	10	53	A

Scenario B					2035 PM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	22	56	C
			3-Lane Mainline North of Exit 15	Diverge	13	59	B
			Mainline adjacent to CD Road at Exit 15	Basic	14	57	B
		Exit 14	CD Road/Mainline Merge	Merge	18	55	B
			Mainline between CD Road Merge and Exit 14 SB On-Ramp	Basic	20	55	C
			Exit 14 SB On-Ramp to Exit 13 SB Off-Ramp Weave	Weaving	18	56	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	20	54	C
			Exit 13 SB On-Ramp	Merge	37	36	E
			Mainline Between Exit 13 and Exit 12	Basic	32	48	D
		Exit 12	Exit 12 SB Off-Ramp	Diverge	20	54	B
			Mainline between Exit 12 SB Off/On-Ramps	Basic	26	53	D
			Exit 12 SB On-Ramp to I-93 SB Off-Ramp to I-89 NB Weave	Weaving	23	52	C
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	17	58	B
			I-93 On-Ramp from I-89 SB	Merge	15	65	B
			Mainline South of I-89 SB On-Ramp	Basic	22	62	C
	Northbound	Exit 15	3-Lane Mainline North of Exit 15	Basic	25	54	C
			CD Road/Mainline Merge	Merge	26	52	C
			Mainline adjacent to CD Road at Exit 15	Basic	16	56	B
		Exit 14	Mainline between Exit 14 NB Off-Ramp and CD Road	Diverge	27	55	C
			Exit 13 NB On-Ramp to Exit 14 NB Off-Ramp Weave	Weaving	25	52	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	25	54	C
			Exit 13 SB Off-Ramp	Diverge	32	52	D
			Mainline Between Exit 13 and Exit 12	Basic	33	52	D
		Exit 12	Exit 12 NB On-Ramp	Merge	29	51	D
			Mainline between Exit 12 Off/On-Ramps	Basic	27	53	D
			Exit 12 NB Off-Ramp	Weaving	21	54	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	19	55	C
			Mainline South of I-89 NB Off-Ramp	Diverge	30	62	D
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	22	35	C
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	23	65	C
			Exit 2 SB Off-Ramp	Diverge	22	60	C
			Mainline between Exit 2 Off/On-Ramps	Basic	19	64	C
			Exit 2 SB On-Ramp	Merge	25	56	C
			Mainline between Exit 1 and Exit 2	Basic	25	54	C
		Exit 1	Exit 1 SB Off-Ramp to CD Road	Diverge	26	48	C
			CD Road between Exit 1 Off/On-Ramps	Basic	32	38	D
			I-89 SB to I-93 NB On-Ramp	Merge	23	37	C
	Northbound	Exit 2	Mainline North of Exit 2	Basic	20	64	C
			Exit 2 NB On-Ramp	Merge	19	63	B
			Mainline between Exit 2 Off/On-Ramps	Basic	18	65	B
			Mainline between Exit 1 and Exit 2	Diverge	24	62	C
		Exit 1	CD Road On-Ramp	Merge	23	51	C
			2-Lane Mainline from I-93 NB off-Ramp to I-89 NB	Basic	9	66	A
I-393	Eastbound	I-93	I-93 On/Off-Ramp Weave	Weaving	18	49	B
			Mainline Between I-93 NB On-Ramp and I-93 NB Off-Ramp	Basic	19	56	C
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	21	53	C
			Mainline between Exit 1 Off/On-Ramps	Basic	27	53	D
			Exit 1 On-Ramp	Merge	31	47	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	30	53	D
			Exit 2 Off-Ramp	Diverge	31	52	D
			Mainline Between Exit 2 Off/On-Ramps	Basic	25	55	C
			Exit 2 On-Ramp	Merge	27	53	C
			Mainline East of Exit 2	Basic	29	53	D
	Westbound	I-93	I-93 Off/On-Ramp Weave	Weaving	20	41	C
			Mainline Between I-93 SB Off-Ramp and I-93 SB On-Ramp	Basic	21	50	C
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	20	49	C
			Mainline between Exit 1 Off/On-Ramps	Basic	24	49	C
			Exit 1 Off-Ramp	Diverge	24	51	C
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	28	46	D
			Exit 2 On-Ramp	Merge	27	37	C
			Mainline Between Exit 2 On/Off-Ramps	Basic	17	52	B
			Exit 2 Off-Ramp	Diverge	16	57	B
I-93 CD	Southbound	Exit 14 & 15	Off-Ramp to CD Road	Diverge	8	54	A
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	6	54	A
			Exit 15 Weave	Weaving	12	45	B
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	13	56	B
			Exit 15 SB On-Ramp to Exit 14 SB Off-Ramp Weave	Weaving	12	56	B
			CD Road Between Exit 14 Off/On-Ramps	Basic	14	57	B
	Northbound	Exit 14 & 15	CD Road between Exit 15 NB On-Ramp and I-93 NB	Merge	18	53	B
			CD Road Exit 15 NB Off-Ramp to Exit 15 NB On-Ramp	Basic	12	58	B
			Exit 15 Weave	Weaving	11	51	B
			CD Road Exit 15 NB Off-Ramp to Exit 15 NB On-Ramp	Basic	11	58	B
			Exit 14 NB On-Ramp to Exit 15 NB Off-Ramp Weave	Weaving	18	50	B
			CD Road Between Exit 14 Off/On-Ramps	Basic	21	52	C
I-89 CD	Northbound	Exit 1	I-89 NB CD Road to Mainline	Merge	29	49	D
			CD Road between Exit 1 Off/On-Ramps	Basic	29	54	D
			CD Road between I-93 SB Off-Ramp and Exit 1 Off-Ramp	Diverge	18	51	B

	Scenario C				2035 AM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	57	40	F
			3-Lane Mainline North of Exit 15	Diverge	31	55	D
			Mainline between Exit 15 Off-Ramps	Basic	18	57	B
			Exit 15 SB Off-Ramp (to 393 EB)	Diverge	14	53	B
			Mainline between Exit 15 Off/On-Ramps	Basic	15	57	B
			Exit 15 SB On-Ramp	Merge	21	47	C
			Mainline between Exit 15 and 14	Basic	28	54	D
		Exit 14	Exit 14 On-Ramp	Merge	19	56	B
		Exit 13	Exit 13 Off-Ramp	Diverge	20	55	C
			Mainline between Exit 13 Off/On-Ramps	Basic	21	54	C
			Exit 13 On-Ramp	Merge	18	55	B
			Mainline between Exit 12 and Exit 13	Basic	18	55	B
		Exit 12	Exit 12 Off-Ramp	Diverge	18	54	B
			Mainline between Exit 12 Off/On-Ramps	Basic	20	54	C
			Exit 12 On-Ramp	Weaving	17	55	B
		I-89	Mainline between I-89 Off/On-ramps	Basic	15	58	B
			I-89 On-Ramp	Merge	15	65	B
			4-Lane Mainline South of I-89	Basic	20	63	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	15	56	B
			Exit 15 On-Ramp	Merge	13	56	B
			Mainline between Exit 15 Off/On-Ramps	Basic	10	58	A
			Exit 15 Off-Ramp (to 393 WB)	Diverge	9	54	A
			Exit 14 to 15 Weave	Weaving	12	55	B
		Exit 14	Mainline between Exit 14 Off/On-Ramps	Basic	16	53	B
			Exit 13 to Exit 14 Weave	Weaving	21	50	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	21	50	C
			Exit 13 Off-Ramp	Diverge	23	53	C
			Mainline between Exit 12 and Exit 13	Basic	21	54	C
		Exit 12	Exit 12 On-Ramp	Merge	22	54	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	52	D
			Exit 12 Off-Ramp	Weaving	22	53	C
		I-89	Mainline between I-89 Off/On-Ramps	Basic	18	56	B
			I-89 Off-Ramp	Diverge	24	59	C
			3-Lane Mainlin South of I-89	Basic	20	64	C
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	28	63	D
			Exit 12 Off-Ramp	Diverge	26	56	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	64	C
			Exit 2 On-Ramp	Merge	31	52	D
			Mainline between Exit 2 and Exit 1	Basic	30	52	D
		Exit 1	Exit 1 Off-Ramp	Diverge	31	47	D
			Mainline between Exit 1 and I-93	Basic	38	37	E
			Exit 1 On-Ramp	Merge	22	37	C
	Northbound	Exit 2	Mainlin North of Exit 2	Basic	11	67	B
			Exit 2 On-Ramp	Merge	11	66	B
			Mainline between Exit 1 and Exit 2	Basic	11	67	A
			Exit 2 Off-Ramp	Diverge	15	65	B
		Exit 1	Exit 1 On-Ramp	Merge	13	65	B
			I-93 On-Ramp	Merge	13	65	B
			between Exit 1 off and on ramps	Basic	16	61	B
			Exit 1 Off-Ramp	Diverge	10	54	A
I-393	Eastbound	I-93	I-93 On-Ramp	Merge	8	48	A
			Mainline between I-93 On-Ramps	Basic	11	57	A
			I-93 to Exit 1 Weave	Weaving	12	56	B
		Exit 1	Mainline between Exit 1 Off/On-Ramps	Basic	14	56	B
			Exit 1 On-Ramp	Merge	15	55	B
			Mainline between Exit 1 and Exit 2	Basic	15	55	B
		Exit 2	Exit 2 Off-Ramp	Diverge	16	53	B
			Mainline between Exit 2 Off/On-Ramps	Basic	8	60	A
			Exit 2 On-Ramp	Merge	9	60	A
			Mainline East of Exit 2	Basic	9	58	A
	Westbound	I-93	I-93 On-Ramp	Merge	30	44	D
			Mainline between I-93 Off/On-Ramps	Basic	34	47	D
			Exit 1 to I-93 Weave	Weaving	25	49	C
		Exit 1	Mainline between Exit 1 Off/On-Ramps	Basic	33	52	D
			Exit 1 Off-Ramp	Diverge	32	53	D
			Mainline between Exit 1 and Exit 2	Basic	36	50	E
		Exit 2	Exit 2 On-Ramp	Merge	34	40	D
			Mainline between Exit 2 Off/On-Ramps	Basic	30	50	D
			Mainline East of Exit 2	Diverge	33	54	D

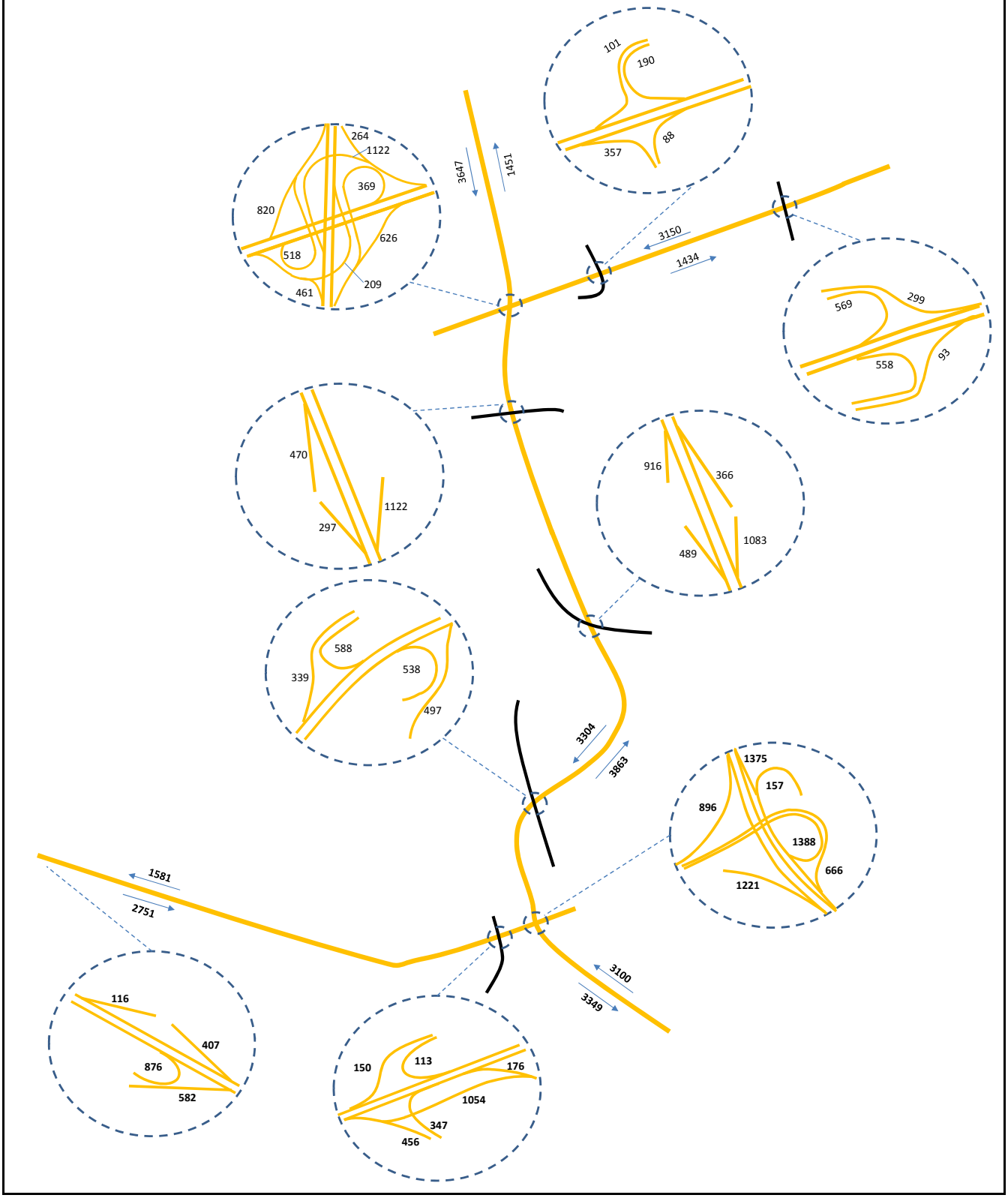
	Scenario C				2035 PM		
	Direction	Locaton	Description	Type	Segment Density (veh/mi/ln)	Speed (mph)	LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	22	57	C
			3-Lane Mainline North of Exit 15	Diverge	15	58	B
			Mainline between Exit 15 Off-Ramps	Basic	11	59	B
			Exit 15 SB Off-Ramp (to 393 EB)	Diverge	8	56	A
			Mainline between Exit 15 Off/On-Ramps	Basic	10	58	A
			Exit 15 SB On-Ramp	Merge	13	53	B
			Mainline between Exit 15 and 14	Basic	22	56	C
		Exit 14	Exit 14 On-Ramp	Merge	18	56	B
		Exit 13	Exit 13 Off-Ramp	Diverge	18	55	B
			Mainline between Exit 13 Off/On-Ramps	Basic	19	54	C
			Exit 13 On-Ramp	Merge	24	51	C
			Mainline between Exit 12 and Exit 13	Basic	22	52	C
		Exit 12	Exit 12 Off-Ramp	Diverge	21	53	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	52	D
			Exit 12 On-Ramp	Weaving	23	52	C
		I-89	Mainline between I-89 Off/On-ramps	Basic	17	58	B
			I-89 On-Ramp	Merge	15	64	B
			4-Lane Mainline South of I-89	Basic	21	63	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	38	48	E
			Exit 15 On-Ramp	Merge	43	36	E
			Mainline between Exit 15 Off/On-Ramps	Basic	22	53	C
			Exit 15 Off-Ramp (to 393 WB)	Diverge	11	55	B
			Exit 14 to 15 Weave	Weaving	21	53	C
		Exit 14	Mainline between Exit 14 Off/On-Ramps	Basic	25	52	C
			Exit 13 to Exit 14 Weave	Weaving	25	52	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	26	52	D
			Exit 13 Off-Ramp	Diverge	21	54	C
			Mainline between Exit 12 and Exit 13	Basic	24	54	C
		Exit 12	Exit 12 On-Ramp	Merge	21	54	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	53	D
			Exit 12 Off-Ramp	Weaving	22	53	C
		I-89	Mainline between I-89 Off/On-Ramps	Basic	19	56	C
			I-89 Off-Ramp	Diverge	27	58	C
			3-Lane Mainlin South of I-89	Basic	23	63	C
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	23	65	C
			Exit 12 Off-Ramp	Diverge	22	59	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	64	C
			Exit 2 On-Ramp	Merge	25	56	C
			Mainline between Exit 2 and Exit 1	Basic	25	54	C
		Exit 1	Exit 1 Off-Ramp	Diverge	26	48	C
			Mainline between Exit 1 and I-93	Basic	33	37	D
			Exit 1 On-Ramp	Merge	18	38	B
	Northbound	Exit 2	Mainlin North of Exit 2	Basic	20	64	C
			Exit 2 On-Ramp	Merge	20	63	B
			Mainline between Exit 1 and Exit 2	Basic	18	64	C
			Exit 2 Off-Ramp	Diverge	24	62	C
		Exit 1	Exit 1 On-Ramp	Merge	22	59	C
			I-93 On-Ramp	Merge	21	62	C
			between Exit 1 off and on ramps	Basic	26	59	D
			Exit 1 Off-Ramp	Diverge	17	52	B
I-393	Eastbound	I-93	I-93 On-Ramp	Merge	13	54	B
			Mainline between I-93 On-Ramps	Basic	18	57	C
			I-93 to Exit 1 Weave	Weaving	20	54	B
		Exit 1	Mainline between Exit 1 Off/On-Ramps	Basic	27	53	D
			Exit 1 On-Ramp	Merge	31	47	D
			Mainline between Exit 1 and Exit 2	Basic	31	53	D
		Exit 2	Exit 2 Off-Ramp	Diverge	32	52	D
			Mainline between Exit 2 Off/On-Ramps	Basic	24	55	C
			Exit 2 On-Ramp	Merge	27	53	C
			Mainline East of Exit 2	Basic	29	53	D
	Westbound	I-93	I-93 On-Ramp	Merge	13	49	B
			Mainline between I-93 Off/On-Ramps	Basic	14	56	B
			Exit 1 to I-93 Weave	Weaving	27	39	C
		Exit 1	Mainline between Exit 1 Off/On-Ramps	Basic	26	47	C
			Exit 1 Off-Ramp	Diverge	24	51	C
			Mainline between Exit 1 and Exit 2	Basic	28	47	D
		Exit 2	Exit 2 On-Ramp	Merge	27	36	C
			Mainline between Exit 2 Off/On-Ramps	Basic	16	51	B
			Mainline East of Exit 2	Diverge	16	57	B

Scenario D (Preferred Alternative) Model Results

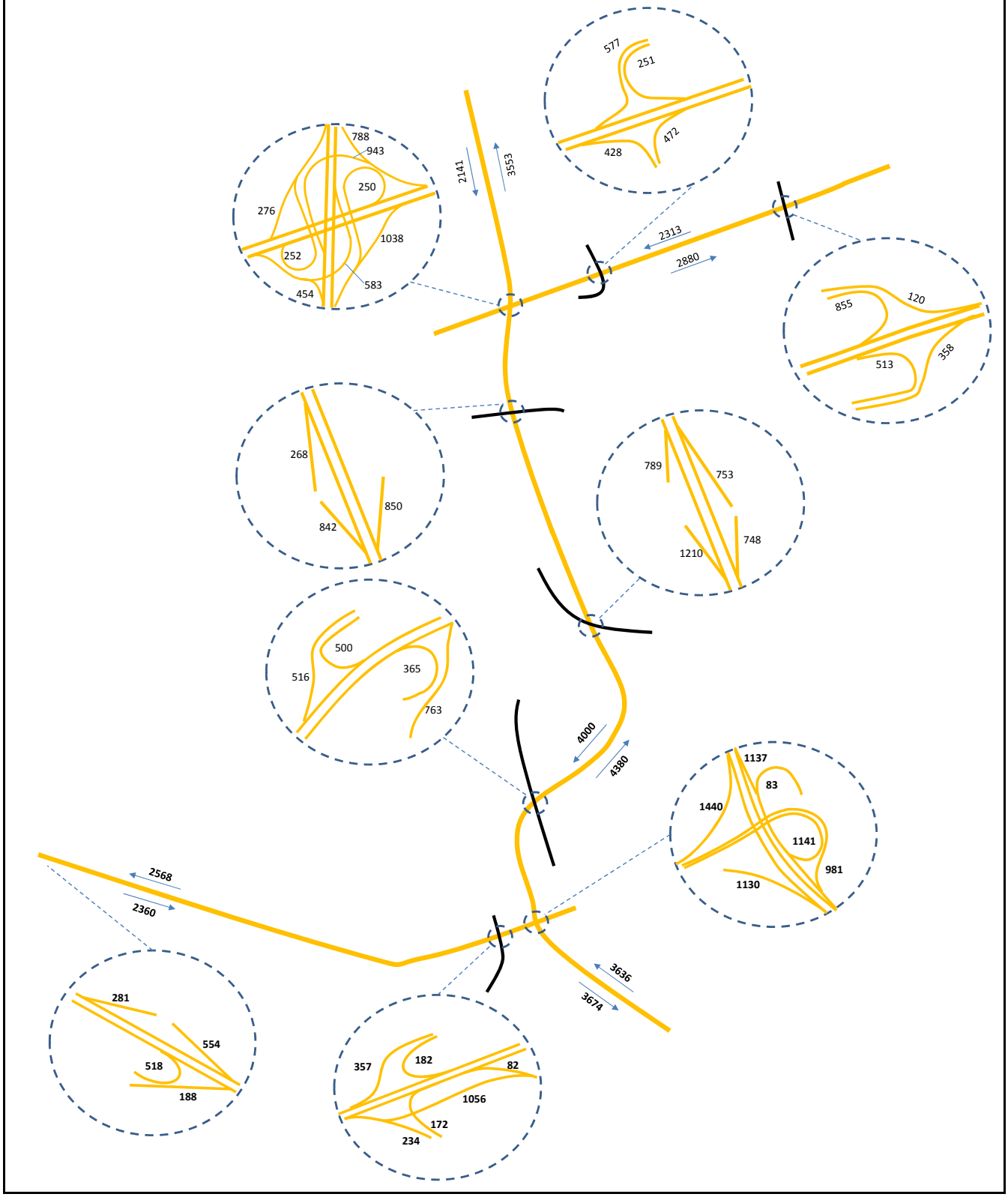
November 2017

Prepared by RSG

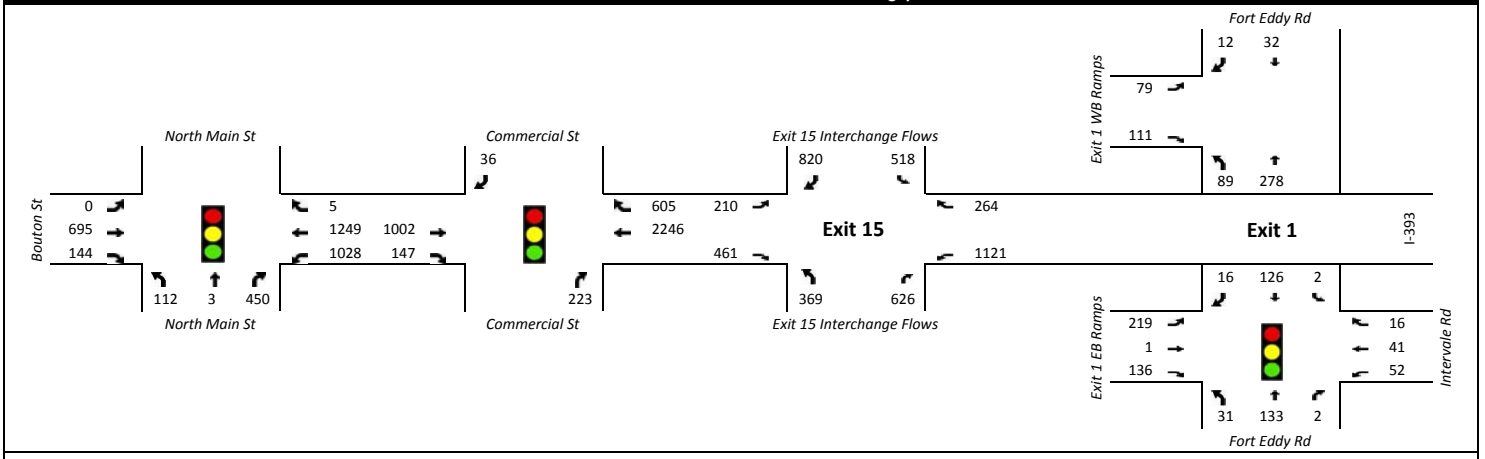
Scenario D - 2035 AM Peak Hour Traffic Volumes - Model Throughput

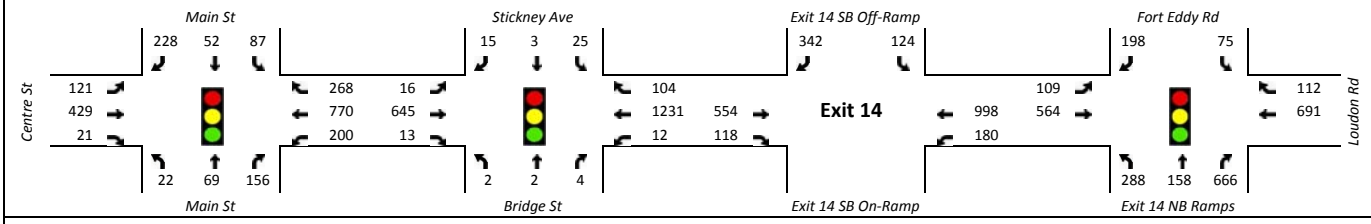


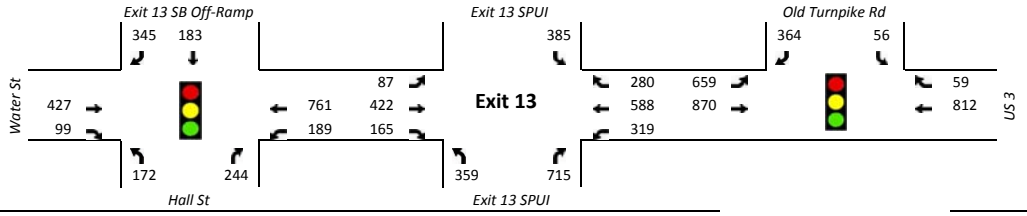
Scenario D - 2035 PM Peak Hour Traffic Volumes - Model Throughput

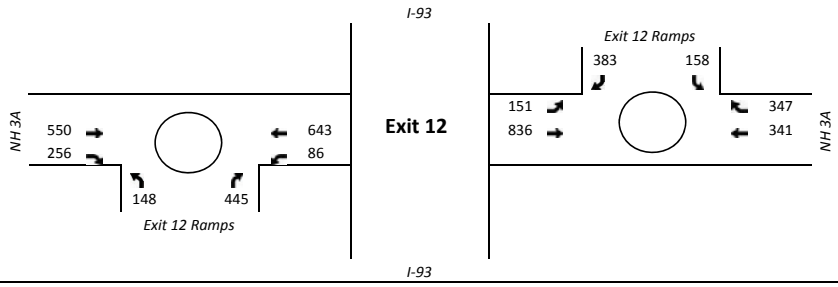


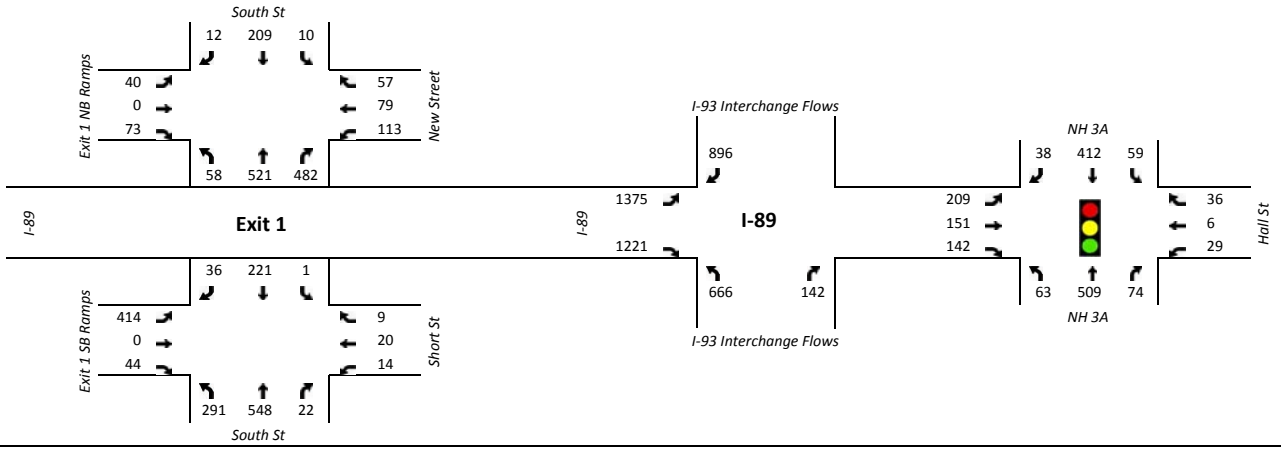
Scenario D - 2035 AM Peak Hour Model Throughput



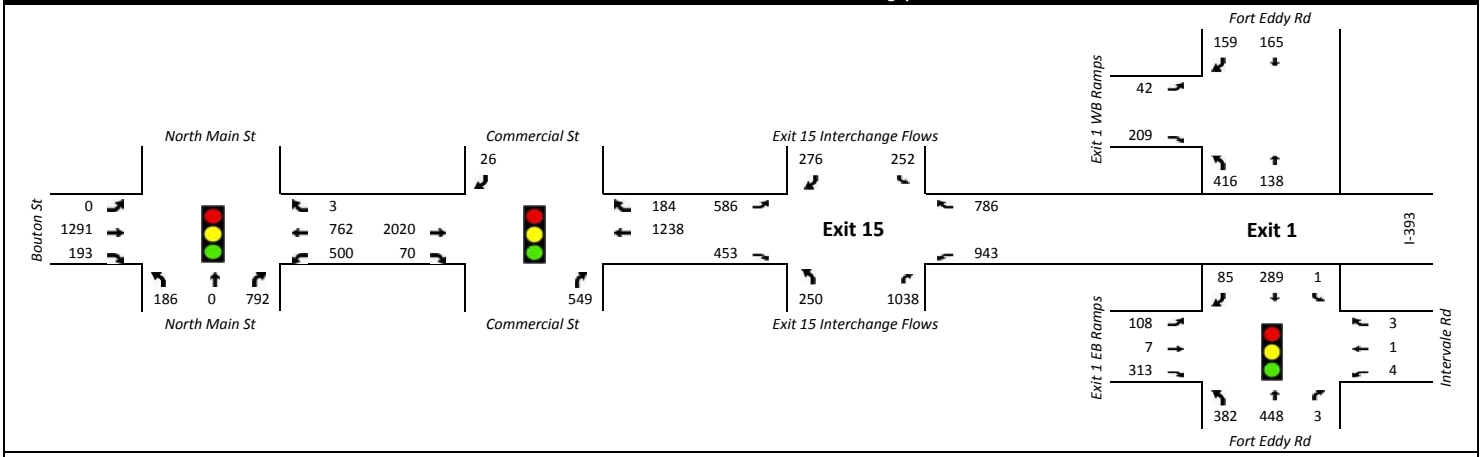


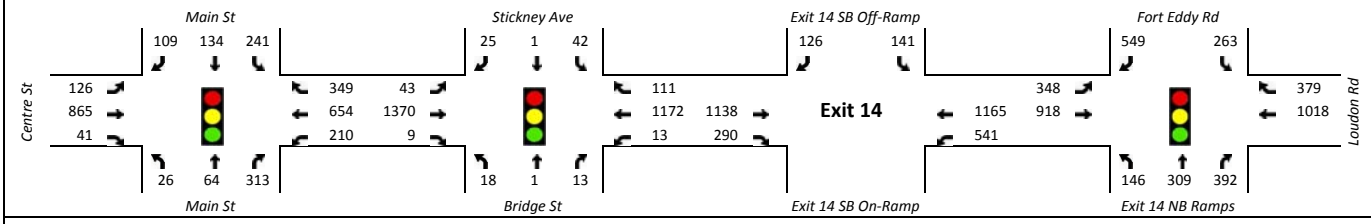


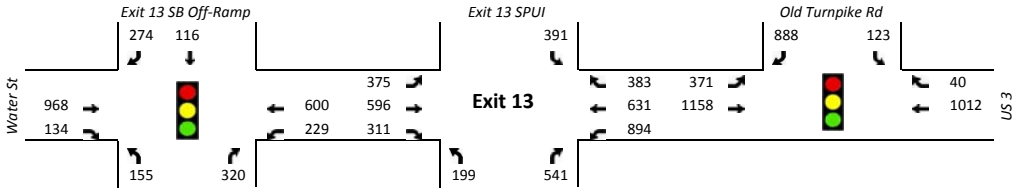


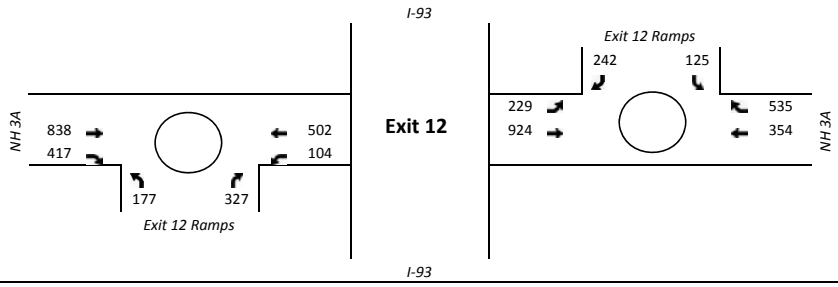


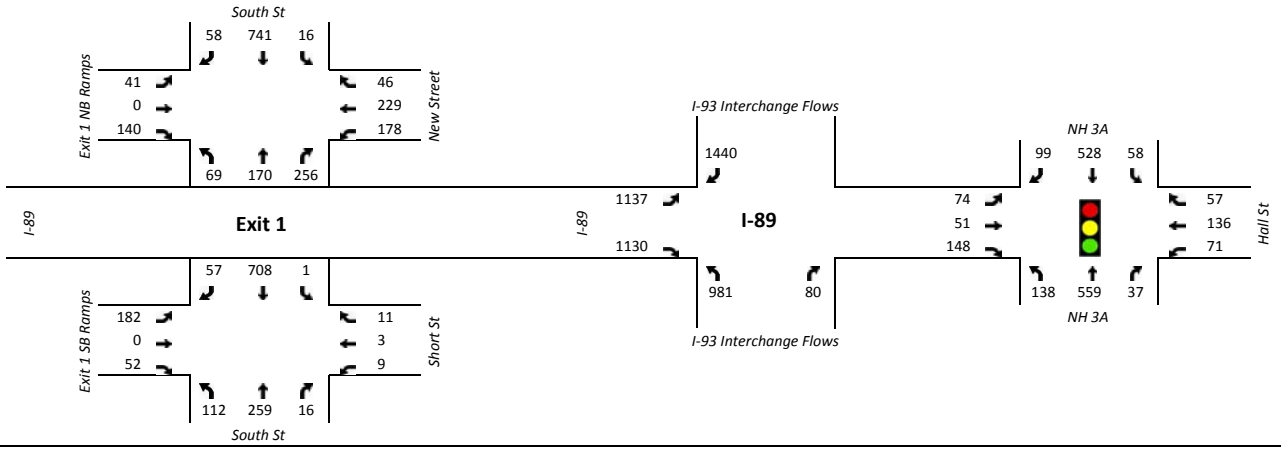
Scenario D - 2035 PM Peak Hour Model Throughput











Scenario D

	Direction	Locaton	Description	Type	2035 AM Segment Density (veh/mi/ln)	2035 AM Speed (mph)	2035 AM LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	81	27	F
			Exit 15 SB Off-Ramps	Diverge	26	55	C
			Mainline adjacent to CD Road at Exit 15	Basic	21	56	C
		Exit 14	CD Road/Mainline Merge	Merge	24	53	C
			Mainline between CD Road Merge and Exit 14 SB On-Ramp	Basic	28	54	D
			Exit 14 SB On-Ramp	Weaving	20	55	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	20	55	C
			Exit 13 SB On-Ramp	Merge	17	55	B
			Mainline Between Exit 13 and Exit 12	Diverge	17	55	B
		Exit 12	Exit 12 SB Off-Ramp	Diverge	18	54	B
			Mainline between Exit 12 SB Off/On-Ramps	Basic	21	54	C
			Exit 12 SB On-Ramp to I-93 SB Off-Ramp to I-89 NB Weave	Weaving	16	55	B
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	14	58	B
			I-93 On-Ramp from I-89 SB	Merge	15	65	B
			Mainline South of I-89 SB On-Ramp	Basic	21	62	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	15	56	B
			Exit 15 NB On-Ramp from I-393 WB	Merge	12	58	B
			Exit 15 NB On-Ramp from I-393 EB	Merge	7	59	A
			Mainline between Exit 15 NB Off/On Ramps	Basic	6	60	A
			Exit 15 NB Off-Ramp	Diverge	16	51	B
		Exit 14	Mainline between Exit 14 and Exit 15 Off-Ramps	Basic	15	53	B
			Exit 14 NB Off-Ramp	Weaving	17	52	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	21	52	C
			Exit 13 SB Off-Ramp	Diverge	25	53	C
			Mainline Between Exit 13 and Exit 12	Basic	22	55	C
		Exit 12	Exit 12 NB On-Ramp	Merge	23	54	C
			Mainline between Exit 12 Off/On-Ramps	Basic	25	53	C
			Exit 12 NB Off-Ramp	Weaving	22	52	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	18	54	B
			Mainline South of I-89 NB Off-Ramp	Diverge	25	63	C
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	29	34	D
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	28	63	D
			Exit 2 SB Off-Ramp	Diverge	26	56	C
			Mainline between Exit 2 Off/On-Ramps	Basic	20	63	C
			Exit 2 SB On-Ramp	Merge	30	53	D
			Mainline between Exit 1 and Exit 2	Basic	31	52	D
		Exit 1	Exit 1 SB Off-Ramp to CD Road	Diverge	31	47	D
			CD Road between Exit 1 Off/On-Ramps	Basic	39	37	E
			I-89 SB to I-93 NB On-Ramp	Merge	29	35	D
	Northbound	Exit 2	Mainline North of Exit 2	Basic	11	67	B
			Exit 2 NB On-Ramp	Merge	10	68	B
			Mainline between Exit 2 Off/On-Ramps	Basic	10	67	A
			Mainline between Exit 1 and Exit 2	Diverge	15	64	B
		Exit 1	CD Road On-Ramp	Merge	13	57	B
			2-Lane Mainline from I-93 NB off-Ramp to I-89 NB	Basic	6	67	A
I-393	Eastbound	I-93	I-393 EB On-Ramp from I-93 SB	Merge	8	55	A
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	12	56	B
			Mainline between Exit 1 Off/On-Ramps	Basic	14	58	B
			Exit 1 On-Ramp	Merge	15	57	B
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	15	56	B
			Exit 2 Off-Ramp	Diverge	15	54	B
			Mainline Between Exit 2 Off/On-Ramps	Basic	9	59	A
			Exit 2 On-Ramp	Merge	9	59	A
			Mainline East of Exit 2	Basic	10	58	A
	Westbound	I-93	I-393 WB On-Ramp from I-93 NB	Merge	17	49	B
			Mainline Between I-93 NB Off-Ramp and I-93 NB On-Ramp	Basic	18	56	C
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	25	51	C
			Mainline between Exit 1 Off/On-Ramps	Basic	39	45	E
			Exit 1 Off-Ramp	Diverge	34	48	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	39	47	E
			Exit 2 On-Ramp	Merge	37	37	E
			Mainline Between Exit 2 On/Off-Ramps	Basic	31	49	D
			Exit 2 Off-Ramp	Diverge	32	54	D
I-93 CD	Southbound	Exit 14 & 15	Off-Ramp to CD Road	Diverge	19	51	B
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	6	60	A
			Exit 15 SB On-Ramp	Merge	17	51	B
			Exit 15 SB On-Ramp to Exit 14 SB Off-Ramp Weave	Weaving	15	52	B
			CD Road Between Exit 14 Off/On-Ramps	Basic	16	54	B
I-89 CD	Northbound	Exit 1	I-89 NB CD Road to Mainline	Merge	15	56	B
			CD Road between Exit 1 Off/On-Ramps	Basic	17	55	B
			CD Road between I-93 SB Off-Ramp and Exit 1 Off-Ramp	Diverge	10	52	B

Scenario D

	Direction	Locaton	Description	Type	2035 PM Segment Density (veh/mi/ln)	2035 PM Speed (mph)	2035 PM LOS
I-93	Southbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	22	55	C
			Exit 15 SB Off-Ramps	Diverge	14	59	B
			Mainline adjacent to CD Road at Exit 15	Basic	12	57	B
		Exit 14	CD Road/Mainline Merge	Merge	19	55	B
			Mainline between CD Road Merge and Exit 14 SB On-Ramp	Basic	22	56	C
			Exit 14 SB On-Ramp	Weaving	20	55	B
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	19	55	C
			Exit 13 SB On-Ramp	Merge	24	52	C
			Mainline Between Exit 13 and Exit 12	Diverge	22	52	C
		Exit 12	Exit 12 SB Off-Ramp	Diverge	21	52	C
			Mainline between Exit 12 SB Off/On-Ramps	Basic	28	52	D
			Exit 12 SB On-Ramp to I-93 SB Off-Ramp to I-89 NB Weave	Weaving	22	52	C
		I-89	Mainline between I-93 Off/On-Ramps from I-89	Basic	17	57	B
			I-93 On-Ramp from I-89 SB	Merge	16	65	B
			Mainline South of I-89 SB On-Ramp	Basic	22	62	C
	Northbound	Exit 15	2-Lane Mainline North of Exit 15	Basic	41	48	E
			Exit 15 NB On-Ramp from I-393 WB	Merge	35	52	E
			Exit 15 NB On-Ramp from I-393 EB	Merge	16	55	B
			Mainline between Exit 15 NB Off/On Ramps	Basic	15	57	B
			Exit 15 NB Off-Ramp	Diverge	24	51	C
		Exit 14	Mainline between Exit 14 and Exit 15 Off-Ramps	Basic	25	52	C
			Exit 14 NB Off-Ramp	Weaving	25	52	C
		Exit 13	Mainline between Exit 13 Off/On-Ramps	Basic	26	53	C
			Exit 13 SB Off-Ramp	Diverge	22	55	C
			Mainline Between Exit 13 and Exit 12	Basic	23	55	C
		Exit 12	Exit 12 NB On-Ramp	Merge	22	55	C
			Mainline between Exit 12 Off/On-Ramps	Basic	26	54	D
			Exit 12 NB Off-Ramp	Weaving	22	53	C
		I-89	Mainline between Off/On Ramps to I-89	Basic	19	55	C
			Mainline South of I-89 NB Off-Ramp	Diverge	29	62	D
			I-93 NB CD Road at I-89 Ramps Weave	Weaving	21	36	C
I-89	Southbound	Exit 2	Mainline North of Exit 2	Basic	23	65	C
			Exit 2 SB Off-Ramp	Diverge	22	60	C
			Mainline between Exit 2 Off/On-Ramps	Basic	19	64	C
			Exit 2 SB On-Ramp	Merge	25	56	C
			Mainline between Exit 1 and Exit 2	Basic	25	54	C
		Exit 1	Exit 1 SB Off-Ramp to CD Road	Diverge	26	48	C
			CD Road between Exit 1 Off/On-Ramps	Basic	32	38	D
			I-89 SB to I-93 NB On-Ramp	Merge	24	36	C
	Northbound	Exit 2	Mainline North of Exit 2	Basic	20	64	C
			Exit 2 NB On-Ramp	Merge	19	63	B
			Mainline between Exit 2 Off/On-Ramps	Basic	18	65	C
			Mainline between Exit 1 and Exit 2	Diverge	24	62	C
		Exit 1	CD Road On-Ramp	Merge	23	50	C
			2-Lane Mainline from I-93 NB off-Ramp to I-89 NB	Basic	8	66	A
I-393	Eastbound	I-93	I-393 EB On-Ramp from I-93 SB	Merge	13	57	B
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	21	53	C
			Mainline between Exit 1 Off/On-Ramps	Basic	26	54	C
			Exit 1 On-Ramp	Merge	30	49	D
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	30	53	D
			Exit 2 Off-Ramp	Diverge	31	52	D
			Mainline Between Exit 2 Off/On-Ramps	Basic	25	55	C
			Exit 2 On-Ramp	Merge	27	53	C
			Mainline East of Exit 2	Basic	29	53	D
	Westbound	I-93	I-393 WB On-Ramp from I-93 NB	Merge	9	52	A
			Mainline Between I-93 NB Off-Ramp and I-93 NB On-Ramp	Basic	9	57	A
		Exit 1	I-93 Off-Ramp to Exit 1 Off-Ramp Weave	Weaving	24	44	C
			Mainline between Exit 1 Off/On-Ramps	Basic	24	49	C
			Exit 1 Off-Ramp	Diverge	24	51	C
		Exit 2	Mainline Between Exit 1 and Exit 2	Basic	28	46	D
			Exit 2 On-Ramp	Merge	27	35	C
			Mainline Between Exit 2 On/Off-Ramps	Basic	17	51	B
			Exit 2 Off-Ramp	Diverge	16	57	B
I-93 CD	Southbound	Exit 14 & 15	Off-Ramp to CD Road	Diverge	9	57	A
			CD Road Exit 15 SB Off-Ramp to Exit 15 SB On-Ramp	Basic	7	59	A
			Exit 15 SB On-Ramp	Merge	15	54	B
			Exit 15 SB On-Ramp to Exit 14 SB Off-Ramp Weave	Weaving	13	55	B
			CD Road Between Exit 14 Off/On-Ramps	Basic	16	55	B
I-89 CD	Northbound	Exit 1	I-89 NB CD Road to Mainline	Merge	29	49	D
			CD Road between Exit 1 Off/On-Ramps	Basic	29	54	D
			CD Road between I-93 SB Off-Ramp and Exit 1 Off-Ramp	Diverge	17	50	B

Local Intersection Operations Summary

November 2017

Prepared by RSG

Design Year 2035 Intersection Operations Summary (AM Peak Period)

		AM									
		No Build		Scenario A		Scenario B		Scenario C		Scenario D	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS	Delay	LOS
US 3/US 202 and Bouton St	Overall	19	B	27	C	21	C	22	C	22	C
	EB	23	C	27	C	24	C	25	C	26	C
	WB	18	B	29	C	20	C	21	C	21	C
	NB	17	B	17	B	18	B	16	B	17	B
Commercial St/US 202 WB	SB	33	C	81	F	52	D	67	E	48	D
Commercial St/US 202 EB	Overall	6	A	6	A	6	A	5	A	10	A
	EB	5	A	5	A	6	A	5	A	8	A
	NB	15	B	13	B	8	A	5	A	18	B
Exit 15 SB Off-Ramp	SB	1050	F	3	A	3	A	3	A	12	B
College Drive/I-393 WB Ramps	EB	9	A	10	A	10	A	10	A	10	A
	NB	0	A	0	A	0	A	0	A	0	A
	SB	0	A	0	A	1	A	0	A	1	A
College Drive/I-393 EB Ramps	Overall	13	B	13	B	13	B	14	B	13	B
	EB	11	B	11	B	12	B	12	B	11	B
	WB	18	B	16	B	15	B	16	B	16	B
	NB	13	B	13	B	14	B	13	B	13	B
	SB	13	B	16	B	14	B	15	B	16	B
US 202-Loudon Road and Centre Street	Overall	66	E	46	D	46	D	39	D	37	D
	EB	41	D	33	C	31	C	26	C	36	D
	WB	105	F	67	E	54	D	52	D	38	D
	NB	27	C	31	C	28	C	25	C	25	C
	SB	32	C	32	C	50	D	35	C	41	D
Loudon Rd/Stickney Ave and Bridge St	Overall	13	B					31	C	5	A
	EB	24	C					11	B	5	A
	WB	6	A	na		na		62	E	2	A
	NB	56	E					41	D	39	D
	SB	44	D					14	B	58	E
Loudon Rd/I-93 SB ramps	Overall	55	D	27	C	31	C			21	C
Exit 14 SPUI	EB	1	A	23	C	23	C			9	A
	WB	52	D	24	C	27	C	na		18	B
	NB	na		54	D	65	E			na	
	SB	111	F	25	C	25	C			39	D
Loudon Rd/I-93 NB on ramp	Overall	33	C								
	EB	15	B	na		na		na		na	
	WB	49	D								
Loudon Rd/Fort Eddy Rd	Overall	299	F	23	C	27	C	33	C	30	C
	EB	29	C	22	C	25	C	22	C	28	C
	WB	694	F	18	B	19	B	38	D	30	C
	NB	366	F	30	C	36	D	40	D	32	C
	SB	25	C	21	C	21	C	23	C	31	C
I-93 SB off ramp and Hall St/Manchester St	Overall	20	C	21	C	21	C	21	C	21	C
	EB	10	B	12	B	11	B	9	A	9	A
	WB	26	C	25	C	22	C	26	C	25	C
	NB	23	C	21	C	23	C	23	C	24	C
	SB	21	C	23	C	27	C	21	C	22	C
I-93 (SPUI)/Manchester St	Overall	123	F	38	D	43	D	44	D	44	D
	EB	28	C	50	D	53	D	51	D	53	D
	WB	37	D	36	D	35	D	35	C	32	C
	NB	326	F	31	C	44	D	47	D	48	D
	SB	45	D	47	D	45	D	43	D	46	D
Manchester St/Old Turnpike	Overall	18	B	19	B	16	B	17	B	17	B
	EB	12	B	13	B	12	B	13	B	11	B
	WB	30	C	33	C	27	C	30	C	29	C
	SB	10	B	12	B	11	B	9	A	10	A
Exit 12 SB Ramps	Overall	6	A	12	B	12	B	15	B	12	B
	EB	3	A	11	B	11	B	13	B	11	B
	WB	4	A	13	B	12	B	17	B	12	B
	NB	16	B	14	B	13	B	14	B	13	B
	SB	6	A	na		na		na		na	
Exit 12 NB Ramps	Overall	6	A	11	B	11	B	16	B	11	B
	EB	4	A	13	B	12	B	19	B	12	B
	WB	1	A	9	A	9	A	11	B	9	A
	NB	18	B	na		na		na		na	
	SB	10	A	5	A	5	A	17	B	4	A
South Street/I-89 Exit 1 NB Ramps	Overall	na		na		12	B	12	B	13	B
	EB	11	B	14	B	15	B	17	B	15	B
	WB	na		na		24	C	24	C	26	C
	NB	1	A	1	A	9	A	10	B	10	B
	SB	0	A	0	A	7	A	7	A	8	A
South Street/I-89 Exit 1 SB Ramps	Overall	na		na		19	B	19	B	19	B
	EB	21	C	24	C	25	C	27	C	26	C
	WB	36	D	42	D	15	B	14	B	12	B
	NB	6	A	7	A	15	B	16	B	16	B
	SB	1	A	1	A	20	B	19	B	20	B
NH-3A/I-89 and Hall St	Overall	41	D	42	D	35	C	34	C	34	C
	EB	45	D	48	D	30	C	29	C	31	C
	WB	38	D	37	D	31	C	27	C	27	C
	NB	36	D	36	D	29	C	29	C	28	C
	SB	43	D	43	D	46	D	46	D	47	D
I-93 NB Off-Ramp/New Road	Overall					5	A	3	A	5	A
	EB					4	A	na		4	A
	WB	na		na		4	A			5	A
	NB					na		15	B	na	
	SB					7	A	na		8	A

Design Year 2035 Intersection Operations Summary (PM Peak Period)

		PM									
		No Build		**Scenario A**		**Scenario B**		**Scenario C**		**Scenario D**	
		Delay	LOS	Delay	LOS	Delay	LOS	Delay		Delay	
US 3/US 202 and Bouton St	Overall	127	F	73	E	30	C	37	D	67	E
	EB	309	F	143	F	40	D	57	E	108	F
	WB	33	C	28	C	23	C	24	C	23	C
	NB	20	B	20	B	25	C	25	C	63	E
Commercial St/US 202 WB	SB	18	C	16	C	12	B	13	B	12	B
Commercial St/US 202 EB	Overall	32	C	22	C	15	B	21	C	39	D
	EB	14	B	10	B	12	B	24	C	33	C
	NB	116	F	76	E	28	C	9	A	63	E
Exit 15 SB Off-Ramp	SB	27	D	2	A	2	A	2	A	3	A
College Drive/I-393 WB Ramps	EB	12	B	13	B	11	B	12	B	12	B
	NB	1	A	2	A	1	A	1	A	1	A
	SB	4	A	4	A	6	A	4	A	5	A
College Drive/I-393 EB Ramps	Overall	17	B	16	B	16	B	14	B	16	B
	EB	13	B	14	B	14	B	14	B	13	B
	WB	28	C	24	C	14	B	18	B	29	C
	NB	14	B	13	B	14	B	12	B	15	B
	SB	24	C	24	C	21	C	20	B	22	C
US 202-Loudon Road and Centre Street	Overall	80	F	60	E	45	D	39	D	34	C
	EB	77	E	84	F	59	E	49	D	30	C
	WB	145	F	41	D	36	D	33	C	33	C
	NB	36	D	27	C	41	D	23	C	19	B
	SB	52	D	91	F	46	D	44	D	60	E
Loudon Rd/Stickney Ave and Bridge St	Overall	25	C					20	C	11	B
	EB	33	C					16	B	11	B
	WB	8	A	na		na		25	C	3	A
	NB	49	D					38	D	43	D
	SB	42	D					17	B	52	D
Loudon Rd/I-93 SB ramps	Overall	26	C	34	C	34	C			17	B
Exit 14 SPUI	EB	2	A	32	C	31	C			7	A
	WB	44	D	32	C	30	C	na		19	B
	NB	na		51	D	59	E			na	
	SB	123	F	44	D	65	E			43	D
Loudon Rd/I-93 NB on ramp	Overall	22	C								
	EB	10	B	na		na		na		na	
	WB	35	C								
Loudon Rd/Fort Eddy Rd	Overall	209	F	57	E	44	D	36	D	46	D
	EB	26	C	45	D	37	D	27	C	33	C
	WB	765	F	110	F	64	E	46	D	65	E
	NB	70	E	24	C	35	C	39	D	56	E
	SB	36	D	24	C	30	C	30	C	27	C
I-93 SB off ramp and Hall St/Manchester St	Overall	30	C	29	C	34	C	33	C	32	C
	EB	33	C	32	C	33	C	36	D	35	D
	WB	32	C	31	C	41	D	39	D	37	D
	NB	23	C	20	C	26	C	22	C	20	C
	SB	24	C	27	C	31	C	24	C	26	C
I-93 (SPUI)/Manchester St	Overall	100	F	47	D	51	D	50	D	51	D
	EB	46	D	52	D	50	D	50	D	51	D
	WB	52	D	51	D	54	D	50	D	51	D
	NB	329	F	28	C	45	D	49	D	48	D
	SB	52	D	52	D	55	E	54	D	51	D
Manchester St/Old Turnpike	Overall	31	C	33	C	15	B	15	B	16	B
	EB	11	B	13	B	11	B	11	B	12	B
	WB	22	C	23	C	20	B	23	C	22	C
	SB	69	E	78	E	17	B	14	B	15	B
Exit 12 SB Ramps	Overall	8	A	14	B	13	B	16	B	14	B
	EB	3	A	14	B	14	B	15	B	14	B
	WB	8	A	13	B	12	B	16	B	12	B
	NB	26	C	16	C	14	B	17	B	16	C
	SB	6	A	na		na		na		na	
Exit 12 NB Ramps	Overall	6	A	12	B	12	B	16	B	12	B
	EB	5	A	13	B	12	B	20	B	12	B
	WB	1	A	9	A	9	A	11	B	9	A
	NB	23	C	na		na		na		na	
	SB	11	B	4	A	4	A	18	B	3	A
South Street/I-89 Exit 1 NB Ramps	Overall	na		na		20	B	19	B	20	C
	EB	77	F	127	F	20	B	22	C	23	C
	WB	na		na		33	C	33	C	35	C
	NB	9	A	8	A	10	A	9	A	8	A
	SB	1	A	1	A	19	B	17	B	19	B
South Street/I-89 Exit 1 SB Ramps	Overall	na		na		14	B	14	B	14	B
	EB	29	D	25	D	26	C	24	C	26	C
	WB	34	D	31	D	16	B	17	B	15	B
	NB	20	C	26	D	8	A	8	A	7	A
	SB	1	A	1	A	14	B	14	B	14	B
NH-3A/I-89 and Hall St	Overall	51	D	56	E	42	D	45	D	45	D
	EB	31	C	32	C	31	C	23	C	24	C
	WB	46	D	51	D	37	D	39	D	39	D
	NB	40	D	42	D	33	C	33	C	33	C
	SB	73	E	83	F	56	E	68	E	69	E
I-93 NB Off-Ramp/New Road	Overall					4	A	na		4	A
	EB					2	A			2	A
	WB	na		na		4	A	na		5	A
	NB					na		14	B	na	
	SB					7	A	na		7	A