**Technical Memorandum**

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY


April 2008

Delaware Valley Regional Planning Commission
190 North Independence Mall West, 8th Floor
Philadelphia, PA 19106-1520

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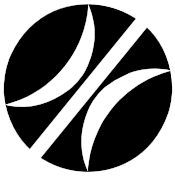
Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency which provides continuing, comprehensive, and coordinated planning to shape a vision for the future growth of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties as well as the City of Philadelphia, in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. DVRPC provides technical assistance and services, conducts high priority studies that respond to the request and demands of member state and local governments, fosters cooperation among various constituents to forge a consensus on diverse regional issues, determines and meets the needs of the private sector, and practices public outreach efforts to promote two-way communication and public awareness of regional issues and the commission.



Our logo is adapted from the official DVRPC seal, and is designed as a stylized image of the Delaware Valley. The outer ring symbolizes the region as a whole while the diagonal bar signifies the Delaware River. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey.

DVRPC is funded by a variety of funding sources including federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania and New Jersey departments of transportation, as well as by DVRPC's state and local member governments. The authors, however, are solely responsible for its findings and conclusions, which may not represent the official views or policies of the funding agencies.

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# TABLE OF CONTENTS

## LIST OF TABLES



## LIST OF FIGURES

# I. INTRODUCTION

This memo, requested by the Pennsylvania Department of Transportation (PENNDOT), documents 2014 and 2034 traffic forecasts for the Interstate 95 / US 322 interchange and the surrounding area. In preparation for projecting future traffic volumes, traffic counts throughout the study area were collected by PENNDOT's consultants (DMJM Harris | AECOM) and the Delaware Valley Regional Planning Commission (DVRPC). Municipal and county planners were contacted to identify the significant proposed residential and commercial developments within the corridor. DVRPC's regional traffic simulation model was focused on the corridor and used to prepare 2014 and 2034 traffic volume estimates for study area roadways under a No-Build and three Build alternatives.

A focused travel simulation was conducted using DVRPC's regional travel forecasting models. The traffic zones in the study area were subdivided into smaller zones to better reflect the highway network and land use characteristics of the study area. The model's highway network within the study area was reviewed and modified as needed to reflect the detailed nature of the traffic improvements to be tested.

The forecasts from this traffic study will be used to evaluate alternative interchange configurations, design ramp merge and weave areas, assess the need for traffic signal and other intersection improvements at ramp junctions, and provide data for pavement design and maintenance of traffic during construction activities.

Chapter II of this memo documents the existing characteristics of the study area, including current daily and AM and PM peak hour traffic volumes. The alternatives analyzed in the study are described in Chapter III. Chapter IV explains the travel forecasting methodology, including a description of the travel simulation model used to develop the traffic projections. The study area's population and employment projections, which provide necessary inputs into the travel model, are also presented in this chapter. Chapter V presents an analysis of the projected 2014 and 2034 daily and peak hour traffic forecasts under each alternative. Finally, conclusions drawn from the traffic study are listed in Chapter VI.

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# II. CHARACTERISTICS OF THE STUDY AREA

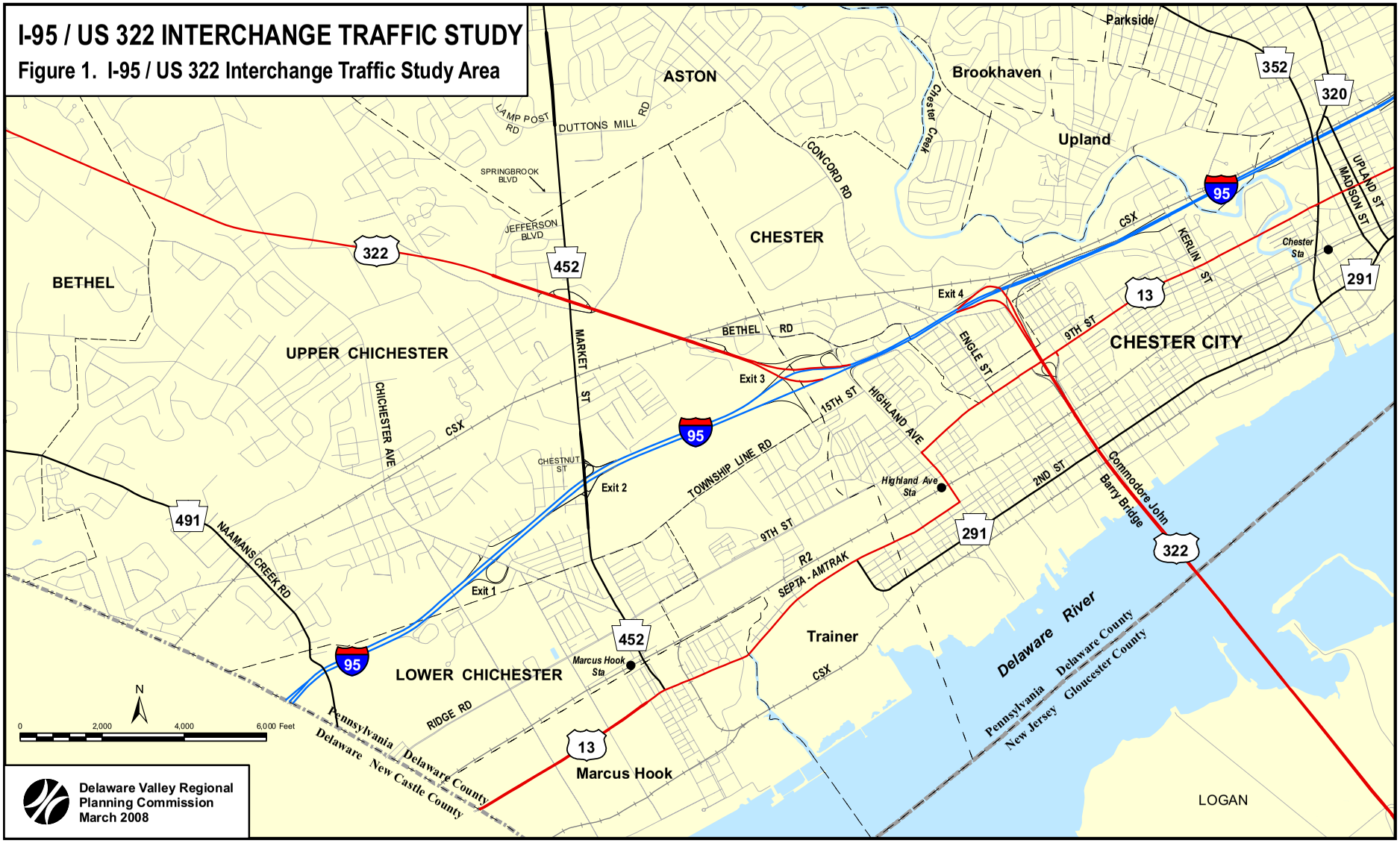
The I-95 / US 322 interchange connects two heavily traveled corridors. Interstate 95 is the region's primary north-south corridor, providing connections between the cities of Wilmington, Delaware; Chester and Philadelphia in Pennsylvania; and Trenton, New Jersey. I-95 also connects the region to other major east coast cities, such as Boston, New York, and Washington, D.C. Traveling north, the highway enters Pennsylvania in Lower Chichester Township, Delaware County, and follows the Delaware River corridor. North of the City of Chester, I-95 connects to I-476, the Philadelphia International Airport, and the Philadelphia sports complex. I-95 carries three northbound and three southbound lanes in this area.

US 322 is an older highway that runs between Atlantic City, New Jersey and Cleveland, Ohio. It enters Pennsylvania from Gloucester County, New Jersey by crossing the Delaware River via the Commodore Barry Bridge. US 322 passes through Delaware and Chester counties and continues through Harrisburg and State College, Pennsylvania. US 322 is primarily a two-lane roadway, although between I-95 and PA 452 (Market Street), it is a four-lane facility.

The portion of I-95 between Exit 3 (West Chester) and Exit 4 (Commodore Barry Bridge) is designated as both I-95 and US 322. This concurrent section of I-95 and US 322, along with their interchange at I-95 Exit 3, is the focus of this traffic study. The traffic study is intended to support an interchange reconstruction project that will increase safety and improve the flow of traffic through the interchange. This project is intended to address a major weaving movement across three lanes of I-95 traffic. Currently, US 322 eastbound traffic merges with the left-most lane of I-95 northbound at Exit 3, and continues towards the Commodore Barry Bridge via a right-side off-ramp at Exit 4. Because of the close proximity of Exits 3 and 4, this weaving movement often causes conflicts with through traffic that result in chronic delays and numerous accidents.

Other issues to be addressed include sub-standard acceleration and deceleration lanes, clearance issues at the US 322 bridge over the Norfolk Southern rail line, other geometric problems associated with US 322 and Bethel Road, and the lack of a connection from US 322 eastbound to I-95 southbound. In addition, the project will improve access to large commercial developments surrounding the interchange and is intended to reduce congestion on other area facilities, such as PA 452.

The study area for traffic forecasting purposes is defined as the municipalities of Aston, Bethel, Chester, Lower Chichester and Upper Chichester townships; Chester City; and Brookhaven, Eddystone, Marcus Hook, Parkside, Trainer, and Upland boroughs in Delaware County. This area, along with its relationship to I-95 and US 322, is shown in Figure 1.


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 1. I-95 / US 322 Interchange Traffic Study Area
ASTON
Brookhaven
Parkside
Upland
CHESTER
CHESTER CITY
BETHEL
UPPER CHICHESTER
LOWER CHICHESTER
Trainer
Marcus Hook
LOGAN
Delaware River
Pennsylvania
Delaware County
New Jersey
Gloucester County
Delaware
New Castle County
Pennsylvania
Delaware County
LAMP POST RD
DUTTONS MILL RD
SPRINGBROOK BLVD
JEFFERSON BLVD
CONCORD RD
Chester Creek
BETHEL RD
MARKET ST
CHICHESTER AVE
CHESTNUT ST
TOWNSHIP LINE RD
NAAMANS CREEK RD
RIDGE RD
CSX
SEPTA - AMTRAK
R2
Exit 1
Exit 2
Exit 3
Exit 4
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
2ND ST
KERLIN ST
UPLAND ST
MADISON ST
Commodore John Barry Bridge
Highland Ave Sta
Marcus Hook Sta
Chester Sta
322
452
95
491
352
320
291
13
N
0
2,000
4,000
6,000 Feet
Delaware Valley Regional Planning Commission
March 2008

## A. Current Average Daily Traffic Volumes

Figure 2 displays the current average annual daily traffic (AADT) volumes for Interstate 95, US 322, their ramps, and other significant roadway facilities in the study area. Traffic volumes along I-95 in this area range from 110,200 to 145,900 vehicles per day (vpd). The highest volume occurs between Exits 3 and 4, where I-95 and US 322 come together. North of the Commodore Barry Bridge interchange (Exit 4), the I-95 traffic volume drops to 132,300 vpd, although this value does not include the 15,100 vehicles on the southbound collector-distributor roadway between Kerlin Street and Exit 4.

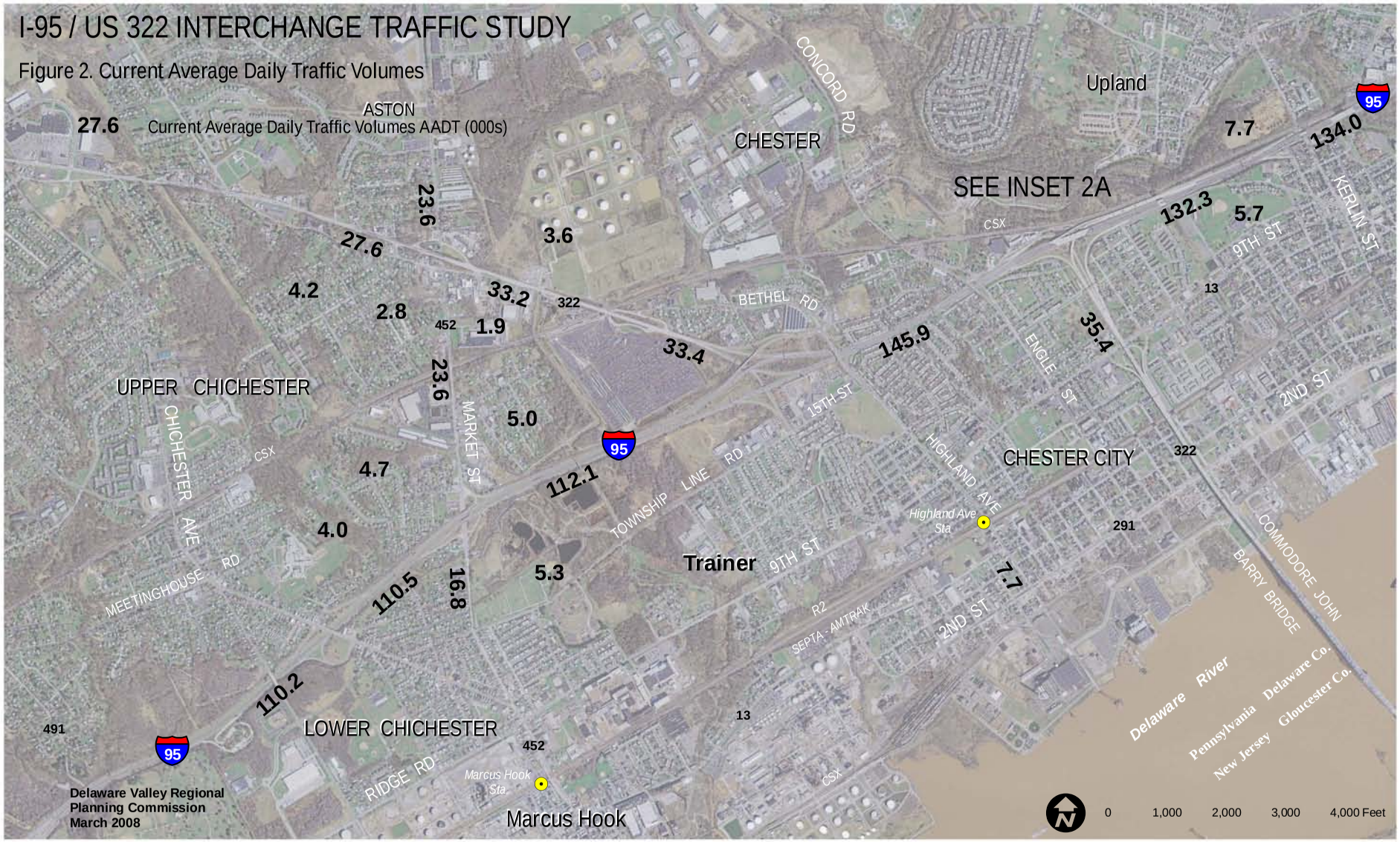
US 322 volumes west of I-95 range from 27,600 to 33,400 vpd. East of I-95, as it approaches the Commodore Barry Bridge, US 322 carries a slightly higher volume of 35,400 vpd. The next highest volume facility in the study area is PA 452, which carries between 16,800 and 23,600 vpd.

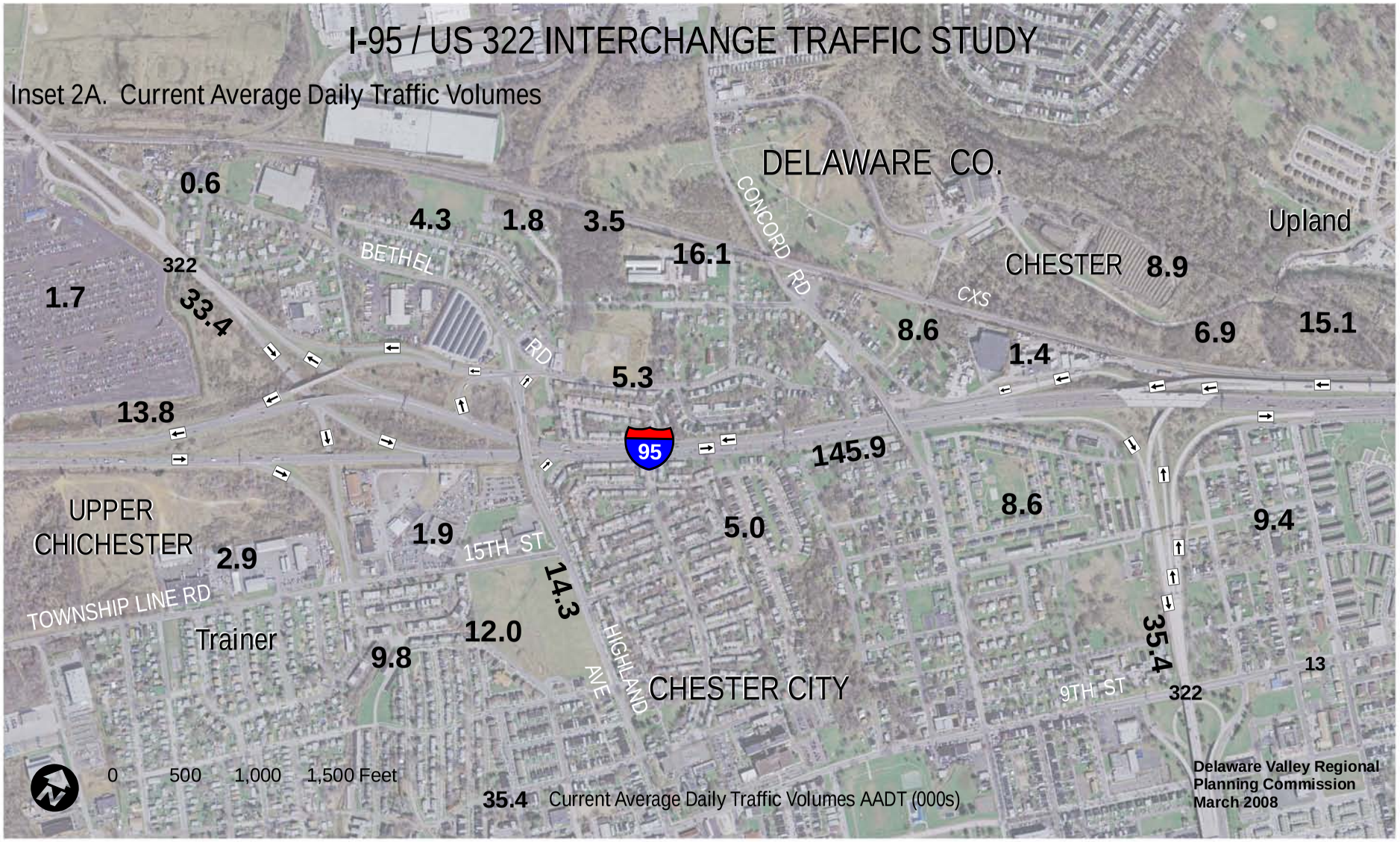
There are several high-volume ramps in the study area. These include the ramp from US 322 eastbound to I-95 northbound at Exit 3, which carries 13,800 vpd, and the corresponding I-95 southbound to US 322 westbound ramp, with a daily volume of 16,100 vehicles. The I-95 southbound off-ramp to Highland Avenue and the northbound on-ramp from Highland Avenue serve 5,300 and 5,000 vpd, respectively. The other ramps in this interchange all carry 3,500 vpd or less.

## B. Current AM and PM Peak Hour Volumes

AM and PM peak hour traffic counts were collected along I-95, US 322, and several ramps in the study area. In addition, peak hour intersection turning movement counts were taken at the ramp junctions and other key signalized intersections in the study area. These include nine intersections along PA 452, extending from its interchange with I-95 north to Lamp Post Lane. These peak hour volumes are shown in Figure 3.

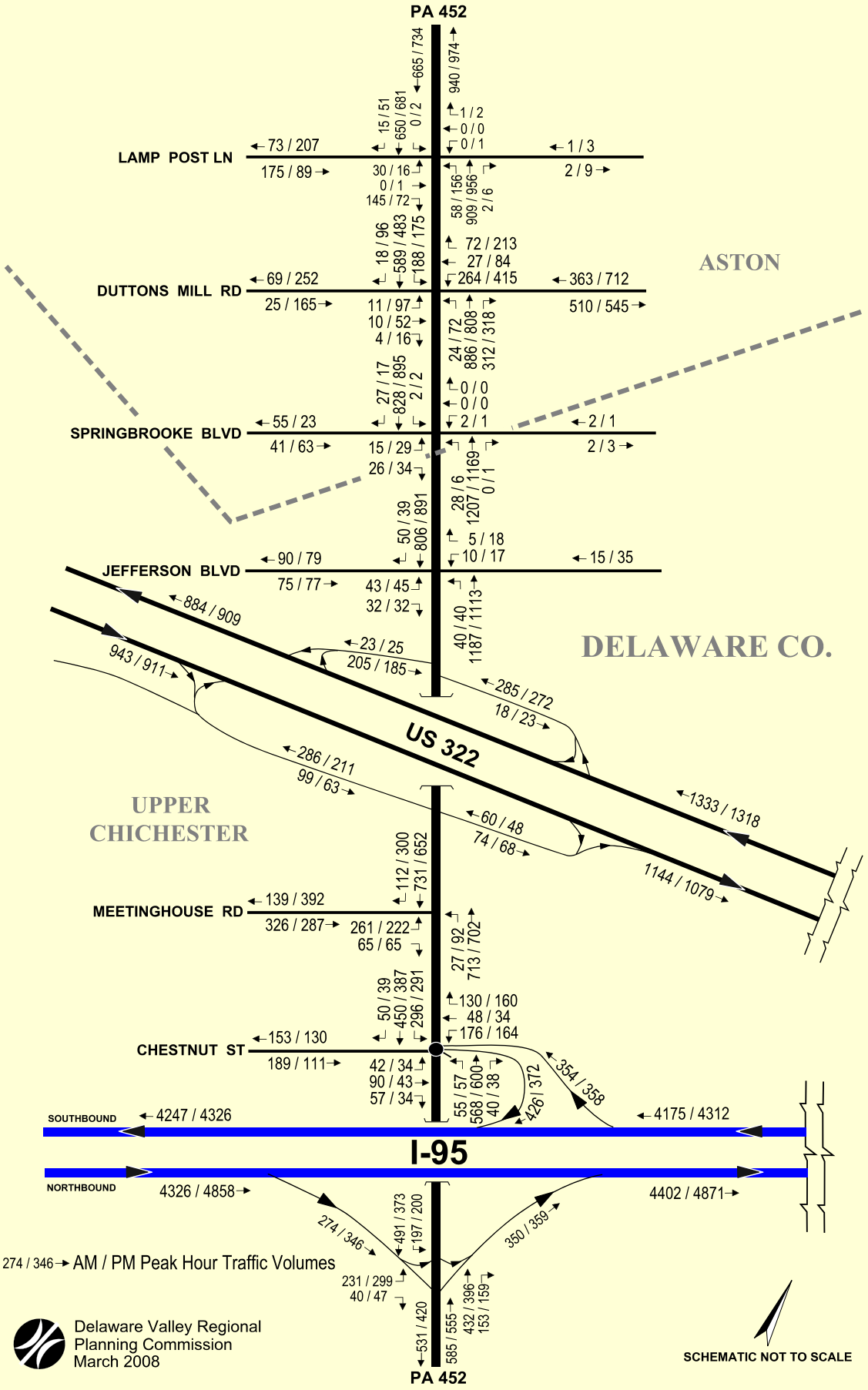
Along I-95, peak hour volumes range from 4,175 to 5,933 vehicles per hour (vph), with the highest volumes occurring just north of Exit 3 and the lowest occurring just south of Exit 3. Peak hour volumes on US 322 are between 884 and 1,353 vph. These volumes are noticeably higher on the east side of PA 452 compared to the west side. Along PA 452, the highest volumes occur between US 322 and Duttons Mill Road. Duttons Mill Road also has the highest volumes of any of PA 452's intersecting streets, because it is the primary entrance to the Duttons Mill Business Park.


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 2. Current Average Daily Traffic Volumes
Current Average Daily Traffic Volumes AADT (000s)
ASTON
CHESTER
Upland
SEE INSET 2A
UPPER CHICHESTER
LOWER CHICHESTER
CHESTER CITY
Trainer
Marcus Hook
27.6
23.6
3.6
27.6
4.2
33.2
322
2.8
452
1.9
33.4
23.6
5.0
4.7
112.1
4.0
110.5
16.8
5.3
110.2
491
452
13
7.7
134.0
132.3
5.7
13
145.9
35.4
322
291
7.7
CONCORD RD
CSX
BETHEL RD
MARKET ST
15TH ST
ENGLE ST
9TH ST
KERLIN ST
2ND ST
HIGHLAND AVE
CHICHESTER AVE
MEETINGHOUSE RD
TOWNSHIP LINE RD
RIDGE RD
SEPTA - AMTRAK
R2
BARRY BRIDGE
COMMODORE JOHN
Highland Ave Sta.
Marcus Hook Sta.
Delaware River
Pennsylvania
New Jersey
Delaware Co.
Gloucester Co.
95
Delaware Valley Regional Planning Commission
March 2008
0
1,000
2,000
3,000
4,000 Feet

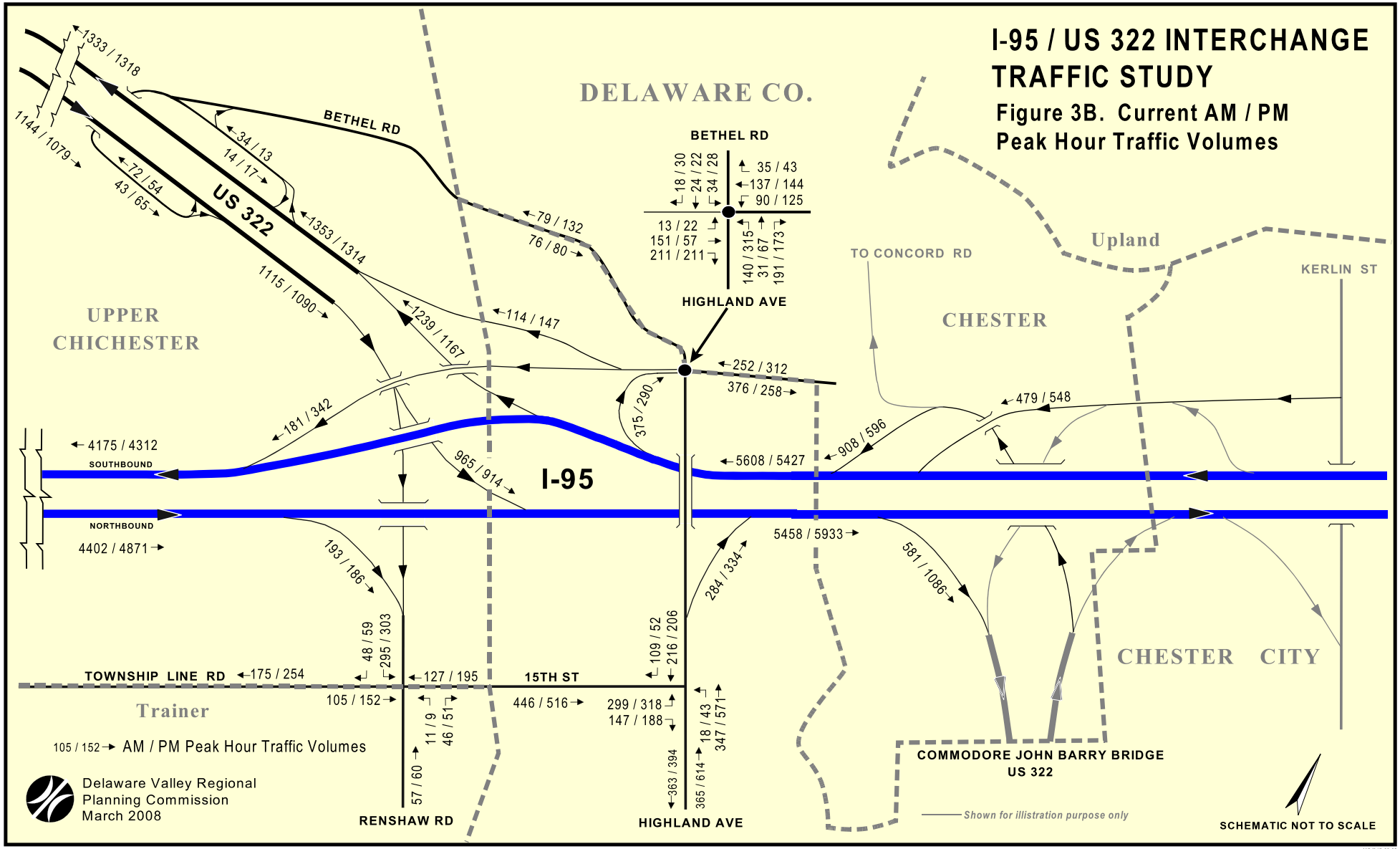

I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 2A. Current Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
CONCORD RD
CXS
BETHEL
RD
322
0.6
4.3
1.8
3.5
16.1
8.9
1.7
33.4
8.6
1.4
6.9
15.1
5.3
13.8
95
145.9
UPPER
CHICHESTER
2.9
1.9
15TH ST
5.0
8.6
9.4
TOWNSHIP LINE RD
14.3
Trainer
12.0
9.8
HIGHLAND
AVE
CHESTER CITY
35.4
9TH ST
322
13
0 500 1,000 1,500 Feet
35.4 Current Average Daily Traffic Volumes AADT (000s)
Delaware Valley Regional
Planning Commission
March 2008

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 3A. Current AM / PM Peak Hour Traffic Volumes




Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE
TRAFFIC STUDY
Figure 3B. Current AM / PM
Peak Hour Traffic Volumes
DELAWARE CO.
BETHEL RD
US 322
I-95
SOUTHBOUND
NORTHBOUND
HIGHLAND AVE
TO CONCORD RD
Upland
KERLIN ST
CHESTER
CHESTER CITY
UPPER
CHICHESTER
TOWNSHIP LINE RD
Trainer
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
105 / 152 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional
Planning Commission
March 2008
Shown for illustration purpose only
SCHEMATIC NOT TO SCALE

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# III. IMPROVEMENT ALTERNATIVES

Traffic forecasts were prepared and evaluated for the years 2014 and 2034 under four different highway network alternatives: a No-Build and three Build alternatives. For each of these alternatives, DVRPC's travel simulation model was modified to reflect the alternative under consideration and was used to prepare travel forecasts representative of that scenario. The No-Build Alternative provides a useful future-year reference against which any impacts associated with the Build alternatives may be compared and quantified. A graphical depiction of the interchange modifications associated with each of the Build alternatives is provided in Figure 4.

## A. No-Build Alternative

The No-Build Alternative does not include any changes to the I-95 / US 322 Interchange. This alternative does, however, include improvements to other regional facilities that are included in DVRPC's Transportation Improvement Program (TIP) and Long Range Plan, and that may have an impact on travel patterns in the study area once they are built. These TIP and Plan projects include the widening of US 322 from US 1 to PA 452 to four lanes, the construction of a new partial interchange between the Commodore Barry Bridge approach and PA 291 to include a US 322 eastbound off-ramp and a westbound on-ramp, and the widening of US 202 from the Delaware State Line to Matlack Street near West Chester Borough. These projects are also included as part of each of the Build alternatives.

## B. Build Alternative 1

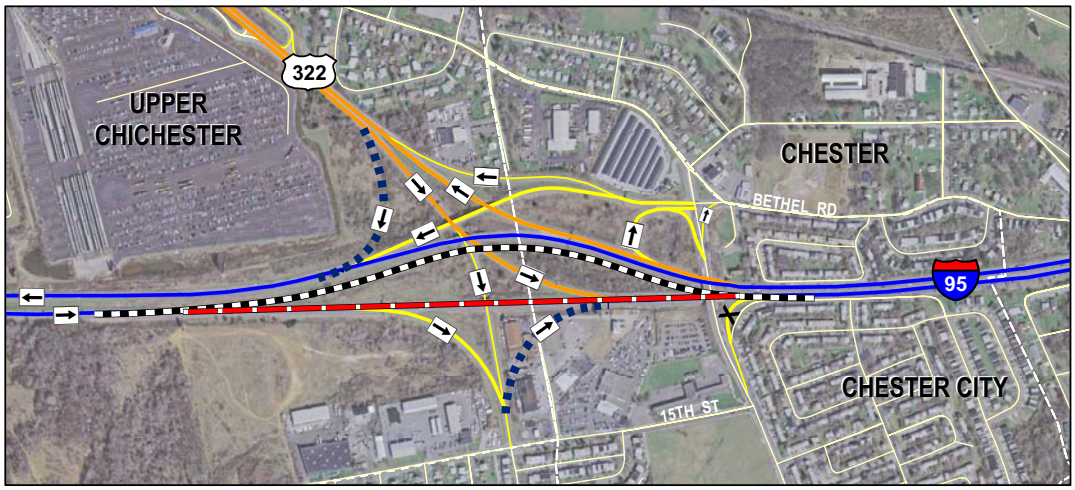
Build Alternative 1 would relocate I-95 northbound to an alignment adjacent to the I-95 southbound lanes. A new auxiliary roadway would be provided along the existing I-95 northbound alignment. This auxiliary roadway would serve as a collector-distributor road, which would accommodate I-95 northbound traffic exiting to Township Line Road / 15$^{th}$ Street. The existing I-95 northbound on-ramp from Highland Avenue would be relocated to Township Line Road. Both this on-ramp and the ramp from US 322 eastbound to I-95 northbound would join the auxiliary roadway, which would then merge with I-95 northbound traffic. Because this merge would be on the right-hand side of I-95 northbound, the weaving movement from US 322 eastbound to the Commodore Barry Bridge would be eliminated. In addition, a new ramp from US 322 eastbound to I-95 southbound would be constructed.

Additional capacity on I-95 through the interchange area would also be provided. In the northbound direction, I-95 would be widened to four lanes just south of the interchange. The right lane would diverge onto the auxiliary roadway and three I-95 northbound lanes would continue through the interchange. The auxiliary roadway, after picking up Township

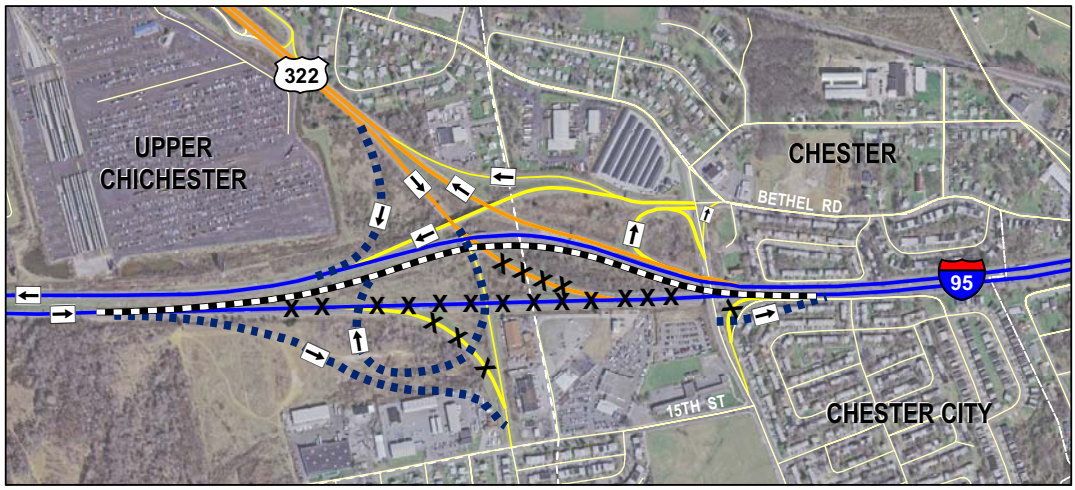
# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 4. Proposed Improvements Under Build Alternatives 1, 2, and 3

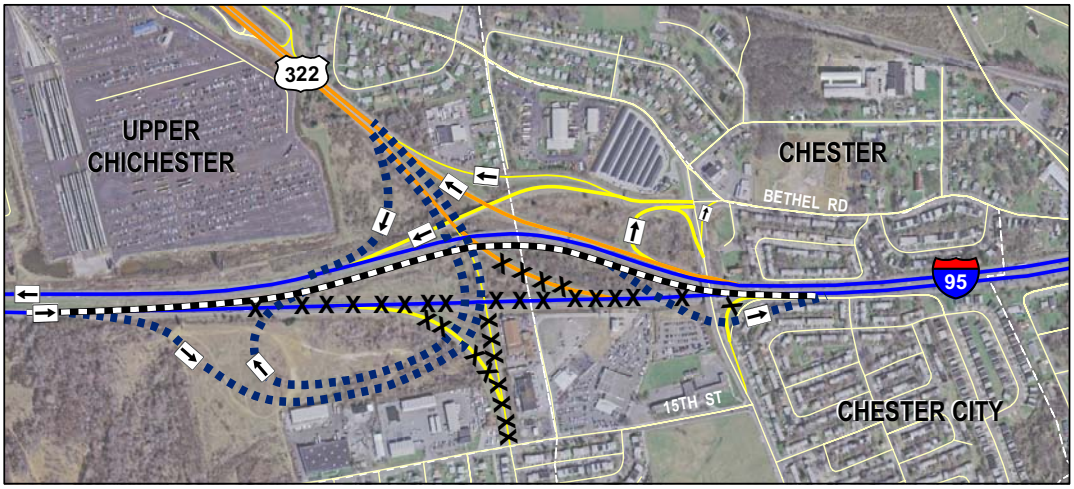
### Build Alternative 1




### Build Alternative 2




### Build Alternative 3




Relocated I-95 Northbound

Proposed Collector - Distributor Road

Proposed Ramps

Removed

0 500 1,000 1,500 2,000 Feet

Delaware Valley Regional Planning Commission
March 2008

Line Road and US 322 eastbound traffic, would merge with I-95 as a two-lane ramp. I-95 northbound would drop from five lanes to four just north of Engle Street. An additional lane drop would occur at the northbound off-ramp to the Commodore Barry Bridge interchange at Exit 4.

In the southbound direction, a fourth I-95 lane would be provided from the Commodore Barry Bridge interchange through the off-ramp to Highland Avenue, and then dropped at the off-ramp to US 322 westbound at Exit 3. The southbound on-ramp from Highland Avenue would combine with the new US 322 eastbound to I-95 southbound ramp. This traffic would be given a much greater distance to merge with I-95 southbound traffic, by providing a fourth travel lane for approximately one-half mile beyond the interchange.

## C. Build Alternative 2

Build Alternative 2 would also relocate I-95 northbound to an alignment adjacent to the southbound travel lanes. However, no auxiliary roadway would be provided. Rather, a new loop ramp from US 322 eastbound to I-95 northbound with a right-hand merge would be constructed to replace the existing US 322 eastbound left-hand merge with I-95. This loop ramp would split off from the existing US 322 eastbound ramp to Township Line Road. This ramp would be widened to two lanes, with one lane continuing to Township Line Road and the other becoming the new loop ramp. The right-hand merge onto I-95 northbound would eliminate the US 322 eastbound to Commodore Barry Bridge interchange weaving movement.

The I-95 northbound on-ramp from Highland Avenue would remain near its present location, but would be modified to allow westbound Highland Avenue traffic to access the ramp via a left turn. As in Alternative 1, a new US 322 eastbound to I-95 southbound ramp and limited widening of I-95, from approximately one-half mile south of Exit 3 to the vicinity of Engle Street, would also be provided as part of Build Alternative 2.

## D. Build Alternative 3

Build Alternative 3, like Alternative 2, would provide a new loop ramp from US 322 eastbound to I-95 northbound. However, the ramp from US 322 eastbound to Township Line Road would be eliminated. This traffic would join I-95 northbound via the new loop ramp and then quickly exit from a new I-95 northbound off-ramp to Highland Avenue. This off-ramp would be across Highland Avenue from a reconstructed I-95 northbound on-ramp, which would be in the same location as the on-ramp from Highland Avenue provided in Build Alternative 2. Build Alternative 3 would also include a new ramp from US 322 eastbound to I-95 southbound. Another new ramp, unique to Alternative 3, would be provided to allow I-95 northbound traffic direct access to US 322 westbound. I-95 mainline widening, similar to that of Build alternatives 1 and 2, would also be provided to maintain

three through travel lanes in each direction through the interchange. In the northbound direction, a fourth lane would be provided between the on-ramp from US 322 eastbound and the off-ramp to Highland Avenue, a distance of approximately 2,000 feet.

# IV. TRAVEL FORECASTING PROCEDURES

DVRPC's travel simulation models are used to forecast future travel patterns. These models utilize a system of traffic zones that follow Census boundaries and rely on demographic and employment data, land use, and transportation network characteristics to simulate trip-making patterns throughout the region.

## A. Socioeconomic Projections

DVRPC's long-range population and employment forecasts are revised periodically to reflect changing market trends, development patterns, local and national economic conditions, and available data. The completed forecasts reflect all reasonably known current information and the best professional judgement of predicted future conditions. The revised forecasts adopted by the DVRPC Board in February 2005 are an update to municipal forecasts that were last completed in 2000, and form the basis for the forecasts used in this traffic study.

DVRPC uses a multistep, multisource methodology to produce its forecasts at the county level. County forecasts serve as control totals for municipal forecasts, which are disaggregated from county totals. Municipal forecasts are based on an analysis of historical data trends adjusted to account for infrastructure availability, environmental constraints to development, local zoning policy, and development proposals. Municipal population forecasts are constrained using density ceilings and floors. County, and, where necessary, municipal input is used throughout the process to derive the most likely population forecasts for all geographic levels.

### 1. Population Forecasting

Population forecasting at the regional level involves review and analysis of six major components: births, deaths, domestic in-migration, domestic out-migration, international immigration, and changes in group quarters populations (e.g., dormitories, military barracks, prisons, and nursing homes). DVRPC uses both the cohort survival concept to age individuals from one age group to the next, and a modified Markov transition probability model based on the most recent US Census and the US Census Bureau's recent Current Population Survey (CPS) research, to determine the flow of individuals between the Delaware Valley and areas outside the region. For movement within the region, Census and IRS migration data, coupled with CPS data, are used to determine migration rates between counties. DVRPC relies on county planning offices to provide information on any known, expected, or forecasted changes in group quarters populations. These major population components are then aggregated and the resulting population forecasts are reviewed by member governments for final adjustments based on local knowledge.

## 2. Employment Forecasting

Employment is influenced by local, national, and global political and socioeconomic factors. The US Census Bureau provides the most reasonable and consistent time series data on county employment by sector, and serves as DVRPC's primary data source for employment forecasting. Employment sectors include mining, agriculture, construction, manufacturing, transportation, wholesale, retail, finance / insurance, service, government, and military. Other supplemental sources of data include the Bureau of Economic Analysis, the Bureau of Labor Statistics, Occupational Privilege tax data, and other public and private sector forecasts. As in the population forecasts, county-level total employment is used as a control total for sector distribution and municipal-level forecasts. Forecasts are then reviewed by member counties for final adjustments based on local knowledge.

## 3. I-95 / US 322 Interchange Study Area Forecasts

As part of the I-95 / US 322 Interchange Traffic Study, DVRPC staff reviewed its most recent current population and employment estimates, its long-range population and employment forecasts, and all proposed land use developments in the study area. In addition, revised long-range population and employment forecast were being developed while this traffic study was underway. A preliminary set of these forecasts was available for the municipalities in this study area. Based on these data, DVRPC developed municipal-level population and employment forecasts for use as inputs to the traffic simulation models. Table 1 summarizes the population and employment forecasts used in the study.

Currently, there are about 107,800 residents and 37,600 jobs in the greater study area. These values are largely unchanged from 2000 levels. Between 2000 and 2005, the population grew by 3,353 residents and employment declined by about 200 jobs. The population increase was largely driven by Bethel Township, which increased its population by 2,700 residents between 2000 and 2005. All other study-area municipalities were stable in terms of both population and employment, with some showing small gains and others showing small losses. This stability is reflective of a mature area that is largely built out. Population and employment changes result primarily from redevelopment of previously developed areas.

This stability is forecast to continue well into the future. Between 2005 and 2030, the total population in the greater study area is projected to increase by only 2,885 residents to 110,639. This represents an increase of just under three percent from the 2005 value. Four of the 12 municipalities in the study area are forecast to experience small declines in population, while the remainder will experience small increases. The largest increases will occur in Chester City, with 933 new residents, and in Bethel Township, with 868 new residents. Bethel Township will also have the highest relative growth at 9.5 percent.

## Table 1. Study Area Population and Employment

| | Population | | | | | | Employment | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | | | | 2005 - 2030 Growth | | | | | | 2005 - 2030 Growth | |
| **Municipality** | **2000** | **2005** | **2015** | **2030** | **Abs.** | **Pct.** | **2000** | **2005** | **2015** | **2030** | **Abs.** | **Pct.** |
| Aston Township | 16,205 | 16,801 | 16,972 | 17,194 | 393 | 2.3% | 5,720 | 5,863 | 6,276 | 6,814 | 951 | 16.2% |
| Bethel Township | 6,420 | 9,102 | 9,479 | 9,970 | 868 | 9.5% | 1,015 | 1,124 | 1,224 | 1,355 | 231 | 20.6% |
| Brookhaven Borough | 7,985 | 7,843 | 7,904 | 7,984 | 141 | 1.8% | 1,953 | 1,923 | 2,011 | 2,125 | 202 | 10.5% |
| Chester City | 36,854 | 37,029 | 37,127 | 37,962 | 933 | 2.5% | 11,191 | 11,158 | 11,965 | 12,980 | 1,822 | 16.3% |
| Chester Township | 4,604 | 4,501 | 4,549 | 4,611 | 110 | 2.4% | 1,743 | 1,686 | 1,814 | 2,358 | 672 | 39.9% |
| Eddystone Borough | 2,442 | 2,379 | 2,364 | 2,345 | -34 | -1.4% | 2,649 | 2,505 | 2,499 | 2,492 | -13 | -0.5% |
| Lower Chichester Township | 3,591 | 3,493 | 3,483 | 3,469 | -24 | -0.7% | 865 | 829 | 850 | 876 | 47 | 5.7% |
| Marcus Hook Borough | 2,314 | 2,264 | 2,276 | 2,293 | 29 | 1.3% | 1,979 | 1,901 | 1,858 | 1,802 | -99 | -5.2% |
| Parkside Borough | 2,265 | 2,210 | 2,223 | 2,239 | 29 | 1.3% | 226 | 221 | 218 | 213 | -8 | -3.6% |
| Trainer Borough | 1,901 | 1,860 | 1,812 | 1,750 | -110 | -5.9% | 1,135 | 1,075 | 1,065 | 1,152 | 77 | 7.2% |
| Upland Borough | 2,977 | 2,908 | 2,901 | 2,892 | -16 | -0.6% | 4,112 | 4,079 | 4,051 | 4,015 | -64 | -1.6% |
| Upper Chichester Township | 16,842 | 17,364 | 17,610 | 17,930 | 566 | 3.3% | 5,192 | 5,207 | 5,304 | 5,641 | 434 | 8.3% |
| **Study Area Total** | **104,400** | **107,754** | **108,700** | **110,639** | **2,885** | **2.7%** | **37,780** | **37,571** | **39,135** | **41,823** | **4,252** | **11.3%** |

DVRPC - September 2007

The study area will add 4,252 new jobs between 2005 and 2030, an increase of 11.3 percent. Again, four of the 12 study area municipalities are projected to experience slight declines in employment. Over 40 percent of the study area employment growth will occur in Chester City. This growth will be driven by the new racetrack / casino and other waterfront redevelopment projects. In total, Chester City employment is projected to increase by 16.3 percent over its 2005 level. Chester and Bethel townships will experience higher employment growth in relative terms, at 39.9 and 20.6 percent, respectively. The majority of the remaining new study area jobs will be located in Aston and Upper Chichester townships.

## B. DVRPC's Travel Simulation Process

For the I-95 / US 322 Interchange Traffic Study, a focused simulation process was employed. A focused simulation process uses DVRPC's regional simulation models, but includes a more detailed representation of the study area. Local streets not included in the regional network, but of interest in this study, are added to the highway network. Traffic zones inside the study area are subdivided so that traffic from existing and proposed land use developments may be loaded more precisely onto the network. The focusing process increases the accuracy of the travel forecasts within the detailed study area. At the same time, all existing and proposed highways throughout the region, and their impact on both regional and interregional travel patterns, become an integral part of the simulation process.

DVRPC's travel models follow the traditional steps of trip generation, trip distribution, modal split, and traffic assignment. However, an iterative feedback loop is employed from traffic assignment to the trip distribution step. The feedback loop ensures that the congestion levels used by the models when determining trip origins and destinations are equivalent to those that result from the traffic assignment step. Additionally, the iterative model structure allows trip making patterns to change in response to changes in traffic patterns, congestion levels, and improvements to the transportation system.

The DVRPC travel simulation process uses the Evans Algorithm to iterate the model. Evans reexecutes the trip distribution and modal split models based on updated highway speeds after each iteration of highway assignment and assigns a weight to each iteration. This weight is then used to prepare a convex combination of the link volumes and trip tables for the current iteration and a running weighted average of the previous iterations. This algorithm converges rapidly to the equilibrium solution on highway travel speeds and congestion levels. About seven iterations are required for the process to converge to the equilibrium state for study area travel patterns.

The DVRPC travel simulation models are disaggregated into separate peak, midday, and evening time periods. This disaggregation begins in trip generation, where factors are used to separate daily trips into peak, midday, and evening travel. The enhanced process then utilizes completely separate model chains for peak, midday, and evening travel simulation

runs. Time-of-day sensitive inputs to the models, such as highway capacities and transit service levels, are disaggregated to be reflective of time-period-specific conditions. Capacity factors are used to allocate daily highway capacity to each time period. Separate transit networks were used to represent the difference in transit service over the course of a day.

The enhanced model is disaggregated into separate model chains for the peak (combined AM and PM), midday (the period between the AM and PM peaks), and evening (the remainder of the day) periods for the trip distribution, modal split, and travel assignment phases of the process. The peak period is defined as 7:00 AM to 9:00 AM and 3:00 PM to 6:00 PM. Peak period and midday travel are based on a series of factors that determine the percentage of daily trips that occur during those periods. Evening travel is then defined as the residual after peak and midday travel are removed from daily travel. External-local productions at the nine-county cordon stations are disaggregated into peak, midday, and evening components using percentages derived from the temporal distribution of traffic counts taken at each cordon station.

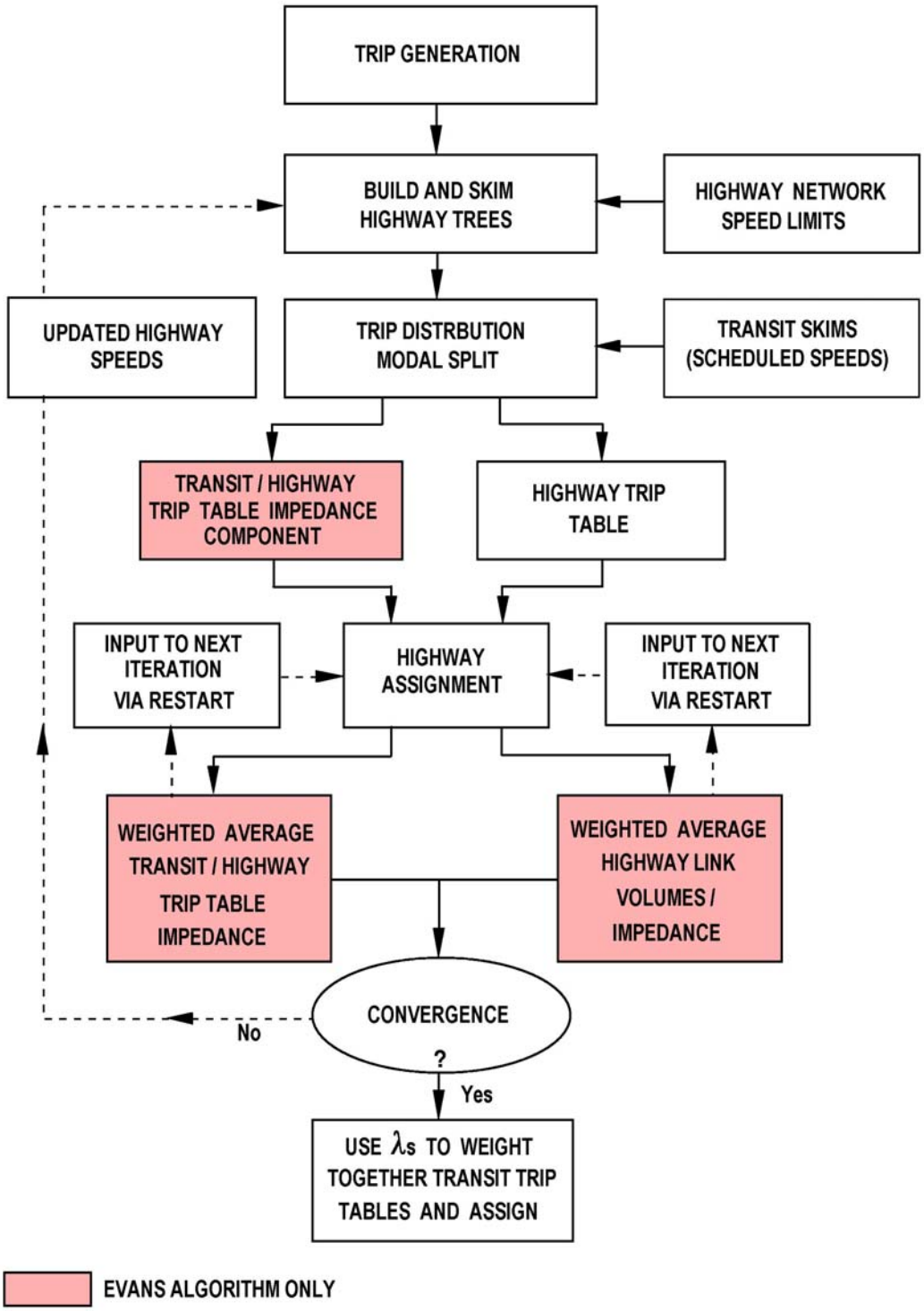
For the I-95 / US 322 Interchange Traffic Study, an additional trip purpose was added to DVRPC's standard travel demand model to represent casino visitor trips. These trips have different characteristics than the other trip purposes in DVRPC's travel demand model. They tend to have a different trip length frequency distribution with a longer average trip length and a somewhat higher average auto occupancy than other trips.

Figure 5 provides a flow chart of the travel demand forecasting process. The first step in the process involves generating the number of trips that are produced by and destined for each traffic zone and cordon station throughout the nine-county region.

## 1. Trip Generation

Both internal trips (those made within the DVRPC region) and external trips (those that cross the boundary of the region) must be considered in the simulation of regional travel. For the simulation of travel demand, internal trip generation is based on zonal forecasts of population and employment, whereas external trips are extrapolated from cordon line traffic counts and other sources. The latter also include trips that pass through the Delaware Valley region. Estimates of internal trip productions and attractions by zone are established for each trip purpose on the basis of trip rates applied to the zonal estimates of demographic and employment data. Trip purposes include work and nonwork trips, light and heavy truck trips, and taxi trips. This part of the DVRPC model is not iterated on highway travel speed. Rather, estimates of daily trip making by traffic zone are calculated and then disaggregated into peak, midday, and evening time periods.

## Figure 5. DVRPC's Travel Modeling Process



## 2. Evans Iterations

The iterative portion of the Evans forecasting process involves updating the highway network restrained link travel speeds, rebuilding the minimum time paths through the network, and skimming the interzonal travel time for the minimum paths. Then the trip distribution, modal split, and highway assignment models are executed in sequence for each pass through the model chain. After convergence is reached, the transit trip tables for each iteration are weighted together and the weighted average table is assigned to the transit network. The highway trip tables are loaded onto the network during each Evans iteration. For each time period, seven iterations of the Evans process are performed to ensure that convergence on travel times is reached.

## 3. Trip Distribution

Trip distribution is the process by which the zonal trip ends established in the trip generation analysis are linked together to form origin-destination patterns in the trip table format. Peak, midday, and evening trip ends are distributed separately. For each Evans iteration, a series of ten gravity-type distribution models are applied at the zonal level. These models follow the trip purpose and vehicle type stratifications established in trip generation.

## 4. Modal Split

The modal split model is also run separately for the peak, midday, and evening time periods. The modal split model calculates the fraction of each person-trip interchange in the trip table that should be allocated to transit, and then assigns the residual to the highway side. The choice between highway and transit usage is made on the basis of comparative cost, travel time, and frequency of service, with other aspects of modal choice being used to modify this basic relationship. In general, the better the transit service, the higher the fraction assigned to transit, although trip purpose and auto ownership also affect the allocation. The model subdivides highway trips into auto drivers and passengers. Auto driver trips are added to the truck, taxi, and external vehicle trips in preparation for assignment to the highway network.

## 5. Highway Assignment

For highway trips, the final step in the focused simulation process is the assignment of vehicle trips to the highway network representative of the alternative being modeled. For peak, midday, and evening travel, the assignment model produces the future traffic volumes for individual highway links that are required for the evaluation of each alternative. The regional nature of the highway network and trip table underlying the focused

assignment process allows the diversion of travel into and through the study area to various points of entry and exit in response to the improvements made in the transportation system.

For each Evans iteration, highway trips are assigned to the network representative of a given alternative by determining the best (minimum time) route through the highway network for each zonal interchange, and then allocating the interzonal highway travel to the highway facilities along that route. This assignment model is "capacity restrained," which means that congestion levels are considered when determining the best route. The Evans equilibrium assignment method is used to implement the capacity constraint. When the assignment and associated trip table reach equilibrium, no path faster than the one actually assigned for each trip can be found through the network, given the capacity restrained travel times on each link.

### 6. Transit Assignment

After equilibrium is achieved, the weighted average transit trip tables are assigned to the transit network to produce link and route passenger volumes. The transit person trips produced by the modal split model are "linked," which means that they do not include any transfers that occur either between transit trips or between auto approaches and transit lines. The transit assignment procedure accomplishes two major tasks. First, the transit trips are "unlinked" to include transfers, and second, the unlinked transit trips are associated with specific transit facilities to produce link, line, and station volumes. These tasks are accomplished simultaneously within the transit assignment model, which assigns the transit trip matrix to minimum impedance paths built through the transit network. There is no capacity-restraining procedure in the transit assignment model.

## C. Highway Traffic Assignment Validation

Before a focused simulation model can be used to predict future trip making patterns, its ability to replicate existing conditions is tested. The simulated highway assignment outputs are compared to current traffic counts taken on roadways serving the study area. The focused simulation model was executed with current conditions and the results were compared with recent traffic counts. Based on this analysis, the focused model produced accurate traffic volumes. The validated model was then executed for the No-Build and each Build alternative, with socioeconomic and land use inputs reflective of future conditions and the specific alternative under evaluation.

A total of 73 locations throughout the greater study area with available daily traffic counts were used for model validation. Eight of these locations are along I-95; five are on US 322; 38 are on either I-95 or US 322 interchange ramps; and 22 are on other facilities, such as PA 452, Highland Avenue, Township Line Road, and PA 291. The total assigned traffic on all facilities, 1.59 million vehicles, is within six percent of the total counted volume of 1.62 million vehicles.

# V. PROJECTED TRAFFIC VOLUMES

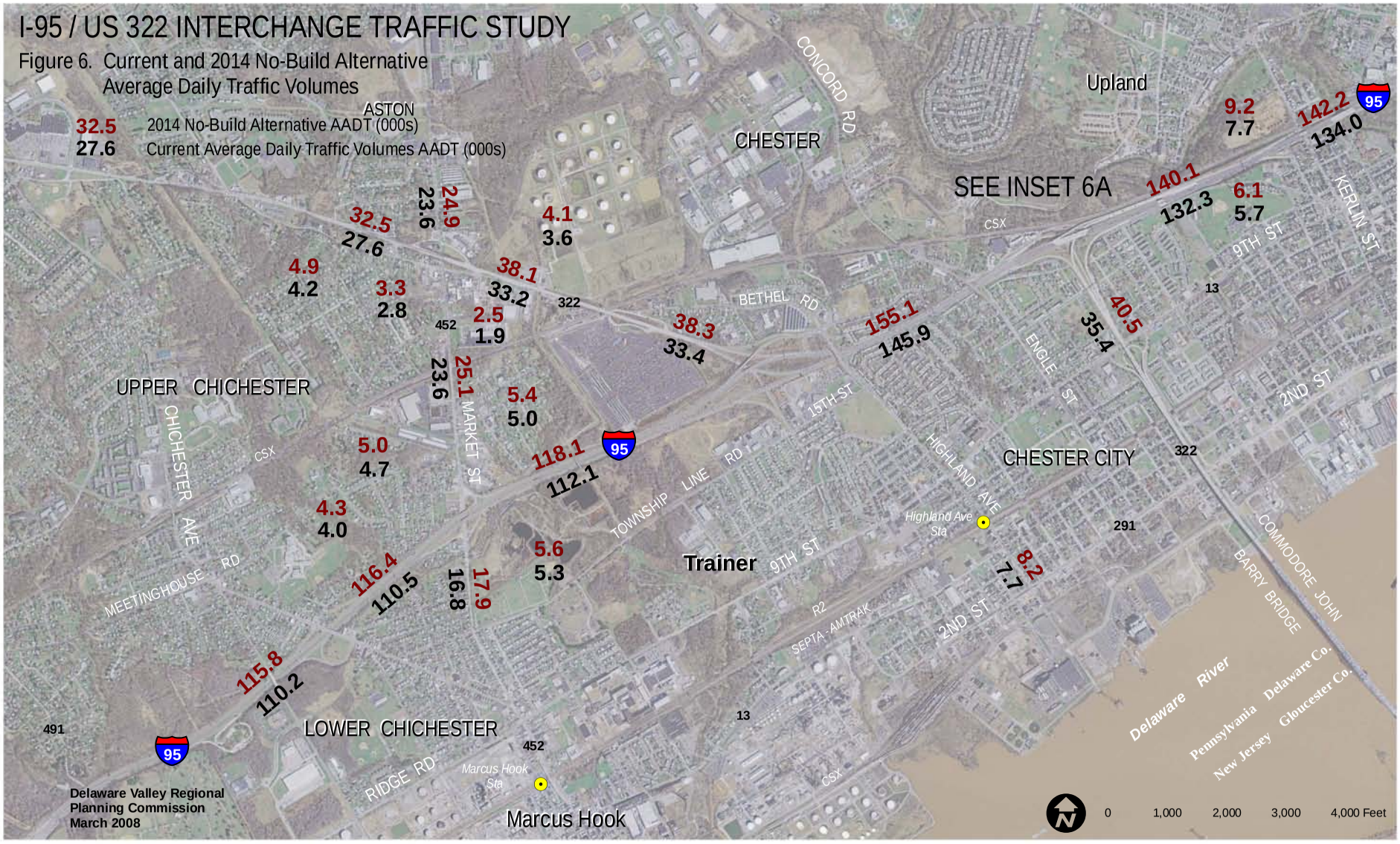
Projected traffic volumes for the anticipated opening year, 2014, and a horizon year of 2034 are presented and analyzed in this chapter. Daily and peak hour forecasts for the No-Build and three Build alternatives are presented. For each alternative, a focused 2030 trip table was prepared by disaggregating the zonal demographic and employment inputs to the trip generation model and executing the DVRPC travel model through traffic assignment. The resulting travel matrix includes all travel patterns throughout the Delaware Valley region, including trips entering and exiting the region at its cordon. Traffic volumes for 2014 were developed by interpolating between the current and 2030 trip tables. Volumes for 2034 were found by extrapolating the trend between the current and 2030 traffic patterns to 2034.

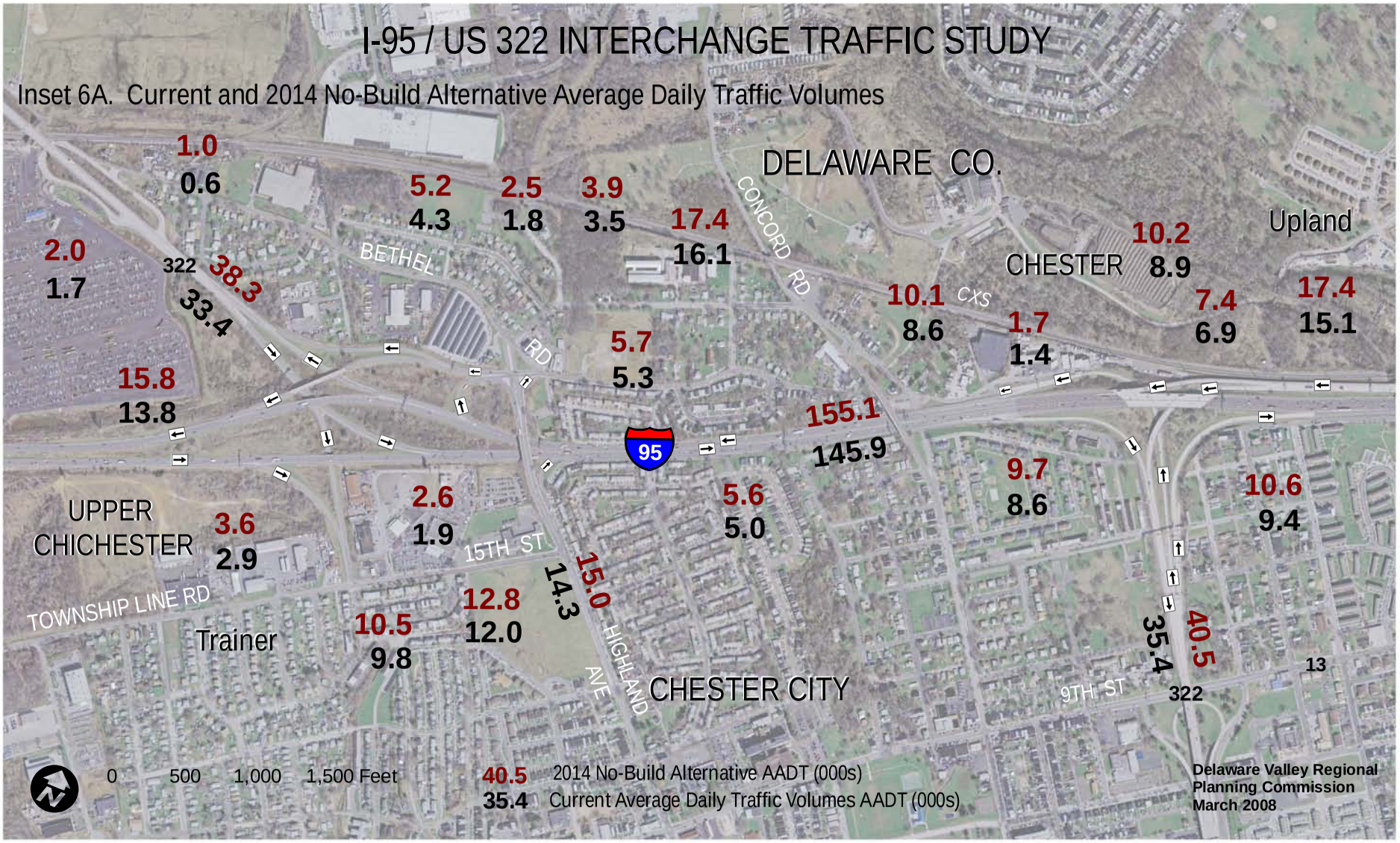
Estimates of future year AM and PM peak hour volumes, including intersection turning movements, were calculated by scaling current peak hour volumes according to growth factors on each link and intersection leg. These growth factors represent the ratio of future year peak hour link volumes to current year peak hour volumes. The future year peak hour volumes for each link and intersection leg were determined by multiplying the forecasted AADT by directional AM and PM peak hour "K" factors. Existing "K" factors were calcualted from traffic counts as the ratio of the highest morning and evening hourly volumes to the total AADT. Future year "K" factors were based on the existing "K" factors and the AADT growth on each intersection approach, accounting for the "peak spreading" that typically occurs as daily traffic volumes and congestion levels increase. The resulting forecasted AM and PM link volumes and intersection turning movements were adjusted as necessary to balance traffic flows between adjacent interchanges and intersections.

## A. 2014 Daily Traffic Forecasts

Figure 6 provides the 2014 average daily traffic volumes for the No-Build Alternative, along with the current traffic volumes for comparison. In the figure, current traffic volumes are shown in black, underneath the line representing the highway links; No-Build volumes are shown in red, just above the line.

Under the No-Build Alternative, 2014 volumes on I-95 in the study area range from 115,800 to 155,100 vehicles per day (vpd), representing increases of 5,600 to 9,200 vpd over current volumes. US 322 volumes are approximately 5,000 vpd higher than current volumes and range from 32,500 to 38,300 west of I-95. This growth is largely a result of the US 322 widening from US 1 to PA 452, which is included in the future highway networks. East of I-95, at the Commodore Barry Bridge interchange, US 322 carries 40,500 vpd in 2014 under the No-Build Alternative. PA 452 volumes increase by 1,100 to 1,300 vpd; 2014 traffic volumes are between 17,900 and 25,100 vpd. Individual ramps within the I-95 / US 322 interchange increase by 400 to 2,000 vpd. The largest increases


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 6. Current and 2014 No-Build Alternative
Average Daily Traffic Volumes
32.5 2014 No-Build Alternative AADT (000s)
27.6 Current Average Daily Traffic Volumes AADT (000s)
ASTON
CHESTER
CONCORD RD
Upland
SEE INSET 6A
CSX
9TH ST
KERLIN ST
BETHEL RD
ENGLE ST
15TH ST
2ND ST
HIGHLAND AVE
CHESTER CITY
322
452
13
291
UPPER CHICHESTER
CHICHESTER AVE
MARKET ST
TOWNSHIP LINE RD
MEETINGHOUSE RD
Highland Ave Sta
Trainer
9TH ST
R2
SEPTA - AMTRAK
2ND ST
COMMODORE JOHN BARRY BRIDGE
Delaware River
Pennsylvania
Delaware Co.
New Jersey
Gloucester Co.
LOWER CHICHESTER
491
RIDGE RD
Marcus Hook Sta
Marcus Hook
Delaware Valley Regional Planning Commission
March 2008
0 1,000 2,000 3,000 4,000 Feet


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 6A. Current and 2014 No-Build Alternative Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
CHESTER CITY
UPPER CHICHESTER
Trainer
BETHEL RD
CONCORD RD
15TH ST
9TH ST
HIGHLAND AVE
TOWNSHIP LINE RD
322
95
CXS
1.0 0.6
5.2 4.3
2.5 1.8
3.9 3.5
17.4 16.1
10.2 8.9
2.0 1.7
38.3 33.4
10.1 8.6
1.7 1.4
7.4 6.9
17.4 15.1
5.7 5.3
15.8 13.8
155.1 145.9
9.7 8.6
10.6 9.4
2.6 1.9
5.6 5.0
3.6 2.9
15.0 14.3
12.8 12.0
10.5 9.8
40.5 35.4
13
0 500 1,000 1,500 Feet
40.5 2014 No-Build Alternative AADT (000s)
35.4 Current Average Daily Traffic Volumes AADT (000s)
Delaware Valley Regional Planning Commission
March 2008

occur on the US 322 eastbound to I-95 northbound ramp and on the reverse movement from I-95 southbound to US 322 westbound. All other ramps increase by 700 vpd or less.

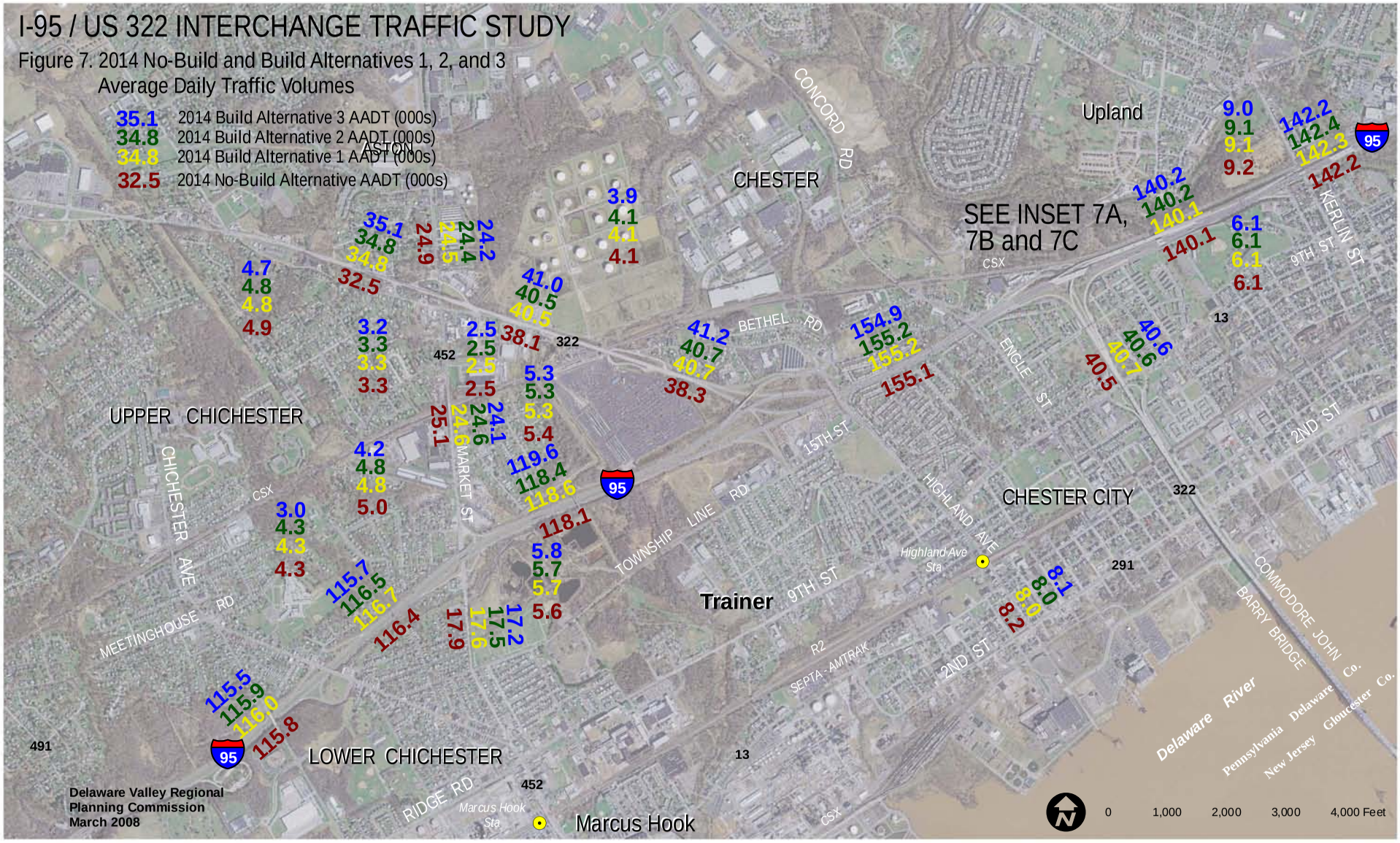
Figure 7 displays the 2014 daily traffic forecasts for the three Build alternatives, along with the corresponding No-Build volume for comparison. Along I-95, average daily traffic volumes under the No-Build and all three Build alternatives are very similar. Build Alternative 1 increases volumes by 0 to 500 vpd, compared to the No-Build Alternative, while Build Alternative 2 increases I-95 volumes by 100 to 300 vpd. Build Alternative 3 volumes along I-95 are between 700 vpd lower and 1,500 vpd higher than the No-Build Alternative volumes.

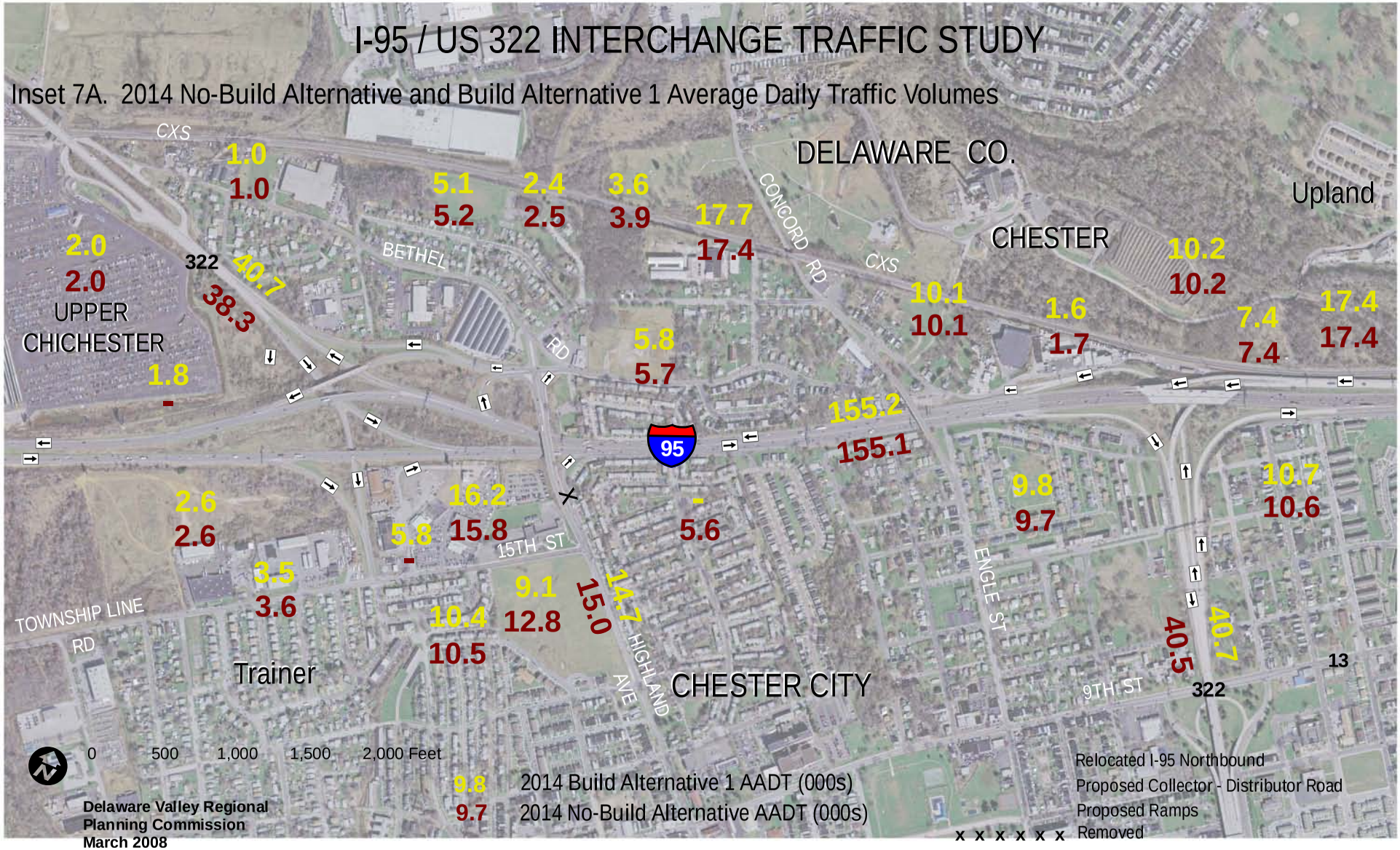
The largest differences occur on either side of the I-95 / PA 452 interchange. The proposed ramps between US 322 eastbound and I-95 southbound in all of the Build alternatives and between I-95 northbound and US 322 westbound in Build Alternative 3 change traffic patterns between I-95, US 322, and PA 452. Absent these ramps, some motorists use the I-95 / PA 452 interchange to make the connections that are currently not served at the I-95 / US 322 interchange.

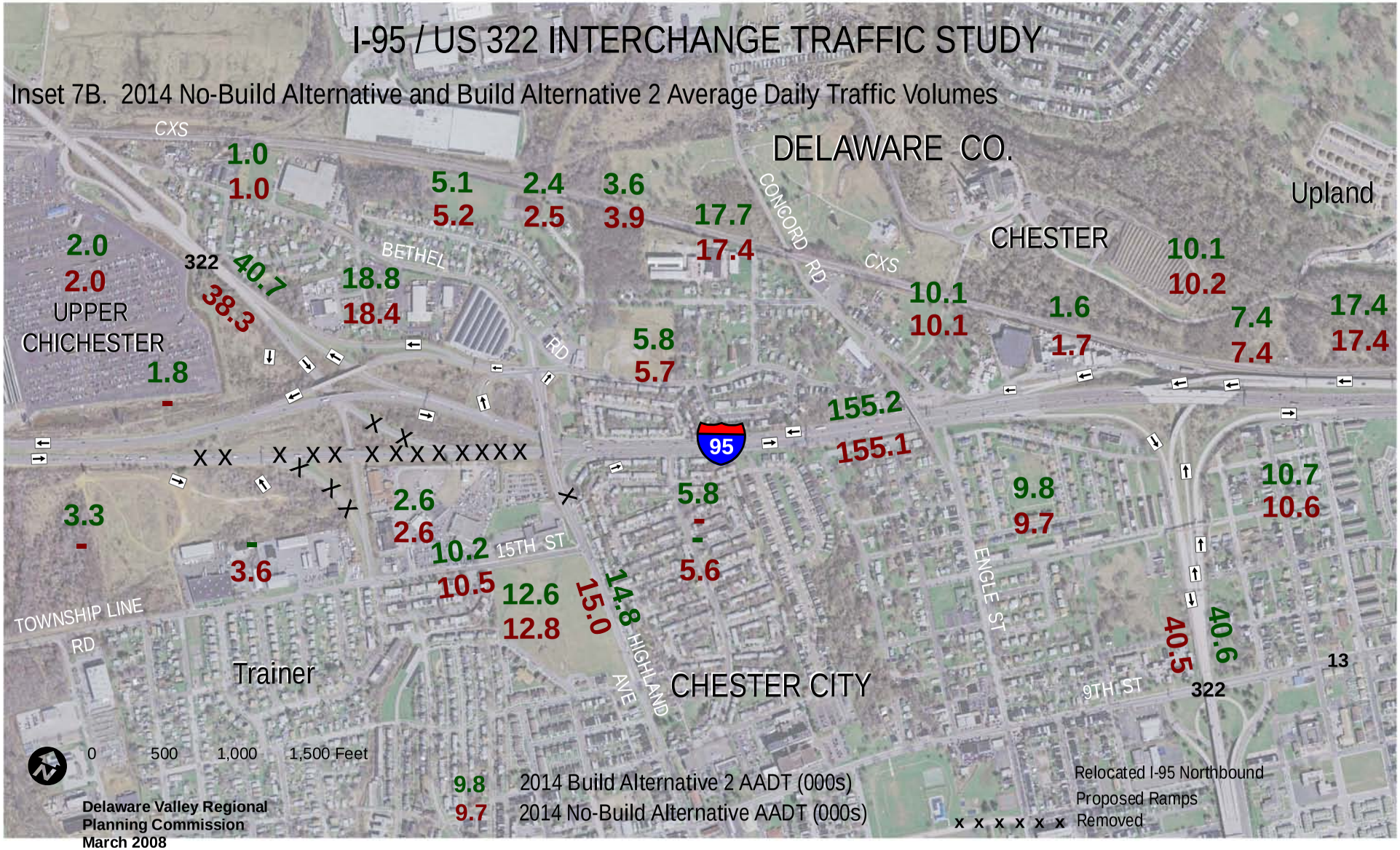
West of I-95, US 322 volumes increase by 2,300 to 2,900 vpd under the various Build alternatives, compared to the corresponding No-Build volume. Daily traffic volumes under Build alternatives 1 and 2 are essentially identical; Build Alternative 3 volumes are 300 to 500 vpd higher than the Alternative 1 / Alternative 2 volume. PA 452 volumes are reduced by 300 to 1,000 vpd compared to the No-Build Alternative.

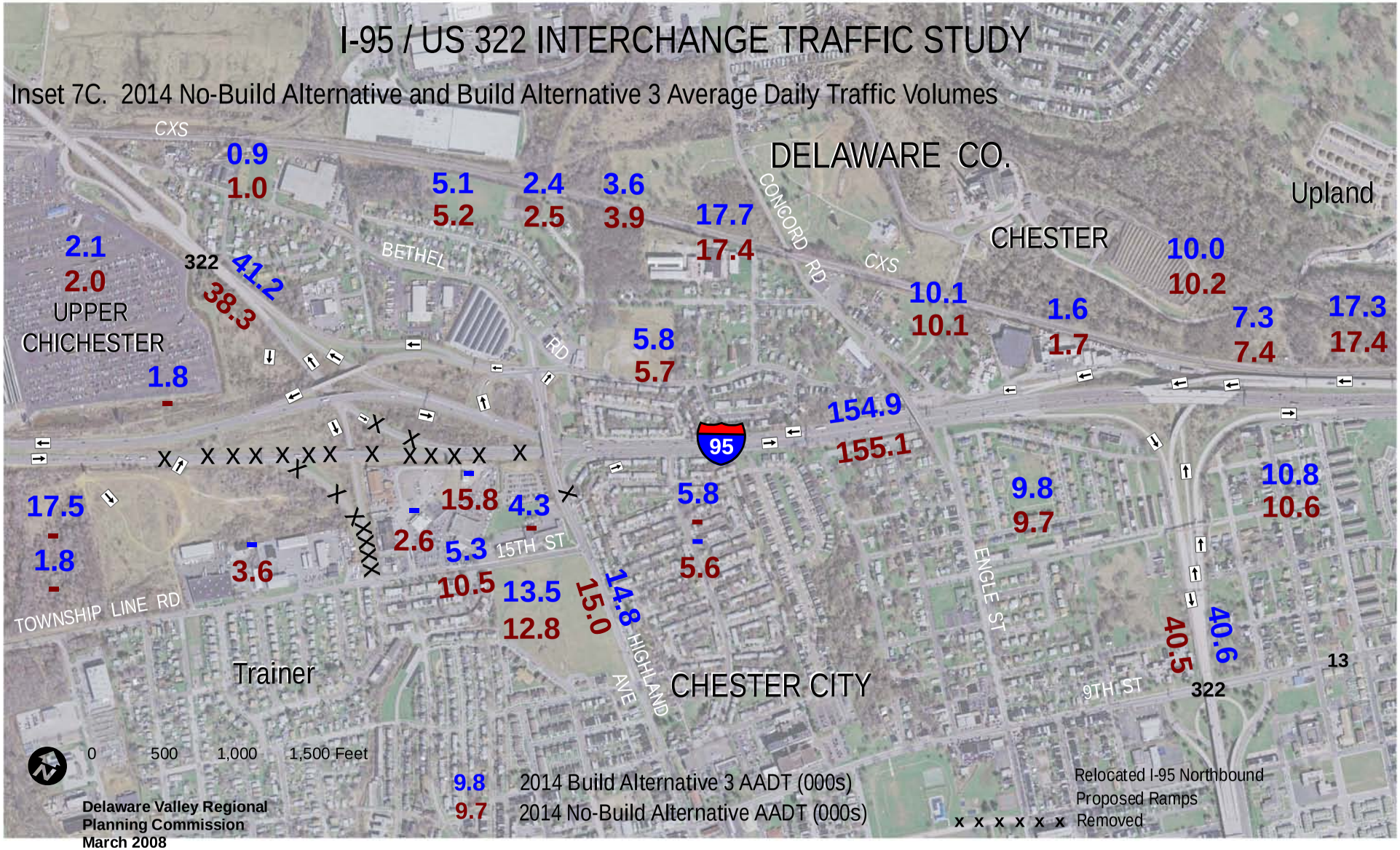
The proposed ramp from US 322 eastbound to I-95 southbound carries 1,800 vpd in 2014 under all three Build alternatives. The proposed ramp from I-95 northbound to US 322 westbound in Build Alternative 3 also carries 1,800 vpd in 2014. The I-95 northbound on-ramp from Highland Avenue or Township Line Road also carries the same volume under each of the Build alternatives, 5,800 vpd, which is 200 vpd higher than the No-Build volume. This increase is due to the enhanced ability of eastbound Highland Avenue traffic to access this ramp under the Build alternatives. This ramp can only be accessed via Highland Avenue westbound in the current and No-Build configurations.

Table 2 provides a summary of the current and 2014 average daily traffic volumes under the No-Build and Build alternatives. The table includes absolute and relative differences between current and No-Build volumes and between No-Build and Build alternative volumes.


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 7. 2014 No-Build and Build Alternatives 1, 2, and 3
Average Daily Traffic Volumes
35.1 2014 Build Alternative 3 AADT (000s)
34.8 2014 Build Alternative 2 AADT (000s)
34.8 2014 Build Alternative 1 AADT (000s)
32.5 2014 No-Build Alternative AADT (000s)
ASTON
CHESTER
CONCORD RD
Upland
SEE INSET 7A, 7B and 7C
CSX
KERLIN ST
9TH ST
BETHEL RD
ENGLE ST
2ND ST
UPPER CHICHESTER
CHICHESTER AVE
MARKET ST
15TH ST
HIGHLAND AVE
CHESTER CITY
Highland Ave Sta
TOWNSHIP LINE RD
Trainer
9TH ST
MEETINGHOUSE RD
SEPTA - AMTRAK
COMMODORE JOHN BARRY BRIDGE
Delaware River
Pennsylvania
New Jersey
Delaware Co.
Gloucester Co.
LOWER CHICHESTER
RIDGE RD
Marcus Hook Sta
Marcus Hook
Delaware Valley Regional Planning Commission
March 2008
0 1,000 2,000 3,000 4,000 Feet


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 7A. 2014 No-Build Alternative and Build Alternative 1 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
BETHEL RD
CONCORD RD
CXS
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
TOWNSHIP LINE RD
322
95
13
1.0 1.0
5.1 5.2
2.4 2.5
3.6 3.9
17.7 17.4
2.0 2.0
40.7 38.3
10.1 10.1
1.6 1.7
10.2 10.2
7.4 7.4
17.4 17.4
1.8 -
5.8 5.7
155.2 155.1
2.6 2.6
16.2 15.8
5.8 -
5.6 -
9.8 9.7
10.7 10.6
3.5 3.6
9.1 12.8
15.0 14.7
10.4 10.5
40.5 40.7
0 500 1,000 1,500 2,000 Feet
9.8 2014 Build Alternative 1 AADT (000s)
9.7 2014 No-Build Alternative AADT (000s)
Relocated I-95 Northbound
Proposed Collector - Distributor Road
Proposed Ramps
x x x x x x Removed
Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 7B. 2014 No-Build Alternative and Build Alternative 2 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
TOWNSHIP LINE RD
BETHEL RD
CONCORD RD
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
CXS
322
95
1.0
1.0
5.1
5.2
2.4
2.5
3.6
3.9
17.7
17.4
2.0
2.0
40.7
38.3
18.8
18.4
10.1
10.1
1.6
1.7
10.1
10.2
7.4
7.4
17.4
17.4
1.8
-
5.8
5.7
155.2
155.1
3.3
-
3.6
-
2.6
2.6
10.2
10.5
12.6
12.8
14.8
15.0
5.8
-
5.6
9.8
9.7
10.7
10.6
40.5
40.6
13
0 500 1,000 1,500 Feet
9.8 2014 Build Alternative 2 AADT (000s)
9.7 2014 No-Build Alternative AADT (000s)
Relocated I-95 Northbound Proposed Ramps Removed
Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 7C. 2014 No-Build Alternative and Build Alternative 3 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
TOWNSHIP LINE RD
BETHEL RD
CONCORD RD
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
CXS
322
95
0.9
1.0
5.1
5.2
2.4
2.5
3.6
3.9
17.7
17.4
2.1
2.0
41.2
38.3
1.8
5.8
5.7
10.1
10.1
1.6
1.7
10.0
10.2
7.3
7.4
17.3
17.4
154.9
155.1
17.5
1.8
3.6
2.6
15.8
5.3
10.5
4.3
13.5
12.8
14.8
15.0
5.8
5.6
9.8
9.7
10.8
10.6
40.5
40.6
13
0 500 1,000 1,500 Feet
9.8 2014 Build Alternative 3 AADT (000s)
9.7 2014 No-Build Alternative AADT (000s)
Relocated I-95 Northbound Proposed Ramps Removed
Delaware Valley Regional Planning Commission
March 2008

## Table 2. Current and 2014 Average Daily Traffic Volumes

| Location | Current Counts | 2014 Forecast No-Build | Current - 2014 Change Absolute | Current - 2014 Change Percent | 2014 Forecast Alternative 1 | Build / No-Build Diff Absolute | Build / No-Build Diff Percent | 2014 Forecast Alternative 2 | Alt 2 / Alt 1 Diff Absolute | Alt 2 / Alt 1 Diff Percent | 2014 Forecast Alternative 3 | Alt 3 / Alt 1 Diff Absolute | Alt 3 / Alt 1 Diff Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Interstate 95 Mainline* | | | | | | | | | | | | | |
| Delaware State Line to Chichester Avenue | 110,200 | 115,800 | 5,600 | 5.1% | 116,000 | 200 | 0.2% | 115,900 | -100 | -0.1% | 115,500 | -500 | -0.4% |
| Chichester Avenue to PA 452 (Market Street) | 110,480 | 116,400 | 5,920 | 5.4% | 116,700 | 300 | 0.3% | 116,500 | -200 | -0.2% | 115,700 | -1,000 | -0.9% |
| PA 452 (Market Street) to US 322 (Conchester Road) | 112,100 | 118,100 | 6,000 | 5.4% | 118,600 | 500 | 0.4% | 118,400 | -200 | -0.2% | 119,600 | 1,000 | 0.8% |
| US 322 (Conchester Road) to US 322 (Commodore Barry Bridge) | 145,890 | 155,100 | 9,210 | 6.3% | 155,200 | 100 | 0.1% | 155,200 | 0 | 0.0% | 154,900 | -300 | -0.2% |
| US 322 (Commodore Barry Bridge) to Kerlin Street | 132,250 | 140,100 | 7,850 | 5.9% | 140,100 | 0 | 0.0% | 140,200 | 100 | 0.1% | 140,200 | 100 | 0.1% |
| Kerlin Street to PA 352 (Edgemont Ave) | 133,983 | 142,200 | 8,217 | 6.1% | 142,300 | 100 | 0.1% | 142,400 | 100 | 0.1% | 142,400 | 100 | 0.1% |
| *Interstate 95 Ramps* | | | | | | | | | | | | | |
| I-95 Northbound Off-Ramp to PA 452 | 4,000 | 4,300 | 300 | 7.5% | 4,300 | 0 | 0.0% | 4,300 | 0 | 0.0% | 3,000 | -1,300 | -30.2% |
| I-95 Northbound On-Ramp from PA 452 | 5,280 | 5,600 | 320 | 6.1% | 5,700 | 100 | 1.8% | 5,700 | 0 | 0.0% | 5,800 | 100 | 1.8% |
| I-95 Southbound On-Ramp from PA 452 | 4,690 | 5,000 | 310 | 6.6% | 4,800 | -200 | -4.0% | 4,800 | 0 | 0.0% | 4,200 | -600 | -12.5% |
| I-95 Southbound Off-Ramp to PA 452 | 5,030 | 5,400 | 370 | 7.4% | 5,300 | -100 | -1.9% | 5,300 | 0 | 0.0% | 5,300 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to Township Line Road / C-D Road | 2,920 | 3,600 | 680 | 23.3% | 3,500 | -100 | -2.8% | 3,300 | -200 | -5.7% | 4,300 | 800 | 22.9% |
| I-95 Northbound On-Ramp from US 322 Eastbound | 13,770 | 15,800 | 2,030 | 14.7% | 16,200 | 400 | 2.5% | 16,200 | 0 | 0.0% | 17,500 | 1,300 | 8.0% |
| I-95 Northbound On-Ramp from Highland Ave/Twp Line/CD Road | 5,040 | 5,600 | 560 | 11.1% | 5,800 | 200 | 3.6% | 5,800 | 0 | 0.0% | 5,800 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to US 322 WB | 0 | 0 | 0 | ----- | 0 | 0 | ----- | 0 | 0 | ----- | 1,800 | 1,800 | ----- |
| I-95 Southbound On-Ramp from US 322 EB | 0 | 0 | 0 | ----- | 1,800 | 1,800 | ----- | 1,800 | 0 | 0.0% | 1,800 | 0 | 0.0% |
| I-95 Southbound On-Ramp from Highland Ave/Bethel Road | 3,520 | 3,900 | 380 | 10.8% | 3,600 | -300 | -7.7% | 3,600 | 0 | 0.0% | 3,600 | 0 | 0.0% |
| I-95 Southbound Off-Ramp to US 322 WB | 16,100 | 17,400 | 1,300 | 8.1% | 17,700 | 300 | 1.7% | 17,700 | 0 | 0.0% | 17,700 | 0 | 0.0% |
| I-95 Southbound Off-Ramp to Highland Avenue | 5,320 | 5,700 | 380 | 7.1% | 5,800 | 100 | 1.8% | 5,800 | 0 | 0.0% | 5,800 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to US 332 EB (Comm Barry Bridge) | 8,580 | 9,700 | 1,120 | 13.1% | 9,800 | 100 | 1.0% | 9,800 | 0 | 0.0% | 9,800 | 0 | 0.0% |
| I-95 Northbound On-Ramp from US 322 WB (Comm Barry Bridge) | 9,400 | 10,600 | 1,200 | 12.8% | 10,700 | 100 | 0.9% | 10,700 | 0 | 0.0% | 10,800 | 100 | 0.9% |
| I-95 Southbound On-Ramp from US 322 WB (Comm Barry Bridge) | 7,520 | 8,500 | 980 | 13.0% | 8,600 | 100 | 1.2% | 8,500 | -100 | -1.2% | 8,400 | -200 | -2.3% |
| I-95 Southbound On-Ramp from Kerlin Street C-D Road | 6,940 | 7,400 | 460 | 6.6% | 7,400 | 0 | 0.0% | 7,400 | 0 | 0.0% | 7,300 | -100 | -1.4% |
| I-95 Southbound Off-Ramp to Kerlin Street C-D Road | 7,400 | 8,200 | 800 | 10.8% | 8,300 | 100 | 1.2% | 8,300 | 0 | 0.0% | 8,300 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to Kerlin Street | 5,667 | 6,100 | 433 | 7.6% | 6,100 | 0 | 0.0% | 6,100 | 0 | 0.0% | 6,100 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to Edgemont Avenue | 4,207 | 4,600 | 393 | 9.3% | 4,600 | 0 | 0.0% | 4,600 | 0 | 0.0% | 4,600 | 0 | 0.0% |
| I-95 Southbound On-Ramp from Edgemont Avenue | 3,301 | 3,700 | 399 | 12.1% | 3,700 | 0 | 0.0% | 3,700 | 0 | 0.0% | 3,600 | -100 | -2.7% |
| *US 322 Mainline* | | | | | | | | | | | | | |
| West of PA 452 Interchange | 27,610 | 32,500 | 4,890 | 17.7% | 34,800 | 2,300 | 7.1% | 34,800 | 0 | 0.0% | 35,100 | 300 | 0.9% |
| PA 452 Interchange to Bethel Road Interchange | 33,200 | 38,100 | 4,900 | 14.8% | 40,500 | 2,400 | 6.3% | 40,500 | 0 | 0.0% | 41,000 | 500 | 1.2% |
| Bethel Road Interchange to Interstate 95 | 33,430 | 38,300 | 4,870 | 14.6% | 40,700 | 2,400 | 6.3% | 40,700 | 0 | 0.0% | 41,200 | 500 | 1.2% |
| Interstate 95 to 9th Street | 35,427 | 40,500 | 5,073 | 14.3% | 40,700 | 200 | 0.5% | 40,600 | -100 | -0.2% | 40,600 | -100 | -0.2% |
| *US 322 Ramps* | | | | | | | | | | | | | |
| US 322 Eastbound Off-Ramp to PA 452 Southbound | 1,270 | 1,600 | 330 | 26.0% | 1,500 | -100 | -6.3% | 1,500 | 0 | 0.0% | 1,400 | -100 | -6.7% |
| US 322 Eastbound On-Ramp from PA 452 Southbound | 2,950 | 3,300 | 350 | 11.9% | 3,300 | 0 | 0.0% | 3,300 | 0 | 0.0% | 3,300 | 0 | 0.0% |
| US 322 Eastbound Off-Ramp to PA 452 Northbound | 1,040 | 1,400 | 360 | 34.6% | 1,400 | 0 | 0.0% | 1,400 | 0 | 0.0% | 1,400 | 0 | 0.0% |
| US 322 Eastbound On-Ramp from PA 452 Northbound | 820 | 1,100 | 280 | 34.1% | 1,100 | 0 | 0.0% | 1,100 | 0 | 0.0% | 1,100 | 0 | 0.0% |
| US 322 Westbound On-Ramp from PA 452 Southbound | 760 | 1,000 | 240 | 31.6% | 1,000 | 0 | 0.0% | 1,000 | 0 | 0.0% | 1,000 | 0 | 0.0% |
| US 322 Westbound Off-Ramp to PA 452 Southbound | 2,070 | 2,300 | 230 | 11.1% | 2,300 | 0 | 0.0% | 2,300 | 0 | 0.0% | 2,200 | -100 | -4.3% |
| US 322 Westbound On-Ramp from PA 452 Northbound | 400 | 600 | 200 | 50.0% | 600 | 0 | 0.0% | 600 | 0 | 0.0% | 400 | -200 | -33.3% |
| US 322 Westbound Off-Ramp to PA 452 Northbound | 3,220 | 3,500 | 280 | 8.7% | 3,500 | 0 | 0.0% | 3,500 | 0 | 0.0% | 3,500 | 0 | 0.0% |

## Table 2. Current and 2014 Average Daily Traffic Volumes

| Location | Current Counts | 2014 Forecast No-Build | Current - 2014 Change Absolute | Current - 2014 Change Percent | 2014 Forecast Alternative 1 | Build / No-Build Diff Absolute | Build / No-Build Diff Percent | 2014 Forecast Alternative 2 | Alt 2 / Alt 1 Diff Absolute | Alt 2 / Alt 1 Diff Percent | 2014 Forecast Alternative 3 | Alt 3 / Alt 1 Diff Absolute | Alt 3 / Alt 1 Diff Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| US 322 Eastbound Off-Ramp to Bethel Road | 780 | 900 | 120 | 15.4% | 900 | 0 | 0.0% | 900 | 0 | 0.0% | 1,000 | 100 | 11.1% |
| US 322 Eastbound On-Ramp from Bethel Road | 910 | 1,100 | 190 | 20.9% | 1,100 | 0 | 0.0% | 1,100 | 0 | 0.0% | 1,100 | 0 | 0.0% |
| US 322 Westbound On-Ramp from Bethel Road | 260 | 500 | 240 | 92.3% | 500 | 0 | 0.0% | 500 | 0 | 0.0% | 400 | -100 | -20.0% |
| US 322 Westbound Off-Ramp to Bethel Road | 360 | 500 | 140 | 38.9% | 500 | 0 | 0.0% | 500 | 0 | 0.0% | 500 | 0 | 0.0% |
| US 322 Eastbound Off-Ramp to Township Line Road | 1,910 | 2,600 | 690 | 36.1% | 2,600 | 0 | 0.0% | 2,600 | 0 | 0.0% | 0 | -2,600 | -100.0% |
| US 322 Westbound On-Ramp from Highland Avenue | 1,760 | 2,500 | 740 | 42.0% | 2,400 | -100 | -4.0% | 2,400 | 0 | 0.0% | 2,400 | 0 | 0.0% |
| US 322 Westbound Off-Ramp to Bethel Road | 1,390 | 1,700 | 310 | 22.3% | 1,600 | -100 | -5.9% | 1,600 | 0 | 0.0% | 1,600 | 0 | 0.0% |
| US 322 Eastbound On-Ramp from I-95 SB and Kerlin St | 8,151 | 10,000 | 1,849 | 22.7% | 10,000 | 0 | 0.0% | 10,000 | 0 | 0.0% | 10,000 | 0 | 0.0% |
| *Other Facilities* | | | | | | | | | | | | | |
| PA 452 West of Dutton Mill Road | 17,487 | 18,700 | 1,213 | 6.9% | 18,300 | -400 | -2.1% | 18,300 | 0 | 0.0% | 18,300 | 0 | 0.0% |
| PA 452 from Dutton Mill Road to Bethel Road | 23,560 | 24,900 | 1,340 | 5.7% | 24,500 | -400 | -1.6% | 24,400 | -100 | -0.4% | 24,200 | -300 | -1.2% |
| PA 452 from Bethel Road to Interstate 95 | 23,560 | 25,100 | 1,540 | 6.5% | 24,600 | -500 | -2.0% | 24,600 | 0 | 0.0% | 24,100 | -500 | -2.0% |
| PA 452 South of Interstate 95 | 16,758 | 17,900 | 1,142 | 6.8% | 17,600 | -300 | -1.7% | 17,500 | -100 | -0.6% | 17,200 | -400 | -2.3% |
| Bethel Road from US 322 to Highland Avenue | 4,291 | 5,200 | 909 | 21.2% | 5,100 | -100 | -1.9% | 5,100 | 0 | 0.0% | 5,100 | 0 | 0.0% |
| Bethel Road from Highland Avenue to Concord Road | 8,623 | 10,100 | 1,477 | 17.1% | 10,100 | 0 | 0.0% | 10,100 | 0 | 0.0% | 10,100 | 0 | 0.0% |
| Highland Avenue from I-95 NB Ramps to I-95 SB Ramps | 12,381 | 13,100 | 719 | 5.8% | 13,200 | 100 | 0.8% | 13,300 | 100 | 0.8% | 14,300 | 1,100 | 8.3% |
| Highland Avenue from I-95 NB Ramps to Twp Line Rd (15th St) | 12,016 | 12,800 | 784 | 6.5% | 9,100 | -3,700 | -28.9% | 12,600 | 3,500 | 38.5% | 13,500 | 4,400 | 48.4% |
| Highland Avenue from Twp Rd (15th St) to US 13 (9th St) | 14,281 | 15,000 | 719 | 5.0% | 14,700 | -300 | -2.0% | 14,800 | 100 | 0.7% | 14,800 | 100 | 0.7% |
| Highland Avenue from US 13 (9th St) to PA 291 (2nd St) | 7,652 | 8,200 | 548 | 7.2% | 8,000 | -200 | -2.4% | 8,000 | 0 | 0.0% | 8,100 | 100 | 1.3% |
| Township Line Road (15th St) from US 322 Ramp to Highland Ave. | 9,751 | 10,500 | 749 | 7.7% | 10,400 | -100 | -1.0% | 10,200 | -200 | -1.9% | 5,300 | -5,100 | -49.0% |

## B. 2014 AM and PM Peak Hour Traffic Forecasts

AM and PM peak hour traffic forecasts for 2014 under the No-Build Alternative are shown in Figure 8. Along I-95, peak hour volumes range from 4,430 to 6,100 vehicles per hour (vph). These volumes represent increases from less than 100 to more than 400 vph over current peak hour volumes. The highest volumes occur just north of Exit 3. This is also the location with the greatest increase over current traffic volumes. The lowest volumes continue to occur just south of Exit 3.

Peak hour volumes on US 322 are between 1,050 and 1,500 vph west of I-95. Higher volumes occur on US 322 east of I-95 on the approach to the Commodore Barry Bridge. Here, 2014 peak hour volumes under the No-Build Alternative range from 1,570 to 2,480 vph. Peak hour ramp volumes also increase throughout the study area. However, few ramps increase by more than 100 vph over current volumes.

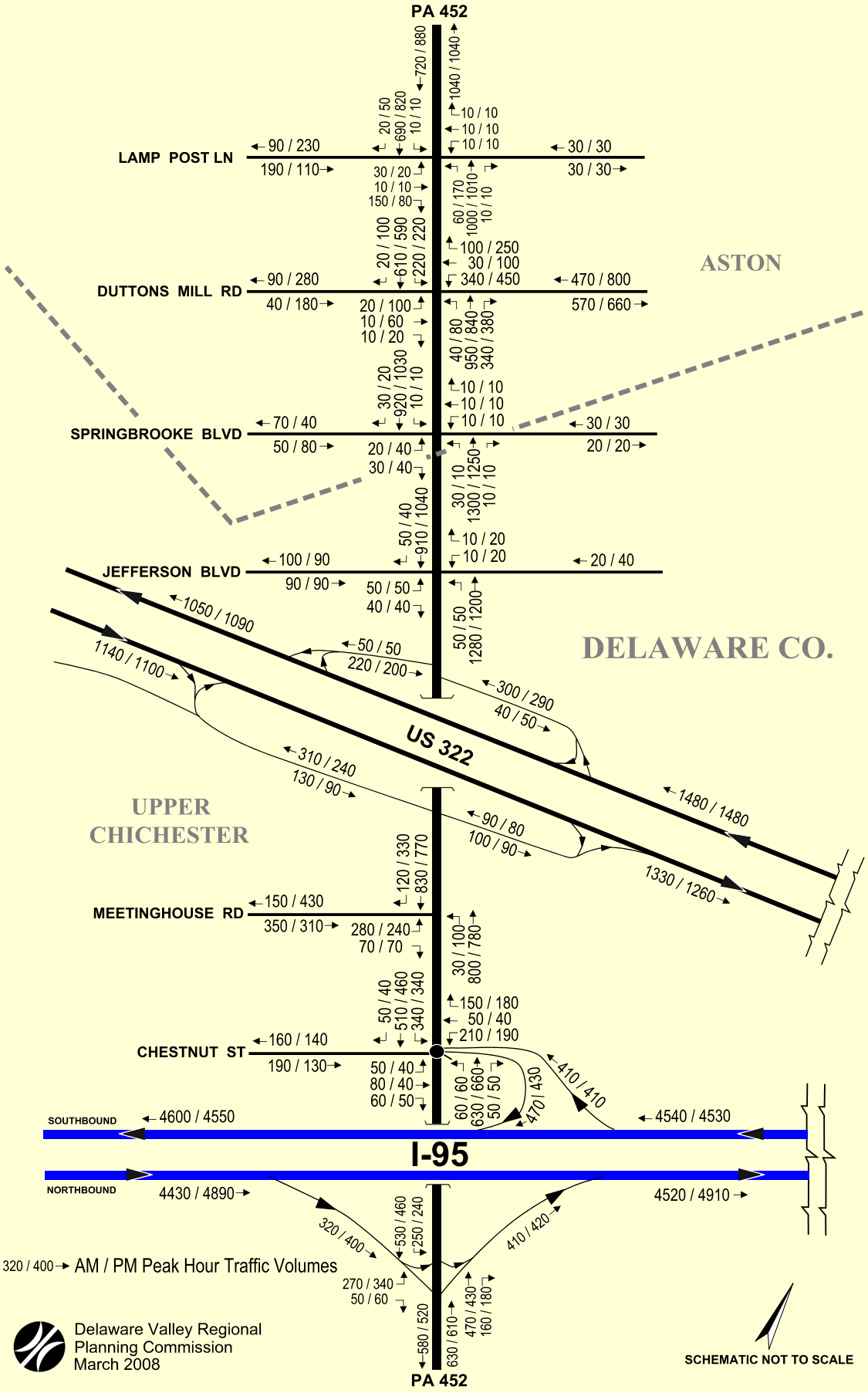
Peak hour volumes along PA 452 increase by more than 100 vph at several locations; however, most individual vehicle movements increase by less than 100 vph. No left- or right-turning volume increases by 100 vph or more, although some eastbound through movements do increase by 100 vph or more during both the AM and PM peak hours.

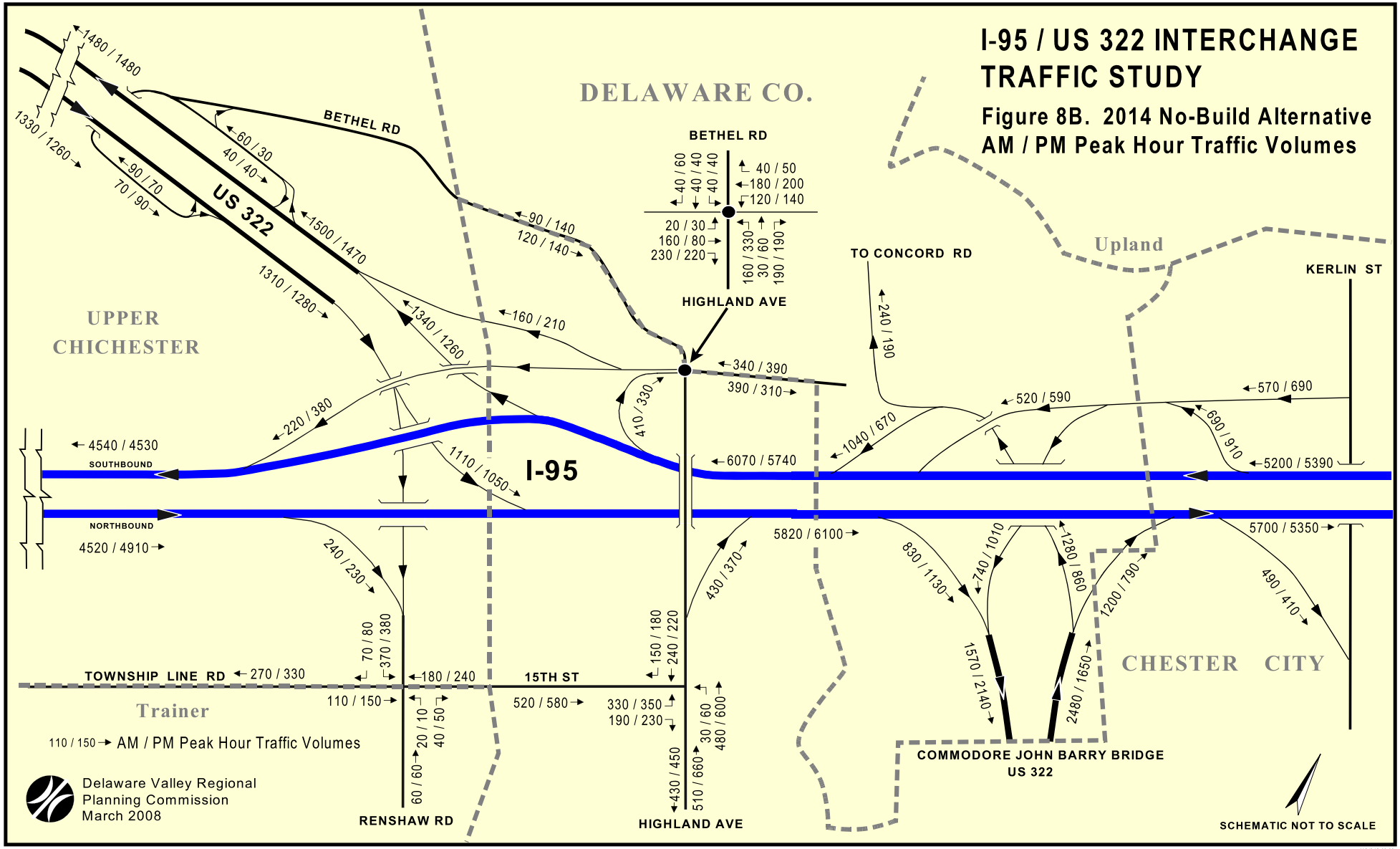
Peak hour traffic volumes in 2014 under Build Alternative 1 tend to be slightly higher than the corresponding No-Build volumes along both I-95 and US 322. The most significant differences occur on US 322 eastbound as it approaches the I-95 interchange at Exit 3. The provision of a new eastbound ramp to I-95 southbound increases both AM and PM peak hour volumes by approximately 200 vph. The relocation of the I-95 northbound on-ramp from Highland Avenue to Township Line Road changes traffic patterns in the vicinity of the Highland Avenue / 15$^{th}$ Street intersection. Peak Hour traffic volumes on most other study area facilities, including PA 452, are largely unchanged from the No-Build Alternative. Figure 9 provides the 2014 AM and PM peak hour traffic forecasts under Build Alternative 1.

Build Alternative 2 peak hour volumes are very similar to the Build Alternative 1 peak hour volumes, and are slightly higher than the corresponding No-Build Alternative volumes. Both the AM and PM peak hour traffic volumes from US 322 eastbound to I-95 southbound, I-95 northbound, and Township Line Road / 15$^{th}$ Street are the same. Other ramps within the I-95 / US 322 interchange are also within 10 vph of the Build Alternative 1 traffic volumes. The only significant differences are in the area of Highland Avenue, Township Line Road, and 15$^{th}$ Street, which is due to the different configuration of ramps in this area under Build Alternative 2. Figure 10 displays the 2014 AM and PM peak hour traffic forecasts for Build Alternative 2.

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

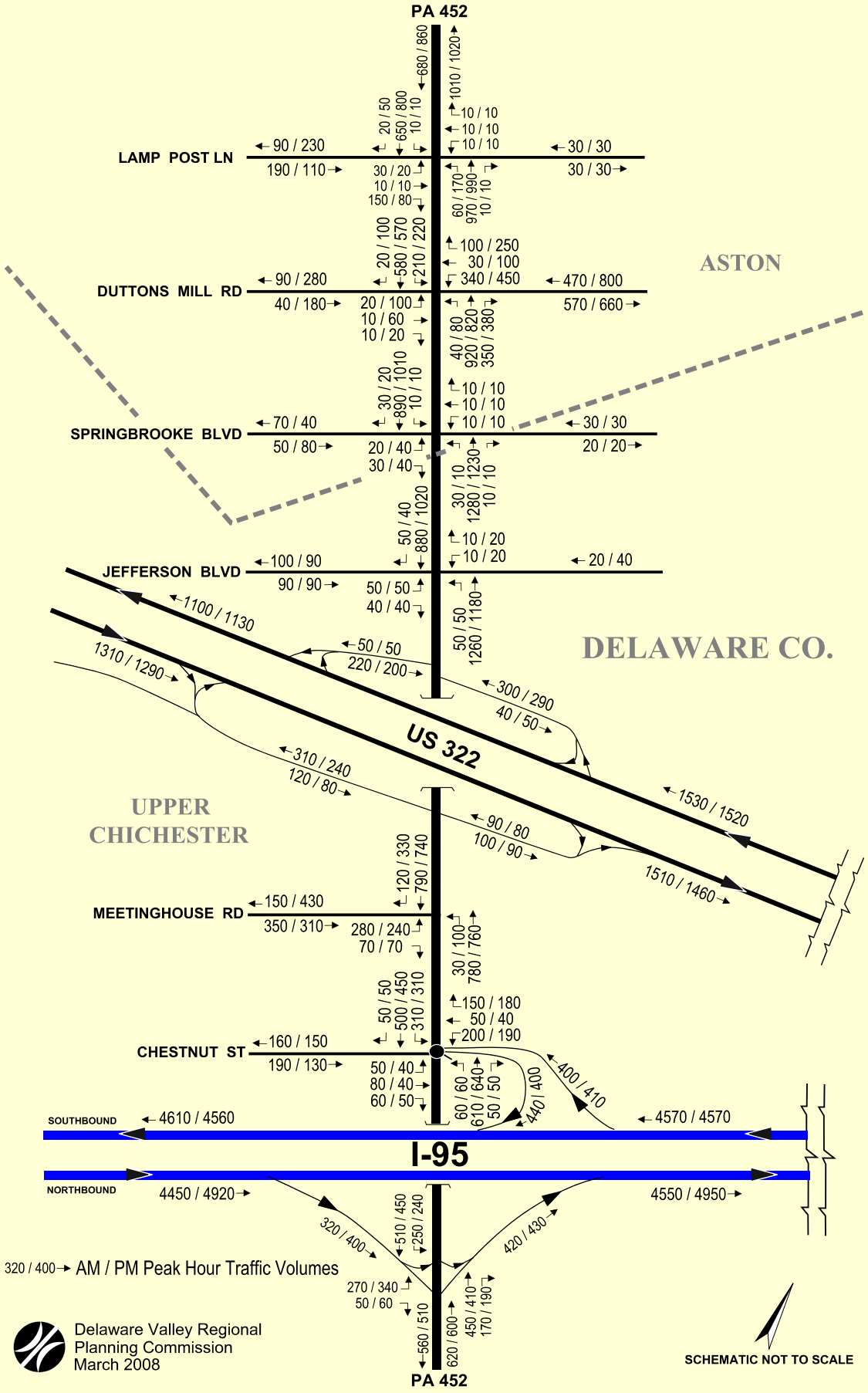
## Figure 8A. 2014 No-Build Alternative AM / PM Peak Hour Traffic Volumes

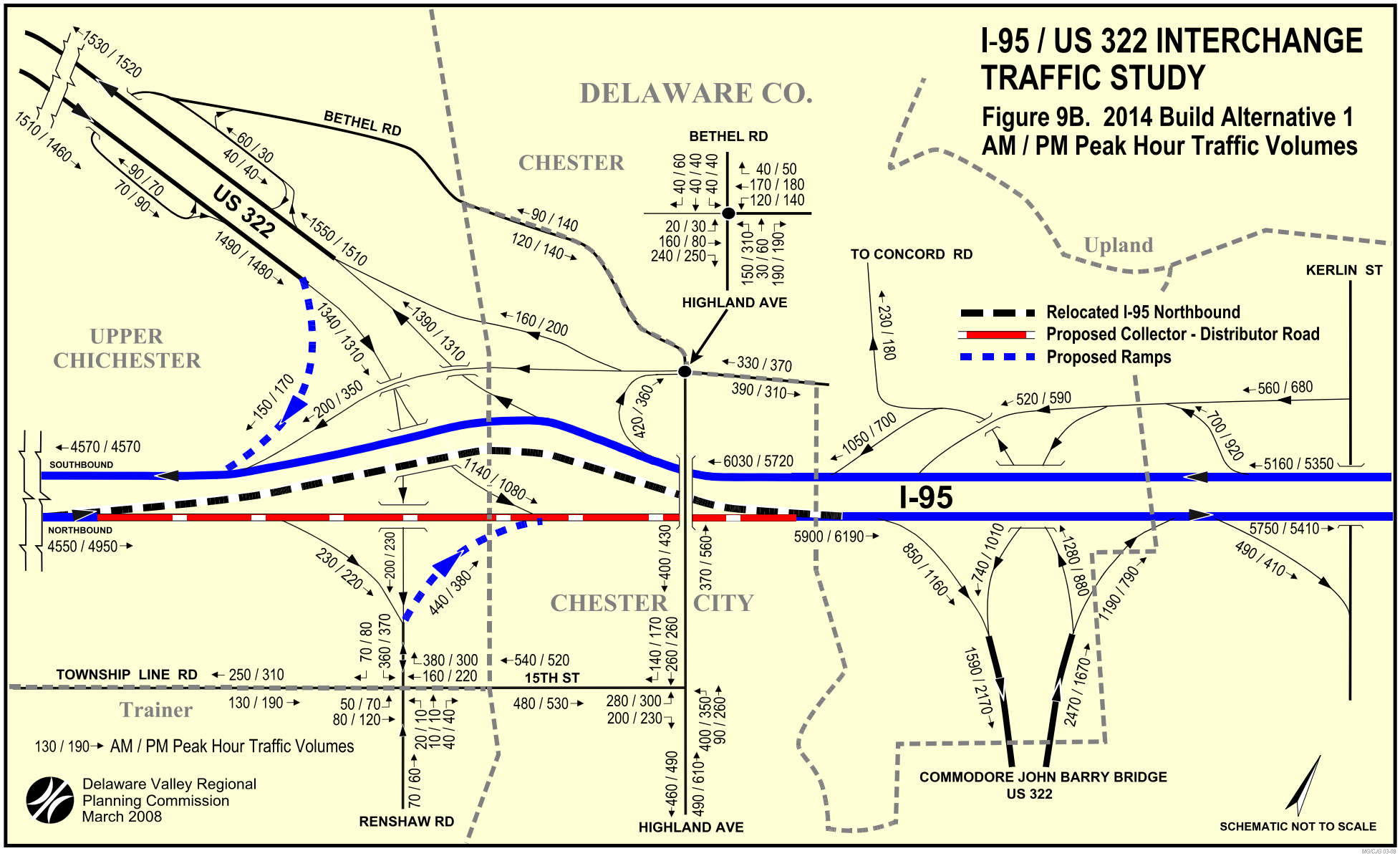



I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 8B. 2014 No-Build Alternative AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Upland
CHESTER CITY
Trainer
I-95
US 322
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
110 / 150 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
March 2008
SCHEMATIC NOT TO SCALE

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

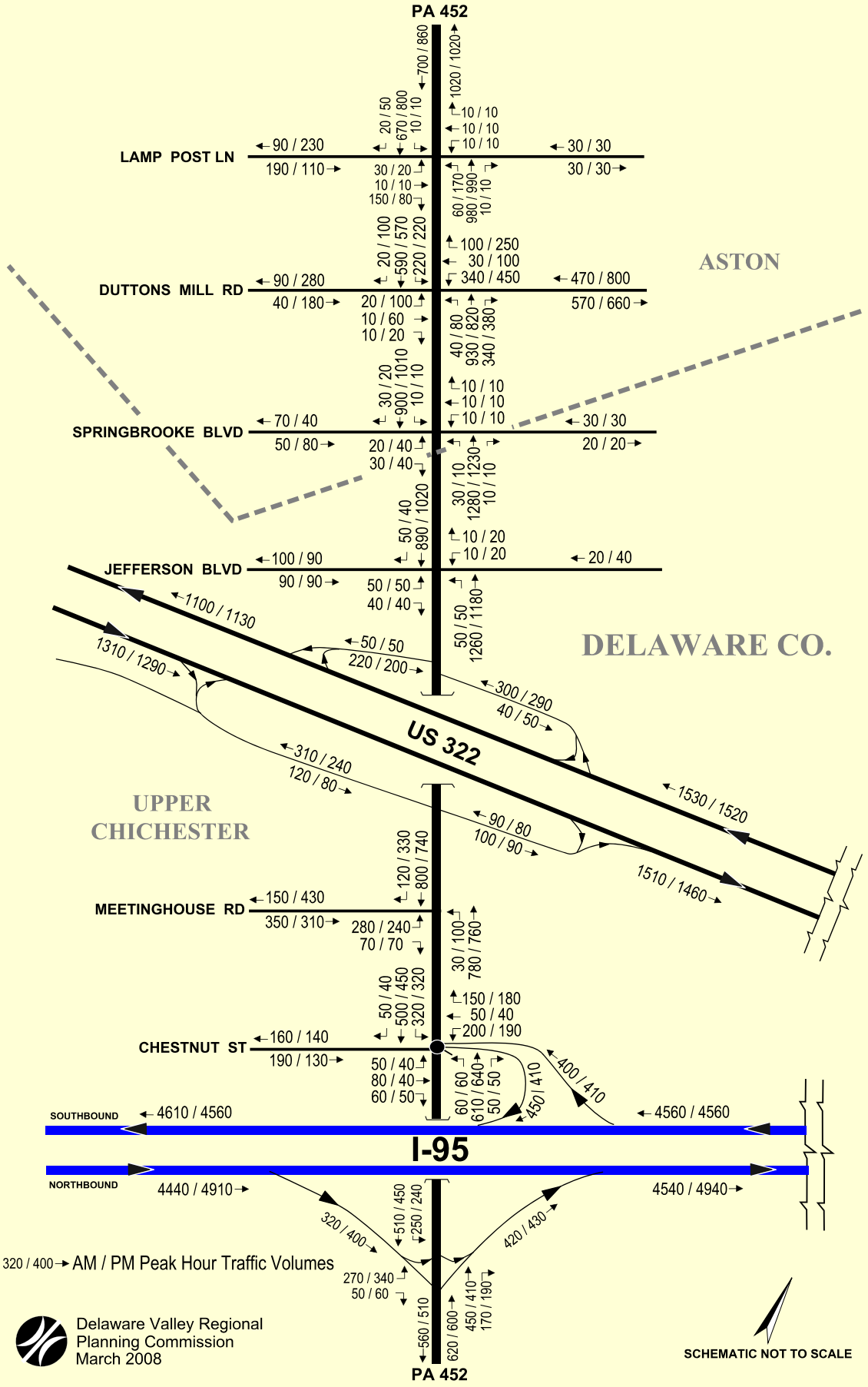
## Figure 9A. 2014 Build Alternative 1 AM / PM Peak Hour Traffic Volumes

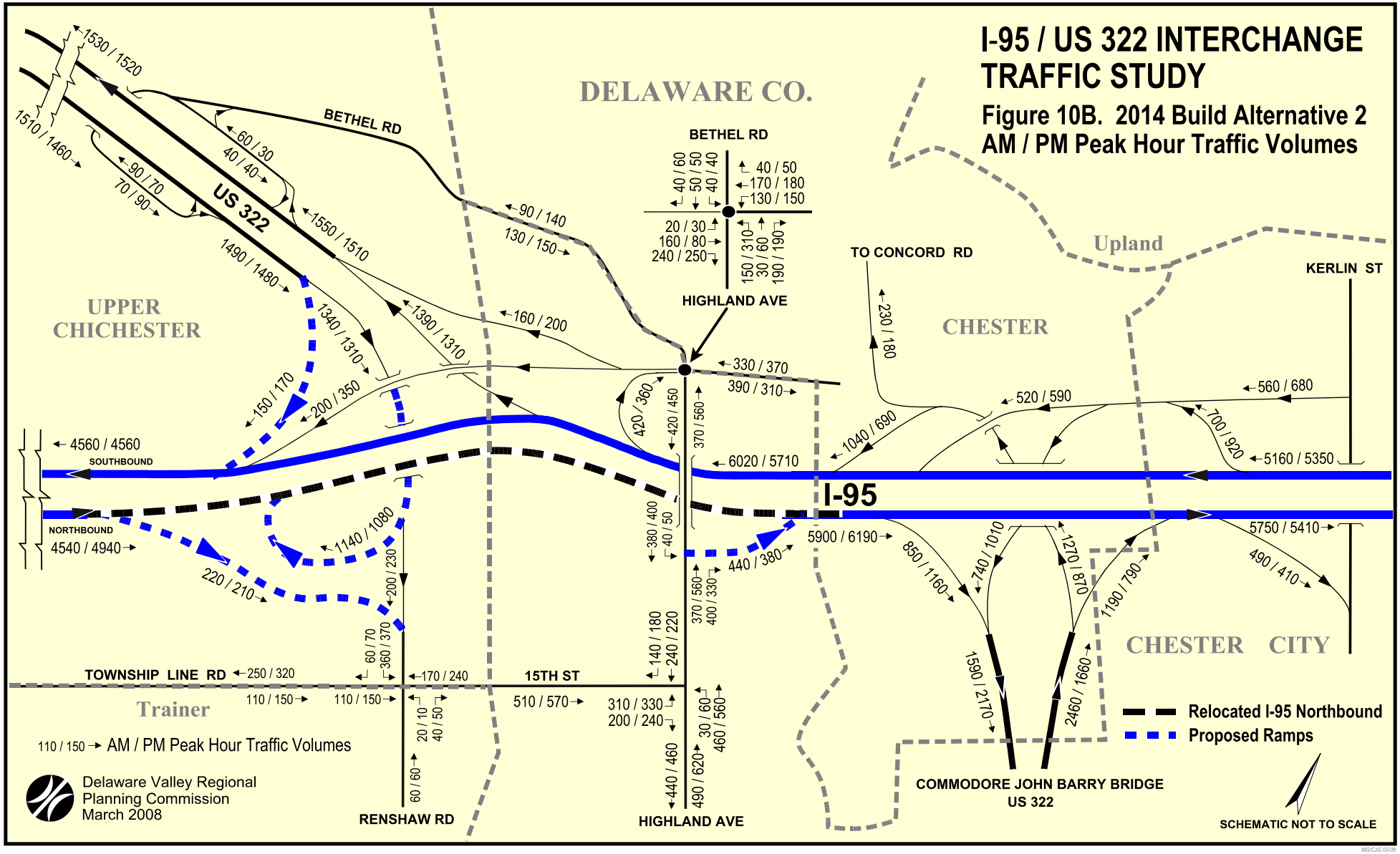



I-95 / US 322 INTERCHANGE
TRAFFIC STUDY
Figure 9B. 2014 Build Alternative 1
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
CHESTER
UPPER CHICHESTER
Upland
Trainer
CHESTER CITY
BETHEL RD
US 322
I-95
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
Relocated I-95 Northbound
Proposed Collector - Distributor Road
Proposed Ramps
SOUTHBOUND
NORTHBOUND
130 / 190 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional
Planning Commission
March 2008
SCHEMATIC NOT TO SCALE

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 10A. 2014 Build Alternative 2 AM / PM Peak Hour Traffic Volumes




I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 10B. 2014 Build Alternative 2
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Trainer
Upland
CHESTER
CHESTER CITY
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
US 322
I-95
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
1530 / 1520
1510 / 1460
90 / 70
70 / 90
60 / 30
40 / 40
1550 / 1510
1490 / 1480
90 / 140
130 / 150
1340 / 1310
1390 / 1310
160 / 200
150 / 170
200 / 350
40 / 60
50 / 50
40 / 40
40 / 50
170 / 180
130 / 150
20 / 30
160 / 80
240 / 250
150 / 310
30 / 60
190 / 190
330 / 370
390 / 310
420 / 360
420 / 450
370 / 560
230 / 180
520 / 590
560 / 680
1040 / 690
700 / 920
5160 / 5350
4560 / 4560
6020 / 5710
4540 / 4940
1140 / 1080
220 / 210
200 / 230
380 / 400
40 / 50
440 / 380
5900 / 6190
850 / 1160
740 / 1010
1270 / 870
1190 / 790
5750 / 5410
490 / 410
60 / 70
360 / 370
250 / 320
170 / 240
140 / 180
240 / 220
370 / 560
400 / 330
110 / 150
110 / 150
510 / 570
310 / 330
200 / 240
20 / 10
40 / 50
30 / 60
460 / 560
60 / 60
440 / 460
490 / 620
1590 / 2170
2460 / 1660
110 / 150 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
March 2008
Relocated I-95 Northbound
Proposed Ramps
SCHEMATIC NOT TO SCALE

Peak hour traffic volumes in 2014 under Build Alternative 3 are higher than either of the other Build alternatives at most locations along I-95. These differences are 90 vph or less. When compared to the No-Build Alternative, they are as much as 130 vph. The largest differences occur in the northbound direction, just south of the I-95 / US 322 interchange at Exit 3. These higher volumes are due to the proposed ramp from I-95 northbound to US 322 westbound under Build Alternative 3. This ramp also increases US 322 westbound volumes, compared to the other Build alternatives. US 322 westbound volumes between I-95 and Bethel Road are 140 vph higher than Build Alternative 1 and Build Alternative 2 volumes in both the AM and PM peak hours. They are also 180 to 190 vph higher than the corresponding volumes under the No-Build Alternative.

Build Alternative 3 combines the I-95 northbound and US 322 eastbound movements to Township Line Road / Highland Avenue onto a single off-ramp exiting at Highland Avenue. This results in significantly less traffic on Township Line Road and 15th Street, but more traffic on Highland Avenue west of 15th Street. Peak hour traffic volumes on most other study area facilities, including PA 452, are largely unchanged from the other Build alternatives. Figure 11 provides the 2014 AM and PM peak hour traffic forecasts under Build Alternative 3.

## C. 2034 Daily Traffic Forecasts

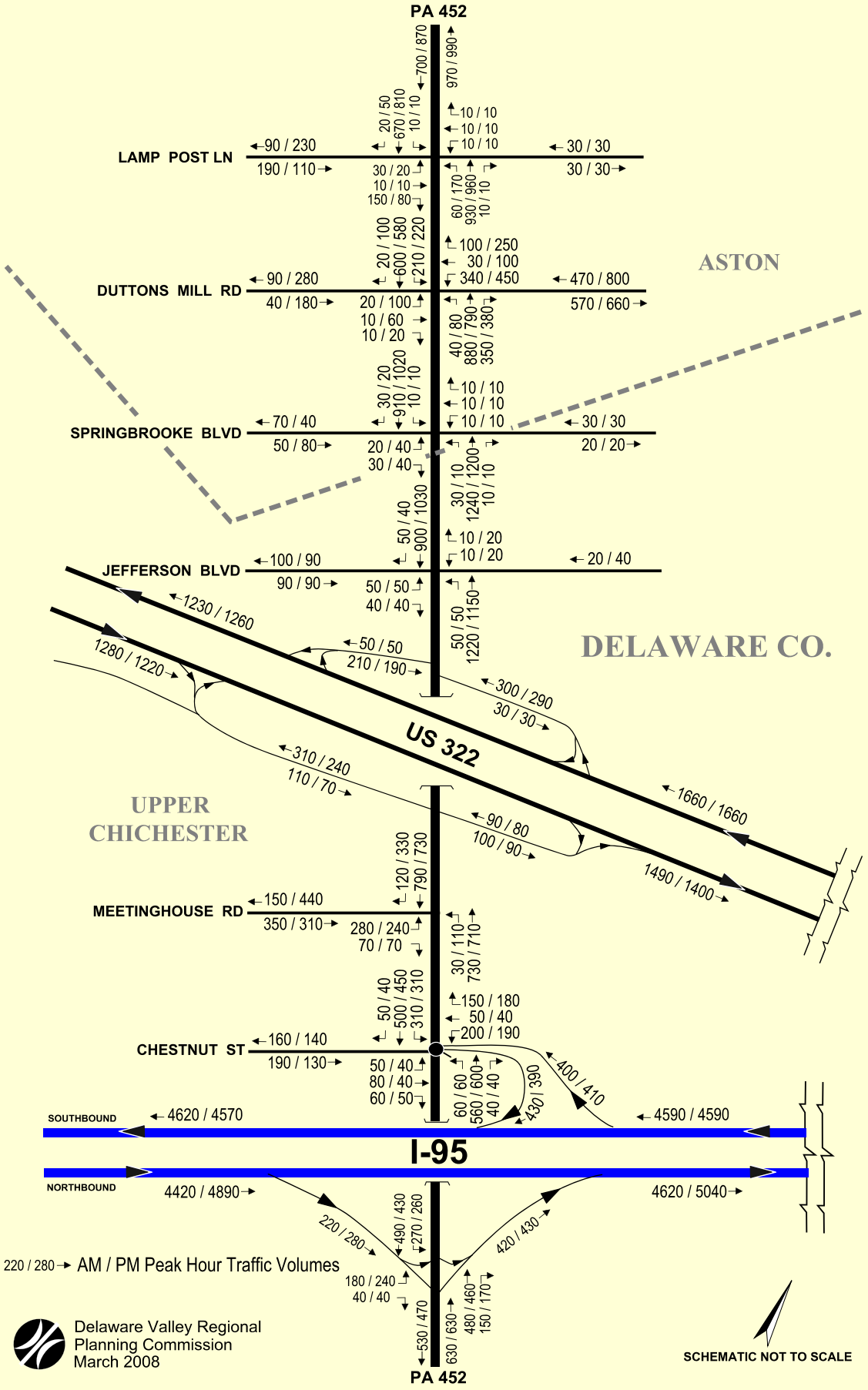
The 2034 daily traffic forecasts generally follow the same patterns as the 2014 daily traffic forecasts, except that the differences are more pronounced. The 2034 No-Build Alternative volumes are significantly higher than the 2014 volumes, and the differences between Build and No-Build Alternative volumes and between the three Build alternatives are also greater. Table 3 provides the 2034 average daily traffic volumes under the No-Build and Build alternatives. The table includes absolute and relative differences between current and No-Build volumes and between No-Build and Build alternative volumes.

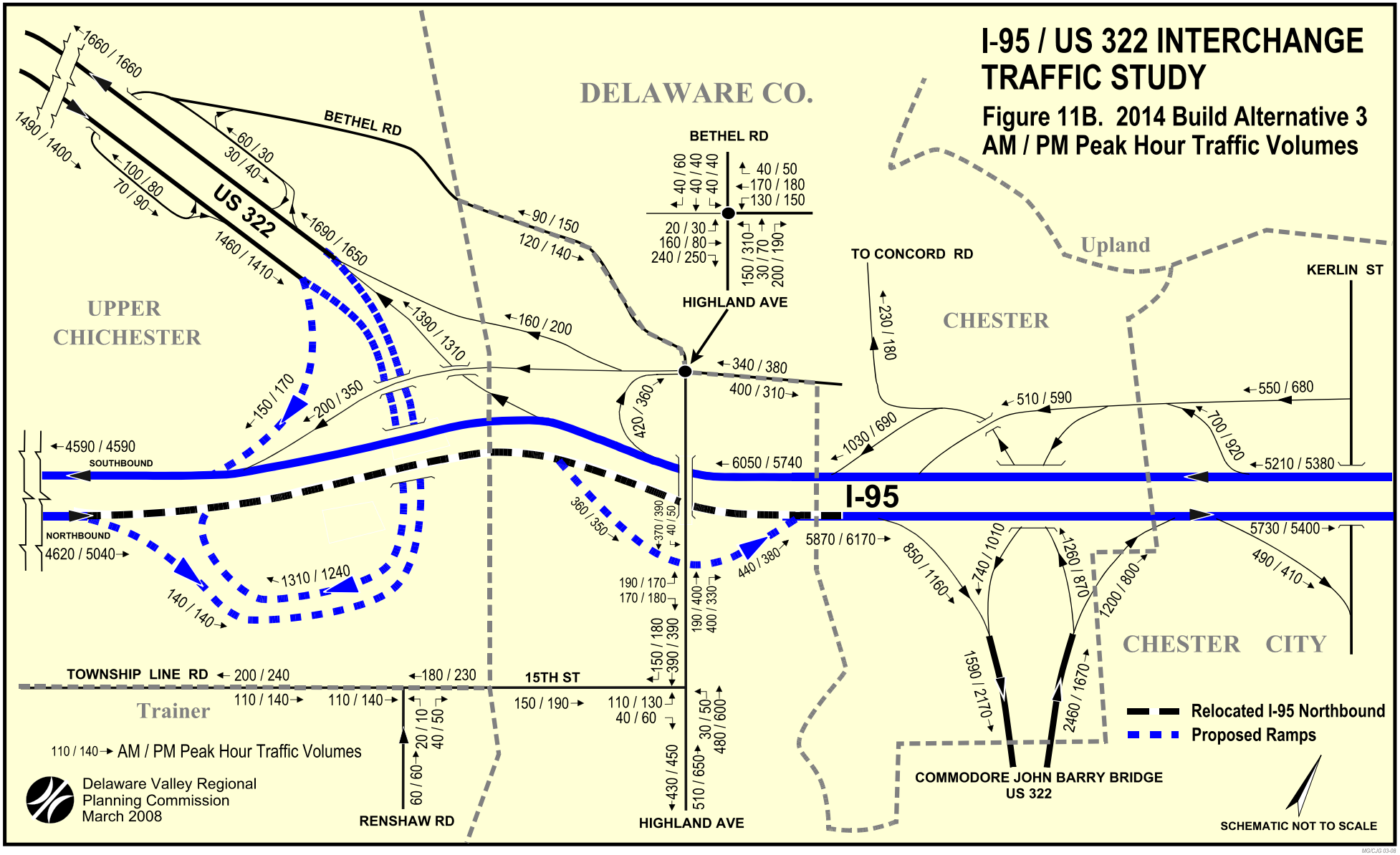
Figure 12 displays the 2034 average daily traffic volumes in the study area for the No-Build Alternative. The current volumes are also shown for comparison. Under the No-Build Alternative, 2034 volumes on I-95 in the study area will range from 126,300 to 172,400 vpd, representing increases of 14.6 to 18.2 percent over current levels. South of the I-95 / US 322 interchange, daily volumes are forecast to be 16,100 to 17,200 vpd higher than current volumes. Just north of the interchange, No-Build volumes will be 26,500 vpd higher than existing volumes. Once north of the Commodore Barry Bridge interchange at Exit 4, 2034 No-Build Alternative volumes will be 22,500 to 23,800 vpd higher than current volumes.

US 322 volumes will range from 41,800 to 47,400 vpd west of I-95 and will be 50,800 vpd east of Exit 4. These volumes represent increases of 14,000 to 15,400 vpd over current levels, or 41.8 to 51.4 percent growth. PA 452 volumes are forecast to be between 20,100 and 27,900 vpd. These increases range from 3,300 to 4,300 vpd, or 15.9 to 19.9 percent, over current traffic volumes.

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 11A. 2014 Build Alternative 3 AM / PM Peak Hour Traffic Volumes



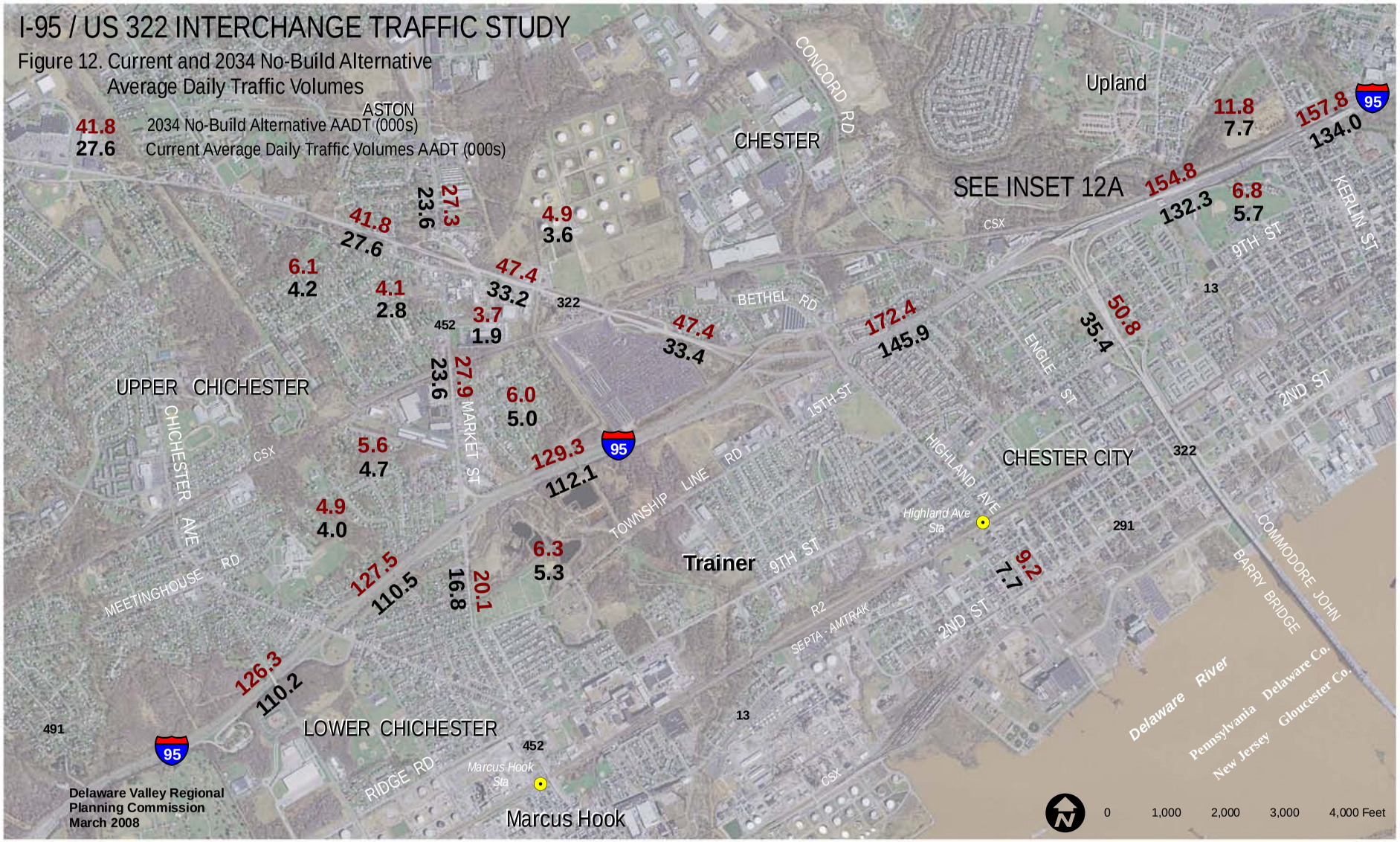

I-95 / US 322 INTERCHANGE
TRAFFIC STUDY
Figure 11B. 2014 Build Alternative 3
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Trainer
Upland
CHESTER
CHESTER CITY
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
US 322
I-95
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
Relocated I-95 Northbound
Proposed Ramps
110 / 140 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional
Planning Commission
March 2008
SCHEMATIC NOT TO SCALE

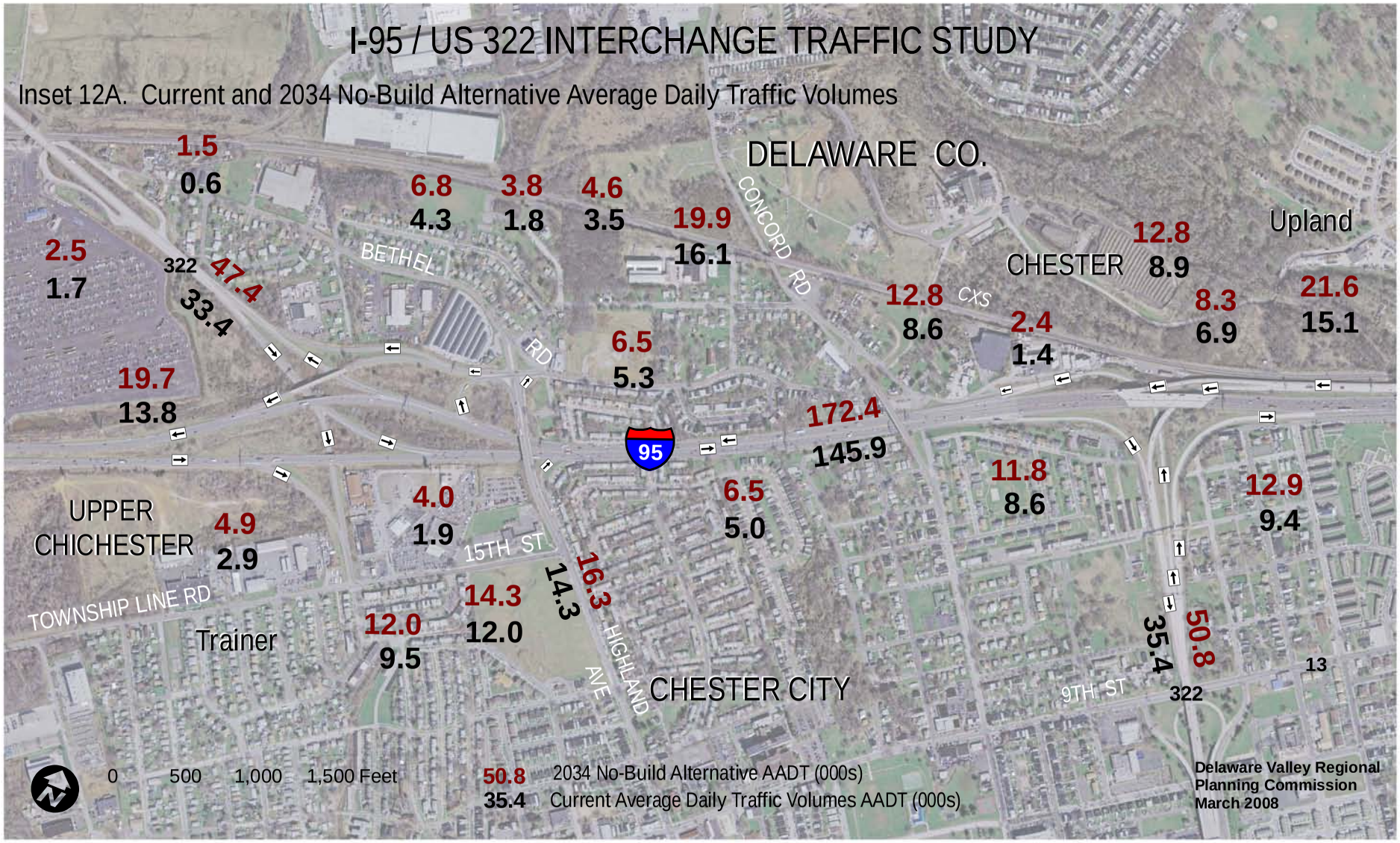
## Table 3. Current and 2034 Average Daily Traffic Volumes

| Location | Current Counts | 2034 Forecast No-Build | Current - 2034 Change Absolute | Current - 2034 Change Percent | 2034 Forecast Alternative 1 | Build / No-Build Diff Absolute | Build / No-Build Diff Percent | 2034 Forecast Alternative 2 | Alt 2 / Alt 1 Diff Absolute | Alt 2 / Alt 1 Diff Percent | 2034 Forecast Alternative 3 | Alt 3 / Alt 1 Diff Absolute | Alt 3 / Alt 1 Diff Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| *Interstate 95 Mainline* | | | | | | | | | | | | | |
| Delaware State Line to Chichester Avenue | 110,200 | 126,300 | 16,100 | 14.6% | 126,800 | 500 | 0.4% | 126,700 | -100 | -0.1% | 127,100 | 300 | 0.2% |
| Chichester Avenue to PA 452 (Market Street) | 110,480 | 127,500 | 17,020 | 15.4% | 128,100 | 600 | 0.5% | 127,800 | -300 | -0.2% | 128,400 | 300 | 0.2% |
| PA 452 (Market Street) to US 322 (Conchester Road) | 112,100 | 129,300 | 17,200 | 15.3% | 130,500 | 1,200 | 0.9% | 130,100 | -400 | -0.3% | 133,400 | 2,900 | 2.2% |
| US 322 (Conchester Road) to US 322 (Commodore Barry Bridge) | 145,890 | 172,400 | 26,510 | 18.2% | 172,900 | 500 | 0.3% | 172,700 | -200 | -0.1% | 172,700 | -200 | -0.1% |
| US 322 (Commodore Barry Bridge) to Kerlin Street | 132,250 | 154,800 | 22,550 | 17.1% | 154,900 | 100 | 0.1% | 155,000 | 100 | 0.1% | 155,300 | 400 | 0.3% |
| Kerlin Street to PA 352 (Edgemont Ave) | 133,983 | 157,800 | 23,817 | 17.8% | 158,000 | 200 | 0.1% | 158,100 | 100 | 0.1% | 158,300 | 300 | 0.2% |
| *Interstate 95 Ramps* | | | | | | | | | | | | | |
| I-95 Northbound Off-Ramp to PA 452 | 4,000 | 4,900 | 900 | 22.5% | 4,900 | 0 | 0.0% | 4,900 | 0 | 0.0% | 3,200 | -1,700 | -34.7% |
| I-95 Northbound On-Ramp from PA 452 | 5,280 | 6,300 | 1,020 | 19.3% | 6,500 | 200 | 3.2% | 6,500 | 0 | 0.0% | 6,700 | 200 | 3.1% |
| I-95 Southbound On-Ramp from PA 452 | 4,690 | 5,600 | 910 | 19.4% | 5,100 | -500 | -8.9% | 5,100 | 0 | 0.0% | 4,400 | -700 | -13.7% |
| I-95 Southbound Off-Ramp to PA 452 | 5,030 | 6,000 | 970 | 19.3% | 5,900 | -100 | -1.7% | 5,800 | -100 | -1.7% | 5,900 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to Township Line Road / C-D Road | 2,920 | 4,900 | 1,980 | 67.8% | 4,800 | -100 | -2.0% | 4,400 | -400 | -8.3% | 7,500 | 2,700 | 56.3% |
| I-95 Northbound On-Ramp from US 322 Eastbound | 13,770 | 19,700 | 5,930 | 43.1% | 20,200 | 500 | 2.5% | 20,100 | -100 | -0.5% | 23,500 | 3,300 | 16.3% |
| I-95 Northbound On-Ramp from Highland Ave/Twp Line/CD Road | 5,040 | 6,500 | 1,460 | 29.0% | 7,100 | 600 | 9.2% | 7,100 | 0 | 0.0% | 7,000 | -100 | -1.4% |
| I-95 Northbound Off-Ramp to US 322 WB | 0 | 0 | 0 | ----- | 0 | 0 | ----- | 0 | 0 | ----- | 2,900 | 2,900 | ----- |
| I-95 Southbound On-Ramp from US 322 EB | 0 | 0 | 0 | ----- | 2,700 | 2,700 | ----- | 2,700 | 0 | 0.0% | 2,900 | 200 | 7.4% |
| I-95 Southbound On-Ramp from Highland Ave/Bethel Road | 3,520 | 4,600 | 1,080 | 30.7% | 4,200 | -400 | -8.7% | 4,200 | 0 | 0.0% | 4,300 | 100 | 2.4% |
| I-95 Southbound Off-Ramp to US 322 WB | 16,100 | 19,900 | 3,800 | 23.6% | 20,400 | 500 | 2.5% | 20,200 | -200 | -1.0% | 20,100 | -300 | -1.5% |
| I-95 Southbound Off-Ramp to Highland Avenue | 5,320 | 6,500 | 1,180 | 22.2% | 6,400 | -100 | -1.5% | 6,500 | 100 | 1.6% | 6,300 | -100 | -1.6% |
| I-95 Northbound Off-Ramp to US 332 EB (Comm Barry Bridge) | 8,580 | 11,800 | 3,220 | 37.5% | 12,200 | 400 | 3.4% | 12,100 | -100 | -0.8% | 12,200 | 0 | 0.0% |
| I-95 Northbound On-Ramp from US 322 WB (Comm Barry Bridge) | 9,400 | 12,900 | 3,500 | 37.2% | 13,200 | 300 | 2.3% | 13,000 | -200 | -1.5% | 13,200 | 0 | 0.0% |
| I-95 Southbound On-Ramp from US 322 WB (Comm Barry Bridge) | 7,520 | 10,400 | 2,880 | 38.3% | 10,700 | 300 | 2.9% | 10,400 | -300 | -2.8% | 10,200 | -500 | -4.7% |
| I-95 Southbound On-Ramp from Kerlin Street C-D Road | 6,940 | 8,300 | 1,360 | 19.6% | 8,300 | 0 | 0.0% | 8,200 | -100 | -1.2% | 8,200 | -100 | -1.2% |
| I-95 Southbound Off-Ramp to Kerlin Street C-D Road | 7,400 | 9,800 | 2,400 | 32.4% | 9,900 | 100 | 1.0% | 9,900 | 0 | 0.0% | 9,900 | 0 | 0.0% |
| I-95 Northbound Off-Ramp to Kerlin Street | 5,667 | 6,800 | 1,133 | 20.0% | 6,800 | 0 | 0.0% | 6,800 | 0 | 0.0% | 6,900 | 100 | 1.5% |
| I-95 Northbound Off-Ramp to Edgemont Avenue | 4,207 | 5,400 | 1,193 | 28.4% | 5,400 | 0 | 0.0% | 5,400 | 0 | 0.0% | 5,500 | 100 | 1.9% |
| I-95 Southbound On-Ramp from Edgemont Avenue | 3,301 | 4,500 | 1,199 | 36.3% | 4,500 | 0 | 0.0% | 4,500 | 0 | 0.0% | 4,500 | 0 | 0.0% |
| *US 322 Mainline* | | | | | | | | | | | | | |
| West of PA 452 Interchange | 27,610 | 41,800 | 14,190 | 51.4% | 44,900 | 3,100 | 7.4% | 44,800 | -100 | -0.2% | 46,700 | 1,800 | 4.0% |
| PA 452 Interchange to Bethel Road Interchange | 33,200 | 47,400 | 14,200 | 42.8% | 50,800 | 3,400 | 7.2% | 50,600 | -200 | -0.4% | 53,200 | 2,400 | 4.7% |
| Bethel Road Interchange to Interstate 95 | 33,430 | 47,400 | 13,970 | 41.8% | 50,800 | 3,400 | 7.2% | 50,600 | -200 | -0.4% | 53,100 | 2,300 | 4.5% |
| Interstate 95 to 9th Street | 35,427 | 50,800 | 15,373 | 43.4% | 51,500 | 700 | 1.4% | 50,900 | -600 | -1.2% | 51,400 | -100 | -0.2% |
| *US 322 Ramps* | | | | | | | | | | | | | |
| US 322 Eastbound Off-Ramp to PA 452 Southbound | 1,270 | 2,200 | 930 | 73.2% | 2,000 | -200 | -9.1% | 2,100 | 100 | 5.0% | 1,700 | -300 | -15.0% |
| US 322 Eastbound On-Ramp from PA 452 Southbound | 2,950 | 3,900 | 950 | 32.2% | 4,000 | 100 | 2.6% | 4,000 | 0 | 0.0% | 4,000 | 0 | 0.0% |
| US 322 Eastbound Off-Ramp to PA 452 Northbound | 1,040 | 2,000 | 960 | 92.3% | 2,000 | 0 | 0.0% | 2,000 | 0 | 0.0% | 2,000 | 0 | 0.0% |
| US 322 Eastbound On-Ramp from PA 452 Northbound | 820 | 1,700 | 880 | 107.3% | 1,700 | 0 | 0.0% | 1,700 | 0 | 0.0% | 1,600 | -100 | -5.9% |
| US 322 Westbound On-Ramp from PA 452 Southbound | 760 | 1,500 | 740 | 97.4% | 1,500 | 0 | 0.0% | 1,500 | 0 | 0.0% | 1,500 | 0 | 0.0% |
| US 322 Westbound Off-Ramp to PA 452 Southbound | 2,070 | 2,600 | 530 | 25.6% | 2,600 | 0 | 0.0% | 2,600 | 0 | 0.0% | 2,500 | -100 | -3.8% |
| US 322 Westbound On-Ramp from PA 452 Northbound | 400 | 900 | 500 | 125.0% | 900 | 0 | 0.0% | 900 | 0 | 0.0% | 500 | -400 | -44.4% |
| US 322 Westbound Off-Ramp to PA 452 Northbound | 3,220 | 4,000 | 780 | 24.2% | 4,000 | 0 | 0.0% | 4,000 | 0 | 0.0% | 4,100 | 100 | 2.5% |

## Table 3. Current and 2034 Average Daily Traffic Volumes

| Location | Current Counts | 2034 Forecast No-Build | Current - 2034 Change Absolute | Current - 2034 Change Percent | 2034 Forecast Alternative 1 | Build / No-Build Diff Absolute | Build / No-Build Diff Percent | 2034 Forecast Alternative 2 | Alt 2 / Alt 1 Diff Absolute | Alt 2 / Alt 1 Diff Percent | 2034 Forecast Alternative 3 | Alt 3 / Alt 1 Diff Absolute | Alt 3 / Alt 1 Diff Percent |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| US 322 Eastbound Off-Ramp to Bethel Road | 780 | 1,200 | 420 | 53.8% | 1,200 | 0 | 0.0% | 1,200 | 0 | 0.0% | 1,500 | 300 | 25.0% |
| US 322 Eastbound On-Ramp from Bethel Road | 910 | 1,300 | 390 | 42.9% | 1,300 | 0 | 0.0% | 1,300 | 0 | 0.0% | 1,300 | 0 | 0.0% |
| US 322 Westbound On-Ramp from Bethel Road | 260 | 800 | 540 | 207.7% | 800 | 0 | 0.0% | 800 | 0 | 0.0% | 600 | -200 | -25.0% |
| US 322 Westbound Off-Ramp to Bethel Road | 360 | 700 | 340 | 94.4% | 700 | 0 | 0.0% | 700 | 0 | 0.0% | 700 | 0 | 0.0% |
| US 322 Eastbound Off-Ramp to Township Line Road | 1,910 | 4,000 | 2,090 | 109.4% | 3,800 | -200 | -5.0% | 3,900 | 100 | 2.6% | 0 | -3,800 | -100.0% |
| US 322 Westbound On-Ramp from Highland Avenue | 1,760 | 3,800 | 2,040 | 115.9% | 3,700 | -100 | -2.6% | 3,700 | 0 | 0.0% | 3,700 | 0 | 0.0% |
| US 322 Westbound Off-Ramp to Bethel Road | 1,390 | 2,400 | 1,010 | 72.7% | 1,900 | -500 | -20.8% | 1,900 | 0 | 0.0% | 2,100 | 200 | 10.5% |
| US 322 Eastbound On-Ramp from I-95 SB and Kerlin St | 8,151 | 13,300 | 5,149 | 63.2% | 13,500 | 200 | 1.5% | 13,500 | 0 | 0.0% | 13,700 | 200 | 1.5% |
| *Other Facilities* | | | | | | | | | | | | | |
| PA 452 West of Dutton Mill Road | 17,487 | 20,900 | 3,413 | 19.5% | 19,800 | -1,100 | -5.3% | 19,900 | 100 | 0.5% | 19,900 | 100 | 0.5% |
| PA 452 from Dutton Mill Road to Bethel Road | 23,560 | 27,300 | 3,740 | 15.9% | 26,200 | -1,100 | -4.0% | 26,100 | -100 | -0.4% | 26,300 | 100 | 0.4% |
| PA 452 from Bethel Road to Interstate 95 | 23,560 | 27,900 | 4,340 | 18.4% | 26,500 | -1,400 | -5.0% | 26,400 | -100 | -0.4% | 25,900 | -600 | -2.3% |
| PA 452 South of Interstate 95 | 16,758 | 20,100 | 3,342 | 19.9% | 19,200 | -900 | -4.5% | 19,000 | -200 | -1.0% | 19,000 | -200 | -1.0% |
| Bethel Road from US 322 to Highland Avenue | 4,291 | 6,800 | 2,509 | 58.5% | 6,600 | -200 | -2.9% | 6,600 | 0 | 0.0% | 6,600 | 0 | 0.0% |
| Bethel Road from Highland Avenue to Concord Road | 8,623 | 12,800 | 4,177 | 48.4% | 12,700 | -100 | -0.8% | 12,700 | 0 | 0.0% | 12,700 | 0 | 0.0% |
| Highland Avenue from I-95 NB Ramps to I-95 SB Ramps | 12,381 | 14,500 | 2,119 | 17.1% | 14,700 | 200 | 1.4% | 14,900 | 200 | 1.4% | 17,700 | 3,000 | 20.4% |
| Highland Avenue from I-95 NB Ramps to Twp Line Rd (15th St) | 12,016 | 14,300 | 2,284 | 19.0% | 9,500 | -4,800 | -33.6% | 13,700 | 4,200 | 44.2% | 16,200 | 6,700 | 70.5% |
| Highland Avenue from Twp Rd (15th St) to US 13 (9th St) | 14,281 | 16,300 | 2,019 | 14.1% | 15,500 | -800 | -4.9% | 15,800 | 300 | 1.9% | 15,800 | 300 | 1.9% |
| Highland Avenue from US 13 (9th St) to PA 291 (2nd St) | 7,652 | 9,200 | 1,548 | 20.2% | 8,600 | -600 | -6.5% | 8,700 | 100 | 1.2% | 8,800 | 200 | 2.3% |
| Township Line Road (15th St) from US 322 Ramp to Highland Ave. | 9,751 | 12,000 | 2,249 | 23.1% | 11,500 | -500 | -4.2% | 11,000 | -500 | -4.3% | 5,600 | -5,900 | -51.3% |


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 12. Current and 2034 No-Build Alternative
Average Daily Traffic Volumes
41.8 2034 No-Build Alternative AADT (000s)
27.6 Current Average Daily Traffic Volumes AADT (000s)
ASTON
CHESTER
CONCORD RD
Upland
SEE INSET 12A
CSX
9TH ST
KERLIN ST
BETHEL RD
UPPER CHICHESTER
CHICHESTER AVE
MARKET ST
TOWNSHIP LINE RD
15TH ST
ENGLE ST
HIGHLAND AVE
CHESTER CITY
2ND ST
Highland Ave Sta
Trainer
MEETINGHOUSE RD
SEPTA - AMTRAK
COMMODORE JOHN BARRY BRIDGE
Delaware River
Pennsylvania
Delaware Co.
New Jersey
Gloucester Co.
LOWER CHICHESTER
RIDGE RD
Marcus Hook Sta
Marcus Hook
Delaware Valley Regional Planning Commission
March 2008
0 1,000 2,000 3,000 4,000 Feet


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 12A. Current and 2034 No-Build Alternative Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
TOWNSHIP LINE RD
BETHEL RD
CONCORD RD
15TH ST
HIGHLAND AVE
9TH ST
322
95
CXS
1.5
0.6
6.8
4.3
3.8
1.8
4.6
3.5
19.9
16.1
12.8
8.9
2.5
1.7
322
47.4
33.4
12.8
8.6
2.4
1.4
8.3
6.9
21.6
15.1
6.5
5.3
19.7
13.8
172.4
145.9
11.8
8.6
12.9
9.4
4.0
1.9
6.5
5.0
4.9
2.9
16.3
14.3
14.3
12.0
12.0
9.5
50.8
35.4
13
0 500 1,000 1,500 Feet
50.8 2034 No-Build Alternative AADT (000s)
35.4 Current Average Daily Traffic Volumes AADT (000s)
Delaware Valley Regional Planning Commission
March 2008

Traffic movements from US 322 eastbound to I-95 northbound and from I-95 southbound to US 322 westbound increase to 19,700 and 19,900 vpd, respectively. These volumes represent increases of 5,900 and 3,800 vpd over current traffic volumes. Other I-95 / US 322 interchange ramps increase by 1,200 to 2,100 vpd over existing values

Figure 13 shows the 2034 daily traffic forecasts for the three Build alternatives, along with the comparable No-Build Alternative forecasts. The additional capacity along I-95 provided by the various Build alternatives reduces conflicts and delays associated with merging and weaving traffic throughout the interchange area. This additional capacity does not, however, attract or divert a large number of new trips into the area.

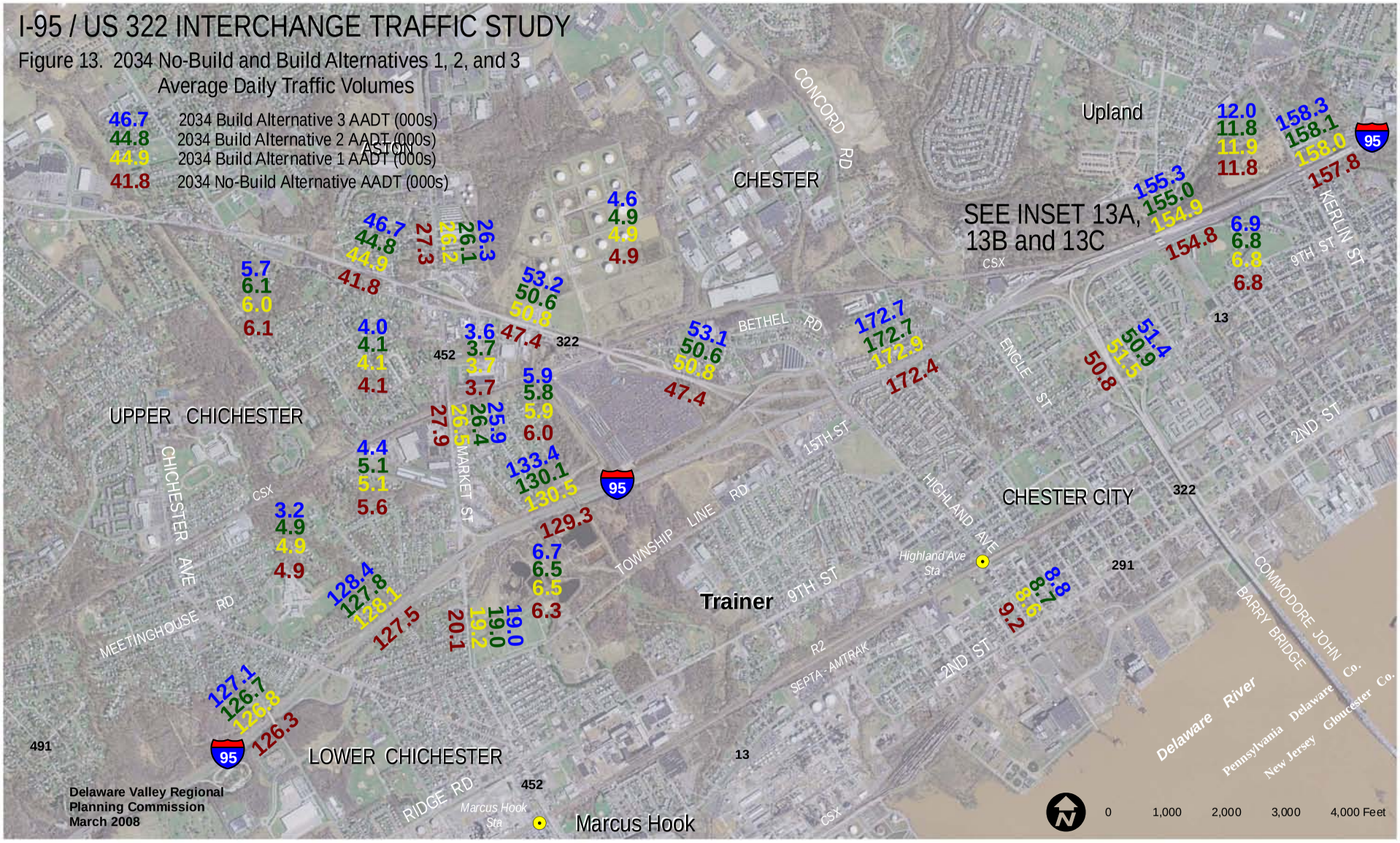
Along I-95, average daily traffic volumes under the No-Build and all three Build alternatives differ by less than 1,000 vpd at all locations except between PA 452 and US 322. At this location, daily volumes vary by as much as 4,100 vpd. Under the No-Build Alternative, this volume is 129,300 vpd. It increases by 1,200 vpd to 130,500 vpd under Build Alternative 1. Build Alternative 2 has a slightly lower volume at 130,100, while the Build Alternative 3 volume is 133,400.

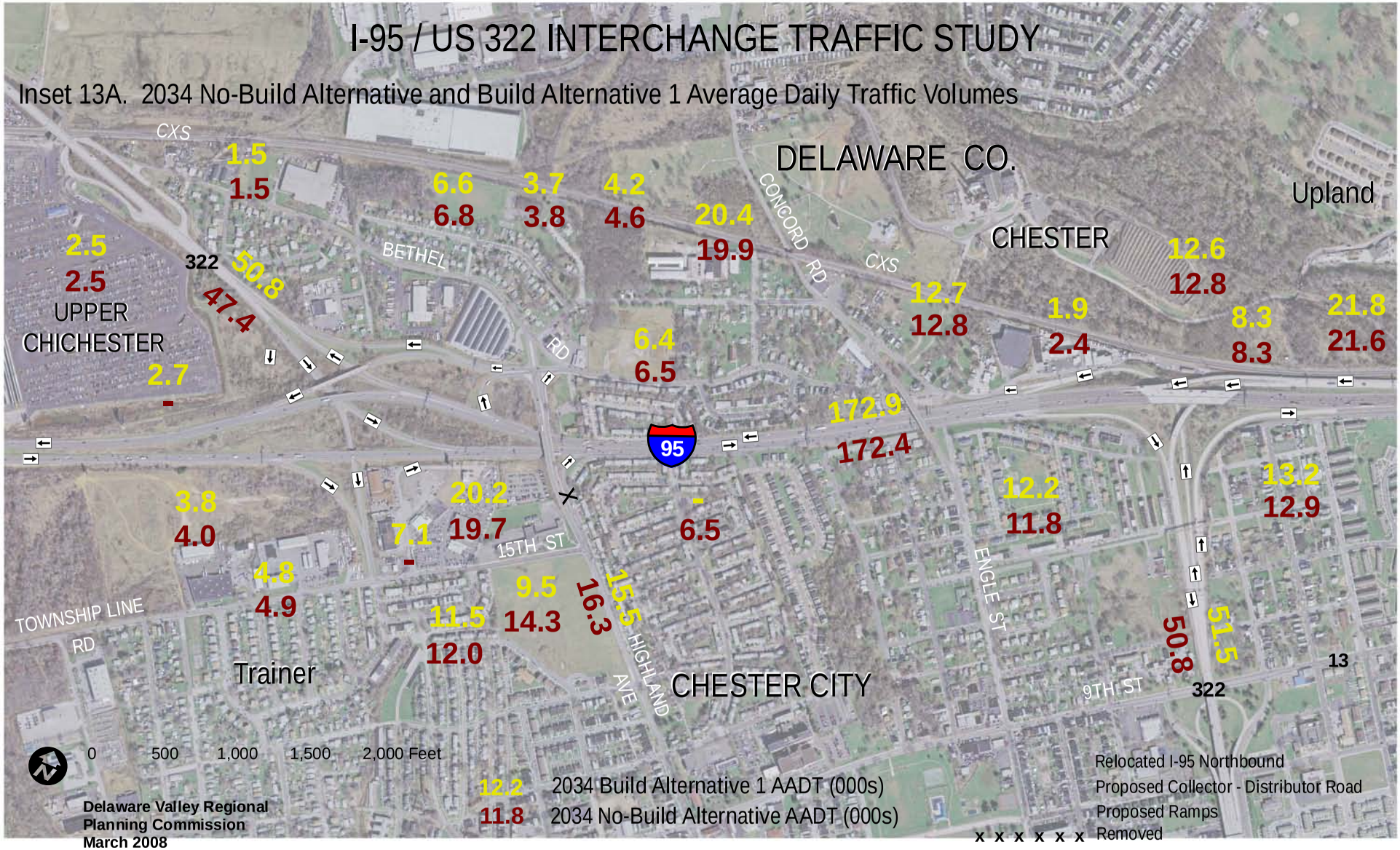
Traffic volumes along US 322 in 2034 under the various Build alternatives, in contrast, are significantly higher than the No-Build Alternative volume at study area locations west of I-95. For example, Build Alternative 1 volumes are 3,100 to 3,400 vpd, or 7.2 to 7.4 percent, higher than the comparable No-Build Alternative volumes. Build Alternative 2 volumes are only 100 to 200 vpd lower than the corresponding Build Alternative 1 volumes. Build Alternative 3 volumes, however, are 4,900 to 5,700 vpd higher than the No-Build Alternative volumes and are 1,800 to 2,600 vpd higher than the other Build Alternative volumes.

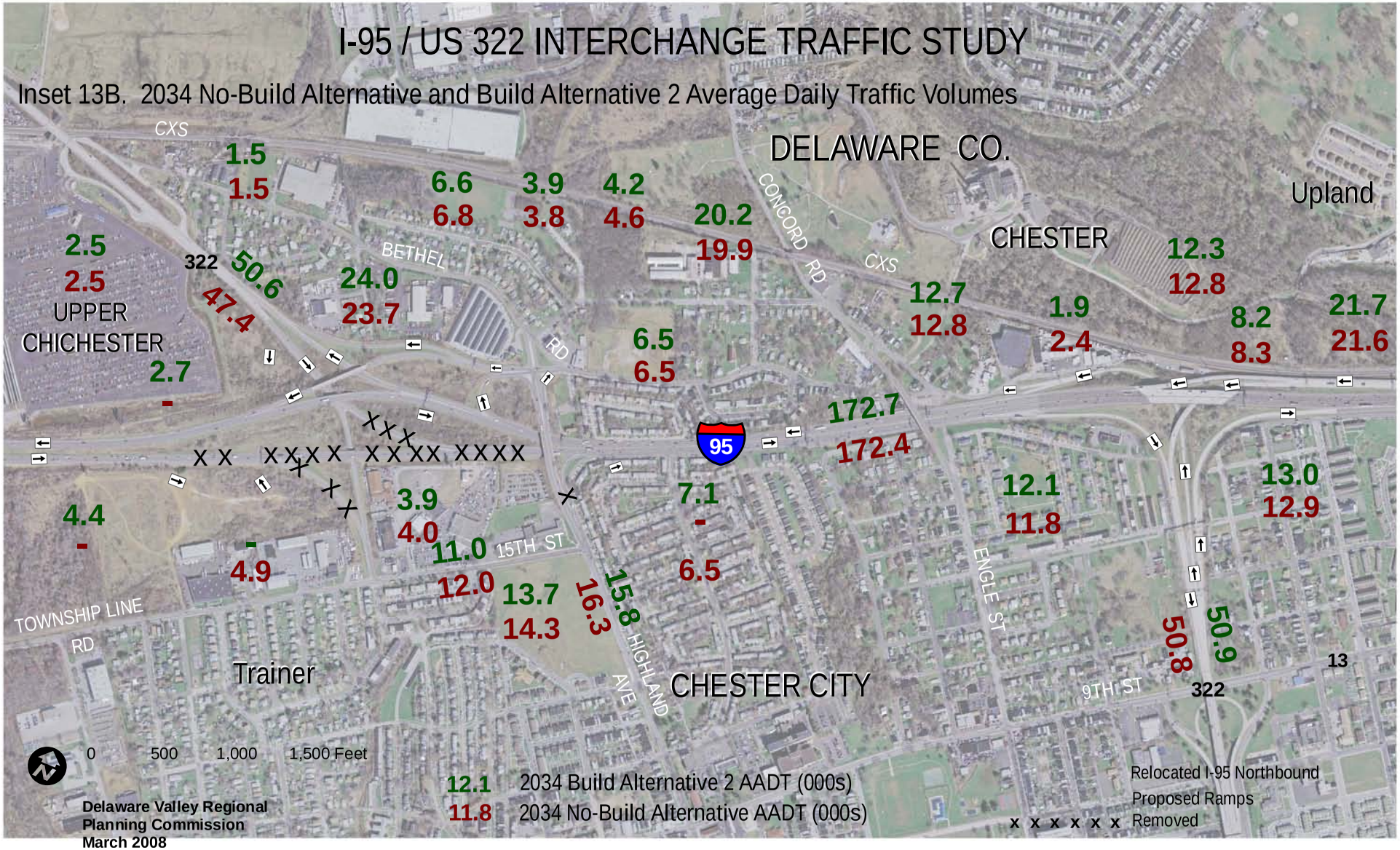
The proposed ramps between US 322 eastbound and I-95 southbound in all Build alternatives and between I-95 northbound and US 322 westbound in Build Alternative 3 are largely responsible for these differences in traffic volumes. The proposed ramp from US 322 eastbound to I-95 southbound carries 2,700 to 2,900 vpd in 2034 under the Build alternatives. The proposed ramp from I-95 northbound to US 322 westbound in Build Alternative 3 also carries 2,900 vpd in 2034.

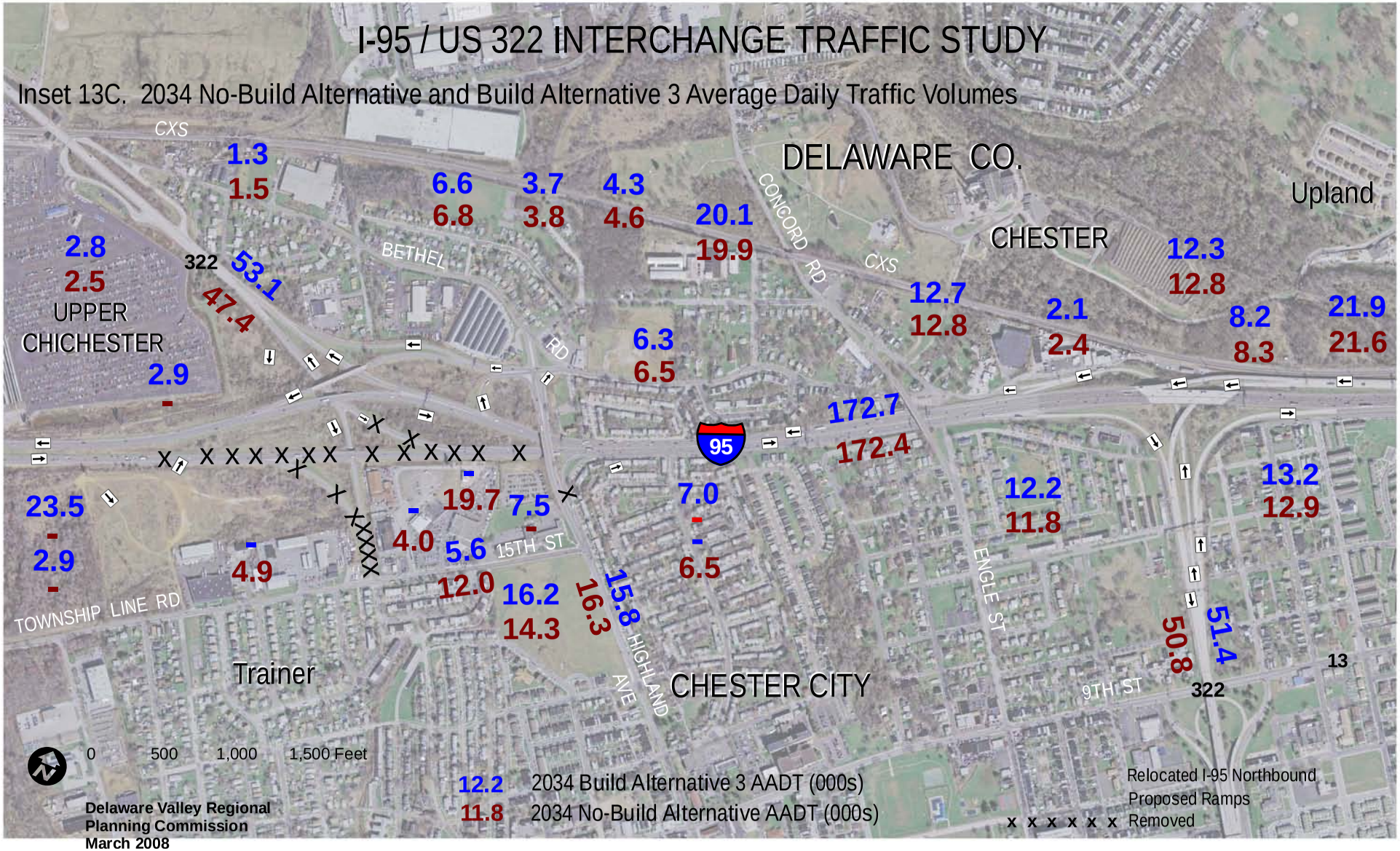
These proposed ramps also affect traffic volumes at the I-95 / PA 452 interchange. The on-ramp from PA 452 to I-95 southbound volume is reduced by 500 to1,200 vpd, compared to the No-Build Alternative volume. The off-ramp from I-95 northbound to PA 452 is reduced by 1,700 vpd under Build Alternative 3, compared to the No-Build Alternative.

PA 452 volumes are also lower under the Build alternatives than under the No-Build Alternative. In 2034, these reductions range from 900 to 2,000 vpd, which is about five to seven percent of the No-Build Alternative volume. The greatest reductions occur under Build Alternative 3 and the smallest occur under Build Alternative 1.


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 13. 2034 No-Build and Build Alternatives 1, 2, and 3
Average Daily Traffic Volumes
46.7 2034 Build Alternative 3 AADT (000s)
44.8 2034 Build Alternative 2 AADT (000s)
44.9 2034 Build Alternative 1 AADT (000s)
41.8 2034 No-Build Alternative AADT (000s)
SEE INSET 13A, 13B and 13C
ASTON
CHESTER
Upland
CONCORD RD
BETHEL RD
ENGLE ST
KERLIN ST
9TH ST
2ND ST
15TH ST
HIGHLAND AVE
CSX
UPPER CHICHESTER
CHICHESTER AVE
MEETINGHOUSE RD
MARKET ST
TOWNSHIP LINE RD
CHESTER CITY
Highland Ave Sta
Trainer
9TH ST
SEPTA - AMTRAK
R2
2ND ST
COMMODORE JOHN BARRY BRIDGE
Delaware River
Pennsylvania
Delaware Co.
New Jersey
Gloucester Co.
LOWER CHICHESTER
RIDGE RD
Marcus Hook Sta
Marcus Hook
95
322
452
491
13
291
Delaware Valley Regional Planning Commission
March 2008
0 1,000 2,000 3,000 4,000 Feet


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 13A. 2034 No-Build Alternative and Build Alternative 1 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
BETHEL RD
CONCORD RD
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
TOWNSHIP LINE RD
CXS
322
95
1.5
1.5
6.6
6.8
3.7
3.8
4.2
4.6
20.4
19.9
2.5
2.5
50.8
47.4
2.7
-
6.4
6.5
12.7
12.8
1.9
2.4
12.6
12.8
8.3
8.3
21.8
21.6
172.9
172.4
3.8
4.0
20.2
19.7
7.1
-
6.5
12.2
11.8
13.2
12.9
4.8
4.9
9.5
14.3
15.5
16.3
11.5
12.0
50.8
51.5
13
0 500 1,000 1,500 2,000 Feet
12.2 2034 Build Alternative 1 AADT (000s)
11.8 2034 No-Build Alternative AADT (000s)
Relocated I-95 Northbound
Proposed Collector - Distributor Road
Proposed Ramps
Removed
Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 13B. 2034 No-Build Alternative and Build Alternative 2 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
TOWNSHIP LINE RD
BETHEL RD
CONCORD RD
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
CXS
322
95
1.5
1.5
6.6
6.8
3.9
3.8
4.2
4.6
20.2
19.9
2.5
2.5
50.6
47.4
24.0
23.7
12.7
12.8
1.9
2.4
12.3
12.8
8.2
8.3
21.7
21.6
2.7
-
6.5
6.5
172.7
172.4
4.4
-
-
4.9
3.9
4.0
11.0
12.0
13.7
14.3
15.8
16.3
7.1
-
6.5
12.1
11.8
13.0
12.9
50.8
50.9
13
322
0 500 1,000 1,500 Feet
12.1 2034 Build Alternative 2 AADT (000s)
11.8 2034 No-Build Alternative AADT (000s)
Relocated I-95 Northbound
Proposed Ramps
Removed
Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Inset 13C. 2034 No-Build Alternative and Build Alternative 3 Average Daily Traffic Volumes
DELAWARE CO.
Upland
CHESTER
UPPER CHICHESTER
Trainer
CHESTER CITY
CXS
BETHEL RD
CONCORD RD
TOWNSHIP LINE RD
15TH ST
HIGHLAND AVE
ENGLE ST
9TH ST
322
95
1.3
1.5
6.6
6.8
3.7
3.8
4.3
4.6
20.1
19.9
2.8
2.5
53.1
47.4
12.7
12.8
2.1
2.4
12.3
12.8
8.2
8.3
21.9
21.6
6.3
6.5
2.9
172.7
172.4
23.5
2.9
4.9
19.7
7.5
4.0
5.6
12.0
16.2
14.3
15.8
16.3
7.0
6.5
12.2
11.8
13.2
12.9
50.8
51.4
13
0 500 1,000 1,500 Feet
12.2 2034 Build Alternative 3 AADT (000s)
11.8 2034 No-Build Alternative AADT (000s)
Relocated I-95 Northbound
Proposed Ramps
x x x x x x Removed
Delaware Valley Regional Planning Commission
March 2008

Most other facilities in the study area have very similar traffic volumes under the No-Build and the three Build Alternatives. An exception is the area around Township Line Road, 15th Street, and Highland Avenue. The various locations of the I-95 northbound off- and on-ramps and the US 322 eastbound off-ramp to Township Line road cause the volumes in this area to vary significantly between alternatives.

## D. 2034 AM and PM Peak Hour Traffic Forecasts

AM and PM peak hour traffic forecasts for 2034 under the No-Build Alternative are shown in Figure 14. Along I-95, peak hour volumes range from 4,830 to 6,790 vehicles per hour (vph). These volumes represent significant increases over current peak hour volumes. Along I-95 northbound, in the weaving area between Exit 3 and Exit 4, there will be an additional demand of over 1,000 vehicles during the AM peak hour and 850 vehicles during the PM peak hour.

Peak hour traffic forecasts on US 322 are between 1,310 and 1,810 vph west of I-95. These volumes represent increases of approximately 400 to 600 vph over current traffic levels. Higher volumes occur on US 322 east of I-95 on the approach to the Commodore Barry Bridge. Here, 2034 peak hour volumes under the No-Build Alternative range from 1,960 to 3,020 vph. The ramp from US 322 eastbound to I-95 northbound and the reverse movement from I-95 southbound to US 322 westbound also exhibit large increases over current volumes. They increase by approximately 300 to 400 vph during the AM and PM peak hours.

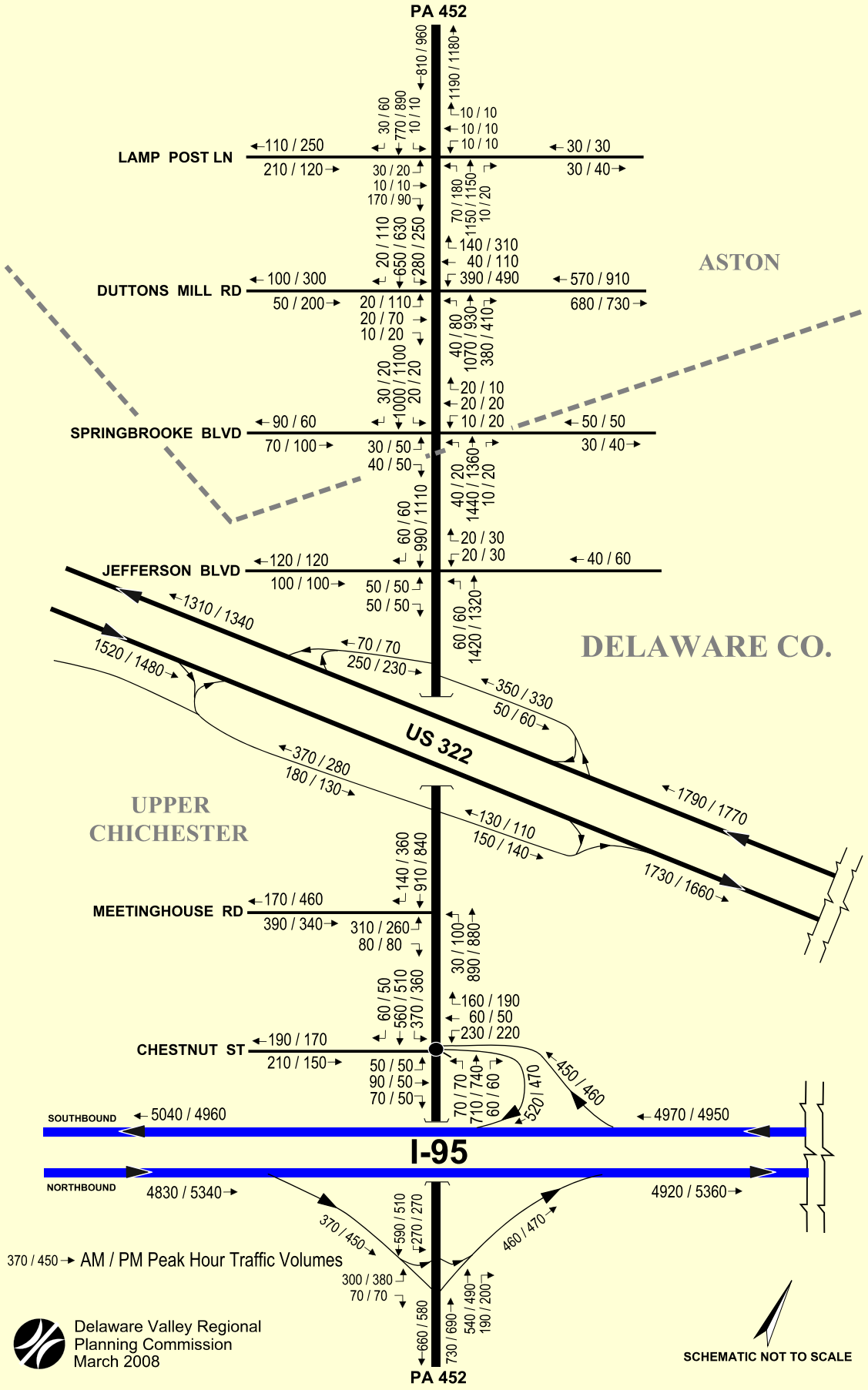
Volumes along PA 452 increase by approximately 200 to 300 vph in both the eastbound and westbound directions during both the AM and the PM peak hours. Traffic growth on streets that intersect with PA 452 is less pronounced. Except for Duttons Mill Road, there are few locations that increase by more than 50 vph. Peak hour volumes on Duttons Mill Road in 2034, however, will be approximately 200 vph over current volumes under the No-Build Alternative.

Peak hour traffic volumes in 2034 under Build Alternative 1 tend to be slightly higher than the corresponding No-Build volumes along both I-95 and US 322. The most significant differences occur on US 322 eastbound as it approaches the I-95 interchange at Exit 3 and on I-95 northbound between exits 3 and 4. Peak hour volumes on US 322 eastbound are approximately 250 vph higher than the corresponding No-Build Alternative volume, while I-95 northbound volumes are 120 to 130 vph higher under Build Alternative 1.

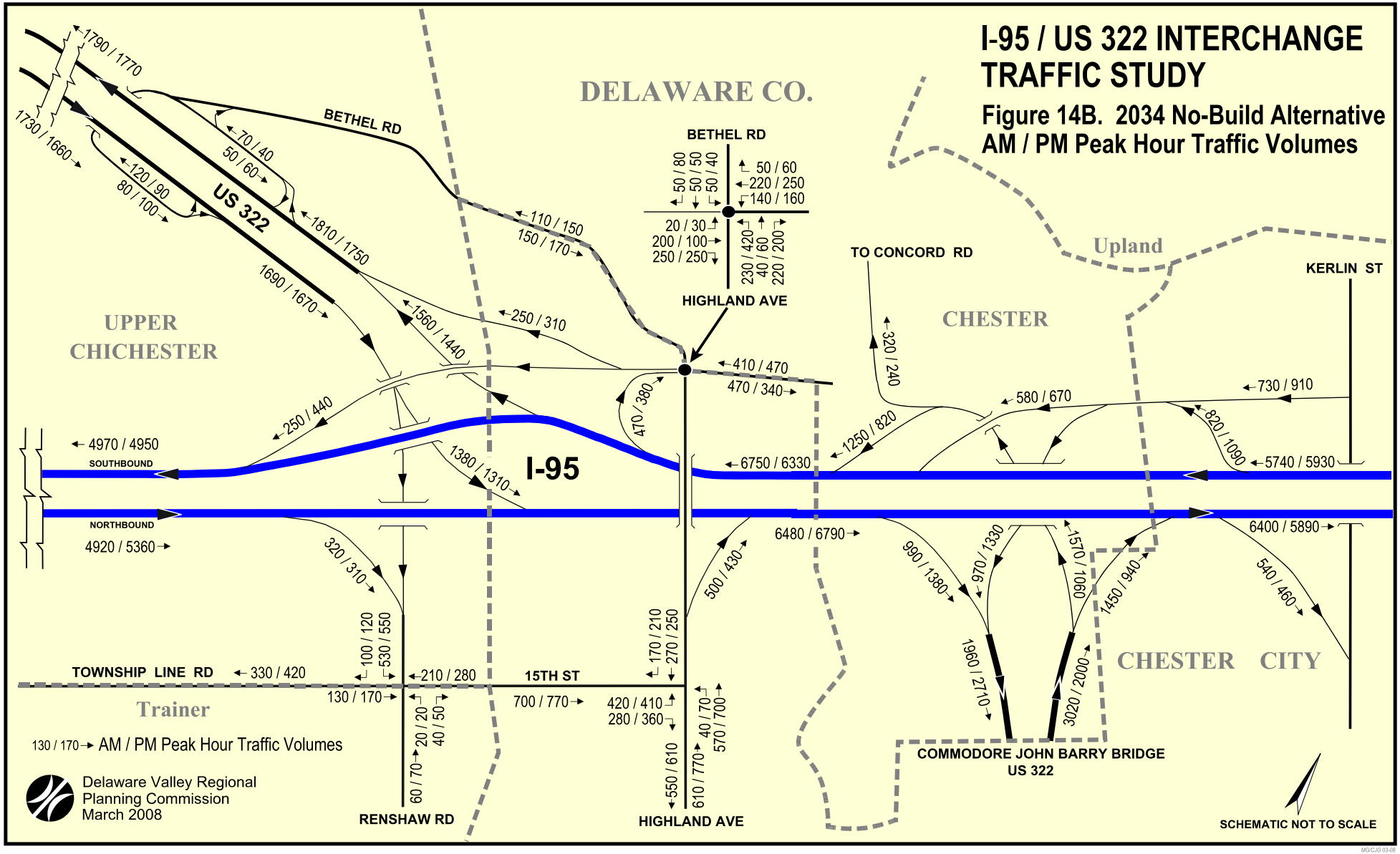
The new US 322 eastbound ramp to I-95 southbound will serve 210 and 250 vehicles in the AM and PM peak hours, respectively. The relocated I-95 northbound on-ramp from Highland Avenue to Township Line Road serves 30 to 40 additional vehicles in the peak hours, compared to the No-Build Alternative.

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 14A. 2034 No-Build Alternative AM / PM Peak Hour Traffic Volumes




Delaware Valley Regional Planning Commission
March 2008


I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 14B. 2034 No-Build Alternative AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Upland
CHESTER
CHESTER CITY
Trainer
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
US 322
I-95
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
1790 / 1770
1730 / 1660
70 / 40
50 / 60
120 / 90
80 / 100
1810 / 1750
1690 / 1670
110 / 150
150 / 170
1560 / 1440
250 / 310
410 / 470
470 / 340
470 / 380
250 / 440
4970 / 4950
4920 / 5360
1380 / 1310
6750 / 6330
1250 / 820
320 / 240
580 / 670
730 / 910
820 / 1090
5740 / 5930
6480 / 6790
6400 / 5890
500 / 430
990 / 1380
970 / 1330
1570 / 1060
1450 / 940
540 / 460
1960 / 2110
3020 / 2000
320 / 310
100 / 120
530 / 550
330 / 420
210 / 280
130 / 170
700 / 770
170 / 210
270 / 250
420 / 410
280 / 360
550 / 610
610 / 770
40 / 70
570 / 700
60 / 70
20 / 20
40 / 50
50 / 80
50 / 50
50 / 40
50 / 60
220 / 250
140 / 160
20 / 30
200 / 100
250 / 250
230 / 420
40 / 60
220 / 200
130 / 170 AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
March 2008
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Peak hour traffic volumes on most other study area facilities, including PA 452, are largely unchanged from the No-Build Alternative. One exception, however, is the I-95 southbound on-ramp from PA 452, where volumes are 40 vph lower than the No-Build Alternative volumes. Figure 15 provides the 2034 AM and PM peak hour traffic forecasts under Build Alternative 1.

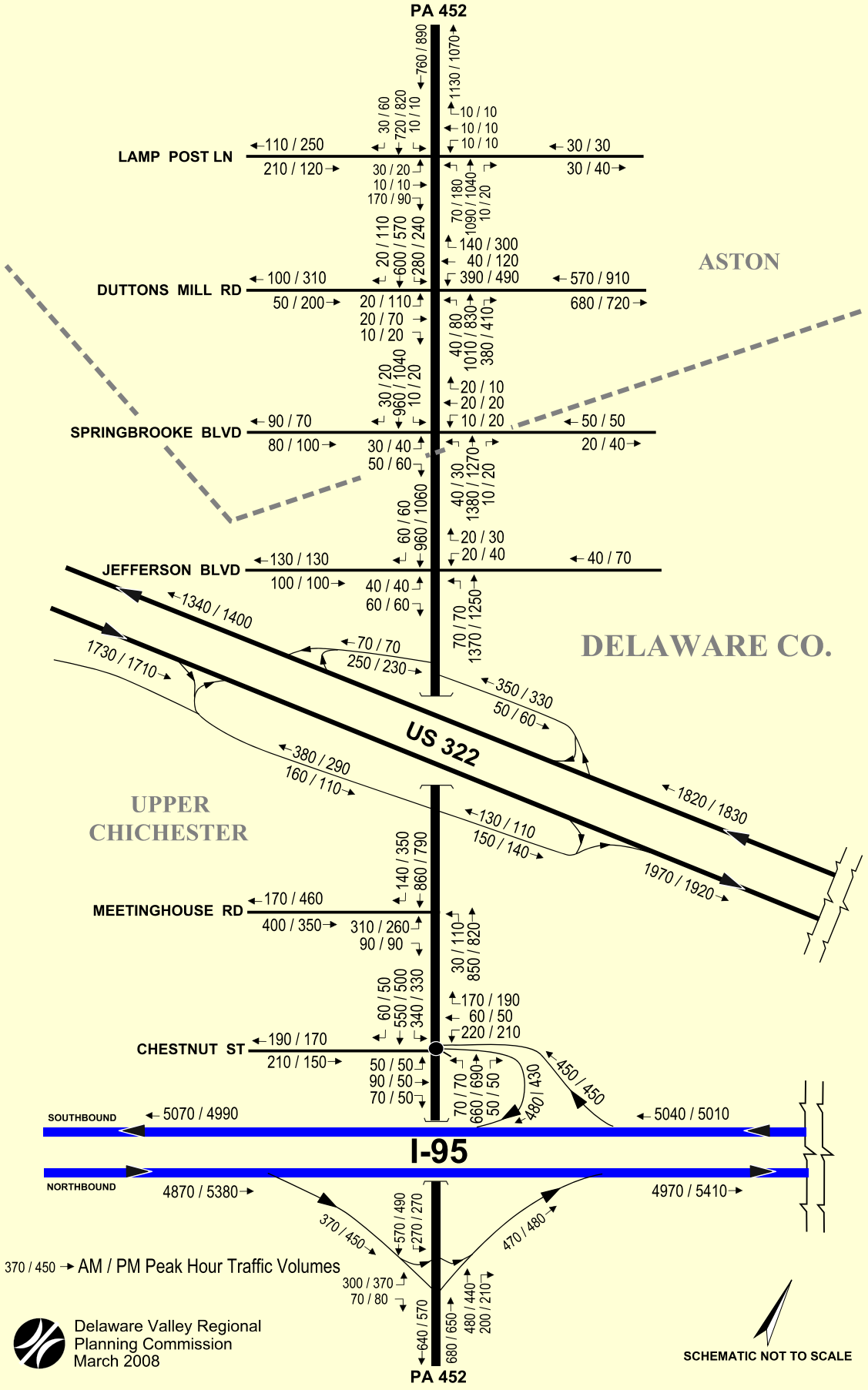
Build Alternative 2 peak hour volumes are very similar to the Build Alternative 1 peak hour volumes. For example, the largest difference in I-95 volumes between the two alternatives is only 30 vph, and the largest difference in US 322 volumes is only 20 vph. The only significant differences are in the area of Highland Avenue, Township Line Road, and 15th Street, due to the relocation of the I-95 northbound on-ramp from Highland Avenue to 15th Street. There are also no significant differences in PA 452 volumes between Build alternatives 1 and 2. At all locations, the peak hour through movement volumes are within 30 vph of one another. Individual left- and right-turning volumes are within 10 vph of one another. Figure 16 displays the 2034 AM and PM peak hour traffic forecasts for Build Alternative 2.

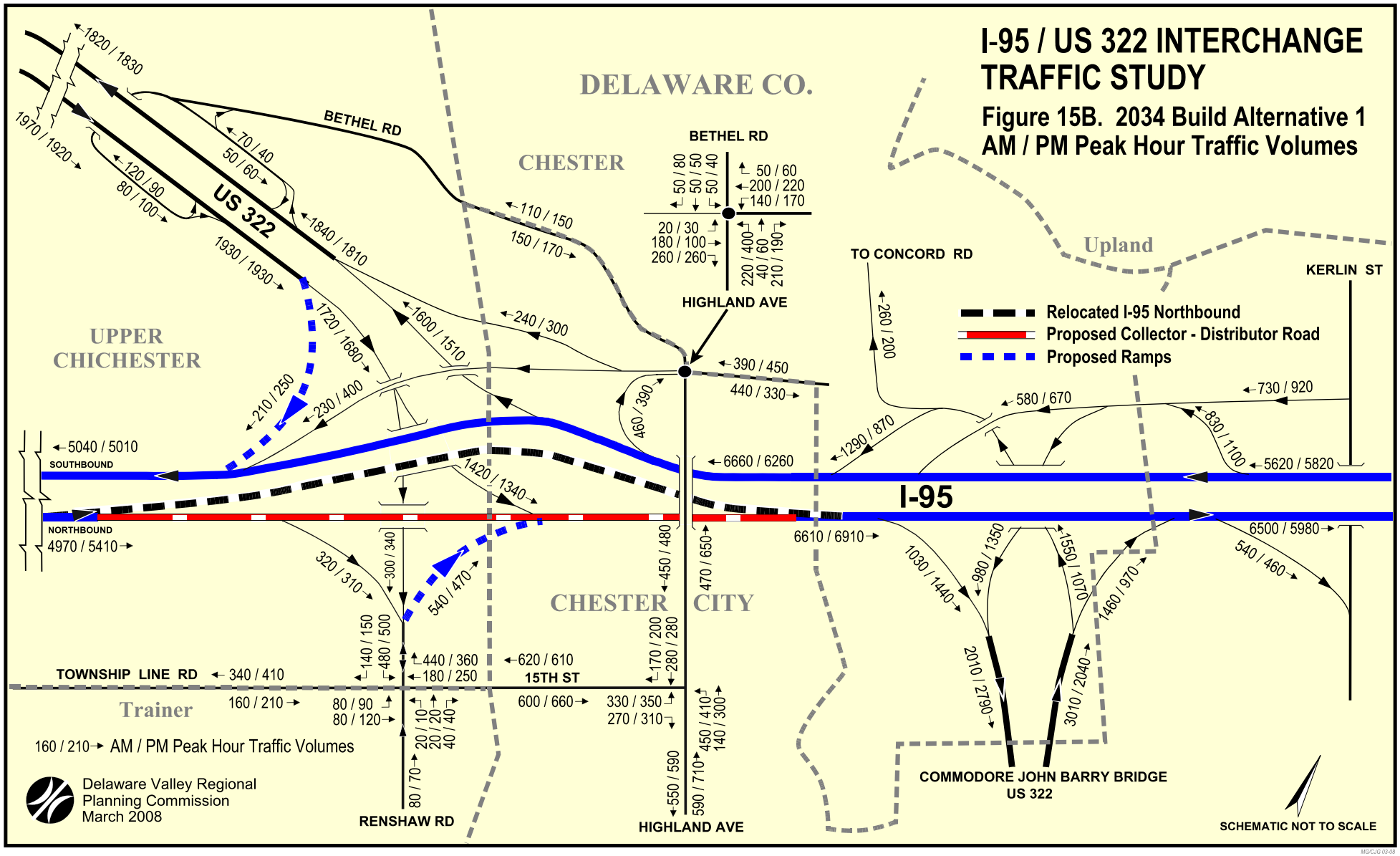
Peak hour traffic volumes in 2034 under Build Alternative 3 are slightly higher than either of the other Build alternatives at most locations along I-95. The largest difference (190 vph) occurs between Build alternatives 2 and 3 in the northbound direction between the PA 452 and US 322 interchanges, during the PM peak hour. When compared to the No-Build Alternative, Build Alternative 3 volumes along I-95 are as much as 230 vph higher. US 322 volumes are also higher than the other Build alternative volumes. US 322 westbound volumes between I-95 and Bethel Road are 200 to 230 vph higher than Build Alternative 1 and Build Alternative 2 volumes during the peak hours. They are also 240 to 260 vph higher than the corresponding volumes under the No-Build Alternative.

Build Alternative 3 tends to have the lowest peak hour volumes along PA 452. Compared to Build Alternative 2, westbound PA 452 volumes are generally 50 to 90 vph lower during both the AM and PM peak hours. They are also 120 to 130 vph lower than the corresponding No-Build Alternative volumes. Figure 17 provides the 2034 AM and PM peak hour traffic forecasts under Build Alternative 3.

# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 15A. 2034 Build Alternative 1 AM / PM Peak Hour Traffic Volumes




I-95 / US 322 INTERCHANGE
TRAFFIC STUDY
Figure 15B. 2034 Build Alternative 1
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
CHESTER
UPPER
CHICHESTER
Upland
CHESTER CITY
Trainer
BETHEL RD
US 322
I-95
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
SOUTHBOUND
NORTHBOUND
Relocated I-95 Northbound
Proposed Collector - Distributor Road
Proposed Ramps
160 / 210 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional
Planning Commission
March 2008
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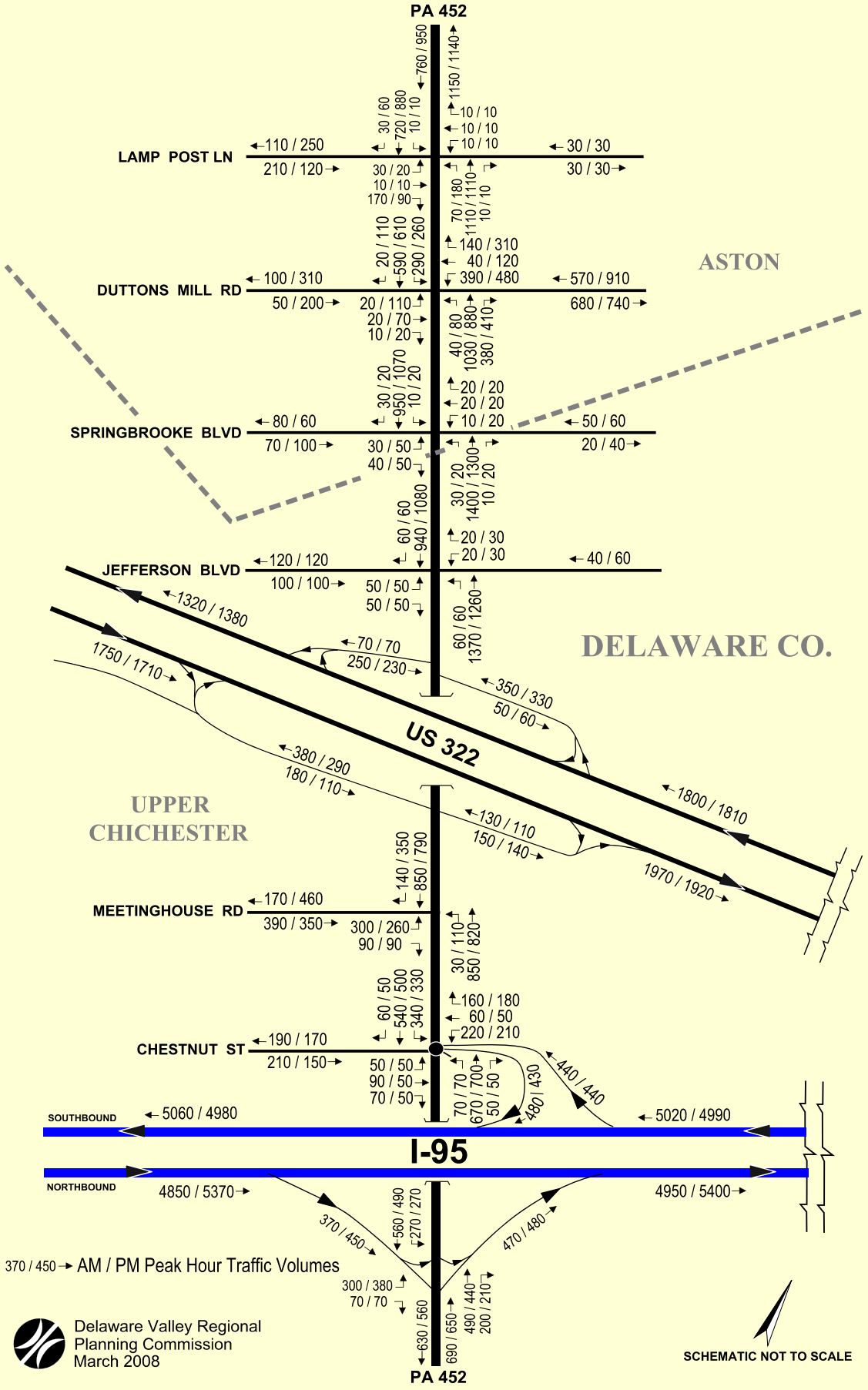
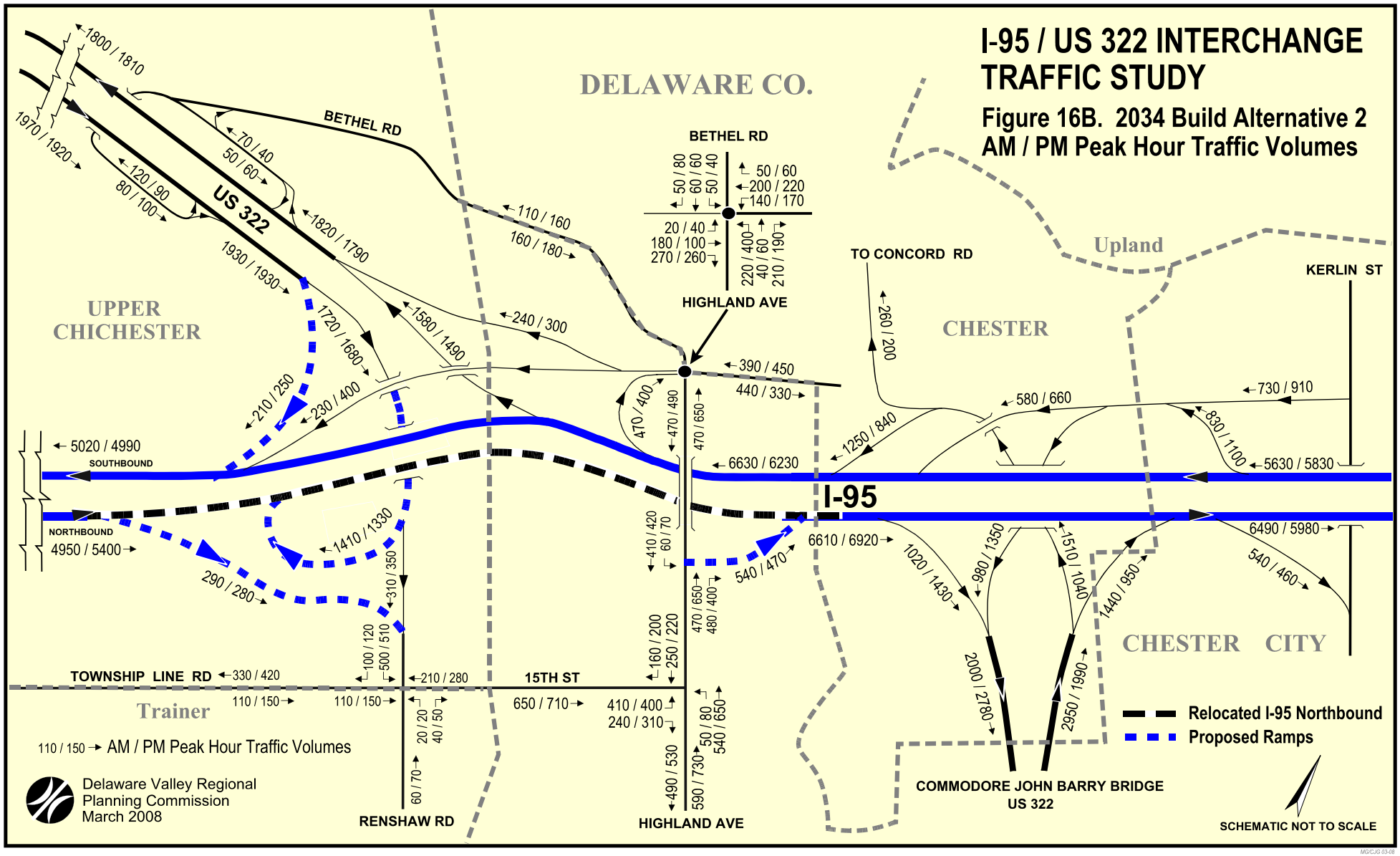
# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 16A. 2034 Build Alternative 2 AM / PM Peak Hour Traffic Volumes




I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 16B. 2034 Build Alternative 2
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Upland
CHESTER
CHESTER CITY
Trainer
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
US 322
I-95
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
1800 / 1810
1970 / 1920
70 / 40
50 / 60
120 / 90
80 / 100
1820 / 1790
1930 / 1930
110 / 160
160 / 180
50 / 80
60 / 60
50 / 40
50 / 60
200 / 220
140 / 170
20 / 40
180 / 100
270 / 260
220 / 400
40 / 60
210 / 190
1720 / 1680
1580 / 1490
240 / 300
390 / 450
440 / 330
210 / 250
230 / 400
470 / 400
470 / 490
470 / 650
290 / 200
580 / 660
730 / 910
1250 / 840
830 / 1100
5020 / 4990
6630 / 6230
5630 / 5830
4950 / 5400
1410 / 1330
290 / 280
310 / 350
410 / 420
60 / 70
540 / 470
6610 / 6920
1020 / 1430
980 / 1350
1510 / 1040
1440 / 950
6490 / 5980
540 / 460
100 / 120
500 / 510
330 / 420
210 / 280
160 / 200
250 / 220
470 / 650
480 / 400
2000 / 2780
2950 / 1990
110 / 150
110 / 150
650 / 710
410 / 400
240 / 310
20 / 20
40 / 50
60 / 70
490 / 530
590 / 730
50 / 80
540 / 650
110 / 150 → AM / PM Peak Hour Traffic Volumes
Relocated I-95 Northbound
Proposed Ramps
Delaware Valley Regional Planning Commission
March 2008
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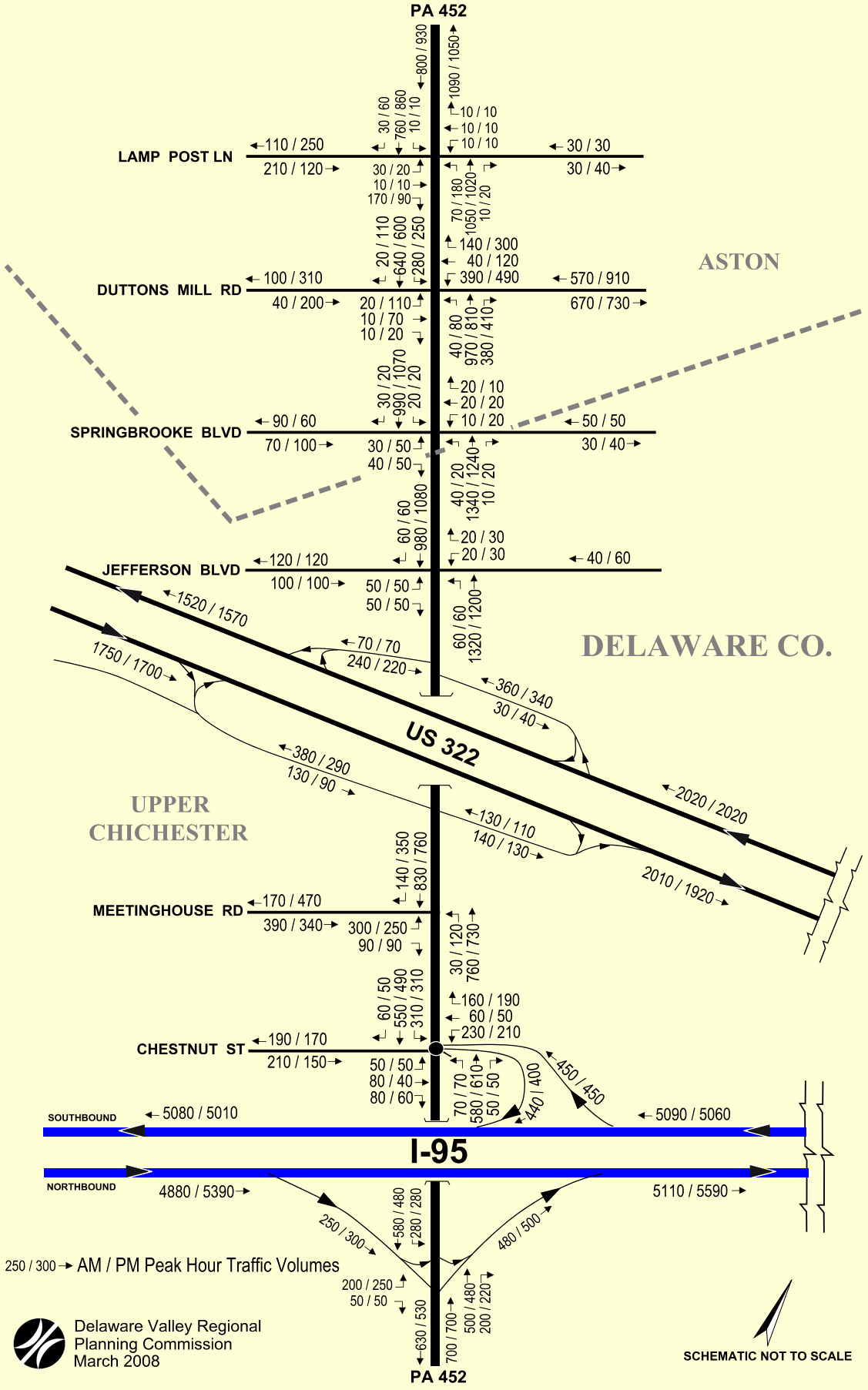
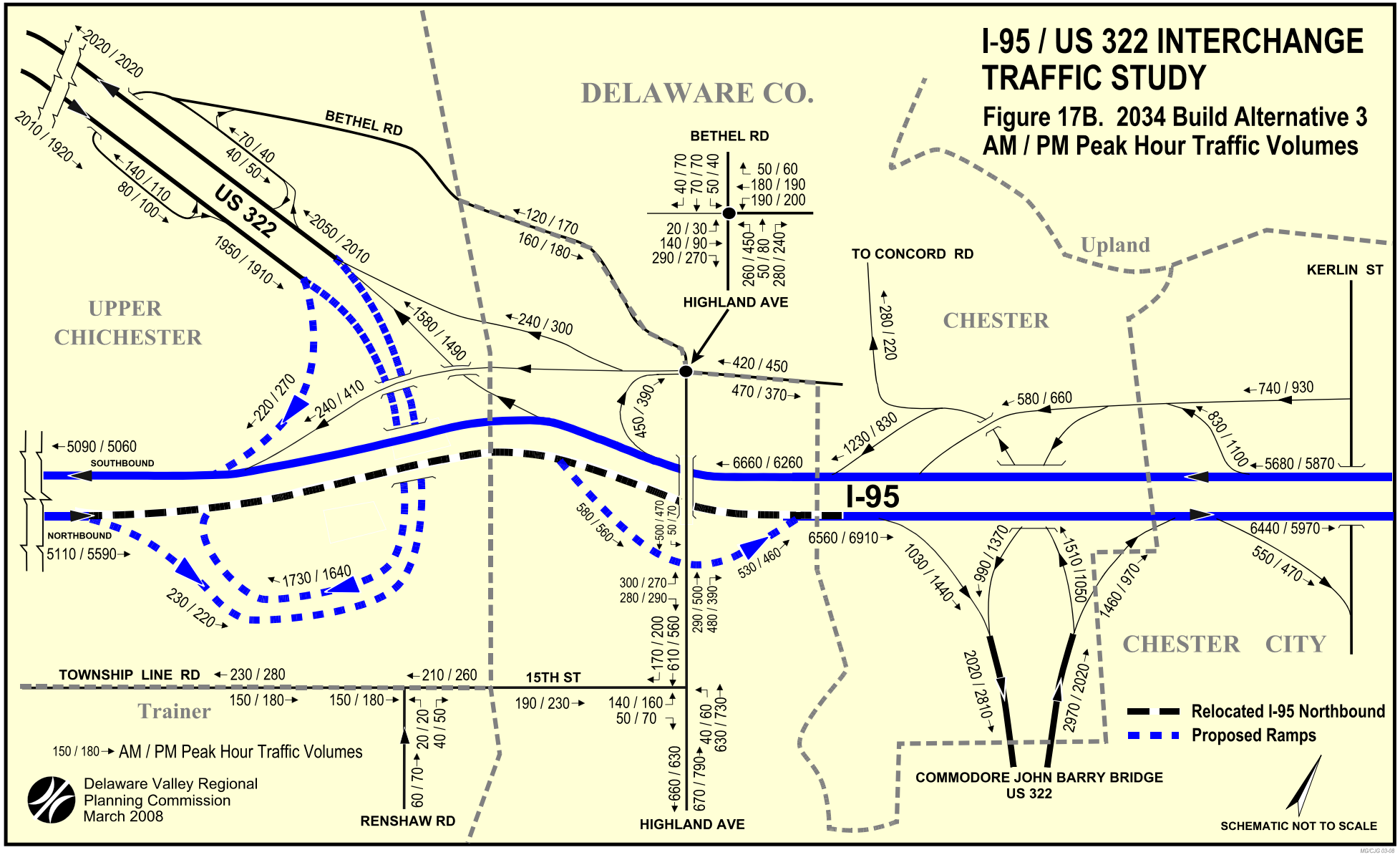
# I-95 / US 322 INTERCHANGE TRAFFIC STUDY

## Figure 17A. 2034 Build Alternative 3 AM / PM Peak Hour Traffic Volumes




I-95 / US 322 INTERCHANGE TRAFFIC STUDY
Figure 17B. 2034 Build Alternative 3
AM / PM Peak Hour Traffic Volumes
DELAWARE CO.
UPPER CHICHESTER
Upland
CHESTER
CHESTER CITY
Trainer
BETHEL RD
HIGHLAND AVE
TO CONCORD RD
KERLIN ST
US 322
I-95
SOUTHBOUND
NORTHBOUND
TOWNSHIP LINE RD
15TH ST
RENSHAW RD
COMMODORE JOHN BARRY BRIDGE
US 322
Relocated I-95 Northbound
Proposed Ramps
150 / 180 → AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
March 2008
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# VI. CONCLUSIONS

The I-95 / US 322 Interchange traffic study supports an interchange reconstruction project that is intended to increase safety and improve the flow of traffic through the interchange. This project will address a major weaving movement across three lanes of I-95 traffic. Currently, US 322 eastbound merges with the left-most lane of I-95 northbound at Exit 3, and continues towards the Commodore Barry Bridge via a right-side off-ramp at Exit 4. Because of the close proximity of Exits 3 and 4, this weaving movement often causes conflicts with through traffic that result in traffic backups and compromises safety. Other issues to be addressed include substandard acceleration and deceleration lanes and the lack of a connection from US 322 eastbound to I-95 southbound.

Traffic volumes along I-95 in this area range from 110,200 to 145,900 vehicles per day (vpd). US 322 volumes west of I-95 range from 27,600 to 33,400 vpd. East of I-95, as it approaches the Commodore Barry Bridge, US 322 carries a slightly higher volume of 35,400 vpd. The next highest volume facility in the study area is PA 452, which carries between 16,800 and 23,600 vpd.

By 2034, if no improvements are made to the interchange, volumes on I-95 in the study area will range from 126,300 to 172,400 vpd, representing increases of 14.6 to 18.2 percent over current levels. South of the I-95 / US 322 interchange, daily volumes are forecast to be 16,100 to 17,200 vpd higher than current volumes. Just north of the interchange, No-Build volumes will be 26,500 vpd higher than existing volumes. And further north of the Commodore Barry Bridge interchange at Exit 4, 2034 No-Build volumes will be 22,500 to 23,800 vpd higher than current volumes.

To address the existing deficiencies and to accommodate future growth in traffic volumes, three Build Alternatives have been proposed. These Build alternatives take different approaches to eliminate the US 322 eastbound weave, but all three provide for a right-side merge onto I-95 northbound. All three Build alternatives also include a new connection from US 322 eastbound to I-95 southbound and provide for some minor I-95 widening through the interchange area. In addition, Build Alternative 3 includes a new ramp from I-95 northbound to US 322 westbound.

The additional capacity along I-95 provided by the various Build alternatives will reduce conflicts and delays associated with merging and weaving traffic throughout the interchange area. This additional capacity does not, however, attract or divert a large number of new trips onto this section of I-95. Along I-95, average daily traffic volumes under the No-Build and all three Build alternatives differ by less than 1,000 vpd at all locations except between PA 452 and US 322. Volumes at this location are affected by the new ramp(s) between US 322 and I-95.

The proposed ramp from US 322 eastbound to I-95 southbound carries 2,700 to 2,900 vpd in 2034 under the Build alternatives. The proposed ramp from I-95 northbound to US 322 westbound in Build Alternative 3 also carries 2,900 vpd in 2034.

Traffic volumes along US 322 in 2034 under the various Build alternatives are higher than the No-Build Alternative volume at study area locations west of I-95. Build Alternative volumes are 3,100 to 5,700 vpd higher than the comparable No-Build Alternative volumes. However, PA 452 volumes are lower under the Build alternatives than under the No-Build Alternative. In 2034, these reductions range from 900 to 2,000 vpd. The greatest reductions occur under Build Alternative 3 and the smallest occur under Build Alternative 1.

These changes in daily traffic volumes translate into corresponding changes in peak hour volumes. That is, there will be large increases in AM and PM peak hour traffic volumes in 2034 compared to current conditions. There will not, however, be significant differences in peak hour traffic volumes between No-Build and Build conditions, or between the various Build alternatives.

# I-95 / US 322 Interchange Traffic Study

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**Geographic Area Covered:** The municipalities of Aston Township, Bethel Township, Brookhaven Borough, Chester City, Chester Township, Eddystone Borough, Lower Chichester Township, Marcus Hook Borough, Parkside Borough, Trainer Borough, Upland Borough, and Upper Chichester Township in Delaware County, Pennsylvania.

**Key Words:** I-95, US 322, Traffic Forecasts, Travel Simulation, AADT, Peak Hour Volumes, Intersection Turning Movements.

## ABSTRACT

This report documents 2014 and 2034 traffic forecasts for the I-95 / US 322 Interchange and surrounding area in Delaware County. Average daily and AM and PM peak hour forecasts are provided for a No-Build and three Build alternatives and compared to current volumes.

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