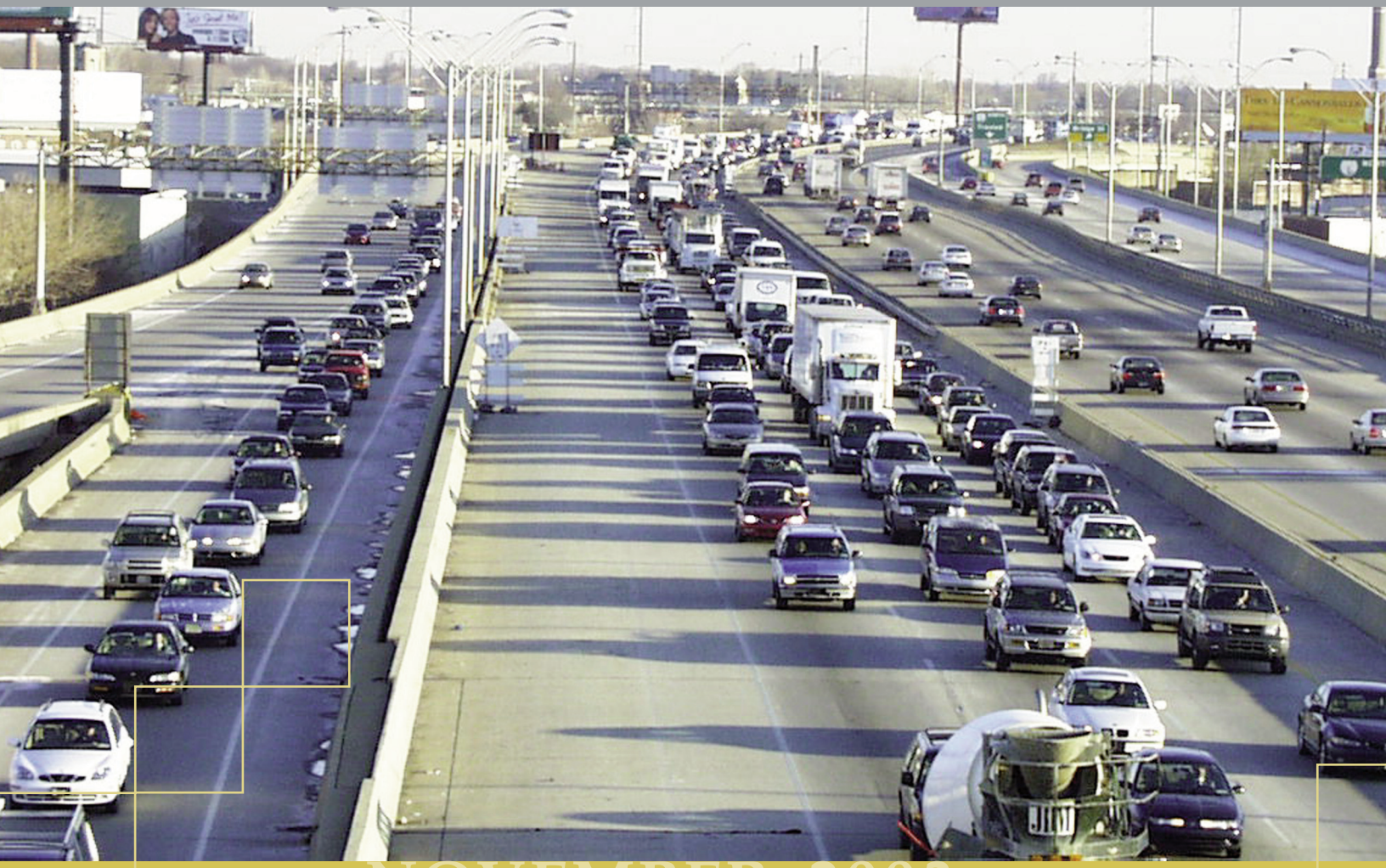
I-95 Interchange Enhancement and Reconstruction

I-95 BETSY ROSS BRIDGE / BRIDGE STREET INTERCHANGE (SECTIONS BRI / BSR) TRAFFIC STUDY



NOVEMBER 2003

Prepared for Pennsylvania Department of Transportation by

Delaware Valley Regional Planning Commission

PENNDOT

I-95 BETSY ROSS BRIDGE / BRIDGE STREET INTERCHANGE (SECTIONS BRI/BSR) TRAFFIC STUDY

November 2003

Prepared for
Pennsylvania Department of Transportation
By
Delaware Valley Regional Planning Commission
The Bourse Building
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Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency that 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. This report was primarily funded by the Pennsylvania Department of Transportation and the Federal Highway Administration (FHWA). 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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EXECUTIVE SUMMARY

This report summarizes traffic forecasts for a base case and three build alternatives for the I-95 Betsy Ross Bridge/Bridge Street Interchange complex (I-95 Sections BRI and BSR) in Northeast Philadelphia. Because large portions of I-95 are being rehabilitated over the next several years, detailed studies of several of the interchanges are being conducted as a precursor to any changes. Average daily and peak hour traffic forecasts are prepared for each alternative for 2025.

The limits of the study area run from Castor Avenue, south of the Betsy Ross Bridge, to Levick Street near the Tacony Palmyra Bridge. In these sections, the alignment of I-95 is approximately northeast/southwest, but it generally follows the alignment of the Delaware River. Much of the main line of I-95 is elevated, and is located between the AMTRAK Northeast Corridor rail line to the west and the industrial activities that line the Delaware River to the east.

Four improvement alternatives were identified for this interchange, all of which involve construction: three "build" alternatives, and one base case alternative that preserved the current interchange configuration, except the I-95 main line is assumed to be widened to four lanes in each direction throughout and the Bridge Street southbound off-ramp is relocated from James Street to Tacony Street opposite Carver Street. For each alternative, DVRPC's regional travel simulation model was used to forecast future travel patterns. The model utilizes 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 study area and region.

Objectives for improvements, which guided the development of the build alternatives, included making improvements to safety and capacity on I-95; improving access to and from I-95; better signage; minimizing the traffic and truck impacts on local streets; minimizing the barrier effect of I-95 on the community; and implementing incident management technology.

Projected traffic volumes for selected highway links within the study area are presented and analyzed. Average daily traffic volumes and AM and PM peak-hour volumes at selected intersections are included for each alternative. The appendices to this report include current traffic counts of the various roadways and intersections examined in the study area.

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I. INTRODUCTION

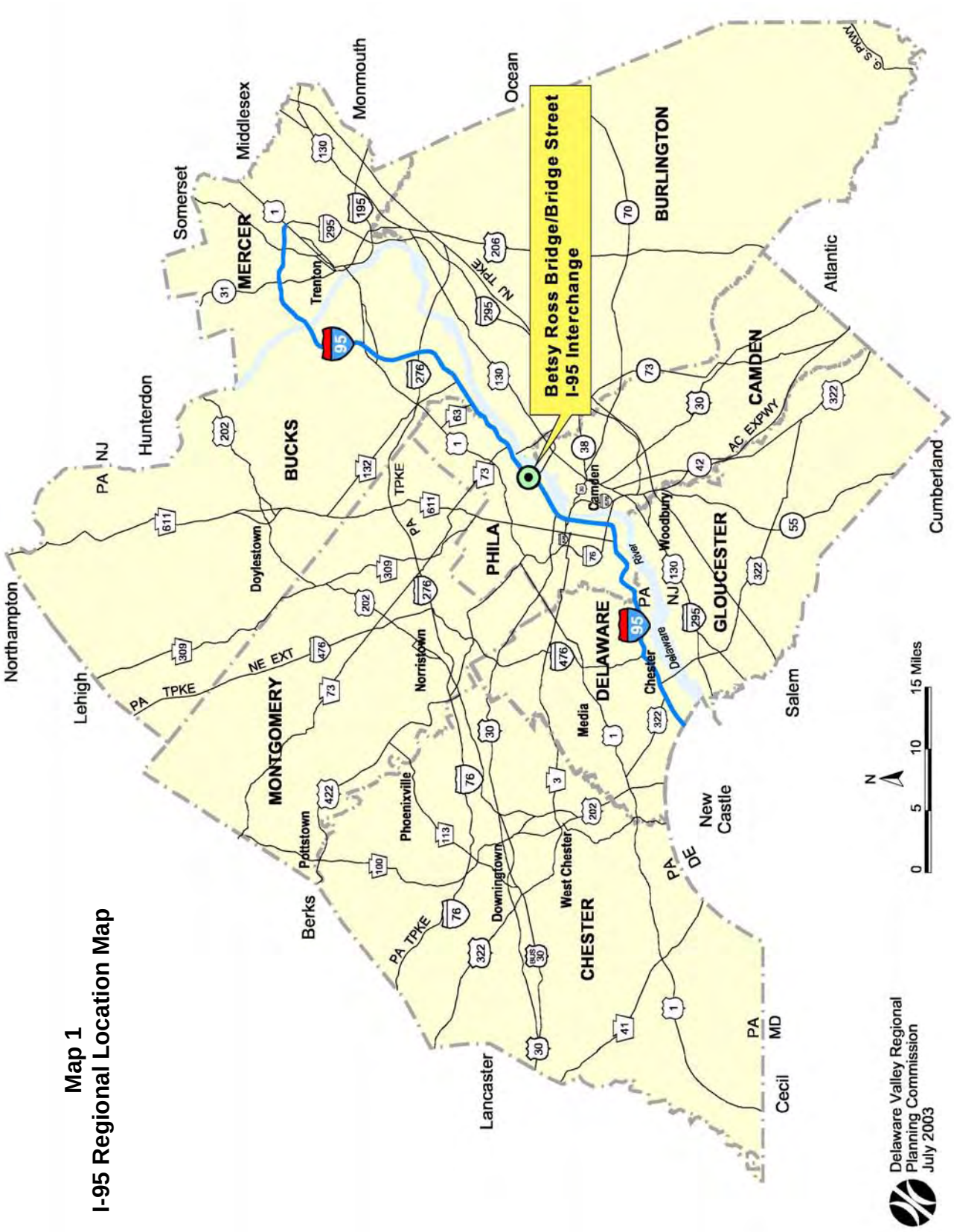
This report summarizes traffic forecasts for a base alternative and three different build alternatives for the Betsy Ross Bridge/Bridge Street Interchange complex (I-95 Sections BRI and BSR) in the Tacony/Bridesburg section of Northeast Philadelphia **(*maps 1 and 2*)**. It was prepared at the request of the Pennsylvania Department of Transportation (PennDOT) and its consultants, who are conducting a point of access study for the interchange area. Because large portions of I-95 are being rehabilitated over the next several years, detailed studies of several of the interchanges were conducted as a precursor to any changes. The forecasts in this report are prepared for 2025.

I-95 in Pennsylvania was constructed in sections beginning in the middle 1960s, and it was not until the 1990s that a continuous roadway between the state of Delaware and New Jersey boundaries was available to travelers. 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-476 becomes a spur heading northwest toward the Pennsylvania Turnpike interchange in Plymouth Meeting. I-95, which is at-grade to this point, continues past the Philadelphia International Airport, where it enters the City of Philadelphia.

Once past the airport, the highway becomes elevated, and passes the Philadelphia stadium complex, the Walt Whitman Bridge, and the Penn's Landing areas. The section within Center City is depressed until just south of the Benjamin Franklin Bridge where it emerges to become elevated once again. The highway remains elevated until well north of the study area, giving access to the various port-related industrial and commercial activities, which are the traditional land uses along the Delaware River, as well as to adjacent residential areas. North of Pennypack Creek, I-95 returns to an at-grade alignment and continues at-grade through the residential and commercial areas of Philadelphia and Bucks County until it crosses over the Delaware River out of Pennsylvania at the Scudders Falls Bridge northwest of Trenton, New Jersey.

In recent years, pavement, bridges, and overpasses have begun to deteriorate, and beginning in 2000 PennDOT began a four-phase series of repairs of I-95 from Center City Philadelphia northward into Bucks County. Planned projects include rebuilding numerous bridges; expanding the Intelligent Transportation System (ITS) by installing closed-circuit TV cameras, dynamic message signs, and microwave sensors; and upgrading the following interchanges:

- I-676 (Vine Expressway)
- Girard Avenue
- Allegheny/Castor Avenue
- Betsy Ross Bridge
- Bridge Street
- Cottman (PA 73)/Princeton Avenue, and
- PA 132 (Street Road)



Map 1
I-95 Regional Location Map

Map 2. I-95 Betsy Ross Bridge / Bridge Street Interchange (Sections BRI/BSR) Study Area

Delaware Valley Regional Planning Commission
July 2003

This report focuses on the Betsy Ross Bridge (BRI) and Bridge Street (BSR) study areas. Approaching this study area from the north, I-95 is a four-lane-by-direction limited access highway. South of the Betsy Ross Bridge/Bridge Street Interchange complex, I-95 has four lanes by direction. Within the interchange complex, I-95 in both the northbound (NB) and southbound (SB) directions, is separated into inner and outer collector distributer roadways. Three center lanes accommodate traffic passing entirely through the BRI Interchange complex, while the outer lanes accommodate traffic movements associated with the Harbison/Aramingo avenues I-95 NB off and SB on-ramps, and traffic to and from the Betsy Ross Bridge. The build alternative options tested in this study are focused on eliminating congestion in the outer lanes resulting from weaving movement conflicts between I-95 and Betsy Ross Bridge traffic, and the multiple merges of Harbison Avenue and bridge traffic onto the I-95 main line. An examination of today's conditions indicates that current traffic flow is severely impacted by these weaving and merge movements, especially during peak flow periods.

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.

Chapter II of this report documents the physical characteristics of the study area. Included are a description of the land uses and surrounding roadway network, along with a discussion of current traffic volumes and levels of service. The four alternatives of the study are described in detail in Chapter III. Chapter IV explains the travel forecasting methodology, with a brief discussion of the focused traffic simulation model used to develop the traffic projections. The regional demographic and employment forecasts and corridor-specific future development proposals, which form the basis for the forecasts, are also presented in this chapter. Chapter V presents an analysis of the travel forecasts for this interchange complex. The forecasts represent projected 2025 daily traffic volumes for I-95, and the adjacent ramps and surrounding roadways, under three build and one base case alternatives. The appendices contain current traffic counts and intersection turning movements.

II. DESCRIPTION OF THE I-95 BETSY ROSS BRIDGE / BRIDGE STREET INTERCHANGE AREA

The limits of the study area run from Castor Avenue northward to Levick Street, and from the Delaware River westward to Frankford Avenue in Northeast Philadelphia. In this section, the alignment of I-95 is approximately northeast/southwest, and generally follows the Delaware River. The main line of the highway is elevated, and is located between the AMTRAK Northeast Corridor rail line to the west and the industrial activities that line the Delaware River to the east.

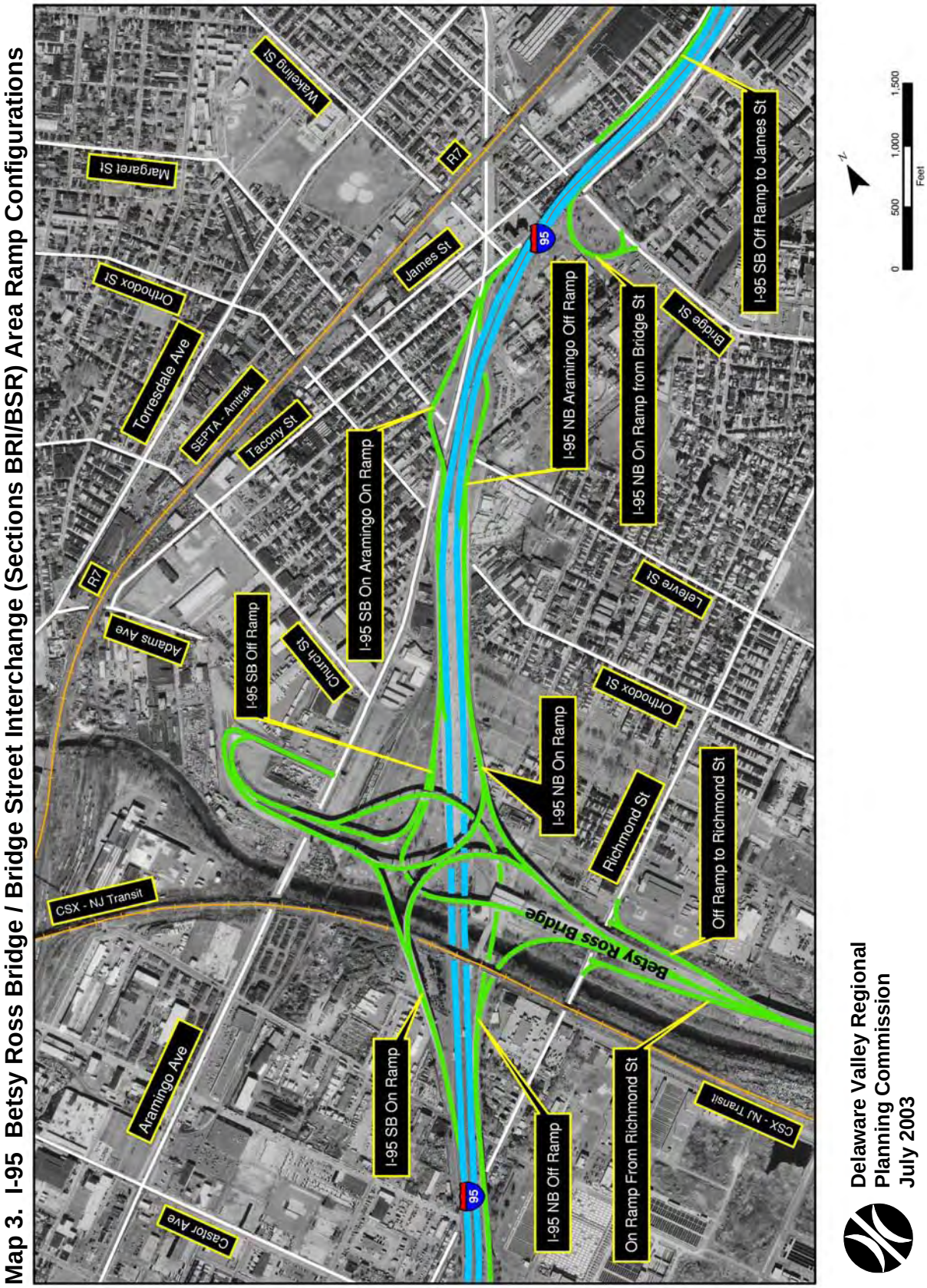
A. Existing Highway Facilities and Land Use

The Betsy Ross Bridge (BRI) and Bridge Street (BSR) Interchange complex stretches from the I-95 James Street southbound off-ramp to the Betsy Ross Bridge/Aramingo Avenue northbound off-ramp-an approximate distance of 2.4 miles. The adjacent I-95 interchanges are located at Princeton/Cottman Avenue (PA 73) at an approximate distance of 2 miles to the north and Allegheny Avenue at an approximate distance 0.5 miles to the south. The main line of I-95 is limited-access, four lanes by direction approaching and departing the interchange, with six lanes by direction within the interchange complex. With the original construction of I-95, all traffic movements between I-95 and the Betsy Ross Bridge are contained within the outer lanes of I-95, just north of the bridge approach roadway **(*see map 3*)**. These outer roadways are also used to provide access to I-95 and the Betsy Ross Bridge from the greater Richmond, Juniata Park, Frankford, Bridesburg, and Wissinoming sections of lower Northeast Philadelphia. This neighborhood access is provided through ramps serving Aramingo Avenue on the Center City side of the interchange and a duplicate complex of ramps serving Harbison Avenue and Bridge Street on the northeast. Betsy Ross Bridge access ramps to and from Richmond Street are also provided, but these ramps do not provide connections to I-95. In addition to Harbison and Aramingo avenues and Richmond and Bridge streets, major arterial streets impacted by the design options include Torresdale Avenue and Tacony Street parallel to I-95 and Orthodox, and Lefevre/Margaret and Bridge streets perpendicular to the expressway.

Land uses within the study area tend to be predominately residential and light commercial on the western side of I-95 and heavy industrial to the east, particularly between Richmond Street and the Delaware River. These land uses tend to occur at high density with row homes predominate in residential neighborhoods. Industrial/commercial land uses in the study area generate high volumes of truck traffic, much of which is destined for I-95.

B. Existing Traffic Volumes

While there has been little new development in the study area since this section of I-95 opened, intensive development has taken place in the greater Northeast, Center City Philadelphia**,** Bucks County, Montgomery County, and New Jersey, which has generated significant additional traffic volumes at this interchange complex. Also, during the same time, main line volumes on I-95 have increased significantly because of development throughout the region. When these factors are added to the general overall increase in regional traffic volumes, capacity on the interchange complex, access ramps, and surrounding street system is severely taxed.


Map 3. I-95 Betsy Ross Bridge / Bridge Street Interchange (Sections BRI/BSR) Area Ramp Configurations
Wakeling St
Margaret St
Orthodox St
Torresdale Ave
SEPTA - Amtrak
Tacony St
R7
James St
95
I-95 SB Off Ramp to James St
Bridge St
I-95 NB Aramingo Off Ramp
I-95 NB On Ramp from Bridge St
I-95 SB On Aramingo On Ramp
Adams Ave
I-95 SB Off Ramp
Church St
Lefevre St
Orthodox St
I-95 NB On Ramp
Richmond St
Off Ramp to Richmond St
CSX - NJ Transit
Betsy Ross Bridge
Aramingo Ave
I-95 SB On Ramp
I-95 NB Off Ramp
On Ramp From Richmond St
Castor Ave
CSX - NJ Transit
0
500
1,000
1,500
Feet
Delaware Valley Regional
Planning Commission
July 2003

Traffic counts were collected on main line I-95, the bridge interchange roadways, and local access ramps within the interchange complex, as well as on impacted arterials and local roads within the study area including: Aramingo, Harbison, and Torresdale avenues; Richmond, Tacony, Orthodox, Lefevre/Margaret, Wakeling, James, Bridge, Van Kirk, and Comly streets. Current Annual Average Daily Traffic Volumes (AADT) are shown in ***figure 1***. Detailed traffic counts for all locations, including hourly counts and turning movements, are included in the two appendices to this report.

On the main line of I-95, 75,900 vehicles currently approach the interchange from the north and 74,300 depart the interchange to the north during an average day. On the southern side of the interchange, the corresponding volumes are 93,000 vehicles per day (vpd) departing to the south and 84,800 vpd arriving from the south. The interchange complex adds 17,100 vpd to I-95 SB and removes 10,500 vpd from NB I-95 traffic volumes. This puts considerable additional pressure on I-95 on the Center City side of the interchange complex and creates traffic congestion on I-95, resulting from weave movements in the outer roadways and merging traffic volumes onto the expressway. I-95 traffic also creates congestion on neighborhood streets, particularly on Aramingo and Harbison avenues, which function as principal arterials. I-95 traffic creates significant cut-through movements onto local, residential streets in the study area.

Current study area traffic count volumes along the adjacent north-south roadways (parallel to I-95) range from a high of 33,100 on Harbison Avenue between Bridge and Wakeling streets to a low of 6,200 vpd on Tacony Street between Church and Orthodox streets. Aramingo Avenue also carries very high traffic volumes (29,300 and 25,500 vpd), especially in the vicinity of the I-95 access ramp opposite the Betsy Ross Bridge approach highway. Other heavily traveled roadway segments in the area include Torresdale Avenue (10,300 to 21,400 vpd), Tacony Street (6,200 to 21,000 vpd), Richmond Street (6,700 to 15,600 vpd), and Bridge Street (6,400 to 11,000 vpd). These roads also function as major arterials. Local streets in the study area tend to run perpendicular to I-95. These include Church Street (6,300 vpd), Orthodox Street (3,700 vpd), Margaret Street (2,000 to 6,400 vpd), Van Kirk Street (2,300 vpd), and Comly Street (4,600 vpd).

It should also be noted that significant peak hour volumes have been recorded at many street intersections within the study area **(*see figure 2*)**. Manual AM and PM peak hour turning movement counts were collected at twenty-four intersections within the study area along Aramingo Avenue at the I-95/Betsy Ross Bridge ramps, Church Street, Orthodox Street, Margaret Street; along Harbison Avenue at Tacony, Wakeling, and Bridge streets; along Torresdale Avenue at Harbison Avenue, Bridge, Wakeling, Margaret, Orthodox, Church streets; and at Adams Avenue. Also Tacony Street at Church, Orthodox, Margaret streets, Aramingo Avenue, Bridge, Van Kirk, and Comly streets. Richmond Street at the Betsy Ross Bridge ramps, Orthodox, Lefevre streets, and finally Bridge Street at the I-95 NB on-ramp. Current AM and PM peak hour turning movement volumes are shown in figure 2 and current AM and PM peak hour ramp volumes in ***figure 3***.

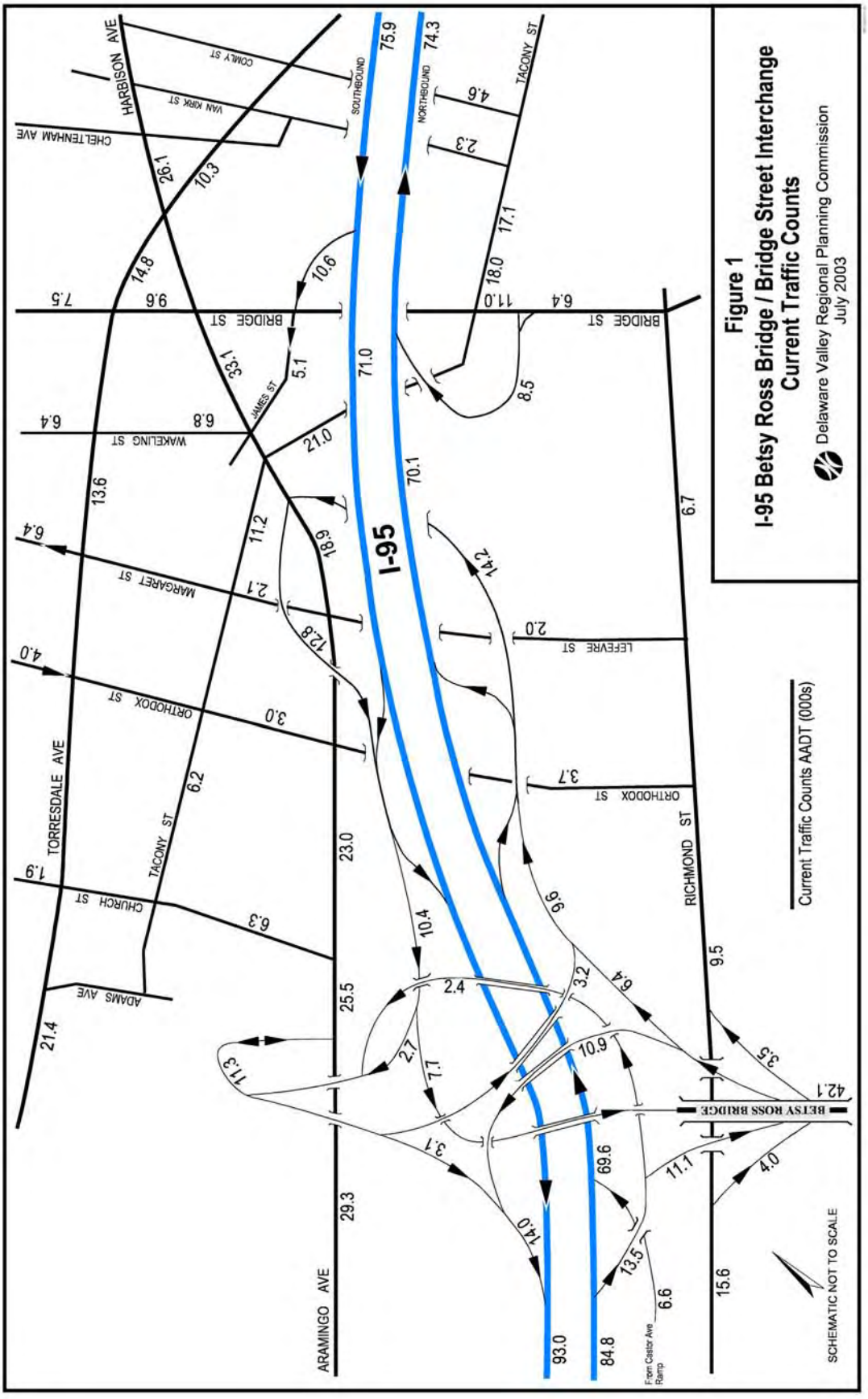


Figure 1
I-95 Betsy Ross Bridge / Bridge Street Interchange
Current Traffic Counts
Delaware Valley Regional Planning Commission
July 2003
Current Traffic Counts AADT (000s)
SCHEMATIC NOT TO SCALE
I-95
SOUTHBOUND
NORTHBOUND
BRIDGE ST
HARRISON AVE
CHELTENHAM AVE
COMLY ST
VAN KIRK ST
JAMES ST
WAKELING ST
MARGARET ST
ORTHODOX ST
LEFEVRE ST
TACONY ST
TORRESDALE AVE
CHURCH ST
ADAMS AVE
ARAMINGO AVE
RICHMOND ST
BETSY ROSS BRIDGE
From Castor Ave Ramp

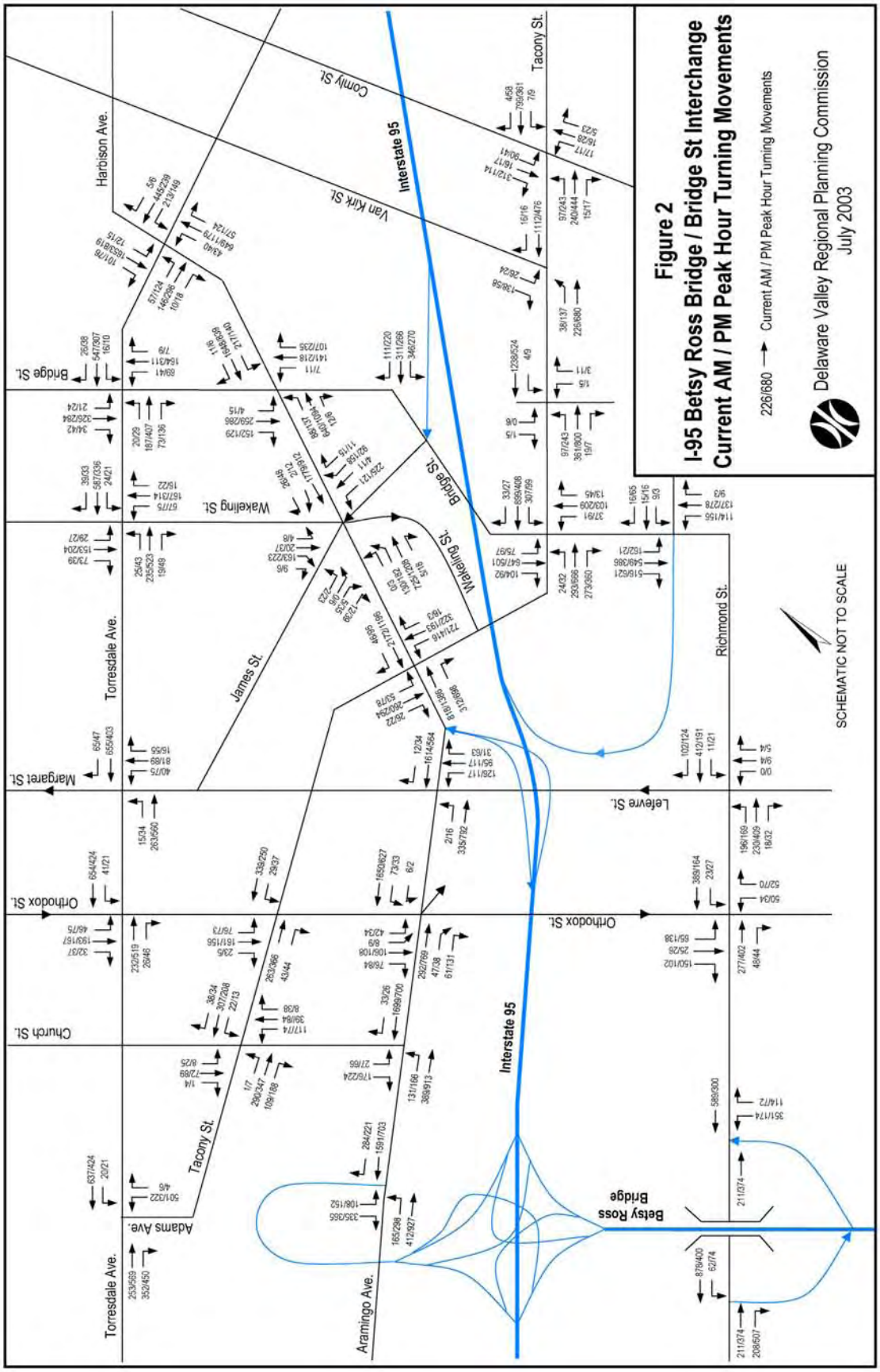


Figure 2
I-95 Betsy Ross Bridge / Bridge St Interchange
Current AM / PM Peak Hour Turning Movements
226/680 → Current AM / PM Peak Hour Turning Movements
Delaware Valley Regional Planning Commission
July 2003
SCHEMATIC NOT TO SCALE
Interstate 95
Bridge St.
Wakeling St.
James St.
Torresdale Ave.
Margaret St.
Orthodox St.
Church St.
Adams Ave.
Tacony St.
Aramingo Ave.
Betsy Ross Bridge
Lefevre St.
Richmond St.
Van Kirk St.
Comly St.
Harbison Ave.

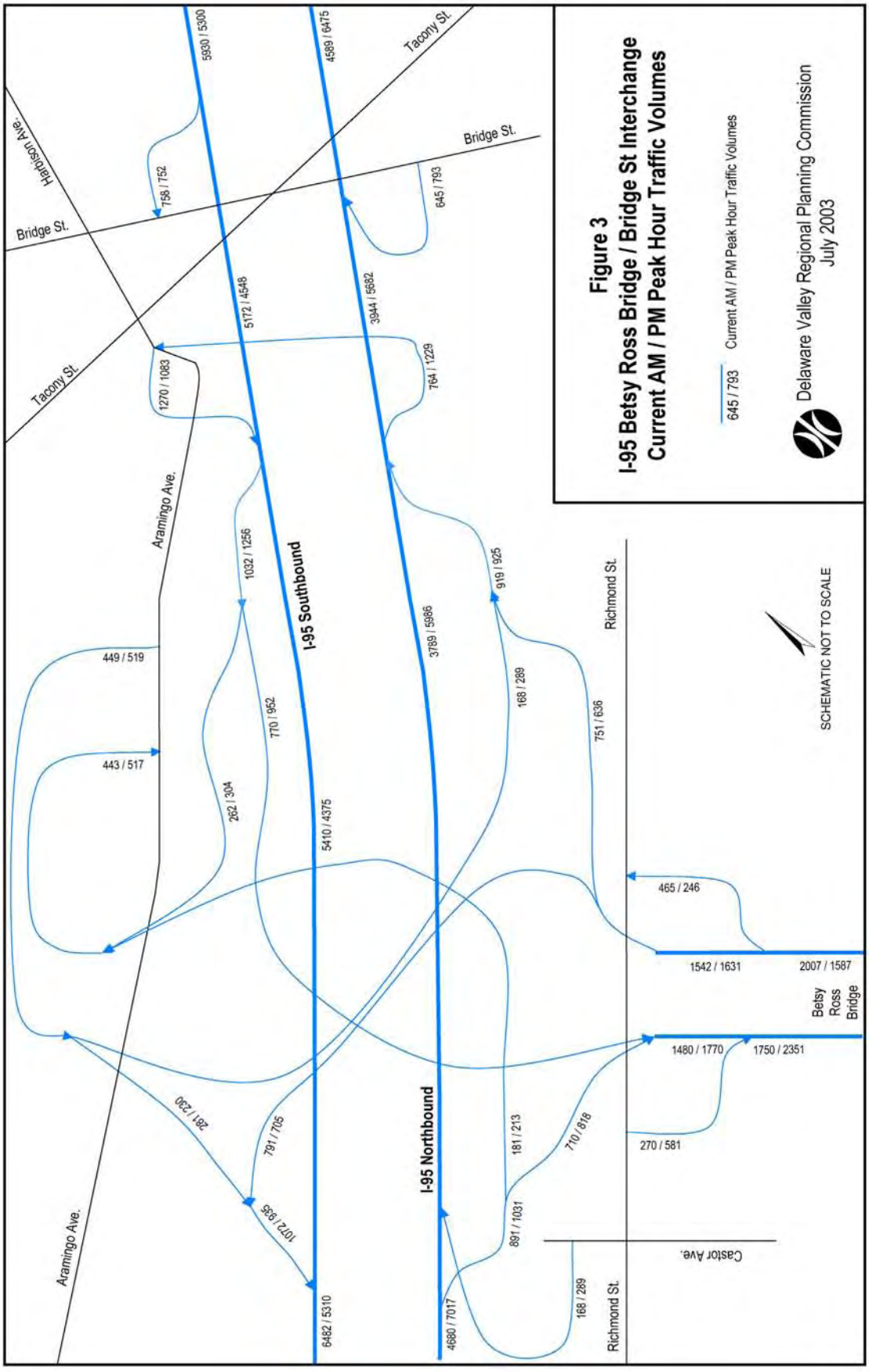


Figure 3
I-95 Betsy Ross Bridge / Bridge St Interchange
Current AM / PM Peak Hour Traffic Volumes
645 / 793 Current AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
SCHEMATIC NOT TO SCALE
I-95 Southbound
I-95 Northbound
Tacony St.
Bridge St.
Hartison Ave.
Aramingo Ave.
Richmond St.
Castor Ave.
Betsy Ross Bridge
5930 / 5300
4589 / 6475
758 / 752
645 / 793
5172 / 4548
3944 / 5682
1270 / 1083
764 / 1229
1032 / 1256
919 / 925
3789 / 5986
449 / 519
443 / 517
770 / 952
168 / 289
751 / 636
262 / 304
5410 / 4375
465 / 246
1542 / 1631
2007 / 1587
1480 / 1770
1750 / 2351
270 / 581
710 / 818
181 / 213
891 / 1031
281 / 230
791 / 705
1072 / 935
6482 / 5310
4680 / 7017
168 / 289

Generally, the heaviest AM and PM peak hour traffic volumes are at the intersections along Aramingo and Harbison avenues as these principal arterials provide the main route of access to both southbound and northbound I-95 ramps. The heaviest intersecting movements occur at Tacony Street and Harbison Avenue, making this location critical for effective I-95 access. Heavy peak hour volumes also occur in the immediate vicinity of the other I-95 access ramps. This is a dense urban area with significant traffic volumes on the major roadways at most intersections.

The ramp to I-95 SB from Harbison carries 1,270 vehicles during the AM peak hour, and 1,083 during the PM peak, while the corresponding SB on-ramp from the Aramingo Connector carries 281 vehicles during the AM peak hour and 230 vehicles during the PM peak hour. Southbound, 758 vehicles exit I-95 at Bridge Street during the AM peak and 752 vehicles exit during the PM peak hour. The corresponding SB off-ramp at the Aramingo Connector carries 262 vehicles in the AM peak hour and 304 vehicles during the PM peak hour.

The NB I-95 on-ramp from the Aramingo Connector serves 168 and 289 vehicles in the AM and PM peak hours, respectively. The corresponding I-95 NB on-ramp volumes to and from Bridge Street are 645 and 793 vehicles in the AM and PM peak hours. NB off-ramp volumes to the Aramingo Connector are 181 and 213 vehicles per hour in the AM and PM peaks. The corresponding peak hour I-95 off-ramp counts at Harbison Avenue are 764 and 1,229 vehicles in the AM and PM peak hours.

Interchange volumes between I-95 and the Betsy Ross Bridge are roughly balanced both temporally and by direction. Between I-95 NB and the bridge there are 710 vehicles in the AM peak hour and 818 vehicles in the PM. Peak hour volumes between I-95 SB and the bridge are 770 during the AM peak and 952 during the PM peak. Corresponding traffic volumes between the bridge and I-95 SB are 791 and 704 in the AM and PM peak hours, respectively. Traffic volumes between the bridge and I-95 NB are 751 and 636 vehicles per hour in the AM and PM peaks, respectively.

As one would expect, Betsy Ross Bridge traffic to and from the Richmond Street ramps tend to be much less than I-95 because of the localized nature of the Richmond Street ramps. Westbound movements tend to be higher in the AM peak hour (465 vehicles versus 246 in the PM) and eastbound ramp traffic larger in the PM 581 versus 270 in the AM.

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III. IMPROVEMENT ALTERNATIVES

The project objectives that guided the development of the design alternatives included improving traffic flows on I-95 and the supporting arterial system in the study area by eliminating merge and weave disturbances. Congestion, noise, and air pollution impacts on the neighborhood are to be mitigated as much as possible. Also included are I-95 improvements to safety and capacity and improved access to and from I-95, including better signage, minimizing the traffic and truck impacts on local streets, and implementing incident management technology. In the alternatives tested in this study, the preferred ramp alternatives in I-95 sections Cottman/Princeton and Girard avenues are assumed. In Allegheny Avenue (section AFC) the existing ramp configuration was assumed.

Four improvement alternatives were identified for the Betsy Ross Bridge/Bridge Street interchanges; three construction, or "build" alternatives (design options), and one limited action, or "base case" alternative. The Alternative 1 (base case) includes provision of four through lanes on I-95 inner roadways throughout the interchange complex in both the north and southbound directions, as well as selected improvements to acceleration and deceleration lanes. In addition, for all alternatives, the I-95 Bridge Street SB off-ramp at James Street will be relocated to Tacony Street opposite Carver Street. Alternative 2 eliminates I-95 slip ramps from the southbound outer roadway and to the northbound outer roadway. Thus, all local traffic to I-95 southbound and from I-95 northbound is routed via the Aramingo Connector in this alternative. The current Betsy Ross Bridge ramp configurations remain the same as current conditions. Alternative 3A directs all local traffic movements onto the Aramingo Connector. This is achieved by removing the Aramingo Avenue ramps, eliminating the outer roadways, and adding direct ramps from the Aramingo Connector to the Betsy Ross Bridge. In addition, Aramingo Avenue is selectively widened to compensate for elimination of existing connections via the outer roadways. The most extensive improvements are under Alternative 3B, which includes all of Alternative 3A plus the Adams Avenue Extension. A more detailed description of the facility improvements included in each alternative follows:

A. Alternative 1 - Base Case

This base case alternative tests traffic flows in the study area assuming that the current I-95 access and merge lane configuration is retained through the outer lane portion of the interchange complex. However, to reroute ramp traffic out of the James Street neighborhood, the existing Bridge Street I-95 SB off-ramp **(*see figure 4*)** is eliminated and replaced by a new ramp approximately 2,000 feet further north, opposite Carver Street. The new ramp will be constructed, along with the necessary deceleration lanes, from the main line of I-95 to Tacony Street. After diverging from I-95, this ramp will be routed under I-95 via an existing underpass and end at an intersection with Tacony Street.

While improvement also increases the capacity on the main line of I-95 by widening the inner through portion to four lanes, it does not alleviate the congestion caused by the I-95 merges at

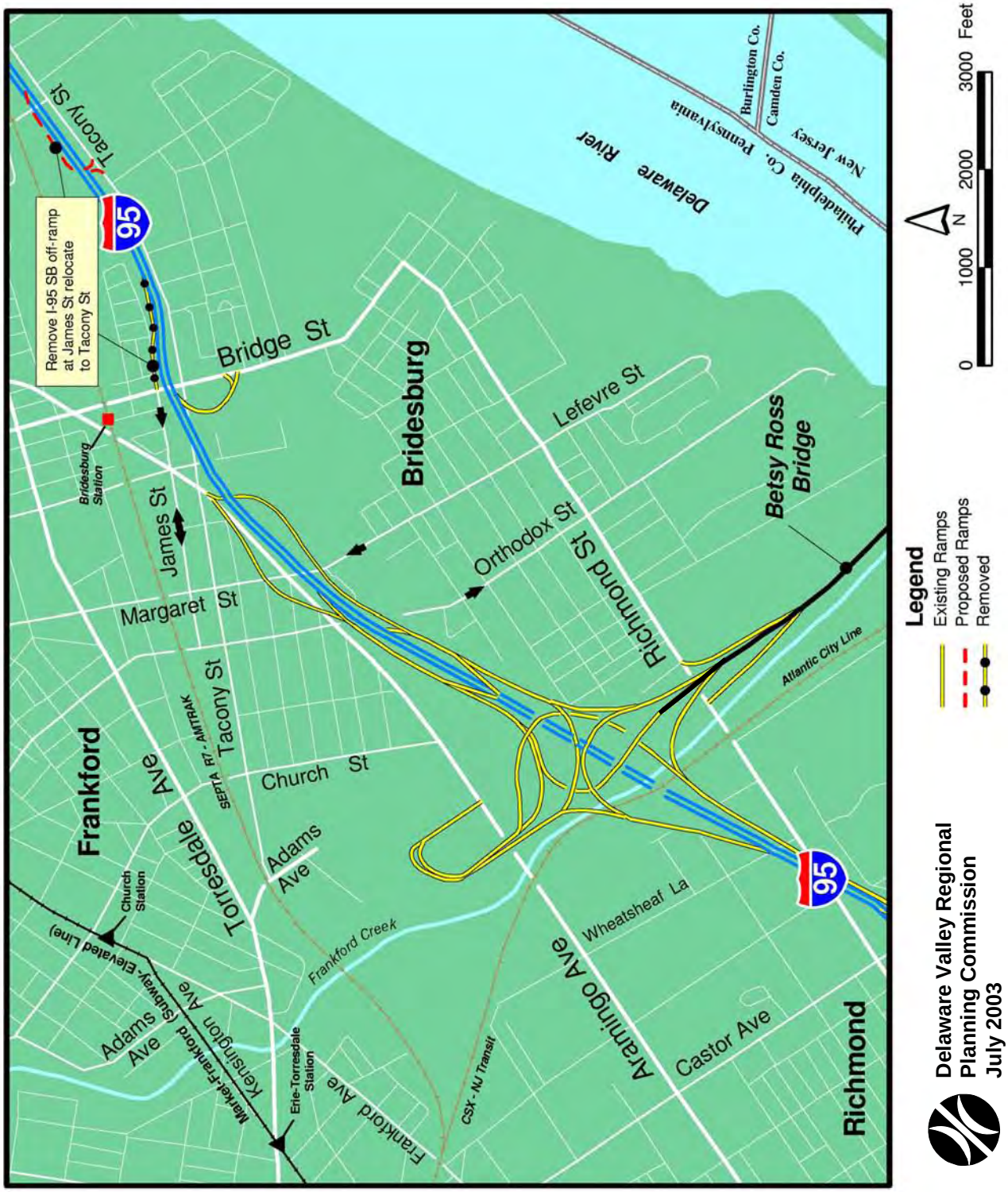

Figure 4. Alternative 1 – Base Case

the end of the outer lane segments, nor does it alleviate weaving movement and related congestion on Aramingo and Harbison avenues within the Harbison Avenue/I-95 on and off-ramps. Alternative 1 also includes the construction of significant study-area improvements along I-95 and Torresdale Avenue included in the DVRPC's Pennsylvania Transportation Improvement Program (TIP) and DVRPC's Year 2025 Transportation and Land Use Plan. An additional TIP project that may impact the study area includes the construction of the Pennsylvania Turnpike/I-95 interchange in Bucks County.

B. Alternative 2

This design option, shown in ***figure 5,*** does not include the proposed extension of the Betsy Ross Bridge approach road across I-95 to the Aramingo Avenue connector ramps. The I-95 outer lane roadways are retained to provide access from I-95 SB to the Betsy Ross Bridge and from the Betsy Ross to I-95 NB. However, the merge from the outer lanes to I-95 SB has been eliminated as has the diverge from I-95 NB to the outer lanes thereby diverting existing I-95 SB-on and I-95 NB-off traffic from/to Harbison/Bridge Street to the Aramingo Connector. In this alternative, the outer lanes function as approach ramps from the Betsy Ross Bridge to/from I-95 NB and SB and provide bridge access to Aramingo and Harbison avenues. The I-95 widening to four lanes and relocation of the Bridge Street SB off-ramp included in Alternative 1 are also included in Alternative 2.

Elements of Alternative 2 include:

- Construction of new north and southbound fourth lanes on I-95 to eliminate current lane drop design,
- Relocation of Bridge Street I-95 SB off-ramp from James Street to Tacony Street opposite Carver Street,
- Removal of the I-95 SB main line merge from the outer lanes, and
- Removal of the I-95 northbound main line slip ramps to the outer lanes.

C. Alternative 3A

Alternative 3A is a more comprehensive design option **(*see figure 6*)** and includes:

- Construction of new north and southbound fourth lanes on I-95 to eliminate current lane drop design,
- Relocation of I-95 Bridge Street SB off-ramp from James Street to Tacony Street opposite Carver Street,
- Completion of the Betsy Ross approach road across I-95 to provide direct connection between the bridge and Aramingo Avenue. Elimination of the NB off-ramp and SB on-ramp to/from Harbison Avenue,
- Elimination of the I-95 outer lanes and the accompanying I-95 NB and SB merges onto I-95 at the end of the outer lanes,
- Construction of new I-95 SB off and NB on-ramps to provide connection between the expressway, Betsy Ross Bridge, and Aramingo Avenue (these new ramps replace the existing bridge access via the I-95 outer lanes), and
- Widening Aramingo Avenue to six lanes (three by direction) from Tacony Street to the Aramingo Avenue I-95 connector ramps.

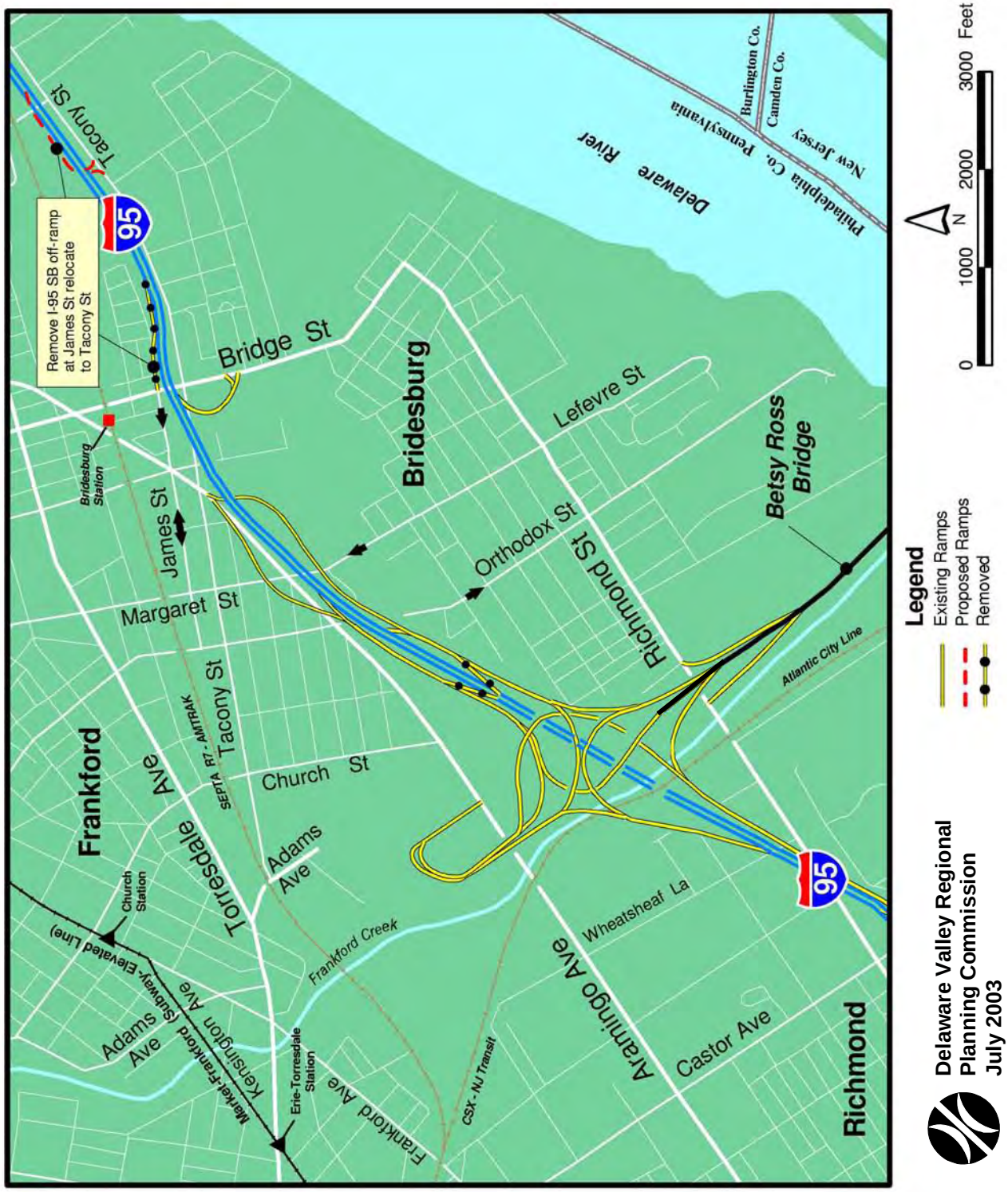

Figure 5. Alternative 2

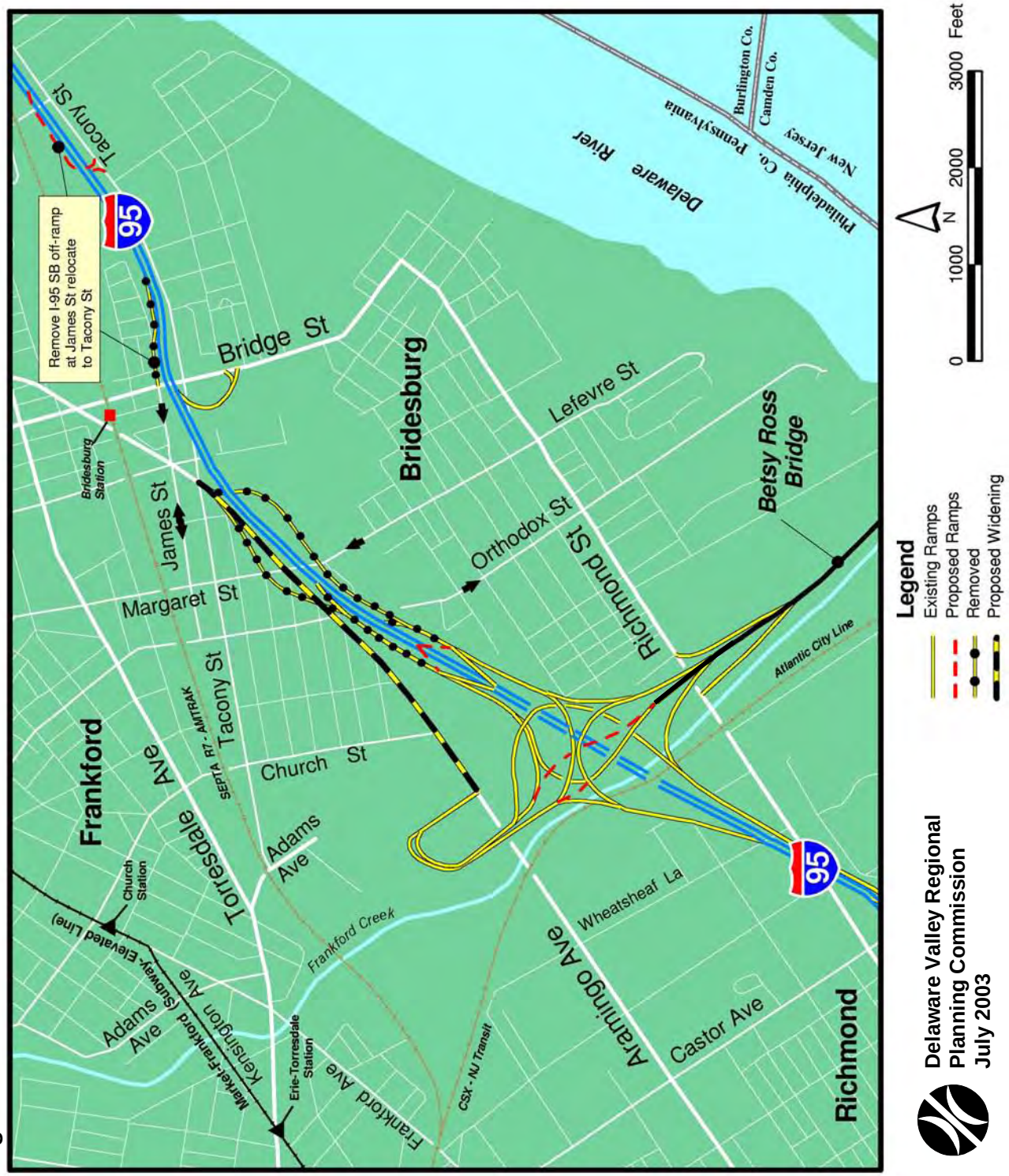

Figure 6. Alternative 3A

D. Alternative 3B

Alternative 3B is the most comprehensive of the design options proposed **(*see figure 7*)**. In addition to the projects in base case (Alternative 1) and Alternative 3A, this option includes the extension of the Aramingo Connector complex to Adams Avenue and redesignating Tacony Street as one-way westbound between Aramingo Avenue and Margaret Street.

Included in Alternative 3B are:

- Construction of new north and southbound fourth lanes on I-95 to eliminate current lane drop design,
- Relocation of I-95 Bridge Street SB off-ramp from James Street to Tacony Street opposite Carver Street,
- Completion of the Betsy Ross approach road across I-95 to provide direct connection between the bridge and Aramingo Avenue,
- Elimination of the NB off-ramp and SB on-ramp to/from Harbison Avenue,
- Elimination of the I-95 outer lanes and the accompanying I-95 NB and SB merges onto I-95 at the end of the outer lanes,
- Construction of new I-95 SB off and NB on-ramps to provide connection between the expressway, Betsy Ross Bridge, and Aramingo Avenue. (These new ramps replace the existing bridge access via the I-95 outer lanes),
- Widening Aramingo Avenue to six lanes (three by direction) from Tacony Street to the Aramingo Avenue I-95 connector ramps,
- Extension of the Aramingo Connector complex to Adams Avenue. (This extension is two-way and provides direct access to Aramingo Avenue as well as I-95 and the Betsy Ross Bridge), and
- Re-designate Tacony Street as one-way westbound between Aramingo Avenue and Margaret Street. (This revised traffic pattern will relieve congestion within the Tacony Street/Aramingo Avenue intersection.)

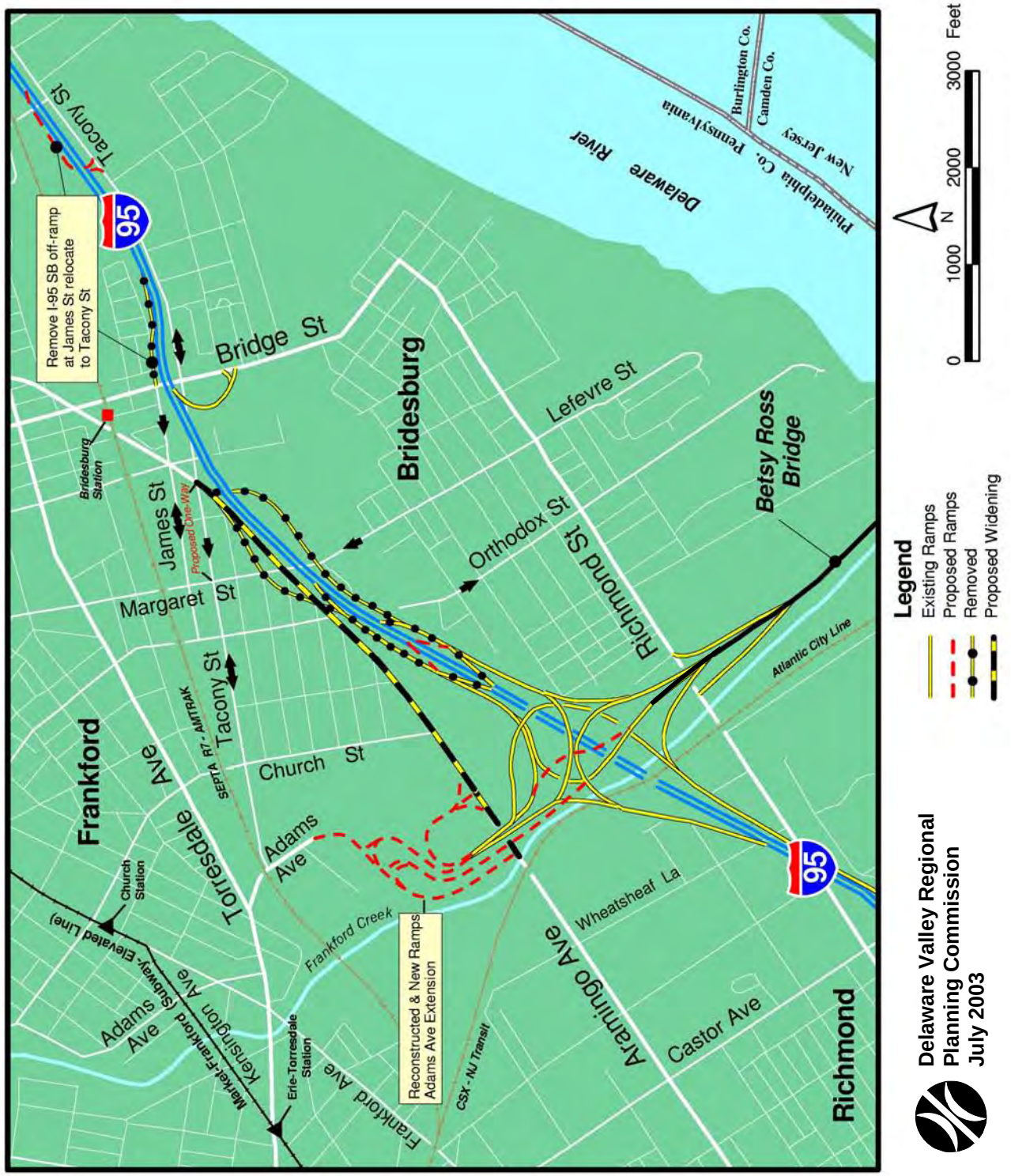

Figure 7. Alternative 3B

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IV. TRAVEL FORECASTING PROCEDURES

Regional travel simulation models are used to forecast future travel patterns. They 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 judgment of predicted future conditions. The revised forecasts adopted by the DVRPC Board on February 24, 2000,[1] reflect an update to municipal forecasts that were last completed in June 1993.

DVRPC uses a multi step, multi source 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' recent Current Population Survey (CPS) research to determine the flow of individuals between the Delaware Valley and the outside world. 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 counties for final adjustments based on local knowledge.

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[1]Delaware Valley Regional Planning Commission, *Year 2025 County & Municipal Population & Employment Forecasts*, Philadelphia, PA, April 2000.

In these forecasts, the study area was considered to be in the Near Northeast section of the City of Philadelphia. This section, in 2000, had a population of 225,200, about 14.7 percent of the total City of Philadelphia population. By 2025, that figure is expected to grow by only 0.1 percent, or 300 persons, to 225,500. In 2025, that will be 15.0 percent of the total City of Philadelphia population, which will have shrunk 2.0 percent to 1,500,000 residents as shown below:

Area	2000 Population Forecast	2025 Population Forecast	Change Absolute	Change %Change
Near Northeast	225,200	225,500	300	0.1%
City of Philadelphia	1,530,950	1,500,000	-30,950	-2.0%

2. Employment Forecasting

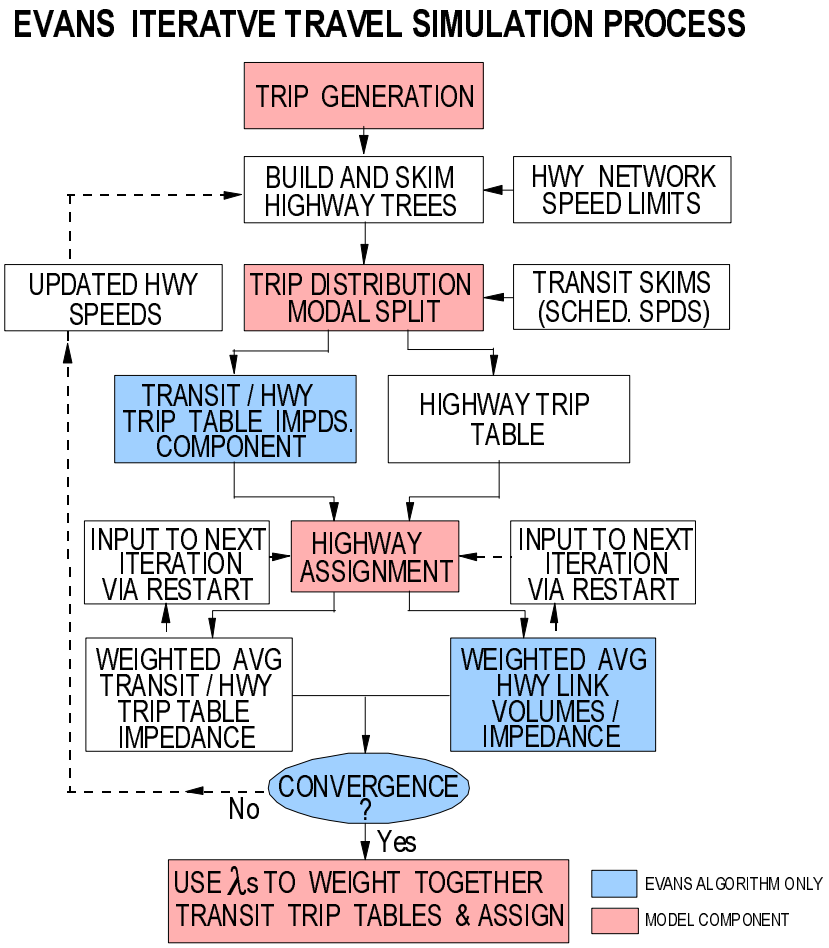
Employment is influenced by local, national, and global political and socioeconomic factors. The Bureau of Economic Analysis provides the most complete and consistent time series data on county employment by sector, and serves as DVRPC's primary data source for employment forecasting. Employment sectors include mining, agriculture, construction, manufacturing, transportation, wholesale, retail, finance/insurance, service, government, and military. Other supplemental sources of data include the US Census, Dun & Bradstreet, Bureau of Labor Statistics, Occupational Privilege tax data, and other public and private sector forecasts. The OBERS shift-share model in combination with the Woods and Poole Economics' sectoral forecasts provides the basis for DVRPC's employment 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.

The Near Northeast section, in 2000, had employment of 69,350, about 9 percent of the City of Philadelphia total employment. By 2025, that figure is expected to grow by almost 10 percent, to 76,250, which will also be about 9 percent of the city's total. Employment figures are shown below:

Area	2000 Employment Forecast	2025 Employment Forecast	Change Absolute	Change % Change
Near Northeast	69,350	76,250	6,900	9.9%
City of Philadelphia	786,150	840,250	54,100	6.9%

B. DVRPC's Travel Simulation Process

For the I-95 study, a focused simulation process was employed ***(see below)***. A focused simulation process allows the use of 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 on 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 re-executes the trip distribution and modal split models, based on updated highway speeds after each iteration of highway assignment, and assigns a weight (λ) 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 I-95 travel patterns. After equilibrium is achieved, the weighted average transit trip tables are assigned to the transit networks to produce link and route passenger volumes.

1. Separate Peak, Midday, and Evening Models

The DVRPC travel simulation models are disaggregated into separate peak period, 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 the peak, midday, and evening time periods. Separate transit networks were required to represent the difference in transit service.

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.

2. The Model Chain

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.

a. 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 current and future 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 includes trips that pass through the Delaware Valley region. Estimates of internal trip productions and attractions by zone are established on the basis of trip rates applied to the zonal estimates of demographic and employment data. 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 and off-peak time periods.

b. 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-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 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.

c. Trip Distribution

Trip distribution is the process whereby 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 seven gravity-type distribution models are applied at the zonal level. These models follow the trip purpose and vehicle type stratifications established in trip generation.

d. 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.

e. Highway Assignment

For highway trip, the final step in the focused simulation process is the assignment of current or future vehicle trips to the highway network representative of the appropriate scenario. 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 the alternatives. The regional nature of the highway network and trip table underlying the focused assignment process allow 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” in 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 can be found through the network, given the capacity-restrained travel times on each link.

f. Transit Assignment

After equilibrium is achieved, the weighted average transit trip tables (using the λs calculated from the overall Evans process as weights) 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" in 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. Traffic Assignment Validation

Before a focused simulation model can be used to predict future trip-making patterns, its ability to replicate existing conditions is validated. 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 compared with recent traffic counts collected by DVRPC. Based on this analysis, the focused model produced accurate traffic volumes. The validated model was then executed for each alternative with socioeconomic and land use inputs reflective of future conditions.

V. PROJECTED TRAFFIC VOLUMES

Projected average daily traffic volumes for selected highway links within the study area are presented and analyzed here. Forecasts are for the horizon year, 2025, which is twenty years after the anticipated opening year.

A. Alternative 1- Base Case

Figure 8 shows the current and 2025 volumes for this alternative in the interchange area. Current year volumes are shown in black, below or to the right of streets in the diagram, while 2025 volumes are shown in red, above or to the right of the streets in the diagram. Generally, the increase in I-95 main line traffic volumes is larger north of the study area than south, reflecting the ultimate capacity of the expressway. A comparison of the 2025 projected volumes under the base case with current traffic counts is given in ***table 1***. Under the base scenario, I-95 south of the Betsy Ross Bridge Interchange is projected to increase by 8.8 percent NB over current counts to 92,200 vpd and by 7.2 percent SB to 99,700 vpd. North of the Bridge Street Interchange, I-95 main line is projected to grow at a higher rate some 23.6 percent NB (to 91,800 vpd) and 22.4 percent SB (to 92,900 vpd). The higher growth rates north of Bridge Street result from the additional capacity due to elimination of lane-drops, resulting in four continuous through lanes in this section, and increases in Betsy Ross Bridge traffic to and from the north. South of the Betsy Ross Bridge, I-95 is currently four lanes by direction. Traffic projections for 2025 are provided at twenty-one I-95 ramp locations for three Betsy Ross ramps in the study area.

The NB I-95 on-ramp from Castor Avenue is projected to grow by 1,722 vpd (26.2 percent) to a link volume of 8,300 vpd by 2025. This projected volume reflects the existing ramp configurations in I-95 Section AFC. The relocated I-95 SB off-ramp at Tacony Street carries 12,800 vpd in 2025, an increase of about 20 percent over the traffic volume on the current James Street configuration. In general, ramps carrying traffic to/from the Aramingo Avenue ramps and traffic between the Betsy Ross Bridge and I-95 north of the interchange complex experience the most growth, particularly in percentage terms (22.9 percent to 56.7 percent) some 5,696 vpd on the Aramingo Connector. This difference in growth rates results primarily from capacity constraints on the Harbison Avenue ramps and on I-95 south of the interchange complex. However, the Harbison Avenue NB off and SB I-95 on ramps do grow substantially absolute terms 3,366 and 3,318 vpd, respectively. The Betsy Ross bridge is projected to grow by 13,084 vpd or 31.1 percent by 2025.

2025 traffic projections are also provided for eighteen links on intersecting streets and nineteen locations on parallel roadways. In absolute terms, projected traffic increases are usually higher on parallel roadways, reflecting the importance of Torresdale, Aramingo, and Harbison avenues and Tacony and Richmond streets for I-95 and Betsy Ross Bridge access and travel throughout Northeast Philadelphia. The absolute increases on parallel roadways range from 1,691 vpd on Tacony Street between Church and Orthodox to 13,543 vpd also on Tacony Street between Bridge and Carver streets. The very large growth between Bridge and Carver results from the

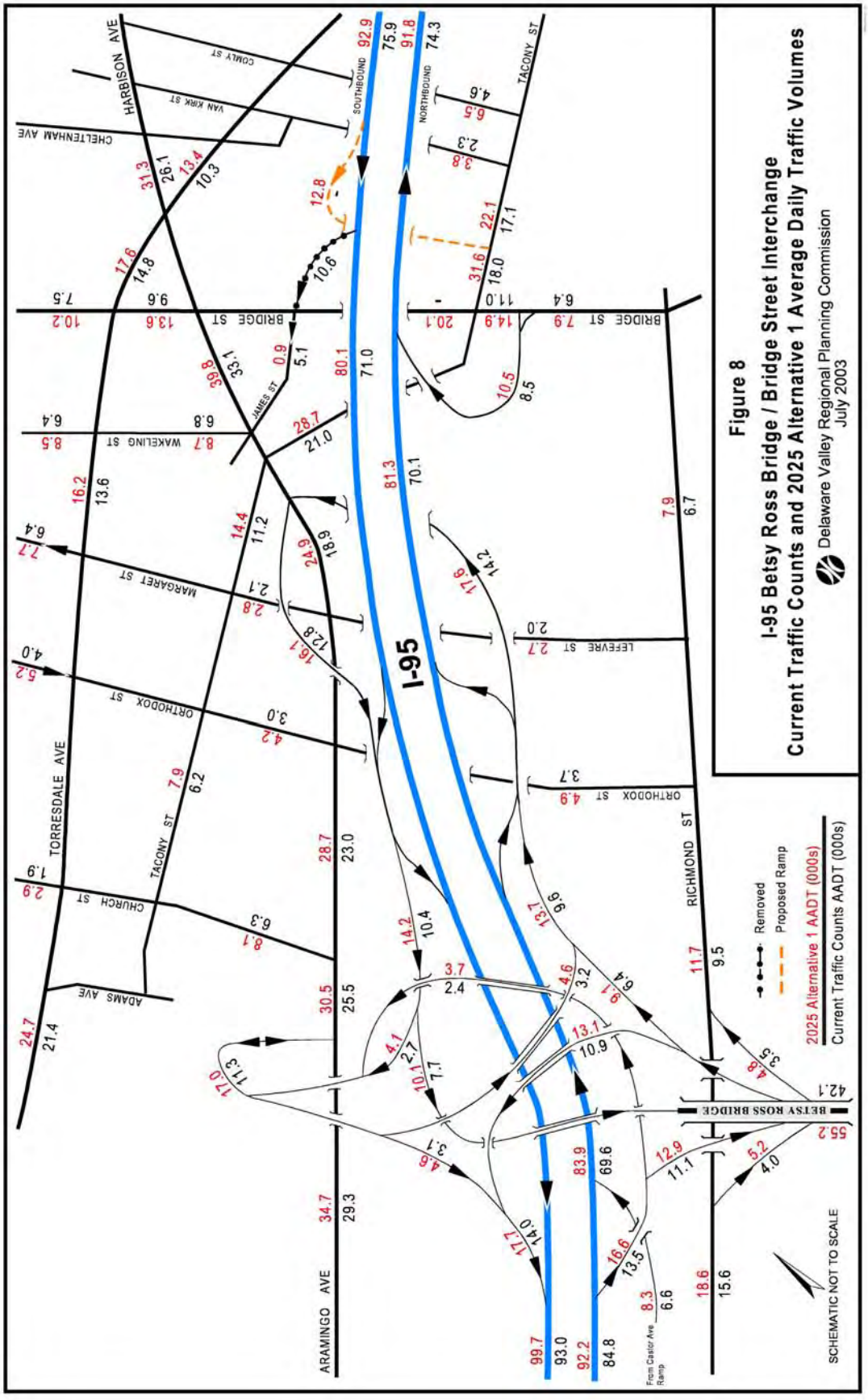


Figure 8
I-95 Betsy Ross Bridge / Bridge Street Interchange
Current Traffic Counts and 2025 Alternative 1 Average Daily Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
I-95
BRIDGE ST
BETSY ROSS BRIDGE
RICHMOND ST
ARAMINGO AVE
TORRESDALE AVE
TACONY ST
HARBISON AVE
CHELTENHAM AVE
COMLY ST
VAN KIRK ST
JAMES ST
WAKELING ST
MARGARET ST
ORTHODOX ST
CHURCH ST
ADAMS AVE
LEFEVRE ST
SOUTHBOUND
NORTHBOUND
Removed
Proposed Ramp
2025 Alternative 1 AADT (000s)
Current Traffic Counts AADT (000s)
SCHEMATIC NOT TO SCALE

Table 1
Current and 2025 Alternative 1 (Base Case)
Average Daily Traffic Volumes

Highway	Highway Section		Current	2025 Alt. 1	2025 Alt. 1/Current	
Facility	From	To	Volume	Volume	Growth	Percent
I-95 Main Line						
I-95 NB	Allegheny Ave.	Betsy Ross\Aramingo Off-ramp	84,763	92,200	7,437	8.8%
I-95 SB	Betsy Ross\Aramingo On-ramp	Allegheny Ave.	92,975	99,700	6,725	7.2%
I-95 NB	Castor Ave.	Betsy Ross\Aramingo On-ramp	69,562	83,900	14,338	20.6%
I-95 NB	Betsy Ross\Aramingo On-ramp	Bridge St.	70,059	81,300	11,241	16.0%
I-95 SB	Bridge St.	Betsy Ross\ Aramingo Off-ramp	70,965	80,100	9,135	12.9%
I-95 NB	Bridge St.	Cottman Ave.	74,272	91,800	17,528	23.6%
I-95 SB	Princeton St.	Bridge St.	75,910	92,900	16,990	22.4%
I-95 Ramps						
I-95 NB On-ramp	Castor Ave.	I-95 NB	6,578	8,300	1,722	26.2%
I-95 NB Off-ramp	I-95 NB	Combined Aramingo\Betsy Ross	13,502	16,600	3,098	22.9%
I-95 SB On-ramp	Combined Aramingo\Betsy Ross	I-95 SB	14,012	17,700	3,688	26.3%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross Bridge	11,141	12,900	1,759	15.8%
I-95 SB On-ramp	Betsy Ross	Combined Aramingo\Betsy Ross	10,881	13,100	2,219	20.4%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo	2,361	3,700	1,339	56.7%
I-95 SB On-ramp	Aramingo	Combined Aramingo\Betsy Ross	3,131	4,600	1,469	46.9%
I-95 NB On-ramp	Combined Aramingo\Betsy Ross	I-95 NB	9,579	13,700	4,121	43.0%
I-95 SB Off-ramp	I-95 SB	Combined Aramingo\Betsy Ross	10,385	14,200	3,815	36.7%
I-95 NB On-ramp	Betsy Ross Bridge	Combined Aramingo\Betsy Ross	6,427	9,100	2,673	41.6%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross	7,725	10,100	2,375	30.7%
I-95 NB On-ramp	Aramingo Ave.	Combined Aramingo\Betsy Ross	3,152	4,600	1,448	45.9%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo Ave.	2,660	4,100	1,440	54.1%
Betsy Ross Off-ramp	Betsy Ross Bridge	Richmond St.	3,500	4,800	1,300	37.1%
Betsy Ross On-ramp	Richmond St.	Betsy Ross Bridge	4,000	5,200	1,200	30.0%
Betsy Ross Off-ramp	Betsy Ross Bridge	Aramingo Ave.	Proposed	--	--	--
Betsy Ross On-ramp	Aramingo Ave.	Betsy Ross Bridge	Proposed	--	--	--
I-95 Off-ramp	Combined I-95 off-ramps	Aramingo Ave.	5,021	7,800	2,779	55.3%
I-95 On-ramp	Aramingo Ave.	Combined I-95 on-ramps	6,283	9,200	2,917	46.4%
Betsy Ross Bridge	Pennsauken, NJ	Philadelphia, PA	42,116	55,200	13,084	31.1%
I-95 NB Off-ramp	I-95 NB	Harbison Ave.\Bridge St.	14,234	17,600	3,366	23.6%
I-95 On-ramp	Harbison Ave.\Bridge St.	I-95 SB	12,782	16,100	3,318	26.0%
I-95 NB On-ramp	Bridge St.	I-95 NB	8,483	10,500	2,017	23.8%
I-95 SB Off-ramp	I-95	Bridge St.	10,632	12,800	2,168	20.4%

Table 1
Current and 2025 Alternative 1 (Base Case)
Average Daily Traffic Volumes (Continued)

Highway Facility	Highway Section From	To	Current Volume	2025 Alt. 1 Volume	2025 Alt. 1/Current Growth	Percent
Intersecting Roads						
Aramingo Connector	I-95/Betsy Ross Bridge Con.Rmps	Aramingo Ave.	11,304	17,000	5,696	50.4%
Church St.	Tacony St.	Aramingo Ave.	6,321	8,100	1,779	28.1%
Church St.	Torresdale Ave.	Frankford Ave.	1,870	2,900	1,030	55.1%
Orthodox St.	Frankford Ave.	Torresdale Ave.	3,813	5,200	1,387	36.4%
Orthodox St.	Tacony St.	Aramingo Ave.	3,022	4,200	1,178	39.0%
Orthodox St.	Aramingo Ave.	Thompson St.	3,682	4,900	1,218	33.1%
Margaret St.	Frankford Ave.	Torresdale Ave.	6,443	7,700	1,257	19.5%
Margaret St.	Tacony St.	Aramingo Ave.	2,067	2,800	733	35.5%
Margaret St.	Aramingo Ave.	Thompson St.	2,000	2,700	700	35.0%
Wakeling St.	Frankford Ave.	Torresdale Ave.	6,443	8,500	2,057	31.9%
Wakeling St.	Torresdale Ave.	Harbison Ave.	6,770	8,700	1,930	28.5%
Bridge St.	Frankford Ave.	Torresdale Ave.	7,484	10,200	2,716	36.3%
Bridge St.	Torresdale Ave.	Harbison Ave.	9,608	13,600	3,992	41.5%
Bridge St.	Harbison Ave.	Tacony St.	--	20,100	--	--
Bridge St.	Tacony St.	I-95 NB On-ramp	11,029	14,900	3,871	35.1%
Bridge St.	I-95 NB On-ramp	Thompson St.	6,442	7,900	1,458	22.6%
Van Kirk St.	Keystone St.	Tacony St.	2,292	3,800	1,508	65.8%
Comly St.	Keystone St.	Tacony St.	4,581	6,500	1,919	41.9%
Parallel Roads						
Torresdale Ave.	Frankford Ave.	Adams Ave.	21,448	24,700	3,252	15.2%
Torresdale Ave.	Margaret St.	Wakeling St.	13,623	16,200	2,577	18.9%
Torresdale Ave.	Bridge St.	Harbison Ave.	14,846	17,600	2,754	18.6%
Torresdale Ave.	Harbison Ave.	Cheltenham Ave.	10,330	13,400	3,070	29.7%
Tacony St.	Church St.	Orthodox St.	6,209	7,900	1,691	27.2%
Tacony St.	Margaret St.	Harbison Ave.	11,174	14,400	3,226	28.9%
Tacony St.	Harbison Ave.	Bridge St.	20,956	28,700	7,744	37.0%
Tacony St.	Bridge St.	Carver St.	18,057	31,600	13,543	75.0%
Tacony St.	Carver St.	Van Kirk St.	17,122	22,100	4,978	29.1%
Aramingo Ave.	Wheatsheaf Ln.	Aramingo Connector	29,265	34,700	5,435	18.6%
Aramingo Ave.	Aramingo Connector	Church St.	25,490	30,500	5,010	19.7%
Aramingo Ave.	Church St.	Orthodox St.	23,010	28,700	5,690	24.7%
Aramingo Ave.	Margaret St.	Tacony St.	18,847	24,900	6,053	32.1%
Harbison Ave.	James St.	Bridge St.	33,149	39,800	6,651	20.1%
Harbison Ave.	Torresdale Ave.	Cheltenham Ave.	26,112	31,300	5,188	19.9%
James St.	Bridge St.	Harbison Ave.	5,073	900	-4,173	-82.3%
(James St. off-ramp from I-95 SB is moved in future alternatives)						
Richmond St.	Wheatsheaf Ln.	Betsy Ross Bridge	15,640	18,600	2,960	18.9%
Richmond St.	Betsy Ross Bridge	Orthodox St.	9,539	11,700	2,161	22.7%
Richmond St.	Lefevre St.	Bridge St.	6,680	7,900	1,220	18.3%

relocation of the Bridge Street SB off-ramp from James to Tacony streets. A corresponding reduction of 4,173 vpd on James Street resulted from the ramp relocation. In total, parallel roadways grew by 4,200 vpd on average, or 24 percent between current counts and the 2025 Base Case Alternative forecasts.

Intersecting roadways in the study area tend to be local streets with smaller current traffic volumes and smaller absolute traffic growths by the year 2025. By 2025, total traffic volumes will have increase by an average of 2,000 vpd or 36.1 percent, a higher percentage growth than the average for the parallel roadways, but much smaller in absolute terms. For individual intersecting streets, traffic volume growths range from 700 vpd for Margaret Street between Aramingo Avenue and Thompson streets to 3,992 on Bridge Street. As noted above, much higher growth on the Aramingo Connector (5,696) resulted from growth in I-95 ramp traffic.

Peak hour ramp and turning movement growth is consistent with AADT growth (***see figures 9 and 10***). There is a general increase in traffic volumes throughout the system when comparing the Base Case Alternative to current volumes, consistent with regional traffic growth expectations for the region. Along Aramingo Avenue, Harbison Avenue, Tioga, and Bridge streets, there are increases in volumes at all intersection approaches, particularly in the vicinity of I-95 ramps. Increases on Torresdale Avenue and Richmond Street are generally lower; sometimes fewer than 100 vehicles in the peak hours.

B. Alternative 2

Design Alternative 2 preserves the existing Betsy Ross Bridge/I- 95 interchange configuration except that the I-95 southbound merge on-ramp from the Harbison/Aramingo avenues outer lanes is eliminated, as is the I-95 northbound slip off-ramp to the northbound outer lanes. As in the Base Case Alternative, the Bridge Street southbound I-95 off-ramp is relocated to Tacony Street opposite Carver Street, and four through lanes are provided for I-95 in both the northbound and southbound directions.

The projected AADT traffic volumes for Alternative 2 are compared with the Base Case in ***figure 11*** and current traffic counts in ***table 2***. As expected, the elimination of the I-95 southbound merge from Harbison/Aramingo and the corresponding northbound slip ramp diverts significant amounts of traffic from the outer lanes to Aramingo Avenue between the existing Tacony Street and the Aramingo Connector. In 2025, this diversion is projected to be on the order of 16,000 vpd, which ranges from 81.5 percent to 112.2 percent over current counts, depending on the location. This significantly increases traffic congestion on this section of Aramingo Avenue, which is not widened in this alternative. Traffic congestion is compounded by large increases in volumes (16,900 vpd) on the existing Aramingo connection as a result of diverted I-95 traffic. Harbison Avenue north of Tacony Street is relieved somewhat (by about 1,900 vpd) as a result of the elimination of the I-95 slip ramps. Elsewhere in the study area, traffic volumes are similar in Alternative 2 and Alternative 1, in most cases being less than 600 vpd different. Peak hour ramp and turning movement differences between alternatives 1 and 2 are consistent with differences between AADT link volumes (***see figures 11A and 11B***)

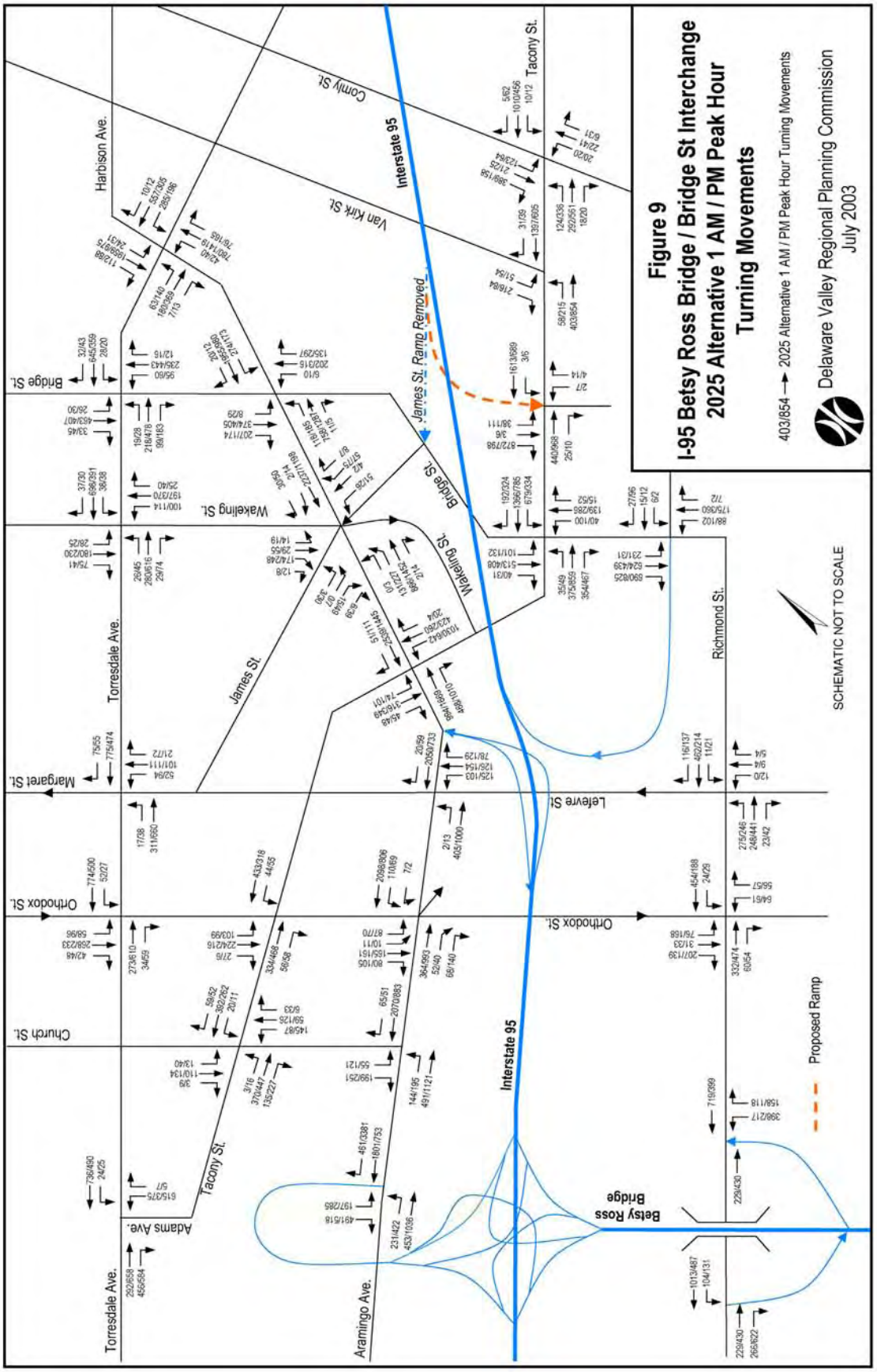


Figure 9
I-95 Betsy Ross Bridge / Bridge St Interchange
2025 Alternative 1 AM / PM Peak Hour
Turning Movements
403/854 → 2025 Alternative 1 AM / PM Peak Hour Turning Movements
Delaware Valley Regional Planning Commission
July 2003
SCHEMATIC NOT TO SCALE
Proposed Ramp
Interstate 95
James St. Ramp Removed
Betsy Ross Bridge
Harbison Ave.
Comly St.
Van Kirk St.
Tacony St.
Bridge St.
Wakeling St.
James St.
Torresdale Ave.
Margaret St.
Orthodox St.
Church St.
Adams Ave.
Aramingo Ave.
Lefevre St.
Richmond St.

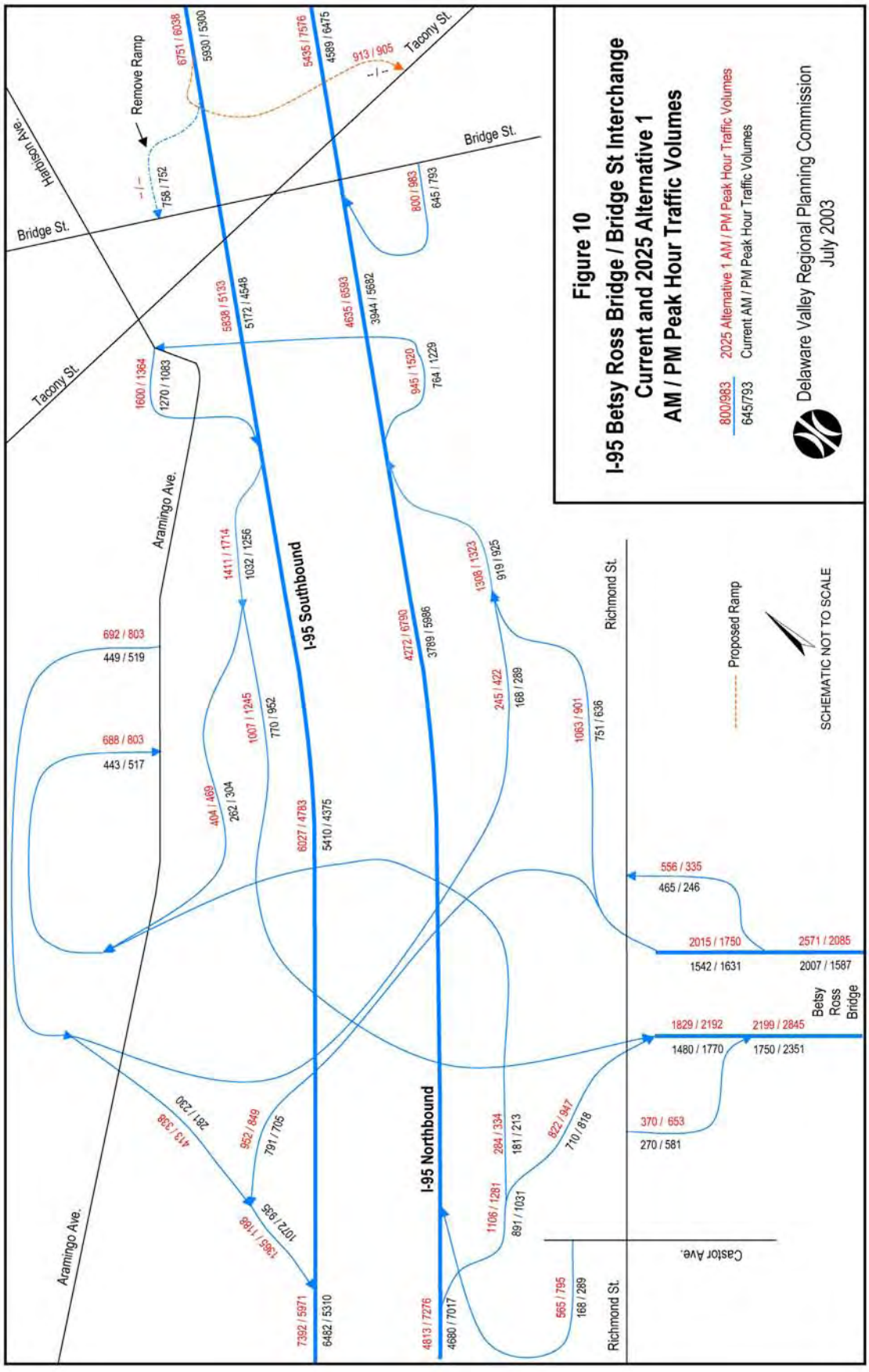


Figure 10
I-95 Betsy Ross Bridge / Bridge St Interchange
Current and 2025 Alternative 1
AM / PM Peak Hour Traffic Volumes
800/983 2025 Alternative 1 AM / PM Peak Hour Traffic Volumes
645/793 Current AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
Proposed Ramp
SCHEMATIC NOT TO SCALE
I-95 Southbound
I-95 Northbound
Remove Ramp
Tacony St.
Bridge St.
Harbison Ave.
Aramingo Ave.
Richmond St.
Castor Ave.
Betsy Ross Bridge
6751 / 6038
5930 / 5300
5435 / 7576
4589 / 6475
913 / 905
158 / 752
800 / 983
645 / 793
5838 / 5133
5172 / 4548
4635 / 6593
3944 / 5682
1600 / 1364
1270 / 1083
945 / 1520
764 / 1229
1411 / 1714
1032 / 1256
1308 / 1323
919 / 925
692 / 803
449 / 519
4272 / 6790
3789 / 5986
688 / 803
443 / 517
1007 / 1245
770 / 952
245 / 422
168 / 289
1063 / 901
751 / 636
404 / 469
262 / 304
6027 / 4783
5410 / 4375
556 / 335
465 / 246
2015 / 1750
1542 / 1631
2571 / 2085
2007 / 1587
1829 / 2192
1480 / 1770
2199 / 2845
1750 / 2351
370 / 653
270 / 581
822 / 947
710 / 818
284 / 334
181 / 213
1106 / 1281
891 / 1031
952 / 849
791 / 705
281 / 230
413 / 338
1072 / 935
1365 / 1188
7392 / 5971
6482 / 5310
4813 / 7276
4680 / 7017
565 / 795
168 / 289

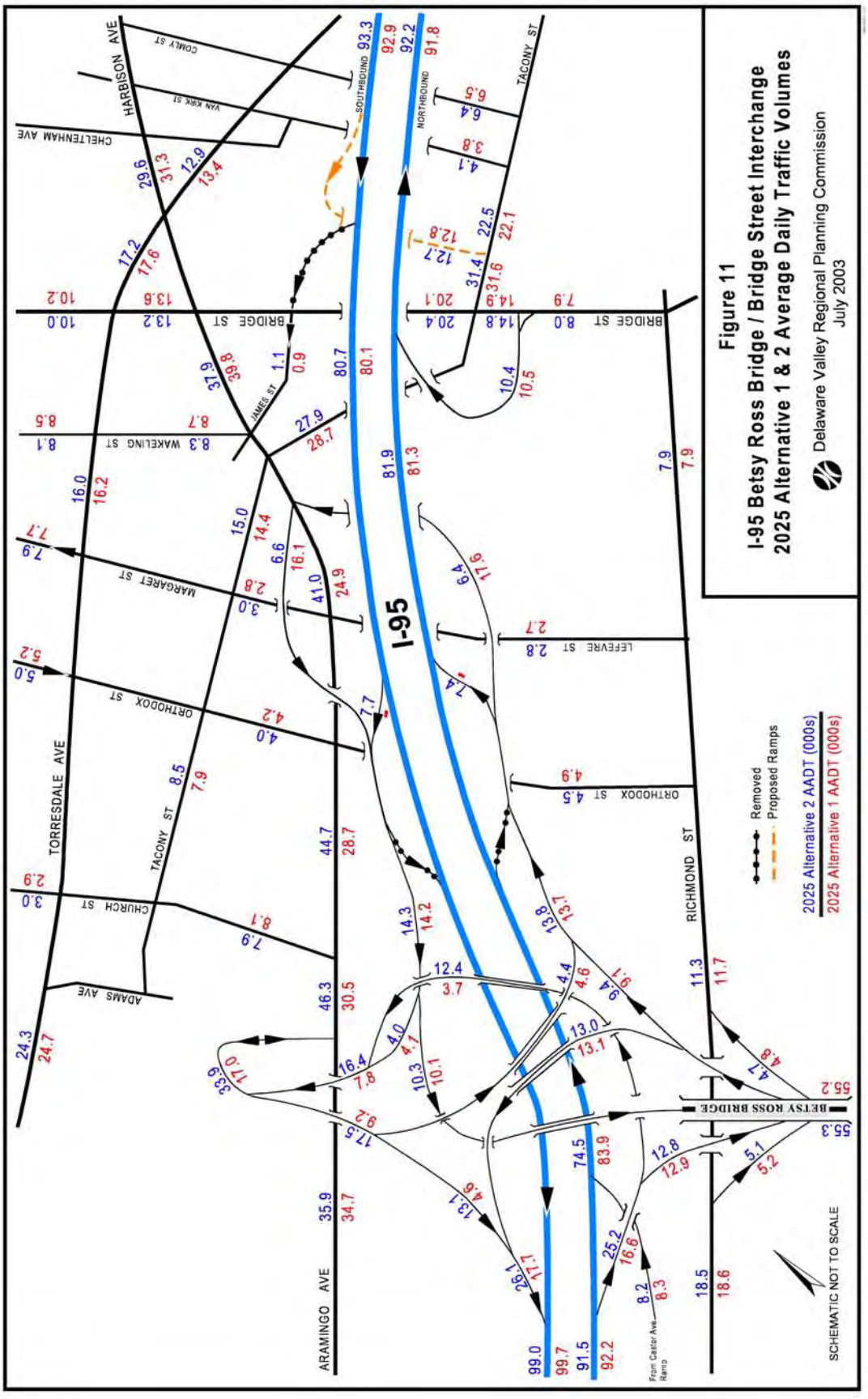


Figure 11
I-95 Betsy Ross Bridge / Bridge Street Interchange
2025 Alternative 1 & 2 Average Daily Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
I-95
BRIDGE ST
TACONY ST
HARBISON AVE
COMLY ST
VAN KIRK ST
CHELTENHAM AVE
JAMES ST
WAKELING ST
MARGARET ST
ORTHODOX ST
LEFEVRE ST
TORRESDALE AVE
CHURCH ST
ADAMS AVE
ARAMINGO AVE
RICHMOND ST
BETSY ROSS BRIDGE
SOUTHBOUND
NORTHBOUND
Removed
Proposed Ramps
2025 Alternative 2 AADT (000s)
2025 Alternative 1 AADT (000s)
From Castor Ave Ramp
SCHEMATIC NOT TO SCALE

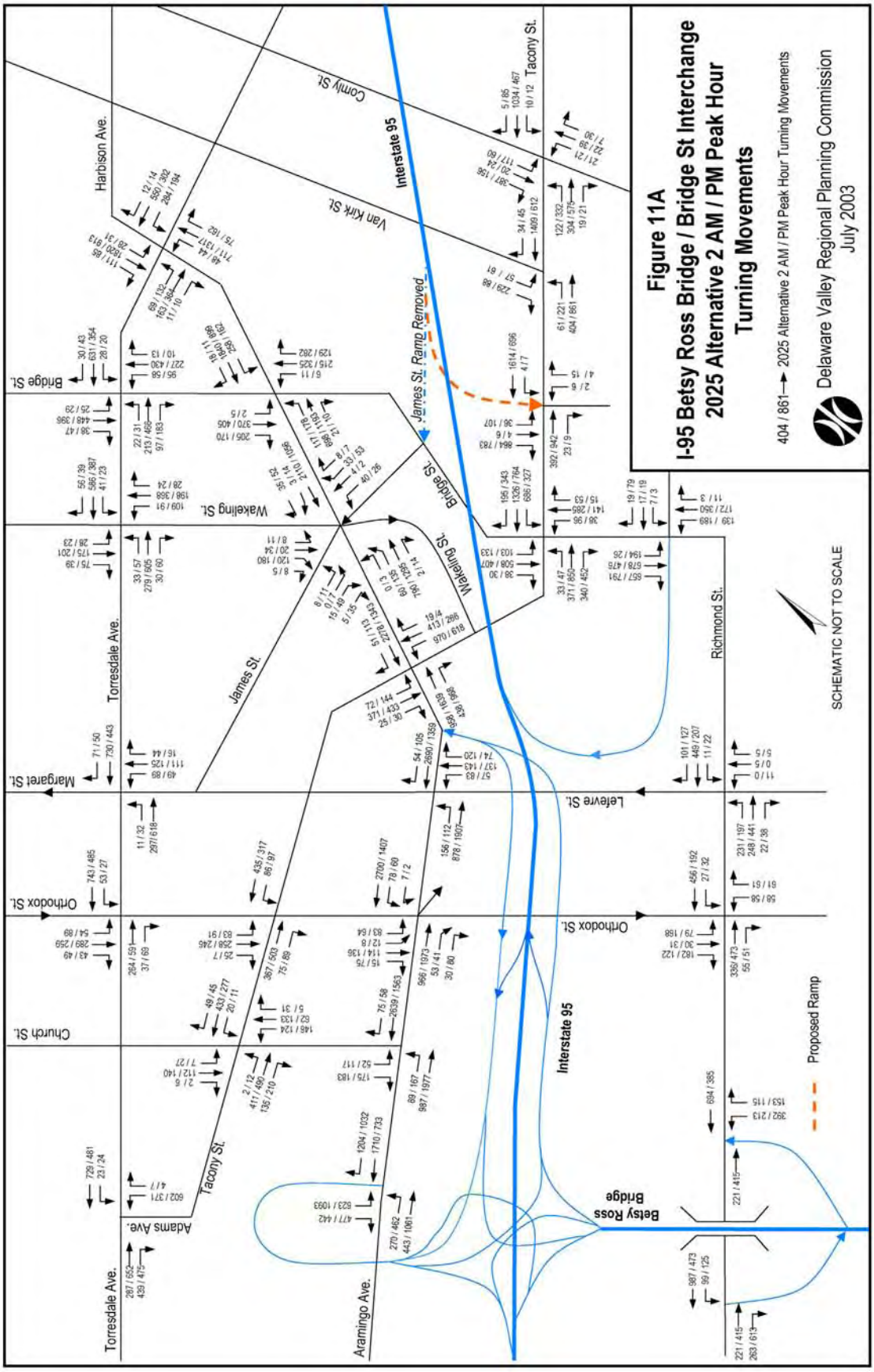


Figure 11A
I-95 Betsy Ross Bridge / Bridge St Interchange
2025 Alternative 2 AM / PM Peak Hour
Turning Movements
404 / 861 → 2025 Alternative 2 AM / PM Peak Hour Turning Movements
Delaware Valley Regional Planning Commission
July 2003
SCHEMATIC NOT TO SCALE
Proposed Ramp
James St. Ramp Removed
Interstate 95
Betsy Ross Bridge
Tacony St.
Comly St.
Van Kirk St.
Harbison Ave.
Bridge St.
Wakeling St.
James St.
Margaret St.
Torresdale Ave.
Orthodox St.
Church St.
Adams Ave.
Aramingo Ave.
Lefevre St.
Richmond St.

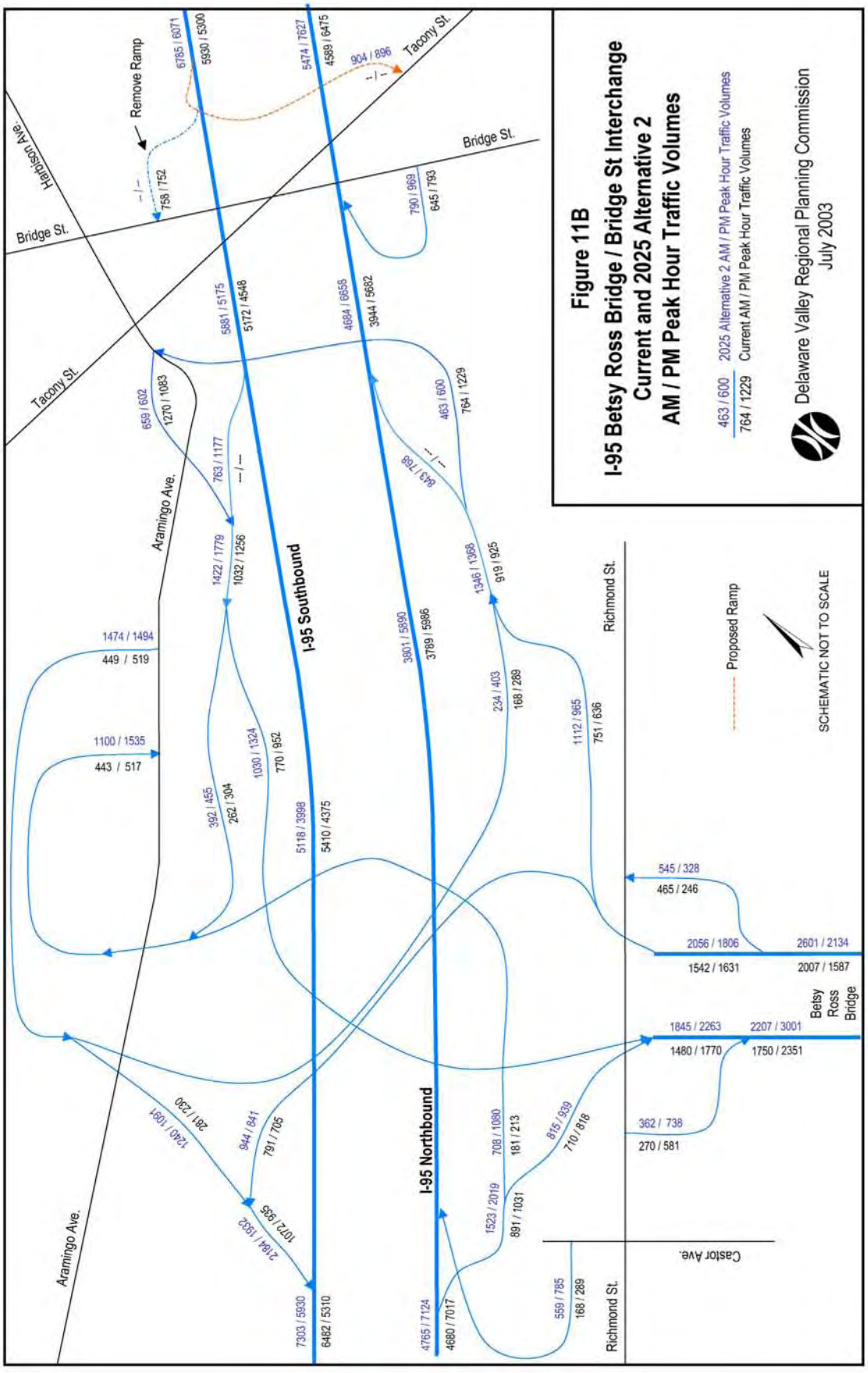


Figure 11B
I-95 Betsy Ross Bridge / Bridge St Interchange
Current and 2025 Alternative 2
AM / PM Peak Hour Traffic Volumes
463 / 600 2025 Alternative 2 AM / PM Peak Hour Traffic Volumes
764 / 1229 Current AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
Remove Ramp
Tacony St.
Bridge St.
Hatboro Ave.
Aramingo Ave.
I-95 Southbound
I-95 Northbound
Richmond St.
Castor Ave.
Betsy Ross Bridge
Proposed Ramp
SCHEMATIC NOT TO SCALE

Table 2
Current and 2025 Alternative 2
Average Daily Traffic Volumes

Highway Facility	Highway Section From	To	Current Volume	2025 Alt. 2 Volume	2025 Alt. 2/Current Growth	Percent
I-95 Main Line						
I-95 NB	Allegheny Ave.	Betsy Ross\Aramingo Off-ramp	84,763	91,503	6,740	8.0%
I-95 SB	Betsy Ross\Aramingo On-ramp	Allegheny Ave.	92,975	99,048	6,073	6.5%
I-95 NB	Castor Ave.	Betsy Ross\Aramingo On-ramp	69,562	74,485	4,923	7.1%
I-95 NB	Betsy Ross\Aramingo On-ramp	Bridge St.	70,059	81,861	11,802	16.8%
I-95 SB	Bridge St.	Betsy Ross\Aramingo Off-ramp	70,965	80,669	9,704	13.7%
I-95 NB	Bridge St.	Cottman Ave.	74,272	92,245	17,973	24.2%
I-95 SB	Princeton St.	Bridge St.	75,910	93,335	17,425	23.0%
I-95 Ramps						
I-95 NB On-ramp	Castor Ave.	I-95 NB	6,578	8,198	1,620	24.6%
I-95 NB Off-Ramp	I-95 NB	Combined Aramingo\Betsy Ross	13,502	25,216	11,714	86.8%
I-95 SB On-ramp	Combined Aramingo\Betsy Ross	I-95-SB	14,012	26,078	12,066	86.1%
I-95 NB Off-Ramp	Combined Aramingo\Betsy Ross	Betsy Ross Bridge	11,141	12,788	1,647	14.8%
I-95 SB On-ramp	Betsy Ross	Combined Aramingo\Betsy Ross	10,881	12,998	2,117	19.5%
I-95 NB Off-Ramp	Combined Aramingo\Betsy Ross	Aramingo	2,361	12,428	10,067	426.4%
I-95 SB On-ramp	Aramingo	Combined Aramingo\Betsy Ross	3,131	13,080	9,949	317.8%
I-95 NB On-Ramp	Combined Aramingo\Betsy Ross	I-95 NB	9,579	13,764	4,185	43.7%
I-95 SB Off-ramp	I-95 SB	Combined Aramingo\Betsy Ross	10,385	14,326	3,941	37.9%
I-95 NB On-ramp	Betsy Ross Bridge	Combined Aramingo\Betsy Ross	6,427	9,362	2,935	45.7%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross	7,725	10,347	2,622	33.9%
I-95 NB On-ramp	Aramingo Ave.	Combined Aramingo\Betsy Ross	3,152	4,402	1,250	39.7%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo Ave.	2,660	3,979	1,319	49.6%
Betsy Ross Off-ramp	Betsy Ross Bridge	Richmond St.	3,500	4,737	1,237	35.3%
Betsy Ross On-ramp	Richmond St.	Betsy Ross Bridge	4,000	5,116	1,116	27.9%
Betsy Ross Off-ramp	Betsy Ross Bridge	Aramingo Ave.	Proposed	--	--	--
Betsy Ross On-ramp	Aramingo Ave.	Betsy Ross Bridge	Proposed	--	--	--
I-95 Off-ramp	Combined I-95 off-ramps	Aramingo Ave.	5,021	16,407	11,386	226.8%
I-95 On-ramp	Aramingo Ave.	Combined I-95 on-ramps	6,283	17,482	11,199	178.2%
Betsy Ross Bridge	Pennsauken, NJ	Philadelphia, PA	42,116	55,348	13,232	31.4%
I-95 NB Off-ramp	I-95 NB	Harbison Ave.\Bridge St.	14,234	6,388	-7,846	-55.1%
I-95 On-ramp	Harbison Ave.\Bridge St.	I-95 SB	12,782	6,627	-6,155	-48.2%
I-95 NB On-ramp	Bridge St.	I-95 NB	8,483	10,384	1,901	22.4%
I-95 SB Off-ramp	I-95	Bridge St.	10,632	12,666	2,034	19.1%

Table 2
Current and 2025 Alternative 2
Average Daily Traffic Volumes (Continued)

Highway	Highway Section				2025	2025
			Current	Alt. 2	Alt. 2/Current	
Facility	From	To	Volume	Volume	Growth	Percent
Intersecting Roads						
Aramingo Connector	I-95/Betsy Ross Bridge Con.Rmps	Aramingo Ave.	11,304	33,889	22,585	199.8%
Church St.	Tacony St.	Aramingo Ave.	6,321	7,901	1,580	25.0%
Church St.	Torresdale Ave.	Frankford Ave.	1,870	2,980	1,110	59.4%
Orthodox St.	Frankford Ave.	Torresdale Ave.	3,813	5,002	1,189	31.2%
Orthodox St.	Tacony St.	Aramingo Ave.	3,022	3,997	975	32.3%
Orthodox St.	Aramingo Ave.	Thompson St.	3,682	4,522	840	22.8%
Margaret St.	Frankford Ave.	Torresdale Ave.	6,443	7,932	1,489	23.1%
Margaret St.	Tacony St.	Aramingo Ave.	2,067	3,024	957	46.3%
Margaret St.	Aramingo Ave.	Thompson St.	2,000	2,795	795	39.8%
Wakeling St.	Frankford Ave.	Torresdale Ave.	6,443	8,034	1,591	24.7%
Wakeling St.	Torresdale Ave.	Harbison Ave.	6,770	8,334	1,564	23.1%
Bridge St.	Frankford Ave.	Torresdale Ave.	7,484	9,998	2,514	33.6%
Bridge St.	Torresdale Ave.	Harbison Ave.	9,608	13,178	3,570	37.2%
Bridge St.	Harbison Ave.	Tacony St.	--	20,400	--	--
Bridge St.	Tacony St.	I-95 NB On-ramp	11,029	14,841	3,812	34.6%
Bridge St.	I-95 NB On-ramp	Thompson St.	6,442	7,979	1,537	23.9%
Van Kirk St.	Keystone St.	Tacony St.	2,292	4,071	1,779	77.6%
Comly St.	Keystone St.	Tacony St.	4,581	6,338	1,757	38.4%
Parallel Roads						
Torresdale Ave.	Frankford Ave.	Adams Ave.	21,448	24,344	2,896	13.5%
Torresdale Ave.	Margaret St.	Wakeling St.	13,623	15,991	2,368	17.4%
Torresdale Ave.	Bridge St.	Harbison Ave.	14,846	17,239	2,393	16.1%
Torresdale Ave.	Harbison Ave.	Cheltenham Ave.	10,330	12,926	2,596	25.1%
Tacony St.	Church St.	Orthodox St.	6,209	8,528	2,319	37.3%
Tacony St.	Margaret St.	Harbison Ave.	11,174	15,026	3,852	34.5%
Tacony St.	Harbison Ave.	Bridge St.	20,956	27,926	6,970	33.3%
Tacony St.	Bridge St.	Carver St.	18,057	31,428	13,371	74.0%
Tacony St.	Carver St.	Van Kirk St.	17,122	22,464	5,342	31.2%
Aramingo Ave.	Wheatsheaf Ln.	Aramingo Connector	29,265	35,920	6,655	22.7%
Aramingo Ave.	Aramingo Connector	Church St.	25,490	46,262	20,772	81.5%
Aramingo Ave.	Church St.	Orthodox St.	23,010	44,664	21,654	94.1%
Aramingo Ave.	Margaret St.	Tacony St.	18,847	39,990	21,143	112.2%
Harbison Ave.	James St.	Bridge St.	33,149	37,876	4,727	14.3%
Harbison Ave.	Torresdale Ave.	Cheltenham Ave.	26,112	29,632	3,520	13.5%
James St.	Bridge St.	Harbison Ave.	5,073	1,065	-4,008	-79.0%
(James St. off-ramp from I-95 SB is moved in future alternatives)						
Richmond St.	Wheatsheaf Ln.	Betsy Ross Bridge	15,640	18,523	2,883	18.4%
Richmond St.	Betsy Ross Bridge	Orthodox St.	9,539	11,260	1,721	18.0%
Richmond St.	Lefevre St.	Bridge St.	6,680	7,921	1,241	18.6%

C. Alternative 3A

This design option includes all previous Alternative 2 improvements in the overall study area. Additional improvements in this alternative include a connection from the Betsy Ross Bridge to Aramingo Avenue, elimination of the I-95 outer roadways and Harbison Avenue ramps, and selective widening of Aramingo Avenue to compensate for I-95 ramp removals. ***Table 3*** compares Alternative 3A 2025 traffic volumes with current counts under this alternative (***see figure 12***), AADT volumes for the I-95 sections north and south of the interchange complex are almost unchanged from Base Case Alternative 1. I-95 main line volumes south of the interchange complex increase by 2.2 percent (2,000 vpd) NB and 0.3 percent (300 vpd) SB. North of the interchange complex, main line traffic is slightly reduced by the interchange improvements -0.7 percent (600 vpd) NB and -1.0 percent (900 vpd) SB. Within the Betsy Ross Bridge/Bridge Street interchange complex, I-95 NB volumes were reduced by 10,700 vpd as a result of closing the Bridge/Harbison outer roadway off-ramp and diverting traffic to the existing NB off-ramp to the Aramingo Connector. A similar reduction also occurred between the existing SB I-95 outer lane merge and the Aramingo Connector SB on-ramp. Other than this, I-95 main line traffic volumes within the interchange complex were almost unchanged.

The principal impact of Alternative 3A vis-a-vis Alternative 1 on the local street system is to increase traffic significantly on Aramingo Avenue between Tacony Street and the Aramingo connector. This segment of Aramingo Avenue is widened from four to six lanes. Traffic volume increases are predicted to range from 20,100 vpd (80.7 percent) to 34,400 vpd (112.8 percent) as one proceeds southward along Aramingo Avenue from Margaret Street to the Aramingo Connection ramps. Margaret, Orthodox, and Church streets also receive traffic increases as a result of the I-95 ramp improvements and Aramingo Avenue widening.

Projected traffic increases by 3,700 relative to Alternative 1 for Aramingo Avenue south of the connector. The projected growth in traffic on Torresdale Avenue between Frankford Avenue and Adams Avenue under Alternative 3A is 4,800 vpd. Otherwise, the effect of Alternative 3A is to reduce neighborhood traffic from the Base Case Alternative 1 volumes. This reduction is relatively significant on Harbison Avenue (about 3,400 vpd or 9 percent), and Wakeling Street (2,600 vpd or 30 percent). Other neighborhood streets in the study area receive relatively small amounts of traffic relief – for the most part less than 1,000 vpd.

Peak hour ramp and turning movement differences between Alternatives 1 and 3A are consistent with differences between AADT link traffic volumes (***see figures 13 and 14***). As one might expect, turning movements and related congestion are reduced in the vicinity of the eliminated I-95 ramps at Harbison/Bridge Street, and increase significantly on Aramingo Avenue at the Aramingo connection ramps and at the intersections of Aramingo Avenue and Church, Orthodox, and Margaret streets.

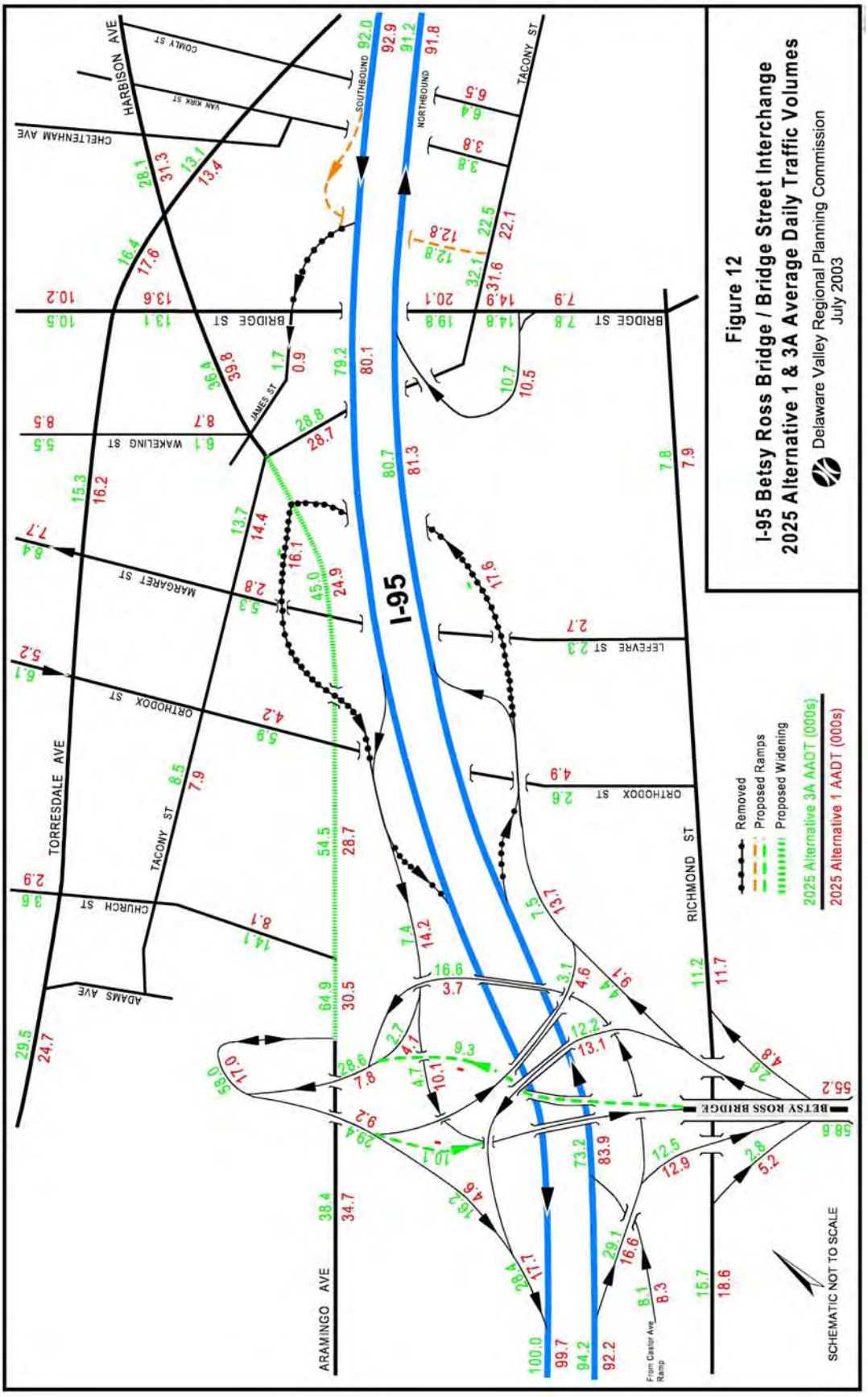


Figure 12
I-95 Betsy Ross Bridge / Bridge Street Interchange
2025 Alternative 1 & 3A Average Daily Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
I-95
SOUTHBOUND
NORTHBOUND
HARBISON AVE
CHELTENHAM AVE
COMLY ST
VAN KIRK ST
TACONY ST
BRIDGE ST
JAMES ST
WAKELING ST
MARGARET ST
ORTHODOX ST
LEFEVRE ST
TORRESDALE AVE
CHURCH ST
ADAMS AVE
RICHMOND ST
BETSY ROSS BRIDGE
ARAMINGO AVE
From Castor Ave Ramp
Removed
Proposed Ramps
Proposed Widening
2025 Alternative 3A AADT (000s)
2025 Alternative 1 AADT (000s)
SCHEMATIC NOT TO SCALE

Table 3
Current and 2025 Alternative 3A
Average Daily Traffic Volumes

Highway	Highway Section			2025	2025	
			Current	Alt. 3A	Alt. 3A/Current	
Facility	From	To	Volume	Volume	Growth	Percent
I-95 Main Line						
I-95 NB	Allegheny Ave.	Betsy Ross\Aramingo Off-ramp	84,763	94,200	9,437	11.1%
I-95 SB	Betsy Ross\Aramingo On-ramp	Allegheny Ave.	92,975	100,200	7,225	7.8%
I-95 NB	Castor Ave.	Betsy Ross\Aramingo On-ramp	69,562	73,200	3,638	5.2%
I-95 NB	Betsy Ross\Aramingo On-ramp	Bridge St.	70,059	80,700	10,641	15.2%
I-95 SB	Bridge St.	Betsy Ross\ Aramingo Off-ramp	70,965	79,200	8,235	11.6%
I-95 NB	Bridge St.	Cottman Ave.	74,272	91,200	16,928	22.8%
I-95 SB	Princeton St.	Bridge St.	75,910	92,000	16,090	21.2%
I-95 Ramps						
I-95 NB On-ramp	Castor Ave.	I-95 NB	6,578	8,100	1,522	23.1%
I-95 NB Off-ramp	I-95 NB	Combined Aramingo\Betsy Ross	13,502	29,100	15,598	115.5%
I-95 SB On-ramp	Combined Aramingo\Betsy Ross	I-95 SB	14,012	28,400	14,388	102.7%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross Bridge	11,141	12,500	1,359	12.2%
I-95 SB On-ramp	Betsy Ross	Combined Aramingo\Betsy Ross	10,881	12,200	1,319	12.1%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo	2,361	16,600	14,239	603.1%
I-95 SB On-ramp	Aramingo	Combined Aramingo\Betsy Ross	3,131	16,200	13,069	417.4%
I-95 NB On-ramp	Combined Aramingo\Betsy Ross	I-95 NB	9,579	7,500	-2,079	-21.7%
I-95 SB Off-ramp	I-95 SB	Combined Aramingo\Betsy Ross	10,385	7,400	-2,985	-28.7%
I-95 NB On-ramp	Betsy Ross Bridge	Combined Aramingo\Betsy Ross	6,427	4,400	-2,027	-31.5%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross	7,725	4,700	-3,025	-39.2%
I-95 NB On-ramp	Aramingo Ave.	Combined Aramingo\Betsy Ross	3,152	3,100	-52	-1.6%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo Ave.	2,660	2,700	40	1.5%
Betsy Ross Off-ramp	Betsy Ross Bridge	Richmond St.	3,500	2,600	-900	-25.7%
Betsy Ross On-ramp	Richmond St.	Betsy Ross Bridge	4,000	2,800	-1,200	-30.0%
Betsy Ross Off-ramp	Betsy Ross Bridge	Aramingo Ave.	Proposed	9,300	--	--
Betsy Ross On-ramp	Aramingo Ave.	Betsy Ross Bridge	Proposed	10,100	--	--
I-95 Off-ramp	Combined I-95 off-ramps	Aramingo Ave.	5,021	28,600	23,579	469.6%
I-95 On-ramp	Aramingo Ave.	Combined I-95 on-ramps	6,283	29,400	23,117	367.9%
Betsy Ross Bridge	Pennsauken, NJ	Philadelphia	42,116	58,600	16,484	39.1%
I-95 NB Off-ramp	I-95 NB	Harbison Ave.\Bridge St.	14,234	--	--	--
I-95 On-ramp	Harbison Ave.\Bridge St.	I-95 SB	12,782	--	--	--
I-95 NB On-ramp	Bridge St.	I-95 NB	8,483	10,700	2,217	26.1%
I-95 SB Off-ramp	I-95	Bridge St.	10,632	12,800	2,168	20.4%

Table 3
Current and 2025 Alternative 3A
Average Daily Traffic Volumes (Continued)

Highway	Highway Section		Current	2025 Alt. 3A	2025 Alt. 3A/Current	
Facility	**From**	**To**	**Volume**	**Volume**	**Growth**	**Percent**
Intersecting Roads						
Aramingo Connector	I-95/Betsy Ross Bridge Con.Rmps	Aramingo Ave.	11,304	58,000	46,696	413.1%
Church St.	Tacony St.	Aramingo Ave.	6,321	14,100	7,779	123.1%
Church St.	Torresdale Ave.	Frankford Ave.	1,870	3,600	1,730	92.5%
Orthodox St.	Frankford Ave.	Torresdale Ave.	3,813	6,100	2,287	60.0%
Orthodox St.	Tacony St.	Aramingo Ave.	3,022	5,900	2,878	95.2%
Orthodox St.	Aramingo Ave.	Thompson St.	3,682	2,600	-1,082	-29.4%
Margaret St.	Frankford Ave.	Torresdale Ave.	6,443	8,400	1,957	30.4%
Margaret St.	Tacony St.	Aramingo Ave.	2,067	5,300	3,233	156.4%
Margaret St.	Aramingo Ave.	Thompson St.	2,000	2,300	300	15.0%
Wakeling St.	Frankford Ave.	Torresdale Ave.	6,443	5,500	-943	-14.6%
Wakeling St.	Torresdale Ave.	Harbison Ave.	6,770	6,100	-670	-9.9%
Bridge St.	Frankford Ave.	Torresdale Ave.	7,484	10,500	3,016	40.3%
Bridge St.	Torresdale Ave.	Harbison Ave.	9,608	13,100	3,492	36.3%
Bridge St.	Harbison Ave.	Tacony St.	--	19,800	--	--
Bridge St.	Tacony St.	I-95 NB On-ramp	11,029	14,800	3,771	34.2%
Bridge St.	I-95 NB On-ramp	Thompson St.	6,442	7,800	1,358	21.1%
Van Kirk St.	Keystone St.	Tacony St.	2,292	3,800	1,508	65.8%
Comly St.	Keystone St.	Tacony St.	4,581	6,400	1,819	39.7%
Parallel Roads						
Torresdale Ave.	Frankford Ave.	Adams Ave.	21,448	29,500	8,052	37.5%
Torresdale Ave.	Margaret St.	Wakeling St.	13,623	15,300	1,677	12.3%
Torresdale Ave.	Bridge St.	Harbison Ave.	14,846	16,400	1,554	10.5%
Torresdale Ave.	Harbison Ave.	Cheltenham Ave.	10,330	13,100	2,770	26.8%
Tacony St.	Church St.	Orthodox St.	6,209	8,500	2,291	36.9%
Tacony St.	Margaret St.	Harbison Ave.	11,174	13,700	2,526	22.6%
Tacony St.	Harbison Ave.	Bridge St.	20,956	28,800	7,844	37.4%
Tacony St.	Bridge St.	Carver St.	18,057	32,100	14,043	77.8%
Tacony St.	Carver St.	Van Kirk St.	17,122	22,500	5,378	31.4%
Aramingo Ave.	Wheatsheaf Ln.	Aramingo Connector	29,265	38,400	9,135	31.2%
Aramingo Ave.	Aramingo Connector	Church St.	25,490	64,900	39,410	154.6%
Aramingo Ave.	Church St.	Orthodox St.	23,010	54,500	31,490	136.9%
Aramingo Ave.	Margaret St.	Tacony St.	18,847	45,000	26,153	138.8%
Harbison Ave.	James St.	Bridge St.	33,149	36,400	3,251	9.8%
Harbison Ave.	Torresdale Ave.	Cheltenham Ave.	26,112	28,100	1,988	7.6%
James St.	Bridge St.	Harbison Ave.	5,073	1,700	-3,373	-66.5%
(James St. off-ramp from I-95 SB is moved in future alternatives)						
Richmond St.	Wheatsheaf Ln.	Betsy Ross Bridge	15,640	15,700	60	0.4%
Richmond St.	Betsy Ross Bridge	Orthodox St.	9,539	11,200	1,661	17.4%
Richmond St.	Lefevre St.	Bridge St.	6,680	7,800	1,120	16.8%

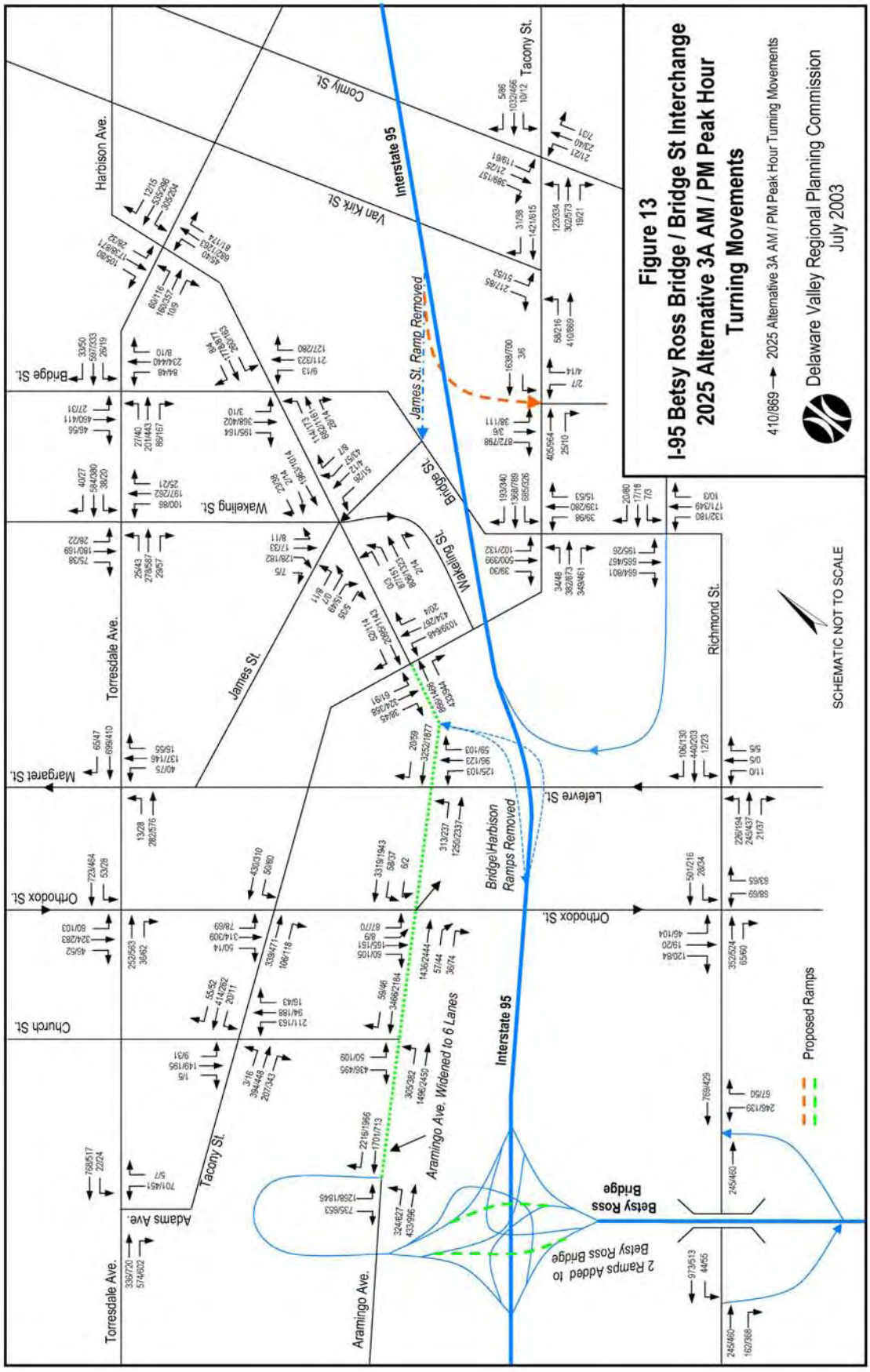


Figure 13
I-95 Betsy Ross Bridge / Bridge St Interchange
2025 Alternative 3A AM / PM Peak Hour
Turning Movements
410/869 → 2025 Alternative 3A AM / PM Peak Hour Turning Movements
Delaware Valley Regional Planning Commission
July 2003
SCHEMATIC NOT TO SCALE
Proposed Ramps
Interstate 95
James St. Ramp Removed
Bridge/Harbison Ramps Removed
Interstate 95
Aramingo Ave. Widened to 6 Lanes
2 Ramps Added to Betsy Ross Bridge
Betsy Ross Bridge
Harbison Ave.
Comly St.
Van Kirk St.
Tacony St.
Bridge St.
Wakeling St.
James St.
Margaret St.
Torresdale Ave.
Orthodox St.
Church St.
Adams Ave.
Aramingo Ave.
Lefevre St.
Richmond St.

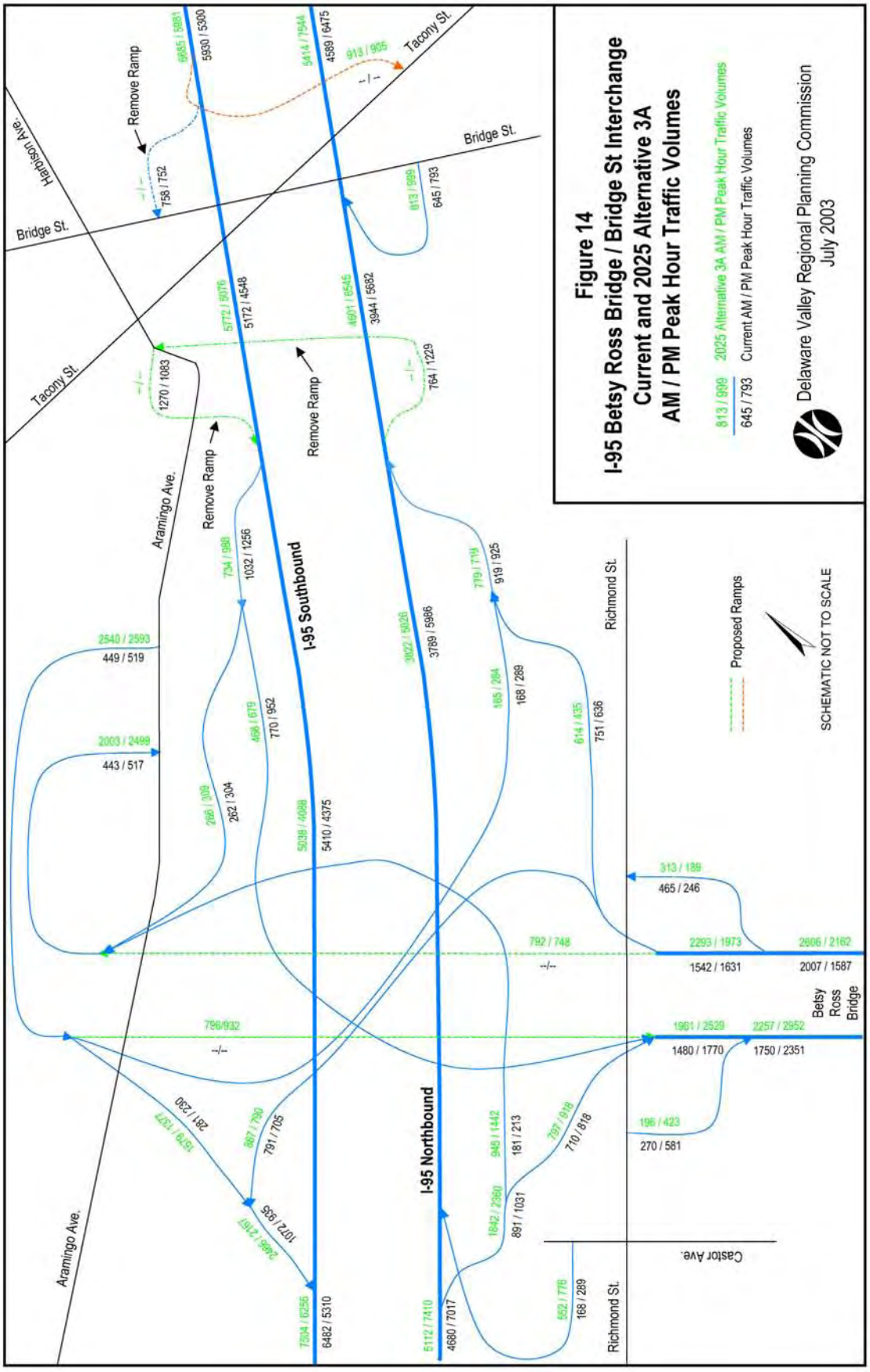


Figure 14
I-95 Betsy Ross Bridge / Bridge St Interchange
Current and 2025 Alternative 3A
AM / PM Peak Hour Traffic Volumes
813 / 999 2025 Alternative 3A AM / PM Peak Hour Traffic Volumes
645 / 793 Current AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
Proposed Ramps
SCHEMATIC NOT TO SCALE
I-95 Southbound
I-95 Northbound
Remove Ramp
Tacony St.
Bridge St.
Hatbison Ave.
Aramingo Ave.
Richmond St.
Castor Ave.
Betsy Ross Bridge
6985 / 5881
5930 / 5300
5414 / 7544
4589 / 6475
913 / 905
758 / 752
813 / 999
645 / 793
5772 / 5076
5172 / 4548
4691 / 8545
3944 / 5682
1270 / 1083
764 / 1229
734 / 998
1032 / 1256
3022 / 5026
3789 / 5986
779 / 719
919 / 925
2540 / 2593
449 / 519
2003 / 2499
443 / 517
466 / 679
770 / 952
165 / 264
168 / 289
614 / 435
751 / 636
266 / 309
262 / 304
5038 / 4088
5410 / 4375
313 / 189
465 / 246
792 / 748
2293 / 1973
1542 / 1631
2606 / 2162
2007 / 1587
786/932
1961 / 2529
1480 / 1770
2257 / 2952
1750 / 2351
281 / 230
1579 / 1727
887 / 799
791 / 705
1072 / 935
2486 / 2167
945 / 1442
1642 / 2360
891 / 1031
181 / 213
797 / 818
710 / 818
196 / 423
270 / 581
7534 / 6256
6482 / 5310
5112 / 7410
4680 / 7017
552 / 776
168 / 289

D. Alternative 3B

Alternatives 3A and 3B are similar except that the Aramingo Connector complex is extended to Adams Avenue and a small portion of Tacony Street is made one-way. A two-way roadway is proposed from the current terminus of Adams Avenue to the Aramingo Connector complex and to Aramingo Avenue. Through this roadway extension, direct access is provided from extended Adams Avenue to I-95 NB and SB, the Betsy Ross Bridge, and Aramingo Avenue. Traffic from I-95 and the Betsy Ross Bridge to the Adams Avenue extension uses the existing Aramingo Connector and one block of Aramingo Avenue. Also in Alternative 3B, Tacony Street is made one-way between Aramingo Avenue and Margaret Street. This is intended to relieve the intersections of Tacony Street and Harbison Avenue. The 2025 AADT traffic volumes resulting from Alternative 3B are compared with alternatives 1 and 3A in ***figure 15,*** in addition ***table 4*** compares Alternative 3B 2025 Traffic Volumes with the current counts.

The significant link traffic volume differences between alternatives 3A and 3B are localized into the immediate vicinity of the Aramingo Connector complex and Tacony Street. The Adams Avenue extension is projected to carry a total of 14,500 vpd in 2025. This traffic is predominately southbound 10.8 vpd versus 3.7 vpd northbound. About one-third of the southbound traffic is destined to I-95 with the remaining two-thirds (6,700 vpd) accessing the Betsy Ross Bridge. Much of this traffic is diverted from the existing Aramingo connector. Bridge traffic is expected to increase by 700 vpd as a result of the Adams Avenue extension. All of the 3.7 vpd northbound traffic on the Adams Avenue extension comes from Aramingo Avenue. The Adams Avenue extension provides significant relief for the Aramingo Connector (44.2 versus 58.0 vpd) and for Aramingo Avenue at the connector terminus (55.2 vpd versus 64.8 vpd).

Alternative 3B **(*see figure 15*)** also provides significant relief for Church Street (6.7 versus 14.1 vpd) and for Tacony Street, particularly in the one-way section between Aramingo Avenue and Margaret Street (9.8 versus 13.7 vpd). Torresdale Avenue traffic south of Adams Avenue is increased from 29,500 to 31,900 vpd as a result of additional vehicles being attracted to the proposed roadway extension in this alternative. Traffic impacts of Alternative 3B compared to 3A on I-95, and other streets and arterial roadways in the study area, tend to be minor.

Peak hour ramp and turning movement differences between alternatives 3A and 3B are consistent with differences between AADT link traffic volumes (***see figures 13, 16, and 17***). As one might expect, turning movements and related congestion are increased in the vicinity of the Aramingo connection, but reduced along Aramingo Avenue at its intersections with Church, Orthodox, Margaret, and, especially, Tioga streets.

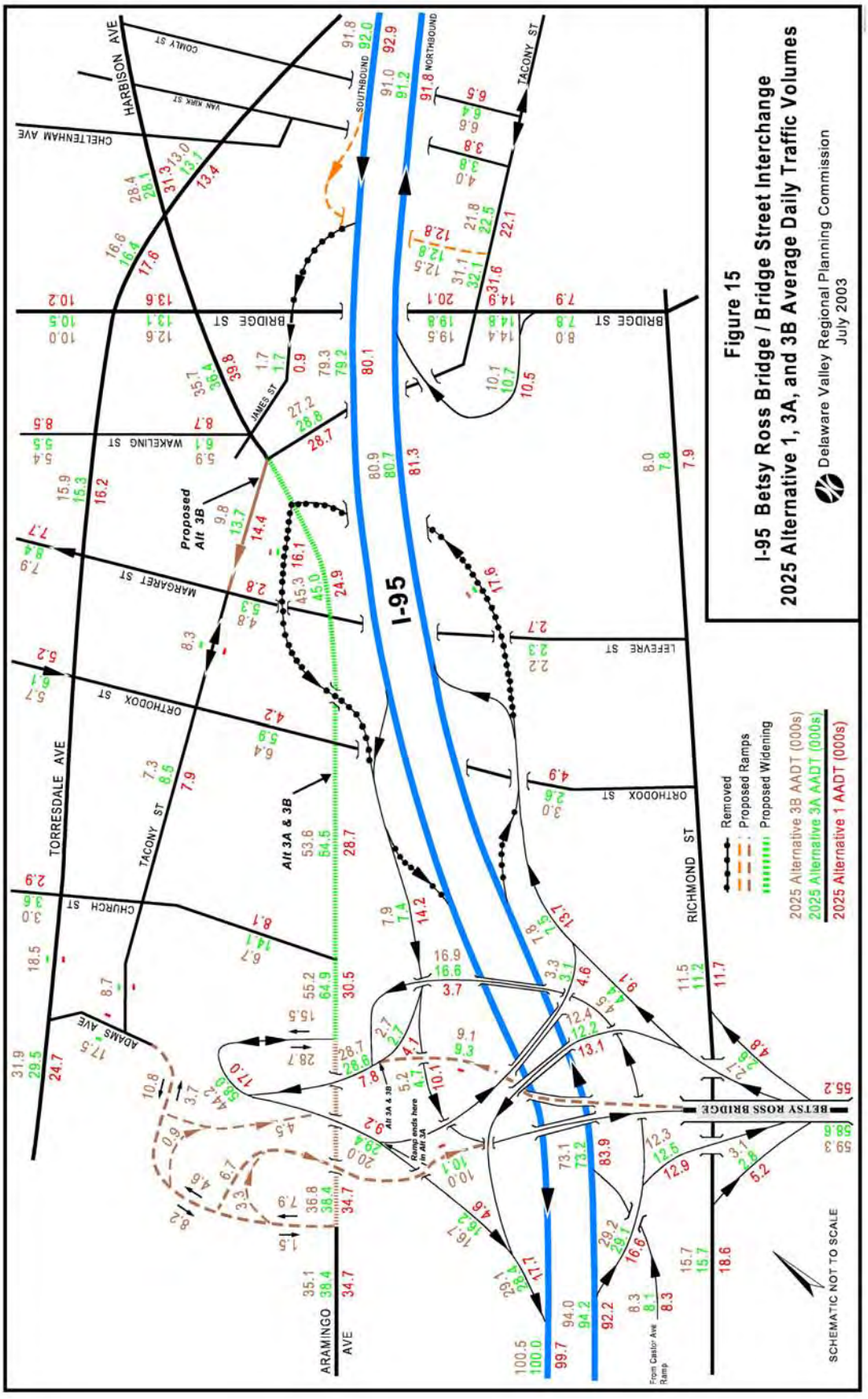


Figure 15
I-95 Betsy Ross Bridge / Bridge Street Interchange
2025 Alternative 1, 3A, and 3B Average Daily Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
I-95
SOUTHBOUND
NORTHBOUND
BRIDGE ST
HARRISON AVE
COULY ST
VAN NUIK ST
CHELTENHAM AVE
TACONY ST
JAMES ST
WAKELING ST
MARGARET ST
ORTHODOX ST
LEFEVRE ST
TORRESDALE AVE
CHURCH ST
ADAMS AVE
ARAMINGO AVE
RICHMOND ST
BETSY ROSS BRIDGE
Proposed Alt 3B
Alt 3A & 3B
Ramp ends here on Alt 3A
From Castor Ave Ramp
Removed
Proposed Ramps
Proposed Widening
2025 Alternative 3B AADT (000s)
2025 Alternative 3A AADT (000s)
2025 Alternative 1 AADT (000s)
SCHEMATIC NOT TO SCALE

Table 4
Current and 2025 Alternative 3B
Average Daily Traffic Volumes

Highway	Highway Section		Current	2025 Alt. 3B	2025 Alt. 3B/Current	
Facility	From	To	Volume	Volume	Growth	Percent
I-95 Main Line						
I-95 NB	Allegheny Ave.	Betsy Ross\Aramingo Off-ramp	84,763	94,000	9,237	10.9%
I-95 SB	Betsy Ross\Aramingo On-ramp	Allegheny Ave.	92,975	100,500	7,525	8.1%
I-95 NB	Castor Ave.	Betsy Ross\Aramingo On-ramp	69,562	73,100	3,538	5.1%
I-95 NB	Betsy Ross\Aramingo On-ramp	Bridge St.	70,059	80,900	10,841	15.5%
I-95 SB	Bridge St.	Betsy Ross\ Aramingo Off-ramp	70,965	79,300	8,335	11.7%
I-95 NB	Bridge St.	Cottman Ave.	74,272	91,000	16,728	22.5%
I-95 SB	Princeton St.	Bridge St.	75,910	91,800	15,890	20.9%
I-95 Ramps						
I-95 NB On-ramp	Castor Ave.	I-95 NB	6,578	8,300	1,722	26.2%
I-95 NB Off-ramp	I-95 NB	Combined Aramingo\Betsy Ross	13,502	29,200	15,698	116.3%
I-95 SB On-ramp	Combined Aramingo\Betsy Ross	I-95 SB	14,012	29,100	15,088	107.7%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross Bridge	11,141	12,300	1,159	10.4%
I-95 SB On-ramp	Betsy Ross	Combined Aramingo\Betsy Ross	10,881	12,400	1,519	14.0%
I-95 NB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo	2,361	16,900	14,539	615.8%
I-95 SB On-ramp	Aramingo	Combined Aramingo\Betsy Ross	3,131	16,700	13,569	433.4%
I-95 NB On-ramp	Combined Aramingo\Betsy Ross	I-95 NB	9,579	7,800	-1,779	-18.6%
I-95 SB Off-ramp	I-95 SB	Combined Aramingo\Betsy Ross	10,385	7,900	-2,485	-23.9%
I-95 NB On-ramp	Betsy Ross Bridge	Combined Aramingo\Betsy Ross	6,427	4,500	-1,927	-30.0%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Betsy Ross	7,725	5,200	-2,525	-32.7%
I-95 NB On-ramp	Aramingo Ave.	Combined Aramingo\Betsy Ross	3,152	3,300	148	4.7%
I-95 SB Off-ramp	Combined Aramingo\Betsy Ross	Aramingo Ave.	2,660	2,700	40	1.5%
Betsy Ross Off-ramp	Betsy Ross Bridge	Richmond St.	3,500	2,700	-800	-22.9%
Betsy Ross On-ramp	Richmond St.	Betsy Ross Bridge	4,000	3,100	-900	-22.5%
Betsy Ross Off-ramp	Betsy Ross Bridge	Aramingo Ave.	Proposed	9,100	--	--
Betsy Ross On-ramp	Aramingo Ave.	Betsy Ross Bridge	Proposed	10,000	--	--
I-95 Off-ramp	Combined I-95 off-ramps	Aramingo Ave.	5,021	28,700	23,679	471.6%
I-95 On-ramp	Aramingo Ave.	Combined I-95 on-ramps	6,283	20,000	13,717	218.3%
Betsy Ross Bridge	Pennsauken, NJ	Philadelphia, PA	42,116	59,300	17,184	40.8%
I-95 NB Off-ramp	I-95 NB	Harbison Ave.\Bridge St.	14,234	--	--	--
I-95 On-ramp	Harbison Ave.\Bridge St.	I-95 SB	12,782	--	--	--
I-95 NB On-ramp	Bridge St.	I-95 NB	8,483	10,100	1,617	19.1%
I-95 SB Off-ramp	I-95	Bridge St.	10,632	12,500	1,868	17.6%

Table 4
Current and 2025 Alternative 3B
Average Daily Traffic Volumes (Continued)

Highway Facility	Highway Section From	To	Current Volume	2025 Alt. 3B Volume	2025 Alt. 3B/Current Growth	Percent
Adams Ave Extension (Proposed)						
I-95 Connecting Ramp	Aramingo Ave.	I-95 On-ramps	--	15,500	--	--
I-95 Connecting Ramp	Adams Ave. Extension	I-95 On-ramps		4,500		
Adams Ave. Ext. EB	Betsy Ross On-ramp	Aramingo Ave.	--	1,500	--	--
Adams Ave. Ext. WB	Betsy Ross On-ramp	Aramingo Ave.		7,900		
Adams Ave. Ext. EB	I-95 On-ramp	Betsy Ross On-ramp	--	8,200	--	--
Adams Ave. Ext. WB	I-95 On-ramp	Betsy Ross On-ramp		4,600		
Adams Ave. Ext. EB	Tacony St.	I-95 On-ramp	--	10,800	--	--
Adams Ave. Ext. WB	Tacony St.	I-95 On-ramp		3,700		
Adams Ave. Ext.	Torresdale Ave.	Tacony St.	--	17,500	--	--
Intersecting Roads						
Aramingo Connector	I-95/Betsy Ross Bridge Con.Rmps	Aramingo Ave.	11,304	44,200	32,896	291.0%
Church St.	Tacony St.	Aramingo Ave.	6,321	6,700	379	6.0%
Church St.	Torresdale Ave.	Frankford Ave.	1,870	3,000	1,130	60.4%
Orthodox St.	Frankford Ave.	Torresdale Ave.	3,813	5,700	1,887	49.5%
Orthodox St.	Tacony St.	Aramingo Ave.	3,022	6,400	3,378	111.8%
Orthodox St.	Aramingo Ave.	Thompson St.	3,682	3,000	-682	-18.5%
Margaret St.	Frankford Ave.	Torresdale Ave.	6,443	7,900	1,457	22.6%
Margaret St.	Tacony St.	Aramingo Ave.	2,067	4,800	2,733	132.2%
Margaret St.	Aramingo Ave.	Thompson St.	2,000	2,200	200	10.0%
Wakeling St.	Frankford Ave.	Torresdale Ave.	6,443	5,400	-1,043	-16.2%
Wakeling St.	Torresdale Ave.	Harbison Ave.	6,770	5,900	-870	-12.9%
Bridge St.	Frankford Ave.	Torresdale Ave.	7,484	10,000	2,516	33.6%
Bridge St.	Torresdale Ave.	Harbison Ave.	9,608	12,600	2,992	31.1%
Bridge St.	Harbison Ave.	Tacony St.	--	19,500	--	--
Bridge St.	Tacony St.	I-95 NB On-ramp	11,029	14,400	3,371	30.6%
Bridge St.	I-95 NB On-ramp	Thompson St.	6,442	8,000	1,558	24.2%
Van Kirk St.	Keystone St.	Tacony St.	2,292	4,000	1,708	74.5%
Comly St.	Keystone St.	Tacony St.	4,581	6,600	2,019	44.1%

Table 4
Current and 2025 Alternative 3B
Average Daily Traffic Volumes (Continued)

Highway Facility	Highway Section From	To	Current Volume	2025 Alt. 3B Volume	2025 Alt. 3B/Current Growth	Percent
Parallel Roads						
Torresdale Ave.	Frankford Ave.	Adams Ave.	21,448	31,900	10,452	48.7%
Torresdale Ave.	Margaret St.	Wakeling St.	13,623	18,500	4,877	35.8%
Torresdale Ave.	Bridge St.	Harbison Ave.	14,846	15,900	1,054	7.1%
Torresdale Ave.	Harbison Ave.	Cheltenham Ave.	10,330	16,600	6,270	60.7%
Tacony St.	Church St.	Adams Ave.	--	8,700	--	--
Tacony St.	Church St.	Orthodox St.	6,209	7,300	1,091	17.6%
Tacony St.	Margaret St.	Harbison Ave.	11,174	9,800	-1,374	-12.3%
Tacony St.	Orthodox St.	Margaret St.	--	8,300	--	--
Tacony St.	Harbison Ave.	Bridge St.	20,956	27,200	6,244	29.8%
Tacony St.	Bridge St.	Carver St.	18,057	31,100	13,043	72.2%
Tacony St.	Carver St.	Van Kirk St.	17,122	21,800	4,678	27.3%
Aramingo Ave.	Wheatsheaf Ln.	Aramingo Connector	29,265	35,100	5,835	19.9%
Aramingo Ave.	Aramingo Ave. Connector	Aramingo Connector	29,265	36,800	7,535	25.7%
Aramingo Ave.	Aramingo Connector	Church St.	25,490	55,200	29,710	116.6%
Aramingo Ave.	Church St.	Orthodox St.	23,010	53,600	30,590	132.9%
Aramingo Ave.	Margaret St.	Tacony St.	18,847	45,300	26,453	140.4%
Harbison Ave.	James St.	Bridge St.	33,149	35,700	2,551	7.7%
Harbison Ave.	Torresdale Ave.	Cheltenham Ave.	26,112	28,400	2,288	8.8%
James St.	Bridge St.	Harbison Ave.	5,073	1,700	-3,373	-66.5%
(James St. off-ramp from I-95 SB is moved in future alternatives)						
Richmond St.	Wheatsheaf Ln.	Betsy Ross Bridge	15,640	15,700	60	0.4%
Richmond St.	Betsy Ross Bridge	Orthodox St.	9,539	11,500	1,961	20.6%
Richmond St.	Lefevre St.	Bridge St.	6,680	8,000	1,320	19.8%

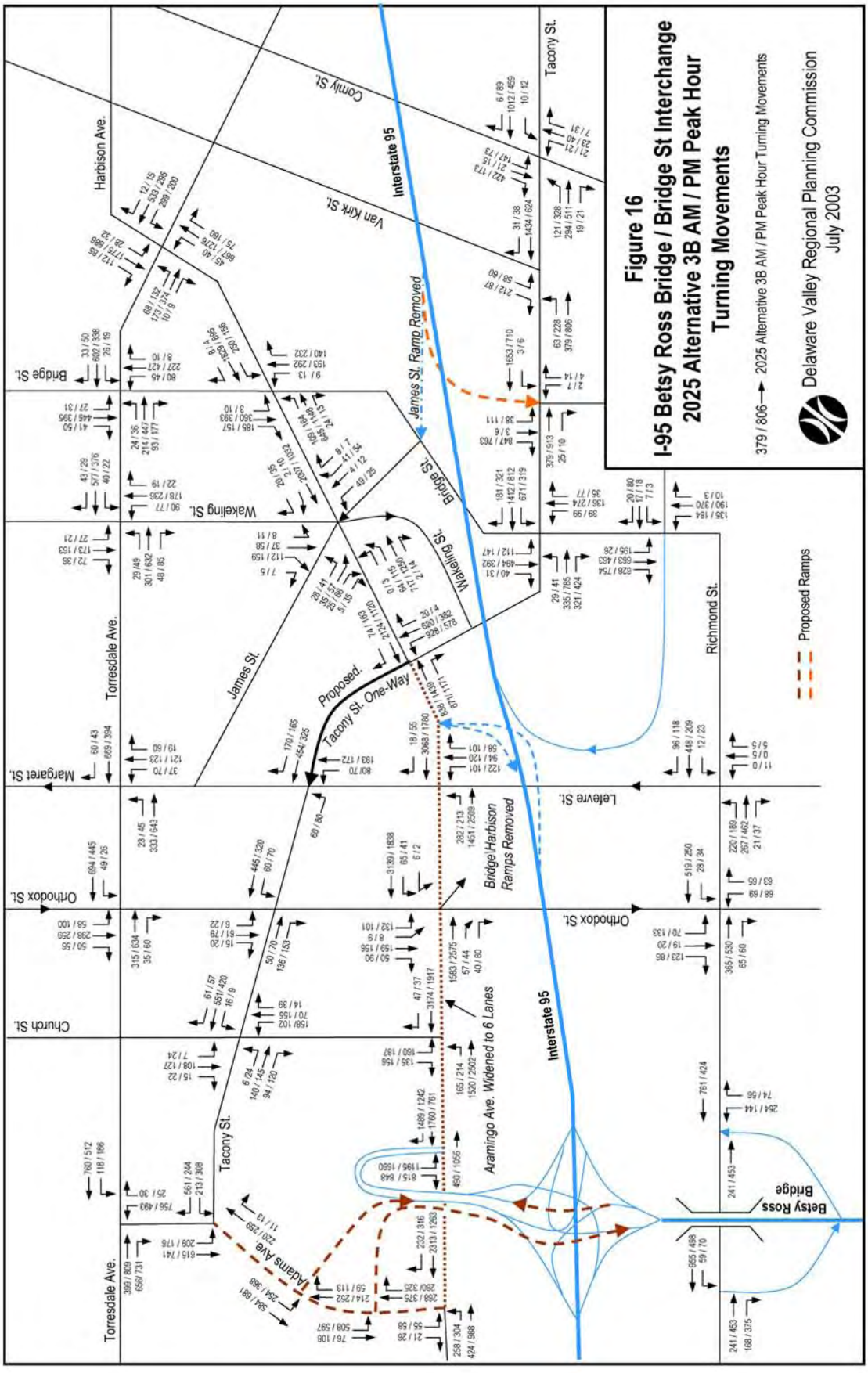


Figure 16
I-95 Betsy Ross Bridge / Bridge St Interchange
2025 Alternative 3B AM / PM Peak Hour
Turning Movements
379 / 806 → 2025 Alternative 3B AM / PM Peak Hour Turning Movements
Delaware Valley Regional Planning Commission
July 2003
Proposed Ramps
Interstate 95
James St. Ramp Removed
Bridge/Harbison Ramps Removed
Aramingo Ave. Widened to 6 Lanes
Proposed. Tacony St. One-Way
Betsy Ross Bridge
Harbison Ave.
Comly St.
Van Kirk St.
Tacony St.
Bridge St.
Wakeling St.
James St.
Torresdale Ave.
Margaret St.
Orthodox St.
Church St.
Lefevre St.
Richmond St.
Adams Ave

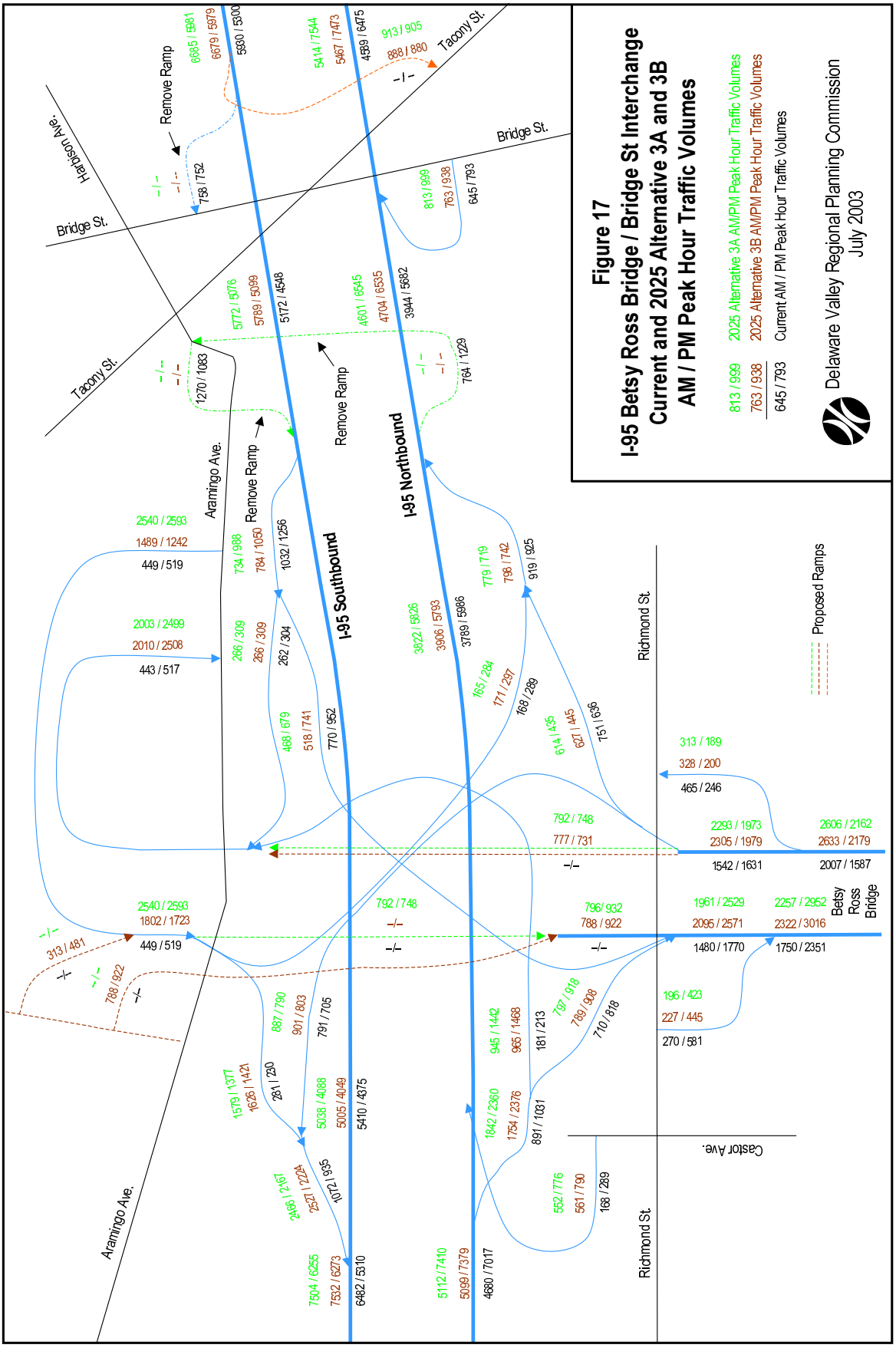


Figure 17
I-95 Betsy Ross Bridge / Bridge St Interchange
Current and 2025 Alternative 3A and 3B
AM / PM Peak Hour Traffic Volumes
813 / 999 2025 Alternative 3A AM/PM Peak Hour Traffic Volumes
763 / 938 2025 Alternative 3B AM/PM Peak Hour Traffic Volumes
645 / 793 Current AM / PM Peak Hour Traffic Volumes
Delaware Valley Regional Planning Commission
July 2003
I-95 Southbound
I-95 Northbound
Remove Ramp
Tacony St.
Bridge St.
Hahnson Ave.
Aramingo Ave.
Richmond St.
Castor Ave.
Betsy Ross Bridge
Proposed Ramps

APPENDIX A
24-HOUR MACHINE TRAFFIC COUNTS

APPENDIX B
INTERSECTION TURNING MOVEMENT COUNTS

Title of Report: I-95 Interchange Enhancement and Reconstruction
I-95 Betsy Ross Bridge/Bridge Street Interchange (Sections BRI/BSR) Traffic Study

Publication No.: 04007

Date Published: November 2003

Geographic Area Covered: I-95 Betsy Ross Bridge/Bridge Street Interchange Complex, City of Philadelphia (Near Northeast section)

Key Words: Traffic Volumes, Peak Hour Traffic, Travel Forecast, I-95, Betsy Ross Bridge, Aramingo Avenue, Bridge Street, Philadelphia

ABSTRACT
This report presents traffic forecasts and analysis for the I-95 Betsy Ross Bridge/Bridge Street interchange complex in Northeast Philadelphia. The report examines the impacts of 2025 traffic volumes on I-95, the interchange ramps, and the local roadway system of four improvement alternatives: Alternative 1 (Base Case), which would encompass only elimination of the I-95 lane drops and relocation of the Bridge Street SB I-95 off-ramp from James Street to Tacony Street opposite Carver Street; and three design alternatives, which would reconfigure the I-95 on and off-ramps, as well as making other improvements to the roadways in the study area. The report also briefly describes the methodology used to develop the traffic forecasts.

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