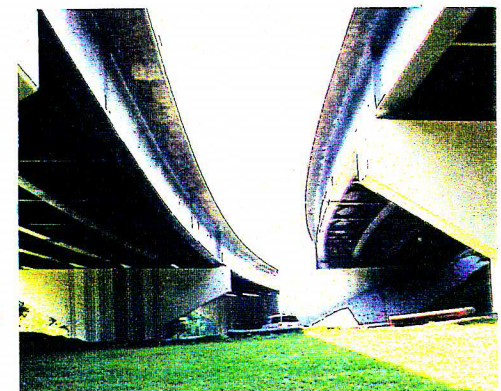
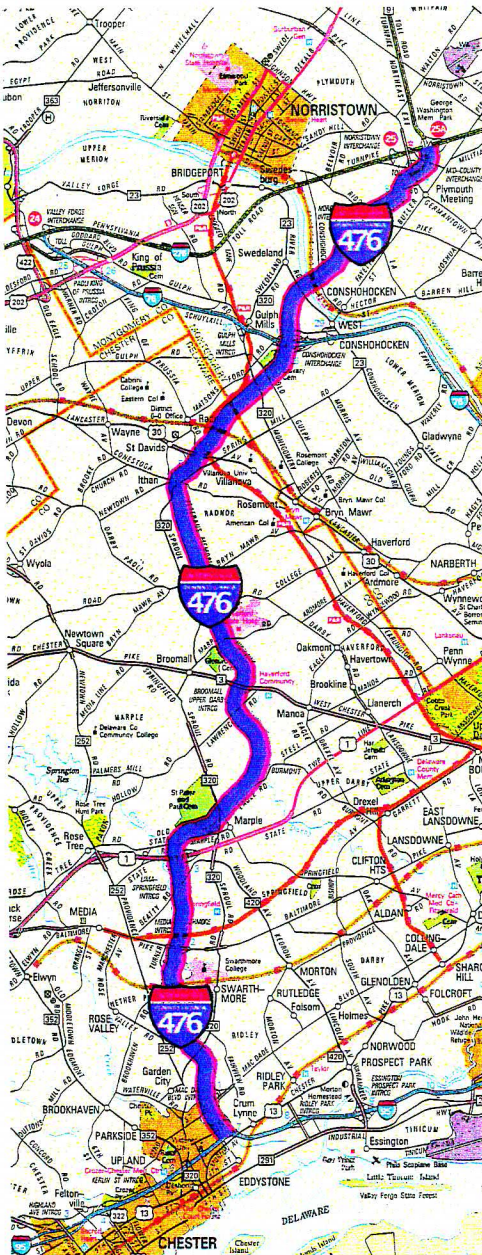


TRAFFIC IMPACTS OF I-476 (MID-COUNTY EXPRESSWAY)



PREPARED FOR :



By : Pennsylvania Department of Transportation
Delaware Valley Regional Planning Commission

OCTOBER 1994

TRAFFIC IMPACTS
OF I-476
(MID-COUNTY EXPRESSWAY)

DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
The Bourse Building
111 S. Independence Mall East
Philadelphia, PA 19106-2515

October 1994

This report, prepared by the Transportation Planning Division of the Delaware Valley Regional Planning Commission, was financed in part by the Federal Transit Administration, the Federal Highway Administration, and the Pennsylvania and New Jersey Departments of Transportation. The authors, however, are solely responsible for its finding and conclusions, which may not represent the official views or policies of the funding agencies.

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development 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. The Commission is an advisory agency which divides its planning and service functions among the Office of the Executive Director, the Office of Public Affairs, and three line Divisions: Transportation Planning, Regional Information Services Center, which includes the Office of Regional Planning, and the Office of Administration and Finance. DVRPC's mission for the 1990s is to emphasize technical assistance and services and to conduct high priority studies for member state and local governments, while determining and meeting the needs of the private sector.



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DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

| | |
|---|---|
| TITLE Traffic Impacts of I-476 (Mid-County Expressway) | Date Published: October 1994 Publication No. 94024 |
|---|---|

Geographic Area Covered:

Delaware and Montgomery Counties, Pennsylvania

Key Words:

Traffic count, Classification count, Average Daily Traffic (ADT), Peak hour count, Ramp count, Truck travel, Traffic Impacts

ABSTRACT

This report presents the results of a traffic counting effort conducted by DVRPC to assess the 1993 usage of I-476 from I-95, Ridley Township, Delaware County, to the Pennsylvania Turnpike (I-276) and Northeast Extension (PA 9), Plymouth Township, Montgomery County. Average Daily Traffic, peak hour counts, truck travel, and ramp volumes are documented. Traffic estimates on interchange and parallel routes of the corridor served by I-476, are also reported. Finally, a brief comparison between the 1993 use of I-476 and previous traffic forecast studies is reported.

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Table of Contents

| | <u>Page</u> |
|---|-------------|
| Executive Summary | 1 |
| I. Introduction | 3 |
| II. Background | 5 |
| <i>History</i> | 5 |
| <i>Description of the I-476 Corridor</i> | 6 |
| <i>Corridor Demographics</i> | 6 |
| III. Methodology and Processing of Traffic Monitoring | 13 |
| <i>Automatic Traffic Recorder (ATR) Counts</i> | 13 |
| <i>Classification Recorder Counts</i> | 14 |
| <i>Manual Classification Counts</i> | 14 |
| <i>Processing</i> | 15 |
| IV. Analysis of Traffic Counts | 17 |
| <i>I-476 Traffic Counts</i> | 17 |
| <i>Traffic on Interchange Roads</i> | 19 |
| <i>Interchange 1</i> | 21 |
| <i>Interchange 2</i> | 21 |
| <i>Interchange 3</i> | 23 |
| <i>Interchange 4</i> | 24 |
| <i>Interchange 5</i> | 24 |
| <i>Interchange 6</i> | 25 |
| <i>Interchange 7</i> | 26 |
| <i>Interchange 8</i> | 26 |
| <i>Interchange 9</i> | 27 |
| <i>Traffic on Parallel Roads</i> | 27 |
| V. Past DVRPC Traffic Forecasts | 35 |
| VI. Conclusions | 37 |

Table of Contents (cont.)**APPENDIX**

| | <u>Page</u> |
|---------------------|-------------|
| Interchange 1 | A-1 |
| Interchange 2 | A-3 |
| Interchange 3 | A-5 |
| Interchange 4 | A-7 |
| Interchange 5 | A-9 |
| Interchange 6 | A-11 |
| Interchange 7 | A-13 |
| Interchange 8 | A-15 |
| Interchange 9 | A-17 |

List of Tables

| | <u>Title</u> | <u>Page</u> |
|-----------|--|-------------|
| Table I | Demographic Data For I-476 Corridor | 10 |
| Table II | I-476 Traffic Volumes (1993 ADT) | 18 |
| Table III | Traffic Impacts on Interchange Roads | 22 |
| Table IV | Traffic Impacts on Parallel Roads | 29 |

List of Illustrations

| | <u>Title</u> | <u>Page</u> |
|----------|--------------------------------------|-------------|
| Figure 1 | Regional Location Map | 4 |
| Figure 2 | I-476 Interchanges | 7 |
| Figure 3 | I-476 Corridor | 8 |
| Figure 4 | I-476 Traffic Volumes | 20 |
| Figure 5 | Interchange and Parallel Roads | 33 |

EXECUTIVE SUMMARY

The opening of a fully completed I-476 in 1992 marked the end of nearly forty years of planning, development, and construction. The 21.5-mile long highway, also known as the Mid-County Expressway and the Blue Route, links I-95 with the Pennsylvania Turnpike (I-276) and its Northeast Extension (PA 9). The expressway winds its way from Ridley Township through the heart of Delaware County north to Plymouth Township in Montgomery County. Along the way the expressway interchanges traffic with MacDade Boulevard, Baltimore Pike, the Media Bypass (US 1), West Chester Pike (PA 3), Lancaster Avenue (US 30), the Schuylkill Expressway (I-76), Ridge Pike, Chemical Road, Germantown Pike, and Plymouth Road.

In 1992, the Pennsylvania Department of Transportation (PennDOT) requested that the Delaware Valley Regional Planning Commission (DVRPC) conduct a traffic study for the entire length of I-476 to establish the usage of the facility, to evaluate its impacts on interchange and parallel routes in the corridor served by I-476, to determine the impact of truck travel on the interstate facility, and to report the diversion of traffic at the two end points of I-476.

This report documents the impacts that I-476 has had on local and through travel. After the full length of the highway opened in December 1992, new traffic patterns formed, such as I-76 (west) to I-476 (north) to the Pennsylvania Turnpike, and Butler Pike to Plymouth Road to I-476. In addition, existing patterns were rearranged, a change which affected local access to I-276, I-76, US 1, and I-95, and transferred through traffic from PA 452, PA 252, PA 320, and PA 420 to I-476.

Analysis of traffic counts collected in 1993 indicated that travel along I-476 ranges from a low of 60,900 vehicles per day between US 1 and PA 3, to a high of 83,000 vehicles just north of I-76. Most of the other segments carry between 65,000 and 70,000 vehicles per day.

The highest peak hour volumes during the morning rush occur at three of the nine I-476 segments with about 3,700 vehicles counted during one hour intervals. The I-476 southbound lanes experience these volumes where the predominant flow is toward I-95, south of Baltimore Pike, and toward I-76, south of Ridge Pike. The I-476 northbound lanes also report a count of this magnitude on the segment of I-476 between PA 3 and US 30. During the afternoon the pattern is reversed at the same locations. The I-476 northbound lanes south of the Baltimore Pike Interchange and south of Ridge Pike serve volumes approaching 3,800 vehicles per hour. The same can be said of the I-476 southbound lanes between US 30 and PA 3.

Of the five locations monitored for truck travel, two sections of I-476 are of equal importance. Two-way truck traffic, in excess of 8,000 commercial vehicles per day, has been counted where I-476 connects MacDade Boulevard with Baltimore Pike and I-76 with Ridge Pike. The truck travel percent of total traffic recorded at the five locations ranges between 7.4 and 11.3. These percentages represent totals varying between 5,000 and 8,100 commercial vehicles per day, respectively.

As expected, high traffic interactions with crossing roads tend to occur where I-476 interchanges with other interstate highways. The two highest interchange volumes, i.e., traffic entering or leaving I-476 per weekday, are seen at I-76/Matsonford Road, with an interaction of over 95,000 vehicles, and at I-95/MacDade Boulevard, with a total exchange of 81,500 vehicles. At the expressway's northern terminus, 42,800 vehicles are exchanged with I-276/PA 9 (PA Tpke/NE Ext.), with 23,900 interacting with the main spine of the turnpike and the remainder with its Northeast Extension. Of the six interchanges with non-interstate highways, the most active are US 1, PA 3, and US 30, each of which handles a daily volume ranging between 41,500 and 45,000 vehicles.

Most of the roads interchanging with I-476 have seen significant growth in traffic since the highway's opening, ranging as high as 99 percent on Plymouth Road. On the other hand, traffic on roads paralleling I-476 has generally declined. Examples include PA 320 (-36%), PA 252 (-25%), PA 452 (-14%), and PA 420 (-12%).

A travel time survey comparing I-476 with parallel roads shows that a motorist on I-476 can travel between I-95 and the Pennsylvania Turnpike in 23 minutes, compared to 49 minutes on the alternate route (PA 320, Matsonford Road, Fayette Street, Butler Pike, and Germantown Pike). This comparison shows a 26 minute or 53 percent saving in travel time for each driver using the entire length of I-476.

In summary, the impact of the long-planned, much-delayed I-476 has been very positive from the standpoint of traffic flow. Separation of local travel from through traffic, a problem that had plagued mid-Delaware County for years, has been accomplished, with the result that the majority of the previously congested streets and roads have now been freed for local drivers. From a regional perspective, this "parkway-like" expressway has been beneficial in saving travel time, improving mobility, and offering additional options to the region's motorists.

I. INTRODUCTION

Fully completed and opened to traffic in 1992, I-476 (also known as the Mid-County Expressway or the Blue Route) divides Delaware County nearly in half. Giving area residents full access to the interstate highway network, I-476 now serves as an important area link for daily travelers, as well as for commercial operators. Running between Ridley Township in Delaware County and Plymouth Township in Montgomery County, the 21.5-mile expressway provides direct connections to major facilities, such as I-95, the Schuylkill Expressway (I-76), and the Pennsylvania Turnpike (I-276) with its Northeast Extension (PA 9) (See Figure 1). Additional interchanges are located at MacDade Boulevard, Baltimore Pike, US 1, PA 3, US 30, Ridge Pike, Chemical Road, Germantown Pike, and Plymouth Road.

The new interstate highway is bordered by other significant parallel routes that fall within its travel corridor, including from west to east, state routes 452, 352, 252, 320, and 420, as well as Butler Pike.

In 1992, the Pennsylvania Department of Transportation (PennDOT) requested that the Delaware Valley Regional Planning Commission (DVRPC) conduct a traffic study for the entire length of I-476 to establish the usage of the facility, to determine the level of truck travel, to report the allocation of traffic at its two limiting points (I-95 and I-276), and to evaluate the impacts of traffic pattern changes on interchanging and parallel routes in the corridor served by the expressway.

This report has been compiled in response to that PennDOT request. It contains a historical background of I-476, demographic characteristics of the corridor, a description of the traffic counting procedures and processing, the 1993 Average Daily Traffic (ADT) for all segments of the interstate highway and its ramps, a comparative traffic analysis of interchanging and selected parallel roads for 1993 traffic "with" and "without" I-476, a review of past traffic projections, and a summary of traffic impacts caused by the opening of I-476. Finally, an appendix containing schematics of each interchange depicting 1993 ADTs is attached at the end of this report.

II. BACKGROUND

History

The idea of a north-south expressway through Delaware County first originated with planners in the 1920s when development of the area seemed imminent. When growth in Delaware County first began to translate into congestion of roads such as PA 320 and PA 252 during the 1950s, the idea of the "Mid-County Expressway" was again suggested. In 1961, what was then called the Pennsylvania Department of Highways presented a proposal to build an expressway through the heart of the county. The department made a presentation to affected communities at a public meeting in which three alignments were presented, each one marked in a different color. The route marked in blue was selected as the preferred alignment, hence the popular reference to the highway as the "Blue Route." Furthermore, considering the importance of such a major road to the overall regional highway network, it was also decided to include the proposed facility in the Interstate Highway System.

Construction on I-476 began in 1967 in Radnor Township between Darby Road and Conestoga Road, and in 1970 the sections of road north of I-76 were begun. By 1979, nearly nine miles of the expressway were completed, but only three miles of the road between I-76 and Chemical Road in Montgomery County were open to travelers.

The passage of the National Environmental Policy Act in 1969, along with intense local opposition, required PennDOT to scale down the design on the remaining 12 miles through Delaware County and stop construction. The court battles raged on for nearly eleven years, and not until 1985 did construction resume on the I-95/MacDade Boulevard interchange, and in 1988 on the remainder of the expressway. Through litigation, the original six-lane design was dropped in favor of four-lanes for the uncompleted section of road between West Chester Pike and I-95. Sound walls, fencing to protect vegetation, wetland controls, studies for park-and-ride lots, and other environmental protections were added to comply with the new federal regulations and to keep the new expressway from encroaching on the local area. The litigation finally ended in 1990 when all cases dealing with the highway were effectively dismissed. PennDOT opened I-476 to traffic between I-95 and the Plymouth Road/Germantown Pike Interchanges in 1991. In December 1992, the expressway was officially completed with the opening of the Pennsylvania Turnpike/Northeast Extension connection, thus ending nearly forty years of planning, development, litigation, and construction.

Description of the I-476 Corridor

Winding its way northward from I-95 in Ridley Township, Delaware County, I-476, as shown in Figure 2, interchanges with MacDade Boulevard, Baltimore Pike, US 1 (Media Bypass), PA 3 (West Chester Pike), US 30 (Lancaster Avenue), I-76 (Schuylkill Expressway), Ridge Pike, Chemical Road, Germantown Pike, Plymouth Road, I-276 (Pennsylvania Turnpike), and PA 9 (Northeast Extension). From its southern terminus at I-95 to PA 3, I-476 is a four-lane expressway. Just north of the PA 3 interchange, the highway widens to six lanes and maintains that width to its termination at the Pennsylvania Turnpike and Northeast Extension. In total, I-476 covers 21.5 miles and required 75 new bridges for the mainline highway and its interchanges. Some 21.9 miles of sound walls were constructed to keep noise levels lower in residential areas adjacent to the new highway. From rustic looking guardrail to carefully planned landscaping, I-476 was given a "parkway" look to enhance the ride for motorists traveling the route.

In its completed state, I-476 links the Delaware County waterfront with the Pennsylvania Turnpike, providing area travelers with direct access to the greater Philadelphia area, and western and northeastern Pennsylvania, as well as, to the entire eastern seaboard through its connections with I-95 in southern Delaware County.

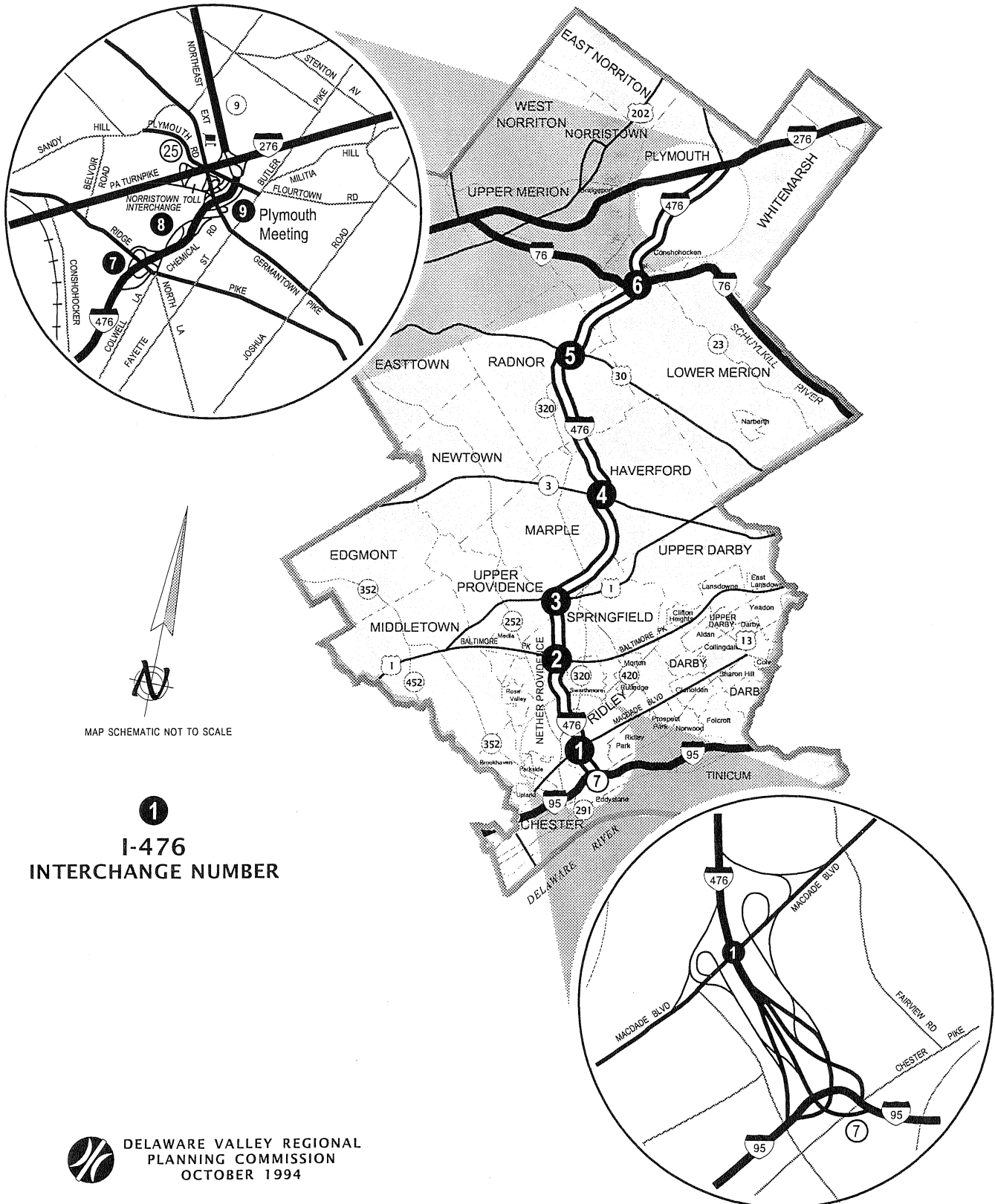
Corridor Demographics

The DVRPC examined demographic and census data in order to establish a basis for evaluating highway needs in the corridor, which was defined as extending approximately five miles on either side of I-476 and from the Delaware River to the Pennsylvania Turnpike. (See Figure 3.) This corridor includes a large portion of Delaware County, as well as portions of Chester and Montgomery counties, and is comprised of the following municipalities:

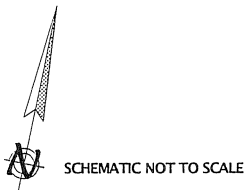
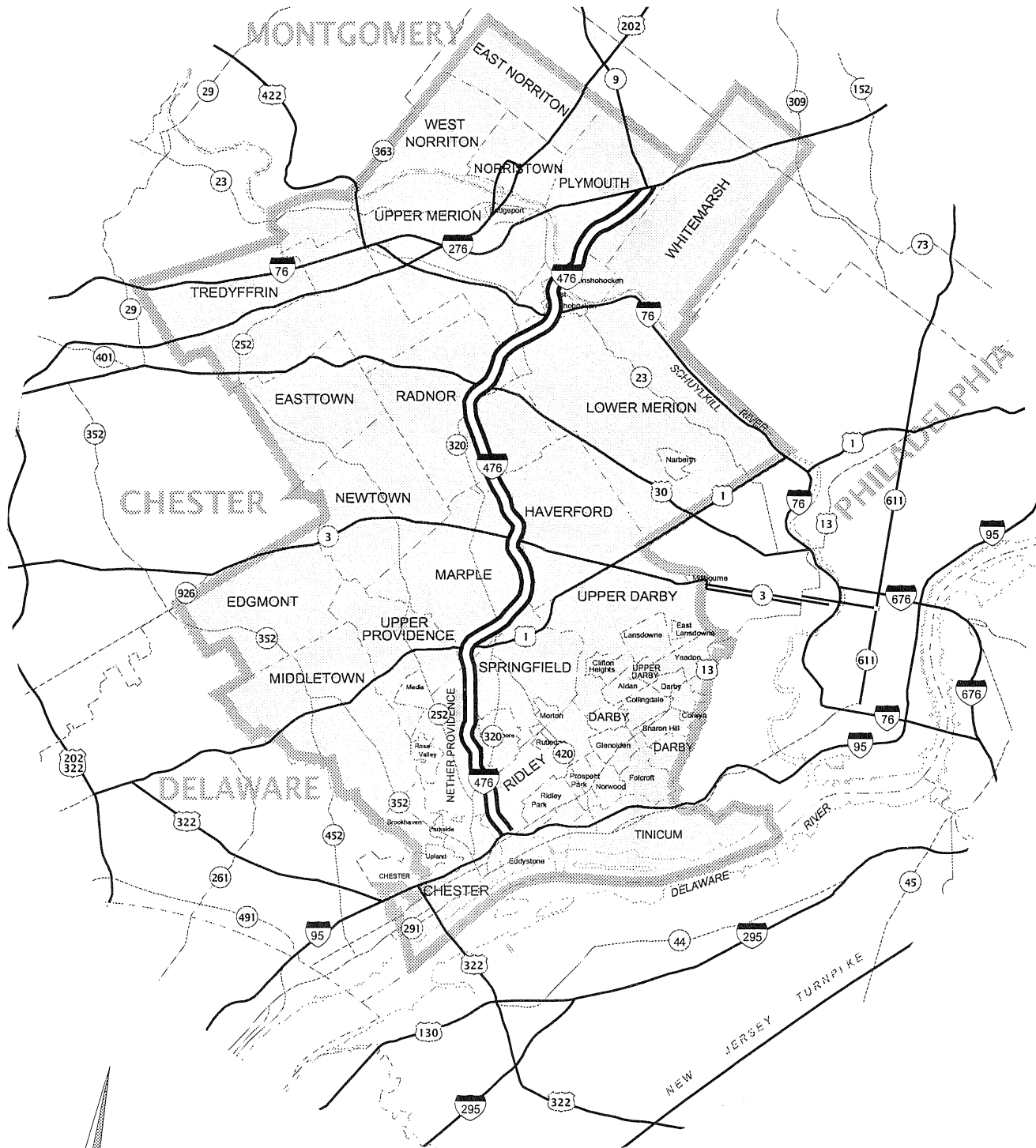
Delaware County

| | |
|----------------|-------------------|
| Chester (city) | Collingdale |
| Eddystone | Sharon Hill |
| Tinicum | Colwyn |
| Upland | Darby (boro) |
| Brookhaven | Rose Valley |
| Parkside | Nether Providence |
| Ridley | Swarthmore |
| Ridley Park | Rutledge |
| Prospect Park | Morton |
| Norwood | Aldan |
| Folcroft | Clifton Heights |
| Glenolden | Yeadon |
| Darby (twp) | Middletown |

FIGURE 2
TRAFFIC IMPACTS OF I-476
I-476 INTERCHANGES



**FIGURE 3
TRAFFIC IMPACTS OF I-476
I-476 CORRIDOR**



Delaware County (con't)

Media
 Upper Providence
 Springfield
 Upper Darby
 Lansdowne
 East Lansdowne
 Edgmont
 Marple
 Haverford
 Newtown
 Radnor

Montgomery County

Lower Merion
 West Conshohocken
 Conshohocken
 Upper Merion
 Bridgeport
 West Norriton
 East Norriton
 Plymouth
 Whitemarsh
 Norristown

Chester County

Easttown
 Tredyffrin

Socio-demographic data related to traffic generation within the corridor is shown in Table I. The table compares characteristics gathered by the Census Bureau in 1980 and 1990, including population, employed residents, employment, and the number of vehicles owned by residents. Employed residents tallies workers where they live and employment where they work. Only civilian workers, 16 years and older, are counted.

A review of Table I reveals that although the corridor's population decreased by almost 15,000 persons (-2.0%) during the ten-year period, all other traffic related factors increased. The number of households increased by 15,000 (+6.0%), reflecting a reduction in the average size of households. The number of residents holding jobs increased by almost 34,000 (+10.5%) and the number of jobs available within the corridor went up by more than 61,000 (+19.1%). In 1990, corridor residents owned 68,000 more vehicles than they did in 1980 (+18.8%). Growth in jobs and increases in vehicles owned have had significant implications for actual and projected traffic levels.

Generally, the fastest growing municipalities are those with newer development and with open land left for expansion, and these are primarily located west of I-476. The older communities to the east of the highway and along the Delaware and Schuylkill rivers are relatively stable or declining slightly. As new areas start to grow, population tends to move in first, which is then followed by jobs. This pattern is seen in the I-476 corridor, with the areas with strong population growth generally lying to the west of those areas showing good employment growth. An exception to this appears to be Tredyffrin Township, which experienced good growth in both population (21.2%) and employment (201.9%) during the 1980s, but this growth was attracted by an uncommon congruence of expressways [US 202 and US 422, with the Valley Forge Interchange of the Pennsylvania Turnpike (I-276 with I-76) lying just outside its borders].

TABLE I
Demographic Data For I-476 Corridor

| Area | Population | | Households | | Employed Residents | | Employment | | Total Vehicles | |
|------------------------|------------|--------|------------|--------|--------------------|--------|------------|--------|----------------|--------|
| | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 |
| CHESTER COUNTY | | | | | | | | | | |
| Easttown Twp. | 9,064 | 9,570 | 2,883 | 3,385 | 4,113 | 4,799 | 5,974 | 5,418 | 5,345 | 6,811 |
| Tredyffrin Twp. | 23,121 | 28,028 | 8,228 | 11,447 | 11,346 | 16,127 | 8,350 | 25,206 | 14,227 | 21,246 |
| DELAWARE COUNTY | | | | | | | | | | |
| Aldan Boro. | 4,671 | 4,549 | 1,718 | 1,769 | 2,198 | 2,318 | 461 | 599 | 2,465 | 2,848 |
| Brookhaven Boro. | 7,912 | 8,567 | 2,883 | 3,508 | 3,982 | 4,929 | 1,608 | 2,237 | 4,685 | 6,146 |
| Chester City | 45,794 | 41,856 | 15,824 | 14,537 | 15,246 | 15,797 | 18,802 | 14,765 | 14,288 | 13,727 |
| Clifton Heights Boro. | 7,320 | 7,111 | 2,712 | 2,747 | 3,205 | 3,352 | 3,417 | 3,321 | 3,141 | 3,393 |
| Collingdale Boro. | 9,539 | 9,175 | 3,247 | 3,317 | 3,856 | 4,268 | 1,743 | 1,966 | 4,031 | 4,717 |
| Colwyn Boro. | 2,851 | 2,613 | 944 | 924 | 1,129 | 1,289 | 256 | 331 | 1,061 | 1,262 |
| Darby Boro. | 11,513 | 11,140 | 3,759 | 3,709 | 4,088 | 4,533 | 2,275 | 3,441 | 3,419 | 4,061 |
| Darby Twp. | 12,264 | 10,955 | 3,808 | 3,822 | 5,282 | 5,108 | 1,710 | 833 | 5,050 | 5,715 |
| East Lansdowne Boro. | 2,806 | 2,691 | 984 | 961 | 1,173 | 1,331 | 318 | 498 | 1,128 | 1,435 |
| Eddystone Boro. | 2,500 | 2,446 | 960 | 993 | 956 | 1,174 | 1,816 | 3,464 | 1,166 | 1,313 |
| Edgmont Twp. | 1,410 | 2,735 | 446 | 1,096 | 651 | 1,247 | 581 | 1,203 | 835 | 2,074 |
| Folcroft Boro. | 8,231 | 7,506 | 2,451 | 2,544 | 3,670 | 3,700 | 3,236 | 4,041 | 3,536 | 4,182 |
| Glenolden Boro. | 7,633 | 7,260 | 2,855 | 2,907 | 3,308 | 3,723 | 2,473 | 2,505 | 3,569 | 4,143 |
| Haverford Twp. | 52,349 | 49,848 | 17,017 | 17,727 | 23,017 | 25,368 | 12,232 | 14,428 | 26,789 | 31,588 |
| Lansdowne Boro. | 11,891 | 11,712 | 4,790 | 4,917 | 5,400 | 6,343 | 2,625 | 2,989 | 5,875 | 6,850 |
| Marple Twp. | 23,642 | 23,123 | 7,624 | 8,193 | 10,949 | 11,791 | 8,464 | 9,866 | 13,444 | 15,459 |
| Media Boro. | 6,119 | 5,957 | 2,827 | 2,867 | 3,212 | 3,243 | 11,487 | 11,210 | 3,150 | 3,553 |
| Middletown Twp. | 12,463 | 14,130 | 3,739 | 4,344 | 5,377 | 5,961 | 9,010 | 10,726 | 6,307 | 8,572 |
| Morton Boro. | 2,412 | 2,851 | 903 | 1,155 | 1,137 | 1,461 | 1,060 | 1,348 | 1,136 | 1,757 |
| Nether Providence Twp. | 12,730 | 13,229 | 4,180 | 4,807 | 5,717 | 6,550 | 1,444 | 4,015 | 7,161 | 8,766 |
| Newtown Twp. | 11,775 | 11,366 | 3,875 | 4,337 | 5,147 | 5,437 | 5,235 | 7,195 | 6,788 | 8,035 |
| Norwood Boro. | 6,647 | 6,162 | 2,220 | 2,219 | 2,893 | 3,130 | 566 | 783 | 3,071 | 3,537 |
| Parkside Boro. | 2,464 | 2,369 | 903 | 928 | 1,114 | 1,176 | 46 | 184 | 1,263 | 1,481 |
| Prospect Park Boro. | 6,593 | 6,764 | 2,523 | 2,617 | 3,143 | 3,385 | 1,174 | 1,621 | 3,190 | 3,811 |
| Radnor Twp. | 27,676 | 28,703 | 9,173 | 9,838 | 12,536 | 13,800 | 17,390 | 28,446 | 14,162 | 17,073 |
| Ridley Twp. | 33,771 | 31,169 | 11,688 | 11,889 | 15,475 | 15,329 | 10,222 | 11,839 | 17,308 | 19,469 |
| Ridley Park Boro. | 7,889 | 7,592 | 2,904 | 3,045 | 3,592 | 3,787 | 1,971 | 2,576 | 4,045 | 4,720 |
| Rose Valley Boro. | 1,038 | 982 | 330 | 334 | 444 | 465 | 84 | 121 | 660 | 757 |
| Rutledge Boro. | 989 | 843 | 323 | 324 | 438 | 419 | 21 | 96 | 499 | 542 |
| Sharon Hill Boro. | 6,221 | 5,771 | 2,116 | 2,156 | 2,584 | 2,845 | 1,622 | 2,137 | 2,640 | 3,083 |

TABLE I (Continued)

| Area | Population | | Households | | Employed Residents | | Employment | | Total Vehicles | |
|--------------------------|----------------|----------------|----------------|----------------|--------------------|----------------|----------------|----------------|----------------|----------------|
| | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 | 1980 | 1990 |
| Springfield Twp. | 25,326 | 24,160 | 8,269 | 8,435 | 11,415 | 11,637 | 12,937 | 11,419 | 14,431 | 15,952 |
| Swarthmore Boro. | 5,950 | 6,157 | 1,944 | 2,023 | 2,726 | 3,290 | 2,405 | 3,222 | 2,656 | 3,260 |
| Tinicum Twp. | 4,291 | 4,440 | 1,540 | 1,736 | 1,802 | 2,174 | 9,714 | 6,013 | 1,989 | 2,686 |
| Upland Boro. | 3,458 | 3,334 | 1,163 | 1,187 | 1,349 | 1,409 | 3,024 | 4,036 | 1,435 | 1,547 |
| Upper Darby Twp. | 83,999 | 81,177 | 32,349 | 32,746 | 37,412 | 40,646 | 21,996 | 21,275 | 38,355 | 44,770 |
| Upper Providence Twp. | 9,477 | 9,727 | 3,426 | 3,723 | 4,794 | 5,183 | 2,124 | 2,881 | 5,795 | 7,139 |
| Yeadon Boro. | 11,727 | 11,980 | 4,477 | 4,794 | 5,031 | 6,129 | 3,187 | 3,385 | 5,424 | 6,013 |
| MONTGOMERY COUNTY | | | | | | | | | | |
| Bridgeport Boro. | 4,843 | 4,292 | 1,961 | 1,813 | 2,421 | 2,118 | 2,442 | 1,416 | 2,331 | 2,349 |
| Conshohocken Boro. | 8,475 | 8,064 | 3,099 | 3,287 | 3,806 | 3,997 | 3,258 | 3,135 | 3,833 | 4,605 |
| East Norriton Twp. | 12,711 | 13,324 | 4,364 | 4,976 | 6,145 | 7,327 | 6,517 | 7,737 | 7,503 | 9,504 |
| Lower Merion Twp. | 59,651 | 58,003 | 21,536 | 22,559 | 26,266 | 29,754 | 35,751 | 45,889 | 34,160 | 39,790 |
| Norristown Boro. | 34,684 | 30,749 | 12,282 | 12,187 | 14,864 | 15,752 | 18,480 | 16,059 | 13,800 | 15,203 |
| Plymouth Twp. | 17,168 | 15,958 | 5,944 | 6,244 | 8,925 | 8,963 | 11,822 | 21,560 | 10,202 | 11,207 |
| Upper Merion Twp. | 26,138 | 25,722 | 9,295 | 10,541 | 14,215 | 15,761 | 32,926 | 34,128 | 15,738 | 19,086 |
| West Conshohocken Boro. | 1,516 | 1,294 | 511 | 470 | 634 | 688 | 2,624 | 1,756 | 609 | 753 |
| West Norriton Twp. | 14,034 | 15,209 | 4,719 | 6,334 | 6,571 | 8,825 | 4,672 | 8,406 | 7,580 | 11,074 |
| Whitemarsh Twp. | 15,101 | 14,863 | 4,952 | 5,518 | 7,319 | 8,006 | 10,092 | 11,282 | 8,793 | 10,625 |
| CORRIDOR TOTALS | 721,847 | 707,226 | 252,668 | 267,936 | 322,073 | 355,844 | 321,644 | 383,007 | 360,068 | 427,689 |

Edgmont Township also showed good percentage growth in both population and employment, but it started from a much smaller base. Middletown and West Norriton townships also showed respectable growth in population. On the employment side, strong growth was seen in Nether Providence, Radnor, Lower Merion, Plymouth, and West Norriton townships. All of these actively growing municipalities are served by I-476, either through direct interchanges or through good access to interchange areas. In summary, demographic and socio-economic trends during the 1980s supported the need for a major north-south facility through Delaware County to link the I-276 (Pennsylvania Turnpike), I-76 (Schuylkill Expressway), and the I-95 corridors.

III. METHODOLOGY AND PROCESSING OF TRAFFIC MONITORING

In order to determine an accurate estimate of the 1993 use of I-476, DVRPC conducted a data collection program that included traffic counting on every segment of the expressway, related ramps, and interchanging highways, as well as roads that parallel I-476. A retrieval of historical records from the regional data file for roads within the corridor provided the basis for additional 1993 counts needed to compare traffic "with" and "without" I-476. The counting effort included 48-hour total volume and vehicle classification counts. The latter was needed in order to estimate the amount of truck travel.

This section describes the counting techniques used by DVRPC in collecting the data and the processing steps used to derive Average Daily Traffic (ADT) estimates.

Automatic Traffic Recorder (ATR) Counts

This is the most common type of count collected by DVRPC when only the total number of all vehicles is sought for the purposes of traffic analysis. It consists of a counting unit installed by a field technician at a predetermined location and is anchored to a fixed object, such as utility pole, tree, sign pole, etc.

Two types of counting equipment have been used by DVRPC: the paper tape counter and the more sophisticated electronic counter, which is considered the state of the art in traffic counting. The operational aspect of these two types is similar in that both use a rubber hose stretched from one side of the road to the counter on the opposite side of the road. A clock mechanism set by the field operator determines the time for tallying the total number of vehicles counted at the end of prescribed intervals. A diaphragm switch, actuated by the tires of a vehicle passing over the hose, sends an air pulse to the recorder, which in turn activates the counting mechanism, or in the case of the electronic counter, activates the electronic memory. At the end of a counting interval, the data are either printed or electronically stored in the counter memory.

At the end of the 48-hour period, the data are delivered to the office for verification and processing. Power for both types of counters is supplied by rechargeable batteries. In the case of the paper tape counts, the data are generally entered into a spreadsheet program, while electronic counter data are downloaded onto a PC that arranges the data in a readable format.

Classification Recorder Counts

In addition to counting total traffic, classification counts for a continuous 24- hour period were taken at selected locations on I-476. This information is not only essential to understanding the impact of I-476 on area travel patterns, but also to estimating the truck share of total traffic. This particular classification recording is made through a system of two units, a field recorder and a data collector. Both units are electronically operated and are regarded as the state of the art in traffic classification recorders.

The field recorder uses a vehicle type program to provide classification counts for one lane of traffic. By using two road tubes spaced 11 feet apart, the program classifies vehicles according to their standard axle-pattern and groups them into 13 categories defined in the printed copies included in the appendix.

The data collector is a user friendly device that prompts the operator through each input requirement. The unit provides several keys for entering numerical data (date, time, station ID, file number, etc.), and also for testing the combined field operation of both recorder and collector. At the end of a counting period, a field technician "collects" the recorded counts from a number of stations before returning to the office to "dump" and print the data. Power to operate the classification equipment is also provided by rechargeable batteries.

There are, however, certain limitations and restrictions in the collection of these counts. For instance, the pneumatic tubes must cross only one lane, a constant vehicle speed across the tube of at least 20 mph is required for accurate classification, and some vehicles that are counted may not be classified properly. In some instances, therefore, there is no alternative but the manual classification count.

Manual Classification Counts

The manual classification is usually slightly more reliable and costly than recorder classification. In its simplest form, the manual count is done by field personnel using a counting tabulator, a sheet of paper, and a pencil. However, most of the manual counts performed by DVRPC involve the use of hand-held electronic counters.

The battery-powered electronic counter is a state of the art device that allows the user to count vehicles continuously, without having to take one's eyes off the road. The device tallies the vehicles counted at predetermined intervals, so that the field personnel need not do so themselves.

After the count is completed, the machine is downloaded onto a PC where the data are placed into a spreadsheet program for easy handling and processing. Two of the four

locations selected by the DVRPC to monitor truck travel on I-476 were counted in this fashion.

Processing

Once the "raw" counts are available in a standard and readable format, they are processed to derive estimates of average daily traffic (ADT) representative of any day throughout the year. Factors representing route type, month of the year, and day of the week are applied to 24-hour "raw" count total. The factors, supplied by PennDOT, are derived from observations of records of continuing counts taken at permanent stations located throughout the state and monitored 365 days a year. This factoring is what is considered in count processing as the seasonal adjustment.

In order to provide a "true" estimate of the daily traffic using I-476, an additional adjustment for the double counting of multi-axle vehicles was necessary. Based on short period manual counts taken at selected locations and compared with actual counting equipment results taken at the same time, two factors were developed for the axle-correction adjustment. The sections between I-95 and US 1, as well as between I-76 and the Pennsylvania Turnpike required an adjustment factor of 0.88. The remaining I-476 segment from US 1 to I-76 called for a truck axle-correction factor of 0.90.

To fulfill the needs of this study for the purpose of estimating the I-476 traffic impacts, DVRPC collected, processed, and analyzed over 200 counts.

IV. ANALYSIS OF TRAFFIC COUNTS

This section presents the results of the 1993 traffic counting effort. Systematically, it includes the ADT, peak-hour, truck, and ramp counts for I-476, as well as interchanging and parallel roads. Traffic estimates for the Pennsylvania Turnpike and its Northeast Extension were obtained from the Engineering Department of the Pennsylvania Turnpike Commission.

I-476 Traffic Counts

A summary of results derived from the field work on I-476 is presented in Table II. This table includes, for each segment of the highway, the number of lanes by direction, the directional ADTs, the contribution of trucks expressed in percent of total daily traffic, and the a.m. and p.m. peak-hour traffic stated in volume and as a percent of the total daily traffic. A review of Table II reveals that I-476 carries a range of daily traffic between 60,900 and 83,000 vehicles. The heaviest volume is reported for the section between I-76 and Ridge Pike. Conversely, the lightest volume is carried by I-476 between US 1 and PA 3.

From a more detailed analysis of traffic data shown in Table II, it is evident that a total volume of 81,500 vehicles exchange among MacDade Boulevard, I-95, and I-476. Of these vehicles 43,300 use I-95 north of the interchange, while the remaining 37,200 vehicles use I-95 south of its interchange with I-476. (See page A-1.) After removing the portion of this traffic destined to or originating from MacDade Boulevard, the four through lanes of I-476 serve 59,200 drivers per day. North of MacDade Boulevard I-476 approaches the next interchange with a total daily volume of 71,500 vehicles.

Following the impact of the Baltimore Pike ramps, I-476 proceeds north with a slightly lower volume of 68,500 vehicles. A further decrease in the I-476 traffic is evident on the portion north of the next interchange with US 1. Because of a significant imbalance in the traffic exchange that favors the southern half of the US 1 interchange, I-476 between US 1 and PA 3 carries the smallest volume of all segments, 60,900 vehicles per day.

After the interchange with PA 3, I-476 starts gaining traffic on its way to I-76. As a matter of fact, the expressway segment between PA 3 and US 30 has an average daily traffic of 64,100 vehicles. The attraction of I-76 is further reflected in the even higher count taken north of US 30 with approximately 68,000 vehicles per day. On the north side of I-76, I-476 reaches its highest level of service with a 1993 count of 83,000 drivers a day.

TABLE II
I-476 Traffic Volumes (1993 ADT)

| Section | Direction | Number of Lanes | Average Daily Traffic (ADT) | Percent Trucks | AM Peak Hour | | PM Peak Hour | |
|---------------------------------|-----------|-----------------|-----------------------------|----------------|--------------|------------------|--------------|------------------|
| | | | | | Volume | Percent of Daily | Volume | Percent of Daily |
| I-95 - MacDade Boulevard* | NB | 3 | 40,100 | - | 2,727 | 6.8% | 4,102 | 10.2% |
| | SB | 3 | 41,400 | - | 4,573 | 11.0% | 3,062 | 7.4% |
| | Total | 6 | 81,500 | | 7,300 | 9.0% | 7,164 | 8.8% |
| MacDade Blvd. - Baltimore Pike | NB | 2 | 35,700 | 11.3 | 2,825 | 7.9% | 3,780 | 10.6% |
| | SB | 2 | 35,800 | 11.3 | 3,629 | 10.1% | 2,894 | 8.1% |
| | Total | 4 | 71,500 | 11.3 | 6,454 | 9.0% | 6,674 | 9.3% |
| Baltimore Pike - US 1 | NB | 2 | 34,400 | - | 2,881 | 8.4% | 3,187 | 9.3% |
| | SB | 2 | 34,100 | - | 3,321 | 9.7% | 2,767 | 8.1% |
| | Total | 4 | 68,500 | | 6,202 | 9.1% | 5,954 | 8.7% |
| US 1 - PA 3 | NB | 2 | 30,400 | 8.5 | 2,744 | 9.0% | 2,552 | 8.4% |
| | SB | 2 | 30,500 | 8.5 | 2,521 | 8.3% | 3,126 | 10.2% |
| | Total | 4 | 60,900 | 8.5 | 5,265 | 8.6% | 5,678 | 9.3% |
| PA 3 - US 30 | NB | 3 | 32,000 | - | 3,650 | 11.4% | 2,282 | 7.1% |
| | SB | 3 | 32,100 | - | 2,383 | 7.4% | 3,787 | 11.8% |
| | Total | 6 | 64,100 | | 6,033 | 9.4% | 6,069 | 9.5% |
| US 30 - I-76 | NB | 3 | 33,800 | 7.6 | 3,439 | 10.2% | 2,668 | 7.9% |
| | SB | 3 | 33,900 | 7.2 | 2,823 | 8.3% | 3,577 | 10.6% |
| | Total | 6 | 67,700 | 7.4 | 6,262 | 9.2% | 6,245 | 9.2% |
| I-76 - Ridge Pike | NB | 3 | 41,700 | 10.4 | 3,120 | 7.5% | 3,783 | 9.1% |
| | SB | 3 | 41,300 | 10.2 | 3,750 | 9.1% | 3,369 | 8.2% |
| | Total | 6 | 83,000 | 10.3 | 6,870 | 8.3% | 7,152 | 8.6% |
| Ridge Pike - Chemical Road | NB | 3 | 35,400 | - | 2,636 | 7.4% | 3,067 | 8.7% |
| | SB | 3 | 35,400 | - | 3,175 | 9.0% | 2,881 | 8.1% |
| | Total | 6 | 70,800 | | 5,811 | 8.2% | 5,948 | 8.4% |
| Chemical Road - Germantown Pike | NB | 3 | 32,400 | - | 2,484 | 7.7% | 2,837 | 8.8% |
| | SB | 3 | 33,800 | - | 3,068 | 9.1% | 2,726 | 8.1% |
| | Total | 6 | 66,200 | | 5,552 | 8.4% | 5,563 | 8.4% |
| Germantown Pike - I-276 / PA 9 | NB | 3 | 21,300 | 9.8 | 1,625 | 7.6% | 2,345 | 11.0% |
| | SB | 3 | 21,500 | 9.6 | 2,372 | 11.0% | 1,862 | 8.7% |
| | Total | 6 | 42,800 | 9.7 | 3,997 | 9.3% | 4,207 | 9.8% |

* - The volumes between I-95 and MacDade Boulevard are artificially high, because the ramps from I-95 that service I-476 also service MacDade Boulevard.

Continuing on the way to the Pennsylvania Turnpike, I-476's daily traffic volume decreases from 70,800 north of Ridge Pike to 66,200 vehicles south of Interchange 9. The impact of this connection can be summarized as follows: over 11,000 vehicles exit I-476 at the Plymouth-Germantown Pike West ramp; some 42,800 go through the turnpike toll area; and more than 12,000 vehicles use the southbound lanes of I-476 from Plymouth Road and eastbound Germantown Pike.

The highest hourly service has been determined for the a.m. and p.m. rush hours on three of the nine segments of I-476. In the morning, the predominant flow is toward I-95 at the southern end of the highway, and further north on the I-476 southbound lanes leading to I-76. The segment between PA 3 and US 30 shows a similar volume only on the northbound direction. The magnitude of this directional traffic is close to 3,700 vehicles per hour. During the afternoon this pattern is reversed. Again, northbound peak hour volumes of approximately 3,800 vehicles per hour approach the Baltimore Pike Interchange and further north the Ridge Pike Interchange, while between US 30 and PA 3 the I-476 southbound lanes serve the same amount of traffic. This change in peak-hour flow direction as one proceeds along I-476 is a symptom of the local nature of the commuting pattern, as well as the still growing function of circumferential roads in accommodating traffic within the Philadelphia suburban area.

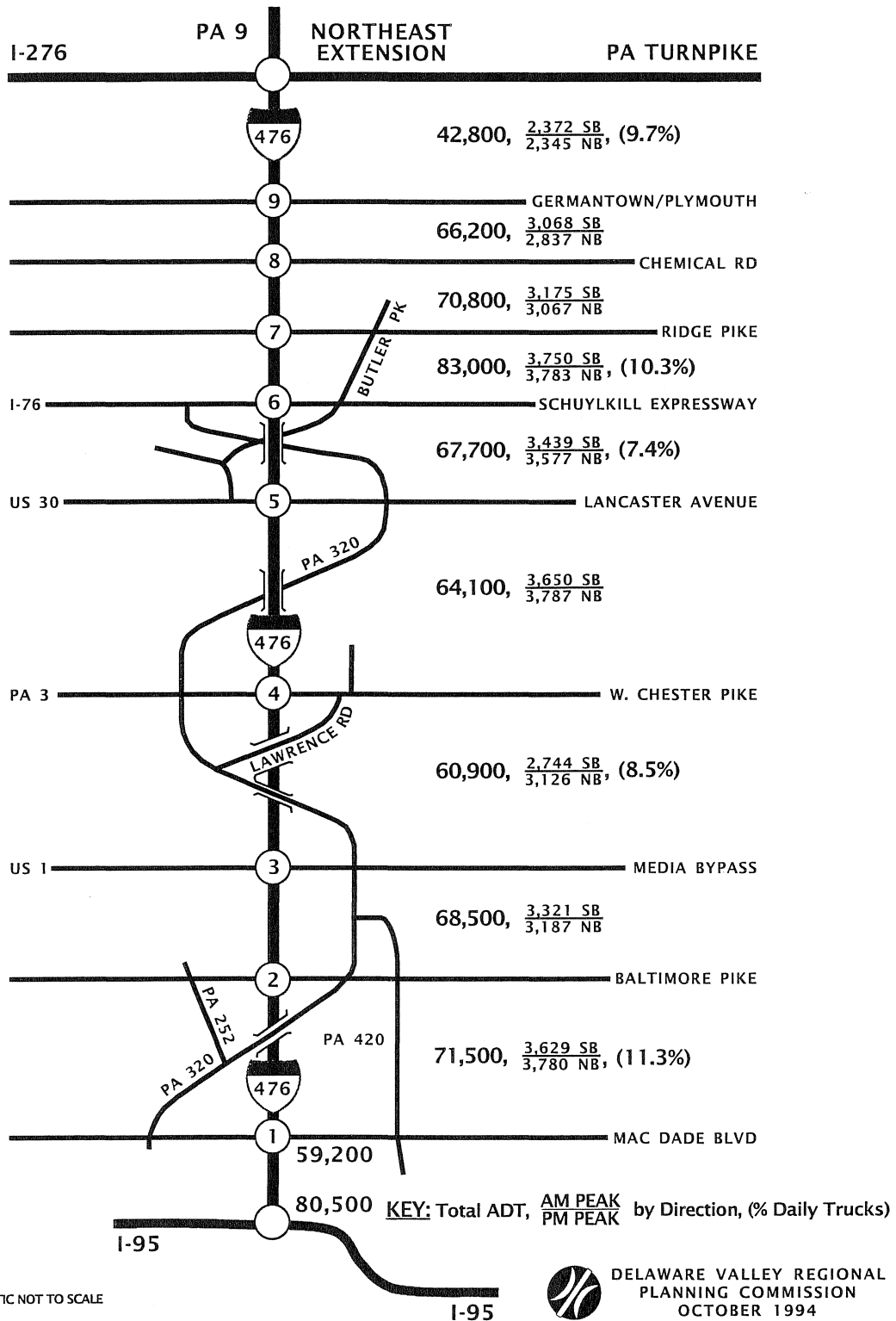
Truck travel was recorded at five locations on I-476. The contribution of commercial vehicles is between 7.4 and 11.3 percent of the daily total traffic. The two highest proportion of trucks to total vehicles were reported between MacDade Boulevard and Baltimore Pike, and between I-76 and Ridge Pike. At these two locations, the presence of trucks is evident through a two-way daily total of over 8,000 commercial vehicles. The lowest truck share of the five locations was observed on the lanes of the I-476 segment between I-76 and US 30 with a two-way volume of over 5,000 trucks. For convenience, a schematic showing total 24-hour traffic volumes, a.m. and p.m. peak hour counts, and percent of truck travel with respect to daily total traffic is displayed in Figure 4.

Traffic on Interchange Roads

In order to evaluate the impact of I-476 on roads leading to the interchanges, a comparison was made between the actual 1993 counts and the estimates made under the assumption that I-476 had not been built. A retrieval of historical counts from DVRPC traffic files provided the basis for the counts of the latter alternative.

In order to accurately compare counts for the same base year (1993), an expansion of the historical counts was necessary. A growth factoring procedure was developed on the basis of the findings of two earlier traffic monitoring programs conducted by DVRPC. The regional (1987-1989) and selected highway corridor (1990-1992) traffic count programs monitored traffic at various locations in the Delaware

FIGURE 4 TRAFFIC IMPACTS OF I-476 1993 TRAFFIC VOLUMES



Valley region. In total, some 64 corridors were investigated. The object of the effort was to develop short-range traffic growth rates for each corridor, based on actual counts and field conditions. Furthermore, traffic studies performed during the last nine years also provided input for this expansion of historical counts to the 1993 base year. Growth rates applied in this analysis range from 1.10 percent for PA 3 to 2.75 percent for US 1.

This section provides a traffic evaluation of the nine interchanges linking I-476 with the local and regional highways. Schematics of each interchange depicting the 1993 traffic counts are shown in the appendix. A summary of these findings is also shown in Table III.

Interchange 1 - MacDade Boulevard. This complex interchange has been configured as half-diamond, half-cloverleaf in order to minimize interference between I-476/I-95 through travel and MacDade Boulevard traffic. MacDade Boulevard, which parallels I-95 and serves Upland, Chester City, Ridley, and Collingdale, approaches the interchange with a roadway of two lanes by direction (See page A-1).

Of the 81,500 vehicles per day entering or leaving I-95, over 22,000 are bound to or from MacDade Boulevard and are separated as quickly as possible from the 59,200 drivers using the mainline of I-476. Six of the eight access ramps linking MacDade Boulevard, with I-95 and I-476 respectively, display balanced traffic ranging between 4,600 and 6,200 daily vehicles. The remaining two ramps, which provide access between the northern area served by I-476 and the area west of the expressway, carry a much lower total of approximately 3,500 vehicles per day. This reduction in traffic volume is a result of the existing I-95 ramps at Chestnut Street in Chester that supplement the same movements through the interchange between I-95 and I-476. In total, the MacDade Boulevard ramps serve daily 34,500 drivers that use either I-95 or I-476. Travel on MacDade Boulevard to the east of I-476 has grown by 5.6 percent since completion of I-476. This growth is mostly attributed to the completion of I-476 north of MacDade Boulevard. On the other hand, the section of MacDade Boulevard on the west side of I-476 has seen a decrease in traffic of 5.5 percent since the opening of the full interchange in 1991. This reduction seems to have occurred with the opening of new southbound ramps at Baltimore Pike (Interchange 2) that now are used for the same movements instead of those of Interchange 1. Of the east-west traffic using MacDade Boulevard, some 13,300 vehicles a day, or 43 percent of the total, pass through the interchange.

Interchange 2 - Baltimore Pike. Situated between Wallingford/Media and Swarthmore, a much simpler diamond type of interchange was constructed at Baltimore Pike. This interchange accommodates 31,000 vehicles on a daily basis (See page A-3). The prevailing direction of service provided by the I-476 ramps is mainly toward I-95.

TABLE III
Traffic Impacts on Interchange Roads

| <i>Location</i> | <i>ADT (Year of Count)</i> | <i>ADT Without I-476 (1993 Estimate)</i> | <i>ADT With I-476 (1993)</i> | <i>Percent Difference</i> |
|--|--------------------------------|--|--------------------------------------|-------------------------------|
| I-95 | | | | |
| Between I-476 & Stewart Ave. | 106,900 ('90) | 113,300 | 125,600 | 10.9% |
| Between I-476 & Chestnut St. | 98,800 ('90) | 104,700 | 120,500 | 15.1% |
| MacDade Blvd.* | | | | |
| Between I-476 & Valley Rd. | 30,900* ('91) | 32,200 | 34,100 | 5.9% |
| Between I-476 & Bullens La. | 26,600 ('91) | 28,600 | 27,000 | -5.6% |
| Baltimore Pike | | | | |
| Between I-476 & Paper Mill Rd. | 24,000 ('89) | 26,400 | 29,500 | 11.7% |
| Between I-476 & Turner Rd. | 24,000 ('89) | 26,400 | 33,400 | 26.5% |
| US 1 - Media Bypass | | | | |
| Between I-476 & Collins Dr. | 39,000 ('88) | 44,400 | 49,200 | 10.8% |
| Between I-476 & Old State Rd. | 39,000 ('88) | 44,400 | 54,500 | 22.7% |
| PA 3 - West Chester Pike | | | | |
| Between I-476 & South Lawrence Rd. | 34,800 ('91) | 35,600 | 49,400 | 38.8% |
| Between I-476 & Ardmore Ave. | 34,800 ('91) | 35,600 | 35,700 | 0.3% |
| US 30 - Lancaster Ave. | | | | |
| Between I-476 & PA 320 | 23,400 ('88) | 25,700 | 32,300 | 25.7% |
| Between I-476 & Radnor Chester Rd. | 23,400 ('88) | 25,700 | 34,000 | 32.3% |
| I-76 - Schuylkill Expressway | | | | |
| Between I-476 & Conshohocken Ramps | 63,300 ('86) | 74,400 | 84,400 | 13.4% |
| Between I-476 & PA 320 | 67,100 ('86) | 78,800 | 89,300 | 13.3% |
| Ridge Pike | | | | |
| Between I-476 & Chemical Rd. | 35,000 ('85) | 40,600 | 35,000 | -13.8% |
| Between Alanwood Rd. & I-476 | 26,900 ('86) | 30,700 | 38,200 | 24.4% |
| Plymouth Rd. | | | | |
| Between I-476 Off Ramp & Butler Pike | 5,900 ('88) | 6,600 | 13,100 | 98.5% |
| Between Germantown Pike & PA Turnpike | 5,900 ('88) | 6,600 | 11,900 | 80.3% |
| Germantown Pike | | | | |
| Between Chemical Rd. & Butler Pike | 14,700 ('91) | 15,300 | 17,600 | 15.0% |
| Between Hickory Rd. & Walton Rd. | 27,000 ('86) | 30,800 | 32,600 | 5.8% |
| I-276 - Pennsylvania Turnpike | | | | |
| Between Interchange 25 & I-476/PA 9 Interchange | 77,400 ('91) | 80,500 | 57,900 | -28.1% |
| Between I-476/PA 9 Interchange & Interchange 26 | 67,200 ('91) | 69,900 | 82,000 | 17.3% |
| PA 9 - Northeast Extension | | | | |
| Between I-276/I-476 Interchange & Interchange 31 | 30,100 ('91) | 31,300 | 41,000 | 31.0% |

* - The counts at this interchange reflect the ADT with the MacDade Boulevard connecting ramps to I-95 in operation

Baltimore Pike is a principal arterial that provides service primarily to the area west of the interchange because of the attraction of the county-seat at Media, and the newer development that has taken place in the western part of Delaware County in the last ten years.

The ramps providing access to and from I-476 North, as well as to Baltimore Pike East to Swarthmore and Springfield, each carry between 3,100 and 4,000 vehicles per day. The I-476 northbound off-ramp to Baltimore Pike westbound, as well as the I-476 southbound on-ramp from Baltimore Pike eastbound each serve over 5,000 drivers per day.

As a matter of fact, although the developed commercial area to the east of the interchange attracted an increase in traffic, it was the western area of the county that attracted an even greater amount of traffic, when a comparison is made "without" the I-476 traffic estimates. Baltimore Pike shows higher traffic growth west of I-476 than east of it (27 and 12 percent, respectively). About 15,000 vehicles on Baltimore Pike pass daily through the interchange without turning onto I-476.

Interchange 3 - US 1 (Media Bypass). Because of limited space available in the vicinity of the interchange, along with the complexity of movements, this connection was designed with three tiers in order to immediately accommodate large volumes of traffic. The lowest level is the US 1/Media Bypass; the second level is the mezzanine where all movements between I-476 and US 1 are made via connecting diamond-type ramps; the third level is the mainline I-476 (See page A-5).

In total 45,000 vehicles per day use the various ramps associated with I-476. The major portion of this traffic (26,300 vehicles per day) enters and exits the southern side of the interchange, heading towards or coming from the I-95 interchange area. The western side of Interchange 3, which serves Upper Providence Township and the area to the west of Media, carries 25,200 vehicles per day, while the eastern end that serves Springfield and Marple townships carries about 20,000 vehicles per day.

Circulation on the mezzanine level is the largest on the northern and eastern sides of the quadrangle, where between 12,500 and 13,100 vehicles are reported daily. On US 1, traffic increased 11 and 23 percent on the east and west sides respectively, as compared to 1993 estimates of traffic "without" I-476. The higher increase on the west side is a follow-up consequence of new patterns that show motorists now using PA 352 or PA 252 and US 1 to connect with I-95 from areas previously served by PA 3 far west of I-476. This new routing offers shorter travel time than staying on PA 3. (See Interchange 4 for additional discussion.) Of the 24,000 vehicles heading west on US 1, 60 percent of them (14,400 daily vehicles) pass through this interchange without using the I-476 ramps. Likewise, 14,900 of the 27,200 drivers traveling east, representing 55 percent of the traffic, did not take advantage of the I-476 interchange.

Interchange 4 - PA 3 (West Chester Pike). Located between Broomall and Manoa, the connection of PA 3 with I-476 is a diamond-type interchange with one loop in the north-west quadrant (See page A-7). The largest traffic exchange occurs between I-476 north of the interchange and PA 3 to the east, with a total of 16,000 vehicles. In contrast, the smallest exchange, less than 6,000 vehicles per day, is reported for the traffic between PA 3 west of the interchange and northbound I-476.

About 19,000 vehicles transfer daily between PA 3 and I-476 south of the interchange, while 22,000 drivers per day make their way to or from the I-476 segment north of the interchange. Each one of the various ramps serves between 2,700 and 5,800 vehicles per day, except for the ramps serving PA 3 to the east and I-476 to the north, which each carry over 8,000 vehicles per day.

Approaching the interchange with two lanes of traffic in each direction, PA 3 carries 49,000 and 36,000 vehicles per day east and west of the I-476 interchange respectively. The high count on PA 3 east of the interchange represents an increase in traffic of 39 percent over the "without" I-476 estimate and is an indication of the function of PA 3 to channel traffic toward the I-476 interchange from the surrounding and heavily populated areas of Haverford and Upper Darby townships. The lower count to the west of the interchange represents a negligible increase in traffic as compared to DVRPC estimated 1993 traffic "without" I-476. This disparity occurs because of new traffic patterns which have formed in a series of new corridors now served by PA 3, PA 252 or PA 352, and US 1 to I-476. In other words, traffic originating in the Newtown and Edgmont areas, as well as further west towards West Chester now appears to be using PA 252 and PA 352 as an access route to I-476 by means of US 1. These two roads are less congested than PA 3 because they pass through a less developed area with fewer traffic controls and intersecting streets. (See Traffic on Parallel Roads for more details.)

Interchange 5 - US 30 (Lancaster Avenue). This interchange, located between Radnor and Villanova and serving Radnor Township in Delaware County, Tredyffrin Township in Chester County, and Lower Merion Township in Montgomery County, was designed with special characteristics such as stone artwork and stenciled bridge panels to improve its attractiveness to community residents and passing motorists. Most of the exchange movements occurring at this interchange are accommodated by the south-west quadrant.

The I-476 ramps, as shown on Page A-9, each has well-balanced daily volumes ranging from 5,700 to 6,200 vehicles, except for the ramps serving I-476 southward from/to US 30 to the east of the interchange. These ramps posted a daily volume of 3,900 vehicles each way. The slightly larger number of vehicle transfers between US 30 and the north side of I-476 rather than the south side of the interstate highway is

apparently a determination by daily commuters that found I-76 to be at this point a more viable route than I-95 into Philadelphia.

The US 30 traffic on the west side of the interchange is slightly higher than that on the east side of the I-476 connection. The 34,000 vehicles counted on the western segment of US 30 serving Radnor, St. Davids, and Wayne in Delaware County and the Chester County bound drivers, signify a 32 percent increase in traffic over estimated 1993 counts "without" I-476. US 30 on the east side of the interchange, which provides access to Lower Merion Township and the Villanova University area, sustains a 26 percent gain in traffic over the 1993 estimated count "without" I-476. It should also be noted that King of Prussia Road, which intersects US 30 in the middle of the interchange and leads to the King of Prussia area near the Schuylkill Expressway interchange with US 202, carries 9,000 vehicles per day to and from the interchange area.

Interchange 6 - I-76 (Schuylkill Expressway)/Matsonford Road. Partially opened in 1979, the I-76 Interchange was fully opened upon completion of the mainline I-476 in 1991. The Schuylkill Expressway is one of the most important routes in the Delaware Valley, linking the Pennsylvania Turnpike and King of Prussia area with Center City Philadelphia and southern New Jersey. In addition to the ramps to and from I-76, local access is provided via Matsonford Road which closely parallels I-476 from just south of the Delaware County Line to West Conshohocken in Montgomery County.

A total of 105,200 daily vehicles use the various ramps associated with Interchange 6 (See page A-11). Of these vehicles, 39,200 switch from I-76 to I-476, while 38,900 proceed in the reverse direction on a daily basis. Some 8,700 vehicles transfer from Matsonford Road to I-476, while 8,400 vehicles per day move in the opposite direction. The balance of approximately 10,000 daily vehicles exchange between I-76 and Matsonford Road.

The largest two-way movement of vehicles, 31,600 per day, occurs on the ramps linking I-76 east of the interchange with I-476 north of it. Another major movement occurs between I-476 south of the interchange and I-76 west of the connection. That exchange accounts for 22,200 vehicles per day.

Counts on I-76 indicate a 13 percent increase in traffic over 1993 counts estimated by DVRPC "without" a fully operational I-476. The Schuylkill Expressway to the east of the I-476 Interchange that would have carried 74,000 vehicles without a completed I-476 now serves 84,000 drivers per day. Likewise, just west of the interchange, traffic which would have totaled 79,000 vehicles per day under the same network assumptions, now totals 89,000 vehicles per day.

Interchange 7 - Ridge Pike. The layout of this interchange is comparable to a partial clover leaf arrangement (See page A-13). In addition to the ramps leading directly to Ridge Pike, however, one of the northbound off-ramps disperses its traffic onto Chemical Road. Traffic wishing to use Ridge Pike in the westbound direction for Norristown and westward points uses this ramp.

In total, 24,600 drivers per day are provided access to and from I-476 via Interchange 7. The ramps at the interchange show balanced daily traffic totals between 3,100 and 5,000 vehicles per day. The only exception to this range is the northbound off-ramp serving northern Chemical Road, which now handles only 500 vehicles per day. The largest volume transfer of 10,000 daily vehicles occurs between the area west of this interchange towards Norristown, and the area south of I-476 towards I-76.

As indicated by the traffic counts taken on Ridge Pike, the opening of I-476 has had quite an effect on the traffic pattern operating on this road. For instance, on the east side of the interchange between Chemical Road and I-476, traffic on Ridge Pike has decreased by almost 14 percent when compared to "without" I-476 estimates. This decrease results from the addition of I-476 ramps and main line into this area. Thus, motorists would find it preferable to continue onto the expressway to reach destinations north of Ridge pike rather than exiting onto Chemical Road. On the west side of the interchange, the appeal of the new continuity provided by the completion of I-476 has an impact on Ridge Pike traffic. This time, however, the attraction for I-476 translates into a 24 percent increase in traffic on Ridge Pike rather than the decrease seen above. It appears that motorists on the west side of this interchange find I-476 more attractive to reach their destinations rather than using local roads that parallel the expressway.

Interchange 8 - Chemical Road. This intermediate interchange between Ridge Pike and Germantown Pike is both the smallest in size and magnitude of service provided of all the I-476 interchanges. Consisting of a single northbound off-ramp and a single southbound on-ramp from Chemical Road, the interchange serves traffic traveling between Germantown Pike east towards Whitemarsh Township and Chestnut Hill in Philadelphia and the section of I-476 south of Ridge Pike. Chemical Road weaves under the expressway from Ridge Pike to Germantown Pike (See page A-15).

Since I-476 has been in full service, Chemical Road has experienced a 40 percent reduction in traffic, with total daily volumes of 8,000 vehicles south of the interchange and 13,100 vehicles north of the interchange. Contributing to these volumes is the I-476 northbound off-ramp which carries 3,000 vehicles per day. The southbound on-ramp, however, only serves 1,600 vehicles per day, an indication that some motorists access the expressway at the preceding Interchange 9, making use of the new I-476 southbound on-ramps at Germantown Pike and Plymouth Road.

Interchange 9 - Germantown Pike/Plymouth Road/I-276 (Pennsylvania Turnpike)/PA 9 (Northeast Extension). The last I-476 interchange serves two local roads (Germantown Pike and Plymouth Road) and two expressways (I-276 and PA 9). The complex layout of this interchange was planned to streamline traffic interchanging among the many highways and at the same time facilitate access to the two toll routes. (See page A-17). Numerous traffic pattern changes have occurred since the completion of the ramps linking I-276 to I-476 in 1992, well after the partial opening of I-476 to Chemical Road in 1979.

Some 66,200 vehicles pass through this interchange every 24 hours. Nearly 43,000 vehicles, 65 percent of the traffic, travel through the toll booths, while the remaining 23,200 connect to or from local roads. Of the local roads, Germantown Pike carries the greater share (65 percent) of this traffic. Significant growth in traffic on Plymouth Road, 99 percent since I-476 was placed in full operation, shows the formation of a new corridor comprised of Butler Pike, Plymouth Road, and I-476. This corridor, serving the area from Plymouth Meeting to Ambler, contributes significantly to this interchange traffic.

The largest dispersion of traffic at the northern terminus of I-476 is to I-276 (Pennsylvania Turnpike) east of the interchange, i.e., towards eastern Montgomery County and southern Bucks County. Nearly 24,000 vehicles per day make their way through this exchange. The I-476 alignment made a profound impact on the westward traffic of I-276 which is now better served by I-76. The impact of a completed I-476 Interchange with I-76 has resulted in a 28 percent reduction of I-276 traffic on the link between Exit 25 and the junction with PA 9. A 1993 count of 57,900 vehicles per day is compared to the 80,500 daily vehicles estimated under the "without" I-476 alternative.

Germantown Pike currently carries 32,600 daily vehicles west of the interchange, a 6 percent increase over the estimated 1993 traffic volume "without" I-476. The 17,600 daily traffic volume east of the interchange beyond Chemical Road is 15 percent higher than the 1993 estimates "without" I-476.

Traffic on Parallel Roads

Of particular interest to local residents is the impact caused by I-476 on roads paralleling the corridor served by this new expressway. The principal routes investigated in this section are from west to east: PA 452, PA 352, PA 252, PA 320, PA 420, and Butler Pike. Shorter segments of additional roads within the I-476 influence are also included in this analysis.

To determine the impact of I-476, historical counts were expanded to the base year (1993) and compared with the actual counts taken with I-476 in full operation, a procedure similar to that used in the evaluation of the impact on interchange roads. The

range of yearly growth applied to parallel roads to obtain the "without" I-476 estimates varies between 1.0 percent for PA 420, to 2.5 percent for PA 352, of their respective ADT counts. A summary of the impact on parallel roads is presented in Table IV.

A review of the table shows that the traffic monitoring performed at these locations of the westernmost PA 452 corridor since the completion of I-476 yields an average decrease in travel of 14.2 percent overall.

The next corridor, represented by PA 352, includes four locations where counting equipment recorded the 1993 volumes. A comparison with the 1993 estimates for the ADT "without" I-476 reveals that PA 352 south of US 1 has 11.0 percent less traffic with I-476 open, whereas an increase of 11.4 percent is seen on PA 352 monitored north of US 1. Apparently, drivers who previously took PA 352 south to I-95 are now using US 1 to access I-476 from the west. Evidently US 1 offers less impediments to motorists than does PA 352 south of US 1. This rearrangement in the pattern of PA 352 travel also explains the reduction in traffic reported for PA 452, since this road's northern terminus is at PA 352 in Middletown Township just north of US 1.

Moving west toward I-476, the next parallel road to the interstate expressway is PA 252. The magnitude of the traffic decrease in this corridor, which extends from PA 320 in Nether Providence Township to the Chester County Line, is about 25.0 percent overall when I-476 is included in the network. The actual range varies from a low of 7.6 percent just south of PA 3 to a high of 38.2 percent near its southern terminus. The lowest reduction is representative of the rearrangement in traffic patterns in which US 1 is now considered the primary access to I-476 as previously described.

As expected, the highest impact of all the roads paralleling I-476 was experienced on PA 320. The eight locations selected for monitoring along this road, which runs between PA 291 in Chester City, Delaware County, and PA 23 in Upper Merion Township, Montgomery County are listed in Table IV. A comparison between the 1993 counts and the estimates of a "without" I-476 scenario, yields a range in traffic reduction for PA 320 that varies from a low of 25.5 percent near Springfield Road in Marple Township, to a high of 50.0 percent between Swarthmore and Elm avenues in Swarthmore. This significant overall reduction of 36 percent in traffic has been welcomed by motorists residing in the area.

TABLE IV
Traffic Impacts on Parallel Roads

| <i>Location</i> | <i>ADT (Year of Count)</i> | <i>ADT Without I-476 (1993 Estimate)</i> | <i>ADT With I-476 (1993)</i> | <i>Percent Difference</i> |
|--|--------------------------------|--|--------------------------------------|-------------------------------|
| PA 452 | | | | |
| <i>Between US 322 & Duttons Mill Rd.</i> | 22,800 ('88) | 24,000 | 20,000 | -16.7% |
| <i>Between US 1 & Hunter St.</i> | 24,100 ('90) | 24,800 | 21,700 | -12.5% |
| <i>Between PA 352 & US 1</i> | 10,900 ('91) | 11,100 | 9,700 | -12.6% |
| PA 352 | | | | |
| <i>Between Chelton Rd. & Upland Ave.</i> | 18,200 ('91) | 19,100 | 18,300 | -4.2% |
| <i>Between Knowlton Rd. & Copes La.</i> | 25,300 ('91) | 26,600 | 22,400 | -15.8% |
| <i>Between Rosetree Rd & Vanleer Ave.</i> | 22,100 ('91) | 23,200 | 24,900 | 7.3% |
| <i>Between Meadows La. & Farmers La.</i> | 12,100 ('91) | 12,700 | 15,600 | 22.8% |
| PA 252 | | | | |
| <i>Between Wallingford Ave. & Green Valley Rd.</i> | 14,400 ('88) | 15,700 | 9,700 | -38.2% |
| <i>Between State Rd. & Meetinghouse La.</i> | 21,300 ('91) | 22,100 | 14,000 | -36.7% |
| <i>Between West Chester Pike & Gradyville Rd.</i> | 21,700 ('91) | 22,500 | 20,800 | -7.6% |
| <i>Between West Chester Pike & Goshen Rd.</i> | 31,700 ('91) | 32,800 | 24,200 | -26.2% |
| <i>Between Wyola Rd. & Chester County Line</i> | 21,900 ('91) | 22,700 | 18,100 | -20.3% |
| PA 320 | | | | |
| <i>Between PA 252 & Bullens La.</i> | 25,100 ('90) | 26,200 | 14,600 | -44.3% |
| <i>Between Swarthmore Ave. & Elm Ave.</i> | 15,700 ('91) | 16,200 | 8,100 | -50.0% |
| <i>Between PA 420 & Kennerly Rd.</i> | 20,700 ('91) | 21,300 | 14,000 | -34.3% |
| <i>Between US 1 & Old Marple Rd.</i> | 26,700 ('91) | 27,500 | 20,100 | -26.9% |
| <i>Between Crum Creek Rd. & Springfield Rd.</i> | 36,000 ('88) | 37,600 | 28,000 | -25.5% |
| <i>Between New Ardmore Rd. & Springfield Rd.</i> | 33,400 ('88) | 35,900 | 22,900 | -36.2% |
| <i>Between Bryn Mawr Ave. & Brennan Dr.</i> | 19,200 ('91) | 19,800 | 11,400 | -42.4% |
| <i>Between Arden Rd. & Gulph Rd.*</i> | 26,500 ('88) | 28,500 | 18,300* | -35.8% |
| PA 420 | | | | |
| <i>Between MacDade Blvd. & 16th Ave.</i> | 23,200 ('91) | 23,700 | 20,700 | -12.7% |
| <i>Between PA 320 & Orchard Rd.</i> | 19,200 ('91) | 19,600 | 17,200 | -12.2% |
| Butler Pike / Fayette Street | | | | |
| <i>Between Plymouth Rd. & Flourtown</i> | 17,100 ('90) | 18,200 | 21,700 | 19.2% |
| <i>Between Cardinal Rd. & Karrs La.</i> | 12,800 ('88) | 13,400 | 12,700 | -5.2% |
| <i>Between 3rd St. & 4th St.</i> | 15,400 ('88) | 16,100 | 15,400 | -4.3% |
| <i>Between 14th St. & 15 th St.</i> | 16,400 ('88) | 18,200 | 17,600 | -3.3% |

* - Counted in 1994 after PA 320 bridge re-opened

TABLE IV (Continued)

| <i>Location</i> | <i>ADT (Year of Count)</i> | <i>ADT Without I-476 (1993 Estimate)</i> | <i>ADT With I-476 (1993)</i> | <i>Percent Difference</i> |
|--|--------------------------------|--|--------------------------------------|-------------------------------|
| Lawrence Road | | | | |
| <i>Between Springhouse Rd. & Canterbury Dr.</i> | 16,900 ('90) | 18,000 | 15,700 | -12.8% |
| Darby Road | | | | |
| <i>Between PA 320 & I-476 Overpass</i> | 11,000 ('90) | 11,500 | 6,900 | -40.0% |
| Old Marple Road | | | | |
| <i>Between PA 320 & Strafford Dr.</i> | 6,600 ('91) | 6,900 | 6,800 | -1.4% |
| State Road | | | | |
| <i>Between PA 252 & Overhill Rd.</i> | 9,300 ('90) | 9,900 | 8,600 | -13.1% |
| Bullens Lane | | | | |
| <i>Between MacDade Blvd. & 25th St.</i> | 9,600 ('91) | 9,900 | 6,100 | -38.4% |
| Swarthmore Avenue | | | | |
| <i>Between PA 320 & Elm St.</i> | 8,800 ('91) | 9,000 | 5,500 | -38.9% |
| Beatty Road | | | | |
| <i>Between Crum Creek Rd. & Minshall St.</i> | 6,300 ('89) | 6,600 | 3,100 | -53.0% |
| Lansdowne Avenue | | | | |
| <i>Between Scottsdale Rd. & Providence Rd.</i> | 18,700 ('88) | 19,600 | 17,300 | -11.7% |
| <i>Between School La. & State Rd.</i> | 28,300 ('91) | 28,900 | 26,200 | -9.3% |
| Springfield Road | | | | |
| <i>Between Bishop Rd. & Norwinden Rd.</i> | 18,500 ('88) | 19,900 | 18,000 | -9.5% |
| <i>Between Britton Rd. & US 1</i> | 19,300 ('88) | 20,700 | 21,100 | 1.9% |
| <i>Between Meetinghouse La. & Old Marple Rd.</i> | 19,300 ('90) | 20,200 | 17,400 | -13.9% |

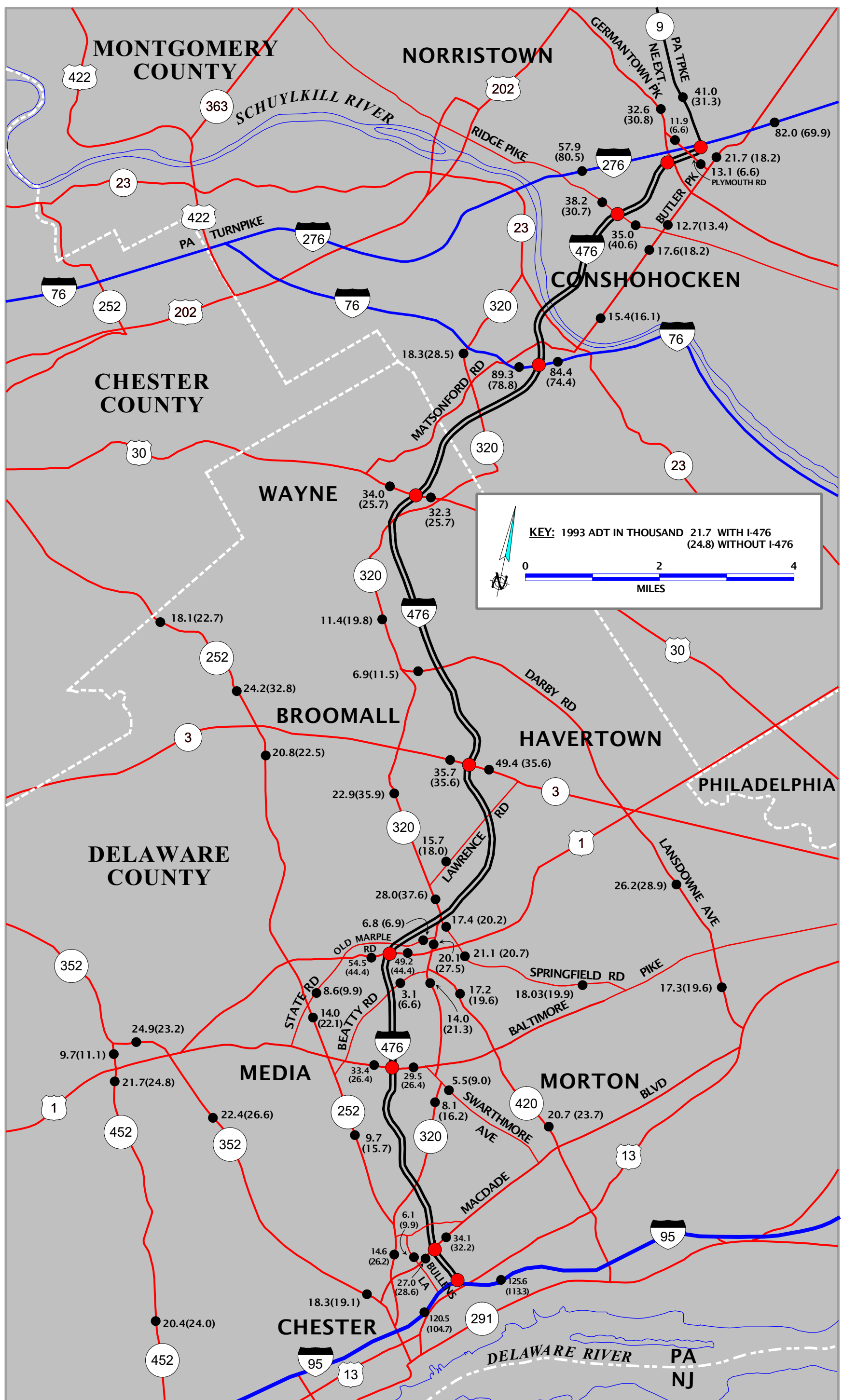
The next eastward highway impacted by I-476 is PA 420, running between I-95 in Tinicum Township and PA 320 in Springfield Township. The 1993 counts, taken at the end points of this road, show that PA 420 now experiences 12.4 percent less traffic than had I-476 not been built.

The last corridor investigated represents the area served by Fayette Street/Butler Pike running between the Schuylkill River in Conshohocken and Germantown Pike at Plymouth Meeting. Counts taken north of 3rd Avenue indicate an average reduction in traffic of 4.2 percent since I-476 opened fully in 1992. The reason for such a small impact is that by 1993 I-476 had been operational from I-76 to Chemical Road for 14 years.

Table IV (page 29) also lists additional roads monitored in this traffic analysis. These are facilities with shorter distances, not necessarily paralleling I-476, and with no direct access to I-476, but nevertheless under the influence of the new interstate highway. With I-476 included in the highway network, these roads show reductions in travel that range from 1.4 percent on Old Marple Road in Marple Township to 40.0 percent on the segment of Darby Road adjacent to I-476 in Haverford Township, to 53.0 percent on Beatty Road in Springfield Township. However, two exceptions are evident: Butler Pike between Plymouth and Flourtown roads, which forms the border between Plymouth and Whitemarsh townships, with an increase of 19.2 percent; and Springfield Road south of US 1 in Springfield Township with 1.9 percent more traffic than the "without" I-476 estimates. The former suggests the formation of a new corridor that comprises Butler Pike, Plymouth Road, and I-476; the latter increase explains the function of Springfield Road in collecting local and through traffic that is then channelled toward the I-476 Interchange with US 1, as well as toward the numerous business and commercial activities that are located east of the same interchange. A graphic summary of the I-476 impacts on interchange and parallel roads is shown in Figure 5.

Finally, DVRPC conducted a travel time survey in order to compare the time necessary to travel north from I-95 to the Pennsylvania Turnpike. Providing a direct connection between the two end points, I-476 was compared to an alternative itinerary made up of PA 320, Matsonford Road, Fayette Street, Butler Pike, and Germantown Pike. Travel was timed during off-peak periods with a minimum of traffic interference and posted speed limits were observed. By using I-476, the total time needed to cover the distance of 21.0 miles was 23 minutes. The alternate routing, 23.0 miles long, required a travel time of 49 minutes. The survey shows that a saving in travel time of up to 26 minutes (53 percent) is gained when motorists use I-476 for its entire length.

**FIGURE 5
TRAFFIC IMPACTS OF I-476
INTERCHANGE AND PARALLEL ROADS**



V. PAST DVRPC TRAFFIC FORECASTS

In the early stages of the I-476 design process, PennDOT asked DVRPC to provide traffic projections for the Year 2000 and beyond for all segments of the highway. When the actual 1993 traffic volumes were compared with the latest traffic forecast in the DVRPC reports that were published in the early 1980s, it was noted that several of the actual 1993 counts were higher than those projected for the Year 2000. For example, the links with the highest discrepancies were located between MacDade Boulevard and Baltimore Pike, and between I-76 and Ridge Pike. On these segments, the 1993 counts were over 10,000 vehicles per day higher than the Year 2000 projected traffic volumes. At the other end of the range, the I-476 segment located between PA 3 and US 30 shows a projected volume of 65,000 versus a 1993 traffic total of 64,000. All other links have inconsistencies that fall in between these two extremes. In general, the fact that traffic has grown faster than originally forecast reflects the need for and importance of I-476 to this part of the region. However, there are several specific reasons for these unforeseen patterns.

Future projections and magnitudes in traffic are usually derived from a laborious and complex simulation process that includes refinement and careful interpretation of up-to-date traffic related factors. The travel forecasting models used at DVRPC follow the usual steps of trip generation, distribution, modal split, and trip assignment that are approved and recommended by the US Department of Transportation for traffic simulation and forecasting purposes. The precision of vehicular levels forecast for a given facility, however, depends on the accuracy of basic socio-economic projections. The 1990 Census survey, which occurred well after the publication of DVRPC forecasts for I-476, reported some important developments that occurred during the late 1980s. For example, throughout the region, women and minorities entered the workforce at higher rates than expected. The number of people employed in the I-476 corridor increased by 25 percent between 1980 and 1990. This type of growth, shown previously in Table I (page 10), had not been anticipated in previous employment forecasts.

During the 1980s the region experienced significant growth in the suburbs and further decline in the older areas of the region. The planning strategy at DVRPC in that period advocated focused growth in both urban and selected suburban areas in order to control urban sprawl, but this did not happen.

Although population growth was non-existent in the I-476 corridor between 1980 and 1990, the rate of household formation was high throughout the region. Household size has continued to decline and this has led to a higher demand for housing in the Philadelphia suburbs. In addition, the average household size in the I-476 corridor decreased at a greater rate than the remainder of the region.

Additionally, when DVRPC developed its forecasts for PennDOT, it assumed that the cost of travel for highway and transit would continue to increase at rates similar to trends established during the 1970s and early 1980s. However, by the time I-476 opened, the cost of driving was increasing at a significantly lower rate. Some out-of-the-pocket costs such as gasoline and parking actually decreased, taking the rate of inflation into account, leading more people to take to the roads with their vehicles rather than use other modes of travel for their daily activities.

Furthermore, the growth in car ownership continued at a rate higher than anticipated by DVRPC. The number of households with one car or less continued to decline, while households with more than two cars continued to increase at a higher rate than that used in the travel forecasts. Therefore, although household size decreased, the number of vehicles per household increased significantly, meaning that more vehicles were being used by fewer people, and there are more vehicles per household within the I-476 corridor than in the region as a whole.

In the late 1980s transit ridership and car/van pool use declined much more than DVRPC considered in its forecasts. The I-476 travel forecasts assumed that transit ridership and ride sharing would stabilize or even increase slightly by the year 2000 due to cost benefits. Therefore, the forecasts presumed a greater role for transit and ridesharing components than actually happened.

Finally, the travel forecasts for I-476 were constrained by the capacity assumed for the four-lane and six-lane sections. That is, it was assumed that the presence of congestion would deter additional motorists from using the highway. However, it became evident that the advantages of using the highway were sufficiently strong that motorists were willing to tolerate higher levels of congestion. This was especially true on the four-lane sections. During certain times of the day, segments of I-476 now carry higher volumes per hour than those suggested by planning practices and used by DVRPC in its traffic simulation and forecast models.

VI. CONCLUSIONS

The effect of placing a large interstate facility in mid-Delaware County and southern Montgomery County has been extensive. Long planned and much delayed, I-476 was finally completed and opened to motorists in 1992. From the standpoint of traffic, the popularity of I-476 as a commuter and commercial gateway to the western suburbs of Philadelphia has been greater than anticipated.

Based on an analysis of vehicle counts taken in 1993, traffic flowing on I-476 displayed the following levels and characteristics:

- Counts taken on I-476 show a significant usage of the expressway, with volumes ranging from a high of 83,000 vehicles between I-76 (Schuylkill Expressway) and Ridge Pike in Montgomery County to a low of 60,900 vehicles per day just south of PA 3 in Delaware County. Most portions of the interstate highway carry daily volumes that range between 65,000 and 70,000 vehicles.
- Peak-hour traffic constitutes between 7.1 and 11.8 percent of daily total traffic. Over some segments, one-way peak-hour traffic is as high as 3,800 vehicles. The highest counts are reported during the afternoon rush in the southbound lanes of the section from US 30 to PA 3, and account for 11.8 percent of its total daily traffic and in the p.m. period along the northbound direction from MacDade Boulevard to Baltimore Pike and from I-76 to Ridge Pike. This reversal of direction is both a reflection of the growing importance of circumferential travel in the Philadelphia urbanized area and the local nature of many of the trips taken on I-476.
- Both manual and machine classification counts taken at five locations along I-476 show that trucks represent between 7.4 and 11.3 percent of total daily traffic using the expressway. These percentages translate into daily volumes of up to more than 8,000 commercial vehicles. The highest truck traffic occurs at I-476 between MacDade Boulevard and Baltimore Pike where 11.3 percent of daily traffic in each direction is classified as trucks, and on the segment between I-76 and Ridge Pike where truck volume constitutes about 10.3 percent of the total daily traffic. At none of the remaining locations does the truck volume exceed 9.7 percent of the total daily traffic.

Major impacts caused by I-476 on regional travel patterns can be summarized as follows:

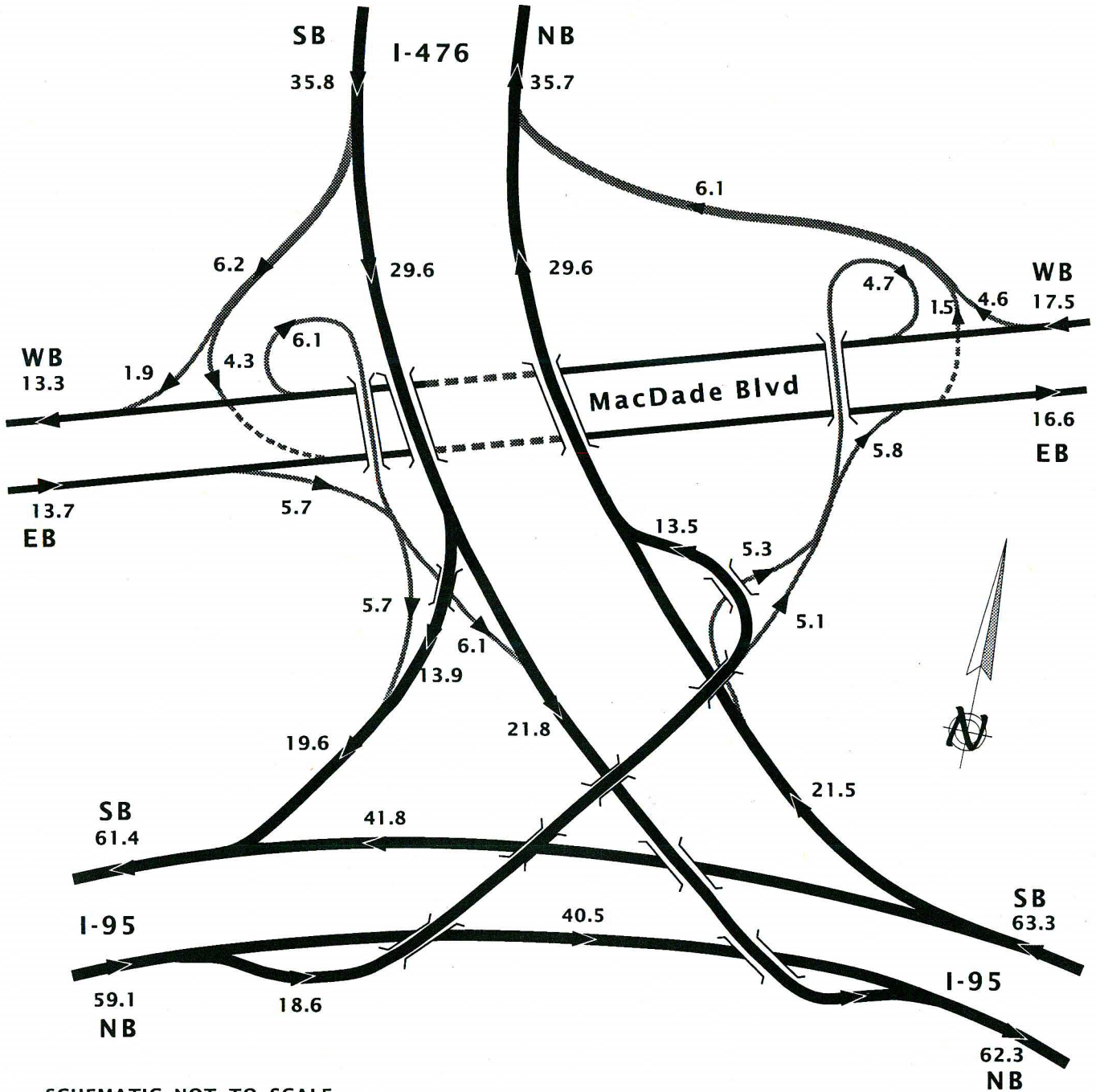
- The three interstate highways that interchange with I-476 ensure that the new highway plays an important role in the regional transportation network. The ramps from I-95 that start I-476 on its way northward serve about 40,000 motorists per day. Likewise, approximately 41,400 vehicles per day make their way onto I-95 from I-476 and MacDade Boulevard. In fact, with the addition of I-476, traffic levels on I-95 have increased by 13 percent over the "without" I-476 estimates.
- At the Schuylkill Expressway interchange, nearly 39,200 vehicles coming from I-76 proceed onto I-476, while 38,900 vehicles per day exit I-476 onto I-76. An additional 17,100 daily drivers traveling to or from Matsonford Road use this interchange to connect with I-476. Such additional volumes heighten I-76 volumes 13 percent over the "without" I-476 estimates.
- At the Pennsylvania Turnpike Interchange, about 43,000 vehicles per day are served by this connection. Nearly 24,000 vehicles per day use I-476 to interact with the turnpike. The Northeast Extension, an important expressway link to Lansdale, Quakertown, and points north, serves 18,900 daily motorists who use I-476. Traffic levels on I-276 to the east of the I-476 Interchange have increased 17 percent with the completion of I-476. On the other hand, the I-276 traffic west of PA 9 shows a substantial decrease of approximately 22,000 vehicles per day, or 28 percent from the "without" I-476 estimates. This reduction is a result of the new full interchange of I-476 with I-76. Travel to/from points west of the Valley Forge Interchange of the turnpike is now directly served by I-76, once drivers leave/enter I-476.
- The 1993 monitoring program indicates that traffic on other interchanging roads has also generally increased. The largest increment is found on Plymouth Road in Montgomery County, where traffic has nearly doubled to 11,300 vehicles per day over the "without" I-476 estimate (6,600 vehicles). Other large increases are seen on US 30, US 1, MacDade Boulevard and PA 3 east of the interstate. In contrast to this general trend, traffic on Chemical Road has declined 40 percent. This is a consequence of the completion of the interchanges with the Pennsylvania Turnpike, Germantown Pike, and Plymouth Road, which eliminated the temporary diversion of traffic onto Chemical Road since 1979 when a partial I-476 was available to drivers.

- Traffic on routes parallel to I-476 have seen reductions by as much as 50 percent on certain segments. To a large extent this is caused by shifting traffic to the new expressway, thus relieving congestion on local roads. Not only has I-476 provided a new link for daily commuters, it also has ensured that through traffic does not interfere with local traffic. Routes such as PA 420, PA 452, PA 252, and PA 320 have all experienced sharp declines in traffic, ranging from 12 percent (PA 420) to 36 percent (PA 320) since the opening of I-476.
- Finally, a travel time survey was taken to determine how long it would take a driver to travel I-476 between I-95 and the Pennsylvania Turnpike and to use an alternative route comprised of PA 320, Matsonford Road, Fayette Street, Butler Pike, and Germantown Pike. The survey concluded that there is a savings of 26 minutes of driving time from 49 to 23 minutes, or a 53 percent reduction for motorists driving the full length of I-476.

In conclusion, the completion of I-476 and its inclusion in the regional network have changed the way regional residents travel for their daily purposes. It has changed the traffic patterns used to access the interstate highway system, as well as the patterns used for through travel. The positive traffic impacts, in addition to the positive reaction of motorists to the "parkway" appearance of the interstate highway, confirmed the need for the long-awaited expressway. This combination of practical and aesthetic needs were met with the construction of Interstate 476.

APPENDIX

**TRAFFIC IMPACTS OF I-476
INTERCHANGE 1
RIDLEY TOWNSHIP, DELAWARE CO.
1993 AVERAGE DAILY TRAFFIC (000)**



SCHEMATIC NOT TO SCALE

**Note: Totals may not add up
due to roundings**

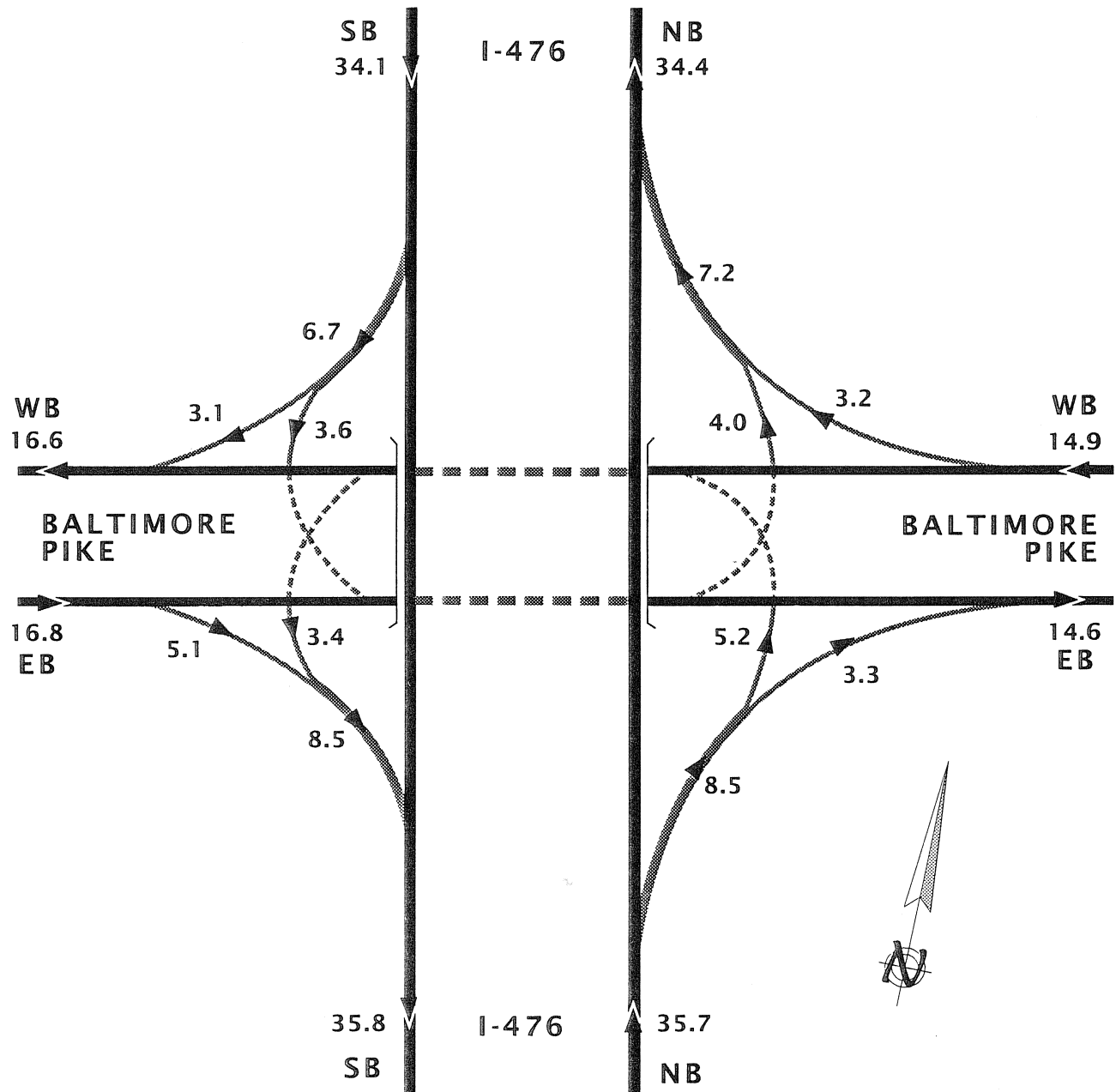


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TRAFFIC IMPACTS OF I-476 INTERCHANGE 2

NETHER PROVIDENCE, DELAWARE CO.

1993 AVERAGE DAILY TRAFFIC (000)



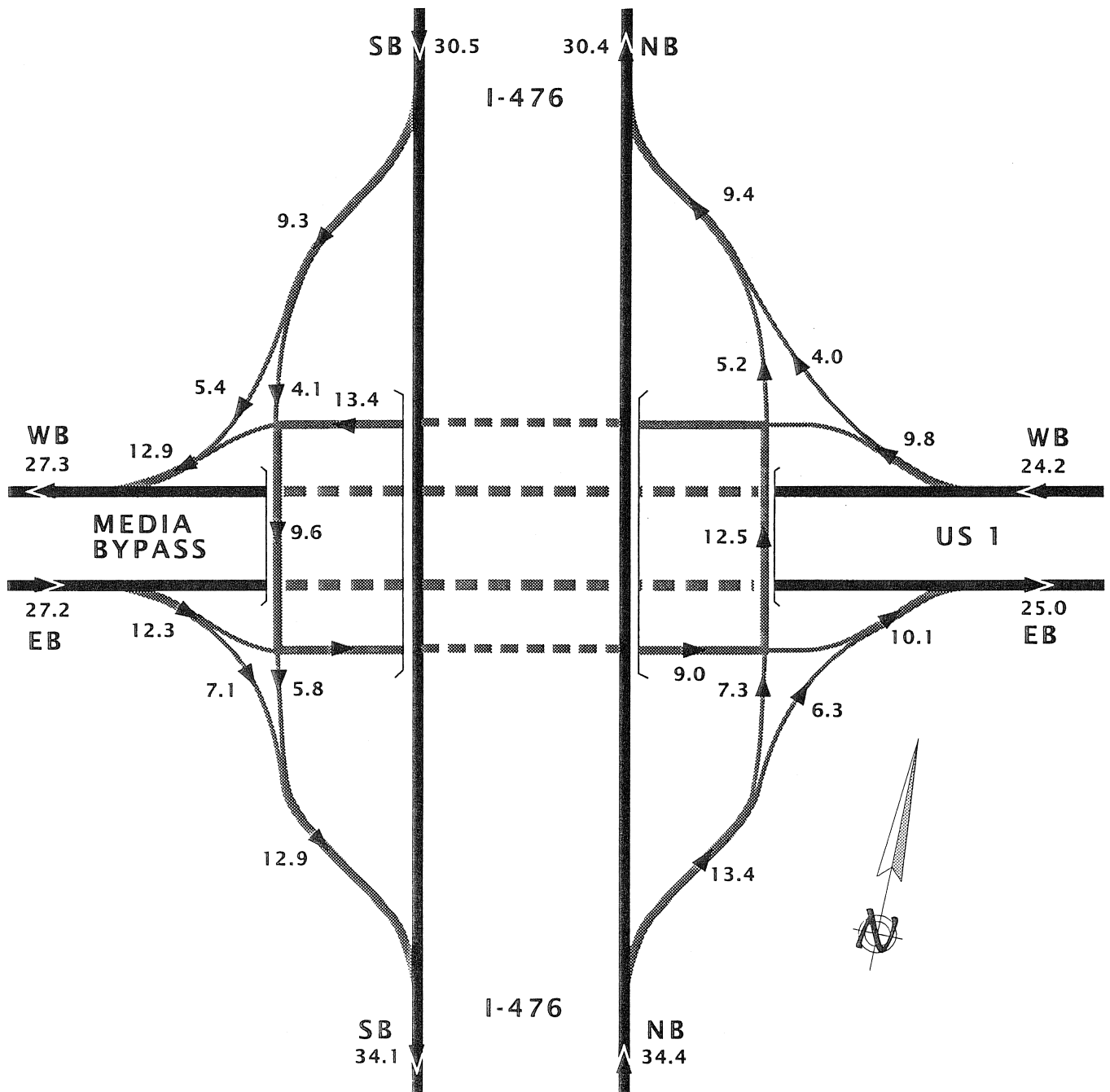
SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



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TRAFFIC IMPACTS OF I-476 INTERCHANGE 3 MARPLE TOWNSHIP, DELAWARE CO. 1993 AVERAGE DAILY TRAFFIC (000)



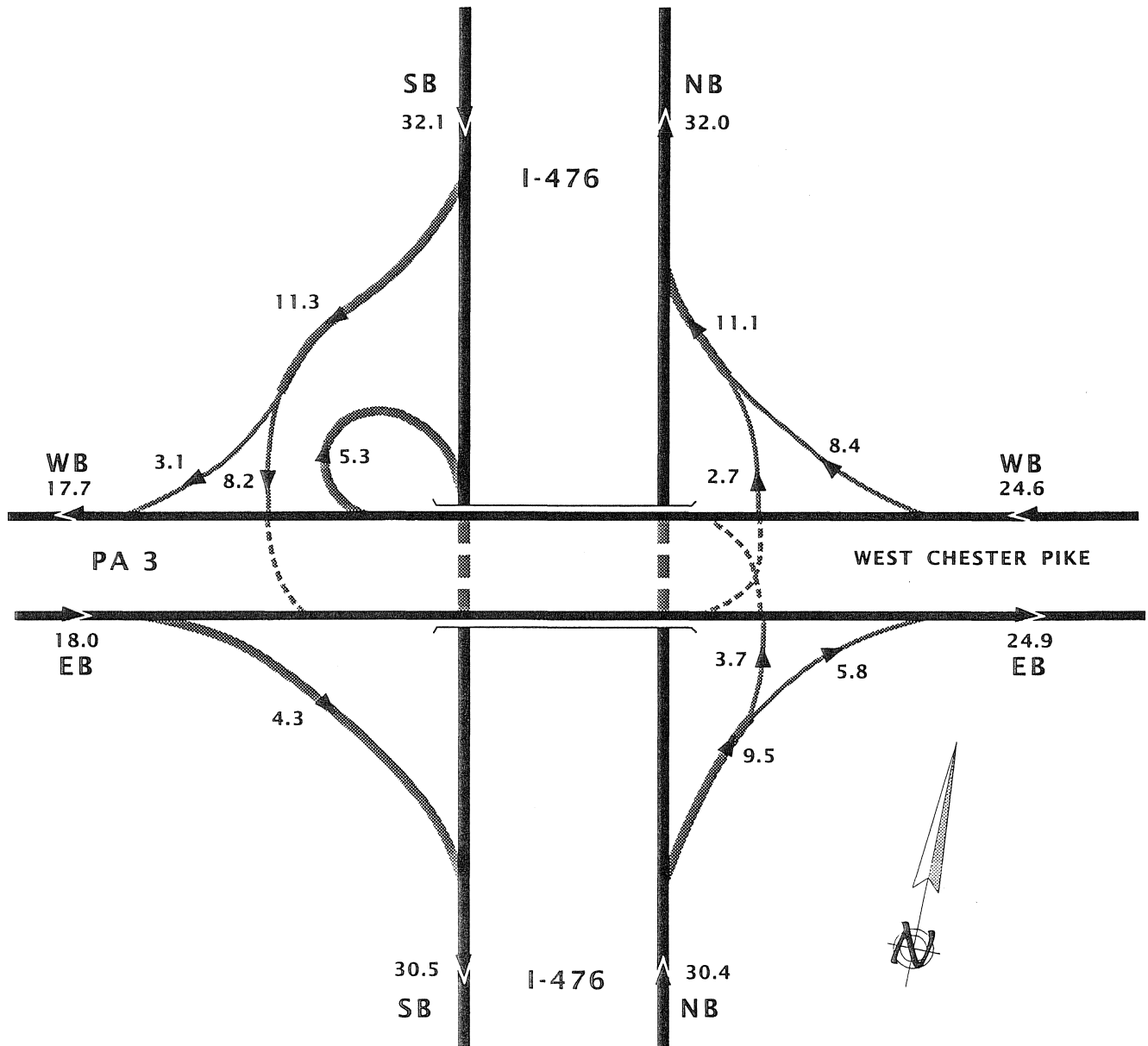
SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



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TRAFFIC IMPACTS OF I-476 INTERCHANGE 4 MARPLE TOWNSHIP, DELAWARE CO. 1993 AVERAGE DAILY TRAFFIC (000)



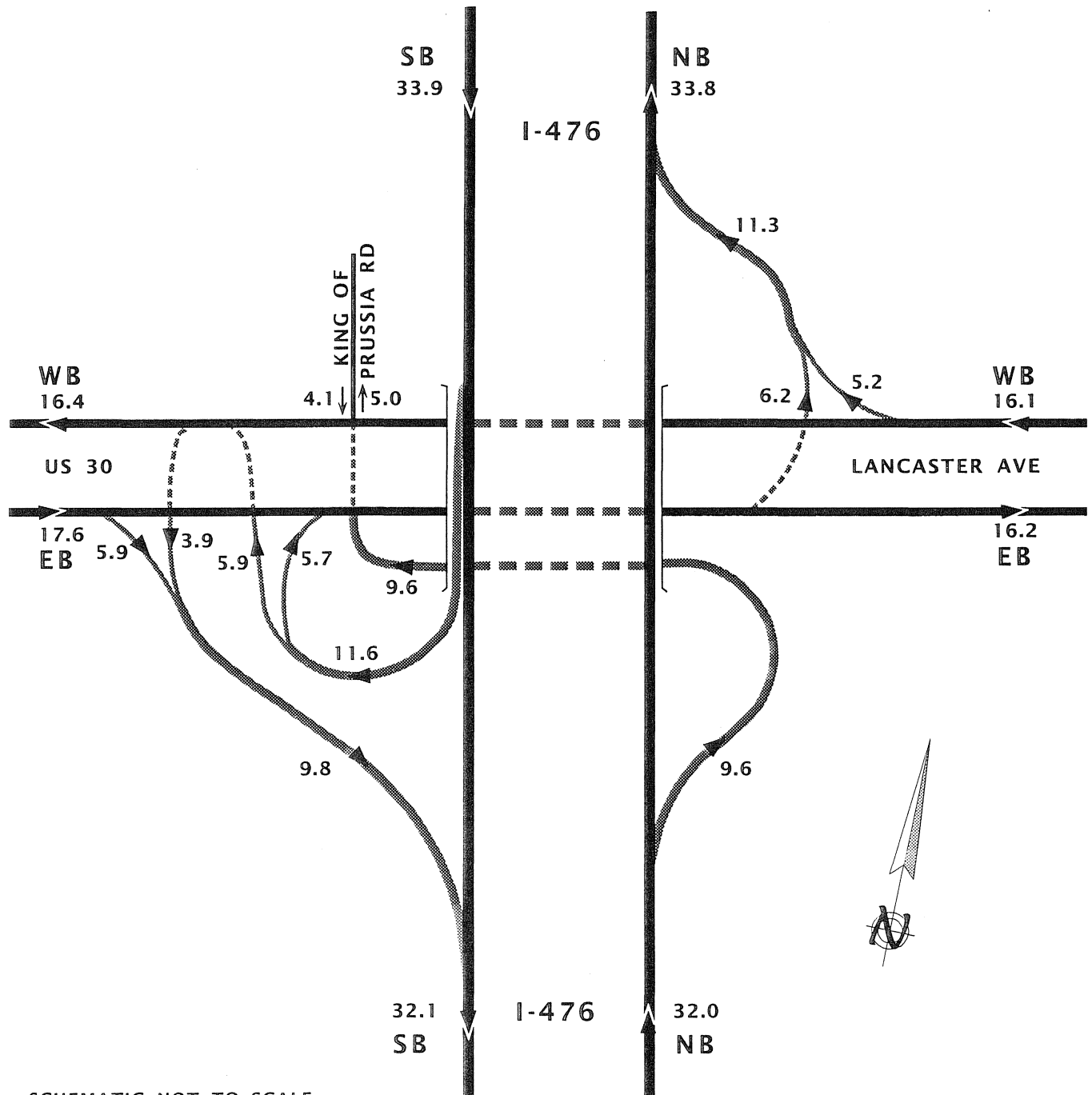
SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



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TRAFFIC IMPACTS OF I-476 INTERCHANGE 5 RADNOR TOWNSHIP, DELAWARE CO. 1993 AVERAGE DAILY TRAFFIC (000)

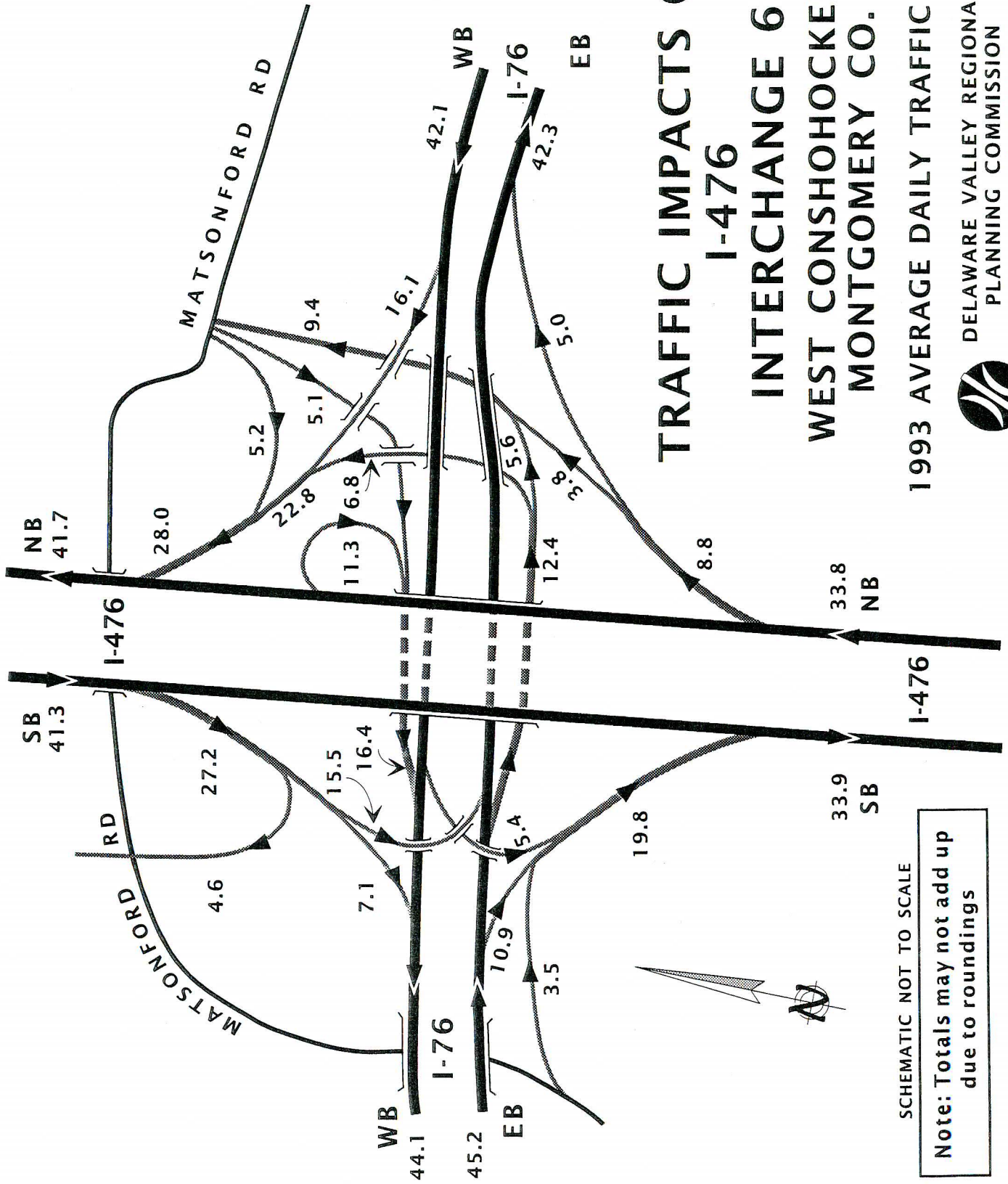


SCHEMATIC NOT TO SCALE

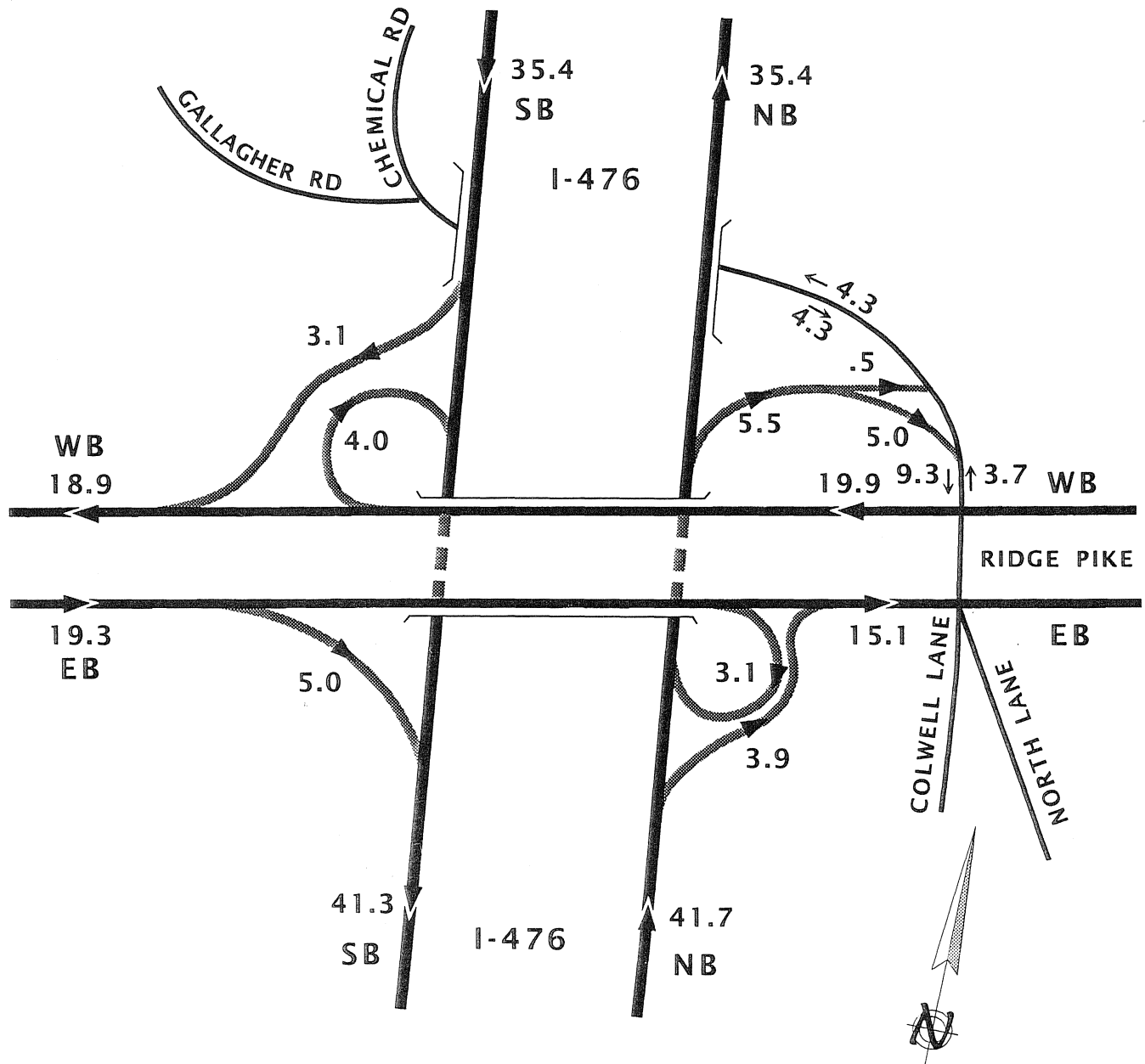
Note: Totals may not add up
due to roundings



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TRAFFIC IMPACTS OF I-476 INTERCHANGE 7 PLYMOUTH TOWNSHIP, MONTGOMERY CO. 1993 AVERAGE DAILY TRAFFIC (000)



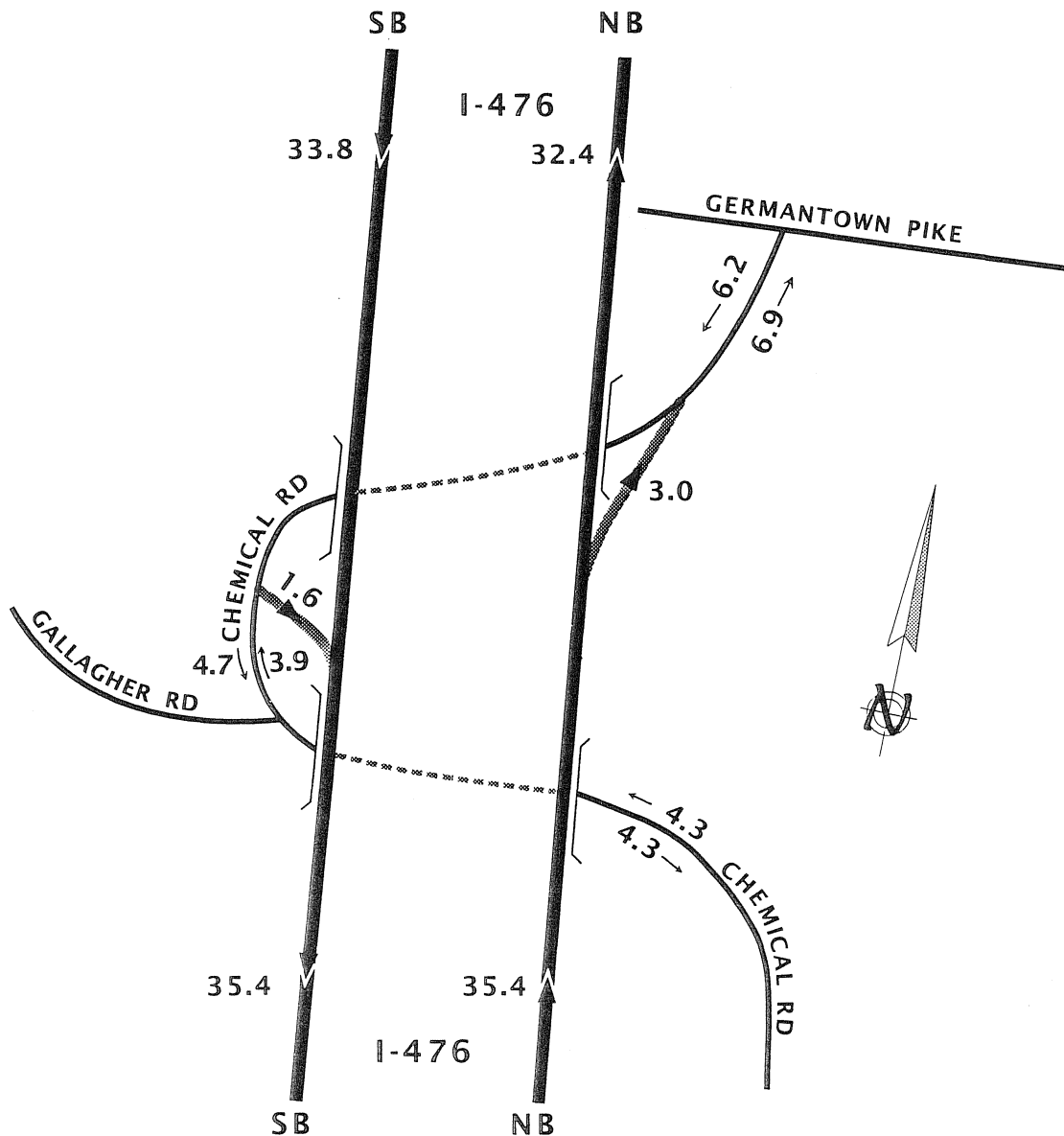
SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



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TRAFFIC IMPACTS OF I-476 INTERCHANGE 8 PLYMOUTH TOWNSHIP, MONTGOMERY CO. 1993 AVERAGE DAILY TRAFFIC (000)



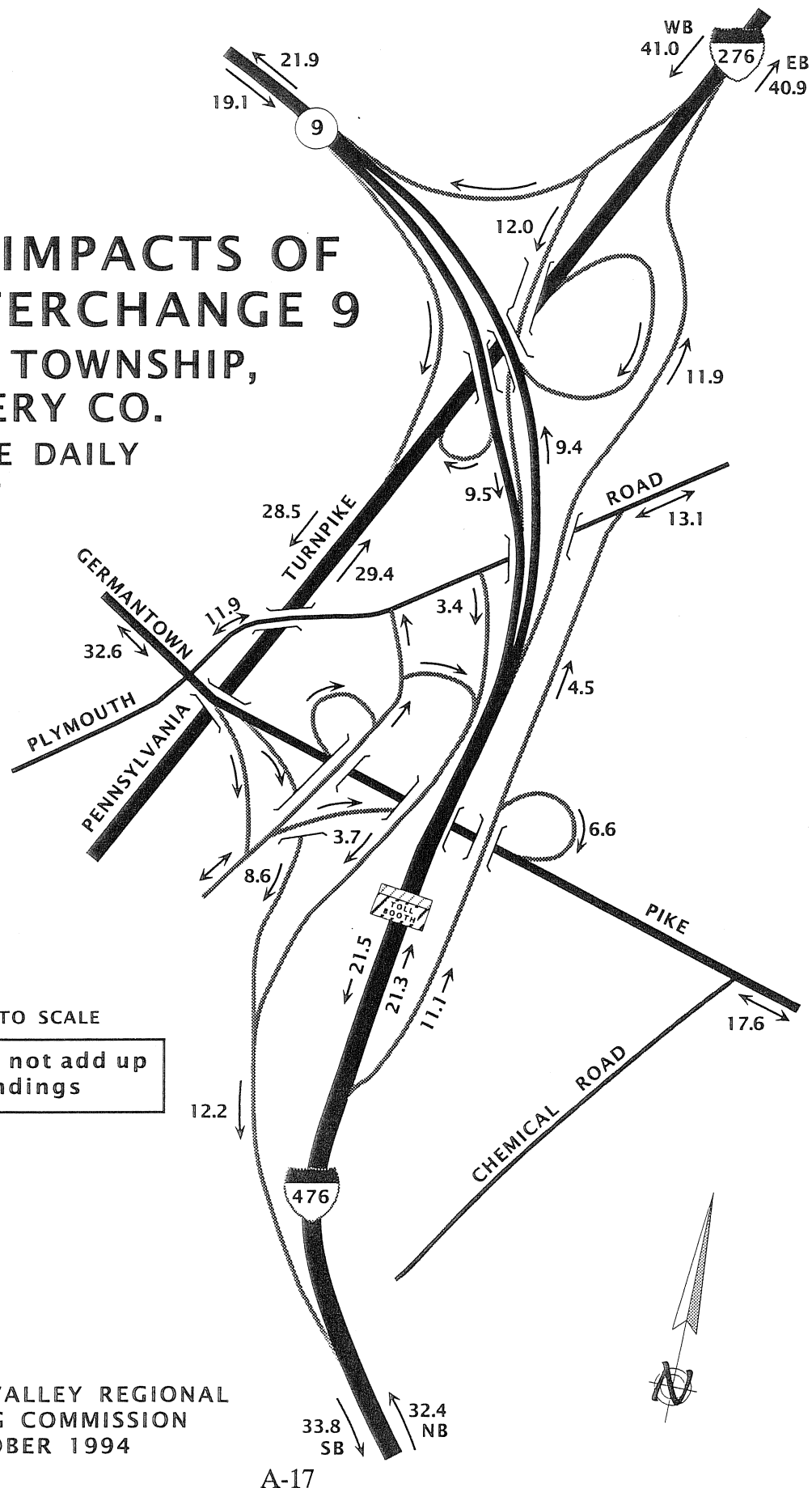
SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



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PLANNING COMMISSION
OCTOBER 1994

TRAFFIC IMPACTS OF I-476 INTERCHANGE 9 PLYMOUTH TOWNSHIP, MONTGOMERY CO. 1993 AVERAGE DAILY TRAFFIC (000)



SCHEMATIC NOT TO SCALE

Note: Totals may not add up
due to roundings



DELAWARE VALLEY REGIONAL
PLANNING COMMISSION
OCTOBER 1994

A-17

