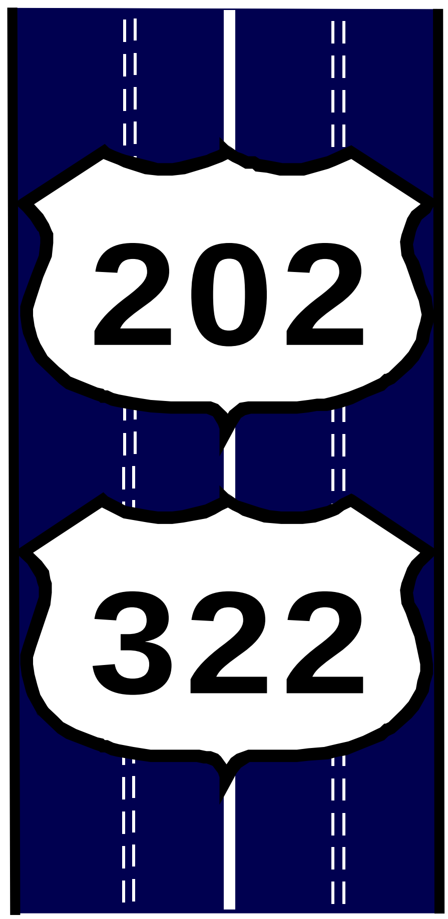
Technical Memorandum

US 322 / 202 Interchange Completion Study



January 2008

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

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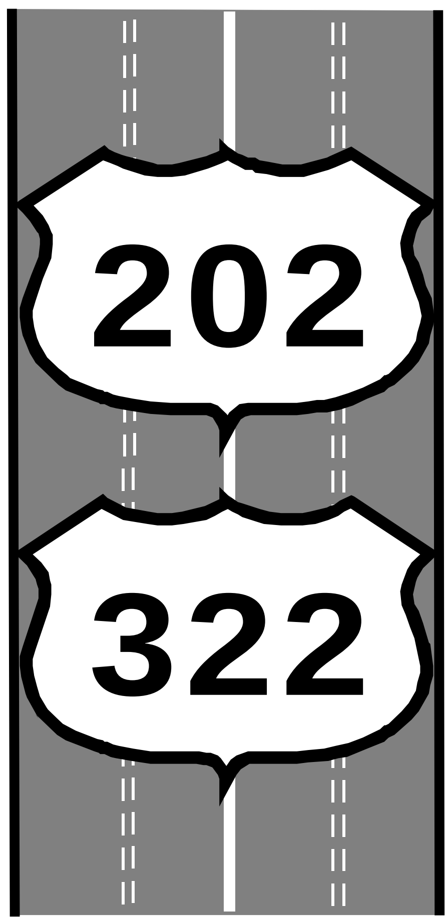

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Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty, and intercity agency that provides continuing, comprehensive, and coordinated planning to shape a vision for the future growth of the Delaware 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 requests 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.

The DVRPC logo is adapted from the official seal of the Commission 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 flowing through it. The two adjoining crescents represent the Commonwealth of Pennsylvania and the State of New Jersey. The logo combines these elements to depict the areas served by DVRPC.

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

DVRPC fully complies with Title VI of the Civil Rights Act of 1964 and related statutes and regulations in all programs and activities. DVRPC's website may be translated into Spanish, Russian, and Traditional Chinese online by visiting www.dvrpc.org. Publications and other public documents can be made available in alternative languages or formats, if requested. For more information, please call (215) 238-2871.

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I. INTRODUCTION

The West Chester Bypass (US 202/322) interchange is located in West Goshen Township, Chester County, near the borough of West Chester. The existing partial interchange consists of ramps from US 202/322 northbound to US 322 westbound, and from US 322 eastbound to US 202/322 southbound. In its current configuration, no direct movements exist from US 202 southbound to US 322 westbound, or from US 322 eastbound to US 202 northbound.

In 2005, The West Chester Regional Planning Commission completed a design feasibility study that indicated two missing ramps in this interchange could be constructed in a reasonable fashion, meeting basic design criteria. The ramps are to mitigate traffic problems on other state and municipal roads in the area, particularly reducing traffic through West Chester Borough and on Phoenixville Pike. An option is also included for movements to Brandywine Industrial Park via slip ramps from the proposed US 202 northbound ramp.

To determine the impact of these proposed ramps, especially on adjacent interchanges, DVRPC was asked to forecast year 2030 traffic volumes in the vicinity. DVRPC also evaluated the potential for land development induced as a result of increased accessibility caused by the ramps, especially to the west of the US 322 Bypass.

This technical memorandum summarizes DVRPC’s study process. Chapter II includes a brief description of existing study area conditions. Chapter III describes DVRPC's travel forecasting model and the socio-economic and land use assumptions used for this study. Chapter IV presents an analysis of future traffic volumes under each alternative studied. Chapter V summarizes implications for land development within the study area examined as part of this study and Chapter VI presents a few conclusions.

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II. STUDY AREA

The traffic study area includes the Borough of West Chester and surrounding townships of East Bradford, East Goshen, and West Goshen (see **Map 1**).

Several major roads traverse the study area:

US 202 through the study area is a divided highway with two through lanes in each direction (three lanes in each direction between US 322 and Paoli Pike). It provides north-south access through the eastern part of the study area and is the highest volume road in the study area. The highway ties in with US 30, a major east-west route north of the study area. From the interchange with US 322 south to High Street US 202 is called the West Chester Bypass and is conterminous with US 322.

US 322 traverses the center of the study area diagonally, roughly dividing the more intensely developed areas to the east and the growing townships of East Bradford, Pocopson and West Bradford to the west. The road profile varies from a two-lane undivided highway in the western half of the study area to a four-lane divided highway in the segment shared with US 202. The road is diverted around West Chester Borough on the West Chester Bypass, partly bypassing the borough on the north and east.

Phoenixville Pike is a two-lane road roughly parallel to US 202 from the US 322 bypass to US 30 north of the study area. As a current access route for US 322 traffic to and from US 202 north of the study area, some traffic will likely be relieved by the proposed ramps.

Of routes which lead directly to West Chester Borough, Paoli Pike and West Chester Pike (PA 3) both serve as east-west conduits to and from the borough via US 202. High Street/Pottstown Pike runs north-south, intersecting Market/Gay streets (PA 3) and providing limited movements via the US 322 bypass at a grade-separated interchange north of the borough. PA 100 intersects US 202 north of the US 322 interchange, bypassing Pottstown Pike/High Street through West Chester Borough.

A. Current Traffic Demand

In order to determine current traffic demand, daily traffic volumes were counted by DVRPC. All traffic counts were seasonally adjusted to represent average annual daily traffic (AADT) conditions. **Figures 1** and **1A** display current daily traffic volumes in the study corridor.

AADT volumes along US 202 in the study area range from 53,500 in both directions north of the High Street interchange to 89,400 in both directions between the Paoli Pike and US 322 interchanges.

Map 1. US 322 / 202 Interchange Completion Study Area

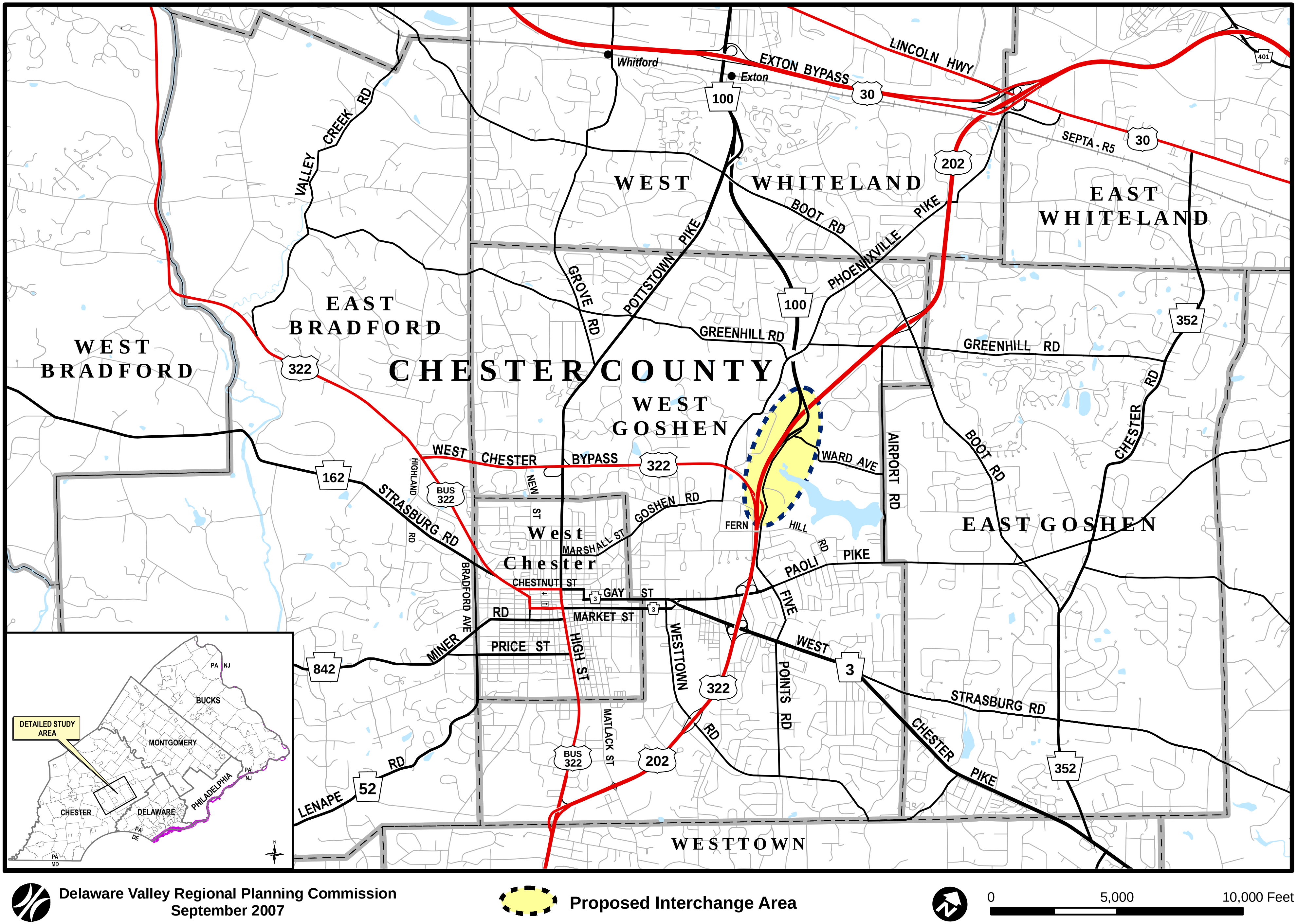

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Figure 1. Current Traffic Counts

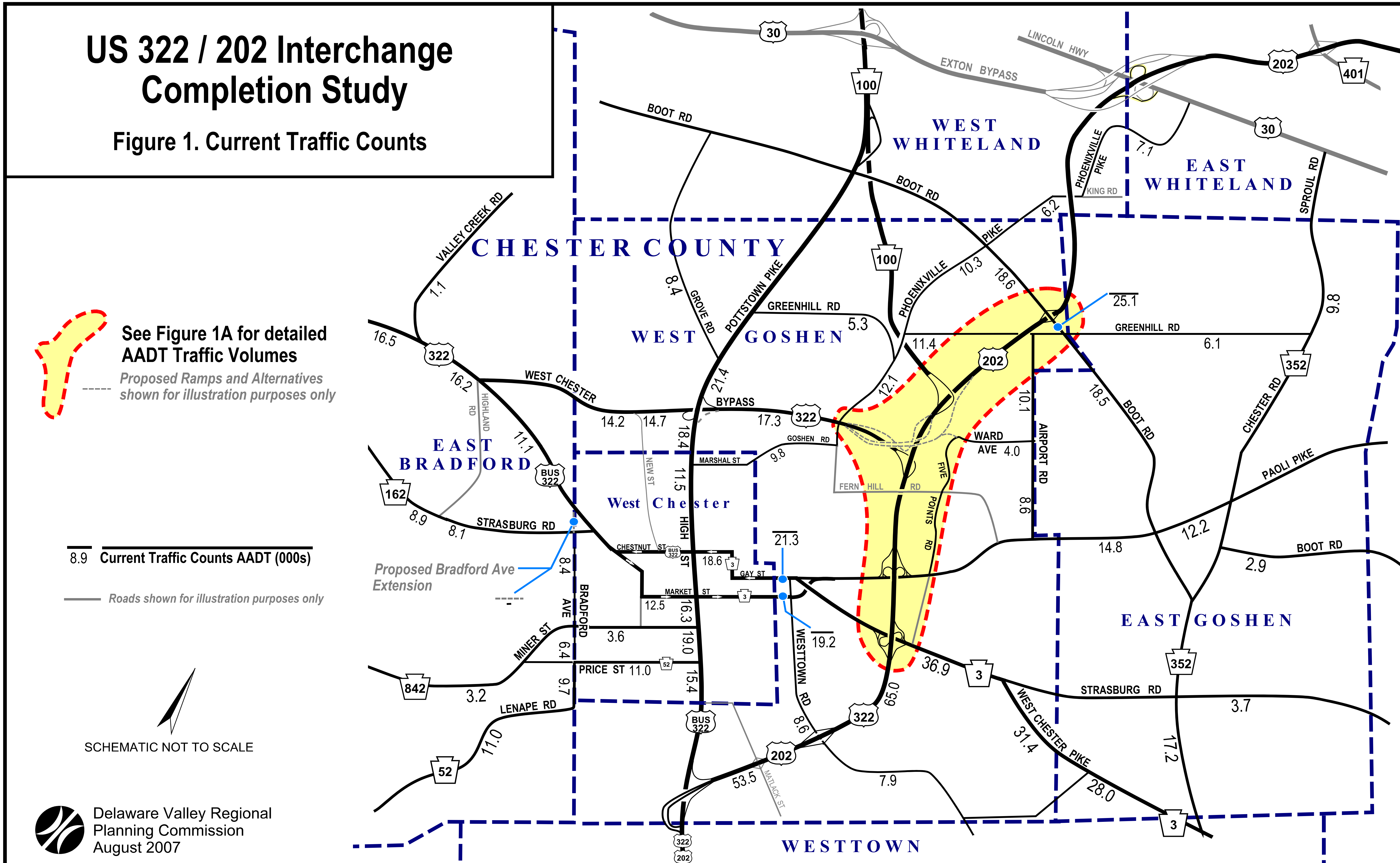

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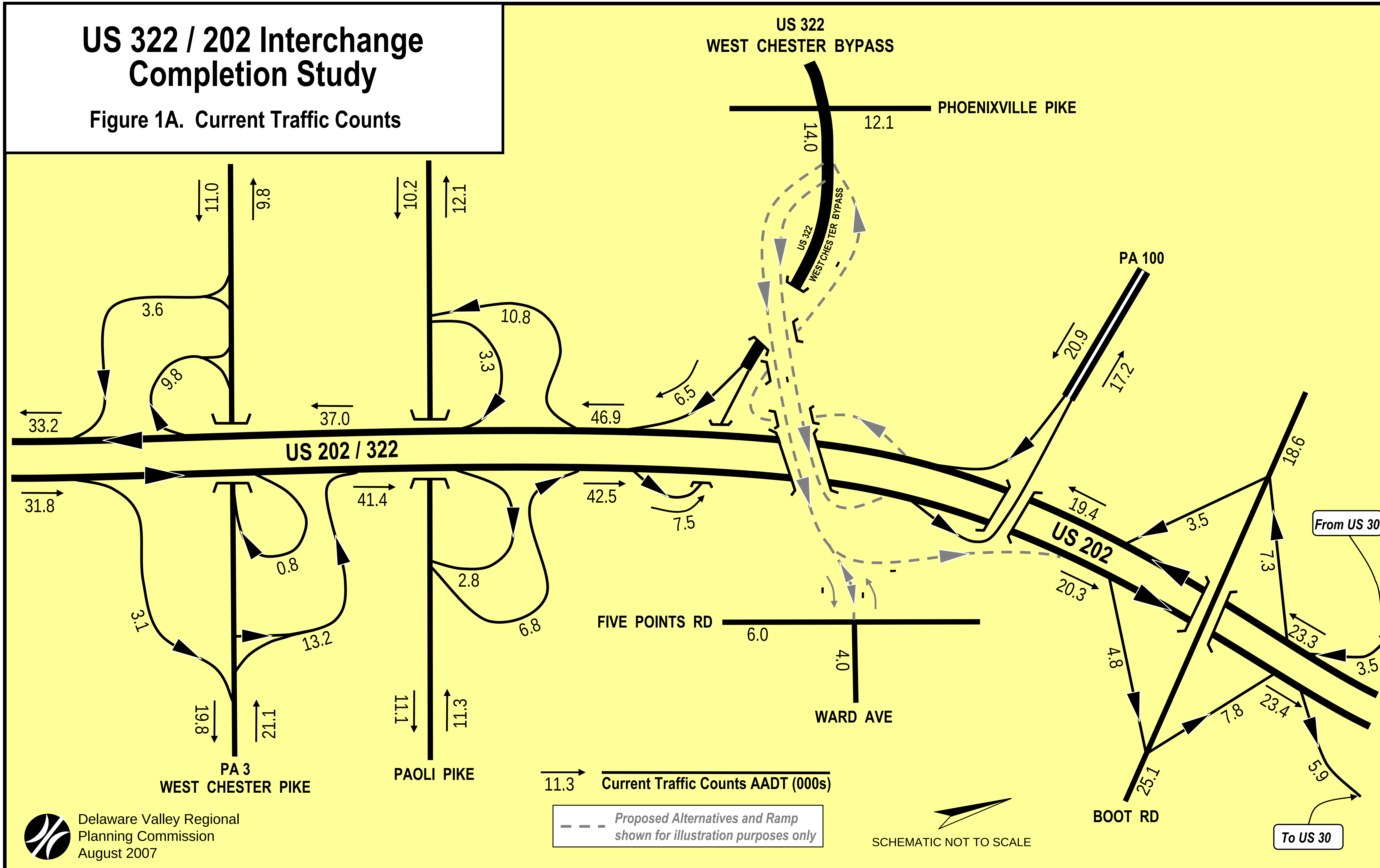
Figure 1A. Current Traffic Counts



Along the US 322 Bypass, AADT volumes are highest between Pottstown Pike and Phoenixville Pike, with 17,300 vehicles in both directions. Ramp volumes at the US 202/322 interchange are 6,500 vehicles per day (vpd) for the ramp from eastbound US 322 to southbound US 202 and 7,500 vehicles per day for the ramp from northbound US 202 to westbound US 322.

Other heavily traveled ramps in the study area are the PA 100 ramps, with AADT volumes of 17,200 vehicles northbound from US 202 and 20,900 vehicles southbound to US 202. Traffic volume exiting US 202 in the study area is heaviest at Paoli Pike and at West Chester Pike (PA 3). The US 202/322 southbound ramp to Paoli Pike is used by 10,800 vehicles per day, while the West Chester Pike (PA 3) interchange southbound off-ramp immediately to the south carries traffic volume of 9,800 vehicles per day. Of traffic entering US 202, 13,200 vehicles per day enter the highway northbound from West Chester Pike (PA 3) and 6,800 northbound from Paoli Pike.

Traffic volumes on the intersecting arterial streets range from between 10,200 and 12,100 vehicles per day by direction on Paoli Pike west of US 202/322 to 19,800 vehicles per day eastbound and 21,100 vehicles per day westbound on West Chester Pike (PA 3) just east of US 202/322.

AM and PM peak hour traffic volumes were also collected along US 202 and US 322 and at interchange ramps. In addition, peak hour turning movements were counted at certain intersections within the study area. AM and PM peak hour traffic volumes for current conditions are displayed in **Figure 2**.

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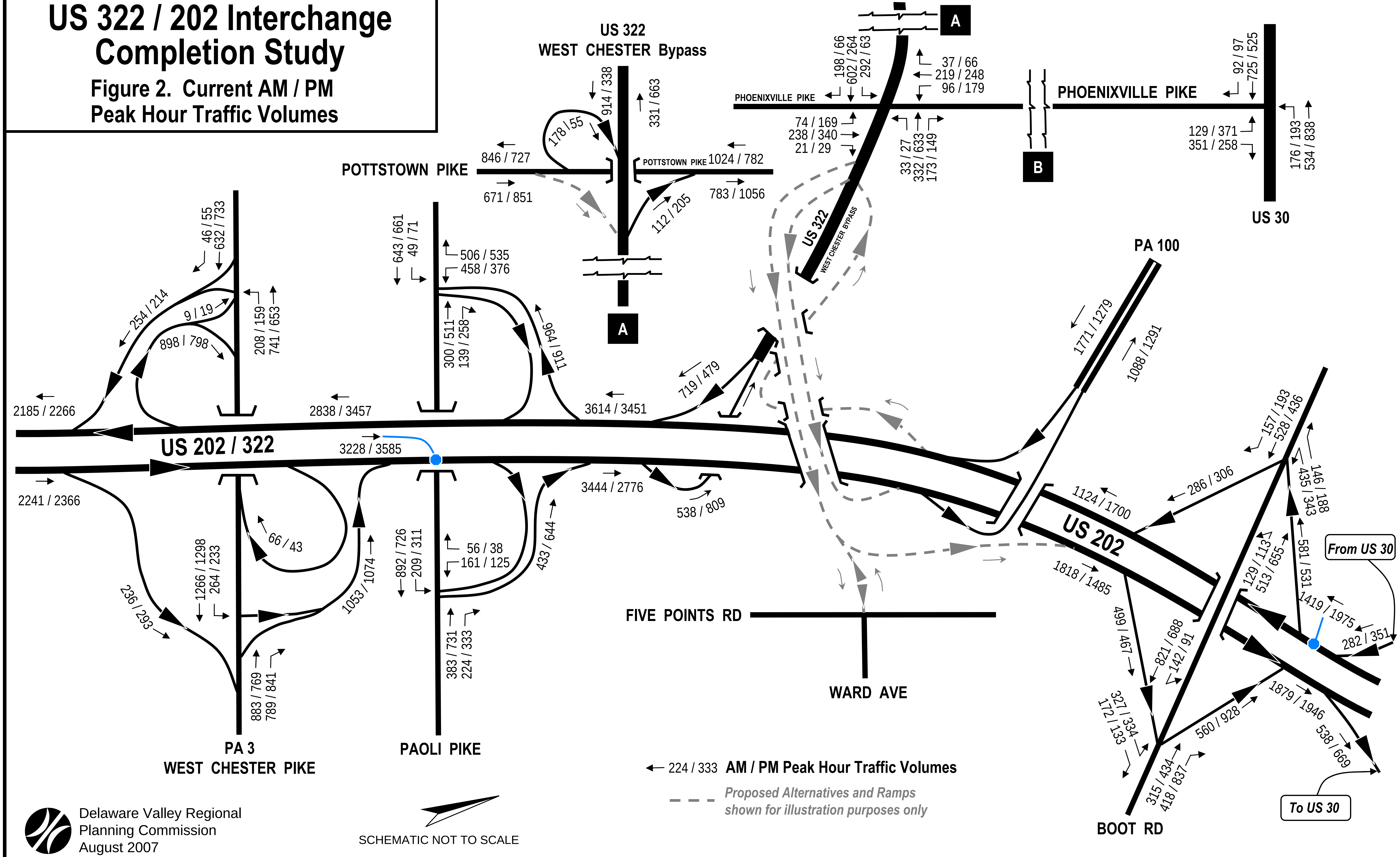
Figure 2. Current AM / PM Peak Hour Traffic Volumes



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III. TRAVEL FORECASTING PROCEDURES

Regional travel simulation models are used to forecast future travel patterns. They utilize a system of traffic zones that follow census tract and block group boundaries and rely on demographic and employment data, land use, and transportation network characteristics to simulate trip-making patterns throughout the region. The travel models used for this study include the entire nine-county DVRPC region, with special attention focused on the study area.

For this study, a focused simulation process is employed. 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.

A. Socio-Economic 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.

DVRPC uses a multi-step, multi-source methodology to produce its population and employment 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 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 and employment 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 census and the US Census Bureau's recent population estimates program 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 population estimates 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.

2. Employment Forecasting

Employment is influenced by local, national, and global political and socio-economic 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' unemployment insurance covered employment (ES 202), Occupational Privilege Tax data, and other public and private sector forecasts. As in the population forecasts, county level total employment is used as a control total for sector distribution and municipal level forecasts. Forecasts are then reviewed by member counties for final adjustments based on local knowledge.

3. Study Area Forecasts

As part of this study, DVRPC staff reviewed its current population and employment estimates, its 2030 long-range population and employment forecasts, and all proposed land-use developments in the study area. The magnitude of any population and/or employment growth associated with each proposal was determined and compared to the DVRPC board-adopted forecast for each municipality in the study area. Based on this review, DVRPC developed revised 2030 municipal-level population and employment forecasts for use as inputs to the traffic simulation models. **Table 1** summarizes the population and employment forecasts used for this study.

In 2005, there were 82,440 residents and 46,615 jobs within the study area. Strong growth in both population and employment is forecast for this area. By 2030, the study area is expected to add 16,472 new residents and 11,160 additional jobs, increases of 20 and 24 percent, respectively.

This growth is concentrated in the western municipalities of the study area. East Bradford, Pocopson and West Bradford townships are forecast to have population and employment growth in excess of 30 percent.

Table 1

2005 and 2030 Population and Employment in the US 322 / 202 Interchange Completion Study Area

Chester County	Population*		2005-2030 Change		Employment*		2005-2030 Change	
	2005	2030	Absolute	Percent	2005	2030	Absolute	Percent
Municipality								
East Bradford Township	10,310	14,000	3,690	36%	1,595	2,146	551	35%
East Goshen Township	17,700	21,130	3,430	19%	8,140	12,382	4,242	52%
Pocopson Township	3,610	4,918	1,308	36%	1,223	1,858	635	52%
West Bradford Township	11,450	15,224	3,774	33%	1,744	2,416	672	39%
West Chester Borough	17,850	18,150	300	2%	14,036	15,516	1,480	11%
West Goshen Township	21,520	25,490	3,970	18%	19,877	23,457	3,580	18%
Study Area Total	**82,440**	**98,912**	**16,472**	**20%**	**46,615**	**57,775**	**11,160**	**24%**

Based on DVRPC Board-Adopted forecasts with additional development planned in the study.

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B. DVRPC’s Travel Simulation Models

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 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, midday, and evening time periods. This disaggregation begins in trip generation where factors are used to separate daily trips into time-period specific travel. The enhanced process then utilizes completely separate model chains for peak, midday, and evening travel simulation runs. Time of day sensitive inputs to the models such as highway capacities and transit service levels are disaggregated to be reflective of time-period specific conditions. Capacity factors are used to allocate daily highway capacity to each time period. Separate transit networks were 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 which 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. Origin-destination patterns are then established and trips are proportioned between highway and transit modes. Finally, the most appropriate route for each trip is determined, and traffic volumes are assigned to individual facilities. **Figure 3** displays a flowchart of the travel simulation modeling process.

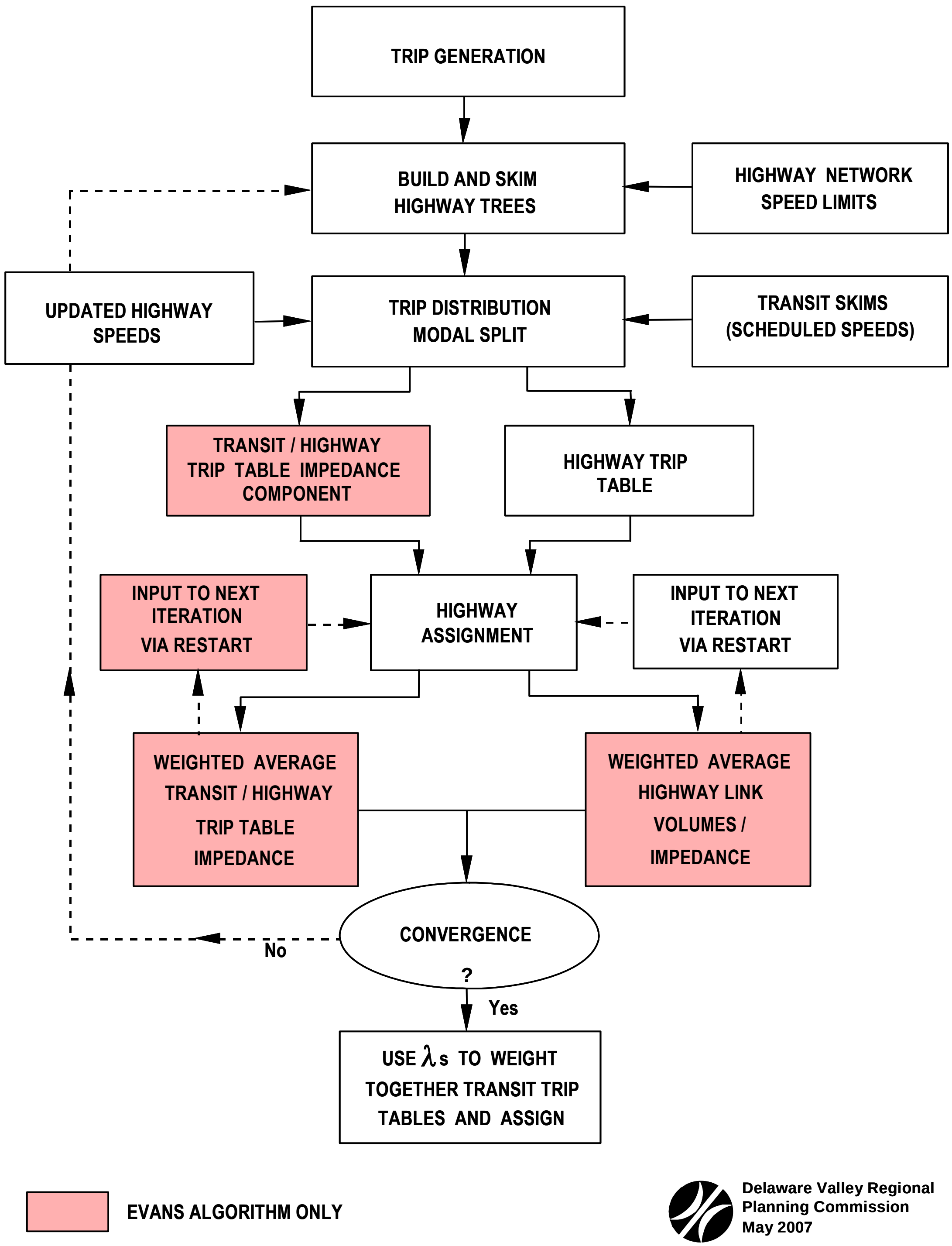
Trip Generation. Both internal trips (those made within the DVRPC region) and external trips (those which cross the boundary of the region) must be considered in the simulation of regional travel. For the simulation of current and future travel demand, internal trip generation is based on zonal forecasts of population and employment, whereas external trips are extrapolated from cordon line traffic counts and other sources. The latter also include trips which 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, midday, and evening time periods.

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

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 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 trip purpose and vehicle type stratifications established in trip generation.

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 which 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

Figure 3. DVRPC's Travel Simulation Modeling Process



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.

Highway Assignment. For highway trips, 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.

C. Improvement Alternatives

Separate model runs are performed for each future-year alternative to be tested. For this study, DVRPC prepared traffic forecasts for a no-build and two build alternatives. The no-build alternative provides a useful future-year reference against which any impacts associated with the build alternative may be compared and quantified. The traffic forecasts and analysis are presented in Chapter IV.

1. The No-Build Alternative

Under the no-build alternative, no improvements to the US 322/202 interchange are modeled. The no-build alternative does, however, assume the implementation of various planned improvements to other regional facilities. Generally, the facility improvements coded into the travel simulation model networks are projects included in DVRPC’s Transportation Improvement Programs (TIP) for Pennsylvania and New Jersey and its Long Range Transportation Plan. Included are: (1) US 30 Business - Widen to 5 lanes Exton Mall to US 202, adding a through lane in both directions. (2) US 202 (Section 100) provide an additional lane in each direction, construct grade separated interchanges at appropriate locations, and improve access, extent Matlack Street to Delaware State Line. In addition to these projects, DVRPC included a requested additional improvement in the no-build and both build alternatives: the extension of Bradford Avenue on the boundary of West Chester Borough and East Bradford Township from Strasburg Road (PA 162) to Downingtown Pike (US 322 Bus.).

2. The Build Alternatives

The two build alternatives also assume construction of all TIP and long-range plan projects in the region. Both alternatives include ramps from US 202 south to US 322 west and from US 322 east to US 202 north, as well as a proposed ramp from Pottstown Pike north to US 322 east, another requested addition.

While both build alternatives provide access to US 202 north, the alignment of the ramp varies by alternative. Alternative 1 allows access to Brandywine Industrial Park via slip ramps from the proposed ramp, which merges with US 202 north of the PA 100. The alignment of Alternative 2 merges with US 202 north before the PA 100, allowing access to the PA 100 northbound, but does not include a slip ramp to the industrial park.

IV. PROJECTED TRAFFIC VOLUMES

Projected daily and peak hour traffic volumes for selected facilities within the study area are presented and analyzed in this chapter. Forecasts are presented for a design year of 2030.

A. No-Build Alternative Traffic Forecasts

Average annual daily traffic forecasts (AADT) under the no-build alternative are provided in **figures 4** and **4A**, along with the build alternatives. In these figures, current average daily traffic volumes are shown in black, underneath the lines representing the highway links. No-build volumes for 2030 are shown in red. **Table 2** also lists these traffic volumes along with comparisons between current and future conditions.

The population growth projected in all municipalities in the study area causes an increase in traffic throughout the study area. Traffic volume on US 202 south of the PA 100 is forecast to increase significantly. Daily traffic volume between the US 322 and Paoli Pike interchanges, the highest-volume segment of US 202 in the study area, is forecast to increase 21 percent in the no-build alternative, an additional 24,100 vehicles per day in both directions.

Traffic volume along the US 322 Bypass increases, with no-build alternative traffic volumes ranging from 17,400 vehicles per day in both directions between Downingtown Pike and New Street to 21,500 vehicles per day between Pottstown Pike and Phoenixville Pike, which are 3,200 and 4,200 vehicles per day higher, respectively, than current volumes. The differences between current and no-build volumes along the US 322 Bypass range from 19 to 24 percent.

The existing US 322 Bypass ramps increase in the no-build alternative from current volumes. The existing ramp from US 322 east to US 202 south carries 8,200 vehicles per day in this alternative, which is 1,700 vehicles more per day than its current volume. The existing ramp from US 202 north to US 322 west carries 8,400 vehicles per day in this alternative, or 900 vehicles more than its current volume.

Traffic using the PA 100 also increases noticeably between 2005 and 2030, by a total of 30 percent in both directions, an additional 11,600 vehicles per day.

Morning and afternoon peak-hour traffic volumes also were forecast along the US 322 Bypass and on US 202 from Boot Rd to West Chester Pike (PA 3). **Figure 5** displays AM and PM peak hour traffic volumes, including intersection turning movements under the no-build alternative for the year 2030.

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Figure 4. Current, 2030 No-Build and Build Alternatives 1 and 2 Average Daily Traffic Volumes

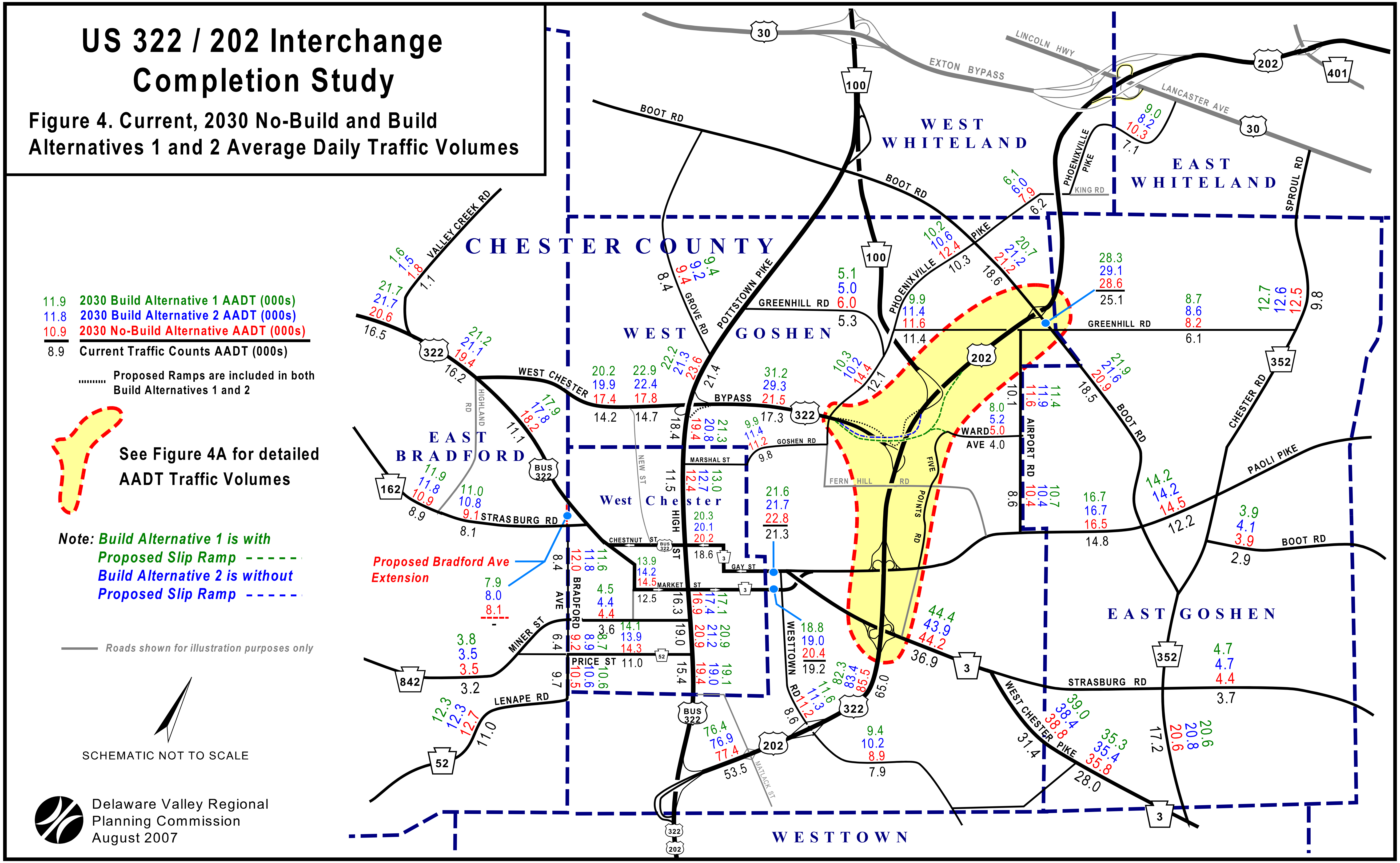

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Figure 4A. Current, 2030 No-Build and Build Alternatives 1 and 2 Average Daily Traffic Volumes

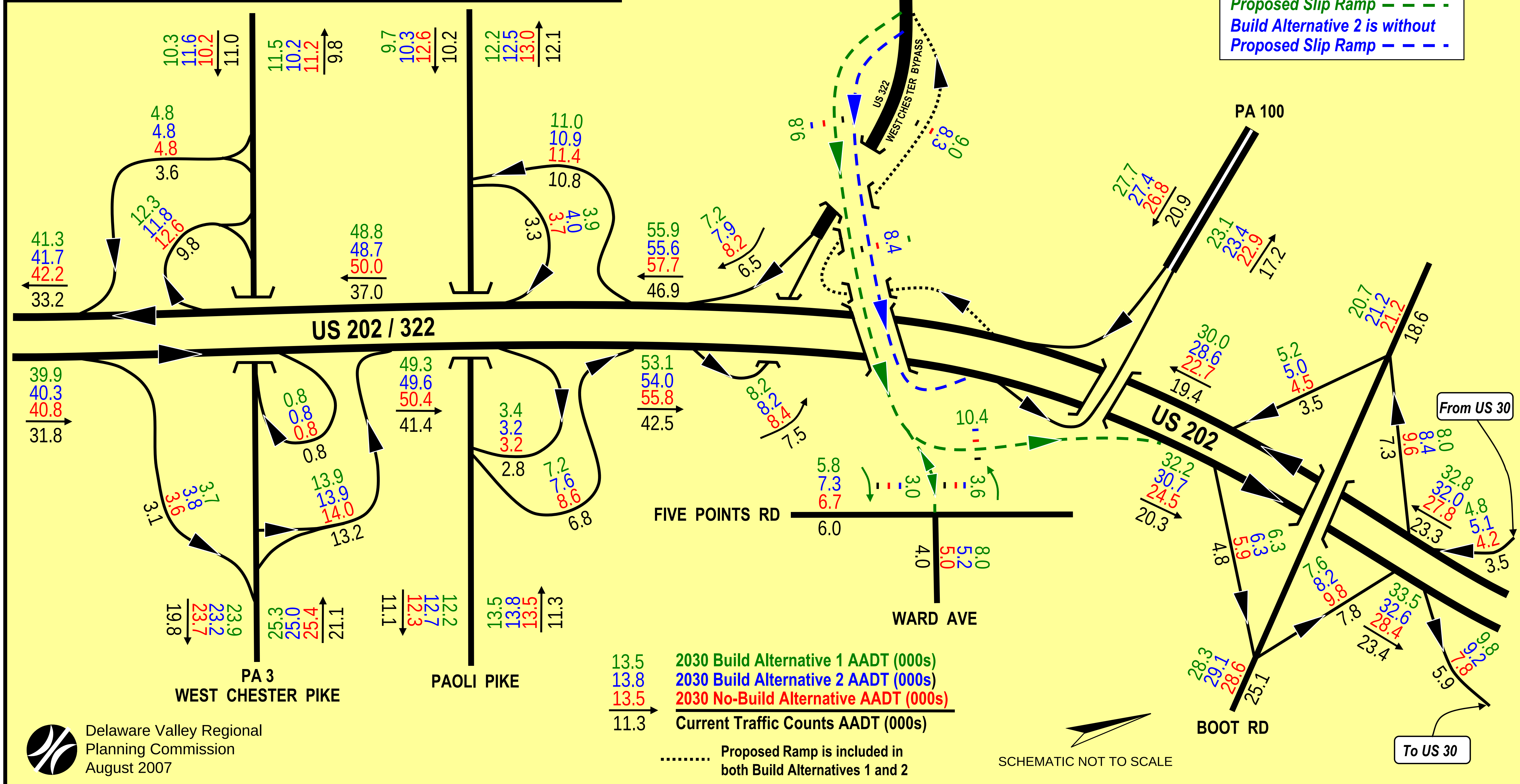

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Table 2
Current, 2030 No-Build Alternative and Build Alternatives 1 and 2
Average Daily Traffic Volumes (in Thousands)

Highway Facility	Location: From	Location: To	Current Traffic Counts	No-Build Alternative 2030 AADT	No-Build Versus Current Diff.	No-Build Versus Current % Diff.	Alternative 1 (Build Alt. with Slip Ramp) 2030 AADT	Alt. 1 Versus No-Bld Diff.	Alt. 1 Versus No-Bld % Diff.	Alternative 2 (Build Alt. w/o Slip Ramp) 2030 AADT	Alt. 2 Versus No-Bld Diff.	Alt. 2 Versus No-Bld % Diff.
North/South Routes												
US 202												
US 202 SB	Exton Bypass (US 30)	Conestoga Rd (PA 401)	37.7	47.2	9.5	25%	49.0	1.7	4%	49.3	2.1	4%
US 202 NB	Exton Bypass (US 30)	Conestoga Rd (PA 401)	36.1	46.7	10.6	29%	47.9	1.2	3%	47.8	1.1	2%
US 202 NB Off-Ramp	US 202 NB	Lancaster Ave/Lincoln Hwy (US 30)	5.9	7.8	1.9	33%	9.8	1.9	25%	9.2	1.4	17%
US 202 SB On-Ramp	Lancaster Ave/Lincoln Hwy (US 30)	US 202 SB	3.5	4.2	0.7	20%	4.8	0.6	15%	5.1	0.9	20%
US 202 SB	Lancaster Ave/Lincoln Hwy (US 30)	Boot Rd	23.3	27.8	4.5	19%	32.8	5.0	18%	32.0	4.2	15%
US 202 NB	Boot Rd	Lancaster Ave/Lincoln Hwy (US 30)	23.4	28.4	5.0	21%	31.5	3.1	11%	34.6	6.2	22%
US 202 SB	Boot Rd	PA 100	19.4	22.7	3.3	19%	30.0	7.3	32%	28.6	5.9	26%
US 202 NB	PA 100	Boot Rd	20.3	24.5	4.2	21%	32.2	7.7	31%	30.7	6.2	25%
West Chester Bypass (US 202/322)												
West Chester Bypass (US 202/322) NB	Paoli Pike	West Chester Bypass (US 322)	42.5	55.8	13.3	31%	53.1	-2.7	-5%	54.0	-1.8	-3%
West Chester Bypass (US 202/322) SB	West Chester Bypass (US 322)	Paoli Pike	46.9	57.7	10.8	23%	55.9	-1.8	-3%	55.6	-2.1	-4%
West Chester Bypass (US 202/322) NB	Paoli Pike	West Chester Pike (PA 3)	41.4	50.4	9.0	22%	49.3	-1.1	-2%	49.6	-0.8	-2%
West Chester Bypass (US 202/322) SB	Paoli Pike	West Chester Pike (PA 3)	37.0	50.0	13.0	35%	48.8	-1.2	-2%	48.7	-1.3	-3%
West Chester Bypass (US 202/322) NB	West Chester Pike (PA 3)	Westtown Rd	31.8	40.8	9.0	28%	39.9	-0.9	-2%	40.3	-0.5	-1%
West Chester Bypass (US 202/322) SB	West Chester Pike (PA 3)	Westtown Rd	33.2	42.2	9.0	27%	41.3	-0.9	-2%	41.7	-0.5	-1%
West Chester Bypass (US 202/322)	S High St (US 322 Bus)	S Matlack St	53.5	77.4	23.9	45%	76.4	-0.9	-1%	76.9	-0.5	-1%
US 202 & Boot Road												
On-Ramp	Boot Rd	US 202 NB	7.8	9.8	2.0	26%	7.6	-2.2	-22%	8.2	-1.6	-16%
On-Ramp	Boot Rd	US 202 SB	3.5	4.5	1.0	29%	5.2	0.7	16%	5.0	0.5	11%
Off-Ramp	US 202 NB	Boot Rd	4.8	5.9	1.1	23%	6.3	0.4	7%	6.3	0.4	7%
Off-Ramp	US 202 SB	Boot Rd	7.3	9.6	2.3	32%	8.0	-1.6	-17%	8.4	-1.2	-12%
West Chester Bypass (US 202/322) & Paoli Pike												
On-Ramp	Paoli Pike	West Chester Bypass (US 202/322) NB	6.8	8.6	1.8	26%	7.2	-1.4	-16%	7.6	-1.0	-12%
On-Ramp	Paoli Pike	West Chester Bypass (US 202/322) SB	3.3	3.7	0.4	13%	3.9	0.2	5%	4.0	0.2	6%
Off-Ramp	West Chester Bypass (US 202/322) NB	Paoli Pike	2.8	3.2	0.4	14%	3.4	0.2	6%	3.2	0.0	0%
Off-Ramp	West Chester Bypass (US 202/322) SB	Paoli Pike	10.8	11.4	0.6	6%	11.0	-0.4	-3%	10.9	-0.5	-4%
West Chester Bypass (US 202/322) & West Chester Pike (PA 3)												
On-Ramp	West Chester Pike (PA 3)	West Chester Bypass (US 202/322) NB	13.2	14.0	0.8	6%	13.9	-0.1	0%	13.9	-0.1	0%
On-Ramp	West Chester Pike (PA 3)	West Chester Bypass (US 202/322) SB	3.6	4.8	1.2	33%	4.8	0.0	0%	4.8	0.0	0%
Off-Ramp	West Chester Bypass (US 202/322) NB	West Chester Pike (PA 3) WB	0.8	0.8	0.0	0%	0.8	0.0	0%	0.8	0.0	0%
Off-Ramp	West Chester Bypass (US 202/322) NB	West Chester Pike (PA 3) EB	3.1	3.6	0.5	16%	3.6	0.0	0%	3.7	0.1	3%
Off-Ramp	West Chester Bypass (US 202/322) SB	West Chester Pike (PA 3)	9.8	12.6	2.8	29%	12.3	-0.3	-2%	11.8	-0.8	-6%
Crossing Streets and Local Roads												
Phoenixville Pike	Lancaster Ave/Lincoln Hwy (US 30)	King Rd	7.1	10.3	3.2	45%	9.0	-1.3	-13%	8.2	-2.1	-21%
Phoenixville Pike	Boot Rd	Greenhill Rd	10.3	12.4	2.1	20%	10.2	-2.2	-18%	10.6	-1.8	-15%
Phoenixville Pike	Boot Rd	King Rd	6.2	7.9	1.7	27%	6.1	-1.8	-23%	6.1	-1.8	-23%
Phoenixville Pike	West Chester Bypass (US 322)	Greenhill Rd	12.1	14.4	2.3	19%	10.3	-4.1	28%	10.2	-4.3	30%
Pottstown Pike	West Chester Bypass (US 322)	Greenhill Rd/Sunset Hollow Rd	21.4	23.6	2.2	10%	22.2	-1.4	-6%	21.3	-2.3	-10%
Pottstown Pike/N High St	West Chester Bypass (US 322)	E Marshall St	18.4	19.4	1.0	5%	21.3	1.9	10%	20.8	1.4	7%
N High St	Chestnut St (PA 3)	E Marshall St	11.5	12.4	0.9	7%	13.0	0.7	6%	12.8	0.4	3%
S High St (US 322 Bus)	Miner St	Market St (PA 3)	16.3	16.9	0.6	4%	17.1	0.2	1%	17.4	0.5	3%
S High St (US 322 Bus)	Price St (PA 52)	Miner St	19.0	20.9	1.9	10%	20.9	0.0	0%	21.2	0.3	1%

Source: Delaware Valley Regional Planning Commission, August 2007

Table 2
Current, 2030 No-Build Alternative and Build Alternatives 1 and 2 Average Daily Traffic Volumes (in Thousands) - Continued

Highway Facility	Location From	Location To	Current Traffic Counts	No-Build Alternative 2030 AADT	No-Build Versus Current Diff.	No-Build Versus Current % Diff.	Alternative 1 (Build Alt. with Slip Ramp) 2030 AADT	Alt. 1 Versus No-Bld Diff.	Alt. 1 Versus No-Bld % Diff.	Alternative 2 (Build Alt. w/o Slip Ramp) 2030 AADT	Alt. 2 Versus No-Bld Diff.	Alt. 2 Versus No-Bld % Diff.
North/South Routes (Contiued)												
Crossing Streets and Local Streets (Continued)												
S High St (US 322 Bus)	Price St	Rosedale Ave	15.4	19.4	4.0	26%	19.1	-0.3	-2%	19.0	-0.4	-2%
S High St (US 322 Bus)	West Chester Bypass (US 202/322)	Rosedale Ave	18.0	24.7	6.7	37%	24.2	-0.5	-2%	23.0	-1.7	-7%
Westtown Rd	E Market St (PA 3)	E Nields St	8.6	11.2	2.6	30%	11.6	0.4	4%	11.3	0.1	1%
Airport Rd	Ward Ave	Greenhill Rd	10.1	11.6	1.5	15%	11.4	-0.2	-2%	11.9	0.3	3%
Airport Rd	Paoli Pike	Ward Ave	8.6	10.4	1.8	21%	10.7	0.3	3%	10.4	0.0	0%
New St	Tigue Rd	Spring Line Dr	3.0	3.5	0.5	16%	3.0	-0.5	-14%	3.2	-0.3	-8%
Chester Rd (PA 352)	King Rd	Greenhill Rd	9.8	12.5	2.7	28%	12.7	0.2	1%	12.6	0.1	1%
Westtown Rd	S Five Points Rd	S Concord Rd	7.9	8.9	1.0	12%	9.4	0.6	6%	10.2	1.3	15%
Chester Rd (PA 352)	West Chester Pike (PA 3)	Strasburg Rd (PA 162)	17.2	20.6	3.4	20%	20.6	0.0	0%	10.6	-10.0	-48%
Valley Creek Rd	Downingtown Pike (US 322)	Harmony Hill Rd	1.1	1.8	0.7	65%	1.2	-0.6	-36%	1.1	-0.7	-39%
S Bradford Ave	Price St (PA 52)	W Miner St (PA 842)	6.4	9.2	2.8	43%	8.7	-0.5	-5%	8.9	-0.3	-3%
Bradford Ave	Strasburg Rd (PA 162)	W Miner St (PA 842)	8.4	12.0	3.6	43%	11.6	-0.5	-4%	11.8	-0.2	-2%
S Bradford Ave	Price St (PA 52)	W Rosedale Ave	9.7	10.5	0.8	8%	10.6	0.1	1%	10.5	0.0	0%
Bradford Ave Proposed Extension	Strasburg Rd	Downingtown Pike (US 322 Bus)		8.1	—	—	7.9	-0.2	-2%	8.0	-0.1	—
Lenape Rd (PA 52)	Birmingham Rd	W Rosedale Ave	11.0	12.7	1.7	15%	12.3	-0.3	-3%	12.2	-0.4	-3%
Lenape Rd (PA 52)	Birmingham Rd	S Creek Rd	10.4	11.5	1.1	11%	11.3	-0.2	-2%	11.3	-0.2	-2%
Dutton Mill Rd	Strasburg Rd	Sugartown Rd	1.8	2.2	0.4	21%	2.2	0.0	-1%	2.2	0.0	-1%
S Creek Rd	N Creek Rd	Bridge Rd	2.8	3.7	0.9	32%	4.3	0.6	16%	4.1	0.4	12%
East/West Routes												
US 202/322 Ramps												
US 202/322 Proposed Ramp	US 202 SB	West Chester Bypass (US 322) WB		—	—	—	9.0	—	—	8.3	—	—
US 202/322 Proposed Ramp	West Chester Bypass (US 322) EB	US 202 NB		—	—	—	9.8	—	—	8.4	—	—
US 202/322 Ramp	West Chester Bypass (US 202/322) NB	West Chester Bypass (US 322) WB	7.5	8.4	0.9	12%	8.2	-0.2	-2%	8.2	-0.2	-2%
US 202/322 Ramp	West Chester Bypass (US 322) EB	West Chester Bypass (US 202/322) SB	6.5	8.2	1.7	26%	7.2	-1.0	-12%	7.9	-0.3	-3%
US 202/322 Proposed Slip Ramp	US 202/322 Ramp NB	Five Points Rd		—	—	—	6.6	—	—	—	—	—
West Chester Bypass (US 322)												
West Chester Bypass (US 322)	Phoenixville Pike	West Chester Bypass (US 202)	14.0	16.6	2.6	19%	33.2	16.6	100%	32.8	16.2	98%
West Chester Bypass (US 322)	Pottstown Pike	Phoenixville Pike	17.3	21.5	4.2	24%	31.2	9.7	45%	29.3	7.8	36%
West Chester Bypass (US 322)	Pottstown Pike	N New St	14.7	17.8	3.1	21%	22.9	5.1	29%	22.4	4.7	26%
West Chester Bypass (US 322)	Downingtown Pike (US 322)	N New St	14.2	17.4	3.2	23%	20.2	2.8	16%	19.9	2.5	14%
PA 100 Spur												
PA 100 NB	West Chester Bypass (US 202/322)	Pottstown Pike	17.2	22.9	5.7	33%	23.1	0.2	1%	23.5	0.6	3%
PA 100 SB	Pottstown Pike (PA 100)	West Chester Bypass (US 202/322)	20.9	26.8	5.9	28%	27.7	0.9	3%	27.4	0.6	2%
West Chester Pike (PA 3)												
West Chester Pike (PA 3) EB	Westtown Rd	West Chester Bypass (US 202/322)	11.1	10.2	-0.9	-8%	10.2	0.0	0%	11.8	1.6	15%
West Chester Pike (PA 3) WB	West Chester Bypass (US 202/322)	Westtown Rd	9.8	11.2	1.4	14%	11.5	0.3	2%	9.5	-1.7	-15%
West Chester Pike (PA 3) EB	West Chester Bypass (US 202/322)	Five Points Rd	19.8	23.7	3.9	19%	23.9	0.2	1%	23.2	-0.4	-2%
West Chester Pike (PA 3) WB	Five Points Rd	West Chester Bypass (US 202/322)	21.1	25.4	4.3	20%	25.3	-0.1	0%	24.3	-1.1	-4%
West Chester Pike (PA 3)	Strasburg Rd	Westtown Way	31.4	38.8	7.4	24%	39.0	0.2	1%	38.4	-0.4	-1%
West Chester Pike (PA 3)	Five Points Rd	Strasburg Rd (PA 162)	36.9	44.2	7.3	20%	44.4	0.2	0%	43.9	-0.4	-1%
West Chester Pike (PA 3)	Chester Rd (PA 352)	Westtown Way	28.0	35.8	7.8	28%	35.3	-0.5	-1%	35.4	-0.4	-1%

Source: Delaware Valley Regional Planning Commission, August 2007

Table 2
Current, 2030 No-Build Alternative and Build Alternatives 1 and 2 Average Daily Traffic Volumes (in Thousands) - Continued

Highway Facility	Location From	Location To	Current Traffic Counts	No-Build Alternative 2030 AADT	No-Build Versus Current Diff.	No-Build Versus Current % Diff.	Alternative 1 (Build Alt. with Slip Ramp) 2030 AADT	Alt. 1 Versus No-Bld Diff.	Alt. 1 Versus No-Bld % Diff.	Alternative 2 (Build Alt. w/o Slip Ramp) 2030 AADT	Alt. 2 Versus No-Bld Diff.	Alt. 2 Versus No-Bld % Diff.
East/West Routes (Continued)												
Crossing Streets and Local Streets												
Boot Rd	Chester Rd (PA 352)	Line Rd	2.9	3.9	1.0	34%	3.9	0.0	0%	4.1	0.2	5%
Boot Rd	Greenhill Rd	Paoli Pike	18.5	20.9	2.4	13%	21.9	1.0	5%	21.6	0.8	4%
Boot Rd	US 202	Phoenixville Pike	18.6	21.2	2.6	14%	20.7	-0.5	-2%	21.2	0.0	0%
Boot Rd	US 202	Greenhill Rd	25.1	28.6	3.5	14%	28.3	-0.3	-1%	29.1	0.5	2%
Boot Rd	Quarry Rd	Circle Dr	7.3	9.0	1.7	24%	9.0	0.0	0%	9.0	-0.1	-1%
Boot Rd	Phoenixville Pike	Ship Rd	19.7	23.3	3.6	18%	23.5	0.2	1%	23.4	0.1	1%
Ward Ave	Five Points Rd	Airport Rd	4.0	5.0	1.0	24%	8.0	3.0	61%	5.1	0.1	2%
Downingtown Pike (US 322)	Valley Creek Rd	Sugar Bridge Rd	16.5	20.6	4.1	25%	21.7	1.1	5%	21.7	1.1	5%
Downingtown Pike (US 322)	West Chester Bypass (US 322)	Valley Creek Rd	16.2	19.4	3.2	19%	21.2	1.8	10%	21.1	1.7	9%
Hannum Ave (US 322 Bus)	West Chester Bypass (US 322)	Strasburg Rd (PA 162)	11.1	18.2	7.1	64%	17.9	-0.3	-2%	17.8	-0.4	-2%
Hannum Ave (US 322 Bus)	New St	Strasburg Rd (PA 162)	15.8	15.6	-0.2	-1%	15.9	0.3	2%	15.8	0.2	1%
Paoli Pike EB	Westtown Rd	West Chester Bypass (US 202/322)	10.2	12.6	2.4	24%	9.7	-2.9	-23%	10.3	-2.3	-18%
Paoli Pike WB	West Chester Bypass (US 202/322)	Westtown Rd	12.1	13.0	0.9	7%	12.2	-0.8	-6%	11.8	-1.2	-10%
Paoli Pike EB	West Chester Bypass (US 202/322)	Five Points Rd	11.1	12.3	1.2	11%	12.2	-0.1	-1%	12.7	0.4	3%
Paoli Pike WB	Five Points Rd	West Chester Bypass (US 202/322)	11.3	13.5	2.2	19%	13.5	0.0	0%	14.5	1.0	7%
Paoli Pike	Chester Rd (PA 352)	Boot Rd	12.2	14.5	2.3	19%	14.2	-0.3	-2%	14.2	-0.3	-2%
Paoli Pike	Boot Rd	Ellis Ln	14.8	16.5	1.7	12%	16.7	0.2	1%	16.7	0.2	1%
W Market St (PA 3)	New St	High St	12.5	14.5	2.0	16%	13.9	-0.6	-4%	14.2	-0.4	-2%
E Market St (PA 3)	High St (PA 100)	Westtown Rd	19.2	20.4	1.2	6%	18.8	-1.6	-8%	19.0	-1.4	-7%
E Gay St (PA 3)	Montgomery Ave	N Matlack St	18.6	20.2	1.6	9%	20.3	0.1	1%	20.1	-0.1	-1%
E Gay St (PA 3)	Westtown Rd	Montgomery Ave	21.3	22.8	1.5	7%	21.6	-1.3	-6%	21.7	-1.2	-5%
Strasburg Rd (PA 162)	Telegraph Rd	N Creek Rd	8.9	10.9	2.0	23%	11.9	1.0	9%	11.8	0.9	8%
Price St (PA 52)	High St	Bradford Ave	10.7	14.3	3.6	33%	14.1	-0.1	-1%	13.9	-0.4	-3%
Strasburg Rd (PA 162)	Highland Rd	N Creek Rd	8.1	9.1	1.0	13%	11.0	1.8	20%	10.8	1.6	18%
Strasburg Rd	Chester Rd (PA 352)	Dutton Mill Rd	3.7	4.4	0.7	18%	4.7	0.3	7%	4.6	0.2	4%
E Marshall St/Goshen Rd	High St	Fernhill Rd	9.8	11.2	1.4	14%	9.9	-1.3	-12%	11.4	0.2	2%
Grove Rd	Southern Dr	Greenhill Rd	8.4	9.4	1.0	12%	9.4	0.0	0%	9.3	-0.1	-1%
W Miner St (PA 842)	Bradford Ave	Price St	5.2	5.9	0.7	14%	8.2	2.2	38%	6.7	0.7	13%
W Miner St (PA 842)	S Wayne St	S High St	3.6	4.4	0.8	23%	4.5	0.1	3%	3.7	-0.7	-16%
W Miner St (PA 842)	Sconnelltown Rd	Birmingham Rd	3.2	3.5	0.3	10%	3.8	0.3	8%	3.8	0.2	6%
Greenhill Rd	Pottstown Pike	Phoenixville Pike	5.3	6.0	0.7	13%	5.1	-0.9	-14%	5.1	-0.9	-15%
Greenhill Rd	Phoenixville Pike	Airport Rd	11.4	11.6	0.2	2%	9.9	-1.8	-15%	11.4	-0.2	-2%
Greenhill Rd	Boot Rd	N Chester Rd (PA 352)	6.1	8.2	2.1	34%	8.7	0.6	7%	8.6	0.4	5%

Source: Delaware Valley Regional Planning Commission, August 2007

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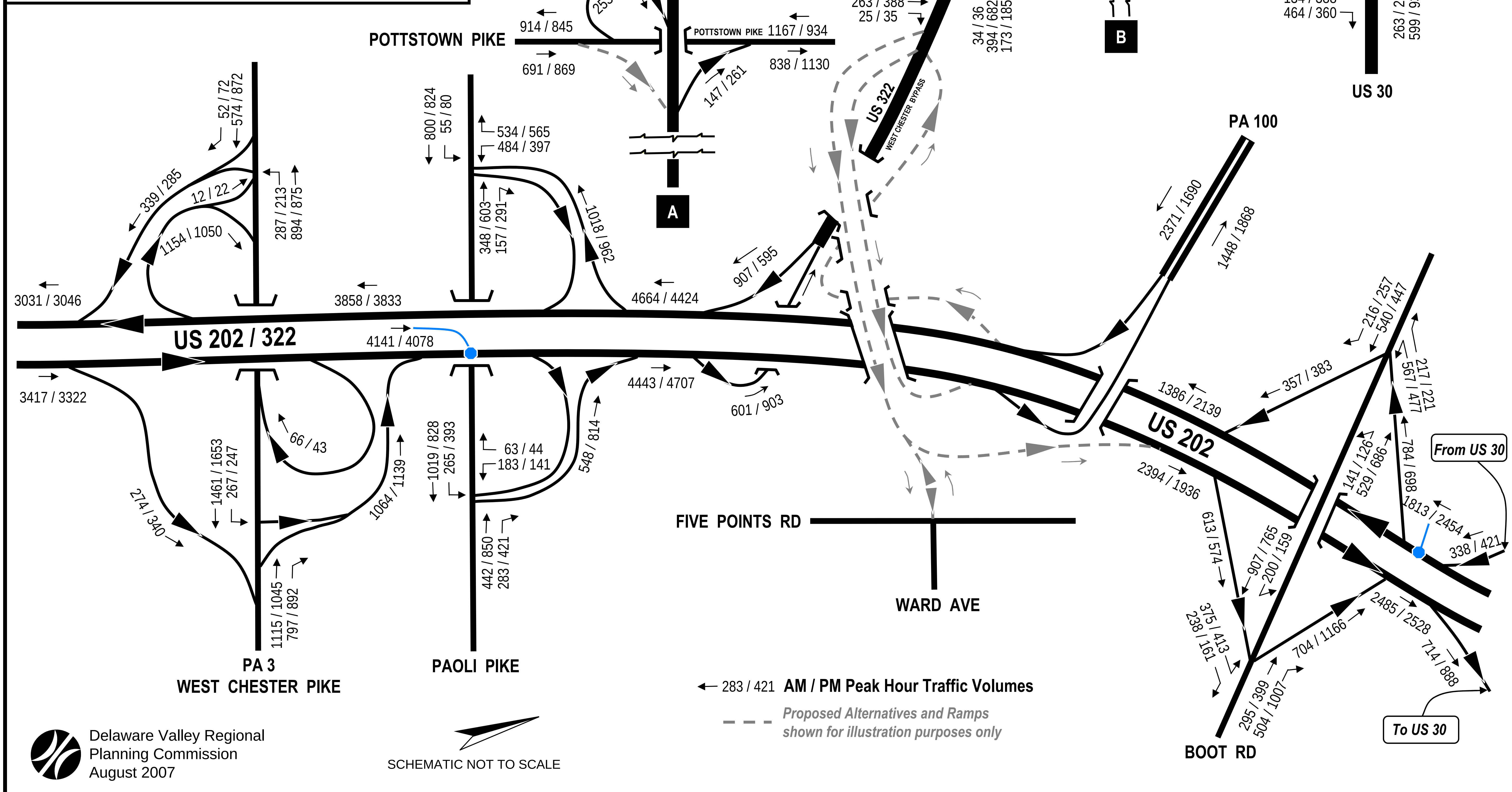
US 322 / 202 Interchange Completion Study

Figure 5. 2030 No-Build Alternative AM / PM Peak Hour Traffic Volumes



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B. Build Alternative 1 Traffic Forecasts

Average annual daily traffic forecasts under Build Alternative 1 are provided in figures 4 and 4A, shown previously, along with the other future alternatives analyzed. In these figures, Build Alternative 1 traffic volumes for 2030 are shown in green. Table 2, shown previously, also lists these traffic volumes along with comparisons between current and future conditions.

In Build Alternative 1, traffic volumes along US 202 range from 62,200 vehicles per day in both directions between Boot Rd and PA 100 to 109,000 vehicles per day between the US 322 Bypass interchange and Paoli Pike. These volumes are 15,000 vehicles per day higher and 4,500 vehicles per day lower, respectively than the corresponding volumes in the no-build alternative.

Along the US 322 Bypass, traffic volumes range from 20,200 vehicles per day in both direction between Downingtown Pike and New Street to 31,200 vehicles per day between Pottstown Pike and Phoenixville Pike, which are between 2,800 and 9,700 vehicles per day higher than corresponding no-build alternative volumes. The differences between no-build and Build Alternative 1 volumes along the US 322 Bypass range from 16 to 47 percent.

At the US 202/322 interchange, the existing ramp from US 322 east to US 202 south carries 7,200 vehicles per day in this alternative, which is 1,000 vehicles less per day than in the no-build alternative. The existing ramp from US 202 north to US 322 west carries 8,200 vehicles per day in this alternative, or 200 vehicles less than in the no-build alternative.

Average annual daily traffic volume on the proposed ramp from US 202 south to the US 322 Bypass west is 9,000 in Build Alternative 1. Volume on the proposed ramp from the US 322 Bypass east to US 202 north is forecast at 9,800 vehicles per day south of the proposed slip ramps and 10,400 vehicles onto US 202 north of the slip ramp. About 3,000 vehicles per day are forecast to enter and 3,600 vehicles per day exit the industrial park via the slip ramps.

As a result of increased accessibility to US 202 and points north caused by the proposed ramps, traffic on Phoenixville Pike north of the US 322 Bypass decreases to 10,300 in this alternative from 14,400 in the no-build alternative, a reduction of 4,100 or 28 percent.

Morning and afternoon peak-hour traffic volumes also were forecast along the US 322 Bypass and on US 202 from Boot Rd to West Chester Pike (PA 3). **Figure 6** displays AM and PM peak hour traffic volumes, including intersection turning movements under the Build Alternative 1 for the year 2030.

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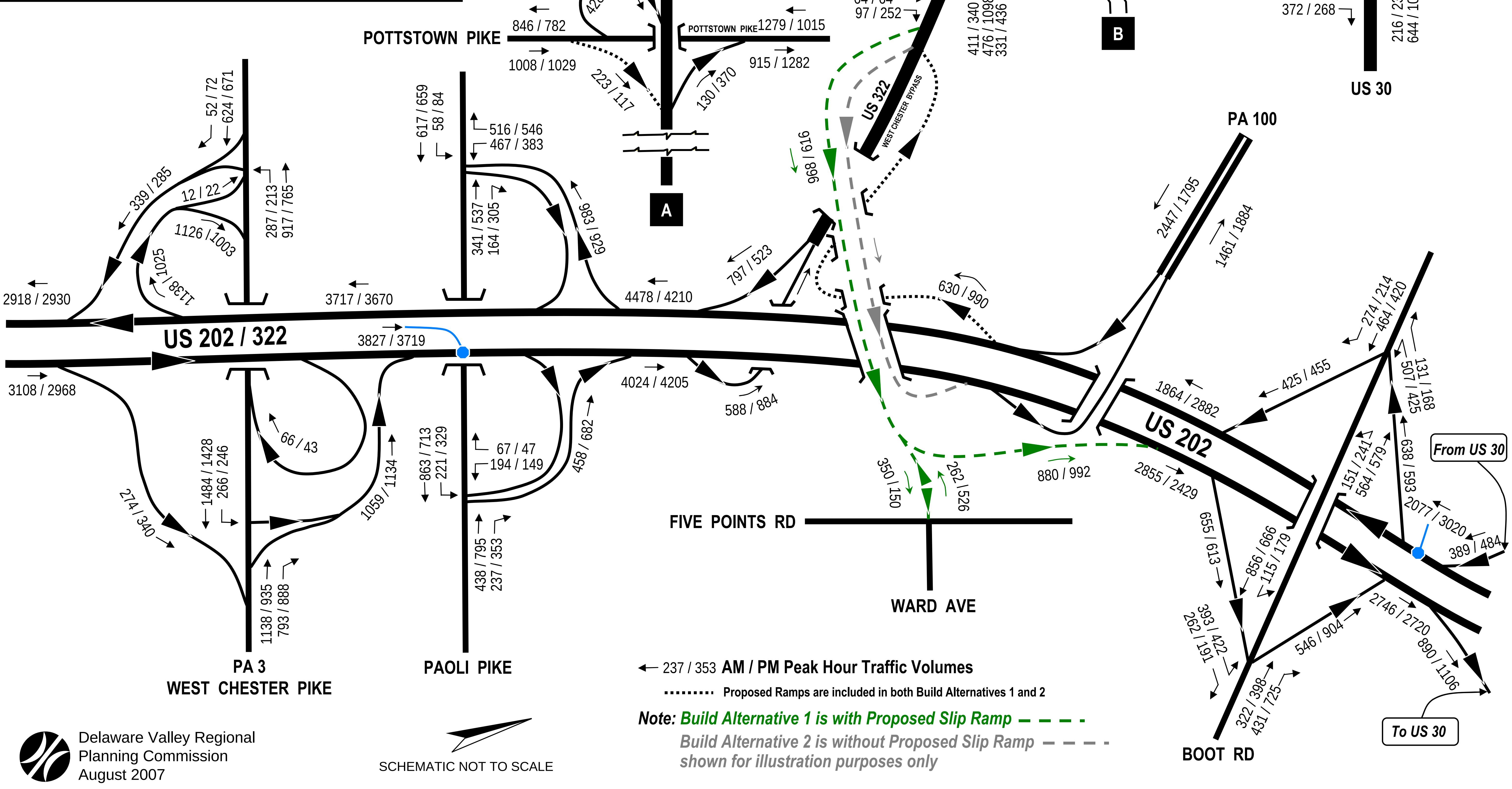
Figure 6. 2030 Build Alternative 1
AM / PM Peak Hour Traffic Volumes



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C. Build Alternative 2 Traffic Forecasts

Average annual daily traffic forecasts in Build Alternative 2 are provided in figures 4 and 4A, shown previously along with the other future alternatives analyzed. In these figures, Build Alternative 2 traffic volumes for 2030 are shown in blue. Table 2 also lists these traffic volumes along with comparisons between current and future conditions.

Compared with Build Alternative 1, for the most part this alternative shows small differences in traffic volumes in the study area. Traffic volume on the proposed ramp from US 322 east to US 202 north is 8,400. Consistent with Build Alternative 1, traffic on Phoenixville Pike north of the US 322 Bypass decreases to 10,200 in this alternative from 14,400 in the no-build alternative, a reduction of 4,200 or 29 percent.

Although providing access to the PA 100 northbound from the US 322 Bypass, traffic volume on PA 100 in this alternative does not differ significantly with a net increase of 400 vehicles per day (vpd), from Build Alternative 1. This path is much longer than the alternative route via Pottstown Pike and therefore gets minimal additional usage in this alternative.

Morning and afternoon peak-hour traffic volumes also were forecast along the US 322 Bypass and on US 202 from Boot Rd to West Chester Pike (PA 3). **Figure 7** displays AM and PM peak hour traffic volumes, including intersection turning movements under the Build Alternative 2 for the year 2030.

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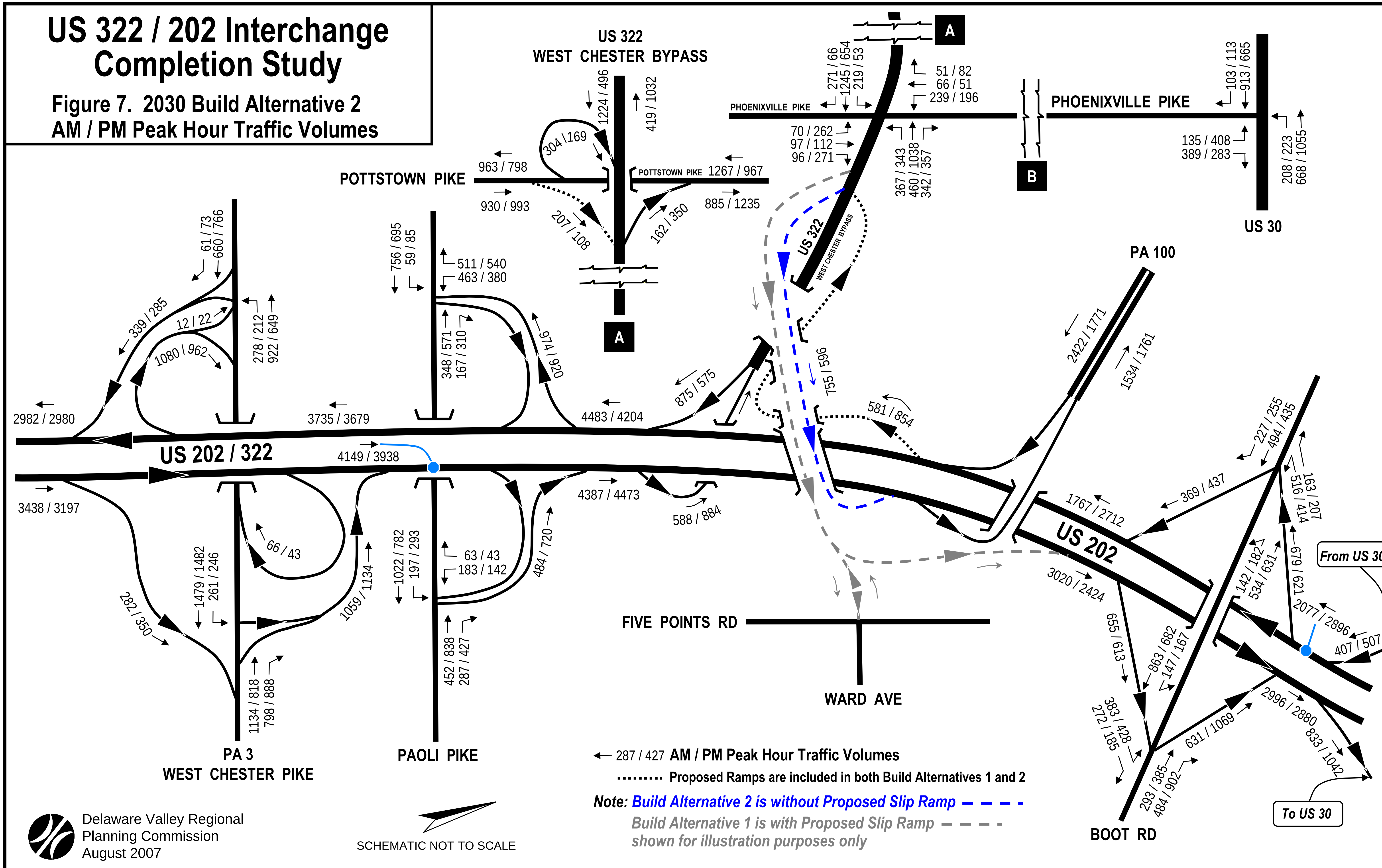
Figure 7. 2030 Build Alternative 2 AM / PM Peak Hour Traffic Volumes



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V. LAND USE IMPACTS OF THE US 322/US 202 INTERCHANGE COMPLETION ALTERNATIVES

DVRPC used UPlan, a land use forecasting and planning model, to estimate the 2030 development impacts of interchange alternatives. This analysis is intended to estimate the effects of completing the interchange connecting US 322 with US 202 on new residential and commercial developments in the study area.

A. Brief Description of the UPlan Model

UPlan is a GIS-based[1], land development model used for long-range regional planning and corridor level scenario testing designed to estimate the effect of proposed transportation improvements on land use patterns. UPlan allocates projected total county population and employment to forecast demand for *new footprint* development associated with regional growth as well as existing and proposed transportation facility improvements. New footprint development consumes previously undeveloped land (greenfields) to satisfy land development demand due to population and employment growth. The *allocation area* is given by assuming new footprint development can occur only in pre-specified locations; where land is vacant, wooded, or in agricultural use and can be considered land available for development. UPlan then evaluates local development attractors (e.g. freeway interchanges, major arterials, rail stations, sewers, and so forth) and discouragements (e.g. wetlands, areas of high congestion, proposed open space, or steep slope) tailored to each parcel available for development. Each attractor and discouragement is assigned a weight representing the magnitude of effect over a buffer width representing the area of effect; these scores are then summed to generate a single net attractiveness value. Parcels with high net attractiveness can be considered prime for development.

UPlan Land Use Attraction and Discouragement Allocation Factors

- Proximity to freeway ramps, highways and rail stations
- Prevailing non-freeway highway congestion levels
- Proximity to like land uses
- Proximity to existing and proposed sewer service areas
- Located within proposed open space or flood plain
- Prevailing slope of terrain

Finally, certain areas that are unsuited to development or already developed can be excluded from the allocation area by using a mask (preserved farm land or open space, water bodies, existing developed areas). These masks will prevent UPlan from allocating development of any kind to that location even if it is highly attractive. Masks represent policy decisions to reserve land from development (protected lands) or conditions that

[1] UPlan uses raster data or grid data, 50 x 50 meter grid size.

preclude development (e.g. existing development or underwater). Attractiveness and discouragement factors have unique values for each development type while masks prohibit all development.

UPlan Development Prohibition Masks

- Existing 2000 development
- Public lands
- Streams and water bodies
- Preserved Open Space

After these processes conclude, UPlan allocates the most attractive land to each development type in the following order:

- Industrial
- High Density Commercial
- High Density Residential
- Low Density Commercial
- Medium Density Residential
- Low Density Residential
- Very Low Density Residential

This allocation order generally reflects bidding power in the land use market. That is, industrial and high density commercial/residential developers can pay the most per acre for highly desirable locations near freeway interchanges or other amenities while low density residential is able to pay the least amount per acre.

UPlan was calibrated using land use survey data as a basis to test the quality and accuracy of model output. During calibration, parameters were adjusted to reflect actual conditions and the model, as a whole, is tuned to reproduce the land use survey and census data patterns. In the transportation/land use impact stage, the calibrated model was applied to forecast 2030 land use patterns, given county growth projections and transportation inputs reflective of the No-build and Build alternatives[2].

[2] For a more complete description of the UPlan model see: Development and Calibration of the UPlan Land Use Planning Model, DVRPC, June, 2005 and Testing and Implementation of the UPlan Land Use Planning Model, DVRPC (Draft) December 2006.

B. UPlan Transportation Network Inputs for the US 322/US 202 Interchange Completion Alternatives

The UPlan inputs for the build ramp alternative differed from the No-build alternative in two ways:

1. Lower non-freeway highway congestion levels along Phoenixville Pike as a result of traffic diversions to US 202 Expressway (both Build alternatives)
2. Provision of a new slip ramp to the Brandywine Industrial Park (Build Alternative 1 only)

UPlan uses estimates of localized non-freeway traffic volume to capacity ratio (V/C) averaged over a system of two kilometer grids (about one square mile) to input the effect of congestion on predicted development patterns. These congestion levels are characterized as low, medium, or high based on the magnitude of the average V/C ratio. Areas with low or medium congestion levels are attractive to residential land uses, while high prevailing congestion levels may be attractive to commercial activities because of visibility to large numbers of the motoring public. Travel simulations for the No-build and both Build alternatives were conducted using the DVRPC board adopted population and employment projections for the year 2030. Based on these projected highway link volumes, study area non-freeway congestion levels were calculated for each alternative. As a result of traffic diversions from local streets to US 202 in the build alternatives, the projected prevailing non-freeway congestion level was reduced from high to medium for the approximate area bounded by US 322 Bypass on the south, Boot Road on the north, Pottstown Pike on the west, and Airport Road on the east.

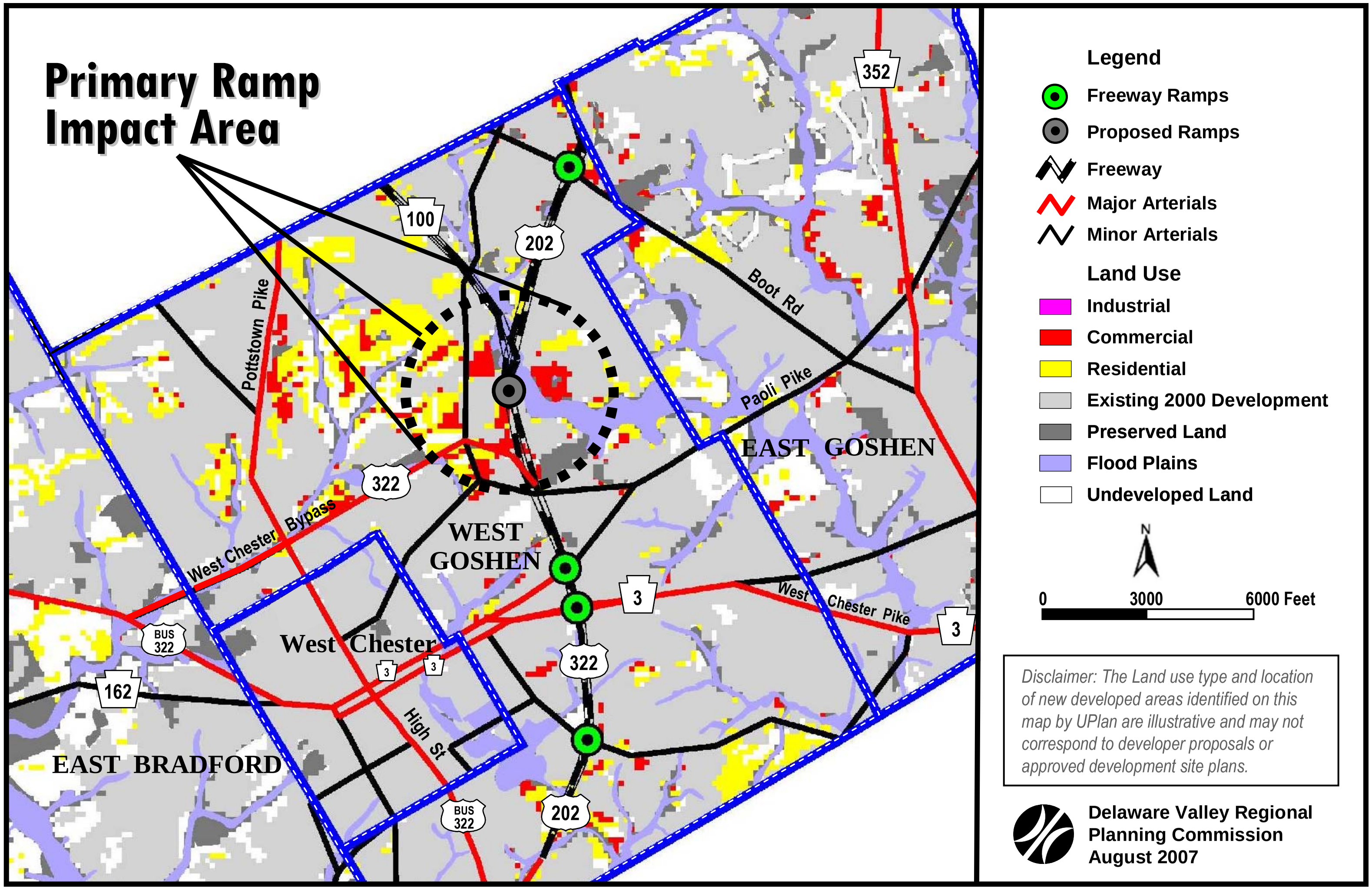
The location of the new ramps assumed to be opened to traffic in Build Alternative 1, including a new slip ramp providing access to Brandywine Industrial Park, are shown on **Map 2**. The ramps in this alternative serve the Brandywine Business Center with direct connections to and from US 202 northbound and from US 322 Bypass eastbound. According to the UPlan calibration, the primary impact area of an existing or proposed freeway ramp extends up to 3,000 feet from the ramp’s intersection with the local street network. This primary impact area is also shown on Map 2.

C. Impact of US 322/US 202 Interchange Completion on Study Area Development Patterns

In support of the US 322/US 202 Interchange Completion Study, UPlan was executed three times to produce separate study area land use allocations for the No-build, Build Alternative 1, and Build Alternative 2. The resulting land use pattern for the No-build alternative is shown in Map 2. In this map, existing land development (base year 2000) is shown in light gray, preserved areas in dark grey, while water bodies and flood plains are shown in blue. Land subject to preservation measures is reflected in the Uplan allocation, such as East Bradford's unsewered areas and preserved land.

US 322 / 202 Interchange Completion Study

Map 2. UPlan 2030 No-Build Land Use Allocation



1. No-Build Alternative

New development allocated by UPlan to the study area under the No-build alternative is shown in yellow for residential development and red for commercial/industrial development. Undeveloped areas are displayed as white. These allocations do not reflect parcel boundaries, but rather 50 meter grids, as described above. Land use types and new developed areas identified on this map are illustrative only and may not correspond to developer proposals or approved site plans. There are small undeveloped (white) areas along the East/West Goshen boarder in the vicinity of the proposed ramp improvements. These areas constitute proposed open space adjacent to the West Chester Reservoir and East Branch Creek. Development is discouraged but not prohibited in these areas.

It is clear that the available land in the primary impact area of the proposed ramp improvements, shown by the dashed circle, and immediate surrounding secondary impact area is completely built out in the No-build Alternative. This development will occur whether or not the proposed ramp improvement is implemented. This development configuration is significant because it drastically limits the potential development impact of the two build alternatives. The land development impacts of each no-build alternative are presented in **Table 3** with the 2030 household and employment forecasts for the No-build alternative, summarized by municipality.

2. Build Alternatives

Because the primary ramp impact area and adjacent secondary impact areas are completely built out by 2030 under the No-build scenario, the magnitude of the differences between Build and No-build scenarios are small, even at the municipal level. For households, all of these Build/No-build differences are on the order of 10 housing units or less. Employment impacts are also small, although East and West Goshen townships have slightly larger employment increases (50 employees) because of the proximity to the proposed slip ramp of the Brandywine Business Center. All of the differences are insignificant compared to municipal totals and the resulting UPlan land use allocation maps are indistinguishable from the No-build in Map 1. For this reason, the UPlan allocation maps for the build alternatives are not shown. The land use impacts from the Build alternatives will not have a significant effect on the simulated traffic volumes described in Chapter IV.

Table 3
2030 UPlan Household and Employment in the
US 322 / 202 Interchange Completion Study

Chester County	2030 No-Build Alt Households	Diff. from 2030 No-Bld Alt Bld Alt 1	Diff. from 2030 No-Bld Alt Bld Alt 2	2030 No-Build Alt Employment	Diff. from 2030 No-Bld Alt Bld Alt 1	Diff. from 2030 No-Bld Alt Bld Alt 2
Municipality						
East Bradford Township	4,712	<50	<50	2,146	10	20
East Goshen Township	9,251	10	10	12,382	50	10
Pocopson Township	1,290	<10	<10	1,858	<10	<10
West Bradford Township	4,966	<10	<10	2,416	<10	<10
West Chester Borough	6,542	<10	<10	15,516	<10	<10
West Goshen Township	9,629	10	10	23,457	50	30

Delaware Valley Regional
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VI. CONCLUSIONS

Currently, only a partial interchange exists between US 322 and US 202 in Chester County. US 322 carries 14,000 vehicles per day in both directions at US 202: 6,500 vehicles per day on the existing US 322 ramp to US 202 southbound and 7,500 vehicles per day on the existing US 322 ramp from US 202 northbound. South of the existing US 322 ramps, traffic volume on US 202 adjacent to the ramps is 89,400 in both directions.

In 2030, population in the study area is projected to increase by 20 percent, while employment in the study area is projected to increase by 24 percent. As a result, traffic in the study area is also expected to increase. Traffic forecast on US 202 south of the existing ramps is 113,500 vehicles per day in both directions, an increase of 27 percent compared with current volumes. Traffic in the no-build alternative on the existing US 322 ramps are forecast to increase by 26 percent on the existing US 322 ramp to US 202 southbound and by 12 percent on the existing US 322 ramp from US 202 northbound.

If the proposed ramps and slip ramp in Alternative 1 are constructed, 10,400 additional daily vehicles will travel to US 202 northbound at US 322 compared with the no-build alternative, including 3,600 from the slip ramp. 9,000 daily vehicles are forecast to travel on the new ramp from US 202 southbound to US 322 westbound. As a result, 1,200 fewer daily vehicles are forecast to use the existing ramps. Additionally, 2,700 fewer daily vehicles are forecast to use the Boot Road interchange and 1,400 fewer vehicles per day are forecast to use the Paoli Pike interchange, though 1,100 additional daily vehicles are forecast to use the PA 100 ramps.

If the proposed ramps in Alternative 2 are constructed without the slip ramp, 8,400 additional daily vehicles will travel to US 202 northbound at US 322 compared with the no-build alternative. 8,300 daily vehicles are forecast to travel on the new ramp from US 202 southbound to US 322 westbound. As a result, 500 fewer daily vehicles are forecast to use the existing ramps. Additionally, 1,900 fewer daily vehicles are forecast to use the Boot Road interchange and 800 fewer vehicles per day are forecast to use the Paoli Pike interchange, though 1,100 additional daily vehicles are forecast to use the PA 100 ramps.

From the land use impact analysis, it is clear that the primary impact area of the proposed ramp improvement and immediate surrounding area will build out, whether or not the proposed ramp improvement is implemented. Therefore, the difference between the build and no-build alternatives is minimal and the land use impacts from the build alternatives alone will not have a significant impact on traffic forecasts.

Forecasted volumes for the proposed US 322/202 Interchange Completion ramps are comparable to those on existing adjacent US 202 interchange ramps and completion of the interchange provides significant traffic benefits. These traffic benefits take the form of reduced traffic volumes on parallel study area roadways and within the US 202 Interchanges at Boot Road and Lancaster Avenue (US 30).

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Geographic Area Covered: The study area includes the following municipalities in Chester County, Pennsylvania; West Goshen, East Goshen, East Bradford, West Bradford townships, and West Chester Borough

Key Words: West Chester Bypass (US 322 / 202), Plan, Graphical Information System (GIS), transportation/land use interactions, land use models, land use policies, corridor planning, model calibration, parameters, variables

ABSTRACT: The West Chester Bypass (US 202/322) Interchange is located in West Goshen Township, Chester County, near the borough of West Chester. The existing partial interchange contains no direct ramp movements from US 202 southbound to US 322 westbound, or from US 322 eastbound to US 202 northbound. To determine the impact of completing this interchange on study area traffic patterns, DVRPC was asked to forecast year 2030 traffic volumes for the proposed ramps and selected study area roadways. DVRPC also evaluated the potential for land development induced as a result of increased accessibility provided by the proposed ramps.

This technical memorandum summarizes the methodology, results and findings of DVRPC's study.

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