Technical Memorandum

COUNTY LINE ROAD TRAFFIC STUDY

March 2008

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

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

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

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

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

This memo, requested by the Pennsylvania Department of Transportation (PENNDOT), documents 2030 traffic forecasts for the County Line Road corridor. In preparation for projecting future traffic volumes, traffic counts throughout the study area were collected by PENNDOT's consultants and the Delaware Valley Regional Planning Commission (DVRPC). Municipal and county planners were contacted to identify the significant proposed residential and commercial developments within the corridor. DVRPC's regional traffic simulation model was focused on the corridor and used to prepare 2030 traffic volume estimates for study area roadways under a No-Build and two Build alternatives.

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

Chapter II of this memo documents the existing characteristics of the study area, including current daily and AM and PM peak hour traffic volumes. The alternatives analyzed in the study are described in Chapter III. Chapter IV explains the travel forecasting methodology, including a description of the travel simulation model used to develop the traffic projections. The study area's population and employment projections, which provide necessary inputs into the travel model, are also presented in this chapter. Chapter V presents an analysis of the projected 2030 daily and peak hour traffic forecasts under each alternative. Finally, conclusions drawn from the traffic study are listed in Chapter VI.

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II. CHARACTERISTICS OF THE STUDY AREA

County Line Road is located on the boundary between Bucks and Montgomery counties in Pennsylvania. It extends from Allentown Road between Salford Township, Montgomery County and West Rockhill Township, Bucks County, to Bustleton Pike, near the junction of Lower Moreland Township, Montgomery County; Lower Southhampton Township, Bucks County; and the Philadelphia County line. Its length of approximately 25 miles forms the majority of the Bucks/Montgomery county border, which is just over 31 miles in length.

This traffic study is primarily concerned with the segment of County Line Road between US 202 (Doylestown Road/Butler Avenue) at Montgomery Township, Montgomery County and New Britain Township, Bucks County, and PA 152 (Limekiln Pike) at Montgomery Township and Warrington Township, Bucks County. Within the study area, County Line Road is a two-lane, urban, Principal Arterial. Adjacent land uses include both residential and commercial.

The study area for traffic forecasting purposes is defined as the municipalities of Chalfont Borough, Doylestown Borough and Township, Hilltown Township, New Britain Borough and Township, Silverdale Borough, and Warrington Township in Bucks County and Hatfield Borough and Township, Horsham Township, Lansdale Borough, and Montgomery Township in Montgomery County. This area, along with its relationship to County Line Road, is shown in Figure 1.

A. Current Average Daily Traffic Volumes

Figure 2 displays the current average annual daily traffic (AADT) volumes for County Line Road and significant intersecting roadways in the corridor between US 202 and Kulp Road. For this analysis, the “current year” is defined as 2006. Daily traffic volumes along County Line Road range from 14,200 vehicles per day (vpd) to 22,900 vpd. The lowest volume occurs between the two Lower State Road intersections with County Line Road. The highest volume occurs just north of US 202. Traffic volumes on County Line Road tend to be higher north of Stump Road than they are south of Stump Road.

The major facilities that intersect County Line Road in this area include US 202 (Doylestown Road/Butler Avenue), Upper State Road, Stump Road, PA 152 (Limekiln Pike), and Lower State Road. Except for Lower State Road, all of these facilities have higher traffic volumes on the Montgomery County side of County Line Road compared to the Bucks County side. The most heavily traveled of these is Doylestown Road/Butler Avenue, with current volumes of 15,800 to 16,500 vpd, followed by Upper State Road, with 10,400 to 15,900 vpd.

Figure 1. County Line Road Traffic Study Area

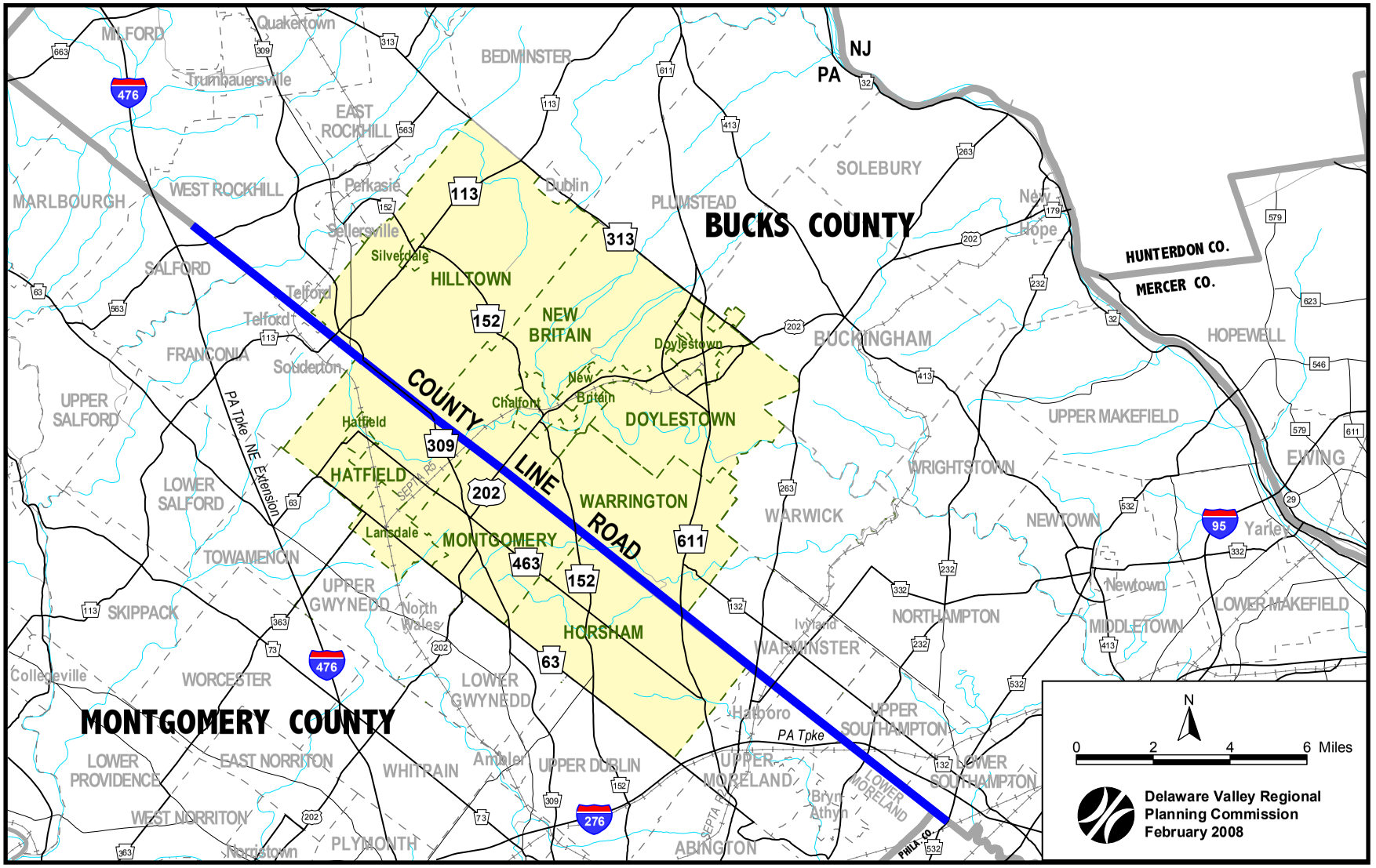
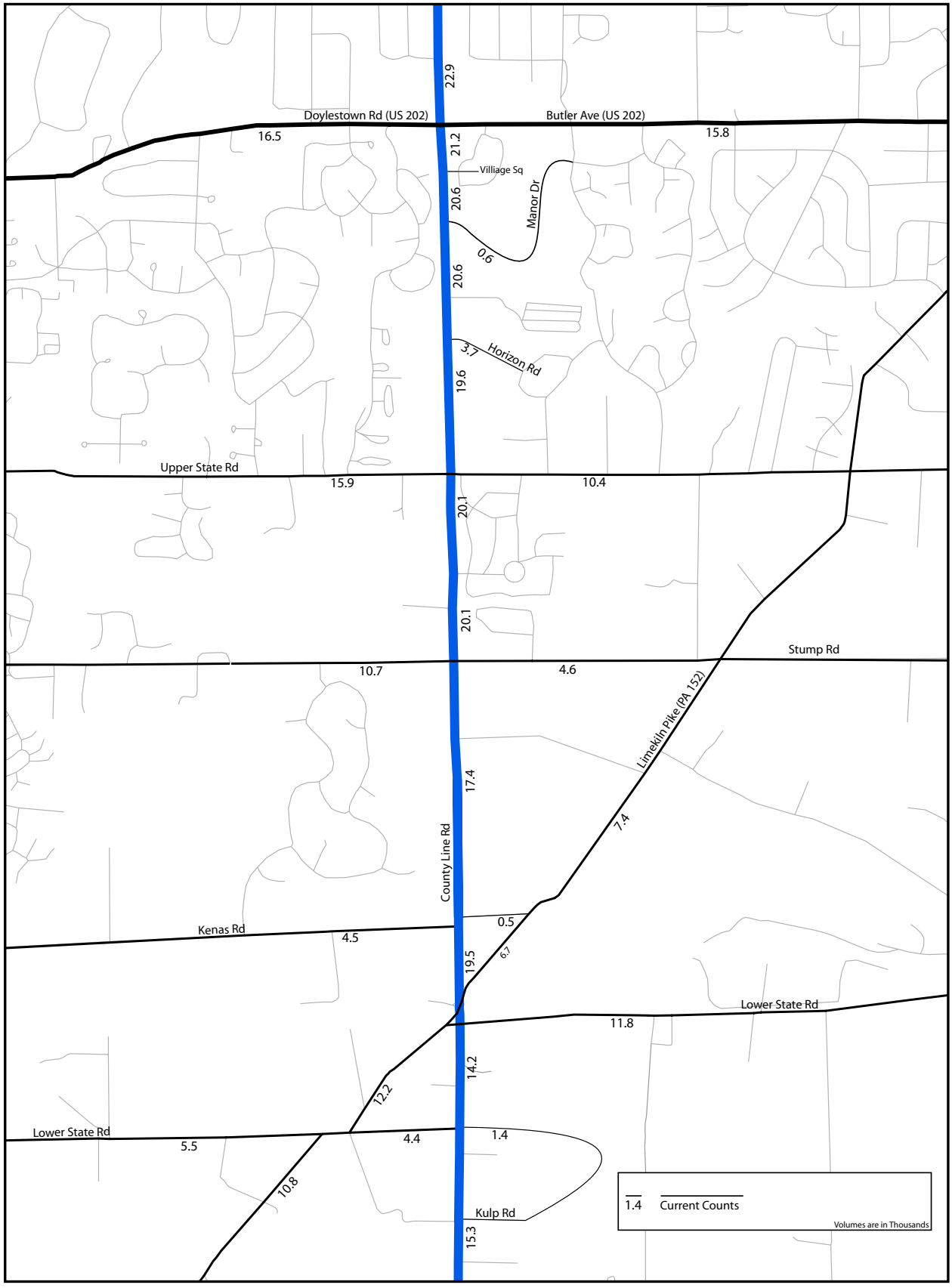


Figure 2. Current Average Daily Traffic Volumes (000s)



Delaware Valley Regional Planning Commission
May 2006

Miles
0 0.25 0.5

B. Current AM and PM Peak Hour Volumes

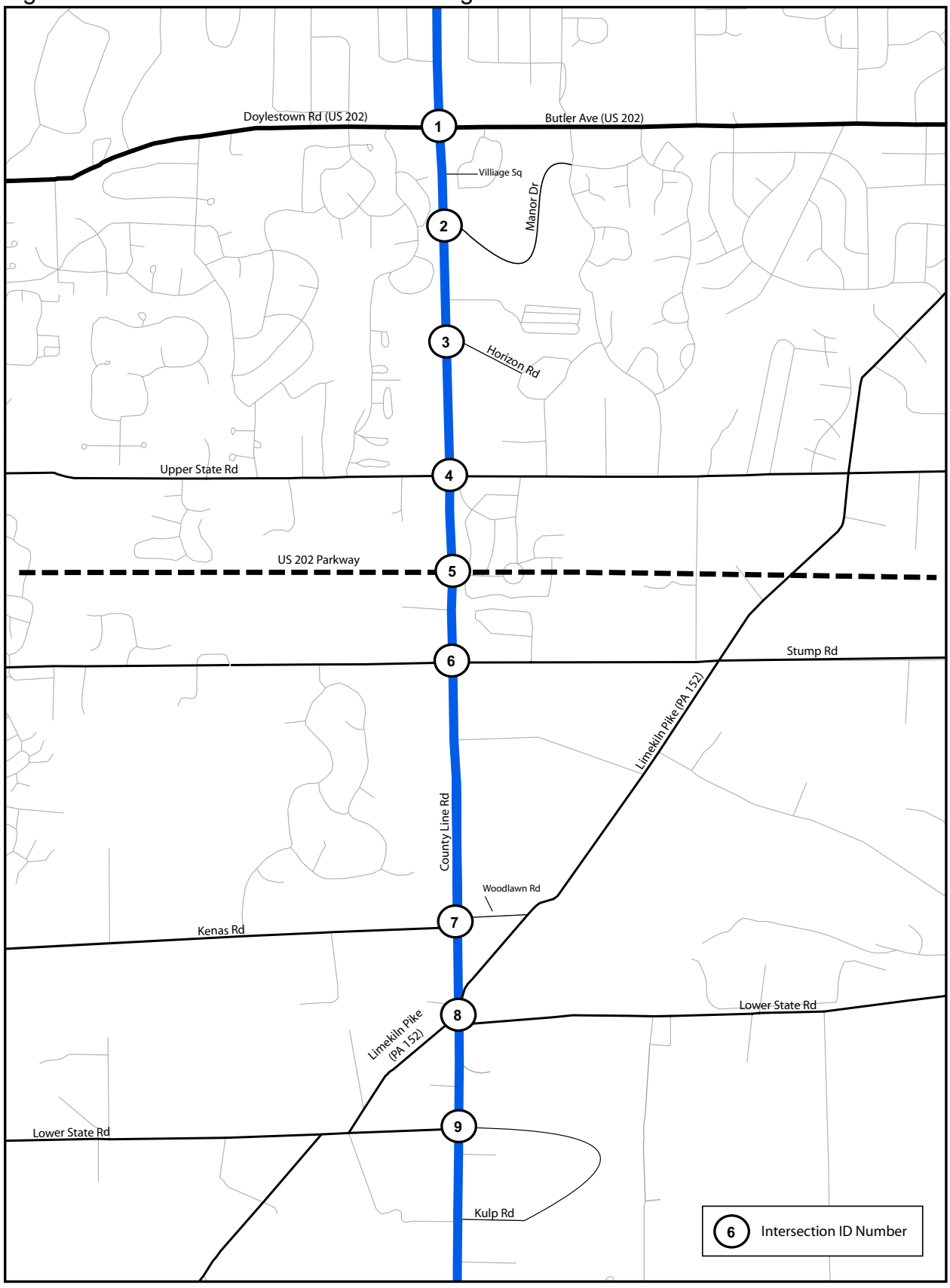
AM and PM peak hour turning movement counts were collected at several key County Line Road intersections. Figure 3 shows the locations of the study area intersections for which turning movement counts and forecasts are available. This intersection location figure also includes a new County Line Road intersection, which will result from construction of the proposed US 202 Parkway between Upper State and Stump Roads. Figure 4 displays the counted AM and PM peak hour traffic volumes, including turning movements at nine intersections in the County Line Road corridor.

Along County Line Road in the AM peak hour, northbound volumes range from 579 to 781 vehicles per hour (vph), with the highest volume occurring south of the intersection with Lower State and Kulp roads. Southbound volumes are generally higher, ranging from 547 to 902 vph, with the highest volume occurring between Upper State and Stump roads. During the AM peak hour, only the portion of County Line Road just south of Limekiln Pike has a lower volume in the southbound direction compared to the northbound direction.

During the PM peak hour, however, the northbound volumes are higher everywhere, except just north of Doylestown Road/Butler Avenue. Northbound volumes range from 667 to 1,030 vph. Southbound PM peak hour volumes are between 512 and 881 vph.

The facilities that cross County Line Road tend to have higher volumes in the westbound direction during the AM peak hour and higher volumes in the eastbound direction during the PM peak. The highest peak hour volumes on intersecting facilities occur on Doylestown Road/Butler Avenue, where peak hour volumes range from 379 to 863 vph; Upper State Road, with volumes of 393 to 635 vph; and PA 152, with peak hour volumes between 136 and 778 vph.

Figure 3. Intersection Locations for Turning Movement Volumes



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Miles
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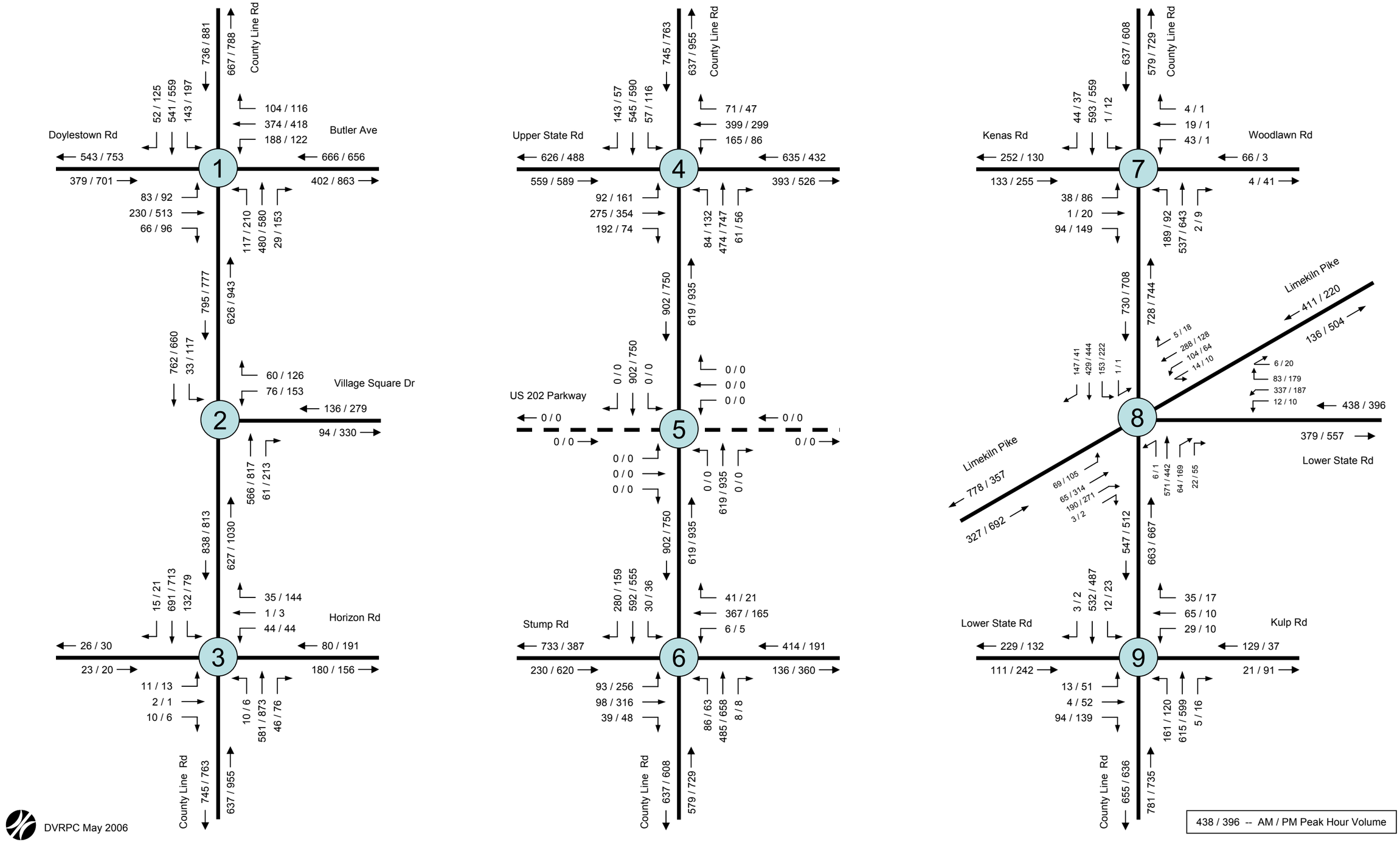
Figure 4. Current AM and PM Peak Hour Intersection Turning Movement Counts



DVRPC May 2006

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III. IMPROVEMENT ALTERNATIVES

Traffic forecasts are prepared and evaluated for the years 2010 and 2030 under three different highway network alternatives: a No-Build and two Build alternatives. For each of these alternatives, DVRPC's travel simulation model is modified to reflect the alternative under consideration and is used to prepare travel forecasts representative of that scenario. The No-Build Alternative provides a useful future-year reference against which any impacts associated with the Build alternatives may be compared and quantified.

A. No-Build Alternative

The No-Build Alternative does not include any changes to County Line Road between US 202 and Kulp Road. This alternative does, however, include improvements to other regional facilities that are included in DVRPC's Transportation Improvement Program (TIP) or Long Range Plan, and that may have an impact on travel patterns in the study area once they are built. These TIP and Plan projects include the widening of PA 463 (Horsham Road) from North Wales Road to PA 611, constructing a two-lane extension of Bristol Road from US 202 to Park Avenue, widening US 202 Section 600 from Johnson Highway to PA 309 (Bethlehem Pike), intersection improvements at the US 202/PA 309/PA 463 ("Five-Points") intersection, and construction of the PA 309 Connector from PA 63 (Sumneytown Pike) to County Line Road. These projects are also included as part of each of the Build alternatives. No improvements to US 202 Section 700 between PA 309 and PA 611 are included in the No-Build Alternative.

B. Widen County Line Road Alternative

County Line Road presently carries two 12-foot lanes, with left-turn lanes at Stump Road, Upper State Road, Manor Drive, the Village Square entrance, and US 202. This build alternative would widen to five lanes approximately 2.4 miles of County Line Road between US 202 and Lower State Road. It would provide two 11-foot travel lanes in each direction, an 11-foot continuous two-way left-turn lane, and five-foot wide shoulder/bicycle lanes in each direction. This build alternative also includes the installation of a new traffic signal at the County Line Road intersection with Horizon Drive/Summer Ridge Drive. Under this build alternative, no improvements to US 202 Section 700 are considered.

C. Widen County Line Road with Parkway Alternative

This widening alternative would also widen to five lanes approximately 2.4 miles of County Line Road between US 202 and Lower State Road with two 11-foot travel lanes in each direction, plus an 11-foot left-turn lane, and five-foot wide shoulder/bicycle lanes in each direction. In addition, this alternative includes the provision of a new US 202 Parkway and

its effects on County Line Road traffic volumes. This Parkway would be located between Upper State and Stump roads, and would extend from PA 63 (Welsh Road) to PA 611. It would have four travel lanes between PA 63 and PA 463 and two travel lanes from PA 463 to PA 611. The US 202 Parkway would be controlled-access, which means that no access to private properties adjacent to the Parkway would be provided. Access to and from the Parkway would only occur at its intersections with cross streets, including County Line Road. This build alternative also includes the installation of new traffic signals at the County Line Road intersections with Horizon Drive/Summer Ridge Drive and the US 202 Section 700 Parkway.

IV. TRAVEL FORECASTING PROCEDURES

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

A. Socioeconomic Projections

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

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

1. Population Forecasting

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

2. Employment Forecasting

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

3. County Line Road Study Area Forecasts

As part of the County Line Road Traffic Study, DVRPC staff reviewed its most recent current population and employment estimates, its long-range population and employment forecasts, and all proposed land use developments in the study area. Based on this review, DVRPC developed 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 in the study.

Between 2005 and 2030, the total population in the greater study area is projected to increase by 38,455 residents to 203,165. This represents an increase of just over 23 percent from the 2005 value of 164,710. Five of the six municipalities that will have the greatest number of new residents border County Line Road. They include Warrington, New Britain, Hilltown and Doylestown townships in Bucks County, and Horsham and Montgomery townships in Montgomery County. All of these areas are projected to add 4,000 or more new residents between 2005 and 2030.

The study area will also add nearly 32,000 new jobs between 2005 and 2030, an increase of 27.8 percent. Municipalities that are projected to add 4,000 or more new jobs include Horsham, Montgomery, and Hatfield townships in Montgomery County and Doylestown and Warrington townships in Bucks County.

The majority of the population growth, 72 percent, will occur in the Bucks County portion of the study area. However, most of the employment growth (59 percent) will occur on the Montgomery County side. This will lead to a large increase in the number of trips that cross County Line Road and/or use County Line Road for a portion of the trip.

Table 1. Study Area Population and Employment

	Population					Employment				
				2005 - 2030 Growth					2005 - 2030 Growth	
Municipality	**2000**	**2005**	**2030**	**Abs.**	**Pct.**	**2000**	**2005**	**2030**	**Abs.**	**Pct.**
Hatfield Borough	2,605	2,610	2,480	-130	-5.0%	1,950	1,943	2,000	57	2.9%
Hatfield Township	16,712	17,430	19,970	2,540	14.6%	13,473	14,244	19,700	5,456	38.3%
Horsham Township	24,232	25,210	29,500	4,290	17.0%	28,938	29,830	36,350	6,520	21.9%
Lansdale Borough	16,071	16,200	16,400	200	1.2%	10,604	10,620	11,200	580	5.5%
Montgomery Township	22,025	23,980	28,000	4,020	16.8%	17,127	17,992	24,100	6,108	33.9%
Montgomery County Municipalities	**81,645**	**85,430**	**96,350**	**10,920**	**12.8%**	**72,092**	**74,629**	**93,350**	**18,721**	**25.1%**
Chalfont Borough	3,900	4,040	4,600	560	13.9%	1,963	1,978	1,874	-104	-5.3%
Doylestown Borough	8,227	8,350	8,585	235	2.8%	11,259	11,134	11,715	581	5.2%
Doylestown Township	17,619	18,570	23,190	4,620	24.9%	8,026	8,407	14,986	6,579	78.3%
Hilltown Township	12,100	13,080	18,515	5,435	41.6%	4,359	5,024	6,398	1,374	27.3%
New Britain Borough	3,125	3,150	3,150	0	0.0%	1,047	998	1,521	523	52.4%
New Britain Township	10,698	11,770	18,190	6,420	54.5%	3,610	3,899	4,164	265	6.8%
Silverdale Borough	1,000	1,030	1,145	115	11.2%	306	315	294	-21	-6.7%
Warrington Township	17,580	19,290	29,440	10,150	52.6%	7,963	8,638	12,681	4,043	46.8%
Bucks County Municipalities	**74,249**	**79,280**	**106,815**	**27,535**	**34.7%**	**38,533**	**40,393**	**53,633**	**13,240**	**32.8%**
Study Area Total	**155,894**	**164,710**	**203,165**	**38,455**	**23.3%**	**110,625**	**115,022**	**146,983**	**31,961**	**27.8%**

DVRPC - September 2005

B. DVRPC's Travel Simulation Process

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

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

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

The DVRPC travel simulation models are disaggregated into separate peak, midday, and evening time periods. This disaggregation begins in trip generation, where factors are used to separate daily trips into peak, midday, and evening travel. The enhanced process then utilizes completely separate model chains for peak, midday, and evening travel simulation runs. Time-of-day sensitive inputs to the models, such as highway capacities and transit service levels, are disaggregated to be reflective of time-period-specific conditions. Capacity factors are used to allocate daily highway capacity to each time period. Separate transit networks were used to represent the difference in transit service over the course of a day.

The enhanced model is disaggregated into separate model chains for the peak (combined AM and PM), midday (the period between the AM and PM peaks), and evening (the remainder of the day) periods for the trip distribution, modal split, and travel assignment phases of the process. The peak period is defined as 7:00 AM to 9:00 AM and 3:00 PM

to 6:00 PM. Peak period and midday travel are based on a series of factors that determine the percentage of daily trips that occur during those periods. Evening travel is then defined as the residual after peak and midday travel are removed from daily travel.

External-local productions at the nine-county cordon stations are disaggregated into peak, midday, and evening components using percentages derived from the temporal distribution of traffic counts taken at each cordon station.

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

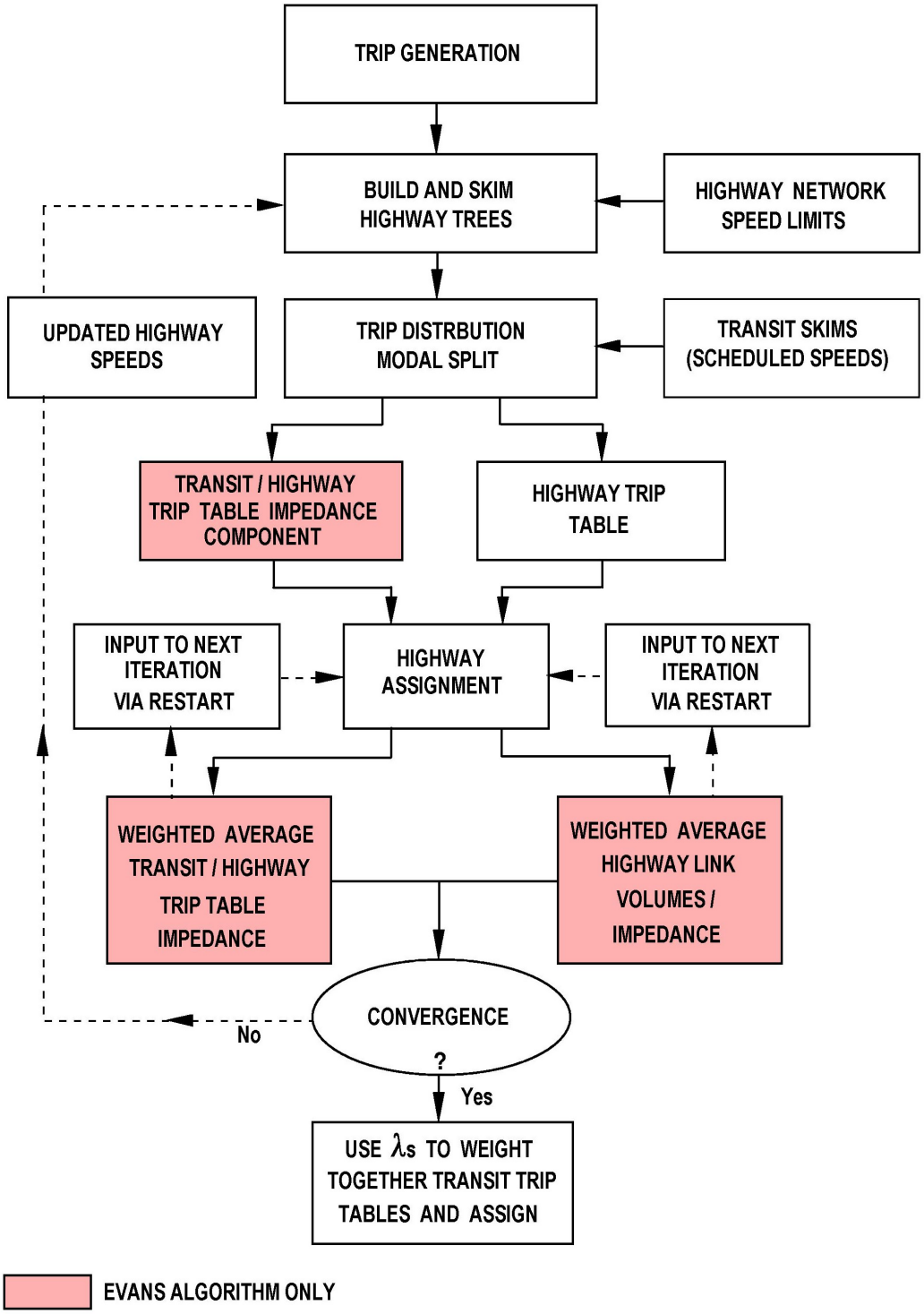
1. Trip Generation

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

2. Evans Iterations

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

Figure 5. DVRPC's Travel Modeling Process



3. Trip Distribution

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

4. Modal Split

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

5. Highway Assignment

For highway trips, the final step in the focused simulation process is the assignment of vehicle trips to the highway network representative of the alternative being modeled. For peak, midday, and evening travel, the assignment model produces the future traffic volumes for individual highway links that are required for the evaluation of each alternative. The regional nature of the highway network and trip table underlying the focused assignment process allows the diversion of travel into and through the study area to various points of entry and exit in response to the improvements made in the transportation system.

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

6. Transit Assignment

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

C. Highway Traffic Assignment Validation

Before a focused simulation model can be used to predict future trip making patterns, its ability to replicate existing conditions is tested. The simulated highway assignment outputs are compared to current traffic counts taken on roadways serving the study area. The focused simulation model was executed with current conditions and the results compared with recent traffic counts. Based on this analysis, the focused model produced accurate traffic volumes. The validated model was then executed for the No-Build and each Build alternative with socioeconomic and land use inputs reflective of 2030 conditions.

The following tabulation summarizes the aggregate error in the assigned daily traffic volumes. A total of 82 locations throughout the greater study area with available daily traffic counts were used for model validation. Ten of these locations are along County Line Road; 30 are other facilities that are generally parallel to County Line Road, including PA 63, PA 463, PA 309, and Bristol Road; and 42 are on facilities that either cross County Line Road or are perpendicular to it, such as US 202, Upper State Road, Stump Road, PA 152, and Lower State Road. The total assigned traffic on all facilities, 1.17 million vehicles, is within about one percent of the total counted volume of 1.15 million vehicles, as shown below:

Facilities	Number of Locations	Counted Volume	Simulated Volume	Difference	Percent Difference
County Line Road	10	187,997	185,875	-2,122	-1.1 %
Parallel Facilities	30	484,818	511,905	27,087	5.6 %
Crossing Facilities	42	479,397	469,930	-9,467	-2.0 %
All Facilities	**82**	**1,152,212**	**1,167,710**	**15,498**	**1.3 %**

V. PROJECTED TRAFFIC VOLUMES

Projected traffic volumes for the anticipated opening year, 2010, and a horizon year of 2030 are presented and analyzed in this chapter. For each alternative, a daily traffic forecast is prepared at each location where a current count was provided in Chapter II. In addition, AM and PM peak hour intersection turning movement forecasts are provided for each alternative at the intersections shown in Figure 3.

A. 2010 Daily Traffic Forecasts

Figure 6 provides the 2010 average daily traffic volumes for the No-Build and Build alternatives. In the figure, current traffic volumes are shown in black, underneath the line representing the highway links. No-Build volumes are shown in red, just above the line. Daily traffic volumes for the Widen County Line Road Alternatives and the Widen County Line Road with Parkway Alternative are shown above the No-Build volume, in blue and green, respectively. Table 2 provides these same volumes, along with comparisons between current and No-Build traffic volumes and between Build and No-Build volumes.

Under the No-Build Alternative, 2010 volumes on County Line Road are projected to be between 16,300 and 24,600 vehicles per day (vpd). These volumes represent increases of approximately 2,000 to 3,000 vpd over current traffic counts. The largest increases occur south of Upper State Road. Here, No-Build Alternative volumes are between 13 and 18 percent higher than the counted volumes. North of Upper State Road, traffic volumes on County Line Road increase by 7 to 12 percent under the No-Build Alternative. Daily traffic volumes on crossing streets increase by 700 to 2,800 vpd. The largest increases occur on PA 152 and US 202.

The Widen County Line Road Alternative results in 2010 daily traffic volumes of 19,200 to 26,300 vpd on County Line Road. Compared to the No-Build Alternative, widening County Line Road increases traffic volumes south of US 202 by 1,800 to 3,700 vpd in 2010. North of US 202, traffic volumes increase by only an additional 100 to 300 vpd. Daily volumes on the facilities that intersect with County Line Road are similar to the No-Build traffic volumes. They are between 0 and 500 vpd higher than the corresponding No-Build volume.

The Widen County Line Road with Parkway Alternative results in even higher traffic volumes along County Line Road. North of Upper State Road, however, this increase is only 100 to 200 vpd, compared to the Widen County Line Road Alternative. South of Upper State Road, volumes increase by 500 to 2,200 vpd in 2010. The largest increases occur just north of and just south of the new US 202 Parkway. Traffic volumes on crossing streets are generally lower under this alternative than they are for both the Widen County Line Road and No-Build alternatives.

Figure 6. 2010 Daily Traffic Volumes for the No-Build and Build Alternatives (000s)

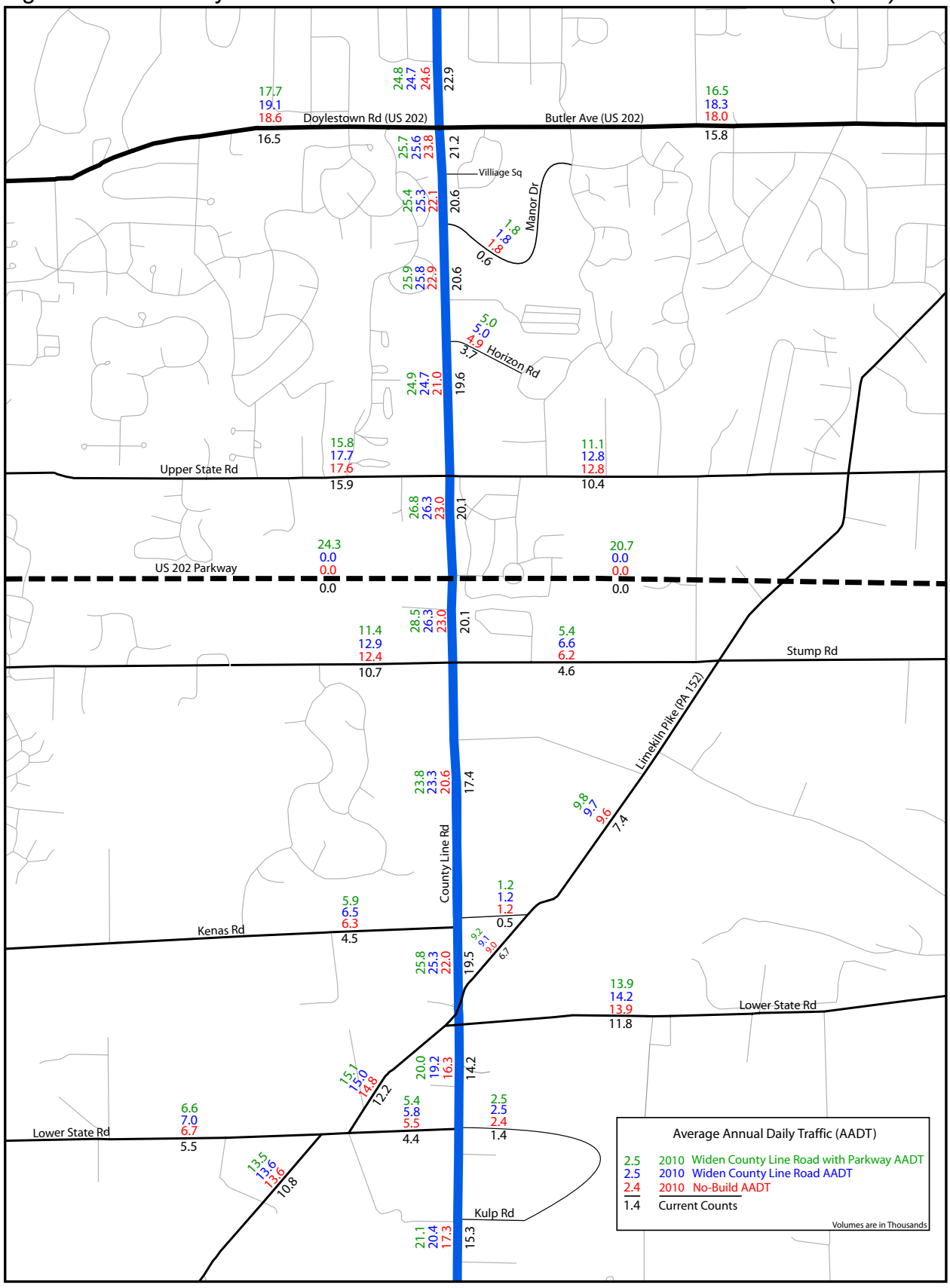


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Table 2. Current and 2010 Average Daily Traffic Volumes

Location	Current Counts	2010 Daily Traffic Volumes									
		No-Build	Widen County Line Rd	Widen C.L.R. w/ 202 Pkwy	No-Build/Count Diff.	No-Build/Count % Diff	Widen CLR/No-Bld Diff.	Widen CLR/No-Bld % Diff	With Pkwy/Without Diff.	With Pkwy/Without % Diff
County Line Road										
Bethlehem Pike (PA 309) to Walnut Street	17,268	19,100	19,400	19,500	1,832	10.6%	300	1.6%	100	0.5%
Walnut Street to Doylestown Road (US 202)	22,863	24,600	24,700	24,800	1,737	7.6%	100	0.4%	100	0.4%
Doylestown Road (US 202) to Village Square Driveway	21,171	23,800	25,600	25,700	2,629	12.4%	1,800	7.6%	100	0.4%
Village Square Driveway to Manor Drive	20,620	23,100	25,300	25,400	2,480	12.0%	2,200	9.5%	100	0.4%
Manor Drive to Horizon Road	20,620	22,900	25,800	25,900	2,280	11.1%	2,900	12.7%	100	0.4%
Horizon Road to Upper State Road	19,614	21,000	24,700	24,900	1,386	7.1%	3,700	17.6%	200	0.8%
Upper State Road to US 202 Parkway	20,124	23,000	26,300	27,200	2,876	14.3%	3,300	14.3%	900	3.4%
US 202 Parkway to Stump Road	20,124	23,000	26,300	28,500	2,876	14.3%	3,300	14.3%	2,200	8.4%
Stump Road to Kenas Road	17,414	20,600	23,300	23,800	3,186	18.3%	2,700	13.1%	500	2.1%
Kenas Road to Limekiln Pike (PA 152)	19,470	22,000	25,300	25,800	2,530	13.0%	3,300	15.0%	500	2.0%
Limekiln Pike (PA 152) to Lower State Road South	14,180	16,300	19,200	20,000	2,120	15.0%	2,900	17.8%	800	4.2%
Lower State Road South to Folly Road	15,273	17,300	20,400	21,100	2,027	13.3%	3,100	17.9%	700	3.4%
Crossing Streets										
US 202 - PA 463 to County Line Road	16,474	18,600	19,100	17,700	2,126	12.9%	500	2.7%	-1,400	-7.3%
US 202 - County Line Road to PA 152 West	15,751	18,000	18,300	16,500	2,249	14.3%	300	1.7%	-1,800	-9.8%
Manor Drive - County Line Road to School House Road	617	1,800	1,800	1,800	1,183	191.7%	0	0.0%	0	0.0%
Horizon Road - County Line Road to Highpoint Drive	3,703	4,900	5,000	5,000	1,197	32.3%	100	2.0%	0	0.0%
Summer Ridge Drive - County Line Road to Upper State Road	388	1,500	1,500	1,800	1,112	286.6%	0	0.0%	300	20.0%
Upper State Road - PA 463 to County Line Road	15,913	17,600	17,700	15,800	1,687	10.6%	100	0.6%	-1,900	-10.7%
Upper State Road - County Line Road to PA 152	10,390	12,800	12,800	11,100	2,410	23.2%	0	0.0%	-1,700	-13.3%
US 202 Parkway - PA 463 to County Line Road	0	0	0	25,200	0	------	0	------	25,200	------
US 202 Parkway - County Line Road to PA 152	0	0	0	20,700	0	------	0	------	20,700	------
Stump Road - PA 463 to County Line Road	10,703	12,400	12,900	11,400	1,697	15.9%	500	4.0%	-1,500	-11.6%
Stump Road - County Line Road to PA 152	4,630	6,200	6,600	5,400	1,570	33.9%	400	6.5%	-1,200	-18.2%
Kenas Road - PA 463 to County Line Road	4,503	6,300	6,500	5,900	1,797	39.9%	200	3.2%	-600	-9.2%
Woodlawn Road - County Line Road to PA 152	479	1,200	1,200	1,200	721	150.5%	0	0.0%	0	0.0%
PA 152 - Stump Road to Woodlawn Road	7,446	9,600	9,700	9,800	2,154	28.9%	100	1.0%	100	1.0%
PA 152 - Woodlawn Road to County Line Road	6,718	9,000	9,100	9,200	2,282	34.0%	100	1.1%	100	1.1%
PA 152 - County Line Road to Lower State Road	12,178	14,800	15,000	15,100	2,622	21.5%	200	1.4%	100	0.7%
PA 152 - Lower State Road to PA 463	10,763	13,600	13,600	13,500	2,837	26.4%	0	0.0%	-100	-0.7%
Lower State Road - PA 463 to PA 152	5,462	6,700	7,000	6,600	1,238	22.7%	300	4.5%	-400	-5.7%
Lower State Road - PA 152 to County Line Road	4,424	5,500	5,800	5,400	1,076	24.3%	300	5.5%	-400	-6.9%
Lower State Road - County Line Road to Bristol Road	11,839	13,900	14,200	13,900	2,061	17.4%	300	2.2%	-300	-2.1%
Kulp Road - County Line Road to Riding Court	1,393	2,400	2,500	2,500	1,007	72.3%	100	4.2%	0	0.0%

B. 2030 Daily Traffic Forecasts

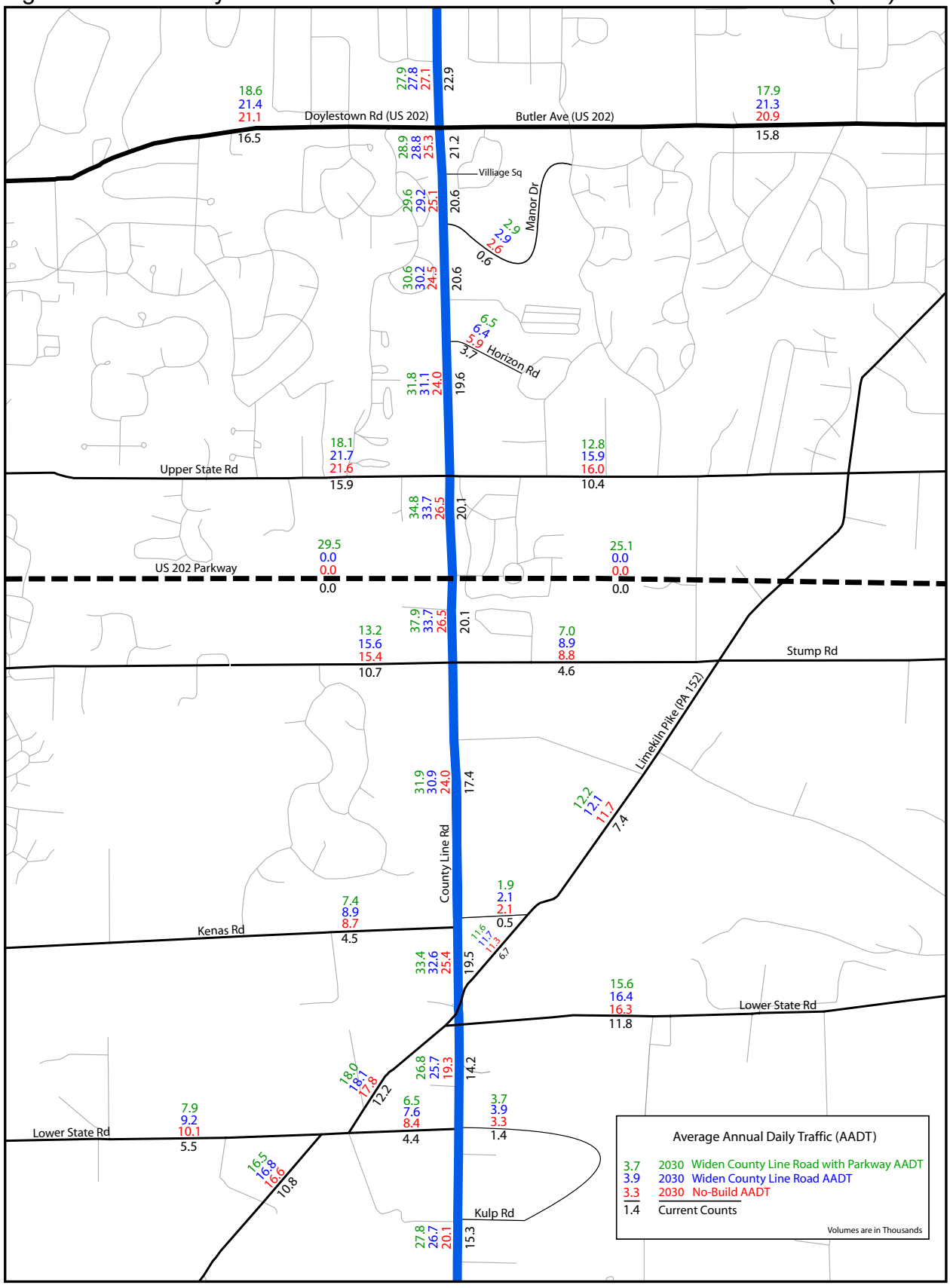
The 2030 daily traffic forecasts generally follow similar patterns to the 2010 forecasts, except that the 2030 volumes are higher than the corresponding 2010 volumes. Figure 7 provides the 2030 average daily traffic volumes for the No-Build and Build alternatives. Table 3 provides these same volumes, along with comparisons between current and No-Build traffic volumes and between Build and No-Build volumes.

Under the No-Build Alternative, 2030 volumes on County Line Road are projected to be between 19,300 and 27,100 vehicles per day (vpd). The highest volumes occur just north of Doylestown Road/Butler Avenue, between Upper State and Stump roads, and between Kenas Road and Limekiln Pike. County Line Road traffic volumes under the No-Build Alternative represent increases of approximately 4,000 to 6,500 vpd over current traffic counts. The largest increases in both absolute and percent terms occur between Upper State Road and Lower State Road. Here, No-Build Alternative volumes are between 31 and 38 percent higher than the counted volumes. North of Upper State Road, traffic volumes on County Line Road increase over the current volumes by 19 to 27 percent under the No-Build Alternative, compared to the current volumes. Daily traffic volumes on crossing streets increase by 1,600 to 5,800 vpd. The largest increases occur on PA 152 and Upper State Road.

The Widen County Line Road Alternative results in 2030 daily traffic volumes of 22,100 to 33,700 vpd on County Line Road. Adding a second travel lane in each direction on County Line Road increases traffic volumes south of US 202 by 3,500 to 7,200 vpd by 2030, over the No-Build Alternative. Still, these volumes equate to significantly less traffic per lane than the No-Build volumes and also less traffic per lane than currently exists. North of US 202, traffic volumes increase by only an additional 200 to 700 vpd, compared to the No-Build Alternative. Daily volumes on the facilities that intersect with County Line Road are similar to the No-Build traffic volumes. They range from 900 vpd less than the corresponding No-Build volume to 600 vpd higher than the No-Build volume. The largest reductions occur on Lower State Road west of County Line Road, while the largest increase occurs on Kulp Road east of County Line Road.

The Widen County Line Road with Parkway Alternative results in similar traffic volumes along County Line Road, except between the US 202 Parkway and Stump Road. Compared to the Widen County Line Road Alternative, this location will have an additional 4,200 vpd. All other locations along County Line Road will be between 100 and 1,100 vpd higher than the corresponding volumes without the US 202 Parkway. This will result in traffic volumes ranging from 22,300 to 37,900 vpd along County Line Road. The highest volume of 37,900 vpd between the US 202 Parkway and Stump Road results in an average of 9,475 vehicles per lane per day, compared to the current average of 10,060. Traffic volumes on many crossing streets are significantly lower under this alternative than under the Widen County Line Road Alternative. For example, volumes on existing US 202 are reduced by 3,800 to 3,400 vpd and Upper State Road volumes by 3,100 to 3,600 vpd.

Figure 7. 2030 Daily Traffic Volumes for the No-Build and Build Alternatives (000s)



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Miles
0 0.25 0.5

Table 3. Current and 2030 Average Daily Traffic Volumes

Location	Current Counts	2030 Daily Traffic Volumes: No-Build	Widen County Line Rd	Widen C.L.R. w/ 202 Pkwy	No-Build/Count Diff.	No-Build/Count % Diff	Widen CLR/No-Bld Diff.	Widen CLR/No-Bld % Diff	With Pkwy/Without Diff.	With Pkwy/Without % Diff
County Line Road										
Bethlehem Pike (PA 309) to Walnut Street	17,268	21,900	22,100	22,300	4,632	26.8%	200	0.9%	200	0.9%
Walnut Street to Doylestown Road (US 202)	22,863	27,100	27,800	27,900	4,237	18.5%	700	2.6%	100	0.4%
Doylestown Road (US 202) to Village Square Driveway	21,171	25,300	28,800	28,900	4,129	19.5%	3,500	13.8%	100	0.3%
Village Square Driveway to Manor Drive	20,620	25,100	29,200	29,600	4,480	21.7%	4,100	16.3%	400	1.4%
Manor Drive to Horizon Road	20,620	24,500	30,200	30,600	3,880	18.8%	5,700	23.3%	400	1.3%
Horizon Road to Upper State Road	19,614	24,000	31,100	31,800	4,386	22.4%	7,100	29.6%	700	2.3%
Upper State Road to US 202 Parkway	20,124	26,500	33,700	34,800	6,376	31.7%	7,200	27.2%	1,100	3.3%
US 202 Parkway to Stump Road	20,124	26,500	33,700	37,900	6,376	31.7%	7,200	27.2%	4,200	12.5%
Stump Road to Kenas Road	17,414	24,000	30,900	31,900	6,586	37.8%	6,900	28.8%	1,000	3.2%
Kenas Road to Limekiln Pike (PA 152)	19,470	25,400	32,600	33,400	5,930	30.5%	7,200	28.3%	800	2.5%
Limekiln Pike (PA 152) to Lower State Road South	14,180	19,300	25,700	26,800	5,120	36.1%	6,400	33.2%	1,100	4.3%
Lower State Road South to Folly Road	15,273	20,100	26,700	27,800	4,827	31.6%	6,600	32.8%	1,100	4.1%
Crossing Streets										
US 202 - PA 463 to County Line Road	16,474	21,100	21,400	18,600	4,626	28.1%	300	1.4%	-2,800	-13.1%
US 202 - County Line Road to PA 152 West	15,751	20,900	21,300	17,900	5,149	32.7%	400	1.9%	-3,400	-16.0%
Manor Drive - County Line Road to School House Road	617	2,600	2,900	2,900	1,983	321.4%	300	11.5%	0	0.0%
Horizon Road - County Line Road to Highpoint Drive	3,703	5,900	6,400	6,500	2,197	59.3%	500	8.5%	100	1.6%
Summer Ridge Drive - County Line Road to Upper State Road	388	2,300	2,600	3,400	1,912	492.8%	300	13.0%	800	30.8%
Upper State Road - PA 463 to County Line Road	15,913	21,600	21,700	18,100	5,687	35.7%	100	0.5%	-3,600	-16.6%
Upper State Road - County Line Road to PA 152	10,390	16,000	15,900	12,800	5,610	54.0%	-100	-0.6%	-3,100	-19.5%
US 202 Parkway - PA 463 to County Line Road	0	0	0	30,500	0	------	0	------	30,500	------
US 202 Parkway - County Line Road to PA 152	0	0	0	25,100	0	------	0	------	25,100	------
Stump Road - PA 463 to County Line Road	10,703	15,400	15,600	13,200	4,697	43.9%	200	1.3%	-2,400	-15.4%
Stump Road - County Line Road to PA 152	4,630	8,800	8,900	7,000	4,170	90.1%	100	1.1%	-1,900	-21.3%
Kenas Road - PA 463 to County Line Road	4,503	8,700	8,900	7,400	4,197	93.2%	200	2.3%	-1,500	-16.9%
Woodlawn Road - County Line Road to PA 152	479	2,100	2,100	1,900	1,621	338.4%	0	0.0%	-200	-9.5%
PA 152 - Stump Road to Woodlawn Road	7,446	11,700	12,100	12,200	4,254	57.1%	400	3.4%	100	0.8%
PA 152 - Woodlawn Road to County Line Road	6,718	11,300	11,700	11,600	4,582	68.2%	400	3.5%	-100	-0.9%
PA 152 - County Line Road to Lower State Road	12,178	17,800	18,100	18,000	5,622	46.2%	300	1.7%	-100	-0.6%
PA 152 - Lower State Road to PA 463	10,763	16,600	16,800	16,500	5,837	54.2%	200	1.2%	-300	-1.8%
Lower State Road - PA 463 to PA 152	5,462	10,100	9,200	7,900	4,638	84.9%	-900	-8.9%	-1,300	-14.1%
Lower State Road - PA 152 to County Line Road	4,424	8,400	7,600	6,500	3,976	89.9%	-800	-9.5%	-1,100	-14.5%
Lower State Road - County Line Road to Bristol Road	11,839	16,300	16,400	15,600	4,461	37.7%	100	0.6%	-800	-4.9%
Kulp Road - County Line Road to Riding Court	1,393	3,300	3,900	3,700	1,907	136.9%	600	18.2%	-200	-5.1%

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C. 2010 Peak Hour Forecasts

Generally, the relationships between current and future peak hour volumes and between the various future year alternatives follow the same patterns and trends as the daily traffic volumes. However, the percentage of daily traffic that occurs during the future AM and PM peak hours is somewhat less than the percentage under current conditions. This is consistent with the "peak spreading" that occurs as traffic volumes increase. As congestion levels rise, a greater percentage of traffic is shifted to the "shoulders" of the peak, i.e., immediately before and after the peak hour.

Figure 8 displays the 2010 AM and PM peak hour traffic volumes, including turning movements at the major intersections along County Line Road. Peak hour volumes under the No-Build Alternative are provided in Figure 8A; Figure 8B shows these same intersections under the Widen County Line Road Alternative; and Figure 8C for the Widen County Line Road with Parkway Alternative.

Peak hour volumes under the No-Build Alternative are approximately 50 to 100 vph higher than the current volumes. In the AM peak hour, northbound volumes range from 670 to 810 vehicles per hour (vph). The highest volume occurs south of the intersection with Lower State and Kulp roads. Southbound volumes range from 610 to 1,010 vph. The highest volume continues to occur between Upper State and Stump roads. PM peak hour volumes in the northbound direction range from 740 to 1,100 vph. Southbound PM peak hour volumes are between 590 and 950 vph. The highest 2010 peak hour volumes on intersecting facilities under the No-Build Alternative occur on Doylestown Road/Butler Avenue, where peak hour volumes range from 460 to 940 vph; Upper State Road, with volumes of 460 to 730 vph; and PA 152, with peak hour volumes between 210 and 890 vph.

Under the Widen County Line Road Alternative, AM and PM peak hour volumes are approximately 100 to150 vph higher than the corresponding volume under the No-Build Alternative. During the AM peak hour, northbound volumes range from 760 to 970, while southbound volumes are between 770 and 1,150. PM peak hour volumes in the northbound direction are between 880 and 1,200 vpd. In the southbound direction, they range from 730 to 1,010 vph. Peak hour volumes on intersecting facilities are mostly higher under the Widen County Line Road Alternative than they are under the No-Build Alternative, but these differences are typically 50 vph or less.

Peak hour, 2010 volumes on County Line Road under the Widen County Line Road with Parkway Alternative will be slightly higher than under the Widen County Line Road Alternative. These differences will also be in the range of 50 vph or less. However, the volumes on the cross streets will be approximately 50 to 100 vph lower under the Widen County Line Road with Parkway Alternative.

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Figure 8A. 2010 Peak Hour Volumes for the No-Build Alternative

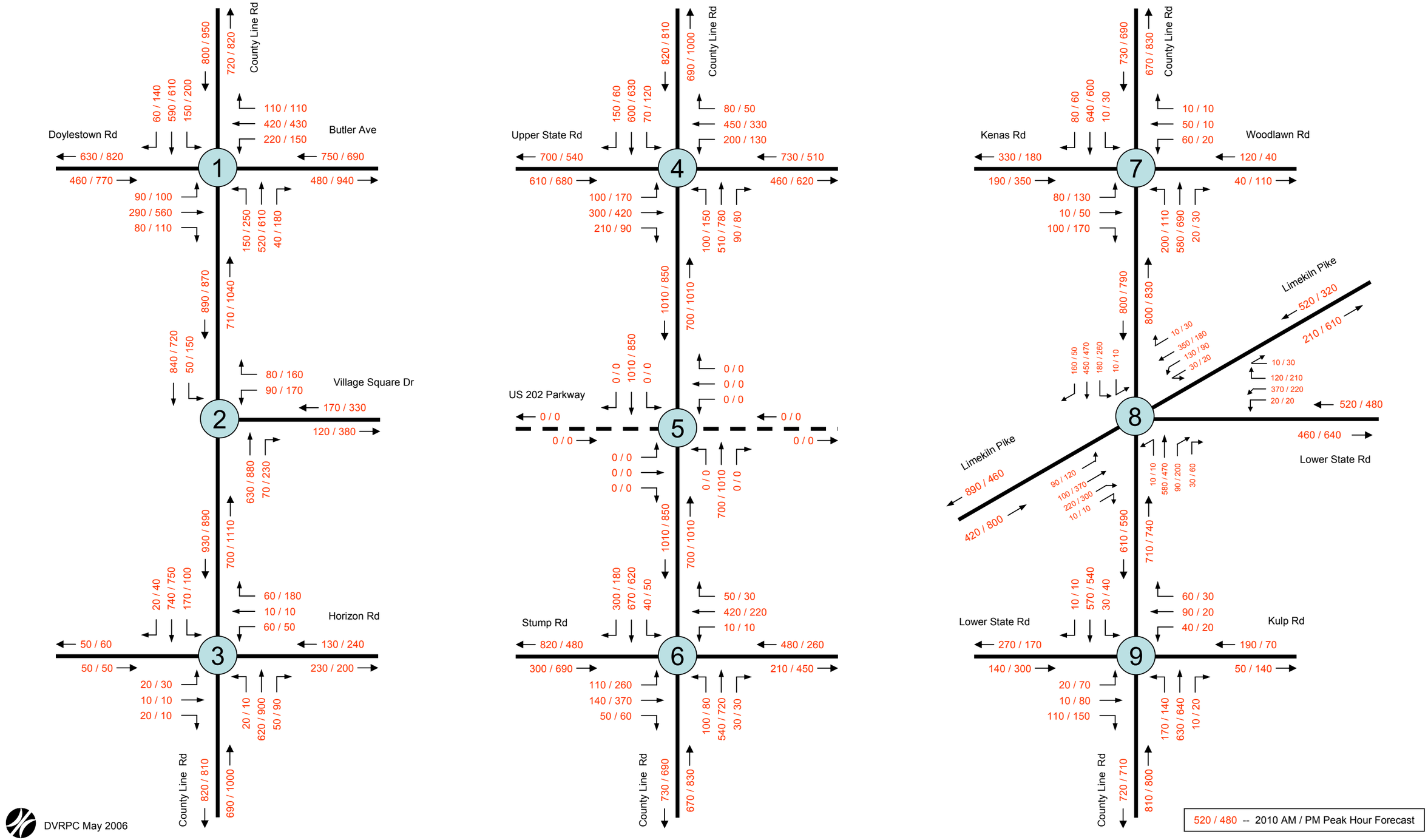

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Figure 8B. 2010 Peak Hour Volumes for the Widen County Line Road Alternative

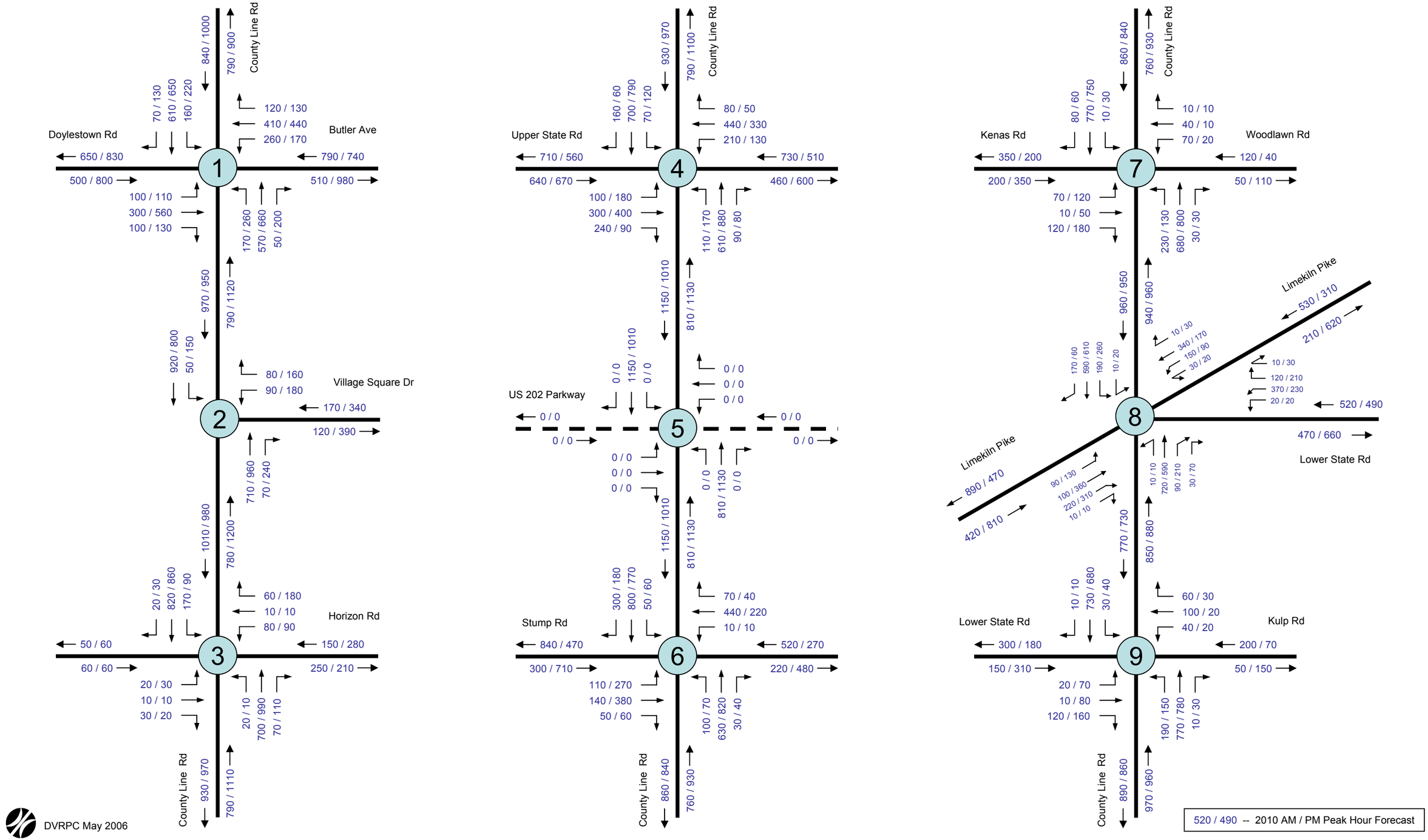

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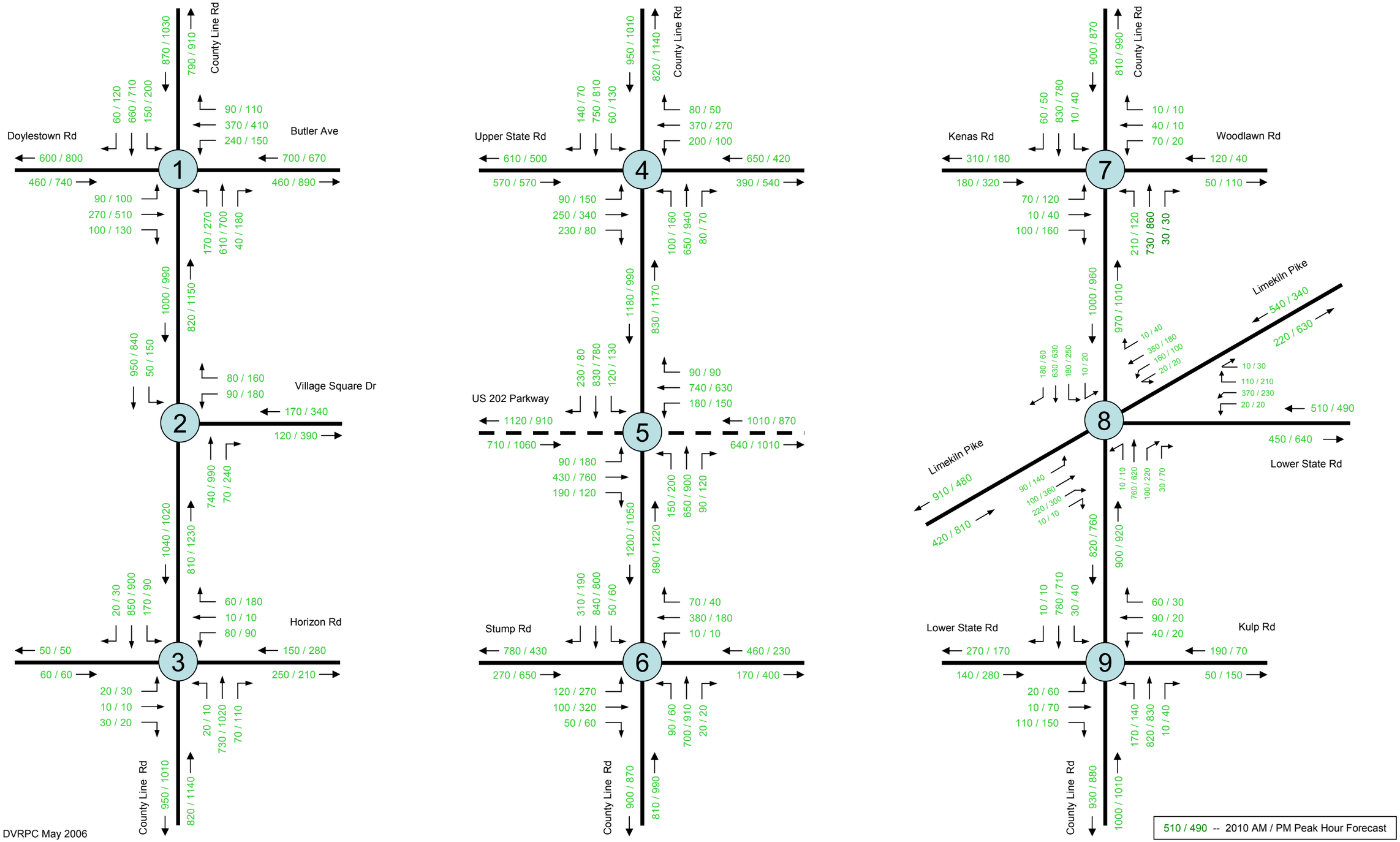
Figure 8C. 2010 Peak Hour Volumes for the Widen County Line Road with Parkway Alternative



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D. 2030 Peak Hour Forecasts

Figure 9A displays the 2030 AM and PM peak hour traffic volumes under the No-Build Alternative; Figure 9B shows these same intersections under the Widen County Line Road Alternative; and Figure 9C provides the peak hour traffic forecasts for the Widen County Line Road with Parkway Alternative.

Along County Line Road in the AM peak hour, northbound volumes under the No-Build Alternative range from 780 to 1,000 vehicles per hour. As with current conditions, the highest volume occurs south of the intersection with Lower State and Kulp roads. Southbound volumes range from 730 to 1,150 vph. Most locations have their higher volume in the southbound direction during the AM peak hour. The highest volume continues to occur between Upper State and Stump roads. The highest volumes tend to occur during the PM peak hour in the northbound direction. These volumes range from 900 to 1,220 vph. Southbound PM peak hour volumes are between 700 and 1,100 vph. The highest 2030 peak hour volumes on intersecting facilities under the No-Build Alternative occur on Doylestown Road/Butler Avenue, where peak hour volumes range from 530 to 1,090 vph; Upper State Road, with volumes of 610 to 910 vph; and PA 152, with peak hour volumes between 260 and 1,070 vph.

Under the Widen County Line Road Alternative, peak hour volumes along County Line Road are higher than the corresponding volumes under the No-Build Alternative. During the AM peak hour, northbound volumes range from 870 to 1,230 vph, while southbound volumes are between 950 and 1,440 vph. In the southbound direction, only the links just north of Doylestown Road/Butler Avenue and just south of PA 152 have volumes less than 1,100 vph. PM peak hour volumes in the northbound direction are between 1,010 and 1,470 vpd. From Stump Road to Village Square Drive, these volumes are all greater than 1,400 vph. In the southbound direction, PM peak hour volumes range from 950 to 1,270 vph. Again, the highest volumes are between Village Square Drive and Stump Road. Peak hour volumes on intersecting facilities are only slightly higher under the Widen County Line Road Alternative than they are under the No-Build Alternative. However, as was the case with the 2010 projections, these differences are typically less than 50 vph.

During the AM peak hour, 2030 volumes on County Line Road under the Widen County Line Road with Parkway Alternative will be between 910 and 1,350 vph in the northbound direction and between 1,000 and 1,530 vph in the southbound direction. In the northbound direction, the highest volumes occur in the area just south of Lower State Road to Woodlawn Road, while the highest volumes in the southbound direction occur between Upper State and Stump roads. During the PM peak hour, northbound volumes will range from 1,260 to 1,590 vph and southbound volumes will be between 1,030 and 1,460 vph. Volumes on many cross streets will be significantly lower than they would be under the Widen Upper State Road Alternative during the AM and PM peaks. Doylestown Road/Butler Avenue volumes will be between 60 and 120 vph lower and Upper State Road volumes will be 140 to 210 vph lower under this alternative.

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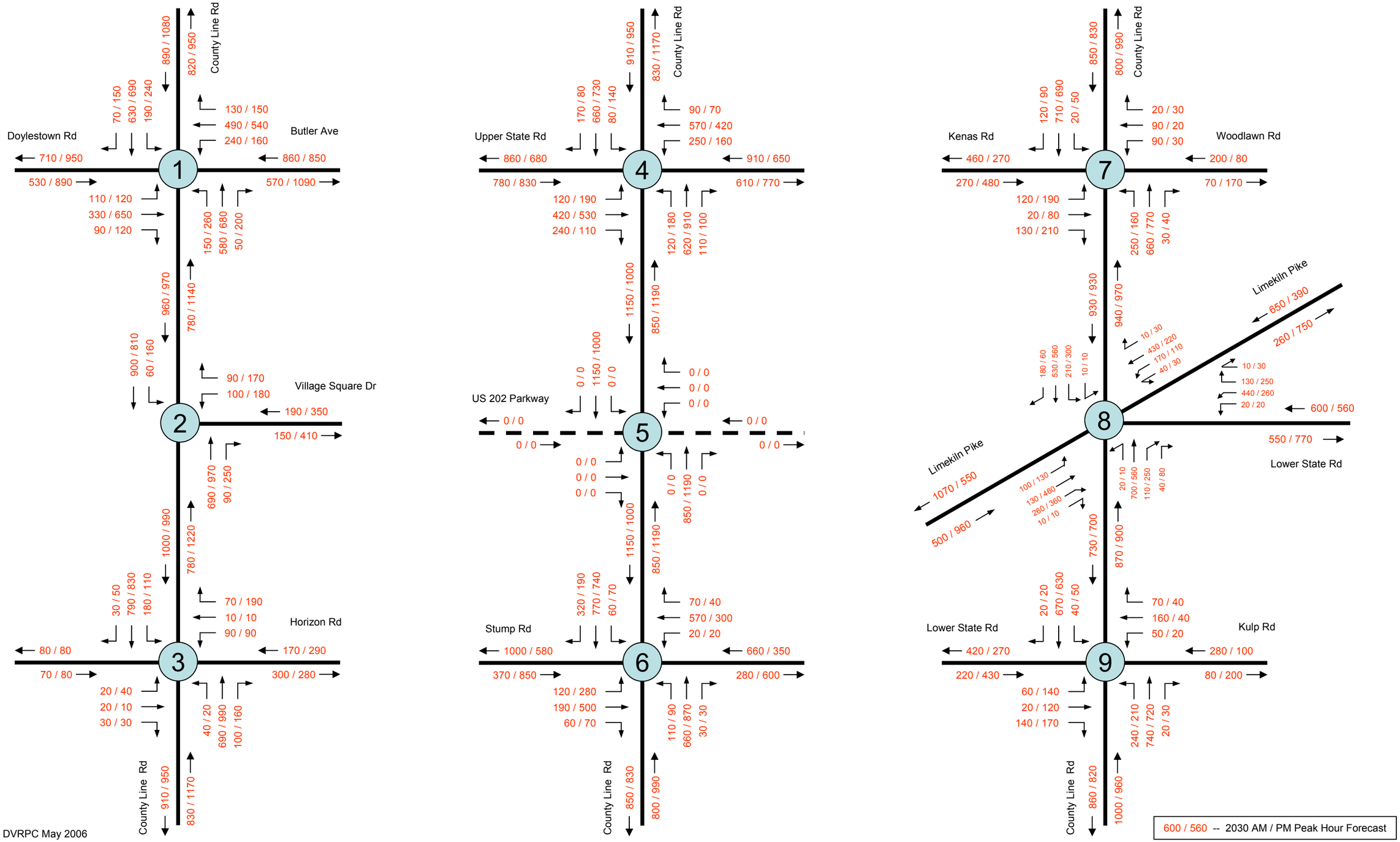
Figure 9A. 2030 Peak Hour Volumes for the No-Build Alternative



600 / 560 -- 2030 AM / PM Peak Hour Forecast

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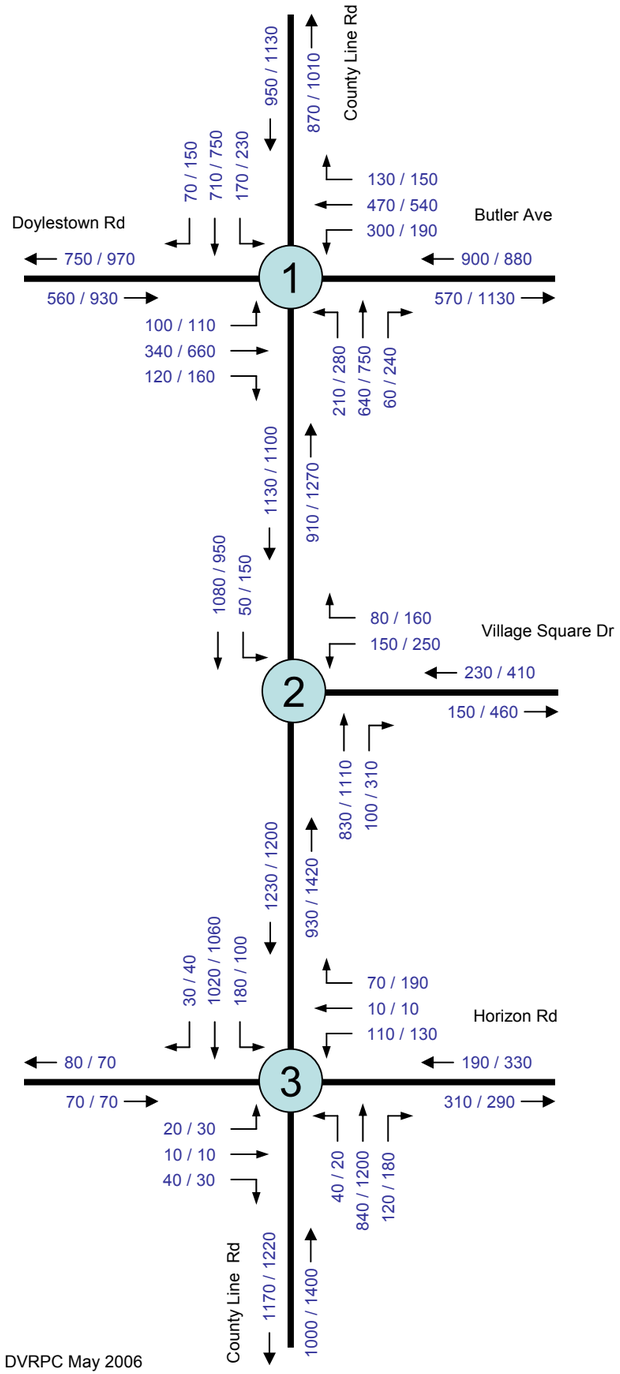
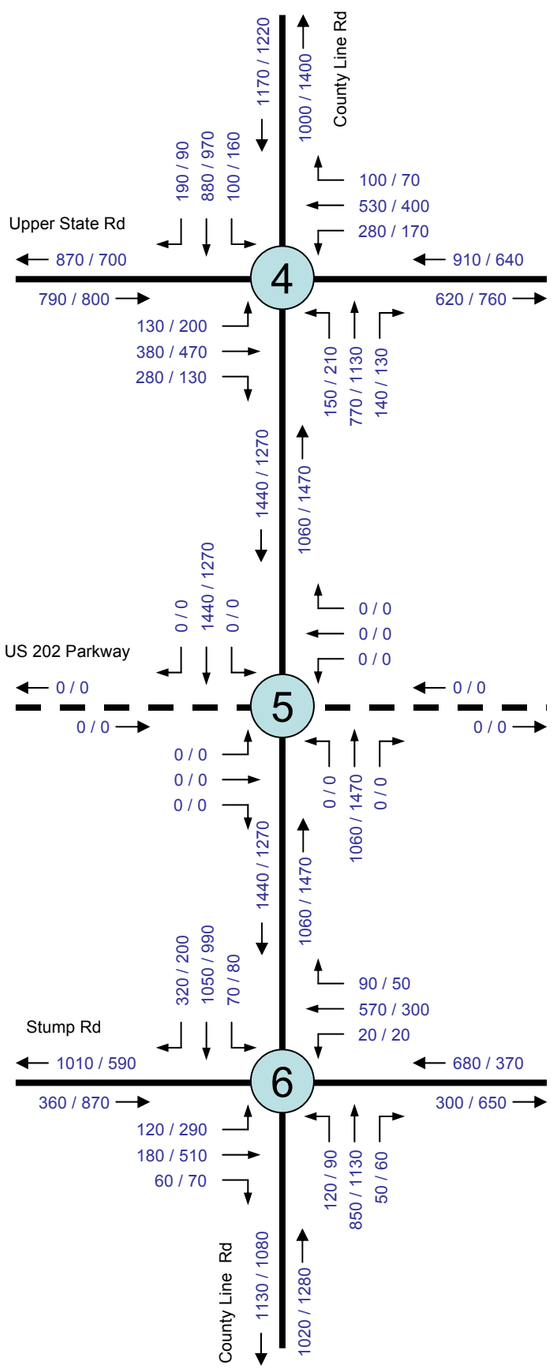
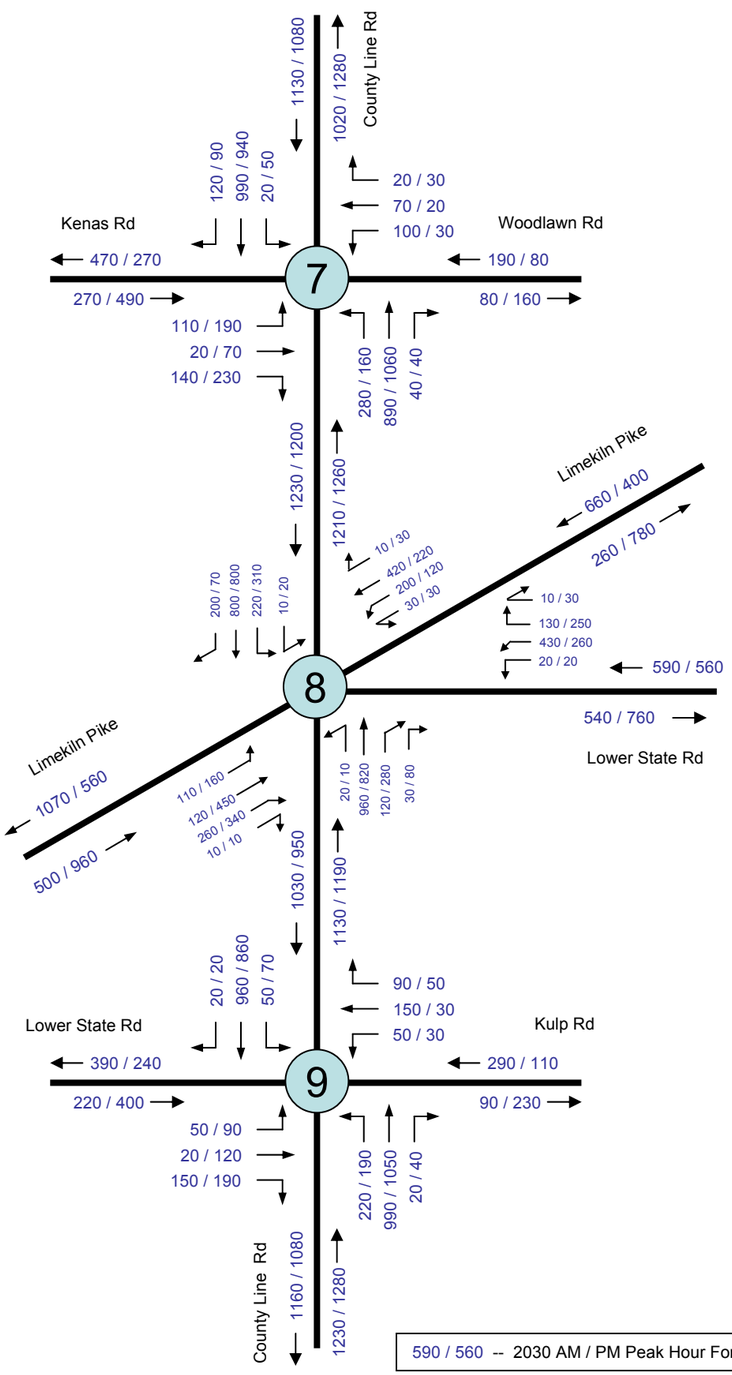
Figure 9B. 2030 Peak Hour Volumes for the Widen County Line Road Alternative







590 / 560 -- 2030 AM / PM Peak Hour Forecast

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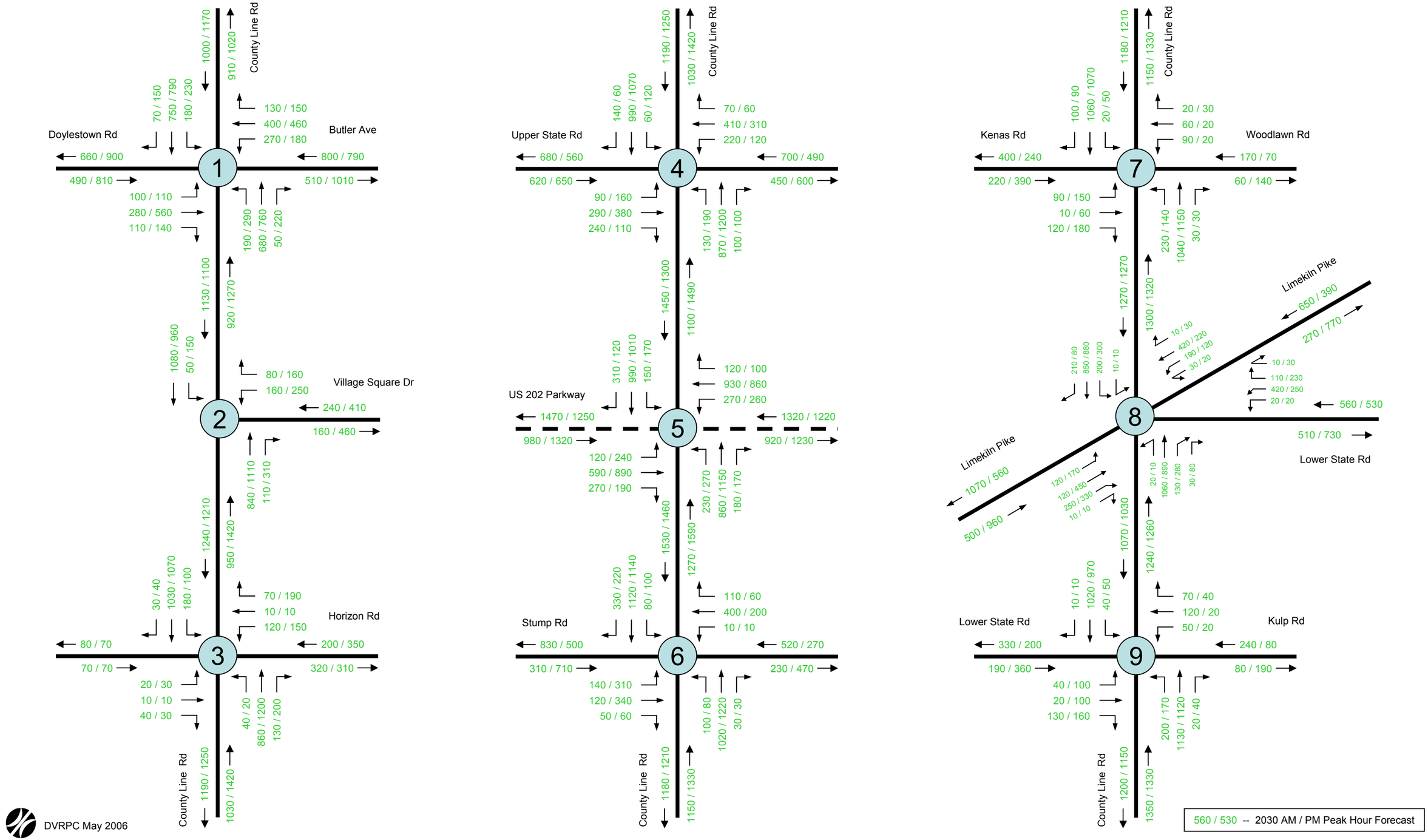
Figure 9C. 2030 Peak Hour Volumes for the Widen County Line Road with Parkway Alternative



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560 / 530 -- 2030 AM / PM Peak Hour Forecast

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VI. CONCLUSIONS

County Line Road is currently a two-lane facility between Doylestown Road/Butler Avenue (US 202) in New Britain and Montgomery townships and Lower State/Kulp roads in Warrington and Horsham townships. Nevertheless, current daily traffic volumes along this portion of County Line Road range from 14,200 vehicles per day (vpd) to 22,900 vpd.

The study area surrounding this portion of County Line Road is projected to increase its population by 23 percent, or 38,500 residents, between 2005 and 2030. The study area will also add nearly 32,000 new jobs, an increase of 28 percent, during this time period.

Future traffic forecasts were evaluated for three different highway network alternatives: a No-Build Alternative, the Widen County Line Road Alternative, and the Widen County Line Road with Parkway Alternative. Under the No-Build Alternative, volumes on County Line Road are projected to be between 16,300 and 24,600 vehicles per day (vpd) by 2010 and between 19,300 and 27,100 vpd by 2030.

Widening County Line Road increases traffic volumes more than the No-Build Alternative. The Widen County Line Road Alternative results in 2010 daily traffic volumes of 19,200 to 26,300 vpd and 2030 volumes of 22,100 to 33,700 vpd on County Line Road. However, this represents a significant reduction in traffic volumes per lane, compared to the No-Build Alternative. Daily volumes on the facilities that intersect with County Line Road are similar to the No-Build traffic volumes.

The Widen County Line Road with Parkway Alternative results in somewhat higher traffic volumes along County Line Road, although traffic volumes on crossing streets are generally lower under this alternative, than they are under both the Widen County Line Road and No-Build alternatives. The Widen County Line Road with Parkway Alternative results in 2010 traffic volumes between 19,500 and 28,500 vpd, and 2030 volumes ranging from 22,300 to 37,900 vpd along County Line Road.

Peak hour volumes in 2010 under the No-Build Alternative are approximately 50 to 100 vph higher than the current volumes and approximately 150 to 250 vph higher in 2030. Under the Widen County Line Road Alternative, 2010 AM and PM peak hour volumes are approximately 100 to 150 vph higher than the corresponding volume under the No-Build Alternative. These differences become somewhat larger by 2030. Peak hour volumes on County Line Road under the Widen County Line Road with Parkway Alternative will be slightly higher than under the Widen County Line Road Alternative. However, the volumes on the cross streets will be significantly lower under the Widen County Line Road with Parkway Alternative.

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County Line Road Traffic Study

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Geographic Area Covered: The municipalities of Chalfont Borough, Doylestown Borough, Doylestown Township, Hilltown Township, New Britain Borough, New Britain Township, Silverdale Borough, and Warrington Township in Bucks County and Hatfield Borough, Hatfield Township, Horsham Township, Lansdale Borough, and Montgomery Township in Montgomery County

Key Words: County Line Road, Traffic Forecasts, Travel Simulation, AADT, Peak Hour Volumes, Intersection Turning Movements.

ABSTRACT

This report documents 2010 and 2030 traffic forecasts for the County Line Road corridor between US 202 (Doylestown Road/Butler Avenue). Average daily and AM and PM peak hour forecasts are provided for a No-Build and two Build alternatives and compared to current volumes.

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