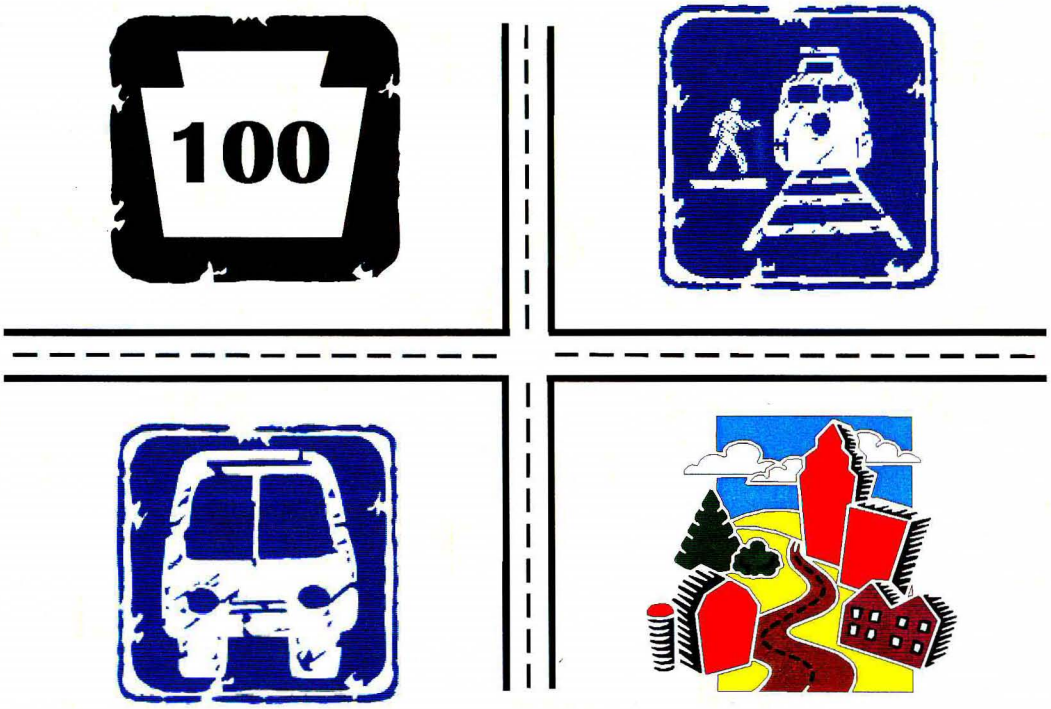
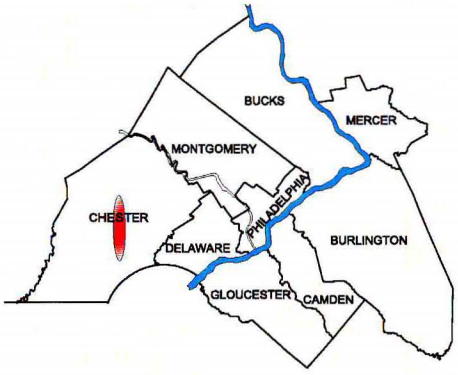


PA 100 Corridor Study



YEAR 2020 PLANNING CORRIDORS
REPORT 2

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

PA 100 Corridor Study

YEAR 2020 PLANNING CORRIDORS
REPORT 2

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The preparation of this report was funded through federal grants from the U.S. Department of Transportation's Federal Highway Administration (FHWA) and Federal Transit Administration (FTA), the Pennsylvania Department of Transportation, and 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.

Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties as well as the City of Philadelphia in Pennsylvania and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Commission is an advisory agency which divides its planning and service functions between the Office of the Executive Director, the Office of Public Affairs, and three line Divisions: Transportation Planning, Regional Planning, and Administration. DVRPC's mission for the 1990s is to emphasize technical assistance and services and to conduct high priority studies for member state and local governments, while determining and meeting the needs of the private sector.

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.

DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title:	PA 100 Corridor Study	Date Published:	January 1998
		Publication No.	98002

Geographic Area Covered: West Vincent, Upper Uwchlan, Uwchlan, West Whiteland, and West Goshen townships in central Chester County, Pennsylvania

Key Words: transportation corridor, development centers, journey to work, mobility alternatives, regional travel demand forecasting, capital improvement plan, transportation demand management, growth management, congestion management systems, transportation improvement program

ABSTRACT

This report documents a comprehensive land use and transportation evaluation of the 13-mile long PA 100 corridor in central Chester County, Pennsylvania. The work augments planning activities conducted independently by the five corridor municipalities through adoption of a multi-modal corridor perspective, application of regional planning initiatives (PA Congestion Management Systems, Mobility Alternatives Programs, etc.) and use of regional evaluation procedures (the regional travel demand forecasting model).

A total of 48 highway, public transportation, travel demand management and intelligent transportation systems improvements are enumerated to directly solve current and future mobility problems identified in and around the corridor. These are enveloped into a recommended Capital Improvement Plan for the corridor, totaling $635 million. The capital recommendations are complemented with a comprehensive list of growth management and travel demand management actions which are also necessary to maintain mobility in the corridor.

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1 EXECUTIVE SUMMARY

This report presents the results of a comprehensive land use and transportation evaluation of the PA 100 corridor, from Horseshoe Trail Road to US 322, in central Chester County, Pennsylvania.

The effort was undertaken as a by-product of the long range transportation plan for the region (*Direction 2020 Plan*), wherein it is recommended that high priority corridors facing emerging problems — such as rapid suburbanization, inadequate public transportation and increasing traffic congestion — be subjected to more refined evaluations with the participation of local governments within the corridor.

The Delaware Valley Regional Planning Commission's (DVRPC) Board of Commissioners directed staff to conduct an assessment of a 13 mile long segment of PA 100 traversing West Vincent, Upper Uwchlan, Uwchlan, West Whiteland and West Goshen townships where the concerns have been further elevated since the opening of the Exton Bypass (US 30) in December 1995. Even before the Bypass, between 1980 and 1990, population and employment growth in the corridor outpaced that of the entire county. (Chester County demonstrated the highest changes in these demographics throughout the Delaware Valley Region.)

The corridor is characterized by mature and new suburban development south of the Pennsylvania Turnpike and rural landscapes north of the Turnpike. Its major transportation spine — PA 100, an arterial highway — serves as the only north-south continuous access route through central Chester County. Undesirable traffic congestion conditions are regarded to exist throughout the central portion of the corridor as a consequence of the development activity levels present there. To address some of the problem, a joint Uwchlan Township / Pennsylvania Department of Transportation (PennDOT) widening project is underway to increase PA 100's cross section from four lanes to six lanes between the Turnpike entrance and the Gordon Drive intersection (approximately 1.5 miles of the 7.5 mile congested segment).

Other plans and projects, in varying stages of readiness, are also being sponsored to address traffic congestion and mobility limitations on the public transportation system in the corridor. However, these actions have been identified independently and are being implemented on a piecemeal basis, largely without coordination or systematic evaluation. As suburbanization intensifies and creeps northward in the corridor, travel to and through the corridor will escalate. Locations which are presently isolated bottlenecks in the north will multiply and converge into congested segments — indicating that this comprehensive review of the corridor is now warranted.

In conducting this study, DVRPC augmented local independent planning initiatives by examining PA 100 as a continuous 13 mile long corridor, estimated the demographic change associated with growth portrayed in municipal planning studies, and performed regional travel simulations for a 1996 Base Year condition and two future Year 2020 transportation improvement investment scenarios (Limited-Build and Full-Build) — to identify the infrastructure needed to support orderly growth in the corridor.

A multi-jurisdictional Study Steering Committee was established to guide the work. Representation from each corridor municipality, the Chester County Planning Commission, PennDOT, the Pennsylvania Turnpike Commission, the Transportation Management Association of Chester County (TMACC), the Central Chester County Chamber of Commerce, Southeastern Pennsylvania Transportation Authority (SEPTA), Krapf's Transit Inc., among others directed the technical activities performed by DVRPC.

Considerable effort was directed in the study to quantify the demographic changes associated with the addition of 6,700 housing units, 2,500,000 square feet of retail, and 11,400,000 square feet of office and light industrial use foreseen in the corridor. Resulting from this effort it is estimated that an additional 19,100 residents and 35,400 jobs will join the corridor's 1995 demographic base — representing a 34 percent increase in population and an 88 percent increase in employment. Uwchlan, West Whiteland and West Goshen will experience most of the growth. The demographic surcharges were subsequently used as inputs to the Year 2020 travel simulation exercises performed for the modeling component of the study.

The initial future year travel simulation assumed that a selected set of committed transportation improvements are implemented in the vicinity of the study corridor (Year 2020 Limited-Build). These include: selective widening along PA 100, between the Bypass and Shoen Road and between Gordon and the Turnpike; widening US 202 - section 400; provision of a new end of the line train station at Thorndale, and increased levels of service along the R5 Regional Rail Line provided to the Exton, Whitford, Downingtown and Thorndale stations.

Performance statistics emanating from the Year 2020 Limited-Build travel simulation indicated that, compared with the simulated 1996 Base Year condition, a 35 percent increase in daily highway vehicle miles traveled and a nine percent increase in daily transit boardings will ensue throughout the study corridor.

Assessment of Limited-Build traffic volumes at selected monitoring locations along PA 100 indicated that: four lanes for through travel, with the widening provided in

part by bypasses, will be needed on PA 100 through the Ludwigs Corner and the Village of Eagle development centers; a two lane cross section will generally be sufficient north of Ludwigs Corner, and between the Ludwigs Corner and Eagle development centers; a continuous six lane cross section will be necessary from the Turnpike entrance to the Exton Bypass supplemented with a "ring road" network surrounding the Lincoln Highway intersection, and; four travel lanes will be necessary south of the Bypass to US 322, which will require widening along the portion of PA 100 within West Goshen Township. The corridor widening alone will not be sufficient to acceptably accommodate all volume. Therefore, active travel demand management (TDM) measures and ridesharing programs will also be required within West Whiteland and West Goshen townships.

The Year 2020 Full-Build travel simulation assumed the network and demographics associated with the Limited-Build scenario as well as the recommendations emanating from Limited-Build alternative's assessment. Additionally, a wider set of improvements were added for the Full-Build modeled network, including: continuous widening of PA 100 to four lanes between Ludwigs Corner and Eagle; widening of US 202 in sections 100 and 300, widening the Lincoln Highway to four continuous through lanes between US 202 and the Exton Bypass / Coatesville-Downingtown Bypass interchange, two new ramps in US 202 section 200, and; a new cross township connector roadway in West Goshen. Public transportation improvements include construction of the Glenloch train station served by the R5 line and four new public bus routes, including the "West Whiteland Circulator".

Performance statistics emanating from the Year 2020 Full-Build travel simulation indicated that, compared with the simulated 1996 Base Year condition, a 36 percent increase in daily highway vehicle miles traveled (or one percent increase over the Limited-Build scenario) will ensue. Daily transit boardings are estimated to rise about 34 percent throughout the study corridor in comparison to the Base Year scenario (or 23 percent higher than the results of the Limited-Build alternative).

Assessment of Full-Build scenario traffic volumes at selected monitoring locations along PA 100 indicated that the identified complement of improvements are generally appropriate to accommodate traffic volume in the corridor. However, travel demand management strategies and actions are again seen as necessary to extend the serviceability of the capital improvements — with the greatest needs demonstrated in Uwchlan, West Whiteland and West Goshen.

Ultimately, 48 individual projects are recommended as a result of the work. The recommendations adopt the set of improvements identified in the Full-Build alternative as the most appropriate set for accommodating travel and growth needs for the broad study area. The projects are subdivided into highway improvements

(35 projects), transit improvements (7 projects), rideshare and transportation demand management improvements (4 projects) and intelligent transportation system improvements (2 projects). The recommendations are arrayed into a capital improvement plan (CIP) for the corridor which cites: project priorities based upon need and deliverability; order of magnitude project cost estimates; project funding status, and; project sponsors. Project priorities and funding elements are framed within four stages (immediate, near, medium and long terms) to coincide with the development of regional, State and federal planning and programming instruments.

A summary of the CIP is shown below.

SUMMARIZED
CAPITAL IMPROVEMENT PLAN

STAGING / COST ESTIMATE (000'S)

IMPROVEMENT CATEGORY	Immed. Term	Near Term	Medium Term	Long Term	Totals
Highway	$ 243,145	$ 44,310	$ 119,860	$ 198,600	$ 605,915
Transit	$ 5,415	$ 3,000	$ 4,485	---	$ 12,900
Rideshare / TDM	$ 270	$ 200	$ 12,280	$ 320	$ 13,070
ITS	$ 1,100	$ 300	$ 2,000	---	$ 3,400
Totals	$ 249,930	$ 47,810	$ 138,625	$ 198,920	$ 635,285

Immediate term improvements (0 to 2 years) are, for the most part, projects which are in or are imminent for construction. Funding commitments, from public and private sector sources, have been identified for 99 percent of the immediate term program needs (1 percent unfunded).

The near term program of improvements (3 to 7 years) include projects, or phases thereof, which coincide with impending updates to DVRPC's Transportation Improvement Program (TIP), and the first four years of the PennDOT Twelve Year Program (STIP). Eleven percent of the near term program amount is attributed to committed public and private sector sources (89 percent unfunded).

The medium term set of improvements (8 to 14 years) coincides with the remaining

program years of a subsequent PennDOT Twelve Year Program. Three percent of the implementation cost for the medium term improvement program are attributed to commitments of the private sector (97 percent unfunded).

The long term program of improvements (15 to 22 years) rounds-out the completion and update of DVRPC's long range transportation plan for the region (Year 2020 Transportation Plan). From a practical stand point, the long term portion of the CIP remains completely unfunded (100 percent unfunded).

It should be noted that the summary CIP table and the immediately preceding financial discussion belies the fact that 45 projects (94 percent of the CIP's total) are located directly within the study corridor, but account for only 16 percent of the plan's funds (approximately $103 million). The remaining three projects and funds ($532 million) are devoted to improvements along US 202 (sections 100, 300 and 400) — which enhance mobility in the broad vicinity of the study corridor.

More detail on project breakdowns and the financial aspects of the capital plan can be obtained by reviewing Table 21 - the CIP (on page 125), and the plan's financial summary - Table 21 (on page 139) in the body of the main report.

Complementing the capital improvement plan, in the study's recommendations, are a broad set of management actions which emphasize transportation demand management and growth management as tools to extend mobility in the corridor. Roles and responsibilities are identified for a full range of programmatic and institutional actions to be implemented regionally, locally, publicly and privately.

Together the capital improvements and the management measures represent a comprehensive and unified implementation strategy — designed to serve sub-regional and the PA 100 corridor's needs. □

2 INTRODUCTION

As part of DIRECTION 2020, the Delaware Valley Regional Planning Commission's (DVRPC) regional long-range plan, comprehensive land use and transportation planning initiatives for the year 2020 were undertaken throughout the region. A product of that effort indicated that high priority corridors facing emerging problems — such as rapid suburbanization, inadequate public transportation and increasing traffic congestion — be subjected to more refined evaluations with the participation of local governments within the corridor.

The PA 100 corridor, traversing West Vincent, Upper Uwchlan, Uwchlan, West Whiteland and West Goshen townships in central Chester County, has been selected as one such corridor. Three key factors contributed to the selection of PA 100 between Horseshoe Trail Road, in West Vincent, and US 322, in West Goshen, as the detailed study corridor.

1) Many independent transportation, traffic and land use planning initiatives have already been undertaken at the municipal level.
2) Second, the Chester County Planning Commission has identified PA 100 as one of three priority corridors in its *"Long Range Strategic Plan for Major Highway Corridors"*. Of the three, PA 100 is the only corridor which has not been incorporated into PennDOT's formal project development process.
3) The Exton Bypass (US 30), upon its opening in December 1995, completed a gap in the regional expressway network. This connection has increased mobility and accessibility for areas surrounding PA 100's interchange with the Bypass. As a consequence, concerns about altered traffic patterns and new congestion locations needed to be addressed.

In conducting this study, DVRPC augmented local planning efforts by examining PA 100 in a continuous 13-mile long corridor. Additionally, DVRPC used regional planning initiatives and evaluation procedures in the effort. The study draws from the findings of the DIRECTION 2020 Plan, and current in-house planning efforts such as the Pennsylvania Congestion Management Systems (PA CMS), the Mobility Alternatives Program (MAP) and livable communities studies so that land use-transportation linkages and multi-modal perspectives are integrated into the evaluation. Lastly, the PA 100 Corridor Study employed the regional travel model to perform travel simulation for a base year condition and two future year investment scenarios.

A variety of exercises were performed with the regional model, which yields performance data, to assess the adequacy of the study area transportation network for each of the tested alternatives.

To guide the work, DVRPC established a collaborative steering committee composed of governmental jurisdictions, key operators and institutional entities located within the corridor (membership on the Study Steering Committee is enumerated in the Appendix). Ultimately, the PA 100 Corridor Study results in a comprehensive and unified implementation strategy — consisting of a capital improvements plan and management actions — to serve sub-regional needs. Appropriate elements of the implementation strategy will serve as updates to the Long Range Plan and/or will be cited as candidate recommendations of the parent plans and programs (PA CMS, MAP, and the Transportation Improvement Program — TIP).

WORK PROGRAM

The following activities were undertaken in order to complete the PA 100 Corridor Study.

1) Obtain instruction from the DVRPC Board of Commissioners regarding the appropriate corridor for consideration.
2) Establish and provide administrative and technical support for a corridor planning steering committee.
3) Use recommendations of the various management systems (as available), land use and transportation planning efforts and steering committee input to critique and supplement the recommendations of the regional plan.
4) Develop a focussed transportation network to perform travel simulation / modeling within the detailed study area.
5) Prepare and evaluate alternate land use conditions (versus the population and employment forecasts of DIRECTION 2020) as the basis for modeling future travel conditions within the study corridor.
6) Test alternate future travel scenarios to determine the set of facilities needed to serve the corridor.
7) Develop a final set of recommended land use conditions and transportation improvements for the corridor.
8) Coordinate the corridor plan with affected local governments, operating agencies and other groups as may be needed.

THE REPORT

This report summarizes the undertakings and findings of the work program through the preparation of the recommendations for the PA 100 corridor. Chapters 3 and 4, respectively, describe the regional setting surrounding the corridor and existing conditions within the corridor. Chapter 5 details the steps taken and results produced in simulating base year and future year travel demands in the corridor.

Chapter 6 summarizes the recommendations emanating from the study and details its improvement plan. Chapter 7 describes implementation practices to achieve the plan. □

3 REGIONAL SETTING

PA 100 is an arterial highway located in the western suburbs of the region (Figure 1). It is oriented circumferentially to the region's core — Center City Philadelphia. It "enters" the region in the north at the Berks County / Montgomery County boundary, and "exits" to the south into the State of Delaware. Between those limits, PA 100 serves as the only north-south arterial access route through central Chester County.

The 13-mile long study corridor lies at the center of its regional alignment and encompasses the municipalities of West Vincent, Upper Uwchlan, Uwchlan, West Whiteland and West Goshen townships.

Landscapes along PA 100 vary considerably. Rural conditions, new and/or mature suburban settings and densely developed boroughs / outlying business districts characterize different portions of PA 100's alignment. Regional development centers[1] that influence corridor travel include: West Chester, Downingtown, Pottstown, Lionville, Exton, Great Valley, King of Prussia, Pottstown, and the City of Philadelphia.

Access to and beyond these activity centers is afforded by a network of freeways, principal arterial highways, and intercity and regional rail services.

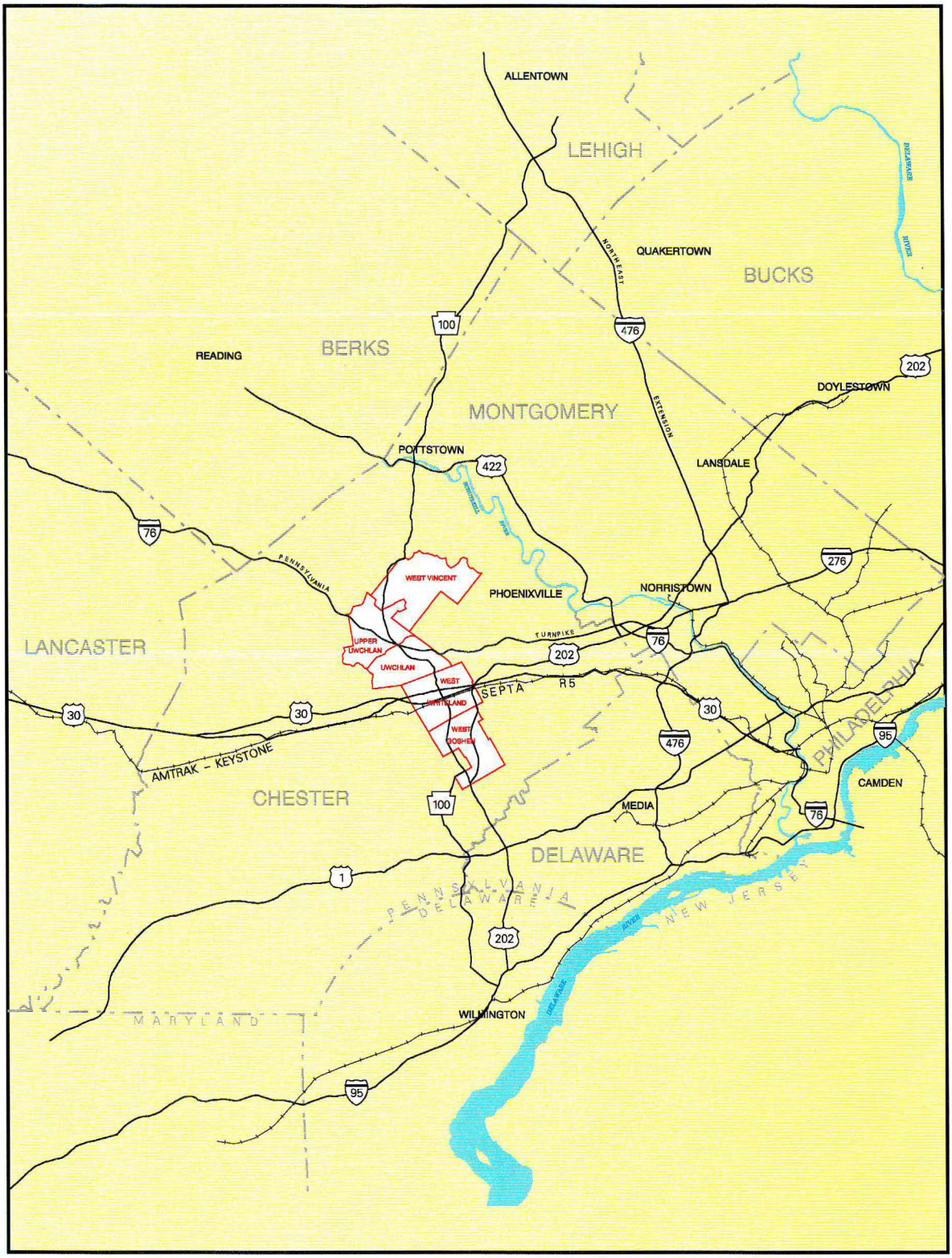
HIGHWAY FACILITIES

Freeways providing mobility in the vicinity of the study corridor include the Pennsylvania Turnpike (I-76), US 202 and US 30 (the Exton Bypass and the Coatesville-Downingtown Bypass).

The Turnpike is a four lane, toll highway providing high levels of mobility for long distance trips to/from the east, west and north. The Turnpike's Downingtown Interchange (interchange #23) is situated in the middle of the PA 100 study corridor and allows for direct movement between the two highways. The nearest neighboring interchanges are 14 miles to the east and west.

[1] Development centers are concentrations of and foci for dense development, typically, offering and mixing opportunities for shopping, employment, entertainment, etc..

PA 100 CORRIDOR STUDY



DELAWARE VALLEY
REGIONAL PLANNING COMMISSION
JANUARY 1998

FIGURE 1:
REGIONAL SETTING

STUDY CORRIDOR

US 202 skirts the study corridor on the southeast. It provides four lanes of limited access mobility between West Chester, to the south, and King of Prussia, to the east. Interchanges in the vicinity of the study corridor are located at PA 401, US 30, Boot Road, the PA 100 Connector Highway, US 322 (the West Chester Bypass), Paoli Pike and PA 3 (West Chester Pike).

US 30 is an east-west, four lane, limited access facility. With the completion of US 30's Exton Bypass (at the end of 1995) — in combination with the Coatesville-Downingtown Bypass, US 202 and the Schuylkill Expressway (I-76) — uninterrupted highway travel is now possible directly from the study corridor to the western limits of Chester County and/or eastward to Central Philadelphia and South Jersey. US 30's interchanges within the study corridor are at Lincoln Highway (Business Route 30), PA 100, and US 202.

Principal arterial highways serving study area travel, include: PA 100, PA 401, PA 113, the Lincoln Highway (Business Route 30), US 202 and US 322. PA 100 varies from two lane undivided conditions to four lane controlled access conditions. A portion of PA 100, within Uwchlan Township, is currently being widened to six lanes.

PA 401 is a two lane, uncontrolled highway linking the northern study corridor with the western reaches of Chester County and with US 202 on the east.

PA 113 traverses the study corridor on a southwest to northeast axis, connecting Downingtown, Lionville and Phoenixville. While a two lane cross section characterizes most of its regional alignment, through the study corridor PA 113 generally offers two through travel lanes in each direction.

The Lincoln Highway provides for local east-west travel between the Coatesville, Downingtown and Exton activity centers. The highway varies between a three lane cross section (affording one through lane in each direction plus a center left turn lane) to four lanes (offering two lanes for through travel in each direction).

US 202, below Matlack Street in West Chester to the Delaware state line, is a four lane controlled access principal arterial highway with a median divisor and at-grade signalized intersections.

US 322 skirts the study corridor's southwestern corner and links US 30, Lincoln Highway, Downingtown, West Chester, PA 100 and US 202. The highway provides one through lane in each direction.

RAIL FACILITIES

The broad study area is served by intercity and regional train service oriented radially to Center City Philadelphia. Intercity service is operated by Amtrak which includes the Keystone and the Pennsylvanian trains. The R5 Line (Paoli / Downingtown to Central Philadelphia and Doylestown) is SEPTA's regional rail service within the corridor.

Amtrak's service extends between New York City, Philadelphia, Harrisburg, and Pittsburgh with local station stops at Paoli, Exton and Downingtown. R5 Line station stops, within the broad study area, are at the Paoli, Malvern, Exton, Whitford and Downingtown stations. □

4 EXISTING CORRIDOR CONDITIONS

The subjects which are detailed in this chapter include: corridor demographics according to the 1980 and 1990 Census; existing land use; existing highways and public transportation services; journey-to-work characteristics according to the 1990 Census; an assessment of existing transportation conditions within the corridor, and; a review of the current projects contained within the Transportation Improvement Program.

DEMOGRAPHICS

Chester County was the fastest growing county in the Delaware Valley Region between 1980 and 1990. Analysis of the demographic data contained in Table 1 shows that conditions within the study corridor outpaced the county's rate of growth.

TABLE 1
CORRIDOR DEMOGRAPHIC CHARACTERISTICS: 1980 and 1990

		Population		Autos / Household		Employed Residents		Employment	
Municipality	Area (mi^2)	1980	1990	1980	1990	1980	1990	1980	1990
West Vincent	17.7	1,992	2,262	1.9	2.3	900	1,176	106	145
Upper Uwchlan	10.8	1,805	4,396	1.9	2.3	848	2,278	741	1,876
Uwchlan	10.4	8,364	12,999	1.8	2.1	4,034	7,471	5,829	5,241
West Whiteland	13.0	9,581	12,403	1.8	1.9	5,067	7,034	3,698	14,960
West Goshen	11.9	16,164	18,082	1.7	1.9	8,166	10,203	7,087	14,921
PA 100 Study Corridor	63.8	37,906	50,142	1.8	2.0	19,024	28,162	17,461	37,143
Chester County	756.0	316,641	376,396	1.6	1.9	145,106	198,869	134,265	197,752

sources: statistics from 1980 and 1990 US Census

Between 1980 and 1990, the County experienced a population growth of 19 percent between 1980 and 1990, whereas total population within the study corridor grew by 32 percent. Employed residents within the County have increased from about 145,000 to about 198,900, between 1980 and 1990, a rise of 37 percent. In the corridor, the rate of growth in employed residents was 48 percent during the same period. Most impressive, however, are the increases in employment. Throughout the County, a 47 percent rise in employment took place

between 1980 and 1990. In the study corridor, the increase in employment was on the order of 113 percent.

LAND USE

Figure 2 illustrates land use conditions in the corridor in 1990. The vast study area is predominated by agricultural use, wooded tracts and single family residential subdivisions. On the other hand, strip commercial development borders PA 100 and Business Route 30. Land use north of the Turnpike is primarily rural — typified by farms, farmettes and low density single family homes. South of the Turnpike, conditions are decidedly suburban — characterized by shopping centers, industrial parks and large residential subdivisions consisting of single family and multi-family dwellings.

By stripping away the lower intensity uses from the existing land use map, concentrated nodes of commercial, industrial and higher density residential use become evident. Figure 3 executes this and reveals the corridor's development centers.

Locally important commercial development centers surround the PA 401 intersection (Ludwigs Corner), in West Vincent Township, and the Park Road - Little Conestoga Road - Byers Road intersection (the Village of Eagle), in Upper Uwchlan.

Uwchlan Township's development center (Lionville) surrounds PA 100 from the Pennsylvania Turnpike through the PA 113 intersection. Lionville includes the Pickering Industrial Park, Stoneridge Corporate Center and the Eagleview Corporate Center.

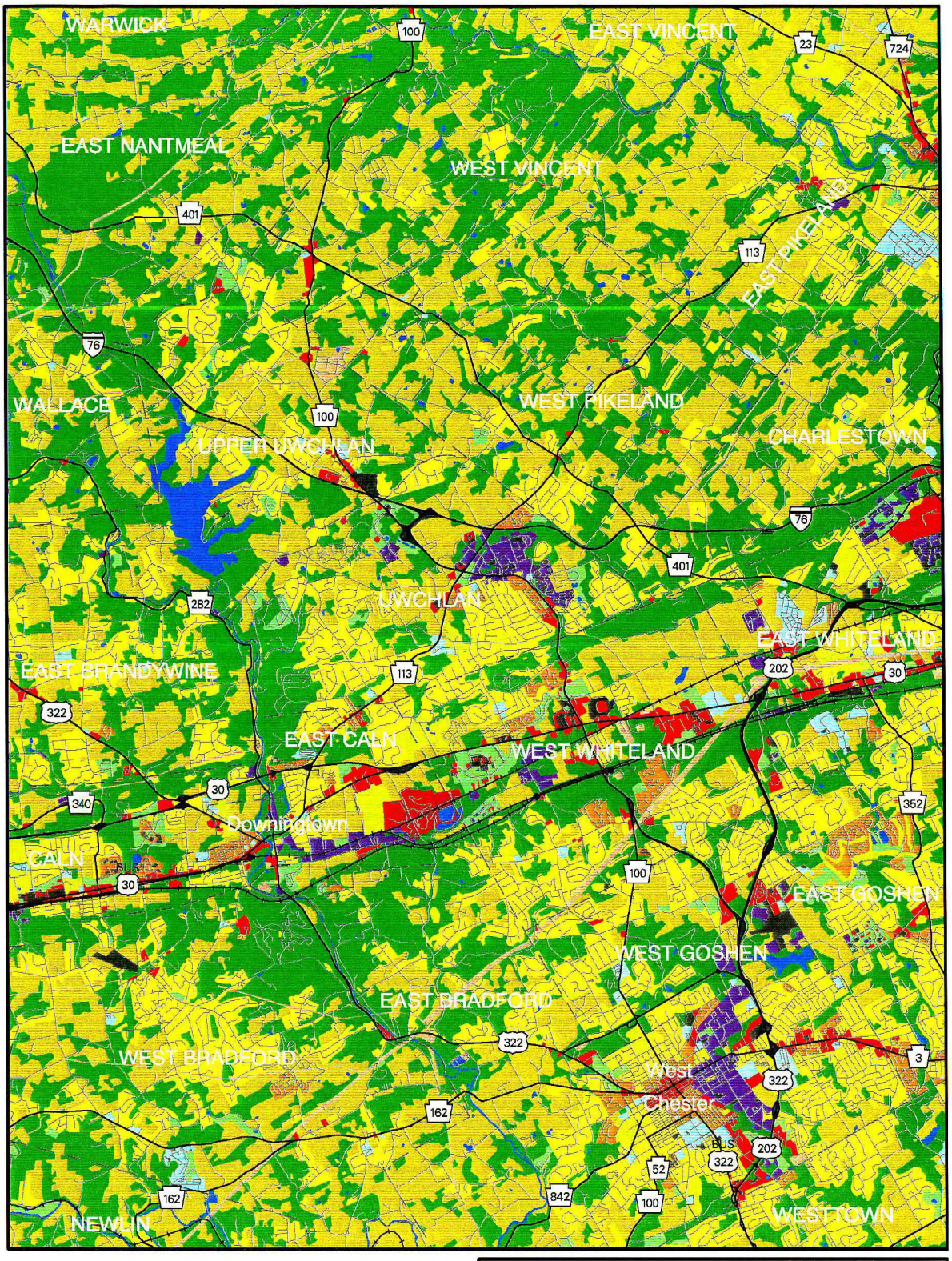
West Whiteland Township's development center (Exton) is formed of large commercial properties radiating along and from the crossroads of PA 100 and the Lincoln Highway. A noteworthy landmark at Exton's crossroads is the Exton Square Mall — a regional mall containing 444,000 square feet of retail floor area.

Other significant development centers within the influence of the study corridor are West Chester and Downingtown.

West Goshen Township is a mature suburban community which serves as a bedroom community for the commercial center of West Chester, and maintains a large employment base in its own right.

Figure 3 also displays the location of major employers within the corridor. These are detailed in Table 2.

PA 100 CORRIDOR STUDY



1 0 1 2 MILES

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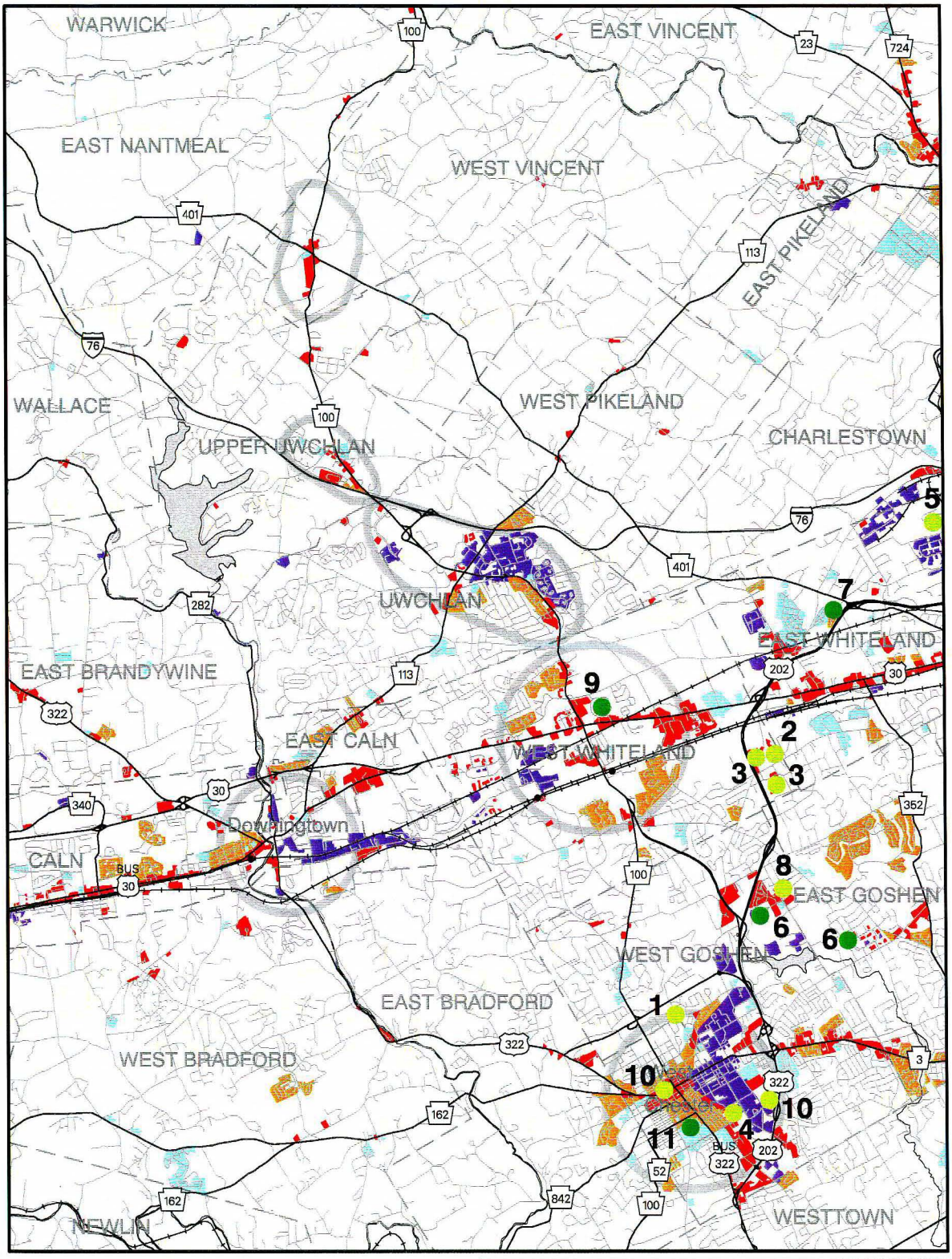
FIGURE 2:
1990 LAND USE

- SINGLE FAMILY (DETACHED)
- MULTI FAMILY
- MANUFACTURING
- TRANSPORTATION
- UTILITY
- COMMERCIAL / SERVICES
- COMMUNITY SERVICE
- MILITARY
- RECREATION
- AGRICULTURE
- MINING
- VACANT
- WOODED
- WATER

PA 100 CORRIDOR STUDY



1 0 1 2 MILES

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FIGURE 3:
DEVELOPMENT CENTERS - 1990

Development Center

EXISTING LAND USE (1990)
- Manufacturing / Industrial
- Community Service
- Commercial / Services
- Multi Family

- Employers With Over 1000 Employees
- Employers With 500-1000 Employees

TABLE 2
MAJOR EMPLOYERS IN THE VICINITY OF PA 100

Fig. 2 ref. #	Company	Services	Local, Full Time Employees
1	Chester County Hospital	Community Hospital	698 employees
2	Johnson-Matthey	Manufacturer	543 employees
3	Roy F. Weston	Environmental Engineering Consultants	833 employees
4	Wyeth-Ayerst Laboratories	Pharmaceutical Company	580 employees
5	Sterling Winthrop	Pharmaceutical Company	500 employees
6	QVC	Cable Shopping Channel	2,031 employees
7	Providian Direct Insurance	Consumer Financial Services	1,300 employees
8	Mars Electronic International	Manufacturer of Electronic Payment Systems	500 employees
9	Exton Square Mall	Regional Shopping Center	1,000+ employees
10	Chester County	County Government Offices	800 employees
11	West Chester University	State University	950 employees

sources: "Largest Chester County Private Sector Employers", 1996 Business List, Philadelphia Business Journal, "Regional Business Directory", Dun & Bradstreet, 1990 - 1992, and discussions with representatives of the Chester County Planning Commission and the Transportation Management Association of Chester County.

HIGHWAYS

Within the northern portion of the study corridor, PA 100 is typically a two lane undivided highway offering one lane for each direction of travel. In the proximity of two hills — one between Font Road and PA 401 and the other north of Horseshoe Trail Road[2] — the cross section has been widened to accommodate a truck passing lane for the up-grade direction of travel. Only the PA 401 intersection, in this four mile long segment, is controlled by a traffic signal. Posted speed limits are 35 to 45 miles per hour.

[2] Horseshoe Trail Road is the northern limit of the detailed study corridor.

From the Turnpike to Boot Road in West Whiteland, an almost six mile stretch, PA 100 is a divided four lane highway providing two travel lanes for each direction of travel[3]. Traffic signals, auxiliary turning lanes and/or jughandles, and median breaks are present at 12 intersections to accommodate turning and crossing traffic movements. The posted speed limit is 45 miles per hour.

South of Boot Road to the boundary between West Whiteland and West Goshen, just over one-half mile in length, PA 100 has a four lane undivided cross section. Entering West Goshen Township, PA 100 narrows to two lanes and maintains that cross section for just over a mile to Grove Road. South of Grove Road to the US 322 interchange (approximately one mile), PA 100 contains three lanes with a center left turn lane supplementing the through travel lane in each direction. Posted speed is 45 miles per hour in this section, and only the Green Hill Road / Sunset Hollow Drive intersection is controlled by a traffic signal.

Other key highway facilities within the study corridor parallel or intersect PA 100. Parallel facilities in the corridor include: Whitford Road, Grove Road, Ship Road, Phoenixville Pike and the PA 100 Connector. Perpendicular highways include PA 401, the Pennsylvania Turnpike (I-76), PA 113, the Lincoln Highway, the Exton Bypass, Boot Road, Green Hill Road and US 322. Table 3 summarizes some of the attributes of these and other study corridor highways.

TABLE 3
CHARACTERISTICS OF MAJOR STUDY CORRIDOR HIGHWAYS

Highway	Limits	Ownership	Functional Classification	Lanes by Direction	Posted Speed (mph)
PA 100	*Horseshoe Trail Rd to PA Turnpike*	PennDOT (SR 0100)	Principal Arterial	1	35 - 45
	PA Turnpike to PA 100 Connector	PennDOT (SR 0100)	Principal Arterial	2	45
	PA 100 Connector to Burke Rd	PennDOT (SR 0100)	Minor Arterial	2	not posted
	Burke Rd to US 322	PennDOT (SR 0100)	Minor Arterial	1	45
PA 401	Vicinity of PA 100	PennDOT (SR 0401)	Major Collector	1	45
Park Rd	Vicinity of PA 100	Upper Uwchlan	Collector	1	35

[3] PA 100 is currently being widened to three through lanes in each direction between the Turnpike interchange and Gordon Drive in Uwchlan Township.

TABLE 3
CHARACTERISTICS OF MAJOR STUDY CORRIDOR HIGHWAYS

Highway	Limits	Ownership	Functional Classification	Lanes by Direction	Posted Speed (mph)
Little Conestoga Rd	Vicinity of PA 100	PennDOT (SR 4016)	Major Collector	1	not posted
Byers Rd	Vicinity of PA 100	PennDOT (SR 1022)	Collector	1	35
PA Turnpike	*Vicinity of PA 100 (Interchange # 23)*	PA Turnpike Commission	Interstate	2	65
PA 113	Vicinity of PA 100	PennDOT (SR 0113)	Minor Arterial	2	35 - 45
Waterloo Blvd	Whitford Rd to PA 100	West Whiteland	Local	1	35
Swedesford Rd	PA 100 to Ship Rd	West Whiteland	Collector	1 - 2	35
Lincoln Highway (Business 30)	US 30 to Whitford Rd	PennDOT (SR 3070)	Principal Arterial	2	45
	Whitford Rd to US 202	PennDOT (SR 3070)	Principal Arterial	1 - 2	45
US 30 (Exton Bypass)	*Business 30 to US 202*	PennDOT (SR 0030)	Freeway/ Expressway	2	not posted
Boot Rd	Whitford Rd to US 322	PennDOT (SR 2020)	Minor Arterial	1	35 - 40
Green Hill Rd	Grove Rd to Phoenixville Pk	PennDOT (SR 2018)	Collector	1	35
US 322 (West Chester Bypass)	*Business 322 to US 202*	PennDOT (SR 0322)	Principal Arterial	1 - 2	not posted
Ship Rd	PA 100 to Boot Rd	PennDOT (SR 1001)	Collector	1	35 - 40
PA 100 Connector Highway	*PA 100 to US 202*	PennDOT (SR 2023)	Freeway/ Expressway	2	not posted
Eagleview Blvd	West of PA 100 and between Sheree Blvd and PA 113	Uwchlan	Collector	2	30
Crump Rd	PA 113 to Whitford Rd	Uwchlan	Collector	1	not posted
Whitford Rd	Crump Rd to Boot Rd	PennDOT (SR 3069)	Collector	1	25 - 30
Grove Rd	Boot Rd to West Whiteland / West Goshen line	PennDOT (SR 3069)	Collector	1	35
	West Whiteland / West Goshen line to PA 100	West Goshen	Collector	1 (note: 1 way nb between PA 100 and Green Hill Rd)	not posted
US 202	*PA 401 to Paoli Pike*	PennDOT (SR 0202)	Freeway/ Expressway	2	not posted

TABLE 3
CHARACTERISTICS OF MAJOR STUDY CORRIDOR HIGHWAYS

Highway	Limits	Ownership	Functional Classification	Lanes by Direction	Posted Speed (mph)
Phoenixville Pike	Boot Rd to US 322	PennDOT (SR 2011)	Minor Arterial	1	40 - 45

NOTE: Italicized cells denote highway segments which are National Highway System (NHS) roadways. NHS routes aim to enhance personal mobility, serve commerce, support economic growth and increase the Nation's competitiveness.

Traffic Volumes

Figure 4 illustrates daily traffic levels occurring along PA 100 and the rest of the study area highway network since 1995. PA 100 experiences daily demands of 12,000 to 13,000 vehicles per day north of Little Conestoga Road. Between Little Conestoga Road and PA 113 daily volume increases to between 20,000 and 30,000. Between PA 113 and the PA 100 Connector Highway, PA 100 serves between 35,000 and 50,000 vehicles per day. South of the Connector Highway, PA 100's average daily traffic volume subsides to about 15,000 vehicles.

Other major facilities within the corridor include the Pennsylvania Turnpike, US 30 (the Exton Bypass), and the Lincoln Highway. Daily traffic loadings on the Pennsylvania Turnpike are between 33,000 and 36,000 vehicles per day. The Exton Bypass carries approximately 48,000 vehicles, to the west of PA 100, and 33,000 daily vehicles, to the east of PA 100. The Lincoln Highway serves between 16,000 and 18,000 vehicles per day.

Evaluation of available in-house traffic count data, covering the period between 1990 and 1995, suggests certain traffic trends were taking place on the study area roadway system prior to the opening of the Exton Bypass. Traffic levels remained fairly steady north of the PA 113 intersection. From PA 113 to the Lincoln Highway, daily volume was rising between one and two percent per year. South of the Lincoln Highway traffic growth was between three percent to five percent per year.

PA 100 CORRIDOR STUDY

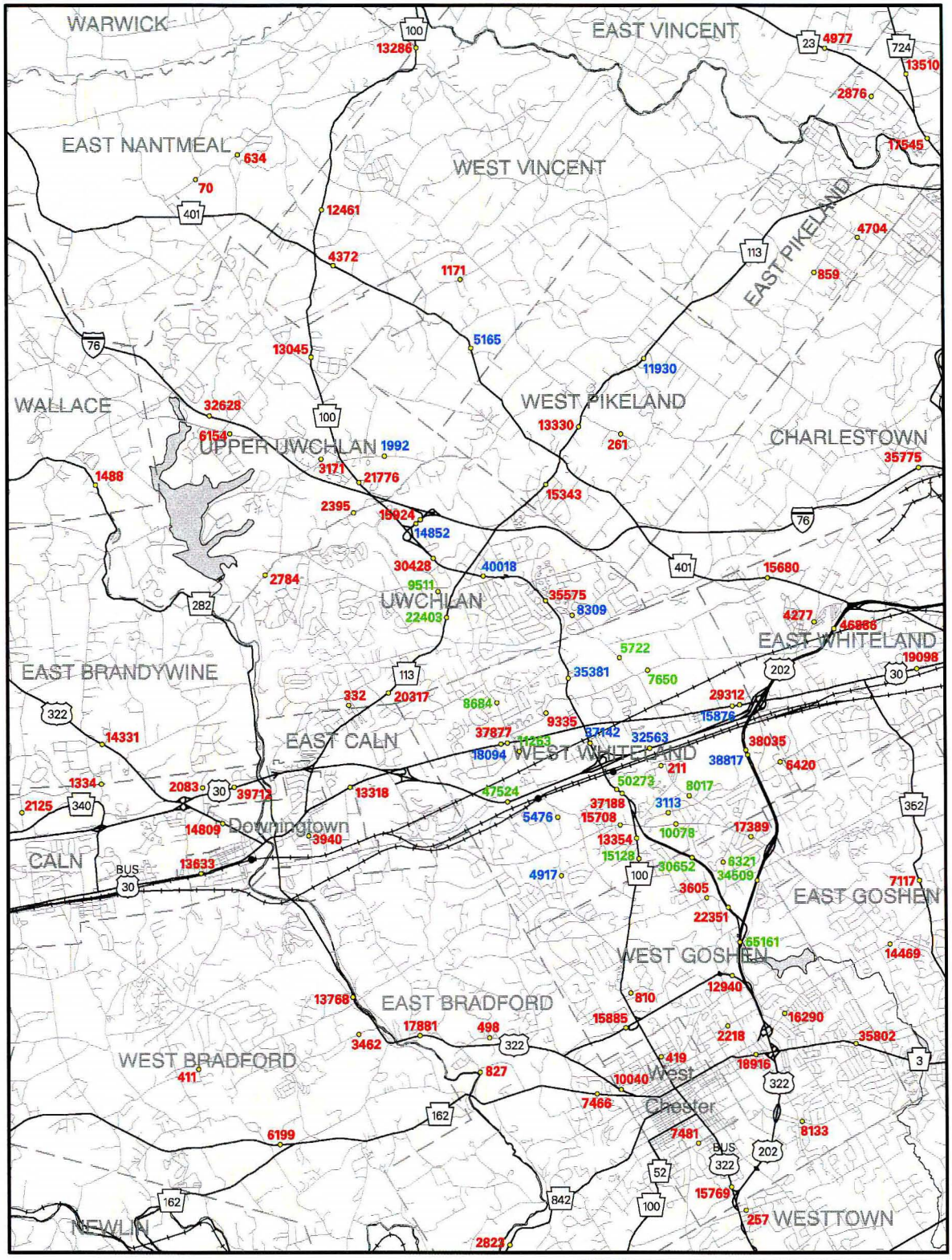

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FIGURE 4:

CURRENT TRAFFIC VOLUMES

- Traffic Count Location (approximate)
- 2823 1995 Traffic Count (AADT)
- 4917 1996 Traffic Count (AADT)
- 6321 1997 Traffic Count (AADT)

Note: Exton Bypass opened December 22, 1995

After the Exton Bypass opened, on December 22, 1995, some interesting changes took place in study area traffic volume.

1) Substantial increases occurred along the PA 100 south of the Bypass and on the PA 100 Connector Highway.
2) Substantial decreases occurred along the Lincoln Highway (about one-half of the traffic) between US 202 and US 30[4].
3) Reductions occurred in traffic volume passing through the Turnpike's Downingtown interchange. Approximately 1,000 fewer vehicles traveled through the toll plaza on an average day during 1996 as compared with 1995[5].

PUBLIC TRANSPORTATION SERVICES

Figure 5 illustrates existing public transportation services provided within the corridor. Services offered include intercity and regional rail service, and public bus routes. Rail service to the corridor is provided by Amtrak and SEPTA. SEPTA and Krapf's Transit, a private operator, provide the bus services.

Rail

In the study area, Amtrak operates intercity service via its Keystone and Pennsylvanian trains between New York City, Philadelphia, Harrisburg, and Pittsburgh. Local station stops are provided at Paoli, Exton and Downingtown. Seven round trips per weekday and three round trips on Saturday and Sunday are currently scheduled at these stations. Lower levels of service are provided to Malvern, Whitford and Coatesville stations. Amtrak's Pennsylvanian service provides one round trip per day, but only stops at Paoli and Downingtown.

In the vicinity of PA 100, the R5 Regional Rail Line has stops at the Paoli, Malvern, Exton, Whitford and Downingtown stations[6]. Current SEPTA service within the corridor is provided with two operating patterns — full service between Philadelphia and Malvern, and reduced service provided to Exton, Whitford, and Downingtown.

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[4] According to data supplied by the Chester County Planning Commission, traffic volume decreases were also experienced along Boot Road and Swedesford Road in sections parallel to the Bypass.

[5] Data supplied by the Pennsylvania Turnpike Commission.

[6] SEPTA service beyond Downingtown, that is to Coatesville and Parkesburg, was discontinued in 1996.

PA 100 CORRIDOR STUDY

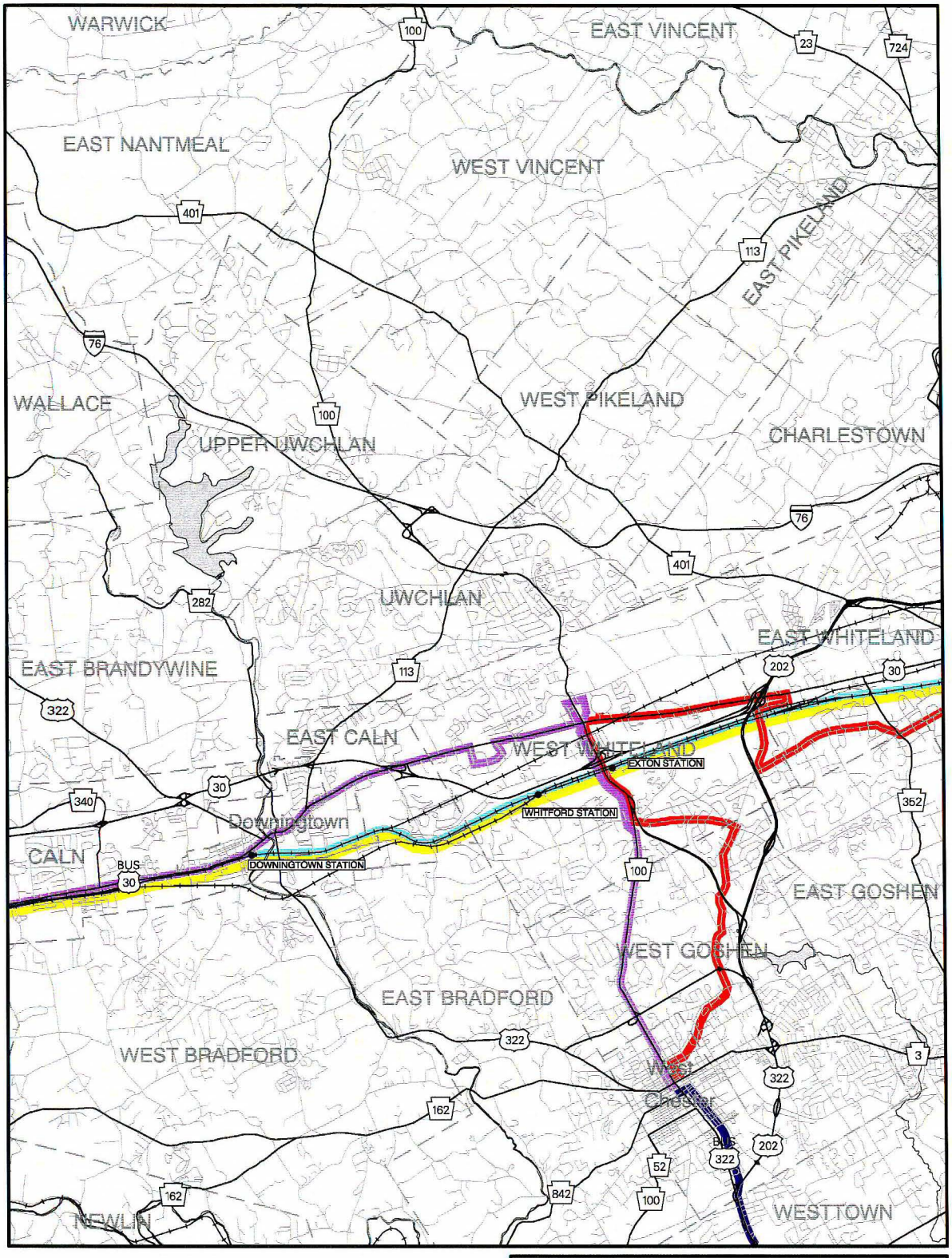

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FIGURE 5:

EXISTING PUBLIC TRANSPORTATION SERVICES

- SEPTA Bus Route 92 (West Chester - King of Prussia)
- SEPTA Bus Route 202 (West Chester - Wilmington)
- Krapf's Bus Route A (West Chester - Coatesville)
- SEPTA R5 (Downingtown - Philadelphia)
- AMTRAK Keystone Service (Harrisburg - Philadelphia)

Weekday service frequencies to Paoli and Malvern (i.e., at the eastern end of the study area) are 15 minutes in the predominant travel direction during the peak periods and 30 minutes in the reverse direction and during the midday. Saturday service is hourly and Sunday service is limited to 4 round trips per day.

Service to Exton, Whitford and Downingtown stations is provided at 30 minute intervals in the predominant peak period travel direction and one hour in the reverse direction. Midday and Saturday service is provided at two hour intervals. There is no Sunday service provided to these stations, Malvern serves as the end-of-the-line station on Sundays.

From the most recent data available from SEPTA, there were a total of 1,168 daily boardings at the stations between and including Malvern and Downingtown.

Station	1995 Boardings
Malvern	192
Exton	383
Whitford	180
Downingtown	413

Parking conditions at the stations serving the study area are somewhat constrained, and until very recently were fully utilized, as can be seen in the data below.

Station	Survey Date	Parking Supply	Parking Demand	% of Capacity	Spaces Remaining
Malvern	Spring '94	143 sp.	143	100	-0-
Exton	Thurs, 1/30/97	316 sp.	319	101	-0-
	Thurs, 6/5/97	436 sp.	322	74	114
Whitford	Thurs, 1/30/97	100 sp.	156	156	-0-
	Thurs, 6/5/97	100 sp.	139	139	-0-
Downingtown	Spring '94	200 sp.	193	97	7

Sources: 1994 - SEPTA, 1997 - DVRPC

As seen above the parking expansion provided at Exton (in March 1997) affords the only readily available supply of station parking in the vicinity of the study corridor.

Bus

There are two public bus routes with stops in the study corridor's municipalities. SEPTA operates Bus Route 92 with termini in West Chester and at the King of Prussia Mall. Krapf's Transit Company operates the Route A Bus with termini in Coatesville and West Chester.

Within the study area the Route 92 Bus travels along Phoenixville Pike, Boot Road, PA 100, the Lincoln Highway, and King Road. En route connections are made with the R5 Regional Rail Line, at the Exton Station, and the Exton Mall. Service is provided hourly between 6 am and 8 pm, Monday through Saturday. During 1995 there were 368 daily boardings made on the Route 92 Bus.

Krapf's Route A Bus travels along the Lincoln Highway and PA 100. Major generators directly served by the bus line are the Oaklands Corporate Center and the Exton Mall. Service is hourly, seven days per week. Weekday operations span the hours of 6 am to 7 pm. Weekend service also begins at 6 am, but ends at 5 pm. During 1995, the A Bus served 846 daily boardings.

1990 Journey-to-Work Travel

A significant share of all trips made on an average weekday are those involving commuting to and from work (approximately 20 to 25 percent of total trips). Typically work trips are compressed into just two to three hours in the morning and two to three hours in the evening on any given workday. The inclination to use public transportation in completing work trips is higher than for any other trip purpose. As a result, travel to and from work creates a high temporal demand on highway and transit facilities and contributes significantly to the degree of congestion and delay encountered on those facilities.

In order to gain a better understanding of these conditions within the corridor, detailed evaluations of Journey-to-Work data from the 1990 Census were conducted.

Tables 4 summarizes some of the information pertinent to the study corridor. At the time the Census was conducted (April 1990) there were about 54,000 work trips made to, from and within the study corridor's municipalities. Roughly one-half of the corridor's work trips were outbound to job sites (26,960), and one-half were inbound (27,327).

TABLE 4
JOURNEY-TO-WORK CHARACTERISTICS

Municipality	Workers Traveling From Municipality					Workers Traveling To Municipality				
	Total Workers	Means of Transportation				Total Workers	Means of Transportation			
		Drive Alone	Car/Van Pool	Public Transit	Other		Drive Alone	Car/Van Pool	Public Transit	Other
West Vincent	1,141	1,002	98	20	21	100	90	2	0	8
Upper Uwchlan	2,154	1,892	181	27	54	698	628	51	0	19
Uwchlan	7,146	6,302	490	167	187	3,681	3,220	354	10	97
West Whiteland	6,759	5,920	471	272	96	10,701	9,355	1,141	101	104
West Goshen	9,760	8,421	788	262	289	12,147	9,884	1,491	195	577
PA 100 Study Corridor	26,960	23,537	2,088	748	647	27,327	23,177	3,039	306	805

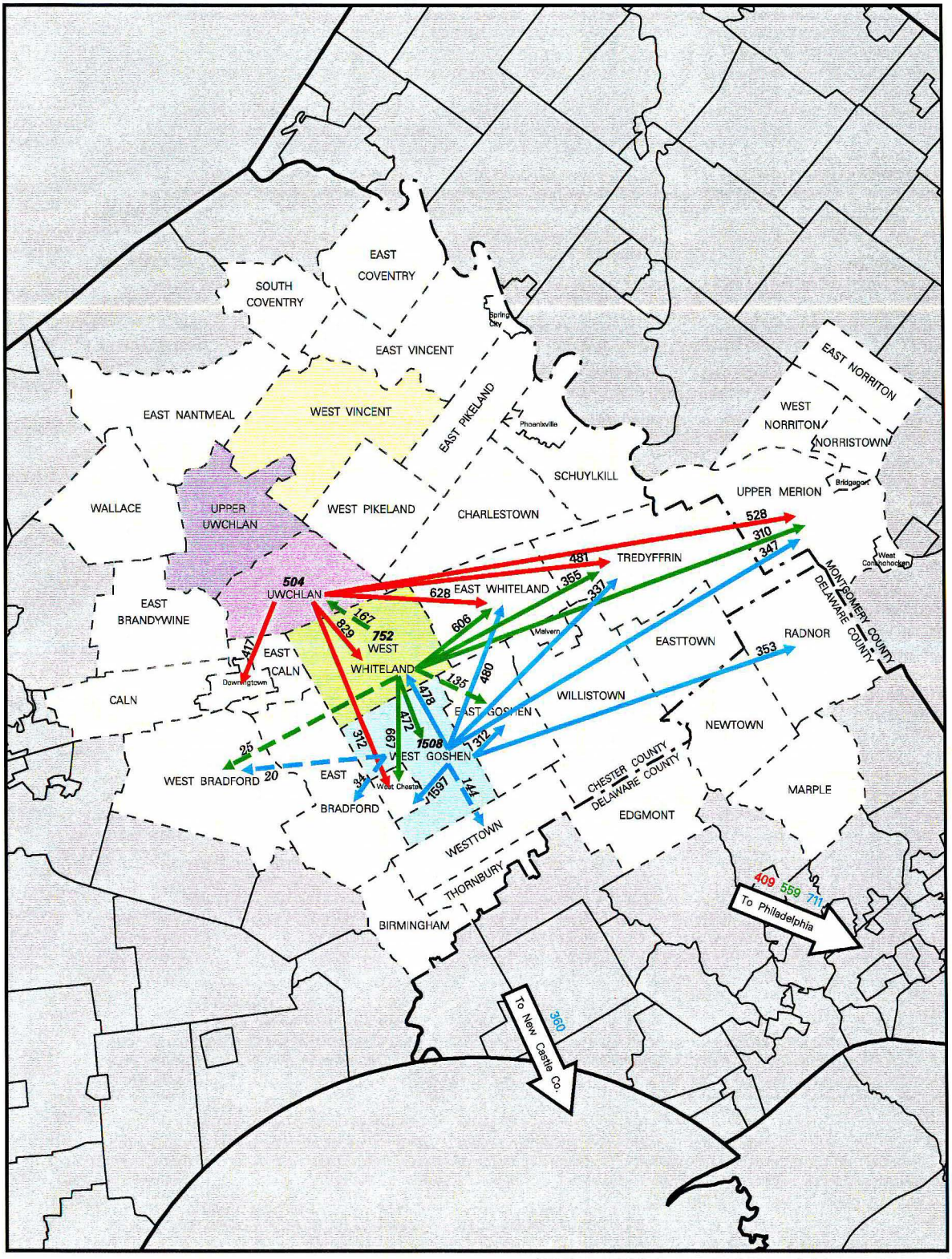
source: 1990 US Census

Typically, West Vincent, Upper Uwchlan and Uwchlan are work trip exporters — from two-thirds of worker trips in Uwchlan to 95 percent of worker trips in West Vincent are outbound. West Goshen and West Whiteland are importers of work trips — between 55 and 60 percent of worker trips in these townships are inbound.

About 85 percent of all worker trips, both to and from the study corridor, were accomplished by driving alone in a private vehicle. Ten percent of all worker trips were accomplished through car pooling or van pooling. On average, two percent of total worker trips were accomplished by using public transportation (mostly outbound from the corridor) and three percent were accomplished by other means, for example by walking or riding a bicycle.

Major work trip origin-destination pairings (desire lines) to / from the corridor municipalities were determined and are shown in Figures 6 and 7. For analytical purposes work trip pairings between municipalities were identified as "major" when a threshold of 300 or more one-way worker trips, between municipal pairs, was equaled or exceeded. As a result, data for West Vincent and Upper Uwchlan, which are not substantial producers or attractors of work trips, are not shown on the maps. Figure 6 shows outbound work trips and Figure 7 illustrates inbound work trips. On each figure, the major work trip desire lines, those exceeding 300 work trips, are represented by arrows with solid lines while the complementary reverse trips, if less than 300 trips, are shown by arrows with dashed lines. The value in the center of the municipality, which is common to both figures, is the number of worker trips that begin and end in the same municipality.

PA 100 CORRIDOR STUDY



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MILES

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FIGURE 6:

SELECTED MAJOR JOURNEY-TO-WORK TRAVEL PATTERNS

(FROM CORRIDOR MUNICIPALITIES)

- Work trips
- Complementary reverse work trips
- ***504*** Total number of internal trips
- 353 Total number of trips
- *299* Total number of complementary reverse work trips

PA 100 CORRIDOR STUDY

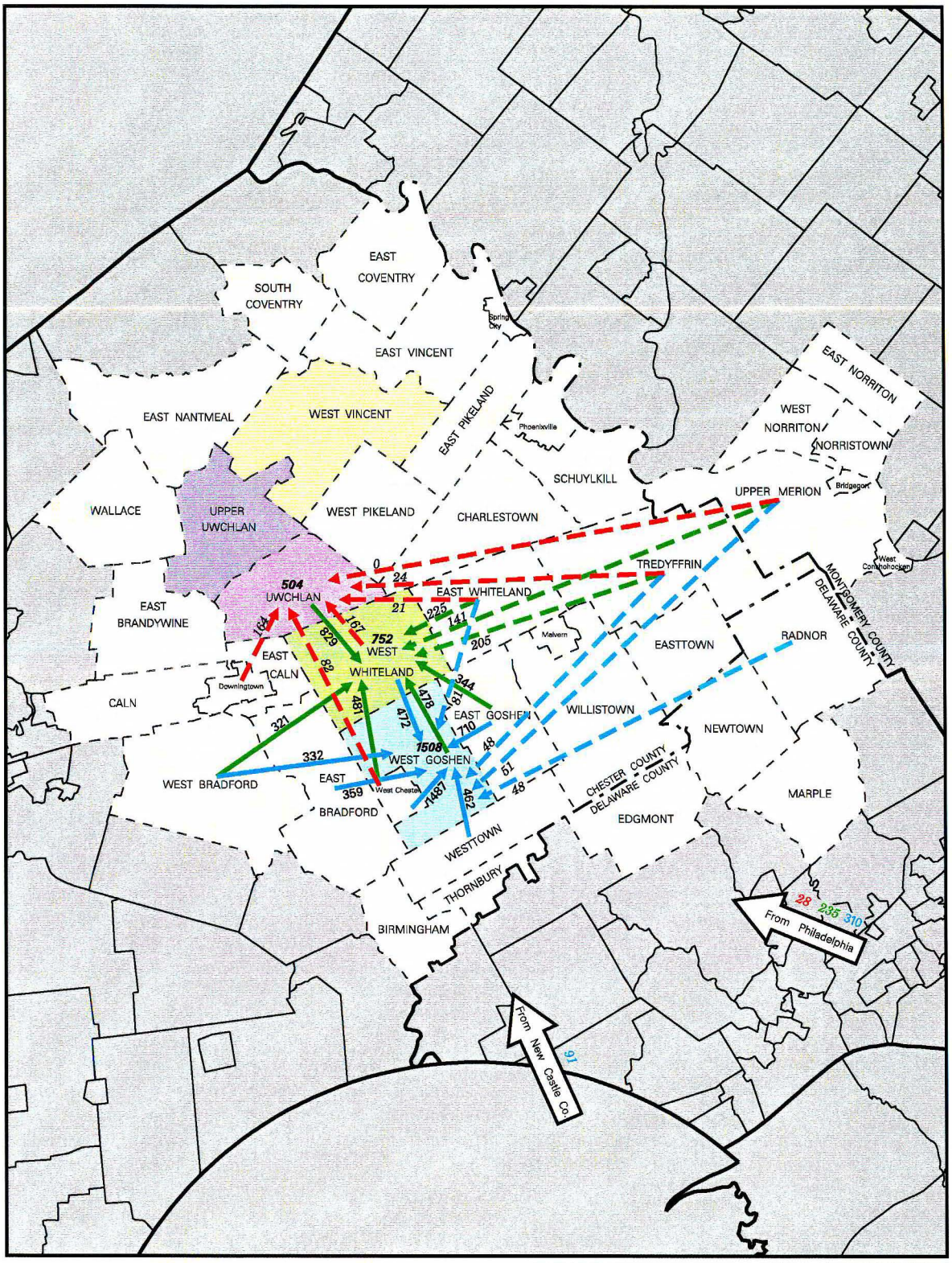

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FIGURE 7:
SELECTED MAJOR JOURNEY-TO-WORK TRAVEL PATTERNS
(TO CORRIDOR MUNICIPALITIES)

- Work trips
- Complementary reverse work trips
- ***504*** Total number of internal trips
- 353 Total number of trips
- *299* Total number of complementary reverse work trips

Observations about the desire lines shown on the figures, are:

1) A marked gravitation of work travel to municipalities containing some of the region's important development centers: Philadelphia (Center City Philadelphia); Upper Merion (King of Prussia); Tredyffrin (Great Valley) and West Chester Borough.
2) Short trip lengths - aside from the Philadelphia and New Castle County (Delaware) trip pairings, work trips are less than ten airline miles in length and frequently take place within municipalities (11% of all trips) or between adjacent municipalities.
3) Inter-municipal travel along the PA 100 corridor (including Uwchlan, West Whiteland, West Goshen and West Chester) accounts for 6,572 daily trips.
4) Inter-municipal travel along the US 202 corridor (between Uwchlan / West Whiteland / West Goshen and East Whiteland / Tredyffrin / Upper Merion) accounts for 4,868 daily trips.
5) Trip pairings between West Goshen and West Chester (3,084 daily trips); between West Goshen and East Goshen (1,022 daily trips), and; between Uwchlan / West Whiteland / West Goshen and the City of Philadelphia (2,252 daily trips) represent other notable trip pairings in the corridor.

Transit Trips

Key observations, regarding daily work trips completed by transit, which emanated from the analysis of Journey-to-Work data are:

1) There was a total of 748 outbound worker trips accomplished via a public transportation mode, 36 percent originated in West Whiteland; 35 percent originated in West Goshen, and; 22 percent originated in Uwchlan Township.
2) Of the total outbound transit trips, 626 trips (84 percent) were to Philadelphia. Transit trips to Philadelphia were almost exclusively accomplished by regional rail (SEPTA R5), representing a 33 percent capture ratio of the work trip travel market from the study area to the city.
3) There were about 300 inbound worker trips accomplished by a transit mode. Of these, 131 of the trips were from Philadelphia, 62 were from West Chester and 45 were from Coatesville.
4) The vast majority of transit work trips to the study corridor were accomplished by bus. Consequently, the highest destinations for transit trips entering the study corridor were to municipalities served by bus routes — West Goshen (195 trips, with 125 emanating in the City of Philadelphia) and West Whiteland (101 trips, with 33 emanating in West Chester).

Work at Home

Overall, an additional 750 workers work at home, representing a 1.4 percent share of all the work trips taking place in the corridor. It is of interest that the relative share of work at home activity, as a percent of all work trip making to/from a municipality, was higher in the northern end of the corridor where auto ownership rates were highest. West Vincent and Upper Uwchlan townships exhibited 2.3 and 3.0 percent shares of work trips completed at home as compared with Uwchlan, West Whiteland and West Goshen which exhibited 1.8 percent, 0.9 percent and 1.2 percent shares, respectively.

ASSESSMENT OF EXISTING TRANSPORTATION CONDITIONS

A current, but generalized, status report on the adequacy of the transportation infrastructure serving the PA 100 corridor has been drawn from a series of sources. These include: documented deficiencies cited within published municipal, county and/or regional traffic and transportation studies; input from the Study Steering Committee members; and a traffic safety inventory prepared for this study.

Operations

Figure 8 shows where intersection and roadway congestion, traffic management / roadway signing inadequacies and rail station parking constraints exist throughout the broad study area.

Congested intersection conditions correspond with locations where peak hour traffic operations were computed at Level of Service "E" or "F" according to traffic studies performed within the corridor, those which were cited within *Centers and Corridors*[7], or those which were identified by the Study Steering Committee.

Congested intersections along PA 100 include:

- PA 401 in Ludwigs Corner, West Vincent;
- Font Road in Upper Uwchlan;
- Park Road in the Village of Eagle, Upper Uwchlan;
- Little Conestoga Road in the Village of Eagle, Upper Uwchlan;
- Byers Road in the Village of Eagle, Upper Uwchlan;
- West Township Line Road in Upper Uwchlan;
- PA 113 in Lionville, Uwchlan;
- Gordon Drive / Rutgers Drive in Lionville, Uwchlan;
- Waterloo Boulevard / Swedesford Road in Exton, West Whiteland;

[7] *Centers and Corridors - Direction 2020 Report 22*, DVRPC, October 1994. *Centers and Corridors* is DVRPC's land use and transportation inventory for the Year 2020 Plan.

PA 100 CORRIDOR STUDY

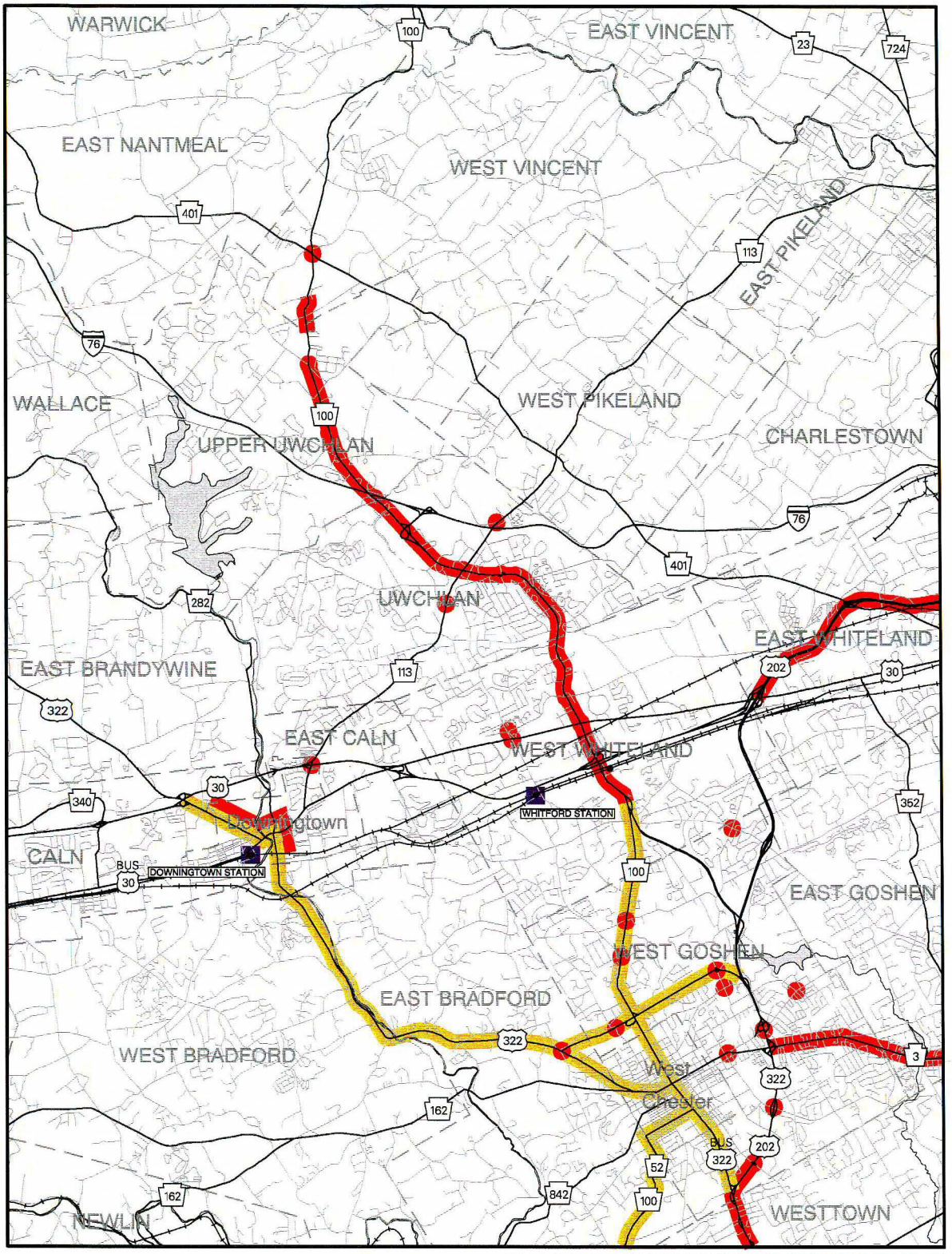

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FIGURE 8:

DOCUMENTED EXISTING TRANSPORTATION DEFICIENCIES

- Intersection Congestion
- Roadway Congestion
- Traffic Management / Roadway Signing
- Rail Station Parking Constraint

- Lincoln Highway in Exton, West Whiteland;
- Green Hill Road in West Goshen;
- Grove Road in West Goshen.

Congested roadway locations are areas between closely spaced congested intersections which are operating in an uncoordinated manner, and/or have been cited from regional studies such as *Centers and Corridors*. The extent of existing roadway congestion, along PA 100, is between Font Road and the Exton Bypass interchange — a distance of about seven and one-half miles.

Other congested facilities within the broad study area include:

- US 202 north of the US 30 / Lincoln Highway interchange (US 202 Section 300);
- US 202 south of Matlack Street (US 202 Section 100);
- PA 3 east of US 202, and;
- US 322 through Downingtown.

Traffic management / roadway signing deficiencies emanate from *Centers and Corridors* documentation and from the Study Steering Committee. Specifically, concerns exist that the amount of through truck and auto traffic traveling the southern portions of PA 100 (i.e., below the Connector Highway) is higher than need be, and that the deficiency could be rectified through a more efficient directional signing plan for trips oriented between US 322 West, in Downingtown, and US 202 South of West Chester. The preferred signing alternate would use US 30, PA 100, the PA 100 Connector Highway and US 202. In addition to reducing traffic along the lower end of PA 100, Business 322 and US 322 (which are narrow and more locally oriented roadways in the study corridor), the revised signing plan would also reduce traffic through a congested segment of US 322 / Business Route 30 in Downingtown.

Traffic Safety

Figure 9 illustrates a comprehensive inventory of traffic safety experiences along PA 100 within the 13-mile long study segment. The information was obtained through PennDOT's Accident Records System and covers the five year time frame between 1991 and 1995. The System contains statistics for reportable accidents only[8], and is used as a tool in determining general accident patterns in terms of location and type.

[8] Reportable accidents in the Commonwealth of Pennsylvania are those which result in injury or fatality, or which require vehicles being towed from the scene.

PA 100 CORRIDOR STUDY

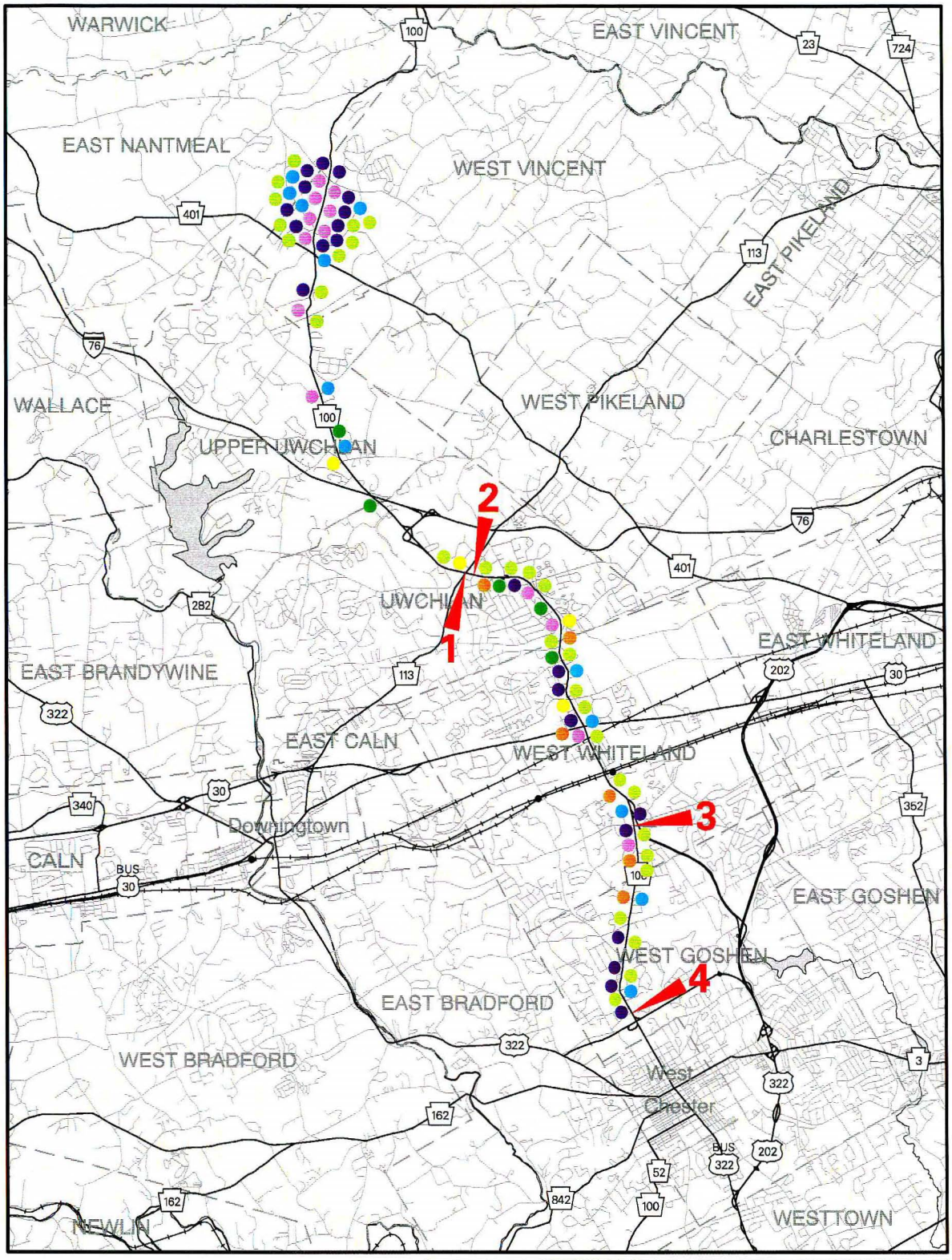

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FIGURE 9:

TRAFFIC SAFETY CONDITIONS
(1991-1995)

ACCIDENT CLUSTERS
- Proceeding without Clearance
- Hit Trees
- Fatals
- Night Curves
- Speeding
- Hit Pedestrians
- Drinking Driver

MAJOR ACCIDENT LOCATIONS
(Intersections)
1. PA 113
2. Welsh Pool Rd
3. Boot Rd
4. Taylors Mill Rd

Between 1991 and 1995 there were a total of 604 reportable traffic accidents within the study corridor:

YEAR	ACCIDENTS
1991	108
1992	135
1993	113
1994	125
1995	123
	604

Five of these accidents involved fatalities and 347 involved injuries. The balance (252) were tow-away accidents involving property damages only.

In addition to total accident experience along the corridor, two special sets of accident data were inspected. The first set identifies locations where intersection accidents or mid-block accidents are concentrated. The second data set identifies clusters where common types of accidents take place and/or common contributing factors are involved.

Intersections that have experienced 15 or more reported traffic accidents over the five year reporting period are shown below.

INTERSECTION	ACCIDENTS
PA 113 and PA 100 in Lionville, Uwchlan	23
Welsh Pool Rd and PA 100 in Lionville, Uwchlan	21
Boot Rd and PA 100 in West Whiteland	21
Taylors Mill Rd and PA 100 in West Goshen	16
Total	81

There were no mid-block accident locations within the study corridor between 1991 and 1995 which exceeded the 15 accident threshold for control sections of 1000 feet.

Clusters of accident types which have been identified within the PA 100 study corridor are also shown on Figure 9. Accident thresholds and length of control sections used in cluster analyses differ dependent upon the accident type or contributing factor being evaluated. Therefore, data regarding one cluster type may not be directly comparable with another. Furthermore, the clusters illustrated on Figure 9 do not indicate the number of incidents so much as they display the location(s) and the general frequency that a certain accident type is exhibited within the corridor.

The number of locations where a given cluster type was cited in the data is tabulated below.

Cluster Type (Accident Threshold)	Locations
Proceeding Without Clearance (8 + acc./1,000')	4
Hit Trees (5 + acc./1,000')	13
Fatal Accidents (3 + acc./1,000')	5
Night Curves (5 + acc./1,000')	22
Speeding (individual occurrences)	12
Hit Pedestrian (5 + acc./1,000')	6
Drinking Driver (individual occurrences)	30

There were four prevalent types of accident clusters along PA 100 within the study limits: night curves, speeding, hit trees, and drinking driver. Night curve accidents were concentrated between PA 401 and Horseshoe Trail Road in West Vincent (11), and between Taylors Mill Road and Greenhill Road in West Goshen Township (4)[9] [10]. The segment of PA 100 between PA 401 and Horseshoe Trail Road is also cited with hit tree accident clusters (7 locations), and 5 accident locations involving speeding. Thirty drinking driver related accidents were dispersed throughout the corridor.

Current Improvement Proposals

Many independent initiatives have been advanced at the municipal level to rectify existing deficiencies and accommodate growth foreseen for the corridor. The efforts have ranged from conducting planning studies — to designing and implementing physical and operational improvements. With the support of the Chester County Planning Commission and the assistance of PennDOT, public funding streams are being used. Private contributions (funding or in-kind services) obtained through the land development application process are also being used.

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[9] Throughout 1991 to 1995 (the time period corresponding to the accident data) PA 100, south of Grove Road, had a northbound up-grade truck passing lane. Subsequent to the reporting period it has been re-striped to a three lane cross section affording a center left-turn lane. It is believed that safer traffic conditions are now present in this portion of the corridor as a consequence of the re-striping.

[10] It should be noted that PennDOT has recently "let" a construction project to relocate utility poles and implement driveway access improvements along PA 100 between Hoffecker Road and the Turnpike interchange — which includes the PA 401 to Horseshoe Trail Road segment. Whether these improvements will address the accident patterns described above should be evaluated.

Figure 10 illustrates projects which are currently proposed for public funding as part of the most recent Transportation Improvement Program (TIP) for the period covering Federal Fiscal Years 1997 - 2000. Project descriptions are given in Table 5.

In addition to projects contained within the current TIP, there are a host of additional transportation improvement proposals, which have been identified through traffic planning activities by the municipalities. Many are still considered current and important for supporting orderly growth along the corridor. Funding for these projects, however, is not clearly defined. Therefore, consideration of these as they may address current conditions is inappropriate. On the other hand, some warrant travel testing for future Year 2020 conditions. As such, they will be detailed in the following chapter.

CONCLUSIONS: ANALYSES OF EXISTING CONDITIONS

Observations reached in assessing the current transportation situation are:

1) There is a good overlap between the study corridor's largest development centers, employers and public transportation services throughout the broad study area. Emerging activity centers in Lionville, Eagle and Ludwigs Corner warrant future year land use evaluations and travel testing.
2) Travel conditions indicative of strong TDM and ridesharing markets exist within and between Uwchlan, West Whiteland, West Goshen (and West Chester).
3) A traffic safety deficiency may exist in the northern limits of the study corridor (i.e., between PA 401 and Horseshoe Trail Road). PennDOT will soon be implementing access and utility relocation improvements through this section of PA 100. A separate follow-up traffic engineering study should be conducted, after project implementation, to ascertain if safety conditions have improved or if more attention is required.
4) The existing Transportation Improvement Program addresses a considerable amount of the identified transportation deficiencies within the corridor. The set of unfunded municipal transportation improvement proposals would extend the coverage of the TIP improvements. These improvements will be subject to evaluation in the futures testing. □

TABLE 5
TRANSPORTATION IMPROVEMENT PROGRAM (FFY 1997 - 2000)

Reference # for Figure 10	Description
1	Lincoln Highway bridge over Valley Creek - bridge replacement
2	Coatesville-Downingtown Bypass (US 30) and PA 113 - Construct eastbound loop-off ramp
3	US 322 and Business Route 322 - Relocate, channelize and install traffic signal
4	PA 113 and PA 401 - Intersection safety improvement, including channelization
5	PA 3 between West Chester Borough Line and Boot Road - Close median openings as part of corridor safety improvement
6	PA 100 and Park / Little Conestoga Roads - Construct left turn lane, channelize and install traffic signal
7	Construct Park and Ride Lot with 35 spaces at PA 100 and PA 113
8	West Chester Borough Closed Loop Traffic Signal System - install borough-wide coordinated traffic signal system.
9	PA 100 and PA 401 - Construct left turn lanes on PA 100
10	PA 113 and PA 100 widening - widen PA 113 to five lanes from the Turnpike bridge to PA 100; widen PA 100 for additional travel lane in each direction from north of the Rutgers/Gordon intersection to the Turnpike interchange; provide additional turning lanes at the PA 100 and PA 113 intersection
11	Construct Paoli Pike Bikeway between US 202 and Taylor Avenue
12	Construct Chester Valley Trail Bikeway
13	Conduct major investment study of the Cross County Metro
14	US 202, Section 100 - Congestion Management Study
15	Central Chester County Closed Loop Traffic Signal System - install coordinated traffic signal system along PA 100, PA 113 and the Lincoln Highway, among others
16	Parking expansion at the Whitford Station - Add 100 parking spaces
17	Construct and provide R5 Line service to the Thorndale Station, provide 450 space parking lot.
18	Operate and maintain West Whiteland Circulator Bus -

PA 100 CORRIDOR STUDY

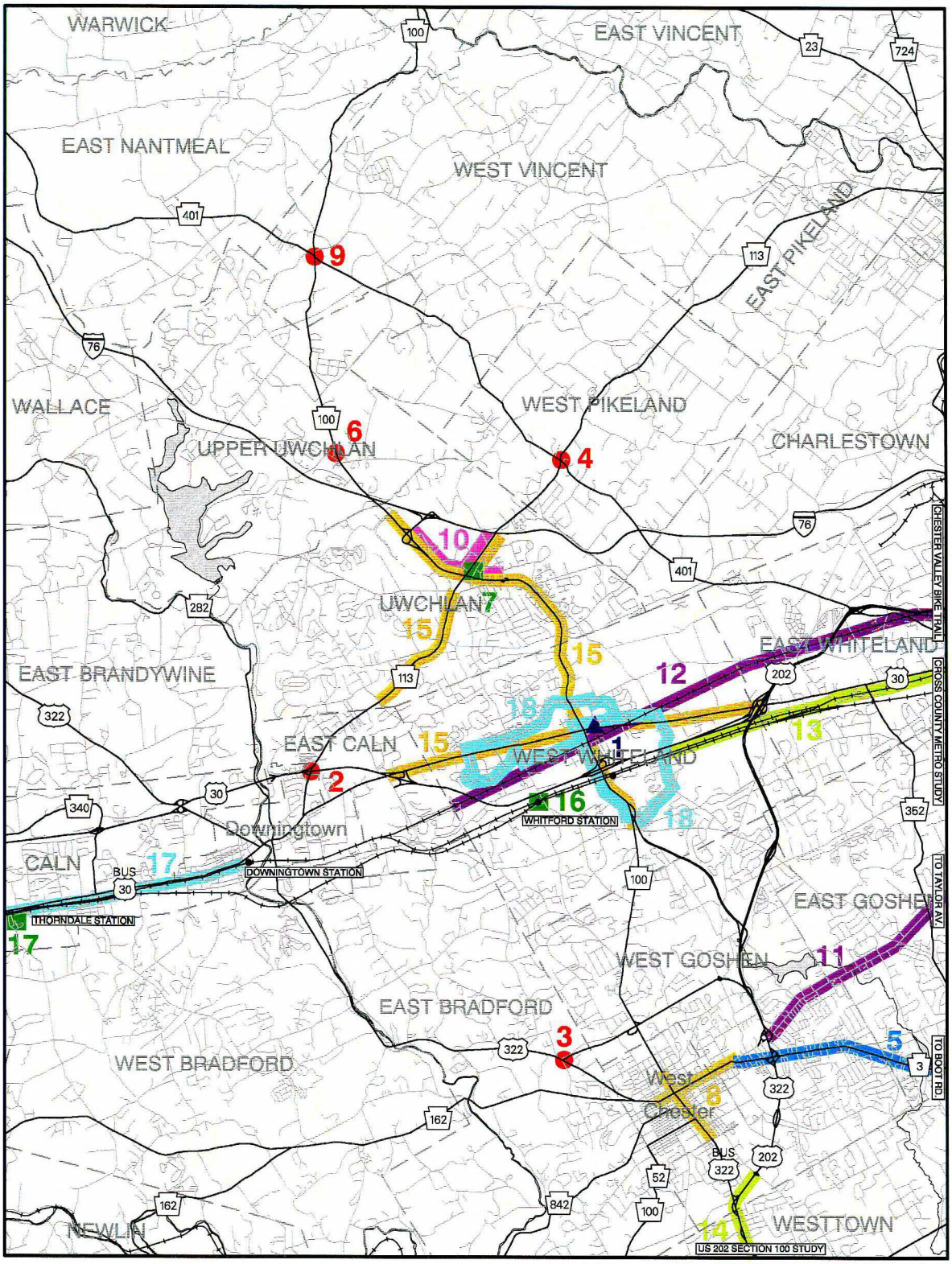

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FIGURE 10:

CURRENT TRANSPORTATION IMPROVEMENT PROGRAM

- Intersection Improvement
- Roadway Widening
- Coordinated Traffic Signal Systems
- Rail Station Parking Expansion / Park and Ride Lot
- New or Enhanced Public Transportation Service
- Corridor Transportation Study
- Bikeway
- Bridge Replacement
- Corridor Safety Improvement

5 TRAVEL DEMAND ANALYSES

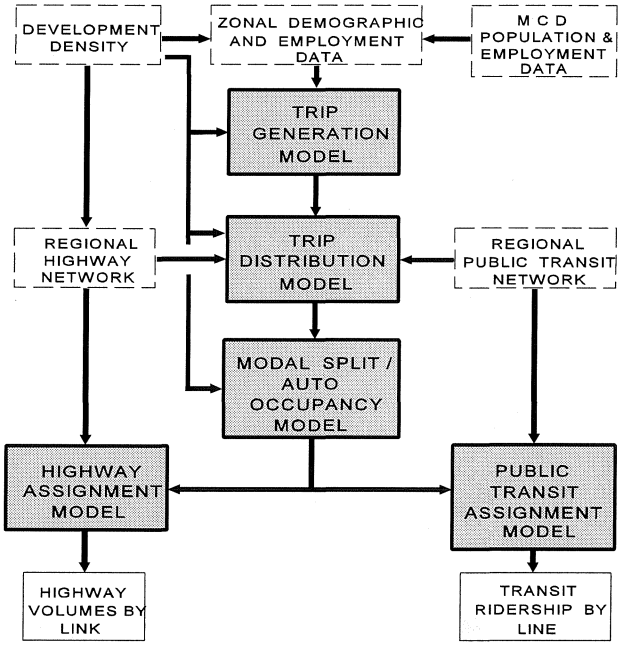
In this study, three alternative travel scenarios were "constructed" using DVRPC's regional travel simulation model. These included: the 1996 Base Year scenario — to establish the corridor baseline, and; two future year alternatives — Year 2020 Limited-Build and the Year 2020 Full-Build scenarios — to evaluate future conditions and test improvement recommendations assuming differing levels of capital investment.

FOCUSED SIMULATION PROCESS

DVRPC maintains a personal computer-based highway and public transportation travel simulation model that estimates travel behavior for a typical weekday and provides related travel data for different transportation network and demographic conditions[11]. A schematic portrayal of the four-step focused travel simulation process is shown on Figure 11.

FIGURE 11

DVRPC REGIONAL TRAVEL SIMULATION PROCESS



[11] DVRPC's travel simulation is performed on desktop micro-computers running the OS/2 version of TRANPLAN.

The regional travel model can be used to locate problem areas, identify future trends and travel conditions, and consider various alternative improvement strategies to address existing and emerging problems. By "focusing" DVRPC's regional travel forecasting model, enhancements are accomplished within a detailed study area, while regional level of detail is maintained elsewhere.

Application of the focused modeling process provided the opportunity to obtain performance data (listed below) and to perform selected link analyses for the simulation exercises conducted as part of the PA 100 Corridor Study.

- highway link daily traffic volumes (AADTs);
- daily transit ridership (boardings) by line, and;
- the following network performance statistics:
  - vehicle miles of travel (VMT),
  - vehicle hours of travel (VHT),
  - network highway speeds,
  - network volume / capacity ratios,
  - fuel consumption (using fleet average fuel consumption rates applied to VMT per highway functional class), and
  - mobile source emissions (using the model's VMT and speed estimates as inputs to Mobile 5.0 emissions software).

1996 Base Year Conditions

The first step in preparing the PA 100 Corridor Study simulation involved updating and focusing the regional model to reflect current demographic and transportation conditions within the study area. To most efficiently accomplish this task, DVRPC's network and supporting demographic database — serving as the baseline for 1995 air quality conformity analysis[12] — was selected and updated. Another reason for choosing the 1995 network was the availability of historical traffic and transit count data for use in calibrating modeled results.

Focusing to improve the level of detail within the study corridor involved the following activities:

- Revising DVRPC's transportation analysis zone (TAZ) structure for finer analytical "grain" and trip assignment within the study corridor. For example, the PA 100 Corridor Study comprises 33 TAZs for study area analyses. (Seven of the ten TAZs covering the five corridor

[12] Demographic data for the air quality simulation are DVRPC's 1995 forecasts for population and employment from the *Direction 2020 Plan*.

municipalities, per DVRPC's 1990 / 1995 TAZ structure, were split to create 23 additional zones for analyzing corridor travel data.)

- Disaggregating DVRPC's 1995 zonal demographic data to "fit" the new TAZ structure for population and employment. (Published block group information from the 1990 Census, 1990 land use mapping and 1995 aerial photography of the study corridor were used to disaggregate population to the new zone structure. Land use maps from 1990, and 1995 aerial photography were consulted as a means of proportioning the 1995 employment statistics to the PA 100 Corridor Study TAZ structure.)
- Updating selected characteristics of the existing modeled highway network so that current highway geometry is reflected in the simulation. (For example the number of travel lanes on PA 113 within the study corridor.)
- Adding key highway facilities to the model, to more closely represent the study corridor's hierarchical and interconnected roadway system. (Examples include: Sheree Boulevard; Eagleview Boulevard, and; Font Road. Note: local neighborhood and subdivisions streets / driveways are generally not included in the modeled network.)
- Updating the transit network in the corridor to reflect the current route and operating configurations of the privately owned and operated Krapf's Transit Company (i.e., Bus Route A service between Coatesville and West Chester).

Once calibrated to 1995 conditions, the Exton Bypass was added to the modeled network — to reflect the study's 1996 Base Year scenario[13] — and the model was run again. The final highway network and TAZ structure emanating from the focusing steps are shown on Figure 12.

Figure 13 illustrates the simulated daily traffic volumes which emanated from the 1996 Base Year model run. Calibrated transit ridership from the 1996 Base Year travel simulation is tabulated below.

[13] The Exton Bypass was opened to traffic on December 22, 1995.

PA 100 CORRIDOR STUDY

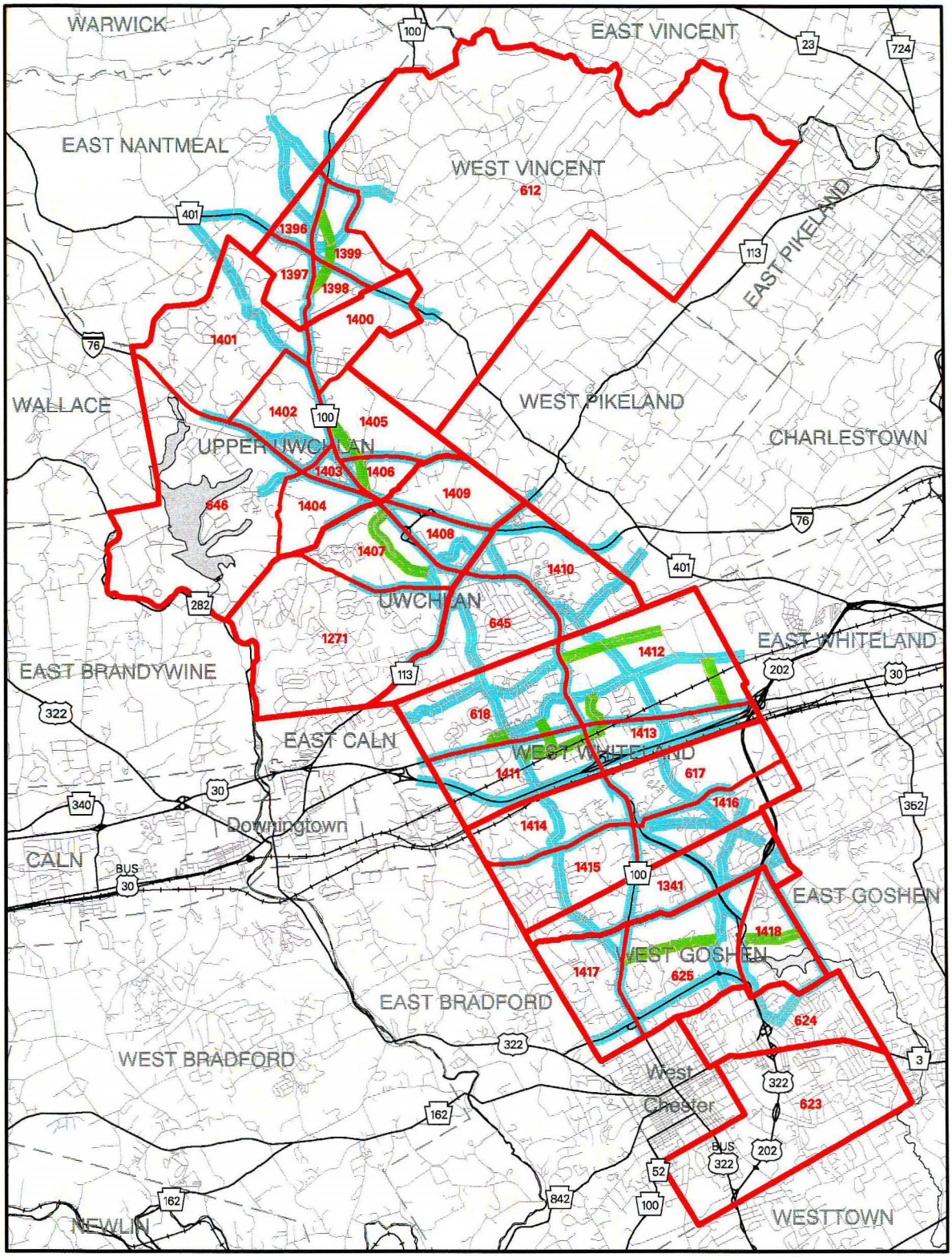


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FIGURE 12:

FOCUSED NETWORK FOR TRAVEL SIMULATION

- Existing Highway
- New Roadway Alignment
- DVRPC TAZ Boundary
- PA 100 Corridor Study TAZ Boundary
- 623 PA 100 Corridor Study TAZ Number

PA 100 CORRIDOR STUDY

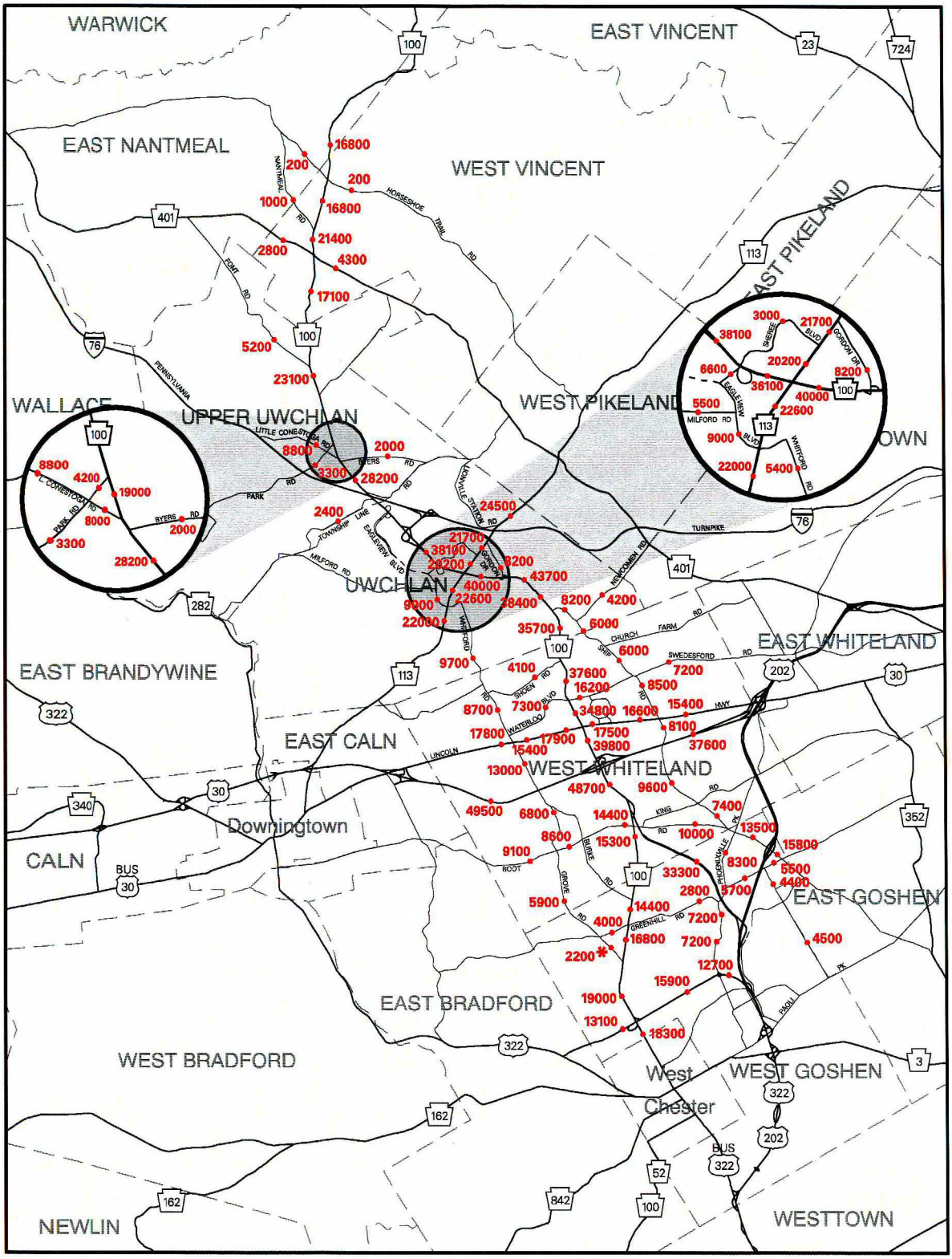

FIGURE 13:

1996 BASE YEAR SIMULATED TRAFFIC VOLUMES

- Traffic Volume Monitoring Location (AADT)
- 2800 Daily Two-Way Traffic Volume
- * One-Way Northbound Traffic Volume

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ROUTE	LIMITS	1996 BASE YEAR SIMULATED BOARDINGS
SEPTA's R5 Line	Parkesburg to Malvern	1,405
SEPTA's 92 Bus	West Chester to King of Prussia	372
Krapf's A Bus	Coatesville to West Chester	786
Total		2,563

Selected Link Analyses

The regional travel model was used to estimate the geographic distribution of highway trips using portions of PA 100. Knowing the distribution and magnitude of vehicle trips traveling sections of PA 100 can be a very useful indicator. For example, it can quantify the reliance on the facility by local traffic versus long distance travelers, and can be valuable in defining appropriate strategies to pursue within the corridor.

For this study a "selected link analysis" was performed for four links along PA 100:

1) at the northern end of the corridor — just north of Horseshoe Trail Road in West Vincent;
2) just south of the Pennsylvania Turnpike interchange in Uwchlan;
3) south of the Exton Bypass in West Whiteland, and;
4) at the southern limit of the corridor — north of US 322 in West Goshen.

The findings of the selected link analyses assuming the 1996 Base Year simulated conditions are summarized in Table 6.

TABLE 6
FINDINGS OF SELECTED LINK ANALYSES - 1996 BASE YEAR SCENARIO

Link	AADT	Significant Trip Origin Sheds	Average Airline Distance to the Link	Potential Strategy(s)
1) North of Horseshoe Trail Road	16,800	**North** — Pottstown and surrounding area (15%), northern Chester Co. (9%) and Berks Co. (18%);	10.4 miles	Park and ride lots beyond the study corridor, i.e.: at PA 100 & US 422; along the Turnpike.
2) South of Pennsylvania Turnpike Interchange	38,100	**North** — Berks Co. (25%); **Internal** — Upper Uwchlan (12%), Uwchlan (7%), West Whiteland (9%);	12.5 miles	Park and ride lots beyond the study corridor, i.e.: at PA 100 & US 422; along the Turnpike. Park and ride lots internal to the study corridor, i.e.: in Eagle, Lionville & Exton.

TABLE 6
FINDINGS OF SELECTED LINK ANALYSES - 1996 BASE YEAR SCENARIO

Link	AADT	Significant Trip Origin Sheds	Average Airline Distance to the Link	Potential Strategy(s)
3) South of Exton Bypass	48,700	**North** — Berks Co. (5%); **Internal** — Uwchlan (5%), West Whiteland (21%), West Goshen (9%); **South** — West Chester and surrounding areas (5%), the State of Delaware (4%), central / eastern Delaware Co. (11%), northwestern Delaware Co. (4%); **West** — Downingtown / Coatesville area (7%), Lancaster Co. (7%);	13.6 miles	Park and ride lots internal to the study corridor, i.e.: in Lionville, Exton and West Goshen. Park and ride lots along US 202. Park and ride lots along US 30
4) North of US 322	19,000	**Internal** — West Whiteland (21%), West Goshen (18%); **South** — West Chester Borough (30%).	5.9 miles	Park and ride lots internal to the study corridor; in Exton and West Goshen

The selected link analyses show findings similar with those of the journey-to-work evaluation: that vehicular trips are relatively short (11.5 miles overall average), and; that substantial trip influences exist internally to the corridor (i.e., within and between Uwchlan, West Whiteland and West Goshen townships).

The analyses also show that strategies useful in combating corridor traffic congestion are as appropriate beyond the corridor boundaries as within them (e.g., park and ride lot implementation).

1996 Base Year Performance Statistics

Performance statistics emanating from the simulated 1996 highway network are shown in Table 7. They have been obtained by manipulating outputs of the Base Year travel simulation using geographic information system (GIS) software[14].

TABLE 7
PERFORMANCE MEASURES - 1996 BASE YEAR MODELED HIGHWAY NETWORK

MCD	Vehicle Miles of Travel	Vehicle Hours of Travel	Avg. Daily Speed (mph)	V/C Ratio	Fuel Consumption (gallons/day)	Mobile Source Emissions (kilograms / day in July)		
						Carbon Monoxide	Non-methane Hydro-carbons	Oxides of Nitrogen
West Vincent	57,036	1,760	30	0.46	2,865	1,326	217	351

[14] DVRPC uses TransCAD GIS + software.

TABLE 7
PERFORMANCE MEASURES - 1996 BASE YEAR MODELED HIGHWAY NETWORK

MCD	Vehicle Miles of Travel	Vehicle Hours of Travel	Avg. Daily Speed (mph)	V/C Ratio	Fuel Consumption (gallons/day)	Mobile Source Emissions (kilograms / day in July)		
						Carbon Monoxide	Non-methane Hydro-carbons	Oxides of Nitrogen
Upper Uwchlan	247,734	6,034	31	0.63	12,488	1,535	250	354
Uwchlan	189,708	6,011	29	0.52	9,537	2,064	331	510
West Whiteland	568,493	14,046	29	0.39	28,773	3,216	525	846
West Goshen	481,501	14,473	25	0.46	24,341	3,632	578	931
PA 100 Study Corridor	1,544,472	42,324	25.6	0.39	78,004	11,773	1,901	2,992

FUTURE LAND USE AND DEMOGRAPHICS

Special effort was devoted in this study to quantifying population and employment estimates associated with future land development scenarios portrayed in planning studies conducted by the corridor municipalities. Once determined, the data served as demographic inputs to the regional model for Year 2020 futures testing.

The size, use(s) and location of future developments (proposed and potential) were tabulated, verified and updated with municipal representatives to the Steering Committee. "Typical densities" (i.e., persons per dwelling type; employees per 1,000 gross square feet, or acre, for office, light industry, retail; etc.) were obtained from published references[15] [16] [17], Steering Committee members and professional judgement.

In turn, the appropriate densities were applied to the various uses to obtain estimates of population and/or employment for a given development. The population and employment increments associated with the future development scenarios were subsequently assessed for reasonableness, modified where appropriate, aggregated to the PA 100 Corridor Study TAZ structure, summed with

[15] *Trip Generation - An Informational Report (5th edition)*, Institute of Transportation Engineers, Washington, D.C., 1991.

[16] *The Fiscal Impact Handbook*, The Center for Urban Policy Research, New Brunswick, NJ, 1978.

[17] *The New Practitioner's Guide to Fiscal Impact Analysis*, The Center for Urban Policy Research, New Brunswick, NJ, 1985.

1995 demographics, and ultimately used as inputs for future Year 2020 modeling activities.

Table 8 summarizes the magnitude of future development foreseen for the corridor according to the municipal studies examined.

TABLE 8
TABULATION OF FUTURE LAND USE

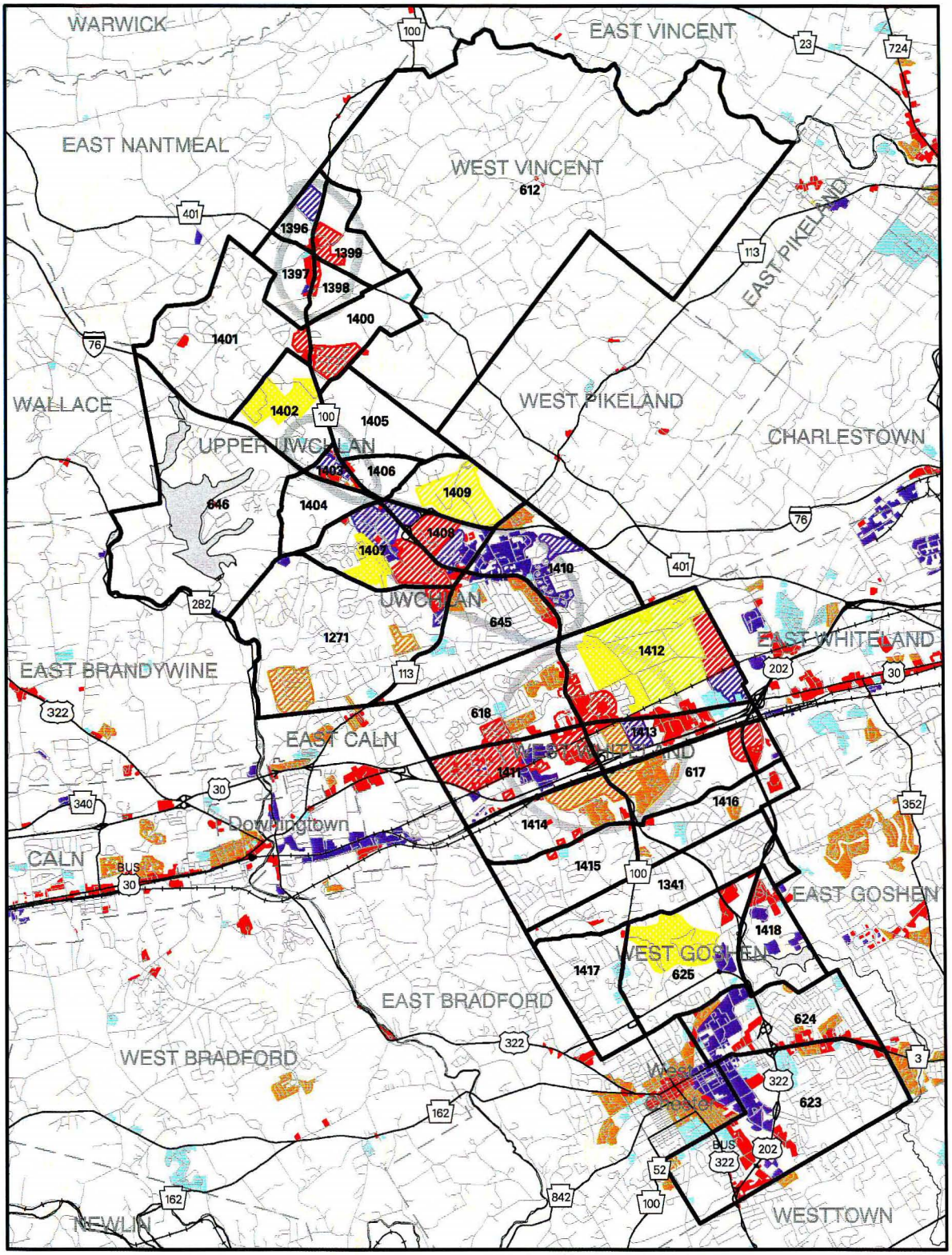
Municipality	Residential (units)	Commercial (square feet in 000's)			Industrial (square feet in 000's)	
	Single Family, Townhses. & Apts.	Retail	Office	Business Center	Warehouse	Light Industry
West Vincent	361	533.2	97.7	-	47.7	31.5
Upper Uwchlan	339	261.8	354.0	1,113.0	-	406.5
Uwchlan	2,177	260.0	1,517.0	90.0	-	354.8
West Whiteland	1,865	1,392.0	3,920.0	60.0	-	450.0
West Goshen	1,913	53.9	61.9	-	-	2,869.6
PA 100 Study Corridor	6,755	2,500.9	5,950.6	1,263.0	47.7	4,112.4

Figure 14 illustrates the location of the significant land development proposals in conjunction with the higher density uses already present in the study corridor. Table 9 summarizes the projected changes to municipal population and employment as a consequence of this "land use assumptions" exercise.

TABLE 9
DEMOGRAPHIC PROJECTIONS: 1995 and 2020

Municipality	Area (mi^2)	Population				Employment			
				Change				Change	
		1995	2020	Abs.	%	1995	2020	Abs.	%
West Vincent	17.7	2,417	3,750	1,333	55	152	3,123	2,971	1,955
Upper Uwchlan	10.8	4,977	5,978	1,001	20	1,931	6,538	4,607	239
Uwchlan	10.4	14,247	20,187	5,940	42	5,344	10,345	5,001	94
West Whiteland	13.0	14,576	19,775	5,199	36	16,616	33,205	16,589	100
West Goshen	11.9	19,361	24,985	5,624	29	16,327	22,560	6,233	38
PA 100 Study Corridor	63.8	55,578	74,675	19,097	34	40,370	75,771	35,401	88

PA 100 CORRIDOR STUDY



By way of summary, the greatest absolute increases in population are projected for Uwchlan, West Whiteland and West Goshen townships — each showing gains of 5,000 to 6,000 persons between 1995 and 2020. Employment's greatest gains will take place in West Whiteland (plus 16,600 jobs), followed not so closely by Upper Uwchlan (plus 4,600 jobs), Uwchlan (plus 5,000 jobs) and West Goshen (plus 6,200 jobs). Total study corridor population will climb 34 percent. Total study corridor employment between 1995 and 2020 is projected to rise almost 90 percent.

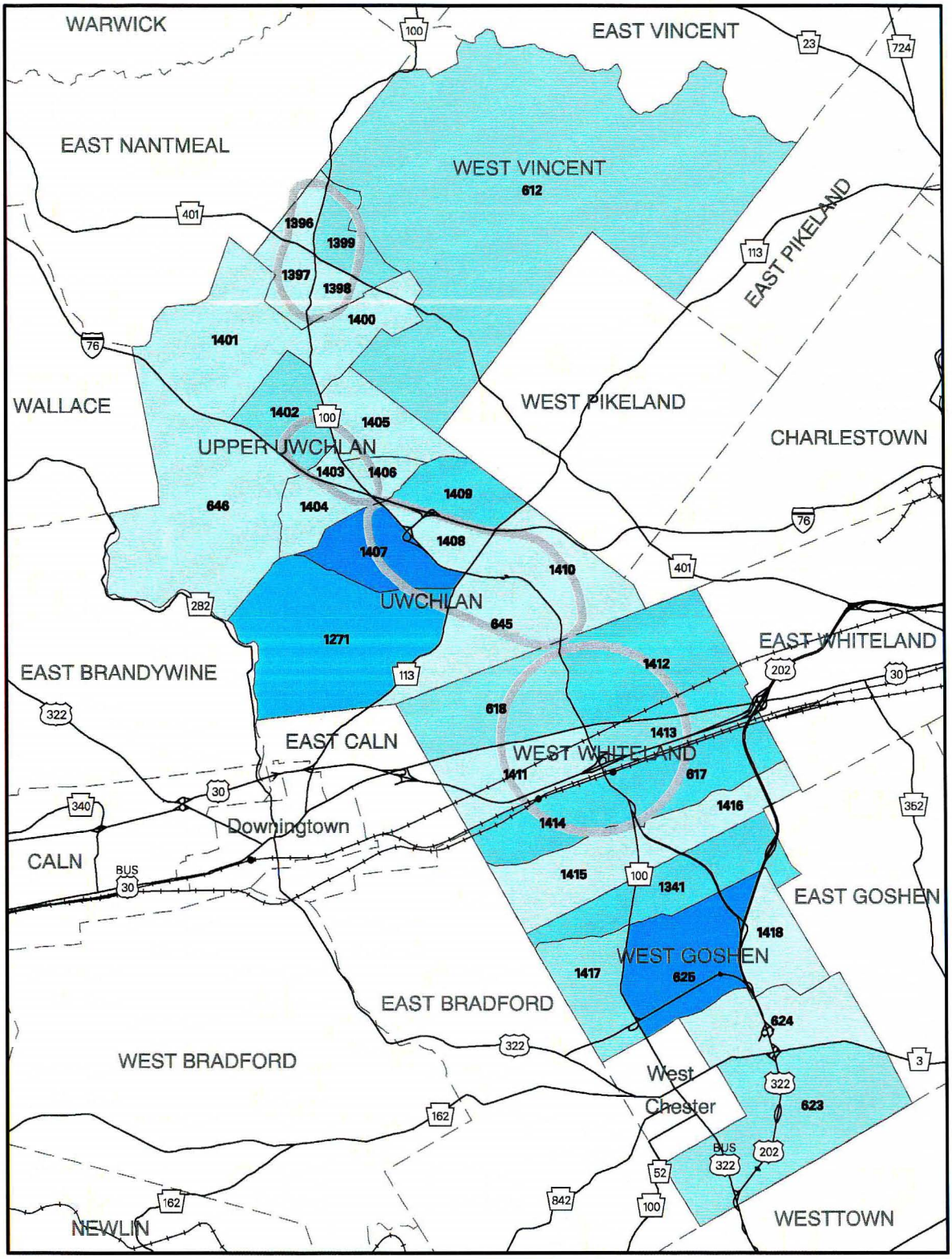
Figures 15 and 16 show the magnitude of the changes stratified by TAZs. In regard to population (see Figure 15):

- Uwchlan Township will experience its largest population gain in developments contiguous with the Eagleview development (TAZ #1407) — integral with the Lionville development center. Substantial gains are also projected as a result of the Altman/Young mixed residential development in the western portion of the Township (TAZ #1271).
- West Whiteland will experience large population gains as a consequence of the continuing development of single family subdivisions of the Church Farm School property (TAZ #1412) and the Whiteland Woods mixed single family and townhouse development (TAZ #1414) — both adjacent to Exton's town center.
- West Goshen will experience its largest population gain with the development of the Jerrehian Estate (TAZ #625).

With respect to employment (see Figure 16):

- The majority of West Vincent Township's employment growth will take place within the northern half of the Ludwigs Corner development center (TAZ #1396 and #1399) as a consequence of the development of the Griffith Tract and the Hamilton development.
- More than half of the new jobs to occupy Upper Uwchlan Township will be centered in the Village of Eagle (TAZ #1403) as a consequence of the Eagle Pointe light industrial development.
- Three-quarters of Uwchlan's employment growth will take place within Lionville — within the Eagleview Corporate Center (TAZ #1407) and as part of the Stone Ridge Corporate Center (#1408).
- West Whiteland Township's largest employment growth will take place on three fronts: in the Glenloch Corporate Center (at the eastern limits of TAZ # 617); the Oaklands Corporate Center (occupying the western half of TAZ #1411), and light industrial development identified in the eastern portions of the Church Farm School property, and expansion at the Exton Square Mall (both in TAZ #1412).

PA 100 CORRIDOR STUDY



1 0 1 2 MILES

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FIGURE 15:

PROJECTED CHANGE IN STUDY CORRIDOR POPULATION 1995 - 2020

- 0 - 499
- 500 - 999
- 1000 - 1499
- 1500 - 1999
- 2000 +

Development Center

623 PA 100 Corridor Study TAZ Number

PA 100 CORRIDOR STUDY

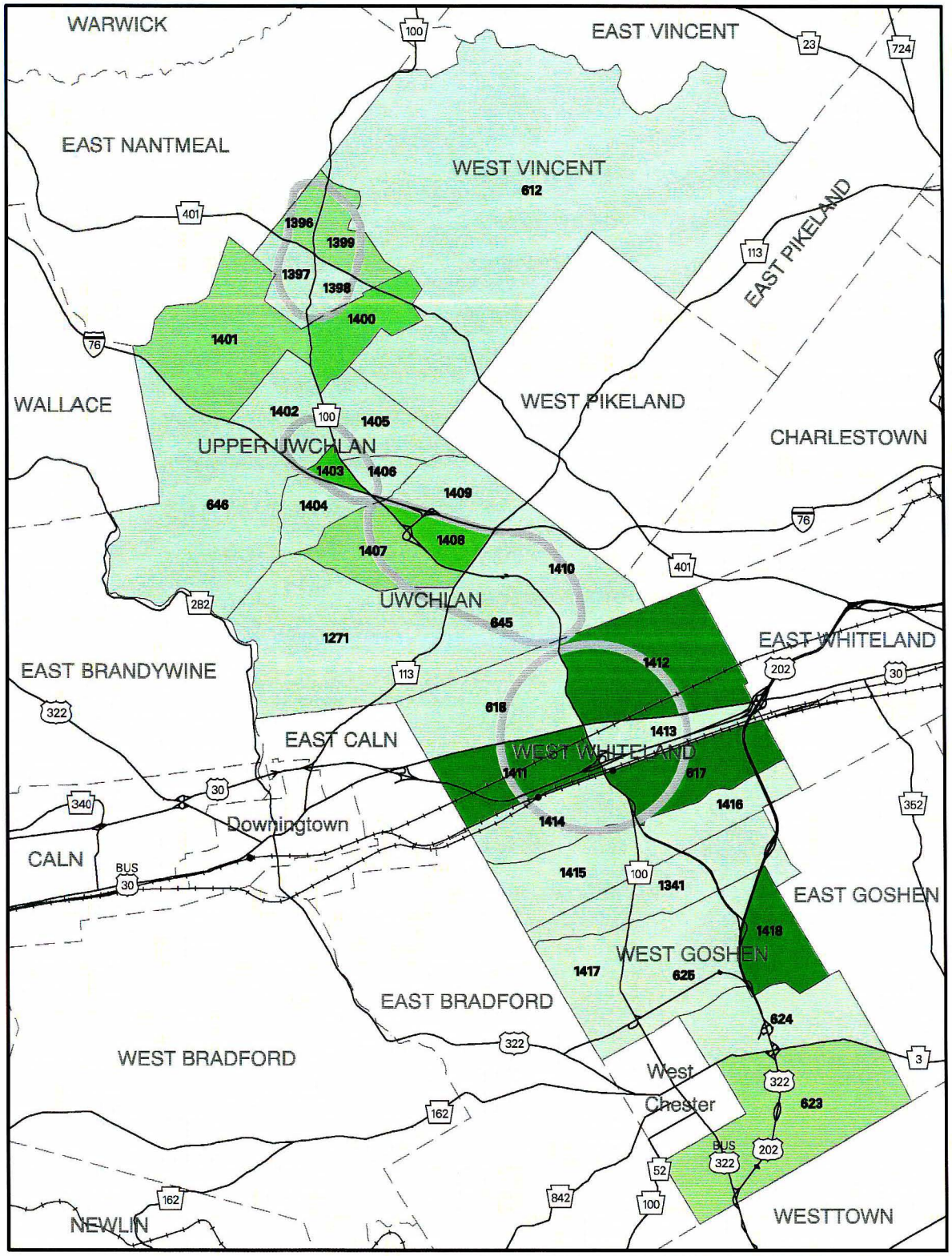

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FIGURE 16:

PROJECTED CHANGE IN STUDY CORRIDOR EMPLOYMENT 1995 - 2020

- 0 - 749
- 750 - 1499
- 1500 - 2249
- 2250 - 2999
- 3000 +

Development Center

623 PA 100 Corridor Study TAZ Number

- Three-quarters of the employment growth in West Goshen will take place in or in the vicinity of the Brandywine Industrial Park along West Goshen's Airport Road corridor (TAZ #1418).

2020 Limited-Build Conditions

Two initial activities were undertaken to prepare the Year 2020 Limited-Build scenario's travel simulation.

- Future study corridor demographics, developed through the land use assumptions exercise, described in the previous section, were input to the regional model for trip generation and trip distribution purposes.
- Second, the regional model's transportation network was updated to reflect a minimum set of "committed" transportation improvements for which funding (public or private) is reasonably assured and/or for which implementation is expected by the horizon year (i.e., the year 2020).

The land use assumptions exercise was fully described in the previous section of this chapter.

The set of committed transportation projects include: those projects in or entering construction; those on the current TIP (FFY 1997 to 2000); those anticipated as conditions in development approvals, and/or; those improvements otherwise identified through the Study Steering Committee. Table 10 lists the set of committed study area highway and transit improvements which were incorporated into the modeling of the Year 2020 Limited-Build scenario.

TABLE 10
STUDY AREA TRANSPORTATION IMPROVEMENTS - YEAR 2020 LIMITED-BUILD TRAVEL SIMULATION

proj. ref # *	Project Description
Publicly Financed Improvements:	
17	PA 113 - Widen to 5 lanes from PA 100 to, but not including, the PA Turnpike bridge
1	PA 100 - Widen to 3 through lanes in each direction from just north of Rutgers/Gordon to the PA Turnpike interchange, including additional turning lanes at the PA 113 intersection
19	PA 113 & Eagleview Blvd - Provide additional turning lanes at the intersection
14	PA 100 & Rutgers / Gordon Dr - Provide double left-turn lane on the Gordon Dr approach
36	Thorndale Station - Construct new end-of-the-line station with 450 parking spaces, provide enhanced service levels along the R-5 Line between Thorndale and Paoli
21	US 202 (Section 400) - Widen to 3 lanes each direction with interchange improvements between PA 252 and I-76
3	PA 100 & Park / Little Conestoga Rd - Intersection improvements, including: signalization, channelization and auxiliary turning lanes
Privately Funded Improvements:	
20	Eagleview Blvd - Construct 4 lane extension to Sheree Blvd
28	Waterloo Blvd - Construct 4 lane extension from Whitford Rd to Lincoln Hwy
9	Exton Town Center East side "Ring Roads" - Construct 2 lane, local service bypass network on the east side of PA 100 from Swedesford Rd through the Exton Mall crossing the Lincoln Hwy to the "Inner Loop" (north of Conrail Tracks) and PA 100, full movement intersections at Swedesford Rd, the Lincoln Hwy and PA 100
11	Church Farm Estates Connector Road - Construct 2 lane highway between Ship Rd and PA 100 (approximately opposite Shoen Rd)
34	Church Farm Connector Road - Construct 4 lane connection between the Lincoln Hwy and Swedesford Rd, due west of the US 202 / US 30 interchange
12	PA 100 - Widen to 3 lanes in each direction from Shoen Rd to, but not including, the Exton Bypass
2	PA 100 & PA 401 - Provide left turn lanes on both PA 100 approaches and a right turn lane on the northbound PA 100 approach
4	PA 100 & PA 401 - Provide left turn lanes on both PA 401 approaches

* Also see Figures 21a , 21b and Table 21

Figure 17 illustrates the simulated daily traffic volumes which emanated from the Year 2020 Limited-Build model run. Table 11 compares current AADTs and the traffic volume outputs of the two simulations. In the Year 2020 Limited-Build scenario, traffic volume increases on the order of 5,000 to 10,000 vehicles per day are projected for PA 100 north of Park Road. Between Park Road and the Exton Bypass daily volumes will increase between 15,000 and 20,000 over current levels. South of the Bypass daily traffic on PA 100 is projected to rise between 5,000 to 10,000 vehicles.

Modeled transit improvements for the Year 2020 Limited-Build scenario are also shown on Table 10. Table 12 shows current daily transit ridership and estimated boardings emanating from the two simulations. According to the model's outputs, there will be a marginal net increase in daily transit ridership in the study corridor assuming Year 2020 Limited-Build conditions (+231 boardings or +9% over current boardings). Gains are attributable to increased service frequencies modeled for the R5 Line. Conversely, bus ridership is projected to hold steady in the scenario.

Year 2020 Limited-Build Performance Statistics

Highway network performance statistics yielded from the Limited-Build simulation are shown in Table 13. In summary, of the modeled network within the entire study corridor, on a daily basis there is about 2.09 million vehicle miles of travel (VMT) and 56,600 vehicle hours of travel (VHT) — representing a 35 percent increase over the 1996 Base Year scenario. Speeds throughout the network are 20.1 miles per hour, representing a decrease of 5.5 miles per hour versus the 1996 Base Year alternative, and the network is operating at 50 percent of its capacity (versus 39 percent in the 1996 Base Year scenario).

PA 100 CORRIDOR STUDY

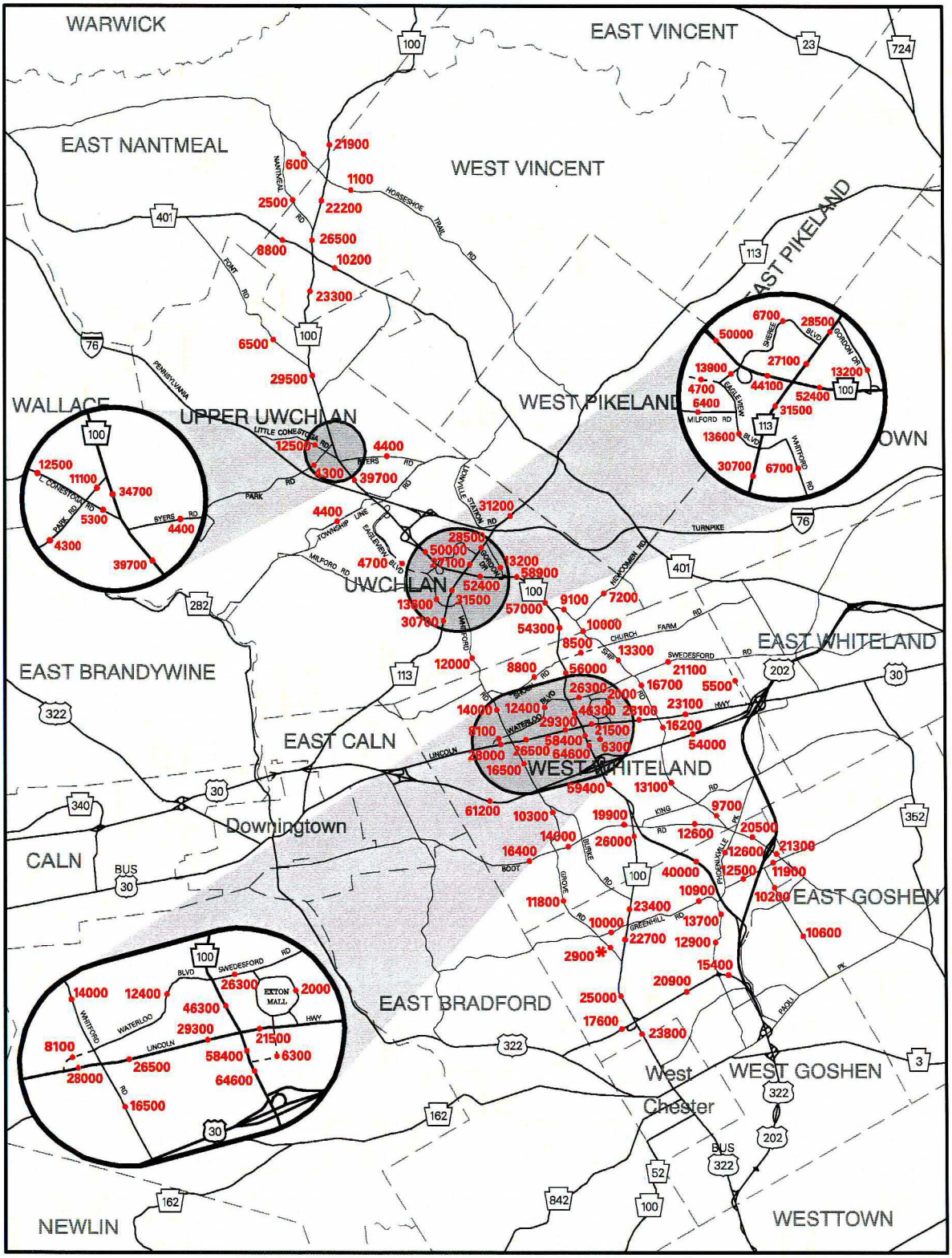

FIGURE 17:

YEAR 2020 LIMITED-BUILD SIMULATED TRAFFIC VOLUMES

- • Traffic Volume Monitoring Location (AADT)
- 2900 Daily Two-Way Traffic Volume
- * One-Way Northbound Traffic Volume

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TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
PA 100	North of Horseshoe Trail Rd	13,286	'95	16,800	21,900	8,614	65
	Horseshoe Trail Rd to Nantmeal Rd	12,461	'95	16,800	22,200	9,739	78
	PA 401 to Font Rd	13,045	'95	17,100	23,300	10,255	79
	Font Rd to Park Rd			23,100	29,500		
	Little Conestoga / Byers to Twp Line Rd	21,776	'95	28,200	39,700	17,924	82
	PA Tnpk Intrchng to Sheree Blvd	30,428	'95	38,100	50,000	19,572	64
	PA 113 to Gordon / Rutgers	40,018	'96	40,000	52,400	12,382	31
	Gordon / Rutgers Dr to Worthington Dr			43,700	58,900		
	Worthington Dr to Ship / Marchwood	35,575	'95	38,400	57,000	21,425	60
	Ship / Marchwood to Shoen			35,700	54,300		
	Shoen to Waterloo / Swedesford	35,381	'96	37,600	56,000	20,619	58
	Waterloo Blvd to Lincoln Hwy			34,800	46,300		
	South of Lincoln Hwy	37,142	'96	39,800	58,400	21,258	57
	Exton Byp to PA 100 Connector	50,273	'97	48,700	59,400	9,127	18
	Boot Rd to Burke Rd	15,128	'97	15,300	26,000	10,872	72
	Burke Rd to Green Hill Rd			14,400	23,400		

TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
PA 100 (cont.)	Green Hill Rd to Grove Rd *			16,800	22,700		
	Grove Rd to US 322			19,000	25,000		
	South of US 322			18,300	23,800		
Horseshoe Trail Rd	West of PA 100			200	600		
	East of PA 100			200	1,100		
Nantmeal Rd	West of PA 100			1,000	2,500		
PA 401	West of PA 100			2,800	8,800		
	East of PA 100	4,372	'95	4,300	10,200	5,828	133
Font Rd	West of PA 100			5,200	6,500		
Park Rd	West of Little Conestoga Rd	3,171	'95	3,300	4,300	1,129	36
Little Conestoga Rd	North of Park Rd			8,800	12,500		
Byers Rd	East of PA 100	1,992	'96	2,000	4,400	2,408	121
Township Line	West of PA 100	2,395	'95	2,400	4,400	2,005	84
PA 113	South of Eagleview Blvd	22,403	'97	22,000	30,700	8,297	37
	Between Eagleview Blvd and PA 100			22,600	31,500		

TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
PA 113 (cont.)	Between PA 100 and Sheree Blvd			20,200	27,100		
	Sheree Blvd to Gordon Dr			21,700	28,500		
	North of PA Tnpk / Lionville Station Rd			24,500	31,200		
Gordon Dr	North of PA 100			8,200	13,200		
Shoen Rd	Whitford Rd to PA100			4,100	8,800		
Proposed Church Farm Estates Connector	PA 100 to Ship Rd			N.A.	8,500		
Waterloo Blvd	Proposed Extension from Whitford Rd to Lincoln Hwy			N.A.	8,100		
	West of PA 100	9,335	'95	7,300	12,400	3,065	33
Swedesford Rd	East of PA 100			16,200	26,300		
	East of Ship Rd	7,650	'97	7,200	21,100	13,450	176
Lincoln Hwy	West of Whitford Rd	18,094	'96	17,800	28,800	9,906	55
	East of Whitford Rd			15,400	26,500		
	West of PA 100			17,900	29,300		
	East of PA 100			17,500	21,500		

TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
Lincoln Hwy (cont.)	West of Ship Rd			16,600	28,100		
	East of Ship Rd	15,876	'96	15,400	23,100	7,224	46
US 30 - Exton Byp	CD Bypass to PA 100	47,524	'97	49,500	61,200	13,676	29
	PA 100 to US 202	32,563	'96	37,600	54,000	21,437	66
Boot Rd	West of Whitford Rd			9,100	16,400		
	Whitford Rd to Burke Rd			8,600	14,000		
	Burke Rd to PA 100	15,708	'95	14,400	19,900	4,192	27
	King Rd to Ship Rd	10,078	'97	10,000	12,600	2,522	25
	Phoenixville Pk to US 202	17,389	'95	13,500	20,500	3,111	18
GreenHill Rd	Whitford / Grove Rd to PA 100 *			4,000	10,000		
	PA 100 to Phoenixville Pk	3,605	'95	2,800	10,900	7,295	202
Prop. W.G. Cross- Twp Connector	PA 100 to Phoenixville Pk			N.A.	N.A.		
US 322	West of PA 100	15,885	'95	13,100	17,600	1,715	11
	Between PA 100 and Phoenixville Pk			15,900	20,900		
	East of Phoenixville Pk	12,940	'95	12,700	15,400	2,460	19

TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
Eagleview Blvd	Milford Rd to PA 113	9,511	'97	9,000	13,600	4,089	43
Whitford Rd	Devon Dr to Whitford Hills Rd			9,700	12,000		
	Shoen Rd to Waterloo Blvd	8,684	'97	8,700	14,000	5,316	61
	South of Lincoln Hwy	11,263	'97	13,000	16,500	5,237	46
	Burke Rd to Boot Rd	5,476	'96	6,800	10,300	4,824	88
Grove Rd	Boot Rd to Green Hill Rd	4,917	'96	5,900	11,800	6,883	140
	Green Hill Rd to PA 100 *			2,200	2,900		
Ship Rd	PA 100 to Newcomen Rd	8,309	'96	8,200	9,100	791	10
	Newcomen Rd to Prop. Church Farm Estates Conn			6,000	10,000		
	Prop. Church Farm Estates Connector to Swedesford Rd	5,722	'97	6,000	13,300	7,578	132
	Swedesford Rd to Lincoln Hwy			8,500	16,700		
	South of Lincoln Hwy			8,100	16,200		
	North of King Rd	8,017	'97	9,600	13,100	5,083	63
	North of Boot Rd			7,400	9,700		
Phoenixville Pk	Boot Rd to Green Hill Rd	6,321	'97	8,300	12,600	6,279	99

TABLE 11
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED AADTs		Differences: Current vs. 2020 Limited-Build	
Highway	Limits	Current AADTs	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
Phoenixville Pk (cont.)	Green Hill Rd to Prop. Cross Township Conn.			7,200	13,700		
Prop. Church Farm Connector	Lincoln Hwy to Swedesford Rd			0	5,500		
PA 100 Connector	PA 100 to US 202	30,652	'97	33,300	40,000	9,348	30

* Grove Road is currently one-way northbound between PA 100 and Green Hill Road. Simulated volumes assume one-way conditions for the 1996 Base Year and 2020 Limited-Build scenarios.

TABLE 12
CURRENT AND SIMULATED AVERAGE DAILY TRANSIT BOARDINGS
1996 BASE YEAR AND 2020 LIMITED-BUILD ALTERNATIVES

				SIMULATED BOARDINGS		Differences: Current vs. 2020 Limited-Build	
Route	Limits	Current Boardings	Year	1996 Base Year	2020 Limited-Build	Absolute	Percent
SEPTA's R-5 Line	1996 - Parksburg to Malvern (fare zones 5&6) 2020 - Thorndale to Malvern (fare zone 5)	1,243	'95	1,405	1,493	250	20
SEPTA's 92 Bus	West Chester to King of Prussia	368	'95	372	356	(12)	(3)
Krapf's A Bus	Coatesville to West Chester	846	'95	786	839	(7)	(1)
TOTAL		2,457		2,563	2,688	231	9

TABLE 13
PERFORMANCE MEASURES - YEAR 2020 LIMITED-BUILD MODELED HIGHWAY NETWORK

MCD	Vehicle Miles of Travel	Vehicle Hours of Travel	Avg. Daily Speed (mph)	V/C Ratio	Fuel Consumption (gallons/day)	Mobile Source Emissions (kilograms / day in July)		
						Carbon Monoxide	Non-methane Hydro-carbons	Oxides of Nitrogen
West Vincent	73,824	2,278	23	0.59	3,709	1,565	263	425
Upper Uwchlan	325,444	7,862	24	0.82	16,409	1,699	301	435
Uwchlan	243,466	7,723	22	0.67	12,239	2,394	371	592
West Whiteland	806,915	19,666	23	0.50	40,851	3,602	589	948
West Goshen	645,301	19,094	19	0.59	32,628	4,068	647	1,043
PA 100 Study Corridor	2,094,950	56,623	20.0	0.50	105,836	13,328	2,170	3,442

Assuming that current vehicle-type characteristics and fuel efficiencies are carried forward to the horizon year, approximately 106,000 gallons of fuel will be consumed on a daily basis throughout the modeled network — a change from 1996 Base Year conditions that is consistent with the increase in VMT. Future year 2020 emissions estimates assume that mandated improvements in vehicle design and re-formulated fuels will result in decreased emissions per vehicle mile traveled. As such, mobile source emissions for the Year 2020 Limited-Build scenario increase an average of just 14 percent over the emission estimates for the 1996 Base Year alternative.

Assessment of Year 2020 Limited-Build Traffic Conditions

Twelve intersections along the corridor were selected as "monitoring" locations for a planning assessment of PA 100's future through-lane requirements. To conduct the assessment, projected Year 2020 Limited-Build AADTs were converted to PM peak hour turning movement traffic volumes at each monitoring intersection. Furthermore, committed intersection geometry (or the existing geometry where no traffic improvements are cited) was identified. Figure 18 illustrates the initial set of intersection conditions (volume and geometry) assumed for the analyses.

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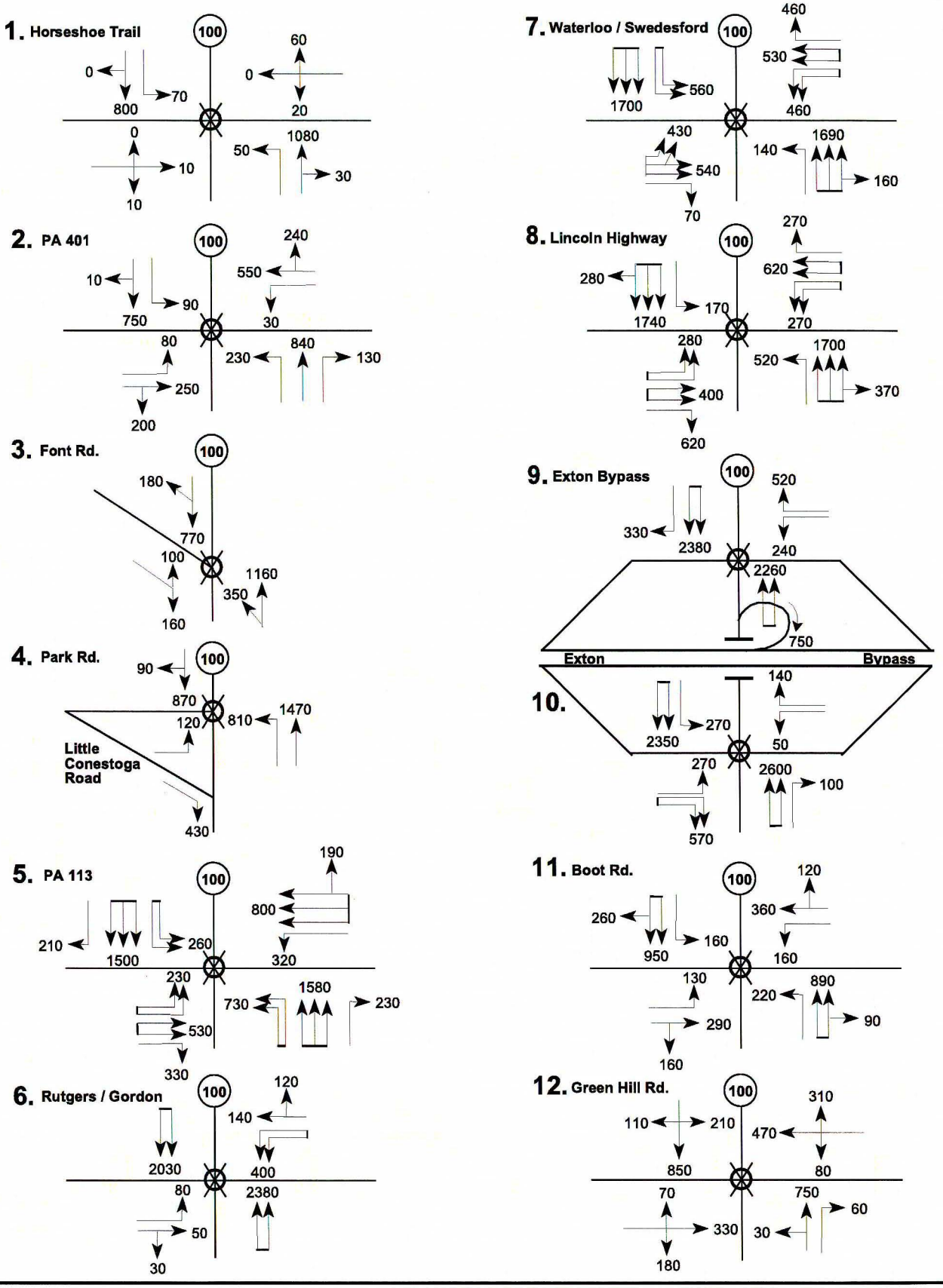

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FIGURE 18:

TRAFFIC CONDITIONS AT SELECTED MONITORING LOCATIONS

Year 2020 Limited-Build PM Peak Hour

250 - Traffic Volume

- Traffic Signal

- Lane Group

The intersection conditions illustrated in Figure 18 were analyzed using the planning methodology for evaluating signalized intersections per the *Highway Capacity Manual* [18]. In that methodology the computed sum of an intersection's critical lane volume is used as an overall indicator of the ability of intersection geometry to accommodate traffic demand. Threshold values for critical lane volumes and capacity levels are listed below.

Maximum Sum of Critical Volumes	Capacity Level
≤ 1,200	Under
1,201 to 1,400	Near
>1,400	Over

The findings of the analyses for each monitoring location is described below and is summarized on Table 14.

1. Horseshoe Trail Road - Existing cross sections on PA 100 (3 lanes) and Horseshoe Trail Road (2 lanes) will be satisfactory if signalized in the future.
2. PA 401 - Providing left turn lanes on all approaches and a northbound right turn lane will not meet future needs. Widening PA 100 for an additional travel lane in each direction plus providing the Ludwigs Corner bypass will be necessary.
3. Font Road - Current geometry will be inadequate in serving future volume. Auxiliary turning lanes on PA 100 and Font Road will be necessary. The current two lane cross section on PA 100, removed from the intersection, should serve future corridor needs (provided no major new development, roadways or driveways are introduced to the section).
4. Park Road / Little Conestoga Road - The committed set of intersection improvements will not satisfactorily address future traffic demand. Widening PA 100 to two lanes each direction and providing the Eagle Bypass will be necessary.
5. PA 113 - Current improvements -- widening along PA 100 (to 3 through lanes in each direction) and adding designated turning lanes at the intersection will just accommodate future traffic demand.
6. Rutgers Drive / Gordon Drive - Widening PA 100 to three lanes in each direction, in addition to the committed improvement to widen the Gordon Drive approach to PA 100, will be necessary to accommodate projected demand.

[18] *Highway Capacity Manual - Special Report #209*, Transportation Research Board, Washington, D.C., 1985.

7. Swedesford Road / Waterloo Boulevard - The capacity yielded from widening PA 100 and adding turning lanes at the intersection (as sponsored through the Mall expansion) will be marginally exceeded by demand volume. A northbound right turn lane will address the situation.
8. Lincoln Highway - The set of committed improvements sponsored with the Mall's expansion, will not be sufficient to accommodate the projected future traffic demands of the Year 2020 Limited-Build scenario. Provision of the "ring roads" on the intersection's southwest quadrant (at least between PA 100 and the Lincoln Highway) and a widened Waterloo Boulevard will extend the intersection's serviceability. Model to quantify.
9. Exton Bypass' Westbound On / Off Ramps - Current geometry will just meet the needs of the future traffic projections.
10. Exton Bypass' Eastbound On / Off Ramps - Current geometry will not satisfy the Year 2020 Limited-Build scenario's projected future peak traffic demands. Travel demand management strategies (i.e., alternate route signing and monitoring, ridesharing and TDM), traffic operations improvements (reconfiguring interchange or adding additional interchanges), and/or widening PA 100 will be necessary to accommodate traffic volume. [It should be noted that this last option was judged to be impractical within the Steering Committee.]
11. Boot Road - Current geometry will just accommodate projected traffic levels. Provision of right turn lanes on the northbound, southbound and westbound approaches will extend serviceability.
12. Green Hill Road - The majority of traffic along this segment is estimated to be local in nature. Therefore, aggressive ridesharing actions are believed to be most applicable in this section of the corridor. Still, widening PA 100 for an additional travel lane in each direction, with a center-left-turn lane, plus a westbound right-turn lane will be necessary to accommodate future traffic demand.

TABLE 14
PLANNING ASSESSMENT OF YEAR 2020 LIMITED-BUILD PM PEAK HOUR TRAFFIC CONDITIONS

Monitoring Location PA 100 &	Existing or Committed Geometry		Limited-Build Conditions		
	Critical Intersection Volume	Capacity Level	Improvement	Critical Intersection Volume	Capacity Level
1. Horseshoe Trail Rd	1,260 (signal assumed)	NEAR			
2. PA 401	1,900	OVER	Widen PA 100 to 2 lanes each direction with Ludwigs Corner Bypass	1,160	UNDER
3. Font Rd	2,660 (signal assumed)	OVER	Add auxiliary turning lanes on all approaches	1,320	NEAR
4. Park Rd/ Little Conestoga Rd	1,890	OVER	Widen PA 100 to 2 lanes each direction with Eagle Bypass	1,410	AT / OVER
5. PA 113	1,450	AT / OVER			
6. Rutgers Dr/ Gordon Dr	1,530	OVER	Widen PA 100 to 3 lanes in each direction	1,130	UNDER
7. Waterloo Blvd/ Swedesford Rd	1,480	OVER	Add nb right turn lane	1,430	AT / OVER
8. Lincoln Hwy	1,550	OVER	Add west-side ring roads	model for best estimates	
9. Exton Bypass WB Ramps	1,430	AT / OVER			
10. Exton Bypass EB Ramps	1,840	OVER	Widen PA 100 to 3 lanes in each direction	1,410	AT / OVER
11. Boot Rd	1,430	AT / OVER	Add right turn lanes on nb, sb and wb approaches	1,350	NEAR
12. Green Hill Rd	2,750	OVER	Widen PA 100 to 2 lanes each direction and add wb right turn lane	1,340	NEAR

MAX. SUM OF CRITICAL VOLUMES
≤ 1,200
1,201 to 1,400
> 1,400

CAPACITY LEVEL
Under
Near
Over

Conclusions: Analyses of Year 2020 Limited-Build Scenario
Conclusions reached regarding through travel lane requirements along PA 100, as a result of the planning assessment of Year 2020 Limited-Build traffic conditions, are:

1) Two travel lanes (1 each direction) will be satisfactory north of Ludwigs Corner.
2) Four travel lanes (2 each direction) will be necessary through Ludwigs Corner. The two lanes by direction should be provided in part by the Ludwigs Corner Bypass.
3) Two travel lanes (1 each direction) will be satisfactory between the Ludwigs Corner Bypass and the Eagle Bypass.
4) Four travel lanes (2 each direction) will be necessary north of the Turnpike through the Village of Eagle. The two lanes by direction, needed through Eagle, should be provided in part by the Eagle Bypass.
5) Six travel lanes (3 each direction) will be needed from the Turnpike through the Exton Bypass interchange.
6) Four travel lanes (2 lanes each direction) will be necessary from the Exton Bypass interchange to US 322.
7) Travel demand management (TDM) and ridesharing actions are appropriate for implementation in West Whiteland and West Goshen townships.
8) A feasibility study of the PA 100 and Exton Bypass interchange should be undertaken to evaluate the practicality of widening PA 100 through the interchange to the PA 100 Connector, and/or options to the present interchange configuration (including additional ramps or interchanges along the Bypass).

2020 Full-Build Conditions

The following activities were undertaken to prepare the Year 2020 Full-Build scenario travel simulation:

- First, a second tier of transportation improvements were added to the "committed" set modeled in the 2020 Limited-Build Scenario. The funding outlook for this second set of improvements is less clear. Testing of the additional improvements sought to provide an understanding of the improvements' effects / benefits.

- Second, future year 2020 employment and population demographics, which resulted from the land use assumptions exercise and were used in the Limited-Build scenario, were surcharged to account for potential induced area-wide development resulting from the full set of transportation improvements.

The improvement projects emanated from various sources (including review of the Limited-Build network, PennDOT's Twelve Year Program, comprehensive transportation plans prepared for the study corridor municipalities, DVRPC's 2020 Plan and suggestions by the Study Corridor Steering Committee). Table 15 lists the set of additional transportation improvements which were assumed as part of the Year 2020 Full-Build highway and transit travel simulation network.

TABLE 15
STUDY AREA TRANSPORTATION IMPROVEMENTS -
YEAR 2020 FULL-BUILD TRAVEL SIMULATION

proj. ref # *	Project Description
Direction 2020 Plan Improvements:	
26	US 202 (section 300) Widen to six lanes from PA 252 to US 30
27	US 202 (section 100) Widen to six lanes between Matlack St and the Delaware St line
32	Boot Rd - Widen to 5 lanes between US 202 and Wilson Rd and Bridge Replacement
29	Waterloo Blvd - Widen to four lanes between Whitford Rd and PA 100
30	Lincoln Hwy - Widen to 2 lanes each direction between PA 100 and Whitford Rd
31	Lincoln Hwy - Widen to 2 lanes each direction between the Exton Mall and US 202
13	PA 100 - Widen to six lanes between Shoen Rd / Church Farm Estates Connector to just north of Gordon / Rutgers
6	PA 100 - Widen to 4 through travel lanes between the Eagle Bypass and the Ludwigs Corner Bypass
5	Eagle Bypass - Construct a 2 lane northbound bypass around the Village of Eagle, convert existing alignment of PA 100 to 2 southbound lanes, continue PA 100 widening (to 4 lanes) southward from the southern limits of the bypass to the Turnpike overpass
15	Ludwigs Corner Bypass - Construct a 2 lane northbound bypass around Ludwigs Corner, convert existing alignment of PA 100 to 2 southbound lanes
40	New bus service - Operate Bus Route "C" between West Chester, Glenloch and Phoenixville (via Paoli Pk, Boot Rd, Phoenixville Pk, Lincoln Hwy and PA 29)
Other Improvements:	
18	PA 113 - Widen to 5 lanes between and including the PA Turnpike and Davis Road (includes Turnpike bridge widening)
10	Exton Town Center West side "Ring Roads" - Construct 2 lane, local service bypass network on the west side of PA 100 by extending Commerce Dr from Whitford Rd to PA 100 and providing connection between Waterloo Blvd and the Lincoln Hwy to Commerce Dr extended, full movement intersections at Waterloo Blvd, the Lincoln Hwy, Commerce Dr, Whitford Rd and PA 100
42	Glenloch Station - Construct new regional rail train station and park and ride lot between Exton and Malvern stations, served by the SEPTA R5 Line
16	PA 100 - Widen to 4 lanes from US 322 to the West Whiteland line

TABLE 15
STUDY AREA TRANSPORTATION IMPROVEMENTS -
YEAR 2020 FULL-BUILD TRAVEL SIMULATION

proj. ref # *	Project Description
33	Boot Road - Widen to 5 lanes from Ship Rd to US 202
23	North Five Points Rd - Extend North Five Points Rd to Ward Rd in West Goshen
35	West Goshen's Cross Township Connector - Construct 2 lane connector highway on new alignment from PA 100 at Grove Rd to Phoenixville Pike
22	US 202 NB On-Ramp - Add ramp from North Five Points Rd to nb US 202 (at a point south of the PA 100 Connector's interchange)
24	US 202 SB Off-Ramp - Provide ramp access from sb US 202 to US 322 wb
38	West Whiteland Circulator Bus - Operate and maintain intra-municipal jitney
41	New Bus Service - Operate Bus Route "D" between Downingtown, Pickering and Eagleview Corporate Centers via PA 113
39	New Bus Service - Operate Bus Route "B" between Glenloch Station and Exton to Pickering and Eagleview Corporate Centers and the Village of Eagle via PA 100
7	Eagle Pointe Boulevard - Construct local service connector / bypass route between Park Road and PA 100
8	Acme Falls Road - Construct local service connector / bypass route between Little Conestoga Rd and PA 100

* Also see Figures 21a, 21b and Table 21

Figure 19 illustrates simulated AADTs which emanated from the Year 2020 Full-Build model run. Table 16 provides a comparison of the Full-Build simulations with current traffic volumes, and the results of the 1996 Base Year and 2020 Limited-Build scenarios. Traffic volume increases on the order of 10,000 to 15,000 vehicles per day are projected, over current demands, for PA 100 north of Park Road. Between Park Road and the Exton Bypass daily volumes will increase by approximately 20,000 to 25,000 vehicles over current levels. South of the Bypass, daily traffic is projected to rise by about 10,000 to 15,000 vehicles.

The Full-Build scenario indicates that for any given segment north of the Exton Bypass, PA 100's AADT will be about 5,000 vehicles per day higher than the Limited-Build alternative. Although a 1,500 vehicle per day reduction is estimated immediately south of the Lincoln Highway due to traffic diversion to the Exton Ring Roads. South of the Bypass, the Full-Build scenario demonstrates a 2,500 AADT increase over the Limited-Build alternative.

PA 100 CORRIDOR STUDY

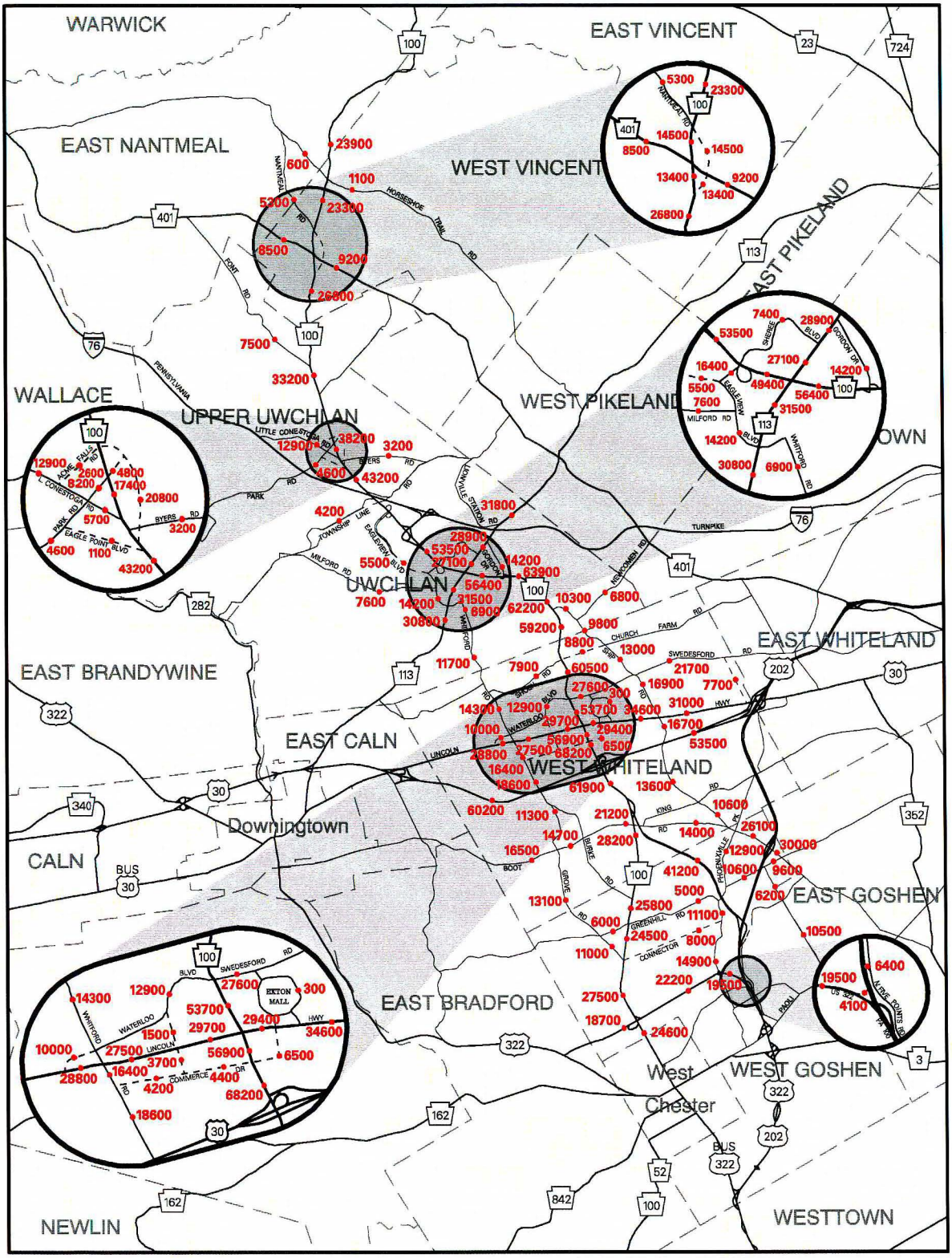

FIGURE 19:

YEAR 2020 FULL-BUILD SIMULATED TRAFFIC VOLUMES

- Traffic Volume Monitoring Location (AADT)
- 2900 Daily Two-Way Traffic Volume

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TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
PA 100	North of Horseshoe Trail Rd	13,286	'95	16,800	21,900	23,900	10,614	80
	Horseshoe Trail Rd to Nantmeal Rd	12,461	'95	16,800	22,200	23,300	10,839	87
	PA 401 to Font Rd	13,045	'95	17,100	23,300	26,800	13,755	105
	Font Rd to Park Rd			23,100	29,500	33,200		
	Little Conestoga / Byers to Twp Line Rd	21,776	'95	28,200	39,700	43,200	21,424	98
	PA Tnpk Intchng to Sheree Blvd	30,428	'95	38,100	50,000	53,500	23,072	76
	PA 113 to Gordon / Rutgers	40,018	'96	40,000	52,400	56,400	16,382	41
	Gordon / Rutgers Dr to Worthington Dr			43,700	58,900	63,900		
	Worthington Dr to Ship / Marchwood	35,575	'95	38,400	57,000	62,200	26,625	75
	Ship / Marchwood to Shoen			35,700	54,300	59,200		
	Shoen to Waterloo / Swedesford	35,381	'96	37,600	56,000	60,500	25,119	71
	Waterloo Blvd to Lincoln Hwy			34,800	46,300	53,700		
	South of Lincoln Hwy	37,142	'96	39,800	58,400	56,900	19,758	53
	Exton Byp to PA 100 Connector	50,273	'97	48,700	59,400	61,900	11,627	23
	Boot Rd to Burke Rd	15,128	'97	15,300	26,000	28,200	13,072	86
	Burke Rd to Green Hill Rd			14,400	23,400	25,800		

TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
PA 100 (cont.)	Green Hill Rd to Grove Rd *			16,800	22,700	24,500		
	Grove Rd to US 322			19,000	25,000	27,500		
	South of US 322			18,300	23,800	24,600		
Horseshoe Trail Rd	West of PA 100			200	600	600		
	East of PA 100			200	1,100	1,100		
Nantmeal Rd	West of PA 100			1,000	2,500	5,300		
PA 401	West of PA 100			2,800	8,800	8,500		
	East of PA 100	4,372	'95	4,300	10,200	9,200	4,828	110
Font Rd	West of PA 100			5,200	6,500	7,500		
Park Rd	West of Little Conestoga Rd	3,171	'95	3,300	4,300	4,600	1,429	45
Little Conestoga Rd	North of Park Rd			8,800	12,500	12,900		
Byers Rd	East of PA 100	1,992	'96	2,000	4,400	3,200	1,208	61
Township Line	West of PA 100	2,395	'95	2,400	4,400	4,200	1,805	75
PA 113	South of Eagleview Blvd	22,403	'97	22,000	30,700	30,800	8,397	37
	Between Eagleview Blvd and PA 100			22,600	31,500	31,500		

TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
PA 113 (cont.)	Between PA 100 and Sheree Blvd			20,200	27,100	27,100		
	Sheree Blvd to Gordon Dr			21,700	28,500	28,900		
	North of PA Tnpk / Lionville Station Rd			24,500	31,200	31,800		
Gordon Dr	North of PA 100			8,200	13,200	14,200		
Shoen Rd	Whitford Rd to PA100			4,100	8,800	7,900		
Proposed Church Farm Estates Connector	PA 100 to Ship Rd			N.A.	8,500	8,800		
Waterloo Blvd	Proposed Extension from Whitford Rd to Lincoln Hwy			N.A.	8,100	10,000		
	West of PA 100	9,335	'95	7,300	12,400	12,900	3,565	38
Swedesford Rd	East of PA 100			16,200	26,300	27,600		
	East of Ship Rd	7,650	'97	7,200	21,100	21,700	14,050	184
Lincoln Hwy	West of Whitford Rd	18,094	'96	17,800	28,800	28,800	10,706	59
	East of Whitford Rd			15,400	26,500	27,500		
	West of PA 100			17,900	29,300	29,700		
	East of PA 100			17,500	21,500	29,400		

TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
Lincoln Hwy (cont.)	West of Ship Rd			16,600	28,100	34,600		
	East of Ship Rd	15,876	'96	15,400	23,100	31,000	15,124	95
US 30 - Exton Byp	CD Bypass to PA 100	47,524	'97	49,500	61,200	60,200	12,676	27
	PA 100 to US 202	32,563	'96	37,600	54,000	53,500	20,937	64
Boot Rd	West of Whitford Rd			9,100	16,400	16,500		
	Whitford Rd to Burke Rd			8,600	14,000	14,700		
	Burke Rd to PA 100	15,708	'95	14,400	19,900	21,200	5,492	35
	King Rd to Ship Rd	10,078	'97	10,000	12,600	14,000	3,922	39
	Phoenixville Pk to US 202	17,389	'95	13,500	20,500	26,100	8,711	50
GreenHill Road	Whitford / Grove Rd to PA 100 *			4,000	10,000	6,000		
	PA 100 to Phoenixville Pk	3,605	'95	2,800	10,900	5,000	1,395	39
Prop. W.G. Cross- Twp Connector	PA 100 to Phoenixville Pk			N.A.	N.A.	8,000		
US 322	West of PA 100	15,885	'95	13,100	17,600	18,700	2,815	18
	Between PA 100 and Phoenixville Pk			15,900	20,900	22,200		
	East of Phoenixville Pk	12,940	'95	12,700	15,400	19,500	6,560	51

TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
Eagleview Blvd	Milford Rd to PA 113	9,511	'97	9,000	13,600	14,200	4,689	49
Whitford Rd	Devon Dr to Whitford Hills Rd			9,700	12,000	11,700		
	Shoen Rd to Waterloo Blvd	8,684	'97	8,700	14,000	14,300	5,616	65
	South of Lincoln Hwy	11,263	'97	13,000	16,500	16,400	5,137	46
	Burke Rd to Boot Rd	5,476	'96	6,800	10,300	11,300	5,824	106
Grove Rd	Boot Rd to Green Hill Rd	4,917	'96	5,900	11,800	13,100	8,183	166
	Green Hill Rd to PA 100 *			2,200	2,900	11,000		
Ship Rd	PA 100 to Newcomen Rd	8,309	'96	8,200	9,100	10,300	1,991	24
	Newcomen Rd to Prop. Church Farm Estates Connector			6,000	10,000	9,800		
	Prop. Church Farm Estates Connector to Swedesford Rd	5,722	'97	6,000	13,300	13,000	7,278	127
	Swedesford Rd to Lincoln Hwy			8,500	16,700	16,900		
	South of Lincoln Hwy			8,100	16,200	16,700		
	North of King Rd	8,017	'97	9,600	13,100	13,600	5,583	70
	North of Boot Rd			7,400	9,700	10,600		
Phoenixville Pk	Boot Rd to Green Hill Rd	6,321	'97	8,300	12,600	12,900	6,579	104

TABLE 16
CURRENT AND SIMULATED AVERAGE DAILY TRAFFIC VOLUMES
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED AADTS			Differences: Current vs. 2020 Full-Build	
Highway	Limits	Current AADTs	Year	1996 BaseYear	2020 Limited-Build	2020 Full-Build	Absolute	Percent
Phoenixville Pk (cont.)	Green Hill Rd to Prop. Cross Township Conn.			7,200	13,700	11,100		
Prop. Church Farm Connector	Lincoln Hwy to Swedesford Rd			0	5,500	7,700		
PA 100 Connector	PA 100 to US 202	30,652	'97	33,300	40,000	41,200	10,548	34

* Grove Road is currently one-way northbound between PA 100 and Green Hill Road. Simulated volumes assume one-way conditions for the 1996 Base Year and 2020 Limited-Build scenarios. In the 2020 Full-Build scenario, simulated volumes assume Grove Road is two-way.

Modeled transit improvements for the Year 2020 Build scenario are also listed in Table 15. Table 17 compares current ridership data with the estimated boardings of the three simulations. According to the modeled outputs, there will be a favorable increase in daily transit ridership in the study corridor assuming Year 2020 Full-Build conditions (+842 boardings or +34% over current boardings).

Gains are attributable to the R5 Line — where increased service frequencies (modeled in the 2020 Limited-Build scenario) and the provision of the Glenloch Station (modeled in the Full-Build scenario) — add 300 daily boardings to current line ridership. Similarly, bus ridership is projected to increase in the corridor as a consequence of adding four new bus routes in the Full-Build scenario. Most notable for the study corridor is Bus Route "B", Glenloch / Exton / Pickering / Eagleview / Eagle service via PA 100 (+238 boardings).

TABLE 17
CURRENT AND SIMULATED AVERAGE DAILY TRANSIT BOARDINGS
1996 BASE YEAR, 2020 LIMITED-BUILD AND 2020 FULL-BUILD ALTERNATIVES

				SIMULATED BOARDINGS			Differences: Current vs. 2020 Full-Build	
Route	Limits	Current Boardings	Year	1996 Base Year	2020 Limited-Build	2020 Full-Build	Absolute	Percent
SEPTA's R-5 Line	1996 - Parksburg to Malvern (fare zones 5&6) 2020 - Thorndale to Malvern (fare zone 5)	1,243	'95	1,405	1,493	1,544	301	24
SEPTA's 92 Bus	West Chester to King of Prussia	368	'95	372	356	363	(5)	(1)
Krapf's A Bus	Coatesville to West Chester	846	'95	786	839	802	(44)	(5)
West Whiteland Circulator Bus	West Whiteland Township	-	-	-	-	78	78	-
Proposed Bus Route "B"	Glenloch, Exton, Pickering, Eagleview, Eagle (via PA 100)	-	-	-	-	238	238	-
Proposed Bus Route "C"	West Chester, Glenloch, Phoenixville (via Paoli Pk, Boot Rd, Phoenixville Pk, Lincoln Hwy, PA 29)	-	-	-	-	231	231	-
Proposed Bus Route "D"	Downingtown, Pickering and Eagleview (via PA 113)	-	-	-	-	44	44	-
TOTAL		2,457		2,563	2,688	3,299	842	34

Selected Link Analyses

The regional travel model was used to estimate the geographic distribution of highway trips assuming the simulated Year 2020 Full-Build transportation network. The analyses were performed for the same links as the 1996 Base Year scenario and the results are shown on Table 18.

TABLE 18
FINDINGS OF SELECTED LINK ANALYSES - YEAR 2020 FULL-BUILD SCENARIO

Link	AADT	Significant Trip Origin Sheds	Average Airline Distance to the Link	Potential Strategy(s)
1) North of Horseshoe Trail Road	23,900	**North** — Pottstown and surrounding area (15%), northern Chester Co. (8%) and Berks Co. (18%);	13.7 miles	Park and ride lots beyond the study corridor, i.e.: at PA 100 & US 422; along the Turnpike.
2) South of Pennsylvania Turnpike Interchange	53,500	**North** — Berks Co. (16%), northern Chester Co. (5%); **Internal** — Upper Uwchlan (11%), Uwchlan (14%), West Whiteland (10%); **East** — Upper Main Line (4%); **West** — Upper Brandywine (4%);	11.0 miles	Park and ride lots beyond the study corridor, i.e.: at PA 100 & US 422; along the Turnpike. Park and ride lots internal to the study corridor, i.e.: in Eagle, Lionville & Exton. Park and ride lots along US 202 - section 400.
3) South of Exton Bypass	61,900	**North** — Berks Co. (4%); **Internal** — Uwchlan (6%), West Whiteland (25%), West Goshen (10%); **South** — West Chester and surrounding areas (5%), the State of Delaware (4%), central / eastern Delaware Co. (8%), northwestern Delaware Co. (3%); **West** — Downingtown / Coatesville area (8%), Lancaster Co. (4%), Upper Brandywine (4%); **East** — East Goshen (3%).	9.1 miles	Park and ride lots internal to the study corridor, i.e.: in Lionville, Exton and West Goshen (the Jerrehian property). Park and ride lots along US 202 - section 100. Park and ride lots along US 30.
4) North of US 322	27,500	**Internal** — West Whiteland (19%), West Goshen (18%); **South** — West Chester Borough (25%); **West**— East Bradford and surrounding areas (10%).	6.5 miles	Park and ride lots internal to the study corridor; in Exton and West Goshen (the Jerrehian property).

In comparison with the selected link analyses for 1996 Base Year conditions, the Year 2020 Full-Build scenario results indicate: shorter overall average trip lengths by the Year 2020 (9.9 miles vs. 11.5 miles in the base year); an increase in the proportion of internal trips, and; a slightly higher orientation of tripmaking between the study corridor and the west.

Year 2020 Full-Build Performance Statistics

Highway network performance statistics yielded from the 2020 Full-Build simulation are shown in Table 19.

TABLE 19
PERFORMANCE MEASURES - YEAR 2020 FULL-BUILD MODELED HIGHWAY NETWORK

MCD	Vehicle Miles of Travel	Vehicle Hours of Travel	Avg. Daily Speed (mph)	V/C Ratio	Fuel Consumption (gallons/day)	Mobile Source Emissions (kilograms / day in July)		
						Carbon Monoxide	Non-methane Hydro-carbons	Oxides of Nitrogen
West Vincent	75,615	2,331	24	0.60	3,799	1,538	252	386
Upper Uwchlan	327,193	7,915	27	0.83	16,496	1,699	298	428
Uwchlan	245,938	7,805	24	0.68	12,363	2,332	381	581
West Whiteland	813,424	19,840	23	0.51	41,179	3,570	578	964
West Goshen	659,156	19,548	22	0.60	33,328	3,995	676	1,052
PA 100 Study Corridor	2,121,326	57,439	22.0	0.51	107,165	13,134	2,185	3,411

In summary, of the Full-Build modeled network, there are about 2.12 million vehicle miles of travel (VMT) and 57,400 vehicle hours of travel (VHT) — representing a 36 percent increase over the 1996 Base Year scenario and a one percent increase over the 2020 Limited-Build scenario. Speeds throughout the network are 22.0 miles per hour (versus 25.6 mph in the base year and 20.0 mph in the Limited-Build). The network operates at 51 percent of its capacity (versus 39 percent and 50 percent in the Base Year and Limited-Build scenarios, respectively).

Daily fuel consumption in the Year 2020 Full-Build network approximates 107,200 gallons, which is one percent above the estimate for the Limited-Build alternative. Future Year 2020 Full-Build emissions estimates are on par with the Limited-Build alternative which is about 14 percent above the Base Year condition.

Assessment of Year 2020 Full-Build Traffic Conditions

Planning assessments to determine PA 100's through travel lane requirements were conducted for the Year 2020 Full-Build scenario. Eleven locations are the same as the Year 2020 Limited-Build scenario's evaluation. In the Full-Build alternative, however, the Grove Road / West Goshen Connector Road intersection was substituted for the Green Hill Road intersection because of higher intersection traffic demands.

Projected Year 2020 Full-Build AADTs were converted to PM peak hour turning movement traffic volumes for the analyses. Traffic related improvements identified in the assessment of Year 2020 Limited-Build's traffic conditions (per Table 14) served as the initial baseline for the Full-Build scenario's analysis.

Figure 20 illustrates initial intersection conditions assumed in the analysis and Table 20 summarizes the analyses. The findings are described below.

1. Horseshoe Trail Road - Existing cross sections on PA 100 (3 lanes) and Horseshoe Trail Road (2 lanes) will be satisfactory if signalized in the future.
2. PA 401 - Widening PA 100 for four through travel lanes and providing the Ludwigs Corner bypass will satisfy Year 2020 Full-Build traffic volumes.
3. Font Road - Adding auxiliary turning lanes alone at the intersection will not serve future volume. Widening PA 100 for four through travel lanes must also be undertaken.
4. Park Road / Little Conestoga Road - Widening PA 100 to 2 lanes in each direction, providing the Eagle Bypass and constructing Eagle Point Boulevard and Acme Falls Road (as traffic relief roadways) will be necessary to provide satisfactory peak traffic operations.
5. PA 113 - The set of committed improvements determined to be adequate for the Limited-Build alternative will not be sufficient in serving projected Full-Build scenario traffic volumes. The Gordon Drive intersection with PA 100 retains sufficient capacity to accommodate traffic overflow. Ridesharing actions in the immediate vicinity are also appropriate.
6. Rutgers Drive / Gordon Drive - Widening PA 100 to three lanes in each direction plus the provision of a double left turn lane on the Gordon Drive approach to PA 100 will satisfy projected demand.
7. Swedesford Road / Waterloo Boulevard - Volume exceeds capacity. Widening Waterloo Boulevard to four lanes between PA 100 and Whitford Rd, assumed in the modeling, exacerbates but does not alone cause the breakdown. Area-wide ridesharing actions are appropriate to extend the intersection's serviceability. Adding new interchanges along the Exton Bypass may also divert / diffuse traffic from the intersection.

PA 100 CORRIDOR STUDY

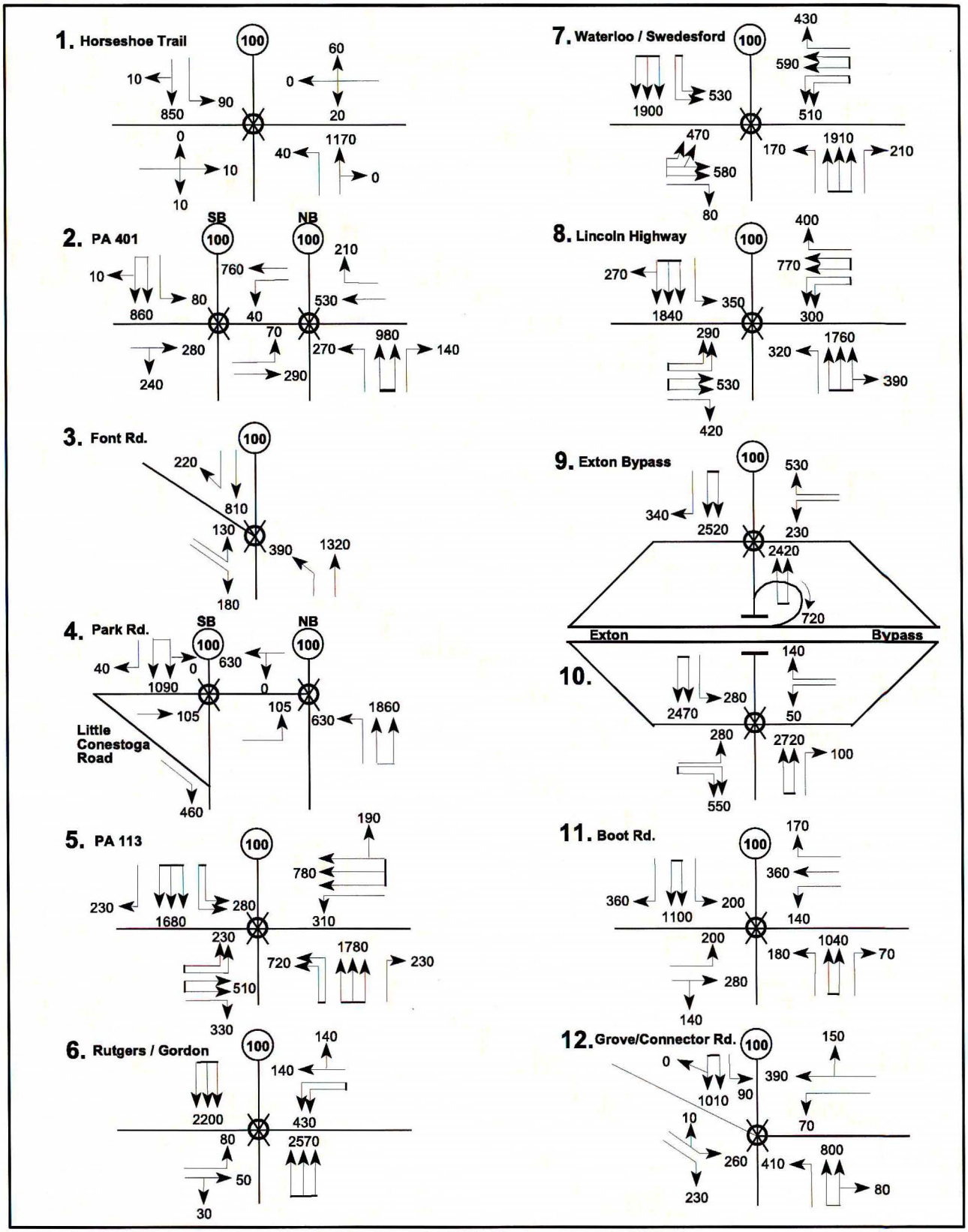

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FIGURE 20 :

TRAFFIC CONDITIONS AT SELECTED MONITORING LOCATIONS

Year 2020 Full-Build PM Peak Hour

250 - Traffic Volume

- Traffic Signal

- Lane Group

TABLE 20
PLANNING ASSESSMENT OF YEAR 2020 FULL-BUILD PM PEAK HOUR TRAFFIC CONDITIONS

	Improved Geometry per Limited-Build		Full-Build Conditions		
Monitoring Location PA 100 &	Critical Intersection Volume	Capacity Level	Improvement	Critical Intersection Volume	Capacity Level
1. Horseshoe Trail Rd	1,340 (signal assumed)	NEAR			
2. PA 401	1,250	UNDER / NEAR			
3. Font Rd	1,500	OVER	Widen PA 100 to 2 lanes in each direction	980	UNDER
4. Park Rd/ Little Conestoga Rd	1,090 (assumes Eagle Pointe Blvd and Acme Falls Rd)	UNDER			
5. PA 113	1,490	OVER	Sufficient capacity at Gordon to accommodate over flow / TDM recommended		
6. Rutgers Dr/ Gordon Dr	1,220	UNDER / NEAR			
7. Waterloo Blvd/ Swedesford Rd	1,550 (assumes widened Waterloo Blvd)	OVER	TDM recommended		
8. Lincoln Hwy	1,470 (assumes all Ring Roads)	OVER	TDM recommended		
9. Exton Bypass WB Ramps	1,490	OVER	Reconfigure interchange or add additional interchange(s) along the Bypass		
10. Exton Bypass EB Ramps	1,920	OVER	Reconfigure interchange or add additional interchange(s) along the Bypass		
11. Boot Rd	1,290	NEAR			
12. Grove / Connector Rd	1,470	OVER	Sufficient capacity at Green Hill Rd to accommodate over flow		

MAX. SUM OF CRITICAL VOLUMES
≤ 1,200
1,201 to 1,400
> 1,400

CAPACITY LEVEL
Under
Near
Over

8. Lincoln Highway - The complete Exton Ring Roads network and a widened Waterloo Boulevard have been assumed in the modeling, which do extend the ability of the intersection to accommodate traffic volume increases. Still, volume exceeds capacity. Greater reliance on the ring roads than modeled, may take place. Area-wide ridesharing actions are appropriate and adding new interchanges along the Exton Bypass may also divert / diffuse traffic from the intersection.
9. Exton Bypass' Westbound On/Off Ramps - Current geometry will not satisfy projected future peak traffic demands. Area-wide travel demand management strategies (i.e., alternate route signing and monitoring, ridesharing and TDM), traffic operations improvements (reconfiguring interchange or adding additional interchanges), [and/or widening PA 100 if possible] will be necessary to accommodate the Full-Build scenario's traffic volume.
10. Exton Bypass' Eastbound On/Off Ramps - Current geometry will not satisfy projected future peak traffic demands. Travel demand management strategies (i.e., alternate route signing and monitoring, ridesharing and TDM), traffic operations improvements (reconfiguring interchange or adding additional interchanges), [and/or widening PA 100 if practical] will be necessary to accommodate projected traffic volume.
11. Boot Road - Right turn lanes on the northbound, southbound and westbound intersection approaches, suggested in the Limited-Build alternative, will be necessary to successfully serve projected Year 2020 Full-Build traffic conditions.
12. Grove Road / Connector Road - Lane configurations per the West Goshen Master Traffic Plan will not quite meet traffic needs. On the other hand, sufficient capacity will exist at the adjacent Green Hill Road intersection to accommodate overflow.

Conclusions: Analyses of Year 2020 Full-Build Scenario

The following conclusions have been reached regarding the PA 100's requirements for through travel lane, assuming Year 2020 Full-Build scenario traffic conditions:

1) Two travel lanes (1 each direction) will be satisfactory north of Ludwigs Corner.
2) Two lanes by direction are appropriate for serving through travel along PA 100 between Ludwigs Corner and the Turnpike.
3) Widening through Ludwigs Corner should be provided in part by the Ludwigs Corner Bypass.
4) Widening through the Village of Eagle should be provided in part by the Eagle Bypass.

5) A cross section of 3 through lanes in each direction is appropriate along PA 100 between the Turnpike and the Exton Bypass.
6) Two travel lanes in each direction will be necessary for serving through travel between the Exton Bypass and US 322 interchanges.
7) Travel demand management strategies and ridesharing programs will be necessary for the corridor — particularly in the central and southern sections (e.g., Uwchlan, West Whiteland and West Goshen townships). The proposed Bus Route "B", Glenloch to Eagle via PA 100, is an appropriate example.
8) A feasibility study of the PA 100 and Exton Bypass interchange should be undertaken to evaluate: the practicality of widening PA 100 through the interchange to the PA 100 Connector, and/or; options to the present interchange configuration, including additional ramps or interchanges along the Bypass. □

6 RECOMMENDATIONS

Implementing a variety of transportation strategies and actions are appropriate, and necessary to provide for long term travel needs within the PA 100 corridor.

This study demonstrates that continuing efforts to widen PA 100 will be required to address future needs. However, the widening alone will not suffice in yielding acceptable peak hour traffic conditions within the corridor for the Year 2020. As a supplement, implementing individual and sets of strategies are recommended to mitigate and manage long term traffic congestion.

The Study's recommendations address mobility, access and safety issues through three broad improvement categories:

1) Capital Improvements - germane to directly solving current and/or future problems identified in the corridor;
2) Management Actions - programmatic and institutional actions implemented regionally, locally, publicly and/or privately which complement and extend the serviceability of the capital improvements, and;
3) Additional Studies - address key issues that emanated from this study, but require detailed evaluations to determine a solution.

CAPITAL IMPROVEMENTS

A large set of capital improvements (48 projects) are recommended for the corridor. Generally, these improvements emanated from the travel forecasting and assessment exercises performed for the Year 2020 Limited-Build and Year 2020 Full-Build scenarios. The recommendations generally mirror the Full-Build alternative's complement of improvements as those most appropriate to serve mobility and growth in the corridor. At the suggestion of the Steering Committee, a handful of the projects (8), which were identified during the assessment of Full-Build conditions and/or were not capable of being modeled, were qualitatively assessed and, where appropriate, added to the list — ensuring comprehensive coverage for the corridor's transportation needs.

The program was subdivided into highway improvements (35 projects), transit improvements (7 projects), ridesharing and transportation demand management improvements (4 projects), and intelligent transportation system improvements (2 projects). Figures 21a and 21b illustrate the PA 100 Corridor Study's recommendations for capital improvements.

PA 100 CORRIDOR STUDY

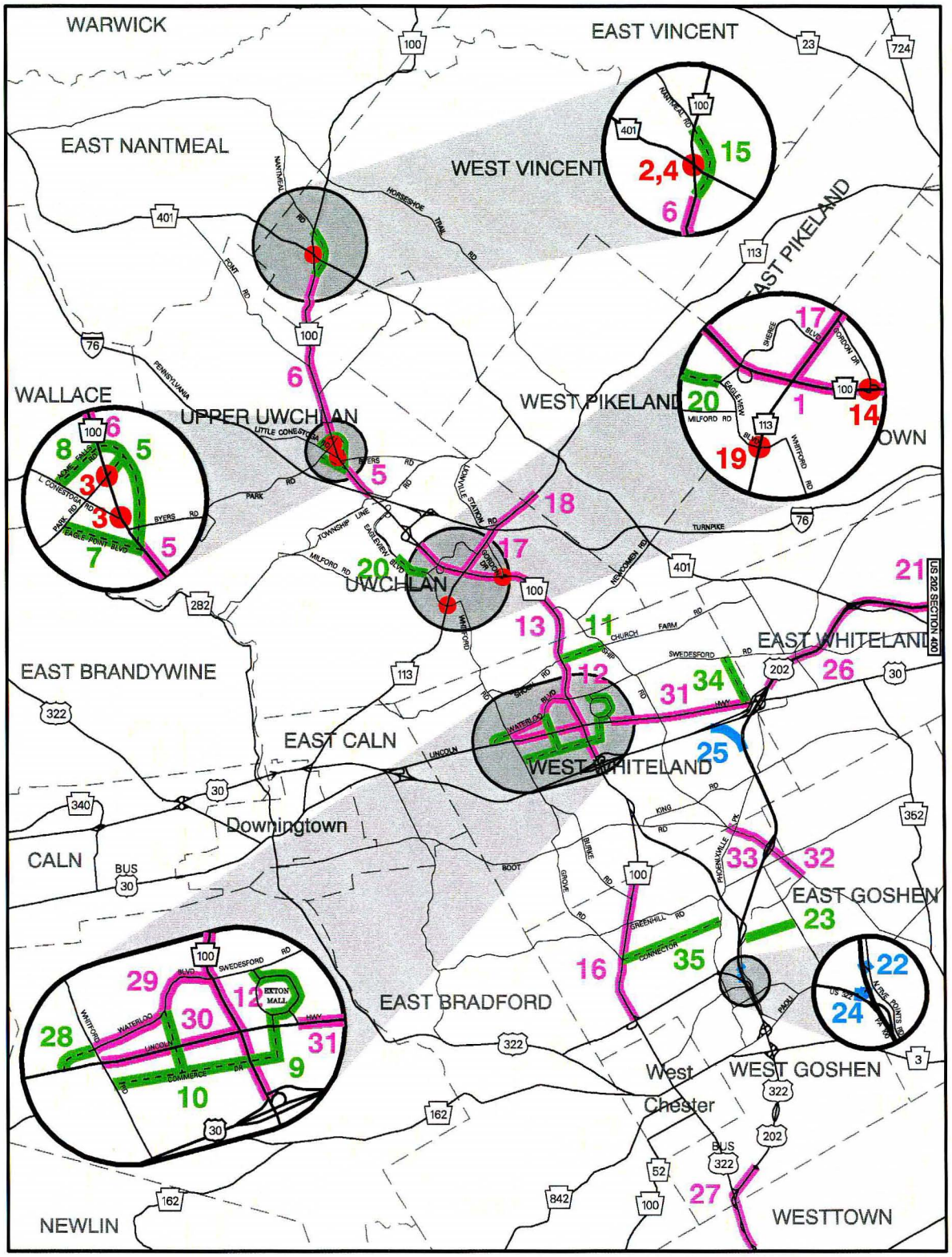

FIGURE 21a:

RECOMMENDED HIGHWAY IMPROVEMENTS

- Roadway Widenings
- Intersection Improvements
- Interchange Improvements
- New Roadway Alignments

Note: See Tables 10, 15 and 21 for more project information

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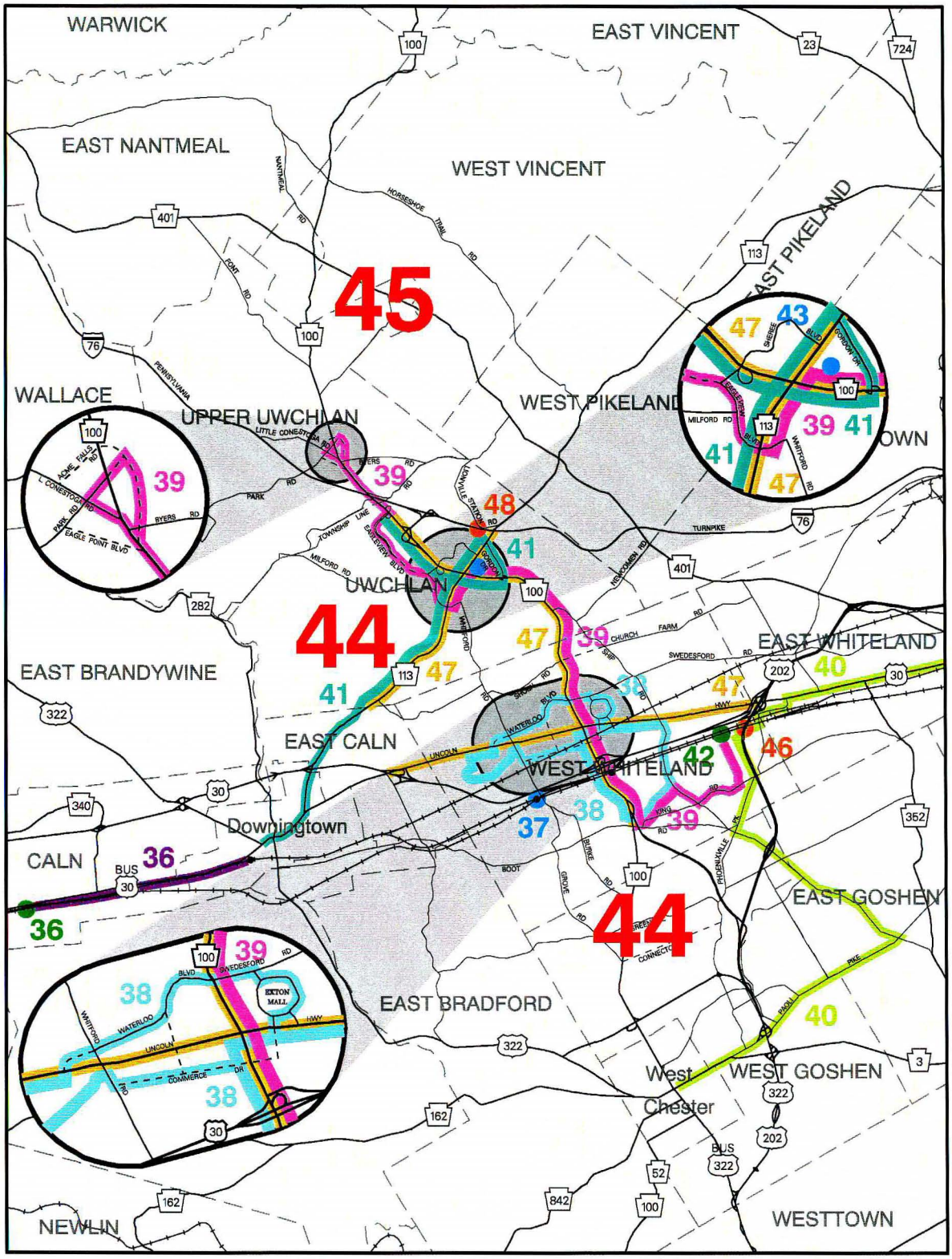

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FIGURE 21b:

RECOMMENDED TRANSIT / TDM / ITS IMPROVEMENTS

- Coordinate Traffic Signal System
- Intersection / Interchange Improvements
- Enhance R-5 Line Service Levels
- New Regional Rail Station
- West Whiteland Circulator Bus
- Bus Route "B" - Glenloch to Eagle via PA 100
- Bus Route "C" - West Chester to Phoenixville via Paoli Pike
- Bus Route "D" - Downingtown to Eagleview Corp. Center via PA 113
- Rail Station Parking Expansion / Park and Ride Lot
- 45 Municipal-Wide Mobility Alternatives Programs

Note: See Tables 10, 15 and 21 for more project information

Capital Improvements Plan

A capital improvements plan (CIP) was prepared to provide structure and direction in implementing the corridor's capital projects (Table 21). The plan presents the recommendations and costs in priority fashion for possible inclusion in the regional Transportation Improvement Program (TIP) and/or for use in seeking alternative sources of financing. The CIP takes project staging and funding into account, as follows:

1) timing based upon transportation "needs" — the year the project is needed to be operational;
2) timing based on project deliverability — the time it takes to build;
3) order of magnitude cost estimates, and;
4) funding status.

The project scheduling portion of Table 21 employs a time line to represent the beginning and duration of the engineering, right-of-way acquisition and construction phases in order to provide an operational improvement at such time as it is estimated to be needed. Project cost estimates were obtained from Steering Committee members, PennDOT and SEPTA, and/or were based upon project data in the Twelve Year Program, the TIP, municipal studies, and/or were estimated from projects of similar scope. Where appropriate, costs have been updated to 1998 dollars.

In addition to needs, staging and costs, the CIP also identifies funding status and sponsors. Project sponsors are those entities with primary responsibility for advocating advancement of a project, not necessarily funding it.

Within the CIP, project staging is defined in four time intervals. The immediate term (0 to 2 years) includes projects which are in or are imminent for construction. The near term program of improvements (3 to 7 years) are projects for which staging can coincide with the development of a subsequent version of the TIP, and the first four years of the PennDOT Twelve Year Program. Medium term improvements (8 to 14 years) coincide with the remaining years of the PennDOT Twelve Year Program. Finally, the long term set of improvements (15 to 22 years) round-out the completion and update of the long range plan for the region (DVRPC's Year 2020 Transportation Plan).

In summary, the plan totals just over $635 million for capital improvements. Of the plan's total projects, 45 (94 percent) are located within study corridor. These total about $103 million (or 16 percent of the total CIP amount). The balance, and bulk, of the plan's needs ($532 million) are aimed at three improvements along US 202 (e.g., sections 100, 300 and 400).

TABLE 21
CAPITAL IMPROVEMENT PLAN

PROJECT SCHEDULING *

proj. ref. # **	Improvement Description	Const. Duration (years)	0-2 years 1998	1999	2000	3-7 years 2001	2002	2003	2004	2005	8-14 years 2006	2007	2008	2009	2010	2011	2012	15-22 years 2013	2014	2015	2016	2017	2018	2019	2020
	HIGHWAY IMPROVEMENTS																								
	PA 100																								
1	100 - Widen, Gordon to Turnpike	2	C	C																					
2	100 & 401 - Left turn lanes on 100	1	E,R,C																						
3	100 & Park/Ltl Conestoga - Lt trn lane, signal, channel.	1	E,R,C																						
4	100 & 401 - Left turn lanes on 401	1			E,R	C																			
5	Eagle Bypass & widening southward to the Tpke Br.	2			E,R	C	C																		
6	100 - Widen between Eagle Byp. and Ludwigs Corner Byp.	2			E	C	C																		
7	Eagle Pointe Blvd	1				E	C																		
8	Acme Falls Rd	1				E	C																		
9	Exton Ring Roads - East	1		E	C																				
10	Exton Ring Roads - West	1		E	C																				
11	Church Farm Estates Connector	1					E	C																	
12	100 - Widen, Shoen to Bypass	3	E	C	C	C																			
13	100 - Widen, Shoen to Gordon	2									E	C	C												
14	100 & Gordon - Double left turn lane on Gordon Dr.	1										E,R	C												
15	Ludwigs Corner Bypass	2													E,R	C	C								
16	100 - Widen, 322 to West Whiteland line	2																		E	C	C			
	PA 113																								
17	113 - Widen, 100 to the Turnpike Bridge	2	E,R,C	C																					
18	113 - Tpke Br. replacement and widening to Davis Rd	3			E	C	C	C																	
19	113 & Eagleview Blvd - Additional turning lanes	1			E,R	C																			
	Eagleview Blvd																								
20	Eagleview Blvd extension	1	E,C																						
	US 202																								
21	202 - Section 400	4	E,R	C	C	C	C																		
22	202 nb on ramp from No. Five Points Rd	1				E	C																		
23	No. Five Points Rd extension	1				E	C																		
24	202 sb off ramp to 322 wb	1				E	C																		
25	US 30 eb ramp to 202 sb	2												E	E,R	C	C								
26	202 - Section 300	3							E	E,R	C	C	C												
27	202 - Section 100	4																	E	E	E,R	C	C	C	C
	Waterloo Blvd																								
28	Waterloo Blvd - extension to Lincoln Hwy	1			E	C																			
29	Waterloo Blvd - widening, Whitford to PA 100	1								E	C														
	Lincoln Hwy																								
30	Lincoln Hwy - Widen, 100 to Whitford	1		E	C																				
31	Lincoln Hwy - Widen, Exton Mall to 202	2												E	E	C	C								
	Boot Rd																								
32	Boot Rd - Bridge replacement and Widen, 202 to Wilson	3					E	E	C	C	C														
33	Boot Rd - Widen, Ship to 202	1														E	C								
	Other																								
34	Church Farm Connector	1							E	C															
35	West Goshen Cross Twp Connector	1													E	C									
	TRANSIT IMPROVEMENTS																								
36	Thorndale Station - Construct and serve R5 rail station	2	C	C																					
37	Whitford Station - Parking expansion	1	E,C																						
38	West Whiteland Circulator Bus	2		O	O >																				
39	Bus Route "B" - Glenloch to Eagle v. PA 100	1						O >																	
40	Bus Route "C" - W. Chester to Phoenixville v. Paoli Pk	1						O >																	
41	Bus Route "D" - Dwningtwn to Eagleview C.C. v. PA 113	1						O >																	
42	Glenloch Station - Construct and serve R5 rail station	2											E	C	C										
	RIDESHARE / TDM IMPROVEMENTS																								
43	100 & 113 park and ride lot	1	E,R,C																						
44	Mobility Alternatives Prgrms: So. & Central (U, WW, WG)	ongoing	>	>	>	>	>	>		>	>	>	>	>	>	>	>	>	>	>	>	>	>	>	>
45	Mobility Alternatives Prgrms: North (WV, UU)	ongoing	>	>	>	>	>	>	>	>	>	>	>		>	>	>	>	>	>	>	>	>	>	>
46	US 202 ramps to Glenloch Station	2												E	E,R	C	C								
	ITS IMPROVEMENTS																								
47	Central Chester Co. closed loop traffic signal system	1	E,R,C																						
48	Turnpike slip ramps at interchange #23	1								E	C														

PROJECT COST ESTIMATES
(Order of magnitude project costs account for Eng. , R-O-W, & Constr. unless noted. 1998 Dollars in 000's.)

proj. ref. # **	Improvement Description	0-2 years funded	0-2 years unfunded	3-7 years funded	3-7 years unfunded	8-14 years funded	8-14 years unfunded	15-22 years funded	15-22 years unfunded	Notes	PROJECT SPONSOR(S) ***
	HIGHWAY IMPROVEMENTS										
	PA 100										
1	100 - Widen, Gordon to Turnpike	$2,200								construction only	U, CC, P
2	100 & 401 - Left turn lanes on 100	$1,100									WV
3	100 & Park/Ltl Conestoga - Lt trn lane, signal, channel.	$1,300									UU, CC, P
4	100 & 401 - Left turn lanes on 401	$375		$725							WV
5	Eagle Bypass & widening southward to the Tpke Br.		$540		$2,160						UU, CC, P
6	100 - Widen between Eagle Byp. and Ludwigs Corner Byp.		$330		$2,970					excludes r-o-w	UU, WV, CC, P
7	Eagle Pointe Blvd			$700						excludes r-o-w	UU
8	Acme Falls Rd			$600						excludes r-o-w	UU
9	Exton Ring Roads - East	$800								excludes r-o-w	WW
10	Exton Ring Roads - West	$1,200								excludes r-o-w	WW
11	Church Farm Estates Connector			$700						excludes r-o-w	WW
12	100 - Widen, Shoen to Bypass	$2,600								excludes r-o-w	WW
13	100 - Widen, Shoen to Gordon						$3,200			excludes r-o-w	U, WW, CC, P
14	100 & Gordon - Double left turn lane on Gordon Dr.						$300				U, CC, P
15	Ludwigs Corner Bypass					$2,700					WV
16	100 - Widen, 322 to West Whiteland line								$3,600	excludes r-o-w	WG, CC, P
		$9,575	$870	$2,725	$5,130	$2,700	$3,500	$0	$3,600		
	PA 113										
17	113 - Widen, 100 to the Turnpike Bridge	$2,300									U, CC, P
18	113 - Tpke Br. replacement and widening to Davis Rd		$825		$5,500					excludes r-o-w	U, PTC
19	113 & Eagleview Blvd - Additional turning lanes		$110		$390						U, CC, P
		$2,300	$935	$0	$5,890	$0	$0	$0	$0		
	Eagleview Blvd										
20	Eagleview Blvd extension	$865								excludes r-o-w	U
		$865	$0	$0	$0	$0	$0	$0	$0		
	US 202										
21	202 - Section 400	$227,000									UM, T, MC, CC, P
22	202 nb on ramp from No. Five Points Rd				$2,300					excludes r-o-w	WG, CC, P
23	No. Five Points Rd extension			$700						excludes r-o-w	WG
24	202 sb off ramp to 322 wb				$2,300					excludes r-o-w	WG, CC, P
25	US 30 eb ramp to 202 sb						$10,000				WW, CC, P
26	202 - Section 300				$15,600		$94,400				WW, EW, T, CC, P
27	202 - Section 100								$195,000		WG, CC, DC, P
		$227,000	$0	$700	$20,200	$0	$104,400	$0	$195,000		
	Waterloo Blvd										
28	Waterloo Blvd - extension to Lincoln Hwy	$100		$400						excludes r-o-w	WW
29	Waterloo Blvd - widening, Whitford to PA 100				$240		$960			excludes r-o-w	WW, CC
		$100	$0	$400	$240	$0	$960	$0	$0		
	Lincoln Hwy										
30	Lincoln Hwy - Widen, 100 to Whitford	$1,500								excludes r-o-w	WW
31	Lincoln Hwy - Widen, Exton Mall to 202						$4,800			excludes r-o-w	WW, CC, P
		$1,500	$0	$0	$0	$0	$4,800	$0	$0		
	Boot Rd										
32	Boot Rd - Bridge replacement and Widen, 202 to Wilson				$8,025					excludes r-o-w	WG, EG, CC, P
33	Boot Rd - Widen, Ship to 202						$1,700			excludes r-o-w	WG, WW, CC, P
		$0	$0	$0	$8,025	$0	$1,700	$0	$0		
	Other										
34	Church Farm Connector			$1,000						excludes r-o-w	WW
35	West Goshen Cross Twp Connector					$1,800				excludes r-o-w	WG
		$0	$0	$1,000	$0	$1,800	$0	$0	$0		
		$241,340	**$1,805**	**$4,825**	**$39,485**	**$4,500**	**$115,360**	**$0**	**$198,600**	**TOTAL HIGHWAY**	
	TRANSIT IMPROVEMENTS										
36	Thorndale Station - Construct and serve R5 rail station	$3,900								construction only	CC, S
37	Whitford Station - Parking expansion	$1,265								excludes r-o-w	WW, CC, S, P
38	West Whiteland Circulator Bus	$250								ops. & maint.	WW, TMA, CC, S, P
39	Bus Route "B" - Glenloch to Eagle v. PA 100				$1,000					establish route	TMA, CC, S
40	Bus Route "C" - W. Chester to Phoenixville v. Paoli Pk				$1,000					establish route	TMA, CC, S
41	Bus Route "D" - Dwningtwn to Eagleview C.C. v. PA 113				$1,000					establish route	TMA, CC, S
42	Glenloch Station - Construct and serve R5 rail station						$4,485			excludes r-o-w	WW, TMA, CC, S
		$5,415	**$0**	**$0**	**$3,000**	**$0**	**$4,485**	**$0**	**$0**	**TOTAL TRANSIT**	
	RIDESHARE / TDM IMPROVEMENTS										
43	100 & 113 park and ride lot	$150									U, TMA, CC, S, P
44	Mobility Alternatives Prgrms: So. & Central (U, WW, WG)	$60		$100		$140		$160		annual contract	U, WW, WG, TMA, CC, P
45	Mobility Alternatives Prgrms: North (WV, UU)	$60		$100		$140		$160		annual contract	WV, UU, TMA, CC, P
46	US 202 ramps to Glenloch Station						$12,000				WW, TMA, CC, S, P
		$270	**$0**	**$200**	**$0**	**$280**	**$12,000**	**$320**	**$0**	**TOTAL RIDESHARE**	
	ITS IMPROVEMENTS										
47	Central Chester Co. closed loop traffic signal system	$1,100									U, WW, CC, P
48	Turnpike slip ramps at interchange #23				$300		$2,000			excludes r-o-w	U, TMA, CC, PTC
		$1,100	**$0**	**$0**	**$300**	**$0**	**$2,000**	**$0**	**$0**	**TOTAL ITS**	
		$248,125	**$1,805**	**$5,025**	**$42,785**	**$4,780**	**$133,845**	**$320**	**$198,600**	**TOTAL FUNDED / UNFUNDED**	
			$249,930		**$47,810**		**$138,625**		**$198,920**	**TOTAL BY STAGE**	
									$635,285	**TOTAL PROGRAM**	

notes:
* Estimated time to complete known and identified project phases.
Abbreviations: E - engnring & environmntl stdies; R - right-of-way acq. & utility reloc.; C - constr'n.; O - operate transit service.

** A lso see: Tables 10 and 15 for more detailed improvement descriptions, and Figures 21a and 21b for improvements mapping

*** Abbreviations: WV- West Vincent, UU - Upper Uwchlan, U - Uwchlan, WW - West Whiteland, WG - West Goshen, CC - Chester Co., P - PennDOT, S - SEPTA, TMA - Transportation Management Association of Chester Co., PTC - Pennsylvania Turnpike Commission, EW - East Whiteland, T - Tredyffrin, EG - East Goshen, UM - Upper Merion, MC - Montgomery Co., DC - Delaware Co.

MANAGEMENT MEASURES

Management strategies account for the broadest set of actions available to enhance travel within the corridor. They range from simple monitoring actions to improving existing institutional arrangements and programs. Alone or in combination they incrementally affect travel within and beyond the corridor.

Certain strategies are integral with growth management and/or are implementable through the land development application, review and approval process. These actions generally fall within the purview of government. Others seek to modify commuting behavior, these tend to center on employers. The effectiveness of travel demand management (TDM) measures increases at locations where supportive land use and urban design characteristics also exist. Therefore, cooperation — even partnering — between the public and private sectors will be necessary to garner full effect of the strategies for improving the corridor.

Interface between the public and private sectors is provided through the transportation management association (TMA) administered DVRPC Mobility Alternatives Program (MAP). MAP's purpose is to assist employers (in the five-county southeastern Pennsylvania portion of the region) in decreasing the number of single occupant vehicles (SOVs) driven to their work site. In the case of the PA 100 corridor, the TMA of Chester County is a key operative in the improvement program.

It is estimated that diligent attention to and successful partnering in aggressively implementing packages of the TDM strategies can reduce work trips by as much as 15 percent, and as a consequence reduce peak period vehicle miles traveled along PA 100 by about 10 percent. Corresponding savings in travel time and fuel consumption can also be expected as a result of the measures.

Identification of appropriate roles and responsibilities across the range of management strategies is presented below.

Pennsylvania Department of Transportation (PennDOT)

1) Participate in ongoing meetings and planning dialogue regarding the corridor.

2) Prioritize the PA 100 Corridor Study recommendations with respect to other statewide and region-wide programs and projects.

3) Target high priority recommendations for funding within the Twelve Year Program.

Southeastern Pennsylvania Transportation Authority (SEPTA)

1) Participate in ongoing meetings and planning dialogue regarding the corridor.

2) Evaluate the PA 100 Corridor Study's recommendations for transit improvements and management programs and incorporate high priority projects into capital and operating programs and budgets.

3) Work with other providers to identify markets and serve corridor travel needs, such as pursuing cooperative fare-transfer agreements with Krapf's Coaches.

4) Consider using smaller vehicles accommodating 20 to 28 seated passengers for new fixed route bus services versus standard vehicles (with 40 ± seats) in an effort to reduce operating costs.

Pennsylvania Turnpike Commission

1) Participate in ongoing meetings and planning dialogue regarding the corridor.

2) Review the recommendations of this corridor study, and where possible expedite those warranting immediate action (e.g., widening the PA 113 bridge over the Turnpike).

3) Consider expanding its "smart highways" programs (including: electronic toll collection, highway advisory radio and variable message signs) to the vicinity of the Downingtown Interchange #23 (i.e., PA 100) as elements to a comprehensive incident management plan for the area and as a mitigation strategy for accommodating displaced traffic during the improvement to US 202 section 300.

Delaware Valley Regional Planning Commission (DVRPC)

1) Monitor the corridor and assess its performance as requested in comparison to the twelve intersection benchmarks contained within this study.

Chester County

1) Work with neighboring counties and PennDOT to advocate and implement a region-wide park-and-ride lot program. Current actions within or close to the corridor are notable and include the proposed lots at PA 100 and PA 113, and the lot at US 202 and Paoli Pike. Aside from the pursuit of lots integral with development centers, the potential development of the Jerrehian property offers a very suitable location and opportunity for a park-and-ride lot to intercept trips originating in the corridor.

Candidate remote park and ride lot locations which would have an influence within the study corridor are: at or near interchanges along the Turnpike (in Berks County, particularly); along US 202 in Delaware County and/or within the State of Delaware; along US 30 in western Chester County and Lancaster County, and; at the US 422 and PA 100 interchange in Montgomery County.

2) Pursue cooperative fare-transfer agreements between SEPTA and Krapf's Coaches, and expand TransitChek's applicability to include the Krapf's system. Both are measures to foster intermodal connectivity within the corridor.

3) Conduct additional planning studies (cited in the next section of this report) through the annual planning work program.

4) Advocate for advancement of the improvement projects included on the Capital Improvement Plan in the region's long range transportation plan (DVRPC's Year 2020 Transportation Plan) and Transportation Improvement Program (TIP), and; PennDOT's Twelve Year Improvement Program.

5) Continue to work with the municipalities to implement the County's comprehensive plan — *Landscapes*[19] — through its "Vision Partnership".

6) Reconvene the Study Steering Committee, as appropriate, to review and revise the Capital Improvements Plan to reflect new conditions and priorities.

TMA of Chester County (TMACC)

1) Continue area-wide ridesharing activities and utilize Mobility Alternatives Program (MAP) resources to reach employers and commuters.

2) Implement comprehensive rideshare and TDM programs within the municipalities comprising the corridor's central and southern sections during the near term (e.g., Uwchlan, West Whiteland, and West Goshen townships) in 3 to 7 years. Expand comprehensive TDM efforts to northern municipalities (West Vincent and Upper Uwchlan) in 8 to 14 years.

3) Coordinate corridor actions with operators and neighboring TMAs. For example, the journey-to-work analyses indicate that Radnor and Upper Merion townships, among others, are significant origins of / destinations for study area work trips.

[19] *Landscapes - Managing Change in Chester County 1996 - 2020*, Chester County Planning Commission, Adopted: July 1996.

Cooperation with the Delaware County and Greater Valley Forge TMAs is therefore appropriate.

Corridor Townships

1) Continue to meet and discuss issues of common concern, including those addressed in this effort.

2) Participate actively in the TMA ensuring that your needs are known.

3) Require that future traffic signal control equipment purchased for new installations and/or intersection upgrades is complementary with the equipment and capabilities of those being installed through the auspices of the Central Chester County Closed Loop Traffic Signal System.

4) Continue to work with Chester County to implement *Landscapes* through the Vision Partnership.

5) Make growth management planning (i) and implementation (ii) activities a basic part of corridor development.

i Growth management planning

a) Continue to require higher density, mixed-use, pedestrian-friendly development through zoning and subdivision and land development regulations within the Ludwigs Corner, Eagle, Lionville and Exton development centers. Such development patterns can reduce site generated trips by as much as 25 percent, and promote use of transit where it already exists or is planned to exist.

b) Expand provisions of park-and-ride facilities throughout the corridor. Integrate park and ride lots into the continuing development within the Ludwigs Corner, Eagle, Lionville and Exton development centers and major development plans lending more support to extended transit service in the corridor.

Certain uses are amenable to shared use of parking facilities for commuting purposes. Churches, synagogues, parks and movie theaters are land uses which don't usually generate peak travel or parking demands during weekday business hours. Dedication for the outright use of these lots for park-and-ride purposes during the development application process may be appropriate.

Parking lots supporting other uses, even office and retail uses, can avail themselves to shared-use (an example is the Exton Square Mall). However, the determination is best made on a case-by-case basis after full occupancy of the buildings. Negotiating with developers prior to development approval is suggested.

The Jerrehian property along Green Hill Road in West Goshen is uniquely situated to serve the corridor's rideshare needs. Incorporating a public access park-and-ride lot in its ultimate development plan should be strongly considered.

c) Require pedestrian and bicycle design elements within land development and subdivision ordinances. Bikeways implementation by the County (Chester Valley Trail and Paoli Pike Bikeway) and Uwchlan Township, and pedestrian circulation plans (West Whiteland Township) are examples of actions already in progress to foster non-motorized travel within the corridor. Expansion of these facilities should be pursued throughout the corridor, made continuous at municipal boundaries, and be integrated with transportation hubs, development centers and major developments (existing and proposed).

d) Consider transit friendly design features within development review procedures where transit service exists or has the potential to. Items germane to vehicle access (lane width, turning radii, pull-out lanes) and transit user priority (bus stop signs, bus shelters, sidewalks) should be addressed.

ii Growth management implementation

a) Require auxiliary turning lanes as part of development access designs and at signalized intersections along major thoroughfares to maximize the capacity of the through travel lanes.

b) Implement trip reduction ordinances requiring that alternate modes and/or flexible work arrangements be employed to control the amount of trips generated by a development during the peak commuting hours.

c) Limit parking supply provided, by adopting maximum parking space requirements in municipal zoning ordinances, to discourage single occupant vehicle usage.

d) Adopt access management zoning overlay districts to reduce or control the design, number and location of driveway access points and signalized intersections. Revised access management practices will yield savings in

access related accidents and travel delays. Median barriers have been shown to reduce each by 30 percent. Access management strategies are most applicable for the currently undivided sections of PA 100 (i.e., north of the Turnpike and south of Boot Road).

Employer / Developer

1) Participate actively in the TMA. TMA administered Mobility Alternatives Program (MAP) and Share-A-Ride services are effective measures in combating traffic congestion and increasing productivity.

   Carpooling at the Merck plant, in Blue Bell, involves 1,000 of its 6,500 total work force (15% participation). Ten percent of Boeing's Ridley Township facility (6,100 total employees) use alternative commute options. Similarly, the UPS facility at the Philadelphia International Airport sees eight percent of its work force commuting via alternate modes (and participation is growing).

2) Decrease the number of single occupant vehicles (SOVs) / increase vehicle occupancies by advancing transit planning and support (i), promoting non-motorized commute options (ii), supporting ridesharing activities (iii), and encouraging alternative commute options (iv) where transit service is not provided.

   i Transit planning

   a) Orient building entrances toward the street with transit service, incorporate shallow setbacks, and place parking "behind" the building to facilitate transit usage.

   b) Work with transit providers to establish new services, route deviations and/or optimized services. UPS has done this to facilitate commuting to its facility near the Philadelphia International Airport.

   c) Purchase TransitCheks to promote transit use. SmithKline Beecham provides TransitCheks as a benefit to its employees using transit, in lieu of free parking.

   d) Provide transit shelters, street lighting, sidewalks and street furniture to encourage transit ridership.

   ii Promoting alternate modes

   a) Provide access treatments for pedestrian and bikes and install storage facilities for bicycles. Merck & Co. sponsors a "Bike to Work" day each Spring.

b) Install bicycle storage facilities.

iii Ridesharing actions

a) Provide shuttles to transit stations. Vanguard provides an intercorporate shuttle service in the environs of its headquarters in Malvern.

b) Provide preferential parking for high occupancy vehicles (HOVs). Vanguard also provides preferred parking spaces to its ridesharing employees.

c) Establish in-house or third party vanpool programs.

d) Provide guaranteed ride home service. Merck & Co. practices this strategy so that in emergency situations employees are not stranded at the work place if they do not have a personal vehicle on site.

e) Participate in the "Share-A-Lot" program. Join with other regional employers to allow employees to stage carpooling activities and park on a remote partnering corporation's parking lot. By agreement, the corridor company returns the favor to the employees of the outlying partnering corporation(s). Some participating Share-A-Lot corporations in the region are — Chester County - Vanguard in Malvern; Montgomery County - U.S. Healthcare and the PMA Group in Blue Bell, Elf Atochem in King of Prussia, Merck and Co. in West Point; Delaware County - Boeing-Philadelphia in Ridley Township; Britton Manor in Painters Crossing.

f) Become an "Adopt-A-Lot" sponsor. Support ridesharing by assuming maintenance responsibilities for public park-and-ride facilities. SmithKline Beecham Pharmaceuticals supports the park-and-ride concept and provides landscaping services at the Matsonford Road Park-and-Ride Lot in West Conshohocken Borough.

iv Alternate commute options

a) Implement telecommuting, alternate work hours and/or flexible work schedules to reduce peak period trip making. Thomas Jefferson University and CoreStates Bank support telecommute options for their Center City Philadelphia employees.

FURTHER STUDY REQUIREMENTS

The need to perform three additional transportation planning / traffic engineering studies has been identified as a consequence of the evaluations performed in this work.

1) Conduct near-term traffic safety evaluation of PA 100 between PA 401 and Horseshoe Trail Road after pending access and utility relocation improvements are completed by PennDOT. Examine accident reports, determine if safety problems persist and, if necessary, identify the appropriate additional countermeasures to implement (signage, striping, etc.).

2) Perform PA 100 and Exton Bypass (US 30) interchange study. Examine alternatives, feasibility and benefits for long term improvement at the interchange. Alternatives can include widening PA 100, reconfiguring the present interchange, providing alternate interchanges or ramps along the Bypass (e.g. at Ship Road, at Whitford Road, between US 30 eastbound and US 202 southbound, and/or to and from the Oaklands Corporate Center).

3) Undertake a traffic and incident management study and plan examining the functional inter-relationships between PA 100, the Turnpike, the Lincoln Highway, US 30, US 202 and US 322 in the study corridor's vicinity. The effort should identify opportunities and improvements necessary to reduce incident detection, response and clearance times. Additionally, detour routes, signing needs and responsibilities need to be designated. Lastly, a comprehensive evaluation of existing directional signing (e.g., the US 322 and US 30 connection via PA 100, and signing within the US 202 / Lincoln Highway / US 30 interchange) should be integrated into this undertaking. □

7 IMPLEMENTATION

The Plan represents a unified implementation strategy, consisting of a Capital Improvement Plan (CIP) and management actions, to serve sub-regional needs. Implementation of the Plan must be pursued on several fronts.

Management actions encompass growth management and travel demand management strategies. Typically these are implemented through requirements specified in municipal zoning and subdivision ordinances, and through partnerships between the private and public sectors as exemplified in the Mobility Alternatives Program. Capital financing for implementing improvements can be secured through local tax revenues, bonding, special assessment districts and/or impact fees.

Very often local revenues are applied as a match to secure a larger share of project costs, taking advantage of state and federal-aid highway and transit funding programs. Uwchlan Township has been very successful in this regard, securing local shares through its traffic impact fee ordinance. Upper Uwchlan is also pursuing the requirements of Pennsylvania's Act 209.

Each path has its rewards and its drawbacks. Some implementation guidelines, offered through the Study Steering Committee by PennDOT's District Planning and Programming Engineer, are particularly relevant to implementing the recommended CIP (regardless of the funding process pursued) and warrant re-emphasis.

1) Cost efficiencies suggest that — where sensible and possible — individual smaller projects should be consolidated. (For example, the project financing PA 100's widening between Gordon Drive and the Turnpike, in Lionville, also covers the construction of double left turn lanes at the PA 100 and PA 113 intersection, and widening PA 113 from PA 100 to the Turnpike Bridge.)
2) Individual phases of the project's development should be undertaken in entirety to expedite the project. (For example, environmental studies and actions were expedited for US 202 section 400 by being funded outside of the normal PennDOT / federal-aid funding process. Once cleared environmentally, the project advanced to construction in short order.) Being no different than any fiscally responsible owner, PennDOT would rather fund projects which are "ready to move", and not tie up its 12-Year Program where alternatives may be pursued.
3) Project advancement requires participation and "buy-in" of all parties (developers / employers included). Long term benefits and cost efficiencies [i.e., the Plan] must be emphasized versus individual, short term wants / needs.

4) The Capital Improvement Plan must reflect the Steering Committee's priorities. The fact is, "realities" will change over the life of the program. This suggests that the improvement program be flexible, and subject to review and revision on an ongoing and regular basis to ensure that implementation needs are reflected accurately in the Plan.

FEDERAL-AID FUNDING GUIDELINES

Because of its complexity and importance, special discussion is made of the federal-aid funding / Transportation Improvement Program process. Still, common implementation ingredients, as discussed above, are found in the TIP process.

The TIP is the culmination of the regional transportation planning process. As a document it includes projects that are consistent with national, state, regional, county and municipal policies, plans and programs. The most relevant federal law which guides the TIP is the Intermodal Surface Transportation Efficiency Act (ISTEA) of 1991. It is the federal authorization bill for highways and transit. (It should be noted that a new re-authorization bill is currently being considered by the congress.)

The recommendations of the PA 100 Corridor Study closely reflect the planning goals of ISTEA, DVRPC, Chester County and the five corridor municipalities. Furthermore, the study's recommendations (including its Capital Improvement Plan) contain five common ingredients with the TIP's project ranking criteria, including:

1) supporting economic activity;
2) improving the mobility of people and goods;
3) supporting land use plans and goals;
4) preserving and modernizing key elements of the existing system, and;
5) mitigating congestion.

Of the set of highways identified in the CIP most are functionally classified at levels which provide for the use of federal highway funds. For example, PA 100 (from the PA 100 Connector Highway north), the PA 100 Connector Highway, US 202, US 322 and the Pennsylvania Turnpike are National Highway System (NHS) roadways. NHS routes aim to enhance personal mobility, serve commerce, support economic growth, and increase the Nation's competitiveness. Projects on the NHS network are eligible for funding under a special category within the federal-aid program — also called the NHS program. On the other hand, additional categories of Federal Highway Administration and Federal Transit Administration funds are also available to the region for implementing the recommended improvements.

In the final analysis, the annual development of the TIP is a highly competitive and complex process. Project inclusion is a necessary initial step toward implementation where federal-aid funding is sought, and will depend upon individual project ranking and selection, funding availability and priority setting by local government. Ultimately, project construction will require multi-jurisdictional support from both the public and private sectors.

Further guidance in the matters of securing federal-aid funding can be obtained by contacting the Assistant Executive Director for Transportation Planning at DVRPC or the Chester County Planning Commission.

CONCLUSIONS: IMPLEMENTATION

Table 22 displays a financial analysis of the CIP. It differentiates between projects contained in the CIP based upon whether the improvements are funded (using public funds - shaded in light blue, or private sources - shaded in green) or are unfunded (shaded in red). A quick overview, indicates the following:

- The immediate term program of improvements (0 to 2 years) totals almost $250 million. Funding has been identified for 99 percent of all project costs, and private sector commitments represent slightly more than three percent of the total program amount. ($1.8 million unfunded)
- The group of near term improvements (3 to 7 years) total approximately $48 million. Eleven percent of the funding is committed and attributed to private (10 percent) and public (less than 1 percent) sector sources. ($42.8 million unfunded)
- The set of medium term improvements (8 to 14 years) total about $139 million. Three percent of the medium term program of improvements will be financed using private funding sources. ($133.8 million unfunded)
- The long term set of improvements (15 to 22 years) totals just under $199 million and requires full funding. ($198.6 million unfunded)

Attainment of the Plan is already being addressed through the independent initiatives of the corridor municipalities. Public and private funding sources are being utilized to advance project engineering, right-of-way acquisition and construction. Continued vigilance will be necessary to procure the unfunded capital program amounts. Ongoing communication and collaboration between the Steering Committee members in implementing and updating the Plan will strengthen its momentum and enhance its meaningfulness to funding agencies. □

TABLE 22
FINANCIAL ANALYSIS OF CAPITAL IMPROVEMENT PLAN

proj. ref. # *	Improvement Description	PROJECT COSTS (order of magnitude. 1998 Dollars in 000's) by PHASE: engineering	right-of-way	construction	total	by STAGE: I (0 to 2 years)	II (3 to 7 years)	III (8 to 14 years)	IV (15 to 22 years)	PROJECT SPONSOR(S) **
PUBLICLY FUNDED IMPROVEMENTS										
1	100 - Widen, Gordon to Turnpike	$0	$0	$2,200	$2,200	$2,200				U, CC, P
3	100 & Park/Ltl Conestoga - Lt trn lane, signal, channel.	$175	$105	$1,020	$1,300	$1,300				UU, CC, P
17	113 - Widen, 100 to the Turnpike Bridge	$270	$110	$1,920	$2,300	$2,300				U, CC, P
21	202 - Section 400	$7,000	$35,000	$185,000	$227,000	$227,000				UM, T, MC, CC, P
36	Thorndale Station - Construct and serve R5 rail station	$0	$0	$3,900	$3,900	$3,900				CC, S
37	Whitford Station - Parking expansion	$165	unk	$1,100	$1,265	$1,265				WW, CC, S, P
38	West Whiteland Circulator Bus	$0	unk	$250	$250	$250				WW, TMA, CC, S, P
43	100 & 113 park and ride lot	$15	$15	$120	$150	$150				U, TMA, CC, S, P
44	Mobility Alternatives Prgrms: So. & Central (U, WW, WG)	na	na	$460	$460	$60	$100	$140	$160	U, WW, WG, TMA, CC, P
45	Mobility Alternatives Prgrms: North (WV, UU)	na	na	$460	$460	$60	$100	$140	$160	WV, UU, TMA, CC, P
47	Central Chester Co. closed loop traffic signal system	$220	$20	$860	$1,100	$1,100				U, WW, CC, P
	subtotals: publicly funded improvements					**$239,585**	**$200**	**$280**	**$320**	
PRIVATELY FUNDED IMPROVEMENTS										
2	100 & 401 - Left turn lanes on 100	$320	$55	$725	$1,100	$1,100				WV
4	100 & 401 - left turn lanes on 401	$320	$55	$725	$1,100	$375	$725			WV
7	Eagle Pointe Blvd	$140	unk	$560	$700		$700			UU
8	Acme Falls Rd	$120	unk	$480	$600		$600			UU
9	Exton Ring Roads - East	$160	unk	$640	$800	$800				WW
10	Exton Ring Roads - West	$240	unk	$960	$1,200	$1,200				WW
11	Church Farm Estates Connector	$140	unk	$560	$700		$700			WW
12	100 - Widen, Shoen to Bypass	$520	unk	$2,080	$2,600	$2,600				WW
15	Ludwigs Corner Bypass	$430	$110	$2,160	$2,700			$2,700		WV
20	Eagleview Blvd extension	$115	unk	$750	$865	$865				U
23	No. Five Points Rd extension	$140	unk	$560	$700		$700			WG
28	Waterloo Blvd - extension to Lincoln Hwy	$100	unk	$400	$500	$100	$400			WW
30	Lincoln Hwy - Widen, 100 to Whitford	$300	unk	$1,200	$1,500	$1,500				WW
34	Church Farm Connector	$200	unk	$800	$1,000		$1,000			WW
35	West Goshen Cross Twp Connector	$360	unk	$1,440	$1,800			$1,800		WG
	subtotals: privately funded improvements					**$8,540**	**$4,825**	**$4,500**	**$0**	
UN-FUNDED IMPROVEMENTS										
5	Eagle Bypass & widening southward to the Tpke Br.	$430	$110	$2,160	$2,700	$540	$2,160			UU, CC, P
6	100 - Widen between Eagle Byp. and Ludwigs Corner Byp.	$330	unk	$2,970	$3,300	$330	$2,970			UU, WV, CC, P
13	100 - Widen, Shoen to Gordon	$640	unk	$2,560	$3,200			$3,200		U, WW, CC, P
14	100 & Gordon - Double left turn lane on Gordon Dr.	$28	$7	$265	$300			$300		U, CC, P
16	100 - Widen, 322 to West Whiteland line	$360	unk	$3,240	$3,600				$3,600	WG, CC, P
18	113 - Tpke Br. replacement and widening to Davis Rd	$825	unk	$5,500	$6,325	$825	$5,500			U, PTC
19	113 & Eagleview Blvd - Additional turning lanes	$43	$67	$390	$500	$110	$390			U, CC, P
22	202 nb on ramp from No. Five Points Rd	$300	unk	$2,000	$2,300		$2,300			WG, CC, P
24	202 sb off ramp to 322 wb	$300	unk	$2,000	$2,300		$2,300			WG, CC, P
25	US 30 eb ramp to 202 sb	$825	$25	$9,150	$10,000			$10,000		WW, CC, P
26	202 - Section 300	$10,400	$5,200	$94,400	$110,000		$15,600	$94,400		WW, EW, T, CC, P
27	202 - Section 100	$15,000	$30,000	$150,000	$195,000				$195,000	WG, CC, DC, P
29	Waterloo Blvd - widening, Whitford to PA 100	$240	unk	$960	$1,200		$240	$960		WW, CC
31	Lincoln Hwy - Widen, Exton Mall to 202	$960	unk	$3,840	$4,800			$4,800		WW, CC, P
32	Boot Rd - Bridge replacement and Widen, 202 to Wilson	$1,165	unk	$6,860	$8,025		$8,025			WG, EG, CC, P
33	Boot Rd - Widen, Ship to 202	$340	unk	$1,360	$1,700			$1,700		WG, WW, CC, P
39	Bus Route "B" - Glenloch to Eagle v. PA 100	na	na	$1,000	$1,000		$1,000			TMA, CC, S
40	Bus Route "C" - W. Chester to Phoenixville v. Paoli Pk	na	na	$1,000	$1,000		$1,000			TMA, CC, S
41	Bus Route "D" - Dwningtwn to Eagleview C.C. v. PA 113	na	na	$1,000	$1,000		$1,000			TMA, CC, S
42	Glenloch Station - Construct and serve R5 rail station	$585	unk	$3,900	$4,485			$4,485		WW, TMA, CC, S
46	US 202 ramps to Glenloch Station	$1,560	$3,120	$7,320	$12,000			$12,000		WW, TMA, CC, S, P
48	Turnpike slip ramps at interchange #23	$300	unk	$2,000	$2,300		$300	$2,000		U, TMA, CC, PTC
	subtotals: un-funded improvements					**$1,805**	**$42,785**	**$133,845**	**$198,600**	
						$249,930	**$47,810**	**$138,625**	**$198,920**	**TOTAL BY STAGE**
									$635,285	**TOTAL PROGRAM**

notes:

* Also see Tables 10 and 15 for more detailed improvement descriptions, and Figures 21a and 21b for improvements mapping.

** Project sponsors are those entities with primary responsibility for advocating advancement of a project not necessarily funding it. Abbreviations : WV - West Vincent, UU - Upper Uwchlan, U - Uwchlan, WW - West Whiteland, WG - West Goshen, CC - Chester Co., P - PennDOT, S - SEPTA, TMA - Transportation Management Association of Chester Co., PTC - Pennsylvania Turnpike Commission, EW - East Whiteland, T - Tredyffrin, EG - East Goshen, UM - Upper Merion, MC - Montgomery Co., DC - Delaware Co.

Appendix

PA 100 Corridor Study
Steering Committee Members

Allen Heist, Manager, West Vincent Township

John J. Roughan, Jr., Manager, Upper Uwchlan Township

John R. Caruolo, President, Caruolo Assoc., Inc.

Doug Hanley, Manager, Uwchlan Township

Jeffrey L. Greene, Principal, Orth-Rodgers & Assoc., Inc.

Joe Roscioli, Director, Department of Public Works, West Whiteland Township

Ken Lawrence, Township Engineer, West Goshen Township

Colin A. Hanna, Commissioner, Chester County

William H. Fulton, Executive Director, Chester County Planning Commission

Lee I. Whitmore, Section Chief for Transportation and Information, Chester County Planning Commission

Chad Dixson, Transportation Planner, Chester County Planning Commission

Dutch Eichorn, Assistant District Traffic Engineer, PennDOT District 6-0

Greg Brown, District Planning & Program Engineer, PennDOT District 6-0

Jim Dellipriscoli, Operations Planner, Suburban Route and Service Planning, SEPTA

Steve D'Antonio, Manager, New Initiatives Service Planning, SEPTA

Walter J. Lawson, Facility Manager, PA Turnpike Commission

Walt Green, Senior Civil Engineer, PA Turnpike Commission

Brad Montgomery, President, Central Chester County Chamber of Commerce

Michael Herron, Executive Director (current), TMA of Chester County

Joel Graeff, Executive Director (former), TMA of Chester County

Gary Krapf, Vice President, Krapf's Transit Inc.

Dale Mahle, President, Tri-County Area Chamber of Commerce

Barbara Cohen, Executive Director, Phoenixville Area Chamber of Commerce □