TRANSIT POTENTIAL IN THE PENNSYLVANIA COUNTIES

October 1992

Delaware Valley Regional Planning Commission

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Delaware Valley Regional Planning Commission
The Bourse Building
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Created in 1965, the Delaware Valley Regional Planning Commission (DVRPC) is an interstate, intercounty and intercity agency which provides continuing, comprehensive and coordinated planning for the orderly growth and development of the Delaware Valley region. The region includes Bucks, Chester, Delaware, and Montgomery counties as well as the City of Philadelphia in Pennsylvania and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. The Commission is an advisory agency which divides its planning and service functions among the Office of the Executive Director, the Office of Public Affairs, and four line Divisions: Transportation Planning, Regional Information Services Center, Strategic Planning, and Finance 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

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Transit Potential in Southeastern Pennsylvania Counties	Publication No. 92020

Geographic Area Covered:

Bucks, Chester, Delaware, Montgomery, and Philadelphia counties

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ABSTRACT

This report assesses the potential for transit service in the five Pennsylvania counties of the DVRPC region using population, number of households, auto ownership, the age structure of residents, and employment for 1990 and 2010. The underlying data is disaggregated to the level of traffic zones and is based on 1990 census data and latest DVRPC estimates. Transit potential is highest in the center and in radial corridors defined by traditional rail commuter routes, and generally shows good correlation with current SEPTA service. Several underserved corridors were identified that warrant further study. The 2010 potential is not significantly different from that for 1990, as most of the growth in travel demand is now occurring in areas with low transit potential.

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Page

TABLE OF CONTENTS

LIST OF TABLES

LIST OF MAPS

EXECUTIVE SUMMARY

This study presents the results of an investigation of the existing and future market potential for transit services in southeastern Pennsylvania. As part of the long-range planning process, several key transit indicators were selected to determine the feasibility of operating or expanding rail and bus services in travel corridors, such as those identified in SEPTA's Vision of the Future - Planning for the Year 2010, a report which provided the impetus for the study at hand.

The indicators used to measure transit potential in the five counties of Bucks, Chester, Delaware, Montgomery, and Philadelphia included population, household size, auto ownership, age distribution within the population, and employment. The potential was mapped for 1990 and 2010 as an abstract index based upon the areal density of each indicator, i.e., number per acre, with one representing the threshold for supporting fixed route service. The underlying data was derived from the 1990 Census and previous DVRPC forecasts, disaggregated to the level of traffic zones.

Since the current market for transit services is closely related to the density of development, it remains focused toward Center City Philadelphia and along traditional rail commuter corridors. Other smaller cities, such as Chester and Norristown, also serve as satellite centers. Much of the newer development in the region lacks sufficient density and supporting pedestrian facilities to attract a strong transit market.

Overall the potential maps correlate well with existing SEPTA service, though some outlying corridors with little or no service were identified that appear to have the potential to support service and warrant further study. These include the Schuylkill Valley from Norristown to Pottstown, north of Lansdale to Quakertown, PA 132 (Street Road) between Warminster and Bensalem, and US 1 from Media to Wawa. The maps also provided a good match with the distribution of regional employment centers as determined in a 1986 study conducted by DVRPC.

Significantly, the 2010 potential map is not drastically different from that for 1990. Most of the growth in travel demand is now occurring in low density areas with little potential to capture transit riders. The potential for transit trips is expected to increase about four percent over the twenty-year period, but the distribution of trips should not change markedly. These findings have implications for both SEPTA and DVRPC, as each agency continues to develop its long-range plan, and for the region's counties and municipalities in their efforts to plan and coordinate land use decisions and the potential for future transit service.

INTRODUCTION

The Southeastern Pennsylvania Transportation Authority (SEPTA) provides public transportation services to the Pennsylvania portion of the Philadelphia metropolitan area, which is delineated by Bucks, Chester, Delaware, Montgomery, and Philadelphia counties. A few routes extend into Mercer County, New Jersey and New Castle County, Delaware. A long range plan is now needed in order to develop a framework for providing public transportation throughout southeastern Pennsylvania for the 21st century. This plan will also be used to refine and extend the goals of SEPTA's Ten-Year Action Plan. Before the plan can be prepared, however, an assessment of the transit potential throughout SEPTA's five-county service area is needed. This knowledge will permit the agency to gauge the effectiveness of the existing service in matching area needs, and it will provide the basis for planning new services to accommodate expected growth. Accordingly, SEPTA asked the Delaware Valley Regional Planning Commission (DVRPC) to conduct such an assessment, using its data bases and forecasts. A similar study is planned for the New Jersey portion of the DVRPC Region.

SEPTA convened a Technical Advisory Committee (TAC) comprised of county planning agencies, the Pennsylvania Department of Transportation, and DVRPC in order to provide guidance and input to their long range planning effort. As part of their duties, the TAC provided oversight responsibility during the study's preparation. This body considered a full range of variables associated with measuring transit potential and selected variables based on data availability, clarity to decision makers and directness to transit use.

The potential for transit use is driven by a number of variables, including population, employment, and auto ownership. In order to support transit in a given area, some combination of these variables must be present in sufficient density. Household density (dwelling units per acre) has been used elsewhere as an indicator of the potential to use transit. This report presents the results of using demographic and employment data to identify corridors and subareas that may have the capability to support transit service. Estimates have been prepared for 1990 using current data, and for 2010 using DVRPC's 20-year forecasts. The results can then be used to gauge where new service may be feasible or where service changes may be in order. However, it is important to remember that this procedure only determines potential demand. Actual demand hinges on several factors, including frequency and quality of service, fare levels, and the propensity of local travelers to use transit.

METHODOLOGY

Though transit trips can be generated from wherever people are when the need to go somewhere else arises, consideration in this report will be limited to the majority which come from residential areas. Population provides the most direct measure of potential demand, and higher densities generate higher demand for transit services. Trip making is also related to the number

of households; large households do generate more trips than smaller ones, but not in proportion. Low auto ownership increases transit demand, as zero-car households rely on public transportation for almost all of their trips, and one-car households need transit as a supplement to the auto. Finally, the age structure of the population affects transit demand, as senior citizens and young people rely more heavily on transit for mobility than does the general population. The only attractor that will be considered is employment, though other activity centers, such as stores, schools, and medical facilities, also attract non-work trips.

Each of these variables is assumed to have the potential for generating trips on public transportation, which in a given area will be proportional to the areal density for that variable. All densities will be specified in terms of gross acres.[1] In addition, potentials will be normalized so that a potential of one represents the threshold for supporting transit service. The lower the threshold the greater its importance in determining transit demand.

The population threshold was set at three per acre, which is equivalent to 1,920 persons per square mile and in rough agreement with the value found in New York as the minimum density that will support fixed route transit service.[2] The threshold for households was then set at one per acre, as this gives a population to household ratio that agrees with the average household size in the region. Zero-car households are largely dependent on public transportation (or the generosity of others) for trip making and their threshold was set at one-half the level used for all households. The threshold for one-car households was set at one, which reflects average transit usage. Though senior citizens make fewer trips overall, their transit ridership is stimulated by the policy in Pennsylvania of allowing seniors to ride free during off-peak hours. Accordingly, their threshold was set at one per acre. The age limits for defining youth were set by noting that twelve is typically the minimum age for independent travel, and that car availability increases rapidly after age 18. Youth were considered to generate transit trips at one-half the rate of senior citizens. The threshold for employment was set at 2.5 jobs per acre, which provided a rough balance between the potentials for trip generation and attraction. The thresholds used are shown in Table 1.

Potentials are calculated for each parameter as abstract indices representing multiples of the threshold. The total potential for generating trips is the average of the individual potentials for population, households, auto ownership, and age structure. Averaging avoids double-counting, but still grants extra weight to zones with large numbers of senior citizens or carless households. The overall, or composite, potential for each zone is then obtained by adding the potential for generating trips to that for employment. A more detailed explanation of the theory used is found in Appendix I.

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[1]Other studies have specified densities in terms of net residential acres. In developed areas roughly one-fourth of the land is used for housing. Since transit lines must traverse both residential and non-residential areas, use of gross acres may be more appropriate.

[2]Pushkarev, Boris S. & Jeffrey M. Zupan, Public Transportation and Land Use Policy, Indiana University Press, Bloomington, 1977.

Table 1

THRESHOLD DENSITIES FOR TRANSIT SERVICE

Variable	Subset	Threshold
Population		3.0 per acre
Households		1.0 per acre
Auto Ownership	0-car households	0.5 per acre
	1-car households	1.0 per acre
Age Segmentation	seniors (>65)	1.0 per acre
	youth (12-18)	2.0 per acre
Employment		2.5 per acre

DEMOGRAPHIC AND EMPLOYMENT DATA

For analytical purposes the five-county region is divided into 985 traffic zones. These are largely conterminous with census tracts, though in Center City Philadelphia tracts have been subdivided to produce a finer net. Variables for each zone are tabulated as densities, e.g., population per acre. Ideally, zones should be constructed with a one-half mile mesh in order to capture the potential within walking distance of a station or stop. This is not practical, and the growing importance of park-and-ride in suburban and rural areas has somewhat obviated the need for walking access. Averaging densities across broader zones does, however, partially mask the presence of high-density trip generators or attractors with easy access to transit services. A finer net would improve the representation in areas with developing employment centers.

A set of twelve transit potential maps for the region were prepared for 1990 and 2010, in order to reflect current circumstances and to show the changes expected in the future. Individual maps show the potentials generated separately by population, households, auto ownership, the presence of youth or senior citizens, and employment. The composite, or total, potential is shown on a final pair of maps. This effectively combines the impacts of each of the separate parameters.

The 1990 data for population, households, car ownership, and age groups are based on estimates prepared earlier by DVRPC, but adjusted at the municipal level to match 1990 Census

population counts. The employment data were adjusted, based on county-level data estimated by the Bureau of Economic Analysis. A 2010 forecast was prepared at the zonal level in 1987. This was adjusted in 1991 by applying county-wide factors based on 1990 Census data and estimates from the Bureau of Economic Analysis. County totals of demographic and employment variables are shown in Appendix II.

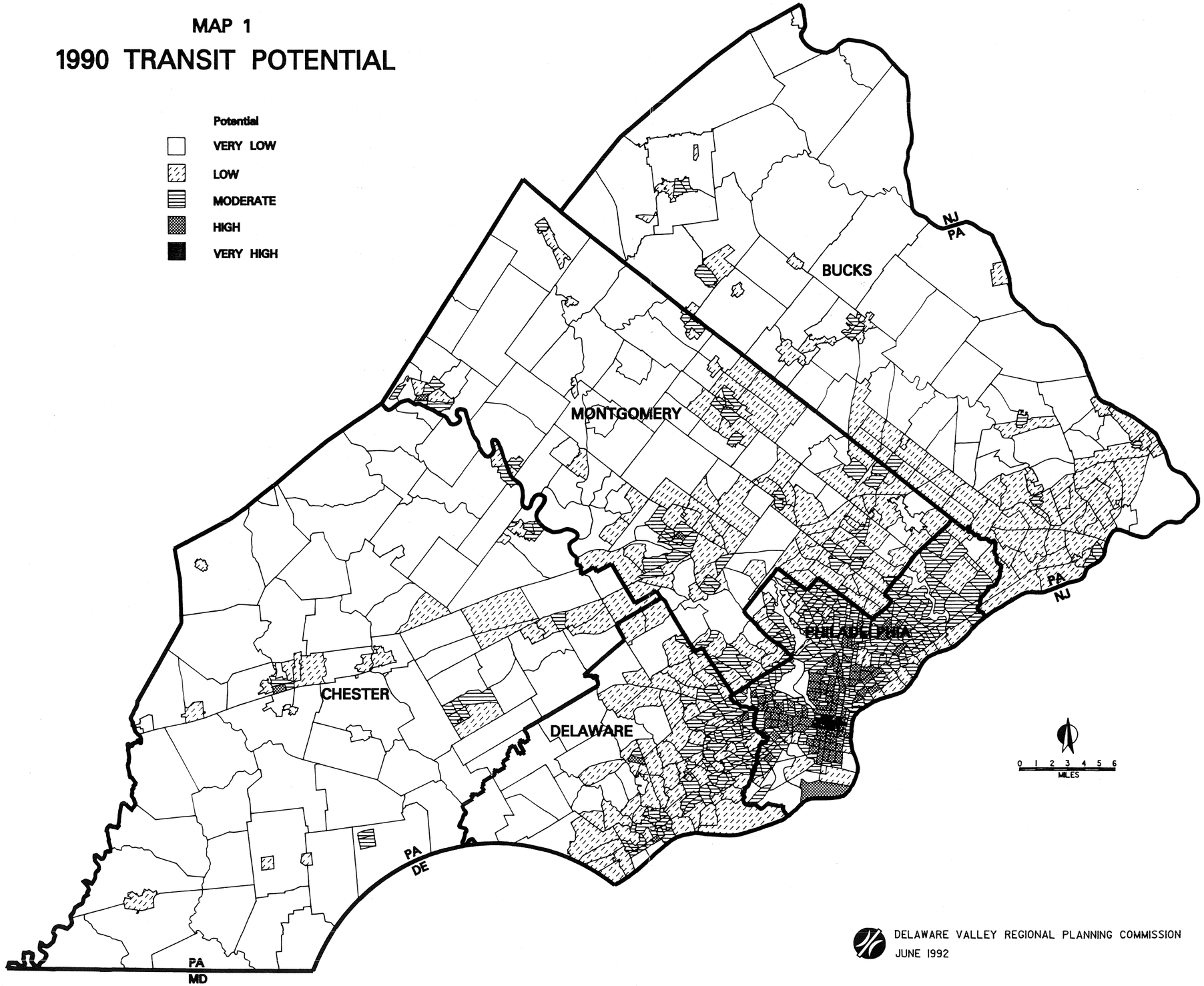
Table 2 shows average values by county of the densities used to calculate the potentials. The averages are weighted by zone, i.e., they represent an average of the densities calculated for each zone. Three points should be noted when scanning the table. First, The spread in values between Philadelphia at the high end and Chester, Montgomery, and Bucks counties at the low end is large. The latter counties have average densities that barely meet the threshold for transit service. This is not to say that these counties do not have areas deserving of service, but rather that the need is limited to specific areas and corridors. Delaware County can support a moderate level of transit service over much of its area. Second, transit demand resulting from low auto ownership and high concentrations of senior citizens or youth is for the most part limited to Philadelphia and Delaware County. Third, while the region is expected to grow in the twenty-year period from 1990 to 2010, the growth is not expected to be large enough to trigger significant changes in the potential demand for transit.

1990 FINDINGS

Map 1 shows the 1990 transit potential for the five Pennsylvania counties. For mapping purposes five ranges were displayed, with each range four times larger than its predecessor. The transit potential in a large metropolitan area, such as Philadelphia, must span a large dynamic range. Using a geometric progression to set the range boundaries allows mapping the potential in the dense urban core, which can support subway service running on a short headway, as well as in the mostly rural fringes, where service is likely to be limited to selected corridors. Though actual ridership depends on circumstances unique to each corridor, generally a potential above one is needed to support conventional fixed route service, and it should be above four if all day service on an hourly headway or better is to be considered. As calculated, the potential ranged from a high of 387 in the zone just west of City Hall in Philadelphia to a low of 0.03 in rural Chester County. Most of the traffic zones with high transit potential are in Philadelphia, with some spillover into Delaware County and a handful scattered elsewhere. Table 3 shows the distribution of transit potential by county among the 985 traffic zones comprising the study area.

More than one-half of the zones (51%) within the five-county SEPTA service show high or moderate potential, though 70 percent of these are in Philadelphia. The close-in older suburban communities in Delaware and Montgomery counties also show good potential. In addition to the City of Philadelphia, the major areas with moderate to high potential include radial corridors running from Philadelphia southwest to Wilmington, northeast to Trenton, north through Lansdale to Quakertown, west through Paoli to Parkesburg, northwest along the Schuylkill

MAP 1
1990 TRANSIT POTENTIAL



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JUNE 1992

Table 2

AVERAGE DENSITY OF DEMOGRAPHIC AND EMPLOYMENT VARIABLES

County	Average Density (per acre)							
	Population		Households		Auto Ownership			
					0-Car HH		1-Car HH	
	1990	2010	1990	2010	1990	2010	1990	2010
Philadelphia	27.8	27.6	12.0	12.4	5.8	6.0	4.7	4.9
Delaware	10.8	10.6	4.0	4.2	0.8	0.8	1.9	1.9
Chester	3.4	3.8	1.0	1.2	0.1	0.2	0.4	0.5
Montgomery	5.3	5.4	2.0	2.2	0.3	0.3	0.8	0.9
Bucks	3.8	4.4	1.3	1.7	0.1	0.2	0.6	0.7

County	Average Density (per acre)					
	Age Group				Employment	
	Seniors		Youth			
	1990	2010	1990	2010	1990	2010
Philadelphia	4.0	3.0	2.1	2.5	30.7	31.9
Delaware	1.6	1.4	0.9	1.0	4.1	4.2
Chester	0.4	0.5	0.4	0.5	2.7	3.0
Montgomery	0.8	0.8	0.4	0.5	3.9	4.2
Bucks	0.5	0.7	0.3	0.4	2.0	2.2

Valley to Pottstown; and clusters around Norristown/King of Prussia and Lansdale. The first two corridors form a portion of the Boston-Washington Northeast Corridor and reflect older urban industrial development. The third corridor constitutes Philadelphia's Main Line and represents older suburban development. In contrast, the clustered areas of good potential are

Table 3

1990 DISTRIBUTION OF TRANSIT POTENTIAL

Index	Potential	Number of Zones					
		Phila.	Dela.	Chest.	Mont.	Bucks	Total
64 ≤ P	very high	32	-	-	-	-	**32**
16 ≤ P < 64	high	113	5	2	3	-	**123**
4 ≤ P < 16	moderate	209	69	13	48	11	**350**
1 ≤ P < 4	low	34	58	23	89	65	**269**
P < 1	very low	22	18	66	60	45	**211**
Total		**410**	**150**	**104**	**200**	**121**	**985**

driven by more recent office park and mall development, though they may contain older communities within their cores. Some of these clusters can be collected into a circumferential corridor defined by US 202, running between West Chester and Doylestown.

Table 4 shows the average potentials, both partial and total, by county. The average transit potential found in Philadelphia is about 12 times higher than that found in Chester and Bucks counties. Philadelphia is clearly in a class by itself. Largely urban, it contains 32 zones in which the potential exceeds 64. In contrast, no zones in the other counties exceed 40. In the highest zones, it is employment that is the driving factor, though the residential zones receive a significant boost from low rates of auto ownership. Delaware and Montgomery counties occupy a middle range with good transit potential in the older suburbs adjacent to the city and also in other traditional centers, such as Chester and Norristown. In these counties household density is the most important parameter. Chester and Bucks counties are the most rural of the suburban counties and have the least transit potential, averaging only about 1.9. Bucks County has no zones with potential above 12. While Chester County has two zones in the high range ($\geq$ 16), it also has the most zones (63) below one. The average potential is 6.9 for the region as a whole, and is 2.9 for the four suburban counties, excluding Philadelphia.

Table 4

1990 AVERAGE POTENTIAL INDEX

Variable	Transit Potential Index					
	Phila.	Dela.	Chest.	Mont.	Bucks	Total
Population	9.25	3.61	1.14	1.77	1.27	**3.41**
Households	12.02	4.05	1.00	1.99	1.34	**4.08**
Autos	16.35	3.41	0.73	1.38	0.82	**4.54**
Age	5.06	2.09	0.54	1.01	0.67	**1.87**
Generators (avg)	10.67	3.29	0.85	1.54	1.03	**3.48**
Employment	12.27	1.62	1.08	1.57	0.80	**3.47**
Total	**22.94**	**4.92**	**1.93**	**3.10**	**1.82**	**6.94**

2010 FINDINGS

The 2010 findings, shown in Map 2, are not strikingly different from that compiled for 1990. Perhaps it should be expected that the maps will show little change given recent trends. Each of the categories shown by shading covers a dynamic range spanned by a factor of four, and a zone would have to be already close to a boundary in order to be pushed into the next category. But other forces are also at work. Most of the areas on the 1990 map showing moderate to high potential are mature areas that are no longer growing. While most of these areas are expected to retain their potential, they will probably not gain much. In contrast, most of the growth is occurring in open or rural areas, and the development itself is usually only of low to moderate density. This suggests that most of the changes that are expected to occur will be in the lowest categories, i.e., from very low to low. Increases in transit potential are indicated along the Harrisburg rail corridor through Chester County, in the Schuylkill Valley, and around Newtown in Bucks County. The 2010 transit potential by county is shown in Table 5.

When comparing the 2010 results with those from 1990, no changes were observed for zones with high or very high potential (index 16 or above). Twelve zones moved from low to moderate potential, most of them located in Montgomery or Bucks County. Seventeen zones moved across the threshold of one for transit service. All but two were in Chester, Montgomery, or Bucks County.

Table 5

2010 DISTRIBUTION OF TRANSIT POTENTIAL

Index	Potential	Number of Zones					
		Phila.	Dela.	Chest.	Mont.	Bucks	Total
64 ≤ P	very high	32	-	-	-	-	**32**
16 ≤ P < 64	high	113	5	2	3	-	**123**
4 ≤ P < 16	moderate	209	71	13	53	16	**362**
1 ≤ P < 4	low	35	57	26	92	64	**274**
P < 1	very low	21	17	63	52	41	**194**
Total		**410**	**150**	**104**	**200**	**121**	**985**

Table 6

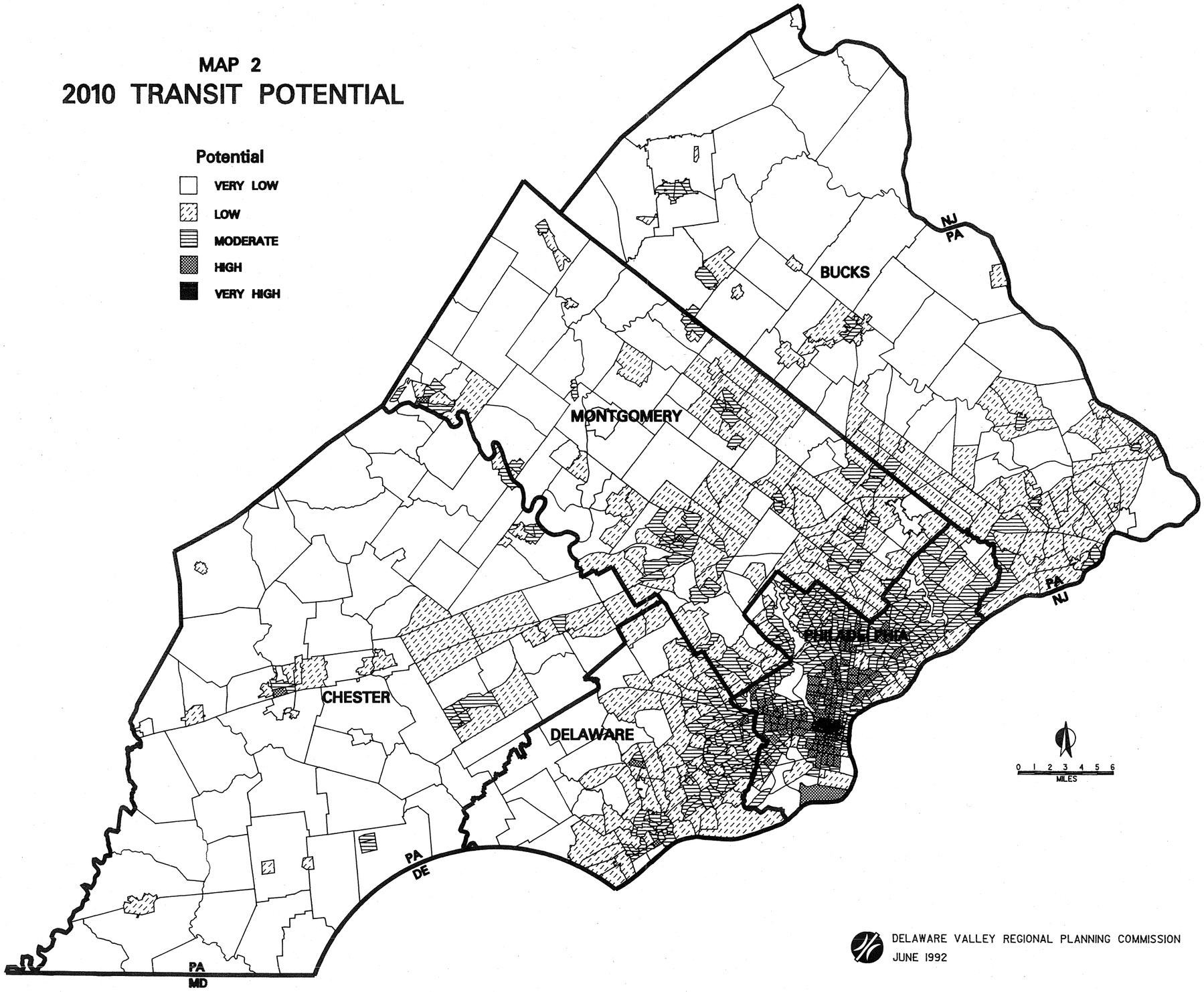
2010 AVERAGE POTENTIAL INDEX

Variable	Transit Potential Index					
	Phila.	Dela.	Chest.	Mont.	Bucks	Total
Population	9.21	3.47	1.28	1.82	1.46	**3.45**
Households	12.37	4.07	1.19	2.16	1.68	**4.29**
Autos	16.83	3.51	0.83	1.48	1.05	**4.74**
Age	4.19	1.89	0.74	1.05	0.87	**1.75**
Generators (avg)	10.65	3.28	1.01	1.63	1.27	**3.57**
Employment	12.75	1.69	1.20	1.68	0.88	**3.64**
Total	**23.40**	**4.96**	**2.21**	**3.31**	**2.14**	**7.20**

MAP 2
2010 TRANSIT POTENTIAL

Potential

- VERY LOW
- LOW
- MODERATE
- HIGH
- VERY HIGH



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JUNE 1992

Table 6 shows the average potentials, both partial and total, by county. The potential for Philadelphia is forecast to increase by two percent to 23.4, but all of this increase will result from an expected increase in employment. In the close-in suburbs, transit potential should show small to moderate gains, with most of the increase occurring on the employment side. Delaware County is expected to increase its potential only slightly to 5.0, and Montgomery County should increase its average potential by 6 percent to 3.3. The largest gains will occur in Chester and Bucks counties, 14 and 18 percent, respectively. Even with these increases, the average potential for these counties only rises to about 2.2. Most of the increase in the latter two counties, however, comes from an expected increase in population. The average potential for the region as a whole rises by about 4 percent to 7.2, and the average potential for the four suburban counties rises about 10 percent to 3.2.

COMPARISON OF TRANSIT POTENTIAL WITH SEPTA SERVICE

SEPTA currently provides comprehensive service throughout Philadelphia, eastern Delaware County, the Main Line west to Ardmore, around Norristown, eastern Montgomery County, and southern Bucks County, and these are the areas that show good potential on the maps for both 1990 and 2010. 'Comprehensive' service means full day service of quality sufficient to provide general mobility over a broad area. The remaining areas with good potential tend to be scattered boroughs located along SEPTA's rail corridors, though some, such as West Chester and Newtown, are now served by bus.

Though a relatively good match exits between the 1990 transit potential and current service, the potential maps do suggest several corridors that currently receive little or no service, including the Schuylkill Valley west of Norristown and another north of Lansdale leading toward the Lehigh Valley. Both these corridors were once served by the Reading Railroad, but these were diesel lines that last saw passenger service in 1981. Also, the Street Road corridor in Bucks County between Warminster and Bensalem shows promise for circumferential service. No service currently exists. Other unserved corridors with potential for service include the Perkiomen Valley north to Pennsburg, US 1 between Media and Wawa, and US 202 between Doylestown and King of Prussia. Though beyond the purview of the study, several of the corridors discussed serve markets which extend beyond the limits of the DVRPC Region, e.g., the Schuylkill Valley west to Reading, the Lansdale-Quakertown line north to the Lehigh Valley, and the US 202 corridor south to Wilmington.

In 1991 SEPTA developed A Vision of the Future, that included a suggested network for the year 2010. The rail and bus portions of the network are shown in Maps 3 and 4, respectively. The network includes existing service, restoration of service on several former Regional Rail lines, and proposed new service on selected rail and highway corridors. All of the promising corridors discussed in the preceding paragraph are included on the maps. However, many of the circumferential routes designed to capture intrasuburban trips do not appear promising when compared with the transit potential maps. An exception may be Newtown via Yardley and

Morrisville to Trenton, which could help serve the growing commuter market from Bucks County to New York. If any of these proposed services are to succeed, they should be auto competitive. In most cases that means express service running through to the final destination. Buses to Trenton should be timed to meet NJ TRANSIT trains, so they could capture some of the growing commuter market to New York from Bucks County. Land use and zoning policies encouraging clustered development at higher densities would help increase the modal share going to transit. Although many of the corridors follow existing or former rail lines, they should not be considered solely in terms of Regional Rail service. Light rail and busways should be considered as alternatives that can offer a higher level of service at less cost.

COMPARISON OF TRANSIT POTENTIAL WITH EMPLOYMENT CENTERS

The movement of jobs from Philadelphia to suburban locations has been responsible for much of the changing travel patterns in the region. Unfortunately, this trend has increased the dependency on automobiles for local trip making, as many of the trips are poorly served by public transportation and much of the newer suburban development is designed around automobile accessibility. Not only are suburban residents increasingly traveling to suburban work sites, a substantial reverse flow of City residents has also developed. Since many of the latter group will be strongly oriented toward using transit, it is important that good transit links be maintained to the City.

Map 5 was originally developed as part of the Regional Employment Centers Study conducted by DVRPC in 1986.[3] It still adequately represents existing and developing employment centers in the five Pennsylvania counties. While the shaded areas represent employment concentrations, the total employment in each area varies widely, ranging from about 300,000 in Center City to less than 1,000 in outlying centers. Most of the centers are located either in the central portion of the region, which already has comprehensive service or along corridors with some transit service. Notable exceptions are the corridors along the Schuylkill Valley above Norristown and that running north from Lansdale to Quakertown. SEPTA's proposed Cross-County Metro service, which would run between Downingtown in Chester County and Morrisville in Bucks County, would link nine of the employment centers shown and could serve as a circumferential feeder to and from radial rail and transit lines.

A major problem in developing transit markets to suburban locations consists of designing services that can deliver riders efficiently to dispersed sites. The job would be made easier if developers would include transit and pedestrian facilities in their plans, and not just surround commercial sites with acres of parking and roadways that pedestrians find difficult to cross.

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[3]Regional Employment Centers Study, Employment Report No. 4, DVRPC, September 1986.

MAP 3

SEPTA RAIL PLANNING CONCEPTS YEAR 2010

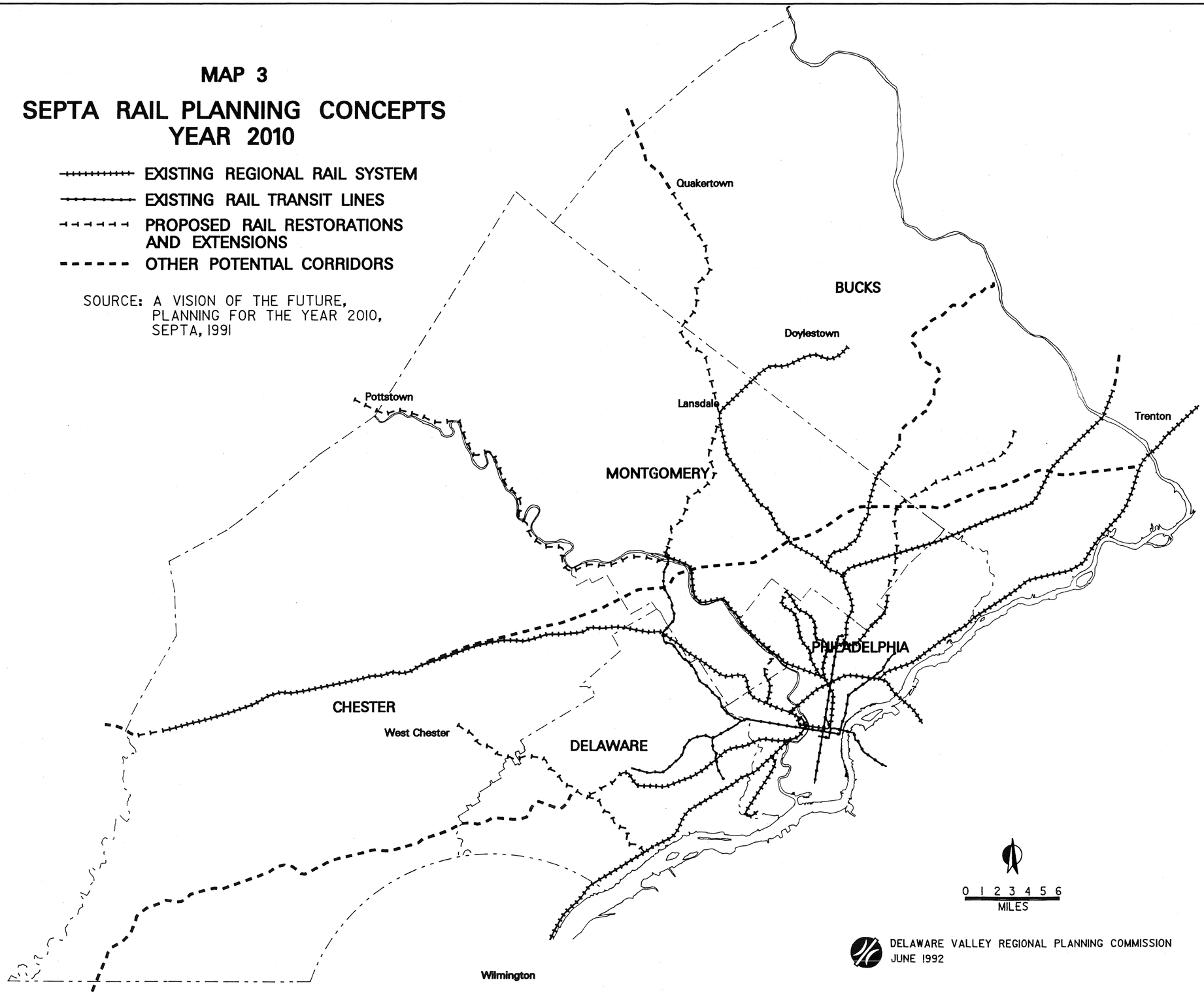
EXISTING REGIONAL RAIL SYSTEM

EXISTING RAIL TRANSIT LINES

PROPOSED RAIL RESTORATIONS AND EXTENSIONS

OTHER POTENTIAL CORRIDORS

SOURCE: A VISION OF THE FUTURE, PLANNING FOR THE YEAR 2010, SEPTA, 1991



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JUNE 1992

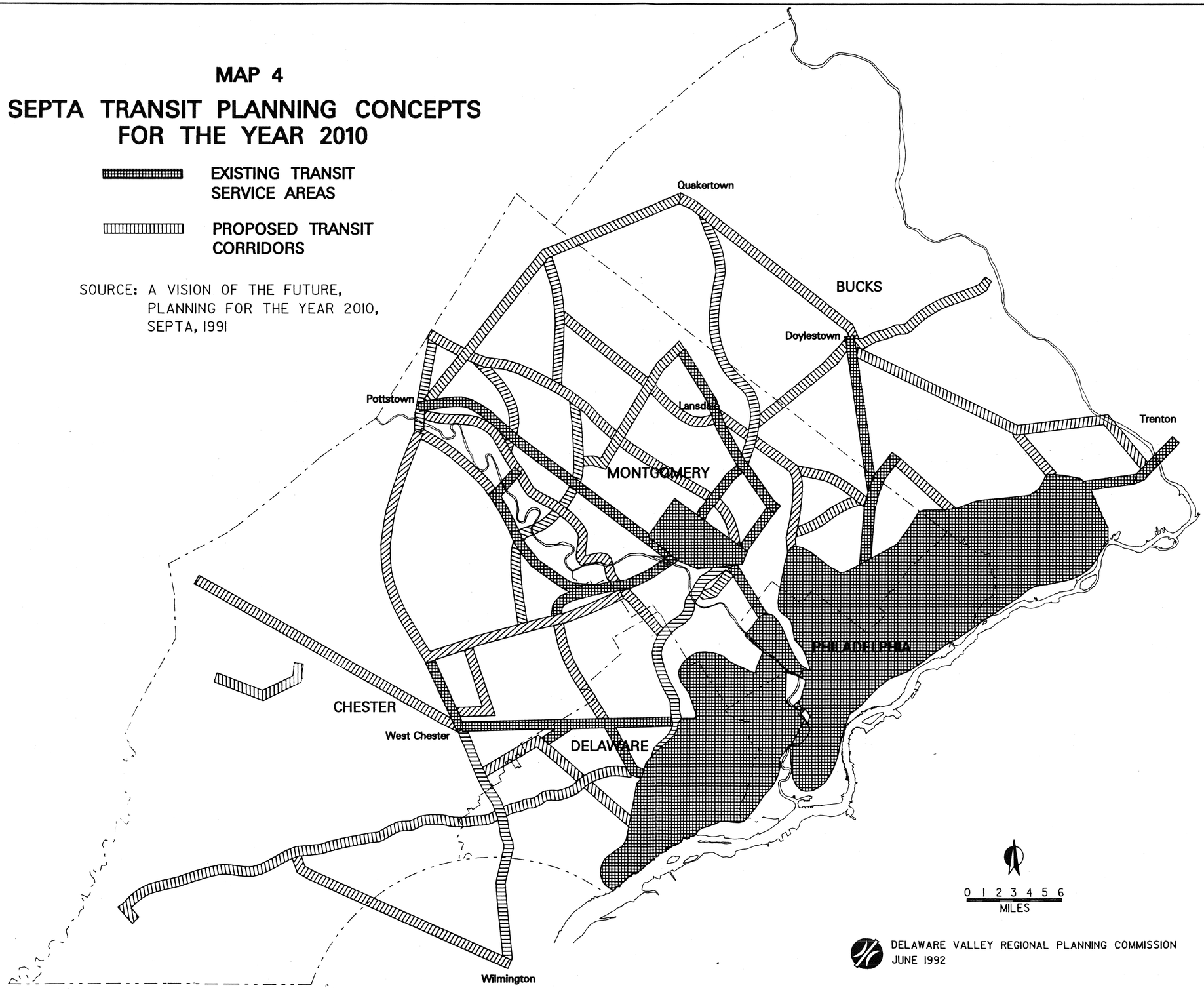
MAP 4

SEPTA TRANSIT PLANNING CONCEPTS FOR THE YEAR 2010

EXISTING TRANSIT SERVICE AREAS

PROPOSED TRANSIT CORRIDORS

SOURCE: A VISION OF THE FUTURE, PLANNING FOR THE YEAR 2010, SEPTA, 1991



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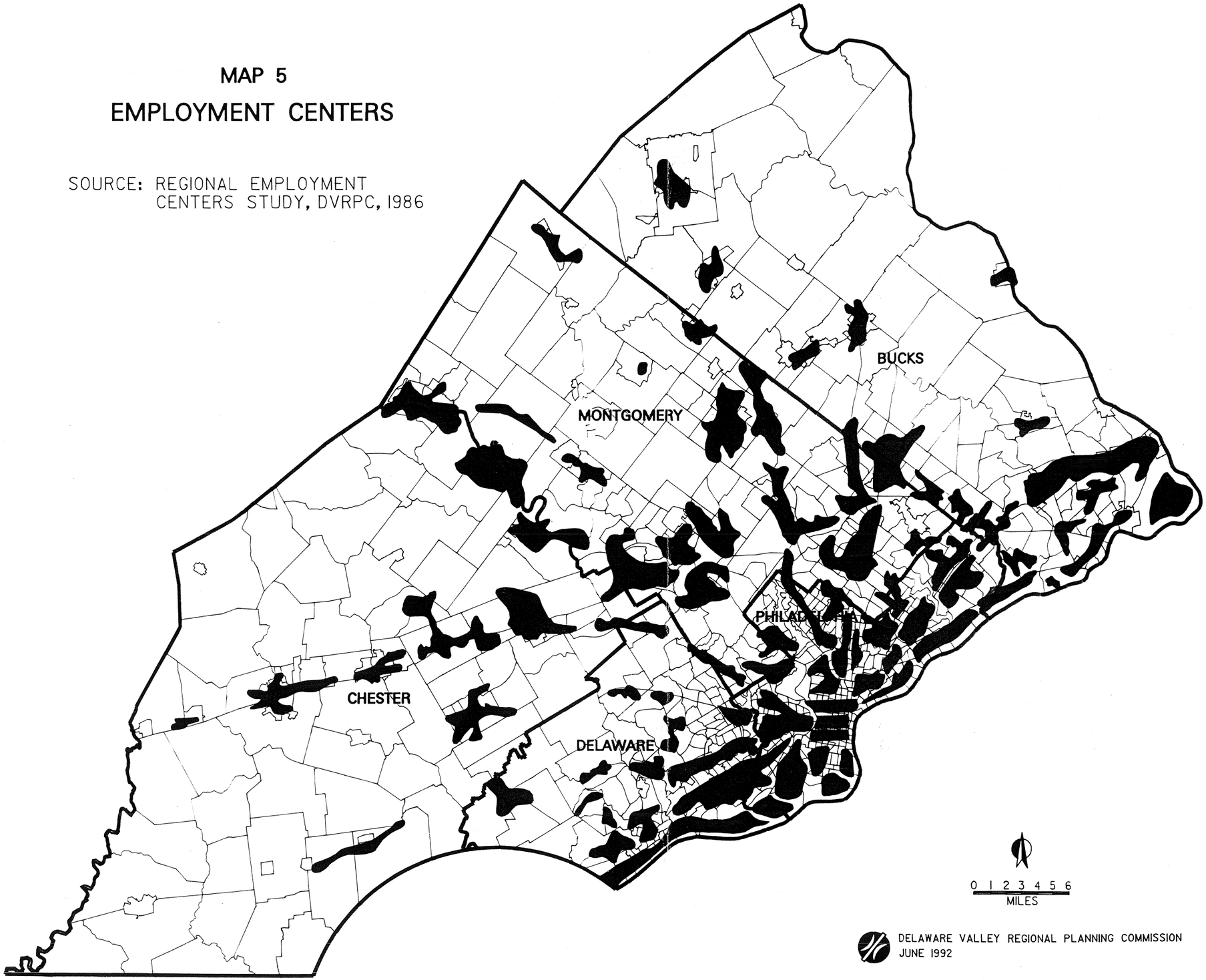
JUNE 1992

MAP 5

EMPLOYMENT CENTERS

SOURCE: REGIONAL EMPLOYMENT
CENTERS STUDY, DVRPC, 1986



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CONCLUSIONS

Transit potential is highest in Center City Philadelphia and in radial corridors defined by traditional rail commuter routes. This is not just the result of historical precedence, but rather is based on having sufficient densities and supporting facilities. Transit works best in a pedestrian friendly environment and where heterogeneous activities are clustered near one another. To the extent that new development can meet these requirements, it can attract transit patronage. Clustering also reduces the need for employees to have cars available at work, which also increases the likelihood that transit will be used for the work trip.

For the most part the actual service operated by SEPTA shows good correlation with the transit potential maps. Principal underserved corridors include, but are not limited to the following:

Name	Range	County
Schuylkill Valley	Norristown to Pottstown	Montgomery, Chester
PA 309	Lansdale to Quakertown	Montgomery, Bucks
PA 132 (Street Rd)	Warminster to Bensalem	Bucks
US 1	Media to Wawa	Delaware
US 202	Doylestown to King of Prussia	Bucks, Montgomery
PA 332/32	Newtown to Morrisville	Bucks
Perkiomen Valley	King of Prussia to Pennsburg	Montgomery

The corridors listed above are included in SEPTA's 2010 planning concept, as well as numerous circumferential bus corridors that appear to have little transit potential. The future, as evidenced by the 2010 transit potential map, will not be significantly different from the present. Most of the growth in travel demand is now occurring in areas with low transit potential, making it difficult to attain the threshold level in the forecast period. Areas with moderate or high potential are generally not growing as fast, but should maintain stable ridership.

This study represents a first step in assessing the long-term needs for public transportation in the Pennsylvania portion of the Delaware Valley Region, and can identify underserved areas or corridors that deserve a closer look. However, this is a broad brush approach that uses demographic and employment parameters to gauge the potential for transit service at the zonal level. Before any new service can be initiated or existing service restructured, a detailed feasibility assessment is needed that looks at land use, travel patterns, connections to other routes, and the propensity to use transit.

It is important to acknowledge that the study approach and methodology are limited in scope, and the results of the study must be viewed with this in mind. The application of the seven variables to measure transit potential represents a variation of the transit overlay technique.[4] While this methodology features several advantages, including ease of data collection and

[4]Corradino, Coomer, and Upshaw, "Successive Overlays - A Small City Transit Surveying Process," Traffic Engineering, December 1974.

graphical representation of variables, it does look at relatively broad geographic areas. Specific details on potential trip generators or attractors are not provided. Hence, although this study used the smallest readily available unit of spatial analysis - the traffic zone -it is still too generalized to yield a sufficient grain of analysis for conducting detailed route and service planning.

This report also provides a foundation for conducting more detailed analysis and illustrates, on a general basis, the employment and demographic trends in the region as they relate to future public transportation. The continuing unchecked dispersal of employment locations followed by scattered residential development serves to undermine the ability of transit to play a productive role in meeting the region's current and future mobility needs. The information contained herein is intended to serve as an indicator of potential transit corridors which need to be strengthened and supported by conscious public policies, if transit service is to be feasible. Continuation of current development trends will only succeed in perpetuating sole reliance on the automobile for most trip making.

Finally, it is important to mention that DVRPC has initiated work to update the region's long range transportation plan for the year 2020. Revised population and employment forecasts at the county level have already been prepared, and municipal forecasts are in progress. Not only can such forecasts be used to update this analysis, studies such as this lay the groundwork for planning and testing new facilities to be included in the future transit network.

APPENDICES

APPENDIX I - THEORY

The transit potential of each zone is a composite resulting from combining partial potentials derived separately for each relevant variable. It will be assumed that each partial potential responds linearly to its underlying variable, i.e.,

$$P_i(x_i) \propto x_i$$

where x_i is the variable measured and $P_i(x_i)$ the potential accruing from x_i. All variables are expressed as areal densities, i.e., per acre. In this way the zonal potentials are not determined by the size of the zone, and more accurately reflect that parameter's ability to drive demand. A linear response implies that if the parameter driving demand doubles, then the demand itself should double.

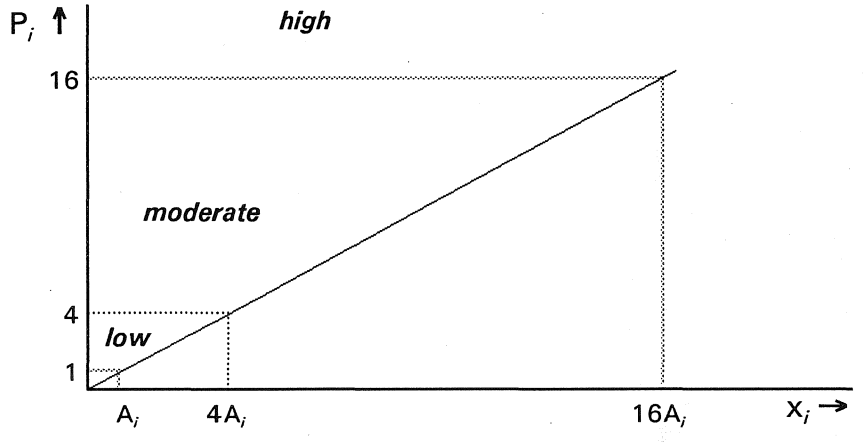
The potential P_i will be normalized so that

$$P_i(A_i) = 1$$

where A_i is the threshold for supporting transit service. This is accomplished by setting

$$P_i = \frac{x_i}{A_i}$$

and can be visualized in the following graph:



Essentially the potential, P_i, is an abstract number that provides a relative measure of potential transit demand. P_i between 1 and 4 indicates low transit potential, between 4 and 16 moderate potential is indicated; and greater than 16 high potential. The dynamic range of this variable is quite large, as the potential in some Center City zones can exceed 300.

Trip generation will be assumed to be determined by four demographic parameters: population, households, auto ownership, and age structure. Auto ownership is specified by the number of zero-car and one-car households, and since these subsets are mutually exclusive the potential generated by auto ownership is equal to the sum of the two subsets, i.e.,

$$P_{auto} = P_{0\text{-}car} + P_{1\text{-}car}$$

Similarly, age structure is also divided into two subsets, youth and senior citizens, and the potential based on age segmentation is obtained by adding that for seniors and for youth, i.e.,

$$P_{age} = P_{senior} + P_{youth}$$

The overall generating potential will be the average of the individual potentials, i.e.,

$$P_{gen} = \tfrac{1}{4} [P_{pop} + P_{hh} + P_{auto} + P_{age}]$$

Averaging allows each to have an impact on the overall potential, without affecting the normalization process. A zone that is strong with respect to some parameters, but weak with the remainder, may fare less well than a zone which shows moderate strength across the board.

Since a given zone can both generate and attract trips, and employment is the only attractor that is being considered, the total potential is found by adding the potentials for each, i.e.,

$$P = P_{gen} + P_{emp}$$

APPENDIX II - DEMOGRAPHIC AND EMPLOYMENT VARIABLES*

						Automobile Ownership			
	Area	Population		Households		0-Car Households		1-Car Households	
County	(acres)	1990	2010	1990	2010	1990	2010	1990	2010
Philadelphia	89.0	1,585.6	1,567.6	600.2	611.6	227.7	231.5	259.7	263.8
Delaware	118.4	547.7	556.8	196.9	209.9	24.8	26.2	85.1	89.4
Chester	487.4	376.4	457.5	129.1	166.2	8.6	10.1	50.0	60.5
Montgomery	317.2	678.1	746.7	243.3	283.6	19.5	22.8	93.4	103.8
Bucks	402.2	541.2	668.2	183.0	245.4	11.7	17.5	70.1	91.3
Total	1,414.2	3,728.9	3,996.7	1,352.5	1,516.6	292.3	308.0	558.2	608.8

	Age Structure					
	Elderly		Youth		Employment	
County	1990	2010	1990	2010	1990	2010
Philadelphia	241.1	177.4	138.6	163.6	845.9	863.0
Delaware	84.7	70.9	46.6	54.1	234.6	245.6
Chester	41.0	57.4	34.5	45.8	180.7	221.9
Montgomery	102.0	99.2	54.7	71.1	480.4	533.3
Bucks	58.9	77.6	50.9	64.0	244.1	282.6
Total	527.8	482.5	325.3	398.7	1,985.8	2,146.5

*These data are being updated based on the latest Census data and 2010 forecasts.