Regional Analysis of What-If Transportation Scenarios

DVRPC
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Regional Analysis of What-If Transportation Scenarios

Final Report

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

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

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

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EXECUTIVE SUMMARY

The DVRPC Board has instructed staff to study potential regional, national, and global changes that should be considered in the development of the 2030 Regional Long-range Plan. This exercise refined the long-range plan contingency management capability as it integrated future forecasts with other local planning efforts. The results serve as a planning foundation for the 2030 Plan development process.

In Phase I, qualitative analyses were performed on the twelve future scenarios, and based on the Phase I results, a subset of five was selected for detailed quantitative evaluations in Phase II. Quantitative evaluations included travel demand model simulations, population / employment allocation tools and other systematic planning analysis techniques.

The end products include a matrix that lists various transportation impact assessments by scenario and relevant long-range planning policy concerns, among which are future spatial characteristics of the region, future mobility and accessibility needs, and potential congestion locations and quantification of the delay cost.

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Chapter 1 Introduction

Project Background:

Regional Analysis of What-If Transportation Scenarios, also known as the What-If Scenarios [WIS], started as a dynamic process to prepare for development of the long-range transportation plan.

The DVRPC Board has instructed staff to study potential regional, national, and global changes that should be considered in the development of the 2030 Regional Long-range Plan, and a scenario-based planning technique was employed to dynamically assess future alternatives. Under the guidance of the DVRPC Board Policy Analysis Committee [BPAC], staff identified several future scenarios derived from the region's overall socioeconomic and spatial prospective. WIS refined the long-range plan contingency management capability as it integrated future forecasts with other local planning efforts, and its results serve as a planning foundation for the 2030 Plan development process.

A set of twelve future scenarios was initially developed from the New Jersey Department of Transportation's statewide long-range transportation plan, *Alternative Futures: Transportation Choices 2025* and the Pennsylvania Department of Transportation's counterpart, *PennPlan Moves*. DVRPC Board Policy Analysis Committee's discussion on key regional issues was also taken into consideration. After a round of qualitative assessments, a subset of five was chosen for in-depth quantitative analyses.

Scenario-Based Planning:

A scenario-based planning technique to evaluate alternative courses of action has been in use for many years. Scenarios can be particularly useful when uncertain outlooks demand a logical process with defensible results about changing situations. A growing number of communities in the U.S. have noted its usefulness, and have increasingly begun to employ the scenario-based planning technique in their long-range strategic planning process.

Recently, the scenario-based method has been utilized to develop alternative visions for future transportation and land use integration. Frequently cited pioneer studies in this area using scenarios include *Puget Sound Vision 2020* (Puget Sound Regional Council 1987), *Montgomery*

County Comprehensive Growth Policy Study (Maryland-National Capital Park and Planning Commission 1989), and *Making the Land Use, Transportation, Air Quality Connection* [LUTRAQ] (Calthorpe Associates et al., 1992).[1]

In all documented cases, the scenarios are inherently shaped by their own unique regional circumstances and further driven by different political forces and organized concerns. Consequential analyses vary in focus, also. Yet, commonly shared are the universal concerns such as the growing severity of traffic congestion, the cost of long-term infrastructure needs, the challenge of meeting tougher air quality standards, and the challenge of making communities more environmentally and economically sustainable.

While the most common analysis measures and planning indicators associated with these scenarios are those of transportation impacts, the measures of land consumption, of air and water quality, of energy usage, and expected infrastructure costs are also able to be quantified.

What-If Scenarios [WIS]:

For DVRPC, WIS was about asking a series of what-if questions. Each question considered hypothetical life preferences, possible social trends, and likewise "what-if" conditions with profound regional impacts. WIS aimed to address related transportation impacts and subsequent long-range planning concerns those scenarios presented. Relevant questions on spatial, economic, demographic, and other aspects of the future condition were grouped together to result in a set of coherent future scenarios.

Initially, a set of twelve what-if scenarios was selected, which became the Phase I set. For Phase II, a subset of five was chosen for in-depth analyses. At each phase, assessment analyses were designed to measure and to evaluate the scenarios' regional implications.

Project Design:

WIS defines the potential spectrum of the future outlooks. WIS was designed as an explorative tool to encourage land use patterns that link transportation facilities to support the region, and serves as an

[1] More recent ones included Denver Regional Council of Governments (1997), Metro Regional Government (1997), and Coalition for Utah's Future (1999).

important guiding light for the future iterations of the regional long-range plan development process. Its outcomes will function as bookends and reference points in shaping visions for the future as well.

As for the general flow of WIS as a process, sustaining trends and phenomena for the future were first identified. Subsequent, topical background research ensued and, constructed from trends and phenomena that could potentially alter the future of the region, a set of project scenarios were developed. Selected scenarios were then tested using various qualitative and quantitative tools. Final outcomes were produced to support alternative visions for the future. General flow of WIS is shown in Figure 1.

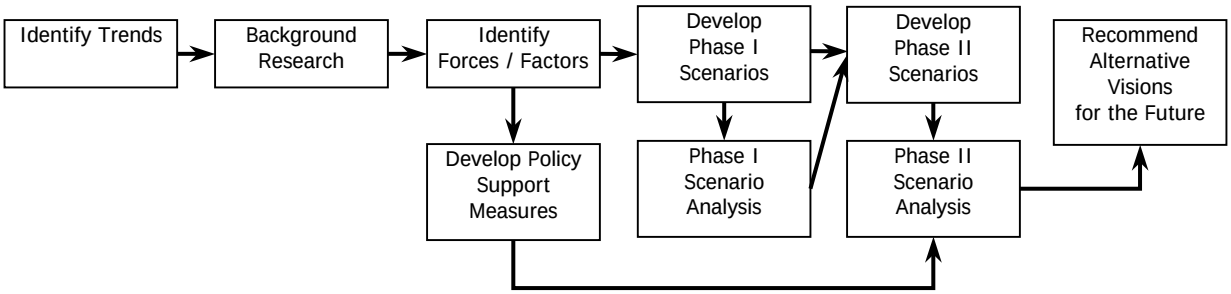

FIGURE 1. GENERAL FLOW OF THE WHAT-IF SCENARIOS [WIS]

With respect to the implication analysis, WIS could be divided into two major portions: Phase I and Phase II. In Phase I, perceptions of the future were tested. Twelve future scenarios were selected for analysis, and their respective merits were qualitatively assessed. In Phase II, simulations of the future were carried out. Based on the Phase I results, a subset of five was chosen for detailed quantitative evaluations using various planning models and tools.

Chapter 2 Perceptions of the Future

The First Year:

Main Goals for the first year were: 1) to develop a number of scenarios that could influence the scope and nature of the long-range regional transportation plan, and; 2) to complete the designed analysis of Phase I. Developed scenarios were assessed qualitatively, and were ranked using multiple criteria by their respective importance for Phase II selection. Project outputs including a first-year report and a presentation were also prepared for BPAC, other DVRPC committees, and the general public.

Phase I Scenarios:

Under the guidance of BPAC, staff drafted a series of what-if scenarios, and performed preliminary research. After several iterations of comments and discussions, a set of twelve scenarios was defined for Phase I. Table 1 lists the Phase I scenarios under their respective categories.

Scenario Category	Phase I Scenario
2025 Plan	• 2025 Plan Prevails
Spatial	• Urban Core Repopulates • Sprawl Accelerates • Information Technology [IT] Amenities Grow
Economy	• Regional Economy Strengthens • Global Trade Intensifies • Energy Cost Rises • Infrastructure Investment Expands
Demographics	• In-Migration Increases • Out-Migration Increases
Others	• "Green" Region Emphasized • Crisis of National Significance Occurs / Homeland Security Tightened

TABLE 1. WHAT-IF SCENARIOS FOR PHASE I

As shown, the twelve Phase I scenarios were grouped into five scenario categories. The 2025 Plan category considered a single scenario in which the current 2025 Long-Range Plan would be successfully implemented. Scenarios under the spatial category largely speculated the future changes in residential densities and employment patterns. Included were *Urban Core Repopulates*, *Sprawl Accelerates*, and *Information Technology [IT] Amenities Grow* scenarios. Those under the economy category reflected the uncertain and changing world economy. They were

Regional Economy Strengthens, *Global Trade Intensifies*, *Energy Cost Rises*, and *Infrastructure Investment Expands* scenarios. *In-Migration Increases*, and *Out-Migration Increases* scenarios dealt with potential population shifts in the region. Finally, *"Green" Region Emphasized*, and *Crisis of National Significance Occurs / Homeland Security Tightened* scenarios represented the developing interests in environmental issues and security concerns. Each scenario is described below with a brief description, trend research summaries, and an initial likelihood judgment.

1. 2025 Plan Prevails

The plan's assumptions regarding population and employment bear out. The policies are observed in regional and county plans. The planned infrastructure is built on schedule. The scenario is the baseline from which the impacts of other scenarios pivot.

For more information on the current 2025 Plan, *Horizons: The Year 2025 Land Use and Transportation Plan for the Delaware Valley* is available upon request.

2. Urban Center Repopulates

Resurgence in the preference for urban amenities occurs, and urban cores in the region are revitalized. People return to the urbanized areas of the region to both live and work.

While the urban core becomes densely populated, the total net population remains stable. In this scenario, the first generation suburbs surrounding the urban core rise with renewed appeals. Both the accessibility of places and the mobility of people are significantly enhanced within the vicinity. Public transportation and otherwise similarly clean transport modes become the preferred choices of travel. Regional air quality improves, and the possibilities for intermodal connection abound. The region consumes less energy as a whole, and can manage and preserve natural resources effectively. High concentration of activities allows necessary infrastructure and supporting institutions to be well utilized.

This scenario may be somewhat likely to take place. Center City Philadelphia has recently experienced one such trend. Core downtown population has grown by more than 20 percent since the 1960s, and is now over 78,000.[2] It is the third largest of its kind in the nation only after New York and Chicago. Center City Philadelphia is a vibrant retail, residential, and tourist destination. However, this trend is observed only in the Center City District, and for the rest of the City and the region, sprawl continues.

3. Sprawl Accelerates

The region spreads out further as suburbanization continues. Low density developments cluster on the periphery while older urban centers begin to deteriorate at a rapid rate.

[2] Selected data on the Center City District are available at http://www.centercityphila.org/. Accessed on 11/29/01.

As sprawl continues, the population spreads out farther. The first generation suburbs suffer while the urban core gets increasingly abandoned. Low density developments being scattered over a massive land area pose a daunting challenge in transit provision. Transit ridership consequently dwindles due to poor transit service, which in turn causes even poorer transit services. The Vicious Cycle begins.[3] Provisions for bicycle, pedestrian, and other nonmotorized modes yield to private automobile, which becomes the primary mode of transportation. Vehicle-miles-traveled [VMT] soars. Rates of land consumption, energy usage, and of natural resource depletion accelerate drastically. Need for physical and institutional infrastructure upkeep arises.

This scenario may be very likely to take place. In fact, more than half of all office space in the Philadelphia metropolitan area is already located outside the central cities.[4] Furthermore, according to the latest census data, Philadelphia continues to experience a population drain, while surrounding suburbs are gaining residents.[5] Philadelphia as a city has lost almost 70,000 residents — a 4.3 percent drop — during the past decade. Meanwhile, all other counties in the DVRPC planning area have posted net gains in 2000.[6] Sprawl is a universal phenomenon, and is no exception in the DVRPC planning area.

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4. Information Technology [IT] Amenities Grow

Opportunities for telecommuting expand as IT improves the ways to link work locations and personnel. Both center-based and home-based telecommuting options increase.

Sprawl continues as more workers telecommute. Urban core and other first generation suburbs in proximity deteriorate. Low density developments and flexible work hours together cause a difficulty in justifying transit service to some outlying areas. Flexibility in work schedule does afford more leisure activities in life, and activities pertaining to nonmotorized modes may increase. However, overall land consumption, energy usage and natural resource depletion heightens, and air quality worsens.

This scenario may be somewhat likely to take place. DVRPC hosts one of the five e-commute pilot programs in the country. Enabling technologies and amenities already exist, and many benefits of telecommuting have been assessed.[7] Currently, organizations get emission credits for implementing telecommuting. Yet, further analyses may be required to determine their precise impacts.[8]

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[3] The Vicious Cycle in transit refers to a downward spiral turn of events of reduced transit patronage leading to less frequent transit schedules leading to increased transit fare leading to further reduced transit patronage (Vuchic 1999).

[4] Garreau (1991) accurately predicted that residential and commercial activities would cluster on the edge of cities in the future. Today, sprawl is so prevalent that such edge cities no longer exist. A recent analysis (Lang 2000) produced by the Brookings Institute confirms this trend. It further reports that 55.2% of all office spaces (in sq.ft.) in the Philadelphia metropolitan area are located in "edgeless" locations. The City of Philadelphia only claims 36.0% of all office spaces in the area, and this number is significantly lower than that of New York (56.7%) or of Chicago (57.3%), both core-dominated cities. Philadelphia metropolitan area is defined by the US Census Bureau, and covers the whole of the DVRPC planning area and additional counties in NJ, DE, and MD.

[5] Preliminary results from the US Census 2000 (US Department of Commerce 2000) recorded the Philadelphia population at 1,517,550. It was a 4.3% decline from 1,585,577 a decade ago.

[6] Popular destinations included Montgomery County (a net gain of 71,986), Chester County (a net gain of 57,105), and Bucks County (a net gain of 56,461).

[7] Under the current CAAA regulation as amended, organizations receive emission credits from the US EPA for implementing telecommuting programs. Environmental benefits abound. For instance, according to the National Environmental Policy Institute, "if 10% of the nation's workforce eCommuted one day a week, the annual pollution savings would be the weight equivalent of three Capitol domes – 12,963 tons." Accessed on 11/29/01 at http://www.ecommute-nepi.org/newindex.html.

[8] Recent US DOT study (Mokhtarian & Henderson 1998) reported that the number of trips taken by telecommuters was not reduced but was actually comparable to that by regular driving public. Furthermore, the study found that telecommuters would tend to take longer trips than their regular driving public counterparts might log.

5. Regional Economy Strengthens

Regional economy rises to and remains at a competitive level in global scale. A sustained demand for the educated and skilled work force continues, and the region responds to meet it.

Assumptions speculate that a strong regional economy assures the region of excellent employment opportunities. Many workers move to the region to live and work. Able workers and strong supportive services and infrastructure keep the region competitive. However, sprawl continues, and the urban core continues to deteriorate slowly. Land consumption, energy utilization, and natural resource usage are all on the rise. The private automobile is still the choice mode of transport, and air quality deteriorates. Leisure activities including bicycling and walking may increase slightly, but overall, they do not result in substantial travel pattern impacts.

This scenario may be somewhat likely to take place. IT is among the potential agents of future prosperity, and the region can tap into its current growth. Many high tech companies are located in Mercer County, NJ, and efforts to attract similar businesses are made throughout the region including concentrated focuses on the Market Street West, Philadelphia Avenue of Technology, and on North Broad Street in Philadelphia. However, it will take continual and coordinated efforts in planning, commerce, policy, and infrastructure for the regional economy to compete globally.

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6. Global Trade Intensifies

Fierce competition for high productivity, improved efficiency, and cheap labor ensues. Company locations are largely polarized to two extremes: global business centers – typically in highly evolved metropolitan areas, and places where cheap labor is readily available – typically in developing countries. The need to import and transport goods from overseas to the markets in this country also increases.

Due to the competitiveness of the oversea markets and labor, local opportunities diminish. As population slowly decreases due to the economic hardship, abandoned and otherwise inactive land mass increases in the region. The automobile is an easily liquefiable asset, yet is also perceived as an essential necessity in job search and work commute.[9] Auto retention rate is high, vehicle fleet is old, and people travel willingly to job locations afar as job opportunities are sparsely distributed. VMT increases, and air quality suffers. Transit services cannot support the low density, and the disadvantaged population relying on public transportation and other nonmotorized modes is most immediately affected. Less amounts of goods passes through the region due to the slow economy as well.

This scenario may be very likely to take place. Free market economy dictates this phenomenon, and we have already seen many manufacturing jobs flow out of the region to elsewhere – often foreign countries. The region can no longer provide affordable labor, and must now compete against large global cities to retain its economic base.

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7. Energy Cost Rises

Fossil fuel costs increase manifold over current rates, and the market fails to produce alternative energy sources in the quantities needed to keep the overall costs down. The cost of living also escalates rapidly.

[9] Kay (1997) comments that even during the Great Depression in the 1920s, people have continued to purchase and operate automobiles. Greater mobility has meant a higher chance of locating and retaining a job.

High energy costs cause people to consider relocation in this scenario. First-generation neighborhoods are likely to benefit from this disposition because they are mostly transit-oriented and are prone to conserve energy. Regional economy in general suffers, and most – if there are any – new development forms are dense and energy-efficient. Public transportation and other nonautomobile travel choices become popular, and effective intermodal connections are sought. VMT by private automobile is reduced, and air quality generally improves. High cost of air fuel is passed onto air passengers, and air travel somewhat declines. Overall, public efforts to conserve energy and to otherwise preserve resources become common and substantial. High energy costs generally constrict the region's economic capacity, and the overall physical and technological infrastructure, as well as institutional support levels, diminish.

This scenario may be somewhat likely to take place. The United States Department of Energy [US DOE] (2001), which publishes annual energy projections, expects that there will be mild increases in petroleum and natural gas costs and mild decreases in coal and electricity costs. While the United States Department of Transportation [US DOT] (2001b) reports that during a twelve-month period from September 2000 to September 2001, the transportation price index for petroleum product input has fallen 11.7 points from 161.9 to 150.2 based on 1982 price weights, events (unfolding as of December 2001) regarding the Enron Chapter 11 bankruptcy filing will add repercussions of uncertainty to the national energy cost fluctuations in the future.

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8. Infrastructure Investment Expands

A series of federal, state, and local policies are implemented to secure funding for the construction and maintenance of vital infrastructure in the DVRPC planning area. Regional systems and facility networks are continuously planned, built, monitored, repaired, and updated.

It is assumed that infrastructure investment expansion has no direct and immediate implications on the regional population growth. However, improved physical infrastructure, increased economic capacities and other relevant social capitals generated can prepare the region to remain competitive, and may draw people to the area in the long run. Yet, without coordinated policy efforts, investment patterns often follow the trend, and its most likely effects include accelerated suburbanization due to the general well-being of suburban/ exurban infrastructure. Consequently, the older communities in the core decline. Land conservation, natural resource management, and energy efficiency rank low in public priority. Transit service struggles as automobiles dominate the transportation realm. VMT escalates. Intermodal connections are emphasized as they are mandated in the Intermodal Surface Transportation Efficiency Act [ISTEA] and the Transportation Equity Act for the 21st Century [TEA-21], yet actual usage may remain below optimum.

This scenario may be somewhat likely to take place. Major funding changes can occur as we have seen examples in the past in ISTEA, TEA-21, and other authorization bills. However, further investments in infrastructure beyond the current level may be difficult to achieve.

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9. In-Migration Increases

A large population enters the region for the appealing state of the area and abundant employment opportunities. Presumably, the influx consists of many young workers from around the country and even from overseas.

Total population increases as more migrants enter the region in this scenario. The housing options the new residents may consider, however, are most likely to be either rental units or relatively new real estate. The first generation suburbs generally offer very few of either. Consequently, the old neighborhoods continue to decline despite the growth because sprawl endures. Bicycling, walking, and other leisure activities increase. However, transit for commuting purposes suffers as the private automobile remains a primary mode of transportation. VMT rises and air quality suffers. Freight movement, both in frequency and in amount, increases in order to support additional residents in the region, and similarly air travel increases as well. Subsequent energy usage also rises, and the general levels of energy conservation and other resource management decrease.

This scenario may be somewhat likely to take place. Preliminary results from the US Census 2000 data indicate that the 20-34 age cohort has gained a net increase of 654,474 – representing a 50.5 percent jump – since 1990.[10] This is the largest increase among the age cohorts in the population pool within the region, and may imply that a large inflow of young workers to the nine-county planning area has occurred.[11]

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10. Out-Migration Increases

The region fails to remain attractive, and a large portion of the population leaves the area. Those who cannot afford to leave remain and age.

The region fails to remain attractive, and is expected to experience a severe population drain in this scenario. The urban core is largely abandoned. The region as a whole slowly disintegrates and the active clusters of activity within the region are rare, sparse, and far between. First generation suburbs are most negatively affected as the transit services and facilities for other nonautomobile modes are severely reduced. Automobile VMT rises slightly. Intermodal efforts are a low priority, and other relevant systems issues including energy conservation, resource management, and overall air quality are likewise. The region's preparedness deteriorates in human, economic, physical, institutional, and other similar social capitals.

This scenario may be somewhat likely to take place. Preliminary results from the US Census 2000 data indicate that from 1990 to 2000, the population growth has slowed down for the region. The nine-county DVRPC planning area has posted a 3.9 percent net gain in population, which is much lower than the national population net gain of 13.2 percent or the Northeast net gain of 5.5 percent.[12] Philadelphia continues to post a net loss – 68,027 fewer residents representing a 4.3 percent decline. The nine-county DVRPC planning area without Philadelphia registers a net gain of 7.6 percent.

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11. "Green" Region Emphasized

The region finds its niche in energy-conscious and environmentally friendly initiatives. Progressive policies and programs place the region among the top tier "green" metropolitan areas around the world.

[10] The 20-34 age cohort for the 9-county DVRPC planning area has grown from 1,296,295 in 1990 to 1,950,769 in 2000.

[11] Age cohorts are broken down into five categories; Up to 19, 20 to 34, 35 to 64, 65 to 84, and 85 and above. Net percentage changes from 1990 to 2000 for these cohorts in the 9-county DVRPC planning area are 7.1%, 50.5%, -32.6%, 1.1%, and 33.6%, respectively. Cohort divisions are made arbitrarily.

[12] During the past decade, the U.S. population has increased by 13.2% from 248.7 million in 1990 to 281.4 million in 2000 (US Department of Commerce 2000). In the DVRPC planning area, the total population has grown by 204,702 during the same period.

Environmental consciousness and associated efforts sweep the region. Net population changes little, but its travel patterns are greatly affected. Uses of public transit, bicycle, and otherwise environmentally friendly modes of transportation increase. Intermodal connections are heavily emphasized. Automobile VMT decreases, and strong conservation and preservation efforts are undertaken. Air quality improves dramatically.

This scenario may be somewhat likely to take place. The political priorities and focus of many current public administrations in the region do not aim for the top tier "green"-ness. However, energy and environmental issues have received higher levels of attention and consideration today compared to a decade ago, and this trend is expected to continue.

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12. Crisis of National Significance Occurs / Homeland Security Tightened

The nation witnesses a rise in violent activities and domestic disturbances. The general public becomes increasingly aware of the vulnerability of life, and becomes reluctant to live and work in areas where large numbers of people congregate in close proximity. Demands for scattered, small employment sites are seen, with a sharp reduction in the preference for downtown office and retail spaces. People tend to shun public transportation.

In this predicament, in short, sprawl accelerates. The nine-county planning area of DVRPC includes many historic landmarks and artifacts of national importance, which can be potential targets of terrorism. Residents elect to leave the region for personal safety concerns. The urban cores become largely inactive and abandoned, and immediately surrounding older communities suffer greatly. Collective fear of terrorism governs various life preferences, and low density developments are preferred to minimize impacts in case of additional terrorist attacks. Transit stations and other public locations are perceived vulnerable, and transit declines rapidly. Automobile usage increases significantly, while intermodal connection is not emphasized. Considerations for nonautomobile modes become stagnant, and air quality deteriorates. Energy conservation and other resource preservation efforts are placed in low priority in short term. Prolonged tension will, however, cause people to conserve resources and energy in a long run.

This scenario may be somewhat likely to take place. Although, various security measures are being implemented to prevent further acts of terrorism, the nation's perception of the normalcy of life has been substantially changed after the September 11 incident. The 2001 Thanksgiving weekend has seen a large increase in automobile travel, and public transportation is largely ignored including air travel options.[13] The airline industry perhaps has suffered the most in long distance travel worldwide.[14] Possible shifts in spatial preferences regarding residence or office location may be too premature to comment on conclusively.

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[13] Recent pre-trip survey results from the American Automobile Association [AAA] indicate that 87% of all travel over the 2001 Thanksgiving weekend may be by motor vehicle, the highest percentage ever recorded. Furthermore, there may be about 500,000 fewer people traveling overall, and travel by air, train, or bus may experience a 27% decline compared to a year ago. The AAA projections dated 11/9/01 can be accessed on the web at http://buffalo.bcentral.com/buffalo/stories/2001/11/05/ daily39.html. Accessed on 12/3/01.

[14] Since 9/11/01, the SwissAir and Sabena Airlines (the royal Belgian carrier) have already filed for bankruptcy. In the U.S., according to the Air Transport Association [ATA], October 2001 has seen a 23% decrease in air passengers despite an average airfare decline of 19.2%. The ATA comment is reported in the *Los Angeles Times* on November 26, 2001, a full text of which news article can be accessed free at http://www.dailypress. com/travel/sns-travel-thanksgiving-lat.story?coll=sns-travel-headlines. Accessed on 12/3/01.

Assessment Measures:

For the Phase I evaluation, a set of twenty assessment indicators were arranged to measure selected impacts, preparedness, and likelihood of each scenario. Regional Form impact indicators (R1-R3) would measure the expected consequences on urban and spatial form of the region. Population growth; the strength and sustainability of the older; first-generation suburbs; and overall land conservation were considered.

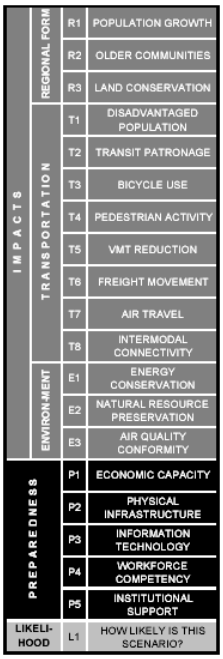
Transportation impact indicators (T1-T8) would consider the expected outcomes in the transportation field. They included the mobility of the transport-disadvantaged population, the level of transit patronage, bicycle usage, pedestrian activities, reduction in VMT, growth in freight movement, air travel, and the level of intermodal connectivity.

Environment impact indicators (E1-E3) assessed the region's level of energy conservation, general effort level in natural resources preservation, and the issues of air quality conformity. Preparedness indicators (P1-P5) gauged the region's readiness for the given scenario. They included the extent of the region's economic capacity, state of the physical infrastructure, sufficient availability of information technology, workforce skill competency, and the level of institutional support and readiness for the given scenario. Table 2 details all assessment measures employed in the Phase I analysis.

Assessment Category		Assessment Measure	
Impacts	Regional Form	R1	Population Growth
		R2	Older Communities
		R3	Land Conservation
	Transportation	T1	Disadvantaged Population
		T2	Transit Patronage
		T3	Bicycle Use
		T4	Pedestrian Activity
		T5	VMT Reduction
		T6	Freight Movement
		T7	Air Travel
		T8	Intermodal Connectivity
	Environment	E1	Energy Conservation
		E2	Natural Resource Preservation
		E3	Air Quality Conformity
Preparedness		P1	Economic Capacity
		P2	Physical Infrastructure
		P3	Information Technology
		P4	Workforce Competency
		P5	Institutional Support
Likelihood		L1	Likelihood of This Scenario Taking Place

Table 2. Phase I Assessment Measures

For each impact assessment measure, an ordinal scale ranging from +3 to –3 was applied to rate each of the scenarios tested. Each positive step would denote a degree of favorable results produced by the given scenario, and each negative step would denote a degree of unfavorable results. Respondents were cautioned that a favorable result could mean either an increase or a decrease in hard data. For instance, in transit patronage measure (T2), a favorable notation could imply an increase in ridership. In VMT reduction measure (T5), on the other hand, a favorable notation would mean a decrease in VMT. Zero represented no significant changes resulted, and a separate notation was also available for indeterminable outcomes. For the *2025 Plan Prevails* scenario only, an additional choice of being unfamiliar with the Plan was offered.



For the preparedness assessment measures, each notation indicated a degree of being sufficiently prepared for the given scenario, and 0 represented being uncertain to make a definitive mark. Otherwise, the rating scheme for these measures were similar to that for the impact assessments above. Again, an ordinal scale from –3 to +3 was used, and each positive notation implied a favorable degree of preparedness.

For the likelihood assessment measure, a favorable rate indicated a range that the scenario was likely to occur. An ordinal scale from 1 to 3 was used instead.

A survey was prepared, and in an attempt to capture a variety of balanced opinions, twelve staff members of diverse specialties and ranks were selected to represent a sensible cross-section of the general planning staff. To further broaden the spectrum of responses, three knowledgeable outside professionals were also asked to participate in the scenario evaluations. In addition to twelve DVRPC staff members, representatives from the Pennsylvania Department of Community and Economic Development, the Burlington County Department of Economic Development, and the Clean Air Council participated in the survey.

The option to choose "Not Familiar with the 2025 Plan" had been exercised by two respondents, and the results for the *2025 Plan Prevails* scenario had a sample size of 13. All other scenarios had a sample size of 15. Due to the small sample size, no statistically meaningful inference could be made from the results. However, the merit of this exercise resided in finding a balanced and intuitive estimate of perceived impacts.

Result Summary:

Figure 2 summarizes the results of the Phase I assessment. Twelve scenarios analyzed by twenty assessment measures had comprised a total of 240 individual assessment items represented in Figure 2. For each individual assessment item, there could also be up to eight scalable assessment notations. Each filled, upward triangle represented a degree of positiveness in range, and each hollowed and downward triangle, that of negativeness, respectively. A dual-head arrow indicates that a wide range of equally diverse opinions existed.

Inherent complexity of the tabulated results warranted a clarification. To interpret Figure 2, one should read row item by column item and then look for the assessment measure in the cell. In other words, in terms of population growth (R1), the *2025 Plan Prevails* scenario (#1) was deemed to generate a modestly favorable result, *Urban Core Repopulates* (#2) a moderately favorable result, and so on. Furthermore, scenarios at both ends of the assessment scale were accentuated in color. Cells in blue implied that for the given row assessment item, the corresponding column scenarios would have highly favorable – the darker the more favorable – impacts. Cells in purple represented the ones with highly unfavorable impacts. Accordingly, an interpretation could be made that *In-Migration* (#9) and *Strong Regional Economy* (#5) would most favorably foster population growth (R1), and that *Out-Migration* (#10) and *Homeland Security* (#12) would most negatively impact it.

In all, respondents collectively viewed the *"Green" Region* (#11) and *Urban Core Revitalization* (#2) as top two scenarios with the most positive impacts. *Suburban Sprawl* (#3), *National Crisis* (#12) and *Mass Out-Migration* (#10) yielded the most negative results. Interestingly, in the most-likely-to-occur assessment, the order was more or less reversed. Responses tended to agree more on scenarios under the spatial and demographics categories and tended to agree less on scenarios under the economic category. The region was assessed to be well prepared for *Strong Regional Economy* (#5) and *IT Amenities* (#4). The region was deemed the least prepared for *Out-Migration* (#10) and *National Crisis* (#12) scenarios. In general, responses tended to converge more on scenarios under the spatial and demographics categories and tended to diverge on scenarios under the economic category. Table 3 details this summary.

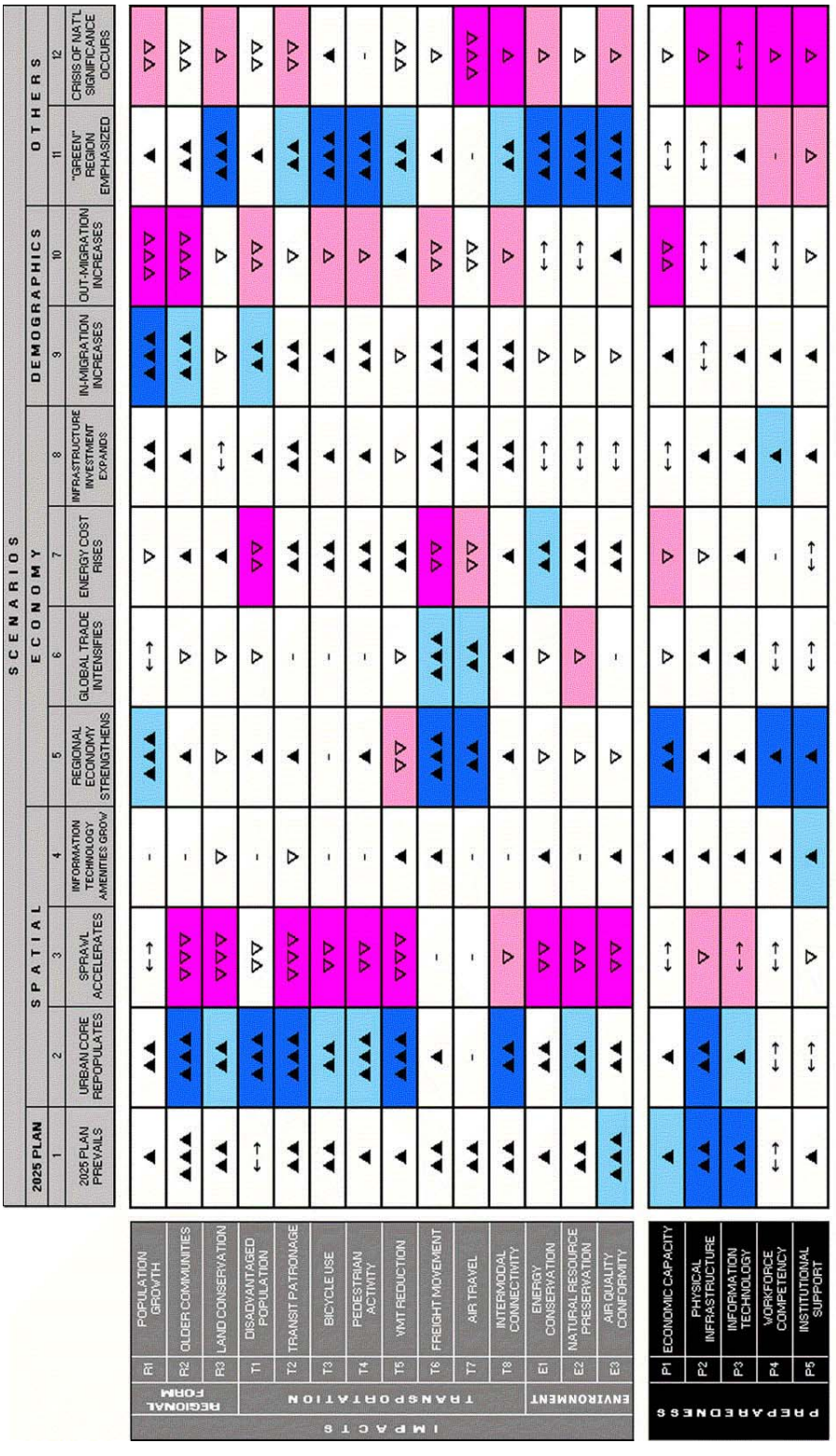


FIGURE 2. PHASE I RESULT TABULATION

	Scenarios
Most Positive Impacts Overall	URBAN CORE REPOPULATES "GREEN" REGION EMPHASIZED
Most Negative Impacts Overall	SPRAWL ACCELERATES OUT-MIGRATION INCREASES
Most Likely To Occur	SPRAWL ACCELERATES GLOBAL TRADE INTENSIFIES
Most Unlikely To Occur	IN-MIGRATION INCREASES "GREEN" REGION EMPHASIZED (tie) URBAN CORE REPOPULATES (tie)
Impact Assessments Generally Agreed	REGIONAL ECONOMY STRENGTHENS "GREEN" REGION EMPHASIZED
Impact Assessments Most Debated	2025 PLAN PREVAILS INFRASTRUCTURE INVESTMENT EXPANDS

TABLE 3. SELECTED PHASE I SCENARIOS

Respondents agreed, in general, on all impact assessment items. Overall, those under the transportation category were more positive than those under other categories, regardless of scenarios. Impacts under the environmental category were perceived to benefit the least under most scenarios. The transportation impact category showed the tightest spread of all opinions. In particular, staff seemed to be quite certain that given any scenario, bicycle usage and pedestrian activity would probably stand to benefit the most. On the other hand, VMT reduction, disadvantaged population, and all impact items under the environmental category could benefit the least overall, albeit the opinions in these areas were relatively diverged and spread.

The preparedness response distribution spreads were the widest among all response distributions, and the respondents were doubtlessly the most cautious in answering the line items under this category. In summary, no clear consensus on preparedness was prominent in most cases, and derived norms were more likely to be unfavorable. For instance, opinions varied the most, and quite significantly so, in the economic capacity preparedness assessment in particular. A derived norm for this assessment also ranked near the least prepared. Respondents viewed information technology as the most prepared asset of the region, and the presence of many academic establishments, medical institutions and high tech projects such as the North Broad Street Initiative may have contributed to this outcome. To the contrary, respondents viewed the institutional support as the least prepared area of the regional readiness analysis regardless of scenarios given. Implied was a lack of communication and cooperation among stakeholders and responsible entities.

Finally, the scenarios were ranked in terms of their overall positiveness of impacts, overall preparedness assessed, and overall likelihood of occurrence. All rankings are arranged in ascending order with 1 being the most desirable and 12 being the least desirable. Figure 3 displays the ranking results. Also, scenarios at the extremes of the ranking criteria are highlighted as well.

	SCENARIOS											
	2025 PLAN		SPATIAL			ECONOMY			DEMOGRAPHICS		OTHERS	
	1	2	3	4	5	6	7	8	9	10	11	12
	2025 PLAN PREVAILS	URBAN CORE REPOPULATES	SPRAWL ACCELERATES	INFORMATION TECHNOLOGY AMENITIES GROW	REGIONAL ECONOMY STRENGTHENS	GLOBAL TRADE INTENSIFIES	ENERGY COST RISES	INFRASTRUCTURE INVESTMENT EXPANDS	IN-MIGRATION INCREASES	OUT-MIGRATION INCREASES	"GREEN" REGION EMPHASIZED	HOMELAND SECURITY TIGHTENED
POSITIVE-NESS (HOW POSITIVE IS THE OVERALL RESULTS?)	3	2	11	8	7	9	6	4	5	10	1	12
PREPARED-NESS (HOW PREPARED IS THE REGION?)	4	3	8	2	1	6	9	5	6	11	10	12
LIKELI-HOOD (HOW LIKELY TO OCCUR IS THIS?)	6	10	1	5	7	2	3	8	12	4	10	8

FIGURE 3. PHASE I SCENARIO RANKING

Characteristics of the scenarios of overall positiveness should be examined carefully and the region ought to foster underlying features that would cause the positiveness. Scenarios of overall negativeness need to be observed for exactly the opposite reason. Scenarios for which the region was deemed least prepared should be considered, and the region must seek to overcome deficiencies. The likelihood measure was considered as a check to bridge the gap between visions and realities. Based on these rankings, scenarios for the Phase II analysis would be determined.

Chapter 3 Simulations of the Future

The Second Year:

Quantitative investigations of the Phase II scenarios were the highlights of the second year WIS analysis. Various planning tools including DVRPC's travel demand model and emissions estimate model were utilized to quantify various outcomes of the selected scenarios. Results were summarized and were laid as a planning foundation for the 2030 Long-range Plan. WIS outputs, including summary reports and presentation, were also prepared for the BPAC, relevant DVRPC committees and the general public.

Phase II Scenarios:

Based on the Phase I ranking criteria, a composite, weighted rank of the scenarios was established. The weighted ranking scheme was designed to select scenarios for their collective merits in positiveness, preparedness, and likelihood of occurrence. The top six scenarios in weighted rank became primary candidates for the Phase II assessment. The BPAC reviewed the recommendation, and comments from the New Jersey Department of Transportation [NJ DOT] were incorporated. Scenarios with similar results were merged, and various scenario description and assumption details were further refined. The final set for the Phase II analysis included five scenarios. Figure 4 details how the Phase II set was finalized.

Initially, the *Urban Core Revitalized* (#2) scenario did not advance to Phase II. While it scored high in positiveness, it was also ranked among the least likely to occur and was ranked among the adequately prepared scenarios. However, features of *Urban Core* included many aspects the region wanted to foster. Instead, characteristics of urban living were combined and built into the *"Green" Region* (#11) scenario. The result was labeled as the *recentralization* scenario. Similar integration of scenarios was also done for the *Sprawl* (#3) and the *Homeland Security* (#12) scenarios for their close likely outcomes. Its result was titled the *Sprawl* scenario.

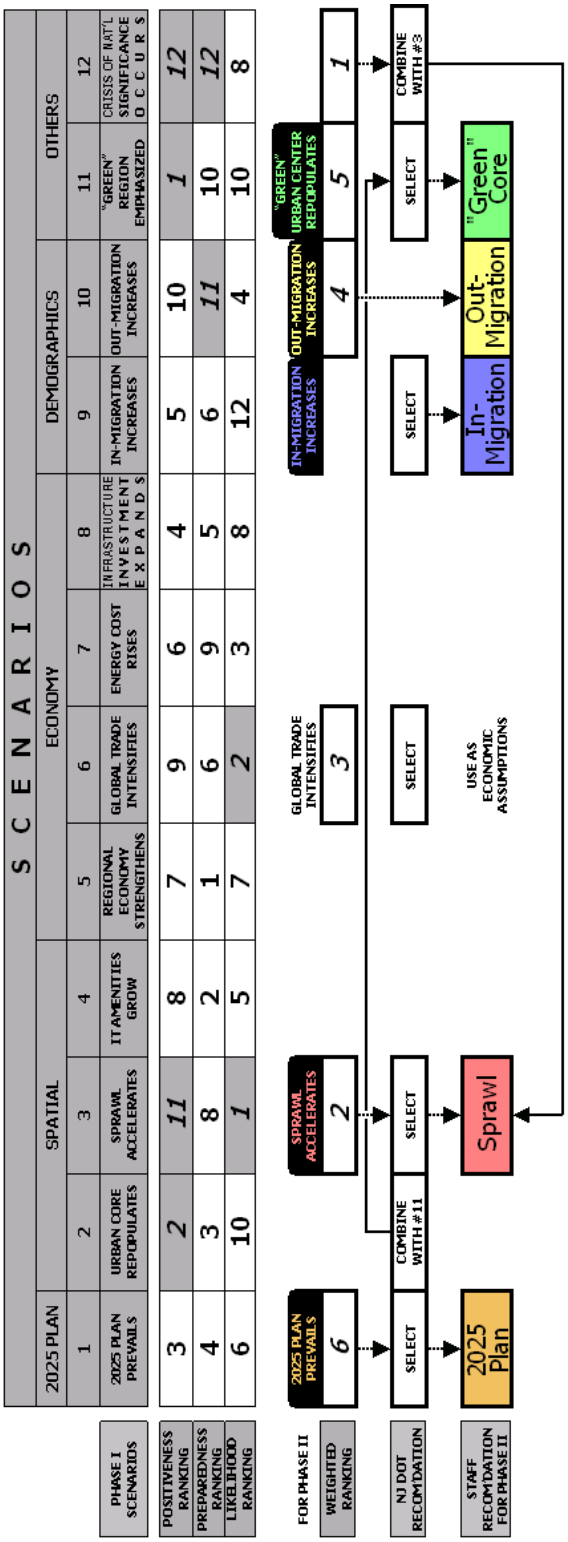


FIGURE 4. PHASE II SCENARIO SELECTION

Also, the *Global Trade* (#6) scenario was deemed an imminent reality rather than a what-if situation. As such, instead of testing it as an individual scenario, various aspects of its economic assumptions were incorporated in the overall Phase II process. Details of these economic assumptions are described in the Scenario Assumptions section below.

Finally, the *2025 Plan* (#1) scenario was included in the Phase II set to offer a sense of coherency, continuity, and comparability to the overall long-range plan principles.

The Phase II set represents a balanced overview of five future scenarios. Figure 5 places them along a spectrum of possible future outlooks ranging from pessimistic to optimistic.

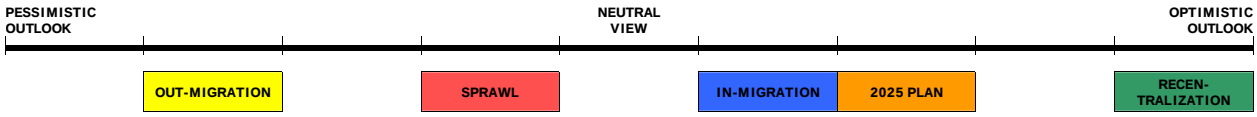


FIGURE 5. PHASE II SCENARIOS AGAINST A RANGE OF OUTLOOKS

Socioeconomic Assumptions:

All population and employment estimates were derived from the DVRPC 1997 travel demand model data, 2000 U.S. Census information, and the DVRPC 2025 regional forecasts. For population, a scenario-specific total for each county was first determined, and then within the given county, each travel analysis zone's [TAZ] share was calculated. Lastly, final adjustments on all TAZ estimates were made based on a population distribution factor by 1997 area type.[15]

For the *Recentralization* and *Sprawl* scenarios, existing 2025 forecasts were maintained at the regional level while distribution patterns within the region varied. In the *In-Migration* and *Out-Migration* scenarios, 500,000 people were added to or subtracted from the 2025 forecast, respectively. Table 4 summarizes how scenario-specific population distribution patterns have changed by scenario and area type. Analysis year is 2025.

[15] For detailed descriptions of the travel demand model utilized, and its socioeconomic and area type data, please refer to DVRPC reports *1997 Travel Simulation for the Delaware Valley Region* (January 2000) and *1997 Zonal Population and Employment Estimates* (January 1999).

Population Changes	CBD	Urban	Suburban	Rural
2025 Plan	↑	↑	↑	-
Recentralization	↑	↑	-	↓↓
Sprawl	↓↓	↓↓	-	↑↑
In-Migration	↓	↓	↑	↑
Out-Migration	↓↓	↓	↑	-

TABLE 4. SCENARIO-SPECIFIC POPULATION DISTRIBUTION PATTERN

Selected aspects of the *Global Economy* (#6) scenario were incorporated into the overall Phase II economic assumptions. These assumptions speculated that a fierce market-driven competition for high productivity, improved efficiency, and cheap labor would ensue. Company locations would be largely polarized to two extremes: global business centers – typically in highly evolved metropolitan areas, and affordable labor sites – increasingly in underdeveloped foreign countries. The DVRPC region must compete against large global cities to retain its economic base. However, in its conversion to service-oriented tertiary economy, the region might lag behind many other comparable metropolitan areas in the U.S.[16]

Furthermore, the next wave would be yet another shift to a knowledge-based system. The regional economy should be increasingly dependent on knowledge workers, especially in healthcare and other nonfinancial service sectors.[17] In particular, business services and accounting, management, information technology, and engineering services would be among the areas the region must concentrate in to remain as an economically viable place. The need to import and transport manufactured goods from overseas to the markets in this country also would increase within the region. Possible future employment shifts are detailed in Table 5. Government and military employment increases are due to overall population increase, and are kept to a minimum. Analysis year is again 2025.

[16] Federal Reserve Bank of Philadelphia (2002), p.6.

[17] *Ibid*., p.12. A large portion of recent employment growth in Philadelphia has been in nonfinancial services, especially in business support and health services. Unfortunately, the shift to service has been driven as much by a decline in manufacturing and other industrial sectors as by growth in service sector.

	AGRIC	MINING	CONSTR	MFG	TRANS	WHSLE	RETAIL	F.I.R.E.	SERVICE	GOVT	MILTRY
Potential Employment Changes	↓	↓	↑	↓	↑	↑	↑	↑	↑	↑	↑

TABLE 5. FUTURE EMPLOYMENT SHIFTS

Simulation Inputs:

2025 Plan Prevails is a center-based and planned in-fill scenario. All assumptions in the current long-range plan bear out. Plan policies are observed in subsequent county and local plans, and planned infrastructure is built on schedule.

2025 Plan

COUNTY	1990 Population	2000 Population	2025 Forecast
Bucks	541,174	597,635	748,120
Chester	376,389	433,501	550,160
Delaware	547,658	550,864	547,784
Montgomery	678,193	750,097	857,030
Philadelphia	1,585,577	1,517,550	1,500,000
Burlington	395,066	423,394	513,450
Camden	502,824	508,932	513,530
Gloucester	230,082	254,673	322,520
Mercer	325,759	350,761	404,850
Regional Total	5,182,722	5,387,407	5,957,444

TABLE 6. POPULATION DATA FOR THE 2025 PLAN SCENARIO

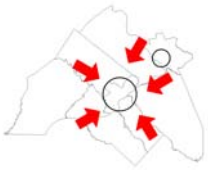
COUNTY	Agric	Mining	Constr	Mfg	Trans	Whsle	Retail	F.I.R.E.*	Service	Govt	Military	Total
Bucks	6,241	299	14,620	39,790	9,810	24,930	56,070	23,630	136,150	25,741	1,079	338,310
Chester	7,807	403	10,860	28,790	12,150	18,110	38,900	36,500	114,940	20,447	93	289,000
Delaware	2,709	171	10,440	25,520	15,260	11,250	42,530	21,190	115,620	24,908	292	269,890
Montgomery	4,975	315	25,140	83,940	21,520	29,800	89,720	61,830	216,640	32,186	1,634	567,700
Philadelphia	1,303	157	26,180	63,870	38,880	28,280	95,720	62,100	389,180	132,803	1,777	840,250
Burlington	4,968	122	11,660	18,920	14,200	17,930	39,880	24,800	82,600	29,126	6,344	250,550
Camden	1,893	177	11,700	20,210	13,020	18,200	40,020	16,250	105,480	36,595	615	264,160
Gloucester	2,882	308	6,590	12,940	4,270	8,700	29,110	4,330	39,300	14,152	68	122,650
Mercer	2,117	213	8,650	19,920	8,470	9,950	32,410	24,510	97,630	65,707	323	269,900
Total	34,895	2,165	125,840	313,900	137,580	167,150	464,360	275,140	1,297,540	381,665	12,225	3,212,410

* FINANCE, INSURANCE, AND REAL ESTATES

TABLE 7. EMPLOYMENT DATA FOR THE 2025 PLAN SCENARIO

Recentralization

"Green" Urban Center Repopulates is a recentralization scenario. Input assumptions include the overall regional population adhering to the 2025 forecast of nearly 6.0 million and employment being a function of population.



Population for this scenario was processed first by county and then by TAZ. Counties with predominantly urban characteristics were given more population than their respective 2025 forecast counterparts stipulated, and those with predominantly rural characteristics received less. Within each county, the total was again distributed by area type, giving preference to CBDs and urban zones while penalizing suburban and rural zones. Table 8 summarizes the population and employment data for this scenario by county.

Recentralization Scenario	Assigned 2025 Population	Assigned 2025 Employment
Bucks	639,290	299,541
Chester	441,325	246,528
Delaware	603,927	270,199
Montgomery	849,893	601,328
Philadelphia	1,788,199	945,950
Burlington	436,681	218,568
Camden	553,150	262,312
Gloucester	258,028	106,703
Mercer	386,331	276,870
Regional Total	5,956,823	3,227,999

TABLE 8. COUNTY POPULATION AND EMPLOYMENT: RECENTRALIZATION

Land consumption rates by spatial pattern varied greatly from study to study. One renowned research work, however, indicated that a recentralization scenario might take roughly 72 percent less land than a plan-mixed scenario (like the 2025 Plan) would.[18]

[18] RERC (1974) as quoted in TRB (1998), p.14.

Sprawl Accelerates is a sprawl scenario. Input assumptions include the overall regional population adhering to the 2025 forecast of nearly 6.0 million and employment being a function of population.

Population for this scenario was also processed in a two-step manner described in the recentralization scenario above, but received more population in suburban and rural counties and TAZs, instead. Table 9 summarizes the population and employment data for this scenario by county.

Sprawl

Sprawl Scenario	Assigned 2025 Population	Assigned 2025 Employment
Bucks	863,032	390,940
Chester	792,241	352,068
Delaware	513,115	276,593
Montgomery	864,157	656,978
Philadelphia	1,014,753	565,898
Burlington	643,864	289,438
Camden	460,622	253,308
Gloucester	424,674	150,047
Mercer	379,474	286,188
Regional Total	5,955,933	3,221,459

TABLE 9. COUNTY POPULATION AND EMPLOYMENT: SPRAWL

In terms of land consumption rate, one study indicated that a sprawl scenario could take roughly 150 percent as much land as a plan-mixed scenario (like the 2025 Plan) would.[19]

[19] RERC (1974) as quoted in TRB (1998), p.14.

In-Migration

In-Migration Increases is a regional growth scenario. Input assumptions include the overall regional population increasing to 6.5 million, employment being a function of population, and distribution patterns being similar to 1997 trend.

Table 10 summarizes the population and employment data for this scenario by county.

In-Migration Scenario	Assigned 2025 Population	Assigned 2025 Employment
Bucks	832,287	389,970
Chester	611,629	341,662
Delaware	600,077	268,477
Montgomery	948,096	670,809
Philadelphia	1,571,591	831,365
Burlington	571,563	286,079
Camden	565,241	268,046
Gloucester	358,236	148,142
Mercer	442,592	317,191
Regional Total	6,501,312	3,521,741

TABLE 10. COUNTY POPULATION AND EMPLOYMENT: IN-MIGRATION

Out-Migration

Out-Migration Increases is a regional decline scenario. Input assumptions include the overall regional population decreasing to 5.5 million, employment being a function of population, and distribution patterns being similar to 1997 trend.

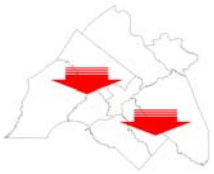


Table 11 summarizes the population and employment data for this scenario by county.

Out-Migration Scenario	Assigned 2025 Population	Assigned 2025 Employment
Bucks	709,777	332,568
Chester	518,949	289,890
Delaware	510,573	228,432
Montgomery	808,406	571,974
Philadelphia	1,309,223	692,574
Burlington	486,730	243,618
Camden	481,592	228,378
Gloucester	304,435	125,893
Mercer	375,406	269,041
Regional Total	5,505,091	2,982,369

TABLE 11. COUNTY POPULATION AND EMPLOYMENT: OUT-MIGRATION

Policy Support Measures:

For Phase II evaluation, various indicators were developed to help assess the regional impacts of a given scenario and determine future policy directions. Developed measures were grouped into four large categories.[20] They are listed in Table 12.

Category	Number	Policy Support Measure
Mobility and Access	TSP1	Determine Regional Mobility and Accessibility
	TSP2	Identify Areas with Future Access Need
	TSP3	Identify Future Residential/Employment Locations for the Mobility Disadvantaged
	TSP4	Identify Future Usage and Needs by Facility Type
	TSP5	Determine Future VMT by Facility Type or Area Type
	TSP6	Assess Transit Demands and Future Service Areas
	TSP7	Assess Freight Activities by Location and by Mode
System Performance and Associated Costs	TSP8	Identify Future Highway Congestion Locations
	TSP9	Assess Future Travel Time and Speed by Scenario
	TSP10	Determine Future Highway Delays and Related Loss Quantification
	TSP11	Identify Probable Accident Injury and Fatality Statistics
Environment and Quality of Life	TSP12	Determine Adequacy of Developable Land/Future Growth Areas
	TSP13	Identify Potential Air Quality Key Locations and Concerns
	TSP14	Determine Energy and Fuel Consumption by Scenario
	TSP15	Address Environmental Justice Concerns
Long-range Plan	TSP16	Assess Future Spatial Characteristics of the Region
	TSP17	Assess 2025 Plan and Offer a Basis for the 2030 Plan
	TSP18	Determine Potential Infrastructure Costs Related to Scenario
	TSP19	Assess the Overall Regional Transportation System Preparedness
	TSP20	Enhance the Long-range Plan Planning Process, Analysis and Methodology

TABLE 12. POLICY SUPPORT MEASURES

Under the Mobility and Access category, TSP1 determines mobility and accessibility changes among scenarios. Highway mobility changes were assessed by comparing the highway travel time matrices from five locations – Center City Philadelphia, King of Prussia Mall, downtown Trenton, Cherry Hill Mall, and Downingtown – with the 2025 Plan travel time matrix. Transit accessibility changes were assessed by measuring the transit route coverage (1/4-mile buffer), regional zero-auto locations and home-based work [HBW] walk-approach transit trip production patterns. TSP2 identifies areas with future mobility deterioration and access degradation. PM peak travel time and speed were used in this analysis. HBW trip production and attractions were utilized to simulate residential and employment locations, respectively. A VMT comparison was also made. TSP3 identifies future residential and employment locations for the mobility disadvantaged. Zero-auto household information was processed to identify the mobility

[20] Detailed descriptions and methodology for the Policy Support Measures can be found in an internal memo titled *Regional Analysis of What-If Transportation Scenarios: Transportation System Policy Consideration, Data and Methodology* (March 2002). Inquiries can be made to Jienki Synn at (215) 238-2947 and at jsynn@dvrpc.org.

disadvantaged. Transit HBW production trips were at the residential locations and the transit HBW attraction trips were at the employment location. TSP4 identifies future highway usage and needs. VMT would represent the usage, and V/C ratio would measure the need. Results were summarized by facility type and county planning area. TSP5 determines future VMT. This was a direct output of the travel demand model. TSP6 assesses future transit demands and service areas. Future transit HBW trips were compared with the current transit coverage. TSP7 assesses future freight activities in the region. TDM outputs of heavy-duty trucks were underestimated, and they could not capture rail freight adequately. No substantial data could be located regarding regional freight modal shares and activities. In lieu of regional data, MOBILE6 vehicle type distribution factors were utilized.

Under the System Performance and Associated Costs category, TSP8 identifies future highway congestion locations. Highway congestion normally occurred at level of service [LOS] E or F as defined in the Highway Capacity Manual (TRB 1994a). TSP 9 determines the travel time and speed conditions by scenario. Highway results were summarized by county planning area and transit results by transit submode. TSP10 determines future highway delays and relevant loss quantification. Monetary estimates per VMT or per traveler were derived. TSP11 identifies probable accident statistics, and assesses potential fatality rates by facility type.

Under the Environment and Quality of Life category, TSP 12 determines the adequacy of the developable land and future growth areas. TSP 13 identifies locations for future air quality concerns. TSP14 determines the energy and fuel consumption pattern by scenario. Consumption pattern per household and per spatial form was derived. TSP15 addresses the Environmental Justice concerns in the long-range process plan.

Under the Long-range Plan category, TSP16 assesses the future characteristics of the region by scenario. Population, employment, and density information were highlighted, and VMT changes by spatial pattern were attempted. TSP 17 assesses the current 2025 Plan, and lays a foundation for the 2030 regional long-range plan. TSP18 determines the potential infrastructure cost by scenario. TSP19 assesses the overall regional transportation system preparedness. Finally, TSP20 enhances the long-range plan planning process, its analysis, and methodology. Applicable results and recommendations from this exercise will help enhance the overall long-range planning process, analysis techniques, and relevant methodology employed.

Result Summary:

A series of maps and tables were prepared to visually represent the future mobility concerns and access needs. For regional mobility, VMT is one of the more important assessment measures. Table 13 shows various VMT results along with other vital transportation statistics by facility type and peak period. Notably, the model results showed that, while *In-Migration* would generate the most VMT, the 500,000 fewer residents in *Sprawl* might also cause almost as much daily VMT as *In-Migration* would. Consequential policy issues including congestion and air quality matters should be carefully considered. *In-Migration* also produced the highest VMT in freight truck movement, again closely followed by *Sprawl*.[21] Transit VMT was the highest under *Recentralization*. Figure 6 compares various VMTs by scenario.

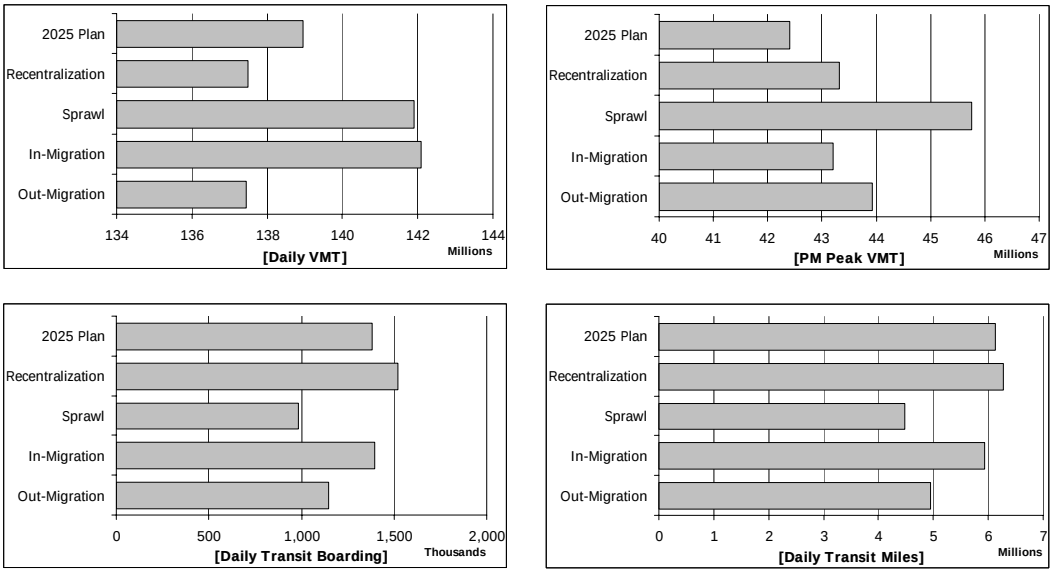


FIGURE 6. SELECTED HIGHWAY AND TRANSIT VMTS

[21] Freight movement assessments were made using the vehicle type distribution factors for heavy-duty diesel trucks in MOBILE6. Factors by county were 0.0519 (Bucks), 0.0580 (Chester), 0.0479 (Delaware), 0.0469 (Montgomery), 0.0489 (Philadelphia) for Pennsylvania counties, and uniformly 0.0366 for all New Jersey counties within the region. Rail movements were not available.

	2025 PLAN	RECENTRALIZATION	SPRAWL	IN-MIGRATION	OUT-MIGRATION
Daily Auto VMT	138,963,900	137,492,300	141,895,900	142,088,700	137,448,200
Daily Vehicle Hour	4,509,276	4,042,129	4,304,157	4,651,049	3,981,657
Avg Daily Speed [mph]	27.8	30.3	29.7	27.8	30.7
Daily Auto Trips	18.2 M	16.8 M	18.2 M	18.9 M	16.7 M
Avg Auto Trip Length [miles]	6.72	7.15	6.88	6.64	7.23
Average Vehicle per Lane	5.9	5.9	6.0	6.0	5.8
Average Volume/Capacity	0.58	0.57	0.59	0.59	0.57
PM Peak VMT	42,399,536	43,316,004	45,755,396	43,207,068	43,928,508
Avg PM Peak Speed [mph]	22.6	26.2	25.3	22.0	27.1
Daily Freeway VMT	44,501,200	43,978,400	44,623,400	45,185,800	43,793,400
Avg Freeway Speed [mph]	51.3	50.9	51.3	50.9	51.1
Daily Arterial VMT	60,324,800	60,319,100	61,633,000	62,355,000	60,113,200
Avg Arterial Speed [mph]	32.7	32.2	33.1	32.4	32.6
Daily Local VMT	30,268,200	29,370,600	31,759,200	30,618,700	29,733,300
Avg Local Speed [mph]	34.0	33.7	34.1	33.8	33.8
PM Peak Person Trips	6,988,077	6,313,797	7,085,144	7,222,047	6,287,179
PM Peak Vehicle Trips	6,194,044	5,679,687	6,214,745	6,459,801	5,608,236
Freight Truck VMT	6,308,345	6,228,390	6,438,524	6,438,965	6,226,329
Transit Trip Production	923,706	1,015,387	666,016	928,919	765,961
Daily Transit Boarding	1,382,506	1,520,681	981,967	1,393,934	1,145,365
Daily Transit Miles	6,122,148	6,276,053	4,476,730	5,935,867	4,949,008
Daily Transit Hours	323,369	344,458	231,064	319,403	263,572
Avg Transit Speed	18.9	18.2	19.4	18.6	18.8

TABLE 13. VMT AND OTHER TRANSPORTATION DEMAND MODEL RESULTS

VMT comparisons were also detailed in Figure 7 along with low level-of-service [LOS] locations. LOS was calculated by roadway volume over capacity [V/C] ratio.[22] Poor LOS locations represent the future congestion locations.

For another look at mobility, the Corridor Mobility Index [CMI] was calculated.[23] CMI is a measure of the mobility level provided by transportation facilities in a corridor with respect to operating standards. Figure 8 displays the CMI changes along with those in highway vehicle trips.

[22] TRB (1994a), p.3-9. Table 3-1. V/C ratio as a LOS measure for a six-lane freeway with free flow speed of 65 mph. V/C ratio from 0.68 to 0.85 constitutes LOS D, from 0.85 to 1.00, LOS E, and greater than 1.0, LOS F.

[23] TRB (1997), Vol. 1, p.4. CMI was defined as [Loaded Highway Volume/ Avg Occupancy x Avg Speed] / Optimum Facility Value (125,000 for freeway and 25,000 for local roads).

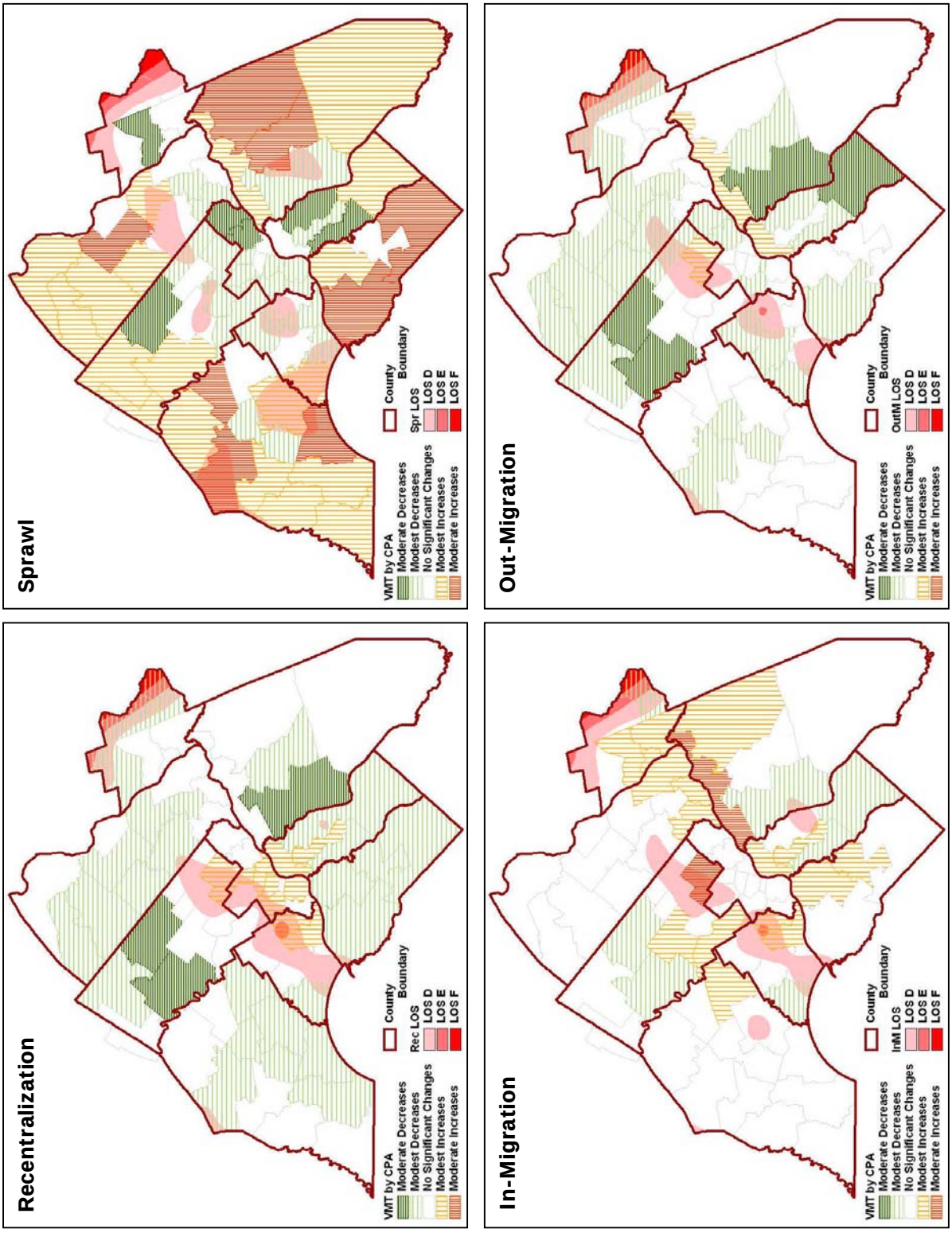


FIGURE 7. VMT CHANGES BY COUNTY PLANNING AREA [CPA]

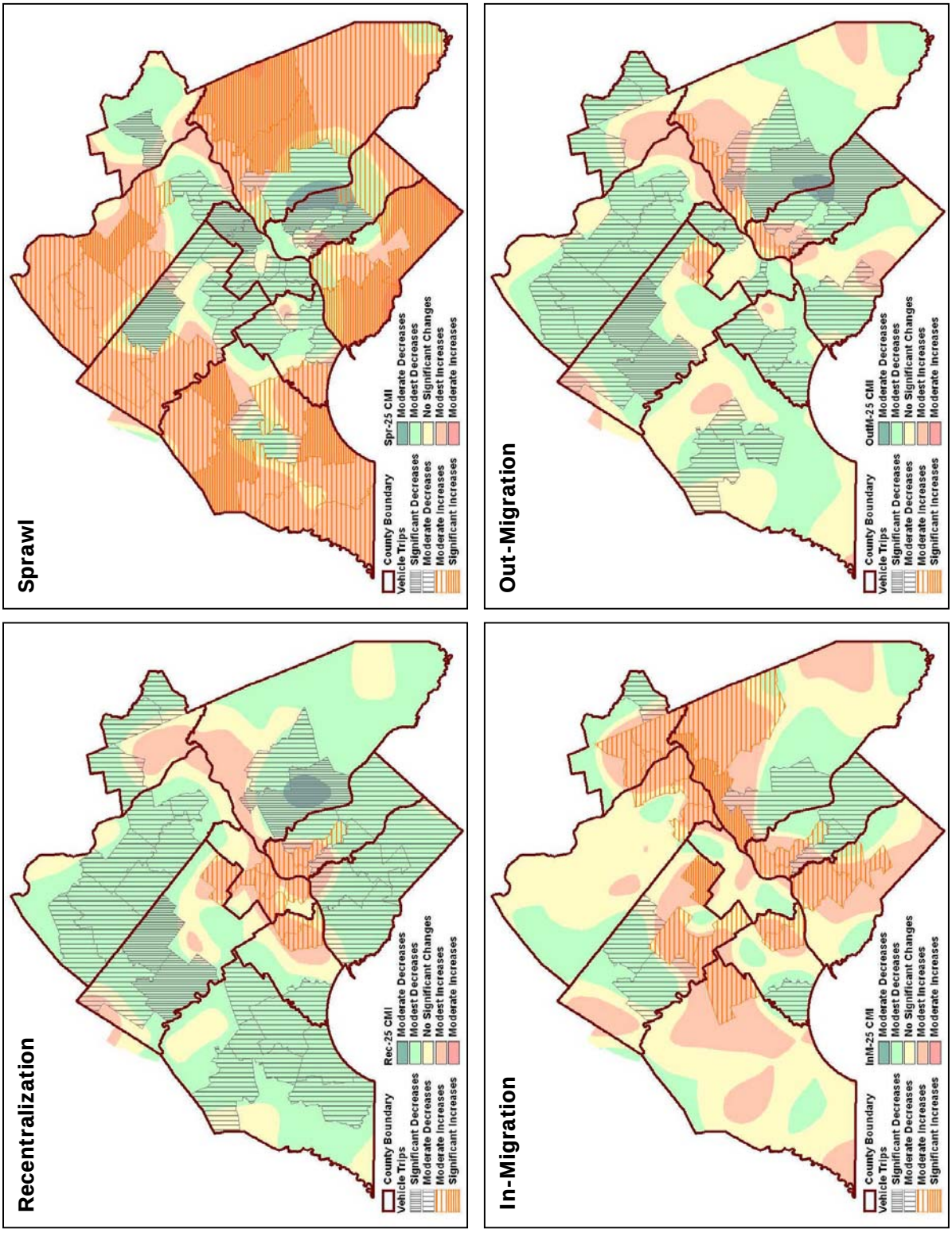


FIGURE 8. CORRIDOR MOBILITY INDEX AND VEHICLE TRIP CHANGES

For regional accessibility, Center City Philadelphia, downtown Trenton, Downingtown, King of Prussia Mall, and Cherry Hill Mall were selected as five key locations for travel time analysis. Then, based on the travel demand model outputs of travel time summary by County Planning Area [CPA], travel time for the region was derived using ArcView Spline slope interpolator.[24] Travel time per scenario from each of the five locations to the rest of the region was measured and compared against that of the *2025 Plan* scenario.

As shown in Table 13, the peak period travel time differences against *2025 Plan* did not vary much from scenario to scenario. Partial explanation for this outcome could be the fact that congestion during the peak period had effectively neutralized any possible differences in travel time. Daily total over a 24-hour period was measured against the *2025 Plan* scenario instead. Resulting differences in time gained/lost are depicted in Figures 9 to 13. Maps are arranged from top left corner and clockwise: *Recentralization*, *Sprawl*, *Out-Migration*, and *In-Migration* scenarios.

As shown in Figure 9, travel time changes from Center City Philadelphia varied by scenario. In *Recentralization*, travel from Center City generally worsened compared to that of the *2025 Plan* scenario. Presumably, concentrated activities at the core would congest the center, and delays were amplified. In *Sprawl*, however, travel was better off from Center City compared to the *2025 Plan* scenario. The sprawling pattern dispersed activities, and spread congestion. In both *In-Migration* and *Out-Migration*, travel time fared generally similar to that of the *2025 Plan* scenario, but northbound travel from Philadelphia was of a concern over all.

Travel time from downtown Trenton in Figure 10 shows a different view. Travel from Trenton was generally better off in *Recentralization* except for the area within an imaginary wedge covering the congested core (shown in dotted blue lines). In *Sprawl*, travel through the drained core was better off compared to the *2025 Plan* travel time, but for the rest of the suburban areas of the region, travel time suffered. *In-Migration* exhibited the combined disadvantages of traversing through a populated core from *Recentralization* as well as growing suburban areas from *Sprawl*. Travel time in *Out-Migration* was comparable to that of the *2025 Plan* scenario, but did have some time losses through suburban locations.

[24] Spline slope interpolator fits a curvature surface on a set number of nearest points. Compared to other surface interpolating functions such as Inverse-Squared Distance Weighting or Kriging, the Spline method tends to generate a smoother surface than others, and is better suited for continuous data such as air, water and/or time.

Travel time from Downingtown is shown in Figure 11. In *Recentralization*, an imaginary wedge covering the congested core was again evident. Almost a reversal of pattern happened in *Sprawl*, where the wedge could be drawn again but in different color. *In-Migration* proved to be somewhat comparable to the *2025 Plan* scenario, but travels to the far ends of the region could require more time than that in the *2025 Plan*. In *Out-Migration*, travel time was better to close locations before reaching the suburban ring of Philadelphia. This ring became clearer in the average speed changes in Figure 14 and in the V/C ratio changes in Figure 15.

From the King of Prussia Mall, travel time patterns were generally the same as those from Downingtown. An imaginary wedge was visible again in *Recentralization*, and a reversal of the pattern was also true in *Sprawl*. *In-Migration* and *Out-Migration* both exhibited some time losses to areas across the core, albeit *Out-Migration* was slightly worse off than *In-Migration* was. Travel time from the King of Prussia Mall is shown in Figure 12.

Travel time from the Cherry Hill Mall is shown in Figure 13. Due to its close proximity to the core, its travel patterns were similar to the Center City Philadelphia pattern. *Recentralization* added congestion and caused overall travel delays, while *Sprawl* with distributed traffic offered some time gains overall. *In-Migration* and *Out-Migration* showed general deterioration in travel time.

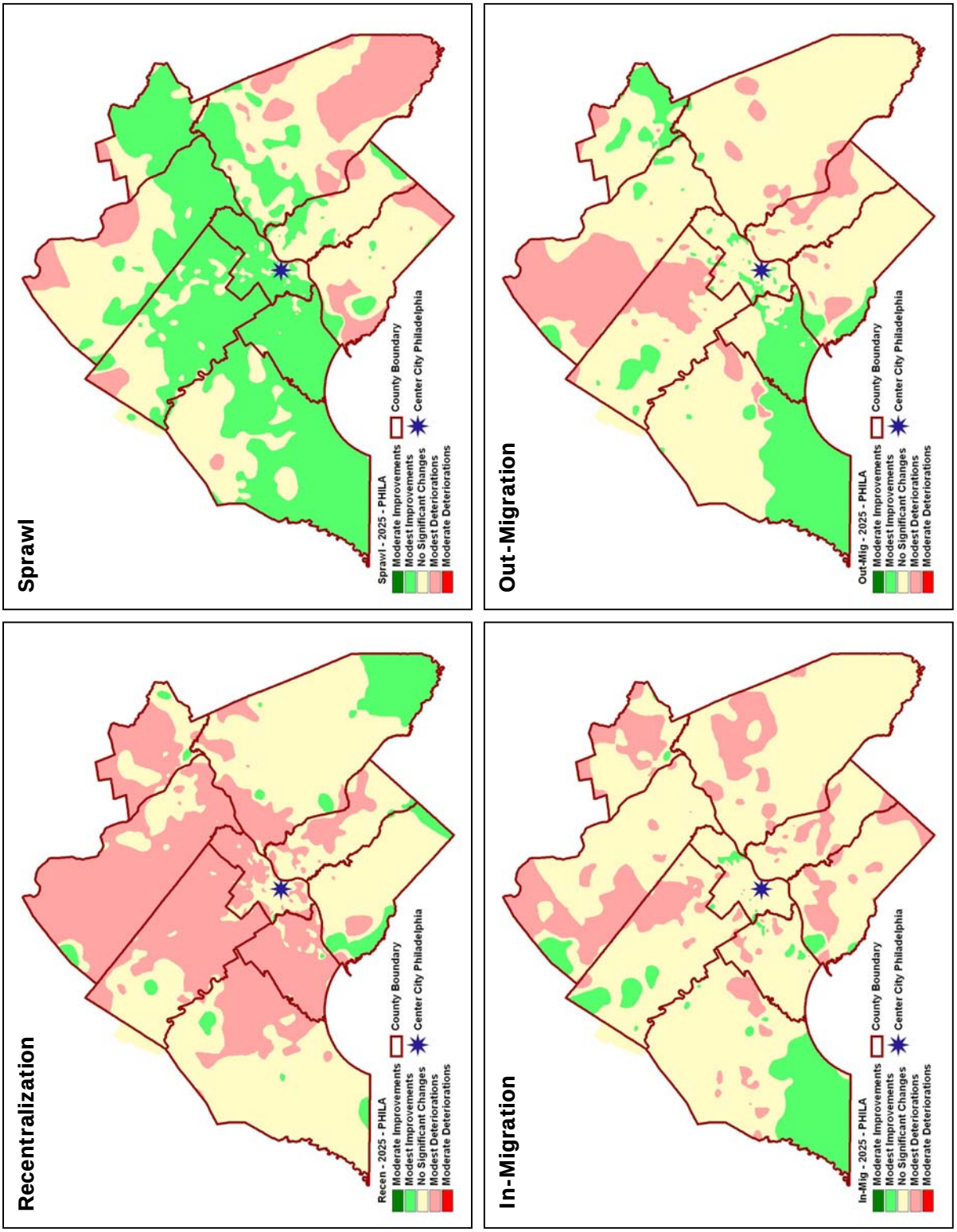


FIGURE 9. TRAVEL TIME CHANGES: FROM CENTER CITY PHILADELPHIA

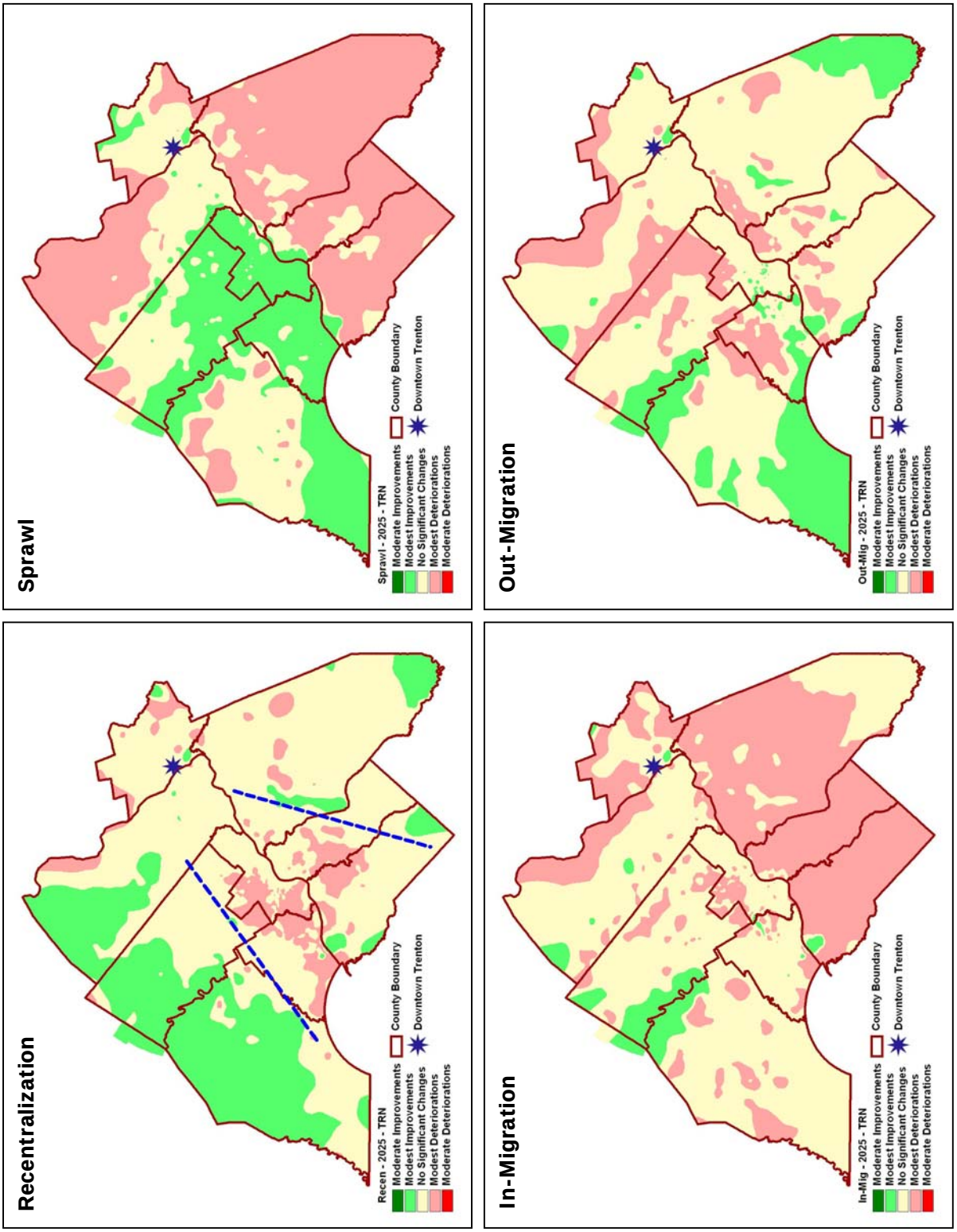


FIGURE 10. TRAVEL TIME CHANGES: FROM TRENTON

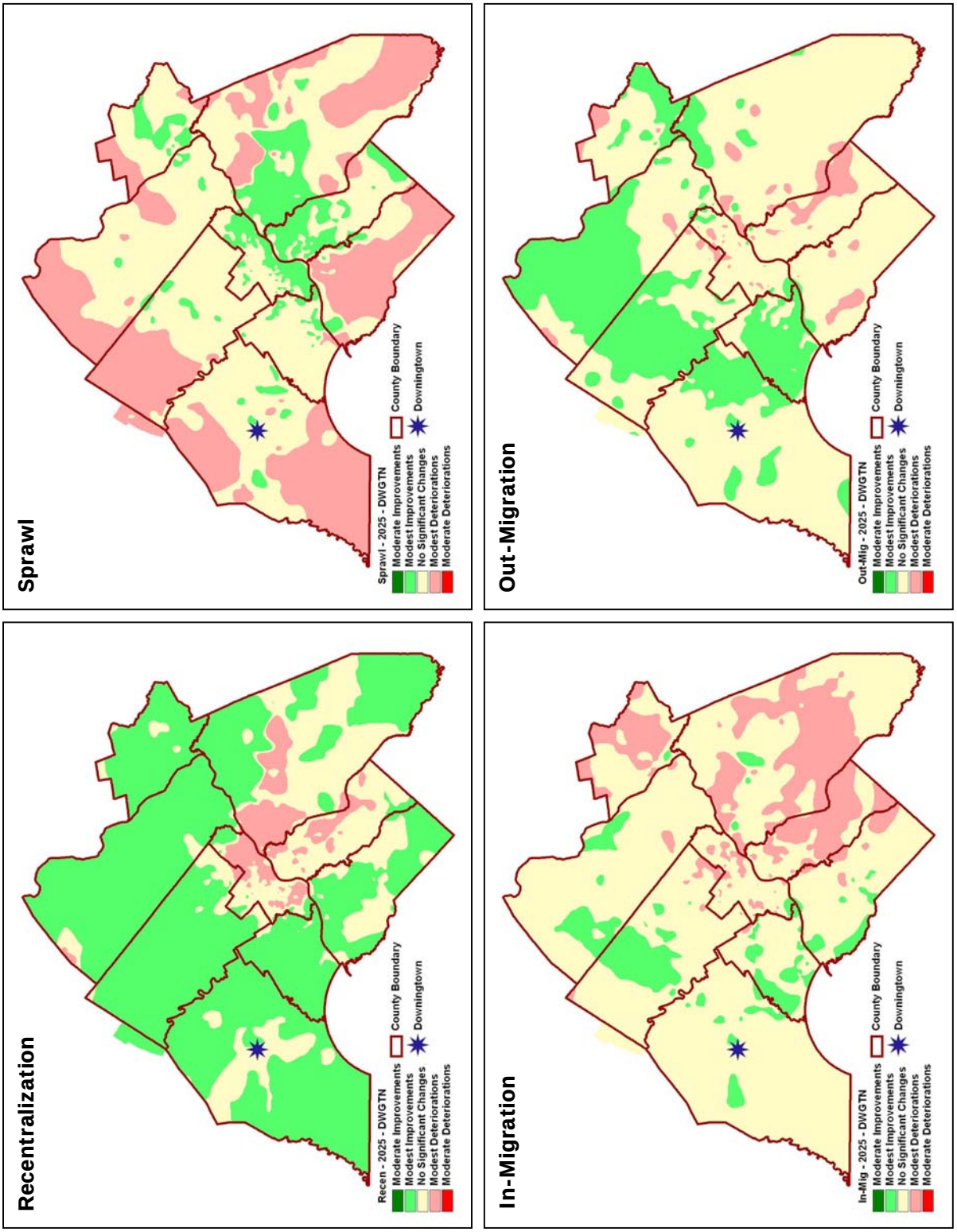


FIGURE 11. TRAVEL TIME CHANGES: FROM DOWNINGTOWN

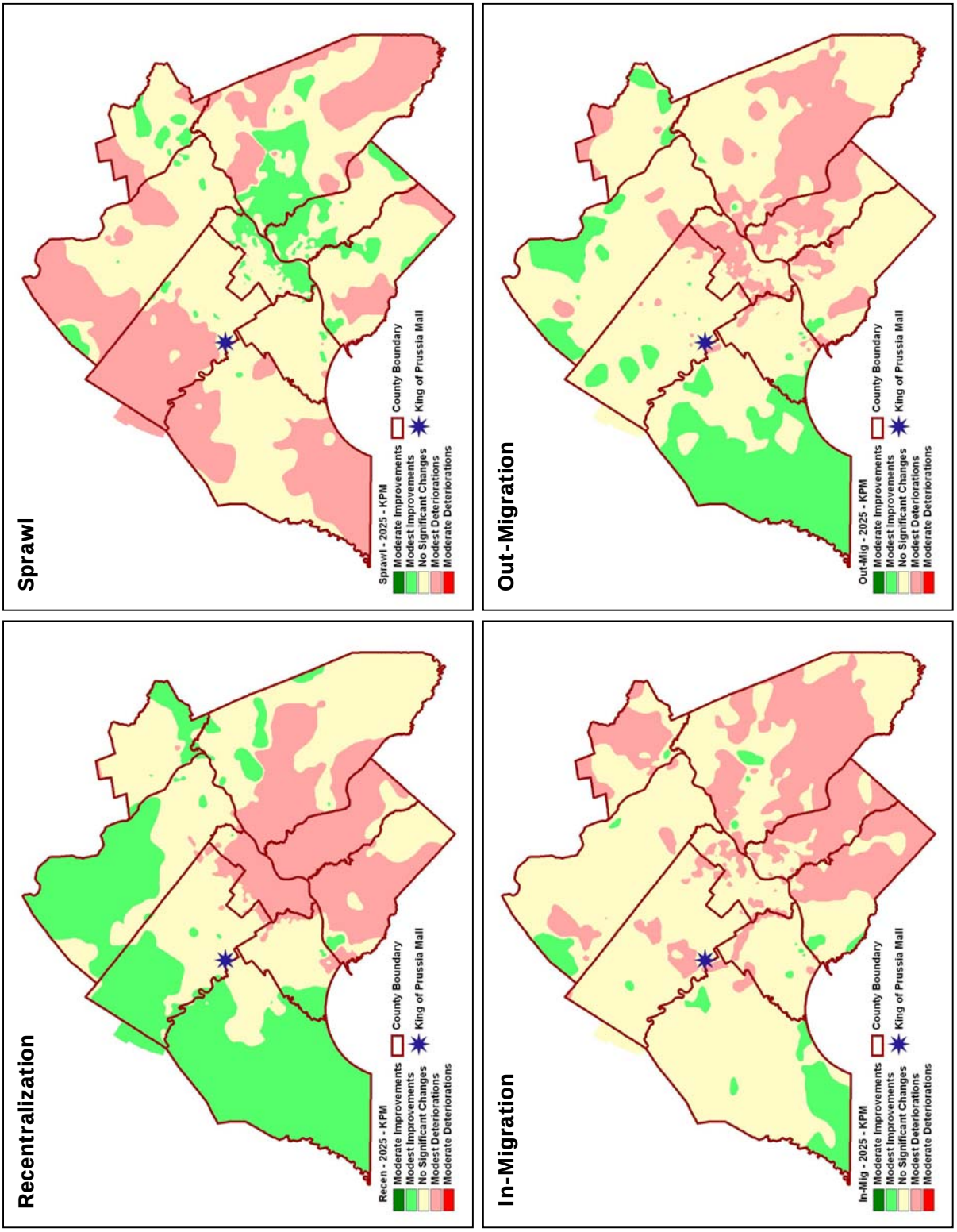


FIGURE 12. TRAVEL TIME CHANGES: FROM KING OF PRUSSIA MALL

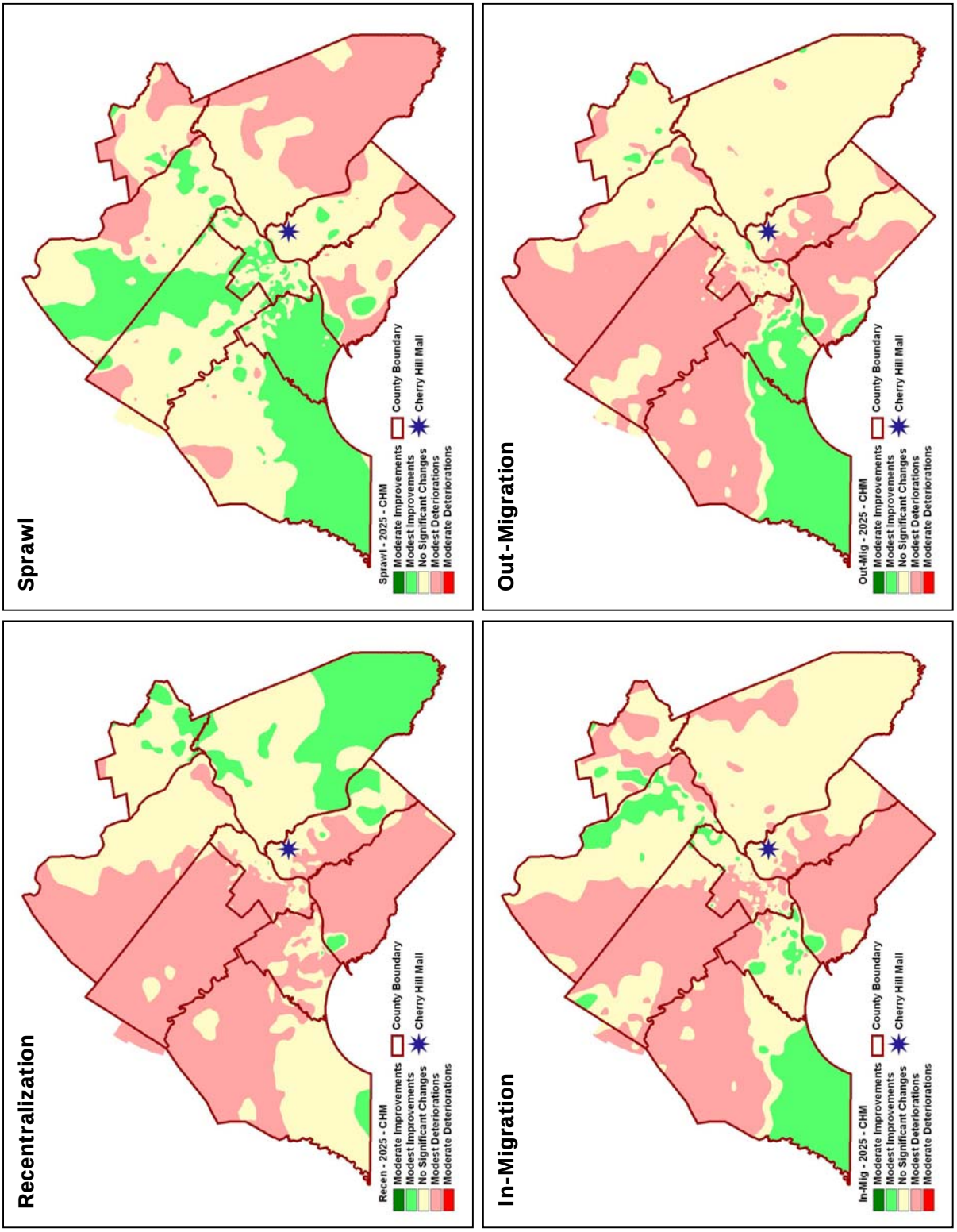


FIGURE 13. TRAVEL TIME CHANGES: FROM CHERRY HILL MALL

Average speed changes paint more definitive pictures of the impacts. When average speed for each scenario was compared against the *2025 Plan*, clear pockets of lowered speed emerged around the core in *Recentralization*. In *Sprawl*, the picture was more or less reversed, and the inner core enjoyed relatively faster speeds than under the *2025 Plan*, while suburban locations suffered a reduction in speed. *In-Migration* exhibited slower speed over much of the region, and *Out-Migration* formed an opened ring of slower speed around the city core, as those who couldn't afford to leave the region moved out of the core and into its immediate suburbs. Speed comparisons are shown in figure 14.

V/C ratio changes were also measured against the *2025 Plan* scenario. Predictably, the center core suffered an increased V/C ratio – a lowered LOS – in *Recentralization*, and almost an opposite pattern resulted in *Sprawl*. *In-Migration* also followed a common expectation of a lowered service level over much of the region. *Out-Migration* formed a more prominent, opened ring around the city core than that in the average travel speed comparison. Figure 15 shows the V/C ratio changes against the *2025 Plan* scenario.

For future residential and employment locations for the mobility disadvantaged, zero-auto household differences from the *2025 Plan* scenario were assessed. The mobility disadvantaged would rely heavily on public transportation and might be limited in job access. As Figure 16 shows, zero-auto households were concentrated in the core in *Recentralization*, were spread out to the outer periphery of the region in *Sprawl*, and increased along existing transit routes in *In-Migration*. Current job access/reverse commute routes are also shown in Figure 16 for comparison purposes.

Figure 17 shows how transit trip productions changed. For instance, the zero-auto household increase locations shown in Figure 16 and the transit trip production locations shown in Figure 17 did not coincide in *Sprawl*. Quite likely, those zero-auto households were not transit-bound because they were outside transit access. Consequences dictated that they must confine their employment searches to the areas within a walkable distance. Future transit expansions under *Sprawl* must consider provisions in these areas first. Current transit routes are also shown in Figure 17 for future transit needs.

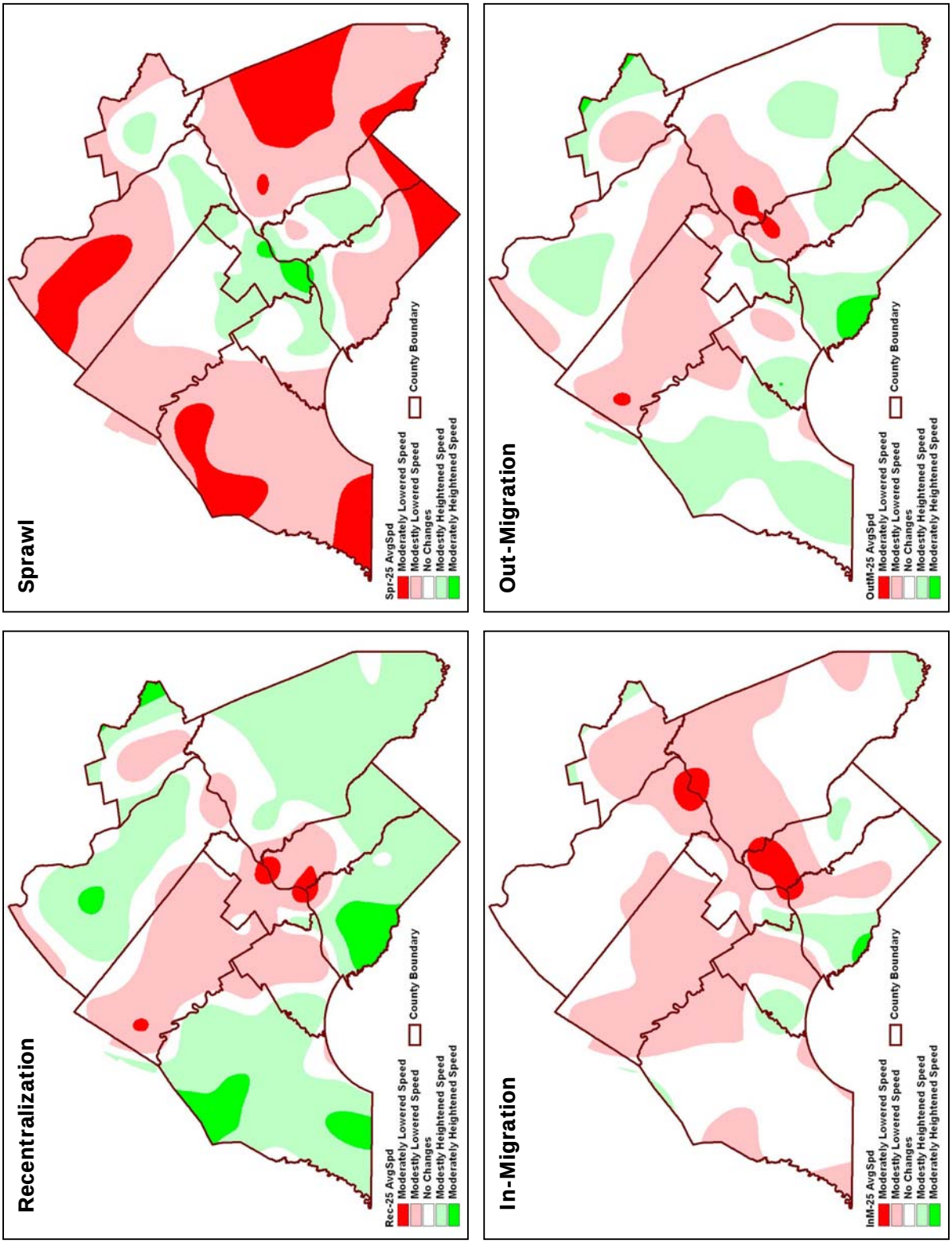


FIGURE 14. AVERAGE TRAVEL SPEED CHANGES

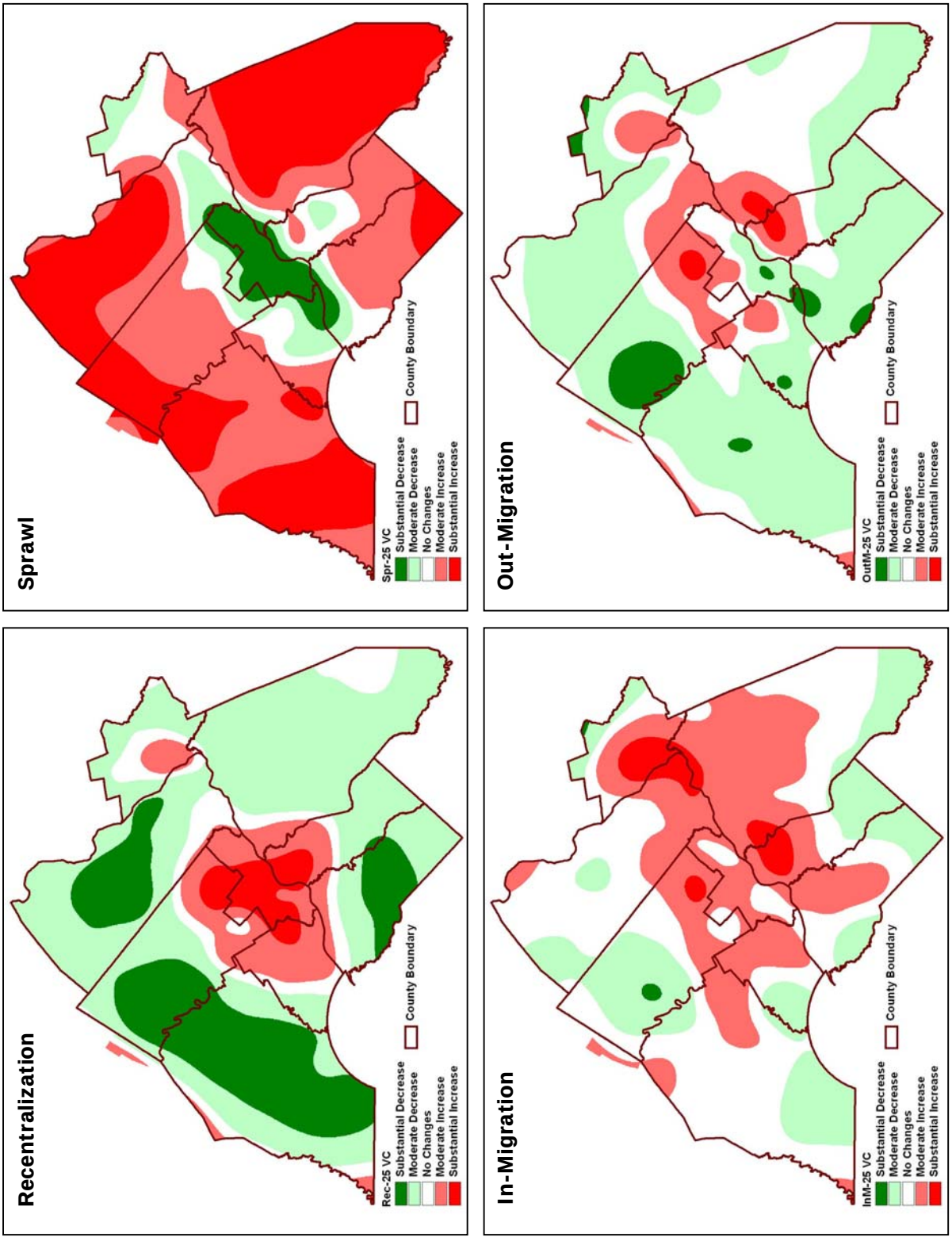


FIGURE 15. V/C RATIO CHANGES

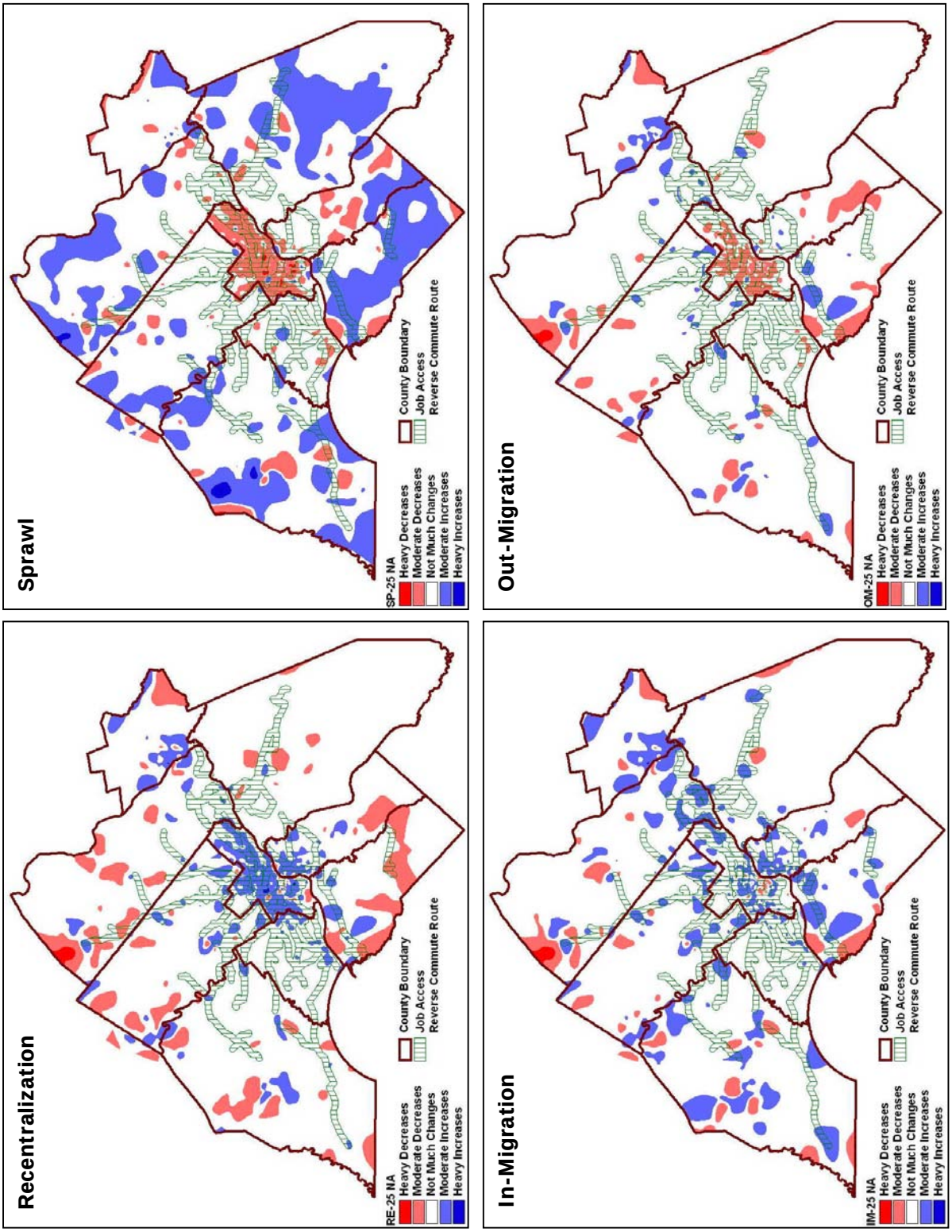


FIGURE 16. ZERO-AUTO HOUSEHOLD CHANGES

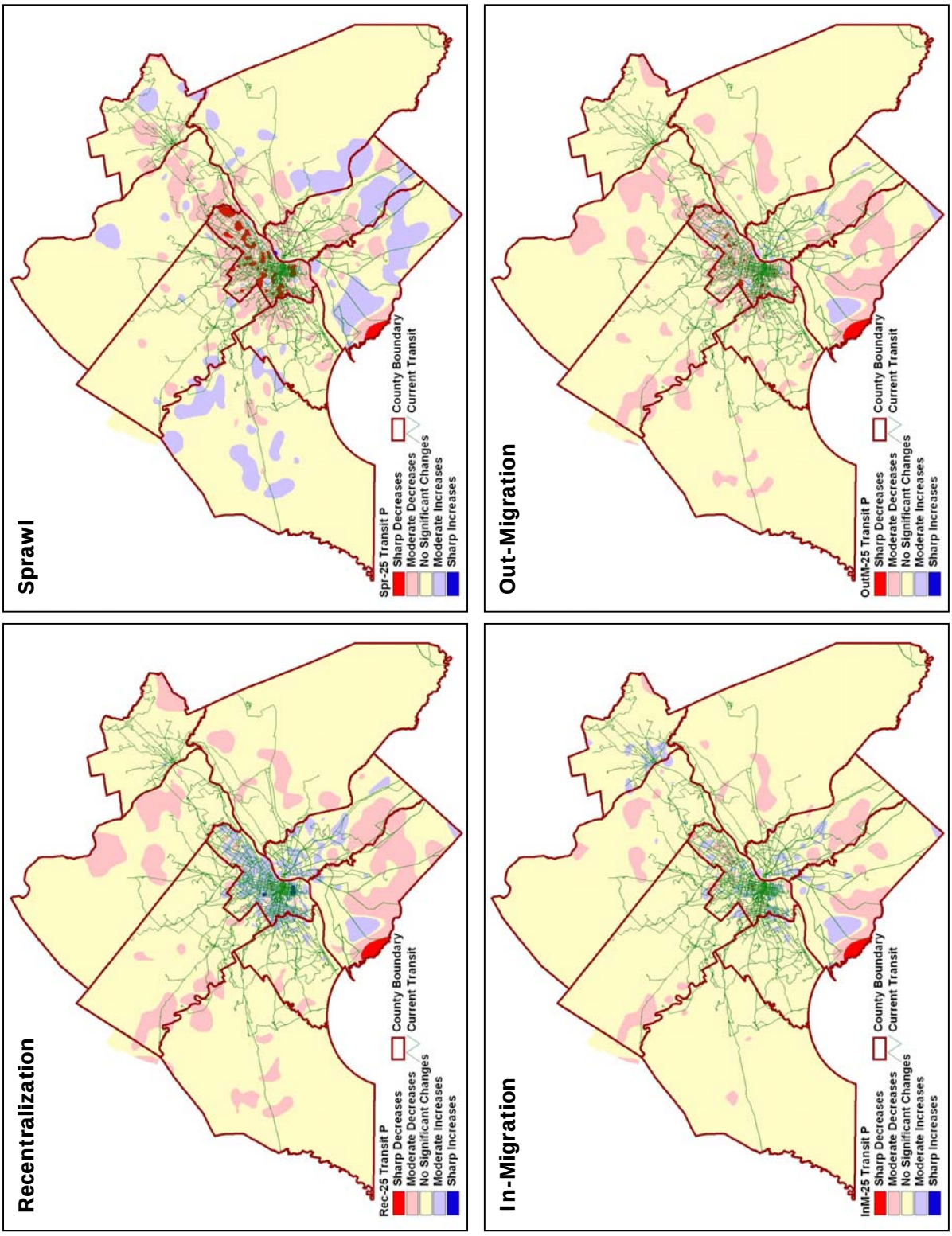


FIGURE 17. TRANSIT PRODUCTION CHANGES

Quantification of transportation impacts was also part of Phase II analysis. While methodology and resulting estimates varied greatly from study to study, an extensive literature search was performed for this analysis to verify differing techniques that might represent the region the best. All costs are converted to a 2000 dollar figure using the Consumer Price Index.[25]

While renowned studies in estimating the congestion cost including TRB (1994b) and Levinson (1995) suggested an estimate of approximately 36 cents per mile traveled during a peak period, numerous others were also assessed and an estimate average was calculated for each scenario.[26] Estimated congestion lost time of forty-two hours and 115 gallons of wasted fuel per peak traveler per year was from the most recent information for the region, and daily per-PM-peak data were derived in a similar manner.[27] Average fuel consumption factors of 21.4 miles per gallon per vehicle and 125,500 BTU per gallon were chosen to calculate automobile energy consumptions.[28] Total regional energy consumption was based on factors suggested by US DOE, and did include automobile energy spent.[29] Supportive infrastructure costs to cover local roads, schools, and utilities were estimated at $25,000 per dwelling unit for *Recentralization*, $45,000 for *Sprawl*, $32,600 for both of the migration-based scenarios, and $31,000 for the *2025 Plan*.[30] For accident statistics, state and nationwide factors used in a recent US DOT report were employed to derive various estimates.[31]

Overall, *Sprawl* and *In-Migration* incurred the highest social costs to the region. In congestion cost estimates, high PM peak VMT and trips generated in *Sprawl* and *In-Migration* caused the most amount-lost in wasted dollar, time, and fuel. In energy consumption estimates, spatial patterns seemed to have dictated the power usage, and the sparsely distributed patterns of *Sprawl* and *Out-Migration* registered high levels of energy lost in overall regional energy consumption. In infrastructure cost estimates, *In-Migration* with the 500,000 more residents required less than what it might cost to support *Sprawl*, while *Recentralization* could utilize infrastructure more efficiently than *Out-Migration* might with the 500,000

[25] US Department of Labor, Bureau of Labor Statistics at http://www.bls.gov/cpi. Last accessed on 3/5/03.

[26] Others included Schrank & Lomax (2002), Delucchi (1997) and TRB (1997). Per-PM-peak congestion cost estimates for *Recentralization* ranged from $13.5 million to $15.6 million, from $15.1 million to $16.5 million for *Sprawl*, from $15.4 million to $15.6 million for *In-Migration*, and from $13.4 million to $15.8 million for *Out-Migration*.

[27] Schrank and Lomax (2002), pp.59-62.

[28] US DOT (2001a), p.261. Average fuel efficiency for passenger car was based on 1999 data.

[29] US DOE (1997) reported that total per-household energy consumption in 1997 was 101M BTU.

[30] Performed calculation employed the percentage distribution reported in RECR(1974) as quoted in TRB(1998), p.14. Assuming the total infrastructure costs for a low-density sprawl at 100%, those for low-density planned, sprawl mixed, planned mixed, and high-density planned were 95.2%, 72.4%, 69.5%, and 55.8%, respectively. Other studies in this area included Frank (1989), Kitzhaber (1999), Burchell (1998), and Duncan, et al. (1989).

[31] US DOT (2000a), p.2, US DOT (2000b), p.3, and US DOT (2000c), p.2-6.

fewer residents. Accident statistics fared more or less the same across the scenarios with only moderate changes. Table 14 summarizes these details.

	2025 PLAN	RECENTRALIZATION	SPRAWL	IN-MIGRATION	OUT-MIGRATION	
PM Peak Characteristics						
PM Peak VMT	42,399,536	43,316,004	45,755,396	43,207,068	43,928,508	
PM Peak Person Trips	6,988,077	6,313,797	7,085,144	7,222,047	6,287,179	
PM Peak Vehicle Trips	6,194,044	5,679,687	6,214,745	6,459,801	5,608,236	
Avg PM Peak Auto Occupancy	1.13	1.11	1.14	1.12	1.12	(passengers)
Avg PM Peak Veh. Trip Length	6.8	7.6	7.4	6.7	7.8	(miles)
Congestion Cost						
Daily Peak Wasted Cost	$ 15.1 M	$ 14.5 M	$ 15.8 M	$ 15.5 M	$ 14.6 M	
Daily Peak Wasted Time	804,107	726,519	815,273	831,030	723,456	(hours)
Daily Peak Wasted Fuel	2,201,723	1,989,279	2,232,296	2,275,439	1,980,892	(gallons)
Energy Spent						
Daily Total Auto Fuel Spent	2,973.8 M	2,942.3 M	3,036.6 M	3,040.7 M	2,941.4 M	(gallons)
Daily Fuel Energy Spent	811,705.0 M	803,109.2 M	828,831.2 M	829,957.4 M	802,851.6 M	(BTUs)
Daily Region'l Energy Spent	222,852.5 B	178,931.9 B	320,603.5 B	253,411.5 B	282,125.7 B	(BTUs)
Daily Per HH Energy Spent	100.6 M	81.3 M	149.1 M	106.2 M	139.6 M	(BTUs)
Supportive Infrastructure						
Total Cost	$ 68.7 B	$ 55.0 B	$ 96.8 B	$ 77.8 B	$ 65.9 B	
Estimated Accident Statistics						
Annual Vehicle Accidents	118,182	116.930	120,675	120,839	116,893	(cases)
Annual Highway Fatality	684	677	697	699	676	(persons)
Annual Highway Injury	58,837	58,214	60,079	60,160	58,196	(persons)

TABLE 14. QUANTIFIED ESTIMATES OF TRANSPORTATION IMPACTS

For other environmental and related quality of life concerns, analyses on land consumption rates, air quality analysis, and environmental justice [EJ] considerations were performed. Table 15 summarizes these results.

		2025 PLAN	RECENTRALIZATION	SPRAWL	IN-MIGRATION	OUT-MIGRATION	
Land Use*							
Avg # of HHs per Acre	CBD	21.9	17.9	10.1	15.0	14.6	(HHs/Acre)
	Urban	7.5	7.9	6.7	6.9	6.3	(HHs/Acre)
	Suburban	1.5	1.6	1.3	1.7	1.6	(HHs/Acre)
	Rural	0.3	0.2	0.4	0.3	0.3	(HHs/Acre)
Developed Area (area type 1-3)		84,205	105,882	57,232	114,447	84,265	(acres)
Growing Area (area type 4-5)		1,953,892	1,777,621	2,177,492	1,875,709	1,838,551	(acres)
Open Area (area type 6)		417,551	572,123	226,902	465,470	532,809	(acres)
Air Quality							
NOx		30.2	30.0	30.8	30.9	29.9	(tons/day)
VOC		37.8	37.5	38.6	38.7	37.4	(tons/day)
Summer Emissions		68.0	67.5	69.4	69.6	67.3	(tons/day)

* Noted data items were also part of the input process. For more information on designated area types, please see DVRPC (2000).

TABLE 15. SELECTED ENVIRONMENTAL IMPACT SUMMARY

DVRPC currently does not have an iterative process between land use and transportation in travel demand simulation. Land use patterns were entered as input parameters, and the results only reflected the entered data. For this simulation, a review of previous research was performed prior to the input data preparation, and its findings were incorporated in the input data arrangement process.[32]

Household density information presented in Table 15 is to show that a level of concentration for each area type and scenario is comparable to that in the *2025 Plan*. For instance, *Sprawl* would not only claim more suburban households but also allocate more suburban land areas than the *2025 Plan* did. Resulting average suburban household density in *Sprawl* is actually lower than that in the *2025 Plan*. A similar clarification can also be made for the CBD household densities between *Recentralization* and the *2025 Plan*. Air quality results were produced using the MOBILE6 emissions analysis model. Figure 18 compares these results.

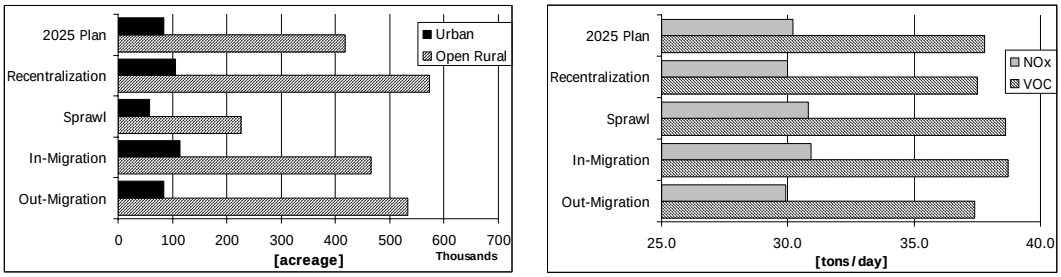


FIGURE 18. LAND CONSUMPTION AND EMISSIONS RESULTS BY SCENARIO

Regional EJ locations were identified in two previous DVRPC reports (2001 and 2002), and those TAZs with higher than three degrees of disadvantages were compared against various measures. One must note that these locations are current and are not the forecasts for 2025. DVRPC has not made any attempts to estimate the future pattern of the EJ high degree of disadvantaged locations, and comparisons contained herein are for informational and policy supportive purposes only. Furthermore, the EJ process is inherently designed to mitigate potentially negative impacts of transportation plans and projects on defined minority, handicapped, and low-income populations in the region, and is mostly compared against binding or imminent projects. To make assumptions regarding possible transportation plans and projects for the future was outside the scope of this project. Instead, defined negative impacts, such as air quality and traffic congestion locations, were compared against the current EJ high degree of disadvantaged locations. Figure 19 details these comparisons.

[32] RERC (1974) as quoted in TRB (1988), p.14. Assuming that the consumed land total for a planned-mix pattern was 100%, the report estimated that those for low-density sprawl, low-density planned, sprawl mixed, and high-density planned would be 150.9%, 135.3%, 91.5%, and 71.5%, respectively.

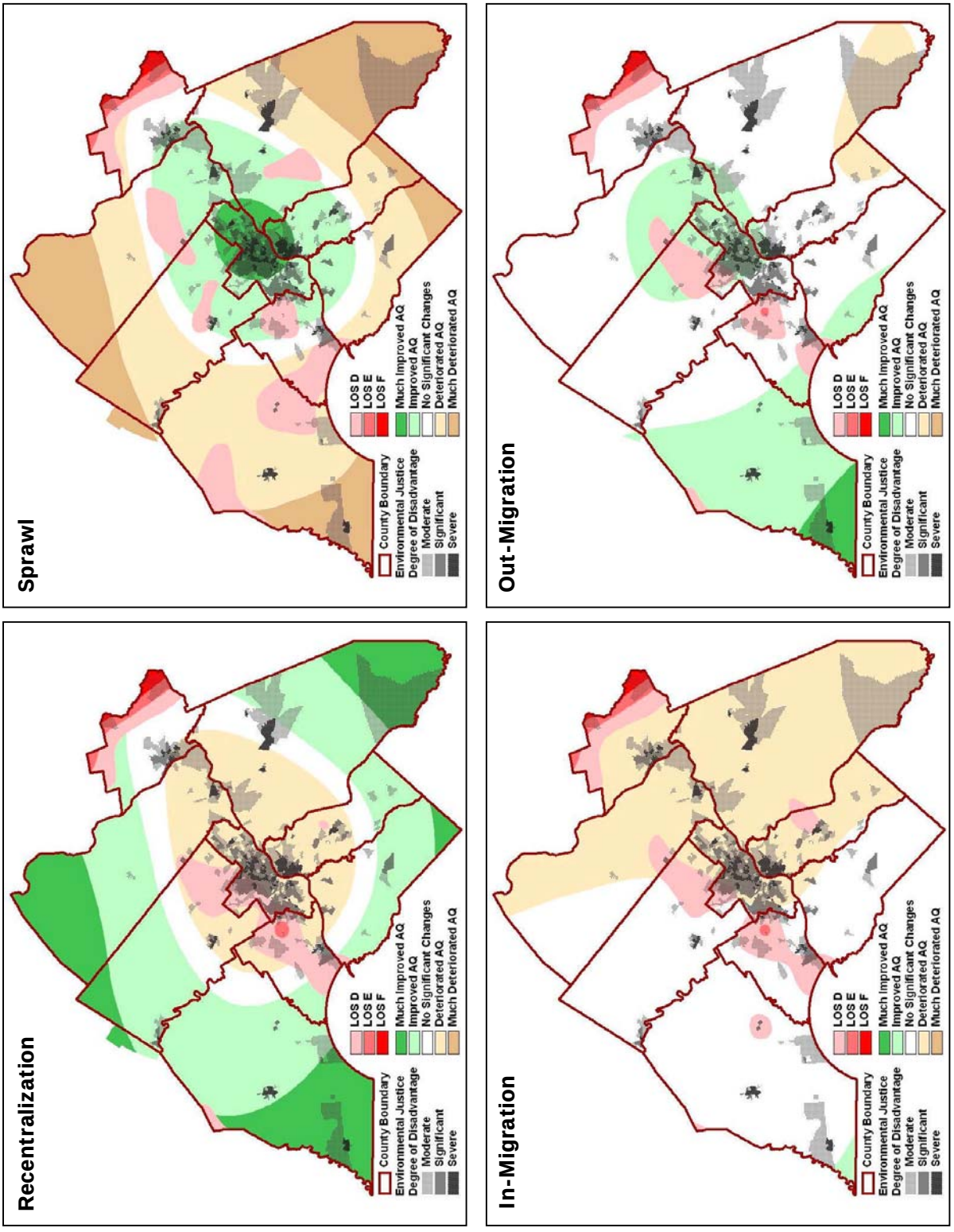


FIGURE 19. EJ DEGREE OF DISADVANTAGED LOCATIONS WITH SELECTED IMPACT MEASURES

Chapter 4 Conclusion

Evaluation Summary:

Evaluation results of the WIS can be summarized into five points. First, *Recentralization* is the most environmentally friendly, but before the region can enjoy its full benefits, adequate transportation infrastructure and relevant policies must be in place to alleviate concentrated traffic at the core. Second, *Sprawl* disperses activity locations and imposes high social costs upon the region. Third, *In-Migration* results imply that the region can handle an influx of additional residents but it may also require some infrastructure improvements and committed economic development / transportation / land use policies. Fourth, *Out-Migration* empties out the regional core, and weakens the region's overall attractiveness, competitiveness, and sustainability. Finally, the *2025 Plan* features many practical characteristics of both *Recentralization* and *Sprawl*, and is an excellent general plan overall. DVRPC must build upon the success of the current long-range plan, and must reinforce its outreach and implementation efforts aggressively in the next iteration. An overall summary of the simulation results is presented in Table 16. All assessment summaries below pivot off the *2025 Plan* scenario.

*Policy Support Measures **	RECENTRALIZATION	SPRAWL	IN-MIGRATION	OUT-MIGRATION
Mobility & Access				
TSP1	Best from suburb to suburb	Best from core to others	Slight deterioration overall	Minor changes
TSP2	Regional Core	Amplified in the suburbs	Slight increase overall	Ring around the core
TSP3	Concentrated in the Core	Spread out in the suburbs	Spreading into the suburbs	Little Changes
TSP4	Rising needs in the Core	Rising needs in the suburbs	Rising needs overall	Needs in the 1st gen suburbs
TSP5	Decreased	Increased	Most Increased	Most Decreased
TSP6	Most Increased	Most Decreased	Increased	Decreased
TSP7	Decreased	Increased	Most Increased	Most Decreased
System Performance & Associated Costs				
TSP8	Concentrated in the Core	Spread to Suburban Areas	Near the Core	Near the Core
TSP9	Shorter time, higher speed	Shortest time, higher speed	Similar time, similar speed	Shorter time, higher speed
TSP10	Increased	Most Increased	Increased	Increased
TSP11	Both Decreased	Both Increased	Both Most Increased	Both Most Decreased
Environment & Quality of Life				
TSP12	More urban, less suburban	Less urban, more suburban	More urban, same suburban	Same urban, less suburban
TSP13	Improved	Deteriorated	Most Deteriorated	Most Improved
TSP14	Most Decreased	Most Increased	Increased	Increased
TSP15	Air quality, Traffic congestion	Transit, Job access, Trip time	Air quality, Job access	Job access, Commuting cost
Long-range Plan				
TSP16	Concentrated	Spread Out	Mixed	Mixed
TSP17	Partially incorporated in the Plan	Partially incorporated in the Plan	Outside the scope of the Plan	Outside the scope of the Plan
TSP18	Most Decreased	Most Increased	Increased	Decreased
TSP19	Generally, prepared	Generally, unprepared	Generally, prepared	Generally, prepared
TSP20	Scenario method introduced	Scenario method introduced	Scenario method introduced	Scenario method introduced
Overall	Generally, favorable	Generally, unfavorable	Generally, favorable	Generally, unfavorable

* Policy Support Measures are described in detail in Table 12 on page 25.

TABLE 16. EVALUATION SUMMARY BY POLICY SUPPORT MEASURE

For the 2030 Plan, DVRPC will continue its role as an objective facilitator in shaping the region's vision for the future. The parameters and outputs from the WIS set reasonable boundaries for the region's future. Based on the scenario outputs, a set of transportation policies for 2030 can be derived to foster positive and deter negative impacts. Each assessment item presented herein can function as not only a reactive gauge to measure changing conditions but as a proactive factor that can induce changes with a proper set of policy commitment and enforcement.

Preparation for the 2030 Plan:

DVRPC, as a metropolitan planning organization [MPO], is in a unique position to bring all sides to the table and tackle important issues. DVRPC's planning process seeks to stimulate passions for the region and encourage empowerment. It strives to make initiatives, facilitate dialogues, and build alliances.

Preparation for the 2030 Plan will consider the following four points: strategic partnership, plan education, project prioritization, and economic development / land-use / transportation connection.

A plan not implemented is a plan wasted. In a highly evolved region with multiple political layers and governance divisions such as ours – where many discussion items can present conflicting arguments – a regional plan must also have an equally sophisticated level of implementation strategy in order to navigate across diverse interests and political principles. Strategic partnership is crucial in opening opportunities. Strategic alliances with selected agencies, interest groups and citizen forums are important in order to create common goals for the region and to develop means to achieve them. These goals and visions can be shared with groups whose ideology may even be very different from DVRPC's. However, innovative partnerships for creating a common end will reinforce the vision's validity, amplify DVRPC's commitment for excellence, and create synergy for future implementation efforts. Joint authorship of the vision will be a binding force to synthesize and align energies for a comprehensive regional plan and its successful implementation.

Equally essential is public education of the current plan and the future vision. DVRPC will continue to reach out to the general public, and share the values and visions for the region. Moreover, this process shall strive to achieve in ways above and beyond what the regulation requirements for a regional plan's public involvement process demand. Public involvement must awaken the collective public interests in the

region's healthy future. Proper understanding of where the region is headed will advance coordinated efforts to support and to implement the plan in the future.

Meanwhile, DVRPC may also prioritize the long-range transportation plan projects based on criteria developed from the plan's vision and goals. Prioritized plan projects will then feed into the region's transportation improvement program [TIP] process in order to implement the plan's vision in stages. Project prioritization will serve to strengthen a cohesive front for the TIP process in achieving the agreed vision and goals embedded in the plan, and will realize the plan incrementally.

Finally, there must be an economic development / land-use / transportation [EcDev/LU/Tr] nexus in the planning process.[33] For DVRPC to assume a leadership role in creating the region's future, this important proactive connection is essential. The region must continue to adopt innovative ideas and benchmark proven others that have gone before it. One such idea in the EcDev/LU/Tr link can be the quality of land via town-based economic development policy. By creating town-based clusters of business, the region can strategically concentrate limited resources, offer easy accessibility and connections to other activity centers, and foster a balanced regional growth while allowing dynamic local land-use adjustments. Implementation of an integrated EcDev/LU/Tr connection in the planning and simulation processes will greatly enhance DVRPC's ability to analyze alternatives, facilitate innovative problem-solving techniques, and ensure the integrity of its plans.

Concluding Remarks:

The WIS has introduced an integrated planning process in which qualitative methods and quantitative techniques are streamlined. Its results offer distinct descriptions of the region's future and possibilities. Tasks ahead include taking the findings to the public, informing them of the open alternatives, and involving them to develop a new vision for 2030. From optimistic to pessimistic outlooks, a balanced set of What-If Scenarios and their results will function as referencing bookends to identify logical boundaries, target important issues, build innovative partnerships, and help shape new visions for the future.

[33] DVRPC (1996) has identified the land-use modeling needs in its travel simulation process.

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DELAWARE VALLEY REGIONAL PLANNING COMMISSION

Publication Abstract

Title of Report:	**Date Published:** July 2003
Regional Analysis of What-If Transportation Scenarios	**Publication Number:** 03020

Geographic Area Covered:

All Traffic Analysis Zones [TAZ] in the Delaware Valley Region, including three zones in Berks County in Pennsylvania and the nine-county DVRPC Planning Area, which covers the counties of Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.

Key Words:

What-If Scenarios, Land-Use/Transportation Scenario Testing, Alternative Future, 2030 Long-Range Transportation Plan Preparation, Policy Support Measures

Abstract:

DVRPC has examined potential regional, national, and global changes that should be considered in a long-range plan, and has developed a set of future scenarios to serve as a planning foundation for the 2030 Plan development process. This report summarizes the scenario assumptions, employed assessment methodology, and analysis results.

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