DRAFT

Connections 2045

Plan for Greater Philadelphia

CONNECTIONS 2045

SEPTEMBER 2017

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy.

We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.

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

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

The Delaware Valley Regional Planning Commission (DVRPC) fully complies with Title VI of the Civil Rights Act of 1964, the Civil Rights Restoration Act of 1987, Executive Order 12898 on Environmental Justice, and related nondiscrimination statutes and regulations in all programs and activities. DVRPC's website, www.dvrpc.org, may be translated into multiple languages. Publications and other public documents can be made available in alternative languages and formats, if requested. DVRPC public meetings are always held in ADA-accessible facilities and in transit-accessible locations when possible. Auxiliary services can be provided to individuals who submit a request at least seven days prior to a meeting. Requests made within seven days will be accommodated to the greatest extent possible.

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CHAPTER 1: INTRODUCTION

The *Connections 2045 Plan for Greater Philadelphia* (*Connections 2045* or, the Plan) outlines a long-range vision and identifies strategies for the future growth of the Greater Philadelphia region. The vision and strategies are based on a thorough review and analysis of trends and forecasts, along with future external forces that will bring change to the region, as well as extensive public and stakeholder outreach. *Connections 2045* maintains the four core principles from the previous *Connections 2040* Plan, and has added equity as a separate core principle. *Connections 2045* focuses on our evolving transportation network and the continuing challenge of rebuilding our transportation infrastructure.

DVRPC

DVRPC is the federally designated Metropolitan Planning Organization (MPO) for the nine-county Greater Philadelphia region. DVRPC serves Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey. DVRPC's mission is to plan for the orderly growth and development of the region in concert with multiple planning partners. DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. A key role of an MPO is to work with local officials to prioritize transportation investments to be funded by federal and state revenue. DVRPC is governed by an 18-member board, composed of state, county, and city representatives from its member governments, as well as various participating, nonvoting members, and federal agency observers.

FIGURE 1: DVRPC NINE-COUNTY REGION

Source: DVRPC, 2017

THE LONG-RANGE PLAN

As the region's MPO, DVRPC is required by the U.S. Department of Transportation (U.S. DOT), in accordance with federal planning regulations, to develop a long-range transportation plan that covers a minimum 20-year planning horizon. The Plan outlines how the region intends to invest in the transportation system. It has been developed through a *Comprehensive, Cooperative, Continuing, Coordinated*, and *Compatible* process that incorporates the key planning factors contained in the federal transportation planning regulations.

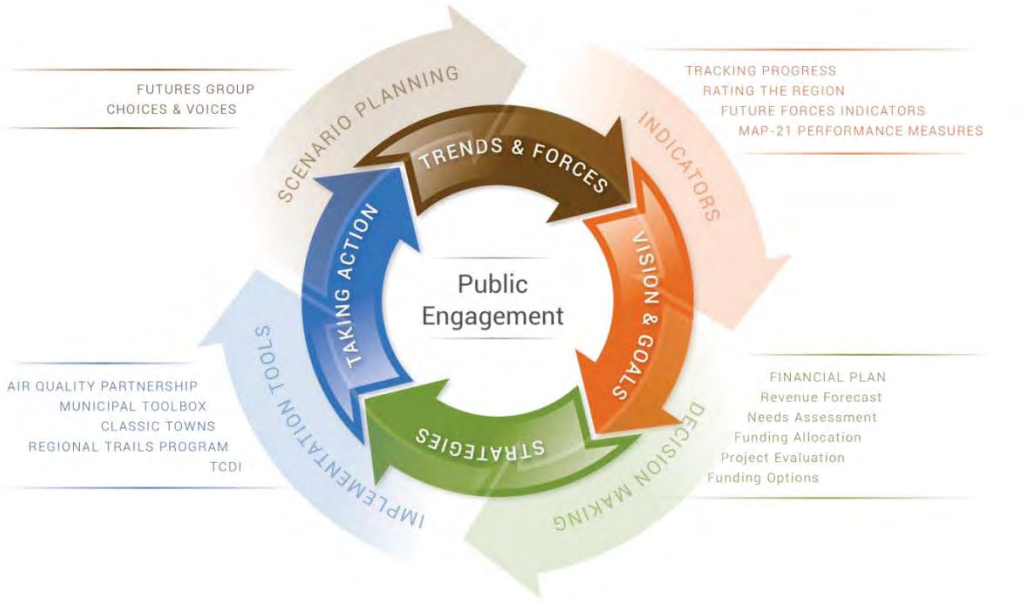
The most recent federal transportation authorizations also require long-range plans to incorporate performance measures. Congress has mandated that states and MPOs adopt performance measures; set targets; and monitor progress in the areas of safety, highway and transit system asset condition, congestion and system performance, freight movement system performance, and environmental sustainability. These rules will continue to be implemented after the adoption of this long-range plan update, and DVRPC will continue to work with federal, state, and local planning partners to move forward with performance measures planning, and to develop targets within the framework of the adopted long-range plan.

KEY PLANNING FACTORS:

- Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.
- Increase the safety of the transportation system for motorized and nonmotorized users.
- Increase the security of the transportation system for motorized and nonmotorized users.
- Increase the accessibility and mobility of people and for freight.
- Protect and enhance the environment, promote energy conservation, improve the quality of life, and promote consistency between transportation improvements and state and local planned growth and economic development patterns.
- Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.
- Promote efficient system management and operation.
- Emphasize the preservation of the existing transportation system.
- Improve the resiliency and reliability of the transportation system, and reduce or mitigate stormwater impacts of surface transportation.
- Enhance travel and tourism.

DVRPC's long-range plan is part of an integrated planning process. It has four key steps: identifying trends and forces shaping the region, working with the public and stakeholders to develop a collective vision and goals for regional development, and then recommending strategies to help achieve the vision. Taking action is an ongoing effort that is carried out through DVRPC's annual work program and by building partnerships with planning partners and implementation agencies to bring the vision to fruition. There are a number of efforts that DVRPC uses to develop and analyze regional conditions and trends, including scenario planning, indicators, and other implementation tools—all of which are considered in guiding decisions.

FIGURE 2: DVRPC LONG-RANGE PLANNING PROCESS



The Plan serves as a blueprint for prioritizing capital transportation investment funding for the region. Recognizing the integrated and holistic relationship between transportation and the built environment, the long-range plan also considers land use, the environment, economic development, and quality of life issues, and offers comprehensive policy guidance for the region and the work of DVRPC.

CONNECTIONS 2045

Federal planning regulations also require that the long-range plan be updated every four years in order to reflect and respond to the most recent trends and needs. *Connections 2045* will be considered for adoption by the DVRPC Board on October 26, 2017, and serves as an update of the previous long-range plan, *Connections 2040*. The Plan was developed around five integrated core principles:

1. **Sustain the Environment**
2. **Develop Livable Communities**
3. **Expand the Economy**
4. **Advance Equity and Foster Diversity**
5. **Create an Integrated, Multimodal Transportation Network**

Connections 2045 introduces several new planning factors to the long-range plan. The Plan addresses the importance of education in recognition of the fact that this basic service is vital to the region's ability to meet its other goals. This update also places an increased emphasis on the necessity of regional cooperation, and government efficiency and innovation in implementing the strategies identified in this plan. The Plan continues a performance-based planning approach that addresses system performance, links transportation investments to long-range plan goals, and tracks a set of indicators to gauge progress.

The concept of sustainability is a key policy value that is woven throughout the Plan. Sustainability refers to the ability of a region to meet its present needs without compromising the ability of future generations to meet

their needs. The Plan includes a number of goals to ensure a sustainable future and outlines what investments and policy decisions the region will need to make over the life of the Plan to achieve the goals.

STAKEHOLDER AND PUBLIC OUTREACH

Long-range planning is a collaborative process that involves close working relationships with regional stakeholders. In addition to the DVRPC Board, DVRPC convenes a number of committees, consisting of representatives from various fields, including: the Public Participation Task Force, Regional Technical Committee, Delaware Valley Goods Movement Task Force, Regional Aviation Committee, Transportation Operations Task Force, Central Jersey Transportation Forum, Regional Community and Economic Development Forum, Regional Safety Task Force, Information Resources Exchange Group, Air Quality Partnership, Coastal Zone Management Program, and Healthy Communities Task Force.

DVRPC also collaborated with regional planning partners, business and economic development groups, environmental and transportation advocacy groups, and the general public in developing the Plan. Public participation is an integral part of the long-range planning process, allowing stakeholders and residents to learn about issues facing the region and participate in the creation of the Plan. The PPTF is the primary vehicle for ongoing public participation in DVRPC's activities. With representatives from the private sector, social service agencies, environmental organizations, and other interested parties, the PPTF has been involved throughout the development of the Plan.

For *Connections 2045*, DVRPC carried out a number of outreach activities to gather input. The purpose of these outreach activities was to give the people who live and work throughout the Greater Philadelphia region an opportunity to share their vision for the region's future and to provide input as to how they would like to see the region grow and prosper. Following the visioning exercises, another round of outreach was conducted to identify appropriate strategies for achieving the vision and attaining the goals outlined in the Plan. DVRPC used a variety of outreach strategies, including in-person workshops and online surveys, to capture the many concerns and recommendations of the region's residents, government officials, and stakeholders. Special emphasis was placed on engaging individuals and organizations that have not participated in previous DVRPC planning exercises.

PLAN CONSISTENCY AND MEGAREGIONAL PLANNING

DVRPC's long-range plan and planning process strive to be consistent with and complementary to the goals and policies of the plans and programs of member municipal and county governments, and the statewide transportation plans of the Pennsylvania and New Jersey departments of transportation (DOTs).

There are many planning issues that extend beyond an MPO's boundary, such as transportation system expansion projects, sprawling development patterns, congestion, climate change, air quality, energy reliance, and transportation funding. DVRPC works with its planning partners, including neighboring MPOs, to identify cross-boundary issues. DVRPC then explores ways to address those issues, both formally and informally, through enhanced coordination and communication with the appropriate statewide planning and operating agencies. These efforts are carried out under the auspices of the Pennsylvania Department of Transportation (PennDOT) Planning Partners meetings, New Jersey Department of Transportation (NJ DOT) MPO Coordination meetings, the Metropolitan Area Planning Forum (New York, New Jersey, and Connecticut MPOs), Mid-Atlantic Regional Planning Roundtable (Pennsylvania, New Jersey, Delaware, Maryland, and Virginia MPOs), and many more informal channels.

CHAPTER 2:

TRENDS, FORECASTS, AND FORCES

DVRPC continuously monitors various trends and forecasts to determine the current state of the region, and to identify concerns and ideas for the future. These factors will affect not only the collective vision for 2045, but also the specific issues that are covered in the Plan. External forces of change that have the potential for significant disruptions were also examined.

POPULATION AND EMPLOYMENT FORECASTS

Population and employment forecasts are a critical component of long-range land use and transportation planning. The 2045 population forecasts incorporate the results of the 2015 Census estimates, and the 2045 employment forecasts are based on the 2015 National Establishment Time-Series (NETS) database. DVRPC worked with its member counties in developing the forecasts, which were adopted by the DVRPC Board. The DVRPC region is forecasted to gain over 658,000 residents between 2015 and 2045, an 11.5 percent increase.

FIGURE 3: REGIONAL POPULATION (1930–2045)

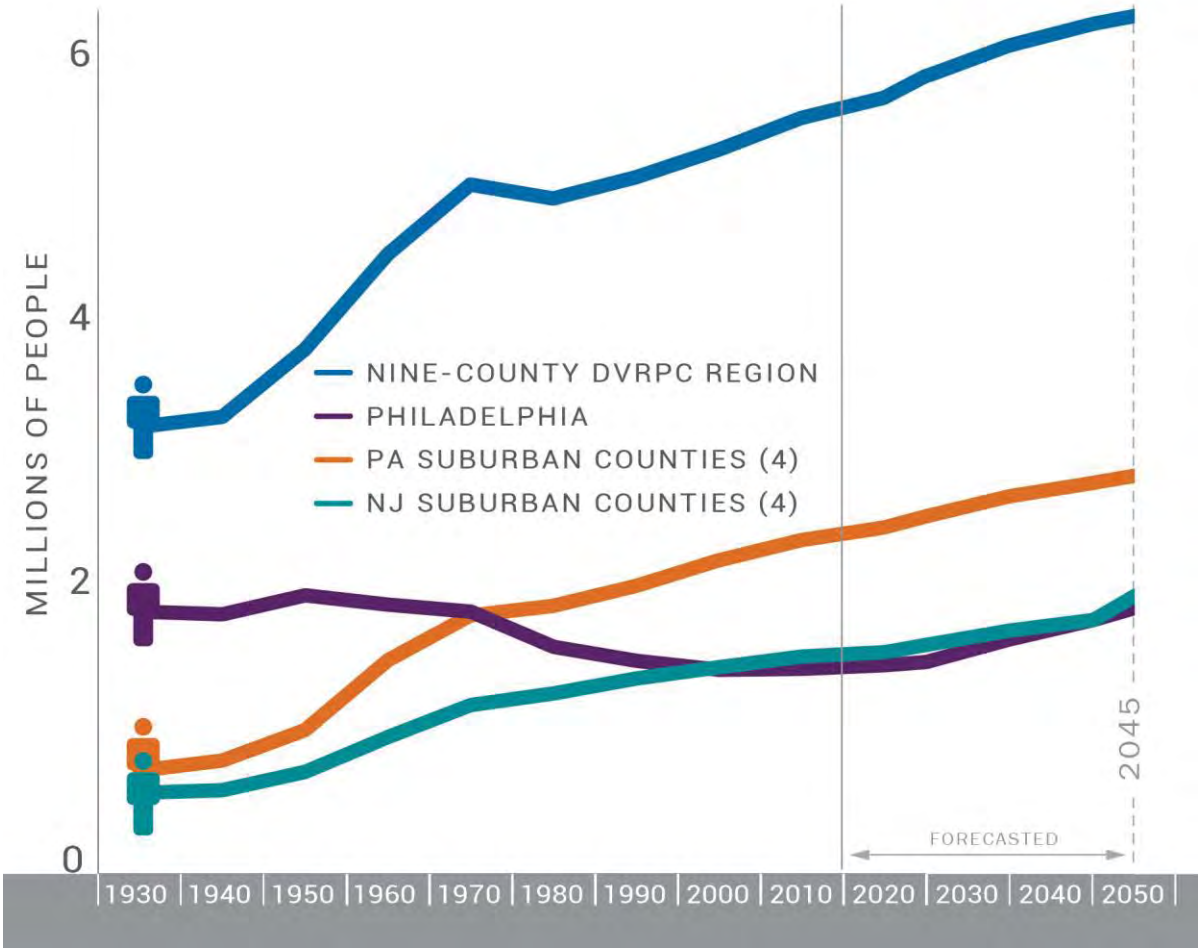


FIGURE 4: 2045 MUNICIPAL POPULATION FORECAST

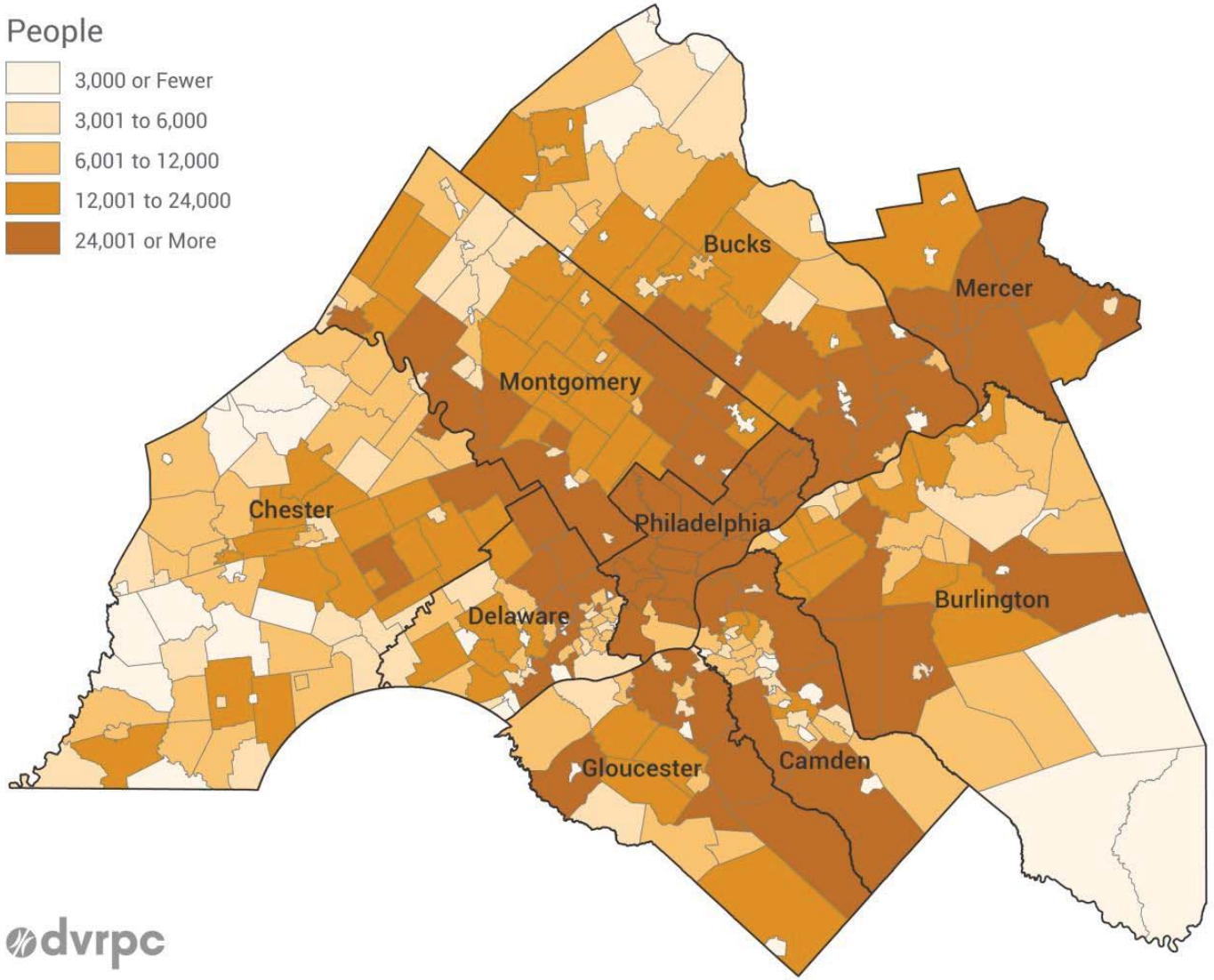


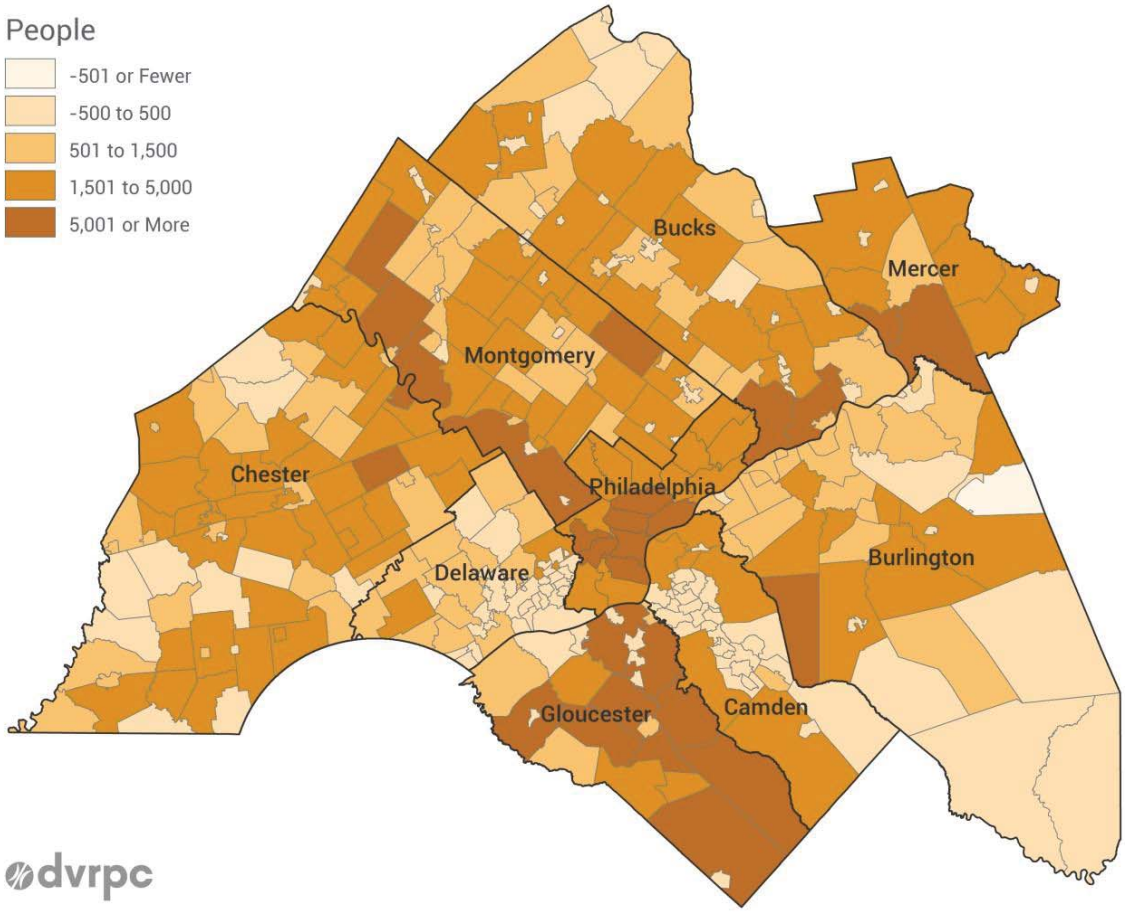
TABLE 1: FORECASTED POPULATION BY COUNTY, 2015–2045

County	2010 Census	2015 Census Estimate	2020 Forecast	2025 Forecast	2030 Forecast	2035 Forecast	2040 Forecast	2045 Forecast	Absolute Change, 2015–2045	Percentage Change 2015–2045
Bucks County	625,249	627,367	640,495	654,792	669,299	681,273	691,111	699,498	72,131	11.5%
Chester County	498,886	515,939	543,702	571,641	599,932	624,832	645,562	662,283	146,344	28.4%
Delaware County	558,979	563,894	568,337	572,758	577,248	581,136	584,329	587,037	23,143	4.1%
Montgomery County	799,874	819,264	840,934	863,327	884,387	903,114	918,918	932,820	113,556	13.9%
Philadelphia County	1,526,006	1,567,443	1,594,787	1,616,816	1,643,971	1,667,290	1,683,402	1,696,133	128,690	8.2%
Five Pennsylvania Counties	**4,008,994**	**4,093,907**	**4,188,255**	**4,279,333**	**4,374,837**	**4,457,645**	**4,523,322**	**4,577,771**	**483,864**	**11.8%**
Burlington County	448,734	450,226	459,344	468,428	475,978	482,560	488,026	492,709	42,483	9.4%
Camden County	513,657	510,923	514,006	517,073	520,189	522,886	525,101	526,997	16,074	3.1%
Gloucester County	288,288	291,479	307,766	323,969	340,425	354,677	366,383	376,308	84,829	29.1%
Mercer County	367,511	371,398	377,328	383,227	389,219	394,407	398,669	402,283	30,885	8.3%
Four New Jersey Counties	**1,618,190**	**1,624,026**	**1,658,444**	**1,692,697**	**1,725,811**	**1,754,530**	**1,778,179**	**1,798,2967**	**174,270**	**10.7%**
Nine-County DVRPC Region	**5,627,184**	**5,717,933**	**5,846,699**	**5,972,030**	**6,100,648**	**6,212,175**	**6,301,501**	**6,376,068**	**658,134**	**11.5%**

Source: DVRPC, June 2016

As it has since the mid-2000s, the population of the City of Philadelphia increased between 2010 and 2015, with the city adding more than 41,000 residents. This population gain is a turning point from the half-century decline in population that the City of Philadelphia had been experiencing since the 1950s. The population increase is forecasted to continue, with the city's population expected to increase by over 8 percent by 2045.

FIGURE 5: ABSOLUTE POPULATION CHANGE (2015–2045)



The share of the region's population living in the city is expected to increase slightly, from 26 percent in 2015 to 27 percent by 2045. The highest percentage population growth, however, is forecasted to continue on the periphery of the region, with slower growth in the region's core. This development pattern has required the building of additional transportation, sewer, water, and other infrastructure while underutilizing already built facilities.

The forecasts are what we can expect to occur in the future based on current programs and patterns. The Plan includes policies and strategies that may ultimately influence actual population and employment in the region.

FIGURE 6: PERCENTAGE POPULATION CHANGE (2015–2045)

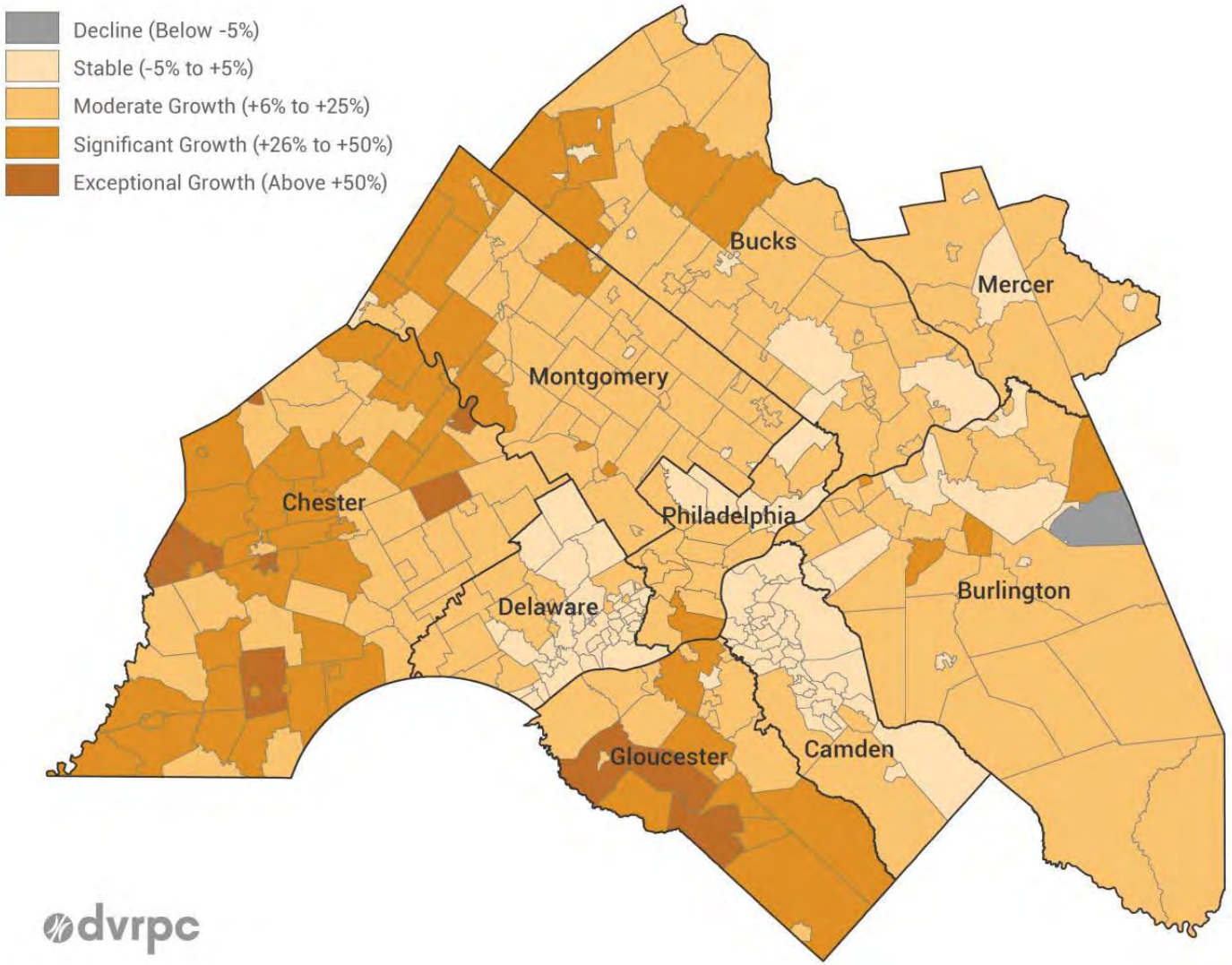


FIGURE 7: 2045 MUNICIPAL EMPLOYMENT FORECAST

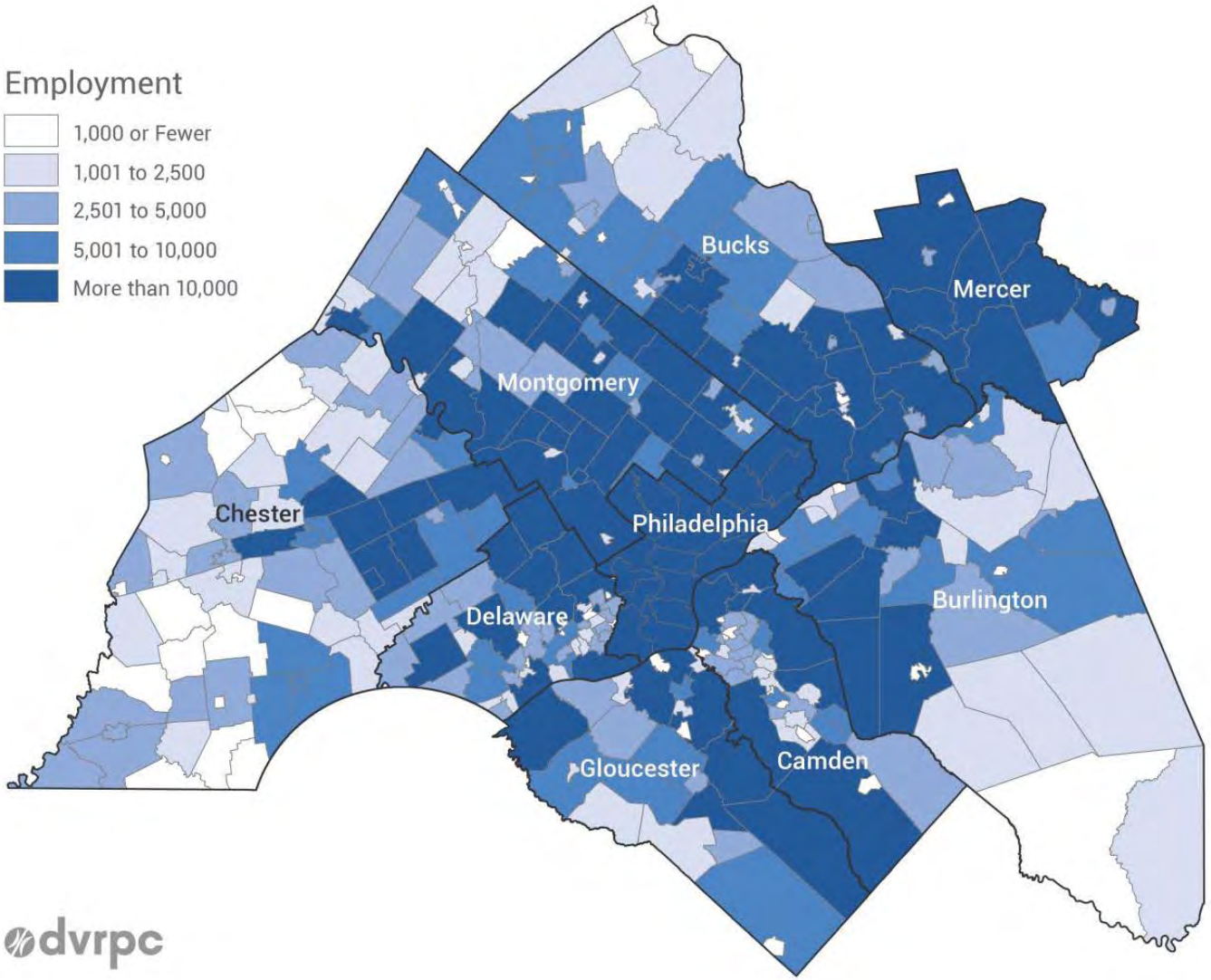
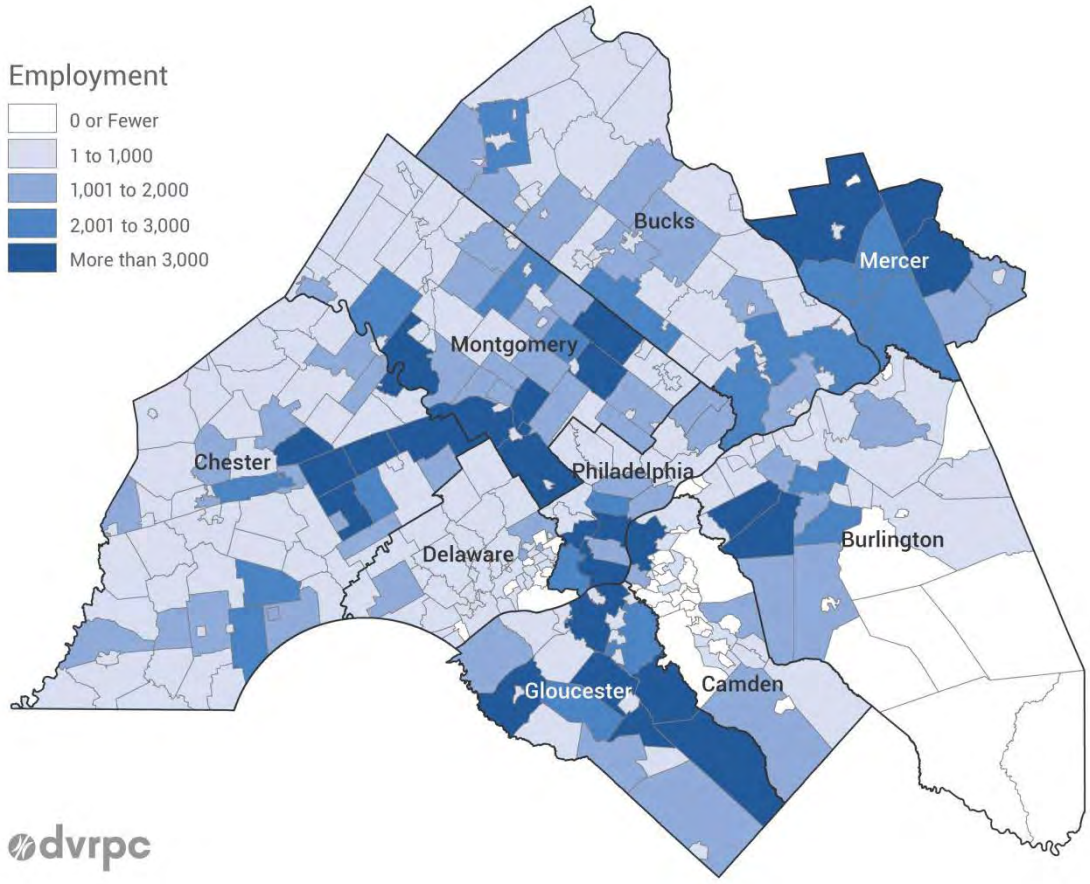


TABLE 2: FORECASTED EMPLOYMENT BY COUNTY, 2015–2045

County	2010 NETS Employment	2015 Employment Estimate	2020 Employment Forecast	2025 Employment Forecast	2030 Employment Forecast	2035 Employment Forecast	2040 Employment Forecast	2045 Employment Forecast	Absolute Change, 2015–2045	Percentage Change 2015–2045
Bucks County	311,930	322,731	329,645	337,203	344,859	351,310	356,671	361,124	38,393	11.9%
Chester County	296,351	309,605	326,320	343,050	359,774	374,967	387,391	397,405	87,800	28.4%
Delaware County	253,980	268,054	270,167	272,269	274,401	276,248	277,763	279,050	10,996	4.1%
Montgomery County	558,374	582,443	598,434	614,469	629,563	642,996	654,966	664,385	81,942	14.1%
Philadelphia County	738,546	772,847	786,308	797,156	810,574	822,002	829,937	836,825	63,978	8.3%
Five Pennsylvania Counties	**2,159,181**	**2,255,680**	**2,310,874**	**2,364,147**	**2,419,171**	**2,467,523**	**2,506,728**	**2,538,789**	**283,109**	**12.6%**
Burlington County	236,921	241,298	246,351	251,368	255,562	258,363	261,195	263,622	22,324	9.3%
Camden County	263,888	263,582	265,169	266,753	268,359	269,750	270,892	271,869	8,287	3.1%
Gloucester County	117,556	121,382	128,161	134,902	141,752	147,682	152,554	156,686	35,304	29.1%
Mercer County	282,209	286,295	290,864	295,408	300,025	304,021	307,302	310,084	23,789	8.3%
Four New Jersey Counties	**900,574**	**912,557**	**930,545**	**948,431**	**965,698**	**979,816**	**991,943**	**1,002,261**	**89,704**	**9.8%**
DVRPC Region	**3,059,755**	**3,168,237**	**3,241,419**	**3,312,578**	**3,384,869**	**3,447,339**	**3,498,671**	**3,541,050**	**372,813**	**11.8%**

Source: DVRPC, September 2016. Base employment data from the NETS database, 2010 and 2013.

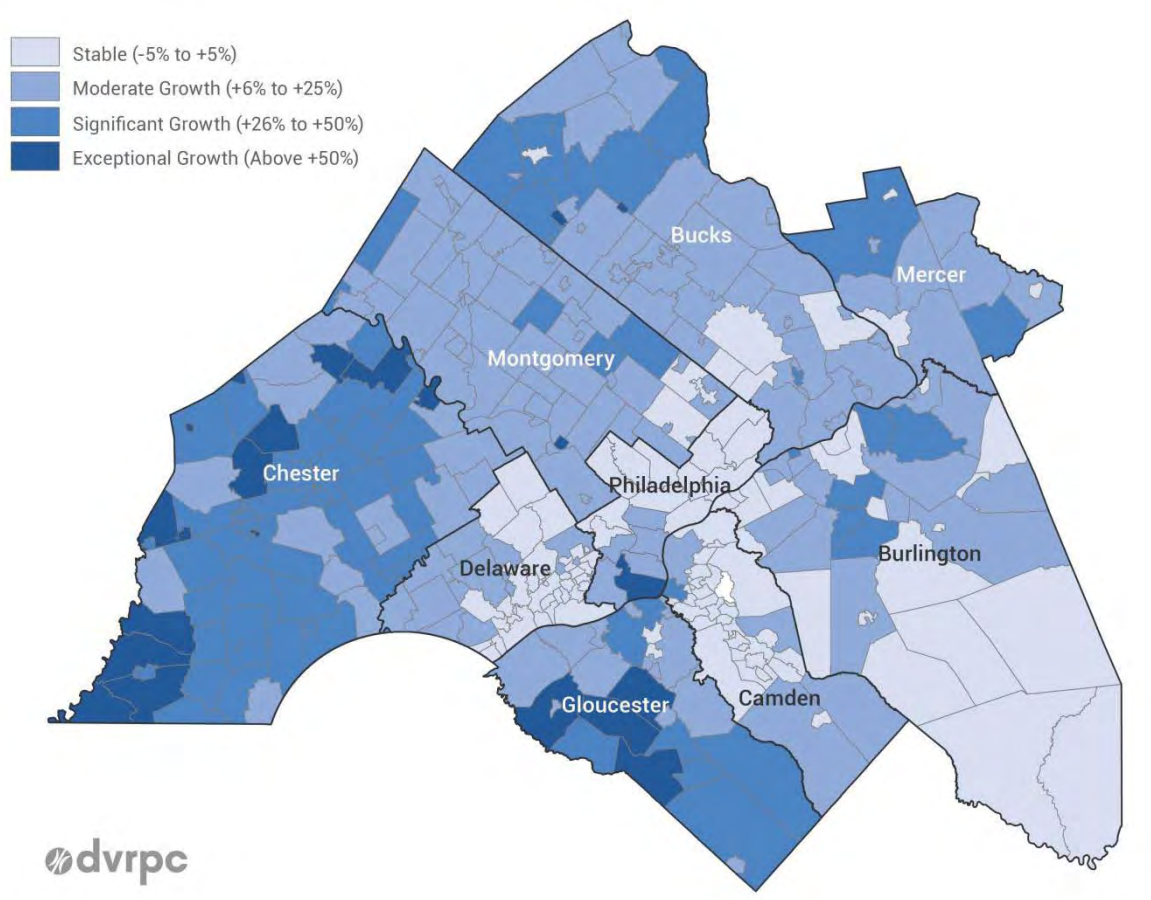
FIGURE 8: ABSOLUTE EMPLOYMENT CHANGE (2015–2045)



The region's five southeastern Pennsylvania counties are forecasted to experience a 12.6 percent increase in employment, while employment in the four New Jersey counties is expected to increase by 9.8 percent. In total, the DVRPC region is forecasted to gain over 372,000 jobs between 2015 and 2045, an increase of almost 12 percent.

The largest percentage increases are forecasted for Gloucester County, New Jersey, and Chester County, Pennsylvania, where employment is forecasted to increase by about 29 percent. The largest absolute increase is forecasted for Chester County, which is expected to gain over 87,800 employees. Other counties forecasted to see a significant number of additional employees include Montgomery County (+ 81,942 employees) and Philadelphia (+ 63,978 employees). Both Philadelphia and Camden City, New Jersey, are forecasted to gain employment with percentage increases of 8.3 percent and 10.1 percent, respectively. The region's other two Core Cities are expected to see their employment stabilize, with a net gain of 2,174 jobs in Trenton, New Jersey, and a gain of 305 jobs in Chester City, Pennsylvania. Similar to future population trends, the highest percentage employment growth is forecasted to occur on the outer edges of the region.

FIGURE 9: PERCENTAGE EMPLOYMENT CHANGE (2015–2045)



The Impact of Changing Demographics

Changing demographics will have a profound impact on regional lifestyle preferences and travel trends in the coming years. The region's largest demographic group is the baby boomers, born between 1946 and 1964 and reaching retirement age between now and 2030. Today's boomers are different from previous generations—not only are there more of them than any generation before, but they are more diverse and mobile, and expect a range of housing and transportation options that will keep them independent and living at home for as long as possible.

Some of these retirees may prefer to live in the region's Centers, provided there are affordable housing options available to them in desirable, safe neighborhoods. Many of them, however, expect to remain where they have spent most of their lives: in the auto-dependent suburbs. Over time, the ability to safely drive decreases, and accessing goods and services can become difficult. Mixed-use communities that are walkable, bikeable, and accessible by public transit can enhance quality of life and improve access to necessary services for all residents, including the elderly.

Millennials—those young adults largely born during the 1980s and 1990s—are currently the largest generation in America. As they continue to establish themselves in communities and workplaces around the country, their attitudes and beliefs will play an increasingly important role in shaping the country.

While it is often difficult to predict the ways in which demographics, changing attitudes, and technology will influence travel behavior and land use patterns, the current behavior and stated preferences of young adults offers us clues on how they think about mobility and the types of communities they will be attracted to. Current behavior is no guarantee of future actions, and the attitudes and beliefs of millennials will certainly evolve and change as they grow older. That said, recent research and data suggests that today's young adults differ from previous generations in a way that may profoundly affect the communities in our region. Some broad-based observations include:

- Millennials are the most racially diverse generation in American history. They are projected to become the most educated generation as well; however, they face a number of economic challenges.
- Young adults have disproportionately been attracted to urban environments in our region and throughout the country. Philadelphia, in particular, has seen impressive growth in its young adult population. Nearly 35 percent of young adults in our region live in Philadelphia. Roughly 40 percent of these young adults live within the five planning districts that constitute the city's urban core.
- Young adults also drive less and use other modes of transportation at higher rates than other generations. Although a portion of this behavior can be attributed to the fact that many millennials currently reside in more urban locations with a variety of transportation options, this behavior may signal a willingness to think more broadly about how they meet their transportation needs in the future.
- They are technologically adept but have been slow to marry. A growing number of millennials will relocate to the suburbs in the coming years. However, some evidence suggests that they will be most attracted to mixed-use walkable communities that offer a mix of urban and suburban benefits.

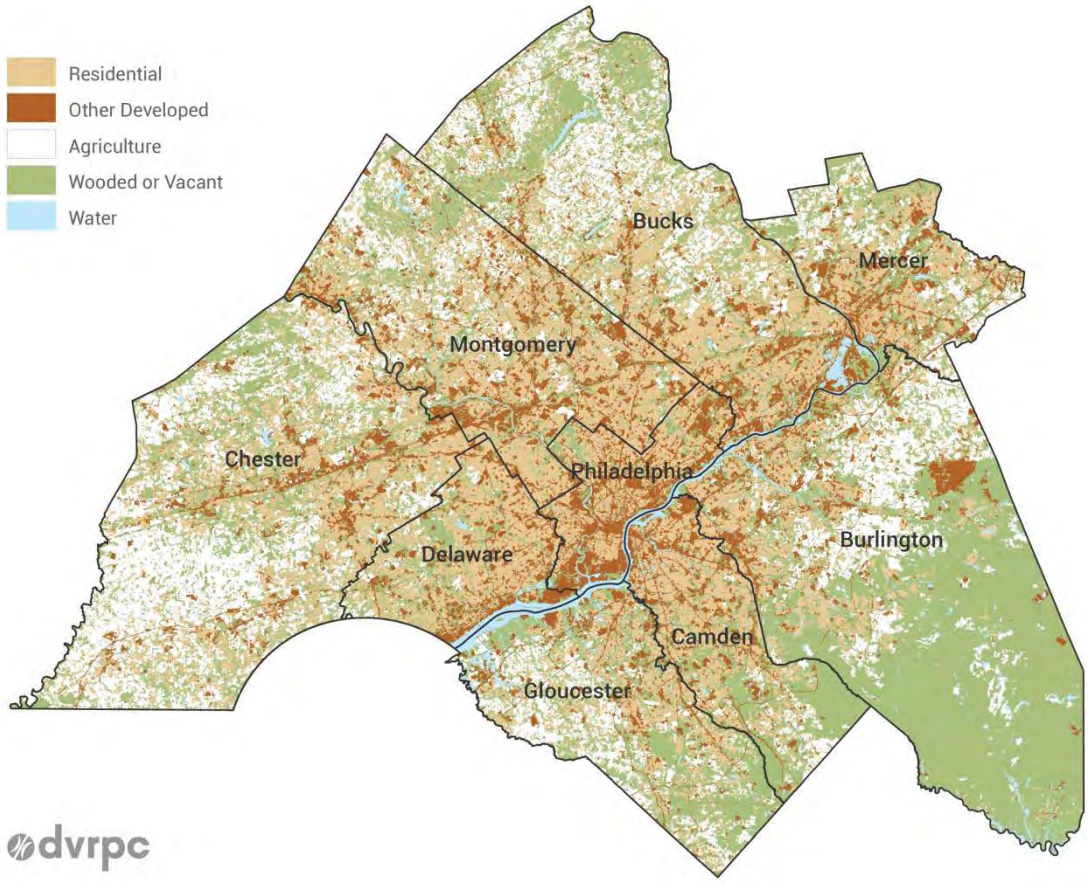
The growth of the immigrant population will also have an impact on land use preferences and travel patterns. Research has shown that new immigrants have more children, and at an earlier age, and often live in larger households with their extended family. They typically travel fewer miles; make fewer vehicle trips; and more often take transit, walk, and bike. Hispanic immigrants are also more likely to carpool.

LAND USE

Land use analysis is another fundamental factor in the planning process. Over the past 85 years, the region has experienced a rapid suburbanization, characterized by "leap frog" development and sprawl. Over this time period, population has increased by 73 percent, but the amount of land consumed for development has increased by 450%. This has led to many negative externalities, including:

- increased reliance on driving and congestion;
- a drastic reduction in open space and agricultural land;
- detrimental impacts to air and water quality; and
- increased need for infrastructure and services.

FIGURE 10: 2015 LAND USE



Development, particularly residential development, slowed between 2010 and 2015, compared to the previous five years—which was not unexpected, given the continued slow recovery from the national and regional economic recession. Between 2010 and 2015, approximately 14,800 acres were developed regionwide, compared with almost 27,400 acres between 2005 and 2010. Similarly, residential acreage increased by approximately 1.4 percent between 2010 and 2015, compared with the 2.3 percent increase during the previous five years. This reduction in land consumption may, in part, be due to higher-density development and redevelopment in the region's core cities and older, developed communities. It may also reflect the impacts of the recession, as college graduates move back home, or the impact of immigration, as immigrants often live with extended families.

The rate of development has been decreasing recently. From 1970 to 1990, development occurred at a rate of approximately one acre per hour; between 1990 and 2000, the rate accelerated to one acre every 45 minutes. Between 2000 and 2010, the rate slowed to approximately one acre of land developed every 82 minutes; and between 2010 and 2015, the rate of development slowed further to one acre every 117 minutes.

FIGURE 11: ACRES DEVELOPED PER HOUR (1970–2015)

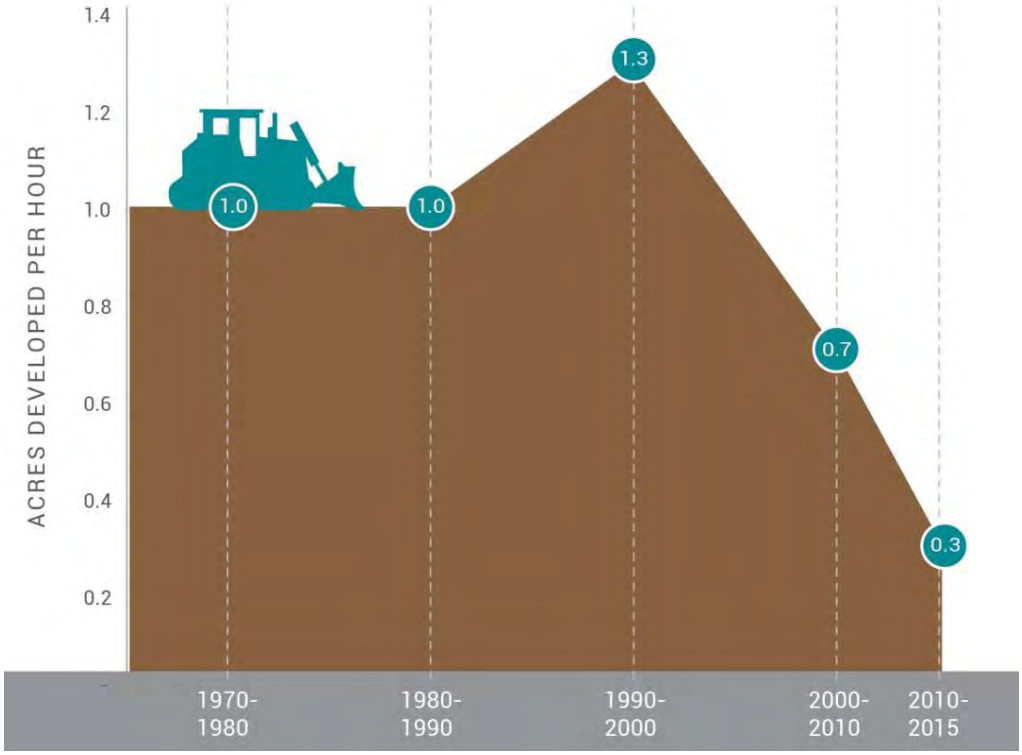
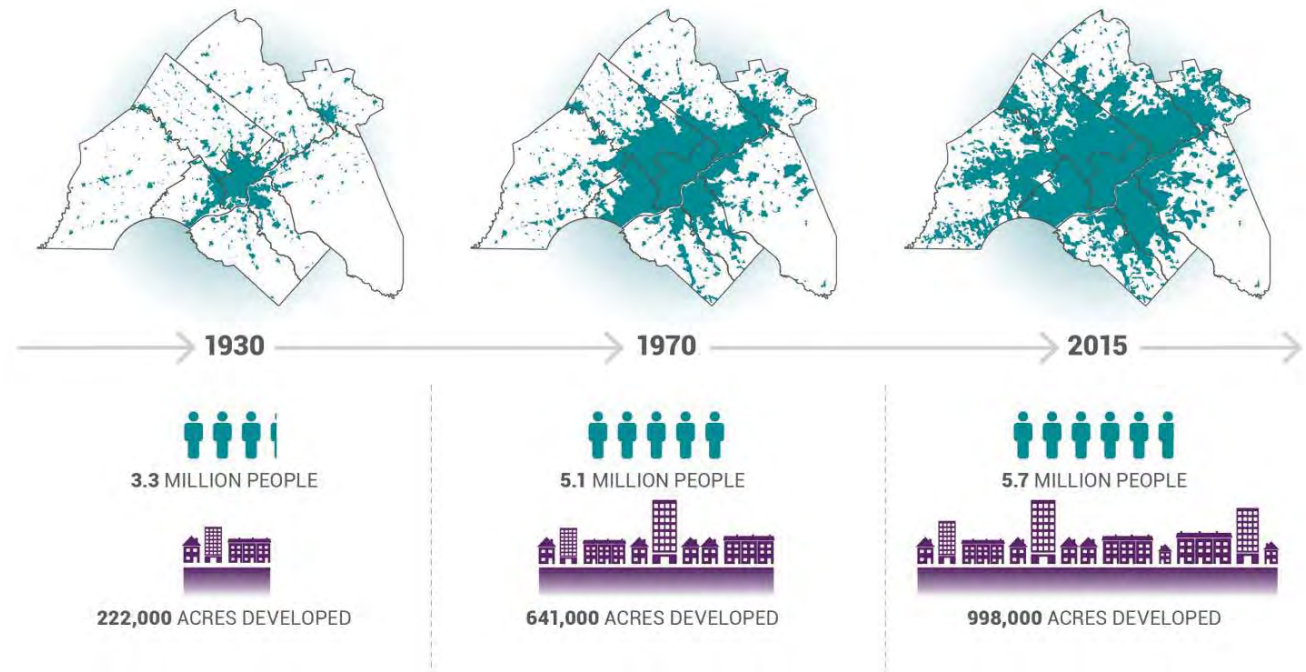


FIGURE 12: EXTENT OF REGIONAL DEVELOPMENT (1930–2015)



OPEN SPACE INVENTORY

DVRPC maintains an inventory of protected public and private open space in the region. The inventory tracks all publicly owned open space, preserved farmland, and nonprofit protected open space. State, county, and municipal programs preserve farms by purchasing development rights with public funds. Nonprofits, such as land trusts and conservancies, protect privately owned open space lands by purchasing easements or by acquiring land outright with a combination of public and private funds. Between 2002 and 2016, the region has steadily increased its inventory of protected public and private open space (Figure 13 and Table 3): a necessary step in managing growth and protecting the environment throughout the region.

FIGURE 13: 2016 PROTECTED OPEN SPACE INVENTORY (IN ACRES)

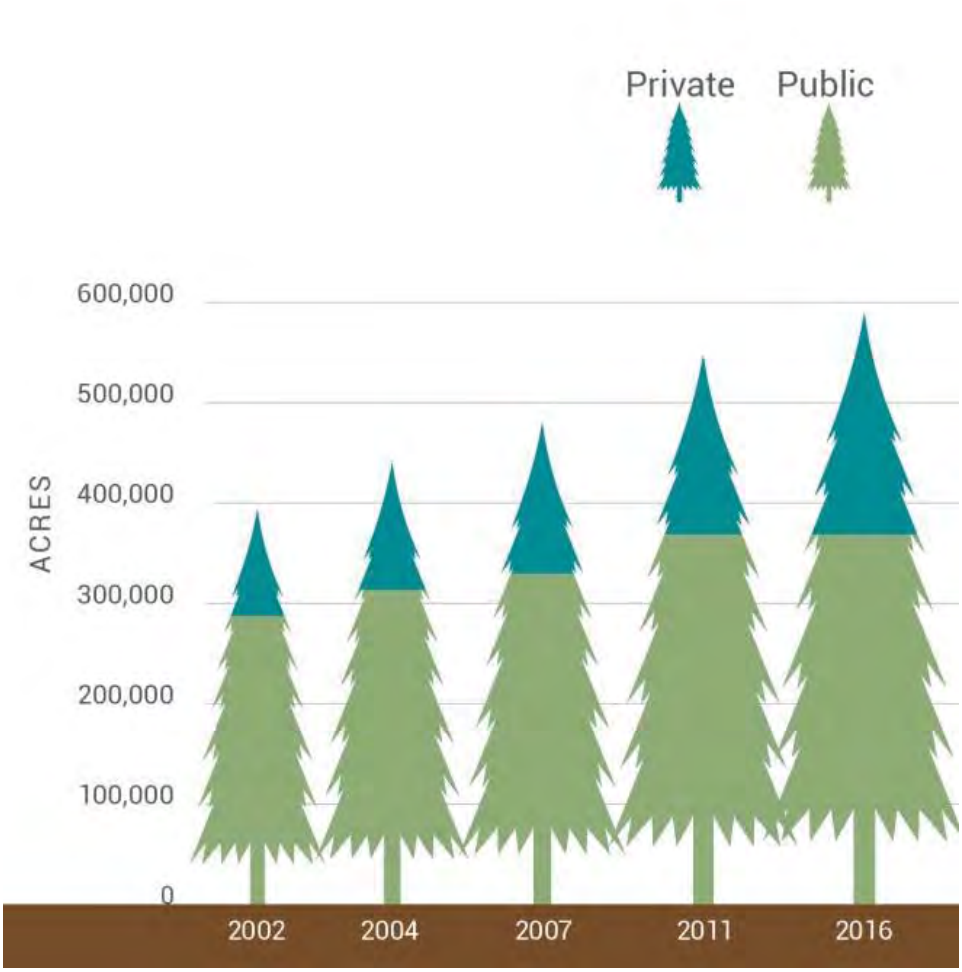
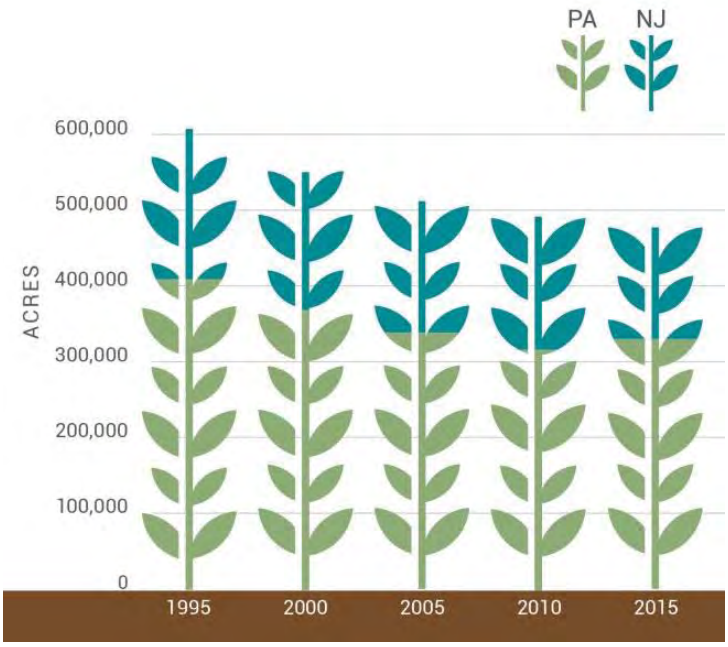


TABLE 3: 2016 DVRPC OPEN SPACE INVENTORY (ACRES)

	Public Protected Open Space					Private Protected Open Space			Total Protected OS	Percent of Total Area
County	Federal	State	County	Municipal	Total Public OS	Non-Profit	Preserved Farmland	Total Private OS		
Burlington	2,652	158,367	3,411	12,306	176,736	8,949	37,598	46,547	223,283	42.6%
Camden	0	20,562	2,919	5,093	28,574	0	1,902	1,902	30,476	20.9%
Gloucester	0	9,351	2,196	5,804	17,351	1,300	17,940	19,241	36,592	17.0%
Mercer	0	4,355	8,613	9,000	21,968	4,663	7,562	12,225	34,193	23.4%
NJ Subregion	**2,652**	**192,634**	**17,139**	**32,204**	**244,629**	**14,912**	**65,003**	**79,915**	**324,544**	**31.5%**
Bucks	0	12,356	9,026	14,289	35,671	23,311	18,860	42,171	77,842	19.6%
Chester	1,290	8,006	5,444	12,982	27,722	58,741	39,973	98,714	126,436	26.0%
Delaware	948	2,592	1,393	4,599	9,531	1,627	1,517	3,144	12,675	10.4%
Montgomery	3,043	3,873	5,250	13,282	25,448	5,849	9,215	15,065	40,512	13.0%
Philadelphia	366	224	11,490	0	12,080	334	0	334	12,414	13.6%
PA Subregion	**5,647**	**27,051**	**32,604**	**45,151**	**110,453**	**89,862**	**69,565**	**159,427**	**269,880**	**19.2%**
DVRPC Region Total	**8,299**	**219,685**	**49,743**	**77,355**	**355,082**	**84,359**	**134,568**	**239,342**	**594,424**	**24.4%**

Despite strides made toward open space protection, the region has suffered from a steady loss in agricultural lands in both the Pennsylvania and New Jersey subregions. Figure 14 shows the decline in agricultural lands not preserved through easements or acquisitions between 1995 and 2015.

FIGURE 14: REGIONAL AGRICULTURAL LAND



Across the region, the largest category of protected open space is state-owned land, which makes up 37 percent of all protected open space. This is followed by preserved farmland, which makes up 24.4 percent of all protected open space.

- Protected open space makes up 24 percent of the nine-county Greater Philadelphia region. This is divided into 15 percent public open space and 10 percent private open space.
- The inventory of protected open space increased by 43,280 acres, or 8 percent, between 2011 and 2016.
- Preserved farmland, which increased by over 24,000 acres, had the largest gain in protected open space of any category of protected open space between 2011 and 2016.
- The county with the greatest amount and percentage increase in protected land was Chester County, which saw a 19,644 acre and 18.4 percent increase, respectively, in its protected open space.
- Burlington County has the greatest amount of protected open space by far, both in total acreage and as a percentage of the county, due primarily to land protection in the Pinelands.
- Between 2011 and 2016. 67 percent of the increase in protected open space was located in a Rural Resource Area or the Greenspace Network, designated for preservation in the Plan.

TRANSPORTATION

The Greater Philadelphia region has one of the most comprehensive transportation systems in the nation. The system includes an extensive highway network, four public transit service providers, two Class I freight railroads, two commercial service airports, numerous intermodal port facilities, and a growing on- and off-road bicycle network. However, the system is mature and many of the aging facilities require significant investment. Recent years have witnessed some change in long-standing travel patterns. This update considers the impact these trends will have on the future needs of travelers in the region.

The number of vehicle miles traveled (VMT) has decreased regionally by 5.4 percent between the 2007 peak and 2014. As the economy has recovered from the mid-2000s recession, VMT has continued to decline in the Pennsylvania portion of the region. Recently, however, VMT has begun to increase again in the New Jersey portion of the region.

Regionally, transit ridership has been on an upswing since 2000. Between 2000 and 2015, ridership in the region increased 11.3 percent overall. Between 2010 and 2015, ridership increased 34 percent on NJ Transit, increased 17 percent on Pottstown Area Rapid Transit, and remained flat on the Southeastern Pennsylvania Transportation Authority (SEPTA) and the Port Authority Transit Corporation (PATCO). Public transit use gained momentum in the mid-2000s when gas prices above $4 per gallon drove an increase in ridership. This growth correlates with the increased economic activity and residential development in and around Center City: the focal point of the regional transit system. The economic upswing started in the late 1990s and has continued throughout the first decade of the 21st century. Most recently, the region has seen trends of reduced car ownership among younger people; the rise of on-demand transportation, such as car sharing and services like Uber; and revitalization of transit-friendly communities. These trends seem to have solidified the resurgence of transit use in the region.

More than 72 percent of commuters in the region travel to work by single-occupant vehicle. Between 2000 and 2014, the growth of commuters who drove alone (6.8 percent) was more than the growth of the total number of commuters (6.6 percent). Since 2000, the number of commuters carpooling has decreased by nearly 18 percent, while those bicycling, taking taxis and “other” to work increased by 51.1 percent, and transit commuting increased by 14.3 percent. Also during this time period, significant growth has occurred in working from home (49 percent). High growth in taxi and other modes may reflect the fast growth in Transportation Network Companies (TNC) services in Greater Philadelphia.

Commute times across the region continue to increase and are consistently higher than national averages. Between 2010 and 2014, commute time in Greater Philadelphia increased 1.9 percent, compared with the national average for the same time period: negative 2.4 percent. In many respects, this is more indicative of land use patterns and lifestyle choices in the region than it is a reflection of congestion.

Congestion on the Pennsylvania subregion’s freeways is significantly higher than on the freeways in the New Jersey subregion, although congestion has increased at a higher rate in New Jersey. As might be expected, congested freeway miles are along the major routes into and out of Philadelphia and the region’s core. The Texas A&M Transportation Institute puts out an annual Urban Mobility Scorecard, which looks at congestion in each of the nation’s 101 major metro areas. The most recent edition found that in 2014, the average auto commuter in the United States wasted 42 hours per year in congested conditions. In comparing metro areas, Philadelphia ranked 22nd worst, with 48 hours of congested time annually per auto commuter. To put this in

context, the Greater Philadelphia region has the seventh highest population of metro areas in the United States.

With a mature transportation system, asset condition continues to be a significant challenge. Between 2005 and 2016, Pennsylvania has reduced the amount of state-maintained structurally deficient bridge deck area in the region by more than 50 percent, and is now close to its desired state-of-good repair (SGR). Bridge conditions in New Jersey continue to outperform the larger region and the nation as a whole. Maintaining these conditions will be challenging as the region's pavement continues to worsen. The largest single 10-year period for building the region's infrastructure occurred during the 1960s; this means many of these facilities have reached the end of their useful lives and need to be reconstructed soon. The region's deficient pavement increased by 8 percent overall between 2005 and 2016. New Jersey has reduced poor pavement by 11 percent, while Pennsylvania has seen a 17 percent increase in poor lane miles during this time period. Both subregions have deficiencies far greater than their SGR goals.

On the transit side, SEPTA has 232 regional rail vehicles past their 35-year expected useful life, and all SEPTA trolleys are approaching the end of their useful life. Act 89, passed by the Pennsylvania legislature in 2013, has provided $60 million per year in dedicated funding for public transit. This funding will allow SEPTA to begin to address its aging vehicle fleet. PATCO has been totally overhauling its heavy rail fleet, effectively resetting the clock on the useful life of those vehicles. PATCO expects to complete the vehicle overhauls of all its trains by the end of 2017. This will bring the New Jersey rail fleet closer to, and maybe even within, the SGR goal for rail vehicles. The average age of the New Jersey Transit rail fleet is much newer than the current PATCO fleet, at 15.6 years.

FIGURE 15: REGIONAL STATE-MAINTAINED BRIDGE CONDITION

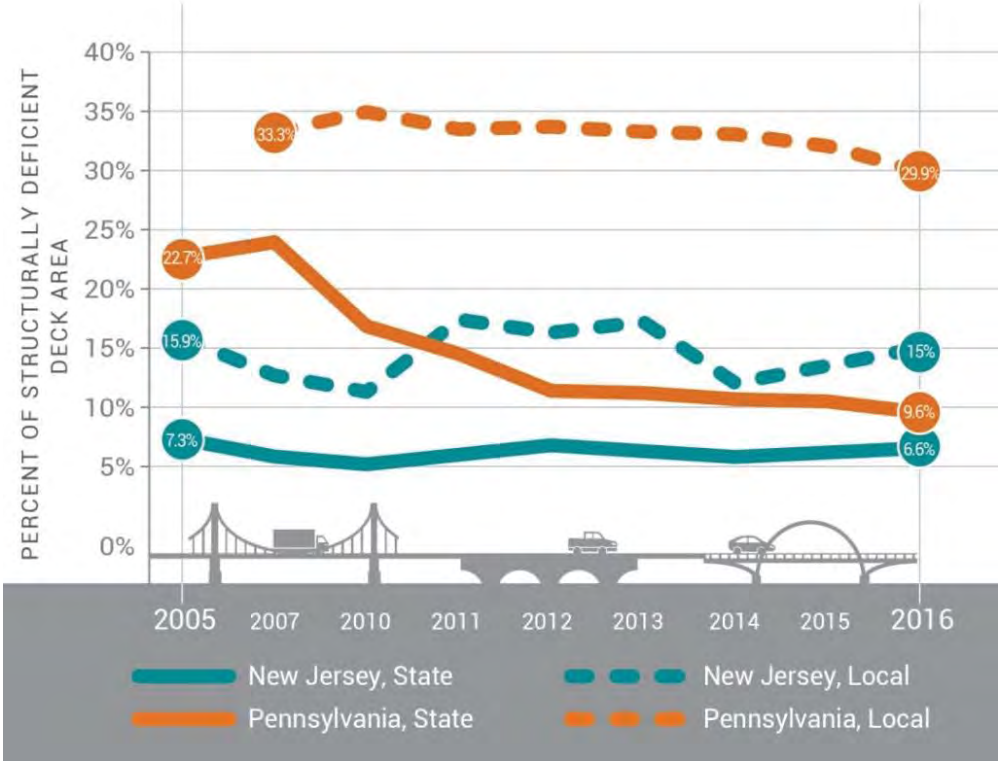
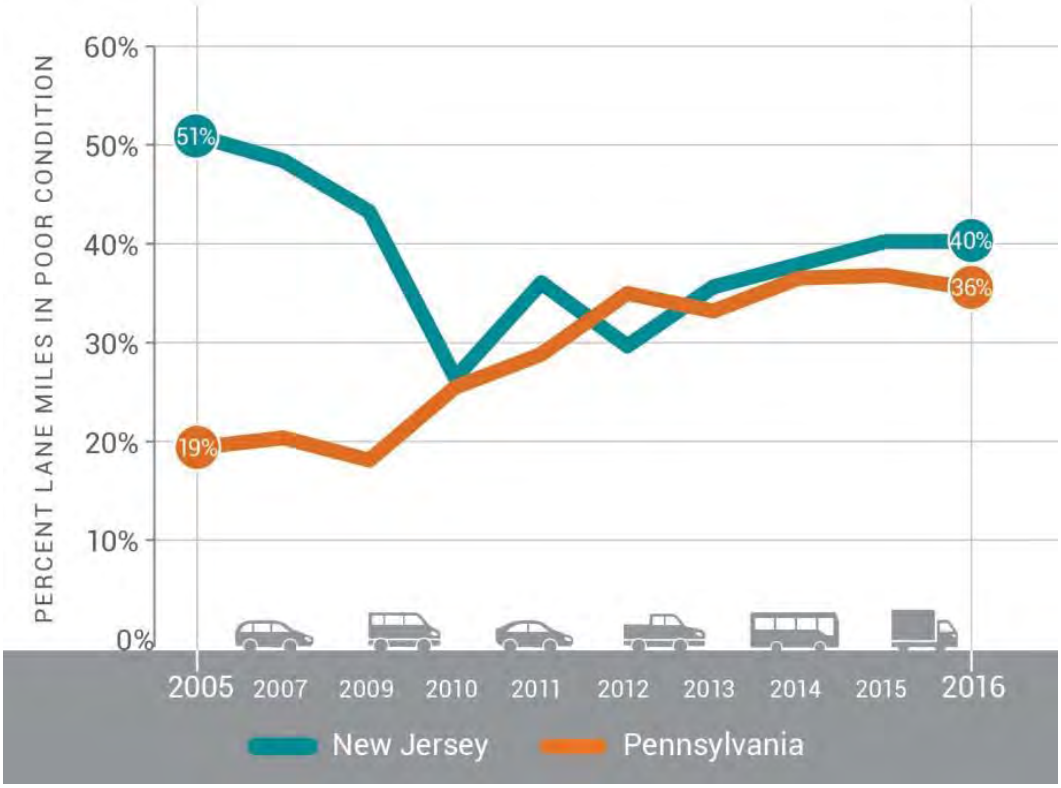


FIGURE 16: REGIONAL PAVEMENT CONDITIONS



REGIONAL INDICATORS

As performance-based planning becomes increasingly important and state of the art, DVRPC has undertaken several initiatives that track the region's performance in various areas. Rating the Region and Tracking Progress are the two largest initiatives, but indicators are also tracked as part of several other planning efforts, such as the Future Forces scenarios and U.S. DOT transportation performance measures.

RATING THE REGION

Rating the Region provides an objective analysis of the state of the Greater Philadelphia region and identifies its relative strengths and weaknesses as compared with the 25 largest metropolitan areas in the United States.

Greater Philadelphia continues to offer a diverse economy, affordable housing opportunities, a quality highway and transit network, relatively short commute times, quality aviation and port facilities, a large number of colleges and universities, and an extensive healthcare network. The challenge now facing the region is capitalizing and building on these strengths while recognizing and working to address identified weaknesses.

In comparison with other regions, our transportation network, diverse economic base, relatively low unemployment rate, and research and development capabilities position us for economic growth. These strengths, however, threaten to be checked by the disparities between city and suburban income, low labor force participation, and poor educational attainment in the inner cities and older, developed areas.

Likewise, our quality-of-life assets—colleges and universities, an extensive healthcare network, arts and cultural resources, and affordable housing—may be countered by challenges, such as a rapidly aging population, limited recreational resource funding, and the fragmentation caused by a large number of government entities, which can at times make it difficult to achieve regional goals.

The region's extensive healthcare network will be of tremendous value as the region works to meet the needs and demands of its growing elderly population. The region must continue to market its strengths, including extensive educational resources, affordable housing, arts and cultural opportunities, and short average commute times, to help attract and retain young, college-educated professionals.

One of the most serious issues facing the region is the disparity in education and income between the primary cities and the suburbs. Access to existing suburban employment centers must continue to be improved. Combined with job training and workforce development, improved mobility can help provide meaningful employment opportunities for city residents, increase labor force participation, and lower unemployment in the region's primary cities. Increased outreach and partnerships between the region's colleges and universities and the local elementary and secondary schools can increase the motivation and performance of students, particularly in the region's urban districts.

In order to remain a desirable locale and to continue growth, the Greater Philadelphia region must be prepared to compete effectively with other major metro areas around the country and around the world for new residents, new jobs, and new capital. The strengths of the region will serve us well as we move toward 2045, provided we recognize and respond to our challenges.

TRACKING PROGRESS

As part of the long-range plan development process, DVRPC utilizes meaningful, reliable, and easy-to-replicate data to track the region's progress toward the goals of the long-range plan, and compiles the data on the Tracking Progress website.[1] Regional indicator data is used to highlight successful initiatives and to identify which issue areas should receive priority attention in the next Plan update. Tracking Progress monitors 31 indicators; most are regionwide, but several of the indicators look at differences between urban, suburban, and rural areas.

Tracking Progress categorizes each of the region's 352 municipalities as one of four Planning Area types: Core Cities, Developed Communities, Growing Suburbs, and Rural Areas. Since 2005, population has increased in Philadelphia and in several Developed Communities. While the rate of growth continues to be higher in the region's Growing Suburbs and Rural Areas, residential construction and mortgage lending activity has been more robust in Core Cities and Developed Communities.

Though the rate of land development slowed in the latter half of the past decade, loss of prime agricultural soils and other natural resources remains a concern, given its negative impacts on surface water quality in the region. At the same time, open space preservation in the region is an ongoing success story, with significant increases in both public and privately protected spaces.

Positive trends can be seen in economic indicators, such as employment, workforce education, and average annual pay. Historically, these have been regional strengths. However, there is a growing economic disparity between the Core Cities and Developed Communities, and the Growing Suburbs and Rural Areas in these

[1] DVRPC, Tracking Progress, http://www.dvrpc.org/TrackingProgress.

factors. Likewise, the older, developed areas continue to experience slower growth in population, employment, and residential tax base.

Based on a review of the indicators, *Connections 2045* will continue to place emphasis on directing future growth and development to the identified Plan Centers and away from the Greenspace Network and Rural Resource Lands. The Plan also incorporates an increased emphasis and analysis related to transportation system preservation needs and funding.

FIGURE 17: TRACKING PROGRESS INDICATORS

PLAN FACTORS	WHAT WE TRACK	TREND
THE ENVIRONMENT	Is land development/land consumption slowing?	
	Did growth occur in appropriate areas?	
	Have acres of public open space Increased?	
	Have acres of privately protected open space increased?	
	Has the amount of farmland production in the region increases?	
	Is air quality improving?	
	Has surface water quality improved?	
COMMUNITIES	Is the population in Core Cities and Developed Communities increasing?	
	Is employment in Core Cities and Developed Communities increasing?	
	Has the tax base increased in Core Cities and Developed Communities?	
	Has residential construction activity increased in Core Cities and Developed Communities?	
	Has mortgage lending activity increased in Core Cities and Developed Communities increased?	
	Do development patterns support expanded transit options?	
ECONOMIC COMPETITIVENESS	Has the number of jobs in the region increased?	
	Has average annual pay in the region increased?	
	Is the workforce becoming more educated?	
	Is housing becoming more affordable?	
	Are greenhouse gas emissions lower?	
	Are we using less energy?	
TRANSPORTATION	Are people driving less?	
	Is transit ridership increasing?	
	Have vehicle fatalities declined?	
	Is congestion getting worse?	
	Are fewer people driving to work alone?	
	Is commute time decreasing?	
	Has the number of deficient bridges decreased?	
	Are roads better maintained?	
	Is the transit system being maintained?	
	Is TIP investment in Plan Centers increasing?	
	Are freight shipments in the region increasing?	
	Is airline passenger traffic increasing?	

SOURCE: DVRPC

FUTURE FORCES

Starting in the fall of 2014, DVRPC convened a group of experts in various disciplines, called the Greater Philadelphia Futures Group. This group was tasked with helping to identify and better understand nonlinear, driving forces of change that are most likely to shape the region going forward. Future Forces are observed trends, largely beyond the region's control, that will have major impacts on Greater Philadelphia and the ability to achieve the vision and goals set forth in the long-range plan. The Futures Group went through a process that identified the following five key Future Forces:

People and jobs moving to walkable communities is the start of a long-term trend.

Increased outsourcing and automation means individuals must create their own economic opportunities.

Continued rise in atmospheric carbon levels leads to significant disruptions from climate change.

Smartphones, apps, and real-time information help people get around using new and existing transportation modes.

An abundance of domestically produced oil and natural gas keeps the cost of energy low.

This effort did not try to predict the future or identify a preferred vision for it. Future Forces are not normative expressions of what we want to happen, and they are not official policy. Rather, Future Forces are exploratory; they attempt to understand how change is likely to occur and use that to guide regional decision making.

Each of the forces would have benefits and consequences for the region. The anticipated benefits of **Enduring Urbanism** include more residents and jobs located in walkable communities, increased transit use, and improved urban schools. Consequences of this scenario, however, could include more gentrification and rising housing costs, particularly in urban areas; an increase in suburban municipalities with fiscal distress; and a loss of industrial land. In the **Free Agent Economy**, the region would become more entrepreneurial and innovative, technology would enable working from anywhere, and on-demand services would be widespread and available for anything. However, low-skilled workers may fall further behind, incomes may be less stable, and an increase in virtual education and telemedicine may weaken the region's two strongest economic sectors. In **Severe Climate**, the region may benefit from a longer growing season for agriculture and lower heating costs, and become an attractive destination for climate refugees. Potential challenges include crisis management from climate events; shortened infrastructure lifespans, with greater risk of sudden failures; and negative health and wildlife habitat impacts. In the **Transportation on Demand** scenario, the region's transportation system would operate much differently than it does today, with reduced need for car ownership and space for parking. This could bring consequences of increased suburban sprawl and congestion, with associated negative impacts to transit service and equity. In the **U.S. Energy Boom**, there could be increased job opportunities for lower-skilled workers, reduced energy prices, and less reliance on

foreign energy sources. However, greenhouse gas (GHG) emissions could increase; more air pollution would harm health; and cheap energy may delay the move to cleaner energy and more efficient vehicles, facilities, and equipment.

The Future Forces were modeled and analyzed as "what-if" scenarios through 2045 to highlight how the region may change over the next 30 years. The scenarios address potential shifts in travel demand and identify specific opportunities and challenges that may arise. In all scenarios, population forecasts were more optimistic, while employment forecasts were lower than the Board-adopted forecasts (6.37 million people and 3.54 million jobs) in *Connections 2045*. Employment forecasts have been revised to match projected growth from an updated 2010 baseline compared to what is in the Future Forces report. Results from modeling the Future Forces scenarios are shown in Table 4 and Figure 18.

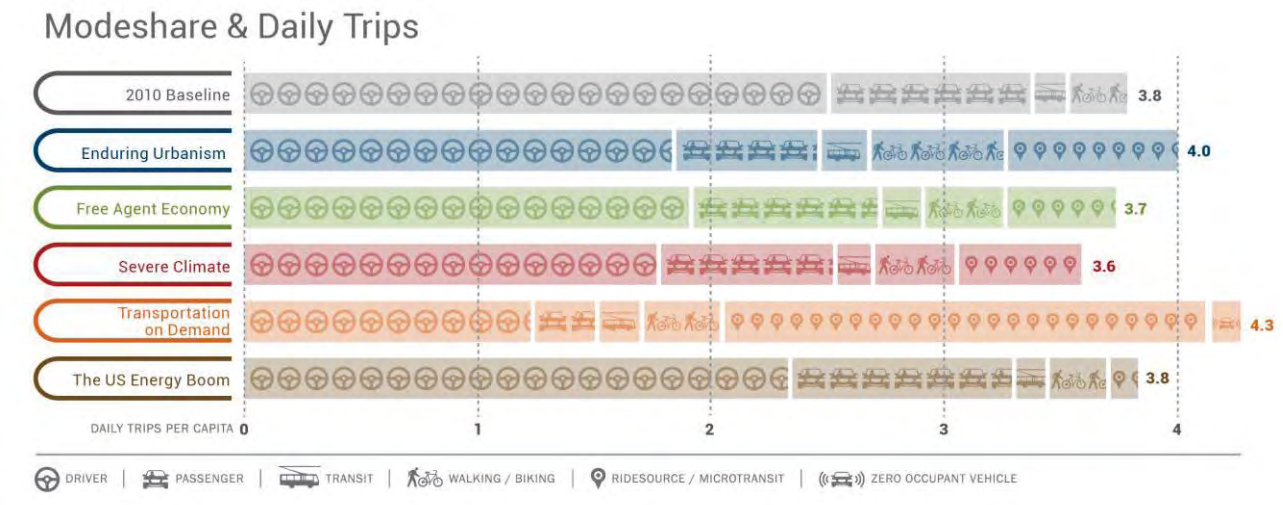
TABLE 4: GREATER PHILADELPHIA FUTURE FORCES WHAT-IF SCENARIO PROJECTIONS FOR 2045

Factor	2010 Baseline	Enduring Urbanism	The Free Agent Economy	Severe Climate	Transportation on Demand	The U.S. Energy Boom
Total Population (millions)	5.63	6.58	6.44	6.45	6.51	6.48
Total Adjusted Employment (millions)	3.06	3.46	3.43	3.40	3.44	3.52
Percentage of Population <16	19%	18%	18%	19%	19%	20%
Percentage of Population >65	13%	20%	20%	19%	20%	18%
Total Households (millions)	2.13	2.62	2.38	2.32	2.46	2.50
Population per Household	2.64	2.51	2.71	2.78	2.64	2.59
New Footprint Residential Acres Developed, 2010–2045	-	20,300	64,300	70,100	145,700	226,400
New Footprint Commercial Acres Developed, 2010–2045	-	25,900	52,700	59,000	62,700	95,500
Population in Centers	23%	25%	24%	23%	23%	20%
Employment in Centers	22%	23%	23%	23%	22%	21%
Annual Residential Energy GHG Emissions per Household (MTCO2E)	7.6	6.4	6.7	6.5	6.2	7.2
Average Annual Household Residential Energy Costsa	$2,210	$1,380	$1,500	$1,810	$1,410	$1,340
Vehicles per 1,000 Capita	573	518	576	565	395	627
Percentage Zero-Car Households	15%	26%	15%	15%	38%	13%
Daily VMT (millions)	107.0	116.1	114.1	109.5	146.4	139.2
Annual VMT per Capita	6,940	6,440	6,470	6,190	8,220	7,840

% VMT through Ride Sourcing/AVs	0%	16%	11%	14%	58%	3%
Average Vehicle Occupancy	1.3	1.6	1.6	1.6	1.8	1.4
Daily VHT (millions)	3.57	3.74	3.66	3.48	4.98	4.68
Average Daily Speed (mph)	30	31	31	32	29	30
Annual Recurring Vehicle Hours of Delay per Capita	22	22	20	21	31	30
Annual Fatal Crashes	326	186	194	176	196	225
Annual Injury Crashes	31,784	16,730	17,410	15,785	17,750	20,240
Daily Gallons of Gasoline (millions)	5.0	2.5	2.6	2.2	2.4	3.4
On-Road GHG Emissions, Tailpipe Only (Annual MTCO2E per Capita)	3.9	1.3	1.3	1.1	1.3	1.8
Daily Linked Transit Trips (millions)	0.8	1.4	1.2	1.2	1.3	0.9
Daily Walking and Biking Trips (millions)	1.5	3.8	2.3	2.3	2.3	1.7
Annual Household Transportation Costsa	$10,870	$14,260	$8,860	$17,530	$15,120	$10,490
Transportation Costs as a % of Income	15%	15%	10%	20%	16%	11%

[a]*In 2010 dollars.*
Source: DVRPC, 2015

FIGURE 18: DAILY TRIPS PER CAPITA AND MODE SHARE



Source: DVRPC, 2015

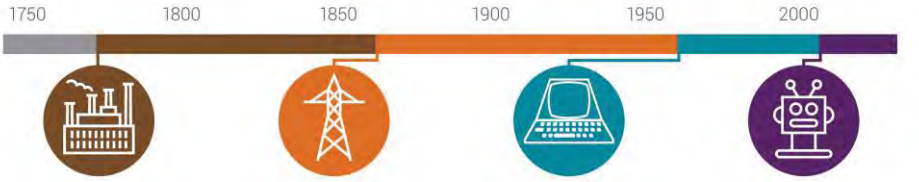
The report also recommends actions and workforce skills needed to better position the region to respond to these Future Forces. Those categorized as Universal Actions are beneficial regardless of whichever Future Force comes to fruition. Contingent Actions, on the other hand, are specific to each Future Forces scenario. Leading Indicators were also identified (see Appendix G), and can help determine if a force is occurring in the region, and can indicate whether those Contingent Actions are needed. As not all of the recommended actions can be implemented, the region must carefully weigh the costs and benefits of each, and prioritize the most critical for implementation. Both sets of recommendations are incorporated into *Connections 2045*.

NETWORKING TRANSPORTATION

Following the Future Forces work, a more in-depth investigation on the Transportation on Demand scenario was undertaken. This effort aims for a better understanding of how the Digital Revolution is reshaping transportation. The Digital Revolution is enabling Transportation on Demand through real-time communications technologies and is also responsible for some of the other Future Forces. By directly connecting buyers and sellers, cutting out the middleman; helping firms operate in a leaner manner; strengthening outsourcing; bolstering automation and robotics; and flattening transaction costs, the Digital Revolution is largely behind the rise of contract employees in the Free Agent Economy. Network effects are also an indirect way in which the Digital Revolution is driving Enduring Urbanism. In addition, digital technologies could help the region to more efficiently use resources and reduce GHG emissions in the fight against Severe Climate.

Thanks to the Digital Revolution, there is a unique opportunity right now to reimagine transportation and urban areas through increased information and connection to the Internet. Grasping how to do this and perceiving the implications of new technologies requires a better understanding of the Digital Revolution.

FIGURE 19: THE FOUR INDUSTRIAL REVOLUTIONS



	FIRST (1770s)	SECOND (1870s)	THIRD (1960s)	FOURTH (2010s)
Technology	Steam Power Mechanical Production	Electricity Mass Production	Electronics Computers Automated Production	Robotics & AI 3D Printing
Urban Form	Factories	Elevators Suburbanization	Globalization Internet & e-commerce	Internet of Things Networked Space
Transportation	Canals Railroads	Subways & Trolleys Cars, Buses, Trucks Airplanes	ITS Real-Time Transport Space Travel	CVs & HAVs UASs (Drones)

Adapted from World Economic Forum

The Digital Revolution

Source: DVRPC, 2017 (Adapted from World Economic Forum)

The initial phase of the Digital Revolution, which is also called the Third Industrial Revolution, introduced widespread use of electronics and computer technologies. Beyond Intelligent Transportation Systems (ITS) infrastructure, this phase did not have significant impacts on regional and local transportation until recently. TNCs, such as Uber and Lyft, use smartphones and real-time information to connect drivers and passengers for on-demand trip making. Between July and September 2016, Uber and Lyft were averaging 59,000 rides per day in the City of Philadelphia alone, according to *The Philadelphia Inquirer*[2]. TNCs are creating new options for how to get around while reducing the need for car ownership and parking. In addition to TNCs, smartphone apps and other sources of real-time information allow individuals to quickly and conveniently identify the best option that meets their specific needs in each circumstance.

The key technologies driving the Digital Revolution are computers, low-cost and readily available data storage, the Internet, digital devices that grant Internet-access from nearly anywhere, and sensors that gather enormous amounts of data and turn it into actionable information that enables remote actions. By enabling the easy transfer of huge quantities of data over vast distances, and providing for remote actions, the Digital Revolution has a flattening effect on distance. Networks are a key consideration in the digital world. They connect groups of people and things and lead to network effects (i.e., where the value of a given network increases exponentially with the number of interconnected people and things). Networks and their effects are spilling over into the real world, which is one of the reasons why there has been so much interest in urban redevelopment over the past decade.

The next phase of the Digital Revolution, often referred to as the Fourth Industrial Revolution, is just getting underway and will increase the use of robotics, machine learning, and artificial intelligence while blending together the biological, physical, and digital worlds. This process is rapidly, fundamentally, and profoundly reshaping many aspects of our economy and society. For transportation, this is likely to mean connected vehicles (CVs); highly automated vehicles (HAVs); and, potentially, automated unmanned aerial systems (UASs), or drones, which can pilot themselves. Other technologies, such as 3-D printers, the Internet of Things (IoT), and virtual communications, could further revolutionize our economic, urban, and transportation environments.

Networking Transportation also considers how the Digital Revolution is shifting transportation engineering perspectives, comparing traditional auto-oriented, planning-driven active transportation and the emerging digital transportation philosophies. While the auto-oriented philosophy has primarily guided transportation decision making over the past century, there is now a widely acknowledged realization that it is impossible to build your way out of congestion. New roads simply push development farther out and quickly fill up with traffic. The development patterns lead to sprawl and inefficient use of natural and man-made resources. More recently, planning has encouraged communities and transportation projects to incorporate more active transportation. This planning philosophy recognizes the key tie between development patterns and transportation demand, and focuses on building dense, mixed-use communities that shorten trip lengths and make transit, biking, and walking more feasible transportation solutions. The Digital Revolution is focusing on putting information in the hands of individuals, where they can find the mode and route that makes the best sense for each individual trip. This can benefit the individual through personalized trip making, whether based on modal preferences, costs, reduced environmental impacts, or some other factor; and benefits society by steering people away from congested facilities.

[2] http://www.philly.com/philly/business/transportation/Uber-and-Lyft-made-44-million-since-becoming-legal-in-Philadelphia.html

TABLE 5: DIFFERENT TRANSPORTATION ENGINEERING SYSTEMS

	Auto-Oriented	Active Transportation	Digital Transportation
Overall Goal	Increase mobility	Increase accessibility	Increase information
Land Use	Separation of uses	Mixed use, high density	Live/work where you want; recognition that size and density have network effects
Trip Priorities	High speed	Short trips, getting exercise	Customization, cost, reliability, use time other than for driving
Safety	Safe mobility	Vision Zero	Connected technologies, warning systems, feedback loops, and data enhance safety
Key Metrics	Level-of-service, vehicle hours of delay, travel-time index/savings	Bike/Ped level of service, trip length, total travel time, VMT, GHG emissions, transit trips	Real-time data, person throughput, wait time, personal ratings, Big Data and analytics
Investment Priorities	New and wider roads	Connections between modes; walking, biking, and transit facilities	Multimodal Smart Roads that increase safety and efficiency
Rationale for Investment	Fight congestion; reduce delay	Build livable communities; sustainability; improve health	Create an integrated, multimodal network, profit (private market)

Source: DVRPC 2016. Adapted from Ian Lockwood, "Livable Traffic Engineering," CNU Orlando, video published November 17, 2012, https://www.youtube.com/watch?v=o7lXblXNOPk (accessed June 4, 2015).

CHAPTER 3: # PLANNING FOR THE FUTURE

THE VISION FOR THE FUTURE

A central purpose of the Plan is to outline a future vision for the region. This forms a basis for defining goals and strategies to achieve a desired future. The vision is based on identifying and analyzing recent and historic trends, as well as future forecasts and forces, and collectively discussing which trends and forecasts the region aims to bolster or alter. Trends provide a view of what we expect to happen if current events continue unabated, though the Future Forces work highlighted that many trends are now nonlinear. The Plan sets out a vision of what the region can attain, which in some instances is different from the trend-based projections. For instance, the Plan promotes additional growth in the region's developed communities and less growth in rural areas relative to the official 2045 population and employment forecasts.

The vision was based on a review of trends, forecasts, and forces, as well as the public outreach efforts conducted for *Connections 2045*. DVRPC held a series of workshops in the spring of 2016 and presented the Future Forces scenarios. Based on the ensuing discussionS, DVRPC staff posed a series of questions to attendees on what they would prefer the region to look like in 2045. These results were augmented by outreach to additional stakeholders, as well as by an online survey. Responses from the outreach efforts were captured and organized into various topics, and the following vision statement captures the views with the greatest support.

FIGURE 20: VISION WORD CLOUD

Between now and 2045, Greater Philadelphia will:

- Sustain **natural resources** through the preservation of open space, better stormwater management, and improved air and water quality. Climate change will be addressed through mitigation and resiliency strategies, energy will be cleaner, and the region will be more energy efficient.

- Focus future development in vibrant, healthy, mixed-use **livable communities** with walkable main streets and downtowns that provide access to green space, live/work opportunities, and a variety of affordable housing options.

- Diversify and expand the **economy**, making it more competitive on the global stage with increased employment opportunities, business retention, entrepreneurialism, advanced manufacturing, and expansion of the region's tech sector. Higher education institutions will be incubators of new technologies and business opportunities.

- Be more **equitable** with a reduction in poverty, increased economic mobility, and racially and socioeconomically integrated communities. Give all children in the region, no matter where they live, access to good schools and an education that prepares them for the jobs of the future.

- Have a well-maintained, integrated multimodal **transportation** network that provides accessibility, reduces congestion and auto-dependence, incorporates new technologies, and moves the region toward zero roadway deaths.

Two other areas that stand out in the vision discussions were the need to increase regional cooperation and government efficiency. These are seen as key strategies to achieving the vision and would mean more transparency and openness, innovation and sustainable practices, collaboration between business and government, and use of data and metrics, with a fairer and more equitable tax structure that will spur regional growth.

Connections 2045 is developed around five core principles that help achieve the vision for the future.

- **Sustain the Environment;**
- **Develop Livable Communities;**
- **Expand the Economy;**
- **Advance Equity and Foster Diversity; and**
- **Create an Integrated, Multimodal Transportation Network.**

The five core principles are each related to the five major topics considered in the Plan: the environment, communities, economic competitiveness, equity, and transportation. Each core principle is outlined in the following pages, and each section contains pertinent issues and challenges related to the principle, as well as a set of goals and strategies to implement the principle. Since the principles are holistic and interrelated, strategies frequently pertain to multiple principles. For the sake of conciseness, though, they are only listed once under a single principle in the Plan.

PRINCIPLE: SUSTAIN THE ENVIRONMENT

Open space, natural areas, farmland, and historic resources are indispensable to our region and its residents. However, many of these resources are threatened by development. *Connections 2045* recognizes that the continued loss of these resources is not sustainable, and the need to accelerate and coordinate growth management and resource protection activities is urgent.

Between 1970 and 2015, 375,500 acres of farms, fields, and forests were lost to development, an average of 22 acres each and every day for 45 years. A continued improvement in the economy would likely increase the rate of development absent other policies to protect open space. The continued disappearance of undeveloped land has serious consequences for air and water quality, agricultural productivity and the farm economy, wildlife habitat, opportunities for recreation and healthy lifestyles, and our region's character and quality of life.

DVRPC'S GROWTH MANAGEMENT AND RESOURCE PROTECTION PLANNING PHILOSOPHY

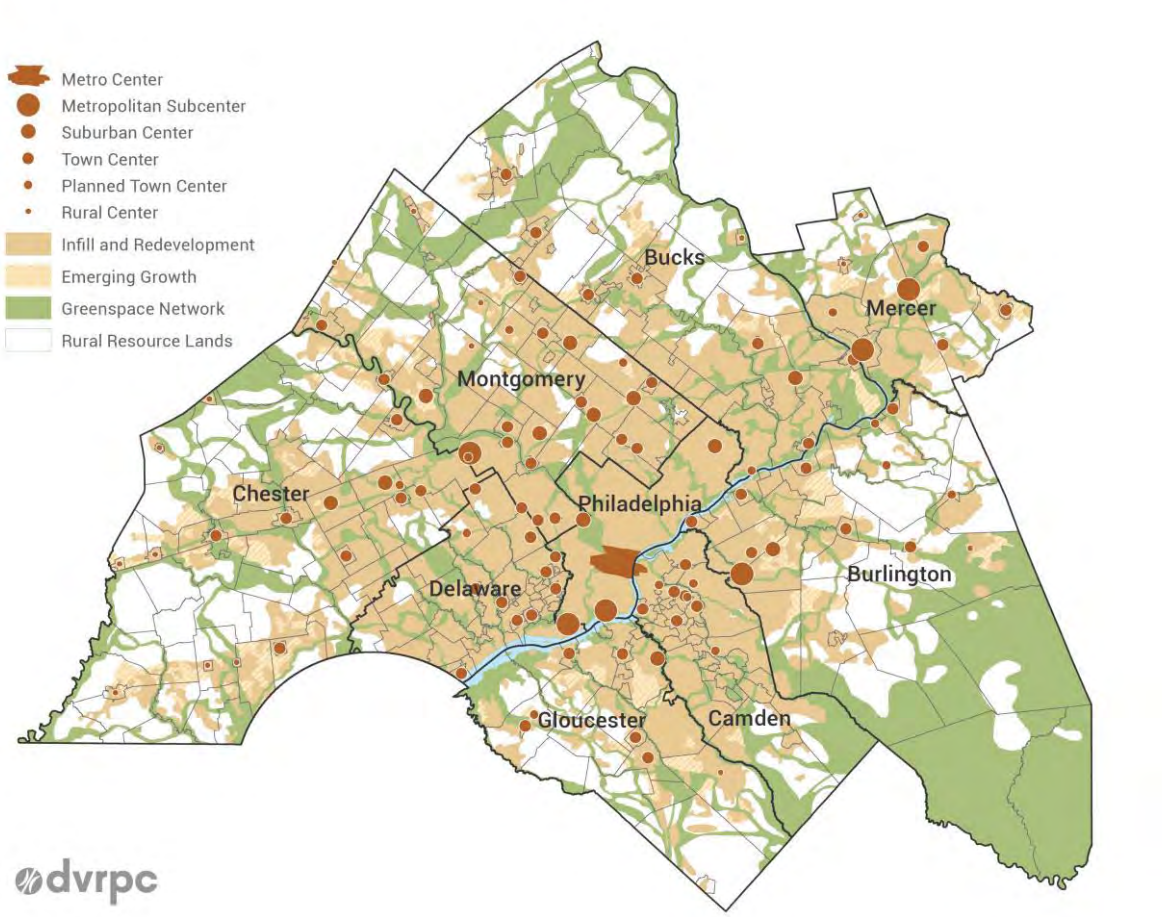
- Land use, growth, and resource protection must be integrated in a comprehensive, cooperative, continuing, and coordinated process.
- The regional Land Use Vision will support the goals and policies of the DVRPC long-range plan.
- Growth should be encouraged in areas of existing development as Infill and Redevelopment, and discouraged in agricultural, natural, and rural areas.

LAND USE VISION

The *Connections 2045* Land Use Vision defines a regional visualization for Centers-based development and the preservation of agricultural and natural lands. The Land Use Vision divides the entire region up into four layers: Infill and Redevelopment areas, Emerging Growth areas, Rural Resource Lands, and the Greenspace Network. Overlaid on these land use areas are over 100 "Centers," which are points of more concentrated development around which new development should be focused. The overall goal of the Land Use Vision is to create a clean and sustainable environment, where key natural resource areas and agricultural lands are protected, open space is provided in an interconnected network, and most new growth is concentrated around identified Centers and as Infill and Redevelopment in areas previously developed.

Of the 2.4 million acres in the region, the Plan proposes that at least one million acres are permanently preserved for natural resource protection, farmland preservation, outdoor recreation, and shaping and differentiating the region's communities. These lands should be strategically located in the Greenspace Network and Rural Resource lands to protect environmentally sensitive areas, create interconnected networks of forests and riparian corridors, and preserve key agricultural landscapes. This open space system will enhance ecosystem health, improve water quality, provide abundant recreational opportunities, and strengthen the region's agricultural economy. With just under 600,000 acres of protected lands in the region to date, the region is over halfway toward meeting this goal.

FIGURE 21: LAND USE VISION



GREENSPACE NETWORK

The Plan proposes linking and expanding the region's existing protected natural areas into a Greenspace Network, where parks, forests, meadows, stream corridors, and floodplains are joined together in an interconnected system. The Greenspace Network is based on the twin principles of protecting core natural resource areas and linking them with greenways to create a connected system of naturally vegetated open space spanning urban, suburban, and rural areas.

The vision of the Greenspace Network is to permanently protect currently unprotected acres in the system through acquisitions, easements, and land use regulations. The network is broken down into approximately 100 distinct corridors. Each corridor is named to promote its identity and brand it as a unique preservation project.

The Greenspace Network reflects numerous regional high-priority environmental goals, including the need to maintain and improve surface water quality and protect large, intact ecosystems. As the region continues to experience the impacts of climate change in the form of more extreme heat and bouts of intense rainfall, the Greenspace Network will help to minimize the damage to life and property caused by flooding, as well as reduce the impacts of extreme heat through vegetative cooling.

The Greenspace Network is also a blueprint for creating a system of landscape-scale green infrastructure that extends into the region's urban and suburban core. Bringing green corridors into urban landscapes and connecting them back out to larger natural areas makes denser communities more attractive and appealing places to live, work, and play; boosts property values; and encourages increased investment in our towns and cities.

FIGURE 22: GREENSPACE NETWORK

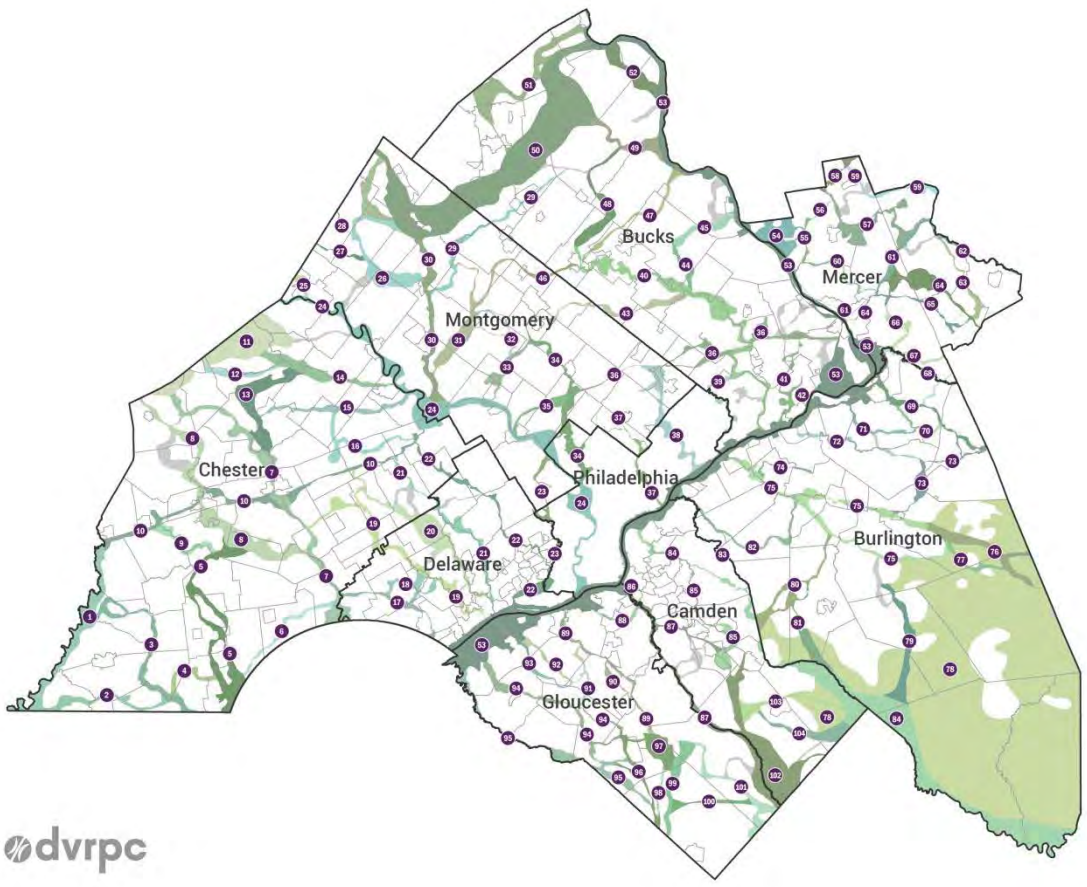


TABLE 6: GREENSPACE NETWORK CORRIDORS

Map ID	Corridor Name	Map ID	Corridor Name
1	Octoraro Creek	53	Delaware River
2	Serpentine Barrens	54	Washington Crossing
3	Big Elk Creek	55	Jacobs Creek
4	White Clay-Ways Run	56	Pennington Mountain
5	White Clay Creek-Doe Run	57	Stony Brook
6	Delaware Arc	58	North Hopewell
7	Brandywine Creek	59	North Mercer

8	West Branch Brandywine Creek	60	Shabakunk-Ewing
9	Buck Run	61	Delaware and Raritan Canal
10	Great Valley Ridgelines	62	Millstone River
11	Big Wood Corridor	63	Big Bear Brook
12	Warwick-Elverson	64	Assunpink Creek
13	Marsh Creek-Beaver Run	65	Miry Run
14	French Creek	66	Pond Run-Back Creek
15	Pickering Creek	67	Doctors Creek
16	Valley Creek-Pigeon Run	68	Crosswicks Creek
17	Harvey Run-Naaman's Creek	69	Blacks Creek
18	West Branch Chester Creek	70	Bacons Run
19	Chester Creek	71	Crafts Creek
20	Ridley Creek	72	Assicunk Creek - Annaricken Brook
21	Crum Creek	73	Budd Run-North Run
22	Darby Creek	74	Mill Creek
23	Cobbs-Mill Creek	75	Rancocas Creek
24	Schuylkill River	76	Mount Misery
25	Manatawny Creek	77	Bishpams Mill Creek
26	Swamp-Deep Creek	78	Pinelands Conservation Areas
27	Minister Creek	79	Batsto-Friendship
28	Middle Creek	80	Southwest Branch Rancocas Creek
29	East Branch Perkiomen Creek	81	Haynes Creek
30	Perkiomen Creek	82	Pennsauken-Masons
31	Skippack Creek	83	South Pennsauken Creek
32	Towamencin Creek	84	River to Bay
33	Stony Creek	85	Cooper River
34	Wissahickon Creek	86	Little Timber
35	Plymouth Meeting	87	Big Timber
36	Cross County Corridor	88	Woodbury Creek
37	Tacony-Cresheim Creek	89	Mantua Creek
37	Tacony-Cresheim Creek	90	Chestnut Branch
38	Pennypack Creek	91	Edwards Run
39	Poquessing Creek	92	Repaupo Creek
40	Neshaminy Creek	93	Pargey Creek
41	Mill-Queen Anne Creek	94	Raccoon Creek

43	Little Neshaminy Creek	95	Oldmans-Reed
44	Mill Creek	96	Still Run (Maurice River)
45	New Hope-Ivyland	97	Glassboro Wildlife Management Area
46	West Branch Neshaminy	98	Little Ease Run
47	Paunnacussing-Pine Run	99	Scotland Run
48	Peace Valley-Deep Run Creek	100	Indian-Faraway
49	Tohickon Creek	101	Hospitality Branch
50	North Woods	102	Great Egg Harbor River
51	Quakertown-Cooks Creek	103	Sleeper Branch
52	Tinicum-Nockamixon	104	Pump Branch
53	Delaware River		

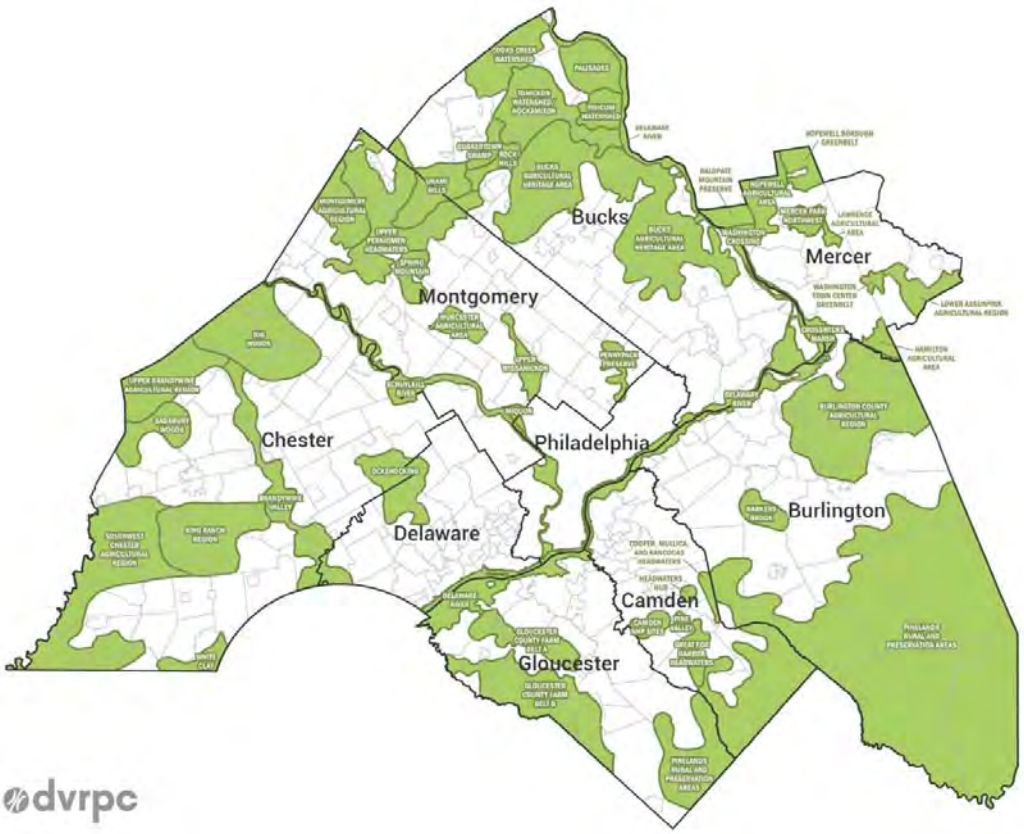
RURAL RESOURCE LANDS AND CONSERVATION FOCUS AREAS

Rural Resource Lands depict agricultural, natural, and rural areas worthy of heightened preservation efforts by governments and nonprofit land trusts. These lands contain villages and scattered low-density development, but they remain mostly agricultural and rural in character. Their integrity should be maintained through strategic acquisitions and easements, land use regulations, good stewardship, and appropriate forms of growth. Rural Resource Lands are not “no-growth zones” but instead are areas whose values can be protected while allowing for limited growth that is in character with the local context.

Rural Resource Lands comprise all of the region’s significant remaining agricultural landscapes. Protecting these resources is not only critical to maintaining the rural character of our region, but also to maintaining the region’s agricultural economy. While farming has always been a dominant economic sector in Greater Philadelphia, it has taken on new importance in recent years with the growing emphasis on eating locally produced food. The advantages of locally produced food are many, including improved health, better food quality, and lower outlays of energy and materials for processing and transportation. Our region also has some of the most highly productive, fertile soils in the Northeast. These soils provide the region with a unique competitive advantage that is lost when farmland is converted to housing or other developed uses.

For planning purposes, the region’s natural and rural areas have been divided up and branded as Conservation Focus Areas. Examples include the Hopewell Big Woods and the King Ranch Region which both cross Chester County; the Unami Hills in Bucks County; and the New Jersey Pinelands, touching Burlington, Camden, and Gloucester counties. The Conservation Focus Areas can be either agricultural or natural in character and comprise both Rural Resource Lands and portions of the Greenspace Network. Preserving unprotected open space and making sure that any new development is context sensitive are key policy recommendations for the Conservation Focus Areas.

FIGURE 23: CONSERVATION FOCUS AREAS



Sustaining the Environment will provide the following benefits:

- Limit the need for additional water, wastewater, and transportation infrastructure, which is becoming increasingly difficult to finance, build, and maintain.
- Preserve natural features, including important habitat areas, woodlands, stream buffers, and wetlands. These features maintain water quality, reduce flooding, recharge groundwater, improve air quality, strengthen biodiversity, enhance personal health, and beautify the region.
- Decrease dependence on the automobile for personal mobility, leading to lower levels of air pollution, less dependence on fossil fuel energy, and fewer GHG emissions.
- Preserved farmland will strengthen the local agricultural industry, enhancing local food production at a time when demand for local food is increasing.
- Prevent expansion of suburban development into rural communities to preserve agricultural character and heritage.
- Protect the context and integrity of historic sites and cultural landscapes that make the Greater Philadelphia region unique.
- Provide an exceptional source of outdoor recreation opportunities that delivers entertainment and increases well-being.

GOAL: PRESERVE OPEN SPACE

Over the last 50 years, Greater Philadelphia's farms, fields, and natural areas have been vanishing, while the amount of developed land has steadily increased. This trend is largely the result of sprawling land use patterns, not population growth. This land consumption pattern has negative consequences for the environment, the transportation system, and the competitiveness of the regional economy.

The loss of healthy forested headwaters, riparian buffers, and naturally functioning floodplains increases stormwater runoff, degrades water quality, fragments natural habitats, decreases biodiversity, and makes natural areas more susceptible to invasive plants and pests. Fragmented and diminished natural resources are also more susceptible to further degradation from the impacts of climate change.

The consequences for local communities are costly: increased flooding; higher costs for clean drinking water; decreases in soil productivity, nutrient cycling, and carbon storage; and reduced property values. Farmland loss threatens the viability of the agricultural industry and reduces the availability of local food at a time when the demand for local food is experiencing double-digit growth. Finally, and perhaps most noticeably, unmanaged growth and the loss of open space strain the region's transportation infrastructure, diminish community character, and limit opportunities for personal interaction with nature and green spaces.

Reversing the current land consumption trend will require the use of growth management and open space preservation techniques. Strategic land preservation, market-based conservation, smart growth, and enhanced community design will be needed to manage growth and protect open space.

Strategies to Preserve Open Space:

- Preserve and protect undeveloped lands through acquisitions; market-based programs such as donated conservation easements, Transfer of Development Rights (TDRs), and purchase of development rights (PDRs); regulatory tools and techniques; and promotion of good stewardship.
- Enact and implement local open space funding programs.
- Promote Infill and Redevelopment in Centers and existing developed areas.
- Promote compact, Centers-based development through smart growth tools and techniques, such as transit-oriented development (TOD), traditional neighborhood design (TND), designating official growth areas, and enhanced community design.
- For new residential projects in Rural Areas, encourage or require TDR programs, conservation subdivision design, and/or TND.

GOAL: MANAGE STORMWATER AND IMPROVE WATER QUALITY

Open space loss and development have a detrimental effect on water quality. Nonpoint source pollution is generated by stormwater runoff from streets, parking lots, driveways, buildings, lawns, and agricultural fields that lack adequate vegetative buffers. Examples of nonpoint source pollutants contained in runoff include excess fertilizers and nutrients, herbicides and insecticides, oil, grease, rubber, salt, sediments, and heavy metals.

Increased stormwater runoff volumes also degrade stream channels and cause erosion, leading to further sedimentation and pollution. As an area becomes developed, stormwater is rapidly directed to streams from

impervious surfaces, enlarging channels, eroding stream banks, lowering dry weather flows, raising temperatures, and decreasing the diversity of aquatic life.

Conversion of land from natural to developed uses is the greatest contributor to increases in nonpoint source pollution problems over time. Accordingly, protection of natural and forested areas is the most important technique for maintaining water quality at the regional scale over time. However, since much of the region is already developed and some additional development is inevitable, it is important to effectively manage stormwater and improve water quality in urban and suburban settings.

Techniques to manage stormwater in developed landscapes include the protection or restoration of wooded riparian buffers, which are strips of forest along the banks of streams. Even a relatively narrow riparian buffer of 50 feet can generate significant improvements in stream health over a riparian zone covered with buildings, pavement, or grass. Buffers of 150 feet or more are generally optimal along permanent streams. Another key technique is stream restoration, where eroded and gullied streams are reconnected to their natural floodplains through regrading and reconstruction of the stream channel. This technique diminishes the erosive force of high-velocity floodwaters. Finally, green stormwater infrastructure—consisting of a variety of approaches to infiltrate stormwater directly into the ground close to where it falls—can be integrated into urban settings at various scales, from small 50-square-foot stormwater planters along a sidewalk to large, formerly grassy park areas converted to warm-season meadows.

Strategies to Manage Stormwater and Improve Water Quality:

- Protect and restore vegetated riparian buffers, maintain naturally functioning floodplains, and preserve wetland buffers to manage stormwater and improve water quality.
- Enact and enforce local ordinances to protect water quality, control stormwater, and control development in floodplains.
- Promote the use of green stormwater infrastructure, such as rain gardens, bioswales, infiltrations strips, tree trenches, conservation landscaping, green roofs, and naturalized retention basins to infiltrate stormwater, reduce flows, and improve water quality.
- Reduce impervious coverage by requiring maximum impervious coverage zoning standards; reducing parking surface through shared parking, institute parking maximum standards, and use of on-street parking; and right-sizing road widths.

GOAL: PROMOTE GREEN STORMWATER INFRASTRUCTURE

Rain gardens, bioswales, green roofs, street trees, urban woodlots, riparian buffers, and other types of naturally vegetated systems are all types of green stormwater infrastructure (GSI). While GSI practices go by many names, they are all simply techniques to soak stormwater directly into the ground where it can be stored and used by vegetation and trees, as opposed to running off directly into rivers and streams.

Connections 2045 promotes using GSI throughout the region's Developed Communities. GSI performs valuable functions, like improving air quality, absorbing stormwater, and greening the community. Green stormwater infrastructure can also replace some types of gray infrastructure, such as underground stormwater pipes. And unlike gray infrastructure, green stormwater infrastructure beautifies a community, boosts property values, and promotes livability.

In natural areas, such as forests, most rainfall soaks into the ground, where it is used by trees and other vegetation or is filtered through the soil to become groundwater. Only a small amount actually runs off land surfaces into waterways.

In urban and built-up suburban areas, rooftops, streets, sidewalks, parking lots, and even compacted soils associated with lawns prevent rainwater from soaking into the ground. Instead, water that drains off these impervious surfaces is carried by drains and pipes quickly to rivers and streams. This stormwater runoff leads to nonpoint source pollution, sedimentation, and the erosion of stream channels, all of which impair water quality and degrade stream health.

GSI mimics what occurs in natural systems by capturing rainwater runoff near where it falls and soaking it into the ground. GSI relies heavily on infiltration into the soil and evapotranspiration from vegetation to clean, store, and absorb stormwater. In addition to vegetation, GSI often utilizes subsurface engineering, like small underground storage chambers, to hold and store stormwater so that it can be taken up by vegetation over time. This management approach helps to reduce pollution, volume, erosion, and flooding in local waterways.

GSI systems provide numerous environmental, economic, and social co-benefits beyond just managing rainfall and runoff. Vegetated GSI systems improve air quality by filtering and removing pollutants from vehicles and industrial sources; they ameliorate the urban heat island by providing shade and facilitating evapotranspiration, create wildlife habitat to expand species diversity, and help communities save money by reducing the need to upgrade gray infrastructure. Finally, GSI systems can enhance parks, streets, sidewalks, public spaces, and parking lots with shade trees, attractive rain gardens, bioswales, and curb bump-outs in an otherwise sterile urban landscape.

For example, many schools, particularly in urban areas of the region, are surrounded by concrete and asphalt. Greening these areas with trees and vegetated GSI can reduce the heat island effect, filter air and water pollution, reduce stormwater runoff, improve recreational opportunities, and create more positive spaces in environments that are critical for the development of children.

Street Trees and Urban Tree Canopy

Whether part of a sophisticated, engineered GSI-approach, or simply planted into the soil along a public right-of-way, street trees are one of the oldest and most effective forms of GSI in an urban environment. While the term “GSI” may be new, street trees have been an important form of urban “greening” since the first cities were built. Recent studies from the University of Pennsylvania show that each year, a single large shade tree can absorb 90 pounds of CO_2 and 10 pounds of air pollution, including four pounds of ozone and three pounds of particulates. One hundred mature tree crowns intercept approximately 100,000 gallons of rainfall per year. Translated into dollars, a single street tree produces $90,000 of direct benefits, such as stormwater retention and air quality improvements, over its lifetime. At the same time, planting a tree within 50 feet of a house can increase the house’s value by 9 percent.

American Forests recommends the following generalized tree canopy targets for built-up areas:

- 50 percent tree canopy in suburban residential;
- 25 percent tree canopy in urban residential; and
- 15 percent tree canopy in central business districts.

Methods to achieve these goals include developing strategies to plant trees in suitable spaces, such as vacant lots, parks, and riparian areas; requiring trees in redevelopment and new development projects; and maintaining existing trees. Tree protection ordinances, tree inventories, and street tree commissions can help communities achieve their goals.

Strategies to Promote Green Stormwater Infrastructure

- Promote the planting and stewardship of shade trees in urban and suburban areas.
- Incorporate green street elements, such as bioswales, curb bump-outs, and tree trenches, when new streets are constructed and when existing streets are upgraded.
- Encourage school districts to undertake schoolyard greening initiatives by working with nonprofits, civic associations, parent-teacher associations, and municipal officials.
- Integrate green stormwater infrastructure, such as shade trees, rain gardens, riparian buffers, green roofs, and other forms of bio-infiltration, into development and redevelopment projects.

GOAL: REDUCE GHG EMISSIONS

Severe weather events and changes to our climate due to global warming pose threats to both the environment and the economy. Global warming is largely due to rising levels of GHGs in the atmosphere. In December 2015, 195 countries, including the United States, adopted the Paris Agreement, the first ever global, legally binding agreement to act on climate change.[3] This agreement establishes a long-term goal of keeping the increase in global temperature to below 2°C (about 4°F). Keeping global temperature change below this threshold is expected to keep the global climate system stable enough to continue to support human civilization without radical changes to agricultural, transportation, and other systems. Under the Paris Agreement the United States set an economy-wide target to reduce net GHG emissions 26 to 28 percent below 2005 levels by 2025.[4]

DVRPC's *Regional Greenhouse Gas Emissions and Energy Use Inventory* estimated that in 2010, the region produced GHGs equivalent to 81.6 million metric tons of CO_2. This was roughly 1.2 percent of the United States' total 2010 GHG emissions, and about equal to the emissions in Austria, which had a population about twice that of the DVRPC region.

The primary source of regional GHG emissions is the burning of fossil fuels (primarily gasoline, natural gas, and heating oil) to produce energy. This burning takes place in furnaces and boilers used to heat buildings; inside vehicle engines to move our cars, trucks, and buses; in industrial operations; and at electrical generating plants to produce the steam that spins generators. Other sources of GHG emissions include methane from agriculture and natural gas system leakages, emissions from oil refining, some industrial processes, and clearing land for buildings and roads.

[3] On June 1, 2017, U.S. President Donald Trump announced that the United States would cease all participation in the 2015 Paris Agreement. In accordance with Article 28 of the Paris Agreement, the earliest possible effective withdrawal date by the United States cannot be before November 4, 2020, one day after the 2020 U.S. presidential election. Until the withdrawal takes effect, the United States may be obligated to maintain its commitments under the agreement, including the requirement to continue reporting its emissions to the United Nations.

[4] Shortly after Trump's announcement, the governors of a number of U.S. states formed the United States Climate Alliance to continue to advance the objectives of the Paris Agreement despite the federal withdrawal, with similar sentiments also being expressed by other state governors, mayors, and businesses.

The data needed to complete DVRPC's 2015 Inventory is not yet fully available. However, preliminary results based on electricity and natural gas utility data, as well as highway transportation data, indicate that GHG emissions from these sources are about 7 percent lower in 2015 than they were in 2010. Lower emissions from electricity generation—more than 20 percent over this period—driven largely by the continued shift from coal to natural gas, as well as a 6 percent decrease in electricity demand, were responsible for the bulk of this reduction. In addition, solar photovoltaic and wind together doubled their share of electricity generation in the region, increasing from 0.7 percent in 2010 to 1.5 percent in 2015. While this remains a small share of generation, its share is increasing at a faster pace than even natural gas. Moreover, solar and wind have achieved price parity with fossil fuels for energy production.

DVRPC's *Connections 2040* Plan set a target of reducing regional 2005 GHG emissions by 60 percent by the year 2040: a goal in accord with the City of Philadelphia's stated goal of an 80 percent reduction in GHG emissions by 2050. The preliminary data for 2015 indicates that the emissions are headed in the right direction, but the pace of reductions needs to be accelerated to achieve these targets.

The long-term regional goal is challenging for an economy that is highly dependent on fossil fuels for its energy. Achieving it will be possible only with significant, coordinated action at the household, firm, community, regional, state, national, and global levels. Achieving the regional goal will also require substantial advances in technologies that produce and use energy. Meeting this challenge requires a commitment across all levels of governance, all economic sectors, and throughout society to convert from fossil fuels to low- to no-carbon energy sources.

In addition to lowered GHG emissions, reduced burning of fossil fuels means cleaner air and improved public health (asthma and other respiratory diseases are exacerbated by air pollution). Retrofitting buildings to be more energy efficient creates local jobs. A regional electricity supply transformed to solar energy—while extremely challenging—has the potential to be more resilient and less susceptible to disruption of fossil fuel supply.

Maintaining and enhancing forests and soils that store carbon is also important. For example, in addition to being a place of beauty and providing critical habitat, the trees located in the Hopewell Big Woods, a 73,000-acre, mostly intact forestland on the border of Chester and Berks counties, stores close to three million tons of carbon valued at over $60 million[5]

Regional land use, housing, and business development patterns will also shape energy use and GHG emissions in the coming decades. As Figure 24 illustrates, those municipalities with walkable, mixed-use neighborhoods; near transit infrastructure; and with smaller houses, use less energy and produce lower GHG emissions per person plus employment. DVRPC's transportation and land use planning policies, priorities, and projects are all aligned to advance these goals. However, it must be emphasized that the impacts of GHG emissions are spread globally. Thus, reductions in the region alone will have little to no impact on the future course of climate change in Greater Philadelphia. Global action is required.

[5] *Return on Environment*, DVRPC 2011 http://www.dvrpc.org/reports/11033A.pdf

FIGURE 24: GHG EMISSIONS PER CAPITA BY MUNICIPALITY*

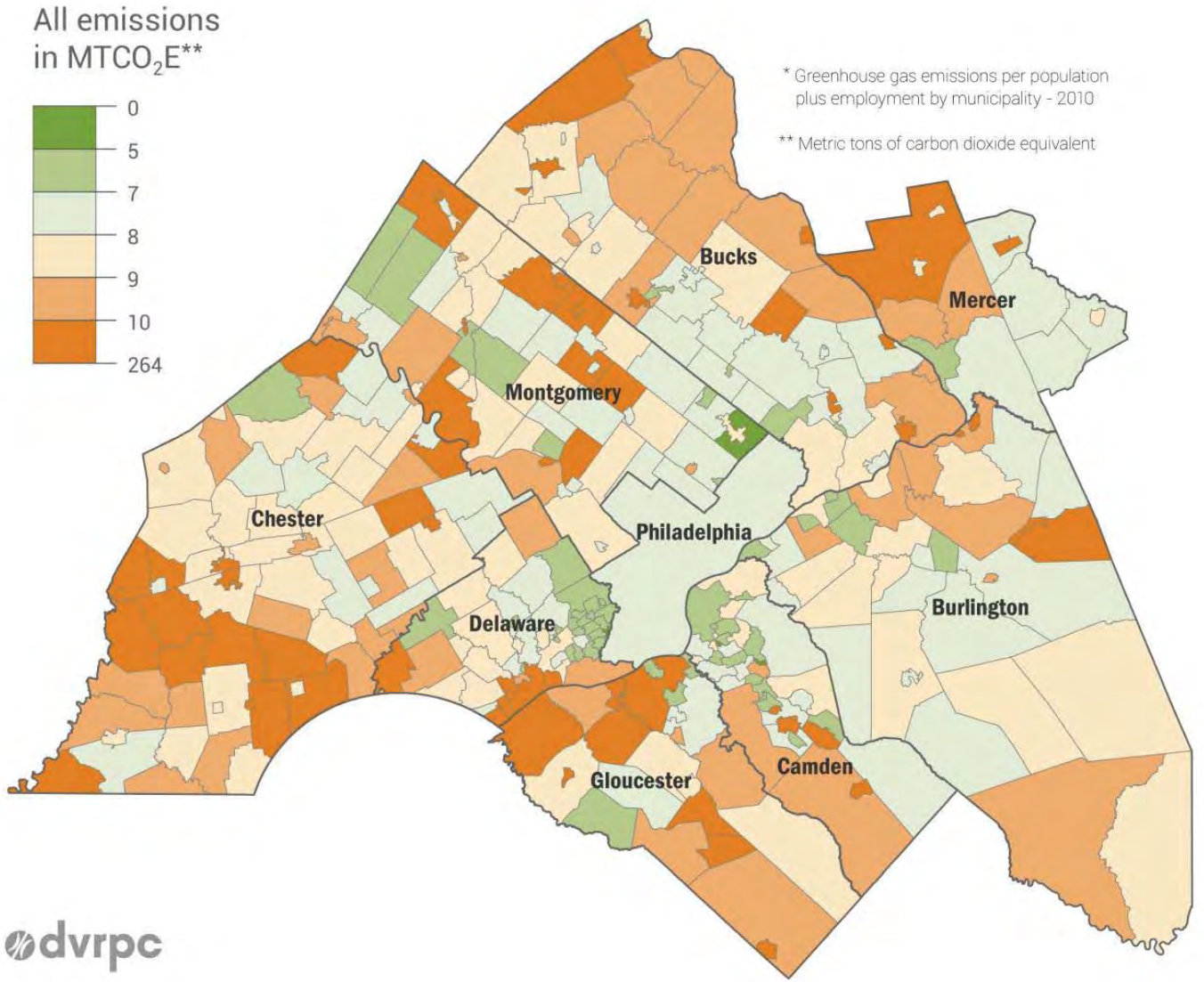


FIGURE 25: GHG EMISSIONS BY SECTOR (2010)

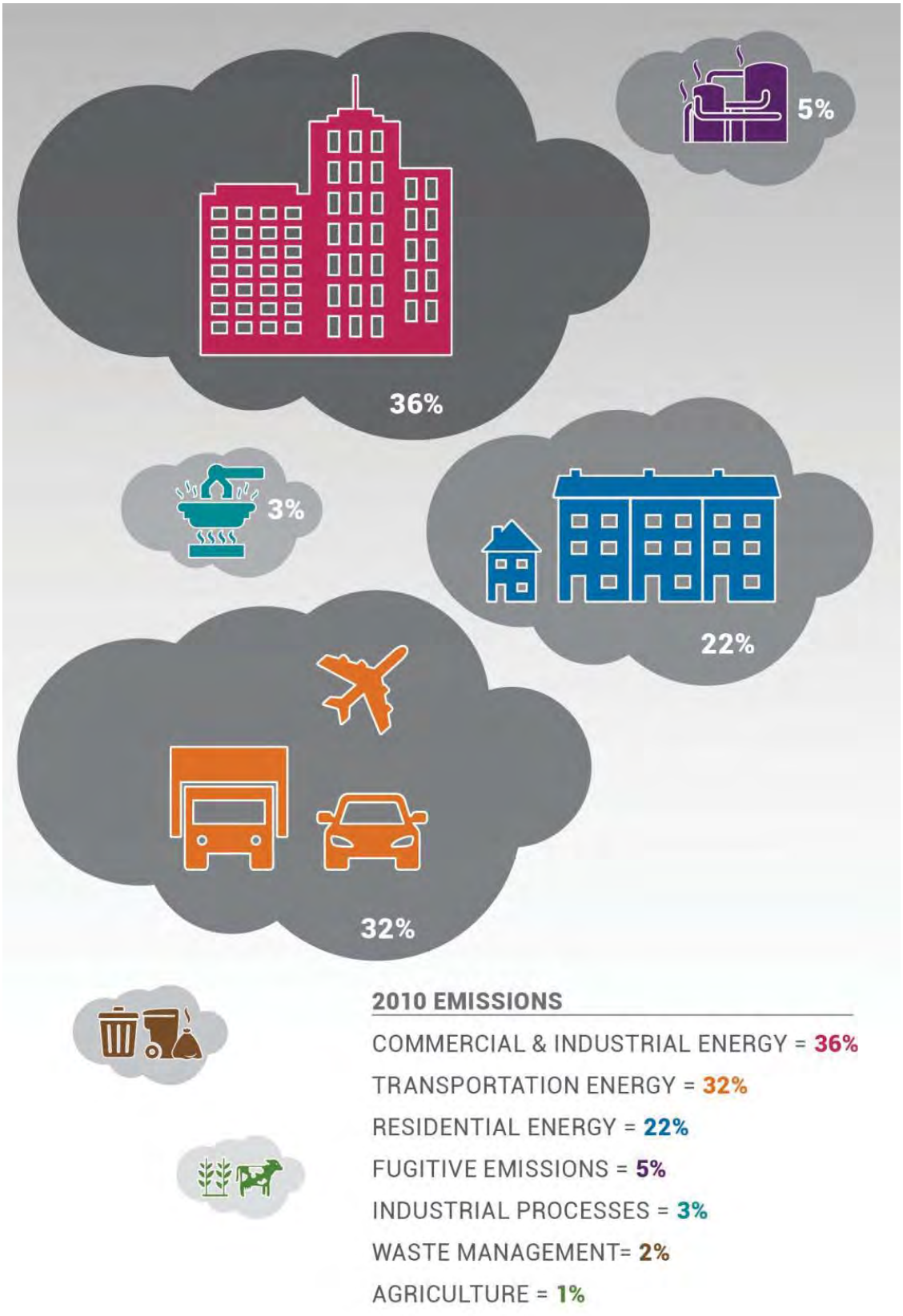
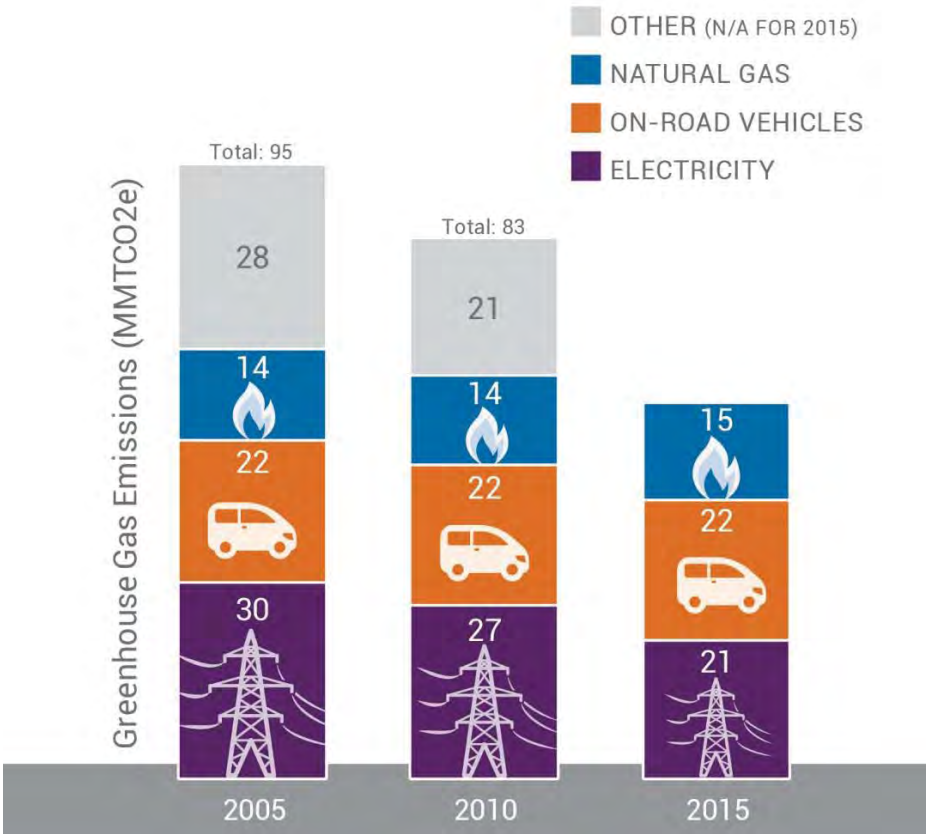


FIGURE 26: REGIONAL GHG EMISSIONS BY YEAR



***Note**: "Electricity" and "natural gas" include emissions resulting from the use of electricity and the combustion of natural gas sold by the region's utilities. "On-road vehicles" includes fossil fuels consumed by motorized vehicles operating on the region's roads. "Other" refers to all other sources of emissions. Estimates for these other sources are available for 2005 and 2010, and are currently under development for 2015. "Total" refers to gross GHG emissions and does not account for GHG sequestration in the region's trees and forests.*

Source: DVRPC, 2017

Strategies to Reduce GHG Emissions

- Support the production of energy with less CO_2 by helping municipalities draft and adopt ordinances to ensure that clean energy production, such as solar photovoltaics, is encouraged in a manner compatible with existing land uses.
- Promote initiatives that improve regional air quality; most initiatives to do so will also reduce GHG emissions.
- Promote energy efficiency in buildings and outdoor lighting.
- Reduce the demand for transportation energy by locating jobs, housing, and services closer together and encouraging denser development.
- Support low-energy transportation: walking, cycling, and transit.
- Support the uptake of plug-in electric vehicles.
- Maintain healthy forest lands by encouraging development in existing Centers.
- Promote planting of additional trees and plants appropriate for a changing climate.

GOAL: PREPARE COMMUNITIES FOR THE IMPACTS OF CLIMATE CHANGE

Despite global efforts to reduce GHG emissions, atmospheric levels continue to rise. This trend has fueled a pattern of rising global temperatures, leading to continued climate change. The amount and rate of climate change that will take place over the remainder of this century and into the next depends on the success or failure of global efforts to reduce GHG emissions. Lower emissions ensure less severe long-term impacts; higher emissions ensure an increasingly untenable future.

However, even the most concerted global action to reduce emissions will have little impact on the climate change that will take place over the course of this 28-year plan. The climate the region experiences today will shift, exposing the region and its residents to new dangers and heightened risks. According to the U.S. Environmental Protection Agency (U.S. EPA), our region can expect increased episodes of extreme heat, more intense precipitation events, sea level rise, and amplified severity of storms in the coming decades. These changes are likely to amplify coastal, riverine, and other inland flooding; harm coastal and inland ecosystems; disrupt fishing and farming; and increase risks to human health.

Climate change poses new threats and exacerbates existing hazards for communities throughout Greater Philadelphia. Yesterday's climate no longer provides a reliable guide for planning for the future. Fortunately, adapting to climate change builds on ongoing regional initiatives like green infrastructure planning and implementation, smart growth initiatives, floodplain management, ecological restoration, asset management, and efforts to reduce the heat island effect. All of these efforts help communities become more resilient to the impacts of climate change.

Strategies to Prepare Communities for the Impacts of Climate Change

- Plan for recent and projected climate changes at the regional and local scale.
- Use climate projections, not historical precedents, to plan, maintain, and construct transportation system elements, such as pavements, bridges, drainage structures, catenaries, and rails.
- Incorporate green infrastructure into urban stormwater management systems to reduce flooding.
- Leverage Federal Emergency Management Agency-mandated hazard mitigation planning to integrate climate change hazards into comprehensive planning.
- Protect and restore vegetated riparian buffers, maintain naturally functioning floodplains, and enhance wetlands.
- Establish cooling centers for extreme heat days.

GOAL: IMPROVE AIR QUALITY

The U.S. EPA has established air quality standards for six criteria pollutants. These pollutants pose a threat to human health and welfare, and regions that do not attain these standards are required to plan emission controls to bring emission levels within the federal air quality regulations.

In recent years, the Greater Philadelphia region has violated two of the six criteria pollutants: ground-level ozone and fine particulate matter ($PM_{2.5}$). Currently, the region does not attain the standard for ground-level ozone. While the region has attained the standard for fine particle pollution, there are still a few days each year when $PM_{2.5}$ levels are deemed unhealthy for groups of people that are sensitive to air pollution. These groups include the elderly, the very young, and people with cardio-vascular diseases.

Ground-level ozone is generally a summertime issue, when sunlight provides the energy needed to drive the chemical reaction to form ozone from its constituent pollutants (nitrogen oxides [NO_x] and volatile organic compounds [VOCs]). NO_x emissions are mostly associated with power generation and transportation sources, while VOCs can come from a number of petroleum-based chemicals. Ground-level ozone can damage lung tissue, exacerbate breathing disorders, and trigger asthma attacks. The region generally experiences between 10 and 30 episodes each year when the ozone standard is violated.

$PM_{2.5}$ pollution is the term for tiny drops of liquid or small bits of dust. Some particles are large enough to be seen as soot or smoke. Other particles are so small that they can only be seen with an electron microscope. Fine particle pollution comes from a variety of natural and man-made sources, such as vehicles, diesel engines, power generation, and forest fires. $PM_{2.5}$ pollution has been implicated in a wide range of health problems, including heart disease, breathing disorders, and even premature death. While the region is in attainment for the $PM_{2.5}$ standard, fine particle pollution reaches unhealthy levels for sensitive groups between two and five days per year. These days can occur anytime of the year, when weather conditions allow local sources of pollution to accumulate over the region or when $PM_{2.5}$ pollution is blown into the region from forest fires or other major sources upwind of the region.

In the Greater Philadelphia region, transportation sources (cars, trucks, and buses) emit up to 50 percent of regional NO_x emissions, which contribute to both ozone and $PM_{2.5}$ pollution. Commercial and residential energy generation and heating account for an additional 25 percent of NO_x emissions. Pollutant sources that contribute to ground-level ozone and $PM_{2.5}$ pollution generally also emit GHGs, so many actions that address climate change also help improve general air quality and benefit public health.

Planning for a sustainable future requires not only decreasing the demand for trips but also making the transportation system more efficient by reducing congestion and optimizing the movement of people, goods, and services in the most energy-efficient ways. Renewable and alternative fuels can play a role in reducing emissions from both the energy generation and transportation sectors, while efficiency and conservation will promote both environmental quality and public health.

Strategies to Improve Air Quality

- Provide air quality forecasts to alert the public about poor air quality days and encourage voluntary measures to reduce air emissions, particularly on days when pollution is forecasted to violate the standards.
- Advance strategies and projects that reduce motor vehicle emissions through trip reduction, alternative commute options, technology advancements for fuels and vehicles, and public policies that support cleaner fuels and emissions standards.
- Work with regional partners to reduce air pollution impacts on at-risk populations.
- Work with the refineries, port facilities, pipeline operators, and freight railroads to promote safety, clean air, and “freight as a good neighbor” initiatives within facility host communities, on National Highway System (NHS) connector roads, and at key highway-railroad grade crossings and railroad bridges.

  Support transportation and land-use projects and policies that promote bicycle, pedestrian, and transit transportation to improve air quality, equity, and accessibility.

GOAL: INCREASE LOCAL FOOD PRODUCTION, DISTRIBUTION, AND ACCESS

Agriculture as both a land use and a way of life dominated Greater Philadelphia and its surrounding countryside from pre-colonial times to the mid-20th century. Native Americans cultivated small patches of agricultural fields, growing corn, beans, and rice. Early European settlers established farms that not only provided food for their families, but also became a thriving industry, selling crops and livestock to nearby cities. As the transportation network grew, so too did the market for the region's products, with local farmers exporting their goods throughout the states and overseas.

Agriculture dominated the region's land use until the 20th century. As Greater Philadelphia increasingly industrialized, the number of farmed acres dropped from 1.91 million in 1900 to 1.26 million in 1950 and then to 430,000 in 2012.[6] Today, farming and food production face a number of challenges. Food system activities take up a significant amount of land, but farmland in metropolitan areas like Greater Philadelphia is often more valuable for development than for farming, resulting in its conversion to other uses. Additionally, the average age of farmers continues to rise, with fewer and fewer young people choosing to pursue a career in agriculture.

Despite these challenges, recent years have seen an increasing interest in food, especially locally-produced. This interest is evident in the growth of farmers' markets and other market opportunities like community-supported agriculture and online food deliveries via platforms, such as Grubhub and Seamless. The renewed attention to food presents economic opportunities for more than just farmers, with local businesses all along the food supply chain—from production to processing and distribution to retailing. Local food production, preparation, and distribution also offer entrepreneurial and job opportunities, and agricultural products remain strong exports.

Although the emerging local food economy presents opportunities for growth, a lack of access to healthy food—whether due to financial, physical, or social constraints—remains a concern for many people. Between 2009 and 2015, the number of households receiving Supplemental Nutrition Assistance benefits in our region grew by over 100,000 households.[7] Additionally, between 2004 and 2013 the prevalence of obese adults in the region increased, growing from 22.5 percent to 26.7 percent.[8] However, during a similar time period, the rate of childhood obesity in the City of Philadelphia decreased for the first time in many years, dropping 6.5 percent, thanks in large part to the efforts of Get Healthy Philly, the School District of Philadelphia, and many other nonprofit and community organizations.[9]

Efforts like Get Healthy Philly that seek to increase local food production, distribution, and/or access are emerging across our region. DVRPC will continue to work with local and healthy food system stakeholders at the regional, county, and municipal levels to support a healthier, more equitable food system.

Strategies to Increase Local Food Production, Distribution, and Access

- Enhance coordination between all food system stakeholders, from the private sector to the public sector, from sustainable agriculture advocates to hunger relief organizations, and from farmland preservation

[6] U.S. Census of Agriculture, 1900, 1950, and 2012.
[7] American Community Survey 5-Year Estimates, 2005–2009, 2011–2015.
[8] Centers for Disease Control and Prevention, May 16, 2016, https://www.cdc.gov/diabetes/data/countydata/countydataindicators.html.
[9] Robert Wood Johnson Foundation, *Signs of Progress, Pennsylvania: Philadelphia*, June 23, 2016, http://www.rwjf.org/en/library/articles-and-news/2013/07/philadelphia--signs-of-progress.html.

coordinators to economic development agencies, to collaborate on improvements to the evolving food system.

- Incorporate farming and food into economic development policies and funding programs.
- Increase food production on protected lands within the region.
- Facilitate local food production and increased access to healthy food in rural, suburban, and urban areas through planning activities, supportive land use ordinances, and innovative incentive programs.

GOAL: PRESERVE HISTORIC RESOURCES AND CULTURAL LANDSCAPES

Greater Philadelphia's rich past is reflected in the variety and number of historic and cultural resources throughout the region. From Native American archeological sites to early Swedish settlements, and from the colonial-era row houses of Society Hill to the hallowed grounds of Valley Forge, Greater Philadelphia's history is incorporated into and enriches the fabric of present-day life. The wealth of resources is underscored by the number of historic landmarks, sites, and districts on the national register of historic places, state- and nationally recognized historic landscapes and heritage areas, sites protected through local historic designations, and countless other historic buildings and resources that lack any formal designation. These resources often form the bedrock of a community's character and identity. While more sites are deemed eligible for the national register every year, there are still many significant sites that have not been identified, recorded, or protected. Nonprofit organizations, government agencies, and local governments are working to identify, protect, preserve, rehabilitate, and restore the region's historic and cultural resources and landscapes as a way to increase livability, enhance "sense of place," and cultivate a unique identity.

Despite efforts to protect the region's historic and cultural resources, they continue to be threatened by demolition, neglect, encroaching sprawl, incompatible land uses, poor planning, and insensitive design. Transportation projects, for example, can impair or destroy historic resources through road widenings, realignments, and capacity enhancements. Furthermore, some historic resources, like bridges, are a part of the transportation system itself, and maintenance and care are needed to ensure their preservation. There are several federal and state laws that were enacted to avoid and minimize impacts and disturbances to historic resources, including the National Environmental Policy Act, Section 106 of the National Historic Preservation Act, Section 4(f) of the Department of Transportation Act, the Pennsylvania History Code, and the New Jersey Register of Historic Places Act. All federally funded transportation agencies must follow federal laws and plan their projects accordingly. As part of this process, state historic preservation offices work with federal agencies to identify historic resources and avoid or minimize any potential adverse effects during the planning, permitting, design, and construction of federally funded and licensed projects.

Since 2005, federal transportation regulations have established formal consultation requirements for MPOs and state DOTs to work with environmental, regulatory, and historic resource agencies in the development of long-range transportation plans. DVRPC is already actively working with the Pennsylvania Historical and Museum Commission and is seeking to work more with New Jersey's State Historic Preservation Office to more carefully consider historic and cultural resources in the planning and design of transportation projects. Additionally, DVRPC continually works with resource agencies and local governments to explore how transportation projects and local plans can better support, rather than impair, historic preservation and revitalization efforts.

Strategies to Preserve Historic Resources and Cultural Landscapes

- Promote the use of historic district designations and tax credits, where appropriate.
- Identify and document historic sites, buildings, and structures that contribute to community identity and character, but which may currently lack any type of formal historic designation.
- Promote growth management and enhanced community design through land development ordinances, design review, and local preservation planning processes in order to protect the context and integrity of historic sites and cultural landscapes.
- Encourage open space and farmland preservation as a means to also preserve the scenic, historic, and cultural context of many historic sites in the region.
- Investigate opportunities for advanced and alternative mitigation and mitigation banking to both speed transportation project delivery and incorporate a community's historic preservation priorities through the Section 106 review process.

PRINCIPLE: DEVELOP LIVABLE COMMUNITIES

From 2015 to 2045, Greater Philadelphia is expected to gain more than 658,000 residents, an increase of 11.5 percent. Similarly, employment in the region is expected to increase by over 372,000 employees, a nearly 12 percent increase. Left uncontrolled, it will increase suburban sprawl, create the need for expensive new infrastructure, underutilize existing facilities, and contribute to the further disappearance of our open space and depletion of our natural resources. These issues can be averted by increasing the livability of the region's existing communities.

Livable communities can be found throughout the region: in Core Cities and their component neighborhoods, in older suburbs, and in town and rural Centers scattered throughout suburban and rural areas. These communities provide a unique sense of place, possess existing infrastructure and institutions, and offer opportunities for new development and revitalization.

DVRPC'S CENTERS-BASED PLANNING PHILOSOPHY

- Livable communities can be found throughout the region: in Core Cities and their component neighborhoods, in the region's older suburbs, and in town and rural Centers scattered throughout the region's suburbs and rural areas.
- Livable communities can be created and supported by investing in and redeveloping Centers, enhancing community design, promoting affordable housing in appropriate locations, increasing parks and recreation opportunities, and creating and maintaining community-centered schools.
- Connections 2045 envisions numerous thriving, compact, mixed-use Centers, where people intuitively want to live, work, and play.
- Investing in Centers will facilitate the most efficient use of infrastructure, conserve open space and natural resources, strengthen local economies, and create the densities needed to support walking, biking, and public transit.

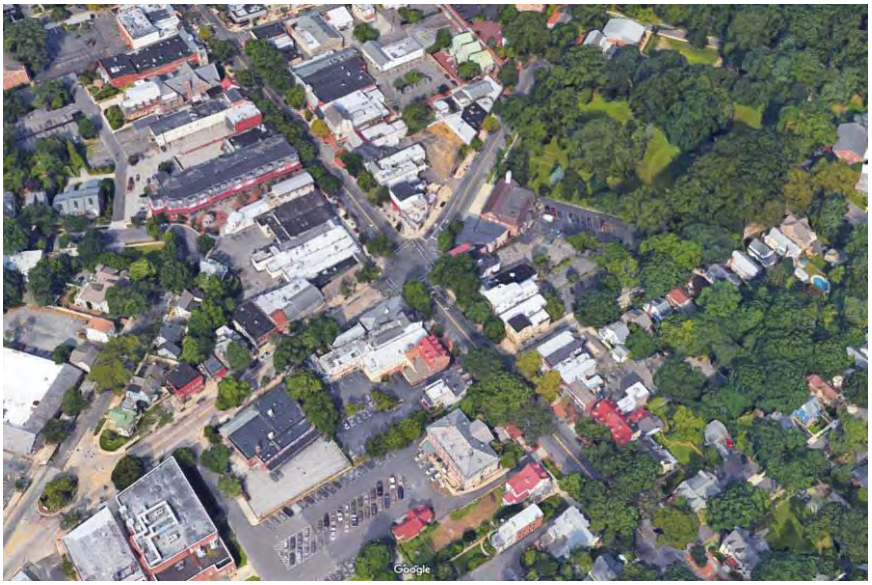
PLANNING AREAS

Diversity in our region's development is useful for defining planning policies and is a real strength. *Connections 2045* respects this diversity and identifies various planning approaches to restore, preserve, foster, or contain future regional growth and development. Four geographic areas are used to help organize the overall Plan.

Core Cities in the region include Philadelphia, Trenton, Camden, and Chester. These cities serve as critical employment, cultural, commercial, and educational centers of the region. Targeted infrastructure investment, maintenance and rehabilitation, and comprehensive neighborhood revitalization can help to revitalize the region's cities and reinforce them as engines of economic growth.

Center City Philadelphia, PA is a Core City in the region

Developed Communities are places that have already experienced most of their population and employment growth. These areas include inner-ring communities adjacent to the Core Cities, railroad boroughs and trolley car communities, and mature suburban townships. Many of these communities are stable and thriving, offering affordable housing opportunities, access to transit, safe pedestrian and bicycling environments, and a strong community identity. Others, however, are struggling with population and employment losses, deteriorating infrastructure systems, aging resident populations living on limited incomes, and stagnant or declining tax bases that cannot keep pace with rising service demands. Rehabilitation and maintenance of infrastructure systems and the housing stock, and local economic and community development, can help to reinforce location advantages while stabilizing neighborhoods and stemming decline.



Haddonfield, NJ is a Developed Community in the region

Growing Suburbs are communities that have many developable acres remaining and are experiencing—or are forecasted to experience—significant population and/or employment growth. Key planning policies in these communities often focus on growth management, open space preservation, congestion management, and community design. Smart growth strategies that support a more concentrated development pattern can provide the critical mass necessary to support transit services and other alternatives to the automobile.

Robbinsville Town Center in Washington Township, NJ is a Growing Suburban the region

Rural Areas include agricultural communities and those with large natural areas. Key policy objectives for these areas include conserving natural resources, limiting development, and preserving the rural lifestyle and village character that makes these areas unique. Livable communities in Rural Centers have an identifiable main street, a mix of land uses, higher densities than their surrounding areas, and a true sense of place.

Honey Brook, PA is a Rural Area in the region

Greater Philadelphia is a complex mosaic of 352 diverse cities, boroughs, and townships. Many municipalities have characteristics of more than one of these Planning Area types. Gloucester Township (in Camden County, New Jersey), for example, has neighborhoods that are fully developed, but it also has a significant number of undeveloped acres and a forecasted population and employment growth more characteristic of a Growing Suburb. While Planning Areas are a guide for policy direction at the regional scale, actual approaches should always be guided by local conditions.

Developing Livable Communities will provide the following benefits:

- Revitalize neighborhoods, support economic growth, and reduce suburban sprawl.
- Create business-friendly Town Centers that strengthen our local and regional economy.
- Improve safety and security through stronger community connections.
- Reduce automobile dependence while promoting transit, walking, and biking.
- Preserve unique community and architectural character.
- Conserve open space to promote access to recreational opportunities and local foods.
- Reduce living and service delivery costs, transportation and logistics needs, and resulting pollution.
- Increase and diversify the region's housing stock that is located near employment opportunities and public transit.

GOAL: INVEST IN CENTERS

Centers are the cornerstone of *Connections 2045*. Centers are neighborhoods, districts, or downtowns that serve as focal points in the regional landscape while also reinforcing a sense of community for local residents. Centers serve as a basis for organizing and focusing the development landscape and provide a framework for the most efficient provision of supportive infrastructure systems, including water, sewer, and transportation. By concentrating growth in and around Centers, we can preserve open space; reduce strains on our natural resources; and create thriving, pedestrian-friendly communities that offer an improved quality of life for all residents.

Connections 2045 identifies a hierarchy of seven Center types based on their geography and local context. Each of the identified Centers have varying characteristics, assets, challenges, and needs. Specific approaches and strategies for improving and revitalizing these areas will differ. The planning strategies within all the identified Centers focus on redevelopment and revitalization through targeted investments, increasing employment opportunities, utilizing the existing infrastructure, and supporting social and educational programs. Identified Centers are listed in Tables 5 and 6, and illustrated in Figures 27 and 28.

Metropolitan Center

The region's Metropolitan Center includes Center City, University City, and the Camden Central Business District, spanning the Delaware River and bounded roughly by 40th Street from Girard to Washington avenues in Philadelphia, and by the Ben Franklin Bridge and Interstate 676 to Clinton Street in Camden. This dense, compact, urban area includes the central business districts of Philadelphia and Camden, major academic and medical institutions, and major tourist and entertainment destinations.

Metropolitan Subcenters

The Plan identifies five Metropolitan Subcenters, reflecting the magnitude of jobs and commercial activity located in these areas. These include the downtown area of Trenton (Mercer County), the destinations of King of Prussia/Valley Forge (Montgomery and Chester counties), International Airport/Navy Yard/Sports Complex (Philadelphia and Delaware counties), Cherry Hill/Mount Laurel/Marlton (Burlington and Camden counties), and the Route 1 Corridor (Mercer County).

Suburban Centers

Suburban Centers are larger geographical areas that may be represented by a developed corridor and can cross municipal boundaries. They are defined primarily by a concentration of single uses, such as office, retail, professional, and light industrial. Suburban Centers generally have more jobs than residents and are more auto dependent, rather than transit oriented or pedestrian scale. Suburban Centers include places such as Oxford Valley (Bucks County), Deptford (Gloucester County), City Avenue Corridor (Philadelphia and Montgomery counties), and Great Valley (Chester County).

Town Centers

Town Centers have a mixture of high-density residential and commercial uses that also display a unique history and sense of place. Town Centers are often identifiable by a thriving downtown or main street that is pedestrian friendly and transit oriented. Town Centers are surrounded by traditional suburban residential development. Town Centers include places such as Doylestown Borough (Bucks County), Kennett Square (Chester County), Lansdowne Borough (Delaware County), Narbeth (Montgomery County), Haddonfield Borough (Camden County), and Pitman Borough (Gloucester County).

Rural Centers

Rural Centers, like Town Centers, have a mix of land uses, a higher density than the surrounding area, and often an identifiable smaller-scale downtown or main street. Rural Centers are usually surrounded by rural or agricultural land uses. Rural Centers include places such as Oxford Borough (Chester County), Harleysville (Montgomery County), and Browns Mills (Burlington County).

Planned Centers

Planned Centers are Town-Center-type developments envisioned for greenfield sites within Growing Suburbs or Rural Areas. Planned Centers can also be found in Developed Communities through redevelopment of greyfields. Planned Centers often call for traditional neighborhood development and incorporate a mix of uses at higher density that support transit and walkability. Planned Centers can be found throughout the region and include places such as The Town Center at Haddon (Camden County), Woolwich Town Center (Gloucester County), and the Village at Valley Forge (Montgomery County).

Neighborhood Centers

Embedded within the region's Core Cities of Philadelphia, Trenton, Camden, and Chester are Neighborhood Centers, which are recognizable places with a mix of commercial, retail, anchor institutional, and residential activities. Neighborhood Centers have an identifiable main street or focal point, are walkable, and have a unique history or sense of a community within the larger city setting. Neighborhood Centers include places such as the Chester Central Business District (Chester City), Parkside and Fairview (Camden City), Pennington Village (City of Trenton), and Germantown (City of Philadelphia).

FIGURE 27: CENTERS

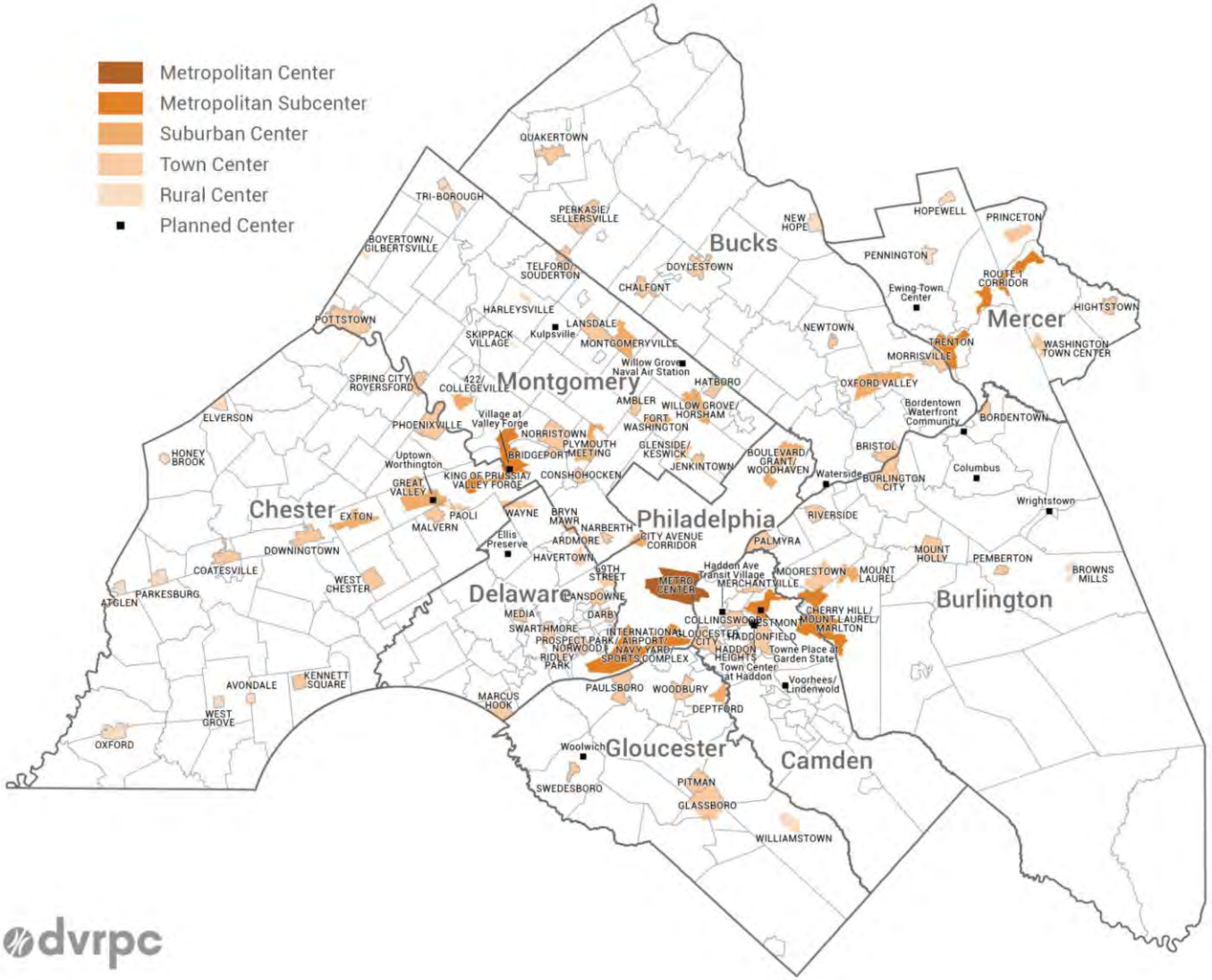
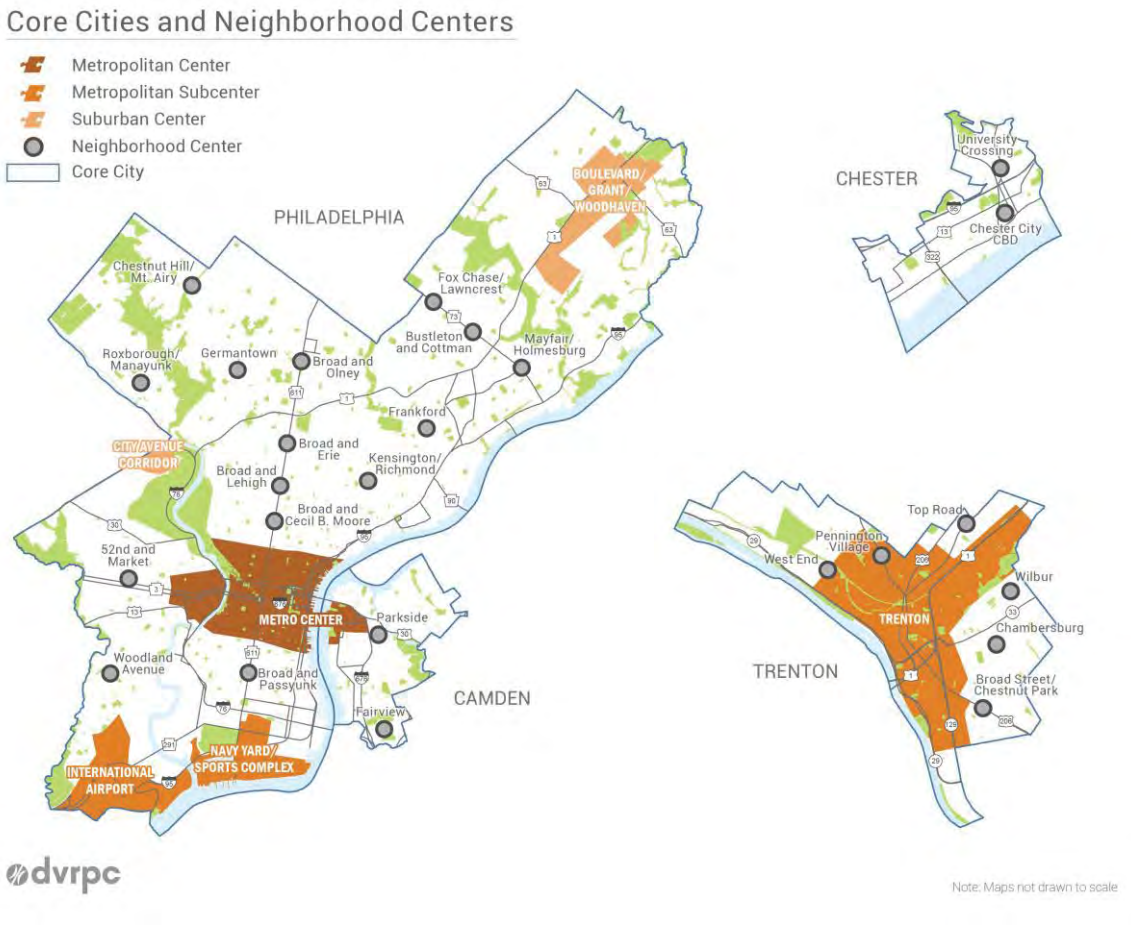


FIGURE 28: CORE CITIES AND NEIGHBORHOOD CENTERS



Strategies to Invest in Centers

- Update local regulatory documents to support transit-oriented economic development activities, such as mixed-use overlay zones, density bonuses, and codes that set separate standards with areas identified for infill/redevelopment.
- Protect the character and uniqueness of existing Centers and communities with historic preservation policies, community identity, or marketing practices.
- Provide funding, specifically for Infill and Redevelopment, through financial incentives, tax credits, or accessible private capital.
- Create special taxing districts for downtown areas such as Business Improvement Districts, Merchants Funds, or Business Associations to provide enhanced services such as streetscaping, maintenance, and marketing.
- Prioritize infrastructure investments in the region's Centers.

TABLE 7: PENNSYLVANIA CENTERS

County	Metropolitan Subcenters	Suburban Centers	Neighborhood Centers	Town Centers	Rural Centers	Planned Centers
Bucks		Oxford Valley		Bristol Borough, Chalfont Borough, Doylestown Borough, Morrisville, Newtown Borough, Perkasie/Sellersville, Quakertown, Telford/Souderton	New Hope Borough	Waterside
Chester	King of Prussia/ Valley Forge	Exton, Great Valley		Coatesville, Downingtown Borough, Kennett Square, Malvern, Paoli, Phoenixville, Spring City/Royersford, West Chester	Atglen, Avondale, Elverson, Honeybrook Borough, Oxford Borough, Parkesburg, West Grove	Uptown Worthington
Delaware	International Airport / Navy Yard / Sports Complex		Chester City: Chester Central Business District, University Crossing	Darby Borough, Havertown, Lansdowne Borough, Marcus Hook, Media, Prospect Park/ Norwood, Ridley Park, Wayne, Swarthmore, 69th Street		Ellis Preserve
Montgomery	King of Prussia/ Valley Forge	City Avenue Corridor, Fort Washington, Montgomeryville, Plymouth Meeting, Willow Grove/ Horsham, Route 422/ Collegeville		Ambler Borough, Ardmore, Bridgeport, Bryn Mawr, Conshohocken, Glenside/Keswick, Hatboro Borough, Jenkintown, Lansdale, Narberth, Norristown, Pottstown, Spring City/Royersford, Telford/Souderton	Tri-Borough, Boyertown/Gilbertsville, Harleysville, Skippack Village	Kulpsville, Village at Valley Forge, Willow Grove Naval Air Station
Philadelphia	International Airport / Navy Yard / Sports Complex	City Avenue Corridor, Boulevard/Grant/ Woodhaven	Broad & Passyunk, Woodland Avenue, 52nd & Market, Broad & Cecil B. Moore, Broad & Lehigh, Broad & Erie, Kensington/Richmond, Roxborough/Manayunk, Germantown, Chestnut Hill/Mt. Airy, Broad & Olney, Frankford, Bustleton & Cottman, Fox Chase/Lawncrest, Mayfair/Holmesburg			

TABLE 8: NEW JERSEY CENTERS

County	Metropolitan Subcenters	Suburban Centers	Neighborhood Centers	Town Centers	Rural Centers	Planned Centers
Burlington	Cherry Hill/Mount Laurel/Marlton	Mount Laurel		Bordentown, Burlington City, Mount Holly, Palmyra, Pemberton Borough, Riverside, Village of Moorestown	Browns Mills	Columbus, Wrightstown, Bordentown Waterfront Community
Camden	Cherry Hill/ Mount Laurel/ Marlton		Camden City: Fairview, Parkside	Collingswood, Gloucester City, Haddonfield, Haddon Heights, Merchantville, Westmont		Voorhees/Lindenwold, The Town Center at Haddon, Haddon Avenue Transit Village, Towne Place at Garden State Park
Gloucester		Deptford		Glassboro, Paulsboro, Pitman, Swedesboro, Woodbury	Williamstown	Woolwich Town Center
Mercer	Trenton, Route 1 Corridor		Trenton: Broad Street/Chestnut Park, Chambersburg, Wilbur, Top Road, Pennington Village, West End	Hightstown, Princeton, Washington Town Center	Pennington Borough, Hopewell Borough	Ewing Town Center

GOAL: PROMOTE AFFORDABLE AND ACCESSIBLE HOUSING

The availability of affordable and accessible housing is critical, both for enhancing the livability of individual neighborhoods and maintaining the economic competitiveness of the region as a whole. A lack of affordable housing opportunities within a reasonable commute of the workplace affects workers' quality of life and can have significant consequences on employers, including difficulty in attracting and maintaining a qualified workforce, increased retraining costs, a need to pay disproportionately high wages, and decreased employee productivity. Local economies may also suffer, as more and more of each family's disposable income is consumed by housing and/or transportation costs.

First-time homebuyers, in particular, may find it difficult to locate an affordable home in the neighborhoods where they grew up, near their current workplace, or close to public transit. Limited opportunities for first-time homeownership can result in a tightening of the rental market, as families that would traditionally purchase their first home find it increasingly difficult to locate an affordable unit in an attractive location. Increased demand for a limited supply of rental units leads to increased rental costs, making it even more difficult to accumulate the necessary capital for a down payment and closing costs.

With the region's baby boomers reaching retirement age over the next 10-15 years, accessible units woven into the fabric of existing and planned Centers, with easy access to the public transportation system, services, shops, restaurants, and other activities, will be needed. *Connections 2045* envisions thriving, vibrant communities, where families can afford to live close to work, the disabled can find accessible units, and seniors can remain in the communities where they raised their children while maintaining the greatest possible independence.

Strategies to Promote Affordable and Accessible Housing

- Build lifelong communities that enable aging in place.
- Allow accessory apartments as a regular, unregulated building use and offer homeowner incentives to building accessory units.
- Support housing programs that encourage rehabilitation or modification of existing units using universal design elements, or visitability (one no-step entrance, minimum 32-inch opening for all doorways, and a bathroom on the first floor) at a minimum.
- Increase and preserve the stock of affordable, accessible housing units in areas that are served by public transit and close to jobs and essential services.
- Investigate techniques and strategies designed to mitigate the displacement of existing residents in areas experiencing rapid redevelopment.
- Revise local zoning to allow a mix of residential housing types (including a variety of smaller housing options, such as more attached homes, multifamily developments, and microapartments) and adaptive reuse, with increased densities; streamline plan review and permitting processes; and enable public-private partnerships.
- Increase employment in places where affordable housing opportunities currently exist, including the region's Core Cities and Developed Communities, by increasing their attractiveness to moderate- and middle-income families searching for affordable housing close to work and in places where they would want to live and raise their families.
- Create accessible, pedestrian-friendly neighborhoods where families with children, seniors, and the disabled can safely walk, bike, and take public transit to jobs and services. Smaller multifamily apartment buildings may be an effective way to add density to choice neighborhoods without compromising the character of existing communities.
- Support shared housing programs that help to make efficient use of the existing housing stock, promote affordable housing, and potentially lessen the need for long-term institutional care.

GOAL: ENHANCE COMMUNITY DESIGN

Well-designed communities add value to the region. They can spur economic development, raise the quality of life, increase residential and retail market values, improve local safety, enhance individual health and wellness, and positively affect the region's image. Well-designed communities are places where people want to live, work, study, and socialize, due to their combination of amenities and character. Greater Philadelphia has many examples of good community design in the identified Centers throughout the region. The region should ensure that redevelopment and new growth are designed to a human scale, according to smart growth principles.

A core tenet of community design is to understand how people use the public realm, such as streets, sidewalks, parks, trails, and bridges, and how the private realm impacts the public realm. Does a building turn

a blank wall to the street, or does it have an inviting facade with awnings and interesting shop windows? How wide is the sidewalk, and are there pedestrian-scale lighting, benches (to allow for places to rest to avoid falls), restrooms, and street trees to encourage walking? Are public spaces well maintained? Are blocks overly long and fronted by surface parking, making it less likely that people will want to walk? Does the design of a road make for inhospitable walking, crossing, and biking conditions? Can a senior, parent with a stroller, or wheelchair user cross the street safely? Does the design of housing allow privacy and community at the same time? A variety of decisions impact the public realm in ways we may not even realize.

Key principles of community design include: valuing the pedestrian experience; mixing residential and commercial uses; locating and orienting buildings toward streets and/or transit stations; preserving and/or adaptively reusing historic buildings; infilling vacant land with context-sensitive development; placing parking on street, behind buildings, in alleyways, or in structures with liner buildings; creating wayfinding and signage systems; locating public facilities, such as schools and municipal offices, in areas that are accessible by a variety of transportation modes and integrated into the fabric of the existing community; and investing in facades, green infrastructure, and streetscaping. Local regulations should provide a predictable development environment that allows for preservation of unique community characteristics and facilitates appropriate growth and change.

Strategies to Enhance Community Design

- Adopt form-based zoning ordinances that focus on form or building type (form-based codes) over use-based codes. Municipalities should adopt separate design guidelines if not using a form-based code.
- Encourage or require transit-oriented design, live/work space, accessory dwelling units, street trees, sidewalks, parking maximums, active design strategies, and universal design standards in zoning, and subdivision and land development ordinances.
- Invest in streetscapes that contribute to the public realm and integrate green infrastructure when possible.
- Investigate opportunities to retrofit large single-use districts, such as office parks and aging shopping centers, into denser, mixed-use neighborhoods.
- Develop parking standards based on parking supply and demand, and reduce parking requirements to allow more room for pedestrian spaces and services.
- Adopt better design standards for parking and manage existing parking resources.
- Design with potential for adaptive reuse in mind. Consider the context and the potential impacts of technological advances, such as autonomous vehicles, when designing parking facilities for different land uses and building types.
- Encourage development patterns that incorporate smart growth and ecological principles, such as TND and conservation subdivision design.
- Ensure effective and contextually appropriate signage, including wayfinding, with well-written zoning codes and design standards that serve the needs of residents, businesses, and visitors.

GOAL: INVEST IN PARKS AND RECREATION

Parks and recreational facilities benefit public health, social life, property value, water quality, wildlife habitat, and overall quality of life for many communities. There is an extensive and growing body of research on the benefits of parks and natural spaces for people and neighborhoods.

In many Developed Communities, parks provide the only connection to the natural world, which satisfies the psychological, emotional, and spiritual needs of humans. Parks can be important places for forming and maintaining social ties because people can meet new people at parks or socialize with those they already know. Urban green space helps lower public healthcare costs by providing benefits, such as active or passive recreation opportunities, injury recovery, improved pregnancy outcomes, lowered obesity rates, and reduction in stress and depression.

A direct economic benefit to parks and recreation can be found in the increased property value of homes located near quality parks. Studies have shown that homeowners are willing to pay a premium to live in close proximity to protected open space. This results in increased wealth for citizens when selling their homes, and increased tax revenue to government based on higher assessments or property transfer taxes.

Landscaped parks provide environmental services like improved air and water quality, and provide habitat for wildlife, especially in urban environments. The trees, plants, and open space in parks provide natural stormwater management, reducing the amount of polluted runoff entering waterways and mitigating flooding. Trees in parks also mitigate air pollution, provide needed shade, lower air temperature, and absorb GHGs.

Strategies to Invest in Parks and Recreation

- Improve accessibility to parks by mitigating physical barriers, such as busy roads, and improving landscape aesthetics and lighting.
- Provide a mix of programming at popular parks to attract a larger number and more diverse group of users.
- Make capital investments in parks based on a long-term strategic vision, effective ongoing maintenance, significant community involvement, and local partners and advocates.
- Develop more parks in underserved areas, as urban greening and access to active and passive recreation can improve mental health, as well as encourage more active lifestyles.

GOAL: CREATE AND MAINTAIN COMMUNITY-CENTERED SCHOOLS

Community-centered schools build connections in the community and help create stronger neighborhoods with greater social cohesion. In addition to offering a first-rate education, community-centered schools can become a hub of the community by offering programs and facilities that meet the needs of all generations. By integrating smart growth principles into educational facility planning, community-centered schools can offer many benefits similar to smart growth: enhanced working environments for employees, better quality of life for students and parents, stronger sense of place, and healthier lifestyles (since walking and biking are viable options), as well as a safe and secure learning environment. Schools that are accessible by multiple forms of transportation can reduce the amount of paved surfaces, reduce pollution, and encourage regular physical activity for children.

Strategies to Create and Maintain Community-Centered Schools

- Engage all community stakeholders in the school facility planning process. Collaborate and share population growth data and demographics with adjacent school districts, municipalities, and other educational agencies.
- Share space by co-locating schools with other public services, such as health clinics, senior centers, senior housing, childhood development centers, day care, and employment services. Other types of services may be explored, such as nonprofits or perhaps a community college, fitness center, or medical office. Co-location can offer cost savings, community integration, and intergenerational support.

- Consider adaptive reuse for new schools or for schools that are no longer in operation. Placing new schools in existing communities helps conserve undeveloped land and ultimately reduces sprawl.
- Integrate school renovation or construction plans into the community revitalization or redevelopment plans and offer bonuses if smart growth goals are met. Community-centered schools should highlight environmentally sensitive features and sustainable design practices.
- Consider active transportation options, such as walking and biking for students. Ensure pedestrian- and bicycle-friendly features, such as sidewalks, bike lanes, bike parking, and street trees, are integrated into the community school setting. Adopt a *Safe Routes to School* program for all community-centered schools in the neighborhood or local jurisdiction.
- Create after-school programs for students, as well as for adult community members. After-school programs should incorporate a variety of educational and recreational activities, such as art programs, English as a Second Language (ESL), and General Education Development classes.

PRINCIPLE: EXPAND THE ECONOMY

Greater Philadelphia's regional economy is large and complex, with an annual gross domestic product of over $391 billion.[10] The region's economy ranks among the most diverse of the nation's major metro areas. Although not booming, the region's economy is resilient; its diversity guards against the extremes in growth or decline that economies dependent on one or two major industries often experience.

DVRPC'S ECONOMIC DEVELOPMENT PLANNING PHILOSOPHY

- Connections 2045 reiterates the goals and strategies embodied in Investing in People and Places, the adopted regional Comprehensive Economic Development Strategy (CEDS).
- Continued coordination across state, city, and county lines; across sectoral interests; and across the public and private sectors is essential to maintaining a broad regional perspective and finding a common vision and goals.
- Invest in Centers to facilitate the most efficient use of infrastructure; conserve open space and natural resources; provide employers with easy access to supplies, markets, and a qualified workforce; and create concentrations of "knowledge density."
- Invest in people to ensure that the region's workforce meets the needs of the region's current and future employers.
- Support the growth of key economic sectors within the region, and invest in innovation, creative thinking, entrepreneurs, and start-ups.

Greater Philadelphia's economy includes concentrations of cutting-edge sectors, such as biotechnology, health services, higher education, and the creative industries. There is also a burgeoning alternative and clean energy industry—a sector poised for continued growth during the coming years—as well as tech industry start-ups. Numerous businesses and professionals possess the skills necessary to transform challenges in energy efficiency and ecological sustainability into a competitive economic advantage. An important driver of continued economic growth is the ability to transfer innovative discoveries from the region's numerous academic and research institutions to industry partners, and to commercialize new technologies.

Greater Philadelphia has tremendous potential for continued economic growth. Its location in the heart of the nation's Northeast Corridor provides a superb locational advantage, with a vast consumer base of over 100 million people living within a 500-mile radius. The region boasts an enviable transportation network (including major highways, an international airport and a network of regional airports, and a myriad of public transit options), and is home to an impressive network of educational and healthcare institutions.

While the region is well positioned, the ongoing development of the Digital Revolution provides much economic uncertainty around the world. Digitization has upended nearly every major industry to date, with education, healthcare, government, and transportation being the most notable holdouts. This process upends dominant market players by new entrants, who often come from outside the industry. It increases fragmentation and creates more options in the short term. However, it risks winner-take-all, monopolistic outcomes in the long run. Digitally connected networks are able to connect potential employers or sellers with readily available workers or buyers in real-time. This can cut out the middleman, or reduce the need for

[10] Bureau of Economic Analysis, 2016. This coverage area includes the nine-county DVRPC region, plus Salem County, New Jersey; New Castle County, Delaware; and Cecil County, Maryland.

employees, while at the same time greatly reducing transaction costs. Multisided platforms are the emerging digital business model. They provide network benefits, where the more members that are using a good or service, the more other market segments will offer it. An example is how the more consumers carry a specific credit card, the more businesses will take it.

Digital companies are not constrained by shelf space and other real-world limitations. They can readily scale up their services to meet increasing demand with little additional cost, reducing the impacts found by traditional economies of scale. 3-D printing allows each item to be unique, customized, and personalized to individual needs. Digital companies tend to be light on assets, and use capital and technology to find new efficiencies, including a reduced need for labor. As robotics and Artificial Intelligence become more commonplace, there are growing concerns not just for routine and manual labor jobs, but also for the higher-skill cognitive and nonroutine ones.

Scores of public and private economic development organizations are at work in the Greater Philadelphia region, each seeking to promote or attract a wide variety of sectors or specific interests. Continued coordination across state, city, and county lines; between sectoral interests; and among the public and private sectors is essential to maintaining a broad view of the region and finding a common vision, goals, and policies.

Connections 2045 reiterates the goals and strategies embodied in *Investing in People and Places*, accepted by the U.S, Economic Development Administration as the regional CEDS. The regional CEDS was created and is maintained under the direction of a committee of state, county, city, and regional economic development and planning professionals. Through the regional CEDS process, DVRPC is actively engaged in regional efforts to support and grow the economy.

Expanding the Economy will provide the following benefits:

- A high-quality, productive workforce.
- A steady supply of jobs in emerging, high-growth industries.
- Business growth in Centers well served by infrastructure and utilities.
- An enhanced climate for entrepreneurship, innovation, and new business formation.
- The creation of jobs that match the skills of the region's workforce, including jobs that provide employment opportunities as a ladder out of poverty for those most in need.
- Reduced energy consumption, resulting in a lower cost of business for area companies.
- Expanded regional connections to the global economy.

GOAL: SUPPORT AND PROMOTE THE GROWTH OF KEY ECONOMIC SECTORS INCLUDING TOURISM

Like many urban areas, the Greater Philadelphia region's economy has undergone a major transition in recent decades. Roughly half a century ago, manufacturing dominated the economy of both the city and the suburbs, accounting for almost 60 percent of the region's jobs. As traditional heavy manufacturing employment has declined, knowledge-based industries have gained prominence, with life sciences, information technology, professional services, and chemicals ranking among the region's top industries. Sectors such as education and health services, professional and business services, financial activities, and information technology have emerged as principal drivers of the digital economy. Other key sectors include

alternative energy and energy conservation, the creative industries, tourism, specialty and precision manufacturing, and food production and distribution.

In order to compete both nationally and internationally, the region must continue to attract new companies and encourage the retention and expansion of existing companies in key economic sectors that have both the greatest potential for growth and pay higher wages. With limited available funding for infrastructure improvements, facilities that serve clusters of key economic sectors should receive priority attention.

Strategies to Support and Promote the Growth of Key Economic Sectors

- Identify key sectors and work with academic institutions, business incubators, venture capitalists, and others to attract or create new companies while simultaneously supporting and expanding existing companies in those sectors.
- Invest in the infrastructure necessary to support the region's businesses, including highways, transit, ports, airports, high-speed broadband and wireless capabilities, and pipelines.
- Prioritize transportation and other infrastructure investments in places that serve clusters of companies, especially those in key economic sectors.
- Develop an economic vision for the digital age.

GOAL: INCREASE INNOVATION AND NEW BUSINESS FORMATION

An important driver of continued economic growth is the ability to transfer innovative discoveries and intellectual knowledge from universities to industry partners, and to commercialize new technologies to stimulate economic growth. Greater Philadelphia has a rich history of innovative thinking and bringing promising new technologies to market. Since 2000, annual research and development (R&D) expenditures by academic and research institutions in the region have consistently amounted to almost 3 percent of the nation's overall R&D expenditures.

Greater Philadelphia is rich in academic resources, and many of the region's universities have affiliations with technology and science incubators, allowing businesses to access a vast pool of university talent and equipment. The availability of venture capital is critical; in 2015, venture capitalists supplied over $625 million to companies throughout the region, but the region's share of what is available nationally has declined in recent years.

Strategies to Increase Innovation and New Business Formation

- Accelerate technology transfer from research institutions to stimulate new company formation related to research results.
- Expand the availability of venture and other investment capital.
- Foster and enhance the region's culture of entrepreneurship by generating collaborations among investigators/inventors, venture capitalists, academics, and experienced start-up business executives.
- Expand programs that provide technical support, mentoring, training, and funding to prospective entrepreneurs and small start-up businesses.

GOAL: SUPPORT SELF-EMPLOYED INDIVIDUALS AND POP-UP BUSINESSES

Trends over the past 20 years point to the slow but steady growth of a free-agent economy, where large companies opt to contract out many necessary tasks, and employees are more likely to freelance, consult,

and do temporary work. Strengthened by the expansion of the Internet and other communications technologies, this continuing trend suggests that workers may be less tied to corporate jobs in the future, and individuals will need to be more entrepreneurial to be successful.

While there will still be traditional industries and jobs, and large companies will remain major economic players, outsourcing and efficiency gains will enable them to effectively compete with fewer employees. Individuals in the traditional workforce will move between jobs more often, with less commitment to one employer. More individuals may have to create their own economic opportunities, opening their own small businesses or temporary pop-up enterprises. They may also have to contribute more to their healthcare and retirement savings, as labor efficiency and the rising costs of full-time employees encourage large companies to continue to reduce their workforces.

Strategies to Support Self-Employed Individuals and Pop-Up Businesses

- Expand and support small business incubators and accelerators.
- Expand and support entrepreneurial training and mentoring programs.
- Invest in and support co-working spaces.
- Simplify business tax collection, licensing, and permitting, and ensure that regulations do not unnecessarily restrict the pop-up economy.
- Increase transit service during off-peak hours to accommodate flexible work schedules, and improve intra-suburban service and service to suburban office parks.
- Update zoning codes to allow for shared office spaces, mixed-use buildings, and home-based businesses.
- Develop portable benefits programs that can be moved from job to job, or gig to gig, creating a modern social safety net that is not tied to a single employer. At a minimum, these programs should include health insurance, retirement, and worker disability. They could also offer dental, vision, and/or life insurance, vacation time, education and training, and other benefits.
- Enable employees to maintain the digital reputations and credentials they build by allowing them to be transferred from one platform to another.

GOAL: ENHANCE THE CLIMATE FOR BUSINESS GROWTH

The Philadelphia region is politically fragmented, with 352 local governments, nine county governments, six regional councils of government, two state governments, and hundreds of school and municipal authorities. To effectively compete in today's economy, the region's decision makers and policy makers must work cooperatively to make the region attractive to current and prospective employers. Although home rule undeniably enhances the ability of local governments to effectively respond to their constituents' unique needs, fragmentation also poses a greater risk for institutional overlap and parochialism. Multilevel governmental regulations and review processes that unreasonably extend the time required to make a decision on a proposed development, or that impose an unfair tax burden on prospective employers, can dissuade businesses from locating or expanding in the region.

Government operated as a bureaucracy throughout the industrial era, where decision making and regulation was linear and top down. The new digital age requires a wholesale rethinking to make government more agile at all levels.[11] Fast changing innovations will stretch regulations and regulators ability to keep up. New

[11] Klaus Schwab, "The Fourth Industrial Revolution: what it means, how to respond." World Economic Forum, January 14, 2016. https://www.weforum.org/agenda/2016/01/the-fourth-industrial-revolution-what-it-means-and-how-to-respond/.

technologies offer citizens the ability engage directly with their representatives on scales that were previously unimaginable. Technology is redistributing and decentralizing power, potentially away from government if it cannot adapt. Networks are the predominant way in which people and organizations organize in today's world. Government-as-a-network can provide a platform of engagement, data sharing, and transparency with citizens and businesses.

Strategies to Enhance the Climate for Business Growth

- Continue to promote and secure a more attractive wage and business tax environment to encourage the attraction, retention, and expansion of businesses in the region.
- Increase the speed, predictability, and transparency of government decision making.
- Foster regional collaboration and engage local business leaders in growing the regional economy.
- Work to enhance the government network, using 3-1-1 and 5-1-1 systems as guidance.

GOAL: FOSTER A HIGH-QUALITY, PRODUCTIVE WORKFORCE

The availability of a skilled, productive workforce is critical if the region expects to continue to compete effectively in today's economy. Greater Philadelphia is home to an impressive number of higher education facilities and ranks sixth nationally in the number of education and knowledge-creation workers per capita. There is a tremendous opportunity to leverage the region's vast higher education resources to raise the level of educational attainment, especially in the region's Core Cities and urbanized areas. Colleges and universities should be actively involved with local elementary and secondary schools to increase the performance and motivation of students.

In an era of rapid technological change, we can no longer expect that a four-year degree will be capable of instilling all the skills one will need for the rest of their career. Instead, workers will need to become lifelong learners in order to keep their skills current. Opportunities to help develop skills through industry and school partnerships, and specialized training that offers pathways into specific careers, such as biotechnicians or energy auditors, also exist. Small employers must be better connected with the resources available through workforce training programs.

Additionally, over the past two decades, immigrants have helped to offset population declines in many U.S. cities, including Philadelphia. In addition to expanding the available labor force, studies have shown that foreign-born residents open small businesses at a higher rate than native-born people and play an important role in supporting and invigorating local and regional economies. As the average age of the region's population continues to increase, the role immigrants play in bolstering the number of working-age individuals will become even more significant.

Strategies to Foster a High-Quality, Productive Workforce

- Explore ways to improve and expand the linkages between the region's high schools and its vocational training networks, technical certification programs, community colleges, and other higher education institutions.
- Leverage the region's impressive higher education resources to raise the level of educational attainment, especially in urban districts.
- Support industry–school partnerships and specialized training (in manufacturing, for example) that offer pathways into specific careers.

- Improve the connections between small employers and the resources available through the region's workforce training networks.
- Expand programs designed to support immigrants seeking to enter the workforce or start a business, including ESL programs, specialized training, and entrepreneurial support.

GOAL: EXPAND THE REGION'S CONNECTIONS TO THE GLOBAL ECONOMY

Expanding the Greater Philadelphia region's connections to the global economy is essential to effectively competing in an interconnected world. In today's economy, the region is competing not only with other nearby major metro areas, but also with global markets, including China, the European Union, Japan, Mexico, and Canada. International trade must be promoted, and foreign direct investment must be attracted.

Competing successfully on an international level requires expanded capacity and connections at Philadelphia International Airport (PHL), as well as enhanced utilization of the region's ports and overall leverage of the region's multimodal infrastructure. Global challenges present local opportunities to redirect regional economic development efforts and to prepare the region to compete in a future where energy-efficient and environmentally benign products and services will be key drivers of growth.

Additionally, Philadelphia must position itself as a world class city and region—an international destination for businesses, talent, visitors, and immigrants. Philadelphia's strengths include its historic architecture, walkability, affordability, museums and cultural attractions, restaurants, and universities. Philadelphia is the Nation's First World Heritage City. Achieving the status of "world class" will require continued investment in regional arts, cultural, and historical institutions; maintaining effective and reliable infrastructure systems; promoting international tourism; improving environmental quality; and promoting entrepreneurship and innovation.

Strategies to Expand the Region's Connections to the Global Economy

- Promote international trade and increase exports from the region.
- Attract additional foreign direct investment.
- Improve domestic and international mobility connections to the nation and world. Expand capacity and improve international connections at PHL. Support the implementation of Amtrak's NEC Future plan.
- Enhance utilization of the region's ports and overall leverage of the region's multimodal infrastructure.
- Enhance the region's desirability to both employers and employees by investing in arts, cultural, and recreational amenities; supporting entrepreneurs and innovative thinkers; improving environmental quality; maintaining affordable housing opportunities; and investing in public infrastructure.
- Support ongoing efforts to make Philadelphia a world-class city and region.

GOAL: DEVELOP A MORE ENERGY-EFFICIENT ECONOMY

High quality of life does not require high energy use: delivering services with less energy has benefits beyond the cost savings. Less driving means shorter trips and less time in traffic. Green buildings, with better insulation and more efficient heating and cooling systems, mean greater comfort. Ninety percent of GHG emissions in the Greater Philadelphia region are associated with the combustion of fossil fuel to produce energy, including that burned to generate electricity. Total expenditure in the region for energy (electricity,

natural gas, gasoline, diesel, heating oil, and jet fuel) in 2010 is estimated at about 6 percent of the region's economy. Thus, an energy-efficient economy is essential to the region's goal of reducing GHG emissions.

Municipal, regional, and state-level policies to encourage energy efficiency and conservation in buildings will further reduce our region's energy requirements. Municipalities can lead by example by adopting these practices within their own operations. The lessons learned and dollars saved will serve as an example to the broader community. As energy becomes more expensive, it is likely that municipalities with lower energy consumption per capita will be more desirable places to live and locate businesses.

A profound transformation of the global economy is expected over the coming decades. Regions that deliver energy efficiency and low GHG emissions will have a competitive advantage. This shift presents a tremendous opportunity for Greater Philadelphia. As we build on our historic advantages of mixed-use development and transit infrastructure, we will also transform our business and workforce infrastructure to provide the products, services, and skills required for this future. This transformation will require the regional cooperation and strong coordination between the states, counties, and municipalities that DVRPC continues to play a critical role in building and leading.

Strategies to Develop a More Energy-Efficient Economy

- Provide services with less energy by encouraging the use of more efficient vehicles, buildings, and equipment, and by expanding transit services.
- Encourage local governments to continue to take the lead in increasing energy efficiency by reducing energy use in their daily operations.
- Educate and prepare the region for emerging energy-efficient technologies.
- Encourage the use of more fuel-efficient or alternative-fuel vehicles to reduce GHG emissions.

PRINCIPLE: ADVANCE EQUITY AND FOSTER DIVERSITY

Equity is a strategy for promoting fair treatment and encouraging success and prosperity by addressing the unique needs and obstacles of all persons. By lifting barriers, restoring rights, and protecting the most vulnerable people in our region, issues of poverty, education, mobility, health, and community can be addressed fairly.[12]

DVRPC'S PHILOSOPHY ON ADVANCING EQUITY AND FOSTERING DIVERSITY

- Allocate funds following the principles of Title VI and environmental justice (EJ).
- DVRPC will support and enhance the principles of equity, which include accessibility, mode choice, affordability, safety, health, diversity, inclusion, living wages, and quality education.
- Encourage planning partners to use DVRPC's equity tools and data sources to further support and enhance equity at the local level
- DVRPC will seek public input in an inclusive and engaging way, and will meaningfully respond to comments and suggestions from the public throughout the planning process.

DVRPC's commitment to Title VI and EJ is reflected in the plans and programs, public involvement efforts, and general way the agency does business.

DVRPC has created an internal technical methodology, the Indicators of Potential Disadvantage (IPD), to identify disadvantaged populations within the Greater Philadelphia region.

FEDERAL REQUIREMENTS

All MPOs in the United States must meet certain requirements as mandated by the federal government.

Title VI of the Civil Rights Act of 1964 states that "no person in the United States shall, on the grounds of race, color, or national origin, be excluded from the participation of, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance."

EJ builds on this framework. EJ is the fair treatment and meaningful involvement of all people, regardless of religion, race, ethnicity, income, or education level, in the planning and decision-making process. Executive Order 12898 mandates that federal agencies incorporate EJ considerations and analysis in their policies, programs, and activities.

To meet the requirements of these laws, an MPO must:

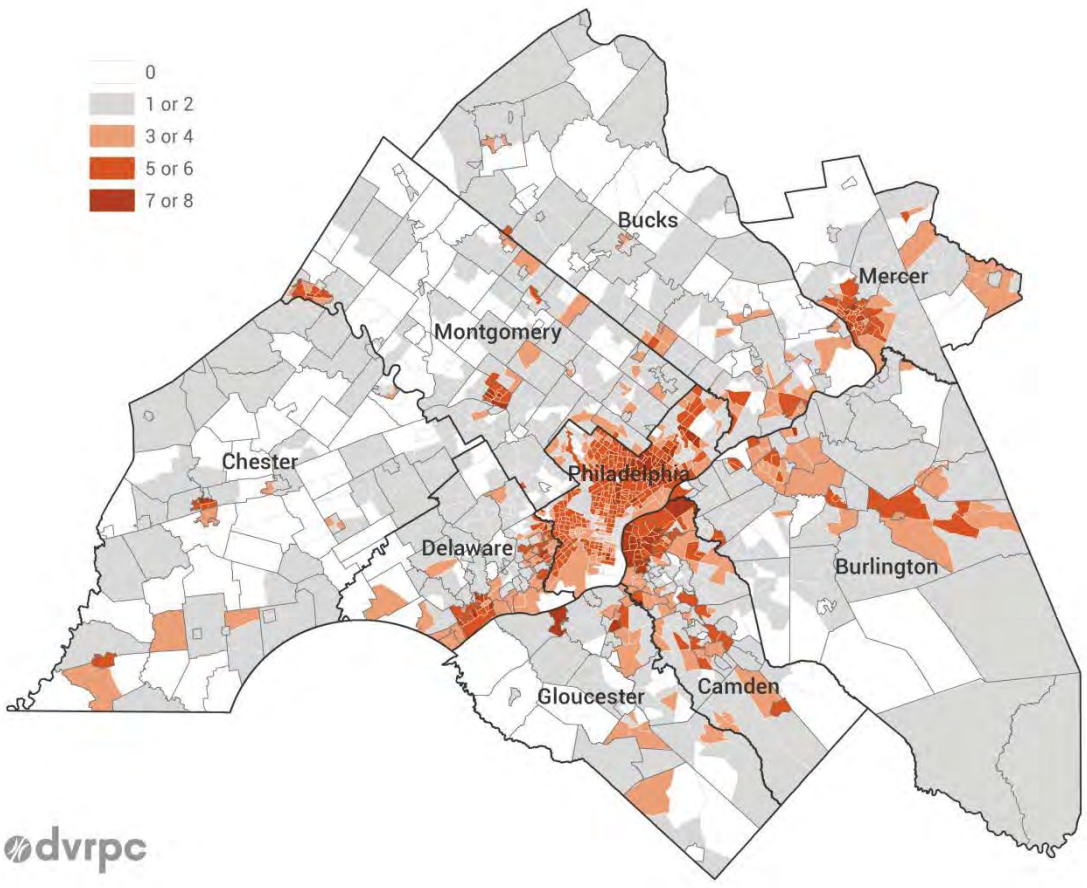
- Enhance its analytical capabilities to ensure that the Long-Range Plan and the Transportation Improvement Program (TIP) comply with Title VI.

[12] Esoko, "What is 'Equity'?," Cultural Organizing, October 2016, http://culturalorganizing.org/wp-content/uploads/2016/10/SalomePDF.pdf.

- Identify residential, employment, and transportation patterns of low-income and minority populations so that their needs may be identified and addressed, and the impacts of transportation can be fairly distributed.

- Evaluate and improve the public involvement process to eliminate barriers and engage minority, disabled, elderly, and low-income populations in regional decision making.

FIGURE 29: IPD BY CENSUS TRACT



EJ is traditionally concerned with the impacts of disparate funding and services on defined minority and low-income groups. DVRPC currently assesses and maps populations based on IPD.[13] These Indicators help DVRPC to identify which areas may face unique planning-related challenges and would be categorized as communities of interest under Title VI and EJ regulations:

- Poverty;
- Carless Households;
- Non-Hispanic Minority;
- Physically Disabled;

[13] Using the American Community Survey five-year estimates data set from the U.S. Census.

- Hispanic;
- Limited English Proficiency;
- Elderly; and
- Female Head of Household with Child.

The IPD methodology is an integral tool that DVRPC uses to understand the region's demographics. This information is used for a variety of DVRPC programs and plans to analyze impacts, recommend solutions that may mitigate adverse project or program consequences, or direct public outreach efforts.

DVRPC's IPD methodology:

- identifies the impacted groups;
- locates them in the region;
- plots key destinations — such as employment or health care locations — that these population groups would access;
- overlays these destinations with the region's existing and proposed transportation network; and
- determines what transportation service gaps exist for these disadvantaged groups.

The work undertaken by DVRPC inherently includes opportunities for EJ considerations and promotes an open public participation process. Specifically, programs such as the Coordinated Human Services Transportation Plan, the Air Quality Partnership, and the Transportation and Community Development Initiative (TCDI) are designed to positively affect various disadvantaged groups and communities throughout the region.

The concept of creating a sustainable future is one that can particularly benefit EJ populations, and many of the goals presented in *Connections 2045* further DVRPC's commitment to EJ and planning for all residents of the nine-county region. Aside from the equity-specific goals in this section, goals related to food systems, investing in the region's Centers, green infrastructure, and economic and workforce development are interrelated and can have far-reaching benefits for the identified populations in the IPD methodology. Policies that promote urban agriculture, revitalizing brownfields and grayfields; creating jobs that match the workforce supply; and upgrading transit, bicycle, and pedestrian facilities, are just a few of the recommendations to improve the quality of life for all residents of the region.

Equity is a principle that goes beyond treatment of individuals to influence the functioning infrastructure, policies, and operations of a region. Advancing equity and fostering diversity will provide the following benefits:

- A prosperous, economically stable region.
- A skilled, supported, and healthy workforce.
- A safe, affordable transportation network.
- Resilient, inclusive, and vibrant communities.
- Healthy housing for all income levels.
- Quality educational opportunities for all persons.

GOAL: PROMOTE EQUITABLE ACCESS TO TRANSPORTATION FOR VULNERABLE PERSONS

To equitably improve economic and social opportunity in the region, planners must consider access to essential services for vulnerable populations. Vulnerable populations include individuals who are low income, senior, or physically or mentally disabled, and who are more acutely affected by infrequent transit service and gaps in infrastructure, such as poor sidewalk connectivity, inaccessible transit stops or vehicles, and disconnected land use planning. These persons are more likely than the general population to be transit dependent and have unique transportation needs for reaching essential services. Essential services are those destinations needed to meet a standard quality of life, including places of employment, grocery stores, schools, medical facilities, recreation and open space areas, senior centers, and centers for the developmentally disabled.

The region's transportation system should link places where people live and work, and be navigable with comfort and dignity by users of all ages and abilities. Improving service in the region requires strengthening coordination efforts, improving reliability, and developing flexible services that improve access to essential services and job opportunities. Fixing infrastructure gaps will require the dedicated efforts of many actors, including federal, state, and local governments; transit agencies; social service providers; real estate developers; major employers; and funders.

Strategies to Promote Equitable Access to Transportation for Vulnerable Persons

- Make transit stop locations, connecting pathways, and street crossings physically accessible.
- Encourage TOD that includes affordable housing and essential services.
- Support policies that make travel safer, such as Complete Streets, Vision Zero, connective sidewalk networks, public restrooms, and places to sit or rest in all communities.
- Link modes by clustering infrastructure, coordinating arrival and departure times, implementing effective wayfinding, and providing free or affordable transfers.
- Prioritize accessibility improvements at/in:
  - key transportation hubs and activity centers that serve significant numbers of vulnerable populations;
  - communities with concentrations of disabled and/or senior populations; and
  - essential service locations, such as hospitals, medical facilities, and senior centers.
- Expand discounted transit passes for vulnerable communities such as free full-week passes for public school students and discounted passes for low-income customers.
- Improve transportation service generally through the deployment of new technology, shared-use mobility, and inter-city connections.
- Improve vulnerable populations' access to online travel information, including outreach and communications provided for limited-English-proficiency populations.
- Incentivize the purchase of more wheelchair-accessible taxis and shared-use vehicles.
- Prioritize convenience and affordability of lifeline services, such as paratransit and low-frequency, fixed-route transit, and connections to essential services, employment, and last-mile connections.
- Work with shared mobility companies to enhance service in low-income and EJ communities.
- Collaborate to develop pilot projects, awareness of options, and subsidies to increase access for low-income individuals to shared mobility services.

GOAL: CREATE AGE-FRIENDLY COMMUNITIES

Across the world, our population is aging, and life expectancy continues to grow. In the United States, the baby boomers, born between 1946 and 1964, began to turn 65 in 2011, with the last boomers turning 65 in 2029. In many ways, the Philadelphia region is getting a preview of what the rest of the nation will eventually face: a demographic imperative to plan better environments for aging populations. It is clear that while the urgency is understood, solutions and the political will to address the needs of an aging population are less apparent. In response, DVRPC seeks to educate regional stakeholders on ways that planners and policy makers can improve and prepare communities for aging, specifically with relation to transportation, housing, and public spaces.

Age-friendly describes places where older adults, defined as anywhere from 50+ to 65+, can "age actively." *Active* is defined as a physical environment that supports older people and allows them to be independent. Perhaps most importantly, it also refers to a place that enables adults to engage with social, economic, and civic life. Because different groups define older adults starting at different ages, a better term might be *aging-friendly communities*, which focuses on the dynamic process of aging rather than a specific age.

The World Health Organization (WHO) created the Global Network of Age-friendly Cities and Communities (GNAFCC) in 2010, as the first major global policy response to aging in cities.

AARP is the U.S. institutional affiliate of GNAFCC, and began their own Network of Age-Friendly Communities in 2012, targeting some of the environmental, economic, and social factors that influence the well-being of older adults. AARP works through their state offices to identify communities for membership in the WHO Global Network. There is growing interest in the age-friendly community designation in Philadelphia and the region. Communities that join undertake an assessment of the eight age-friendly domains: outdoor spaces and buildings, transportation, housing, social participation, respect and social inclusion, civic participation and employment, communication and information, and community support and health services.

Strategies to Create Age-Friendly Communities

- Update county and municipal master or comprehensive plans to support age-friendly communities as an explicit goal.
- Update zoning and subdivision and land use ordinances to allow for accessory dwelling units, shared housing, lower parking requirements for senior housing, visitability requirements, TOD, adult day care centers, long-term care facilities, home-based offices, and sidewalk requirements.
- Adopt transportation policies and practices that require or encourage Complete Streets, lower speed limit zones, senior pedestrian zones, accessible transit vehicles and stations, free or low-cost transit passes for older adults, wayfinding and legible signage, and programs for older cyclists.
- Ensure that public realm infrastructure supports aging populations, such as by providing bus shelters, benches, public restrooms, and playgrounds/outdoor exercise equipment for all ages.
- Consider establishing an age-friendly business program at the municipal level to help businesses attract, engage, and retain older adults as customers by considering the age-friendly features of the business. Low- and no-cost changes include improving access, such as places to rest and putting products within reach; to improving the overall experience, like minimizing excessive music or noise, providing well-lit displays, offering home delivery, and training staff on how to assist those with vision, hearing, or cognitive issues.

- Encourage the development of alternative housing types, such as co-housing, cottage housing, accessory dwelling units, and grandfamilies housing (allows grandparent caregivers to live with grandchildren and not violate rules of age-restricted senior housing; combines features of senior housing with on-site services, such as after-school education, youth activities, and case management).
- Require or incentivize the building of new housing or adapting existing housing to make homes visitable through universal design features that adapt to changing needs.
- Co-locate senior housing and continuing care retirement communities with schools, community centers, day care centers, libraries, or other municipal uses, for cost savings, intergenerational support, and community integration.
- Consider retrofitting age-restricted communities in the Growing Suburbs with sidewalks, connected streets, enhanced transit access, ridesharing services or partnerships, benches, and public restrooms.
- Support aging in place by offering support services, such as healthcare, social work, and social activities, to naturally occurring retirement communities, which are often market-rate apartment buildings predominantly occupied by seniors.
- Support the creation of more villages, which are grassroots membership organizations that coordinate access to affordable services and social support for older adults through vetted providers, often members themselves, to enable seniors to remain in their homes and communities.
- As some older adults need or want to work longer, encourage policies and practices that focus on supporting older workers, such as flexible work schedules, shared jobs, paid and unpaid opportunities, retraining and skills development programs for "encore careers," senior entrepreneurship, and post-retirement options.
- Involve older adults in making planning decisions.

GOAL: GIVE ALL CHILDREN IN THE REGION ACCESS TO GOOD SCHOOLS

Schools play an invaluable role in educating our children and serving the broader needs of the community. However, income, social, and racial inequality can create challenges for our schools and communities. Children from low-income households, students with special needs, and students of color often arrive with more intensive needs than their peers. The disadvantages these students face often manifest themselves when looking at indicators, such as standardized test scores, school size, disciplinary records, out-of-school time, and graduation rates.

Closing opportunity and achievement gaps and promoting equitable outcomes for all children requires a comprehensive approach that is based on the needs of families in a specific community. At a broader level, we must realize that discrepancies in educational attainment may be reinforced by educational funding inequities and the lack of access to support services in many of our lower-income communities. Reviewing the impact of education finance policies on communities in our region may help to improve the well-being of disadvantaged schools and students.

Connected educational programs think of communities as ecosystems and use human and social capital to gain better understanding of, and solutions to, problems. They better prepare individuals for the working world while enhancing community, family, and social life. These efforts should tie middle and high schools in with other parts of the emerging educational ecosystem: maker labs, innovation challenges, hack-a-thons, interactive art installations, online experiences, and universities.

Strategies to Give All Children in the Region Access to Good Schools

- Use big data to develop connected learning communities and leverage technology as an educational resource.[14]
- Explore opportunities to provide Universal Pre-Kindergarten programs that offer high-quality affordable educational services for all age-appropriate residents.
- Promote schools as platforms to provide multiple support services, such as extended learning programs, nutrition counseling, free or subsidized breakfasts and lunches, and health services to low-income families in the community.
- Work with political leaders and community stakeholders on school funding allocations to ensure all school districts receive adequate financial support.
- Collect and share relevant data related to student opportunity and achievement with researchers, education advocates, and policy makers so that they can make informed decisions about state education finance policy.

GOAL: DEVELOPMENT WITHOUT DISPLACEMENT

As previously lower-income areas have seen renewed development interest, there is rising concern that lower-income individuals could be priced out of their community. While development, particularly in the region's Centers, is generally a positive outcome, there need to be structural and institutional safeguards that ensure more equitable housing, health, educational, and economic outcomes for low- and moderate-income individuals and families.[15] At the same time, many other neighborhoods continue to struggle with vacancy, lack of opportunity, and disinvestment. Residents of all communities want access to jobs, better education, and healthier and more vibrant neighborhoods. Regardless of where individuals live, they should have influence over the decision-making process that affects their community, benefit from improvements, access resources and services that improve quality of life and fulfill basic needs, have choices about where they live and work, and should not be involuntarily displaced from their preferred neighborhood.

Strategies to Develop without Displacement

- Strengthen the ability of neighborhood groups and residents to create inclusive neighborhoods through community organizations, planning and zoning decisions, and other means.
- Create and preserve quality affordable housing throughout the region.
- Expand economic opportunity in neighborhood and regional centers and work with major employers to increase local hiring and sourcing.
- Research and better understand the impacts of displacement and extend assistance programs.
- Improve efforts to increase hiring of minority-, women-, and disabled-owned business enterprises and workers in projects with public funding.
- Use local land banks, code enforcement, and other means to fight blight, decay, and abandonment.

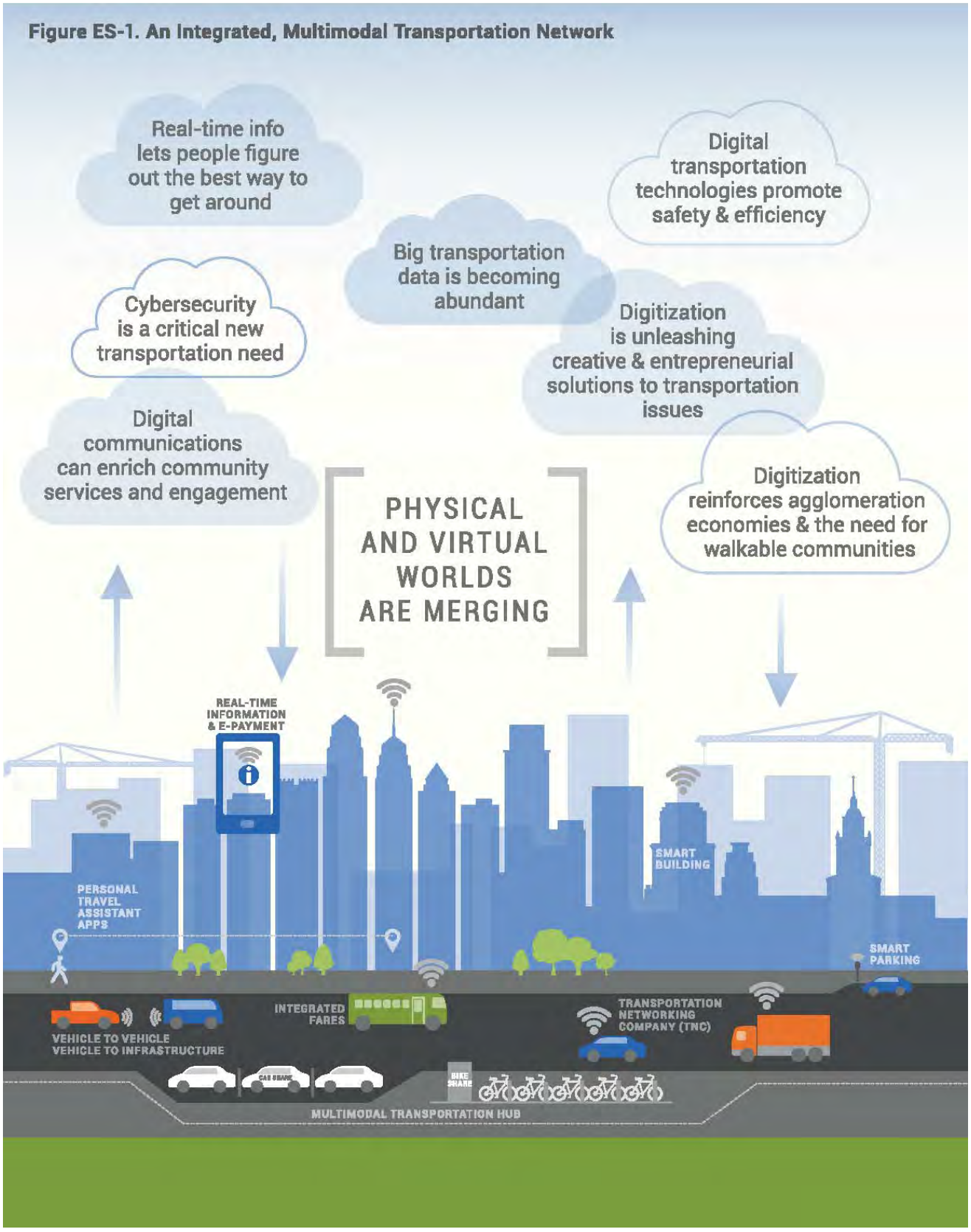
[14] Judi Fusco, Julie Remold, Jeremy Roschelle, and Patti Schank, "Smart and Connected Communities for Learning," The Center for Innovative Research in Cyber Learning, undated, http://circlcenter.org/smart-and-connected-communities-for-learning/ (accessed May 18, 2016).
[15] Philadelphia Association of Community Development Corporations, *Beyond Gentrification: Toward Equitable Neighborhoods* (Philadelphia, PA: Philadelphia Association of Community Development Corporations, 2015), http://www.phillylandbank.org/sites/phillylandbank.org/files/u3/PACDC_EcDevPlat_Full%20Platform.pdf.

PRINCIPLE: CREATE AN INTEGRATED, MULTIMODAL TRANSPORTATION NETWORK

Transportation is entering an era of rapid change fueled by the Digital Revolution. TNCs, such as Uber and Lyft, are providing tens of thousands of rides each day, just a few years after commencing service in the region. Sensors, the IoT, and other communications technologies are collecting vast amounts of data. They can be used to provide real-time information and improve decision making, from individual routing to operations and capital investments. Connected and automated vehicle (AV) technologies are not far off and are likely to bring about even safer and more efficient transportation. Communication technologies enable the ability to work remotely from anywhere in the world, potentially creating a disconnect between where people live and where they are employed. This further breaks down the notion of a region being a commute shed around a principle city. The future anticipates a move away from using a personal vehicle to complete all trips, to one where individuals use the most convenient mode(s) available. The future of transportation is multimodal, and each individual trip will more likely be multimodal.

Recognizing how technology is reshaping transportation, *Connections 2045* envisions a well-maintained, integrated multimodal transportation network that provides accessibility and equity for all citizens and visitors throughout the region, reduces congestion and auto-dependence, enhances goods movement, and moves the region toward zero roadway deaths. Integrated, multimodal transportation networks use digital devices connected to the Internet to collect data in order to provide real-time information about how to more efficiently move people and goods within existing transportation facilities, and how to use a variety of shared modes to get around an area or region quickly. The region's transit system is a tremendous asset and serves as the backbone to this network. It provides a significant competitive advantage for the region, responds to concerns about climate change, and recognizes the role of space-efficient transportation in supporting dense development patterns and agglomeration economies. This vision, challenges in achieving it, and some recommendations to further it are illustrated in Figure 30.

FIGURE 30: AN INTEGRATED, MULTIMODAL TRANSPORTATION NETWORK



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Networking transportation will mean more options, increased safety & efficiency, and less congestion.

Government provides flexible oversight, and builds partnerships with private companies and other institutions.

- Ensure low-income and environmental justice communities can access and benefit from new technologies and services.
- Connect infrastructure, and update institutional practices & regulations for a digital world.

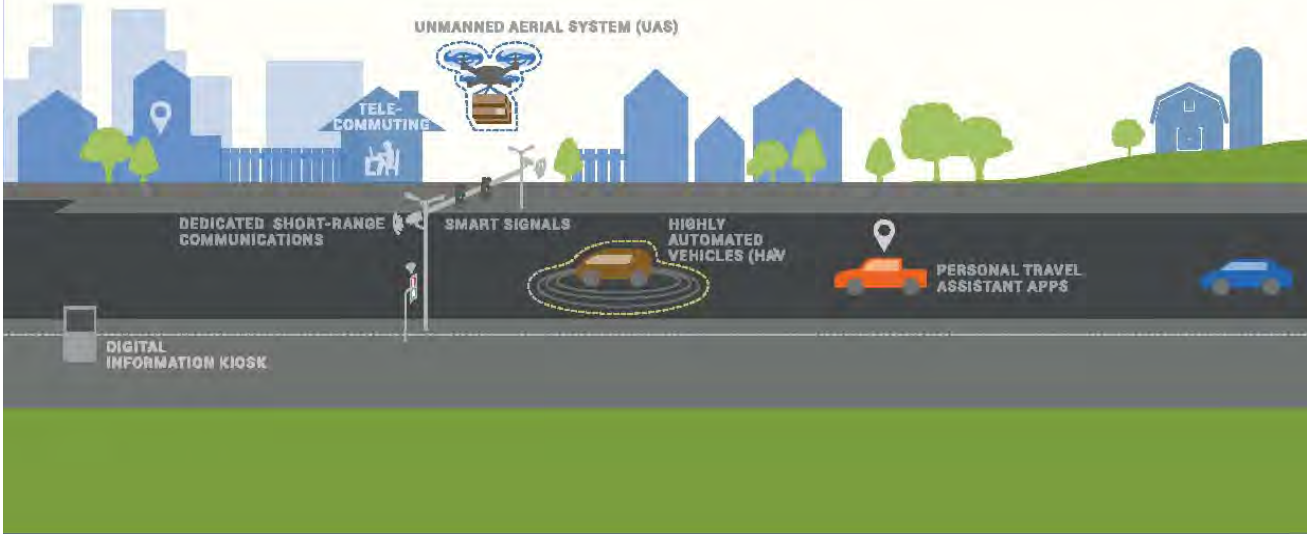
Transit serves as the backbone to an integrated multimodal network, and needs to be flexible and adaptable to fast changing conditions.

TNCs are receiving substantial venture capital & must grow fast to maintain their value.

- Growth may require changing travel behavior.
- At the same time they face labor, regulatory, cost, and potential technological disruption issues.

In the future, HAVs and UASs may revolutionize passenger and goods movement.

- This promises even greater safety and efficiency, and lower costs.
- The potential loss of driver and other jobs means government must prepare workers for the jobs of tomorrow.
- Achieving the full benefits of HAVs may require separate facilities.



Transportation networks have been a key component of prosperous regions throughout history, and the efficient movement of people and goods locally, regionally, and internationally will continue to be a hallmark of thriving regions in the future. Greater Philadelphia enjoys a tremendous advantage by virtue of its location in the Northeast and Mid-Atlantic megaregions. However, the region must address several challenges to continue to take advantage of this locational benefit in the future. We need to make investments in new digital transportation technologies. At the same time, the region's 20th-century physical infrastructure of roads, bridges, and transit systems remains critical to our ability to travel about the region. These facilities are too often in a state of disrepair, and much of the region's transportation infrastructure will need to be reconstructed and brought up to modern standards over the next several decades. In addition, the region needs to upgrade PHL and ports, and support Amtrak's Northeast Corridor Future plan. These facilities serve as vital links to the nation and world in a global economy.

DVRPC'S TRANSPORTATION PLANNING PHILOSOPHY

- Transportation investments will support the goals and policies of the DVRPC long-range plan.
- The transportation planning process will go beyond the federally required "3C" process to be Comprehensive, Cooperative, Continuing, Coordinated, and Compatible.
- Priorities are to 1) preserve and maintain the existing transportation system and rights-of-way; 2) use technology, design, and markets to improve the operation and efficiency of existing transportation facilities for all users; and 3) address the capacity of the existing multimodal transportation system, limiting the addition of through travel lanes.
- Investment benefits and costs should be strategically distributed across the region, with careful consideration of land use, environmental, economic, and social impacts. Projects should be affordable and incorporate context-sensitive design and other smart transportation techniques.
- The region will be innovative at incorporating policy approaches, ITS applications, and emerging technologies. DVRPC will be bold in supporting projects that continue to transform the region into a better place to live, visit, work, and play.

Given the limited funding available for building new facilities, the region's transportation agencies need to find ways to do more within existing constraints. Transportation Systems Management and Operations (TSMO) is one way in which the region is finding new efficiencies. TSMO is the application of technology, robust planning, improved preparedness, and extensive inter- and intra-agency coordination. TSMO strategies can provide more reliable travel times for people and goods movement; provide a variety of transportation options and traveler information to meet diverse travel demands; and enhance transportation safety, security, and incident management for all modes. The I-76 Integrated Corridor Management project is one example of a TSMO application. Another opportunity to increase efficiency is to increase vehicle occupancy. Every day a huge surplus of transportation supply is squandered by the fact that 85 percent of vehicles travel with only a single occupant. Many of the new TNCs and real-time information apps are actively seeking ways to capitalize on this opportunity.

Establishing an integrated, multimodal transportation network will provide the following benefits:

- A safer, lower-cost, more sustainable and equitable transportation network with more options in how to get around.
- Increased use of data and real-time information will enable more efficient movement of people, goods, and services within existing transportation facilities.
- Reduced automobile dependence, congestion, and associated pollution.
- Preservation of open space and natural and cultural resources that would be lost by the construction of new roads.
- Generating added value via freight distribution channels and increased productivity.
- Creation of new jobs and building of agglomeration economies by focusing investment in centers and attracting businesses that benefit from a high-performing transit system, educated workforce, and location within the northeast and mid-atlantic megaregions.
- Reduced parking demand, flexible employment opportunities, more customer service, improved connections between modes, pricing to balance supply and demand, and more responsive operations.
- Increased transparency, better decision making, and a more engaged citizenry.

During the visioning workshops, the region's residents stated a desire for more walkable communities and noted that transportation is more and more about having choices in how to get around and less about vehicle ownership. The main tools to develop an integrated network are community and market design, along with applying new technologies.

TRANSPORTATION SUBPRINCIPLE: USE DESIGN TO MAKE THE NETWORK MORE SAFE, MULTIMODAL, AND ENVIRONMENTALLY FRIENDLY

How we lay out our neighborhoods and design our streets has major implications for how we get around. Dense, mixed-use centers can shorten trips and make transit, walking, and biking more feasible. Likewise, streets that are limited to a few narrow lanes, and incorporate bike lanes and sidewalks, can calm traffic and encourage alternative forms of transportation. This can reduce the demands placed on the transportation network and provide more options in getting around. It is imperative that the region's transportation system be both comprehensive in the modes it comprises and seamless in the connections between the various modes.

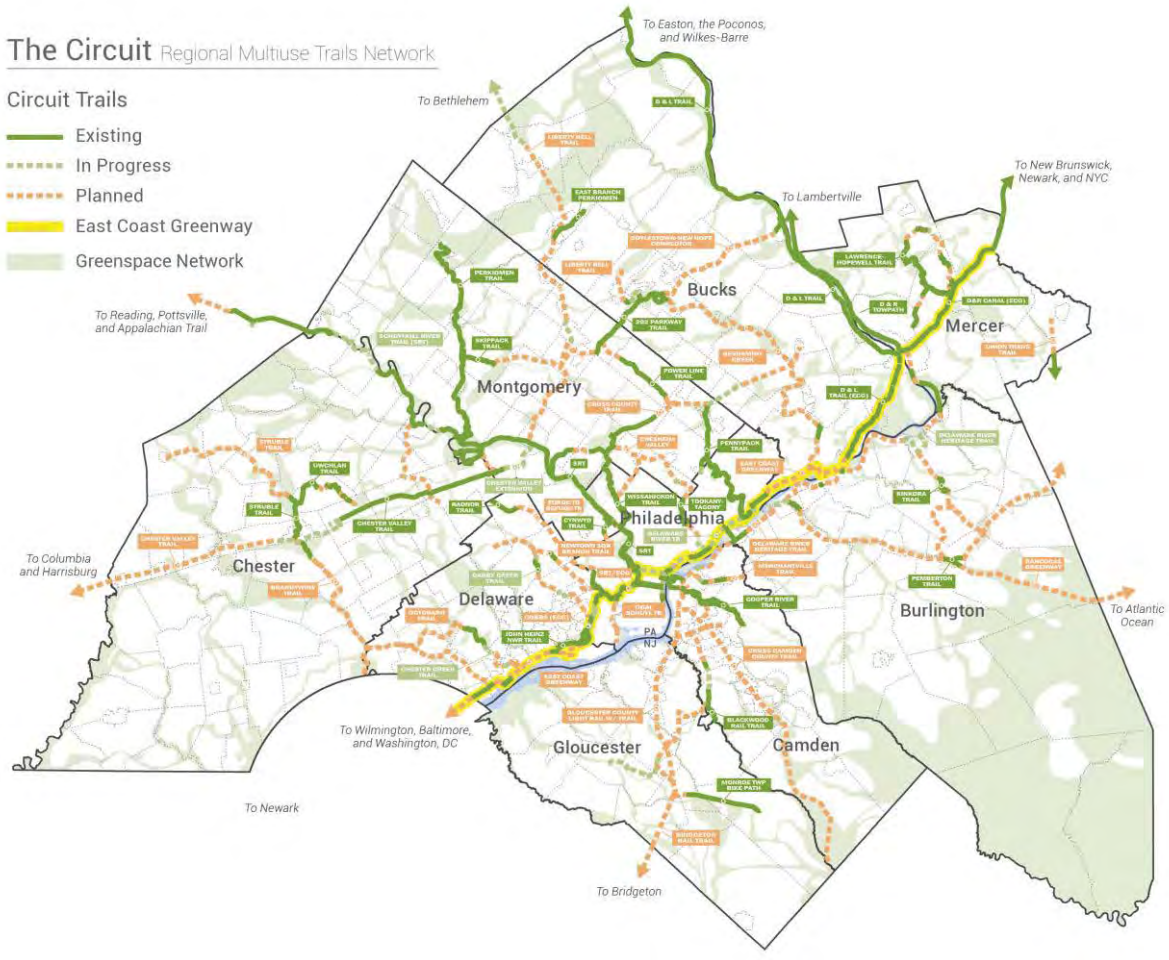
GOAL: INTEGRATE EXISTING AND NEW MODES INTO A MULTIMODAL NETWORK

The region's transportation network is an ecosystem consisting of a variety of modes: walking, biking, bikesharing, transit, paratransit, intercity buses and rail, ridesourcing, microtransit, personal vehicles, freight, and aviation. Seamless connections that enable easy transfer between modes are critical to promoting transit, biking, and walking, and to achieving a more sustainable future. Creating multimodal transportation hubs that combine a transit station with carsharing, bikesharing, and TNC and taxi pick-up and drop-off areas can enhance connections. Transit station circulation will need to improve kiss-and-ride access. Pick-up/drop-off areas will become more important than parking lots for accessing destinations.

Biking and **walking** are low impact, healthy, environmentally friendly, and sustainable modes of transportation that are accessible to a wide range of users for a variety of trip purposes. They are also

increasing in popularity as a healthy alternative to driving, and these forms of transportation are ideal for a Centers-based development pattern. Improving safety, comfort, and connectivity for bicyclists and pedestrians is critical to this objective. A common transportation planning adage is that every trip is a pedestrian trip, since even trips by car will begin and end on foot. As a result, pedestrian planning and the consideration of pedestrian needs are integral elements of nearly all regional planning activities. More short trips in the region could be made by bicycle if safer and more comfortable accommodations were provided. Context-sensitive bicycle and pedestrian accommodations should be pursued throughout the region as part of a Complete Streets policy framework. Complete Streets are those that accommodate pedestrians, bicyclists, transit, freight vehicles, and cars, and allow us to maximize regional transportation choices and mobility. Continued investments in the Circuit regional trail network will enhance walking and biking, as well as community livability.

FIGURE 31: THE CIRCUIT REGIONAL MULTIUSE TRAILS NETWORK



Source: DVRPC, 2017

The Circuit Coalition is a collaboration of nonprofit organizations, foundations, local governments and agencies working to complete a connected network of multiuse trails—the Circuit Trails—across the Greater Philadelphia region. Today, 320 miles of the 775-mile trail network are complete, with an additional 65 miles expected to be constructed over the next five years. When fully constructed, the Circuit Trails will be a

network unlike any other in the country—connecting urban, suburban, and rural communities with dedicated nonmotorized rights-of-ways separated from vehicular traffic. Utilizing a unique partnership of private foundations, county governments, state agencies and the Pennsylvania and New Jersey DOTs, the region is actively leveraging many tens of millions of dollars to build these significant pieces of transportation infrastructure. The Circuit will make our region stronger by providing a place for healthy transportation and recreation, connecting our communities to green space, and making our neighborhoods more attractive places to live and work.

Achieving a more walkable and bikeable Greater Philadelphia requires improvements in infrastructure and changes in policy that facilitate greater local mobility and regional access. These policies include an emphasis on bicycle- and pedestrian-friendly engineering solutions, more focused enforcement of bicycle and pedestrian safety, and the provision of educational programs for cyclists, pedestrians, and drivers.

Our robust public transit system in Greater Philadelphia represents a significant competitive advantage at a time when mixed-use, transit-served Centers are also places of increasing value and economic success. However, the challenge of maintaining our inherited transit infrastructure makes it hard to adapt to new service needs and opportunities. The existing system has a large backlog of state of good repair (SGR) needs. As a result, riding is not always as easy, reliable, seamless, and accessible as it could be. DVRPC works with our partner transit agencies to think about transit system improvements, operations, expansion, access, and TOD priorities in a coordinated way.

Shared mobility providers offer service through digital networks, which are typically accessed through a smartphone app that uses real-time data to match supply and demand.[16] Services that include vehicle sharing can vary by whether they are one-way (meaning the vehicle can be picked up in one location and dropped off at another) or round trip (meaning the trip must end at the same location where it started). In Greater Philadelphia, Indego Bikesharing is an example of a one-way trip, which generally ends at a different station from where it started. Enterprise Carshare and Zipcar are examples of a round trip, for which the vehicle must be returned to the same location where it was picked up. Free-floating systems break away from station infrastructure altogether and aim to move vehicles and bicycle pick-up and drop-off locations closer to trip origins and destinations.[17] In peer-to-peer networks, an individual rents their personal vehicle (or bike, scooter, etc.) to someone else. Types of digital transportation service providers in Greater Philadelphia include:

- **Bikesharing** services set up publicly accessible bicycles for short-term use. They can fill in missing gaps in transit service and can serve as an overflow for peak-period transit ridership. Bikesharing programs are often operated municipally through a public-private partnership but also can be found on corporate and university campuses, in residential properties, and hotels.

- **Carsharing** allows an individual to rent a car on an hourly or daily basis. Reservations are usually made in advance but often can be done with very short (30 minutes or less) notice. Each carsharing vehicle is estimated to replace 9 to 13 personally owned vehicles.

[16] "Episode 2—Shared Mobility Conversation with Susan Shaheen." ITE Talks Transportation Podcast Series https://www.spreaker.com/user/ite-talks-transportation/episode-2-shared-mobility-conversation-w

[17] *New Mobility* (Toronto: WSP, August 2016 update), http://www.wsp-pb.com/Globaln/WSP-Canada/In%20the%20media/Project%20News/2016/16-08-31%20-%20New%20Mobility/WSP%20Metrolinx%20New%20Mobility%20Report%20July%202016.pdf.

- **Courier networking** services offer on-demand pick-up and/or delivery of goods, groceries, and take-out foods. By delivering needed, and potentially bulky or heavy, goods to a household, these services play an important role in helping individuals to live car-free or car-lite if they choose.

- **TNCs** facilitate rides through a digital network using independent contractor or professional drivers depending on the form:

    - **Microtransit** services generally combine trips to move multiple passengers simultaneously on demand. These services often create partnerships with charter bus companies, which supply the vehicles, drivers, and insurance.

    - **Ridesourcing** uses an app to electronically hail a driver, who "contracts" with the service. The cost of the trip is indicated before the request is finalized. The app guides the driver to pick up the passenger and then take them to their desired destination. Payment is handled electronically within the app, so the driver has no need to carry cash.

    - **Ridesplitting** combines aspects of ridesourcing and microtransit. These services may use larger vehicles, which are owned by independent contractor drivers, to simultaneously pick up and drop off multiple passengers for a discounted price. This may increase vehicle occupancy rates and help to alleviate congestion.

GOAL: SUPPORT AN ACTIVE FREIGHT NETWORK AND AVIATION SYSTEM

Freight shipments and deliveries provide vivid evidence of the Greater Philadelphia region's vigorous economic activity and open trade with other regions, states, and countries. The movement of goods by trucks, trains, ships, and airplanes is enabled by an extraordinary multimodal freight network. Among the primary attributes of the Delaware Valley's freight transportation network are:

- 319 miles of the Primary Highway Freight System;

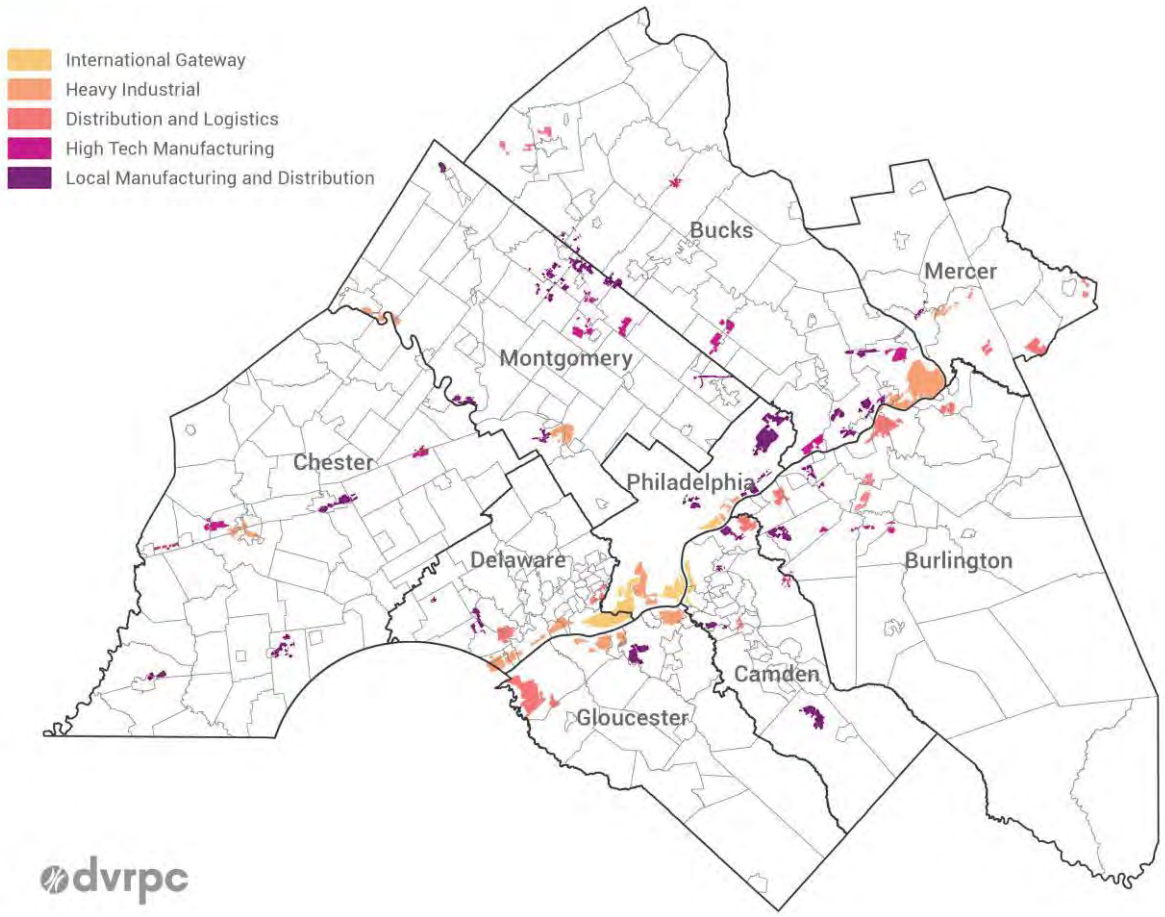
- 700 miles of rail lines that can be used to haul freight;

- 31 port terminals on the Delaware and Schuylkill rivers; and

- two commercial airports and 11 reliever airports.

The freight network serves local businesses and residents, and it may also be used as a platform to reach the 100 million people who live within 500 miles of the region. Greater Philadelphia has 67 identified "freight centers," which are major focal points and trip generators. The freight centers are a testament to the broad range of manufacturing, warehousing, transportation, quarry, and utility activity that occurs locally. They also highlight the strong linkage between freight transportation and job retention and creation.

FIGURE 32: FREIGHT CENTERS



Source: DVRPC, 2017

The growth in e-commerce, along with the flourishing of downtown areas throughout the region, has led to a significant increase in deliveries of goods to stores, homes, and offices. This important form of commerce must be integrated with street design and personal travel modes, such as bicycling, walking, and transit. Among the identified best practices are internal loading zones, off-hour deliveries, and alternate delivery sites.

Recent innovations in logistics and supply chains, such as containerization, just-in-time deliveries, and e-commerce have revolutionized and altered global shipping patterns. For example, just a few years ago, it would have been hard to imagine that shop owners and individual consumers would be able to place orders and initiate same-day deliveries with a simple click at a personal computer.

Major external projects also exert significant influences. For example, the Marcellus Shale natural gas venture is leading to the repurposing of idled refineries to process liquid products, and pipelines are being constructed to transport propane and ethane for processing and shipping from the port. Additionally, the expansion of the Panama Canal has helped drive the deepening of the main channel of the Delaware River to 45 feet; the opening of a new general cargo marine terminal in Paulsboro, New Jersey; and major renovations to the Tioga and Packer Avenue marine terminals in search of new business and new markets.

This activity is so important that DVRPC and many of its member governments are formulating plans and projects to better accommodate the unique needs of shippers, receivers, and carriers and the demands placed on transportation infrastructure due to the transport of freight. Goods movement planning includes promoting freight-as-a-good-neighbor strategies and fostering public- private partnerships to fund necessary projects. New analytic tools are also emerging, such as freight performance measurements. Among the region's top objectives for utilizing and targeting traditional funding sources to integrate freight facilities and operations with community goals are:

- Maintain and enhance the newly designated National Highway Freight Network, made up of the Primary Highway Freight System and Critical Urban Freight Corridors.
- Monitor the availability and promote the adequate supply of overnight truck parking.
- Improve first-mile and last-mile connections (both highway and rail) to designated freight centers.
- Incorporate goods movement and delivery considerations within the design of Complete Streets.
- Enhance safety for pedestrians, rail operators, and motorists at highway-railroad grade crossings (especially for the 29 grade crossings on the region's interstate, Class I main lines).
- Provide additional capacity at rail freight bottlenecks, railyards, and rail lines shared with passenger rail operations.
- Promote the use and acquisition of vehicles and equipment throughout all freight modes that help achieve improved air quality.
- Assist partners with the pursuit of project funding through competitive grant programs (e.g., U.S. DOT's Fostering Advancements in Shipping and Transportation for the Long-Term Achievement of National Efficiencies (FASTLANE) program and NJ DOT and PennDOT freight-eligible programs).

Aviation is a critical link in connecting the Greater Philadelphia region with the nation and world. The region's aviation system encompasses commercial, reliever, and general aviation airports, as well as one heliport, in the traditional nine-county DVRPC jurisdiction, as well as Salem County, New Jersey; New Castle County, Delaware; and Cecil County, Maryland. Having an accessible and efficient aviation system helps foster a high quality of life for residents, businesses, and visitors alike, allowing access to people and markets worldwide.

PHL regularly ranks among the busiest airports nationwide by aircraft movements (takeoffs or landings). PHL produces $15.4 billion in annual output within the 11-county Philadelphia metropolitan statistical area, supporting 96,300 jobs and $4.8 billion in total earnings.[18] PHL's hub status means flights are abundant for business and leisure travelers, as well as cargo needs. As commercial aviation continues to consolidate, it is economically vital for the region that PHL be maintained and expanded as a hub operation; for instance, by adding direct flights to emerging markets in Asia and Latin America. In addition to PHL, commercial service is once again available from Trenton/Mercer airport, providing a choice of three commercial airports in the region for travelers and airlines. Future plans at PHL include two runway extensions, a new front entrance to replace the terminals B and C ticketing areas, and other terminal infrastructure improvements. Growth at PHL

[18] Econsult Solutions, *Regional Economic Impact of Philadelphia International Airport*.

not only creates jobs, but also contributes to the region's overall economic development by providing greater transportation and shipping services, which attract a diversity of industries.

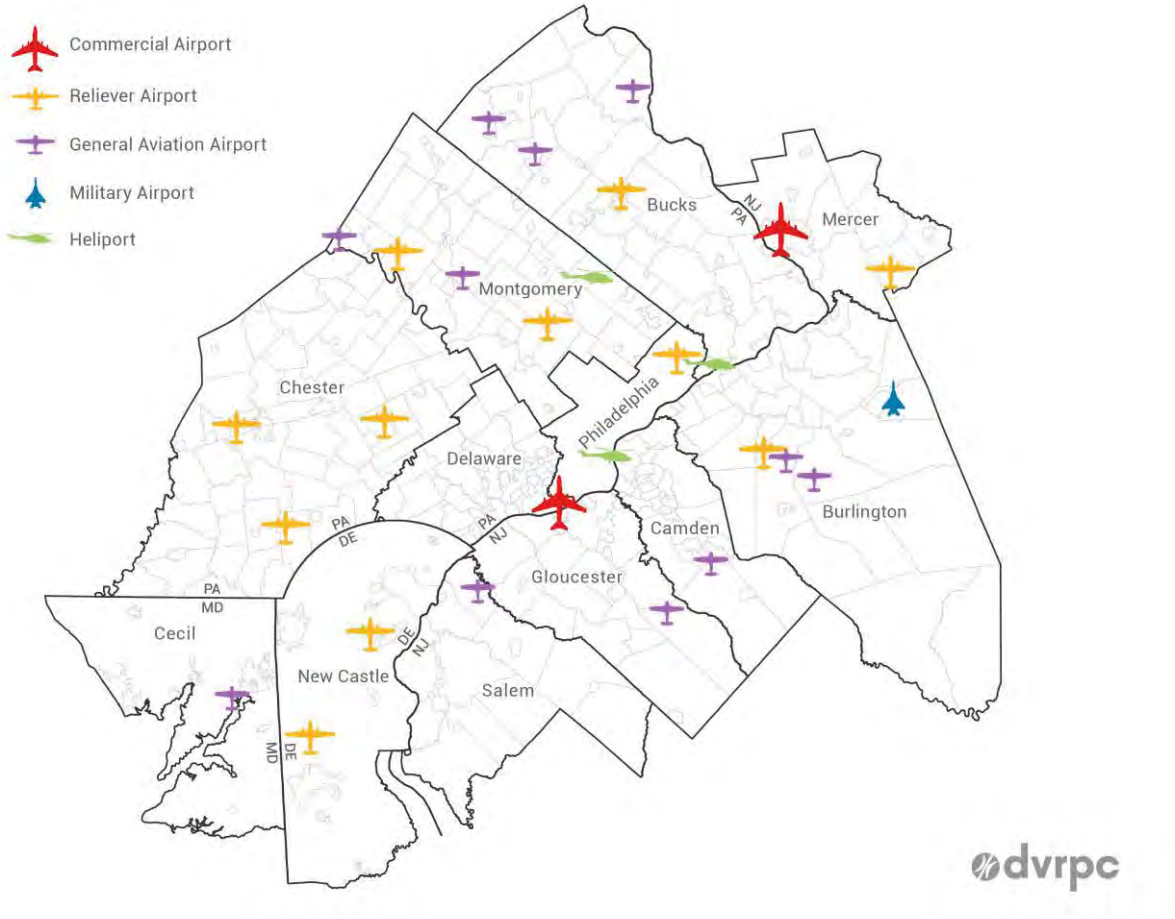
In addition to the two commercial airports, the region's 11 reliever airports play a key role in the regional aviation system by providing access for business aircraft. These facilities allow for improved access to business centers throughout the area while freeing up capacity at commercial airports. Another 11 general aviation airports provide facilities for both business and recreational aircraft. The region is further complemented by three heliports, providing dedicated facilities for helicopter, or vertical flight (VF), needs, in addition to VF facilities at many airports. One airport is dedicated to military aircraft.

With the scarcity of undeveloped land in Greater Philadelphia, airports are often affected by competing land uses. Commercial airports may seek to expand into neighboring areas, while, conversely, new residential or commercial developments may encroach on existing reliever and general aviation facilities. As the replacement cost and feasibility of building new airports is prohibitive, and available open land in the region is hard to find for future replacement airports, preservation of these facilities is important for future aviation success in stimulating regional economic activity and relieving congestion at commercial airports.

Aviation planning has many challenges, including congestion, competing land uses, and economic uncertainty. The decisions made now in regard to aviation planning will be felt for many decades to come, so it is critical that the region work together to provide a comprehensive and effective plan.

- Greater Philadelphia's most recently completed Regional Airport System Plan (2014) identified the following key recommendations for the region's extensive and complementary network of aviation facilities:
- Expand commercial air service within the region.
- Preserve public-use general aviation and reliever facilities.
- Sustain and improve infrastructure to attract more users.
- Improve community outreach to inform the public of the importance of airports to the local and regional economy.
- Improve efforts to attract students to careers in aviation fields.

FIGURE 33: GREATER PHILADELPHIA REGIONAL AIRPORT SYSTEM



Source: DVRPC, 2017

GOAL: CREATE A SAFER TRANSPORTATION SYSTEM

The region's Transportation Safety Action Plan focuses on reducing crashes and fatalities on the regional roadway system by providing a roadmap for effective collaboration and coordination among safety professionals and stakeholders. Strategies for advancing this goal are detailed in agreed-upon key emphasis areas, which focus on various safety issues, including: aggressive driving, impaired driving, roadway departure crashes, and seatbelt use. The Transportation Safety Action Plan is a data-driven living document that is coordinated with New Jersey's and Pennsylvania's statewide safety plans.

Pedestrian fatality rates are higher than the national average in both New Jersey and Pennsylvania, and in the DVRPC region. Both states are current Federal Highway Administration (FHWA) Pedestrian Safety Focus States, and Philadelphia is a Focus City. Ensuring pedestrian safety is one of seven key emphasis areas identified in the Transportation Safety Action Plan.

GOAL: INCREASE ACCESSIBILITY AND MOBILITY

Accessibility refers to the ability to reach desired destinations within the region, and *mobility* refers to the movement of people and goods. Mobility is increased when the transportation network is multimodal and

provides connections between various modes. The ability to reach destinations throughout the region is a challenge for many members of society who do not have access to an automobile.

GOAL: LIMIT TRANSPORTATION IMPACTS ON THE NATURAL ENVIRONMENT

Transportation has a significant impact on the natural environment. Automobiles, in particular, contribute significantly to air and noise pollution and GHG emissions; while oils, grease, heavy metals, and other toxins in stormwater runoff from roads pollute surface waters.

Design Strategies to Make Transportation More Efficient, Multimodal, Environmentally Friendly, and Safe

The region's Centers-based land use strategy is also a transportation strategy. By prioritizing investment in dense, mixed-use communities, the region can limit demand on the transportation network and reduce how much infrastructure is needed to meet travel needs. Doing so requires designing for space-efficient transportation options, such as walking, biking, and transit trips; and centralizing major destinations within multimodal development Centers.

- Promote land use and development patterns that reduce the need for long trips.
    - Encourage investment in the region's Centers and older, developed areas.
    - Promote TOD and mixed-use development.
    - Reduce parking minimums.
    - Prioritize shared and transit vehicle parking over personally owned vehicles.
- Provide more options for commuters and transportation network users by developing safe, efficient, and multimodal street networks.
    - Context-sensitive solutions can help to distinguish between the design needs for high-mobility facilities, like limited access highways; and high-accessibility facilities, such as residential and main streets.
    - Develop Complete Streets to accommodate all modes and users, including space for goods delivery. Provide for safe-system accessibility for all segments of the population, including EJ, elderly, and persons with disabilities; and increase affordable transportation alternatives.
    - Comply with regulations and guidelines of the Americans with Disabilities Act (ADA) and Title VI.
    - Use traffic calming, roundabouts, and road diets to enhance safety and operations, where appropriate traffic conditions exist.
    - Limit arterial, collector, and local road lane widths to 10 feet in order to calm traffic and increase safety.
    - Optimize efficiency through incident management, access control, signal system improvements, and needed highway improvements.
    - Improve bicycle and pedestrian facilities, and increase transit coverage area, service hours, and the number of multimodal transportation centers.
    - Build multimodal transportation hubs combining transit stations and stops with carsharing, bikesharing, and pick-up/drop-off zones. Improve scheduling and operations to accommodate intermodal movements.
- Avoid and minimize impacts to sensitive environmental resources throughout project planning, design, and construction.
    - Where impacts are unavoidable, work with federal and state resource agencies to assist in the identification of compensatory mitigation measures.

- Incorporate green stormwater infrastructure into road construction, rehabilitation, and retrofits to capture and infiltrate stormwater.
- Increase resilience of the transportation system and communication networks to infrastructure failure, floods, winter weather, and other extreme weather events.

- Consider safety in all projects.
  - Seek funding for specific improvements to transportation infrastructure to increase safety.
  - Maintain a regional crash database and conduct studies and projects to identify high crash locations and develop safety enhancements.
  - Support appropriate enforcement to improve safety, including building knowledge for applicable legislative initiatives, supporting relevant professional development for law enforcement staff, and educating members of the judicial branch of the consequences of frequently reducing charges.
  - Promote and coordinate programs that educate about and market safety.
  - Use incident management to:
    - Improve interagency communication and coordination.
    - Improve incident detection and verification.
    - Respond to and clear traffic incidents as quickly and safely as possible.
    - Reduce the number of overall major, secondary, and work-zone-related traffic incidents.
    - Reduce crashes at signalized intersections.

TRANSPORTATION SUBPRINCIPLE: USE MARKETS TO IMPROVE TRANSPORTATION INFRASTRUCTURE CONDITION AND EFFICIENCY

How states, regions, and municipalities address transportation marketplaces with rules, regulations, and taxes will have major implications on our region's ability to achieve the goals set in *Connections 2045*. Smart investments in transportation save time and money, improve the environment, and enhance the region's economy. Being competitive in the global economy requires well-maintained, safe, efficient, and reliable transportation infrastructure that promotes network effects and agglomeration economies. Transportation facilities need to enable easy accessibility and mobility within the region while also physically and virtually connecting the region with major economic centers around the world.

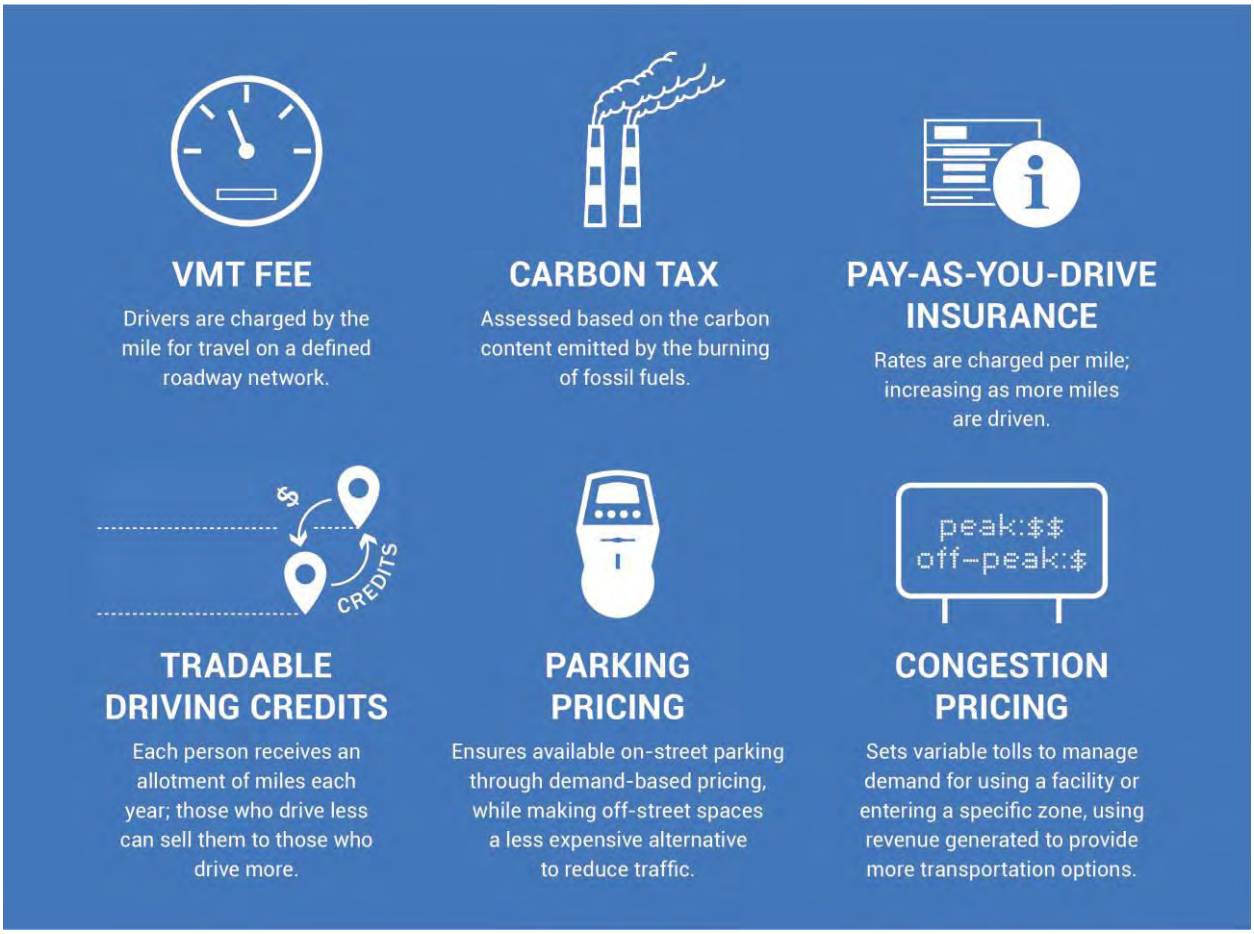
The Digital Revolution is generating new energy, entrepreneurship, and creativity to address transportation challenges. New digital shared services are expanding transportation options and mobility, particularly for less mobile populations, such as the young, the elderly, and individuals with disabilities. TNCs are offering new services and using "surge" or peak-period pricing to better manage supply and demand. Increased private market investment may come from new ways of doing business in the digital world. In a knowledge economy, data is currency.[19] Companies may collect and find ways to monetize data as a way of getting a return on their investment.

Ultimately, there needs to be more discussion about the long-term replacement for the gas tax. Digital technologies may also make other best practice recommendations, such as pay-as-you-drive insurance policies, VMT fees, tolling, and congestion pricing more feasible. Increasing private market investment could come in different forms. Digitization offers the opportunity to readily charge vehicles by use, time-of-day,

[19] *New Mobility*.

carbon emissions, or any other relevant factor. These new forms of charging can help the region to meet other goals, such as reducing congestion or limiting GHG emissions.

FIGURE 34: MARKET FUNDING MECHANISMS



Source: DVRPC, 2017

GOAL: REBUILD AND MAINTAIN THE REGION'S TRANSPORTATION INFRASTRUCTURE

Infrastructure is a critical platform upon which we build our communities and the economy. The region's 20th-century physical infrastructure of roads, bridges, and transit systems remains essential to our ability to travel about the region. These facilities are too often in a state of disrepair. Pennsylvania has the second highest number of structurally deficient state-maintained bridges in the nation, and 38 percent of the region's state-maintained lane miles of pavement are in poor condition. SEPTA has rail bridges that are a century old, substations and catenaries from the 1930s, commuter trains from the 1970s, and trolleys from the early 1980s. The rebuilding of the existing network of roads, transit lines, and other transportation facilities is the focus for transportation investments moving forward at the national, state, and regional level. Rebuilding is an opportunity to digitize these facilities by incorporating technologies like dedicated short-range communications (DSRC), which can talk with CVs and infrastructure; connecting traffic signals to the Internet; and using sensors to track infrastructure condition and better time repairs.

We must continue to prioritize projects based on quantitative data to ensure that funds are spent efficiently and effectively. We must also plan for the future and preserve vital rights-of-way so that the system can expand. Utilizing abandoned rail lines as trails in the interim is one way in which key corridors can be preserved for future use.

GOAL: INCREASE RELIABILITY AND REDUCE CONGESTION

Congestion has a significant impact on a region's economic competitiveness, since people and goods sitting in traffic equates to money lost. In 2015, the average auto commuter in the Greater Philadelphia region sat in traffic in excess of 48 hours due to congestion, which ranked 22nd nationally. This cost the average commuter more than $1,100 in lost time and wasted fuel consumption. Reducing congestion has traditionally been accomplished by expanding capacity. Widening roads, however, leads to unintended consequences that promulgate auto-dependence and the need to build more roads. When roads are built for cars, they can become barriers to pedestrians and other modes. People and businesses locate farther and farther from regional core areas to avoid congestion. Parking lots become oversized, creating another barrier to alternative modes. Vehicle ownership rates increase as people have fewer options for how to get around. As development continues to spread out, the need for auto-oriented transportation is reinforced. Rather than solving problems as intended, building new and wider roads creates a rebound effect that actually makes congestion worse over time.

The same peak hours generally occur every weekday, but on any given day unusual circumstances like crashes or weather can dramatically change the performance of the roadway. Travelers want consistency or dependability in travel times from one day to the next. This is referred to as "travel-time reliability." Travel-time reliability is a measure of the variation in how long it takes to make the same trip from one day to another. When your usual half-hour trip takes an hour and makes you late, it can be frustrating. Data collected by the FHWA indicates that nonrecurring congestion—which is caused by weather, crashes, construction, disabled vehicles, and special events—actually accounts for more hours of delay than the everyday (recurring) congestion that results from road capacity constraints and heavy volumes.

One way to make the transportation system more reliable is to reduce demand through travel demand management strategies. These strategies include: carpool and vanpool programs, telecommuting, variable work hours, parking cash out, and other policies that provide alternatives to the single-occupant vehicle.

Congestion pricing uses economic principles to encourage more efficient use of transportation facilities. The cost to use the facility increases when demand is high during peak periods, which can help to balance supply of and demand for transportation infrastructure. This may be the most effective and efficient way to reduce congestion. New digital vehicle and infrastructure technologies make congestion pricing, and other alternative funding strategies, possible.

The federally required **Congestion Management Process (CMP)** advances the goals of the long-range plan and strengthens the connection between the Plan and the Transportation Improvement Program. The CMP's guiding principle is that transportation investments will support the land use goals and policies of the Plan. It identifies and prioritizes the region's congested corridors and identifies multimodal design and technology strategies to mitigate congestion. Where additions to capacity are found to be appropriate, the CMP includes supplemental strategies to get the most long-term value from the project.

Regulations require projects that add single-occupancy vehicle capacity to be consistent with the CMP in order to be eligible for federal funding. The CMP defines procedures for all federally funded major capacity-

adding road projects, whether in congested corridors or not. Additionally, the CMP provides information about the performance of the regional transportation system and identifies inexpensive strategies appropriate almost everywhere to minimize congestion and enhance the mobility of people and goods.

GOAL: BUILD PARTNERSHIPS

Local governments must build partnerships with stakeholders and residents through open data, crowdsourcing, prototyping, and trials. These partnerships can help generate new community activities and ideas, tap into citizen knowledge and expertise, and enhance local government services. Partnerships between TNCs, transit agencies, and local governments have sought to improve transportation all over the country. These partnerships can help to grow services and promote more efficient transportation and car-free or car-lite lifestyles. As public funding for transportation infrastructure continues to stagnate, the private market seems poised to take more of a lead in developing the digital transportation infrastructure of the future. This may mean a new world of financing infrastructure, one that might rely more heavily on public-private partnerships.

Paratransit services can partner with TNC app technologies, and provide an opportunity to vastly improve dial-a-ride programs for seniors and persons with disabilities. The existing programs often require individuals to make requests up to 24 hours in advance. Real-time, app-based technology can allow requests to be made as needed and reduce wait times and missed appointments.

PERFORMANCE-BASED PLANNING

Transportation projects should support the five core plan principles of sustaining natural resources; creating livable communities; building the economy; fostering equity among the region's residents; and creating an integrated, multimodal transportation network. In particular, investments should serve areas that are either already developed or designated as appropriate for future growth, encourage growth and reinvestment in the region's Centers, have limited environmental impact, and support key economic sectors. Potential projects are evaluated to make sure that they help achieve the key principles outlined in the Plan. Governments and agencies at all levels must make sound investment decisions and be good stewards of limited public resources.

Market-Based Strategies to Improve the Condition and Efficiency of Transportation Infrastructure

- Use pricing to balance the demand for and supply of transportation infrastructure.
    - Change pricing structures and use sensors and real-time information to increase the use of off-street parking spaces and increase the availability of on-street spaces.
    - Use digital technologies and variable roadway pricing to reduce congestion and balance demand for road space with available supply.

- Increase travel-time reliability for all users.
    - Use Information Technology Services (ITS) to enable Transportation Systems Management and Operations (TSMO) strategies.
    - Prioritize systems that reduce delays through known bottlenecks.
    - Enhance regional traffic signal coordination systems and support systems that respond to current conditions.
    - Implement and expand transportation systems that improve reliability for transit, pedestrians, bicycles, commercial vehicles, and the freight network.

- Manage demand for transportation.
    - Support and enhance programs to reduce the number of vehicle trips and the amount of VMT, particularly single-occupant—and future zero-occupant—vehicle trips, and encourage practices that spread travel throughout the day and throughout the week.
    - Encourage the reduction in the use of travel modes that contribute significantly to air pollution by increasing the use of public transit, bicycle and pedestrian facilities, telecommuting, and ridesharing.

- Prepare for the increased provision of private-market shared mobility services.
    - Limit barriers to entry and allow for the formation of new transportation services and innovation. Provide public oversight of new shared mobility services in advance of regulations.
    - Encourage mobility-as-a-service multimodal travel pass or ticket options that combine different modes and services onto a single payment platform.
    - Revise zoning and regulations to offer density bonuses for developments that incorporate shared mobility infrastructure.
    - Avoid exclusive agreements with singular service providers.
    - Determine where technology and data sharing can complement customer protection regulations.
    - Clearly define the process for licensing and regulating new private-market transportation services.
    - Review taxi regulations in light of the rules developed to govern TNCs.

- Build partnerships with the private-market and nonprofits.
    - Incentivize the private sector, nonprofits, and public-private partnerships to speed up and incorporate new technologies into infrastructure development.
    - Seek mutually beneficial partnerships between local governments and transit agencies with TNCs and other digital transportation service providers.

- Select projects for capital programming based on sound long-range strategic planning considerations, life-cycle investment analyses, and system performance and condition data.
    - Consider the land use impacts of transportation investments in the development of plans and programs.
    - Increase the level of investment in transportation facilities that promote freight movement and economic development.
    - Develop and employ asset-management systems to select cost-effective capital projects.
    - Set goals and indicators to track performance and progress toward attaining them.
    - Conduct analysis and planning on a corridor-wide, rather than a facility-level, basis to expand the scope of potential solutions, consider all modes, and choose the most efficient way to move people and goods on a case-by-case basis.
    - Devote sufficient resources to address reconstruction and maintenance needs in order to improve infrastructure condition.
    - Limit new capacity to appropriate areas, as identified in the CMP, and focus construction of new capacity on missing links and priority bottlenecks.
    - Preserve existing rail and road rights-of-way for future transportation uses.
    - Modernize and speed up procurement. Digitization will require purchasing and maintaining new types of technology and may challenge traditional procurement practices.
    - Undertake flexible, low-cost pilot projects to test ideas in advance of major capital expenditures.

TRANSPORTATION SUBPRINCIPLE: INCORPORATE NEW TECHNOLOGIES AND SERVICES TO CREATE A SEAMLESS TRANSPORTATION NETWORK

While technology has long played a key role in transforming how people get around, the pace at which innovations are coming to the market seems to be accelerating. There are numerous transformative technologies that have the potential to revolutionize transportation; many come from the Digital Revolution. These technologies have the ability to network various modes together and increase the availability of real-time information in ways that improve both efficiency and safety. Networked transportation is made up of a variety of components, including: Big Data, CVs, digital mapping, AVs, the IoT, real-time information, TNCs and other digital transportation providers, UASs, and more. In the future, networked transportation may create more mobility-as-a-service arrangements, where individuals can buy a monthly pass with unlimited or a fixed number of trips on a variety of transportation modes.

Achieving future technological solutions will mean that innovations will need to be economically viable, overcome potential liability and regulatory issues, and gain acceptance by society at large. Monitoring the impacts of upcoming technology is another reason for regular updates to the region's long-range plan.

Alternative fuel vehicles present an opportunity to serve the region's mobility needs while simultaneously reducing energy use, petroleum dependence, fueling costs, and GHG emissions. Electric vehicles (EVs) are powered by an electric motor using electrical energy stored in rechargeable batteries or other storage devices (such as a hydrogen fuel cell). EVs include plug-in hybrid electric vehicles—which have a supplementary internal combustion engine—and all-electric vehicles. Future vehicles may alternatively be fueled by liquefied natural gas, propane, biogas, compressed air, or hydrogen fuel cells. Another possibility is that they will take a hybrid approach, with the ability to be powered by a variety of different fuel sources. Regardless, the region will need to find ways to build out supportive infrastructure, most likely electric, to fuel the vehicles of the future.

Gas taxes are the primary way in which the region and nation pay for transportation infrastructure construction and maintenance. Increasing fuel efficiency along with new types of fuel will further reduce the flat-rate gas tax revenues that fund most transportation projects, making it even more difficult to maintain the system in the future. Increased use of alternative-fuel vehicles will necessitate finding a new way to raise revenue for transportation infrastructure.

AV and **HAV** systems comprise hardware and software, both remote and on-board, which perform the functions needed to drive a vehicle. The key hardware components include an on-board computer that makes decisions; a global positioning system (GPS) signal system; an inertial measurement unit for when the GPS is out of signal; radar sensors that detect nearby vehicles; ultrasonic sensors that detect other vehicles and objects alongside the AV; light detection and ranging that identifies lane markings; and video cameras that read traffic signals, road signs, and watch for pedestrians and obstructions.

HAVs still face a number of technological challenges. HAVs must be able to transfer control of the vehicle in degraded conditions, but it is unclear whether a driver will be ready to take over when this happens, particularly as driver skills will atrophy when computers start to do most of the driving. Operating systems are based on millions of lines of code, and testing is occurring through trial and error, which means it is hard to test them all. HAVs require sensitive computer equipment, which will be exposed to the elements. This

creates additional risk of failure. Work zones create a particular problem for HAVs because they take precedence over all the other detailed road information that these vehicles are programmed to read.[20]

HAVs could alter the vehicle ownership model, with a decrease in privately owned cars and an increase in shared vehicle ownership. This could revolutionize the carsharing model, and by removing the sunk costs of automobile ownership, other modes may benefit. While their eventual timeline to show up in large numbers in the region's streets remains unknown, the region needs to begin planning for them now. Some initial considerations in planning for HAVs include:

- There is no guarantee they will be shared, though sharing should be the goal.
- It is not clear what the land use implications will be, though supporting regional Centers with denser land use patterns and building agglomeration economies should be the goal.
- While they will increase the capacity of existing facilities, the rebound effect suggests they will equally increase VMT. Particularly significant is the potential for zero-occupant vehicles to clog the road, increasing the need for road pricing.
- AVs are likely to be electric, increasing the need to build out EV infrastructure.
- AVs use road markings for guidance. These need to be well-maintained. Signs need to be kept clear and readable and will require additional tree trimming to ensure visibility.
- It is unclear where AV technology is on the cost curve. This will have a major impact on the rate of uptake, once they overcome technology, liability, and legislative hurdles.
- There is likely to be a long period where HAVs and human-driven vehicles share the road. Until AVs are operating on their own infrastructure, society is unlikely to see significant benefits in terms of safety or congestion reduction. Achieving this would require either:
    - construction of new HAV-only facilities;
    - conversion of existing facilities, or a proportion of existing facilities, to HAV-only; or
    - banning human drivers.
- HAVs will make the system more complex and reliant on advanced communications networks, increasing the risk of system failures.
- The actual price to use shared HAVs is likely to fluctuate based on supply and demand. It is unlikely that shared HAV fleets will be sized to meet peak-hour demand, as this would be inefficient. This means the calculus of each trip that an individual takes could vary based on the available supply and demand for each mode and create price surges, leading to affordability and equity issues.

"**Big Data** is a broad term for data sets so large or complex that traditional data processing applications are inadequate."[21] The steadily decreasing cost of computing power—storage, memory, processing, bandwidth—

[20] Aarian Marshall, "Why Self-Driving Cars *Can't Even* With Construction Zones," *Wired*, February 10, 2017, https://www.wired.com/2017/02/self-driving-cars-cant-even-construction-zones/ (accessed February 13, 2017).
[21] Abbas Mohaddes and Peter Sweatman, Transformational Technologies in Transportation: State of the Activities (Transportation Research Board, May 2016), http://www.trb.org/Main/Blurbs/174370.aspx.

is enabling Big Data.[22] Big Data sets are often mined or use other advanced methods to extract value and/or develop predictive analytics. Big Data can help to improve decision making, which in turn can enhance operational efficiencies, reduce costs, and decrease risks.

CVs use DSRC through licensed wireless networks, cellular technologies, satellite, the Internet, and telematics to connect cars, trucks, buses, motorcycles, bicyclists, pedestrians, and infrastructure.[23] Telematics integrate telecommunication and information technologies for enhanced vehicle safety and mobility.[24] Connected systems create machine awareness with other CVs, infrastructure, and other objects. This can provide warnings to the driver about safety hazards, such as curves, intersections, and nearby vehicles. CVs can overcome range, sight, and data interpretation problems with sensors, while enabling more coordination and traffic flow management.[25] By cooperating with each other, CVs are anticipated to reduce crash and fatality rates for nonimpaired drivers by up to 80 percent.[26] However, connected and wireless technologies open CVs up to hacking and cybersecurity risks. In the longer term, CV technologies may move much road information—signs, speed limits, even traffic signals—to the vehicle dashboard, reducing roadside clutter and lowering maintenance costs.

The **IoT** uses physical objects and sensors embedded in electronics, software, and other devices to capture and exchange data.[27] The IoT was made possible by the convergence of multiple technologies, including wireless communications, the Internet, embedded systems, sensors, and microelectronics.[28] A number of technologies are driving the IoT, including: wearable devices, smart homes and buildings, Smart Cities, and smart enterprises. It will eventually include CVs. The IoT will collect and analyze data, develop algorithms to more efficiently manage systems, and enable remote actions.

Nanotechnology refers to controlling individual atoms and molecules (which are less than 100 nanometers, where a nanometer is one billionth of a meter), in order to enhance material properties with greater strength and lighter weight, gain more control over the light spectrum, and increase chemical reactivity to greater levels than larger-scale counterparts. Nanotechnology can enhance battery life, provide lightweight and high-strength materials, and reduce the size and increase the computing power of remote sensors.

Real-time information is available through traffic navigation tools and apps, such as Google Maps, Waze, and SEPTA and NJ Transit Apps. They help to use the transportation network more efficiently in several ways. First, mode optimization can determine the most efficient mode using information about travel time, cost, and available travel options. Once a mode is chosen, route optimization can identify the fastest and most direct route. Second, navigation tools route people and vehicles away from congested facilities and onto less congested facilities. This lets individuals make faster trips while also benefitting society with reduced congestion. Lastly, for vehicles, facility optimization can balance volumes throughout the system and reduce congestion but may increase VMT, particularly on roads with historically lower traffic volumes. A potential byproduct, though, is that some vehicles may use residential streets that are not designed for high volumes or

[22] Ibid.
[23] Ibid.
[24] Peter Jin, *Emerging Transportation Technologies White Papers* (Austin, TX: The University of Texas at Austin Center for Transportation Research, May 2015), http://library.ctr.utexas.edu/ctr-publications/0-6803-P2.pdf.
[25] Steven Schladover, "Progress toward Automated Driving," Halmstad Colloquium (video), February 12, 2012, https://www.youtube.com/watch?v=4wfpUSTG9zU (accessed June 7, 2016).
[26] Ibid.
[27] Mohaddes and Sweatman.
[28] Ibid.

speeds to bypass congestion. A number of applications are improving the travel information we have at our fingertips and changing how we get around the region:

- **Dynamic carpooling apps** enable real-time ridesharing by connecting drivers and potential passengers.
- **Freight apps** are digital goods movement brokerages that replace conventional intermediaries for small trucking carriers to transact business with shippers. Real-time, on-demand routing programs can promote efficiencies and reduce congestion through fewer empty truck legs and decreased truck VMT.
- **Multimodal apps** provide real-time travel and cost information for a variety of modes, allowing the user to select the option that best suits their needs.
- **Parking apps** aim to provide better space availability information or easier payment options to make parking in the region more efficient.
- **Ridesharing apps** allow for real-time carpooling by connecting drivers and potential passengers.
- **Taxi apps** operate within the traditional taxi medallion framework. Users are able to access the technology through a handheld device to summon a licensed taxi driver, and in some apps the passenger can electronically pay for the trip.

(UASs), more commonly known as drones, are remotely piloted aircraft. They can be used to inspect previously hard-to-reach facilities, such as bridges, tiers, towers, or windmills. Safety can be enhanced by not sending humans to inspect dangerous (such as first responders in disaster zones) and hard-to-reach spaces, and access can be gained to areas that were previously unreachable. Operating a UAS is much easier than flying a helicopter, so it is not surprising that different companies are working on UASs that can fly passengers.

GOAL: CREATE A MORE SECURE TRANSPORTATION SYSTEM

There has been an increased national focus on security since the events of September 11, 2001, which established a larger role for MPOs in this area. One goal of this effort is to explore ways that MPOs can play a part in security planning. DVRPC's primary role is facilitating the exchange of ideas and resource sharing to build upon existing programs to further security efforts in the region.

Cybersecurity is a new and growing need in transportation due to the increasing use of digitally connected and automated systems, along with mobile devices. Increasing data in the cloud, the IoT, mobile devices, and wearable technologies all create a variety of potential hosts and networks that cybercriminals can hack into.[29] Protection of CVs and their users must incorporate up-to-date cybersecurity strategies. Currently, these include: testing of security measures with crowdsourcing, improvement of mobile device protections, enterprise networks, placement of smart devices inside the IoT, user interface web protections, next-generation endpoint security, and cloud-based data security. Passenger and customer privacy must be protected by safeguarding sensitive data and reviewing and revising open-records statutes and policies to ensure personal data is kept private. The way traveler information is transferred to the public needs to be safeguarded.

[29] Ibid.

GOAL: IMPROVE TRANSPORTATION SYSTEMS MANAGEMENT AND OPERATIONS

Approximately 60 percent of traffic congestion in major urban areas like Greater Philadelphia is due to temporary or nonrecurring conditions, such as disabled vehicles, traffic crashes, maintenance and construction activity, or adverse weather conditions. TSMO targets mitigating nonrecurring congestion and addresses the entire transportation system as a whole because it deals directly with the root causes of congestion and unreliable travel. TSMO programs are defined by the FHWA as "a set of integrated strategies to optimize the performance of operations on existing infrastructure through implementation of multimodal, cross-jurisdictional systems, services, and projects designed to preserve capacity and improve security, safety, and reliability of a transportation system." It optimizes the existing infrastructure, is complementary to many short and long-range transportation strategies, and should be integrated to address current and future goals.

Benefits of TSMO programs have been widely documented. For example, deploying emergency service patrols on expressways in New Jersey yields a benefit-to-cost ratio of over 33:1 and results in reductions in incident duration, fewer secondary crashes, and saving millions of gallons of fuel. Improving traffic signal timings by installing adaptive traffic signal control technologies reduces travel times and delays by 10 to 50 percent, translating into a noticeable reduction in emissions of pollutants. Using Automatic Vehicle Location systems on buses has improved on-time bus performance by 12 to 23 percent, thereby reducing passenger wait time at bus stops.

DVRPC's TSMO Plan was developed in cooperation with DVRPC's Transportation Operations Task Force, which is composed of traffic, transit, and emergency management operators in the region. The TSMO Plan contains three major operational policies: reliability, mobility, and safety and incident management. Several basic tenets cut across them: viewing the transportation system as an integrated network, using technology to support TSMO strategies, the need to obtain accurate real-time transportation network status, the ability to share information among agencies and with the public, and having the appropriate resources available to respond to various situations.

Strategies to Incorporate New Technologies and Services to Create a Seamless Network

- Connect modes to each other and the Internet.
  - Improve connections between modes, e.g. via standardized multimodal digital payment systems and alternative payment systems.
  - Work with the private sector to build a regional "Mobility Internet."
  - Integrate paratransit with new mobility options.
  - Use digital technologies and networks to improve the reach of emergency communications and create evacuation plans for larger numbers of carless households.
  - Identify best practices for digital infrastructure development and partnerships, and incorporate technologies through traffic signal upgrades and roadside warning devices.
  - Be flexible and avoid tech 'lock-ins' that limit what can be done to respond to changing future conditions.

- Use TSMO strategies to improve the flow of people and goods.
  - Take an Integrated Corridor Management approach to manage traffic across multiple modes and jurisdictions.
  - Provide real-time traveler information across all modes and enhance regional multimodal trip planning tools.
  - Expand traffic surveillance and transportation system condition data collection capabilities.

- Implement advanced integrated traffic and transit management systems.

- Make transit more competitive.
  - Pursue transit-first strategies, such as transit signal priority, off-board fare payment, and dedicated bus lanes.
  - Make transit more competitive by using Big Data, on-demand, and automated technologies to optimize bus routes in ways that better meet demand by time and location.

- Open access to data and use it to promote more efficient transportation.
  - Adopt open data and open-source software policies.
  - Create interdisciplinary regional or local data coordination teams, as well as agreements among private transportation operators that ensure transportation data is open and freely available while protecting competitive and proprietary information and personal privacy.
  - Set goals and indicators to track performance and progress toward attaining them.

- Create a more secure transportation system:
  - Elevate security in the planning process by considering regional transportation security in programs and projects.
  - Conduct studies, analysis, and mapping to improve transportation security planning.
  - Coordinate and cooperate with other bodies involved in regional resiliency, transportation security planning, emergency response efforts, and recovery efforts.
  - Implement up-to-date cybersecurity strategies to protect transportation infrastructure and personal privacy.
    Appoint a digital risk officer, especially as more transportation activity moves to the Internet.

- Prepare for CVs, EVs, and HAVs.
  - Enhance management systems for maintenance of signs and lane markings, as well as timing and location for road construction activities.
  - Ensure federal and state HAV regulations reflect and respond to specific needs of dense, urban areas.
  - Develop an HAV action plan.
  - Improve EV charging infrastructure availability and allow drivers to easily locate them.

CHAPTER 4: TRANSPORTATION INVESTMENTS

The vision for the future is to achieve and maintain an SGR for all existing transportation infrastructure, integrating modes and improving the efficiency of the network—through **design**, **markets**, and **technology**—while making it safer, more connected, and multimodal. To achieve this vision, we will need to make the choices that support it through the investments identified in the long-range financial plan.

Connections 2045 outlines a strategy for how Greater Philadelphia will make capital investments in transportation infrastructure to help achieve the Plan's vision over the next 28 years. DVRPC worked with PennDOT, NJ DOT, SEPTA, NJ Transit, the Delaware River Port Authority/PATCO, county and municipal government partners, and other regional stakeholders to determine what investments need to be made over the life of The Plan. *Connections 2045* aims to maximize the safety, and efficiency of our existing transportation network, while bringing it into a state-of-good repair. A Long-Range Plan Working Group, comprised members from DVRPC's Regional Technical Committee, was highly involved in the development of the financial plan. Developing the financial plan consists of five steps:

- **Assessing transportation infrastructure needs;**
- **Forecasting revenue;**
- **Allocating forecasted revenue to project types;**
- **Evaluating and selecting Major Regional Projects; and**
- **Identifying options to close the funding gap.**

At the heart of this exercise is an in-depth needs assessment that utilizes asset management systems, which collect detailed data and monitor the various components of the network to identify maintenance and replacement needs for existing infrastructure. The needs assessment identifies what is required to bring the existing roadway and transit systems to an SGR. It also identifies operational improvements and system expansion projects that are necessary for the region to continue to grow and prosper in the future. The financial plan prioritizes projects for funding by developing forecasts of reasonably anticipated revenue, allocating the revenue to project categories based on need and policy, and evaluating and selecting specific major regionally significant projects for funding in the Plan. The reality is that we cannot afford all of the identified needs. Therefore, *Connections 2045* outlines a Vision Plan and then identifies a fiscally constrained plan (Funded Plan) of projects that can be achieved over the life of the Plan.

Federal regulations require that MPOs, such as DVPRC, develop a regional long-range transportation plan with a fiscally constrained financial plan covering a minimum 20-year planning horizon. Fiscal constraint means that total transportation expenditures identified in a long-range plan must not exceed the total revenues reasonably expected to be available for the region over the life of the Plan, and over each individual funding period in the Plan. All revenues and project funding categories' needs are presented in year-of-expenditure (Y-O-E) dollars, which account for the impact of inflation over time. *Connections 2045* forecasts a 3 percent annual inflation rate over the life of the Plan. There are four separate financial plans, one roadway and one transit, for each of the Pennsylvania and New Jersey subregions.

The **TIP** is a short-term implementation program of capital improvements that are drawn from and consistent with the DVRPC long-range plan. The TIP is multimodal in nature and includes bridge, roadway, bicycle, pedestrian, freight, operational, public transit station, vehicle, equipment, and SGR projects of all sizes and scopes. Required by federal law to cover a four-year time period, the TIP represents the transportation improvement funding priorities of the region and lists all projects that intend to use federal funds, along with state-funded capital projects. Anticipated costs and schedules by phase are indicated for every project in the TIP. Project phases may include preliminary engineering, final design, right-of-way acquisition, utility clearance, and construction for highway-funded projects and purchase, capital, operating, or debt service phases for public transit projects. The list of projects in the TIP must be financially constrained to the amount of funds that are reasonably expected to be available.

The *Connections 2045* financial plan contains four funding periods that align with both the 2017 Pennsylvania and 2018 New Jersey TIPs. In Pennsylvania, the first funding period will comprise years two to six of the 2017 TIP. The second period will round out the statewide 12-year plan. In New Jersey, the first funding period matches up with the first four years of the 2018 New Jersey TIP. The second funding period corresponds with the remainder of the 10-year plan.

TABLE 9: CONNECTIONS 2045 FUNDING PERIODS

Funding Period	Pennsylvania	New Jersey
1	2018–2022	2018–2021
2	2023–2028	2022–2027
3	2029–2035	2028–2035
4	2036–2045	2036–2045

Source: DVRPC, 2017

INVESTING IN THE VISION

The transportation investments outlined in *Connections 2045* help to create a well-maintained, safe, sustainable and seamlessly connected multimodal transportation network. These investments will also further the regional transportation, land use, environmental, equity, and economic competitiveness goals contained in the Plan. The top priority is to rebuild, maintain, and update existing transportation infrastructure. Nearly 70 percent of projected available funding will be allocated to rebuild the roadway and transit networks. Transit, bicycle, and pedestrian projects reflect a significant funding commitment in the Plan. These types of investments will help to focus growth and development in Centers, make transportation more space efficient, and lower demand for new roadway facilities. In turn, we can expect reduced maintenance needs in the future. Placing development near existing transit routes will help increase ridership. It will improve the operating cost recovery of our transit system, making it more self-sufficient, and will allow more capital funding for system improvements. The next largest amount of funding is allocated toward improving the operation of the system and using technology to increase the flow of information, find new efficiencies, and improve safety. Given uncertainty of the future with regard to a changing climate and advances in technology,

a multimodal network offers flexibility to respond to shifts in demand. Taken altogether, the financial plan reflects the goal of constructing an integrated multimodal transportation network.

The Plan seeks to create more transportation choices for retirees and young people, many of whom are already showing a preference for smaller housing units located in dense, vibrant communities with easy access to a variety of transportation modes. Drivers will benefit from the provision of better information, improved safety, and reduced congestion. In a world of rapid technological and intense global competition, the provision of mixed-use, transit-oriented neighborhoods are critical for building a flexible transportation network, reducing CO_2 emissions, and enhancing community livability in ways that can attract skilled workers and provide for a high quality of life. While the financial plan developed here serves as an initial down payment for achieving the vision, there is still much work to be done. The needs of the system demand a new way of funding it: one that can both support the goals and policies set within the Plan while also addressing the funding needed to make the vision a reality.

ASSESSING FUTURE NEEDS

The needs assessment determined the projects that are necessary to achieve the goals outlined in *Connections 2045*. Detailed documentation on the needs assessment that went into developing the financial plan can be found in Appendix E. The *Connections 2045* financial plan analysis uses asset management systems data developed by PennDOT, NJ DOT, and SEPTA. The Fixing America's Surface Transportation Act (FAST Act) continues the directions given to MPOs in the Moving Ahead for Progress in the 21st Century Act to be more proactive in identifying asset management needs, and DVRPC continues to improve its efforts in quantifying system preservation needs over the life of a long-range plan. The Plan is based on the best data and methodology available to date, and we are continuing to partner and work with the DOTs and transit agencies and have already identified a number of ways that this analysis can be improved on in the future.

Roadway, bike and pedestrian, and transit investments are grouped into the following categories:

Roadway System Preservation maintains existing roadway pavement and bridge infrastructure. Needs estimates for these categories were developed using the federally required Pavement Management System and Bridge Management System databases, which track the condition of each roadway lane mile and bridge. DVRPC used historic data from these management systems to estimate future rates of decline. This estimate also includes what DVRPC forecasts as the needs for county and local roadways and bridges eligible for federal aid.

Roadway Operational Improvements use physical changes or technology to improve the efficiency of the existing network. Physical improvements include roundabouts, new turn lanes, and roadway realignment, to improve the functionality and safety of the roadway network. Technological improvements include the use of ITS, incident management programs, traffic signal upgrades, and connected vehicle and infrastructure technologies. The region’s 2017 TSMO Plan is the basis for the needs assessment for this category. ITS and incident management programs have capital funding components but also have substantial maintenance (e.g., hardware and software) and operations (e.g., personnel) costs associated with them.

Bike and Pedestrian needs are reflected in the region’s desire to build more bikeable and walkable communities and to develop more space-efficient transportation options. On-road needs are based on increasing existing sidewalk locations by 50 percent and tripling the number of bike lanes in the region. Off-

road needs are based on constructing all unbuilt, multiuse trails in The Circuit regional trail network, along with some other multiuse trails that are not a part of The Circuit.

Roadway System Expansion projects add capacity to the roadway network by widening or extending existing facilities, or building new roads or interchanges. These projects have a significant impact on regional travel, and most projects in this category are listed in the Plan as Major Regional Projects. Minor new capacity projects are widenings of generally less than three lane-miles in length on minor arterial, collector, or local roads. The need for Major Regional Projects was based on the projects included in the previous *Connections 2040* Plan, a review of recent transportation and corridor studies, and a call for projects from planning partners. All roadway system expansion projects are required to be consistent with the region's CMP and are evaluated to be consistent with land use, environmental, economic development, environmental justice, and transportation goals.

Roadway Other includes needs for miscellaneous items, such as parking facilities, drainage, environmental mitigation, Transportation Management Associations (TMAs), engineering, regional and local planning, and debt service. These needs are forecasted using projects and costs that are included in the current TIPs for Pennsylvania and New Jersey.

Transit System Preservation represents needs for existing rail infrastructure, vehicle fleets, and stations. Regular vehicle track, signal, catenary, power substations, signals, vehicle overhaul and replacement, station renovations, and ADA accessibility needs were used to develop the need for each of these three categories using asset management data.

Transit Operational Improvements reflect the need to improve the functionality of the existing system. Types of projects include real-time information systems, signal preemption, fare modernization, and double tracking and sidings to improve service frequency. The estimated needs were developed by DVRPC and regional transit agencies.

Transit System Expansion identifies new transit facilities, routes, and lines that the region would like to pursue. Need for this category is based on a short list of projects developed by the Long-Range Plan Working Group and includes projects listed in the *Connections 2040* Plan and recent transit expansion project studies conducted by DVRPC and other entities.

Transit Other is a miscellaneous category that includes safety, security, coordinated human services, trackage fees paid by regional transit agencies to Amtrak, and debt service. Need for this category is estimated by remaining debt obligation payments and accounting for outlays over the life of the Plan based on current and future expenditures.

Regionally, the needs assessment identified approximately $130 billion in transportation improvements, predominantly to preserve and maintain our existing network. These needs represent the region's desired investments, or the Vision Plan.

TABLE 10: TOTAL TRANSPORTATION NEED (2014–2040, IN BILLIONS OF Y-O-E $)

Mode	Project Category	Pennsylvania	New Jersey
Roadway	System Preservation		
	- Pavement Preservation	$ 19.0 B	$ 7.8 B
	- Bridge Preservation	$ 23.6 B	$ 3.5 B
	Operational Improvements	$ 7.9 B	$ 3.8 B
	Bicycle and Pedestrian	$ 3.5 B	$ 1.5 B
	System Expansion	$ 1.8 B	$ 0.6 B
	Other	$ 0.6 B	$ 0.7 B
Roadway Subtotal		$ 56.4 B	$ 17.9 B
Transit	System Preservation		
	- Rail Infrastructure	$ 9.1 B	$ 1.0 B
	- Vehicles	$ 12.9 B	$ 4.9 B
	- Station Enhancements	$ 3.8 B	$ 0.6 B
	Operational Improvements	$ 4.5 B	$ 0.5 B
	System Expansion	$ 8.7 B	$ 3.8 B
	Other	$ 4.7 B	$ 1.3 B
Transit Subtotal		$ 43.7 B	$ 12.1 B
Subregion Total		**$ 100.1 B**	**$ 30.0 B**

Source: DVRPC, 2017

The infrastructure in the Pennsylvania subregion is generally older and more expansive, and this is reflected in the total estimated need for the subregion. In Pennsylvania, there is an estimated $56 billion in roadway need, and more than $43 billion in transit need, over the life of the Plan. Total roadway need for the New Jersey subregion is estimated to be nearly $18 billion, and total transit need for the New Jersey subregion over the life of *Connections 2045* is estimated to be greater than $12 billion. These figures are in Y-O-E dollars to account for the impact of inflation over time.

PROJECTING FUTURE REVENUES

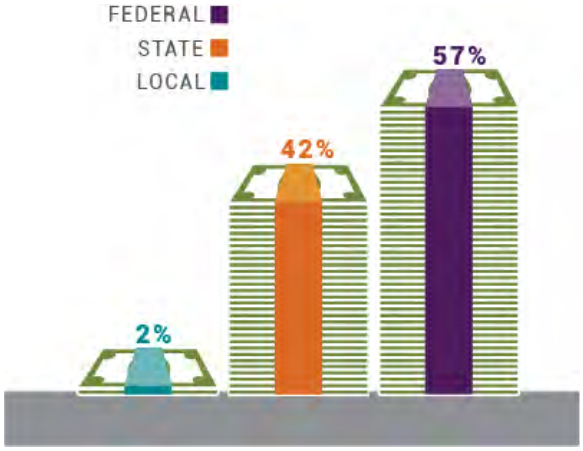
DVRPC identified all federal, state, and local revenue sources that the region can reasonably expect to receive through the year 2045. Revenue estimates are for capital project expenditures. Preparation of this financial plan revenue estimate included a review of historical data and trends. All planning principles and financial assumptions in identifying federal and state financial resources and investment needs are developed with and reviewed by federal, state, and transit partners. The Plan anticipates $65.3 billion Y-O-E dollars in total federal, state, and local funding from 2018 to 2045. Detailed assumptions that went into the revenue forecast can be found in Appendix D.

TABLE 11: FUNDING BY SOURCE AND MODE (2018–2045, IN BILLIONS OF Y-O-E $)

State	Mode	Federal	State	Local	Total
Pennsylvania	Highway	$ 17.5 B	$ 6.8 B	$ 0.3 B	$ 24.7 B
	Transit	$ 9.1 B	$ 9.9 B	$ 0.6 B	$ 19.7 B
	Subtotal	$ 26.6 B	$ 16.7 B	$ 0.9 B	$ 44.4 B
New Jersey	Highway	$ 7.8 B	$ 5.9 B	$ 0.0 B	$ 13.7 B
	Transit	$ 2.5 B	$ 4.5 B	$ 0.1 B	$ 7.2 B
	Subtotal	$ 10.3 B	$ 10.4 B	$ 0.1 B	$ 20.9 B
Region Total		$ 37.0 B	$ 27.2 B	$ 1.0 B	$ 65.3 B

Source: DVRPC, 2017

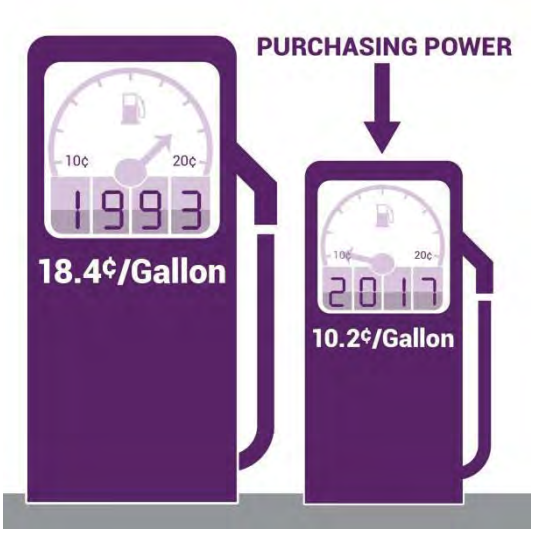
FIGURE 35: REGIONAL FUNDING BY SOURCE



Source: DVRPC, 2017

Federal funding includes the federal Highway and Transit Trust Funds, which are primarily funded through gas tax receipts and are the region's largest funding source, accounting for approximately 57 percent of forecasted revenue. The federal gas tax of 18.4 cents per gallon has not been increased since 1993. Meanwhile, the FAST Act transfers $52 billion to the Highway Trust Fund and $18 billion to the Transit Trust Fund to keep both solvent through the year 2020. Since 2008, the Highway and Transit Trust Fund accounts have required $143 billion in general fund infusions to meet authorized funding levels. The Congressional Budget Office (CBO) estimates $139 billion will be required to maintain current spending levels between 2020, when the FAST Act expires, and 2027, the last year in the most recent CBO projection. More fuel-efficient and alternative-fuel vehicles and a slight decrease in total driving since the economic recession have meant flat gas tax revenue collection. Inflation since the last gas tax increase has eaten away 45 percent of its purchasing power.

FIGURE 36: THE EFFECT OF INFLATION ON THE FEDERAL GAS TAX



Source: Producer Price Index, Construction Materials Index, 1993–2017

The development of CVs and other digital technologies make alternative funding options, such as VMT fees, congestion pricing, and others, more feasible. *Connections 2045* assumes federal funding will remain flat through the year 2029. After that time, it assumes a growth rate of 3 percent per year compounded annually from 2029 to 2045, based on an eventual need to shift to a new paradigm for federal transportation funding.

State funding is the second largest source of funding for transportation projects. The states contribute 42 percent of total regional funding (Pennsylvania contributes 28 percent and New Jersey 15 percent of total anticipated funding) in *Connections 2045*.

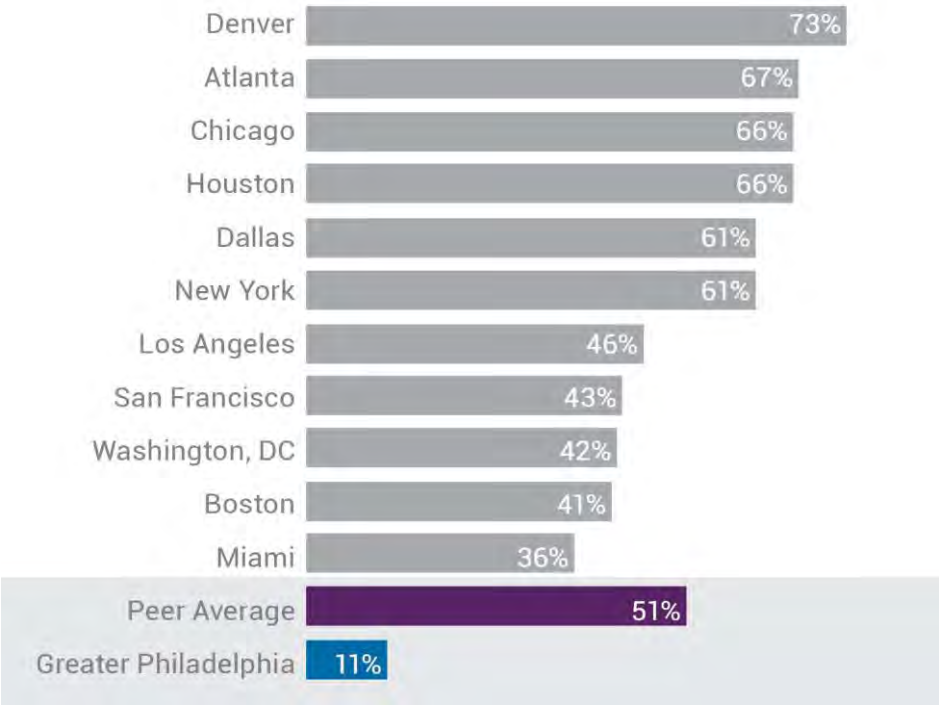
Pennsylvania's Act 89 of 2013 is now fully implemented and is generating billions in additional transportation revenue each year. This act rescinded the state retail tax of 12 cents per gallon on gasoline and diesel fuels, removed the $1.25 cap on the wholesale gas tax over a five-year period, and increased fees on vehicle registrations, driver's licenses, traffic violations, and permits. This act is advancing many transportation projects throughout the commonwealth.

In 2016, New Jersey also passed legislation to increase state transportation funding through its Transportation Trust Fund (TTF). The combined Motor Fuels/Petroleum Products Gross Receipts Tax rate at the consumer level increased from 14.5 to 37.1 cents per gallon of tax imposed. Thanks to the Public Question 2 Amendment Referendum, voted on in November 2016, these receipts are now constitutionally dedicated to the TTF. Passage of Question 2 also enables the state to authorize up to $12 billion in bonds to fund transportation projects. This legislation increases annual spending on New Jersey's road, bridge, and rail infrastructure by $400 million annually. It also plans to double transportation aid for municipalities and counties, fund light-rail expansion projects in both North and South Jersey, and upgrade New Jersey's freight-rail infrastructure.

Financial guidance from PennDOT and NJ DOT assumes flat funding in both states through 2045.

Local funding is the source of just 2 percent of the reasonably anticipated funds documented in *Connections 2045*. Many regions around the country contribute a significant amount in local funding toward transportation projects. Local transportation funding generally comprises revenues derived within the jurisdiction, such as a dedicated sales tax or dedicated bonds. Due to its flexibility, local funding is critical to making multimodal investments and improvements to transportation networks. The Greater Philadelphia region provides very little transportation funding from local sources, compared to peer regions around the country. For example, over the past decade, Greater Philadelphia has generated just 11 percent of transit capital expenditures locally, while 11 peer regions (the other 9 largest in the United States, plus San Francisco and Denver) have collectively generated 51 percent of their transit capital funds locally; see Figure 37. If federal funding decreases in the future, regions with a strong dedicated local source of transportation funding will be more competitive by better maintaining their network and promoting economic growth.

FIGURE 37: PERCENTAGE OF TRANSIT CAPITAL FUNDING FROM LOCAL SOURCES, 10-YEAR AVERAGE (2006–2015)



Source: National Transit Database, 2006–2015

Act 89 increases state funding allocations to local projects in Pennsylvania by 60 percent, about $220 million per year. It provides state funds for better timing of local traffic signals; increases the prevailing wage law threshold to projects costing more than $100,000; allows for local match savings by participating in PennDOT's bridge bundling program; and waves local match requirements for some transit capital investment projects. Higher levels of investment on state projects are likely to increase the need for local match funds. To offset this need, Act 89 allows counties to place a $5 annual surcharge on vehicle registration fees. Bucks, Chester, Montgomery, and Philadelphia counties have all enacted this county vehicle registration surcharge to help fund local transportation infrastructure repairs.

New Jersey does not grant authority to raise transportation revenues at the regional or local level. Limited or no local funding options in the region mean that local matches for state-maintained facilities must largely come from municipal or county general funds. Not only do transportation projects have to compete with many other municipal budget needs, but state-maintained facilities also have to compete with all the locally maintained roads and bridges that municipalities and counties manage. These local facilities are often in a worse state of repair than state roads and bridges.

AUTHORITY AND OTHER FUNDING

There are several transportation authorities in the region, such as the Pennsylvania and New Jersey turnpike authorities and DRPA, which generate their own revenues, generally via tolling. Revenue generated by these authorities is not included as a revenue source in the Plan.

THE FUNDING GAP

In the Pennsylvania subregion, based on forecasted revenue figures, there is a total estimated funding gap of about $32 billion for roadway projects over the life of the Plan. Only about 43 percent of the total roadway vision can be funded. There is a total transit funding deficit of $24 billion over the life of the Plan. Only about 45 percent of the total identified transit vision can be funded.

In the New Jersey subregion, on the roadway side, there is a roadway funding deficit of $4.1 billion over the life of the Plan. About 77 percent of the total vision can be funded. On the transit side, there is a total funding deficit of about $4.8 billion over the life of the Plan, with the ability to fund approximately 60 percent of the projects identified in the transit vision.

FIGURE 38: REGIONAL TRANSPORTATION NEEDS COMPARED TO AVAILABLE FUNDING (BILLIONS OF Y-O-E $)

ALLOCATING REVENUES TO PROJECT TYPES

Funding is allocated to each of the roadway and transit funding categories based on comparative need, as well as meeting regional goals. Long-range plan policy prioritizes preservation and maintenance needs, followed by operational improvements, then system expansion projects. This approach follows the lead of the U.S., Pennsylvania, and New Jersey DOTs. This “fix-it-first” policy allocates more funding to preserving and maintaining existing roadway and transit networks. The goal is to achieve and maintain an SGR for existing transportation infrastructure.

The roadway funding allocation was revised to reflect a changing transportation vision and needs. In Pennsylvania, the cap on roadway system expansion was reduced from 5 percent to 4 percent of available roadway funds. This 1 percent was reallocated to pavement preservation, operational improvements, and the "Other" category. It will help the region to better prepare for the needs of connected and automated vehicles—which will require better pavement conditions, line striping, and vehicle-to-infrastructure communications—as well as climate change and increased precipitation, which will require more investment in stormwater infrastructure and wetlands mitigation (in the "Other" category).

Table 10 identifies the target allocations and resulting revenue for each funding category. Funding within each category is allocated to both Major Regional Projects, which are listed in the Plan, and to smaller-scale projects as they are programmed in the TIP. The Plan also sets aside funding for smaller-scale projects that will be identified in the current and future TIPs.

TABLE 12: FUNDING ALLOCATION TO PROJECT CATEGORIES

Mode	Project Category	Pennsylvania		New Jersey	
		Target Allocation	Allocated Revenue	Target Allocation	Allocated Revenue
Roadway	System Preservation				
	- Pavement Preservation	30.5%	$ 7.5 B	48.5%	$ 6.7 B
	- Bridge Preservation	50.0%	$ 12.3 B	25.0%	$ 3.4 B
	Operational Improvements	11.75%	$ 2.9 B	15.25%	$ 2.1 B
	Bicycle and Pedestrian	1.5%	$ 0.4 B	2.0%	$ 0.3 B
	System Expansion	4.0%	$ 1.0 B	4.0%	$ 0.5 B
	Other	2.25%	$ 0.6 B	5.25%	$ 0.7 B
Roadway Subtotal		100.0%	$ 24.7 B	100.0%	$ 13.7 B
Transit	System Preservation				
	- Rail Infrastructure	14.00%	$ 2.8 B	7.5%	$ 0.5 B
	- Vehicles	45.80%	$ 9.0 B	34.3%	$ 2.5 B
	- Station Enhancements	10.90%	$ 2.1 B	3.0%	$ 0.2 B
	Operational Improvements	3.50%	$ 0.7 B	2.0%	$ 0.1 B
	System Expansion	3.60%	$ 0.7 B	35.7%	$ 2.6 B
	Other	22.20%	$ 4.4 B	17.5%	$ 1.3 B
Transit Subtotal		100.0%	$ 19.7 B	100.0%	$ 7.2 B
Region Total		100.0%	$ 44.4 B	100.0%	20.9 B

Source: DVRPC, 2017

Together, roadway maintenance and preservation categories (pavement reconstruction and bridge replacement) account for 80.5 percent of total roadway expenditures in Pennsylvania and 73.5 percent in New Jersey. In Pennsylvania, the transit preservation and maintenance categories (rail infrastructure, vehicles, and station enhancements) account for over 70 percent of transit expenditures; in New Jersey, they account for nearly 45 percent of transit expenditures. A higher percentage was allocated in Pennsylvania because it has a much larger and older system.

Even if all anticipated Plan revenues were directed toward preserving and maintaining the roadway and transit system, there would not be enough money to address the identified need. Furthermore, the region would not have funding for any other critical types of improvements to address congestion, safety, or mobility. With system preservation needs on the rise, only 4 percent of expected revenue was allocated for roadway system expansion projects in Pennsylvania and New Jersey, primarily for eliminating choke points in the network and for improving connections between facilities. A larger percentage of funding is reserved for operational improvements, which tend to have a higher return on congestion reduction than system expansion projects, per dollar spent. SGR needs are a higher priority than system expansion for transit. Most transit SGR and operational improvement needs were met in New Jersey, with the remaining 35.7 percent of funding going to system expansion.

MAJOR REGIONAL PROJECT EVALUATION AND SELECTION

With constrained available funding, it is imperative to select projects judiciously, based on a quantitative assessment. Investments in the system need to support the core principles of *Connections 2045:* Sustain the Environment; Develop Livable Communities; Expand the Economy; Advance Equity and Foster Diversity; and Create an Integrated, Multimodal Transportation Network. Investments also need to focus on modernizing the region's aging transportation system while working toward other key goals, such as: improving safety, reducing congestion, increasing mobility options for people and goods, incorporating technology, seamlessly connecting the multimodal transportation network, and identifying additional funding. As projects move from the Plan into the TIP, capital programming should be based on sound long-range strategic planning considerations, life-cycle investment analyses, and system performance and condition data (actual and projected). Careful tradeoff analysis must be done in order to ensure that the region gets the best possible return on its transportation investments.

Major Regional Projects are large-scale projects that will have a significant impact on regional travel. Almost all system expansion projects are Major Regional Projects, as are reconstruction projects on the region's freeways. Major Operational Improvement initiatives, such as SEPTA's fare modernization project, are also listed in the Plan. For the sake of brevity, smaller-scale projects that were identified in the needs assessment are not listed in the Plan document. Instead, the various funding categories in the Plan serve as placeholders for their funding, and they may be explicitly listed in future iterations of the TIP. Major regional projects are defined as:

System Expansion:

- **Roads**: Addition of new through lanes by widening, extending, or building new limited-access freeways of any length; creating a new interchange or adding missing movements between freeways (HPMS functional classes 1 or 2) and arterials (HPMS functional classes 3 or 4); or widening, extending, or building new principal arterials (HPMS functional classes 3 or 4) for more than three lane miles.

- **Transit**: New stations on existing lines (including station parking needs), extension of existing lines, or new rail and bus rapid transit (BRT) routes.

Operational Improvement and System Preservation:

- **Roads**: Projects that improve or reconstruct NHS facilities, or facilities with more than 25,000 vehicles per day, have more than 25,000 square feet of bridge deck area, cover more than 20 lane miles, or cost more than $10 million.

- **Transit**: Projects that improve or make major repairs to existing rail lines at a cost greater than $20 million; make major improvements to stations (generally aimed at rehabbing/upgrading the full facility; but can include major ADA initiatives to bring a station into compliance or roof replacements greater than 50,000 square feet) with more than 5,000 daily boardings or alightings, or cost greater than $20 million; make procurements that replace five or more vehicles in existing rail fleets; double track or add sidings to existing passenger rail lines; or upgrade a traditional bus route with bus rapid transit service.

Major Regional Project costs are typically broken out over several funding categories, as their scope can involve road reconstruction, replacing or rehabilitating bridges, operational or safety improvements, and/or system expansion components.

Project Screening: DVRPC and its planning partners developed a screening and evaluation process to assess whether they meet key objectives of the Plan. The first step in the analysis is a screening process to determine if a proposed project meets the key criteria of investing in areas that are currently developed or have been identified as areas appropriate for development over the life of the Plan on the land use vision map. Major regional roadway projects have an additional screening criterion: consistency with the region's CMP. Consistency is determined by whether the subcorridor where a potential new roadway capacity project is located has been identified in the CMP as appropriate for adding capacity. If a project fails the screening process, it is not considered for inclusion in the Plan. Projects that do not pass this initial screen are removed from the needs assessment and for any additional consideration in the long-range financial plan. Projects that pass this screen go through the full evaluation criteria. See Appendix F for more information on the project evaluation criteria. There are three sets of evaluation criteria DVRPC and its planning partners use: the first is for roadway system expansion, the second is for transit system expansion projects, and the third is for all other types of projects.

Major regional roadway system expansion projects that pass the screening are further evaluated by the following criteria:

- Does the project serve the region's identified population and employment Centers?
- Are there significant environmental issues that will be impacted by a project, as measured by DVRPC's Environmental Screening Tool?
- Is the project located in a CMP Priority Subcorridor?
- What is the reduction in regional vehicle hours of travel associated with this project?
- What is the average annual daily traffic multiplied by the peak-period volume-to-capacity ratio within the project limits?
- What is the daily truck traffic on the facility?
- How far has the project advanced?

Major regional transit system expansion projects are evaluated with the following criteria:

- Does the project serve areas that will support a high level of transit service, as measured by DVRPC's Transit Score Index?

- Does the project serve EJ communities with additional transit needs, as identified by DVRPC's IPD analysis?
- What is the potential for TOD?
- What is the status of the project?
- Is the project located in a CMP Priority Subcorridor?
- What is the project's anticipated farebox recovery rate?

Major regional roadway and transit system preservation and operational improvement projects were prioritized using the multimodal benefit criteria developed for the TIP. These criteria consider:

- Facility/Asset Condition: Does the project bring a facility or asset into an SGR, extend the useful life of a facility, or remove a functionally obsolete bridge rating.
- Safety: Is the project safety-critical for transit, in a high-crash road location, or does it incorporate an FHWA proven safety countermeasure.
- Reduce Congestion: Is the project located in a CMP congested corridor, or is it an appropriate-everywhere CMP strategy; annual average daily traffic per lane, and daily transit riders per daily seats.
- Invest in Centers: Is the project located in a *Connections 2045* Center or freight center; or high, medium-high, or medium transit score areas; or will it improve a connection between two or more key Centers.
- Facility/Asset Use: What is the daily VMT, truck VMT, and transit ridership.
- Economic Competitiveness: Will the project result in reduced operating/maintenance costs, or is it part of an economic development or TOD project.
- Multimodal Bike/Pedestrian: Do a large number of bicyclists and pedestrians use the facility, or does the project include new trails, sidewalks, bike lanes; or connections to other multimodal facilities.
- EJ: Will the project benefit high IPD communities.
- Air Quality/Green Design: Will the project deliver air quality benefits and incorporate environmentally friendly principles and techniques.

Project selection was based on this evaluation criteria and collaboration with the Long-Range Plan Working Group. Once projects were selected, they were broken out into two lists: An unconstrained Vision Plan, and a fiscally constrained Funded Plan.

Air Quality Conformity

The U.S. EPA has established health-based standards for six criteria air pollutants, referred to as the National Ambient Air Quality Standards (NAAQS). Air quality in the region does not meet the standard for ground-level ozone and previously has not met the standards for PM2.5. The Clean Air Act requires DVRPC to demonstrate that the transportation projects contained in the TIPs and Plan do not make the region's air quality worse, or impede the region's progress toward meeting the NAAQS. The process of this demonstration is referred to as transportation conformity.

DVRPC demonstrates transportation conformity by using a travel demand model to estimate the motor vehicle emissions from all of the regionally significant, non-exempt projects in the TIPs and Plan and comparing those emissions against budgets or limits established by the states. This process is conducted in close coordination with an interagency consultation group, which comprises state and federal regulatory

environmental and transportation agencies. DVRPC has successfully demonstrated the transportation conformity of Connections 2045 and the Pennsylvania and New Jersey TIPs in accordance with the corresponding state implementation plans and Clean Air Act requirements. More details are available at http://www.dvrpc.org/AirQuality/Conformity/

THE VISION PLAN

The Vision Plan includes all of the identified improvements that are needed to attain the region's transportation goals outlined in the long-range plan. Since the Plan considers a 28-year horizon, there is a focus on Major Regional Projects. However, the needs assessment considers all sizes and types of projects that are critical to achieving our transportation goals. Major Regional Projects that are not included in the Funded Plan are listed as unfunded aspirational projects.

THE FUNDED PLAN

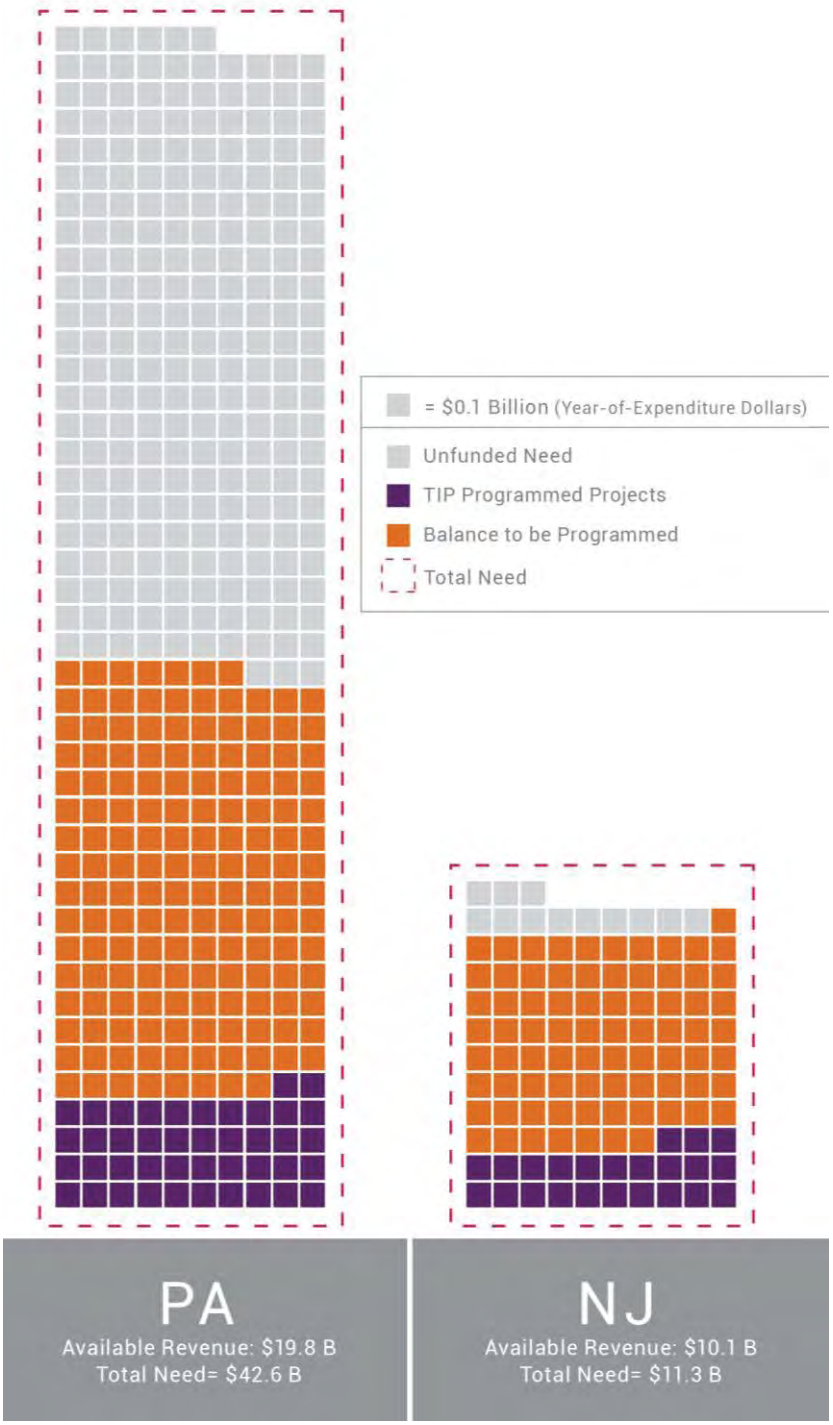
The Funded Plan is the list of fiscally constrained projects that can be paid for with the reasonably anticipated revenue through 2045. The Long-Range Plan Working Group helped for form definitions for Major Regional Projects and identify the projects that are ultimately included in the Funded Plan. The Working Group reviewed the project evaluation and used it to guide and inform project selection.

The Major Regional Projects that the region intends to fund over the life of the Plan are indicated in the following tables for system preservation, operational improvements, and system expansion projects for both roadways and transit, as well as for bike and pedestrian investments. There is also a table for externally funded Major Regional Projects, which do not anticipate using federal or state transportation funds. Each project is identified by facility, project scope and location, and completion date based on the end of the funding period that the project is expected to be complete. Project costs are given in Y-O-E dollars for funded projects and in current-year dollars for the unfunded projects that are part of the Vision Plan. A detailed map of Major Regional Projects can be found on the DVRPC website.

MAJOR REGIONAL ROADWAY PRESERVATION PROJECTS

The major regional roadway preservation projects identified in the Plan illustrate the scope and the scale of the effort needed to maintain the existing system. Identifying the timing and scope of reconstruction projects is difficult, as minor repairs can extend facility lifespans, but generally are costlier over time than repairing and replacing as needed. In addition, any given facility can decline more quickly—or slowly—than is generally predicted. Some of the projects identified will be completed, drawing from the balance of unallocated system preservation funds, but some of them will not be able to advance as a result of funding constraint. Only about 46 percent of the Pennsylvania subregion's, and 89 percent of the New Jersey subregion's, preservation projects can be funded, based on the Plan's revenue projection and funding allocation. Figure 39 illustrates the programmed and available funding for roadway preservation projects as compared with the total need in each state's subregion.

FIGURE 39: ROADWAY PRESERVATION TIP PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

I-95 is a clear example of the difficult task of addressing the rebuilding of our infrastructure in a fiscally constrained environment. The focus right now is on reconstructing the portion between Cottman Avenue and

Race Street in Philadelphia. Starting in the 2030s, the next section of reconstruction will be in Center City and South Philadelphia between I-676 and Broad Street. Much of this segment in South Philadelphia is a viaduct bridge structure. Then reconstruction will need to advance from Broad Street all the way to the Delaware state line. Funding these projects—along with a myriad of other major facilities to reconstruct, such as portions of I-76 and I-476—will be highly challenging at current funding levels.

Table 11 identifies major regional roadway preservation projects that are currently funded in the TIP, with a list of illustrative projects and their costs as a sample of major regional reconstruction projects that need to be advanced over the life of *Connections 2045*. The illustrative projects were carried over from the 2040 plan and identified by regional stakeholders. Only about 46 percent of the Pennsylvania subregion's roadway preservation needs and 89 percent of the New Jersey subregion's roadway preservation needs are met in the Plan.

TABLE 13: ILLUSTRATIVE LIST OF MAJOR REGIONAL ROADWAY PRESERVATION PROJECTS

Facility	Project Scope	Location	Timing	LRP Projects Funded in TIP Millions of Y-O-E $s	Illustrative Project Cost Millions of 2017 $s
PA 309 Sellersville Bypass	Resurface from Church Road to Tollgate Road	Bucks	2018–2028	$ 56.6	
I-95	Rehabilitate bridges over Neshaminy Creek	Bucks	TBD		$ 36.0
US 1 Lincoln Highway	Rehabilitate bridge over Delaware Canal and Conrail	Bucks	TBD		$ 16.5
PA 332 Newtown Bypass	Reconstruct bridge over SEPTA	Bucks	TBD		$ 10.0
Butler Pike	Reconstruct bridge over PA 611 Bypass	Bucks	TBD		$ 27.0
Old Lincoln Highway	Reconstruct bridge over Conrail	Bucks	TBD		$ 26.0
Newportville-Falls Road	Rehabilitate bridge over Conrail	Bucks	TBD		$ 11.0
Darby Road Extension	Replace North Valley Road Bridge; realign to connect new bridge with Darby Boulevard	Chester	2018-2022	$ 37.2	
Baltimore Pike	Replace bridge over Brandywine Creek	Chester	TBD		$ 26.0
US 202 Section 200	Reconstruct Section 200 (from Matlack Street north to US 30); intersection improvements at PA 100 Bypass	Chester	TBD		$ 150.0
Swedesford Road	Replace bridge over County Line Expressway	Chester	TBD		$ 24.0
Black Rock Road	Rehabilitate bridge over Schuylkill River	Chester	TBD		$12.0
US 1	Reconstruct from Schoolhouse Road to Maryland state line	Chester	2018–2028	$ 125.9	

US 422	Reconstruct from Sanatoga Interchange to just east of Stowe Interchange and west of Schuylkill River bridge; realign from Porter to Park Road; improve acceleration lane for westbound on-ramp from Sanatoga Interchange; reconstruct bridge over Schuylkill River and provide Schuylkill River Trail crossing	Chester, Montgomery	2018–2028	$ 217.2	
I-476	Reconstruct throughout Delaware County	Delaware	TBD		$ 700.0
Media Bypass	Replace bridge over Crum Creek and Crum Creek Road	Delaware	TBD		$ 25.0
PA 291	Replace bridge over Little Crum Creek and Conrail	Delaware	TBD		$ 29.0
I-95	Reconstruct throughout Delaware County	Delaware	TBD		$ 725.0
I-476	Reconstruct bridges over Balligomingo Road	Montgomery	TBD		$ 80.0
US 422 Pottstown Expressway	Replace bridges over Perkiomen Creek	Montgomery	TBD		$ 67.5
Belmont Avenue	Rehabilitate bridge over Schuylkill River	Montgomery	TBD		$ 33.0
Church Road/Schoolhouse Road/Water Street	Reconstruct roadway to provide for truck traffic bypass	Montgomery	TBD		$ 25.0
Langely Avenue	Reconstruct, realign, and new streetscaping from 26th Street to Broad Street	Philadelphia	2018–2022	$ 3.0	
US 1 Roosevelt Boulevard	Reconstruct bridge over Wayne Junction	Philadelphia	2018–2028	$ 84.4	
Passyunk Avenue	Rehabilitate bridge over Schuylkill River	Philadelphia	TBD		$ 65.0
Henry Avenue	Replace bridge over Lincoln Drive	Philadelphia	TBD		$ 95.0
I-95 Girard Point Bridge	Rehabilitate bridge over Schuylkill River	Philadelphia	TBD		$ 30.0
I-95 South Philadelphia	Reconstruct from I-676 to Broad Street	Philadelphia	TBD		$ 3,000.0
I-76	Rehabilitate throughout Philadelphia	Philadelphia	TBD		$ 400.0
Henry Avenue	Replace bridge over Wissahickon Creek	Philadelphia	TBD		$ 46.0
NJ 70	Reconstruct from NJ 38 to Cropwell Road	Burlington, Camden	2018–2027	$ 62.5	
I-676	Reconstruct from County Route 537 to US 30	Camden	TBD		$ 26.0
I-76	Reconstruct from I-676 to I-295	Camden	TBD		$ 47.0
US 30	Reconstruct bridge over Cooper River	Camden	TBD		$ 27.0
NJ 73	Reconstruct bridge over US 130	Camden	TBD		$ 22.5
I-295	Reconstruct bridges over Big River Creek	Gloucester	TBD		$ 35.0

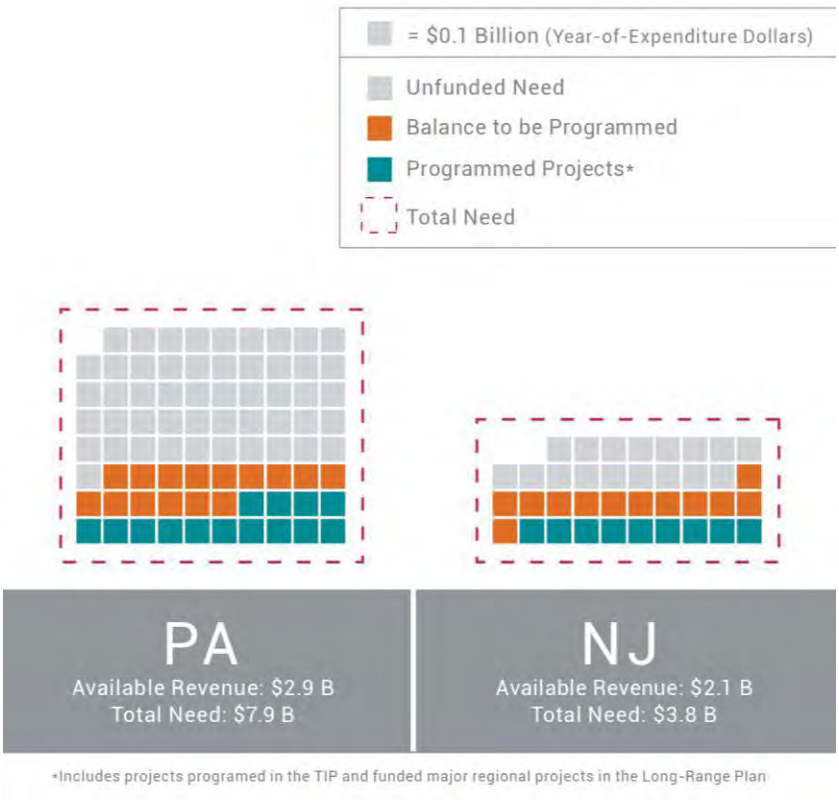
US 322	Reconstruct bridge over Main Street	Gloucester	TBD		$ 43.0
US 130	Reconstruct bridge over Big Timber Creek	Gloucester	2022–2027	$ 31.8	
US 1	Rehabilitate bridge over D&R Canal	Mercer	TBD		$ 22.0
Clarksville Road (CR 638)	Replace Clarksville Road bridge over NE Corridor rail line, adding bike and pedestrian facilities	Mercer	TBD		$ 27.5
NJ 133	Reconstruct bridges over NJ Turnpike	Mercer	TBD		$ 36.0

Source: DVRPC, 2017

MAJOR REGIONAL ROADWAY OPERATIONAL IMPROVEMENT PROJECTS

Operational improvements increase the efficiency of the existing transportation network. In many cases, these projects make interchange improvements that will improve the flow of traffic and help to remove traffic from local streets. Examples of this type of project are the I-95 and I-476, and the I-476 and I-76 interchange improvements along with US 1 between PA 352 and PA 452 in Delaware County. Other types of operational improvement projects include the intersection improvement at US 202 and PA 926: the result of "right-sizing" what was a widening and grade-separated interchange project into an affordable, short-term project that can improve safety and reduce congestion more immediately. Any major regional system preservation project that has operational improvement components is listed here. Figure 40 illustrates the programmed and available funding for roadway operations projects as compared with the total need in each state's subregion.

FIGURE 40: ROADWAY OPERATIONAL IMPROVEMENT PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

Major Regional Roadway Operational Improvement Projects focus on physical changes to the roadway system. DVRPC and its planning partners developed a TSMO Plan that details specific ITS, DSRC, Active Traffic Management (ATM), and signal improvement projects. ATM blends technology and increased management to enhance roadway throughput using techniques, such as: variable speed limits, queue detection, dynamic lane assignments, junction control, adaptive ramp metering, and continuous monitoring systems. Only about 37 percent of the Pennsylvania subregion's and 55 percent of the New Jersey subregion's operational improvements can be funded in the Plan.

TABLE 14: MAJOR REGIONAL ROADWAY OPERATIONAL IMPROVEMENT PROJECTS

Facility	Project Scope	Location	Timing	Funded Cost Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
US 202 at PA 926	Intersection improvements	Chester	2018–2022	$ 3.3	
US 422 Corridor ITS	ITS improvements along US 422, Ridge Pike, PA 23, and PA 724	Chester, Montgomery	Unfunded		$ 50.0
US 1 at PA 352 and PA 452	Reconstruction of PA 352 cloverleaf interchange, Media Bypass/Baltimore Pike interchange, and PA 452 intersection; eliminate lane drops	Delaware	2018–2028	$ 187.8	
I-95 and I-476 Interchange	One new lane in each direction on I-95 through interchange; addition of lane on ramp from SB I-476 to SB I-95	Delaware	2029–2035	$ 195.0	
US 202 (Section 500) Markley Street	Reconstruct from Main Street to Johnson Highway; widen to add center turn lane between Marshall Street and Johnson Highway	Montgomery	2018–2022	$ 17.0	
Ridge Pike	Reconstruct four-lane road from Butler Pike to I-276 PA Turnpike; widen to add center turn lane; reconstruct two bridges over Norfolk-Southern rail tracks	Montgomery	2018–2022	$ 25.7	
I-476 and I-76	Ramp modifications	Montgomery	2029–2045	$ 18.0	
I-76 and PA 23 Matsonford Road	Interchange modification	Montgomery	2029–2045	$ 18.0	
US 422 at Santoga Interchange	Ramp modifications	Montgomery	2029–2045	$ 16.0	
US 422	Reconstruct from Berks County line to Schuylkill River Bridge; reconfigure "S" curve in West Pottsgrove; realign Stowe interchange	Montgomery	2018–2022	$ 41.5	
I-276 at PA 611 Willow Grove	Interchange modification	Montgomery	2029–2045	$ 36.0	
US 202 Dekalb Street	Convert from one-way traffic flow to two-way, and full reconstruction of road in Norristown	Montgomery	Unfunded		$ 15.0
PA 100 at PA 73	Modify interchange into a single-point urban-style interchange	Montgomery	Unfunded		$ 70.0
PA 611 – Easton Road	Corridor, signals, and intersection improvements between Blair Mill Road and County Line Road	Montgomery	2029–2045	$ 73.0	
PA 611 ITS	Eastern Montgomery County ITS improvements and multimodal upgrades from Cheltenham Avenue to County Line Road	Montgomery	2029–2045	$ 36.0	
Sumneytown Pike	Corridor and intersection improvement from PA 63 to PA 363	Montgomery	2029–2045	$ 36.0	
I-95 Philadelphia North	Reconstruct from Race Street to Cottman Avenue; interchange improvements at Vine, Girard, Allegheny, Betsy Ross Bridge, Bridge, and Cottman interchanges	Philadelphia	2018–2028	$ 1,800.0	

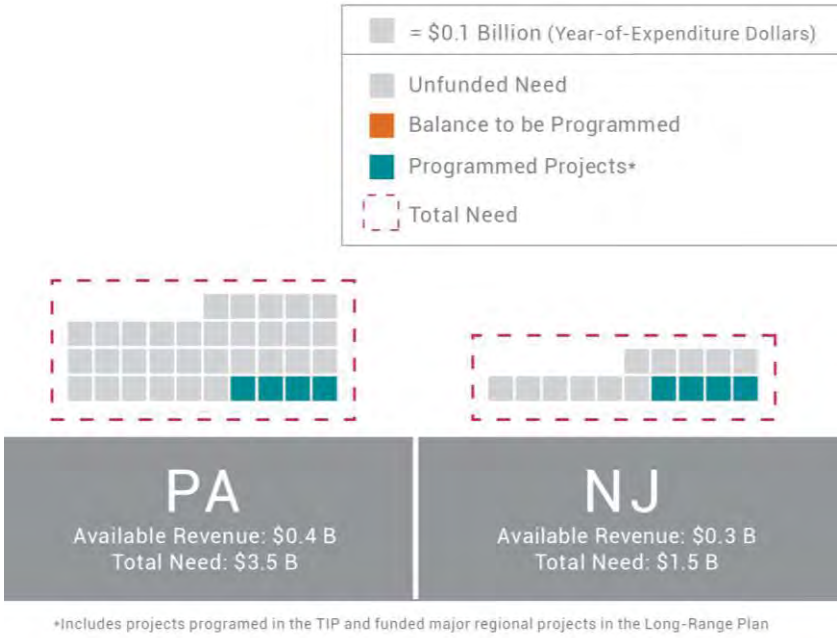
Roosevelt Boulevard	Reconstruct and improve safety from Broad Street to Bensalem Township	Philadelphia	Unfunded		$ 1,500.0
Eakins Oval	Reconfiguration of circulation paths and patterns around Eakins Oval and Benjamin Franklin Parkway	Philadelphia	2029–2045	$ 45.0	
30th Street Station Vehicle Circulation	Improvements from 30th Street District Plan, including repurposing Little Market Street; improvements to Market Street, Arch Street, and 30th Street; realignment of JFK Boulevard; I-76 ramp reconfigurations	Philadelphia	2029–2045	$ 75.0	
Vision Zero in Philadelphia	Improve road safety with engineering enhancements	Philadelphia	2029–2035	$ 80.0	$ 50.0
US 130 Corridor Improvements	Eliminate US 130-Rising Sun intersection by realigning Rising Sun Road to connect with Dunns Mill Road; add jughandles and signalize Campus Drive intersection; replace jughandle at northbound US 130 and Bridgeboro Road (CR 625) and add new signalized intersection and connecting road; redesign intersection at Florence-Bustleton Road (CR 659) to replace northbound US 130 jughandle with reverse jughandle; add left-turning lane in southbound from US 130 to Florence-Columbus Road (CR 656) and separate ramp from CR 656 to northbound US 130	Burlington	2028–2045	$ 445.0	
NJ 70	Operation and safety improvements from NJ 38 to NJ 73; intersection improvements at Kingston Road and Covered Bridge Road	Burlington, Camden	2028–2045	$ 305.0	
NJ 29	Convert to an urban boulevard from US 1 to Sullivan Way	Mercer	Unfunded		$ 220.0
Princeton-Hightstown Road Improvements	Widening, reconstruction, and signal upgrades from Wallace-Cranbury Road to Clarksville Road	Mercer	2018–2021	$ 4.5	
I-195 ATM	Dynamic speed limit, dynamic lane assignment, and queue warning between NJ Turnpike and I-295	Mercer	2028–2035	$ 25.0	

Source: DVRPC, 2017

MAJOR REGIONAL BIKE AND PEDESTRIAN PROJECTS

Bike and pedestrian improvements in *Connections 2045* include on-road improvements and completing The Circuit, a 775-mile regional trail network. About 320 miles of this system are complete, and about 65 miles are anticipated to be constructed over the next five years. At current funding levels, another 90 miles of trail are projected to be completed over the life of the Plan. The City of Philadelphia, the Commonwealth of Pennsylvania, and the William Penn Foundation have created a partnership that will build a cap over I-95 in Old City, Philadelphia, helping to better connect Penn's Landing with Center City. In addition, there are countless on-street facilities that are on their way to being built or envisioned to be in the scope of future reconstruction projects. Only about 11 percent of the Pennsylvania subregion's and 20 percent of the New Jersey subregion's bicycle and pedestrian improvements can be funded. Figure 41 illustrates the programmed and available funding for roadway bike and pedestrian projects as compared with the total need in each state's subregion.

FIGURE 41: BIKE AND PEDESTRIAN PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

TABLE 15: MAJOR REGIONAL BIKE AND PEDESTRIAN PROJECTS

Facility	Project Scope	Location	Timing	Local, Private, and Other Funded Millions of Y-O-E $s	State and Federal Funded Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
The Circuit in Pennsylvania	Complete 243 miles of the Circuit regional trail network	Pennsylvania Subregion	2018–2045		$ 108.0	$ 172.0
The Circuit in New Jersey	Complete 142 miles of the Circuit regional trail network	New Jersey Subregion	2018–2045		$ 22.0	$ 120.0
Penn's Landing Cap and Civic Space	Cap over I-95 and Columbus Boulevard between Walnut and Chestnut Streets creating an 8-acre civic space; extension of the South Street Bridge to the waterfront; and construction of a two mile on-road section of the Delaware River Trail from Spring Garden Street to Washington Avenue in Center City, Philadelphia.	Philadelphia	2018–2045	$ 115.0	$ 110.0	$ 10.0
Vine Street Expressway	New cap over I-676 around 10th Street	Philadelphia	Unfunded			$ 35.0
Schuylkill River Swing Bridge	Provide a bicycle and pedestrian connection between the Kingsessing and Grays Ferry neighborhoods of Philadelphia across the Schuylkill River	Philadelphia	2018–2022		$ 14.0	
30th Street Station Bike/ Pedestrian Bridge Connections	Construction of two new bike/ped bridges over the Schuylkill River as part of the 30th Street Station District Plan	Philadelphia	Unfunded			$ 225.0
Schuylkill Promenade and Boardwalk	Construct new promenade and boardwalk on the west bank of the Schuylkill River between Market Street and Arch Street	Philadelphia	Unfunded			$ 40.0

Source: DVRPC, 2017

MAJOR REGIONAL ROADWAY SYSTEM EXPANSION PROJECTS

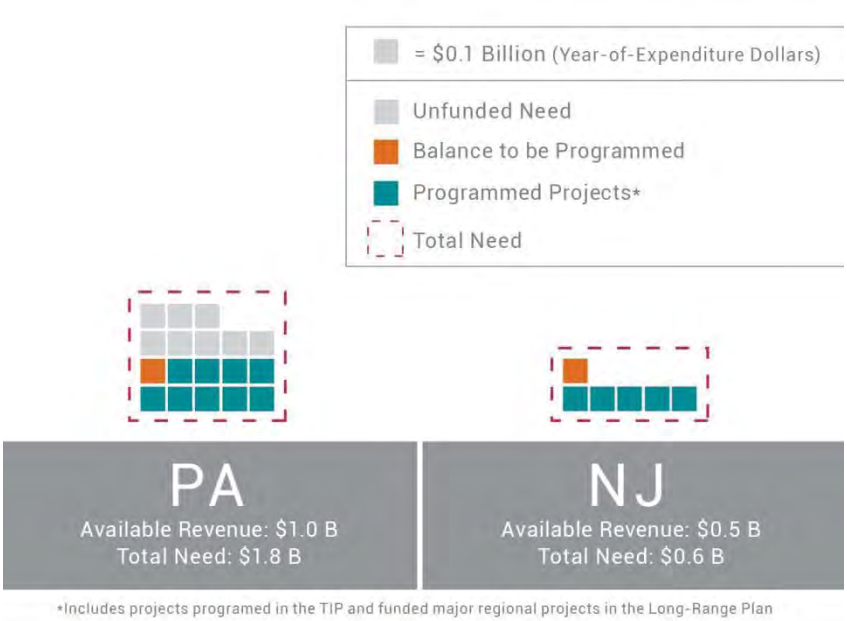
Due to overwhelming needs in system preservation and increasing needs for operational improvements, new roadway capacity funding is capped at 4 percent of total anticipated roadway revenue. Though limited in scope, the system expansion transportation investments included in the Plan support its land use, environmental, and economic development goals. Any major regional system preservation or operational improvement project that increases system capacity is listed here. The US 1 reconstruction in Bucks County is one example of a system expansion project that is also helping to rebuild the network.

A number of the major regional roadway system expansion projects improve operations by eliminating bottlenecks or bridging gaps. The Adams Avenue Connector, for example, provides a connection between I-95 and the Betsy Ross Bridge. Similarly, the I-295 and I-76/NJ 42 direct connection and I-295 at NJ 42 missing movements projects complete this critical interchange and improve the functionality and safety of the network. Each of these will also help to better facilitate goods movement. Other system expansion projects improve the region's economic competitiveness. The North Delaware Avenue and Lafayette Street extensions provide access to planned residential and recreational facilities in key regional Centers. System expansion projects also go through right-sizing to ensure the improvement is cost affordable. US 1 in Mercer County was originally programmed as a set of grade-separated intersections. However, the project will now consist of minor widening in one section, along with improvements at several other key intersections, in an effort to improve safety and reduce congestion.

Improved movements and new exits along the Pennsylvania Turnpike are proposed to give better access to a number of key regional business centers. Though not funded in the Plan, these projects would support the redevelopment of these areas and make the Turnpike into more of a regional beltway. They have the potential to become a public-private partnership between PennDOT, the Pennsylvania Turnpike, and property developers. Figure 42 illustrates the programmed and available funding for roadway system expansion projects as compared with the total need in each state's subregion. Only about 56 percent of the Pennsylvania subregion's, and 83 percent[30] of the New Jersey subregion's roadway system expansion projects can be funded.

[30] Not accounting for two study and development projects: NJ 70 Gateway/Airport Circle and NJ 30 Camden Feeder Roads in the 2018 NJ TIP.

FIGURE 42: ROADWAY NETWORK EXPANSION PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

TABLE 16: MAJOR REGIONAL ROADWAY NETWORK EXPANSION PROJECTS

Facility	Project Scope	Location	Timing	System Expansion Cost Millions of Y-O-E $s	Total Funded Cost Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
US 1 from Alexander Road to Mapleton Road/Plainsboro-Cranbury Road	Reconstruct from I-276 (PA Turnpike) to NJ state line; widen from PA Turnpike to PA 413; interchange improvements	Bucks	2018–2035	$ 61.9	$ 269.0	
I-95 at Street Road (PA 132)	Replace bridge over I-95 and Amtrak Northeast Corridor with wider structure; provide turning lanes on bridge; widen I-95; improve connection to US Route 13	Bucks	Unfunded			$ 162.0
John Fries Highway (PA 663)	Widen and reconstruct from PA 309 to PA Turnpike	Bucks	Unfunded			$ 27.0
County Line Road	Widen and reconstruct from Doylestown Road to PA 611	Bucks, Montgomery	2018–2028	$ 6.9	$ 15.7	
PA 309 Connector Road	Construct new road from Allentown Road to County Line Road; improve PA 309 Interchange	Bucks, Montgomery	2018–2028	$ 70.9	$ 94.5	
I-95 Bucks/ Philadelphia Active Traffic	Part-time shoulder use and other operational strategies from Woodhaven Road to	Bucks, Philadelphia	Unfunded			$ 22.0

Management	Academy Road					
US 30 Coatesville-Downingtown Bypass	Reconstruct from Exton Bypass to PA 10; complete interchanges at PA 113 and Airport Road; potential addition of through lanes and capacity enhancements between PA 113 and PA 340 (as determined by traffic analysis)	Chester	2018–2028	$ 272.8	$ 826.3	
US 202 (Section 100)	Widen from West Chester to Delaware state line from four to six lanes; grade separated interchanges at US 1 and at PA 926	Chester, Delaware	Unfunded			$ 350.0
US 322	Widen and reconstruct from US 1 to I-95	Delaware	2018–2028	$ 94.1	$ 240.8	
I-95/US 322/ Highland Avenue Interchange	Realign I-95 and add new movements at interchange to US 322, Bethel Road, and Highland Avenue	Delaware	2029–2045	$ 22.2	$ 147.7	
I-476 Active Traffic Management	Part-time shoulder use and other operational strategies from PA 3 to I-95	Delaware	2029–2045	$ 22.5	$ 45.0	
I-95 Delaware County Active Traffic Management	Part-time shoulder use and other operational strategies from Stewart Avenue to US 322 East	Delaware	Unfunded			$ 23.0
Lafayette Street	Extend roadway from Barbadoes Street to Diamond Avenue	Montgomery	2018-2022	$ 12.0	$ 24.1	
US 202 (Section 600)	Widen and reconstruct from Johnson Highway to PA 309	Montgomery	2018–2028	$ 104.0	$ 203.9	
US 422 Bridge and PA 23 Interchange	Bridge replacement and new bridge over Schuylkill River—existing bridge is five lanes, new bridge will have six lanes; intersection/interchange improvements at US 422 and PA 23 Interchange	Montgomery	2018–2022	$ 10.6	$ 21.1	
I-76 Integrated Corridor Management	ATM, multimodal improvements and coordination, and safety analysis from PA Turnpike to US 1; part-time shoulder use from US 202/US 422 to I-476/Conshohocken, and I-476/ Conshohocken to Belmont Avenue/Green Lane	Montgomery	2018–2028	$ 62.5	$ 125.0	
US 422 Mainline Widening	Reconstruct and widen from four to six lanes from US 202 to PA 363	Montgomery	2029–2045	$ 18.3	$ 36.6	
I-276/I-76 Valley Forge Interchange	Ramp modifications	Montgomery	Unfunded			$ 22.0
I-276 and Virginia Drive	Add full movements	Montgomery	Unfunded			$ 49.0
I-276 and Henderson Road	New interchange	Montgomery	Unfunded			$ 43.0

I-276 and PA 63 Welsh Road	New interchange	Montgomery	Unfunded			$ 43.0
I-276 Fort Washington Interchange	Ramp modifications	Montgomery	Unfunded			$ 22.0
US 202/ Dannehower Bridge and Lafayette Street Interchange	Reconstruct Dannehower Bridge and add new half-diamond interchange at Lafayette Street	Montgomery	Unfunded			$ 58.0
US 422 Active Traffic Management	Part-time shoulder use and other operational strategies from US 202 to PA 29	Montgomery	Unfunded			$ 18.0
North Delaware Avenue	Extend roadway from Orthodox Street to Buckius Street	Philadelphia	2018–2022	$ 6.6	$ 6.6	
Adams Avenue Connector	Extend roadway to new ramps at I-95 and Aramingo Avenue	Philadelphia	2018–2022	$ 13.7	$ 13.7	
I-76 Philadelphia Active Traffic Management	Part-time shoulder use and other operational strategies from US 1 to I-676	Philadelphia	Unfunded			$ 48.0
I-295 at NJ 38	Add missing movements at interchange	Burlington	2018–2027	$ 121.0	$ 121.0	
NJ 73 at Church Road and Fellowship Road	Convert intersections into grade-separated interchanges	Burlington	2018–2027	$ 30.2	$ 60.4	
I-295 Direct Connect	Direct connection of I-295 through interchange at I-76/NJ 42	Camden	2018–2027	$ 152.4	$ 325.0	
I-295 and NJ 42 Missing Moves	Add Missing Movements to interchange at I-76/NJ 42	Camden, Gloucester	2018–2021	$ 80.0	$ 160.0	
US 322	Widen from US 130 to NJ Turnpike	Gloucester	2028–2045	$ 45.5	$ 91.0	
US 322 Rowan University Bypass	Bypass around US 322 and NJ 55 interchange; intersection improvements at US 322 and Joseph Bowe Boulevard; corridor improvements in campus/downtown area between Lehigh Road and Yale Road	Gloucester	Unfunded			$ 36.0
US 1 Penns Neck	Widen from six to eight lanes from Dinky Bridge to Scudders Mill Road; intersection improvements at Washington Road and Harrison Street	Mercer	2018–2027	$ 34.9	$ 34.9	
Vaughn Drive Connector	Extend Vaughn Drive to Princeton Hightstown Road (CR 571)	Mercer	2028–2045	$ 57.0	$ 57.0	

Source: DVRPC, 2017

TABLE 17: OTHER MAJOR REGIONAL PROJECTS

Facility	Project Scope	Location	Timing	Total Funded Cost Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
I-95	Sound walls in Chester City	Delaware	2029–2035	$ 20.0	
Delaware River Ferry	Year-round service between Philadelphia and City of Camden	Camden, Philadelphia	Unfunded		TBD

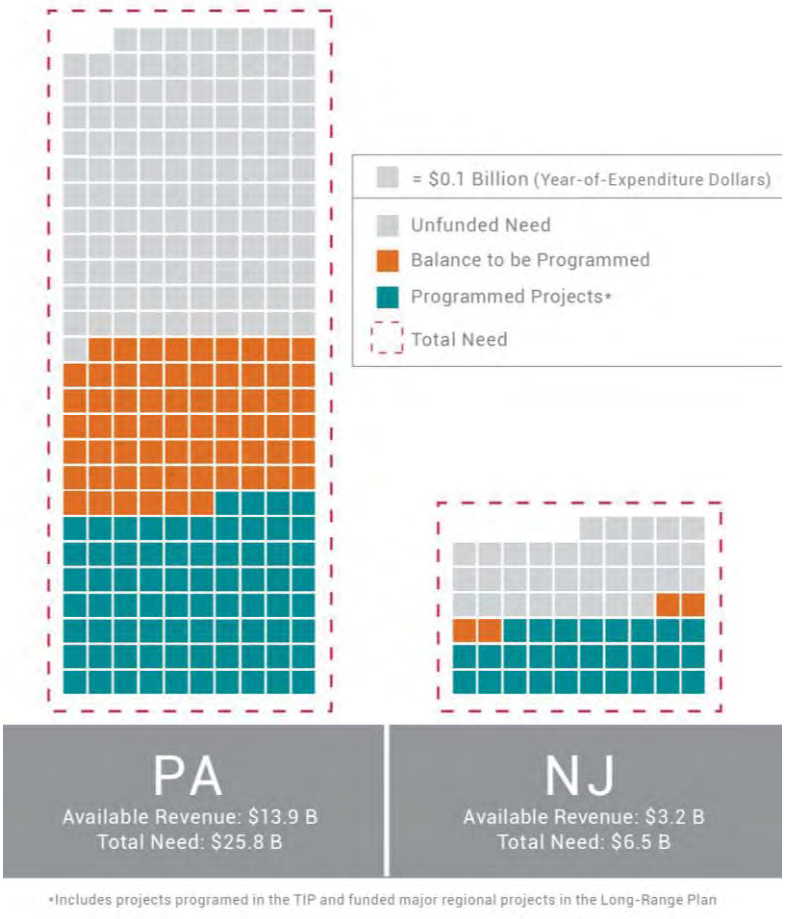
Source: DVRPC, 2017

MAJOR REGIONAL TRANSIT SYSTEM PRESERVATION PROJECTS

Major regional transit system preservation projects (vehicles, stations, and rail infrastructure) will occur on the Atlantic City Rail Line, along with a number of key SEPTA bridges and power substations, which are critical to the long-term viability of the regional rail system. A major renovation of City Hall Station is underway, and significant Regional Rail station upgrades are envisioned at Villanova, Paoli, Exton, Ardmore, Levittown, and Fern Rock. Major transit rail bridge rehabilitations are planned for the Chestnut Hill East and West and Norristown High Speed lines, along with the mainline track between Suburban Station and 30th Street Station. Critical trolley and Regional Rail vehicle replacements will occur over the life of the Plan. Fleets will be expanded, which will help to reduce system overcrowding. Trolley modernization will significantly speed up service, meet ADA-accessibility requirements, and positively transform the streetscape in the neighborhoods where they operate.

Figure 43 illustrates the programmed and available funding for transit preservation projects as compared with the total need in each state's subregion. About 54 percent of the Pennsylvania subregion's and 49 percent of the New Jersey subregion's transit system preservation improvements can be funded.

FIGURE 43: TRANSIT SYSTEM PRESERVATION PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

TABLE 18: MAJOR REGIONAL TRANSIT SYSTEM PRESERVATION PROJECTS

Facility	Project Scope	Location	Timing	Federal and State Funded Cost Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
Trenton Line	Levittown Station Reconstruction	Bucks	2018–2022	$ 36.0	
Woodbourne Substation	New substation on West Trenton Line	Bucks	2018–2022	$ 23.5	
Paoli-Thorndale Line	Devon Station renovation	Chester	2023–2035	$ 20.0	
Frazer Shop and Yard	Rail shop and yard upgrade	Chester	2018–2022	$ 119.1	
Paoli Thorndale Line	Paoli Intermodal Center (phases 1 and 2)	Chester	2018–2028	$ 81.9	
Paoli-Thorndale Line	Exton Station improvements	Chester	2018–2035	$ 62.9	
Paoli-Thorndale Line	Villanova Station rehabilitation	Delaware	2018–2035	$ 32.2	
Media-Elwyn Line	Secane Station renovation	Delaware	2018–2035	$ 24.2	
Wilmington-Newark Line	Marcus Hook Station renovation	Delaware	2023–2035	$ 22.5	
Norristown High Speed Line	Tie replacement and continuous welded rail	Delaware, Montgomery	2018–2028	$ 26.0	
Routes 101 & 102	Positive Train Control	Delaware	2018–2022	$ 75.0	
69th Street Transportation Center	Rehabilitate parking structure; Transportation Center enhancements	Delaware	2018–2028	$ 31.0	
Market-Frankford Line	Replace existing heavy-rail vehicle fleet	Delaware, Philadelphia	2029–2045	$ 1,100.0	
Trolleys	Street track improvements	Delaware, Philadelphia	2023–2035	$ 27.3	
Norristown High Speed Line	Replace heavy-rail vehicles	Delaware, Montgomery	2036–2045	$ 130.0	
West Trenton Line	Philmont Station parking	Montgomery	2018–2022	$ 25.0	
Norristown High Speed Line	Rehabilitate Bridgeport Viaduct over Schuylkill River and Bridge 0.15 over 69th Street yard tracks	Montgomery, Delaware	2018–2028	$ 50.5	
West Trenton Line	Noble Station renovation, parking garage, and storage track	Montgomery	2018–2028	$ 53.0	
Paoli-Thorndale Line	Ardmore Transportation Center (phases 1 and 2)	Montgomery	2018–2035	$ 46.3	

Regional Rail Mainline	Jenkintown-Wyncote Station renovation	Montgomery	2018–2028	$ 25.3
Wayne Junction Station	Static Frequency Converter (SFC) #1-4	Philadelphia	2018–2022	$ 60.0
30th Street West	Catenary replacement	Philadelphia	2018–2022	$ 77.0
30th Street to Philadelphia	Signals, catenary, and right-of-way improvements	Philadelphia	2018–2022	$ 41.8
Buses and Trolleys	Computer Aided Radio Dispatch signal and communication system upgrades and replacements	Philadelphia	2018–2022	$ 32.5
Market-Frankford Line	30th Street Station improvements	Philadelphia	2018–2022	$ 11.0
Market-Frankford Line	40th Street Station renovation	Philadelphia	2018–2022	$ 10.9
Market-Frankford Line	Arrot Transportation Center (Margaret-Orthodox Station) renovation	Philadelphia	2018–2022	$ 39.9
Market-Frankford Line	11th Street Station renovation	Philadelphia	2018–2022	$ 9.5
Broad Street Line	Erie Station renovation	Philadelphia	2018–2028	$ 9.0
Wissahickon Transportation Center	Improvements	Philadelphia	2018–2022	$ 13.3
City Hall and 15th Street Stations	Renovation	Philadelphia	2018–2028	$ 146.5
Regional Rail and Broad Street Line	Station ventilation improvements at Suburban and AT&T stations	Philadelphia	2018–2028	$ 20.0
Center City Concourse Improvements	Renovation	Philadelphia	2018–2035	$ 59.7
Mainline-Schuylkill Bridges	30th Street to Suburban Station	Philadelphia	2018–2035	$ 58.0
Wayne Junction Shop	Shop Improvement/Expansion	Philadelphia	2018–2035	$ 150.0
Buses	Midvale facility and security enhancements	Philadelphia	2018–2035	$ 26.7
Broad Street Line	Replace existing heavy-rail vehicle fleet	Philadelphia	2029–2045	$ 625.0
Chestnut Hill East Line	Rehabilitate five bridges	Philadelphia	2023–2035	$ 39.0
Chestnut Hill West Line	Rehabilitate seven bridges	Philadelphia	2023–2035	$ 45.5
Fern Rock Station	Transportation Center and parking enhancements	Philadelphia	2023–2035	$ 77.5
Regional Rail Vehicles	Replace Silverliner IV fleet	Pennsylvania Subregion	2023–2029	$ 1,100.0
SEPTA Multilevel	Procure 45 new ADA-accessible	Pennsylvania	2018–	$ 174.3

Push-Pull Cars	push-pull cars to replace existing fleet	Subregion	2022	
Regional Rail Locomotives	Procure (15) electric locomotives	Pennsylvania Subregion	2018–2022	$ 154.5
Trolley Modernization	Replace existing trolley fleet with ADA-compliant trolleys to expand capacity and provide faster, more reliable service	Pennsylvania Subregion	2018–2045	$ 713.3
NJ Transit Buses	Procure 560 45-foot buses for routine fleet replacement	NJ Subregion	2018–2045	$ 335.0
Atlantic City Line Vehicles	Procure five locomotives and 20 commuter rail vehicles	Camden, Philadelphia	2028–2045	$ 215.0
River Line	Procure 20 light-rail vehicles	Camden, Burlington, Mercer	2036–2045	$ 130.0
PATCO	Procure 120 heavy-rail vehicles	Camden, Philadelphia	2036–2045	$ 100.0
Atlantic City Line Stations	Rehabilitate Cherry Hill, Lindenwold, and Atco stations	Camden	2036–2045	$ 65.0
Walter Rand Transportation Center	Station enhancements	Camden	2028–2035	$ 50.0
NJ Transit NE Corridor	Replace 42 commuter rail vehicles for routine fleet replacement	Mercer	2028–2045	$ 390.0

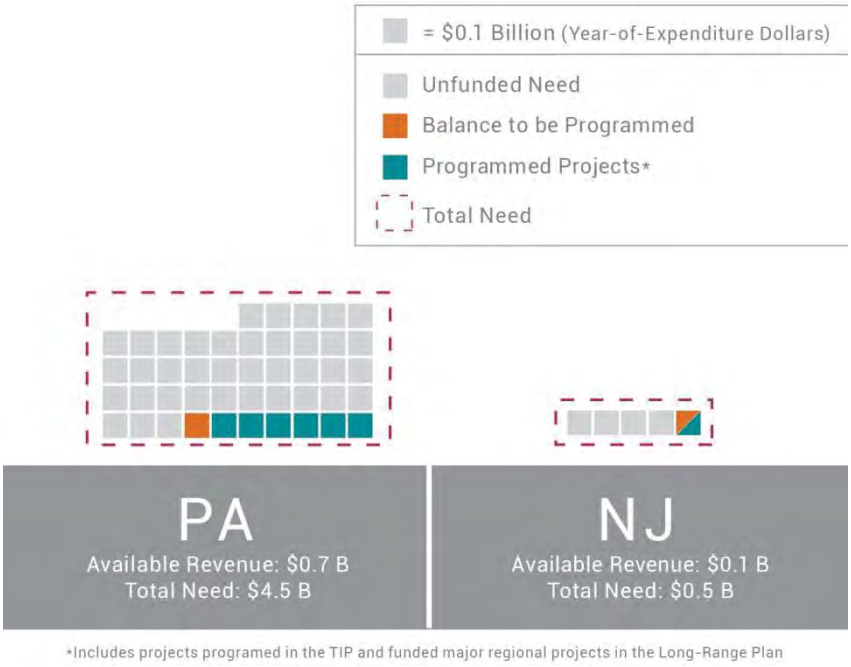
Source: DVRPC, 2017

MAJOR REGIONAL TRANSIT OPERATIONAL IMPROVEMENT PROJECTS

Operational improvements include new sidings, additional vehicles to expand the fleet, and other projects that allow for increased service frequency. Projects such as the Norristown Line third track will enable service and safety improvements. New, frequent express bus service along the Roosevelt Boulevard corridor in Philadelphia with amenities like high-quality stations and a unique brand will serve multiple travel markets. NJ Transit will fully implement positive train control in the region. Finally, full implementation of SEPTA Key will give the region one of the most advanced payment systems in the country.

Figure 44 illustrates the programmed and available funding for transit operational improvement projects as compared with the total need in each state's subregion. Only about 16 percent of the Pennsylvania subregion's and 20 percent of New Jersey subregion's transit operational improvements can be funded.

FIGURE 44: TRANSIT SYSTEM OPERATIONAL IMPROVEMENT PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

TABLE 19: MAJOR REGIONAL TRANSIT OPERATIONAL IMPROVEMENT PROJECTS

Facility	Project Scope	Location	Timing	Funded Cost Millions of Y-O-E $s	Unfunded Cost Millions of 2017 $s
Regional Rail System: Core Capacity Improvements	Interlockings, sidings, flyovers, and freight separation projects to increase service frequency on Regional Rail lines	Bucks, Delaware, Montgomery, Philadelphia	Unfunded		$ 850.0
Roosevelt Boulevard Direct Bus Phase I	Station infrastructure and passenger amenities to allow direct bus service along Roosevelt Boulevard between Neshaminy Mall and Frankford Transportation Center	Bucks, Philadelphia	2018–2021	$ 4.0	
West Chester Pike Enhanced Bus Service	Signal prioritization and transit amenities from West Chester Transportation Center to 69th Street Transportation Center	Chester, Delaware	Unfunded		$ 8.0
Media Trolley Line Second Track	Double tracking from east of Pine Ridge Station to Woodland Avenue	Delaware	Unfunded		$ 19.0
Trolley Modernization	Communications, signals, power supplies, subway station and in-street	Delaware, Philadelphia	2018–2045	$ 440.0	

	stops, track and bridge improvements, fare payment and trolley maintenance upgrades				
Norristown Regional Rail Line	Third track	Montgomery	2023–2035	$ 34.5	
Market-Frankford Line Capacity Enhancements	Lengthened station platforms, 80 supplemental rail cars, reconfigured railcar seating, power system improvements, and ADA accessibility improvements	Philadelphia	Unfunded		$ 870.0
Roosevelt Boulevard Direct Bus Phase II	Station infrastructure and passenger amenities to allow direct bus service along Roosevelt Boulevard between Frankford Transportation Center and Wissahickon Transportation Center	Philadelphia	Unfunded		$ 6.0
SEPTA Key	Updated system-wide fare collection system	Pennsylvania subregion	2018–2022	$ 130.3	
Real-Time Information/ Audio Visual Public Address System	New passenger information at rail and transit stations	Pennsylvania subregion	2018–2022	$ 34.7	
Improved Transit Service to Philadelphia International Airport	Infrastructure improvements to increase Airport Line service frequency, as well as enhancement of other transit modes that serve PHL	Philadelphia	Unfunded		$75.0
NJ Transit Positive Train Control	Installation of positive train control on all active NJ Transit rail lines	Camden, Mercer, Burlington	2018–2021	$ 21.6	
Atlantic City Line Frequency Improvements	Siding and station improvements; new commuter rail vehicles	Camden	Unfunded		$ 105.0

Source: DVRPC, 2017

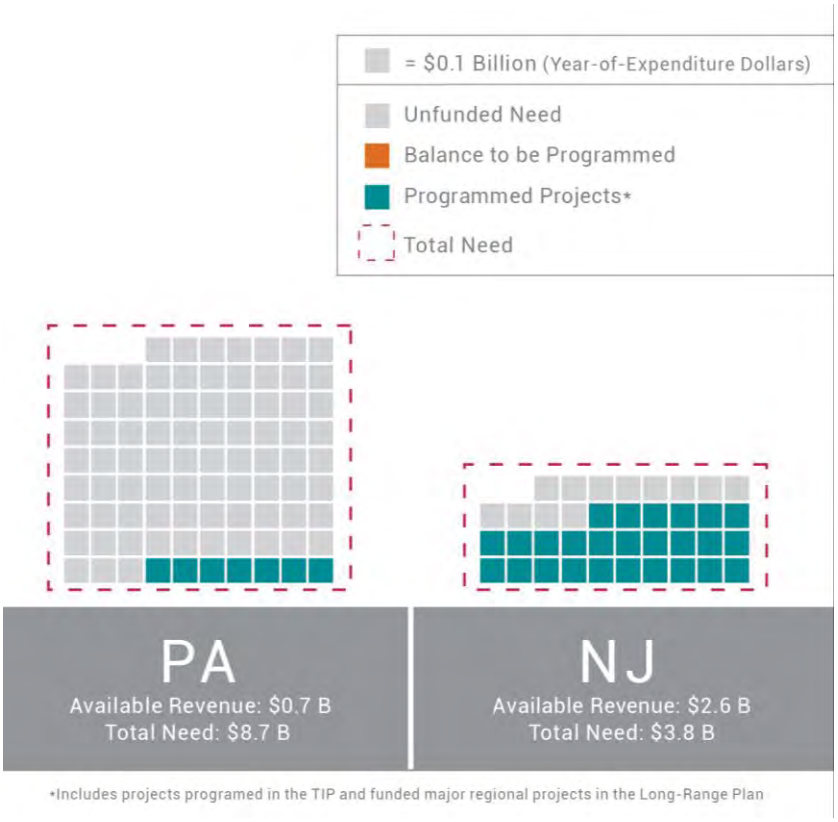
MAJOR REGIONAL TRANSIT SYSTEM EXPANSION PROJECTS

The Media-Elwyn Line extension to Wawa is funded in the TIP's 12-year program and will open by 2026. It is being financed with the help of EB-5 program funds. The Norristown High Speed Line Spur to King of Prussia is funded in the Plan and will open in the later years of the Plan. PATCO's Franklin Square Station will also be reopened.

In New Jersey, the South Jersey BRT will run along NJ 42 and NJ 55 in Gloucester County into Center City, Philadelphia. The Glassboro-Camden Line will be constructed in the later years of the Plan.

Figure 45 illustrates the programmed and available funding for transit network expansion projects as compared with the total need in each state's subregion. Only about 8 percent of the Pennsylvania subregion's and 68 percent of the New Jersey subregion's transit system expansion improvements can be funded.

FIGURE 45: TRANSIT NETWORK EXPANSION PROGRAMMED PROJECTS, ALLOCATED REVENUE, AND TOTAL NEED (2018–2045, IN BILLIONS OF Y-O-E $)



Source: DVRPC, 2017

TABLE 20: MAJOR REGIONAL TRANSIT SYSTEM EXPANSION PROJECTS

Facility	Project Scope	Location	Timing	Funded Cost Millions of Y-O-E $s		Unfunded Cost Millions of 2017 $s
				State and Local	Federal New Starts/ Small Starts	
Bethlehem Branch Passenger Rail Extension	Extend service from Lansdale to Perkasie	Bucks, Montgomery	Unfunded			$ 282.0
Atglen Regional Rail Extension	Extend Paoli-Thorndale Line to Atglen	Chester	Unfunded			$ 15.5
West Chester Rail Service restoration	Extend Media/Elwyn/Wawa Line to West Chester Borough	Chester, Delaware	Unfunded			$ 126.0
Pottstown Rail Extension	Extend Norristown Line to Pottstown	Chester, Montgomery	Unfunded			$ 419.0
Media-Elwyn Line Rail Extension	Extend from Elwyn to Wawa	Delaware	2018–2022	$ 150.6	-	
Norristown High Speed Line King of Prussia Expansion	Rail Line Extension from Hughes Park to King of Prussia	Montgomery	2023–2035	$ 550.0	$ 550.0	
New West Market Market-Frankford Line Station	New Station on Market-Frankford Line	Philadelphia	Unfunded			$ 345.0
Roosevelt Boulevard Surface Transit Line	New surface transit line along Roosevelt Boulevard	Bucks, Philadelphia	Unfunded			$ 500.0
Delaware Avenue Transit Service	New transit service within Philadelphia	Philadelphia	Unfunded			$ 920.0
Broad Street Transit Extension	Transit Extension to Navy Yard	Philadelphia	Unfunded			$ 1,250.0
Franklin Square Station	New station on the PATCO Line in Philadelphia	Philadelphia	2018–2027		$ 26.0	
South Jersey BRT	New BRT from Avondale Park-and-Ride and Delsea Drive to Center City, Philadelphia	Camden	Unfunded			$ 50.0
Glassboro-Camden Line	Construct new transit line from Camden to Gloucester County	Camden, Gloucester	2028–2035	$ 2,430.0	$ 700.0	
US 1 BRT	Express bus network serving the US 1 corridor and providing access from Somerset County on US 206, Monmouth County on CR 571, Burlington County on I-295, and	Mercer, Bucks	Unfunded			$ 150.0

	Bucks County on I-95			
West Trenton Line	Re-establish passenger service on the West Trenton Line to Newark and Secaucus (from West Trenton Station to Bridgewater); relocate West Trenton Station to Parkway Avenue TOD	Mercer	Unfunded	$ 150.0

Source: DVRPC, 2017

EXTERNALLY FUNDED PROJECTS

In addition to those projects receiving federal and state transportation dollars, *Connections 2045* includes a list of non-federally and state-funded projects. These projects generally are funded through toll revenues, but some will be funded from other sources. The New Jersey Turnpike has recently completed its Exits 6 to 9 widening project. The new I-95 and Pennsylvania Turnpike Interchange addresses the missing movement between these two critical facilities in the region's highway network. The Pennsylvania Turnpike is the subject of two widening feasibility studies. The first feasibility study is for the section between Mid-County and Bensalem (mileposts 50 to 59); the second is for the area around the Delaware River Crossing. Separately, the extension of Lafayette Street in Norristown and the Lafayette/Ridge interchange will provide direct access from the Pennsylvania Turnpike to Norristown: one of the region's Town Centers.

TABLE 21: EXTERNALLY FUNDED MAJOR REGIONAL PROJECTS

Facility	Project Scope	Location	Timing	Cost Millions of 2017 $s
I-95 at PA Turnpike	New partial interchange at I-276; widen Pennsylvania Turnpike from US 1 to New Jersey; widen I-95 from PA 413 to Pennsylvania Turnpike	Bucks	2018–2022	$ 140.0
I-95 at Scudders Falls Bridge	Widen I-95 from PA 332 to the Delaware River Bridge; replace and widen the Delaware River Bridge; reconfigure I-95 interchanges at Taylorsville Road and NJ 29; repave I-95 from PA 332 to CR 579 (Bear Tavern Road)	Bucks, Mercer	2018–2022	$ 512.0
PA Turnpike	All electronic tolling	Bucks, Chester, Montgomery	2018–2028	$ 257.0
Amtrak NEC Future	Includes capacity improvements throughout corridor; new right-of-way and station to directly serve PHL airport; new hub station at Baldwin/Chester, and other improvements to support higher speeds and increased levels of service.	Bucks, Delaware, Philadelphia, Mercer	Unfunded	TBD
I-476 PA Turnpike NE Extension	Reconstruct and widen to six lanes from Lansdale to Quakertown	Bucks, Montgomery	2018–2028	$ 450.0
I-76 PA Turnpike	Reconstruct and widen from Morgantown, Berks County to Valley Forge	Chester, Montgomery	2018–2035	$500.0

I-276 and Lafayette Street/Ridge Avenue	New interchange	Montgomery	2023–2028	$ 66.4
30th Street-Mantua-Philadelphia Zoo Connector	New fixed-guideway shuttle service connecting 30th Street Station; new 30th Street District development; the Mantua neighborhood; and the Philadelphia Zoo	Philadelphia	Unfunded	TBD
Atlantic City Expressway	Construction of a third lane in the westbound direction from milepost 31 to milepost 44	Camden	2018–2027	$ 150.0
Atlantic City Expressway	Implement all electronic tolling throughout entire facility	Camden, Gloucester	2018–2021	$ 50.0

Source: DVRPC, 2017

Port and Rail Freight Improvements

Strategic improvements to the region's world-class port and rail freight networks will streamline operations, strengthen Greater Philadelphia's ability to compete with other regions, and complement highway and highway connector improvements. Many of these projects will be identified through statewide freight plans and result from public-private partnerships and from revenue sources outside of DVRPC's traditional funding purview. FASTLANE grants are just one example of these outside funding sources that assist nationally and regionally significant freight and highway projects that align with the FHWA program goals.

The Commonwealth of Pennsylvania recently unveiled a $300 million Capital Investment Program, which targets the Packer Avenue Marine Terminal complex and the Tioga Marine Terminal in Philadelphia. These improvements will result in doubling container capacity at the facilities, provide increased capacity for noncontainerized cargoes, and bring a substantial increase in automobile-handling capacity. In New Jersey, a project of similar consequence was recently realized with the opening of the South Jersey Port Corporation's new Paulsboro Marine Terminal.

Dramatic advances have also occurred with regional rail freight facilities, such as the modernization of the Delair Bridge, the region's most important railroad link between New Jersey and Pennsylvania. Future rail freight projects may include providing doublestack clearance on CSX's Philadelphia Subdivision Line traversing Philadelphia and Delaware County, and creating additional capacity on the SEPTA Airport Line for freight trains bound for the Delaware County industrial waterfront.

Philadelphia International Airport

Airport capital improvements are primarily funded with fees paid by commercial airlines. PHL is planning a number of major improvements and renovations in the coming years that will significantly enhance and facilitate the traveling experience. A new air traffic control tower and a new arrivals building for terminals B and C will be constructed. Travelers will have access to new restaurants and retail offerings and be able to order food directly to their seats as they wait at gates. Also, the airport's fuel pumping and storage system will be modernized; many roofs, elevators, escalators, and heating, ventilation, and air conditioning (HVAC) units will be replaced; and aircraft de-icing equipment and airfield snow removal equipment will be purchased.

CLOSING THE FUNDING GAP

DVRPC's transportation infrastructure needs assessment found a minimum regional funding gap of nearly $65 billion between the Vision Plan and the Funded Plan over the life of *Connections 2045*. Failure to maintain and improve the transportation network reduces the region's economic competitiveness, as it becomes a less attractive location for business investment; the environment is degraded due to increased congestion; more vehicular damage is caused due to poor road conditions; and vehicular crashes increase due to less-safe travel conditions.

The majority of the funding that the region currently uses to build, maintain, and repair its road and transit infrastructure currently comes from the federal and state governments. The region does not have the power to control the level of federal or state funding that it receives. Given the large set of needs that will remain unmet at current funding levels, the region should continue to explore ways to close its funding gap. This can be through project right-sizing, better program management, innovative project delivery, and raising additional revenues with a focus on local funding options or public-private partnerships. It is likely that a combination of several funding mechanisms, with help from all levels of government, is needed to fully fund the region's identified needs. The region's local funding contribution is low compared to other large metropolitan areas. This restricts Greater Philadelphia's ability to fulfill the Vision Plan and puts the region at a competitive disadvantage when compared to its peers across the nation and around the world.

The gas tax that is used to fund road and transit projects at the federal and state levels is quickly becoming obsolete due to increased use of electric vehicles that do not pay into it, more fuel-efficient vehicles that pay less per mile driven, and flat rates of total VMT. There is a need to have a serious discussion about what sort of tax or fee should replace the gas tax. This is also an opportunity to think about how the design of markets and pricing the system can help to further the goals of the Plan while creating a more equitable, safe, and efficient transportation network.

The Plan continues the dialogue and consensus building around the search for optimal funding solutions. This will become an even more significant issue if federal transportation dollars do not grow to keep up with future needs or even with inflation. This Plan issues a challenge to the region's leaders, stakeholders, and citizenry to reach consensus on new local and regional means of maintaining, modernizing, and integrating the region's critical transportation infrastructure, which improves our standard of living, economic competitiveness, and sustainability.

PROJECT RIGHT-SIZING

Right-sizing and seeking efficiencies throughout the transportation network works to resolve transportation problems with solutions that are context sensitive, affordable, supported by the surrounding communities, and implementable in a reasonable timeframe. Right-sizing means the DOT will consider reduced-scale alternatives like transportation system management before developing alternatives, such as new or widened roadways. If safety, and not congestion, is the problem, then the DOT will consider focused solutions that can improve safety without increasing capacity. That said, safety must be considered in all projects.

LOCAL FUNDING OPTIONS

Additional funding is needed if the region wants to realize the transportation vision set forth in this Plan. New funds will most likely need to be generated at all levels, including locally. To do this, the region needs to find ways to translate the recent growth into improvements in the transportation system. Ideally, any new local transportation funding sources should be easy to implement, stable and sustainable over time, equitable both

for system users and over geographic areas, should further the goals and policies of the Plan, and not yield unintended negative economic impacts. In addition, the region can use financing to help advance large-scale projects using tools, such as bonds, Transportation Infrastructure Finance and Infrastructure loans, the EB-5 program, state infrastructure banks, and public-private partnerships. See Appendix D for more information on these tools.

DVRPC's work in this effort recognizes that poor infrastructure conditions and the failure to improve transportation system performance puts the region at an economic disadvantage compared to our peer competitor regions, both in the United States and around the world. The goal has been to find ways to use the region's economic growth as a means to enhance the transportation network. DVRPC has reviewed more than two dozen different taxes or fees that could potentially fund the region's transportation system. *Connections 2045* maintains the focus on direct user fees, which are widely considered to be the fairest way to pay for system improvements. These fees are related to the use of the transportation system and can include VMT fees, tolling, gas taxes, or transit fares, among others. Most of these funding options require state-enabling legislation before the region can pursue them any further. It is not likely that any single option could fill the funding gap on its own. DVRPC has not identified any of the options as a preferred alternative. Rather, the hope is to encourage discussion and develop consensus on the optimal funding mechanisms to help the region achieve its transportation goals.

TABLE 22: REGIONAL USER FEES SUMMARY

Funding Option	Description	Proposed Rate	% Increase	Annual Revenue (2017 MM $s)		Long-Term Annual Change		Long-Term Implications
				PA Sub-region	NJ Sub-region	VMT (MM)	Transit Ridership (MM)	
Access Fees	Charge on nonresidential taxable property located within a quarter-mile of transit stations	$0.25 per square foot	Varies	$ 40.0	$ 5.0	0.0	0.0	Could lead to slight shift away from transit-oriented locations; alternatively could finance new transit routes, increasing transit-accessible locations and ridership
Carbon Tax	Tax placed on carbon emissions	$15 per $MTCO_2E$	1.2% to cost of driving per mile	$ 250.0	$ 110.0	–140.0	+0.4	Likely to increase use of alternative-fuel or energy-efficient vehicles, and may encourage alternative modes of transportation
Congestion Pricing	(a) Cordon toll around Center City; (b) Peak-hour congestion pricing on region's highways	(a) $5 per vehicle entering cordon area; (b) $0.20 per peak hour vehicle mile driven	(a) ~25% per Center City vehicle trip; (b) ~37% per peak-period highway trip	(a) $110.0 (b) $300.0	(a) $0.0 (b) $160.0	(a) –180.0 (b) –270.0	(a) +3.6 (b) +5.6	(a)May have negative impacts on Center City, but this area of the region has the most transportation options; (b) Option with most congestion reduction, high administration costs
Fuel Sales Tax	Applies a sales tax to the purchase price of gasoline, not including liquid fuels taxes	2% of the retail gasoline price	2% increase to fuel cost	$ 40.0	$ 25.0	–40.0	+0.1	Likely to increase use of alternative-fuel or energy-efficient vehicles, and may encourage use of alternative modes
Regional Toll Surcharge	(a) Add surcharge to 12 regional turnpike exits; (b) add surcharge to nine bridges over the Delaware River	(a) $1.00 per trip; (b) $1.00 per crossing	20–100%	(a) $ 95.0 (b) $ 45.0	(a) $ 20.0 (b) $ 45.0	(a) –190.0 (b) –90.0	(a) +0.6 (b) +2.0	Many trips lack transportation alternatives; may benefit goods movement through reduced congestion

Sales Tax	Levied as a percentage of the purchase price for goods, products, and services	Increase 0.5%	13%–17%	$ 250.0	$ 100.0	–8.0	0.0	Little impact on transportation system use and development patterns
Toll Existing Highways	Assessed as a user fee on designated limited access roads and bridges	$0.10 per mile	~19% per highway trip	$ 420.0	$ 290.0	–290.0	+0.7	May shift traffic onto local roads; high administration costs; may encourage TOD
Transit Fare Increases	Cost per transit trip or monthly/weekly pass	3.0%	3% fare increase	$ 9.0	$ 1.0	+16.0	–5.6	May reduce transit ridership and increase congestion
VMT Fee	A fee on each vehicle mile driven, assessed at inspection and registration	$0.01 per mile	1.9% compared to cost per mile driven	$ 240.0	$ 150.0	–660.0	+2.9	Largest decline in VMT; may encourage more compact development patterns
Vehicle Registration Fee	Annual assessment on vehicle ownership	$10 per vehicle per year	0.2% to annual vehicle ownership cost	$ 20.0	$ 10.0	–2.4	0.0	Very little impact on transportation system use and development patterns

Source: DVRPC, 2017

For revenue and adequacy, taxes and fees deemed to have very high local yields would generate more than $300 million regionally per year; high yields would generate more than $150 million; good yields would generate more than $75 million; medium yields would generate more than $25 million; and low yields would generate less than $25 million annually. The region currently generates about $100 million per year in local funding. Revenue yield considers the ability to roughly double (good rating or better) the current regional contributions, with no more than a 10 percent increase in current transportation costs.

None of these fees are necessarily easy to implement, as state-enabling legislation (for anything besides transit fares) is required. Adding tolls to interstate highways is not allowed under current federal regulations and would require federal government approval. It is likely much easier to implement an increase to an existing fee, than it is to create a new payment system. The way in which we charge for the use of the transportation system can potentially help realize some of the Plan's goals while also building agglomeration economies needed to make the region more economically competitive. Achieving this means new charges should support denser, Centers-based development patterns, encouraging more development areas served by transit, with the requisite pedestrian and bike facilities. This can reduce development pressure in the less-developed portions of the region. Careful market design can help to make the transportation network more efficient, while reducing energy use and lowering congestion.

CHAPTER 5: TAKING ACTION

Connections 2045 serves as the key policy directive for DVRPC, but it is also a regional blueprint for future growth and development. As such, it will require collective action to achieve its vision. Attaining the vision and goals outlined in the Plan will require a shared effort that begins with an assessment of the impact our individual actions have on the region. By "thinking regionally but acting locally," the region can achieve coordinated and cooperative action across municipal, county, state, and federal levels, and between the public and private sectors.

Two themes routinely heard during the public outreach for *Connections 2045* are the increased need for regional coordination and government efficiency. These strategies represent the key strategies for implementing the Plan, and they offer a future that is more transparent, innovative, and collaborative. They can increase partnerships between businesses and governments, and develop a fairer and more equitable tax structure that can spur regional growth.

REGIONAL COORDINATION AND GOVERNMENT EFFICIENCY

Networks are now the primary way in which people organize in the digital era. Multi-municipal planning and shared services are one way in which local governments can leverage network effects. Multi-municipal planning is a key foundation to increasing both regional coordination and government efficiency. The nine-county DVRPC region includes 352 municipalities. Multi-municipal planning allows neighboring municipalities to develop a shared vision and to coordinate on various planning issues, including growth management, provision of infrastructure, preservation of natural and historic resources, and economic development. It can also help municipalities receive funding from state agencies, address issues that cross municipal boundaries, and reinforce the importance of local planning.

Through recent efforts to combat suburban sprawl and preserve natural resources, many municipalities have been taking a proactive approach to planning and are working cooperatively with neighboring municipalities to plan for future development. What follows summarizes some of the benefits that multi-municipal planning can bring.

- Multi-municipal planning can encourage economic development. By cooperating, local governments can formulate a consistent and comprehensive strategy for economic development, rather than competing for tax revenues. Because local governments may designate growth areas, they can identify areas where commercial or industrial development should be encouraged, and provide public investment in these areas to attract developers. This can also strengthen existing communities by focusing development within existing Centers, and by concentrating commercial and high-density residential growth in these areas.

- Multi-municipal planning can preserve farmland and natural resources. Often, natural features such as watersheds are more appropriate areas for environmental planning activities than political boundaries. Also, by allowing Transfer of Development Rights across municipal boundaries, more farmland and other natural resources can be preserved.

- Multi-municipal planning can save money. Not only can costs of activities, such as developing a comprehensive plan, be shared by several municipalities, multi-municipal planning can provide the basis for other service-sharing relationships. State agencies often give priority in grant programs and

funding decisions to multi-municipal planning areas and often give greater weight to multi-municipal plans than to individual local plans.

- Multi-municipal planning can provide additional defense against curative amendments. Municipalities are required to provide land for every type of use. Local governments that adopt multi-municipal planning still must provide land for every use, but not individually. For example, if several municipalities participate in a multi-municipal plan and one already has adequate high-density housing, the participating communities may collectively satisfy their high-density housing requirements. If the ordinance is challenged, the court would evaluate the entire area of the multi-municipal plan, not just the individual municipality, enhancing the rationale for the zoning strategy.

Once a multi-municipal comprehensive plan has been completed, a joint zoning ordinance may also be prepared. The joint zoning ordinance would become the primary implementation tool for the multi-municipal plan. However, each municipality may still enact their own zoning ordinance. If separate zoning ordinances do remain, each of the participating municipalities needs to work together to ensure consistency with the multi-municipal comprehensive plan.

While municipal cooperation can be taken to great lengths, as with the merger of Princeton Borough and Princeton Township in 2013, most cooperative partnerships happen on a much smaller scale. Municipalities can cooperate in several ways, whether by sharing services, equipment, or personnel; pooling procurement efforts; or by regularly collaborating on regional approaches and ideas to help facilitate sound local decision making.

OTHER ORGANIZATIONS PROMOTING REGIONAL COOPERATION

In addition to DVRPC's coordination efforts there are other organizations that bring together municipal officials on a regular basis to discuss issues and solve problems. Local examples include:

- Municipal Leagues (e.g., New Jersey League of Municipalities, Pennsylvania League of Cities and Municipalities);
- County Associations (e.g., New Jersey Association of Counties, County Commissioners Association of Pennsylvania);
- Elected Official Associations (e.g., Pennsylvania State Association of Township Supervisors, Pennsylvania State Association of Township Commissioners, Pennsylvania State Association of Boroughs);
- Planning/Zoning Associations (e.g., American Planning Association—New Jersey chapter, American Planning Association—Pennsylvania chapter, Montgomery County Zoning Officers Association, New Jersey Planning Officials, New Jersey County Planners Association, Pennsylvania Association of Zoning Officers);
- Municipal Management Associations (e.g., New Jersey Municipal Management Association, Association for Pennsylvania Municipal Management);
- Mayors' Associations (e.g., New Jersey Conference of Mayors, Pennsylvania State Mayors' Association); and
- Consortia or Councils of Governments (e.g., Bucks County Consortium).

In addition to helping municipalities share knowledge and gain confidence in their decision making, properly planned and implemented shared services provide benefits in at least one of six distinct areas:

- Allows municipalities to offer new services to their constituents where none previously existed;
- May reduce costs and time spent on existing services by creating economies of scale;
- Avoids future costs of programs and tools through coordinated planning and efficiencies;
- Eliminates service duplication that can save time, money, and other municipal resources;
- Offers municipalities options for maintaining or expanding service within an existing budget despite fiscal or staffing constraints; and
- Increases competitiveness for outside funding, as government agencies often give priority in grant programs and funding decisions to areas with multi-municipal plans.

There are many other areas where government can better coordinate, and information is a key tool to facilitate that. Data coordination is an area of growing interest that can help different governments and others better coordinate, but more importantly, make better decisions.

In a globally connected world, capability is not what you can do on your own, but rather what you can accomplish by working with others. Unfortunately, most government functions remain based on the bureaucratic needs that remain from the previous industrial age. To be effective and efficient, government needs to be reimagined as more of a network. Examples of government-as-a-network exist in 3-1-1 and 5-1-1 information systems along open data efforts, such as data.gov. These should be an inspiration for reinventing government 2.0, which harnesses collaborative software and apps to connect with citizens, helps citizens connect with each other, and enables them to be problem solvers. In this new vision government is a platform that increases access to data and information, promotes transparency, and serves as a convener and coordinator for collective action. Local governments can use triple-bottom-line accounting, which considers social, environmental, and financial impacts, as the basis for decision making.

INNOVATIONS IN PROJECT DELIVERY

Better transportation project delivery methods can increase worksite safety, reduce congestion from construction, and lower the cost of transportation projects. FHWA's Everyday Counts campaign highlights the economic and quality-of-life benefits from maintaining and reconstructing transportation facilities while minimizing impact on the traveling public. Some examples of the techniques that are being used in the region and around the country to do this include:

- **INVEST** is an FWHA tool that provides information and techniques to help agencies integrate sustainability best practices into their projects and programs.
- **Accelerated bridge construction** uses geosynthetic materials to quickly and cheaply construct abutments and roadway approaches, and prefabricated bridges that are built offsite, or nearby, and can be slid into place and paved, and allow the road to reopen within 48 to 72 hours.
- **AASHTOWare** is bridge and pavement management software that can more accurately design facility requirements for given traffic and weather conditions.
- **Cold-in-place recycling** is a no-heat paving solution. Two to five inches of the current road surface are pulverized down to a specific aggregate size, mixed with a rejuvenating asphalt emulsion, and then reused to pave that same road, saving labor, material, and transportation costs.
- **Warm-mix paving asphalt**'s heating requirements are 30 to 120 degrees Fahrenheit less than traditional asphalt, reducing fuel consumption and emissions. Secondary benefits include allowing and prolonging the construction period in cold climate, extending material handling time, and fume reduction
- **Waste and recycled materials**, such as rubber tires, coal ash, fly ash, foundry sand, slag, asphalt shingles, construction and demolition materials, and silica fume, have been added to pavement mixtures to reduce cost and improve performance.
- **Precast concrete paving** involves panels being precast offsite, where they can be subject to higher-quality control standards, and installed during low-volume periods—such as overnight or weekends. They can reduce one of the major causes of road delay: construction.

OUR VISION, YOUR VISION

DVRPC acts as a facilitator to bring together stakeholders throughout the area to discuss regional issues. A number of committees bring together elected officials, planners, professional practitioners, and the private sector. DVRPC also strives to implement the vision and policies of *Connections 2045* through its work program and projects, and to provide an array of services to municipalities throughout the region.

The next section contains some highlighted initiatives from DVRPC and its stakeholders, and includes action steps that everyone in the region can take to help bring the Plan to fruition. Taking these steps can help reduce energy use and resulting GHG emissions, strengthen and create livable communities, support local economies, make the region more equitable for everyone, and improve the functionality of the region's transportation system. Many actions will even save you some money and contribute to a healthier lifestyle.

ACTIONS TO SUSTAIN THE ENVIRONMENT

DVRPC SPOTLIGHT

Air Quality Partnership is a public-private coalition of businesses and organizations that promote better air quality through voluntary actions to reduce air pollution. The partnership is administered by DVRPC and provides a daily air quality forecast for the region and tips to protect personal health through a broad-based outreach effort.

TreeVitalize is a program launched by the Pennsylvania Department of Conservation and Natural Resources to increase public awareness of the importance of community trees and to reverse the loss of tree cover in the state's metropolitan areas. To directly reverse that loss, DVRPC has partnered with the Pennsylvania Horticultural Society (PHS) to access funding from the Pennsylvania Infrastructure Investment Authority (PENNVEST) for tree planting projects that manage stormwater. To date, the DVRPC/PHS partnership has received funding awards from PENNVEST to plant over 4,500 trees in communities across the region.

Municipal Actions to Protect Water Quality is a recent two-year DVRPC project funded by the William Penn Foundation, working with stakeholders across the Delaware River Watershed to assist municipalities in their efforts to protect and improve water quality. Intensive stakeholder input obtained through hundreds of one-on-one phone and in-person interviews confirmed that nonpoint-source stormwater runoff caused by development, suburbanization, and forest fragmentation is among the most serious threats to water quality across the watershed. The technical results of this project, due to be published Fall of 2017, will advance key recommendations to protect headwater forests, preserve and restore vegetated riparian buffers, and mimic natural processes in urban settings by utilizing green stormwater infrastructure.

The Climate Change Adaptation Community of Practice is an ongoing series of DVRPC-hosted, half-day solutions-focused workshops, taking place two to four times per year. The Community of Practice brings together regional professionals currently engaged in preparing for climate change. Each workshop features one or more professionals presenting on their current activities related to addressing a particular climate change adaptation issue. Topics have included Forests, Urban Trees, and Climate Change; Public Health and Climate Change; and Waterfront Development and Climate Change.

FOCUS ON REGIONAL STAKEHOLDERS

SEPTA SUSTAINABILITY PROGRAM

SEP-TAINABLE 2020 is SEPTA's second-generation strategic business plan, which outlines its triple-bottom-line approach to sustainability: accounting for environmental, social, and economic organizational needs and regional opportunities. One of the guiding principles of the sustainability program is to develop financially sound investments and programs. As a result, a new economic goal was added to track and report the grants, revenue, and savings SEPTA receives from sustainability initiatives. By tracking the positive financial impacts of sustainability initiatives, SEPTA knows which investments and programs provide the greatest financial yield. Having this information allows SEPTA to make financially informed decisions on whether to continue or expand programs, helping SEPTA to grow its environmental and social impact while simultaneously improving its economic position. The total positive financial impact of sustainability initiatives exceeds $121 million. For more information about SEPTA's sustainability program visit: http://www.septa.org/sustain.

TDR ORDINANCE APPLICATION IN FORT WASHINGTON OFFICE PARK

The Fort Washington Office Park opened in the 1950s, purposely located at the Pennsylvania Turnpike and PA 309 interchange to provide easy access, but also sited in flood-prone lowlands. Over time the office park grew, along with other development in the watershed. Now, the office park suffers from severe flooding, threatening people's safety and causing significant property damage.
To deal with these ongoing challenges and maintain the strong economic base that the business park provides, Upper Dublin Township sought a solution that would resolve the flooding issue and also modernize the 1950s-era office park setting. A TDR ordinance provided the solution.

TDR ordinances are traditionally applied in Growing Suburbs and Rural Areas to use the development process to preserve agricultural or natural resource areas in one part of a municipality in exchange for increasing density in other locations better supported by land conditions and infrastructure. In the Fort Washington Office Park, the TDR ordinance is crafted to provide incentives to property owners to demolish their buildings in the flood-prone areas and to clear and stabilize the land, in exchange for selling their development credits. Development credits may be purchased and used by developers for increasing density and building types, including residential and retail uses, on the higher-ground areas of the business park. Design regulations are also incorporated to create a more sustainable, inviting, and pedestrian-oriented pattern with both civic spaces and greenways.

NEW JERSEY RESILIENT COASTAL COMMUNITIES INITIATIVE

New Jersey's Resilient Coastal Communities Initiative is run by the New Jersey Department of Environmental Protection's Office of Coastal and Land Use Planning, and DVRPC is an active participant in this initiative. DVRPC has been working with six municipalities along tidal waterways in Burlington County to help them understand their vulnerability to coastal storms and sea level rise. The project uses maps and data to show municipalities how they may be affected by flooding from sea level rise and storm surge in the second half of the 21st century. In visualizing how these hazards differ from historic and current coastal floods, partner communities can better plan and prepare for a future of increasing coastal hazards. At the same time, this partnership helps make the communities more resilient to current threats from flooding, coastal erosion, and severe storms.

The project used two tools—the Coastal Vulnerability Assessment, and the Getting to Resilience questionnaire—to assess each municipality's vulnerable assets (such as buildings, infrastructure, and natural resources) and develop strategies for making them more resilient to future coastal floods. The Coastal Vulnerability Assessment models the impacts of storm surge and sea level rise in different decades and generates maps to help communities see how buildings, infrastructure, and natural resources could be harmed by flooding. The assessment also helps identify vulnerable populations that may require additional assistance in the event of a coastal emergency.
Final reports for each of the six municipalities will be published in late 2017. These documents will be the basis for implementing projects that will enable them to best guard against the effects of coastal flooding, such as zoning or land development ordinance updates; green and gray stormwater infrastructure improvements; wetland conservation and restoration; and other, risk-based management strategies.

New Jersey Department of Environmental Protection, Land Use Management, Coastal Hazards of New Jersey: Now and with a Changing Climate, Updated January 26, 2017, http://www.state.nj.us/dep/cmp/czm_hazards.html.

WHAT YOU CAN DO

- Start or join a neighborhood composting program and recycle to reduce household waste.
- Make sure your home is properly insulated and turn the thermostat to 75 degrees or higher in the summer months, and 68 degrees or lower in the winter months.
- Reduce polluting activities, such as driving, mowing your lawn, or filling your car's gas tank on days with poor air quality.
- Purchase light-emitting diode (LED) or compact fluorescent light bulbs, and energy-efficient appliances and vehicles; turn off lights and appliances when not in use.
- Support local food production by purchasing fresh food from local sources.
- Plant a tree or grow a garden.

ACTIONS TO DEVELOP LIVABLE COMMUNITIES

DVRPC SPOTLIGHT

Transportation and Community Development Initiative (TCDI) provides grants to support local planning initiatives that implement the region's long-range plan. Between fiscal years 2002 and 2017, DVRPC has distributed $16.0 million to over 230 communities throughout the region for TCDI planning grants, leveraging over $330 million in public and private funding. Leveraged dollars included additional planning, engineering, and construction activities.

Municipal Implementation Tools are a series of brochures specifically written for busy municipal officials and staff that want an introductory overview on topical issues. Twenty-nine brochures have been published to date. Recent publications have focused on tax incentives, attracting immigrant populations, the pop-up economy, and crime prevention. Previous issues have covered a wide range of topics, such as shared services, noncontiguous parcel clustering, zoning for wireless service facilities, and energy-efficient traffic signals and streetlights.

Classic Towns is a marketing program that aims to promote the region's developed municipalities and neighborhoods as great places to live, work, and play. This competitive program includes 22 designated Classic Towns that financially contribute to a pool of funding collectively used for marketing the Classic Towns and enhancing their staffs' skills. Marketing includes a promotional video, website, and events, such as a Classic Towns photo contest and traveling show. Targeted professional development bolsters skills in public relations, marketing, using social media, and engaging local businesses.

The Healthy Communities Task Force was first convened in 2014 to bring together public health, planning, and related professionals in the Greater Philadelphia area. The Task Force provides a venue for people interested in fostering healthy communities to learn about other communities, both near and far, that are successfully integrating planning and public health. It serves as a way for professionals in these fields and stakeholders in our communities to deepen their understanding of healthy communities and build the relationships to achieve them. Recent meeting topics have included the Intersection of Civic Space and Mental Health, Climate Change and Health, Health and Housing, Active Transportation and Equity, Aging-Friendly Communities, and Integrating Health into Comprehensive Planning. DVRPC will continue to convene the Task Force, as well as work both internally and with state, county, and municipal partners to support the integration of health into different projects and processes across our region.

Promoting Green Stormwater Infrastructure in Montgomery County is part of a larger greenway planning effort for western Montgomery County. The Montgomery County Planning Commission engaged DVRPC to help small towns and boroughs envision how they can incorporate GSI directly in their downtowns. GSI systems will improve the livability of these downtown locations through greening and beautification and by increasing amenities for pedestrians, while at the same time managing stormwater. DVRPC recently developed photo simulations of curb bump-outs and stormwater planters in downtown Harleysville and Red Hill Borough to help them visualize these techniques and promote their implementation.

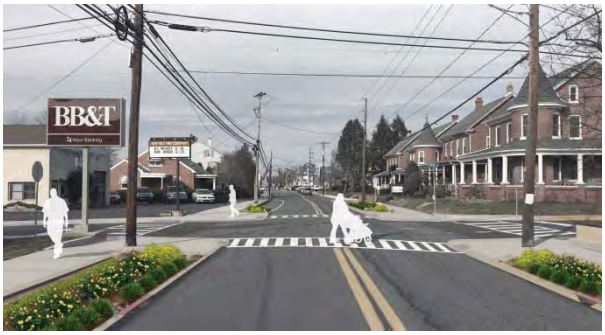
Before

After

Street-side rain garden simulated in Harleysville.

Before

After



Stormwater bump-outs simulated for an intersection in Red Hill.

FOCUS ON REGIONAL STAKEHOLDERS

OXFORD MILLS—SOUTH KENSINGTON, PHILADELPHIA

In 2014, a pair of abandoned factory buildings in Philadelphia's South Kensington neighborhood were reborn as Oxford Mills: a mixed-use hub for the city's education and nonprofit communities. Included in the development are 94 below-market-rate apartments and a collection of office and retail spaces, with most tenants having close ties to the city's public school system. Oxford Mills was conceived as a collaborative and supportive environment for teachers and like-minded professionals to live, work, and socialize at a low cost. The project was the brainchild of business partners Gabe Canuso and Greg Hill, of D3 Real Estate Developers, and the Seawall Development Company, modeled on similar facilities delivered by Seawall in Baltimore. Rent discounts of $200 to $400 are made possible through their decision to use federal historic and New Market tax credits, which ultimately lowered the debt-service required to finance redevelopment of the former textile mill and lamp factory. According to Hill, roughly 60 percent of the units are rented by educators, with the remaining occupants having comparable earnings. Tenants of each residence can appreciate their design on top of their affordability, with carefully preserved details, original masonry, and sustainably sourced and manufactured materials on many new installations. On-site amenities are plentiful, including a fitness center, copy room, courtyard with outdoor furniture, event space, and coffee shop.

Source: https://savingplaces.org/stories/at-philadelphias-oxford-mills-former-textile-mill-becomes-beacon-for-educators

KING OF PRUSSIA

With more than 21 million square feet of commercial space and more than 59,000 jobs, the King of Prussia area is Greater Philadelphia's second largest economic center. This regional center includes the King of Prussia Mall and is located near two of the region's top tourist destinations: Valley Forge National Historic Park and the Valley Forge Casino resort. SEPTA, PennDOT, Upper Merion Township, the King of Prussia Business Improvement District, and many others are working together to make this part of the region more multimodal and accessible. King of Prussia Rail (Norristown High Speed Line Spur to Hughes Park) will improve connections to other regional centers, such as Philadelphia and Norristown, Pennsylvania. By creating new travel options, visitors, employees, and residents can avoid congested roadways in the area. The First Avenue Linear Park is a public-private partnership that will be a model for many other areas in the future. The Linear Park will stretch 2.6 miles, traversing 26 privately owned parcels, from North Gulph Road to Allendale Road. It will feature a multiuse path, landscaping, lighting, activities, and street furniture. First Avenue itself will be given a road diet, with bike lanes and center-turn lanes. These transportation improvements will help to serve new development in the area, such as the new Village at Valley Forge and King of Prussia Town Center. These developments utilize new urbanism to create a new walkable main street with nearly 400,000 square feet of retail and restaurants; 1.5 million square feet of office space; 500 hotel rooms; and more than 3,000 residential units. By making the area more multimodal and a mixed-use live, work, play center, King of Prussia will be well prepared to prosper in the age of Centers-based development.

CAMPBELL'S HEALTHY COMMUNITIES PROGRAM

In 2011, the Campbell Soup Company launched Campbell's Healthy Communities, a 10-year, $10 million effort to measurably improve the health of young people in Camden, New Jersey, by reducing childhood obesity and hunger. The program follows a collective impact framework, focusing on four strategic areas: food access, physical activity and access, nutrition education, and public will. During the first four years of the program, Campbell's Healthy Communities funded 10 organizations to implement strategic programmatic interventions in 10 school- and community-based sites. According to the program's 2014 Annual Report, "the funding also addressed system-wide change targeting environmental and policy changes in our schools, behavioral changes in our children and families, and citywide changes in our food system." In Fiscal Year 2015 alone, Healthy Communities' support helped The Food Trust add seven new stores to the Camden Healthy Corner Store Network; helped the YMCA and Soccer for Success to provide over 100,000 hours of physical activity; and helped a number of organizations provide almost 30,000 hours of nutrition education to Camden children and adults.

Campbell Soup Company and The Food Trust, Campbell Healthy Communities Annual Report Fiscal Year 2014, November 1, 2014, http://thefoodtrust.org/uploads/media_items/campbell-healthy-communities-annual-report-fy-2014-fi nal.original.pdf.

Campbell Soup Company, Campbell Healthy Communities Annual Report Fiscal Year 2015, January 2016, https://www.campbellsoupcompany.com/wp-content/uploads/sites/31/2016/05/2015-Healthy-Communities-Annual-Report.pdf.

WHAT YOU CAN DO

- Live, work, shop, and play in the region's Centers.
- Volunteer to help clean up your street, local park, or open space.
- Support community-building, mixed-use developments when they are proposed in your neighborhood.
- Reduce stormwater runoff and water use by planting native plants, installing rain barrels, and replacing pavement with pervious materials.
- Take advantage of our region's extensive park and trail network by getting exercise and enjoying the outdoors.

ACTIONS TO EXPAND THE ECONOMY

DVRPC SPOTLIGHT

DVRPC administers the **Regional Comprehensive Economic Development Strategy (CEDS).** Called *Investing in People and Places,* it includes an overview of the regional economy; identifies regional strengths, weaknesses, opportunities, and threats; indicates performance measures that are tracked to measure progress made toward achieving the regional goals; and contains a list of key regional economic development projects and activities designed to advance the CEDS goals and objectives. The CEDS is updated annually and is developed under the ongoing guidance of a Review Committee, which includes representatives of state, county, and city planning and economic development agencies; regional economic development organizations; chambers of commerce; academia; and the private sector.

DVRPC's **Regional Street Lighting Procurement Program** pools together municipal buying power to assemble the resources needed to design, procure, and finance the transition to LED street lighting and other outdoor lighting needs. By pooling buying power, municipalities can access energy performance contracting, technical expertise, and financing for their projects without a need for upfront capital or in-house technical expertise.

The Regional Circuit Rider for Energy Efficiency in Local Government Operations (Circuit Rider) serves as a shared energy management resource for smaller municipalities in southeastern Pennsylvania, helping identify and implement cost-effective strategies to reduce energy use in municipal buildings, outdoor lighting, and water/sewage treatment facilities. The Circuit Rider provides municipal governments with a forum to learn about and share energy management best practices, and serves as a one-stop-shop for municipalities to access resources and funding to implement cost-effective energy management projects in their municipal operations. The Circuit Rider has worked directly with municipal governments in southeastern Pennsylvania to provide free technical consulting services to measure, analyze, and develop implementation strategies for cost-effective energy-management practices.

FOCUS ON REGIONAL STAKEHOLDERS

THE PENNOVATION CENTER

The Pennovation Center is an innovation hub, incubator, and laboratory at the University of Pennsylvania that stimulates entrepreneurial activity and promotes the commercialization of research discoveries. The Center's mission is to facilitate the creation and growth of technology-based start-ups by providing them with value-added University of Pennsylvania and local tech community resources. The 58,000-square-foot facility features a shared co-working space operated by Benjamin's Desk and offers multiple community spaces reserved for activities that foster collaboration among faculty, students, entrepreneurs, investors, and corporate and economic development partners.

THE WELCOMING CENTER FOR NEW PENNSYLVANIANS

The Welcoming Center for New Pennsylvanians is a non-profit organization based in Philadelphia that serves the region's immigrant communities. Its mission is to accelerate immigrant integration and economic advancement through education and training, employment, and entrepreneurship. Immigrants of all ages and education levels attend the Center's contextualized English and high school equivalency classes year round. Targeted classes with a focus on job preparedness are also made available so students may obtain the skills needed to thrive in the region's growing economy. The Center's Small Business Department helps immigrant entrepreneurs to start or expand their own businesses by providing free business classes and one-on-one technical assistance. Immigrants are integral to the economic growth of our region and, by providing education, resources, and vocational training, the Welcoming Center helps to cultivate a stronger and more diverse economy.

SELLING TO THE WORLD: THE GREATER PHILADELPHIA EXPORT PLAN

In April 2016, the Economy League of Greater Philadelphia and the World Trade Center of Greater Philadelphia released Selling to the World: The Greater Philadelphia Export Plan, a metro export plan developed by business leaders, state and federal trade officials, and economic development experts from across southeastern Pennsylvania, southern New Jersey, and northern Delaware. Created with support from the Global Cities Initiative, a joint project of the Brookings Institution and JPMorgan Chase, the Plan provides an action-oriented guide to export-led job and revenue growth in Greater Philadelphia. To implement the Plan, the World Trade Center will enhance and leverage its export assistance programs, providing exporters in targeted sectors with counseling, market research, seminars and workshops, and assistance on overseas exhibitions and trade missions.

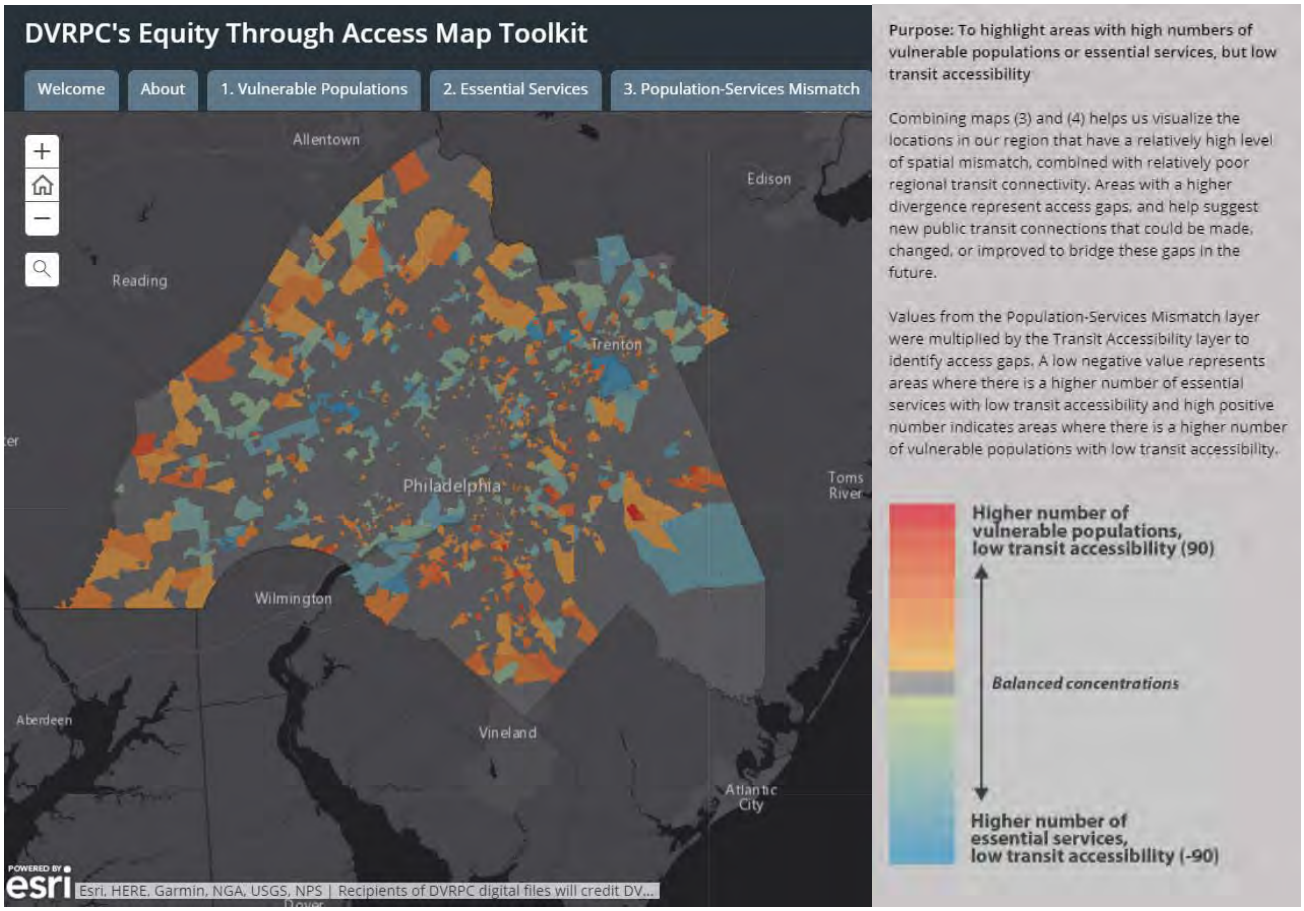
WHAT YOU CAN DO

- Conduct an energy-efficiency audit on your home or business and consider renewable energy sources.
- Integrate sustainable business practices into your company's operation.
- Buy local goods and services from businesses in your community.

ACTIONS TO ADVANCE EQUITY AND PROMOTE DIVERSITY

DVRPC SPOTLIGHT

As part of the **Equity Through Access (ETA)** project, DVRPC created an ETA Priority Score Map Toolkit. This interactive web-based tool demonstrates disparities in access to essential health services like hospitals, health clinics, recreational spaces, senior centers, and more in the Greater Philadelphia region. Users can view layers representing different data sets, including the locations of essential services; bus routes, transit stops, and rail lines; transit walksheds; distributions of vulnerable populations like seniors, households in poverty, and people with disabilities; and areas where transit access is low. By reviewing these simple, color-coded layers, users can explore the relationships between transportation access, opportunity, and equity.



DVRPC Equity Through Access Map Toolkit
Source: http://www.dvrpc.org/ETA/

In February 2017, DVRPC staff led a regional **Paratransit Coordination Workshop** for human service transportation providers from Mercer County and neighboring counties as part of the ongoing ETA project. The workshop was requested by Mercer County, which was concerned that mobility-restricted populations lacked adequate information about their transportation options and that a general lack of communication between local providers was causing service requests to go unfulfilled.

This workshop brought together representatives from human service transportation providers, TMAs, and TNCs to discuss existing mobility issues in the region and develop coordination strategies to help solve them.

Workshop activities included presentations on regional best practice examples of transportation coordination, opportunities for collaboration between human service transportation providers and TNCs, identifying existing service overlaps and potential service transfer points, and a brainstorming session to identify current issues facing service providers and ways to collaborate to meet the existing need. Attendees identified a need for agencies to improve data sharing practices, for human service transportation operators to better coordinate among themselves and with TNCs to redirect customers that they cannot serve, and for agencies and TNCs to collaborate on ways to work through regulatory limitations related to driver and vehicle qualifications.

FOCUS ON REGIONAL STAKEHOLDERS

JOHN C. ANDERSON APARTMENTS—CENTER CITY PHILADELPHIA

The stylish John C. Anderson Apartments debuted in 2014 as the state's first senior housing project specifically catering to the Lesbian, Gay, Bisexual, and Transgender (LBGT) community. Situated in the heart of Center City Philadelphia's well-known Gayborhood, the development features 62 one-bedroom apartments with modern kitchens and open floor plans. Applicants of any sexual orientation are welcome, as long as they qualify under the income and age restrictions. Units are reserved for those who earn between $8,000 and $33,000 annually, equating to 20–60% of area median income. Monthly rents are paid on a sliding scale, ranging from $192 to $786. Named for a former city councilman whose political legacy was cut tragically short due to his sudden AIDS-related death in 1983, the John C. Anderson Apartments provide an affordable option to an aging LGBT cohort. Many from this generation were pioneering activists urging equal rights, although they often suffer from housing discrimination to this day. The Anderson Apartments were among the first of several federally supported LGBT-friendly residences to emerge across the nation after a report from the U.S. Department of Housing and Urban Development brought to light the adverse treatment prevalent within the housing market. Mark Segal, publisher of the Philadelphia Gay News, helped arrange a public-private partnership to develop the property with federal and state grants and low-income housing tax credits. Overwhelming interest in the John C. Anderson Apartments has spilled over onto a 100-person waitlist, suggesting that the model can be scaled up or replicated elsewhere in the region and nationwide.

Sources: https://www.washingtonpost.com/politics/a-philadelphia-apartment-building-may-be-a-national-model-for-low-income-lgbt-seniors/2014/09/12/f64e06bc-352d-11e4-8f02-03c644b2d7d0_story.html?utm_term=.a8c601dca1cd

http://www.philly.com/philly/columnists/inga_saffron/20140117_Changing_Skyline__John_C__Anderson_Apartments__LGBT-friendly_and_urban-friendly.html

THE WELCOMING CENTER FOR NEW PENNSYLVANIANS

The Welcoming Center for New Pennsylvanians was created to provide economic opportunity for newly arrived individuals from around the world. The Welcoming Center believes that attracting and supporting immigrants reinvigorates and enhances the region's economy by providing a steady influx of new customers, workers, and entrepreneurs. Working closely with the many regional stakeholders that have a stake in immigration, the Welcoming Center acts as a centralized employment and referral center for the region's growing immigrant community. Since opening in 2003, the Welcoming Center has worked tirelessly to help new Americans in this region, both through direct services and by raising awareness among the business and political community about the positive impact that immigrants have on the local and regional economy.

ENTREPRENEUR WORKS

Entrepreneur Works, a program partner of the Urban Affairs Coalition, provides business loans of up to $50,000; peer support and mentoring; business skills training; business counseling; credit building; and networking opportunities to low income microentrepreneurs and the self-employed in low- and moderate-income neighborhoods in the Greater Philadelphia metropolitan region. Across the region, Entrepreneur Works clients have opened and expanded small businesses, created jobs for themselves and their neighbors, and strengthened the local economy.

SMART CITIES COUNCIL GRANT – CITY OF PHILADELPHIA

Philadelphia was awarded a Smart Cities Council Readiness Challenge Grant in early 2017 by the Smart Cities Council. The grant recognized Philadelphia's efforts to integrate existing information and communication technologies to improve municipal services, and provided resources to support the City in creating a strategic plan for implementing Smart City technology. Smart Cities use intelligent infrastructure with embedded sensors that are connected to the Internet and capture data. Local governments like Philadelphia use this data to monitor local environments, send information, and even perform actions remotely. In addition to efficiency, Smart Cities increase transparency, partnerships, and citizen engagement. Smart Cities Council Chairman Jesse Berst said "smart cities are cities where everyone works together toward a common vision…" to make "…a meaningful difference in the lives of the city's residents."

Source: beta.phila.gov/press-releases/mayor/philadelphia-awarded-smart-cities-council-readiness-challenge-grant/

WHAT YOU CAN DO

- Attend public meetings to participate in and influence the decision-making process in your community.
- Stay informed on the issues facing your community and the region.
- Support policies, organizations, and programs that voice action and support for equity

ACTIONS TO CREATE AN INTEGRATED, MULTIMODAL TRANSPORTATION NETWORK

DVRPC SPOTLIGHT

The Mobility Alternatives Program (MAP) helps companies improve their benefits package, helps employees save time and money on their commute, and helps reduce traffic and air pollution in the region. MAP has information on transportation alternatives, including transit, carpooling, vanpools, and even working from home, and how companies and individuals can take advantage of them. In addition, there is information on incentives, emergency rides home, flex time, and parking management. DVRPC works with TMA's to provide these services, and also enables companies to use Share-A-Ride, a free, comprehensive, computerized commute match service that can put employees in touch with the most convenient transit options or other commuters going their way.

Ride ECO is a commuter benefit program administered by DVRPC that employers can offer to their employees to help pay for commuting on transit. It encourages transit use and saves employers and commuters money because the program takes advantage of federal legislation that allows tax-free dollars to pay for transit fares.

The Regional Trails Program, administered by DVRPC, with funding from the William Penn Foundation, aims to capitalize upon opportunities for trail development by providing funding for targeted, priority trail design, construction and planning projects that promote a truly connected, regional network of multiuse trails with Philadelphia and Camden as its hub. DVRPC coordinates this program with the region's TIP, TAP, DNCR and other mechanisms to leverage funding. Currently, the region enjoys 775 miles of trail network and expects 320 additional miles to be constructed over the next five years. The program also provides technical assistance to trail developers, counties, municipalities and nonprofit organizations.

FOCUS ON REGIONAL STAKEHOLDERS

PENNDOT CONNECTS

PennDOT Connects recognizes the critical role that transportation plays in connecting communities and supporting economic development. It is a tool to increase collaboration between the DOT and local communities, governments, and agencies as transportation projects are being developed. PennDOT will consider comprehensive plans, trail plans, multimodal plans, resource management studies, bicycle and pedestrian facilities, transit access, stormwater management, utility issues, freight generators, and more. The DOT will use outreach to better understand issues in the area they are working in and ensure that projects will support the community's stated goals. PennDOT Connects will document these efforts to make sure recommendations are considered throughout the scoping and design process. By reaching out more and earlier in the process, and building better partnerships throughout, PennDOT aims to improve decision making that helps to deliver projects that reduce costs, improve economic competitiveness, enhance quality of life, increase safety, and make the commonwealth's transportation network more efficient.

ZLINE

In 2012, the Greater Mercer Transportation Management Association (GMTMA) learned that businesses located in the Matrix Business Park in Robbinsville, New Jersey, were having issues filling available positions. At the time, the Business Park was home to Green Mountain Coffee and several other light industrial businesses. Unemployment rates were still high following the recession, and many local people were in need of jobs. However, the business park was about five miles away from the nearest transit lines. To help resolve this issue, GMTMA developed a partnership with the Chamber of Commerce, the town of Robbinsville, Rise (a social service provider), and Mercer County Community College, among other partners, and obtained a technical assistance grant from the Community Transportation Association of America to address job access issues. In 2013, Amazon announced that it would be moving 2,000 jobs to the Matrix Business Park. Amazon's arrival helped move the project forward by providing the additional funding necessary to launch the shuttle. The aforementioned partnership met with human resource representatives from the 13 participating companies and gathered data, like shift times and policies on mandatory overtime, to ensure that a shuttle could be scheduled at convenient times. They also worked to ensure that the ZLine would be connected to existing transit, and that bus schedules would be coordinated.

The partnership secured New Jersey Job Access Reverse Commute funding, and the ZLine was launched in 2014. The ZLine runs a 4.2-mile route between Hamilton Marketplace and the Matrix Business Park, bridging the gap between four bus lines and the business center, and connecting residents from Trenton, Hightstown, and East Windsor to job opportunities. After its launch, ZLine ridership surveys found that 89 percent of riders reported a household income of less than $35,000 and 37 percent reported less than $15,000. Additionally, 41 percent of riders reported that they would not have been able to make the trip to the Matrix Business Park without the shuttle, and 74 percent reported that they did not have a car to make the trip. In its first year, the ZLine amassed 98,000 total rides.

Transportation Management Associations (TMAs)

The region's Transportation Management Associations (TMAs) are nonprofit, member-based organizations that seek to improve transportation in the region. They serve as an important link with the region's business community and help to promote Transportation Demand Management strategies such as taking transit, car or vanpooling, walking or biking to work, and telecommuting and compressed work hours. There are several TMAs that serve the Greater Philadelphia region, and they each offer a range of programs and services, such as shuttles, ride matching, education, and advocacy.

TMAs in Pennsylvania:

- Bucks County TMA
- Delaware County TMA
- Greater Valley Forge TMA
- TMA of Chester County
- Central Philadelphia TMA
- Partnership TMA

TMAs in New Jersey:

- Cross-County Connection TMA
- Greater Mercer TMA

VISION ZERO

Vision Zero is a transportation planning philosophy that does not accept any death or serious injury as an acceptable price for mobility. It affirms that traffic crashes are not accidents; they are preventable incidents that can be systematically eliminated. It aims to protect all roadway users through equitable engineering, education, and enforcement methods, and prioritizes speed control to lessen crash severity. Implementing Vision Zero requires collaboration and partnerships inside local government with police, firefighters, educators, and transportation agencies; and outside it with community groups and others. Transportation projects can include traffic calming, lower speed limits, intersection improvements, road diets, and other appropriate safety measures.

In November 2016, Philadelphia Mayor James F. Kenney signed an executive order to create a Vision Zero Task Force. The Task Force's efforts will build on the city's traffic safety actions, with an ultimate goal of reducing all traffic-related fatalities and serious injuries to zero by 2030. Philadelphia joins Pennsylvania and New Jersey in adopting this philosophy, as both have incorporated Toward Zero Deaths in the recent Strategic Highway Safety Plan updates. DVRPC's Regional Safety Task Force is incorporating Vision Zero into its mission statement, and Connections 2045 provides some initial funding for Vision Zero that can be drawn from as individual projects advance.

WHAT YOU CAN DO

- Take transit, walk, or bike to work and for trips shorter than two miles.
- Carpool, or link automobile trips together, and travel during off-peak times.
- Use green driving techniques: avoid rapid acceleration and unnecessary braking, keep tires properly inflated, remove excess weight from your vehicle, maintain steady speeds, use cruise control and the highest gear, keep your engine tuned and follow the manufacturer's recommend maintenance schedule, and don't let your car idle for more than 30 seconds.
- Buy local, and consider the shipping impacts of online purchases, where faster delivery can often mean greater carbon emissions.
- Use real-time information, multimodal travel apps, virtual ticketing, and EZ Pass to make your trip more efficient. However, do not use your cellphone while driving.
- Purchase the least-polluting vehicle you can afford. If buying an electric vehicle is not an option, consider a hybrid or a model with high fuel economy.
- Keep a travel diary and use it to examine your travel behavior.
- Facilitate walking or biking "school buses" in your neighborhood to help children learn how to safely get around on these modes.
- Keep your sidewalks clean and in good repair.

MOVING FORWARD

The rapid acceleration of technology over the next several decades creates opportunities and challenges to implementing the Plan. It will be vital to keep in mind the appropriate role of technology. It should not dictate how we design and develop our built environment. Rather, it should be a tool we leverage to build more people-centric communities. More attention will also need to be paid to how we design markets, and to community design practices.

Connections 2045 was developed with input from a broad array of regional stakeholders and the general public and is intended to provide a path forward toward a more sustainable future. Likewise, its implementation will also rely on a large cast of governmental entities; federal, state, and local agencies; nonprofit groups; and citizens. DVRPC will continue to work with regional stakeholders and the public to make the vision of the Plan a reality.

As the region implements Connections 2045, it will be important to determine whether the goals contained in the Plan are being met. DVRPC will continue to compile a meaningful time-series data set that will help us assess how well we are doing. This, in turn, will help us prioritize attention where it is most effective and will inform future DVRPC activities, including subsequent long-range planning efforts.

Implementing the Plan depends on making everyday decisions to support the vision. Your help is needed to fully implement Connections 2045. Join us in shaping the future of our region by participating in public meetings, reviewing our website and publications, or submitting comments on our plans and programs.

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Connections 2045

Plan for Greater Philadelphia

Publication Number: 17039A

Date Published: September 2017

Geographic Area Covered:
The nine-county DVRPC region, which covers the counties of Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania, and Burlington, Camden, Gloucester, and Mercer counties in New Jersey.

Key Words:

Long-Range Plan, Greater Philadelphia, regional policy, core planning principles, sustainability, equity, innovation, financial plan, transportation needs, trends, forecasts, vision, future, funding gap, funding options, multimodal, growth management, livable communities, economy, land use, centers, technology, major regional projects, MPO, implementation, natural resource protection, open space preservation, transportation

Abstract:
Connections 2045 Plan for Greater Philadelphia is the Long-Range Plan for the Greater Philadelphia region. It assesses regional trends and forecasts and sets forth a vision for the future. The Plan is organized around five core principle to achieve the vision: Sustain the Environment; Develop Livable Communities; Expand the Economy; Advance Equity and Foster Diversity; and Create an Integrated, Multimodal Transportation Network. The Plan includes goals and strategies under each of the five core principles. It also identifies a set of investments in the region's transportation system that are needed to preserve and maintain the existing system, as well as other critical improvements that make the system operate more efficiently and expand capacity. Due to declining funding revenues, only a portion of these investments can be afforded. The Plan prioritizes investments, based on quantitative analysis, and presents an overview of alternatives to address the funding shortfall.

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