See back cover for **more info** about the Plan's **public comment period**

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

DRAFT FOR PUBLIC COMMENT
JULY 2021

PLAN FOR GREATER PHILADELPHIA
PROCESS AND ANALYSIS MANUAL

Connections 2050

The Delaware Valley Regional Planning Commission is the federally designated Metropolitan Planning Organization for the Greater Philadelphia region, established by an Interstate Compact between the Commonwealth of Pennsylvania and the State of New Jersey. Members include Bucks, Chester, Delaware, Montgomery, and Philadelphia counties, plus the City of Chester, in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties, plus the cities of Camden and Trenton, in New Jersey.

DVRPC serves strictly as an advisory agency. Any planning or design concepts as prepared by DVRPC are conceptual and may require engineering design and feasibility analysis. Actual authority for carrying out any planning proposals rest solely with the governing bodies of the states, local governments or authorities that have the primary responsibility to own, manage or maintain any transportation facility.

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

DVRPC's vision for the Greater Philadelphia Region is a prosperous, innovative, equitable, resilient, and sustainable region that increases mobility choices by investing in a safe and modern transportation system; that protects and preserves our natural resources while creating healthy communities; and that fosters greater opportunities for all.

DVRPC's mission is to achieve this vision by convening the widest array of partners to inform and facilitate data-driven decision-making. We are engaged across the region, and strive to be leaders and innovators, exploring new ideas and creating best practices.

DVRPC is funded through 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.

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Executive Summary

The Connections 2050 Process and Analysis Manual serves as the technical documentation of the *Connections 2050 Plan for Greater Philadelphia*. It's a companion document to the primary plan report, the *Connections 2050 Policy Manual,* which highlights the Plan's vision, principles, goals, and key policies and strategies to achieve the vision. The *Process and Analysis Manual* provides the basis for those policies and records how the plan was development and how it responds to Federal planning requirements, including consideration of key planning factors and transportation performance management.

The Introduction reviews how the Plan was developed through the use of scenario planning to better understand trends and forces shaping the region, public outreach to develop a broadly shared vision and goals for regional development and recommend strategies to achieve the vision, and then by deciding how limited funds will be invested in transportation infrastructure. This section also highlights the need to plan at the megaregional level, beyond DVRPC's planning region, notes how the Plan incorporates the Federal Highway Administration's ten planning factors, and considers how the planning field can overcome its historic inequities.

DVRPC worked with the Socioeconomic and Land Use Analytics Committee (SLUAC), made of staff from DVRPC's county planning partners and a newly developed UrbanSim land use model to build a regional development pipeline of permitted and plan real estate projects. SLUAC analyzed regional demographic and economic trends to forecast the region's population to grow by 8.8 percent from 2015 to 2050 and number of jobs in the region to grow by 15.4 percent over the same period. About half of this growth accounts for jobs lost during the Covid-19 pandemic recession. The Demographic section also documents how DVRPC's Indicators of Potential Disadvantage (IPD) analysis is used throughout the Commission's program areas to demonstrate compliance with Title VI of the Civil Rights Act and fair treatment of population groups identified through environmental justice (EJ).

The Economy section considers how the Digital Revolution is driving change, and reviews the important roles of broadband access in job creation and economic growth in a digital world. This section also considers the economic importance of expanding access to opportunity, particularly through education, quality of life amenities, and better connections to the national and global economy. It also considers how the COVID-19 pandemic highlights the need to build more resiliency into the region's economy.

The Environment and Land Use section assesses the region's environmental resources, including open space—where Greater Philadelphia is a national leader in land preservation—water quality, and local agriculture. It updates the region's longstanding Land Use Vision for areas appropriate for future growth and development—Plan enters, Infill and Redevelopment where there is already development, and emerging growth areas—along with areas appropriate for additional land preservation—rural resource lands, and the Greenspace Network. The overall goal is to create a clean and sustainable environment, where key natural resource areas and agricultural lands are protected, linear open space corridors interconnect to form a seamless greenspace network. This smart growth development pattern will support the growth of dense, walkable communities within more than 125 Plan Centers. Centers are neighborhoods, districts, or downtowns that serve as focal points in the regional landscape that serve as a basis for organizing and focusing the development landscape and provide a framework for the most efficient provision of water, sewer, and transportation infrastructure. Focusing growth in Centers can also support other Plan goals, such as creating more affordable housing and protecting historic resources and landscapes.

The Energy and Climate change section reviews data from DVRPC's five-year greenhouse gas inventories and ways to both reduce regional emission and adapt to a changing climate. The Plan also establishes a goal to increase the installed capacity of solar PV to 8 GW by 2050 in the New Jersey subregion and 4.3 GW by 2030 in the Pennsylvania subregion.

The Transportation section examines how the Plan can achieve a Vision Zero goal of no transportation-related fatalities or serious injuries by 2050. Critical to this is providing for the safe opportunity to travel on foot, by bicycle, and using transit. This section documents the region's asset management needs in order to maintain and modernize existing transportation infrastructure, along with the use of the federally mandated Congestion Management Process (CMP) and transportation system management and operations (TSMO) better utilizing existing facilities and enhancing their safety. It outlines DVRPC's role in transportation emergency preparedness planning. And last, it analyzes emerging transportation technologies, which could drastically change:

- Vehicle and infrastructure construction through 3-D printing and nanotechnology.
- Vehicle power and operations through electric vehicles, connected vehicles, automated vehicles, and unmanned aerial systems.
- Integrate different modes and infrastructure through 5G, Artificial Intelligence, the Internet of Things, real-time info, and shared mobility.

The *Process and Analysis Manual* contains the detailed version of the financial plan, including a complete list of all projects in the fiscally constrained (funded) plan and the aspirational (unfunded) plan. The financial plan estimated the region can reasonably anticipate $67.3 in revenue to fund transportation infrastructure from fiscal (FY) 2022 to FY 2050. However, over that same period the vision plan for transportation infrastructure—which aims to maintain, modernize, and make existing infrastructure safer, while expanding and better integrating multimodal travel options—would cost about $152 billion to fully implement. Given these severe funding constraints, the Plan aims to maximize investments through a performance-based planning approach to transportation infrastructure investments, including the use of DVRPC's TIP-LRP Project Benefit Criteria. The Plan also uses federal Transportation Performance Management measures to inform funding decisions (see Appendix B). In addition, the Plan looks at potential for increased revenues at the federal, state, and local levels (see appendix A).

Appendix C outlines when and how the Plan could be amended in the future. Appendix D has a list of acronyms used throughout this document.

Introduction

The *Connections 2050* Plan for Greater Philadelphia (*Connections 2050,* Long-Range Plan, or "the Plan") outlines a long-range vision and goals, identifying strategies for the future growth of the Greater Philadelphia region. The Plan is documented in two companion reports. The *Policy Manual* outlines the vision, goals, and strategies established for the region. This document—the *Process Manual*—provides the basis for those policies, namely extensive public and stakeholder outreach, and thorough review and analysis of trends, forecasts, and forces affecting the region. It aims to better connect the Long-Range Plan with implementation efforts in the Commission's annual work program and indicates some future work program ideas that would support the Plan's vision and goals. It contains the detailed version of the financial plan, including a complete list of all projects in the fiscally constrained (funded) plan and the aspirational (unfunded) plan. Both components of *Connections 2050* will be presented to the DVRPC Board for adoption on September 23, 2021, and serve as an update of the previous Long-Range Plan, *Connections 2045*.

DVRPC

The Delaware Valley Regional Planning Commission (DVRPC) is the federally designated Metropolitan Planning Organization (MPO) for the nine-county Greater Philadelphia region, tasked with developing a long-range transportation plan to ensure the orderly growth and development of the region in concert with multiple planning partners. DVRPC serves Bucks, Chester, Delaware, Montgomery, and Philadelphia counties in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer counties in New Jersey (See Figure 1).

DVRPC is governed by an 18-member board, composed of state, county, and city representatives from its member governments, as well as various participating, non-voting members and federal agency observers.

Figure 1: DVRPC NINE-COUNTY REGION

Source: DVRPC, 2021.

Long-Range Planning Process

DVRPC is required by the U.S. Department of Transportation (U.S. DOT), in accordance with federal planning regulations,[1] to develop a plan for a minimum 20-year horizon. Federal planning regulations also require that the Long-Range Plan be updated every four years in order

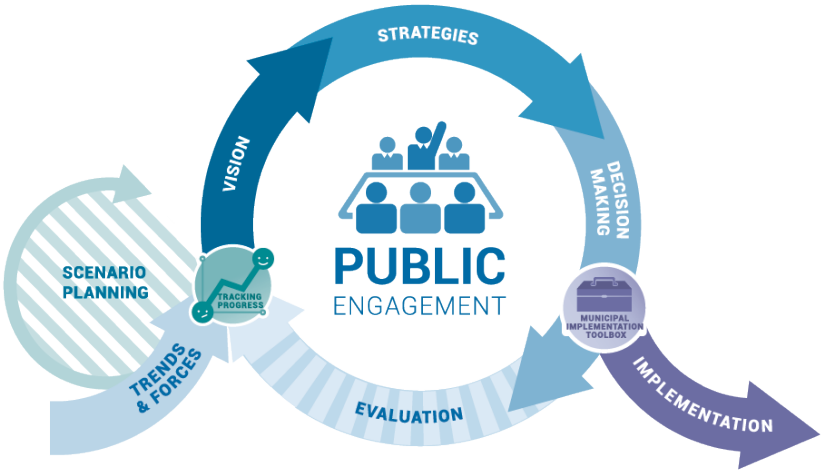
[1] 23 U.S. Code § 134 - Metropolitan transportation planning. See also: https://www.law.cornell.edu/cfr/text/23/450.324

to reflect and respond to the most recent trends and needs of the region. Per these requirements, the Plan outlines how the region intends to invest in the transportation network.

Connections 2050 was created through an integrated planning process. There are five key steps in the Long-Range Plan's development (See Figure 2):

1. Analyze external trends and forces shaping the region.
2. Identify alternate scenarios of extreme, but plausible, futures for the region.
3. Develop a broadly shared vision and goals for regional development.
4. Recommend strategies to achieve the vision.
5. Decide how limited funds will be invested in transportation infrastructure.

Figure 2: DVRPC LONG-RANGE PLANNING PROCESS



Source: DVRPC, 2021.

The Plan serves as a blueprint for prioritizing funding for capital transportation investment in 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, equity, and quality of life issues, and offers comprehensive policy guidance for the region and the work of DVRPC.

Implementation is an ongoing effort that is carried out through DVRPC's annual work program and by building coalitions with planning partners and stakeholder agencies to bring the vision to fruition.

DVRPC evaluates the process used to develop the Plan and its effectiveness in shaping regional decision making by surveying planning partners and local representatives. Regional indicators in the online *Tracking Progress* platform serve as a linkage between different iterations of the Plan and measure how well the region is performing in achieving the Plan's goals. Stakeholder and public input throughout the planning process are paramount to developing a plan that can be implemented down to the local level to ensure regional performance targets are achieved.

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. These committees include:

- Public Participation Task Force (PPTF);
- Regional Technical Committee (RTC);
- Delaware Valley Goods Movement Task Force (DVGMTF);
- Regional Aviation Committee;
- Transportation Operations Task Force (TOTF);
- Central Jersey Transportation Forum (CJTF);

- Climate Adaptation Forum;
- Regional Community and Economic Development Forum;
- Regional Safety Task Force (RSTF);
- Information Resources Exchange Group;
- Air Quality Partnership (AQP);
- Greater Philadelphia Futures Group; and
- Healthy Communities Task Force.

DVRPC also collaborated with regional planning partners, business and economic development groups, 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 services agencies, environmental organizations, and other interested parties, the PPTF has been involved throughout the development of the Plan.

Although DVRPC engages with thousands of people in any given year, many are subject matter experts and local government officials. DVRPC carried out a number of different types of outreach activities to gather input from the general public at every step in the planning process. DVRPC executed a significant and sophisticated social media campaign, using paid placements and organic posts on several of the Commission's social media channels, as well as modest incentives to encourage participation. A short video was produced to communicate the importance of a regional long-range plan, which can be viewed on the Plan's webpage at www.dvrpc.org/2050.

The purpose of these outreach activities was to give people who live and work throughout the Greater Philadelphia region an opportunity to share their lived experiences, concerns, and vision for the region's future. Several outreach techniques were employed to the general public to provide input as to how they would like to see the region grow and prosper. In the spring and summer of 2020, Greater Philadelphians from across the region shared their values, concerns, and goals for the future.

- Over 150 people attended a total of five online visioning workshops. These 60-minute workshops provided an in-depth explanation of the Long-Range Plan and offered thought-provoking exercises on different planning topics.
- Twelve organizations hosted a virtual Community Conversation—a similar exercise facilitated for a more targeted audience. Two additional youth-focused community conversations were hosted by regional high schools.
- More than 600 people completed an online survey that was available in English and Spanish. Hard copies were mailed out upon request.

By attending a workshop or taking the survey, individuals were entered into a giveaway to win a $50 gift card to support a local restaurant of their choice. DVRPC gave away 20 gift cards in June and July 2020. DVRPC heard from over 700 unique voices during this visioning process. Staff then analyzed all the comments received and used them to develop a broadly shared vision for Greater Philadelphia as the key framework for *Connections 2050*.

While the survey and in-person workshops asked the same questions around values, concerns, and a vision for the future, their results weren't readily comparable. This is because the in-person comments were open ended, while the survey was multiple choice. In addition, more people took the survey, so its results would overwhelm the very rich open-ended comments. DVRPC staff coded 384 open ended values, 415 open ended concerns, and nearly 1,400 open-ended vision statements to group similar comments together and identify the most frequent responses. Open-ended survey comments were included as

part of this analysis. Staff then looked at the 10 most frequently heard themes for each of the values, concerns, and visions and compared them with the top 10 survey responses for the same question. Table 1 identifies the top combined open-ended vision statements and vision choices from the survey. The table then shows how each of these was incorporated into the 2050 Plan. Eight of the top 10 were in both the survey and workshop responses.

Table 1: Top Public Outreach Vision Comments from Workshops and Survey

Total Rank	Survey Rank	Workshop Rank	Vision Comment Category	Incorporation in the Plan
1	2	1	Modernize and expand regional public transit service and networks, expand walking and biking infrastructure	Transportation Focus Area
2	1	3	Design, redevelop, build affordable, livable communities where it is safe and easy to walk, bike, and take transit for most daily activities	Communities Focus Area
3	6	2	Equity / Address income disparities	Equity Principle
4	3	6	Grow the regional economy by rebuilding small businesses post-COVID-19, attracting more high-paying jobs, increasing workforce skills, and improving connections to the global economy	Economy Focus Area
5	7	4	Sustainability / Combat climate change	Sustainability and Resilience Principles
6	5	8	Improve education for everyone	Economy Focus Area
7	8	7	Natural Environment / Protect open space and provide more parks	Environment Focus Area
8	10	5	Promote civic dialogue through citizen engagement, local solutions, bipartisanship, regional cooperation	Equity Principle, Communities Focus Area
9	4	N/A	Invest in green technology, clean energy, and recycling / material reuse; and expand the sharing economy	Environment and Economy Focus Areas
10	9	N/A	Rebuild public infrastructure	Transportation Focus Area
11	N/A	9	Basic needs, social services, & health care	Equity Principle
12	N/A	10	Accessibility	Transportation Focus Area

Total Rank determined by adding reverse scores for the survey rank and workshop rank, meaning the top response scored 10 points, the second 9 points, and so on.
Source: DVRPC, 2021.

DVRPC staff categorized more than 1,000 recommendations from the strategy workshops. The top themes were the basis for the 15 key strategies listed in the Policy Manual, and were additionally used as more specific checklist strategies included with most of the key strategies.

Connections 2050

The Plan is developed around the three core plan principles of equity, sustainability, and resiliency, which are applied to four focus areas: environment, communities, economy, and multimodal transportation.

The *Connections 2050* Vision is:

An equitable, resilient, and sustainable Greater Philadelphia region that:

- preserves and protects the natural **environment**;
- develops inclusive, healthy, and walkable **communities**;
- grows a prosperous and innovative **economy** with broadly shared prosperity; and
- maintains an integrated, safe, multimodal **transportation** network that serves everyone and expands access to opportunity.

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 measure progress. It identifies 15 high-level strategies the region will need to pursue in order to achieve the vision. These strategies are listed in the *Policy Manual*. It will take the coordinated efforts of governments at all levels, private and non-profit organizations, and individuals working in concert with each other to make the vision a reality.

Plan Consistency

DVRPC strives to ensure that its long-range planning process and Plan are consistent with, and complementary to, the goals and policies outlined in the plans and programs of member municipal and county governments, as well as the statewide transportation plans of the Pennsylvania and New Jersey departments of transportation (DOTs). Table 2 includes a list of plans and policies with which *Connections 2050* is consistent

Table 2: PLANS AND POLICIES FOR *CONNECTIONS 2050* CONSISTENCY

Organization	Plan Type	Plan Title	Year Adopted
Bucks County	Comprehensive Plan	Bucks County Comprehensive Plan 2011	2011
Chester County	Comprehensive Plan	Landscapes 3	2018
Delaware County	Comprehensive Plan	Delaware County 2035	2017
Montgomery County	Comprehensive Plan	Montco 2040: A Shared Vision	2015
City of Philadelphia	Comprehensive Plan	Phila 2035	2013
Burlington County	Highway Master Plan	Burlington County Highway Master Plan	2019
Camden County	Comprehensive Plan	Camden County Master Plan	2014

Organization	Plan Type	Plan Title	Year Adopted
Gloucester County	County Master Plan	gc2040	2015
Mercer County	Master Plan	Mercer County Master Plan	2010
PennDOT	Long-Range Transportation Plan	PA on Track	2016
PennDOT	Transportation Asset Management Plan (TAMP)	PA State Transportation Asset Management Plan 2019	2019
PennDOT	State Transportation Improvement Program (STIP)	PA State Transportation Improvement Program (STIP)	2021
NJDOT	Statewide Long-Range Transportation Plan	Transportation Choices 2030	2008
NJDOT	TAMP	New Jersey Transportation Asset Management Plan	2019
NJDOT	STIP	NJ Statewide Transportation Improvement Program FY 2022 - 2031	2021
DRPA-PATCO	Capital Program	FY 2020–2029 DRPA-PATCO Projects	2021
New Jersey Office of Planning Advocacy	New Jersey State Plan	New Jersey State Development and Redevelopment Plan	2001
SEPTA	Infrastructure Program	SEPTA Forward	2021
SEPTA	Capital Program	FY 2022 Capital Budget and FY 2022–2033 Capital Program	2021
NJ TRANSIT	Strategic Plan	NJT 2030	2020
NJ TRANSIT	Capital Program	NJ TRANSIT: Capital Plan	2020

Source: DVRPC, 2021.

Megaregional Planning

There are many planning issues that extend beyond an MPO's boundary, such as transportation network expansion projects, sprawling development patterns, commutes, congestion, climate change, air and water 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 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 (NJDOT) 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), CJTF, and many more informal channels.

Planning Factors

Federal regulations require long-range plans to be developed through a Comprehensive, Cooperative, Continuing, Coordinated, and Compatible process. Regulations further stipulate the long-range plan provide for consideration and implementation of projects, strategies, and services addressing 10 planning factors. Table 3 indicates what each of these planning factors is and summarizes how DVRPC has considered each in the development of *Connections 2050*.

The most recent federal transportation authorizations mandate that states and MPOs incorporate performance measures; set targets; and monitor progress of their long-range plans in the areas of safety, infrastructure preservation, congestion reduction, system reliability, freight movement and economic vitality, environmental sustainability, and reduced project delivery delays. These performance measures are detailed in Appendix B. DVRPC will continue to work with federal, state, and local planning partners on implementing the performance measures planning targets within the framework of the Plan.

Table 3: DVRPC CONSIDERATION OF FEDERAL HIGHWAY ADMINISTRATION (FHWA) PLANNING FACTORS

FHWA Planning Factor	*Connections 2050* Consideration
(1) Support the economic vitality of the metropolitan area, especially by enabling global competitiveness, productivity, and efficiency.	The Plan's vision has a focus area on growing an innovative economy with broadly shared prosperity. The Plan sets an economic goal of improving connections to the global economy and identifies strategies to bolster connections to the global economy and access to communications technologies.
(2) Increase the safety of the transportation system for motorized and non-motorized users.	The Plan sets a Vision Zero transportation goal of no traffic fatalities or serious injuries by 2050, and identifies a range of strategies to safely accommodate walking, biking, transit, and transportation network users of all abilities. The TIP-LRP Benefit Criteria[2] scores projects higher if they implement FHWA-proven safety countermeasures or other safety strategies with specific crash reduction factors, addressing DOT-identified high-crash locations and crashes in Communities of Concern[3]; or implement safety-critical transit projects that help meet safety performance measures identified by a Public Transportation Agency Safety Plan (PTASP).

[2] Project selection for the Transportation Improvement Program (TIP) and Long-Range Plan (LRP) is guided by a universal, multimodal performance-based evaluation process. The DVRPC TIP-LRP Benefit Evaluation Criteria (TIP-LRP Benefit Criteria) is a data-informed support tool that highlights trade-offs that could occur as a result of a given investment or set of investments, analyzes how new candidate projects align with the vision and goals of the Plan, and considers how each project supports the FHWA and FTA Transportation Performance Management process.

[3] Communities with higher rates of potentially disadvantaged populations. See DVPRC. *Crashes and Communities of Concern in the Greater Philadelphia Region*. 2018. https://www.dvrpc.org/Products/18022

FHWA Planning Factor	*Connections 2050* Consideration
(3) Increase the security of the transportation system for motorized and non-motorized users.	The Plan sets a transportation goal of promoting security and cybersecurity, and identifies strategies to maintain existing transportation infrastructure and facilitate the equitable deployment of new modes and technologies.
(4) Increase accessibility and mobility of people and freight.	The Plan's vision has a focus area on developing inclusive, healthy, and walkable communities. The Plan sets an economic goal to improve global connections—facilitate goods movement and aviation; support the Federal Railroad Administration's (FRA's) Northeast Corridor (NEC) Future plan; and expand broadband, wi-fi, and fifth-generation wireless network (5G) cellular infrastructure—and transportation goals to integrate existing and emerging transportation modes into an accessible, multimodal mobility-as-a-service (MaaS) network, which collects real-time data, and uses it to plan and pay for travel using the best option available and to increase mobility and reliability while reducing congestion and vehicle miles traveled (VMT). The Plan identifies a range of economic strategies to bolster connections to the global economy and access to communications technologies and transportation strategies to maintain existing transportation infrastructure and facilitate the equitable deployment of new modes and technologies.
(5) 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.	The Plan's vision has sustainability as a principle and a focus area on preserving and protecting the natural environment. It promotes strategies to reduce greenhouse gas (GHG) emissions[4] and improve air quality, expand nature in the built environment, improve water quality, and adapt to climate change.
(6) Enhance the integration and connectivity of the transportation system, across and between modes, for people and freight.	The Plan's vision has a focus area on maintaining a safe, multimodal transportation network that serves everyone and expands access to opportunity. The Plan identifies a range of strategies to provide real-time travel information across modes, ensure interoperable communications technologies across public safety agencies, and coordinate across levels of government on resiliency, security, and cybersecurity.
(7) Promote efficient system management and operation.	The Plan identifies a range of strategies to apply integrated corridor management (ICM) techniques, implement integrated traffic signal and transit management systems, and utilize traffic incident management.

[4] *Connections 2050* establishes a goal of reducing greenhouse gas emissions to net zero by the year 2050 and preparing communities for the impacts of climate change (see Policy Manual).

FHWA Planning Factor	*Connections 2050* Consideration
(8) Emphasize the preservation of the existing transportation system.	The Plan sets a transportation goal to rebuild and modernize the region's transportation assets to achieve and maintain a state-of-good repair (SGR), including full Americans with Disabilities Act (ADA) accessibility. The TIP-LRP Benefit Criteria score projects if they bring an existing transportation facility or asset into an SGR, extend the useful life of a facility or asset, or reduce operating and maintenance costs.
(9) Improve the resiliency and reliability of the transportation system and reduce or mitigate stormwater impacts of surface transportation.	Resiliency is a Plan principle. In addition, the Plan sets a transportation goal to increase mobility and reliability while reducing congestion and VMT. It identifies a range of strategies to mitigate stormwater runoff by expanding nature in the built environment, improving water quality, and adapting to a changing climate.
(10) Enhance travel and tourism.	The Plan identifies tourism as a key economic sector. The TIP-LRP Benefit Criteria scores projects based on location near a major tourist attraction.

Source : DVRPC, 2021.

Planning History and Inequities

The history of the United States has been shaped in part by the legacy of slavery, racism, and discrimination. Past planning practice has, both purposely and inadvertently, supported this legacy through racial and ethnic segregation, race-based and racist zoning, postwar urban renewal, redlining, construction of federally funded highway infrastructure in predominantly in Black and Brown communities, housing discrimination, racially restrictive land use covenants, and government-sanctioned white flight.

Although the reverberations of these past practices still impact communities of color in the United States, many in the planning field are now working to support equity, diversity, and access with restorative justice and transformative justice policies, such as Title VI of the Civil Rights Act, Environmental Justice (EJ), participatory planning practices, community engagement, needs-based community assessments, community partnership, citizen power, government transparency, translation services, and cultural competency. The American Planning Association report *Planning with Diverse Communities* identified five major elements that can increase a person or community's quality of life. Each of these elements, listed below, correlates with the history of racism in planning and aims to work toward greater social, economic, and environmental benefit for everyone:

1. Expand economic opportunity.
2. Activate mobility and diversifying mode choice.
3. Support housing options and housing affordability.
4. Advance health and safety.
5. Enhance culturally inclusive placemaking.

The report suggests approaches and tools to achieve more equitable outcomes and to address inequalities facing people of color. It details the responsibilities and roles of planners in working toward a healthier future for all.

Although the status quo supports structural inequalities that can dilute the impact of equity-focused and justice-oriented planning, the field

has a unique ability to guide investment, provide accessible opportunities, convene government agencies, and change perspectives. The promotion and implementation of equitable planning actions can disrupt segregation, disinvestment, isolation, and disenfranchisement. DVRPC seeks to be an active and evolving participant and leader in the region's inclusive, vibrant, and equitable future.

Demographics and Economy

DVRPC develops tools and conducts in-depth socioeconomic analysis to better understand current conditions of the region. These efforts also help to speculate what current behavioral trends last and what may change in the future, and then develop policy recommendations to steer the region toward the vision for *Connections 2050*. The following section highlights key areas and tools used for agency socioeconomic analysis and gives recommendations for improving conditions that support the Plan's three principles of Equity, Resiliency, and Sustainability.

Population and Employment Forecasts

Detailed results and description of forecasting methodologies can be found in the DVRPC publication *Population and Employment Forecasts 2015–2050* (ADR21014); however, the following provides a high-level look at the forecasting process, methodologies, and results.

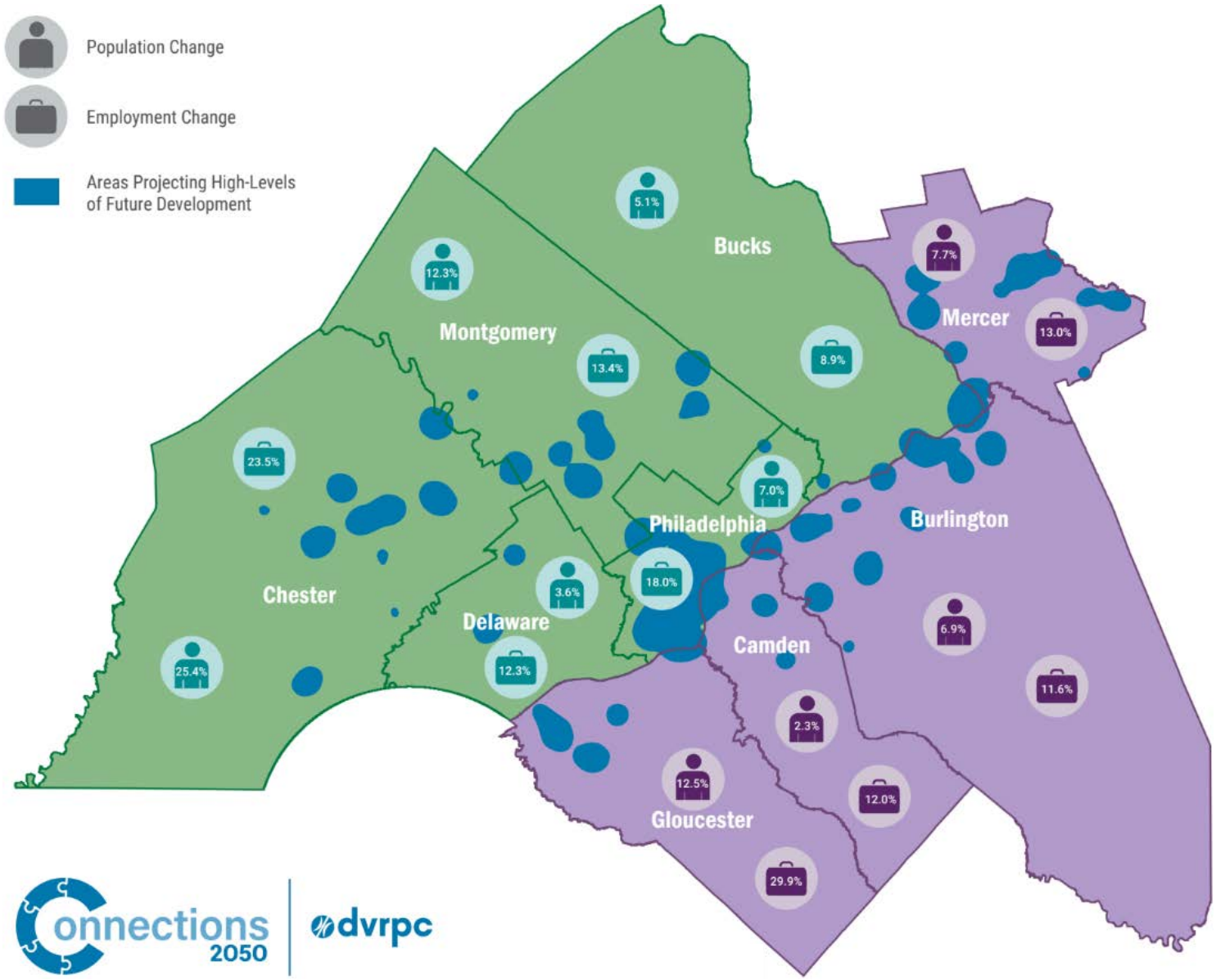
Forecasting Process and Methods

The forecast effort for *Connections 2050* commenced a number of updates to DVRPC's processes and methodologies. A key part of the process update was the formation of the Socioeconomic and Land Use Analytics Committee (SLUAC), a group of county representatives from around the region who serve demographic and economic analysis roles and convened to discuss, review, and advise on a number of related DVRPC initiatives. This team's first project was a collaboration to aid in the assembly and review of forecast input data, as well as providing feedback on the results of a new land use model, UrbanSim, for forecasting and other analyses.

The UrbanSim model offers predictive capabilities and new ways to foster a collaborative forecasting process with regional planning partners. Within its web Geographic Information System (GIS) display, SLUAC members can access, review, and comment on data used in the model, as well as model results shared by DVRPC staff. UrbanSim simulates residential and non-residential models simultaneously, with some interplay between the two.

Another process improvement has been the creation of a regionwide real estate development pipeline. This was developed using recently built and proposed buildings from DVRPC's CoStar commercial real estate development subscription, parcel and permitting data from various counties, articles on proposed development in local publications, and insights and records our county planning partners provided on the scale and time of development projects planned throughout the region. Based on these data-gathering efforts, more than half the population growth, and a significant share of the employment growth, is from known growth from recently completed projects, projects undergoing development review in our municipalities, or interpretations of significant master plans around the region. Figure 3 shows areas with high levels of future development in the development pipeline for 2020-2050 along with 2020-2050 forecasted percentage change by county for population and employment.

Figure 3: FORECASTED POPULATION AND EMPLOYMENT CHANGE WITH HIGH INTENSITY DEVELOPMENT AREAS 2020-2050



Source: DVRPC, 2021.

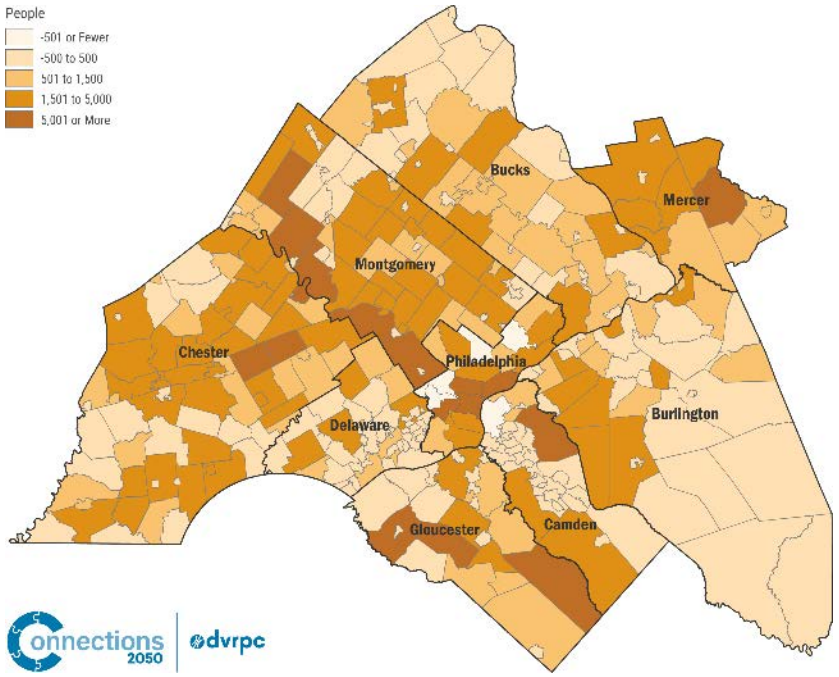
Recent Trends, Pandemic Implications, and Future Outlook

One of the key areas of discussion with the SLUAC was prepandemic trends for population and employment. Population growth in the latter half of the previous decade did not match the pace of forecasts outlined in *Connections 2045*. An aging population with increasing deaths and slower birth rate, as well as significant declines in international migration, did less to counteract the usual net negative impact of domestic migration.

The pandemic has exacerbated trends for deaths and births, so much that deaths will exceed births in the region a few years earlier than prepandemic forecasts. Immigration, already down from the policies of the Trump administration, slowed to a near halt due to the virus's spread. These population factors will undoubtedly see some rebound in the near term as vaccinations increase and Coronavirus Disease 2019 (COVID-19) cases wane, but postpandemic behaviors will need to change course significantly to see growth like the region experienced decades ago. Fortunately, there are signs of a slowing negative domestic migration change, and some believe the region stands to gain from more expensive markets and those experiencing more acute effects of climate change.

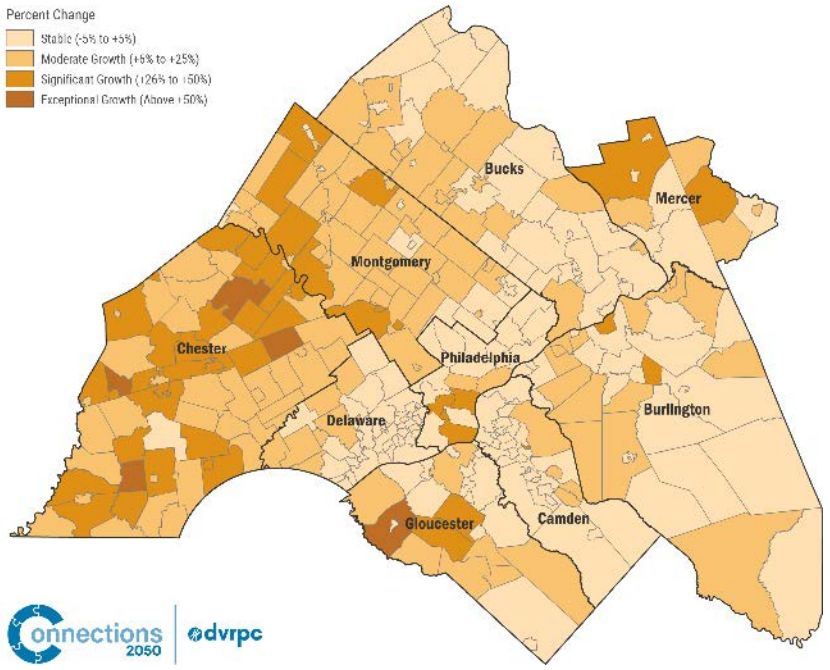
The forecast estimates an 8.8 percent increase in population from 2015 to 2050, down from the prior forecast of 11.5 percent growth from 2015 to 2045 (see Table 4). Regional population is estimated to reach six million by 2035 and 6.2 million by 2050. Figures 4–6 show three different views of the 2050 population forecast. Figure 4 shows absolute change from 2015 to 2050, Figure 5 shows percentage change for the same period, and Figure 6 shows total forecasted population for 2050.

Figure 4: ABSOLUTE CHANGE IN POPULATION (2015–2050)



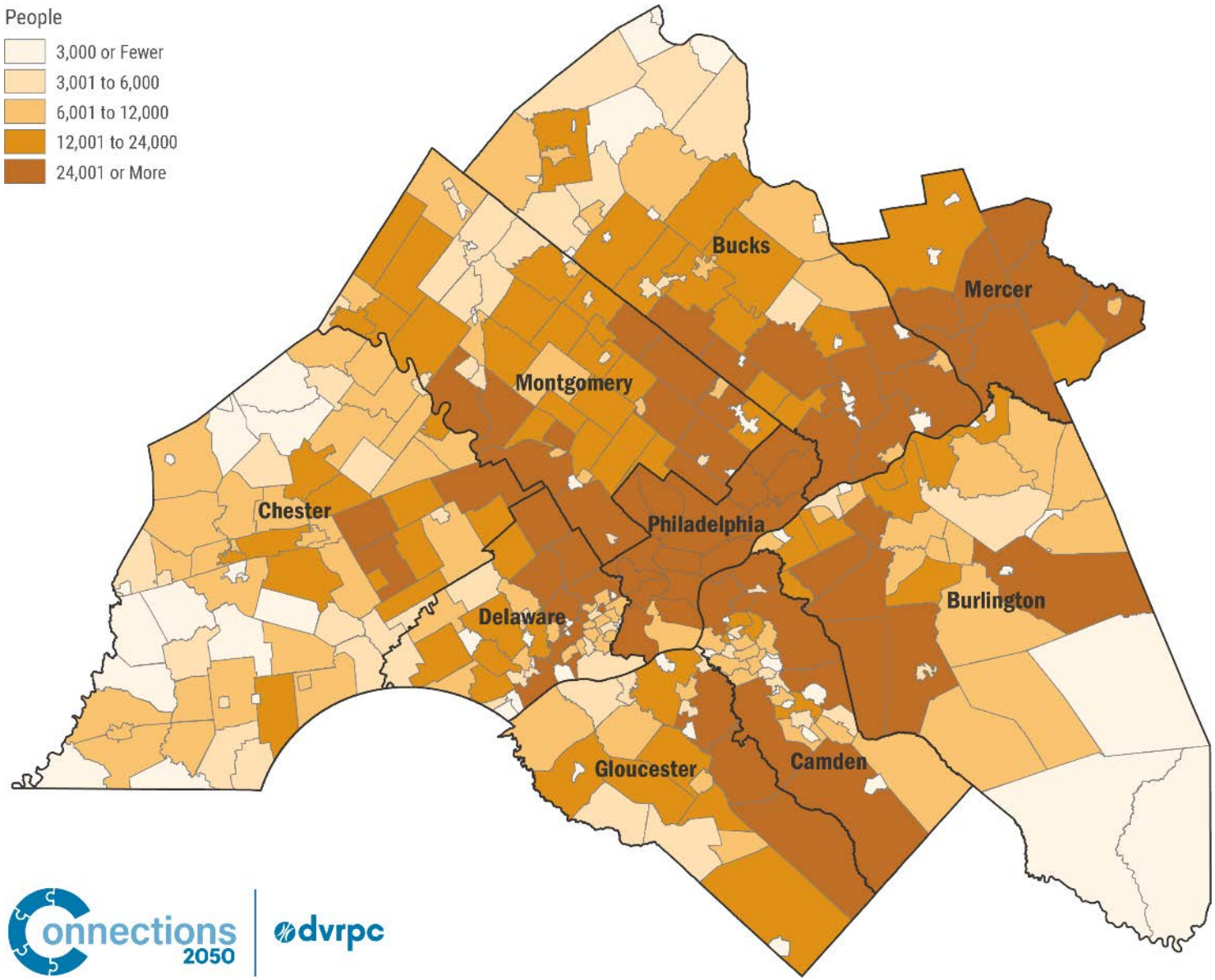
Source: DVRPC, 2021.

Figure 5: PERCENTAGE CHANGE IN POPULATION (2015–2050)



Source: DVRPC, 2021.

Figure 6: TOTAL FORECASTED POPULATION (2050)



Source: DVRPC, 2021.

Table 4: FORECASTED POPULATION BY COUNTY, 2015–2050

County	2015	2020	2025	2030	2035	2040	2045	2050	Absolute Change, 2015–2050	Percentage Change, 2015–2050
Burlington	446,863	447,971	463,830	471,001	474,401	476,962	477,540	477,884	31,021	6.9%
Camden	507,692	507,378	512,630	512,790	515,571	518,525	519,127	519,476	11,784	2.3%
Gloucester	291,091	291,710	295,192	298,495	307,003	312,710	321,140	327,608	36,517	12.5%
Mercer	368,200	367,925	378,112	392,070	394,244	395,881	396,202	396,462	28,262	7.7%
Four New Jersey Counties	**1,615,861**	**1,617,004**	**1,651,789**	**1,676,386**	**1,693,254**	**1,706,118**	**1,716,054**	**1,723,480**	**107,619**	**6.7%**
Bucks	625,225	629,040	635,768	641,786	646,930	651,113	654,442	657,131	31,906	5.1%
Chester	515,043	528,218	563,468	586,300	604,007	620,391	634,119	645,673	130,630	25.4%
Delaware	563,142	566,610	570,207	573,667	576,903	579,706	581,763	583,376	20,234	3.6%
Montgomery	817,199	833,914	852,415	868,662	883,800	896,576	907,942	917,924	100,725	12.3%
Philadelphia	1,571,440	1,590,161	1,627,244	1,650,559	1,658,977	1,665,398	1,670,261	1,680,798	109,358	7.0%
Five Pennsylvania Counties	**4,092,049**	**4,147,943**	**4,249,102**	**4,320,974**	**4,370,617**	**4,413,184**	**4,448,527**	**4,484,902**	**392,853**	**9.6%**
DVRPC Region	**5,705,895**	**5,762,927**	**5,898,866**	**5,995,330**	**6,061,836**	**6,117,262**	**6,162,536**	**6,206,332**	**500,437**	**8.8%**

Source: DVRPC, June 2021.
Base populations from U.S. Census Bureau Population Estimates Program (2019 release).

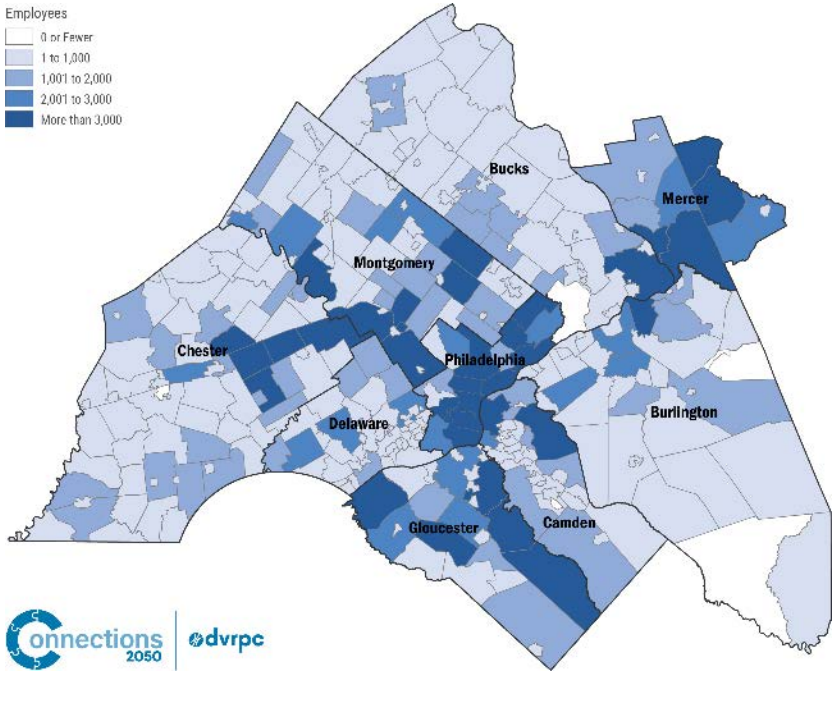
Employment in the latter half of the last decade fared better. By 2019, the region had achieved about 67 percent of the employment growth predicted to occur between 2015 and 2045 in the previous forecast. Despite the slowing pace of working-age population growth, the unemployment rate declined to historic lows as employment growth coming out of the Great Recession extended for longer than many predicted.

The pandemic recession broke records for depth and steepness of job declines. U.S. Bureau of Labor Statistics data used in model parameters showed regional total employment decline more than 6.5 percent, returning the region to an employment level only 0.7 percent higher in 2020 than it was in 2015. However, due to the speed of vaccine distribution, various stimulus measures, and high levels of household savings, many experts are now moving their predictions for an employment rebound to occur sooner than previous recessions.

Although not all employment sectors will exceed pre-pandemic levels, the employment forecast assumes total employment will reach 2019 levels by 2023 or 2024 and then see a smoother, slower trendline through 2050.

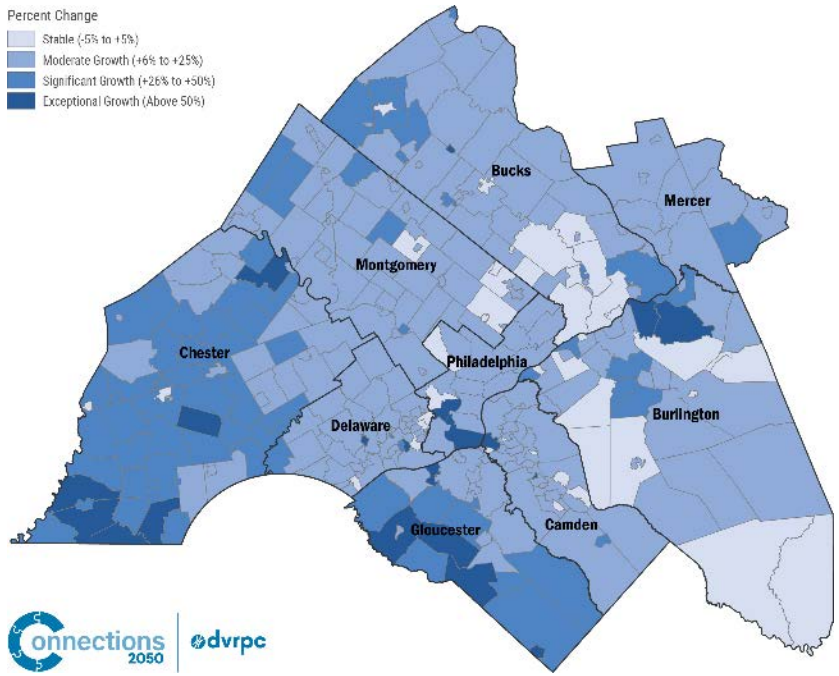
Table 4 shows the employment forecast by county, subregion, and region. The forecast estimates a 15.4 percent increase in employment from 2015 to 2050. Although this appears to be out of sync with the population growth rate of 8.8 percent over the same period, the divergence of the observed data from 2015 to 2019 is the chief reason for this anomaly. From 2019 to 2050, the population growth rate is forecast to be 8.0 percent, while employment is forecast to be 6.9 percent. Regional employment is forecast to exceed 3.5 million jobs by 2050. Figures 7–9 show three different views of the 2050 employment forecast. Figure 7 shows absolute change from 2015 to 2050, Figure 8 shows percentage change for the same period, and Figure 9 shows total forecasted employment for 2050.

Figure 7: ABSOLUTE CHANGE IN EMPLOYMENT (2015–2050)



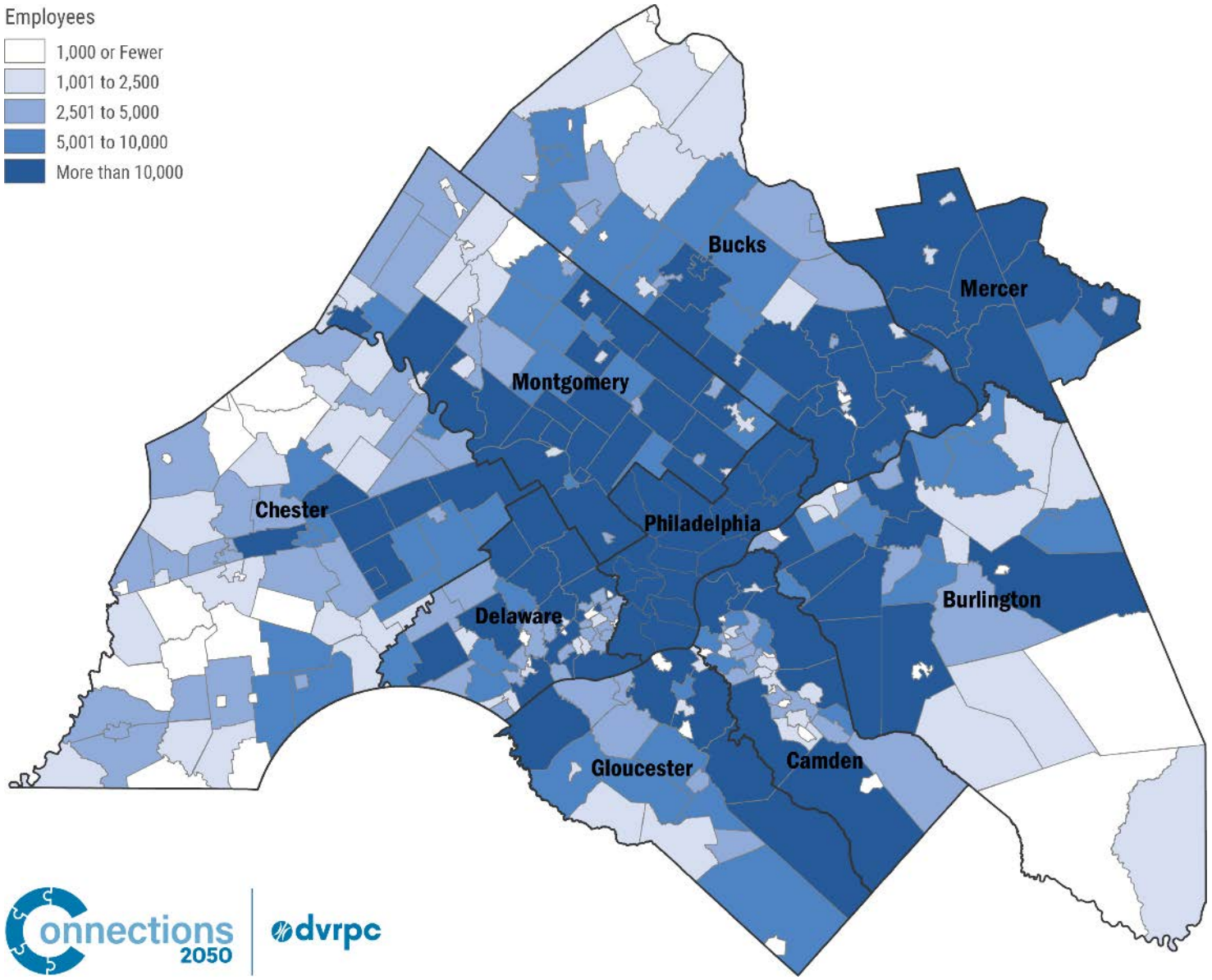
Source: DVRPC, 2021.

Figure 8: PERCENTAGE CHANGE IN EMPLOYMENT (2015–2050)



Source: DVRPC, 2021.

Figure 9: TOTAL FORECASTED EMPLOYEMENT (2050)



Source: DVRPC, 2021.

Table 5: FORECASTED EMPLOYMENT BY COUNTY (2015–2050)

County	2015	2020	2025	2030	2035	2040	2045	2050	Absolute Change, 2015–2050	Percentage Change, 2015–2050
Burlington	243,773	241,044	259,622	263,784	265,316	267,490	269,911	272,016	28,243	11.6%
Camden	235,055	231,475	251,236	254,730	256,495	258,893	261,276	263,284	28,229	12.0%
Gloucester	116,906	123,027	138,978	142,306	144,046	146,652	149,362	151,891	34,985	29.9%
Mercer	229,501	230,526	246,875	249,634	251,430	254,122	256,973	259,402	29,901	13.0%
Four New Jersey Counties	**827,250**	**828,092**	**898,736**	**912,484**	**919,322**	**929,197**	**939,567**	**948,643**	**121,393**	**14.7%**
Bucks	315,665	308,713	326,700	332,639	335,324	338,108	341,149	343,632	27,967	8.9%
Chester	302,656	298,305	336,321	345,083	351,403	358,837	366,724	373,664	71,008	23.5%
Delaware	261,417	262,851	279,772	283,398	285,407	288,280	291,175	293,526	32,109	12.3%
Montgomery	567,585	559,413	601,014	610,266	616,333	625,549	635,373	643,790	76,205	13.4%
Philadelphia	766,163	804,345	839,480	857,981	872,566	882,135	889,907	904,311	138,148	18.0%
Five Pennsylvania Counties	**2,213,486**	**2,233,627**	**2,383,287**	**2,429,367**	**2,461,033**	**2,492,909**	**2,524,328**	**2,558,923**	**345,437**	**15.6%**
DVRPC Region	**3,038,721**	**3,059,699**	**3,279,998**	**3,339,821**	**3,378,320**	**3,420,066**	**3,461,850**	**3,505,516**	**466,795**	**15.4%**

Source: DVRPC, June 2021.
Base employment data from the National Establishments Time Series (NETS) database.

Indicators of Potential Disadvantage (IPD) by Census Tract

IPD analysis is used throughout DVRPC's programs to demonstrate compliance with Title VI of the Civil Rights Act and fair treatment of population groups identified through EJ. Title VI of the Civil Rights Act states that "no person in the United States, shall, on the grounds of race, color, or national origin be excluded from participation in, be denied the benefits of, or be subjected to discrimination under any program or activity receiving federal financial assistance." EJ is defined by the federal government as, "the fair treatment and meaningful involvement of all people regardless of race, color, national origin, or income with respect to the development, implementation, and enforcement of environmental laws, regulations, and policies." Fair treatment means that no group of people, including a racial, ethnic, or

socioeconomic group, should bear a disproportionate share of the negative environmental consequences resulting from industrial, municipal, and commercial operations or the execution of federal, state, local, and tribal programs and policies. Neither Title VI of the Civil Rights Act nor Executive Order #12898 provides specific guidance to evaluate discrimination within a region's transportation planning process. Therefore, MPOs must devise their own methods for ensuring that population groups and issues are represented in decision making and planning efforts, guided by resources and requirements put out by the FHWA, Federal Transit Administration (FTA), and the MPO's state DOTs. It should be noted that although DVRPC employs the IPD methodology to ascertain population data, it is just one tool that is part of a larger strategy that includes public participation, stakeholder outreach, data sources, and other research utilized by DVRPC staff to plan for all residents in the Greater Philadelphia region.

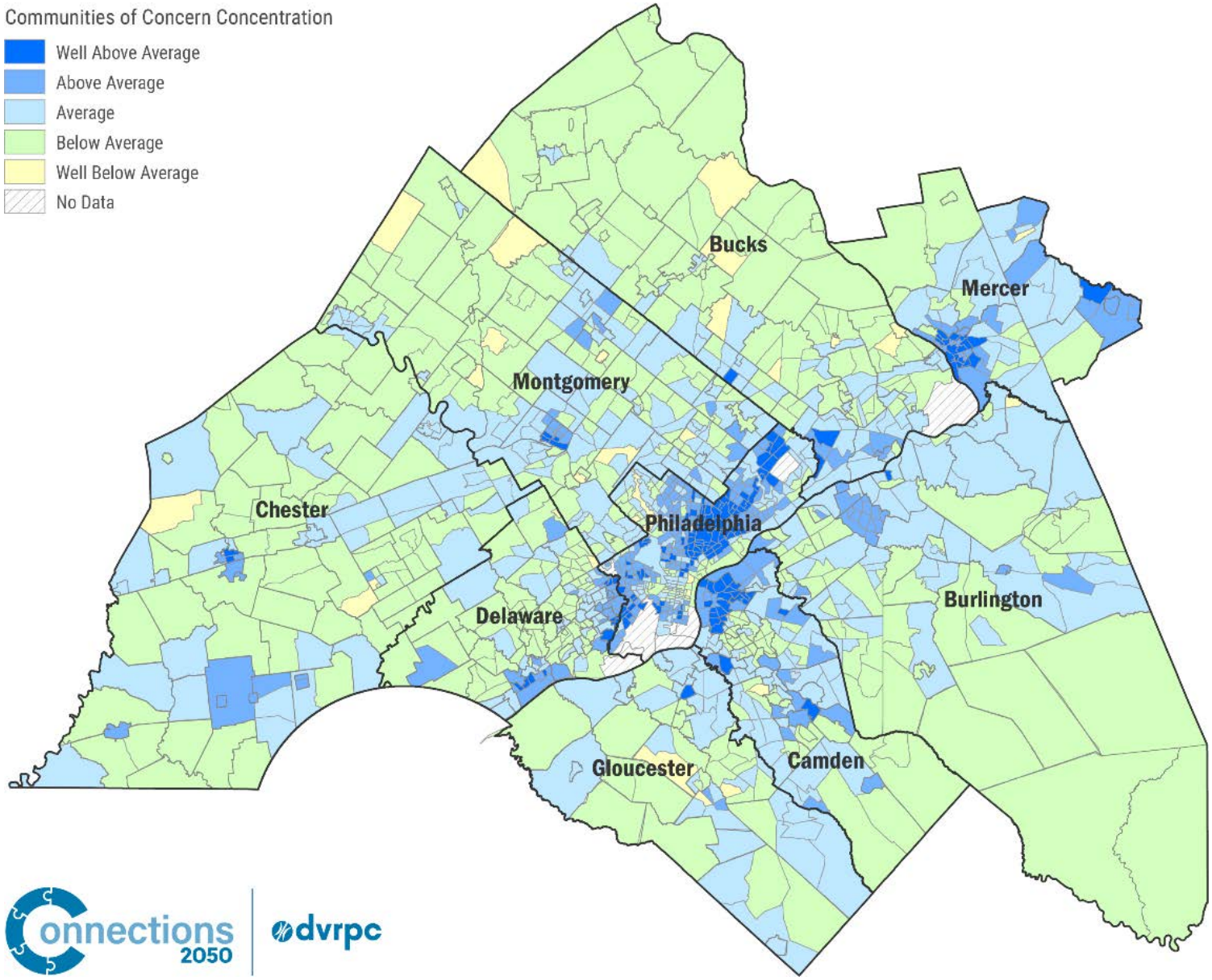
DVRPC first created the analysis in 2001, then named "Degrees of Disadvantage (DOD)." Over the years, this analysis was adopted or adapted by peer organizations around the country, cited as a best practice for considering equity issues in planning and demonstrating compliance with federal non-discrimination mandates. The IPD analysis identifies populations of interest under Title VI and EJ using U.S. Census Bureau American Community Survey (ACS) five-year estimates data, then maps these populations in each of the census tracts in the region via GIS (see Figure 10). Each population group is an "indicator" in the analysis, as detailed in Table 6.

Table 6: IPD POPULATION GROUPS AND DATA SOURCES

Indicator	ACS Data Table	Protected Population	Authorizing Source
Youth	B09001: Population under 18 Years by Age	Age	FHWA's Title VI Program and Additional Nondiscrimination Requirements (FHWA Title VI)
Older Adults	S0101: Age and Sex	Age	FHWA Title VI
Female	S0101: Age and Sex	Sex	FHWA Title VI
Racial Minority	B02001: Race	Race and Minority	Executive Order 12898, Title VI of the Civil Rights Act of 1964, FHWA Title VI, **and** Title VI Requirements and Guidelines
Ethnic Minority	B03002: Hispanic or Latino Origin by Race	Minority and National Origin	Executive Order 12898, Title VI of the Civil Rights Act of 1964, FHWA Title VI, **and** Title VI Requirements and Guidelines
Foreign Born	B05012: Nativity in the United States	National Origin	Title VI of the Civil Rights Act of 1964, FHWA Title VI, **and** Title VI Requirements and Guidelines
Limited English Proficiency	S1601: Language Spoken at Home	Limited English Proficiency and National Origin	Title VI of the Civil Rights Act of 1964, FHWA Title VI, **and** Title VI Requirements and Guidelines
Disabled	S1810: Disability Characteristics	Disability	FHWA Title VI
Low-Income	S1701: Poverty Status in the Past 12 Months	Low-Income	Executive Order 12898 **and** FHWA Title VI

Source: DVRPC, 2021.

Figure 10: IPD BY CENSUS TRACT (2018)



Sources: U.S. Census Bureau, 2014–2018 American Community Survey 5-Year Estimates.

Economic Development

Greater Philadelphia has a strong base of highly skilled workers, top-tier universities, and support infrastructure for a wide variety of high-tech industries. The region is home to over 100 educational institutions that offer at least a two-year associate's degree and ranks third nationally in the number of four-year colleges and universities. Like many urban areas, the region's economy has undergone a major transition in recent decades. Roughly a half-century ago, manufacturing jobs dominated; more recently they have been replaced with knowledge-based industries in the life sciences, information technology (IT), professional and business services, and chemicals industries, which have become the principal drivers of the region's economy.

The Digital Revolution

The Digital Revolution emerged in the 1960s as the economy began to move away from a focus on industrial-era production and toward the creation of information and content. It has been driven by the growth of a set of inter-related technologies: ever-ubiquitous computing; mobile and broadband internet; the proliferation of digital devices; the declining cost and increasing capacity of data storage; and sensors that gather data, process it, and turn it into actionable information.[5] The Digital Revolution has been reshaping nearly every industry in an ongoing process that:

- connects people with each other and more and more things to the internet;
- creates new options for doing things (fragmentation);
- drastically increases data collection and availability;
- reduces transaction costs by more directly linking buyers and sellers;
- enables remote actions;
- facilitates greater customization and personalization;
- flattens distance and the cost of distance;
- empowers user-driven networks; and
- enables real-time communications.

Digital companies are often multisided platforms that connect different parties in a transaction in real time. They are asset light, are not constrained by the physical world's space limitations, and can readily scale up their services. The digital economy reinforces network effects, where the more users there are of a good or service, the more powerful it will be in the marketplace. For instance, the more potential passengers a transportation network has in its service, the more people will want to be drivers for it, making it more attractive to new passengers. This promotes winner-take-all outcomes that risk the rise of dominant monopolies over time. This also has geographic implications, as the Digital Revolution has centralized economic growth in a handful of innovation hubs and the largest regions around the United States and the world.[6]

The Digital Revolution is evolving around new technologies (see section on Emerging Transportation Technologies), but there is much uncertainty about what their long-term implications will be. They raise significant concerns about the future of work, especially as they continue to replace jobs with low digital-skill requirements with jobs that have high digital-skill needs. Surveillance capitalism—where

[5] Shawn Dubravac, Ph.D. *Digital Destiny: How the New Age of Data Will Transform the Way We Work, Live, and Communicate* (Washington, DC: Regnery Publishing, 2015).

[6] Enrico Moretti, *The New Geography of Jobs* (Boston: Mariner Books, 2013).

individuals trade their personal data for free digital services—is also emerging as an entirely new economic form. The biggest beneficiaries in this transaction are those who collect the data; use it to learn and understand everything about us; and then develop algorithms that shape our thinking, behaviors, and purchasing habits.[7]

Regional Economic Development

The region is powered by a robust and diversified IT industry comprising both IT products and services, and its cluster of biopharmaceuticals, biotech, research and development (R&D), and support companies is one of the largest in the nation. With deep roots in public health, the Greater Philadelphia region has become one of the nation's top life science industry centers. Other key sectors include alternative energy and energy conservation, the creative industries, tourism, food production and distribution, defense systems, aerospace, and shipbuilding. Regional employment, however, is primarily concentrated in four sectors—Business Services, Distribution and Electronic Commerce, Education and Knowledge Creation, and Financial Services—that account for over 60 percent of all employment in the region. Despite high performance, heavy reliance on these four sectors alone poses a threat to the resilience of Greater Philadelphia's economy. With limited available funding for infrastructure improvements, facilities that serve clusters of these key economic sectors should receive priority attention.

DVRPC manages the regional Comprehensive Economic Development Strategy (CEDS) for the Greater Philadelphia region. The CEDS is the region's strategy-driven framework to increase economic productivity, diversify local wealth, improve the culture for under-represented businesses, and increase individual prosperity for the region's residents. The CEDS document, Growing Greater Philadelphia, was most recently updated in September of 2019 and was developed through guidance and support by an Economic Development Committee made up of public- and private-sector representatives. It is the result of an 18-month process of conducting research and gathering information from planning partners, stakeholders, and elected officials, and provides a framework for our regional economic development partners to prioritize strategies for implementation that supports the vision and goals of the region's Long-Range Plan. Several key themes emerged from *Growing Greater Philadelphia,* including Broadband and Remote Capabilities, Access to Economic Opportunity and Quality of Life Amenities, and Economic Resiliency.

Broadband and Remote Capabilities

As was true with waterways, highways, railways, and electricity in prior decades, broadband is a crucial driver of job creation and economic growth. Internet applications reliant on high-speed broadband are increasingly critical for innovations in health care, education, transportation, business, emergency management, and communications. The American Recovery and Reinvestment Act of 2009 allocated $7.2 billion to expand broadband services, create jobs, and stimulate economic growth.

Theoretically, broadband has three layers and can be compared to the National Highway System (NHS) of Interstate roads, state roads, and local roads. The highest level of the internet, the "backbone," is hosted by commercial, government, academic, and other high-capacity network centers. The "middle mile" refers to the segment linking the operator's "core" network to the local network. The "last mile" then transports the internet to homes and businesses (see Figure 11). Community anchors, emergency services, hospitals and schools,

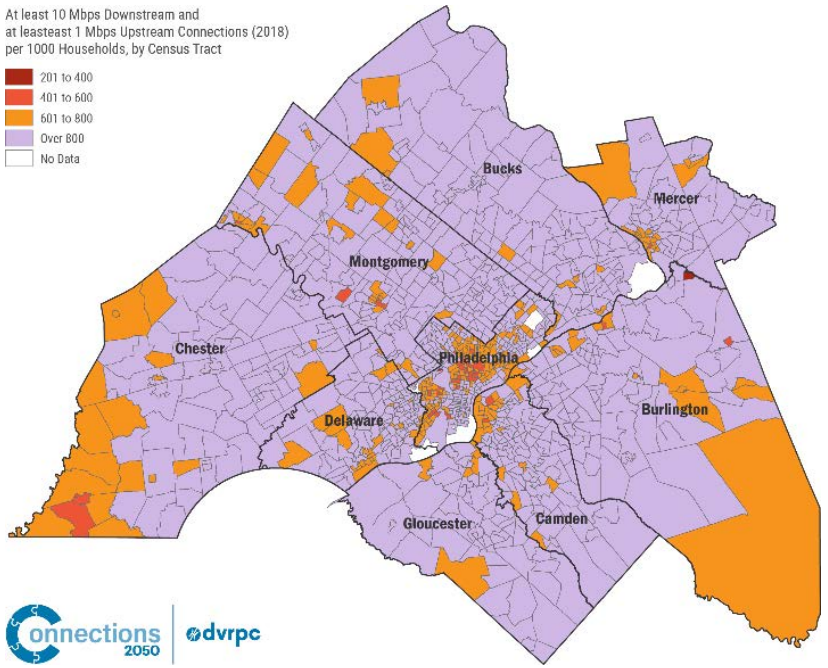
[7] Shoshana Zuboff, *The Age of Surveillance Capitalism: The Fight for a Human Future at the New Frontier of Power* (New York: Public Affairs, 2018).

municipal offices, and large businesses have the means and capacity to access broadband-based services. The majority of home and small business users rely on last-mile hosts and internet service providers to obtain broadband.

The availability of, and access to, broadband has changed the ways in which the public informs and entertains itself, as well as how people shop, communicate, and commute. Most importantly, its availability can have significant ramifications for the region's digital divide. Greater Philadelphia's digital divide is more an issue of cost than it is availability, with low-income, minority communities disproportionately falling on the wrong side of the divide. In 2017, the average estimated unemployment rate for the region was 8.0 percent compared to 11.6 percent in census tracts with below-average household broadband subscriptions (less than 79.9 percent). The digital divide also exists due to a lack of readiness and ability to utilize the technology once deployed. Implementing strategies, policies, and programs aimed at bridging the digital divide will be neither equitable nor entirely successful if the issue of digital readiness is not part of their implementation. Ways in which to empower the population to fully utilize and leverage these technologies include closing the generation gap for seniors, developing the workforce, and equipping students.

Broadband provides significant benefits to the next generation of entrepreneurs and small businesses—the engines of job creation and economic growth for the country. The innovation capabilities of a region are linked to internet availability and usability.

Figure 11: BROADBAND RESIDENTIAL CONNECTIONS



Source: FCC, 2017.

Access to Economic Opportunity and Quality of Life Amenities

Greater Philadelphia has a strong quality of life presence with cultural amenities, communities, and neighborhoods with historic charm and identity, a diverse ethnic population, education options, and access to health care. Access to these amenities provides opportunities at every level to expand the regional economy for minority entrepreneurs and businesses, as well as larger corporations with headquarters located in the region. Investments in new multimodal infrastructure and energy-efficient industrial sectors will provide new types of jobs that respond to the changing economy and workforce.

Increased prosperity and educational level are desired by residents and stakeholders in order to achieve economic growth and to have a higher quality of life. Local leaders make individual decisions regarding economic development strategies, such as location, or size through zoning and building regulations. Successfully attracting new businesses to, and forging new educational opportunities for, one's community, however, requires coordinated actions across many communities and levels of government because these decisions impact so many stakeholders. This coordination is critical to ensuring a high-quality life with economic opportunity and prosperity.

Education

Education is vital to the region's ability to meet the Plan's goals, such as increasing equity, growing workforce skills, and focusing growth and development in Centers. Schools play an invaluable role in educating our children and serving the broader needs of the community. However, income, social, and racial inequities can create challenges for our schools and communities. Students from low-income households, with special needs, and of color often have more intensive needs than their peers. The disadvantages these students face in the classroom become evident when looking at indicators like standardized test scores, class 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 based on the needs of families in their communities. We must also address discrepancies in educational attainment that may be reinforced by educational funding inequities and the lack of access to support services in many of the region's lower-income communities. By reviewing the impact of education finance policies, communities in our region may help to improve the performance and well-being of disadvantaged schools and students.

Co-creation is an emerging movement within the education field that puts teachers and learners in a partnership that allows students to be active learners who are highly involved in the design and development of their curriculum. It empowers and it provides learners ownership in their education, and provides both learners and teachers with a deeper understanding of the goals of the education process. This is an interesting trend that has potential connections with, and applications in, community planning.

As digital technologies will continue to have a bigger role in the future of society and the economy, connected education systems better integrate schools into the broader community. 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 programs should connect middle and high schools with other parts of the existing and emerging educational system, including maker labs, innovation challenges, hack-a-thons, interactive art installations, online experiences, and universities. Such resources present an opportunity to use co-creation techniques to promote inclusive, equitable, and cultural approaches to community-led research. These can build off experiential community knowledge and allow students to take ownership of research and build leadership skills.

Schools can do more to prepare students for the downsides of technology and prepare the next generation of leaders by increasing focus on civics education and developing skills to combat misinformation and disinformation. Key skills include media literacy to help students discern what is, and is not, credible on the internet; digital citizenship and empathy related to cyberbullying; seeking out and understanding conflicting perspectives; and instilling humility and understanding of peoples' vulnerability on digital platforms.[8]

Economic Resiliency

Education was just one of the sectors that needed to pivot quickly as a result of the COVID-19 pandemic, which highlighted flaws in the economic system more generally. Recent events in the region and nationwide, including severe weather events, the effects of climate change and, most notably, the widespread disruptions caused by pandemic-related closures, have changed or threatened the resiliency of the regional economy.

Economic resilience refers to the ability to withstand an initial economic shock, to recover quickly from a shock, and to avoid the shock altogether. It involves the coordination of stakeholders at all levels of government to protect and recover damaged infrastructure and support systems to businesses as they work to recover and return to full productivity. Local communities and businesses must prepare for potential economic risks, including locations likely to experience significant natural disasters or public health emergencies, or immediate or pending economic shifts that could cause high unemployment, impact supply chains, and lead to mortgage foreclosures. Establishing local and regional vulnerabilities are critical to mitigating an economic incident to support long-term recovery efforts, particularly through prioritizing resources, overriding markets, helping with small and large business impacts, effectively dealing with business failures and closures, maintaining a supply of critical goods, and responding to price increases.

Greater Philadelphia is part of a robust regional, national, and global supply chain network with many local industries and businesses playing key roles in critical supply chains. Freight transportation acts as a link between key segments of supply chains and is vital to long-term supply chain resiliency and maintaining critical supplies during disaster events. Understanding critical supply chains and their vulnerabilities in the region is not only helpful for future emergency management operations but is also an important first step in building a more resilient region that can withstand, and bounce back from, disruption.

Goods Movement and Freight Centers

The movement of goods in Greater Philadelphia is critical to the regional economy and our way of life. Every industry and every household in the region rely on the various components of the freight transportation system to access products that keep us fed, entertained, sheltered, and employed. The complicated supply chains that fuel our region are supported by a robust, multimodal network of facilities that allow for the movement of goods by highway, rail, water, air, and pipeline.

Highway—Truck freight remains an essential component of the national freight system, handling over 70 percent of freight by volume. The 320 miles of highways designated as components of the National Highway Freight Network are the core of the region's truck highway system.

[8] Jon Valant, "We've Built Schools for a Modern Economy—but they Overlook the Challenges of our Modern Democracy," Brookings, February 1, 2021, www.brookings.edu/blog/brown-center-chalkboard/2021/02/01/weve-built-schools-for-a-modern-economy-but-they-overlook-the-challenges-of-our-modern-democracy/ (accessed February 2, 2021).

Freight Rail—The region's 700-mile freight rail network serves many industries and provides critical intermodal service. This network is served by two Class I carriers and seven short-line railroads with service at two intermodal terminals, two auto terminals, and half a dozen transload facilities.

Maritime—The Delaware River port system terminals serve as a gateway for international trade and domestic commerce for bulk commodities. The region has 37 individual marine terminals, each specializing in various services. The completion of the river deepening and a decline in refining has helped diversify maritime commodities, with the port continuing to be a national leader in produce, meats, cocoa beans, and forest products.

Airports—The regional aviation system is a critical component in trade and business development. Philadelphia International Airport (PHL) is the only international, commercial service facility in the region, and it provides a variety of freight services. The region's other commercial service and reliever airports provide business services that support and encourage business activity in the region.

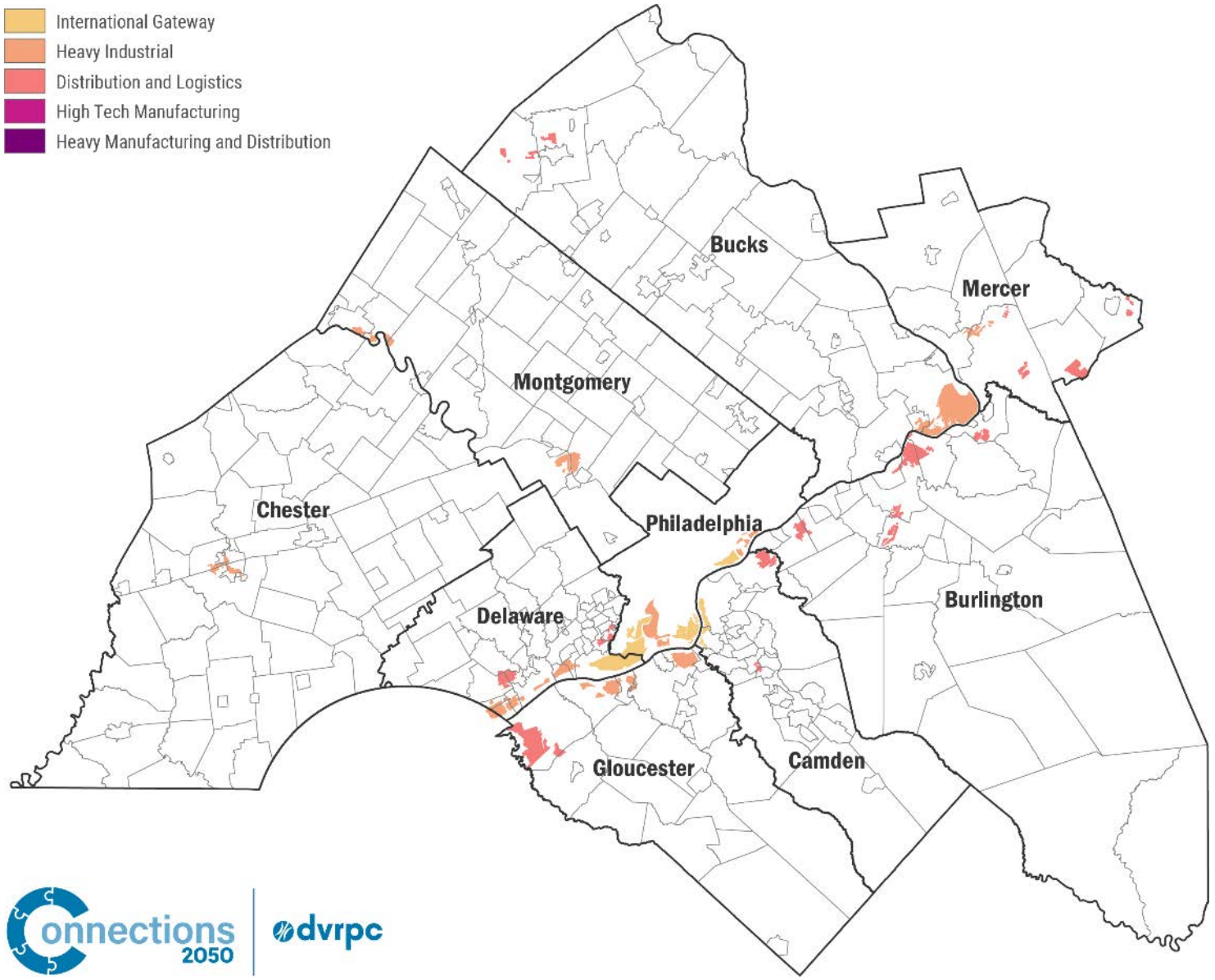
These transportation networks provide the linkages between regional Centers and the global and national economy. Located in the NEC, with truck access within a day and a half to over 160 million residents of the United States and Canada, the region provides tremendous opportunities for freight-related industries. The key nodes for freight generation in the region are the Greater Philadelphia's Freight Centers (see Figure 12). These Centers are physical clusters of freight-intensive land uses and industries that are classified into typologies that represent a unique type of development and employment, as well as supporting infrastructure, and context of neighboring land-uses.

Regionally there are over 460 million square feet of industrial properties. The robust freight network and market access have made the region an increasingly attractive location for development of distribution centers that are critical to the consumer economy. The demand for new properties has resulted in over 24 million square feet of new industrial development in the past five years, with an increasing share being redevelopment. This growth is expected to continue as increasing e-commerce demand and changing consumer behavior drive the need for higher velocity and shorter time windows for deliveries—trends that accelerated through the COVID-19 pandemic.

The growth of e-commerce has resulted in changing dynamics in urban centers and other commercial corridors across the region. Many commercial corridors continue to struggle with accommodating safe, efficient deliveries as they balance limited right-of-way with added demands of a multimodal transportation system. Through freight demand management, curbside management, and truck route planning, local municipalities can better integrate truck activity. These strategies can ensure safer environments for all road users while preserving the critical supply of products that bring vitality to the region's communities.

Innovation in freight transportation will continue to redefine the composition of the transportation network and the efficiency of goods movement in the region. Automated vehicle technology and truck platooning could alter supply chains and the modal share of goods being shipped. Automation in distribution centers has increased the capacity of warehouses to handle goods, resulting in growth in trip generation that must be accommodated from new developments. Other technologies seeking to enhance last-mile deliveries are gaining traction, as demonstrated by the enabling legislation in Pennsylvania for Personal Delivery Devices. Tracking these innovations and integrating them with freight planning initiatives will be essential.

Figure 12: FREIGHT CENTERS



Source: DVRPC, 2021.

Recent and Upcoming Goods Movement Projects

The Southport Auto Terminal and Vehicle Processing Center, completed in 2019, receives around 200,000 vehicles from Korea and Mexico per year.[9] The terminal includes a dedicated auto berth located next to PhilaPort's existing Pier 122. Vehicles can be driven straight from the ship to the first point of rest at the processing center. The terminal is also adjacent to Class I rail links, and the Norfolk Southern Navy Yard facility has been opened for the delivery of domestic export models to the port. The new terminal and processing center are estimated to generate around $124 million in economic activity and create as many as 2,500 jobs.[10]

The Repauno Port and Rail Terminal, located at the former DuPont Repauno site in Gloucester County, New Jersey is currently being redeveloped to create a multiuse port facility for energy products, roll-on/roll-off, project cargo, bulk cargo, warehousing, and logistics. The site is served by Conrail with access to CSX and Norfolk Southern, and easy truck access to I-295 and the New Jersey Turnpike. Plans to build a 1,600-foot-long pier for tanker loading at the site have also been approved. The redevelopment of this site could potentially introduce new commodity movement for liquid fuels, as it is the only terminal on the Delaware River that is not pipeline served.

The New Jersey Wind Port is being planned by the state of New Jersey to help meet the state goal of 100 percent clean energy by 2050 and 7,500 megawatts (MW) of offshore wind energy by 2035. The wind turbine structures will be manufactured locally, and the monopiles (foundation supports) will be manufactured at a facility at the Port of Paulsboro Marine Terminal in Gloucester County.[11] The Wind Port has the potential to create up to 1,500 manufacturing, assembly, and operations jobs, as well as hundreds of construction jobs in New Jersey.

The PHL West Cargo Redevelopment and Expansion Plan proposes a multiphase redevelopment and expansion of the existing Cargo City facility that currently occupies 135 acres. This project includes redeveloping and upgrading outdated facilities, developing an additional 148 acres of newly acquired property, extensions of taxiways to the new cargo area, and relocation of Tinicum Island Road.[12] A portion of the road relocation will be funded by the Commonwealth of Pennsylvania's Multimodal Transportation Fund.[13]

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[9] "Southport Auto Terminal and Vehicle Processing Center," STV Incorporated, https://www.stvinc.com/project/southport-auto-terminal-and-vehicle-processing-center.

[10] "PhilaPort Opens the Southport Auto Terminal and Vehicle Processing Center," Food Logistics, October 31, 2019, https://www.foodlogistics.com/transportation/ocean-ports-carriers/news/21095102/philaport-opens-the-southport-auto-terminal-and-vehicle-processing-center.

[11] "Ocean Wind, EEW Begin Construction of Manufacturing Facility at Port of Paulsboro," New Jersey Business, April 19, 2021, https://njbmagazine.com/njb-news-now/ocean-wind-eew-begin-construction-of-manufacturing-facility-at-port-of-paulsboro/.

[12] "West Cargo EA," PHL, https://www.phl.org/west-cargo-ea.

[13] "PHL Awarded $1.4 Million for Tinicum Island Road Project," PHL, November 26, 2019, https://www.phl.org/node/561.

The critical nature of freight activity reinforces the need for DVRPC and its member governments to formulate plans and projects to better accommodate the unique needs of shippers, receivers, and carriers, and plan for the demands placed on transportation infrastructure due to goods movement. 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 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.
- Encourage the designation of truck routes to inform Complete Streets planning and serve as the foundation for future geometric improvements, safety improvements, and truck wayfinding signage.
- Enhance safety for pedestrians, rail operators, and motorists at roadway-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, such as U.S. DOT's Infrastructure for Building America [INFRA] grant program and NJDOT and PennDOT freight-eligible programs.
- Promote the preservation of industrial and freight land use, especially in designated Freight Centers.

Twelve-County Aviation Planning

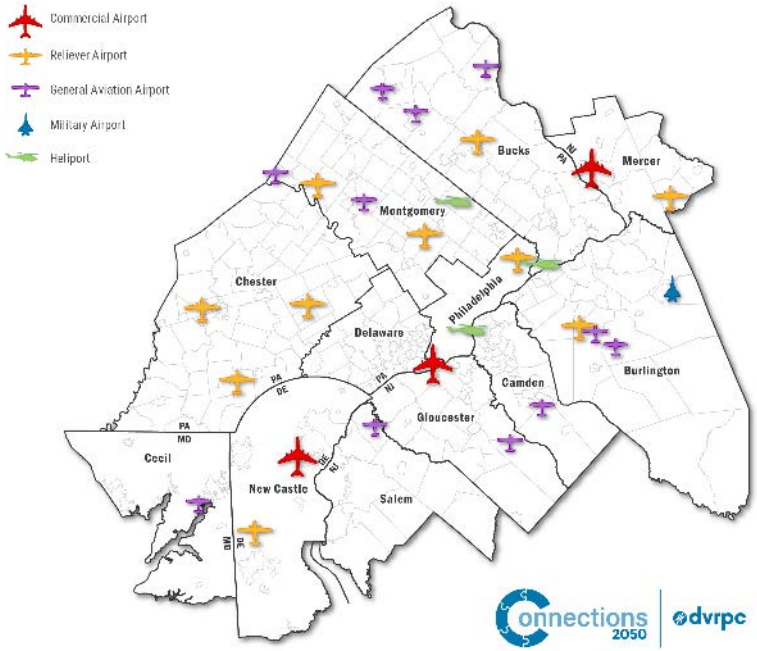
Aviation is a critical link in connecting Greater Philadelphia to the nation and world. The region's aviation system encompasses commercial, reliever, and general aviation airports, as well as three heliports, in the nine-county DVRPC jurisdiction, plus Salem County, New Jersey; New Castle County, Delaware; 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 also plays a key role in regional goods movement, helping to move high-value and time-sensitive shipments, handling 555,000 tons of cargo in 2018.

PHL consistently ranks among the busiest airports nationwide by aircraft movements (takeoffs or landings). PHL produces $16.8 billion in annual output within the 11-county Philadelphia metropolitan statistical area, supporting 106,800 jobs and $5.4 billion in total earnings. 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 between two commercial airports in the region for travelers and airlines.

PHL has recently completed a runway-lengthening project that enhances aircraft operations, as well as terminal improvements that improve the passenger experience. In 2018, PHL acquired a 135-acre tract of land that is being planned for air cargo facilities. This development and supporting highway improvements will be critical as the airport tries to capture a larger share of the $53 billion in air cargo activity originating in a 400-mile radius around PHL. Growth at PHL creates jobs and contributes to regional economic development by

providing greater transportation and shipping services, which attract a diversity of other industries.

Figure 13: TWELVE-COUNTY AVIATION PLANNING REGION



Source: DVRPC, 2021.

In addition to the two commercial airports in the 12-county Aviation Planning region, the 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. Many regional airports have facilities for helicopters or vertical flight (VF), and the region is further complemented by three heliports with dedicated VF facilities. One airport is dedicated to military aircraft (see Figure 13).

Greater Philadelphia's development density presents challenges to all types of airports. Commercial airports seeking to expand operations face objections and difficulties in minimizing impacts on neighboring communities. Residential development, unrestrained by the existence of general aviation and reliever airports, continues to threaten the existence of these facilities. The preservation of these facilities through appropriate measures that minimize external threats, enhance economic viability, and better highlight the importance of the aviation system are critical to the success of aviation in the region.

Aviation planning has many challenges, including congestion, competing land uses, and economic uncertainty. The decisions made now regarding 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 *2040 Regional Airport System Plan (2014)* identified the following key recommendations for the region's extensive and complementary system 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.

The *Regional Airport System Plan* is currently being updated, with an expected completion in 2022.

The Environment and Land Use

The natural environment was the original use for all lands in the region prior to the arrival of indigenous communities approximately 10,000 to 12,000 years ago. The arrival of Europeans in the 17th century marked the beginning of increasingly intensive commercial, residential, and agricultural land uses. DVRPC tracks land use in the region with an inventory that has been collected every five years since 1970 (excluding 1975 and 1985). DVRPC's *Land Use in the Delaware Valley, 2015: Enhanced Land Use Data (ADR026)* dataset contains 73 different land use subcategories grouped under 13 parent categories, including residential, industrial, transportation, utility, commercial, institutional, military, recreational, agricultural, mining, wooded, undeveloped, and water (See Figure 14).

Environmental Resources

Open space, farmland, soil, water, and natural resources are indispensable to our region and its residents. However, many of these resources are threatened by development. *Connections 2050* recognizes that the loss of these resources is not sustainable, and the need to accelerate and coordinate growth management and resource protection activities is urgent.

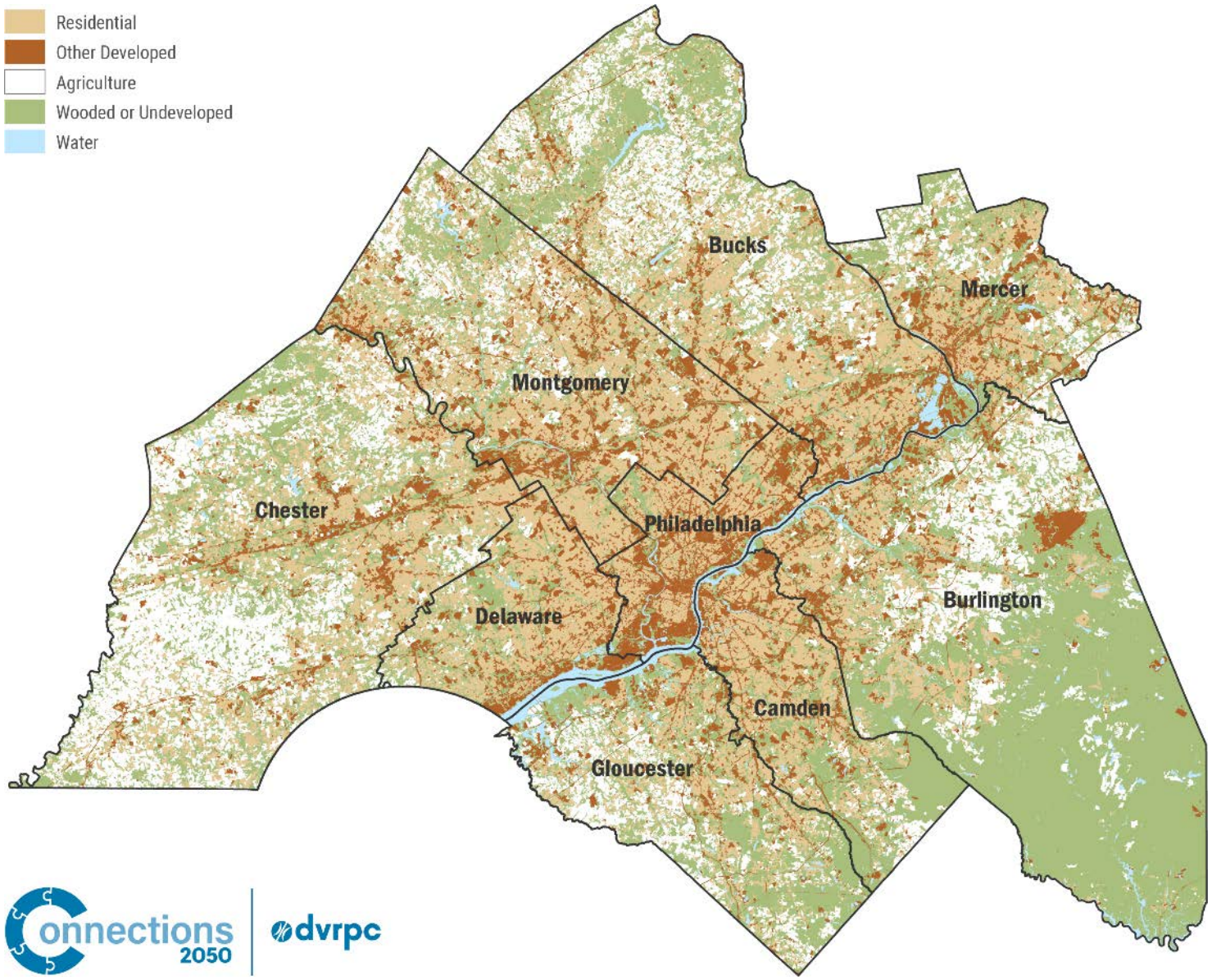
Open Space

Between 1930 and 2015, the population in Greater Philadelphia increased by 73 percent, while the amount of land consumed for development increased by 450 percent, resulting in significant declines in farms, fields, forests, and natural areas. This sprawling development pattern—and the concurrent loss of open space—negatively impacts the environment, the economy, the transportation network, and our region's character and quality of life. The loss of healthy forested headwaters, riparian buffers, and naturally functioning floodplains 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 as the demand for local food is experiencing significant 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. The current land consumption trend has seen a slowing in greenfield development. Strengthening this trend will require both growth management and open space preservation techniques. Strategic land preservation, market-based conservation, smart growth, and enhanced community design will all be needed to slow and stabilize unsustainable growth patterns at the regional scale.

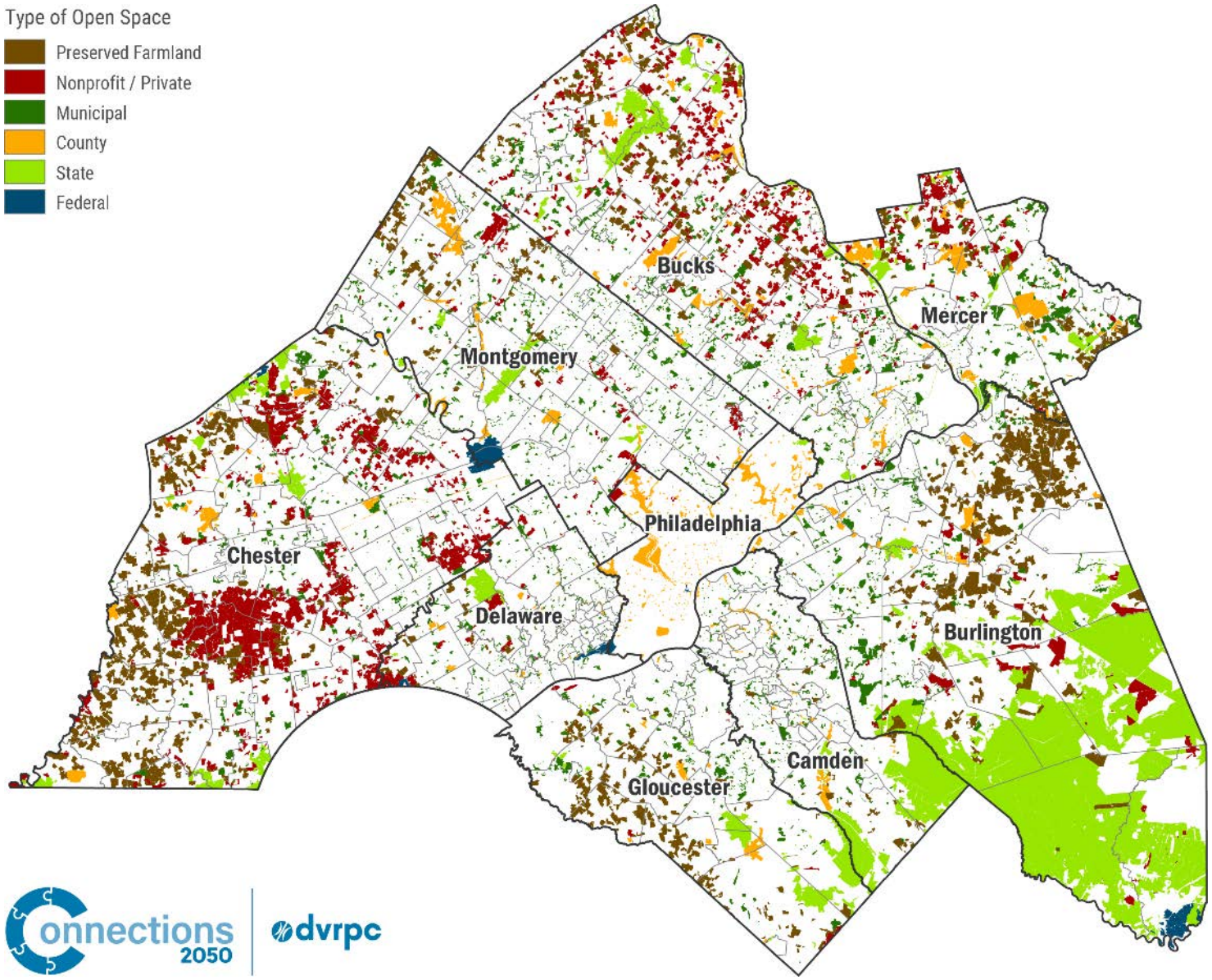
DVRPC maintains an inventory of protected public and private open space to track the region's progress toward meeting its land preservation goals. The inventory tracks all publicly owned open space, preserved farmland, and non-profit protected open space. State, county, and municipal programs preserve farms by purchasing development rights with public funds. Non-profits, 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 2020, the region has steadily increased its inventory of protected public and private open

Figure 14: 2015 LAND USE



Source: DVRPC, 2015.

Figure 15: PROTECTED OPEN SPACE



Source: DVRPC, 2021.

Table 7: PROTECTED OPEN SPACE

County	Public Protected Open Space					Private Protected Open Space				
	Federal	State	County	Municipal	Total Public OS	Non-Profit/ Private	Preserved Farmland	Total Private OS	County Total	% of Land Area
Burlington	2,648	159,734	2,794	11,741	176,917	8,492	40,829	49,321	226,238	43.18%
Camden	0	20,652	2,970	5,648	29,270	0	2,833	2,833	32,103	22.04%
Gloucester	0	10,062	2,371	6,832	19,265	789	25,674	26,463	45,728	21.23%
Mercer	0	4,480	8,466	11,095	24,041	7,453	8,245	15,698	39,739	27.16%
NJ Subregion	2,648	194,928	16,601	35,316	249,493	16,734	77,581	94,315	343,808	33.33%
Bucks	0	12,788	9,231	16,295	38,314	27,718	18,303	46,021	84,335	21.20%
Chester	1,290	9,046	4,992	12,883	28,211	64,852	45,539	110,391	138,602	28.53%
Delaware	949	2,601	1,404	4,617	9,571	3,377	2,028	5,405	14,976	12.28%
Montgomery	2,402	4,302	5,985	13,141	25,830	5,905	10,009	15,914	41,744	13.39%
Philadelphia	367	257	11,694	0	12,318	509	0	509	12,827	14.07%
PA Subregion	5,008	28,994	33,306	46,936	114,244	102,361	75,879	178,240	292,484	20.77%
DVRPC Region Total	7,656	223,922	49,907	82,252	363,737	119,095	153,460	272,555	636,292	26.08%

Source: DVRPC, 2021.

space, a necessary step in managing growth and protecting the environment throughout the region (Figure 15 and Table 7).

Across the region, the largest category of protected open space is state-owned land, which makes up 35 percent of all protected open space. This is followed by preserved farmland, comprising an additional 24 percent of protected open space. Overall, protected open space makes up 26 percent of the nine-county Greater Philadelphia region. This is divided into 15 percent publicly owned open space lands and 11 percent privately owned lands. The inventory of protected open space increased by almost 32,000 acres, or 5.4 percent, between 2016 and 2020.

Water Quality and Stormwater Runoff

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 flows into drains and is carried by pipes quickly to rivers and streams. This stormwater runoff leads to non-point source pollution from fertilizers and nutrients, insecticides, oils and greases, salts, sediments, and heavy metals. Rapid stormwater runoff also increases the volume and velocity of stormwater, thereby eroding and enlarging stream channels. The end result is impaired water quality and degraded stream health. Conversion of land from natural to developed uses is the greatest contributor to impairments in water quality over time. Accordingly, protection of natural and forested areas is the most important technique for maintaining water quality at the regional scale.

It is also important to effectively manage stormwater and improve water quality in existing urban and suburban settings. Techniques to manage stormwater in developed landscapes include conservation landscaping; naturalized retention basins; street trees; warm-season meadows; vegetated riparian buffers; and engineered soil-vegetation systems, commonly referred to as Green Stormwater Infrastructure (GSI), that soak up and slowly infiltrate stormwater. GSI techniques (including rain gardens, green roofs, tree trenches, stormwater planters, and vegetated bioswales) can all be used to soak stormwater directly into the ground. There it can be stored and used by vegetation and trees over time, as opposed to quickly running off into rivers and streams. GSI also performs other valuable functions like improving air quality, greening the community, ameliorating the urban heat island effect, and fostering a sense of place. And unlike gray infrastructure, GSI beautifies a community, boosts property values, and promotes livability.

Whether part of a sophisticated, engineered GSI-approach, or simply planted along a public right-of-way, street trees are one of the oldest and most effective forms of stormwater management and “greening” in an urban environment. Studies from the University of Pennsylvania show that each year, a single large street tree can absorb 90 pounds of carbon dioxide (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.[14]

Stream restoration, by which an eroded and gullied stream is reconnected to its natural floodplains through regrading and reconstruction of the stream channel, is another technique for improving water quality. This technique diminishes the erosive force of high-velocity floodwaters by allowing them to spread out over a larger floodplain. This is becoming an increasingly important technique given the number of degraded streams in Greater Philadelphia.

Local Food Production and Distribution

Agriculture—as both a land use and a way of life—dominated Greater Philadelphia and its surrounding countryside from precolonial times to the mid–20th century. However, as Greater Philadelphia industrialized and subsequently suburbanized, 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. 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 locally produced food. 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 FreshDirect. The renewed attention to local food presents economic opportunities for farmers and 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.

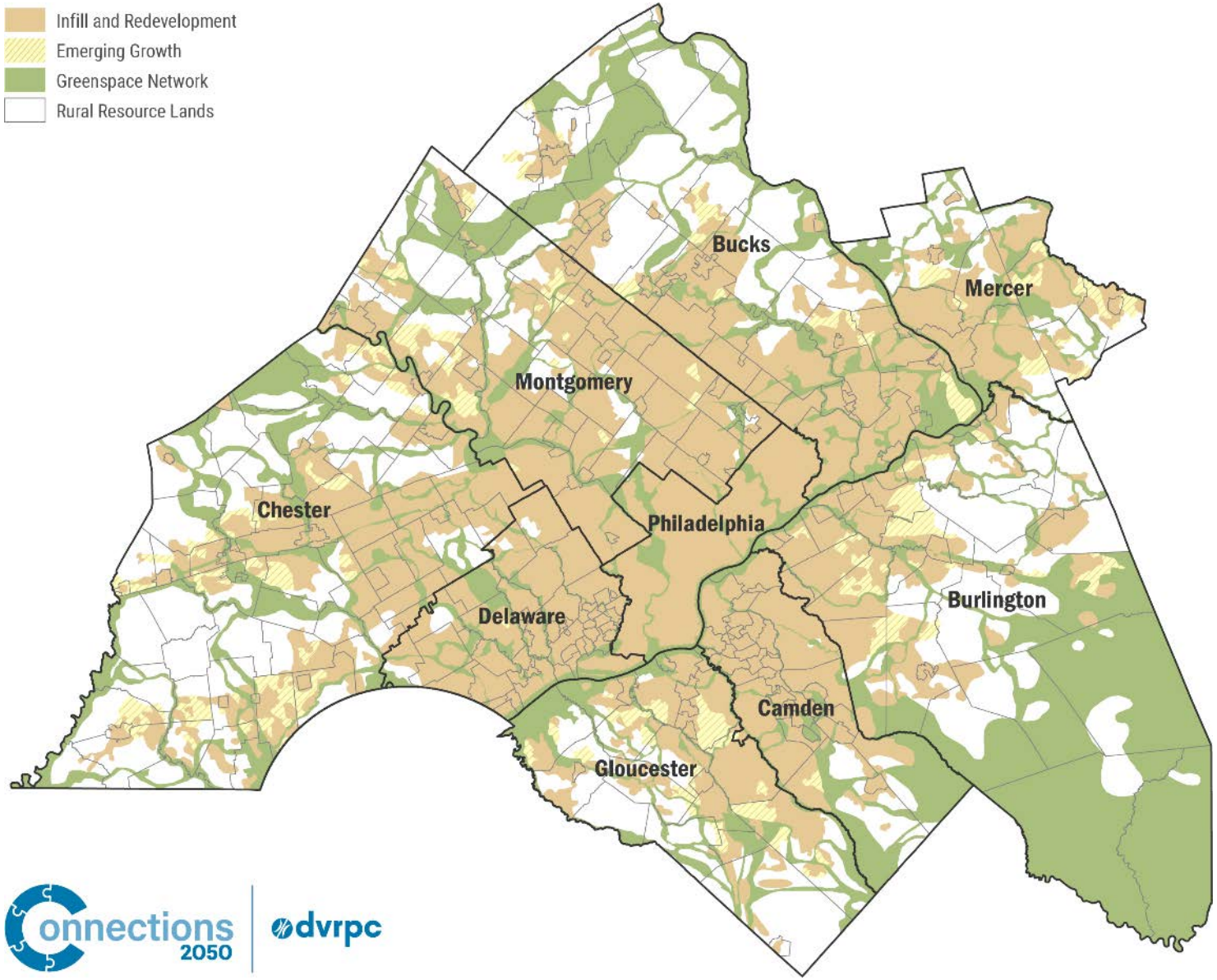
Land Use Vision

The *Connections 2050* Land Use Vision emphasizes Centers-based development and the preservation of agricultural and natural lands. The Land Use Vision divides the entire region up into four typologies: Infill and Redevelopment areas, Emerging Growth areas, Rural Resource Lands, and the Greenspace Network (see Figure 16). 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, linear open space corridors interconnect to form a seamless network, and most new growth is concentrated in Emerging Growth areas, or as Infill and Redevelopment in previously developed areas.

There are 2.4 million acres of land in the region. The Plan proposes that at least one million acres be permanently preserved by 2040 for natural resource protection, farmland preservation, outdoor recreation, and for shaping and defining 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 over 636,000 acres of protected lands to date, the region is nearly two-thirds of the way toward meeting this goal.

[14] "All about Trees," Keystone 10 Million Trees Partnership, http://www.tenmilliontrees.org/trees/#:~:text=A%20single%20street%20tree%20returns,first%20three%20years%20of%20maintenance)%20.

Figure 16: LAND USE VISION



Source: DVRPC, 2021.

Infill and Redevelopment Areas

These lands account for most of the region's existing development, occupying the full spectrum of land use typologies, from densely developed urban cores to first-generation suburbs to low-density residential suburban subdivisions. They do not include scattered or isolated development in otherwise rural areas. Although these areas are already developed, over the timeframe of this plan they offer a wide array of opportunities for redevelopment and infill development. Such opportunities include vacant parcels, underutilized parcels, parcels that can be repurposed for other uses, and opportunities to increase density in strategic locations.

Emerging Growth Areas

These are typically greenfield (undeveloped) areas in our region's suburban fringes that have been targeted by the counties for new growth. Although they represent "new development," many of these areas are proximate to one or more of our region's designated Centers and should take advantage of that proximity by extending the development pattern of those Centers into the new growth areas. This pattern is defined by compact and walkable forms of development, higher densities relative to the surrounding suburban context, the inclusion of GSI, and the linkage of bicycle and pedestrian facilities between the new growth areas and existing Centers.

Greenspace Network

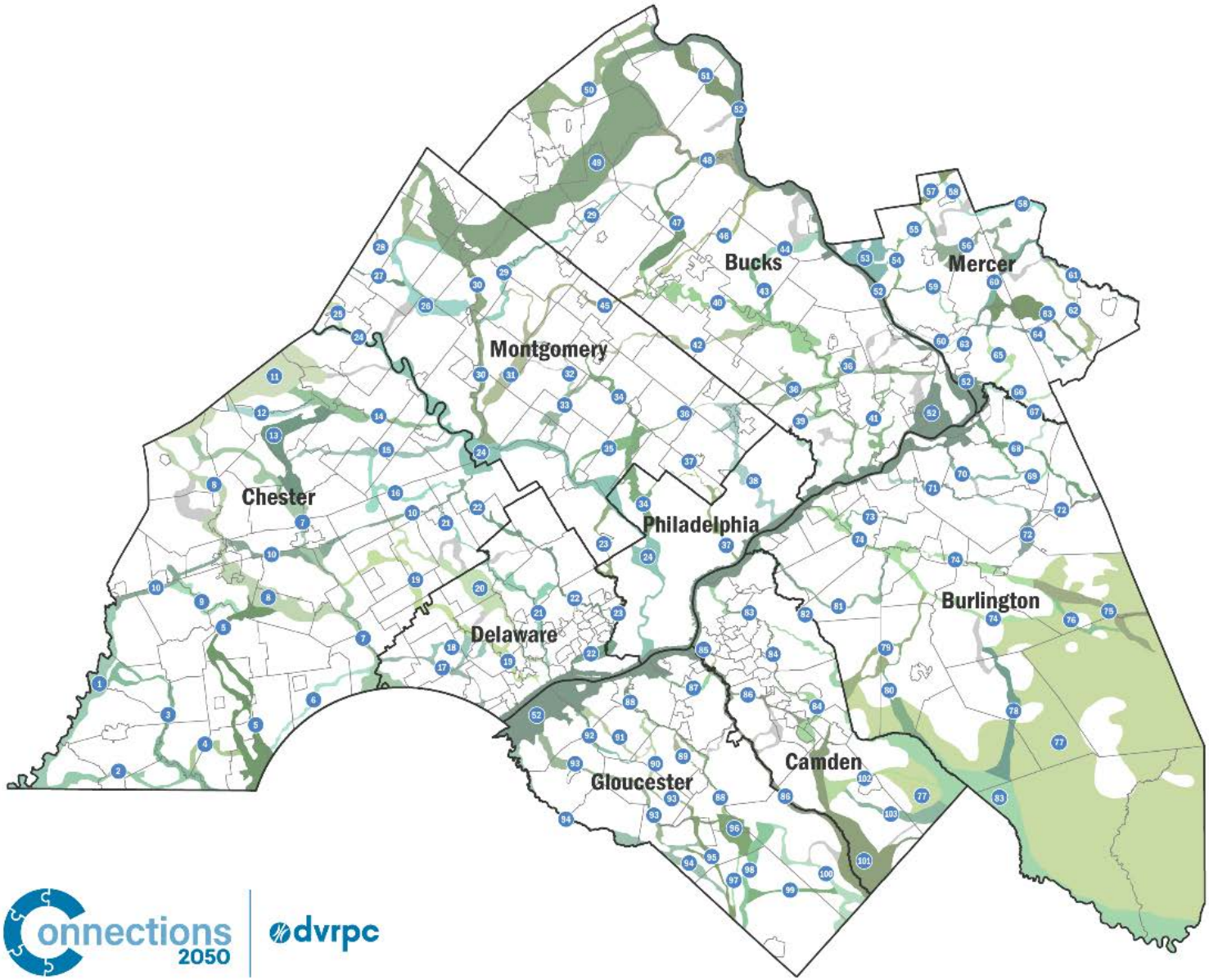
The Land Use Vision proposes linking and expanding the region's existing protected natural areas into a Greenspace Network, where parks, forests, meadows, stream corridors, and floodplains are joined together in an interconnected system. The Greenspace Network is based on the twin principles of protecting 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 goal 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 just over 100 corridors. Each corridor is named to promote its identity and brand it as a unique preservation project (see Figure 17 and corresponding list).

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, such as the Pinelands, Highlands, and Big Woods. 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 both to minimize the damages to life and property caused by flooding and to 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, provides greenspace for residents that currently lack access to natural areas, boosts property values, and encourages increased investment in our towns and cities.

Figure 17: GREENSPACE NETWORK



Source: DVRPC, 2021.

1 Octoraro Creek
2 Serpentine Barrens
3 Big Elk Creek
4 White Clay-Ways Run
5 White Clay Creek-Doe Run
6 Delaware Arc
7 Brandywine Creek
8 West Branch Brandywine Creek
9 Buck Run
10 Great Valley Ridgelines
11 Big Wood Corridor
12 Warwick-Elverson
13 Marsh Creek-Beaver Run
14 French Creek
15 Pickering Creek
16 Valley Creek-Pigeon Run
17 Harvey Run-Naaman's Creek
18 West Branch Chester Creek
19 Chester Creek
20 Ridley Creek
21 Crum Creek
22 Darby Creek
23 Cobbs-Mill Creek
24 Schuylkill River
25 Manatawny Creek
26 Swamp-Deep Creek
27 Minister Creek
28 Middle Creek
29 East Branch Perkiomen Creek
30 Perkiomen Creek
31 Skippack Creek
32 Towamencin Creek
33 Stony Creek
34 Wissahickon Creek
35 Plymouth Meeting
36 Cross County Corridor
37 Tacony-Cresheim Creek
38 Pennypack Creek
39 Poquessing Creek
40 Neshaminy Creek
41 Mill-Queen Anne Creek
42 Little Neshaminy Creek
43 Mill Creek
44 New Hope-Ivyland
45 West Branch Neshaminy
46 Paunnacussing-Pine Run
47 Peace Valley-Deep Run Creek
48 Tohickon Creek
49 North Woods
50 Quakertown-Cooks Creek
51 Tinicum-Nockamixon
52 Delaware River
53 Washington Crossing
54 Jacobs Creek
55 Pennington Mountain
56 Stony Brook
57 North Hopewell
58 North Mercer
59 Shabakunk-Ewing
60 Delaware and Raritan Canal
61 Millstone River
62 Big Bear Brook
63 Assunpink Creek
64 Miry Run
65 Pond Run-Back Creek
66 Doctors Creek
67 Crosswicks Creek
68 Blacks Creek
69 Bacons Run
70 Crafts Creek
71 Assicunk Creek - Annaricken Brook
72 Budd Run-North Run
73 Mill Creek
74 Rancocas Creek
75 Mount Misery
76 Bishpams Mill Creek
77 Pinelands Conservation Areas
78 Batsto-Friendship
79 Southwest Branch Rancocas Creek
80 Haynes Creek
81 Pennsauken-Masons
82 South Pennsauken Creek
83 River to Bay
84 Cooper River
85 Little Timber
86 Big Timber
87 Woodbury Creek
88 Mantua Creek
89 Chestnut Branch
90 Edwards Run
91 Repaupo Creek
92 Pargey Creek
93 Raccoon Creek
94 Oldmans-Reed
95 Still Run (Maurice River)
96 Glassboro Wildlife Management Area
97 Little Ease Run
98 Scotland Run
99 Indian-Faraway
100 Hospitality Branch
101 Great Egg Harbor River
102 Sleeper Branch
103 Pump Branch

Rural Resource Lands

Rural Resource Lands are predominantly agricultural, natural, and rural areas worthy of heightened preservation efforts by governments and non-profit land trusts. Rural Resource 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 critical to maintaining both the region’s rural character and its farming economy. Although 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 highly productive, fertile soils compared with many other parts of the Northeast. These soils provide the Greater Philadelphia region with a unique competitive advantage that is diminished when farmland is converted to housing or other developed uses.

Smart Growth and Community Form

A major focus in the Plan is to help protect the region’s remaining environmental resources by applying smart growth techniques to focus growth and development in more than 125 Plan Centers. The physical form of communities throughout Greater Philadelphia is determined by the arrangement of various structural elements, such as natural features, transportation corridors, and open space, as well as the distribution of various land uses, public facilities, and activity centers. At the neighborhood level, the composition of these elements defines the relationship between people and the built and natural environment. When considered together, these communities serve as the building blocks that define the form and character of the region.

Smart growth is a comprehensive approach to planning and designing the built environment that can be used to shape community form at a variety of scales, from an individual property or block to the larger city or region. Community leaders can use smart growth principles to create places that provide people with more choices in housing, transportation, and lifestyle. Smart growth is based on the philosophy that new growth can help achieve a variety of economic, environmental, and transportation goals if it is done thoughtfully and responds to a community’s own sense of how it wants to grow.

At a regional level, smart growth works by directing development toward existing communities that are already served by infrastructure, seeking to build on the foundations that existing neighborhoods offer while conserving valuable open space and natural resources. Realizing smart growth requires integrated development approaches that recognize the interconnections between land use and transportation. For example, the transportation investments made in a region have a tremendous effect on land use and development patterns. In turn, these patterns influence the travel behavior of households and individuals.

Much of our region’s growth in the latter part of the 20th century was single use, auto dependent, and unconnected to existing development and infrastructure. This pattern of development has negatively impacted our environment, increased our energy needs, and strained our transportation system. Smart growth planning has driven efforts to increase the availability of high-quality transit service, create

connectivity within road networks, and enhance facilities for pedestrians and cyclists.

Smart growth communities also offer an alternative to sprawl by providing a mix of land uses, densities, and housing types. Accordingly, multifamily housing is often critical to the success of smart growth development, particularly because America's changing population is creating demand for new types of homes. By design more compact and of higher density than conventional suburban development, multifamily households consume less land and energy than residents of less compact development. Similarly, when new multifamily housing is strategically integrated into walkable communities with transit access, multifamily housing can have important fiscal and community benefits. Despite these potential advantages, multifamily housing remains controversial and is often difficult to construct because of existing zoning and building codes that favor lower-density development and segregated uses and opposition from the community.

Affordable Housing

DVRPC recently completed research and analysis on a variety of topics related to multifamily housing in Greater Philadelphia.[15] This multifaceted research investigation focused on market-rate apartments and included documenting housing and real estate trends, generating localized demographic multipliers for multifamily housing, and analyzing site-specific trip generation. Key findings from this research include the fact that multifamily households are typically smaller and generate fewer school-age children than those of other housing types, and multifamily residents often own fewer vehicles, require less parking, and generate less congestion than their single-family peers.

Although a recent surge in multifamily housing construction has added some much-needed diversity to the region's housing stock, DVRPC's research raises some important concerns. Newly constructed market-rate apartments are almost always marketed as luxury residences that are priced beyond the means of all but the region's wealthiest citizens. As such, new multifamily construction may be exacerbating housing affordability and equity issues in some communities. DVRPC and its planning partners have identified affordable housing as a critical research topic. Beginning in Fiscal Year (FY) 2022, DVRPC will begin a new initiative designed to provide more data on the composition of the region's housing stock, housing production trends, and projected needs. DVRPC will then lead a collaborative effort to identify and evaluate municipal strategies that can be used to preserve and promote affordable and workforce housing.

[15] "Community Impacts of Multifamily Development," DVRPC, https://www.dvrpc.org/SmartGrowth/Multifamily.

Placing and retaining schools in already developed neighborhoods can also conserve land and reduce sprawl. More investment in community schools can promote more walking and biking to school and reduce demands on the transportation network to bus students to and from school while encouraging physical activity. Community-centered schools build connections in the community and help create stronger neighborhoods with greater social cohesion. Co-locating schools with other public services, such as health clinics, senior centers, senior housing, childhood development centers, day care, after-school programs, and employment services can more efficiently use space, reduce the cost of vital public services, and promote intergenerational engagement. Other types of services may be explored, such as non-profits or perhaps a community college or recreation center. Greening schoolyards can provide communities with beneficial natural amenities. Studies have found that students surrounded by nature have better learning outcomes.[16]

Centers

Connections 2050 supports smart growth by focusing new development in more than 125 Centers across the region. 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 2050 identifies seven Center types based on their geography and local context. Each Center type has unique characteristics, assets, challenges, and needs. Table 8 outlines the definitions and attributes for each type of Center, Figures 18 and 19 identify locations of various Centers throughout the DVRPC region.

- METRO CENTER: Central business districts of Philadelphia and Camden.
- METRO SUBCENTER: Areas with a magnitude of jobs and commercial activity.
- SUBURBAN CENTER: Developed, auto-oriented, largely single-use corridors that generally have more jobs than residents.
- TOWN CENTER: Mix of high-density residential and commercial uses, a thriving downtown or main street, and a strong sense of place; frequently surrounded by traditional suburban residential development.
- RURAL CENTER: Contain higher-density land uses and often an identifiable downtown or main street; usually surrounded by rural or agricultural land uses.
- PLANNED CENTER: Newly constructed Town Center developments that often incorporate traditional neighborhood development and a mix of uses
- NEIGHBORHOOD CENTER: Walkable, recognizable places with a mix of commercial, retail, anchor institutional, and residential activities within the larger urban setting.

[16] Terrapin Bright Green LLC, *The Economics of Biophilia: Why Designing with Nature in Mind Makes Economic Sense* (New York: Terrapin Bright Green, 2012), http://www.terrapinbrightgreen.com/wp-content/uploads/2012/06/The-Economics-of-Biophilia_Terrapin-Bright-Green-2012e.pdf.

Table 8: CENTERS DEFINITIONS

Attributes	METRO CENTER	METRO SUBCENTER	SUBURBAN CENTER	TOWN CENTER	RURAL CENTER	PLANNED CENTER	NEIGHBORHOOD CENTER
Includes the region's central business district(s)	x						
Contains leading academic and medical institutions, and major tourist and entertainment destinations	x						
Has a magnitude of jobs and commercial activity	x	x					
Large area represented by a developed corridor			x				
Can cross municipal boundaries	x	x	x				
Primarily defined by single-use districts, such as office, retail, and light industrial, although there may be efforts to increase mixed-use space in these communities			x				
Generally has more jobs than residents and tends to be auto dependent		x	x				
Consists of a contiguous area				x	x	x	x
Has a mixture of high-density residential and commercial uses	x			x			
Has a minimum of both six people per acre and three jobs per acre				x	x		
Is generally served by transit	x			x	x		x
May display a unique history and sense of place	x			x	x		x
Often identifiable by a thriving downtown or main street that is pedestrian friendly and transit oriented				x			

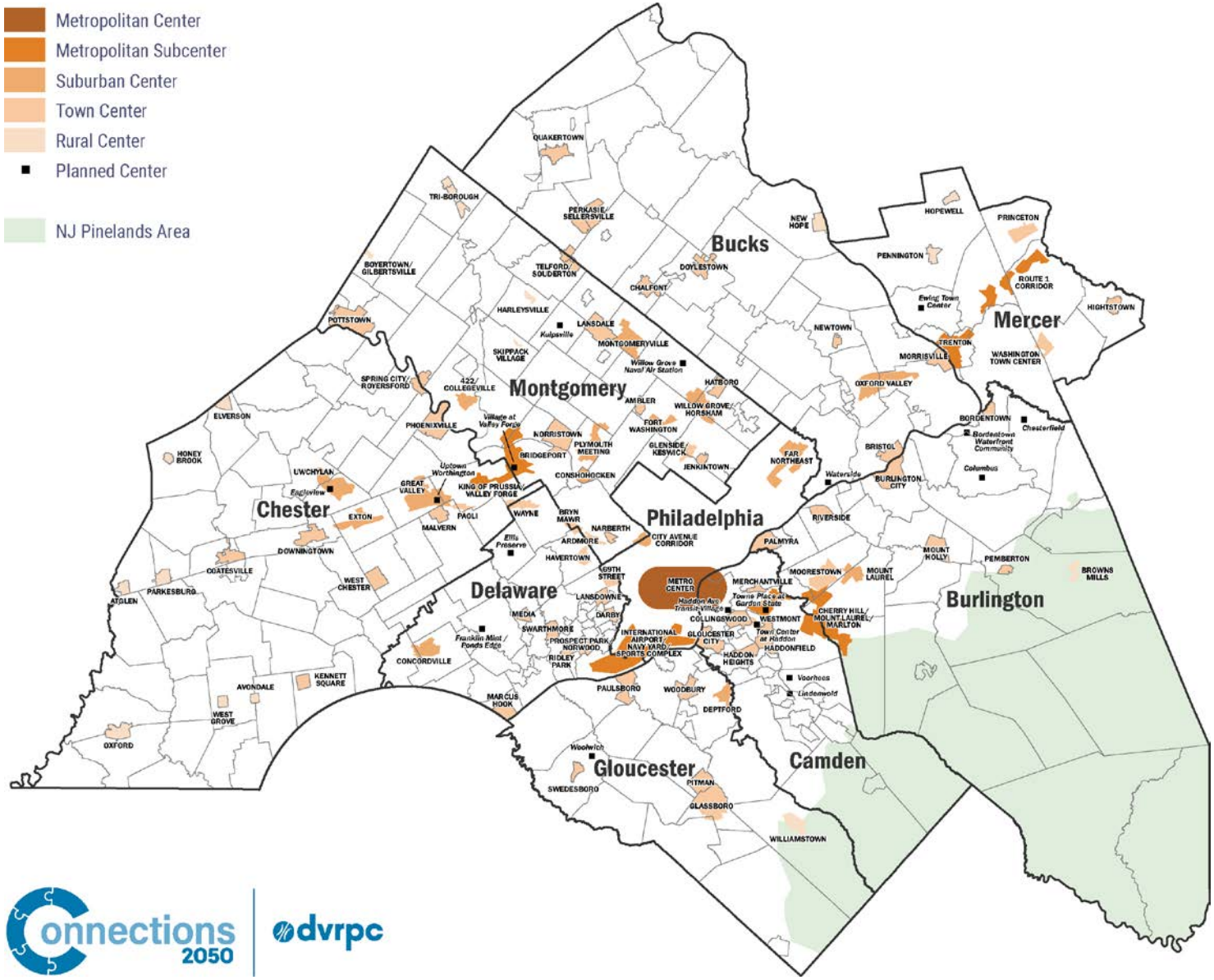
Attributes	METRO CENTER	METRO SUBCENTER	SUBURBAN CENTER	TOWN CENTER	RURAL CENTER	PLANNED CENTER	NEIGHBORHOOD CENTER
Generally surrounded by traditional suburban residential development			x	x			
Has, or will have, a mix of land uses	x			x	x	x	x
Has, or will have, higher density than the surrounding area	x	x	x	x	x	x	x
Often has, or is planning for, a smaller-scale downtown or main street					x	x	
Usually surrounded by rural or agricultural land uses					x		
Plans for traditional neighborhood development that supports transit and walkability						x	
Embedded within the region's Core Cities of Philadelphia, Trenton, Camden, and Chester							x

Source: DVRPC, 2021.

DVRPC worked with its county planning partners to update the Centers in *Connections 2050*. The update used a general guideline that a Town or Suburban Center should have a minimum of 10,000 residents plus jobs—or an anticipation of reaching that number by 2050—to rise to regional prominence. Two new Centers were added in Chester County for this plan update: Uwchlan as a Suburban Center, and Eagleview as a Planned Center. Two new Centers were added in Delaware County: Concordville as a Suburban Center and Pond's Edge/Franklin Station as a Planned Center. Burlington County added Old York Village (the Chesterfield transfer of development rights receiving site) as a Planned Center. The Spring Mill section of Whitemarsh Township was added to the Conshohocken Town Center in Montgomery County.

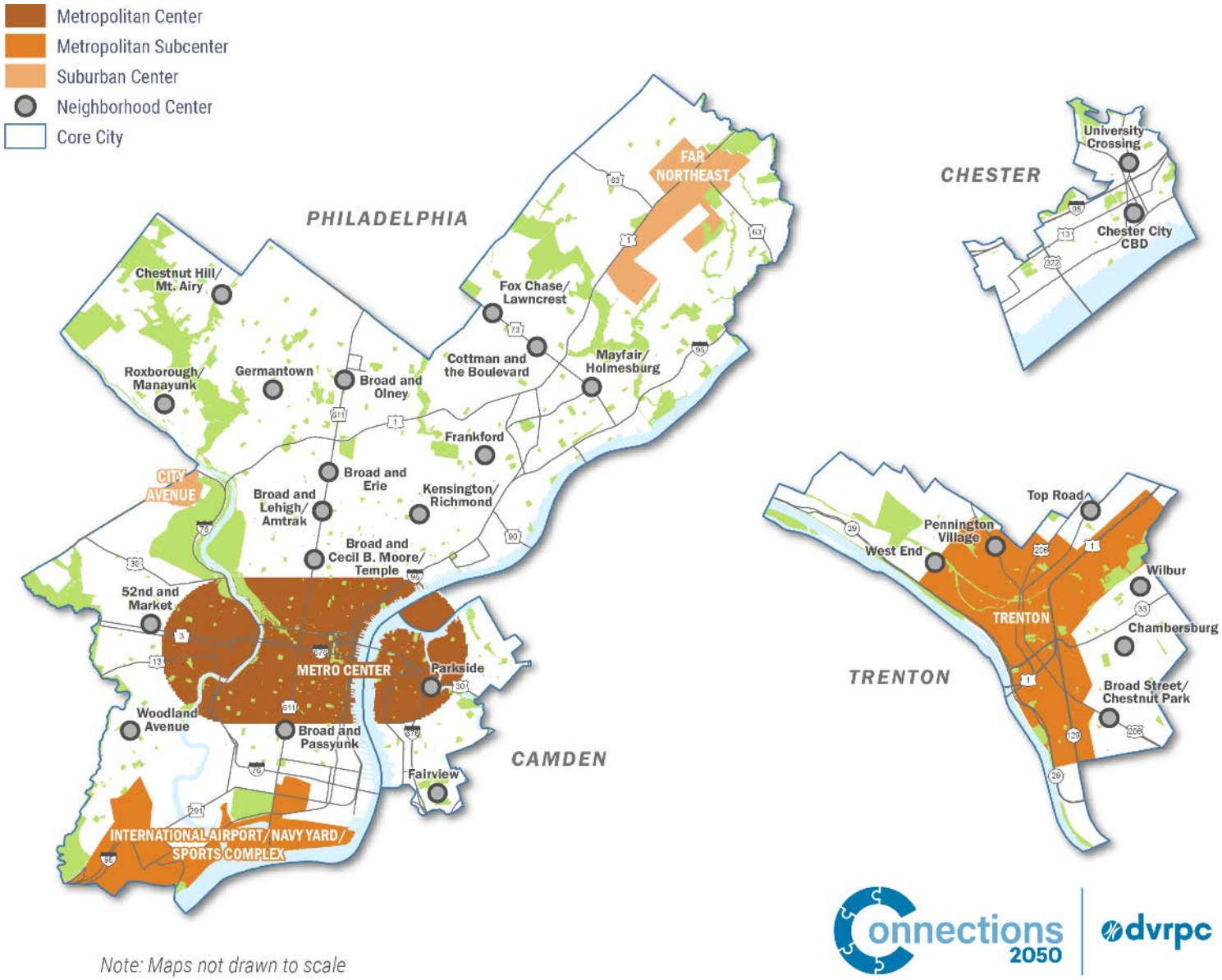
In the next Plan update, the DVRPC will take a new look at Centers, particularly in light of the post-pandemic world. There is a need to reconsider goals for Centers and what policies can help to achieve those goals. Some preliminary ideas for improving Centers analysis and policy are to: make Center definitions more quantitative, consider whether it would be useful to add other types of Centers, characterize Centers by their development status in addition to type, determine what additional data about Centers would be useful to track, and refine the goals and strategies for Centers to go beyond their current role of primary locations for regional development.

Figure 18: PLANNING CENTERS



Sources: DVRPC, 2021; NJ Pinelands Commission, 2020.

Figure 19: CORE CITIES AND NEIGHBORHOOD CENTERS



Source: DVRPC, 2021.

Planning Areas

Greater Philadelphia is a complex mosaic of 351 diverse cities, boroughs, and townships. Separate from Centers, four geographic typologies are used for generalized regional trend analysis. Known as Planning Areas, these aggregations of municipalities with some shared characteristics provide some coarse insights into current and past conditions.

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.

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.

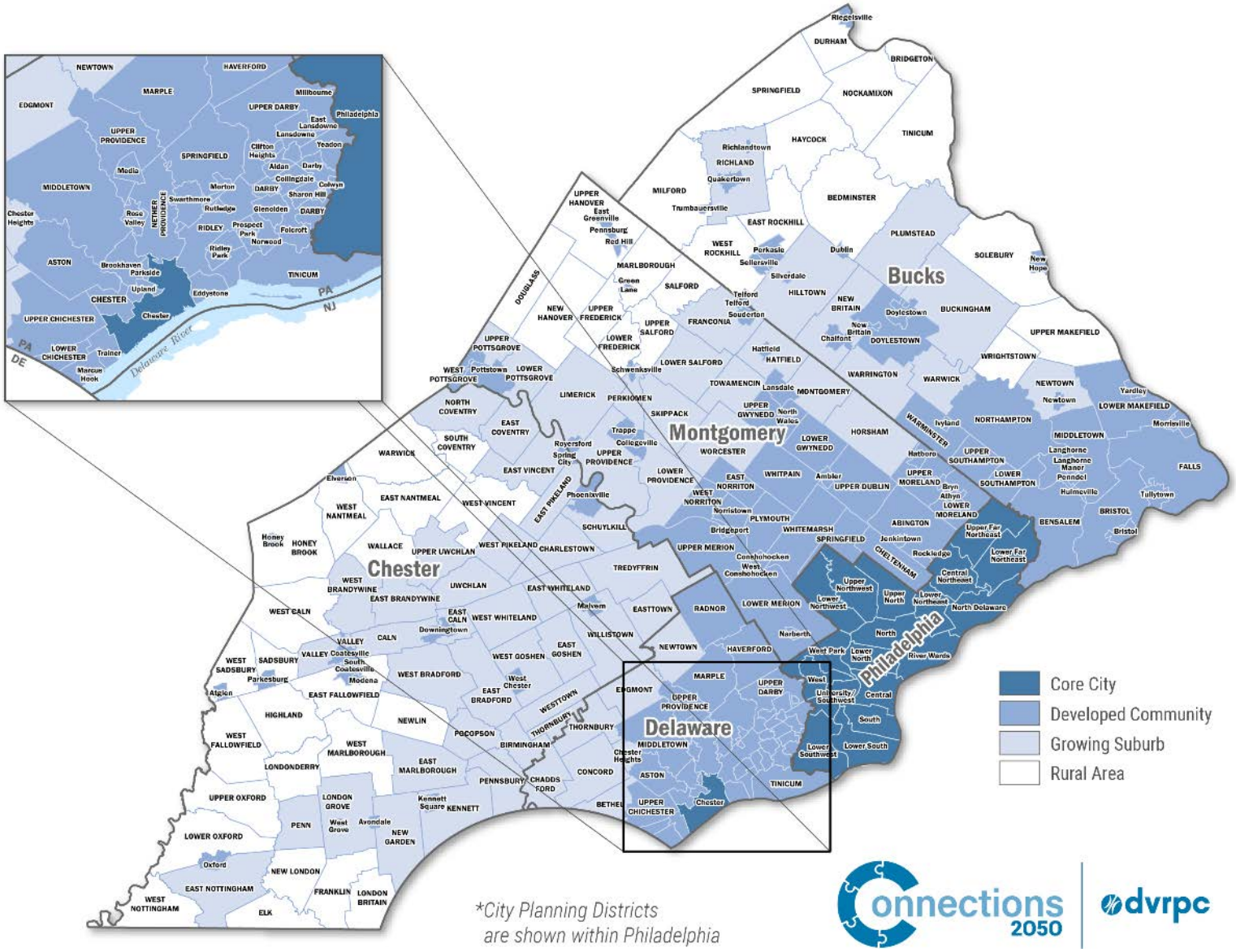
Growing Suburbs are communities that have many developable acres remaining and are experiencing—or are forecasted to experience—significant population and/or employment growth. Key planning policies in these communities often focus on growth management, open space preservation, congestion management, 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.

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 make these areas unique.

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 characteristic of a Growing Suburb. Although Planning Areas are a guide for policy direction at the regional scale; actual approaches should always be guided by local conditions.

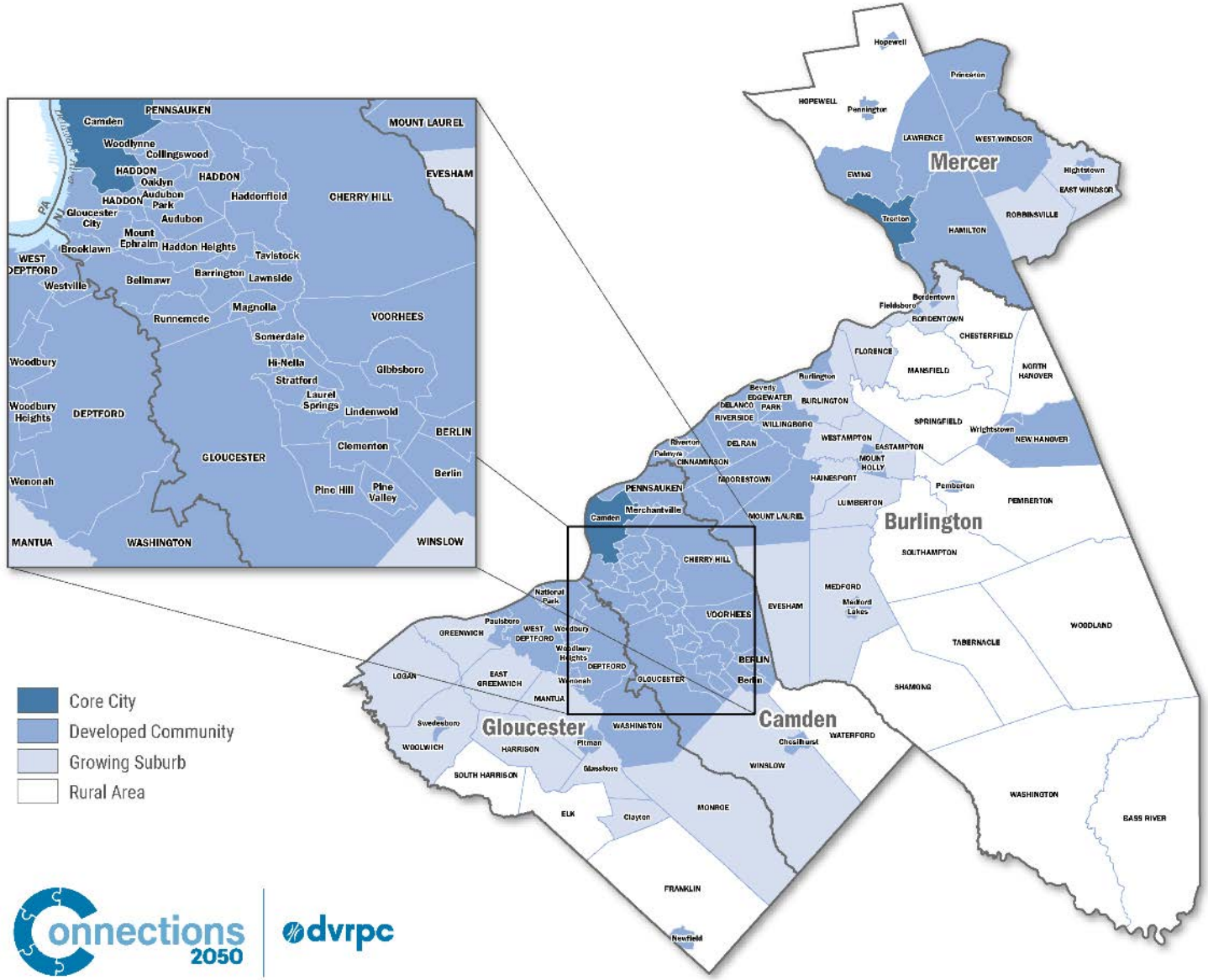
Figures 20 and 21 display the Planning Area typologies applied to Greater Philadelphia's 351 municipalities.

Figure 20: PENNSYLVANIA PLANNING AREAS



Source: DVRPC, 2021.

Figure 21: NEW JERSEY PLANNING AREAS



Source: DVRPC, 2021.

Historic Resources and Landscapes

Greater Philadelphia's rich past is reflected in the variety and number of historic and cultural resources throughout the region. From indigenous archaeological sites to early Swedish settlements, and from the colonial-era row houses of Society Hill to the dozens of pre–20th century towns and villages that dot our landscape, 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, buildings, 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, and are crucial in establishing the "sense of place" that is simultaneously a key ingredient and outcome of Centers-based development.

Despite sustained efforts by non-profit organizations, government agencies, and local governments to identify, protect, preserve, rehabilitate, and restore the region's historic and cultural resources, these resources continue to be threatened by demolition, neglect, encroaching sprawl, incompatible land uses, poor planning, and insensitive design. The loss of these resources undermines key aspects of the Centers-based development philosophy, such as utilizing existing infrastructure, creating and celebrating a community's unique character, and enhancing human-scaled development patterns that promote walking and biking as viable transportation alternatives.

Transportation projects, in particular, 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 network itself, and maintenance and care are needed to ensure their preservation. To ameliorate these impacts, federally funded transportation agencies must follow federal historic preservation 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. 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.

Energy and Climate Change

Global climate change caused by human activity is, arguably, the most significant long-term threat to human civilization. The overall warming of the Earth has resulted in higher temperatures, increased damage and flooding due to more intense storms, and sea level rise.[17] These changes have already disrupted life in the region and will continue to do so on a larger scale, unless immediate action is taken globally to reduce and eliminate the emission of the GHGs responsible for the change in our climate.

DVRPC's Regional Energy Use and Greenhouse Gas Emissions Inventory—conducted every five years since 2005—estimates that in 2015, the region produced gross GHG emissions equivalent to 75.3 million metric tons (MMT) of CO_2.[18] Of this, 66.5 MMT was attributable to combustion of fossil fuels to produce energy, and an additional 2.9 MMT was attributable to fossil fuel refining, transmission, and distribution. This makes over 92 percent of gross regional GHG emissions attributable to fossil fuels. DVRPC's 2018 publication Municipal Management in a Changing Climate documents historic climate change in Greater Philadelphia, presents projections for the future climate, and provides an overview of some of the actions municipalities can take to prepare for climate change. Addressing the cause of climate change requires a reinvention of the way we produce and use energy, moving away from fossil fuels to low- or no-carbon sources.

The region must also adapt to the impacts of climate change that are already occurring. Over the past few decades, it has gotten noticeably warmer in Greater Philadelphia. This warming is projected to continue for the foreseeable future, with temperatures 3°F to 9°F higher at the end of this century compared with the start, regardless of how GHG emissions change. In general, extreme weather—heat, cold, heavy

Pennsylvania Department of Environmental Protection's (PA DEP) Climate Change Advisory Committee

DVRPC participates as a member of the PA DEP Climate Change Advisory Committee (CCAC). The CCAC is charged with advising the PA DEP on implementing Act 79, the Pennsylvania Climate Change Act. This committee helps guide the development of the Commonwealth's Climate Change Action Plan.

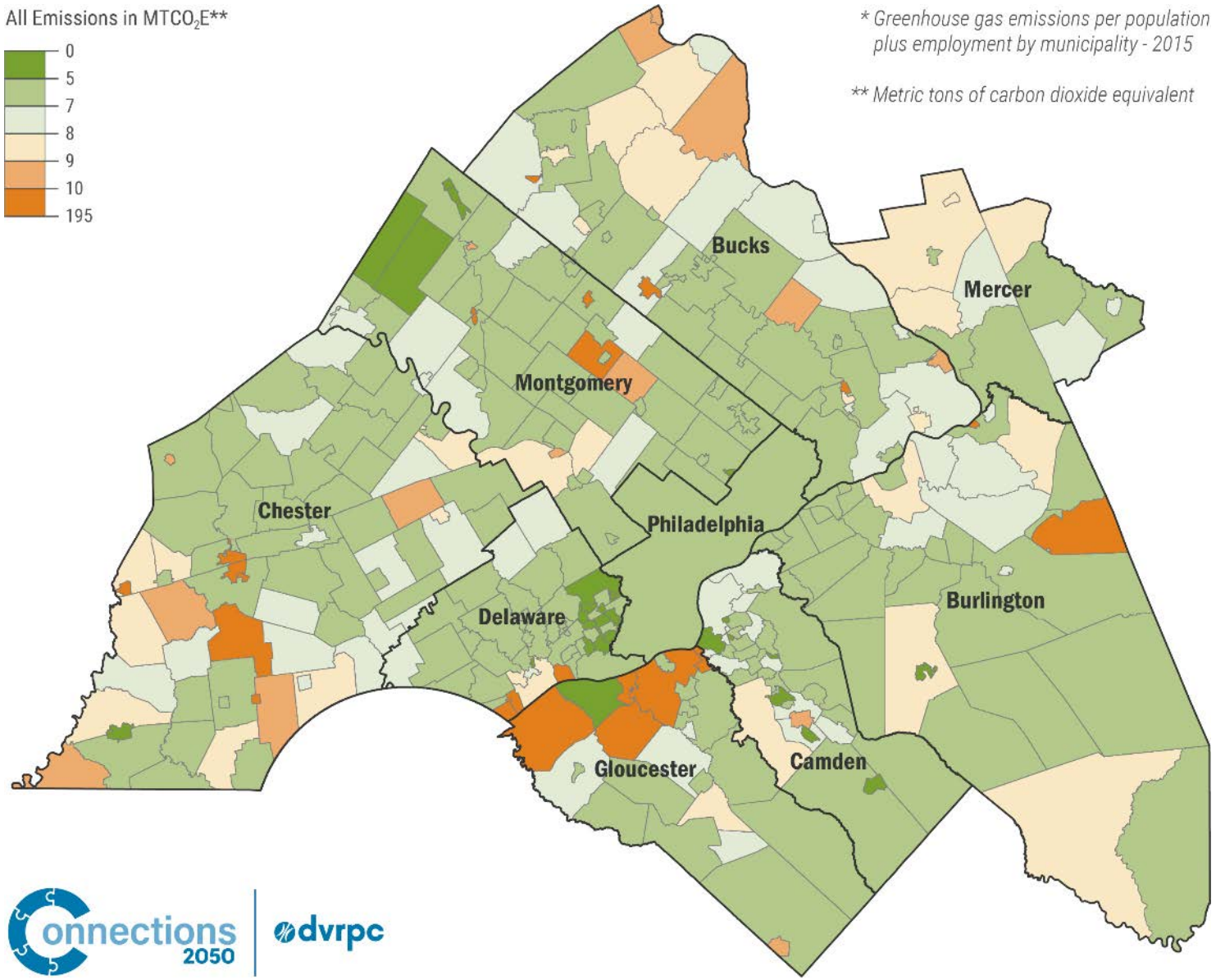
Local Climate Action Planning

DVRPC supports a wide range of local climate action planning. This includes providing data from DVRPC's inventory work, coordinating and advising, and drafting material. This work is carried out with partner organizations, including the PA DEP's Local Climate Action Planning program, Sustainable Jersey, the Montgomery County Consortium of Communities, and the Sierra Club's Ready for 100 program.

[17] NASA's website is a good source of reliable information on global climate change: the evidence, causes, effects, and solution. See https://climate.nasa.gov. Another excellent source is the Fourth National Climate Assessment. Volume I, assessing the physical science of climate change, is available at https://science2017.globalchange.gov/. Volume II, *Impacts, Risks, and Adaptation in the United States*, is available at https://nca2018.globalchange.gov/

[18] DVRPC, *Energy Use and Greenhouse Gas Emissions Inventory for Greater Philadelphia* (Philadelphia: DVRPC, 2018), https://www.dvrpc.org/Reports/18018.pdf.

Figure 22: GHG EMISSIONS PER CAPITA AND EMPLOYMENT BY MUNICIPALITY (2015)



Source: DVRPC, 2018.

precipitation, and drought—has increased and is expected to increase more. Climate change presents planners in Greater Philadelphia with two major tasks: Mitigation (i.e. the reduction of GHG emissions) and Resiliency, or Adaptation (i.e. preparing the region for the ongoing and projected changes to the region's climate), both immediately and in the long term.

Figure 22 shows GHG emissions per capita and employment by municipality for 2015. DVRPC is actively engaged in multiple initiatives to plan comprehensively for both reducing GHG emissions and for preparing for the impact.

Mitigation: Reducing GHG Emissions

Reducing GHG emissions is essential to slowing, halting, and even reversing climate change. Any reduction in GHG emissions today will reduce the extent and impact of future climate change. The general consensus among climate scientists is that, in order to keep the climate stable and able to support human and natural systems in a recognizable way, global emissions of GHGs need to reach zero by the year 2050. *Connections 2050* establishes a goal of reducing greenhouse gas emissions in Greater Philadelphia to net zero by the year 2050 and preparing communities for the impacts of climate change (see *Connections 2050 Policy Manual*). This exceeds the New Jersey goal to reduce statewide GHG emissions to 80 percent below 2006 levels by 2050, as well as the Pennsylvania goal to reduce GHG emissions to 80 percent below 2005 levels by 2050. It is, however, in line with the Biden administration's stated GHG reduction goal.[19]

Achieving any of these goals will require strong national and state leadership, the strong support of the business community, significant technological breakthroughs, and changes in our culture. DVRPC is one of many government agencies needed to participate in GHG reduction efforts and can play some core roles in transportation and local government. There are two broad approaches to this task: (1) using less energy through efficiency and conservation, and (2) generating electricity or power using cleaner sources.

Energy Efficiency and Conservation

Reducing the demand for energy is one effective way to reduce GHG emissions-associated energy use. Reducing energy demand can be accomplished by increasing the efficiency of the process that uses energy, or by using less of the process that requires energy. Examples of energy efficiency include replacing a gasoline vehicle with an electric vehicle (EV) or an incandescent lamp with a Light-Emitting Diode (LED) lamp. Both provide their service (transportation or light) using much less energy. An example of energy conservation would be to run several errands in one car trip rather than multiple trips, or to turn down the thermostat controlling heating in a building. Both actions reduce the demand for the service provided by energy.

Mobile Energy

Mobile energy use produces close to 31 percent of regional GHG emissions. As a transportation-focused agency, this is the area where DVRPC's work can have perhaps the greatest impact. There are many DVRPC projects and programs that have the effect of reducing mobile energy use, either as the primary goal or as one of many benefits.

[19] On the first day of his administration, President Biden fulfilled his promise to rejoin the Paris Agreement and set a course for the United States to tackle the climate crisis at home and abroad, reaching net zero emissions economywide by no later than 2050. "FACT SHEET: President Biden Sets 2030 Greenhouse Gas Pollution Reduction Target Aimed at Creating Good-Paying Union Jobs and Securing U.S. Leadership on Clean Energy Technologies," The White House, April 22, 2021, https://www.whitehouse.gov/briefing-room/statements-releases/2021/04/22/fact-sheet-president-biden-sets-2030-greenhouse-gas-pollution-reduction-target-aimed-at-creating-good-paying-union-jobs-and-securing-u-s-leadership-on-clean-energy-technologies/.

Transportation Electrification

Electric Vehicles (EVs) use significantly less energy than equivalent gasoline or diesel-powered vehicles. Because they are so much more efficient, EVs produce less GHG emissions than their fossil fuel counterparts—even though fossil fuels are used, in part, to generate the electricity they use. The absence of tailpipe emissions and overall lower emissions are also beneficial to the region's air quality.

DVRPC works closely with both Pennsylvania and New Jersey to promote, improve, and simplify the opportunities for fleet owners and individuals in the region to move to EVs. These include active participation in Drive Electric PA,[20] and developing the Planning for Electric Vehicles - Mapping Vehicle Distribution and Workplace Charging Demand web map.

DVRPC initiated and hosts the Interagency Battery Electric Bus Dialogue, an information-sharing forum that brings together 11 of the largest U.S. transit agencies to share and discuss concerns and successes in a secure, vendor-free environment. DVRPC also advises counties and municipalities directly on the transition to EVs in their fleets, providing an Electric Vehicle Resource Kit for Municipalities.

Other DVRPC Projects and Programs Related to Mobile Energy

Many of the strategies required to reduce GHG emissions have many other benefits as well. These include efficient use of resources, growth patterns that minimize commuting, promotion of public transit infrastructure, efforts to reduce transportation-related air pollution, efficiency in goods movement, improving infrastructure for walking and cycling, and working to reduce overall transportation demand. All reduce energy required to travel, help reduce sprawl, make neighborhoods more walkable, and reduce congestion on roads. Major DVRPC activities in these areas include:

- providing ongoing support and collaboration with regional partners to encourage bikeshare program coordination across municipal and county boundaries;
- promoting growth patterns that minimize commuting by car, enhance walkability, and encourage transit-oriented development;
- supporting public transit infrastructure;
- ensuring that transportation investments are tied to long-term land use and environmental goals;
- efforts to improve transportation-related air pollution, which also serve to reduce GHG emissions;
- promoting efficiency and GHG reductions in goods movement; and
- improving infrastructure for walking and biking.

[20] Drive Electric Pennsylvania Coalition," PA DEP, www.dep.pa.gov/Business/Energy/OfficeofPollutionPrevention/State-Energy-Plan/Pages/Drive-Electric-PA-Coalition.aspx.

Stationary Energy

Stationary energy use (primarily heating, cooling, lighting, and powering equipment) produces just over 60 percent of regional GHG emissions created from both the direct on-site combustion of fossil fuel and to the energy used to produce the electricity use. Although DVRPC's work is primarily focused on transportation-related energy, the agency carries out several activities directly related to reducing stationary energy use.

Producing Cleaner Electricity

Using cleaner fuels to produce electricity not only reduces GHG emissions but also reduces air pollution and its negative effects on public health. The degree to which electrification contributes to GHG reduction depends on the success of reducing GHG emissions from electricity generation itself. As the region shifts to using electricity for heating and cooling buildings, moving vehicles, providing heat for industrial processes, and other uses, it is critical that the electricity used comes from clean sources.

The production of electricity used in Greater Philadelphia has been made significantly cleaner over the past decade. The primary reason for this has been a switch to natural gas-fired generators from coal-fired generators. This switch was made largely as a result of price drops in natural gas stemming from increased supply from hydraulic fracturing. Although natural gas is a fossil fuel that burns more cleanly than coal, it cannot be a long-term solution for electricity production if the region is to meet its GHG emissions goals.

There are ways to generate electricity without GHG emissions. The largest of these is nuclear power, which provides about 40 percent of the region's electricity supply. In addition, electricity can be generated using natural resources that are not finite. These are generally referred to as *renewable energy sources*. Major sources of renewable electricity include photovoltaic (PV) panels (solar power), windmills (wind power), and hydroelectric dams (hydropower). All of these sources produce electricity with no GHG emissions or air pollution and low overall environmental impacts.

One challenge for many renewable energy sources is that they are intermittent by nature. Solar power is not produced at night, and

Regional Streetlight Procurement Program (RSLPP)

LED streetlights, traffic signals, and exterior lighting present an excellent opportunity for municipalities to reduce energy use and operating costs while improving public safety. DVRPC's RSLPP pools the decision-making and purchasing power of municipalities so that they can confidently and cost-effectively access the resources needed to complete an LED street and exterior lighting project. To date, 61 municipalities have participated in the RSLPP, resulting in the conversion of more than 40,000 streetlights. Altogether, these conversions will result in $26.6 Million in net savings over the life of the projects and 8,430 Metric tons of CO2 emissions saved annually. DVRPC will launch a third round of the RSLPP in 2021.

Energy Management in Municipal Buildings

In 2013 and 2014, DVRPC worked with nine municipalities in southeastern Pennsylvania to provide direct technical assistance to measure, analyze, and develop implementation strategies for energy management in municipal buildings. DVRPC and municipalities identified opportunities to improve how energy is used in a green facility, prioritized these improvements, and published the results in *Municipal Energy Management: Best Practices from DVRPC's Direct Technical Assistance Program* (2016).

production is reduced on cloudy days; wind power is not produced when the air is still. Some of this can be addressed by battery storage and demand reduction. However, storage available today is only sufficient to address generation disruptions lasting a few hours. Ongoing research may result in affordable, longer-term storage availability in the coming decades for suppliers and end users.

Until long-term storage is available, generation that can be turned on when needed will be required. Right now, in Greater Philadelphia, this "dispatchable" power is provided by nuclear power (which does not produce GHG emissions but does present national security and radioactive waste challenges) and by burning natural gas or coal. One issue in meeting regional emissions goals is ensuring that, should the amount of nuclear power decrease, it is replaced with other GHG-free generation rather than with natural gas power plants.

Deploying Solar Power in Greater Philadelphia

Renewables continue to expand their contribution to the electricity generation mix but still account for only about 5 percent of the electricity used in Greater Philadelphia. Solar PV accounts for a very small amount of the electricity that is used in the region. As of August 2020, there were 912.29 MW of solar PV installed in the New Jersey counties of the DVRPC region and 123.36 MW of solar PV installed in the Pennsylvania counties of the region. To help speed solar PV adoption, DVRPC has been active in promoting, improving, and simplifying the opportunities for solar power in the region.

DVRPC has developed separate solar PV deployment goals for each state. Both Pennsylvania and New Jersey have existing goals and aspirations for solar PV development included as part of their statewide planning and support PV development in different ways. New Jersey is considered one of the top five states for solar growth potential by the Solar Energy Industries Association; Pennsylvania ranks 19th. The New Jersey Energy Master Plan (2019) has a goal to ensure at least 75 percent of electricity demand is met by carbon-free renewable generation by 2050 and has modeled that the state could most cost-effectively meet this goal by building 32 GW of in-state solar, 11 GW of offshore wind, and 9 gigawatts (GW) of storage. Thirty-two GW of solar is an eight-fold increase in solar PV generation in New Jersey over this time period, and this increase was applied to the New Jersey portion of Greater Philadelphia. *Finding Pennsylvania's Solar Future* (2018) was a planning process that modeled the statewide sale of electricity generated from solar power and set a goal for 10 percent of total statewide electricity sales by 2030. *Connections 2050* establishes a goal to increase the installed capacity of solar PV to 8 GW by 2050 in the New Jersey subregion and 4.3 GW by 2030 in the Pennsylvania subregion.

Background on the Goal and Potential Barriers

Generation of electricity from renewable resources like solar energy plays an important role in reducing GHG emissions in Greater Philadelphia. The use of solar PV in the region has the potential to benefit the local economy by producing well-paying jobs, and the electricity generated by solar PV has the potential to be more resilient and less susceptible to disruption than fossil-fueled sources of electricity. Solar PV installations can also reduce electricity costs for homes and businesses. Local governments, such as counties and municipalities, play an important role in supporting the development of solar PV as a distributed resource that offsets the demand for grid electricity, as well as the development of large-scale solar PV, which produces electricity that is sold directly into the grid's electricity supply.

Local zoning and building regulations, and electrical permits for solar PV projects, can increase the installed cost of a solar PV system. Non-hardware costs like regulation compliance associated with distributed solar PV installations can make up more than 65 percent of the installed cost of solar PV. Onerous permitting procedures alone, for instance, can add $700 to the installed cost of a solar PV system. The

Municipal Support for Solar PV

DVRPC's Renewable Energy Ordinance Frameworks were developed to serve as a resource for municipalities as they develop and update ordinances to govern the siting of small-scale renewable energy systems in their communities. The purpose of these frameworks is to provide clear, consistent guidance on how to construct renewable energy ordinances that are consistent with state laws; are not overly restrictive or contradictory to the nature of renewable energy systems; and promote safe and sound community development. Renewable Energy Ordinance Frameworks have been developed for solar PV, geothermal power, and wind power.

SolSmart is a national designation program that provides a framework for municipalities, counties, and regions to reduce soft costs and take action to become more supportive of solar PV in their communities. Local governments and regions that achieve the appropriate actions under SolSmart become designated as *solar friendly*. DVRPC has served as a SolSmart Advisor to 17 local governments in the region and, in 2020, was awarded the program's Regional Bronze Designation.

Solar Foundation has found that streamlining local regulatory processes can reduce the cost of a typical residential rooftop system by $2,500. Regionally consistent and streamlined permitting, inspection, and zoning processes that support distributed and even large-scale solar PV can reduce the time and cost of developing and installing solar PV. Conversely, inconsistent and overly restrictive or cumbersome local regulatory processes add time and cost to a solar PV installation project.

Counties and municipalities can lead by example by procuring electricity for their operations from both large- and small-scale solar PV. Local governments can also stay engaged in state-level and utility conversations on the development of policies, incentives, and regulations that support the development and use of solar PV and solar PV installations that include battery storage in Pennsylvania and New Jersey. Some of these state-level interventions that impact solar PV include the adoption of commercial property-assessed clean energy, community solar legislation, joining the Regional Greenhouse Gas Initiative, and the inclusion of larger solar PV carve-outs in the state's renewable portfolio standards. All of these can provide funding, financing, and/or contracting pathways that allow for more widespread adoption of solar PV.

DVRPC can support the local governments in their role as solar PV stewards by providing regionally consistent guidance on best practices for permissive solar PV regulations, supporting local governments with procuring solar PV for their operations and facilitating residential group-purchase programs, and staying engaged in state and utility conversations related to solar PV regulations and incentives.

Resiliency: Preparing for Climate Change Impacts

Even the most concerted global action to reduce emissions will inevitably have little impact on the climate change that is forecasted to take place between now and 2050. This is because most of the change we can expect in the next several decades is the result of historic GHG emissions. Accordingly, our region must prepare for the impacts of climate change over the life of this plan regardless of how successful we will be in reducing emissions.

Climate change impacts will include increased episodes of extreme heat, more freeze-thaw cycles, more intense precipitation events, increased flooding, sea level rise, and more powerful storms. These

changes will have implications for multiple sectors, including transportation, energy, water, agriculture, housing, and public health. Plans for adapting to these changes should include both shorter- and longer-term strategies. In the short term, providing cooling centers, maintaining existing stormwater facilities, installing GSI, raising and hardening infrastructure, increasing urban greening, protecting open space, and preparing neighborhoods and communities to respond to extreme weather events will be required. Preparing for longer-term climate change may also require relocating communities and major infrastructure to be out of harm's way.

Fortunately, adapting to climate change builds on a wide variety of regional initiatives and strategies already in place as part of the Plan. These include GSI, landscape-level conservation, urban greening, floodplain management, smart growth, ecological restoration, and asset management. Existing plans and protocols for hazard mitigation, emergency management, and municipal operations can also be employed to address acute threats, such as the occurrence of extreme weather events. Taken together, these efforts will help communities become more resilient to the impacts of climate change.

Preparing the Region for Extreme Heat

Temperatures are projected to rise due to global climate change. The Union of Concerned Scientists has projected that there will be 10–15 days with a heat index above 105°F in the region by mid-century. Extreme heat is the deadliest of all climate-related disasters in the United States, but it will not be felt equally across the region. Neighborhoods without access to parks and other green spaces will be exposed to the most dangerous levels of heat. These areas are known as *heat islands*, and they tend to house the region's most vulnerable residents. Municipalities and counties will need to address heat islands and implement heat response plans in order to protect residents from rising temperatures through 2050.

Municipal Implementation Tools

To assist DVRPC's local government partners, DVRPC has published Municipal Implementation Tool #33 – Municipal Management of Extreme Heat. This document outlines the main drivers of extreme heat in the region, how to identify heat islands and heat-vulnerable populations, and strategies for reducing heat islands and responding to heat waves.

Heat island reduction strategies have many co-benefits. Beyond lowering temperatures, these strategies often reduce air pollution, energy use, and stormwater runoff. The five main interventions municipalities can implement to reduce heat islands are:

1. planting and maintaining trees and vegetation;
2. cool roofs;
3. green roofs;
4. cool pavements; and
5. shade structures and water features.

These interventions can be implemented through a combination of plans, ordinances, programs, and incentives. Even with heat island reduction measures, extreme heat events will still occur. There are many ways in which municipalities and counties can act to protect their residents and infrastructure during extreme heat events including:

1. forecasting, monitoring, and notifying residents of extreme heat events;
2. educating residents on the dangers of extreme heat and ways to stay cool; and
3. responding to heat waves by opening cooling centers, fortifying electricity and water infrastructure, restricting heat-vulnerable

transportation infrastructure, and implementing community buddy programs.

DVRPC is committed to providing technical assistance to counties and municipalities for identifying heat islands and vulnerable populations, heat island mitigation strategies, and heat response plan formation as a way to protect the region from extreme heat.

Transportation

The vision for the future of transportation infrastructure in Greater Philadelphia has, for many plan iterations, centered on achieving and maintaining a State of Good Repair (SGR) for all existing facilities—consistent with both Pennsylvania and New Jersey state DOTs—as well as integrating modes through network connections and multimodal strategies to expand access to opportunity for everyone, and focusing on safety in line with state targets: in short, maintaining and modernizing our transportation system. *Connections 2050* takes the additional step of solidifying the region's commitment to safe travel within the region by adopting a Vision Zero policy, which aims to systematically eliminate preventable traffic crashes through equitable engineering, education, and enforcement while prioritizing speed control and maintaining and modernizing the transportation network.

Safety and Vision Zero

Vehicle crashes are currently the single leading cause of death in the United States for all persons between 8 and 24 years of age. In Greater Philadelphia, there has been an increase in Individuals Killed or Seriously Injured (KSI) between 2015 and 2019. The 433 people killed in crashes in 2018 was the highest total in the region since 2007.

This has been driven, in part, by a steep increase in crashes involving pedestrians and bicyclists. Because bicyclists and pedestrians are especially vulnerable when involved in crashes, fatalities among those populations are of special concern. Unfortunately, bicyclist and pedestrian KSI is rising in the region. Fatalities and serious injuries suffered by bicyclists and pedestrians made up 23 percent of the regional totals in 2019.

The risk of being hurt or killed in a traffic crash is a public health crisis that impacts everyone, and certain communities are especially vulnerable. In Greater Philadelphia, low-income and minority communities, referred to as *Communities of Concern*, bear a disproportionate burden of high-crash roadways in their communities.[21] Traffic volumes in 2020 reduced dramatically as a result of virus-related travel restrictions, yet traffic fatalities and serious injuries did not drop similarly, resulting in an unprecedented increase in the rate of crashes per VMT.[22] This break from the typical pattern underscored that crashes are not simply "the cost of doing business" and that more emphasis is needed to protect all road users. Beyond the trauma and sorrow that result from a fatal crash, traffic fatalities also have significant economic costs. The FHWA estimates that there is a cost of approximately $11.3 million per fatality and $655,000 per serious injury resulting from a crash.[23]

In response to the alarming crash rates and KSI trends, there has been significant regional momentum toward a greater focus on safety, specifically by adopting Vision Zero policies. Originally introduced in Sweden, Vision Zero departs from traditional approaches by recognizing that human error is inevitable and must be compensated

[21] DVRPC, *Crashes and Communities of Concern in the Greater Philadelphia Region* (Philadelphia: DVRPC, 2018), https://www.dvrpc.org/Reports/18022.pdf.
[22] "First Look at 2020 Traffic Fatality Rates Shows Sharp Spike," Sam Schwartz, August 31, 2020, https://www.samschwartz.com/staff-reflections/2020/8/31/first-look-at-2020-traffic-fatality-rates-shows-sharp-spike.
[23] Tim Harmon, Geni Bahar, and Frank Gross, *Crash Costs for Highway Safety Analysis*, (Washington, DC: FHWA, 2018), https://safety.fhwa.dot.gov/hsip/docs/fhwasa17071.pdf.

for through system design and supported by policy, education, and enforcement. Cities and MPOs across the nation have embraced Vision Zero as a way to elevate safety needs and prioritize safety projects. The Biden administration-proposed American Jobs Plan includes funding to improve road safety for all users, including increases to existing safety programs and a new Safe Streets for All program to fund state and local Vision Zero plans and other improvements to reduce crashes and fatalities, especially for cyclists and pedestrians.

Locally, Philadelphia adopted a Vision Zero policy[24] in 2017, establishing an executive task force and developing a five-year action plan. Other organizations adopting or endorsing Vision Zero in the region include Greater Mercer Transportation Management Association (TMA), Greater Mercer Public Health Partnership,[25] Central Jersey Transportation Forum, and DVRPC's RSTF. Both New Jersey and Pennsylvania have adopted Strategic Highway Safety Plans (SHSPs) supporting their vision Toward Zero Deaths—a national strategy that is data driven and focuses on identifying and creating opportunities for changing our highway safety culture. There is also a growing number of Complete Streets policies throughout the region meant to ensure that facilities are designed and operated to enable safe use and support mobility for all users.

As part of the Plan's development, DVPRC's RTC Financial Planning Subcommittee supported the adoption of a Regional Vision Zero policy (RVZ 2050). Achieving Regional Vision Zero will require coordination among regional partners, guided by data and analysis. Having set a goal of zero deaths by 2050, it will be necessary to track progress toward that goal and make data-driven assessments of what strategies are working to achieve it. Critically, safety must be a priority in all roadway funding decisions. For instance, in a prelude to adopting Regional Vision Zero, DVRPC's stakeholder-driven 2019 update of the TIP-LRP Benefit Criteria—a tool used to inform regional transportation investment decisions—elevated crash safety to the highest-weighted criteria. Using this tool helps to promote capital transportation investment projects that have substantive safety benefits and advances Long-Range Plan safety goals.

RVZ 2050 also provides the context needed to pursue regional safety targets to meet FHWA's Fixing America's Surface Transportation Act (FAST Act) Transportation Performance Management (TPM) safety requirements (see Appendix B). The safety targets initiative requires establishing baseline data and crash reduction targets, and measures progress toward meeting those targets. This process requires collaboration among regional and state stakeholders to address areas of concern for fatalities and serious injuries within the metropolitan planning area, and to advance substantive transportation safety projects to protect the traveling public from crash risk.

DVRPC's Transportation Safety Analysis and Plan (TSAP) analyzes regional crash data to determine the primary causes of serious crashes in the region. The TSAP measures trends using the American Association of State Highway and Transportation Officials' Safety Emphasis Area framework.[26] TSAP 2021 will incorporate FHWA's Safe System approach, which builds on Vision Zero's acknowledgement of human vulnerability and recognizes that responsibility for improved safety must be shared among road designers, auto manufacturers, and others and is not limited only to system users. Departing from the traditional categories like engineering, education and enforcement—the "3 Es"—as strategy areas, the Safe System philosophy incorporates the 3 Es into the categories of Safe People, Safe Roads,

[24] Philadelphia Vision Zero, http://visionzerophl.com/.
[25] Greater Mercer Public Health Partnership, https://healthymercer.org/.

[26] FHWA, "Chapter 3 – SHSP Content," in *Strategic Highway Safety Plans: A Champion's Guidebook to Saving Lives*, 2nd ed. (Washington, DC: FHWA, 2013), https://safety.fhwa.dot.gov/shsp/guidebook/ch3.cfm.

Safe Speeds, Safe Vehicles, and Post-Crash Care. TSAP, within the context of RVZ 2050, will identify crash areas of over-representation, which will be the focus of targeted interventions moving forward.

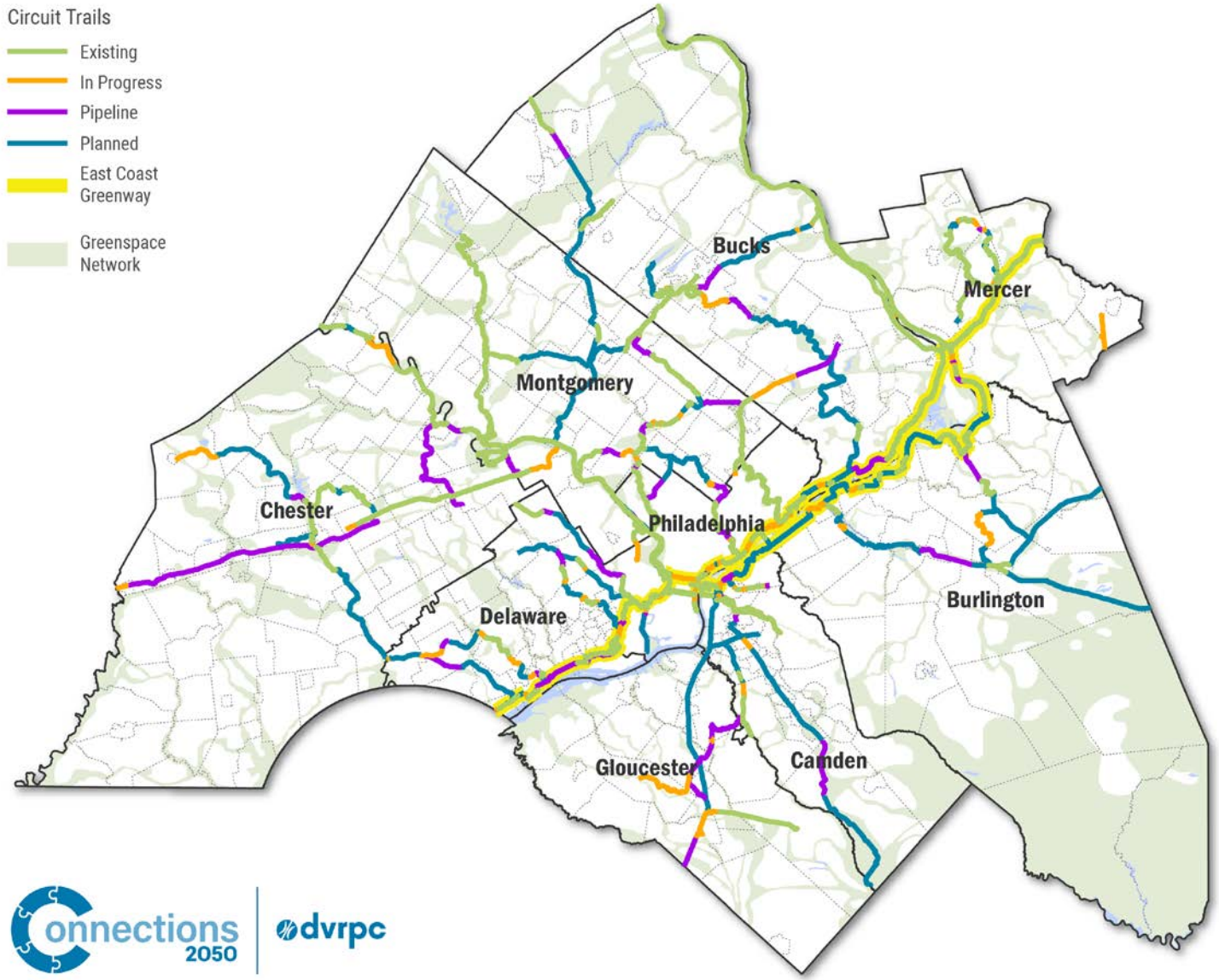
Biking and Walking

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. The recent COVID-19 pandemic showed a spike in pedestrian and bicycle activity, both as a means of transportation and of exercise. Capitalizing on that growth is critical to creating lasting commitment to walking and biking. Such a commitment to walking and biking would have equity benefits as well. Transportation investments that focus only on vehicles perpetuate racial injustice by making transportation access about the financial privilege of owning a car. Walking and biking, conversely, are equitable modes of transportation: walking is free, and biking has minimal costs. Both modes improve health outcomes for all people. As a result, pedestrian planning and the consideration of pedestrian needs are integral elements of nearly all regional planning activities.

An increase in shorter trips made by bicycle or on foot could be achieved if safer and more comfortable accommodations were provided regionally. These shorter trips could contribute to achieving individual and environmental health goals. 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, where appropriate, accommodate pedestrians, bicyclists, transit, freight vehicles, and cars, and allow for maximized modal choice and mobility.

Improving bicycling and walking conditions is important not just for on-road accommodations but also on off-road and trail settings. Utilizing a unique partnership of private foundations, county governments, state agencies, and the Pennsylvania and New Jersey DOTs, the region is actively leveraging tens of millions of dollars initially provided by the William Penn Foundation to build significant pieces of transportation infrastructure. The Circuit Trails Coalition is a collaboration of more than 80 non-profit organizations, foundations, local governments, and agencies working to complete a connected network of multiuse trails across the Greater Philadelphia region. Today, 355 miles of the 827-mile network are complete and connect to a larger system of local trails. The Circuit Trails Coalition has a goal of reaching 500 miles of completed trails by 2025 (see Figure 23).

Figure 24: THE CIRCUIT MULTIUSE TRAIL NETWORK



Source: DVRPC, 2021.

With continued investment, the Circuit will be a network unlike any other in the country— connecting urban, suburban, and rural communities with dedicated non-motorized rights-of-ways separated from vehicular traffic. The network 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 to infrastructure and changes in policy that facilitate greater local mobility and regional access. Programs that assist municipalities in planning, designing, and implementing facilities, through an access to transit focus or temporary installations, should be continued. These policies include an emphasis on bicycle- and pedestrian-friendly engineering solutions, and the provision of educational programs for cyclists, pedestrians, and drivers.

Greater Philadelphia Pedestrian Portal

DVRPC is undertaking this multilayered project with the goal to help communities build more sidewalks to the places we need to go. The Greater Philadelphia Pedestrian Portal's interactive map of sidewalk inventory data identifies gaps in the region's pedestrian facilities, priorities for the most crucial improvements, and recommendations for how to fill in those gaps so that neighborhoods throughout the region can become more connected.

Regional Transit Screening Platform

The Regional Transit Screening Platform contains a set of screening tools that shed light on public transit needs and opportunities in the DVRPC region. It was designed in collaboration with a broad array of regional stakeholders to generate and evaluate ideas for service, operational, and capital improvements that could be considered for further study. Four distinct analyses, displayed as separate web maps and tools, are available to answer specific questions regarding transit planning in the DVRPC region:

- Where are the gaps in the transit network?
- Where should efforts to improve transit reliability be focused?
- Where is there potential latent demand for higher-frequency transit service?
- Where can rail station accessibility improvements have the greatest impact for wheelchair users?

Maintaining these web maps and tools with updated data is critical to their relevance and usefulness. Efforts have been made to script and document these analyses to streamline future updates. Since the initial release in 2019, the wheelchair accessibility analysis has been updated to reflect newly accessible stations, and an update to the surface transit reliability analysis to reflect updated ridership information is in the works. As more new data, updated bus routes, and newer versions of the regional transit model are released, updates will be scheduled as warranted.

Equity through Access (ETA)

The ETA project is DVRPC's update of the region's Coordinated Human Services Transportation Plan (CHSTP). ETA seeks to improve economic and social opportunity in the region by expanding access to essential services for vulnerable populations: those who are more critically impacted by barriers and gaps in infrastructure, service coordination, and policies. Vulnerable populations are individuals who are low income, seniors, physically disabled, mentally disabled, and more likely to be transit dependent than the general population. *Essential services* are defined as destinations needed to meet a standard quality of life and include places of employment, grocery stores, schools, medical facilities, recreation/open space areas, senior centers, and centers for the developmentally disabled. This project responds to the changing CHSTP funding landscape and looks for new ways to promote accessible, affordable, and safe mobility.

ETA focuses on developing and prioritizing projects that may be funded outside of traditional CHSTP funding sources, such as section 5310 or New Jersey Job Access Reverse Commute funding. ETA has engaged local governments; human services agencies; non-profits; transportation providers; advocates; and low-income, senior, and disabled users to identify unmet mobility needs and service gaps, recommend new or different kinds of transportation access solutions, and enable more people to access social and economic mobility. It has two main project components as required by the FTA: an ETA Map Toolkit and a *Gaps and Bridges* plan document.

The ETA Map Toolkit is a web map that demonstrates disparities in access to essential services like hospitals, health clinics, recreational spaces, senior centers, and more in the Greater Philadelphia region. Users can view layers representing different datasets, 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.

The 2020 Gaps and Bridges Update is an outline of issues and needs that vulnerable populations face in accessing essential services. This document was informed by research on best practices for accessibility and feedback from stakeholders during the project outreach process. "Gaps" are factors in the region that constrain access to transportation or mobility for vulnerable populations. "Bridges" are potential solutions, based on case studies and expert opinion, aimed at developing more comprehensive and effective regional transit service and multimodal infrastructure. Gaps and Bridges are the priority needs and strategies for the ETA project and form the basis of the CHSTP.

Transportation Asset Management (TAM)

Greater Philadelphia has a network of transportation infrastructure that is aging and in need of major preservation investments. In conjunction with a long-term goal of rebuilding and modernizing transportation infrastructure, DVRPC's long-range planning process has long been rooted in performance-based planning and programming (PBPP) and TAM. The intent of PBPP is to ensure targeted investment of federal transportation funds by increasing accountability and transparency and providing for better investment decisions that focus on key outcomes. TAM is the strategic and systematic practice to optimize transit capital asset procurement, operation, inspection, maintenance, rehabilitation, and replacement to manage life cycle performance, risk, and cost in order to provide safe, cost-effective, and reliable transportation service. TAM places value in understanding the negative impacts of deferred maintenance and the positive outcomes of optimized investment decisions that improve SGR. Discussions of both road and transit performance measures and targets must be included in the statewide and metropolitan long-range plans.

Connections 2050 continues to focus heavily on the tenets of TAM. The Plan was developed using indicators to gauge progress toward regional goals, scenarios that consider alternate futures, and investments that were selected using project evaluation criteria that are based on regional and Long-Range Plan goals, including asset management, safety, and system reliability. TAM also relates to many of the goals and the vision set in the Plan: reducing resource use, pollution, and waste; improving the efficiency of the existing transportation network; better integrating modes; and developing walkable communities. Successfully implementing TAM requires using resources more efficiently to reduce an agency's environmental footprint, managing waste responsibly, building and supporting healthy places, and becoming more resilient to prepare for climate change.

Roadway TAM

Each state DOT is required to produce a Transportation Asset Management Plan (TAMP), which aligns the performance of roadway assets with the value they provide to road users. It uses data-driven decision making to guide a process for setting a desired SGR and managing progress toward it. A roadway TAMP must set four-year targets for FHWA asset management transportation performance measures and include a discussion on the DOT's progress in meeting these identified targets.

PennDOT's first TAMP was submitted in 2018, with the first four-year update due in April 2022. To help guide their asset management activities, PennDOT has developed a bridge asset management system called BridgeCare—an open-source, enterprise-level code that applies lowest life cycle cost (LLCC) logic to bridge deterioration, treatments, costs, and improvements—and a pavement asset management system (PAMS). LLCC maximizes an asset's life at the lowest cost by using a risk-based prioritization process of preservation, rehabilitation, and reconstruction that identifies the most appropriate treatment at the necessary time. The emphasis is on preserving assets in fair condition before fixing the worst assets.

BridgeCare and PAMS were used to generate regional pavement and bridge investment needs through 2050. Bridgecare estimates that the region will need to invest about $550 million (in 2021 $s) per year in bridge maintenance projects to remain in an SGR. Currently, the Pennsylvania TIP is investing about $180 million, and the Plan aims for $250 million per year. This long-term underfunding of bridges will likely mean a substantial increase in deck area in poor condition and many closed bridges by 2050l

The federal TPMs and the TAMP were the drivers for PennDOT's increase in funding to the Interstate Management Program (IMP) over time. The IMP received an additional $150 million in FY2021, plus another $50 million for the following six years to reach a total of $1

billion per year by FY2027. This is not new money, it is generated by reducing funding for each regional Transportation Improvement Program (TIP) throughout the Commonwealth, which will impact the maintenance and improvement of Non-Interstate facilities.

NJDOT submitted its initial TAMP in 2019. Somewhat unique among state DOTs, NJDOT controls just 61 percent of NHS pavement and 47 percent of NHS bridge deck area. Transportation authorities maintain 23 percent of NHS pavement and 51 percent of bridge deck area. Local governments maintain 16 percent of NHS pavement and 2 percent of bridge deck area. NJDOT is developing bridge and pavement management software programs to better model bridge and pavement deterioration and the effectiveness of certain improvements. One early result of the TAMP is increased funding levels for pavement improvement projects in the statewide TIP.

Transit TAM

Although federal requirements call for more consideration and dialogue on the impacts of different transit investments on system conditions, they do not tie federal funding to impacts. DOTs and transit agencies are required to submit an annual report to FHWA identifying system conditions through four performance measures. Every four years, they must update a TAMP to manage assets across their entire life cycle. Transit agencies and MPOs are required to set transit condition performance measure targets and submit annual reports on the progress achieved toward them for each asset category (equipment, vehicles, infrastructure, and facilities) in the TAMP. A transit TAMP must also include an asset inventory. Transit operators must submit system condition data annually and identify performance targets for the following year to the National Transit Database (NTD). The Southeastern Pennsylvania Transportation Authority (SEPTA), New Jersey Transit (NJ TRANSIT), and the Delaware River Port Authority (DRPA)/Port Authority transit Corporation (PATCO) submitted their respective TAMPs to FTA by October 1, 2018.

SEPTA's TAMP will develop the data and support investment decisions needed to achieve goals like rebuilding the system and resource management. SEPTA continues to prioritize the replacement and renewal of infrastructure and vehicles; however, SGR projects require a careful balance between operational impacts and other strategic initiatives. SEPTA has developed a systemwide asset management database. This database tracks more than 6,000 assets for their age, useful life remaining, and cost of renewal and replacement activities. SEPTA bundles together SGR projects so as to minimize passenger and operations disruptions.

NJ TRANSIT has prepared an Enterprise Asset Management Program TAMP that sets forth its blueprint to identify, describe, and improve asset management practices, with the vision to maintain the agency's assets in an SGR. The TAMP presents a summary inventory of assets, describes the current condition of the assets, sets near-term targets for the required performance measures, and explains how NJ TRANSIT managers develop and present requests for operating and maintenance budgets and capital asset replacements. It also identifies NJ TRANSIT programs and projects aimed at helping to achieve TAM and TPM targets.

DRPA/PATCO's TAMP includes a blueprint to identify, describe, and improve asset management practices, with the vision to maintain the agency's assets in an SGR. It also identifies their programs and projects aimed at helping to achieve their TAM targets.

Transportation Infrastructure Resiliency to Climate Change

One major threat to maintaining an SGR throughout the region is climate change. Transportation infrastructure systems and operations are vulnerable to climate hazards, including extreme heat, freeze-thaw cycles, intense precipitation, winter precipitation, sea level rise, and powerful storms. These weather-related events can and do result in both short- and long-term disruptions to the transportation system, such as temporary congestion caused by intense precipitation,

pavement buckling during episodes of extreme heat, or a road washout that may take months or years to fix. To minimize these risks, transportation engineers build transportation systems to withstand local weather and climate by referring to historical weather records, especially extreme weather events. For example, bridges are often designed to withstand storms that have a probability of occurring only once or twice every 100 years.

However, due to climate change, historical climate is no longer a reliable predictor of future risk. Heat waves will likely be more severe, sea level rise will amplify storm surges in coastal areas, and precipitation will likely be more intense. These changes increase the risk of delays, disruptions, damage, and failure across our land-, air-, and water-based transportation systems. Since most transportation infrastructure being built now is expected to last for 50 years or longer, it is important to understand how future climate might affect these investments in the coming decades. Moreover, almost all of Greater Philadelphia's transportation infrastructure was built before future climate change was considered. Accordingly, PennDOT, NJDOT, transit operators, and other transportation infrastructure managers need to incorporate climate change projections into their transportation operations and maintenance programs moving forward. To this end, PennDOT, NJDOT, SEPTA and others have already begun assessing the vulnerability of their assets to climate change, both to inform operations and maintenance of existing assets, and to construct new assets that account for future climate change. This work is necessary to ensure the continued reliability and adaptability of the transportation system over time. In some extreme cases, it may be necessary to consider abandoning or relocating assets that can no longer be protected.

Other dimensions of daily transportation operations will also be affected by climate change. For example, increased episodes of extreme heat will make pedestrian and bike travel more uncomfortable and will also impact those walking to, or waiting outdoors at, transit stops. Transportation operators and local governments can respond to these impacts by constructing transit shelters that provide shade, or by planting street trees that provide shade along sidewalks or other areas with high levels of bicycle or pedestrian traffic.[27]

Limiting Transportation Impacts on the Natural Environment

Although climate can cause major disruptions to the transportation network, transportation also has significant impacts on the environment. These include direct impacts from the construction and operation of transportation facilities, such as water pollution, increased rates and volumes of stormwater runoff, air pollution, GHG emissions, noise pollution, barriers to the movement of wildlife, and impacts to cultural and historic resources. Transportation systems also impact the environment indirectly: the construction and expansion of transportation facilities is part and parcel of sprawling development patterns that convert natural areas, woodlands, and farms into residential and commercial areas, further fragmenting and disrupting natural processes.

Strategies to address these problems include the use of GSI to capture and cleanse rainfall runoff; enhanced culverts and bridges to facilitate the movement and passage of wildlife; incentives to increase the use of less-polluting and non-motorized modes of transportation; and policies to limit the expansion of new highway capacity into rural areas while focusing new development in existing cities, towns, and villages. DVRPC works to identify and minimize conflicts between transportation and the environment throughout its transportation project development

[27] See DVRPC's Municipal Implementation Tool #31, *Municipal Management in a Changing Climate.*

process. To this end, DVRPC employs an environmental lens in all of its transportation studies and plans, and utilizes PennDOT Connects and the Capital Project Screening process in Pennsylvania and New Jersey, respectively, to provide and document early-stage environmental reviews of candidate projects for the TIP. These reviews enable planners to identify potential threats to environmental resources, as well as opportunities to avoid and minimize those threats before a project advances to final design.

When unavoidable environmental impacts occur in the execution of transportation projects, DVRPC can utilize its knowledge and extensive partnerships to help guide mitigation efforts. The Land Use Vision identifies broad priority areas for preservation and restoration where larger-scale mitigation projects, including potential wetland banking projects, should be focused. In addition, DVRPC partners regularly with county and state natural resources specialists, numerous land trusts and conservancies, and private mitigation firms to inform our natural resource and conservation planning. These relationships well position DVPRC to convene discussions around potential mitigation sites and projects.

Transportation System and Congestion Management

Transportation agencies are facing trends of growing demand for travel with less funding and space available. Congestion has the potential to significantly impact a region's economic competitiveness. In 2019, the average auto commuter in the Greater Philadelphia region lost 142 hours due to congestion, ranking third among regions nationally.[28] This costs the average commuter about $2,102 a year in fuel consumption and time lost. The costs are even greater when considering delays in the movement of goods. Reducing congestion has historically been accomplished by expanding capacity. More recently, however, it has been shown that widening roads induces additional users, curtailing progress on mobility. It also encourages auto dependence and can become a barrier to pedestrians and other right-of-way users. Transportation planners now must expand their focus from solely building and preserving transportation infrastructure to actively managing and operating the existing network as efficiently as possible to meet user demands.

Congestion Management Process (CMP)

DVRPC systematically manages congestion in Greater Philadelphia with a CMP. It helps facilitate the efficient movement of people and goods through analysis and enhanced coordination, as well as through specific multimodal strategies for all locations in the region. The CMP uses performance-based and other objective measures to advance the Plan's goals and strengthen the connection between the Plan and the TIP. Federal regulations require projects that add single-occupancy vehicle (SOV) capacity be consistent with the CMP in order to be eligible for federal funding (See Figure 24).

Objectives set in the CMP relate to the transportation goals of the Long-Range Plan, including "increasing mobility and reliability, while reducing congestion and vehicle miles traveled" within the transportation network. CMP transportation system objectives include:

- minimizing growth in recurring congestion and improving mobility
- improving reliability;
- improving accessibility including providing transit where it is most needed;
- maintaining the existing core transportation network,
- improving safety;

[28] INRIX, 2021. https://inrix.com/press-releases/2019-traffic-scorecard-us/.

- maintaining goods movement;
- improving security and maintaining transportation preparedness for major events;
- integrating federal Performance Measure Rule 3 (PM3) system performance, freight, and CMAQ performance measures;
- supporting DVRPC Long-Range Plan land use and other principles; and
- advancing equity and fostering diversity.

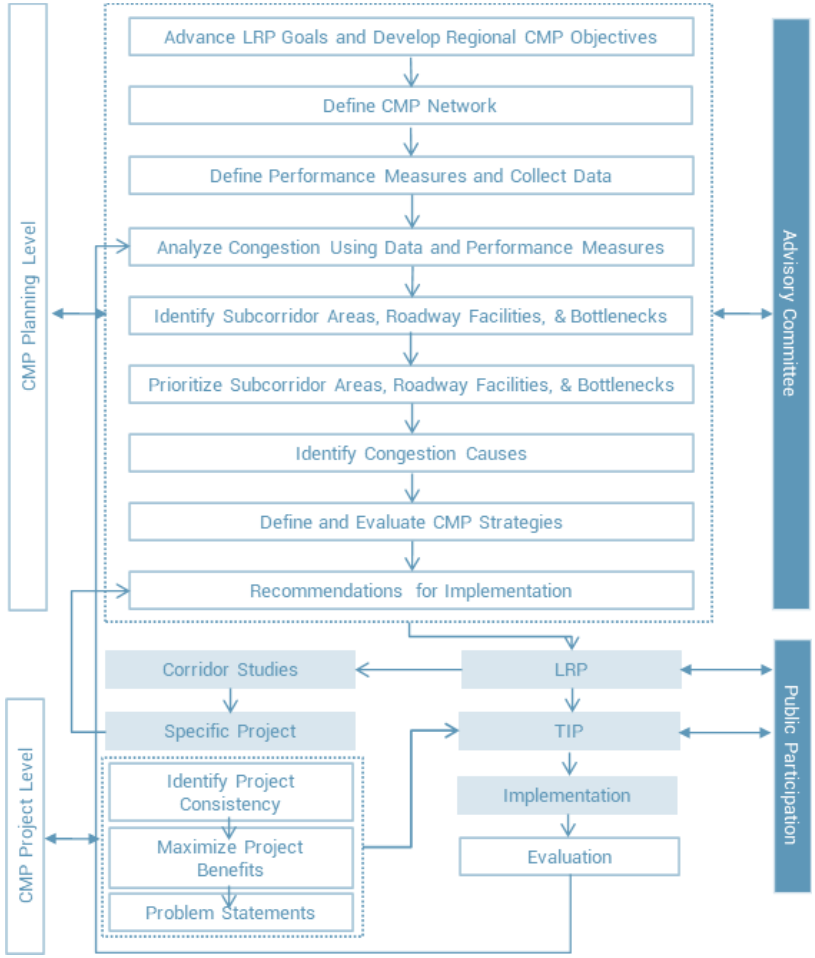
Types of Congestion

Congestion occurs when demand for road space exceeds supply. The U.S. DOT defines *congestion* as "the level at which the transportation system performance[29] is no longer acceptable due to traffic interference." Sources of congestion vary, and mitigation strategies differ, depending on the source of congestion (see Figure 25).

There are two primary types of congestion: recurring and non-recurring. Recurring congestion tends to be concentrated in shorter time periods, such as rush hour, and is typically associated with excessive traffic volumes resulting in reduced speed and flow rate on the roadway network. Bottlenecks and poor signal timing are also recurring sources of congestion. Recurring congestion is identified using the Travel Time Index, which measures the ratio of peak-period average travel time to free-flow travel time (uncongested travel time) for a given roadway segment. This measure indicates locations that are highly congested on a recurring basis.

Non-recurring congestion is caused by irregularly occurring traffic events that affect travel time reliability, which is the source of approximately 60 percent of traffic congestion in major urban areas.

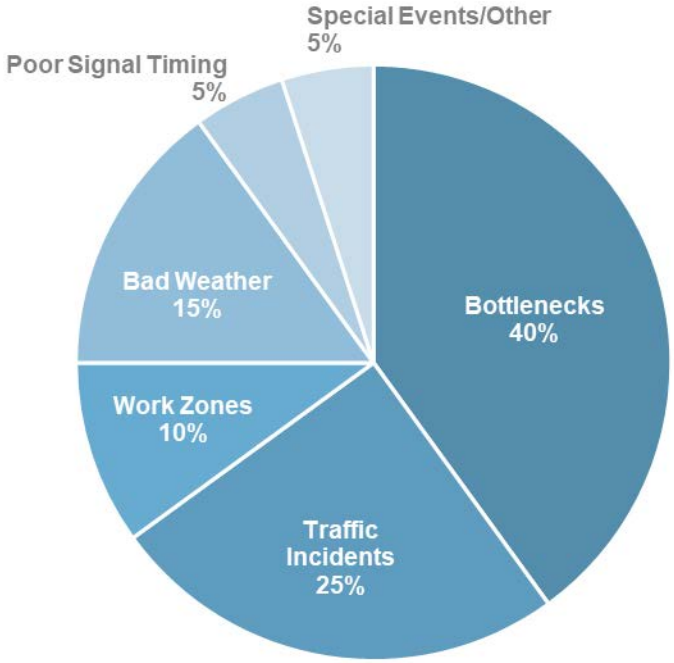
Figure 25: CMP PROCESS



Source: 2019 Congestion Management Process, DVRPC.

[29] Performance may vary by type of transportation facility, location, or time of day.

Figure 26: SOURCES OF CONGESTION NATIONAL SUMMARY



Source: Adapted from FHWA, 2021.

The causes of non- recurring congestion include traffic incidents (such as disabled vehicles, vehicle fires, or crashes), special events, adverse weather conditions, and work zones for short-term maintenance or construction projects. In 2019, about 61 percent of traffic events in the region were attributable to construction; 35 percent to traffic incidents; 1 percent to adverse weather[30]; and 3 percent to others, such as utilities and maintenance crews.[31] Non-recurring congestion is identified using the Planning Time Index (PTI), which measures the ratio of the peak-period 95th percent travel time[32] to the free-flow travel time for a given roadway segment. This measure indicates locations with highly unreliable travel times.

Travel time reliability, or the variability of congestion, is an important measure to evaluate as a part of non-recurring congestion. Traffic incidents can unexpectedly make the typical 20-minute trip a 40-minute one. Also, the interaction between multiple types and sources of congestion may vary from day to day, causing reliability issues for commuters. For example, high congestion levels can lead to increases in traffic crashes due to closer vehicle spacing. Adverse weather may lead to crashes, or to capacity reductions caused by lane submersion from flooding, snow accumulation, or wind-blown debris.

CMP Outcomes

Congestion and reliability measures help to identify the extent, intensity, and variability of congestion on the transportation network. The main data source used to inform these measures is INRIX XD travel time data, which was collected and processed on most roads in the region for every minute of every day for all of 2017 and analyzed over weekdays and peak time periods.

Most Congested Roadway Facilities

There are 276 roadway facilities identified in the DVRPC region (168 in Pennsylvania and 108 in New Jersey) that are ranked separately from

[30] Locations with the most reported adverse weather conditions in the region include portions of I-76 from I-676 (Vine Street Expressway) to the PA Turnpike in Philadelphia and Montgomery counties, and both I-76 from the Walt Whitman Bridge to I-295 and US 130 from I-76 to I-295 in Camden and Gloucester counties.

[31] Regional Integrated Multimodal Information Sharing System (RIMIS).

[32] The 95th percentile indicates that 95 percent of the travel times are less, and 5 percent more, and measures the variability or reliability of travel. A PTI of 1.00 means the trip time is consistently the same from day to day, while higher values mean more variation and congestion.

most to least in Peak Vehicle Delay[33] and Peak Volume Delay.[34] Facilities are weighed against other regional priorities and the region's extreme funding constraint. Table 9 lists the most congested focus roadway facilities, depicted in Figure 26.

Table 9: MOST CONGESTED FOCUS ROADWAY FACILITIES

Roadway Segment	From Limit	To Limit	Municipality	County
Pennsylvania				
I-676 (Vine Street Expressway)	I-76	I-95	Philadelphia	Philadelphia
I-76	I-676 (Vine Street Expressway)	US 30 (Girard Avenue)	Philadelphia	Philadelphia
I-76	US 30 (Girard Avenue)	US 1 (City Avenue)	Philadelphia	Philadelphia
I-95	Frankford Avenue	I-76 (Walt Whitman Bridge)	Philadelphia	Philadelphia
I-95	PA 90 (Betsy Ross Bridge)	Frankford Avenue	Philadelphia	Philadelphia
Market Street	Front Street	PA 611 (Broad Street)	Philadelphia	Philadelphia
PA 3 (Chestnut Street)	Broad Street	23rd Street	Philadelphia	Philadelphia
PA 3 (Walnut Street)	Broad Street	23rd Street	Philadelphia	Philadelphia
PA 3 (Walnut Street)	Front Street	Broad Street	Philadelphia	Philadelphia
US 1 (City Avenue)	US 30 (Lancaster Avenue)	I-76	Lower Merion, Philadelphia	Montgomery, Philadelphia
New Jersey				
CR 544 (Evesham Road)	US 30	CR 673	Magnolia, Lawnside, Voorhees	Camden
I-295	NJ 42 (Exit 26)	NJ 70 (Exit 34)	Various	Camden
I-676	Benjamin Franklin Bridge	I-76 (Walt Whitman Bridge)	Camden City	Camden
I-76	Walt Whitman Bridge	I-295	Camden City, Gloucester City, Bellmawr	Camden
NJ 168 (Black Horse Pike)	I-295	NJ 42	Gloucester City, Runnemede, Bellmawr	Camden
NJ 38	NJ 73	I-295	Maple Shade, Moorestown, Mt. Laurel	Burlington
NJ 41	NJ 42	US 30	Deptford, Runnemede, Barrington	Camden, Gloucester
NJ 41	NJ 70	NJ 38	Cherry Hill, Maple Shade	Camden, Burlington
NJ 73	NJ Turnpike (Exit 4)	NJ 70	Mt. Laurel, Evesham	Burlington
US 1	Alexander Road	County Line	West Windsor	Mercer

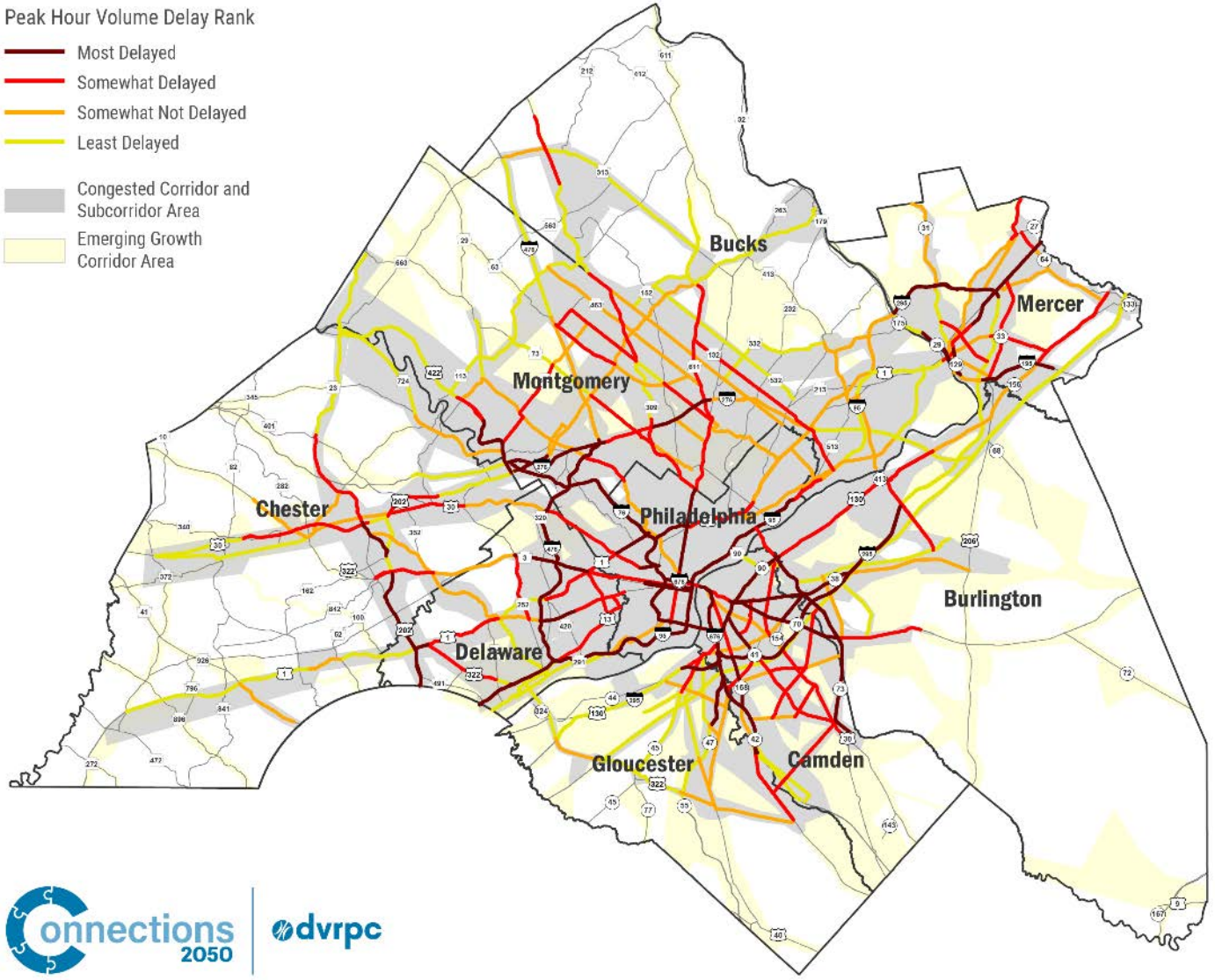
[33] Peak Vehicle Delay indicates the travel time or planning time delay by roadway segment, measured in seconds, which is the difference between the average peak-period travel time and the free-flow time.

[34] Peak Volume Delay indicates peak-period vehicle delay as a function of traffic volumes for the peak hour (7 percent of traffic flow for the AM, and 9 percent for the PM), measured in hours.

Roadway Segment	From Limit	To Limit	Municipality	County
US 1	I-295	Alexander Road	Lawrence, West Windsor	Mercer

Source: DVRPC, 2021.

Figure 27: MOST CONGESTED FOCUS ROADWAY FACILITIES



Source: DVRPC, 2021.

Most Congested Intersection Bottlenecks

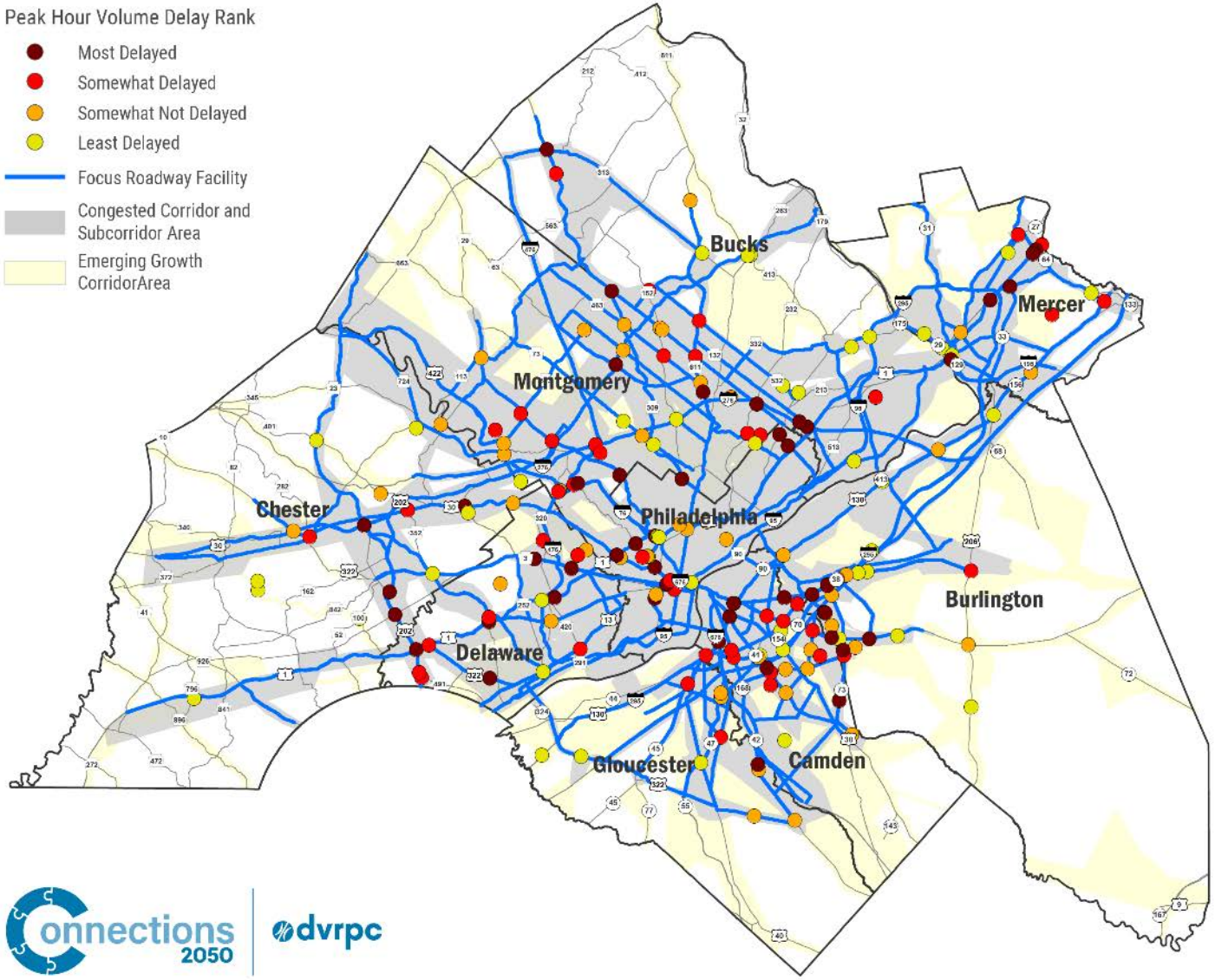
The CMP identifies and prioritizes roadway facilities that may not indicate significant levels of congestion but experience reduced mobility at one or more intersections and result in a bottleneck. There are 189 focus intersection bottlenecks identified in the DVRPC region (109 in Pennsylvania and 80 in New Jersey). Table 10 lists the most congested intersection bottlenecks, depicted in Figure 27. In addition to the most delayed bottlenecks, Figure 27 also shows intersections that experience lower-level delays.

Table 10: MOST CONGESTED FOCUS ROADWAY FACILITIES

Intersection Name	Municipality	County
Pennsylvania		
Byberry Road @ PA 532 (Bustleton Avenue)	Philadelphia	Philadelphia
PA 309 (Bethlehem Pike) @ Line Lexington Road	Hatfield Township	Montgomery
PA 309/Ogontz Avenue @ Cheltenham Ave	Cheltenham Township, Philadelphia	Montgomery; Philadelphia
Philmont Avenue /Tomlinson Road @ Pine Road	Lower Moreland Township	Montgomery
US 1 (Baltimore Pike) @ US 202 (Wilmington Pike)	Concord Township	Delaware
US 1 (City Avenue) @ PA 23 (Conshohocken State Rd)	Lower Merion Township, Philadelphia	Montgomery; Philadelphia
US 202 (DeKalb Pike) @ Sumneytown Pike	Lower Gwynedd Township	Montgomery
US 322 (Conchester Highway) @ Bethel Avenue	Upper Chichester Township	Delaware
New Jersey		
CR 535 (Old Trenton Road) @ CR 526 (Edinburg Road)	West Windsor Township	Mercer
CR 677 (W Somerdale Road) @ CR 669 (Warwick Road)	Somerdale Borough	Camden
NJ 38 @ CR 607 (S Church Street)	Moorestown Township	Burlington
NJ 73 @ Brick Road	Evesham Township	Burlington
NJ 73 @ Church Road E	Mount Laurel Township	Burlington
NJ 73 @ Ramblewood Parkway/Church Road	Mount Laurel Township	Burlington
US 1 (Brunswick Pike) @ CR 571 (Washington Road)	West Windsor Township	Mercer
US 206 @ NJ 38 (S Pemberton Road)	Southampton Township	Burlington

Source: DVRPC, 2021.

Figure 28: FOCUS INTERSECTION BOTTLENECKS



Source: DVRPC, 2021.

Most Traffic Incidents

The CMP also identifies and prioritizes roadway facilities that experience reduced mobility as a result of traffic incidents. There are 20 focus roadway facilities identified in the DVRPC region (10 in Pennsylvania and 10 in New Jersey) with the most traffic incidents. Table 11 lists the facilities with the most traffic incidents.

Table 11: MOST TRAFFIC INCIDENTS BY CMP ROADWAY FACILITY (2019)

Roadway Segment	From Limit	To Limit	Municipality	County
Pennsylvania				
I-676 (Vine Street Expressway)	I-76	I-95	Philadelphia	Philadelphia
I-95	PA 90 (Betsy Ross Bridge)	Frankford Avenue	Philadelphia	Philadelphia
I-76	I-676 (Vine Street Expressway)	US 30 (Girard Avenue)	Philadelphia	Philadelphia
US 1 (Roosevelt Expressway)	I-76	PA 611	Philadelphia	Philadelphia
I-76	US 30 (Girard Avenue)	US 1 (City Avenue)	Philadelphia	Philadelphia
I-76	Walt Whitman Bridge	I-676 (Vine Street Expressway)	Philadelphia	Philadelphia
I-95	Academy Road	PA 90 (Betsy Ross Bridge)	Philadelphia	Philadelphia
I-95	Frankford Avenue	I-76 (Walt Whitman Bridge)	Philadelphia	Philadelphia
I-95	I-476	US 322 (Commodore Barry Bridge)	Chester	Delaware
I-95	PA-DE State Line	US 322 (Commodore Barry Bridge)	Upper Chichester	Delaware
New Jersey				
I-76	Walt Whitman Bridge	I-295	Camden, Gloucester, Bellmawr	Camden
I-295	NJ 42 (Exit 26)	NJ 70 (Exit 34)	various	Camden
I-295	US 130	NJ 42 (Exit 26)	West Deptford, Westville, Bellmawr	Camden
NJ 42	AC Expressway	I-295	various	Camden, Gloucester

Roadway Segment	From Limit	To Limit	Municipality	County
US 1	Alexander Road	County Line	West Windsor	Mercer
NJ 29	Cass Street	I-295	Trenton, Hamilton	Mercer
I-676	I-76	Benjamin Franklin Bridge	Camden City	Camden
I-295	NJ 70 (Exit 34)	CR 541 (Exit 47)	various	Camden, Burlington
I-195	I-295	I-95 (NJ Turnpike)	Hamilton, Robbinsville	Mercer
US 30	US 130	I-295	various	Camden

Source: DVRPC RIMIS System, 2021.

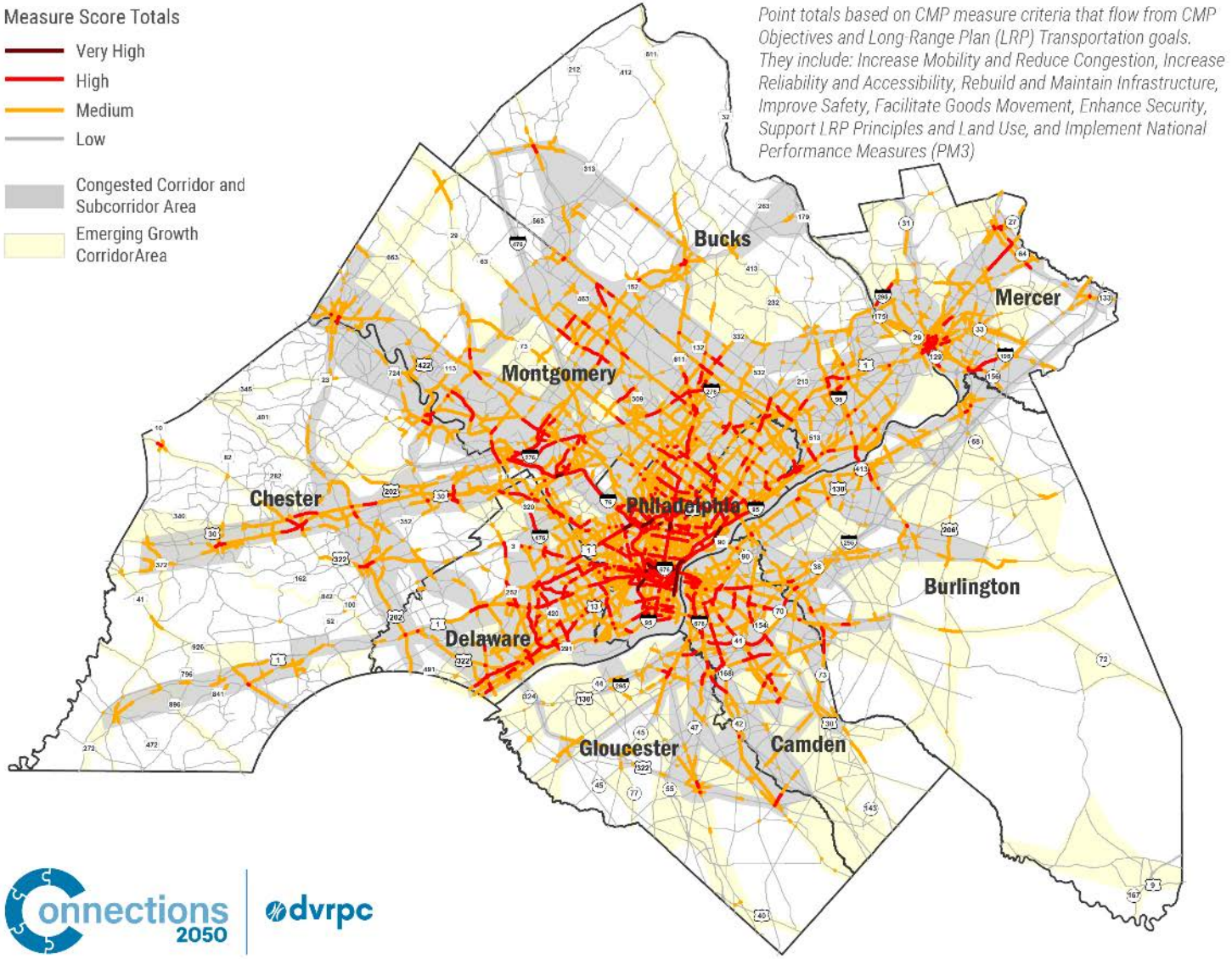
Priority Corridors

The CMP identifies priority congested corridor and subcorridor areas based on the analysis criteria associated with each CMP objective. The more criteria a location meets, the stronger support it will receive for recommended improvements via targeted strategies that are designed to minimize growth in recurring and non-recurring congestion, and improve the reliability of the transportation network. Figure 28 identifies the score totals of analysis criteria by segment in priority congested corridor and subcorridor areas.

Plan goals and CMP objectives flow into specific CMP measure criteria that are used in the analysis of the performance of the regional transportation system, and for developing strategies to mitigate congestion. Objective CMP measure criteria help drive the process of identifying which strategies are more appropriate than others by corridor and subcorridor area, using Plan goals and CMP objectives. Every subcorridor in the region presents its own unique mobility challenges, so care is taken to select the strategies that best fit the conditions, goals, and character of the area under consideration.

The CMP includes a list of over 100 strategies to mitigate congestion. Very appropriate and secondary strategies are applied at the congested corridor and subcorridor levels. In addition, the CMP contains a set of appropriate every strategies at regional planning scale.

Figure 29: OBJECTIVE CMP MEASURE CRITERIA SCORE TOTALS



Source: DVRPC, 2021.

DVRPC Regional Transportation Systems Management and Operations (TSMO) Plan

One major category of strategies for addressing congestion is TSMO, a strategic approach to proactively improve mobility, reliability, safety, and security for all modes of transportation. It focuses on mitigation of non-recurring congestion by addressing these conditions with the goal of improving reliability of the transportation network. It does this by integrating planning and design with operations and maintenance to manage the transportation network holistically. TSMO optimizes existing infrastructure, complements many short- and long-range transportation strategies, and is a vital component to addressing current and future planning goals.

Benefits of TSMO programs have been widely documented. For example, deploying Safety Service Patrols on expressways in New Jersey has led to reductions in incident duration, fewer secondary crashes, and saving millions of gallons of fuel. By improving traffic signal timing with adaptive traffic signal control technologies, travel times and delays are reduced by 10 to 50 percent; and emissions pollutants are reduced considerably. By using automatic vehicle location systems on buses, on-time bus performance is improved by 12 to 23 percent, which reduces passenger wait time at bus stops.

DVRPC's *Transportation System Maintenance and Operations Plan* was developed in cooperation with the DVRPC's Transportation Operations Task Force (TOTF)—composed of traffic, transit, emergency management agencies, local governments, and other regional partners—to lay out a vision for transportation systems management and operations in the Greater Philadelphia region. Several basic tenets inform the vision and goals of the Master Plan. These include viewing the transportation system as an integrated network, using technology and innovation to support TSMO strategies, and obtaining accurate real-time network conditions and cooperation among regional transportation and emergency management partners.

Regional TSMO Vision, Goals, and Objectives

TSMO promotes more efficient and cost-effective use of the existing transportation network, providing reliability, mobility and safety for people and goods. The four major goals of DVRPC's *Transportation System Maintenance and Operations Plan* are the backbone of the operational vision for the Greater Philadelphia region. They provide a high-level view of the desired operation of the region's transportation network. The objectives associated with each of the goals provide specific and measurable initiatives for Greater Philadelphia. Table 12 shows the four regional goals with their associated objectives.

To achieve these objectives, Transportation agencies across the region are using a variety of TSMO strategies, often in combination, to more effectively and efficiently operate their transportation infrastructure.

Table 12: TSMO GOALS AND OBJECTIVES

Goals	Objectives
Reliability: Use TSMO strategies to provide reliable travel times for people and goods movement.	• Use Intelligent Transportation Systems (ITS) to enable TSMO strategies. • Improve travel time reliability for all users. • Implement 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.
Mobility: Use TSMO strategies to provide a variety of transportation options and traveler information to meet diverse travel demands.	• Implement ICM strategies to manage traffic across multiple modes and jurisdictions. • Provide real-time traveler information that may affect roadway users and travel choices across all modes. • Improve connections between modes to enhance traveler mobility. • Enhance regional multimodal trip planning tools. • Expand traffic surveillance and transportation system condition data collection capabilities. • Implement advanced integrated traffic and transit management systems. • Implement technologies to control and operate transportation systems. • Encourage initial deployment or implementation of emerging technologies.
Equitable Access: People of all ages, abilities, languages, backgrounds, and incomes have access to safe, reliable, efficient mobility options.	• Improve access to transportation modes. • Reduce transit service gaps. • Improve access to first-mile/last-mile modes of transportation.
Safety and Incident Management: Use TSMO strategies to enhance transportation safety, security, and incident management for all modes.	• 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 major, secondary, and work zone related traffic incidents. • Reduce crashes at signalized intersections. • Increase resilience of the transportation system and communication networks to infrastructure failure and floods, winter weather, and other extreme weather events.

Source: DVRPC, 2021.

TSMO strategies focus on lower-cost operational and multimodal approaches that are coordinated between technologies and agencies to make better use of existing transportation facilities. It is not enough to simply install ITS devices and infrastructure; there is also a need to strategically plan for operations and maintenance with respect to emerging digital technologies, changing travel patterns, use of transportation network companies, and multimodal integration. Examples of TSMO strategies being used include:

- traffic incident management;
- work zone management;
- traveler information;
- ICM;
- traffic signal coordination;
- active transportation and demand management;
- special event coordination;
- road weather management;
- transit management;
- freight management; and
- connected and automated transportation readiness.

Transportation Emergency Preparedness Planning

In addition to addressing non-recurring congestion, transportation planners must prepare for even less frequent emergency-related disruptions to travel. The emergency preparedness and security of the transportation system is a primary concern at the federal, state, and local levels. Security is essential for every mode of transportation, both freight and passenger. Natural disasters like floods, blizzards, or tornadoes, and man-made ones like industrial plant emergencies or acts of terrorism, can cause serious disruption to the transportation system and pose danger to the public. At the same time, the transportation system is what provides a means for exit during an emergency when people need to evacuate or be routed around an area.

The transportation network is one of the most important pieces of any emergency response. Virtually all response personnel, equipment, and supplies rely on some form of transportation to deliver timely support. The public needs transportation facilities to obtain critical care, gather supplies, and/or evacuate from affected areas. Any mode of transportation may be used in responses, but the surface transportation system typically carries most emergency resources. Transportation considerations are important at all levels of emergency preparedness management planning. Such planning involves preventing incidents, preparing for potential incidents, responding to incidents quickly and efficiently, and recovering from them.

In Greater Philadelphia, DVRPC is not directly responsible for emergency preparedness, security, or evacuation planning efforts; this is handled at the state, county, and municipal levels. DVRPC does, however, embrace its role in championing emergency preparedness and security by convening, collaborating, and coordinating with first responders.

The unpredictability of certain disaster events has led the region's county emergency management partners to move toward an All Hazard Mitigation approach. "Hazard mitigation" describes sustained actions taken to prevent or minimize long-term risks to life and property

from hazards and their effects.[35] Hazard mitigation identifies and profiles hazards; analyzes risk factors to people, property, and the environment; and develops mitigation actions in responses.

Hazard mitigation plans generally have four distinct phases: preparedness, mitigation, response, and recovery. The phases are valuable in providing the means to distinguish the emergency management functions and also offer the potential to define those elements that relate to the transportation planning process. After identifying risks and vulnerabilities that are common in our area, long-term strategies are identified for protecting people and property from natural, human, and technological disasters in the future. These strategies include specific, actionable projects that can come in the form of infrastructure improvements or policy-related initiatives.

Table 13: COUNTY EMERGENCY MANAGEMENT AGENCIES AND PLANS

Pennsylvania Agency	Plan
Bucks County Emergency Management Agency	Hazard Mitigation Plan - 2016
Chester County Emergency Management Division	Multi-Jurisdictional Hazard Mitigation Plan - 2019
Delaware County Emergency Services	Hazard Mitigation Plan - 2016
Montgomery Department of Public Safety	Montgomery County Hazard Mitigation Plan - 2017
Philadelphia Office of Emergency Management	City of Philadelphia All Hazard Mitigation Plan - 2017
	Evacuation routes and rallying points for high rise buildings
New Jersey Agency	**Plan**
Burlington County Public Safety	Hazard Mitigation Plan - 2019
Camden Department of Public Safety	Hazard Mitigation Plan - 2022
Gloucester County Emergency Response	Multi-Jurisdictional Hazard Mitigation Plan
Mercer Emergency Management and Public Safety	Multi-jurisdictional Hazard Mitigation Plan- 2016

Source: DVRPC, 2021.

[35] Emergency Management Institute, "Lesson Summary: IS-318, Mitigation Planning for Local and Tribal Communities," Federal Emergency Management Agency, https://emilms.fema.gov/IS318/MP0101010t.htm.

Hazard mitigation plans also address local government planning responsibilities, which require state and local governments to develop and adopt an approved mitigation plan as a condition for receiving certain federal disaster grants and loans. Table 13 lists the latest version of each county's hazard mitigation plan and the department responsible for its preparation.

The individual county plans tend to have a set of common goals and objectives, many of which are captured within the *Connections 2050* Vision. Common regional hazard mitigation goals and objectives include:

- Sustain and enhance public safety, health, and security capabilities:
  - Prioritize mitigation actions that affect vulnerable populations.
  - Provide essential training to key personnel.
- Protect property:
  - Develop and implement mitigation programs and strategies that protect critical facilities and services.
  - Promote sound land use planning based on known community hazards.
  - Adopt and enforce building codes and standards.
- Protect the natural environment:
  - Support and enhance mitigation actions that protect the natural environment from natural hazards and climate change.
  - Ensure the protection of waterways and drinking water sources.
  - Promote actions to minimize flooding impacts.
- Promote a sustainable economy:
  - Support continuity of operations pre-, during, and posthazard events.
  - Prioritize mitigation strategies that support the continuation of critical business operations during and following a disaster.
  - Sustain, promote, and enhance partnerships with external public and private entities to identify and share resources.
  - Educate businesses about contingency planning.
- Increase disaster resilience of public and private infrastructure:
  - Elevate structures above the floodplain.
  - Reduce the occurrences and impact of power outages.
  - Reduce the potential impact from dam failure.
- Sustain and strengthen all hazards preparedness and awareness:
  - Ensure that the public understands potential hazards and is aware of which actions to be taken to minimize their risks.
- Sustain and enhance communications and network security capabilities:
  - Maintain and enhance communications systems for interoperability and reliability for mission critical voice and data information.
  - Elevate critical equipment including computer servers, generators, and water heaters, above the base flood elevation.

Emerging Transportation Technologies

Technology has a long history of transforming the movement of people and goods. What has changed more recently is the accelerated pace at which innovations are being brought to market. There are numerous transformative technologies on the horizon with the potential to revolutionize transportation. These technologies are changing how vehicles and infrastructure are constructed, operate, and are powered; how vehicles operate; and how we can integrate and improve transportation services and options.

Infrastructure and Vehicle Construction

3D printing and nanotechnology offer opportunities to substantially alter how infrastructure and vehicles are built.

3D Printing

3D printing, or additive manufacturing, can produce an item by breaking it into individual layers and progressively "printing" them using a variety of materials.[36] Although traditional production contains trade-offs between design, production, and transportation, 3D printing overcomes these challenges and limitations by combining these three phases.[37] It could reduce the need for "long supply chains, assembly plants, and delivery," and potentially shift manufacturing from a drawn-out, linear, and multiparty process to one where individual inventors can design, prototype, test, and refine on their own.[38]

MIT researchers have developed tiny interlocking 3D-printed composite material pieces that can be linked together to build structurally sound vehicles, airplanes, bridges, levees, or dams.[39] These materials can easily be disassembled and reassembled with ease, simplifying maintenance and repairs.[40] Such interchangeable materials may become the basis for road and bridge construction in the future. Advanced Paving Technologies has developed a concept for a 3D-printing road pavement machine, which would conduct a Light Detection and Ranging (LiDAR) scan of the roadway and use that to print a smooth new surface for it—filling in dips, bumps, cracks, and ruts in the process.[41]

Nanotechnology

Nanotechnology enhances material properties at the individual atom and molecular levels, Nanotechnology can enhance battery life; provide lightweight and high-strength materials; and reduce the size, and increase the computing power, of remote sensors. Lightweight, high-strength materials could be used for vehicles, drones, sensors, and beyond. This is a possible solution to some of the resource limitations that manufacturers may face with mass production of connected and automated vehicles.

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[36] Abbas Mohaddes and Peter Sweatman, *Transformational Technologies in Transportation: State of the Activities* (Transportation Research Board, May 2016), www.trb.org/Main/Blurbs/174370.aspx.
[37] Mohaddes and Sweatman.
[38] Mohaddes and Sweatman.
[39] David L. Chandler, "How to Make Big Things Out of Small Pieces," *MIT News*, August 15, 2013, www.web.mit.edu/newsoffice/2013/how-to-make-big-things-out-of-small-pieces-0815.html (accessed December 9, 2013).
[40] Chandler, "How to Make Big Things Out of Small Pieces."
[41] Michael Molitch-Hou, "Advanced Paving Tech Seeks to Pave Roads of the Future in 3D," *3D Printing Industry*, September 21, 2015, www.3dprintingindustry.com/news/advanced-paving-tech-seeks-to-pave-the-roads-of-the-future-in-3d-57958/ (accessed January 5, 2021).

Vehicle Power and Operations

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. In addition to power sources, new vehicle capabilities from AVs, connected vehicles (CVs), and unmanned aerial systems could vastly increase vehicle safety, efficiency, and convenience.

Electric Vehicles (EVs)

Although EVs are the primary emerging alternative fuel, vehicles may alternatively be fueled by natural gas, propane, biogas and biofuels, or compressed air. They could also take a hybrid approach, where a vehicle can be powered through a variety of fuel sources. A key policy that will push vehicles to alternative fuel vehicles is legislation to begin to phase out internal combustion engines (ICE) in the coming years. Thirteen countries, including France, Costa Rica, and the United Kingdom, have already passed legislation to do so. In addition, Audi has pledged to stop producing ICE vehicles by 2033, and GM and VW have both pledged to do so by 2035. A well-planned infrastructure network, considering the different characteristics of these vehicles, will also be essential to the adoption of alternative fuels for powering vehicles.

EVs are powered by an electric motor using energy stored in rechargeable batteries or other devices (such as a hydrogen fuel cell). EVs include plug-in hybrid EVs—which have a supplementary ICE—and all-EVs. Although EVs are currently more expensive than traditional ICE vehicles, estimates suggest they will be cost competitive by the mid–2020s.[42] As battery technology advances, EV ownership costs could decrease considerably. Already, EVs are generally cheaper to operate due to lower fuel costs, although these costs are offset by the expense of purchasing and installing residential charging infrastructure.

If EV uptake moves faster than upgrades to the electrical grid, they could put additional pressure on aging infrastructure, and demand for more energy could cause less efficient and rarely used fossil fuel power plants to be put back into service. Even with less harmful vehicles, there is the question as to whether the environment can afford the stresses caused by the billions of cars forecast to be built between now and 2050. Globally, between 57 and 97 million cars were built annually from 2000 to 2019.[43] Although EVs are much more efficient in operating, manufacturing them is highly energy intensive. Replacing the world's two billion ICE vehicles with EVs would use between 20 and 25 percent of the annual U.S. energy consumption and put a strain on a significant number of finite resources.[44] Although there are certain air quality improvements associated with this change in fleet, powering vehicles with electricity rather than ICEs does not address any of the transportation challenges unrelated to vehicle tailpipe emissions: road construction, parking, congestion, sprawl, and crashes. And with less gas being purchased, the gas tax revenue structure currently in place would

[42] Colin McKerracher et al., *An Integrated Perspective on the Future of Mobility* (McKinsey & Company, 2016), https://www.mckinsey.com/~/media/mckinsey/business%20functions/sustainability/our%20insights/an%20integrated%20perspective%20on%20the%20future%20of%20mobility/an-integrated-perspective-on-the-future-of-mobility.pdf.

[43] I. Wagner, "Estimated Worldwide Automobile Production from 2000 to 2019," *Statista*, April 1, 2020, www.statista.com/statistics/262747/worldwide-automobile-production-since-2000/ (accessed August 11, 2020).

[44] Lloyd Alter, "Why Electric Cars Won't Save Us: There are not Enough Resources to Build Them," *Treehugger*, June 10, 2019, www.treehugger.com/cars/why-electric-cars-wont-save-us-there-are-not-enough-resources-build-them.html (accessed June 18, 2019).

have to be completely revamped. Many DOTs are already in the process of determining how to replace this potential loss of revenue.

Electric Vertical Take-Off and Landing (EVTOL) Vehicles

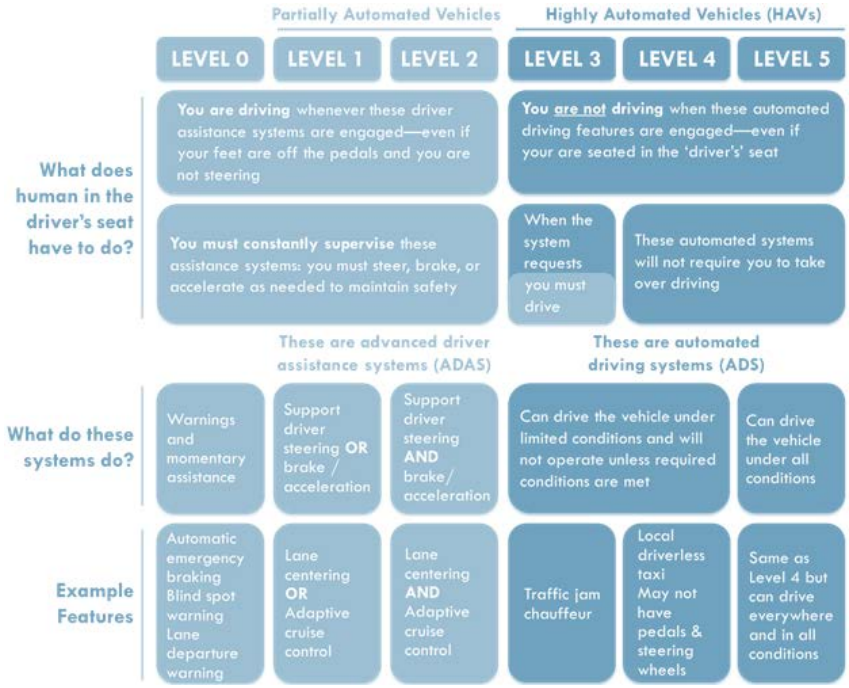
EVOTL vehicles are propulsion aircraft that can take off, hover, and land vertically. A number of companies are working to develop passenger applications for EVOTL services, which could serve commuters within a region or provide city-to-city travel with distances between 50 and 200 miles.

Automated Vehicles (AVs)

An AV has one or more automated components, ranging from lane-keeping to adaptive cruise control to traffic jam assistance to self-driving capability. Hardware and software, both remote and on board, perform the functions needed to drive a vehicle. The key hardware components include an on-board computer that makes decisions, along with servers and power supplies; 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; LiDAR that identifies lane markings; and video cameras that read traffic signals and road signs, and watch for pedestrians and obstructions. The software is either an advanced driver assistance system (ADAS) or an automated driving system (ADS). An ADAS can support human steering, braking, and acceleration for a period of time. An ADS is capable of operating without driver control for a duration under specific conditions. The ADS is programmed to work in a specific context, known as the operational design domain (ODD), including geographic location, weather, time of day, traffic volumes, and road conditions. Much of the current technology found under the hood is proprietary, and AVs also harness the power of artificial intelligence (AI). Both of these can make it hard to fully know how highly automated vehicles (HAVs) operate.

The Society of Automotive Engineers has created a chart showing how AV technologies could progress in steps over time and is intended to simplify this process in order to communicate it to the public and to standardize definitions (see Figure 29). It does not account for how automation relates to other technologies, such as CVs, EVs, and shared mobility.

Figure 30: VEHICLE AUTOMATION LEVELS



Source: DVRPC, adapted from Society of Automotive Engineers, 2020.

Level 1 uses ADAS to automate some driving tasks through one of the following:

- adaptive cruise control, lane-keeping assistance, or dynamic driving assistance;
- collision alerts and mitigation features;
- parking assistance features, such as semi- or fully automated parking assistance, remote parking, trailer assistance and surround view cameras; and
- other driving aids, such as automatic high beams, night vision, and driver monitoring.

Level 2 automation expands Level 1 through a combination of ADAS capabilities, such as adaptive cruise control and lane-keeping assistance. The driver remains responsible for the driving tasks in both Level 1 and Level 2. Many vehicles sold today are Level 2.

Level 3 is the first to enable automated systems, but only in specific conditions, such as stop-and-go traffic on a highway. BMW has filed a voluntary safety self-assessment with the National Highway Traffic Safety Administration to launch the first Level 3 HAV incorporated within the iNext EV.

Level 4 HAVs will handle all driving tasks within specific conditions, such as enclosed parking garages or dedicated freeway lanes. These parking garages may need to be suitably equipped (sensors to communicate where empty spaces are) and exclude both pedestrians and non-AVs. An ODD represents the operating conditions (geographic location, weather, time of day, traffic volumes, and road conditions) that a Level 3 or 4 system is capable of operating in. Each model of HAV may have a unique ODD. Level 4 vehicles are already operating without safety drivers in a few applications. Since Level 4 HAVs are restricted to specific ODDs and locations where a high-definition map is available, there may be equity and accessibility issues—which means the government should play a proactive role to address those gaps before services start operating.

Level 5 HAVs, which can go from any point to any other point in any condition without requiring a safety driver, are likely decades away from becoming commercially available. This is what most people think of when they think of HAVs. At this level, consumer vehicles will become more appealing to purchase since owners will be able to use them anywhere and everywhere.

HAV Uncertainty

Vehicle automation presents an opportunity for systemic change in the transportation network, with many potential benefits. HAVs could enable society to more productively use two limited, but highly valuable, resources: space and time. Even so, there is much uncertainty in the development and deployment of HAVs, which could place limitations on them. Understanding these uncertainties is the first step in identifying the challenges, opportunities, benefits, and risks that will come with the arrival of HAVs. Uncertainties related to development and deployment include:

- Safety: Machine precision and vigilance will reduce crashes, but AVs risk new types of crashes and will need to convince the public that they are safer than human drivers.
- AI and reliance on technology: Limitations with machine learning could prove to be a dead end in the technology's development. Algorithms may be able to make better and fairer judgments, or they may have societal biases programmed within.
- Profitable business models: Some of the leading AV companies have pursued a strategy of developing the technology first and figuring out profitability later. Some challenges include the need for constant supervision for Level 2 and 3 AVs, and conditional supervision for Level 4. Best business cases are middle-mile trucking, last-mile sidewalk delivery devices, and low-speed

automated shuttles. Individuals may be most interested in purchasing Level 5 HAVs, but only if they are affordable.

- Infrastructure investment needs: AV developers intend for the technology to operate on existing infrastructure, but they may need more investment in things like 5G[45] and other CV technologies, smoother pavement, better lane markings, standardized signs, TSMO, real-time work zone data, and other digital technologies.
- Cybersecurity: Increased connectivity comes with new vulnerabilities, but HAVs offer an opportunity to redesign vehicles from the chassis up to incorporate cybersecurity best practices.
- Regulations: Often seen as slowing down innovation, uniform federal standards may be critical to facilitating deployment.
- COVID-19: The pandemic may shape how HAVs are deployed, making shared mobility less appealing. Increased demand for goods movement and delivery could benefit middle-mile freight movement and sidewalk delivery technologies.
- Equity: AVs could greatly increase access to opportunity for everyone, but only if shared mobility providers serve low-income communities to the same or better degree than other areas.

There are also uncertainties that may arise once HAVs are deployed. These include:

- Economy and jobs: Automation will increase productivity and displace low-skill jobs with high-skill ones. The winner-take-all digital economy also risks the rise of monopolistic services.
- Mobility: Zero-occupant trips, lower travel costs, and mobility for non-drivers could increase travel.
- Congestion: HAVs may expand road capacity due to reduced headways, smoother traffic flow, and more efficient routing; or they could reduce road capacity due to increased travel, cautious driving, and following all rules of the road.
- Energy use and GHG emissions: HAVs could still use ICEs or could reduce emissions by moving to EVs and using eco-driving techniques and more efficient routing.
- Urban vitality and open space preservation: Increased willingness to travel leads to more spread-out development patterns. Conversely, reduced parking needs could enable denser development.
- Equity: Ability to pay for priority access; AI fails to detect darker skin tones or uses age, gender, or race in algorithms. It may make it harder for persons with disabilities to enter/exit without driver assistance, or algorithms could reduce human bias. A portion of transportation savings could be used to subsidize low-income travelers.
- Redesigned transportation network: Need to accommodate new technologies, vehicle types, travel speeds, and increased system complexity; or HAVs operate within existing infrastructure.
- Data: 5G captures much more data, but will this be proprietary or shared with privacy built in? Or, will privacy protections limit data collection? The potential for bad data creates other types of risk.

Connected Vehicles (CVs)

CV technologies are a separate innovation from automation. They use licensed, wireless, and cellular networks; satellites; the internet; and telematics to connect cars, trucks, buses, motorcycles, bicyclists, pedestrians, and infrastructure through cellular vehicle-to-everything (C-V2X) technologies.[46] CVs create machine awareness

[45] Fifth-generation technology standard for broadband cellular networks.
[46] Mohaddes and Sweatman.

by transmitting precise and in-depth real-time location, speed, acceleration, fault conditions, and other data.[47]

External CV sensors can use real-time data to monitor for any number of roadway hazards and issue warnings to the driver.[48] CVs can verify that vehicles are aware of each other, advance warnings about hazards and intentions between vehicles, help with maneuvering, and overcome range, sight, and data interpretation problems with sensors.[49] They can also enable system coordination, cooperation, and smooth traffic flow by connecting with traffic management systems. C-V2X can enhance communications within truck platoons, help to facilitate cooperative driving (where drivers work together to optimize available road space and reduce disruptions from lane changes and sudden braking by conveying intentions to other road users).[50] By cooperating with each other, CVs are often forecasted to reduce crash and fatality rates for non-impaired drivers by up to 80 percent.[51]

CV technology is the linchpin in truck platooning, where multiple trucks are linked and operate as a convoy. In addition to reducing driver workload, truck platooning increases fuel efficiency. Although heavily dependent on roadway conditions, platooning has the potential to increase fuel efficiency of the lead vehicle by over 5 percent and upward of 10 percent for trailing vehicles. PennDOT, Michigan DOT, and Ohio DOT partnered in a multistate "SmartBelt" coalition that completed an October 2020 truck platoon demonstration across jurisdictional boundaries. The 280-mile test run delivered donations to food pantries in Pittsburgh, Toledo, and Detroit, and found that potholes were a leading cause of disengagements.

As this technology finds its way into more vehicles, first responders must be adequately trained on how to handle sensitive and necessary data for crash reconstruction purposes. Due to the lack of a federal mandate, there are many questions for first responders, including: Where is the vehicle's "black box"? How much of that data is stored within the vehicle, and how much is buried beneath layers of proprietary technology? Who is responsible for, or has access to that data? Are small, primarily volunteer, fire departments throughout the country adequately prepared to deal with crashes involving these types of vehicles?

Unmanned Aerial Systems (UASs)

UASs, more commonly known as drones, are remotely piloted aircraft. They can be used to inspect previously hard-to-reach facilities, such as bridges, towers, or windmills. Humans can use them to avoid dangerous and hard-to-reach spaces (such as first responders in disaster zones), and gain access to areas that were previously unreachable. More and more, drones are also being used for crash reconstruction purposes. Their use reduces responders'

[47] Matthew Cuddy et al., *The Smart/Connected City and its Implications for Connected Transportation* (Washington, DC: FHWA, 2014), https://www.its.dot.gov/itspac/Dec2014/Smart_Connected_City_FINAL_111314.pdf.
[48] Federal Highway Administration, *The Smart/Connected City and its Implications for Connected Transportation.*
[49] Steven Schladover, "Progress toward Automated Driving," *Halmstad Colloquium* (video), February 12, 2012, www.youtube.com/watch?v=4wfpUSTG9zU (accessed June 7, 2016).
[50] "Cellular Vehicle-to-Everything (C-V2X) – Why Does it Matter?," RoboticsBiz, August 25, 2020, https://roboticsbiz.com/cellular-vehicle-to-everything-c-v2x-why-does-it-matter/.
[51] National Highway Traffic Safety Administration, "U.S. DOT Advances Deployment of Connected Vehicle Technology to Prevent Hundreds of Thousands of Crashes," December 13, 2016, https://one.nhtsa.gov/About-NHTSA/Press-Releases/nhtsa_v2v_proposed_rule_12132016 (accessed November 13, 2017).

exposure to hazardous roadway conditions, decreases the overall reconstruction time (which, in turn, allows the roadway to reopen sooner), and often captures more accurate information than traditional reconstruction methods. Operating a UAS is much easier and cheaper than flying a helicopter, so it is not surprising that numerous companies are working on UASs that can carry passengers.

Integrating and Improving Transportation Services, Modes, and Infrastructure

Emerging digital 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. A variety of new private-market transportation services are emerging, thanks to digital technologies.

5G

5G promises to increase connection speeds by utilizing more high-bandwidth, short-range airwaves to increase the number of available channels. This will give cellular networks lower latency and the capacity to connect with more devices, including CVs and AVs. 5G may be a necessary component to HAV deployment but could take a generation to build out.[52]

Artificial Intelligence (AI)

AI is a set of algorithms that aims to handle unforeseen circumstances and can function with unstructured data. AI systems use algorithms to write their own code, which often reaches a complexity well beyond human comprehension.[53] AI is enabling machines to learn from experience, adapt, and perform tasks that previously required human cognition.[54] This technology enables a range of system functions that can sense and perceive the environment, reason and analyze information, learn from experience, adapt to new situations, make decisions in real time, communicate, and take action.[55]

U.S. DOT's Intelligent Transportation Systems Joint Program Office has conducted research into a variety of ways in which AI could be deployed throughout the transportation network. Some potential AI applications for urban arterials include:[56]

- updated and optimized traffic signal coordination plans;
- real-time adaptive traffic signal optimization;
- traffic signal decision support subsystems to proactively respond to non-recurring congestion at the network level;
- protection for users by detecting misbehavior in, and attacks on, ITS and CV applications by identifying anomalies in data communications. Similarly, AI could improve field maintenance of traffic signals, detection systems, closed-circuit television

[52] Anthony Townsend, "Fables of the Driverless Revolution," TD Future Cities Speaker Series, May 21, 2019, www.facebook.com/EvergreenCanada/videos/327925417872999/ (accessed May 25, 2019).
[53] Aarian Marshall, "The Maddening Struggle to Make Robot-Cars Safe—And Prove It," *Wired*, December 15, 2018, www.wired.com/story/zoox-self-driving-cars-safety/ (accessed December 20, 2018).
[54] Meenakshy Vasudevan et al., *Identifying Real-World Transportation Applications Using Artificial Intelligence* (Washington, DC: Federal Highway Administration, July 2020), https://rosap.ntl.bts.gov/view/dot/50752.
[55] Vasudevan et al.
[56] Vasudevan, et al.

(CCTV), dynamic message signs (DMS), and other digital field devices;

- comprehensive traffic modeling through the development of massive scale models using neural networks tailored to representation of the network state, applying a vaster set of data available from network users;
- crash and incident detection by using AI to monitor arterial surveillance and traffic signal operation CCTVs;
- pedestrian, cyclist, and micromobility detection to improve traffic control and management of pedestrian crossing times, minimum green times, and priority service;
- prediction of safety metrics as connected and automated vehicles are integrated into the person-driven fleet;
- transit signal priority optimization using real-time information gathered and analyzed from across the entire transportation network;
- transit network optimization by analyzing and adapting to ridership and other variables; headways and routes can be adjusted as more information is fed into the system; and
- integration of AI learning and CCTV imagery to identify and enforce bus lane violations, improving transit travel times.

Another strength of AI is in predictive analysis, which can strengthen agency planning around asset replacement, facility demand and crash risks, including under adverse conditions. The potential for AI applications and use cases across the transportation industry will likely expand significantly in the coming years. However, there are real-world limitations and obstacles that may hinder AI effectiveness, both now and in the future. The Intelligent Transportation Systems Joint Program Office report notes the following considerations for AI implementation:

- Stakeholder Acceptance: Users are often wary to blindly trust the technology.
- Workforce Availability: As with other sectors, AI requires a highly trained (and adequately compensated) workforce.
- Data: Agencies must continually gather and store massive amounts of extremely accurate data, which is not inexpensive.
- Computing Power: To work with such large datasets, the computing capabilities must also be massive.
- Bias: The starting AI application must be void of bias.
- Privacy: To work effectively, AI requires data; where this data comes from, and who/what has access to it, is a major concern.
- Ethics: As with bias, the AI must not discriminate or profile specific population groups.
- Liability: In the event of an incident involving AI application, who is liable?

The Internet of Things (IoT)

The IoT uses physical objects and sensors embedded in electronics, software, and other devices to capture and exchange data.[57] The IoT was made possible by the convergence of multiple technologies, including wireless communications, the Internet, embedded systems, sensors, and microelectronics.[58] 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 and HAVs. The IoT will collect and analyze data, develop algorithms to more efficiently manage systems, and enable remote actions. IoT and Big Data are intertwined, where one only

[57] Mohaddes and Sweatman.

[58] Mohaddes and Sweatman.

functions properly when the other does. Therefore, many of the same security concerns and sharing agreements that apply to Big Data also apply to IoT.

Big Data

"Big Data is a broad term for data sets so large or complex that traditional data processing applications are inadequate."[59] The steadily decreasing cost of computing power—storage, memory, processing, bandwidth—is enabling Big Data.[60] Big Data can help to improve decision making, which in turn can enhance operational efficiencies, reduce costs, and decrease risks. AI applications, optimizing route choice for transit, and ICM are a few of the many things dependent on Big Data.

Big Data, however, comes with its own challenges. Putting large datasets to work in an effective way requires a workforce with strong computer science skills, which does not currently exist across the transportation industry. Traditionally, DOTs hire engineers and planners, not data scientists. To attract the skilled workers needed to effectively navigate the IT terrain, DOTs must compete with the salaries and allure of private enterprise. Although the amending of hiring criteria seems on the surface to be a relatively minor issue, changing decades of institutional inertia is not an easy feat.

Although data storage costs are dropping, data security costs are rising. As agencies become more reliant on Big Data, this will increase risk from nefarious actors. Additionally, select outputs of data must be shared with partnering agencies for it to be of use. This may not seem to be a heavy lift, but given the difficulties that arise when one agency would like to view a neighboring agency's CCTV, it is certainly an obstacle that must be overcome.

Real-Time Information

The ability to access information and communicate in real time through a variety of digital devices and automated data collection systems is critical to shared mobility services and offers the potential to transform the transportation network. Real-time information is available through traffic navigation tools and apps, such as Google Maps, INRIX, 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 transportation mode based on travel time, cost, and available modal options. Once a mode is chosen, route optimization can identify the quickest and most direct route. Second, navigation tools route people and vehicles away from congested facilities and onto less congested ones. This lets individuals make faster trips while also reducing congestion. Although facility optimization can balance vehicle volumes throughout the system and reduce congestion, it may increase VMT, particularly on roads with historically lower traffic volumes. Some vehicles may use residential streets that are not designed for high volumes or speeds to bypass congestion. A recurring issue is large trucks using navigation intended for passenger vehicles, leading to tractor trailers becoming lodged beneath overpasses or exceeding the weight limits on smaller bridges.

[59] Mohaddes and Sweatman.

[60] Shawn Dubravac, *Digital Destiny: How the New Age of Data Will Transform the Way We Work, Live, and Communicate* (Washington, DC: Regnery Publishing, 2015).

Shared Mobility

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.[61] 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 Bikeshare is an example of a one-way trip that generally ends at a different station from where it started. Typically, carsharing providers require round trips, for which the vehicle must be returned to the same location where it was picked up. Free-floating or dockless 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.[62] In peer-to-peer networks, an individual can rent their personal vehicle (or bike, scooter, etc.) to someone else. Ideally, a common platform will emerge that allows these services to be jointly booked and paid for through a single app that also connects with public transit. Common types of shared mobility services include:

- Bikesharing services with publicly accessible bicycles for short-term use. Bikesharing programs can help improve first- and last-mile connections to transit.
- Electric-scooter (e-scooter) sharing involves generally dockless programs that allow individuals to rent these rideable vehicles for a short duration.
- Carsharing allows an individual to rent a car on an hourly or daily basis. Each carsharing vehicle is generally estimated to replace 9–13 personally owned vehicles.
- Courier networking services offer on-demand pick-up and/or delivery of goods, groceries, and take-out foods.
- Transportation Network Companies facilitate rides through a digital network using independent contractors 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. By combining passenger trips, microtransit may be able to reduce traffic volumes and road congestion.
    - Ridehailing uses an app to electronically hail a driver, who "contracts" with the service. Ridehailing services have generally increased car trips and congestion to date.
    - Ridesplitting combines aspects of ridehailing and microtransit. These services may use larger vehicles, which increases vehicle occupancy rates and may alleviate congestion.

These emerging technologies open entirely new possibilities for the transportation realm, and their capabilities are growing at an exponential rate. There is an opportunity to use the combination of these technologies to integrate new and existing modes together in a multimodal, mobility-as-a-service network that creates ways of

[61] "Episode 2—Shared Mobility Conversation with Susan Shaheen." *ITE Talks Transportation Podcast Series*, www.spreaker.com/user/ite-talks-transportation/episode-2-shared-mobility-conversation-w (accessed June 28, 2016).

[62] *New Mobility* (Toronto: WSP, August 2016 update), 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.

getting around that are less dependent on auto ownership. In some cases, technologies that have been around for years, such as drones, are being repurposed and put to use in new ways.

Future technological solutions and services will require that innovations be economically viable, overcome potential liability and regulatory issues, and gain acceptance by society at large. Other keys to fully harnessing technological advances include consistent and ongoing coordination and collaboration among transportation agencies. Travelers do not see (or care about) jurisdictional boundaries; they want to get to work and school and back home as easily and efficiently as possible, regardless of who operates a given roadway. However, if a jurisdiction has fully equipped its infrastructure and properly trained its responders to allow for Level 5 automation, but its neighboring jurisdictions are only prepared for Level 3, then travel across these boundaries may be impaired. Although taking all the operating agencies and emerging technologies into account may seem like a gargantuan task, strengthening partnerships is critical to obtaining their potential to enhance the entire transportation network.

Transportation Investments

The vision for the future of transportation infrastructure in Greater Philadelphia centers on achieving and maintaining a State of Good Repair (SGR) for all existing facilities—consistent with both Pennsylvania and New Jersey state DOTs—as well as achieving a Vision Zero goal of no transportation injuries and serious fatalities by 2050, and integrating modes through network connections and multimodal strategies to expand access to opportunity for everyone. As a result of the region's commitment to safe travel through a Vision Zero policy, transportation investments will work to systematically eliminate preventable traffic crashes through equitable engineering, education, and enforcement while prioritizing speed control and maintaining and modernizing the transportation network.

The regional funding priorities and capital investments outlined in the *Connections 2050* financial plan have been made in close consultation with the RTC's Financial Planning Subcommittee with the aim of achieving the Plan's vision over the next 29 years. DVRPC facilitated 15 meetings with members of the subcommittee, along with many more targeted conversations, between September 2020 and May 2021. Long-range planning staff worked with PennDOT, NJDOT, SEPTA, NJ TRANSIT, DRPA/PATCO, county and municipal government partners, and other regional stakeholders to determine what investments need to be made over the life of the Plan to achieve the vision.

The financial plan consists of five steps:

1. determining a transportation infrastructure Capital Vision;
2. forecasting revenue;
3. allocating forecasted revenue to project types;
4. evaluating and selecting Major Regional Projects (MRPs); and
5. identifying options to close the funding gap.

The aspirational vision for transportation infrastructure should be consistent with the Plan's goals and policies, and respond to changing regional demographics, the digital economy's ongoing evolution, asset management needs, climate change, the implications of emerging technologies, the desire for a more equitable transportation network, and recovery from the Covid-19 pandemic.

There are four separate financial plans: one roadway and one transit for each of the Pennsylvania and New Jersey subregions. Each contains four funding periods that align with both the 2021 Pennsylvania and 2022 New Jersey TIPs, respectively (see Table 14). In Pennsylvania, the first funding period will comprise years two to six of the FYI 2021 TIP. The second period corresponds with the last six years of the statewide 12-year plan. In New Jersey, the first funding period is aligned with the first four years of the FY 2022 TIP. The second funding period corresponds with the remainder of the statewide 10-year plan.

Table 14: *CONNECTIONS 2050* FUNDING PERIODS

Funding Period	PENNSYLVANIA	NEW JERSEY
1	2022–2026	2022–2025
2	2027–2032	2026–2031
3	2033–2040	2032–2040
4	2041–2050	2041–2050

Source: DVRPC, 2021.

Transportation Capital Vision

Regionally, the Capital Vision identified approximately $154.2 billion in transportation improvements, predominantly to preserve and maintain our existing system. The infrastructure in the Pennsylvania subregion is generally older and more expansive, which is reflected in the total estimated need for the subregion. In Pennsylvania, the Vision Plan would invest $64 billion in roadways, and $55.5 billion in transit over the life of the Plan. In the New Jersey subregion, the Vision Plan would invest $18.2 billion in roadways, and $16.5 billion in transit over the life of *Connections 2050* (see Table 15).

Since we cannot afford all of the identified needs, the *Connections 2050* outlines a Vision Plan and then identifies a fiscally constrained plan (Funded Plan) of projects that can be achieved over the next 29 years with reasonably anticipated funding.

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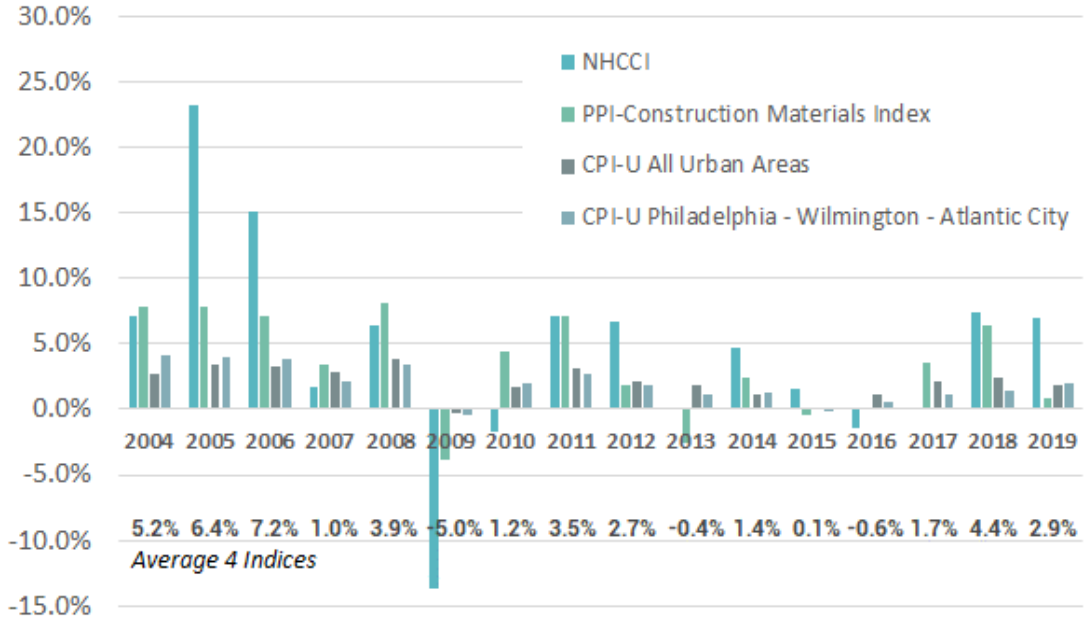
Table 15: TOTAL TRANSPORTATION VISION PLAN (2022–2050, IN BILLIONS OF YOE $)

Mode	Project Category	Pennsylvania	New Jersey
Roadway	System Preservation		
	- Pavement Preservation	$ 8.5 B	$ 4.5 B
	- Bridge Preservation	$ 25.7 B	$ 5.5 B
	Bicycle and Pedestrian	$ 10.5 B	$ 3.4 B
	Operational Improvements	$ 16.6 B	$ 3.7 B
	System Expansion	$ 1.6 B	$ 0.8 B
	Other	$ 1.1 B	$ 0.3 B
Roadway Subtotal		$ 64.0 B	$ 18.2 B
Transit	System Preservation		
	- Rail Infrastructure	$ 8.6 B	$ 1.0 B
	- Vehicles	$ 19.7 B	$ 6.0 B
	- Station Enhancements	$ 4.3 B	$ 1.1 B
	Operational Improvements	$ 5.5 B	$ 0.4 B
	System Expansion	$ 10.5 B	$ 6.8 B
	Other	$ 4.8 B	$ 1.1 B
Transit Subtotal		$ 55.5 B	$ 16.5 B
Subregion Total		**$ 119.5B**	**$ 34.7 B**

Figures may not add up due to rounding. Source: DVRPC, 2021.

Federal regulations require that future transportation project cost estimates use year of expenditure (YOE) dollars. These dollars account for the inflation that can be reasonably anticipated between the present day and the year(s) that the project is planned for construction. Generally, inflation related to the construction industry is more variable than the larger economy. DVRPC analyzes annual inflation rates for four indices: The National Highway Construction Cost Index (NHCCI), the Producer Price Index for Construction Materials Special Index (PPI-Construction Materials Index), the Consumer Price Index for all urban areas (CPI-U All Urban Areas), and the Consumer Price Index for the greater Philadelphia area (CPI-U Philadelphia-Wilmington-Atlantic City). Inflation rates have been around 2 percent in recent years (see Figure 30). This rate is used to bring projects' earlier cost estimates into 2021 dollars. *Connections 2050* uses a more conservative 3 percent annual inflation rate to estimate how costs will increase in the future beyond 2021. This inflation rate is consistent with both state departments of transportation.

Figure 31: ANNUAL INFLATION COMPARISON



Source: DVRPC, 2020.

Roadway Capital Vision

Roadway infrastructure includes all auto-accessible roads and bridges controlled by state, county, local, and private entities. Table 16 outlines the existing road infrastructure In Greater Philadelphia, which informs additional needs, especially for preservation.

This Roadway Capital Vision breaks road, bike, and pedestrian needs into six major categories. Table 17 lists each expenditure category and describes the types of projects they contain.

Table 16: ROAD INFRASTRUCTURE IN GREATER PHILADELPHIA

Infrastructure	Owner	Pennsylvania Subregion	New Jersey Subregion
Roads (Linear Miles)	State DOT	3,552	524
	Other State/Federal Agency	169	159
	Turnpike/Toll Authority	94	100
	County/Local/Municipal	11,616	7,300
Bridges	State-Maintained Bridges >8 feet	2,793	546
	State-Maintained Deck Area (millions of square feet)	27.1	6.5
	Locally Maintained Bridges, >20 feet	959	328
	Locally Maintained Deck Area (millions of square feet)	2.9	0.6
CCTV Cameras	State DOT	454	110
	Turnpike / Toll Authority	22	260
	County / Local / Municipal	1000	270
Dynamic Message Signs (DMS)	State DOT	197	64
	Turnpike / Toll Authority	43	63
	County / Local / Municipal	-	17
Traffic Signals	State DOT	3	635
	County / Local / Municipal	5769	866
Safety Service Patrols	State DOT	15	11
	Turnpike / Toll Authority	4	10

Source: DVRPC, PennDOT, NJDOT, PTC, NJTA, SJTA, DRPA, BCBC, Mercer Co, Burlington Co., Camden Co, Gloucester Co, 2021.

Table 17: ROADWAY EXPENDITURE CATEGORIES AND PROJECT TYPES

Category ID	Category	Types of Projects
R1	Pavement Preservation	Preventative maintenance; resurfacing; reconstruction; appurtenances (signs, guardrails, pavement markings, drainage, and retaining walls); ADA curb cuts; local and county federal aid road maintenance
R2	Bridge Preservation	Preventative maintenance; painting; substructure rehabilitation; superstructure rehabilitation or replacement; bridge deck overlays or replacement; parapet repairs; culvert rehabilitation or replacement; local federal aid bridges; bridge removal
R3	Bicycle and Pedestrian	Streetscaping; sidewalks; multiuse paths; bike lanes; pedestrian and bicycle safety improvements; pedestrian bridge or tunnel
R4	Operational Improvements	Access management; roadway, interchange, or intersection realignment; channelization new turn lanes; roundabouts; Complete Streets; road diets; safety initiatives HSIP; rail crossings; ITS deployment; active traffic management; ICM; traffic operations centers; incident management; signal modernization, interconnection, or closed-loop signal systems; dedicated short-range communications (DSRC), 5G, vehicle-to-infrastructure, and vehicle-to-vehicle infrastructure
R5	Network Expansion	New roads, lanes, bypasses, bridges, or interchanges; roadway relocations
R6	Other	Debt service; environmental mitigation; mobility alternatives program (MAP); air quality programs; dams; Congestion Mitigation and Air Quality (CMAQ); TMAs; regional and local planning; parking facilities

Source: DVRPC, 2021.

R1. Pavement Preservation

Pavement Preservation maintains existing roadway pavement infrastructure. DVRPC conducts an extensive needs assessment for system preservation that informs the Capital Vision for each state subregion. The FAST Act directs MPOs to be proactive in identifying asset management needs, and DVRPC improves its capabilities in quantifying system preservation needs over the life of the Long-Range Plan with each update.

PennDOT provided pavement needs using its PAMS, which is based on the Deighton pavement model. It projects future pavement project needs based on current condition data. For previous long-range plans, DVRPC developed a methodology for analyzing future pavement condition based on normal wear and tear on the roads and accounting for the impact of future road projects. This analysis was done for New Jersey using data from the NJDOT Pavement Management System (PMS), which tracks the condition of each roadway lane mile to identify maintenance and replacement needs to bring the existing network to

an SGR. DVRPC used historic data from the PMS to estimate future rates of decline and has updated its project costs for preservation improvements working with each DOT's asset management units.

Pavement preservation needs are broken out into the following categories for each state subregion:

Major Regional Pavement Reconstruction [R1.01] Projects that improve or reconstruct regional Interstate or NHS facilities, or facilities with more than 25,000 vehicles per day; cover more than 20 lane miles; or cost more than $25 million. These are listed as MRPs in that section of the Plan. As both DOTs move toward LLCC techniques, reconstruction is increasingly a last resort for pavements that can no longer be maintained in a cost-effective manner or show signs of structural failure. Each project is based on a structural evaluation that indicates whether resurfacing can improve performance or determines if structural improvements or reconstruction is needed.

Minor Interstate Maintenance [R1.02] Preventive maintenance, resurfacing, reconstruction, and appurtenances on Interstate roadway facilities that do not meet the regional definition for MRPs. Regular preventative maintenance can delay future resurfacing and reconstruction needs by extending the life of pavement. These projects include crack sealing, milling and filling, shoulder cuts, oil chip sealing, or microsurfacing. Resurfacing generally occurs every seven years on Interstates. Appurtenances include signs, guardrail/guide barriers, drainage, pavement markings, lighting, and retaining walls that are part of the Interstate network.

Minor Non-Interstate Maintenance [R1.03] Preventative maintenance, resurfacing, reconstruction, and appurtenances on state-maintained roadway facilities that do not meet the regional definition for MRPs. Resurfacing generally occurs every 12–15 years on BPNs 2 and 3, and every 25 years on a business plan network (BPN) 4.

Local Federal Aid Roadways [R1.04] Preventative maintenance, resurfacing, and reconstruction for local federal aid roads.

Pennsylvania

PennDOT's PAMS contains data on 9,225 lane miles of roadway in the DVPRC region. Of these, approximately 35 percent are currently in poor condition. DVRPC estimates the following costs to achieve an SGR for pavement in the state subregion (see Table 18).

Table 18: PENNSYLVANIA SUBREGION PAVEMENT PRESERVATION NEEDS (R1)

R1	Pavement Preservation	2022–2026	2027–2032	2033–2040	2041–2050	Total
R1.01	Major Regional Pavement Reconstruction	$ 612.9	$ 924.1	$ 1,070.3	$ 322.7	$ 2,930.0
R1.02	Minor Interstate Maintenance	$ 193.8	$ 38.6	$ 43.3	$ 180.7	$ 456.4
R1.03	Minor Non-Interstate Roadway Maintenance	$ 626.9	$ 864.8	$ 663.0	$ 2,149.8	$ 4,304.6
R1.04	Local Federal Aid Roadways	$ 94.7	$ 133.8	$ 219.4	$ 357.8	$ 805.6
R1	TOTAL	$1,528.3	$1,961.3	$1,996.0	$3,011.0	**$ 8,496.5**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

NJ DOT maintains approximately 2,113 lane miles of roadway within the DVRPC region. Of these, approximately 18 percent are currently in poor condition. DVRPC estimates the following costs to achieve an SGR for pavement in the state subregion (see Table 19).

Table 19: NEW JERSEY SUBREGION PAVEMENT PRESERVATION NEEDS (R1)

R1	Pavement Preservation	2022–2025	2026–2031	2032–2040	2041–2050	Total
R1.01	Major Regional Pavement Reconstruction	$231.5	$100.0	$225.9	$332.4	$889.8
R1.02	Minor Interstate Maintenance	$ 96.9	$ 24.3	$ 79.8	$ 80.4	$ 281.4
R1.03	Minor Non-Interstate Roadway Maintenance	$ 910.9	$ 254.3	$ 535.5	$ 1,194.9	$ 2,895.6
R1.04	Local Federal Aid Roadways	$ 51.2	$ 89.0	$ 166.6	$ 245.1	$ 551.8
R1	TOTAL	$1,290.6	$467.5	$1,007.7	$1,852.8	**$4,618.61**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

R2. Bridge Preservation

Bridge Preservation maintains existing bridge facilities. PennDOT has developed an open-source BridgeCare model that incorporates LLCC logic, deterioration rates, treatments, and consequences within an enterprise interface. PennDOT ran this model to identify bridge investment needs to maintain an SGR in the Pennsylvania subregion over the life of the Plan.

Similar to pavement, DVRPC developed a methodology for analyzing future bridge conditions based on normal wear and tear and accounting for the impact of future bridge projects in New Jersey. This analysis is done using data from the NJDOT Bridge Management System databases, which track the condition of each bridge to identify maintenance and replacement needs to bring the existing network to an SGR. 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 bridges eligible for federal aid.

Bridge preservation needs are broken out into the following categories for each state subregion:

Major Regional Bridge Reconstruction [R2.01] Projects that improve or reconstruct regional Interstate or NHS bridge 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 $25 million. These are listed as MRPs.

Minor Interstate Bridge Preservation [R2.02] Maintenance, rehabilitation, and replacement of Interstate bridge facilities. Maintenance can include scouring, washing, or replacement of expansion joints, rocker bearings, or underpinnings. These projects

should occur at each bridge every 15–25 years, as long as the bridge is in an SGR. Bridges in poor condition are generally targeted for rehabilitation or replacement and undergo basic maintenance only as an emergency stop-gap measure to ensure it can remain open to traffic. Rehabilitation can include rehabilitating or replacing one or more of the three main bridge components: the deck, the superstructure, or the substructure. This can also include painting metal bridges and deck overlays. Keeping the bridge deck watertight is critical to keeping corrosive materials out of the substructure and superstructure structural components. Replacement generally occurs when a bridge that has passed its expected lifespan and has two or more of its components (deck, superstructure, or substructure) in poor condition.

Non-Interstate Bridge Preservation [R2.03] Bridge maintenance, rehabilitation, and replacement on state-maintained non-Interstate bridges.

Bridge Removal [R2.04] Removal of bridges that will not be replaced.

Local Federal Aid Bridges [R2.05] Rehabilitation and replacement needs for county and local facilities receiving federal funding.

Public-Private Partnerships [R2.06] Accounts for the region's share of the rapid bridge replacement project with Plenary Welsh Keystone Partners, which is scheduled to end in 2047.

Pennsylvania

The five-county DVRPC Pennsylvania subregion currently has 2,793 state-maintained bridges greater than eight feet in length, with 27.1 million square feet of bridge deck area. In addition, county and local transportation agencies maintain 959 bridges over 20 feet in length, with 2.9 million square feet of deck area. FHWA has set a minimum target threshold of 10 percent of NHS bridge deck area in structurally deficient condition. Currently, 6.7 percent of the Pennsylvania subregion's NHS bridge deck area is in poor, or structurally deficient, condition. DVRPC estimates the following costs to achieve an SGR for bridges in the state subregion (see Table 20).

Table 20: PENNSYLVANIA SUBREGION BRIDGE PRESERVATION NEEDS (R2)

R2	Bridge Preservation	2022–2026	2027–2032	2033–2040	2041–2050	Total
R2.01	Major Regional Bridge Preservation	$ 955.8	$ 1,173.6	$ 3,675.5	$ 3,089.8	$ 8,894.7
R2.02	Minor Interstate Bridge Preservation	$ 454.0	$ 366.1	$ 2,002.6	$ 3,960.8	$ 6,783.6
R2.03	Non-Interstate Bridge Maintenance	$ 653.7	$ 1,898.4	$ 1,516.9	$ 2,929.7	$ 6,998.7
R2.04	Bridge Removal	$ 22.6	$ -	$ 23.8	$ 38.8	$ 85.1
R2.05	Local Federal Aid Bridges	$ 298.9	$ 405.9	$ 839.8	$ 1,401.3	$ 2,945.9
R2.06	Public-Private Partnerships	$ 0.5	$ 0.7	$ 1.1	$ 1.3	$ 3.6
R2	TOTAL	$2,385.4	$3,844.7	$8,059.8	$11,421.6	**$ 25,711.6**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

The four-county DVRPC New Jersey subregion currently has 546 state-maintained bridges greater than eight feet in length with 6.5 million square feet of bridge deck area. In addition, county and local transportation agencies maintain 370 bridges over 20 feet in length, with 1 million square feet of deck area. Approximately 4.5 percent of the state-owned bridge deck area is rated as structurally deficient, while 17.0 percent of the locally maintained deck area is structurally deficient. DVRPC estimates the following costs to achieve an SGR for bridges in the state subregion (see Table 21).

Table 21: NEW JERSEY SUBREGION BRIDGE PRESERVATION NEEDS (R2)

R2	Bridge Preservation	2022–2025	2026–2031	2032–2040	2041–2050	Total
R2.01	Major Regional Bridge Preservation	$241.2	$29.7	$230.8	$159.1	$660.8
R2.02	Minor Interstate Bridge Preservation	$ 98.0	$ 15.2	$ 131.3	$ 239.7	$ 484.2
R2.03	Non-Interstate Bridge Maintenance	$ 1,069.3	$ 233.7	$ 718.8	$ 1,109.3	$ 3,131.1
R2.04	Bridge Removal	$ -	$ -	$ -	$ -	$ -
R2.05	Local Federal Aid Bridges	$ 259.4	$ 37.8	$ 89.6	$ 261.0	$ 647.8
R2.06	Public-Private Partnerships	$ -	$ -	$ -	$ -	$ -
R2	TOTAL	$1,667.8	$316.5	$1,170.5	$1,769.1	**$5,584.6**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

R3. Bicycle and Pedestrian

This category identifies the vision for trails, sidewalks, bike lanes, and other infrastructure to increase the region's bike and pedestrian friendliness, and to achieve a more multimodal transportation network. DVRPC's Office of Transit, Bicycle, and Pedestrian Planning developed a Capital Vision for bicycle and pedestrian infrastructure that reflects the region's desire to build more bikeable and walkable communities and to develop more space-efficient transportation options.

On- and off-road facility investment needs were identified by analyzing the region's sidewalks, on-road bicycle infrastructure, and off-road facilities. Estimates for new sidewalks are based on construction of new facilities on one side of the street for 25 percent of street segments that currently do not have any sidewalks (excluding limited-access highways). DVRPC has developed a complete sidewalk inventory for Greater Philadelphia that is displayed in its new, interactive Pedestrian Portal which informed this analysis. Estimates for on-road bicycle infrastructure are based on the construction of all miles of the top 20 percent of priorities defined in DVRPC's Bicycle

Level of Traffic Stress Connectivity analysis. Finally, the estimate for off-road facilities is based on gaps in the network of side paths and completion of the Circuit.

Bike and pedestrian needs are broken out into the following categories for each state subregion:

Major Regional Bike and Pedestrian Projects [R3.01] Larger, high-cost projects, such as the Circuit. These are listed as MRPs.

Minor On-Road Facilities [R3.02] Needs for pedestrian and bike safety and intersection improvements (countdown timers and crosswalks), streetscaping, sidewalks, bike lanes, bike and pedestrian bridges, overpasses or tunnels, and project engineering.

Minor Off-Road facilities [R3.03] Completion of some additional side path and trail segments not considered to be part of the Circuit.

Pennsylvania

Using the assumptions noted, DVRPC assessed needs for Pennsylvania as 2,500 miles of new sidewalk, 672 miles of on-road bicycle infrastructure, 75 miles of new side path, and completion of the remaining 267 of 561 miles of the Circuit. DVRPC estimates the following costs to build this infrastructure over the next 29 years (see Table 22).

Table 22: PENNSYLVANIA SUBREGION BIKE/PED CAPITAL VISION (R3)

R3	Bike/Ped	2022–2026	2027–2032	2033–2040	2041–2050	Total
R3.01	Major Regional Bike and Pedestrian Projects	$227.8	$-	$1,225.7	$1,859.0	$3,312.5
R3.02	Minor On-Road Facilities	$ 815.7	$ 1,151.6	$ 1,888.4	$ 3,080.0	$ 6,935.7
R3.03	Minor Off-Road Facilities	$ 23.9	$ 33.7	$ 55.3	$ 90.2	$ 203.2
R3	TOTAL	$1,067.4	$1,185.3	$3,169.5	$5,029.1	**$10,451.3**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

Using the assumptions noted, DVRPC assessed needs for New Jersey as 1,175 miles of new sidewalk; 373 miles of on-road bicycle infrastructure; 41 miles of new side path; and completion of the remaining 179 miles of the Circuit. DVRPC estimates the following costs to build this infrastructure over the next 29 years (see Table 23).

Table 23: NEW JERSEY SUBREGION BIKE/PED CAPITAL VISION (R3)

R3	Bike/Ped	2022–2025	2026–2031	2032–2040	2041–2050	Total
R3.01	Major Regional Bike and Pedestrian Projects	$ 36.3	$ 63.1	$ 118.2	$ 174.0	$ 391.7
R3.02	Minor On-Road Facilities	$ 337.1	$ 464.4	$ 783.1	$ 1,346.9	$ 2,931.5
R3.03	Minor Off-Road Facilities	$ 12.9	$ 18.0	$ 29.9	$ 49.5	$ 110.3
R3	TOTAL	$ 386.3	$ 545.5	$ 931.2	$ 1,570.4	**$ 3,433.45**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

R4. Roadway Operational Improvements

The Capital Vision identifies needs for operational improvements, which use physical changes or new technology to increase the efficiency of the existing system. Physical improvements in this category include roundabouts, new turn lanes, roadway realignment, complete streets, road diets, and traffic calming to improve the functionality and safety of the roadway system. Technological improvements include the use of ITS equipment, incident management programs, traffic signal upgrades, and connected vehicle and infrastructure technologies.

Transportation operations have unique funding and implementation requirements. Although ITS projects are like other major transportation capital investments in that they are funded through the TIP, there are substantial maintenance and operations costs associated with them. Hardware, software, and communications have to be continually maintained and updated to remain consistent with the latest IT standards.

With the adoption of a Vision Zero goal, DVRPC will explore separating this category between safety-focused projects and efficiency-focused projects for future iterations of the Plan. Needs for operational improvements to the roadway network are broken out into the following categories for each state subregion:

Major Regional Safety/Operations [R4.01] Projects that improve safety and operations on NHS facilities, or facilities with more than 25,000 vehicles per day; cover more than 20 lane miles; cost more than $25 million; or would need to be included in air quality conformity analysis because they would significantly alter regional travel patterns. These are listed as MRPs.

Minor Regional Safety/Operations [R4.02] Intersection/interchange improvements, roadway realignments, channelization, roundabouts, access management, new turning lanes, and grade-separated rail crossings that do not rise to the level of MRP. Funding for these specific projects will be identified in the current and future TIPs.

Intelligent Transportation Systems [R4.03] Capital and operating costs for ITS deployment and traffic operations centers may include traveler information services, such as DMS to inform drivers to take alternative routes in the event of traffic or transit delays, CCTV cameras, fiber, incident detection, or future connected vehicle applications. Funds will support DOT, county, and local operations.

Incident Management [R4.04] Capital and operating funds for safety service patrols, local traffic incident management task forces, emergency communication networks, and collision investigation and reconstruction tools.

Traffic Management and Signals [R4.05] Traffic signal replacement and upgrades, including the annual retiming program; as well as advanced traffic management systems, including variable speed limits and queue detection systems, ramp metering, and ICM. Some projects listed in operational improvements also have system expansion components, such as flex lanes.

Pennsylvania

Regional needs and associated cost estimates are derived from DVRPC's Office of Transportation Operations Management and its regular updates to the *Transportation System Management and Operations Plan*. DVRPC estimates the following costs to build this infrastructure over the next 29 years in Pennsylvania (see Table 24).

Table 24: PENNSYLVANIA SUBREGION OPERATIONS CAPITAL VISION (R4)

R4	Operational Improvements	2022–2026	2027–2032	2033–2040	2041–2050	Total
R4.01	Major Regional Safety/Operations	$335.8	$400.2	$4,690.5	$7,185.0	$12,611.4
R4.02	Safety/Operational Improvements	$ 312.2	$ 189.7	$ 498.3	$ 812.7	$ 1,813.0
R4.03	Intelligent Transportation Systems	$ 40.6	$ 129.1	$ 231.4	$ 378.3	$ 779.3
R4.04	Incident Management	$ 35.7	$ 58.0	$ 141.1	$ 263.7	$ 498.5
R4.05	Traffic Management and Signals	$ 51.3	$ 128.4	$ 241.7	$ 501.2	$ 922.6
R4	TOTAL	$775.6	$905.4	$5,802.9	$9,140.9	**$16,624.8**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

In New Jersey, regional needs and associated cost estimates are derived from DVRPC's Office of Transportation Operations Management and its regular updates to the *Transportation Systems Management and Operations Plan*. DVRPC estimates the following costs to build this infrastructure over the next 29 years in New Jersey (see Table 265.

Table 25: NEW JERSEY SUBREGION OPERATIONS CAPITAL VISION (R4)

R4	Operational Improvements	2022–2025	2026–2031	2032–2040	2041–2050	Total
R4.01	Major Regional Safety/Operations	$ 128.3	$ 55.8	$ 882.4	$ 878.9	$ 1,945.3
R4.02	Safety/Operational Improvements	$ 45.8	$ 34.3	$ 98.2	$ 144.5	$ 322.9
R4.03	Intelligent Transportation Systems	$ 26.7	$ 71.0	$ 142.6	$ 195.7	$ 436.0
R4.04	Incident Management	$ 23.8	$ 86.6	$ 113.9	$ 175.3	$ 399.6
R4.05	Traffic Management and Signals	$ 28.3	$ 87.8	$ 159.2	$ 272.1	$ 547.3
R4	TOTAL	$ 252.8	$ 335.4	$ 1,396.3	$ 1,666.6	**$ 3,651.1**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

R5. Roadway Expansion

Roadway Expansion projects add capacity by widening or extending existing facilities, or building new roads or interchanges. The need for MRPs is based on the projects included in the previous *Connections 2045* Plan, a review of recent transportation and corridor studies, and a call for projects from planning partners for improvements necessary for the region to continue to grow and prosper in the future. All roadway expansion projects are required to be consistent with the region's CMP and Land Use Vision and are evaluated for consistency with land use, environmental, economic development, environmental justice, and transportation goals.

The Capital Vision for expansion of the roadway network is broken out into the following categories for each state subregion:

Major Regional New Capacity [R5.01] Large-scale projects that will have a significant impact on regional travel. These include addition of new through lanes by widening, extending, or building new limited access highways of any length; creating new interchanges between highways (HPMS[63] functional classes 1 or 2) and arterials (HPMS functional classes 1 3 or 4); or widening, extending, or building new principal arterials (HPMS functional classes 3 or 4) for more than three lane miles. Some projects listed in system expansion also have operational improvement components. These include adding flex lanes or part-time shoulder use lanes to existing facilities. These projects exceed $25 million and are listed as MRPs.

Minor Regional New Capacity [R5.02] Network expansion projects that do not rise to the level of MRP but will have a significant impact on regional travel. These projects are generally less than three lane miles in length on minor arterial, collector, or local roads. They are derived

[63] Highway Performance Monitoring System

from the current TIPs, the unfunded TIP illustrative lists, and the call for projects to the Financial Planning Subcommittee.

Pennsylvania

Cost estimates for roadway system expansion projects are derived from the current Pennsylvania TIP, PennDOT, or from studies completed by county or other partner agencies (see Table 26).

Table 26: PENNSYLVANIA SUBREGION NETWORK EXPANSION CAPITAL VISION (R5)

R5	Network Expansion	2022–2026	2027–2032	2033–2040	2041–2050	Total
R5.01	Major Regional New Capacity	$185.4	$252.4	$683.5	$190.6	$1,311.9
R5.02	Minor New Capacity	$ 38.8	$ 25.0	$ 171.2	$ 149.8	$ 384.8
R5	TOTAL	$224.2	$277.4	$854.7	$340.4	**$1,696.7**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

Cost estimates for roadway system expansion projects are derived from the current New Jersey TIP, NJDOT, or from studies completed by county or other partner agencies(see Table 27).

Table 27: NEW JERSEY SUBREGION NETWORK EXPANSION CAPITAL VISION (R5)

R5	Network Expansion	2022–2025	2026–2031	2032–2040	2041–2050	Total
R5.01	Major Regional New Capacity	$ 207.1	$ 55.8	$ 200.6	$ 213.0	$ 676.4
R5.02	Minor New Capacity	$ 49.8	$ 20.2	$ 27.3	$ 4.3	$ 101.6
R5	TOTAL	$ 256.8	$ 76.0	$ 227.9	$ 217.2	**$ 777.9**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

R6. Roadway Other

Other roadway needs include miscellaneous items—such as parking facilities, drainage, environmental mitigation, TMAs, engineering, regional and local planning, and debt service—that do not fit neatly into categories R1 through R5. These needs are largely obligations that must be fully funded.

Needs for operational improvements to the roadway network are broken out into the following categories for each state subregion:

Major Regional Roadway Other [R6.01] Projects exceeding $25 million that do not fall into previous roadway categories. These are listed as MRPs.

Environmental Mitigation and Air Quality [R6.02] Remediation and testing associated with underground storage tanks, lead-based paint and asbestos abatement, contaminated soil and groundwater, and air quality. This line item is also for non–project-specific needs, including wetland mitigation and cultural resource preservation. In many instances, an environmental mitigation project is attached to a specific highway project. When this happens, the environmental mitigation need is included as part of the highway project costs and is not included in this funding category. However, ongoing maintenance needs for completed projects are included here. This category also includes funding for the CMAQ project engineering, diesel retrofits, and the Air Quality Action Program.

Debt Service [R6.03] Funding required to cover the repayment of interest and principal on a debt, such as a bond, for capital improvements already made or being made.

Travel Demand Management [R6.04] Travel Demand Management strategies include carpool and vanpool programs, telecommuting, variable work hours, and other policies that provide alternatives to SOVs. Funding in this category is for TMAs; marketing for the MAP/Assisting Commuters After COVID, and Share-A-Ride. Some of these programs require a local match, which is not reflected in the Capital Vision.

Rail Improvements [R6.05] Roadway funds dedicated for rail improvements to both the freight and passenger rail networks.

Miscellaneous Roadway Other [R6.05] Parking facilities, security, consultant and design services, dam rehabilitation/reconstruction, local and regional planning, regional GIS support, the regional travel demand model, and other miscellaneous items, such as equipment purchases and maintenance and storage facilities.

Pennsylvania

To develop the “Roadway Other” needs assessment for southeastern Pennsylvania, DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where PennDOT was able to provide a more accurate cost estimate for future years (see Table 28).

Table 28: PENNSYLVANIA SUBREGION ROADWAY OTHER CAPITAL VISION (R6)

R6	Network Expansion	2022–2026	2027–2032	2033–2040	2041–2050	Total
R6.01	Major Regional Roadway Other	$ 1.6	$ 13.6	$ -	$ -	$ 15.1
R6.02	Environmental Mitigation and Air Quality	$ 106.2	$ 149.9	$ 166.4	$ 219.3	$ 641.6
R6.03	Debt Service	$ -	$ -	$ -	$ -	$ -
R6.04	Travel Demand Management	$ 6.8	$ 9.5	$ 15.6	$ 25.5	$ 57.5
R6.05	Rail Improvements	$ -	$ -	$ -	$ -	$ -
R6.06	Miscellaneous Other	$ 46.7	$ 64.4	$ 106.8	$ 174.1	$ 392.0
R6	TOTAL	$ 161.2	$ 237.4	$ 288.8	$ 418.9	**$ 1,106.2**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

To develop the “Roadway Other" needs assessment for southern New Jersey, DVRPC extended historic spending levels on most of the subcategories in these areas, and updated them in the instances where NJDOT was able to provide a more accurate cost estimate for future years (see Table 29).

Table 29: NEW JERSEY SUBREGION ROADWAY OTHER CAPITAL VISION (R6)

R5	Network Expansion	2022–2025	2026–2031	2032–2040	2041–2050	Total
R6.01	Major Regional Roadway Other	$ -	$ -	$ -	$ -	$ -
R6.02	Environmental Mitigation and Air Quality	$ 3.6	$ 4.2	$ 9.4	$ 13.9	$ 31.1
R6.03	Debt Service	$ -	$ -	$ -	$ -	$ -
R6.04	Travel Demand Management	$ 8.9	$ 10.3	$ 23.1	$ 34.0	$ 76.4
R6.05	Rail Improvements	$ 1.0	$ 1.2	$ 2.7	$ 3.9	$ 8.8
R6.06	Miscellaneous Other	$ 21.8	$ 25.2	$ 56.7	$ 83.4	$ 187.0
R6	TOTAL	$ 35.3	$ 40.9	$ 91.9	$ 135.2	**$ 303.3**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

Transit Capital Vision

Transit infrastructure consists of facilities that are maintained and operated by the region's local transit service providers. Table 30 outlines the existing transit infrastructure In Greater Philadelphia, which informs additional needs, especially for preservation. A number of facilities are used by the region's transit service providers but are not listed here because the asset is leased without maintenance responsibilities. Both SEPTA and NJ TRANSIT lease rail track from Amtrak and various regional freight rail operators. Another example is 30th Street Station in Philadelphia, which is used by both SEPTA and NJ TRANSIT and maintained by Amtrak. There is also rail infrastructure for which the region's transit operators have maintenance responsibility but is not in active service. Examples include SEPTA's Chester Trunk Line from Chester City to West Chester, Pennsylvania; and NJ TRANSIT's Vineland Secondary Route.

This Vision Plan breaks transit infrastructure and service needs into six major categories. Table 31 lists each expenditure category and describes the types of projects they contain.

Table 30: TRANSIT INFRASTRUCTURE IN GREATER PHILADELPHIA

Infrastructure	SEPTA	NJ TRANSIT	PATCO	PART
Rail Track Miles	397.4	117.4	35.3	-
- Elevated Track Miles	30.8	-	-	-
- Tunnel Track Miles	58.4	-	2.4	-
Interlockings	90	33	14	-
Bridges	341	58	26	-
At-Grade Crossings	182	99	-	-
Power Substations and Switching Stations	77	-	11	-
Rail Stations and Bus Terminals	342	28	13	1
- Regional Rail Stations	153*	7	-	-
- Heavy Rail Stations	52	-	13	-
- Trolley/Light Rail Stations	75	20	-	-
- Bus Terminals or Loops	62	1	-	-
Buses	1,390	275	-	8
Paratransit Vehicles	459		0	2
Heavy Rail Vehicles	343	-	120	-

Infrastructure	SEPTA	NJ TRANSIT	PATCO	PART
Light Rail Vehicles	182	20	-	-
Regional Rail Vehicles	335	42	-	-
Trackless Trolleys	38	-	-	-
Locomotives	8	12	-	-
Push Pull Cars	53	20	-	-
Maintenance Vehicles	936		63	2
Vehicle Maintenance and Storage Shops	23	5	3	1

** Includes three stations in Delaware state: Claymont, Churchmans Crossing, and Newark. Wilmington Station is owned by Amtrak.*
Sources: SEPTA, NJ TRANSIT, PATCO, and Pottstown Area Rapid Transit (PART), 2012.

Table 31: EXPENDITURE CATEGORIES AND PROJECT TYPES

Category ID	Category	Types of Projects
T1	Rail Infrastructure Preservation	Track rehabilitation, resurfacing, or replacement; catenary rehabilitation or replacement; signal replacement; rail bridge rehabilitation or replacement; substation improvements
T2	Vehicle Rehabilitation/Replacement	New or rehabilitated buses, paratransit, commuter rail, light rail, or heavy rail vehicles; maintenance and storage facilities; vehicle maintenance equipment
T3	Station Preservation	Station rehabilitation and improvements; access improvements; non-expansion parking improvements and maintenance; transit-oriented development; transportation centers; ADA compliance
T4	System/ Operational Improvements	ITS; real-time passenger information; positive train control; fare modernization; traffic signal pre-emption; double tracking; sidings; light rail restoration
T5	Network Expansion	New stations on existing lines (including station parking needs), extension of existing lines, or new rail and bus rapid transit (BRT) routes
T6	Other	Safety and security; Amtrak lease agreements, coordinated human services; preventative maintenance (operating budget), debt service

Source: DVRPC, 2021.

These categories are further broken out into subcategories for a more granular analysis of investment needs over the life of the Plan. These subcategories and their associated needs are outlined in the following sections.

T1. Rail Infrastructure Preservation

This is the first of three transit system preservation categories included in the Transit Capital Vision. Greater Philadelphia's existing transit network is among the oldest in the nation and includes over 640 miles of existing track, accounting for segments with two or more tracks running in parallel. Rail infrastructure needs include bridges, rails, rail ties, beds, signals, catenaries, and power substations.

Needs for rail infrastructure preservation are broken out into the following categories for each state subregion:

Major Regional Rail Infrastructure Preservation [T1.01] Projects that improve or make major repairs to existing rail lines or cost greater than $25 million. These are listed as MRPs.

Track Rehabilitation/Resurfacing/Replacement [T1.02] Yards program, yard tracks program, track and right-of-way, and regular funding for rail maintenance. This category also includes tunnels and tunnel support systems.

Catenary and Substation Rehabilitation/Replacement [T1.03] Replacement of major power components, such as transformers, transformer breakers, trolley breakers, feeder switches, substation switchgears and protective relaying.

Signal and Communications Rehabilitation/Replacement [T1.04] Improvements to communications systems, signal systems, and IT infrastructure.

Rail Bridge/Elevated Structure Improvements [T1.05] Replacement of bridges for rail, as well as set-aside funding from the Infrastructure Safety and Renewal Program to address future bridge needs as they arise.

Pennsylvania

Much of SEPTA's guideway infrastructure is approaching the end of its 50-year life expectancy, fueling replacement needs. SEPTA rail infrastructure needs were developed using its asset management system to determine regular maintenance cycles, such as how often infrastructure needs to be rehabilitated, restored, or replaced (see Table 32).

Table 32: PENNSYLVANIA SUBREGION RAIL INFRASTRUCTURE PRESERVATION CAPITAL VISION (T1)

T1	Rail Infrastructure	2022–2026	2027–2032	2033–2040	2041–2050	Total
T1.01	Major Regional Rail Infrastructure Preservation	$ 9.0	$ 27.3	$ 126.0	$ 1,640.1	$ 1,802.4
T1.02	Track Rehabilitation/Resurfacing/Replacement	$ 695.3	$ 634.6	$ 1,495.3	$ 101.8	$ 2,927.0
T1.03	Catenary and Substation Rehabilitation/Replacement	$ 402.9	$ 96.9	$ 474.0	$ 31.5	$ 1,005.3
T1.04	Signal and Communications Rehabilitation/Replacement	$ 281.2	$ 198.7	$ 869.7	$ 49.1	$ 1,398.7
T1.05	Rail Bridge/Elevated Structure Improvements	$ 1,074.0	$ 120.2	$ 275.6	$ 41.4	$ 1,511.1
T1	TOTAL	$ 2,462.4	$ 1,077.6	$ 3,240.5	$ 1,864.0	**$ 8,644.5**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

The basis of need for NJ TRANSIT rail infrastructure was the NJ TRANSIT Capital Budget and FY2020 TIP for New Jersey. DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where NJ TRANSIT was able to provide a more accurate cost estimate for future years. DRPA/PATCO identified its needs as part of the Plan update. All PATCO needs are accounted for in New Jersey (see Table 33).

Table 33: NEW JERSEY SUBREGION RAIL INFRASTRUCTURE PRESERVATION CAPITAL VISION (T1)

T1	Rail Infrastructure	2022–2025	2026–2031	2032–2040	2041–2050	Total
T1.01	Major Regional Rail Infrastructure Preservation	$ 12.0	$ 12.0	$ 13.0	$ 22.0	$ 59.0
T1.02	Track Rehabilitation/Resurfacing/Replacement	$ 71.0	$ 114.7	$ 192.9	$ 292.6	$ 671.2
T1.03	Catenary and Substation Rehabilitation/Replacement	$ 9.0	$ 10.7	$ 9.2	$ 33.0	$ 62.0
T1.04	Signal and Communications Rehabilitation/Replacement	$ 9.1	$ 9.4	$ 25.3	$ 46.4	$ 90.2
T1.05	Rail Bridge/Elevated Structure Improvements	$ 17.5	$ 19.1	$ 20.2	$ 38.8	$ 95.6
T1	TOTAL	$ 118.7	$ 165.9	$ 260.6	$ 432.8	**$ 978.0**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

T2. Vehicle Rehabilitation/Replacement

This is the second of three transit system preservation categories included in the Transit Capital Vision. Over 2,850 transit vehicles currently operate in Greater Philadelphia to bring passengers from place to place.

Needs for vehicle rehabilitation and replacement are broken out into the following categories for each state subregion:

Major Regional Revenue Vehicle Replacements [T2.01] New buses, light rail vehicles, heavy rail vehicles and commuter rail vehicles; fleetwide vehicle overhauls; and new or expanded vehicle storage and maintenance facilities. Projects in this category exceed $25 million and are listed as MRPs.

Minor Vehicle Purchases [T2.02] Bus replacement every 12 years; new minivans, hi-cap paratransit vehicles, or paratransit sedans for SEPTA operations every six years; or fewer than five new rail vehicles.

Routine Vehicle Overhaul [T2.03] Partial or complete disassembly of the existing fleet totaling less than $25 million; inspection to detect damaged, defective, or worn parts; repair or replacement of parts; and reassembly, testing, and trial-run prior to returning to its full operating level. This occurs at the mid-year of a fleet's expected lifespan. For buses, this is year 6 of a 12-year lifespan; for light, heavy, and commuter rail cars, this is around year 15 of a 30-year lifespan.

Vehicle Storage and Maintenance Facilities and Equipment [T2.04] Replacing shop roofs, installing new fencing, and constructing or expanding a new rail shop or yard storage to meet the needs of a larger rail fleet. This category also includes replacement of vehicle maintenance equipment, such as new vehicle washers.

Utility Vehicles [T2.05] Maintenance and replacement needs for all non-revenue transit vehicles.

Pennsylvania

Vehicles comprise nearly 40 percent of SEPTA's SGR backlog. SEPTA has one of the oldest rail fleets in the country and most of SEPTA's rail fleet will require replacement over the horizon of the Long-Range Plan. Vehicle replacement and overhauls are the highest priority for SEPTA's Capital Program, and these needs represent a programmatic approach to infrastructure renewal. Needs for vehicle infrastructure were determined using SEPTA's asset management system. PART identified bus replacement needs as part of the Plan update (see Table 34).

Table 34: PENNSYLVANIA SUBREGION VEHICLE REHABILITATION/REPLACEMENT CAPITAL VISION (T2)

T2	Vehicle Rehabilitation/Replacement	2022–2026	2027–2032	2033–2040	2041–2050	Total
T2.01	Major Regional Revenue Vehicle Replacements	$ 1,269.0	$ 2,686.0	$ 1,405.3	$ 2,682.1	$ 8,042.3
T2.02	Minor Vehicle Purchases	$ 625.4	$ 902.1	$ 1,793.1	$ 2,339.6	$ 5,660.1
T2.03	Routine Vehicle Overhaul	$ 557.3	$ 655.7	$ 1,617.2	$ 2,110.1	$ 4,940.3
T2.04	Vehicle Storage and Maintenance Facilities and Equipment	$ 137.8	$ 109.8	$ 216.8	$ 172.2	$ 636.6
T2.05	Utility Vehicles	$ 115.5	$ 114.5	$ 143.7	$ 6.7	$ 380.5
T2	TOTAL	$ 2,704.9	$ 4,468.1	$ 5,176.1	$ 7,310.7	**$ 19,659.8**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

The basis of need for NJ TRANSIT vehicles was the NJ TRANSIT Capital Budget and FY2022 TIP for New Jersey. DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where NJ TRANSIT was able to provide a more accurate cost estimate for future years. DRPA/PATCO identified its needs as part of the Plan update (see Table 35).

Table 35: NEW JERSEY SUBREGION VEHICLE REHABILITATION/REPLACEMENT CAPITAL VISION (T2)

T2	Vehicle Rehabilitation/Replacement	2022–2025	2026–2031	2032–2040	2041–2050	Total
T2.01	Major Regional Revenue Vehicle Replacements	$ 143.8	$ 144.4	$ 590.1	$ 1,134.2	$ 2,012.6
T2.02	Minor Vehicle Purchases	$ 163.6	$ 190.4	$ 426.9	$ 628.1	$ 1,409.0
T2.03	Routine Vehicle Overhaul	$ 254.7	$ 330.8	$ 703.3	$ 1,034.7	$ 2,323.5
T2.04	Vehicle Storage and Maintenance Facilities and Equipment	$ 35.6	$ 49.2	$ 87.2	$ 131.3	$ 303.2
T2.05	Utility Vehicles	$ 2.2	$ 2.5	$ 4.7	$ 10.3	$ 19.6
T2	TOTAL	$ 599.8	$ 717.3	$ 1,812.2	$ 2,938.6	**$ 6,067.9**

All figures in millions of YOE dollars. Figures may not add up due to rounding.}
Source: DVRPC, 2021.

T3. Transit Stations

This is the third and final transit system preservation category included in the Transit Capital Vision. It identifies Greater Philadelphia's existing inventory of more than 380 rail stations and bus terminals, including regional rail stations, heavy rail stations, trolley/light rail stations, and bus terminals or loops.

Needs for transit stations are broken out into the following categories for each state subregion:

Major Regional Station Renovation [T3.01] Major improvements to stations[64] with more than 5,000 daily boardings or alightings, or which cost greater than $25 million. Regular renovation, including those required to meet ADA accessibility requirements. These typically occur approximately every 30 years. Projects in this category are listed as MRPs.

Minor Station Rehabilitation [T3.02] Renovation projects at existing transit stations and passenger amenities that do not rise to the level of an MRP.

Parking and Passenger Amenities [T3.03] Expansion of parking at existing stations, creation of new park-and-ride lots, and rehabilitation of existing parking facilities; historic preservation, rehabilitation, and related activities; bus shelters; landscaping and other scenic beautification, including street lights and public art; pedestrian access and walkways; bicycle access, storage facilities, and installation of equipment for transporting bicycles on transit vehicles; transit connections to parks; signage; and enhanced access to transit for persons with disabilities.

Pennsylvania

Stations are the second leading cost in SEPTA's backlog of SGR projects. Needs for transit stations were determined using SEPTA's asset management system. PART identified its needs as part of the Plan update (See Table 36).

Table 36: PENNSYLVANIA SUBREGION TRANSIT STATION PRESERVATION CAPITAL VISION (T3)

T3	Transit Stations	2022–2026	2027–2032	2033–2040	2041–2050	Total
T3.01	Major Regional Station Renovation	$ 84.0	$ 202.5	$ 20.6	$ 1,705.3	$ 2,012.4
T3.02	Minor Station Rehabilitation	$ 880.5	$ 239.2	$ 595.6	$ 441.8	$ 2,157.1
T3.03	Parking and Passenger Amenities	$ 0.1	$ 4.8	$ 43.9	$ 104.6	$ 153.4
T3	TOTAL	$ 964.6	$ 446.5	$ 660.0	$ 2,251.7	**$ 4,322.9**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

[64] 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.

New Jersey

With the *NJT2030* Strategic Plan, NJ TRANSIT initiated its first-ever systemwide assessment of facilities to build a comprehensive maintenance, repair, and modernization plan.[65] The basis of need for NJ TRANSIT vehicles was the NJ TRANSIT Capital Budget and FY2022 TIP for New Jersey. DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where NJ TRANSIT was able to provide a more accurate cost estimate for future years. DRPA/PATCO identified its needs as part of the Plan update (See Table 37).

Table 37: NEW JERSEY SUBREGION TRANSIT STATION PRESERVATION CAPITAL VISION (T3)

T3	Transit Stations	2022–2025	2026–2031	2032–2040	2041–2050	Total
T3.01	Major Regional Station Renovation	$ 12.4	$ 37.2	$ 45.6	$ 639.9	$ 735.1
T3.02	Minor Station Rehabilitation	$ 12.5	$ 14.5	$ 20.2	$ 58.4	$ 105.7
T3.03	Parking and Passenger Amenities	$ 32.1	$ 43.5	$ 90.5	$ 135.4	$ 301.4
T3	TOTAL	$ 57.0	$ 95.2	$ 156.3	$ 833.6	**$ 1,142.2**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

T4. Transit Operational Improvements

Transit Operational improvements reflect the need to improve the functionality of the existing system. Types of projects include real-time information systems, signal pre-emption, fare modernization, and double tracking and sidings to improve service frequency. Technology enables transportation operations centers to relay accurate, up-to-date travel information to the public, and is a main focus for transit agencies in both state subregions. Deploying technology also saves agencies money by automating functions like transit fare collection.

Needs for operational improvements to the transit network are broken out into the following categories for each state subregion:

Major Regional Safety/Operations [T4.01] Projects that double-track or add sidings to existing passenger rail lines; upgrade a traditional bus route with BRT service; or would need to be included in air quality conformity analysis because they would significantly alter regional travel patterns. These projects exceed $25 million and are listed as MRPs.

ITS and Real-Time Information [T4.02] Improvements to transit operations centers, facilities, and other assets, including CCTV cameras, variable message signs, incident detection, travel time detectors, traffic signals, and real-time traveler information systems.

[65] "Our Plan Moving Forward," NJ TRANSIT, www.njtplans.com/downloads.html#strategic-plan.

Signal Prioritization [T4.03] Bus and trolley priority treatment at intersections needs are estimated for two bus or trolley routes per year at an average cost of $5 million per route. No need is listed for this category because costs are included in Trolley Modernization and Bus Priority Corridor projects, which fall under other categories.

Pennsylvania

Needs for this category include improvements to the SEPTA Operations Center, which covers all operating assets (rail, subway surface, buses, SEPTA police dispatch, and paratransit). SEPTA and PART identified their needs as part of the Plan update (see Table 38).

Table 38: PENNSYLVANIA SUBREGION TRANSIT OPERATIONAL IMPROVEMENTS CAPITAL VISION (T4)

T4	Transit Operational Improvements	2022–2026	2027–2032	2033–2040	2041–2050	Total
T4.01	Major Regional Safety/Operations	$ 341.8	$ 139.0	$ 1,759.8	$ 2,430.9	$ 4,671.6
T4.02	ITS and Real-Time Information	$ 127.5	$ 247.8	$ 213.5	$ 278.5	$ 867.2
T4.03	Signal Prioritization	$ -	$ -	$ -	$ -	$ -
T4	TOTAL	$ 469.3	$ 386.8	$ 1,973.3	$ 2,709.5	**$ 5,538.9**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

Needs for this category include NJ TRANSIT's ITS program. The basis of need for NJ TRANSIT vehicles was the NJ TRANSIT Capital Budget and FY2022 TIP for New Jersey. DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where NJ TRANSIT was able to provide a more accurate cost estimate for future years. DRPA/PATCO identified its needs as part of the Plan update (see Table 39).

Table 39: NEW JERSEY SUBREGION TRANSIT OPERATIONAL IMPROVEMENTS CAPITAL VISION (T4)

T4	Transit Operational Improvements	2022–2025	2026–2031	2032–2040	2041–2050	Total
T4.01	Major Regional Safety/Operations	$ -	$ -	$ 182.3	$ -	$ 182.3
T4.02	ITS and Real-Time Information	$ 17.9	$ 20.1	$ 44.9	$ 69.5	$ 152.5
T4.03	Signal Prioritization	$ 10.4	$ 15.8	$ 31.3	$ 46.1	$ 103.6
T4	TOTAL	$ 28.3	$ 35.9	$ 258.6	$ 115.6	**$ 438.4**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

T5. Transit System Expansion

This category includes 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 Financial Planning Subcommittee and includes projects listed (but not yet completed) in the *Connections 2045* Plan, county and city plans, and transit expansion project studies conducted by DVRPC and other entities.

Needs for expansions to the transit network are broken out into the following categories for each state subregion:

Major Regional Transit System Expansion [T5.01] New stations on existing lines (including station parking needs), extension of existing lines, new rail and BRT routes, or new ferry service. These projects exceed $25 million and are listed as MRPs.

Minor Regional Transit System Expansion [T5.02] New stations on existing lines, short extensions, and BRT projects under $25 million.

Pennsylvania

SEPTA has identified projects of significance that will meet current demands and accelerate regional economic growth by 50 percent. King of Prussia Rail, Trolley Modernization, capacity expansion on Regional Rail and the Market-Frankford Line, and service improvements on the bus network will create jobs, grow the economy, and improve quality of life throughout the region. Additional needs within SEPTA's territory have been identified by county and city planning partners. PART made service changes in January 2020 aimed at simplifying bus routes, maximizing service, and adding new destinations, and there are no additional expansion needs identified for PART (see Table 40).

Table 40: PENNSYLVANIA SUBREGION TRANSIT SYSTEM EXPANSION CAPITAL VISION (T5)

T5	Transit System Expansion	2022–2026	2027–2032	2033–2040	2041–2050	Total
T5.01	Major Regional Transit System Expansion	$ 779.1	$ 802.2	$ 3,037.9	$ 5,889.4	$ 10,508.6
T5.02	Minor Regional Transit System Expansion	$ -	$ -	$ 10.9	$ 17.7	$ 28.7
T5	TOTAL	$ 779.1	$ 802.2	$ 3,048.9	$ 5,907.1	**$ 10,537.2**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

Both NJ TRANSIT and DRPA/PATCO have identified several rail, light rail, and BRT network expansions. Project needs in this category were identified by NJ TRANSIT, DRPA/PATCO, and county representatives from the New Jersey state subregion. Although not included in the fiscally constrained *Connections 2050* financial plan, the Glassboro-Camden Line remains the priority transit system expansion project in the New Jersey subregion (see Table 41).

Table 41: NEW JERSEY SUBREGION TRANSIT SYSTEM EXPANSION CAPITAL VISION (T5)

T5	Transit System Expansion	2022–2025	2026–2031	2032–2040	2041–2050	Total
T5.01	Major Regional Transit System Expansion	$ -	$ -	$ 4,137.2	$ 2,624.6	$ 6,761.8
T5.02	Minor Regional Transit System Expansion	$ -	$ -	$ 31.0	$ -	$ 31.0
T5	TOTAL	$ -	$ -	$ 4,168.3	$ 2,624.6	**$ 6,792.8**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

T6. Transit Other

Transit Other is a miscellaneous category that includes safety, security, coordinated human services, trackage fees paid by regional transit agencies to Amtrak, federal operating funds, 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. These needs are largely obligations that must be fully funded.

Needs for other transit obligations are broken out into the following categories for each state subregion:

Major Regional Transit Other [T6.01] Amtrak Lease Agreements and other transit projects exceeding $25 million.

Safety and Security [T6.02] Environmental cleanup and protection activities. This can include remediation and testing associated with underground storage tanks, lead-based paint and asbestos abatement, contaminated soil and groundwater, and air quality. This category also includes site assessments to determine environmental exposures prior to acquiring properties, as well as activities that reduce transit's environmental footprint.

Coordinated Human Services [T6.03] Grants for senior and disabled services or by shared ride programs. The category funds items like communications equipment, capital equipment, operating costs, or vanpools.

Debt Service [T6.04] Funds to retire remaining debt on capital projects.

Preventative Maintenance [T6.05] Federal funds for operating assistance and preventative maintenance included as a line item in the TIPs.

Miscellaneous Transit Other [T6.06] Includes warehouse leases, copier leases, computer-aided radio dispatch microwave Towers

Lease, Federal PM Operating and Tire leases, ferry program funds, operating assistance funds for PART, and other miscellaneous items.

Pennsylvania

The estimated cost of Transit Other needs in the Pennsylvania subregion is based on safety and security needs identified by SEPTA, Amtrak trackage leases, ongoing funding for coordinated human services, federal preventative maintenance funds, and current outstanding debt service. SEPTA identified its needs as part of the Plan update. There were no needs identified by PART for this category (see Table 42).

Table 42: PENNSYLVANIA SUBREGION TRANSIT OTHER CAPITAL VISION (T6)

T6	Transit Other	2022–2026	2027–2032	2033–2040	2041–2050	Total
T6.01	Major Regional Transit Other	$ 330.2	$ 466.4	$ 860.2	$ 1,683.5	$ 3,340.3
T6.02	Safety and Security	$ -	$ -	$ -	$ -	$ -
T6.03	Coordinated Human Services	$ -	$ -	$ -	$ -	$ -
T6.04	Debt Service	$ 284.3	$ 299.4	$ 184.0	$ 92.0	$ 859.7
T6.05	Preventative Maintenance	$ 154.5	$ 154.5	$ 150.0	$ 150.0	$ 609.0
T6.06	Transit Miscellaneous Other	$ -	$ -	$ -	$ -	$ -
T6	TOTAL	$ 769.0	$ 920.3	$ 1,194.2	$ 1,925.5	**$ 4,809.0**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

New Jersey

The basis of need for NJ TRANSIT was the agency's Capital Budget and FY2022 TIP for New Jersey. DVRPC maintained current TIP spending levels for most of the subcategories over the life of the Plan, updating in instances where NJ TRANSIT was able to provide a more accurate cost estimate for future years. DRPA/PATCO identified its safety and security needs as part of the Plan update, which are in category T6.02 (see Table 43).

Table 43: NEW JERSEY SUBREGION ROADWAY OTHER CAPITAL VISION (R6)

T6	Transit Other	2022–2025	2026–2031	2032–2040	2041–2050	Total
T6.01	Major Regional Transit Other	$ 40.0	$ 74.9	$ 140.2	$ 206.3	$ 461.4
T6.02	Safety and Security	$ 8.0	$ 9.2	$ 20.7	$ 30.5	$ 68.4
T6.03	Coordinated Human Services	$ 27.6	$ 32.0	$ 71.9	$ 105.9	$ 237.4
T6.04	Debt Service	$ -	$ -	$ -	$ -	$ -
T6.05	Preventative Maintenance	$ 14.2	$ 18.5	$ 39.3	$ 57.8	$ 129.7
T6.06	Transit Miscellaneous Other	$ 26.4	$ 30.6	$ 68.7	$ 101.1	$ 226.8
T6	TOTAL	$ 116.2	$ 165.2	$ 340.9	$ 501.6	**$ 1,123.8**

All figures in millions of YOE dollars. Figures may not add up due to rounding.
Source: DVRPC, 2021.

Revenue Forecast

DVRPC identified all federal, state, and local revenue sources for capital project expenditures that the region can reasonably expect to receive through the year 2050. Transportation revenues come to the region through various sources, including:

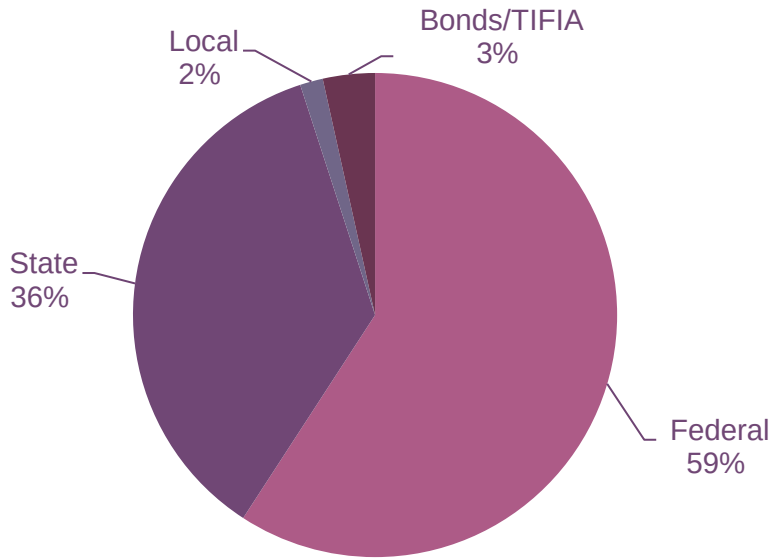
- **Formula funds** come from federal and state sources and are generally distributed as a proportion based on data like population, employment, existing transportation infrastructure, use of transportation facilities, and/or condition of assets within an area.
- **Discretionary funding programs** include ongoing programs like PennDOT Secretary's Discretionary funds in Pennsylvania, which are used to help advance large projects that would be hard to fit within regional formula funding pools.
- **Additional funds** are often received for a project specific purpose, and are not an ongoing source of revenue.
    - **Competitive grants** are generally awarded to specific projects. They include PennDOT's multimodal fund, NJDOT's Local Freight Impact Funds, FHWA's Rebuilding American Infrastructure with Sustainability and Equity (RAISE) program (formerly known as INFRA, TIGER and BUILD), and FTA's New Starts and Small Starts.
    - **Additional project-specific funds** may be contributed by municipalities as part of a match or to sponsor a specific project.
    - **Authorities** like tolling agencies collect and distribute funding. Revenue generated by such authorities is not included as an additional revenue source for state-funded projects in DVRPC's Long-Range Plan.
- **IMP** allocates federal and state funding to Interstate highway projects throughout the Pennsylvania subregion based on project needs and readiness to advance.
- **Debt service or borrowing** allow sponsoring agencies to secure funding for a desired capital improvement project and repay the principal debt and interest over time as additional regional funding becomes available.

All planning principles and financial assumptions made in identifying financial resources and investment needs are developed in close consultation with the RTC Financial Planning Subcommittee of federal, state, and transit planning partners. Preparation of this financial plan revenue estimate included a review of historical data and trends. Historical data and trends serve as general guidance on how much funding the region can expect to receive in the future. Sources of this information include:

- the current and previous statewide transportation improvement programs (STIPs);
- information from state DOTs and transit agencies; and
- FHWA, FAST Act planning guidance, and federal authorization levels.

DVRPC develops the Plan's revenue forecast at the federal, state, and local level, and considers other sources of funding such as bonds and Transportation Infrastructure Finance and Innovation Act (TIFIA)[66] funding (see Figure 31). Appendix A includes a review of recent dialogue around reauthorizing federal transportation legislation, along with recent efforts to increase state and local transportation revenue.

Figure 32: PERCENTAGE OF GREATER PHILADELPHIA'S REGIONAL FUNDING BY SOURCE



Source: DVRPC, 2021.

Federal Funding

Federal funds to the region are dependent on federal authorization bills. The current federal funding legislation is the FAST Act. The federal government's surface transportation programs are financed mostly through the Highway Trust Fund, which has two accounts: one for highways and one for mass transit. These accounts are primarily funded through gas tax receipts. The federal gas tax of 18.4 cents per gallon of gasoline and 24.4 cents per gallon for diesel fuel has not been increased since 1993. More fuel-efficient and alternative-fuel vehicles and a slight decrease in total driving since the economic

[66] TIFIA is administered by the U.S. DOT and provides credit assistance for qualified projects of regional and national significance.

recession of 2008 has meant flat gas tax revenue collection. Inflation since the last gas tax increase has also eaten away nearly 50 percent of its purchasing power (See PPI-Construction Materials Index in Figure 30).

Table 44: CBO BASELINE PROJECTIONS FOR HIGHWAY TRUST FUND ACCOUNTS ($ BILLIONS YOE)

	2020	2021	2022	2023	2024	2025	2026	2027	2028	2029	2030	2031
Highway Account End-of-Year Balance	12.54	8.45	a	a	a	a	a	a	a	a	a	a
Highway Account Shortfall	a	a	–0.16	–9.64	–20.53	–33.35	–48.09	–64.29	–81.64	–100.25	–119.85	–140.54
Transit Account End-of-Year Balance	5.13	3.87	a	a	a	a	a	a	a	a	a	a
Transit Account Shortfall	a	a	–0.17	–4.70	–10.02	–15.76	–21.74	–27.95	–34.26	–40.78	–47.55	–54.59

Source: Adapted from CBO, February 2021.

a. Under current law, the Highway Trust Fund cannot incur negative balances. However, following the rules governing baseline projections in the Balanced Budget and Emergency Deficit Control Act of 1985, CBO's baseline for surface transportation spending reflects the assumption that obligations presented to the Highway Trust Fund will be paid in full. The memorandum to this table shows the cumulative shortfall of fund balances, assuming spending amounts consistent with CBO's February 2021 baseline. Following the rules for baseline construction, those amounts are estimated by adjusting the obligation limitations enacted under Public Law 116–260, the Consolidated Appropriations Act, 2021, by projected inflation.

Facing exhaustion of surface transportation funds, the U.S. House of Representatives passed a continuing resolution,[67] which included a one-year extension of the FAST Act. This included an additional $13.6 billion added to the Highway Trust Fund ($10.4 billion to the Highway Account and $3.2 billion for the Mass Transit Account). The extension is set to expire in September 2021. To remain solvent, the Highway Trust Fund has now required $150 billion in transfers from the General Fund since 2008. The Congressional Budget Office (CBO) projects that balances in both the highway and transit accounts of the Highway Trust Fund will be exhausted in 2022 if no additional funding is authorized (see Table 44). If the taxes that are currently credited to the trust fund remained in place, and if funding for highway and transit

[67] 116th Congress, 2nd Session, "A Bill Making Continuing Appropriations for Fiscal Year 2021, and for Other Purposes," U.S. House of Representatives, https://rules.house.gov/sites/democrats.rules.house.gov/files/BILLS-116HR8319IH.pdf.

programs increased annually at the rate of inflation, the shortfalls accumulated in the Highway Trust Fund's highway and mass transit accounts from 2022 to 2031 would total $195 billion.[68] DVRPC estimates future funding levels by projecting growth rates for federal funding in each future six-year federal transportation legislation out to the year 2050. For roads, the Commission then projects how much federal funding will be allocated to each state, and then from the state to the region. For transit, the Commission projects a portion of total federal funds directly to the region's urban areas.

In Pennsylvania, federal road funds are then divided into several different funding pots. Formula funding (the largest of these) is allocated to each of the MPOs and regional planning organizations in the state. Beginning in Federal Fiscal Year 2023, a new formula will be used to allocate these funds to MPOs and Regional Planning Organizations throughout the Commonwealth, with 40 percent attributable to bridge condition data, and 60 percent attributable to highway condition data. A second funding pot, the IMP, funds projects on the Interstate system. A third pot comes from discretionary line items that are distributed through state-level decision making, largely based on need and helping to advance large projects that are hard to fit within regional formula distributions. Lastly, the region receives additional funding based on competitive grants or local or toll authority funds applied to specific projects, which are not a source of ongoing funding.

In New Jersey, NJDOT manages all state facilities through its Statewide Program. Formula funds are directed to each of the state's three MPOs to maintain county and local road facilities. DVRPC estimates how much of the state share will be allocated to the region in the long term based on historical distributions.

Federal transit funds are allocated directly to urban areas. Short-term allocations are based on actual funds identified in each state's STIP. Longer-term allocations are based on expected funding levels, as well as regional, state, and national population; employment; VMT; transit ridership; and infrastructure condition trends. Different types of funds have different formula criteria. Thus, important considerations in future transit funding levels include: (1) how Greater Philadelphia's population growth will compare to the nation as a whole; (2) how its transit ridership will grow relative to the nation's; and (3) how much rail service will increase relative to that of all other transit agencies.

Based on guidance from PennDOT and dialogue with NJDOT and other regional planning partners, *Connections 2050* assumes that federal funding will remain flat through the year 2033 (the completion of the current Pennsylvania TIP). After that time, it assumes a growth rate of 3 percent per year—compounded for each future six-year federal transportation bill from 2033 to 2050—based on an eventual need to shift from gas tax funding to a new paradigm for federal transportation funding. Several proposals have been put forward to increase federal funding. These are discussed in Appendix A, but are not included in the revenue forecast.

Figure 32 shows historical and current transportation funding levels from 1992 to 2020, and projected funding levels to 2050, using a variety of methods. The stepped blue line is DVRPC's forecast of future federal transportation authorizations and represents the flat funding through 2033 and 3 percent growth rate thereafter.

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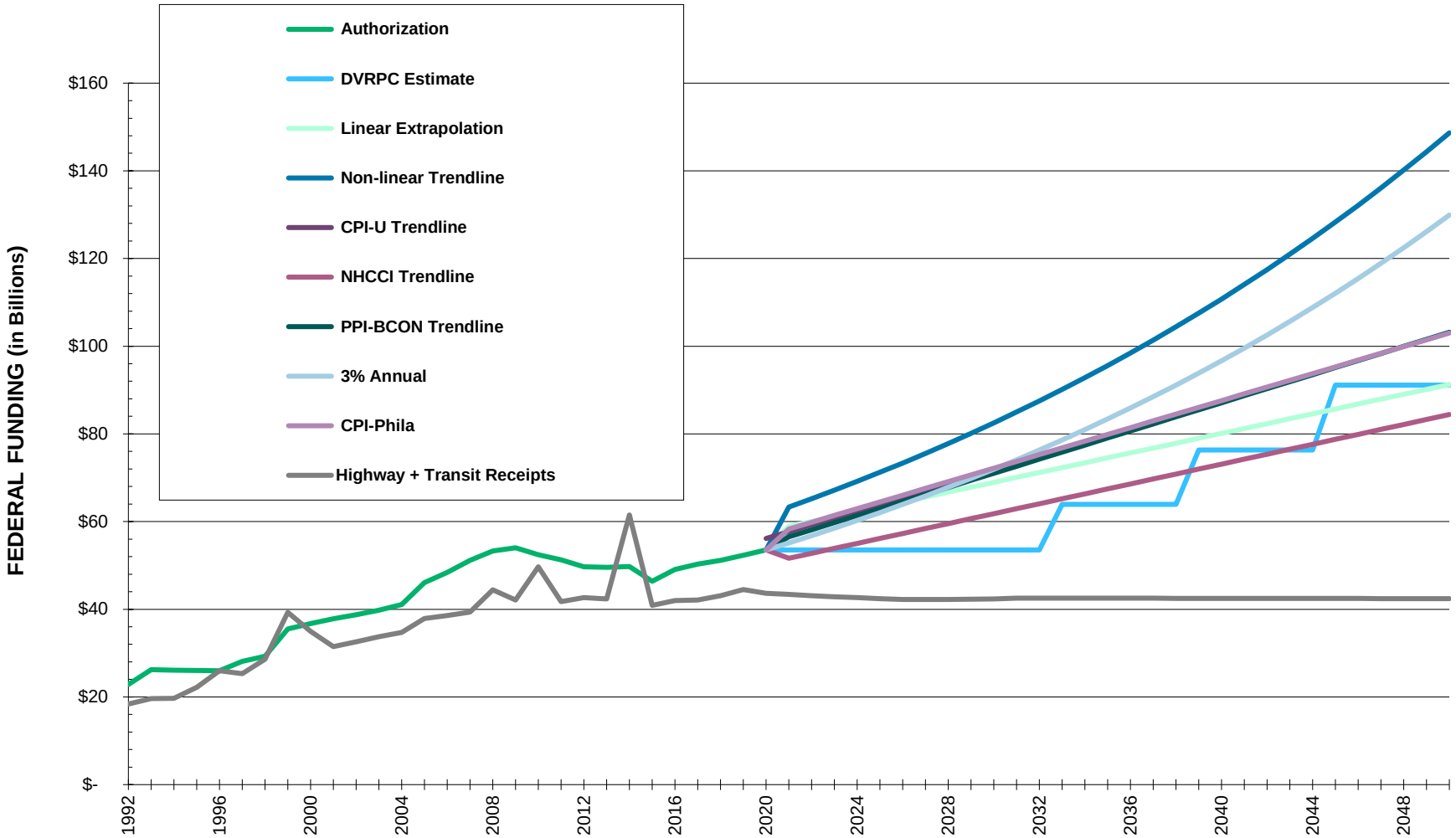
[68] See Joseph Kile, "Testimony on Addressing the Long-Term Solvency of the Highway Trust Fund," CBO, April 14, 2021, https://www.cbo.gov/publication/57138; and "Details about Baseline Projections for Selected Programs: Highway Trust Fund Accounts," CBO, February 2021, www.cbo.gov/publication/51300.

Figure 33: HISTORIC AND PROJECTED FEDERAL TRANSPORTATION FUNDING (NATIONWIDE)



Source: DVRPC, 2021.

Fixed Guideway Capital Investment Grants (CIG)

The FTA's discretionary New Starts program is the federal government's primary financial resource for supporting locally planned, implemented, and operated fixed guideway transit capital investments. The FAST Act authorizes appropriations from the General Fund for CIGs at $2.3 billion in FY2016 and each year thereafter.

CIGs are broken into New Starts, Small Starts, and Core Capacity categories. New Starts projects are new, fixed guideway projects or extensions to existing fixed guideway systems with a total estimated capital cost of $300 million or more, or that are seeking $100 million or more in CIG program funds. Small Starts are those new projects or extensions, or corridor-based BRT projects, with a total estimated capital cost of less than $300 million and that are seeking less than $100 million in CIG program funds. The Core Capacity category (which was included under Moving Ahead for Progress in the 21st Century's (MAP-21's) New Starts program) is now separated out as its own category and funds substantial corridor-based capital investments in existing fixed guideway systems that increase capacity 10 percent or more in corridors that are at capacity today or will be in five years. They may not include elements designed to maintain an SGR.

With the *Connections 2050* Plan update, DVRPC has assigned New Starts, Small Starts, and Core Capacity funds to specific projects. DVRPC has traditionally assumed that the region, as a whole, may be able to receive up to two New Start and two Small Start matches—one for each state subregion—over the life of the Long-Range Plan. If no project is likely to be eligible for the funding, no funding is assumed. This is the case for the New Jersey subregion in this Plan update. New Starts and Small Starts projects must include plans for a local financial commitment of both capital and operating funds.

State Funding

State funding is the second-largest source of funding for transportation projects. DVRPC projects annual state transportation funding levels for both roadway and transit revenues, then estimates what percentage of state funds will come to the region. Following guidance from PennDOT, DVRPC assumes that funding levels in both states will remain flat through the year 2050. These assumptions have not been adjusted for revenue impacts from the COVID-19 pandemic and the corresponding economic slowdown, which may affect actual revenues.

The states contribute 35.3 percent of total anticipated regional funding (Pennsylvania contributes 21.4 percent and New Jersey 13.7 percent) in *Connections 2050*. Pennsylvania's Act 89 of 2013 generates billions in additional transportation revenue each year through imposing the highest gas tax in the United States, currently at 77.10 cents per gallon. Following a major increase in the Motor Fuels/Petroleum Products Gross Receipts Tax rate with the passing of New Jersey's 2016 Transportation Trust Fund (TTF), the combined rate at the consumer level increased again in September 2020 to 50.7 cents for gasoline and 57.7 cents for diesel fuel. Citing lower fuel consumption trends, which the COVID-19 pandemic has exacerbated, New Jersey's Department of Treasury announced an increase of 9.3 cents per gallon in order to ensure compliance with the 2016 law that requires a steady stream of revenue to support the state's TTF.

In addition to federal funds that move through the states for distribution, each state has its own funding pots to allocate. In Pennsylvania, State Highway and State Bridge funds are distributed as formula funding and through the IMP. Act 89 and Act 44 provide transit funds to the region. Other discretionary funding sources include the Statewide Reserve, Statewide Program, and Rapid Bridge Replacement Program. In New Jersey, the TTF is allocated via the Statewide Program and includes funds for both roadway and transit.

Competitive State Funds

Additional funds to the region come in the form of competitive grants. In Pennsylvania, Act 89 created two new Multimodal Transportation Funds administered by PennDOT and the Department of Community and Economic Development, respectively. Pennsylvania also administers competitive Automated Red-Light Enforcement, annual Freight Rail Assistance Program, annual Rail Transportation Assistance Program, and Green Light Go programs.

Both Pennsylvania and New Jersey administer a federally funded Transportation Alternatives Program (TAP), which builds pedestrian and bicycle facilities, creates safe routes to school, preserves historic transportation structures, provides environmental mitigation, and develops multiuse trails. Federal and state competitive grants are considered additional funds to the region within the region's TIP and the long-range financial plan. Only funds that can be reasonably anticipated in the Plan are included in the revenue forecast; this includes funds the region has already secured or has a reasonable hope of securing in the future.

Local Funding

Many regions around the country contribute a significant amount in local funding toward transportation projects. Due to its flexibility, local funding is critical to making multimodal investments and improvements to transportation networks. Both Pennsylvania and New Jersey states restrict the ability of local taxation to support transportation projects. This has been a major challenge for the region in keeping up with network preservation and building a future network with capital expansion. The region has largely lacked a specific plan for how to obtain the required local funding match for securing competitive funding, such as the FTA Capital Investment Grants Program. Most projects funded through the New Starts program in recent years have had upwards of a 60 percent local funding match. In Pennsylvania, a local funding option exists through the creation of a Transit Revitalization Investment District (TRID). However, a TRID alone is not likely to provide enough funding to fully pay for a major new network expansion project. If federal funding decreases in the future, regions with a dedicated, local source of transportation funding will be able to better maintain their network and promote economic growth.

Local funding is the source of just 2 percent of the reasonably anticipated funds documented in *Connections 2050*. Local transportation funding generally comprises revenues derived within the jurisdiction, such as a dedicated sales tax or dedicated bonds. The amount of local funds forecast for the life of the Plan is based on match fund levels in the current Pennsylvania and New Jersey STIPs. These are forecast to grow with state and federal funds to maintain their required match levels. In New Jersey, NJDOT uses toll credits to count against federal local matching fund requirements.

Other Funding

DVRPC works with several partner transportation authorities that generate their own revenues, generally via tolling. Revenue generated by partner authorities is not included as a revenue source in DVRPC's Long-Range Plan. For the most part, all capital and operating expenditures of these authorities are covered by authority toll revenues. In some instances, federal dollars are used in conjunction with authority revenue to fund specific capital projects. In these cases, DVRPC tracks both federal and non-federal capital expenditures for such projects and accounts for the federal funding as a part of its regional transportation expenditures.

There are a variety of sources from which transportation agencies can get additional financing to help deal with lumpy project costs, including bonds, public-private partnerships, TIFIA financing via the FAST Act, the EB-5 Immigrant Investor Visa program, and state infrastructure banks. Beyond existing loan programs, this type of financing is generally not considered unless it is tied to a specific project. In

Connections 2050, SEPTA Silverliner VIs are assumed to be purchased with either TIFIA funds or bonds in the 2040s. This would happen roughly as the Authority pays off its existing debt in 2044.

Recommended Forecast

Once federal and state funds have been estimated for each year from 2022 to 2050, funding distribution formulas are used to estimate federal and state funding to the region. The Plan anticipates $67.3 billion YOE dollars in total federal, state, local, and debt funding from 2022 to 2050. This is only a slight increase over the Amended *Connections 2045* projection of $65.3 billion. These revenue estimates are for capital project expenditures only and do not include any operating funds. All revenue amounts are in YOE dollars, which account for the effect of inflation over time as required by federal regulations. Beyond the $2.3 billion in bond or TIFIA funding for SEPTA in the 2040s, no new or undefined funding sources are recognized. Table 45 shows the reasonably anticipated funding by source and mode in the recommended forecast. Table 46 shows the reasonably anticipated funding by mode and plan period[69] in the recommended forecast.

[69] The exact years of plan periods differ for each state subregion, aligning with each TIP, respectively, and are identified in Table 14.

Table 45: FUNDING BY SOURCE AND MODE (2022–2050, IN BILLIONS OF YOE $)

Funding Source ($B YOE)		PA Subregion	NJ Subregion	Long-Range Plan Total
Roadway	Federal	$ 19.8 B	$ 7.6 B	$ 27.3 B
	State	$ 3.4 B	$ 6.7 B	$ 10.1 B
	Local	$ 0.3 B	$ 0.0 B	$ 0.3 B
	Roadway Total	**$ 23.5 B**	**$ 14.3 B**	**$ 37.7 B**
Transit	Federal	$ 9.3 B	$ 2.6 B	$ 11.8 B
	- New-Start/Small-Start	$ 1.1 B	$ 0.0 B	$ 1.1 B
	State	$ 11.1 B	$ 2.6 B	$ 13.7 B
	Local	$ 0.7 B	$ 0.0 B	$ 0.7 B
	Other	$ 2.3 B	$ 0.0 B	$ 2.3 B
	Transit Total	**$ 24.4 B**	**$ 5.2 B**	**$ 29.6 B**
DVRPC Total		**$ 47.9 B**	**$ 19.4 B**	**$ 67.3 B**

Figures may not add up due to rounding.
Source: DVRPC, 2021.

Table 46: FUNDING BY MODE AND PLAN PERIOD (2022–2050, IN BILLIONS OF YOE $)

Subregion	Mode	Funding Period 1	2	3	4	Long-Range Plan Total 2022–2050
Pennsylvania	Roadway	$ 3.3 B	$ 4.1 B	$ 6.3 B	$ 9.8 B	$ 23.5 B
	Transit	$ 3.2 B	$ 3.9 B	$ 5.7 B	$ 10.4 B	$ 23.3 B
	New-Start/Small-Start	$ 0.0 B	$ 0.2 B	$ 0.9 B	$ 0.0 B	$ 1.1 B
	Subregion Total	**$ 6.5 B**	**$ 8.2 B**	**$ 12.9 B**	**$ 20.2 B**	**$ 47.9 B**
New Jersey	Roadway	$ 2.2 B	$ 2.8 B	$ 4.0 B	$ 5.3 B	$ 14.3 B
	Transit	$ 0.6 B	$ 0.9 B	$ 1.6 B	$ 2.1 B	$ 5.2 B
	New-Start/Small-Start	$ 0.0 B	$ 0.0 B	$ 0.0 B	$ 0.0 B	$ 0.0 B
	Subregion Total	**$ 2.8 B**	**$ 3.7 B**	**$ 5.6 B**	**$ 7.3 B**	**$ 19.4 B**
DVRPC Total		**$ 9.3 B**	**$ 11.9 B**	**$ 18.5 B**	**$ 27.5 B**	**$ 67.3 B**

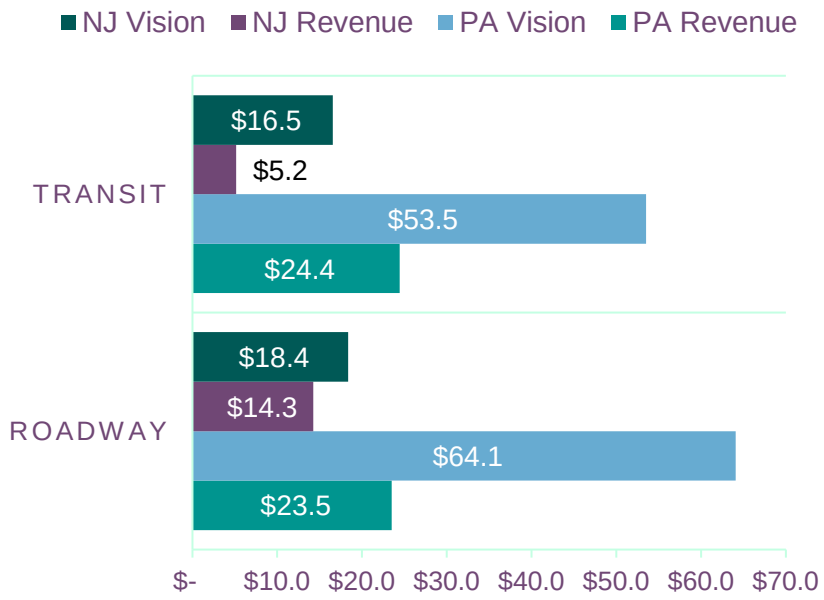
Figures may not add up due to rounding.
Source: DVRPC, 2021.

Funding Allocation

Funding is allocated to each of the roadway and transit funding categories based on comparative need, as well as the Plan's vision, goals, and policies. Long-Range Plan policy prioritizes preservation and maintenance needs, followed by operational improvements, then bike and pedestrian and system expansion projects. This approach follows the policy guidance of the United States, and Pennsylvania and New Jersey DOTs, which take a Lowest Life-Cycle Cost (LLCC) approach to prioritize preservation and maintenance of existing roadway and transit networks. The goal is to achieve and maintain an SGR for existing transportation infrastructure. The plan must also fully fund the "Other" needs for both roadway and transit, as these categories largely comprise financial obligations and federal mandates, such as debt service and environmental mitigation.

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 safety, congestion, mobility, or expanding bike and pedestrian facilities (see Figure 33).

Figure 34: CAPITAL VISION VERSUS AVAILABLE REVENUE FOR ROADWAY AND TRANSIT ($B YOE)



Source: DVRPC, 2021.

Connections 2050 updates the allocation of available funds from *Connections 2045* to reflect the current Capital Vision. For roadways in both state subregions, the LLCC approach to pavement needs allows a shift of some funds to bridge preservation and bicycle and pedestrian improvements. A 4 percent cap on roadway system expansion is maintained for both 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.

For Pennsylvania transit, an increased need for vehicle preservation necessitated a shift of funds from rail infrastructure, station preservation, and operational improvements. Allocated funds for transit system expansion also increased significantly to advance federal funding for several high-cost, high-benefit projects. In New Jersey, with the Glassboro-Camden Line not meeting eligibility requirements for New Starts funding, it has been removed from the funded plan for now, and nearly all system expansion funding has shifted to the other five categories—largely to preservation.

Table 47 identifies the target allocations and resulting revenue for each funding category. Funding within each category is allocated to Major Regional Projects (MRPs), which are listed in the Plan and sets aside funding for smaller-scale projects that will be identified in the current and future TIPs.

Table 47: FUNDING ALLOCATION TO PROJECT CATEGORIES

Mode	Project Category	Pennsylvania		New Jersey	
		Target Allocation	Allocated Revenue	Target Allocation	Allocated Revenue
Roadway	System Preservation				
	- Pavement Preservation	21.5%	$ 5.1 B	31.5%	$ 4.5 B
	- Bridge Preservation	55.0%	$ 12.9 B	38.4%	$ 5.5 B
	Bicycle and Pedestrian	4.0%	$ 0.9 B	5.0%	$ 0.7 B
	Operational Improvements	11.0%	$ 2.6 B	19.0%	$ 2.7 B
	System Expansion	4.0%	$ 0.9 B	4.0%	$ 0.6 B
	Other	4.5%	$ 1.1 B	2.1%	$ 0.3 B
Roadway Subtotal		**100.0%**	**$ 23.5 B**	**100.0%**	**$ 14.3 B**
Transit	System Preservation				
	- Rail Infrastructure	7.5%	$ 2.0 B	8.3%	$ 0.5 B
	- Vehicles	54.4%	$ 12.8 B	55.0%	$ 2.8 B
	- Stations	5.0%	$ 0.5 B	10.0%	$ 0.5 B
	Operational Improvements	1.7%	$ 0.6 B	4.0%	$ 0.2 B
	System Expansion	12.9%	$ 2.1 B	1.0%	$ 0.0 B
	Other	18.5%	$ 5.2 B	21.8%	$ 1.1 B
Transit Subtotal		**100.0%**	**$ 24.4 B**	**100.0%**	**$ 5.2 B**
Region Total		**100.0%**	**$ 47.8 B**	**100.0%**	**$ 19.5 B**

Figures may not add up due to rounding.
Source: DVRPC, 2021.

Project Evaluation and Selection

FHWA requires a project evaluation process to guide selecting projects for the TIP and Plan. In addition, with constrained available funding, it is imperative to select projects judiciously, based on quantitative assessment. Investments in the system must support the vision, principles, and goals identified in the *Connections 2050* Plan. Priorities include modernizing the region's aging transportation system. improving safety to obtain a Vision Zero goal of no transportation fatalities or serious injuries by 2050, reducing congestion, increasing mobility options for people and goods, incorporating technology, and seamlessly connecting the multimodal transportation network. 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 trade-off analysis must be done in order to ensure that the region gets the best possible return on its transportation investments.

System Expansion Prescreening Criteria

As a first step in analyzing transportation projects in the Vision Plan, roadway and transit system expansion projects undergo a screening for consistency with the region's Land Use Vision and the CMP. Proposed system expansion projects must be consistent with the Plan's Land Use Vision and CMP to be further evaluated.

Long-Range Plan Consistency

Projects should be primarily located in either Existing Infill or Redevelopment or Emerging Growth areas, as defined by the current adopted Plan's Land Use Vision map.

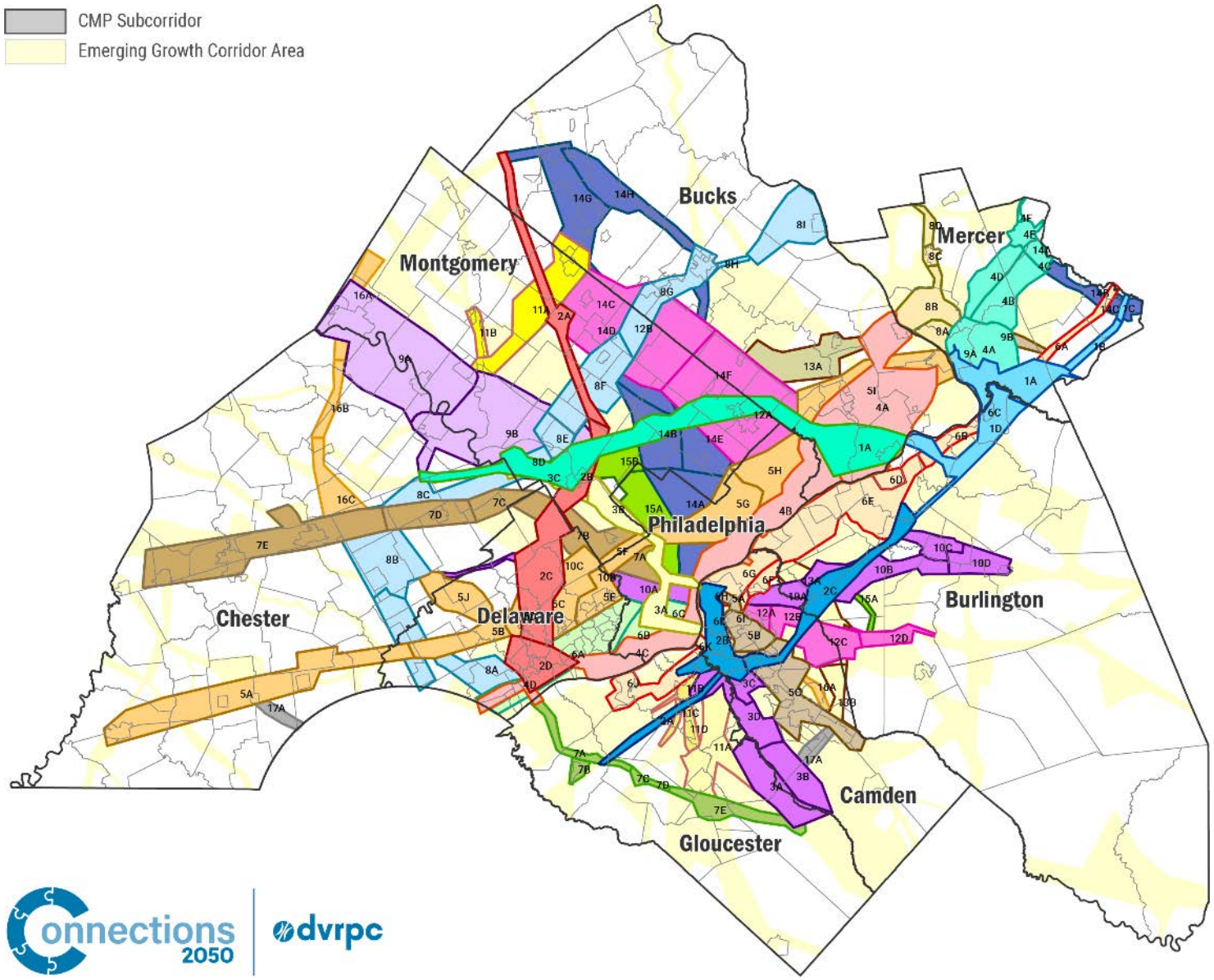
- **Limited access roadways:** All interchanges located in Existing Infill and Redevelopment or Emerging Growth areas.
- **Non-limited access roadways:** At least 75 percent of total project limits in Existing Infill and Redevelopment or Emerging Growth areas.
- **Transit fixed guideway rail and BRT:** At least 75 percent of station stops located in Existing Infill and Redevelopment or Emerging Growth areas.

CMP Consistency

Any roadway project adding SOV capacity must be consistent with the CMP to be eligible for federal funding.

- Proposed roadway network expansion must be located in a subcorridor where adding SOV capacity is listed as a very appropriate or secondary strategy (See Figure 34).
- If the project is not located in a CMP corridor, or if adding SOV capacity is not a strategy for the subcorridor where the project is located, the project must follow CMP procedures before it can be considered in this evaluation.

Figure 35: CMP SUBCORRIDORS



Source: DVRPC, 2021.

Pennsylvania CMP Corridors

1. I-276 (PA Turnpike)
2. I-476
3. I-76 and I-676
4. I-95
5. US 1
6. US 13/MacDade Blvd/PA 291
7. US 30
8. US 202, US 322, US 30, and PA 100
9. US 422
10. PA 3 and Center City
11. PA 113 and PA 29 Area
12. PA 132, PA 63, and County Line Road
13. PA 332
14. PA 611, PA 309, and PA 313
15. Ridge-Lincoln-Cheltenham
16. PA 100
17. PA 41

New Jersey CMP Corridors

1. I-295 and NJ Turnpike (N)
2. I-295 and NJ Turnpike (S)
3. AC Expressway/NJ 42
4. US 1 and US 206
5. US 30
6. US 130
7. US 322 and Cross Keys Area
8. NJ 31
9. NJ 33
10. NJ 38
11. NJ 41, NJ 45, NJ 47, and NJ 55
12. NJ 70
13. NJ 73
14. CR 571
15. CR 603
16. CR 561
17. CR 689

TIP-LRP Benefit Criteria

Projects that pass prescreening are further analyzed by the TIP-LRP Benefit Criteria: a data-informed support tool to guide the region's transportation project investment decisions. The TIP-LRP Benefit Criteria analyze how each proposed project aligns with the overall vision and goals of the Plan, and evaluates how each project contributes to implementing the vision in the TIP. They also provide data to analyze how each project supports the FHWA and FTA TPMs and related safety and asset management plans.

The TIP-LRP Benefit Criteria highlight some of the trade-offs that occur within a given investment or set of investments, as the region strives to develop a balanced program that includes diverse project types and regional equity. They were developed to:

- align with the Plan and other regional objectives;
- be relevant to different types of TIP and Plan projects;
- indicate differences between projects;
- avoid measuring the same goal(s) multiple times;
- cover the entire nine-county region;
- be more quantitative than qualitative;
- incorporate scale;
- use readily available data with a strong likelihood of continued availability; and
- be simple and understandable.

The TIP-LRP Benefit Criteria are universal so that they can be used to evaluate a variety of modes (roadway, transit, bike, pedestrian, freight) and project types, and can be used in all of the New Jersey and Pennsylvania counties in the region. The process draws from many of DVRPC's existing analytical processes, most notably the CMP.

Project Evaluation results are one of many considerations that go into determining which projects are ultimately advanced into the TIP or Plan. There are many benefits that an individual project may have that are not fully captured in this analysis. Projects may also have inaccurate, missing, or incomplete data. Some other project selection considerations include geographic equity, regional and local priorities, political support, funding eligibility, performance-based planning and asset management, project readiness, and ability to leverage other investments.

Measuring GHG impacts of transportation projects requires a detailed, complex effort that is not consistent with the goal of keeping the project evaluation process simple and high-level in order to ensure it can be completed within the necessary planning timeframe. While GHGs aren't measured directly, projects that enhance safety, reduce congestion, invest in Centers, expand multimodal options, and improve air quality can all help to lower emissions. DVRPC routinely updates the criteria, and will continue to seek better ways to more directly measure GHG emissions within the project evaluation criteria.

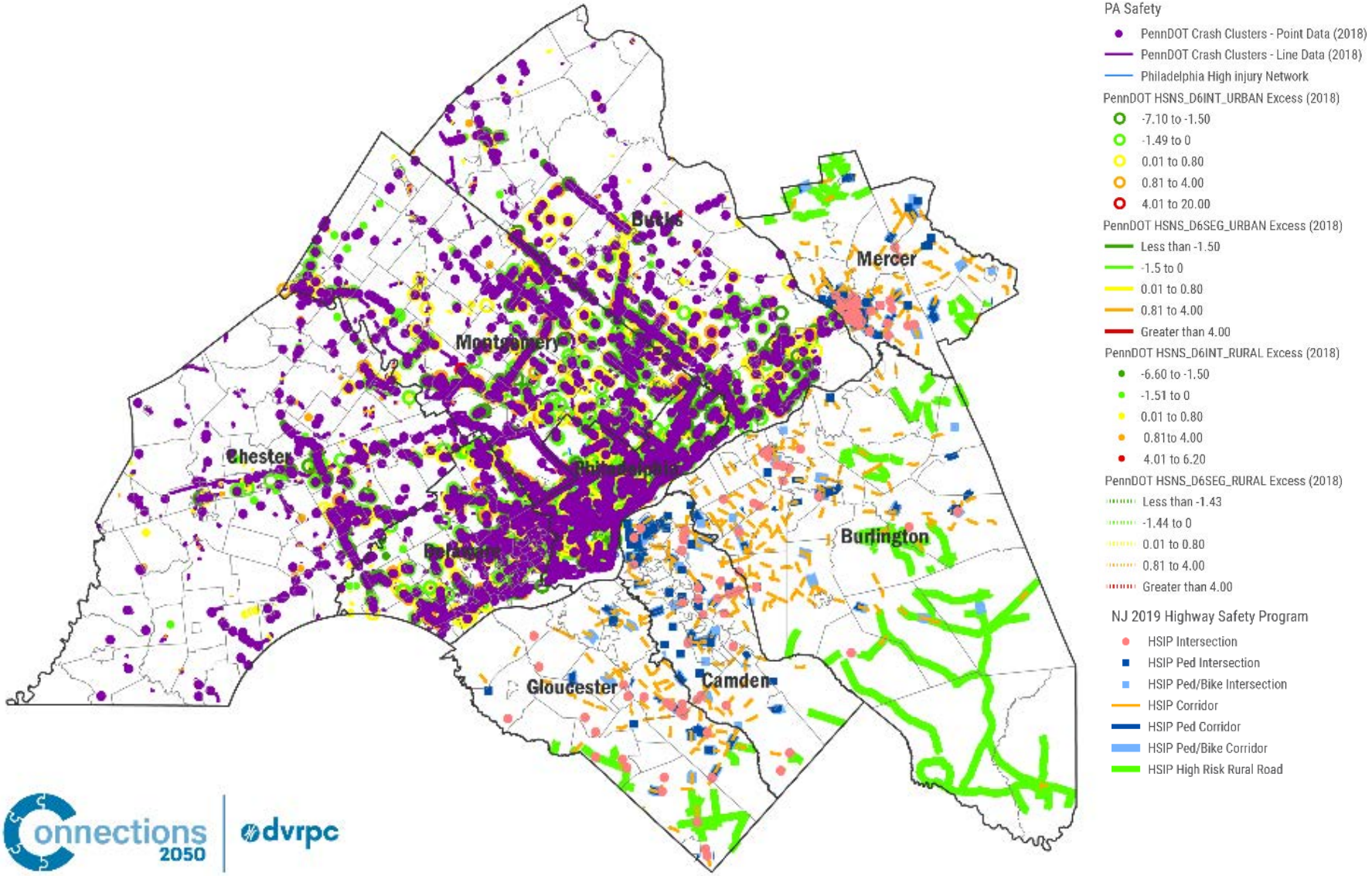
Funding sources that have their own criteria developed for very specific analysis include the TAP, Highway Safety Improvement Program (HSIP), and CMAQ program. In these instances, the more specific project evaluation criteria are used in conjunction with, or in place of, the TIP-LRP Benefit Criteria.

The TIP-LRP Benefit Criteria were developed with DVRPC's RTC and were designed to align directly with the multimodal goals of the Plan, as well as reflect the increasingly multimodal nature of projects in both the TIP and Plan. Criteria are broken into the following parent categories:

Safety

Relates to the Plan goal of creating a safer transportation system. Projects score points by implementing FHWA safety countermeasures

Figure 36: DOT SAFETY PROBLEM LOCATIONS



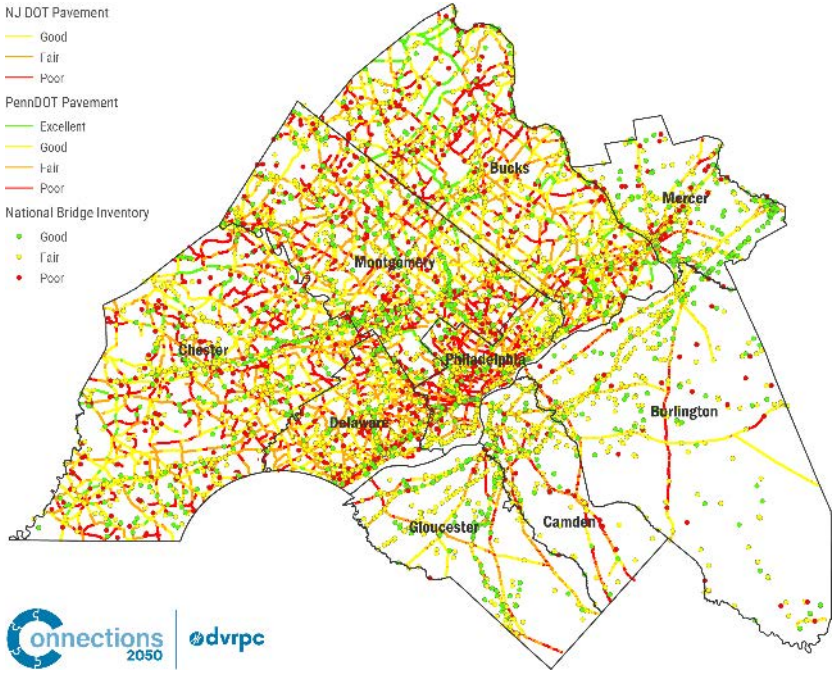
Source: NJDOT, 2019, PennDOT, 2018.

or other safety strategies with specific crash reduction factors, addressing DOT-identified high-crash locations and crashes in Communities of Concern; or implementing safety-critical transit projects that help meet safety performance measures identified by a PTASP (See Figure 35).

Facility/Asset Condition and Maintenance

Relates to the Plan goal of rebuilding and maintaining the region's transportation infrastructure. Projects score by bringing a facility or asset into an SGR, extending the useful life of a facility or asset, or providing reduced operating/maintenance costs (See Figure 36).

Figure 37: BRIDGE AND PAVEMENT ASSET CONDITION



Source: NJDOT, 2021, PennDOT, 2021.

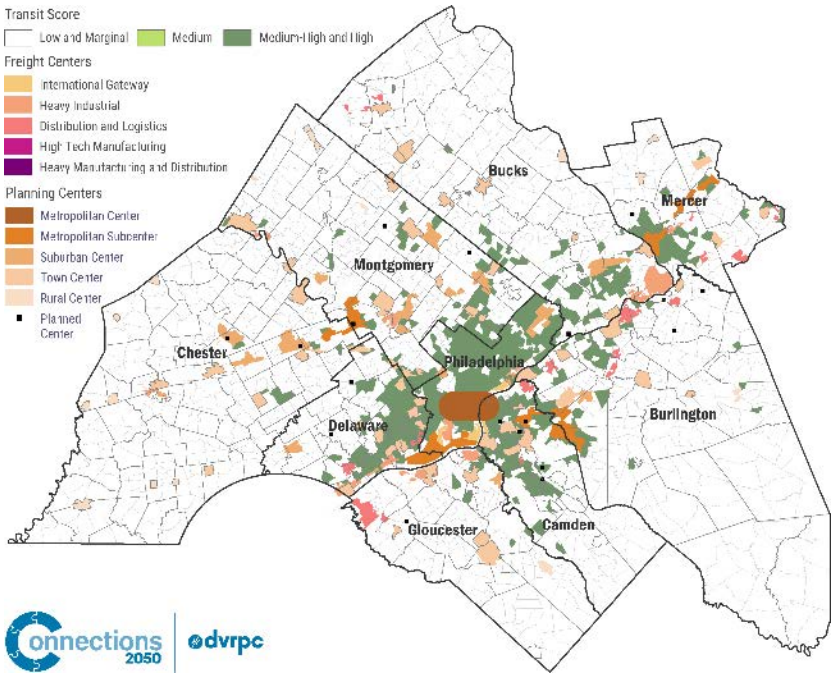
Reliability and Congestion

Increasing reliability and reducing congestion are goals in the Plan. Projects score based on a project's location in a CMP congested corridor; implementing a CMP strategy appropriate for that corridor being located on a road with a high PTI, or being a transit facility with a low on-time performance.

Centers and the Economy

Reflects the Plan's goal to create livable communities within more than 120 regional development Centers and 44 Freight Centers. Projects score based on location within a quarter-mile of a planning or Freight Center; location within a high, medium-high, or medium transit score

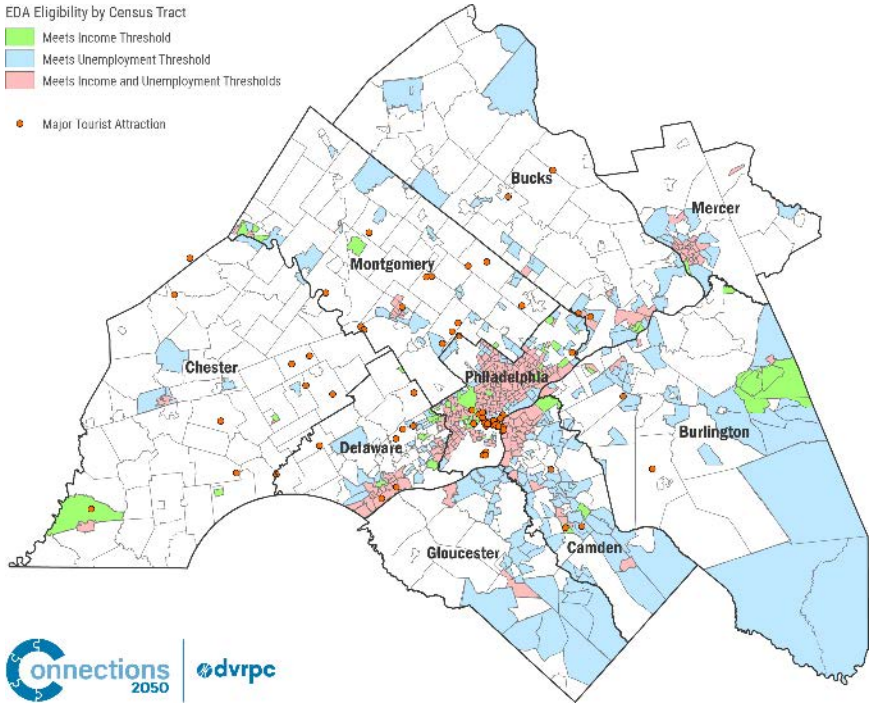
Figure 38: CENTERS AND TRANSIT SCORE BY TAZ



Source: DVRPC, 2021.

area, providing a connection between two or more Centers; location within a municipality that meets U.S. Economic Development Administration funding eligibility requirements (per capita income or unemployment); location within a half-mile of a major regional visitor attraction; or being part of a major county-identified economic development project (See Figures 37 and 38).

Figure 39: U.S. ECONOMIC DEVELOPMENT ADMINISTRATION FUNDING ELIGIBILE-AREAS



Source: U.S. Department of Commerce, U.S. Economic Development Administration, 2021. Multimodal Use

Assesses how much multimodal use the facility or asset receives, to determine the scale of the project's impact on the transportation system. Projects score based on the total number of person trips (driver trips + passenger trips + transit trips + bike trips + pedestrian trips) and daily trucks using the facility or asset, and overall benefit to multimodal trip making.

Equity

Evaluates how the project serves under-represented and disadvantaged communities, and other population groups with additional transportation needs. Projects score based on location in census tracts with high IPDs. There is no score for projects that increase vehicle speeds above 30 miles per hour, or traffic volumes in census tracts with above-average or well-above-average IPD scores (see Figure 10).

The Environment

Relates to the Plan goal of limiting transportation impacts on the natural environment. Projects score by delivering high air quality benefits (per FHWA guidance) or incorporating environmentally friendly design principles.

Criteria Weighting

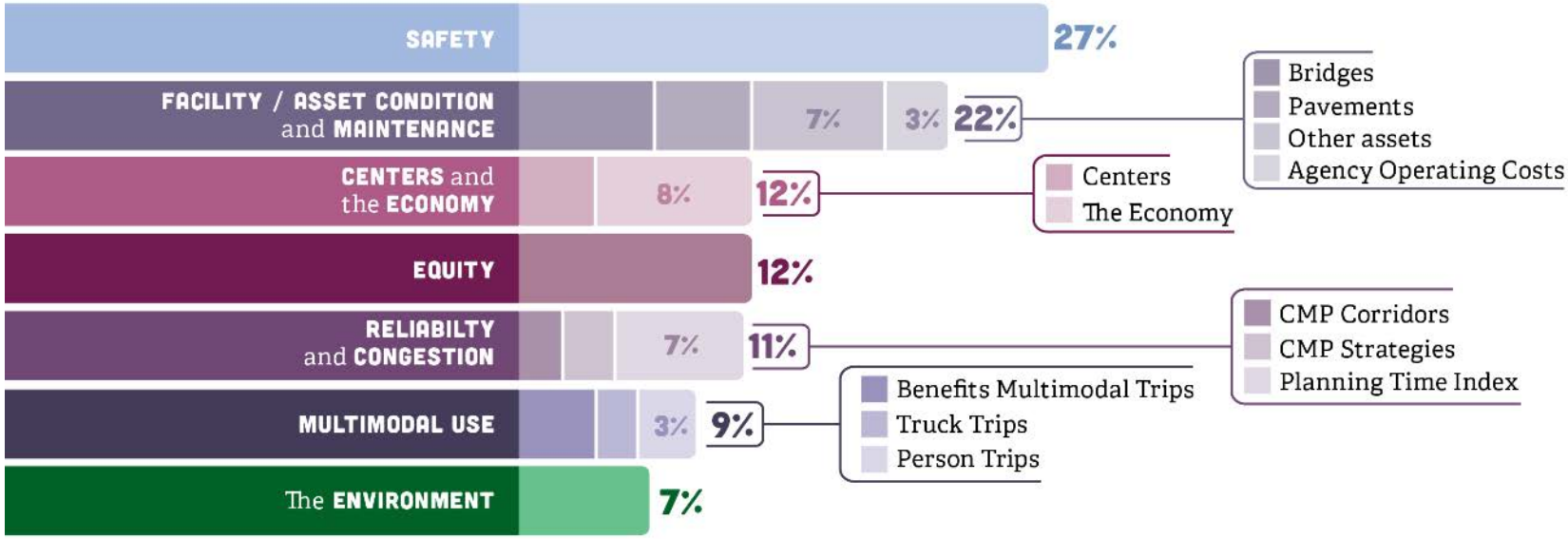
Each of the criteria is assigned a weight, reflective of the region's vision and goals, the results of which are shown in Figure 39.[70] During project evaluation, each candidate project receives a total benefit score equal to the sum of the weight multiplied by the rating for each criterion. The tool compares the project's estimated total state and federal cost to the total benefit score, resulting in a benefit-cost ratio. Other funding sources, such as additional local funding beyond match requirements, non-traditional funding grants, and developer or private

[70] A Criteria Rating Scale Summary of each project's benefit score is available in the TIP-LRP Project Benefit Evaluation Criteria document.

contributions, do not count toward a project's cost for the benefit-cost ratio. The tool provides a ranking of projects with the highest total benefit points, benefit-cost ratios, and cost-benefit per total users.

Using this information, the Financial Planning Subcommittee and RTC make a recommendation and, ultimately, the DVRPC Board makes the final determination of projects to be included in the Plan.

Figure 40: TIP-LRP BENEFIT CRITERIA MAIN CRITERIA AND SUBCRITERIA WEIGHTING



Source: DVRPC, 2018.

Air Quality Conformity

Once projects are selected for fiscal constraint, they must enter conformity analysis. The U.S. Environmental Protection Agency (U.S. EPA) has established health-based standards for six criteria air pollutants, referred to as the National Ambient Air Quality Standards (NAAQS). Conformity is the federally mandated analytical process through which MPOs must demonstrate that the transportation investments, strategies, and programs included in their long-range plans are consistent with air quality goals established in State Implementation Plans for achieving NAAQS. A transportation conformity demonstration is required at least once every four years, or when an MPO: 1) adopts a new Plan or TIP; or 2) amends, adds, or deletes a regionally significant, non-exempt project in a Plan or TIP.

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, comprising state and federal regulatory environmental and transportation agencies. DVRPC has successfully demonstrated the transportation conformity of *Connections 2050* in accordance with the corresponding state implementation plans and

Clean Air Act requirements. More details are available at http://www.dvrpc.org/AirQuality/Conformity/.

MRPs

MRPs are large-scale projects that will have a significant impact on regional travel. Almost all system expansion projects are MRPs, as are large-scale reconstruction projects on the region's freeways and bridges. Major Operational Improvement initiatives, such as SEPTA's Trolley Modernization project, are listed in the Plan, as are large-scale bike and pedestrian initiatives, such as the Circuit Trails network. 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. MRPs are discrete projects with defined start and end dates, and not part of an ongoing program, such as the Transit Vehicle Overhaul Program. They are further defined as follows.

System Expansion

- Roads: Addition of new through lanes by widening, extending, or building new limited access highways of any length; creating a new interchange between highways (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. Some projects listed in system expansion also have operational improvement components. These include: adding flex lanes or part-time shoulder use lanes to existing facilities, and adding missing movements to existing partial interchanges.
- Transit: New stations on existing lines (including station parking needs), extension of existing lines, or new rail and 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, cost more than $25 million, or would need to be included in air quality conformity analysis because they would significantly alter regional travel patterns.
- 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 $25 million; make procurements that replace five or more vehicles in existing rail fleets; double track or add sidings to existing passenger rail lines; upgrade a traditional bus route with BRT service; or would need to be included in air quality conformity analysis because they would significantly alter regional travel patterns.

Many MRPs fit into more than one of the above categories. Any project with a system expansion component—no matter the size—will be listed in this category in the Plan. Any project that makes operational improvements, but does not contain system expansion elements, will be listed in this category. System preservation projects that don't make operational or system expansion improvements will be listed in this category. Only projects that deal exclusively with bike and pedestrian facilities will be listed in this category, although nearly all system preservation, operational improvement, and system expansion MRPs include some bike and pedestrian component. Only projects that do not fit into any of these categories will be listed as Other.

Due to the limited funding available for achieving the region's vision, MRPs are categorized as fiscally constrained (Funded Plan) and aspirational (Vision Plan). Projects in the Funded Plan are those that were selected by the Financial Planning Subcommittee, following project evaluation, to receive reasonably anticipated revenues. Projects in the Vision Plan include the remainder of MRPs that cannot be funded at this time. There is also a table for externally funded MRPs, 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 YOE dollars for funded projects and in 2021 dollars for the unfunded projects that are part of the Vision Plan. A detailed map of MRPs can be found at www.dvrpc.org/2050.

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 are generally costlier over time than repairing and replacing as needed. In addition, any given facility can decline more quickly—or slowly—than predicted by a model. 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 constraints.

Table 48 identifies major regional roadway (pavement and bridge) preservation projects that are fully funded in the TIP, as well as illustrative projects as a sample of major regional reconstruction projects that need to be advanced over the life of *Connections 2050*. I-95 South in Philadelphia, a $4.6 billion project, is a clear example of the difficult task of addressing the rebuilding of our infrastructure in a fiscally constrained environment. The illustrative projects in this list were carried over from the 2045 plan or identified by regional stakeholders. Table 49 identifies major regional roadway (pavement and bridge) preservation projects that are not able to be funded with reasonably anticipated revenues.

Table 48: MAJOR REGIONAL ROADWAY PRESERVATION PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
PA 309 (Sellersville Bypass) Resurfacing	Resurface from Church Road to Tollgate Road.	Bucks	2022–2026	$ 12.0
State Road	Full depth pavement reconstruction for ~2.2 miles of SR 2002 (State Road) from the bridge crossing the Neshaminy Creek to PA 413 (New Rodgers Road).	Bucks	2027–2032	$ 28.4
I-95 over Neshaminy Creek (multiple)	Rehabilitate bridges over Neshaminy Creek.	Bucks	2033–2040	$ 59.0
Old Lincoln Highway over Conrail	Reconstruct bridge over Conrail.	Bucks	2033–2040	$ 46.5
US 1 (Baltimore Pike) over Brandywine Creek	Replace bridge over Brandywine Creek.	Chester, Delaware	2033–2040	$ 39.8
US 422 Reconstruction	Reconstruction and realignment; improve acceleration lane for westbound on-ramp; and reconstruct bridge over Schuylkill River in Pottstown.	Chester, Montgomery	2022–2032	$ 167.0
US 1 from Schoolhouse Road to MD State Line	Reconstruct from Schoolhouse Road to Maryland State Line.	Chester	2022–2032	$ 271.2
North Valley Road/Darby Road Ext over Amtrak	Replace North Valley Road Bridge over Amtrak, realign to connect new bridge with Darby Boulevard.	Chester	2022–2032	$ 20.3
I-476: I-76 Interchange to MacDade	Pavement preservation and guide rail upgrades on I-476 from the I-76 interchange to MacDade Boulevard interchange	Delaware, Montgomery	2022–2032	$ 34.8
Media Bypass over Crum Creek and Crum Creek Road	Reconstruct bridge over Crum Creek and Crum Creek Road.	Delaware	2033–2040	$ 41.3
Wanamaker Avenue over Darby Creek	Replacement of both the southbound and northbound bridge which carries PA 420 over Darby Creek between the Tinicum Township and Prospect Park Borough.	Delaware	2022–2032	$ 27.8
Belmont Avenue over Schuylkill River	Rehabilitate bridge over the Schuylkill River.	Montgomery	2022–2032	$ 18.3

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
I-476 over Balligomingo Road (multiple)	Rehabilitate bridge over Balligomingo Road.	Montgomery	2033–2040	$ 51.7
Ridge Pike over Norfolk Southern and PA Turnpike	Combined replacement of Ridge Pike over Norfolk Southern tracks, and over I-276 (PA Turnpike).	Montgomery	2022–2026	$ 23.8
I-76 Pavement Preservation from US 1 to I-676	Pavement preservation and guide rail upgrades on I-76 (Schuylkill Expressway) from US 1 (Roosevelt Expressway) to I-676 (Vine Street Expressway) in Philadelphia.	Philadelphia	2022–2032	$ 40.6
Swanson Street Reconstruction	Reconstruction of the existing roadway, including stormwater improvements, street lighting, pavement markings, landscaping and a new signal at the Snyder Avenue intersection.	Philadelphia	2022–2026	$ 21.4
59th Street over AMTRAK	Replacement of 59th Street bridge over AMTRAK in Philadelphia, including related pedestrian and operations work.	Philadelphia	2022–2032	$ 37.5
Falls Road Bridge	Historically sensitive improvements to extend the useful life of the bridge.	Philadelphia	2022–2032	$ 24.9
Girard Point Bridge (I-95)	Repair Girard Point Bridge (I-95) and approaches and assess for potential tolling.	Philadelphia	2033–2040	$ 316.2
Henry Avenue over Lincoln Drive and Wissahickon Creek	Rehabilitate bridge over Lincoln Drive and Wissahickon Creek.	Philadelphia	2033–2040	$ 128.2
I-76 Philadelphia (multiple)	Rehabilitate bridges in Philadelphia.	Philadelphia	2033–2040	$ 553.4
I-95 South Philadelphia	Reconstruct/rehabilitate from I-676 to Broad Street.	Philadelphia	2033–2050	$ 4,622.2
Market Street over Schuylkill and CSX	Rehabilitate bridges over Schuylkill River and CSX rail tracks.	Philadelphia	2022–2032	$ 104.1
US 1 (Roosevelt Boulevard) over Wayne Junction	Rehabilitate the bridge carrying US 1 (Roosevelt Boulevard) over Roberts Road, Wayne Avenue Station, Clarissa Street, Germantown Avenue, and N. Gratz Street.	Philadelphia	2022–2026	$ 13.1
NJ 70 Reconstruction	Reconstruct from NJ 38 to Cooper Avenue.	Burlington, Camden	2022–2031	$ 146.0

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
NJ 47	Reconstruct NJ 47 bridge over Big Timber Creek.	Camden, Gloucester	2022–2025	$ 23.7
US 130	Reconstruct US 130 bridge over Big Timber Creek.	Camden, Gloucester	2022–2025	$ 38.2
I-676 Reconstruction	Reconstruct from County Route 537 to US 30.	Camden	2032–2050	$ 51.3
I-76 Reconstruction	Reconstruct from I-676 to I-295.	Camden	2032–2050	$ 92.7
NJ 73 and Ramp G, Bridge over US 130	Replace the structurally deficient and functionally obsolete bridge, built in 1930 and modified in 1959.	Camden	2022–2031	$ 34.0
I-76/I-676 Bridges and Pavement	Replace bridge decks and superstructure of I-76/I-676 in several places. Two bridges will be widened.	Camden	2022–2025	$ 138.0
NJ 42, Kennedy Avenue to Atlantic City Expressway	Resurface, rehabilitate and reconstruct within the project limits. ADA compliance improvements will be included.	Gloucester	2022–2025	$ 37.0
NJ 47, Grove Street to US 130, Pavement	Resurface, rehabilitate and reconstruct within the project limits. The project will update the ADA requirements and correct a culvert that causes a flooding condition.	Gloucester	2022–2025	$ 32.3
I-295 over Big River Creek	Reconstruct bridges over Big River Creek.	Gloucester	2032–2050	$ 62.7
US 322 over Main Street	Reconstruct bridge over Main Street.	Gloucester	2032–2050	$ 84.9
CR 626 (Lincoln Ave/ Chambers Street) Bridge	Replace the Lincoln Avenue Bridge over Amtrak NEC rail line, an inactive rail yard, and Assunpink Creek.	Mercer	2022–2031	$ 41.1
CR 638 (Clarksville Road) over NEC	Reconstruct CR 638 (Clarksville Road) bridge over the NEC rail line, adding bicycle and pedestrian facilities.	Mercer	2032–2050	$ 54.3
NJ 133 over NJ Turnpike	Reconstruct bridges over NJ Turnpike.	Mercer	2032–2050	$ 65.3

Source: DVRPC, 2021.

Table 49: MAJOR REGIONAL ROADWAY PRESERVATION PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $)
I-95 Delaware County (multiple)	Rehabilitate pavement and rehabilitate bridge over Bartram Avenue/Conrail.	Delaware	$ 183.7
PA 291 over Conrail	Replace bridge over Conrail Chester Secondary line near PHL.	Delaware	$ 31.3
Church Road/School House Lane/Water Street	Reconstruct the existing roadway to provide for truck traffic bypass.	Montgomery	$ 27.1
Farnworth Avenue (CR 545)	Replace bridge over Conrail Robbinsville Secondary Branch.	Burlington	$ 46.1
NJ 64/CR 571 over NEC	Reconstruct bridge over NEC.	Mercer	$ 27.5

Timing for unfunded preservation projects is to be determined by state DOTs.
Source: DVRPC, 2021.

Major Regional Bike and Pedestrian Projects

Only projects that deal exclusively with bike and pedestrian facilities will be listed in this category, although nearly all system preservation, operational improvement, and system expansion MRPs include some bike and pedestrian components. The only project explicitly for bike and pedestrian improvements that is fiscally constrained in its entirety in the *Connections 2050* Funded Plan is the Penn's Landing Cap over I-95. The City of Philadelphia, the Commonwealth of Pennsylvania, and the William Penn Foundation have created a partnership that will build the cap in Old City, Philadelphia, helping to better connect Penn's Landing with Center City. Other projects in the Vision Plan, such as the Circuit Trails do have some funds allocated in the Pennsylvania and New Jersey TIPs but cannot be fiscally constrained because there is not enough funding to complete the entire scope with reasonably anticipated revenues. Not listed here are smaller-scale projects that do not rise to the level of MRP but are desired by counties, such as improved bike and pedestrian connections between the Paoli-Thorndale regional rail line and Norristown High Speed Line in Radnor Township.

Table 50 identifies major regional bike and pedestrian projects that are funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 51 identifies major regional bike and pedestrian projects that are not able to be funded with reasonably anticipated revenues.

Table 50: MAJOR REGIONAL BIKE AND PEDESTRIAN PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
I-95 at Penn's Landing	Access and community improvement via cap over I-95 from Chestnut Street to Walnut Street in Center City.	Philadelphia	2022–2026	$ 227.8
The Circuit (PA Programmed)	Various trail and greenway segments of the Circuit Trails regional trail network.	All PA Counties	2022–2026	$ 6.0

Source: DVRPC, 2021.

Table 51: MAJOR REGIONAL BIKE AND PEDESTRIAN PROJECTS—VISION PLAN

Facility	Project Scope	Location	Timing	Cost (Millions of 2021 $)
The Circuit Trails (PA Need)	Complete 294.5 miles of the Circuit Trails regional trail network.	All PA Counties	2022–2050	$ 369.4
30th Street Station Bike/Ped Bridges	Construction of two new bike/ped bridges over the Schuylkill River as part of 30th Street Station District Plan.	Philadelphia	2033–2050	$ 243.6
Philadelphia High-Quality Bike Network	Construct a network of high-quality protected bike lanes, off-street facilities, and neighborhood bikeways.	Philadelphia	2033–2050	$ 800.0
Vine Street Expressway	New cap over I-676 in Chinatown area of Philadelphia.	Philadelphia	2033–2050	$ 37.9
The Circuit Trails (NJ Need)	Complete 179 miles of the Circuit Trails regional trail network.	All NJ Counties	2022–2050	$ 190.7

Source: DVRPC, 2021.

Major Regional Roadway Operational Improvement Projects

Operational improvements increase the efficiency of the existing transportation network. Any major regional system preservation project that has operational improvement components, but not system expansion, is listed here. In many cases, these projects make interchange improvements that will improve the flow of traffic and help to remove traffic from local streets. Major regional roadway operational improvement projects do not only focus on physical changes to the roadway network. Also included are TSMO projects with specific ITS, CV infrastructure, Active Traffic Management (ATM), and signal improvement elements. As part of the forthcoming District 6 Traffic Management Center, PennDOT will take over the active management of 700 traffic signals in the city of Philadelphia, another 700 in the four

suburban southeastern Pennsylvania counties, and another 700 in the rest of the state, along what are being deemed "super critical corridors." Super critical corridors are arterial roadways that parallel expressways and have at least 25,000 Average Annual Daily Traffic.

Table 52 identifies major regional roadway operational improvement projects that are fully funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 53 identifies major regional roadway operational improvement projects that are not able to be funded with reasonably anticipated revenues.

Table 52: MAJOR REGIONAL ROADWAY OPERATIONAL IMPROVEMENT PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
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	2041–2050	$ 258.6
US 1 at PA 352 and PA 452	Reconstruction of PA 352 cloverleaf interchange, Media Bypass/Baltimore Pike interchange, and PA 452 intersection; and eliminate lane drops.	Delaware	2022–2040	$ 424.4
PA 291 (Second Street/Industrial Highway)	PA 291 in Chester City, Eddystone Borough, and Ridley Township. Includes traffic-calming methods, enhanced crosswalks, landscaping, new and altered traffic signals, and facility for the East Coast Greenway.	Delaware	2033–2050	$ 56.9
PennDOT District 6 Traffic Management Center	New Regional Traffic Management Center at PennDOT District 6 Headquarters.	Montgomery	2022–2026	$ 10.5
I-276 and PA 611 Willow Grove Interchange	Interchange modification.	Montgomery	2027–2032	$ 80.3
I-476 and I-76 Interchange	Ramp modifications.	Montgomery	2041–2050	$ 24.2
I-76 and PA 23 (Matsonford Road) Interchange	Interchange modification.	Montgomery	2041–2050	$ 24.2
PA 611	Eastern Montgomery County ITS improvements and multi-modal upgrades from Cheltenham Avenue to County Line Road.	Montgomery	2041–2050	$ 44.7
PA 611 (Easton Road)	Corridor, signals, and intersection improvements between Blair Mill Road and County Line Road.	Montgomery	2041–2050	$ 89.3
PA 63 (Welsh Road)	Bridge replacements and minor widening between Blair Mill Road and Twining Road.	Montgomery	2027–2032	$ 27.5

Facility	Project Scope	Location	Timing	Cost (Millions of YOE $)
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	2022–2032	$ 8.4
Sumneytown Pike from PA 63 to PA 363	Corridor and intersection improvement from PA 63 to PA 363.	Montgomery	2041–2050	$ 44.7
US 202 (Section 500) (Markley Street)	Reconstruct from Main Street to Johnson Highway; widen to add a center turn lane between Marshall Street and Johnson Highway.	Montgomery	2022–2026	$ 7.8
30th St. Station Vehicle Circulation	Vehicle circulation improvements from 30th Street District Plan on Market, Arch, and 30th streets; repurpose Little Market Street; realign JFK Boulevard and I-76 ramp.	Philadelphia	2041–2050	$ 89.3
Eakins Oval	Reconfiguration of circulation paths and patterns around Eakins Oval and Benjamin Franklin Parkway.	Philadelphia	2041–2050	$ 55.8
I-95 Philadelphia North (Sector A)	Reconstruct from Race Street to State Road; interchange improvements at Vine, Girard, Allegheny, Betsy Ross Bridge, Bridge, and Cottman interchanges.	Philadelphia	2022–2040	$ 2,440.9
Vision Zero Safety Improvements in Philadelphia (Programmed)	Improve road safety with engineering enhancements in Philadelphia.	Philadelphia	2033–2040	$ 85.6
NJ 70 Corridor/Intersection Improvements	Operational and safety improvements from NJ 38 to NJ 73; Intersection Improvements at Kingston Road and Covered Bridge Road.	Burlington, Camden	2032–2050	$ 601.7
US 130	Realign sections of US 130 corridor from Campus Drive and Rising Sun Road, and redesign multiple intersections with new signals.	Burlington	2032–2050	$ 483.7
Trenton Station Area Access	Revise operations to Market, Clinton, Wallenberg, and Greenwood to improve multimodal access to Trenton Transit Center.	Mercer	2032–2040	$ 54.5
Trenton City Traffic Signal Upgrades	Mark comprehensive upgrades and interconnect 127 urban traffic signals; remove any that are not warranted.	Mercer	2032–2040	$ 79.1

Source: DVRPC, 2021.

Table 53: MAJOR REGIONAL ROADWAY OPERATIONAL IMPROVEMENT PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
US 422 Corridor ITS	Implement ITS improvements along US 422, Ridge Pike, PA 23, and PA 724.	Chester, Montgomery	$ 54.1
US 202 (Section 200)	Improve the operational efficiency of US 202 Section 200 through West Goshen Township.	Chester	$ 162.4
Germantown Pike: PA 363 to Ridge Pike	Corridor and intersection improvements from PA 363 to Ridge Pike (~four miles).	Montgomery	$ 30.0
PA 100 at King Street, High Street	Eliminate northbound cloverleaf to High Street; College Drive extension to King Street.	Montgomery	$ 15.0
PA 100 at PA 73	Modify interchange into a single-point urban-style interchange.	Montgomery	$ 75.8
PA 309 at County Line Road	Improve intersection at Line Lexington Road.	Montgomery	$ 15.0
Township Line Road	Widen between US 422 and Cemetery Road; install shoulders and turn lanes (~4.3 miles).	Montgomery	$ 40.0
Trooper Road	Widen to five lanes (center turn) from US 422 to Egypt Road (~1.5 miles).	Montgomery	$ 35.0
US 1 (Roosevelt Boulevard) Operational Improvements	Operational Improvements from Broad Street to Bensalem Township. See also Roosevelt Boulevard transit line.	Philadelphia	$ 5,000.0
Spring Garden Greenway	Realignment, signal improvements, ECG and Circuit train construction, safety improvements.	Philadelphia	$ 51.0
Vision Zero Safety Improvements (Unfunded Vision)	Improve road safety with engineering enhancements.	Philadelphia	$ 550.0
NJ 38 and Lenola Road (CR 608)	Intersection improvements.	Burlington	$ 27.9
I-295 and NJ 168 Interchange	Interchange improvements.	Camden	$ 27.5
I-195 Active Traffic Management	Dynamic speed limit, dynamic lane assignment, and queue warning between NJ Turnpike and I-295.	Mercer	$ 16.2
NJ 29 from US 1 to Sullivan Way	Convert NJ 29 to an Urban Boulevard from US 1 to Sullivan Way.	Mercer	$ 241.3

Source: DVRPC, 2021.

Major Regional Roadway System Expansion Projects

Due to overwhelming needs in system preservation, increasing needs for operational improvements, and bike and pedestrian alignment with the regional vision, new roadway capacity funding is capped at 4 percent of total anticipated roadway revenue. Although 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 also increases system capacity is listed here. US 1 in Bucks County is one example of a system expansion project that is also helping to rebuild the network. System Expansion is the only category for which there are minor (under $25 million) projects listed, due to their impact on air quality conformity.

Table 54 identifies all major and minor regional roadway system expansion projects that are fully funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 55 identifies major and minor regional roadway system expansion projects that are not able to be funded with reasonably anticipated revenues under the 4 percent cap.

Table 54: MAJOR AND MAJOR REGIONAL ROADWAY SYSTEM EXPANSION PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	System Expansion Cost (in Millions of YOE $)	Total Cost (in Millions of YOE $)
PA 309 Connector Road	Construct new road from Allentown Road to County Line Road; Improve PA 309 interchange.	Bucks, Montgomery	2022–2032	$ 79.1	$ 101.4
County Line Road	Widen and reconstruct between US 202 and Stump Road and between Kulp Road and PA 611.	Bucks, Montgomery	2022–2026	$ 1.1	$ 2.5
US 1	Reconstruct from I-276 (PA Turnpike) to NJ state line; widen from PA Turnpike to PA 413; I-276 and US 1 improvements.	Bucks	2022–2040	$ 83.5	$ 363.1
Bristol Road Extension	Extend roadway from US 202 to Park Avenue.	Bucks	2022–2032	$ 21.5	$ 21.5
PA 663 from Portzer to Hickory	Widen to four lanes between Portzer Road and Hickory Drive, including turn lanes; and construct 8-foot wide bike/pedestrian pathway.	Bucks	2022–2026	$ 1.5	$ 1.5
US 202 at US 1 Loop Road and PA 926	Complete southwestern loop road.	Chester, Delaware	2022–2026	$ 1.7	$ 3.4
US 30 (Coatesville-Downingtown Bypass) Eastern section	Reconstruct and widen from just west of Reeceville Road to Quarry Road, including six interchange projects.	Chester	2022–2040	$ 281.8	$ 1,127.4

Facility	Project Scope	Location	Timing	System Expansion Cost (in Millions of YOE $)	Total Cost (in Millions of YOE $)
US 30 (Coatesville-Downingtown Bypass) Western section	Reconstruct from PA 10 to just west of Reeceville Road; interchange improvements at PA 82, Airport Road, and Bus. 30/PA10.	Chester	2022–2032	$ 49.6	$ 495.7
Ship Road and US 30 Business Couplet	Convert the present location of Ship Road to northbound only and construct a southbound leg, as well as a 10-foot-wide multimodal trail.	Chester	2022–2026	$ 0.9	$ 0.9
Ashburn Road Extension	0.34-mile extension to Township Line Road.	Chester	2022–2026	$ 1.8	$ 1.8
US 202 at PA 100	Establishment of two southbound and two northbound lanes at the US 202 and High Street interchange and additional eastbound left-turn lane on Matlack to US 202.	Chester	2033–2040	$ 1.0	$ 2.6
I-476 Active Traffic Management	Part-time shoulder use and other operational strategies from PA 3 to I-95.	Delaware	2022–2032	$ 28.5	$ 57.1
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	2022–2032	$ 18.0	$ 119.8
US 322 from Clayton Park Drive to I-95	Widen and reconstruct from Clayton Park Drive to I-95.	Delaware	2022–2026	$ 78.0	$ 260.0
Bridgewater Road Extension	Extend from Concord Road to PA 452/US 322.	Delaware	2022–2026	$ 22.7	$ 22.7
Bryn Mawr Avenue Extension	Bypass for PA 3 (West Chester Pike) and PA 252 (Newtown Street) Intersection, connecting to existing Cornerstone Drive.	Delaware	2041–2050	$ 6.0	$ 12.1
Henderson Road and South Gulph Road	Widen Henderson Road from South Gulph Road to Shoemaker; Widen South Gulph Road from Crooked Lane to I-76 Gulph Mills intersection.	Montgomery	2022–2032	$ 9.9	$ 19.8
Belmont Avenue and I-76 Interchange	Widen Belmont Avenue to provide additional lanes, intersection improvements and streetscape improvements; modify I-76 and railroad overpasses.	Montgomery	2022–2040	$ 38.4	$ 76.7

Facility	Project Scope	Location	Timing	System Expansion Cost (in Millions of YOE $)	Total Cost (in Millions of YOE $)
I-76 ICM	Various ITS and TSMO strategies, SEPTA coordination, biking and safety enhancements from PA Turnpike to US 1; part-time shoulder use from US 202/422 to I-476, and I-476 to Belmont Avenue.	Montgomery	2022–2032	$ 110.4	$ 220.7
US 202 (Section 600)	Widen and reconstruct from Johnson Highway to PA 309.	Montgomery	2022–2032	$ 23.0	$ 57.6
Horsham Road Widening	Widen to two through lanes in each direction from Limekiln Pike to Davis Grove. Widen Limekiln Pike to two through lanes at intersection with Horsham Road.	Montgomery	2022–2026	$ 3.9	$ 3.9
Ridge Pike	Reconstruct from Butler Pike to Philadelphia City Line; widen from three to four lanes from Church Lane to Philadelphia.	Montgomery	2022–2026	$ 6.8	$ 27.3
Spring House Road	Widen for additional through lane from Norristown Road to Sumneytown Pike	Montgomery	2022–2026	$ 0.9	$ 0.9
PA 23 and Trout Creek Road Bridge	Replace weight-restricted bridge on a new alignment; realign roadway between Moore Road and Vandenberg Road providing two westbound lanes and one eastbound lane.	Montgomery	2027–2032	$ 4.8	$ 19.3
US 422 Mainline Widening	Reconstruct and widen from four to six lanes from US 202 to PA 363.	Montgomery	2033–2040	$ 54.2	$ 108.3
I-276 Fort Washington Interchange	Ramp modifications.	Montgomery	2033–2040	$ $2.1	$ 8.5
NJ 73 and Church Road	Grade separated interchanges at Church Road (CR 616) and Fellowship Road (CR 673).	Burlington	2022–2031	$ 55.8	$ 111.6
NJ 73 from Dutch Road to NJ 70	Intersection improvements at NJ 73 and Evesham Road (CR 544).	Burlington	2022–2031	$ 24.3	$ 48.7
Rising Sun Road to Dunns Mill Road Connector	The construction of a two-lane bypass road from Rising Sun Road to Dunns Mill Road, near the Route 130 / Dunns Mill Road intersection.	Burlington	2022–2025	$ 2.6	$ 2.6

Facility	Project Scope	Location	Timing	System Expansion Cost (in Millions of YOE $)	Total Cost (in Millions of YOE $)
I-295 at NJ 42 Missing Moves, Bellmawr	Add missing movements to interchange at I-76/NJ 42 in Bellmawr.	Camden, Gloucester	2022–2025	$ 56.8	$ 113.6
I-295 Direct Connect through I-76/NJ 42	Direct connection of I-295 through interchange at I-76 / NJ 42.	Camden	2022–2025	$ 150.2	$ 320.4
US 322	Widen from US 130 to NJ Turnpike.	Gloucester	2032–2050	$ 49.5	$ 99.1
322 Bypass near Rowan University	Bypass around US 322/NJ 55; intersection improvements at US 322/Joseph Bowe Boulevard; corridor improvements in campus/downtown area.	Gloucester	2032–2040	$ 50.6	$ 60.7
NJ 44 Truck Bypass and Du-Pont Port Access Road	New 0.61-mile truck bypass roadway, beginning near existing NJ 44 Bridge over Sand Ditch, with the northbound and southbound ramps on separate alignments.	Gloucester	2032–2040	$ 9.2	$ 9.2
CR 676/Mantua Boulevard/Rowan Fossil Park Access Road Extension	New roadway as an extension of CR 676 in Mantua Township; through lane to connect CR 553 to Rowan Fossil Park Access Road.	Gloucester	2032–2040	$ 12.0	$ 12.0
US 1 (Alexander Road) to Mapleton Road	Widen from six to eight lanes from Dinky Bridge to Scudders Mill Road; intersection improvements at Washington Road and Harrison Street.	Mercer	2022–2031	$ 40.2	$ 40.2
NJ 133 and Cranbury Station Road Interchange	Construct a new interchange to facilitate access to distribution centers.	Mercer	2022–2025	$ 6.0	$ 6.0

Source: DVRPC, 2021.

Table 55: MAJOR REGIONAL ROADWAY SYSTEM EXPANSION PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
I-95 Bucks/Philadelphia Active Traffic Management	Part-time shoulder use and other operational strategies from Woodhaven Road to Academy Road.	Bucks, Philadelphia	$ 23.75
I-95 at PA 132 (Street Road)	Replace bridge over I-95 and NEC with wider structure. Provide turning lanes on bridge, widen I-95, improve connection to US 13.	Bucks	$ 162.36
PA 663 (John Fries Highway)	Widen and reconstruct from PA 309 to PA Turnpike.	Bucks	$ 27.06
US 422 Active Traffic Management	Part-time shoulder use and other operational strategies from US 202 to PA 29.	Chester, Montgomery	$ 19.48
PA 100 Northbound at Exton Station	Additional northbound lane between Pottstown Pike on-ramp and the US 30 (Exton Bypass); intersection improvements.	Chester	$ 15.92
PA 113 from US 30 to Peck Road	Widen from US 30 to Peck Road to remove bottleneck.	Chester	$ 16.67
Guthriesville Loop Road	Extend new road from Reeceville Road to Horseshoe Pike.	Chester	$ 6.21
US 202 (Section 100)	TSMO, ATM, and/or select widening for congestion mitigation between West Chester and Delaware state line.	Chester	$ 150.00
I-95 Delaware County Active Traffic Management	Part-time shoulder use and other operational strategies southbound from Stewart Avenue to I-476 and northbound from US 322 East to Stewart Avenue.	Delaware	$ 24.56
Perkiomen Crossing (Phase 2)	Additional bridge over Perkiomen Creek between Ridge Pike and Germantown Pike to connect with PA 29. New connections and relocate intersections on both ends.	Montgomery	$ 62.40
Second Conshohocken Bridge	Over Schuylkill River.	Montgomery	$ 54.12
Germantown Pike from Whitehall Road to Potshop Road	Rebuilding/3R and widening from Whitehall Road to Potshop Road.	Montgomery	$ 23.81
Keystone Blvd. Extension	Extend Keystone Boulevard from its current terminus to Grosstown Road.	Montgomery	$ 16.24
Market Street New Connector	Construct new connector roadway between Grosser Road and PA 73.	Montgomery	$ 16.24
Germantown Pike Widening	Widen to six lanes from Walton Road to Launfall Road (~0.5 miles).	Montgomery	$ 15.00

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
Oak Drive Extension	Construction of ~0.7 mile new roadway from PA 113 (Oak Drive) to PA 63 (Credit Union Driveway).	Montgomery	$ 12.00
PA 113 Relocation (Lederach)	Relocate the roadway around Lederach Village (Whitaker Way to Landis Road) (~0.9 miles).	Montgomery	$ 10.00
Stanbridge Street Extension	Extend Stanbridge Street half-mile from State Hospital to Johnson Highway.	Montgomery	$ 20.00
US 202 Dannehower Bridge and Lafayette Street Interchange	Reconstruct Dannehower Bridge and add new half-diamond interchange at Lafayette Street.	Montgomery	$ 190.00
I-76 Philadelphia Active Traffic Management	Part-time shoulder use and other operational strategies from from US 1 (Roosevelt Blvd) to I-676 (Vine St Expressway).	Philadelphia	$ 51.40
I-295 at NJ 38 Missing Moves	Add missing movements to interchange at NJ 38.	Burlington	$ 204.9
I-295	Capacity and operational improvements from CR 649 (Sloan Avenue) to CR 583 (Princeton Pike).	Mercer	$ 69.8
Direct Connection from NJ 129 NB to US 1 SB and US 1 NB to NJ 129 SB	Add missing movement that currently directs heavy trucks through residential neighborhoods.	Mercer	$ 70.0

Source: DVRPC, 2021.

Major Regional Roadway Other Projects

Other roadway needs include miscellaneous items—such as parking facilities, drainage, environmental mitigation, TMAs, engineering, regional and local planning, and debt service—that do not fit neatly into categories R1 through R5. These needs are largely obligations that must be fully funded. These are not typically listed as MRPs, as expenditures are either lower cost or bundled into large program line items. The one exception in *Connections 2050* is Chester City and Township Sound Walls in Delaware County, which falls below the $25 million threshold for MRPs but has been grandfathered into the Plan as one. Table 56 lists this project, which is fully funded in the Pennsylvania TIP.

Table 56: MAJOR REGIONAL ROADWAY OTHER PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
I-95 Sound Walls in Chester	Sound walls or landscaped berms along I-95 to reduce noise and pollution in Chester City and Chester Township.	Delaware	2022–2032	$ 15.1

Source: DVRPC, 2021.

Major Regional Transit System Preservation Projects

Major regional transit system preservation projects include rail infrastructure, vehicles, and stations. Most of the need in both state subregions is currently in the vehicle preservation category. Large expenses, such as the SEPTA Bus Purchase Program and NEC Rail Vehicles, limit the number of total transit improvements that can be fiscally constrained, given the current revenue outlook.

Table 57 identifies major regional transit system preservation projects that are fully funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 58 identifies major regional transit system preservation projects that are not able to be funded with reasonably anticipated revenues.

Table 57: MAJOR REGIONAL TRANSIT SYSTEM PRESERVATION PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
SEPTA Bus Purchase Program	Routine procurements of electric, hybrid, and diesel 40-foot buses, 60-foot buses, and trackless trolleys.	All PA Counties	2022–2050	$ 3,041.0
Paratransit Vehicle Replacements	Acquisition of revenue vehicles for paratransit and shared ride.	All PA Counties	2022–2032	$ 77.0
Utility Fleet Vehicle Replacements	Upgrade and replace the Authority's utility fleet and automotive service fleet.	All PA Counties	2022–2032	$ 81.0
Regional Rail Station Enhancements	ADA and parking at Conshohocken Station; accessibility upgrades at Bristol, Chestnut Hill East, Devon, East Falls, Glenside, Ivy Ridge, Jenkintown-Wyncote, Marcus Hook, Malvern, Noble, Roslyn, Stenton, Swarthmore, Willow Grove, Wissahickon, Wyndmoor, and Wynnewood.	All PA Counties	2022–2032	$ 377.5
SEPTA Multilevel Push-Pull Cars	Procure 45 new ADA-accessible push-pull cars to replace existing fleet.	All PA Counties	2022–2026	$ 114.6
Regional Rail Vehicles	Replace existing heavy rail vehicle fleet of Silverliner VIs.	All PA Counties	2041–2050	$ 1,361.6

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
Regional Rail Substations	Substation Design and Equipment Purchase, plus replacements at 18th St, Brill, Cresheim Valley, Lansdale/Hatboro/12th and Portal, Wayne Junction, and Woodbourne.	Bucks, Montgomery, Philadelphia	2022–2032	$ 398.6
Frazer Shop and Yard	Rail shop and yard upgrade.	Chester	2022–2026	$ 139.00
Norristown High Speed Line tracks	Tie replacement and continuous welded rail.	Delaware, Montgomery	2022–2032	$ 83.1
Norristown High Speed Line fleet	Replace existing heavy rail fleet.	Delaware, Montgomery	2033–2050	$ 258.8
Transit Substation Replacements (multiple)	SEPTA Transit Substation Program for overhauls, plus replacements at Ellen, Market, Park, Broad, Louden, Caster, and Ranstead.	Delaware, Philadelphia	2022–2032	$ 400.7
Transit Station Enhancements	8th Street Customer Service, 11th Street, 30th Street, 34th Street, Spring Garden, Ellsworth-Federal, Erie, Fairmount, Hunting Park, Logan, Lombard-South, Snyder, Susquehanna-Dauphin, Tasker-Morris, Wyoming, Chinatown.	Delaware, Philadelphia	2022–2032	$ 278.2
Market-Frankford Line Vehicles	Replace existing heavy rail vehicle fleet.	Delaware, Philadelphia	2033–2040	$ 1,201.7
Norristown High Speed Line Viaduct	Rehabilitate Bridgeport Viaduct over Schuylkill River and Bridge 0.15 over 69th Street yard tracks.	Montgomery	2022–2026	$ 35.00
Chestnut Hill East Line	Rehabilitate five bridges.	Philadelphia	2022–2032	$ 30.00
Chestnut Hill West Line	Rehabilitate seven bridges.	Philadelphia	2022–2032	$ 35.00
Regional Rail from 30th Street to Suburban Station	Rehabilitation of seven Mainline-Schuylkill bridges from 30th Street to Suburban Station.	Philadelphia	2022–2032	$ 57.05
City Hall and 15th Street Stations	Renovation.	Philadelphia	2022–2032	$ 66.6
Fern Rock Station Modifications	Safety improvements and station modifications.	Philadelphia	2022–2032	$ 20.5
Broad Street Line at NRG Station	Station ventilation improvements at NRG Station.	Philadelphia	2022–2032	$ 10.00
Buses and Trolleys	Computer-aided radio dispatch signal and communication system upgrades and replacements.	Philadelphia	2022–2026	$ 92.50

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
Regional Rail from 30th Street Station Westbound to K and Zoo Interlockings	Catenary replacement from 30th Street Station westbound to K and Zoo Interlockings.	Philadelphia	2022–2026	$ 83.35
Southwest Connection Regional Rail from 30th Street Station to Phil Interlocking	Signals, catenary, and right-of-way improvements from 30th Street Station to Phil Interlocking.	Philadelphia	2022–2026	$ 70.99
Center City Concourse	Renovation.	Philadelphia	2022–2026	$ 59.65
Midvale Bus Garage Roof	Garage roof replacement.	Philadelphia	2022–2026	$ 30.03
Zoo Interlocking	Zoo interlocking SGR improvements, including retaining wall construction and first and second phase of track work.	Philadelphia	2033–2040	$ 55.20
Broad Street Line Vehicles	Replace existing heavy rail vehicle fleet.	Philadelphia	2041–2050	$ 1,031.5
Trolley track and Right-of-Way Improvements	Street track Improvements for SEPTA trolleys.	Philadelphia	2022–2032	$ 27.50
River LINE Light Rail Vehicles	Procure 20 light rail vehicles.	Burlington, Camden, Mercer	2041–2050	$ 145.0
PATCO Bridges Rehabilitation	Concrete and steel repairs, bearing replacement, column repairs, drainage, and abutment/wingwall repairs.	Camden	2022–2031	$ 24.0
PATCO Station Platform Rehabilitation	Rehabilitation, as well as replacement of concrete platforms and supporting structures, including concrete and steel repairs.	Camden	2022–2031	$ 49.6
Atlantic City Line Vehicles	Procure five locomotives and 20 commuter rail vehicles.	Camden	2032–2050	$ 235.1
PATCO Heavy Rail Vehicles	Procure 120 heavy rail vehicles.	Camden	2041–2050	$ 120.9
Atlantic City Line Stations	Station enhancements at Atco, Cherry Hill, and Lindenwold stations.	Camden	2041–2050	$ 72.5
NJ TRANSIT NEC Rail Vehicles	Replace 42 commuter rail vehicles.	Mercer	2032–2050	$ 448.7

Source: DVRPC, 2021.

Table 58: MAJOR REGIONAL TRANSIT SYSTEM PRESERVATION PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
Keystone Corridor Improvements	Track 2 upgrades and bidirectional signaling from Paoli to Overbrook.	Chester, Montgomery, Philadelphia	$ 38.59
Exton Station (Phase 3)	Construct multilevel parking garage.	Chester	$ 32.64
Paoli Station	Multimodal center, access, and parking improvements.	Chester	$ 50.28
Keystone Corridor Stations	Station enhancements, relocation, and construction at Coatesville, Parkesburg, and Downingtown.	Chester	$ 85.25
Highland Avenue Regional Rail Station Replacement/Relocation	Station will soon be closing; could be relocated to Engle/Townsend Street.	Delaware	$ 29.23
Station Parking	Regional rail parking expansions at Philmont, Noble, Ivy Ridge, Fern Rock, Gwynedd Valley, and new storage track at Noble Station.	Montgomery	$ 186.98
Ardmore Transportation Center (Phase 2)	New parking garage.	Montgomery	$ 26.05
Callowhill Shop	Facility rehabilitation.	Philadelphia	$ 100.00
Walter Rand Transportation Center	Replace the existing facility with an expanded multipurpose transit center with intermodal connectivity.	Camden	$ 275.0

Source: DVRPC, 2021.

Major Regional Transit Operational Improvement Projects

Operational improvements for transit include new sidings, additional vehicles to expand the fleet, and other projects that allow for increased service frequency. In Pennsylvania, projects like the Norristown Line third track will enable service and safety improvements. Completion of the SEPTA Key project will give the region one of the most advanced payment systems in the country. Trolley Modernization, which contains both preservation and operations improvements, accounts by far for the largest cost in this category. There are currently no fiscally constrained projects for this category in the New Jersey subregion.

Table 59 identifies major regional transit operational improvement projects that are fully funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 60 identifies major regional transit operational improvement projects that are not able to be funded with reasonably anticipated revenues.

Table 59: MAJOR REGIONAL TRANSIT OPERATIONAL IMPROVEMENT PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
SEPTA Real-Time Information/Audio Visual Public Address System	Upgrade and modernization of passenger information at rail and transit stations.	All PA Counties	2022–2026	$ 37.75
SEPTA Key	Systemwide updates to fare collection system.	All PA Counties	2022–2026	$ 23.6
Media/Sharon Hill Lines	Route 101 and 102 positive train control and right-of-way improvements.	Delaware	2022–2026	$ 76.40
SEPTA Trolley Modernization	Replace existing trolley fleet with ADA-compliant trolleys to expand capacity and provide faster, more reliable service.	Delaware, Philadelphia	2022–2050	$ 3,052.6
Norristown Regional Rail track	Third Track at Norristown Station.	Montgomery	2027–2032	$ 34.50
Broad Street Line Signals	Modernization of the signal system on the Broad Street Line.	Philadelphia	2022–2032	$ 65.00

Source: DVRPC, 2021.

Table 60: MAJOR REGIONAL TRANSIT OPERATIONAL IMPROVEMENT PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
Bus Priority Corridors	Construct bus-only lanes and other bus priority treatments and amenities (shelters, real-time information, boarding bulbs/islands).	All PA Counties	$ 300.0
Bus Network Infrastructure	Zero emission fleet infrastructure and other bus network operational improvements.	All PA Counties	$ 325.0
Regional Rail Enhancements (multiple)	Interlockings, sidings, flyovers, and freight separation projects to increase service frequency on regional rail lines.	Bucks, Delaware, Montgomery, Philadelphia	$ 918.0
Market-Frankford Line Capacity Enhancements	Reconfigured railcar seating, power system improvements, and ADA accessibility improvements. Add pocket track.	Delaware, Philadelphia	$ 941.7
69th Street Transportation Center	Construct parking structure, transportation center enhancements.	Delaware	$ 31.0
South Philadelphia Transportation Center	Construction of bus loops for east-west and north-south routes in South Philadelphia.	Philadelphia	$ 11.8
Eastwick Intermodal Station	Construct new intermodal station and extend Route 36 trolley.	Philadelphia	$ 110.0
PATCO Interlocking and Track Rehabilitation Phase II	Rehabilitation of Locust Hall Way, East/West Ferry, and East Crest interlockings, including removal and replacement of switches, frogs, ties, and cabling.	Camden	$ 35.0
Atlantic City Line Investments for Added Frequency	Siding and station improvements, as well as new vehicles for increased service frequency.	Camden, Philadelphia	$ 111.3
Morrisville Yard	Construction of a storage yard south of Trenton Station in NJ for SEPTA equipment.	Bucks	$ 34.3

Source: DVRPC, 2021.

Major Regional Transit System Expansion Projects

Transit system expansion projects ensure the region's equity and economic competitiveness in the future. In Pennsylvania, the Media-Elwyn Line extension to Wawa is funded in the TIP's 12-year program and will open by 2026. The King of Prussia Rail project to extend a spur of the Norristown High Speed Line 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.[71] In New Jersey, the Glassboro-Camden Line was moved to the Vision Plan due to funding constraints and the project's ineligibility for federal New Starts funding. The Glassboro-Camden Line remains a regional priority, although one that will need a state funding agreement to advance. System Expansion is the only category for which there are minor (under $25 million) projects listed, due to their impact on air quality conformity.

Table 61 identifies major regional transit system expansion projects that are fully funded in the TIP or have been selected to receive funding in the later years of *Connections 2050*. Table 62 identifies major regional transit system expansion projects that are not able to be funded with reasonably anticipated revenues.

Table 61: MAJOR REGIONAL TRANSIT SYSTEM EXPANSION PROJECTS—FUNDED PLAN

Facility	Project Scope	Location	Timing	Cost (in Millions of YOE $)
Media-Elwyn Line Extension	Extend from Elwyn to Wawa, PA.	Delaware	2022–2026	$ 28.2
King of Prussia Rail	Norristown High Speed Line Extension from Hughes Park to First and Moore.	Montgomery	2022–2040	$ 2,754.3
Franklin Square Station	Scoping, preliminary design work, ADA accessibility, structural, electrical, plumbing, communication, signal and security elements needed to enhance the currently closed station to full operation.	Philadelphia	2022–2026	$ 24.0

Source: DVRPC, 2021.

[71] All funding for this project has been obligated for 2021, but construction will not be complete until 2024.

Table 62: MAJOR REGIONAL TRANSIT SYSTEM EXPANSION PROJECTS—VISION PLAN

Facility	Project Scope	Location	Cost (Millions of 2021 $s)
Bethlehem Branch Passenger Rail Restoration	Restore service from Lansdale to Perkasie.	Bucks, Montgomery	$ 305.3
Roosevelt Boulevard Transit	New surface transit line along Roosevelt Boulevard.	Bucks, Philadelphia	$ 541.2
Atglen Regional Rail Extension	Rail line extension from Thorndale to Atglen.	Chester	$ 17.1
Frazer Station	New SEPTA station on the Keystone Corridor between Malvern and Exton.	Chester	$ 123.9
West Chester Rail Service	Restore service by extending Media/Elwyn/Wawa Line to West Chester Borough.	Chester	$ 411.3
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	$ 214.7
Market-Frankford Line West Market Street Station	New Station on the Market-Frankford Line along West Market Street in Center City.	Philadelphia	$ 373.4
Delaware Avenue Transit	New transit service within Philadelphia.	Philadelphia	$ 920.1
PATCO Extension to University City	Transit extension to University City.	Philadelphia	$ 1,500.0
Broad Street Line Extension	Transit extension to Navy Yard.	Philadelphia	$ 1,353.0
Glassboro-Camden Line	Construct new transit line from Camden to Gloucester County.	Camden, Gloucester	$ 1,500.0
South Jersey BRT	New BRT from Avondale Park and Ride and Delsea Drive to Center City, Philadelphia.	Camden	$ 53.9
US 1 BRT	Express bus network from Somerset County on US 206, Monmouth County on CR 571, Burlington Count on I-295, and Bucks County on I-95.	Mercer, Bucks	$ 162.4
West Trenton Line and Station	Re-establish passenger service on the West Trenton Line (CSX) to Newark and Secaucus (from West Trenton Station to Bridgewater, NJ). Service three stations in the region, including Hopewell Borough, I-95 Hopewell Township, and West Trenton Ewing Township (existing site with substantial modifications).	Mercer	$ 707.3
Extend River LINE to NJ State House	On-street service from Trenton Transit Center to West State Street.	Mercer	$ 19.9

Source: DVRPC, 2021.

Externally Funded Projects

In addition to those projects receiving federal and state transportation dollars, *Connections 2050* includes a list of externally funded projects due to their impacts on the regional network and air quality conformity. These projects generally are funded through toll revenues, but some will be funded from other sources.

Table 63 identifies major externally funded projects that are funded by their sponsoring authority. Because these projects are not funded with regional dollars, they are listed in 2021 dollars rather than YOE. Table 64 identifies major regional externally funded projects not yet funded but are planned for future implementation by their sponsoring authority.

Table 63: MAJOR REGIONAL EXTERNALLY FUNDED PROJECTS—FUNDED PLAN

Facility	Sponsoring Authority	Project Scope	Location	Timing	Cost (in Millions of 2021 $s)
Tacony-Palmyra Bridge	Burlington County Bridge Commission	Rehabilitation.	Philadelphia, Burlington	2022–2026	$ 27.0
I-295 Scudder Falls Bridge	Delaware River Joint Toll Bridge Condition (DRJTBC)	Replacement.	Bucks, Mercer	2022–2026	$ 570.0
Multiple Toll Bridges	DRJTBC	Implementation of all-electronic tolling.	Bucks, Mercer	2022–2032	$ 43.0
I-95 and I-276 (PA Turnpike) Interchange (Stage 3)	New Jersey Turnpike Authority (NJTA)/ Pennsylvania Turnpike Commission (PTC)	Widen the existing bridge over the Delaware River	Bucks, Burlington	2027–2040	$ 500.0
NJ Turnpike Interchange 1 to 4	NJTA	Widening program.	Camden, Gloucester	2027–2040	$ 1,500.0
PA Turnpike Northeast Extension—MP A38-A44	PTC	Reconstruction and widening.	Bucks, Montgomery	2022–2026	$ 160.0
PA Turnpike	PTC	Electronic tolling.	Bucks, Chester, Montgomery	2022–2032	$ 257.0
I-95 and I-276 (PA Turnpike) Interchange—Stage 2	PTC	Add additional movements to existing partial interchange.	Bucks	2022–2032	$ 190.0
PA Turnpike—MP 324-326	PTC	Reconstruction and widening.	Chester, Philadelphia	2022–2026	$ 125.0

Facility	Sponsoring Authority	Project Scope	Location	Timing	Cost (in Millions of 2021 $s)
PA Turnpike—MP 312-319	PTC	Reconstruction and widening.	Chester	2022–2026	$ 175.0
I-276/I-76 Valley Forge Interchange	PTC	Modifications.	Montgomery	2033–2040	$ 41.6
I-276 and Virginia Drive	PTC	Add full movements.	Montgomery	2027–2032	$ 27.4
I-276 and Henderson Road	PTC	New interchange.	Montgomery	2033–2040	$ 32.50
I-276 and PA 63 (Welsh Road)	PTC	New interchange.	Montgomery	2027–2032	$ 54.6
I-276 and Lafayette Street Interchange (Phases 4 and 5)	PTC /Montgomery	New interchange.	Montgomery	2022–2026	$ 73.0
HILCO S. Philly Refinery Site	Private	Reconfiguration of circulation paths and patterns.	Philadelphia	2027–2040	$ 15.0
Atlantic City Expressway	South Jersey Transportation Authority (SJTA)	Third lane widening.	Camden, Gloucester	2022–2032	$ 142.5
Atlantic City Expressway	SJTA	Electronic tolling and ITS upgrades.	Camden, Gloucester	2022–2026	$ 55.0
SJTA Facilities	SJTA	Rehabilitation, replacement, and improvements including service areas, maintenance yards, and parking facilities.	Camden, Gloucester	2022–2050	$ 20.0
Atlantic City Expressway Bridges	SJTA	Rehabilitation.	Camden, Gloucester	2022–2040	$ 41.0
Atlantic City Expressway	SJTA	Resurfacing program.	Camden, Gloucester	2022–2050	$ 55.0
Vaughn Drive Connector	Private	Extend to CR 571 (Princeton Hightstown Road)	Mercer	2022–2026	$ 34.1
West Trenton Bypass	Private	New service road connector from Bear Tavern Road to Decou Avenue / Parkway Avenue	Mercer	2022–2026	$ 11.9

Source: DVRPC, 2021.

Table 64: MAJOR REGIONAL EXTERNALLY FUNDED PROJECTS—VISION PLAN

Facility	Sponsoring Authority	Project Scope	Location	Cost (Millions of 2021 $s)
NEC at Washington Crossing	FRA and Northeast Corridor Commission (NECC)	Bridge replacement.	Bucks, Mercer	$ 54.8
CONNECT NEC 2035	FRA and NECC	Capacity improvements throughout the NEC.	Bucks, Delaware, Philadelphia, Mercer	TBD
Amtrak Service from Reading to Philadelphia	FRA and NECC	Restore passenger train service.	Chester, Montgomery, Philadelphia	TBD
Amtrak Service at Chester Transportation Center	FRA and NECC	Reinstitute intercity services.	Delaware	TBD
PA Turnpike Northeast Extension—MP A43-A44	PTC	Reconstruction and widening.	Bucks, Montgomery	$ 45.0
PA Turnpike—MP 298-312	PTC	Reconstruction and widening.	Chester	$ 270.0
PA Turnpike—MP 320-324	PTC	Reconstruction and widening.	Chester	$ 200.0
Neshaminy Falls Interchange	PTC	New westbound half-interchange.	Bucks	$ 12.0

Source: DVRPC, 2021.

Port and Rail Freight Improvements

Strategic improvements to the region's world-class port and rail freight networks will streamline operations, improve connections to the global economy, complement highway and highway connector improvements, and enhance the industry's ability to be a good neighbor. 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. INFRA grants are just one example of these outside funding sources that assist nationally and regionally significant freight and highway projects that align with FHWA program goals.

The completion in 2020 of the Delaware River Main Channel Deepening Project, a state of Pennsylvania and federal investment, has deepened the river to 40–45 feet, allowing larger ships to navigate the shipping channel and increasing access to regional ports. In Pennsylvania, the Southport Auto Terminal and Vehicle Processing Center has also recently been opened, allowing the port to handle a significant increase in automobile capacity. In New Jersey, the Repauno Port and Rail Terminal is currently under development and will provide increased capacity for non-containerized cargo; and the New Jersey Wind Port, with manufacturing facilities at the Port of Paulsboro, will help the state to reach their goal of 100 percent clean energy by 2050.

Advances have also occurred with regional freight rail facilities, such as the return of Class I rail service at the Navy Yard for domestic automobile exports. Future investment through the Pennsylvania Rail Transportation Assistance Program and the Rail Freight Assistance Program has also been awarded for the lowering of tracks to permit routing of double-stack container and multilevel auto rack traffic to/from the Port of Philadelphia on CSX's Subdivision Line. The New Jersey Rail Freight Assistance Program also awarded funding for expanded rail cargo at the South Jersey Port Corporation's Balzano Marine Terminal in Camden.

PHL

Airport capital improvements are primarily funded with fees paid by commercial airlines. PHL has invested in a number of ongoing and completed projects that will significantly enhance and facilitate the passenger traveling experience and expand air cargo operations. Some of the passenger improvements include updated restrooms, passenger boarding bridge upgrades, ADA-compliant curb ramp improvements at arrivals, and expanded taxi lanes. Additional ongoing projects include the East Airfield Rehabilitation Project and the new and improved pedestrian safety enhancements on the airport's roadways. Planning for the PHL West Cargo Redevelopment and Expansion Plan Project is also underway. This project will redevelop and upgrade outdated Cargo City facilities, develop an additional 148 acres of newly acquired property, extend taxiways to the new cargo area, and relocate Tinicum Island Road for easier freight access.

Demonstration of Fiscal Constraint

Fiscal constraint means that total transportation expenditures identified in the 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.

Tables 65 and 66 show how much funding has been allocated to MRPs in the Plan, and other TIP projects, as well as a balance to be programmed for future projects as they are identified in successive TIPs. DVRPC aims to have a substantial balance of available funds in each project category after programmed TIP and fiscally constrained projects in the Plan are accounted for. The proposed funding allocation leaves a balance of 35.1 and 24.1 percent of funds over the life of the Plan for Pennsylvania roadway and transit projects, respectively. It leaves a balance of 71.3 and 34.3 percent of funds over the life of the Plan for New Jersey roadway and transit projects that arise in the TIP between 2022 and 2050.

Table 65: PENNSYLVANIA FUNDING ALLOCATION OVER THE LIFE OF THE PLAN (BILLIONS OF YOE $)

Mode	Category	Available Revenue	MRPs	Non-MRP TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 5.05	$ (2.73)	$(0.15)	$ 2.16
	R2. Bridge	$ 12.93	$ (6.81)	$(0.50)	$ 5.61
	R3. Bike/Pedestrian	$ 0.94	$ (0.28)	$(0.08)	$ 0.58
	R4. Operational Improvements	$ 2.59	$ (1.65)	$(0.52)	$ 0.42
	R5. System Expansion	$ 0.94	$ (0.92)	$-	$ 0.02
	R6. Other	$ 1.06	$ (0.02)	$(0.36)	$ 0.68
	Road Subtotal	$ 23.50	$ (12.41)	$(1.62)	$ 9.47
Transit	T1. Rail Infrastructure	$ 1.76	$ (0.88)	$(0.86)	$ 0.02
	T2. Vehicles	$ 12.41	$ (9.21)	$(1.62)	$ 1.57
	T3. Station Enhancements	$ 1.16	$ (0.53)	$(0.03)	$ 0.60
	T4. Operational Improvements*	$ 1.40	$ (1.17)	$(0.41)	$ 0.03
	T5. System Expansion*	$ 1.91	$ (2.80)	$ -	$ 0.01
	New Starts/Small Starts*	$ 1.10			
	T6. Other	$ 4.59	$ -	$(1.58)	$ 3.01
	Transit Subtotal	$ 24.30	$ (14.59)	$(4.49)	$ 5.22
PA Subregion Total		**$ 47.80**	**$ (27.00)**	**$(6.11)**	**$ 14.69**

**$200 million in New Starts funds are Core Capacity funds to be allocated to 'Operational Improvements' for Trolley Modernization and $900 million for System Expansion for the KOP Rail project.*
Figures may not add up due to rounding.
Source: DVRPC, 2021.

Table 66: NEW JERSEY ALLOCATED FUNDING OVER THE LIFE OF THE PLAN (BILLIONS OF YOE $)

Mode	Category	Available Revenue	MRPs	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 4.22	$ (0.38)	$ (0.83)	$ 3.00
	R2. Bridge	$ 5.02	$ (0.27)	$ (0.16)	$ 4.59
	R3. Bike/Pedestrian	$ 0.99	$ -	$ (0.03)	$ 0.96
	R4. Operational Improvements	$ 2.90	$ (1.44)	$ (0.09)	$ 1.38
	R5. System Expansion	$ 0.83	$ (0.46)	$ -	$ 0.37
	R6. Other	$ 0.34	$ -	$ (0.07)	$ 0.27
	Road Subtotal	$ 14.30	$ (2.55)	$ (1.18)	$ 10.57
Transit	T1. Rail Infrastructure	$ 0.55	$ (0.02)	$ (0.15)	$ 0.38
	T2. Vehicles	$ 2.81	$ (2.01)	$ (0.60)	$ 0.20
	T3. Station Enhancements	$ 0.51	$ (0.12)	$ (0.08)	$ 0.31
	T4. Operational Improvements*	$ 0.17	$ -	$ (0.05)	$ 0.12
	T5. System Expansion*	$ 0.04	$ -	$ (0.00)	$ 0.04
	New Starts/Small Starts	$ -	$ -	$ -	$ -
	T6. Other	$ 1.12	$ (0.24)	$ (0.14)	$ 0.73
	Transit Subtotal	$ 5.20	$ (2.40)	$ (1.02)	$ 1.78
NJ Subregion Total		**$ 19.50**	**$ (4.95)**	**$ (2.20)**	**$ 12.35**

Source: DVRPC, 2021.

Appendices

Appendix A: Future Funding Outlook

There has been promising dialogue at the federal, state, and local levels focused on reducing the funding gap between the needs for transportation infrastructure, and the resources available to meet them. Aside from the assumption—based on an eventual replacement to the gas tax— that federal funding will increase starting in 2033, no other assumptions have been made regarding a future increase in available transportation revenue. Any significant changes in revenue made after this Plan's adoption will require an amendment (see Appendix C).

Federal Funding Reauthorization Proposals

With the one-year extension of the FAST Act set to expire on September 30, 2021, a number of proposals have emerged for reauthorization. The Biden administration (Administration) initially proposed a joint set of eight-year initiatives as part of the Build Back Better agenda. The first is called the American Jobs Plan, which would invest in traditional infrastructure, broadband, water and energy infrastructure, public schools, supply chains, R&D, manufacturing and small business, EV charging infrastructure, and GHG reductions. Its transportation-related priorities include modernizing existing facilities, such as roads, transit, and ports; expanding investment in freight and passenger rail, including transit and high-speed rail; increasing sustainability through electrification and other low-carbon emissions approaches; and making the network more resilient in the face of a changing climate. The second, called the American Families Plan, extends the definition of infrastructure to build a care economy,[1] particularly for seniors, children, and persons with disabilities.

Several counteroffers for the American Jobs Plan have been made between the Administration and Republican Senate representatives. In addition, both houses have been in active negotiations for a FAST Act replacement. Higher funding levels would be a welcome reprieve to a long-underfunded transportation network, but the construction of new facilities without a guarantee of long-term revenue to ensure their maintenance (especially given the large backlog of existing maintenance needs) remains a concern.

State Funding Proposals

In Pennsylvania, PennDOT's Pathways study estimated that the state's roads and bridges need an annual investment of $15 billion. PennDOT currently has less than half that amount to fund the system: just $6.9 billion from all federal, state, and local funding sources. The Pathways study looked for both short- and long-term funding solutions. One immediate response proposed is a public-private partnership to apply all electronic tolling on large, critical Interstate or highway bridges that need repairs. Nine candidate bridges have been identified across the Commonwealth, including the Girard Point Bridge on I-95 in South Philadelphia. Managed lanes were also identified as a near-term revenue generation strategy. Four potential longer-term solutions were identified: congestion pricing, corridor tolling, road user charges (also known as mileage-based user fees), and tax and fee increases. In March 2021, Governor Wolf established the Transportation Revenue Options Commission through an Executive Order. It is tasked with developing comprehensive funding recommendations for the Commonwealth's transportation network, with a long-term goal of

[1] Ito Peng defines this as "the sector of economy that is responsible for the provision of care and services that contribute to the nurturing and reproduction of current and future populations. More specifically, it involves child care, elder care, education, healthcare, and personal social and domestic services that are provided in both paid and unpaid forms and within formal and informal sectors." The Care Work and the Economy Project. https://research.american.edu/careworkeconomy/blog/2021/04/02/what-is-the-care-economy-and-why-we-should-know-more-about-it-particularly-now/

replacing the gas tax. Its recommendations are due to be submitted before August 2021.

In New Jersey, the Department of Treasury is able to adjust the state gas tax each year to collect revenues equivalent to authorized funding levels. Both Pennsylvania's and New Jersey's DOTs are members of the Eastern Transportation Coalition, a partnership of 17 states plus the District of Columbia, which is also studying the feasibility of mileage-based user fees as a sustainable alternative to the gas tax.

Local Funding Proposals

Currently, state law in both Pennsylvania and New Jersey limits the ability of municipal and county governments to generate revenue to fund transportation projects. At the same time, Act 44 of 2007 (which dedicated $450 million in annual PA Turnpike payments used to fund transit throughout the Commonwealth) is set to reduce those payments to $50 million per year in 2022. This makes the identification of new revenue sources and mechanisms particularly critical.

The Pennsylvania state legislature has proposed House Bill 2068 of 2020 (HB 2068), which would enable counties to raise additional revenues to support transit investments through three revenue sources: sales tax, real estate transfer tax, or property tax. This bill is still working its way through the legislative process.

Several recent efforts have looked at local funding options in the region. The SE Pennsylvania Partnership for Mobility, launched by SEPTA and the PA Turnpike Commission in coordination with PennDOT, has published a report that identifies state and local funding options, as well as resources to enact enabling legislation. DVRPC has conducted additional research focused on potential administrative funding mechanisms.

Additional Local Funding Options

Recognizing that available transportation revenues fall well short of what is needed to maintain and improve the region's transportation network, DVRPC and its Pennsylvania planning partners conducted a Southeastern Pennsylvania Regional Transportation Funding Options study to establish guiding principles for generating local funding, identify potential administrative funding structures, investigate potential funding sources, and develop a plan for implementation. Although this study focused on southeastern Pennsylvania, its findings are broadly applicable to the four-county New Jersey state subregion as well.

Guiding Principles for Generating Local Transportation Funds

Stakeholder meetings and individual interviews produced eight guiding principles for the study. These principles were used to guide the development of preferred alternative funding mechanisms and administrative funding structures that would have consensus among Pennsylvania planning partners (See Figure A-1).

Figure A-1: GUIDING PRINCIPLES FOR REGIONAL TRANSPORTATION FUNDING OPTIONS

Source: DVRPC, 2021.

Potential Administrative Funding Structures

An administrative funding structure, as defined in this study, is the legal organization that will receive and distribute funding for regional transportation improvement projects located within the five-county region of southeastern Pennsylvania. Several assumptions inform how an administrative funding structure would operate: (1) it would not have taxing authority; (2) it would select regional projects for funding; (3) it would serve as a conduit for funding to infrastructure owners; and (4) the southeastern Pennsylvania counties would not issue bonds for purposes of regional transportation projects but would dedicate annual revenue through their regional contributions. It is assumed that the infrastructure owners, such as PennDOT and SEPTA, would be responsible for securing bond financing for regional projects funded through this program. The study analyzed six potential administrative structures, reflected in Figure A–2.

Figure A-2: SUMMARY OF PRELIMINARY FINDINGS ON ADMINISTRATIVE STRUCTURES

Summary of Preliminary Findings

	Joint Municipal Authority	Regional Asset District/State Legislative Option	Existing Entity/ Legal Agreement	Metropolitan Transportation Authority	Transportation Development District	Transit Revitalization Investment District Act
Preliminary Analysis for Regional Program	**Potential Candidate**	**Strong Candidate**	**Strong Candidate**	**Poor Candidate**	**Poor Candidate**	**Poor Candidate**
County Authority to Create	Yes	Yes	N/A	Yes	No	Yes
Taxing Authority	No	Yes	No	No	Yes	Yes
Broad Flexibility for Projects	Yes	Yes	Yes	No	No	No
Broad Flexibility for Uses of Funds	Yes	Yes	Yes	No	Yes	No
Ease of Implementation	No	No	Yes	No	No	No

During preliminary research, the enabling legislations of six administrating structures were evaluated to determine if existing legislation met the guiding principals of the proposed program. For example, taxing authority was reviewed to see if existing legislation already provided authority for taxation as it relates to infrastructure investment. Some programs, such as the TDD And TRID do provide taxing authority, but not to the level needed to advance the proposed program based on the guiding principles.

Source: DVRPC, 2021.

Based on preliminary research, three of the administrative structures were identified as most plausible: Joint Municipal Authority, Regional Asset District Model/State Legislative Option, and Existing Entity/Legal Agreement.

- **Joint Municipal Authority**: As a unit of local government that can be formed by the five counties, a joint municipal authority is a potential candidate. The enabling legislation provides broad mechanisms would require state enabling legislation to allow the counties to apply them.

- **Regional Asset District Model/State Legislative Option**: As a unit of local government, a state legislative option modeled after the Regional Asset District in Allegheny County also is a proven model and a good candidate for an administrative structure. The challenge, however, is that this option would require enabling legislation, making implementation subject to the political and legislative process. This option would require additional steps and is less desirable than a joint municipal authority.
- **Existing Entity/Legal Agreement**: Using the DVRPC Southeastern Pennsylvania Corporation (DVRPC SPC) for the administrative structure exceeds the purpose and use for the organization as it is currently structured.[73] Board composition (five members requiring unanimous decision making), 501(c)3 non-profit incorporation, and process for facilitating funding through grant agreements all pose challenges that would have to be addressed through changes in DVRPC SPC's structure or rules for this approach to be feasible.

The process for bond financing and the contractual agreements supporting the transfer of funds from the counties to the regional entity would be finalized during the implementation phase. This includes any variances between the different classes of counties.

Potential Funding Mechanisms

The study evaluated a range of potential fees and taxes that could be enacted to generate new revenue for transportation infrastructure in southeastern Pennsylvania. Thirteen potential mechanisms were identified based on their ability to address regional goals, potential for revenue generation, bondability, applicability at the local (rather than state) level, and relationship to transportation. Many of these mechanisms would require state enabling legislation to allow the counties to apply them. A number of other potential mechanisms that did meet these goals were considered and ultimately dismissed (see Figure A-3).

The study identified an annual regional revenue target of $75 million to $100 million per year. This range was established by reviewing the revenue projections by county to determine a feasible regional program contribution from each county. As a guiding principle, the county contribution to the regional program was established to be no more than 50 percent of the total amount generated by the county. Such an annual revenue stream would enable the region to advance numerous projects through a combination of cash outlays and leveraging the funds with bond financing.

Since not all projects would be eligible for bond financing, the revenue target aims to split revenues equally between pay-as-you-go and bonding to fund a program of both short-term cash projects ($50 million per year) and longer-term bonded projects ($600 million bonded over 30 years), for a total 30-year, self-funded program of $2.1 billion. It is also possible that infrastructure owners could utilize the regional program to secure additional federal and state grant awards by having match funds available. In most cases, one single funding mechanism may not reach the regional funding program target levels. Some counties may need to enact two or more funding mechanisms to achieve program targets. No single mechanism was recommended, as it is anticipated that individual counties may prefer one approach over another based on local conditions.

[73] *DVRPC Southeastern Pennsylvania Corporation* was formed to enable its member governments (Bucks, Chester, Delaware, Montgomery and Philadelphia counties) to pursue and accept funding for planning and direct service activities that are not possible through existing organizational structures. *DVRPC Southeastern Pennsylvania Corporation* is dedicated to advancing policies and programs in the Greater Philadelphia region that promote livability, resiliency, efficiency, and a healthy economy.

Figure A-3: FUNDING MECHINISMS REVENUE PROJECTIONS BY COUNTY

Funding Mechanisms Revenue Projections by County

Funding Mechanism	County	Current Rate	Rate Increase	Base/Taxable Revenue	New Revenue Generated	County Share in Millions (65%)	Regional Share in Millions (35%)
LOCAL GASOLINE SALES TAX Base Increase: 2.0% of gasoline sales (excluding federal and state taxes)	BUCKS	None at local level	2%	$ 2,292,086,483	$ 45,842,000	$6	
	CHESTER					$6	
	DELAWARE					$6	
	MONTGOMERY					$6	
	PHILADELPHIA					$6	
				Totals	**$ 45,842,000**	$30	$16.0
CIGARETTE TAX Base Increase: 10%	BUCKS	$2.60	10%	$ 58,221,000	$ 2,328,840	$1.5	
	CHESTER	$2.60	10%	$ 47,131,000	$ 1,885,240	$1.2	
	DELAWARE	$2.60	10%	$ 51,752,000	$ 2,070,080	$1.3	
	MONTGOMERY	$2.60	10%	$ 74,855,000	$ 2,994,200	$1.9	
	PHILADELPHIA	$4.60	10%	$ 143,242,000	$ 5,729,680	$3.7	
				Totals	**$ 15,008,040**	$9.6	$5.3
VEHICLE REGISTRATION FEE Base Increase: $5.00	BUCKS	$43.00	$5.00	$ 24,601,000	$ 2,861,000	$1.9	
	CHESTER	$43.00	$5.00	$ 19,230,000	$ 2,236,000	$1.5	
	DELAWARE	$43.00	$5.00	$ 16,882,000	$ 1,963,000	$1.3	
	MONTGOMERY	$43.00	$5.00	$ 29,467,000	$ 3,426,000	$2.2	
	PHILADELPHIA	$43.00	$5.00	$ 31,752,000	$ 3,692,000	$2.4	
				Totals	**$ 14,178,000**	$9.3	$5.0
MALT BEVERAGE TAX Base Increase: 100%	BUCKS	$0.01	100.00%	$ 1,230,000	$ 1,230,000	$0.8	
	CHESTER	$0.01	100.00%	$ 996,000	$ 996,000	$0.6	
	DELAWARE	$0.01	100.00%	$ 1,094,000	$ 1,094,000	$0.7	
	MONTGOMERY	$0.01	100.00%	$ 1,582,000	$ 1,582,000	$1.0	
	PHILADELPHIA	$0.01	100.00%	$ 3,027,000	$ 3,027,000	$2.0	
				Totals	**$ 7,929,000**	$5.1	$2.8
LIQUOR TAX Base Increase: 1.00%	BUCKS	18.00%	1.00%	$ 19,934,000	$ 1,107,444	$0.7	
	CHESTER	18.00%	1.00%	$ 16,137,000	$ 896,500	$0.6	
	DELAWARE	18.00%	1.00%	$ 17,719,000	$ 984,389	$0.6	
	MONTGOMERY	18.00%	1.00%	$ 25,629,000	$ 1,423,833	$0.9	
	PHILADELPHIA	18.00%	1.00%	$ 49,043,000	$ 2,724,611	$1.8	
				Totals	**$ 7,136,778**	$4.6	$2.5
HOTEL OCCUPANCY TAX Base Increase: 1.00%	BUCKS	11.00%	1.00%	$ 3,000,000	$ 272,727	$0.2	
	CHESTER	11.00%	1.00%	$ 3,000,000	$ 272,727	$0.2	
	DELAWARE	9.00%	1.00%	$ 3,000,000	$ 333,333	$0.2	
	MONTGOMERY	10.00%	1.00%	$ 15,000,000	$ 1,500,000	$1.0	
	PHILADELPHIA	14.50%	1.00%	$ 41,275,000	$ 2,846,552	$1.9	
				Totals	**$ 5,225,340**	$3.5	$1.8

(continued on next page)

Funding Mechanisms Revenue Projections by County

Funding Mechanism	County	Current Rate	Rate Increase	Base/Taxable Revenue	New Revenue Generated	County Share in Millions (65%)	Regional Share in Millions (35%)
EARNED INCOME TAX Base Increase: 0.2% above existing rates	BUCKS	Varies	0.20%	$ 31,635,703,200	$ 63,271,406	$41	
	CHESTER		0.20%	$ 30,505,135,200	$ 61,010,270	$40	
	DELAWARE		0.20%	$ 23,758,138,800	$ 47,516,278	$31	
	MONTGOMERY		0.20%	$ 46,317,202,800	$ 92,634,406	$60	
	PHILADELPHIA		0.20%	$ 33,288,948,000	$ 66,577,896	$43	
				Totals	**$ 331,010,256**	$215	$115.9
REALTY TRANSFER TAX Base Increase: 0.5%	BUCKS	2.00%	0.50%	$ 88,378,000	$ 22,094,500	$14	
	CHESTER	2.00%	0.50%	$ 94,441,622	$ 23,610,406	$15	
	DELAWARE	2.00%	0.50%	$ 59,536,234	$ 14,884,059	$10	
	MONTGOMERY	2.00%	0.50%	$ 126,378,420	$ 31,594,605	$21	
	PHILADELPHIA	4.28%	0.50%	$ 334,832,480	$ 39,134,231	$25	
				Totals	**$ 131,317,800**	$85	$46.0
LOCAL SERVICES TAX Base Increase: $52.00/year ($1.00/week) for jobs with annual salary over $12,000	BUCKS	$52 (max)	$52.00	261,833 jobs	$ 13,615,316	$9	
	CHESTER		$52.00	247,696 jobs	$ 12,880,192	$8	
	DELAWARE		$52.00	222,456 jobs	$ 11,567,712	$8	
	MONTGOMERY		$52.00	490,047 jobs	$ 25,482,444	$17	
	PHILADELPHIA		$52.00	677,173 jobs	$ 35,212,996	$23	
				Totals	**$ 98,758,660**	$64	$34.6
VEHICLE PROPERTY TAX Base Increase: New 0.25% tax on estimated vehicle value	BUCKS	None	0.25%	$ 6,840,000,000	$ 17,100,000	$11	
	CHESTER		0.25%	$ 5,400,000,000	$ 13,500,000	$9	
	DELAWARE		0.25%	$ 4,680,000,000	$ 11,700,000	$8	
	MONTGOMERY		0.25%	$ 8,280,000,000	$ 20,700,000	$13	
	PHILADELPHIA		0.25%	$ 8,880,000,000	$ 22,200,000	$14	
				Totals	**$ 85,200,000**	$55	$29.8
PROPERTY TAX SURCHARGE Base Increase: 0.025% above existing rates	BUCKS	Varies	0.025%	$ 65,229,856,851	$ 16,307,464	$11	
	CHESTER		0.025%	$ 39,616,382,417	$ 9,904,096	$6	
	DELAWARE		0.025%	$ 31,534,195,241	$ 7,883,549	$5	
	MONTGOMERY		0.025%	$ 59,394,622,723	$ 14,848,656	$10	
	PHILADELPHIA		0.025%	$ 102,982,111,762	$ 25,745,528	$17	
				Totals	**$ 74,689,292**	$49	$26.1
SALES TAX Base Increase: 0.25%	BUCKS	6.00%	0.25%	$ 293,070,000	$ 12,211,250	$8	
	CHESTER	6.00%	0.25%	$ 279,094,000	$ 11,628,917	$8	
	DELAWARE	6.00%	0.25%	$ 267,958,000	$ 11,164,917	$7	
	MONTGOMERY	6.00%	0.25%	$ 309,754,000	$ 12,906,417	$8	
	PHILADELPHIA	8.00%	0.25%	$ 604,612,000	$ 18,894,125	$12	
				Totals	**$ 66,805,625**	$43	$23.4
TNC FEE Base Increase: $1.00/trip	BUCKS	Varies	$1.00	Assume 10 million trips/year	$ 10,000,000	$2	
	CHESTER					$2	
	DELAWARE					$2	
	MONTGOMERY					$2	
	PHILADELPHIA		$1.00	36M trips/year	$ 36,000,000	$23	
				Totals	**$ 46,000,000**	$31	$16.1

Source: DVRPC, 2021.

This table demonstrates revenue generation potential for the 13 identified potential local funding options per county, using a reasonably assumed rate increase, given existing rates locally or in comparable regions within Pennsylvania or around the country. The revenue generation potential for any given option could be increased or decreased by modifying this rate. The county share of 65 percent compared with the regional share of 35 percent is only one of a range of potential ratios and is shown only as an example of a potential distribution.

Additional revenue sources that could be considered in the future include Interstate tolling, congestion pricing, mileage-based user fees, lead acid battery tax, local gasoline tax, excise taxes (such as cigarette and beverage taxes), wealth tax, increased parking/traffic violation fees, a VMT generation charge on commercial property, and a fee on parking spaces contained within commercial property.

Implementation

The local funding implementation pathway identified in the study includes three primary milestones: (1) secure legal authority for funding mechanisms and enact at the county level; (2) organize the administrative structure; and (3) establish program guidelines and a Local Priority Transportation Improvement Program. These steps are further detailed in Figure A-4.

DVRPC will continue to facilitate dialogue and work on consensus resolutions to a number of challenges that remain. Next steps include:

1. Communicate the findings of the Southeastern Pennsylvania Regional Transportation Funding Options Study.
2. Engage the Southeastern Pennsylvania Business Community and the County Commissioners Association of Pennsylvania.
3. Conduct public polling market research.
4. Provide supporting information for enabling legislation.
5. Determine the preferred alternative for the administrative structure, funding mechanisms, program budget, contribution formula, priority project list, and project selection process.
6. Better define what constitutes a “regional project.”
7. Determine the final administrative structure and draft legal agreements.

Figure A-4: REGIONAL TRANSPORTATION PROGRAM IMPLEMENTATION FRAMEWORK

STEP 1	STEP 2	STEP 3	STEP 4
Secure Legal Authority for Counties to Raise Revenue	**Enact New County Revenue Mechanisms and Collect Funds**	**Establish Entity to Oversee Regional Program**	**Determine County Contribution to Regional Program**
LEGISLATIVE ACTION	**COUNTY ACTION**	**COUNTY ACTION**	**COUNTY ACTION**
Pass/amend legislation to give counties the authority to raise new revenue for transportation.	Each county to enact new revenue mechanism(s) and collect funds.	Establish an administrative structure for governance of the regional program.	Agree on a formula to determine each county's contribution.

STEP 5	STEP 6	STEP 7	STEP 8
Set Parameters for Regional Project Type/Use of Funds and Project Selection Criteria	**Prioritize and Award Funding to Regional Projects**	**Distribute Regional Funds to Infrastructure Owners**	**Prepare Annual Reports**
ADMINISTRATIVE STRUCTURE	**ADMINISTRATIVE STRUCTURE**	**ADMINISTRATIVE STRUCTURE**	**ADMINISTRATIVE STRUCTURE**
Define the types of projects and uses of funds eligible under the regional program.	Based on the project selection criteria, the Board of Directors of the Administrative Structure formally selects projects for funding.	The Administrative Structure enters into grant agreements with the infrastructure owner of each selected project.	Prepare an annual report for public distribution and maintain a website for full transparency of the use of funds and project outcomes.

Source: DVRPC, 2021.

Appendix B: Federal Performance Measures

Federal legislation (MAP–21 and the subsequent FAST Act) required state DOTs and MPOs to establish and use a performance-based approach in transportation decision making to achieve national goals. This includes tracking performance measures, setting data-driven targets for each measure, and selecting projects to help meet those targets. The FAST Act also required that the TIP include a description of its anticipated effect toward achieving the established performance targets, linking investment priorities to those performance targets.

The goal of PBPP is to ensure targeted investment of federal transportation funds by increasing accountability and transparency and providing for better investment decisions that focus on key outcomes related to seven national goals:

1. safety;
2. infrastructure preservation;
3. congestion reduction;
4. system reliability;
5. freight movement and economic vitality;
6. environmental sustainability; and
7. reduced project delivery delays.

Roadway Performance Measures

FHWA regulations have established final rules on performance measures that address the seven PBPP goals, accordingly:

1. fatalities and serious injuries, both number and rate per VMT, on all public roads;
2. pavement condition on the Interstate system and on the remainder of the NHS;
3. bridge condition on the NHS;
4. performance (system reliability) of the Interstate system and the remainder of the NHS;
5. freight movement on the Interstate system;
6. traffic congestion; and
7. on-road mobile source emissions.

The FHWA has established three performance measure regulations for Roadway Safety (Performance Measure Rule 1 [PM1]); Bridge and Pavement Condition (Performance Measure Rule 2 [PM2]); and System Performance (PM3) which looks at system performance, including congestion reduction, system reliability, freight movement and economic vitality, and environmental sustainability. There are multiple performance measures established within these groupings. Table B-1 summarizes these measures, the area for which they are being reported, the facilities included, and the update frequency.

State DOTs are required to establish targets for each performance measure and report progress toward the target, with the exception of the Urbanized Area measures where DOTs and MPO's contribute to establishing the unified target. MPOs, such as DVRPC, must either support the respective state DOT and transit operator targets, or they may establish their own regional targets. For additional information or to view the latest transportation performance management updates, visit www.dvrpc.org/TPM.[74]

[74] For more information about the development and implementation of TPM policy and rulemaking, see www.fhwa.dot.gov/tpm for roadways and www.transit.dot.gov/performance-based-planning for Transit.

As a bi-state MPO, DVRPC must plan and program projects to contribute toward separate sets of targets: one set for each state in which the Planning Area boundary extends. DVRPC has agreed to support the PM1, PM2, and PM3 targets set by PennDOT and NJDOT, respectively. Written procedures were developed between the state DOTs and MPOs regarding the coordination of TPM activities. DVRPC first included the PM1, PM2, and PM3 measures in the 2020 Amendment to the *Connections 2045* Plan (DVRPC Publication #20016). This document expands on the legislative requirements and how each performance measure is computed.

Table B-1: FHWA PERFORMANCE MEASURES SUMMARY

GOAL AREA	PERFORMANCE MEASURE	GEOGRAPHY	NETWORK	REPORTING FREQUENCY
PM1 Roadway Safety	Number of Fatalities	Statewide or Regional	All Roads	Annual
	Fatality Rate (per 100 million VMT)			
	Number of Serious Injuries			
	Serious Injury Rate (per 100 million VMT)			
	Number of Non-Motorized Fatalities and Serious Injuries			
PM2 Bridge and Pavement Condition	Good Pavement Lane Miles	Statewide or Regional	Interstates and NHS	Two-Year Interim Target, Four-Year Target
	Poor Pavement Lane Miles			
	Good Bridge Deck Area		NHS	
	Poor Bridge Deck Area			
PM3 System Performance	Person Miles Traveled with Reliable Travel Times (%)	Statewide or Regional	Interstates and NHS	Two-Year Interim Target, Four-Year Target
	Truck Travel Time Reliability Index		Interstates	
	Percentage Non-SOV Travel	Philadelphia (PA-NJDE-MD); and New York (NY-CT-NJ) Urbanized Areas (UZAs)	All UZAs (via ACS)	
	Annual Hours of Peak Hour Excessive Delay (PHED) per Capita		All NHS roads within UZAs, AM and PM Peak Periods	
	CMAQ Emissions Reductions	Regional and Statewide	CMAQ Projects	

Source: DVRPC adapted from FHWA, 2020.

PM1: Roadway Safety

Connections 2050 adopts a Vision Zero goal of no transportation deaths or fatalities by the year 2050. Vision Zero is a planning philosophy that aims to end fatal and serious injury crashes by protecting all roadway users through equitable engineering, education, and enforcement while prioritizing speed control.

Both PennDOT and NJDOT adopted their goals to support Toward Zero Deaths: A National Strategy on Highway Safety. State DOTs report baseline values, targets, and progress toward meeting the targets to FHWA in an annual safety report. Table B-2 details PennDOT's and NJDOT's statewide safety targets for calendar year 2021.

Table B-2: ROADWAY SAFETY TARGETS

Measure	New Jersey		Pennsylvania	
	Baseline (2015–19)	Target (2017–21)	Baseline (2015–19)	Target (2017–21)
Number of Fatalities	605	574	1,146.3	1,088.2
Rate of Fatalities (per 100 million VMT)	0.780	0.740	1.121	1.059
Number of Serious Injuries	1,101.4	2,124,8	3,971.2	4,551.2
Rate of Serious Injuries (per 100 million VMT)	1.422	2.724	3.883	4.431
Number of Non-Motorized Fatalities and Serious Injuries	393.9	588.5	698.4	800.8

Source : NJ DOT and PennDOT, 2021.

Targets are important for agencies to make interim progress toward the long-term goal of Toward Zero Deaths. Agencies and stakeholders involved in developing these plans are cognizant that reaching zero fatalities will require time and significant effort. Therefore, annual targets must be data driven, realistic, and achievable. This will help agencies better utilize their safety resources in ways that can result in the greatest reduction in fatalities and serious injuries over time.

PennDOT published its most recent SHSP in early 2017. The goals outlined in PennDOT's 2017 SHSP were used to help define targets for the Safety PM Rule. PennDOT's 2017 SHSP set a goal of reducing fatalities and serious injuries on PennDOT roadways by 2 percent per year. However, this reduction may not be readily apparent in the safety targets because of the specific calculation required for the baseline and target numbers.[75]

[75] Using a five-year average and projected numbers in the target calculation, as required, can result in a higher target number than baseline number. For example, the higher target number for the serious injury calculation is a direct result of Pennsylvania changing the definition of a serious injury to include many injuries not previously counted as serious. This increased the 2016 and subsequent years' serious injury number significantly. The five-year average baseline calculation uses the lower 2015 number as part of calculating the average. The target calculation projects a 2 percent reduction in 2020 and 2021, the calculation uses higher numbers in these years than in 2015 in calculating the average (due to the definition change), resulting in a higher target than baseline number. The same principle applies to the baseline and target calculations of the nonmotorized fatalities and serious injuries.

The New Jersey 2020 SHSP is an action-oriented and data-driven statewide, coordinated safety plan that provides a comprehensive framework for reducing fatal and serious injury crashes on all public roads in New Jersey.[76] The SHSP was updated in collaboration with federal, state, county/regional, municipal, and non-profit and private safety stakeholders, including New Jersey's three MPOs, to focus on action-oriented and data-driven activities that will be most effective in reducing fatalities and serious injuries by incorporating the 5 Es: Education, Enforcement, Engineering, Emergency Response, and Equity. The previous New Jersey 2015 SHSP established a statewide goal to reduce serious injuries and fatalities by 2.5 percent annually. The current New Jersey 2020 SHSP sets a more aggressive statewide goal to reduce serious injury and fatal crashes by 3 percent annually.

Progress toward Achieving the Roadway Safety Targets

DVRPC facilitates coordination among county and municipal partners, state DOT's, and FHWA to bring data-driven safety improvements to both local and state roads. The region's data-driven TSAP focuses on key regional emphasis areas for reducing roadway crashes, injuries, and fatalities. It is a living document that guides effective collaboration and coordination among safety professionals and stakeholders to address various road-user issues, including intersection safety, impaired driving, roadway departure crashes, and pedestrian and bicyclist safety. The TSAP is coordinated with the Pennsylvania and New Jersey SHSPs, which seek to maximize funds from the federal HSIP. As both states are FHWA Pedestrian and Bicyclist Safety Focus States, expanding pedestrian and bicyclist safety planning to identify eligible projects and secure HSIP funds is a regional priority.

NJDOT develops an annual safety investment strategy for all HSIP-funded activities and projects. The annual investment strategy demonstrates the linkage between the objectives of the SHSP and the projects being implemented to focus on the most effective safety improvements.

Safety is the highest-ranked criterion in DVPRC's TIP-LRP Benefit Criteria, accounting for 27 percent of the investment recommendation. Each MRP is evaluated based on implementation of FHWA-proven safety countermeasures or other safety strategies with specific crash reduction factors; whether it is located in state DOT or county-identified high-crash locations and crashes in Communities of Concern; or if it is a safety-critical transit projects that helps meet the safety performance measures identified by a PTASP. This focus on safety is intended to gear all transportation investments toward achieving greater safety outcomes, beyond safety-specific programming through HSIP. *Connections 2050* aims to invest 11.5 percent of total roadway revenues in Pennsylvania to safety and operational improvements, and 18.5 percent in New Jersey. In both states, the bulk of the Plan's reasonably anticipated roadway funds will be spent on roadway system preservation projects (80.5 percent in Pennsylvania and 78.5 percent in New Jersey), which will also have safety benefits.

A state is considered to have met or made significant progress when at least four out of the five safety performance targets (SPTs) are met, or the actual outcome for the SPT is better than baseline performance. For the 2015–2019 reporting period, New Jersey only met or made significant progress on two of the five performance measures (Number and Rate of Fatalities). Pennsylvania only met or made significant progress on two any of the five performance measures (Number and Rate of Fatalities). The penalty for not meeting targets or making significant progress is that the state DOT must:

[76] The *2020 New Jersey State Highway Safety Plan* is available online at www.saferoadsforallnj.com.

- Submit an HSIP Implementation Plan.
- Use obligation authority equal to the HSIP apportionment for the prior year, only for highway safety projects.

The HSIP Implementation Plan should guide the state's project decisions so that the combined 148(i) provisions lead to the state meeting or making significant progress toward meeting its SPTs in subsequent years.

PM2: Roadway Infrastructure Condition

Federal regulations require DOTs to (1) submit a TAMP that, at a minimum, forecasts asset deterioration, determines costs and benefits over an asset's life cycle, and identifies short- and long-term budget needs; and (2) produce a recommended program that is financially constrained.

PennDOT's pavement condition targets are consistent with its asset management objectives of maintaining the system at the desired SGR, managing to LLCC, and achieving national and state transportation goals. LLCC is a tool to determine the best option by considering all transportation agency expenditures and user costs throughout the life of an alternative, not just the initial investment. PennDOT's PAMS program is able to project future pavement conditions, given different investment levels. PennDOT's BridgeCare software is able to project future bridge conditions, given different investment levels.

NJDOTs TAMP reviews the current state of physical assets; identifies objectives for asset condition and performance; analyzes future conditions under different investment levels; determines the best investment strategies for assets across their life cycle, given the investment level; and considers risks to accomplishing the objectives and implementing planned investment strategies. Roadway maintenance is a major focus area of NJDOT's TAMP. It set targets of $400 million in statewide annual pavement projects and $510 million annually for bridge projects, for all state-maintained facilities. The New Jersey TTF provides $400 million annually to all local governments in New Jersey for the funding of road, bridge, and other transportation projects.

NJDOT and PennDOT submitted their first biennial (two-year) PM2 progress reports in October 2020. The DVRPC Board revised certain four-year targets based on the biennial review and agreed to plan and program projects that contribute toward meeting or exceeding NJDOT's statewide bridge and pavement infrastructure targets on January 28, 2021 (see Tables B-3 and B-4). In New Jersey, initial reporting in the 2017 baseline misclassified one bridge with 785,818 square feet of deck area, which represents 1.3 percent of all NHS deck area. This bridge was listed in fair condition but should have been identified as poor. Had this bridge been correctly recorded at the time, the baseline percentage for poor would have been 7.8 percent. NJDOT adjusted its four-year target to reflect this correction.

Table B-3: PAVEMENT CONDITION TARGETS

Measure	New Jersey				Pennsylvania			
	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target
% Interstate Lane Miles in Good Condition	61.25%	n/a	62.1%	50%	67.2%	n/a	71.5%	60%
% Interstate Lane Miles in Poor Condition	1.01%	n/a	1.8%	2.5%	0.4%	n/a	0.4%	2%
% Non-Interstate NHS Pavement Lane Miles in Good Condition	32.45%	25%	33%	25%	36.8%	35%	37.6%	33%
% Non-Interstate NHS Pavement Lane Miles in Poor Condition	2.38%	2.5%	10.7%	15%**	2.3%	4%	2%	5%

Lavender Text indicates target not achieved.
**Measure based on Full Distress + International Roughness Index methodology.*
***Four-year target was adjusted for the New Jersey Percentage Non-Interstate NHS Pavement Lane Miles in Poor Condition at the mid-term reporting period.*
Source: PennDOT and NJDOT, 2021.

Table B-4: BRIDGE CONDITION TARGETS

Measure	New Jersey				Pennsylvania			
	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target
% NHS Deck Area in Good Condition	21.7%	19.4%	22.1%	21.3%	23.7%	25.8%	27.0%	26%
% NHS Deck Area in Poor Condition	6.5%	6.5%	**6.8%**	6.8%*	5.1%	5.6%	5.1%	6%

Lavender Text indicates target not achieved.
**Four-year targets were adjusted for the New Jersey Percentage NHS Bridge Deck Area in Good Condition and Poor Condition at the mid-term reporting period.*
Source: PennDOT and NJDOT, 2021.

Progress toward Achieving the Roadway Condition Targets

Roadway and bridge maintenance are a major focus for both state DOTs and DVRPC. *Connections 2050* utilizes an LLCC approach that emphasizes transportation system preservation and maintenance needs to extend the useful life of a facility at the lowest possible expense. This in turn informs the fiscally constrained list of projects included in both the Plan and TIP.

For the Pennsylvania subregion, the Plan identifies $34.2 billion needed for pavement and bridge preservation projects from FY2022 to FY2050. Of this total need, $1.97 billion is programmed in the four-year FY2021 TIP for system preservation, under the regional TIP, which does not include the majority of the I-95 reconstruction because it is listed on the Statewide Interstate Management Program. In *Connections 2050*, system preservation receives the most funding of all highway project types. Of the entire $23.5 billion YOE in reasonably anticipated roadway revenues, 55 percent, or $12.9 billion, is allocated to bridge preservation. The second highest allocation is for pavement preservation, 21.5 percent, or $5.0 billion.

The Pennsylvania FY2021 TIP allocates 26.9 percent or $529.1 million—out of $1.97 billion total—to bridge preservation projects in the first four years of all projects in the TIP. DVRPC Regional Highway Programs allocate 16.8 percent or $331.7 million for roadway rehabilitation, reconstruction, and restoration over the first four years of the TIP. A past focus on fix-it-first has helped to reduce the Pennsylvania subregion's state-maintained poor-condition bridges from 22 percent of all deck area in 2007 to just 9 percent in 2019.

For the New Jersey subregion, the Plan identified $10.2 billion needed for pavement and bridge preservation projects from FY2022 to FY2050. The Plan fully funds these needs by allocating 73.5 percent of reasonably anticipated available revenues to bridge and pavement preservation projects. A past fix-it-first focus on pavement conditions has reduced the New Jersey subregion's state-maintained lane miles of poor pavement from 51 percent in 2005 to 19 percent in 2020.

Facility and asset condition is the second highest weighted criterion in DVPRC's TIP-LRP Benefit Criteria, accounting for 22 percent of the investment recommendation. Projects score by bringing a facility or asset into an SGR, extending its useful life, or providing reduced operating and maintenance costs.

PM3: System Performance

The PM3 metrics are intended to help better align proposed project improvements through PBPP. The PM3 measures are Travel Time Reliability (Interstate and Non-Interstate), Truck Travel Time Reliability (Interstate), CMAQ Congestion (Annual Hours of PHED per Capita, and Percentage Non-SOV Commute Mode Share within each UZA), and CMAQ emissions reduction targets.

Travel Time Reliability

Travel time reliability measures are used to address the performance of the NHS and the Interstate network. These measures include Interstate and Non-Interstate Level of Travel Time Reliability (LOTTR) and Truck Travel Time reliability (TTTR).

LOTTR indicates the percentage of person miles traveled that are reliable on the interstate and non-interstate systems within a region. Travel times, VMT and average vehicle occupancy are factored into this reliability measure to calculate the percentage. Table B-5 shows the Interstate and Non-Interstate roadways in Greater Philadelphia that are unreliable according to the 2019 two-year Interim Performance for LOTTR. LOTTR indicates roadway travel time reliability measured by the ratio of the 80th percentile travel time to a "normal" travel time (50th percentile). Any roadway with an LOTTR value of 1.50 or more is considered unreliable (See Figure 40).

Roadways that are highly unreliable in the Pennsylvania portion of the DVRPC region include I-676 from I-76 to I-95, and I-95 from the Benjamin Franklin Bridge to Cottman Avenue in Philadelphia; I-76 from I-95 to I-276 in Philadelphia and Montgomery counties; I-476 from I-95 to PA 3 in Delaware County; and I-276 from just west of US 1 to PA Route 309 in Montgomery and Bucks counties. Roadways that are highly unreliable in the New Jersey portion of the DVRPC region include I-295 from I-76 to NJ 38 in Camden and Burlington counties; NJ 42 from the Atlantic City Expressway to I-295 in Camden and Gloucester counties; and portions of US 1 from I-295 to Washington Road in Mercer County.

TTTR—the freight reliability measure—is a statewide measure that helps to assess freight movements on the Interstate system within a region. The TTTR indicates the reliability of the Interstates for freight movement measured by the ratio of the 95th percentile travel time to a "normal" travel time (50th percentile). Unlike LOTTR, there is no threshold established for unreliability; the higher the index, the more unreliable (See Figure 41). Table B-5 shows the Interstate roadways that are unreliable according to the 2019 two-year Interim Performance for TTTR.

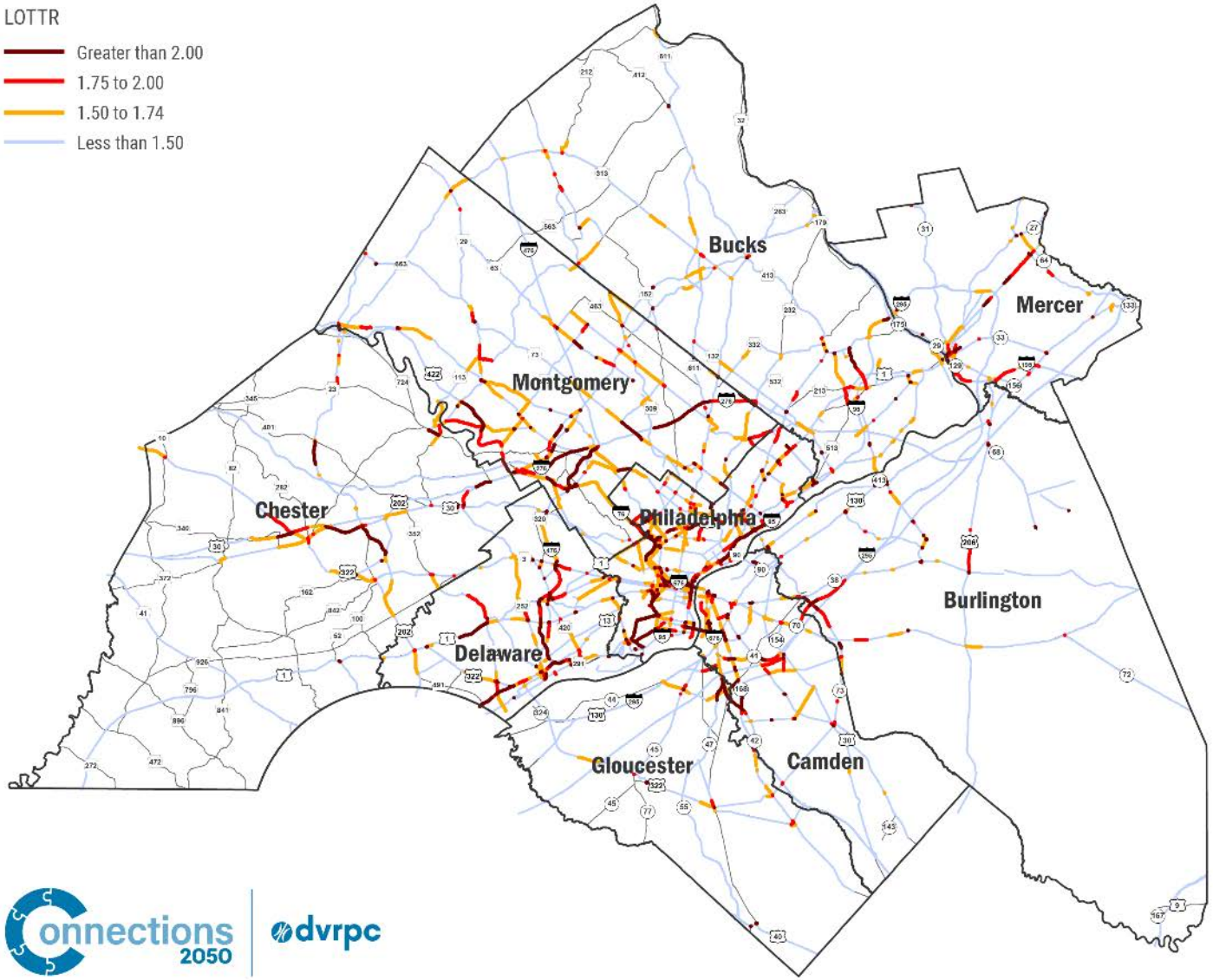
Roadways with highly unreliable truck travel times in the Pennsylvania portion of the DVRPC region include I-676 from I-76 to I-95 in Philadelphia; I-76 from I-95 to I-276 in Philadelphia and Montgomery counties; most sections of I-95 from the Pennsylvania-Delaware State lines to just south of I-276 in Bucks County; I-476 from I-95 to I-276 in Delaware and Montgomery counties; and portions of I-276 from I-76 to US 1 in Montgomery and Bucks counties. In the New Jersey portion of the DVRPC region, unreliable locations include I-676/I-76 from the Benjamin Franklin Bridge to I-295 in Camden County; I-295 from US 130 to NJ 38 in Gloucester, Camden, and Burlington counties; and portions of I-195 from I-295 to the Mercer and Monmouth county lines in Mercer County.

Table B-5: TRAVEL TIME RELIABILITY TARGETS

Measure	New Jersey				Pennsylvania			
	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target
% Person Miles Traveled on the Interstate that are Reliable (LOTTR)	82.1%	82.0%	80.6%	82.0%	89.8%	89.8%	89.9%	89.5%**
% Person Miles Traveled on the Non-Interstate NHS that are Reliable (LOTTR)	84.1%	n/a*	86.2%	84.1%	87.4%	n/a*	88.5%	87.4%
Truck Travel Time Reliability (TTTR)	1.82	1.90	1.89	1.95	1.35	1.34	1.36	1.40**

Lavender Text indicates target not achieved.
**Measure based on Full Distress + International Roughness Index methodology.*
***Four-year target was adjusted for the New Jersey Percentage Non-Interstate NHS Pavement Lane Miles in Poor Condition at the mid-term reporting period.*
Source: DVRPC, 2021.

Figure 41: LEVEL OF TRAVEL TIME RELIABILITY (LOTTR) INTERSTATE AND NON-INTERSTATE ROADWAYS



Source: NPMRDS & CATT Lab, 2019.

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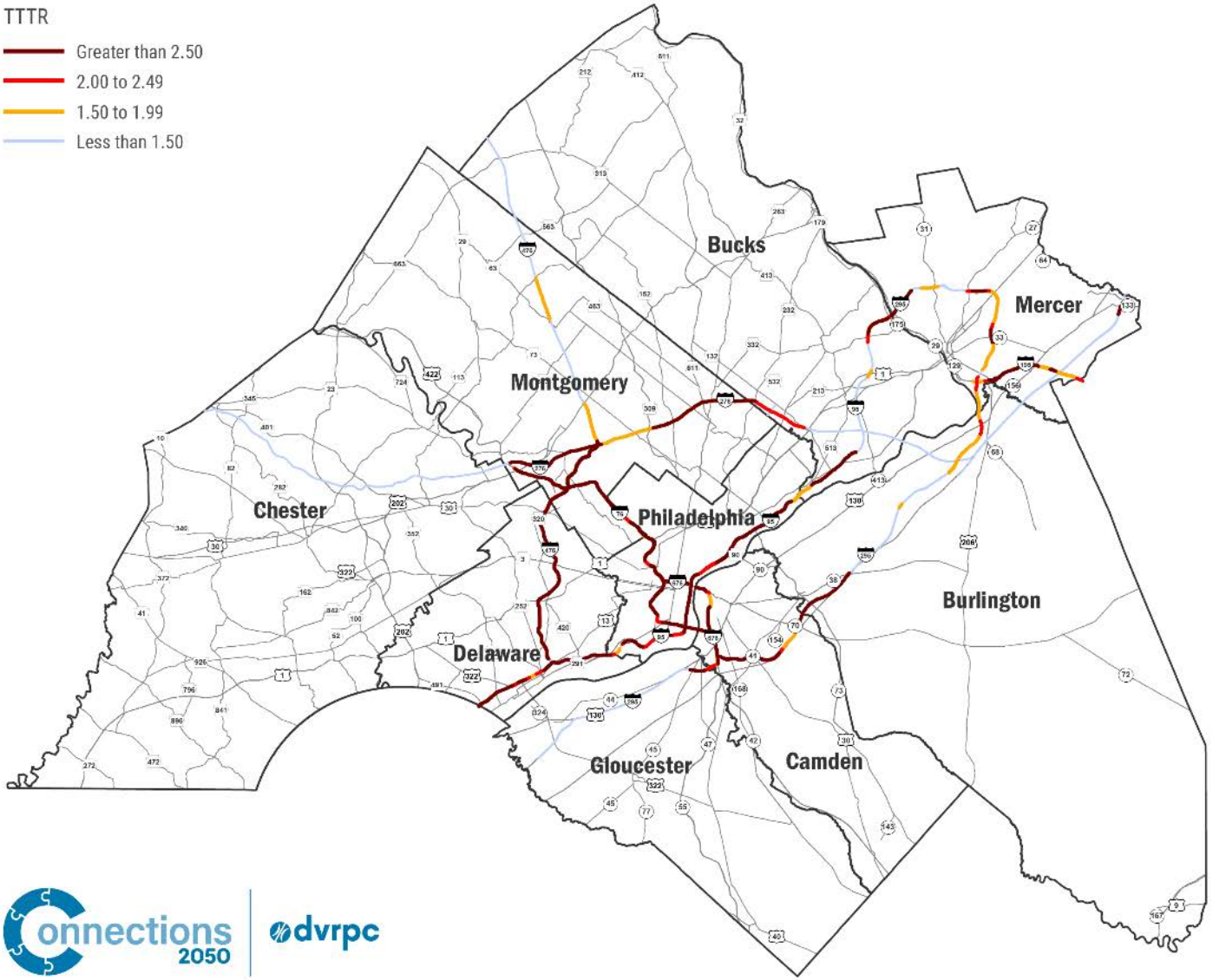
Figure 42: TRUCK TRAVEL TIME RELIABILITY (TTTR) INTERSTATE ROADWAYS



Source: NPMRDS & CATT Lab, 2019.

CMAQ Congestion

Annual Hours of PHED per Capita is a UZA-specific measure that helps to identify areas with excessive traffic congestion and assess their pollutant emissions in a region. Part of the CMAQ Program, this measure only applies to UZAs that contain populations over one million and that are in all or part of a designated "non-attainment" or "maintenance area" under the Clean Air Act (See Figure 42).[77] Roadways outside the UZAs are excluded from this measure. Most of the DVRPC region is in the Philadelphia UZA but a portion of Mercer County is in the New York City UZA. Table B-6 shows the annual hours of PHED per Capita for the Philadelphia and New York City UZAs.

Roadways that experience the most excessive congestion during the peak periods in the Pennsylvania portion of the Philadelphia UZA include I-76 from I-676 to I-276 in Philadelphia and Montgomery counties; I-476 from US 1 to US 30 in Delaware County; portions of I-95 from I-676 to Cottman Avenue in Philadelphia; portions of US 322 in Delaware County; and portions of US 422 in Montgomery County. The most excessive delay locations in the New Jersey counties of the Philadelphia UZA include portions of I-295 from NJ 42 to NJ 38 in Camden and Burlington counties, and NJ 55 from the Deptford area to NJ 42 in Gloucester County.

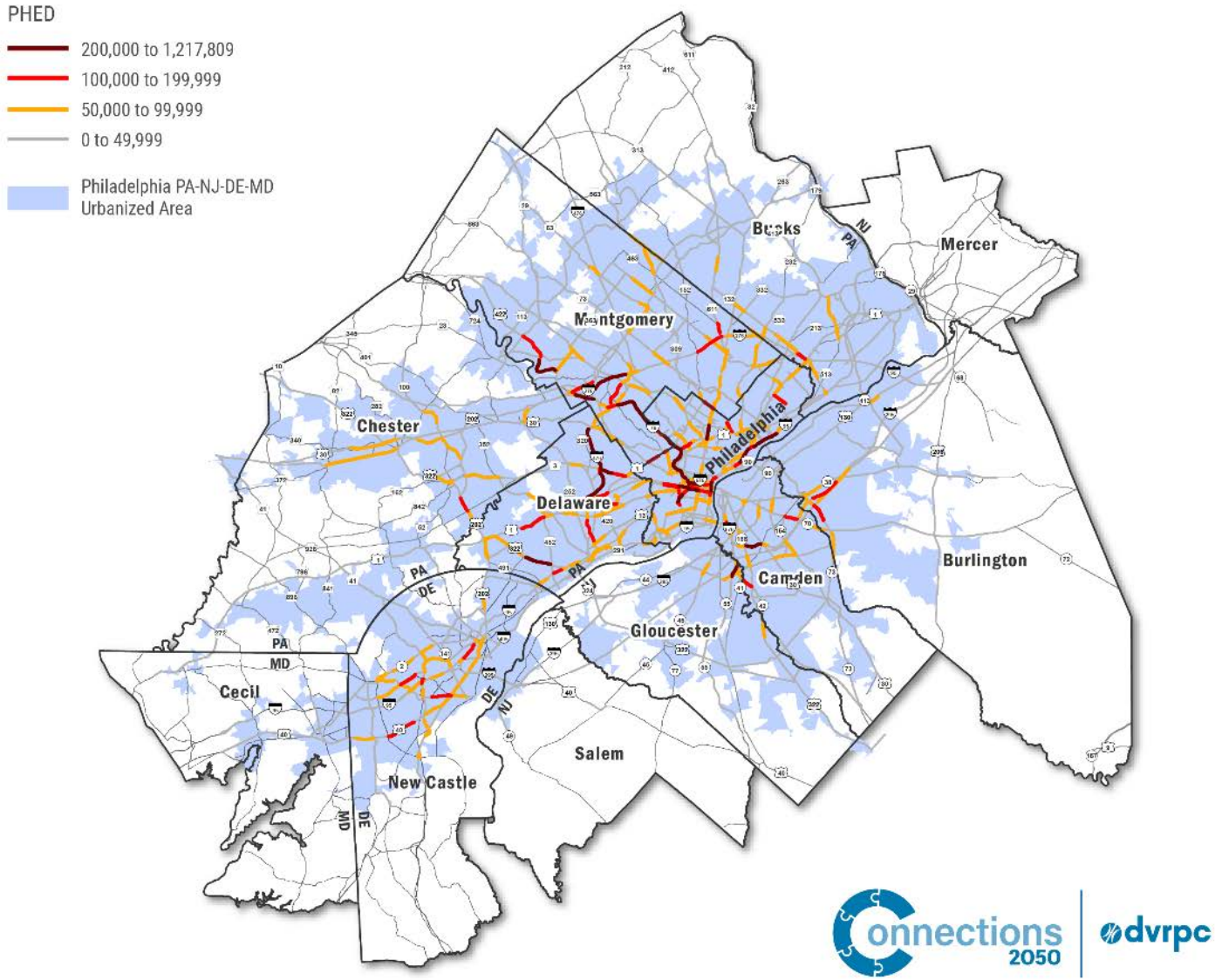
Table B-6: CMAQ CONGESTION TARGETS

Measure	New Jersey				Pennsylvania			
	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target	2017 Baseline	2019 Two-Year Target	2019 Actual	2021 Four-Year Target
% Non-SOV Travel: Philadelphia UZA	27.9%	28.0%	28.2%	28.1%	27.9%	28.0%	28.2%	28.1%
% Non-SOV Travel: New York City UZA	51.6%	51.6%	51.6%	51.7%	n/a	n/a	n/a	n/a
Annual PHED: Phila UZA (Hours of Delay per Capita)	16.8	n/a	14.6	17.2	16.8	n/a	14.6	17.2
Annual PHED: NYC UZA (Hours of Delay per Capita)	20.0	n/a*	22.3	22.0	n/a	n/a	n/a	n/a

**Two-year targets are not required for the first reporting period.*
Source: DVRPC, 2021.

[77] Nonattainment means that an area has monitored air quality that does not meet the National Ambient Air Quality Standards (NAAQS). Once a nonattainment area meets the standards and additional re-designation requirements, EPA will designate the area as a "maintenance area."

Figure 43: PEAK HOUR EXCESSIVE DELAY (PHED) IN THE PHILADELPHIA PA-NJ-DE-MD URBANIZED AREA



Source: U.S. Census Bureau, 2010, and NPMRDS & CATT Lab, 2019.

Progress toward Achieving the CMAQ Congestion Targets

NJDOT and PennDOT have committed to develop projects that improve travel time reliability and help meet state targets. DVRPC is committed to improving reliability on roadways within its region, as well as working with its county, city, and transit partners.

One of DVRPC's goals is to serve the region's freight stakeholders and maintain the Philadelphia-Camden-Trenton region as an international Freight Center. DVRPC's Freight Planning Program is informed by the DVGMTF, a broad-based freight advisory committee that provides a forum for the private- and public-sector freight communities to interject their unique perspectives on regional plans and specific projects.

The CMP is a key part of DVRPC's commitment to improving travel time reliability. DVRPC facilitates a CMP Planning Advisory Committee that is part of a systematic and ongoing process to determine where traffic congestion exists, identify causes, prioritize congested locations according to congestion and other CMP objective measures, and to help develop strategies to reduce congestion. The goals of the Long-Range Plan provide guidelines for developing CMP objectives. These objectives include consistency with the *Connections 2050* principles of equity, resiliency, and sustainability along with goals to:

1. Maintain a safe, multimodal transportation network that serves everyone and expands access to opportunity.
2. Rebuild and modernize the region's transportation assets to achieve and maintain an SGR, including full ADA accessibility.
3. Obtain a Vision Zero goal of no fatalities or serious injuries by 2050.
4. Preserve and protect the natural environment.
5. Develop inclusive, healthy, and walkable communities.
6. Grow a prosperous and innovative economy with broadly shared prosperity.;
7. Improve global connections: facilitate goods movement and aviation; support the FRA's NEC Future plan; and expand broadband, wi-fi, and 5G cellular infrastructure.
8. Strengthen transportation network security and cybersecurity.
9. Integrate existing and emerging transportation modes into an accessible, multimodal MaaS mobility-as-a-service network, which collects real-time data and uses it to plan and pay for travel using the best option available. Transit, walking, and biking—including a completed Circuit Trails system—serve as integral components of this network.

The CMP integrates the PM3 Performance Management Measures to assist in identifying and prioritizing congested locations for targeted action. It does this based on reliability and traffic congestion in order to apply appropriate strategies for improving mobility.

DVRPC includes freight as a primary planning factor through its Long-Range Plan, TIP development, and the development of technical studies. The Congestion and Reliability criterion in DVRPC's TIP-LRP Benefit Criteria accounts for 13 percent of the project-level investment decision recommendation. Projects score based on location in a CMP congested corridor, implementing a CMP strategy appropriate for that corridor, or being located on a road with a high (PTI) or transit facility with a low on-time performance.

Truck counts are a component of the Multimodal Use criterion in the TIP-LRP Benefit Criteria. Projects score based on the total number of person trips (driver trips + passenger trips + transit trips + bike trips + pedestrian trips, each multiplied by the project's length and divided by average trip distance) and daily trucks using the facility or asset, and overall benefit to multimodal trip making. This criterion accounts for 9 percent of the project-level investment decision recommendation. The FY2021 Pennsylvania TIP and the FY2022 New Jersey TIP show a sampling of projects that support freight mobility and travel time reliability as part of promoting goods movement and economic development.

CMAQ Emissions Reduction

DVRPC coordinated efforts with NJDOT and other MPOs in both Pennsylvania and New Jersey to develop cumulative On-Road Mobile Source Emissions two-year and four-year targets as daily kilograms (See Table B-7). DVRPC's *Congestion Mitigation and Air Quality Baseline Report and Performance Plan (2018–2021) (Publication #TM19003)* describes the process in developing the regional targets (see page 15 in that document).

Table B-7: CMAQ EMISSION REDUCTION TARGETS (KG PER DAY)

Measure	New Jersey			Pennsylvania		
	2017 Baseline	2019 Two-Year Target	2021 Four-Year Target	2017 Baseline	2019 Two-Year Target	2021 Four-Year Target
Particulate matter finer than 2.5 micrometers ($PM_{2.5}$)	9.572	4.29	8.52	25.870	10.76	20.49
Oxides of nitrogen (NOx)	244.301	971.78	231.85	971.78	337.7	612.82
Volatile organic compounds (VOCs)	44.493	17.682	36.324	302.38	109.46	201.73
Carbon monoxide (CO)	n/a	n/a	n/a	1,135.4	567.7	250*

**Four-year target was adjusted for Pennsylvania CO at the mid-term reporting period.*
Source: DVRPC, 2021.

Progress toward Achieving the CMAQ Emission Reduction Targets

DVRPC's *Congestion Mitigation and Air Quality Baseline Report and Performance Plan (2018–2021) (Publication# TM19003)* identifies all TIP projects that will help the MPO and states meet two- and four-year targets for traffic congestion and on-road mobile source emissions (see Table 9 in that document). DVRPC will continue to promote and develop projects and programs with air quality benefits to its counties and planning partners. DVRPC's CMP facilitates a CMP Planning Advisory Committee and generates a list of the top-most congested roadway facilities and 10 bottleneck locations for state, county, and local roadways.

The Environment criterion in DVRPC's TIP-LRP Benefit Criteria accounts for 7 percent of the project-level investment decision recommendation. Projects score in this criterion by delivering high air quality benefits (per FHWA guidance) or incorporating environmentally friendly design principles.

In Pennsylvania, there are several continuing statewide programs that utilize CMAQ funding to reduce emissions, as well as congestion. These include the AQP (MPMS #17928), retrofit for bike lanes and shoulders (MPMS #63406), signal retiming programming and Philadelphia signal retiming programming (MPMS #s 84457 and 96223), Mobility Alternative Program and Share-a-Ride Program (MPMS #110429), Commuter Services (MPMS #110460), and TMAs (MPMS #111424).

In New Jersey, these include the active traffic management system (DB #13303), bicycle and pedestrian facilities/accommodations (DB #X185), intelligent traffic signal systems (DC #15343), transportation

demand management program support (DB #X43), ozone action program (DB #D0407), rail rolling stock procurement (DB #T112), and the small/special services program (DB #T120).

Transit Performance Measures

For transit, the FTA has established performance measures for Transit Asset Management and Transit Safety (see Table B-8). FTA regulations establish a strategic and systematic process of operating, maintaining, and improving public capital assets effectively through their life cycle. The performance management requirements are a minimum standard for transit operators and involve measuring and monitoring the following:

1. transit rolling stock;
2. transit support equipment;
3. transit infrastructure;
4. transit facilities; and
5. transit safety.

DVRPC first included transit asset condition measures in the 2020 Amendment to the *Connections 2045* Plan. Transit agencies were required to set their initial SPTs by July 20, 2020, after the *Connections 2045* Amendment was published. *Connections 2050* is the first Long-Range Plan to include the safety TPM for Greater Philadelphia.

FTA regulations require transit agencies to annually set condition and SPTs for their transit assets. MPOs are then required to set their own targets or adopt the transit operators' targets for the transit asset portfolio in their region. DVRPC has agreed to support the targets for transit assets and transit safety set by SEPTA, NJ TRANSIT, and DRPA/PATCO, respectively.

Table B-8: FTA PERFORMANCE MEASURES SUMMARY

GOAL AREA	PERFORMANCE MEASURE	GEOGRAPHY	NETWORK/ASSETS	REPORTING FREQUENCY
Transit Assets	Rolling Stock	Entire Transit Agency Service Area	Revenue Vehicles	Annual
	Equipment		Non-Revenue Vehicles	
	Facilities		Passenger and Administrative/ Maintenance Facilities	
	Infrastructure		Rail Track	
Transit Safety	Fatalities	Entire Transit Agency Service Area	Entire Transit Agency Service Area	Annual
	Injuries			
	Safety Events			
	System Reliability			

Source: DVRPC adapted from FHWA, 2020.

Transit agencies are required to upload their performance targets, as well as a supporting narrative, in their annual NTD submission, and report progress against these targets. They are also required to develop a TAMP that monitors system condition, sets performance targets, and prioritizes investments to achieve SGR targets. The TAMP must include the following elements in order to ensure assets are in an SGR:

- Inventory of Capital Assets;
- Condition Assessment;
- Decision Support Tools;
- Investment Prioritization;
- TAM and SGR Policy;
- Implementation Strategy;
- List of Key Annual Activities;
- Identification of Resources; and
- Evaluation Plan.

There are three Tier 1 agencies and one Tier 2 agency providing public transit service that are subject to this FTA TAM performance management rule in the DVRPC region. The Tier 1 agencies are SEPTA, NJ TRANSIT, and DRPA/PATCO. The Tier 2 agency is PART. In Pennsylvania, PennDOT has developed a group TAMP and set of performance measure targets for the Tier 2 agencies statewide.

Transit Assets

A transit asset is in an SGR if: (1) it can perform its designed function; (2) it does not pose a known unacceptable safety risk; and (3) its life cycle investments have been met or recovered.

TAM places value and understanding on the negative impacts of deferring maintenance and the positive outcomes of optimizing investment decisions that improve SGR. TAM also relates to many of the goals and the vision set in *Connections 2050*: reducing resource use, pollution, and waste; improving efficiency of existing systems and processes; establishing transit as a key transportation option; and supporting walkable communities. Successfully implementing TAM requires using resources more efficiently to reduce an agency's environmental footprint, managing waste responsibly, building and supporting healthy places, and becoming more resilient to prepare for climate change.[78]

Measure 1: Percentage of Revenue Vehicles That Have Met or Exceeded Their Useful Life Benchmark (ULB)

The transit agencies provide ULBs for their respective sizable fleets. Information about SEPTA's fleet can be found in Table B-9.

NJ TRANSIT owns and maintains a fleet of 200 locomotives, 160 self-propelled cars, and 953 locomotive-hauled cars to serve the state of New Jersey. In addition, the agency maintains and operates 15 diesel locomotives and 65 single-level passenger cars owned by the Metro-North Railroad that are configured to operate with NJ TRANSIT's fleet. All locomotives and loco-hauled cars are operated in push-pull service. NJ TRANSIT's commuter rail ULB for locomotives, passenger cars, and self-propelled passenger cars is 30 years, which is lower than FTA's ULB of 39 years. NJ TRANSIT owns a fleet of over 3,000 buses consisting of two types: (1) over-the-road for longer-haul commuting services and (2) transit. The active bus fleet in daily service is considered to be in an SGR.

[78] Parsons Brinkerhoff, *Asset Management Guide: Focusing on the Management of our Transit Investments* (Washington, DC: Federal Transit Administration, 2012) www.transit.dot.gov/sites/fta.dot.gov/files/docs/research-innovation/57411/ftareportno0098.pdf.

The DRPA/PATCO has 75 Budd rail cars from 1969 (52 years old) and 45 Vickers cars from 1980 (41 years old). They were recently rehabilitated over a number of years, a project that was completed in 2019. This rehabilitation adds 25 years of useful life to these vehicles.

Table B-9: PERCENTAGE OF ROLLING STOCK THAT HAS MET OR EXCEEDED THEIR ULB

Agency	NTD Category	ULB	FY2020 Target	FY2020 Actual	FY2021 Target
SEPTA	Articulated Bus	14	0%	0%	0%
	Bus	14 (12 Electric)	10%	**17.9%**	15%
	Heavy Rail Passenger Car	40	0%	0%	0%
	Commuter Rail Locomotive	30	100%	100%	100%
	Commuter Rail Passenger Coach	39	0%	0%	0%
	Commuter Rail Self-Propelled Passenger Vehicle	39	0%	0%	0%
	Cutaway Car	10	66%	66%	66%
	Light Rail Vehicle	31	0%	0%	0%
	Trolley Bus	18	0%	0%	0%
	Vintage Trolley/Streetcar	58	100%	100%	100%
DRPA/PATCO	Heavy Rail Passenger Vehicle	25	0%	0%	0%
NJ TRANSIT	Articulated Bus	12	20%	**95.4%**	0%
	Automobile	5	52.8%	27.1%	6%
	Over-the-Road Bus	14	46.4%	**52.0%**	27%
	Bus	12	0%	**19.3%**	24%
	Cutaway Car	5	1.5%	**23.6%**	64.4%
	Light Rail Vehicle	31	0%	0%	0%
	Minivan	8	4.4%	**8.4%**	5%
	Commuter Rail Locomotive	30	6.4%	6.4%	7.5%
	Commuter Rail Passenger Coach	30	17.9%	17.9%	16.7%

***Lavender Text** indicates target not achieved.*
Source: DVRPC, 2021.

Progress toward Achieving the Transit Assets Measure 1 Targets

SEPTA will complete a five-year procurement of 525 hybrid buses in 2021 and recently put a new fleet of 30 electric buses into service. The electric bus fleet project included the installation of new infrastructure, including charging stations, at Southern Depot. SEPTA completed a major procurement of locomotives in FY2019, which allowed the Authority to retire eight 30-year-old locomotives. The new locomotives will increase the reliability of the commuter rail service. SEPTA has an order for 45 multilevel vehicles in the Pennsylvania TIP. Over the life of *Connections 2050*, SEPTA has allocated funding to replace all the rail vehicles in its fleet. These include all trolleys as part of the trolley modernization project, the Norristown High Speed Line fleet as part of the King of Prussia rail expansion, the Market-Frankford Line, the Broad Street Line, and a new Silverliner VI fleet to replace the Silverliner IVs that date from the mid-1970s. The Plan also includes funding to replace 80 to 100 buses each year.

NJ TRANSIT expects to retire and replace the entire self-propelled passenger car fleet with new multilevel vehicles by 2023. *Connections 2050* includes future projects to replace the River LINE light rail vehicles, Atlantic City Line locomotives, and push-pull vehicles when these vehicles reach the end of their ULB. The Plan also allocates funding to regular bus replacement, as NJ TRANSIT buses serving the region reach the end of their useful life.

Measure 2: Average Age of Non-Revenue Fleet

The three transit agencies maintain a diverse portfolio of support vehicles, including fleets of police cars, utility vans, and rail maintenance vehicles (see Table B-10). The performance targets are developed by comparing the age of the vehicles to their ULB.

Table B-10: PERCENTAGE OF SUPPORT VEHICLES THAT HAVE MET OR EXCEEDED THEIR ULB

Agency	NTD Category	FY2020 Target	FY2020 Actual	FY2021 Target
SEPTA	Automobiles	50%	41%	50%
	Trucks and Other Rubber Tire Vehicles	25%	33%	25%
	Steel-Wheel Vehicles	55%	49%	55%
DRPA/PATCO	All Support Vehicles	28%	16%	22%
NJ TRANSIT	Automobiles	40%	77.1%	0%
	Trucks and Other Rubber Tire Vehicles	50.6%	34.3%	64.2%
	Steel-Wheel Vehicles	24.1%	25.8%	33.9%

Lavender Text indicates target not achieved.
Source: DVRPC, 2021

Progress toward Achieving the Transit Assets Measure 2 Targets

As part of each Long-Range Plan update, SEPTA, NJ TRANSIT, DRPA/PATCO, and DVRPC collaborate on a complete needs assessment to estimate what it would cost to bring all non-revenue vehicles into an SGR within 10 years and maintain an SGR throughout the life of the Plan. The assessment in this update estimated that $380.5 million (YOE) in Pennsylvania and $20.5 million (YOE) in New Jersey will be needed to achieve and maintain an SGR for the region's non-revenue vehicles. The Plan allocates 51 percent in Pennsylvania and 55 percent in New Jersey of reasonably anticipated transit revenue to transit vehicles (revenue and non-revenue).

To ensure adequate and reliable utility vehicles, SEPTA has developed a program to periodically renew this fleet on a vehicle-by-vehicle basis, contingent upon the vehicle's age, condition, and usage within the Authority.

Measure 3. Average Condition of Facilities

FTA requires transit agencies to evaluate all facilities on the Transit Economic Requirements Model scale, on which a rating of 5.0 is new and 1.0 is unusable. Assets below a rating of 3.0 are not in an SGR. Facilities are evaluated every four years (see Table B-11).

Table B-11: PASSENGER AND ADMINISTRATIVE FACILITIES PERFORMANCE TARGETS

Agency	NTD Category	FY2020 Target	FY2020 Actual	FY2021 Target
SEPTA	Passenger Facilities	5%	2%	5%
	Administration Facilities	5%	4%	5%
DRPA/PATCO	Passenger Facilities	0%	7.7%	0%
	Administration Facilities	0%	0%	0%
NJ TRANSIT	Passenger Facilities	0%	3.5%	4%
	Administration Facilities	0%	3.1%	4%

Lavender Text indicates target not achieved.
Source: DVRPC, 2021.

Progress toward Achieving the Transit Assets Measure 3 Targets

As part of each Long-Range Plan update, SEPTA, NJ TRANSIT, DRPA/PATCO, and DVRPC collaborate on a full needs assessment to estimate what it would cost to bring all station, maintenance, and administrative facilities into an SGR within 10 years and maintain an SGR throughout the life of the Plan. This assessment estimated that $4.3 billion (YOE) in Pennsylvania and $1.1 billion (YOE) in New Jersey will be needed to achieve and maintain an SGR for the region's station infrastructure. The Plan allocates 5.0 percent of reasonably anticipated transit revenue to station infrastructure in Pennsylvania and 10.0 percent in New Jersey.

The Plan fiscally constrains a number of major station projects in both state subregions through the year 2050. These include transit station renovations at City Hall and 15th Street, 8th Street Customer Service, 11th Street, 30th Street, 34th Street, Spring Garden, Ellsworth-Federal, Erie, Fairmount, Hunting Park, Logan, Lombard-South, Snyder, Susquehanna-Dauphin, Tasker-Morris, Wyoming, and Chinatown. In

addition, regional rail station accessibility upgrades are planned at Conshohocken Station, Bristol, Chestnut Hill East, Devon, East Falls, Glenside, Ivy Ridge, Jenkintown-Wyncote, Marcus Hook, Malvern, Noble, Roslyn, Stenton, Swarthmore, Willow Grove, Wissahickon, Wyndmoor, and Wynnewood. NJ TRANSIT has fiscally constrained major station renovations along the Atlantic City Line and at the three NEC Line stations in the region.

Measure 4: Percentage of Track Segments with Performance Restrictions

The Percentage of Track Segments with Performance Restrictions is to be calculated once a month and averaged at the end of the year. Performance targets are based on infrastructure condition and speed restriction reports and include provisions for planned maintenance work throughout the year (see Table B-12). Projects that affect track (either through slow zones or track outages) are considered.

Table B-12: PERCENTAGE OF TRACK SEGMENTS THAT HAVE PERFORMANCE RESTRICTIONS

Agency	NTD Category	FY2020 Target	FY2020 Actual	FY2021 Target
SEPTA	Commuter Rail	10%	3%	10%
	Heavy Rail	10%	1.6%	10%
	Streetcar Rail	5%	1.1%	5%
DRPA/PATCO	Heavy Rail	0.76%	0.32%	0.43%
NJ TRANSIT	Commuter Rail	1%	0.94%	1%
	Light Rail	4.1%	2.4%	2.4%
	Hybrid Rail	0.43%	0.18%	0.18%

Source: DVRPC, 2021.

Progress toward Achieving the Transit Assets Measure 4 Targets

As part of each Long-Range Plan update, SEPTA, NJ TRANSIT, DRPA/PATCO, and DVRPC collaborate on a complete needs assessment to estimate the cost to achieve and maintain an SGR for all rail infrastructure throughout the life of the Plan. The assessment in this plan update estimated that $8.6 billion (YOE) in Pennsylvania and $978 million (YOE) in New Jersey will be needed to achieve and maintain an SGR for the region's rail infrastructure. The Plan allocates 7.5 percent of reasonably available transit revenue to rail infrastructure in Pennsylvania and 8.25 percent in New Jersey.

SEPTA will continue the cyclical replacement of railroad tie timbers and overhead contact wire, even though these projects will cause performance restrictions. In the case of a condition that requires a speed restriction, SEPTA deploys crews to fix the issue as soon as possible. SEPTA's Resiliency Program is performing several projects that will harden the infrastructure against extreme weather events. Such projects include stabilization of slopes, installation of new pumps, flood mitigation, and emergency power for the signal system. SEPTA is continuing to update its power substations across the system.

NJ TRANSIT is making significant new investments in a series of hardening projects. This initiative is to prepare for possible future extreme weather events and security threats, and to ensure capital assets can continue to operate at full performance in order to provide safe, reliable, convenient, and cost-effective services. These projects include new rail vehicle storage, upgraded power systems, maintenance facilities, emergency control centers, security improvements and signal and communications systems resilience upgrades.

Transit Safety

The PTASP regulation, at 49 C.F.R. Part 673, requires that covered public transportation providers and state DOTs establish SPTs to address the safety performance measures identified in the National Public Transportation Safety Plan (49 C.F.R. §673.11(a)(3)). Transit agencies and states must identify SPTs by mode for each of the following categories:

- Fatalities: total number of fatalities reported to the NTD and rate per total vehicle revenue miles (VRM) by mode.
- Injuries: total number of injuries reported to NTD and rate per total VRM by mode;
- Safety Events: total number of safety events reported to NTD and rate per total VRM by mode; and
- System Reliability: mean distance between major mechanical failures by mode.

Transit agencies are required to report their targets and performance to their respective state DOTs and MPOs to prioritize funding to improve transit safety performance. 49 C.F.R. §673.15(b) requires, to the maximum extent practicable, a state or transit agency to coordinate with states and MPOs in the selection of state and MPO SPTs; and in accordance with 49 U.S.C. 5303(h)(2)(B) and 5304(d)(2)(B), states and transit agencies must make their SPTs available to states and MPOs to aid in the planning process. MPOs are required to set performance targets for each performance measure, per 23 C.F.R. § 450.306; and these must be established 180 days after the transit agency establishes their performance targets. FTA will not impose penalties for failing to meet SPTs set by transit providers.

Transit agencies and states must identify SPTs by mode for four separate categories. DVRPC has agreed to be consistent with the initial targets for transit safety set by SEPTA, NJ TRANSIT, and DRPA/PATCO, and will support the respective transit agencies' efforts at achieving those targets. The DVRPC Board adopted the transit safety targets in January 2021. Since this is the first time these measures have been included in the Plan, there is no discussion on progress toward targets (see Table B-13).

Measure 1: Fatalities

The transit safety performance measure requires that transit providers set annual targets for the number of fatalities that occur on each mode of transit that the agency operates, excluding deaths that result from trespassing, suicide, or natural causes. The National Public Transportation Safety Plan defines the modes as rail, fixed guideway bus service, and non-fixed route bus service. Fatalities are required to be calculated for both the total number of fatalities and the fatality rate per VRM.

Specific targets are set for:

- total fatalities, by mode, across the transit agency's system; and
- rate of fatalities, by mode, per VRM operated by the transit agency.

Table B-13: TRANSIT SAFETY RULE—FATALITIES AND INJURIES (NUMBER/RATE)

NTD Category	FY2021 Target
Fatalities	**Number/Rate**
SEPTA Systemwide	-- / 0.0173 per 100,000 mikes
NJ TRANSIT River LINE	1 / 0.79 per 1 million miles
NJ TRANSIT Bus	4 / 0.055 per 1 million miles
PATCO	0 / 0 per 100,000 miles
Passenger Injuries	
SEPTA Bus	-- / 5.53 per 100,000 miles
SEPTA Trolley Bus	-- / 5.75 per 100,000 miles
SEPTA Heavy Rail (Market-Frankford Line)	-- / 0.79 per 100,000 miles
SEPTA Heavy Rail (Broad Street Line)	-- / 0.40 per 100,000 miles
SEPTA Heavy Rail (Norristown High Speed Line)	-- / 3.48 per 100,000 miles
SEPTA Light Rail	-- / 6.48 per 100,000 miles
SEPTA Commuter Rail	-- / 0.69 per 100,000 miles
NJ TRANSIT River LINE	4 / 3.18 per 1 million miles
NJ TRANSIT BUS	244 / 3.35 per 1 million miles
DRPA/PATCO	41 / 1 per 100,000 miles
Employee Injuries per 200,000 work hours	
SEPTA	-- / 3.28
NJ TRANSIT River LINE	0 / 0
NJ TRANSIT Bus	423 / 0.79

Source: NTD.
Note: SEPTA has only submitted rates, not numbers, for their Fatalities and Injuries targets.

Measure 2: Injuries

The PTASP requires that transit agencies set annual targets for the number of injuries that occur on each mode of transit that the agency operates. Injuries are defined as "harm to a person that requires immediate medical attention away from the scene." Injuries are required to be calculated for both the total number of injuries and the injury rate per VRM for each of the modes that the agency operates.

Specific targets are set for:

- total injuries, by mode, across the transit agency's system; and rate of injuries, by mode, per VRM operated by the transit agency.

Measure 3: Safety Events

Transit providers are required to set annual targets for the number and rate of safety events by mode that occur across the transit agency's system (see Table B-14). A safety event is defined by FTA as a "collision, derailment, fire, hazardous material spill, or evacuation." Safety events are required to be calculated for both the total number of events and the event rate per VRM for each of the modes that the agency operates.

Specific targets are set for:

- total safety events, by mode, across the transit agency's system; and
- rate of safety events, by mode, per VRM operated by the transit agency.

Table B-14: TRANSIT SAFETY RULE: SAFETY EVENTS

NTD Category	FY2021 Target
SEPTA Vehicle Accidents	
SEPTA Bus	--/ 8.18 per 100,000 miles
SEPTA Trolley Bus	-- / 9.51 per 100,000 miles
SEPTA Heavy Rail (Market-Frankford Line)	-- / 0.09 per 100,000 miles
SEPTA Heavy Rail (Broad Street Line)	-- / 0.07 per 100,000 miles
SEPTA Heavy Rail (Norristown High Speed Line)	-- / 2.30 per 100,000 miles
SEPTA Light Rail	-- / 8.38 per 100,000 miles
SEPTA Commuter Rail	-- / 0.07 per 100,000 miles
SEPTA Station Accidents	
SEPTA Heavy Rail (Market-Frankford Line)	-- / 1.59 per 100,000 miles
SEPTA Heavy Rail (Broad Street Line)	-- / 0.56 per 100,000 miles
SEPTA Heavy Rail (Norristown High Speed Line)	-- / 0.72 per 100,000 miles
SEPTA Light Rail	-- / 1.01 per 100,000 miles
SEPTA Commuter Rail	-- / 0.95 per 100,000 miles
SEPTA Safety Events	
SEPTA Bus	595
SEPTA Trolley Bus	13
SEPTA Heavy Rail	132
SEPTA Light Rail	104
SEPTA Commuter Rail	3
NJ TRANSIT Collisions	
NJ TRANSIT Light Rail (River LINE)	12 / 9.53 per 1 million miles
NJ TRANSIT Bus	264 / 3.63 per 1 million miles
NJ TRANSIT Fire Events	
NJ TRANSIT Light Rail (RiverLine)	1.59 per 1 million miles
NJ TRANSIT Bus	0.16 per 1 million miles
DRPA/PATCO System	50 / 1 per 100,000 miles

Note: SEPTA has only submitted rates, not numbers, for their Vehicle Accidents and Station Accidents targets.
Source: SEPTA, DRPA/PATCO, and New Jersey Transit, 2021.

Measure 4: System Reliability

Transit providers are required to set annual targets for the agency's system reliability for each mode of transit that the agency operates (see Table B-15). The system reliability performance measure accounts for major mechanical failings of a vehicle that prevent the vehicle from starting or completing a scheduled trip. Mechanical failings and interrupted trips can create hazardous conditions for the transit operators and passengers, depending on the location of the service interruption and if passengers are required to de-board in unsafe locations.

Specific targets are set for:

- miles traveled between major mechanical failures calculated for each mode that the transit agency operates.

Table B-15: TRANSIT SAFETY RULE—SYSTEM RELIABILITY (MEAN DISTANCE IN MILES BETWEEN MAJOR SERVICE FAILURES)

Service	FY2021 Target
SEPTA Heavy Rail (Market-Frankford Line)	85,000
SEPTA Heavy Rail (Broad Street Line)	130,000
SEPTA Heavy Rail (Norristown High Speed Line)	35,000
SEPTA Light Rail (City)	8,000
SEPTA Light Rail (Media-Sharon Hill Line)	20,000
SEPTA Commuter Rail	30,000
NJ TRANSIT Light Rail (River Line)	6,284
NJ TRANSIT Bus	135.45 per 1 million miles
DRPA/PATCO	230 Total Service Failures

Source: SEPTA, DRPA/PATCO, and New Jersey Transit, 2021

Appendix C: Amending the Long-Range Plan

Federal regulations require an MPO's long-range plan to be updated every four years. In the intervening period, DVRPC may amend the Plan to reflect revision(s) to an MRP's or other air quality significant project's scope or timing; to add a new MRP and/or minor system expansion projects to the fiscally constrained financial plan; or to revise the document's policies, core principles, goals, strategies, and population and employment forecasts. System expansion project cost changes may also require analysis to ensure the category remains below the agreed-to cap on roadway new-capacity projects. All air quality significant projects—which are expected to change traffic patterns or volumes—that are added to the Plan must undergo conformity analysis. Several types of amendments may be considered, depending on the revision(s) to the project list:

- **Administrative Modification**: A minor change to an existing MRP, or minor system expansion project that occurs through a TIP amendment that does not require public review or comment, redetermination of fiscal constraint, or transportation conformity, and will be incorporated into the next Plan amendment or update.
- **Minor Amendment**: A major change to the total estimated project cost of an MRP, or minor system expansion project through a TIP amendment that requires an abbreviated public review and comment period, and redetermination of fiscal constraint. Redetermination of transportation conformity is not required.
- **Major Amendment**: A major change to the scope or timing of an MRP or minor system expansion project that requires public review and comment, redetermination of fiscal constraint, and re-determination of transportation conformity.

Administrative modifications and minor amendments will be conducted as part of the TIP amendment process during monthly RTC and DVRPC Board meetings. A major amendment will generally take about four to six months to complete (some of these tasks can be done concurrently), and should be handled in accordance with the process outlined in Table C-1.

Table C-1: MAJOR AMENDMENT PROCESS AND TIMELINE

Step	Action	Time Required
Request	Sponsoring agency makes a formal request for a Long-Range Plan amendment in written format. If the amendment is to an MRP the request should include project name, scope, construction or implementation timing, cost, and a map showing the completed facility (if available).	-
Data and Information Gathering	DVRPC staff and sponsoring agency to discuss the amendment request and address any outstanding questions or issues.	1–2 weeks
Project Evaluation	Financial plan implications will be analyzed, and project(s) will be evaluated using DVRPCs TIP-LRP Benefit Criteria.	1–2 weeks
Consultation	DVRPC staff, sponsoring agency, and RTC Financial Planning subcommittee meet to recommend or not recommend the proposed amendment.	2–4 weeks
Summary Memo	DVRPC staff will develop a summary memo for the amendment. This may require meeting any new mandatory federal requirements.	2–4 weeks
Air Quality Conformity	DVRPC staff will conduct air quality conformity analysis, if required, and coordinate with the Interagency Consultation Group.	6–8 weeks
Public Comment Period	Amendment will be posted on DVRPCs website for public comment for 30 days. DVRPC will prepare a formal response to any comment received, and comments will be considered in the final decision.	6–8 weeks
Committee and Board Actions	Amendment will be brought to the RTC and DVRPC Board for adoption.	2–4 weeks
Federal Approval	FHWA, FTA, and U.S. EPA review and issue joint approval of the amendment.	2–3 months

Source: DVRPC, 2020.

Appendix D: Acronyms

5G	Fifth Generation Wireless Network
ADA	Americans with Disabilities Act
ADAS	Advanced Driver Assistance Systems
ADS	Automated Driving Systems
AI	Artificial Intelligence
AQP	Air Quality Partnership (of DVRPC)
ATM	Active Traffic Management
AV	Automated Vehicle
BPN	Business Plan Network
BRT	Bus Rapid Transit
CBO	Congressional Budget Office
CCAC	Climate Change Advisory Committee
CCTV	Closed-Circuit Television Cameras
CEDS	Comprehensive Economic Development Strategy
CHSTP	Coordinated Human Services Transportation Plan
CIG	Capital Investment Group
CJTF	Central Jersey Transportation Forum (of DVRPC)
CMAQ	Congestion Mitigation and Air Quality (Federal Funding)
CMP	Congestion Management Process
CO	Carbon Monoxide
CO_2	Carbon Dioxide
COVID-19	Coronavirus Disease 2019
CPI	Consumer Price Index
CV	Connected Vehicle
C-V2X	Cellular Vehicle-to-Everything
DMS	Dynamic Message Sign
DOT	Department of Transportation
DRJTBC	Delaware River Joint Toll Bridge Commission
DRPA	Delaware River Port Authority
DSRC	Dedicated Short-Range Communications
DVGMTF	Delaware Valley Goods Movement Task Force (of DVRPC)
DVRPC SPC	DVRPC Southeastern Pennsylvania Corporation
DVRPC	Delaware Valley Regional Planning Commission
EJ	Environmental Justice
ETA	Equity Through Access
EV	Electric Vehicle
EVTOL	Electric Vertical Take-Off and Landing Vehicle
FAST Act	Fixing America's Surface Transportation Act
FHWA	Federal Highway Administration
FRA	Federal Railroad Administration
FTA	Federal Transit Administration
FY	Fiscal Year (state: July 1 to June 30; federal: October 1 to September 30)
GHG	Greenhouse Gases
GIS	Geographic Information System
GPS	Global Positioning System
GSI	Green Stormwater Infrastructure
GW	Gigawatt
HAV	Highly Automated Vehicle
HPMS	Highway Performance Monitoring System
HSIP	Highway Safety Improvement Program
ICE	Internal Combustion Engine
ICM	Integrated Corridor Management
IMP	Interstate Management Program
INFRA	Infrastructure for Building America
IoT	Internet of Things
IPD	Indicators of Potential Disadvantage
IT	Information Technology
ITS	Intelligent Transportation Systems
KSI	Individuals Killed or Seriously Injured
LED	Light-Emitting Diode
LiDAR	Light Detection and Ranging
LLCC	Lowest Life Cycle Cost
LOTTR	Level of Travel Time Reliability
MaaS	Mobility-as-a-Service
MAP	Mobility Alternatives Program
MAP-21	Moving Ahead for Progress in the 21st Century (2012 Federal Transportation Funding Bill)
MMT	Million Metric Tons
MPO	Metropolitan Planning Organization
MRP	Major Regional Project
MW	Megawatt
NAAQS	National Ambient Air Quality Standards
NEC	Northeast Corridor
NECC	Northeast Corridor Commission
NETS	National Establishment Time Series

NHS	National Highway System
NJDCA	New Jersey Department of Community Affairs
NJDOT	New Jersey Department of Transportation
NJ TRANSIT	New Jersey Transit
NJTA	New Jersey Turnpike Authority
NOx	Oxides of Nitrogen
NTD	National Transit Database
ODD	Operational Design Domain
P3	Public-Private Partnership (also called “3P”)
PA DEP	Pennsylvania Department of Environmental Protection
PAMS	Pavement Asset Management System
PART	Pottstown Area Rapid Transit
PATCO	Port Authority Transit Corporation
PBPP	Performance-Based Planning and Programming
PennDOT	Pennsylvania Department of Transportation
PHED	Peak-Hour Excessive Delay
PHL	Philadelphia International Airport
PM1	Performance Measure Rule 1
PM2	Performance Measure Rule 2
$PM_{2.5}$	Particulate Matter Finer than 2.5 Micrometers
PM3	Performance Measure Rule 3
PMS	Pavement Management System
PPI	Producer Price Index
PPTF	Public Participation Task Force (of DVRPC)
PTASP	Public Transportation Agency Safety Plan
PTC	Pennsylvania Turnpike Commission
PTI	Planning Time Index
PV	Photovoltaic
R&D	Research and Development
RIMIS	Regional Integrated Multimodal Information Sharing Project
RSLPP	Regional Streetlight Procurement Program
RSTF	Regional Safety Task Force (of DVRPC)
RTC	Regional Technical Committee (of DVRPC)
RTMC	Regional Traffic Management Center
RVZ	Regional Vision Zero
SEPTA	Southeastern Pennsylvania Transportation Authority
SGR	State-of-Good Repair
SHSP	Strategic Highway Safety Plan
SIP	State Implementation Plan
SJTA	South Jersey Transportation Authority
SLUAC	Socioeconomic and Land Use Analytics Committee
SOV	Single-Occupancy Vehicle
SPT	Safety Performance Target
STIP	State Transportation Improvement Program
STRA-21	Surface Transportation Reauthorization Act
TAM	Transportation Asset Management
TAMP	Transportation Asset Management Plan
TAP	Transportation Alternatives Program
TIFIA	Transportation Infrastructure Finance Innovation Act
TIP	Transportation Improvement Program
TIP-LRP Benefit Criteria	Transportation Improvement Program—Long-Range Plan Project Benefit Evaluation Criteria
TMA	Transportation Management Association
TOTF	Transportation Operations Task Force (of DVRPC)
TPM	Transportation Performance Management
TRID	Transit Revitalization Investment District
TSAP	Transportation Safety Analysis and Plan
TSMO	Transportation System Management and Operations
TTF	Transportation Trust Fund
TTTR	Truck Travel Time Reliability
UAS	Unmanned Aerial System
ULB	Useful Life Benchmark
U.S. DOT	U.S Department of Transportation
U.S. EPA	U.S. Environmental Protection Agency
UZA	Urbanized Area
VF	Vertical Flight
VMT	Vehicle Miles Traveled
VOC	Volatile Organic Compounds
VRM	Vehicle Revenue Miles
YOE	Year of Expenditure

Connections 2050

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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, public outreach, planning factors, megaregional planning, equity, diversity, trends, future, forecasts, demographics, economy, digital revolution, broadband, freight, goods movement, aviation, environment, land use, open space, water, greenspace network, planning areas, historic resources, climate change, greenhouse gases, energy, solar power, resiliency, centers, smart growth, transportation, safety, vision zero, walking, biking, The Circuit, asset management, congestion, congestion management process, transportation system management and operations, emergency management, transportation technology, nanotechnology, 3D printing, electric vehicles, connected vehicles, automated vehicles, artificial intelligence, 5G, Internet of Things, real-time information, shared mobility, financial plan, major regional projects, funding gap, funding options, multimodal, technology, MPO, transportation performance management.

Abstract:

The *Connections 2050 Plan for Greater Philadelphia: Process and Analysis Manual* documents the long-range planning process, public outreach, and quantitative effort and analysis used to develop the *Connections 2050* vision, principles, goals, policies and strategies—which are documented in Policy Manual's companion report the *Connections 2050 Plan for Greater Philadelphia: Policy Manual*—along with the financial plan's capital vision, revenue forecast, allocation, project evaluation and selection, fiscal constraint analysis, and regional funding options. This draft version is for the Plan's public comment period.

Staff Project Team:

Brett Fusco, *Manager, Office of Long-Range Planning*
Jaclyn Davis, *Assistant Manager, Office of Long-Range Planning*

Staff Contact:

Brett Fusco
Manager, Office of Long-Range Planning
215.238.2937
bfusco@dvrpc.org

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

190 N Independence Mall West
8th Floor
Philadelphia, PA 19106-1520
215.592.1800 | fax: 215.592.9125
www.dvrpc.org

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dvrpc
REGIONAL
PLANNING COMMISSION

190 N INDEPENDENCE MALL WEST
8TH FLOOR
PHILADELPHIA, PA 19106-1520
215.592.1800 | FAX: 215.592.9125
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Public Comment Period

The Draft *Connections 2050* Plan is available for public comment from July 28, 2021 to August 30, 2021.

The Plan comprises two documents:

- The *Connections 2050 Policy Manual* is the primary document, which highlights the Plan's vision, strategies to achieve the vision, and has a summary of the financial plan.
- The *Connections 2050 Process and Analysis Manual* is a more technical document that reviews the Plan's development and outreach, contains supporting information for the Plan's vision and strategies, and has a detailed financial plan.

These draft documents will be made available online at www.dvrpc.org/2050 and at various regional libraries.

As part of the comment period, two online public information sessions will be held on August 11, 2021 at 2 PM and August 18, 2021 at 7 PM, via webinar and a call-in function.

Comments may be submitted at the public information sessions, by mail, email, or online form at www.dvrpc.org/2050. Additional details are available on this webpage.

Submitted comments will be presented to the DVRPC Board, and all comments and responses will be posted on DVRPC's 2050 Plan webpage.