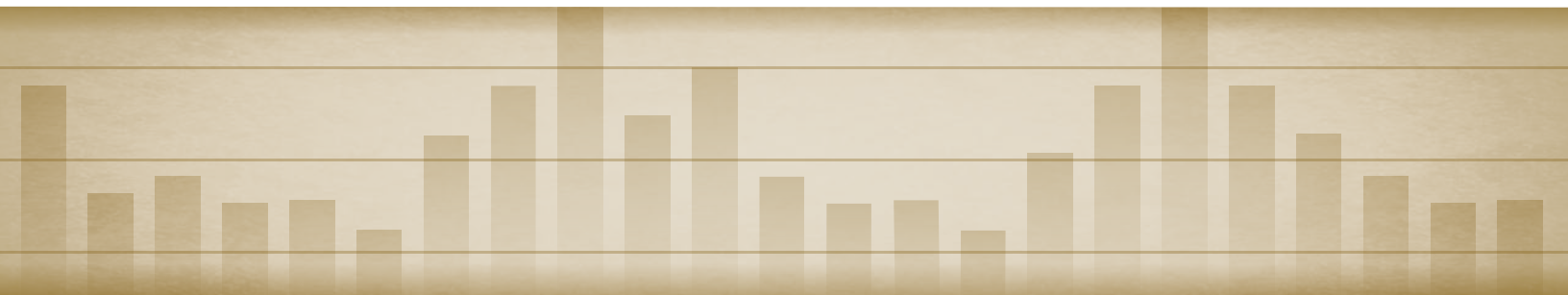
CONNECTIONS 2040

PLAN FOR GREATER PHILADELPHIA

TECHNICAL ANALYSIS

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION



The Delaware Valley Regional Planning Commission is dedicated to uniting the region's elected officials, planning professionals, and the public with a common vision of making a great region even greater. Shaping the way we live, work, and play, DVRPC builds consensus on improving transportation, promoting smart growth, protecting the environment, and enhancing the economy. We serve a diverse region of nine counties: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey. DVRPC is the federally designated Metropolitan Planning Organization for the Greater Philadelphia Region — leading the way to a better future.

DELAWARE VALLEY dvrpc REGIONAL PLANNING COMMISSION

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

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

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Table of Contents

Figures

Tables

Executive Summary

The *Connections 2040 Regional Plan for Greater Philadelphia: Technical Analysis* documents the analysis and details the financial plan for Greater Philadelphia's transportation infrastructure between 2014 and 2040. The financial plan was developed with DVRPC's federal, state, and local planning partners, as well as from public input. The Long-Range Plan Committee, made up from members of the Regional Technical Committee (RTC), was highly involved in the financial plan development.

A needs assessment was conducted to determine how much funding was needed to maintain the region's existing transportation infrastructure and to develop the identified operational improvement and system expansion projects. More than $116 billion in need was identified. Two appendices in this document describe the analysis that went into identifying bridge and pavement needs in Greater Philadelphia.

Using past federal, state, and local funding levels, and future guidance from federal and state partners, DVRPC estimated $52.5 billion in revenues would be available to help pay for the identified needs over the life of the Plan.

Given that needs are more than twice the anticipated revenue, DVRPC conducted a trade-off analysis between different funding categories (preservation, operational improvements, and system expansion) to estimate the impacts on system condition, delay, operating and maintenance costs, and growth in vehicle miles traveled (VMT). The Long-Range Plan Committee agreed to revise the *Connections (2035)* plan allocations to reduce the region's cap on roadway system expansion from 10 percent to five percent. System preservation allocation for transit was increased in Pennsylvania to deal with a growing backlog of state-of-good repair (SGR) needs. A lower SGR need for transit in New Jersey meant more investment in operational improvements and system expansion projects.

The Long-Range Plan Committee developed a set of project evaluation criteria. These criteria measured the benefits of projects, and then identified an optimized project list based on benefit to cost. The Committee determined the final list of Major Regional Projects selected for inclusion in the *Connections 2040 Plan for Greater Philadelphia* ("*Connections 2040*" or "the Plan"). A list of these projects is included in Chapter 5 of this document.

A Metropolitan Planning Organization's long-range plan must be fiscally constrained over the life of the plan and for each funding period contained within. A demonstration of revenues to expenditures is contained within. The first two funding periods of the *Connections 2040* financial plan are based on the FY 2013 Pennsylvania and FY 2014 New Jersey Transportation Improvement Programs (TIPs). The Plan has no expenditures programmed in the first two funding periods beyond what is in the current TIPs.

Given the ongoing funding gap, the Plan conducted analysis on potential regional funding options. The final section of this document details the analysis done on different potential revenue sources and the assumptions made. The Plan focuses mainly on funding options that are related to the use of the transportation system. These are considered the fairest way by which to pay for needed transportation system repairs and improvements. The Plan calls for taking action to find ways to fill the region's funding gap.

CHAPTER 1: Introduction

The *Connections 2040 Plan for Greater Philadelphia: Technical Analysis* documents the analysis and assumptions that went into developing the needs assessment, revenue forecast, funding allocation, project evaluation, selection, and options for filling the region's funding gap. The financial plan was developed in consultation with federal, state, and transit partners, including:

- Federal Highway Administration (FHWA),
- Federal Transit Administration (FTA),
- Pennsylvania Department of Transportation (PennDOT),
- New Jersey Department of Transportation (NJDOT),
- Southeastern Pennsylvania Transportation Authority (SEPTA),
- New Jersey Transit (NJ Transit),
- Port Authority Transit Corporation (PATCO) of the Delaware River Port Authority (DRPA), and
- Pottstown Area Rapid Transit (PART).

A Long-Range Plan Committee was highly involved in the development of the financial plan. This Committee was comprised of members from DVRPC's Regional Technical Committee (RTC).

The long-range financial plan focuses on Greater Philadelphia's transportation infrastructure capital needs. It consists of:

- Infrastructure Needs Assessment:
  - Pavement Analysis (Appendix A) and
  - Bridge Analysis (Appendix B);
- Revenue Forecast;
- Allocating Identified Revenue to Project Categories Based on Need and Policy;
- Project Evaluation;
- Project Selection;
- Demonstration of Fiscal Constraint; and
- Closing the Funding Gap Analysis.

There are four separate financial plans, one roadway and one transit for each of the Pennsylvania and New Jersey subregions.

Federal regulations require that a regional long-range transportation plan be fiscally constrained. This means that total transportation expenditures identified in a long-range plan must not exceed the total revenues reasonably expected to be available for the region over the life of the plan, and over each individual funding period in the plan. All revenues and project funding categories' needs are presented in year-of-expenditure (Y-O-E) dollars, which account for the impact of inflation over time.

The previous long-range plan, *Connections (2035)*, identified a $45 billion (Y-O-E) funding gap for the region's transportation infrastructure from 2010 to 2035. *Connections 2040* identifies an even larger gap, $64 billion, from 2014 to 2040. Managing this gap cannot be done on a year-to-year basis. *Connections 2040* attempts to create a long-term financial plan for maintaining reasonable infrastructure condition and making the operational improvements and system expansions to improve the region's economic competitiveness and quality of life. It is recognized that not every last need will be met.

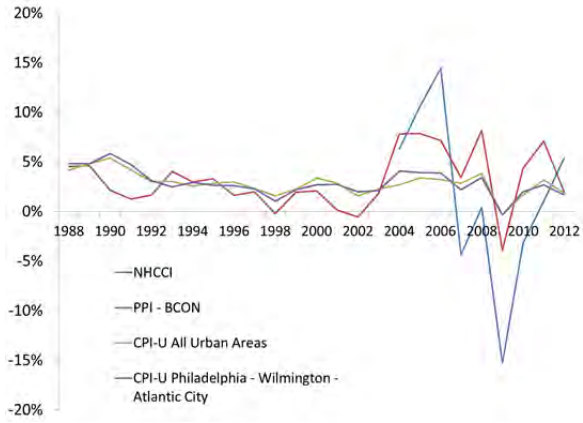
The Plan's transportation philosophy is fix it first, improve it second, and expand it third. This is the starting point for prioritizing regional transportation funding.

As projects move from the Plan into the TIP, capital programming should be based on sound long-range strategic planning considerations, life-cycle investment analyses, and system performance and condition data (actual and projected). Careful tradeoff analysis must be done in order to ensure that the region gets the best possible return on its transportation investments.

Inflation and Year-of-Expenditure Dollars

Federal regulations require Metropolitan Planning Organizations (MPOs), such as DVPRC, to develop future transportation project cost estimates using year-of-expenditure (Y-O-E) dollars. These dollars account for the inflation that is reasonably anticipated between the present day and the year(s) that the project is planned for construction. Generally, inflation related to the construction industry has had more variability than the larger economy. The following chart shows annual inflation rates for four indices: the National Highway Construction Cost Index (NHCCI), the Producer Price Index for broad construction (PPI-BCON), 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).

Figure 1. Annual Inflation Comparison



Source: Federal Highway Administration (2003 to 2012) and Bureau of Labor Statistics (1988 to 2012)

Given that the current economic downturn may have lingering effects, DVRPC estimates the short-term inflation rate to be lower. Longer-term competition for scarce resources will likely mean higher inflation in later years. DVRPC assumes the following inflation rates between the present day (2013) and 2040.

- 2013 to 2018: 3.0 Percent;
- 2019 to 2024: 3.0 Percent;

Innovations in Project Delivery

Improving transportation project delivery promises to increase worksite safety, reduce congestion from construction, and lower the cost of transportation projects. FHWA's Everyday Counts campaign has highlighted the economic and quality-of-life benefits from maintaining and reconstructing transportation facilities with a minimum impact on the traveling public. The following is a sampling of some of the techniques that are being used in the region and around the country to do this:

- Accelerated Bridge Construction - uses geosynthetic materials to quickly and cheaply construct abutments and roadway approaches; and prefabricated bridges that are built offsite or nearby and can be slid into place and paved, and allow the road to reopen within 48 to 72 hours.
- Mechanistic-Empirical Pavement Design Guide (MEPDG) - can more accurately design needed pavement depth for given traffic and weather conditions.
- Warm mix paving - traditional asphalt needs to be heated 30 to 120 degrees Fahrenheit hotter than warm-mix asphalts. By reducing the energy needed to heat up asphalt, both cost and greenhouse gas emissions are reduced.
- Waste and recycled materials - such as rubber tires, fly ash, and silica fume, have been added to pavement mixtures to reduce cost and improve performance.
- Intelligent Compaction Rollers – use vibration analysis to analyze pavement compaction in real time, ensuring that pavement and base layer is properly compacted and not over- or undercompacted. The real-time information improves efficiency, reducing construction time and fuel use.
- Precast Concrete Paving – panels can be precast offsite, where they can be subject to higher quality control standards and installed during low volume periods. With overnight or over weekend construction time, these can reduce one of the major causes of road delay: construction.

- 2025 to 2030: 3.5 Percent; and
- 2031 to 2040: 4.0 Percent.

Analysis Periods

Connections 2040 will consist of four funding periods that align with both the 2013 Pennsylvania and 2014 New Jersey TIPs. In Pennsylvania, the first funding period will comprise years two to six of the 2013 TIP. The second period will round out the statewide 12-year plan. In New Jersey, the first funding period matches up with the first four years of the 2014 New Jersey TIP. The second funding period corresponds with the remainder of the 10-year plan.

Table 1. Connections 2040 Funding Periods

Funding Period	Pennsylvania	New Jersey
1	2014-2018	2014-2017
2	2019-2024	2018-2023
3	2025-2030	2024-2030
4	2031-2040	2031-2040

Source: DVRPC 2012

Asset Management

The *Connections 2040* financial plan analysis uses asset management systems data developed by PennDOT, NJDOT, and SEPTA. For pavement and bridges, DVRPC developed models using historic data to estimate future rates of decline.

Asset management practices are still in their infancy, and the state of the art is still being developed. This is particularly true at the regional level. MAP-21 directs MPOs to be more proactive in identifying asset management needs, and DVRPC continues to improve its efforts in quantifying system preservation needs over the life of a long-range plan. However, this is a much longer view than many asset management systems, which typically have a 10-year horizon. The Plan is based on the best data and methodology available to date. However, we are continuing to partner and work with the DOTs and transit agencies, and have already identified a number of ways that this analysis can be improved on in the future.

CHAPTER 2: Needs Assessment

Connections 2040 develops a vision for transportation infrastructure based on achieving and maintaining a state of good repair (SGR), improving the operation of existing facilities, and, where appropriate, expanding the system. In short, maintaining and modernizing our transportation system.

Tables 2 and 3 indicate the extensive scope of the roadway and transit infrastructure in the Greater Philadelphia region.

Table 2. Road Infrastructure in Greater Philadelphia

Infrastructure	Owner	Pennsylvania	New Jersey
Roads (Linear Miles)	State DOT	3,555	529
	Other State Agency	117	236
	Turnpike/Toll Authority	83	99
	County/Local/Municipal	11,395	7,444
Bridges	State Maintained Bridges >8'	2,752	779
	State Maintained Deck Area (millions of square feet)	26.68	12.86
	Locally Maintained Bridges, >20'	821	409
	Locally Maintained Deck Area (millions of square feet)	2.66	1.05

Source: DVRPC 2012

Transit infrastructure consists of facilities that are maintained and operated by the region's local transit service providers. A number of facilities are used by the region's transit service providers, but are not listed here because they lease the asset and are not responsible for its maintenance. Some examples include 30th Street Station in Philadelphia, which is used by both SEPTA and NJ Transit; however, Amtrak is responsible for its maintenance. Both SEPTA and NJ Transit lease rail track from Amtrak and various regional freight rail operators. At the same time, there is rail infrastructure that the region's transit operators have maintenance responsibility for, but is not in active service. Examples of these types of facilities include SEPTA's Chester Trunk Line from Chester City to West Chester, Pennsylvania, and NJ Transit's Vineland Secondary Route.

Table 3. 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	-
- 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	-	13
Heavy Rail Vehicles	343	-	121	-
Light Rail Vehicles	182	20	-	-
Regional Rail Vehicles	335	42	-	-
Trackless Trolleys	38	-	-	-
Locomotives	8	12	-	-
Push Pull Cars	53	20	-	-
Vehicle Maintenance and Storage Shops	23	5	3	1

* Includes three stations in Delaware: Claymont, Churchman's Crossing, and Newark. Wilmington Station is owned by Amtrak.

Source: SEPTA, NJ Transit, PATCO, and PART, 2012

The needs assessment breaks road, bike, pedestrian, and transit infrastructure needs into nine major categories. Roadway preservation includes both pavement and bridge needs, while transit preservation includes rail infrastructure, vehicle, and station needs.


Roadway Preservation (R1 – R2)


Roadway Operational Improvements (R3)


Bicycle and Pedestrian (R4)


Roadway System Expansion (R5)


Roadway Other (R6)


Transit System Preservation (T1 - T3)


Transit Operational Improvements (T4)


Transit System Expansion (T5)


Transit Other (T6)

Table 4. 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); Local and County Federal Aid Road Maintenance
R2	Bridge Preservation	Preventative Maintenance; Painting; Substructure, Superstructure, Bridge Deck, Parapet, Culvert, or Viaduct Rehabilitation or Replacement; Local Federal Aid Bridges; Bridge Removal
R3	Operational Improvements	Access Management; Interchange Reconstruction or Realignment; Channelization; Roadway Realignment; New Turn Lanes; Roundabouts; Regional Safety Initiatives (HSIP); Rail Crossings; ITS Deployment; Traffic Operations Center(s); Incident Management; Signal Modernization, Interconnection, or Closed-Loop Signal Systems; Traffic Management Systems
R4	Bike and Pedestrian	Streetscaping; Sidewalks; Multiuse Paths; Bike Lanes; Pedestrian and Bike Safety Improvements; Pedestrian Bridge or Tunnel; ADA Curb Cuts
R5	System Expansion	New Roads, Lanes, Bypasses, Bridges, or Interchanges; Roadway Relocations
R6	Other	Debt Service; Environmental Mitigation; RideECO; Mobility Alternatives Program; Air Quality Programs; Dams; CMAQ; Transportation Management Associations; Regional and Local Planning; Parking Facilities

Source: DVRPC 2013

Table 5. Transit Expenditure Categories and Project Types

Category ID	Category	Types of Projects
T1	Rail Infrastructure	Track Rehabilitation, Resurfacing, or Replacement; Catenary Rehabilitation or Replacement; Signal Rehabilitation or Replacement; Rail Bridge Improvements; Regional Substation Improvements; Positive Train Control; Amtrak Lease Agreements
T2	Vehicles	New or Rehabilitated Buses, Paratransit, Commuter Rail, Light Rail, or Heavy Rail Vehicles; Maintenance and Storage Facilities; Vehicle Maintenance Equipment
T3	Station Enhancements	Station Rehabilitation and Improvements; Access Improvements; Expanded Parking; Transit-Oriented Development; Park and Ride; Parking Lot Rehabilitation or Expansion; Transportation Center; ADA Compliance
T4	Operational Improvements	ITS; Fare Modernization; Real-Time Information; Signal Preemption; Doubling Tracking; Sidings; Light Rail Restoration
T5	System Expansion	New Station on Existing Line (Including New Parking Facilities); Extension of Existing Line; New Bus or Rail Route; Bus Rapid Transit
T6	Other	Safety; Security; Coordinated Human Services; Debt Service

Source: DVRPC 2013

Tables 4 and 5 describe the types of projects contained in each expenditure category.

Projects currently listed on the illustrative unfunded list in the Pennsylvania Transportation Improvement Program (TIP), and the Tier 2 list in the New Jersey TIP, are included in the needs assessment. These projects have demonstrated a project need but lack the funding necessary to advance.

Tables 6 and 7 summarize the total estimated need for each project category. After that, the next four sections detail the region's estimated need for each roadway and transit category, in both state subregions. Roadway and transit needs are higher in Pennsylvania in the first funding period, than in the second, due to the backlog of SGR needs.

Table 6. Pennsylvania Subregion Total Expenditure Need (In Billions of Y-O-E $s)

Mode	Subcategory	2014-2018	2019-2024	2025-2030	2031-2040	Total
Roadway	R1. Pavement Preservation	$ 2.49 B	$ 1.97 B	$ 2.33 B	$ 5.81 B	$ 12.61 B
	R2. Bridge Preservation	$ 4.78 B	$ 4.48 B	$ 4.16 B	$ 20.50 B	$ 33.93 B
	R3. Operational Improvements	$ 0.51 B	$ 0.74 B	$ 0.88 B	$ 1.74 B	$ 3.88 B
	R4. Bicycle and Pedestrian	$ 0.06 B	$ 0.08 B	$ 0.10 B	$ 0.24 B	$ 0.48 B
	R5. System Expansion	$ 0.30 B	$ 0.31 B	$ 0.21 B	$ 0.73 B	$ 1.55 B
	R6. Other	$ 0.06 B	$ 0.08 B	$ 0.10 B	$ 0.22 B	$ 0.45 B
	Roadway Subtotal	$ 8.21 B	$ 7.66 B	$ 7.79 B	$ 29.24 B	$ 52.90 B
Transit	T1. Rail Infrastructure	$ 2.86 B	$ 1.70 B	$ 2.65 B	$ 4.17 B	$ 11.38 B
	T2. Vehicles	$ 2.16 B	$ 2.71 B	$ 2.51 B	$ 4.22 B	$ 11.61 B
	T3. Station Enhancements	$ 1.02 B	$ 1.16 B	$ 1.40 B	$ 1.59 B	$ 5.17 B
	T4. Operational Improvements	$ 0.28 B	$ 0.11 B	$ 0.77 B	$ 1.75 B	$ 2.91 B
	T5. System Expansion	$ 0.00 B	$ 0.00 B	$ 1.74 B	$ 3.96 B	$ 5.69 B
	T6. Other	$ 0.50 B	$ 0.53 B	$ 0. 41 B	$ 0. 59 B	$ 2.03 B
	Transit Subtotal	$ 6.83 B	$ 6.21 B	$ 9.48 B	$ 16.27 B	$ 38.79 B
PA Subregion Total		$ 15.05 B	$ 13.87 B	$ 17.27 B	$ 45.51 B	$ 91.70 B

Totals may not add up due to rounding.
Source: DVRPC 2013

Table 7. New Jersey Subregion Total Expenditure Need (In Billions of Y-O-E $s)

Mode	Subcategory	2014-2017	2018-2023	2024-2030	2031-2040	Total
Roadway	R1. Pavement Preservation	$ 0.49 B	$ 0.69 B	$ 1.25 B	$ 3.66 B	$ 6.10 B
	R2. Bridge Preservation	$ 0.90 B	$ 0.96 B	$ 1.05 B	$ 3.30 B	$ 6.21 B
	R3. Operational Improvements	$ 0.33 B	$ 0.33 B	$ 0.63 B	$ 1.28 B	$ 2.57 B
	R4. Bicycle and Pedestrian	$ 0.03 B	$ 0.04 B	$ 0.06 B	$ 0.12 B	$ 0.24 B
	R5. System Expansion	$ 0.22 B	$ 0.11 B	$ 0.24 B	$ 0.42 B	$ 0.98 B
	R6. Other	$ 0.03 B	$ 0.06 B	$ 0.09 B	$ 0.17 B	$ 0.35 B
	Roadway Subtotal	$ 2.00 B	$ 2.19 B	$ 3.31 B	$ 8.94 B	$ 16.45 B
Transit	T1. Rail Infrastructure	$ 0.10 B	$ 0.14 B	$ 0.21 B	$ 0.43 B	$ 0.88 B
	T2. Vehicles	$ 0.27 B	$ 0.22 B	$ 0.40 B	$ 0.82 B	$ 1.71 B
	T3. Station Enhancements	$ 0.01 B	$ 0.05 B	$ 0.03 B	$ 0.07 B	$ 0.13 B
	T4. Operational Improvements	$ 0.04 B	$ 0.07 B	$ 0.11 B	$ 0.57 B	$ 0.79 B
	T5. System Expansion	$ 0.02 B	$ 0.03 B	$ 1.29 B	$ 2.58 B	$ 3.92 B
	T6. Other	$ 0.24 B	$ 0.20 B	$ 0.17 B	$ 0.34 B	$ 0.94 B
	Transit Subtotal	$ 0.69 B	$ 0.67 B	$ 2.56 B	$ 5.50 B	$ 8.37 B
NJ Subregion Total		**$ 2.68 B**	**$ 2.86 B**	**$ 5.52B**	**$ 13.74 B**	**$ 24.81**

Totals may not add up due to rounding.
Source: DVRPC 2013

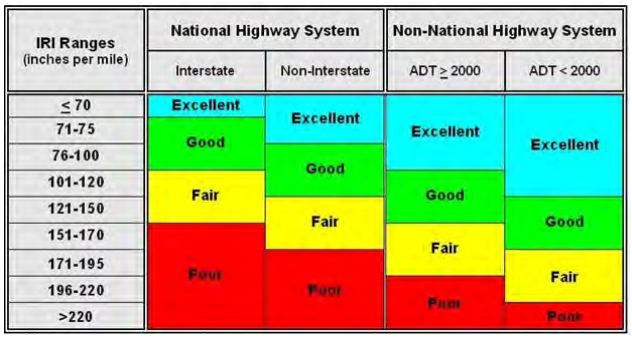
Pennsylvania Subregion Roadway Needs

The following sections detail the identified roadway needs over the life of the Plan for the Pennsylvania subregion for each of the six roadway funding categories.

R1. Pennsylvania Subregion Pavement Needs

State DOTs are required to maintain a Pavement Management System (PMS), which tracks the condition of all federal- and state-maintained roadways. The PMS tracks conditions for each road segment in the region. One measure of road condition is the International Roughness Index (IRI). The IRI determines pavement roughness conditions based on total inches of surface variation per mile. Depending on the functional class of road, different IRI ratings are acceptable, see Figure 2. Roadway that is in 'poor' condition by its IRI rating is considered deficient. PennDOT's PMS contains data on 10,818 lane miles of roadway in the DVPRC region, of various state, municipal, and turnpike owners. Of these, approximately 32.3 percent are currently in poor condition.

Figure 2. PennDOT International Roughness Index Reporting Guidelines



Source: PennDOT, 2004

PennDOT has divided the region's road system into four Business Plan Networks (BPN), as follows:

- BPN 1 is interstate highways;
- BPN 2 is the noninterstate portion of the National Highway System (NHS);
- BPN 3 is for arterial and connector roads with greater than 2,000 vehicles per day; and
- BPN 4 is for arterials and connector roads with less than 2,000 vehicles per day.

PennDOT has set SGR targets for each BPN as a percent of deficient lane miles out of the total system. For interstates, this target is 1.5 percent, and for noninterstate NHS, the target is five percent. For BPN 3 and 4, the targets are to maintain the current deficiency levels at 25.2 percent and 30.9 percent, respectively. Averaging by lane miles in each functional class, an overall target of around 17.4 percent can be identified. PennDOT's pavement expenditure needs are based on a goal of achieving a SGR by 2025 and maintaining that out to 2040.

Table 8. PennDOT Pavement Condition Targets for DVRPC Region

BPN	Description	Percent Poor Lane Miles
1	Interstate/Ramps	1.5%
2	NHS (noninterstate)	5.0%
3	>2,000 AADT	25.2%
4	<2,000 AADT	30.9%
Total		17.4%

Source: DVRPC 2012

MAP-21 will require each state to set performance measure targets with respect to pavement conditions on the National Highway System, using national guidance. As a result, these targets may be amended soon.

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 used data from PennDOT's PMS and is detailed in Appendix A. Needs for culvert rehabilitation and replacement are included in pavement reconstruction, and are not included in the bridge needs assessment (R2).

'Major Regional Pavement Reconstruction' [R1.01] is for specific regional NHS roadway reconstruction priorities. Major regional pavement reconstruction projects can be found in Chapter 6 of this document.

'Preventative Maintenance' [R1.02] projects include crack sealing, milling and filling, shoulder cuts, oil chip sealing, or microsurfacing. Regular preventative maintenance can delay future resurfacing and reconstruction needs by extending the life of pavement.

'Resurfacing' [R1.03] generally occurs every seven years on interstates, every 12 to 15 years on BPNs 2 and 3, and every 25 years on BPN 4, but only on roads less than 50 years old.

'Reconstruction' [R1.04] needs are identified for roads when they are more than 50 years old and in poor condition.

'Appurtenances' [R1.05] include signs, guardrail/guide barriers, drainage, pavement markings, lighting, and retaining walls that are part of the roadway system. Annual needs for each of these within the state system were developed by the PennDOT State Asset Management Unit. Regional need was estimated by dividing the region's linear miles of state-maintained roads by the total statewide miles of roads. Estimates can be found in Appendix B of PennDOT's *Developing Regional Long-Range Plans: Resource Guidance for Pennsylvania Planning Partners*.

'Local Federal Aid Roadways' [R1.06] needs assume an average cost of $7,500 per lane mile per year for 921.9 linear miles of local federal aid roads, assuming two lane miles per linear mile. The source of this annual cost estimate can be found in Appendix B of PennDOT's *Developing Regional Long-Range Plans: Resource Guidance for Pennsylvania Planning Partners*

Table 9. Pavement Resurfacing Reconstruction Needs (R1)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R1.01	Major Regional Pavement Reconstruction	$ 380.7	$ 272.8	$ 599.3	$ 1,388.6	$ 2,641.4
R1.02	Preventative Maintenance	$ 261.9	$ 435.1	$ 597.6	$ 1,620.6	$ 2,915.2
R1.03	Resurfacing	$ 489.8	$ 723.0	$ 693.0	$ 1,826.5	$ 3,732.3
R1.04	Reconstruction	$ 1,213.5	$ 319.7	$ 173.6	$ 370.8	$ 2,077.7
R1.05	Appurtenances	$ 75.4	$ 106.5	$ 130.9	$ 298.6	$ 611.4
R1.06	Local Federal Aid Roadways	$ 77.8	$ 109.9	$ 135.1	$ 308.1	$ 630.8
R1	Total	$ 2,499.2	$ 1,967.0	$ 2,329.4	$ 5,813.2	$ 12,608.7

Source: DVRPC 2013

R2. Pennsylvania Subregion Bridge Needs

State DOTs are required to maintain a Bridge Management System (BMS), which tracks the structural condition of key bridge elements for all bridges greater than 20 feet in length, regardless of ownership. The BMS contains the most recent bridge inspection data. These inspections are done every two years for all bridges, and more often on structurally deficient bridges. The inspections determine the condition of the deck, substructure, and superstructure on a scale of zero to nine; any of these items scoring a four or below indicates that the bridge is structurally deficient and in need of significant repair work or replacement.

PennDOT has set targets for bridge conditions based on percent of deck area in a structurally deficient condition by BPN. These targets are based on the

Performance Measures Guidance document. This report identifies the targets for the state and for each district.

Table 10. PennDOT Bridge Condition Targets for DVRPC Region

BPN	Description	Percent SD Deck Area
1	Interstate/Ramps	4.8%
2	NHS (noninterstate)	5.5%
3	>2,000 AADT	10.3%
4	<2,000 AADT	9.5%
Total State-maintained, >8 feet		7.3%
Locally maintained, >20 feet		15.4%

Source: PennDOT 2010

MAP-21 will require each state to set performance measure targets with respect to bridge conditions on the National Highway System, using national guidance. As a result, these targets may soon be amended.

DVRPC developed a routine for analyzing future bridge conditions based on normal wear and tear on the facilities and accounting for the impact of future bridge projects. This analysis used data from PennDOT's BMS and is detailed in Appendix B. Need for culvert rehabilitation and replacement is included in pavement reconstruction (R1) and is not included here in the bridge needs assessment.

'Major Regional Bridge Replacement' [R2.01] generally, major regional bridge projects are replacements on the National Highway System and are among the largest bridges by deck area for each county. Specific bridge reconstruction projects in this category are listed in Chapter 6 of this document.

'Bridge Maintenance' [R2.02] projects include scouring, washing, or replacement of expansion joints, rocker bearings, or underpinnings. These projects should occur at each bridge every 15 to 25 years, as long as the bridge is in a SGR. Bridges in poor condition are generally targeted for rehabilitation or replacement and undergo basic maintenance only as an emergency stopgap measure to ensure that the bridge can remain open to traffic.

'Bridge Rehabilitation' [R2.03] generally involves 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 water tight is critical to keeping corrosive materials out of the substructure and superstructure structural components.

'Bridge Replacement' [R2.04] generally replaces a bridge that has passed its expected 50- to 100-year lifespan, and has two or more of its components (deck, superstructure, or substructure) in poor condition.

'Bridge Removal' [R2.05] includes funds for removing bridges that will not be replaced.

'Local Federal Aid Bridges' [R2.06] accounts for rehabilitation and replacement needs for local federal aid bridges.

Table 11. Bridge Rehabilitation Replacement (R2)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R2.01	Major Regional Bridge Replacement	$ 877.9	$ 1,162.0	$ 222.3	$ 8,282.5	$ 10,544.7
R2.02	Bridge Maintenance	$ 180.9	$ 269.3	$ 333.9	$ 735.2	$ 1,519.4
R2.03	Bridge Rehabilitation	$ 842.0	$ 726.4	$ 210.5	$ 4,606.7	$ 6,385.6
R2.04	Bridge Replacement	$ 1,435.0	$ 535.5	$ 1,857.3	$ 5,118.6	$ 8,946.4
R2.05	Bridge Removal	$ 2.4	$ 3.4	$ 4.2	$ 9.5	$ 19.5
R2.06	Local Federal Aid Bridges	$ 620.3	$ 902.4	$ 1,442.9	$ 1,490.8	$ 4,456.4
R2	Total	$ 4,783.4	$ 4,484.7	$ 4,162.4	$ 20,503.5	$ 33,934.0

Source: DVRPC 2013

R3. Pennsylvania Subregion Operational Improvement Needs

The Transportation Operations Master Plan (TOMP) presents a comprehensive long-term vision of transportation operations, bridging individual programs to create a cohesive regional vision. It was developed in cooperation with DVRPC's Transportation Operations Task Force (TOTF), which is composed of traffic, transit, and emergency management operators in the region.

The TOMP highlights four major operational themes: incident management, traffic management, transit operations, and traveler information. Several operational needs emerged, including obtaining real-time accurate information, sharing information among agencies and with the public, and having the appropriate resources available to respond to incidents. The TOMP identifies operational strategies such as the addition of transportation operations centers, variable speed limit signs, closed-circuit TV cameras, weigh-in-motion detectors, modernization of traffic signals, closed-loop traffic signal systems, cyclical resynchronization of traffic lights, and locations for parking management systems.

Transportation operations have unique funding and implementation requirements. While Intelligent Transportation Systems (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.

'Major Regional Safety/Operational Projects' [R3.01] include specific safety and operational projects, along with the safety/operational components of major preservation and system expansion projects.

'Safety/Operational Improvements' [R3.02] include intersection/interchange improvements, roadway realignments, channelization, roundabouts, access management, new turning lanes, and grade-separated rail crossings.

'Intelligent Transportation Systems' [R3.03] includes capital and operating costs for ITS deployment and traffic operations centers. Funds will support DOT, local/county, and DRPA operations. Proposed projects and facilities include, but are not limited to (bold indicates a county identified priority):

- ITS Infrastructure (mostly infill to additional equipment where needed along these facilities):
  - **I-76 Schuylkill Expressway;**
  - US 1 Expressway;
  - **I-95;**
  - I-476;
  - I-676;

- US 1;
- **US 30;**
- **US 202;**
- US 422;
- **PA 309;**
- US 322;
- PA 100; and
- PA Turnpike.

- Road Weather Information Systems (RWIS):
  - Bucks County;
  - Chester County;
  - Delaware County;
  - Montgomery County; and
  - Philadelphia.
- Roadway Treatment Systems;
- City of Philadelphia – Traffic Operations Center (TOC), Variable Message Sign (VMS), Closed Circuit Television Cameras (CCTV), Detectors; and
- PennDOT District 6-0 Regional Traffic Management Center (RTMC).

'**Incident Management' [R3.04]** includes capital and operating funds for emergency service patrols. Proposed incident management projects and locations include, but are not limited to (bold indicates a county identified priority):

- Emergency Service Patrols:
  - **I-95;**
  - I-76/US 1 Freeway;
  - I-476;
  - US 422;
  - PA 309;
  - US 1;
  - **US 202**; and
  - **US 30 Bypass**,
- Regional Integrated Multimodal Information Sharing (RIMIS):
  - Enhancements/upgrades; and
  - Data Interfaces.
- Incident Management (IM):
  - IM Task Forces;
  - IM Grant Initiative;
  - Quick Clearance/IM Safety Issues (i.e., "Move It/Move Over/Quick Clearance" Policies);
  - Accident investigation equipment; and
  - Towing Incentive Program.
- Emergency Communications Network; and
- Arterial Management – Integrated Corridor Management.

'Traffic Management and Signals' [R3.05] includes needs for traffic signal replacement and retiming, traffic management through variable speed limit signs, active traffic management, and local traffic signals. It also includes funding needs for upgrading to adaptive signal control technology (ASCT), which uses real-time data to optimize traffic flow.

Traffic management and signal projects and locations include, but are not limited to (bold indicates a county identified priority):

- Traffic Signal Retiming and Upgrade Programs:
  - Project Management;
  - Priority Network Signal Retiming Program;
  - Priority Network Signal Upgrade Program; and
  - Integrate Signals into PennDOT RTMC.
- Traffic Signal Communication Hubs;
- Philadelphia Traffic Signals;
- **Ramp Metering**;
- Variable Speed Limits;
- Active Traffic Management; and
- Parking Management.

Table 12. Operational Improvement Needs by Subcategory (R3)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R3.01	Major Regional Safety/Operational Projects	$ 235.4	$ 219.9	$ 126.0	$ 212.1	$ 793.5
R3.02	Safety/Operational Improvements	$ 106.6	$ 150.4	$ 184.9	$ 421.8	$ 863.8
R3.03	Intelligent Transportation Systems	$ 47.8	$ 118.1	$ 208.0	$ 380.8	$ 754.7
R3.04	Incident Management	$ 35.2	$ 63.6	$ 110.1	$ 322.0	$ 530.9
R3.05	Traffic Management and Signals	$ 87.5	$ 192.4	$ 254.4	$ 404.7	$ 939.1
R3	Total	$ 512.4	$ 744.5	$ 883.5	$ 1,741.5	$ 3,881.9

Source: DVRPC 2013

R4. Pennsylvania Subregion Bike/Pedestrian Needs

This category identifies needs for trails, sidewalks, bike lanes, and other infrastructure to increase the region's bike and pedestrian friendliness to achieve Plan goals of a more multimodal transportation system.

'Off-road Trails' [R4.01] includes funding for The Circuit priority regional trail network and the completion of some additional segments on the wider Regional Trail Network envisioned in the *Connections (2035)* Long-Range Plan.

'On-road Facilities' [R4.02] include needs for pedestrian and bike safety and intersection improvements (countdown timers and crosswalks), streetscaping, sidewalks, Americans with Disabilities Act (ADA) curb cut requirements, bike lanes, bike/pedestrian bridges, overpasses or tunnels, and project engineering.

Table 13. Bike/Pedestrian Projects (R4)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R4.01	Off-road Trails	$ 33.6	$ 47.4	$ 58.2	$ 132.8	$ 272.0
R4.02	On-road Facilities	$ 26.2	$ 37.0	$ 45.5	$ 103.8	$ 212.5
R4	Total	$ 59.8	$ 84.4	$ 103.7	$ 236.6	$ 484.6

Source: DVRPC 2013

R5. Pennsylvania Subregion Roadway System Expansion Needs

A needs estimate was developed by updating the costs from the Major Regional Project list in the *Connections (2035)* Long-Range Plan. Additional needs were identified during a review of recent transportation studies and a call for projects with regional stakeholders. Projects included in the Plan can be found in Chapter 6.

'Major Regional Projects' [R5.01] are projects that add to, or substantially change, regional traffic patterns. Major new roadway capacity is defined as widening, extending, or building new limited-access freeways of any length; creating a new interchange or adding missing movements between freeways

(functional classes 1, 11, 12, or 99) and arterials; or widening, extending, or building new principal arterials (functional classes 2 or 12) for more than one lane mile. Hard shoulder running projects were identified as part of the update to the TOMP, but are considered to be system expansion projects in the Long-Range Plan. Proposed hard shoulder running projects include:

- I-476:
  - PA 3 to Baltimore Pike SB;
  - Baltimore Pike to PA 3 NB; and
  - I-95 to/from Baltimore Pike.
- I-95 Southbound:
  - Street Rd. (Exit 37) to Cornwells Heights SEPTA Station;
  - Woodhaven Rd to Cottman/Princeton Ave. (Exit 35 to Exit 30);
  - I-76 to Broad St. (Exit 19 to Exit 17); and
  - I-476 to US 322 East (Exit 7 to Exit 4).
- I-95 Northbound:
  - Delaware State Line to US 322 West (Exit 3); and
  - I-76 to I-676 (Exit 19 to Exit 22).
- I-76:
  - I-676 to Girard Ave. WB (Zoo traffic).
- US 422:
  - PA 363 to PA 29 WB.

'Minor System Expansion Projects' [R5.02] includes funding for minor system expansion projects in the current fiscally constrained TIP, projects identified in the unfunded TIP illustrative list, and projects brought forward during the call for projects.

Specific minor regional projects considered in the Plan include US 1/Baltimore Pike widening in selective locations between Kennett Square Bypass and Greenwood Road; widening South Gulph Road from Henderson to Gulf Mills Road; extending Bryn Mawr Avenue to create a bypass around the intersection of PA 3 West Chester Pike and PA 252 Newtown Street; widening PA 113 from US 30 to Peck Road; extending Bridgewater Road from Concord Road to PA 452/US 322; connecting Portzer Road between Route 663 and PA 309; extending Bristol Road from US 202 to Park Avenue; widening Belmont Avenue around I-76; widening PA 252 Providence Road from Palmer's Mill Road to Kirk Lane; extending Boot Road over Brandywine Creek; completing the US 202 and US 1 loop roads from Applied Card Way to Hillman Drive; extending Galloway Road from Hulmeville Road to Bridgewater Road; extending Guthriesville Loop Road from Bollinger Road to US 322; and connecting G.O. Carlson Boulevard between PA 340 and Lloyd Avenue.

Table 14. Roadway System Expansion (R5)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R5.01	Major Regional Project	$ 281.7	$ 305.7	$ 184.8	$ 661.1	$ 1,433.3
R5.02	Minor System Expansion	$ 19.5	$ -	$ 28.2	$ 64.3	$ 112.1
R5	Total	$ 301.2	$ 305.7	$ 213.0	$ 725.5	$ 1,545.4

Source: DVRPC 2013

R6. Pennsylvania Subregion Other Needs

To develop the 'Roadway Other' needs assessment, 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 give a better cost estimate. Many of these needs are fixed, so this category is generally fully funded.

'Environmental Mitigation' [R6.01] includes PennDOT's environmental cleanup and protection program, consisting of 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.

'Air Quality' [R6.02] includes funding for the CMAQ project engineering, diesel retrofits, and the Air Quality Action Program. Current federal guidance suggests a minimum of 25 percent of CMAQ funds should go toward diesel retrofit projects. MAP-21 federal guidance is not yet available, but the priority to reduce $PM_{2.5}$ (fine particular matter) includes diesel retrofits for this purpose.

'Debt Service' [R6.03] has no current funding need in the Pennsylvania subregion.

'Travel Demand Management' [R6.04] includes funding for Transportation Management Associations (TMAs); marketing for the RideECO commuter benefits program, the Mobility Alternatives Program (MAP), and Share-A-Ride (SAR). Some of these programs require a local match, which is not reflected in the need here.

'Rail Improvements' [R6.05] include improvements to both the freight and passenger rail systems. No funding need is estimated here because of a lack of a comprehensive needs assessment. This does not mean there is no need.

'Miscellaneous Other' [R6.06] includes funding for parking facilities, security, consultant and design services, dam rehabilitation/reconstruction, local and regional planning, regional GIS support, and the regional travel demand model, and other miscellaneous items, such as equipment purchases, and maintenance and storage facilities.

Table 15. Roadway Other (R6)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
R6.01	Environmental Mitigation	$ 14.4	$ 20.4	$ 25.0	$ 57.1	$ 116.9
R6.02	Air Quality	$ 10.7	$ 15.2	$ 18.7	$ 42.5	$ 87.1
R6.03	Debt Service	$ -	$ -	$ -	$ -	$ -
R6.04	Travel Demand Management	$ 14.0	$ 19.7	$ 24.3	$ 55.3	$ 113.3
R6.05	Rail Improvements	$ -	$ -	$ -	$ -	$ -
R6.06	Miscellaneous Other	$ 19.0	$ 22.5	$ 27.6	$ 63.0	$ 132.0
R6	Total	$ 58.1	$ 77.7	$ 95.6	$ 218.0	$ 449.4

Source: DVRPC 2013

Pennsylvania Subregion Transit Needs

The following sections detail the identified transit needs over the life of *Connections 2040* for the Pennsylvania subregion for each of the six transit funding categories.

T1. Pennsylvania Subregion Rail Infrastructure Needs

SEPTA rail infrastructure needs were developed using its new asset management system to determine regular maintenance cycles, such as how often they need to be rehabilitated, restored, or replaced. Rail infrastructure needs include bridges, rails, rail ties, beds, signals, catenaries, and power substations. PATCO identified its rail infrastructure needs, which are also included here.

'Track Rehabilitation/Resurfacing/Replacement' [T1.01] includes continuous welded rail/slope/sinks and replacement of the ties and on the Norristown High Speed Line (NHSL), Route 11 and Route 15 track renewal, and regular funding for rail maintenance through SEPTA's infrastructure safety and renewal program. SEPTA's asset management program defined full rail needs. Much of SEPTA's rail track infrastructure is approaching the end of its 50-year life expectancy.

'Catenary and Substation Rehabilitation/ Replacement' [T1.02] includes catenary replacement on the Doylestown, Warminster, Fox Chase, and Media-Elwyn lines and the 30th Street 'K' and Powelton Yard, along with substation replacements at Wayne Junction, Bethayres, Ambler, Jenkintown, Wayne Junction Static Frequency Converter, Media-Sharon Hill, Lenni, Morton, Chestnut Hill East, Doylestown, and Hatboro substations, plus equipment replacement on Market-Frankford Line substations. SEPTA's asset management program defined full catenary and substation needs.

'Signal and Communications Rehabilitation/ Replacement' [T1.03] includes funding needs for Automatic Train Control, Norristown Line signals and special work, Cynwyd Line connection, signals, special work, and right-of-way improvements, Route 101/102 signals and interlocking improvements (for Automatic Trolley Control), radiax/radio interoperability for the Broad Street and Market-Frankford lines, Paoli Line interlockings and signals, Broad Ridge Spur signals, and switch heaters for the Powelton rail yard. SEPTA's asset management program defined full signal and communications needs.

'Rail Bridge/Elevated Structure Improvements' [T1.04] include replacement of bridge 0.35 on the Chestnut Hill West Line, the NHSL Schuylkill River Viaduct, NHSL Bridge 0.15, three Media-Elwyn Line viaduct timbers and the Crum Creek Viaduct, the Stone Arch Bridge Program, rehabilitation of seven bridges on the Chestnut Hill West Line, five bridges on the Chestnut Hill East Line, and mainline bridge rehab, as well as funding from the infrastructure safety and renewal program to address future bridge needs as they arise. SEPTA's asset management program defined full rail bridge needs.

'Tunnel/Tunnel Support Systems Improvements' [T1.05] includes funding to replace and upgrade the tunnel systems' lighting. SEPTA's asset management program defined full tunnel needs.

'Amtrak Lease Agreements' [T1.06] are payments that SEPTA makes to Amtrak to use tracks on the Trenton, Wilmington, and Paoli-Thorndale lines. These leases also help Amtrak pay for track, bridge, signal, and catenary needs along these routes.

T2. Pennsylvania Subregion Vehicle Infrastructure Needs

Needs for vehicle infrastructure were determined using SEPTA's new asset management system. Major new vehicle purchases may be completed through bonding to flatten large up-front costs. SEPTA's willingness or ability to issue additional bonds may be limited in the future due to already high levels of indebtedness.

Table 16. Rail Infrastructure Rehabilitation and Restoration (T1)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T1.01	Track Rehabilitation/Resurfacing/ Replacement	$ 575.2	$ 736.8	$ 1,020.4	$ 1,632.6	$ 3,965.0
T1.02	Catenary and Substation Rehabilitation/Replacement	$ 464.6	$ 247.2	$ 599.8	$ 147.5	$ 1,459.0
T1.03	Signal/Communications Rehabilitation/Replacement	$ 338.1	$ 444.2	$ 527.1	$ 1,261.8	$ 2,571.2
T1.04	Rail Bridge/Elevated Structure Improvements	$ 1,018.4	$ 45.7	$ 178.9	$ 342.2	$ 1,585.3
T1.05	Tunnel/Tunnel Support Systems Improvements	$ 309.4	$ 3.7	$ 60.1	$ 177.2	$ 550.3
T1.06	Amtrak Lease Agreements	$ 152.0	$ 220.0	$ 268.5	$ 608.0	$ 1,248.6
T1	Total	$ 2,857.7	$ 1,697.5	$ 2,654.8	$ 4,169.4	$ 11,379.4

Source: DVRPC 2013

DRPA/PATCO and Pottstown Area Rapid Transit (PART) also identified their vehicle fleet needs.

'New Bus' [T2.01] includes the need to regularly replace buses every 12 years. This would require the purchase of 2,260 new 40-foot buses, 255 new 60-foot buses, and 38 trackless trolleys over the 27-year *Connections 2040* Plan.

'New Light Rail Vehicle' [T2.02] includes the need to purchase 55 articulated trolleys and 115 trolleys.

'New Heavy Rail Vehicle' [T2.03] includes the need to either purchase new, or rehabilitate 125 Broad Street Line vehicles in the 2020s. The federal portion for the ongoing rehabilitation of PATCO's 121 vehicles is also included here.

'New Commuter Rail Vehicle' [T2.04] includes the need to purchase 245 new Silverliner VI vehicles to replace the aging Silverliner IV vehicles and expand the size of the fleet to deal with overcrowding issues on the regional rail lines.

'New Paratransit Vehicle' [T2.05] includes the need to purchase 148 new seven-passenger minivans, 121 new 12-passenger minivans, 1,725 new hi-cap paratransit vehicles, and 60 new paratransit sedans for SEPTA operations.

'Vehicle Overhaul Program' [T2.06] includes regular vehicle overhaul (buses, light, heavy, and commuter rail cars) at the midyear of the expected lifespan (six years for buses and 15 to 20 years for rail vehicles). Included in this category is an overhaul of the Market-Frankford Line and Norristown High Speed Line vehicles to extend their service lives. Both of these fleets will have reached an age where they would typically be replaced.

'Vehicle Storage and Maintenance Facilities' [T2.07] includes the need to replace the roof at the Berridge shop, Woodland shop, Callowhill shop, Fern Rock carhouse, Comly shop, 69th Street Transportation Center support facility, Overbrook support facility, Comly support facility, Roberts support facility, and Callowhill bus garage; new fencing at Powelton Yard, 69th Street Motor Shop, and Lansdale Signal Hut; a new rail shop at Midvale; and expansion of rail yard storage to meet the needs of a larger rail fleet.

'Utility Vehicles' [T2.08] includes maintenance and replacement needs for all nonrevenue transit vehicles.

Table 17. Transit Vehicle Rehabilitation and Replacement (T2)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T2.01	New Bus	$ 324.4	$ 370.4	$ 616.1	$ 1,112.8	$ 2,423.7
T2.02	New Light Rail Vehicle	$ 437.7	$ 690.5	$ 141.2	$ 103.1	$ 1,372.6
T2.03	New Heavy Rail Vehicle	$ 3.3	$ 495.6	$ 377.9	$ 787.2	$ 1,664.0
T2.04	New Commuter Rail Vehicle	$ 747.2	$ 326.8	$ 313.3	$ 302.1	$ 1,689.4
T2.05	New Paratransit Vehicle	$ 13.4	$ 20.1	$ 29.3	$ 59.0	$ 121.9
T2.06	Vehicle Overhaul Program	$ 331.4	$ 491.6	$ 604.4	$ 1,381.7	$ 2,809.1
T2.07	Vehicle Storage and Maintenance Equipment	$ 133.4	$ 164.7	$ 159.4	$ 121.7	$ 579.2
T2.08	Utility Vehicles	$ 112.5	$ 100.5	$ 201.2	$ 337.9	$ 752.1
T2.09	Vehicle Maintenance Equipment	$ 59.1	$ 50.8	$ 69.9	$ 17.4	$ 197.3
T2	Total	$ 2,162.5	$ 2,711.1	$ 2,512.8	$ 4,222.8	$ 11,609.3

Source: DVRPC 2013

'Vehicle Maintenance Equipment' [T2.09] includes replacement needs for vehicle maintenance equipment, such as new vehicle washers for the Midvale bus garage.

T3. Pennsylvania Subregion Station Infrastructure Needs

Needs for this infrastructure were determined using SEPTA's new asset management system. DRPA/PATCO identified station needs as part of the financial plan update.

'Station Renovation' [T3.01] includes regular renovation, approximately every 30 years, for all stations in the subregion, including meeting Americans with Disabilities Act accessibility requirements. Specific current projects include SEPTA's Smart Stations program for the Broad Street and Market-Frankford lines, ramp replacement at Fern Rock, bus trolley loop rehabilitation, rehabilitations at Exton, Fifth Street, Noble, Elkins Park, Roslyn, Hatboro, Willow Grove, Secane, City Hall, Paoli, Ardmore, Levittown, and 69th Street, and Americans with Disabilities Act accessibility requirements at Race-Vine Station.

Station needs also account for relocating Highland Avenue Station in Chester City, and consolidating separate stations on the Norristown High Speed Line and the Paoli-Thorndale Line, in Radnor Township.

'Parking' [T3.02] includes expansion of parking at existing stations, creation of new park-and-ride lots, and rehabilitation of existing parking facilities. Specific project locations include Gwynedd Valley, North Wales, and Philmont.

Table 18. Station Enhancements (T3)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T3.01	Station Renovation	$ 963.1	$ 405.7	$ 548.0	$ 1,390.4	$ 3,307.2
T3.02	Parking	$ 59.4	$ 753.5	$ 852.7	$ 197.8	$ 1,863.3
T3.03	Passenger Amenities	$ -	$ -	$ -	$ -	$ -
T3	Total	$ 1,022.4	$ 1,159.2	$ 1,400.6	$ 1,588.2	$ 5,170.5

Source: DVRPC 2013

Table 19. Transit Operational Improvements (T4)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T4.01	Intelligent Transportation Systems	$ 6.1	$ 10.7	$ 16.6	$ 52.1	$ 85.5
T4.02	Real-Time Information	$ 14.1	$ 19.9	$ 24.4	$ 55.7	$ 114.0
T4.03	Signal Prioritization	$ 56.3	$ 79.5	$ 97.7	$ 203.8	$ 437.2
T4.04	Fare Modernization	$ 207.5	$ -	$ -	$ -	$ 207.5
T4.05	Double Tracking and Sidings	$ -	$ -	$ 433.4	$ 990.2	$ 1,422.0
T4.06	Trolley Reactivation	$ -	$ -	$ 194.7	$ 444.2	$ 638.9
T4	Total	$ 283.9	$ 110.0	$ 766.8	$ 1,746.0	$ 2,906.8

Source: DVRPC 2013

'Passenger Amenities' [T3.03] includes historic preservation, rehabilitation, and related activities; bus shelters; landscaping and other scenic beautification, including: street lights; 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. There are funding needs here, but since no comprehensive needs assessment has been prepared for this category, this has been left blank.

T4. Pennsylvania Subregion Operational Improvement Needs

Both SEPTA and DRPA/PATCO identified needs for operational improvements within their networks.

'Intelligent Transportation Systems' [T4.01] includes improvements to the SEPTA Operations Center, which covers all operating assets (rail, subway surface, buses, SEPTA police dispatch, and paratransit).

'Real-Time Information' [T4.02] needs estimate is based on creating smart bus stops, website, and an Interactive Voice Response (IVR) system.

'Signal Prioritization' [T4.03] needs estimate is based on creating bus and trolley priority treatment at intersections for two bus or trolley routes per year at an average cost of $5 million per route. The 2013 Pennsylvania TIP has signal prioritization projects on Routes 6, 52, 60, and 66. Other example locations could include recent DVRPC signal prioritization studies along West Chester Pike and PA 611.

'Fare Modernization' [T4.04] is based on the remaining obligations for fare modernization or "New Payment Technologies" estimate in the 2012 SEPTA Capital Budget, which was $207.5 million.

'Double Tracks and Sidings' [T4.05] includes a third track for the Norristown Line, separation between SEPTA and CSX on the West Trenton Line, 3.5 miles of double tracking on the Warminster Line, trailing point crossover between Hunt and Wayne, the Phil flyover, double tracking the Media trolley line between I-476 and Woodland Avenue, and restoring two-way service on the Route 13 trolley between Yeadon loop and Darby Transportation Center.

'Trolley Reactivation' [T4.06] includes reactivating bus routes 23 and 56 as trolleys.

T5. Pennsylvania Subregion Transit System Expansion Needs

The region's desired list of system expansion projects are drawn from the *Connections (2035)* Plan, DVRPC's *Long-Range Vision for Transit* report, and county and transit agency priorities.

Table 20. System Expansion (T5)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T5.01	System Expansion	$ -	$ -	$ 1,735.5	$ 3,958.7	$ 5,694.2

Source: DVRPC 2013

'System Expansion' [T5.01] includes potential projects such as the extension of the Elwyn Line to Wawa, rapid transit service along Roosevelt Boulevard, extension of the Norristown High Speed Line to King of Prussia, extension of the Lansdale Line to Pennridge, extension of the Paoli-Thorndale Line to Atglen, a new line along Delaware Avenue in Philadelphia, extension of the Broad Street Line to the Navy Yard, and a new Cultural Connector Line from City Branch to the Centennial District in Philadelphia. A full list of the projects in the Plan can be found in Chapter 6 of this document.

T6. Pennsylvania Subregion Transit Other Needs

The estimated cost of 'Other' transit needs in the Pennsylvania subregion is based on safety and security needs identified by SEPTA, ongoing funding for coordinated human services, and current outstanding debt service.

'Safety' [T6.01] includes 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.

'Security' [T6.02] estimate provided by SEPTA and PATCO.

'Coordinated Human Services' [T6.03 includes grants that are made under Job Access and Reverse Commute (JARC), New Freedom, and Section 5310 programs for items such as communications equipment, capital equipment, operating costs, and vanpools.

'Debt Service' [T6.04] includes debt service on infrastructure and the 1234 Market Street building, debt on variable rate interest, and debt on the Silverliner V cars and Wayne Junction Station.

'Transit Other' [T6.05] includes warehouse lease, copiers leases, CARD microwave Towers Lease, and Federal PM Operating and Tire leases, funds for the Delaware River Ferry system, and operating assistance funds for Pottstown Area Rapid Transit.

Table 21. Transit Other (T6)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2018	2019-2024	2025-2030	2031-2040	Total
T6.01	Safety	$ 7.5	$ -	$ -	$ -	$ 7.5
T6.02	Security	$ -	$ -	$ -	$ -	$ -
T6.03	Coordinated Human Services	$ 45.1	$ 63.6	$ 78.2	$ 178.4	$ 365.3
T6.04	Debt Service	$ 255.3	$ 227.6	$ 91.1	$ -	$ 574.1
T6.05	Transit Other	$ 196.6	$ 238.1	$ 241.0	$ 411.3	$ 1,087.1
T6	Total	$ 504.5	$ 529.4	$ 410.4	$ 589.7	$ 2,034.0

Source: DVRPC 2013

New Jersey Subregion Roadway Needs

The following sections detail the identified roadway needs over the life of *Connections 2040* for the New Jersey subregion for each of the six roadway funding categories.

R1. New Jersey Subregion Pavement Needs

NJDOT has defined a state of good repair as achieving and maintaining 80 percent of its lane miles in either 'good' or 'fair to mediocre' condition (less than 20 percent deficient by International Roughness Index (IRI) and Surface Distress Index (SDI)). The IRI measures smoothness conditions, while the SDI evaluates the type, severity, and extent of surface distress exhibited by cracking and other visible deterioration. SDI is reported on a scale of zero to five (where five is a perfect pavement free of any distress). The criteria used to evaluate the pavement condition status are shown in Table 22.

Table 22. Pavement Condition Criteria

Condition Status	International Roughness Index (IRI, in/mi)	Surface Distress Index (SDI)
Deficient (Poor)	> 170	0 - 2.4
Fair	95 - 170	> 2.4 and < 3.5
Good	> 0 and < 95	3.5 - 5.0

Source: The Road Information Program, Washington, D.C. 2004

State DOTs are required to maintain a Pavement Management System (PMS), which tracks the condition of all federal- and state-maintained roadways. Statewide, New Jersey DOT maintains approximately 4,675 two-way directional miles in the state highway system, which is about 8,364 lane miles of mainline pavement. Of this amount, approximately 1,055 linear miles and 1,970 lane miles are within the DVRPC region, about 23.6 percent of the total statewide network.

Permanent Pavement

New Jersey DOT's pavement reconstruction project on I-295 from milepost 45 to milepost 57 rubblized the old road materials to build a 12-inch thick base. This strong base is designed to allow the road to exist in perpetuity so long as it receives regular preservation and resurfacing activities that keep it watertight and protect the base layer. The actual cost of a road rubblization project is slightly higher than regular reconstruction. But by not having to reconstruct this road, considerable savings can be achieved in the future. NJDOT is currently investigating other roads where this process could be replicated.

Utilizing roadway data collected and stored in the PMS, NJDOT is able to forecast future pavement conditions under various budget scenarios. A query is run using the PMS database to calculate lane miles of mainline pavement falling into each condition status category, followed by further analysis on the deficient portion using the following three conditions:

- **Rough Only:** Road segments with deficient roughness, but without deficient surface distress.
- **Distressed Only:** Road segments with deficient surface distress, but without deficient roughness.
- **Rough and Distressed:** Road segments with deficient roughness and deficient surface distress.

DVRPC developed a routine 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 used data from NJDOT's PMS and is detailed in Appendix A. Needs for culvert rehabilitation and replacement are included in pavement reconstruction needs and excluded in the bridge needs assessment (R2).

'Major Regional Pavement Reconstruction' [R1.01] is reserved to list specific regional roadway reconstruction priorities that are not currently in the

TIP. Major regional pavement reconstruction projects considered here can be found in the fiscally constrained and unfunded transportation vision major regional project tables in *Connections 2040*.

'**Preventative Maintenance' [R1.02]** projects include crack sealing, milling and filling, shoulder cuts, oil chip sealing, or microsurfacing.

'Resurfacing' [R1.03] should occur every seven years on interstates, every 12 to 15 years on the NHS and other major arterials, and every 25 years on lower traffic arterials and local roads. Resurfacing need is only identified on roads less than 50 years old.

'Reconstruction' [R1.04] need is identified on roads greater than 50 years old and in poor condition.

'Appurtenances' [R1.05] includes signs, guardrail/guide barriers, drainage, pavement markings, lighting, and retaining walls that are part of the roadway system. Regional need for New Jersey was estimated by using a methodology developed by the PennDOT Bureau of Maintenance and Operations. More information can be found in Appendix B of PennDOT's *Developing Regional Long-Range Plans: Resource Guidance for Pennsylvania Planning Partners.*

'Local Federal Aid Roadways' [R1.06] assumes $7,500 per lane mile per year for 660 linear miles of local federal aid roads, assuming two lane miles per linear mile. The source of this annual cost estimate can be found in Appendix B of PennDOT's *Developing Regional Long-Range Plans: Resource Guidance for Pennsylvania Planning Partners.*

R2. New Jersey Subregion Bridge Needs

State DOTs are required to maintain a Bridge Management System (BMS), which tracks the structural condition of key bridge elements for all bridges greater than 20 feet in length, regardless of ownership. The BMS scores the condition of the deck, substructure, and superstructure on a scale of zero to nine. Any of these items scoring a four or below indicates that the bridge is structurally deficient and in need of major repair work or replacement.

NJDOT defines a bridge as being in a SGR if it does not need any significant maintenance work in the next 10 years. NJDOT has set varying state-of-good-repair targets for each subclass of bridges in its system. For major viaducts, the goal is 89 percent, for moveable bridges it is 67 percent, for standard bridges it is 93 percent, and for minor bridges it is 95 percent. The actual statewide conditions for these subclasses are 81 percent of major viaducts are in a SGR, as are 37 percent of moveable bridges, 90 percent of standard bridges, and 94 percent of minor bridges. NJDOT prioritizes its bridge maintenance work to address high volume roads and bridges.

Table 23. Pavement (R1)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R1.01	Major Regional Pavement Reconstruction	$ 101.9	$ 71.0	$ 155.6	$ 310.2	$ 638.7
R1.02	Preventative Maintenance	$ 43.9	$ 99.0	$ 111.9	$ 389.3	$ 644.1
R1.03	Resurfacing	$ 159.8	$ 212.5	$ 640.6	$ 1,920.0	$ 2,932.9
R1.04	Reconstruction	$ 63.8	$ 91.4	$ 29.8	$ 415.1	$ 600.2
R1.05	Appurtenances	$ 81.4	$ 141.5	$ 202.9	$ 404.6	$ 830.3
R1.06	Local Federal Aid Roads	$ 44.6	$ 77.5	$ 111.2	$ 221.6	$ 454.8
R1	Total	$ 495.3	$ 692.9	$ 1,252.0	$ 3,660.8	$ 6,101.0

Source: DVRPC 2013

Table 24. Bridges (R2)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R2.01	Major Regional Bridge Replacement	$ -	$ -	$ 186.9	$ 225.9	$ 412.7
R2.02	Bridge Maintenance	$ 48.4	$ 69.7	$ 84.9	$ 226.7	$ 429.8
R2.03	Bridge Rehabilitation	$ 417.4	$ 600.7	$ 415.2	$ 1,272.8	$ 2,706.0
R2.04	Bridge Replacement	$ 294.5	$ 279.7	$ 12.6	$ 871.6	$ 1,458.4
R2.05	Bridge Removal	$ -	$ -	$ -	$ -	$ -
R2.06	Local Federal Aid Bridges	$ 138.0	$ 14.0	$ 165.5	$ 480.0	$ 797.5
R2	Total	$ 898.3	$ 964.2	$ 1,052.0	$ 3,302.7	$ 6,217.2

Source: DVRPC 2013

The four-county DVRPC New Jersey subregion currently has about seven million square feet of bridge deck area maintained by state, county, or local transportation agencies. Approximately 12 percent of the state's bridges are rated as deficient, but they account for only five percent of the New Jersey subregion's deck area.

DVRPC developed a methodology for analyzing future pavement condition based on normal wear and tear on bridges and accounting for the impact of bridge projects programmed in the 2014 NJ TIP. This analysis used data from NJDOT's BMS and is detailed in Appendix B. Needs for culvert rehabilitation and replacement are included in pavement reconstruction needs and are not included in the bridge needs assessment (R2).

'Major Regional Bridge Replacement' [R2.01] Major regional bridge reconstruction projects considered here can be found in the fiscally constrained and unfunded transportation vision major regional project tables in *Connections 2040*.

'Bridge Maintenance' [R2.02] projects include bridge deck overlays, scour, expansion joint replacement, painting, and other low-cost preservation activities. These projects should occur at each bridge every 15 to 25 years, as long as the bridge is in a SGR. Bridges in poor condition are generally targeted for rehabilitation or replacement and undergo basic maintenance only as emergency stopgap measures to ensure that the bridge can remain open to traffic.

'Bridge Rehabilitation' [R2.03] generally involves rehabilitating or replacing one or more of the three main bridge components: the deck, the superstructure, or the substructure.

'Bridge Replacement' [R2.04] generally, each bridge is built with an expected 50- to 100-year lifespan. After a bridge has passed this lifespan and is approaching a condition that warrants replacement, it is replaced with a new bridge.

'Bridge removals' [R2.05] currently has no identified need in the New Jersey subregion.

'Local Federal Aid Bridges' [R2.06] includes needs for county and locally maintained bridges over 20 feet in length that are eligible for federal aid.

R3. New Jersey Subregion Operational Improvement Needs

DVRPC's transportation operations staff developed the Transportation Operations Master Plan (TOMP) for the nine-county region. The purpose of the TOMP is to present a comprehensive long-term vision of transportation operations, bridging individual programs to create a cohesive regional vision. It was developed in cooperation with DVRPC's Transportation Operations Task Force (TOTF), which is composed of traffic,

transit, and emergency management operators in the region. The TOMP highlights four major operational themes: incident management, traffic management, transit operations, and traveler information. Several operational needs emerged, including obtaining real-time accurate information, sharing information among agencies and with the public, and having the appropriate resources available to respond to incidents. The TOMP identifies operational strategies, such as the addition of transportation operations centers, variable speed limit signs, closed circuit TV cameras, weigh-in-motion detectors, modernization of traffic signals, closed-loop traffic signal systems, cyclical resynchronization of traffic lights, and locations for parking management systems.

Transportation operations have unique funding and implementation requirements. While Intelligent Transportation Systems (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.

'Major Regional Safety/Operational Projects' [R3.01] includes the NJ 29 conversion from a freeway to a parkway and the operational portion of other major regional projects, including Direct Connect and Missing Moves.

'Safety/Operational Improvements' [R3.02] includes intersection/interchange improvements, roadway realignments, channelization, roundabouts, access management, new turning lanes, and grade-separated rail crossings.

'Intelligent Transportation Systems' [R3.03] includes capital and operating costs for ITS deployment and traffic operations centers. Funds will support DOT, local/county, and DRPA operations. ITS deployment includes:

- ITS Infrastructure (mostly infill to additional equipment where needed along these facilities):
  - I-76;
  - I-95;
  - I-195;
  - I-295;
  - I-676;
  - US 1 Freeway;
  - US 130;
  - NJ 42;
  - NJ 55;
  - NJ 90; and
  - NJ 29/NJ 129.
- Road Weather Information Systems (RWIS):
  - Burlington County;
  - Camden County;
  - Gloucester County; and
  - Mercer County.
- Roadway Treatment Systems;
- NJDOT Transportation Operations Centers (TOCs); and
- County TOCs:
  - Camden County;
  - Burlington County;
  - Gloucester County; and
  - Mercer County.

'Incident Management' [R3.04] includes capital and operating funds for emergency service patrols. Proposed incident management projects include:

- Emergency Service Patrols:
  - Sixteen hours, limited weekends; and
  - Twenty-four hours, full weekends.
- Regional Integrated Multimodal Information System (RIMIS):
  - Enhancements/upgrades.
- Incident Management (IM):
  - IM Task Forces;
  - IM Grant Initiative;

Table 25. Roadway Operational Improvements (R3)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R3.01	Major Regional Safety/Operational Projects	$ 173.2	$ 51.9	$ 192.0	$ 382.8	$ 799.9
R3.02	Safety/Operational Improvements	$ 89.8	$ 156.2	$ 224.1	$ 446.7	$ 296.6
R3.03	Intelligent Transportation Systems	$ 25.2	$ 38.6	$ 80.5	$ 104.9	$ 249.2
R3.04	Incident Management	$ 32.8	$ 62.6	$ 77.7	$ 180.9	$ 354.0
R3.05	Traffic Management and Signals	$ 6.0	$ 21.3	$ 52.7	$ 151.4	$ 231.4
R3	Total	$ 327.1	$ 330.6	$ 627.0	$ 1,266.7	$ 2,551.4

Source: DVRPC 2013

  - Quick Clearance/IM Safety Issues (i.e., "Move It/Move Over/Quick Clearance" Policies);
  - Accident Investigation Equipment; and
  - Towing Incentive Program.
- Arterial Management – Integrated Corridor Management.

'Traffic Management and Signals' [R3.05] includes needs for traffic signal replacement and retiming, traffic management through variable speed limit signs, active traffic management, which allows for hard shoulder running, and local traffic signals. Traffic Management and Signal needs include:

- County Traffic Signal Retiming and Upgrade Programs;
- Ramp Metering;
- Variable Speed Limits;
- Hard Shoulder Running;
- Active Traffic Management; and
- Parking Management.

R4. New Jersey Subregion Bike/Pedestrian Needs

This category reflects needs for bicycling and pedestrians and contains a number of related items, such as landscaping, beautification, signage, street furniture, etc. Estimated need for these categories is based on funding levels in the FY 2012 to 15 DVRPC TIP, as well as some target funding levels to increase the region's bike and pedestrian friendliness in order to help achieve some of the Plan's goals.

'Off-road Trails' [R4.01] includes funding for The Circuit priority regional trail network and for some of the wider Regional Trail Network envisioned in the *Connections* (2035) Long-Range Plan.

'On-road Facilities' [R4.02] includes needs for pedestrian and bike safety and intersection improvements (e.g., countdown timers and crosswalks), streetscaping, sidewalks, bike lanes, bike/pedestrian bridges, overpasses, or tunnels, and project engineering.

Table 26. Bike/Pedestrian Projects (R4)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R4.01	Off-road Trails	$ 18.4	$ 27.5	$ 39.5	$ 78.8	$ 164.2
R4.02	On-road Facilities	$ 8.7	$ 13.1	$ 18.7	$ 37.4	$ 77.9
R4	Total	$ 27.1	$ 40.6	$ 58.2	$ 116.1	$ 242.1

Source: DVRPC 2013

Table 27. System Expansion Projects (R5)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R5.01	Major Regional Projects	$ 216.4	$ 105.5	$ 193.7	$ 386.1	$ 901.7
R5.02	Minor System Expansion	$ -	$ -	$ 44.5	$ 37.4	$ 81.9
R5	Total	$ 216.4	$ 105.5	$ 238.1	$ 423.5	$ 983.6

Source: DVRPC 2013

R5. New Jersey Subregion Roadway System Expansion Needs

System expansion needs estimates were based on updating the costs from the Major Regional Project list in the *Connections (2035)* Long-Range Plan. Additional needs were identified during a review of recent transportation studies and a call for projects with regional stakeholders. Projects included in the Plan can be found in Chapter 6.

'Major Regional Projects' [R5.01] are projects that add to or substantially change regional traffic patterns. Projects included in the Plan can be found on the major regional roadway system expansion projects table in *Connections 2040*.

'Minor System Expansion Projects' [R5.02] has identified three projects in the New Jersey subregion: a new connector road, called the West Trenton Bypass, from Bear Tavern Road to the intersection of Decou Avenue and Parkway Avenue; a one-lane grade-separated interchange on CR 533 over CR 638; and a new connector road in Ewing Village from Parkway Avenue to Scotch Road.

R6. New Jersey Subregion Roadway Other Needs

To develop the roadway 'Other' needs assessment, DVRPC extended historic spending levels on most of the subcategories in these areas and updated in the instances where NJDOT was able to give a better cost estimate.

'Environmental Mitigation' [R6.01] includes 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, cultural resource preservation, etc. 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. Ongoing need for previously completed projects is listed here.

'Air Quality' [R6.02] includes funding for CMAQ project engineering, diesel retrofits, and the Air Quality Partnership. Current federal guidance suggests that a minimum of 25 percent of CMAQ funds should go toward diesel retrofit projects.

'Debt Service' [R6.03] has no current regional need for NJDOT roadways.

'Travel Demand Management' [R6.04] includes funding for Transportation Management Associations (TMAs), and marketing for the RideECO commuter benefits program, the Mobility Alternatives Program (MAP), and Share-A-Ride (SAR).

'Rail Improvements' [R6.05] includes improvements to both the freight and passenger rail systems. No comprehensive needs assessment has been prepared for this category. While no funding need is shown at this time, there are unmet needs.

Table 28. Roadway Other (R6)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
R6.01	Environmental Mitigation	$ 0.5	$ 0.8	$ 1.1	$ 2.2	$ 4.6
R6.02	Air Quality	$ 1.5	$ 2.1	$ 2.6	$ 5.9	$ 12.0
R6.03	Debt Service	$ -	$ -	$ -	$ -	$ -
R6.04	Travel Demand Management	$ 9.8	$ 17.1	$ 24.5	$ 48.8	$ 100.2
R6.05	Rail Improvements	$ -	$ -	$ -	$ -	$ -
R6.06	Miscellaneous Other	$ 23.1	$ 40.1	$ 57.6	$ 114.8	$ 235.5
R6	Total	$ 34.8	$ 60.1	$ 85.7	$ 171.7	$ 352.3

Source: DVRPC 2013

'Roadway Other' [R6.06] includes funding for 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, maintenance and storage facilities.

New Jersey Subregion Transit Needs

The following sections detail the identified transit needs over the life of *Connections 2040* for the New Jersey subregion for each of the six transit funding categories.

T1. New Jersey Subregion Rail Infrastructure Needs

The basis of need for New Jersey Transit (NJ Transit) rail infrastructure was the statewide ARC Financial Plan. DRPA/PATCO identified its needs as part of the Plan update.

'**Track Rehabilitation/Resurfacing/Replacement**' **[T1.01]** is based on allocating six percent of NJ Transit's annual statewide needs to the DVRPC region, as identified in NJ Transit's ARC Financial Plan and a federal share for track needs identified by DRPA/PATCO.

'**Catenary and Substation Rehabilitation/ Replacement**' **[T1.02]** is a federal share based on needs identified by DRPA/PATCO.

'Signal/Communications Rehabilitation/Replacement' [T1.03] is based on allocating six percent of NJ Transit's annual statewide needs to the DVRPC region, as identified in NJ Transit's ARC Financial Plan and a federal share for needs identified by DRPA/PATCO.

'Rail Bridge/Elevated Structure Improvements' [T1.04] is based on allocating six percent of NJ Transit's annual statewide needs to the DVRPC region, as identified in NJ Transit's ARC Financial Plan and a federal share for needs identified by DRPA/PATCO.

'Tunnel/Tunnel Support Systems Improvements' [T1.05] is a federal share based on needs identified by DRPA/PATCO.

'Amtrak Lease Agreements' [T1.06] accounts for annual payments made by NJ Transit to lease track from Amtrak on the Northeast Corridor.

T2. New Jersey Subregion Vehicle Infrastructure Needs

NJ Transit identified the funding period in which each of its transit vehicles operating in the DVRPC region would need to be replaced or rehabilitated. DRPA/PATCO's vehicle fleet is currently being overhauled.

'New Bus' [T2.01] includes replacement needs for 96 new cruiser buses in 2016, 2028, and 2040. These buses run on the commuter routes between southern New Jersey and Philadelphia. Currently 40-feet in length, future buses will be 45-feet long to help meet increasing ridership demand. This category also includes the need to replace 179 transit buses in

Table 29. Rail Infrastructure Rehabilitation and Restoration (T1)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T1.01	Track Rehabilitation/ Resurfacing/Replacement	$ 62.7	$ 77.3	$ 131.2	$ 261.7	$ 532.9
T1.02	Catenary and Substation Rehabilitation/Replacement	$ 0.5	$ 0.8	$ 1.1	$ 2.2	$ 4.6
T1.03	Signal/Communications Rehabilitation/Replacement	$ 9.5	$ 7.0	$ 10.1	$ 20.1	$ 46.8
T1.04	Rail Bridge/Elevated Structure Improvements	$ 19.6	$ 34.1	$ 48.9	$ 97.5	$ 200.1
T1.05	Tunnel/Tunnel Support Systems Improvements	$ -	$ -	$ -	$ -	$ -
T1.06	Amtrak Lease Agreements	$ 9.2	$ 16.0	$ 23.0	$ 45.8	$ 94.1
T1	Total	$ 101.4	$ 135.2	$ 214.4	$ 427.4	$ 878.4

Source: DVRPC 2013

2022 and 2034. These buses will continue to be 40-feet long and operate as local bus service in each of the four New Jersey counties.

'New Light Rail Vehicle' [T2.02] includes replacement needs for the RiverLine vehicles in the 2031 to 2040 funding period.

'New Heavy Rail Vehicle' [T2.03] includes $5 million per year funding in 2014, 2015, and 2016 for the ongoing renovation of PATCO's 121 heavy rail vehicle fleet.

'New Commuter Rail Vehicle' [T2.04] includes identified needs for new 21 Electric Motor Units (EMUs) for the Northeast Corridor in the first and second funding periods, replacing 21 Northeast Corridor arrow cars in the 2020s, replacing 20 Atlantic City rail cars in the 2020s, and six new Atlantic City locomotives in the 2030s.

'New Paratransit Vehicle' [T2.05] includes regular replacement of paratransit vehicles for NJ Transit operations.

'Vehicle Overhaul Program' [T2.06] includes the need to regularly overhaul buses and rail vehicles (light, heavy, and commuter) at the midyear of the expected lifespan.

'Vehicle Storage and Maintenance Facilities' [T2.07] includes needs to maintain buildings and facilities at the Hamilton, Newton Avenue, and Washington Township bus garages, Camden City train yard, and Morrisville, Pennsylvania, train yard.

'Utility Vehicles' [T2.08] includes maintenance and replacement needs for all nonrevenue transit vehicles.

'Vehicle Maintenance Equipment' [T2.09] includes replacement needs for vehicle maintenance equipment.

T3. New Jersey Subregion Station Infrastructure Needs

NJ Transit identified when its stations in the region are planned for renovation. DRPA/PATCO estimated ongoing federal need for station renewal activities.

'Station Renovation' [T3.01] includes renovating all stations on the Atlantic City Line. It is based on NJ Transit's capital budget program.

'Expanded Station Parking' [T3.02] includes needs to expand parking at existing stations, create new park-and-ride lots, and maintenance and repaving needs at existing parking facilities.

Table 30. Transit Vehicle Rehabilitation and Replacement (T2)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T2.01	New Bus	$ 52.5	$116.8	$ 76.2	$ 299.1	$ 544.5
T2.02	New Light Rail Vehicle	$ -	$ -	$ -	$ 134.3	$ 134.3
T2.03	New Heavy Rail Vehicle	$ 20.3	$ -	$ -	$ -	$ 20.3
T2.04	New Commuter Rail Vehicle	$ 82.7	$ -	$ 197.4	$ 103.5	$ 383.6
T2.05	New Paratransit Vehicle	$ 2.6	$ 4.5	$ 6.5	$ 12.9	$ 26.5
T2.06	Vehicle Overhaul Program	$ 86.4	$ 56.4	$ 42.6	$ 123.7	$ 309.2
T2.07	Vehicle Storage and Maintenance Facilities	$ 32.9	$ 36.7	$ 71.6	$ 142.8	$ 284.1
T2.08	Vehicle Maintenance Equipment	$ 0.5	$ 0.8	$ 1.2	$ 2.3	$ 4.8
T2.09	Nonrevenue Vehicles	$ -	$ -	$ -	$ -	$ -
T2	Total	$ 277.8	$ 215.2	$ 395.5	$ 818.6	$ 1,707.2

Source: DVRPC 2013

Table 31. Station Enhancements (T3)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T3.01	Station Renovation	$ 3.2	$ 5.5	$ 15.9	$ 38.1	$ 62.6
T3.02	Parking (including Park-and-Ride Facilities)	$ 7.0	$ 12.2	$ 17.4	$ 34.8	$ 71.4
T3.03	Passenger Amenities	$ -	$ -	$ -	$ -	$ -
T3	Total	$ 10.1	$ 17.6	$ 33.3	$ 72.8	$ 134.0

Source: DVRPC 2013

'Passenger Amenities' [T3.03] includes historic preservation, rehabilitation, and related activities; bus shelters; landscaping and other scenic beautification, including street lights; public art; pedestrian access and walkways; bicycle access, including 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.

T4. New Jersey Subregion Operational Improvement Needs

NJ Transit, DRPA/PATCO, and DVRPC worked together to identify system and operational improvements. NJ Transit's primary focus is improving real-time passenger information.

'Intelligent Transportation Systems' [T4.01] needs estimate is based on creating smart bus stops, a website, and an Interactive Voice Response (IVR) system.

'Real-Time Information' [T4.02] need is included in T4.01 Intelligent Transportation Systems.

'Signal Prioritization' [T4.03] needs estimate is based on creating bus and trolley priority treatment at intersections for one bus route per year at an average cost of $5 million per route.

'Fare Modernization' [T4.04] is based on annual maintenance needs for NJ Transit farebox equipment.

'Double Tracks and Sidings' [T4.05] includes double tracking portions of the Atlantic City Line, purchasing additional vehicles, and station improvements to allow for more frequent service.

Table 32. Transit Operational Improvements (T4)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T4.01	Intelligent Transportation Systems	$ 15.2	$ 26.4	$ 37.9	$ 75.6	$ 155.1
T4.02	Real-Time Information	$ -	$ -	$ -	$ -	$ -
T4.03	Signal Prioritization	$ 22.5	$ 39.1	$ 56.1	$ 111.9	$ 229.7
T4.04	Fare Modernization	$ 4.5	$ 7.8	$ 11.2	$ 22.4	$ 45.9
T4.05	Double Tracking and Sidings	$ -	$ -	$ -	$ 358.2	$ 358.2
T4	Total	$ 42.2	$ 73.4	$ 105.3	$ 568.1	$ 788.9

Source: DVRPC 2013

Table 33. System Expansion (T5)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T5	System Expansion	$ 16.0	$ 30.0	$ 1,294.4	$ 2,580.9	$ 3,921.3

Source: DVRPC 2013

T5. New Jersey Subregion Transit System Expansion Needs

NJ Transit is committed to expanding public transit infrastructure through a continued obligation of the Transportation Trust Fund and federal resources.

Specific system expansion projects include new stations on existing lines (including station parking needs), extension of existing lines, new bus or rail routes, and development of bus rapid transit (BRT). Transit system expansion need is based on updated cost estimates for system expansion projects in the *Connections (2035)* plan, along with projects in DVRPC's *Long-Range Vision for Transit.*

BRT service could be accompanied by intercept parking garages and park-and-ride lots to increase multimodal connectivity. Other opportunities include promoting transit-oriented development around stations, encouraging and implementing new commuter option programs, and working with the state Transportation Management Associations (TMAs) to further extend reach into local communities. Shuttles, vanpools, taxis, and local paratransit services will feed the regional rail, bus, and light rail services, facilitating easy, timed transfers between services at key stations in the region.

'System Expansion' [T5.01] needs are project based. Identified projects include the NJ 42/55 South Jersey Bus Rapid Transit (BRT), US 1 BRT, the Glassboro-Camden Rail Line, and the West Trenton Line.

T6. New Jersey Subregion Transit Other Needs

Transit 'Other' funding needs are based on spending levels in the FY 2012 to 2015 TIP, and by need as indicated by NJ Transit and DRPA/PATCO.

'Safety' [T6.01] includes needs assessment that NJ Transit and PATCO have identified.

'Security' [T6.02] is based on upgrades, emergency, and annual needs identified in NJ Transit's ARC Financial Plan. Regional needs are estimated to be 23 percent of statewide needs.

'Coordinated Human Services' [T6.03] includes grants that are made under Job Access and Reverse Commute (JARC), New Freedom, and Section 5310 programs for items such as communications equipment, capital equipment, operating costs, or vanpools. These services are generally run by suburban operators for senior and disabled services, or shared ride programs.

'Debt Service' [T6.04] includes funds to retire the remaining debt on the RiverLine.

'Transit Other' [T6.05] includes the cost estimates for expenditure estimates for project planning, capital claims, environmental compliance, and capital program management.

Table 34. Transit Other (T6)

FP ID	LRP Subcategory	Millions of Y-O-E $s				
		2014-2017	2018-2023	2024-2030	2031-2040	Total
T6.01	Safety	$ 32.2	$ 56.0	$ 80.3	$ 160.1	$ 328.5
T6.02	Security	$ 9.6	$ 16.6	$ 23.9	$ 47.6	$ 97.6
T6.03	Coordinated Human Services	$ 16.0	$ 24.0	$ 44.9	$ 89.6	$ 174.5
T6.04	Debt Service	$ 172.5	$ 86.3	$ -	$ -	$ 258.8
T6.05	Transit Other	$ 7.7	$ 13.3	$ 19.1	$ 38.1	$ 78.1
T6	Total	$ 238.0	$ 196.2	$ 168.2	$ 335.3	$ 937.6

Source: DVRPC 2013

CHAPTER 3: Revenue Forecast

Revenue estimates for *Connections 2040* come from all federal, state, and local sources that the region can reasonably expect to receive through fiscal year (FY) 2040. All planning principles and financial assumptions in identifying federal and state financial resources are developed with and reviewed by the federal, state, and transit partners.

Federal funds to the region are dependent on federal authorization bills. The current federal funding legislation is MAP-21, which will expire at the end of FY 2014. State funding is set by state law. Historical data and trends serve as general guidance as to 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, MAP-21 planning guidance, and federal authorization levels.

Roadway and transit apportionment formulas used in this plan apply each state's share of the total authorized amount, and the DVRPC region's share of the state's share to calculate regional anticipated funding.

These revenue estimates are for capital project expenditures only, and do not include any operating funds. All revenue amounts are in year of expenditure dollars, as required by federal regulations. No new or undefined funding sources are recognized for the fiscally constrained plan. Relevant planning principles and financial assumptions are detailed in the following sections.

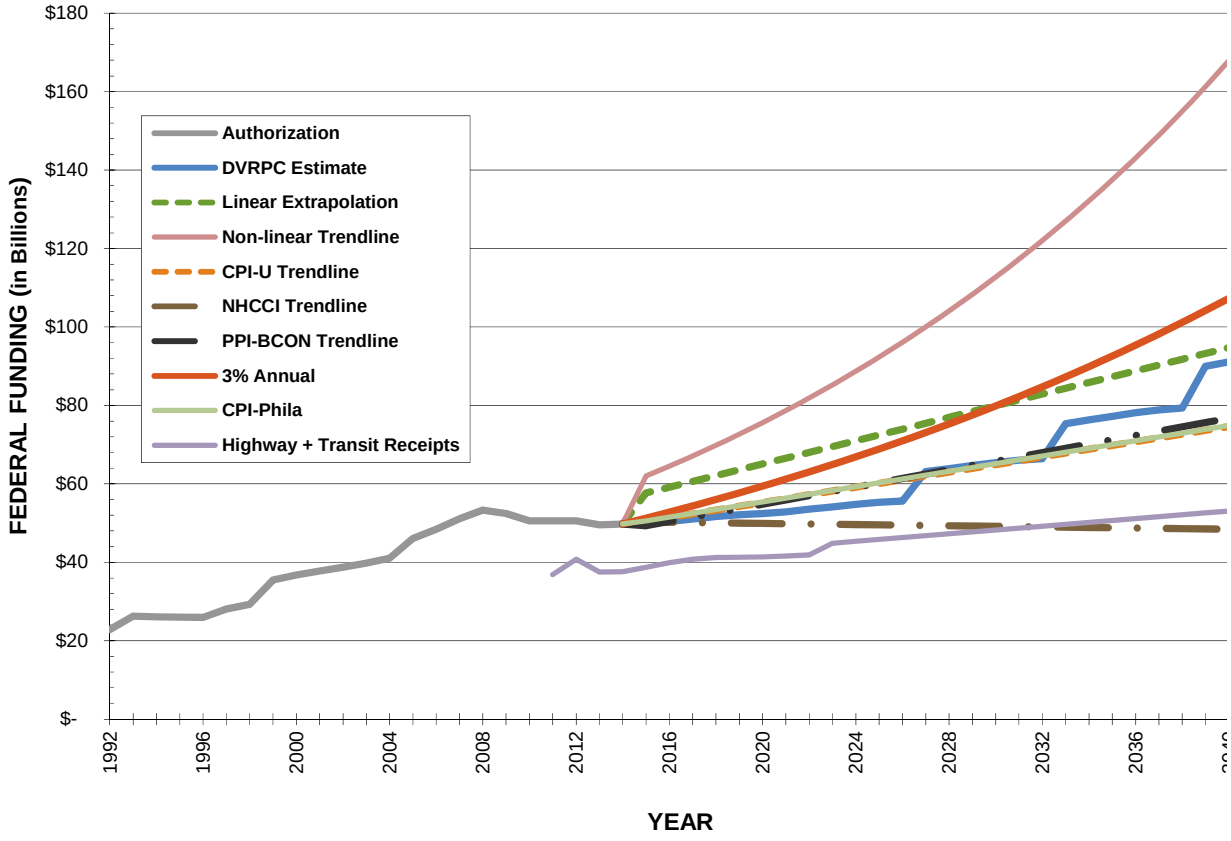
Federal Funding

The current two-year $109 billion MAP-21 federal transportation bill was passed after 33 months of extensions to the previous bill, SAFETEA-LU. Not only did MAP-21 take much longer to pass, but it was for only two years, compared to six years for previous bills. It maintained flat funding at the average annual rate of SAFETEA-LU, whereas each of the successive recent previous bills had largely increased in funding amounts. This is just one of several stark departures from previous long-range financial plan assumptions. Other assumptions that now appear less certain include: the expectation that funding will increase by three percent, compounded annually; and that revenue forecasts will correspond with six-year federal transportation legislation authorization periods. State guidance from Pennsylvania and New Jersey assumes that federal funding will be flat out to at least 2024.

DVRPC has historically used a method of estimating future federal funding by mimicking federal transportation legislation, with each six-year bill increasing by 19.4 percent (three percent compounded annually). This method also assumes an 80/20 split of federal funds between highways and transit, following a three percent takedown. This methodology was the basis for forecasts in the *Destination 2030* and *Connections (2035)* Plans. Three percent growth was a conservative rate compared to the growth over the previous federal transportation bills. The Intermodal Surface Transportation Equity Act (ISTEA), enacted in 1992, provided $155 billion in federal transportation funds over a six-year period. The Transportation Equity Act for the 21st century (TEA-21), enacted in 1998, provided $217 billion over six years, a 40 percent increase over ISTEA. SAFETEA-LU then provided $294 billion, again over six years. This was an increase of 35 percent over TEA-21 funding levels.

Figure 3 shows historic transportation funding levels from 1992 to 2014, and projected funding levels to 2040, using a variety of methods. The stepped line is DVRPC's traditional forecast of future federal transportation authorizations.

Figure 3. Historic and Forecasted Federal Transportation Funding Level (Nationwide)



Source: DVRPC 2013

As shown in Figure 3, the DVRPC methodology, while once conservative, would now expect a higher growth rate than most standard measures of inflation.

Recent analysis by the Congressional Budget Office (CBO) indicates long-term federal funding concerns. Tables 35 and 36 show the February 2013 projections for the highway transit fund and transit trust fund accounts. While the CBO reflects relatively flat transportation expenditures (outlays) out to 2023, the Highway Trust Fund would need an infusion of $91 billion to maintain this level of spending, while the Transit Trust Fund would need $33 billion.

Table 35. CBO Federal Highway Trust Fund February 2013 Forecast (Billions)

Highway Account	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Start-of-Year Balance	$ 14	$ 10	$ 5	$ 5	$ (6)	$ (16)	$ (26)	$ (36)	$ (46)	$ (56)	$ (67)	$ (79)
Revenues, Interest & Intergov.transfers	$ 35	$ 33	$ 33	$ 34	$ 35	$ 35	$ 36	$ 36	$ 36	$ 36	$ 36	$ 36
General Fund Transfer	$ 2	$ 6	$ 10	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Estimated Flexing -- Transfer of Cash	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Outlays	$ 42	$ 44	$ 44	$ 45	$ 45	$ 45	$ 46	$ 46	$ 46	$ 47	$ 48	$ 48
End-of-Year Balance	$ 10	$ 5	$ 5	$ (6)	$ (16)	$ (26)	$ (36)	$ (46)	$ (56)	$ (67)	$ (79)	$ (91)

Source: Congressional Budget Office 2013

Table 36. CBO Federal Transit Trust Fund February 2013 Forecast (Billions)

Transit Account	2012	2013	2014	2015	2016	2017	2018	2019	2020	2021	2022	2023
Start-of-Year Balance	$ 7	$ 5	$ 3	$ 2	$ (1)	$ (4)	$ (7)	$ (11)	$ (15)	$ (19)	$ (23)	$ (28)
Revenues & Interest	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5	$ 5
Intergovernmental Transfer	$ -	$ -	$ 2	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Estimated Flexing – Transfer of Cash	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -
Outlays	$ 7	$ 7	$ 8	$ 8	$ 8	$ 8	$ 9	$ 9	$ 9	$ 9	$ 10	$ 10
End-of-Year Balance	$ 5	$ 3	$ 2	$ (1)	$ (4)	$ (7)	$ (11)	$ (15)	$ (19)	$ (23)	$ (28)	$ (33)

Source: Congressional Budget Office 2013

New Starts, Small Starts, and Very Small Starts

The Federal Transit Administration's (FTA) discretionary New Starts program is the federal government's primary financial resource for supporting locally planned, implemented, and operated fixed-guideway transit capital investments. New Starts projects are fixed guideway transit lines that can receive up to $750 million in federal funding. Small Starts funds up to $75 million toward the construction of any project with a total capital development cost of less than $250 million. The Very Small Starts funding program allows for up to a 50 percent federal match on a new fixed guideway or bus rapid transit project under $50 million in capital costs.

MAP-21 provides efficiencies and expanded project eligibility to the New Starts program. Duplicative steps in the process are eliminated, and project evaluation criteria are simplified. Projects that expand the capacity of existing fixed guideways by more than 10 percent, and bus rapid transit routes that operate in a dedicated right of way, are now eligible for New Starts funding. MAP-21 includes funding of about $1.9 billion per year for the New Starts program.

The total impact of MAP-21 on these grant programs will not be fully known until the final rulemaking is complete. This will determine if there is a change to the cap on New Starts applications, which is currently $750 million. Projects requesting less than $100 million, or that are less than 50 percent New Starts funded, are eligible for an expedited project review. DVRPC has traditionally assumed that the region as a whole may be able to receive two New Start matches over the life of the long-range plan, one for each state subregion.

With the *Connections 2040* Plan update, DVRPC will assign New Starts, Small Starts, and Very Small Starts funds to specific projects. Up to one of each of these grants will be allowed for each state subregion. If no project is likely to be eligible for the funding, no funding is assumed. New Starts and Small Starts projects must include plans for the 50 percent local match requirements. The requirement includes a commitment of both capital and operating funds.

Two major issues have hurt the region's chances of securing this competitive funding. The first is that the region has largely lacked a specific plan for how to obtain the needed local funding match. The second issue is that the region's proposed projects haven't scored high enough to be eligible for funding. Most projects funded through the New Starts program over the past few years have had upwards of a 60 percent local funding match. Both states restrict the ability of local taxation to support transportation projects. One way to meet the local funding need would be a direct commitment of state funds, or a private-public partnership. 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 system expansion project.

State Funding

In April 2010, FHWA denied the Pennsylvania Turnpike's request to toll I-80. This was a critical component to funding Act 44 of 2007. Without I-80 tolling, Pennsylvania Turnpike lease payments to the state are capped at $250 million per year for transit operating costs and $200 million per year for roads and bridges. Had this portion of Act 44 been implemented, the Pennsylvania side of the region could have anticipated an additional $10.1 billion (including transit operating funds) over the life of the Plan. What remains of Act 44 funding is unclear due to growing Pennsylvania Turnpike Commission debt and uncertainty that it will be able to meet all future obligations.

In 2011, the Transportation Funding Advisory Commission (TFAC) estimated a $3.5 billion annual unmet transportation funding need in the commonwealth. This amount is increasing each year. TFAC identified and recommended an additional funding stream of $2.5 billion per year, filling the remainder of the gap with efficiencies and cost savings. The Commission also advocated for increasing private sector involvement in transportation project finance, giving local governments more control over planning and funding of projects, and using new technologies to lower costs. Only a few of the TFAC recommendations have been implemented to date, most notably the Public and Private Partnerships for Transportation Act (Act 88 of 2012).

Though not enacted as of Plan development, help may be on the way. In February 2013, Governor Corbett proposed removing the $1.25 cap on the wholesale price of gasoline under the Oil Company Franchise Tax. The cap would be removed in three phases over five years. In each of the first two years after the removal of the wholesale cap, the retail tax on gasoline would be reduced by one cent per gallon. The first year of this action is estimated to increase statewide transportation funding by over $500 million. By year five, the total increase would be $1.8 billion. Ten years after enactment, the $450 million annual lease payments made by the Pennsylvania Turnpike would be discontinued. This would greatly impact SEPTA, as $250 million of the annual lease payments go toward transit operating subsidies throughout the commonwealth.

Table 37. Impact of Governor Corbett's Statewide Transportation Funding Proposal

Mode	Year 1 Increase (millions)	Year 5 Increase (millions)
State Roads and Bridges	$ 310	$ 1,200
Public Transportation	$ 40	$ 250
Local Roads and Bridges	$ 70	$ 200
PA Turnpike Expansion Projects	$ 30	$ 85
Multimodal Fund	$ 60	$ 80
Total	$ 510	$ 1,800

Source: PennDOT 2013

The proposed funding increase for Pennsylvania is not included in the Plan's fiscally constrained revenue forecast. If enacted by FY 2014, it is estimated that the region would receive about $8.3 billion in additional road funds and about $4.7 billion in additional transit funds, assuming current funding formulas are maintained. An undefined portion of the additional transit funds would likely go to the operating budget.

A second funding proposal has been put forward by the Pennsylvania Senate Transportation Committee Chairman, John Rafferty. This proposal would lift the cap on the Oil Company Franchise Tax over a three-year period, and result in $2.5 billion in additional roadway, transit, rail, port, and aviation funding once the cap is fully removed. The additional funding in this proposal would come from increased driver's license and vehicle registration fees, along with a surcharge

on fines for moving traffic violations. About $1.9 billion would go toward roads and bridges, $510 million to transit, and $115 million to airports, ports, and railways.

In New Jersey, the Transportation Trust Fund (TTF) was renewed at $8 billion over five years in 2011. Serious issues remain with the TTF structure. The gas tax has not been raised since 1988, and as of July 1, 2013 it is the second lowest in the nation. The state has borrowed heavily to pay for transportation projects, and as a result, all $900 million in annual gas tax revenues the state brings in each year go toward debt repayment. The current TTF consists of an additional $4.4 billion in borrowed funding through bonds, transfers $3.1 billion in Port Authority and turnpike funds that were slated for the Access to the Region's Core project, and $500 million in general funds. Port Authority funding is only in place until 2017, after which a new source will need to be found, or the TTF funding levels could be reduced. A cap on operating and maintenance funds based on 2007 funding levels means that this budget is significantly short of what is needed. Capital funds have been used to meet these needs. Aside from recent turnpike and transit fare increases, there seems to be little likelihood of new transportation revenue in New Jersey.

Local Funding

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. Local funds are forecast to grow with state and federal funds to maintain their appropriate match levels.

Authority and 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 nonfederal capital expenditures for such projects and accounts for the federal funding as a part of its regional transportation expenditures.

Funding Distribution Formulas

Once federal and state funds have been estimated for each year from 2014 to 2040, funding distribution formulas are used to estimate: (1) how much federal funding is allocated to each state; (2) how much of each state's share of federal funding is allocated to the region; and (3) how much state funding is allocated to the region. 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, vehicle miles traveled, transit ridership, and infrastructure condition trends. Both states reserve a pool of transportation funds that can be allocated anywhere within their jurisdictions based on needs. These funds often are used to help areas pay for larger projects.

Controversy between donor and donee funding states is an ongoing issue that has been somewhat mitigated by the $53.3 billion in general fund transfers from FY 2008 to FY 2014. This has allowed virtually every state to get more federal funding back than they have put in. Historically, Pennsylvania has been viewed as a donee state, and New Jersey as a donor state. *Connections 2040* assumes that future state-of-good-repair needs will play some role in future apportionments. Over time, the plan assumes that both state shares are likely to remain about the same as they currently are. The assumption is that modest population growth, compared to the entire nation, will be canceled out by the region's far greater backlog of state-of-good-repair needs.

Federal Funds Apportioned to States

DVRPC has used percent allocations of federal funding to each state, then distributed to the region, and state funding allocated to the region to determine how much funding the region expects to receive each year. Short-term funding comes from dividing each state's STIP identified formula funds by total authorized federal funding. DVRPC has used the averages from 2013 to 2024 for Pennsylvania and 2014 to 2023 for New Jersey.

While MAP-21 maintained the highway funding apportionment formulas, the relative transit formulas have decreased compared to what was expected in the *Connections (2035)* Plan. In that plan, Pennsylvania was estimated to receive 4.5 percent of federal funding in the short term, while New Jersey anticipated 7.2 percent. Cancelation of the ARC tunnel may explain some of the decline in New Jersey.

The current TIP shows that Pennsylvania is receiving about 4.5 percent of federal highway funds. With an expectation that future funding will be based more on asset-management needs, and that the commonwealth has the highest number of structurally deficient bridges in the nation, DVRPC anticipates that this federal apportionment will continue. For Pennsylvania transit, the region has grown ridership steadily over the past decade, and needs are high. While currently receiving 3.2 percent of federal funds, the region hopes for a higher apportionment of future funds to reflect the backlog of state-of-good-repair needs.

In New Jersey, the highway side was decreased from 3.3. percent to 3.1 percent, recognizing that the donor/donee state issue is less significant than it was, and that although needs are great and population is growing, it is doubtful that the state will see a 10 percent gain in apportionment. On the transit side, New Jersey's long-term apportionment expectation remains at 5.7 percent.

Table 38. Distribution of Federal Funds to States

Time Period	PA Statewide		NJ Statewide	
	Roadway	Transit	Roadway	Transit
Short-term (2014-24)	4.5%	3.2%	3.0%	5.6%
Long-term (2025-40)	4.5%	3.5%	3.1%	5.7%

Source: DVRPC 2012

Federal Funds from the States to the Region

A percent of each state's federal funds are then allocated to each of the MPOs (and RPOs in Pennsylvania). The region has seen an increase in short-term federal highway funding relative to *Connections (2035)*, which estimated 22.4 percent in Pennsylvania, and 17.9 percent in New Jersey. On the transit side, Pennsylvania's short-term apportionment of federal funds is down from 70.6 percent, while New Jersey's is up from 8.8 percent. Longer-term forecasts are based on historic apportionment percentages for the region in Pennsylvania, which may mean a slightly lower percent on the highway side, and slightly higher percent on the transit side. The region is expected to grow faster than either state as a whole, helping to justify longer-term higher funding expectations.

Table 39. Distribution of Federal Funds to the Region

Time Period	PA Subregion		NJ Subregion	
	Roadway	Transit	Roadway	Transit
Short-term (2014-24)	26.8%	63.3%	18.0%	12.1%
Long-term (2025-40)	26.0%	67.0%	20.0%	12.0%

Source: DVRPC 2012

State Funds Apportioned to the Region

New Jersey percent allocations in the short term are based on historic state funding in the STIP, while the long-term allocation recognizes that higher growth is likely to occur in the southern part of the state. In Pennsylvania, Section 1517 Capital Improvements funds are allocated by formula: the percent of transit

Table 40. Regional Distribution of State Funds

Time Period	DVRPC PA Subregion				DVRPC NJ Subregion	
	Roadway	IMP	Transit (SEPTA)	Transit (PART)	Roadway	Transit
Short-term (2014-24)	21.0%	26.9%	53.0%	0.9%	16.4%	17.1%
Long-term (2025-40)	26.0%	35.5%	67.0%	1.0%	17.0%	20.0%

Source: DVRPC 2012

passengers in the region compared to the total passenger ridership on all transit systems in the commonwealth. Section 1514 funds are allocated by grant. It is assumed that the region will receive a similar percent of the grant-allocated funds as formula-allocated funds. Table 40 also includes Interstate Management Program (IMP) funds, which is a statewide program containing both state and federal funding sources. The region assumes that it will receive about 32 percent of these funds over the long-term, though this amount will fluctuate from year to year.

Pennsylvania reserves federal and state funds for use anywhere in the state at the discretion of the PennDOT secretary and state-level decision-makers. These include federal programs, such as Safe Routes to School and Transportation Enhancements, as well as a 20 percent reserve of NHS, STP, and state highway funds to the SPIKE program. A portion of Act 44 funds are used as a statewide discretionary program as highway funds for economic development projects. For all of these discretionary sources, the region assumes that it will receive the same overall funding allocation as it does for formula funds. However, these funds will have much more variance year to year.

New Jersey has a statewide funding program that allows for funds to be used on larger projects, or directed to where needs are otherwise the greatest. The region anticipates receiving about 17 percent of these funds on average each year.

In Pennsylvania, the short-term highway apportionment is up from 20.7 percent, but on the transit side, it is down from 69.9 percent, when compared to *Connections (2035).* In New Jersey, short-term state highway funding apportionment is up from 8.8 percent compared to the previous plan (this did not account for the DVRPC region's share of the statewide program), while transit is up from 16.2 percent. The recent renewal of the New Jersey Transportation Trust Fund included revenue from the Port Authority of New York and New Jersey, which had been earmarked for the Access to the Region's Core (ARC) commuter rail tunnel. The state agreed to keep this funding in the Port Authority area. Longer-term state-of-good-repair needs are likely much greater in northern New Jersey.

Connections 2040 Revenue Forecasts

Guidance from both Pennsylvania and New Jersey is for flat state and federal funding over the life of the respective 12-year and 10-year plans. In addition, Congressional Budget Office (CBO) federal gas tax revenue forecasts are increasingly bleak. To maintain current levels of federal expenditure, without increasing taxes, is estimated to require $134 billion in general fund transfers between FY 2015 and FY 2023. Even then, increasing vehicle fuel efficiency, alternative fuels, and flat levels of driving mean that these forecasts may be optimistic.

There seems to be a paradigm shift surrounding transportation funding. The traditional assumption has been that revenue shortfalls will be made up for with future increases. Given the current political and economic climate, it may be time to rethink how the

Table 41. Flat Federal and State Funding 2014-2024, 3% Percent Federal and State Growth Forecast 2025-2040

Funding Source		PA Subregion	NJ Subregion	LRP Total
Roadway	Federal	$ 16.8 B	$ 7.5 B	$ 24.3 B
	State	$ 3.3 B	$ 5.0 B	$ 8.4 B
	Local	$ 0.4 B	$ 0.0 B	$ 0.5 B
	Roadway Total	$ 20.6 B	$ 12.6 B	$ 33.1 B
Transit	Federal	$ 7.4 B	$ 2.3 B	$ 9.7 B
	New-Start/Small-Start	$ 0.0 B	$ 0.02 B	$ 0.02 B
	State	$ 4.7 B	$ 4.3 B	$ 8.9 B
	Local	$ 0.5 B	$ 0.2 B	$ 0.7 B
	Transit Total	$ 12.6 B	$ 6.8 B	$ 19.4 B
DVRPC Total		$ 33.2 B	$ 19.4 B	$ 52.5 B

Source: DVRPC 2012

region forecasts revenues. DVRPC identified a series of future revenue forecasts for discussion with its planning partners. Each assumes a flat 11 years of funding at both the state and federal levels from 2014 to 2024, though this assumption means that the $134 billion federal funding gap will somehow be filled. None of the following projections assume any New Starts or Small Starts funding. All three assume a $25 million Very Small Starts grant in the first funding period in New Jersey to help pay for the South Jersey BRT project.

The first revenue forecast assumes 10-years of flat federal and state funding. From 2025 to 2040 it uses DVRPC's standard projection of funding increases of 19.6 percent every six years at the federal level, and state increases of three percent annually. It would estimate $52.5 billion over the life of the Plan, as shown in Table 41.

Table 42.Flat Federal and State Funding 2014-2024, Stronger Federal and/or State Growth 2025-2040

Funding Source		PA Subregion	NJ Subregion	LRP Total
Roadway	Federal	$ 15.7 B	$ 8.5 B	$ 24.5 B
	State	$ 8.4 B	$ 4.0 B	$ 12.4 B
	Local	$ 0.7 B	$ 0.1 B	$ 0.8 B
	Roadway Total	$ 24.7 B	$ 12.6 B	$ 37.8 B
Transit	Federal	$ 7.9 B	$ 2.2 B	$ 10.1 B
	New-Start/Small-Start	$ 0.0 B	$ 0.02 B	$ 0.02 B
	State	$ 7.7 B	$ 4.6 B	$ 11.6 B
	Local	$ 0.9 B	$ 0.1 B	$ 1.0 B
	Transit Total	$ 16.5 B	$ 6.9 B	$ 22.6 B
DVRPC Total		$ 41.2 B	$ 19.5 B	$ 59.9 B

Source: DVRPC 2012

Table 43.Flat Federal and State Funding 2014 -2040

Funding Source		PA Subregion	NJ Subregion	LRP Total
Roadway	Federal	$ 11.6 B	$ 6.3 B	$ 18.3 B
	State	$ 4.8 B	$ 3.3 B	$ 8.1 B
	Local	$ 0.4 B	$ 0.1 B	$ 0.4 B
	Roadway Total	$ 16.8 B	$ 9.6 B	$ 26.5 B
Transit	Federal	$ 5.8 B	$ 1.6 B	$ 7.4 B
	New-Start/Small-Start	$ 0.0 B	$ 0.02 B	$ 0.02 B
	State	$ 4.7 B	$ 4.0 B	$ 8.7 B
	Local	$ 0.6 B	$ 0.1 B	$ 0.6 B
	Transit Total	$ 11.1 B	$ 5.8 B	$ 16.8 B
DVRPC Total		$ 27.4 B	$ 15.4 B	$ 43.3 B

Source: DVRPC 2012

The second forecast assumes either the federal government or the state governments eventually take the lead, growing revenues at a higher rate than normal from 2025 to 2040. With a $59.9 billion forecast, shown in Table 42, this represents a best-case scenario for funding in the region.

The third forecast assumes no additional federal funding, and that after 11 years of flat funding, expenditures drop to the Federal TTF revenue trend, of about $45.8 billion in 2025. This gradually increases to $53.1 billion in 2040. Neither state takes action to increase funding, and only minor 1.5 percent annual increases in state funding result in largely flat funding levels over the next 27 years. This scenario would estimate only $43.3 billion over the life of the Plan, see Table 43.

The Long-Range Plan Committee met and discussed each alternative forecast. The group agreed with the $52.5 billion Flat Federal and State Funding 2014 to 2024, Three Percent Federal and State Growth Forecast 2025 to 2040 scenario. Though there was considerable discussion that the lower estimate was more likely than the higher estimate.

Table 44 shows the estimated reasonably anticipated funding by time period and mode. In addition to this formula-based funding, including the New Jersey Statewide and Pennsylvania Interstate Management funds that the region expects, the current Pennsylvania and New Jersey TIPs anticipate about $900 million in grants and add-ons. These are not shown here, but are included in the Chapter 8 Demonstration of Fiscal Constraint.

Table 44. Connections 2040 Reasonably Anticipated Funding by Time Period and Mode

Subregion	Mode	Funding Period 1	2	3	4	LRP Total 2014-2040
Pennsylvania	Roadway	$ 2.6 B	$ 3.7 B	$ 5.0 B	$ 10.4 B	$ 20.6 B
	Transit	$ 1.6 B	$ 2.1 B	$ 2.8 B	$ 6.0 B	$ 12.6 B
	New-/Small-/Very Small-Starts	$ 0.0 B	$ 0.0 B	$ 0.0 B	$ 0.0 B	$ 0.0 B
	Subregion Total	$ 4.3 B	$ 4.7 B	$ 7.8 B	$ 16.3 B	$ 33.2 B
New Jersey	Roadway	$ 1.4 B	$ 2.2 B	$ 3.1 B	$ 5.8 B	$ 12.6 B
	Transit	$ 0.9 B	$ 1.1 B	$ 1.7 B	$ 3.1 B	$ 6.8 B
	New-/Small-/Very Small-Starts	$ 0.01 B	$ 0.01 B	$ 0.0 B	$ 0.0 B	$ 0.02 B
	Subregion Total	$ 2.3 B	$ 3.3 B	$ 4.8 B	$ 8.9 B	$ 19.4 B
DVRPC Total		$ 6.6 B	$ 8.0 B	$ 12.6 B	$ 25.3 B	$ 52.5 B

Source: DVRPC 2012

CHAPTER 4: Funding Allocation

To help guide the allocation of anticipated funding to specific project categories, DVRPC conducted an analysis to determine some of the impacts of different levels of funding for each category. This analysis is based on maintaining *Connections (2035)* allocations compared to increasing or decreasing different categories. It was done separately for each state subregion, as both have their own financial plan.

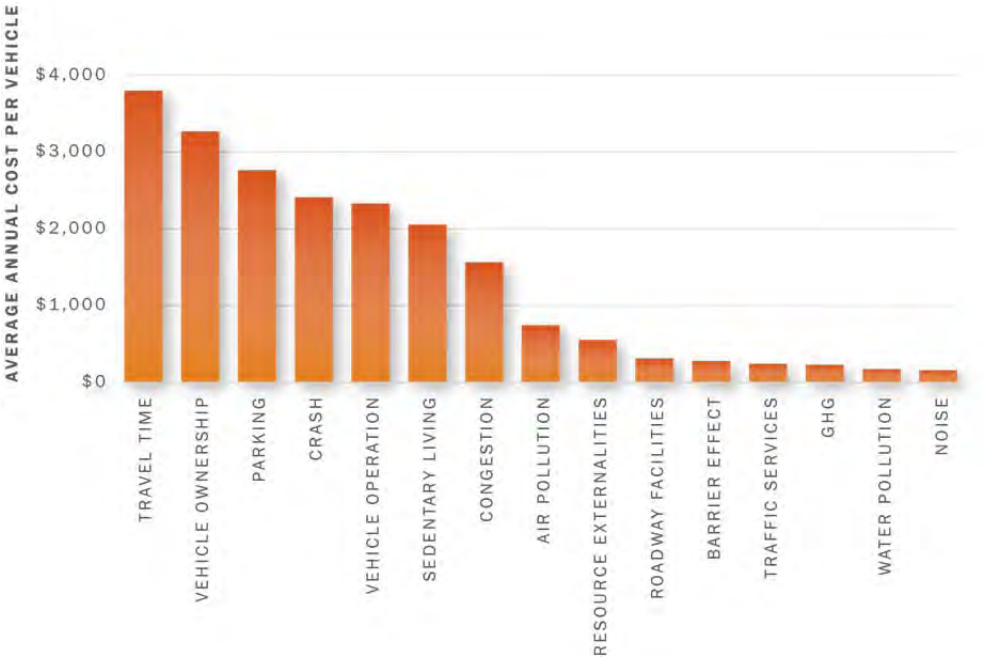
Anticipated change in vehicle hours of delay was used to compare different funding levels for each category. As an overall impact, however, travel delay is a relatively minor expense to the transportation system. The Victoria Transportation Policy Institute (VTPI) has found the cost of congestion to be much lower than those of crash damages, or even nonresidential parking.

Future pavement and bridge conditions are of particular concern, given the long-term fix-it-first philosophy undertaken by the region. Delay impacts due to poor road and bridge conditions were estimated and used to compare the trade-offs of system expansion and operational improvement projects to preservation investments.

Two other items were also considered: change in VMT, and increased operating and maintenance expenses. With growing funding constraints, it is critical that the region find ways to maintain current degrees of mobility and accessibility without increasing VMT. It will not be possible to meet the demand for new road capacity. Instead, *Connections 2040* continues the focus on land use and development patterns that reduce the need for driving and promote multimodal transportation alternatives.

In the following sections, DVRPC has estimated the delay impacts of various funding levels to different project categories. A different funding allocation to each category out of total funding was tested for future-year conditions. This is the basis of the delay estimate. In many instances, a portion of the total category funding has been removed, as it would go toward federal local aid facilities, preservation projects, or other projects in the category that could not be modeled or would not change overall delay conditions.

Figure 4. Average Annual Vehicle Costs

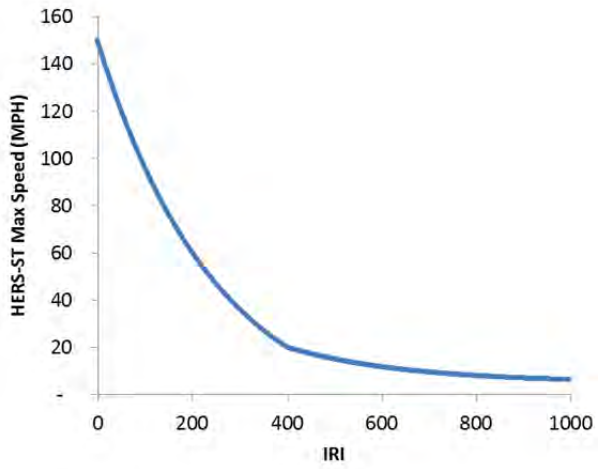


Source: VTPI 2010

Pavement Delay

Figure 5 comes from the HERS-ST pavement economic and engineering requirements model. It shows a maximum theoretical pavement speed based on the road's International Roughness Index (IRI), which measures inches of variation in the roadway surface per mile.

Figure 5. HERS-ST Maximum Speed Based On International Roughness Index (IRI)



Source: HERS-ST

DVRPC estimated future pavement hours of delay, based on pavement condition under different funding levels. Each road segment's IRI was compared to the theoretical maximum speed on the chart above. If the theoretical speed is greater than the posted speed limit, then no delay is expected. If the speed in the chart above is less than indicated speed limit for the road, daily pavement delay is defined as the difference between the theoretical speed and the posted speed multiplied by segment length (in miles) and AADT. In 2012, there is an estimated 3,160 daily vehicle hours of pavement delay in the Pennsylvania subregion.

While recurring delay occurs during congested periods of the day and week, pavement delay occurs 24 hours a day, seven days a week. Table 45 indicates the results for Pennsylvania based on maintaining the *Connections (2035)* 30 percent funding allocation, compared to an increase to 32 percent allocation, and a decrease to 28 percent allocation.

Daily VMT on poor roads and pavement hours of delay are based on current year AADT and do not account for likely growth in VMT between now and 2040. These figures are likely to be even higher if traffic volume growth is accounted for. Most of this delay will occur on lower volume arterial roadways.

Table 46 presents the same analysis for the New Jersey subregion. The *Connections (2035)* Plan allocated 31.5 percent of available revenue to pavement. For direct comparison between subregions, deficient lane miles are shown under both PennDOT and NJDOT standards.

Table 45. Pennsylvania Pavement Funding Allocation Results

	Percent Funding Allocation		
	28.0 %	30.0%	32.0%
Total Funding 2014-2040 (Billions of Y-O-E $s)	$5.8	$6.2	$6.6
Percent Lane Miles in Poor Condition in 2040	56%	54%	50%
Daily VMT on Poor Condition Roads in 2040 (millions)	18.6	18.3	15.8
Daily Pavement Hours of Delay in 2040	293,800	272,500	254,400

Source: DVRPC 2012

Table 46. New Jersey Pavement Funding Allocation Results

	Percent Funding Allocation			
	31.5%	36.0%	38.0%	40.0%
Total Funding 2014-2040 (Billions of Y-O-E $s)	$ 3.3	$ 3.8	$ 3.9	$ 4.1
Percent Lane Miles in Poor Condition in 2040, NJ DOT Standards	42%	36%	32%	29%
Percent Lane Miles in Poor Condition in 2040, PennDOT Standards	44%	38%	34%	31%
Daily VMT on Poor Condition Roads in 2040 (millions)	6.2	5.2	4.4	4.0
Daily Pavement Hours of Delay in 2040	228,100	110,200	83,300	63,900

Source: DVRPC 2012

Bridge Closure Delay

The impact of different levels of bridge funding in Pennsylvania is shown in Table 47. Since any funding allocation is well short of the estimated need, there is not much variation in the results. However, maintaining the *Connections (2035)* bridge funding allocation of 42.5 percent is estimated to mean about 12 bridges would close, leading to an additional 200,000 daily VMT (assuming that all trips are still completed, and not accounting for future-year traffic volume growth), and an additional 20,920 vehicle hours of travel induced. This estimate is based on the detour length identified in the Bridge Management System and an average speed of 30 miles per hour, based on modeling done for the system's system expansion impacts. About 26 percent of the region's deck area would be structurally deficient.

The capacity of the system would be further reduced by removing the road segments that become unusable due to closed bridges. However, some trips would not be made, as the increased trip length would convince some people not to travel, make shorter trips, or shift modes. DVRPC assumes that these overall impacts are roughly offsetting in terms of delay.

Increasing the allocation to 49 percent or more of available funding would mean that no bridges close. The percent of structurally deficient deck area would increase to about 25 percent, compared to 11 percent in 2012. Another 36 percent of the region's deck area would be 'on-deck,' meaning that it is on the verge of becoming structurally deficient.

Table 47. Pennsylvania Bridge Funding Allocation Results

	Percent Funding Allocation			
	42.5 %	49.0%	50.0%	53.0%
Total Funding, 2014-2040 (billions of Y-O-E $s)	$ 8.3	$ 9.5	$ 9.7	$ 10.0
Number of Bridges Replaced, 2014-2040	448	466	472	480
Average Bridge Age in 2040 (years)	66.5	66.2	66.1	66.1
Percent Structurally Deficient Deck Area 2040	26%	25%	25%	25%
AADT on Structurally Deficient Bridges in 2040 (millions)	11.5	13.1	13.0	13.1
Number of Closed Bridges in 2040	12	-	-	-
Deck Area of Closed Bridges in 2040 (millions Sq. Ft.)	0.2	-	-	-
Cost to Replace Closed Bridges (Billions 2012 $s)	$ 0.2	-	-	-
AADT on Closed Bridges in 2040 (millions)	0.2	-	-	-
Additional Daily VMT due to Closed Bridge Detours (millions)	0.6	-	-	-
Additional Daily Vehicle Hours of Travel Due to Detouring Around Closed Bridges in 2040[1]	20,920	-	-	-
Percent of I-95 Structurally Deficient in 2040	21%	21%	21%	21%

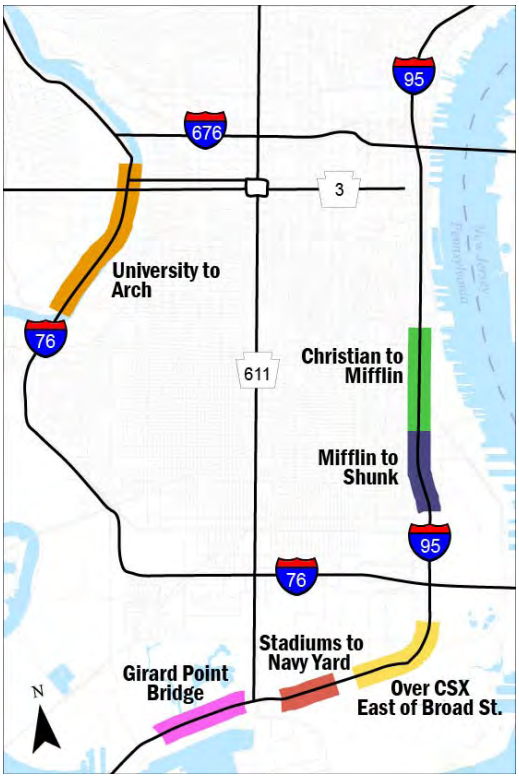
1. Assumes a regional average speed of 30.0 mph, based on regional system expansion modeling, which is shown later in this chapter.

Source: DVRPC 2012

There are six large bridges in need of significant reconstruction in the Pennsylvania subregion before 2040 that collectively need about $2 billion in 2012 dollars. They are I-95 from Christian to Mifflin, I-76 from Arch to University, I-95 over CSX tracks east of Broad St, the I-95 Girard Point double decker, I-95 from Shunk to Mifflin, and I-95 from the stadiums to the Navy Yard, all in Philadelphia. Only the Christian to Mifflin Bridge is funded in all of the above bridge allocation scenarios.

A second bridge, I-95 over CSX east of Broad Street, is replaced in the 49, 50, and 53 percent funding allocations. While this bridge is not expected to be structurally deficient in 2040, it will become so shortly after if it is not rehabilitated. Similarly, the I-95 Girard Point bridge will reach a point where it should receive a major reconstruction by 2040, but is not expected to become structurally deficient until shortly beyond the Plan horizon. None of the funding allocations are likely to fund the needed project on this bridge.

Figure 6. The Big 6 Bridges in Philadelphia



Source: DVRPC 2012

Table 48. Pennsylvania Subregion Major Bridges in Need of Reconstruction Prior to 2040

Bridge	Bridge Key	Deck Area (Sq. Ft)	Recon. Cost (Millions 2012 $s)	Funding Allocation			
				42.5 %	49.0%	50.0%	53.0%
I-95, Christian St. to Mifflin St.	38555	617,636	$ 440.0	Rec	Rec	Rec	Rec
I-95, Over CSX tracks east of Broad St.	38542	564,316	$ 365.0	SD	SD	SD	SD
I-76, University to Arch	38477	443,664	$ 290.0	SD	SD	SD	Rec
I-95 Shunk to Mifflin	38552	416,324	$ 270.0	SD	SD	SD	SD
I-95 Stadiums to Navy Yard	38537	319,375	$ 250.0	OD	Rec	Rec	Rec
I-95 Girard Point Bridge	38530	614,873	$ 400.0	OD	OD	OD	OD

OD – On-Deck bridge, on the verge of becoming structurally deficient
SD – Structurally Deficient in 2040
Rec – bridge reconstructed in funding allocation prior to 2040

Source: DVRPC 2012

In New Jersey, no bridges would be structurally deficient under the *Connections (2035)* 40 percent funding allocation. Dropping the allocation from 40 percent to 38 percent would still mean no structurally deficient bridges. Decreasing the allocation to 36 percent would leave only 0.1 percent structurally deficient deck area. None of the proposed allocations forecasts any bridges closing.

Table 49. New Jersey Bridge Funding Allocation Results

	Percent Funding Allocation			
	36.0%	38.0%	40.0%	42.0%
Total Funding, 2014-2040 (billions of Y-O-E $s)	$4.4	$4.6	$4.6	$4.8
Number of Bridges Replaced, 2014-2040	78	75	72	70
Average Bridge Age in 2040 (years)	73.3	73.7	73.9	74.1
Percent Structurally Deficient Deck Area 2040	0.1%	0.0%	0.0%	0.0%
AADT on Structurally Deficient Bridges in 2040 (millions)	0.1	0	0	0
Number of Closed Bridges in 2040	-	-	-	-
AADT on Closed Bridges in 2040 (millions)	-	-	-	-
Additional Daily VMT due to Closed Bridge Detours (millions)	-	-	-	-
Additional Daily Vehicle Hours of Travel Due to Detouring Around Closed Bridges in 2040	-	-	-	-

Source: DVRPC 2012

ITS Delay Reduction

While there is not a lot of good modeling data to determine the impact of ITS investments on roadway conditions, the Texas Transportation Institute (TTI) annually estimates the impact of existing operations on congestion. In the 2011 Urban Mobility Report, TTI found the Philadelphia region (an area that includes Wilmington, Delaware, and parts of Maryland) had 134.9 million vehicle hours of delay over the course of the year, which is about 539,600 vehicle hours of delay per day.

TTI also found that operational treatments reduce about 35,400 daily vehicle hours of delay for the larger region. The annual cost of the ITS components is estimated at $186.5 million. Assuming that this ITS expenditure is largely on equipment with a 10-year lifespan (and disregarding the operating costs), each hour of delay reduction costs about $2.11 (in 2010 dollars), or $2.24 in current-year 2012 dollars (assuming three percent inflation).

DVRPC modeled 490,000 daily vehicle hours of delay for the region in 2010. Proportionally comparing the DVRPC region to the larger TTI region estiamtes a reduction of 32,100 vehicle hours of delay in the nine-county region due to existing ITS infrastructure. Assuming that two-thirds of the delay reduction (based on VMT and population) occurs in the Pennsylvania subregion, yields an estimated 21,400 daily vehicle hours of delay reduction from existing ITS infrastructure. The remaining third, 10,700 hours, is assumed to occur in the New Jersey subregion.

Maintaining the Pennsylvania subregion's existing ITS infrastructure is estimated to cost $550 million (Y-O-E) over the life of the Plan. This includes operating and maintenance expenses. Building out the TOMP by 2040 would cost an estimated $2.2 billion (Y-O-E). This is about 11 percent of total identified revenues for Pennsylvania subregion roadways.

The operating improvement cost for the major regional system projects is $820 million (Y-O-E) over the 27-year plan horizon. These costs are funded in the Plan, so this amount comes off the top of the potential funding allocation for the Roadway Operational Improvements funding category. These projects will likely have delay reduction benefits, but they are not quantified here. Since the same physical improvements are assumed in all funding allocation levels there would be no difference in delay impacts. The comparison then focuses only on the ITS impacts above and beyond the major regional operational improvements.

After accounting for the major regional projects, what is remaining for the operational improvement funding allocation is split between ITS and other minor physical operational improvements. Seventy percent is assigned to the ITS, Incident Management, and Signal subcategories. The remaining 30 percent would go toward minor physical improvements to the system, including intersection improvements, roadway realignments, channelization, and access management.

Fully funding the TOMP for New Jersey would require about $830 million, or about seven percent of total available revenue. This subregion has identified $560

Table 50. ITS, Incident Management, and Signals Delay Reduction

	Percent Funding Allocation			
ITS, Incident Management, Traffic Management, and Signals	9.0%	11.5%	12.5%	14.0 %
Pennsylvania Expenditure (Billions Y-O-E $s)	$0.87	$1.23	$1.38	$1.59
Pennsylvania Daily Vehicle Hours of Delay Reduction in 2040	-33,840	-48,040	-53,720	-62,250
New Jersey Expenditure (Billions Y-O-E $s)	$0.46	$0.56	$0.62	$0.75
New Jersey Daily Vehicle Hours of Delay Reduction in 2040	-18,050	-22,060	-24,070	-28,100
Regional Expenditure (Billions Y-O-E $s)	$1.33	$1.89	$2.00	$2.79
Regional Delay Reduction in 2040	-51,890	-70,100	-77,790	-90,350

Source: DVRPC 2012

million in major regional operational improvement projects. These projects are funded first, with the remainder going toward minor physical system improvement projects, and signals and ITS projects. Physical improvement projects include roundabouts, access management, channelization, realignment, and intersection improvements.

The needs assessment identified about 33 percent of overall operational improvement needs that were related to ITS, incident management, traffic management, and signals. This percentage is assumed to go toward these types of projects at each different funding allocation in Table 50.

Assuming that a cost of $5.07 per daily hour of delay reduced in this ratio (the base year 2012 cost in 2040 dollars), DVRPC estimated daily vehicle hours of delay based on various expenditure levels for ITS. The results are shown in Table 50.

ITS innovations can make roads more efficient. New adaptive signal control technology (ASCT) uses remote sensors and computing power to respond to real-time traffic. FHWA estimates that ASCT systems can increase traffic throughput by 10 to 50 percent, depending on the corridor and type of previous signal system. These new technologies may provide even more cost-effective congestion relief in the future.

Vehicle technology is undergoing major transformations, which is likely to fundamentally alter how we travel around over the next decade. Connected vehicle and self-driving car technologies promise a safer, more efficient transportation system in the near future. How this will impact ITS and road design is yet to be fully determined. Lane markings, guardrails, traffic signals, variable message signs, and other elements of the cartway may soon be replaced by in-road sensors and other new technologies.

Connected cars (pictured) and driverless cars present the future opportunity for significant operational improvements to the existing roadway system.

Photo by FHWA

Road throughput may be increased, as computers allow for closer vehicle spacing. This would mean a substantial increase in existing road capacity, potentially mitigating or decreasing the need for additional new or widened roads.

Roadway System Expansion Delay Reduction

In Pennsylvania, existing and proposed major and minor system expansion projects included in the *Connections (2035)* Plan comprise about 8.3 percent of reasonably anticipated revenue for *Connections 2040*. In New Jersey, the existing set and proposed new projects would cost about eight percent of reasonably anticipated revenue in the Plan. *Connections (2035)* policy set a 10 percent cap on system expansion projects, meaning the region could identify further projects if it wishes to continue to fund this project category at previous levels. However, given the considerable and growing backlog of bridge and pavement needs, adding more system expansion projects was not recommended.

DVRPC modeled the impact of major regional system expansion interchanges and widenings as two separate groups in the TIM 1.0 model. The results of these model runs are shown in Table 51. The model was run using 2035 demographics, as 2040 demographics had not been prepared at that point. Population and employment growth forecasts an increase in both VMT and recurring vehicle hours of delay, as the size of the road system is unable to keep up with the additional demand. The theoretical capacity of the network was determined, and regional capacity is estimated to increase by 4.2 percent as a result of all the major regional system expansion projects in the *Connections (2035)* Plan.

Included in all model runs were projects that were already completed, or nearing completion. These projects include the interchange replacing the Marlton Circle, US 202 Section 700, the first phase of the PA 309 connector road, and the new interchange at I-76 and Henderson Road.

Overall, the model suggests an increase in VMT of about one-tenth the increase in capacity, a small reduction in transit ridership as a result of these projects, and some reduction in travel delay. For approximately $2.5 billion (Y-O-E), travel delay is reduced by about 38,500 hours per day in 2040. Assuming a 50-year life for these facilities, the capital cost is about $3.05 (in 2012 dollars) per hour of delay reduced. This does not account for the ongoing operating and maintenance costs associated with new facilities. Overall, the system expansion delay reduction capital cost is about 36 percent higher than for ITS improvements.

Assuming a cost of $3.05 (in 2012 dollars) per daily hour of delay reduction holds for all investments in new road capacity, Table 52 estimates total vehicle-hour-of-delay reductions for different funding levels.

Table 51. Regional Roadway System Expansion Impacts

Project	Entire Network	Build	No-Build	Difference	% Change	System Expansion Cost (YOE)
Interchanges	Daily Capacity (millions of vehicle miles)	196.9	196.6	0.3	0.1%	$0.9 B
	Peak VMT (millions)	44.53	44.49	0.04	0.1%	
	Daily VMT (millions)	117.9	117.8	0.1	0.01%	
	Daily Transit Ridership	736,270	736,440	-170	0.0%	
	Peak Average Speed (mph)	25.1	25.0	0.1	0.2%	
	Daily Vehicle Hours of Delay	819,140	825,680	-6,540	-0.8%	
Widenings	Daily Capacity (millions of vehicle miles)	196.9	188.9	8.0	4.1%	$1.6 B
	Peak VMT (millions)	44.53	44.28	0.25	0.6%	
	Daily VMT (Millions)	117.3	117.8	0.5	0.04%	
	Daily Transit Ridership	736,270	736,300	-30	0.0%	
	Peak Average Speed (mph)	25.1	24.8	0.3	1.1%	
	Daily Vehicle Hours of Delay	819,140	851,130	-31,990	3.8%	

Source: DVRPC 2012

Table 52. Regional Roadway System Expansion Expenditure and Delay Reduction

	Percent Funding Allocation				
	4.0%	5.0 %	7.0%	8.0%	10.0%
Pennsylvania System Expansion Funding (Billions Y-O-E $s)	$0.83	$1.03	$1.45	$1.65	$2.07
Pennsylvania System Expansion Daily Vehicle Hours of Delay Reduction	-12,800	-16,000	-22,300	-25,540	-31,900
New Jersey System Expansion Funding (Billions Y-O-E $s)	$0.48	$0.61	$0.85	$0.98	$1.22
New Jersey System Expansion Daily Vehicle Hours of Delay Reduction	-7,530	-9,400	-13,200	-15,060	-18,800
Regional System Expansion Funding (Billions Y-O-E $s)	$1.31	$1.67	$2.33	$2.63	$3.33
Regional System Expansion Daily Vehicle Hours of Delay Reduction	-20,330	-25,700	-36,000	-40,600	-51,400

Source: DVRPC 2012

The Fundamental Law of Road Congestion: Evidence from US Cities, by University of Toronto researchers Gilles Duranton and Matthew A. Turner, found that each one percent increase in regional road capacity corresponded with a one percent increase in regional VMT. While the TIM 1.0 model expects regional VMT to increase by only 0.4 percent as a result of a 4.2 percent increase in road capacity, this research suggests the actual result would also increase VMT by 4.2 percent. This would mean an additional 4.9 million daily VMT, at best leading to little change in roadway congestion and very likely worsening it. The University of Toronto researchers suggest that the only way to significantly reduce congestion in urban areas is to introduce congestion-based pricing.

Investing in system expansion means there are even more facilities that the region needs to maintain in the future, as existing bridges and pavement are rapidly deteriorating. These projects will likely increase VMT, impact our air quality nonattainment status, and result in less investment in multimodal projects that can lower demand for the road network and promote transportation alternatives.

Bike and Pedestrian Facilities

This portion of the analysis will focus on how much different levels of funding can complete the region's priority trail network, The Circuit. This 750-mile system is about one-third complete, with another 50 miles currently under construction. There are 272 unbuilt miles in Pennsylvania, and 140 in New Jersey. Table 53 looks at how many miles of multiuse trails could be built under different funding allocations. In Pennsylvania, about 56 percent of identified bike and pedestrian needs is for regional trails; this number increases to 68 percent in New Jersey. These percentages are used to determine how much bike and pedestrian funding is directed toward regional trail projects under different funding allocation scenarios.

Table 53. Mixed-Use Trail Completion

	Percent Funding Allocation		
	1.5%	1.75 %	2.0%
Pennsylvania Mixed-Use Trail Funding (Billions Y-O-E $s)	$0.17	$0.20	$0.23
Pennsylvania Miles of Mixed-Use Trails Built	211	246	282
New Jersey Mixed-Use Trail Funding (Billions Y-O-E $s)	$0.12	$0.14	$0.17
New Jersey Miles of Mixed-Use Trails Built	155	168	192

Source: DVRPC 2012

Table 54. Operating and Maintenance Cost Impacts from Different Roadway Investments

Project Type	Operating and Maintenance Costs	Notes
Roadway System Expansion	Highest	PennDOT Bureau of Maintenance and Operations estimates annual operating and maintenance costs per lane mile of interstates at $70,000, noninterstate NHS facilities at $62,000, arterials with more than 2,000 vehicles per day at $23,500, and arterials with less than 2,000 vehicles per day at $4,300.
ITS	2nd Highest	DVRPC estimates annual O&M costs at 5 percent of capital costs.
Pavement Preservation	Lowest (tie)	Likely to reduce costs due to fewer emergency repair needs.
Bridge Preservation	Lowest (tie)	

Source: DVRPC 2012

DVRPC is currently unable to anticipate reduced delay from construction of bike and pedestrian facilities. This does not mean that there is not any, and more facilities should mean more delay reduction. The TIM 3.0 regional travel demand model upgrade, when completed, should be able to model the regional travel effects of these facilities.

Transit Delay Reduction

TTI has also estimated the impact of existing transit operations on congestion. In the 2011 Urban Mobility Report, TTI found that the Philadelphia region (an area that includes Wilmington, Delaware, and parts of Maryland) transit system is responsible for reducing about 104,300 daily vehicle hours of delay. Assuming that the DVRPC regional portion of the TTI findings is 490,000 divided by 539,600 (as in the ITS/ Operational Improvements section), an estimated 94,710 regional hours of delay are averted due to our existing transit network. More than 90 percent of transit ridership occurs in the Pennsylvania subregion, so an estimated 85,240 vehicle hours of delay reduction are assumed on this side of the region.

Any new transit facilities proposed in the fiscally constrained, funded plan would likely also reduce vehicle hours of delay, as single-occupant vehicle drivers switch to transit use, particularly during peak travel periods. However, failure to maintain the system, or service degradation, could increase delay.

DVRPC was able to model three transit projects as part of the project evaluation process (see next chapter). The South Jersey BRT is expected to reduce daily vehicle hours of delay by 9,330, the US 1 BRT by 7,480, and the Glassboro-Camden line by 10,710.

Future VMT and Operating and Maintenance Costs from Transportation Investments

Long-term VMT and operating and maintenance cost impacts of decisions are relevant considerations to transportation investments. Generally, roadway

Table 55. Long-Term VMT Impacts from Different Roadway Investments

Project Type	VMT Change	Notes
Roadway System Expansion	Highest	New facilities promote new development, and possibly move development from multimodal areas to driving dependent areas
ITS	2nd Highest	Improves traffic movement and travel speeds, may induce trips or create modeshift from alternative modes to driving
Pavement Preservation	2nd Lowest	Reduces vehicle operating costs
Bridge Preservation	Lowest	Very little impact

Source: DVRPC 2012

system expansion and ITS improvements are more likely to increase VMT and will have higher operating and maintenance costs than bridge and roadway preservation investments. Better system preservation generally tends to be much less expensive over time, as demonstrated by AASHTO's *Rough Roads Ahead*, which found that the costs of maintaining a road in a good condition were one-third to one-fourteenth the cost of deferring maintenance and having to eventually reconstruct the road.

Proposed Funding Allocation and Delay Reduction Summary

DVRPC prepared different funding allocations for the Pennsylvania and New Jersey subregions for both highway and transit. These alternatives were also compared to the allocations set in the *Connections (2035)* Plan.

The Pennsylvania Roadway 2 option cuts operational improvements and system expansion, while boosting bridge funding, to improve future bridge conditions. The Pennsylvania Roadway 3 option combines pavement and bridge into a larger system preservation category, and combines operational improvements and system expansion into a larger system improvements category. Combining funding categories in this manner is not recommended by FHWA, as the air quality conformity process needs a clear distinction between projects with capacity-adding elements and those without.

The New Jersey Roadway 2 option increases pavement funding by reducing bridge and system expansion funds. The Roadway 3 option further increases system preservation funding, this time at the expense of operational improvements. Table 57 compares total estimated delay under maintaining the *Connections (2035)* funding allocations with the DVRPC proposed funding allocations for *Connections 2040*.

The Pennsylvania Roadway 2 option ensures no bridge closures, but slightly increases delay by 0.2 hours annually per capita. The Pennsylvania Roadway 3 option increases the underlying funding for system expansion to 7.5 percent, while reducing the funding for operational improvements. Since the latter is more cost effective, delay would increase by 1.2 hours per capita annually. However, these figures could be adjusted, as increased pavement funding could reduce delay, without giving up substantial declines in bridge condition. The 7.5 percent target was maintained for this analysis, as the Long-Range Plan Committee wanted to see the results of largely retaining all the incomplete *Connections (2035)* system expansion projects.

Table 56. Potential Roadway Funding Allocations

	Pennsylvania			New Jersey		
	2035 Plan	Road 2	Road 3*	2035 Plan	Road 2	Road 3
Pavement Resurfacing/Recon.	30.0%	30.0%	83.0%	31.5%	38.5%	40.0%
Bridge Rehab./Replacement	42.5%	50.0%		40.0%	37.0%	38.5%
Operational Improvements	14.0%	11.5%	13.5%	14.0%	14.0%	12.0%
Roadway Expansion	10.0%	5.0%		10.0%	7.0%	5.0%
Bicycle & Pedestrian	1.75%	1.5%	3.5%	1.5%	1.5%	1.5%
Other	1.75%	2.0%		3.0%	3.0%	3.0%
Total	100%	100%	100%	100%	100%	100%

* PA Roadway 3 would reduce the number of LRP financial plan categories to three: system preservation, system improvements, and bike/pedestrian and other. This is not recommended by FHWA.

Source: DVRPC 2012

Table 57. Funding Allocation Daily Vehicle Hours of Delay Summary

	Pennsylvania			New Jersey		
	2035 Plan	Road 2	Road 3***	2035 Plan	Road 2	Road 3
Base Recurring Delay in 2040	514,900	514,900	514,900	227,100	227,100	227,100
Pavement Delay	272,500	272,500	272,500	228,100	83,300	63,900
Bridge Delay	20,920	-	-	-	-	-
Operational Improvements Delay Reduction	(62,250)	(53,720)	(16,800)	(28,100)	(28,100)	(24,070)
System Expansion Delay Reduction	(31,900)	(15,950)	(22,330)	(18,800)	(15,060)	(13,200)
Transit Delay Reduction	(85,240)*	(85,240)*	(85,240)*	(26,280)**	(26,280)**	(26,280)**
Total Daily Vehicle Hours of Delay	628,930	632,440	663,030	382,020	240,960	227,450
Annual Hours of Delay per Capita	35.2	35.4	37.1	68.0	39.0	35.9

* Assumes no service reduction/cuts, while further delay reduction is expected from new transit facilities.
** Assumes 9,330 hours of delay reduction from South Jersey BRT, and 7,480 hours of delay reduction from US 1 BRT.
*** Assumes 30 percent allocation to pavement, 53 percent allocation to bridges, 6 percent allocation to operational improvements, and 7.5 percent allocation to system expansion.

Source: DVRPC 2012

Transit Funding Allocation

SEPTA currently has a $4.7 billion backlog of identified needs and an annual capital budget of about $300 million. At current funding levels, if SEPTA only worked on current backlog projects, it would take 16 years to complete. In the meantime, other state-of-good-repair projects would accrue. Over the 27-year life of *Connections 2040*, revenue is estimated at just $12.6 billion, while maintaining the existing rail, vehicle, and station infrastructure is estimated at $28.2 billion. Even if all available revenue were used on system preservation, only about 45 percent of this

Table 58. 2014 to 2040 Pennsylvania Transit Vehicle Replacement Needs (T2.01 to T2.04)

Vehicle	Total Needed	Purchased under Funding Allocation		
		31.5%	33.5%	38.0%
New Vehicle Funding ($ Billions Y-O-E)	$ 7.2	$ 3.4	$ 3.6	$ 4.0
40' Buses	2,260	1,938	1,972	2,049
60' Buses	255	117	140	191
Trackless Trolleys	38	0	0	0
Silver Liner VIs	270	16*	19*	26*
Trolleys	115	0	0	0
Articulated Trolleys	55	0	0	0
Broad Street Line	125	0	0	0
Market-Frankford Line**	220	0	0	0
Norristown High Speed Line**	26	0	0	0

* Vehicle numbers are representative of the available funding. Vehicle purchases are not cost effective at these low numbers.
** Vehicle fleet is being targeted for additional vehicle overhaul to extend service life as a cost savings measure.

Source: DVRPC 2013

Table 59. Potential Transit Funding Allocations

	Pennsylvania			New Jersey	
	2035 Plan	Transit 2	Transit 3	2035 Plan	Transit 2
Rail Infrastructure	22.0%	30.0%	32.0%	7.5%	13.0%
Vehicle Replacement/Rehab	38.0%	31.0%	33.0%	46.5%	23.5%
Station Enhancements	17.0%	13.5%	14.5%	10.0%	2.0%
Operational Improvements	5.0%	5.0%	5.0%	1.5%	8.0%
System Expansion	9.3%	5.0%	0.0%	25.0%	40.0%
Other	8.7%	15.5%	15.5%	9.5%	13.5%
Total	100%	100%	100%	100%	100.0%

Source: DVRPC 2013

need can be funded.

The 'T6 Other' funding category comes in at nearly 16 percent of funding need, largely due to the debt service on the Silverliner V cars. This category also includes other transit debt servicing, operating costs for Pottstown Area Rapid Transit (PART), leases on warehouses, tires, and copiers, safety and security needs, and coordinated human services.

SEPTA requested that system preservation funding allocation be proportional with its need. About 40 percent of system preservation need falls into rail improvements, 41 percent is vehicle replacement or rehabilitation, and 18 percent is station enhancements. Table 58 tracks vehicle replacements over the life of the plan as they arise. Very little funding will be available for rail vehicle and bus purchases. Two vehicle fleets, those on the Market-Frankford Line and the Norristown High Speed Line, are being targeted for additional vehicle overhaul in lieu of replacement. This is a cost-savings measure, as they will have reached an age where they would normally be replaced. Similar results would be found on the rail network, where many of SEPTA's rails are reaching the end of their 50-year lifespan, and for stations, which should undergo a major renovation every 30 to 40 years.

The major difference between the Pennsylvania Transit 2 and Transit 3 options in Table 59 is that the first allows for some system expansion. There is enough to fund one or two system expansions if the region is able to attract New Starts or Small Starts funding.

Funding allocation for NJ Transit was based on meeting all SGR needs and operational improvements. What was left over after these needs were met went to system expansion. The resulting allocation is shown in NJ Transit 2 in Table 59. The New Jersey Long-Range Plan Subcommittee considered including the West Trenton Line in the fiscally constrained plan if the North Jersey Transportation Planning Association (NJTPA) did likewise. Indications from NJTPA were that this line would not be in their fiscally constrained plan. As a result, West Trenton was placed on the unfunded list. Funding that would have gone to that line was put toward the Glassboro-Camden Line. While substantial funding is dedicated to this project, it will still be under construction in 2040 and not yet operational.

Connections 2040 Funding Allocations

The Long-Range Plan Committee considered the delay, operating cost, and VMT implications of different funding allocations. The committees then agreed to the following revenue allocation targets for the *Connections 2040* Plan:

- Pennsylvania Road 2 and Transit 3; and
- New Jersey Road 3 and Transit 2.

CHAPTER 5: Project Evaluation

Regional transportation needs stretch well beyond the reasonably anticipated revenue available to fund them. As a result, it is ever more imperative that transportation investments are made wisely and efficiently. To that end, DVRPC and its planning partners are utilizing Decision Lens, a proprietary software program that helps to guide the decision-making process to evaluate potential major regional projects for inclusion in the fiscally constrained, funded plan.

DVRPC has developed evaluation criteria for transportation projects over the past several plan iterations. *Connections (2035)* focused on evaluating system expansion projects. *Connections 2040* will also identify major regional pavement, bridge, and transit preservation projects, focusing on facilities that are on the National Highway System (NHS) and have a daily AADT of greater than 25,000 vehicles per day. Transit infrastructure renewal projects, such as track, bridges/viaducts, major passenger stations, and energy substations, are the focus of transit system preservation major regional projects. The identified projects are critical needs determined by SEPTA, NJ Transit, and DRPA/PATCO.

Pavement Reconstruction Criteria

Major pavement reconstruction criteria used in the Plan and funding allocation impact analysis included: AADT, daily trucks (ESAL, or equivalent single-axle load), IRI, pavement age, pavement speed restriction, and Business Plan Network (BPN). Table 60 identifies the scoring routine for each pavement segment. For more information on pavement criteria, see Appendix A.

Bridge Replacement Criteria

Major bridge replacement criteria used in developing *Connections 2040* and funding allocation impact analysis included: AADT; daily trucks; minimum deck, superstructure, or substructure rating; state rank; district rank; detour length; TIP status; truss (yes/no); and Business Plan Network (BPN). Table 61 identifies the scoring routine for each bridge. More information on bridge prioritization criteria can be found in Appendix B.

Once each bridge and pavement segment are rated and given a point total, projects undergo a cost optimization that compares the cost to the total points.

Table 60. Pavement Criteria

Criteria	Rating
Age	If pavement age >60, 1 point; if pavement age >50 and surface age >15, 0.9 points; if pavement age >50, 0.6 points; if surface age >15, 0.3 points.
Speed Restriction	If IRI speed limit is greater than the pavement segment's posted speed limit + 10 mph, 0 points; else (Posted Speed + 10 – Theoretical IRI Speed)/10. [See HERS-ST Maximum Speed Based On International Roughness Index (IRI) chart in Chapter 4 of this document].
Business Plan Network (BPN)	If pavement segment is an interstate, 1 point; if segment is a noninterstate National Highway System, 0.5 points, if segment has greater than 2,000 vehicles per day, 0.25 points; if segment is state-maintained with less than 2,000 vehicles per day, 0.125 points.
AADT	Road Segment AADT divided by Maximum AADT all road segments.
Equivalent Single-Axle Load (ESAL)	Road Segment ESAL divided by Maximum ESAL all road segments.
IRI Condition	If road segment is in fair condition, 4 points; if road segment is in poor condition, 2 points; if road segment is in good condition, 0.5 points.

Source: DVRPC 2013

Table 61. Bridge Criteria

Criteria	Rating	FP 1 & 2	FP 3 & 4
AADT	Bridge AADT/Maximum AADT all bridges.	0%	12.1%
Daily Trucks	Bridge Trucks/Maximum Trucks for all bridges.	0%	12.1%
Business Plan Network (BPN)	If pavement segment is an interstate, 1 point; if segment is a noninterstate national highway system, 0.5 points; if segment has greater than 2,000 vehicles per day, 0.25 points; if segment is state-maintained with less than 2,000 vehicles per day, 0.125 points.	0%	6.1%
Minimum Bridge Rating (halved during first two funding periods)	If minimum (deck, super, substructure) <= 2, 8 points; if minimum (deck, super, substructure) <= 3, 4 points; if minimum (deck, super, sub) >=4 and <=5, 2 points; if minimum (deck, super, sub) >=3 and <=4; 1 point; if minimum (deck, super, substructure) <= 6, 0.5 points.	0%	48.5%
State Rank (SRANK)	If SRANK<=100, 1 point; if SRANK <=250, 0.5 points; If SRANK <=500, 0.25 points; if SRANK <=1,000, 0.125 points.	0%	6.1%
District Rank (DRANK)	If DRANK<=100, 1 point; if DRANK <=250, 0.5 points; if DRANK <=500, 0.25 points; if DRANK <=1,000, 0.125 points.	0%	6.1%
TIP Status	If bridge has TIP funds during funding period, 3 points; else 0 points.	100%	0%
Detour Length	If detour >= 10 miles, 1 point; if detour >= 7 miles, 0.5 points; if detour >= 5 miles, 0.25 points; if detour >= 3 miles, 0.125 points; else 0 points.	0%	6.1%
Truss	If bridge is a truss, 0.5 points; else 0 points.	0%	3.0%

Source: DVRPC 2013

Transit Preservation Criteria

SEPTA has developed criteria for evaluating projects for inclusion in the capital budget. Renewal and replacement activities are prioritized based on the following criteria:

- Age divided by useful life;
- Cost per passenger; and
- Safety criticality.

SEPTA has identified over 6,000 capital renewal activities and associated useful life years identified for each. For example, a bridge anticipates a useful life of 50 to 100 years depending on material and type of construction.

Each activity has an associated number of passengers affected. Estimated ridership for a single bus is determined by dividing the total number of daily bus riders by the size of the bus fleet. Shop and maintenance equipment is determined by the ridership on the routes that it serves. Some items may not have ridership associated with them, such as nonrevenue vehicles or transit police cars.

SEPTA will always pursue and prioritize safety projects. Those that are deemed to be a safety improvement will receive a heavier weight than those that are not critical safety projects.

System Expansion Criteria

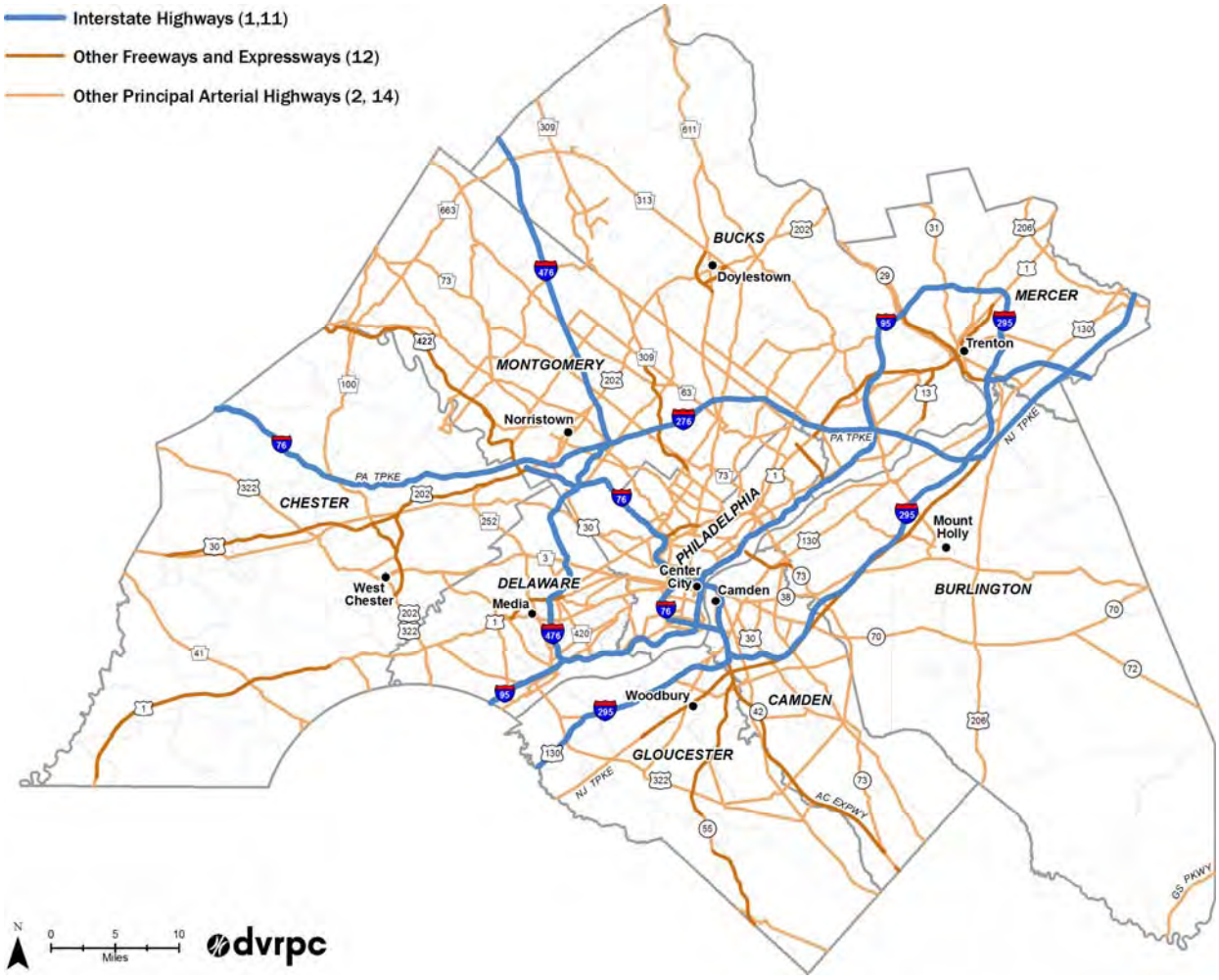
A primary objective of the DVRPC long-range planning process is to ensure that transportation investments help further the goals of the long-range plan. *Connections 2040* has four core principles: Create Livable Communities; Manage Growth and Protect the Environment; Build the Economy; and Establish a Modern Multimodal Transportation System. These four principles form a framework for the goals of the Plan. Under this context, the individual goals of rebuilding the existing system, reducing congestion, improving safety and security, increasing mobility and accessibility, limiting

impacts on the natural environment, and improving transportation operations all further the principle of investing in a modern, multimodal transportation system.

The previous *Connections (2035)* and *Destination 2030* plans began the process of developing project evaluation criteria. The *Destination 2030* criteria were both quantitative and qualitative and were established around key transportation goals. All highway and transit major regional projects were evaluated using 14 criteria. One shortfall of this process was that while some criteria were suitable for all types of projects, others only pertained to specific categories of projects.

Connections 2040 continues to carefully define major regional projects that are included in the financial plan. Major regional projects are large-scale projects that will have a significant impact on regional travel. These projects consist of new roadway capacity or new fixed guideway or bus rapid transit, along with major reconstruction projects. Major new roadway capacity is defined as widening, extending, or building new limited-access highways of any length; creating a new interchange or adding missing movements

Figure 7. Major Regional Roadways



between freeways (functional classes 1, 11, 12, or 99) and arterials; or widening, extending, or building new principal arterials (functional classes 2 or 12) for more than one lane mile. Any project that upgrades an existing road from another functional class to one of the aforementioned functional classes is also a major regional system expansion project. Major new transit capacity projects include: new fixed-route guideway (regional rail, subway, light rail, trolley, and trackless trolley) or bus rapid transit (BRT) service with dedicated lanes. Given fiscal constraint, major regional projects should undergo a more rigorous analysis.

The system expansion analysis is done in a two-tier project evaluation. The first tier is a screening to determine if the project warrants additional consideration. For roadways, this means that a proposed project invests in areas that are currently developed or have been identified as areas appropriate for development over the life of the plan, and that the project is consistent with the region's Congestion Management Process (CMP).

Transit projects must also serve areas that are currently developed or have been identified as areas appropriate for development over the life of the plan. The projects that pass the screening are then further evaluated by a series of measures that assess the extent to which proposed major regional projects meet key goals of *Connections 2040* using Decision Lens. The DVRPC Long-Range Plan Committee used the Decision Lens results as guidance for selecting the major regional projects included in the *Connections 2040* plan. These projects are identified in the next section of this document.

Decision Lens

Decision Lens is a proprietary software program licensed by the Pennsylvania Department of Transportation (PennDOT). Decision Lens facilitates collaborative group decision-making in four basic steps.

- Build a model:
  - Develop the criteria that will analyze the alternatives; and
  - Identify the alternatives that will be considered.
- Compare criteria:
  - Use pairwise judgment process to weight the criteria to each other; and
  - Evaluate alternatives.
- Allocate resources; and
- Analyze alternative costs to benefits to select those with best return on investment.

Building a model starts with brainstorming different potential criteria. DVRPC reviewed past and ongoing industry research, as well as best practices from peer Metropolitan Planning Organizations, to determine an initial list of feasible criteria. The initial list for system expansion projects included 41 highway and 29 transit criteria. A regional stakeholder committee then met to develop a set of transit and highway criteria. The committee broke into three separate highway and three separate transit groups, with each group identifying a full set of criteria. The groups were not restricted to the initial lists, and a number of notable new criteria were identified by the stakeholder group. The criteria lists developed by these groups were used by DVRPC staff as a basis for an initial set of highway and transit criteria. The Long-Range Plan Committee discussed and revised the proposed criteria, and agreed upon a final list.

In the next step, Compare Criteria, the Long-Range Plan Committee voted on the final set of criteria, as a single group. Each criterion was compared to each of the other criteria in a head-to-head pairwise judgment. In this voting, each criterion is compared to every other criterion on an individual basis. This determines which of the two criteria is the more important on a scale of one to nine. Each increasing number on this scale considered to be that many times more important to the decision-making process. The result is a weighting of each criterion reflecting its overall importance in the decision-making process.

In the Evaluate Alternatives step, DVRPC analyzed each proposed major regional system expansion project to score it relative to each criterion. DVRPC conducted a GIS-based analysis for criteria such as: location in CMP Priority and Congested Subcorridors; Environmental Screening Tool impacts; Plan and Freight Centers served; Degrees of Disadvantage impacts; and Transit Score of communities proposed to be served by new transit facilities. Each project was rated based on scales identified by the Long-Range Plan Committee. In a number of instances, these scales are set up as quintiles, where the top 20 percent of projects will receive the highest score, the next 20 percent of projects will receive the second highest score, and so forth. These quintiles will be revised to the target set by the lowest and highest score projects included in the Plan. These targets will then be used in the future when, or if, any Plan amendments occur.

DVRPC intended to run its travel demand model for a baseline of 2040 population and employment using the existing transportation network. Each project would then be run through the model separately and compared to the baseline to determine new regional transit ridership and change in vehicle hours traveled (VHT) for transit projects, and change in VHT and change in volume to capacity (V/C) ratio for highway projects. However, time constraints due to upgrading the region's TIM 2.0 version of the travel demand model made modeling all the projects unfeasible.

The last step in Decision Lens allocated resources and conducted a cost-benefit analysis. The cost side of this equation is the system expansion cost of the proposed project paid for from state and federal transportation funding sources. Thus, additional local, private, tolling, or other nontraditional funding do not count toward the project cost in this analysis and will increase the projects' cost-to-benefit ratio, improving its relative score. The Decision Lens funding allocation recommendations are not final. The Long-Range Plan Committee and DVRPC Board can still revise the final list to incorporate local knowledge, geographic equity, or other important considerations not considered by the evaluation criteria.

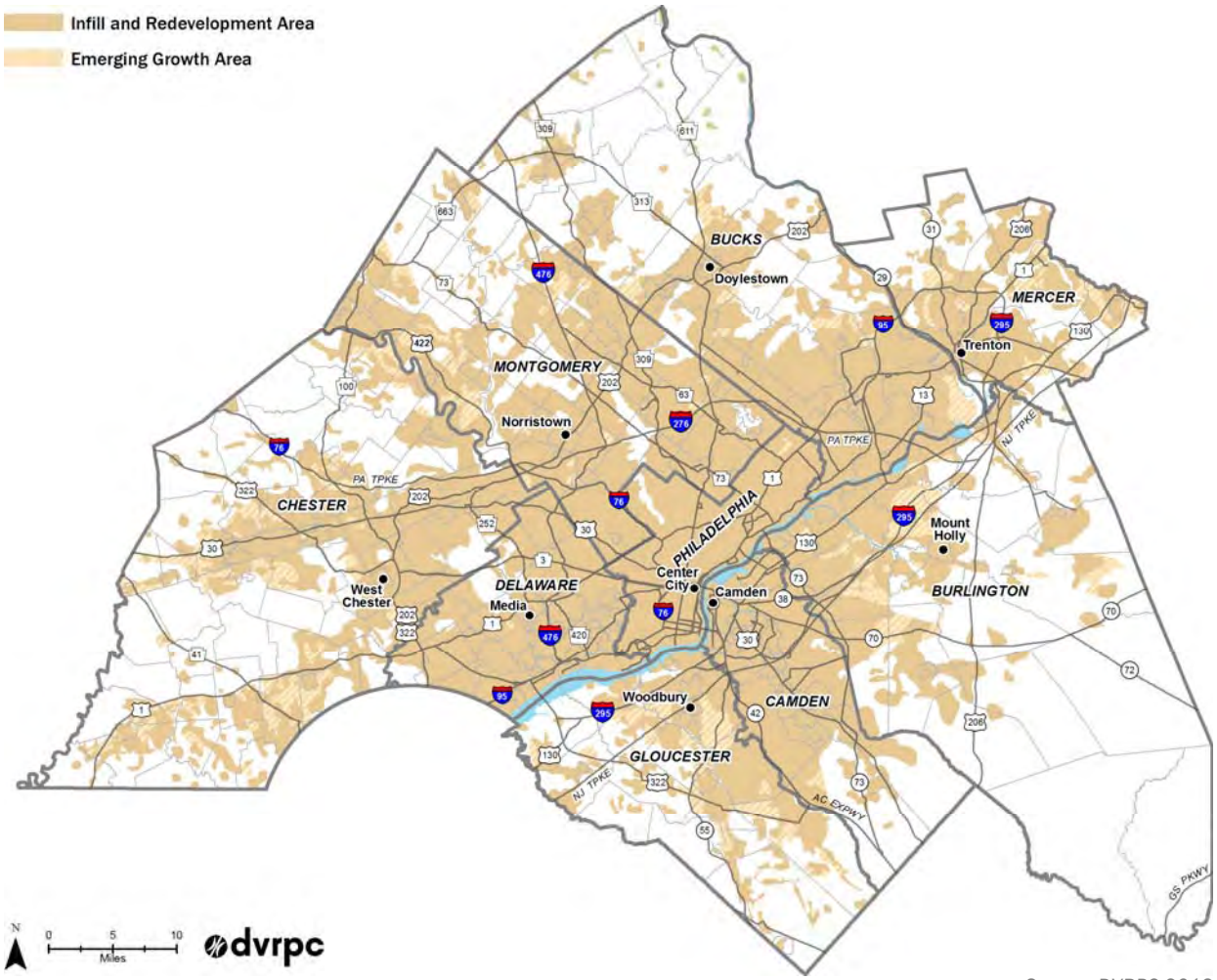
Screening Criteria

Screening criteria removes projects that do not meet certain basic criteria from the project selection process. Both highway and transit system expansion projects should be primarily located in either Existing Infill/Redevelopment or Emerging Growth areas, as defined by the *Connections 2040* Land Use Vision map. For arterials, more than 75 percent of total project limits, at a minimum, should be included in such areas. For limited-access freeways, all interchanges must be located in these areas. For fixed guideway rail and BRT projects, 75 percent of station stops should be located in Infill/Redevelopment or Emerging Growth areas.

Any highway project adding single-occupancy vehicle (SOV) capacity must be consistent with the CMP to be eligible for federal funding. The CMP identifies congested subcorridors and multimodal strategies to mitigate the congestion. Where more SOV road capacity is appropriate, the CMP includes potential supplemental strategies to get the most long-term value from the investment. The CMP also identifies emerging/regionally significant corridors where proactive steps are especially important to prevent congestion, and inexpensive strategies that are appropriate everywhere.

To be consistent with the CMP, a proposed roadway system expansion project must be located in a subcorridor where adding SOV capacity is listed as a very appropriate or secondary strategy. If adding SOV capacity is not included as a strategy, the project must undergo quantitative analysis, including the listed strategies and comparison of the results for the region, as well as for the project area. Projects outside of corridors must demonstrate consistency with the Plan, follow CMP procedures, and compare well with projects located in corridors.

Figure 8. Connections 2040 Land Use



Source: DVRPC 2013

While not a screening criteria, system expansion projects should be timed to the greatest extent possible to align with the ongoing effort to rebuild the regional transportation system. Due to ongoing funding constraints, any selected system expansion project should be timed so as to coincide with the existing facility's normal reconstruction cycle.

Roadway Evaluation Criteria

Projects that pass the initial screening will be assessed based on the criteria that follows. Each criterion has a set of rating measures to score the project. These criteria were weighted by the Long-Range Plan Committee in Decision Lens and used to create an overall benefits score using both the projects rating and the criteria weights. The resulting score was then compared to the project's federal and state costs. Decision Lens performs an optimization to identify the set of projects that best maximize the cost-to-benefit ratio, within a constrained funding level.

Is the project located in a CMP Priority or Congested Subcorridor?

The CMP has conducted considerable analysis of the regional transportation network and the impact of congestion. Developed with the counties, DOTs, transit operators, and other regional stakeholders, the CMP has identified a subset of Priority Subcorridors for transportation investment with specific strategies

for mitigating congestion. This criterion also considers Congested Subcorridors as a secondary rating factor. In areas where Priority and Congested Subcorridors overlap, only the higher value will be counted.

- Definition: Percent of project limits in a Priority Subcorridor * 100 percent + percent of project limits in a Congested Subcorridor * 50 percent.
- Rating: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point.

What is the reduction in regional vehicle hours of travel (VHT) associated with the project?

This criterion elevates those projects that have the greatest potential to either reduce VHT or delay as a result of recurring congestion.

- Definition: Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline and 2040 demographics and the existing transportation system plus the built project for comparison.
- Rating: Evaluated projects will be grouped into quintiles ranging from the highest decrease/lowest increase in VHT quintile = 1 point; 2nd highest decrease/2nd lowest increase in VHT quintile = .5 point; 3rd highest decrease/3rd lowest increase in VHT quintile = .25 point; 4th lowest decrease/4th lowest increase in VHT quintile = .125 point; lowest decrease/highest increase in VHT quintile = 0 points.

What is the average annual daily traffic multiplied by the peak-period volume-to-capacity (V/C) ratio within the project limits?

This criterion elevates those projects that have the greatest significance for carrying regional travel, while prioritizing the largest facilities by their level of congestion. Thus, a road with less daily traffic but more congestion could receive a higher score relative to a road with more daily traffic but less congestion depending upon actual annual average daily traffic (AADT) and/or V/C ratio.

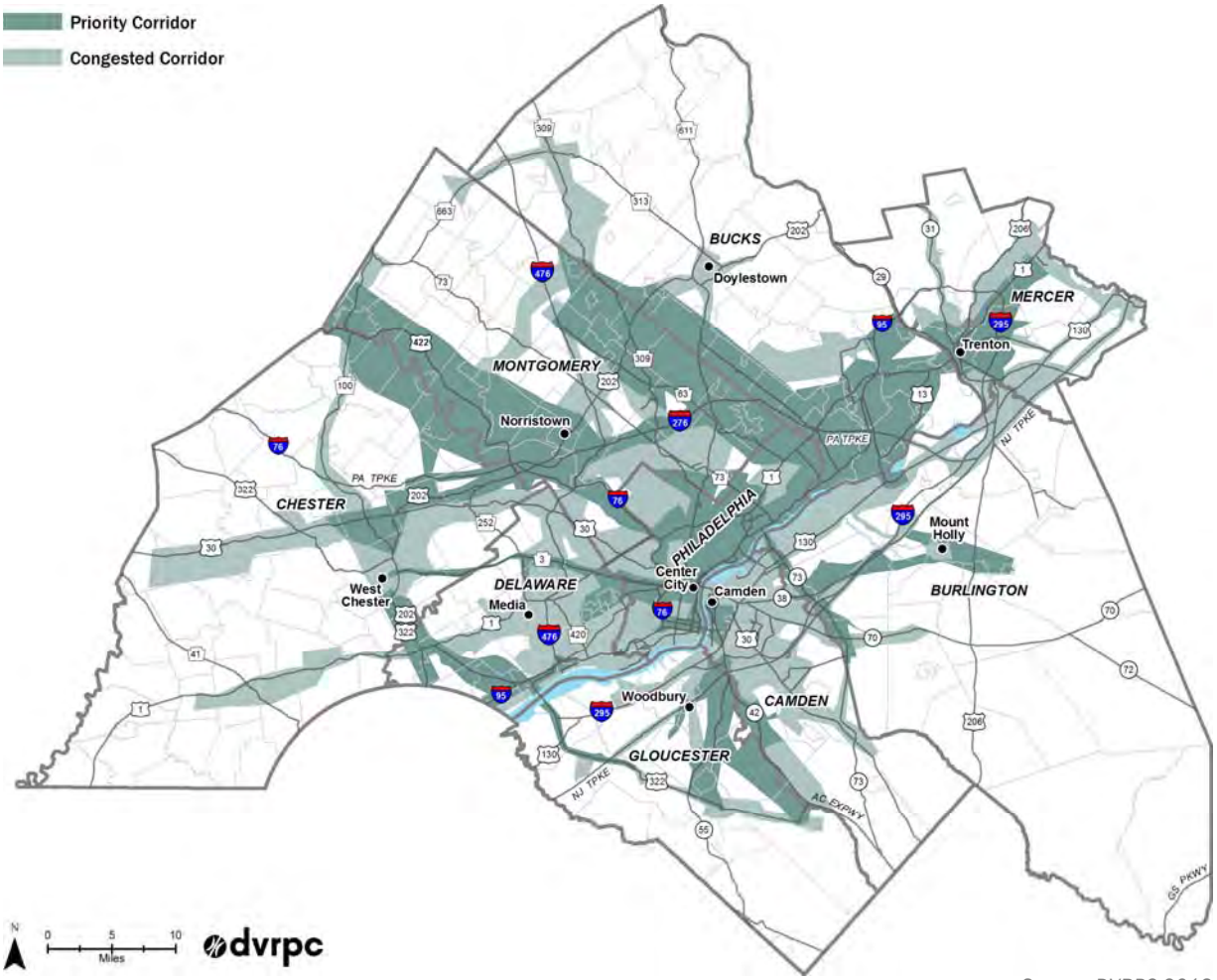
- Definition: Use AADT data from the most current available Roadway Management System (RMS) for Pennsylvania, or Linear Reference System (LRS) for New Jersey, and compute V/C ratio using daily capacity as defined in DVRPC's Travel Demand Model.
- Rating: Highest AADT * V/C ratio quintile = 1 point; 2nd highest AADT * V/C ratio quintile = .5 point; 3rd highest AADT * V/C ratio quintile = .25 point; 4th highest AADT * V/C ratio quintile = .125 point; lowest AADT * V/C ratio quintile = 0 points.

What is the daily truck traffic on the facility?

Truck traffic is critical for the movement of freight and a very important segment of the regional economy. Improvements to these facilities with high amounts of truck traffic will contribute to the improvement of goods movement in the region.

- Definition: Using data from the most current available Roadway Management System (RMS) for Pennsylvania, and by functional class using DVRPC average regional values for "heavy trucks" plus buses as derived from traffic counts and travel surveys over time for New Jersey

Figure 9. 2011 CMP Priority Subcorridors



Source: DVRPC 2013

- Rating: >7,500 = 1 point; >5,000 = .5 point; >2,500 = .25 point; >1,000 = .125 point. Are there significant environmental issues that will be impacted by the project?

MAP-21 includes language that directs MPOs to more fully incorporate environmental considerations into the short- and long-range transportation planning process. The environmental screening tool aims to evaluate the impacts of transportation projects on environmental features and assigns a quantitative value to those impacts. To begin this process, each proposed major regional project is assigned a buffer. For highway projects, the size of the buffer is based upon the type of facility and whether the capacity increase is a widening of an existing facility within an existing right of way (ROW) or is a new alignment.

Buffer sizes reflect the fact that transportation impacts extend well beyond the project right of way, due to habitat fragmentation, the systemic nature of ecosystem function, and secondary impacts, such as potential land use change and water quality impacts. Buffer distances are sized based on similar studies and in a "regionally appropriate" manner. The buffer categories are as follows:

- Highway capacity enhancement within existing arterial ROW: one-half of a mile.
- Highway capacity enhancement within existing freeway ROW: one mile.
- New highway right-of-way facility: two miles.

Proposed projects are overlaid with 10 key environmental data layers outlined below. The data layers are "rasterized" into a grid of 30-meter cells. The presence of an environmental feature within a cell will give that cell a value of one point. The presence of two features will give the cell a value of two, and so forth, with a maximum cell value of 10. The value of each and every cell within a project's buffer area will be summed to produce a cumulative score.

This analysis calculates the natural and ecological context of transportation projects and provides an early indication of potential relative environmental impacts. A high score indicates a higher likelihood of potential impacts and conflicts with conservation objectives.

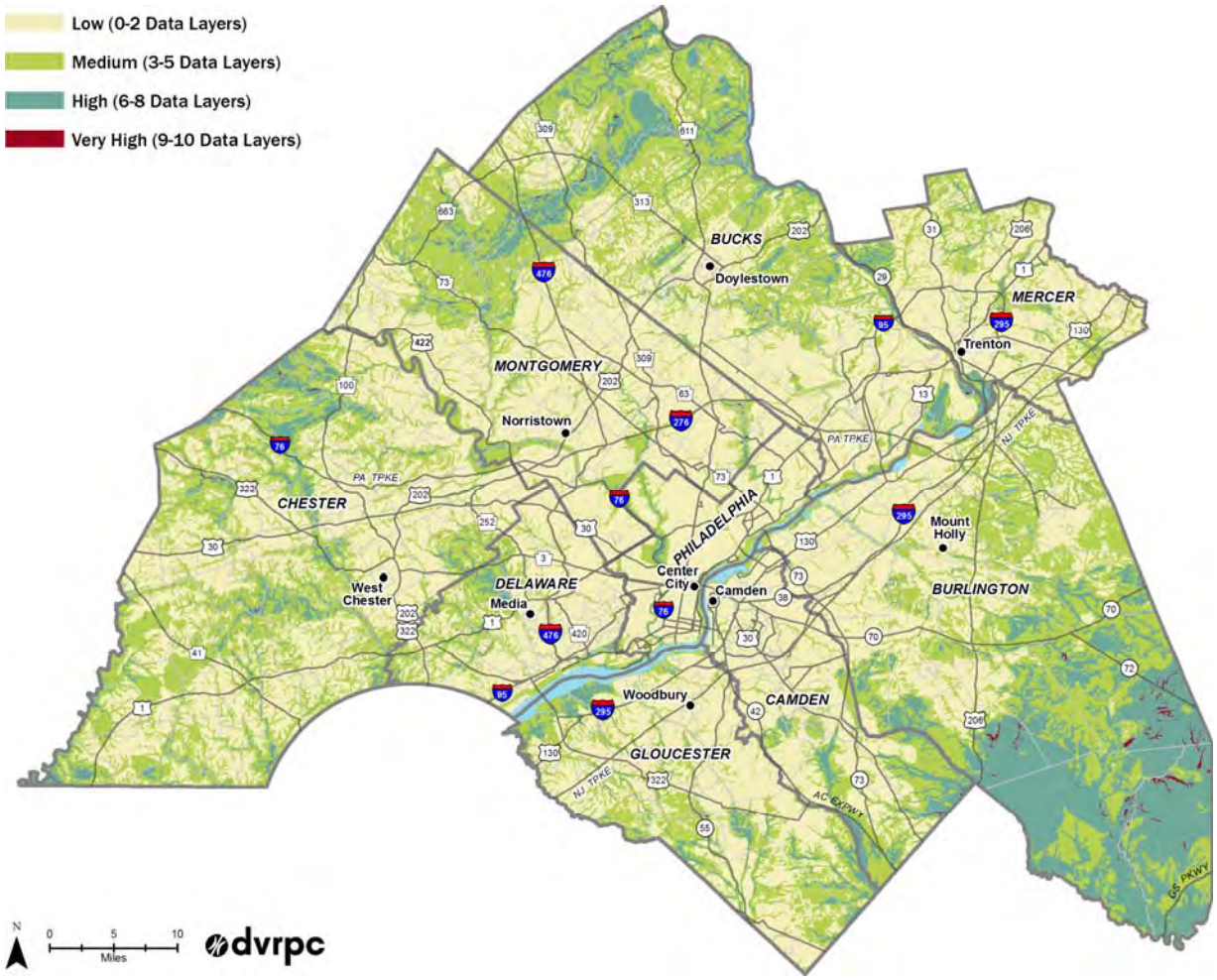
The following data layers are included in the Environmental Screening Tool:

- 2040 Greenspace Network;
- 2040 Conservation Focus Areas;
- 2040 Rural Resource Lands;
- Wetlands:
  - Pennsylvania – National Wetlands Inventory; and
  - New Jersey – NJ DEP Land Use/Land Cover Data.
- Woodlands – DVRPC 2010 Land Use;
- Floodplains – FEMA 100-year floodplains;
- Steep Slopes – Over 10 percent;
- Riparian Buffers – All streams within the DVRPC region will be assigned a 300-foot buffer;
- High-Value Habitat Areas:
  - Pennsylvania – Smart Conservation Model values of 8, 9, and 10; and
  - New Jersey – Landscape Project Critical Habitat Areas; and
- Significant Natural Areas
  - Pennsylvania – Natural Areas Inventory sites; and
  - New Jersey – Natural Heritage Priority sites.

Each of these environmental data layers are weighted equally since the point of the analysis is to evaluate and compare the impacts of transportation projects on the environment, not compare the relative weight of one environmental feature to another. However, the screening tool achieves appropriate weight or "depth" due to feature overlap. For example, a wooded floodplain area within the Greenspace Network scores three times higher than land that is wooded but not within a floodplain or the Greenspace Network. It should be noted that key agricultural lands are incorporated into this analysis insomuch as they are included within DVPRC's Conservation Focus Areas.

- Definition: For capacity enhancement on a limited access freeway or interchange, consider a one-mile buffer around project limits; for capacity enhancement on an arterial, consider a .5-mile buffer; for new alignments, consider a two-mile buffer.
- Rating: Percent of project area with a range of 0 to 2 Environmental Screening Tool score; >90 percent = 1 point; >75 percent = .5 point; >60 percent = .25 point; >40 percent = .125 point.

Figure 10. DVRPC Environmental Screening Tool



Source: DVRPC 2013

How far has the project advanced?

This criterion reflects project readiness and gives a higher score to those projects that have advanced through the various stages of the project development process. Projects that have advanced further through this process have undergone rigorous examination and typically have a higher level of support from regional stakeholders compared to other projects. This criterion prioritizes those projects that are most ready to move forward to construction.

- Definition: Project status in the respective Pennsylvania or New Jersey department of transportation project database. This criterion gives credit for the highest authorized phase. Each preceding phase must also have been authorized (e.g., A project would not receive credit for authorized Utility or Right of Way (ROW) unless it had previously been authorized for Final Design).
- Rating: Authorized for Construction = 1 point; Authorized for Utility or ROW = .5 point; Authorized for Final Design = .25 point; Authorized for Preliminary Engineering = .125 point.

What is the total population and employment in Regional Plan Centers and Freight Centers served by the project?

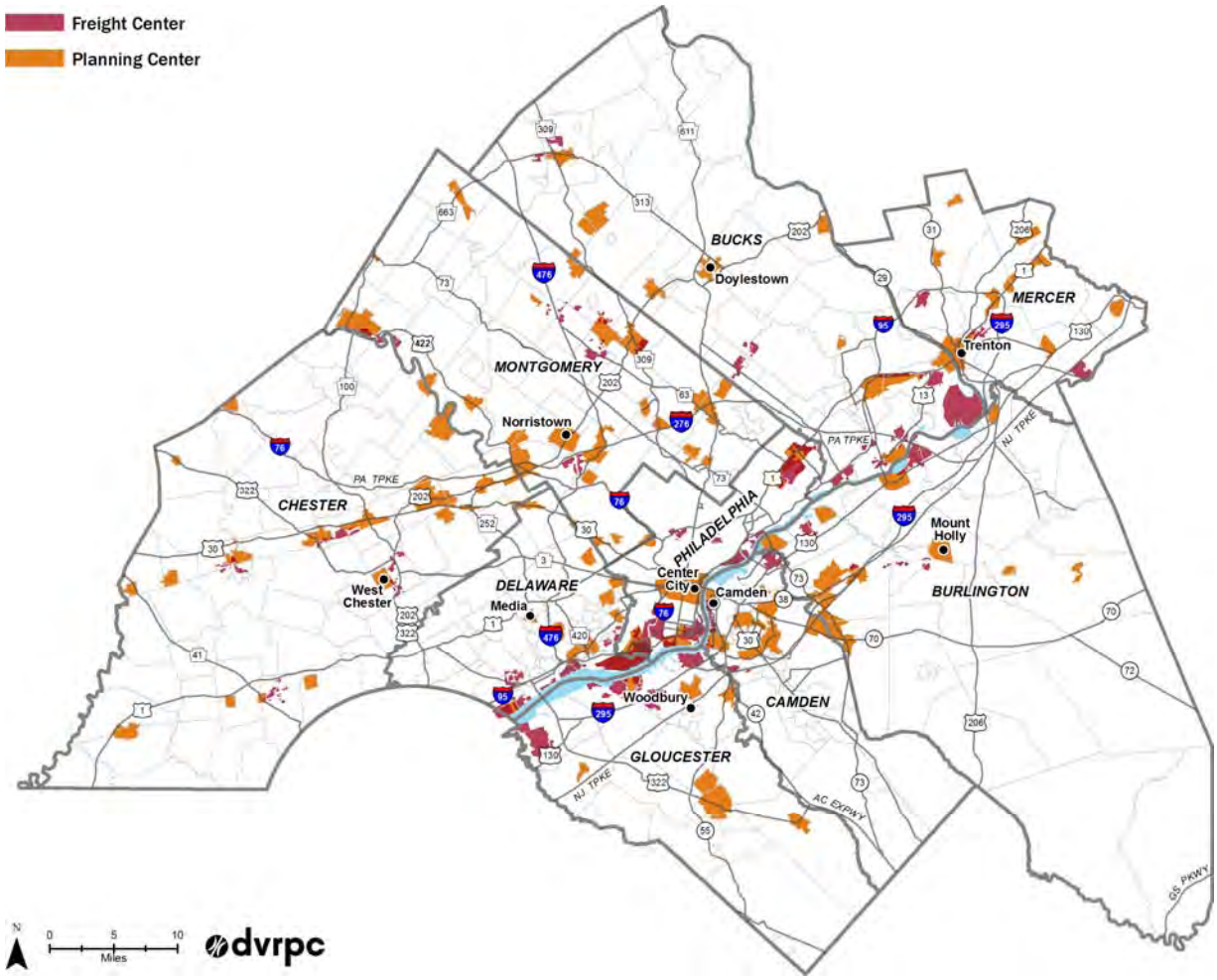
Highway system expansions should enforce existing or planned developed places that are designated as a Plan or Freight Center in *Connections 2040*.

- Definition: Use population and employment data from the U.S. Census. To be counted as serving a center, an arterial, interchange(s), or on-/off-ramps

of a limited-access freeway, the project must be located within one mile of the center.

- Rating: All evaluated projects will be broken down into quintiles ranging from the highest population plus employment quintile = 1 point; 2nd highest population plus employment quintile = .5 point; 3rd highest population plus employment quintile = .25 point; 4th highest population plus employment quintile = .125 point; lowest population plus employment quintile = 0 points.

Figure 11. Connections 2040 Plan and Freight Centers



Source: DVRPC 2013

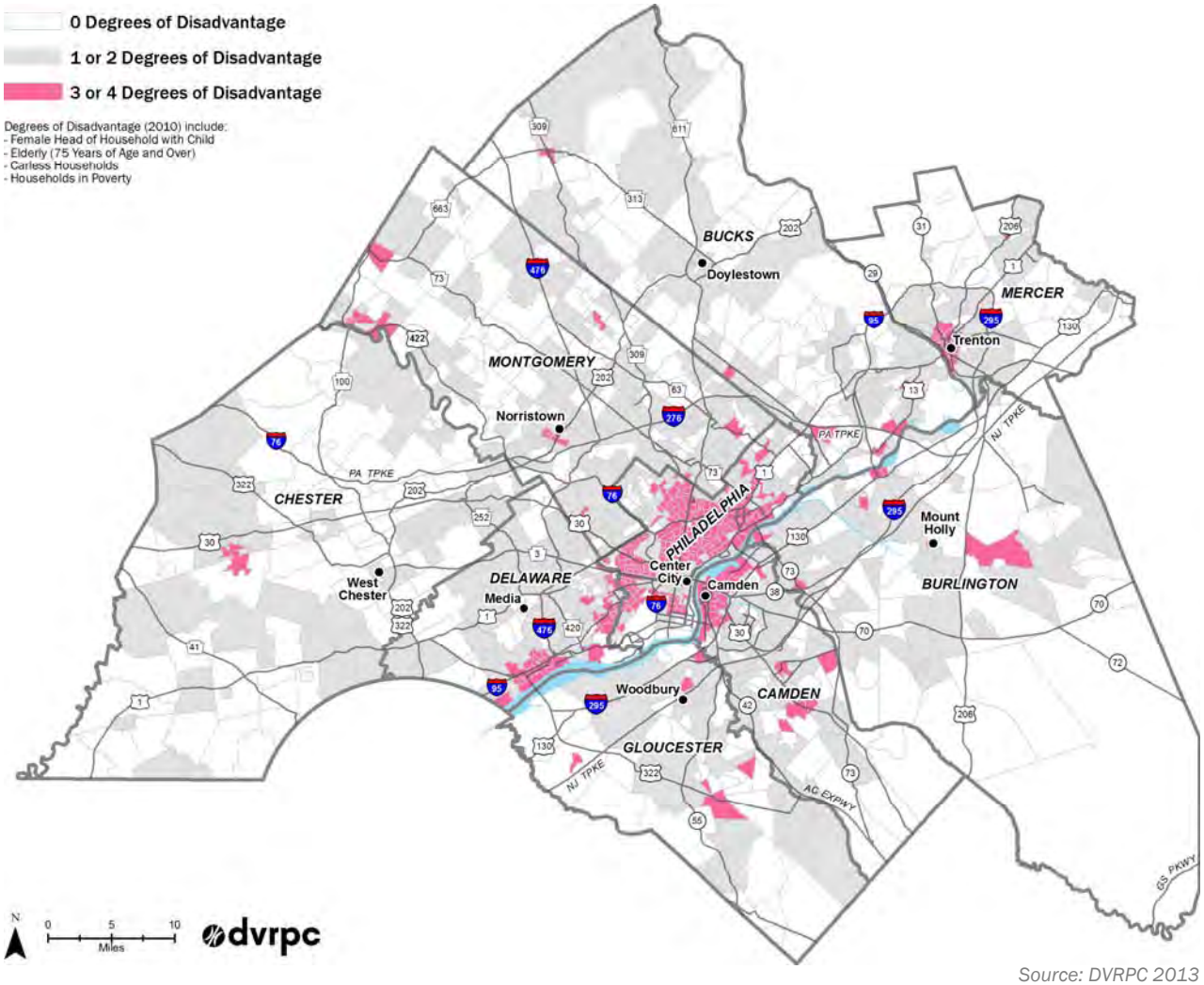
Transit Evaluation Criteria

Projects that pass the initial transit screening will be assessed based on the following criteria. Each criterion has a set of rating measures to score the project. These criteria were also weighted by the Long-Range Plan Committee in Decision Lens and used to create an overall benefits score using both the projects rating and the criteria weights. The resulting score will be compared to the project's federal and state costs. Decision Lens will then identify the set of projects that best maximize the cost-to-benefit ratio.

How well does the project serve Environmental Justice communities and underserved population groups?

Many communities are heavily reliant on transit service to provide accessibility to school, employment, and services. Does the project serve Environmental Justice communities and the additional population groups, as defined by the DVRPC Degree of Disadvantage (DOD) methodology, with additional transit needs? This analysis uses four of the eight DODs identified by DVRPC. The four DODs are based on census tracts that meet or exceed the regional average in elderly, disabled, poverty, or female head of household demographics.

Figure 12. Degree of Disadvantage Analysis



Source: DVRPC 2013

- Definition: Percent of station stops in DOD communities.
- Rating: Percent of station stops in areas with 3 to 4 Degrees of Disadvantage (DODs) * 100 percent + percent of station stops in 1 to 2 DODs * 50 percent; >70 percent = 1 point; >50 percent = .5 point; >30 percent = .25 point; >10 percent = .125 point.

How fully has the project been studied?

The Federal Transit Administration (FTA) has set definitions for the level of study that a transit system expansion project must complete in order to be eligible for federal New Starts funding. A more detailed level of study produces more robust farebox recovery rates and cost estimates, as well as a better understanding of various alternative routings, and indicates a higher level of local and political support.

- Rating: If the project has a completed Environmental Impact Statement (EIS) = 1 point; a completed FTA Alternatives Analysis (Full Alternatives Analysis) = .5 point; a feasibility analysis or non-FTA alternatives analysis (Conceptual AA) = .25 point; a sketch-level planning study (Sketch Plan) = .125 point.

Is the project located in a CMP Priority or Congested Subcorridor?

The CMP has conducted considerable analysis of the regional transportation network and the impact of congestion. Developed with the counties, DOTs, transit operators, and other regional stakeholders, the CMP has identified a subset of Priority Subcorridors for transportation investment with specific strategies for mitigating congestion. This criterion also considers Congested Subcorridors as a secondary rating factor.

- Definition: Percent of proposed fixed guideway or BRT station stops in Priority Subcorridor x 100 percent + percent of proposed fixed guideway or BRT station stops in Congested Subcorridor x 50 percent.
- Rating: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point.

What is the reduction in regional vehicle hours of travel (VHT) associated with the project?

This criterion elevates those projects that have the greatest potential to either reduce VMT or delay as a result of recurring congestion by shifting vehicle trips to transit trips.

- Definition: Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline, and 2040 demographics and the existing transportation system plus the built project for comparison.
- Rating: Evaluated projects will be broken down into quintiles ranging from the highest decrease/lowest increase in VHT quintile = 1 point; 2nd highest decrease/2nd lowest increase in VHT quintile = .5 point; 3rd highest decrease/3rd lowest increase in VHT quintile = .25 point; 4th lowest decrease/4th lowest increase in VHT quintile = .125 point; to lowest decrease/highest increase in VHT quintile = 0 points.

How much new transit ridership is generated by the project?

The ability of a transit project to attract new riders to the transit system, as opposed to merely shifting riders from bus to rail, is critical for reducing congestion, increasing safety, promoting livability, and achieving sustainability.

- Definition: Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline, and 2040 demographics and the existing transportation system plus the built project for comparison.
- Rating: Evaluated projects will be broken down into quintiles ranging from the highest new passenger quintile = 1 point; 2nd highest new passenger quintile = .5 point; 3rd highest new passenger quintile = .25 point; 4th highest new passenger quintile = .125 point; to lowest new passenger quintile = 0 points.

What is the anticipated farebox recovery rate?

Given that future funding constraints will likely be ongoing, we must ensure that future revenues from a project will be able to fund its ongoing operating and maintenance costs

- Definition: Use estimated farebox recovery rate from highest level of study completed to date.
- Rating: Evaluated projects farebox recovery rate > 100 percent = 1 point; farebox recovery rate > 80 percent = .5 point; farebox recovery rate > 60 percent = .25 point; farebox recovery rate > 40 percent = .125 point; farebox recovery rate < 40 percent or not estimated as part of a study = 0 points.

What is the proposed project's transit-oriented development (TOD) potential?

Transit network expansions should encourage future TOD. This indicator looks at the TOD potential of station stops along the proposed route.

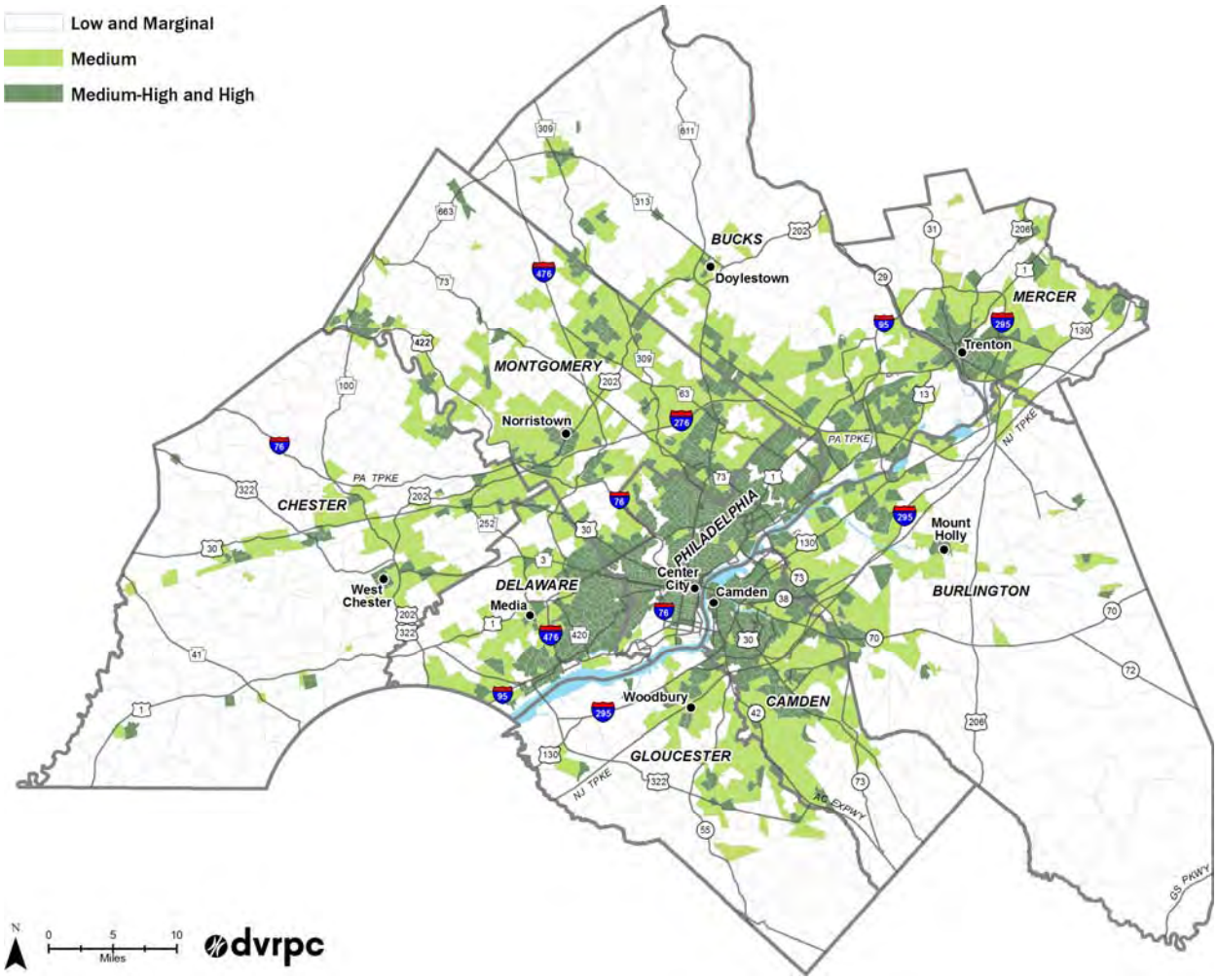
- Definition: Amount of vacant land within one-half mile of proposed station stops based on DVRPC's 2010 land use file.
- Rating: Evaluated projects will be broken down into quintiles ranging from the highest vacant acres quintile = 1 point; 2nd highest vacant acres quintile = .5 point; 3rd highest vacant acres quintile = .25 point; 4th highest vacant acres quintile = .125 point; lowest vacant acres quintile = 0 points.

What is the transit score of the communities the route proposes to serve?

Transit network expansions should enforce existing or planned developed places where the requisite density exists to ensure high levels of ridership. The Transit Score Index indicates whether a project has the requisite density to be successful. Because the region's Centers have a high degree of density, this measure also serves as a proxy for serving centers of place. Analysis is based on the percentage of the proposed station stops that serve census tracts ranked as either Medium-High or High using the Transit Score Index for fixed guideway, and Medium, Medium-High, or High for BRT.

- Definition: Based on the 2010 DVRPC/NJ Transit Score Index.
- Rating:
  - For Fixed Guideway Rail: percent of proposed station stops in Medium-High or High Transit Score TAZs: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point; and
  - For Bus Rapid Transit: percent of proposed station stops in Medium, Medium-High, or High Transit Score TAZs: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point.

Figure 13. 2010 Transit Score by TAZ



Source: DVRPC 2013

Weighting Evaluation Criteria

The Decision Lens software was used by the Long-Range Plan Committee to conduct a pairwise comparison of each of the evaluation criteria, in which each criterion is compared to every other criterion on an individual basis. A separate exercise was conducted for roadway and transit evaluation criteria. Tables 66 and 67 show the weighting of each criterion based on the results of the Decision Lens voting.

The Decision Lens model provides two ways to check the group results for validity. The first, inconsistency, measures how well the group votes between the different criteria. For instance, if criterion A is greater than criterion B and criterion B is greater than criterion C, logically, criterion A is also greater than criterion C. If the group were to vote criterion C greater than criterion A, than the group is being inconsistent. A valid Decision Lens model will have an inconsistency score below .1. This exercise produced an inconsistency rating of .016 for the roadway criteria and .019 for the transit criteria.

The second checkpoint is alignment, which measures the group's synchronicity. If all members of the group vote exactly the same way, then the results are from 'group think' and are considered to lack diverging viewpoints. If all the votes are completely different, then there is too little agreement between the group. An alignment above .9 is considered groupthink, while a score below .1 indicates lack of substantive agreement. A score between .2 and .8 is considered ideal. The project evaluation criteria results from this exercise produced an alignment of .339 for the highway criteria and .299 for the transit criteria.

Table 62. Roadway Major Regional System Expansion Project Screening Summary Table

Criterion	Description
Location in Infill/Redevelopment or Emerging Growth Areas	As defined by the *Connections 2040* Land Use Vision map, for all classes of roads, except limited-access freeways, more than 75 percent of project length, at a minimum, should be included in Infill/Redevelopment or Emerging Growth areas. For limited-access freeways, all interchanges must be located in these areas.
Consistency with Congestion Management Process (CMP)	Any project adding single-occupant vehicle (SOV) capacity must be consistent with the CMP to be eligible for federal funding. The CMP identifies congested subcorridors and multimodal strategies to mitigate the congestion. Where more SOV road capacity is appropriate, the CMP includes potential supplemental strategies to get the most long-term value from the investment. The CMP also identifies emerging/regionally significant corridors where proactive steps are especially important to prevent congestion, and inexpensive strategies that are appropriate everywhere. To be consistent with the CMP, a proposed project must be located in a subcorridor where adding SOV capacity is listed as a very appropriate or supplemental strategy. If adding SOV capacity is not included as a strategy, the project must undergo quantitative analysis, including the listed strategies and comparison of the results for the region, as well as for the project area. Projects outside of corridors must demonstrate consistency with the Plan, follow CMP procedures, and compare well with projects located in corridors.

Source: DVRPC 2012

Table 63. Transit Major Regional System Expansion Project Screening Summary Table

Criterion	Description
Location in Infill/Redevelopment or Emerging Growth Areas	A minimum of 75 percent of proposed station stops must be located in Infill/Redevelopment or Emerging Growth areas on the *Connections 2040* Land Use Vision map.

Source: DVRPC 2012

Table 64. Roadway Major Regional System Expansion Project Evaluation Criteria Summary

Criterion / Weight	Rating
What is the total population and employment in regional Plan Centers and Freight Centers served by the project? – 27.2%	Using population and employment data from the U.S. Census. To be counted as serving a Center, an arterial project must be located within one mile of the Center, if the project is on a limited-access facility, the on-/off-ramps must be located within one mile of the center. Break all projects into quintiles ranging from the highest population plus employment quintile = 1 point, 2nd highest population plus employment quintile = .5 point; 3rd highest population plus employment quintile = .25 point; 4th highest population plus employment quintile = .125 point; to lowest population plus employment quintile = 0 points.
What is the project's status in the respective Pennsylvania or New Jersey Department of Transportation project database? – 22.5%	Each preceding phase must also have been authorized. Authorized for Construction = 1 point; Authorized for Utility or ROW = .5 point; Authorized for Final Design = .25 point; Authorized for Preliminary Engineering = .125 point.
What is the reduction in regional vehicle hours of travel (VHT) associated with the project? – 15.5%	Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline, and 2040 demographics and the existing transportation system plus the built project for comparison. Break all projects into quintiles ranging from the highest decrease/lowest increase in VHT quintile = 1 point, 2nd highest decrease/2nd lowest increase in VHT quintile = .5 point; 3rd highest decrease/3rd lowest increase in VHT quintile = .25 point; 4th highest decrease/4th lowest increase in VHT quintile = .125 point; to lowest decrease/highest increase in VHT quintile = 0 points.
Is the project located in a CMP Priority or Congested Subcorridor? – 10.8%	Percent of project limits in Priority Subcorridor x 100 percent + percent of project limits in Congested Subcorridor x 50 percent; >80% percent = 1 point; >60% percent = .5 point; >40% percent = .25 point; >20% percent = .125 point.
What is the facility's vehicular Average Annual Daily Traffic (AADT) multiplied by its V/C Ratio? – 10.7%	Using AADT data from the most current available Roadway Management System (RMS) for Pennsylvania or Linear Reference System (LRS) for New Jersey and compute V/C ratio using daily capacity as defined in DVRPC's Travel Demand Model: highest AADT * V/C ratio quintile = 1 point, 2nd highest AADT * V/C ratio quintile = .5 point; 3rd highest AADT * V/C ratio quintile = .25 point; 4th highest AADT * V/C ratio quintile = .125 point; to lowest AADT * V/C ratio quintile = 0 points.
What is the percentage of the project limits with low DVRPC Environmental Screening Tool impacts? – 7.4%	For capacity enhancement on a limited-access freeway, consider a one-mile buffer around project limits; for capacity enhancement on an arterial, consider a .5-mile buffer; for new alignment, consider a two-mile buffer. Percent of project area with a range of 0 to 2 Environmental Screening Tool score; >90 percent = 1 point; >75 percent = .5 point; >60 percent = .25 point; >40 percent = .125 point.
What is the facility's truck Average Annual Daily Traffic (AADT)? – 5.9%	Using data from the most current available Roadway Management System (RMS) for Pennsylvania and by functional class using DVRPC average regional values for "heavy trucks" plus buses as derived by DVRPC from traffic counts and travel surveys over time for New Jersey: >7,500 = 1 point; >5,000 = .5 point; >2,500 = .25 point; >1,000 = .125 point.

Source: DVRPC 2012

Table 65. Transit Major Regional System Expansion Project Evaluation Criteria Summary

Criterion / Weight	Rating
How much new ridership is generated by the line? – 27.2%	Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline, and 2040 demographics and the existing transportation system plus the built project for comparison. Break all projects into quintiles ranging from the highest new passenger quintile = 1 point, 2nd highest new passenger quintile = .5 point; 3rd highest new passenger quintile = .25 point; 4th highest new passenger quintile = .125 point; to lowest new passenger quintile = 0 points.
What is the transit score of the communities the route proposes to serve? – 18%	Based on the 2010 DVRPC/NJ Transit Score Index: For Fixed-Guideway Rail: percent of proposed station stops in Medium-High or High Transit Score TAZs: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point For Bus Rapid Transit: percent of proposed station stops in Medium, Medium-High, or High Transit Score TAZs: >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point.
What is the reduction in regional vehicle hours of travel (VHT) associated with the project? – 11.7%	Projects will be evaluated using DVRPC's travel demand model using 2040 demographics and the existing transportation system as a baseline, and 2040 demographics and the existing transportation system plus the built project for comparison. Break all projects into quintiles ranging from the highest decrease/lowest increase in VHT quintile = 1 point, 2nd highest decrease/2nd lowest increase in VHT quintile = .5 point; 3rd highest decrease/3rd lowest increase in VHT quintile = .25 point; 4th highest decrease/4th lowest increase in VHT quintile = .125 point; to lowest decrease/highest increase in VHT quintile = 0 points.
What is the potential for transit-oriented development (TOD)? – 11.3%	Amount of vacant land within one-half mile of proposed station stops based on DVRPC's land use files. Break all projects into quintiles ranging from the highest vacant acres with TOD potential quintile = 1 point, 2nd highest vacant acres with TOD potential quintile = .5 point; 3rd highest vacant acres with TOD potential quintile = .25 point; 4th highest vacant acres with TOD potential quintile = .125 point; lowest vacant acres with TOD potential quintile = 0 points.
How fully has the project been studied? – 10.1%	If the project has a completed Environmental Impact Statement (EIS) = 1 point; a completed FTA Alternatives Analysis (Full Alternatives Analysis) = .5 point; a feasibility analysis or non-FTA alternatives analysis (Conceptual AA) = .25 point; a sketch level planning study (Sketch Plan) = .125 point.
Is the project located in a CMP Priority or Congested Subcorridor? – 8%	Percent of proposed station stops in Priority Subcorridor x 100 percent + percent of proposed station stops in Congested Subcorridor x 50 percent; >80 percent = 1 point; >60 percent = .5 point; >40 percent = .25 point; >20 percent = .125 point.
What is the project's anticipated farebox recovery rate? – 7.9%	Use estimated farebox recovery rate from highest level of study completed to date. Break all projects into quintiles ranging from the highest farebox recovery rate quintile = 1 point, 2nd highest farebox recovery rate quintile = .5 point; 3rd highest farebox recovery rate quintile = .25 point; 4th highest farebox recovery rate quintile = .125 point; lowest farebox recovery rate quintile = 0 points; farebox recovery rate not estimated as part of a study = 0 points.
How well does the project serve Environmental Justice and DOD population groups? – 5.8%	Percent of proposed station stops in areas with three to four Degrees of Disadvantage (DODs) * 100 percent + percent of station stops in areas with one to two DODs * 50 percent; >70 percent = 1 point; >50 percent = .5 point; >30 percent = .25 point; >10 percent = .125 point.

Source: DVRPC 2012

Project Evaluation

In the next step in the project evaluation process, DVRPC staff evaluated each candidate project using the selection criteria and computed a final score based on the weight of each of the criterion. As Plan development continued, the timing of modeling each project individually proved unfeasible, largely due to an upgrade in DVRPC's modeling software. The Long-Range Plan Committee agreed to revise the weighting, removing the vehicle hours of travel criterion and proportional reweighting the rest of the criteria.

The Long-Range Plan Committee then used the resulting project ranking and cost optimization into considerations when selecting projects to include in the fiscally constrained long-range plan. The final list of Plan projects is indicated in the next section.

Table 66. Revised Roadway Criterion Weighting Factors

Criterion	Original Weight	Revised Weight
What is the total population and employment in Regional Plan Centers and Freight Centers served by the project?	27.2%	32.2%
What is the project's status in the respective Pennsylvania or New Jersey department of transportation project database?	22.5%	26.6%
What is the reduction in regional vehicle hours of travel (VHT) associated with the project?	15.5%	0%
Is the project located in a CMP Priority or Congested Subcorridor?	10.8%	12.8%
What is the facility's vehicular Average Annual Daily Traffic (AADT) multiplied by its V/C Ratio?	10.7%	12.7%
What is the percentage of the project limits with low DVRPC Environmental Screening Tool impacts?	7.4%	8.8%
What is the facility's truck Average Annual Daily Traffic (AADT)?	5.9%	7.0%

Source: DVRPC 2012

Table 67. Revised Transit Criterion Weighting Factors

Criterion	Original Weight	Revised Weight
How much new ridership is generated by the line?	27.2%	30.8%
What is the Transit Score of the communities that the route proposes to serve?	18%	20.4%
What is the reduction in regional vehicle hours of travel (VHT) associated with the project?	11.7%	0%
What is the potential for transit-oriented development (TOD)?	11.3%	12.8%
How fully has the project been studied?	10.1%	11.4%
Is the project located in a CMP Priority or Congested Subcorridor?	8%	9.1%
What is the project's anticipated farebox recovery rate?	7.9%	8.9%
How well does the project serve Environmental Justice and DOD population groups?	5.8%	6.6%

Source: DVRPC 2012

CHAPTER 6: Project Selection

Fiscally constrained projects funded in *Connections 2040* and the percentage cost for each category are shown for each federally funded major regional project in tables 69 to 74. Different tables highlight different project categories, including roadway preservation, roadway operational improvements, roadway system expansion, roadway minor system expansion, bike and pedestrian projects, transit preservation, transit operational improvements, and transit system expansion projects. Tables 74 and 75 list the minor roadway expansion projects in the Plan.

Each major regional project included in the fiscally constrained, funded Plan has a major regional project identification (MRP ID). MRP ID is continuous from plan to plan, allowing for comparison across plans. Unfunded Vision Plan projects are listed throughout these tables. Often they do not have a unique MRP ID, and are instead listed under a financial plan category. Costs for these projects are listed in 2013 dollars, as there is not an estimated time period to convert into Y-O-E dollars.

Each project also has the name of the facility, scope, location, a construction timing phase aligned with the four funding periods in the Plan, and its air quality code. Where appropriate, the 'other funding' columns indicate additional funding from nonfederal sources, such as local or county, or other external sources, which are generally toll revenues from regional authorities or developer contributions. These funds are shown in 2013 dollars as provided by the sponsoring agency or authority.

Each roadway project's estimated federal costs are shown in Y-O-E dollars in one or more project categories: pavement preservation (R1), bridge preservation (R2), operational improvements (R3), or system expansion (R5). The total federally funded project cost for all categories in Y-O-E dollars is summed in the final column. In many cases, cost estimates are highly preliminary and at a planning stage. As the project is developed, estimates will be refined to meet the specific needs of each project. The timing of project construction will also have a major impact on costs, as the longer a project is delayed, the more the project will cost as a result of inflation. The Transit Major Regional Project tables are similar to the roadway tables in that they show the facility name, limits, location, description, and funding period timing. Each project's total federal cost is shown in Y-O-E dollars in one or more project categories: rail infrastructure (T1), vehicles (R2), station enhancements (T3), operational improvements (T4), and system expansion (T5). A final column sums the anticipated total project cost in Y-O-E dollars.

Table 77 indicates the externally funded major regional projects. This table indicates the facility name, limits, timing, location, project description, and estimated cost in 2013 dollars, as provided by the sponsoring agency or authority. These are major regional projects that do not receive federal funding and are not counted against the Plan's anticipated revenues.

In the preservation category, the list generally highlights the largest and highest traffic volume bridges in need of major reconstruction in each county. This is not an exhaustive list for any facility or financial plan category. Among the unfunded projects, some of the largest and most critical bridges on I-95 in South Philadelphia and Delaware County are identified, among the estimated $6 to $11 billion (Y-O-E) in total need for all the bridges on this facility between now and 2040.

The designated air quality code was agreed to by the transportation conformity interagency consultation group. Table 68 gives a description for each air quality code. For more information see the *Transportation Conformity Demonstration: FY 2013 Pennsylvania TIP, FY 2014 New Jersey TIP, and Connections 2040 Long-Range Plan* (DVRPC publication #13063).

Table 68. Air Quality Codes

Exempt Project Category†—Other Projects	DVRPC AQ Code
Specific activities that do not involve or lead directly to construction, such as planning and technical studies	X1
Grants for training and research programs	X2
Planning activities conducted pursuant to Title 23 and 49 U.S.C.	X3
Federal aid systems revisions	X4
Engineering to assess social, economic, and environmental effects of the proposed action or alternatives to that action	X5
Noise attenuation	X6
Advance land acquisitions (23 CFR 712 or 23 CFR 771)	X7
Acquisition of scenic easements	X8
Plantings, landscaping, etc.	X9
Sign removal	X10
Directional and informational signs	X11
Transportation enhancement activities (except rehabilitation and operation of historic transportation buildings, structures, or facilities)	X12
Repair of damage caused by natural disasters, civil unrest, or terrorist acts, except projects involving substantial functional, locational, or capacity changes	X13

Exempt Project Category†— Safety Projects	DVRPC AQ Code
Railroad/highway crossing	S1
Hazard elimination program	S2
Safer non-federal-aid system roads	S3
Shoulder improvements	S4
Increasing sight distance	S5
Safety improvement program	S6
Traffic control device and operating assistance other than signalization projects	S7
Railroad/highway crossing warning devices	S8
Guardrails, median barriers, crash cushions	S9
Pavement resurfacing and/or rehabilitation	S10
Pavement marking demonstration	S11
Emergency relief (23 U.S.C. 125)	S12
Fencing	S13
Skid treatments	S14
Safety roadside rest areas	S15
Adding medians	S16
Truck-climbing lanes outside the urbanized area	S17
Lighting improvements	S18
Widening narrow pavements or reconstructing bridges (no additional travel lanes)	S19
Emergency truck pullovers	S20

Exempt Project Category†—Air Quality Projects	DVRPC AQ Code
Continuation of ridesharing and van-pooling promotion activities at current levels	A1
Bicycle and pedestrian facilities	A2

Exempt Project Category†—Mass Transit Projects	DVRPC AQ Code
Operating assistance to transit agencies	M1
Purchase of support vehicles	M2
Rehabilitation of transit vehicles	M3
Purchase of office, shop, and operating equipment for existing facilities	M4
Purchase of operating equipment for vehicles (e.g., radios, fareboxes, lifts, etc.)	M5
Construction or renovation of power, signal, and communications systems	M6
Construction of small passenger shelters and information kiosks	M7
Reconstruction or renovation of transit buildings and structures	M8
Rehabilitation or reconstruction of track structures, track, and tracked-in existing rights-of-way	M9
Purchase of new buses and rail cars to replace existing vehicles or for minor expansions of the fleet	M10
Construction of new bus or rail storage/maintenance facilities categorically excluded in 23 CFR part 771	M11

Exempt Project Category†—Study and Development Projects (NJ) and Projects Planned for Funding in Future Years (PA)	DVRPC AQ Code
Project in the Study and Development Program expected to result in an exempt project	SDX
Project in the Study and Development Program expected to result in a nonexempt project	SDN
Project on the Illustrative Unfunded List expected to result in a nonexempt project	FYN

Exempt Project Category†—No Regional Emissions Analysis Required	DVRPC AQ Code
Intersection channelization projects	R1
Intersection signalization projects at individual intersections	R2
Interchange reconfiguration projects	R3
Changes in vertical and horizontal alignment	R4
Truck size and weight inspection stations	R5
Bus terminals and transfer points	R6

Source: DVRPC 2013

Table 69. Major Regional Roadway Preservation Projects

MRP ID	Facility	Project Scope	Air Quality Code	Location									Period				Other Funding (in Millions 2013 $s)			R1. Pavement Cost (in Millions YOE $s)	R2. Bridge Cost (in Millions YOE $s)	Total Federal Funding via DVRPC (in Millions Y-O-E $s)	Unfunded Need in Millions 2013 $s
				Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County Funding	Private Funding	External Funding				
2	US 422	Reconstruct from PA 724 to Schuylkill River; Reconstruct bridge over Schuylkill River providing for Schuylkill River Trail crossing	S10						X		X				X	X	$ -	$ -	$ -	$ 108.2	$ 72.2	$ 180.4	$ -
3	US 1	Reconstruct from Schoolhouse Road to Maryland State Line	S10						X						X	X	$ -	$ -	$ -	$ 320.4	$ -	$ 320.4	$ -
100	I-95 South Philadelphia	Reconstruct viaducts from Christian Street to Mifflin Street	S10									X				X	$ -	$ -	$ -	$ -	$ 980.2	$ 980.2	$ -
102	US 1/Roosevelt Boulevard	Replace bridge over Wayne Junction	S19									X		X			$ -	$ -	$ -	$ -	$ 78.3	$ 78.3	$ -
104	Bridges Over Vine Street Expressway (I-676)	Reconstruct Spring Garden Street Bridges over I-76 and the Schuylkill River; reconstruct 18th, 19th, 20th, 21st, and 22nd Street bridges, and (2) pedestrian walkways over the Vine Street Expressway	S19									X	X	X			$ -	$ -	$ -	$ -	$ 251.0	$ 251.0	$ -
134	US 422	Reconstruct and realign from Porter Road to Park Road, including (2) bridges over Porter Road and Sanatoga Road and Creek, and Pleasantview Road and Park Road bridges over 422	S10								X				X	X	$ -	$ -	$ -	$ 81.1	$ 81.1	$ 162.4	$ -
141	I-676	Reconstruct from CR 537 to US 30	S10		X										X	X	$ -	$ -	$ -	$ 47.5	$ -	$ 47.5	$ -
142	I-76	Reconstruct from I-676 to I-295	S10		X										X	X	$ -	$ -	$ -	$ 85.8	$ -	$ 85.8	$ -
143	NJ 38	Reconstruct bridge over NJ Turnpike	S10	X												X	$ -	$ -	$ -	$ -	$ 151.3	$ 151.3	$ -
144	I-676	Rehabilitate bridge over local streets in Camden City south of US 30	S19		X										X		$ -	$ -	$ -	$ -	$ 103.5	$ 103.5	$ -
145	I-676	Rehabilitate bridge over Conrail	S19		X										X		$ -	$ -	$ -	$ -	$ 83.4	$ 83.4	$ -
146	US 1	Rehabilitate bridge over D & R Canal	S19				X									X	$ -	$ -	$ -	$ -	$ 74.5	$ 74.5	$ -
147	PA 611	Reconstruct bridge over Neshaminy Creek						X									$ -	$ -	$ -	$ -	$ -	$ -	$ 16.0
148	I-76	Reconstruct eastbound bridge over City Avenue	S19								X					X	$ -	$ -	$ -	$ -	$ 27.6	$ 27.6	$ -
152	North Valley Road	Replace North Valley Road Bridge over Amtrak, realign to connect new bridge with Darby Road	S19						X						X		$ -	$ -	$ -	$ -	$ 32.6	$ 32.6	$ -
154	I-95 South Philadelphia	Reconstruct bridge over Pattison Avenue	S19									X			X		$ -	$ -	$ -	$ -	$ 72.1	$ 72.1	$ -
155	I-676	Reconstruct bridge over Schuylkill River, Ramp D, and CSX	S19									X				X	$ -	$ -	$ -	$ -	$ 145.7	$ 145.7	$ -
158	NJ 70	Reconstruct from MP 0 to MP 7.7	S19	X	X								X	X			$ -	$ -	$ -	$ 33.1	$ -	$ 33.1	$ -
159	US 30 Coatesville/Downingtown Bypass	Reconstruct from Reeceville Road to PA 10	S10						X						X	X	$ -	$ -	$ -	$ 330.3	$ -	$ 330.3	$ -
R2	US 1 Bypass	Reconstruct bridges over Norfolk Southern Line, and Trenton Avenue/US 1	Unfunded					X									$ -	$ -	$ -	$ -	$ -	$ -	$ 45.0
R2	US 1	Reconstruct bridge over Delaware Canal and Conrail Line	Unfunded					X									$ -	$ -	$ -	$ -	$ -	$ -	$ 45.0
R2	PA 332 Newtown Bypass	Reconstruct bridge over SEPTA	Unfunded					X									$ -	$ -	$ -	$ -	$ -	$ -	$ 7.5
R2	US 202	Reconstruct northbound and southbound bridges over Amtrak, off-ramp, and local road	Unfunded						X								$ -	$ -	$ -	$ -	$ -	$ -	$ 75.0
R2	I-95 Delaware County	Reconstruct bridges over Bartram Avenue/Conrail (northbound and southbound); over Amtrak (northbound and southbound); over Chester Creek; and over Sellers Avenue (northbound and southbound)	Unfunded							X							$ -	$ -	$ -	$ -	$ -	$ -	$ 380.0
R2	I-76 Montgomery County	Reconstruct bridges over Norfolk Southern; Arrowmink Creek; Westbound over City Avenue; and over South Gulph Road/SEPTA	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ 160.0
R2	I-476 Mid-County Expressway	Reconstruct bridges over Avondale Road/Dicks Run (northbound and southbound); Conestoga Rd. and Sproul Rd. (northbound and southbound); I-76 Schuylkill Expressway (northbound and southbound); and Conrail (northbound and southbound)	Unfunded							X	X						$ -	$ -	$ -	$ -	$ -	$ -	$ 235.0
R2	I-76 Philadelphia	Reconstruct bridges over Schuylkill River/CSX rail tracks; Between 34th Street and Grays Ferry Avenue; and from Arch Street to University Avenue	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ 470.0
R2	I-95 South Philadelphia	Reconstruct viaduct bridges over Penrose Avenue/Mingo Creek (northbound and southbound0, Over CSX track east of Broad Street, from Shunk Street to Mifflin Street, Terminal Avenue, and from stadiums to Navy Yard	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ 1,260.0
R2	I-95 Girard Point Bridge	Reconstruct double-decker bridge	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ 400.0
R2	I-676	Reconstruct ramps for 7th and 8th streets	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ 35.0
New Jersey Totals																	$ -	$ -	$ -	$ 166.4	$ 412.7	$ 579.1	$ -
Pennsylvania Totals																	$ -	$ -	$ -	$ 840.0	$ 1,740.7	$ 2,580.8	$ 3,128.5

Source: DVRPC 2013

Table 70. Major Regional Roadway Operational Improvement Projects

MRP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (in Millions 2013 $s)			R1. Pavement Cost (in Millions YOE $s)	R2. Bridge Cost (in Millions YOE $s)	R3. Operational Improvement Cost (in Millions YOE $s)	Total Project Federal Funding via DVRPC (in Millions YOE $s)	Unfunded Need in Millions 2013 $s
				Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External					
5	US 1 at PA 352	Reconstruct cloverleaf interchange and eliminate lane drops	R3							X			X	X	X		$ -	$ -	$ -	$ 40.9	$ 40.9	$ 81.8	$ 163.7	$ -
20	I-95 and I-476	One new lane in each direction on I-95 through interchange; Addition of lane on ramp from SB I-476 to SB I-95, and addition of lane on ramp from NB I-95 to NB I-476	2040M							X					X	X	$ -	$ -	$ -	$ 107.1	$ -	$ 107.1	$ 214.3	$ -
21	US 202 (Section 500) Markley Street	Reconstruction from Main St. to Johnson Highway; Widening to add center turn lane between Marshall St. and Johnson Highway	2025M								X		X				$ -	$ -	$ -	$ 19.1	$ -	$ 9.2	$ 28.3	$ -
25	South Pemberton Road	Lane and shoulder widening for center turn from Hanover St. (CR 616) to US 206	R1	X									X				$ -	$ -	$ -	$ -	$ -	$ 27.0	$ 27.0	$ -
29	US 130 & CR 551 (Brooklawn Circle)	Redesign intersection at Brooklawn Circle	R1		X								X				$ -	$ -	$ -	$ -	$ -	$ 4.5	$ 4.5	$ -
31	NJ 29	Convert NJ 29 to an Urban Boulevard from US 1 to Sullivan Way	2025M				X								X	X	$ -	$ -	$ -	$ 286.7	$ -	$ 59.3	$ 346.0	$ -
64	Ridge Pike	Reconstruct from Butler Pike to I-276 PA Turnpike; Widen to add center turn lane	2040M								X				X	X	$ -	$ -	$ -	$ 45.7	$ -	$ 11.4	$ 57.1	$ -
65	I-95 Philadelphia North	Reconstruct from Northern Liberties to Holmesburg; Interchange Improvements at Vine, Girard, Allegheny, Betsy Ross Bridge, Bridge, and Cottman Interchanges	2025M									X	X	X			$ -	$ -	$ -	$ 149.8	$ 1,605.0	$ 385.2	$ 2,140.0	$ -
81	Princeton-Hightstown Road (CR 571)	New turn lanes, reconstruction and signal improvements from Wallace-Cranbury Rd. to Clarksville Rd.	2025M				X						X	X			$ -	$ -	$ -	$ 5.4	$ -	$ 5.4	$ 10.7	$ -
93	NJ 70	Operational and safety improvements from NJ 38 to NJ 73; Intersection improvements at Kingston Road and Covered Bridge Road	R1	X	X										X	X	$ -	$ -	$ -	$ -	$ -	$ 390.5	$ 390.5	$ -
106	I-476 and I-76	Interchange modifications	2040M								X				X	X	$ -	$ -	$ -	$ 9.0	$ 1.0	$ 10.0	$ 20.0	$ -
107	I-76 at PA 23 Matsonford Road	Interchange modifications	2040M								X				X	X	$ -	$ -	$ -	$ 10.0	$ -	$ 10.0	$ 20.0	$ -
108	US 422 at Sanatoga Interchange	Interchange modifications	2040M								X				X	X	$ -	$ -	$ -	$ 9.0	$ -	$ 9.0	$ 18.0	$ -
110	I-276 at PA 611 Willow Grove	Interchange modifications	R3								X				X	X	$ -	$ -	$ -	$ 20.0	$ -	$ 20.0	$ 40.1	$ -
135	US 422	Reconstruct from Berks County line to Schuylkill River Bridge; Reconfigure "S" curve in West Pottsgrove; Realign Stowe interchange	R3								X		X	X	X		$ -	$ -	$ -	$ 103.9	$ -	$ 81.9	$ 185.8	$ -
136	US 202 Intersection Improvements	At PA 926 and US 1	2040M						X	X			X				$ -	$ -	$ -	$ -	$ -	$ 6.1	$ 6.1	$ -
New Jersey Totals																	$ -	$ -	$ -	$ 292.1	$ -	$ 506.5	$ 798.5	$ -
Pennsylvania Totals																	$ -	$ -	$ -	$ 514.6	$ 1,646.9	$ 731.9	$ 2,893.4	$ -

Source: DVRPC 2013

Table 71. Major Regional Bicycle and Pedestrian Projects

MRP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (in MM 2013 $s)			R4. Bicycle / Pedestrian Improvement Cost (in Millions YOE $s)	Total Project Federal Funding via DVRPC (in Millions YOE $s)	Unfunded Need in Millions 2013 $s
				Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External			
R4.01	The Circuit – Pennsylvania	Complete 272 multiuse trail miles	A2					X	X	X	X	X	X	X	X	X	$ -	$ -	$ -	$ 128.3	$ 128.3	$ 47.2
R4.01	The Circuit – New Jersey	Complete 140 multiuse trail miles	A2	X	X	X	X						X	X	X	X	$ -	$ -	$ -	$ 99.7	$ 99.7	$ 19.7
New Jersey Totals																	$ -	$ -	$ -	$ 99.7	$ 99.7	$ 19.7
Pennsylvania Totals																	$ -	$ -	$ -	$ 128.3	$ 128.3	$ 47.2

Source: DVRPC 2013

Table 72. Major Regional Roadway System Expansion Projects

MRP ID	MAP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (in MM 2013 $s)			R1. Pavement Cost (in Millions YOE $s)	R2. Bridge Cost (in Millions YOE $s)	R3. Operational Improvement Cost (in Millions YOE $s)	R5. System Expansion Cost (in MM Y-O-E$s)				R5. System Expansion Cost (in Millions YOE $s)	Total Project Federal Funding via DVRPC (in Millions YOE $s)	Unfunded Need (in Millions 2013 $s)
					Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External				FP 1	FP 2	FP 3	FP 4			
34	1	County Line Road	Widen and Reconstruct from PA 309 to PA 611	2025M					X			X		X				$ -	$ -	$ -	$ 13.2	$ -	$ -	$ 12.2	$ -	$ -	$ -	$ 12.2	$ 25.4	$ -
35	2	I-95 at PA Turnpike	New partial Interchange at I-276 (PA Turnpike); Widen PA Turnpike from US 1 to New Jersey; Widen I-95 from PA 413 to PA Turnpike	2035M					X					X	X			$ -	$ -	$ 423.2	$ 53.4	$ -	$ -	$ 82.8	$ 30.8	$ -	$ -	$ 113.4	$ 166.8	$ -
37	3	US 1	Reconstruct from I-276 (PA Turnpike) to NJ State Line; Widen from PA Turnpike to PA 413; Interchange improvements	2040M					X							X	X	$ -	$ -	$ -	$ 307.9	$ -	$ -	$ -	$ -	$ 31.3	$ 71.4	$ 102.6	$ 410.6	$ -
39	11	US 202 (Section 100)	Widen from West Chester to Delaware State Line; Grade-separated interchange at US 1	Unfunded						X	X							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 300.0
41	6	French Creek Parkway	Construct new road between PA 23 and PA 29	2040M						X				X	X	X	X	$ -	$ -	$ -	$ -	$ -	$ -	$ 5.7	$ -	$ 14.2	$ 32.3	$ 52.2	$ 52.2	$ -
42	7	PA 100	Widen from Shoen Road to Gordon Road	2040M						X				X				$ -	$ -	$ -	$ 4.6	$ -	$ -	$ 7.3	$ -	$ -	$ -	$ 7.3	$ 11.9	$ -
43	8	US 202 (Section 300)	Widen and Reconstruct from PA 252 to US 30	2025M						X				X				$ -	$ -	$ -	$ 54.0	$ 3.6	$ -	$ 20.2	$ -	$ -	$ -	$ 20.2	$ 77.8	$ -
48	9	US 30/Coatesville-Downingtown Bypass	Interchange improvements at PA 10 and Airport Road	2040M						X						X	X	$ -	$ -	$ -	$ 280.0	$ -	$ -	$ -	$ -	$ 11.5	$ 26.3	$ 37.8	$ 597.6	$ -
50	12	US 322	Widen and reconstruct from US 1 to I-95	2025M							X			X	X			$ -	$ -	$ -	$ 146.2	$ -	$ -	$ 42.6	$51.2	$ -	$ -	$ 93.7	$ 239.9	$ -
55	16	Lafayette Street	Roadway extension from Barbadoes St. to Diamond Avenue	2035M								X		X	X			$ 5.7	$ -	$ -	$ 20.6	$ -	$ -	$ 20.6	$ -	$ -	$ -	$ 20.6	$ 41.1	$ -
56	17	US 202 (Section 600)	Widen and reconstruct from Johnson Highway to PA 309	2025M								X		X	X			$ -	$ -	$ -	$ 88.7	$ -	$ -	$ 25.7	$ 87.1	$ -	$ -	$ 112.8	$ 201.5	$ -
57	5	PA 309 Connector Road	Construct new road from Allentown Road to County Line Road; Interchange improvements at PA 309	2040M					X			X				X	X	$ -	$ -	$ -	$ 15.5	$ -	$ -	$ 3.2	$ 43.3	$ -	$ -	$ 46.6	$ 62.1	$ -
66	30	North Delaware Avenue	Extend road from Lewis Street to Bridge Street	2025M									X	X				$ 2.6	$ -	$ -	$ -	$ -	$ -	$ 13.0	$ -	$ -	$ -	$ 13.0	$ 13.0	$ -
67	29	Penrose Avenue/26th Street	New access road to Navy Yard business center	2025M									X	X				$ 1.6	$ -	$ -	$ -	$ -	$ -	$ 6.8	$ -	$ -	$ -	$ 6.8	$ 6.8	$ -
68	31	Adams Avenue Connector	Extend road to new ramps at I-95 and Aramingo Avenue	2040M									X	X	X			$ -	$ -	$ -	$ -	$ -	$ -	$ 13.4	$ 13.4	$ -	$ -	$ 26.8	$ 26.8	$ -
72	34	I-295 at NJ 38	Add missing movements to interchange at NJ 38	Unfunded	X													$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 126.5
75	36	I-295 at I-76/NJ 42	Add missing movements to interchange at I-76/NJ 42	2025M		X	X							X	X			$ -	$ -	$ -	$ -	$ -	$ 67.0	$ 67.0	$ -	$ -	$ -	$ 67.0	$ 133.9	$ -
77	35	I-295 (Direct Connect)	Direct connection of I-295 through interchange at I-76/NJ 42	2025M		X								X	X			$ 7.0	$ -	$ -	$ 167.5	$ -	$ 121.3	$ -	$ -	$ -	$ -	$ 255.0	$ 543.8	$ -
79	37	US 322	Widen from US 130 to NJ Turnpike	2040M			X									X	X	$ -	$ -	$ -	$ 45.8	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.8	$ 91.7	$ -
84	38	US 1 - Penns Neck Area	New connector road, interchanges and widening in vicinity of Penns Neck	Unfunded				X										$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 177.4
95	18	US 422 at PA 363 Interchange (River Crossing)	Interchange improvements, add full movements	2025M								X		X				$ -	$ -	$ -	$ 6.2	$ -	$ 3.1	$ 3.1	$ -	$ -	$ -	$ 3.1	$ 12.3	$ -
96	19	US 422 Bridge at PA 23 Interchange (River Crossing)	Bridge replacement and widening over Schuylkill River - existing bridge is 5 lanes, new bridge will have 6 lanes; Intersection/interchange improvements	2025M								X		X	X			$ -	$ -	$ -	$ -	$ 77.6	$ -	$ 16.7	$ 60.9	$ -	$ -	$ 77.6	$ 155.1	$ -
98	20	US 422 Mainline Widening (River Crossing)	Widen from 4 to 6 lanes from US 202 to PA 363	2040M						X		X				X	X	$ -	$ -	$ -	$ 33.8	$ -	$ -	$ -	$ -	$ 10.8	$ 23.5	$ 33.8	$ 67.7	$ -
109	22	I-276/I-76 Valley Forge Interchange	Interchange modifications	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20.0
111	23	I-276 at Virginia Drive	Add full movements	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 45.0
112	24	I-276 at Henderson Road	New interchange	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 40.0

Continued on next page

Table 71. Major Regional Roadway System Expansion Projects (Continued)

MRP ID	MAP ID	Facility	Project Scope	Air Quality Code	Location								Funding Period				Other Funding (in MM 2013 $s)			R1. Pavement Cost (in Millions YOE $s)	R2. Bridge Cost (in Millions YOE $s)	R3. Operational Improvement Cost (in Millions YOE $s)	R5. System Expansion Cost (in MM Y-O-E$s)				R5. System Expansion Cost (in Millions YOE $s)	Total Project Federal Funding via DVRPC (in Millions YOE $s)	Unfunded Need (in Millions 2013 $s)
					Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External				FP 1	FP 2	FP 3	FP 4			
113	21	I-276 at Lafayette Street / Ridge Avenue	New interchange	2040M								X				X	X	$ -	$ -	$ -	$ -	$14.8	$ -	$ -	$ -	$ 18.1	$ 41.2	$ 59.3	$ 74.1	$ -
114	28	I-276 at PA 63 (Welsh Road)	New interchange	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$	$	$ -	$ -	$ 40.0
115	14	I-95/US 322/Highland Avenue Interchange	Realign I-95 and add new movements at interchange to US 322, Bethel Road, and Highland Avenue	2040M							X					X	X	$ -	$ -	$ -	$ 37.6	$ 37.6	$ 52.6	$ -	$ -	$ 6.9	$ 15.7	$ 22.5	$ 150.2	$ -
128	25	US 202 Dannehower Bridge and Lafayette Street	New interchange	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53.7
129	26	I-276 at PA 611	Interchange modifications	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20.0
130	13	I-476 Hard Shoulder Running	From PA 3 to I-95	2040M							X					X		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6.9	$ 15.7	$ 22.6	$ 22.6	$ -
131	4	I-95 Bucks County Hard Shoulder Running	From Street Road (Exit 37) to Cornwell Heights Park and Ride	Unfunded					X									$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1.6
132	33	I-76 Hard Shoulder Running	I-676 to Girard Avenue	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 0.6
133	27	US 422 Hard Shoulder Running	From PA 363 to PA 29	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6.8
137	11	US 30/Coatesville-Downingtown Bypass	Widen and reconstruct from US 30 Business/Exton Bypass to Reeceville Road	Unfunded						X								$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 83.7
138	39	Vaughn Drive Connector	Extend Vaughn Drive to Princeton Hightstown Road (CR 571)	2040M				X								X	X	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 19.4	$ 38.4	$ 57.8	$ 57.8	$ -
149	32	I-95 Philadelphia Hard Shoulder Running	From Woodhaven Road to Cottman/Princeton Avenue (Exit 35 to Exit 30); I-76 to I-676 (Exit 19 to Exit 22); I-76 to Broad Street (Exit 19 to Exit 17)	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10.8
151	15	I-95 Delaware County Hard Shoulder Running	From I-476 to US 322 (Exit 7 to Exit 4); Delaware State Line to US 322 West (Exit 3)	Unfunded							X							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6.5
New Jersey Totals																		$ 7.0	$ -	$ -	$ 213.4	$ -	$ 88.2	$216.4	$105.5	$ 34.7	$ 69.2	$ 425.8	$ 827.4	$ 322.4
Pennsylvania Totals																		$ 9.9	$ -	$423.2	$ 781.5	$ 133.6	$ 55.7	$273.0	$286.8	$122.4	$214.5	$896.7	$1,867.4	$ 795.7

Source: DVRPC 2013

Table 73. Major Regional Transit System Preservation and Operational Improvement Projects

MRP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (Millions 2013 $s)			T1. Rail Infrastructure Cost (in Millions YOE $s)	T2. Vehicle Cost (in Millions YOE $s)	T3. Station Enhancement Cost (in Millions YOE $s)	T4. Operational Improvement Cost (in Millions YOE $S)	Total Project Federal Funding via DVRPC (in Millions YOE $S)	Unfunded Need (in Millions 2013 $s)
				Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External						
T1	Media, Norristown, Warminster, Fox Chase lines	Catenary and catenary structure replacement projects	M6					X		X	X	X	X				$ -	$ -	$ -	$ 15.5	$ -	$ -	$ -	$ 15.5	$ -
T1	Chestnut Hill East Line	Rehabilitate bridges	M9									X			X		$ -	$ -	$ -	$ 40.5	$ -	$ -	$ -	$ 40.5	$ -
T1	Chestnut Hill West Line	Rehabilitate bridge 0.35	M9									X		X			$ -	$ -	$ -	$ 5.5	$ -	$ -	$ -	$ 5.5	$ -
T1	Chestnut Hill West Line	Rehabilitate bridges	M9									X			X		$ -	$ -	$ -	$ 44.1	$ -	$ -	$ -	$ 44.1	$ -
T1	Media-Elwyn Line	Bridge timber replacement & painting	M9							X					X		$ -	$ -	$ -	$ 18.3	$ -	$ -	$ -	$ 18.3	$ -
T1	Regional Rail Stone Arch Bridges	Rehabilitation	M9									X			X		$ -	$ -	$ -	$ 6.2	$ -	$ -	$ -	$ 6.2	$ -
T1	Media-Elwyn Line	Reconstruct Crum Creek Viaduct	M9							X				X			$ -	$ -	$ -	$ 59.0	$ -	$ -	$ -	$ 59.0	$ -
T1	Norristown High Speed Line	Rehabilitate Bridgeport Viaduct over Schuylkill River	M9								X				X		$ -	$ -	$ -	$ 33.8	$ -	$ -	$ -	$ 33.8	$ -
T1	Norristown High Speed Line	Rehabilitate Bridge 0.15 near 69th Street Transportation Center	M9							X			X		X		$ -	$ -	$ -	$ 22.0	$ -	$ -	$ -	$ 22.0	$ -
T1	Norristown High Speed Line	Tie and signal replacements; slope stability projects	M6							X	X					X	$ -	$ -	$ -	$ 70.9	$ -	$ -	$ -	$ 70.9	$ -
T1	30th Street Rail Yard	Catenary and structure replacement	M6									X				X	$ -	$ -	$ -	$ 111.2	$ -	$ -	$ -	$ 111.2	$ -
T1	Substations at Jenkintown, Lenni, Morton, Bethayres, Chestnut Hill East, Ambler, Doylestown, Hatboro, Clifton, Wayne Junction, and along the Market-Frankford Line	Replacements and rehabilitations	M6					X	X	X	X	X	X	X	X		$ -	$ -	$ -	$ 162.4	$ -	$ -	$ -	$ 162.4	$ -
T1	Trenton, Wilmington, and Paoli-Thorndale Lines	SEPTA/Amtrak lease agreements for trackage rights	M9				X	X	X	X	X	X	X	X	X	X	$ -	$ -	$ -	$ 1,541.5	$ -	$ -	$ -	$ 1,541.5	$ -
T1	Jenkintown Static Frequency Converter	Rehabilitate	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 30.6
T1	Woodbourne Traction & Signal Substations	New substation	Unfunded					X									$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 34.0
T1	Mainline Bridge Program	Rehabilitation of bridges	Unfunded								X	X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 53.3
AC	SEPTA Regional Rail	Automatic Train Control	M6				X	X	X	X	X	X	X				$ -	$ -	$ -	$ -	$ -	$ -	$ 106.6	$ 106.6	$ -
T1	SEPTA Routes 101 and 102	Signals and interlocking improvements	M9							X			X				$ -	$ -	$ -	$ -	$ -	$ -	$ 33.0	$ 33.0	$ -
T1	Broad Street and Market-Frankford Lines	Communications systems	M6							X		X			X		$ -	$ -	$ -	$ -	$ -	$ -	$ 52.6	$ 52.6	$ -
T1	Paoli-Thorndale Line	Signal and switch improvements	M9						X	X	X				X		$ -	$ -	$ -	$ -	$ -	$ -	$ 71.8	$ 71.8	$ -
T1	Broad Street Spur	Signal replacements	M6									X			X		$ -	$ -	$ -	$ -	$ -	$ -	$ 11.0	$ 11.0	$ -
T2	Atlantic City Rail Line	Purchase new rail cars, new locomotives, rehabilitate Cherry Hill, Atco, and Lindenwold stations	M10		X							X			X	X	$ -	$ -	$ -	$ -	$ 217.5	$ 67.2	$ -	$ 284.6	$ -
T2	NJ Transit Buses	Procure 358 40' transit buses and 288 45' cruiser buses	M10	X	X	X	X					X	X	X	X	X	$ -	$ -	$ -	$ -	$ 539.4	$ -	$ -	$ 539.4	$ -
T2	NJ Transit Northeast Corridor Rail Vehicles	Replace 42 commuter rail vehicles	M10				X						X		X		$ -	$ -	$ -	$ -	$ 470.1	$ -	$ -	$ 470.1	$ -
T2	SEPTA Buses	Procure 2,216 40' and 255 60' Buses	M10					X	X	X	X	X	X	X	X	X	$ -	$ -	$ -	$ -	$ 3,073.3	$ -	$ -	$ 3,073.3	$ -
T2	Berridge; Callowhill; 69th Street TC; Overbrook; Fern Rock; Comly; Woodland; Frontier; Roberts; and Powelton Facilities	Roof replacements	M8							X		X	X	X	X		$ -	$ -	$ -	$ -	$ 94.8	$ -	$ -	$ 94.8	$ -
T2	Callowhill Shop	Facility replacement	M8									X				X	$ -	$ -	$ -	$ -	$ 278.5	$ -	$ -	$ 278.5	$ -
T2	Midvale	New rail shop	M8									X				X	$ -	$ -	$ -	$ -	$ 222.8	$ -	$ -	$ 222.8	$ -
T2	Rail Yard Storage	Expansion program	M8					X	X	X	X	X				X	$ -	$ -	$ -	$ -	$ 76.9	$ -	$ -	$ 76.9	$ -
T2	SEPTA Commuter Rail Vehicles	Purchase 245 Silverliner VIs	Unfunded				X	X	X	X	X	X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,900.0
T2	SEPTA Trolleys	Purchase 115 trolleys and 55 articulated trolleys	Unfunded							X		X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,005.0

Continued on next page

Table 72. Major Regional Transit System Preservation and Operational Improvement Projects (Continued)

MRP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (2013 $s)			T1. Rail Infrastructure Cost (in Millions YOE $s)	T2. Vehicle Cost (in Millions YOE $s)	T3. Station Enhancement Cost (in Millions YOE $s)	T4. Operational Improvement Costs (in Millions YOE $s)	Total Project Federal Funding via DVRPC (in Millions YOE $s)	Unfunded Need (in Millions 2013 $s)
				Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External						
T2	Broad Street Line Vehicles	Rehabilitate 125 heavy rail vehicles	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 1,050.0
T2	SEPTA Buses	Procure 44 40' buses and 38 trackless trolleys	Unfunded					X	X	X	X	X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 57.2
T2	SEPTA Locomotives	Replace 9 diesel/electric locomotives	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 95.9
T3	Margaret-Orthodox (MFL), Erie (BSL), Snyder (BSL), 40th Street (MFL), 69th Street Transportation Center (MFL), and Cecil B. Moore (BSL) Stations	Station accessibility improvements	M8							X		X			X	X	$ -	$ -	$ -	$ -	$ -	$ 110.3	$ -	$ 110.3	$ -
AD	City Hall Station	Renovation	M8									X	X	X	X		$ -	$ -	$ -	$ -	$ -	$ 167.2	$ -	$ 167.2	$ -
T3	Exton Station	Renovation	M8						X						X	X	$ -	$ -	$ -	$ -	$ -	$ 35.4	$ -	$ 35.4	$ -
T3	5th Street Station	Renovation	M8									X				X	$ -	$ -	$ -	$ -	$ -	$ 25.6	$ -	$ 25.6	$ -
T3	Paoli Station	Transportation Center enhancements	M8						X				X	X	X		$ -	$ -	$ -	$ -	$ -	$ 46.3	$ -	$ 46.3	$ -
T3	Ardmore Station	Transportation Center enhancements	M8								X			X	X		$ -	$ -	$ -	$ -	$ -	$ 10.6	$ -	$ 10.6	$ -
T3	Fern Rock Station	Transportation Center enhancements	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 77.2
T3	Levittown Station	Renovation	M8					X						X	X		$ -	$ -	$ -	$ -	$ -	$ 25.6	$ -	$ 25.6	$ -
T3	Villanova Station	Renovation	M8							X					X	X	$ -	$ -	$ -	$ -	$ -	$ 30.6	$ -	$ 30.6	$ -
T3	Wynnewood Station	Renovation	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20.0
T3	Devon Station	Renovation	Unfunded						X								$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 20.0
T3	Secane Station	Renovation	Unfunded							X							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 22.5
T3	Gwynedd Valley, North Wales, and Philmont stations	Regional rail parking expansions	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 10.3
T3	Noble, Elkins Park, Roslyn, Hatboro, East Falls, and Willow Grove Stations	Regional rail station enhancements	Unfunded					X			X	X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 32.0
T3	69th Street	Build parking structure, Transportation Center enhancements	M8							X				X	X		$ -	$ -	$ -	$ -	$ -	$ 25.9	$ -	$ 25.9	$ -
T3	AT&T, Wyoming, Fairmount, and Hunting Park Stations	Broad Street Line Station program	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 28.5
T3	Ridge & Summit, 5th & Godfrey, 61st & Pine, Wycombe Bus and Trolley Loops	Bus and trolley loop program	Unfunded							X		X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 6.6
AB	Atlantic City Rail Line Service Frequency Improvements	Siding and station improvements, new vehicles for increased service frequency	2040M		X										X	X	$ -	$ -	$ -	$ -	$ 40.1	$ -	$ 112.3	$ 152.4	$ -
B	Fare Modernization	New fare payment technologies at SEPTA for all modes	M5				X	X	X	X	X	X	X				$ -	$ -	$ -	$ -	$ -	$ -	$ 207.5	$ 207.5	$ -
G	Route 23/56 trolley service restoration	Improvements and vehicle purchase for entire routes	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 319.0
T4	Regional Rail System - Core Capacity Program	A core capacity program of projects to increase the speed and frequency of the Regional Rail system. Projects include interlockings, sidings, flyovers, and freight separation projects.	Unfunded					X		X	X	X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 710.0
New Jersey Totals																	$ -	$ -	$ -	$ -	$ 1,267.1	$ 67.2	$ 112.3	$ 1,446.3	$ -
Pennsylvania Totals																	$ -	$ -	$ -	$ 2,406.0	$ 3,746.1	$ 477.6	$ 207.5	$ 6,837.2	$ 5,472.1

Source: DVRPC 2013

Table 74. Major Regional Transit System Expansion Projects

MRP ID	MAP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				Other Funding (2013 $s)			New Starts / Small Starts / Very Small Starts (Y-O-E $s)	State and Local Funds (in Millions Y-O-E $s)	Total Funding by Period (in Millions of Y-O-E $s)				Total Project Funding (in Millions of Y-O-E $s)	Unfunded Need (in Millions of 2013 $s)
					Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	Local / County	Private	External			1	2	3	4		
H	45	Airport Line/Route 36	New Airport Line station at Eastwick and extend Route 36	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 36.0
N	40	Pennridge Line	Lansdale Line extension to Pennridge, PA	Unfunded					X			X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 182.0
O	42	Pottstown Line	Norristown Line extension to Pottstown, PA	Unfunded						X		X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 500.0
P	43	Wawa Line	Media-Elwyn Line extension to Wawa, PA	Unfunded							X							$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 91.4
Q	44	Norristown High Speed Line	Extend from Hughes Park to King of Prussia	Unfunded								X						$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 400.0
R	47	Broad Street Line	Broad Street Line extension from AT&T Station to the Navy Yard	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 429.0
S	52	US 1 BRT	New Bus Rapid Transit service in central New Jersey along US 1 Corridor	2040M				X								X	X	$ -	$ -	$ -	$ -	$ 494.3	$ -	$ -	$ 165.1	$ 329.2	$ 494.3	$ -
T	51	Glassboro-Camden Line	Begin construction on new transit line from Camden to Gloucester County (not operational in 2040)	Not Operational in Plan Horizon		X	X									X	X	$ -	$ -	$ -	$ -	$ 2,084.9	$ -	$ -	$ 795.5	$ 1,289.4	$ 2,084.9	$ 528.0
V	46	Delaware Ave. Line	New transit line within Philadelphia	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 850.0
W	41	Atglen Line	Paoli-Thorndale Line extension to Atglen	Unfunded						X								$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 55.0
X	50	South Jersey BRT	New BRT from Avandale park-and-ride and Delsea Drive to Center City, Philadelphia	2025M		X	X						X	X	X			$ -	$ -	$ -	$ 23.0	$ 23.0	$ 16.0	$ 30.0	$ -	$ -	$ 46.0	$ -
Y	53	West Trenton Line	New transit line from West Trenton Station to Bridgewater, NJ; Relocate West Trenton Station to Parkway Avenue TOD.	Unfunded				X										$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 110.0
Z	48	Roosevelt Boulevard Line	New transit line along Roosevelt Boulevard from Lower Bucks County to Frankford Transportation Center and Broad Street	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 67.0
AA	49	Cultural Connector	New Transit Line along City Branch to Centennial District	Unfunded									X					$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 258.0
New Jersey Totals																		$ -	$ -	$ -	$ 23.0	$ 1,946.8	$ 16.0	$ 30.0	$ 806.7	$ 1,117.2	$ 1,969.8	$ 638.0
Pennsylvania Totals																		$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ -	$ 2,843.2

Source: DVRPC 2013

Table 75. Pennsylvania Minor System Expansion Projects (R5.02)

MRP ID	Facility	Project Scope	Air Quality Code	Location					Funding Period			% Funding by Category				Total Federal Project Cost (in MM YOE $s)
				Bucks	Chester	Delaware	Montgomery	Philadelphia	2014-2018	2019-2024	2025-2030	2031-2040	R1. Pavement	R2. Bridge	R3. Operational Improvements	R5. System Expansion	
44	US 1 Baltimore Pike	Selective widening from two lanes in each direction to three lanes in each direction from Kennett Square Bypass to Greenwood Road; relocate School House Rd. intersection; add left-turn lanes on US 1 at School House Rd.; and install new traffic signals	2025M		X				X				-	-	50%	50%	$ 5.7
54	South Gulph Road	Widen from Henderson to Gulf Mills Road	2040M				X				X	X	50%	-	-	50%	$ 8.7
101	Bryn Mawr Avenue Extension	Bypass for PA 3 West Chester Pike and PA 252 Newtown St. intersection	2040M				X				X	X	-	-	50%	50%	$ 8.8
116	PA 113	Widen from US 30 to Peck Road	2040M		X						X	X	-	-	-	100%	$ 8.0
117	Bridgewater Road Extension	Road extension from Concord Road to PA 452/US 322	2040M			X					X	X	-	-	-	100%	$ 16.6
118	Portzer Road Connector	Road extension from Route 663 to Route 309	2040M	X							X	X	-	-	-	100%	$ 0.7
119	Bristol Road Extension	Road extension from US 202 to Park Avenue	2040M	X							X	X	-	-	-	100%	$ 12.1
120	Belmont Ave at I-76 Interchange	Widen Belmont Avenue to provide additional lanes, intersection improvements and streetscape improvements; modify I-76 and railroad overpasses	2040M				X				X	X	-	-	50%	50%	$ 56.2
121	PA 252, Providence Road Widening	Widening and signal improvements from Palmer's Mill Road to Kirk Lane	2025M			X			X				-	-	-	100%	$ 3.0
122	Boot Road Extension	New bridge over Brandywine Creek	2025M		X				X				-	-	-	100%	$ 4.5
123	US 202 and US 1 Loop Roads	Complete loop roads connecting Applied Card Way to Hillman Drive at the existing Route 202/Hillman Drive signalized intersection, and connecting Hillman Drive to Painters Crossing / Brandywine Drive	2025M			X			X				-	-	-	100%	$ 4.2
124	Galloway Road Connector	Road extension from Hulmeville Road to Bridgewater Road	2025M	X					X				-	-	-	100%	$ 4.9
125	Guthriesville Loop Road	Road extension from Bollinger Road to US 322 (north of Corner Ketch Rd)	2040M		X						X	X	-	-	-	100%	$ 10.6
126	G.O. Carlson Boulevard Extension	New 2-lane collector road and bridge between two unconnected portions of GO Carlson Blvd. (PA 340 to Lloyd Ave.)	2040M		X						X	X	-	-	-	100%	$ 7.6

Source: DVRPC 2013

Table 76. New Jersey Minor System Expansion Projects (R5.02)

MRP ID	Facility	Project Scope	Air Quality Code	Location				Plan Period				Total Federal Project Cost (in MM YOE $s)
				Burlington	Camden	Gloucester	Mercer	2014-2017	2018-2023	2024-2030	2031-2040	
83	West Trenton Bypass	New connector road from Bear Tavern Road to Intersection of Decou Ave. and Parkway Ave.; connect Sylvia Ave. through Ewing Town Center	2040M				X			X	X	$ 37.4
99	CR 533	Grade separate interchange by adding one flying express lane in each direction on CR 533 over CR 638	2035M				X			X		$ 25.7
127	Ewing Village Access Improvements	Extend connector road 0.4 miles to improve access from the Parkway Avenue redevelopment area to Scotch Road.	2040M				X			X	X	$ 18.8

Source: DVRPC 2013

All identified minor regional system expansion projects were included in the Plan in both subregions. Table 75 shows the Pennsylvania minor system expansion projects, while Table 76 shows the New Jersey projects. Funding for each of these projects is considered to be entirely system expansion.

In Pennsylvania, nearly the entire five percent cap in system expansion projects was filled by identified major and minor system expansion projects. Future cost overruns or adding new projects in this subregion may require some projects to be removed from the fiscally constrained, Funded Plan.

Table 77. Externally Funded Major Regional Projects

MRP ID	MAP ID	Facility	Project Scope	Air Quality Code	Location									Funding Period				External Cost in 2013 $s
					Burlington	Camden	Gloucester	Mercer	Bucks	Chester	Delaware	Montgomery	Philadelphia	1	2	3	4	
32	A	I-476 (PA Turnpike Northeast Extension)	Widen to 6 lanes from Lansdale to Quakertown	2040M					X			X				X	X	$ 665.0
36	B	I-95 at Scudders Falls Bridge	Widen I-95 from PA 332 to the Delaware River Bridge; replace and widen the Delaware River Bridge; Reconfigure I-95 interchanges at Taylorsville Road and NJ 29; and repave I-95 from PA 332 to CR 579 (Bear Tavern Road)	2025M				X	X					X				$ 328.6
40	C	I-76 (PA Turnpike)	Widen to 6 lanes from Morgantown, Berks County to Valley Forge	2025M						X		X		X	X			$ 300.0
52	D	I-476 (PA Turnpike Northeast Extension)	Widen to 6 lanes from Mid-County to Lansdale interchanges	2025M								X		X				$ 246.5
71	E	New Jersey Turnpike	Widen from Exit 6 to Exit 9	2025M	X			X						X				$ 2,500.0
103	F	Atlantic City Expressway	Widen to 6 lanes from Route 73 to Atlantic County	2025M		X								X				$ 150.0
139	G	Garden State Parkway	Widen to 6 lanes from Interchange 30 to Interchange 63; Improvements to the Bass River and Mullica River crossings.	2025M	X									X				$ 540.0
140	H	Atlantic City Expressway	All electronic tolling	2025M		X								X				$ 50.0

Source: DVRPC 2013

CHAPTER 7: Demonstration of Fiscal Constraint

The TIP is required to be consistent with the Long-Range Plan. The Plan identifies overall need and allocates funding to various funding categories. It also identifies specific major regional projects for funding over its life. This analysis shows how the Plan and the TIP draw down revenues from the various funding categories.

Tables 78 to 85 show anticipated revenues, allocation levels to project categories, and programmed spending for each project category. Programmed spending is the sum of projects identified in *Connections 2040* and in the current FY 2013 Pennsylvania TIP and FY 2014 New Jersey TIP documents. The last column in each table indicates the balance to be programmed in future TIP documents. The first and second funding periods for each state add on nontraditional revenues from earmarks, grants, and other one-time funding sources. These funds are not otherwise included in the Plan's anticipated revenue forecast. The large balance to be programmed in New Jersey in the first two periods is the result of the statewide program. Statewide projects are those projects managed by NJDOT on a statewide basis that are not specific to any particular MPO region or that provide direct support to NJDOT The Plan anticipates the revenues expected from this program. However, the expenditures from this program cannot be allocated to specific funding categories. Instead, statewide funds generally target

Table 78. Pennsylvania Funding Period 1 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 501.6	$ 5.4	$ (355.4)	$ (99.9)	$ 51.7
	R2. Bridge	$ 1,328.2	$ 1.4	$ (877.9)	$ (411.2)	$ 40.4
	R3. Operational Improvements	$ 281.1	$ 238.9	$ (252.5)	$ (250.2)	$ 17.3
	R4. Bike/Pedestrian	$ 87.7	$ 13.9	$ (27.6)	$ (71.4)	$ 2.5
	R5. System Expansion	$ 279.8	$ 10.2	$ (273.0)	$ (16.6)	$ 0.3
	R6. Other	$ 100.6	$ -	$ -	$ (99.0)	$ 1.6
	Road Subtotal	$ 2,579.0	$ 269.7	$ (1,786.4)	$ (948.4)	$ 113.9
Transit	T1. Rail Infrastructure	$ 501.6	$ -	$ (307.1)	$ (195.1)	$ -
	T2. Vehicles	$ 686.5	$ -	$ (132.1)	$ (555.2)	$ -
	T3. Station Enhancements	$ 48.0	$ -	$ (27.6)	$ (20.4)	$ -
	T4. Operational Improvements	$ 208.4	$ -	$ (207.5)	$ (1.2)	$ -
	T5. System Expansion	$ -	$ -	$ -	$ -	$ -
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 303.6	$ -	$ -	$ (304.0)	$ -
	Transit Subtotal	$ 1,748.2	$ -	$ (674.3)	$ (1,075.8)	$ -
PA Subregion Total		$ 4,327.1	$ 269.7	$ (2,460.7)	$ (2,024.2)	$ 112.0

Source: DVRPC 2013

areas where needs are greatest in the state, but project descriptions often indicate an amount of money that can be spent anywhere in the state.

The Pennsylvania Turnpike is the largest source of add-ons for the Pennsylvania subregion in the first funding period. More than $200 million from the Pennsylvania Turnpike Commission is being directed toward the completion of the I-95 and Pennsylvania Turnpike Interchange. Other add-ons include Transportation Investment Generating Economic Recovery (TIGER) funds for completing regional trails in Philadelphia, previously identified earmark funds, and state economic development funds.

In New Jersey, the revenue forecast accounts for the statewide program. However, the expenditures do not. The 'Balance to be Programmed' column for roads is largely made up of expenditures from the statewide program.

Table 79. New Jersey Funding Period 1 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 437.7	$ 79.6	$ (110.2)	$ (5.6)	$ 401.5
	R2. Bridge	$ 488.0	$ 142.6	$ -	$ (291.6)	$ 338.9
	R3. Operational Improvements	$ 208.1	$ 32.9	$ (173.2)	$ (56.4)	$ 11.4
	R4. Bike/Pedestrian	$ 25.9	$ 4.4	$ (2.3)	$ (23.3)	$ 4.7
	R5. System Expansion	$ 210.9	$ 10.0	$ (216.4)	$ (2.3)	$ 4.5
	R6. Other	$ 86.1	$ -	$ -	$ (79.1)	$ 7.1
	Road Subtotal	$ 1,456.7	$ 269.7	$ (502.0)	$ (458.2)	$ 764.4
Transit	T1. Rail Infrastructure	$ 43.4	$ 4.7	$ -	$ (46.3)	$ 1.7
	T2. Vehicles	$ 446.4	$ 4.0	$ --	$ (434.6)	$ 15.7
	T3. Station Enhancements	$ 28.0	$ 2.2	$ -	$ (27.9)	$ 2.3
	T4. Operational Improvements	$ 27.9	$ -	$ -	$ (27.3)	$ 0.6
	T5. System Expansion	$ 10.7	$ -	$ (16.0)	$ (1.8)	$ 1.0
	New Starts/Small Starts/Very Small Starts	$ 8.0	$ -	$ -	$ -	$ -
	T6. Other	$ 314.4	$ 0.9	$ -	$ (304.2)	$ 1.0
	Transit Subtotal	$ 1,748.2	$ 11.7	$ (16.0)	$ (842.2)	$ 32.3
NJ Subregion Total		$ 4,327.1	$ 281.1	$ (515.8)	$ (1,304.1)	$ 796.7

Source: DVRPC 2013

Table 80. Pennsylvania Funding Period 2 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 384.0	$ -	$ (269.2)	$ (24.9)	$ 90.0
	R2. Bridge	$ 1,434.9	$ -	$ (1,162.0)	$ (246.4)	$ 26.6
	R3. Operational Improvements	$ 332.2	$ -	$ (222.8)	$ (90.7)	$ 18.7
	R4. Bike/Pedestrian	$ 112.9	$ -	$ -	$ (102.5)	$ 10.4
	R5. System Expansion	$ 287.0	$ -	$ (286.8)	$ -	$ 0.2
	R6. Other	$ 106.3	$ -	$ -	$ (102.5)	$ 3.8
	Road Subtotal	$ 2,657.3	$ -	$ (1,940.7)	$ (566.9)	$ 149.6
Transit	T1. Rail Infrastructure	$ 705.9	$ -	$ (478.7)	$ (227.8)	$ -
	T2. Vehicles	$ 982.6	$ -	$ (225.0)	$ (758.5)	$ -
	T3. Station Enhancements	$ 90.5	$ -	$ (90.6)	$ -	$ -
	T4. Operational Improvements	$ -	$ -	$ -	$ -	$ -
	T5. System Expansion	$ -	$ -	$ -	$ -	$ -
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 278.8	$ -	$ -	$ (279.1)	$ -
	Transit Subtotal	$ 2,057.9	$ -	$ (794.3)	$ (1,265.4)	$ -
PA Subregion Total		$ 4,715.2	$ -	$ (2,735.0)	$ (1,832.3)	$ 147.8

DVRPC 2013

Table 81. New Jersey Funding Period 2 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 790.1	$ -	$ (95.8)	$ (200.0)	$ 494.3
	R2. Bridge	$ 844.2	$ -	$ -	$ (272.6)	$ 571.6
	R3. Operational Improvements	$ 259.8	$ -	$ (51.9)	$ (53.8)	$ 154.1
	R4. Bike/Pedestrian	$ 32.5	$ -	$ -	$ (12.3)	$ 20.2
	R5. System Expansion	$ 108.2	$ -	$ (105.5)	$ -	$ 2.7
	R6. Other	$ 129.9	$ -	$ -	$ (108.9)	$ 21.0
	Road Subtotal	$ 2,164.6	$ -	$ (253.3)	$ (647.5)	$ 1,263.8
Transit	T1. Rail Infrastructure	$ 85.6	$ 2.0	$ -	$ (85.3	$ 0.2
	T2. Vehicles	$ 663.3	$ 1.6	$ --	$ (663.2)	$ 0.1
	T3. Station Enhancements	$ 71.1	$ 0.0	$ -	$ (70.6)	$ 0.5
	T4. Operational Improvements	$ 35.6	$ -	$ -	$ (34.7)	$ 0.9
	T5. System Expansion	$ 24.4	$ -	$ (30.0)	$ (6.3)	$ 3.1
	New Starts/Small Starts/Very Small Starts	$ 15.0	$ -	$ -	$ -	$ -
	T6. Other	$ 231.1	$ 0.2	$ -	$ (231.0)	$ 0.1
	Transit Subtotal	$ 1,126.1	$ 3.8	$ (30.0)	$ (1,091.2)	$ 5.0
NJ Subregion Total		$ 3,290.7	$ 3.8	$ (283.3)	$ (1,738.7)	$ 1,268.8

DVRPC 2013

Very few TIP projects have been identified beyond the first and second funding periods. Other TIP projects identified as roadway system expansion are minor regional projects (R5.02) that have also been programmed in the Plan. The 'Balance to be Programmed' column represents funding for future TIP projects in the third and fourth funding periods that have not yet been identified.

Table 82. Pennsylvania Funding Period 3 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 2,110.5	$ -	$ (525.6)	$ -	$ 1,584.9
	R2. Bridge	$ 1,986.4	$ -	$ (184.2)	$ -	$ 1,802.8
	R3. Operational Improvements	$ 571.1	$ -	$ (169.1)	$ -	$ 402.0
	R4. Bike/Pedestrian	$ 64.6	$ -	$ (31.4)	$ -	$ 33.1
	R5. System Expansion	$ 158.9	$ -	$ (129.8)	$ (28.2)	$ 0.9
	R6. Other	$ 74.5	$ -	$ -	$ -	$ 74.5
	Road Subtotal	$ 4,965.9	$ -	$ (1,032.6)	$ (28.2)	$ 3,905.0
Transit	T1. Rail Infrastructure	$ 902.4	$ -	$ (597.9)	$ -	$ 304.6
	T2. Vehicles	$ 930.6	$ -	$ (910.6)	$ -	$ 20.0
	T3. Station Enhancements	$ 408.9	$ -	$ (217.8)	$ (102.6)	$ 88.5
	T4. Operational Improvements	$ 141.0	$ -	$ -	$ -	$ 141.0
	T5. System Expansion	$ -	$ -	$ -	$ -	$ -
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 437.1	$ -	$ -	$ -	$ 437.1
	Transit Subtotal	$ 2,820.0	$ -	$ (1,726.3)	$ (102.6)	$ 991.1
PA Subregion Total		$ 7,785.9	$ -	$ (2,758.9)	$ (130.8)	$ 4,896.1

DVRPC 2013

Table 83. New Jersey Funding Period 3 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 1,321.2	$ -	$ (155.6)	$ -	$ 1,165.6
	R2. Bridge	$ 1,211.1	$ -	$ (186.9)	$ -	$ 1,024.2
	R3. Operational Improvements	$ 369.6	$ -	$ (150.2)	$ -	$ 219.4
	R4. Bike/Pedestrian	$ 47.2	$ -	$ (27.2)	$ -	$ 19.9
	R5. System Expansion	$ 102.2	$ -	$ (79.2)	$ -	$ 23.0
	R6. Other	$ 94.4	$ -	$ -	$ -	$ 94.4
	Road Subtotal	$ 3,145.7	$ -	$ (599.1)	$ -	$ 2,546.5
Transit	T1. Rail Infrastructure	$ 71.1	$ -	$ -	$ -	$ 71.1
	T2. Vehicles	$ 368.2	$ -	$ (292.9)	$ -	$ 75.3
	T3. Station Enhancements	$ 67.0	$ -	$ -	$ -	$ 67.0
	T4. Operational Improvements	$ 125.5	$ -	$ (112.3)	$ -	$ 13.3
	T5. System Expansion	$ 970.8	$ -	$ (960.6)	$ -	$ 10.1
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 71.1	$ -	$ -	$ -	$ 71.1
	Transit Subtotal	$ 1,673.8	$ -	$ (1,365.8)	$ -	$ 308.0
NJ Subregion Total		$ 4,819.4	$ -	$ (1,965.0)	$ -	$ 2,854.5

DVRPC 2013

Table 84. Pennsylvania Funding Period 4 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 3,113.1	$ -	$ (990.4)	$ -	$ 2,122.7
	R2. Bridge	$ 5,514.9	$ -	$ (1,297.2)	$ -	$ 4,217.7
	R3. Operational Improvements	$ 1,193.4	$ -	$ (175.7)	$ -	$ 1,017.7
	R4. Bike/Pedestrian	$ 103.8	$ -	$ (69.2)	$ -	$ 34.6
	R5. System Expansion	$ 296.3	$ -	$ (214.5)	$ (64.3)	$ 17.4
	R6. Other	$ 155.7	$ -	$ -	$ -	$ 155.7
	Road Subtotal	$ 10,377.0	$ -	$ (2,146.9)	$ (64.3)	$ 7,565.8
Transit	T1. Rail Infrastructure	$ 1,550.0	$ -	$ (1,022.3)	$ -	$ 527.7
	T2. Vehicles	$ 2,533.6	$ -	$ (2,478.4)	$ -	$ 55.2
	T3. Station Enhancements	$ 685.6	$ -	$ (141.6)	$ -	$ 544.0
	T4. Operational Improvements	$ 268.3	$ -	$ -	$ -	$ 268.3
	T5. System Expansion	$ -	$ -	$ -	$ -	$ -
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 924.0	$ -	$ -	$ -	$ 924.0
	Transit Subtotal	$ 5,961.4	$ -	$ (3,642.3)	$ -	$ 2,319.1
PA Subregion Total		$ 16,338.4	$ -	$ (6,389.2)	$ (64.3)	$ 9,984.8

DVRPC 2013

Table 85. New Jersey Funding Period 4 Allocation

Mode	Category	Millions of Y-O-E $s				
		Formula Funding	Add-Ons	Major Regional Projects	Other TIP Projects	Balance to be Programmed
Roadway	R1. Pavement	$ 2,439.4	$ -	$ (310.2)	$ -	$ 2,129.2
	R2. Bridge	$ 2,236.1	$ -	$ (225.9)	$ -	$ 2,010.3
	R3. Operational Improvements	$ 667.9	$ -	$ (299.6)	$ -	$ 368.4
	R4. Bike/Pedestrian	$ 87.1	$ -	$ (70.2)	$ -	$ 16.9
	R5. System Expansion	$ 203.3	$ -	$ (106.6)	$ -	$ 96.7
	R6. Other	$ 174.2	$ -	$ -	$ -	$ 174.2
	Road Subtotal	$ 5,808.1	$ -	$ (1,012.5)	$ -	$ 4,795.7
Transit	T1. Rail Infrastructure	$ 78.3	$ -	$ -	$ -	$ 78.3
	T2. Vehicles	$ 1,128.1	$ -	$ (974.2)	$ -	$ 154.0
	T3. Station Enhancements	$ 125.3	$ -	$ (67.2)	$ -	$ 58.2
	T4. Operational Improvements	$ 78.3	$ -	$ -	$ -	$ 78.3
	T5. System Expansion	$ 1,645.2	$ -	$ (1,618.6)	$ -	$ 26.6
	New Starts/Small Starts/Very Small Starts	$ -	$ -	$ -	$ -	$ -
	T6. Other	$ 78.3	$ -	$ -	$ -	$ 78.3
	Transit Subtotal	$ 3,133.7	$ -	$ (2,659.9)	$ -	$ 473.8
NJ Subregion Total		$ 8,941.8	$ -	$ (3,672.3)	$ -	$ 5,205.1

DVRPC 2013

CHAPTER 8: Filling the Funding Gap Analysis

The section presents background data used in the 'Closing the Funding Gap' section in Chapter 5 of the *Connections 2040* Plan. The DVRPC region has traditionally had a lower level of local funding for transportation infrastructure than most of our peer regions.

The 2011 Local Transit Funding Comparison (Table 86) compares our region's local transit funding level to the other largest regions around the country and it highlights the stark difference in local funding levels. This analysis leaves out funding derived from bonds, and looks at dedicated funding levels only. Total funding for transit capital and operating is shown by source: federal, state, local, or fare collections.

Our per-capita local funding of $21 per capita lags behind the peer average of $125 per capita and is a significant competitive disadvantage for our region. Closing this gap remains a critical issue, as underfunding the system limits our ability to perform much needed maintenance and repair of our existing transit infrastructure. Provision of additional local funding will continue to become an integral part of transportation funding, especially in light of stagnant federal transportation funding.

The Plan looks at alternatives for increasing local funding for transportation projects. There are various revenue mechanisms that could help close this gap by providing additional local funding, as well as encourage more efficient use of the transportation system. Some of these potential fees include carbon tax, congestion pricing, fuel sales tax, regional toll surcharge, sales tax, highway tolls, transit fare increases, VMT fee, and vehicle registration fee. These mechanisms provide different levels of funding and impacts on the transportation system. In order to fully fund all transportation needs, a combination of some of these revenue mechanisms will be necessary. The revenue potential and transportation impacts of these fees are analyzed in more detail later in this section.

These different mechanisms are provided for informational purpose, and DVRPC has not taken a position on which, if any, should be pursued. If the region were to pursue any of these options further, more study would be needed for better revenue estimates and transportation impacts. In addition to regionwide implementation, these options could also be considered on a project-by-project basis. Such an approach may lead to regional travel distortions, but may be necessary to maintain facilities given future funding limitations.

Table 86. 2011 Local Transit Funding Comparison

Capital Funds	Atlanta	Boston	Chicago	Dallas	Denver	Houston	Los Angeles	Miami	New York*	San Francisco	Washington D.C.	Peer Average	Greater Philadelphia*
Fare Revenue (MM)	$ 0.5	$ 1.3	$ 34.9	$ 1.2	$ 1.1	$ -	$ -	$ 0.2	$1,172.0	$ 0.1	$ -	$ 101.0	$ -
Other Revenue (MM)	$ -	$ 1.0	$ 0.4	$ -	$ -	$ -	$ 0.7	$ 4.6	$ -	$ -	$ 0.5	$ 0.6	$ -
Local Funds (MM)	$ 80.7	$ 177.2	$ 239.3	$ 10.0	$ 402.7	$ 308.9	$ 567.4	$ 32.2	$ 723.3	$ 356.0	$ 559.5	$ 288.7	$ 35.8
State Funds (MM)	$ 0.8	$ 35.8	$ 49.8	$ 0.8	$ -	$ 0.1	$ 237.1	$ 19.3	$ 274.5	$ 135.3	$ 59.0	$ 73.1	$ 136.7
Federal Assistance (MM)	$ 40.2	$ 227.0	$ 295.8	$174.9	$ 224.4	$ 95.5	$ 214.9	$ 83.1	$1,748.3	$ 325.2	$ 685.3	$ 344.3	$ 283.7
% Local	66.1%	40.1%	38.6%	5.4%	64.1%	76.4%	55.6%	23.1%	18.5%	43.6%	42.9%	35.7%	7.8%
Operating Funds	**Atlanta**	**Boston**	**Chicago**	**Dallas**	**Denver**	**Houston**	**Los Angeles**	**Miami**	**New York***	**San Francisco**	**Washington D.C.**	**Peer Average**	**Philadelphia***
Fare Revenue (MM)	$136.4	$ 473.6	$ 785.6	$ 69.6	$ 108.9	$ 76.6	$ 580.5	$ 159.6	$6,167.8	$ 686.1	$ 798.0	$ 846.4	$ 559.3
Other Revenue (MM)	$ 37.0	$ 76.5	$ 73.1	$ 58.1	$ 13.6	$ 4.4	$ 87.4	$ 12.5	$ 739.3	$ 82.8	$ 149.1	$ 111.3	$ 66.4
Local Funds (MM)	$299.3	$ 146.4	$ 649.2	$498.5	$ 233.1	$ 271.6	$1,048.2	$ 397.9	$2,030.3	$ 698.5	$ 543.3	$ 572.8	$ 80.6
State Funds (MM)	$ 5.9	$ 857.7	$ 565.5	$ 1.5	$ -	$ 0.2	$ 258.2	$ 70.6	$4,054.9	$ 220.9	$ 315.9	$ 533.9	$ 594.1
Federal Assistance	$ 91.3	$ 28.5	$ 206.2	$ 51.4	$ 70.8	$ 64.4	$ 390.9	$ 104.6	$ 517.6	$ 76.4	$ 86.2	$ 146.1	$ 119.0
% Local	52.5%	9.2%	28.5%	73.4%	54.7%	65.1%	44.3%	53.4%	15.0%	39.6%	28.7%	25.9%	5.7%
% Local Capital + Operating	55.0%	16.0%	30.6%	58.7%	60.3%	70.7%	47.7%	48.6%	15.8%	40.9%	34.5%	28.5%	6.2%
Local Dedicated Funding Sources	None	None	None	Sales Tax	Sales Tax	Sales Tax	None	None	Tolls	None	Sales and Property Taxes, Tolls		None
% Fare	19.8%	23.5%	28.3%	8.2%	10.4%	9.3%	17.1%	18.1%	42.1%	26.6%	25.0%	31.4%	29.8%
% Other Revenue	5.3%	3.8%	2.5%	6.7%	1.3%	0.5%	2.6%	1.9%	4.2%	3.2%	4.7%	3.7%	3.5%
Regional Population (MM)	5.2	4.5	9.5	6.3	2.5	5.8	12.8	5.5	18.8	4.3	5.5	7.0	5.6
Total Funding Per Capita	$133	$448	$306	$138	$430	$141	$265	$160	$927	$601	$581	$355	$335
Local Funding Per Capita	$73	$72	$94	$81	$259	$99	$126	$78	$147	$246	$200	$125	$21

* Assumes 86 percent of NJ Transit ridership occurs in the New York City region and 10.5 percent occurs in the Greater Philadelphia region.

Source: National Transit Database 2011

Regional User Fees

Beginning with the 2007 report, *Options for Filling the Region's Funding Gap*, DVRPC has considered the potential impact of different regional funding options. As a result of ongoing public dialogue about local funding options, *Connections 2040* turns the focus to direct user fees. These types of fees are seen as the fairest way to pay for transportation system improvements. The sales tax is also considered, as it applies to broad economic activity, which is often dependent on transportation to some degree, and it is commonly used as a transportation funding mechanism.

Additional road pricing can help the region achieve a number of goals in the Plan, such as: reducing congestion and single-occupant vehicle trips, enhancing safety, improving air quality, promoting livability, and making the region more sustainable, while providing additional transportation revenue. Pricing promotes more efficient use of our existing road network and can help to delay or reduce the need for more system expansion. Road pricing can be combined with improved transit, bike, and pedestrian facilities, along with travel demand management strategies, such as flexible work hours, carpooling, and park-and-ride lots to ensure that individuals have alternatives to paying higher fees.

To compute the impacts of different potential funding mechanisms, DVRPC utilized existing transportation use data, including results from the TIM 1.0 travel demand model. Elasticity of demand is used to estimate the response to increased user fees on the transportation system. The estimated regional VMT and transit ridership impacts are also shown.

Table 87 indicates the elasticity of demand used for each tax and fee. Some of the proposed options do not have an elasticity of demand. For these, the most similar elasticity of demand was estimated and used. The elasticity of demand measures how much more or less of something is consumed if its price is increased or decreased. For each 1.0 percent increase in congestion pricing, a 0.41 percent decrease in trip frequency is expected, in addition to a 0.15 percent shorter average trip length. The percent increase in price is in comparison to the current price for a similar trip, including vehicle ownership and operating costs.

Table 87. Long-Term Transportation Elasticity of Demand

Tax / Fee Option	Elasticities*			
	Trip Frequency	Trip Length	Other	Other Type
Congestion Pricing	-0.41	-0.15	-0.33	Shift from peak-period to off-peak travel
Tolling	-0.08	-0.26	+0.08	Shift from toll roads to local roads
VMT Fee	-0.16	-0.45	-	-
Gas Tax	-0.08	-0.23	-0.47	Increased fuel efficiency
Transit Fares*	-0.75	-	***	
Vehicle Registration Fees	-0.04	-	-	-

* Each elasticity measures the impact of a 1.0 percent increase in each tax or fee increase. For instance a 1.0 percent increase in congestion pricing would expect a 0.41 percent decrease in trip frequency, a 0.15 percent decrease in trip length, and would shift 0.33 percent of trips from peak period to off-peak travel times. Elasticities are nonlinear and change is related by the following equation:

Change = (1+ Elasticity/100)^(Percent Change in Price *100)

** Trip frequency applies to transit ridership; in all other instances this refers to automobile driver trips.

*** Reduced transit trips are reassigned, with 33 percent foregone altogether, and 69 percent of the remaining trips becoming driver trips. New driver trips are estimated to average 6.2 miles in length.

Source: DVRPC 2012, adapted from Ficklin, Daily Automobile Trip and Vehicle Miles Traveled Elasticity With Respect to Fuel Price: An Analysis Using 2001 and 2009 NHTS Data, 2010; Graham and Glaister, The Demand for Automobile Fuel: A Survey of Elasticities., 2002; Perry, Is Pay-As-You-Drive Insurance a Better Way to Reduce Gasoline than Gasoline Taxes? 2005; Richardson and Bae. Congestion Pricing in Europe: Implications for the United States, 2008; and Victoria Transportation Policy Institute (VTPI), Transit Price Elasticities and Cross-Elasticities, 2011, and Transportation Elasticities: How Prices and Other Factors Affect Travel Behavior, 2011.

Table 88. Regional Funding Options Summary

Funding Option [1]	Proposed Rate	% Increase[1]	Revenue (MM 2012 $s)	Long-Term Annual VMT Change (MM)	Long-Term Transit Ridership Change (MM)	Long-Term Impacts
Carbon Tax	$15 per ton of transportation generated CO_2E	1.3%	$ 350.0	-160.0	+0.4	Likely to increase use of alternative fuel or energy efficient vehicles, and may encourage alternative modes of transportation
Congestion Pricing	(a) Cordon line - $5 per car per day entering Center City Cordon Line (Callowhill St. to South St. and Schuylkill River to Delaware River) (b) Interstate Highways - Average 20 cents per mile during peak period	(a) 25.0% (b) 36.0%	(a) $ 110.0 (b) $ 660.0	(a) -190.0 (b) -260.0	(a) +4.0 (b) +5.4	(a) May have negative impacts on Center City, but this area of the region has the most transportation options; high administration costs (b) Option with most congestion reduction, high administration costs
Fuel Sales Tax	6% of consumer price	2.0%	$ 420.0	-230.0	+0.6	Likely to increase use of alternative fuel or energy efficient vehicles, and may encourage alternative modes of transportation
Regional Toll Surcharge	(a) $1.00 surcharge on 12 regional turnpike interchanges (b) $1.00 surcharge on 9 toll bridges crossing Delaware River	(a) 23.7% (b) 20% - 100.0%	(a) $ 100.0 (b) $ 100.0	(a) -180.0 (b) -180.0	(a) +0.5 (b) +1.8	Many trips lack transportation alternatives
Sales Tax	Increase existing rate by 0.25 percent	0.25%	$ 170.0	-4.0	0.0	Little impact on transportation system use and development patterns
Toll Existing Highways	$0.10 (average) per VMT on major regional limited access highways	18.7%	$ 970.0	-540.0	+1.0	May shift traffic onto local roads, high administration costs; may encourage transit use
Transit Fare Increases	Increase all fares by 1 percent	1%	$ 1.5	+8.0	-2.9	May reduce transit ridership and increase VMT
Vehicle Miles Traveled Fee	$0.01 per mile	1.8%	$ 380.0	-620.0	+2.7	Largest decline in VMT, may encourage more compact development patterns
Vehicle Registration Fee	Increase $10 per vehicle	0.2%	$ 33.0	-2.0	0.0	Very little impact on transportation system use and development patterns

[1] Percent increase determined by comparing per-mile cost to $0.555 federal reimbursement rate for all fees except: cordon line toll (average cost of vehicle trip to Center City); regional toll surcharge (average toll paid); sales tax (current purchase price of goods and services); transit fares (existing fares); and vehicle registration fees (average annual auto costs).

DVRPC 2013

Only the carbon and sales taxes do not have an identified elasticity. For the carbon tax option, the gas tax elasticity is substituted. Such a tax would be very similar, where switching to more fuel-efficient or alternative-fueled vehicles could reduce the tax paid. For the sales tax, the vehicle registration fee is substituted. For both of these fees, the impact is based more on reduced discretionary income than transportation costs. However, the distribution of the sales tax elasticity with respect to VMT will be

computed more in line with tolling, VMT, and gas tax options, where about one-quarter of the elasticity is based on fewer trips, and three-quarters is based on taking shorter trips.

When VMT is reduced, some trips are not made, others are made by a different mode, and in other cases, a shorter vehicular trip is made, or occupants carpool to reduce SOV trips. In a congestion pricing scheme, where tolls vary by time of day, trips can be shifted from peak to off-peak periods.

Increasing transit ridership has a key side benefit of improving the system's operating cost recovery ratio. Increasing this key metric makes the transit system more financially sound. Reducing transit operating subsidy levies makes the region more economically competitive.

In making comparisons, note the 2012 federal reimbursement rate is 55.5 cents per personal vehicle mile. In 2012, there were about 39 billion VMT in the region, and about 384 million transit trips. The region spent an estimated $22 billion in 2012 on vehicle ownership and operating costs, and transit fares. In comparison, the FY 2013 TIP shows the region expended about $1.5 billion on transportation infrastructure.

The following sections detail assumptions used for each tax or fee option. All financial figures are in 2012 dollars, unless otherwise noted.

Carbon Tax

A carbon tax would levy a fee per ton of transportation-generated CO_2. It is very similar to a gas tax, as this tax already captures many of the other fuels that are used in transportation, except electricity. Drivers facing increased fuel costs can take fewer trips, shorter trips, complete trips with alternative modes, or use/purchase more fuel-efficient or lower carbon content fueled vehicles.

In 2010, the region emitted 21.5 million metric tons of carbon dioxide-equivalent (21.5 $MMTCO_2E$ or 23.7 $MTCO_2E$) from on-road motor vehicle and transit uses. DVRPC used a fee of $15 per ton, as proposed in the American Clean Energy and Security Act of 2009 (ACES). This bill was never enacted by Congress.

At this level, the carbon tax mechanism would be the equivalent of seven-tenths of a cent per mile in additional cost per vehicle mile traveled. This is a 1.5 percent increase over the 2010 federal personal vehicle reimbursement rate of 50 cents per mile.

Such a fee would generate approximately $350 million in additional funding and would likely increase alternative-fueled or energy-efficient vehicles. It would reduce annual VMT in the region by 0.4 percent, around 160 million miles. It would generate an estimated 400,000 additional transit trips per year (eight percent of trips reduced are assumed to be made on transit, based on current modeshare). It is estimated to reduce annual CO_2E by about 150,000 tons.

Congestion Pricing

Congestion pricing uses economic principles to encourage more efficient use of transportation facilities. When demand is high during peak periods the cost to use the facility increases. There are a number of different ways to implement congestion pricing, such as: pricing a single facility or bridge, pricing a class of facilities, pricing all roads, putting a cordon line toll around a major destination area, or increasing the cost of parking during peak-period demand. The Plan considers a cordon line charge on the roads within Center City, Philadelphia, and congestion pricing along all major limited access highway facilities.

Though not proposed or further discussed here, new roadway widening and hard shoulder running projects proposed in the Plan could be priced as High Occupancy Toll (HOT) lanes. In this case, new through lanes could be priced during peak periods for single-occupant drivers. They would be free to use for carpoolers. The existing lanes on the facility would remain unpriced. By potentially freeing up some traffic in the existing free lanes, congestion can be reduced,

while at the same time generating revenue to pay for the project and ongoing operating costs.

Cordon Line

Cordon lines at Callowhill Street, South Street, and the Schuylkill and Delaware rivers could demarcate a congestion pricing zone around Center City. Each entering vehicle would be charged a $5 fee during peak travel times, from 7 am to 6 pm each day. Based on the experience in London, an immediate 20 percent decline in traffic volume is expected, while bus speeds were increased by about six percent. While not a cordon line toll, the recently introduced tolls on the new Washington State Route 520 bridge, with congestion pricing of up to $3.50 per crossing were predicted to have nearly a 50 percent decline in traffic when the bridge reopened. The first month of traffic was even lower than forecast. Each month thereafter had a greater traffic volume than forecast, and by the end of the first year traffic volumes had returned to 70 percent of their pre-toll levels.

London has found about 55 percent of all vehicles entering the congestion zone are unique, nonresident vehicles (vehicles that belong to an individual living outside the cordon line zone). About five percent of the vehicles are unique resident vehicles living within the cordon line area. Vehicles owned by residents living inside the cordon line pay only 10 percent of the fee amount in London. Making a similar assumption, Center City residents would pay the equivalent of 50 cents per day, or an annual cost of $125 per year. The remaining 40 percent of the total vehicle volume in London's cordon area is nonunique (these vehicles come into or go out of the cordon line multiple times per day), or otherwise exempt from payment. This percentage comes from Transport for London's impact study of Central London Congestion Charging Scheme, which has been largely viewed as a success.

About 250,000 cars pass through the Center City cordon line during the peak period each weekday. The average cost of a trip into Center City is estimated to cost $8 (7.3 miles each way at $0.555 per mile), plus $12 for parking. A $5 congestion charge would add 25 percent to the cost of each trip.

Applied to the City of Philadelphia, congestion pricing would generate approximately $110 million in additional funding. It is estimated to reduce annual VMT by 190 million, while encouraging an additional four million transit trips. Other benefits may accrue from reduced noise and air emissions, improved bike, pedestrian, and transit access, and enhanced public space.

Priced Highways

The second congestion pricing mechanism would apply a fee of approximately $0.20 per mile on all limited-access highways during the peak period. This is double the current per mile fee on the Pennsylvania Turnpike. The peak period used here is 6 am to 9 am each weekday morning and 3 pm to 7 pm each weekday afternoon. These seven hours account for 47 percent of the VMT that occurs on the region's highways. For travelers using roads during this period, this represents a 36 percent increase in vehicle operating costs per mile. Peak-period drivers would have several options: pay the increased rate (and benefit from reduced congestion), switch the trip to a nonpeak period, shift from charged highways to nontolled local roads, shift modes, or not take the trip.

Under this scheme, the congestion fee would generate $660 million in additional funding. It would reduce annual peak period highway VMT by about 620 million, helping to ensure a smoother flow of traffic, and increase transit ridership by 2.7 million trips per year. However, it shifts about 110 million annual VMT from the peak to off-peak period, and adds about 250 million annual VMT to local roads (from highways) during peak periods. The net decline in annual VMT is about 260 million miles.

Fuel Sales Tax

A fuel sales tax would be assessed as a percentage of consumer fuel price, excluding the portion made up by the liquid fuels tax. Drivers confronted with an increasing fuel price can take fewer trips, shorter trips, complete trips with alternative modes, or

use/purchase more fuel-efficient or alternative-fuel vehicles.

The EIA's 2012 average fuel cost for the mid-Atlantic region was $3.76 per gallon for gasoline and $4.10 per gallon for diesel. The estimate assumes the region's gasoline fleet gets an average of 18 miles per gallon and drives about 39 billion miles per year (based on the regional travel demand model and MOVES).

A regional fuel sales tax of six percent would generate about $420 million in additional funding; reduce overall VMT by 230 million miles per year; and increase transit ridership by 600,000 trips per year.

Regional Toll Surcharge

A regional toll mechanism would levy a $1.00 surcharge on the 14 regional Pennsylvania Turnpike interchanges and nine regional New Jersey Turnpike interchanges. A second option would apply it to the nine toll bridges crossing the Delaware River in the region.

Tolled Roads

Revenue and VMT impacts from a $1.00 surcharge are computed using exit count data from the Pennsylvania and New Jersey turnpikes. A $1.00 surcharge represents a 24 percent increase in the Pennsylvania Turnpike toll rate based on the current amount of $4.22, averaged from the Pennsylvania Turnpike Financial Reports' net toll revenue and volumes. The revenue generated by the surcharge would be about $80 million on the Pennsylvania Turnpike. The surcharge would result in a VMT reduction of 200 million on the Pennsylvania Turnpike. This would decrease Pennsylvania Turnpike revenues by about $27 million. It would also mean an additional 45 million annual VMT shifting to local roads, and about 400,000 additional transit trips.

The New Jersey Turnpike's average toll charge is higher, at $4.48 per trip. A $1.00 surcharge represents a 22 percent price increase. The surcharge would result in $20 million in revenues, while reducing New Jersey Turnpike revenue by $7 million. From a transportation impact, it would reduce VMT on the turnpike by 40 million miles per year, while increasing VMT on local roads by nine million miles per year. It would also mean an additional 100,000 annual transit trips.

Tolled Bridges

The nine current and soon to be tolled Delaware River crossings in the region are the Commodore Barry, Walt Whitman, Benjamin Franklin, Betsy Ross, Tacony-Palmyra, Burlington-Bristol, US 1 Trenton-Morrisville, US 202 New Hope-Lambertville, and (soon) the I-95 Scudders Falls bridges. A $1.00 surcharge represents a 20 percent increase on the four DRPA bridges based on the current toll of $5.00. Two of the Delaware River Joint Tollbridge Commission (DRJTBC) bridges have a $1 toll, while the eventual toll on I-95 has yet to be determined. This would represent a 100 percent cost increase on these bridges. The two Burlington County Bridge Commission bridges have a $2 auto toll rate. The surcharge is estimated to generate $100 million in revenue and result in an annual VMT reduction of 180 million miles, and increase transit ridership by about 1.8 million annual trips.

Sales Tax

The sales tax is maintained in this list because it is commonly used as a revenue generator for transportation in other regions around the country. Virtually all goods and services require some use of the transportation system.

A 0.25 percent increase to the sales tax would have minor transportation impacts, based on reduced discretionary income. The revenue generated from a sales tax increase can be computed from the receipts reported by Pennsylvania Department of Revenue and New Jersey Department of Taxation. For the DVRPC counties in Pennsylvania, sales tax revenue by county does not capture the entire sales tax receipts because many businesses report their sales at a statewide level and not for each county. DVRPC estimates that the five-county southeast Pennsylvania region generates 33 percent of the state's total receipts. Similarly, the New Jersey subregion's population is 18 percent of the state total. This is used as a proxy for

sales tax share of the state total. Based on the current sales tax revenues, a 0.25 percent rate increase would bring in additional $120 million and $50 million to the Pennsylvania and New Jersey subregions, respectively.

DVRPC estimates the transportation impacts to be in line overall with raising vehicle registration fees. However, unlike vehicle registration fees, trip length will be more likely to be shortened (-0.03 elasticity) than reduced number of trips (-0.01 elasticity). The result is an estimated four million fewer annual VMT, and an increase of 8,000 transit trips per year.

Toll Existing Highways

Currently, there is no enabling federal legislation to allow tolling on publicly built facilities. However, future facility replacement needs and lack of funding may require some sort of tolling to repay either infrastructure bank loans, or as part of a public-private partnership. This fee estimates the revenue potential of tolling on all limited-access facilities in the region, including I-76, I-95, I-676, I-476, and US 422, and sections of US 1, US 202, and PA 309 in Pennsylvania; and I-76, I-95 (the section in Mercer County that is not the NJ Turnpike), I-195, I-295, I-676, and portions of NJ 42 and NJ 55 in New Jersey. The toll is assumed to be $0.10 per mile, based on current average rates on the Pennsylvania Turnpike. This is less than the current average on the NJ Turnpike, about 12 cents per mile. This would represent a 19 percent increase from the average federal reimbursement rate vehicle operating cost of $0.555 per mile.

This is estimated to result in an annual VMT reduction of 600 million miles on the region's highways. However, local road VMT would increase by about 30 million miles, leaving a net 570 million mile reduction in annual regional VMT. Transit ridership is estimated to increase by one million trips per year. Tolling major regional highways under these assumptions is estimated to generate $970 million in revenue.

Transit Fare Increases

A one percent transit fare increase of the existing fare rates can generate approximately $1.3 million. The bulk of the revenue accrues to SEPTA, with $1 million in additional fare revenue. The remainder would be collected by NJ Transit. The transit fare increase would also reduce transit ridership. A one percent transit fare increase would increase VMT in our region by approximately 8.4 million miles, while reducing annual transit trips by 2.9 million.

Vehicle Miles Traveled Fee

A fee on vehicle miles traveled (VMT) is assessed at a specific rate per miles driven and can be imposed on all VMT, or only on specific facilities. This charges roads more like a utility, directly based on system use. Technology can be used to track VMT on all road segments and charge drivers as they use them. With such a system, fees could vary by type of road and time of day. This could help to better capture the impact of congestion, and even reduce the use of local roads (assuming they have a higher charge per mile than arterials and highways).

Fees can be assessed by reading the odometer at each vehicle inspection, or each time the car is refueled. The former option would require substantial one-time payments every year. A trial in Oregon had each participants' car record miles driven in state and out of state, charging only for the in-state miles. Where and when those miles were driven was not recorded. Even with this sort of VMT fee system, fees could vary by vehicle weight and/or fuel efficiency. This could capture the impact a vehicle has on road deterioration and emissions.

This fee could generate $380 million per year, while reducing annual VMT by 620 million miles and increasing transit ridership by about 2.7 million trips.

Vehicle Registration Fee

Currently, vehicle registration fees are collected at $36 per passenger vehicle in Pennsylvania and on a sliding scale between $35.50 and $84 in New Jersey. Pennsylvania could follow New Jersey's lead and vary these fees by vehicle weight, age, and fuel efficiency.

A $10 increase in the vehicle registration fee would generate $33 million per year in the region. Its impact on the transportation system is minimal, with an annual estimated reduction of two million VMT and no substantial change in total transit ridership.

Other Considerations

DVRPC's Options for Filling the Region's Funding Gap considered five factors for each potential tax or fee option, including:

- Ease of Implementation - Is there an existing mechanism for collection of this revenue source?
- Revenue Yield and Adequacy- How much would the source generate and will it be sufficient?
- Stability and Sustainability – Will the source be stable and not fluctuate unpredictably?
- Fairness and Equity – Will the costs of the revenue be balanced with the benefits? Will the revenue distribute across jurisdictions?
- Economic Efficiency – How will the source impact economic behavior? How will it impact regional land development patterns?

Ease of Implementation

None of these fees are necessarily easy to implement, as state-enabling legislation (for anything besides transit fares) is required. It is likely much easier to implement an increase to an existing fee, such as the sales tax, toll surcharge, increased transit fares, vehicle registration fees, or add on a sales tax to fuel purchases, then it is to create entirely new systems for congestion pricing, tolling currently free facilities, collect fees based on VMT, or tax carbon emissions. Implementing a regional toll surcharge on existing toll facilities would be subject to bondholder approval.

Tolling has generally had very high administrative costs associated with it. The cost of collecting tolls can be up to 30 percent of the amount collected. It is currently unclear whether electronic tolling will lead to a reduction in the high administrative cost of tolling.

Revenue Yield and Adequacy

The region currently generates about $100 million per year in local funding. This section considers the ability to roughly double the current regional contribution, with no more than a 10 percent increase in current transportation costs. Transit fare increases are the only option that fails this test. Other fees would place a heavier burden on a subset of regional transportation users: congestion pricing (both cordon line and tolled limited-access facilities), regional toll surcharges, and tolling existing highways.

Stability and Sustainability

A carbon tax would have to increase at the rate of declining carbon emissions to remain stable and effective over time. A cordon line congestion charge assumes that Center City will remain the economic and cultural center of the region. If such a fee could not be implemented without harming the future growth of Center City, then this charge would be inconsistent with the Plan's goal of investing in existing centers. More study is needed to make that determination.

Congestion pricing on highways should remain consistent over time, with minor fluctuations due to the economy. The longer-term impact of driverless cars is a bit of an unknown at this point.

Fuel sales taxes are dependent on gasoline and diesel remaining the primary fuel source. They also face risks from improving fuel efficiency, leading to lower overall consumption and possible fuel price decreases.

The regional toll surcharge, sales tax, tolling of existing highways, and VMT fees should be able to maintain consistent revenue generation, with some minor fluctuation due to the economy.

Flat rate fees can be difficult to increase, and often fail to keep up with inflation. This is a concern with the carbon tax, toll surcharges, flat rate tolling, transit fares, VMT fees, and vehicle registration fees. Ideally, long-term carbon emissions will be substantially reduced, with the Plan setting a goal of lowering regional 2005 emission levels by 60 percent between now and 2040. While vehicle ownership rates have outpaced population growth over the past several

decades, future vehicle technologies, such as driverless cars, may revolutionize the vehicle ownership model. In a future with more car sharing, there may be fewer cars in the region to pay vehicle registration fees.

Percent-based fees can grow with the economy or system use. Assuming long-term economic growth, the sales tax increases revenue over time in line with inflation. Limited-access facility congestion price rates would have to grow with demand to ensure free flow of traffic. The fuel sales tax would grow with expected increasing energy costs, but as vehicles continue to become more energy efficient and use alternative fuels, the overall revenue generation could decline.

Fairness and Equity

All the potential fees can be viewed as regressive in one way or another. For the most part, they would charge all consumers the same amount for an item, regardless of income. This can be overcome, to a certain extent, by providing lower-cost alternatives, such as transit, walking, and biking facilities.

The sales tax is generally considered the most regressive transportation funding options. This tax is not based on the use of the system, and would force those that do not have vehicles to pay for transportation improvements that they may provide little or no benefit.

The carbon tax, and any other option that would drastically lower VMT and fuel use, could be seen as less regressive. Reducing greenhouse gas emissions is one of the preeminent challenges of our time. Using economics to do so will increase intergenerational equity for future populations. It will also reduce impacts on poorer populations, which most analysts find to be more likely to be substantially burdened by climate change.

A VMT fee is based on how much driving an individual does, and therefore is considered to be one of the most equitable transportation funding structures.

Economic Efficiency

Much of DVRPC's work in this effort came about out of a recognition that poor infrastructure conditions and the failure to improve transportation system performance puts the region at an economic disadvantage compared to our peer competitor regions, both in the United States and around the world. The goal has been to find ways to use the region's economic growth as a means to enhance the transportation network. To that extent, economists have generally found that sales taxes are a good way to generate revenue without harming economic growth.

Congestion pricing can promote the more efficient use of the transportation system throughout the day, reducing the need to make costly system expansions, while promoting alternative modes. .A cordon line congestion charge risks shifting regional development patterns and limiting growth in Center City relative to the rest of the region. However, a cordon line charge takes advantage of the plethora of transportation options into and around Center City.

Gas taxes, and other taxes that encourage environmental efficiency, can lead to technological innovations that lead to more efficient resource use and other economic gains.

Overall, increased transportation costs will likely mean denser, center-based development patterns. This would shift development to areas served by transit, with the requisite pedestrian and bike facilities. This also helps to limit development pressure in the less-developed portions of the region. Lastly, a more efficient transportation system, with reduced energy use and lower congestion, will make the region more economically competitive.

Appendix A. Pavement Needs Analysis

As part of DVRPC's effort to develop the Transportation Investment Scenarios to guide the development of the *Connections 2040* Plan, DVRPC conducted the following analysis on pavements in the Pennsylvania subregion using the roadway management system (RMS) database provided by PennDOT's Bureau of Maintenance and Operations (BOMO). The RMS identifies pavement condition in terms of its International Roughness Index (IRI). This analysis also uses long-range plan guidance developed by PennDOT.

Table 89. PennDOT Recommended Pavement Maintenance Project Cycles

BPN	Project Category	Cycle (in years after opening/reconstruction)
1-3	Preservation	Years 5, 7, 10, 18, 21, 23, 30, 33, 34, 42, and 43
1-3	Resurfacing	Years 14, 26, and 38
1-3	Reconstruction	Every 50 Years
4	Preservation	Years 0, 7, 10, 14, 15, 16, 20, 22
4	Resurfacing	At 25 years
4	Reconstruction	As needed

Source: PennDOT 2010 and the U.S. Department of Transportation (HERS-ST).

PennDOT District 6 has indicated that the region resurfaces its interstates (BPN 1) every seven years, while state guidance recommends resurfacing BPNs 2 and 3 every 12 to 14 years. Roads in BPN 1 to 3 all aim for a 50-year life, at which point they are reconstructed. Essentially, state guidance recommends preservation projects every four years on the first three BPN networks, and every three years on BPN 4. In exchange, BPN 4 has less frequent resurfacing.

Project costs are estimated on a lane miles basis. DVRPC reviewed cost estimates by PennDOT, the U.S. Department of Transportation's pavement condition modeling software (HERS-ST), DVRPC Transportation Improvement Program data, and a previous regional pavement needs analysis conducted by Econsult for the *Connections (2035)* Plan.

Table 90. Estimated Pavement Costs

BPN	Cost per Lane Mile (2012 $s)		
	Preservation	Resurfacing	Reconstruction
1	$ 24,000	$ 210,000	$ 2,130,000
2	$ 24,000	$ 210,000	$ 1,500,000
3	$ 24,000	$ 190,000	$ 890,000
4	$ 24,000	$ 190,000	$ 890,000

Source: PennDOT 2010 and the U.S. Department of Transportation (HERS-ST).

While there are essentially three main material types, composite pavements (concrete underneath an asphalt surface), asphalt, and concrete, DVRPC found the costs for each are similar enough to use a single cost factor. In addition, roads have a high degree of substitutability between these materials. If the cost of one is too high, another can replace it.

Estimating Pavement Deterioration

To estimate when lane miles will be in need of resurfacing or reconstruction, DVRPC developed a methodology based on current pavement condition using the IRI, PennDOT's regular work cycles, and the surface's age (based on the year pavement surface was constructed or reconstructed). DVRPC used regression analysis to estimate the rate of pavement deterioration and surface improvement per project type in each Business Plan Network (BPN), based on PennDOT's 2006 to 2010 inspection data.

DVRPC assumes that a reconstruction project results in an IRI of 35 at opening. To estimate maintaining conditions and repaving needs over a regular number

Table 91. Pavement Deterioration and Improvement Estimates

BPN	Material	Multiplier	IRI Change	R-Squared
1 & 2	Asphalt	Annual Change Increase per Age Year Preservation Project Resurfacing	+9.426 +0.040 -16.503 -60.581	.394
	Composite	Annual Change Increase per Age Year Preservation Project Resurfacing	+3.876 +.0077 -11.809 -50.748	.353
	Concrete	Annual Change Increase per Age Year Preservation Project Resurfacing	+5.481 +.0001 -9.929 -45.711	.365
3 & 4	Asphalt	Annual Change Increase per Age Year Preservation Project Resurfacing	+9.781 -0.0113 -19.199 -47.161	.356
	Composite	Annual Change Increase per Age Year Preservation Project Resurfacing	+9.356 +0.052 -20.363 -51.821	.316
	Concrete	Annual Change Increase per Age Year Preservation Project Resurfacing	+11.751 +0.0225 -22.005 -48.317	.326

Source: DVRPC 2012

of years, DVRPC estimated the frequency with which roads need to be preserved, with resurfacing occurring at the point when the road is in 'Fair' condition. Preservation projects are estimated to occur every four years for BPN 1 and 2, and every three years for BPN 3 and 4. These activities include crack sealing, shoulder cutting, and seal coating.

To estimate the total resulting number of projects, DVRPC used the following routine:

- If the IRI is in fair condition for its BPN, resurface.
- If the IRI is in poor condition, based on PennDOT standards for each BPN, reconstruct.
- If pavement is in good or excellent condition for its BPN, preservation projects are scheduled every four years for BPN 1 through 3, and every three years for BPN 4. No preservation projects are scheduled if pavement is being reconstructed during the funding period.

Pennsylvania Pavement Needs Assessment

This methodology was used to identify the year of different project types for each of the Pennsylvania subregion's 8,921 state-maintained lane miles. The mix of lane miles by BPN and material type is shown in Table 92.

Table 92. State-Maintained Lane Miles by BPN and Material

BPN	Asphalt	Composite	Concrete	Total
1	50.2	364.0	110.1	524.3
2	632.6	1,260.9	227.2	2,120.8
3	4,099.1	818.3	80.4	4,997.8
4	1,261.7	3.0	3.7	1,278.4
Total	6,043.6	2,456.2	421.5	8,921.3

Source: DVRPC 2012

DVRPC then estimated the total need for pavement preservation, resurfacing, and reconstruction projects for all pavement segments through the year 2040.

The first two funding periods estimate a much higher need on an annual basis; these periods have a large amount of reconstruction projects as the region catches up on its backlog of pavement need. This is mainly accomplished by 2025 in the needs assessment, at which point resurfacing and preservation represent the greater portion of the project mix. The $10.8 billion in estimated need for the 27-year Plan horizon is lower than the estimate by Econsult in 2007, for the previous long-range plan update. Using a much more generalized analysis, rather than segment-by-segment modeling, Econsult estimated a need of approximately $27.6 billion (Y-O-E) in pavement work for the period through 2030 (a shorter period than is included in this year's analysis) (Econsult 2007, Pages 42-43). However, Econsult's estimates also took into account local facilities. Table 94 identifies the number of lane miles of reconstruction and resurfacing recommended in the needs assessment by BPN.

Table 93. Estimated Need Pennsylvania Subregion 2014-2040

Funding Period	Millions of Y-O-E $s			
	Preservation	Resurfacing	Reconstruction	Total
2014-18	$ 261.9	$ 489.8	$ 1,893.9	$ 2,645.6
2019-24	$ 435.1	$ 859.4	$ 1,286.8	$ 2,581.3
2025-30	$ 597.6	$ 992.7	$ 173.4	$ 1,763.8
2031-40	$ 1,620.6	$ 1,826.5	$ 370.8	$ 3,817.9
Total	$ 2,915.2	$ 4,168.3	$ 3,725.1	$ 10,808.6

Source: DVRPC 2012

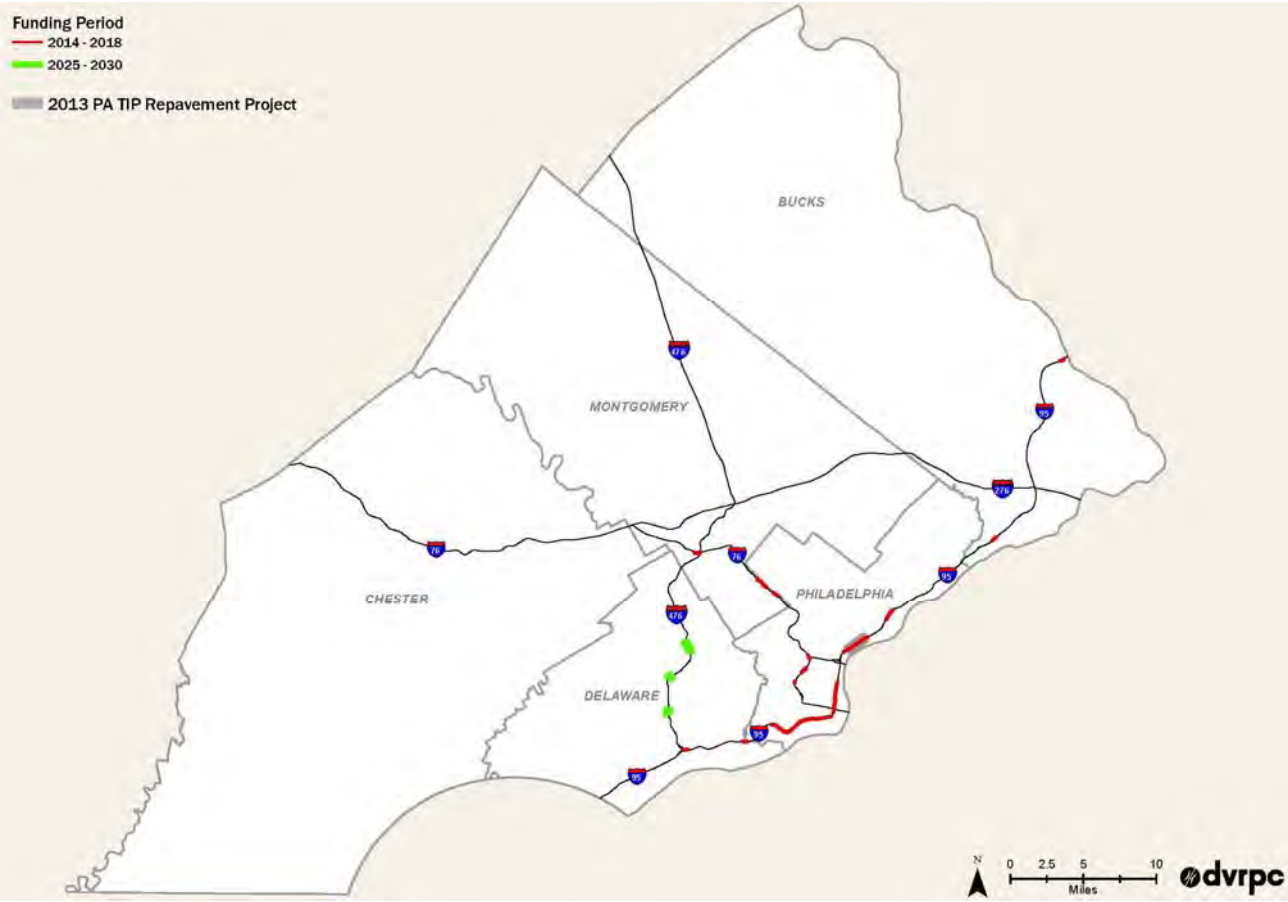
Table 94. DVRPC Pennsylvania Subregion Estimated Reconstruction and Resurfacing Need by Plan Period and BPN

BPN	Funding Period	Lane Miles		
		Preservation	Resurfacing	Reconstruction
1	2014-18	596.6	110.2	99.4
	2019-24	949.7	185.7	0
	2025-30	948.9	261.1	3.8
	2031-40	2,066.3	448.7	0
	Total	4,561.4	1,005.7	103.1
2	2014-18	2,346.4	709.3	581.1
	2019-24	4,428.6	680.7	6.0
	2025-30	3,751.9	760.6	13.6
	2031-40	7,984.1	1,773.1	0.7
	Total	18,511.0	3,923.7	601.3
3	2014-18	5,509.5	1,378.7	520.4
	2019-24	5,838.0	2,105.3	1,006.7
	2025-30	6,850.8	1,760.1	85.7
	2031-40	12,611.9	3,535.2	93.0
	Total	30,810.3	8,779.3	1,705.7
4	2014-18	350.1	0	156.3
	2019-24	995.9	277.3	61.1
	2025-30	675.7	296.9	1.5
	2031-40	1,097.4	416.8	88.5
	Total	3,119.2	973.7	307.4

Source: DVRPC 2012

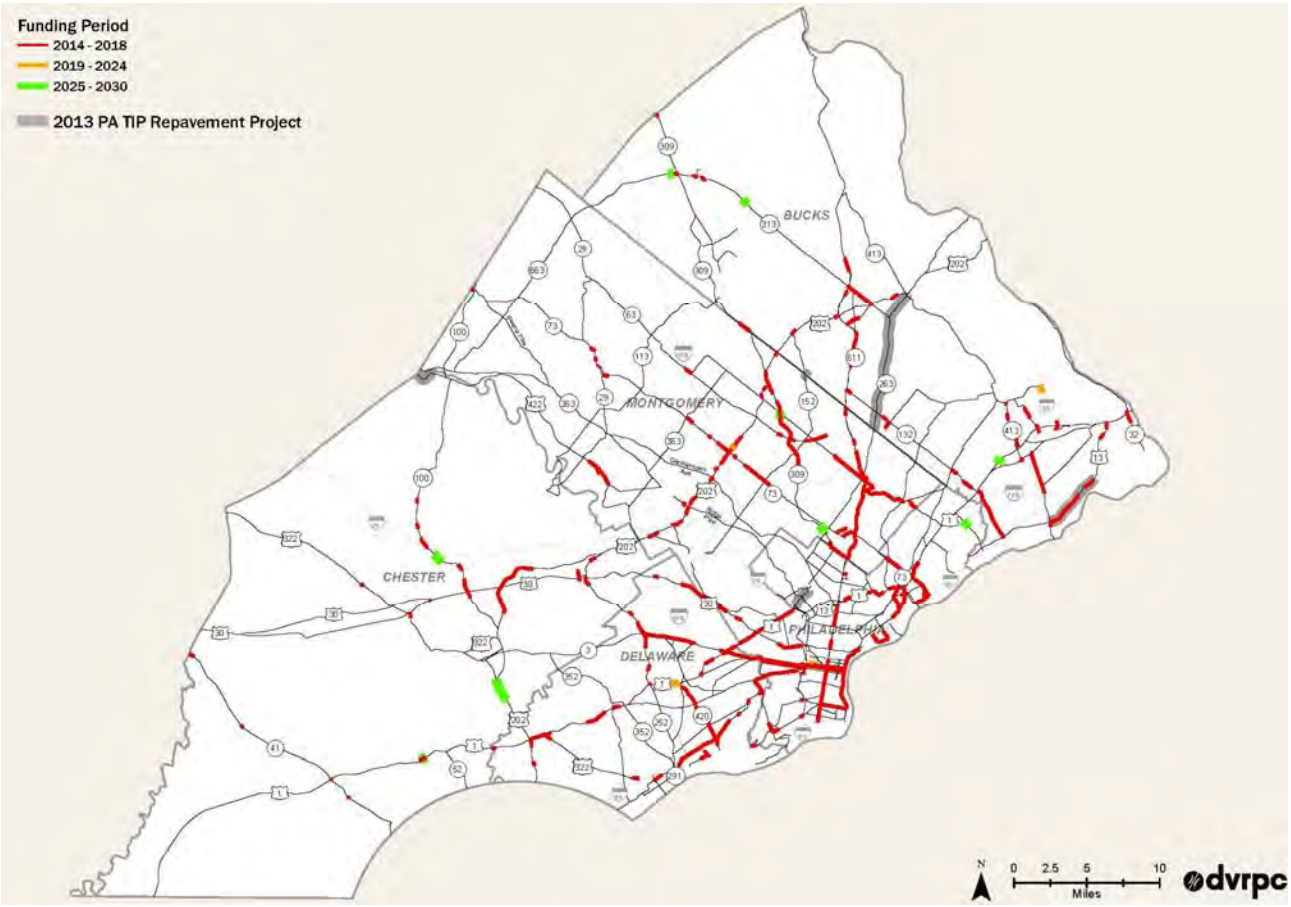
Figures 14 and 15 show pavement reconstruction needs by funding period for the interstates and the noninterstate National Highway System.

Figure 14. Pennsylvania Pavement Needs Assessment: Interstates



Source: DVRPC 2013

Figure 15. Pennsylvania Pavement Needs Assessment: Noninterstate National Highway System



Source: DVRPC 2013

New Jersey Pavement Needs Assessment

The same approach was incorporated using New Jersey pavement condition based on the Roadway Management System (RMS). This routine was used to identify the year and type of investment for each of the region's 1,970 state-maintained lane miles in New Jersey. Though NJDOT does not use the same BPN designation as PennDOT, the New Jersey road network was broken down into this system for means of analysis. The mix of lane miles by BPN and material type is shown in Table 95.

Table 95. Lane-Miles by Material

Material	Lane Miles
Asphalt	779.1
Composite	956.5
Concrete	234.4
Total	1,970.0

Source: DVRPC 2012

DVRPC then estimated the total need for pavement preservation, resurfacing, and reconstruction projects for all pavement segments through the year 2040. Total need is estimated at $4.8 billion (Y-O-E). Higher short-term (2014-17) needs are a reflection of the current backlog of pavement need in New Jersey.

Table 97 identifies the number of lane miles of reconstruction and resurfacing recommended in the needs assessment.

Table 97. New Jersey Subregion Estimated Reconstruction and Resurfacing Need by Plan Period and BPN

Funding Period	Lane Miles		
	Preservation	Resurfacing	Reconstruction
2014-17	1,219.5	410.3	254.8
2018-23	3,341.1	1,008.7	251.1
2024-30	3,251.7	2,635.0	46.6
2031-40	6,700.8	5,646.3	284.4
Total	14,516.1	9,699.7	716.5

Source: DVRPC 2012

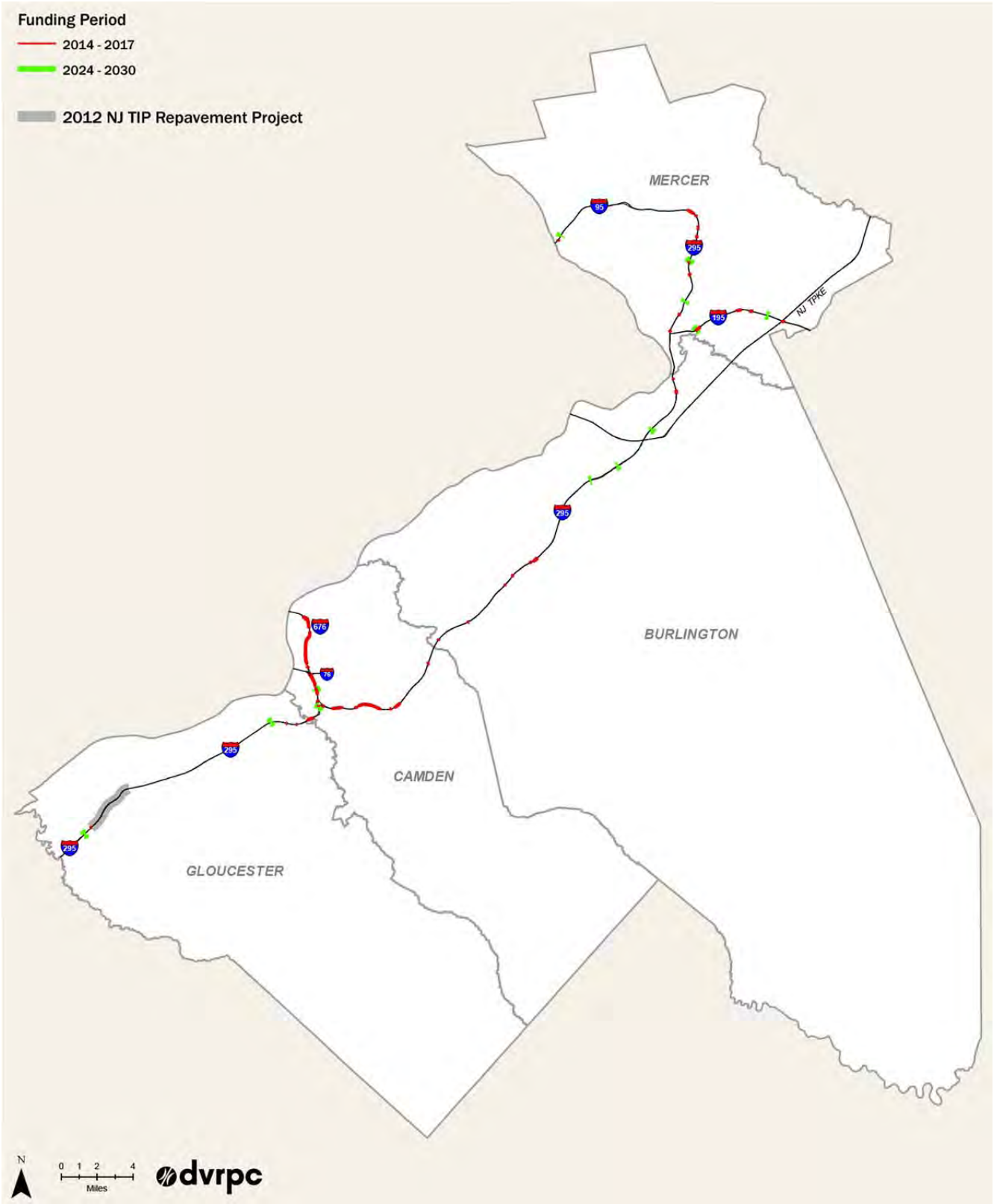
The maps that follow show pavement reconstruction needs by funding period for the interstates and noninterstate National Highway System.

Table 96. New Jersey Pavement Estimated Funding Need 2014-2040

Funding Period	Millions of Y-O-E $s			
	Preservation	Resurfacing	Reconstruction	Total
2014-17	$ 43.3	$ 157.5	$ 251.6	$ 452.4
2018-23	$ 97.5	$ 209.3	$ 278.9	$ 585.6
2024-30	$ 112.2	$ 642.2	$ 61.9	$ 816.2
2031-40	$ 390.3	$ 1,924.6	$ 640.2	$ 2,955.1
Total	$ 643.2	$ 2,933.6	$ 1,232.7	$ 4,809.5

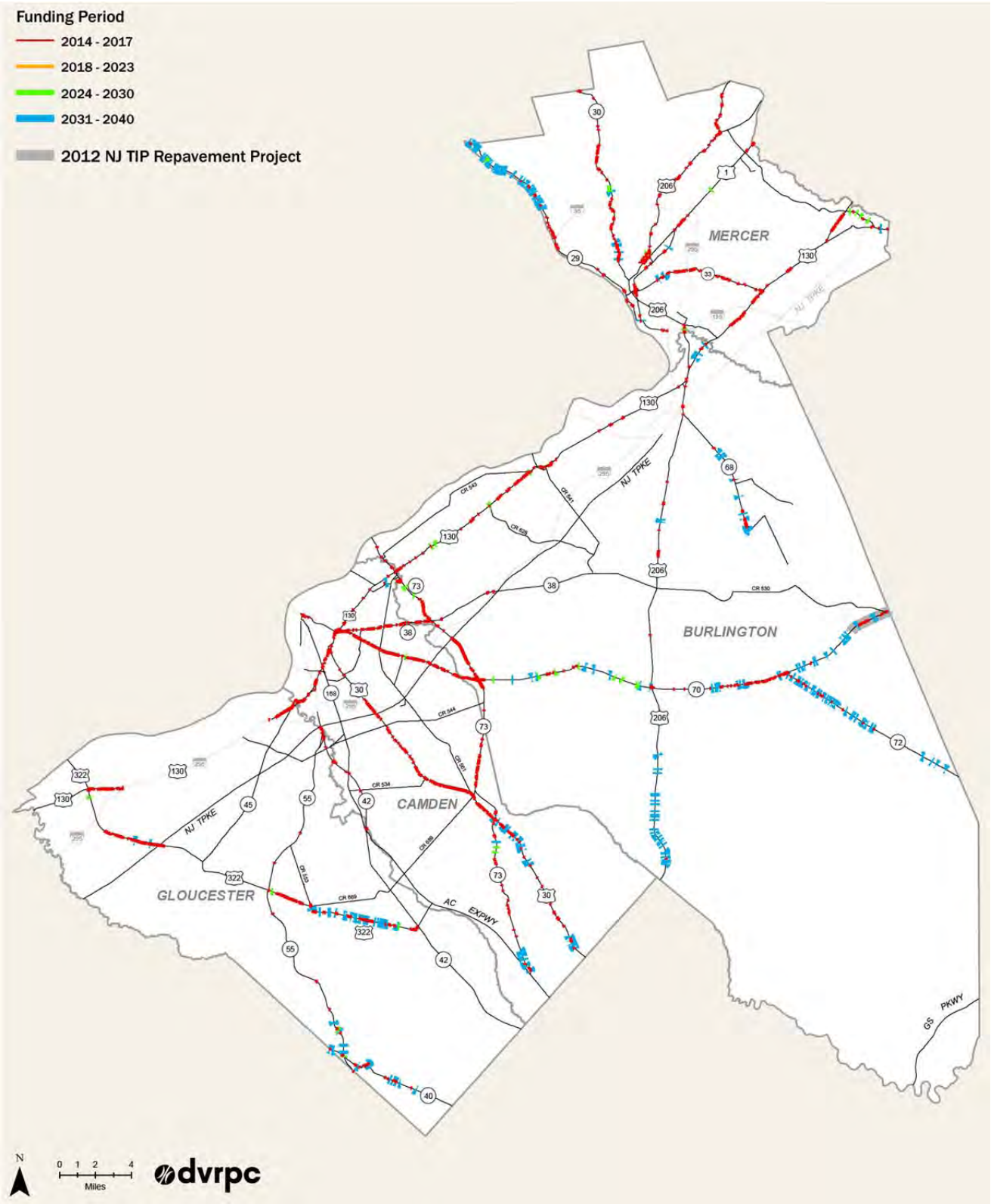
Source: DVRPC 2012

Figure 16. New Jersey Pavement Needs Assessment: Interstates



Source: DVRPC 2013

Figure 17. New Jersy Pavement Needs Assessment: Noninterstate National Highway System



Source: DVRPC 2013

Appendix B. Bridge Needs Analysis

DVRPC developed bridge needs for the *Connections 2040 Transportation Investment Scenarios* (DVRPC publication number 13004) using a series of linear regression models. These models used 25 years of bridge inspection data provided by PennDOT District 6, along with data from the bridge management system (BMS) database, to identify the annual rate at which bridge ratings decline and the effectiveness of preservation and rehabilitation projects on bridge ratings. After that report was completed, PennDOT's Asset Management unit worked with CH2M Hill to identify 50 years of need for Interstate 95. CH2M Hill's work uses NCHRP Report #713 *Estimating Life Expectancies of Highway Assets*. The *Connections 2040* needs assessment blended elements from both the initial DVPRC models and the I-95 work using the NCHRP highway assets methodology.

The resulting analysis identifies project needs for each individual bridge in the region over the life of the Plan. It incorporates the effect of planned TIP investments in bridges. This analysis is based on long-range plan guidance developed by PennDOT's Bureau of Maintenance and Operations, supplemented by DVPRC and PennDOT District 6, where needed. This analysis only considers the needs for state-owned bridges over eight feet in length, and local bridges longer than 20 feet. Culverts have been removed from this analysis and culvert work and needs are incorporated into a separate pavement analysis.

Bridge Project Estimated Costs

The BMS identifies current bridge conditions, and DVRPC used these conditions to estimate when each bridge in the Pennsylvania subregion will need preservation, rehabilitation, or replacement. PennDOT's Asset Management Unit has identified estimated construction costs for each of these types of projects per square foot of bridge deck area. These costs do not include preliminary and final engineering, right-of-way acquisition, or utility costs.

Table 98. PennDOT Statewide Bridge Maintenance Project Cycles and Estimated Construction Costs

Project	Cycle	Cost / Square Foot
Preservation	At 25 and 75 Years of Bridge Age	$ 87.50
Reconstruction	At 50 Years of Bridge Age	$ 400.00
Replacement	At 100 Years Bridge Age	$ 650.00

Source: PennDOT 2010

DVRPC analyzed project costs in the FY 2013 Pennsylvania Transportation Improvement Program (TIP) to estimate regional bridge costs. These costs are full project costs, meaning they include engineering, right-of-way, and utility costs. This analysis is further refined to consider main material type—concrete, metal, masonry, or timber—and Business Plan Network (BPN). There are five BPNs in the region: 1 designates interstates, 2 noninterstate National Highway System (NHS), 3 is for state-maintained roads with more than 2,000 average annual daily traffic (AADT), 4 designates roads with less than 2,000 AADT, and 5 designates locally maintained facilities. These costs reflect all stages in a bridge project, including study, engineering, utility, right-of-way acquisition, and construction. Costs also reflect previous obligations to the project prior to the current TIP.

Table 99. DVRPC Average Bridge Project Cost in the 2013 PA TIP

Bridge Material	BPN	Average Cost Per Square Foot (2012 $s)		
		Preserv-ation Cost	Rehabili-tation Cost	Replace-ment Cost
Concrete	1, 2	$ 170	$ 1,570	$ 1,790
Concrete	3, 4, 5	$ 60	$ 970	$ 1,490
Metal	1, 2	$ 290	$ 540	$ 870
Metal	3, 4, 5	$ 120	$ 580	$ 1,400
Masonry	All	$ 30	$ 1,440	$ 2,510
Timber	All	$ 30	$ 1,300	$ 2,510

Source: DVRPC 2012

With only 12 timber bridges in the region, there is a lack of meaningful data for this type of bridge. There are no replacement or preservation projects in the 2013 TIP for timber bridges. Costs for these project types are assumed to be in line with masonry bridges, given the historic nature of both material types. Likewise, high concrete rehabilitation costs are likely associated with the large number of historic concrete bridges being rehabilitated in the current DVRPC TIP. Metal bridges appear to be more expensive on the lower end of PennDOT's BPN spectrum. This could be a result of the economy of scale issue that PennDOT District 6 has noted with respect to bridge costs—smaller bridges tend to have higher costs on a square foot basis.

There are just fewer than 200 historic masonry bridges in the Pennsylvania subregion. These bridges have the potential to last indefinitely given regular rehabilitation and low traffic volumes. These bridges are particularly low cost to maintain, but very expensive to replace. High replacement costs are due in part to expanding deck area to meet current road standards and attempts to replicate the historic nature of these bridges.

Discussion with PennDOT District 6 bridge engineers identified a desire to do more preservation projects than state guidance recommends. This analysis assumes preservation projects at years 15 and 30 after bridge construction, and again after bridge rehabilitation (which still is expected to occur around year 50).

In comparison, the NCHRP report estimates the average effectiveness of five different project types (superstructure rehabilitation, superstructure

Table 100. NCHRP Report #713 Estimating Life Expectancies of Highway Assets Bridge Improvement and Cost Expectations

Action	Change in Condition Rating			Cost per Square Foot
	Deck	Superstructure	Substructure	
Do Nothing	0	0	0	--
Superstructure Rehabilitation	0	+1	0	$ 5.02
Substructure Rehabilitation	0	0	+2	$ 16.97
Repaint & Rehabilitate Superstructure	0	+2	0	$ 44.25
Deck Overlay	+1	0	0	$ 49.94
Superstructure Rehabilitation + Deck Overlay	+1	+1	0	$ 54.97
Substructure Rehabilitation + Deck Overlay	+1	0	+2	$ 66.92
Superstructure Rehabilitation + Substructure Rehabilitation + Deck Overlay (Minor Rehabilitation)	+1	+1	+2	$ 71.94
Superstructure Rehabilitation + Substructure Rehabilitation + Deck Replacement (Major Rehabilitation)	+3	+1	+2	$ 134.52
Superstructure Rehabilitation with Paint + Substructure Rehabilitation + Deck Replacement (Major Rehabilitation)	+3	+2	+2	$ 193.61
Bridge Replacement	+9	+9	+9	$ 398.02

Source: NCHRP 2012

Table 101. Estimated Project Cost by Bridge Material Type and Functional Class

Action	Cost Per Square Foot of Deck Area (2012 $s)						
	Metal / Concrete BPN 1	Concrete BPN 1 & 2	Concrete BPN 3 & 4	Metal BPN 2	Metal BPN 3 & 4	Masonry	Timber
Substructure Rehabilitation	$ 8	$ 23	$ 19	$ 18	$ 11	$ 32	$ 32
Superstructure Rehabilitation	$ 28	$ 76	$ 64	$ 60	$ 37	$ 107	$ 107
Repaint & Rehabilitate Superstructure	$ 72	$ 199	$ 166	$ 156	$ 97	N/A	$ 279
Deck Overlay	$ 82	$ 225	$ 187	$ 176	$ 109	$ 315	$ 315
Deck Replacement	$ 139	$ 383	$ 319	$ 300	$ 186	N/A	$ 538
Bridge Replacement	$ 650	$ 1,790	$ 1,490	$ 1,400	$ 870	$ 2,510	$ 2.510

Source: DVRPC 2012

rehabilitation with painting, substructure rehabilitation, deck overlay, and deck replacement) on the bridges deck, superstructure, and substructure condition. In addition to the effectiveness, it estimates a construction cost per square foot based on national averages.

DVRPC's methodology blended elements of the NCHRP report with its previous efforts by considering rates of decline and project effectiveness for bridges built with different materials (metal, concrete, masonry, and timber) and functional classes, while utilizing the five rehabilitation project categories in the NCHRP report (superstructure rehabilitation, superstructure rehabilitation with painting, substructure rehabilitation, deck overlay, and deck replacement).

The costs in the NCHRP report seem low, especially compared to state cost guidance of $650 per square foot for a bridge replacement. DVRPC's TIP costs include all phases (preliminary engineering, final design, right of way, utility, and construction), whereas state guidance and NHCRP only includes construction costs. DVRPC took a hybrid approach to future bridge project costs, using the replacement costs for all phases. For all other projects, DVRPC used a proportion for each NCHRP-identified cost to the DVRPC estimate replacement cost divided by the NCHRP bridge replacement cost. The final estimated cost for each type of project is identified in Table 101.

The only bridge replacement cost for interstate projects currently in the Pennsylvania TIP are for I-95 North, which consists of a series of large contracts. Each contract contains a substantial scope of bridge and other (pavement rehabilitation, on-/off-ramps, and operational improvements) that makes it difficult to determine the costs of the bridge portion only. DVRPC used 25 years of TIP bridge project history, provided by PennDOT District 6 to estimate that historic bridge costs have been about $520 (in 2010 dollars) per square foot on interstates. However, some of the projects in this TIP history are quite old, so DVRPC used the state guidance of $650 per square foot on interstate bridges. This lower cost for these facilities reflects the economy of scale identified by various bridge engineers, as these facilities tend to be much larger than other bridges in the region.

In addition, each bridge will have preservation needs over the life of the Plan. PennDOT guidance estimates that $1.75 (in 2010 dollars) is needed per square foot of bridge deck area per year for projects such as scouring and expansion joint replacement. While these projects will not improve bridge rating, they are necessary to slow the bridge's rate of decline.

Bridge Decline and Project Effectiveness

DVRPC used 25 years of PennDOT bridge inspection data to estimate the average deterioration rate of different types of bridges in the region. This analysis looked at how projects impacted bridges made of different main materials: concrete, metal, masonry, and timber. The goal was to determine the general impact of preservation, reconstruction, and rebuilding projects on bridge condition.

Each of the state-owned bridges in the DVRPC region has received anywhere between one and 21 inspections between 1985 and 2010. Typically, each bridge was inspected every two years. Inspections give ratings to three bridge elements: superstructure, substructure, and deck. The conditions are qualitative, on a scale of zero to nine, with detailed information on what to consider in determining each element's condition. All inspections should come within +/-1 point of the actual rating. They should remain consistent over time, and the inspector cannot increase a rating from the previous inspection without having a good reason to do so.

To estimate the number of bridge projects that have occurred in the region, DVPRC used the Bridge Inspection database for all three ratings: deck, superstructure, and substructure. Each bridge's inspection records were listed together, in order by date, in an excel spreadsheet. DVRPC tracked the total number and impact of improvements on each bridge over the analysis period, determining where increases in any rating indicated a rehabilitation or replacement project.

Where the average rating increased from one inspection compared to the previous, DVRPC identified projects on a routine:

- A bridge replacement project is assumed if all three ratings increased by three or more points between inspections, or two of the three increased by four or more points. In some cases, the bridge deck and superstructure appear to have been replaced on top of the old substructure.
- A deck overlay project is assumed if the deck rating increased by one point (using the NCHRP assumption for deck overlay rating improvement). Any deck improvement to a masonry bridge is assumed to be an overlay, as deck replacement is not possible.

Table 102. DVRPC Project Estimation on Cold Spring Creamery Road over Branch of Pine Run

Insp-ection #	Inspection Date	Deck Rating	Super-structure Rating	Sub-structure Rating	Deck Overlay	Deck Replace-ment	Super-structure Rehabil-itation	Super-structure Rehabil-itation + Paint	Sub-structure Rehabill-itation
1	5/13/1986	7	7	7	0	0	0	0	0
2	1/27/1988	7	6	6	0	0	0	0	0
3	2/7/1990	6	6	6	0	0	0	0	0
4	2/27/1992	6	6	5	0	0	0	0	0
5	2/16/1994	5	5	5	0	0	0	0	0
6	10/12/1995	5	6	6	0	0	0	0	0
7	10/29/1997	5	5	5	0	0	0	0	0
8	1/6/2000	5	5	4	0	0	0	0	0
9	5/8/2002	6	6	6	1	0	1	0	1
10	6/3/2004	5	5	4	0	0	0	0	0
11	6/7/2006	5	5	4	0	0	0	0	0
12	6/17/2008	5	5	4	0	0	0	0	0

Source: DVRPC 2012

- A deck replacement project is assumed if the deck rating increased by more than one point. The level of improvement is tracked and the average of all improvements is used (as opposed to the NCHRP assumption of three points). Any improvement to a masonry bridge deck is assumed to be an overlay, as deck replacement is not possible.
- A superstructure rehabilitation is assumed if the superstructure rating increased by one point (using the NCHRP assumption for superstructure rehab rating improvement). Any masonry bridge with an improvement of one or more points is assumed to be a superstructure rehabilitation, since these bridges are not painted.
- A superstructure rehabilitation + paint is assumed if the superstructure rating increased by more than one point. The level of improvement is tracked and the average of all improvements is used (as opposed to the NCHRP assumption of three points). Masonry bridges are not painted, so any masonry bridge superstructure improvement is assumed to be the result of a superstructure rehabilitation project.

Table 103. Average Rate of Decline over 25 Year Bridge Inspection Record Period

Project/Improvement	Concrete BPN 1 & 2	Concrete BPN 3 & 4	Metal BPN 1 & 2	Metal BPN 3 & 4	Masonry	Timber
Total Deck Rating Change*	-526	-924	-526	-924	-3	-1
Total Deck Overlay Rating Improvement*	745	1,040	745	1,040	5	2
Total Deck Replacement Rating Improvement*	347	334	347	334	N/A	5
Total Deck Inspection Years*	16,011	23,554	16,011	23,554	163	78
Average Deck Decline/Year*	-.101	-.098	-.101	-.098	-.049	-.103
Years per 1 Point Deck Decline	9.9	10.2	9.9	10.2	20.4	9.8
Total Superstructure Rating Change	-527	-856	-416	-466	-109	0
Superstructure Rehabilitation Improvement Points	335	514	290	275	228	7
Superstructure Rehabilitation + Paint Improvement Points	29	125	125	43	N/A	4
Total Superstructure Inspection Years	9,334	16,039	7,529	8,842	2,779	78
Average Superstructure Decline/Year	-.095	-.093	-0.110	-.0089	-0.121	-0.141
Years per 1 Point Superstructure Decline	10.7	11.3	9.1	11.3	8.3	7.1
Total Substructure Rating Change	-527	-896	-451	-471	-85	-2
Substructure Rehabilitation Improvement Points	449	865	471	513	236	10
Total Substructure Inspection Years	9,334	16,039	7,529	8,842	2,779	78
Average Substructure Decline/Year	-0.105	-0.110	-0.122	-0.111	-0.116	-0.154
Years per 1 Point Substructure Decline	9.6	9.1	8.2	9.0	8.7	6.5

*Bridge decks for metal and concrete bridges were combined in this analysis and differentiate only between functional class. Bridge deck rating records contain much incomplete data, thus the lower number of inspection years for this rating compared to superstructure and substructure.

Source: DVRPC 2012

- A substructure rehabilitation is assumed if the superstructure rating increased by one or more point(s). The level of improvement is tracked and the average of all improvements is used (as opposed to the NCHRP assumption of two points).

An example of this routine is shown in Table 102 for a bridge on Cold Spring Creamery Road over a branch of Pine Run in Bucks County, Pennsylvania.

The DVRPC methodology estimates one rehabilitation project that consisted of a deck overlay, superstructure, and substructure rehabilitation during the inspection period. Table 103 compares the number of bridge projects estimated in the 25-year bridge inspection records and the number of projects estimated using DVRPC's methodology.

Table 104 details the effectiveness of different projects and their frequency over a 25-year period. One would expect that these frequencies would increase as the region's bridges continue to age. With average effectiveness estimated, the average rate of decline can be determined for all bridge types using the bridge inspection records. Average decline per year is determined by taking the total change minus project rating improvements. The result is then divided by the total number of inspection years. The inverse of average decline per year is the number of years per one point decline in bridge rating.

Table 104. Estimated Count and Effectiveness of PennDOT Bridge Projects from 1985 to 2010

Project/Improvement	Concrete BPN 1 & 2	Concrete BPN 3 & 4	Metal BPN 1 & 2	Metal BPN 3 & 4	Masonry	Timber
Deck Overlay Count*	745	1,040	745	1,040	5	2
Deck Overlay Improvement Points*	745	1,040	745	1,040	5	2
Average Deck Overlay Improvement*	1	1	1	1	1	1
Deck Replacement Count*	142	131	142	131	N/A	2
Deck Replacement Improvement Points*	347	334	347	334	N/A	5
Average Deck Replacement Improvement*	2.44	2.55	2.44	2.55	N/A	2.5
Superstructure Rehabilitation Count	335	514	290	275	159	7
Superstructure Rehabilitation Improvement Points	335	514	290	275	228	7
Average Superstructure Rehabilitation Improvement	1	1	1	1	1.43	1
Superstructure Rehabilitation + Painting Count	14	44	52	21	N/A	2
Superstructure Rehabilitation + Paint Improvement Points	29	125	125	43	N/A	4
Average Superstructure Rehabilitation + Paint Improvement	2.07	2.84	2.40	2.05	N/A	2
Substructure Rehabilitation Count	397	763	392	437	181	9
Substructure Rehabilitation Improvement Points	449	865	471	513	236	10
Average Substructure Rehabilitation Improvement	1.13	1.13	1.20	1.17	1.30	1.11

*Bridge decks for metal and concrete bridges were combined in this analysis and differentiate only between functional class.

Table 105. Functionally Obsolete Bridge Replacements Expanded Deck Area in the 2013 Pennsylvania TIP

Bridge ID	Existing Deck Area (Sq. Ft)	Replacement Deck Area (Sq. Ft)	Percent Increase	Existing Number of Lanes
09101200202764	1,440	1,920	33%	1
09210300300000	631	1,064	69%	1
09403301200000	2,880	4,042	40%	2
09410100300000	570	998	75%	2
09721004170001	537	781	45%	2
15004103500100	1,064	1,456	37%	2
15004103600000	2,464	3,256	32%	2
15032203900459	6,912	10,787	56%	2
15037200600384	1,378	1,464	6%	2
23702300200209	426	853	100%	1
23741000100000	1,027	1,541	50%	1
46704601500190	15,729	26,425	68%	2
46710403400014	1,915	2,245	17%	2

Source: DVRPC 2012

Functionally obsolete bridges are not prioritized for replacement in this analysis. They are, however, not built to modern safety standards and generally will not be replaced as is. There are always exceptions to this rule, such as the I-76 Bridge along the Schuylkill River between Arch Street and University Avenue. Generally, though, the region's bridge deck area will increase as functionally obsolete bridges are replaced. Functionally obsolete bridges are more likely to be replaced, rather than rehabilitated, when two of the three ratings (deck, superstructure, or substructure) drop to a score of five or below.

DVRPC reviewed anticipated deck area expansion as part of the replacement of functionally obsolete bridges in the Pennsylvania 2013 TIP. There were 13 bridges that had identified current and future deck area as part of a replacement project.

The average one-lane bridge replacement increases in deck area by 53 percent in the 2013 Pennsylvania TIP, while the average two-lane bridge replacement increases by 54 percent. Though no larger bridges increased in deck area, DVRPC assumed that larger bridges, by number of lanes, will increase by a lower overall increment. This analysis estimates the following percent increase in deck area based on the number of lanes on the bridge:

- One- and two-lane bridges are estimated to increase by 50 percent;
- Three- and four-lane bridges by 30 percent;
- Five- and six-lane bridges by 20 percent; and,
- Any bridge larger than seven lanes by 10 percent.

Increasing bridge deck area will increase the future replacement cost of functionally obsolete bridges.

Forecasting Future Bridge Condition

DVRPC developed a methodology to estimate the year in which each bridge in the Pennsylvania subregion will need to be replaced or undergo one or more rehabilitation projects (superstructure rehabilitation,

Table 106. Potential Bridge Projects

Project #	Project Type	Deck Overlay	Deck Replacement	Super-structure Rehab-ilitation	Super-structure Rehabilitation + Paint	Sub-structure Replace-ment
1	Replacement	N/A	N/A	N/A	N/A	N/A
2	Major Rehabilitation		X		X	X
3	Minor Rehabilitation	X		X		X
4	Deck Overlay + Super Rehabilitation	X		X		
5	Deck Overlay + Super Rehabilitation + Paint	X			X	
6	Deck Overlay + Substructure Replacement	X				X
7	Deck Replacement + Super Rehabilitation		X	X		
8	Deck Replacement + Super Rehabilitation + Paint		X		X	
9	Deck Replacement + Substructure Replacement		X			X
10	Superstructure Rehabilitation + Substructure Rehabilitation			X		X
11	Superstructure Rehabilitation + Paint + Substructure Rehabilitation				X	X
12	Deck Overlay	X				
13	Deck Replacement		X			
14	Superstructure Rehabilitation			X		
15	Superstructure Rehabilitation + Paint				X	
16	Substructure Rehabilitation					X

Source: DVRPC 2012

superstructure rehabilitation with painting, substructure rehabilitation, deck overlay, or deck replacement). The routine looked at five different rehabilitation project types, as well as replacement. These were then optimized to see which type of intervention could extend the bridge's useful life at the lowest cost per year. The five project types are: bridge deck overlay, bridge deck replacement, superstructure rehabilitation, superstructure rehabilitation with painting, and substructure rehabilitation. There are 16 different permutations of these projects that could be completed on a single bridge.

In each funding period, the spreadsheet was set up to consider how many years of useful life could be added to the bridge under each of these 16 projects. Next, the cost per additional useful life year was computed. The lowest cost per useful life year was the recommended project for funding. Bridges with more than 25 useful life years remaining were restricted from this exercise. Rehabilitation projects were required to add at least 10 useful life years to be considered. This is to limit impacts to the traveling public, which must deal with additional construction delay.

Table 107. Example: Identifying Projects on I-95 over Van Kirk Street in Philadelphia (Bridge Key 38627)

Project #	Project Type	Useful Years Added	Cost Per Useful Year Added	Notes
1	Replacement	48	$563,000	
2	Major Rehabilitation	12	$768,000	
3	Minor Rehabilitation	2	N/A	
4	Deck Overlay + Super Rehabilitation	1	N/A	
5	Deck Overlay + Super Rehabilitation + Paint	1	N/A	
6	Deck Overlay + Sub Rehabilitation	2	N/A	
7	Deck Replacement + Super Rehabilitation	1	N/A	
8	Deck Replacement + Super Rehabilitation + Paint	1	N/A	
9	Deck Replacement + Sub Rehabilitation	12	$516,000	Lowest Cost
10	Super Rehabilitation + Sub Rehabilitation	0	N/A	
11	Super Rehabilitation + Paint + Sub Rehabilitation	0	N/A	
12	Deck Overlay	1	N/A	
13	Deck Replacement	1	N/A	
14	Super Rehabilitation	0	N/A	
15	Super Rehabilitation + Paint	0	N/A	
16	Sub Rehabilitation	0	N/A	

2024 Estimated Conditions: Deck 4; Superstructure 6; Substructure 5

Source: DVRPC 2012

Table 107 gives an example of these two calculations to identify the lowest-cost bridge projects. In the example, the project identified for this bridge would be to replace the deck and rehabilitate the substructure. Rehabilitating this bridge in the third funding period would leave the deck, superstructure, and substructure all with a value of five. If the work is not done, the analysis estimates that by 2040 the deck rating will drop to a three, the superstructure rating to a five, and the substructure rating to a four. At that point, the analysis would assume that the bridge needs to be replaced in the fourth funding period. This routine identified the lowest-cost project for each of the region's 2,142 state bridges for each funding period. A separate analysis was done for the 750 local bridges longer than 20 feet.

Once the lowest-cost project that added the minimum required useful life years was identified, this analysis prioritized all bridges in each funding period, and available funds for each period were then spent out on the highest priority projects. Future TIP updates will identify projects for funding.

Bridge Project Prioritization - Pennsylvania

Since funding will not cover all needs, the bridges were prioritized for funding in the *Connections 2040* Plan based on AADT, daily truck volume, state rank, district rank, BPN, and bridge type. This prioritization was set for the third and fourth funding periods only. The first and second funding periods reflect the 300 plus bridge projects already identified in the FY 2013 Pennsylvania TIP.

- Average Annual Daily Traffic – the highest total AADT bridge in the Pennsylvania subregion has 244,174 daily vehicles. This bridge receives a score of one, and all other bridges receive a score of AADT divided by 244,174.
- Daily Trucks – this is an estimate based on multiplying AADT by percent of trucks. The bridge with the most daily truck traffic carried 12,349 trucks per day. This bridge receives one point; all other bridges receive a score of daily trucks divided by 12,349.
- State Rank – If a bridge is one of the state's top 100 priority bridges based on bridge risk assessment, it receives one point; if a bridge is ranked between 101 and 250, it receives .5 points; if a bridge is ranked between 251 and 500, it receives .25 points, and if a bridge is ranked between 501 and 1,000, it receives .125 points.
- Business Plan Network – BPN 1 receives 1 point; BPN 2 receives .5 points; BPN 3 receives .25 points; BPN 4 and locally owned receives .125 points.
- Bridge Type – if a bridge is a truss of any type, it receives .5 points. These bridges are weighed more heavily because they have more potential failure points, so they are more likely to fail than other bridge types.
- TIP Status – Bridges programmed for funding in the TIP are awarded two points in the first and second Plan funding periods.
- Minimum Bridge Rating – bridges with a minimum rating (of deck, superstructure, or substructure rating) of less than three are given one point; bridges with a minimum rating between four and five are given .5 points. This is to prioritize bridges that are in danger of becoming functionally obsolete or closing.
- Bypass Length – any detour over 10 miles gets 1 point; over seven miles receives .5 points; over five miles receives .25 points; and over three miles receives .125 points.

Bridges are then reprioritized in each funding period to reflect changes in each rating. As bridges are replaced, trusses are removed as well. TIP status is only valid during the first two funding periods, as the current TIP extends out to 2025, but has no bridge funding programmed in the final year.

Bridge Project Prioritization – New Jersey

Bridges were prioritized for funding in New Jersey somewhat differently based on readily available data in the New Jersey BMS. The criteria used for this subregion includes: AADT, daily truck volume, state rank, district rank, BPN, bridge type, minimum rating (between deck, superstructure, and substructure), and bypass length.

- Average Annual Daily Traffic – each bridge with an AADT over 75,000 receives one point; each bridge with an AADT over 50,000 receives .67 points; each bridge with an AADT over 25,000 receives .33 points; each bridge with an AADT over 10,000 receives .17 points; each bridge with an AADT over 2,500 receives .1 points; and each bridge with an AADT over 500 receives .05 points.
- Daily Trucks – this is an estimate based on multiplying AADT by percent of trucks. The bridge with the most daily truck traffic carried 17,725 trucks per day. This bridge receives one point; all other bridges receive a score of daily trucks divided by 17,725.
- Business Plan Network – This serves as a proxy for functional class rating, setting up the New Jersey roadway network into the same categories as used in Pennsylvania. BPN 1 receives 1 point; BPN 2 receives .5 points; BPN 3 receives .25 points; and BPN 4 and locally owned receives .125 points.
- Bridge Type – if a bridge is a truss of any type, it receives .5 points. These bridges are weighed more heavily because they have more potential failure points, so they are more likely to fail than other bridge types.
- Minimum Rating – bridges with a minimum rating (lowest of deck, superstructure, and substructure ratings) of less than three are given one point; bridges with a minimum rating between four and five are given .5 points; bridges with a rating between three and four are given .25 points. This is to

prioritize bridges that are in danger of becoming structurally deficient or closing.

- Bypass Length – any detour over 10 miles gets one point; over seven miles receives .5 points; over five miles receives .25 points; and over three miles receives .125 points.

Bridges are then reprioritized in each funding period to reflect changes in each bridge rating; TIP status is only valid for the first two Plan periods. As bridges are replaced, trusses are also removed.

Pennsylvania Subregion Bridge Needs Assessment

The count of each type of bridge in the region is as follows:

- 1,837 Concrete;
- 850 Metal;
- 194 Masonry; and
- 12 Timber.

In addition, the Pennsylvania subregion has 750 local bridges over 20 feet long that are eligible for federal funding.

The region currently has a considerable backlog of bridge repair needs, and there is far less funding available than what is required to reduce the backlog and keep up with ongoing needs as the system continues to age. DVPRC identified approximately 50 bridges in the Pennsylvania Bridge Management System that appear to have been replaced or rehabbed since the last inspection. This was determined by the "Year_Built" and "Year_Reconstruction" fields in the bridge database. When "Year_Built" was greater than or equal to 2008 and one or more rating factor was six or below, the three ratings were estimated at nine minus the expected annual decline for the material type and BPN of the bridge for the number of years since replacement. Where the "Year_Reconstruction" field was greater than or equal to 2008, and the minimum rating was equal to or less than four, DVRPC applied the anticipated effectiveness of a rehabilitation project to the bridge's minimum rating based on material type and BPN.

Incorporating the costs of bridge preservation, rehabilitation, and reconstruction from 2014 to 2040, DVRPC is targeting maintaining bridge deck area at about 8.3 percent of deck area in structurally deficient condition as the identified state-of-good-repair target for bridges in the region. This target comes from PennDOT state guidance and is determined by averaging weighted targets, using square feet of deck area, set for each of the region's BPN categories. DVRPC estimates that the region's need is approximately $22.5 billion (Y-O-E). Table 108 shows funding need for each *Connections 2040* financial plan funding period and by type of project.

The highest cost is associated with bridge replacement, and this analysis envisions the need to replace 921 state-maintained bridges from 2014 to

Table 108. DVRPC Pennsylvania Subregion State-Maintained Bridges Estimated Funding Need by Plan Period

Plan Period	Total Need in Millions of Y-O-E $s				Total Need in Millions of 2012 $s
	Preservation	Rehabilitation	Replacement	Total	
2014-18	$ 180.9	$ 842.0	$ 1,898.0	$ 2,920.9	$ 2,592.2
2019-24	$ 269.3	$ 726.4	$ 2,376.7	$ 3,372.5	$ 2,546.8
2025-30	$ 333.9	$ 210.5	$ 1,857.3	$ 2,401.8	$ 1,475.5
2031-40	$ 735.2	$ 4,606.7	$ 8,432.8	$ 13,724.7	$ 6,183.3
Total	$ 1,519.4	$ 6,385.6	$ 14,564.9	$ 22,469.9	$ 12,800.8

Source: DVRPC 2012

Table 109. Pennsylvania State-Maintained Bridge Projects by Funding Period

Project #	Project Type	2014-2018	2019-2023	2024-2030	2031-2040	Total
1	Replacement	150	72	239	194	655
2	Major Rehabilitation	56	20	2	116	194
3	Minor Rehabilitation	84	79	77	725	965
4	Deck Overlay + Super Rehabilitation	6	2	4	6	18
5	Deck Overlay + Super Rehabilitation + Paint	0	0	1	0	1
6	Deck Overlay + Sub Rehabilitation	11	20	23	30	84
7	Deck Replacement + Super Rehabilitation	0	0	0	0	0
8	Deck Replacement + Super Rehabilitation + Paint	1	0	0	0	1
9	Deck Replacement + Sub Rehabilitation	6	0	1	0	7
10	Super Rehabilitation + Sub Rehabilitation	25	20	19	2	66
11	Super Rehabilitation + Paint + Sub Rehabilitation	19	12	26	28	85
12	Deck Overlay	0	0	0	0	0
13	Deck Replacement	0	0	0	0	0
14	Super Rehabilitation	1	1	0	0	2
15	Super Rehabilitation + Paint	1	0	0	0	1
16	Sub Rehabilitation	63	66	35	10	174

Source: DVRPC 2012

2040. Table 109 details the number of projects by project type and funding period.

The PennDOT statewide goal for local bridges over 20 feet is to reduce structurally deficient deck area to 15 percent. This target was set for funding needs for local bridges over 20 feet in the Pennsylvania subregion.

Total funding need to achieve and maintain this target is estimated at $4.2 billion (Y-O-E) over the life of the Plan. Some 452 local bridges over 20 feet are estimated to need replacement between 2014 and 2040.

Table 110. DVRPC Pennsylvania Subregion Locally Maintained Bridge Estimated Funding Need by Plan Period

Plan Period	Total Need in Millions of Y-O-E $s				Total Need in Millions of2012 $s
	Preservation	Rehabilitation	Replacement	Total	
2014-18	$ 28.8	$ 51.9	$ 637.9	$ 718.6	$ 630.3
2019-24	$ 40.0	$ 416.3	$ 906.2	$ 1,362.5	$ 980.2
2025-30	$ 55.9	$ 58.8	$ 687.4	$ 802.2	$ 456.1
2031-40	$ 91.4	$ 229.8	$ 1,039.1	$ 1,360.3	$ 773.4
Total	$ 216.1	$ 756.9	$ 3,270.5	$ 4,243.5	$ 2,840.1

Source: DVRPC 2012

New Jersey Subregion Bridge Needs Assessment

The count of each type of bridge in the New Jersey subregion is:

- 329 Concrete;
- 474 Metal;
- 9 Masonry; and
- 56 Timber.

Incorporating the cost of bridge preservation, rehabilitation, and reconstruction from 2014 to 2040, DVRPC estimates the region's state-maintained bridge need is approximately $5 billion (Y-O-E). The DVRPC New Jersey Subregion State-Maintained Estimated Funding Need by Plan Period (Table 111) shows funding need for each *Connections 2040* financial plan funding period and by type of project.

Locally maintained bridges are estimated to need $800 million (Y-O-E) over the life of the Plan. This analysis would replace 136 state and local bridges in the New Jersey subregion over the life of the *Connections 2040* Plan.

Table 111. DVRPC New Jersey Subregion State-Maintained Bridge Estimated Funding Need by Plan Period

Plan Period	Total Need in Millions of Y-O-E $s				Total Need in Millions of 2012 $s
	Preservation	Rehabilitation	Replacement	Total	
2014-17	$ 47.7	$ 411.2	$ 290.2	$ 749.1	$ 675.5
2018-23	$ 68.7	$ 591.9	$ 275.6	$ 936.2	$ 728.2
2024-30	$ 85.1	$ 416.2	$ 200.0	$ 701.3	$ 436.2
2031-40	$ 222.2	$ 1,275.9	$ 1,100.1	$ 2,603.2	$ 1,160.1
Total	$ 428.8	$ 2,695.2	$ 1,865.8	$ 4,989.8	$ 3,000.0

Source: DVRPC 2012

Table 112. DVRPC New Jersey Subregion Locally Maintained Bridges over 20 Feet Estimated Funding Need by Plan Period

Plan Period	Total Need in Millions of Y-O-E $s				Total Need in Millions of 2012 $s
	Preservation	Rehabilitation	Replacement	Total	
2014-17	$ 8.1	$ 11.6	$ 116.3	$ 136.0	$ 122.6
2018-23	$ 0.6	$ 3.7	$ 9.5	$ 14.0	$ 10.7
2024-30	$ 1.5	$ 4.1	$ 160.4	$ 165.9	$ 103.2
2031-40	$ 8.3	$ 52.0	$ 420.9	$ 421.2	$ 214.4
Total	$ 18.4	$ 71.4	$ 707.1	$ 796.1	$ 451.0

Source: DVRPC 2012

Appendix C. Completed Major Regional Projects

Table 113 lists major regional projects included in the *Connections (2035)* Plan, adopted in July 2009, which have since been completed, or are expected to be completed, prior to FY 2014, the first year of the *Connections 2040* Plan.

Table 113. Recently Completed Major Regional Projects

MRP ID	Facility	Scope	Location
33	US 202 (Sec. 700)	New 2-Lane parkway and intersection improvements from Montgomeryville to Doylestown	Bucks, Montgomery
43	US 202 (Section 300)	Widen and reconstruct from PA 252 to US 30	Chester
47	I-76 (PA Turnpike)	Electronic interchange at PA 29	Chester
54*	I-76 and Henderson Road (Phases 1 and 2)*	Widen and reconstruct Henderson Rd./South Gulph Rd. from Monroe Boulevard to I-76 Gulph Mills Interchange; construct new ramps to I-76	Montgomery
57**	PA 309 Connector Road (Phase 1)**	Road enhancements from Sumneytown Pike to Allentown Road.	Montgomery
73	NJ 73	Widen and intersection improvements in vicinity of Fox Meadow Road	Burlington
76	NJ 42 at College Drive	New interchange	Camden
80	Paulsboro Brownfields Access	New roadway from the eastern or southern boundary of BP redevelopment site, bridging Mantua Creek and connecting to the newly improved Interchange 19 on I-295 via Paradise Road (CR 656).	Gloucester
94	US 322 Mullica Hill Bypass	New bypass in vicinity of US 322 and NJ 45	Gloucester
104	I-276 (PA Turnpike)	Electronic interchange at Philadelphia Park	Bucks
K	Pennsauken Transfer Station	New station for RiverLine and Atlantic City Rail Line	Camden

* Phase 3 is still to be completed, and is listed as a minor regional project in the *Connections 2040* Plan.
** Phase 2 is still to be completed and is listed as a major regional project in the *Connections 2040* Plan.

Source: DVRPC 2013

Table 114 lists projects from the *Connections (2035)* Plan that have been removed from *the Connections 2040* plan and are no longer being pursued.

Table 114. Major Regional Projects no Longer Being Pursued

MRP ID	Facility	Scope	Location
46	US 30 Business	Widen US 30 Business to 5 lanes from US 202 to Exton Mall	Chester
70	New Jersey Turnpike	Widen from Exit 4 to Delaware Memorial Bridge	Burlington, Camden, Gloucester
M	Delaware River Tram	Aerial Tram from Philadelphia to Camden	Camden, Philadelphia

Source: DVRPC 2013

Publication Title: *Connections 2040: Plan For Greater Philadelphia: Technical Analysis*

Publication Number: 13043

Date Published: September 2013

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

Key Words:
Financial Plan, Major Regional Projects, Transportation Investments, Transportation Revenue, Revenue Forecast, Funding Options, Asset Management, Project Evaluation, Evaluation Criteria, Needs Assessment, Funding Allocation, Infrastructure, Transportation Projects, Preservation, Operational Improvements, System Expansion, Fiscal Constraint, Funding Gap, Technology, Project Delivery.

Abstract:
The *Connections 2040 Plan for Greater Philadelphia: Technical Analysis* documents the quantitative effort and assumptions that went into developing the needs assessment, revenue forecast, allocation, project evaluation and selection, fiscal constraint analysis, and regional funding options for the *Connections 2040 Plan for Greater Philadelphia*.

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September 2013 I Publication Number: 13043