

An aerial photograph of a city street grid, with a blue highlighted path representing a transit route. The path starts from the bottom left, moves north, then east, then north again, and finally east towards the right edge of the image. The background shows a dense urban grid and a waterfront area on the right side.

Concept Development for
**TRANSIT ON
DELAWARE AVENUE**



November 2018



The Delaware Valley Regional Planning Commission

is the federally designated Metropolitan Planning Organization for a diverse nine-county region in two states: Bucks, Chester, Delaware, Montgomery, and Philadelphia in Pennsylvania; and Burlington, Camden, Gloucester, and Mercer in New Jersey.



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TABLE OF CONTENTS

EXECUTIVE SUMMARY	1
CHAPTER 1: PROJECT BACKGROUND	7
Previous and Ongoing Studies	9
Assessing Corridor Characteristics for Trolley Extension Readiness	14
CHAPTER 2: NEAR-TERM RECOMMENDATIONS	29
Strategies Toward a Multimodal Waterfront	30
Increase Service Frequency along the Waterfront	32
Better Integrate Delaware River Waterfront Transit Service with the Rest of the Network	33
Improve Safety, Comfort, and Visibility of Pedestrian Connections and Bus Stops	36
Decrease Transit Trip Duration	38
Redistribute Existing Vehicle Fleet	39
Conclusion: Near-Term Recommendations	40
CHAPTER 3: LONG-TERM RECOMMENDATIONS	43
Strategies Toward a Multimodal Waterfront	44
Provide Frequent Service	46
Support Transit Connections with Infrastructure and Free Transfers	46
Create Stations	48
Reconfigure Delaware Avenue Right-of-Way, Including a Dedicated Transit Right-of-Way	49
Establish a Dedicated Vehicle Fleet	50
Conclusion: Long-Term Recommendations	52
CHAPTER 4: NEXT STEPS	55
APPENDICES	
Appendix A: Central Delaware Waterfront Strategic Modeling Results	A-1
Appendix B: Light Rail Transit on Delaware Avenue Meeting #2 Summary	B-1

FIGURES AND TABLES

FIGURES

EXECUTIVE SUMMARY

Figure 1: Delaware Avenue Existing Conditions and Vision for the Future 2

CHAPTER 1: PROJECT BACKGROUND

Figure 2: Study Area of Delaware Avenue Corridor 8

Figure 3: Stops from Previous Studies and Stakeholder Workshops 11

Figure 4: Central Delaware Waterfront Strategic Modeling Scenarios 12

Figure 5: Existing and Proposed Waterfront Destinations 16

Figure 6: Change in Transit Score Level for Delaware Avenue Corridor 17

Figure 7: Route 25 Service and Ridership 18

Figure 8: Transit Overview of Delaware Avenue Corridor 19

Figure 9: Route 25 Average Daily Ridership 20

Figure 10: Daily Ridership of Routes Operating on Delaware Avenue Corridor 21

Figure 11: Freight on Delaware Avenue (by Pier 70) 22

Figure 12: Freight Characteristics on Delaware Avenue 23

Figure 13: Speed of Throughput on Delaware Avenue Corridor 25

CHAPTER 2: NEAR-TERM RECOMMENDATIONS

Figure 14: Enhanced Delaware River Waterfront Transit Service Near-Term Opportunities 30

Figure 15: Physical Connections between Delaware Avenue and Center City 34

Figure 16: Spring Garden Street MFL Underpass 35

Figure 17: Stairs at Penn's Landing 35

Figure 18: Potential Transit Center Site (Pier 70) 35

Figure 19: Pedestrian and Bicycle Facilities and Conditions 37

Figure 20: Proposed Consistent and Wider Stop Spacing 38

Figure 21: Queue Jumps 39

CHAPTER 3: LONG-TERM RECOMMENDATIONS

Figure 22: Enhanced Delaware River Waterfront Transit Service Long-Term Opportunities 44

Figure 23: Example of a Potential Modern Trolley Station 48

Figure 24: Visions of Robust Changes to the Right-of-Way 49

TABLES

EXECUTIVE SUMMARY

Table 1: Phased Recommendations 4

CHAPTER 1: PROJECT BACKGROUND

Table 2: Summary of Delaware Avenue Transit Proposals from Past Studies 10

Table 3: Ridership Estimations for Central Delaware Waterfront Strategic Modeling Scenarios 13

CHAPTER 2: NEAR-TERM RECOMMENDATIONS

Table 4: Near-Term Recommendations 31

Table 5: Existing and Proposed Frequency 32

Table 6: Ridership of Non-Route 25 Bus Routes at Destination Nodes along Delaware Avenue 33

CHAPTER 3: LONG-TERM RECOMMENDATIONS

Table 7: Long-Term Recommendations 45

Table 8: Increased Service Frequency 46

Table 9: Priority Station Connection Recommendations 47

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Route 25 bus heading north along Delaware Avenue between the Delaware River and I-95.

Source: DVRPC

EXECUTIVE SUMMARY

High-quality, high-capacity transit along Philadelphia's waterfront is widely believed to be essential in realizing the City of Philadelphia-adopted Delaware River Waterfront Corporation (DRWC) Master Plan for the Central Delaware ("Master Plan"). The Master Plan is a framework plan for land use, transportation, open space, and economic development strategies along Philadelphia's waterfront. Since 2011, the rate of land use development has picked up and is expected to continue, but transit planning and operational investments have lagged. Improved transit service and visibility is needed soon in order to support incoming development and the overall Master Plan realization.

Previous planning studies have pointed to rail transit as the mode of choice to realize the Master Plan's vision. Some transit advocates have suggested expanding the Southeastern Pennsylvania Transportation Authority's (SEPTA's) trolley system along Delaware Avenue. Now, with SEPTA's upcoming procurement of new trolley vehicles ("Trolley Modernization") and the associated

investments to infrastructure it will require, it is timely to explore the question: *Does it make sense to expand SEPTA's trolley system to serve Delaware Avenue within the 8-10 year Trolley Modernization timeline?* This report was initiated to explore that question.

Several factors suggest that extending rail transit to Delaware Avenue within the timeframe of Trolley Modernization is not feasible for a variety of economic, operational, and physical factors. These factors include:

- existing population and employment densities that are lower than typically needed to support high-intensity rail infrastructure;
- bus ridership along the corridor that is relatively low compared to other routes within SEPTA's system;
- an active freight line that currently operates in the median of Delaware Avenue; and,
- vehicle capacity demands on portions of Delaware Avenue that limit the opportunities to dedicate a portion of the existing right-of-way to rail service.

These challenges reflect the *existing* context along the waterfront; the *future* could look very different (see *Figure 1*). Multi-agency, collaborative planning and actions could steer each of these challenges toward a more promising transit future. Improving physical connections and timing of service between Delaware Avenue and connecting transit service, raising the profile of bus stops and pedestrians along the corridor, and trying to provide shorter trips overall can be near-term strategies to make transit a stronger mode choice. The strategies could center around changes to the existing service along the waterfront, SEPTA's Route 25, or it could center on a new enhanced Delaware River waterfront transit service.

To start, small changes to increase the convenience and comfort of transit riders along Delaware Avenue could increase ridership. Running service more frequently, predictably, and for a greater span of the day could become an attractive draw for new riders.

As waterfront transit ridership and population and employment density increase in the future, a

dedicated right-of-way for transit service would create markedly improved service over operating within mixed traffic. The opportunity to dedicate an exclusive transit right-of-way, or lanes, could only occur with systemic mobility shifts along the waterfront that could be made possible through the Pennsylvania Department of Transportation's (PennDOT's) planning for the massive I-95 Sector B (roughly between Spring Garden Street and Broad Street). If vehicular capacity shifts away from Delaware Avenue and onto I-95 (by strategically adding or relocating on/off ramps), right-of-way limitations along Delaware Avenue could be unlocked and a greater degree of change could occur with the design and transit operations along Delaware Avenue. These changes should include a dedicated transit right-of-way to strengthen transit's role, and allow Delaware Avenue to serve shorter shopping, recreational, and tourist vehicular trips, and having longer trips use I-95 instead of Delaware Avenue.

Sector B construction is expected to be complete sometime around 2035—far beyond SEPTA's Trolley Modernization timeline and likely well after

the waterfront realizes significant development growth. In the meantime, there are meaningful ways to improve transit along the waterfront. Short-term physical and operational improvements along Delaware Avenue can be pursued through DRWC's current Transit Study, using this report's guidance. Opportunities to connect the waterfront to SEPTA's broader network will be evaluated as part of SEPTA's upcoming Comprehensive Bus Network Redesign work.

Coordination among the various stakeholders shaping transportation and land use along the waterfront agree that transit programming for Delaware Avenue over the next 20 years should realize strides toward high-quality, high-capacity transit in tandem with development of the waterfront by:

- implementing quick, strategic, and systematic changes within the existing right-of-way over the next 10 years; and,
- crafting robust changes to the Delaware Avenue right-of-way that allow for a dedicated, high-quality, high-capacity alignment for transit (bus or rail) through coordinated I-95 Sector B planning and construction.

Figure 1: Delaware Avenue Existing Conditions and Vision for the Future



Source: DVRPC

Existing Route 25 bus stop, Delaware Avenue by Columbus Commons.



Source: DVRPC

I-95 and Delaware Avenue run parallel to each other, separating Center City from the waterfront.

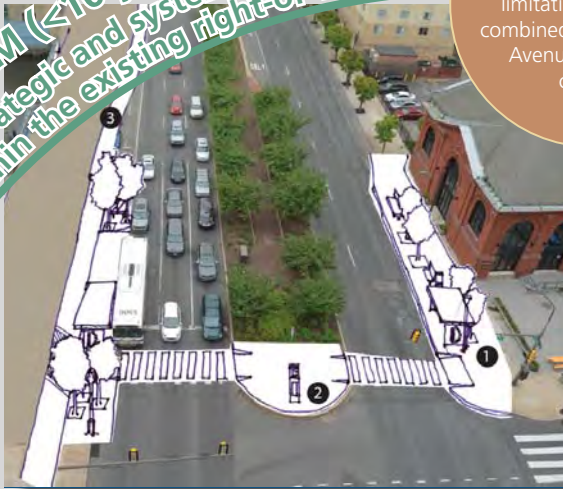


Source: DRWC

A vision for Delaware Avenue's future, as depicted in DRWC's Master Plan for the Central Delaware.

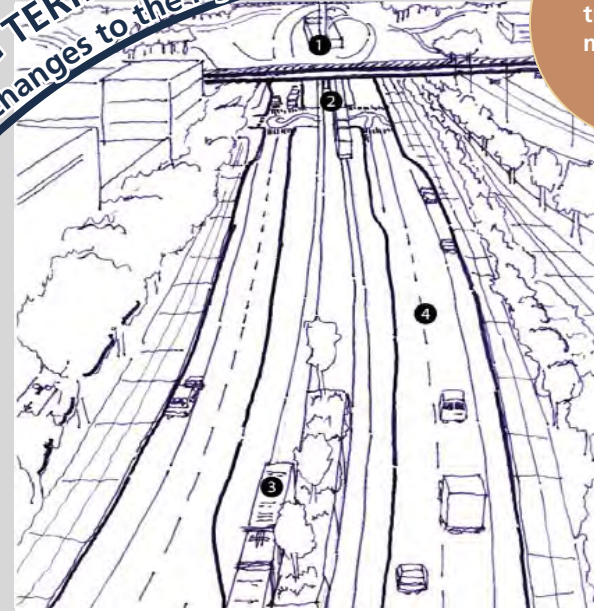
The images below illustrate near- and long-term opportunities for Delaware Avenue, as unlocked by the I-95 Sector B Project.

NEAR TERM (<10 years)
Quick, strategic and systematic changes within the existing right-of-way



I-95 Sector B
unlocks right-of-way limitations along the combined I-95/ Delaware Avenue waterfront corridor

LONG TERM (10+ years)
Robust changes to the right-of-way



High-quality, high-capacity transit on a multimodal Delaware Avenue

- 1 Bus Stations**
Curb-side stations located close to destinations, far side when practical, including shelters, wayfinding, benches, and landscaping.
- 2 Intersections Branded for Stations**
Pedestrian crossings at intersections with stations including wayfinding maps and schedule information.
- 3 Delaware River Trail**
Pending extension of the Delaware River Trail from (approximately) Washington Avenue to Spring Garden Street.

- 1 Penn's Landing Central Access Philadelphia (CAP) Project**
PennDOT's planned cap over I-95 and Delaware Avenue will bridge the distance between the Delaware Waterfront and Center City. The funded portion between Walnut and Chestnut streets could be extended in the future north to Market Street to more directly link transit service with the Market Frankford Line (MFL) 2nd Street Station (p. 46).
- 2 Vertical Circulation**
Access between the Delaware Avenue elevation and the top of the cap is fluid. Pedestrian infrastructure at the Penn's Landing intersection of Delaware Avenue allows access to the center, transit median. The transit median should have elevators, ramps, stairs, and/or escalators to access a transit station and the cap.
- 3 Dedicated Transit Right-of-Way**
A dedicated space for either Direct Bus, or a new trolley extension, offers congestion-free travel for transit. Alignment could be curb side or in the median, which would include relocation of, or rights within, Conrail's asset.
- 4 Right-Sized Delaware Avenue**
New ramps and capacity afforded through I-95 (re)construction allow for a redesign of Delaware Avenue to a right-sized Complete Street.

Source: DVRPC

Table 1: Phased Recommendations

ENHANCED DELAWARE RIVER WATERFRONT TRANSIT SERVICE NEAR-TERM RECOMMENDATIONS (<10 years)			ENHANCED DELAWARE RIVER WATERFRONT TRANSIT SERVICE LONG-TERM RECOMMENDATIONS (10+ years)					
Recommendation	Changes	Service Extents	Service Extents	Recommendation	Changes			
<i>Increase Service Frequency along the Waterfront</i>	15 minutes 6am-6pm			<i>Provide Frequent Service</i>	<15 minutes peak/non-peak			
	20 minutes weekend						<i>Support Transit Connections with Infrastructure</i>	Connect to Route 15 at the Frankford Loop
	30 minutes 6pm-11pm							Connect to MFL at 2nd Street
<i>Better Integrate Waterfront Transit with the Rest of the Network</i>	Connect to MFL at Spring Garden Street					<i>Create Stations</i>		Connect to Sports Complex, FDR Park, and Navy Yard
	Connect to other bus service at Penn's Landing							
	Connect to other bus service at a future South Philadelphia transportation center							
	Free transfers							
<i>Improve Safety, Comfort, and Visibility of Pedestrian Connections and Bus Stops</i>	Fill in sidewalk gaps					<i>Reconfigure Delaware Avenue Right-of-Way, Including a Dedicated Transit Right-of-Way</i>	Dedicated transit right-of-way with stops at the same/similar locations as near-term	
	Bicycle and pedestrian improvements at intersections and driveways							
	Add shelters and signs at bus stops							
	Create place-making and public art opportunities around bus stops							
<i>Decrease Transit Trip Duration</i>	Limited stop service with stops at: Spring Garden Street, Race Street, Market Street, Spruce Street, Lombard Circle, Washington Avenue, Pier 70			<i>Establish a Dedicated Vehicle Fleet</i>	Purchase additional buses or trolleys			
	Operate with existing 40' buses							

Source: DVRPC

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A Civic Vision for the Central Delaware: Rendering showing improvements along Delaware Avenue.

Source: PennPraxis

1

PROJECT BACKGROUND

Rail transit on Delaware Avenue/Columbus Boulevard ("Delaware Avenue") has been considered and recommended several times by various planning studies. It is widely accepted that Philadelphia's premiere waterfront cannot develop as envisioned without high-quality, high-capacity transit. As DRWC works to bring the multimodal vision of the Master Plan to fruition, new development, parks, and trails, are coming to life. However, the planning and realization of improved transit service along Delaware Avenue has stalled.

Separately, SEPTA is preparing to procure new modern vehicles for their trolley fleet, which will necessitate changes to the design and operations of trolley service along trolley corridors. The modernization of trolley service and infrastructure presents an opportunity to contemplate expanded trolley service to new corridors.

SEPTA and the City of Philadelphia asked the Delaware Valley Regional Planning Commission (DVRPC) to take a fresh and focused look at the feasibility of extending

trolley service along Delaware Avenue within the 8–10 year Trolley Modernization timeline.

The study proposed was to focus on a potential expansion of the nearby Route 15 trolley. The Route 15 trolley is a cross-town route that operates primarily on Girard Avenue, just north of Philadelphia's Central District. The expansion would operate between the Frankford Loop, near the SugarHouse Casino, and approximately the Pier 70 shopping center, traversing Delaware Avenue (without previously proposed extensions into Center City). DVRPC's work centered on conducting a fatal flaw assessment of Delaware Avenue's readiness for passenger rail. Unlike previous Delaware Avenue light rail studies, this study focused on the imminent decisions needed to advance Trolley Modernization such as: the potential to expand rail service, vehicle requirements that inform vehicle specifications procurement and take into account operational needs at the end of the line (i.e. double-ended vs. single-ended vehicles, and maintenance and storage needs).

The study would also identify near-term transit options within the study area of Delaware Avenue, shown in *Figure 2*, between the Frankford Loop and the Pier 70 shopping center, primarily along SEPTA's Route 25 bus. The study includes analysis and near-term recommendations for an enhanced Delaware River waterfront transit service, that could be a new service, or could happen through changes to the Route 25 which serves the entire length of the study area in its southern half of service.

PROJECT GOALS

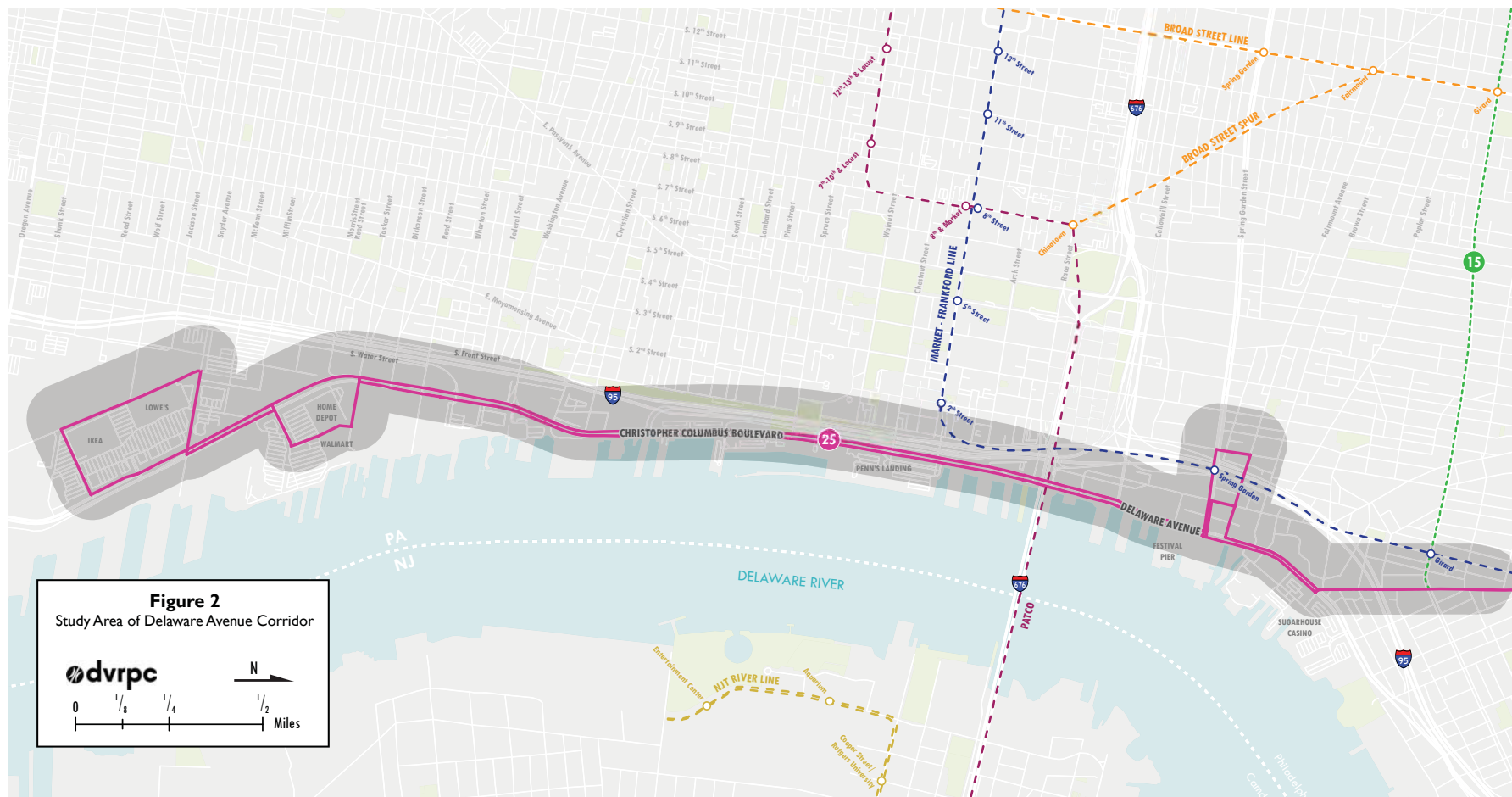
The goals for the study were to:

- **determine if Delaware Avenue could support an extension of the trolley system in the near term (roughly 8-10 years);** and,
- **identify near-term transit recommendations that foster high-quality transit**

PROJECT PROCESS

DVRPC developed existing conditions, visioning concepts, and recommendations with significant input from waterfront stakeholders, including: SEPTA, PennDOT, the City of Philadelphia, DRWC, and the Philadelphia Water Department. The project included several stakeholder meetings that set the course for recommendations included in this report. A summary of stakeholder workshop findings is included in *Appendix B*.

Figure 2: Study Area of Delaware Avenue Corridor



PREVIOUS AND ONGOING STUDIES

ONGOING RELEVANT STUDIES

A number of current planning efforts have relevance to the context of Delaware Avenue. These studies and projects provide opportunities for interagency collaboration to reimagine Delaware Avenue both in the near and long term, to be more livable and transit supportive.

- 1 PennDOT is undergoing reconstruction of I-95. **Sector B**, the section of I-95 that parallels Delaware Avenue through Center City Philadelphia, is currently in conceptual planning. The proximity of the two corridors makes the planning context of both interconnected. A **"capping" of I-95 and Delaware Avenue** between Walnut and Chestnut streets that will create an elevated park between Center City and the waterfront, is in final design.



- 2 DRWC is working on realization of a new, active waterfront envisioned in their **Master Plan for the Central Delaware**. Chief among the creation of this vision are an increase in population and employment, and multimodal infrastructure.

- 3 DRWC is also underway with a **Waterfront Transit Study** focused on developing immediate or near-term transportation changes that support waterfront transit.

- 4 Additionally, the Philadelphia City Planning Commission (PCPC) adopted a strategic plan for the **Central District** and the **South District**, in 2013 and 2015, respectively. These local, or district, plans are consistent with its 2035 Comprehensive Plan and Citywide Vision 2035, and further support DRWC's Master Plan goals.



SEPTA is actively preparing for an upcoming trolley vehicle replacement that will require operational and infrastructure changes to the city's trolley network. This process, or **"Trolley Modernization"** includes a collaborative look at what opportunities are created for expansion. The Modern Trolley Station Design Guide focuses on designs and options for both existing trolley corridors and significantly altered, or new, corridors.

- 6 South of the study area, PhilaPort is planning an expansion of **Southport**, one of Philadelphia's largest ports. Access to and from Southport for trucks, freight rail, and ships to provide goods movement is expected to grow in relation to Southport's expansion, which could have rippling impacts to the surrounding waterfront study area.

- 7 PennDOT, SEPTA, and Navy Yard stakeholders recently completed a **feasibility analysis of expanding the Broad Street Line to the Navy Yard**. The Navy Yard has often been cited as a southern terminus for transit service along the waterfront, although physical conditions of crossing I-76, I-95, and the CSX Rail Yard make this connection challenging.



- 8 SEPTA, the City of Philadelphia, and DVRPC are currently exploring bus route network changes and siting of facilities to centralize transit service at a potential South Philadelphia Transportation Center.

- 9 SEPTA is evaluating its service network in an upcoming **Comprehensive Bus Network Redesign**. The newly released **Philadelphia Bus Network Choices Report** examined SEPTA's route patterns and schedules and found that opportunities exist to reimagine bus service to get more people to more places, sooner.

PREVIOUS TRANSIT PROPOSALS

Several transportation studies have explored opportunities to bring high-quality, high-capacity transit options to Delaware Avenue. For decades these studies have explored a number of light rail and bus service options with various alignments and service patterns to support future land use scenarios. *Table 2* outlines a decade's worth of Delaware Avenue transit studies, including the recommended alignment of a (typically) dedicated right-of-way for light rail transit. *Figure 3* illustrates the transit service proposed in those studies. Potential stops that were identified during a 2017 stakeholder workshop for this study are also included as a suggested stop-spacing strategy. A key for the previous studies and resources referenced is provided below.













A comparison of these studies reveals several aspects of transit service that are common among studies, and others that are less agreed upon. **Transit service has been consistently suggested to be light rail (streetcar/trolley) operating in an exclusive right-of-way with stops spaced farther than typical one-block bus stop spacing.** Many studies have stops in common at key east-west cross-streets, like Reed, Christian, South, Spruce, Race, and Spring Garden streets, and Frankford Avenue.

Studies differ in the alignment of the transit right-of-way and overall Delaware Avenue cross-section. **Operationally they propose different service**

characteristics like termini, stop locations, and stop spacing, and whether or not the service continues west into Center City.

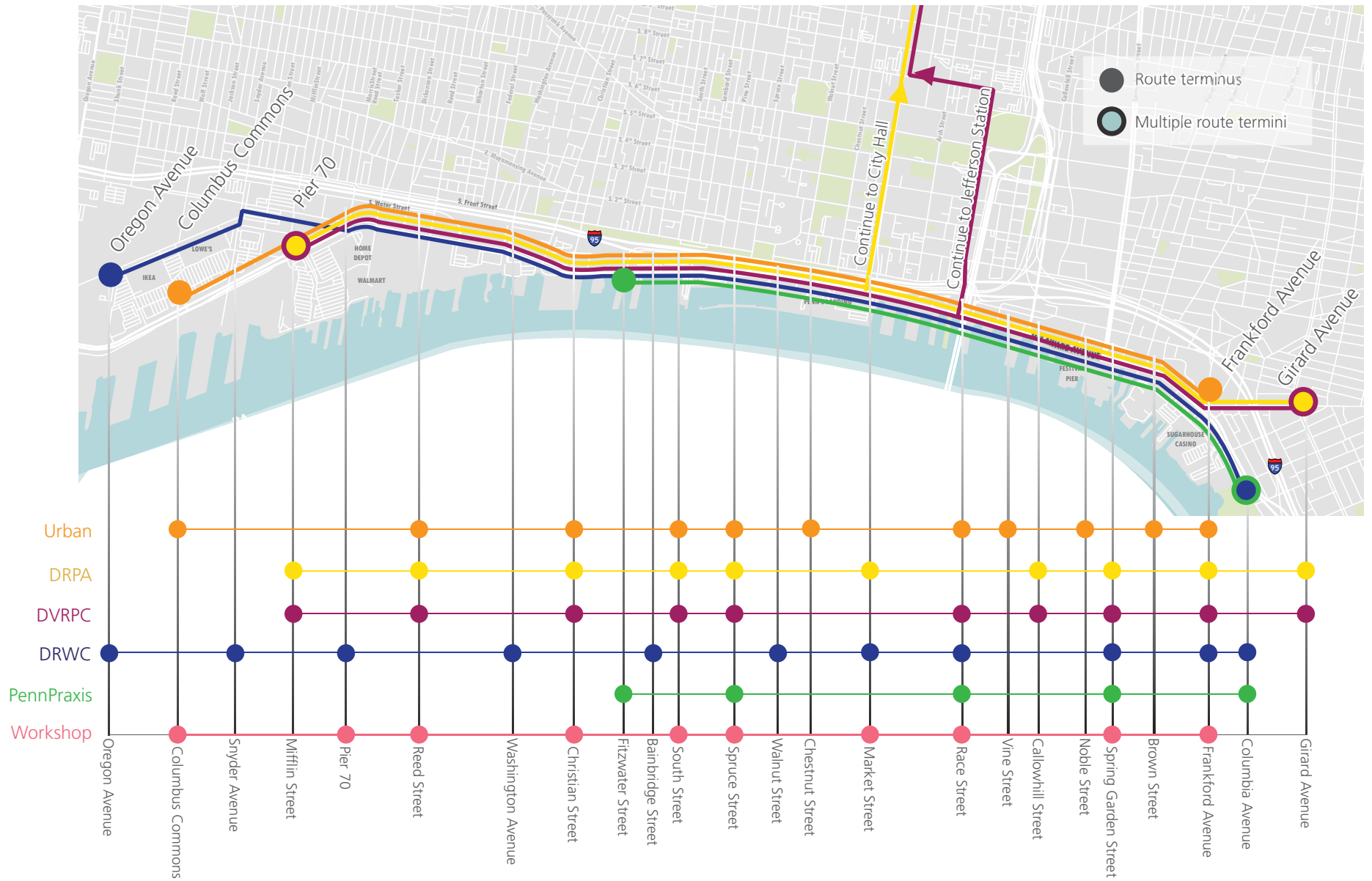
These similarities suggest an interest in a high-quality major capital and operational transit investment. This would necessarily need to address the Conrail-owned right-of-way situated in the middle of Delaware Avenue and the number of lanes designated for vehicles. Little has been suggested as to how to make these massive changes and how to slowly build the ridership to call for high-intensity transit service.

Table 2: Summary of Delaware Avenue Transit Proposals from Past Studies

Past Study for Delaware Avenue	Alignment	Key
Urban Engineers, 2007: <i>Market/Columbus Light Rail/Streetcar Conceptual Study Report</i>		
DRPA, 2010: <i>Philadelphia Waterfront Transit Expansion Alternatives Analysis</i>		
DVRPC, 2015: <i>Central Delaware Waterfront Strategic Modeling Results</i>		
DRWC, 2011: <i>Master Plan for the Central Delaware</i>		
PennPraxis, 2007: <i>A Civic Vision for the Central Delaware</i>		
PCPC, 2013: <i>Central District Plan</i>		

Source: DVRPC 

Figure 3: Stops from Previous Studies and Stakeholder Workshop



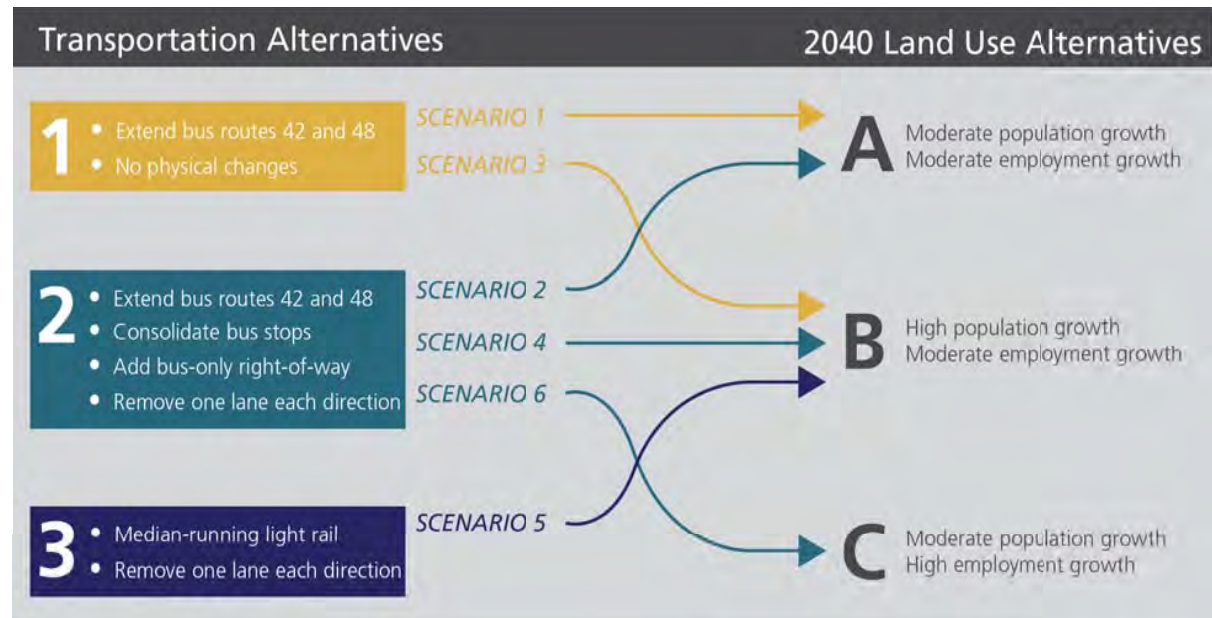
Sources: PennPraxis, Urban Engineers, Port Authority Transit Corporation (PATCO), DRWC, Concept Development for Transit on Delaware Avenue Workshop (PCPC Central District Plan does not identify specific stops so it is not included in summary)

WATERFRONT TRANSIT MODELING

In 2015, DVRPC conducted a *Central Delaware Waterfront Strategic Modeling Results* study that analyzed a range of bus and rail options serving Delaware Avenue under a variety of development patterns that emphasized growth in residential and commercial development along the Delaware River waterfront. DVRPC's current regional travel forecasting model, the Transportation Improvement Model (TIM) 2.1, was used to simulate travel patterns for a 2040 horizon year for six transportation and land use scenarios. To create the six scenarios, three transportation alternatives (1 through 3) were combined with three land use options (A through C). The land use scenarios were developed using possible buildout ranges of DRWC's Master Plan vision for land use and development along the waterfront. These scenarios were then evaluated in terms of highway traffic volumes, transit ridership, and peak-hour intersection Level of Service within the Columbus Boulevard corridor (see *Figure 4* and *Table 3*).

Transit ridership changes were evaluated for transit service that serves Penn's Landing and the waterfront area, including 14 SEPTA bus lines. In addition, the boarding volumes at some rail stations were also included in the analysis. The selected stations were those most likely to be impacted by one or more of the transportation alternatives. Each scenario included a land use and/or transportation alternative that would benefit ridership: either high population or employment, a dedicated transit right-of-way on Delaware Avenue, or far greater service frequency on Route 25 than current scheduling (10-minute AM, 5-minute PM, and 30-minute off-peak service in scenarios with Transportation Alternative 1). The following points gleaned from the modeling study demonstrate the potential to increase transit ridership near the

Figure 4: Central Delaware Waterfront Strategic Modeling Scenarios



Source: DVRPC



waterfront, particularly along Route 25, with both service improvements and a dedicated transit right-of-way:

- Light rail on Delaware Avenue showed a ridership of **6,400 daily riders**.
- All scenarios showed ridership increases for both bus and rail.
- **Scenario 5 (light rail in a dedicated right-of-way) has the highest absolute transit ridership increases;**
- In all scenarios, **Route 25 has the highest percentage increase (not absolute) among transit lines.**
- The *MFL Spring Garden and 2nd Street stations* show the greatest percentage increase in ridership, along with the 5th and 15th Street stations (the current two highest-ridership MFL stations included in the study).

In short, the study concluded that the Delaware Avenue corridor could accommodate large increases in residential and commercial development without significantly affecting vehicular delay or congestion, provided some form of enhanced transit service were provided. This service could entail the extension of existing bus routes, either in mixed traffic or with a dedicated lane, or a light rail service serving Delaware Avenue with a connection to Center City Philadelphia. Ridership growth is greatest in the light rail alternative, Scenario 5. However, Scenario 4 which relies on changes to bus service, shows ridership growth almost as good as that of Scenario 5's but could be realized at a fraction of the cost. A copy of the modeling analysis can be found in Appendix A.

Table 3: Ridership Estimations for Central Delaware Waterfront Strategic Modeling Scenarios

	Transit Line/Facility	Current Daily Ridership	Scenario 1 Current-2040		Scenario 2 Current-2040		Scenario 3 Current-2040		Scenario 4 Current-2040		Scenario 5 Current-2040		Scenario 6 Current-2040	
			Total Change	Percentage Change	Total Change	Percentage Change	Total Change	Percentage Change	Total Change	Percentage Change	Total Change	Percentage Change	Total Change	Percentage Change
Transit Lines	12 Kingsessing to Society Hill	2,900	300	10.3%	300	10.3%	300	10.3%	300	10.3%	300	10.3%	200	6.9%
	17 South Phila. to Penn's Landing	13,400	1,300	9.7%	1,300	9.7%	1,400	10.4%	1,400	10.4%	1,500	11.2%	1,200	9.0%
	21 69th Street Terminal to Penn's Landing	8,700	500	5.7%	500	5.7%	600	6.9%	600	6.9%	700	8.0%	400	4.6%
	25 Columbus Commons to FTC	4,300	1,700	39.5%	1,600	37.2%	1,900	44.2%	1,800	41.9%	1,100	25.6%	1,600	37.2%
	33 Tioga to Penn's Landing	15,700	2,600	16.6%	2,600	16.6%	2,700	17.2%	2,800	17.8%	2,700	17.2%	2,600	16.6%
	40 West Park to Society Hill	5,500	500	9.1%	500	9.1%	600	10.9%	600	10.9%	700	12.7%	500	9.1%
	42 Wycombe/West Phila. to Penn's Landing	11,500	1,400	12.2%	2,200	19.1%	1,600	13.9%	2,400	20.9%	1,400	12.2%	2,200	19.1%
	43 Parkside to Northern Liberty & Kensington	3,200	600	18.8%	600	18.8%	700	21.9%	700	21.9%	700	21.9%	600	18.8%
	48 North Phila. to Penn's Landing	8,700	1,600	18.4%	1,700	19.5%	1,700	19.5%	1,800	20.7%	1,100	12.6%	1,700	19.5%
	5 Penn's Landing to FTC via Frankford	4,600	700	15.2%	700	15.2%	900	19.6%	900	19.6%	900	19.6%	700	15.2%
	57 South Phila. to Fern Rock TC	10,800	1,100	10.2%	1,000	9.3%	1,600	14.8%	1,500	13.9%	1,500	13.9%	1,100	10.2%
	64 Parkside to Pier 70 via Washington	5,400	400	7.4%	300	5.6%	400	7.4%	400	7.4%	700	13.0%	200	3.7%
	7 Strawberry Mansion to Pier 70	4,900	500	10.2%	600	12.2%	600	12.2%	600	12.2%	600	12.2%	500	10.2%
G South Phila. to Overbrook & Lankanau	13,500	900	6.7%	900	6.7%	900	6.7%	1,000	7.4%	1,000	7.4%	800	5.9%	
	Delaware Avenue Light Rail									6,400				
	TRANSIT LINE SUBTOTAL	113,100	14,100	12.5%	14,800	13.1%	15,900	14.1%	16,800	14.9%	21,300	18.8%	14,300	12.6%
MFL Station	Girard Station	3,600	1,000	27.8%	1,000	27.8%	1,200	33.3%	1,200	33.3%	900	25.0%	1,000	27.8%
	<i>Spring Garden Station</i>	2,700	2,400	88.9%	2,400	88.9%	2,600	96.3%	2,600	96.3%	2,400	88.9%	2,700	100.0%
	<i>2nd Street Station</i>	2,600	1,200	46.2%	1,200	46.2%	1,400	53.8%	1,400	53.8%	800	30.8%	1,300	50.0%
	5th Street Station	4,000	1,300	32.5%	1,300	32.5%	1,500	37.5%	1,500	37.5%	1,400	35.0%	1,500	37.5%
	8th Street Station	9,800	700	7.1%	700	7.1%	800	8.2%	800	8.2%	700	7.1%	800	8.2%
	11th Street Station	9,000	900	10.0%	900	10.0%	900	10.0%	900	10.0%	900	10.0%	1,000	11.1%
	13th Street Station	5,100	400	7.8%	400	7.8%	400	7.8%	400	7.8%	400	7.8%	400	7.8%
	15th Street Station	29,100	2,500	8.6%	2,500	8.6%	2,700	9.3%	2,700	9.3%	2,700	9.3%	2,500	8.6%
	MFL STATION SUBTOTAL	65,900	10,400	15.8%	10,400	15.8%	11,500	17.5%	11,500	17.5%	10,200	15.5%	11,200	17.0%
	TOTAL TRANSIT LINE AND RAIL STATION RIDERSHIP*	179,000	27,600	13.5%	28,200	13.7%	30,700	15.0%	31,600	15.4%	34,700	16.9%	28,900	14.1%

*Total Ridership also includes PATCO and BSL subtotals, both omitted from Table 3.



ASSESSING CORRIDOR CHARACTERISTICS FOR TROLLEY EXTENSION READINESS

While previous planning studies point to rail as the high-quality transit mode of choice, inherent characteristics of the corridor and study area do not readily suggest its near-term implementation feasibility.

Challenges for rail readiness, including extending trolley service onto Delaware Avenue, are discussed in this section, and include the following topics:

existing population and employment densities along the waterfront that do not warrant rail investment, at least not yet;

fairly low existing transit ridership;

an active freight line within the right-of-way; and,

current vehicle capacity demands on portions of Delaware Avenue that limit the opportunities to dedicate right-of-way for transit only.

1. Existing population and employment densities along the waterfront that do not warrant rail investment, at least not yet.

Transit planners are often asked to what degree transit investments are appropriate for various communities. DVRPC’s transit score, a measure of population and employment density coupled with zero-car households, was created to assess the appropriateness of a range of intensities of transit modes and service. Transit score uses American Community Survey data and National Establishment Time-Series data from 2015 to determine an existing transit score. A future transit score can be projected by using future land use assumptions to input future population and employment data. Within the study area, there is a great deal of pending and proposed development that is likely to change the transit score in the future, as shown in *Figure 5*.

The future could be significantly different due to the Master Plan’s vision for mixed-use development

along the waterfront. Developments with the most potential to impact waterfront mobility due to proposed residential and employment densities are shown below, and include:

- 709-717 North Penn Street (two acres, up to 400,000 square feet development);
- Festival Pier (11 Acres, 550 residential units, 30,000 square feet retail);
- Liberty on the River (18 Acres, 10 high-rises, 100 townhouses, and a 22-story hotel); and
- Former proposed Foxwoods Casino (21 Acres, 670 residential units, commercial retail).

Figure 6 shows a progression of existing transit score, future transit score, and the difference predicted between 2015 and 2040. From top to bottom, the figure shows the current (2015) transit score, a future (2040) transit score that uses population and

employment densities for 2040 established during the waterfront modeling study, and finally, the change (2015–2040) shows a significant increase in transit score along much of the study area.

Additional employment and population will increase the level of intensity of transportation services appropriate for the study area. However, this development has yet to be realized. **So, while we can say high-intensity transit service based on transit score is not warranted today, it is likely to be warranted in the next few decades if development occurs the way it is predicted to.**

Proposed waterfront developments; see Figure 5 for location.

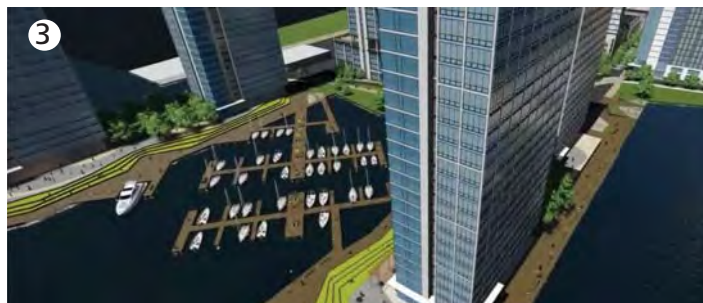
- 1 709-717 North Penn Street
- 2 Festival Pier
- 3 Liberty on the River
- 4 Former Foxwoods Casino



Source: Cecil Baker + Partners



Source: DRWC



Source: Barton Partners



Source: Atrium Design Group

Figure 5: Existing and Proposed Waterfront Destinations

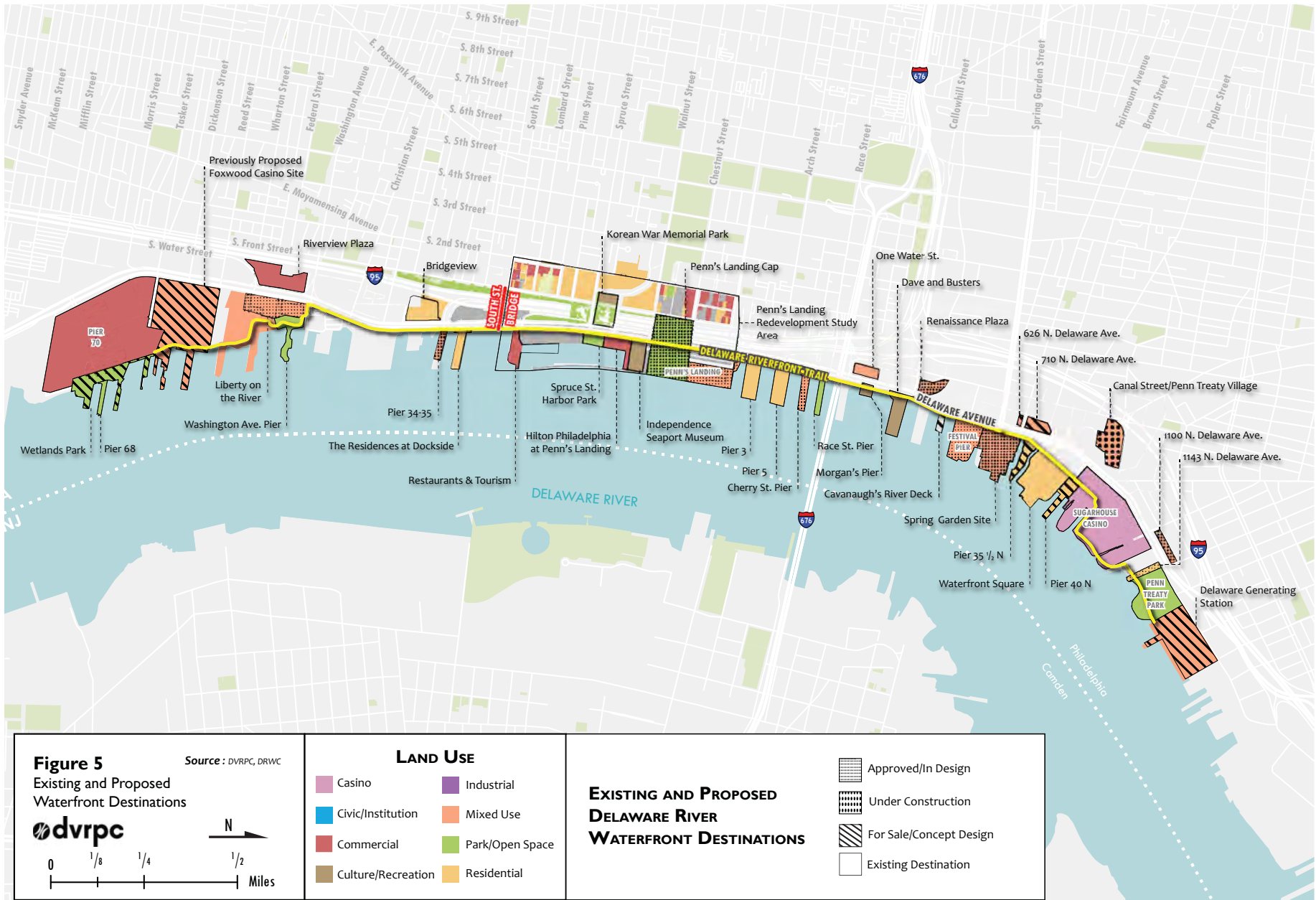
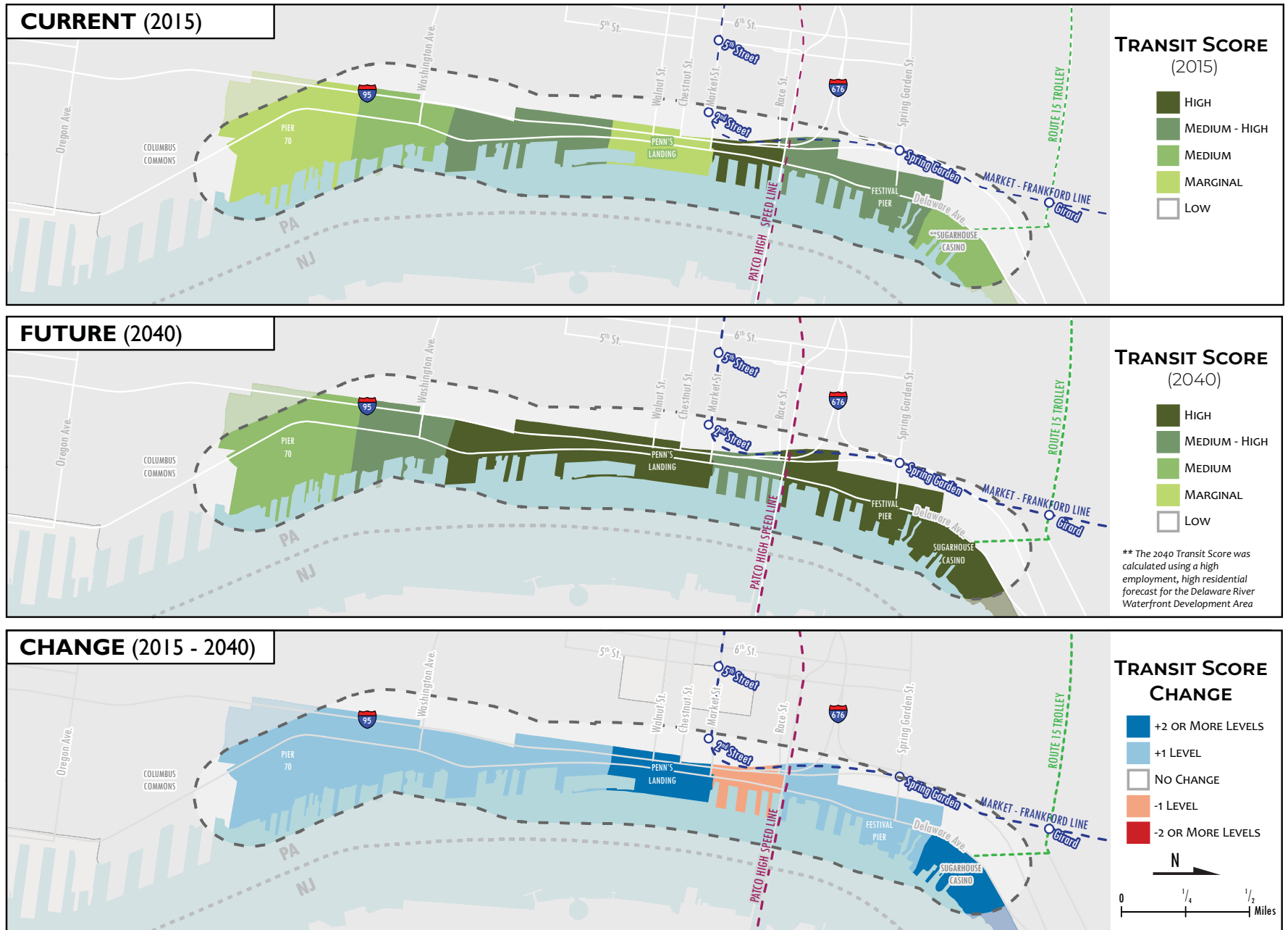


Figure 6: Change in Transit Score Level for Delaware Avenue Corridor



Source: DVRPC, SEPTA



2. Fairly low existing transit ridership.

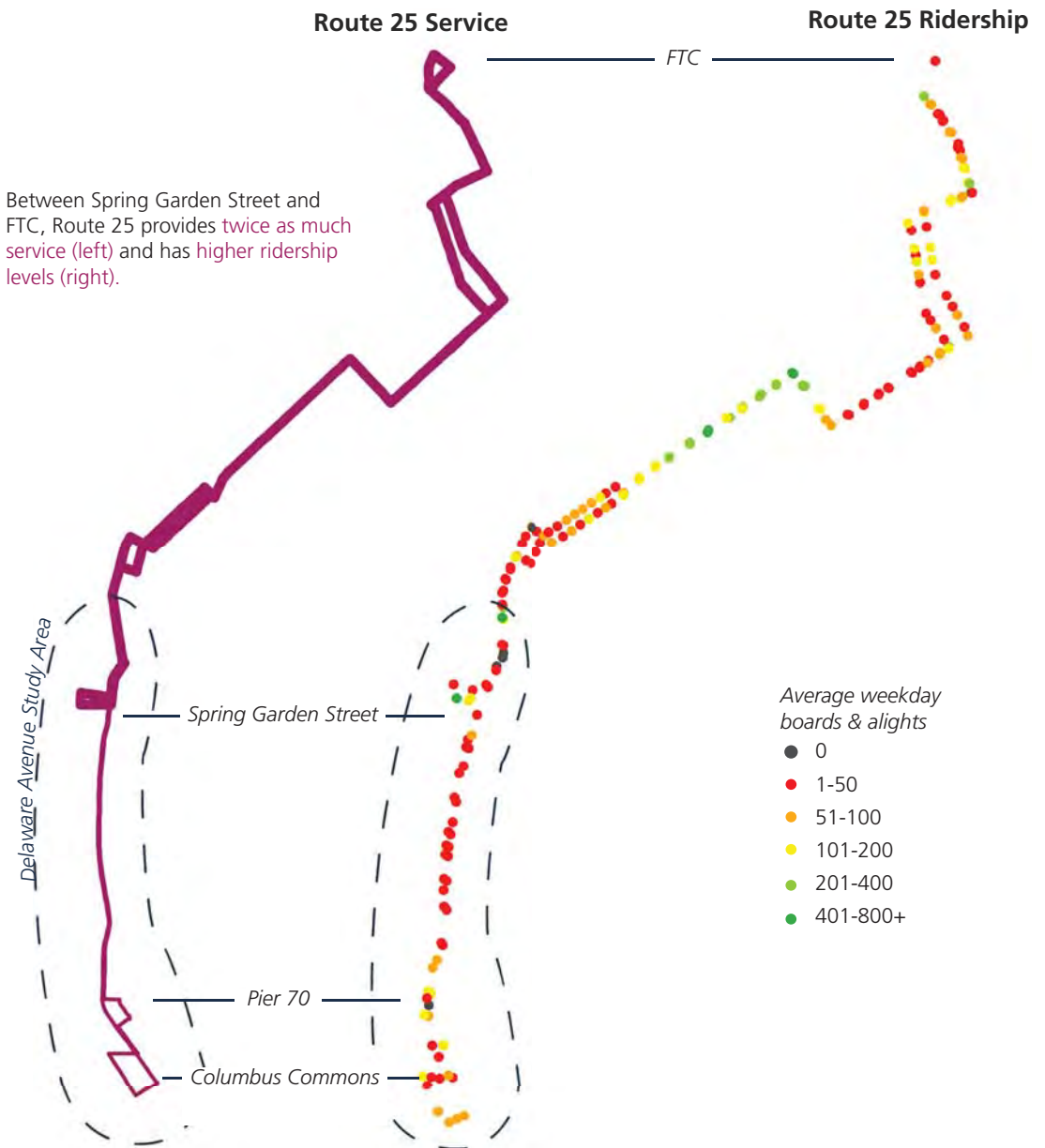
Transit improvements are often made where high ridership demonstrates that current service is in demand. Within the study area, there are a number of transit routes that connect to, or operate on a portion of Delaware Avenue. Only SEPTA bus Route 25 operates with service patterns between FTC and Pier 70 or Columbus Commons, as shown in *Figure 7*.

Of SEPTA's 87 City Transit Routes, Route 25 was rated 55th in daily ridership in 2016, or about the bottom third. One reason for the generally low ridership is the less-than-convenient Route 25 service characteristics. Route 25 is not a high-frequency route, its schedule patterns are confusing, and its travel time is often not competitive with driving, biking, or walking. The longest route pattern is approximately 10 miles in total, stretching from FTC and running south to the Columbus Commons shopping center. The route loops back north on Weccacoe Avenue. More than half of buses run only between FTC and Spring Garden Street; less than half serve the study area between Spring Garden Street and Columbus Commons. This leaves the southernmost portion of the corridor with far less service.

Figure 8 shows all SEPTA Transit Routes, including Route 25, within the study area. While most of the corridor's service connects to east-west service through Center City, there are few opportunities, other than at Pier 70 and Columbus Commons to connect west south of Chestnut Street.

South of Spring Garden Street, where service is less frequent, there are several places of interest along the waterfront, such as Penn's Landing, Spruce Street Harbor Park, and Pier 70. Typically, recreational and tourist destinations are not as significant passenger generators as home and work destinations. However, on Delaware Avenue these places of interest are associated with stop locations that show peaks in ridership, indicating that tourist and recreational trips are generators of transit ridership, see *Figures 9 and 10*. Ridership peaks at tourist and recreational destinations that serve the corridor. While end-to-end Route 25 service has fairly low ridership, there are clearly tourist and recreational nodes that see peaks in activity. This could indicate a need to build up transit's visibility and connections at these nodes.

Figure 7. Route 25 Service and Ridership



Between Spring Garden Street and FTC, Route 25 provides **twice as much service (left)** and has **higher ridership levels (right)**.

Sources: DVRPC, SEPTA, Spring 2015 Ridership

Figure 8: Transit Overview of Delaware Avenue Corridor

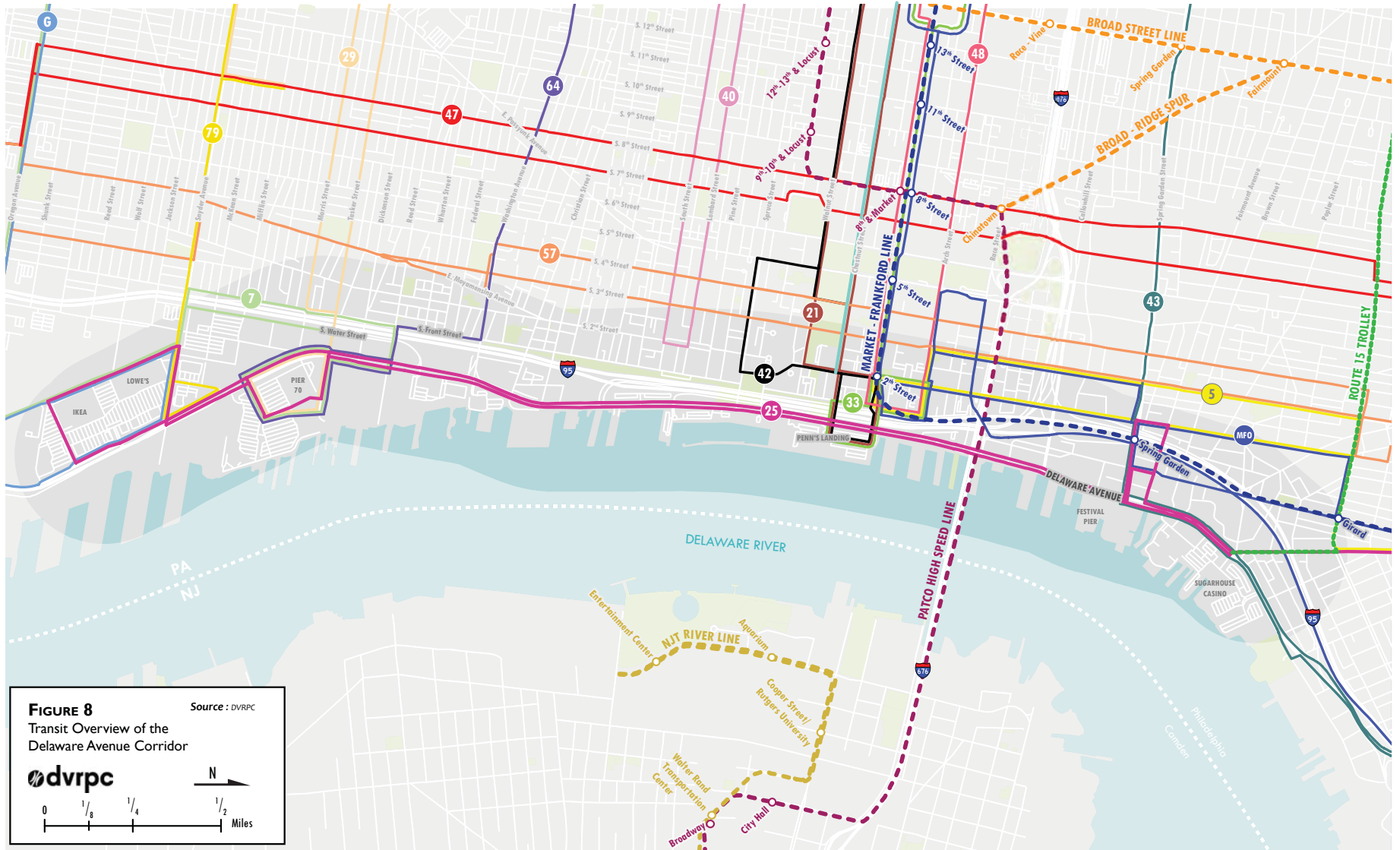
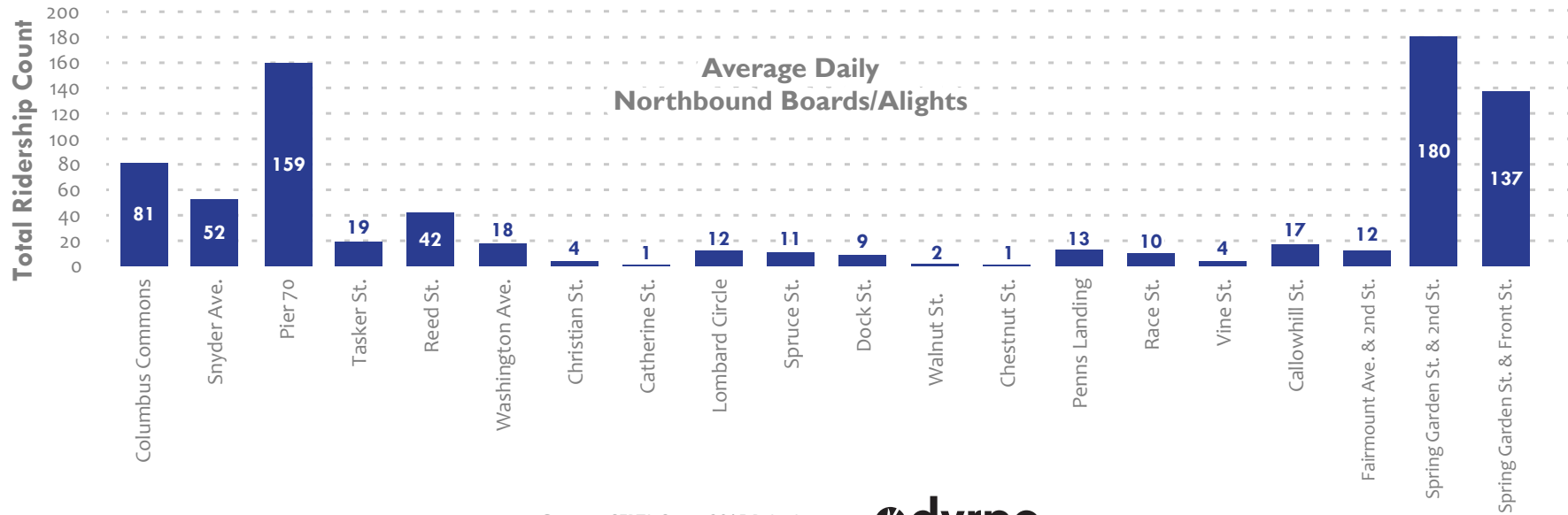


Figure 9: Route 25 Average Daily Ridership



Source: SEPTA, Spring 2015 Ridership

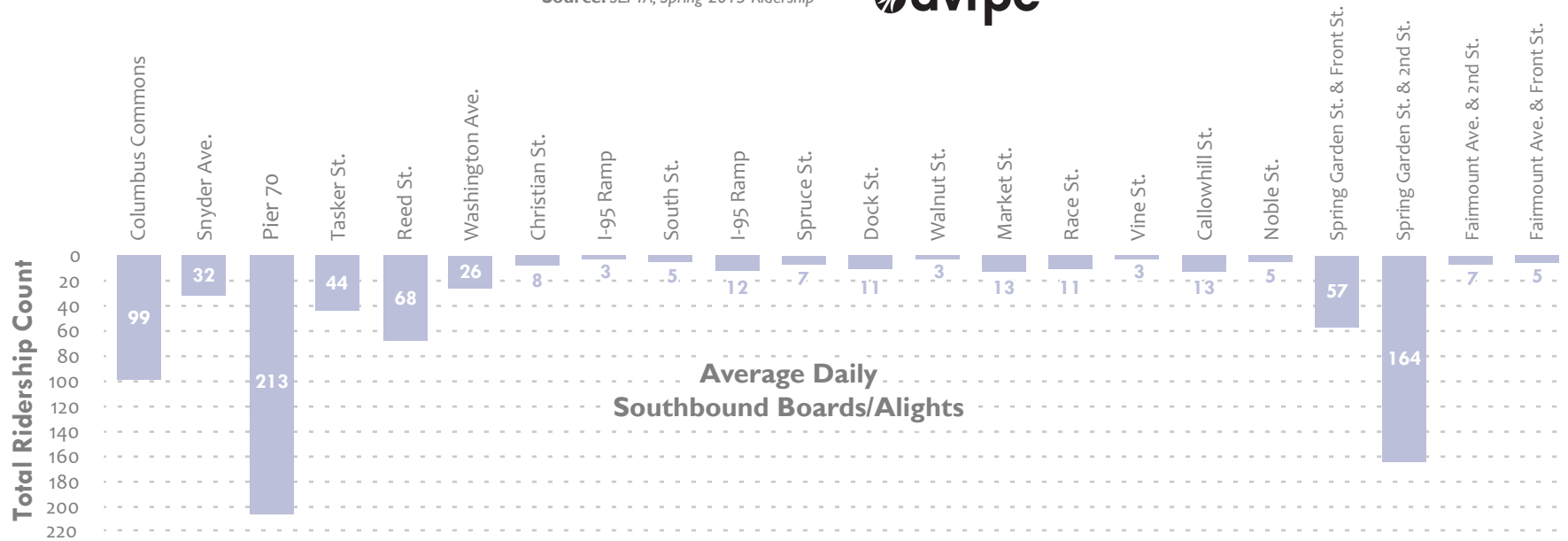
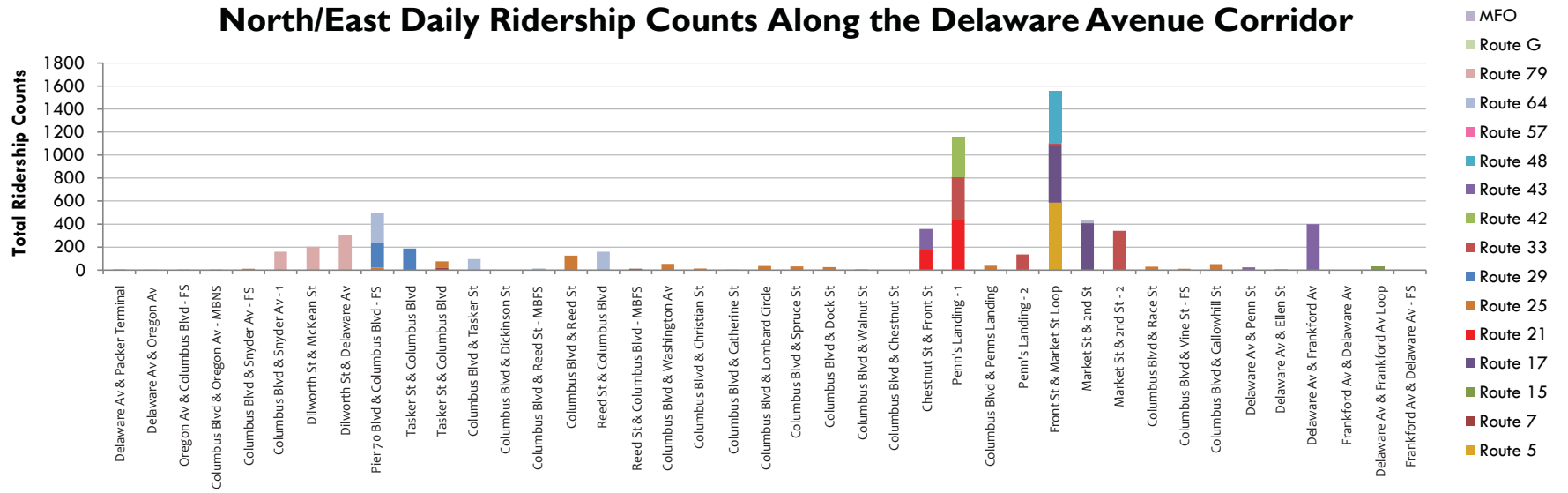
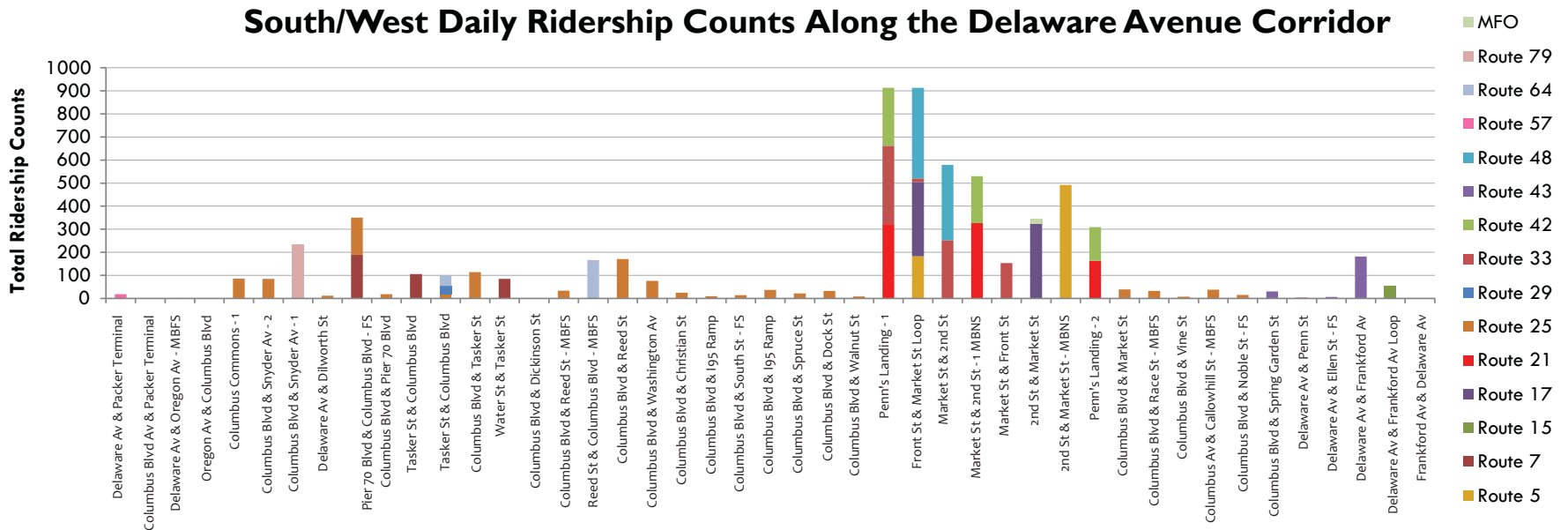


Figure 10: Daily Ridership of Routes Operating on Delaware Avenue Corridor



dvrpc Source: SEPTA, Spring 2015 Ridership



3. An active freight line within the right-of-way

Many past transit proposals have emphasized a median transit alignment. **Much of the median is under Conrail's jurisdiction with active Conrail track from approximately Lombard Street to points south, as shown in Figures 11 and 12.** Freight activity is infrequent between Lombard Street and Pier 70, serving just one forest products terminal at Pier 38/40 (see Figure 12). Frequency of freight rail traffic increases to the south near Pier 70 and then more significantly near Oregon Avenue where the Packer Avenue Marine Terminal is located. Freight activity proximate to the Packer Avenue Terminal is anticipated to increase due to planned expansion at the Southport terminal and following the dredging of the Delaware River.

If passenger and freight rail were to share the rail right-of-way, as suggested in past proposals, south of Lombard Street, then it would require negotiations and use restrictions between PhilaPort,

Conrail, SEPTA, DRWC, the City of Philadelphia, and possibly CSX and Norfolk Southern. **This sharing would likely need to be spatial, as well as temporal, as the gauge for trolley (light rail) track (5'2½") and standard rail track (4'8½") is different and could not share track.**

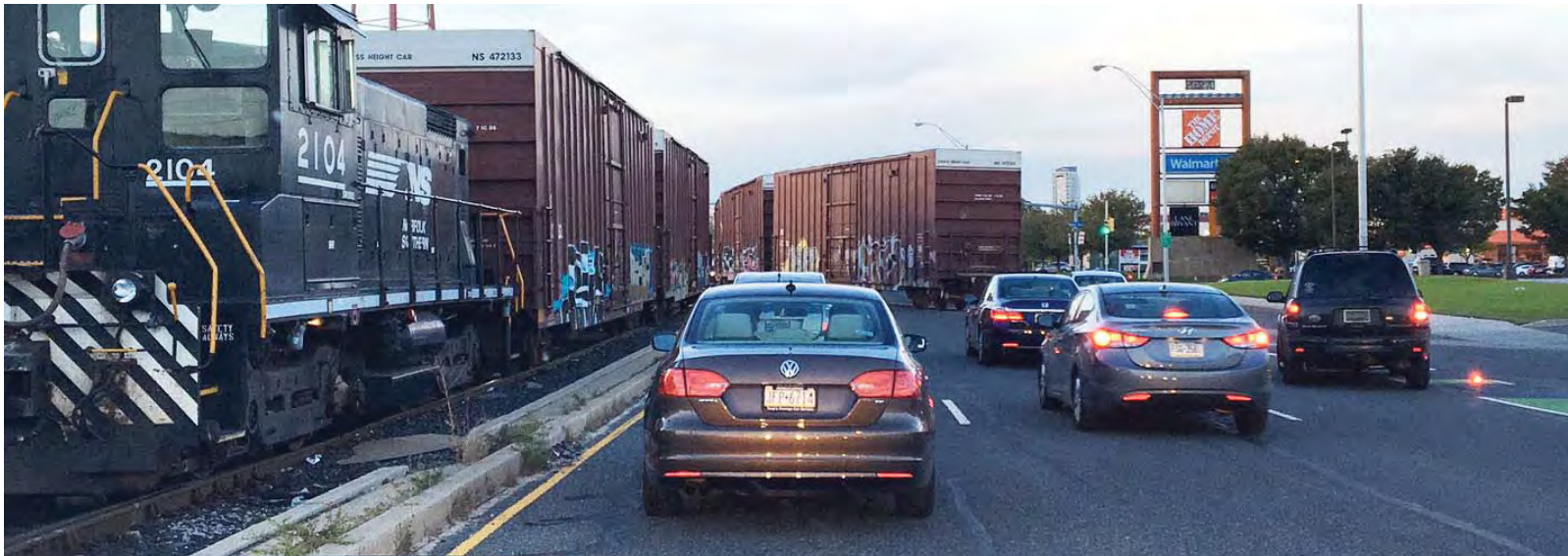
A legal agreement between the City of Philadelphia and three railroad companies (Baltimore and Ohio Railroad, the Pennsylvania Railroad, and the Philadelphia and Reading Railroad), called the "South Philadelphia Agreement," established the terms for the companies to share use of the rail lines in Philadelphia. This agreement restricts the uses and ownership along the Delaware waterfront rail line in Philadelphia. A full legal interpretation of the legal issues surrounding the sharing, ownership, operations, and even removal, of the rail right-of-way is required to realistically imagine any of these

scenarios.

As an operator of freight rail, Conrail has little need to relinquish its asset along Delaware Avenue. It is actively providing a service, albeit infrequent, to businesses along the corridor. Opportunities to relocate industrial uses that rely on freight services are limited. Light industrial uses within the study area require access to both rail and ports. That condition would be difficult to relocate elsewhere.

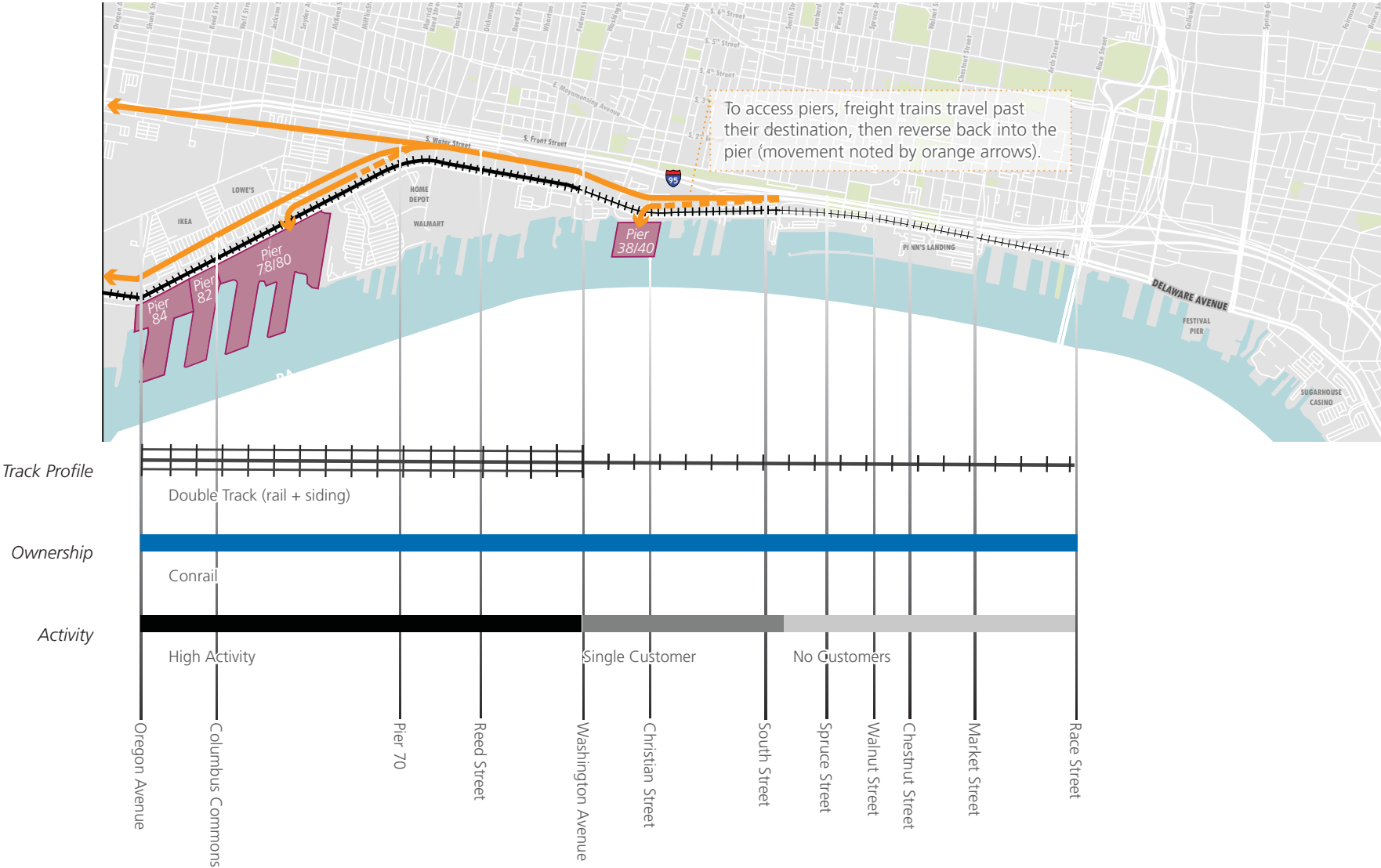
Due to the significant time that negotiations, design, and construction could require, and the emphasis on an approximate decade planning horizon, potential transit alignments that would not necessitate complex negotiations with Conrail or interplay with Federal Railroad Association regulations are more readily attainable.

Figure 11. Freight on Delaware Avenue (by Pier 70)



Source: DVRPC

Figure 12: Freight Characteristics on Delaware Avenue



Source: DVRPC

4. Current vehicle capacity demands on portions of Delaware Avenue that limit the opportunities to dedicate right-of-way for transit only

Delaware Avenue is a significant north-south arterial on the eastern side of the city, paralleling I-95. Within the study area there are four I-95 access points. The corridor can function as an alternative to I-95 during heavy congestion periods and is a designated detour route for I-95. During sporting events at the Sports Complex and festivals held at Penn's Landing and Spruce Street Harbor Park, it provides access to large, typically off-peak events.

A common perception is that Delaware Avenue is highly congested in Center City. A closer look at the data reveals that overall mobility is acceptable with the possible exception of the southern end of the corridor, particularly between Washington Avenue and Reed Street, and in the vicinity of the double slide-under ramps. However, vehicular travel through the corridor is not always reliable.

Most of the corridor experiences traffic volumes of around 15,000 vehicles per day (Annual Average Daily Traffic). Volume to Capacity (V/C) ratio is a measure that compares the traffic demand (vehicle volume) for a given roadway with its supply (carrying capacity). DVRPC's 2015 Congestion Management Process (CMP) analyzed the performance of the regional multimodal transportation network,

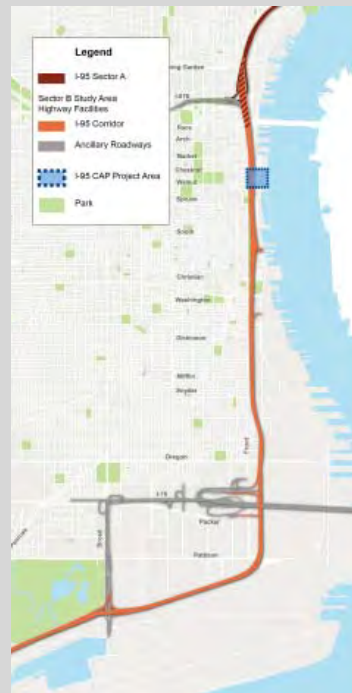
I-95 Sector B

The long-term potential for high-quality transit on Delaware Avenue hinges on the reconstruction of I-95, which is currently in the conceptual planning phase. Sector B is the section of this reconstruction project that parallels Delaware Avenue through Center City Philadelphia. It spans approximately six miles in length, extending from Spring Garden Street to Broad Street (by the stadiums). The Sector B study area incorporates the full right-of-way of I-95 and Delaware Avenue, for a total right-of-way around 350 feet in width.



Source: DVRPC

Within the Sector B study area I-95 runs parallel to Delaware Avenue and separates the city from the waterfront. PennDOT is exploring alternatives that shift throughput from Delaware Avenue onto I-95, and is developing plans for multimodal access to the waterfront. Information about Sector B is available at www.95revive.com



Source: PennDOT

Vehicle Capacity Impacts

The opportunity to rethink the full right-of-way to better accommodate vehicle capacity and reduce throughput and congestion on Delaware Avenue is a priority of the Sector B project, as PennDOT is actively developing strategies to reroute throughput from Delaware Avenue onto I-95.

Transit Opportunities

Sector B initiatives incorporate design and analysis to enhance bicycle, pedestrian, and transit facilities, with the goal of improving multimodal transportation accessibility. The realization of the project will enhance the feasibility of transit along the waterfront by alleviating traffic on Delaware Avenue, and improving connections for riders to access stations.

Projects and Studies

The CAP project explores opportunities to better connect Center City with the Delaware River waterfront by expanding the Penn's Landing cap and implementing multimodal accessibility improvements. The project was initiated in 2016, and is currently in the preliminary phases of design and engineering with construction anticipated to begin in 2021. The Central to South Philadelphia Planning Study assesses the traffic and vehicular capacity of I-95 and Delaware Avenue, with focus on the existing interchange areas and potential alternatives for consideration.

including calculating peak-hour V/C ratios for most major roads. The CMP V/C data for Delaware Avenue shows that while most of the study area has acceptable peak-hour V/C ratios, there are portions where the V/C ratio is greater than 0.85, which corresponds to a generalized Level of Service E.

The I-95 Corridor Coalition has contracted with private companies to provide speed and travel time data collected anonymously from GPS units and cell phones in vehicles and has made this data available for planning purposes via the University of Maryland's Probe Data Analytics Suite. Using this data to analyze all weekdays in 2016 showed that average travel speeds on Delaware Avenue between Market and Morris streets was between 10 and 15 miles per hour (mph) throughout most of the day, while average speeds throughout most of the rest of the corridor were between 15 and 25 mph throughout most of the day, as depicted in *Figure 13*.

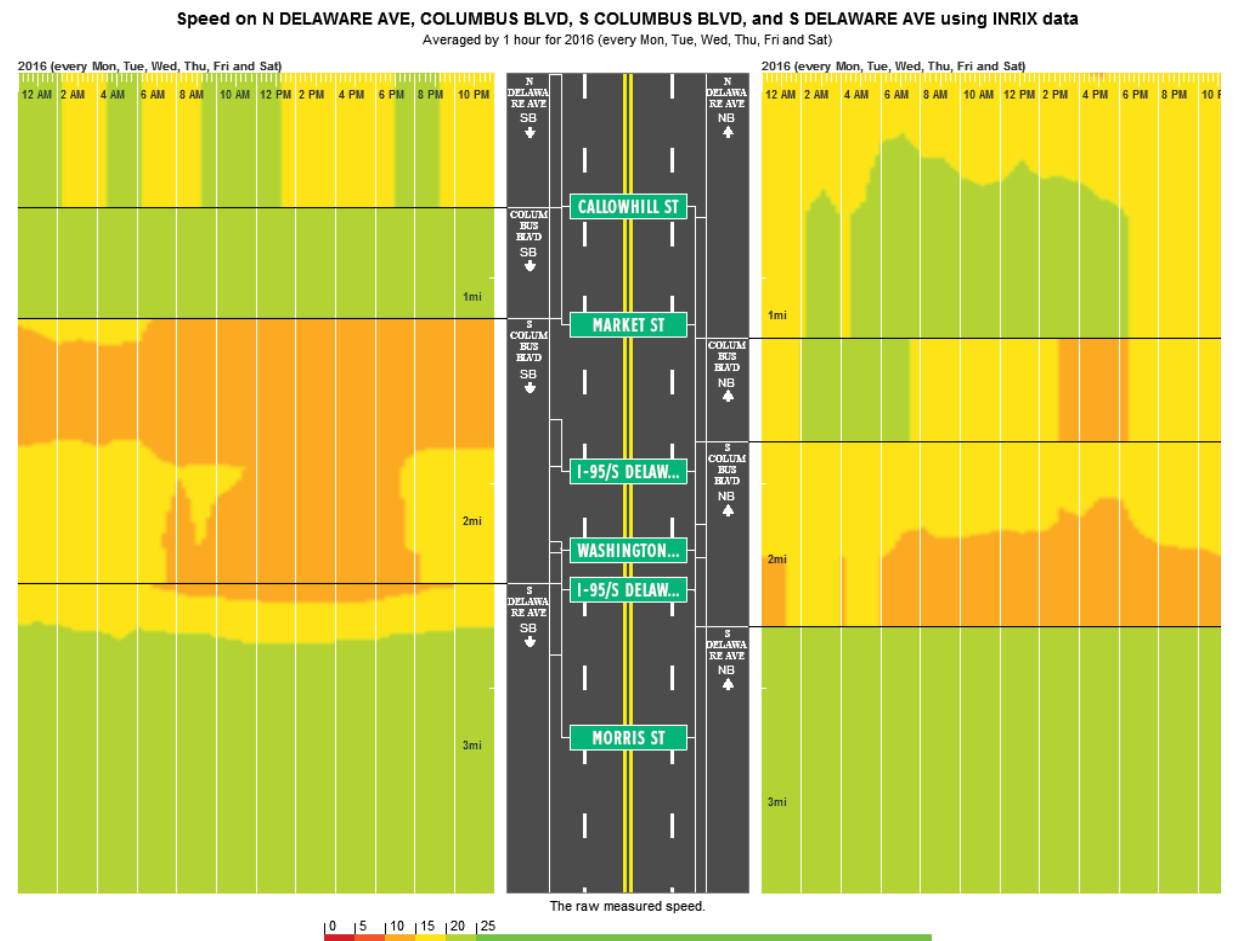
The speed and V/C ratio analysis suggests that the corridor has acceptable mobility for a busy, urban, multimodal arterial, with the exception of the most congested portions between Washington Avenue and Reed Street and at the slide under ramps. Delay here makes travel reliability poor, which means that travel times are unpredictable and highly variable through this section. An anticipated Center City population growth of over 30,000 people over 30 years could worsen congestion and reliability. The added possibility that the additional waterfront population would develop without a competitive transit option available would further deteriorate travel conditions along Delaware Avenue.

PennDOT's ongoing planning for the reconstruction of the Sector B portion of I-95 will affect the volumes of vehicles that will use Delaware Avenue to access

I-95. **If new on/off ramps allow for vehicles to get onto I-95 north and south of the study area, there will be greater opportunities to redistribute space within the Delaware Avenue cross-section.** Reducing the amount of vehicle lanes to accommodate transit-only lanes

would significantly benefit transit by separating transit from the congestion and reliability delays of being in mixed traffic with autos. However, this shift in capacity is not likely to be possible until Sector B construction is completed.

Figure 13: Speed of Throughput on Delaware Avenue Corridor



Source: University of Maryland CATT Laboratory Probe Data Analytics Suite

CONCLUSIONS: NEAR-TERM RECOMMENDATIONS

Coupled together, these indicators do not suggest a readiness for the major investment of a trolley expansion on Delaware Avenue as part of Trolley Modernization. But these rather standard transit predictors of population and employment, existing transit ridership, and ease of implementation are only part of the equation. Proactively pulling for transit can bring new transit investments to realization.

Stakeholders agree that there is still an immediate need to increase transit effectiveness along Delaware Avenue in order to catalyze development that supports a multimodal waterfront vision. Initial near-term improvements to shape an enhanced Delaware River Waterfront transit route that improves frequency and accessibility can work toward making transit more competitive with auto use for existing land uses and pending development. Working with stakeholders to create the right context for high-profile, high-intensity transit through multiple ongoing planning, design, and policy efforts, these near-term strategies could build up over the long term.

The subsequent chapters present near-term strategies to implement quickly (Chapter 2), and long-term strategies to build toward over the next several decades (Chapter 3), in partnership with waterfront stakeholders, that could grow into the transportation vision described in the Master Plan.

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Route 25 bus at Delaware Avenue and Callowhill Street.

Source: DVRPC

2

NEAR-TERM RECOMMENDATIONS

This chapter outlines improvements to transit service along Delaware Avenue that are feasible within the next 10 years, or near term. These recommendations, displayed in *Table 4*, are near term because they can be implemented without adjustment to the existing right-of-way, and with the goal of building ridership that justifies continued transit operational improvements and support of a multimodal waterfront. These recommendations for the waterfront should be taken into account as SEPTA embarks on evaluation of its entire network through the Comprehensive Bus Network Redesign work. The DRWC Waterfront Transit Study can take this report's recommendations to the next level by determining their near term feasibility and prioritizing next steps.

The vision shapes an enhanced Delaware River waterfront transit service with access to connections west, particularly to University City and Center City via the MFL and connecting service. **The near term vision could layer onto, or replace the southern portion of the existing Route 25 bus operating between Spring Garden and**

Pier 70. The new, near-term service would have limited stations and several operational and capital improvements to local bus service akin to SEPTA's new Direct Bus service, which went into service along the Roosevelt Boulevard corridor in the fall of 2017. *Figure 14*, on the following page, provides a proposed vision of a waterfront-exclusive service and its station opportunities, with noted near-term opportunities for consideration.

In the long term, the service could expand with an exclusive transit right-of-way either in the form of a bus, or trolley service, with necessary adaptations to its service pattern and those of either, or both, Routes 25 and 15. These long-term recommendations are explained in Chapter 3.

STRATEGIES TOWARD A MULTIMODAL WATERFRONT

The goal of building ridership through quick, strategic, and systematic changes within the existing right-of-way is the focus of this chapter, and expressed through five priorities:

Increase service frequency along the waterfront;

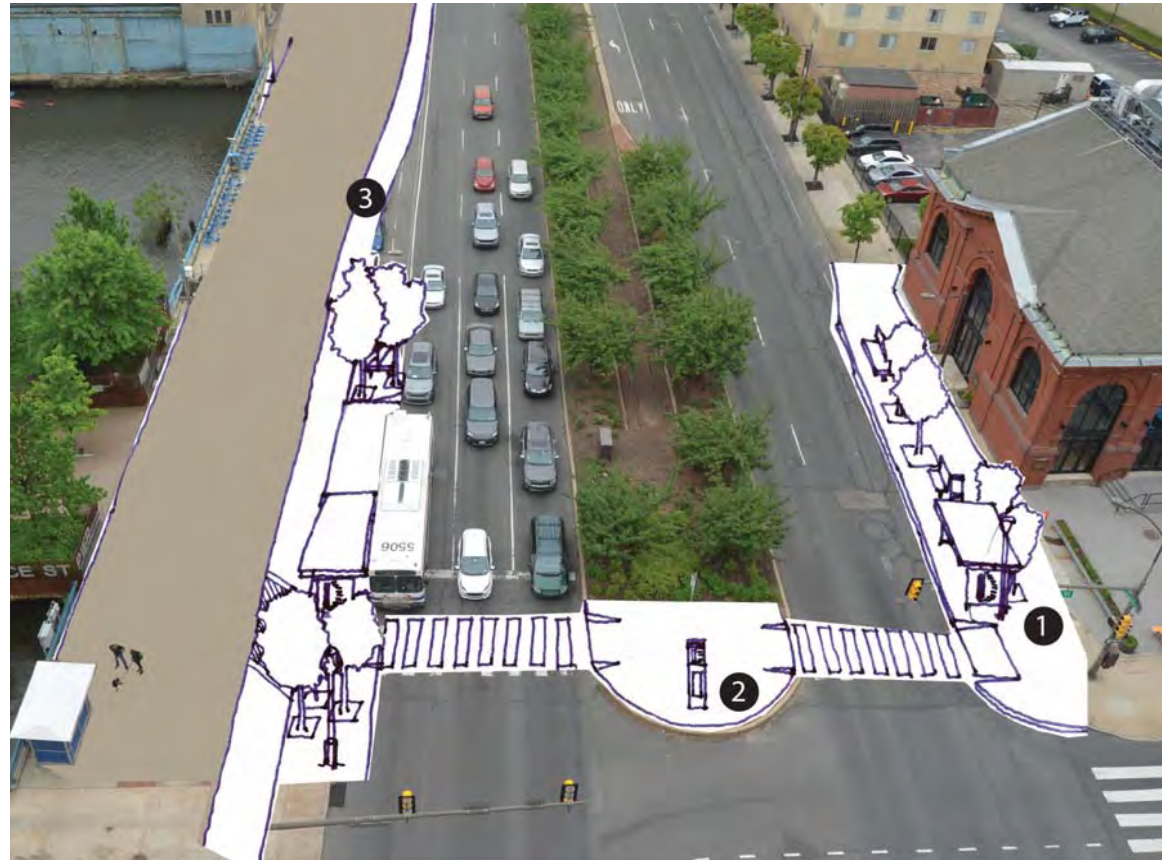
Better integrate waterfront transit with the rest of the network;

Improve safety, comfort, and visibility of pedestrian connections and bus stops;

Decrease transit trip duration; and,

Redistribute existing vehicle fleet.

Figure 14: Enhanced Delaware River Waterfront Transit Service Near-Term Opportunities



Rendering of near-term station improvements at Delaware Avenue at Race Street.

Source: DVRPC

Key	Opportunity Area
1	Bus Stations Curb-side stations located close to destinations, far side when practical. Include shelters, wayfinding, benches, and landscaping branded for the waterfront service.
2	Intersections branded for stations Strengthen pedestrian crossings at intersections with stations. Including wayfinding with maps and schedule information.
3	Delaware River Trail Pending extension of the Delaware River Trail from (approximately) Washington Avenue to Spring Garden Street.

Table 4: Near-Term Recommendations

ENHANCED DELAWARE RIVER WATERFRONT TRANSIT SERVICE NEAR-TERM RECOMMENDATIONS (<10 years)		
Recommendation	Changes	Service Extents
<i>Increase Service Frequency along the Waterfront</i>	15 minutes 6am-6pm	
	20 minutes weekend	
	30 minutes 6pm-11pm	
<i>Better Integrate Waterfront Transit with the Rest of the Network</i>	Connect to MFL at Spring Garden Street	
	Connect to other bus service at Penn's Landing	
	Connect to other bus service at a future South Philadelphia transportation center	
	Free Transfers	
<i>Improve Safety, Comfort, and Visibility of Pedestrian Connections and Bus Stops</i>	Fill in sidewalk gaps	
	Bicycle and pedestrian improvements at intersections and driveways	
	Add shelters and signs at bus stops	
	Create place-making and public art opportunities around bus stops	
<i>Decrease Transit Trip Duration</i>	Limited stop service with stops at: Spring Garden Street, Race Street, Market Street, Spruce Street, Lombard Circle, Washington Avenue, Pier 70	
<i>Redistribute Existing Vehicle Fleet</i>	Operate with existing 40' buses	

INCREASE SERVICE FREQUENCY ALONG THE WATERFRONT

The existing transit service on Delaware Avenue consists of primarily one bus route: SEPTA bus Route 25. Route 25 makes 29 stops along the study area. There are two instances in which Route 25 diverts from Delaware Avenue, at Spring Garden Street and Pier 70 Boulevard, which lengthens the route and travel time.

Spanning about 10 miles at its full extent, Route 25 is a lengthy route. During peak hours, many of the southbound buses turn around at Front and Spring Garden streets (about one-third of morning peak-hour and half of evening peak-hour buses).

Given the existing and proposed mix of recreation, employment, residential, and tourist destinations along Delaware Avenue, transit riders along the corridor use transit for a variety of different trip types beyond commuting. An ongoing survey of transit in South Philadelphia has shown that while 50 percent of those surveyed use transit for work trips, two-thirds of participants also identified that they use transit for shopping and errands.

The future mix of uses along the waterfront could likely support frequent and consistent service outside of daily commuting trips in order to foster transit as the mode of choice for all types of trips and throughout all times of day. The span of transit use should include weekends, evenings, and mid-day use.

CONSISTENCY OF SERVICE

The consistency of a route's service makes it easier for passengers to anticipate when the next bus will come. This process is made simpler for the passenger if the bus service runs with regular frequencies that are maintained all day. With regular 15-minute service from 6am-6pm, most passengers will not need to look up the schedule of

Table 5: Existing and Proposed Frequency

<i>Proposed service frequencies include 15-minute headways all day, and 20 minutes on weekends.</i>		
Time of Day	Current Frequency	Proposed Frequency
Weekday Peak (AM/PM)	13/12 minutes	15 minutes
Weekday Off Peak	30 minutes	15 minutes
Weekend	30 minutes	20 minutes

Sources: SEPTA (existing); DVRPC (proposed)

the bus, thereby increasing the legibility of service. Such a predictable service builds flexibility into the transit network, allowing passengers to rely on transit for a variety of trip types without needing to reference a schedule or having to wait a prolonged amount of time if they miss a bus.

Currently, Route 25 service is irregular, ranging from 13 to 30 minutes. For employees and customers of the retail stores in Pier 70 and Columbus Commons, this random frequency makes it especially difficult to effectively use the bus for transportation. Service improvements that provide more consistent frequencies that are continuous throughout the day would increase the predictability of the route, particularly for those that don't use the service daily, like recreational and tourist trips.

FREQUENCY OF SERVICE

One of the most powerful and persuasive elements to attract passengers to a transit system is how often it runs, or its frequency. Frequent transit headways allow the passenger to travel when they want and make transit connections more feasible or easier to plan. Frequency helps to make up for reliability

issues, ensuring that when one vehicle is delayed or breaks down another vehicle will arrive shortly. Increasing frequency in the southern portion of the route could attract new ridership from existing and proposed land uses.

A near-term strategy might be to pilot an enhanced Delaware River waterfront transit service with 15-minute service all day during weekdays. Although this decreases frequencies from 13 and 12 minutes in the AM and PM peak periods, the increase in frequency from 30 minutes to 15 minutes for off-peak periods would improve the overall frequency of the route for a greater portion of the schedule. This proposal is shown in Table 5.

BETTER INTEGRATE DELAWARE RIVER WATERFRONT TRANSIT SERVICE WITH THE REST OF THE NETWORK

The convenience and competitiveness of transit improves with a connected network with the ability to transfer between services. However, transit connections have the potential to increase travel time for passengers if schedules are not aligned between connecting services.

With Route 25's current 25–30-minute service frequency, there is little incentive for passengers to connect to, or from, the waterfront. However, if service switched to 15-minute frequency, and if arrivals are better coordinated with surrounding transit, SEPTA could increase the attractiveness of waterfront transit service.

SCHEDULING

Table 6 shows the ridership at several key destinations, or nodes, along Delaware Avenue. This table summarizes routes other than Route 25,

that provide east-west access across the network. These nodes are key places and routes that already serve riders. Connections between a revised Route 25 and east-west routes could provide passengers access to L-shaped trips (not routes) that best fit their travel needs. **If transit along the waterfront is high frequency, passengers connecting to other routes will benefit from easy connections with little delay.**

FREE TRANSFERS

To further encourage transit ridership along the waterfront, SEPTA could eliminate the cost of transfers at connections to the waterfront, such as to and from the MFL 2nd Street station. This would open up transit connection opportunities for passengers that were previously deterred by having to pay. With the newly-implemented SEPTA Key fare card, SEPTA

is afforded greater opportunities to explore new fare structures like that of either system-wide free transit connections or free transit connections between key routes. Free transit connections would increase network-wide connection opportunities that encourage shorter, more reliable routes versus longer, less reliable routes that are created to avoid current transfer penalties.

PHYSICAL CONNECTIONS

Immediate physical improvements to increase potential transit connections from Route 25 include filling in the gaps in sidewalks, crosswalks, and ramps to make connections accessible for passengers.

Way-finding, in the form of signs that display schedule information and maps of nearby transit, could be added to bus stations to inform and guide passengers between transit services.

Table 6: Ridership of Non-Route 25 SEPTA Bus Routes at Destination Nodes Along Delaware Avenue

Node (# of Stops Included)	Route Connections at Node	Weekday Average	Saturday	Sunday	Weekly Total
Columbus Commons (7)	7, 79	239	223	157	1,575
Snyder Avenue (3)	7, 79	220	135	119	1,354
Pier 70 (9)	7, 29, 64	2,314	2,203	1,502	15,275
Tasker Street (3)	29, 64	110	147	62	759
Reed Street (4)	64	111	130	100	785
Penn's Landing (9)	21, 33, 42	901	789	823	6,117
Spring Garden Street (1)	43	25	32	3	160

Source: SEPTA Spring 2015 Ridership

Physical connections to cross Delaware Avenue and between Delaware Avenue and the rest of Center City to the west are severely limited adjacent to the depressed portion of I-95. These connections are depicted in *Figure 15*. In the northern and southern parts of the study area, I-95 is elevated. Here, the surrounding street grid connects to Delaware Avenue via an underpass and typically at a signalized intersection with crosswalks across Delaware Avenue. These nodes are easy for a pedestrian to cross Delaware Avenue to make a transfer, or to connect to Center City.

In contrast, from approximately Arch Street to Catharine Street, I-95 is depressed below the surrounding elevation, for approximately one mile. Here, there are only five signalized intersections with crosswalks to cross Delaware Avenue: I-95 on/off ramps, I-95 on-ramp, Spruce Street, Dock Street, and just east of Market Street. Only two of these locations, Spruce and Dock streets, provide at-grade access to destinations west of the study area. Four overpasses located at South, Walnut, Chestnut, and Market streets provide access west but necessitate significant vertical and out-of-direction movements for pedestrians.

Transit connections should be supported with physical infrastructure like signals and crosswalks and prioritizing easy, at-grade, signalized crossings across Delaware Avenue. For this reason, **near-term recommended stops and transit connection opportunities should locate around existing Route 25 high-ridership stops, signalized intersection crossings of I-95, and the at-grade street network connection at Spruce and Dock streets.**

Figure 15: Physical Connections between Delaware Avenue and Center City

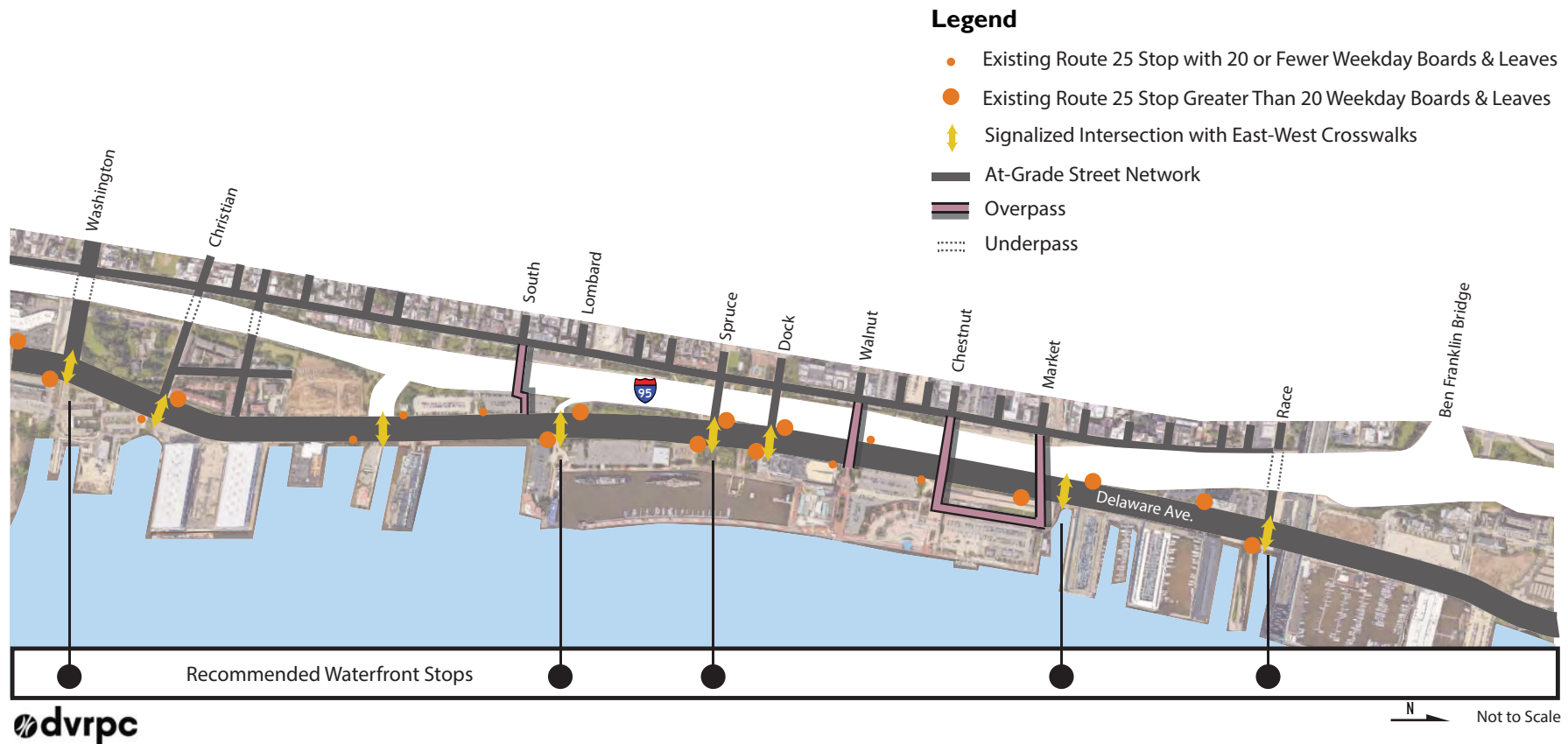


Figure 16: Spring Garden Street MFL Underpass



Source: DVRPC

SPRING GARDEN STREET CONNECTIONS (MFL)

Spring Garden Street is a key intersection with Delaware Avenue to access northern parts of Center City. It was identified as a River Access Street in the Master Plan for the Central Delaware and plays a key role in transit connection options throughout the city with an MFL station. The recent Spring Garden Connector Project did much to brighten the physical appearance under the I-95/MFL underpass (Figure 16). Painted crosswalks and pedestrian refuge islands improve the intersection at Delaware Avenue and Spring Garden Street. **Wayfinding that highlights the MFL and waterfront service proximity, pedestrian crossing interventions like leading pedestrian intervals at signals, and Americans with Disabilities Act (ADA) access at the Spring Garden Station would strengthen the connection between the MFL and Delaware Avenue.**

Figure 17: Stairs at Penn's Landing



Source: DVRPC

PENN'S LANDING CONNECTIONS (ROUTES 21, 33, 42)

Despite proximity and frequency of service to nearby bus routes and the MFL, connecting from the waterfront to other transit service at Market Street is physically difficult because of the required vertical and horizontal connections. Market Street is elevated above I-95 and Delaware Avenue. To transfer to other routes, including the MFL's 2nd Street Station, passengers must walk east from Delaware Avenue toward the waterfront to climb the stairs and ramp shown in Figure 17 and connect to the Market Street bridge (approximately .25 miles). For those willing to make the walk, there is a lack of signage to indicate the possibility of a transit connection or how to navigate the connections.

While the separation between Penn's Landing and Center City is challenging, it can still be improved. **Clear signage indicating the destinations and distances from both directions would help. Adequate lighting and maintaining clear sidewalks in good condition would make the walk more hospitable.** Enhancements like artwork, a painted or imprinted path along the sidewalk, or a connected series of pictures or notes that share a story would help enrich the experience and work toward shortening the perceived distance.

Figure 18: Potential Transportation Center Site (Pier 70)



Source: Google Earth, 2017

SOUTH PHILADELPHIA CONNECTIONS (ROUTES 6, 7, 29, 47, 57, 64, 79)

The potential for transit connections at Pier 70 is currently inhibited by the distance between Route 25 and several other routes that run to or near the shopping center. **These routes could be consolidated into a central bus turnaround and layover area at Pier 70.** Rerouting buses to meet at a central location would also decrease the costs associated with building multiple layovers or many terminus locations. DVRPC is conducting a study to look at constructing a transportation center in South Philadelphia. A transportation center near Pier 70 would go a long way to adding amenities for waiting customers and employees. The transportation center would also function as a layover area for buses to recover (which enables operators to better keep to schedules) with bathrooms for SEPTA operators, while also providing opportunities for customers to transfer easily between routes. An overview of the area that could potentially accommodate this center is shown in Figure 18.

IMPROVE SAFETY, COMFORT, AND VISIBILITY OF PEDESTRIAN CONNECTIONS AND BUS STOPS

Most passengers get to or from transit as a pedestrian. To be enticed to make that trip, the pedestrian portion of the trip must be sufficiently safe and comfortable, and typically not much more than a quarter-mile in length to, or from, the bus. Despite great strides in improving bicycle and pedestrian infrastructure along Delaware Avenue, portions of the corridor remain inhospitable. Corridor investments that improve first- and last-mile connections and enhance the visibility of transit along the corridor would work toward enticing more people to use transit to access the corridor.

BICYCLE AND PEDESTRIAN IMPROVEMENTS AT INTERSECTIONS AND DRIVEWAYS

Locations where bicyclists and pedestrians cross paths with motorists, like at intersections and driveways, create conflict points. Because of the width of Delaware Avenue's travel lanes, pedestrians have a substantial distance to cross at intersections. For example, a pedestrian at the northeast corner of the intersection at Washington Avenue has about 175 feet to walk to get to the sidewalk on the west side of Delaware Avenue.

Streetscape projects that improve the visibility and safety of pedestrians and bicyclists should be implemented in the near term. These projects should be focused on the primary and secondary connector streets identified in the Master Plan. **Strategies like bumpouts, leading pedestrian intervals, painting bike lanes through crosswalks, and other best practices should be employed.**

Safety and multimodal enhancements at the intersection of Washington and Delaware avenues

have been a focus of many stakeholders. DVRPC published the *Washington Avenue and Columbus Boulevard Conceptual Bicycle and Pedestrian Plan* (2016) report, which looked at bicycle and pedestrian improvements on Washington Avenue between Delaware Avenue and Front Street. DRWC is also working with a team on the design of streetscape improvements, particularly for bicycle facilities, on Washington Avenue as a connector street to the Delaware River Trail. DRWC is also working to address similar design outcomes along Frankford Avenue.

FILL IN SIDEWALK GAPS

Figure 19 shows a diagram of some of the corridor characteristics that create the sense of safety and comfort for pedestrians. While much of the corridor has sidewalks, gaps in the network exist. **Sidewalk gaps should be filled wherever possible.** In some places the sidewalk exists but is narrow, in disrepair, or has a severe cross-slope that limits who can use the sidewalk. These locations should be addressed by replacing the sidewalk to be completely ADA accessible, or by directing pedestrians to alternative, accessible routes.

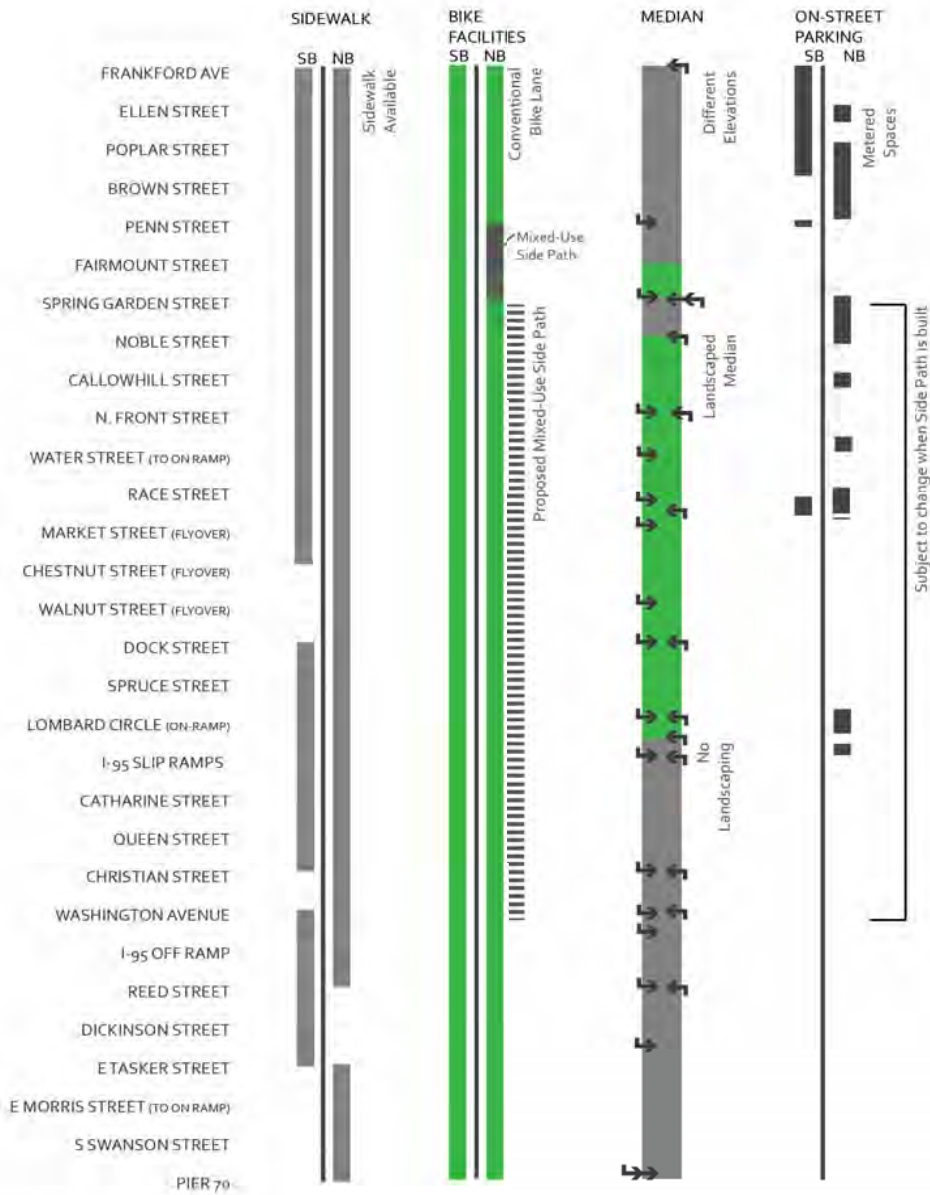
ADDING SHELTERS AND SIGNS AT STOPS

Existing bus stops along Delaware Avenue are distinguished by little more than a bus stop sign. **Adding the City of Philadelphia's new bus shelters at stops along Delaware Avenue would make passenger wait times more comfortable.** Stops should include shelter from rain and snow, seating, a trash can, and a standard bus schedule. The continuity of shelters along the corridor would increase the visibility of transit, potentially attracting new ridership.

CREATE PLACE-MAKING AND PUBLIC ART OPPORTUNITIES AROUND BUS STOPS

Each bus stop should be treated as a gateway to the waterfront. As such, place-making and public art opportunities could distinguish stops and destinations along the corridor through art banners, paving, landscaping, or lighting. These places could include programming and furnishings that foster social engagement and become wayfinding tools for people traveling along the corridor to recognize transit's presence and accessibility.

Figure 19. Pedestrian and Bicycle Facilities and Conditions



Insufficient sidewalk infrastructure.



Route 25 bus stop lacking connection pedestrian amenities.



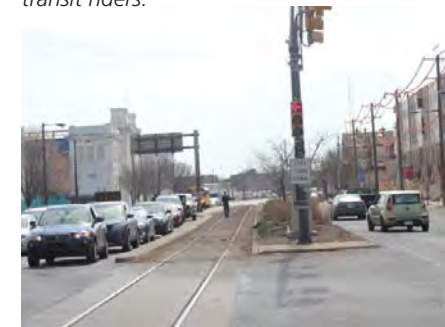
Gaps in pedestrian infrastructure.



Signage scaled for drivers could be improved for better wayfinding for pedestrians and transit riders.



Bicycle facilities on Delaware Avenue.



Pedestrians using median as refuge island.

Subject to change when Side Path is built

DECREASE TRANSIT TRIP DURATION

Faster transit operations along Delaware Avenue would make transit a more attractive option and work toward increasing ridership. Travel times could be shortened in the near term if stops were wider spaced, transit throughput is prioritized at intersections, and service frequencies increase. In addition to delays from block-by-block stops, there are 16 traffic lights from Pier 70 to Frankford Avenue, causing the Route 25 buses to stop frequently. Compounding this delay, almost all of the Route 25 stops are sited on the near side of intersections, which means that the bus might have to stop once for passengers to board and alight, and remain stopped through multiple cycles if it misses the green light.

WIDER STOP SPACING

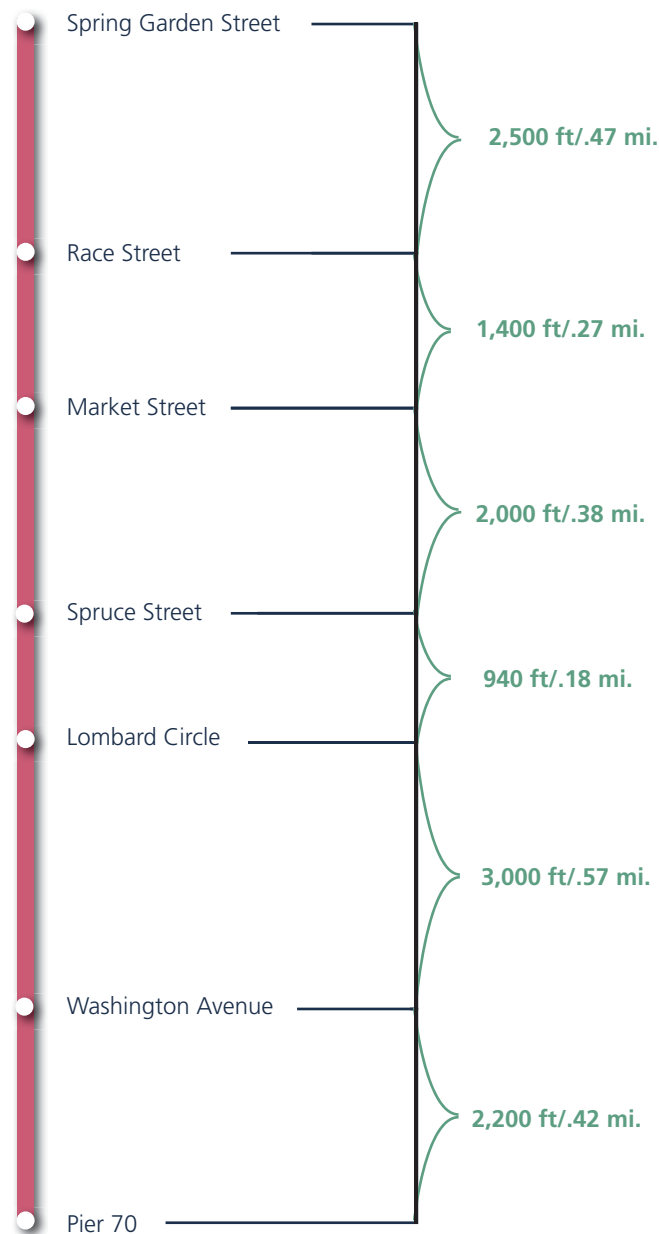
Stops should be sited to ensure optimal distance between them, maximize existing ridership, encourage points of connection to the rest of the transit network, and maintain existing transit-accessible destinations. SEPTA's published standard for bus stop spacing is a minimum of 500 feet for established routes, and a minimum of 1,000 feet for new routes. Best practices for Bus Rapid Transit (BRT) routes as published in the Institute for Transportation and Development Policy's BRT Standard recommends that average distance between stops fall within the range of 0.2–0.5 miles, or approximately 1,000–2,600 feet.

Per these recommendations, consolidating stops on Delaware Avenue should prioritize:

- **stop spacing of 1,000–2,600 feet;**
- **high ridership stops;**
- **potential transit connection locations;**
- **land use connections;**
- **past studies; and,**
- **stakeholder input.**

The resulting proposed service, shown in *Figure 20*, suggests more consistent and wider stop spacing along Delaware Avenue than exists today.

Figure 20: Proposed Consistent and Wider Stop Spacing



Source: DVRPC



SIGNAL OPTIMIZATION, TRANSIT-SIGNAL PRIORITY (TSP), AND QUEUE JUMPS

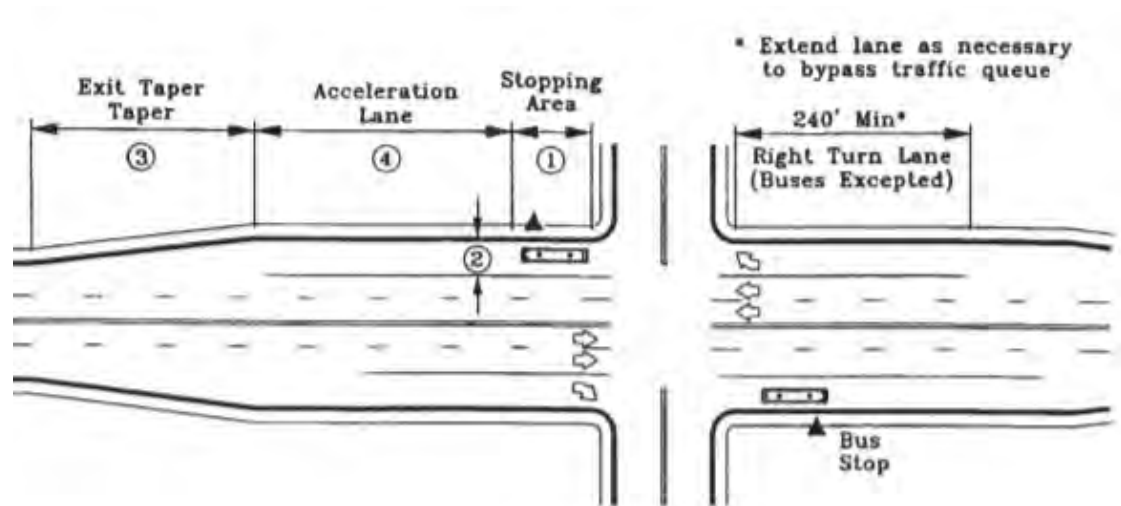
To combat delays at intersections, traffic signal timing should be optimized by evaluating the current volumes and timings to allow for more efficient traffic throughput. Optimizing signals has the benefit of facilitating traffic flows for both transit and vehicles.

Additionally, TSP could be implemented along Delaware Avenue, which would modify the phase split times of the traffic signals in favor of the bus. In practice, intersections with TSP are triggered when a bus approaches, and the green phase is extended or the red phase truncated to provide adequate time for the transit vehicle to pass through the intersection. To enhance the effectiveness of TSP, stops should be sited on the far side where possible, as this allows the transit vehicle to clear the intersection before stopping to load and unload passengers.

DVRPC has explored the potential of TSP as a best practice in prior planning projects with SEPTA. For purposes of order-of-magnitude time savings estimates, previous studies drew on the TSP experiences of Los Angeles and Portland in referencing a rule-of-thumb reduction of 6.8 percent in running time savings following TSP implementation. This reduction could shorten the overall length of transit trips from one end of the study corridor to the other.

Queue jumps are another technique that favors buses quickly getting past vehicles queued at the intersection. A queue jump designates part of a turn or parking lane to buses in advance of an

Figure 21: Queue Jumps



Sources: Texas Transportation Institute; Transportation Research Board, TCRP Report 19: "Guidelines for the Location and Design of Bus Stops," 1996.

intersection (see Figure 21). If cars are queued at an intersection, the approaching bus can use the queue jump to pass traffic in order to get through the intersection first.

Opportunities for queue jumps on Delaware Avenue are limited due to a lack of right-turn lanes and parking lanes. The right-of-way is restricted to allow for this space because of the wall adjacent to the I-95 depressed portion, and land uses and the Delaware River Trail on the east side. Space may be possible at Snyder Street and Pier 70 Boulevard. These opportunities would need to be fully analyzed before advancing.

Redistribute Existing Vehicle Fleet

A redistribution of existing 40-foot buses already in service could be used to provide this enhanced Delaware River waterfront transit service. As a transition toward the future, SEPTA could also consider piloting the use of a new vehicle type along Delaware Avenue. Several cities in the United States and Europe are even currently experimenting with self-driving (autonomous) buses along selected routes. As a relatively simple and direct route, Delaware Avenue could be examined for such an application.

CONCLUSION: NEAR TERM RECOMMENDATIONS

Within the next ten years, there are opportunities to improve transit and increase ridership along Delaware Avenue. Near term enhanced Delaware River waterfront transit service recommendations include:

- Schedule changes to improve frequency and consistency of service, with 15 minute frequency throughout the weekday;
- Network improvements such as well-timed and easy to navigate transit connections, especially those at Spring Garden Street, Penn's Landing, and Pier 70;
- Connectivity and accessibility improvements along Delaware Avenue with an emphasis on enhanced pedestrian connections to and at bus stops;
- Operational changes such as limited stop spacing, signal optimization, TSP, and queue jumps to decrease travel times and create a transit service more competitive with other modes; and,
- Redistributing the existing bus fleet to allow great service frequency along the waterfront.

Through implementation of the proposed quick, strategic, and systematic changes within the existing right-of-way, there is opportunity to create a reliable, attractive transit service along Delaware Avenue and build support for future enhancements and expansions of waterfront transit.

These recommendations will inform two processes already underway: DRWC's Waterfront Transit Planning and SEPTA's Comprehensive Bus Network Redesign. The Waterfront Transit Plan can build off of these recommendations to prioritize near term operational and physical improvements for implementation. SEPTA's Comprehensive Bus Network Redesign should consider the stakeholder consensus to build up transit service along Delaware Avenue to fulfill the multimodal, density, and recreational destination vision for the waterfront. This vision for the waterfront may require a unique evaluation of the role of the corridor within the larger network when compared to other corridors. The Delaware Avenue corridor fills a visionary role whereas other corridors will likely be evaluated for their existing ridership demand.

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Master Plan for the Central Delaware: Rendering showing improvements at Delaware Avenue and Spring Garden Street.

Source: DRWC

3

LONG-TERM RECOMMENDATIONS

Long-term recommendations, displayed in *Table 7*, require greater resources, either through cost or through coordination time, and significantly, call for a reimagining of the Delaware Avenue right-of-way to fully transform the corridor into a multimodal, vibrant waterfront. While some of the long-term recommendations are operational only, meaning they do not require capital improvements to be implemented, the **long-term recommendations are predicated on the notion that vehicular capacity from this section of Delaware Avenue can be transferred to I-95 through PennDOT's Sector B planning. With less vehicular demand on Delaware Avenue, the right-of-way can be reimagined into a multimodal, transit-rich waterfront.**

In its current, typically six lane configuration, single-occupancy vehicles traveling through the waterfront area are prioritized over all other modes along the waterfront. The predominance of travel lanes; flyovers; and local, regional, and interstate traffic create an auto-oriented place. While much has been done in the last decade

or so to accommodate bicycle and pedestrian mobility, the vastness of the drive lanes in the joint I-95/Delaware Avenue corridor are too great to surmount the sense of auto-orientation of the corridor. If through the I-95 Sector B planning, ramps to/from I-95 are located near the northern and southern limits of the waterfront study area, vehicles can more readily avoid Delaware Avenue and use I-95. **Space can then be rededicated to include a transit right-of-way,** as illustrated in *Figure 22*.

A dedicated transit right-of-way that does not mix with freight rail or vehicular traffic would enable a first-class transit service. This service could expand the Delaware River waterfront transit service either in the form of a bus, or trolley service. Mode choice might necessitate adaptations to the service pattern of either or both routes 25 (bus) and 15 (trolley). In some cases, the long-term recommendations are improvements that would be needed regardless of mode choice. When recommendations differ between bus and rail modes, those differences are noted.

STRATEGIES TOWARD A MULTIMODAL WATERFRONT

This chapter outlines long-term transit improvements, including those that would require a reimagining of the right-of-way to allow more space for transit, its effectiveness, visibility, and accessibility. Priorities are to:

Provide frequent service;

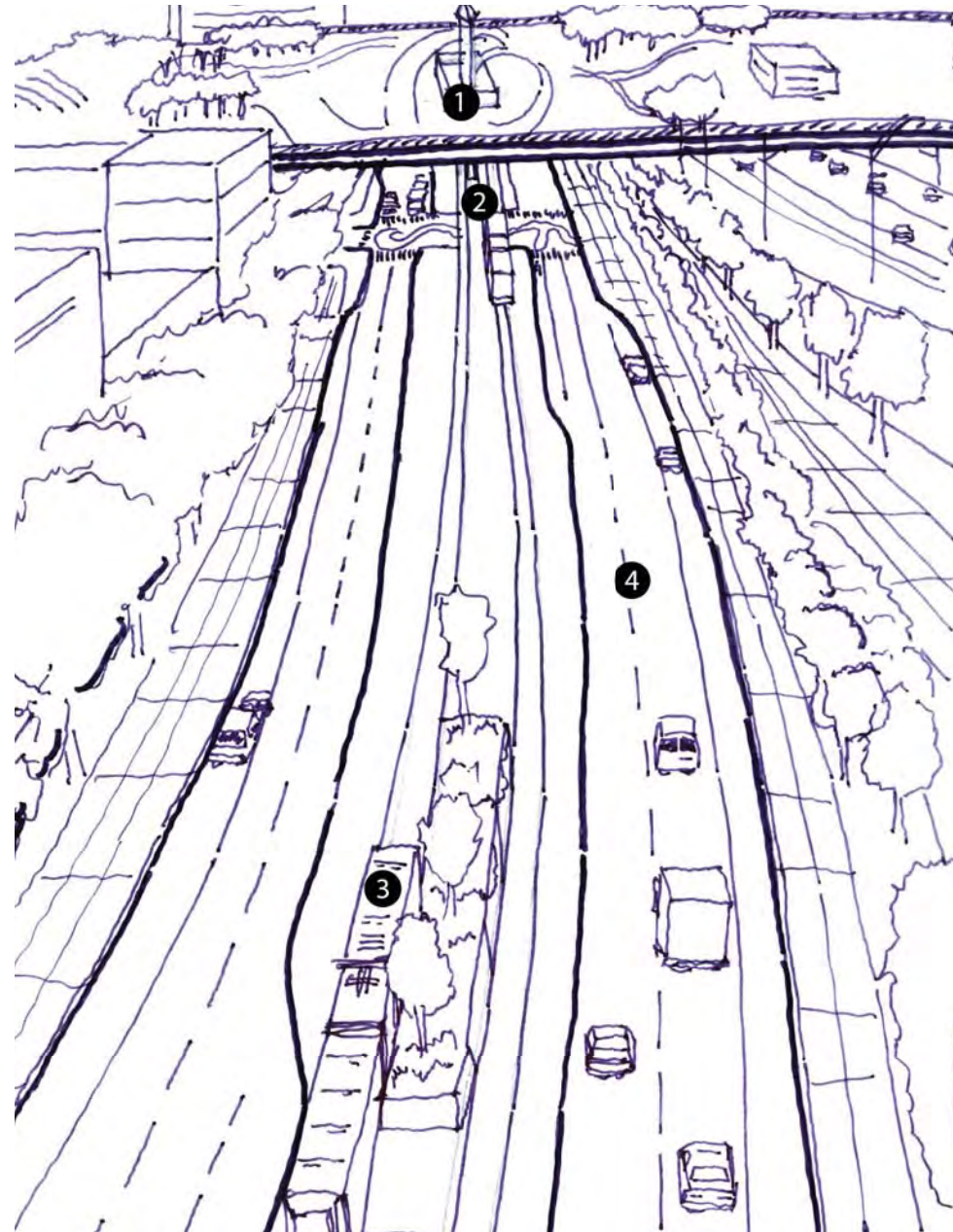
Support transit connections with infrastructure;

Create stations;

Reconfigure Delaware Avenue right-of-way, including a dedicated transit right-of-way; and,

Establish a dedicated vehicle fleet.

Figure 22: Enhanced Delaware River Waterfront Transit Service
Long-Term Opportunities














Rendering of long-term improvements at Delaware Avenue.

Source: DVRPC

Key	Opportunity Area
1	Penn's Landing CAP Project Cap over I-95 and Delaware Avenue bridges the distance between the waterfront and Center City. Funded portion between Walnut and Chestnut streets could be extended in the future north to Market Street to directly link transit service with the MFL 2nd Street Station.
2	Vertical Circulation Access between the Delaware Avenue elevation and the top of the cap is fluid. Pedestrian infrastructure at the Penn's Landing intersection of Delaware Avenue allows access to the center, transit median. The transit median should have elevators, ramps, stairs, and/or escalators to access a transit station and the cap.
3	Dedicated Transit Right-of-Way A dedicated space offers congestion-free travel for transit. Alignment could be curb side or in the median, which would include relocation of, or rights within, Conrail's asset.
4	Right-Sized Delaware Avenue New ramps and capacity afforded by I-95 (re)construction allow for a redesign of Delaware Avenue to a right-sized Complete Street.

Table 7: Long-Term Recommendations

ENHANCED DELAWARE RIVER WATERFRONT TRANSIT SERVICE LONG-TERM RECOMMENDATIONS (10+ years)		
Recommendation	Changes	Service Extents
<i>Provide Frequent Service</i>	<15 minutes peak/nonpeak	 Frankford Loop
<i>Support Transit Connections with Infrastructure</i>	Connect to Route 15 at the Frankford Loop	 Spring Garden
	Connect to the MFL at 2nd Street	 Race
	Connect to Sports Complex, FDR Park, and Navy Yard	 Market  Spruce
<i>Create Stations</i>	Create stations with a larger footprint and more passenger amenities	 Lombard Circle
<i>Reconfigure Delaware Avenue Right-of-Way, Including a Dedicated Transit Right-of-Way</i>	Dedicated transit right-of-way with stops at the same/similar locations as near-term	 Washington  Pier 70
<i>Establish a Dedicated Vehicle Fleet</i>	Purchase additional buses or trolleys	 Snyder  Columbus Commons  Navy Yard

PROVIDE FREQUENT SERVICE

In the long term, transit service along the waterfront could increase frequencies to less than 15 minutes in order to serve an increased population of residents, workers, and visitors to the waterfront (See *Table 8*). **A proposed 10 minute frequency is similar to SEPTA's newly established Direct Bus service on Roosevelt Boulevard.** Direct Bus has 10-minute frequency during peak periods and 15-minute frequency during the rest of the day (except for late-night service, which operates at 30-minute frequency). These frequencies also match the Federal Transit Administration's Small Starts BRT standards.

Table 8: Increased Service Frequency

Increased Service Frequency Near- and Long-Term Proposals			
	Existing	Near Term	Long Term
Weekday Peak	13/12 min.	15 min.	10 min.
Weekday Off-Peak	30 min.	15 min.	<15 min.
Weekend	30 min.	20 min.	<15 min.
Late Night	30 min.	30 min.	30 min.

SUPPORT TRANSIT CONNECTIONS WITH INFRASTRUCTURE AND FREE TRANSFERS

CONNECT TO ROUTE 15

Currently, transit connections between Delaware Avenue to and from SEPTA's Route 15 trolley line can be made at the Frankford Loop, near the SugarHouse Casino. Connections to Route 15 provide an east-west connection through Center City, north of the MFL's Market Street alignment, and extend west to the Centennial District and West Philadelphia neighborhoods. A future high-intensity transit service along the waterfront should capitalize on the connection to Route 15 and access to the SugarHouse Casino made in this location (*Table 9*).

Space within the Frankford Loop is restricted, even for the existing Route 15, which short turns here during PennDOT's planning and reconstruction of Richmond Street. In the long term, this location has many transit possibilities: it could be an end of line for the Girard Avenue portion of Route 15, it could be a transit connection opportunity between Route 15 and a future waterfront high-intensity transit service, and it could be a hub for a transit service that operates with a split from Girard Avenue into a northbound and southbound waterfront service. **To allow for the greatest flexibility for future transit, and to continue to serve SugarHouse Casino and the adjacent neighborhood, opportunities for expanding or establishing a new turnaround, or layover, in this vicinity should be explored.**

CONNECT TO MFL'S 2ND STREET STATION

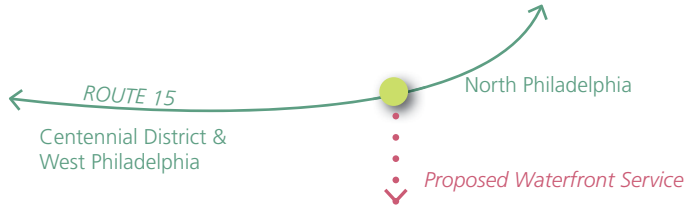
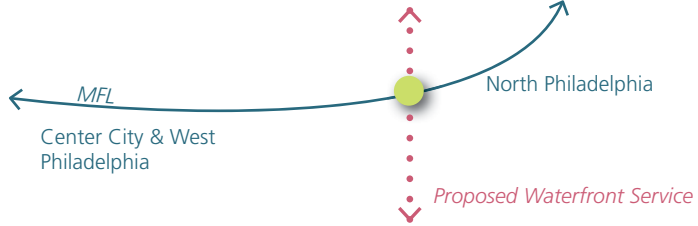
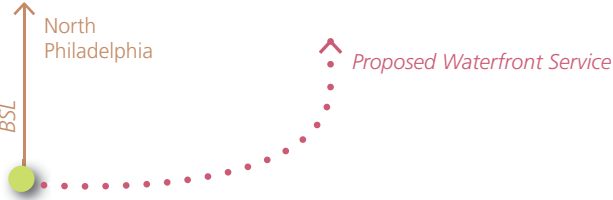
East-west connections via the MFL are paramount for a new waterfront service. The MFL's central alignment within Center City, grade-separated, exclusive right-of-way, and high frequency of service make connections to the MFL's 2nd

Street Station from Delaware Avenue essential. **A long-term transit service should provide comfortable pedestrian connections and well-timed service operations to the MFL in order to provide access from the waterfront to a critical number of jobs within Center and University cities in a short amount of time.**

The planned Penn's Landing Park will cap over a large portion of I-95 from Front Street to the waterfront between Walnut Street and Chestnut Street. Without a connection for pedestrians and vehicular and transit passengers along Delaware Avenue to the Penn's Landing Park cap, the CAP project could functionally disconnect Delaware Avenue from both Center City and the waterfront. **A connection from the Delaware Avenue street grade to the top of the cap, not just from the adjacent land uses to the east and west, should be included in design plans for the cap.**

CAP plans may want to consider a future phase expanding north to Market Street in order to house an elevator, ramp, and/or escalator connecting Delaware Avenue passengers vertically to above-ground (top of cap) connections and horizontally to 2nd Street Station. During a stakeholder workshop, participants brainstormed ambitious opportunities to better connect a transit service along Delaware Avenue to the 2nd Street MFL Station. One way to bridge transit to Market Street or the cap elevation would be to build a ramp to connect the route up to the park at Market Street. Other ways might include even more intensive connections, such as an underground tunnel connection west to the 2nd Street Station, although the elevation of I-95 and the underground MFL would likely preclude such an alignment.

Table 9: Priority Station Connection Recommendations

Proposed Waterfront Stations	
Frankford Loop	<p>Route 15 Trolley at Frankford Loop</p> 
Penn's Landing (Market Street and Spruce Street)	<p>MFL at 2nd Street Station</p> 
Navy Yard	<p>Broad Street Line at the Navy Yard</p> 

Source: DVRPC 

CONNECT TO SPORTS COMPLEX, FDR PARK, NAVY YARD, AND BROAD STREET LINE

Connections made to east-west bus routes at the southern end of Route 25, where a SEPTA bus transportation center is being considered, could also lay the foundation for an eventual connection over to other major destinations in South Philadelphia to the west, including the Sports Complex, FDR Park, and the Navy Yard by way of Pattison Avenue. This connection could become even more advantageous in the long term if the Broad Street Line is extended to the Navy Yard as planned. The predominance of PhilaPort industrial uses, and the complex interchange of I-76 and I-95, make for a complicated area to pass through to get to South Philadelphia key destinations. **A long-term alignment might avoid this complicated area by using Oregon Avenue to get west and then traveling south on one of the north-south streets that access the stadiums.**

CREATE STATIONS

A future high-capacity transit service along the waterfront will require stations that can accommodate all users and that are highly visible.

Regardless of whether the stations serve bus or rail or whether the service is center or curb side running, stations will need to be at minimum 8'6" wide to be accessible.

Depending on whether the service is center or curb side running, other modes, like bicycles, may need to circumnavigate transit stations. In these cases, additional width may be required to maintain additional clearances from moving traffic or to accommodate street furnishings that separate passenger waiting areas from other users of the street. **The length of stops will be determined by the design vehicle (bus or trolley) and number of doors on the vehicle that will be accessed from the platform.** The *SEPTA Bus Stop Design Guidelines* and the *Modern Trolley Station Design Guide* both provide guidance on how to design for stations.

DVRPC's recently published *Modern Trolley Station Design Guide* outlines the requirements for accessible trolley stations when SEPTA purchases a new, modern trolley fleet. The design guidance is transferable to both trolley and BRT corridors. Modern station improvements will include wider platforms for universal access that are near level with vehicles, real-time arrival information, stormwater infrastructure elements in the stations, integrated bicycle-trolley design to avert conflicts with bike lanes, and a "low-friction" payment system that would be paired with multidoor boarding. These elements, as depicted in *Figure 23*, elevate the safety and comfort for all users in a way that is far beyond what a simpler bus stop does.

Figure 23: Example of a Potential Modern Trolley Station



Rendering of potential modern trolley vehicle and station as depicted in the *Modern Trolley Station Design Guide*.

Source: DVRPC, 2017

RECONFIGURE DELAWARE AVENUE RIGHT-OF-WAY, INCLUDING A DEDICATED TRANSIT RIGHT-OF-WAY

Included in DRWC's Waterfront Master Plan is a call for a dedicated transit right-of-way, a concept that is consistent with many past waterfront transit studies (see *Figure 24*). Most of those studies have also focused on a rail service along the waterfront. Whether the future service is provided by bus or rail, is less important than actually establishing the transit right-of-way itself. Separating transit from

vehicular lanes removes the auto traffic delay and associated reliability issues along Delaware Avenue so that transit can be both faster and more reliable potentially than auto traffic, but certainly more so than how the bus operates today. This gives transit the greatest chance to be competitive with driving. A dedicated transit right-of-way would also go a long way in heightening the visibility and

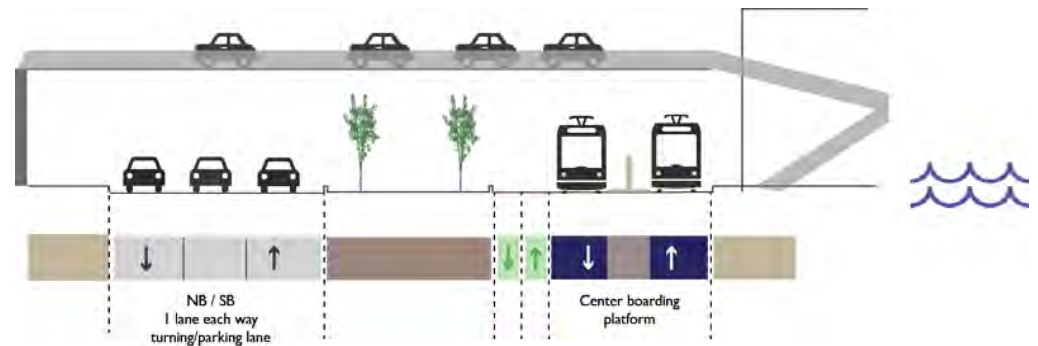
convenience of taking transit by putting it at the forefront visually. **Stakeholders should work together toward dedicating a transit right-of-way along Delaware Avenue as part of I-95 Sector B planning.**

Figure 24: Visions of Robust Changes to the Right-of-Way

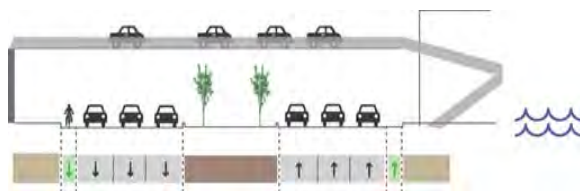


Existing Right-of-Way.

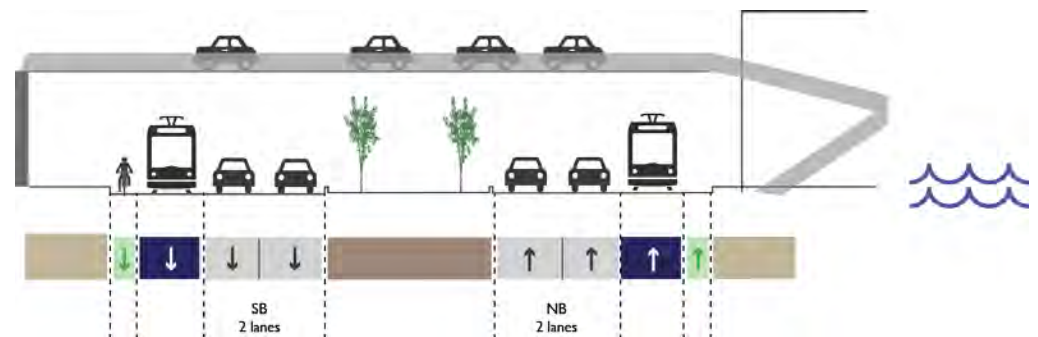
Source: DVRPC



Right-of-Way Cross-Section Option: East-side alignment, dedicated lanes



Existing Right-of-Way Cross-Section.



Right-of-Way Cross-Section Option: Side-running alignment, dedicated lanes

 Source: DVRPC

ESTABLISH A DEDICATED VEHICLE FLEET

In the long term, a high-capacity transit service will likely require adding additional vehicles to SEPTA's fleet in order to meet service demands. Bus service would require use of vehicles from SEPTA's diesel, hybrid-electric, or newly purchased electric buses fleet. Additional analysis would be needed to identify the service pattern and frequency of service in order to identify the number of new buses needed to add to the fleet. Buses would offer the greatest amount of interoperable flexibility for SEPTA to store and maintain the vehicles with their existing maintenance and storage facilities.

To distinguish a waterfront, high-frequency service from the rest of SEPTA's bus network, it could be established as Waterfront Direct if it fits with service standards that are anticipated to be created for Direct Bus. If it is considered a Waterfront Direct Bus service, the bus could be wrapped in a branded Direct Bus wrap similar to the buses serving Roosevelt Boulevard, shown on the facing page. While this distinguishes the Direct Bus brand, it has also reportedly complicated servicing vehicles and putting buses into operation because it is less interoperable with the rest of SEPTA's bus fleet.

A high capacity transit service could also be served with a trolley vehicle. SEPTA is in the process of preparing to replace their aging trolley fleet with modern vehicles. This report recommends starting with near-term improvements to bus service along the waterfront that can grow to a higher-capacity service, potentially including a trolley expansion to Delaware Avenue in the long term. Because the build-out of the waterfront development is uncertain, as is the ridership on a new, near-term, waterfront bus service, modern vehicles for the waterfront will likely not be part

of SEPTA's initial procurement (within 8–10 years). When and if it is determined to switch from bus to rail service, SEPTA could purchase additional modern trolley vehicles, the number of which would be based on the service pattern and frequency of service.

Trolley vehicles for a waterfront rail service should be the same as whatever vehicle SEPTA determines to purchase for the rest of the system. Modern trolley vehicles are anticipated to be articulated vehicles with low floors. It is not known whether the fleet would be single or double ended. Either type would likely serve Delaware Avenue well. Both single- and double-ended vehicles would require a lane in each direction along the length of the service. Both vehicle types would need to be stored at the end of the day at a trolley yard, likely at 63rd Street and Girard Avenue where the Route 15 trolleys are stored overnight.

A double-ended trolley would allow for simpler turnarounds at either end of the route because the vehicle would not require space to turn around. Single-ended vehicles would require greater space to turn the vehicles either by turning around in a loop, or by navigating a series of 90-degree turns within the street network or off site. Off-site end of lines could potentially be incorporated at the Frankford Loop or Westmoreland Loop at the northern end, and in, or around, a potential South Philadelphia transportation center somewhere at the southern end of service.

The position of a dedicated transit right-of-way could also dictate where doors on the vehicle fleet would be needed. Curbside

service, or a center median alignment with stations for each direction could work with buses and single- and double-ended vehicles that typically have doors on the right side of the vehicle. A center median or bidirectional, one-side-of-the-street alignment with a shared boarding platform between running-ways would require a bus or a trolley to have doors on the left side of the vehicle.

Given the longer timeframe of these recommendations, it is also possible that a new type of vehicle, not yet in use in this region, could serve the corridor. Over time, it may even be possible—if not likely—that self-driving (autonomous) buses could serve this route. Stakeholders should continue to keep their eye on technological advances in transit vehicles that might impact vehicle fleet choice.

Conceptual Branding for Direct Bus Service



Source: SEPTA

In 2017 SEPTA initiated a new Direct Bus service operating on Roosevelt Boulevard, known as *Boulevard Direct*. To distinguish this service as a direct route and to differentiate from traditional bus services, SEPTA developed a branding identity for Boulevard Direct. This design treatment is applied to signage, stations, and buses, and used for marketing materials and campaigns. (Brand and design elements for Boulevard Direct as concepts, below, and as implemented, at right).



Source: SEPTA



Source: SEPTA

CONCLUSION: LONG-TERM RECOMMENDATIONS

Once near-term waterfront service improvements have proven to be in demand, and a dedicated transit right-of-way is incorporated along Delaware Avenue through the I-95 Sector B process, long-term improvements can occur. Long-term recommendations expand on the near-term recommendations by:

- Increasing service frequency to <15 minutes;
- supporting transit connection activities with infrastructure at the Frankford Loop, Market Street, and the Navy Yard, and providing free transfers;
- transforming stops into stations;
- dedicating a transit right-of-way along Delaware Avenue for waterfront service; and,
- procuring a distinct bus or trolley vehicle fleet.

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Existing View of Delaware Avenue from the Median.

Source: DVRPC

4

NEXT STEPS

Creating a multimodal waterfront with high-frequency transit will take the ongoing coordination of several key stakeholders. Together, SEPTA, the City of Philadelphia, DRWC, PennDOT, and City Council District 1 should partner to create change along Delaware Avenue starting now and continuing until the full waterfront vision is realized. Stakeholders' actions taken today will build the framework for more significant changes to the waterfront in the future.

The partnership of stakeholders' aim should be to create a transit culture. A transit culture is one in which transit as a mode choice is elevated to a normative, or even preferred, status over other modes. When taking transit is a lifestyle choice, as opposed to an obligation, it can create a transit culture. The operational and capital improvements to transit service described in this report can significantly improve the competitiveness of taking transit over other modes.

Because the more acute pressure is to realize the waterfront vision than it is to satisfy demands stemming from high existing ridership along Delaware Avenue, SEPTA is less likely to be a singular catalyst for changing waterfront transit service. A champion for transit along Delaware Avenue could instead take the shape of a joint partnership between SEPTA, the City of Philadelphia, DRWC, PennDOT, and City Council District 1. As a joint partnership, each stakeholder would be a driver of change, committed to bringing high-frequency transit service to Delaware Avenue.

Next steps to cultivate a waterfront transit culture are to create an alliance of stakeholders that have regular and ongoing meetings to develop a new service plan and coordinate on decisions. The features of this alliance are outlined in the following section as strategies.

1. Develop and implement a new service plan and capital improvements along the waterfront.

Separate from SEPTA's annual service planning process, an analysis should be done to develop a service plan for transit along Delaware Avenue that shapes, and can increase in intensity with, development along the waterfront. The plan should use the near- and long-term recommendations of this report as guidance for outlining the service and capital improvements needed, tailoring as appropriate. The plan should outline:

- a short-term augment of service with performance measures to assess the costs to provide the service with the change in ridership;
- capital improvements that expand the visibility of transit and passenger comfort while walking along the corridor and waiting at stops; and
- targets for both ridership and development (residential units and office and commercial square footage) that would trigger an increase in even greater service, or a lack of development or ridership within a set timeframe that would reverse the increase in service.

This plan could work in tandem with several planning efforts already underway that will shape mobility along the waterfront. Stakeholders should coordinate on each of these projects to realize their implications for the waterfront transit.

- DRWC is working with a consultant to identify and initiate short-term transit improvements along Delaware Avenue that support existing land uses, as well as set the stage for the anticipated future development.
- SEPTA's upcoming Comprehensive Bus Network Redesign will evaluate options to improve the overall transit network. This comprehensive analysis will take into account and have impact on connections to and from the waterfront from not just Route 25, but from service around the region.
- The City of Philadelphia recently released a city-wide transportation plan, ***Connect; Philadelphia's Strategic Transportation Plan***.
- Additionally, with the recent implementation of a new mode for SEPTA, Direct Bus, it is likely that service standards will be created to better define Direct Bus. These service standards will define under what conditions, if at all, Direct Bus would expand throughout SEPTA's service area. Service along Delaware Avenue that is proactive toward shaping a vision, rather than reactive to service demands, and that is driven in large part by recreational and tourist trips, may or may not fall within service standards for Direct Bus.

2. Coordinate on policy and design decisions that create a transit supportive corridor.

Many current public agency and private developer actions will impact the future of the Delaware Avenue corridor, but chief among them is PennDOT's planning and design of I-95 Sector B. While Sector B is not expected to be under construction for several years, many other actions, like developer approvals for properties along Delaware Avenue, are more immediate. As these policy and design actions take place, stakeholders will need to meet regularly to ensure that their outcome is addressing inherent characteristics of the corridor that support transit investments.

Chapter 1 describes several inherent characteristics of Delaware Avenue that do not support near-term readiness for expensive trolley expansion, but those same characteristics can be strategically changed so as to support a multimodal, transit-rich corridor in the future.

Regular and ongoing coordination of stakeholders along the waterfront can steer both opportunistic and strategic outcomes of their projects to address the following:

1. Increase population and employment densities along the waterfront through developer site plans that support multimodal access.
2. Provide a transit service to the waterfront that boosts ridership.
3. Remove barriers caused by freight rail within the transit service area.
4. Shift vehicular capacity away from Delaware Avenue onto I-95 to allow the right-of-way to be reimagined with a dedicated transit right-of-way and safe and comfortable pedestrian and bicycle infrastructure.

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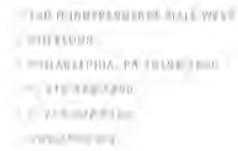
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APPENDICIES

Appendix A: Central Delaware Waterfront
Strategic Modeling Results

Appendix B: Light Rail Transit on Delaware
Avenue Meeting #2 Summary

APPENDIX A: CENTRAL DELAWARE WATERFRONT STRATEGIC MODELING RESULTS



memorandum

Date: March 1, 2015
To: Central Delaware Waterfront Steering Committee
From: Matthew Gates
Subject: Central Delaware Waterfront Strategic Modeling Results

INTRODUCTION

The Central Delaware Waterfront Strategic Modeling Study's purpose was to determine the highway traffic and public transportation ridership potential under several transportation and development scenarios in the portion of Center City Philadelphia adjacent to the Delaware River. Christopher Columbus Boulevard is the primary north-south arterial serving the development along the waterfront. Although Columbus Boulevard has good connections to interstate facilities such as I-95 and I-676, its connections to the Center City street grid are limited to a handful of high-volume intersections. The intersection spacing, combined with limited bus service and high volumes of automobile traffic, results in a somewhat difficult environment for pedestrians.

This portion of the waterfront has been the subject of several planning efforts in the recent past, which shared common themes of creating a denser, mixed-use development pattern, improving transit service, and enhancing the public's ability to access the river and riverfront. In 2010, the Delaware River Port Authority published its *Philadelphia Waterfront Transit Expansion Alternatives Analysis* which examined rail service along Columbus Boulevard with connections to Center City. An earlier effort by PennPraxis, the *Civic Vision for the Central Delaware*, offered a framework for development that would, in effect, extend Center City's walkable street grid to the waterfront, encouraging smaller buildings and additional street connections with improved transit, and discouraging the big-box, suburban-style development that characterizes much of the waterfront today.

Many of these same themes are reflected in the Delaware River Waterfront Corporation's (DRWC) 2011 *Master Plan for the Central Delaware*, which also included a detailed strategy of investment in recreational, cultural, and entertainment attractions based on a parcel-by-parcel analysis of constraints and

opportunities. In 2013, the Philadelphia City Planning Commission (PCPC) adopted a strategic plan for the Central District. This local plan is fully consistent with its 2035 Comprehensive Plan, *Citywide Vision 2035*, but the majority of its land use and development recommendations are meant to be accomplished within a 10-year time frame.

This transportation study draws on those efforts and analyzes bus and rail options serving Columbus Boulevard under a variety of development patterns that emphasized growth in either residential or commercial development along the Delaware River waterfront. DVRPC's current regional travel forecasting model, the Transportation Improvement Model (TIM) 2.1, was used to simulate travel patterns for a 2040 horizon year for six transportation and land use scenarios. To create the six scenarios, three transportation alternatives were combined with three land use options. These scenarios were then evaluated in terms of highway traffic volumes, transit ridership, and peak hour intersection "level-of-service" within the Columbus Boulevard corridor.

TRANSPORTATION SYSTEM ALTERNATIVES

The transportation system alternatives were developed to provide better transit service along Columbus Boulevard between Frankford Avenue and Snyder Avenue that would also connect the waterfront to the core of Center City Philadelphia. They include both bus and light rail alternatives.

Transportation Alternative 1

This alternative would extend SEPTA's route 42 bus south and its route 48 bus north along Columbus Boulevard, operating in mixed traffic. No changes would be made to the physical geometry of Columbus Boulevard. The routes 42 and 48 provide frequent service across Center City. The 42 bus travels from 61st and Pine streets through West Philadelphia and University City to the Delaware Waterfront at Penn's Landing. The route 48 bus travels from North Philadelphia at Allegheny and 29th Street through Strawberry Mansion, Brewerytown, and Fairmount to the Market and Front streets, near the Delaware Waterfront.

Under this alternative, the 42 bus would extend south on Dock Street to Columbus Boulevard and continue to the Columbus Shopping Center, just south of Snyder Avenue. The 48 bus would extend north from Race Street along Columbus Boulevard to Frankford Avenue. The headways of the existing routes would continue. The 42 has 6 minute AM peak, 8 minute PM peak, 10 minute midday/evening, and 20 minute late night service; while the 48 has 6 minute AM, 8 minute PM, 12 minute midday, 20 minute evening, and 30 minute late night service. The route 25 bus would continue to operate from Frankford Transportation Center to Columbus Commons providing 10 minute AM, 5 minute PM, and 30 minute off-peak service.

Transportation Alternative 2

Transportation Alternative 2 would also extend SEPTA's route 42 bus south to Columbus Common and its 48 north to Frankford Avenue. However, along Columbus Boulevard a dedicated bus only right-of-way would be provided. This right-of-way would require that the number of through lanes on Columbus Boulevard for automobiles be reduced from three per direction to two per direction. To further reduce bus travel times along Columbus Boulevard, the stops would be consolidated to just 10 locations. These would be located at

the intersections of Columbus Boulevard and Columbus Commons Drive; Snyder Avenue; Pier 70 Drive; Reed, Christian, South, Dock, and Spring Garden streets; and Frankford Avenue.

Transportation Alternative 3

Transportation Alternative 3 would be an entirely new street running light rail transit service which would run in the median of Columbus Boulevard and extend from Frankford Avenue to Race Street, operate to 8th and Market Street to connect to the Jefferson Station Concourse, loop around Franklin Square back to Race Street, and continue in the Columbus Boulevard Median to Pier 70. Under this alternative, Columbus Boulevard would be reduced to two through lanes per direction between Frankford Avenue and Washington Street. South of Washington Street, Columbus Boulevard would continue to operate with three through lanes for automobile traffic. The light rail service would operate with 10 minute headways during the AM and PM peak periods, 15 minute headways during midday, and 30 minute headways during the evening.

LAND DEVELOPMENT ALTERNATIVES

Three different future year land use development alternatives were included in the analysis. All land use alternatives were consistent with DRWC’s Master Plan for the Central Delaware. However, since the plan emphasizes mixed use development and most waterfront land is privately owned, there are a number of potential future outcomes for the area. All three land development alternatives assumed the same development pattern in the “priority” areas, but allowed for different mixes of residential and commercial development in the “non-priority” areas. Priority areas are those were large parcels of publically owned land exist and where strategic public investment is recommended in the short term. The non-priority areas include all other land east of I-95 between Oregon and Allegheny avenues.

Three priority areas were identified: Washington Avenue area, Penn’s Landing, and the Spring Garden Street area. The primary recommendation for the property between Washington Avenue and Tasker Street is a major new residential neighborhood, organized in mid-rise buildings. Penn’s Landing would continue to support large-scale civic functions, but would also accommodate new residential and retail development. In the Spring Garden area, the Festival Pier site would be redeveloped into a compact, mixed-use residential community that would include restaurants and retail activities and also accommodate public events. North of Spring Garden Street, the irregularly shaped local street network would be maintained and continued further south, creating small blocks for residential development. In total, the priority areas would see an additional 6,795 residents and 3,707 jobs by 2040, as summarized in the table below.

Table 1. Priority Area Population and Employment Forecasts

Priority Area	2010 Population	New Population	2040 Population	2010 Employment	New Employment	2040 Employment
Washington Ave	796	2,226	3,022	1,906	458	2,870
Penn’s Landing	1,169	768	1,937	1,985	710	2,967
Spring Garden St	4,824	3,801	8,625	4,687	2,539	5,617
Priority Area Total	6,789	6,795	13,584	8,578	3,707	11,455

All three land use alternatives assumed the same development in the priority areas, but different mixes of new residential and commercial development in the non-priority areas. Land Use Alternative 1 includes moderate growth in both population and employment. Alternative 2 includes much higher population growth, but the same employment as Alternative 1 while Alternative 3 includes much higher employment growth, but the same population growth as Alternative 1. For the purposes of this study, the 2040 population and employment forecasts for the non-priority areas for the three land use alternatives shown in Table 2. Outside of the study area, DVRPC’s Board adopted long range population and employment estimates were retained.

Table 2. Non-Priority Area Population and Employment Forecasts

Land Use Alternative	2010 Population	New Population	2040 Population	2010 Employment	New Employment	2040 Employment
Alternative 1	64,181	7,213	71,394	56,123	9,129	65,252
Alternative 2	64,181	14,427	78,608	56,123	9,129	65,252
Alternative 3	64,181	7,213	71,394	56,123	16,262	72,385

Future Year Scenarios

The project scope allowed for the evaluation of six 2040 future year scenarios. These scenarios were created by combining the various transportation and land use alternatives discussed above. The elements of each scenario were determined by a steering committee comprised of members from DRWC, Septa, PCPC, and DVRPC, and are shown in Table 3.

Table 3. 2040 Scenarios

2040 Scenario	Transportation Alternative	Land Use Alternative
1	1	1
2	2	1
3	1	2
4	2	2
5	3	2
6	2	3

DVRPC TRAVEL FORECASTING PROCESS

Travel forecasts for this study were conducted using DVRPC's most recent travel demand model TIM2.1 (Transportation Improvement Model version 2.1). TIM2.1 is a traditional four-step, trip-based model built on PTV's VISUM software platform. The model includes representations of the highway and public transit systems in DVRPC's nine member counties plus an extended area of 16 counties (where a less detailed transportation network is modeled) in Pennsylvania, New Jersey, Delaware, and Maryland, immediately surrounding the DVRPC region. The transit network represents operational characteristics of the regional transit system including route alignment, stop locations, service schedules, and fare information.

TIM2.1 follows the traditional steps of trip generation, trip distribution, modal split, and traffic assignment. However, an iterative feedback loop is employed from traffic assignment to the trip distribution step. The feedback loop ensures that the congestion levels used by the models when determining trip origins and destinations are equivalent to those that result from the traffic assignment step. Additionally, the iterative model structure allows trip making patterns to change in response to changes in traffic patterns, congestion levels, and changes to the transportation system.

TIM2.1 is disaggregated into four time periods: AM peak (6 AM to 10 AM), midday (10 AM to 3 PM), PM peak (3 PM to 7 PM), and evening (7 PM to 6 AM). This disaggregation begins in trip generation, where factors are used to separate daily trips into the individual time periods. TIM2.1 then utilizes completely separate model chains for AM peak, midday, PM peak, and evening travel simulation runs. Time-of-day sensitive inputs to the models, such as highway capacities and transit service levels, are disaggregated to be reflective of time-period-specific conditions.

Trip Generation

The trip generation module uses both socio-economic and location attributes to estimate the magnitude of travel demand for any given geographic area. Base year estimates and future year forecasts of population, households by income, employment by industry, land use, retail density, and many other variables are used to determine the number of trips produced by and attracted to small areas known as transportation analysis zones or TAZs. These trips are calculated for several trip purposes on the basis of trip rates applied to the zonal estimates of demographic and employment data. Trip purposes include work, shopping, school/university, and other non-work trips, light and heavy truck trips, and taxi trips.

Trip Distribution

Trip distribution is the process by which the zonal trip ends established in the trip generation analysis are linked together to form origin-destination patterns in a trip table format. AM peak, midday, PM peak, and evening trip ends are distributed separately based on a set of impedance calculations that consider the time and cost of travel. Separate distribution models are applied at the zonal level for each trip purpose.

Modal Split

The modal split model is also run separately for each time period. The modal split module calculates the fraction of each TAZ-to-TAZ cell in the trip table that should be allocated to transit, and then assigns the residual to the highway side. The choice between highway and transit usage is made on the basis of comparative cost, travel time, and frequency of service, with other aspects of modal choice being used to

modify this basic relationship. In general, the better the transit service, the higher the fraction assigned to transit, although trip purpose and auto ownership also affect the allocation. The model further divides highway trips into auto drivers and passengers.

Highway Assignment

For highway trips, the final step in the simulation process is the assignment of vehicle trips to the highway network representative of the alternative being modeled. For AM, midday, PM, and evening travel, the assignment model produces the future traffic volumes for individual highway links that are required for the evaluation of each alternative. The regional nature of the highway network and trip table underlying the assignment process allows the diversion of travel into and through the study area to various points of entry and exit in response to the changes made to the transportation system.

Highway trips are assigned to the network representative of a given alternative by determining the best (minimum time) route through the highway network for each origin-destination pair, and then allocating highway travel to the facilities along that route. This assignment model is "capacity restrained," which means that congestion levels are considered when determining the best route. An iterative equilibrium assignment method is used to implement the capacity constraint. When the assignment and associated trip table reach equilibrium, no path significantly faster than the one actually assigned for each trip can be found through the network, given the capacity restrained travel times on each link.

Transit Assignment

After equilibrium is achieved, the transit trip tables are assigned to the transit network to produce link and route passenger volumes. The transit person trips produced by the modal split model are "linked," which means that they do not include any transfers that occur either between transit trips or between auto approaches and transit lines. The transit assignment procedure accomplishes two major tasks. First, the transit trips are "unlinked" to include transfers, and second, the unlinked transit trips are associated with specific transit facilities to produce link, line, and station volumes. These tasks are accomplished simultaneously within the transit assignment model, which assigns the transit trip matrix to minimum impedance paths built through the transit network. There is no capacity-restraining procedure in the transit assignment model.

RESULTS

For each of the 2040 future year scenarios, the inputs to the TIM2.1 model were modified to reflect the relevant zonal demographic and employment estimates as well as the necessary changes to the highway and transit networks. The model was then executed with those inputs and the changes in highway volume and transit ridership from a 2010 base year were tabulated and analyzed. All of the results presented in this section are for an average annual weekday.

Travel forecasting models are designed to provide the most likely future travel patterns, traffic volumes, and transit ridership indicative of the model inputs. Travel forecasts are highly influenced by the future transportation network and projected future land use, population, and employment. When these projections are met, travel model outputs generally fall within 15 percent of the actual, future values.

Unforeseen changes in the national and regional economies and other market forces can have a profound effect on future land use and therefore travel patterns. The TIM2.1 travel model assumes that household income, transit fares, parking charges, tolls, and other auto operating costs will all increase at approximately the same rate thru 2040. Unanticipated policy changes that heavily influence one or more of these variables can cause the margin of error in the traffic forecasts to increase.

Transit Ridership Results

Transit ridership changes were evaluated for 14 SEPTA bus lines whose service areas intersected with the Central Delaware Waterfront study area. In addition, the boarding volumes at some rail stations were also included in the analysis. The selected stations were those most likely to be impacted by one or more of the transportation alternatives. They include the Market-Frankford Subway-Elevated (MFL) line stations between 15th Street and Girard; the Broad Street Subway's (BSS) Spring Garden, Chinatown, and 8th & Market stations; and the PATCO stations from 15-16th & Locust to 8th & Market.

Table 4 provides the transit ridership results for all six 2040 scenarios along with comparisons to the 2010 base year counted volumes. All scenarios have significantly increased ridership on the bus lines that serve Penn's Landing and the waterfront area. These increases range from 14,100 to 16,800 riders per day, which is 12.5 to 14.9 percent higher than the current total ridership of 13,100. The Route 42 bus increases by between 1,400 and 2,400 daily riders above current levels, while the route 48 increases by 1,100 to 1,800 riders per day. Scenarios 2 and 4, which provide a dedicated bus-only lane along Columbus Boulevard, have 900 more daily riders on the routes 42 and 48 buses than their corresponding scenario with the same land use, but no bus only lane. Most of this additional ridership occurs on the route 42.

The light rail line in Scenario 5 carries 6,400 riders per day in 2040. When this rail line ridership is included with the bus lines serving Penn's Landing and the Waterfront, the total ridership is much higher than the other scenarios with Land Use Alternative 2, even though some former bus riders will divert to the rail line. It is 4,500 riders per day higher than the transportation alternative with bus-only lanes and 5,400 riders per day higher than the alternative that extends the routes 42 and 48 buses in mixed traffic.

There is less difference in rail station boardings among the six scenarios, compared to the bus line ridership. Total boardings on the MFL, BSS, and PATCO are between 13,400 and 14,800 riders per day higher than the current volume, which represent increases of 14.5 to 16.1 percent. Most of the difference in rail station boardings among the scenarios occurs at the Market Frankford Line stations, especially its 2nd Street station. The highest number of boardings at this station, 4,000 per day under scenarios 3 and 4, are 600 riders higher than the Scenario 5 value. No other station has ridership differences greater than 200 riders per day among the six scenarios.

Land Use Alternative 2 has 7,200 additional residents in the study area than Land Use Alternative 1. Accordingly, the scenarios that include Land Use Alternative 2 have higher transit ridership than those with Land Use Alternative 1, by 700 to 900 additional bus riders per day. However, rail station boardings decrease slightly, by 100 to 200 per day. Land Use Alternative 3 has the same population as Land Use Alternative 1, but 7,100 more jobs. Although Scenario 6, with Land Use Alternative 3 has fewer bus riders than Scenario 2, with Land Use Alternative 1 (both scenarios have Transportation Alternative 2), Scenario 6 has 1,200

additional daily rail station boardings. The largest differences occur at the MFL's Spring Garden and 5th Street stations. Comparing Scenario 6 to Scenario 4, which have the same transportation alternative but land use alternatives 3 and 2, respectively, shows that additional population along the waterfront results in higher transit ridership than an equal amount of additional jobs.

Table 4. 2040 Transit Ridership Forecast Results

Transit Facility	Counted	Scenario 1	Current - 2040		Scenario 2	Current - 2040		Scenario 3	Current - 2040		Scenario 4	Current - 2040		Scenario 5	Current - 2040		Scenario 6	Current - 2040	
	Ridership	Ridership	Diff.	Pct.	Ridership	Diff.	Pct.	Ridership	Diff.	Pct.	Ridership	Diff.	Pct.	Ridership	Diff.	Pct.	Ridership	Diff.	Pct.
<i>Transit Lines</i>																			
12 Kingsessing to Society Hill	2,900	3,200	300	10.3%	3,200	300	10.3%	3,200	300	10.3%	3,200	300	10.3%	3,200	300	10.3%	3,100	200	6.9%
17 South Phila to Penn's Landing	13,400	14,700	1,300	9.7%	14,700	1,300	9.7%	14,800	1,400	10.4%	14,800	1,400	10.4%	14,900	1,500	11.2%	14,600	1,200	9.0%
21 69th St Terminal To Penn's Landing	8,700	9,200	500	5.7%	9,200	500	5.7%	9,300	600	6.9%	9,300	600	6.9%	9,400	700	8.0%	9,100	400	4.6%
25 Columbus Commons to FTC	4,300	6,000	1,700	39.5%	5,900	1,600	37.2%	6,200	1,900	44.2%	6,100	1,800	41.9%	5,400	1,100	25.6%	5,900	1,600	37.2%
33 Tioga To Penn's Landing	15,700	18,300	2,600	16.6%	18,300	2,600	16.6%	18,400	2,700	17.2%	18,500	2,800	17.8%	18,400	2,700	17.2%	18,300	2,600	16.6%
40 West Park To Society Hill	5,500	6,000	500	9.1%	6,000	500	9.1%	6,100	600	10.9%	6,100	600	10.9%	6,200	700	12.7%	6,000	500	9.1%
42 Wycombe/West Phila. To Penn's Land.	11,500	12,900	1,400	12.2%	13,700	2,200	19.1%	13,100	1,600	13.9%	13,900	2,400	20.9%	12,900	1,400	12.2%	13,700	2,200	19.1%
43 Parkside To Northern Liberty & Kens	3,200	3,800	600	18.8%	3,800	600	18.8%	3,900	700	21.9%	3,900	700	21.9%	3,900	700	21.9%	3,800	600	18.8%
48 North Phila. To Penn's Landing	8,700	10,300	1,600	18.4%	10,400	1,700	19.5%	10,400	1,700	19.5%	10,500	1,800	20.7%	9,800	1,100	12.6%	10,400	1,700	19.5%
5 Penn's Landing to FTC via Frankford	4,600	5,300	700	15.2%	5,300	700	15.2%	5,500	900	19.6%	5,500	900	19.6%	5,500	900	19.6%	5,300	700	15.2%
57 South Phila to Fern Rock Trans Cent	10,800	11,900	1,100	10.2%	11,800	1,000	9.3%	12,400	1,600	14.8%	12,300	1,500	13.9%	12,300	1,500	13.9%	11,900	1,100	10.2%
64 Parkside to Pier 70 via Washington	5,400	5,800	400	7.4%	5,700	300	5.6%	5,800	400	7.4%	5,800	400	7.4%	6,100	700	13.0%	5,600	200	3.7%
7 Strawberry Mansion to Pier 70	4,900	5,400	500	10.2%	5,500	600	12.2%	5,500	600	12.2%	5,500	600	12.2%	5,500	600	12.2%	5,400	500	10.2%
G South Phila to Overbrook & Lankanau	13,500	14,400	900	6.7%	14,400	900	6.7%	14,400	900	6.7%	14,500	1,000	7.4%	14,500	1,000	7.4%	14,300	800	5.9%
Delaware Ave Light Rail														6,400	6,400				
Transit Line Subtotal	113,100	127,200	14,100	12.5%	127,900	14,800	13.1%	129,000	15,900	14.1%	129,900	16,800	14.9%	134,400	21,300	18.8%	127,400	14,300	12.6%
<i>Market-Frankford Line Rail Stations</i>																			
Girard Station	3,600	4,600	1,000	27.8%	4,600	1,000	27.8%	4,800	1,200	33.3%	4,800	1,200	33.3%	4,500	900	25.0%	4,600	1,000	27.8%
Spring Garden Station	2,700	5,100	2,400	88.9%	5,100	2,400	88.9%	5,300	2,600	96.3%	5,300	2,600	96.3%	5,100	2,400	88.9%	5,400	2,700	100.0%
2nd Street Station	2,600	3,800	1,200	46.2%	3,800	1,200	46.2%	4,000	1,400	53.8%	4,000	1,400	53.8%	3,400	800	30.8%	3,900	1,300	50.0%
5th Street Station	4,000	5,300	1,300	32.5%	5,300	1,300	32.5%	5,500	1,500	37.5%	5,500	1,500	37.5%	5,400	1,400	35.0%	5,500	1,500	37.5%
8th Street Station	9,800	10,500	700	7.1%	10,500	700	7.1%	10,600	800	8.2%	10,600	800	8.2%	10,500	700	7.1%	10,600	800	8.2%
11th Street Station	9,000	9,900	900	10.0%	9,900	900	10.0%	9,900	900	10.0%	9,900	900	10.0%	9,900	900	10.0%	10,000	1,000	11.1%
13th Street Station	5,100	5,500	400	7.8%	5,500	400	7.8%	5,500	400	7.8%	5,500	400	7.8%	5,500	400	7.8%	5,500	400	7.8%
15th Street Station	29,100	31,600	2,500	8.6%	31,600	2,500	8.6%	31,800	2,700	9.3%	31,800	2,700	9.3%	31,800	2,700	9.3%	31,600	2,500	8.6%
Market Frankford Line Station Subtotal	65,900	76,300	10,400	15.8%	76,300	10,400	15.8%	77,400	11,500	17.5%	77,400	11,500	17.5%	76,100	10,200	15.5%	77,100	11,200	17.0%
<i>Broad Street Subway Stations</i>																			
Chinatown Station	200	300	100	50.0%	300	100	50.0%	300	100	50.0%	300	100	50.0%	300	100	50.0%	300	100	50.0%
8th & Market Streets Station	3,000	3,400	400	13.3%	3,400	400	13.3%	3,500	500	16.7%	3,500	500	16.7%	3,400	400	13.3%	3,500	500	16.7%
Spring Garden Station	7,400	9,000	1,600	21.6%	9,000	1,600	21.6%	9,200	1,800	24.3%	9,200	1,800	24.3%	9,000	1,600	21.6%	9,000	1,600	21.6%
Broad-Ridge Spur Station Subtotal	10,600	12,700	2,100	19.8%	12,700	2,100	19.8%	13,000	2,400	22.6%	13,000	2,400	22.6%	12,700	2,100	19.8%	12,800	2,200	20.8%
<i>PATCO Speedline Stations</i>																			
15-16th & Locust Streets Station	6,600	6,900	300	4.5%	6,900	300	4.5%	6,900	300	4.5%	6,900	300	4.5%	7,000	400	6.1%	7,000	400	6.1%
12-13th & Locust Streets Station	1,700	1,800	100	5.9%	1,800	100	5.9%	1,800	100	5.9%	1,800	100	5.9%	1,800	100	5.9%	1,800	100	5.9%
9-10th & Locust Streets Station	1,600	1,600	0	0.0%	1,600	0	0.0%	1,600	0	0.0%	1,600	0	0.0%	1,600	0	0.0%	1,700	100	6.3%
8th & Market Streets Station	5,700	6,300	600	10.5%	6,200	500	8.8%	6,200	500	8.8%	6,200	500	8.8%	6,300	600	10.5%	6,300	600	10.5%
PATCO Station Subtotal	15,600	16,600	1,000	6.4%	16,500	900	5.8%	16,500	900	5.8%	16,500	900	5.8%	16,700	1,100	7.1%	16,800	1,200	7.5%
All Area Rail Station Totals	92,100	105,600	13,500	14.7%	105,500	13,400	14.5%	106,900	14,800	16.1%	106,900	14,800	16.1%	105,500	13,400	14.5%	106,700	14,600	15.9%
total Transit Line and Rail Station Ridership	205,200	232,800	27,600	13.5%	233,400	28,200	13.7%	235,900	30,700	15.0%	236,800	31,600	15.4%	239,900	34,700	16.9%	234,100	28,900	14.1%

Daily Highway Traffic Volume Results

Average weekday traffic volumes were evaluated along Columbus Boulevard, Interstate 95, and several of their crossing streets. Like the transit forecasts, 2040 volumes for each of the six scenarios are compared to a current, counted volume. A summary of the current and 2040 traffic volumes under each scenario is provided in Table 5.

Daily traffic volumes vary significantly along the length of Columbus Boulevard. The lowest volume in the study area, 17,700 vehicles per day (vpd), occurs at the far southern end, just south of Pier 70. As one proceeds north, volumes steadily increase until Dickinson Street, where volumes reach 39,000 vpd. They remain in the mid- to upper 30,000 range until reaching the I-95 northbound off-ramp. Between this ramp and Washington Avenue the daily volume is 46,100. This value increases to 51,200 north of Washington Avenue, and reaches 60,200 vpd between Washington Avenue and the I-95 on- and off-ramps near the Dockside apartment building (commonly referred to as the “slide-under” ramps). From this point north, volumes steadily decrease until one reaches Market Street, where 29,000 vpd are observed. At the northern end of the study area, between Callowhill and Beach streets, daily volumes are in the low to mid-20,000 range.

Between Snyder Avenue and Reed Street, daily traffic volumes on Columbus Boulevard increase significantly under all of the 2040 scenarios compared to the current counts, by between 5,300 and 16,800 vpd. Large increases also occur between Reed Street and Washington Avenue under the transportation alternatives that extend the 42 and 48 bus routes in mixed traffic, by between 7,900 and 11,400 vpd. The alternatives that provide a dedicated bus lane, or rail service exhibit much smaller increases along this section of Columbus Boulevard, increasing by only 2,500 to 7,300 vpd. Similar patterns hold between Washington Avenue and Dock Street, except that in some cases where a travel lane is removed from Columbus Boulevard, 2040 traffic volumes are lower than the current counted volumes. This is also the case north of Spring Garden Street. However, traffic volumes increase between Dock Street and Spring Garden Street under all scenarios with enhanced bus service, by 2,000 to 5,700 vpd. Scenario 5, which provides light rail service, sees lower volumes between Dock and Chestnut streets and Callowhill and Spring Garden streets, and only 500 to 700 additional vehicles per day between Chestnut and Race streets.

Traffic volumes along I-95 under the various 2040 scenarios are between 2.4 and 9.3 percent higher than current volumes, while individual ramps are at most 700 vpd higher. Although Columbus Boulevard traffic volumes vary considerably among the various scenarios, the daily traffic volumes on the adjacent I-95 as well as the arterials that intersect with Columbus Boulevard, vary much less. Interstate 95 volumes are at most 1,000 vehicles per day per direction different between the scenarios with the highest and lowest volume. Traffic volumes on intersecting arterials under the 2040 scenarios range from 400 vpd lower than current levels to 5,800 vpd higher. The largest increases tend to occur at Spring Garden and Lombard streets and at Oregon, Snyder, and Washington avenues. Large increases also occur on Lombard and South streets, although these streets do not have intersections with Columbus Boulevard.

Peak Hour Intersection Forecasts and Levels-of-Service

To evaluate the impacts the proposed scenarios would have on automobile traffic, congestion, and delay along Columbus Boulevard, eight key intersections were analyzed. The analysis included developing peak hour forecasts of individual intersection turning movements, optimizing the signal timing plans, and calculating intersection delay per vehicle and the corresponding level of service for current conditions and each of the 2040 scenarios. While there does not tend to be a significant amount of congestion along Columbus Boulevard during traditional peak hours, there are locations that present bottlenecks during weekends, game days at the Sports Complex, and other special events. These bottlenecks can result in long queues that spill back to upstream intersections, affecting their operations as well. For the purposes of this study, the key intersections were evaluated for the Friday afternoon peak hour condition. This hour was chosen because it represents the condition with the greatest, regularly recurring congestion, while avoiding the worst-case conditions. The eight key intersections that were evaluated are:

- Columbus Boulevard and Frankford Avenue,
- Columbus Boulevard and Spring Garden Street,
- Columbus Boulevard and Callowhill Street,
- Columbus Boulevard and the I-95 “slide under” on- and off-ramps,
- Columbus Boulevard and Washington Avenue,
- Columbus Boulevard and the I-95 northbound off-ramp near the Riverview Shopping Center,
- Columbus Boulevard and Reed Street, and
- Columbus Boulevard and Tasker Street.

For each intersection, figures displaying the counted Friday afternoon peak hour turning volumes and 2040 turning movement forecasts for each scenario are provided in the Appendix. Also included on the figures is a graphic depicting the lane configuration of each approach to the intersection. The graphic shows the number of thru lanes, left- and right-turn pockets, and shared thru-and-right and thru-and-left lanes. Finally, the figure includes the average control-delay experienced by automobiles traveling through the intersection and the corresponding overall intersection level-of-service (LOS), as determined by the methods in the *2010 Highway Capacity Manual*.

Currently, the Columbus Boulevard intersections with the I-95 slide-under ramps and Washington Avenue operate with level of service “E” during the Friday afternoon peak hour, with average vehicle delays of 65.6 and 57.7 seconds, respectively. The Callowhill Street intersection operates with LOS A, and the Spring Garden Street intersection operates with LOS C. All of the other intersections currently operate with LOS B. Thus, most of the existing congestion along Columbus Boulevard originates at the Washington Avenue and I-95 slide-under ramps.

In 2040, the I-95 slide-under ramps intersection operates at LOS F under all scenarios, except Scenario 3, where it operates at LOS E, with an average delay of 75.3 seconds. The delay for the other scenarios ranges from 76.1 to 104.1 seconds per vehicle, with the highest delay occurring under Scenario 6. The Washington Avenue intersection operates at LOS F under all future year scenarios, with average delay ranging from 74.9 to 194.6 seconds. Again, the lowest delay occurs under Scenario 3 and the highest occurs under Scenario 6. In fact, for all eight intersections, the highest delay occurs under Scenario 6.

The Frankford Avenue intersection operates at LOS B under all six future year scenarios, while the Spring Garden Street and Callowhill Street intersections operate at LOS C and LOS A, respectively, under all 2040 scenarios. The Columbus Boulevard and I-95 northbound off-ramp intersection operates at either LOS B or LOS C in 2040, with average vehicle delays ranging from 17.2 to 26.9 seconds. The Reed Street intersection operates with LOS B or LOS C under scenarios 2 thru 5, but with LOS D under Scenario 6, where the average delay per vehicle is 38.2 seconds. The Tasker Street intersection operates with LOS B under scenarios 2 thru 5, and LOS C under Scenario 6.

For all future year scenarios, the Washington Avenue and I-95 slide-under ramps intersections will continue to cause the most delay and congestion along Columbus Boulevard. Some of this delay could be mitigated by providing dual left-turn lanes from Washington Avenue to northbound Columbus Boulevard and a dedicated right-turn lane from Columbus Boulevard to the I-95 slide-under on-ramp. Under such conditions, the slide-under intersection would operate at LOS E during all six 2040 scenarios, with delays ranging from 73.3 to 79.1 seconds per vehicle, which is slightly higher than its current delay during the Friday afternoon peak hour. Operations at the Washington Avenue intersection would only be significantly improved under Scenario 3, where delay would average 52.3 seconds per vehicle. The other scenarios would still operate under LOS F, with Scenario 6 averaging 184.8 seconds per vehicle.

CONCLUSION

The Columbus Boulevard corridor could accommodate large increases in residential and/or commercial development without significantly affecting vehicular delay or congestion, provided some form of enhanced transit service were provided. This service could entail the extension of existing bus routes, either in mixed traffic or with a dedicated lane, or a light rail service serving the Boulevard with a connection to Center City Philadelphia. Although the light rail service would attract the highest number of additional transit riders, all of these alternatives would result in similar operations at most of the key intersections along Columbus Boulevard under scenarios 2 thru 5. These scenarios include 12,800 more jobs and from 14,000 to 21,200 more residents than currently exist along the waterfront.

Scenario 6 would have the greatest potential to increase delay and congestion for traffic on Columbus Boulevard. This scenario includes an additional 20,000 jobs and 14,000 residents along the waterfront compared to current levels and the conversion of one thru lane per direction on Columbus Boulevard into a dedicated bus only lane.

APPENDIX B: LIGHT RAIL TRANSIT ON DELAWARE AVENUE MEETING #2 SUMMARY



190 N INDEPENDENCE MALL WEST
8TH FLOOR
PHILADELPHIA, PA 19106-1520
P: 215-592-1800
F: 215-592-9125
www.dvrpc.org

memorandum

DATE: Friday, January 6, 2017

TO: LRT on Delaware Avenue Stakeholders

FROM: Betsy Mastaglio, DVRPC

SUBJECT: LRT on Delaware Avenue Stakeholder Meeting #2 Summary

On Friday, October 21st, 2016 LRT on Delaware Avenue stakeholders met at DVRPC's office to discuss light rail service on Delaware Avenue as part of Trolley Modernization. The agenda was as follows:

- Project Overview
 - DVRPC's LRT on Delaware Avenue project overview, including needs and opportunities for the corridor, Betsy Mastaglio
 - PennDOT's Sector B project overview, Elaine Elbich
 - SEPTA's Route 15 service update, Dan Nemiroff
- Breakout groups (4 facilitated groups) to discuss:
 - Preferred Alignment
 - Stations
 - Termini
 - Connection to MFL
- Report Back/Closing

Prevailing theme of breakout sessions and reporting back. There's an *immediate* need to increase transit effectiveness along Delaware Avenue in order to catalyze development that supports a multimodal waterfront vision. With the details of SEPTA's modern trolley vehicle fleet yet unknown, initial short term improvements that improve bus frequency, and accessibility via transfer options, can work toward making transit more competitive with auto use for existing land uses and pending development. Additional transit investments can be implemented incrementally to meet the demand from new development along Delaware Avenue and increased ridership. Long term, the potential for I-95 Sector B planning to minimize the gap between Center City and the waterfront and to transfer considerable auto and truck volumes from Delaware Avenue to I-95 will allow for greater (more impactful) opportunities to reimagine the Delaware Avenue right of way to support a multimodal waterfront vision. For transit, this might include, a dedicated right-of-way for bus or rail running on short headways and operating at longer spans of weekday and weekend hours should population and employment along Delaware Avenue meet recommended targets.

I. Project Overview

Introduction (DVRPC)

The DVRPC project overview reviewed the nature of the study to examine the possibility of near-term light rail options along the Delaware Avenue corridor. A light rail extension of the Route 15 trolley (more exclusive right-of-way; less frequent stops; more frequent headways) could provide more convenient transit service between the Frankford loop to the north, and to the south, with a terminus in the vicinity of Pier 70 or Columbus Commons. Currently, SEPTA's Route 25 bus serves this area between Front Street and the Delaware River.

I-95 (PennDOT)

Sector B of the I-95 reconstruction project extends from roughly Race Street to Broad Street. Priorities for Sector B will include waterfront connectivity and reconfiguration of confusing ramps (i.e. ramps in the Stadium area). The reconstruction of Sector B presents opportunities to rethink the placement and configuration of interchanges and pedestrian connections, as well as new opportunities for trails, better bike and pedestrian facilities, and green infrastructure.

The width of I-95 in Sector B is approximately 200' in this section; Columbus Boulevard runs alongside at a width of about 100'. There is already some consideration among the project team of creating Columbus Boulevard "express lanes" inside the current I-95 footprint, to relocate through-traffic on Columbus Boulevard to I-95 with the aim of making Delaware Avenue more multimodal. Community outreach will be a critical component of PennDOT's I-95 project.

Route 15 (SEPTA)

In the northern section of the Delaware Avenue LRT study area, SEPTA operated trolley service from 63rd and Girard to the Richmond Street – Westmoreland Loop. Service between Girard and Richmond Street is temporarily on bus substitution during I-95 reconstruction and the trolley currently turns around at the Frankford loop. Service runs approximately every 9 minutes during peak times and every 15-20 minutes during nonpeak and weekend hours. When service resumes to Richmond Street, stops will likely be consolidated to Cumberland Street, Lehigh Avenue, and Cambria Street. Service along Richmond Street is much lower than on Girard Avenue and therefore probably will not require each run of the Route 15 to continue to Westmoreland loop.

Freight integration (DVRPC)

Many past studies have emphasized a median alignment which is on active Conrail track from approximately Lombard Street to points south. Frequency of freight rail traffic increases to the south near Pier 70 and then is significantly busy near Oregon Avenue where the Packer Avenue Marine Terminal is located. Freight activity proximate to the Packer Avenue Terminal is anticipated to increase due to planned expansion at the Southport terminal and following the dredging of the Delaware River.

Passenger and freight rail sharing south of Lombard Street would require negotiations and use restrictions between the Port Authority of Philadelphia, Conrail, the Philadelphia Beltline Railroad, SEPTA, DRWC, and the City of Philadelphia. Due to the significant time that negotiations, design, and construction could require, and the emphasis on a short-term planning horizon, the DVRPC project team recommended considering three potential transit alignments that would limit any complex negotiations with Conrail or interplay with FRA regulations.

Suggested LRT alignments for break out groups (DVRPC)

- Side – Mixed traffic
- Side – Exclusive transit lane
- East Side bi-directional exclusive transit lane

Needs and opportunities of suggested LRT alignment and impacts to other modes (DVRPC)

Auto: The side mixed traffic alternative would maintain the same level of service for auto travel. The two exclusive lane alternatives would require dedicating one lane of traffic in each direction to transit.

Bicycle and Pedestrians: Both curbside alternatives would connect passengers directly to adjacent sidewalks similar to existing bus stops. The curbside alternatives would require some negotiation of cyclists navigating around boarding platforms. Because the east side bi-directional alternative would require extensively redistributing the right-of-way, it could conceivably separate transit facilities from both pedestrian and bicyclist facilities, reducing the number of conflict areas between modes.

Transit: The side mixed traffic alternative would subject transit to the same delays experienced by cars, now and with any future increase, or decrease, in auto travel. The exclusive lane alternatives would realize running time savings from the elimination of auto congestion and shield that savings from any possible future capacity issues.

Freight: Freight rail sidings cross the east, northbound travel lanes of Delaware Avenue.¹ The curbside alternatives would bear the coordination and potential conflict of crossing those tracks in the northbound direction. The east side, bi-directional alternative would have both directions crossing the freight rail sidings.

Land Use Access: Exclusive lane alternatives would reduce vehicular access to driveways on the east side of the corridor. Each alternative could reduce on-street parking.

Complexity: The cost and complexity of coordination and design increase with the level of interventions—side mixed ▶ side exclusive ▶ east side bi-directional.

II. Breakout groups

Breakout groups came virtually to unanimous agreement on some aspects of LRT on Delaware Avenue, while reactions to some aspects varied, leaving them unresolved.

Breakout groups *agreed* that:

- The Waterfront Vision depends upon high quality bicycle, pedestrian and transit access along Delaware Avenue.
- Due to the perceived immediacy of development activity along Delaware Avenue, and the longer planning horizon of trolley modernization and I-95 reconstruction, there are two logical planning horizons for making Delaware Avenue more multimodal-friendly: within the next 10 years and within the next 15 to 40 years.

¹ In addition to the frequent rail sidings on the northbound travel lanes, there are three west-side/southbound sidings south of Morris Street.

- A strong connection between Center City and the waterfront needs to exist at Market Street.

Breakout groups *left unresolved, or disagreed on*:

- The alignment and need for a dedicated right-of-way
- Service termini
- Station spacing and locations
- Project phasing
- Single- or double-ended LRT vehicles
- How and where to connect to the MFL

The following is a summary of the four breakout groups' discussions. For an individualized summary of each group, see *Delaware Avenue 10_21 Breakout Group Summary*, pages 8-9.

Goals: When asked to rate the following statements in accordance with their vision for the corridor, stakeholder groups largely agreed to the following priority:

1 Urban Waterfront Destination: Delaware Avenue should be the front door to a stellar mixed use waterfront neighborhood with high quality bicycle, pedestrian, and transit access along it. Industrial uses, freight access, and vehicle throughput should be de-emphasized north of Washington Avenue.

2 A Delicate Balance: Delaware Avenue is an important mobility spine and economic engine because of its mobility for cars, prime location and access for industrial and freight uses, and select locations for riverside commercial and recreational uses.

3 Mobility and Access: Delaware Avenue should provide vital redundancy to I-95, immediate access between I-95 and a couple of key destinations along the corridor (ie. Pier 70 and Penn's Landing), and secondary access to the sports complexes.

Planning Year: Stakeholders discussed two different planning horizons: one near-term (2025 or sooner) and another that correlates to PennDOT's planning, design, and construction for I-95 (2035-2045).

Alignment: Undecided. Each break out group chose a different alignment with one group planning so far out into the future that the alignment wasn't discussed.

Termini and stations: Stakeholders named Frankford loop as the northern terminus. Groups identified a phasing for the southern terminus. A phased implementation might consider a short term southern terminus close to Penn's Landing, a long term terminus in the vicinity of Pier 70 or Columbus Commons and an ultimate terminus at the Navy Yard or Stadium district. Groups 2 and 3 discussed possible stations between termini.

Figure 1: Breakout Stations' Proposed Stations (Station locations in blue are agreed upon stations; Groups 1 and 4 did not identify station locations)

Group 2	Group 3	Notes
Frankford	Frankford	Northern terminus
Spring Garden	Spring Garden	
-	Race Street	
Market Street	Market Street	Connection to Center City
Spruce	Spruce	
-	South	
Christian	Christian	
Reed	Reed	1 st Phase southern terminus
Pier 70	Pier 70	2nd Phase southern terminus (option)
Columbus Commons	Columbus Commons	2nd Phase southern terminus (option)
Navy Yard/Stadium District (long term)	Navy Yard/Stadium District (long term)	3 rd Phase (ultimate) build out southern terminus

Vehicle: Depending on the alignment, frequency of service, and physical limits at termini, vehicles could be single- or double-ended. Single-ended vehicles would require a significant footprint with (2) 9'-wide trolley lanes but would match the rest of the vehicle fleet and allow for multiple vehicles to run at once and have higher frequency of service. Double-ended vehicles would be unique to the fleet, and require longer headways but have a minimal footprint ((1) 9'-wide trolley lane) along its route and at termini.

Connections to the Market Frankford Line: Stakeholders see a connection to Market Street—both to the MFL and to bus service—as a critical link bridging Center City with the waterfront. While the Central Delaware Waterfront Vision and the proposed cap over I-95 rely on a physical connection between Center City and the Waterfront over I-95 between Chestnut and Walnut Streets, the *transit* connection between Center City and waterfront destinations is at Market Street. A stop at Market Street would connect to several bus transfers and to the Market-Frankford line.

Strategies for shortening the distance to 2nd Street MFL station were identified through the use of stairs, ramps, and elevators. Break out groups sited this vertical transition both in the median of Delaware Avenue and connected to the ramps of Market and Chestnut Streets. One group considered the LRT vehicle ramping up from Delaware Avenue to an I-95 cap between Market and Chestnut Streets that would allow the vehicle to veer west to align a stop above the 2nd Street MFL station.

Just where this connection occurs will have a significant impact on the concentration of activity associated at the proposed stop, or transfer center. A station along the east side of Delaware Avenue concentrates activity along the waterfront and asks transfer passengers to walk two blocks plus 20 feet vertically to get up and over I-95. This location might also suggest that some bus service be extended east to the waterfront—essentially extending Center City directly to the waterfront. A station that is located proximate to the 2nd Street MFL station brings passengers away from the waterfront, and a linear transit service, into Center City. A station in the Delaware Avenue median or above I-95 concentrates activity in a third, neither immediately waterfront nor

Center City, location. This station and transfer location should be considered not only for the engineering and operational possibilities, but also as an opportunity to transition between Center City and Delaware Avenue, and as a critical public space for human interaction.

III. Opportunities (Reporting back) and next steps

Opportunities: A number of trends are occurring along Delaware Avenue that impact the use of transit both now and in the future. To realize the vision for the waterfront, these trends can be harnessed to support high quality transit and multimodal access along the corridor. The following table outlines the trends, opportunities, and possible strategies to support transportation alternatives for the waterfront vision. These trends—freight, vehicular traffic, coordination with I-95, waterfront development, and transit were discussed at the wrap up of Stakeholder Meeting #2. The Opportunities and Strategies in the matrix address initial recommendations that can be included in the report that respond to the trends identified during the reporting back discussion. See *Draft Opportunities Action Plan Matrix*, page 10.

Next Steps:

DVRPC will focus on the Opportunities Action Plan Matrix for stakeholders to initiate, or support, more convenient transit service along Delaware Avenue. Project next steps will focus on near-term bus capital and operations improvements and next on targets for augmenting service, scaled appropriately, as population, employment, and public open space and programming grow with development. To address long term opportunities, DVRPC will develop illustrative alternatives for a reimagined Delaware Avenue that defines the right-of-way to go along with the more land use-focused Waterfront Vision. These future conceptual alternatives will include accommodation of multimodal facilities, likely in the form of a road diet, for Delaware Avenue that can inform planning for, and be realized alongside, I-95 Sector B reconstruction.

To conclude the project*, the DVRPC team will complete the following tasks:

Task 1: Convene Septa, PennDOT and DRWC stakeholders to brainstorm short- and medium-term operational, capital, policy, and educational approaches to support more convenient transit service along Delaware Avenue starting with those identified in the Opportunities Action Plan Matrix, including:

- Changes to bus service, including coordination with on-going DVRPC's South Philly Transportation Center project.
- Developer, resident and employee education and policies that incentivize transit use.
- Discuss how to incrementally phase strategies, including the possibility of directing impact fees from developers toward transit.

Deliverable: Electronic delivery of memo outlining strategies to be reviewed by full stakeholder list

Winter 2017

Task 2: Create illustrative alternatives (either through plans, sections or sketches) for long-term (post I-95 reconstruction) Delaware Avenue waterfront vision that emphasizes multimodalism, likely in the form of a road diet. Suggestions for future coordination and planning analysis to support alternatives will be identified.

Deliverable: Electronic delivery of alternatives to be reviewed by full stakeholder list

Spring 2017

Task 3: Prepare draft and final reports summarizing project process and recommendations.


Deliverable: Draft and Final report publications
Spring-Summer 2017

*In response to the prevailing theme of stakeholders' concerns for the corridor expressed at the October 2016 meeting (see page 1), DVRPC will adapt the project tasks by replacing the modeling of future light rail ridership, with the identification of short and near term transit strategies and the conceptualization of a future Delaware Avenue right of way. For ridership, the report will refer to DVRPC's March 2015 *Central Delaware Waterfront Strategic Modeling Results memorandum* which examined bus in mixed traffic lanes, dedicated bus lanes, and dedicated light rail median lane under various land use scenarios as well as the modeling work DVRPC is conducting in support of the I-95 Sector B planning.

DELAWARE AVENUE 10_21 BREAKOUT GROUP SUMMARY

	Group 1	Group 2	Group 3	Group 4
Participants	Matt Gates, DVRPC Chris Puchalsky, DVRPC Betsy Mastaglio, DVRPC Byron Comati, SEPTA Michael Carroll, Streets Sara Patterson, MB (PennDOT cons.)	Amy Bernknopf, DVRPC Dan Nemiroff, SEPTA Trish Ellis, OTIS Fran Hanney, PennDOT	Jesse Buerk, DVRPC Jen Barr, SEPTA David Kanthor, PCPC Kyle Oszyczek, AECOM (PennDOT I-95 Sector B consultant)	Greg Krykewycz, DVRPC Carrie Sauer, DVRPC Steve D'Antonio, SEPTA Elaine Elbich, PennDOT Angie Dixon, OTIS Connie Bird, PWD(?) Karen Thompson, DRWC
Repeating group theme(s)	Physically and perceptually close connection to Center city was a primary goal of any transit service along Columbus Boulevard. 2 nd street suggested as the most important connection so as to not force northbound passengers out of direction.	The group was interested in getting transit mixed into the corridor to see how it would perform. As the new development occurs, adapt transit.	SEPTA felt strongly that it's premature to dismiss the median alternative. The Urban Waterfront Destination is the adopted vision and others probably shouldn't be considered. One suggestion was that a phased approach could work (to use the median alignment). Termini will require loops, or double-ended vehicles could be used to eliminate the need for loops.	This group viewed this project and timelines through the lens of opportunities afforded by I-95 reconstruction. Transit ideas focused on a southern branch of the Route 15, connections with the MFL at 2 nd Street, and dedicated but balanced runningway so project would benefit waterfront development as well as existing S. Philly neighborhoods.
Planning horizon year	2045, or later	Near-term 2025	2035	2035/2040 (linked with I95 timetable)
Vision preference 1. Mobility and Access 2. Urban Waterfront Destination 3. A Delicate Balance	2,3,1 Some discussion occurred on whether Urban Waterfront Destination or A Delicate Balance (2) was the most important. Nobody thought Mobility and Access (1).	1,3,2 Mobility and Access (1) for the near-term vision, and A Delicate Balance (3) for the far-term vision.	2, 3 (close 2 nd), 1	2, 1 (but context-appropriate/multimodal), 3
Alignment	Undecided. A dedicated lane with connection to Center City was far more important to group than location within r.o.w.	Mixed Traffic Alignment because of the near-term focus.	East Side Alignment, with the caveat that the median should still be considered. For east side, potential single track with double-sided cars.	Side exclusive, potentially shared with continuing bus service
Stations	Only discussed stop at Market Street.	The following stops were picked based on ridership and land uses: Spring Garden, Market Street, Spruce/Dock Street, Christian, and Reed Street.	(N to S): Frankford Ave., Spring Garden St., Race St., Market St., Spruce St., South St., Between Washington & Christian Streets, Reed St., Mifflin St. (entrance to Home Depot/Wal-Mart), Ikea entrance (Pier 70)	Not discussed
Northern Termini	Frankford Loop	Frankford Loop	Frankford Loop	Frankford loop
Southern Termini	Pier 70 and possibly beyond to Navy Yard	Pier 70 and possibly extended to the Navy Yard	Pier 70 – depends if you need a loop or use double-ended cars	Not discussed; possible future extension to Navy Yard
Service, Operations and connections to Route 15	<ul style="list-style-type: none"> Route 15 service splits at Girard and Frankford with alternating service between Richmond Street (north) and Delaware Avenue (south). Delaware Avenue service could alternate between service that swings west to 2nd Street and service that stays on Delaware Avenue. Delaware Avenue service could alternate between westbound along Girard Avenue and northbound along Richmond Street 	<ul style="list-style-type: none"> Active lane control weekends and off-peak between Pier 70 and Market Street Far-side stop at Christian so the location is also serving Washington Avenue well Between Market/Dock/Spruce streets determine if 2 or 3 stops are necessary by ridership demand Potential capacity for single track ROW between Market and Frankford 	Not discussed in depth. Double-ended car option was suggested as a way to roll out in phases, for example Frankford to South St. as a first phase while freight/I-95 issues are being figured out. Possibility of using I-95 "bathtub" was discussed, could potentially allow for express service to stadiums?	Discussed only in general terms as a southerly branch of Route 15 from Frankford Loop.

DELAWARE AVENUE 10_21 BREAKOUT GROUP SUMMARY

				
<p>Connections to MFL</p>	<p>Connection at 2nd street was considered crucial. Either:</p> <ul style="list-style-type: none"> • Passengers use a new pedestrian stair and elevator in the Columbus median to access the existing bridge with strong urban design to shorten the perception of it being super long. Service remains on Columbus. • LRT uses a ramp to access the existing bridge alongside a new capped I-95 section between Market and Chestnut (approx.) that physically connect Center city with the waterfront. • A flyover structure for LRT that would tie in to vertical circulation with the MFL platform at 2nd Street. 	<ul style="list-style-type: none"> • Connections at Frankford Loop and possibly Spring Garden 	<p>Discussed connections at Frankford Loop, Spring Garden, and Market Street. At Market, an elevator would likely be needed to get pedestrians from Del. Ave up to Market.</p>	<p>Direct connection at Girard Station for non-Center City oriented trips. Focus on 2nd Street for Center City trips. Stairs and ramp at northwest corner of Penns Landing bus loop are currently being rebuilt. The area within and surrounding the loop is envisioned for infill redevelopment, with the bus/street loop becoming an urban street for that development. This project will offer opportunities for new elevators and better connections with street level. In the meantime, the rebuilt stairs and ramp will help. Discussion also focused on Market Street bus connections available at 2nd/Market rather than just the MFL connection. Fast, very frequent bus service across (routes 17, 48, 33, etc.) would provide excellent connectivity to points west.</p>
<p>Other topics discussed</p>	<ul style="list-style-type: none"> • Some of the connections at Market Street required a single track, double-ended vehicle. • Vehicular capacity along Columbus Boulevard may be necessary during I-95 construction 	<ul style="list-style-type: none"> • Lots of discussion regarding that the roadway currently is at capacity and therefore any near-term interventions would need to be mixed traffic • With the possibility of the new ramp for I-95, there may be additional capacity for a dedicated transit ROW 	<ul style="list-style-type: none"> • There are potentially many opportunities that could open up from the I-95 Sector B project, but not much is known at this time. • Jen suggested that a short-term approach could include tweaking existing bus service on Del. Ave. to help inform long-term decisions while building short-term momentum. For example, go to 10-15 minute headways, experiment with exclusive bus lane, etc. • Traffic issues at Washington Avenue need to be figured out for that intersection to work with LRT. • Redirecting some traffic to I-95 seems to be a critical piece of making this work. 	<p>The I95 project has the ability to take significant truck traffic off of Columbus/Delaware with the introduction of new southerly interchanges (at Washington). This will make the waterfront vision more achievable. There was also discussion on whether long-range traffic forecasts significantly overstate corridor automobile travel in the future. Also, notes that Pier 38/40 is likely to be repurposed soon.</p>

	Condition (trend)	Opportunity	Near- (2017-2027) or Far- (2027-2057) Term Strategy	Strategies
Freight Rail	Existing service and planned expansions compete with mobility of other modes and development goals of the Waterfront Vision, particularly north of Pier 70 (between Snyder Avenue and Tasker Street).	Define sufficient space and operational limits for freight rail to prosper, while not impeding the realization of the Waterfront Vision.	Near	<ul style="list-style-type: none"> ➤ Set temporal restrictions for freight service, transit service, and/or turn lanes. ➤ Limit, or preclude, industrial land uses north of Oregon Avenue by concentrating industrial land uses to the south, closer to Packer Avenue Terminal.
			Far	<ul style="list-style-type: none"> ➤ Identify alternative rail rights-of-way in which Conrail can serve customers outside of Delaware Avenue. ➤ Designate a paper passenger rail right-of-way between Oregon Avenue and the Navy Yard.
Vehicular Traffic	Existing lack of reliability combined with proposed waterfront development (.5 parking spots/residential unit) and anticipated Center City population growth suggest an increase in vehicular volumes along Delaware Avenue.	Provide reliable and safe alternatives to driving to and through the corridor, to reduce auto delay and improve reliability.	Near	<ul style="list-style-type: none"> ➤ Optimize signal timing. ➤ Introduce more traffic calming to slow vehicular traffic and improve conditions for walking and bicycling. ➤ Initiate active lane control strategies. ➤ Prioritize implementation of high quality bicycle facilities such as physically separated bicycle lanes, bike boxes, and bicycle parking. ➤ Operate enhanced Route 25 bus service (greater frequency and stop consolidation) between the Frankford loop and Columbus Commons (Ikea shopping center) with stops for key destinations along the corridor, particularly at Market Street. ➤ Improve physical and operational conditions for transfers, especially at perpendicular corridors with high frequency service (Market, Chestnut, Walnut, and Snyder). ➤ Encourage use of developer incentives that encourage the use of public transit. ➤ Direct impact fees from developers to transit upgrades. ➤ Experiment with signal timing, traffic calming, and intersection configurations that may reduce auto delays. ➤ Blanket the corridor with the highest quality bicycle facilities.
			Far	<ul style="list-style-type: none"> ➤ Promote and capitalize on impact fees that support near and long term transit options. ➤ Support through traffic use of I-95, and local traffic on Delaware Avenue.
I-95 Coordination	Parallel routing (redundancy) of I-95 Sector B and Delaware Avenue creates a mutual relationship for capacity, access, and local vs through traffic.	Provide supplementary vehicle capacity on Delaware Avenue up to, and during, I-95 construction. Post (re)construction, balance land use and mobility goals between the joint I-95/Delaware Avenue corridor.	Near	<ul style="list-style-type: none"> ➤ Provide additional carrying capacity along Delaware Avenue during I-95 construction through non auto modes (public transit and additional bicycle facilities).
			Far	<ul style="list-style-type: none"> ➤ Shift vehicular capacity from Delaware Avenue to I-95 ➤ Ameliorate the physical barrier of I-95 between Center City and the waterfront. ➤ Change interchange locations that direct vehicular access between I-95 and Delaware Avenue. ➤ Incorporate I-95 program that aims for a dedicated transit right-of-way, protected bicycle and pedestrian facilities, and reduced number of travel lanes along Columbus Boulevard between Frankford Avenue and the Navy Yard. ➤ Develop a long-term cross section for Delaware Avenue in tandem with I-95 Sector B planning. ➤ Blueprint a service plan for transit operating in a dedicated right-of-way, with ADA-compliant platforms, a connection to Market Street, and stations.

DRAFT OPPORTUNITIES ACTION PLAN

	Condition (trend)	Opportunity	Near- (2017-2027) or Far- (2027-2057) Term Strategy	Strategies
Waterfront Development	Existing corridor character and limited transit service supports auto dependent development.	Provide immediate and future alternatives to driving that reduce auto dependence of planned development.	Near	<ul style="list-style-type: none"> ➤ Capitalize on developer incentives that have a revenue stream to dedicate toward transit. ➤ Support service and passenger amenities at stops. ➤ Initiate enhanced connections to Market Street/Center City.
			Far	<ul style="list-style-type: none"> ➤ Work with Conrail to relocate freight rail customers that require rail north of Snyder Avenue. ➤ Implement signal and curbside strategies that support more reliable transit. ➤ Blueprint a service plan for transit operating in a dedicated right-of-way, with ADA-compliant platforms, a connection to Market Street, and stations.
Transit	Existing land uses don't support demand for high quality transit in SEPTA's constrained capital and operations budget. However, without high quality transit in place, current and future development will be forced to build auto-dependent developments that rely on car ownership and operating private shuttles.	Provide near-term public transit investment that's more competitive with auto travel and could help catalyze development that supports the waterfront vision. Grow transit service as ridership increases and waterfront development occurs.	Near	<ul style="list-style-type: none"> ➤ Pilot enhanced Route 25 bus service between the Frankford loop and Columbus Commons (Ikea shopping center) with stops for key destinations along the corridor. ➤ Grow service and passenger amenities as ridership warrants. ➤ Improve physical and operational conditions for transfers, especially at perpendicular corridors with high frequency service (Market, Chestnut, Walnut, and Snyder).
			Far	<ul style="list-style-type: none"> ➤ Plan and initiate high quality transit service with connections to Market Street/Center City. ➤ Implement signal, on-board, scheduling, and curbside strategies that support more reliable transit. ➤ Blueprint a service plan for transit operating in a dedicated right-of-way, with ADA-compliant platforms, a connection to Market Street, and high quality waterfront stations.

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Concept Development for TRANSIT ON DELAWARE AVENUE

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ABSTRACT

Trolley, or light rail, service has long been suggested along Delaware Avenue but has lagged in advancing. DVRPC conducted this study to explore the possibility of expanding trolley service along Delaware Avenue as a part of and to coincide with their 8-10 year trolley modernization timeline. Analysis shows that adding rail transit along the waterfront has real challenges--lower existing population and employment density than typically justifies rail investment, relatively low bus ridership along the corridor's primary bus route (SEPTA's Route 25), an active freight line operating within most of the corridor's median, and capacity demands stemming from its proximity to the I-95 interstate. Given those challenges, implementing near term improvements to existing bus service such as rebalancing frequencies, improving transit connection opportunities, improving safety, visibility and comfort of pedestrian connections and transit stops, decreasing travel times, and designating a vehicle fleet could build public transportation ridership and foster the multi modal corridor envisioned in the Delaware River Waterfront Corporations Master Plan for the Central Delaware. Long term, the service could grow to include a dedicated transit right-of-way within a reimagined Delaware Avenue right-of-way made possible by shifting vehicular capacity to I-95 north and south of the Delaware Avenue study area through the Pennsylvania Department of Transportation's I-95 Sector B planning and design.

STAFF CONTACT

Betsy Mastaglio, RLA
Manager, Office of Transit, Bicycle,
and Pedestrian Planning
(215) 238-2812
bmastaglio@dvrpc.org



Delaware Valley Regional Planning Commission
190 N. Independence Mall West, 8th Floor
Philadelphia, PA 19106
Phone: (215) 592-1800
Fax: (215) 592-9125
www.dvrpc.org



190 N. Independence Mall West

8th Floor | Philadelphia, PA 19106-1520

(215) 592-1800 | www.dvrpc.org

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