

A. EXECUTIVE SUMMARY

A.1. INTRODUCTION

A.1.1. Study Description and Project Background

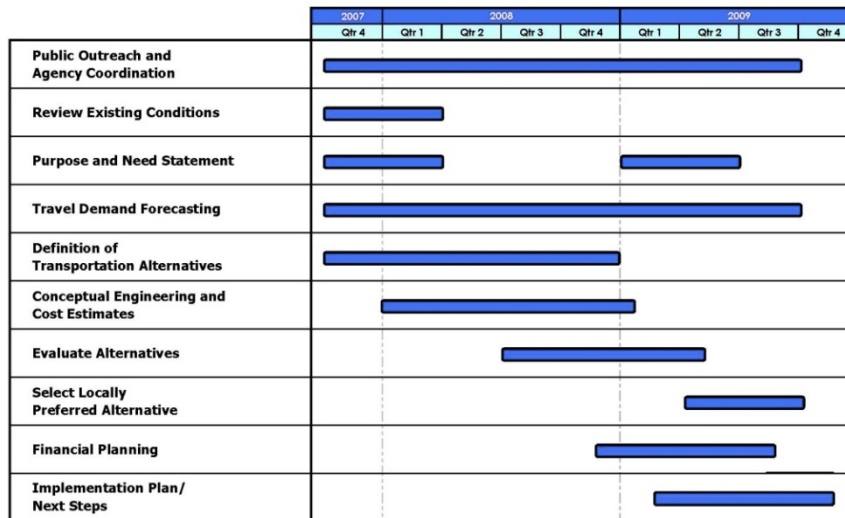
The PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis (a 26-month study) was prepared to identify and evaluate on-street and underground transit alternatives to link Philadelphia’s Delaware River Waterfront (the Waterfront) with the city’s key residential neighborhoods and commercial areas, including its central business district, historic attractions, the Pennsylvania Convention Center, predominant redevelopment locations, nearby hotels and recreational amenities. As part of this Alternatives Analysis (AA), the Delaware River Port Authority (DRPA), along with its subsidiary the Port Authority Transit Corporation (PATCO), developed and evaluated candidate light- and heavy-rail alternatives that would provide the necessary connections between important generators. This study identifies capital and operating costs, ridership forecasts, a preliminary assessment of environmental impacts, financial planning, and public and stakeholder outreach. A stated aim of the project at the outset of the AA was to position the project for federal New Starts funding.

A preceding feasibility study (the *Southern New Jersey to Philadelphia Transit Study, 2005*) considered options to expand transit services in South Jersey and Philadelphia. The study concluded that potentially adding transit system capacity in both South Jersey and Philadelphia warranted further evaluation as an AA. Specifically, the effort determined that rail transit in Philadelphia could improve mobility options, enhance system connectivity, and support economic development in areas of Philadelphia and southern New Jersey experiencing significant attention and investment.

A.1.2. Timeline

Figure A-1 presents the key tasks carried out as part of the AA as well as the project schedule.

FIGURE A-1: PROJECT SCHEDULE



A.2. PROBLEM STATEMENT

A.2.1. Description of the Study Area

The study area is bound by Girard Avenue on the north, Mifflin Street on the south, 40th Street on the west and the Delaware River on the east (Figure A-2). There is a growing consensus that the Waterfront, an increasingly popular destination for both recreational and residential activities, is underserved by transit. The Waterfront is an increasingly significant destination for residents and tourists, and its importance is projected to grow.

The most popular tourist destination on the Waterfront is Penn's Landing. The Penn's Landing Corporation – a non-profit, quasi-public corporation that until January 2009 managed the publicly owned land on the central waterfront on behalf of the City of Philadelphia and the Commonwealth of Pennsylvania – estimated that approximately 1.5 million visitors per year attend events at Penn's Landing.¹

In addition, two casino projects within the study area, the SugarHouse Casino at Columbus Boulevard and Shackamaxon Street and the Foxwoods Casino Philadelphia at Columbus Boulevard and Reed Street, would bring thousands of new daily users to the project area. Once in operation, the combined casinos could attract up to 34,000 visitors to the project area on a typical Saturday and employ an estimated 2,000 people. Without mitigation, the influx of new users could further degrade the performance of the existing transportation network. In addition, further residential and commercial development is planned for the Delaware River waterfront. The recently completed Waterfront Towers, Dockside Apartments, and Hyatt Hotel demonstrate the importance of the corridor as an economic development driver.

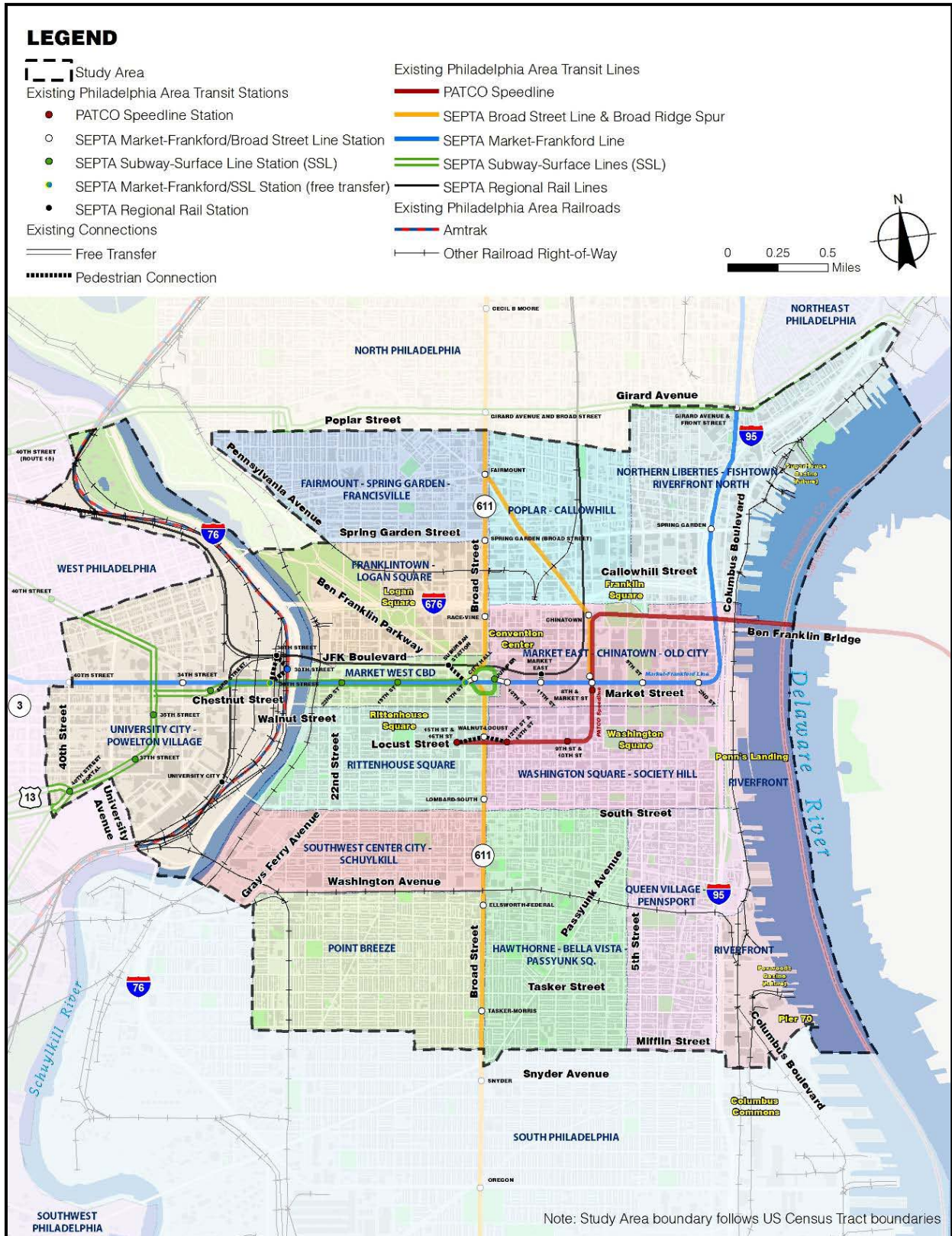
Existing Transportation Conditions

Columbus Boulevard/Delaware Avenue provides crucial access to I-95 from the Waterfront, Old City, Northern Liberties, Fishtown, Queen Village, and Pennsport areas. Almost all traffic accessing I-95 from these neighborhoods uses Columbus Boulevard/Delaware Avenue, which has the highest average annual daily traffic (AADT) of any principal arterial in the study area at its peak section between Washington Avenue and Christian Street (AADT of 50,041 vehicles in 2006).

Currently, during peak times, signalized intersections along the busiest section of Columbus Boulevard/Delaware Avenue—between the Exit 20 ramp to/from I-95 (located just north of Catherine Street) and Pier 70—suffer from poor levels-of-service (LOS E or LOS F). North of the Exit 20 on/off-ramp and the nearby Lombard/Pine Street on-ramp, traffic volumes decrease by nearly half. On-ramps to I-95 North are located at Lombard Street, Catherine Street, and Columbia Avenue, which are all signalized intersections. Only the Catherine Street on-ramp provides access to I-676 west via I-95. Access to I-95 South from Columbus Boulevard/Delaware Avenue is limited, with one on-ramp located one block to the west of Columbus Boulevard at Morris and Water Streets.

¹ Penn's Landing Development Corporation, 2008

FIGURE A-2: STUDY AREA



In 2005, the daily person trips (including all transportation modes) to the Waterfront project area was 7,361. By 2030, this number is expected to increase by 20 percent. Without a viable alternative to reduce congestion and travel times, an increase in trips will degrade the performance of the current transportation system network along the Waterfront. This assumption includes the presence of both the Foxwoods and the SugarHouse casinos at full build-out.

The projected increase of 20 percent in tripmaking to the Waterfront represents the greatest anticipated percentage increase in zone-to-zone travel of any travel zone in Philadelphia. Overall zone-to-zone travel in Philadelphia is expected to be stagnant from 2005 to 2030, as the city's population and job base is not anticipated to expand significantly.

A.2.2. Study Goals and Objectives

Founded in 1682, Philadelphia has a highly developed network of expressways, roads, bridges, mass transit facilities and bike and pedestrian trails. Philadelphia's first rapid transit line was a subway under Market Street that opened incrementally between December 1905 and August 1908. Mass transit facilities now include light and heavy rail, buses, and trolleys.

While the system is extensive, disconnects do exist. Two separate agencies, PATCO and SEPTA, operate rail transportation facilities in Center City, and connectivity between the systems could be enhanced. Rail lines leading to what were once bustling areas of the City could be better used, while areas of potential economic growth and vitality (specifically the Delaware River waterfront) are underserved.

With its compact development patterns, mixed-use vitality, and long history of mass transportation and pedestrian accessibility, Philadelphia remains highly dependent on its strong system of mass transportation.

Philadelphia has experienced significant private investment to create residential, entertainment and business facilities throughout the study area but there is no commensurate means to ensure mobility and address the transportation challenges posed by this growth in economic development activity. To support continued growth, Philadelphia's growing neighborhoods must be better integrated with both the Waterfront and the region's vast transit network.

Six goals have been established to help guide selecting and evaluating alternatives. These goals have been reviewed and endorsed by the project Technical Advisory Committee and form the basis of the project evaluation criteria.

1. Improve mobility, access and transit linkages to the Philadelphia Waterfront

- Reduce congestion
- Increase share of travel demand accommodated by transit

2. Improve mobility, access and transit linkages from New Jersey to growing commercial areas of Philadelphia

- Reduce congestion
- Increase share of travel demand accommodated by transit

3. Support economic development and regional competitiveness

- Ensure that alternatives support existing and future land use in Philadelphia’s expanding retail, commercial, residential and recreation areas
- Support the *Civic Vision for the Central Delaware* developed by PennPraxis and relevant implementation documents to be developed by the Delaware River Waterfront Corporation to advance development along Columbus Boulevard/Delaware Avenue.

4. Maximize use of existing mass transportation assets

- Maximize use of the region’s existing and committed transportation infrastructure
- Use existing in-service or out-of-service facilities if possible
- Develop new uses for existing transportation assets
- Minimize disruption to the existing regional transportation system

5. Enhance regional transit linkages and connectivity

- Provide additional transit choices
- Provide additional transit connectivity region-wide to serve future travel patterns and markets

6. Support regional efforts to develop consistent with smart and sustainable principles and in compliance with federal, state and local environmental regulations.

- Comply with federal, state, city and regional rules and goals for air quality, noise, surface and groundwater quality, stormwater management, energy consumption, environmental justice, park access and hazardous materials
- Minimize community disruption, displacements and relocations
- Minimize adverse impacts to parks, historic resources, visual and aesthetics
- Ensure the alternatives can be implemented in conformity with FTA’s New Starts criteria

A.2.3. Purpose and Need Statement

The objective of the project is to create an improved transit connection between the Waterfront (a city-endorsed redevelopment zone) and the hub of the regional transportation network in Center City to support waterfront redevelopment. Increasing mobility options between Columbus Boulevard and Center City is likely to support existing and future development by providing access to existing and future jobs and residential locations in a cost-effective and environmentally friendly way.

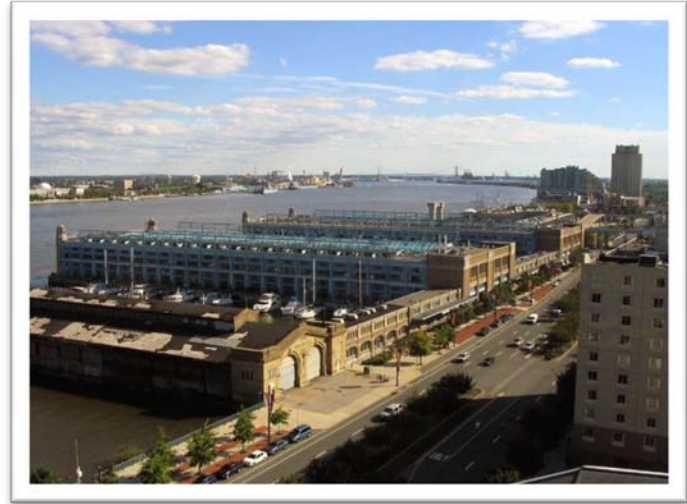
The investment alternatives evaluated in this AA would provide a direct rail connection between many of Philadelphia’s historic assets (Independence Mall, the Liberty Bell, and the National Constitution Center), the central business district, the region’s transit core and Penn’s Landing, and Columbus Boulevard/Delaware Avenue. The heart of the project area, the Franklin Square/Market

Street to Columbus Boulevard/Delaware Avenue corridor, is within three blocks of over 80 percent of the city's most visited tourist destinations.²

By 2030, a projected 33,771 jobs will exist within a half mile of the Waterfront, including those linked to the casinos. This figure is expected to represent 8.4 percent of all jobs within the City of Philadelphia by 2030.

Integrating this proposed transit service with existing service to Center City will establish a stronger physical connection between South Jersey, the Waterfront, Center City, West Philadelphia, and the western suburbs, thus improving the lives of residents, visitors, and employees in the Philadelphia metropolitan region. New transit will also help improve land use and promote smarter development in the future.

The alternatives under consideration in the PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis will address the following needs:



Source: bridgeandtunnelclub.com

- Provide greater access to the Delaware River Waterfront project area, as the number of person trips from the region to the immediate project area is projected to grow 20 percent by 2030.
- Provide greater transit system connectivity that improves links between Philadelphia's Delaware River Waterfront and the region's existing mature transit network.
- Strengthen the linkage between existing PATCO users, both from South Jersey and Philadelphia to the Philadelphia Waterfront, to ease access to jobs, residential areas and entertainment venues.
- Support continued economic development within the study area while minimizing congestion and providing better transportation connectivity between people and activity centers.
- Support regional efforts to improve air quality by decreasing reliance on single-occupancy automobile tripmaking.
- Expand the region's core fixed-guideway rail system in a way that allows for future expansion and connectivity.
- Assist the City of Philadelphia and the region to implement the City's waterfront vision.

² Center City District, *State of Center City 2008*, 2008

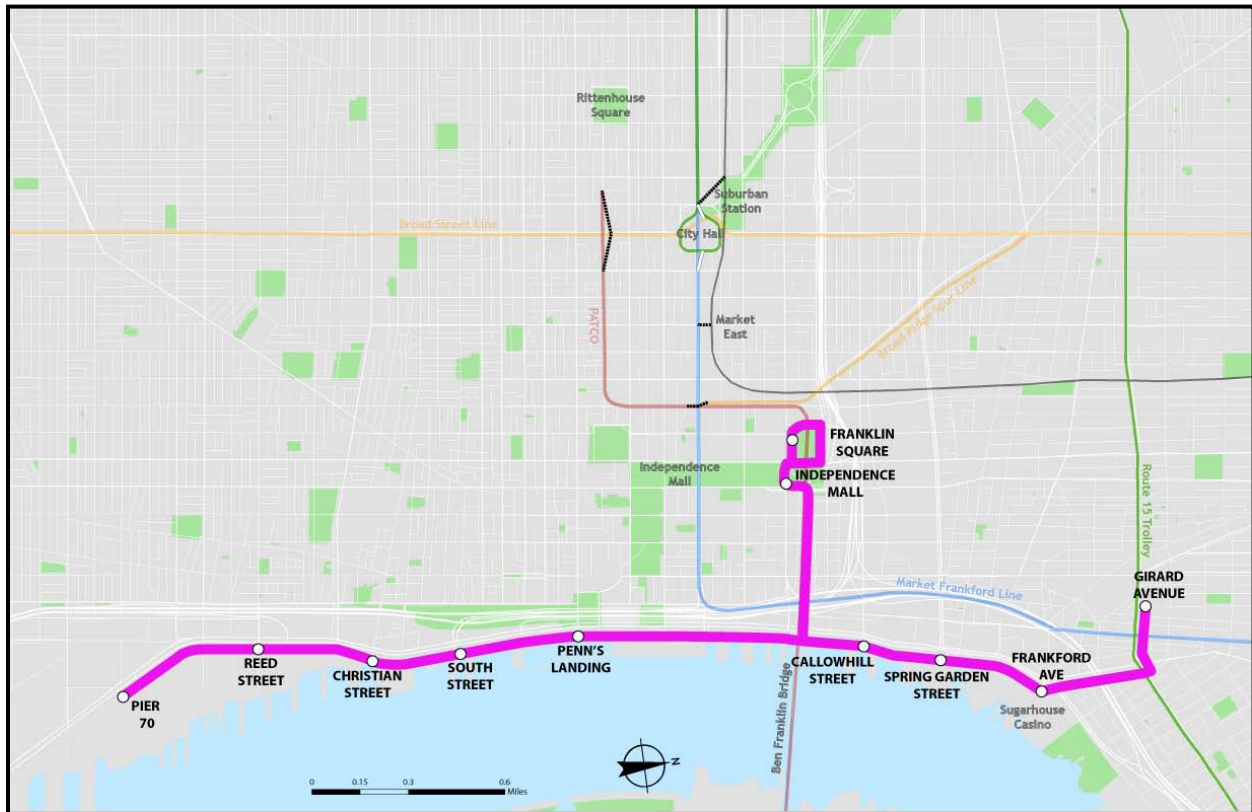
A.3. ALTERNATIVES EVALUATED

Two short-list alternatives were carried over into an Alternatives Analysis phase from the feasibility study. Below is the description of the two alternatives, as well as the third alternative added at the request of the City of Philadelphia. A fourth alternative consists of a low-cost transportation system management alternative.

A.3.1. Alternative 1: Franklin Square to Philadelphia Waterfront

Alternative 1 (Figure A-3), would operate between Franklin Square and the Waterfront (Columbus Boulevard/Delaware Avenue) and would link to a reopened PATCO Franklin Square Station. The alignment would loop around Franklin Square and access the Waterfront via Race Street with a slight turn to operate under the Ben Franklin Bridge approach. At Race Street, it would access the Columbus Boulevard, operating north to the Girard Avenue Market-Frankford Line station via Frankford Avenue and south to Pier 70 at the Home Depot and Superfresh. The mode would be street-running light rail.

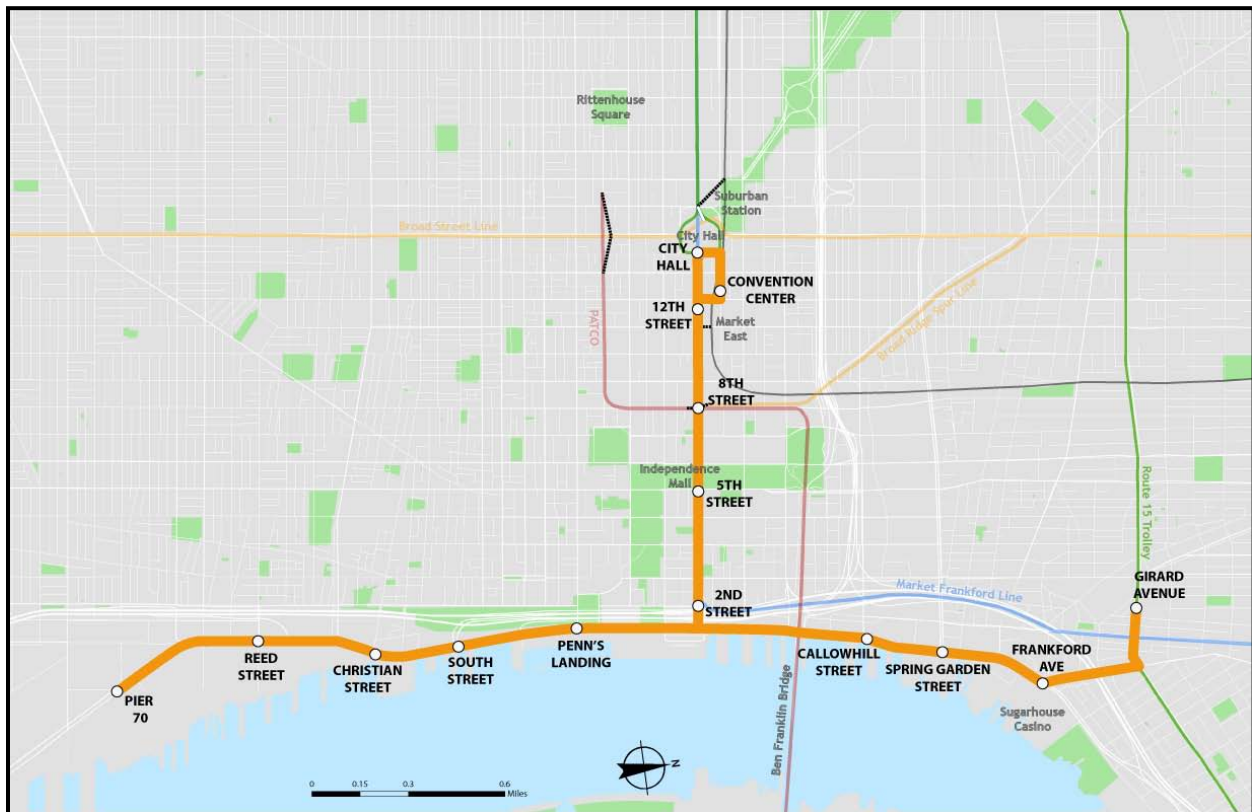
FIGURE A-3: ALTERNATIVE 1 ROUTE MAP



A.3.2. Alternative 2: City Hall to Philadelphia Waterfront via Market Street

Alternative 2 (Figure A-4) would operate between the Philadelphia City Hall area and the Waterfront via Market Street. Using Market Street as the east-west spine, this proposed light rail alignment would turn north on Juniper Street at Philadelphia's City Hall and east on Filbert Street to serve the Pennsylvania Convention Center and the Reading Terminal Market before turning south on 12th Street and west on Market Street. Like Alternative 1, the northern limit would be the Girard Avenue Market-Frankford Line station via Frankford Avenue and the southern limit is Pier 70 at the Home Depot and Superfresh. The mode would be street-running light rail.

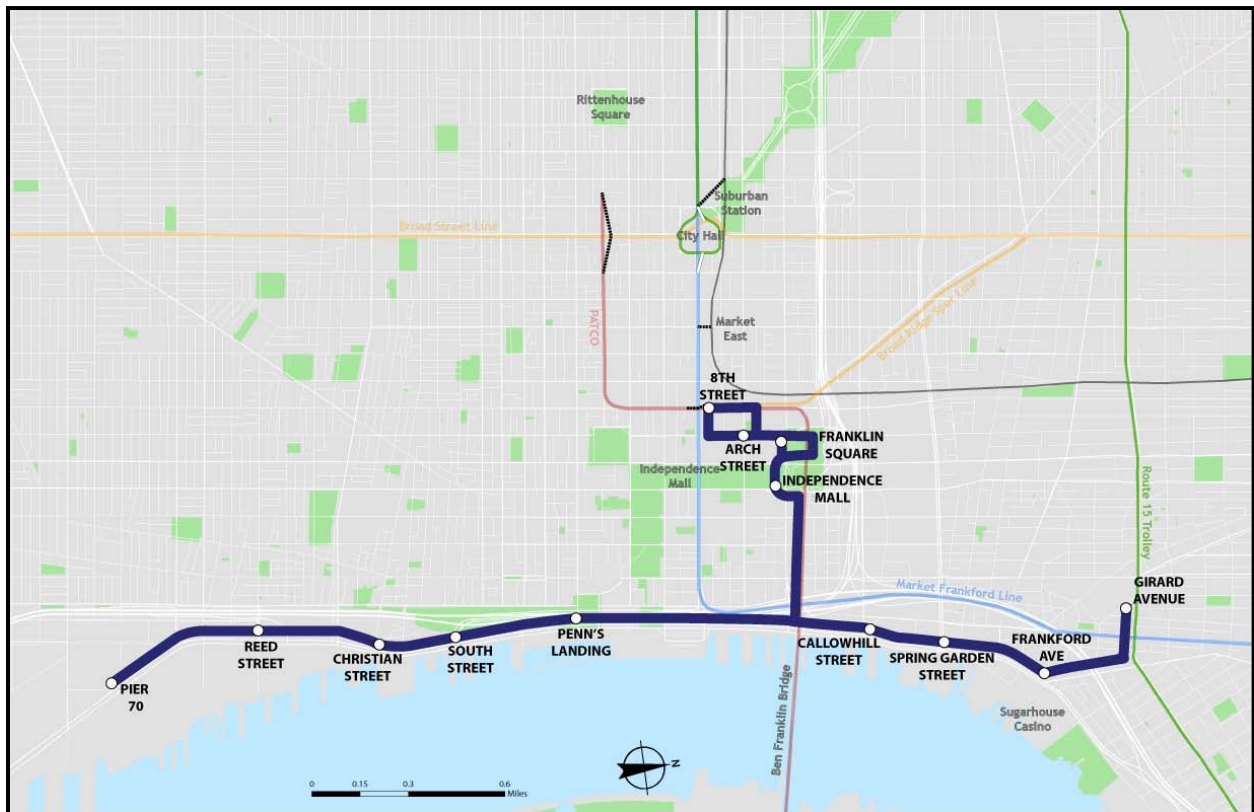
FIGURE A-4: ALTERNATIVE 2 ROUTE MAP



A.3.3. Alternative 3: 8th and Market to Philadelphia Waterfront via Franklin Square

Alternative 3 (Figure A-5), which emerged from combining input received at the project’s two January 2008 open houses with suggestions from the City of Philadelphia, would follow the routing of Alternative 1 between Franklin Square and the Waterfront but would also operate to 8th and Market where it would access the Market East Concourse. After Franklin Square, the westbound service would operate in a loop fashion south on North 7th Street, west on Cherry Street, south on 8th Street, east on Market Street, north on North 7th Street and around Franklin Square back to Columbus Boulevard/Delaware Avenue via the route shared with Alternative 1. Variations on this alternative were suggested by the public during the project’s open house sessions in January 2008.

FIGURE A-5: ALTERNATIVE 3 ROUTE MAP



A.4. ALTERNATIVES EVALUATION PROCESS

The PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis began with the two alternatives retained from the feasibility study: (1) a trolley shuttle from Franklin Square to Pier 70 to the south and Spring Garden Street to the north; and, (2) an extension of SEPTA’s Green Line Trolleys from Juniper/13th Streets and Market Street to Pier 70 and Spring Garden (underground). These alternatives were labeled 1 and 3a, respectively.

The AA followed a three-phase screening process to identify the candidate Build Alternatives:

- **Phase I Fatal Flaw Screen.** The Fatal Flaw Screen comprised the following two steps: Step One consolidated and combined recommended alternatives to eliminate duplication; and Step Two assessed the candidate alternatives according to the project’s goals and objectives. Each alternative received one of three possible grades: (P) Pass; (F) Fail; or (U) Undecided. An F grade eliminated the alternative from further consideration and a P or U grade advanced the alternative to the Phase II High Level Screen.
- **Phase II High Level Screen.** The Phase II screen comprised both qualitative and quantitative factors in addition to reasonable engineering estimates. The results were reviewed by the DRPA/PATCO project team. Projects that were not eliminated by the Phase II screen were advanced to the Phase III Short List Screen. High level screen criteria are shown in Table A-1.
- **Phase III Short List Screen.** The Phase III screen comprised both engineering and qualitative analyses to determine specifics of the remaining alternatives. Critical criteria such as final estimated capital and operating and maintenance costs, ridership and cost effectiveness were developed. Based on the results, the final alternatives were ranked using a trade-off analysis. The Locally Preferred Alternative was selected by the DRPA/PATCO project team after considering input from the public open houses, elected officials, the study’s Technical Advisory Committee, stakeholders, and others in October 2009. Short list screen criteria are shown in Table A-2.

TABLE A-1: HIGH LEVEL SCREENING CRITERIA

Criteria	Description
Preliminary Estimated Capital Cost	Preliminary estimation of capital cost
Construction Impacts	Severity and duration of impacts related to construction activity
Transportation System Connectivity	Degree to which alternative enhances transportation system connectivity
Transportation System Integration	Degree to which alternative would integrate into the existing transportation system
Impact on Non-Vehicular Activity	Degree of accommodation for pedestrian and bicycle facilities
Consistency with Present Land Use	Degree to which the alternative is consistent with existing land use
Consistency with Future Land Use Goals	Degree to which the alternative is consistent with future proposed land use goals as articulated by the City of Philadelphia
Adverse Impact on Parklands	Degree of potential impact to parklands and Section 4(f) resources

TABLE A-2: SHORT LIST SCREENING CRITERIA

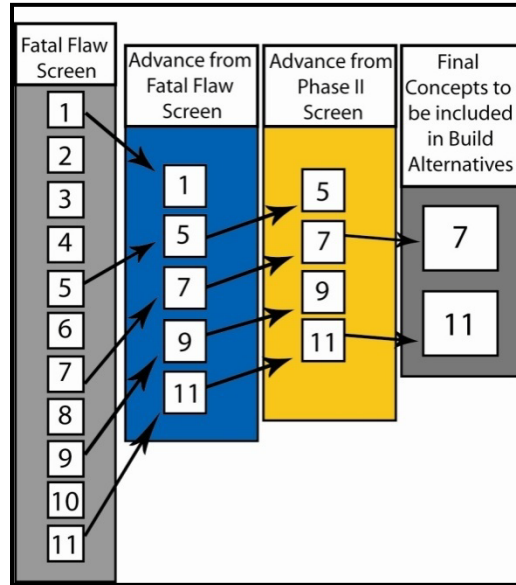
Criteria	Description
Ridership	Estimated daily ridership for the alternative
Capital Cost	Estimation of the alternative's capital cost
Operation and Maintenance Cost (O&M Cost)	Estimation of the alternative's O&M Cost
Adverse Air Quality Impacts	Adverse impact of alternative on regional air quality
Travel Time Savings	AM peak period travel time savings
Peak Period Vehicle Reduction	Estimated number of peak period vehicles to be eliminated by the operation of the alternative
Adverse Impact on Traffic Operations	Degree to which the alternative would negatively affect traffic operations
Cost Effectiveness	Estimation of how the alternative would achieve FTA goals for cost effectiveness
Adverse Impact on Historic or Archaeological Resources	Degree of potential impact on historic or archaeological resources
Implementation Challenges	Judgment based on legislative and public support for alternative as well as lack of jurisdictional obstacles
Other Significant Adverse Impacts	Degree of other significant negative impacts of alternative

The three-phase project-review screen process was applied to the following 11 alternatives.

1. Alternative 1 Extended
2. Modification of Alternative 1 Extended with the subsurface portion of the proposed line extending from City Hall to 5th Street under Independence Mall, connecting to Franklin Square underground.
3. Reorienting the east-west portion of the proposed underground line along Spring Garden Street with 9th Street as the north-west connector between Spring Garden Street and Market Street.
4. Add a new station on the Market-Frankford Line at 20th Street and extend PATCO from its terminus at 15th/16th and Locust to 20th and Market.
5. Extend service beyond the southern terminus at Pier 70 to Navy Yard and Sports Complex.
6. Extend the existing PATCO Lindenwold Line to 30th Street Station.
7. Reorient the northern terminus of the proposed line to Girard Avenue instead of Penn Treaty Park and intersect with the Girard Avenue Trolley (SEPTA Route 15) and the Market-Frankford Line at Girard Avenue.
8. Extend the proposed line to the Art Museum or the Art Museum area, possibly through the use of the City Branch railroad cut.
9. Extend the proposed line north of Penn Treaty Park to Allegheny Avenue.
10. Extend northern terminus of line to Bensalem.
11. Extend Alternative 1 above ground to 8th and Market.

Two alternatives advanced to the final list of candidate alternatives. The results of the final screening phase are presented below. Figure A-7 demonstrates the screening process: 11 initial alternatives were narrowed down to five alternatives using the fatal flaw screen; five alternatives were narrowed down to four alternatives to the Phase II screen described previously; using the Phase II screening process, two alternatives were selected as final concepts.

FIGURE A-7: SCREENING PROCESS



A.4.1. Final Screening Results

The result of the Phase III screen:

- The northern terminus of all Build Alternatives will be Girard Avenue.
- The addition of Candidate Alternative 11 to the final list of Build Alternatives to be evaluated.

The following Build Alternatives were evaluated during the PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis.

TABLE A-3: FINAL ALTERNATIVES

Name	Alternative Title for Alternatives Analysis	Source
Franklin Square to Philadelphia Waterfront	1	Feasibility Study
City Hall to Philadelphia Waterfront via Market Street	2	Feasibility Study
8 th and Market to Philadelphia Waterfront via Franklin Square	3	Alternatives Screening

A.5. RESULTS

A.5.1. Operational Characteristics of the Alignments

The service is expected to operate between 6:00 AM and 1:00 AM daily with varying frequency (or headway) ranging from 10 minutes in the peak hours to 30 minutes in the off-peak hours. The analysis assumed that weekend service would be provided as well at longer headways. Table A-4 demonstrates the headways for Alternatives 1, 2, 3, and the TSM Alternative.

TABLE A-4: HEADWAYS BY TIME PERIOD

Segment	Weekday (in minutes)				Weekend (in minutes)	
	AM Peak 6:00–9:00 AM	Mid-Day 9:00 AM– 3:00 PM	PM Peak 3:00–7:00 PM	Late PM/Early AM 7:00 PM–1:00 AM	Weekend Day 6:00 AM–7:00 PM	Late PM/Early AM 7:00 PM–1:00 AM
North	10	10	10	30	15	30
South	10	15	10	30	15	30
Waterfront	10	15	10	30	15	30

Alternative 1 is the shortest alignment while the TSM alignment is the longest. Table A-5 demonstrates alignment lengths by the different alternative.

TABLE A-5: ALIGNMENT LENGTHS

Segment	Alternative 1 Alignment Length (miles)	Alternative 2 Alignment Length (miles)	Alternative 3 Alignment Length (miles)	TSM Alignment Length (miles)
North	3.93	6.08	4.67	8.85
South	5.70	6.19	6.44	10.00
Waterfront	6.62	6.62	6.62	6.62
TOTAL	16.25	18.89	17.73	25.47

A.6. SELECTION OF LOCALLY PREFERRED ALTERNATIVE

Considering input provided by the public, stakeholders, elected officials, and the project’s Technical Advisory Committee (TAC), in addition to detailed analysis of the alternatives according to the evaluation criteria described above, the DRPA/PATCO project team selected Alternative 2 as the Locally Preferred Alternative. Alternative 2 will provide the greatest geographic coverage of the three proposed alignment alternatives, is expected to attract the greatest ridership, and is competitive on capital and operating costs with the other two Build Alternatives. It will provide greater access to Philadelphia’s Center City transportation core compared to the other two Build Alternatives and serve as a stronger transit connection between the Waterfront and the region’s mature rail and bus network.

A.7. PUBLIC INVOLVEMENT AND NEXT STEPS

Two sets of public open houses were convened during the PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis. These events were conducted open-house style to ensure that the public had ample opportunity to review the candidate alternatives and speak directly to the DRPA/PATCO project team members and consultants. This approach resulted in dynamic information exchanges between the project team and the public/stakeholders. Modifications were made to the conceptual alignment based on input received at the open houses.

The first round of public open houses was held in January 2008, in which draft alignments were presented and comments were collected via comment form. The second round of public open houses was held in September 2009 where the final three alignments were presented along with the results of the analysis of ridership, costs and project benefits.

In addition to the open houses, the project team maintained a website containing relevant material related to the alignments under consideration, project schedule, and a feedback form. By November 2009, the website had been visited over 33,000 times.

A.7.1. January 2008 Open Houses

In January 2008, two open houses were convened to inform the public about the project purpose, the schedule and process, the existing conditions and the alignments under consideration. The open houses were held in Philadelphia on January 22, 2008, at the Painted Bride Gallery Café at 230 Vine Street and on January 24, 2008, at the Emanuel Evangelical Lutheran Church at 1001 South 4th Street.

A total of 126 people attended these two sessions and 93 submitted comments via the response form. The meetings were advertised in the *Philadelphia Inquirer*, the *South Philly Review*, *Metro* and via an email circulation from DRPA to both the DRPA email list and a project email list developed by the project's public involvement subconsultant. Local businesses were provided with meeting flyers and the project team submitted meeting announcements to websites such as PlanPhilly.com.

Comments received at the January 2008 open houses led the project team to modify the northern terminus of the project from Penn Treaty Park to a connection to SEPTA's Market-Frankford Line at Girard Avenue, also enabling a direct transfer to SEPTA's Route 15 trolley.

A.7.2. September 2009 Open Houses

In September 2009, two open houses were convened to review the technical results of the conceptual engineering evaluation on the three revised candidate alignments. The revised candidate alignments were posted to the project website in May 2008. The open houses were held in Philadelphia on September 22, 2009, at Friends Meeting House at 4th and Arch Streets and on September 30, 2009, at the Historical Society of Pennsylvania at 1300 Locust Street.

A total of 98 people attended these two open house sessions and 61 submitted comments via the response form. The meetings were advertised in the *Philadelphia Daily News*, the *Philadelphia Tribune* and via an email circulation from DRPA to both the DRPA email list and a project email list developed by the project's public involvement subconsultant. Individuals who had provided the

project team with input through the project's website were also contacted. Local businesses were provided with meeting flyers and the project team submitted meeting announcements to websites such as PlanPhilly.com and PhiladelphiaSpeaks.com.

A.7.3. Other Outreach

In addition to the public open houses, the DRPA/PATCO project team presented the project at a variety of events for stakeholder groups throughout the AA. Organizations that were briefed on the project include the Delaware Valley Regional Planning Commission (DVRPC) Regional Transportation Committee, DVRPC Regional Citizen's Committee, the DVRPC Board of Commissioners, the Delaware Valley Association of Rail Passengers, the Greater Philadelphia Chamber of Commerce, the East of Broad Improvement Association, the Philadelphia chapter of the ACEC/PA, Earth Day Community Event in Washington Township, NJ, Women's Transportation Seminar, the Old City District and the SEPTA Citizen's Advisory Committee, among others.



A.7.4. Next Steps

The DRPA/PATCO project team sought and received FTA's concurrence in February 2010 to initiate an Environmental Assessment (EA), with FTA serving as the lead federal agency. The EA will identify and document any potential impacts and present sound avoidance and/or mitigation strategies. DRPA/PATCO remains committed to a robust public- and stakeholder-involvement process during the environmental phase, consistent with National Environmental Policy Act (NEPA) and FTA regulations.