

G. EVALUATION OF ALTERNATIVES

G.1. APPROACH

The Build Alternatives in this AA were evaluated on numerous factors including transportation benefits, support for regional land use and air quality goals, cost, anticipated ridership, and community and stakeholder support. The evaluation of build alternatives also considered FTA's New Starts criteria, information used by FTA to help inform decisions on which fixed-guideway projects should be advanced through the project development process in anticipation of a financial commitment by FTA.

All Build Alternatives evaluated in this final screening phase addressed the needs identified in the project's Purpose and Need. The needs are listed below:

- Provide greater access to the Delaware waterfront project area as the number of person trips from the region to the immediate project is projected to increase 20 percent by 2030
- Provide greater transit system connectivity to better link Philadelphia's Delaware waterfront with the region's existing mature transit network
- Strengthen the linkage between existing PATCO users, both from South Jersey and Philadelphia, and the Philadelphia Waterfront to ease access to jobs, residential and entertainment locations
- 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 to prepare for future expansion
- Assist the City of Philadelphia and the region to implement the city's waterfront vision

The final Build Alternative evaluation screen is based on the degree to which each alternative would support the project goals established at the outset of the project plus how each alternative compared on key criteria such as estimated ridership and cost. To the degree possible, the evaluation and comparison of the Build Alternatives included FTA's New Starts criteria. Input received at the open houses and stakeholder outreach along with specific guidance provided by the Technical Advisory Committee also factored into the final analysis.

G.2. COMPLIANCE WITH PROJECT GOALS

The Build Alternatives were first evaluated qualitatively to determine the degree to which each achieved the goals outlined at the project's outset. As discussed previously, the goals were endorsed by the project's Technical Advisory Committee. The goals are:

- Improve mobility, access and transit linkages to the Philadelphia Waterfront
- Improve mobility, access and transit linkages from New Jersey to growing commercial areas of Philadelphia
- Support economic development and regional competitiveness
- Maximize use of existing mass transportation assets
- Enhance regional transit linkages and connectivity
- Support regional efforts to develop consistent with smart and sustainable principles and in compliance with federal, state and local environmental regulations

G.3. QUANTITATIVE ANALYSIS AND SELECTED NEW STARTS FACTORS

In addition to the qualitative assessment, the AA process also estimated capital and operating and maintenance costs, ridership estimates and other project benefits that permit a specific comparison of the Build Alternatives. The FTA New Starts criteria were considered as part of this analysis.

The quantitative criteria and New Starts criteria are listed in Table G-1.

TABLE G-1: TECHNICAL ANALYSIS SELECTED NEW STARTS FACTORS

Technical Results and Selected New Starts Factors	Measures
Ridership Estimates	❖ Daily estimated ridership
Cost Estimates	❖ Total estimated capital cost ❖ Annual estimated O&M cost
Ridership Estimates	❖ Daily estimated ridership
New Transit Users	❖ New transit trips
User Benefits	❖ Travel time savings
Public Support	❖ Degree of public support for candidate Build Alternatives

The issue of financial capacity of the sponsoring agency is also an important consideration but is not directly applicable to evaluating the merits of the alternatives. However, the financial capacity of the sponsoring agency can affect the decision on the overall affordability of an alternative if the cost of construction or operations and maintenance exceed likely available financial resources.

G.4. ATTAINMENT OF PROJECT GOALS AND OBJECTIVES

Table G-2 contains a summary of the degree to which the Build Alternatives comply with the project goals.

TABLE G-2: ATTAINMENT OF PROJECT GOALS AND OBJECTIVES

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Improve mobility, access and transit linkages to the Philadelphia Waterfront	Medium	High	Medium	High
Improve mobility, access and transit linkages from New Jersey to growing commercial areas of Philadelphia	Medium	High	High	Medium
Support economic development and regional competitiveness	Medium	High	Medium	Medium
Maximize use of existing mass transportation assets	Medium	High	High	Medium
Enhance regional transit linkages and connectivity	Medium	High	High	High
Support regional efforts to develop consistent with smart and sustainable principles and in compliance with federal, state and local environmental regulations	High	High	High	Medium

G.4.1. Improve mobility, access and transit linkages to the Philadelphia Waterfront

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

The Waterfront is a growing part of the city with significant existing and planned development. I-95 and Columbus Boulevard are parallel roadway facilities in the project area. While I-95 primarily carries through traffic, Columbus Boulevard serves as the major north-south route carrying travelers from north of Center City to south Philadelphia neighborhoods, points along the Waterfront as well as multiple destinations including Pier 70; various hotel, restaurant and entertainment locations; and recently-completed retail facilities south of Pier 70. Presently portions of Columbus Boulevard already experience congestion at various locations throughout the day with a particular focus at Washington Avenue and Columbus Boulevard. With additional residential, commercial, and casino development planned along the corridor, congestion is expected to worsen in the coming years.

All three alternatives would provide access to the Waterfront from Center City as well as from Northern Liberties/Fishtown neighborhoods. All alternatives would provide a connection to SEPTA’s Market-Frankford Line and SEPTA’s Route 15 Trolley at the Girard Avenue Station and all would feature a direct connection to PATCO’s Lindenwold Line.

Alternative 2 would provide greater overall connectivity to the Waterfront because it would provide more close transfer locations to the existing Center City transportation system compared to Alternative 1 and Alternative 3. While Alternative 3 would provide numerous transportation connections at 8th and Market, it would not provide proximate connections to SEPTA’s Broad Street Line (beyond the Broad-Ridge Spur) or SEPTA’s Green Line trolleys. Alternative 1 would provide only a single Center City connection point—at PATCO’s soon-to-be-reopened Franklin Square Station.

Alternative 1 would provide Center City access to SEPTA’s Broad Street Line, SEPTA’s Green Line trolleys, and proximate access to SEPTA’s Market East Station—all connections that are either indirect or less convenient for potential users of Alternative 1 or Alternative 3. As a result, Alternative 2 would result in the most new riders—5,400 versus No Build and 2,000 new riders versus TSM Alternative.

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Improve mobility, access and transit linkages to the Philadelphia Waterfront	Medium	High	Medium	High

G.4.2. Improve mobility, access and transit linkages from New Jersey to growing commercial areas of Philadelphia

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

All alternatives would provide similar access to New Jersey via PATCO—Alternative 1 via the reopened Franklin Square Station and Alternative 2 and Alternative 3 at 8th and Market. However, Alternative 2 and Alternative 3 would provide the closest access to Greyhound Bus Terminal and Market Street bus alignments where most NJ TRANSIT buses operate, thus, giving additional travel alternatives to passengers. As a result, Alternative 2 and Alternative 3 would provide the maximum number of connections for users traveling between New Jersey and the Waterfront.

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Improve mobility, access and transit linkages from New Jersey to growing commercial areas of Philadelphia	Medium	High	High	Medium

G.4.3. Support economic development and regional competitiveness

- Objective: Ensure alternatives support existing and future land use in Philadelphia’s expanding retail, commercial, residential and recreation areas

As noted above, the Waterfront is expanding in significance as a destination for residents, tourists, and investment. The Delaware River Waterfront Corporation was created by the City of Philadelphia to specifically manage the development of the Waterfront. To that end, the DRWC along with its regional partners have initiated the creation of a master plan to guide development and investment along Columbus Boulevard. A cornerstone of the forthcoming master plan will be support and accommodation for light rail.

All three alternatives would provide access to the Waterfront to support the development objectives of the DRWC and the City of Philadelphia. Because Alternative 2 creates the strongest linkage between Center City and the Delaware River Waterfront, it is likely to provide the greatest support for economic development investments. In addition to providing peak period utility, Alternative 2 is likely to also capture mid-day and weekend tourists and conventioners who seek to travel easily between the attractions in Center City (Reading Terminal Market and the Pennsylvania Convention Center), Independence National Historical Park, Penn’s Landing and the residential and entertainment attractions present and planned for Columbus Boulevard.

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Support economic development and regional competitiveness	Medium	High	Medium	Medium

G.4.4. Maximize use of existing mass transportation assets

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

There is currently no direct access to the Waterfront destinations from New Jersey, Northern Liberties/Fishtown neighborhoods on the north and certain neighborhoods in South Philadelphia. To access locations up and down Columbus Boulevard by transit, most users must take a bus to Penn’s Landing and await a transfer to the SEPTA Route 25 bus that operates on an hourly basis. Congestion, particularly at Columbus Boulevard and Washington Avenue, degrades the performance of this infrequent bus service.

All proposed alternatives would provide direct access to the existing and future destinations along the Waterfront from locations in Center City. Because Alternative 2 provides the greatest linkages to most existing infrastructure in the City with proximate access to most key transit facilities, such as SEPTA’s Market-Frankford line, SEPTA’s Broad Street line, SEPTA’s Broad-Ridge spur, PATCO’s Lindenwold Line, SEPTA’s Green Line trolleys, SEPTA’s Regional Rail, and the Greyhound Bus Terminal, Alternative 2 would best tie into existing transportation investments.

All alternatives would use the existing Philadelphia Belt Line right-of-way on the Waterfront; outside of the Waterfront, all alternatives would use the existing street grid to operate. Unlike Alternative 1, Alternative 2 and Alternative 3 would not require additional supportive investments, the reopening of PATCO’s Franklin Square Station, to enhance regional connectivity, because they would both access much of the regional transit system at 8th and Market Streets.

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Maximize use of existing mass transportation assets	Medium	High	High	Medium

G.4.5. Enhance regional transit linkages and connectivity

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

All alternatives would provide similar but not identical access to the Waterfront from Center City, New Jersey, and access points on the north, south and west of the three alignments. Region-wide connectivity, however, would be most improved by Alternative 2 and Alternative 3 because of numerous connections along Market Street in Center City. Much of the region’s mass transportation assets are directed to the corridor between 8th Street and City Hall along Market Street. Alternative 2 and Alternative 3 would provide the most regional travelers with the most direct access to Philadelphia’s Delaware River Waterfront compared to Alternative 1.

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Enhance regional transit linkages and connectivity	Medium	High	High	High

G.4.6. Support regional efforts to develop consistent with smart and sustainable principles and in compliance with federal, state and local environmental regulations

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

The alternatives would help advance regional goals for sustainability, smart growth and environmentally-sensitive development. The plan to add light rail transit to Columbus Boulevard and Center City would be consistent with recently adopted regional and citywide initiatives to reduce vehicle miles traveled, reduce the consumption of fossil fuels by vehicles, and improve air and water quality. First, the alternatives would all help implement some of the key goals and strategies of DVRPC’s *Connection 2035 Long Range Transportation Plan*. Second, the alternatives would all help the City of Philadelphia implement the *Greenworks Plan* and reduce the city’s carbon footprint.

DVRPC’s Connections 2035

The three Build Alternatives would support the following four key strategies identified in DVRPC’s *Connections 2035 Long Range Transportation Plan*:

1. Protect our natural environment
2. Create livable communities
3. Build an energy-efficient economy
4. Modernize the transportation system

A future light rail line along Columbus Boulevard is listed within the constrained portion of DVRPC 2035 Long Range Transportation preserving the project's eligibility for federal financing in the future.



The addition of rail transit service along Columbus Boulevard is also consistent with many of the goals of Connections 2035 including:

- **Improve air quality** by providing additional transit options as a means to reduce motor vehicle emissions
- **Invest in centers** by attracting new residents and jobs to the region's cities and centers; restoring and maintaining existing infrastructure; and targeting infrastructure expansions to manage growth, curtail sprawl, and encourage a more sustainable, center-based regional development pattern.
- **Enhance community design** by designing places that are oriented around pedestrians to reduce reliance on automobile travel while increasing mobility for the elderly, the young and the disabled.
- **Reduce greenhouse gas emissions** by reducing the demand for services and energy provision by locating jobs, housing and services closer together and encouraging denser development.
- **Rebuild and maintain the region's transportation infrastructure**
- **Ensure transportation investments support Long Range Plan goals** by promoting transit oriented development and mixed-use development; encouraging investment in older, developed areas and brownfields; increasing the level of investment in transportation facilities that promote freight movement and economic development; and considering the land use impacts of transportation investments in the development of plans and programs.
- **Increase mobility and accessibility** by promoting coordination and integration of all transportation systems and complying with regulations and guidance for the Americans with Disabilities Act and Title VI.
- **Reduce congestion** by reducing the amount of vehicle miles traveled, particularly single occupant vehicle trips.
- **Limit transportation impacts on the natural environment** by promoting the use of public transit to encourage the reduction in use of modes contributing significantly to air pollution.

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²⁵ DVRPC, *Connections 2035 Long Range Transportation Plan*, 2009

The City of Philadelphia’s Greenworks Plan

In April 2009, the City of Philadelphia released “Greenworks Philadelphia,” a plan for urban sustainability aimed at making Philadelphia the greenest city in America. If the plans for Greenworks are realized, city government would reduce its annual energy consumption by 30 percent.²⁶

The implementation of a light rail system would help achieve many of the specific aims of Greenworks Philadelphia, including:

- Improving Air Quality toward Attainment of Federal Standards
- Reducing Vehicle Miles Traveled by 10 Percent
- Reducing Greenhouse Gas Emissions by 20 Percent
- Planning for an Expanded Transportation System (including the “creation of a light-rail line Delaware Avenue/Columbus Boulevard, using existing rails”)²⁷

Evaluation

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Support regional efforts to develop consistent with smart and sustainable principles and in compliance with federal, state and local environmental regulations	High	High	High	Medium

G.5. TECHNICAL ANALYSIS AND SELECTED FTA NEW STARTS FACTORS

G.5.1. Capital Cost Estimates

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Capital Cost (millions of \$2008)	\$363.68	\$427.50	\$399.49	\$78.71
Annualized Capital Cost (millions of \$2008)	\$30.83	\$36.21	\$33.87	\$7.25

G.5.2. Operations and Maintenance Cost Estimates

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
Annual Estimated O&M Cost Estimates (millions of \$2008)	\$11.472	\$13.013	\$12.269	\$12.143

²⁶ PennPraxis, <http://planphilly.com/node/8791>

²⁷ The City of Philadelphia, *Greenworks Philadelphia*, 2009

G.5.3. Ridership Estimates

Table G-3 shows the anticipated ridership for the Build and TSM Alternative identified by service (North Service, South Service and Waterfront Service).

TABLE G-3: PROJECTED DAILY TRANSIT BOARDINGS

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
North Service	1,300	3,400	1,300	2,100
South Service	2,500	11,500	4,000	2,500
Waterfront Service	4,000	2,400	3,500	2,300
TOTAL	7,800	17,300	8,800	6,800

G.5.4. New Transit Trips

The identification of new transit trips (Table G-4) resulting from the Build Alternatives measures the expected number of trips diverted from other non-transit modes. This is an estimate of the number of people who will abandon their present non-transit mode of travel (e.g., single-occupant vehicle) in favor of the Build Alternative. In most cases, the purpose of a project is not to divert users from one transit mode to another, though this is often acceptable as a new service will result in increased convenience and decreased travel time for some existing transit users. The aim of this measure is to help estimate the number of new users a new service will attract versus the number of existing transit users who will switch to the new transit facility under study.

TABLE G-4: PROJECTED NEW TRANSIT TRIPS

	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
vs. No Build	1,500	5,400	1,900	3,400
vs. TSM	—	2,000	—	—

Alternative 2 is anticipated to result in more new transit trips compared to the other Build Alternatives or the TSM Alternative.

G.5.5. User Benefits

FTA developed a new measure for potential New Starts projects to help determine the benefits of a proposed project. Called *user benefits*, this measure is aimed at identifying anticipated travel time savings (Table G-5) for all users of the proposed project (both new transit riders and existing transit riders). According to the FTA, transportation system user benefits reflect the improvements in regional mobility—as measured by the weighted in- and out-of-vehicle changes in travel time to users of the regional transit system—caused by the implementation of the proposed New Starts project.²⁸

²⁸ FTA, *FY2009 New Starts and Small Starts Evaluation and Ratings Process*, July 2007

TABLE G-5: PROJECTED DAILY TRAVEL TIME SAVINGS (IN HOURS)

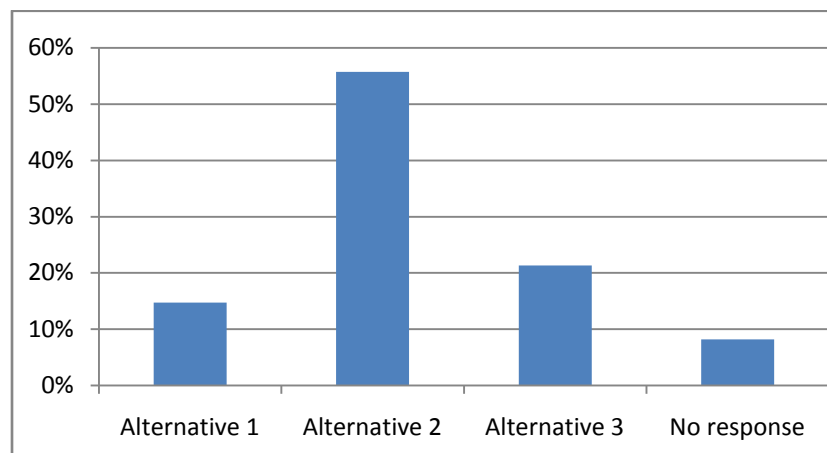
	Alternative 1	Alternative 2	Alternative 3	TSM Alternative
vs. No Build	1,600	4,880	1,900	3,850
vs. TSM	—	1,270	—	—

Alternative 2 is anticipated to result in more travel time savings compared to the other build alternatives or the TSM Alternative.

G.5.6. Public Support

In addition to stakeholder and public outreach in more informal settings, two public open houses were conducted on September 22 and September 30, 2009. At the open houses, attendees were asked to review the alignments and the technical analysis and select a preferred alignment. Those that completed the comment form preferred Alternative 2 compared to the other Build Alternatives (Figure G-1).

FIGURE G-1: PUBLIC SUPPORT FOR BUILD ALTERNATIVES



G.6. SELECTION OF LOCALLY PREFERRED ALTERNATIVE

The Locally Preferred Alternative in an Alternatives Analysis is the concept that best achieves the aims of the study and satisfies the goals of the sponsoring agency and the region as a whole. For the PATCO Philadelphia Waterfront Transit Expansion Alternatives Analysis, **Alternative 2** was selected as the Locally Preferred Alternative. Refinements to the Locally Preferred Alternative will occur in the subsequent project phase, which will include the evaluation and mitigation of environmental impacts and preliminary engineering.



G.6.1. Summary Details of Locally Preferred Alternative

Preferred Alignment: Alternative 2 would operate between the Waterfront and Center City via Market Street. Along Columbus Boulevard/Delaware Avenue, it would operate in the median, sharing the existing Belt Line trackage where feasible. Additional trackage would be added to the majority of the Columbus Boulevard/Delaware Avenue with the aim of ensuring the availability of two tracks for the LRT service periods. Along Market Street, the LRT would operate in the curb lanes heading east and west. The cartway of Market Street may need to be enlarged to accommodate the proposed LRT service, pending review during Preliminary Engineering.

Mode: Street-running light rail transit

Proposed Station Locations:

- Pier 70
- Reed Street
- Christian Street
- Penn’s Landing
- Callowhill Street
- Spring Garden Street
- Frankford Avenue
- Girard Avenue
- 2nd and Market Streets
- 6th and Market Streets
- 8th and Market Streets
- 11th and Market Streets
- Juniper and Filbert Streets
- Pennsylvania Convention Center

G.6.2. Service Frequencies

Policy headways were established by service and time period, as shown in Table G-6.

TABLE G-6: ALTERNATIVE 2: POLICY HEADWAYS BY TIME PERIOD

	Weekday (in minutes)				Weekend (in minutes)	
	6:00 AM–9:00 AM	9:00 AM–3:00 PM	3:00PM–7:00 PM	7:00 PM–1:00 AM	6:00 AM–7:00 PM	7:00 PM–1:00 AM
Alternative 2, North	10	10	10	30	15	30
Alternative 2, South	10	15	10	30	15	30
Alternative 2, Waterfront	10	15	10	30	15	30

G.6.3. Alignment Length

TABLE G-7: ALTERNATIVE 2: ALIGNMENT LENGTHS

Service	Alignment Length (miles)
Alternative 2, North	6.08
Alternative 2, South	6.19
Alternative 2, Waterfront	6.62