# *OAKLAND TRANSIT CONNECTOR*

# *AND*

# *DOWNTOWN PITTSBURGH TO OAKLAND CONNECTOR*

# *PITTSBURGH, PA*

## *Project Information Document*


***by***

***Lea+Elliott, Inc.***

***for the***

***Transportation Action Partnership***


## *FINAL REPORT*

Lea+Elliott

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## 1.0 INTRODUCTION

One of the key long-term transportation goals for the greater Pittsburgh area is to develop transit links connecting the region's three major economic centers; Downtown Pittsburgh, the Oakland section of the City and the Pittsburgh International Airport. Conceptually these links would be provided as follows:

- Build a transit connection between Downtown Pittsburgh and the Oakland area of the City which are the second and third largest activity centers in the State.
- Build a fixed guideway circulator system within the Oakland area connecting the University of Pittsburgh, University of Pittsburgh Medical Center, Carnegie Mellon University and the Pittsburgh Technology Center along the Monongahela River.
- And in the future, extend the area's existing light rail system to connect Downtown with the Pittsburgh International Airport, via the North Shore Connector, currently under construction.

To assist in the pursuit of these goals, the County's Chief Executive has established the Transportation Action Partnership (TAP). The TAP includes representatives from the Allegheny County Economic Development, the Port Authority of Allegheny County, the Allegheny Conference on Community Development, the City of Pittsburgh, the Southwestern Pennsylvania Commission, the Urban Redevelopment Authority of Pittsburgh and the Pittsburgh Parking Authority. TAP's near-term focus is on the first two transit links above, namely the transit connector between Downtown Pittsburgh and Oakland, and the development of a circulator system within the Oakland Area.

The Oakland segment of the Transit Connector is expected to be an Automated People Mover (APM) class of technology, based on the findings of a prior study entitled "*Oakland Transit Connector – Techno-Economic Study*" which was prepared in 2007 on behalf of the Allegheny Conference Oakland Investment Committee. The Downtown-Oakland Transit Connector segment may be an extension of the Oakland APM System, the existing light rail system (commonly known as the "T"), or other technology such as BRT depending in part on the level of ridership and the development opportunities along the segment of this corridor.

In recognition of the economic conditions and the tight funding climate existing at this time, TAP has been charged with identifying and exploring the viability of alternative approaches for financing and possibly delivering these transportation system improvements through a Public Private Partnership (P3). To carry out this charge, TAP is issuing a series of documents, or Project Prospectus, to elicit comments from potential industry participants including suppliers, contractors, financial institutions, etc. who may eventually participate by responding to requests for proposals on the project. These documents include:

1. Project Information Document (this document)
2. Project Procurement Structures
3. Project technical and Financial Structures

In parallel with this solicitation of input from the industry, TAP, with the Pittsburgh Chamber of Commerce, is also working on developing the necessary state legislation so that the eventual local sponsor for these projects will have the authority to enter into a P3 with the project developer.

Through these documents input is being sought from industry on the following topics:

- Viability of the Oakland Transit Connector, including determination of priority of Automated Fixed Guideway Transit (AGT) for this corridor
- Viability of the Downtown-to-Oakland Connector, including consideration of priority of AGT versus PAAC bus operations in this corridor
- Determine priority for the Downtown-to-Oakland Connector compared to the Oakland Transit Connector
- Views on potential development opportunities, revenue streams, public/private partnering (P3) and other associated opportunities that can increase corridor(s) viability for utilizing a public-private partnership structure to implement the project(s)

This document is the Project Information Document and is designed to provide industry reviewers with background information on:

- Regional characteristics
- The corridor of interest where fixed guideway systems are being proposed
- Options for an Oakland Transit Connector
- Options for a Downtown to Oakland Transit Connector

**For additional information and reference material on the Pittsburgh region and the Downtown to Oakland Corridor beyond that presented herein, please refer to the website identified in the solicitation for input from industry being issued with this document.**

## 2.0 REGIONAL CONTEXT

This section provides background information on demographic trends and characteristics for the area overall and the Downtown Pittsburgh and Oakland Area in particular to assist industry reviewers in assessing the market potential for transit in the project corridors.

As depicted in Figure 1, a number of bus routes pass through the corridor and connect to other transit services including the existing light rail system in the Downtown area and dedicated busways to the northeast and south. These transit services are operated by the Port Authority of Allegheny County (PAAC) who is currently conducting an extensive evaluation of its routes and services through the ongoing preparation of the Transit Development Plan (TPD). Through the TPD, the PAAC is seeking to make adjustments to its exiting bus route structure that will improve efficiencies in operation by matching existing services with current demands and projected changes in demand by location. As part of this plan development, the PAAC issued a Market Analysis for the entire region which provides extensive information on the characteristics of the corridor of interest and daily travel patterns to/from these areas of the City and is cited extensively in this section of this document.

Before reviewing the insight provided by the PAAC's Market Study, here is a brief overview of the three areas of interest within the corridor which will be referenced throughout this report.

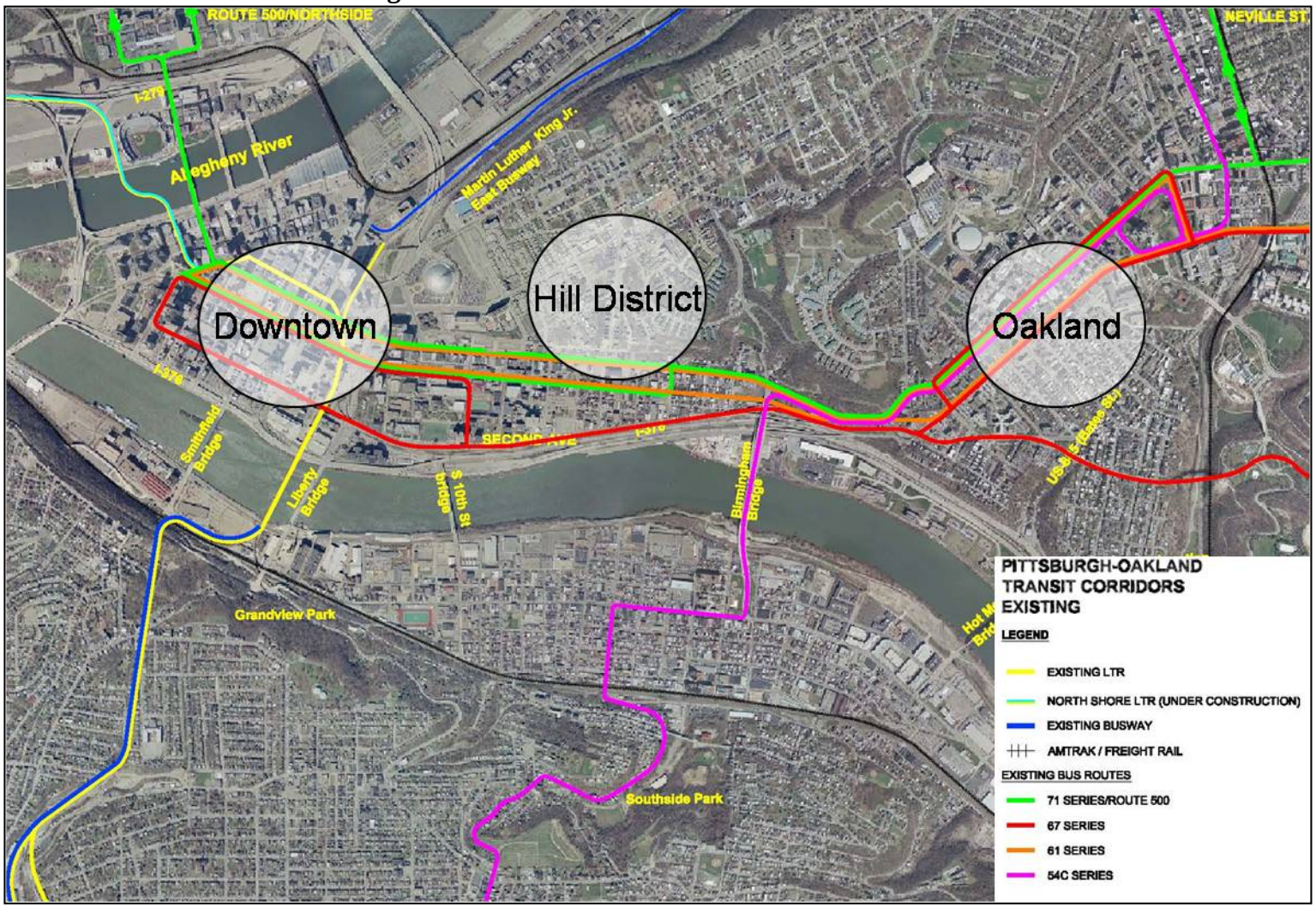
### Downtown

Downtown Pittsburgh is the Central Business District, also referred to as the Golden Triangle. It is generally defined as the area bound by the Monongahela and Allegheny Rivers and the Crosstown Expressway. The area is the major urban center of the metropolitan area and is home to major corporations such as PNC Bank, U.S. Steel, PPG, Mellon Financial, Heinz, Federated Investors and Alcoa.

### Hill District

The Hill District is an older urban residential area that is home to almost 17,000 people many of whom work in the Downtown or Oakland area. As noted on the City's website, the neighborhood has a rich cultural history. Real estate is reasonably priced in the Hill, where many old buildings and even large parcels of land are surprisingly inexpensive. Hill District residents have a strong sense of community and history, and work through church and civic organizations to generate pride and redevelopment opportunities.

**Figure 1**
**Existing Transit Services in Downtown to Oakland Corridor**



## Oakland

Oakland is considered the cultural, medical, educational, and technological center of Pittsburgh, boasting many world-renowned institutions and attractions and is the third largest activity center in the state. The area is comprised of the region's largest medical and research institutions, four universities, three historic districts, two retail areas, cultural institutions and seven residential neighborhoods. The Oakland area has limited access to the regional highway network and the recent growth has strained the Oakland roadway network which is often operating at capacity. Hence, public transit is viewed as a means to relieve existing congestion and more importantly, accommodate future growth by linking the existing Oakland research and medical care facilities with the Technology Center and other development parcels along the Monongahela River.

## County Overview

Over the last few decades Allegheny County has been undergoing a shift from an economy dominated by heavy industry to more of a postindustrial knowledge based economy with emphasis on research, finance, technology and health care. These shifts have resulted in changes in residential and employment patterns as described in the following sections.

## Population Trends

Allegheny County is home to approximately 1.2 million residents. In terms of recent trends, 97 of 130 municipalities lost population in the 1990s and only 16 municipalities increased their population by 5 percent. Most of the growing communities lie at the County's outer north, west and southwest areas and population decline was concentrated in the urban core and extended outward along the County's three rivers.

These general trends are expected to continue at least in the near term with the highest rates of growth anticipated in the outer north and west fringes. Population in other areas of the County are expected to remain stable or decline.

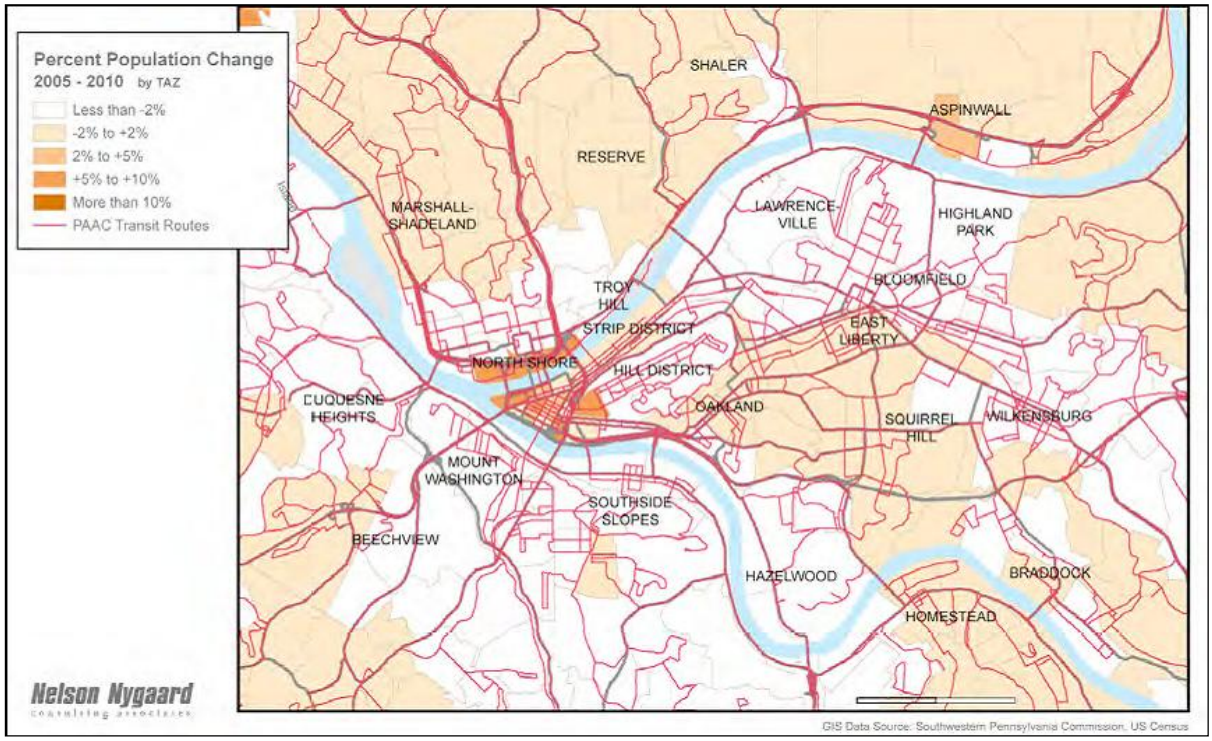
Per Figure 2, some growth in population in the Downtown area is projected in the near-term, while remaining stable in Oakland. Please refer to forecasts in the Allegheny Places reference documents that are provided in the information website associated with this solicitation.

## Employment Trends

At the present time, there are approximately 880,000 jobs in Allegheny County, of which 69% are in service industries, 17% are in retail trade, and 5% are in manufacturing. Within the City of Pittsburgh, there are 370,000 jobs, 102,000 of which are in Downtown Pittsburgh and 55,000 are in Oakland. These two areas account for 18% of the total jobs in Allegheny County, and 23% of the county's service jobs.

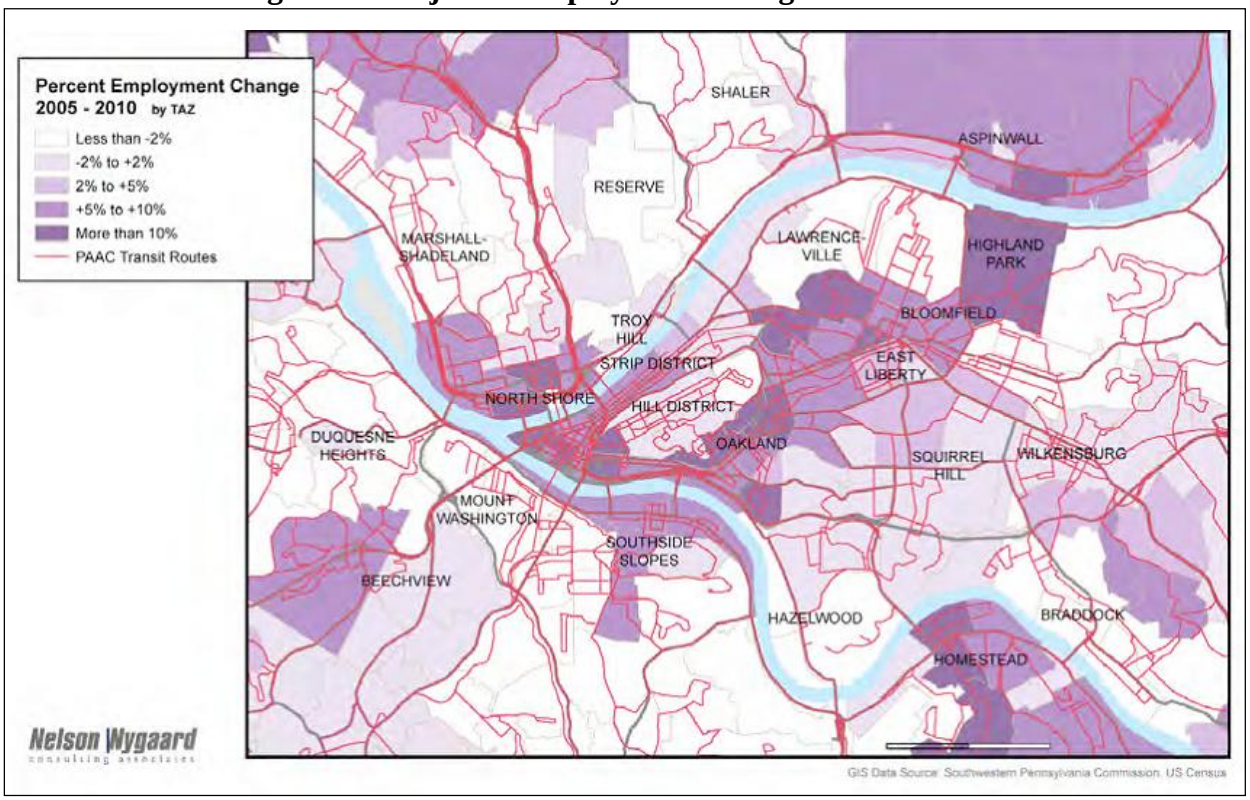
Employment is projected to grow in the core areas of Downtown and Oakland. However, as with population growth, most employment growth is occurring in the outer areas of the County as well (see Figure 3).

## Figure 2 - Projected Population Change – 2005 to 2010




Source: Market Analysis, PAAC Transit Development Plan, July 2008

## Figure 3 - Projected Employment Change – 2005 to 2010



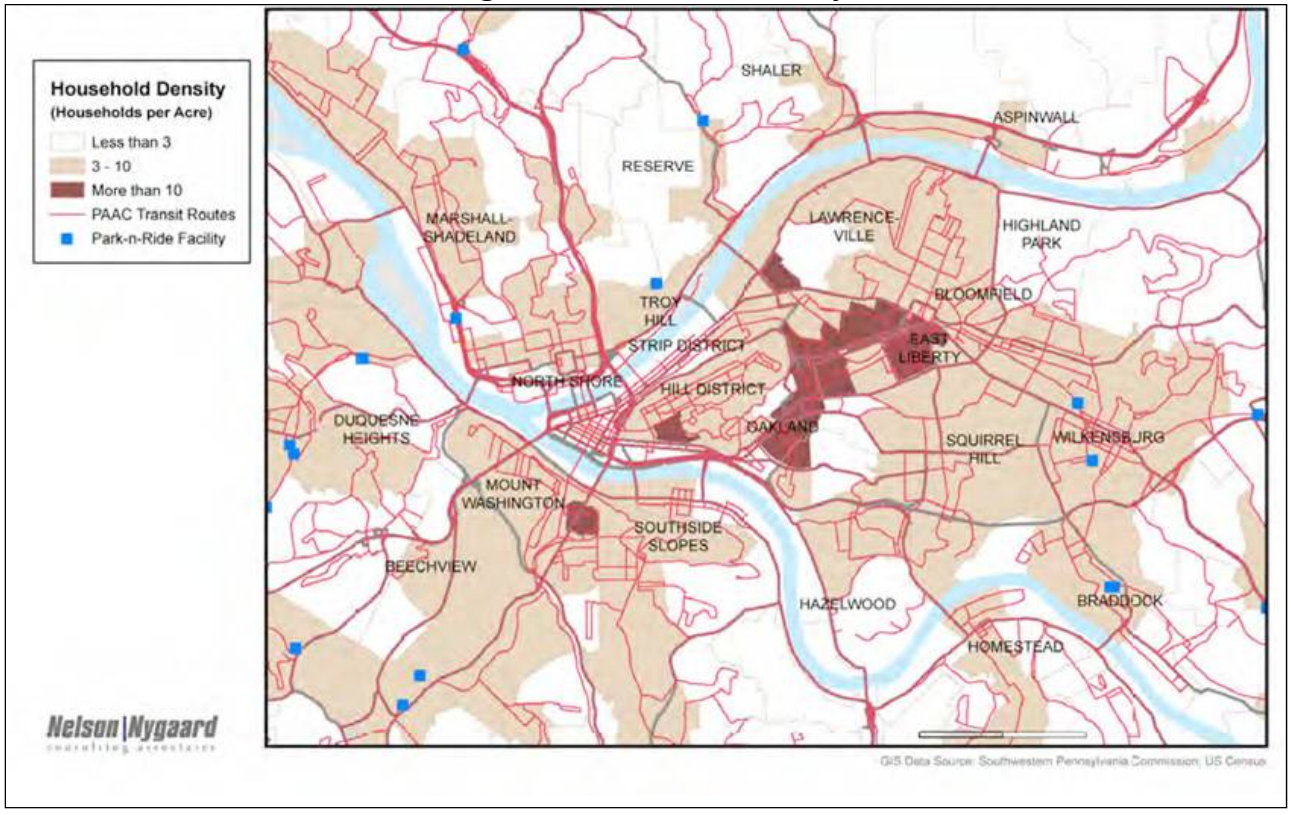
## Population and Employment Densities

The PAAC Market Study examined population and employment densities within the County to assess areas that might support fixed route transit services. The report cites research that has shown that traditional fixed-route transit can operate productively in areas that have at least 3 households per acre or at least 4 jobs per acre. Further, those areas with 3 to 10 households per acre or 4 to 20 jobs per acre have a medium level of transit supportiveness, and those with higher levels have a high level of transit supportiveness.

Figures 4 and 5 illustrate household and employment densities in terms of these ranges. As shown, population densities are highest in the urban core of Pittsburgh, and generally decline with distance from Pittsburgh. As described in the previous section, recent trends have population growth occurring in outer areas, while population in the core area has been declining. As a result, the outer areas are becoming more densely developed, while the core area is becoming less dense. Still, the areas with the greatest population and employment densities, and the most transit supportive, continue to be the older, more traditional core areas. And, there is a trend beginning where people are moving into downtown to new or redeveloped residential facilities.

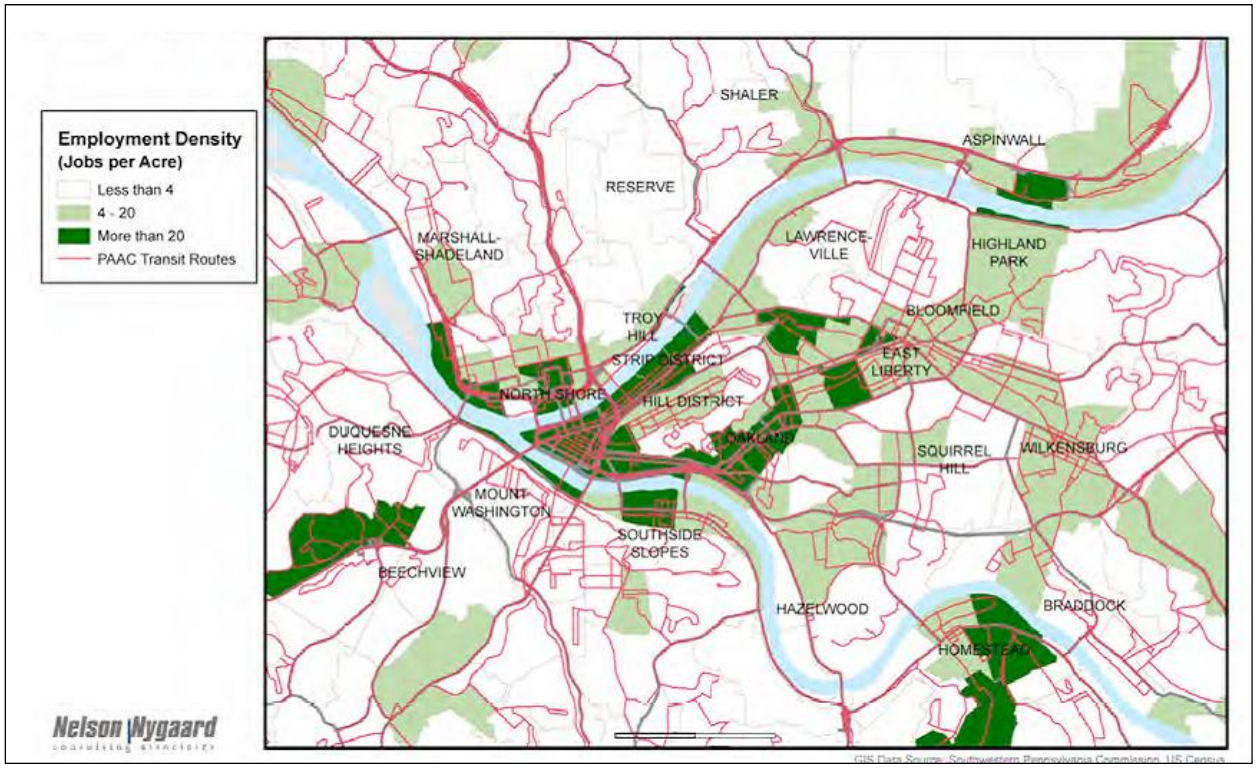
Per this analysis, the TDP Market Analysis found that that the Downtown to Oakland corridor has very high household and employment densities and would likely support improved and premium transit services.

**Figure 4 - Household Density**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

**Figure 5 - Employment Density**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

## Populations with High Transit Needs

The Market Analysis also examined population patterns of groups which typically have high transit usage including seniors, youths, minorities, those with low incomes, and households without automobiles. Such additional information is available on the PAAC's TDP website at http://tdp.portauthority.org/paac/

## Origin-Destination and Transit Use Patterns

This section provided excerpts of the origin/destination and transit mode share data provided in the Market Analysis as they pertain to Downtown and the Oakland Area.

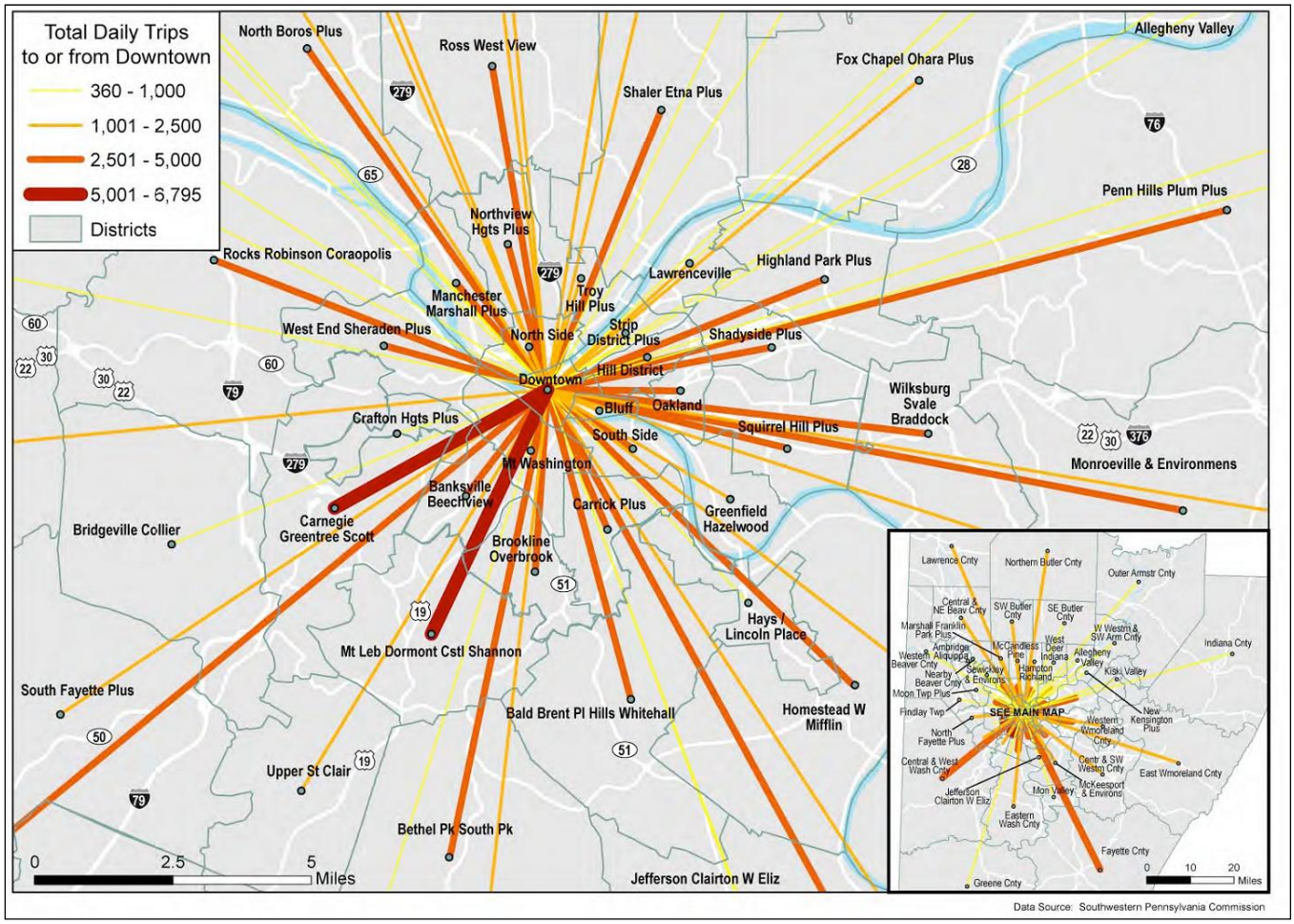
### Downtown Pittsburgh

Figure 6 shows distribution of trips to and from Downtown and Figure 7 displays the percentage of all trips that are made by transit to and from Downtown.

Some noteworthy transit related characteristics for Downtown are:

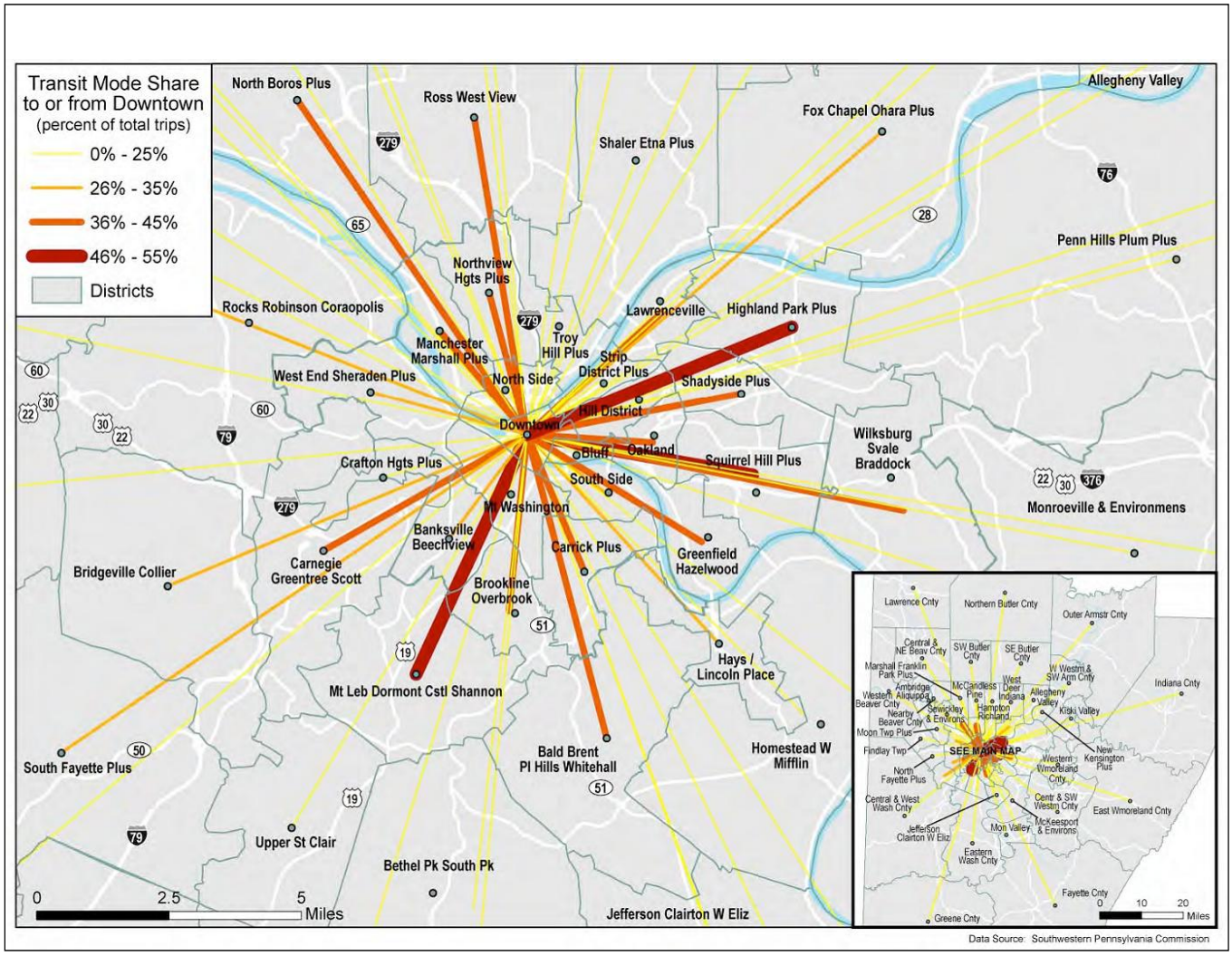
- Downtown attracts trips from throughout the county and from beyond.
- The overall mode share to Downtown is estimated to be about 48% with transit mode shares in some corridors exceeding 50%
- The transit mode share between Oakland and downtown is also high (between 36% and 45%), but the PACC study noted that a higher transit share in this corridor should be achievable with service improvements.

**Figure 6 - Total Daily Trips to/from Downtown**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

**Figure 7 - Transit Mode Share to/from Downtown**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

## Oakland

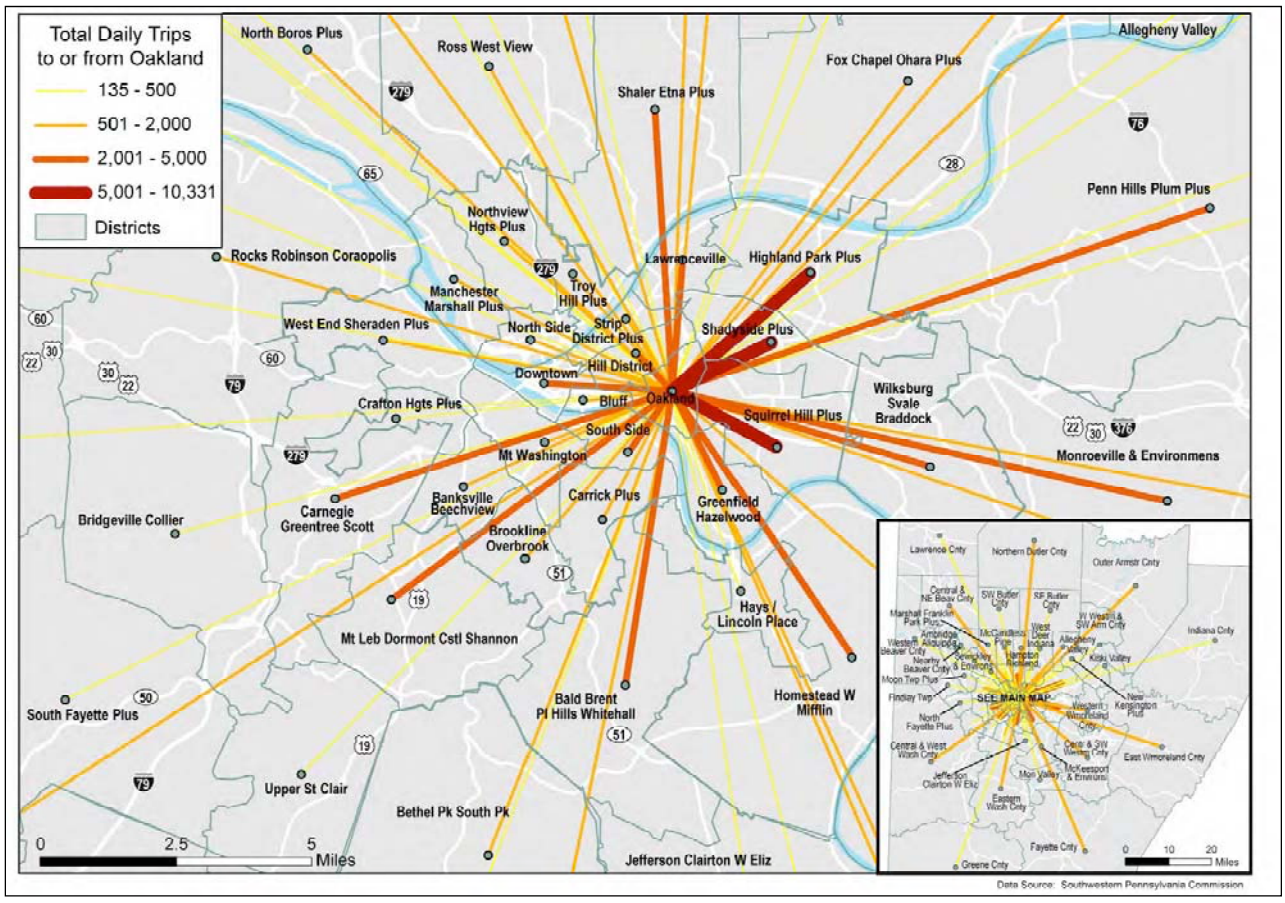
After downtown, the largest travel flows are to Oakland in the County. Figure 8 shows travel flows to and from Oakland and Figure 9 shows mode share of trips to Oakland.

These figures indicate that:

- Flows to Oakland vary from those to Downtown in a several ways. First, the highest volumes are from other parts of the east side, with the highest volumes from Highland Park, East Liberty, Homewood, Shadyside, Squirrel Hill, and other neighborhoods in the same environs. This is not surprising, as these areas are close to Oakland, and they are well linked by transit.
- Second, there is significantly less travel from the west and south. This is also not surprising, as these areas are located closer to Downtown and farther from Oakland.

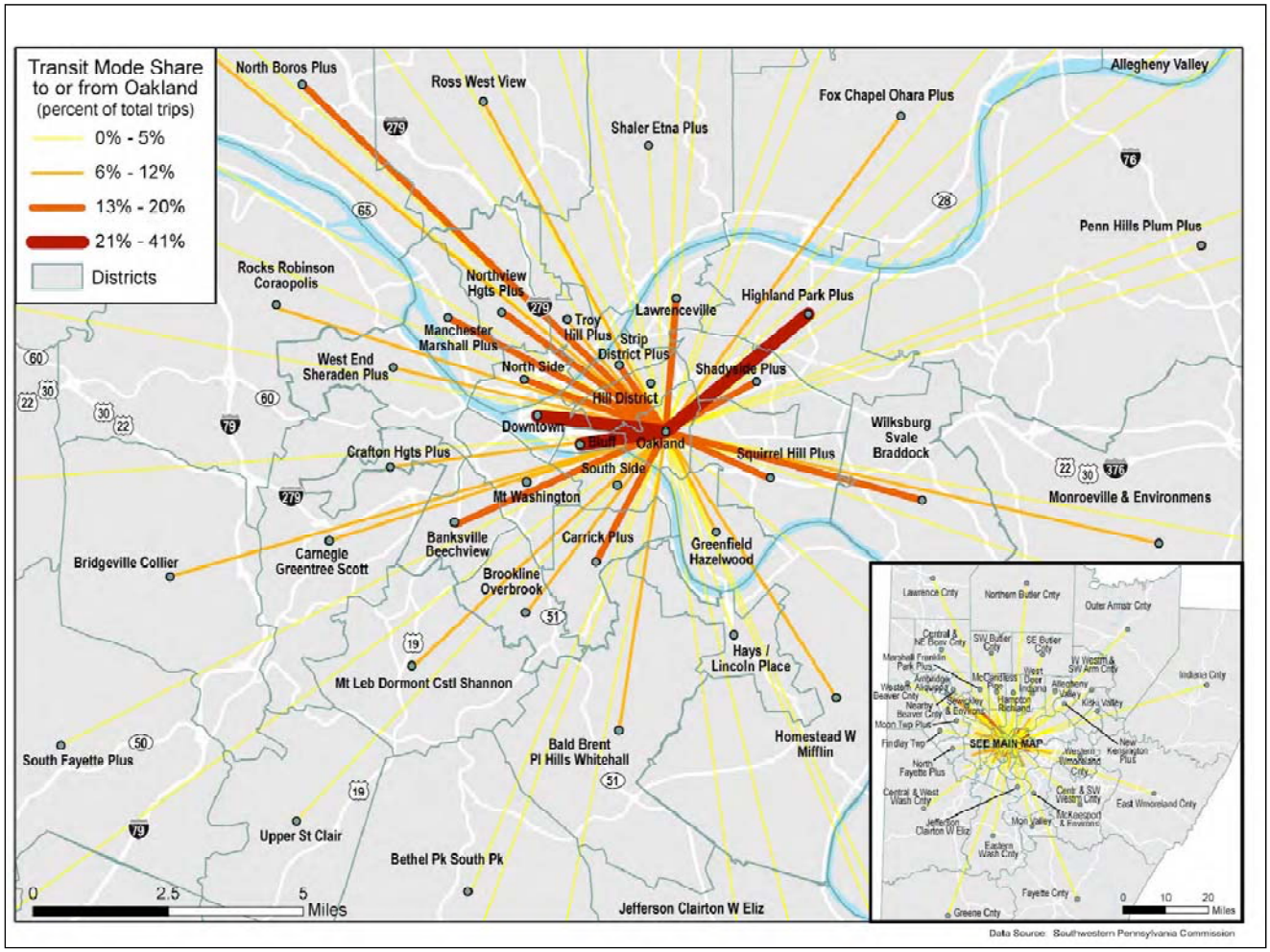
Transit mode shares to Oakland are high, but lower than to downtown. Overall, the transit mode share for trips to Oakland is estimated to be about 30% with transit mode shares in some corridors exceeding 40%. The PAAC Market Analysis noted that Oakland shares many of the same characteristics as Downtown, and while transit service to Oakland is generally very good, higher transit mode shares should be possible.

**Figure 8 - Total Daily Trips to/From Oakland**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

**Figure 9 - Transit Mode Share to/from Oakland**




Source: Market Analysis, PAAC Transit Development Plan, July 2008

## 3.0 OAKLAND TRANSIT CONNECTOR

The Allegheny Conference Oakland Investment Committee ("OIC") engaged a consultant team to evaluate several aspects of the feasibility of undertaking, operating and maintaining a Transit Connector on a dedicated right-of-way in the Greater Oakland area of Pittsburgh. As noted, this area is comprised of the region's largest medical and research institutions, three historic districts, two retail areas, cultural institutions and seven residential neighborhoods. One of the OIC's objectives was to develop a means of rapid transportation that will connect this highly congested area to the Monongahela River corridor, where there is an opportunity for physical expansion of research and health care facilities.

To meet the transportation needs of the area, the prior study found that any new system must be a grade separated fixed guideway transit system in order to meet the "pent up" growth demands that can be satisfied on multiple sites including the riverfront sites and further, a transit link would make these remote sites viable for development to meet the growth demands. This system is also intended to supplement the existing Port Authority of Allegheny County (PAAC) transit

system, connecting with it as it is currently configured and with its future expansion. This section reviews the findings of that evaluation including the technologies that were evaluated for use on the Oakland Transit Connector project, ridership forecasts and incremental development options and phasing considerations based on ridership projections.

## Alignment Characteristics, Requirements and Configurations

Due to the landlocked nature of Central Oakland, and the inability to supplement roadway capacity, transportation improvement alternatives focused on fixed guideway transit systems that operate within their own dedicated right of way.

The critical goals of the Transit Connector are:

- Satisfy the total passenger demand safely.
- Provide a dependable reliable service with frequent headways (between 5 and 10 minutes between trains).
- Provide a good level of service (improved travel times and supplemented transportation capacity that makes growth opportunities viable).
- Minimize capital investment, operation and maintenance costs
- Fit the Connector into the urban landscape and ensure that the system advances the overall quality of life for the Oakland area.

This implies that, with a minimum cost, the proposed project must simultaneously achieve compatibility with the site-specific requirements of the project corridor while also meeting safety, reliability, comfort, and speed requirements.

Prior work had established an "ultimate build" alternative for the Oakland Transit Connector and through coordination and work sessions with the OIC and its other consultants, different alignment alternatives and station platform configurations were evaluated. Input from the Oakland institutions and a review of their masterplans provided a basis to refine the alignment to avoid/minimize impacts on existing facilities, planned facilities and to facilitate independent implementation of the institutions' masterplans from the implementation of the transit connector. This reduces the complexity of the interfaces thus reducing implementation schedule and budget risks for both the institutional facilities and the transit connector.

Refinements were also made based on the following considerations:

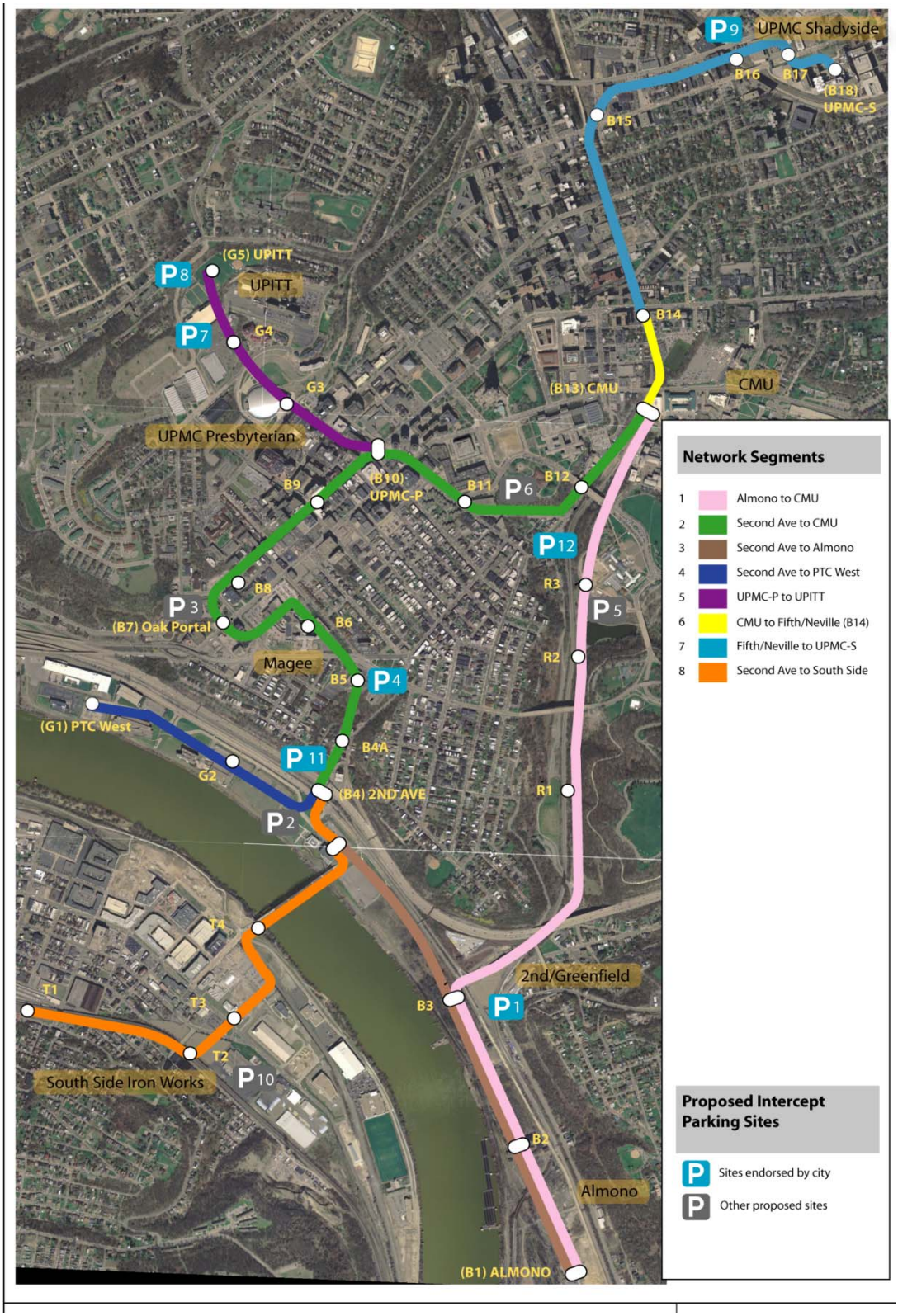
- Avoid or at worst minimize any impacts on existing or planned future facilities of the Oakland institutions.
- Maintain alignments within the public right-of-way as much as practicable to avoid/minimize need for property acquisitions

Finally, a system of the magnitude of the Oakland Connector is typically implemented in a phased manner. Hence, for planning and evaluation purposes, the refined full-build system network was subdivided into operational routes or segments described below and illustrated in Figure 10:

- Segment 1 Almono to CMU via Junction
- Segment 2: Second Avenue to CMU
- Segment 3: Second Avenue to Almono
- Segment 4: Second Avenue to PTC West
- Segment 5: UPMC-P to Petersen Center/UPITT
- Segment 6: CMU to Fifth/Neville
- Segment 7: Fifth/Neville to UPMC-Shadyside
- Segment 8: Second Avenue to South Side

In addition, as shown on Figure 10, a number of intercept parking locations were indentified for potential development in conjunction with the Oakland Transit Connector. These parking facilities are projected to play an integral part in the overall ridership potential of the transit connector and subsequent sections describe the capacity and usage patterns projected for these parking facilities. The figure also notes which intercept parking locations were initially endorsed by the City of Pittsburgh Planning Department.

**Figure 10**
**Proposed Oakland Transit Connector**
**Full Build Alignment and Phasing Segments**



## Technology Assessment

Based on the conceptual full build alignment, the following classes of technologies were considered for application for some or all of the Oakland Transit Connector.

1. Light Rail Transit (LRT)
2. Rapid Rail Transit (RRT)
3. Diesel Multiple Units (DMUs)
4. Cable suspended/Gondola
5. Automated People Mover (APMs)
    a. Personal Rapid Transit (PRT)
    b. Monorails
    c. Cable-driven Automated People Mover (APM)
    d. Self-propelled APM
    e. Maglev

The goal of this evaluation was to identify which class of technology is best suited for the Oakland Connector and then establish a generic set of guidelines for system planning purposes that is compatible with the technology from a variety of suppliers.

The findings of this evaluation were as follows:

- Fully automated, driverless Automated People Mover (APM) systems are considered to be the most appropriate class of transit for most of the Oakland Connector segments because 1) their physical space requirements are compatible with the site constraints presented by the Oakland area, 2) they have been service-proven in high capacity, high performance and complex operations, including “must ride” systems, 3) they can meet the ridership requirements within the limited available space/facility and restraints of station space arrangements and 4) they are compatible with the local terrain and weather conditions.

- A connection between CMU and the ALMONO site through Junction Hollow is also possible utilizing heavy rail technology such as the Diesel Multiple Unit (DMU) on the existing CSX tracks.

- Cable suspended/gondola type systems also appear to be especially viable for connecting from Second Avenue to the South Side Works over the Monongahela River, and from Presbyterian Hospital to the Petersen Center and beyond due to the terrain and as-built conditions along Desoto Street.

## Segment Characteristics

The table below summarizes features of each segment in the full build scenario including length, number of stations, estimated travel times and the potential transit technology. Note that along Segment 1 which connects Almono to CMU via Junction Hollow, two potential transit vehicle technologies could be used. One is APM technology operating on an independent and elevated guideway and the other is Diesel Multiple Unit (DMU) heavy rail which would share the existing CSX freight tracks. The other primary route would be Segment 2 which would proceed from Second Avenue to CMU along the Fifth Avenue corridor through Central Oakland. The remaining Segments could ultimately be individual radial branches connecting from Segment 2 to the other destinations such as PTC West, Almono, the Peterson Center, Shadyside and the South Side. Due to the existing traffic conditions and right of way constraints, it is presumed that an APM technology on an elevated guideway would be the transit system of choice on most of these segments. The exception would be Gondola technology which might be considered for Segment 5 due to the steep grade up Desoto Ave and Segment 8 due to the river crossing.

**Table 1**
**Features of Each Operating Segment**

| Segment | Description | Length in Miles | No. of Stations | Travel Time in minutes | Potential Transit Technology |
|---|---|---|---|---|---|
| 1 | Almono to CMU (via Junction Hollow) | 2.1 | 7 | 7.1 APM<br>20 DMU | APM or DMU |
| 2 | Second Ave to CMU | 1.9 | 11 | 9.4 | APM |
| 3 | Second Ave to Almono | 1.2 | 3 | 3.7 | APM |
| 4 | Second Save to PTC West | 0.5 | 2 | 2.3 | APM |
| 5 | UPMC-P to Petersen Center/UPITT | 0.6 | 3 | 2.9 | APM or Gondola |
| 6 | CMU to Fifth/Neville | 0.3 | 1 | 1.1 | APM |
| 7 | Fifth/Neville to UPMC-Shadyside | 1.0 | 4 | 4.9 | APM |
| 8 | Second Ave to South Side | 1.4 | 4 | 5.5 | APM or Gondola |

Note: Travel time estimates assume operations by APM technology and nominal dwell times of 15 seconds.

## Ridership Evaluation

One member of the consultant team, Trans Associates (TA), prepared ridership projections for a variety of development scenarios for the Oakland Transit Connector utilizing the Southwestern Pennsylvania Commission (SPC) Regional Transportation Model. The SPC Model is based on the official land use and transportation networks for the region including both vehicle and transit modes. TA carried out several refinements to prepare the regional model for use in the Study to better reflect the micro-level travel patterns in the Oakland area. The refinements were based on:

- A home to work survey of employees from the various institutions in the Oakland area
- Existing transit ridership from the Port Authority
- Supplemental land use and growth forecasts to reflect potential development planned for PTC West, ALMONO site, the Oakland Portal, South Side Works, and Shadyside areas. The development scenarios were defined through consultation with the Oakland institutions, the Urban Redevelopment Authority (URA), the ALMONO Partnership, and other developers including Soffer and Gustine.
- The proposed series of intercept park and ride facilities would be available to potential Connector users (see Figure 10)
- APM routes, segments and travel times
- The 4 travel analysis zones for Oakland in the SPC model were subdivided to over 100 zones again to better capture micro-level travel patterns.

Modeling was conducted for two timeframes based on 2007 existing conditions and projected conditions in 2030. Some of the key factors and variables in TA's modeling process were:

- Modeling was based on typical weekday conditions

- Factors to convert weekday to other time periods are:
  - Saturdays: 0.403
  - Sundays: 0.227
  - Annual: 261.775

- Trip modes available
  - Automobile
  - PAAC Bus/Transit
  - Walk
  - APM only
  - APM park/ride
  - APM/PAAC or Institutional bus transfers

- Mode choice decisions driven by
  - Origin to Destination Travel times including:
    - Walk, bus, auto or people mover trip times;
    - Drive, walk or bus access time to People Mover;
    - People Mover wait times.
  - Costs
    - Average transit fare: $0.77 per trip – Sensitivities to increased fares
    - Average parking fee: $2.88 per day
    - Vehicle operating costs
  - Availability of intercept parking at APM Station
    - Park/ride for superior travel time
    - Demand for park/ride use reflects congestion in Oakland area
  - For Bus to People Mover or Auto to People Mover transfers one end of the trip must be in the Oakland study area.

TA prepared 2007 and 2030 model runs for a variety of system scenarios including a no build case and different combinations of the system segments depicted in Figure 10. The system development system scenarios pass through either Junction Hollow or Central Oakland as described below:

Junction Hollow Scenarios (Segment 1):

- Almono to CMU via DMU rail operation on existing CSX tracks
- Almono to CMU via APM operating on an independent guideway

Central Oakland Scenarios (All APM operating on an independent guideway)

- Second Avenue to CMU via Fifth Avenue through Central Oakland
- Alomono to University of Pittsburgh Medical Center-Shadyside (UPMC-S)
- PTC West to UPMC-S
- PTC West to Petersen Center/UPITT
- Almono to Petersen Center/UPITT
- Build Full System

In each case, TA's projections provided data on:

- Trips by mode
- APM, PM and daily Connector ridership
- Peak and daily intercept parking demand
- Connector ridership by institutions

Estimated daily ridership based on various system development scenarios are presented in the following series tables.

## Table 2
## Daily Trips by Mode-2007

| MODE | No APM or DMU | Junction Hollow Scenarios | | | Central Oakland Scenarios | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Almono to CMU w/DMU (a) | Almono to CMU w/DMU (b) | Almono to CMU w/APM (b) | Second Ave to CMU | Almono to UPMC-S | PTC to UPMC-S | PTC to Petersen / UPITT (c) | Almono to Petersen/ UPITT (c) | Full System (d) |
| **AUTO ONLY** | 179,713 | 177,844 | 177,844 | 176,382 | 152,401 | 145,562 | 146,252 | 157,257 | 151,288 | 145,809 |
| **BUS ONLY** | 77,856 | 66,186 | 77,856 | 77,856 | 63,538 | 59,801 | 63,696 | 63,283 | 61,450 | 54,009 |
| **APM or DMU** | 0 | 13,540 | 1,869 | 3,332 | 41,630 | 52,206 | 47,621 | 37,029 | 44,831 | 57,751 |
| **TOTAL** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** | **257,569** |
| **% Transit** | **30%** | **31%** | **31%** | **32%** | **41%** | **43%** | **43%** | **39%** | **41%** | **43%** |
| **Access to APM/DMU** | | | | | | | | | | |
| **Park/Ride** | 0% | 13% | 96% | 97% | 59% | 53% | 56% | 54% | 47% | 48% |
| **Walk/Ride** | 0% | 1% | 4% | 3% | 6% | 12% | 11% | 6% | 15% | 10% |
| **Bus Transfers** | 0% | 86% | 0% | 0% | 35% | 35% | 33% | 40% | 37% | 42% |

a.) DMU Case with 5 minute walk limit, and transfers to institutional shuttles and PAAC buses.
b.) Cases with 5 minute walk limit but no dual transfers to busses
c.) Segment 2 would extend from Second Ave to UPMC-Presbyterian in this scenario
d.) Segment 1 ridership based on boardings at intermediate stations R1, R2 and R3 and Segment 8 estimated by Trans Associates
Source data: Trans Associates

## Table 3
## Daily Boardings by Segment - 2007

| Segment | Description | Junction Hollow Scenarios | | | Central Oakland Scenarios | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Almono to CMU w/DMU (a) | Almono to CMU w/DMU (b) | Almono to CMU w/APM (b) | Second Ave to CMU | Almono to UPMC-S | PTC to UPMC-S | PTC to Petersen/ UPITT (c) | Almono to Petersen/ UPITT (c) | Full System (d) |
| 1 | Almono to CMU (via Junction Hollow) | 13,540 | 1,869 | 3,332 | | | | | | 46 |
| 2 | Second Ave to CMU | | | | 41,630 | 35,573 | 33,676 | 25,498 | 28,360 | 33,080 |
| 3 | Second Ave to Almono | | | | | 3,963 | | | 7,190 | 3,782 |
| 4 | Second Ave to PTC West | | | | | | 2,680 | 2,946 | | 2,728 |
| 5 | UPMC-P to Petersen Center & UPITT | | | | | | | 8,586 | 9,282 | 5,872 |
| 6 | CMU to Fifth & Neville | | | | | 3,927 | 3,032 | | | 4,014 |
| 7 | Fifth and Neville to UPMC-Shadyside | | | | | 8,744 | 8,233 | | | 8,238 |
| 8 | Second Ave to Southside | | | | | | | | | 3,437 |
| Total Daily Ridership | | 13,540 | 1,869 | 3,332 | 41,630 | 52,207 | 47,621 | 37,030 | 44,832 | 61,197 |

a.) DMU Case with 5 minute walk limit, and transfers to institutional shuttles and PAAC buses.
b.) Cases with 5 minute walk limit but no dual transfers to busses
c.) Segment 2 would extend from Second Ave to UPMC-Presbyterian in this scenario
d.) Segment 1 ridership based on boardings at intermediate stations R1, R2 and R3 and Segment 8 estimated by Trans Associates

Source data: Trans Associates

## Table 4
## Daily Boardings by Segment - 2030

| Segment | Description | Junction Hollow Scenarios | | | Central Oakland Scenarios | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | Almono to CMU w/DMU (a) | Almono to CMU w/DMU (b) | Almono to CMU w/APM (b) | Second Ave to CMU | Almono to UPMC-S | PTC to UPMC-S | PTC to Petersen/ UPITT (c) | Almono to Petersen/ UPITT (c) | Full System (d) |
| 1 | Almono to CMU (via Junction Hollow) | 25,205 | 9,955 | 13,925 | | | | | | 99 |
| 2 | Second Ave to CMU | | | | 53,793 | 49,069 | 47,776 | 34,188 | 36,007 | 47,812 |
| 3 | Second Ave to Almono | | | | | 22,533 | | | 24,794 | 22,556 |
| 4 | Second Ave to PTC West | | | | | | 3,933 | 4,651 | | 5,621 |
| 5 | UPMC-P to Petersen Center & UPITT | | | | | | | 10,632 | 10,427 | 5,890 |
| 6 | CMU to Fifth & Neville | | | | | 4,306 | 3,512 | | | 4,603 |
| 7 | Fifth and Neville to UPMC-Shadyside | | | | | 13,621 | 13,185 | | | 14,511 |
| 8 | Second Ave to Southside | | | | | | | | | 4,744 |
| Total Daily Ridership | | 25,205 | 9,955 | 13,925 | 53,793 | 89,529 | 68,406 | 49,471 | 71,228 | 105,836 |

a.) DMU Case with 5 minute walk limit, and transfers to institutional shuttles and PAAC buses.
b.) Cases with 5 minute walk limit but no dual transfers to busses
c.) Segment 2 would extend from Second Ave to UPMC-Presbyterian in this scenario
d.) Segment 1 ridership based on boardings at intermediate stations R1, R2 and R3 and Segment 8 estimated by Trans Associates

Source data: Trans Associates

**Table 5**
**Segment 1 - DMU and APM Daily Ridership Profile - 2007**

| | | Max Walk = 5 minutes, with transfers to PAAC buses and Institution shuttles | | Max Walk = 5 minutes & No dual transfers | |
|---|---|---|---|---|---|
| | | Daily Passengers (DMU) | % of Total Passengers | *Daily Passengers (APM)* | *Daily Passengers (DMU)* |
| | **Total** | **13,540** | | ***3,332*** | ***1,869*** |
| **Access to APM or DMU** | **Park/Ride** | **1,794** | **13%** | ***3,240*** | ***1,793*** |
| | **Walk-up** | **74** | **1%** | ***91*** | ***76*** |
| | **Bus Transfer** | **11,672** | **86%** | ***0*** | ***0*** |
| | | | | | |
| **Destinations** | **CML** | **288** | **2%** | ***491*** | ***288*** |
| | **CMU** | **1,687** | **12%** | ***1,553*** | ***970*** |
| | **PITT** | **1,503** | **11%** | ***591*** | ***181*** |
| | **UPMC** | **7,430** | **55%** | ***0*** | ***0*** |
| | **Other** | **2,632** | **19%** | ***697*** | ***430*** |

Source data: Trans Associates

**Table 6**
**Segment 1 - DMU and APM Daily Ridership Profile - 2030**

| | | Max Walk = 5 minutes, with transfers to PAAC buses and Institution shuttles | | Max Walk = 5 minutes & No dual transfers | |
|---|---|---|---|---|---|
| | | Daily Passengers (DMU) | % of Total Passengers | *Daily Passengers (APM)* | *Daily Passengers (DMU)* |
| | **Total** | **25,205** | | ***13,925*** | ***9,955*** |
| **Access to APM** | **Park/Ride** | **9,532** | **38%** | ***13,309*** | ***1,793*** |
| | **Walk-up** | **409** | **2%** | ***616*** | ***76*** |
| | **Bus Transfer** | **15,264** | **61%** | ***0*** | ***0*** |
| | | | | | |
| **Destinations** | **CML** | **800** | **3%** | ***1,021*** | ***800*** |
| | **CMU** | **1,780** | **7%** | ***1,356*** | ***1,029*** |
| | **PITT** | **1,702** | **7%** | ***625*** | ***249*** |
| | **UPMC** | **7,660** | **30%** | ***0*** | ***0*** |
| | **Other** | **13,263** | **53%** | ***10,923*** | ***7,877*** |

Source data: Trans Associates

**Table 7**
**Segment 2 - APM Daily Ridership Profile**

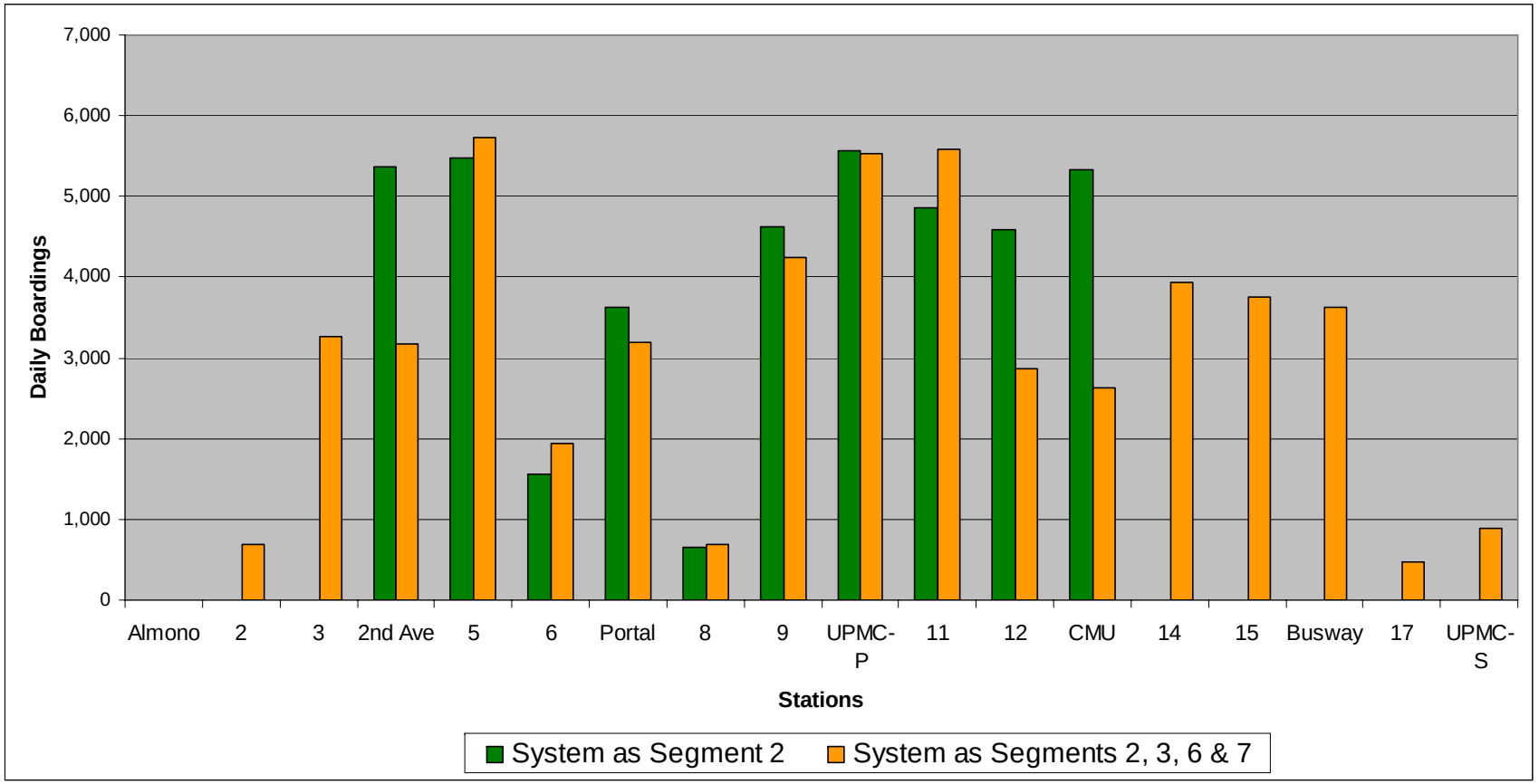
| | | 2007 | | 2030 | |
|---|---|---|---|---|---|
| | | Daily Passengers | % of Total Passengers | Daily Passengers | % of Total Passengers |
| | Total | 41,630 | | 53,793 | |
| Access to APM | Park/Ride | 24,471 | 59% | 35,566 | 66% |
| | Walk-up | 2,666 | 6% | 3,062 | 6% |
| | Bus Transfer | 14,493 | 35% | 15,164 | 28% |
| | | | | | |
| Destinations | CML | 630 | 2% | 1,695 | 3% |
| | CMU | 4,582 | 11% | 5,096 | 9% |
| | PITT | 11,585 | 28% | 12,431 | 23% |
| | UPMC | 13,889 | 33% | 15,558 | 29% |
| | Other | 10,944 | 26% | 19,013 | 35% |

Factors and assumptions considered by model in estimating mode choice:

- Origin-Destination travel time by mode – car, bus, walk or people mover;
- Parking fare at average cost of $2.88 per day;
- Drive or walk time to/from people mover;
- People mover in-vehicle time based on maximum speed of 30 MPH and 15 second dwell times ;
- Parking fare if remote parking for people mover at $2.88 per day;
- People mover fare at $0.77 per trip;
- Bus trips to/from People Mover are Institutional Shuttles or Port Authority Buses;
- Auto - People Mover transfers limited to trips with one end in Oakland study area;
- Bus - People Mover transfers limited to trips with one end study in Oakland study area.

Source data: Trans Associates

**Table 8**
**Segment 2 – APM Ridership Profile**
**Change in Boarding Station as APM System Expands**



Some of the key findings of TA's ridership projections are noted below:

- With the implementation of the Connector system, transit use in the Central Oakland area is projected to increase from current levels of 30% to about 40% to 43%.

- For scenarios through Central Oakland, approximately 50% to 60% of the system passengers would park at a remote intercept parking facility and ride the Connector to their final destination.

- About 35% to 40% f the Connector passengers would transfer to/from the PAAC system.

- On average about 70% of the Connector riders were estimated to be bound for one of the four major Oakland institutions and about 30% are associated with other activities in the Oakland area.

- While the Segment 1 alignment provides the most direct connection between Carnegie Mellon University (CMU) and the ALMONO development site via Junction Hollow, ridership on this segment is projected to be limited both for the existing conditions and the long-term planning horizon case when the ALMONO site would be fully developed.

- Ridership projections for Segment 1 were further reduced when dual transfers to/from DMU or APM and shuttle busses for a single trip were restricted in the modeling scenarios.

- **The most heavily traveled route is projected to be Segment 2** which would traverse through Central Oakland from Second Avenue to CMU and connect the major Oakland institutions including CMU, the museums, University of Pittsburgh, UPMC and the Second Avenue portal to Oakland.

- Additional route spurs could connect from the Second Avenue end of Segment 2 to the riverfront sites of the ALMONO, PTC West and the South Side Works, each of which are in various stages of readiness to accommodate development driven by growth demands. Also Segment 2 could be connected to the Petersen Center and the University of Pittsburgh student housing.

- As indicated by the graph in Table 8, the modeling results indicate that some APM riders would board at stations closer to their point of origin if the coverage and routes of the system were to be extended over time.

- Extension beyond CMU to Shadyside appears viable based on projected ridership for the current and future conditions cases. An incremental extension beyond CMU to Fifth Avenue/Neville (station B-14) provides a justifiable priority since it is a short extension that would provide connectivity to in-bound Port Authority service in a less congested location as discussed during a meeting with the Port Authority of Allegheny County; this offers opportunity to optimize transit services for all patrons.

## Fleet Requirements

Estimates of fleet sizing requirements are based on a variety of factors including peak ridership demand, travel times, service frequency or headways, the passenger capacity of the train vehicles, spare equipment needed to allow equipment to be cycled through for maintenance and standby trains that can be pressed into service in the event of an equipment failure. Fleet planning for the Oakland connector was based on the following factors:

- Peak link loads from TA ridership forecasts for 2007 and 2030
- "Generic" APM vehicle technology
- Trains would operate in two car sets – 150 passengers per train
- Service Frequency of 3 to 4 minutes during peak periods
- Simulated route times developed by Lea+Elliott (see Section 4)
- Standby trains were assumed to be available for major operational Segments such as 1 and 2 and spare cars would be needed at a rate of 10% of the fleet with a minimum of one spare car per segment
- Additional fleet in Year 15 to accommodate projected growth in demand

The resulting fleet requirement estimates are summarized below by segment.

**Table 9**
**Fleet Requirements by Operating Segment**

| Segment | Description | APM Vehicles Required in Year 1 | Additional APM Vehicles Required in Year 15 |
|---|---|---|---|
| **1** | **Almono to CMU (via Junction Hollow)** | **9** | **0** |
| **2** | **Second Ave to CMU** | **13** | **4** |
| **3** | **Second Ave to Almono** | **10** | **1** |
| **4** | **Second Ave to PTC West** | **4** | **0** |
| **5** | **UPMC-P to Petersen Center & UPITT** | **4** | **0** |
| **6** | **CMU to Fifth & Neville** | **2** | **0** |
| **7** | **Fifth and Neville to UPMC- Shadyside** | **6** | **2** |
| **8** | **Second Ave to Southside** | **6** | **0** |

Source: Lea+Elliott

As noted, rail service on Segment 1 from the Almono to CMU could be provided utilizing heavy rail Diesel Multiple Unit (DMU) type technology sharing use of the existing freight tracks (CSX tracks). The fleet sizing for this option was developed based on TA's projected ridership for this scenario and estimated route times for the train. The route would have 4 stops with a dwell time of 1 minute per stop. Per Federal Railroad Administration guidelines, reversing a passenger train requires certain procedural and manual checks. This process would take a minimum of 10 minutes at each end station before the train is ready to travel back. The route times and service frequency would thus be as follows:

- Route time: 30 minutes
  - 20 minutes travel time
  - 10 for FRA mandated inspection and at end station
- Service Frequency – 30 minutes

The resulting train equipment requirements are estimated as follows:

- Year 1
  - 2 locomotives plus 1 spare
  - 5 coaches
  - 2 cabs

- Year 15
  - 2 additional coaches

## Intercept Parking Facilities

Presently, there are a number of parking facilities scattered throughout the Oakland area that are operated by the Oakland institutions and a variety of public and private entities. The operational breakdown of these facilities in terms of parking capacity are as follows:

| | |
|---|---|
| • Approximate Total spaces | 18,413 |
| • Institution and/or Parking Authority | 13,719 |
| • At Shadyside | 2,696 |
| • On-Street Parking | 892 |
| • Private controlled spaces | 1,106 |

Source: Trans Associates

These parking facilities are used by employees, students and visitors to the area and by all accounts, available parking is in short supply during peak periods. Additional supply of parking for the area is anticipated in three forms. First, developments planned along Second Avenue and the Oakland Portal include provisions for parking facilities. Second, as depicted in the Figure 10, twelve potential sites for intercept parking have been identified in the Oakland area that would compliment the operation of the Connector. Third, if the Connector were to go forward, one or more of the institutions might consider building remote parking for their employees to free up near-in space for customer parking or other uses.

For each Connector development scenario that was modeled, TA estimated the number of spaces at each proposed intercept parking site that would be needed to accommodate the projected peak demand. TA had noted the following in describing the characteristics of the demand for intercept parking:

- APM intercept park/ride users are those who currently park in the Oakland area
- Individuals would elect to use available intercept parking and ride the Connector if the combined cost and or travel would be superior to their existing option of parking and walking to their destination.
- The predicted demand level for intercept parking is driven in large part by the congestion in Oakland and not necessarily limitations in parking supply.
- If intercept parking were not available, these individuals would likely otherwise continue to drive and park closer to their destinations.
- Turnover rate per space per day = 1.65 and average vehicle occupancy is 1.15 persons per vehicle.
- Projected parking demand was not constrained by the estimated parking capacity that could be provided at each proposed intercept parking site.

Tables 10 and 11 compare parking capacity at each intercept parking location to the projected peak parking demand under various Connector scenarios in 2007 and 2030. The estimated space requirements include replacement for parking spaces that currently exist at some locations and the cells shaded in red indicate instances where projected parking demand exceeds the estimated parking capacity available at a site.

## Table 10
## Estimated Intercept Parking Space Requirements - 2007

| Segment | Parking Location & ( APM Station #) | Max Site Capacity | Junction Hollow Scenarios | | Central Oakland Scenarios | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Almono to CMU w/APM | Almono to CMU w/DMU | Second Ave to CMU | Almono to UPMC-S | PTC to UPMC-S | PTC to Petersen/ UPITT (b) | Almono to Petersen/ UPITT (b) | Full System |
| 1 | Second Ave (B3) (a) | 2,844 | 952 | 174 | | | | | | |
| 2 | PTC East (B4) | 3,082 | | | 484 | 165 | 672 | 602 | 156 | 172 |
| 2 | Allies-Bates (B5) (a) | 3,594 | | | 2,201 | 2,231 | 2,228 | 2,904 | 2,694 | 2,280 |
| 2 | Oakland Portal (B7) | 3,336 | | | 1,179 | 1,243 | 1,242 | 755 | 755 | 843 |
| 2 | Katz (B11) | 1,374 | | | 1,349 | 1,380 | 1,379 | | | 1,371 |
| 2 | Joncaire (B12) (a) | 792 | | 363 | 1,690 | 824 | 825 | | | 811 |
| 3 | Second Ave (B3) | 2,844 | | | | 1,215 | | | 2,173 | 1,239 |
| 5 | Cost Center (G4) | 1,140 | | | | | | 928 | 922 | 404 |
| 5 | Centre Ave (G5) | 2,796 | | | | | | 824 | 879 | 366 |
| 7 | East Busway (B16) | 3,480 | | | | 1,215 | 1,222 | | | 1,027 |
| TOTAL SPACES | | 22,438 | 952 | 537 | 6,903 | 8,273 | 7,568 | 6,013 | 7,579 | 8,513 |

a.) Needed spaces includes APM passenger demand for intercept parking plus replacement of existing spaces at a site
b.) Segment 2 would extend from Second Ave to UPMC-Presbyterian in this scenario

Source: Trans Associates

## Table 11
## Estimated Intercept Parking Space Requirements - 2030

| Segment | Parking Location & ( APM Station #) | Max Site Capacity | Junction Hollow Scenarios | | Central Oakland Scenarios | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|
| | | | Almono to CMU w/APM | Almono to CMU w/DMU | Second Ave to CMU | Almono to UPMC-S | PTC to UPMC-S | PTC to Petersen/ UPITT (b) | Almono to Petersen/ UPITT (b) | Full System |
| 1 | Second Ave (B3) (a) | 2,844 | 4,139 | 1,462 | | | | | | |
| 2 | PTC East (B4) | 3,082 | | | 1,083 | 1,748 | 2,542 | 1,034 | 1,657 | 1,931 |
| 2 | Allies-Bates (B5) (a) | 3,594 | | | 4,238 | 2,024 | 1,793 | 3,174 | 3,608 | 2,033 |
| 2 | Oakland Portal (B7) | 3,336 | | | 1,460 | 1,476 | 1,383 | 1,290 | 1,283 | 1,510 |
| 2 | Katz (B11) | 1,374 | | | 2,017 | 2,632 | 2,441 | | | 2,659 |
| 2 | Joncaire (B12) (a) | 792 | | 1,595 | 2,528 | 1,047 | 1,051 | | | 868 |
| 3 | Second Ave (B3) | 2,844 | | | | 2,163 | | | 2,154 | 2,174 |
| 5 | Cost Center (G4) | 1,140 | | | | | | 1,670 | 1,671 | 499 |
| 5 | Centre Ave (G5) | 2,796 | | | | | | 1,249 | 1,329 | 375 |
| 7 | East Busway (B16) | 3,480 | | | | 3,240 | 3,238 | | | 2,941 |
| TOTAL SPACES | | 22,438 | 4,139 | 3,058 | 11,326 | 14,330 | 12,448 | 8,417 | 11,702 | 14,990 |

a.) Needed spaces includes APM passenger demand for intercept parking plus replacement of existing spaces at a site
b.) Segment 2 would extend from Second Ave to UPMC-Presbyterian in this scenario

Source: Trans Associates

Table 12 presents projected intercept parking requirements assuming development of Segment 2 of the Connector only.

**Table 12**
**Segment 2- Intercept Parking Needs**

| Intercept Parking Site | | | Spaces Required (a) | | Need Exceed Site Capacity | | Park/Ride Accommodated | |
|---|---|---|---|---|---|---|---|---|
| Parking Location & (APM Station #) | City Endorsed | Max Capacity | 2007 Peak | 2030 Peak | 2007 Peak | 2030 Peak | 2007 Peak | 2030 Peak |
| PTC East (B4) | Yes | 3,082 | 484 | 1,083 | _ | _ | 484 | 1,083 |
| Allies-Bates (B5) | Yes | 3,594 | 2,201 | 4,238 | _ | 644 | 2,201 | 3,594 |
| Oakland Portal (B7) | No | 3,336 | 1,179 | 1,460 | _ | _ | 1,179 | 1,460 |
| Katz (B11) | No | 1,374 | 1,349 | 2,017 | _ | 643 | 1,349 | 1,374 |
| Joncaire (B12) | Yes | 792 | 1,690 | 2,528 | 898 | 1,736 | 792 | 792 |
| Totals | | 12,178 | 6,903 | 11,326 | 898 | 3,023 | 6,005 | 8,303 |

a.) Required spaces includes APM passenger demand for intercept parking plus replacement of existing spaces at a site

Source: Trans Associates

Some observations of note are as follows:

- Additional capacity would be needed at those sites where demand would exceed projected supply to maintain the projected level of ridership.
- The ridership modeling indicates that there would be demand for intercept parking at several sites that were not initially endorsed by the City of Pittsburgh however, the City indicated willingness to reconsider their findings as appropriate.
- For sites such as PTC-East and Oakland Portal, where private development is already being contemplated, public/private partnerships might be pursued with these developers to accommodate the intercept parking needs.

## Implementation Phasing

As noted, a transit system of the magnitude similar to the Oakland Connector is typically implemented in a phased manner. Minimum operating segments and their relative priorities are established based on two key factors, (1) ridership projections on the route(s), and (2) the incremental benefit obtained from the implementation of the route. With respect to phasing considerations, the key findings are noted below:

1. Segment 2 appears to be a viable candidate as an initial segment for the system as it is projected to be the most heavily traveled, it would connect the major Oakland institutions including CMU, the museums, University of Pittsburgh, UPMC and the Second Avenue portal to Oakland and long-term it could also be linked to all the other routes (with the exception to the Junction Hollow route that provides the most direct connection between CMU and the ALMONO site). If this segment were to be implemented as an initial phase of the Connector, it appears that it would provide immediate/near term benefits such as:

    a. Immediate relief to traffic congestion in Central Oakland by diverting automobile trips to intercept parking facilities served by the system.

    b. Transit connections to the riverfront sites. In the near-term, shuttle bus services could connect between the Second Avenue station and the PTC West, ALMONO and South Side Works sites and this shuttle service could operate in relatively congestion free roadways. The transit system could then be extended to these sites in a phased manner in the future with prioritization tied to the growth/development at these sites.

    c. Connectivity between the Oakland institutions that builds upon, and further facilitates, the existing synergies in support of the regional growth potential.

    d. Convenient connections to the existing Port Authority operations through an incremental extension beyond CMU (B13) to Fifth/Neville (B14).

2. A connection between CMU and the ALMONO site through Junction Hollow is also possible utilizing heavy rail technology such as the Diesel Multiple Unit (DMU) on the existing CSX tracks or through a separate APM system technology. This alignment/option could be implemented faster compared to the Segment 2 through Central Oakland, but the level of ridership does not seem to support its implementation as a higher priority and immediate benefits are more likely to be realized when development at the ALMONO site occurs.

3. Additional route spurs could connect from the Second Avenue end of Segment 2 to the riverfront sites of the ALMONO, PTC West and the South Side Works, each of which are in various stages of readiness to accommodate development driven by the growth demands.

4. An incremental extension beyond CMU to Fifth Avenue/Neville (station B-14) provides a justifiable priority since it is a short extension and would provide connectivity to in-bound Port Authority service in a less congested location as discussed during a meeting with the Port Authority of Allegheny County; this offers the opportunity to optimize transit services to all patrons. A phased extension up to Shadyside also appears to be viable based on the

ridership projections and UPMC's planned facility development in the Shadyside area. This leg would also provide a direct connection to the MLK busway and Port Authority services entering into Oakland from the north. These connections would provide opportunities for riders into Oakland to transfer the Transit Connector that would benefit the Port Authority operations since routes could be re-configured along the heavily congested Oakland access roadways without diminishing service to the patrons.

5. The most challenging segment from a construction standpoint would be the extending the system up Desoto Street to the Petersen Center and Cost Centre areas on the UPITT campus. This leg would involve approximately 3,000 linear feet of guideway going up Desoto Street at a grade of approximately 8%. Riders on this spur for the Petersen Center could park in an intercept parking facility and utilize the transit connector, thus creating an opportunity to off-load vehicular traffic from the streets of Central Oakland. Also, ridership appears to be generated from the University of Pittsburgh student housing. One alternate option to extending the transit connector along this segment would be to provide:

    - A pedestrian bridge connection between the station at Fifth Avenue and the Petersen Center. The bridge would provide an alternative means to walking up/down the steep vertical grade to/from the Petersen Center.
    - Limited shuttle bus service between the student housing and the University of Pittsburgh facilities. The bus service would be more cost effective considering that substantial road based traffic would have been removed due to the implementation of the initial segment the transit connector.

6. An extension to the South Side Works could be provided either through the selected APM system technology which would traverse of the Monongahela River, or through a cable suspended (gondola) system over the river with a connection to the APM system near Second Avenue. The cable suspended option over the river appears to be a more cost effective solution since it can easily traverse the river with minimal infrastructure (and thus much lower costs), and its operational route would have two stations – one centrally located in the South Side Works and the second connected to the APM System in the vicinity of second Avenue.

## 4.0 DOWNTOWN TO OAKLAND CORRIDOR

This section presents various options for providing a fixed guideway link between Downtown and Oakland for industry consideration. TAP is interested in industry input regarding views on the most viable alignment, preferred technology, phasing and project structuring considerations including development opportunities along each corridor. As noted in the introduction, a fixed guideway system along this corridor could be implemented as an extension of the existing 'T' light rail system independent of the Oakland Transit Connector presented in the previous section or in combination with a system that provides a similar level of coverage within the Oakland area.

## Alignment Options

Transportation improvement options for this corridor have been evaluated in several previous studies including those listed below:

- *The Spine Line Corridor Study* sponsored by The Port Authority of Allegheny County and the Federal Transit Administration, 1993
- *The Eastern Corridor Transit Study (ECTS)* sponsored by the Port Authority of Allegheny County (PAAC) and the Southwestern Pennsylvania Commission (SPC) and the Westmoreland County Transit Authority (WCTA), 2003
- *Oakland Transit Study Critical Point Analysis* sponsored by the Oakland Investment Committee, 2005
- *The Eastern Corridor Transit Study Transitional Analysis to Locally Preferred Alternatives (ECTS-TA)* sponsored by the Southwestern Pennsylvania Commission (SPC), Westmoreland County Transit Authority (WCTA), Allegheny County and the Pennsylvania Department of Transportation (PennDOT), 2006

Some of the common themes in each of these studies were as follows:

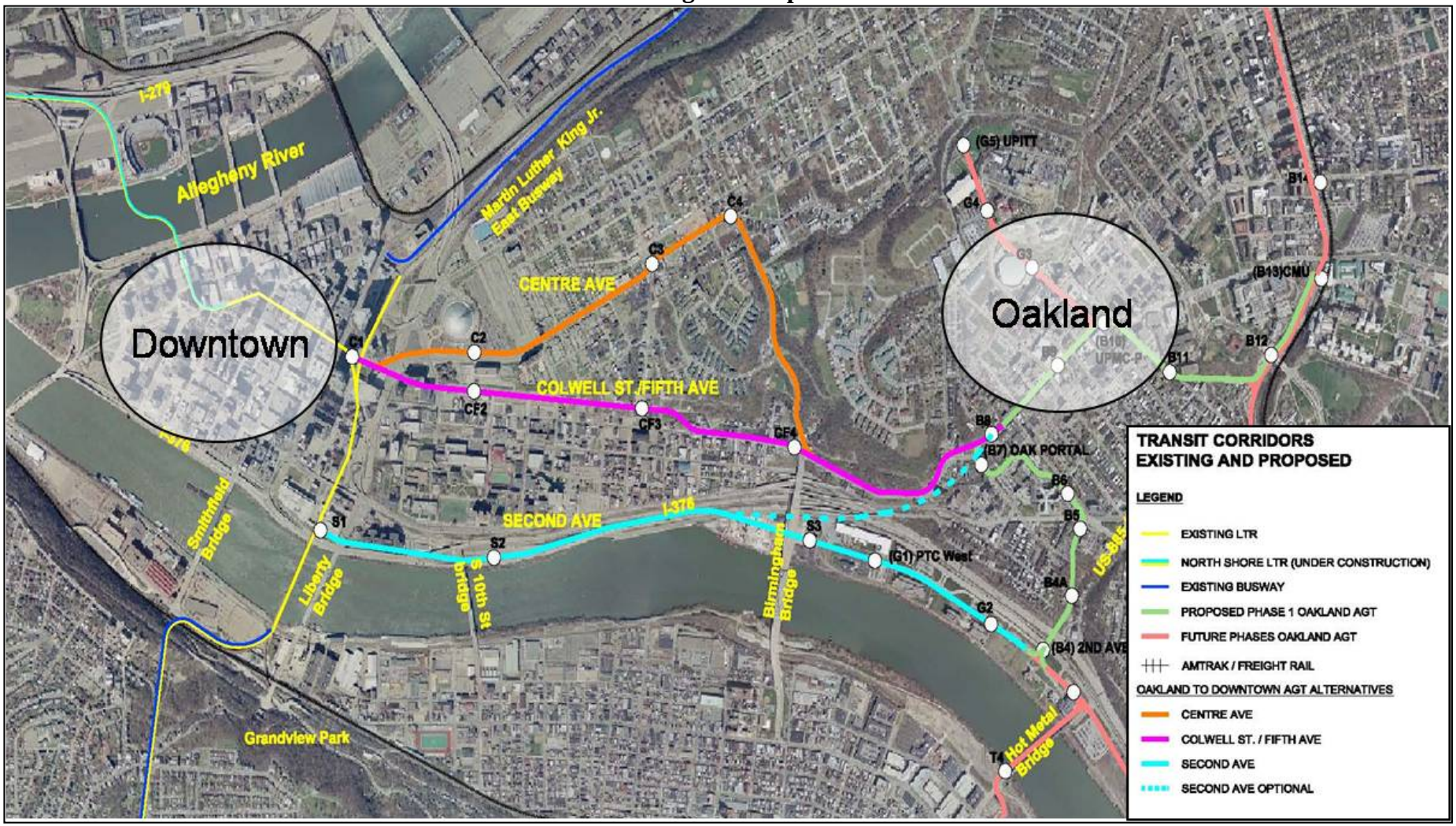
- Each considered a fixed guideway transit link between Downtown and Oakland along one or more of the following alignments:
    a) Central Ave
    b) Cowell Ave
    c) Fifth/Forbes
    d) Second Avenue
- Each considered extending the existing 'T' light rail system operated by the PAAC between Downtown and Oakland in one or more of these corridors
- Subway and at-grade configurations were considered, depending on the specific alignment option.
- While subway options were generally more desirable, the cost of this approach was a constraint to subsequent implementation.
- For the Center Ave and Colwell Street Alternatives proposed station stops between Downtown and Oakland would be at the existing 'T' Steel Plaza Station and the vicinity of the Mellon Arena, Dinwiddie Street and Kirkpatrick Street.
- For the Second Ave Alignment Alternative proposed station stops between Downtown and Oakland would be at the existing 'T' First Ave Station and in the vicinity of Duquesne University, the Birmingham Bridge and the Technology Center.

The findings from these prior studies regarding the various alignment options are summarized in Table 13. As indicated by these prior studies, fixed guideway alignments appear to be most viable along the Central Ave, Cowell Ave or Second Avenue corridors and these options are depicted in Figure 11 along with possible station locations.

**Table 13**
**Evaluation of Downtown to Oakland Transit Corridor Alternatives**
**Summary of Findings from Previous Studies**

| Downtown to Oakland Corridor Alternatives | Spine Line Study 1993 | Eastern Corridor Transit Study 2003 | Oakland Transit Critical Point Study 2005 | Eastern Corridor Transit Study 2006 |
|---|---|---|---|---|
| **Technology Considered** | Light Rail Transit | Light Rail Transit | Light Rail Transit or Bus Rapid Transit | Light Rail Transit or Bus Rapid Transit |
| **Centre Ave Alignment** | Subway: preferred<br>At-grade: not viable street too narrow | Subway : preferred<br>At-grade: an option | Subway and at-grade mix | Subway: preferred<br>At-grade: an option |
| **Colwell Ave Alignment** | Subway: preferred<br>At-grade: an option | Subway: option considered but not advanced | Not considered | Not considered |
| **Fifth/Forbes Alignment** | Construction too disruptive not considered | TSM – improve existing bus routes | BRT – Forbes width limiting | BRT – Enhance exiting bus routes |
| **Second Ave Downtown to Technology Center** | At-grade:<br>along old B&O ROW (now Furnace Trail) | Not considered | At-grade:<br>Via 2nd Ave or Furnace Trail | Not considered |

**Figure 11**
**Pittsburgh – Oakland Transit Corridors**
**Existing and Proposed**



**Alignment Proposed by the City of Pittsburgh Planning Department**

In addition to the general concepts being put forward by TAP for industry consideration, the City of Pittsburgh Planning Department also developed a proposed alignment for a fixed guideway link between Downtown and Oakland for consideration in this process. The proposal would involve extending the existing 'T' light rail system as described in the following and depicted in Figure 12.

The proposed 'T' extension would consist of trains running both below and at grade along Fifth Avenue. The proposed alignment allows for a future expansion beyond Oakland that could connect to the East Busway to maximize regional connectivity.

The track between the Steel Plaza and First Avenue stations Downtown would need to be reconfigured to allow trains to move seamlessly to and from both the South Hills and the North Shore Connector. From the South Hills, Oakland-bound trains would stop at First Avenue before splitting off onto the Oakland Connector track. From the North Shore, Oakland-bound trains would stop at Steel Plaza before splitting off onto the Oakland Connector track. This is the most logical place to integrate the existing and proposed systems.

The new stops to be constructed are separated into two categories; above grade and below grade. Two new below grade stops will be below Fifth Avenue in Uptown. The remaining stops within Oakland will be at grade along Fifth Avenue. All station locations are designed to maximize the use of existing developments, and to increase future development potential, while creating a transit line within walking distance for the entire community.

Station locations are indicated on Figure 12 and the rational for each are as follows:

1. Below Grade: Between Magee and Stevenson on Fifth Avenue;
   This stop will serve the Consol Energy Center, the new multi-purpose arena. This stop will also be pivotal for the employees and students that commute to Duquesne University and Mercy Hospital. This stop will also be critical for the re-birth of the Lower Hill District (at the 28-acre Mellon Arena site) and the next phase of Crawford Square.

2. Below Grade: Between Miltenberger and Gist on Fifth Avenue;
   This stop is located where Fifth Avenue and Dinwiddie Street meet. It is near the old Fifth Avenue High School, which has great potential for a historic redevelopment, as does much of the surrounding area. This station will be a direct link for residents of the middle section of Uptown and the Hill District. This stop is within walking distance to most businesses in the neighborhood.

3. At Grade: Between Moultrie and the Birmingham Bridge on Fifth Avenue;
   This stop is where the below grade section comes to the surface and will run along Fifth Avenue. This stop could be utilized as a major transit hub for passengers heading towards the Southside and Oakland.

4. At Grade: Between Halket and the Craft Avenue on Fifth Avenue;
   This stop will be pivotal to West Oakland in alleviating traffic congestion. This stop will

serve both Magee Hospital and Carlow University, two large institutions in Oakland that have a large pool of commuters.

5. At Grade: Between McKee Pl. and the Meyran on Fifth Avenue;
   This stop will be one of two serving the hospitals of the University of Pittsburgh Medical Center and Central Oakland.

6. At Grade: Between Thackeray and the University Pl. on Fifth Avenue;
   This stop be the second of two serving the hospitals of the University of Pittsburgh Medical Center and will be close to the dormitories of the University of Pittsburgh. It will also be a major connection for the Central Oakland Business District.

7. At Grade: Between Ruskin Ave. and Bellefield Ave. on Fifth Avenue;
   This stop will serve the University of Pittsburgh. It will also be the terminus of line and the point where trains switch direction for their journey back toward Downtown. The orientation of this station makes it well positioned for a connection to the East Busway via North Oakland along either Centre Ave. or the Neville St connector.

## Ridership and Trip Times

The forecasts in the 1993 Spine Line Study provide the best available indicator of the level of ridership that can be anticipated on a fixed guideway link between Downtown and Oakland both on an overall basis and on a comparative basis by alignment option. These forecasts are summarized in Table 14. As a comparative measure, the estimated number of daily passengers on the current PAAC bus services within the corridor is also provided.

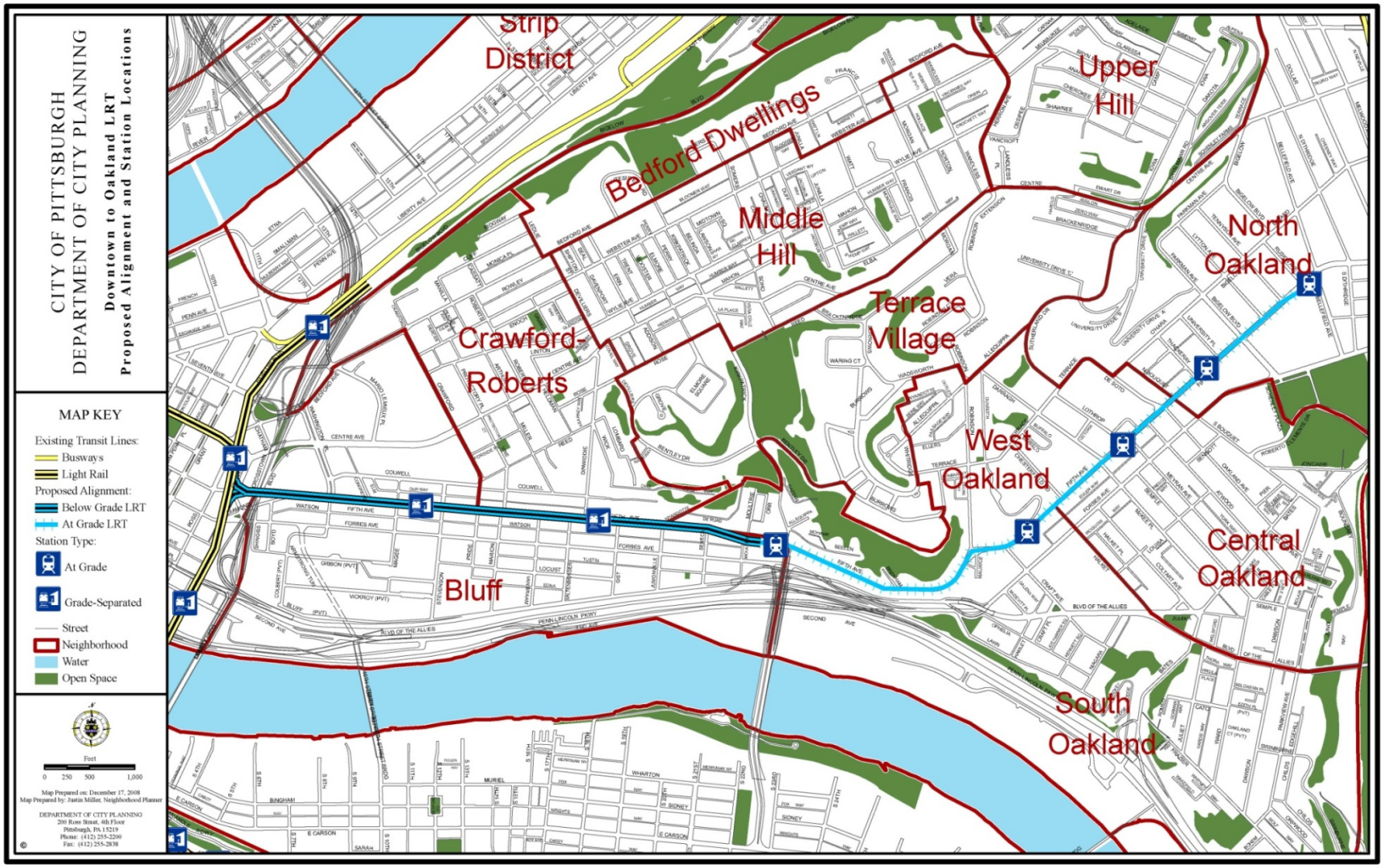
**Table 14**
**Comparison of Daily Ridership within Downtown to Oakland Corridor**
**Existing PAAC Bus Services vs. Fixed Guideway Alternatives**

| Existing PACC Bus (1) | Estimated Ridership by Alternative 1993 Spine Line Study (2) | | |
|---|---|---|---|
| | Second Ave | Colwell Street | Centre Ave |
| 18,000 | 24,220 | 31,690 | 30,110 |

Notes: 1. Ridership data for Downtown to Oakland bus routes from PAAC
2. Forecast year 2005 prepared 1993

Preliminary estimates of one-way trip times between Downtown Pittsburgh and CMU in Oakland for each of the three alignment alternatives in Figure 11 were developed assuming a grade separated APM system with 15 second dwell times at each station. The estimated one-way trip times are as follows: Second Avenue – 16 minutes, Colwell Street – 11 minutes and Centre Avenue – 12 minutes.

**Figure 12**
**Downtown to Oakland LRT – Proposed Alignment and Station Locations**



## Land Use along Transit Corridors

In assessing the potential for a Public-Private Partnership to develop a Downtown to Oakland fixed guideway link, one strategy that is conceptually being considered by TAP is to have adjacent parcels along the corridor be made available to the P3 partner for development. Zoning and contractual mechanisms for facilitating such development by the P3 partner are under investigation and could be accommodated by establishing a Transit Revitalization Improvement District and/or a long-term land lease. Whatever the approach, the basic concept is viewed as a potential revenue stream that the P3 partner could generate to support the financing for the overall development of the transit corridor.

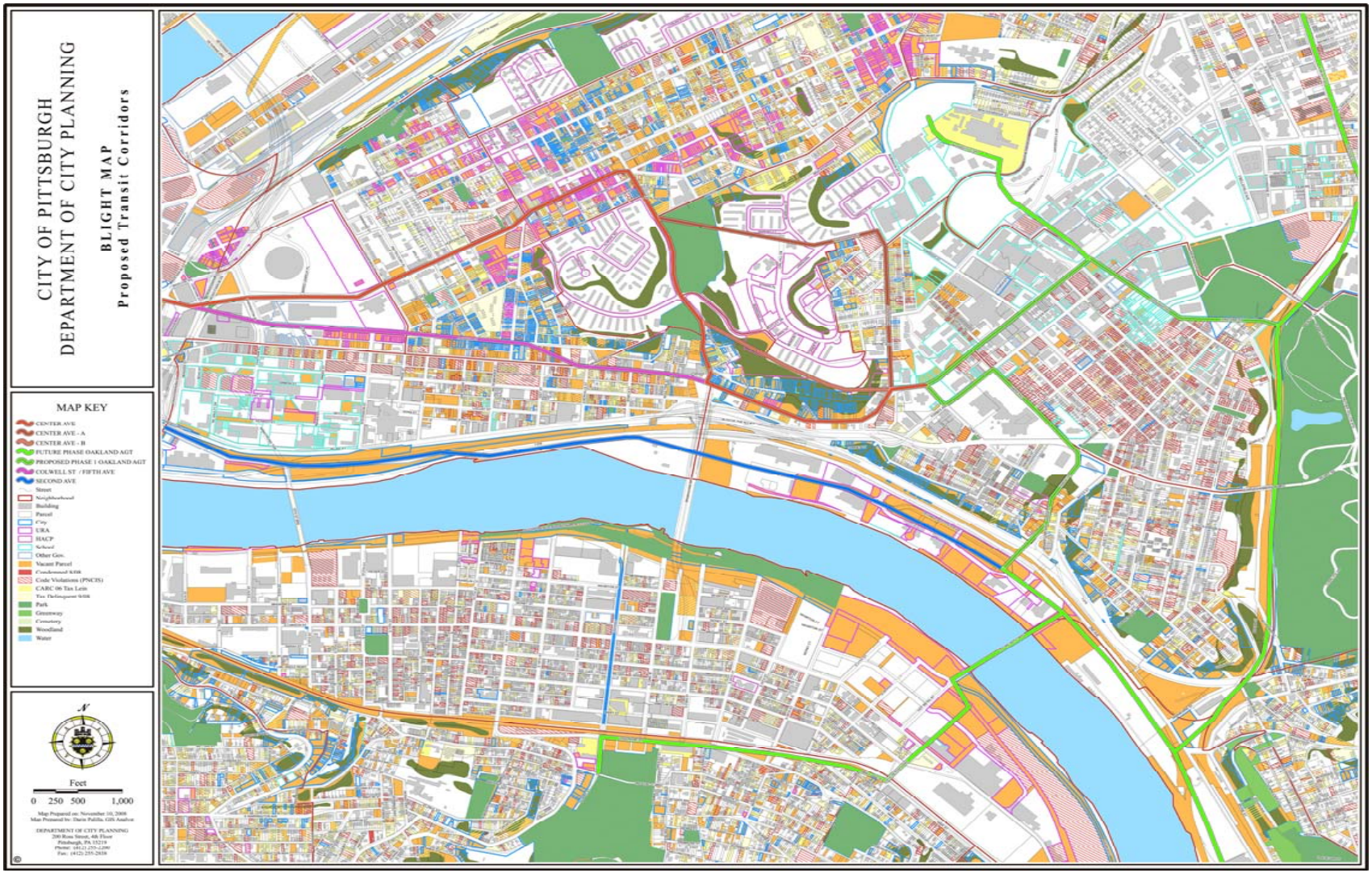
With this approach in mind, this section provides information on land use along each of the alternative corridors to assist industry reviewers in assessing the potential for land development in tandem with new transit services to the area.

The City of Pittsburgh Planning Department provided the land use information presented herein. Figure 13 shows existing land use characteristics along each of the proposed alignments. Table 15 presents a summary of land use information provided by the City within a three block wide corridor along each of the alternative transit alignments.

**Table 15**
**Pittsburgh - Oakland Transit Corridor Review**
**Land Use Distribution along Conceptual Transit Alignments**

| | | Alternative Transit Corridors | | | |
|---|---|---|---|---|---|
| **Category** | **Use Designation** | **Center Ave** | **Cowell Ave** | **2nd Ave** | **Oakland Phase 1** |
| Commercial | Occupied | 20.5% | 46.0% | 7.8% | 19.0% |
| | Vacant | 3.5% | 9.6% | 2.3% | 1.5% |
| Government | Federal Government | 0.0% | 0.0% | 0.2% | 0.2% |
| | State | 0.0% | 0.0% | 0.0% | 0.2% |
| | County Government | 30.5% | 1.2% | 0.7% | 1.2% |
| | Municipal Government | 11.3% | 4.5% | 5.7% | 17.9% |
| | Municipal Urban Renewal | 5.7% | 3.6% | 6.4% | 3.9% |
| Industrial | Warehouse/Light Manuf/Other | 0.4% | 3.5% | 13.0% | 0.4% |
| | Vacant | 0.0% | 0.0% | 63.8% | 0.0% |
| Other | College/Univ/Academy | 1.2% | 0.0% | 0.0% | 19.9% |
| | Places of Worship | 0.5% | 3.9% | 0.0% | 0.0% |
| | Hospitals | 0.0% | 0.0% | 0.0% | 15.6% |
| Residential | Single Family | 0.2% | 0.9% | 0.0% | 1.4% |
| | Multi-family | 0.5% | 2.9% | 0.0% | 1.7% |
| | Large Multi-Family | 3.5% | 2.4% | 0.0% | 0.2% |
| | Housing Authority | 20.5% | 12.0% | 0.0% | 0.6% |
| | Vacant | 1.6% | 8.0% | 0.0% | 8.0% |
| Mixed | Retail/Apt Above | 0.2% | 1.5% | 0.0% | 0.5% |
| Utility | Railroad | 0.0% | 0.0% | 0.0% | 7.9% |
| **TOTALS** | | **100%** | **100%** | **100%** | **100%** |
| Source Land Use Data: City of Pittsburgh Planning Department | | | | | |

**Figure 13**
**Land Use along Proposed Transit Corridors**



## Phased Development Scenarios

In the event that a mechanism can be established whereby the P3 partner will have the option to develop land along the corridor as part of the transit improvement program between Downtown and Oakland, the following implementation scenarios are offered for industry consideration and are illustrated in Figure 14 and 15.

**Near-term: Figure 14**

- PAAC Optimizes Bus Service into Hub and Spoke Routing between Downtown and Oakland - As noted, there are multiple bus routes that travel through the Oakland to Downtown corridor daily. One possible outcome of the Port Authority's TDP is to optimize the bus routing by creating feeder routes in the Downtown and Oakland hubs allowing for a reduction in the number of bus trips between the hubs.
- While PAAC modifies the bus routing, the P3 partner could begin land development along the future Downtown to Oakland Transit to realize a revenue stream that will support future transit development

**Long-term: Figure 15**

- P3 Partner constructs a fixed guideway transit connector in the Downtown to Oakland that interfaces with PAAC system at each hub
- In this scenario, the transit link would complement the land use development already undertaken by the P3 partner.

**Figure 14**
**Near-term – Optimize Bus Routing with Feeder Hub and Spoke System**

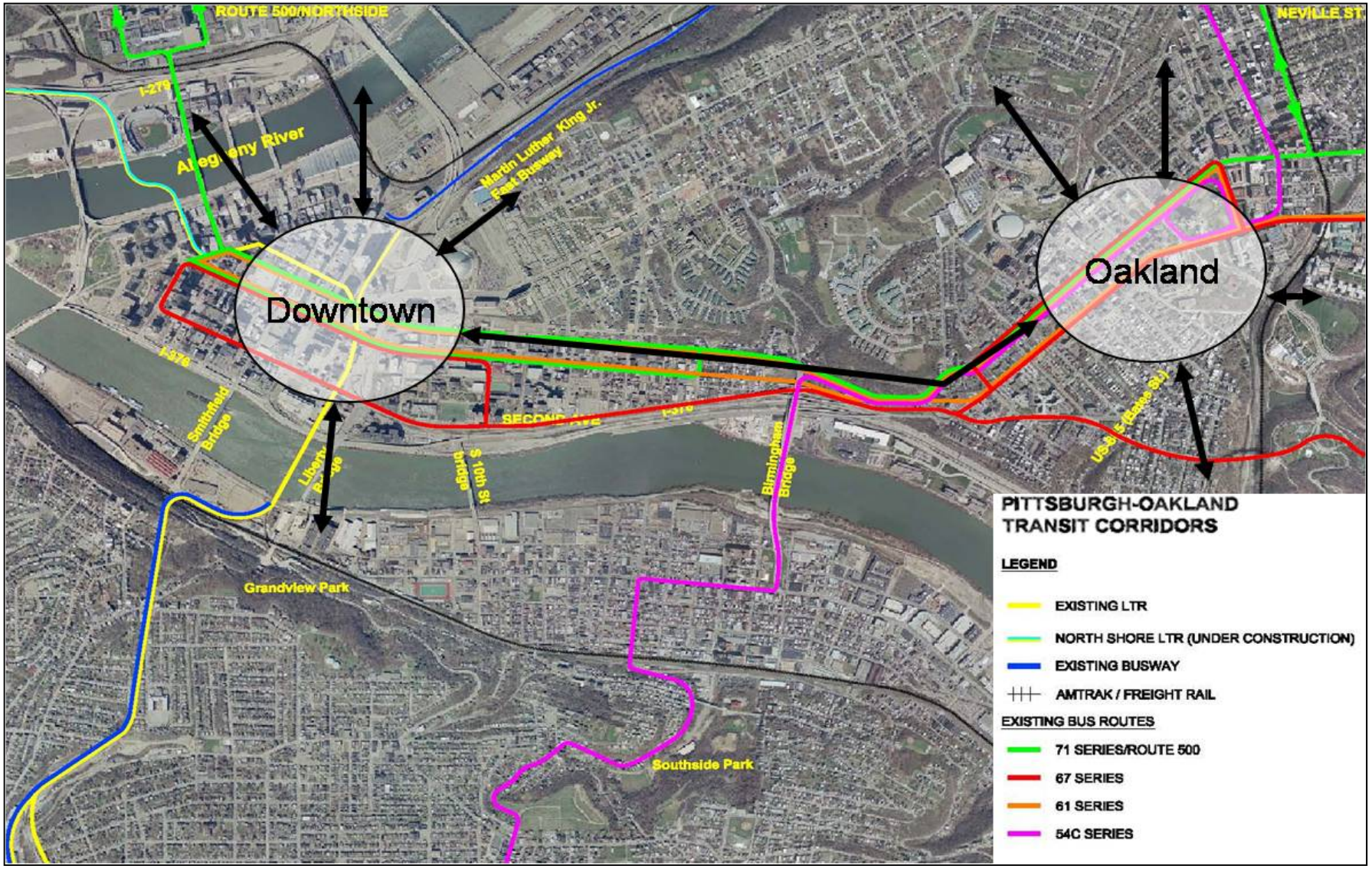


**Figure 15**
**Long-term – Connect Hubs via one of the Fixed Guideway Transit Options**