Route for Change
Transforming The Boulevard

Roosevelt Boulevard

Section 3 – Appendix 14

DVRPC Regional Travel Demand Model Analysis

February 2020

Introduction

The Delaware Valley Regional Planning Commission (DVRPC) prepared and used DVRPC's regional travel forecasting model to support the Roosevelt Boulevard improvement alternatives analysis. The regional model was calibrated and validated to represent the base-year travel conditions and volumes on highway links and bus routes along Roosevelt Boulevard. A subarea model of the Roosevelt Boulevard corridor was also extracted from the regional model and calibrated with the peak-hour traffic counts, providing demand inputs to the VISSIM microscopic simulation models. The regional model was further transitioned to forecast the 2025 no-build travel volume and provide demand inputs for interim improvement analysis in VISSIM, and model the 2040 long-term improvement alternatives and produce traffic and transit forecasts and multi-modal accessibility measures. This memo documents the development and validation of the base-year regional and subarea models, the preparation and applications for the regional model for 2025 no-build and 2040 alternative analysis, and the detailed results of 2040 modeling analysis.

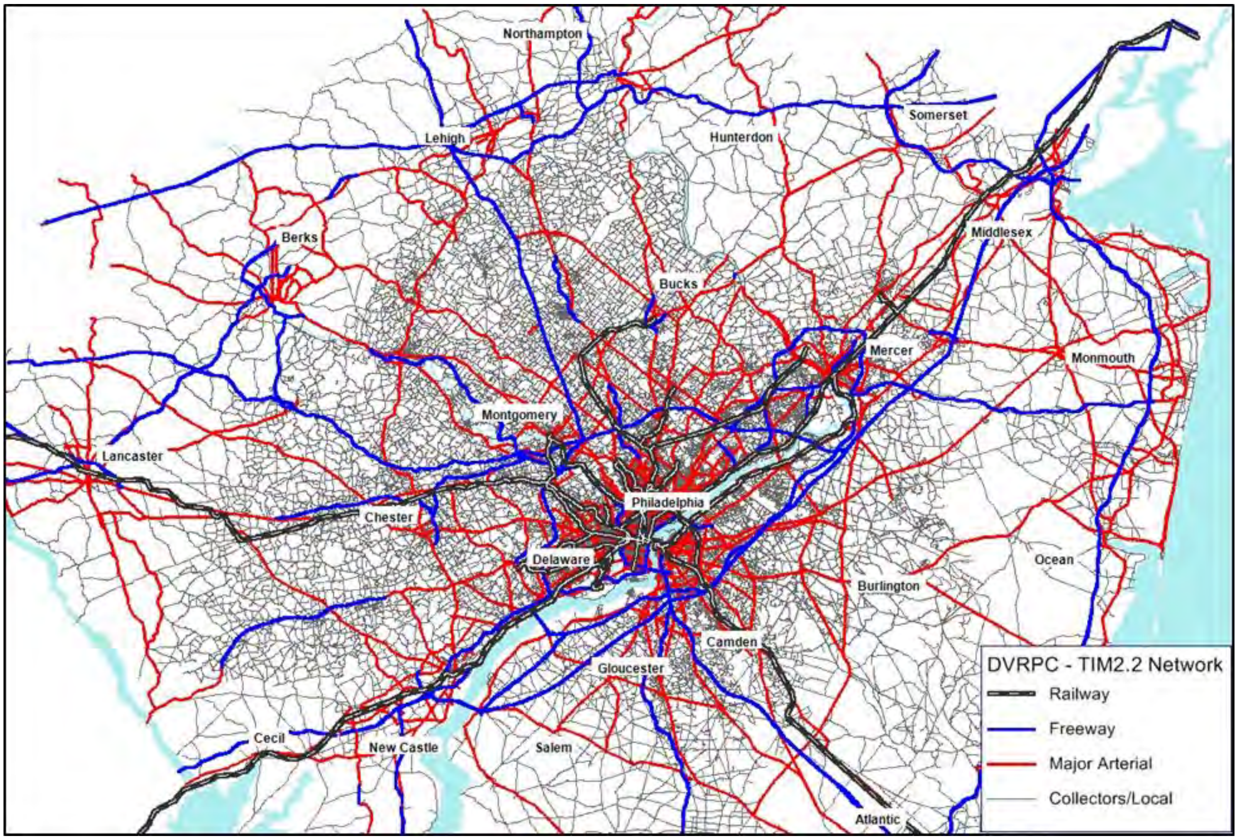
Regional Travel Demand Model

DVRPC's regional travel forecasting model—Travel Improvement Model version 2.2 (TIM 2.2)—is a best-in-class, conventional, four-step (i.e. trip generation, trip distribution, mode choice, and traffic assignment) model, built on the PTV's VISUM software platform. The model includes approximately 3,400 traffic analysis zones, 90,000 nodes, and 260,000 links. It covers DVRPC's nine-member counties plus an extended area of 16 counties (where a less detailed transportation network and simplified zonal system is modeled) in Pennsylvania, New Jersey, Delaware, and Maryland surrounding the DVRPC Region. Figure 1 shows the multimodal transportation network of the TIM 2.2 model.

The TIM 2.2 model has several new features that improve transit modeling and analysis. These include an improved representation of the regional transit network using the General Transit Feed Specification (GTFS) data provided by transit providers. The transit network is very accurate with regard to route alignment, stop locations, service schedules, and fare information. On the demand side, trip generation is segmented by purpose and by income; mode choice is modeled by a nested LOGIT model in VISUM with true sub-nest for transit by access mode. For transit assignment, the model employs a schedule-based path choice method, which considers actual schedules of all bus and rail lines, including transfer time, at different times of day.

The TIM 2.2 model was developed to forecast the annual average weekday traffic (AAWT) condition in the base year of 2010. The model was calibrated and validated from different aspects, including average trip length, district-to-district trip totals, screenline volume (crossing county boundaries, Center City, and river crossings / bridges), transit ridership, and vehicle miles traveled (VMT). The regional model calibration focused on travel patterns and statistics at the regional level. The TIM 2.2 model and its variants have been used for numerous projects to forecast impacts to traffic flow and transit ridership. Within the past several years, the regional model, in conjunction with related sub-area models using both macrosimulation and microsimulation techniques, has been used simulate traffic in Center City and along I-95. The TIM 2.2 model has also been used to develop preliminary ridership forecasts for several Roosevelt Boulevard transit concepts.

Figure 1: DVRPC's TIM 2.2 Network



2013 Regional Model Validation

To prepare the TIM 2.2 model for this project, the base-year model was transitioned from 2010 to 2013 with latest employment and demographic estimates and any transportation projects that had already been completed by 2013. Additional data collection and validation was conducted to accurately present travel (turning) restrictions, crossover locations, and number of lanes of the Roosevelt Boulevard highway links. Highway connectors were also added or modified to better distribute volume onto the road network. Transit schedules and stop locations were checked and updated to reflect the base-year service conditions. The updated model was then calibrated and validated against traffic and transit counts collected around 2013 with a focus on traffic volume and transit ridership along the Roosevelt Boulevard corridor between Broad St and Rockhill Dr (Neshaminy Mall).

Highway Volume Validation

Highway volume calibration involved adjustments of the model assumptions of link capacity, free-flow speed, and volume-delay functions by link type to reflect the observed travel time at the corridor level (based on INRIX travel time data) and match simulated highway volumes with traffic counts. It is worthy to note that intersection delay (caused by signals and other traffic controls) are not explicitly accounted in the regional model, but modeled by a combination of lower free-flow speed (compared to posted speed) and link capacity settings on arterial streets. For the Roosevelt Boulevard highway links, free-flow speed was set to 32 ~ 37mph and link capacity was set to 700 ~ 750vphpl, varied by link type (inner vs. outer lanes) and locations, through model calibration.

Traffic counts collected by DVRPC between 2010 and 2015 were used as validation targets. Complete counts on both inner (express) and outer (local) lanes are available at 16 locations along Roosevelt Boulevard. These locations were used as screenlines to measure traffic throughputs by direction across Roosevelt Boulevard. Traffic counts on major highways Frankford Ave (US-13) and Bustleton Ave (PA-532) and I-95 that are parallel to Roosevelt Boulevard

(US-1) were also used as screenline targets to measure the model's traffic distribution at the larger corridor level (between Roosevelt Boulevard and I-95). Because counts are not always available at exactly comparable locations across all these highways (e.g. near same cross streets), screenlines were divided into six segments (A to F) so that the average screenline volumes can always be compared by segment. Figure 2 shows the screenline locations (colored by segment) in the larger corridor level. Table 1 lists the detailed screenline locations along Roosevelt Boulevard with reference to the nearest major cross streets to the north and south limits, and compares the model's daily volumes with the observed daily counts. Table 2 compares the model's daily volumes with the observed daily counts by screenline segment across US-1, US-13, PA-532, and I-95.

Figure 2: Highway Screenlines for Model Validation and Forecast Comparison

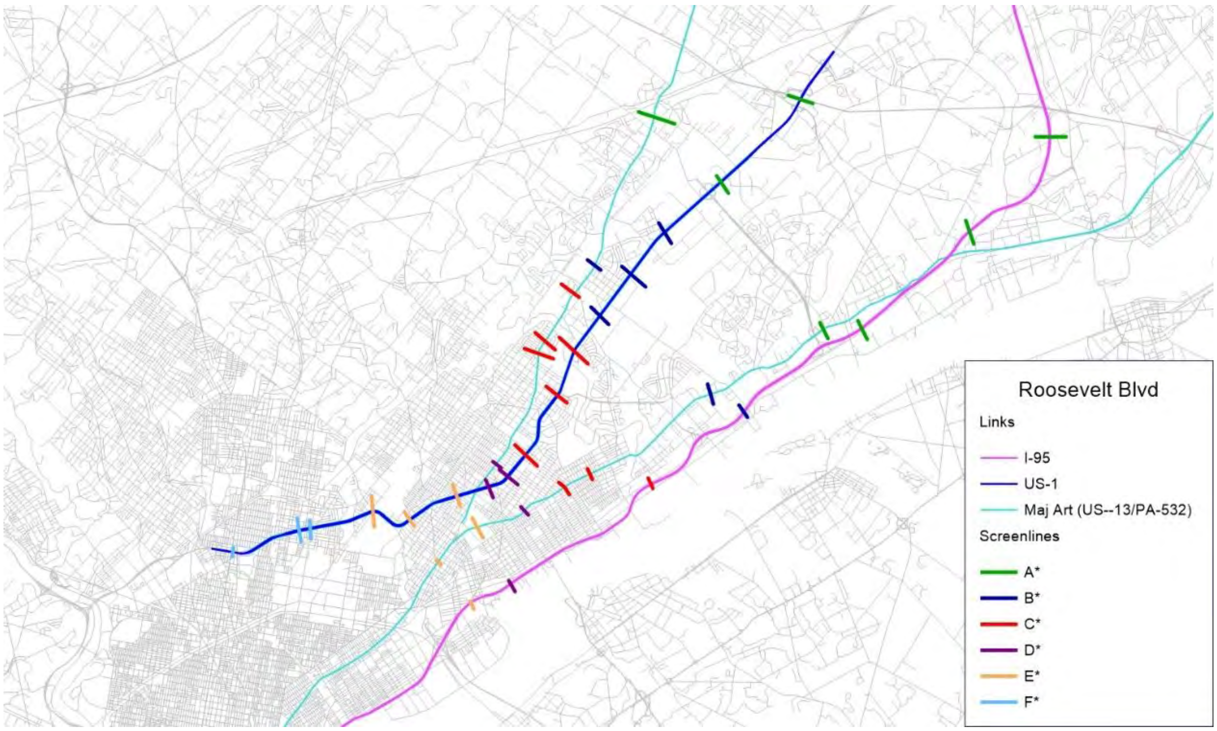


Table 1: Screenline Locations, Daily Traffic Counts, and Base-Year Model Volumes on Roosevelt Boulevard

ID	From Limit	To Limit	Count	Model	Diff	% Diff
A.1.1	I-276	Street Rd (PA-413)	74,512	81,002	6,490	9%
A.1.3	Street Rd	Woodhaven Rd	69,830	72,270	2,440	3%
B.1.1	Comly Rd	Red Lion Rd	52,600	59,903	7,303	14%
B.1.2	Red Lion Rd	Grant Ave	58,544	53,328	-5,216	-9%
B.1.3	Grant Ave	Welsh Rd	64,694	55,781	-8,913	-14%
C.1.2	Welsh Rd	Holme Ave	72,196	67,553	-4,643	-6%
C.1.3	Holme Ave	Rhawn St	74,919	86,423	11,504	15%
C.1.4	Cottman Ave	Tyson Ave	71,509	82,402	10,893	15%
D.1.2	Tyson Ave	Harbison Ave	79,227	86,385	7,158	9%
D.1.3	Harbison Ave	Bustleton Ave	64,820	69,792	4,972	8%
E.1.1	Bustleton Ave	Oxford Ave	72,034	72,206	172	0%

E.1.2	Oxford Ave	Adams Ave	90,012	90,879	867	1%
E.1.3	Adams Ave	Whitaker Ave	86,894	100,090	13,196	15%
F.1.1	Rising Sun Ave	Mascher St	89,605	87,582	-2,023	-2%
F.1.2	Mascher St	3rd St	95,051	87,591	-7,460	-8%
F.1.3	3rd St	Broad St	90,052	87,958	-2,094	-2%

Table 2: Screenline Locations, Daily Traffic Counts, and Base-Year Model Volumes in the Larger Corridor

	Screenline		US-1			I-95			US-13			PA-532		
	From	To	Count	Model	% Diff	Count	Model	% Diff	Count	Model	% Diff	Count	Model	% Diff
A	I-276	Woodhaven	72,171	76,636	6%	79,499	90,735	14%	21,016	21,187	1%	27,494	23,102	-16%
B	Woodhaven	Welsh	58,612	56,337	-4%	134,201	152,259	13%	16,525	13,172	-20%	30,160	27,607	-8%
C	Welsh	Tyson	72,875	78,793	8%	148,920	154,331	4%	17,681	26,288	49%	24,205	17,799	-26%
D	Tyson	Bustleton	72,024	78,089	8%	155,491	160,732	3%	18,815	21,526	14%	19,240	23,223	21%
E	Bustleton	Whitaker	82,980	88,392	7%	129,685	143,031	10%	12,176	13,047	7%			
F	Whitaker	Broad	91,570	87,710	-4%									

Overall, the differences between the model's highway volumes and count targets were within 15% at all screenline locations along Roosevelt Boulevard, with an average difference of 3%. The regional model's volumes were close to traffic counts across other screenline segments along I-95 and other major highways (US-13 and PA-532).

Transit Volume Validation

Transit volume calibration involved the addition of transit connectors along Roosevelt Boulevard (to allow bus access and reduce unnecessary transfers across the Boulevard) and the adjustment of the access and egress time to bus stops (to reflect the time required to cross the Boulevard from one side to the other). Transit ridership counts on SEPTA buses from 2013 were used to validate transit volumes in the regional model. Table 3 compares the model's bus volumes with ridership counts on major SEPTA bus routes (1, 14, 8 and R) in the base year. Overall, the difference between the model's transit ridership and counts was within 5% for all these routes combined.

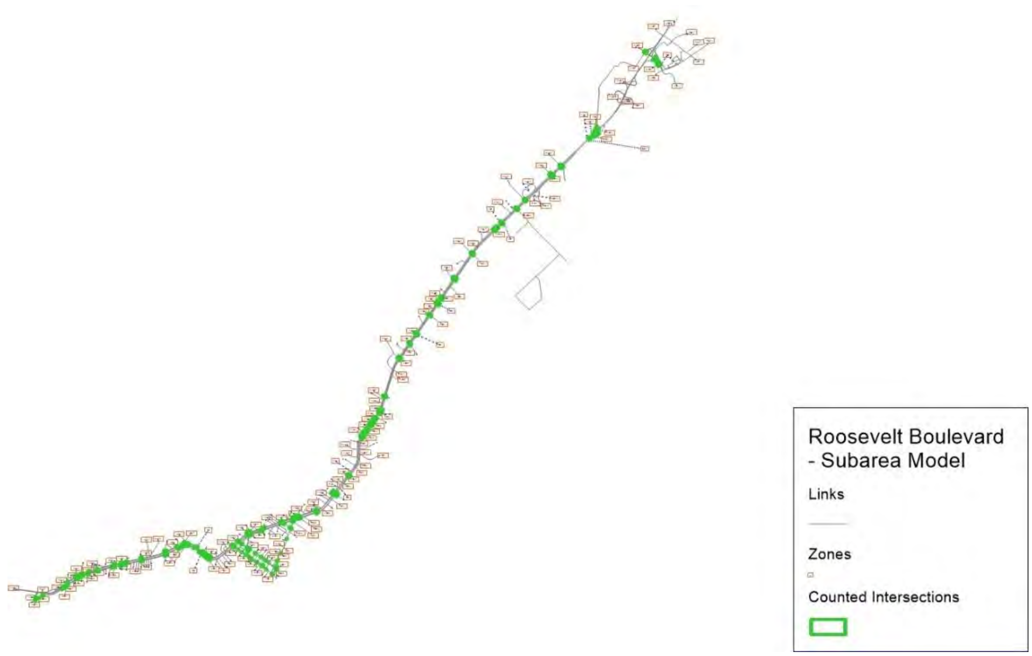
Table 3: Base-Year Model Ridership vs. Counts

SEPTA Bus Route	Count	Model	Diff	% Diff
1	3,384	4,255	871	26%
14	12,553	11,408	-1,145	-9%
Primary Buses	*15,937*	*15,663*	*-274*	*-2%*
8	3,189	2,788	-401	-13%
R	8,344	7,602	-742	-9%
Secondary Buses	*11,533*	*10,390*	*-1,143*	*-10%*
All Buses	27,470	26,053	-1,417	-5%

2013 Subarea Model Development and Validation

After the regional model was calibrated at the daily level, the highway network of the Roosevelt Boulevard study area was extracted from the regional network. The extracted subarea network was the same network of the VISSIM simulation model. When the subarea model was extracted, zones were created at the ends of Roosevelt Boulevard and cross streets. Travel demand for all regional trips that entered to or exited Roosevelt Boulevard from its north and south ends and other cross streets in both AM and PM peak periods were extracted, and scaled down as the seed matrix for developing the peak-hour origin-destination (OD) demand matrix that will be used for microsimulation in VISSIM. Figure 3 shows the extent of the subarea model, zones, and counted intersections. There are 146 intersections where peak-hour turning-movements counts were collected by SkyComp. In addition, estimated peak-hour counts were provided by HNTB for a limited number of minor cross streets. These counts were combined, balanced between adjacent intersections, and used for adjusting the extracted seed OD to develop the peak-hour OD.

Figure 3: Subarea Model

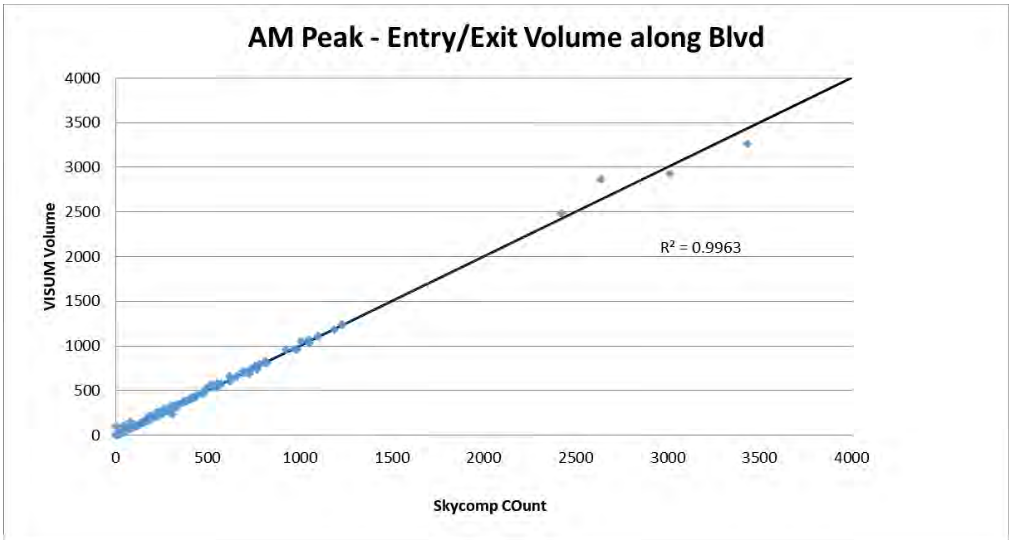


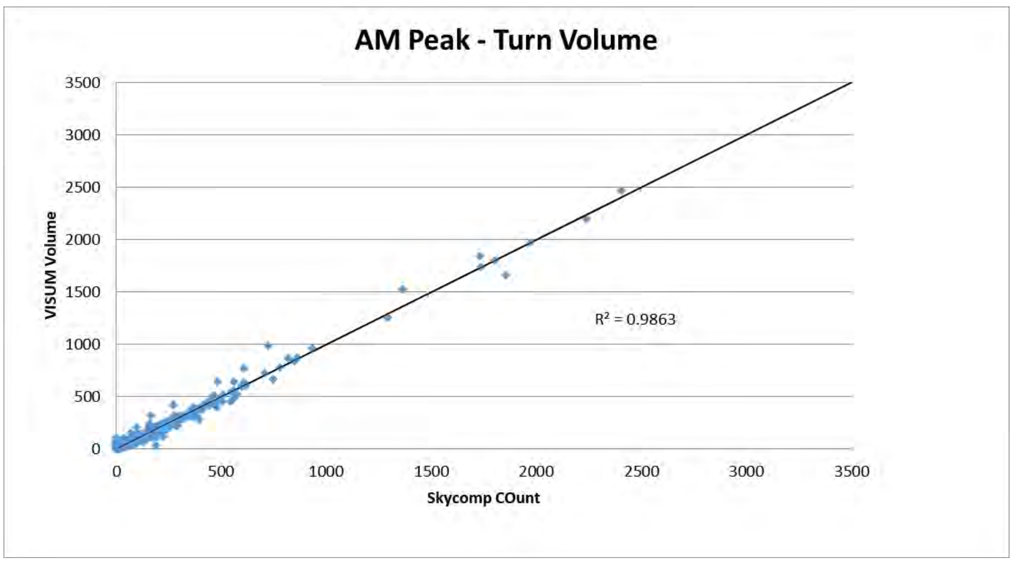
The subarea model calibration used the matrix correction procedure in VISUM—TFlowFuzzy. TFlowFuzzy is meant to adjust a demand matrix, so that its assignment volumes match with observed counts. The matrix correction at this stage was to account for the unknown bias in trip generation and the limitation in trip distribution due to large zones with limited connectors used in the regional model, which cannot present traffic entering or exiting from all cross streets to or from Roosevelt Bouvard. At each counted intersection, turning-movement counts were reported from SkyComp by lane groups (i.e. from/to inner lanes versus outer lanes). Since the choice of driving on inner (express) lanes verse outer (local) lanes often depends on the demographic and other characteristics of drivers more than the operational characteristics (e.g. speed and capacity) of inner lanes versus outer lanes that can be presented in the model, it is difficult to replicate the traffic volume distribution on inner lanes versus outer lanes, while it can retain the total volume that travels through an intersection by inner lanes and outer lanes together, at the screenline level. Therefore, the constants or targets used for TFlowFuzzy were:

- Entry/exit volumes from/to cross streets
- Right and left-turn volumes from Roosevelt Boulevard to cross streets and vice versa
- Total screeline volumes that cross an intersection along Roosevelt Boulevard

In this way, TFlowFuzzy can find a feasible solution that meets the count targets without over-fitting the OD demand matrix. Figures 4 and 5 compare the peak-hour assignment volumes with SkyComp counts by the entry/exit totals on cross streets, right and left turns from and to Roosevelt Boulevard, and screenline totals across the Boulevard (as targets used in TFlowFuzzy). In these figures, observed counts are on the X-axis and model assigned volumes are on the Y-axis. On the 'Target' line the assignment volume is equal to the target count. The comparison indicates a perfect match as most pairs of simulated volume and observed count fall along the 45-degree target line.

Figure 4: Subarea Model Volume Validation – AM Peak Hour





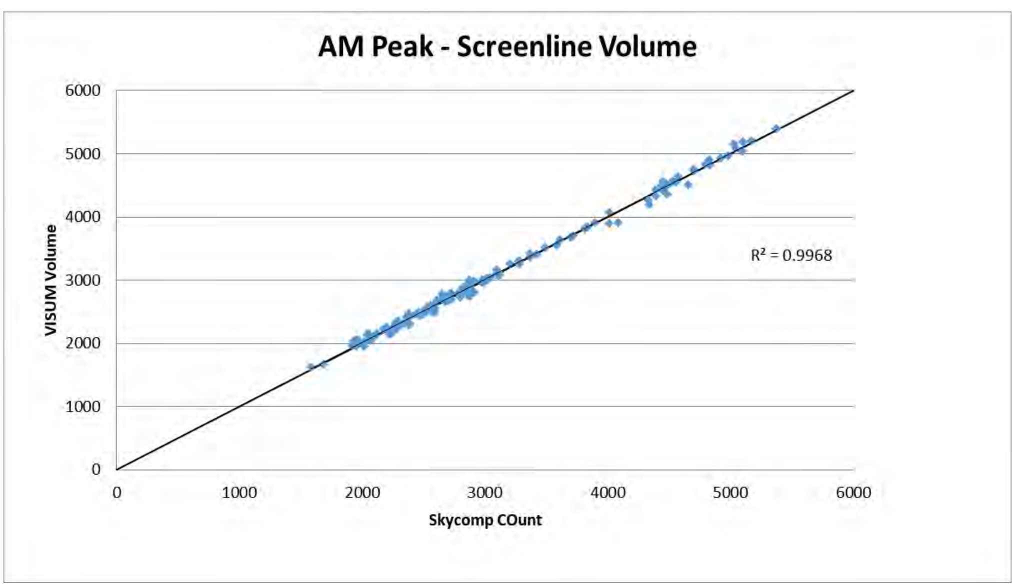
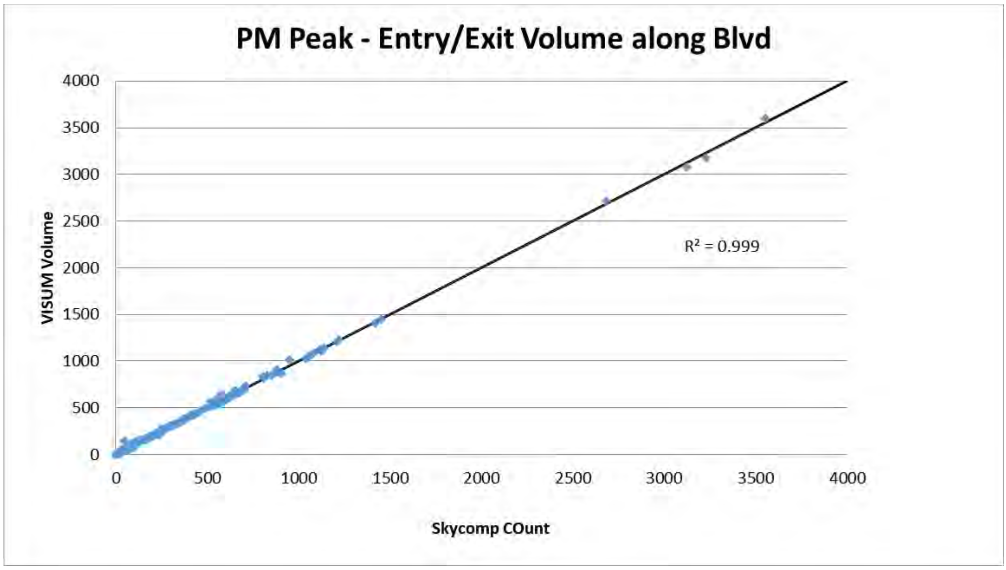
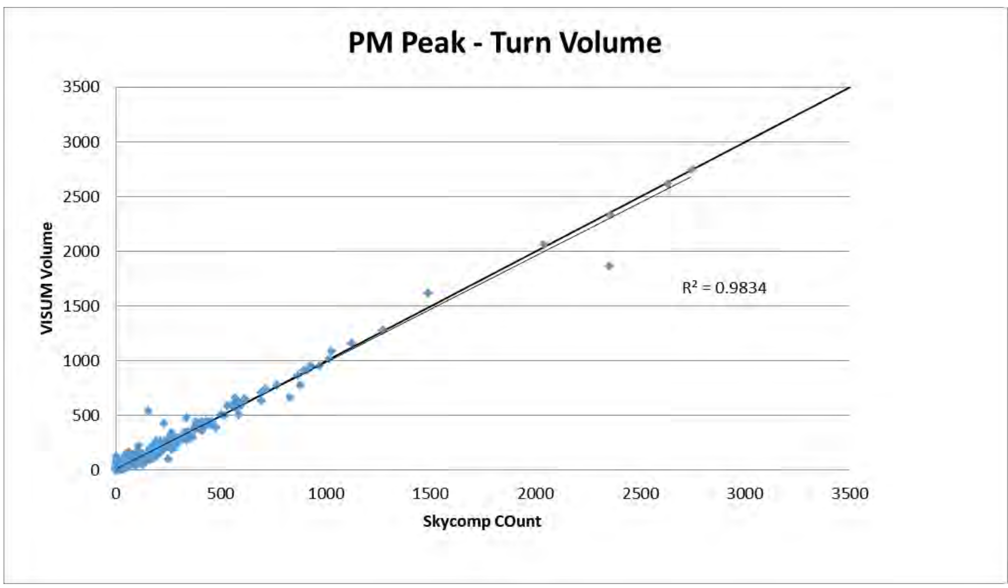


Figure 5: Subarea Model Volume Validation – PM Peak Hour





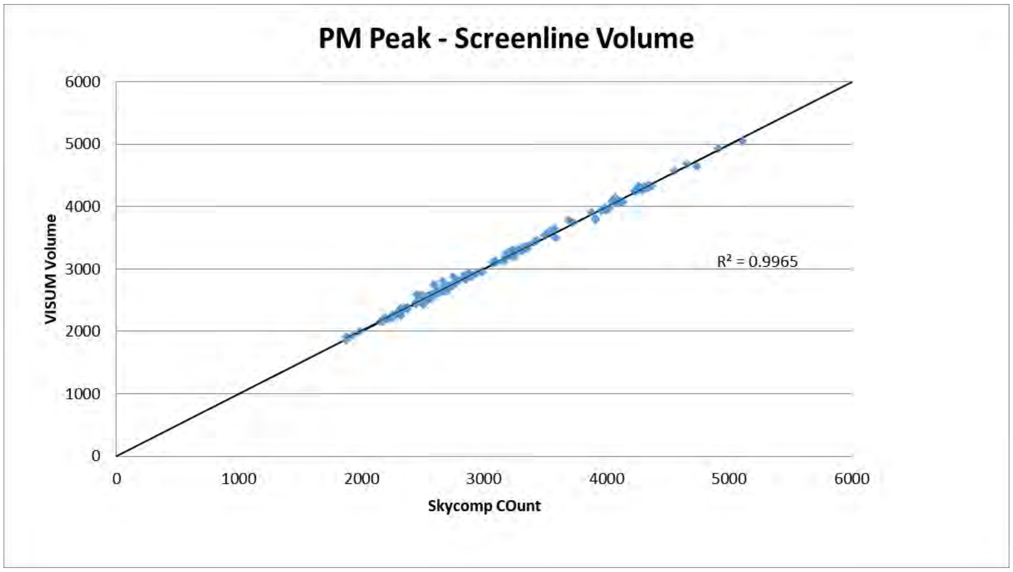


Table 4 presents the subarea calibration results for the AM and PM peak hour. Key statistics reported are:

- N, the number of counts used for comparison
- R2, the coefficient of determination or 'goodness of fit' statistic, shows how well the regression line represents the assignment data.
- % GEH < 5, the percent of locations where GEH < 5 —GEH is a static used to compare two volumes and a GEH of less than 5.0 is considered a good match between the modelled and observed hourly volumes

Table 4: Subarea Model Peak-Hour Volumes vs. Counts

AM Peak Hour	N	R	% GEH < 5
Enter/Exit Volume on Cross Streets	260	1.00	97%
Left/right turn volume from/to Blvd	912	0.99	93%
Screenline Volume on Blvd	170	1.00	100%

PM Peak Hour	N	R	% GEH < 5
Enter/Exit Volume on Cross Streets	260	1.00	98%
Left/right turn volume from/to Blvd	912	0.98	94%
Screenline Volume on Blvd	170	1.00	100%

2025 No-Build Modeling

To support the 2025 interim improvement analysis, the regional model was used for forecasting the 2025 no-build travel volume on Roosevelt Boulevard and providing the demand input for the 2025 VISSIM model. The calibrated base-year regional model was updated to include projects identified in the DVRPC's Long Range Plan to be completed by 2025. Some of these projects directly affect travel patterns in the study area and adjacent areas, such as highway improvement projects on US-1 in the Bucks County and improvement projects on I-95, while others have indirect effects through changes in travel demand in the greater DVRPC region. The model was also updated with demographic and employment forecasts for 2025. Table 5 shows the changes in the total population, households, and employment from 2013 to 2025 in the study area, surrounding counties, and the DVRPC region. For the 9-county DVRPC region, population, households, and employment were projected to increase by 5~6% from 2013 to 2025; while forecasted growth was only 2~3% in the immediate study area (1-mile buffer to Roosevelt Boulevard).

Table 5: Demographics and Employment Changes 2013 - 2025

	2013			2025			% Diff		
	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp
1-Mile Buffer	*260,591*	*92,891*	*93,642*	*265,490*	*95,305*	*95,337*	*2%*	*3%*	*2%*
Bucks	631,667	238,413	295,756	673,289	257,427	314,249	7%	8%	6%
Chester	510,684	187,856	297,835	573,115	212,844	329,575	12%	13%	11%
Delaware	559,320	209,589	240,698	564,477	213,851	242,990	1%	2%	1%
Montgomery	805,644	311,325	548,495	849,692	332,523	577,191	5%	7%	5%
Philadelphia	1,532,703	605,105	720,985	1,572,176	628,477	738,152	3%	4%	2%
PA Counties	*4,040,018*	*1,552,288*	*2,103,769*	*4,232,749*	*1,645,122*	*2,202,157*	*5%*	*6%*	*5%*
Burlington	450,191	167,441	219,104	471,735	177,175	228,585	5%	6%	4%
Camden	514,129	191,749	250,717	520,985	195,851	254,606	1%	2%	2%
Mercer	367,283	133,769	267,142	377,426	138,555	275,979	3%	4%	3%
Gloucester	291,071	105,628	114,963	332,198	121,332	128,777	14%	15%	12%
NJ Counties	*1,622,674*	*598,587*	*851,926*	*1,702,344*	*632,913*	*887,947*	*5%*	*6%*	*4%*
DVRPC Region	*5,662,692*	*2,150,875*	*2,955,695*	*5,935,093*	*2,278,035*	*3,090,104*	*5%*	*6%*	*5%*

The 2025 no-build scenario also replaced the SEPTA 1 bus with the Boulevard Direct Bus Service, providing limited-stop service between Neshaminy Mall and Wissahickon Transfer Center (WTC). The Direct Bus service operates separately as two routes (A and B), split at Frankford Transportation Center (FTC), including stops at the following locations:

Direct Bus A Stops:

- FTC
- Cottman Avenue
- Rhawn Street
- Welsh Road
- Grant Avenue
- Red Lion Road
- Neshaminy Interplex
- Neshaminy Mall

Direct Bus B Stops:

- FTC
- Pratt
- Tower Boulevard (Adams Ave)
- Rising Sun Avenue
- 5th Street
- 9th Street Hunting Park
- Wissahickon Transfer Center

Direct Bus services were coded with frequency and run time provided by SEPTA. The services run at high frequencies throughout weekdays: 10-min headway during the peak hours and 15-min headway during the off-peak hours.

Furthermore, the 2025 no-build scenario included the implementation of Business Access and Transit (BAT) Lane on Roosevelt Boulevard: the outer (local) lanes are designated as BAT lanes in the northbound direction between Harbison Avenue and the City/County line and in the southbound direction between the City/County line and Cottman Avenue. Within BAT lanes, personal vehicular usage is restricted to driveway access and right turns only. However, such lane specific restriction cannot be applied explicitly on links in the regional model. Instead, the conversion to

BAT lanes is modeled as a general reduction in link capacity on the Roosevelt Boulevard local lanes. BAT lane capacity was set to 30% of the full lane capacity, through sensitivity tests. The overall reductions in vehicular capacity are 23% for the local lanes and 11% for the Boulevard roadway as a whole. Table 6 compares the 2025 no-build daily volumes with the 2013 base-year daily volumes, by screenline locations on Roosevelt Boulevard.

Table 6: Boulevard Highway Volumes – 2025 NB vs. 2013

ID	From Limit	To Limit	2013	2025 NB	Diff	% Diff
A.1.1	I-276	Street Rd (PA-413)	81,002	87,919	6,917	9%
A.1.3	Street Rd	Woodhaven Rd	72,270	76,320	4,050	6%
B.1.1	Comly Rd	Red Lion Rd	59,903	59,981	78	0%
B.1.2	Red Lion Rd	Grant Ave	53,328	51,658	-1,670	-3%
B.1.3	Grant Ave	Welsh Rd	55,781	52,241	-3,540	-6%
C.1.2	Welsh Rd	Holme Ave	67,553	63,799	-3,754	-6%
C.1.3	Holme Ave	Rhawn St	86,423	80,428	-5,995	-7%
C.1.4	Cottman Ave	Tyson Ave	82,402	76,105	-6,297	-8%
D.1.2	Tyson Ave	Harbison Ave	86,385	79,464	-6,921	-8%
D.1.3	Harbison Ave	Bustleton Ave	69,792	63,790	-6,002	-9%
E.1.1	Bustleton Ave	Oxford Ave	72,206	72,227	21	0%
E.1.2	Oxford Ave	Adams Ave	90,879	92,996	2,117	2%
E.1.3	Adams Ave	Whitaker Ave	100,090	106,577	6,487	6%
F.1.1	Rising Sun Ave	Mascher St	87,582	89,880	2,298	3%
F.1.2	Mascher St	3rd St	87,591	89,624	2,033	2%
F.1.3	3rd St	Broad St	87,958	88,404	446	1%

Daily highway volumes increased on the north section as a result of US-1 improvement projects in Bucks County, decreased in the middle section due to the BAT lane conversation, and recovered after the end of the BAT lanes on the south section. Highway volumes changed at about the same rates in the AM and PM peak periods. Based on the changes of highway volumes in the regional model, the subarea model was also updated to reflect the changes of screenline volumes along Roosevelt Boulevard and entry/exit volumes on cross streets connecting to the Boulevard. The projected subarea OD was used for VISSIM analysis of the 2025 interim improvement alternatives.

2040 No-Build Modeling

The TIM 2.2 regional model was further updated and used for modeling the 2040 no-build and long-term improvement alternatives and providing a comprehensive analysis of the impact on highway and transit volumes and multimodal accessibility on the Boulevard under different scenarios. For the 2040 modeling analysis, the regional model was updated to include projects identified in the DVRPC's Long Range Plan (Connections 2040) to be completed by 2040 and the latest population and employment forecasts for 2040. Table 7 shows the changes of the total population, households, and employment from 2013 to 2040 in the study area, surrounding counties, and the DVRPC region. For the 9-county DVRPC region, the projected growth was 11% for population, 9% for household, and 18% for employment, from 2013 to 2040. For the 1-mile buffer area to Roosevelt Boulevard, the projected growth was 5% for population, 4% for household and 18% for employment through 2040.

Table 7: Demographics and Employment Changes 2013 – 2040

	2013			2040			% Diff		
	Pop	HH	Emp	Pop	HH	Emp	Pop	HH	Emp
1-Mile Buffer	*260,591*	*92,891*	*93,642*	*273,322*	*96,217*	*110,604*	*5%*	*4%*	*18%*
Bucks	631,667	238,413	295,756	691,113	257,812	356,668	9%	8%	21%
Chester	510,684	187,856	297,835	645,557	235,167	387,396	26%	25%	30%
Delaware	559,320	209,589	240,698	584,324	210,557	277,761	4%	0%	15%
Montgomery	805,644	311,325	548,495	918,921	347,018	654,963	14%	11%	19%
Philadelphia	1,532,703	605,105	720,985	1,683,399	663,651	829,932	10%	10%	15%
PA Counties	*4,040,018*	*1,552,288*	*2,103,769*	*4,523,314*	*1,714,205*	*2,506,720*	*12%*	*10%*	*19%*
Burlington	450,191	167,441	219,104	488,021	177,691	261,189	8%	6%	19%
Camden	514,129	191,749	250,717	525,097	190,078	270,844	2%	-1%	8%
Mercer	367,283	133,769	267,142	398,665	137,317	307,305	9%	3%	15%
Gloucester	291,071	105,628	114,963	366,382	129,696	152,556	26%	23%	33%
NJ Counties	*1,622,674*	*598,587*	*851,926*	*1,778,165*	*634,782*	*991,894*	*10%*	*6%*	*16%*
DVRPC Region	*5,662,692*	*2,150,875*	*2,955,695*	*6,301,479*	*2,348,987*	*3,498,614*	*11%*	*9%*	*18%*

It is worthy to note that the employment data source and forecasts were updated since the development of 2013 base-year and 2025 no-build models, as recommended by the project steering committee. The employment forecasts for 2013 and 2025 were based on the 2010 National Employment Time Series (NETS) data from 2010, while the employment forecasts for 2040 were updated based on a newer version of the NETS data from 2013. The population and household data source and forecasts remained the same.

The 2040 no-build model also included the following recommendations from the 2025 interim improvement analysis that may be significant enough to impact regional traffic patterns:

- Outermost lane of outer/local lanes will be the BAT lane between Bustleton Ave and Neshaminy Mall (also a part of 2025 No Build)
- Outermost lane of outer/local lanes will be a parking/bump-out lane between Pratt Street and Devereaux Ave.
- Outermost lane of outer/local lanes will be the BAT lane between 9th Street and Pratt Street
- Access to Roosevelt Boulevard from Whitaker (EB) removed

Table 8 compares the 2040 no-build daily volumes with the 2013 base-year daily volumes, by screenline locations on Roosevelt Boulevard. The highway volumes on Roosevelt Boulevard only slightly increased from the base year 2013 to 2040 in the no-build scenario, given the capacity reduction on the outer lanes compared to the base year.

Table 8: Boulevard Highway Volumes – 2040 NB vs. 2013

ID	From Limit	To Limit	2013	2040 NB	Diff	% Diff
A.1.1	I-276	Street Rd (PA-413)	81,002	90,388	9,386	12%
A.1.3	Street Rd	Woodhaven Rd	72,270	80,343	8,073	11%
B.1.1	Comly Rd	Red Lion Rd	59,903	67,132	7,229	12%
B.1.2	Red Lion Rd	Grant Ave	53,328	60,817	7,489	14%
B.1.3	Grant Ave	Welsh Rd	55,781	62,450	6,669	12%

C.1.2	Welsh Rd	Holme Ave	67,553	74,109	6,556	10%
C.1.3	Holme Ave	Rhawn St	86,423	90,932	4,509	5%
C.1.4	Cottman Ave	Tyson Ave	82,402	85,257	2,855	3%
D.1.2	Tyson Ave	Harbison Ave	86,385	87,534	1,149	1%
D.1.3	Harbison Ave	Bustleton Ave	69,792	70,865	1,073	2%
E.1.1	Bustleton Ave	Oxford Ave	72,206	77,123	4,917	7%
E.1.2	Oxford Ave	Adams Ave	90,879	97,602	6,723	7%
E.1.3	Adams Ave	Whitaker Ave	100,090	109,430	9,340	9%
F.1.1	Rising Sun Ave	Mascher St	87,582	92,213	4,631	5%
F.1.2	Mascher St	3rd St	87,591	92,515	4,924	6%
F.1.3	3rd St	Broad St	87,958	91,768	3,810	4%

Table 9 shows the transit ridership in the 2040 no-build scenario. Overall, the bus ridership increased about 40% from the base year on Roosevelt Boulevard. Direct Bus Services not only drew bus ridership from existing local services but also attracted more transit riders on the Boulevard.

Table 9: 2040 No-Build Transit Ridership

SEPTA Bus Route	2013	2040	Diff	% Diff
1	4,255	1,770	-2,485	-58%
14	11,408	8,222	-3,186	-28%
Boulevard Direct A		6,278	6,278	
Boulevard Direct B		11,679	11,679	
Primary Buses	*15,663*	*27,949*	*12,286*	*78%*
8	2,788	1,537	-1,251	-45%
R	7,602	6,813	-789	-10%
Secondary Buses	*10,390*	*8,350*	*-2,040*	*-20%*
All Buses	26,053	36,299	10,246	39%

2040 Long-Term Improvements Modeling

The 2040 no-build model was modified to present two long-term improvement alternatives. The geometry and lane usage by mode under no-build and these two improvement alternatives are compared below:

No Build Conditions:

- Transit Lanes: one BAT lane in each direction for partial length of the corridor, shared by motorists and buses.
- Motorist Lanes: six lanes in each direction comprised of three inner lanes and three outer lanes.
- Bike Lane: none.

Alt 1 – Partially Capped Express Lanes:

- Transit Lanes: one Bus Rapid Transit (BRT) lane physically separated from other modes in each direction.

- Motorist Lanes: four lanes in each direction comprised of two express (inner) lanes below grade (free-flow speed of 50 mph and link capacity of 1750 vphpl) and two local (outer) lanes at grade with reduced speed (free-flow speed of 25 mph and link capacity of 500 vphpl).
- Bike Lanes: one bi-directional protected bike lane physically separated from other modes on each side of the Boulevard.
- Access onto and off express lanes via ramps at 18 locations, located at major cross streets.

Alt 2 – Neighborhood Boulevard with BRT or LRT

- Transit Lanes: one BRT or LRT lane adjacent to the median (in inner lanes) in each direction.
- Motorist Lanes: three lanes in each direction comprised of two inner lanes and one outer lane, with reduced speed on all lanes (free-flow speed of 25 mph and link capacity of 500 vphpl).
- Bike Lanes: One bi-directional protected bike lane physically separated from other on each side the Boulevard.
- Parking/ delivery Lanes: One lane in the outer lanes which converts to a BAT lane for local buses in the peak periods.
- 30 - 35 additional signalized intersections.

To the modeling setting, the change of motorist lanes was presented by the adjustments to the free-flow speed and link capacity (as listed above under each alternative); the change of transit lanes was assumed not to change bus run time but increase the service frequency: 2 ~ 6-min headways during the peak hours and 5~10-min headways during the off-peak hours; and the addition of bike lanes was presented as allowing bike travel on existing outer lanes, which is anticipated to change the accessibility to employment and other resources by biking in the model area. Other network changes were coded as specified for each improvement scenario, such as access to express lanes at limited locations via ramps and additional intersections on the Boulevard.

The long-term improvement alternatives were evaluated with the full four-step modeling process, which was also applied to the no-build model. In the four-step process, trip generation (the amount of motorized trips generated) were the same for the no-build and build (improvement) scenarios, based on the same zonal data and trip rates (assuming no reduction of travel, no change of time of day of travel, and no shift to non-motorized trips), but trip distribution (the destination choice and trip length), mode choice (switching between auto and transit), and traffic assignment (the highway or transit route choice to the destination) could change as network or service changes at a considerable level. It is reasonable and important to allow and present travel behavioral changes of these types, giving the transformational nature of the proposed alternatives.

The following sections provide a detailed comparison of highway volumes, vehicle miles travelled (VMT), potentially congested miles, transit ridership, and multimodal accessibility on Roosevelt Boulevard and in the larger corridor or impacted area between the no-build and build alternatives, in the AM (6:00-10:00AM) and PM (3:00-7:00PM) peak periods, respectively.

Impacts on Highway Volumes

1) Alternative 1

Table 10 shows how highway volumes changed on the Boulevard inner lanes and outer lanes respectively, between Alternative 1 (Alt 1) and No-Build (NB), in the AM and PM peak periods. Highway volumes increased about 50~60% on inner lanes and decreased about 30~50% on outer lanes in the treatment area—approximately screenline sections C to F. Overall, the total traffic volume (with inner and outer lanes combined) increased about 15~20% on Roosevelt Boulevard in Alternative 1. The conversion to express lanes resulted in more automobile travel on the Boulevard.

Table 10: Boulevard Highway Volumes - Alt 1 vs. No Build

(a) AM Peak Period

Screenline	US-1 Inner Lanes	US-1 Outer Lanes	US-1 Total

	From	To	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff
A	I-276	Woodhaven	11,250	12,317	9%	8,033	8,016	0%	19,282	20,333	5%
B	Woodhaven	Welsh	10,394	13,120	26%	4,724	4,177	-12%	15,118	17,298	14%
C	Welsh	Tyson	11,792	17,949	52%	8,198	4,019	-51%	19,991	21,969	10%
D	Tyson	Bustleton	11,851	20,095	70%	6,935	3,132	-55%	18,786	23,226	24%
E	Bustleton	Whitaker	13,828	20,809	50%	7,704	5,085	-34%	21,532	25,894	20%
F	Whitaker	Broad	13,437	19,705	47%	7,848	6,163	-21%	21,285	25,868	22%

(b) PM Peak Period

	Screenline		US-1 Inner Lanes			US-1 Outer Lanes			US-1 Total		
	From	To	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff
A	I-276	Woodhaven	13,855	13,921	0%	8,955	9,214	3%	22,810	23,135	1%
B	Woodhaven	Welsh	11,948	14,972	25%	7,040	5,779	-18%	18,988	20,751	9%
C	Welsh	Tyson	13,587	20,021	47%	9,843	4,762	-52%	23,430	24,783	6%
D	Tyson	Bustleton	13,395	21,874	63%	7,979	3,279	-59%	21,374	25,152	18%
E	Bustleton	Whitaker	15,931	23,089	45%	9,624	6,016	-37%	25,555	29,105	14%
F	Whitaker	Broad	14,492	21,742	50%	9,495	6,765	-29%	23,987	28,506	19%

Table 11 below compares highway volumes on US-1 (Roosevelt Boulevard), I-95, US-13 (Frankford Ave) and PA-532 (Bustleton Ave) between Alt 1 and NB, in the larger corridor area. In Alt 1, highway volumes increased about 15~20% on the Boulevard, and decreased very slightly on I-95 and other major arterials.

Table 11: Corridor Highway Volumes - Alt 1 vs. No Build

(a) AM Peak Period

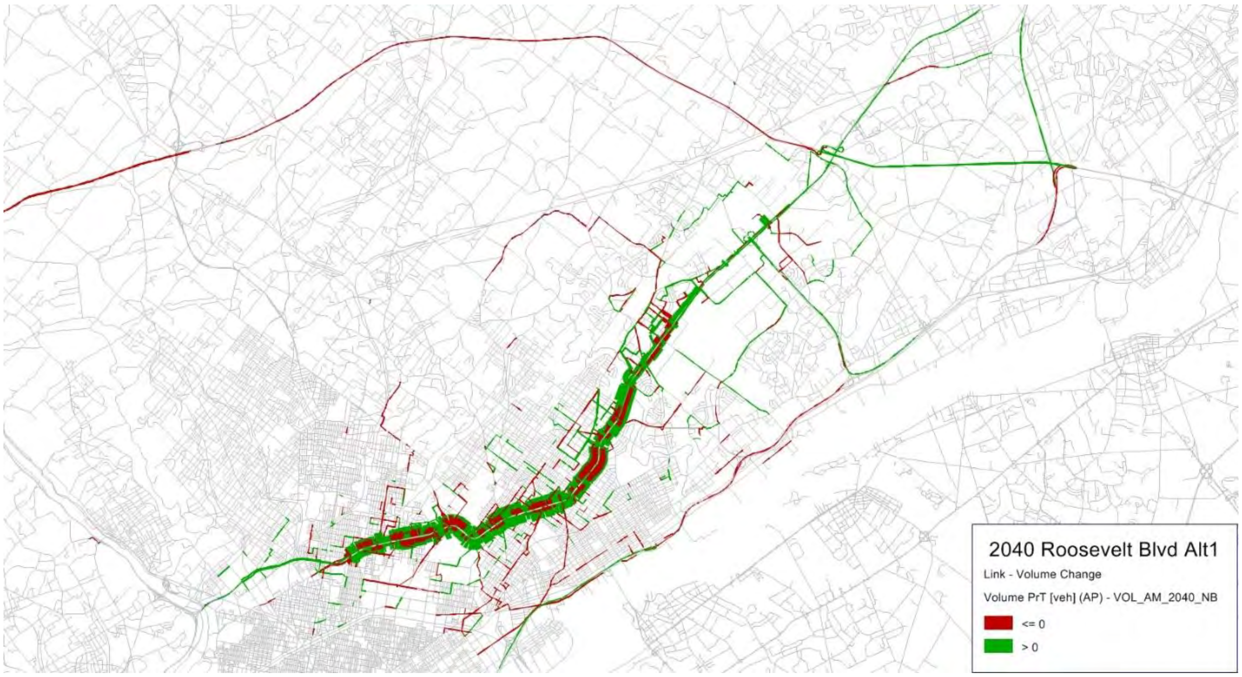
	Screenline		US-1			I-95			US-13			PA-532		
	From	To	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff
A	I-276	Woodhaven	20,923	21,583	3%	29,561	29,483	0%	5,303	5,372	1%	6,715	6,700	0%
B	Woodhaven	Welsh	15,118	17,298	14%	42,614	42,203	-1%	3,772	3,740	-1%	7,410	7,872	6%
C	Welsh	Tyson	19,991	21,969	10%	44,188	43,597	-1%	6,054	6,109	1%	5,108	5,301	4%
D	Tyson	Bustleton	18,786	23,226	24%	48,271	47,632	-1%	5,572	5,372	-4%	6,166	6,164	0%
E	Bustleton	Whitaker	21,553	25,894	20%	44,000	43,596	-1%	3,296	3,201	-3%			
F	Whitaker	Broad	21,375	24,647	15%									

(b) PM Peak Period

	Screenline		US-1			I-95			US-13			PA-532		
	From	To	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff	NB	ALT 1	% Diff
A	I-276	Woodhaven	24,460	24,589	1%	33,291	33,441	0%	5,976	5,991	0%	7,572	7,539	0%
B	Woodhaven	Welsh	18,988	20,751	9%	47,642	47,258	-1%	3,961	3,899	-2%	8,421	8,550	2%
C	Welsh	Tyson	23,429	24,783	6%	49,657	49,354	-1%	7,527	7,536	0%	5,784	6,116	6%
D	Tyson	Bustleton	21,373	25,152	18%	54,338	53,988	-1%	7,229	7,039	-3%	6,285	6,289	0%
E	Bustleton	Whitaker	25,555	29,105	14%	49,721	49,494	0%	4,069	4,004	-2%			
F	Whitaker	Broad	24,045	27,366	14%									

In addition to the impact on major highways, Figure 6 shows how traffic volumes changed on all highway links in the larger corridor in the AM peak period. The pattern of volume change is the same in the PM peak period. Links were color coded in green if volume increased and in red if volume decreased, and the width of link bars presented the magnitude of volume change. The plot shows in Alt 1 highway volumes increased largely on the Boulevard and decreased on roads that are not only parallel to but also connecting to the Boulevard, indicating a small change of traffic distribution in the corridor—more and/or longer trips along the Boulevard than along cross streets.

Figure 6: Network Highway Volume Change – Alt 1 vs. NB (AM Peak Period)



2) Alternative 2

Table 12 below shows how highway volumes changed on the Boulevard inner lanes and outer lanes respectively, between Alternative 2 (Alt 2) and No-Build (NB), in the AM and PM peak periods. Highway volumes decreased about 60% on both inner and outer lanes and the combined Boulevard total in the treatment area, due to the travel speed reduction throughout the Boulevard.

Table 12: Boulevard Highway Volumes - Alt 2 vs. No Build

(c) AM Peak Period

	Screenline		US-1 Inner Lanes			US-1 Outer Lanes			US-1 Total		
	From	To	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff
A	I-276	Woodhaven	11,250	10,384	-8%	8,033	7,755	-3%	19,282	18,139	-6%
B	Woodhaven	Welsh	10,394	7,071	-32%	4,724	2,098	-56%	15,118	9,169	-39%
C	Welsh	Tyson	11,792	4,233	-64%	8,198	3,113	-62%	19,991	7,346	-63%
D	Tyson	Bustleton	11,851	4,228	-64%	6,935	2,218	-68%	18,786	6,447	-66%
E	Bustleton	Whitaker	13,828	5,918	-57%	7,704	2,710	-65%	21,532	8,627	-60%
F	Whitaker	Broad	13,437	5,436	-60%	7,848	3,283	-58%	21,285	8,719	-59%

(d) PM Peak Period

	Screenline		US-1 Inner Lanes			US-1 Outer Lanes			US-1 Total		
	From	To	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff
A	I-276	Woodhaven	13,855	13,351	-4%	8,955	8,516	-5%	22,810	21,866	-4%
B	Woodhaven	Welsh	11,948	8,367	-30%	7,040	3,566	-49%	18,988	11,933	-37%
C	Welsh	Tyson	13,587	5,074	-63%	9,843	3,338	-66%	23,430	8,412	-64%
D	Tyson	Bustleton	13,395	5,221	-61%	7,979	2,872	-64%	21,374	8,093	-62%

E	Bustleton	Whitaker	15,931	6,820	-57%	9,624	3,325	-65%	25,555	10,145	-60%
F	Whitaker	Broad	14,492	6,301	-57%	9,495	4,026	-58%	23,987	10,326	-57%

Table 13 compares highway volumes on US-1 (Roosevelt Boulevard), I-95, US-13 (Frankford Ave) and PA-532 (Bustleton Ave) between Alt 2 and NB, in the AM and PM peak periods. In Alt 2 highway volumes decreased significantly (60%) on Roosevelt Boulevard, increased slightly on I-95, and increased more considerably on sections of many other major and minor arterials in the larger corridor area.

Table 13: Corridor Highway Volumes - Alt 2 vs. No Build

(c) AM Peak Period

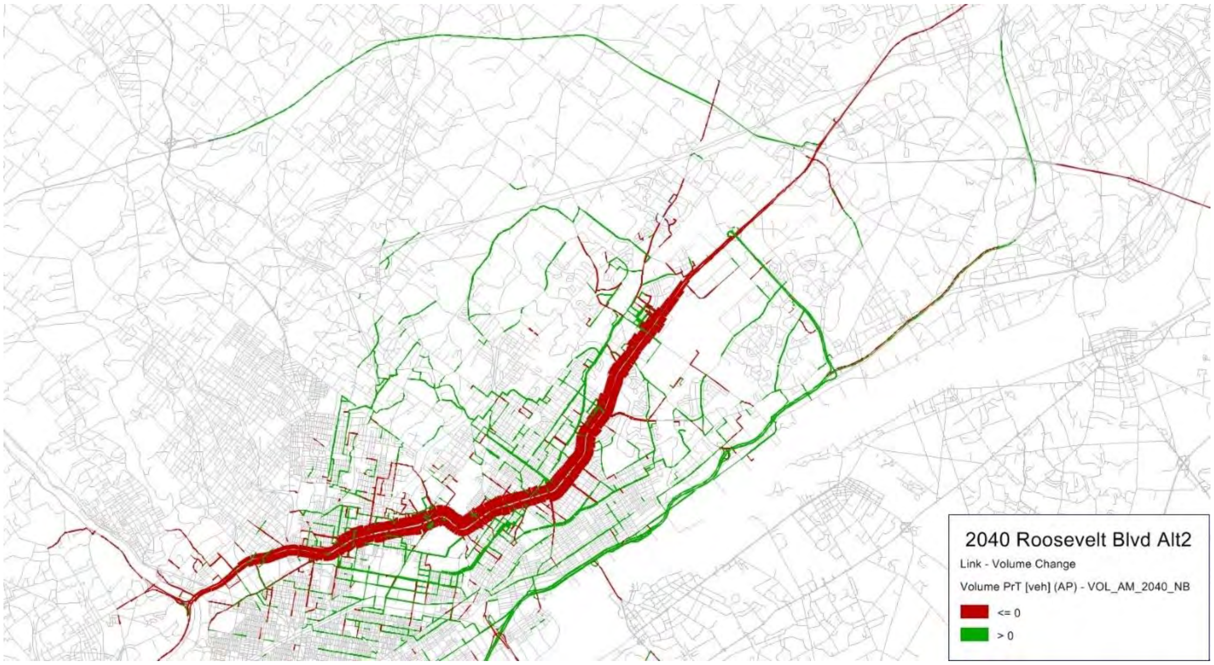
	Screenline		US-1			I-95			US-13			PA-532		
	From	To	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff
A	I-276	Woodhaven	20,923	20,127	-4%	29,561	29,492	0%	5,303	5,251	-1%	6,715	6,580	-2%
B	Woodhaven	Welsh	15,118	9,169	-39%	42,614	43,329	2%	3,772	3,873	3%	7,410	7,681	4%
C	Welsh	Tyson	19,991	7,346	-63%	44,188	45,136	2%	6,054	6,758	12%	5,108	6,186	21%
D	Tyson	Bustleton	18,786	7,346	-61%	48,271	49,203	2%	5,572	7,160	29%	6,166	6,302	2%
E	Bustleton	Whitaker	21,553	8,627	-60%	44,000	44,691	2%	3,296	3,609	9%			
F	Whitaker	Broad	21,375	11,304	-47%									

(d) PM Peak Period

	Screenline		US-1			I-95			US-13			PA-532		
	From	To	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff	NB	ALT 2	% Diff
A	I-276	Woodhaven	24,460	23,865	-2%	33,291	32,924	-1%	5,976	5,948	0%	7,572	7,438	-2%
B	Woodhaven	Welsh	18,988	11,933	-37%	47,642	48,370	2%	3,961	4,012	1%	8,421	8,528	1%
C	Welsh	Tyson	23,429	8,412	-64%	49,657	50,594	2%	7,527	7,782	3%	5,784	6,537	13%
D	Tyson	Bustleton	21,373	8,093	-62%	54,338	55,310	2%	7,229	8,183	13%	6,285	6,270	0%
E	Bustleton	Whitaker	25,555	10,145	-60%	49,721	50,507	2%	4,069	4,215	4%			
F	Whitaker	Broad	24,045	12,793	-47%									

Figure 7 shows how traffic volumes changed on the highway network in the larger area in the AM peak period. The pattern of volume change is the same for the PM peak period. Again, links were color coded in green if volume increased and in red if volume decreased, and the width of link bars presented the magnitude of volume changes. The plot shows traffic volumes decreased significantly on the Boulevard and increased on all other roads, including many local neighborhood streets, throughout a larger area in Alt 2. It indicated both traffic distribution (destination choice and trip length) and route choice changed more substantially in the larger corridor area, as a result of the speed reduction throughout the Boulevard in this scenario—much less and/or shorter trips along the Boulevard direction and driving through locals instead of the Boulevard.

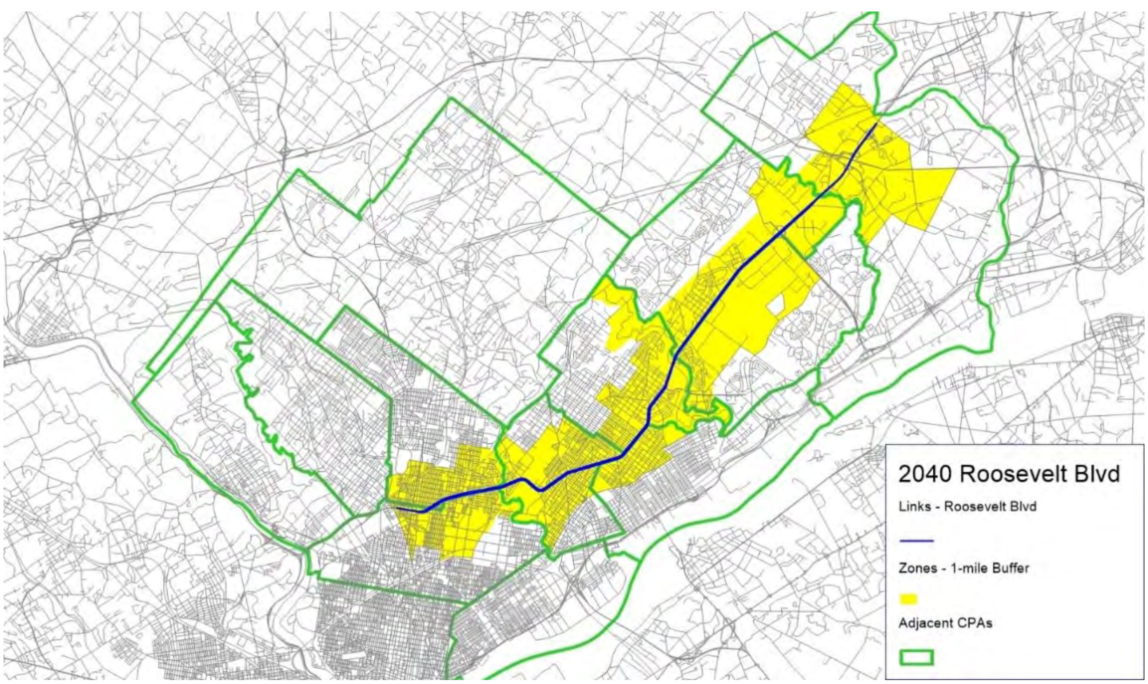
Figure 7: Network Highway Volume Change – Alt 2 vs. NB (AM Peak Period)



Impacts on Vehicle Miles Travelled

As the build alternatives could make a large impact on highway volume and traffic distribution (e.g. destination and route choice of motorists) in a larger area beyond Roosevelt Boulevard and a few major highways that are parallel to the Boulevard, the total vehicle miles travelled (VMT) was summarized and compared for Roosevelt Boulevard and different impacted areas between the no-build and build alternatives. Figure 8 shows the impact areas for VMT comparison, including traffic analysis zones (TAZs) within 1-mile buffer distance from the Blvd—the area in yellow–and adjacent county planning areas (CPAs), where traffic volume changes were observed in build alternatives—the area within the green polygons.

Figure 8: Impact Areas



1) Alternative 1

Table 14 shows the changes of VMT on the Boulevard, within 1-mile buffer zones, and in the adjacent CPAs by highway link type, between the Alternative 1 and no-build scenarios. For Roosevelt Boulevard, the inner lanes were defined as the parkway type, the outer lanes were defined as the major arterial type in the regional model, and the Roosevelt Expressway west of Board St were defined as the freeway type. When comparing the VMT changes in the 1-mile buffer area and adjacent CPAs, the changes of VMT were also compared with the Roosevelt Boulevard arterial section excluded from other freeways, parkways and major arterials in the summary areas, in order to isolate the impacts on the Boulevard versus elsewhere. Overall, VMT increased 11% in the AM peak period and 8% in the PM peak period on the Boulevard, where VMT increased significantly on the inner lanes (under the parkway link type) and decreased on the outer lanes (under the major arterial link type) in Alt 1, due to the large difference in travel speed; and the total VMT remained almost the same as NB in the impact areas.

Table 14: Vehicle Miles Travelled (VMT) by Link Type - Alt 1 vs. No Build

(a) AM Peak Period

VMT Difference	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	1,886	64,277	-30,839			35,324
1-Mile Buffer	2,368	64,669	-31,797	-342	3,903	38,802
excl Blvd	482	392	-958	-342	3,903	3,478
Adjacent CPAs	-2,054	64,832	-34,929	-933	2,562	29,479
excl Blvd	-3,939	555	-4,090	-933	2,562	-5,845

VMT % Diff	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	2%	40%	-37%			11%
1-Mile Buffer	2%	29%	-8%	0%	4%	3%
excl Blvd	15	1%	0%	0%	4%	0%
Adjacent CPAs	0%	22%	-3%	0%	1%	1%
excl Blvd	0%	0%	0%	0%	1%	0%

(b) PM Peak Period

VMT Difference	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	2,253	66,950	-39,755			29,449
1-Mile Buffer	2,192	67,305	-40,468	-402	6,894	35,521
excl Blvd	-61	354	-713	-402	6,894	6,072
Adjacent CPAs	285	67,360	-41,759	-629	6,661	31,918
excl Blvd	-1,969	410	-2,004	-629	6,661	2,469

VMT % Diff	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	2%	36%	-38%			8%
1-Mile Buffer	2%	26%	-8%	0%	4%	3%
excl Blvd	0%	1%	0%	0%	4%	1%
Adjacent CPAs	0%	20%	-3%	0%	2%	1%
excl Blvd	0%	0%	0%	0%	2%	0%

2) Alternative 2

Table 15 shows the changes of VMT on the Boulevard, within 1-mile buffer zones, and in the adjacent CPAs by link type (with the Boulevard separated from other arterials whereas necessary), between the Alternative 2 and no-build scenarios. Overall, VMT decreased about 40% in the AM and PM peak periods on the Boulevard (on both inner and outer lanes); VMT increased on all other roads (the increase is more substantial on local roads); and the total VMT decreased just slightly in the larger areas.

Table 15: Vehicle Miles Travelled (VMT) by Link Type - Alt 2 vs. No Build

(a) AM Peak Period

VMT Difference	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	-12,350	-69,198	-43,931			-125,479
1-Mile Buffer	-11,128	-69,962	-35,474	5,316	10,152	-101,096
excl Blvd	1,222	-764	8,457	5,316	10,152	24,383
Adjacent CPAs	-3,033	-69,956	-26,747	10,798	17,204	-71,734
excl Blvd	9,317	-757	17,183	10,798	17,204	53,745

VMT % Diff	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	-15%	-43%	-52%			-39%
1-Mile Buffer	-10%	-32%	-8%	2%	11%	-9%
excl Blvd	4%	-1%	3%	2%	11%	3%
Adjacent CPAs	0%	-24%	-2%	2%	7%	-2%
excl Blvd	1%	-1%	2%	2%	7%	2%

(b) PM Peak Period

VMT Difference	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	-15,990	-77,029	-54,147			-147,166
1-Mile Buffer	-15,029	-77,589	-49,497	3,393	19,497	-119,226
excl Blvd	961	-560	4,649	3,393	19,497	27,940
Adjacent CPAs		-77,334	-42,316	7,427	33,403	-86,430
excl Blvd		-305	11,831			60,736

VMT % Diff	Freeway	Parkway	Major Arterial	Minor Arterial	Collector & Local	Total
BLVD	-17%	-42%	-52%			-39%
1-Mile Buffer	-11%	-30%	-10%	1%	13%	-9%
excl Blvd	2%	-1%	1%	1%	13%	3%
Adjacent CPAs	-1%	-23%	-3%	1%	8%	-2%
excl Blvd	1%	0%	1%	1%	8%	2%

Impacts on Congested Miles

While VMT could increase on Roosevelt Boulevard or local roads in the build alternatives, it is meaningful and useful to estimate and compare how much congestion the increased VMT would add to Roosevelt Boulevard and other roads. In the regional model, the level of congestion (or level of service) could be evaluated with volume-to-capacity (V/C) ratio of highway links. As V/C ratio increases, the probability of traffic slowing down increases and the level of service decreases. When V/C is greater than 0.85 in the four-hour peak period, it is more likely traffic flow will become unstable and break down into congestion during the peak hour. Links where V/C is greater than 0.85 can be thought as "congested" links, and the change of the total miles of these links can be used to evaluate the impact on congestion of different build alternatives.

1) Alternative 1

Table 16 shows the changes of the total center-line miles of likely congested links, where V/C was greater than 0.85, in the AM and PM peak hours, between the Alternative 1 and no-build scenarios. On the Boulevard, the congested miles increased about 6 miles (50%) in the AM peak period (mainly on the inner lanes), while the congested miles almost didn't increase in the PM peak period (because the Boulevard was already largely congested—with an average link V/C greater than 0.85 in the no-build scenario), but the average link V/C was even higher in Alt 1.

Table 16: Congested Miles (V/C > 0.85) by Link Type - Alt 1 vs. No Build

(a) AM Peak Period

Congested Mile Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	0.0	7.2	-1.0			6.2
1-Mile Buffer	0.0	7.1	-1.1	0.3	2.0	8.2
excl Blvd	0.0	-0.1	-0.1	0.3	2.0	2.0
Adjacent CPAs	-0.5	7.1	-1.2	-0.5	1.4	6.3
excl Blvd	-0.5	-0.1	-0.2	-0.5	1.4	0.1

Mile % Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	0%	118%	-27%			51%
1-Mile Buffer	0%	86%	-3%	0%	30%	7%
excl Blvd	0%	-5%	0%	0%	30%	2%
Adjacent CPAs	-3%	49%	-1%	0%	7%	2%
excl Blvd	-3%	-1%	0%	0%	7%	0%

(b) PM Peak Period

Mile Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	0.3	2.8	-2.9			0.2
1-Mile Buffer	0.3	2.8	-1.4	-1.8	3.2	3.1
excl Blvd	0.0	0.0	1.5	-1.8	3.2	2.9
Adjacent CPAs	0.3	2.8	-1.7	-0.9	3.3	3.7
excl Blvd	0.0	0.0	1.2	-0.9	3.3	3.5

Mile % Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	7%	17%	-34%			1%
1-Mile Buffer	7%	13%	-2%	-2%	14%	1%
excl Blvd	0%	0%	2%	-2%	14%	2%
Adjacent CPAs	1%	10%	-1%	0%	6%	1%

excl Blvd	0%	0%	1%	0%	6%	1%

2) Alternative 2

Table 17 shows the changes of the total miles of likely congested links, where V/C was greater than 0.85, in the AM and PM peak hours, between the Alternative 2 and no-build scenarios. The congested miles decreased 2.6 miles (20%) in the AM peak period and 13 miles (44%) in the PM peak period on the Boulevard, but the congested miles increased 12~15 miles (10% in average) on other roads in the 1-mile buffer area in the AM and PM peak periods (including 9 miles of increase on minor arterials and local streets).

Table 17: Congested Miles (V/C > 0.85) by Link Type - Alt 2 vs. No Build

(a) AM Peak Period

Congested Miles Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	-1.7	-1.2	0.4			-2.6
1-Mile Buffer	-1.7	-1.5	3.7	6.3	2.6	9.5
excl Blvd	0.0	-0.2	3.4	6.3	2.6	12.0
Adjacent CPAs	-1.7	-1.5	9.6	10.2	1.7	18.5
excl Blvd	0.0	-0.2	9.3	10.2	1.7	21.0

Congested Miles % Diff	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	-71%	-20%	10%			-21%
1-Mile Buffer	-63%	-18%	10%	11%	39%	8%
excl Blvd	0%	-11%	10%	11%	39%	12%
Adjacent CPAs	-9%	-10%	8%	8%	8%	6%
excl Blvd	0%	-3%	8%	8%	8%	8%

(b) PM Peak Period

Congested Miles Difference	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	-3.1	-6.7	-2.9			-12.8
1-Mile Buffer	-3.1	-6.9	3.5	4.6	4.3	2.3
excl Blvd	0.0	-0.2	6.5	4.6	4.3	15.1
Adjacent CPAs	-3.1	-7.0	9.9	9.5	9.3	18.6
excl Blvd	0.0	-0.3	12.9	9.5	9.3	31.4

Congested Miles % Diff	Freeway	Parkway	Major Arterials	Minor Arterials	Collectors & Locals	Total
BLVD	-82%	-41%	-35%			-45%
1-Mile Buffer	-82%	-32%	5%	5%	19%	1%
excl Blvd	0%	-5%	11%	5%	19%	8%
Adjacent CPAs	-9%	-24%	5%	4%	16%	3%
excl Blvd	0%	-2%	7%	5%	19%	6%

Impacts on Transit Ridership

As travel and traffic conditions change on the Boulevard, and designated BRT lanes is added to the transit supply side along with increased service frequency, transit ridership is expected to increase in the build alternatives.

1) Alternative 1

Table 19 shows the change of bus ridership between the Alternative 1 and No-Build scenario. In Alt 1, the bus ridership increased 27% and 38% on all Boulevard bus routes combined, in the AM and PM peak period respectively. In addition to the improvement on transit service by itself, the ridership increase was also contributed by the increase of travel (more and/or longer trips) along the Boulevard, as the conversion to express lanes increases the overall travel utility (used for trip distribution) along the Boulevard direction in the regional model.

Table 18: Transit Ridership Alt 1 vs. No Build

(a) AM Peak Period

SEPTA Bus Route	NB	ALT 1	Diff	% Diff
1	442	373	-69	-16%
14	2,234	1,902	-332	-15%
Boulevard Direct A	1,854	3,656	1,803	97%
Boulevard Direct B	3,091	4,855	1,765	57%
Primary Buses	*7,620*	*10,786*	*3,166*	*42%*
8	515	437	-78	-15%
R	1,425	951	-474	-33%
Secondary Buses	*1,939*	*1,387*	*-552*	*-28%*
All Buses	9,559	12,174	2,615	27%

(b) PM Peak Period

SEPTA Bus Route	NB	ALT 1	Diff	% Diff
1	539	481	-58	-11%
14	2,313	2,028	-285	-12%
Boulevard Direct A	2,128	4,675	2,547	120%
Boulevard Direct B	3,645	6,288	2,643	72%
Primary Buses	*8,625*	*13,471*	*4,846*	*56%*
8	587	492	-95	-16%
R	1,663	1,000	-663	-40%
Secondary Buses	*2,250*	*1,492*	*-758*	*-34%*
All Buses	10,875	14,964	4,089	38%

2) Alternative 2

Table 19 shows the change of bus ridership between the Alternative 2 and no-build scenarios. In Alt 2, bus ridership also increased significantly on the Boulevard in both AM and PM peak periods, while highway volumes decreased significantly. Mode choice was shifted from auto to transit, as a result of the reduction of highway speed limit along with the increase of transit service frequency and reliability on the Boulevard.

Table 19: Transit Ridership: Alt 2 vs. No Build

(a) AM Peak Period

SEPTA Bus Route	NB	ALT 2	Diff	% Diff
1	442	362	-80	-18%
14	2,234	1,959	-275	-12%
Boulevard Direct A	1,854	3,710	1,856	100%

Boulevard Direct B	3,091	4,748	1,657	54%
Primary Buses	*7,620*	*10,779*	*3,159*	*41%*
8	515	448	-67	-13%
R	1,425	958	-466	-33%
Secondary Buses	*1,939*	*1,406*	*-533*	*-27%*
All Buses	9,559	12,185	2,626	27%

(b) PM Peak Period

SEPTA Bus Route	NB	ALT 2	Diff	% Diff
1	539	475	-64	-12%
14	2,313	2,073	-239	-10%
Boulevard Direct A	2,128	4,741	2,614	123%
Boulevard Direct B	3,645	6,145	2,499	69%
Primary Buses	*8,625*	*13,435*	*4,810*	*56%*
8	587	509	-78	-13%
R	1,663	1,019	-644	-39%
Secondary Buses	*2,250*	*1,528*	*-722*	*-32%*
All Buses	10,875	14,963	4,088	38%

Impacts on Multimodal Accessibility

The build alternatives could also change the accessibility to jobs and other opportunities or services in the study area by travel mode. For each improvement alternative, the impacts on multimodal accessibility to opportunities or services can be measured based on the simulated travel time in the VISUM regional model and the demographic, employment, and land use data integrated in the regional model. Generally, accessibility measurements start from a point of interest, either a node (an intersection) or a TAZ in two steps. First, travel time from the starting node or zone were obtained from simulations. Then opportunities (e.g. the number of jobs) or services (e.g. the number of activity centers for seniors) at the destination node or TAZ, that are within a catchment of travel time (e.g. 30-minutes of driving time), were aggregated and compared between the build and no-build alternatives.

For the accessibility measures by driving, biking and walking, a node-based measuring method was used. It mapped the opportunity data (population, employment and other point of interest, e.g. activity centers) to the Census block level, specified an access node by mode to each Census block, and used the node-to-node travel time isochrone to filter and aggregate the opportunity data at qualified destination Census bocks from origin Census blocks in the Roosevelt Boulevard corridor. The node-based accessibility measure is most precise measure available, as it uses the travel time data provided at the finest resolution from the regional model.

The accessibility measures by driving were based on the loaded highway travel time in the AM and PM peak periods, taking into consideration of highway volume and delay. For accessibility measures by biking and walking, the regional network was edited to allow bike and walk access on links wherever it is permitted in reality. It assumed the biking speed is 14mph on bike lanes and 12mph elsewhere biking is allowed, and the walking speed is 2.4mph wherever walking is allowed. The biking and walking speeds and node-to-node travel time remain the same regardless of traffic conditions and the time of day.

For the accessibility measures by transit, a zone-based measuring method was used, since it is not feasible to find a nearby transit access node (transit stop) for each Census block. In this case, the employment and other opportunity data was aggregated at the TAZ level, and the TAZ-to-TAZ travel time skims, which present the average travel time between TAZs, were used to filter eligible destination TAZs from origin TAZs in the Boulevard corridor. Since TAZs in the study area are relatively large and skim matrices represent aggregated travel times, the zone-based accessibility measure is less accurate than the node-based measure, and it may not be sensitive to small variations in model inputs.

The accessibility to jobs by driving, transit, walking, and biking was measured with different travel-time thresholds (30-minutes for driving and transit, and 15-mintues for walking and biking). The percent differences of the total jobs that can be reached within the travel-time threshold, specified by mode, were calculated and compared between the no-build and build alternatives.

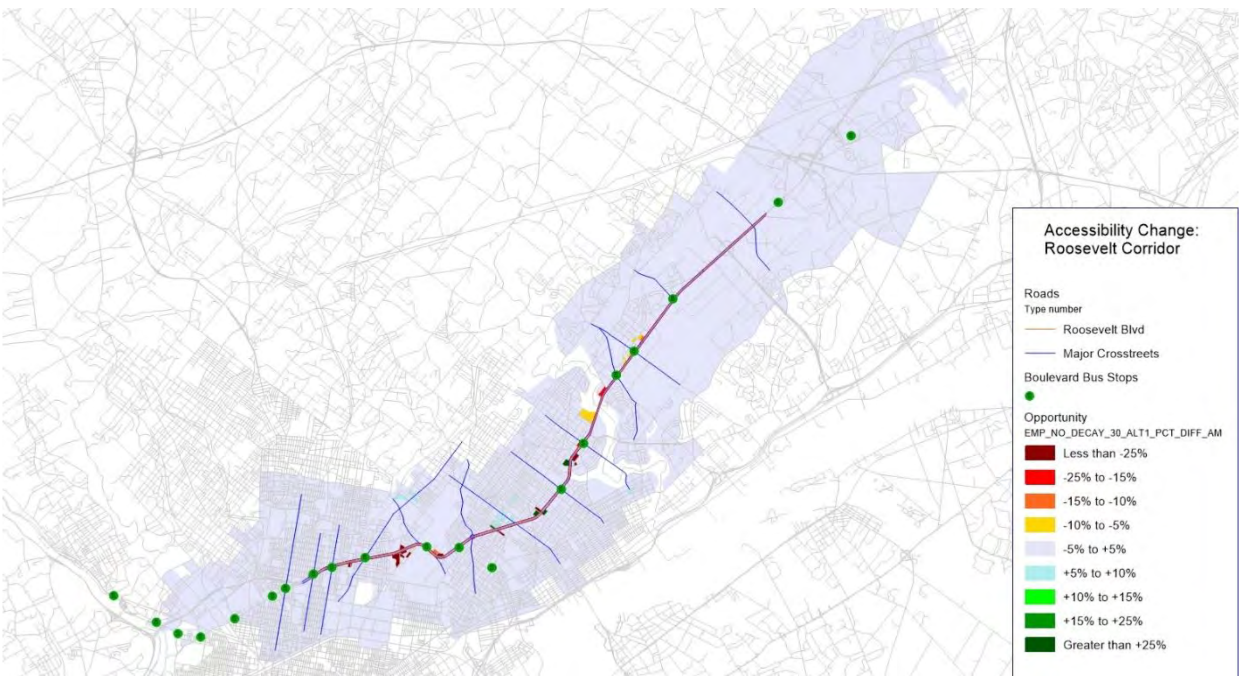
1) Alternative 1

Figure 9 and 10 show the percent differences of jobs that can be reached by auto and transit within 30 minutes for Census Blocks or TAZs in the 1-mile buffer area between Alt 1 and NB, in the AM and PM peak periods. The areas, where the job accessibility increased, are marked in green and where the job accessibility decreased, are marked in red. The darker is the color, the larger is the difference.

Overall, the job accessibility within 30-minutes driving time was not increased with the express lanes (the accessibility even decreased for a shorter travel-time threshold due to the limited ramp access onto and off of the express lanes). On the other hand, the accessibility to jobs within 30-minutes via transit increased more considerably for TAZs that are immediately adjacent to the Boulevard (i.e. can access the BRT service directly).

Figure 9: Change of Job Accessibility by Auto within 30 min from Boulevard - Alt 1 vs. No Build

(a) AM Peak Period



(b) PM Peak Period

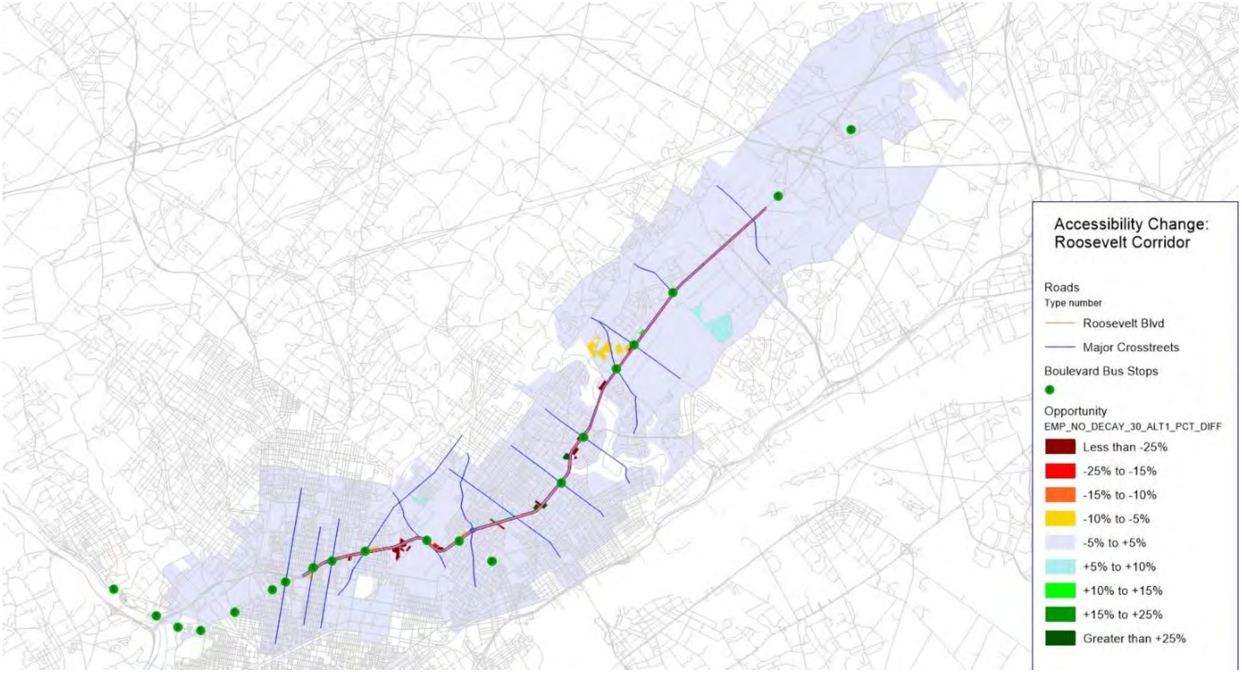
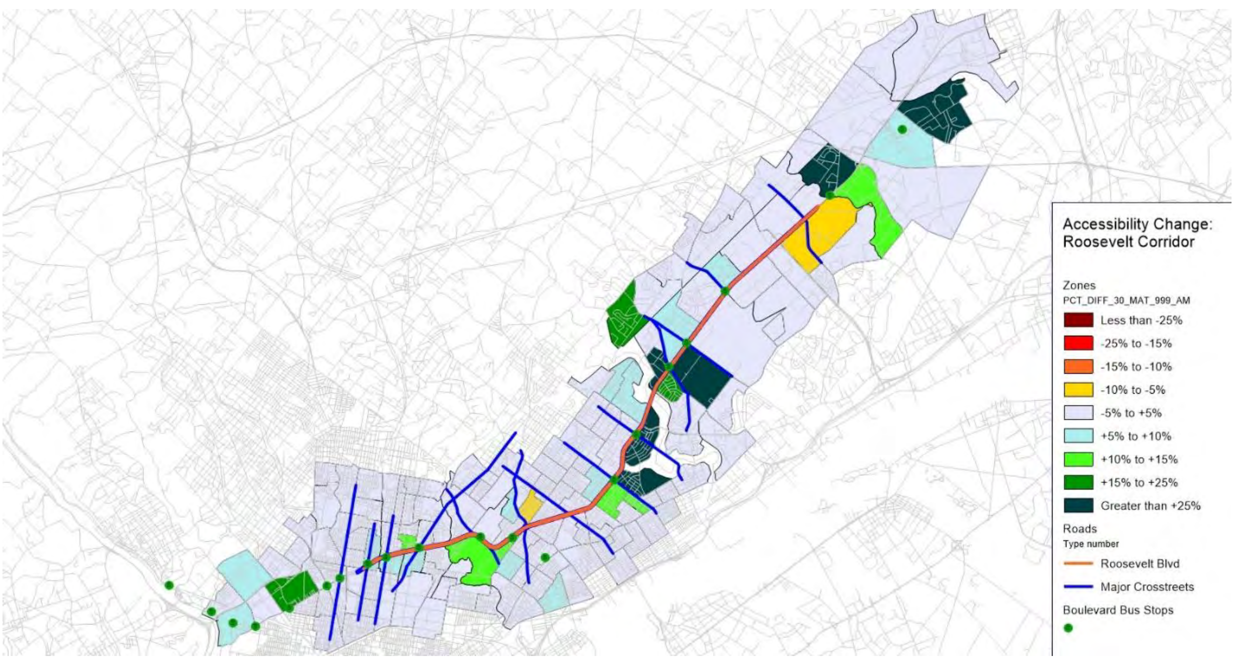


Figure 10: Change of Job Accessibility by Transit within 30 min from Boulevard - Alt 1/2 vs. No Build

(a) AM Peak Period



(b) PM Peak Period

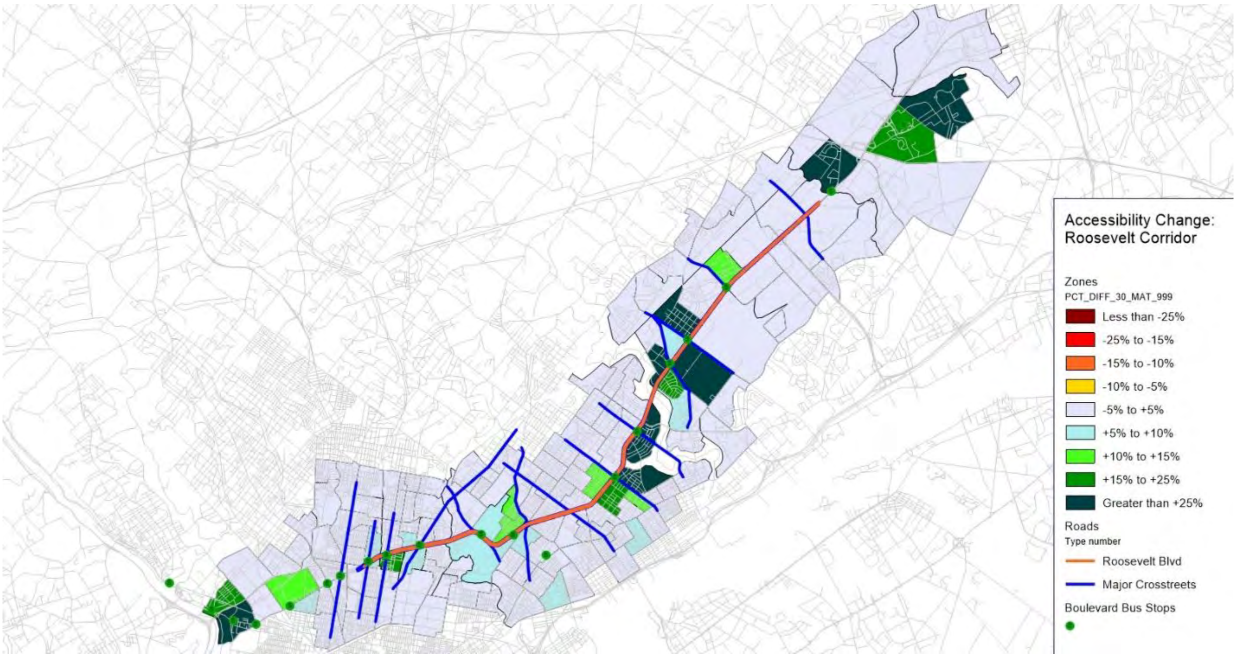


Figure 11 and 12 show the percent differences of jobs that can be reached by biking and walking within 15 minutes for Census Blocks in the 1-mile buffer area between NB and Alt 1 (the differences are the same between AM and PM periods, as the models assumed no changes of biking and walking speeds). The job accessibility by biking increased significantly in the Boulevard corridor area, with protected bike lanes added onto the Boulevard. The job accessibility by walking increased only at locations where intersecting streets (e.g. Napfle St) are connected to cross the Boulevard, with ramps in place nearby, in Alt 1.

Figure 11: Change of Job Accessibility by Biking within 15 min from Boulevard - Alt 1 vs. No Build

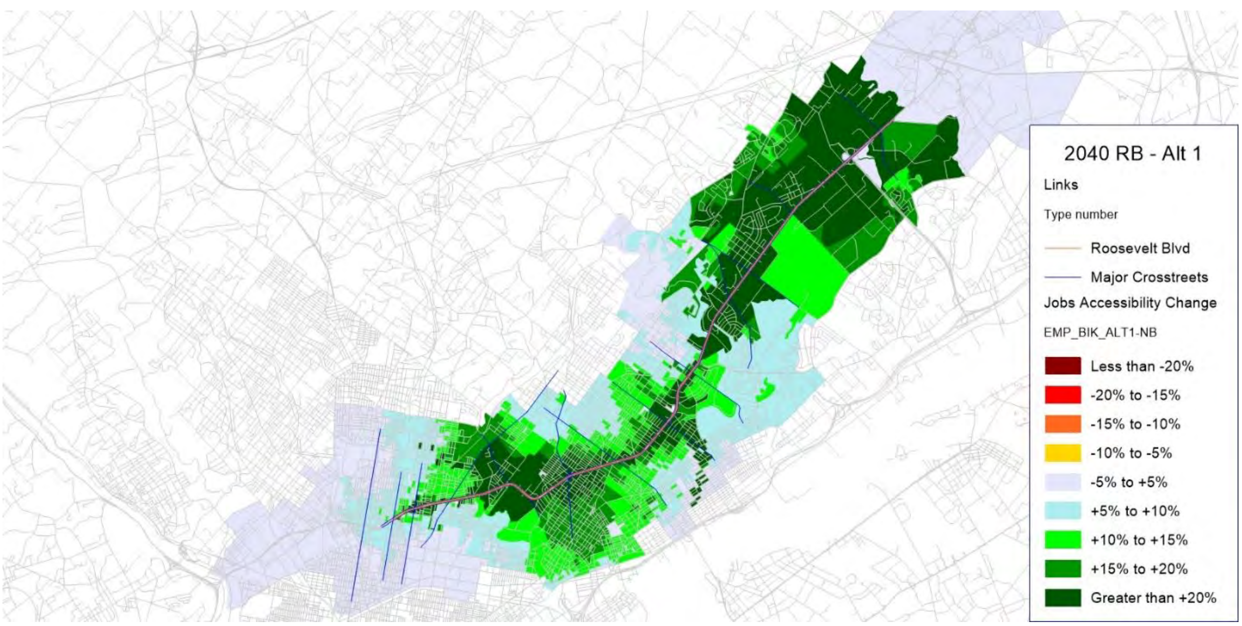


Figure 12: Change of Job Accessibility by Walking within 15 min from Boulevard - Alt 1 vs. No Build

2) Alternative 2

Figure 13 show the percent differences of jobs that can be reached by driving within 30 minutes for Census Blocks in the 1-mile buffer area between Alt 2 and NB, in the AM and PM peak periods. Since bus services are the same for Alt 1 and Alt 2, the percent differences of jobs that can reached by transit between Alt 2 and NB are the same as the differences between Alt 1 and NB (see Figure 10). Overall, the job accessibility by auto decreased, and the accessibility by transit increased on the Boulevard.

Figure 13: Change of Job Accessibility by Auto within 30 min from Boulevard - Alt 2 vs. No Build

(a) AM Peak Period

(b) PM Peak Period

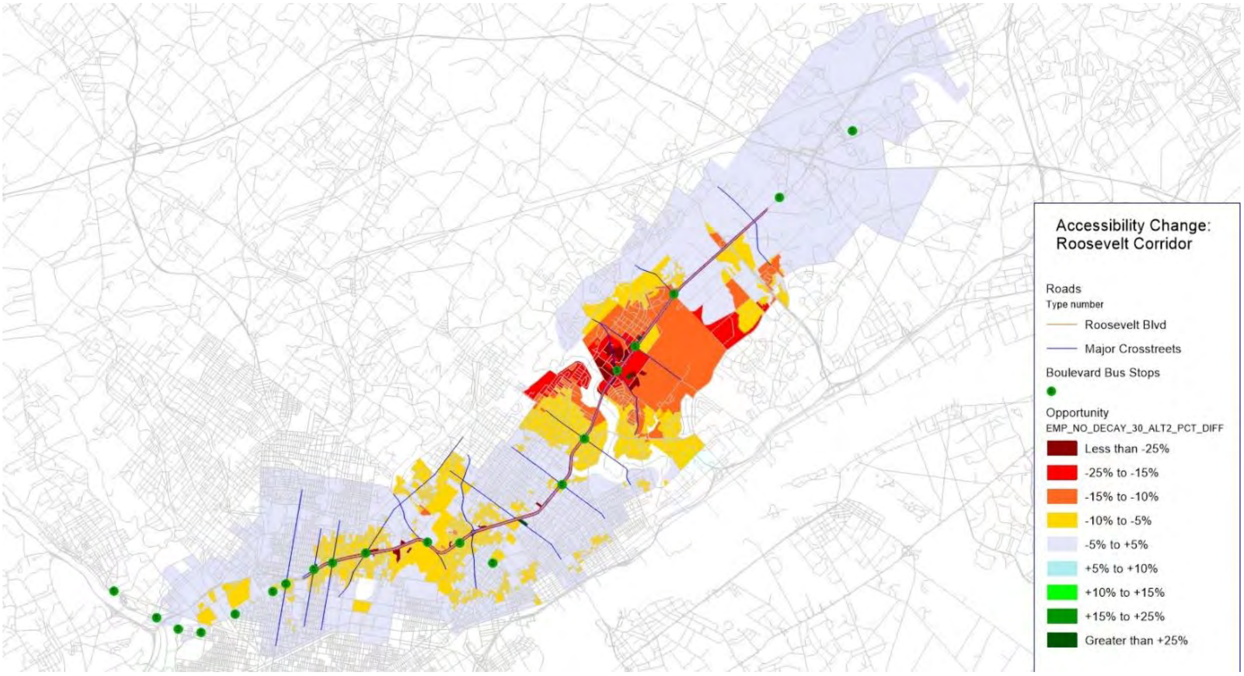


Figure 14 and 15 show the percent differences of jobs that can be reached by biking and walking within 15 minutes for Census Blocks in the 1-mile buffer area between NB and Alt 2. The job accessibility by biking increased significantly, with protected bike lanes added onto the Boulevard. The job accessibility by walking also increased at those locations where new intersections are added and intersecting streets are connected to cross the Boulevard.

Figure 14: Change of Job Accessibility by Biking within 15 min from Boulevard - Alt 2 vs. No Build

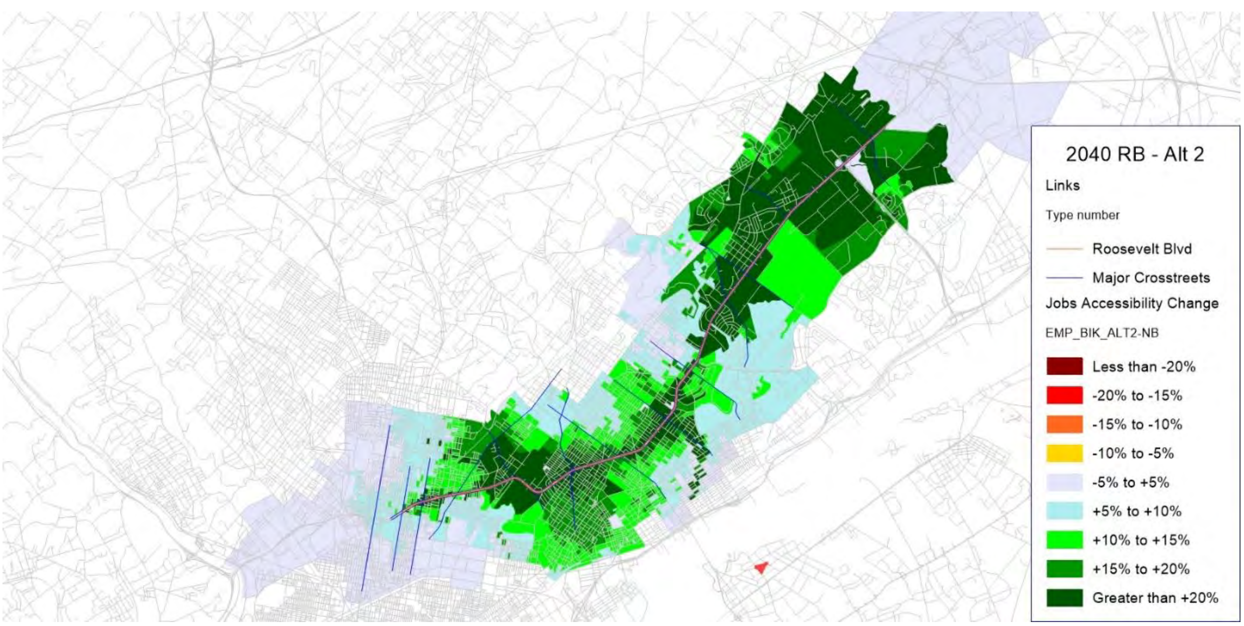


Figure 15: Change of Job Accessibility by Walking within 15 min from Boulevard - Alt 2 vs. No Build

In a summary, Table 20 compares the average number of jobs that are reachable by mode between the no-build and build alternatives within the travel time thresholds for all Census Blocks or TAZs in the 1-mile buffer area to Roosevelt Boulevard, and overall accessibility scores compared to the no-build scenario (with scores equal to 1).

Table 20: Access Alt 1 and 2 vs. No Build

(a) AM Peak Period

Mode (travel time)	No-Build Job Access	No-Build Score	Alt 1 Job Access	Alt 1 Score	Alt 2 Job Access	Alt 2 Score
Auto (30-min)	1,898,069	1.00	1,899,517	1.00	1,829,224	0.96
Transit (30-min)	93,631	1.00	96,470	1.03	96,494	1.03
Walk (15-min)	2,262	1.00	2,265	1.00	2,279	1.01
Bike (15-min)	48,834	1.00	54,984	1.13	55,080	1.13

(b) PM Peak Period

Mode (travel time)	No-Build Job Access	No-Build Score	Alt 1 Job Access	Alt 1 Score	Alt 2 Job Access	Alt 2 Score
Auto (30-min)	1,450,765	1.00	1,449,082	1.00	1,381,909	0.95
Transit (30-min)	89,253	1.00	93,409	1.05	93,450	1.05
Walk (15-min)	2,262	1.00	2,265	1.00	2,279	1.01
Bike (15-min)	48,834	1.00	54,984	1.13	55,080	1.13

Route for Change
Transforming The Boulevard

Roosevelt Boulevard

Section 3 – Appendix 15

Capital Improvements Grant Screening

February 2020

1. INTRODUCTION

a. Program Overview

Roosevelt Boulevard (US 1) is a major multimodal corridor that is vital to the quality of life and economic vitality in and around northeast Philadelphia and Bensalem Township, Pennsylvania. The Roosevelt Boulevard Route for Change Program (the Program) is examining how specific improvements can make Roosevelt Boulevard (the Boulevard) more safe, accessible, reliable, and transformative for all users. In the short term, the Program is focused on identifying and implementing a set of interim improvements by the year 2025. Subsequently, the Program will focus on improvements to transform the Boulevard by the year 2040.

One of the potential long-term transformations includes the development of two bus rapid transit (BRT) routes along the Boulevard as shown on **Figure 1**. The BRT ‘A’ service (i.e., Boulevard Direct Bus A) would extend between Frankford Transportation Center in Philadelphia and the Neshaminy Mall in Bensalem. The BRT ‘B’ service (i.e., Boulevard Direct Bus B) would extend between the Wissahickon Transportation Center and the Frankford Transportation Center.

The BRT is intended to provide quality, high-capacity transit service that reduces automobile-reliance and supports the desired land use vision for the corridor including Walkable Station Areas (WSAs) surrounding some of the BRT stations (see Section 2). **For purposes of this memorandum, WSAs are referred to as Transit-Oriented Development (TODs) which is a more common reference.**

b. Report Purpose

Transit’s effectiveness depends on its ability to draw ridership. Land use plays a key role in shaping ridership and the success of transit systems. Factors such as density, mix, and connectivity affect how people travel within a community. Similarly, the design and operations of transit affects the feasibility and effectiveness of land use decisions. Thus, it is important to consider land use and transit investment in a coordinated manner.

Transit-oriented development (TOD) is planned higher-density, mixed-use development within walking distance of a transit station. The purpose of this report is to

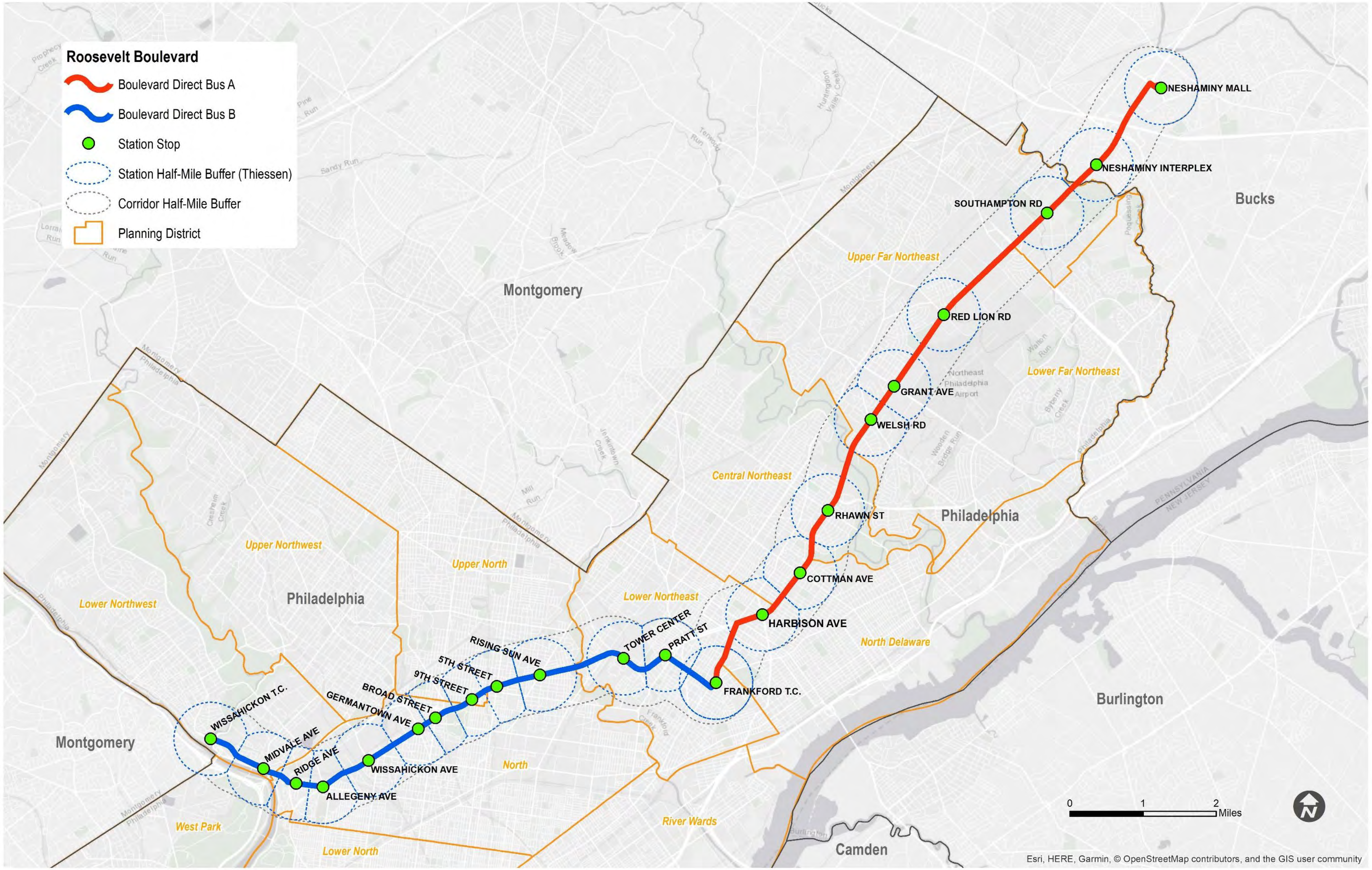
1. Describe the key elements of a successful TOD, and the benefits and challenges of TOD.

2. Summarize the land use and economic development goals of the U.S. Federal Transit Administration (FTA) Capital Improvement Grant (CIG) program (49 U.S.C. 5309) CIG program, and how the existing land use conditions meets the goals of the CIG program.

3. Identify potential locations for TOD in the corridor.

4. Present a typology of potential TODs for the Roosevelt Boulevard corridor.

Figure 1 – Bus Rapid Transit Routes and Stations



2. WHERE ARE THE BOULEVARD'S TOD OPPORTUNITIES?

As shown on **Figure 1**, two BRT routes are planned for the Roosevelt Boulevard corridor with a total of 22 stations (Note: the Frankford Transportation Center serves both routes). The BRT 'A' service would extend between Frankford Transportation Center in Philadelphia and the Neshaminy Mall in Bensalem. The route is envisioned to include 10 potential stations. Of these, five stations in the City of Philadelphia are being considered for future TOD including:

- Frankford Transportation Center (FTC)
- Cottman Avenue
- Welsh Road
- Grant Avenue
- Red Lion Avenue

Two stations in Bensalem Township are also candidates for redevelopment as TODs including:

- Neshaminy Interplex
- Neshaminy Mall

The BRT 'B' service would extend between the Wissahickon Transportation Center and the Frankford Transportation Center. The route would potentially include 13 stations, seven of which are within the Route for Change study area. Of these, four stations are under consideration for future TOD including:

- Broad Street
- 9th Street
- Tower Center
- Frankford Transportation Center

Nine of these 10 potential TOD locations were identified based on current clusters of vacant, underdeveloped or large footprint commercial properties within one-half mile radius of BRT stations. The FTC vicinity is already designated under the City's TOD Overlay Zoning District.

3. WHAT IS TOD?

TOD can be defined as moderate to higher density compact mixed-use development, located within an easy five to ten minute (approximately one-quarter to one-half mile) walk of a transit facility. TOD is designed to promote public transit and active transportation without excluding the automobile.

The *Philadelphia 2035 Citywide Vision* defines TOD as:

> *"Mixed-use development, including residential, commercial, and institutional uses, centered at transit stations to maximize access to and ridership of public transportation. TOD generally encourages higher density and reduced parking."*

TOD focuses well-planned, compact development within an easy walk of transit stations, bringing potential riders closers to transit services. It promotes transit ridership by making access to and from transit easier and more competitive to other modes. TOD most often occurs when regional or local governments encourage it through land use planning, zoning laws, and changes to building codes, among other things.

The benefits of TOD are maximized when station area development exhibits the following physical characteristics:

- Mix of land uses
- Compact and higher densities than typical development
- A high-quality transit stop or station as a center of activity
- Easy access by all modes of ground-based travel
- Limited, managed parking
- Offers a public place of activity for the surrounding community

Not all development near transit stations is transit oriented. Development near transit that has the same parking ratio, roadway design and vehicular usages as conventional development is more appropriately termed 'transit adjacent development' rather than TOD. Successful TODs increase transit ridership and lower automobile dependency by incorporating the key features described above.

a. The 5D's Transit Oriented Development

There are five key features of the built environment that significantly influence the number of trips made and the modes chosen (including public transit). These features are commonly known as the "5Ds" including:

- **Density** is a measure of intensity; how many people, workers, or built structures occupy a specified land area, such as gross hectares of residentially-zoned land.
- **Diversity** reflects the mix of land uses and the degree to which they are spatially balanced (e.g., jobs-housing balance) as well as the variety of housing types and mobility options (e.g., bikeways and motorways).
- **Design** entails details that influence the likelihood of walking or biking (e.g., street network characteristics: pedestrian- and bike-friendliness). Street networks vary from dense urban grids of highly interconnected, straight streets to sparse suburban networks of curvilinear streets and cul-de-sacs. Designs that include pedestrian friendly amenities such as pedestrian-scale lights, plantings, and active streetscapes promote longer walk distances.

- **Destination** accessibility measures ease of access to trip destinations at the city, regional, and corridor levels. Destination is an important measure of the job-housing balance (e.g., the number of jobs or other attractions reachable within 30 minutes travel time).

- **Distance** to transit is usually measured as the shortest street routes from the residences or workplaces in an area to the nearest rail station or bus stop. Greater density and diversity typically reduces distance.

The positive effect that the 5Ds can play on increasing transit ridership and reducing vehicle miles travelled (VMT) by motorists has been documented in various research.[1] For example, distance to transit is the most important factor influencing transit ridership. Street design, particularly grid-like street patterns, is second in importance. Destination accessibility has the greatest impact on the percent change in VMT and a doubling of access to key destinations results in a 20 percent decline in VMT.[2] Design attributes, such as the presence of the sidewalks and streets connections, has the second strongest influence on total VMT.

b. TOD Supportive Transit

Locating the right land uses adjacent to transit is only part of making successful TOD. The ease of riding transit is an important element. Key elements that the transit service must possess to support TOD include:

- Frequent service (every 10 minutes or less during peak periods, every 20 minutes or less during off-peak periods).

- Service throughout the day, every day of the week.

- High quality transit stops or stations that provide enhanced waiting amenities for passengers.

- The transit station functions as a major stop for through service and/or as a transit center for several routes that terminate at the TOD.

The type of transit that serves the TOD is less important than the service it provides. Service can be provided by on-street major routes, by BRT on a dedicated transitway, or by a rail route.

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[1] Ewing, R. and Cevero, R. Travel and the Built Environment, *Journal of the American Planning Association. 2010.*
[2] Note: This research was published prior to the emergence of Transportation Network Companies (TNCs) which have impacted transit ridership.

4. Key Benefits and Challenges of TOD

a. Benefits of TOD

A successful TOD provides long-term benefits to both the community and the transit system. Creating a mix of uses within a TOD promotes activity around the clock. In turn, this promote more efficient use of the transit system, including travel in both directions and in non-peak periods. In addition, people who live in a TOD are five times more likely to commute by transit than other residents.[3] People living and working in TODs typically walk more, use transit more, and own fewer cars than the surrounding community.

According to the Federal Transit Administration[4], TOD has the following benefits:

- increased ridership and associated revenue gains for transit systems
- incorporation of public and private sector engagement and investment
- revitalization of neighborhoods
- a larger supply of affordable housing
- economic returns to surrounding landowners and businesses
- congestion relief and associated environmental benefits
- improved safety for pedestrians and cyclists through non-motorized infrastructure

A TOD that embraces the 5Ds will draw more riders to transit and away from vehicles. TOD and high-quality transit such as BRT or Light Rail Transit (LRT) create a ready-supply of transit riders. Convenient access to transit, combined with walkability and diverse services in the station area, creates travel choices for people of all ages and incomes. In turn, this can benefit the Greater Philadelphia regional transportation system by reducing congestion, pollution and greenhouse gases. Increased ridership contributes to a healthier bottom line for SEPTA as well.

TOD can influence not just the area directly adjacent to transit stations, but also development patterns across entire corridors. Successful corridor-wide TOD programs allow for well-planned, higher density development, to be focused where the transportation infrastructure can best support it. Various studies and reports have referred to multiple TODs along a transit corridor as “pearls on a necklace”. In addition, because TOD can support higher density development patterns, it can reduce the strain and cost of expanding other parts of a region’s infrastructure.

b. Challenges to Implementing TOD in a BRT corridor

One of the key factors that attracts developers to transit corridors is the perception of a long-term governmental investment. For rail corridors, this investment is easy to visualize with tracks, stations, and other permanent features. For arterial BRT corridors, like the Roosevelt Boulevard, even if the cost of the capital investment is similar to rail, there is a perception of impermanence that can affect the ability of an area to attract private investment.

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[3] Arrington, G.B. and Cevero, R., *Effects of TOD on Housing, Parking and Travel,* Transit Cooperative Research Program Report 128, Transportation Research Board of the National Academies, Washington, DC 2008

[4] https://www.transit.dot.gov/tod. Accessed January 2019.

A 2008 study[5] found the following challenges to implementing TOD in a BRT corridor.

- Cooperation among key stakeholders, including public agencies, non-profit development organizations, property owners, and private developers, is critical to success.

- For developers, permanence of the BRT is an important factor. However, this perception can be created even with relatively low infrastructure investment, if there is a clear, long-term public agency commitment.

- Frequency, speed and convenience of the service were important to many developers and property owners. These features differentiated BRT from conventional bus service, which was generally not considered appealing for TOD.

- In downscale corridors, streetscape improvements that accompany the BRT may be at least as important as the transit service for attracting new investment.

- In some cities, developers and properties owners cited the value of a prominent visual profile for the BRT and aesthetically appealing infrastructure.

- It does not appear to be necessary to provide financial incentives for BRT-related TOD. Developers appeared much more interested in an expedited permitting or rezoning process, as time is a critical factor in making development projects financially viable.

As the Program continues the planning process to introduce a new BRT system and WSAs into the corridor's development future. the development potential of the station areas should be evaluated. The real estate dynamics of each station area present unique challenges and opportunities. Ultimately, market fundamentals will govern whether private investment will occur at transit station locations. As a result, supportive real estate market conditions are required for WSAs to thrive. Simply providing high quality transit service, even when it is supported by an appropriate regulatory framework, is not enough. Therefore, as a next step, a more detailed market feasibility study of potential transit station locations is critical.

The market studies would provide the insight required by developers and property owners to determine whether their project is even 'feasible' to continue. Most real estate developers will conduct such a study to determine if the project is worth the time and money to continue.

The recommended market feasibility study would explore each station areas' past demographic, economic, and real estate market trends as well as regional forecasts in order to estimate each station's future market-supportable development. It would also examine current real estate market conditions and assess future market demand for office, housing, local-serving retail, and hotels. The region's economic outlook, competing urban and suburban centers throughout the region would be considered as part of the assessment. A feasibility study would highlight the

[5] Breakthrough Technologies Institute, *Bus Rapid Transit and Transit Oriented Development: Case Studies on Transit Oriented Development Around Bus Rapid Transit Systems in North America and Australia*, Washington, DC, 2008

requirements needed in order to successfully navigate the many issues that arise in both developing on vacant land or redeveloping existing structures at each station area.

A feasibility study may also assess the costs associated with the overall project. In some feasibility studies, there may be a sales forecasts to help clarify the budget and give needed insight into the potential revenue streams as well as the costs associated with construction.

In addition to analyzing market factors, a feasibility study can test scenarios for redevelopment along the proposed BRT that expand on traditional estimates of market support. These market scenarios would move beyond current build-out estimates, rather than relying solely on market trends and the historic nature of development. Such scenarios would consider opportunities to expand development capacity along the proposed BRT corridor to accommodate future demand generated by this major transit infrastructure upgrade.

5. SUPPORT FOR BRT AND TOD ALONG THE BOULEVARD

Long-range plans at the regional, city and neighborhood level all support BRT and TOD along the Boulevard. Specific supporting provisions are summarized below.

a. Delaware Valley Regional Planning Commission (DVRPC)

The *Connections 2045 Plan for Greater Philadelphia,* adopted by the Delaware Valley Regional Planning Commission (DVRPC) in 2017, is a long-range plan to 'achieve a more sustainable and prosperous future for Greater Philadelphia. The Plan includes five core, integrated principles including:

- Sustain the Environment
- Develop Livable Communities
- Expand the Economy
- Advance Equity and Foster Diversity
- Create an Integrated, Multimodal Transportation Network

As presented below, the *2045 Plan* reinforces the concept of TOD along the Boulevard in several ways. For example, it envisions that livable centers:

- Can be created and supported by investing in and redeveloping centers
- Promote affordable housing in appropriate locations

This concept of 'centers,' i.e., places where growth is concentrated, is a cornerstone of the Plan. The density and mix of uses within centers can enhance the feasibility of walking, biking, and public transit as an alternative to the automobile. Two centers are identified along the Boulevard.

- The Boulevard/Grant Avenue/ Woodhaven Road vicinity is categorized as a 'Suburban Town Center.' This category reflects a lack of integrated mixed uses and acknowledges an auto dependent, rather than transit-oriented and pedestrian-scale, character. These centers also typically have more jobs than residents. The *2045 Plan* recommends working to improve the jobs-housing balance in Suburban Centers. This can be done through TOD. This center encompasses multiple potential TOD locations including the Welsh Road, Grant Avenue and Red Lion Road station areas.

- The Boulevard/Cottman Avenue vicinity is identified as a 'Neighborhood Center.' This category refers to recognizable places with a mix of commercial, retail, institutional and residential land uses. These centers have a main street or focal point, are walkable and a unique history or sense of community.

As a strategy to invest in centers, the *2045 Plan* recommends updating local regulatory documents to support transit-oriented economic development, such as mixed-use overlay districts, density bonuses and codes that set separate standards with areas identified for infill and redevelopment.

Affordable housing strategies related to mixed use environments set forth in the *2045 Plan* include:

- Increase and preserve the supply of affordable, accessible housing units in areas served by public transit and close to essential jobs and services.

- Increase employment in places where affordable housing opportunities currently exist.

- Create accessible, pedestrian-friendly neighborhoods where families with children, seniors and the disabled can safely walk, bike or take public transit to jobs and services.

Access to essential services for vulnerable populations is a key goal of the plan. Vulnerable populations include individuals who are low income, senior, or physically or mentally disabled. These persons are more likely than the general population to be transit dependent. Thus, strategies to promote equitable access to transportation for vulnerable persons include encouraging TOD that includes affordable housing and essential services.

Furthermore, the *2045 Plan* identifies a transit line along the Boulevard between Lower Bucks County and the Frankford Transportation Center as well as between the Frankford Transportation Center and Broad Streets as a new regional transit system expansion project.

b. City of Philadelphia

The City of Philadelphia has adopted multiple plans in recent years which support the concept of TOD including:

- *Philadelphia 2035 Citywide Vision* (2011)
- Connect: Philadelphia's Strategic Transportation Plan (2018)
- Housing for Equity: An Action Plan for Philadelphia (Draft 2018)

Key provisions of each are presented below.

Philadelphia 2035 Citywide Vision

Two key elements of the *2035 Citywide Vision* support BRT and TOD along Roosevelt Boulevard, including:

- Advance rapid transit along Roosevelt Boulevard although the Vision does not specify a particular transit technology.

- Encourage the growth and development of both existing and emerging 'Regional Centers.' It identifies the Far Northeast District, which encompasses the Welsh Road, Grant Avenue and Red Lion Road station areas, as a Regional Center.

In addition, several individual District Plans for planning areas along the Boulevard have been prepared as a second phase of the Citywide Vision. Whereas 2035 Vision Plan documents the comprehensive vision of citywide initiatives and strategies, the District Plans outline specific land use and capital investment recommendations. Supporting elements of the District Plans are also highlighted below.

CONNECT: Philadelphia's Strategic Transportation Plan

CONNECT is the City's strategic transportation plan for the next seven years (2019 – 2025). The Plan focuses on investing in transportation infrastructure and access to ensure that all people can affordably connect to opportunities, including education and employment, and have the ability to fully participate in their communities and the economy. This is reinforced by one of the Plan's five goals: 'Transit First – Moving people equitably, affordably, and reliably around a growing city.'

The *Connect Plan* highlights that Philadelphians are highly reliant on public transit. Forty percent of residents get to work without a car, most of whom use transit. One third of total residents, and one half of residents in poverty, do not have a car. These residents depend on transit. It further notes that improving and expanding frequent, reliable transit service is key to connecting communities in need with jobs, education and other activities. It is also key making transit the most convenient option for people from all backgrounds and for all trip purposes.

Towards these ends, the *Connect Plan* recommends the City partner with PennDOT and SEPTA to implement dedicated bus facilities (e.g., Business Access and Transit Lanes) along Roosevelt Boulevard by 2020. The lanes are a step towards a full BRT.

Housing for Equity: An Action Plan for Philadelphia

The *Action Plan* outlines a number of strategies to promote housing that addresses the needs of residents at all income levels. Two of the key themes related to TOD and the CIG program's affordable housing provisions include:

- Preserving and protecting long-term affordability
- Encouraging equitable growth without displacement

Three key strategies are identified in the *Action Plan* to harness the City's growth to benefit all residents including the following.

- Zone for greater density in neighborhoods with strong market and for TOD near transit access points. For example, the TOD section of the zoning code offers increased height, density and reduced parking to incentivize this type of development. The City will continue to promote the remapping of TOD districts.

- Explore ways to capture the value created by up-zoning or increases in allowable density to fund citywide housing programs.

- Continue to preserve long-term affordability in strengthening markets by continuing the collaboration between the City and the Philadelphia Housing Authority (PHA) with the goal of preserving and/or redeveloping units on a one-for-one basis.

District Plans

Several District Plans include recommendations which support the BRT and TOD along the Boulevard. Key elements are summarized below. The location of each district is shown on **Figure 1.**

Lower Northeast District Plan (2012)

The 2035 Citywide Vision Plan recommends the creation of a 'neighborhood center' surrounding the Frankford Transportation Center (FTC). To attain such, the District Plan recommends multiple actions. One key action is to strengthen the commercial node on Frankford Avenue by changing the existing assorted land uses to CMX-3 Community/Commercial Mixed-Use zoning to spur growth and development. This zoning district reflects the density and mix of uses typically associated with TOD. In addition, the FTC would serve as termini of both the BRT 'A' and 'B' routes.

Central Northeast District Plan (2014)

The Plan identifies the Cottman and Boulevard Regional Center as a focus area. The Plan's aim is to transform a shopping area into a vibrant town center, supporting the 2035 Citywide Vision. The regional center is bound on one edge by Cottman Avenue and by Roosevelt Boulevard on another. Key recommendations include rezoning for commercial mixed-use and creating a mixed use regional center. The Plan also calls for an attractive and convenient station at this location as part of plans for faster and more frequent transit service along the Boulevard.

North Delaware District Plan (2016)

The Plan supports advancing the recommendations previously proposed for enhanced bus service along Roosevelt Boulevard as well as those from the upcoming Roosevelt Boulevard Multimodal (i.e., Route for Change) Program.

Upper North District Plan (2016)

One of the largest concentrations of vacant land in the City is the 48 acre Logan Redevelopment Area (i.e., Logan Triangle) at the Boulevard and 9th Street. Ninth Street is the location of a proposed BRT station and TOD. The promotion of a mix of uses and a high quality design for the Logan Triangle is a priority recommendation in the Plan.

The Plan notes that redevelopment of Logan Triangle presents a critical opportunity to incorporate Complete Streets standards and multi-modal design. The Logan neighborhood to the north and west has a dense, walkable development pattern. The Triangle's redevelopment should extend this walkability to give residents unimpeded access to commercial services, employment and transit at the Triangle, in addition to recreation at Hunting Park to the south.

The Plan also recommends accommodating all transportation modes in the redevelopment of the Triangle. This includes:

- developing a circulation hierarchy within the site that ensures safe and pleasant access for pedestrians and cyclists

- creating pedestrian connections across Roosevelt Boulevard to improve access and safety
- integrating the proposed future BRT

North District Plan (2017)

The Plan recommends increasing the allowable housing density with base zoning and a TOD overlay near major transit stations. This includes the area surrounding the intersection of Broad Street and Roosevelt Boulevard. This intersection is served by SEPTA's Broad Street Line (BSL) subway station and would be a BRT station at street level.

Zoning recommendations in the Plan include Community Commercial Mixed-Use (CMX-3) to promote development and density in the surrounding area. This zoning district exhibits many traits similar to successful TODs.

In order to preserve existing single-family housing stock, portions of this area are also recommended for rezoning as Residential Single-family Attached (RSA-5). With a minimum lot size of 1440 square feet, this district provides a transit-supportive maximum density of 30 dwelling units (i.e., rowhouses) per acre.

Far Northeast District Plan (2017)

The Far Northeast Districts (i.e., Upper and Lower) already serve as an economic engine for the city and region providing over 50,000 jobs. A significant portion of these jobs are generated by the auto-oriented shopping centers along Roosevelt Boulevard. This 1.2 mile stretch on the east side of the Boulevard extends between south of Welsh Road to Blue Grass road and includes a number of shopping centers. The segment of the Boulevard would include three BRT stations and associated TODs at Welsh Road, Grant Avenue and Red Lion Road. The Plan recommends implementing interventions, including a potential street grid to improve traffic circulation and wayfinding at the Northeast Village Shopping Center at Welsh Road and the Boulevard.

The Plan encourages transit-supportive development through zoning and capital investments to allow transit areas, such as the Boulevard Direct bus stations, to become vibrant neighborhood modes. The Boulevard Direct stations are likely locations for future BRT stations. The proposed zoning includes designating the northeast quadrant of Welsh Road and the Boulevard as Community Commercial Mixed-Use (CMX 3,4). This zoning district exhibits many traits similar to successful TODs.

Transit Oriented Development Overlay District

In 2018, the City adopted a zoning code amendment to incentivize development of TOD along the Market Frankford Line in North Philadelphia. Section 14- 513 of the Philadelphia City Code establishes a Transit-Oriented Development (TOD) Overlay District. The district is intended to encourage compact urban growth patterns, opportunities for increased transportation mode choice, reduced reliance on the automobile, and a safe and pleasant pedestrian environment. The regulations help ensure an attractive streetscape, a functional mix of complementary uses and provision of amenities that support the use of transit, bicycles, and pedestrian facilities. The district standards apply to new construction and expansions of more than 30 percent of gross floor area on lots located within TOD districts designated in the code.

Currently, the code authorizes four TOD Transit Stations along the Market-Frankford Line (MFL) including:

- 46th Street Station
- Erie-Torresdale Station
- Allegheny Station
- Spring Garden Station

The code simplifies defines a uniform radius for TODs relative to stations (i.e., 500 feet from entrances) and allows new TOD areas to be added to the code.

- Increases development potential in TOD areas
  - For properties in residential and commercial zoning districts with a base height limit of 38 feet, the limit is increased to 45 feet
  - For properties in CMX-3, CMX-4, CMX-5, or RMX-3 zones, maximum base FAR is increased by 30 percent
  - For any lot within a CMX-1, CMX-2, CMX-2.5, or RM-1 district, the maximum number of dwelling units permitted is increased by 50 percent

- Encourages better pedestrian environments
  - Requires active ground floor uses, where permitted within a base district
  - Prohibits auto-serving uses, including drive-throughs and non-accessory surface parking
  - Limits the permitted locations of accessory parking lots and the number of permitted curb-cuts
  - Requires building to the streetline

- Provides greater incentives for public benefits
  - CMX-3 properties are newly eligible for FAR bonuses for transit-improvements, public space, and underground parking within the TOD
  - Mixed-Income housing bonus increased to 200 percent for CMX-3 properties

- Reduces parking requirements
  - For lots within a CMX-4, CMX-5, RMX-3, or RM-4 districts, auto parking minimums are reduced by five spaces or by 50 percent, whichever reduction is greater.
  - For lots within any other base zoning district, auto parking minimums are reduced by five spaces
  - Accessory parking may not exceed the normal parking minimum by more than 50 percent

6. TOD Types

TOD is not ‘one size fits all.’ Each station area is shaped by a mix of site-specific, local and regional factors. Development around each stop or station faces unique challenges and requires specially tailored strategies to be successful. Successful TOD projects reflect these conditions and market realities.

However, there are several similar traits and functions of TODs that can be categorized in a typology. This typology helps provide TOD stakeholders – including the public, City agencies and elected officials, community groups, developers, SEPTA and others – with a common understanding of potential future development along key stations on the Boulevard. Typologies help clarify what to expect in terms of the:

- Character of the station area
- Land uses/activities
- Transit mode
- Peak frequency of transit
- Daily average and peak transit ridership
- Land use mix and density
- Street arrangement
- Retail and employment characteristics

To understand TOD opportunities at each station along the Boulevard, a typology of four station categories was created for Roosevelt Boulevard. The typologies include recommendations for:

- Land use mix
- Density and massing
- Building placement and location
- Urban design

The TOD typology for Roosevelt Boulevard includes:

- Mixed Use Center – Balanced Ratio of Residents and Jobs
- Residential Centers - High Ratio of Residents to Jobs
    - Urban Neighborhood
    - Transit Neighborhood

The land use and design considerations for each typology are further explained below. Potential station locations are also identified for each typology. Two or more typologies may be appropriate at some stations to allow better transitions to adjacent land uses or to better support infill and redevelopment visions within the District Plans.

For stations in the City of Philadelphia, potential base zoning districts (reflecting the District Plans recommendations) are identified. The TOD Overlay District discussed above could be applied to the recommended station locations to ensure that automobile oriented uses are precluded. Further evaluation with the Philadelphia City Planning Commission (PCPC) is recommended to also ensure that the development encouraged in the TODs does not limit the desired growth in other nearby commercial centers and corridors. **Figures 2 and 3** illustrate the potential areas for TOD and adjacent commercials corridors/centers.

In addition, the typologies identify the existing zoning classifications for potential TOD locations in Bensalem Township.

Figure 2 - BRT Route ‘A’ Commercial Corridors and TOD Locations

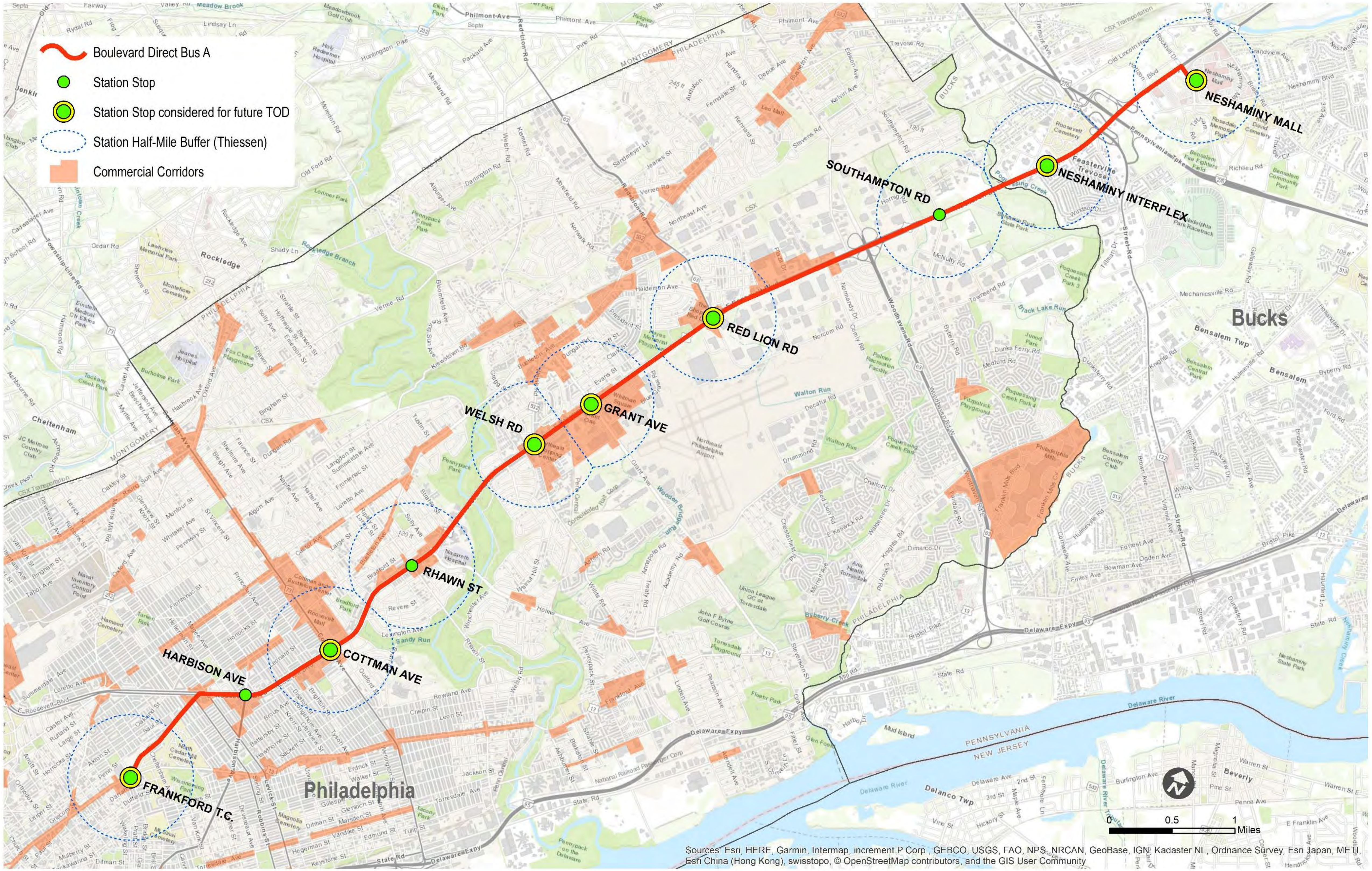
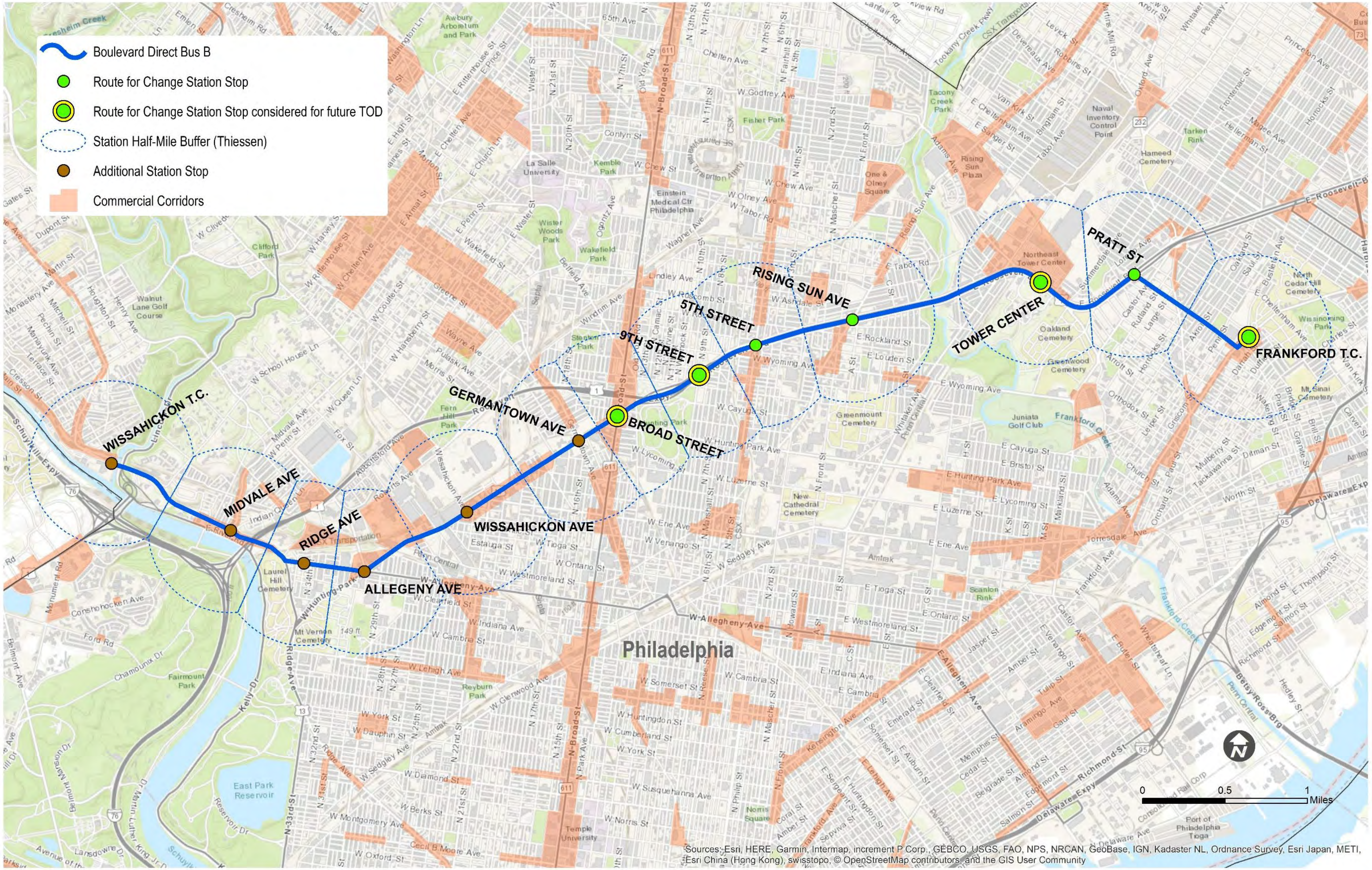


Figure 3 - BRT Route ‘B’ Commercial Corridors and TOD Locations



Mixed Use Center

Potential Stations: 9th Street, Cottman Avenue, Tower Boulevard, Welsh Road, Grant Avenue, Red Lion Road, Neshaminy Interplex, and Neshaminy Mall

Recommended Base Zoning District: City of Philadelphia CMX-3, RMX-3
Existing Zoning District: Bensalem Township GC, H-C1, PCP

Land Uses	Design Considerations
• Regional scale retail • Office buildings • Hotels • Multiple family dwellings • Public buildings • Vertical mixed-use buildings • Research and development • Civic building and community facilities including government offices, public safety buildings, colleges, primary and secondary schools. • Commercial/Mixed	• Highly connected street pattern • Formal streetscape landscaping of similar types of trees at a pedestrian scale • Pedestrian-scale street lighting • 70 percent or more of street frontages should consist of doors and windows • Varied sidewalk materials including brick, concrete, granite, slate, etc. to provide a visually interesting walkway. • Sidewalks to be constructed on every street. • Very high percentage of first floor uses should be shops and storefronts • Structured parking is encouraged with entrances not on the main streets • Where structured parking is not feasible, parking should be located away from the main streets and behind buildings • Street design should accommodate transit by using non-conductive piping, centrally locating utilities in the sidewalk • Underground utilities

Examples

Neighborhood Center

Potential Stations: 9th Street, Cottman Avenue, Neshaminy Mall

Base Zoning Districts: City of Philadelphia'CMX-1, 2, 2.5
Existing Zoning District: Bensalem Township H-C1

Land Uses	Design Considerations
• Single family attached/ high density single family detached (Traditional neighborhood designs) • Office • Light manufacturing • Mixed-use developments including big box retail/office/residential uses • Neighborhood-level retail and convenience uses within pedestrian walksheds. • Civic building and community facilities including government offices, public safety buildings, colleges, primary and secondary schools.	• Multistory (2+) Buildings built with no or shallow setbacks from street • Highly connected street pattern. • Formal streetscape landscaping of similar types of trees at a pedestrian scale in commercial and high density residential areas • Pedestrian-scale street lighting • 70 percent or more of street frontages should be windows and doors in commercial districts • Varied sidewalk materials including brick, concrete, granite, slate, etc. to provide a visually interesting walkway. Sidewalks to be provided on all streets. • Very high percentage of first floor uses should be shops and storefronts • Parking should be located away from the main streets, behind or between buildings and allowed on-street.

Examples

Transit Center

Potential Stations: Broad Street

Base Zoning Districts: City of Philadelphia CMX-3, ICMX-3

Land Uses	Design Considerations
• Single family attached or multifamily • Office • Light manufacturing • Mixed-use developments including retail/office/residential uses • Neighborhood-level retail and convenience uses within pedestrian walksheds. • Civic building and community facilities including government offices, public safety buildings, colleges, primary and secondary schools.	• Multistory (2+) Buildings built with no or shallow setbacks from street • Highly connected street pattern • Formal streetscape landscaping of similar types of trees at a pedestrian scale in commercial and high density residential areas • Pedestrian-scale street lighting • 70 percent or more of street frontages should be windows and doors in commercial districts • Varied sidewalk materials including brick, concrete, granite, slate, etc. to provide a visually interesting walkway. Sidewalks to be provided on all streets • Very high percentage of first floor uses should be shops and storefronts • Parking should be located away from the main streets, behind or between buildings and allowed on-street.

Examples

7. FEDERAL TRANSIT ADMINISTRATION CAPITAL IMPROVEMENTS GRANT ANALYSIS

a. Introduction

The FTA CIG program can be used to support BRT investments such as those envisioned in the Program. These funds are commonly known as New Starts and Small Starts funding. The CIG program is a discretionary grant program, that historically has had significantly more funding requests than available funding. To create a level playing field for all projects seeking CIG funds, the FTA has developed a series of criteria to measure the effectiveness of each project. As part of this evaluation, applicants are required to document existing land use and economic development conditions and the project's effects on both.

The land use measure includes an examination of existing:

- corridor and station area development
- corridor and station area development character
- station area pedestrian facilities, including access for persons with disabilities and
- corridor and station area parking supply

FTA also considers a comparison of the proportion of existing "legally binding affordability restricted" housing within one-half mile of station areas to the proportion of "legally binding affordability restricted" housing in the counties through which the project travels.[6]

A preliminary analysis was performed for the BRT 'A' and 'B' corridors to assess how the projects would perform based on the CIG land use criteria. The results are discussed below.

Note the analysis excludes an analysis of the Central Business District supply and cost of parking and commercial floor area ratios which will be required to support an application.

b. Population, Employment and Dwelling Units

The FTA's Quantitative Element Rating Guide[7] (referred to hereafter as the FTA Rating Guide) sets forth the ratings and thresholds for employees served by a BRT route and the average

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[6] A legally binding affordability restriction is a lien, deed of trust or other legal instrument attached to a property and/or housing structure that restricts the cost of housing units to be affordable to households at specified income levels for a defined period of time and requires that households at these income levels occupy these units. This definition, includes, but is not limited to, state or federally supported public housing, and housing owned by organizations dedicated to providing affordable housing. For the land use measure looking at existing affordable housing, FTA is seeking legally binding affordability restricted units to renters with incomes below 60 percent of the area median income and/or owners with incomes below the area median that are within ½ mile of station areas and in the counties through which the project travels.

[7] Federal Transit Administration, *Guidelines for Land Use and Economic Development Effects for New Starts and Small Starts Projects,* 2013.

population density (persons per square mile) within a half mile of the stations. The ratings and thresholds are presented in **Table 1.**

Table 1 – FTA Employment, Population and Dwelling Rating Thresholds

Rating	Employees Served by System	Average Population Density (persons per square mile)	Residential Dwelling Units per Acre
High	> 220,000	> 15,000	> 25
Medium-High	140,000 – 219,999	9,600 – 15,000	15 – 25
Medium	70,000 – 139,999	5,760 – 9,599	10 – 15
Low-Medium	40,000 – 69,999	2,561 – 5,759	5 – 10
Low	< 40,000	< 2,560	< 5

The existing conditions and 2035 forecast conditions for the corridors and stations using these three criteria were assessed for the BRT Routes A and B.[8] A half mile distance from the BRT routes was used to determine the number of employees served by the system. Population and residential dwelling unit densities are based on a half-mile radius from the proposed stations.

Key findings comparing 2035 forecast conditions to the FTA thresholds are summarized in **Table 2**. Existing conditions and 2035 forecast conditions by stations and corridor for BRT Route A are presented in **Table 3** and for BRT Route B in **Table 4**.

Table 2 – FTA Employment, Population and Dwelling Rating Thresholds

Corridor	Employees Served by System	Average Population Density (persons per square mile)	Residential Dwelling Units per Acre
BRT Route A	Low	Medium-High	Low-Medium
BRT Route B	Low	Medium-High	Low-Medium

The Average Population Density and Residential Dwelling Unit per Acre ratings for each route can be enhanced by encouraging TOD with higher densities than currently planned at the 10 stations with redevelopment potential. However, this is a policy decision which should be made with substantial public and property owner input to the planning process.

Improving the employment rating is likely to be challenging. For example, attaining a medium-high rating would require approximately 23,000,000 square feet of additional commercial development on each route.[9] This is a significant increase above the existing supply, especially compared with other employment centers such as the downtown Philadelphia office market.

[8] DVRPC Demographic and Employment Forecast Zonal Data - 2010 to 2040

[9] Assuming approximately 200 square feet per employee.

Table 3 – BRT Route ‘A’ Employment, Population Density and Housing Density

STATION STOP	2015			2035		
	Employment Served by System	Average Population Density (persons per sq.mi.)	Residential DU (HH) per acre	Employment Served by System	Average Population Density (persons per sq.mi.)	Residential DU (HH) per Acre
FRANKFORD T.C.*	2,003	20,873	12	2,182	21,749	12
HARBISON AVE	2,089	22,312	12	2,152	23,095	12
COTTMAN AVE*	2,076	15,675	9	2,148	16,206	9
RHAWN ST	3,645	10,637	7	3,786	11,032	7
WELSH RD*	1,865	11,056	9	1,948	11,524	9
GRANT AVE*	2,964	5,083	4	3,095	5,280	4
RED LION RD*	2,917	5,094	3	3,047	5,284	3
SOUTHAMPTON RD	2,226	477	0	2,327	494	0
NESHAMINY INTERPLEX*	3,131	2,396	1	3,337	2,558	1
NESHAMINY MALL*	1,590	1,483	1	1,699	1,585	1
ROOSEVELT BLVD BRT Route A	**24,506**	**9,443**	**6**	**25,721**	**9,813**	**6**

*Potential Route for Change TOD Locations

Table 4 – BRT Route 'B' Employment, Population Density and Housing Density

STATION STOP	2015			2035		
	Employment Served by System	Average Population Density (persons per sq.mi.)	Residential DU (HH) per acre	Employment Served by System	Average Population Density (persons per sq.mi.)	Residential DU (HH) per acre
WISSAHICKON T.C.	3,041	6,624	5	3,182	6,876	5
MIDVALE AVE	667	6,598	5	695	6,855	5
RIDGE AVE	1,170	7,225	5	1,241	7,556	5
ALLEGENY AVE	1,348	9,534	6	1,431	9,990	6
WISSAHICKON AVE	1,505	8,842	5	1,596	9,263	5
GERMANTOWN AVE	1,425	15,213	10	1,510	15,939	10
BROAD STREET*	765	12,564	7	806	13,116	7
9TH STREET*	989	23,409	12	1,033	24,382	12
5TH STREET	1,354	21,582	11	1,410	22,435	11
RISING SUN AVE	2,147	23,005	11	2,236	23,971	11
TOWER CENTER/FRIENDS HOSP.*	3,332	6,001	3	3,450	6,264	3
PRATT ST	1,431	20,490	11	1,482	21,385	11
FRANKFORD T.C.*	2,003	20,981	12	2,074	21,860	12
ROOSEVELT BLVD BRT Route B	**21,177**	**13,908**	**8**	**22,144**	**14,504**	**8**

*Potential Route for Change TOD Locations

Detailed analyses by station of the existing and 2035 forecast conditions using FTA templates are provided in Appendix A. Additional documentation regarding transit supportive land use and affordable housing policies and programs that is required as part of the FTA CIG application is also outlined in Appendix B.

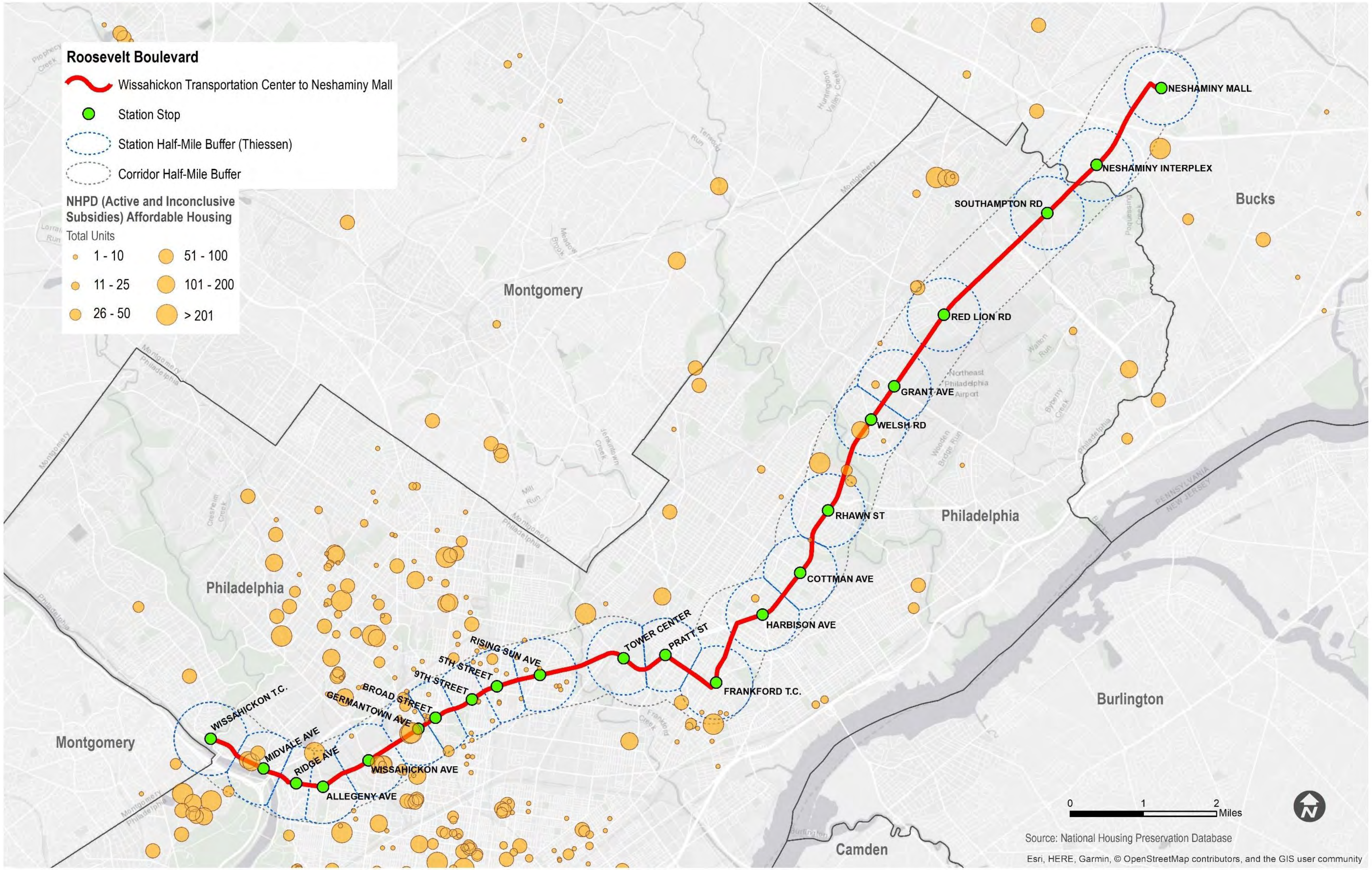
c. Affordable Housing

FTA evaluates affordable housing in the land use criterion to ensure that neighborhoods surrounding proposed transit stations have tools in place to ensure that as service is improved over time there is a mix of housing options for existing and future residents. One measure of the readiness of a community to accept a new transit investment and avoid significant gentrification that can occur over time is the presence of “legally binding affordability restricted” units. These units have protections in place to ensure that they will continue to be available to low- and moderate-income households as changes in the corridor occur.

Data obtained from the National Housing Preservation Database (NHPD) was used to screen the supply of “legally binding affordability restricted” housing. The data in the NHPD come from the US Department of Housing and Urban Development (HUD) and the US Department of Agriculture (USDA), and include ten federally subsidized programs. The database does not include data from any State of Pennsylvania or City of Philadelphia subsidized programs. **Figure 4** shows the location of the supply of affordable housing compared to the half-mile radius from each station.

A cursory, visual analysis indicates that station areas (half-mile radius) along both BRT corridors have a relatively low supply of legally binding affordable housing compared to other neighborhoods in Northeast Philadelphia and lower Bucks County. Increasing the supply of restricted affordable housing in the station areas would enhance both BRT routes in terms of the FTA CIG land use criteria. It would also meet DVRPC’s Connection 2045 aspirations for linking transit and affordable housing for vulnerable populations.

Figure 4 – Affordable Housing Units



APPENDIX A – STATION AREA LAND USE AND EMPLOYMENT ANALYSIS

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA)

PROJECT NAME: ROOSEVELT BLVD DIRECT BUS A, Philadelphia

Population, Employment and Housing – Metropolitan Area, CBD, and Corridor

Geographic Area Item	Current Year (2015)	Horizon (20 Years)	Growth (%)
Metropolitan Area			
Total Population	5,680,904	6,197,543	9.1%
Total Employment	2,976,909	3,239,069	8.8%
Central Business District [see footnote 1]			
Total Employment	277,201	291,058	5.0%
Employment – Percent of Metropolitan Area	9.3%	9.0%	
CBD Land Area (sq. mi.)	6.4	6.4	
Employment Density (e.g., jobs per sq. mi.)	43,043.6	45,195.3	
Corridor			
Total Population	95,984	99,819	4.0%
Total Employment	36,440	38,101	4.6%
Population – Percent of Metropolitan Area	2%	2%	
Employment – Percent of Metropolitan Area	1%	1%	
Corridor Land Area (sq. mi.)	11.30	11.3	
Population Density (persons per sq. mi.)	8,494.2	8,833.5	
Employment Density (jobs per sq. mi.)	3,224.8	3,371.8	
Total - All Counties in which Project Stations are Located			
Housing Units - All Types	885,906		
Housing Units - Legally Binding Affordability Restricted	40,864		
Number of Counties	2		
Total - All Station Areas (1/2-mile radius) [See footnote 2]			
Housing Units - All Types	27,378		
Housing Units - Legally Binding Affordability Restricted	227		
Population	70,474	73,235	3.9%
Employment at New Project Stations	24,609	25,721	4.5%
Employment at Existing Stations Along the Line [see footnote 3]			
Land Area (square miles)	7.47	7.5	
Housing Unit Density (units per sq. mi.) - All Types	3,665.1		
Population Density (persons per sq. mi.)	9,434.3	9,803.9	
Employment Density (persons per sq. mi.)	3,294.4	3,443.2	
Station-Area Share of Legally Binding Affordability Restricted Housing Units	1%		

Share of Housing Units that are Legally Binding Affordability Restricted in the Corridor compared to Share in the Counties	
Proportion in All Station Areas	1%
Proportion in All Counties in which Project Stations are Located	5%
Ratio, Proportion in All Station Areas to Proportion in All Counties in which Project Stations are Located	0.18

Housing Totals for Each County in which Project Stations are Located

	Current Year	
County 1 — **County Name:**	PHILADELPHIA	
Housing Units - All Types [See footnote 4]	628,477	
Housing Units - Legally Binding Affordability Restricted	37,739	
County 2 — **County Name:**	BUCKS	
Housing Units - All Types	257,429	
Housing Units - Legally Binding Affordability Restricted	3,125	
County 3 — **County Name:**		
Housing Units - All Types		
Housing Units - Legally Binding Affordability Restricted		
County 4 — **County Name:**		
Housing Units - All Types		
Housing Units - Legally Binding Affordability Restricted		

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 2

Housing, Population and Employment for Each Station Area That is Part of the Proposed Project

	Current Year	Horizon	Growth (%)
Station Area 1 [See footnote 5] — Station Name:	**FRANKFORD TRANSIT CENTER**		
Housing Units - All Types	5,913		
Population	16,490	17,182	4.2%
Employment	2,106	2,182	3.6%
Land Area (square miles)	0.79	0.8	
Housing Unit Density (units per sq. mi.) - All Types	7,485		
Population Density (persons per sq. mi.)	20,873	21,749	
Employment Density (persons per sq. mi.)	2,666	2,762	
Station Area 2 — Station Name:	**HARBISON AVE**		
Housing Units - All Types	5,805		
Population	16,380	16,954	3.5%
Employment	2,089	2,152	3.0%
Land Area (square miles)	0.73	0.7	
Housing Unit Density (units per sq. mi.) - All Types	7,952		
Population Density (persons per sq. mi.)	22,438	23,225	
Employment Density (persons per sq. mi.)	2,862	2,948	
Station Area 3 — Station Name:	**COTTMAN AVE**		
Housing Units - All Types	4,209		
Population	11,380	11,765	3.4%
Employment	2,076	2,148	3.5%
Land Area (square miles)	0.73	0.7	
Housing Unit Density (units per sq. mi.) - All Types	5,766		
Population Density (persons per sq. mi.)	15,589	16,116	
Employment Density (persons per sq. mi.)	2,844	2,942	
Station Area 4 — Station Name:	**RHAWN ST**		
Housing Units - All Types	3,454		
Population	8,266	8,573	3.7%
Employment	3,645	3,786	3.9%
Land Area (square miles)	0.78	0.8	
Housing Unit Density (units per sq. mi.) - All Types	4,428		
Population Density (persons per sq. mi.)	10,597	10,991	
Employment Density (persons per sq. mi.)	4,673	4,854	
Station Area 5 — Station Name:	**WELSH RD**		
Housing Units - All Types	3,661		
Population	7,231	7,537	4.2%
Employment	1,865	1,948	4.5%
Land Area (square miles)	0.65	0.7	
Housing Unit Density (units per sq. mi.) - All Types	5,632		
Population Density (persons per sq. mi.)	11,125	11,595	
Employment Density (persons per sq. mi.)	2,869	2,997	
Station Area 6 — Station Name:	**GRANT AVE**		
Housing Units - All Types	1,555		
Population	3,325	3,453	3.8%
Employment	2,964	3,095	4.4%
Land Area (square miles)	0.65	0.7	
Housing Unit Density (units per sq. mi.) - All Types	2,392		
Population Density (persons per sq. mi.)	5,115	5,312	
Employment Density (persons per sq. mi.)	4,560	4,762	
Station Area 7 — Station Name:	**RED LION RD**		
Housing Units - All Types	1,564		
Population	4,000	4,150	3.8%
Employment	2,917	3,047	4.5%
Land Area (square miles)	0.79	0.8	
Housing Unit Density (units per sq. mi.) - All Types	1,980		
Population Density (persons per sq. mi.)	5,063	5,253	
Employment Density (persons per sq. mi.)	3,692	3,857	

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 3	Current Year	Horizon	Growth (%)
Station Area 8 — **Station Name:**	**SOUTHAMPTON RD**		
Housing Units - All Types	55		
Population	371	385	3.8%
Employment	2,226	2,327	4.5%
Land Area (square miles)	0.78	0.8	
Housing Unit Density (units per sq. mi.) - All Types	71		
Population Density (persons per sq. mi.)	476	494	
Employment Density (persons per sq. mi.)	2,854	2,983	
Station Area 9 — **Station Name:**	**NESHAMINY INTERPLEX**		
Housing Units - All Types	718		
Population	1,866	1,992	6.8%
Employment	3,131	3,337	6.6%
Land Area (square miles)	0.78	0.8	
Housing Unit Density (units per sq. mi.) - All Types	921		
Population Density (persons per sq. mi.)	2,392	2,554	
Employment Density (persons per sq. mi.)	4,014	4,278	
Station Area 10 — **Station Name:**	**NESHAMINY MALL**		
Housing Units - All Types	444		
Population	1,165	1,244	6.8%
Employment	1,590	1,699	6.9%
Land Area (square miles)	0.8	0.8	
Housing Unit Density (units per sq. mi.) - All Types	562		
Population Density (persons per sq. mi.)	1,475	1,575	
Employment Density (persons per sq. mi.)	2,013	2,151	
Station Area 11 — **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 12 — **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 13 — **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 14 — **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 4			
	Current Year	Horizon	Growth (%)
Station Area 15 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 16 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 17 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 18 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 19 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	

[1] Optionally, employment for the largest activity center(s) served by the project may be reported.
[2] See Appendix A of the Reporting Instructions for a sample methodology for estimating station area population, households, and employment.
[3] This information should be entered only for projects that are extensions to existing lines. Provide the total employment served within a 1/2-mile radius of the existing stations along the entire line on which a no-transfer ride from the proposed project's stations can be reached. Do not include employment within a ½-mile radius of the new stations.
[4] Countywide housing unit totals are available from the U.S. Census Bureau's American Community Survey website
[5] Reporting of data by individual station area is required.

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA)

PROJECT NAME: ROOSEVELT BLVD DIRECT BUS B, Philadelphia

Population, Employment and Housing – Metropolitan Area, CBD, and Corridor			
Geographic Area Item	**Current Year (2015)**	**Horizon (20 Years)**	**Growth (%)**
Metropolitan Area			
Total Population	5,680,904	6,197,543	9.1%
Total Employment	2,976,909	3,239,069	8.8%
Central Business District [see footnote 1]			
Total Employment	277,201	291,058	5.0%
Employment – Percent of Metropolitan Area	9.3%	9.0%	
CBD Land Area (sq. mi.)	6.4	6.4	
Employment Density (e.g., jobs per sq. mi.)	43,043.6	45,195.3	
Corridor			
Total Population	118,933	124,092	4.3%
Total Employment	23,938	25,018	4.5%
Population – Percent of Metropolitan Area	2%	2%	
Employment – Percent of Metropolitan Area	1%	1%	
Corridor Land Area (sq. mi.)	8.55	8.6	
Population Density (persons per sq. mi.)	13,910.3	14,513.7	
Employment Density (jobs per sq. mi.)	2,799.8	2,926.1	
Total - All Counties in which Project Stations are Located			
Housing Units - All Types	628,477		
Housing Units - Legally Binding Affordability Restricted	37,739		
Number of Counties	1		
Total - All Station Areas (1/2-mile radius) [See footnote 2]			
Housing Units - All Types	37,721		
Housing Units - Legally Binding Affordability Restricted	1,725		
Population	103,767	108,214	4.3%
Employment at New Project Stations	21,177	22,146	4.6%
Employment at Existing Stations Along the Line [see footnote 3]			
Land Area (square miles)	7.45	7.5	
Housing Unit Density (units per sq. mi.) - All Types	5,061.1		
Population Density (persons per sq. mi.)	13,922.6	14,519.3	
Employment Density (persons per sq. mi.)	2,841.4	2,971.4	
Station-Area Share of Legally Binding Affordability Restricted Housing Units	5%		

Share of Housing Units that are Legally Binding Affordability Restricted in the Corridor compared to Share in the Counties	
Proportion in All Station Areas	5%
Proportion in All Counties in which Project Stations are Located	6%
Ratio, Proportion in All Station Areas to Proportion in All Counties in which Project Stations are Located	0.76

Housing Totals for Each County in which Project Stations are Located		
	Current Year	
County 1 — **County Name:**	PHILADELPHIA	
Housing Units - All Types [See footnote 4]	628,477	
Housing Units - Legally Binding Affordability Restricted	37,739	
County 2 — **County Name:**		
Housing Units - All Types		
Housing Units - Legally Binding Affordability Restricted		
County 3 — **County Name:**		
Housing Units - All Types		
Housing Units - Legally Binding Affordability Restricted		
County 4 — **County Name:**		
Housing Units - All Types		
Housing Units - Legally Binding Affordability Restricted		

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 2

Housing, Population and Employment for Each Station Area That is Part of the Proposed Project	Current Year	Horizon	Growth (%)
Station Area 1 [See footnote 5] — **Station Name:**	**WISSAHICKON T.C.**		
Housing Units - All Types	2,531		
Population	4,989	5,179	3.8%
Employment	3,041	3,182	4.6%
Land Area (square miles)	0.75	0.8	
Housing Unit Density (units per sq. mi.) - All Types	3,361		
Population Density (persons per sq. mi.)	6,624	6,877	
Employment Density (persons per sq. mi.)	4,038	4,225	
Station Area 2 — **Station Name:**	**MIDVALE AVE**		
Housing Units - All Types	1,781		
Population	3,919	4,072	3.9%
Employment	667	695	4.2%
Land Area (square miles)	0.59	0.6	
Housing Unit Density (units per sq. mi.) - All Types	3,019		
Population Density (persons per sq. mi.)	6,642	6,902	
Employment Density (persons per sq. mi.)	1,131	1,178	
Station Area 3 — **Station Name:**	**RIDGE AVE**		
Housing Units - All Types	1,314		
Population	2,995	3,132	4.6%
Employment	1,170	1,241	6.1%
Land Area (square miles)	0.41	0.4	
Housing Unit Density (units per sq. mi.) - All Types	3,205		
Population Density (persons per sq. mi.)	7,305	7,639	
Employment Density (persons per sq. mi.)	2,854	3,027	
Station Area 4 — **Station Name:**	**ALLEGENY AVE**		
Housing Units - All Types	1,932		
Population	4,832	5,063	4.8%
Employment	1,348	1,431	6.2%
Land Area (square miles)	0.51	0.5	
Housing Unit Density (units per sq. mi.) - All Types	3,788		
Population Density (persons per sq. mi.)	9,475	9,927	
Employment Density (persons per sq. mi.)	2,643	2,806	
Station Area 5 — **Station Name:**	**WISSAHICKON AVE**		
Housing Units - All Types	2,351		
Population	6,005	6,291	4.8%
Employment	1,505	1,596	6.0%
Land Area (square miles)	0.68	0.7	
Housing Unit Density (units per sq. mi.) - All Types	3,457		
Population Density (persons per sq. mi.)	8,831	9,251	
Employment Density (persons per sq. mi.)	2,213	2,347	
Station Area 6 — **Station Name:**	**GERMANTOWN AVE**		
Housing Units - All Types	3,070		
Population	7,462	7,818	4.8%
Employment	1,425	1,510	6.0%
Land Area (square miles)	0.49	0.5	
Housing Unit Density (units per sq. mi.) - All Types	6,265		
Population Density (persons per sq. mi.)	15,229	15,955	
Employment Density (persons per sq. mi.)	2,908	3,082	
Station Area 7 — **Station Name:**	**BROAD STREET**		
Housing Units - All Types	1,894		
Population	5,028	5,248	4.4%
Employment	765	806	5.4%
Land Area (square miles)	0.40	0.4	
Housing Unit Density (units per sq. mi.) - All Types	4,735		
Population Density (persons per sq. mi.)	12,570	13,120	
Employment Density (persons per sq. mi.)	1,913	2,015	

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 3

	Current Year	Horizon	Growth (%)
Station Area 8 **Station Name:**	**9TH STREET**		
Housing Units - All Types	3,511		
Population	10,582	11,021	4.1%
Employment	989	1,033	4.4%
Land Area (square miles)	0.45	0.5	
Housing Unit Density (units per sq. mi.) - All Types	7,802		
Population Density (persons per sq. mi.)	23,516	24,491	
Employment Density (persons per sq. mi.)	2,198	2,296	
Station Area 9 **Station Name:**	**5TH STREET**		
Housing Units - All Types	3,355		
Population	10,199	10,602	4.0%
Employment	1,354	1,410	4.1%
Land Area (square miles)	0.47	0.5	
Housing Unit Density (units per sq. mi.) - All Types	7,138		
Population Density (persons per sq. mi.)	21,700	22,557	
Employment Density (persons per sq. mi.)	2,881	3,000	
Station Area 10 **Station Name:**	**RISING SUN AVE**		
Housing Units - All Types	4,877		
Population	15,553	16,206	4.2%
Employment	2,147	2,236	4.1%
Land Area (square miles)	0.68	0.7	
Housing Unit Density (units per sq. mi.) - All Types	7,172		
Population Density (persons per sq. mi.)	22,872	23,832	
Employment Density (persons per sq. mi.)	3,157	3,288	
Station Area 11 **Station Name:**	**TOWER CENTER**		
Housing Units - All Types	1,307		
Population	3,972	4,146	4.4%
Employment	3,332	3,450	3.5%
Land Area (square miles)	0.66	0.7	
Housing Unit Density (units per sq. mi.) - All Types	1,980		
Population Density (persons per sq. mi.)	6,018	6,282	
Employment Density (persons per sq. mi.)	5,048	5,227	
Station Area 12 **Station Name:**	**PRATT ST**		
Housing Units - All Types	4,198		
Population	12,669	13,222	4.4%
Employment	1,431	1,482	3.6%
Land Area (square miles)	0.62	0.6	
Housing Unit Density (units per sq. mi.) - All Types	6,771		
Population Density (persons per sq. mi.)	20,434	21,326	
Employment Density (persons per sq. mi.)	2,308	2,390	
Station Area 13 **Station Name:**	**FRANKFORD TRANSIT CENTER**		
Housing Units - All Types	5,600		
Population	15,562	16,214	4.2%
Employment	2,003	2,074	3.5%
Land Area (square miles)	0.74	0.7	
Housing Unit Density (units per sq. mi.) - All Types	7,568		
Population Density (persons per sq. mi.)	21,030	21,911	
Employment Density (persons per sq. mi.)	2,707	2,803	
Station Area 14 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	

NEW STARTS LAND USE TEMPLATE (QUANTITATIVE DATA) page 4	Current Year	Horizon	Growth (%)
Station Area 15 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 16 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 17 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 18 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	
Station Area 19 **Station Name:**			
Housing Units - All Types			
Population			0.0%
Employment			0.0%
Land Area (square miles)		0.0	
Housing Unit Density (units per sq. mi.) - All Types	0		
Population Density (persons per sq. mi.)	0	0	
Employment Density (persons per sq. mi.)	0	0	

[1] Optionally, employment for the largest activity center(s) served by the project may be reported.
[2] See Appendix A of the Reporting Instructions for a sample methodology for estimating station area population, households, and employment.
[3] This information should be entered only for projects that are extensions to existing lines. Provide the total employment served within a 1/2-mile radius of the existing stations along the entire line on which a no-transfer ride from the proposed project's stations can be reached. Do not include employment within a ½-mile radius of the new stations.
[4] Countywide housing unit totals are available from the U.S. Census Bureau's American Community Survey website
[5] Reporting of data by individual station area is required.

APPENDIX B – FTA ADDITIONAL LAND USE INFORMATION

FTA requests that project sponsors submit the following information:

Existing Land Use	
Information Requested	Documentation
Existing corridor and station area development (population, employment, high trip generators)	• Corridor and station area population, housing units, and employment+ • Listing and description of high trip generators (examples include colleges/universities, stadiums/arenas, hospitals/medical centers, shopping centers, performing arts centers, and other significant trip generators)*
Existing station area development character	• Description of character of existing land use mix and pedestrian environment in corridor and station areas* • Station area maps with uses and building footprints shown* • Ground-level or aerial photographs of station areas*
Existing station area pedestrian facilities, including access for persons with disabilities	• Station area maps identifying pedestrian facilities and access provisions for persons with disabilities* • Documentation of achievement of curb ramp transition plans and milestones required under CFR 35.150(d)(2)*
Existing corridor and station area parking supply	• Existing parking spaces per square footage of commercial development and/or per dwelling unit* • Parking spaces per employee in the CBD and/or other major employment centers* • Land area within ½ mile of station devoted to parking* • Average daily parking cost in the CBD and/or other areas*
Existing affordable housing	• Total number of legally binding affordability restricted housing units within a ½-mile radius of all station areas+ • Total housing units of all types and total housing units that are legally binding affordability restricted for each county in which project stations are located+ • A signed certification by the head(s) of the entities, such as state or local housing agencies or nonprofit organizations that maintain databases of affordable housing units, from where the information was gathered attesting to the accuracy of the numbers provided.* (Certification is not needed if using the National Housing Preservation Database to obtain affordable housing counts.)
* Provide this information as supporting documentation. + Enter this information in the quantitative land use template.	

Information Requested	Documentation
I. Transit Supportive Plans and Policies **a. Growth Management**	
Concentration of development around established activity centers and regional transit	• Regional plans or policies that promote increased development, infill development, and redevelopment in established urban centers and activity centers, and/or limit development away from primary activity centers • Regional plans or policies to concentrate development around major transit facilities • Local comprehensive plans or capital improvement plans that give priority to infill development and/or provide for opportunities for high density redevelopment
Land conservation and management	• Growth management plans (e.g. growth management areas, urban growth boundaries, agricultural preservation plans, open space preservation plans) with maps • Policies that allow for transfer of development rights from open space or agricultural land to urban areas

Information Requested	Documentation
I. Transit Supportive Plans and Policies **b. Transit Supportive Corridor Policies**	
Plans and policies to increase corridor and station area development	• Adopted city, county, and regional plans and policies and private sector plans and initiatives that promote development in the transit corridor and station areas; plans may include general plans, specific plans (subarea, station area, etc.), redevelopment project plans, or other district plans • Examples of transit supportive policies include: general policy statements in support of transit as a principal mode of transportation in the corridor; policies that support and promote the use of transit; policies/plans that provide for high density development in the corridor and station areas; and policies that support changes to zoning in the corridor and station areas
Plans and policies to enhance transit-friendly character of station area development	• Elements of adopted city, county, and regional plans and policies that promote transit-friendly character of corridor and station area development • Policies to promote mixed-use projects • Policies to promote housing and transit-oriented retail • Policies that allow/promote vertical zoning • Façade improvement programs • Funds to support transit-oriented plans • Private sector plans and initiatives consistent with the public plans and policies listed above
Plans to develop pedestrian facilities and enhance disabled access	• Requirements and policies for sidewalks, connected street or walkway networks, and other pedestrian facility development plans for station areas • Capital improvement programs to enhance pedestrian-friendly design in station areas • Curb ramp transition plans and milestones required under CFR 35.150(d)(2), and other plans for retrofitting existing pedestrian infrastructure to accommodate persons with disabilities in station areas • Street design guidelines or manuals addressing pedestrian and transit-oriented street design
Parking policies (allowances for reductions in parking and traffic mitigation for development near station areas, plans for park-and-ride lots, parking management)	• Policies to reduce parking requirements or cap parking • Policies establishing maximum allowable parking for new development in areas served by transit • Shared parking allowances • Mandatory minimum cost for parking in areas served by transit • Parking taxes

Information Requested	Documentation
I. Transit Supportive Plans and Policies **c. Supportive Zoning Regulations Near Transit Stations**	
Zoning ordinances that support increased development density in transit station areas	• Ordinances and maps describing existing zoning (allowable uses and densities) • Recent changes to zoning ordinances to allow or encourage development with transit supportive densities and uses • Transit overlay zoning • Zoning incentives for increased development in station areas (density bonuses, housing fund subsidies, regulation relaxation, expedited zoning review, etc.)
Zoning ordinances that enhance transit-oriented character of station area development and pedestrian access	• Zoning regulations that allow mixed-use development • Zoning regulations addressing placement of building footprints, pedestrian facilities, façade treatments, etc. • Architectural design guidelines and mechanisms for implementation/enforcement of these guidelines
Zoning allowances for reduced parking	• Residential and commercial parking requirements (minimums and/or maximums) in station areas under existing zoning • Zoning ordinances providing reduced parking requirements for development near transit stations

Information Requested	Documentation
I. Transit Supportive Plans and Policies **d. Tools to Implement Transit-Supportive Policies**	
Outreach to government agencies and the community in support of transit-supportive planning	• Promotion and outreach activities by the transit agency, local jurisdictions, and/or regional agencies specifically in support of station area planning, growth management, and transit-oriented development (as opposed to general outreach in support of the proposed transit project) • Inter-local agreements, resolutions, or letters of endorsement from other government agencies in support of coordinating planning with transit investment • Actions of other groups, including Chambers of Commerce, professional development groups, citizen coalitions, as well as the private/commercial sector, in support of transit-oriented development practices • Public outreach materials and brochures
Regulatory and financial incentives to promote transit-supportive development	• Regulatory incentives (e.g., density bonuses, streamlined processing of development applications) for developments near transit • Zoning requirements for traffic mitigation (e.g., fees and in-kind contributions) and citations of how such requirements can be waived or reduced for locations near transit stations • Programs that promote or provide incentives for transit- oriented development such as tax increment financing zones, tax abatement programs, and transit-oriented loan support programs • Other economic development and revitalization strategies for station areas or within the corridor
Efforts to engage the development community in station-area planning and transit-supportive development	• Outreach, education, and involvement activities targeted at the development community (including developers, property owners, and financial institutions) • Transit-oriented market studies • Joint development programs and proposals • Letters of endorsement or other indicators of support from the local development community
Public involvement in corridor and station area planning	• Description of the public involvement process for land use planning, including corridor and station area transit-supportive planning activities • Description of the level of participation in transit-supportive planning activities and support for these activities by the general public and community groups • Public outreach materials and brochures

Information Requested	Documentation
II. Performance and Impacts of Policies **a. Performance of Transit-Supportive Plans and Policies**	
Demonstrated cases of developments affected by transit supportive policies	• Documentation of projects that have recently been built consistent with transit-oriented design principles (higher density, orientation toward street, provision of pedestrian access from transit, etc.) • Documentation of projects that incorporate a mix of uses or increased amounts of housing
Station area development proposals and status	• Descriptions and plans for new development, including joint development proposals, including size, types of uses, and expected dates of start of construction and completion
II. Performance and Impacts of Policies **b. Potential Impact of Transit Investment on Regional Development**	
Adaptability of station area for transit-supportive development	• Description or inventory of land near transit stations that is vacant or available for redevelopment, and amount of development anticipated for these parcels • Projected timeline for development of station area properties • Amount of development allowed at station area build-out compared to existing amount of development
Corridor economic development	• Regional and corridor economic conditions and growth projections • Development market trends in existing corridors and station areas (for areas with existing transit) • Demonstrated market support for higher-density and transit/pedestrian-oriented development • Locations of major employment centers in the region, and expected growth in these centers • Projected population, employment, and growth rates in corridor or station areas compared to region

Information Requested	Documentation
III. Tools to Maintain or Increase the Share of Affordable Housing in the Project Corridor	
Evaluation of corridor-specific affordable housing needs and supply	• Needs assessment that evaluates the demand of affordable housing and compares it to the supply of housing
Plans and policies to preserve and increase affordable housing in region and/or corridor	• Inclusionary zoning or housing programs that require or provide incentives for developers to set aside a percentage of units for income-qualified buyers or renters • Density bonuses or reduction of parking requirements for the provision of units made available for income-qualified buyers or renters • Employer assisted housing policies, using tax credits, partnerships, matching funds, and/or other mechanisms to encourage employers to help employees to buy or rent homes close to work or transit • Rent controls or condominium conversion controls on existing units to maintain affordability for renters • Zoning to promote housing diversity, such as zoning that permits accessory or “in-law” units, and residential zoning based on floor area ratio rather than dwelling units to reduce the disincentive to build smaller units • Tenant “right of first refusal” laws, which require that an owner provide the tenants with an opportunity to purchase the property at the same price as a third-party buyer • Affordability covenants, which limit appreciation of rents and/or sales values for units rented or sold to income-qualified tenants for a given length of time

Information Requested	Documentation
Adopted financing tools and strategies targeted to preserve and increase affordable housing in the region and/or corridor	• Funding for targeted property acquisition, rehabilitation, and development of low-income housing, including direct funding for public and nonprofit development authorities, low-income housing tax credits (including criteria that favor application of credits in transit station areas), and local tax abatements for low-income or senior housing • Land banking programs to support the assembly of land for new affordable housing development by public, private, or nonprofit developers • Financial assistance to housing owners and/or tenants through mechanisms, including affordable housing operating subsidies, weatherization and utilities support programs, tax abatement or mortgage or other home ownership assistance for lower-income and senior households • Local or regional affordable housing trust funds to provide a source of low-interest loans for affordable housing developers. • Targeted tax increment financing, other value-capture strategies, or transfer tax programs to generate revenue that can be directed toward low-income housing programs
Evidence of developer and public-sector activity to preserve and increase affordable housing in the corridor	• Examples of the provision of affordable housing in new or existing developments, including number of units, specific affordability restrictions, length of time restrictions apply, etc.
Extent to which local plans and policies account for long-term affordability and the needs of very- and extremely-low income households in the corridor	• Documentation of evidence that legal affordability restrictions in the transit corridor will be continued over the long-term following the project's opening. Examples include commitments tied to the receipt of Low-Income Housing Tax Credits, HOME or other HUD funds, payment in lieu of taxes (PILOT) agreements, and other legal instruments tied to the receipt of Federal, state, local and/or private funds/financing