East Liberty Priority Corridors
Pedestrian and Traffic Safety Plan

For The

City of Pittsburgh, Allegheny County

Prepared By:

TRAFFIC PLANNING AND DESIGN, INC.
1370 Washington Pike
Bridgeville, PA 15017

TPD# COPI.00022

March 6, 2023

Prepared By: Amanda Purcell, P.E.

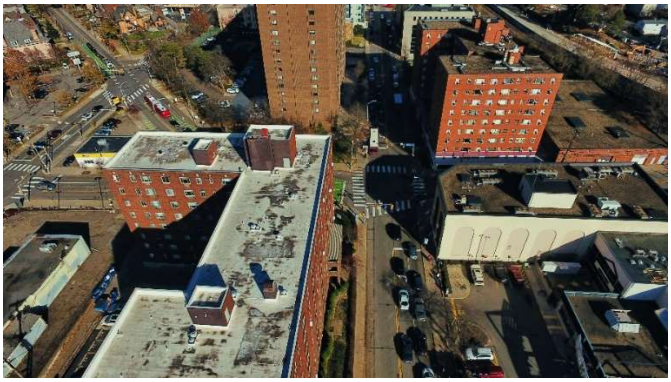


TABLE OF CONTENTS

I. INTRODUCTION 3

II. PEDESTRIAN SAFETY & TRAFFIC SAFETY 4

A. EXISTING ROADWAY CONDITIONS 4

B. PEDESTRIAN SAFETY CONCERNS PER PUBLIC COMMENTS 5

C. PEDESTRIAN SAFETY CONCERNS BASED ON CRASHES 12

D. TRAFFIC SAFETY CONCERNS PER PUBLIC COMMENTS 14

E. CRASH DATA INVESTIGATION 16

III. TRAFFIC CONDITIONS 19

A. CAPACITY ANALYSIS 20

B. AUXILIARY TURN LANE ANALYSIS 25

C. LEFT TURN SIGNAL PHASING 26

D. ALTERNATIVE ANALYSES – BAUM BOULEVARD AT HIGHLAND AVENUE 27

E. ALTERNATIVE ANALYSES – PENN AVENUE AT CENTRE AVENUE 29

F. ALTERNATIVE ANALYSES – NEGLEY AVENUE AT PENN AVENUE 32

IV. POTENTIAL NEW CROSSWALKS 33

V. TRANSIT AMENITIES IMPROVEMENTS 34

VI. CONCLUSIONS 39

A. PEDESTRIAN SAFETY COUNTERMEASURES 39

B. TRAFFIC SAFETY COUNTERMEASURES 41

C. TRANSIT STOP AMENITIES 43

APPENDICES (UNDER SEPARATE COVER)

APPENDIX A: FIELD NOTES

APPENDIX B: EXISTING TRAFFIC COUNTS

APPENDIX C: SIGNAL PERMIT PLANS

APPENDIX D: CAPACITY ANALYSIS

APPENDIX E: AUXILIARY TURN LANE WARRANT ANALYSIS

APPENDIX F: TRAFFIC SIGNAL WARRANT ANALYSIS

APPENDIX G: LEFT TURN PHASING ANALYSIS

APPENDIX H: USLIMITS2 REPORTS

APPENDIX I: TRANSIT DATA

APPENDIX J: NEGLEY AVENUE AT PENN AVENUE ROUNDABOUT CONCEPT

I. INTRODUCTION

County:	Allegheny County
Municipality:	City of Pittsburgh
City Project Number	2022-ITQB-134
Federal Oversight:	No

East Liberty is a neighborhood in Pittsburgh, Pennsylvania's East End. It is bordered by Highland Park, Morningside, Stanton Heights, Garfield, Friendship, Shadyside and Larimer. According to the 2020 American Community Survey, the current population of the neighborhood is 5,741 with a median age group of 36. Per 100 residents, the male female ratio of the neighborhood is 47:53. Around eleven percent (11%) of the residents of this neighborhood are aged below 18 and sixteen percent (16%) are in the age group over 65. The major two racial demographic group of this neighborhood are White (43%) and Black or African American (41%) (ACS, 2020). This neighborhood has a higher percentage of households with Zero Vehicles (38%) compared to the city average (23%) and county (13%) (ACS, 2020). Over 50% of the residents drive single occupancy vehicles to their work commutes while another 30% use public transit (ACS, 2020). The average work commute time of East Liberty is 23 minutes and close to 50% of the daily trips generated from this neighborhood are under 3 miles (ACS 2020, Zone activity Analysis, Streetlight).

Due to the high concentration of employment, housing mix, retail/grocery stores, flat topography, presence of quality sidewalks, bike infrastructure, high frequency transit lines and a transit station, this neighborhood is an ideal destination for residents who enjoy a healthier and more active living style with less reliance on automobile travel. To promote that, this plan will address three (3) key mobility issues identified by the community in the pre-scoping survey phase of this project and includes the conceptual design plans for the five (5) identified corridors.

The three key mobility issues are:

- ***Pedestrian Safety***
- ***Traffic Safety***
- ***Bus Stop Accessibility***

The five study corridors are:

- ***Penn Avenue from East liberty Boulevard to N Negley Avenue***
- ***Centre Avenue from North Negley Avenue to East Liberty Boulevard***
- ***Highland Avenue from Centre Avenue to St Marie Street***
- ***North Negley Avenue from Centre Avenue to Hays Street***
- ***East Liberty Boulevard from North Negley Avenue to Penn Avenue***

II. PEDESTRIAN SAFETY & TRAFFIC SAFETY

A. EXISTING ROADWAY CONDITIONS

A field review of the existing roadway system in the study area was conducted. The existing roadway characteristics within the study area are summarized in **Table 1**.

TABLE 1
ROADWAY CHARACTERISTICS WITHIN STUDY AREA

Roadway	Ownership	Functional Class	Predominant Directional Orientation	Posted Speed Limit	85th Percentile Speed	ADT
Penn Avenue Negley Avenue to Centre Avenue Centre Avenue to Shady Avenue Shady Avenue to East Liberty Boulevard	City State (SR 380) State (SR 380)	Principle Arterial	East-West	25 MPH 25 MPH 35 MPH	29 MPH EB 33 MPH WB	9,321 VPD EB 8,761 VPD WB
Centre Avenue From N Negley Avenue to East Liberty Boulevard	City State (SR 380)	Principle Arterial	East-West	25 MPH	33 MPH NB 33 MPH SB	2,650 VPD NB 3,627 VPD SB
Highland Avenue From Centre Avenue to St Marie Street	City	Major Collector	North-South	25MPH	34 MPH NB 34 MPH SB	8,788 VPD
Negley Avenue From Centre Avenue to Hays Street	City	Minor Arterial	North-South	25 MPH	North Negley 32 MPH NB 33 MPH SB South Negley 32 MPH NB 31 MPH SB	12,454 VPD 11,199 VPD
East Liberty Boulevard From N Negley Boulevard to Penn Avenue	City	Minor Arterial	East-West	35 MPH	@ Beatty 37 MPH EB 33 MPH WB @ Sheridan 33 MPH EB 33 MPH WB	4,697 VPD EB 4,317 VPD WB 5,563 VPD EB 5,435 VPD WB

As part of the data collection effort for this study, an extensive field investigation was conducted. The field investigation was attended by City personnel, PRT Staff and the design team over two days. During the field investigation, the team had statistics of past 311 complaints/comments, input received during the project comment period, preliminary crash history information, and traffic signal permit drawings. The purpose of the field investigation was to identify pedestrian/transit barriers, identify safety challenges, and brainstorm potential mitigation solutions. The field notes are included in **Appendix A.**

B. PEDESTRIAN SAFETY CONCERNS PER PUBLIC COMMENTS

The City of Pittsburgh Department of Mobility and Infrastructure (DOMI) completed a public involvement program in advance of preparing the East Liberty Priority Corridors Pedestrian & Traffic Safety Plan (Safety Plan). As part of the public involvement effort, substantial public comment was gathered by DOMI from an online platform between April 2022 and October 2022. Within that timeframe the following seven intersections received the most feedback regarding pedestrian safety:

- Penn Avenue at Centre Avenue
- Centre Avenue at Highland Avenue
- Penn Avenue at Beatty Street
- Penn Avenue at Highland Avenue
- Baum Boulevard at Highland Avenue
- Penn Avenue at Negley Avenue
- East Liberty Boulevard at Highland Avenue

The comments received for each intersection are summarized below. In many locations, the comments were repeated from separate respondents.

Penn Avenue at Centre Avenue

Penn Avenue and Centre Avenue received 24 comments from the public, the comments are all similar in content specifically:

- The intersection is difficult to navigate as a pedestrian.

During field observations, the project team observed:

- Right of way is not being yielded to the pedestrians in the crosswalks.

Suggested modifications at the intersection include:

- Eliminate Right turn lane from Penn Avenue eastbound to Centre Avenue southbound.
- Change pavement marking to make a painted island to separate traffic.
- Increase the duration of the leading pedestrian interval.

Centre Avenue at Highland Avenue

There were ten comments received for this intersection. Four of them were location only, no description. Issues identified include:

- The intersection is very difficult to navigate as a pedestrian, specifically crossing the west leg of Centre Avenue.
- There is a need for loading zones along Highland for food pickup.

During field observations, the project team observed:

- Conventional style crosswalks.
- Poor pedestrian visibility in crosswalks for right turns.
- Lack of left turn signal phasing.

Suggested modifications at the intersection include:

- High visibility crosswalks.
- Install left turn signal heads.
- Removal of SW approach right turn lane and install a curb bump out on SW approach.

Penn Avenue at Beatty Street

There were eight comments received for this intersection. Issues identified include:

- Crash history.
- Drivers' failure to yield to pedestrians crossing Penn Avenue; uncomfortable crossing.

During field observations, the project team observed:

- Crossing concerns.
- Poor pedestrian visibility in crosswalks for right turns.
- Lack of left turn signal phasing.

Suggested modifications at the intersection include:

- Add a ped refuge and curb extension along Penn Avenue.
- Eliminate left turns.

Penn Avenue at Highland Avenue

There were nine comments received for this intersection. Four of them were location only, no description. Issues identified include:

- Pittsburgh left contributes to pedestrian challenges.
- Drivers block the crosswalk.

During field observations, the project team observed:

- Crossing concerns.
- Pedestrian signals need updated and placed on recall.

Suggested modifications at the intersection include:

- Install high visibility crosswalks in durable material.
- Update curb ramps and provide pedestrian signals with upgraded signal.
- Incorporate protected left turns for Highland and Penn, include pedestrian signals.

Highland Avenue at Baum Boulevard

There were seven comments received for this intersection. Two of them were location only, no description. Issues identified include:

- Excessive curb radius at intersection reduces sidewalk width.
- A high volume of turns and quick turns from Baum Boulevard contribute to pedestrian safety issues.

During field observations, the project team observed:

- Crossing concerns.

Suggested modifications at the intersection include:

- Move stop bar closer to stop sign.
- Designate last block of Baum as one way WB and create diagonal parking.

Penn Avenue at Negley Avenue

There were seven comments received for this intersection. Two of them were location only, no description. Issues identified include:

- Protected turns or protected lane requested due to difficult high conflict turns and the grade of Penn inbound.
- Pedestrian movements will increase with the opening of the Whole Foods; the intersection lacks countdown pedestrian signals.
- Lack of adequate intersection lighting.

During field observations, the project team observed:

- Lack of pedestrian signals.

Suggested modifications at the intersection include:

- Provide pedestrian signal heads with upgraded signal.
- Provide curb extensions on Negley.

East Liberty Avenue at Highland Avenue – There were six comments received for this intersection. Three of them were location only, no description. Issues identified include:

- Protected turns are requested due to intersecting bikeways and heavy vehicular turning traffic.
- Signal should have walk phase on recall.
- Large number of high school and middle school students use the intersection. Pedestrian accommodations should reflect that.

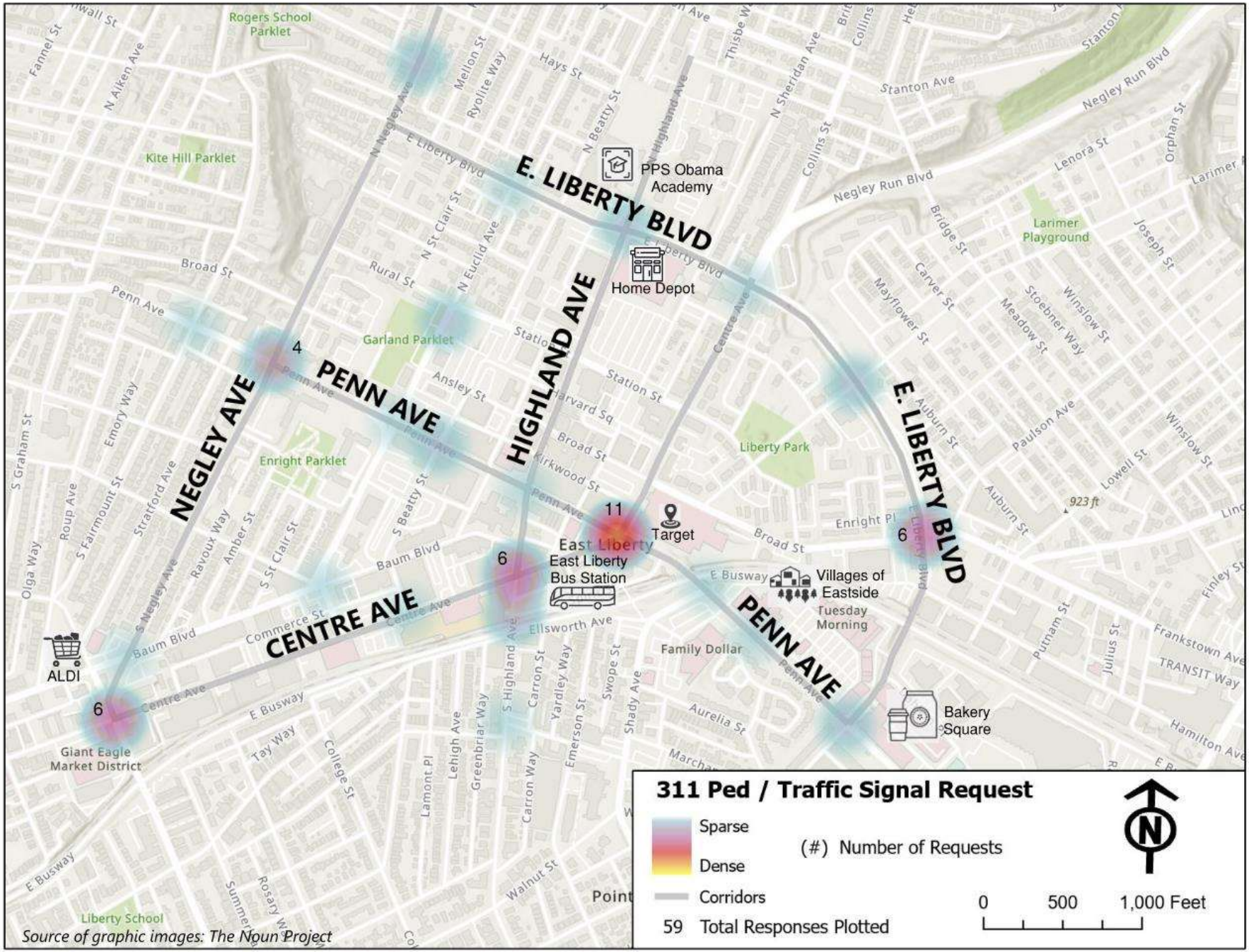
During field observations, the project team observed:

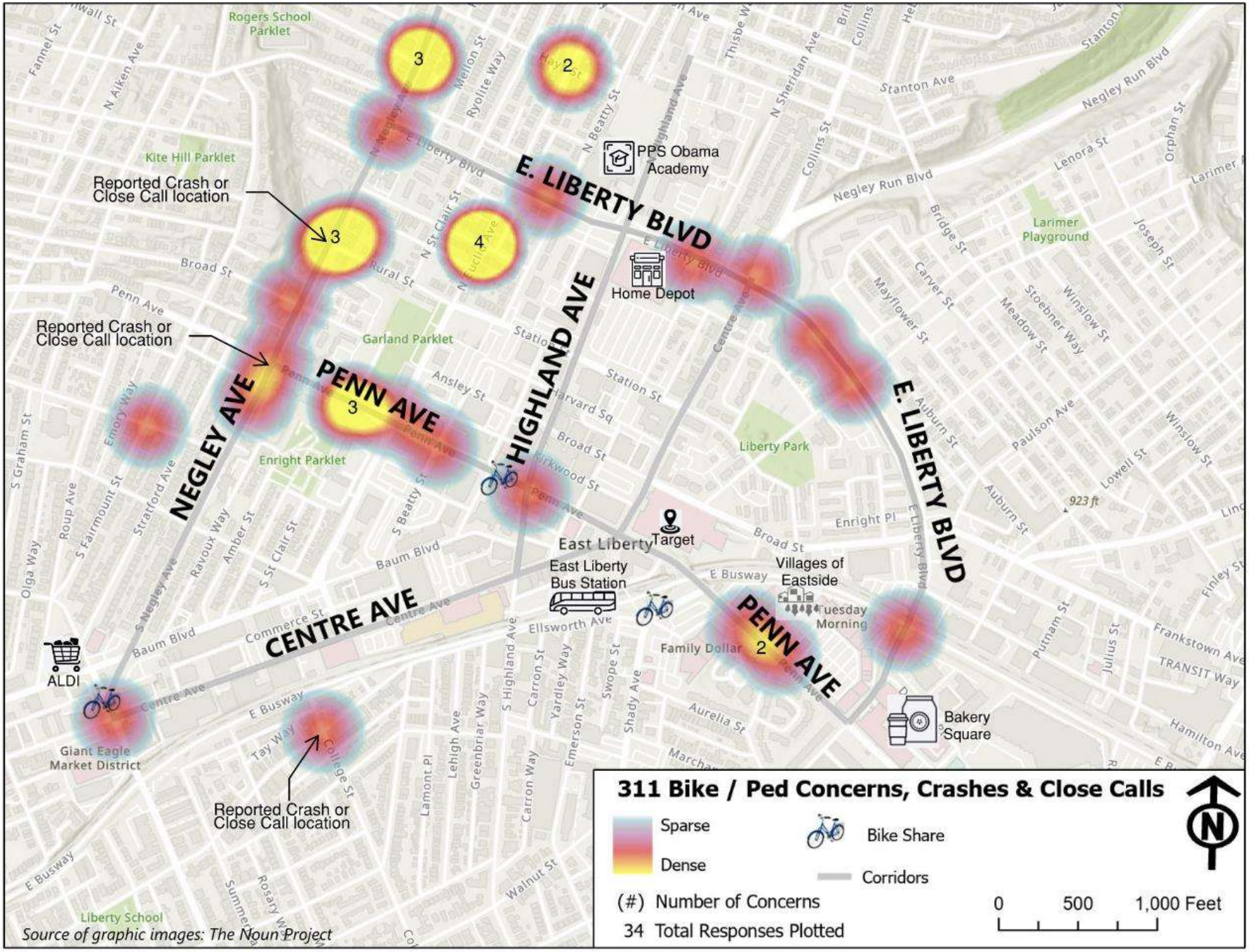
- High volume ped crossing.
- Island grades are too steep for ADA.

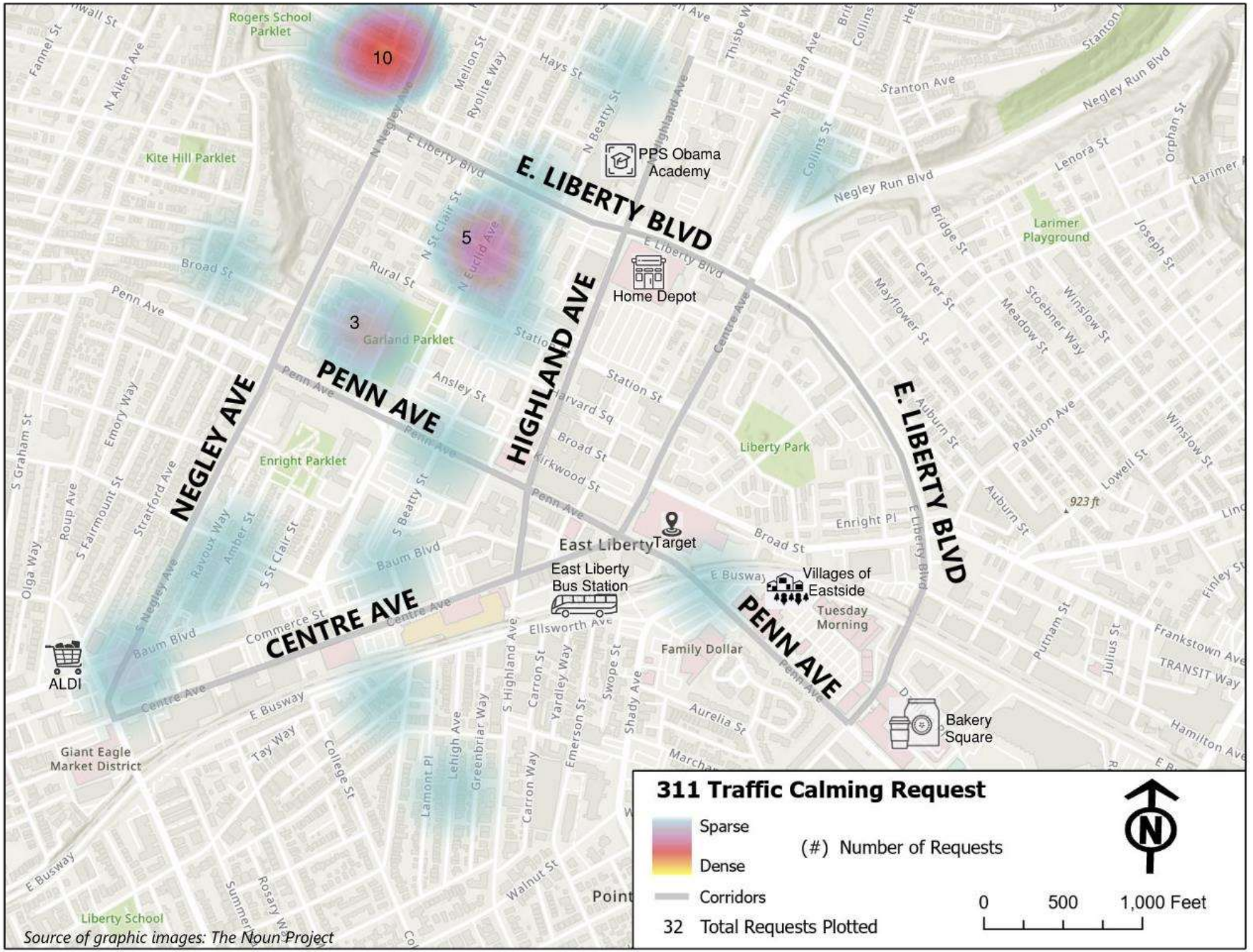
Suggested modifications at the intersection include:

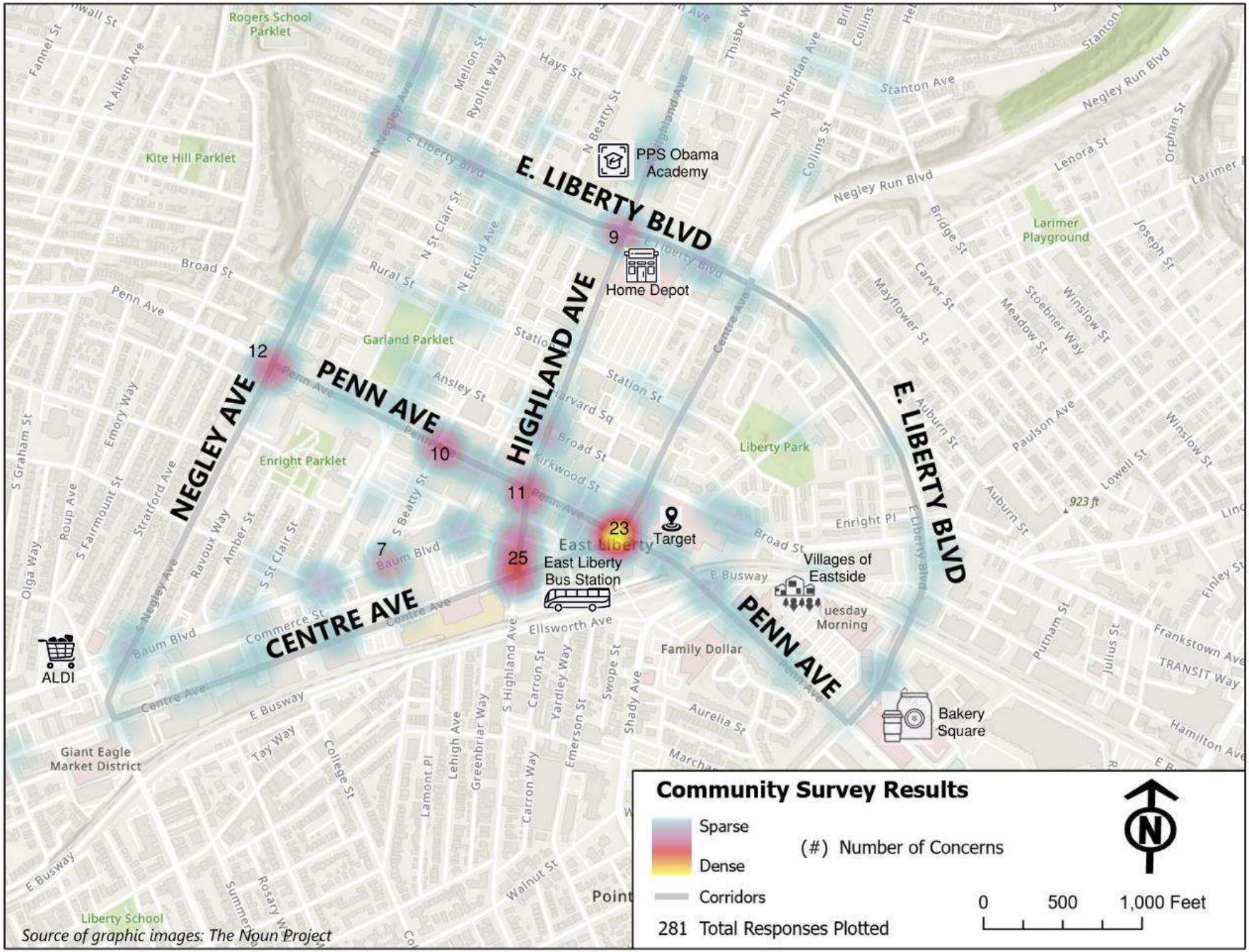
- Reprogram signal to have ped phase on recall.
- Level median island to accommodate ADA requirements.
- Provide curb extensions where right turn lanes do not exist.

Additionally, 311 data was reviewed for the calendar years 2019, 2020 and 2021 for specific call types. Heat maps of the pedestrian related call types are shown in the following figures. Although, the actual request or comment is not known, the problem area and call types are known. These figures provide a high-level view of potential problem areas that should be further considered in the study.


311 Ped / Traffic Signal Request
Sparse
Dense
(#) Number of Requests
Corridors
59 Total Responses Plotted
0
500
1,000 Feet
N
E. LIBERTY BLVD
HIGHLAND AVE
NEGLEY AVE
PENN AVE
CENTRE AVE
PENN AVE
E. LIBERTY BLVD
PPS Obama Academy
Home Depot
Target
East Liberty
East Liberty Bus Station
Villages of Eastside
Tuesday Morning
Family Dollar
Bakery Square
ALDI
Giant Eagle Market District
Rogers School Parklet
Kite Hill Parklet
Garland Parklet
Enright Parklet
Liberty Park
Larimer Playground
Liberty School
Source of graphic images: The Noun Project


Rogers School Parklet
Kite Hill Parklet
Reported Crash or Close Call location
Reported Crash or Close Call location
Reported Crash or Close Call location
Garland Parklet
Enright Parklet
Liberty Park
Larimer Playground
PPS Obama Academy
Home Depot
Target
East Liberty
East Liberty Bus Station
Villages of Eastside
Tuesday Morning
Family Dollar
Bakery Square
ALDI
Giant Eagle Market District
Liberty School
E. LIBERTY BLVD
HIGHLAND AVE
NEGLEY AVE
PENN AVE
CENTRE AVE
311 Bike / Ped Concerns, Crashes & Close Calls
Sparse
Dense
Bike Share
Corridors
(#) Number of Concerns
34 Total Responses Plotted
0
500
1,000 Feet
Source of graphic images: The Noun Project


Rogers School Parklet
10
Kite Hill Parklet
PPS Obama Academy
E. LIBERTY BLVD
5
Home Depot
3
Garland Parklet
NEGLEY AVE
PENN AVE
HIGHLAND AVE
E. LIBERTY BLVD
Enright Parklet
Liberty Park
East Liberty
Target
East Liberty Bus Station
Villages of Eastside
Tuesday Morning
CENTRE AVE
PENN AVE
Family Dollar
ALDI
Bakery Square
Giant Eagle Market District
Liberty School
923 ft
Larimer Playground
Source of graphic images: The Noun Project
311 Traffic Calming Request
Sparse
Dense
(#) Number of Requests
Corridors
32 Total Requests Plotted
0 500 1,000 Feet


E. LIBERTY BLVD
HIGHLAND AVE
NEGLEY AVE
PENN AVE
CENTRE AVE
E. LIBERTY BLVD
PENN AVE
9
10
11
12
7
23
25
PPS Obama Academy
Home Depot
Target
East Liberty
East Liberty Bus Station
Villages of Eastside
Tuesday Morning
Family Dollar
Bakery Square
ALDI
Giant Eagle Market District
Rogers School Parklet
Kite Hill Parklet
Garland Parklet
Enright Parklet
Liberty Park
Larimer Playground
Liberty School
Point
Community Survey Results
Sparse
Dense
Corridors
281 Total Responses Plotted
(#) Number of Concerns
0
500
1,000 Feet
N
Source of graphic images: The Noun Project

C. PEDESTRIAN SAFETY CONCERNS BASED ON CRASHES

As part of the Safety Plan, crash data throughout the study area was reviewed for the most recent 5-year period available, specifically looking at pedestrian related crashes. The locations with the most pedestrian crashes are as follows:

- Centre Avenue at Penn Avenue: 4 Crashes
- Penn Avenue at Highland Avenue: 4 Crashes
- Negley Avenue at Broad Street: 3 Crashes
- East Liberty Boulevard at Centre Avenue & Negley Run Boulevard: 2 Crashes
- Centre Avenue at Highland Avenue: 2 Crashes
- Baum Boulevard at Negley Avenue: 2 Crashes
- East Liberty Boulevard at Broad Street/Frankstown Avenue: 2 crashes

The study area was evaluated using the **Safe System Approach**, which considers five elements of a safe transportation system—safe road users, safe vehicles, safe speeds, safe roads, and post-crash care—in an integrated and holistic manner. In looking at these intersections from a safe systems approach, each of these intersections have unique characteristics that present challenges to pedestrians that should be planned for in the future.

Centre Avenue at Penn Avenue

This intersection is characterized by very high traffic volumes with sweeping intersection radii and tight signal spacing, which makes this intersection especially challenging for pedestrians. Moving the stop bars as close to the crosswalks as possible and removing any obstructions that obscure pedestrians waiting to cross the street will begin to slow vehicle speeds at the crosswalks. The tight signal spacing and high volumes leads to congestion and aggressive driving. Kirkwood Street, Annie Way and Spirit Street are all within the queues of the Penn and Center intersection. These are locations where passive pedestrian detection may be a benefit to reduce the side street calls and maintain a high degree of service to pedestrians.

During field observations, the project team observed:

- Right of way is not being yielded to the pedestrians in the crosswalks.

Suggested modifications at the intersection include:

- Eliminate Right turn lane from Penn eastbound to Centre southbound. Change pavement marking to make a painted island to separate traffic.
- Increase the duration of the leading pedestrian interval.

Penn Avenue at Highland Avenue

This intersection is the center of the business district with high transit use, high pedestrian activity, and high turning volumes. To reduce the decision making required of the drivers at this intersection, protected left turns could be implemented to reduce both vehicular and pedestrian conflicts.

During field observations, the project team observed:

- Crossing concerns.
- Pedestrian signals need updated and placed on recall.

Suggested modifications at the intersection include:

- Install high visibility crosswalks in durable material.
- Update curb ramps and provide pedestrian signals with upgraded signal.
- Incorporate protected left turns for Highland and Penn, include pedestrian signals.

Negley Avenue at Broad Street

This intersection is an unsignalized pedestrian crossing with a high ADT of almost 12,500 VPD and an 85th percentile speed of 33 MPH on Negley Avenue. Negley Avenue and the area surrounding this intersection needs appropriate traffic calming that will allow it to function as a minor arterial but within the context of an urban neighborhood at an operating speed closer to 25 MPH. A pedestrian refuge area and curb extensions would assist pedestrian in crossing the street and would allow vehicles to exit the residential units on east side of Negley Avenue where sight distance is currently limited by parking.

During field observations, the project team observed:

- Pedestrians have a hard time finding a gap in traffic from both directions.
- Parked cars close to intersection impede sign distance.

Suggested modifications at the intersection include:

- Create concrete curb extensions and provide pedestrian refuge in median.
- Install RRFB for visibility.
- Remove four (4) parking spots on Negley to create room to shift traffic and provide space for a pedestrian refuge in median.

East Liberty Boulevard at Centre Avenue & Negley Run Boulevard

There is an offset through this intersection along Centre Avenue/Negley Run Boulevard with a change in speed and character of the roadway at this intersection. Efforts should focus on minimizing obstructions at the intersection by combining streetlights and signal poles and ensuring adequate street lighting so that pedestrians are clearly visible to approaching drivers especially when coming from a less pedestrian intense area such as Negley Run Boulevard.

During field observations, the project team observed:

- No Pedestrian signals are present.

Suggested modifications at the intersection include:

- Add pedestrian signals.
- Provide curb extensions.

Centre Avenue at Highland Avenue

This is a skewed intersection where the crosswalk on the west leg of Centre Avenue is obscured by a building on the corner. Right turning traffic from Highland Avenue cannot see pedestrians entering the crosswalk. While this does not appear to be a factor in either of the crashes that occurred in the last five years, it is a cause for uneasiness and poses a safety risk. Ultimately, relocating the crosswalk to the corner and along the pedestrian route is the ideal solution.

During field observations, the project team observed:

- Conventional style crosswalks.
- Poor pedestrian visibility in crosswalks for right turns.
- Lack of left turn signal phasing.

Suggested modifications at the intersection include:

- High visibility crosswalks.
- Install left turn signal heads.
- Removal of SW approach right turn lane and install a curb bump out on SW approach.

Baum Boulevard at Negley Avenue
This is a skewed intersection with a missing crosswalk. The intersection is in a neighborhood setting with sidewalk connections on all sides. The crosswalk should be marked and accommodated in a safe manner.

During field observations, the project team observed:

- No crossing on the north side of intersection.

Suggested modifications at the intersection include:

- Add missing crosswalk and high visibility cross walks.
- Provide pedestrian signals with upgraded signal.

East Liberty Boulevard at Broad Street/Frankstown Avenue
Prior to the signal update at this intersection, the pedestrian crossings consisted of red/yellow/green signals for all crossings including the long East Liberty Boulevard crossings. It lacked accessible pedestrian accommodations even though it is near facilities that assist people with mobility impairment. The current intersection is an example of positive pedestrian improvement upgrades.

D. TRAFFIC SAFETY CONCERNS PER PUBLIC COMMENTS

During the public comment period, comments were collected from throughout the neighborhood. The top six locations for traffic safety requests listed below:

1. Highland Avenue north of East liberty
2. Center Avenue at Highland Avenue
3. Penn Avenue at Centre Avenue
4. Penn Avenue at Negley Avenue
5. Negley Avenue at Hays Street
6. Penn Avenue at Highland Avenue

There is substantial overlap between the traffic safety concern area and the pedestrian concern area. This is to be expected since traffic safety and traffic congestion impact pedestrian safety.

Highland Avenue north of East Liberty Boulevard
There were seven comments received for this intersection. Two of them were location only, no description. Issues identified include:

- Excessive speed.
- Lack of bike infrastructure.

During field observations, the project team observed:

- Pedestrian desire is in an area without a marked crosswalk.
- Along this stretch more parking would benefit the community

Suggested modifications at the intersection include:

- Install a raised mid-block cross walk.
- Place lighting along the walkway connecting the location to Beatty Street
- Raised cross walk with drainage improvements/investigation.

Penn Avenue at Centre Avenue

There were five comments received for this intersection. Two of them were location only, no description. Issues identified include:

- Too many traffic signals too close to each other causing congestion and safety issues.
- Removal of the right turn lane would make greater sidewalk space.
- Review signal timing.

During field observations, the project team observed:

- Traffic making right turn from Penn to Centre, thus making the crossing time longer for pedestrians crossing Penn.
- Traffic backs up from and through adjacent signalized intersections.

Suggested modifications at the intersection include:

- Eliminate Right turn land from Penn eastbound to Centre southbound. Change pavement marking to make a painted island to separate traffic.
- Increase the duration of the leading pedestrian interval.

Penn Avenue at Negley Avenue

There were five comments received for this intersection. One of them were location only, no description. Issues identified include:

- Road diet and no turn on red signs for bike and ped safety.
- Review mixing zones.
- Right turning vehicles do not yield to cyclists.

During field observations, the project team observed:

- Bike and vehicular conflicts where the bike lane crosses the right turn lane cars not yielding to bikes.
- Signal not to current city standard.
- Lane configurations need to be adjusted for current development.

Suggested modifications at the intersection include:

- Realign south approach. (Soften the deflection created by the median and Left Lane. Creating a thru movement that is the natural and primary movement for vehicular traffic.)
- Complete upgrade of signal to city standard, protected left turns for Penn and Negley and add pedestrian signals.

Negley Avenue at Hays Street

There were three comments received for this intersection. Issues identified include:

- Excessive speed.
- Sight distance obstructions due to parked vehicles.

During field observations, the project team observed:

- Lacks curb ramps, crosswalk markings and pedestrian crossing signage.

Suggested modifications at the intersection include:

- Provide pedestrian warning signage.
- Provide high visibility crosswalk markings.
- Provide updated curb ramps for crossing Negley Avenue and curb bump outs.

Penn Avenue at Highland Avenue

There were three comments received for this intersection. One of them were location only, no description. Issues identified include:

- Turning vehicular traffic in all directions make bike travel treacherous.
- Rush hour results in grid locking and jaywalking.

During field observations, the project team observed:

- Pedestrian signals need updated and placed on recall.
- Signal needs upgraded to city current standards.

Suggested modifications at the intersection include:

- Install high visibility crosswalks in durable material.
- Update curb ramps and provide pedestrian signals with upgraded signal.
- Upgrade signal to current city standards.

E. CRASH DATA INVESTIGATION

As part of the Safety Plan, crash data throughout the study area was reviewed for the most recent 5-year period available, Crash data were obtained from PennDOT for the study area intersections. PennDOT defines a reportable crash as follows, "A reportable (crash) is one in which an injury or fatality occurs or if at least one of the vehicles involved requires towing from the scene." Reportable crashes were tabulated for the five-year period beginning 1/1/2017 and ending 12/31/2021. For a given intersection, PennDOT considers a crash occurrence of 5 reportable, correctable crashes over a continuous twelve-month period during the past five years to be a threshold value, above which the intersection design should be reviewed to examine if corrective measures can be taken to enhance safety.

Study area intersections that meet the 5 reportable, correctable crashes over a continuous twelve-month period include:

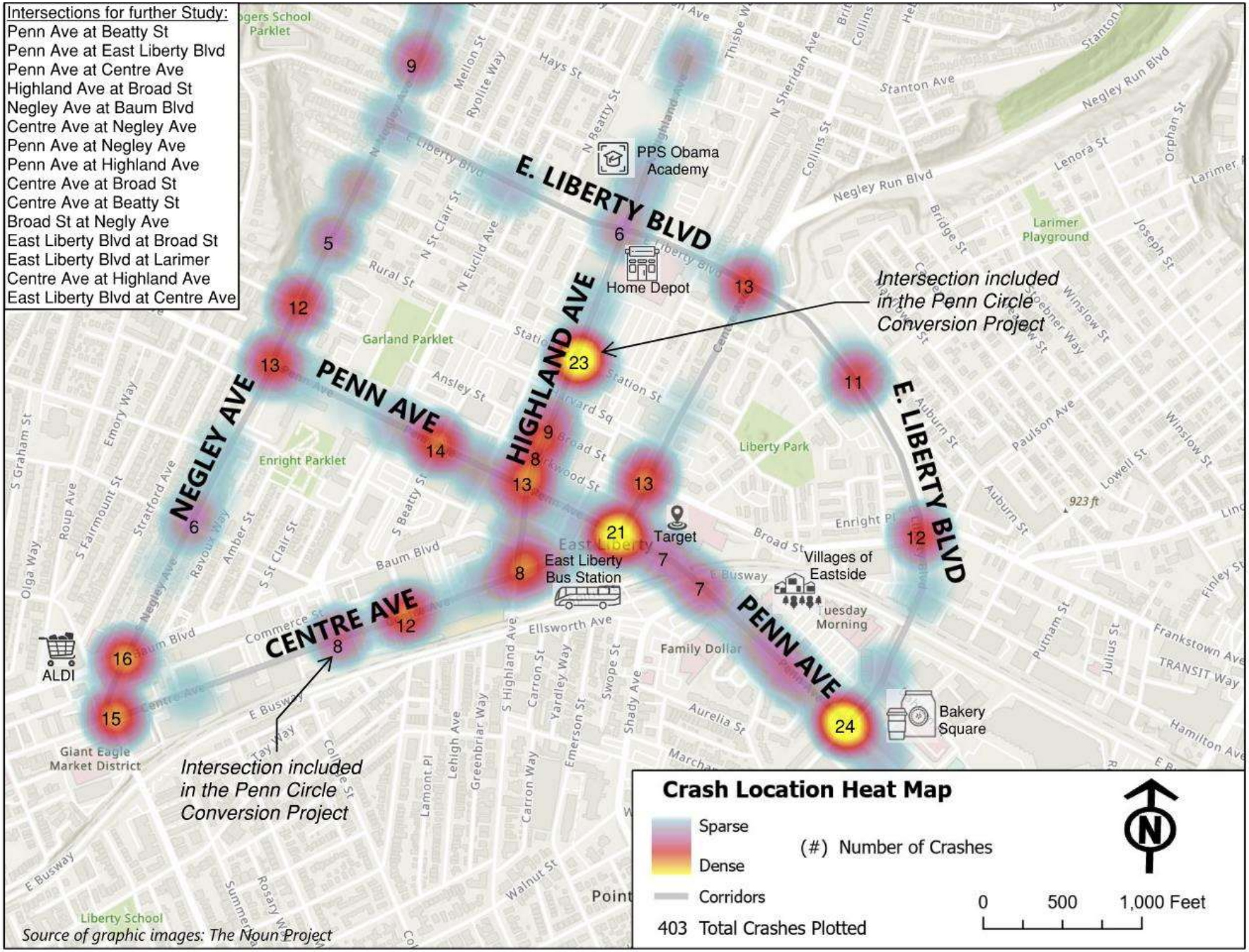
- Penn Avenue at Beatty Street
- Penn Avenue at East Liberty Boulevard
- Highland Avenue at Broad Street
- Centre Avenue at Negley Avenue
- Centre Avenue at Beatty Street

In accordance with typical PennDOT policy the crash data investigation was provided for their review under separate cover.

The following table summarized the crash type at each of these five intersections and potential remediation strategies.

TABLE 2
POTENTIAL MITIGATION STRATEGIES

Crash Mitigation Recommendation			
Intersection	**Number of crashes**	**Crash Pattern Identified**	**Potential mitigation**
Penn Avenue at Beatty Street	14	Angle Crashes	Physically prohibit left turns from both NB and SB Beatty Street by constructing a divertor island in place of Penn Avenue left turn lanes. Divertor island will also function as pedestrian refuge island.
Penn Avenue at East Liberty Boulevard	24 (1 suspected serious)	Predominant crash type is angle; they tend to occur from both directions	Consider road diet on Penn Avenue to provide left turn lanes and left turn signal phasing.
Highland Avenue at Broad Street & Kirkland	17	Angle crashes	Consider curb extensions to enhance sight distance for Broad Street approach.
Centre Avenue at Negley Avenue	15 (1 suspected serious)	Angle Crashes	Consider left turn signal phasing.
Centre Avenue at Beatty Street	12	Angle Crashes	Post all approaches as No Turn on Red. Confirm traffic signal clearance intervals are adequate. Restripe Centre Avenue to one lane to slow vehicles and reduce potential for serious injury crashes.


Intersections for further Study:
Penn Ave at Beatty St
Penn Ave at East Liberty Blvd
Penn Ave at Centre Ave
Highland Ave at Broad St
Negley Ave at Baum Blvd
Centre Ave at Negley Ave
Penn Ave at Negley Ave
Penn Ave at Highland Ave
Centre Ave at Broad St
Centre Ave at Beatty St
Broad St at Negly Ave
East Liberty Blvd at Broad St
East Liberty Blvd at Larimer
Centre Ave at Highland Ave
East Liberty Blvd at Centre Ave
E. LIBERTY BLVD
PENN AVE
HIGHLAND AVE
NEGLEY AVE
CENTRE AVE
PENN AVE
E. LIBERTY BLVD
PPS Obama Academy
Home Depot
Intersection included in the Penn Circle Conversion Project
Garland Parklet
Enright Parklet
Liberty Park
Larimer Playground
Target
East Liberty Bus Station
Villages of Eastside
Tuesday Morning
Family Dollar
ALDI
Giant Eagle Market District
Bakery Square
Intersection included in the Penn Circle Conversion Project
Crash Location Heat Map
Sparse
Dense
(#) Number of Crashes
Corridors
403 Total Crashes Plotted
0
500
1,000 Feet
Source of graphic images: The Noun Project

III. TRAFFIC CONDITIONS

Traffic conditions within the study area were analyzed using a mix of traffic data from various sources including updated traffic counts conducted by the project team. The traffic evaluations reviewed include:

- Intersection capacity analyses – measuring the quantitative measure of traffic flow through an intersection typically expressed in seconds of delay per vehicle.
- Auxiliary turn lane analysis – calculating the need for left and/or right turns at an intersection and the need to provide separate turn lanes for safety/traffic flow.
- Left turn signal phasing evaluation – calculating the need for left turn signal phasing based upon left turn demand.
- Alternatives scenario review – developing various alternatives to mitigate pedestrian and vehicle safety issues.

The traffic conditions analysis will review existing conditions to be used as a baseline and then test the proposed conditions for operational impacts.

Traffic Data

Manual traffic counts were conducted at Centre Avenue & Penn Avenue and Centre Avenue & Kirkwood Street for 15-minute intervals during the weekday morning (7:00 A.M. to 9:00 P.M.), weekday midday (12:00 to 2:00 P.M.), weekday afternoon (4:00 to 6:00 P.M.) and Saturday midday (11:00 to 2:00 P.M.) peak periods. Data pertaining to heavy vehicles, pedestrians, and transit vehicles were also observed during the counts. The counts were conducted in November 2022 and are included in **Appendix B.** Additional traffic counts were obtained from the East End Signal Retiming Project, Technical Memorandum #1 Dated July 28, 2022 prepared by Trans Associates. Applicable count data is included in **Appendix B**. Additionally, a historical review of the available ADTs was compiled as **Table 3** for the study area roadways using PennDOT's OneMap site. This gives an understanding of how traffic volumes have fluctuated over time.

Automatic traffic counters were also placed in November 2022 to record vehicle speed, classification, and volume along Negley Avenue, Highland Avenue, and East Liberty Boulevard. Negley Avenue has a posted speed limit of 25 MPH with an 85th percentile speed of SB 33 MPH & NB 32 MPH. Highland Avenue has a speed limit of 25 MPH with an 85th percentile speed of 34 MPH both NB & SB. Both streets could benefit from traffic calming in the study area. Vertical deflection is proposed on both of these streets. On Negley Avenue, raised intersections are proposed at Friendship Avenue and Coral Street to reduce variation in speed and create a street where cyclists and pedestrians can comfortably cross. On Highland Avenue, speed humps and a raised crosswalk are proposed.

TABLE 3
HISTORICAL ADTS IN EAST LIBERTY FROM PENNDOT ONE MAP

Historical ADTS in East Liberty From PennDOT ONE MAP										
	Centre Avenue West of Highland	Centre Avenue East of Highland	Centre Avenue North of Penn	Penn Avenue East of Centre	Broad Street East of Centre	Negley Avenue north of Penn	Negley Avenue South of Penn	Highland Avenue North of Rural	EB East Liberty Boulevard	WB East Liberty Boulevard
2010		7,753		13,589	9,630	11,838	10,996			
2011		15,340	3,615	13,443	9,527	11,711	10,878			
2012		15,340	7,556	13,443	7,784	11,711	10,878			
2013		14,864	7,435	13,025	7,659	11,347	10,541			
2014		14,737	7,354	19,362	7,576	11,223	10,426			
2015	11,064	14,569	9,220	19,141	7,722	8,787	11,080		7,877	7,877
2016	10,940	14,405	9,116	18,926	7,636	6,433	11,502	5,976	7,789	7,789
2017	10,825	12,142	9,020	20,175	7,556	6,365	11,381	6,336	4,844	5,271
2018	9,971	12,013	16,466	20,100	7,476	6,298	11,260	6,269	4,793	5,215
2019	9,874	6752		19,905	8,410	6,237	11,151	6,208	4,747	5,164
2020	8,184	10,391		16,497	6,970	5,169	9,242	4,656	3,934	4,280
2021	-	6,373	-	22,333	-	-	-	-	-	-

Notes:

1. Negley Avenue bike lanes were installed in 2017
2. East Liberty Boulevard bike lanes were installed prior to 2015

East Liberty Boulevard Speed Limit Evaluation

The posted speed limit on East Liberty Boulevard was also reviewed using the Federal Highway Administration (FHWA) USLIMITS2 evaluator which is a web-based tool designed to help practitioners set reasonable, safe, and consistent speed limits for specific segments of roads. The 85th percentile speed along East Liberty Boulevard varies from 33 MPH to 37 MPH. The roadway is currently posted at 35 MPH. Under current conditions, the USLIMITS2 program recommends a reasonable speed limit of 25 MPH. Based on this information, it is recommended to reduce the speed limit to 25 MPH on East Liberty Boulevard. If the speed limit is adjusted, then the yellow clearance intervals of the traffic signals would also need to be reviewed.

A. CAPACITY ANALYSIS

LEVELS OF SERVICE FOR AN INTERSECTION

For intersections, level of service is a qualitative measure of intersection capacity defined in terms of the average control delay per vehicle, which is a measure of driver discomfort and frustration, fuel consumption, and lost travel time. LOS criteria are stated in terms of control delay per vehicle for a one-hour analysis period. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

The criteria are shown in **Table 4.** Delay, as it relates to level of service, is a complex measure and is

dependent upon a number of variables. For signalized intersections, these variables include the quality of vehicle progression, the cycle length, the green time ratio, and the volume/capacity ratio for the lane group in question. For unsignalized intersections, delay is related to the availability of gaps in the flow of traffic on the major street and the driver's discretion in selecting an appropriate gap for a particular movement from the minor street (straight across, left or right turn).

TABLE 4
LEVEL OF SERVICE CRITERIA
UNSIGNALIZED AND SIGNALIZED INTERSECTIONS

Level of Service	Control Delay Per Vehicle (Seconds)	
	Signalized	Unsignalized
A	< 10	< 10
B	> 10 and < 20	> 10 and < 15
C	> 20 and < 35	> 15 and < 25
D	> 35 and < 55	> 25 and < 35
E	> 55 and < 80	> 35 and < 50
F	> 80 or v/c > 1.0	> 50 or v/c > 1.0

1 = Obtained from Exhibits 19-8 and 20-2 of the Transportation Research Board's Highway Capacity Manual 6th Edition

METHODOLOGY

Capacity analyses were conducted for the weekday AM and weekday PM peaks, at the study area intersections. These analyses were conducted according to the methodologies contained in the *Highway Capacity Manual* (HCM) 6th Edition using *Synchro* version 11.1, build 2, revision 9 software, a Trafficware product.

The following items should be noted with respect to the capacity analyses:

- The Pennsylvania default values for signalized intersections in an Urban Core land use context contained in Chapter 10 of PennDOT's *Publication 46* were utilized for the base saturation flow rate (2100 pcphpl), start-up lost time (2.5 seconds), extension of effective green time (4.0 seconds) and number of left turn sneakers (2 vehicles).
- The signal timings at the study area intersections were optimized under the proposed conditions.
- A default peak hour factor of 0.92 was utilized where field data was not available.
- The peak hour factors were calculated utilizing the manual traffic count data where available. The calculated peak hour factors are included with the turning movement data.
- PennDOT Guidelines allow for overall intersection LOS D in urban areas as acceptable for signalized intersections.

The following conditions were analyzed, as applicable:

- Existing Conditions
- Improvement Plan 1 includes:
  - Negley at East Liberty – Protected/Prohibited SB Left turn phasing.
  - Negley at Penn – WB approach left-thru/right lanes, NB approach left – thru/right lanes.
  - Negley at Centre – Protected/Permitted on all approaches.
  - Centre at Beatty – One through lane on the EB & WB approaches with left turn lanes.

- Centre at Highland – EB approach left-thru/right lanes with protected/permitted phasing on all approaches.
- Centre at Penn – EB approach left-thru/right lanes, adjust curb lines to shorten crossing lengths.
- Centre at Station – SB approach shared left-thru-right lane.
- Penn at Highland – Protected/Prohibited phasing on all four approaches.
- Penn at Shady – WB approach left-thru lanes; reduction to one through lane inbound and one left turn lane inbound.
- Penn at the Village of Eastside – WB approach thru/right lane EB approach left-thru lanes.
- Penn at East Liberty – WB approach left-thru/right lanes and the EB approach left-thru/right lanes, protected/permitted on EB & WB approaches, SB approach left/thru – right.

The traffic signal permit plans are included in **Appendix C**. The capacity analysis worksheets are included in **Appendix D**.

LEVELS OF SERVICE IN THE STUDY AREA

Levels of service (LOS) at the study area intersections for the weekday A.M. and weekday P.M. Generator peak hours are summarized in matrix form in **Table 5** for the existing conditions, and the Build conditions.

TABLE 5
LEVEL OF SERVICE SUMMARY (DELAY)

Intersection	Approach/ Movement	LOS (Delay sec/veh)			
		Existing Conditions	Existing Conditions	Build Conditions	
				Build 1	Build 1
		AM	PM	AM	PM
Penn Avenue at Centre Avenue	EB	D(44.5)	D(40.9)	E(55.9)	E(58.5)
	WB	F(92.9)	D(47.9)	E(62.0)	E(57.1)
	NB	B(14.7)	C(21.2)	C(22.7)	C(29.6)
	SB	C(27.5)	D(41.3)	D(42.8)	D(36.7)
	ILOS	D(54.5)	D(37.5)	D(48.9)	D(45.8)
Centre Avenue at Station Street	EB				
	WB	D(38.2)	D(41.1)	C(29.6)	D(51.4)
	NB	A(5.6)	A(4.9)	A(3.2)	A(0.3)
	SB	A(4.8)	A(3.7)	B(11.5)	A(1.2)
	ILOS	A(6.4)	A(6.0)	A(9.4)	A(2.8)
Penn Avenue at East Liberty Boulevard	EB	A(5.9)	A(7.5)	B(10.4)	A(6.9)
	WB	B(10.5)	A(9.5)	B(13.5)	B(12.3)
	NB	C(24.8)	D(52.4)	D(39.5)	D(36.5)
	SB	C(25.9)	B(10.3)	D(54.3)	D(42.6)
	ILOS	B(12.6)	B(12.0)	C(21.6)	B(15.5)

Penn Avenue at Shady Avenue	EB	C(21.9	C(31.0)	C(22.6)	C(22.2)
	WB	B(15.3)	B(4.4)	A(4.2)	B(16.4)
	NB	B(16.3)	C(21.6)	B(19.3)	C(21.8)
	SB				
	ILOS	B(17.6)	C(22.5)	B(12.8)	B(19.9)
Centre Avenue at Broad Street	EB	C(34.0)	C(31.9)	C(32.5)	C(27.5)
	WB	D(41.5)	C(54.1)	D(38.4)	C(31.4)
	NB	B(19.0)	A(9.4)	A(6.2)	B(10.7)
	SB	A(8.2)	A(8.4)	B(11.6)	C(19.8)
	ILOS	C(26.4)	C(27.6)	C(22.1)	C(2.3)
Penn Avenue at Negley Avenue	EB	E(56.0)	D(40.9)	D(53.9)	E(72.)
	WB	D(37.3)	D(43.7)	D(46.5)	D(48.5)
	NB	C(28.0)	E(58.0)	C(31.0)	E(68.4)
	SB	D(50.0)	D(53.4)	D(46.6)	D(38.7)
	ILOS	D(43.6)	D(49.3)	D(45.4)	E(59.8)
Centre Avenue at Highland Avenue	EB	A(7.4)	B(11.9)	A(9.1)	C(34.3)
	WB	B(11.9)	B(15.0)	B(6.9)	C(27.2)
	NB	D(51.3)	D(47.8)	C(34.1)	D(46.2)
	SB	D(49.1)	D(43.7)	E(65.0)	D(40.9)
	ILOS	C(27.2)	C(26.2)	C(28.3)	D(36.5)
Penn Avenue at Highland Avenue	EB	B(13.2)	B(17.4)	C(29.2)	D(44.0)
	WB	B(13.7)	B(14.4)	C(25.1)	D(41.4)
	NB	B(16.7)	C(20.0)	C(21.1)	C(28.0)
	SB	B(16.5)	B(14.9)	D(35.3)	D(35.8)
	ILOS	B(14.7)	B(16.9)	C(27.5)	D(38.6)
East Liberty Boulevard at Centre Avenue	EB	C(24.1)	C(26.0)	C(29.3)	B(17.7)
	WB	C(32.5)	C(31.8)	D(40.2)	B(17.5)
	NB	C(21.2)	C(27.8)	B(14.8)	B(17.3)
	SB	C(27.4)	C(29.8)	C(21.0)	B(17.1)
	ILOS	C(28.0)	C(28.6)	C(28.8)	B(17.5)
Centre Avenue at Beatty Street	EB	A(2.3)	A(5.6)	A(2.1)	A(0.5)
	WB	A(2.5)	A(4.5)	A(1.0)	A(0.3)
	NB	D(50.1)	D(51.5)	D(46.2)	D(39.2)
	SB	D(48.4)	D(51.9)	D(44.0)	D(38.7)
	ILOS	A(7.2)	B(12.7)	A(6.0)	A(6.7)

Negley Avenue at East Liberty Boulevard	EB	C(29.9)	F(102.0)	C(21.6)	E(58.4)
	WB	F(114.0)	C(21.5)	D(44.9)	D(37.7)
	NB	B(17.8)	B(19.8)	D(29.8)	D(35.3)
	SB	B(11.8)	A(9.5)	C(26.2)	C(27.1)
	ILOS	D(41.4)	C(24.3)	C(32.0)	D(35.7)
Centre Avenue at Kirkwood Street	EB	C(34.4)	D(41.4)	D(42.4)	D(38.5)
	WB	C(27.0)	D(40.5)	C(33.8)	D(37.2)
	NB	A(7.8)	D(44.2)	A(3.0)	C(25.5)
	SB	A(5.4)	B(10.9)	A(1.6)	A(3.2)
	ILOS	A(8.4)	D(36.8)	A(5.0)	B(24.0)
Broad Street at Larimer Avenue	EB	A(2.5)	A(6.0)	A(2.0)	A(5.0)
	WB	A(2.3)	A(4.9)	A(1.9)	A(4.6)
	NB	C(33.7)	D(41.6)	D(31.4)	D(35.2)
	SB	c(22.1)	CB(15.0)	B(19.0)	C(32.9)
	ILOS	B(9.3)	B(11.2)	A(8.1)	B(11.2)
Negley Avenue at Baum Boulevard	EB	C(23.2)	C(26.4)	C(22.7)	C(24.3)
	WB	C(25.0)	C(33.4)	C(24.5)	C(31.1)
	NB	C(30.4)	D(37.0)	C(28.7)	C(34.7)
	SB	C(26.4)	C(27.2)	C(26.1)	C(27.0)
	ILOS	C(25.2)	C(29.7)	C(24.7)	C(27.8)
Centre Avenue at Negley Avenue	EB	C(30.8)	D(35.9)	C(23.6)	D(37.6)
	WB	C(32.0)	C(34.0)	C(37.1)	D(36.1)
	NB	D(39.7)	D(45.9)	C(31.0)	D(43.7)
	SB	D(39.1)	D(40.2)	C(31.4)	D(36.0)
	ILOS	D(35.5)	D(38.9)	C(33.1)	D(38.4)
Penn Avenue at Villages of Eastside	EB			A(0.8)	A(4.1)
	WB			B(13.4)	A(6.7)
	NB				
	SB			D(35.4)	D(45.2)
	ILOS			B(11.1)	B(10.7)

B. AUXILIARY TURN LANE ANALYSIS

A review of select turn lanes was completed. The auxiliary turn lane analysis reviews the need for turn lanes at an intersection based on volume of vehicles making the select turn. TPD evaluated auxiliary turn lane warrants at the identified area intersections. The warrant analysis was conducted according to the methodologies contained in Chapter 11 of PennDOT's *Publication 46* utilizing the posted speed limits. The recommendations were then tested in the capacity analysis to ensure any recommended changes do not dramatically impact the capacity of an intersection. The auxiliary turn lane warrant analysis worksheets are contained in **Appendix E.**

Findings

Table 6 summarizes the results of the auxiliary turn lane analysis.

TABLE 6
AUXILIARY TURN LANE ANALYSIS SUMMARY

Intersection	Auxiliary Lane	Existing Conditions		Build Conditions		
		Lane Y/N	Existing Length	Warrant Satisfied	Warranted Length	Recommended Length
Negley Avenue at East Liberty Boulevard	NB Left	N	-	Y	75'	0
	NB Right	Y	150'	Y	275'	150'
	SB Left	Y	80	Y	200'	80'
Negley Avenue at Broad Street	NB Left	N	-	N		
	SB Left	N	-	N		
Penn Avenue at Negley Avenue	NB Left	Y	75'	Y	75'	75'
	NB Right	Y	150'	Y	150'	0'
	SB Left	Y	150'	Y	75'	150'
	EB Right	N		N		
Negley Avenue at Baum Boulevard	NB Left	N	-	N	-	-
	NB Right	Y	75'	N	0'	75'
	SB Left	N	-	N	0'	-
	SB Right	Y	185'	Y	200'	185'
Centre Avenue at Beatty Street	EB	N	-	Y	75'	75'
	WB	Y	80'	Y	75	75'
Centre Avenue at Highland Avenue	EB Right	Y	130'	Y	150'	0'
Penn Avenue at Centre Avenue	EB Right	N	-	N	-	-
Centre Avenue at Station Street	SB left	Y	125'	N	-	-
Penn Avenue at East Liberty Boulevard	EB Left	N	-	Y	275'	200'

C. LEFT TURN SIGNAL PHASING

Left turn signal phasing can be helpful to both vehicular traffic and pedestrian traffic. Left turn phasing reduces the number of decisions that a driver must make and reduces vehicular/ pedestrian conflicts. However, it reduces the capacity of the intersection and increases the wait time for pedestrians. Therefore, the tradeoffs must be considered. The left turn signal phasing analysis considers the left turn traffic volumes and opposing through volumes at the intersection to determine if the phasing is warranted. In some cases, phasing can be justified due to pedestrian conflicts and the desire to separate vulnerable users from vehicular traffic.

Methodology

TPD evaluated left-turn signal phasing at the study area intersections, as necessary. The evaluation of left-turn phasing was conducted according to the methodologies contained in Chapter 3 of PennDOT's *Publication 149*. There are several conditions to review when evaluating left turn phasing, but the most common criteria are as follows:

- a minimum approach volume of two left turns for each existing cycle during two or more separate one-hour periods of a normal weekday
- a specific conflict factor thresholds should also be exceeded for two separate one-hour periods during a normal weekday. A conflict factor is the product of the left turn volume and the opposing through traffic volume for a one-hour period of a normal weekday.
- Other considerations include pedestrian conflicts, crash data, and level of service.
- Meeting these thresholds only indicates the need for a left turn phase, but the type of operation should be the most safe and efficient operation.

The left-turn phasing analysis worksheets are included in **Appendix G**. **Table 7** summarizes the results of the left-turn signal phasing evaluation.

TABLE 7
LEFT-TURN SIGNAL PHASING SUMMARY

Intersection	Direction	Full Build-Out/Design Year (2025/2030)		
		Existing Left-Turn Phasing	Pub 149 Calculated Left-Turn Phasing	Recommended Left-Turn Phasing
Negley Avenue at East Liberty	SB	Protected/Permitted	Protected/Prohibited	Protected/Prohibited
Negley Avenue at Centre Avenue	NB/SB	None	None	Protected/Permitted
	EB/WB	None	None	Protected/Permitted
Centre Avenue at Highland Avenue	EB/WB	None	None	Protected/Permitted
	NB/SB	None	None	Protected/Permitted
Penn Avenue at Highland Avenue	NB/SB	None	None	Protected/Prohibited
	EB	None	Protected/Permitted	Protected/Prohibited
	WB	None	None	Protected/Prohibited
Penn Avenue at East Liberty Boulevard	EB	Protected/Permitted	Protected/Prohibited	Protected/Prohibited*
	WB	None	Protected/Prohibited	Protected/Prohibited*

*Can only be implemented if the movement is in an exclusive lane.

As seen in the table there are several instances where protected/permitted or protected/prohibited phasing is recommended without meeting the conflict factor threshold. The recommendation for the protected phase is a result of the crash analysis and LOS analysis. The protected phase allows for the separation of pedestrians from left turns which reduces conflicts at the intersection. The LOS was reviewed to ensure that a minimum LOS D could be maintained.

D. ALTERNATIVE ANALYSES – BAUM BOULEVARD AT HIGHLAND AVENUE

During field investigation, improvements to the intersection of Baum Boulevard and Highland Avenue was discussed due to public comments regarding pedestrian safety, bus loading issues, and traffic safety. During the field view, a heavy left turn volume was observed from Baum Boulevard to NB Highland Avenue which impacts the ease and safety of pedestrian crossings. Three alternatives for improving this intersection are further discussed in this section.

Baum Boulevard One way between South Whitfield Street and Highland Avenue

The first alternative for remediating concerns was to review the possibility of establishing Baum Boulevard between South Whitfield Street and Highland Avenue as one way westbound. There is the potential to provide back in angle parking on one side with parallel parking on the other thereby increasing the on-street parking supply. This scenario eliminates the volume approaching Highland Avenue from Baum but increases traffic along other streets like Whitfield Street.

At the current time, with the Penn Circle Conversion Project about to begin, the impact of this network change is difficult to quantify. The Penn Circle conversion will change traffic patterns in East Liberty and has the potential to greatly reduce traffic at Baum Boulevard and Highland Avenue since traffic will be able to turn left at Baum Boulevard and Euclid Avenue.

Based on the existing PM peak traffic counts, approximately 350 vehicles travel EB straight through the Baum Boulevard/Euclid Avenue intersection. From there traffic can disperse through Beatty Street, Trade Street, Whitfield Street or Highland Avenue.

In reviewing the origin-destination data for the traffic on Baum Boulevard at Highland Avenue, there is a substantial draw toward Penn Avenue, (74 percent). **Table 8** summarized the origin-designation data was utilized in the review. When the Penn Circle conversion occurs, this traffic may be more likely to turn left at Euclid to reach Penn Avenue. If that occurs, there may be increased queues in the through/left lane at Baum Boulevard/Euclid Avenue pushing the traffic that would have turned right at Baum Boulevard/Highland Avenue to turn right at Euclid Avenue instead.

In considering volume reduction techniques for the block of Baum Boulevard at Highland, the Penn Circle Conversion Project may have an overall positive impact. Additional visual cues at Baum Boulevard at Euclid Avenue could also direct drivers to more desirable routes. If community support exists for this scenario, it is recommended to further study this after the opening of the Penn Circle two-way conversion.

TABLE 8
ORIGIN-DESTINATION INFORMATION FOR
BAUM BOULEVARD AT HIGHLAND AVENUE

Origin/ Destinations	Destination											
	E. Penn		% Of 2021	W. Penn		% Of 2021	N. Highland (After Penn Intersection)		% Of 2021	S. Highland		% Of 2021
	2019	2021		2019	2021		2019	2021		2019	2021	
Origin-Baum Boulevard Avg. All Day 24 hrs (Weekday)	4785	2019	26%	4873	3671	48%	1312	1370	18%	1547	611	8%
Early Peak (6-10 AM)	668	239	27%	667	420	48%	195	170	19%	193	50	6%
Mid day (10 AM-3PM)	1183	585	25%	1202	1130	48%	397	437	18%	423	224	9%
Peak PM (3 PM-7PM)	1822	630	25%	1885	1215	48%	482	461	18%	595	218	9%
Late PM (7 PM-12 AM)	865	421	28%	876	717	48%	197	245	16%	287	103	7%

- Baum Boulevard to the East along Penn Avenue 27%
- Baum Boulevard to the West along Penn Avenue 48%
- Baum Boulevard to North Highland beyond Penn Avenue 18%
- Baum Boulevard to South Highland 7%

Baum Boulevard at Highland Avenue Right in Right out only with restrictions to the opposing garage
A second alternative that was reviewed was to modify the Baum Boulevard approach and the private garage to right-in/right-out only. This could be accomplished with a median island or a triangular shaped island on Baum Boulevard with signage at the garage. This alternative doesn't eliminate vehicular conflicts at the intersection but does reduce them and eliminates a left turn that is difficult and congested in the peak hours.

A median island that forces only right turns at the intersection could also benefit pedestrians wishing to cross Highland Avenue at this location by providing a pedestrian refuge. A triangular shaped island on the approach could assist pedestrians wishing crossing Baum Boulevard. Without physical islands to block the prohibited movements, compliance may be compromised.

In the peak hours observed queues along Highland Avenue from both Centre Avenue and Penn Avenue extend beyond this intersection. Due to this issue, the right in/right out alternative is not recommended.

Pedestrianize Baum Boulevard from Highland Avenue to South Whitfield Street
A third alternative that was considered was to pedestrianize Baum Boulevard between Highland Avenue and Whitfield Street. This is the most impactful option considered with respect to vehicular restrictions and access to adjacent buildings. It is expected that traffic on Beatty Street and Whitfield Street would increase under this scenario. However, it does create a plaza and programmable space that could enhance the area.

Currently, buildings appear to use Commerce Street for deliveries, but customer loading areas would be impacted. Additionally, coordination with property owners is needed to determine if Commerce Street could be used as a dead end or if accommodations would be needed for it to egress to Baum with a route through the pedestrianized area. Due to the complications with access and loading, this alternative is not recommended at this time. If it was a preferred option, targeted public involvement would be necessary to ensure suitable accommodations can be made for adjacent property owners.

E. ALTERNATIVE ANALYSES – PENN AVENUE AT CENTRE AVENUE

The intersection of Penn Avenue at Centre Avenue was observed and reviewed thoroughly. More public comments have been received regarding this intersection than any other. Comments and observations indicate challenges for both pedestrian and vehicular traffic. Pedestrians have difficulties crossing the intersection due to the high turning movements and vehicular volumes in general. Vehicular drivers are faced with heavy congestion and atypical signal phasing. Three alternatives were reviewed for the intersection.

Signal Removal at the intersection of Kirkwood Street and Centre Avenue

In order to improve traffic operations at Penn Avenue at Centre Avenue, an alternative to remove the signal at Kirkwood Street and Centre Avenue was evaluated and a traffic signal warrant analysis was conducted. The analysis was conducted using existing traffic volumes. The traffic signal warrant analysis was conducted in accordance with PennDOT Publication 212, *Official Traffic Control Devices*, Subchapter D, "Highway Traffic Signals".

The existing traffic volumes were evaluated at the subject intersection to determine if the following applicable warrants are satisfied currently.

- Warrant 1, Eight-Hour Vehicular Volumes Warrant.
- Warrant 2, Four-Hour Vehicular Volume Warrant.
- Warrant 3, Peak Hour Volume Warrant.

All relevant signal warrant analysis worksheets and supporting documentation, including the signal warrant volume development calculations, are included in **Appendix F**.

Findings

Table 9 summarizes the results of the preliminary traffic signal warrant analysis.

TABLE 9
TRAFFIC SIGNAL WARRANT ANALYSIS SUMMARY

Intersection	Warrant	Warrant Satisfied?
Kirkwood Street and Centre Avenue	Warrant 1, Eight-Hour Vehicular Volume	Yes
	Warrant 2, Four-Hour Vehicular Volume	No
	Warrant 3, Peak Hour Volume	No

As can be seen from the table, the existing signal meets the signal warrants, therefore removal would be difficult. It should be noted that there is a second signalized access to the garage on Broad Street. To mitigate the need for a traffic signal, an alternative to make Kirkwood Street right out only and Target Driveway enter only at Centre Avenue, would eliminate the need for the traffic signal.

Kirkwood Right out & Garage Enter Only

This alternative evaluates the removal of the traffic signal at Centre Avenue & Kirkwood Street/Target Garage Entrance. The Target Garage entrance on Centre Avenue would be made enter only. Exiting traffic would be rerouted to the other existing signalized exit at Broad Street & Larimar Avenue. The benefit of this would be to eliminate a signal with less than 200 feet of spacing on Centre Avenue between the Target Garage and Penn Avenue. The traffic signal at Centre Avenue & Broad Street is able to accommodate the rerouted traffic signal with the addition of a protected/permitted left turn arrow on WB Broad Street.

The benefits of this improvement include:

- Elimination of closely spaced traffic signals on Centre Avenue between Penn and Broad.
- The ability to maintain traffic progression along Centre Avenue with greater signal spacing.
- Eliminate the "dead time" caused by early return to green on Centre Avenue or the yellow/red change on Centre Avenue which affects traffic flow at the oversaturated signal at Centre Avenue & Penn Avenue.
- The traffic signal at Broad Street & Larimar Avenue/Garage is under capacity and can accommodate all exiting traffic from the garage.
- The traffic signal at Centre Avenue & Broad Street is under capacity and can accommodate the rerouted traffic from the garage with the additional of a protected/permitted left turn arrow for WB Broad Street.
- Queues and delay on SB Centre Avenue at Penn Avenue would decrease slightly with better progression on Centre Avenue due to the signal removal.

The LOS summary for this improvement is shown in **Table 10** as the Build Option 2 improvement.

Traffic signal removals require specific criteria and study. It is recommended to further study this recommendation in conjunction with the opening of the Penn Circle two-way conversion. The conversion could have an impact on the traffic patterns throughout East Liberty. The traffic signal appears to be very near the traffic signal warrant thresholds. If traffic patterns reroute exiting traffic to Broad Street or network changes make Broad Street and Station Street more convenient, the usefulness of the existing signal at Kirkwood would be questionable.

TABLE 10
LEVEL OF SERVICE ANALYSIS FOR
KIRKWOOD RIGHT OUT & GARAGE ENTER ONLY

Intersection	Approach/ Movement	Existing AM	Existing PM	Build 2 AM	Build 2 PM
Penn Avenue at Centre Avenue	EB	D(44.5)	D(40.9)	E(60.2)	D(49.9)
	WB	F(92.9)	D(47.9)	E(63.1)	D(48.9)
	NB	B(14.7)	C(21.2)	C(31.5)	C(21.6)
	SB	C(27.5)	D(41.3)	D(38.3)	C(29.6)
	ILOS	**D(54.5)**	**D(37.5)**	**D(50.7)**	**D(37.7)**
Broad Street at Larimer Avenue	EB	A(2.5)	A(6.0)	A(3.1)	A(9.9)
	WB	A(2.3)	A(4.9)	A(3.0)	A(9.0)
	NB	C(33.7)	D(41.6)	D(36.8)	D(37.2)
	SB	c(22.1)	CB(15.0)	D(37.3)	C(26.0)
	ILOS	**B(9.3)**	**B(11.2)**	**B(15.2)**	**B(18.0)**
Centre Avenue at Broad Street	EB	C(34.0)	C(31.9)	C(33.4)	D(35.6)
	WB	D(41.5)	C(54.1)	C(26.3)	C(20.8)
	NB	B(19.0)	A(9.4)	B(11.9)	C(32.0)
	SB	A(8.2)	A(8.4)	B(17.3)	A(4.6)
	ILOS	**C(26.4)**	**C(27.6)**	**C(20.7)**	**C(25.4)**

(1) Build 2 evaluates the intersections with traffic rerouted due to a proposed right out and Target Garage enter only

Penn Avenue at Centre Avenue Leading Through Interval

The two options presented in the chart above for the intersection of Penn Avenue at Centre Avenue are both longer term projects with either physical or extensive coordination involved. Alternatively, a scenario including only timing and phasing changes was evaluated. The intersection currently has a leading pedestrian interval for the crosswalks on the west & east legs of the intersection. Due to the right turn conflicts the leading pedestrian interval was not implemented at the north and south crosswalks.

A leading through interval (LTI) is similar to the leading pedestrian interval, but also allows the through traffic to move with the pedestrian advance. At this intersection, a LTI could be implemented on both the westbound and northbound approaches, giving some conflict free crossing time to the pedestrians in the east crosswalk and the north crosswalk. These are the two crossings that have the most pedestrian complaints. They are the widest pedestrian crossings, and they have heavy right turn traffic with exclusive lanes and phases that oppose them.

The LTI was modeled in the capacity software for the intersection under both existing roadway geometry and the Build 1 plan. Improvement Plan 3 evaluates Penn Avenue at Centre Avenue with the LTI. Improvement Plan 5 evaluates the intersection with the LTI and the reduction in the eastbound right lane as discussed in Improvement Plan 1. Both scenarios show improvement over existing operation since the all-stop of the LPI is replaced with some vehicular movement during a conflict free partial pedestrian interval.

Although this is a unique approach, it is a low-cost solution that could be implemented rapidly. If compliance is low or drivers do not appear to understand the signals, the intersection should revert back to the existing signal phasing.

The LOS summary for this improvement is shown in **Table 11**. Build Option 3 is the LTI under existing roadway conditions and Build Option 5 is LTI with the recommendations from the Build 1 scenario.

TABLE 11
LEVEL OF SERVICE ANALYSIS FOR
PENN AVENUE AT CENTRE AVENUE LEADING THROUGH INTERVAL

Intersection	Approach/ Movement	Existing AM	Existing PM	Build 3 AM	Build 3 PM	Build 5 AM	Build 5 PM
Penn Avenue at Centre Avenue	EB	D(44.5)	D(40.9)	C(29.6)	D(36.7)	D(40.0)	D(43.8)
	WB	F(92.9)	D(47.9)	D(37.5)	C(31.7)	D(37.5)	C(31.6)
	NB	B(14.7)	C(21.2)	C(23.6)	D(36.6)	C(23.6)	D(38.6)
	SB	C(27.5)	D(41.3)	C(34.4)	D(35.7)	C(34.4)	D(38.7)
	ILOS	**D(54.5)**	**D(37.5)**	**C(32.9)**	**C(34.9)**	**C(34.6)**	**D(37.3)**

(1) Build 3 evaluates Penn Avenue at Centre Avenue with the LTI.
(2) Build 5 evaluates the intersection with the LTI and the reduction in the eastbound right lane as discussed in Improvement Plan 1.

F. ALTERNATIVE ANALYSES – NEGLEY AVENUE AT PENN AVENUE

Negley Avenue at Penn Avenue Roundabout

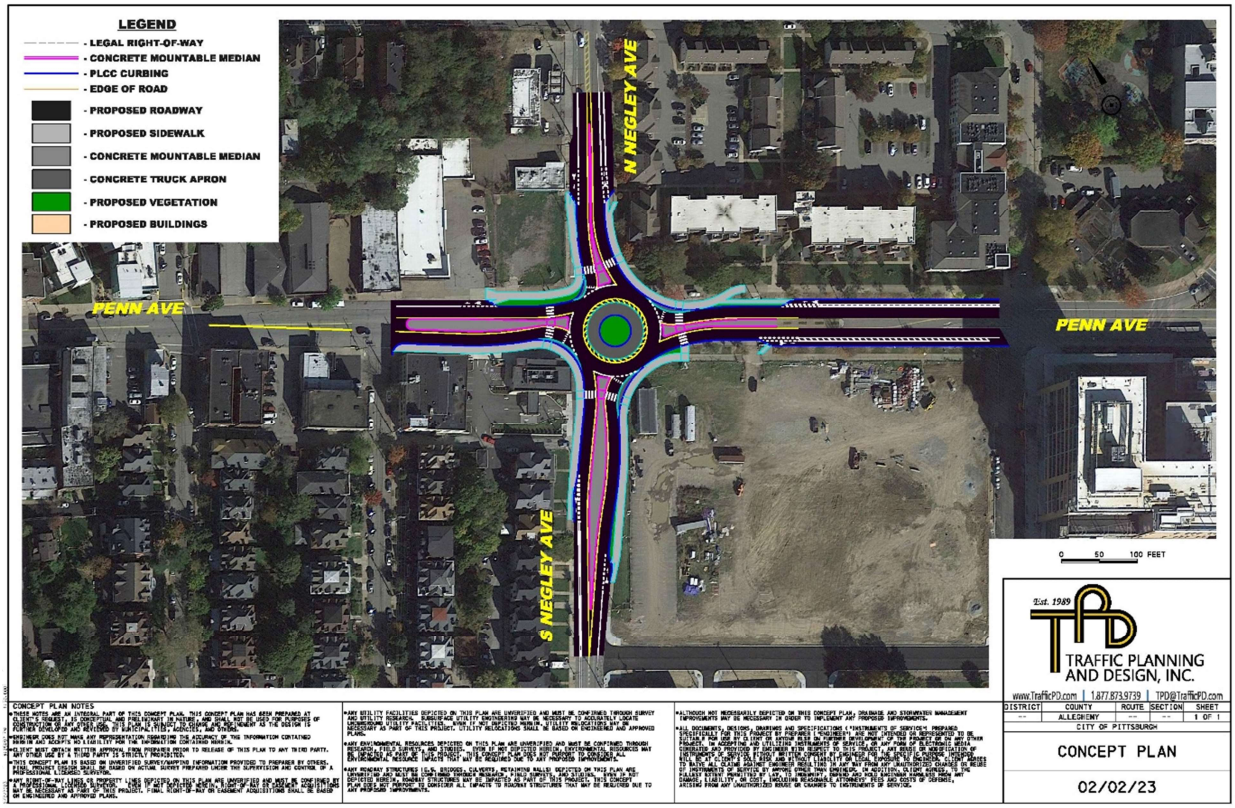
In addition to optimizing signal timings and reviewing the lane arrangement at the Negley Avenue and Penn Avenue Intersection, a preliminary assessment to convert the intersection to a roundabout was reviewed. A roundabout was evaluated because the existing intersection has a large footprint; all roads leading to the intersection are one lane in each direction; and the intersection serves as a gateway to East Liberty, Bloomfield and Friendship.

A 90-foot inscribed circle was used for the design concept. Minimum sidewalk widths of ten feet were maintained around the circle to allow cyclists to share the sidewalks. Some right of way impacts occur in the southeast quadrant of the intersection. See **Appendix J** for the full-size concept plan. The LOS summary for this improvement is shown in **Table 12** with the roundabout LOS Build Option 4 below.

TABLE 12
LEVEL OF SERVICE ANALYSIS FOR
NEGLEY AVENUE AT PENN AVENUE ROUNDABOUT

Intersection	Approach/ Movement	Existing AM	Existing PM	Build 4 AM	Build 4 PM
Penn Avenue at Negley Avenue	EB	E(56.0)	D(40.9)	B(11.8)	C(17.7)
	WB	D(37.3)	D(43.7)	B(14.9)	F(62.0)
	NB	C(28.0)	E(58.0)	A(7.5)	F(120.2)
	SB	D(50.0)	D(53.4)	D(30.3)	B(11.2)
	ILOS	D(43.6)	D(49.3)	**C(18.4)**	**F(59.6)**

In review of the capacity analysis, the Max v/c ratio for the morning time period is 0.72 and for the afternoon is 0.97. Although these are both less than 1, manual traffic counts were not available so caution must be used considering the results. Turning movement counts utilized in the analysis were taken from Inrix data which is compiled from Bluetooth devices. This is acceptable for a planning study, but should this alternative be advanced, additional analysis is recommended.



IV. POTENTIAL NEW CROSSWALKS

Based on the existing demand and walking routes observed during the field view, there are several pedestrian desire lines identified where pedestrians were noted but crosswalks were missing. Three locations where marked crosswalks are proposed to be installed:

- East Liberty Boulevard at Sheridan Avenue
- East Liberty Boulevard at Beatty Street
- Negley Avenue at Broad Street

East Liberty Boulevard at Sheridan Avenue

A crosswalk at East Liberty Boulevard and Sheridan Avenue is being recommended to accommodate a desire line that is evident by the worn in paths over the landscaped median. East Liberty Boulevard has a 35-mph speed limit with an ADT of 10,998 vehicles per day near Sheridan Avenue. In this area, East Liberty Boulevard is one travel lane, one bike lane, and one parking lane in each direction. In the recommended condition, it is envisioned to have curb extensions on both corners of the intersection and an accessible median cut through at Sheridan Avenue to allow for pedestrian crossings. The crossings would be marked with high visibility markings, a raised crossing, and pedestrian actuated RRFBs including passive detection.

East Liberty Boulevard at Beatty Street

East Liberty Boulevard at Beatty Street is also clearly a desire path as evident by the worn paths across the landscape median. East Liberty Boulevard has a speed limit of 35 mph and an ADT of 9,014 vehicle per day near Beatty Street. It includes one travel lane, one bike lane, and one parking lane in each

direction. It is also adjacent to the Obama Academy, a Pittsburgh Public School housing grades 6-12 and falls within the 15 mph school zone.

In the recommended condition, it is envisioned to have curb extensions on both corners of the intersection and an accessible median cut through at Beatty Street to allow for one pedestrian crossing. The crossings would be marked with high visibility markings, a raised crossing, and pedestrian actuated RRFBs including passive detection.

Although parking is permitted on East Liberty Boulevard, curb extensions are recommended to prohibit parking in close proximity to the crosswalks and provide the required sight distance of approximately 305 feet.

Negley Avenue at Broad Street

Crosswalks are being proposed to cross Negley Avenue at Broad Street to provide a more visible crossing to/from the bus stops at the intersection. The intersection has experienced three pedestrian crashes in the last five years. The Negley Avenue approaches are uncontrolled and consist of one lane in each direct with a NB parking lane. Negley Avenue has a speed limit of 25 miles per hour and an ADT of 12,454 vehicles per day. The 85th percentile speeds are 33 mph northbound and 32 mph southbound.

The recommended design of the intersection is to include curb extensions on the corners to eliminate parking/visibility obstructions near the intersection; a six-foot-wide concrete pedestrian refuge island in the center of the street to allow for a staged crossing; high visibility markings; and a pedestrian actuated RRFB.

V. TRANSIT AMENITIES IMPROVEMENTS

The bus stops were reviewed in the project area for appropriate spacing and amenity improvements. The analysis was conducted according to the guidelines contained in the Port Authority of Allegheny County Bus Stop and Street Design Guidelines, 2019.

During the public comment phase of the project, comments regarding public transit were received. The following is a summary.

- Bus stops were requested at:
  - Inbound Penn Avenue at Spirit Street
  - Penn Avenue near St Clair Street

- Bus stops consolidations were requested:
  - On Penn between Euclid Avenue and Centre Avenue

- Additional amenities were requested at:
  - 501 North Negley – Garbage Can
  - 5917 Penn Avenue – Shelter
  - 6315 Penn Avenue – Larger stop

- Layovers were requested at:
  - 115 North Beatty Street

Bus shelters

In order to encourage greater transit ridership, comfortable bus stops and convenient access along with safer walking routes to bus stops could reduce barriers to public transit and make public transit more competitive with other modes of transportation. Ideally, following the PRTs recommendations for shelter locations, a bus stop would include a shelter where more than 30 passengers board per day. Bus shelters provide protection from the sun, wind and rain. **They should be ADA accessible, well lit, and include a garbage can.**

There are currently bus shelters located at stops that serve very few passengers and conversely, very busy stops that lack shelters. Rebalancing of the shelters is necessary as the system changes. **Tables 13, 14, 15** show the existing bus shelter locations, Shelters that could be removed, and additional bus shelter locations based on the PRTs ridership criteria.

TABLE 13
EXISTING BUS SHELTER LOCATIONS

Stop Name	Direction	Routes Serviced	Weekday FY2021
PENN AVENUE AT HIGHLAND AVENUE	Outbound	71C, 74, 77, 82, 86, 88, 89	132
PENN AVENUE AT SHADY AVENUE FS (GIANT EAGLE)	Outbound	71C, 74, 75, 77, 82, 86, 88, 89	120
PENN AVENUE AT HIGHLAND AVENUE	Inbound	71C, 74, 77, 82, 86, 88, 89	119
PENN AVENUE AT EASTSIDE III DR[1]	Outbound	71C, 74, 77, 82, 86, 88, 89	106
NEGLEY AVENUE AT CENTRE AVENUE [5]	Inbound	71A, 71C	86
CENTRE AVENUE AT NEGLEY AVENUE	Inbound	82, 86	59
EAST LIBERTY BOULEVARD AT FRANKSTOWN AVENUE	Outbound	74, 75, 77, 82, 86, 89, P17	38
BEATTY STREET AT CENTRE AVENUE	Inbound	82, 86	14
CENTRE AVENUE AT S EUCLID AVENUE	Inbound	82, 86	14
HIGHLAND AVENUE AT EAST LIBERTY BOULEVARD[4]	Inbound	71B	7
CENTRE AVENUE AT WHOLE FOODS	Outbound	82, 86	7
PENN AVENUE AT NEGLEY AVENUE	Inbound	88	6
EAST LIBERTY BOULEVARD AT NEGLEY RUN BOULEVARD	Outbound	75, 89	6

1. This stop is within the transit station and includes shelter and garbage cans.
2. Per PRTs bus stop and Street Design Guidelines, bus stops are proposed to have shelters where >30 boardings per day occur.
4. The bus stop on Highland Avenue at East Liberty Boulevard no longer exists. It should be removed from the inventory.
5. The bus stop on Negley Avenue at Centre Avenue exists and should be added to the inventory.

TABLE 14
EXISTING BUS SHELTERS TO BE REMOVED
BASED ON RIDERSHIP

Stop Name	Direction	Routes Serviced	Ons Avg Weekday FY2021
BEATTY STREET AT CENTRE AVENUE	Inbound	82, 86	14
CENTRE AVENUE AT S EUCLID AVENUE	Inbound	82, 86	14
CENTRE AVENUE AT WHOLE FOODS	Outbound	82, 86	7
PENN AVENUE AT NEGLEY AVENUE	Inbound	88	6
EAST LIBERTY BOULEVARD AT NEGLEY RUN BOULEVARD	Outbound	75, 89	6

1. Per PRTs bus stop and Street Design Guidelines, bus stops are proposed to have shelters where >30 boardings per day occur.

TABLE 15
ADDITIONAL BUS SHELTER LOCATIONS
BASED ON RIDERSHIP

Stop Name	Direction	Routes Serviced	Ons Avg Weekday FY2021
PENN AVENUE AT SHERIDAN AVENUE	**Inbound**	**71C, 74, 77, 82, 86, 88, 89**	**79**
PENN AVENUE AT VILLAGE OF EASTSIDE SHPG CTR	**Inbound**	**71C, 74, 75, 77, 82, 86, 88, 89**	**40**
PENN AVENUE OPP SHADY AVENUE	**Inbound**	**71C, 74, 77, 82, 86, 88, 89**	**29**

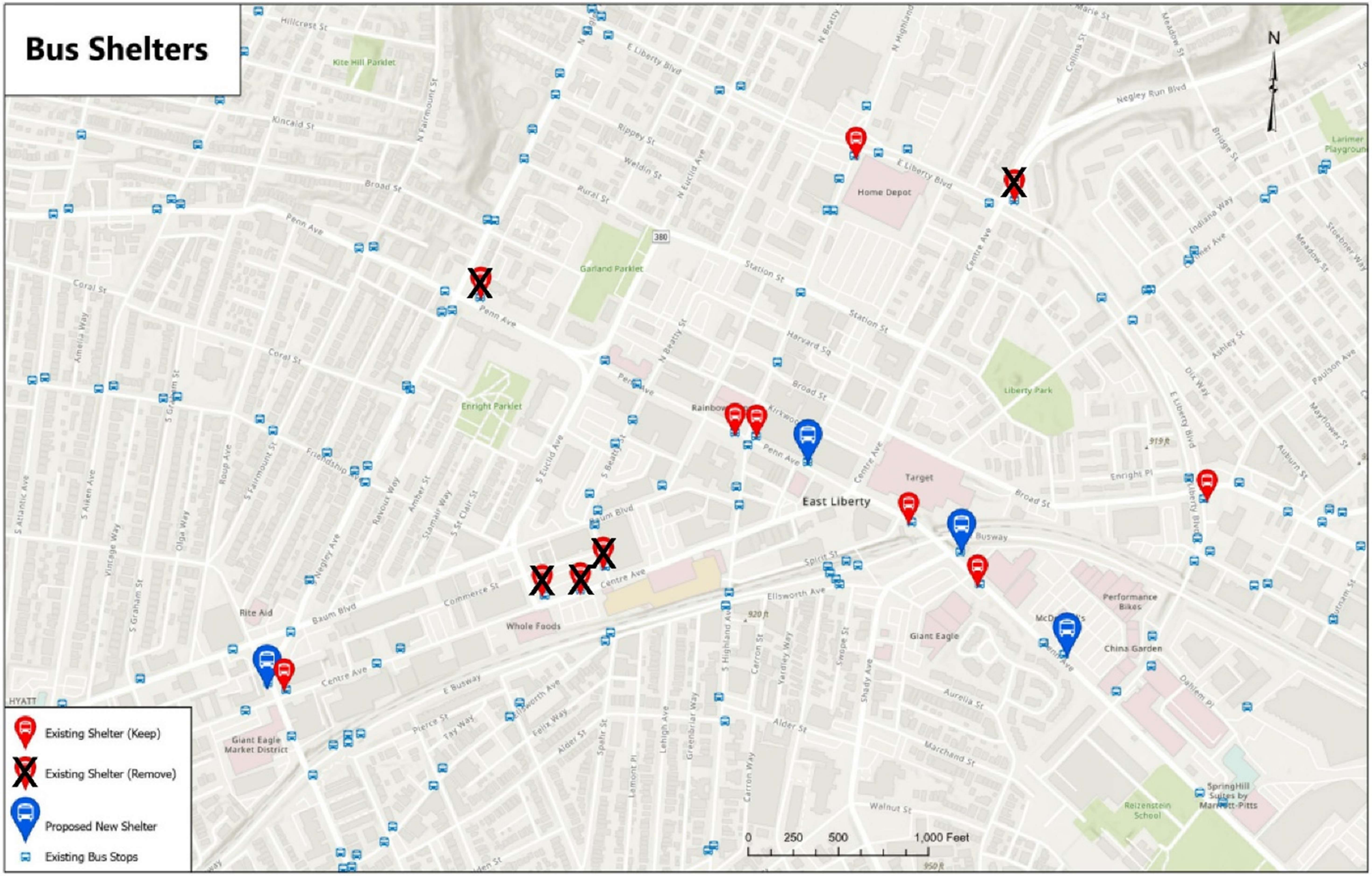
1. Bold items are new shelter locations.
2. The stop with 29 boarding passengers was included in the potential bus shelter location, since it is near a future development site.

It may be challenging to find the physical space to install a shelter at some of the proposed bus shelter locations given the dense urban landscape. However, there may be opportunities in the future.

- At Negley Avenue and Centre Avenue, the roadway could be permanently reconfigured to match the pavement markings creating additional space on the sidewalk for a shelter.
- On Penn Avenue at the Village of Eastside, either a narrow shelter on the sidewalk or an easement with future redevelopment of the site opportunities.
- At Penn Avenue opposite Shady, a future development could be required to provide a shelter and easement based on the criteria provided in PRTs design guides.

The City of Pittsburgh contracts with a shelter company to install and maintain shelters. They have a variety of different designs to fit the urban street environment. In the event that a shelter cannot be found to fit, a leaning rail should be considered.

Bus Shelters



Benches

Following the PRTs recommendations for bench stop locations, a bench stop is where 10 to 30 passengers per day board transit. Benches or lean rails are ideal for narrow locations and can provide passengers an area to rest while waiting. The stop should be ADA accessible, well-lit, and include a garbage can. The following table shows the stops with average ridership below 30 to 10 riders per day. **Table 16** provides locations that meet these criteria.

TABLE 16
POTENTIAL BENCH/TRASH CAN LOCATIONS

Stop Name	Direction	Routes Serviced	Ons Avg Weekday FY2021	Proposed Amenity
NEGLEY AVENUE AT PENN AVENUE	Outbound	71A, 71C, 77, 87	27	Bench Garbage Can
NEGLEY AVENUE AT CORAL STREET	Inbound	71A, 71C, 77, 87	24	Leaning Rail Garbage Can
HIGHLAND AVENUE AT BAUM BOULEVARD	Inbound	71B	20	Bench Garbage Can
NEGLEY AVENUE AT FRIENDSHIP AVENUE	Inbound	71A, 71C, 77	18	Leaning Rail Garbage Can
NEGLEY AVENUE AT PENN AVENUE FS	Inbound	71A, 71C, 77, 87	17	Bench Garbage Can
BEATTY STREET AT PENN AVENUE NS	Both	74, 82, 86, 89	16	Bench Garbage Can
HIGHLAND AVENUE AT PENN AVENUE	Outbound	71B	15	Leaning Rail Garbage Can
NEGLEY AVENUE AT BLACK STREET	Inbound	71A, 87	15	Leaning Rail Garbage Can
BEATTY STREET AT CENTRE AVENUE	Inbound	82, 86	14	Bench Garbage Can
CENTRE AVENUE AT S EUCLID AVENUE	Inbound	82, 86	14	Bench Garbage Can
NEGLEY AVENUE AT MARGARETTA STREET [3]	Inbound	71A, 87	13	Leaning Rail Garbage Can
NEGLEY AVENUE AT HAYS STREET	Inbound	71A, 87	12	Leaning Rail Garbage Can
PENN AVENUE OPP VILLAGE OF EASTSIDE SHPG CTR	Outbound	71C, 74, 75, 77, 82, 86, 88, 89	12	Bench Garbage Can
HIGHLAND AVENUE AT HAYS STREET	Inbound	71B, 75	11	Bench Garbage Can
NEGLEY AVENUE AT BROAD STREET	Inbound	71A, 87	10	Leaning Rail Garbage Can
NEGLEY AVENUE OPP RIPPEY STREET FS[1]	Inbound	71A, 87	10	Leaning Rail Garbage Can
PENN AVENUE AT EUCLID AVENUE	Inbound	71C, 77, 88	10	Bench Garbage Can

1. Pending bus stop consolidation.
2. Currently the bus stop at Negley opposite Rural sees lower numbers than would justify a bench or additional amenities. However, there are development proposals for both sides of Negley Avenue currently underway and if any stop consolidation occurs, the remaining stops may see increased ridership.
3. Location mentioned in transit comment #1.

Stop Consolidation and Stop Additions
In addition to providing bus stop amenities to compete with other modes of transportation, public transit must weigh the convenience of additional stops and the delay each stop adds to the overall trip, which in turn impacts system costs and passengers commute times. In high density locations, the PRT has an ideal stop spacing of 650 feet for key corridors and local routes. The majority of the study area meets this criterion; however, a number of study area locations do not, as noted below.

Negley Avenue from Broad Street to Hays Street
Within approximately 2500 feet there are seven pairs of bus stops. Inbound and outbound bus stops at both Black Street and Rippey Street should be considered for consolidation.

Highland Avenue from Rippey Street to Hays Street
Rippey Street is approximately 350 feet south of East Liberty Boulevard. There is both a nearside and a farside stop on Highland Avenue at East Liberty Boulevard. This leads to three inbound bus stops in very close proximity and two outbound bus stops very close together. Ideally, the Rippey Street stops would be consolidated into the nearby stops. The inbound Highland at East Liberty stop would be a far side stop incorporating a bus loading platform that extends along the sidewalk for greater capacity.

Penn Avenue from Euclid Avenue to Centre Avenue
The spacing of the inbound stops between Penn at Sheridan and Penn at Highland is about 300 feet, which is considerably less than the 650 feet minimum desirable spacing recommended by the PRT. However, the boarding numbers at both locations are substantial and combining the stops may result in overcrowding of the sidewalk, therefore, it is recommended that these two stops remain separate.

Since the opening of Whole Foods on Penn Avenue between Negley Avenue and Euclid Avenue, an outbound bus stop has been added on Penn Avenue at St Clair Street. An inbound stop at St Clair Street is planned to be installed with enhanced pedestrian crossing features.

VI. CONCLUSIONS

Five major transportation corridors were reviewed within the East Liberty neighborhood with regard to pedestrian safety, traffic safety and transit accessibility. This section summarized the conclusions of the report.

A. PEDESTRIAN SAFETY COUNTERMEASURES

The following conclusions are related to the pedestrian safety within the study corridor. Recommendations are provided separately.

- Penn Avenue from East liberty Boulevard to North Negley Avenue
  - Penn Avenue from East Liberty Boulevard to Centre Avenue is a state-owned roadway. Therefore, any improvements must be coordinated and permitted through the state.
  - Penn Avenue from East Liberty Boulevard to Spirit Street has a higher speed limit with less frequent pedestrian crossings. Each of the intersections through this area have a history of pedestrian crashes.
  - Penn Avenue at Centre is challenging to navigate as a pedestrian and has seen multiple pedestrian crashes.

- Penn Avenue at Highland Avenue has a crash history that includes pedestrian crashes.
- Penn Avenue at Negley Avenue is a wide intersection with multiple turn lanes and outdated traffic signals. The crash history includes both bicycle and pedestrian crashes.
- Crossing concerns exist throughout the Penn Avenue corridor.

» Centre Avenue from N Negley Avenue to East Liberty Boulevard

- Centre Avenue at Negley Avenue has an exclusive pedestrian phase but still has a history of pedestrian crashes.
- Centre Avenue at Highland Avenue has skewed geometry and the crosswalk on the west leg sits back from the intersection where it is obscured by the building. The intersection has a history of pedestrian crashes.
- Centre Avenue at East Liberty Boulevard has antiquated signal equipment lacking countdown pedestrian signals.
- Generally, corridor wide the crosswalk markings need refreshed and should be updated to high visibility markings as needed.

» Highland Avenue from Centre Avenue to St Marie Street

- Highland Avenue from St Marie Street to East Liberty Boulevard has an 85th percentile speed of 34 mph, which is 9 mph over the posted speed limit.
- On Highland Avenue at the field there are bus stops on each side of Highland Avenue. The location lacks a crosswalk.
- The Obama Academy is located northwest of the intersection of Highland Avenue and East Liberty Boulevard. The students use public transportation which requires them to cross both East Liberty Boulevard and Highland Avenue. The traffic signal is actuated meaning the walk signal only displays when the push button is pressed.
- Highland between East Liberty Boulevard and Station Street has designated on street parking that is used sparingly. There are pedestrian crossing issues at the uncontrolled intersection locations due to drivers not yielding.
- Highland Avenue at Station Street is a high crash location that will be reconstructed with the Penn Circle conversion project currently under construction.
- Highland between Station Street and Penn Avenue has frequent parking that is too close to the intersection blocking visibility for drivers trying to enter Highland Avenue.
- Highland Avenue at Baum Boulevard has heavy pedestrian usage due to nearby land uses, residential, restaurant, and parking, but lacks convenient and safe crossing treatments. It has a history of pedestrian crashes.

» N Negley Avenue from Centre Avenue to Hays Street

- Negley Avenue at Baum Boulevard is missing a desirable crosswalk along the north approach. The intersection has a history of pedestrian crashes.
- Negley Avenue from Baum to Coral has an 85th percentile speed of 32 mph southbound 31 mph northbound.
- The Coral Street neighborway begins/ends at Negley Avenue. The intersection lacks marked crosswalks. Turning on/off Coral Street on a bike and crossing Coral Street as a pedestrian can be difficult.

- Negley Avenue from Broad Street to Stanton Avenue has an 85th percentile speed of 33 mph southbound and 32 mph northbound.
- Negley Avenue at Broad Street has a history of pedestrian crashes. There are bus stops on both sides of the street with few gaps in traffic for pedestrians to cross.
- Negley Avenue at East Liberty Boulevard has multiple bus stops. The crossing of East Liberty Boulevard is very wide and the intersection lacks pedestrian countdown signals.
- Negley Avenue at Black Street has substantial turning traffic that conflicts with bike and pedestrian movements. The intersection has a history of pedestrian crashes. The signal equipment if programmed for replacement.

» East Liberty Boulevard from N Negley Avenue to Penn Avenue

- The intersections of East Liberty Boulevard at Euclid, East Liberty Boulevard at Centre/Negley Run and the intersection of East Liberty Boulevard at Larimar Avenue lack have outdated signal equipment that lack pedestrian countdown heads.
- East Liberty Boulevard at Beatty Street, East Liberty Boulevard at Selma Street and East Liberty Boulevard at Sheridan Street are locations of clear pedestrian activity but lack crosswalks and a median break to facilitate an ADA acceptable crossing.
- East Liberty Boulevard at Larimer Avenue and East Liberty Boulevard at Broad/Frankstown have pedestrian visibility issues due to the presence of parked cars.
- Crosswalks along the corridor should be upgraded to high visibility as applicable.

B. TRAFFIC SAFETY COUNTERMEASURES

The following conclusions are related to the traffic safety within the study corridor. Recommendations are provided separately.

» Penn Avenue from East liberty Boulevard to North Negley Avenue

- Signal equipment is antiquated, and signage is faded at Penn Avenue at East Liberty Boulevard, Penn Avenue at Highland Avenue and Penn Avenue at Negley Avenue.
- The intersection of Penn Avenue at East Liberty Boulevard experiences heavy left turns and has a history of angle crashes.
- From Penn Avenue onto Shady Avenue the right turn is difficult for buses to maneuver.
- Left turning traffic at Sheridan Sq, Whitfield Street and Beatty Street cannot see though queued traffic to safely turn.
- The intersection of Penn Avenue at Centre Avenue is heavily congested under current operations. Traffic backs up through adjacent signalized intersections.
- At Penn Avenue and St Clair Street, the underutilized left turn lane creates a longer than necessary pedestrian crossing.
- At Penn and Negley, bike and vehicular conflicts exist at mixing zones and through the intersection. The lane configuration is not optimized for existing conditions or conditions after anticipated development. The traffic signal is antiquated.

» Centre Avenue from N Negley Avenue to East Liberty Boulevard

- At Centre Avenue at Negley Avenue, the intersection markings are not per the signal plan. The signal equipment is antiquated.

- On Centre Avenue between Negley and Euclid the outbound direction is driven as two lanes when the parking lane is vacant.
- On Centre Avenue between Euclid and Highland, the lane arrangement varies and is inconsistent causing driver confusion.
- Centre at Beatty and Centre Avenue/Negley Run Boulevard at East Liberty Boulevard have an antiquated traffic signal with signs that are faded.
- Centre Avenue at Highland is a skewed intersection with an exclusive right turn lane. The skewed intersection causes issues for left turning traffic and the right turn lane creates a longer pedestrian crossing.
- Centre Avenue at Broad Street experiences queued traffic due to proximity of adjacent signals.
- Centre/ Negley Run Boulevard at East Liberty Boulevard is the start of the two-way cycle track. Drivers have been observed driving on the cycle track.

» Highland Avenue from Centre Avenue to St Marie Street

- At the intersection of Baum Boulevard and Highland, there is a high volume of left turning traffic the gridlocks the intersection.
- Along Highland Avenue from Kirkwood Street to Harvard Street, and at St Marie Street drivers park too close to the intersections and block sight distance for entering traffic.
- Highland Avenue between Station Street and Stanton Avenue lacks bike infrastructure and the 85th percentile speed is 34 mph; 9 mph over the posted speed limit.

» N Negley Avenue from Centre Avenue to Hays Street

- At Negley Avenue at Roup Street, a large painted curb extension exists.
- Negley Avenue at Baum Boulevard, traffic routinely blocks the intersection, and the signal equipment is not to current city standard.
- On Negley Avenue at Friendship Avenue, Rural Street, Rippey Street, East Liberty Boulevard, and Black Street, the signal equipment is antiquated.
- On Negley Avenue at Broad Street, drivers park too close to the intersection obstructing a clear view for traffic trying to enter Negley Avenue.
- On Negley Avenue between Broad and Rippey Street, left turn lanes are provided that are underutilized. The space could be reallocated to creating buffered bike lanes.
- Adjacent business at Rural Street have created a driveway curb cut the length of their frontage.
- Negley Avenue from Broad Street to Stanton Avenue includes narrow, uncomfortable bike lanes.
- On Negley Avenue south of Penn the 85th percentile speed is 31 mph southbound and 32 mph northbound. North of Penn Avenue the 85th percentile speeds are 33 mph southbound and 32 mph northbound.

» East Liberty Boulevard from N Negley Avenue to Penn Avenue

- The intersections of East Liberty Boulevard at Euclid Avenue, East Liberty Boulevard at Centre/Negley Run Boulevard and the intersection of East Liberty Boulevard at Larimar Avenue have outdated signal equipment that lack pedestrian countdown heads.

- On East Liberty Boulevard, Bike lanes are in front of bus stops which require the bus to drive in the bike lane for boarding and alighting passengers.
- Vehicles park too close to the intersection at Selma Street
- East Liberty Boulevard at Hamilton Avenue, the intersection lacks no turn on red sign and needs increased bike accommodation in the eastbound direction.
- On East Liberty Boulevard at the railroad underpass, the roadway lacks adequate lighting.
- On East Liberty Boulevard near Dahlem Street, vegetation overgrows the sidewalk.

C. TRANSIT STOP AMENITIES

The following conclusions are related to the transit stop amenities within the study corridors. Recommendations are provided separately.

- Existing Bus stops were reviewed consistent with the PRTs bus stop and Street Design Guidelines.
  - Bus stops are recommended to have shelters where >30 boardings per day occur. Based on these criteria six existing stops with shelters would no longer be a candidate for a shelter and three additional stope would be candidates for shelters.
  - Bus stops are recommended to have benches and trash cans in locations that have 10-30 passengers per day. In the study area, 17 locations meet these criteria.
- The existing bus stop spacing was reviewed. Based on the recommended minimum spacing of 650 feet, three bus stops locations are candidates for bus stop consolidation. Those include:
  - Negley Avenue from Broad Street to Hays Street
  - Highland Avenue from Rippey Street to Hays Street
  - Penn Avenue from Euclid Avenue to Centre Avenue