TABLE OF CONTENTS

Tables

Figures

Technical Appendix

1.0 INTRODUCTION AND SUMMARY

1.1 Purpose of Report and Study Objectives

This report provides the results of the analysis of the transportation study for the proposed Arsenal development, the composition and location of which are detailed below. The study, as documented in this report, was performed in order to meet the study requirements established by the City of Pittsburgh Department of Mobility and Infrastructure (DOMI) and Department of City Planning (DCP).

The considerations studied in detail include the traffic, parking, loading, site access, pedestrian access, bicycle access, and safety aspects of the proposed project.

The study objectives were to identify impacts upon the considerations listed above, and to develop appropriate mitigation strategies as necessary. These objectives were accomplished through performance of the following tasks:

- Performance of traffic, bicycle, and pedestrian counts and analysis of existing traffic conditions.
- Assessment of current bus routes and stops within the study area.
- Projection of future 2021 background traffic volumes by projecting area-wide traffic growth.
- Assessment of traffic operations under 2021 no build conditions.
- Projection of future 2021 build (full occupancy) traffic volumes.
- Assessment of traffic operations under 2021 build conditions (full occupancy) and determination of mitigating actions required to address the impacts of the proposed development.
- Assessment of parking requirements and supply.
- Assessment of pedestrian access and safety.
- Assessment of bicycle requirements and supply.
- Assessment of loading facilities demand, access, and operation.

The study, as documented in this report, was performed in order to determine the traffic, parking, bicycling and pedestrian impacts of the proposed development.

1.2 Executive Summary

An overview of the project description, principal findings resulting from the analysis, and recommended mitigation strategies is presented in this summary.

1.2.1 Site Location and Study Area

The Arsenal Phase 2 development site is bounded by the 40th Street Bridge to the east, 39th Street to the west, Arsenal Phase 1 development to the south, and the railroad tracks that are parallel to the Allegheny River to the north, with site access driveways located on 39th Street. The site is currently occupied by some surface parking and cleared development site. The proposed development will replace these land uses with a combination of

uses which will include residential, office and parking components. The site location and study intersections are shown in Figure S-1.

The study area includes the following intersections, as shown in Figure S-1:

- Butler Street and 40th Street (signalized);
- Butler Street and 41st Street (unsignalized);
- Butler Street and 38th Street (unsignalized);
- Butler Street and 39th Street (unsignalized);
- Foster Street and the 40th Street Bridge/40th Street (unsignalized); and
- 39th Street and Site Driveways (total of three driveways, unsignalized).

1.2.2 Development Description

The proposed Arsenal Phase 2 development is anticipated to include 343 apartment units, 3,876 gross square feet of office space in the old Officers Quarters building and 558 parking spaces. In addition the development will provide sufficient bicycle parking which will satisfy the City of Pittsburgh Zoning Code requirements. The proposed site plan is presented in Figure S-2.

Access to the Phase 2 development will be provided via three (3) site driveways on 39th Street.

1.2.3 Principal Findings

Parking Analysis

Parking requirement calculations were completed using the methodologies presented in the *City of Pittsburgh Urban Zoning Code: Chapter 914: Parking Loading and Access*. Based on the Zoning Code, the proposed Arsenal Phase 2 development is required to provide the following minimum numbers of parking spaces:

- Apartments
    - 242 automobile parking spaces required
        - Including 8 ADA accessible spaces, of which two (2) must be van accessible.
    - 115 bicycle spaces, of which at least 69 (60%) must be protected bicycle parking spaces.
- Office Space (Former Officers Quarters)
    - 1 automobile parking space required
        - ADA spaces included in apartment ADA spaces above.
    - Zero (0) bicycle parking spaces.
- TOTAL: a minimum of 243 automobile parking spaces with 101 bicycle spaces (for maximum automobile parking reduction) is required.

These parking calculations include permitted bicycle space reductions, as per Section 914.05E of the City of Pittsburgh Urban Zoning Code. As stated in the Code, the reduction in the number of automobile parking spaces shall be reduced by no more than one (1) space for each Bicycle Parking Space (minimum reduction), but by no more than thirty (30) percent of the total required spaces (maximum reduction), not including spaces reserved for persons with disabilities.

As previously noted, the development is planned to provide a total of 558 automobile parking spaces, which exceeds the minimum Zoning Code requirement (no bicycle reduction) by 214 spaces.

Further details of the parking analysis are presented in Section 3.4 of this report.

Trip Generation

Vehicular trip generation for the proposed Arsenal development was projected based upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation,* Tenth Edition. ITE Land Use Code 221 (apartment) was used to determine the trip generation for the proposed development.

It was recommended by the City of Pittsburgh, Department of City Planning (DCP) that modal split reductions should be applied for the proposed residential component of the development. According to the City of Pittsburgh PGHSNAP data for the Lower Lawrenceville neighborhood, bicycle trips account for up to 7.5%, walking trips account for up to 13.7%, and transit trips account for up to 18.2% of the projected site generated trips. This reduction results in a total trip reduction of 39.4% of trips.

Using this methodology, the proposed development is anticipated to generate the following numbers of trips:

- 69 automobile trips during the A.M. peak hour (18 trips entering/51 trips exiting), and 87automobile trips during the P.M. peak hour (53 trips entering/34 trips exiting);
- 21 transit trips during the A.M. peak hour (6 trips entering/15 trips exiting), and 26 transit trips during the P.M. peak hour (16 trips entering/10 trips exiting);
- 16 walking trips during the A.M. peak hour (4 trips entering/12 trips exiting), and 20 walking trips during the P.M. peak hour (12 trips entering/8 trips exiting); and
- 8 bicycle trips during the A.M. peak hour (2 trips entering/6 trips exiting), and 11 bicycle trips during the P.M. peak hour (7 trips entering/4 trips exiting).

Further details of the traffic analysis are presented in Section 4.1 of this report.

Traffic Analysis

2021 Build Mitigated Conditions

Traffic analyses were performed using methodologies published in the *Highway Capacity Manual 2010*, by the Transportation Research Board using Synchro, Version 10 traffic analysis and simulation software and Highway

Capacity Software. The capacity analyses under 2021 build mitigated conditions resulted in determination of overall intersection levels of service as compared to 2021 no-build conditions as follows:

- Butler Street and 39th Street
    - Southbound 39th Street degrades
        - During the A.M. peak hour from E/46.6 seconds to F/102.1 seconds of delay
        - During the P.M. peak hour from F/309.4 to F/518.7 seconds
    - Overall intersection degrades
        - During the A.M. peak hour from A/5.3 to B/13.7 seconds
        - During the P.M. peak hour from B/34.5 to E/65.0 seconds

Despite the increases in delay, traffic signal warrant criteria are not met at this location. Continued monitoring and performance of new traffic/pedestrian/bicycle counts at this location are recommended after full occupancy of the Phase 2 development, with reevaluation of traffic signal warrants at that time.

- 40th Street Bridge and Foster Street/40th Street
    - Westbound 40th Street/Foster Street approach degrades
        - During the A.M. peak hour from D/31.9 to E/35.1 seconds
        - During the P.M peak hour from F/478.3 to F/502.8 seconds
- 39th Street and Mineral Way/Site Driveway #1
    - Westbound Site Driveway #1 approach degrades
        - During the A.M. peak hour from A/9.8 to B/10.3 seconds

Further details of the traffic analysis are presented in Section 4.0 and Section 5.0 of this report.

Queuing Analysis

For dense urban conditions, queuing analyses provide a far more accurate representation of traffic flow than level of service designations. The 95th percentile queue lengths for the study intersections under 2019 existing, 2021 no build and 2021 build mitigated conditions were evaluated. Analyses were performed using methodologies published in the *Highway Capacity Manual 2010*, by the Transportation Research Board using Synchro, Version 10 traffic analysis and simulation software.

The results of the queuing analyses indicate that under 2021 build mitigated conditions; all queues are projected to be contained within the available queue storage areas with the following exceptions:

- Butler Street and 40th Street Intersection
    - The westbound Butler Street left/through lane is projected to have a queue length of 490 feet during the A.M. peak hour. It should be noted that the 2021.no build (without the development

in place) conditions were projected to have a queue length of 485 feet during the A.M. peak hour. This calculated increase in queue length is less than one (1) vehicle. During the P.M. peak hour the queue length is projected to be 287 feet, as compared to 271 feet under 2021 no build conditions. The increase in queue length is less than one (1) vehicle.

  - The westbound Butler Street right turn lane is projected to have a queue length of 450 feet in the A.M peak hour, as compared to 442 feet under 2021 no build conditions. This calculated increase in queue length is less than one (1) vehicle.

- 40th Street Bridge and Foster Street/40th Street intersection
  - The westbound Foster Street/40th Street approach is projected to have a queue length of 683 feet in the P.M. peak hour as compared to 668 feet under 2021 no build conditions. This calculated increase in queue length is less than one (1) vehicle.

Further details of the queuing analysis are presented in Section 5.5 of this report.

Loading Analysis

Per the requirements of the Zoning Code, four (4) loading spaces are required for the Phase 2 development. Three (3) loading spaces are proposed: one on Willow Street and two loading zone spaces along Foster Street.

The developer will request an Administrator Exception for a Reduction from 4 to 3 loading spaces, with the corresponding report to be submitted to the Zoning Administrator by Trans Associates.

1.2.4 Recommendations

In order to provide the optimal levels of service and traffic flow for the study intersections, the following mitigation measures, as shown in Figures S-3 and S-4, are recommended:

Butler Street and 40th Street

- Optimize signal timing splits and offsets at the intersection.

Butler Street and 39th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Butler Street and 38th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Additional On- and Off-Site Improvements

- Provide on-site bicycle parking that can accommodate at least 101 bicycles on-site (to obtain the maximum parking reduction) as required by the City of Pittsburgh Urban Zoning Code.
- Install stop sign control on all site driveways' egress approaches.
- Provide off-street loading in accordance with Section 914.10.A Of the City of Pittsburgh Zoning Code. A Zoning Administrator's Exception will be requested if needed.
- Maintain existing pedestrian sidewalk connections surrounding the site.

Public Benefits Related to the Recommended Improvements

- Improved pedestrian crossing amenities at the intersections of Butler Street and 39th Street and Butler Street and 38th Street.
- Dedication of a continuous 14 foot wide strip of property along the rear of the site (parallel to the railroad tracks) for the potential future development of the Allegheny Green Boulevard along the northern side of the property and adjacent to the existing railroad tracks (already done as part of the Phase 1 project).

2.0 PROPOSED DEVELOPMENT

2.1 Summary of Development

A description of the proposed development is presented in this section.

2.1.1 Location

The development site is bounded by the 40th Street Bridge to the east, 39th Street to the west, the Arsenal Phase 1 development to the south, and the railroad tracks that are parallel to the Allegheny River to the north, with site access driveways located on 39th Street. The site is currently occupied by some surface parking and cleared development site. The proposed development will replace these land uses with a combination of buildings which are anticipated to include residential, office, and parking components. The site location is shown in Figure 1.

2.1.2 Development Plan

The proposed Arsenal Phase 2 development is anticipated to include 343 apartment units, 3,876 gross square feet of office space in the old Officers Quarters building and 558 parking spaces. In addition the development will provide sufficient bicycle parking which will satisfy the City of Pittsburgh Zoning Code requirements. The proposed site plan is presented in Figure 2.

Access to the development will be provided via three (3) site driveways as follows:

1. 39th Street and Site Driveway #1 (full-movement opposite Mineral Way);
2. 39th Street and Site Driveway #2 (full-movement opposite Foster Street); and
3. 39th Street and Site Driveway #3 (full-movement northernmost driveway).

3.0 AREA CONDITIONS

3.1 Study Area

The study area for the site has been determined based upon the area of influence and the area of significant traffic impact. The study area, study intersections and study methodology have been approved by the City of Pittsburgh Department of City Planning (DCP) and Department of Mobility and Infrastructure (DOMI) as part of the TIS Scoping Form approval process. The approved TIS Scoping Form is included in the Technical Appendix to this report.

3.1.1 Area of Influence

The area of influence for the Arsenal development is shown in Figure 1.

3.1.2 Area of Significant Traffic Impact

The area of significant traffic impact will be on the streets immediately surrounding the development. Based upon discussions with DOMI and DCP, as contained in the approved TIS Scoping Form, the City required intersection capacity analysis at the following intersections:

- Butler Street and 40th Street (signalized);
- Butler Street and 41st Street (unsignalized);
- Butler Street and 38th Street (unsignalized);
- Butler Street and 39th Street (unsignalized);
- Foster Street and the 40th Street Bridge/40th Street (unsignalized); and
- 39th Street and Site Driveways (total of three driveways, unsignalized).

The study intersections associated with the site are illustrated in Figure 1.

3.2 Study Area Land Use

3.2.1 Existing Land Use

The site is currently occupied by some surface parking and cleared development site. The proposed development will replace these land uses with a combination of uses which will include residential, office and parking components.

3.2.2 Anticipated Future Development

See Section 2.1.2 and Figure 2. The previously approved and constructed Arsenal Phase 1 site plan is shown in Figure 3. All components of Phase 1 were not fully occupied at the time of the traffic counts.

3.2.3 Existing Travel Mode Splits

The urban location of the site provides numerous opportunities for a variety of transportation modes. The site is well-located for public transit use, bicycle travel and pedestrian travel.

It was recommended by the City of Pittsburgh, Department of City Planning (DCP) that modal split reductions should be applied for the proposed residential component of the development. According to the City of Pittsburgh PGHSNAP data for the Lower Lawrenceville neighborhood, bicycle trips account for up to 7.5%, walking trips account for up to 13.7%, and transit trips account for up to 18.2% of the projected site generated trips. This reduction results in a total trip reduction of 39.4% of trips.

Port Authority of Allegheny County bus routes frequently traverse the immediate project area as presented in Figure 4, with bus stops in the area also shown.

3.3 Site Accessibility

3.3.1 Public and Private Roadway Systems and Residential Permit Parking

Site accessibility is greatly influenced by the roadway system adjacent to the site and within the study area. The existing roadway system, including traffic control devices, is documented in this section. Existing residential permit parking in the study area is shown in Figure 5.

3.3.1.1 Existing Area Roadway System

The existing area roadway system is presented in Figure 1. The study area includes major roadways within the Lawrenceville section of the City of Pittsburgh including Butler Street and the 40th Street Bridge. The following study intersection is signalized:

- Butler Street and 40th Street.

3.3.1.2 Future Area Roadway Systems

No major changes in the study area corridors are currently approved. No changes in the City roadway system, traffic flow directions or intersection controls have been assumed on public roadways within the study area. Projected site generated trips from approved but not yet fully occupied developments were included in the background traffic projections of this study.

3.3.2 Traffic Volumes and Conditions

Documentation of existing vehicular, pedestrian and bicycle volumes and conditions in the study area includes descriptions of the data collection effort and documentation of existing pedestrian, bicycling and vehicular traffic patterns.

3.3.2.1 Data Collection

A data collection effort was organized and conducted by Trans Associates (TA) in March 2019. The data collection included the following items:

- Field reconnaissance of the study area, including roadway geometry, crosswalk locations, and existing traffic control;
- Acquisition of intersection as-built drawings, signal permit drawings and signal phasing and timing information from the City of Pittsburgh Department of Public Works;
- Performance of vehicle turning movement counts for the study intersections during the following peak periods:
    - Weekday A.M. peak period – 7:00 A.M. to 9:00 A.M.
    - Weekday P.M. peak period – 4:00 P.M. to 6:00 P.M.
- Performance of pedestrian, bicycle and heavy vehicle (truck) counts at all study intersections; and
- Identification of Port Authority bus routes adjacent to the site; and
- Review of a detailed site plan for the proposed development.

3.3.2.2 Automatic Traffic Recorder Counts

Not applicable.

3.3.2.3 Peak Hours

Manual turning movement counts were performed by TA from 7:00 A.M. to 9:00 A.M. and from 4:00 P.M. to 6:00 P.M. during typical weekdays (Tuesday through Thursday) in March 2019.

The overall peak hours determined from these counts are as follows:

- A.M. Peak Hour – 7:45 A.M. to 8:45 A.M.
- P.M. Peak Hour – 4:30 P.M. to 5:30 P.M.

Summaries of the data collected during the manual turning movement counts at each of the study intersections have been included in the Technical Appendix to this report.

3.3.2.4 Peak Hour Traffic Volumes

The results of the manual turning movement counts performed were plotted on schematic diagrams of the study intersections. The 2019 existing peak hour traffic volumes are presented in Figure 6. The existing peak hour pedestrian volumes are presented in Figure 7. Existing peak hour bicycle volumes are contained in the Technical

Appendix. Summaries of the data collected at each of the study intersections have been included in the Technical Appendix to this report.

3.3.2.5 2019 Existing Conditions – Intersection Levels of Service

Levels of service at each of the study intersections have been determined for the peak hours. These levels of service (LOS) were determined through implementation of signalized and unsignalized intersection capacity analysis methodologies presented in the 2010 Highway Capacity Manual, published by the Transportation Research Board. A detailed description of LOS is provided in the Technical Appendix to this report.

The results of the analyses are summarized in Figure 8 for the A.M. and P.M. peak hours, as well as in Table 1. As shown in Figure 8, all overall intersection levels of service currently operate at LOS D or better except for the following:

- 40th Street Bridge and Foster Street
    - This intersection currently operates at LOS F during the A.M. and P.M. peak hours.

Detailed capacity and levels of service printouts are provided in the Technical Appendix to this report.

3.3.3 Transit Routes and Service

Public transit in the study area is provided by the Port Authority of Allegheny County (PAAC) and includes the bus routes and bus stop locations are presented in Figure 4.

3.3.4 Existing Relevant Transportation Systems Management (TSM) Programs

Not applicable.

3.3.5 Other Considerations

Not applicable.

3.4 Parking Analysis

Parking Analysis

Parking requirement calculations were completed using the methodologies presented in the *City of Pittsburgh Urban Zoning Code: Chapter 914: Parking Loading and Access*. Based on the Zoning Code, the proposed Arsenal Phase 2 development is required to provide the following minimum numbers of parking spaces:

- Apartments
    - 242 automobile parking spaces required
        - Including 8 ADA accessible spaces, of which two (2) must be van accessible.

    - 115 bicycle spaces, of which at least 69 (60%) must be protected bicycle parking spaces.
- Office Space (Former Officers Quarters)
    - 1 automobile parking space required
        - ADA spaces included in apartment ADA spaces above.
    - Zero (0) bicycle parking spaces.
- TOTAL: a minimum of 243 automobile parking spaces with 101 bicycle spaces (for maximum automobile parking reduction) is required.

These parking calculations include permitted bicycle space reductions, as per Section 914.05E of the City of Pittsburgh Urban Zoning Code. As stated in the Code, the reduction in the number of automobile parking spaces shall be reduced by no more than one (1) space for each Bicycle Parking Space (minimum reduction), but by no more than thirty (30) percent of the total required spaces (maximum reduction), not including spaces reserved for persons with disabilities.

As previously noted, the development is planned to provide a total of 558 automobile parking spaces, which exceeds the minimum Zoning Code requirement (no bicycle reduction) by 214 spaces.

Detailed parking requirement calculations are presented in Table 2. Phase 1 (already approved and built) parking requirements are shown in Table 2A, with the combined Phase 1 and Phase 2 requirements shown in Table 2B. A detailed parking supply versus parking required summary is presented in Table 3. The parking provided meets the requirements of the Zoning Code.

4.0 PROJECTED TRAFFIC VOLUMES AND INTERSECTION CAPACITY ANALYSIS

4.1 Site-Generated Traffic

4.1.1 Vehicular Trip Generation

Vehicular trip generation for the proposed Arsenal development was projected based upon data contained in the Institute of Transportation Engineers (ITE) publication *Trip Generation*, Tenth Edition. ITE Land Use Code 221 (apartment) was used to determine the trip generation for the proposed development.

It was recommended by the City of Pittsburgh, Department of City Planning (DCP) that modal split reductions should be applied for the proposed residential component of the development. According to the City of Pittsburgh PGHSNAP data for the Lower Lawrenceville neighborhood, bicycle trips account for up to 7.5%, walking trips account for up to 13.7%, and transit trips account for up to 18.2% of the projected site generated trips. This reduction results in a total trip reduction of 39.4% of trips.

Using this methodology, the proposed development is anticipated to generate the following numbers of trips:

- 69 automobile trips during the A.M. peak hour (18 trips entering/51 trips exiting), and 87automobile trips during the P.M. peak hour (53 trips entering/34 trips exiting);
- 21 transit trips during the A.M. peak hour (6 trips entering/15 trips exiting), and 26 transit trips during the P.M. peak hour (16 trips entering/10 trips exiting);
- 16 walking trips during the A.M. peak hour (4 trips entering/12 trips exiting), and 20 walking trips during the P.M. peak hour (12 trips entering/8 trips exiting); and
- 8 bicycle trips during the A.M. peak hour (2 trips entering/6 trips exiting), and 11 bicycle trips during the P.M. peak hour (7 trips entering/4 trips exiting).

Detailed trip generation calculations are summarized in Table 4. Copies of the trip generation calculations are also included in the Technical Appendix to this report.

4.1.2 Vehicular Trip Arrival and Departure Distributions

Vehicular arrival/departure distributions for the proposed Arsenal Phase 2 development were based on existing traffic patterns on the surrounding roadway network. The resultant arrival/departure distribution for the site generated trips is presented in Figure 9.

4.1.3 Vehicular Trip Assignment – Determination of Site-Generated Traffic

The trip distribution presented in Figure 9 was applied to the new site generated trips generated during the A.M. and P.M. peak hours from Table 4. The resultant total site generated trips for the proposed Arsenal Phase 2 development is shown in Figure 10.

4.1.4 Pedestrian Trip Generation

Site generated pedestrian trips were projected based on the PGHSNAP data as detailed in Section 4.1. The projected pedestrian trips that are anticipated to utilize the transit system were assumed to utilize stops along Butler Street between 39th and 40th Streets. New site generated pedestrian trips are shown in Figure 11.

4.1.5 Bicycle Trip Generation

Site generated bicycle trips were projected based on the PGHSNAP data as detailed in Section 4.1.

4.2 Background Traffic (Base Traffic)

4.2.1 Background Traffic Growth

In order to project year 2021 background traffic volumes, an annual traffic growth factor was determined and applied to all of the existing traffic volume data. According to The Southwestern Pennsylvania Commission (SPC) Cycle 10 projections, traffic in the Lawrenceville section of the City of Pittsburgh has a linear growth rate of 0.50 percent annually. Utilizing this growth rate, the 2019 existing traffic volumes were increased to produce the 2021 background traffic volumes (without development) traffic volumes as shown in Figure 12.

Additionally, as requested by the City of Pittsburgh DCP and DOMI, the projected site generated trips from the unoccupied portion of the Arsenal Phase 1 development, as shown in Figure 13, were included in the 2021 background traffic volume projections. Additionally rerouting of illegal left turns (Figure 14) was also performed. Additionally, trips projected for the approved Tech Mill 41 and 40th Street hotel projects were determined (See Figure 15) for additional to 2021 projections.

4.2.2 Year 2021 No Build Conditions Traffic Volumes

The 2021 no build conditions traffic volumes were determined by adding the 2021 background traffic volumes (Figure 12) to the trips projected to be generated by the Arsenal Phase 1 development (Figure 13) rerouting of illegal left turns (Figure 14) and other approved developments (Figure 15). 2021 no build pedestrian volumes were developed and are shown in Figure 17, and used for analysis. The resultant 2021 no build conditions traffic volumes are presented in Figure 16.

4.2.3 Opening Year 2021 No Build Conditions - Intersection Levels of Service

Levels of service at each of the study intersections have been determined for the peak hours. These levels of service (LOS) were determined through implementation of signalized intersection capacity analysis methodologies presented in the 2010 Highway Capacity Manual, published by the Transportation Research Board.

The results of the capacity analyses are summarized in Figure 18 for the A.M. and P.M. peak hours, as well as in Table 1. As shown in Table 1, all overall intersection levels of service currently operate at LOS D or better except for the following:

- 40th Street Bridge and Foster Street
    - The overall intersection is projected to operate at LOS E during the P.M. peak hour.

Detailed capacity and levels of service printouts are provided in the Technical Appendix to this report.

4.3 Build Traffic Volumes (With Development)

4.3.1 Year 2021 Build Conditions Traffic Volumes (With Development)

The forecasted opening year 2021 build traffic volumes (with development) for the A.M. and P.M. peak hours were determined by adding the projected site generated trips (Figure 10) to the forecasted 2021 no build traffic volumes (Figure 16).

The resultant forecasted opening year 2021 build traffic volumes (with development) are presented in Figure 19. The 2021 build pedestrian volumes are shown in Figure 20.

4.3.2 2021 Build Traffic Volumes - Intersections Levels of Service

Levels of service at each of the study intersections have been determined for the peak hours. These levels of service (LOS) were determined through implementation of signalized intersection capacity analysis methodologies presented in the 2010 Highway Capacity Manual, published by the Transportation Research Board.

The results of the capacity analyses are summarized in Figure 21 for the A.M. and P.M. peak hours, as well as in Table 1. As shown in Table 1, all overall intersection levels of service currently operate at LOS D or better except for the following:

- 40th Street Bridge and Foster Street
    - The overall intersection is projected to operate at LOS E during the P.M. peak hour.
- Butler Street and 39th Street
    - The overall intersection is projected to operate at LOS E during the P.M. peak hour.

Detailed capacity and levels of service printouts are provided in the Technical Appendix to this report.

4.3.3 2021 Mitigated Build Traffic Volumes - Intersections Levels of Service

In order to provide the best possible levels of service and traffic flow for the study intersections, the following mitigation measures for the driveway, roadways, and traffic control were included in the analysis:

Butler Street and 40th Street

- Optimize signal timing splits and offsets at the intersection.

Butler Street and 39th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Butler Street and 38th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Additional On- and Off-Site Improvements

- Provide on-site bicycle parking that can accommodate at least 101 bicycles on-site (to obtain the maximum parking reduction) as required by the City of Pittsburgh Urban Zoning Code.
- Install stop sign control on all site driveways' egress approaches.
- Provide off-street loading in accordance with Section 914.10.A Of the City of Pittsburgh Zoning Code. A Zoning Administrator's Exception will be requested if needed.
- Maintain existing pedestrian sidewalk connections surrounding the site.

Public Benefits Related to the Recommended Improvements

- Improved pedestrian crossing amenities at the intersections of Butler Street and 39th Street and Butler Street and 38th Street.
- Dedication of a continuous 14 foot wide strip of property along the rear of the site (parallel to the railroad tracks) for the potential future development of the Allegheny Green Boulevard along the northern side of the property and adjacent to the existing railroad tracks (already done as part of the Phase 1 project).

The results of the 2021 build mitigated conditions levels of service are presented in Table 1 for both the A.M. and P.M. peak hours. Results of the 2021 build mitigated conditions analyses are presented graphically in Figure 21 for the A.M. and P.M. peak hour. As shown in Table 1, the capacity analyses under 2021 build mitigated conditions resulted in determination of overall intersection levels of service as compared to 2021 no-build conditions as follows:

- Butler Street and 39th Street
    - Southbound 39th Street degrades
        - During the A.M. peak hour from E/46.6 seconds to F/102.1 seconds of delay
        - During the P.M. peak hour from F/309.4 to F/518.7 seconds
    - Overall intersection degrades
        - During the A.M. peak hour from A/5.3 to B/13.7 seconds
        - During the P.M. peak hour from B/34.5 to E/65.0 seconds

Despite the increases in delay, traffic signal warrant criteria are not met at this location. Continued monitoring and performance of new traffic/pedestrian/bicycle counts at this location are recommended after full occupancy of the Phase 2 development, with reevaluation of traffic signal warrants at that time.

- 40th Street Bridge and Foster Street/40th Street
    - Westbound 40th Street/Foster Street approach degrades
        - During the A.M. peak hour from D/31.9 to E/35.1 seconds
        - During the P.M peak hour from F/478.3 to F/502.8 seconds
- 39th Street and Mineral Way/Site Driveway #1
    - Westbound Site Driveway #1 approach degrades
        - During the A.M. peak hour from A/9.8 to B/10.3 seconds
- 40th Street Bridge and Foster Street
    - The overall intersection is projected to operate at LOS E during the P.M. peak hour. The capacity analyses of this intersection resulted in overall intersection levels of service that are significantly improved over 2020 base (without the development in place) conditions as a result of the proposed mitigation measures, which include a westbound left turn prohibition from Foster Street onto 40th Street.

Detailed capacity and level of service printouts are provided in the Technical Appendix to this report.

5.0 SUPPLEMENTARY TRAFFIC ANALYSIS

5.1 Site Access

Access to the development will be provided via three (3) site driveways as follows:

1. 39th Street and Site Driveway #1 (full-movement opposite Mineral Way);
2. 39th Street and Site Driveway #2 (full-movement opposite Foster Street); and
3. 39th Street and Site Driveway #3 (full-movement northernmost driveway).

The proposed site plan is presented in Figure 2.

5.2 Traffic Safety

Traffic safety conditions within the study area will be maintained through additional traffic controls, as necessary as detailed in Section 6.1.

5.3 Traffic Signals

Traffic signal warrants were not evaluated at the proposed site driveways due to projected traffic volumes and locations. Traffic volumes projected for the site driveways do not meet minimum volume requirements of signal warrant installation criteria. Therefore, signal operation is not recommended at these locations.

Traffic signal warrant criteria was evaluated for the study intersection of Butler Street and 39th Street based on the 2009 Manual on Uniform Traffic Control Devices (MUTCD) criteria for Warrant 3 (peak hour). Based on the results of the analysis, the study intersection does not satisfy the warrant criteria for installation of traffic signal control for Warrant 3 (peak Hour) conditions for the A.M. and P.M. peak hours. Therefore, installation of a traffic signal is not warranted. . Continued monitoring and performance of new traffic/pedestrian/bicycle counts at this location are recommended after full occupancy of the Phase 2 development, with reevaluation of traffic signal warrants at that time.

5.4 Site Circulation and Parking

5.4.1 Automobiles

See Section 5.1.

5.4.2 Loading Vehicles and Truck Loading Management Plan

Per Table 6, the requirements of the Zoning Code, four (4) loading spaces are required for the Phase 2 development. Three (3) loading spaces are proposed: one on Willow Street and two loading zone spaces along Foster Street.

The developer will request an Administrator Exception for a Reduction from 4 to 3 loading spaces, with the corresponding report to be submitted to the Zoning Administrator by Trans Associates.

5.4.3 Emergency Vehicles

Emergency (fire, paramedics, etc.) vehicles will have multiple access points to the site via the surrounding roadways.

5.5 Queuing Analysis

For dense urban conditions, queuing analyses provide a far more accurate representation of traffic flow than level of service designations. The 95th percentile queue lengths for the study intersections under 2019 existing, 2021 no build and 2021 build mitigated conditions were evaluated. Analyses were performed using methodologies published in the *Highway Capacity Manual 2010*, by the Transportation Research Board using Synchro, Version 10 traffic analysis and simulation software.

The results of the queuing analyses indicate that under 2021 build mitigated conditions; all queues are projected to be contained within the available queue storage areas with the following exceptions:

- Butler Street and 40th Street Intersection
    - The westbound Butler Street left/through lane is projected to have a queue length of 490 feet during the A.M. peak hour. It should be noted that the 2021.no build (without the development in place) conditions were projected to have a queue length of 485 feet during the A.M. peak hour. This calculated increase in queue length is less than one (1) vehicle. During the P.M. peak hour the queue length is projected to be 287 feet, as compared to 271 feet under 2021 no build conditions. The increase in queue length is less than one (1) vehicle.
    - The westbound Butler Street right turn lane is projected to have a queue length of 450 feet in the A.M peak hour, as compared to 442 feet under 2021 no build conditions. This calculated increase in queue length is less than one (1) vehicle.
- 40th Street Bridge and Foster Street/40th Street intersection
    - The westbound Foster Street/40th Street approach is projected to have a queue length of 683 feet in the P.M. peak hour as compared to 668 feet under 2021 no build conditions. This calculated increase in queue length is less than one (1) vehicle.

Detailed queuing analyses are summarized in Table 7. In addition, the 2021 no build (without development) and 2021 build mitigated (with development) conditions 95th percentile queues lengths are presented graphically in Figure 22 and Figure 23 for the A.M. and P.M. peak hours, respectively.

Detailed analysis printouts are included in the Technical Appendix to this report.

5.6 Sight Distance Evaluation

The proposed site driveways will be located in such a manner as to meet the sight distance requirements of PennDOT/City of Pittsburgh. Landscape and streetscape elements will not interfere with required sight distances. Please note all proposed site driveways will be stop controlled for all egress movements.

6.0 IMPROVEMENT ANALYSIS, FINDINGS AND RECOMMENDATIONS

6.1 Improvements to Accommodate Base Traffic and Site Traffic

This study has been performed in order to determine the traffic impacts of the proposed Arsenal development based upon the City of Pittsburgh's traffic and parking impact study methodologies. In order to provide optimized levels of service and traffic flow for the study intersections, the following mitigation measures, shown in Figures 24 and 25, are recommended:

Butler Street and 40th Street

- Optimize signal timing splits and offsets at the intersection.

Butler Street and 39th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Butler Street and 38th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Additional On- and Off-Site Improvements

- Provide on-site bicycle parking that can accommodate at least 101 bicycles on-site (to obtain the maximum parking reduction) as required by the City of Pittsburgh Urban Zoning Code.
- Install stop sign control on all site driveways' egress approaches.
- Provide off-street loading in accordance with Section 914.10.A Of the City of Pittsburgh Zoning Code. A Zoning Administrator's Exception will be requested if needed.
- Maintain existing pedestrian sidewalk connections surrounding the site.

Public Benefits Related to the Recommended Improvements

- Improved pedestrian crossing amenities at the intersections of Butler Street and 39th Street and Butler Street and 38th Street.
- Dedication of a continuous 14 foot wide strip of property along the rear of the site (parallel to the railroad tracks) for the potential future development of the Allegheny Green Boulevard along the northern side of the property and adjacent to the existing railroad tracks (already done as part of the Phase 1 project).

6.2 Status of Improvements Already Funded, Programmed or Planned

Not applicable.

6.3 Evaluation of Benefits and Costs of Proposed Improvements

Not applicable.

7.0 FINDINGS

7.1 Site Accessibility

See Sections 5.1 and 5.4.

7.2 Traffic Impacts

See Sections 4.2, 4.3, and 5.2.

7.3 Need for Improvements

See Section 6.1.

8.0 RECOMMENDATIONS

8.1 Site Access/Circulation Plan

See Section 5.4.

8.2 Roadway Improvements

See Section 6.1.

8.3 Transportation Systems Management (TSM) Actions

Not applicable.

8.4 Traffic Operations Plan

Not applicable.

8.5 Truck Loading Management Plan

See Section 5.4.2.

8.6 Construction Management Plan

To be developed as design and construction plans advance.

8.7 Parking Management Plan (PMP)

See Section 3.4.4.

9.0 CONCLUSIONS

This study has been performed in order to determine the traffic, parking, pedestrian, bicycle and loading impacts of the proposed Arsenal development based upon the City of Pittsburgh's traffic and parking impact study methodologies and to develop a program of recommended improvements. As detailed in Section 6.1 and in Figures 24 and 25, the following improvements should be implemented in order to minimize the impact of the development on the surrounding roadway network:

Butler Street and 40th Street

- Optimize signal timing splits and offsets at the intersection.

Butler Street and 39th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Butler Street and 38th Street

- Install pedestrian crosswalk thermoplastic piano key markings on all approaches to the intersection.

Additional On- and Off-Site Improvements

- Provide on-site bicycle parking that can accommodate at least 101 bicycles on-site (to obtain the maximum parking reduction) as required by the City of Pittsburgh Urban Zoning Code.
- Install stop sign control on all site driveways' egress approaches.
- Provide off-street loading in accordance with Section 914.10.A Of the City of Pittsburgh Zoning Code. A Zoning Administrator's Exception will be requested if needed.
- Maintain existing pedestrian sidewalk connections surrounding the site.

Public Benefits Related to the Recommended Improvements

- Improved pedestrian crossing amenities at the intersections of Butler Street and 39th Street and Butler Street and 38th Street.
- Dedication of a continuous 14 foot wide strip of property along the rear of the site (parallel to the railroad tracks) for the potential future development of the Allegheny Green Boulevard along the northern side of the property and adjacent to the existing railroad tracks (already done as part of the Phase 1 project).

Provided these recommendations are implemented, the traffic, parking, pedestrian, bicycle, and loading impacts of the proposed Arsenal Phase 2 development will be appropriately mitigated.