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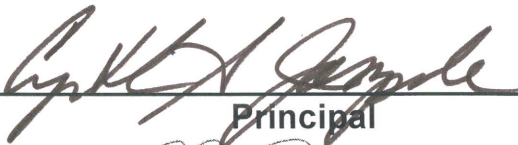


**PITTSBURGH PENGUINS ARENA
TRAFFIC AND PARKING STUDY
City of Pittsburgh, Allegheny County, Pennsylvania**

**Prepared For:
PITTSBURGH PENGUINS
Pittsburgh, Pennsylvania**

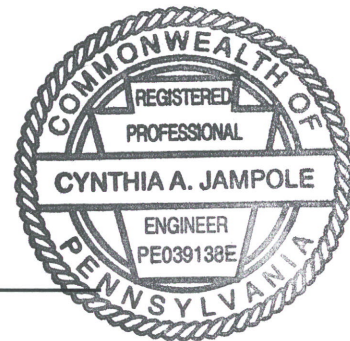
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1.0 INTRODUCTION AND SUMMARY

1.1 Purpose of Report and Study Objectives

This report provides the results of the traffic analysis study performed to determine the impacts of the proposed new Pittsburgh Penguins Arena. The study, as documented in this report, was performed in order to meet the study requirements established by the City of Pittsburgh Department of City Planning (DCP) and to identify the recommendations for roadway and/or traffic signal improvements necessary to mitigate the projected impacts of the project.

Data collection and analysis procedures for the study included the following:

- Manual turning movement counts were performed at all study intersections. In addition pedestrian counts were performed at selected key intersections. Data available from the Isle of Capri traffic study was utilized to the maximum extent possible. The manual turning movement counts were conducted for the following peak periods:
 - A.M. peak weekday
 - P.M. peak (non-event day) weekday
 - Saturday P.M. peak (with evening event at Mellon Arena)
- Field view of existing roadway conditions in the study area, including collection of geometric data and observation of traffic operations during each analysis period.
- Performance of pedestrian movement counts at select intersections.
- Performance of automatic traffic recorder (ATR) counts.
- Projection of future 2010 and 2020 background traffic volumes by projecting area-wide traffic growth including data from the Southwestern Pennsylvania Commission, and data from the Department of City Planning (DCP) related to approved projects in the study area, including the Duquesne University Master Plan.
- Trip generation for a maximum A.J. Palumbo Center Saturday evening event to be included in all future analysis scenarios.
- Trip generation for the proposed site development plan, for the three peak periods described above, based on available data.
- Trip distribution, based upon market data provided and existing roadway network travel patterns.
- Analysis of all study intersections and site access points using the Highway Capacity Software (HCS) method of analysis, for existing, future base mitigated and unmitigated, and future combined conditions mitigated and unmitigated for all three peak hours selected for analysis by DCP.
- Development of transportation network improvements, a traffic management plan, and a truck loading management plan to accommodate site traffic.

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 proposed Pittsburgh Penguins Arena will be located in the City of Pittsburgh, Pennsylvania. The site is located on the eastern edge of the Central Business District (CBD) of the City of Pittsburgh. The proposed new arena will be located between Centre Avenue, Fifth Avenue, and Washington Place. Study intersections representing the area of significant traffic impact, as selected by DCP, are shown in Figure 1. The study area for this project as defined by DCP is considered one of the most extensive study areas for any downtown project over the last 20 years.

1.2.2 Development Description

The Pittsburgh Penguins Arena is proposed to have a capacity of 18,500 seats, as compared to the existing capacity of 16,900 seats in Mellon Arena. In addition, a four story 500 space parking garage and 150 space surface parking lot will be constructed on site, adjacent to the new arena. The foundation and structure of the parking garage have been designed to take the load of two additional floors of parking in the future if needed, potentially adding 280 spaces. The parking garage will have 50 spaces reserved at all times for Penguins use only. The remaining spaces will be available to commuter traffic during the daytime peak period and for arena patrons during event times on evenings and weekends. The proposed site plan is presented in Figure 2. In order to provide a conservative parking analysis, all future “with development” scenarios have been analyzed with trips projected for the maximum potential future garage size of 780 spaces.

As part of this traffic analysis, full development of the 28 acre Mellon Arena site was assumed to occur by the year 2020, based on data contained in the feasibility study entitled “Mellon Arena Site Redevelopment Study: Urban Design Documents,” prepared by Urban Design Associates, dated September 2001. This study presents a conceptual development plan for the entire 28 acre Mellon Arena site and includes land uses consistent with the requirements/limitations of the Pittsburgh Zoning Code for this area, such as residential rental units, owned housing units, office space, retail space, parking facilities and a hotel. Parking for these land uses will be provided on the 28 acre site. This parking would not be available for weekday daytime commuter traffic; however, some of it would be available for evening and weekend event parking.

The development of the 28 acres will be subject to a future and separate master planning process based on new market and urban design studies. That process is separate from the current arena master plan process. The 2001 feasibility study for the 28 acres was never presented to the Planning Commission for approval. However, the basic development program was useful in this study for estimating future traffic and parking demands.

1.2.3 Principal Findings

Based upon the HCS analyses performed, no significant degradations in levels of service (that is, degrees of delay and congestion) at the study intersections are expected with the build traffic volumes as compared to the base traffic volumes.

During the A.M. peak hour, the following overall intersections are expected to have moderate to severe overall congestion (Level of Service E and F):

| A.M. Peak Hour | | | | |
|----------------|----------------------------------|----------------------------------|-------------------------------------|-------------------------------------|
| 2007 Existing | 2010 Base (mitigated) | 2010 Combined (mitigated) | 2020 Base (mitigated) | 2020 Combined (mitigated) |
| -- | -- | -- | Forbes Avenue and Armstrong Tunnels | Forbes Avenue and Armstrong Tunnels |
| -- | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square |

The A.M. peak hour intersection levels of service are summarized in Table 1 for the 2007 Existing, 2010 Base (unmitigated and mitigated), 2010 Combined (unmitigated and mitigated), 2020 Base (unmitigated and mitigated), and 2020 Combined (unmitigated and mitigated) conditions. Comparing future conditions with and without the new arena in place, no significant worsening of congestion is expected as a result of the construction of the new Pittsburgh Penguins Arena with proper mitigation measures in place during the weekday A.M. peak hour.

During the P.M. peak hour, the following overall intersections are expected to have moderate to severe overall congestion (Level of Service E and F):

| P.M. Peak Hour | | | | |
|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|-------------------------------------|
| 2007 Existing | 2010 Base (mitigated) | 2010 Combined (mitigated) | 2020 Base (mitigated) | 2020 Combined (mitigated) |
| Bedford Avenue and Washington Place | Bedford Avenue and Washington Place | Bedford Avenue and Washington Place | Bedford Avenue and Washington Place | Bedford Avenue and Washington Place |
| Centre Avenue and Washington Place | -- | -- | -- | Centre Avenue and Washington Place |
| -- | Fifth Avenue and Washington Place | Fifth Avenue and Washington Place | Fifth Avenue and Washington Place | Fifth Avenue and Washington Place |
| Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square | Forbes Avenue and Chatham Square |

The P.M. peak hour intersection levels of service are summarized in Table 2 for the 2007 Existing, 2010 Base (unmitigated and mitigated), 2010 Combined (unmitigated and mitigated), 2020 Base (unmitigated and mitigated), and 2020 Combined (unmitigated and mitigated) conditions. Comparing future conditions with and without the new arena project, no significant worsening in congestion in the weekday P.M. peak hour is expected as a result of construction of the new Pittsburgh Penguins Arena.

During the Saturday evening peak hour (during the event entering period), the following overall intersections are expected to have moderate to severe overall congestion (Level of Service E and F):

| Saturday Evening Peak Hour (Event Arrival Period) | | | | |
|---|------------------------------------|------------------------------------|------------------------------------|------------------------------------|
| 2007 Existing | 2010 Base (mitigated) | 2010 Combined (mitigated) | 2020 Base (mitigated) | 2020 Combined (mitigated) |
| Centre Avenue and Washington Place | Centre Avenue and Washington Place | Centre Avenue and Washington Place | Centre Avenue and Washington Place | Centre Avenue and Washington Place |

The Saturday peak hour intersection levels of service are summarized in Table 3 for the 2007 Existing, 2010 Base (unmitigated and mitigated), 2010 Combined (unmitigated and mitigated), 2020 Base (unmitigated and mitigated), and 2020 Combined (unmitigated and mitigated) conditions. Comparing future conditions with and without the new arena project, no significant

worsening of congestion in the Saturday peak hour is expected as a result of construction of the new Pittsburgh Penguins Arena.

1.2.4 Recommendations

Mitigation measures have been developed to alleviate the traffic impacts of the project on the study area to the maximum extent possible. A transportation management plan has also been developed in order to optimize traffic and pedestrian conditions in the study area during the peak periods studied. The following mitigation measures are recommended:

- Design and operate the proposed garage driveway on Centre Avenue as right-in right-out only operation during the 2010 combined analysis scenario. This intersection will remain unsignalized until the signal at Centre Avenue and Mario Lemieux Place is removed during construction of the 28 acre development.
- Install a new traffic signal at the intersection of the proposed garage driveway and Centre Avenue by the year 2020 (only when the traffic signal at Centre Avenue and Mario Lemieux Place is removed).
- Add westbound right turn signal control head at the intersection of Centre Avenue and Washington Place.
- Optimize traffic signal timings and phasings at all signalized study intersections as necessary, with the exception of the intersections of Centre Avenue with Dinwiddie, Devillers, and Kirkpatrick Streets.
- Develop and install appropriate signage directing arena patrons to the new Penguins Arena and parking lots/garages.
- Prohibit on-street parking on the southern side of Centre Avenue in the vicinity of the proposed new site (garage) driveway.
- Provide the (PennDOT and City) required sight distances at all proposed site driveways.
- Install stop sign on the exiting driveway approach of the 150 space parking lot onto Stevenson Street/Colwell Street.
- Continue to utilize off-duty City of Pittsburgh police officers for traffic control before and after events.

Figure 53 summarizes the proposed mitigation measures.

2.0 PROPOSED DEVELOPMENT

2.1 Summary of Development

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

2.1.1 Location

The proposed Pittsburgh Penguins Arena will be located in the City of Pittsburgh, Pennsylvania, across Centre Avenue from the current Mellon Arena. The site is located on the eastern edge of the Central Business District (CBD) of the City of Pittsburgh. The proposed new arena will be located between Centre Avenue, Fifth Avenue, and Washington Place. Study intersections representing the area of significant traffic impact, as selected by DCP, are shown in Figure 1.

2.1.2 Development Plan

The Pittsburgh Penguins Arena is proposed to have a capacity of 18,500 seats, as compared to the existing capacity of 16,900 seats in Mellon Arena. In addition, a four story 500 space parking garage and 150 space surface parking lot will be constructed on site, adjacent to the new arena. The foundation and structure of the parking garage have been designed to take the load of two additional floors of parking in the future if needed, potentially adding 280 spaces. The parking garage will have 50 spaces reserved at all times for Penguins use only. The remaining spaces will be available to commuter traffic during the daytime peak period and for arena patrons during event times on evenings and weekends. The proposed site plan is presented in Figure 2.

As part of this traffic analysis, full development of the 28 acre Mellon Arena site was assumed to occur by the year 2020, based on data contained in the feasibility study entitled “Mellon Arena Site Redevelopment Study: Urban Design Documents,” prepared by Urban Design Associates, dated September 2001. This study presents a conceptual development plan for the entire 28 acre Mellon Arena site and includes land uses consistent with the requirements/limitations of the Pittsburgh Zoning Code for this area, such as residential rental units, owned housing units, office space, retail space, parking facilities and a hotel. Parking for these land uses will be provided on the 28 acre site. This parking would not be available for weekday daytime commuter traffic; however, some of it would be available for evening and weekend event parking.

The development of the 28 acres will be subject to a future and separate master planning process based on new market and urban design studies. That process is separate from the current arena master plan process. The 2001 feasibility study for the 28 acres was never

presented to the Planning Commission for approval. However, the basic development program was useful in this study for estimating future traffic and parking demands.

2.2 Land Development Control Status

This section presents the current zoning and subdivision status of the project site.

2.2.1 Existing and Proposed Zoning

The site is currently zoned GT-E which is a transitional zone between the Golden Triangle and Crawford Square Districts. No rezoning is anticipated.

2.2.2 Subdivision

No subdivision is anticipated for the project.

2.2.3 Other

Not applicable.

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 and study intersections have been selected by the City of Pittsburgh Department of City Planning (DCP), as shown in the Scoping Form B and corresponding DCP approval letter contained in the Technical Appendix.

3.1.1 Area of Influence

The area of influence for the Pittsburgh Penguins Arena is shown in Figure 1.

3.1.2 Area of Significant Traffic Impact

Based upon the size and location of the proposed arena, the area of significant traffic impact was determined. This area, including the intersections selected and approved by DCP for detailed study, is shown in Figure 1.

3.2 Study Area Land Use

3.2.1 Existing Land Use

The existing land uses on the site include a hospital building and associated parking garage, several buildings and surface parking lots.

3.2.2 Anticipated Future Development

The proposed development is described in Section 2.1.2 of this report.

3.2.3 Existing Zoning and Anticipated Changes

The existing zoning of the site is GT-E. No change is anticipated.

3.3 Site Accessibility

3.3.1 Area Roadway System

3.3.1.1 Existing Area Roadway Systems

As shown in Figure 1, the Crosstown Expressway (I-579) is the major transportation artery in the study area. Extending from the Veterans Bridge to the Liberty Bridge, it provides connections to I-279 to the north, Route 28 to the Allegheny Valley, the Boulevard of the Allies,

and US Route 19. Ramps provide direct connections to the Crosstown Expressway from the study area.

Forbes and Fifth Avenues are parallel streets classified as principal arterials, and operating as a one-way pair, providing a major connection from downtown Pittsburgh to Oakland, passing through the southern portion of the study area. These streets also provide access to the Bluff/Uptown neighborhoods, and serve traffic to and from adjacent traffic generators including Duquesne University and Mercy Hospital. Forbes Avenue operates as one-way eastbound, and provides two travel lanes with parking on both sides. Fifth Avenue operates one-way westbound, and provides two travel lanes with parking on both sides.

Colwell Street operates two-way between Washington Place and Pride Street within the study area. It provides one lane in each direction, with parking permitted on both sides. Colwell Street primarily provides access to local properties, including a significant number of parking lots located on and adjacent to the project site.

Seventh Avenue provides an east/west connection between the study area and downtown Pittsburgh. It extends from Bedford Avenue across the Crosstown Expressway on split, directional ramps. It extends through downtown to Liberty Avenue.

Taken together, this roadway network provides the site with regional and local roadway connections. The adjacent roadways have the ability to handle large volumes of traffic, and are connected to all major interstate highways and expressways serving the downtown area.

3.3.1.2 *Future Area Roadway Systems*

No known changes are planned for the study area or adjacent roadways at this time.

3.3.2 *Traffic and Pedestrian Volumes and Conditions*

Documentation of existing traffic and pedestrian volumes and conditions in the study area includes descriptions of the data collection effort and documentation of existing pedestrian and vehicular traffic patterns and presentation of the capacity analysis results for the existing 2007 conditions.

3.3.2.1 *Data Collection*

A data collection effort was organized and conducted by Trans Associates (TA) during May 2007. The data collection included the following items:

- Manual turning movement counts were performed at all study intersections. In addition pedestrian counts were performed at selected key intersections. Data available from the Isle of Capri traffic study was utilized to the maximum extent possible. The manual turning movement counts were conducted for the following peak periods:
 - A.M. peak weekday
 - P.M. peak (non-event day) weekday
 - Saturday P.M. peak (with evening event at Mellon Arena)
- Field view of existing roadway conditions in the study area, including collection of geometric data and observation of traffic operations during each analysis period.
- Performance of pedestrian movement counts at select intersections.
- Performance of automatic traffic recorder (ATR) counts.

3.3.2.2 Automatic Traffic Recorder Counts

As described in Section 3.3.2.1, 48-hour ATR counts were performed at the locations indicated in Figure 1. The plotted ATR counts and summary sheets are provided in the Technical Appendix to this report.

3.3.2.3 Peak Periods

Based upon the vehicular turning movement counts, the traffic peak hours were determined to be 7:30 to 8:30 A.M. (weekday), 4:30 to 5:30 P.M. (weekday), and 6:15 to 7:15 P.M. (Saturday) (event arrival time).

3.3.2.4 Existing Peak Hour Traffic and Pedestrian Volumes

For the peak hours specified in Section 3.3.2.3, the existing peak hour vehicular turning movement volumes were plotted on schematic diagrams of the study intersections. These volumes are presented in Figures 3, 4, and 5. Peak hour turning movement count summaries are included in the Technical Appendix to this report.

3.3.2.5 2007 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 the signalized intersection capacity analysis methodologies presented in the 2000 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 Figures 6, 7, and 8 as well as in Tables 1, 2, and 3 for the A.M., P.M., and Saturday (event arrival) peak hours, respectively. These results

establish the current operating conditions of the study intersections. It should be noted that the pedestrian volumes described in Section 3.3.2.4 were used in the capacity analysis to incorporate pedestrian impacts within the study area. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour and LOS F during the Saturday peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

3.3.3 Transit Routes and Service

The study area is well served by public transportation. Three routes, the 81A, 81B, and 81C provide service on Centre Avenue past the site between Downtown Pittsburgh and eastern neighborhoods.

Extensive transit service is also available on Forbes and Fifth Avenues. These streets are served by routes 61A, 61B, 61C, 71A, 71C, 71D, and 501, among others. These routes have a combined headway as short as two minutes during peak periods, and provide service to downtown Pittsburgh and neighborhoods to the east, including Oakland.

The site is served by the Steel Plaza station of the Port Authority's light rail system, with a station entrance located at the intersection of Centre and Sixth Avenues. The T provides service to the southern suburbs and the downtown area, and has planned extensions to the North Side and to the convention center.

The site is also within walking distance of downtown Pittsburgh, the hub of the regional transit system, with routes to most areas of Allegheny County.

3.3.4 Existing Relevant Transportation Systems Management (TSM) Programs

The study area is served by the I-279 high occupancy vehicle (HOV) lane via a ramp at the intersection of Bedford Avenue and Mario Lemieux Place. This facility is open to vehicles with two or more passengers during the peak hours, and is reversed to operate inbound during the

morning and outbound during the evening. After certain sporting events, the HOV lane operates outbound without restriction.

3.3.5 Other Considerations

3.3.5.1 Background Data

Background information related to the existing conditions in the study area was obtained from the following agencies:

- The City of Pittsburgh Department of City Planning (DCP); and
- The City of Pittsburgh Department of Public Works (DPW).

4.0 PROJECTED TRAFFIC VOLUMES AND INTERSECTION CAPACITY ANALYSIS

4.1 Site-Generated Traffic

4.1.1 Trip Generation

The Pittsburgh Penguins Arena is proposed to have a capacity of 18,500 seats, as compared to the existing capacity of 16,900 seats in Mellon Arena. In addition, a four story 500 space parking garage and 150 space surface parking lot will be constructed on site, adjacent to the new arena. The foundation and structure of the parking garage have been designed to take the load of two additional floors of parking in the future if needed, potentially adding 280 spaces. The parking garage will have 50 spaces reserved at all times for Penguins use only. The remaining spaces will be available to commuter traffic during the daytime peak period and for arena patrons during event times on evenings and weekends. Trip generation for the proposed arena was not calculated directly, as trip generation for such facilities is dependent upon the parking supply. The on-site parking supply that would be available for arena events was used as the basis for this calculation. Currently, there are 500 spaces on the site of the new arena. In the future, these spaces will be removed and replaced by a 500 space arena garage and a 150 space surface lot, as shown on the site plan in Figure 2. For the purpose of this study and to be conservative, TA has assumed that the additional two floors of the garage will be in place in 2010, adding 280 spaces. Therefore, there will be an incremental increase of 430 ($500 + 280 + 150 - 500 = 430$) spaces on the new arena site. Trips for these spaces have been generated for both 2010 and 2020 with development conditions.

As part of this traffic analysis, full development of the 28 acre Mellon Arena site was assumed to occur by the year 2020, based on data contained in the feasibility study entitled "Mellon Arena Site Redevelopment Study: Urban Design Documents," prepared by Urban Design Associates, dated September 2001. This study presents a conceptual development plan for the entire 28 acre Mellon Arena site and includes land uses consistent with the requirements/limitations of the Pittsburgh Zoning Code for this area, such as residential rental units, owned housing units, office space, retail space, parking facilities and a hotel. Parking for these land uses will be provided on the 28 acre site. This parking would not be available for weekday daytime commuter traffic; however, some of it would be available for evening and weekend event parking.

The development of the 28 acres will be subject to a future and separate master planning process based on new market and urban design studies. That process is separate from the current arena master plan process. The 2001 feasibility study for the 28 acres was never presented to the Planning Commission for approval. However, the basic development program was useful in this study for determining future traffic and parking demands. Trip generation for

these proposed land uses was calculated based on data contained in the ITE Trip Generation Manual 7th Edition. The 28 acre new vehicle trip calculations are included in the Technical Appendix to this report.

4.1.2 Trip Arrival and Departure Distribution

Arrival/departure distributions were developed for the projected new trips for the proposed Pittsburgh Penguins Arena was based on existing commuter traffic patterns on the surrounding roadway network and the proposed driveway locations for the new parking garage and surface parking lot. The existing commuter arrival/departure distributions are presented graphically in Figure 9.

4.2 Background Traffic (Base Traffic)

4.2.1 Background Traffic Growth

The data collected by TA reflects the 2007 existing conditions. Turning movement counts collected during non-event times were scaled to reflect event conditions. In order to project year 2010 and 2020 traffic volumes, an annual traffic growth factor was determined and applied to all the existing traffic volume data. An annual linear growth rate of 0.5 percent per year was used. This factor, obtained from the Southwestern Pennsylvania Commission (SPC), was applied to all turning movement counts used in this analysis except driveway volumes.

The Department of City Planning also requested that trips associated with a maximum A.J. Palumbo Center event during the Saturday evening peak hour be included in the analysis. Trip generation calculations for the A.J. Palumbo Center event are included in the Technical Appendix to this report. The trips associated with the A.J. Palumbo Center event are presented graphically in Figure 10.

4.2.2 Projects to Be Added to Background Traffic

In addition to the SPC traffic growth rate, traffic volumes associated with the approved Duquesne University Master Plan have been included in the background traffic volumes. This data was obtained from the following reports:

- “Duquesne University Master Plan Traffic and Parking Study” prepared by Trans Associates, dated April 14, 2004.
- “Forbes Avenue and Locust Street Parking Garages - Feasibility Study” prepared by WTW Architects and Trans Associates, dated April 2006.

Traffic volumes associated with Duquesne University are included in the Technical Appendix to this report.

4.3 Year 2010 Base Conditions

4.3.1 Year 2010 Base Conditions Traffic Volumes

As described in Section 4.2.1, a 0.5 percent per year linear growth factor was applied to the 2007 existing traffic volumes combined with the trips from the approved Duquesne University Master Plan and the A.J. Palumbo Center Saturday evening event trips. The resultant 2010 base conditions traffic volumes are plotted in Figures 11, 12, and 13.

4.3.2 Year 2010 Base Conditions - Intersections Levels of Service (Unmitigated)

Using the analysis methodologies described in Section 3.3.2.5, unmitigated intersection levels of service were determined at all of the study intersections under 2010 base conditions assuming existing intersection geometry and signal timings. The results of the analyses are summarized in Figures 14, 15, and 16 as well as in Tables 1, 2, and 3 for the A.M., P.M., and Saturday (event arrival) peak hours, respectively. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour and LOS E during the Saturday peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the A.M. and P.M. peak hours and LOS F during the Saturday peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour.
- Fifth Avenue and Magee Street
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Forbes Avenue and Armstrong Tunnel
 - The overall intersection operates at LOS E during the P.M. peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. and P.M. peak hours and LOS E during the Saturday peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.3.3 Year 2010 Base Conditions – Intersections Levels of Service (Mitigated)

Using the analysis methodologies described in Section 3.3.2.5, mitigated intersection levels of service were determined at all of the study intersections under 2010 base conditions assuming existing intersection geometry and optimized traffic signal timings. The results of the analysis are presented in Figures 17, 18, and 19 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the Saturday peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. peak hour and LOS E during the P.M. peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.4 Year 2010 Combined Conditions (With Development)

4.4.1 Year 2010 Combined Conditions Traffic Volumes (With Development)

The projected site-generated traffic volumes from the Pittsburgh Penguins Arena for the incremental increase of 430 parking spaces to be located on the new arena site were added to the 2010 base traffic volumes to develop the 2010 combined (with development) traffic volumes. The new trips associated with the additional 430 parking spaces to be located on the new arena site were included. These trips are presented graphically in Figures, 20, 21, and 22.

In addition to the new trips, traffic removals and reroutings were performed. This includes the removal of traffic associated with the hospital garage, and the rerouting of Colwell Street and Magee Street traffic due to development of the arena site. The traffic removal and rerouting was performed based on the existing travel patterns on the roadway networks.

The resultant 2010 combined traffic volumes are presented in Figures 23, 24, and 25.

The removed and rerouted traffic volumes are included in the Technical Appendix to this report.

4.4.2 2010 Combined Traffic Volumes - Intersections Levels of Service (Unmitigated)

Using the methodologies described in Section 3.3.2.5, unmitigated intersection levels of service were determined at all of the study intersections under 2010 combined conditions. It should be noted that existing signal timings and roadway conditions were used for analysis purposes. The results of the analysis are presented in Figures 26, 27, and 28 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. and Saturday peak hours.
- Bedford Avenue and Crawford Street
 - The overall intersection operates at LOS F during the A.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the A.M. and P.M. peak hour and LOS F during Saturday peak hour.
- Centre Avenue and Crawford Street
 - The overall intersection operates at LOS E during the P.M. peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Fifth Avenue and Stevenson Street
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Forbes Avenue and Armstrong Tunnel
 - The overall intersection operates at LOS E during the P.M. peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. and P.M. peak hours and LOS E during the Saturday peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.4.3 2010 Combined Traffic Volumes - Intersections Levels of Service (Mitigated)

Using the methodologies described in Section 3.3.2.5, mitigated intersection levels of service were determined at all of the study intersections under 2010 combined conditions. It should be noted that optimized signal timings and existing roadway conditions were used for analysis purposes. The results of the analysis are presented in Figures 29, 30, and 31 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS F during the Saturday peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. peak hour and LOS E during the P.M. peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour.

Mitigation strategies developed to address any degradation in level of service are described in a later section of this report.

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

4.5 Year 2020 Base Conditions

4.5.1 Year 2020 Base Conditions Traffic Volumes

As described in Section 4.2.1, a 0.5 percent per year linear growth factor was applied to the 2007 existing traffic volumes combined with the trips from the approved Duquesne University Master Plan and the A.J. Palumbo Center Saturday evening event trips. The resultant 2020 base conditions traffic volumes are plotted in Figures 32, 33, and 34.

4.5.2 Year 2020 Base Conditions - Intersections Levels of Service (Unmitigated)

Using the analysis methodologies described in Section 3.3.2.5, unmitigated intersection levels of service were determined at all of the study intersections under 2020 base conditions assuming existing intersection geometry and signal timings. The results of the analyses are

summarized in Figures 35, 36, and 37 as well as in Tables 1, 2, and 3 for the A.M., P.M., and Saturday (event arrival) peak hours, respectively. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour and LOS E during the Saturday peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the A.M. peak hour and LOS F during the P.M. and Saturday peak hours.
- Forbes Avenue and Armstrong Tunnel
 - The overall intersection operates at LOS E during the A.M. and P.M. peak hours.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. and P.M. peak hours and LOS E during the Saturday peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Fifth Avenue and Magee Street
 - The overall intersection operates at LOS F during the P.M. peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.5.3 Year 2020 Base Conditions – Intersections Levels of Service (Mitigated)

Using the analysis methodologies described in Section 3.3.2.5, mitigated intersection levels of service were determined at all of the study intersections under 2020 base conditions assuming existing intersection geometry and optimized traffic signal timings. The results of the analysis are presented in Figures 38, 39, and 40 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS F during the Saturday peak hour.
- Forbes Avenue and Armstrong Tunnel
 - The overall intersection operates at LOS E during the A.M. peak hour.

- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. peak hour and LOS E during the P.M. peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.6 Year 2020 Combined Conditions

4.6.1 Year 2020 Combined Conditions Traffic Volumes (With Development)

The projected site-generated traffic volumes from the Pittsburgh Penguins Arena and from the 28 acre Mellon Arena site development were added to the 2020 base traffic volumes to develop the 2020 combined (with development) traffic volumes. The new trips include trips associated with the incremental increase of 430 parking spaces to be constructed on the new arena site. These trips are presented in Figures 41, 42, and 43.

In addition to the new trips, additional traffic removals and rerouting were performed. This includes commuter traffic removals of commuters (the 28 acre site will not provide commuter parking as it does currently), removal of trips for the hospital garage, removal of trips on Mario Lemieux Place, and the rerouting of Colwell Street and Magee Street traffic due to development of the arena site. The traffic removal and rerouting was performed based on the existing travel patterns on the roadway networks.

The resultant 2020 combined traffic volumes are presented in Figures 44, 45, and 46.

The removed and rerouted traffic volumes are included in the Technical Appendix to this report.

4.6.2 2020 Combined Traffic Volumes - Intersections Levels of Service (Unmitigated)

Using the methodologies described in Section 3.3.2.5, unmitigated intersection levels of service were determined at all of the study intersections under 2020 combined conditions. It should be noted that existing signal timings and roadway conditions were used for analysis purposes. The results of the analysis are presented in Figures 47, 48, and 49 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. and Saturday peak hours.
- Bedford Avenue and Crawford Street
 - The overall intersection operates at LOS F during the A.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS F during the A.M., P.M., and Saturday peak hours.
- Forbes Avenue and Armstrong Tunnel
 - The overall intersection operates at LOS E during the A.M. and P.M. peak hours.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. and P.M. peak hours and LOS E during the Saturday peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Fifth Avenue and Stevenson Street
 - The overall intersection operates at LOS E during the P.M. peak hour.

Detailed capacity analysis worksheets are provided in the Technical Appendix to this report.

4.6.3 2020 Combined Traffic Volumes - Intersections Levels of Service (Mitigated)

Using the methodologies described in Section 3.3.2.5, mitigated intersection levels of service were determined at all of the study intersections under 2020 combined conditions. It should be noted that optimized signal timings and existing roadway conditions were used for analysis purposes. The results of the analysis are presented in Figures 50, 51, and 52 and in Tables 1, 2, and 3. As summarized in Tables 1, 2, and 3, all overall intersections operate at an acceptable Level of Service D or better except for the following:

- Bedford Avenue and Washington Place
 - The overall intersection operates at LOS F during the P.M. peak hour.
- Centre Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour and LOS F during the Saturday peak hour.
- Forbes Avenue and Chatham Square/Washington Place
 - The overall intersection operates at LOS F during the A.M. peak hour and LOS E during the P.M. peak hour.
- Forbes Avenue and Armstrong Tunnel

- The overall intersection operates at LOS E during the A.M. peak hour.
- Fifth Avenue and Washington Place
 - The overall intersection operates at LOS E during the P.M. peak hour.

Mitigation strategies developed to address any degradation in level of service are described in a later section of this report.

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

5.0 TRAFFIC ANALYSIS

5.1 Site Access

Site access to the proposed Pittsburgh Penguins Arena parking garage and on site surface lot will be via Centre Avenue and Colwell Street. Access to the loading dock will be through Our Way.

Pedestrians will have three main access points to the arena, two on Centre Avenue and one on Fifth Avenue.

5.2 Traffic Safety

All roadway and signal improvements for the project will be designed to provide a high degree of safety for motorists and pedestrians. To the extent possible within the constraints of the project, mitigation measures will address existing safety issues within the study area that are influenced by project-generated traffic.

5.3 Traffic Signals

With the exception of the intersections of Pride Street with Colwell Street and Our Way, every intersection in the study area is signalized. This is reflective of the site's location adjacent to the central business district, and is typical of a densely-developed urban district. This extensive level of signalization provides for convenient pedestrian crossings at signalized intersections throughout the study area, and allows for heavy traffic flows to disperse throughout the network rather than being concentrated on a few arterials.

The traffic signals in the study area include a wide range of equipment and standards. A few installations are relatively old, and have signals mounted on span wire or on poles at the side of the road. These installations generally do not include pedestrian signals.

5.4 Site Circulation and Parking

5.4.1 Automobiles

See Sections 4.1.2 and 5.1. The on-site garage and surface parking lot will be accessed by automobiles via driveways located on Centre Avenue and Colwell Street.

5.4.2 Loading Vehicles

In order to accommodate truck deliveries, a loading dock is proposed along the eastern side of the arena. Access to the loading dock will be from Our Way, which will be widened in conjunction with the development.

5.4.3 Emergency Vehicles

Emergency (fire, paramedics, police, etc.) vehicles will have access to the site via the public roadways that completely surround and traverse the arena site. Emergency service facilities are located nearby within several blocks of the site as follows:

- Zone 2 Police Station at 2000 Centre Avenue (at DeVilliers Street);
- Company No. 4 Fire Station at 1324 Forbes Avenue/Mercy Hospital;
- Medic 5 Paramedic/Ambulance Unit in the Upper Hill District;
- Medic 14 Unit in Downtown Pittsburgh; and
- Mercy Hospital of Pittsburgh at Stevenson and Locust Streets.

5.4.4 Other Specialized Vehicles

Public bus service provided by the Port Authority of Allegheny County will continue to be provided on Centre, Forbes and Fifth Avenues.

5.5 Queuing Analysis

Queuing analysis was performed to determine queuing using SYNCHRO Version 6 and 7 traffic modeling/analysis software. Queue lengths both increase and decrease in length between the 2010/2020 base and combined conditions, however, the changes in queue length do not vary substantially from queues that would occur without the development. The 95th percentile queue lengths are presented in Table 4. Significant queuing will occur on eastbound Forbes Avenue, as it does today, on the approaches to the Armstrong Tunnels and to Chatham Square. Queuing will continue onto northbound Chatham Square and Washington Place. Significant queuing will also occur on eastbound Bigelow Boulevard at its intersection with Bedford Avenue and Washington Place as it does today.

5.6 Sight Distance Evaluation

All site driveways will be designed to provide adequate sight distances to ensure safe operation according to the provisions of Chapter 441 of the Pennsylvania Code.

6.0 IMPROVEMENT ANALYSIS

6.1 Improvements to Accommodate Base Traffic and Site Traffic

Based on the results of the 2010 and 2020 combined conditions traffic impact analyses, recommended roadway improvements have been developed. As noted previously, the study area roadway network has the capacity to carry heavy traffic flows, having been designed to accommodate the traffic demands of the Mellon Arena and adjacent developments. In particular, the site has excellent access to I-579 as well as to adjacent bridges and the entire regional highway system. Due to this high level of existing accessibility, no major improvements to the roadway network are proposed.

Traffic patterns and roadway improvements have been designed in order to minimize the traffic impact of the development on the adjacent roadways and residential neighborhoods. The following mitigation measures are recommended:

- Design and operate the proposed garage driveway on Centre Avenue as right-in right-out only operation during the 2010 combined analysis scenario. This intersection will remain unsignalized until the signal at Centre Avenue and Mario Lemieux Place is removed during construction of the 28 acre development.
- Install a new traffic signal at the intersection of the proposed garage driveway and Centre Avenue by the year 2020 (only when the traffic signal at Centre Avenue and Mario Lemieux Place is removed).
- Add westbound right turn signal control head at the intersection of Centre Avenue and Washington Place.
- Optimize traffic signal timings and phasings at all signalized study intersections as necessary, with the exception of the intersections of Centre Avenue with Dinwiddie, Devillers, and Kirkpatrick Streets.
- Develop and install appropriate signage directing arena patrons to the new Penguins Arena and parking lots/garages.
- Prohibit on-street parking on the southern side of Centre Avenue in the vicinity of the proposed new site (garage) driveway.
- Provide the (PennDOT and City) required sight distances at all proposed site driveways.
- Install stop sign on the exiting driveway approach of the 150 space parking lot onto Stevenson Street/Colwell Street.
- Continue to utilize off-duty City of Pittsburgh police officers for traffic control before and after events.

The proposed mitigation measures are summarized in Figure 53.

7.0 FINDINGS

7.1 Site Accessibility

See Section 3.3. Site accessibility is adequate to provide for vehicular and pedestrian access.

7.2 Traffic Impacts

See Section 4.3.2.

7.3 Need for Improvements

Based on the results of the 2010 and 2020 combined conditions traffic impact analysis, recommended roadway improvements have been developed. As noted previously, the study area roadway network has the capacity to carry heavy traffic flows, having been designed to accommodate the traffic demands of the Mellon Arena and adjacent developments. In particular, the site has excellent access to I-579 as well as to adjacent bridges and the entire regional highway system. Due to this high level of existing accessibility, no major improvements to the roadway network are proposed.

Traffic patterns and roadway improvements have been designed in order to minimize the traffic impact of the development on the adjacent roadways and residential neighborhoods. The following mitigation measures are recommended:

- Design and operate the proposed garage driveway on Centre Avenue as right-in right-out only operation during the 2010 combined analysis scenario. This intersection will remain unsignalized until the signal at Centre Avenue and Mario Lemieux Place is removed during construction of the 28 acre development.
- Install a new traffic signal at the intersection of the proposed garage driveway and Centre Avenue by the year 2020 (only when the traffic signal at Centre Avenue and Mario Lemieux Place is removed).
- Add westbound right turn signal control head at the intersection of Centre Avenue and Washington Place.
- Optimize traffic signal timings and phasings at all signalized study intersections as necessary, with the exception of the intersections of Centre Avenue with Dinwiddie, Devillers, and Kirkpatrick Streets.
- Develop and install appropriate signage directing arena patrons to the new Penguins Arena and parking lots/garages.
- Prohibit on-street parking on the southern side of Centre Avenue in the vicinity of the proposed new site (garage) driveway.
- Provide the (PennDOT and City) required sight distances at all proposed site driveways.

- Install stop sign on the exiting driveway approach of the 150 space parking lot onto Stevenson Street/Colwell Street.
- Continue to utilize off-duty City of Pittsburgh police officers for traffic control before and after events.

Figure 53 summarizes the proposed mitigation measures.

8.0 RECOMMENDATIONS

8.1 Site Access/Circulation Plan

See Section 5.4.

8.2 Roadway Improvements

Based on the results of the 2010 and 2020 combined conditions traffic impact analysis, recommended roadway improvements were developed. As noted previously, the study area roadway network has the capacity to carry heavy traffic flows, having been designed to accommodate the traffic demands of the Mellon Arena and adjacent developments. In particular, the site has excellent access to I-579 as well as to adjacent bridges and the entire regional highway system. Due to this high level of existing accessibility, no major improvements to the roadway network are proposed.

Traffic patterns and roadway improvements have been designed in order to minimize the traffic impact of the development on the adjacent residential neighborhoods. The following mitigation measures are recommended:

- Design and operate the proposed garage driveway on Centre Avenue as right-in right-out only operation during the 2010 combined analysis scenario. This intersection will remain unsignalized until the signal at Centre Avenue and Mario Lemieux Place is removed during construction of the 28 acre development.
- Install a new traffic signal at the intersection of the proposed garage driveway and Centre Avenue by the year 2020 (only when the traffic signal at Centre Avenue and Mario Lemieux Place is removed).
- Add westbound right turn traffic signal control head at the intersection of Centre Avenue and Washington Place.
- Optimize traffic signal timings and phasings at all signalized study intersections as necessary, with the exception of the intersections of Centre Avenue with Dinwiddie, Devillers, and Kirkpatrick Streets.
- Develop and install appropriate signage directing arena patrons to the new Penguins Arena and parking lots/garages.
- Prohibit on-street parking on the southern side of Centre Avenue in the vicinity of the proposed new site driveway.
- Provide the required sight distances at all proposed site driveways.
- Install stop sign on the exiting driveway approach of the 150 space parking lot onto Stevenon Street /Our Colwell Street.
- Continue to utilize off-duty City of Pittsburgh police officers for traffic control before and after events.

The proposed mitigation measures are summarized in Figure 53.

8.3 Transportation Systems Management Actions

Not applicable.

8.4 Traffic Operations Plan

The roadway network adjacent to the site has the capacity to carry heavy traffic flows. As demonstrated in our analysis of three peak periods, the traffic patterns in the study area are anticipated to vary significantly throughout the day and the week.

During peak periods of demand (events), some degree of traffic management may be required. This includes the use of off-duty police officers to control traffic flow as necessary. This need for police intervention should be periodically reevaluated.

8.5 Truck Loading Management Plan

Truck access to the site will comply with the requirements of the City of Pittsburgh's Truck Route Ordinance, which requires that vehicles over 14,000 lbs gross weight follow a designated network of streets to reach their destination. Adjacent to the site, the legislated truck route network includes Washington Place, Forbes Avenue, and Fifth Avenue. The site loading dock driveway will connect directly with the truck route network on Fifth Avenue at Stevenson Street. The approved City of Pittsburgh truck route is presented graphically in Figure 54.

Autoturn analyses have been performed for a WB-65 sized truck turning onto Our Way from both Forbes and Fifth Avenues. Based on the analysis, the WB-65 sized truck may require that on-street parking on Stevenson Street be temporarily prohibited in order for the trucks to make the necessary turning maneuvers. During events when large trucks are expected, the arena should coordinate with the City of Pittsburgh for on-street parking control at this location. Autoturn analyses are presented in the Technical Appendix to this report.

The internal loading dock facility is anticipated to be large enough to accommodate all typical loading operations at the site. Internal staging can accommodate additional trucks to prevent staging from occurring on streets adjacent to the facility entrance. Should any special event result in the need for more trucks than the loading docks can accommodate, the 150 space on-site parking lot will be used for staging purposes.

During the 2007 concert year, a maximum of 39 vehicles were present at one time. This included 21 trucks and 18 buses. The detailed operational data for Mellon Arena is included in the Technical Appendix.

8.6 Construction Management Plan

A construction management plan (CMP) will be specifically formulated to minimize the impact of the project on the surrounding area. The following conditions are being set forth to be instituted as part of this plan:

- Noise and vibration from construction work will be minimized so as to not interfere with functions of the adjacent residential neighborhood;
- Fire lanes must not be interrupted during construction;
- The staging of trucks must not occur on adjacent neighborhood streets without an approved designated area;
- Truck routing patterns will utilize Washington Place, Forbes Avenue and Fifth Avenue as primary access routes; and
- The contractor shall be responsible for keeping streets along approved truck routes free of dirt, debris and/or mud from hauling.

9.0 CONCLUSIONS

This study has been performed to determine the traffic impacts of the proposed Pittsburgh Penguins Arena. Based upon the analysis results, recommended mitigation strategies have been developed. These strategies include the recommended roadway improvements described in Section 6.1 and in Figure 53.

Provided these recommendations are implemented, the traffic and parking impacts of the proposed Pittsburgh Penguins Arena will be mitigated to the maximum extent possible.