



Traffic Impact Study

**Live! Casino and Hotel
Philadelphia, PA**

Prepared for:
Stadium Casino, LLC

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EXECUTIVE SUMMARY

SUMMARY OF TIS

This Traffic Impact Study (TIS) has been prepared on behalf of Stadium Casino, LLC, to evaluate the potential impacts of Live! Casino and Hotel on the roadway network in south Philadelphia. An analysis of the potential impacts of the proposed casino facility was conducted by evaluating existing, future no build, and future build condition traffic operations during a Friday Commuter peak hour, Friday Pre-Event peak hour, Friday Casino peak hour, and Saturday Casino peak hour. In addition, an assessment of pedestrian facilities was also conducted to evaluate pedestrian circulation to and from the proposed development.

The proposed development would be located in the South Philadelphia Stadium District – an area that is characterized by upgraded local roadway facilities and ample freeway connections that were designed to accommodate large traffic volumes associated with events at the stadium complex. The results of the capacity analyses conducted for this study verify that the proposed development would have a minimal impact on the study area roadway network during non-event periods due to the ample roadway capacity. Impacts during stadium events would also be minimal given that the proposed development would likely become a pre- or post-game destination. As such, a significant portion of casino patrons arriving or departing during event periods would likely be people visiting the casino on their way to or from a stadium event. Furthermore, patrons not destined for a stadium event would likely avoid the casino before and after events because of stadium-related congestion.

Based on the results of the capacity analyses presented in this document, the proposed development would result in minor intersection-specific impacts. Relatively low-cost improvements such as adjustments to signal operation/timing, new or improved pedestrian facilities, and left-turn treatments would mitigate the operational deficiencies related to traffic generated by the proposed site. It should also be noted that some of the proposed mitigation measures would result in an improvement in delay or queuing even when compared to the Existing and/or No Build Conditions.

SITE FEATURES AND ACCESS

The casino facility is proposed for the existing Holiday Inn Hotel site located at 900 Packer Avenue, which currently consists of a 240-room hotel, meeting and convention space, and a restaurant/bar. The Live! Casino and Hotel development will include a 270,000 square-foot, Las Vegas style casino entertainment facility, a 2,600-space parking garage, and a luxury upgrade to the existing 240-room hotel. Within the 270,000 square-foot casino entertainment facility would be a 100,000 square-foot casino floor with 2,013 slot machines and 125 table games (3,028 total gaming positions), three restaurant/dining venues, and 6,500 square feet of private event space. In addition, the existing 240-room hotel would be upgraded to a 220-room luxury hotel. The conceptual site plan for the proposed casino facility is located in **APPENDIX A**.

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The proposed casino facility would be accessed via two driveways on S. Darien Street, and an exit-only driveway on S. 10th Street. Access to the porte-cochere and valet drop-off would be provided via a driveway located approximately 200 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps. Valet staff would utilize a driveway into the parking garage that is connected directly to the porte-cochere, thus eliminating additional vehicle trips on S. Darien Street. The valet pick-up area would be located inside the parking garage. Access to the garage for public parking would be provided via a two-way driveway located approximately 550 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps. An additional exit point for the garage would be provided via a one-way service road that would connect to S. 10th Street.

It is anticipated that the Pennsylvania Gaming Commission would award the casino license in 2013. Therefore, this study assumes that the proposed casino would open in 2016.

STUDY PERIODS AND STUDY AREA

Following a meeting with the City of Philadelphia Streets Department and PennDOT, it was determined that the TIS would analyze a typical Friday PM commuter peak period (4:00 PM – 7:00 PM), a Friday pre-Phillies game (pre-event) peak period (5:00 PM – 8:00 PM), a Friday evening casino peak period (7:00 PM – 10:00 PM), and a Saturday evening casino peak period (8:00 PM – 11:00 PM). In addition, a study area was identified that is bounded by Penrose Avenue to the west, I-95 to the east, W Oregon Avenue to the north, and I-95 to the south, and includes the following intersections:

1. Penrose Avenue and Pattison Avenue (signalized)
2. Pattison Avenue and S. Broad Street (signalized)
3. Pattison Avenue and S. 11th Street (Pre-Event Only) (signalized)
4. Pattison Avenue and S. Darien Street (signalized)
5. Pattison Avenue and S. 7th Street (signalized)
6. S. Broad Street and Terminal Avenue/I-95 Ramps (Pre-Event Only) (signalized)
7. S. Broad Street and I-95 Northbound Off-Ramp (unsignalized)
8. S. Broad Street Southbound and I-95 Southbound On-Ramp (unsignalized)
9. S. Broad Street and Packer Avenue (signalized)
10. S. Broad Street and Pollock Street (signalized)
11. S. Broad Street and W Oregon Avenue (signalized)
12. Packer Avenue and S. 10th Street (signalized)
13. Packer Avenue and S. Darien Street/I-76 Eastbound Ramps (signalized)
14. Packer Avenue and S. 7th Street (signalized)

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15. Packer Avenue and I-95 Northbound Off-Ramp (Friday Commuter and Pre-Event Only) (unsignalized)

18. S. Front Street and I-95 Southbound On-Ramp/I-76 Westbound Off-Ramp (signalized)

16. Packer Avenue and S. Front Street (signalized)

19. S. Front Street and I-95 Southbound Off-Ramp/I-95 Northbound On-Ramp/Dunkin Donuts Driveway (signalized)

17. S. Front Street and I-76 Eastbound On-Ramp (unsignalized)

SITE TRIP GENERATION

In order to estimate the number of trips that would be generated by the proposed casino, rates of the following three similar casinos within the US were analyzed in order to develop an average trip generation rate for the casino component of Live! Casino and Hotel:

1. Rivers Casino, Pittsburgh, PA
2. SugarHouse Casino, Philadelphia, PA
3. St. Charles Casino, St. Louis, MO

Trip generation rates for the three casinos were averaged in order to develop a vehicle trip generation rate to be used to estimate trips generated by the proposed casino. Based on the results of the analysis, a rate of 0.42 trips per gaming position was utilized for the Friday Commuter and Pre-Event peak hours, a rate of 0.47 trips per gaming position was utilized for the Friday Casino peak hour, and a rate of 0.59 trips per gaming position was utilized for the Saturday Casino peak hour.

In addition to the gaming components, Live! Casino and Hotel also includes restaurants, event space, and a hotel. Each of the casinos used to develop the trip generation rates also contain restaurants. Therefore, it is assumed that the average trip generation rates include trips generated by restaurant patrons. The ITE *Trip Generation Manual (9th Edition)* was utilized to generate trips for the hotel and event space components.

A 2% multi-modal trip credit was added to the base trip generation for all non-event analysis periods. A pre-event “stay-away” reduction factor of 15%, and a linked trip reduction factor of 15%, was applied to the TIS based on information contained in the *Philadelphia Sports Complex Parking and Traffic Management Plan* (Langan, 2010). Based on the results of the trip generation analysis presented in this document, the proposed Live! Casino and Hotel would generate the following number of new peak hour trips to the study area roadway network:

1. Friday Commuter Peak Hour: 1,412
2. Friday Pre-Event Peak Hour: 988
3. Friday Evening Casino Peak Hour: 1,448

4. Saturday Evening Casino Peak Hour: 1,831

SITE TRIP DISTRIBUTION

In order to estimate the entering and exiting distribution of trips to and from the site, a gravity model was developed that evaluated population, as well as travel time and distance to and from the proposed project in comparison to other existing casinos in the Philadelphia metropolitan area. Casinos considered in the analysis include Harrah's (Chester, PA), Valley Forge (King of Prussia, PA), SugarHouse (Philadelphia), and Parx (Bensalem, PA). Based on the results of the gravity model, approximately 8% of trips would originate from the north and utilize Broad Street (7%) and local roads (1%). An additional 19% of trips would originate from the north via I-95, of which approximately 3% would come from New Jersey via the Ben Franklin Bridge. Approximately 18% of trips would originate from the south via I-95 to Broad Street (5%), I-95 to Packer Avenue (11%), and Penrose Avenue (2%). Finally, 30% of trips would originate from New Jersey via the Walt Whitman Bridge, while 25% would originate from points west via I-76 eastbound. Outbound trips are anticipated to follow the same pattern.

Multimodal trips were added to the study area roadway network based on existing and anticipated pedestrian travel patterns. It should also be noted that all transit trips are shown as pedestrian trips between the transit station/bus stop and the site.

SITE IMPACTS AND RECOMMENDED MITIGATION MEASURES

The capacity analysis shows that the proposed development would result in site-specific impacts at seven of the nineteen study area intersections. These intersections would experience an overall increase in delay of greater than ten seconds, or contain movements that would experience an increase in delay, volume to capacity (V/C) ratio, and/or queuing, resulting in a LOS E or F during the 2016 and 2021 Build Conditions. Relatively low-cost and low-intensity mitigation measures such as adjustments to signal operations, and additional left-turn treatments were evaluated and recommended. **TABLE E-1** indicates the operational deficiency identified in the Build Condition analysis and the recommended mitigation measure.

In addition to vehicular operations, pedestrian and bicycle facilities to and from the proposed site were evaluated. Sidewalks are currently provided along the S. 10th Street and Packer Avenue site frontages; however, no sidewalk is currently provided along the S. Darien Street frontage. In addition, ADA-compliant curb ramps and pedestrian signal heads are not currently provided at the intersections of Packer Avenue and S. 10th Street, and Packer Avenue and S. Darien Street. Therefore, it is recommended that the pedestrian facilities along all three site frontages be improved to accommodate pedestrian flow to and from the proposed development, particularly pedestrians traveling between the site and the stadiums. In addition, pedestrian signal heads and ADA compliant curb ramps are recommended for the intersections of Packer Avenue and S. 10th Street, Packer Avenue and S. Darien Street, and Packer Avenue and S. 7th Street.

CONCLUSION

In summary, the proposed development would be located in an area of Philadelphia that has upgraded local roadway facilities, as well as ample freeway connections that were designed to accommodate large traffic volumes for events within the stadium complex. Because of the ample capacity provided within the study area, the results of the analysis presented above show that the proposed development would result in minor site-specific impacts. The recommended vehicular and pedestrian mitigation measures would be capable of addressing these impacts, and in some locations, the proposed mitigation measures would result in improved operations over the Existing and/or No Build Conditions.

TABLE E-1: Summary of Deficiencies and Recommended Mitigation Measures

Operational Deficiency	Recommended Mitigation Measure
1. Additional right-turn volume from westbound Packer Avenue to northbound S. Broad Street would increase delay and queuing on the westbound Packer Avenue approach, resulting in a V/C ratio greater than 1.0 (LOS F).	Reallocate green time from S. Broad Street to eastbound/westbound Packer Avenue.
2. Delay for the westbound left-turn movement from Packer Avenue to S. 10 th Street would increase by 31 seconds during the Friday Pre-Event peak hour (LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide additional green time for the eastbound/westbound Packer Avenue approaches at the S. 10 th Street intersection.
3. Delay for the westbound left-turn movement from Packer Avenue to S. Darien Street would increase by over 200 seconds per vehicle during the non-event peak hours. Furthermore, event and non-event peak hour queues would extend to the intersection of Packer Avenue and S. 7 th Street.	Provide an additional westbound left-turn lane and extend the storage length. The dual left-turn would operate in a protected phase. The opposing eastbound left-turn would also be modified to operate in a protected phase. The additional lane could be added by restriping the existing pavement to reduce the width of the existing shoulders. The bike lanes would be maintained.
4. The increase in traffic on northbound S. Darien Street would result in an increase in delay and queuing for the southbound left-turn from the I-76 EB off-ramp to eastbound Packer Avenue during the Friday Commuter peak hour (LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide a protected-permissive left-turn phase for the southbound left-turn movement.
5. The left-turn from the proposed garage to northbound S. Darien Street would operate at LOS E and F during the 2016 and 2021 Friday Pre-Event peak hour, respectively.	Consider routing all departing traffic to the S. 10 th Street exit if field operations determine this is needed.
6. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result in an increase in delay for the eastbound left-turn movement from Packer Avenue to northbound S. 7 th Street (LOS D to LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide a protected-permissive phase for the eastbound/westbound left-turn movement.

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Operational Deficiency	Recommended Mitigation Measure
7. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result in an increase in delay I-95 Northbound Off-Ramp (LOS C to LOS E).	This is a borderline condition that only occurs for the one hour prior to an event, and does not justify additional mitigation measures.
8. Additional site-generated traffic volume on the northbound left-turn movement from S. Front Street to the I-95 northbound on-ramp would result in an increase in delay during the Friday Commuter peak hour (LOS D to LOS F)	Reallocate green time from southbound S. Front Street to the northbound left-turn phase.
9. Additional site-generated traffic volume on the eastbound right-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts would result in an increase in delay of 60 seconds (LOS F) during the Friday Pre-Event peak hour.	Reallocate green time from northbound/southbound S. Front Street to the eastbound approach phase.
10. Additional site-generated traffic volume on the northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would result in an increase in delay of 23 seconds (LOS F).	Consider reallocating green time from eastbound/westbound Pattison Avenue to the northbound/southbound phase.
11. Provide pedestrian and bicycle facilities.	Upgrade sidewalk along S. Darien Street and S. 10 th Street. Install ADA-compliant curb ramps and pedestrian countdown signals at the Packer Avenue intersections with S. 10 th Street, S. Darien Street, and S. 7 th Street. Provide bicycle racks or lockers on site.

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1.0 INTRODUCTION

This Traffic Impact Study (TIS) has been prepared on behalf of Stadium Casino, LLC, to evaluate the potential impacts of Live! Casino and Hotel on the roadway network in South Philadelphia. The casino facility is proposed for the existing Holiday Inn Hotel site located at 900 Packer Avenue, which consists of a 240-room hotel, meeting and convention space, and a restaurant/bar. The site is located in the Philadelphia Stadium District and is bounded by Packer Avenue to the north, S. 10th Street to the west, S. Darien Street to the east, and a stadium parking facility to the south (**EXHIBIT 1**). It is easily accessible from I-76, as well as I-95, and takes advantage of the extensive roadway network that has been built to accommodate the large amount of traffic associated with events at Citizens Bank Park, Lincoln Financial Field, and the Wells Fargo Center.

Development of the Live! Casino and Hotel includes a 270,000 square foot, Las Vegas style casino entertainment facility, a 2,600-space parking garage, and a luxury upgrade to the existing 240-room hotel. Within the 270,000 square-foot casino entertainment facility would be a 100,000 square foot casino floor with 2,013 slot machines and 125 table games (3,028 total gaming positions), three restaurant/dining venues, and 6,500 square feet of private event space. In addition, the existing 240-room hotel would be upgraded to a 220-room luxury hotel. The conceptual site plan for the proposed casino facility is located in **APPENDIX A**.

The proposed casino facility would be accessed via two driveways on S. Darien Street, and an exit-only driveway on S. 10th Street. Access to the porte-cochere and valet drop-off would be provided via a driveway located approximately 200 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps. Valet staff would utilize a driveway into the parking garage that is connected directly to the porte-cochere, thus eliminating additional vehicle trips on S. Darien Street. The valet pick-up area would be located inside the parking garage. Access to the garage for public parking would be provided via a two-way driveway located approximately 550 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps.

A one-way service road is also proposed for the south side of the site, adjacent to the parking garage, between S. Darien Street and S. 10th Street. The service road would be used for deliveries and trash pick-up, and would serve as a secondary exit for the garage.

The site is easily accessible from several ramps to the regional freeway network. Therefore, it is anticipated that the majority of vehicles would access the site via I-76 and I-95. Direct access to and from I-76 eastbound would be provided via the existing on and off-ramps to S. Darien Street/Packer Avenue (Exit 350). Vehicles coming from points east, including New Jersey, would utilize the I-76 westbound off-ramp to S. 7th Street (Exit 350), turn right onto Packer Avenue, and then left onto Darien Street. Vehicles exiting the site, destined for points west on I-

76 westbound would travel approximately one-half mile west on Packer Avenue to the I-76 westbound on-ramp from S. Broad Street. Access to and from the north on I-95 would be provided via the existing ramps to and from S. Front Street (Exit 19). Finally, vehicles originating from or destined to points south on I-95 could utilize Exit 17 to S. Broad Street, or Exit 19 to Packer Avenue. A detailed description of anticipated arrival and departure patterns is provided in **Section 4.3**.

It is anticipated that the Pennsylvania Gaming Commission would award the casino license in 2013. Therefore, this study assumes that the proposed casino would open in 2016.

1.1 SCOPE OF STUDY

This TIS will analyze the impacts of the proposed development on the adjoining roadways and intersections. As part of this study, Stantec has:

- Examined existing conditions surrounding the site;
- Obtained manual turning movement counts (TMC) at critical intersections during Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak periods;
- Estimated the traffic that will be generated by the proposed development;
- Estimated the arrival and departure trip distributions for the proposed development;
- Assessed the pedestrian facilities to/from the site;
- Evaluated internal site traffic and pedestrian flow;
- Estimated traffic growth in the area independent of this development;
- Prepared projected traffic volumes with and without the development;
- Compared projected conditions with existing conditions;
- Evaluated the traffic impact of the proposed development; and,
- Recommended mitigation measures to address deficiencies related to additional traffic generated by the proposed site.

1.2 STUDY AREA

The study area is bounded by Penrose Avenue to the west, I-95 to the east, W Oregon Avenue to the north, and I-95 to the south, and includes the following intersections:

1. Penrose Avenue and Pattison Avenue (signalized)
2. Pattison Avenue and S. Broad Street (signalized)
3. Pattison Avenue and S. 11th Street (Pre-Event Only) (signalized)
4. Pattison Avenue and S. Darien Street (signalized)
5. Pattison Avenue and S. 7th Street (signalized)
6. S. Broad Street and Terminal Avenue/I-95 Ramps (Pre-Event Only) (signalized)
7. S. Broad Street and I-95 Northbound Off-Ramp (unsignalized)
8. S. Broad Street Southbound and I-95 Southbound On-Ramp (unsignalized)
9. S. Broad Street and Packer Avenue (signalized)
10. S. Broad Street and Pollock Street (signalized)
11. S. Broad Street and W Oregon Avenue (signalized)
12. Packer Avenue and S. 10th Street (signalized)
13. Packer Avenue and S. Darien Street/I-76 Eastbound Ramps (signalized)
14. Packer Avenue and S. 7th Street (signalized)
15. Packer Avenue and I-95 Northbound Off-Ramp (Friday Commuter and Pre-Event Only) (unsignalized)
16. Packer Avenue and S. Front Street (signalized)
17. S. Front Street and I-76 Eastbound On-Ramp (unsignalized)
18. S. Front Street and I-95 Southbound On-Ramp/I-76 Westbound Off-Ramp (signalized)
19. S. Front Street and I-95 Southbound Off-Ramp/I-95 Northbound On-Ramp/Dunkin Donuts Driveway (signalized)

A field investigation was performed to inventory the surrounding roadways and intersections. Intersection photographs and aerials can be found in **APPENDIX B**. It should be noted that the lane widths identified in the descriptions of the study area roadways, below, represent average measured widths.

S. Broad Street (PA 611) is classified as an urban principal arterial. Within the study area, S. Broad Street ranges from a six- to eight-lane roadway with auxiliary turning lanes, south of Pollock Street, to a four-lane roadway with limited auxiliary lanes, north of Pollock Street. Northbound and southbound S. Broad Street is separated by a wide median that ranges from approximately 35 feet to just under 150 feet between I-95 and Pollock Street. The average lane width in this area is approximately 12 feet. North of Pollock Street, S. Broad Street is a four-lane roadway with eight to nine-foot shoulders, a ten-foot median, and ten-foot travel lanes. Some on-street parking is allowed along S. Broad Street in this area. The posted speed limit along the entire length of S. Broad Street within the study area is 35 mph.

S. Broad Street intersects with the following seven study area intersections:

1. S. Broad Street and Terminal Avenue (**FIGURE B-1**)
2. S. Broad Street Northbound and I-95 Northbound Off-Ramp
3. S. Broad Street Southbound and I-95 Southbound On-Ramp
4. S. Broad Street and Pattison Avenue (**FIGURE B-2**)
5. S. Broad Street and Packer Avenue (**FIGURE B-3**)
6. S. Broad Street and Pollock Street (**FIGURE B-4**)
7. S. Broad Street and W Oregon Avenue (**FIGURE B-5**)

S. 11th Street/Terminal Avenue is classified as a local roadway. Between Pattison Avenue and Lincoln Financial Field, S. 11th Street consists of three northbound lanes and two southbound lanes with a two-way left-turn (TWLT) lane. The average lane width in this area is 12 feet. S. 11th Street passes under I-95 and continues under the freeway to S. Broad Street as Terminal Avenue. The roadway consists of two 16-foot travel lanes in this area, as well as one 32-foot wide channelized right-turn lane that connects westbound Terminal Avenue to northbound S. Broad Street. The speed limit is not posted; therefore, a speed limit of 30 mph was assumed for the corridor within the study area.

S. 11th Street intersects with the following two study area intersections:

1. S. Broad Street and Terminal Avenue (**FIGURE B-1**)
2. Pattison Avenue and S. 11th Street (**FIGURE B-7**)

Pattison Avenue is classified as an urban principal arterial. The roadway consists of three westbound lanes and one eastbound lane between Penrose Avenue and S. 20th Street. East of S. 20th Street, the roadway consists of three eastbound and three westbound lanes, a TWLT lane, and auxiliary left-turn lanes at intersections. Lane widths along the length of the corridor range from 10 to 12 feet. The posted speed limit on Pattison Avenue is 35 mph.

Pattison Avenue intersects with the following five study area intersections:

1. Pattison Avenue and Penrose Avenue (**FIGURE B-6**)
2. Pattison Avenue and S. Broad Street (**FIGURE B-2**)
3. Pattison Avenue and S. 11th Street (**FIGURE B-7**)
4. Pattison Avenue and S. Darien Street (**FIGURE B-8**)
5. Pattison Avenue and S. 7th Street (**FIGURE B-9**)

Penrose Avenue (SR 0291) is classified as an urban principal arterial. Within the study area, the roadway consists of three northbound lanes, two southbound lanes (opening to three lanes at the Pattison Avenue intersection), left-turn and right-turn auxiliary lanes, and a northbound and southbound bicycle lane. The average lane width is approximately 11 feet, and the average bicycle lane width is five feet. The posted speed limit is 35 mph.

Penrose Avenue intersects with the following study area intersection:

1. Penrose Avenue and Pattison Avenue (**FIGURE B-6**)

Packer Avenue is classified as an urban minor arterial. The roadway consists of four ten-foot travel lanes, two seven-foot shoulders, and an eastbound five-foot bike lane, between S. Broad Street and S. 10th Street. East of S. 10th Street, Packer Avenue consists of six ten-foot travel lanes, two eight-foot shoulders, and two five-foot bicycle lanes. Left-turn auxiliary lanes are provided at all signalized intersections, and a TWLT lane is provided between S. 7th Street and S. Front Street. On-street parking is allowed within the shoulder along designated portions of the corridor. The posted speed limit on Packer Avenue is 30 mph.

Packer Avenue intersects with the following five study area intersections:

1. Packer Avenue and S. Broad Street (**FIGURE B-3**)
2. Packer Avenue and S. 10th Street (**FIGURE B-10**)
3. Packer Avenue and S. Darien Street (**FIGURE B-11**)
4. Packer Avenue and S. 7th Street (**FIGURE B-12**)

5. Packer Avenue and S. Front Street (**FIGURE B-13**)

S. 10th Street is classified as a local roadway. The roadway consists of four eleven-foot travel lanes, two nine-foot shoulders, left-turn auxiliary lanes, and a TWLT lane. The speed limit is not posted; therefore, a speed limit of 30 mph was assumed for the corridor within the study area.

S. 10th Street intersects with the following study area intersection:

1. S. 10th Street and Packer Avenue (**FIGURE B-10**)

S. Darien Street is classified as a local roadway. The roadway consists of four ten-foot travel lanes, two five-foot shoulders, left-turn auxiliary lanes, and a TWLT lane. The speed limit is not posted; therefore, a speed limit of 30 mph was assumed for the corridor within the study area. S. Darien Street would serve as the primary means of access to the proposed site.

S. Darien Street intersects with the following two study area intersections:

1. S. Darien Street and Packer Avenue (**FIGURE B-11**)

2. S. Darien Street and Pattison Avenue (**FIGURE B-8**)

S. 7th Street is classified as an urban minor arterial. South of Packer Avenue, the roadway consists of four twelve-foot travel lanes, two five-foot shoulders, left-turn auxiliary lanes, and a TWLT lane. Parking is prohibited along this section of the corridor. North of Packer Avenue, S. 7th Street widens to consist of four travel lanes. The two inner lanes (one in each direction) measure approximately twelve feet, while the outside lanes are in excess of 13 feet wide with large shoulders that permit on-street parking. The speed limit is not posted; therefore, a speed limit of 30 mph was assumed for the corridor within the study area.

S. 7th Street intersects with the following two study area intersections:

1. S. 7th Street and Packer Avenue (**FIGURE B-12**)

2. S. 7th Street and Pattison Avenue (**FIGURE B-9**)

S. Front Street is classified as an urban principal arterial. The roadway consists of four eleven-foot travel lanes, two four- to five-foot shoulders, left-turn auxiliary lanes, and a TWLT lane. The posted speed limit on S. Front Street is 35 mph.

S. Front Street intersects with the following four study area intersections:

1. S. Front Street and Packer Avenue (**FIGURE B-13**)

2. S. Front Street and I-76 Eastbound On-Ramp (**FIGURE B-14**)

3. S. Front Street and I-76 Westbound Off-Ramp/I-95 Southbound On-Ramp (**FIGURE B-15**)
4. S. Front Street and I-95 Southbound Off-Ramp/I-95 Northbound On-Ramp/Dunkin Donuts Driveway (**FIGURE B-15**)

Pollock Street is classified as a local roadway. Within the study area, the roadway serves as a connection between the I-76 westbound off-ramp and S. Broad Street. Pollock Street is one-way westbound between the ramp terminus and S. Broad Street, and consists of two 14-foot travel lanes and one seven-foot parking lane. The roadway is one-way eastbound on the west side of S. Broad Street and consists of two ten-foot travel lanes and two eight-foot parking lanes. The posted speed limit on both segments is 25 mph.

Pollock Street intersects with the following study area intersection:

1. Pollock Street and S. Broad Street (**FIGURE B-4**)

W Oregon Avenue (SR 2001) is classified as an urban principal arterial. On the west side of S. Broad Street, the roadway consists of four ten-foot travel lanes, a five-foot striped median, a five-foot bicycle lane (westbound), an eight-foot parking lane (westbound), and eastbound left and right-turn auxiliary lanes. On the east side of S. Broad Street, the roadway consists of four ten-foot travel lanes, a five-foot striped median, two five-foot bicycle lanes, and two eight-foot parking lanes. The posted speed limit on W Oregon Avenue is 30 mph.

W Oregon Avenue intersects with the following study area intersection:

1. W Oregon Avenue and S. Broad Street (**FIGURE B-5**)

2.0 EXISTING CONDITIONS

Existing traffic data was collected to establish “average-day” baseline conditions (vehicular volumes, intersection and lane geometry, sidewalk conditions, etc.). A comprehensive data collection and analysis program was implemented based on direction provided by PennDOT and the City of Philadelphia in a letter prepared by Orth Rodgers and Associates (May 23, 2013). The data collection program consisted of the following (see **EXHIBIT 1**):

- Manual Turning Movement Counts (TMCs)
- Pedestrian and Bicycle Facility Assessment
- Transit Facility Assessment
- Crash Analysis
- Sight Distance Analysis

2.1 TRAFFIC VOLUME DATA

Manual turning movement counts (TMCs) were conducted during the following periods:

- Friday Commuter Peak Period: Friday, June 14, 2013, 4:00 PM – 7:00 PM (all non-event intersections);
- Friday Pre-Event Peak Period: Friday, May 31, 2013, 5:00 PM – 8:00 PM (all intersections);
- Friday Casino Peak Period: Friday, June 14, 2013, 7:00 PM – 10:00 PM (intersections on Packer Avenue and S. Front Street); and,
- Saturday Casino Peak Period: Saturday, June 15, 2013, 8:00 PM – 11:00 PM (intersections on Packer Avenue and S. Front Street)

The TMC data included passenger cars, heavy vehicles, and pedestrians.

It should also be noted that the pre-event data collection occurred prior to a 7:05 PM baseball game at Citizens Bank Park between the Philadelphia Phillies and Milwaukee Brewers. The reported attendance at the game was 37,420 (85.7% capacity). Therefore, to be conservative, the pre-event traffic volume entering the stadium complex area was increased to emulate an event with full attendance. The event-generated traffic for movements entering the stadium complex area was estimated by determining the difference in volume for the Friday Commuter and Pre-Event peak hours. The difference was then multiplied by 1.14 (14%). The additional

volume was then distributed throughout the study area roadway network (see **APPENDIX E, FIGURE 1**).

The TMC data was reduced and the study area was determined to have the following peak hours:

- Friday Commuter Peak Hour: 4:00 PM – 5:00 PM
- Friday Pre-Event Peak Hour: 6:00 PM – 7:00 PM
- Friday Casino Peak Hour: 7:00 PM – 8:00 PM
- Saturday Casino Peak Hour: 8:00 PM – 9:00 PM

Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hour volume diagrams are contained in **EXHIBITS 2, 3, 4, and 5**, respectively. The raw traffic data is located in **APPENDIX C**.

2.2 RESIDUAL QUEUE MEASUREMENTS

Peak residual queues were measured at each study area intersection during the four data collection periods. Residual queues represent the number of vehicles in a queue at a signalized intersection that do not clear the intersection within one cycle. The measurements are necessary for assessing unmet demand at an intersection, which may not have been accounted for in the turning movement count data. If a particular movement experiences a significant residual queue, traffic volume may be added to that movement in order to calibrate the Synchro 8/SimTraffic models.

The results of the queue measurements are shown in **APPENDIX C**. Based on the results of the analysis, no residual queuing was experienced at any of the study area intersections during the Friday Commuter, Friday Casino, or Saturday Casino peak hours. Minor residual queuing was experienced at the intersections of Pattison Avenue and S. 11th Street, Packer Avenue and S. Broad Street, Packer Avenue and S. 10th Street, Packer Avenue and S. Darien Street, and Packer Avenue and S. 7th Street, during the Friday Pre-Event peak hour. The highest residual queues occurred along westbound Packer Avenue, particularly on movements into the stadium complex area. The largest residual queue (15 vehicles) was experienced on the westbound left-turn movement from Packer Avenue to S. 10th Street.

Given that these residual queues are relatively low, and that the Pre-Event peak hour volume was increased to account for the stadium attendance (see **Section 2.1**), no additional traffic was added to the Friday Pre-Event peak hour traffic volumes.

2.3 PEDESTRIAN AND BICYCLE FACILITIES

In addition to collecting pedestrian volume data at the study area intersections as part of the turning movement counts, Stantec conducted an inventory and assessment of pedestrian and bicycle facilities that provide access to and from the proposed casino site. Based on the results of the data collection, peak hour pedestrian volumes at intersections within the study area were relatively low during non-event peak hours. However, during the Pre-Event peak hour, pedestrian activity increased between the stadium areas and the surrounding parking lots along Pattison Avenue, S. 11th Street, S. 10th Street, S. Darien Street, and S. 7th Street. In addition, pedestrian activity to and from the residential areas to the north of the stadium complex was slightly higher during the Pre-Event peak hour.

Pedestrian volumes for the four peak hours are shown on the parallel movement in **EXHIBITS 2** through **5**. For example, the pedestrian volume crossing the east leg of an intersection is shown under the northbound through movement volume.

Sidewalks and crosswalks are currently provided along all of the study area roadways. Furthermore, many of the pedestrian facilities within the stadium complex have been upgraded to include wide sidewalks, crosswalks, and pedestrian signal heads. Bicycle lanes and/or wide shoulders are also provided along some study area roadways including Packer Avenue, W Oregon Avenue, Pattison Avenue, S. 10th Street, S. Darien Street, and S. 7th Street.

2.3.1 Existing Pedestrian Facilities within Project Site Area

It is anticipated that the majority of pedestrian and bicycle activity to and from the proposed casino site would occur during pre- and post-event periods at the stadium complex, with minor pedestrian trips generated from nearby residential neighborhoods and transit stations. Therefore, the assessment of the pedestrian facilities focuses on the Packer Avenue, S. 10th Street, S. Darien Street, and S. 7th Street.

Packer Avenue

A sidewalk is provided along the south side of Packer Avenue between S. Broad Street and S. Front Street. It varies in width as it approaches the project site from the west. The sidewalk is approximately five feet wide between S. Broad Street and S. Juniper Street where it widens to ten feet along the residential neighborhood. East of S. 13th Street, the sidewalk widens to 18 feet as it passes along a stadium parking facility (**FIGURE 1**), and then narrows to 9 feet in approach to the intersection of S. 10th Street and Packer Avenue. Planter boxes with trees are installed along the curb in the 18-foot wide segment of the sidewalk, which reduces the effective width of the sidewalk to approximately 9 - 12 feet. Continental-style crosswalks are provided on all four legs of the intersection of Packer Avenue and S. 10th Street. However, the curb ramps do not comply with current ADA standards, and no pedestrian signal heads are present.



FIGURE 1: Sidewalk along Eastbound Packer Avenue West of S. 10th Street



FIGURE 2: Sidewalk and Bike Lane Along Project Site Frontage

A six-foot sidewalk is provided along the project site frontage, between S. 10th Street and S. Darien Street (**FIGURE 2**). A standard crosswalk is provided across S. Darien Street. However, the crosswalk style does not match those utilized at the adjacent intersections, and the curb ramps do not comply with current ADA standards. Pedestrian signal heads are not provided.

East of project site, the sidewalk widens to 10 feet between S. Darien Street and S. 7th Street (**FIGURE 3**). Continental-style crosswalks connecting ADA-compliant curb ramps are provided across all four legs of the intersection of Packer Avenue and S. 7th Street, but pedestrian signal heads are not present. The sidewalk then narrows to four to five feet between S. 7th Street and S. Front Street.

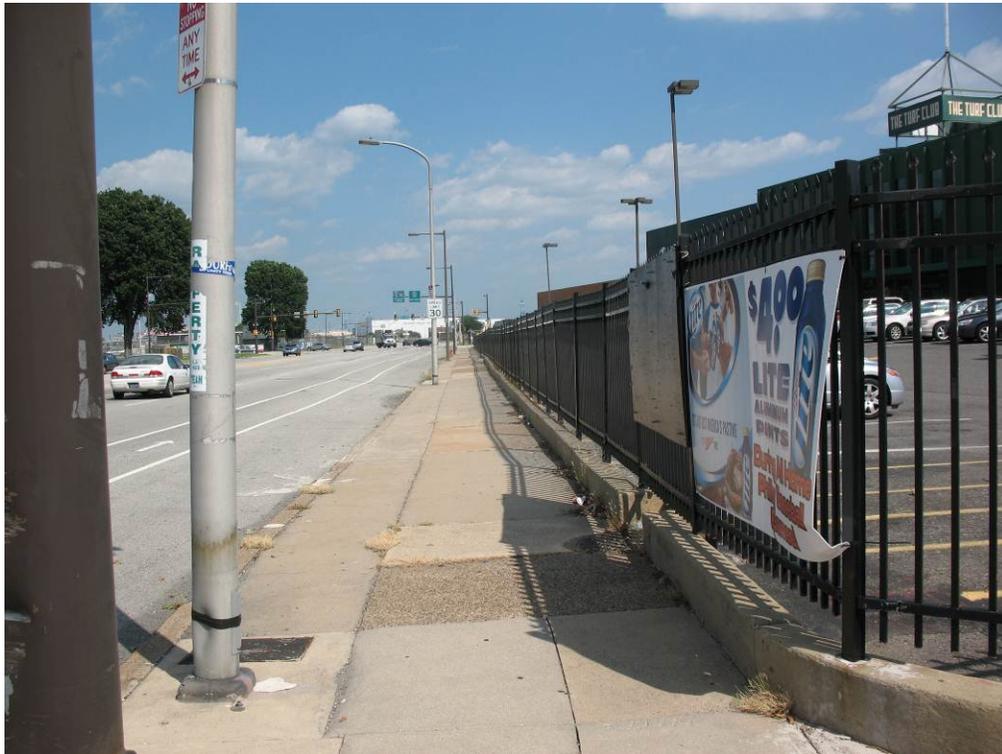


FIGURE 3: Sidewalk Along Packer Avenue East of S. Darien Street

A sidewalk is provided along the north side of Packer Avenue, west of S. 10th Street, which connects a parking lot along the westbound side of Packer Avenue with the S. 10th Street and Packer Avenue intersection. It is likely that this sidewalk is only utilized during event periods for pedestrians walking between the parking lot and the stadium complex. It is not anticipated that this parking area will be utilized by patrons of the casino.

Bike lanes, approximately five feet in width, are also provided along eastbound and westbound Packer Avenue between Penrose Avenue and S. Front Street. The Packer Avenue bike lanes tie into existing bike lanes on Penrose Avenue. Bike lanes are not currently provided on S. Front

Street. Along the project site frontage, the bicycle lanes are separated from the curb by 8-foot wide shoulders. On-street parking within the shoulder is permitted along most sections of Packer Avenue, but is not permitted along the project site frontage. It should also be noted that that the westbound bike lane merges with the shoulder between S. 10th Street and S. Broad Street.

S. 10th Street

S. 10th Street provides connection between the project site, residential areas to the north, and the stadium complex to the south. Four-foot sidewalks are provided along the east and west sides of S. 10th Street, north of the intersection of Packer Avenue and S. 10th Street. As discussed in the section above, continental-style crosswalks are provided on all four legs of the intersection. However, the curb ramps do not comply with current ADA standards, and no pedestrian signal heads are present.

A six-foot wide sidewalk is currently provided along the site frontage. This sidewalk widens to approximately 17 feet (12-foot effective width), south of the project site (**FIGURE 4**). The widened sidewalk connects stadium parking Lot Q with Citizens Bank Park. On the west side of S. 10th Street, a 19-foot wide sidewalk (16-foot effective width) is provided between Packer Avenue and Hartranft Street/Citizens Bank Park.



FIGURE 4: Sidewalk Reduction Along S. 10th Street Frontage

S. Darien Street

S. Darien Street will provide an additional connection between the project site and the stadium complex. However, sidewalk coverage on S. Darien Street is limited. Sidewalks are not currently provided along the site frontage. Instead, the area that would likely be used for a sidewalk is occupied by pull-outs which are used for truck and bus parking (**FIGURE 5**). A 14-foot wide sidewalk (10-foot effective width) on the southbound side of S. Darien Street begins just south of the project site, connecting Lot Q with the stadiums to the south (**FIGURE 6**).

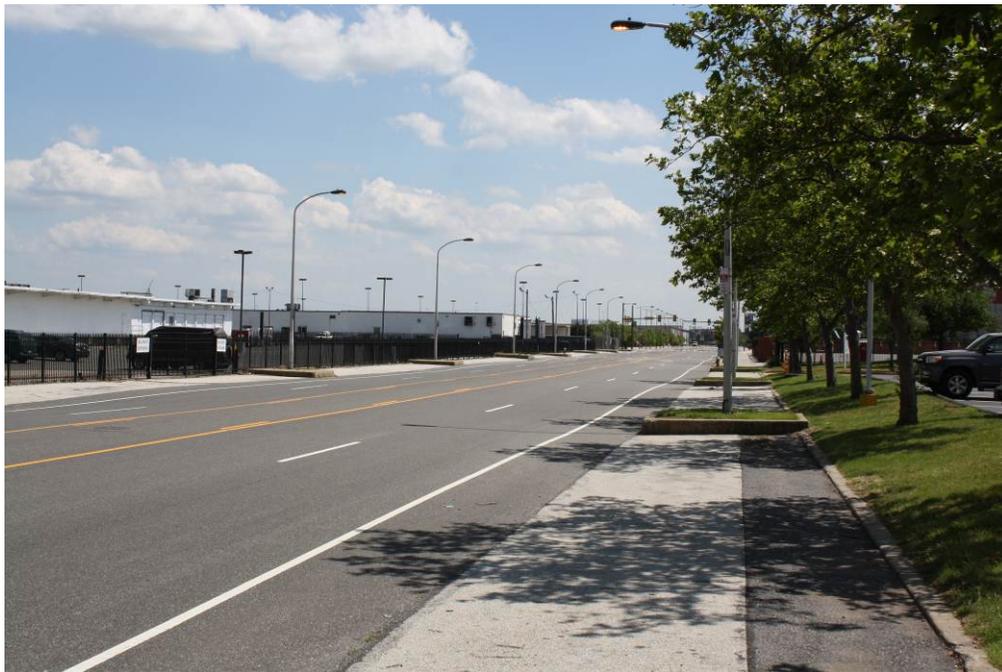


FIGURE 5: Pull-Outs on S. Darien Street Along Site Frontage

A standard crosswalk is provided across S. Darien Street at the intersection with Packer Avenue. However, the crosswalk style does not match those utilized at the adjacent intersections, and the curb ramps do not comply with current ADA standards. Pedestrian signal heads are not provided. Continental-style crosswalks are provided at the intersection of S. Darien Street and Hartranft Street. Curb ramps and pedestrian signal heads are provided at this intersection as well.



FIGURE 6: The Terminus of the Existing Sidewalk South of Project Site

S. 7th Street

Similar to S. 10th Street, S. 7th Street provides a connection between the residential areas to the north, and the stadium complex to the south. However, S. 7th Street does not support as much event-related pedestrian activity as S. 10th Street because it is located further away from the stadium facilities. As such, pedestrian activity along S. 7th Street to and from the proposed casino site is also anticipated to be minimal.

Four- to five-foot wide sidewalks are provided along the east and west sides of S. 7th Street, north and south of the Packer Avenue intersection. In addition, five-foot wide shoulders are provided along northbound and southbound S. 7th Street, south of the Packer Avenue intersection. As discussed in the section above, continental-style crosswalks are provided on all four legs of the intersection, and ADA compliant curb ramps exist. However, pedestrian signal heads are not present.

2.4 TRANSIT FACILITIES

Live! Casino and Hotel is located in close proximity to several transit routes, which will likely result in a portion of employees and patrons utilizing transit to get to and from the facility (**EXHIBIT 6**). The AT&T Station of SEPTA's Broad Street subway line is located approximately 0.75 miles from the proposed site. The Broad Street line operates every eight to twelve minutes between 5:00 AM and midnight. Between midnight and 5:00 AM, bus service is provided along Broad Street.

SEPTA Bus Routes 23 and 68 operate on Packer Avenue and S. 10th Street, with a northbound/eastbound stop on S. 10th Street, approximately 300 feet north of the site. A southbound/westbound stop is provided on southbound S. 10th Street at the Packer Avenue intersection. Service on Route 23 is provided every seven to ten minutes on weekdays, and every 20 minutes on weekends. Service on Route 68 is provided at a frequency of 30 minutes to one hour on weekdays and one hour on weekends. Both bus routes operate between 5:00 AM and 2:00 AM.

SEPTA Bus Route G operates near the site, with a stop at the S. 7th Street and Packer Avenue intersection, approximately 800 feet east of the site. Route G operates at a frequency of eight to ten minutes during weekday peak periods, and 20 to 30 minutes during weekday off-peak periods and weekends. SEPTA Bus Route 4 passes near the site as well, with a stop at the intersection of Packer Avenue and S. Broad Street, approximately one-half mile west of the site. Route 4 operates at a frequency of 15 to 20 minutes on weekdays, 20 to 30 minutes on Saturdays, and 30 minutes on Sunday. Both routes operate between 5:00 AM and 2:00 AM.

2.5 CRASH DATA

The City of Philadelphia provided crash data for each study area intersection for a five-year period between 2008 and 2013. The crash summaries provided by the City classify crash data into various categories, including year, roadway conditions, time-of-day, type of vehicle, severity of the crash, and vehicle direction. The raw crash data can be found in **APPENDIX D**.

Stantec conducted an analysis of the crash data for each study area intersection in order to identify trends in the data that may suggest the need for mitigation measures. A summary table can be found in **APPENDIX D**. Based on the crash data supplied by the City of Philadelphia, there was a total of 193 reportable crashes at the study area intersections during the five-year analysis period. Of the 193 reportable crashes, 33% (63) resulted in property damage only, 58% (112) resulted in injuries, 8% (16) of the crashes involved a pedestrian, and there was one crash that involved a bicyclist. There was only one fatality recorded within the study area during the analysis period. The fatal crash involved a pedestrian at the intersection of Packer Avenue and S. 7th Street.

On average, the majority of the study area intersections experienced less than two reportable crashes per year over the five-year analysis period. The highest number of reportable crashes

occurred at the intersections of S. Broad Street (southbound) and Pattison Avenue (32 crashes), S. Broad Street and Terminal Ave/I-95 Ramps (30 crashes), and S. Broad Street (southbound) and Packer Avenue (26 crashes). Upon closer examination of the crash data for those intersections, it was determined that approximately 50% of the crashes were angle crashes. However, based on the report information provided, no discernible pattern was identified at any of the intersections. The majority of crashes occurred during daylight hours and on dry pavement, and the time of day of the crashes was widespread.

2.6 SIGHT DISTANCE

PennDOT TIS guidelines require that sight distance be evaluated at proposed driveways. Therefore, the available sight distance was measured at the proposed porte-cochere driveway on S. Darien Street, the garage driveway on S. Darien Street, and the service road/garage exit on S. 10th Street. PennDOT Form M-950S was utilized to provide the sight distance measuring guidance for the intersection. Based on the results of the sight distance analysis, all existing available sight distances conform to the standards provided in Form M-950S (**TABLE 1**).

Given the nature of S. Darien Street and S. 10th Street, sight distances were measured to be the full length of the corridors between Packer Avenue and Hartranft Street. Therefore, measurements in **TABLE 1** reflect that the sight distances from all proposed driveways would be equal to the distance to the nearest signalized intersection. Based on the results, all driveways would have sight distances that exceed those required in Form M-950S.

TABLE 1: Sight Distance at the Proposed Driveways

Intersection	Approach	Sight Distance	Measured Available Sight Distance (ft)*	Required Sight Distance** (ft)
Porte-Cochere and S. Darien Street	Northbound S. Darien Street	Left	211	196
		Stopping	863	196
	Porte-Cochere Exit	Right	230	196
Garage Driveway and S. Darien Street	Northbound S. Darien Street	Left	555	196
		Stopping	545	196
	Garage Exit	Left	535	196
		Right	568	196
Service Road Exit and S. 10 th Street	Service Road	Right	480	196

*Sight distances for all approaches exceeded the distance to the nearest signalized intersection. Therefore, all sight distances show are in the table are equal to the distance between the movement and the nearest signalized intersection. **30 mph @ 0%.

2.7 CAPACITY ANALYSIS METHODOLOGY

Capacity analysis, a procedure used to estimate the traffic-carrying ability of roadway facilities over a range of defined operating conditions, was performed using Synchro 8 which is based on the methodology of the *2010 Highway Capacity Manual (HCM)* to establish average volume to capacity (V/C) ratios, delays and Level of Service (LOS) for each intersection. Roadway geometry, signal timing, and traffic data were entered into the model.

The V/C ratio relates the demand at a particular intersection (traffic volume) to the available capacity. The available capacity for each movement varies depending on number of lanes, lane width, perception/reaction time, green time, and cycle length, among others. A V/C ratio of 1.0 means that the demand for a particular movement is equal to the capacity. A movement with a V/C ratio at or over 1.0 is considered undesirable because the movement volume exceeds the capacity, which results in queuing, indicating unmet demand along that approach.

LOS is an evaluation of the quality of operation of an intersection and is a measure of the average delay a driver experiences while traveling through the intersection. LOS is dependent on a range of defined operating conditions such as traffic demand, lane geometry, and traffic signal timing and phasing.

LOS can range from A to F and is based on the average control delay per vehicle in seconds. For a signalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 80 seconds per vehicle, or a V/C ratio greater than 1.0. For an unsignalized intersection, LOS A indicates operations with an average control delay less than 10 seconds per vehicle, while LOS F describes operations with an average control delay in excess of 50 seconds per vehicle, or a V/C ratio greater than 1.0. The *2010 HCM* delay criteria for signalized and unsignalized intersections are summarized in **TABLE 2**.

TABLE 2: LOS Criteria for Signalized and Unsignalized Intersections		
Level of Service	Average Control Delay (seconds/vehicle)	
	Signalized	Unsignalized
A	Less than or equal to 10.0	Less than or equal to 10.0
B	>10.0 and ≤ 20.0	>10.0 and ≤ 15.0
C	>20.0 and ≤ 35.0	>15.0 and ≤ 25.0
D	>35.0 and ≤ 55.0	>25.0 and ≤ 35.0
E	>55.0 and ≤ 80.0	>35.0 and ≤ 50.0
F	Greater than 80.0 or V/C greater than 1.0	Greater than 50.0 or V/C greater than 1.0

All Synchro 8 output files are included in **APPENDIX H**. Signal timing and phasing was obtained from the City of Philadelphia (**APPENDIX F**). However, field measurements were required at several intersections because the plans supplied did not reflect current operating conditions. For example, the signal plans supplied for the intersections of Pattison Avenue and S. 11th Street, S.

Darien Street, and S. 7th Street did not reflect the protected-permissive phasing that was recently added at these intersections.

2.8 2013 EXISTING CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2013 Existing Condition capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

2.8.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups within the study area operate at LOS D or better during the Friday Commuter, Friday Casino, and Saturday Casino peak hours.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 24 feet (less than 1 vehicle) in the Friday Commuter peak hour.

2.8.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups within the study area operate at LOS D or better during the Friday Pre-Event peak hour, with the exception of the following movements:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue, which operates at LOS F (94 seconds of delay and V/C > 1.0);
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street, which operates at LOS F (77 seconds of delay and V/C > 1.0);
- The westbound left-turn movement at the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps, which operates at LOS F (145 seconds of delay and V/C > 1.0);
- The eastbound left-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which operates at LOS E (64 seconds of delay); and,
- The eastbound shared through-right movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which operates at LOS F (98 seconds of delay and V/C > 1.0).

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 23 feet (less than 1 vehicle), and 55 feet (approximately 2 vehicles), respectively.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 316 feet (approximately 11 vehicles).
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 180 feet (approximately 6 vehicles) and 377 feet (approximately 13 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 52 feet (approximately 2 vehicles).

3.0 2016 AND 2021 NO BUILD CONDITIONS

3.1 2016 AND 2021 NO BUILD TRAFFIC VOLUMES

PennDOT's Pennsylvania Traffic Data Book was consulted to develop a background growth rate for the roadways in the study area. Based on the information contained in the data book, the estimated annual growth rate for the City of Philadelphia is 0%. However, given the anticipated growth of the Philadelphia Naval Yard, an annual growth rate of 1% was applied to develop 2016 (estimated year of completion) and 2021 (ETC +5) analysis year No Build traffic volumes. Furthermore, there were no additional developments planned for the study area at the time this TIS was conducted. Therefore, only the background growth rate was applied to develop 2016 No Build and 2021 No Build Condition volumes (**EXHIBITS 12 through 19**).

3.2 2016 NO BUILD CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2016 No Build Condition capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

3.2.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups within the study area would operate at LOS D or better during the Friday Commuter, Friday Casino, and Saturday Casino peak hours.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 32 feet (approximately 1 vehicle) and 4 feet (less than 1 vehicle) in the Friday Casino and Commuter peak hours, respectively.
- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 7 feet (less than 1 vehicle) in the Friday Commuter peak hour.

3.2.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups within the study area would operate at LOS D or better during the Friday Pre-Event peak hour, with the exception of the following movements:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue, which would degrade to 106 seconds of delay (LOS F);
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street, which would degrade to 91 seconds of delay (LOS F);
- The westbound left-turn movement at the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps, which would degrade to 165 seconds of delay (LOS F);
- The eastbound left-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which would degrade to 69 seconds (LOS E); and,
- The eastbound shared through-right movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which would degrade to 115 seconds of delay (LOS F).

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 41 feet (approximately 1 vehicle), and 68 feet (approximately 2 vehicles), respectively.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 12 feet (less than 1 vehicle) and 342 feet (approximately 11 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 204 feet (approximately 7 vehicles) and 402 feet (approximately 13 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 52 feet (approximately 2 vehicles).
- Packer Avenue and S. 7th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 2 feet (less than 1 vehicle).

3.3 2021 NO BUILD CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2021 No Build Condition capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

3.3.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups within the study area would operate at LOS D or better during the Friday Commuter, Friday Casino, and Saturday Casino peak hours, with the exception of the following movements:

- The northbound left-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which would operate at LOS E (60 seconds of delay) during the Friday Commuter peak hour.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 47 feet (approximately 1 vehicle) and 19 feet (less than 1 vehicle) in the Friday Casino and Commuter peak hours, respectively.
- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 43 feet (approximately 1 vehicle) in the Friday Commuter peak hour.

3.3.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups within the study area would operate at LOS D or better during the Friday Pre-Event peak hour, with the exception of the following movements:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue, which would degrade to 131 seconds of delay (LOS F);
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street, which would degrade to 118 seconds of delay (LOS F);
- The westbound left-turn movement at the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps, which would degrade to 198 seconds of delay (LOS F);

- The eastbound left-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which would degrade to 81 seconds of delay (LOS F); and,
- The eastbound shared through-right movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway, which would continue to 146 seconds of delay (LOS F).

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 58 feet (approximately 2 vehicles), and 83 feet (approximately 3 vehicles), respectively.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 213 feet (approximately 7 vehicles) and 389 feet (approximately 13 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 240 feet (approximately 8 vehicles) and 441 feet (approximately 15 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 67 feet (approximately 2 vehicles).
- Packer Avenue and S. 7th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 18 feet (less than 1 vehicle).

4.0 2016 AND 2021 BUILD CONDITONS

4.1 SITE ACCESS AND CIRCULATION

The proposed site would be accessed via two driveways on S. Darien Street, including the porte-cochere driveway and parking garage driveway (see **APPENDIX A** for site plan). Access to the porte-cochere would be provided via a dual lane enter-only driveway, located approximately 200 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound ramps. The porte-cochere serves as the drop-off for buses, taxis, and limousines, as well as valet parking. Buses, taxis, and limousines would exit the porte-cochere via a right-turn only driveway, located approximately 100 feet south of the porte-cochere entrance driveway. Bus and taxi queuing areas are proposed along S. 10th Street. Valet staff would utilize a driveway that connects the porte-cochere directly to the parking garage, avoiding the need for valet vehicles to re-enter S. Darien Street. Patrons picking up valet-parked vehicles would do so within the parking garage and would depart via one of two parking garage exits.

Access to the parking garage would be provided via a single lane entry and dual lane exit driveway, approximately 550 feet south of the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound ramps. The dual-lane exit would consist of a left-turn lane and a right-turn lane, and would be unsignalized. Signs within the parking garage would direct people destined for I-76 eastbound, Pattison Avenue, or I-95 to this exit. A secondary exit-only driveway from the garage to S. 10th Street would also be provided. Signs within the parking garage would direct drivers destined for Broad Street and I-76 westbound to this exit. Based on the anticipated peak hour volumes, the proposed configuration of the driveways and parking garage would be adequate to handle the anticipated demand.

A one-way westbound private driveway would be provided south of the garage for deliveries. This driveway would then tie into the exiting driveway from the garage to S. 10th Street. In addition, the proposed site plan indicates that the existing two-way left-turn lane on S. Darien Street would be restriped as two northbound left-turn only lanes for the garage and porte-cochere driveways. This configuration is recommended in order to guide drivers to the access driveways, reduce the potential for stopped traffic in through lanes, and eliminate the potential conflicts with opposing left-turning vehicles, which can occur with two-way left-turn lanes.

4.2 TRIP GENERATION

4.2.1 Casino Trip Generation Rate Calculation

The number of trips generated by a proposed development is typically estimated utilizing the Institute of Transportation Engineers (ITE) *Trip Generation Manual*. However, upon review of the data contained within the manual concerning casino trip generation, it was determined that the data is too limited and would not be applicable to this study. In lieu of utilizing the *Manual*, the City of Philadelphia Streets Department and PennDOT required that the trip generation rates of at least three existing casinos within the US, of similar type, be analyzed in order to develop an average trip generation rate for the casino component of the Live! Casino and Hotel. Therefore, the trip generation of the following three urban casinos was analyzed:

1. Rivers Casino, Pittsburgh, PA
2. SugarHouse Casino, Philadelphia, PA
3. St. Charles Casino, St. Louis, MO

The raw casino count data is contained in **APPENDIX C**.

Rivers Casino, located in Pittsburgh, PA is very similar to the proposed Live! Casino and Hotel in that it is located within a stadium district with local roadway and freeway connections that have been constructed to accommodate large stadium-event traffic volumes. Rivers Casino is located within 1,000 feet of Heinz Field (football), and $\frac{3}{4}$ miles of PNX Park (baseball). In order to determine the number of trips generated by the casino, a data collection program was conducted that accounted for passenger cars, charter/casino buses, taxis/limousines, pedestrians, and transit trips. The data collection was conducted on Friday, June 7, 2013 between 4:00 PM and 11:00 PM, and a Saturday, June 8, 2013 between 8:00 PM and 11:00 PM. There were no stadium events on either date.

SugarHouse Casino is located on North Delaware Avenue in Philadelphia, PA. It was selected for the analysis because of its urban location, as well as its proximity to Center City Philadelphia, I-95, and the Delaware River crossings. In order to determine the number of trips generated by the casino, a data collection program was conducted that accounted for passenger cars, charter/casino buses, and taxis/limousines. The data collection was conducted on Friday, May 31, 2013 between 4:00 PM and 11:00 PM, and a Saturday, June 8, 2013 between 8:00 PM and 11:00 PM.

St. Charles Casino in St. Louis, Missouri is located just outside the City, along the Missouri River. It is located within an urbanized area, and is easily accessible from the regional freeway network, as well as the local roadway network. St. Charles Casino was the subject of an ITE-published study, *Trip Generation Statistics of Medium Sized Casinos* (Trueblood and Gude, 1998). The study contains data that was collected during a typical Friday and Saturday in 1998.

The data that was published within the study was utilized to analyze the trip generation characteristics of the St. Charles Casino.

A summary of the peak hour trip generation rates of all three casinos studied is contained in **TABLE 3**. Pedestrian trips were excluded from the rate calculation for the Rivers Casino because the data collected for SugarHouse and St. Charles Casino did not include pedestrian trip generation. Pedestrian trips will be calculated separately utilizing other data (see **Section 4.2.4**).

Following the removal of pedestrian trips, the rates for the three casinos were averaged in order to develop a vehicle trip generation rate to be used for the Live! Casino and Hotel traffic impact study. Based on the results of the analysis, a rate of 0.42 trips per gaming position will be utilized for the Friday Commuter and Pre-Event peak hours, a rate of 0.47 trips per gaming position will be utilized for the Friday Casino peak hour, and a rate of 0.59 trips per gaming position will be utilized for the Saturday Casino peak hour.

4.2.2 Auxiliary Uses

In addition to the gaming components, Live! Casino and Hotel also includes restaurants, event space, and a hotel. Each of the casinos used to develop the casino trip generation rates contain restaurants. Therefore, it is assumed that the rates developed in **Section 4.2.1** include trips generated by restaurant patrons.

The studied casinos do not include hotels, and some have limited event space. Therefore, the *ITE Trip Generation Manual (9th Edition)* Land Use Code 310, Hotel, was utilized to generate trips for the hotel component of the Live! Casino and Hotel (**EXHIBIT 20**). Hotel trips were generated for the Friday Commuter and Friday Pre-Event peak hours only because the *ITE Trip Generation Manual* does not provide trip generation rates for hotels during off-peak periods. For the purpose of this study, it is assumed that the majority of hotel trips occurring during the Friday and Saturday Casino peak hours would be generated by patrons of the casino, and would not represent added trips to the roadway network.

Trips associated with the 6,500 square feet of private event space were also generated separately. The *ITE Trip Generation Manual* does not contain a specific Land Use Code for event space. The proposed event space will be associated with one of the restaurant venues and will likely be used for corporate events, parties, and other casino-related events. It is likely that food and drinks will be served at events within this space, and most events are anticipated to last for a few hours or more. Therefore, Land Use Code 931, Quality Restaurant, was determined to best approximate this type of use. Trips generated by the event space are shown in **EXHIBIT 20**.

TABLE 3: Trip Generation Table

Peak Hour		Enter	Exit	Total	# of Gaming Positions	Trip Generation Rate per Gaming Position
Friday Commuter/Pre-Event	SugarHouse: Philadelphia	449	431	880	1,952	0.45
	Rivers: Pittsburgh	819	509	1,328	3,810	0.35
	St. Charles: St. Louis	475	600	1,075	2,387	0.45
	Total	1,743	1,540	3,283	Average:	0.42
	Splits	53%	47%			
Friday Evening Casino Peak	SugarHouse: Philadelphia	423	492	915	1,952	0.47
	Rivers: Pittsburgh	555	879	1,434	3,810	0.38
	St. Charles: St. Louis	725	625	1,350	2,387	0.57
	Total	1,703	1,996	3,699	Average:	0.47
	Splits	46%	54%			
Saturday Evening Casino Peak	SugarHouse: Philadelphia	469	508	977	1,952	0.50
	Rivers: Pittsburgh	1,015	1,317	2,332	3,810	0.61
	St. Charles: St. Louis	850	750	1,600	2,387	0.67
	Total	2,334	2,575	4,909	Average:	0.59
	Splits	48%	52%			

4.2.3 Live! Casino and Hotel Vehicle Trip Generation

Utilizing the trip generation rates identified in **Sections 4.2.1** and **4.2.2**, the number of new non-event vehicle trips generated by the proposed casino and hotel were calculated (**EXHIBIT 20**). However, the number of trips that would be generated by the casino before and after an event in the stadium complex, such as a Phillies game, would likely be reduced due to the existing and perceived congestion experienced on the study area roadway network prior to, and after an event. Furthermore, it is likely that a portion of the casino patrons arriving during pre/post-event periods would be people that are also attending the stadium complex event.

The *Philadelphia Sports Complex Parking and Traffic Management Plan* (Langan, 2010) considered the impact of stadium complex events on other land uses within the stadium district and developed “stay-away” and linked trip reduction factors. The stay-away factor represents an estimated percentage of casino patrons who would likely avoid arriving to or departing from the casino before or after stadium complex events. Based on the results of the Langan study, a stay-away factor of 15% was estimated for Phillies games, a factor of 25% was estimated for Eagles games, and a factor of 10% was estimated for Flyers games. Because the Live! Casino and Hotel TIS analyzes a pre-Phillies game period, a stay-away factor of 15% was applied to the base number of trips generated by the casino during this period.

In addition to the stay-away factor, some trips generated by the casino during the pre and post-event periods would likely consist of stadium patrons. These “linked” trips would consist of patrons that either drive to the stadium complex, park within the casino parking garage and then walk to the event, or drive to a stadium parking lot and then walk to the casino either before or after the event. The *Philadelphia Sports Complex Parking and Traffic Management Plan* recommended a linked trip factor of 15% for Phillies games.

In order to estimate the number of linked trips that would occur with patrons parking onsite versus offsite, it was necessary to examine pre- and post-event parking policies currently proposed for the Live! Casino and Hotel parking garage. Based on information provided by the developer, access to the parking garage in advance of a stadium event will be restricted to casino reward cardholders only. Therefore, it was assumed that 50% of the linked trips would be from cardholders who park in the casino parking garage, while the other 50% would be from stadium patrons who park in a stadium lot and then walk to the casino prior to the game. Linked trips to the parking garage will be accounted for in the driveway volumes. However, linked trips from off-site patrons will be deducted from the total trips generated by the casino, and applied to the network pedestrian volumes.

Based on the analysis presented above, the proposed Live! Casino and Hotel would generate the following number of new peak hour trips to the study area roadway network:

- Friday Commuter Peak Hour: 1,412
- Friday Pre-Event Peak Hour: 988

- Friday Evening Casino Peak Hour: 1,448
- Saturday Evening Casino Peak Hour: 1,831

4.2.4 Live! Casino and Hotel Multimodal Trips

The proposed Live! Casino and Hotel project will be located near public transit. Several buses stop within two blocks of the site, and the SEPTA Broad Street subway line is located approximately $\frac{3}{4}$ mile away. Despite the transit connections to the site, it is anticipated that the number of patrons accessing the casino via transit, walking, or bicycling will be minimal during non-event periods. The Philadelphia Gaming Advisory Task Force prepared a report in 2007, entitled *Interim Report of Findings*, which estimated modal splits for potential casino sites across Philadelphia. Specifically, the report identified a public transit mode split of 2%, and a pedestrian mode split of less than 1%, for potential sites in South Philadelphia.

Based on the findings of this report, and to be conservative in the analysis of the Live! Casino and Hotel, a combined mode split of 2% was applied for pedestrian and transit trips generated by the site. Furthermore, the mode split is applied in the analysis in addition to the number of trips calculated from the average rates, rather than a reduction factor because pedestrian trips were excluded from the base trip generation rates (see **Section 4.2.1**).

It should be noted that the 2% mode split would only apply during non-event periods. It is anticipated that pedestrian and bicycle trips would increase during pre- and post-event periods. Pre-event peak hour pedestrian trip generation is accounted for in the linked trips (see **Section 4.2.3**).

4.3 TRIP DISTRIBUTION

4.3.1 Vehicle Trip Distribution

The Live! Casino and Hotel project is located on a site that takes advantage of the extensive freeway connections and the extra capacity on the local roadway network that is in place in order to accommodate event traffic. Therefore, it is anticipated that the majority of the trips generated by the proposed project will utilize connections to I-95 and I-76 to access the site. In order to estimate the entering and exiting distribution of trips to and from the site, a gravity model was developed that evaluated population, as well as travel time and distance to and from the proposed project in comparison to other existing casinos in the Philadelphia metropolitan area. Casinos considered in the analysis include Harrah's (Chester, PA), Valley Forge (King of Prussia, PA), SugarHouse (Philadelphia), and Parx (Bensalem, PA).

The first step in the gravity model process was to identify travel time zones around the proposed casino in which the travel time to the proposed site would be less than or equal to the travel time to the nearest adjacent casino. The travel time estimates were calculated using Google and

exclude the effects of traffic congestion. Based on the travel time analysis the following five travel time zones were identified (**EXHIBIT 21**):

1. From the South via I-95 and Penrose Avenue;
2. From the North via I-95 (includes traffic from New Jersey via Ben Franklin Bridge);
3. From the North via Broad Street/Local Roadways;
4. From the East via I-76 Westbound (Walt Whitman Bridge); and,
5. From the West via I-76 Eastbound.

In order to determine the distribution of site generated traffic, the population of each zone was calculated utilizing 2011 population estimates for census blocks within the zones. The following assumptions were utilized during the calculation of the zone populations:

1. It is likely that some trips to the proposed casino would originate from areas that are outside the identified travel time zones and closer to Valley Forge or Parx Casino. However, it is also likely that some trips that originate from inside the Live! Casino and Hotel travel time zones would be destined for Valley Forge or Parx. Therefore, for the purposes of this study, it is assumed that the inbound and outbound cross-zone activity between the proposed casino and Valley Forge and Parx would cancel out.
2. Given the close proximity of SugarHouse and Harrah's (within 10 miles), it is likely that the decision to patronize SugarHouse, Harrah's, or Live! Casino and Hotel would not solely be based on proximity. Customer preference, amenities, and games may play an important role when a customer decides which local casino to patronize. Furthermore, it is likely that casinos in the Philadelphia area will be tapping into similar markets, and a portion of the patrons of the new casino will be redistributed from nearby casinos. Therefore, this analysis assumes that 25% of trips generated in the travel time zones for Harrah's and SugarHouse would divert to the proposed Live! Casino and Hotel.
3. Approximately one-third of vehicles accessing the site from points south via I-95 would utilize the Broad Street exit (Interchange 17), while two-thirds would utilize the Packer Avenue exit (Interchange 19).

Based on the assumptions presented above, trip distribution percentages developed (**EXHIBIT 22**). Approximately 8% of trips would originate from the north and utilize Broad Street (7%) and local roads (1%). An additional 19% of trips would originate from the north via I-95, of which approximately 3% would come from New Jersey via the Ben Franklin Bridge. Approximately 18% of trips would originate from the south via I-95 to Broad Street (5%), I-95 to Packer Avenue (11%), and Penrose Avenue (2%). Finally, 30% of trips would originate from New Jersey via the Walt Whitman Bridge while 25% would originate from points west via I-76 eastbound. Outbound

trips are anticipated to follow the same pattern. The inbound and outbound trip distributions on the study area roadway network are shown in **EXHIBITS 23** and **24**, respectively.

4.3.2 Multimodal Trip Distribution

Non-event multimodal trips were added to the study area roadway network based on the following four assumptions:

1. All transit trips will be shown as pedestrian trips from the transit station or bus stop to the site.
2. 50% of the multimodal trips would originate from/be destined for the AT&T Station of the Broad Street subway line. It is assumed that these trips would be routed via Pattison Avenue to S. 11th Street to S. 10th Street.
3. 25% of the multimodal trips would originate from/be destined for bus stops on S. 10th Street and S. 7th Street. Based on the distance from the proposed casino to the bus stops, as well as service frequency, it is assumed that one-third (8%) would travel to/from S. 7th Street, while two-thirds would travel to/from S. 10th Street (17%).
4. 25% of the multimodal trips would originate from/be destined for residential areas to the north and west.

Additional pedestrian trips that result from linked casino trips during event periods will be distributed on S. Darien Street and S. 10th Street. Based on the location of the main gates to Citizens Bank Park as well as parking lot locations it is assumed that 33% of the linked pedestrian trips would utilize S. Darien Street while 67% would utilize S. 10th Street.

4.4 2016 AND 2021 BUILD CONDITION TRAFFIC VOLUMES

Vehicular and pedestrian trips generated by the proposed development were distributed on the study area roadway network based on the distributions calculated in **Section 4.2**. The resulting site generated trip increments are shown in **APPENDIX E, FIGURES 2** through **6**. The site generated trip increments were added to the 2016 and 2021 No Build Condition traffic volumes to develop 2016 and 2021 Build Condition traffic volumes (**EXHIBITS 25** through **32**).

4.5 2016 BUILD CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2016 Build Condition capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

4.5.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2016 No Build Condition during the Friday Commuter, Friday Casino, and Saturday Casino peak hours, with the exception of the following movements/intersections:

- The westbound shared through-right movement at the intersection of S. Broad Street and Packer Avenue would operate at a V/C ratio greater than 1.0 (LOS F) during all three peak hours.
- The intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps would experience an increase in overall delay of greater than 10 seconds from the No Build Condition during all three peak hours. This is due largely to the increase in delay on the westbound left-turn movement, which would operate at LOS F during all three peak hours, and the southbound left-turn movement, which would operate at LOS E during the Friday Commuter peak hour.
- The intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts Driveway would experience an increase in overall delay of greater than 10 seconds from the No Build Condition during the Friday Commuter peak hour. This is due to the increase in delay on the northbound left-turn movement, which would operate at LOS F.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 107 feet (approximately 4 vehicles) and 92 feet (approximately 3 vehicles) in the Friday Casino and Commuter peak hours, respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage in all three peak hours. The highest peak hour queues would occur during the Saturday Casino Peak hour where the 50th and 95th percentile queues would exceed the existing storage bay by 325 feet (approximately 11 vehicles) and 533 feet (approximately 18 vehicles), respectively.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 39 feet (approximately 1 vehicle) and 92 feet (approximately 3 vehicles) during the Friday, and Saturday Casino peak hours, respectively. However, it should be noted that the left turn bay is preceded by a two-way left-turn lane. Therefore, any queue spillback would likely be contained within the two-way left-turn lane, and would not block the northbound through lanes.

- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 26 feet (less than 1 vehicle) and 205 feet (approximately 7 vehicles) in the Friday Commuter peak hour, respectively.

4.5.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2016 No Build Condition during the Friday Pre-Event peak hour, with the exception of the following movements/intersections:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would degrade from 106 seconds of delay (LOS F) in the No Build Condition to 128 seconds of delay (LOS F) in the Build Condition.
- The westbound shared through-right movement at the intersection of S. Broad Street and Packer Avenue would operate at a V/C ratio greater than 1.0 (LOS F).
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street would degrade from 91 seconds of delay (LOS F) in the No Build Condition to 115 seconds of delay (LOS F) in the Build Condition.
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street would degrade from 165 seconds of delay (LOS F) in the No Build Condition to 616 seconds of delay (LOS F) in the Build Condition. As a result of the increase in delay for this movement, the overall intersection delay would increase from 52 seconds (LOS D) to 188 seconds (LOS F).
- The eastbound left-turn from the casino garage to northbound S. Darien Street would operate at LOS E (50 seconds of delay).
- The eastbound left-turn movement at the intersection of Packer Avenue and S. 7th Street would degrade from 37 seconds of delay (LOS D) in the No Build Condition to 70 seconds of delay (LOS E) in the Build Condition.
- The intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts Driveway would experience an increase in overall delay from 56 seconds (LOS E) in the No Build Condition to 77 seconds (LOS E) in the Build Condition. This is due to the increase in delay on the eastbound approach. The eastbound left-turn movement would continue to operate at 69 seconds of delay (LOS E), as it does in the No Build Condition. However, the eastbound shared through-right movement would degrade from 115 seconds of delay (LOS F) to 174 seconds of delay (LOS F).

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 41 feet (approximately 1 vehicle), and 68 feet (approximately 2 vehicles), respectively.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 190 feet (approximately 6 vehicles) and 361 feet (approximately 12 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 672 feet (approximately 22 vehicles) and 903 feet (approximately 30 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 91 feet (approximately 3 vehicles).
- Packer Avenue and S. 7th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 49 feet (approximately 2 vehicles).

4.6 2021 BUILD CONDITION CAPACITY ANALYSIS RESULTS

The results of the 2021 Build Condition capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

4.6.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2021 No Build Condition during the Friday Commuter, Friday Casino, and Saturday Casino peak hours, with the exception of the following movements/intersections:

- The westbound shared through-right movement at the intersection of S. Broad Street and Packer Avenue would operate at a V/C ratio greater than 1.0 (LOS F) during all three peak hours.
- The intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps would experience an increase in overall delay of greater than 10 seconds from the No Build Condition during all three peak hours. This is due largely to the increase in delay on the westbound left-turn movement, which would operate at LOS F during all three peak

hours, and the southbound left-turn movement, which would operate at LOS F during the Friday Commuter peak hour.

- The intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts Driveway would experience an increase in overall delay of greater than 10 seconds from the No Build Condition during the Friday Commuter peak hour. This is due to the increase in delay on the northbound left-turn movement, which would operate at LOS F.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 131 feet (approximately 4 vehicles) and 116 feet (approximately 4 vehicles) in the Friday Casino and Commuter peak hours, respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage in all three peak hours. The highest peak hour queues would occur during the Saturday Casino Peak hour where the 50th and 95th percentile queues would exceed the existing storage bay by 328 feet (approximately 11 vehicles) and 535 feet (approximately 18 vehicles), respectively.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 42 feet (approximately 1 vehicle) and 94 feet (approximately 3 vehicles) during the Friday, and Saturday Casino peak hours, respectively. However, it should be noted that the left turn bay is preceded by a two-way left-turn lane. Therefore, any queue spillback would likely be contained within the two-way left-turn lane, and would not block the northbound through lanes.
- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 59 feet (approximately 2 vehicles) and 242 feet (approximately 8 vehicles) in the Friday Commuter peak hour, respectively. The 95th percentile queue would also exceed the storage bay length by 2 feet (less than one vehicle) in the Friday Casino peak hour.

4.6.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2021 No Build Condition during the Friday Pre-Event peak hour, with the exception of the following movements/intersections:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would degrade from 131 seconds of delay (LOS F) in the No Build Condition to 154 seconds of delay (LOS F) in the Build Condition.
- The westbound shared through-right movement at the intersection of S. Broad Street and Packer Avenue would operate at a V/C ratio greater than 1.0 (LOS F).
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street would degrade from 118 seconds of delay (LOS F) in the No Build Condition to 149 seconds of delay (LOS F) in the Build Condition.
- The westbound left-turn movement at the intersection of Packer Avenue and S. 10th Street would degrade from 198 seconds of delay (LOS F) in the No Build Condition to 663 seconds of delay (LOS F) in the Build Condition. As a result of the increase in delay for this movement, the overall intersection delay would increase from 60 seconds (LOS D) to 200 seconds (LOS F).
- The eastbound left-turn from the casino garage to northbound S. Darien Street would operate at LOS F (71 seconds of delay).
- The eastbound left-turn movement at the intersection of Packer Avenue and S. 7th Street would degrade from 47 seconds of delay (LOS D) in the No Build Condition to 102 seconds of delay (LOS F) in the Build Condition.
- The I-95 Northbound off-ramp movement to Packer Avenue would operate at 36 seconds of delay (LOS E).
- The intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts Driveway would experience an increase in overall delay from 68 seconds (LOS E) in the No Build Condition to 90 seconds (LOS F) in the Build Condition. This is due to the increase in delay on the eastbound approach. The eastbound left-turn movement would continue to operate at 81 seconds of delay (LOS F), as it does in the No Build Condition. However, the eastbound shared through-right movement would degrade from 146 seconds of delay (LOS F) to 206 seconds of delay (LOS F).

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 67 feet (approximately 2 vehicles), and 85 feet (approximately 3 vehicles), respectively.

- Packer Avenue and S. 10th Street: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 233 feet (approximately 8 vehicles) and 404 feet (approximately 14 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 50th and 95th percentile queues would exceed the left-turn storage by 709 feet (approximately 24 vehicles) and 941 feet (approximately 31 vehicles), respectively.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 115 feet (approximately 4 vehicles).
- Packer Avenue and S. 7th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 72 feet (approximately 2 vehicles).

4.7 CONCLUSIONS

Based on the results of the 2016 and 2021 Build Condition capacity analyses, the following eleven operational deficiencies were identified as related to the proposed development:

1. The proposed site would add between 147 and 302 vehicles to the right-turn movement from westbound Packer Avenue to northbound S. Broad Street, depending on the peak hour. The majority of these vehicles would be destined for the ramp from northbound S. Broad Street to I-76 westbound. The additional right-turn volume on the movement would increase delay and queuing on the westbound approach, and would result in a V/C ratio greater than 1.0 (LOS F).
2. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result an increase in delay for the westbound left-turn movement from Packer Avenue to southbound S. 10th Street. Delay would increase from 118 seconds per vehicle (LOS F) in the 2021 No Build Condition to 149 seconds per vehicle (LOS F) in the 2021 Build Condition.
3. S. Darien Street provides the primary means of access to the proposed site, including the porte-cochere and parking garage. Therefore, the majority of inbound traffic would be routed through the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound ramps. This would result in a significant increase in left-turn volume from westbound Packer Avenue to southbound S. Darien Street during the four peak hours. As a result, the westbound left-turn movement delay would increase by over 200 seconds per vehicle during the non-event peak hours, and over 400 seconds per vehicle during the Pre-Event peak hour. Furthermore, queues during the four peak hours would extend to the intersection of Packer Avenue and S. 7th Street, making it difficult for vehicles coming from the I-76 westbound off-ramp to S. 7th Street to access the left-turn to S. Darien Street.

4. The increase in northbound traffic on S. Darien Street would result in an increase in delay and queuing for the southbound left-turn from the I-76 Eastbound off-ramp to eastbound Packer Avenue, during the Friday Commuter peak hour.
5. The left-turn from the proposed garage to northbound S. Darien Street would operate at LOS E and F during the 2016 and 2021 Friday Pre-Event peak hour, respectively, due to the high volume of event traffic traveling southbound on S. Darien Street.
6. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result an increase in delay for the eastbound left-turn movement from Packer Avenue to northbound S. 7th Street. Delay would increase from 47 seconds per vehicle (LOS D) in the 2021 No Build Condition to 102 seconds per vehicle (LOS F) in the 2021 Build Condition.
7. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result in an increase in delay for the I-95 Northbound Off-Ramp movement to westbound Packer Avenue. Delay would increase from 23 seconds per vehicle (LOS C) in the 2021 No Build Condition to 36 seconds per vehicle (LOS E) in the 2021 Build Condition.
8. Additional site-generate traffic volume on the left-turn movement from northbound S. Front Street to the I-95 northbound on-ramp would result in an increase in delay and queuing during the Friday Commuter peak hour. Delay would increase from 60 seconds per vehicle (LOS E) in the 2021 No Build Condition to 163 seconds per vehicle (LOS F) in the 2021 Build Condition. Furthermore, queues would increase by approximately 200 feet, which would spill back into the northbound through lanes.
9. Additional site-generated traffic volume on the eastbound right-turn movement at the intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts Driveway would result in a further degradation in delay during the Pre-Event peak hour. Delay would increase from 146 seconds per vehicle (LOS F) in the 2021 No Build Condition to 206 seconds per vehicle (LOS F) in the 2021 Build Condition.
10. Additional site-generated traffic volume on the northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would result in a further degradation in delay during the Pre-Event peak hour. Delay would increase from 131 seconds per vehicle (LOS F) in the 2021 No Build Condition to 154 seconds per vehicle (LOS F) in the 2021 Build Condition.
11. Improve pedestrian and bicycle facilities along the site frontage to connect to existing sidewalks and bicycle lanes.

5.0 2016 and 2021 Build Condition with Improvements

5.1 VEHICULAR MITIGATION MEASURES

In order to address site-related operational deficiencies, Stantec identified and evaluated several improvement measures including signal-timing adjustments, protected and protected-permissive left-turn phases, and additional auxiliary lanes. Mitigation measures were evaluated in the 2016 and 2021 Build Conditions. The proposed adjustments and their impact to intersection operations are described below:

5.1.1 Packer Avenue and S. Broad Street

Approximately 7 seconds of green time was reallocated from the S. Broad Street phase to the eastbound/westbound Packer Avenue phase. As a result, the westbound shared through-right movement would improve to LOS C or D in each of the peak hour due to the V/C ratio falling below 1.0. S. Broad Street would experience an average increase in delay of less than 10 seconds per vehicle, and would continue to operate at LOS C or better during all peak hours.

5.1.2 Packer Avenue and S Darien Street, S 10th Street, and S 7th Street

Similar to the previous two intersections, signal timing adjustments were evaluated at the S. Darien Street, S. 10th Street, and S. 7th Street intersections. However, it was determined that timing improvements at the individual intersections alone would not address the operational deficiencies identified in **Section 4.7**. Therefore, additional measures were needed.

In order to address the operational deficiencies at these intersections during the Friday Commuter and Friday Pre-Event peak hour, the existing pre-timed signals were upgraded to an actuated, coordinated signal system, with the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps acting as the master intersection. The cycle lengths for the three intersections were increased to 100 seconds. In addition, protected-permissive left-turn phases were added for the eastbound and westbound left-turn movements at the intersection of Packer Avenue and S. 7th Street, and for the southbound left-turn movement at the intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps. Detectors were added for the S. 10th Street, S. 7th Street, and S. Darien Street/I-76 Eastbound Ramp approaches, as well as the eastbound and westbound protected-permissive left-turn movements.

Despite the recommended coordinated signal improvements, the westbound left-turn from Packer Avenue to S. Darien Street would continue to experience queues that would extend to the intersection of S. 7th Street during multiple peak hours. Not only would this block the left-most travel lane along westbound Packer Avenue, it would also make it difficult for vehicles on S. 7th Street to enter the left-turn lane to access the site. Therefore, in order to mitigate the queuing and improve access to the site from S. 7th Street and the I-76 westbound off-ramp, an

additional westbound left-turn lane was added, along with the extension of the existing left-turn lane and the implementation of a protected left-turn phase. This intersection improvement also required that the existing eastbound protected-permissive left-turn movement be upgraded to a protected-only phase.

PennDOT Publication 46 guidelines were utilized to estimate the required length of the dual left-turn lane (**APPENDIX G**) that would be needed to accommodate the anticipated left-turn volume. Based on the findings from Publication 46 Exhibit 11-8, the recommended turn bay length ranges from 200 feet during the Friday Casino peak-hour to just over 400 feet during the Friday Pre-Event peak hour. These lengths were verified with 95th percentile queue data obtained from the capacity analysis models (see **EXHIBIT 11**). Providing a 400-foot dual left-turn to address the storage needs during the Friday Pre-Event peak hour would not be possible, as it would significantly reduce the adjacent eastbound left-turn lane storage. Furthermore, a 95th percentile queue length of over 400 feet would only be experienced for one hour prior to a stadium event, and not on a daily basis. Therefore, a recommended storage bay length of 250 feet was determined by taking the average of the 95th percentile queues for the non-event peak periods. 250 feet was also determined to be the length that could be accommodated while minimizing the impact to the eastbound left-turn lane from Packer Avenue to S. 7th Street.

The addition of a second westbound left-turn lane could be accomplished by restriping the existing pavement. Eight-foot shoulders are currently provided on the north and south sides of Packer Avenue. Therefore, the roadway could likely be restriped within the area of S. Darien Street to incorporate the additional left-turn lane without the need for widening or affecting the width of the bicycle lanes. However, it should be noted that a pavement assessment would be required during the design of the proposed intersection improvements to determine if the shoulders have been constructed for vehicular traffic. Reconstruction of the shoulder areas may be required to accommodate vehicular traffic if it is determined that the pavement depth is insufficient.

When combined, these improvements result in a significant improvement in operation during all four peak hours, when compared to the Build Condition. Based on the results of the capacity analysis, all queue and LOS deficiencies would improve and fall within acceptable ranges (LOS D or better). Furthermore, overall intersection operation would improve over the Friday Pre-Event peak hour No Build Condition (see **Sections 5.2** and **5.3**).

5.1.3 Site Access Driveways

It is recommended that the existing lane configuration on S. Darien Street be maintained, with the exception of the northbound S. Darien Street approach to the intersection with the parking garage driveway. It is recommended that the existing two-way left-turn lane be converted to a dedicated northbound left turn lane at this location. Based on the left-turn lane warrant criteria for left turn lanes on four-lane undivided highways, a dedicated left-turn lane would be warranted for the northbound left-turn movement during the Friday Commuter and Pre-Event peak hours (**APPENDIX G**).

PennDOT Publication 46 was used to estimate the left-turn lane length that would be needed to accommodate the demand (**APPENDIX G**). Based on this methodology, the recommended turn bay length is 75 feet. This turn bay length was verified as acceptable utilizing queue information produced by Synchro, which shows a maximum 95th percentile queue length of 3 feet.

The 2021 Build Condition capacity analysis indicates that the left-turn movement from the proposed garage driveway to northbound S. Darien Street would operate at LOS E and F during the 2016 and 2021 Build Friday Pre-Event peak hour, respectively. This is primarily due to the heavy event traffic volumes that exist along S. Darien Street. While the trip generation rates applied in this TIS indicate a significant exiting volume during the Pre-Event peak hour, it is likely that actual exiting volumes would be lower. It is likely that event congestion would discourage drivers from leaving during the Pre-Event peak hour.

No mitigation measures for the site driveway are recommended at this time. Upon opening, if it is determined that delay and queuing along the site driveway during pre-event periods is high, the operator of the casino could consider routing all exiting traffic to the S. 10th Street exit.

5.1.4 Packer Avenue and I-95 Northbound Off-Ramp

The capacity analysis results show that the off-ramp movement to Packer Avenue would operate at LOS E (36 seconds of delay) during the Friday Pre-Event peak hour. This delay is just over the threshold between a LOS D and LOS E of 35 seconds of delay per vehicle. This movement could be mitigated with a signal. However, given that this is a borderline failing condition, which only occurs during the Pre-Event peak hour, a signal would not be warranted at this location. Therefore, no mitigation measures are recommended.

5.1.5 S. Front Street and I-95 Ramps/Dunkin Donuts Driveway

The protected-permissive northbound left-turn phase was extended by 6 seconds by decreasing the amount of green time allocated for the southbound through movement during the Friday Commuter peak hour. As a result, delay would decrease from 163 seconds per vehicle (LOS F) in the 2021 Build Condition to 51 second per vehicle (LOS D) in the 2021 Build with Improvements Condition. In addition, 95th percentile queues would be reduced by approximately 100 feet. The reallocation of green time would result in an increase in delay of approximately 20 seconds per vehicle for the southbound through movement, resulting in a LOS D. However, overall intersection delay would decrease from 45 seconds per vehicle (LOS D) to 31 seconds per vehicle (LOS C).

The eastbound approach phase was extended by 13 seconds during the Friday Pre-Event peak hour to address capacity deficiencies during this period. As a result, delay would decrease from 206 seconds per vehicle (LOS F) in the 2021 Build Condition to 62 seconds per vehicle (LOS E) in the 2021 Build with Improvements Condition. However, it should be noted that the V/C ratio would only decrease from 1.40 to 1.05. Therefore, this movement would still operate at LOS F, according to *Highway Capacity Manual 2010* guidelines. In addition to the decrease in delay,

95th percentile queuing during the 2021 horizon year would be reduced by approximately 200 feet.

5.1.6 S. Broad Street and Pattison Avenue

The northbound right-turn movement is oversaturated given the large amount of event-based traffic that make this turn. During the Friday Pre-Event peak hour, the proposed casino would add approximately 26 vehicles to this movement (only 3% of the total right-turn volume). An additional two seconds of green time was added to the northbound/southbound through/right phase, resulting in a reduction in delay that would return the movement to No Build Condition operation. However, given the high delay in the No Build Condition, the additional green time may have limited benefit to overall traffic flow. The City may want to consider implementing other improvements during pre-event periods before implementing this signal timing adjustment.

5.2 2016 BUILD CONDITION WITH IMPROVEMENTS CAPACITY ANALYSIS RESULTS

The results of the 2016 Build Condition with Improvements capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

5.2.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2016 No Build Condition during the Friday Commuter, Friday Casino, and Saturday Casino peak hours, with the exception of the following movements/intersections:

- The intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps would operate with an overall intersection delay that is greater than 10 seconds over the No Build Condition. However, the proposed improvements at this intersection result in a significant decrease in intersection delay when compared to the Build Condition. Delay would decrease by approximately 40, 14, and 62 seconds per vehicle in the Friday Commuter, Friday Casino, and Saturday Casino peak hours, respectively.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The eastbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 2 feet (less than one vehicle) in the Friday Commuter peak hour. This equates to a negligible queue spillback that would not affect the eastbound through lanes.

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 19 feet (less than one vehicle) in the Saturday Casino peak hour. This equates to a negligible queue spillback that would not noticeably affect the eastbound through lanes.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 30 feet, 39 feet, and 99 feet in the Friday Commuter, Friday Casino, and Saturday Casino peak hours, respectively. However, as previously stated, any queue spillback would likely be contained within the adjacent two-way left-turn lane and would not negatively affect the northbound through lanes. The left-turn lane striping could also be extended an additional 130 feet without affecting access to driveways along S. 10th Street.
- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 126 feet (approximately 4 vehicles) during the Friday Commuter peak hour. However, it should be noted that, despite the queue spillback, the signal timing adjustments proposed for this movement would result in significant improvement over the Build Condition. Most notably, the 50th percentile queue would no longer exceed the storage bay length. Furthermore, the results of the Synchro capacity analysis, which considers queue spillback when determining approach delay and LOS, show that the northbound through movement would continue to operate at LOS A.

5.2.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2016 No Build Condition during the Friday Pre-Event peak hour, with the exception of the following movements/intersections:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would continue to operate at LOS F, but would operate within 10 seconds of the No Build Condition delay.
- The eastbound left-turn movement from the garage driveway to S. Darien Street would continue to operate at LOS E. However, all queued vehicles would be contained on-site, and would not affect traffic flow on S. Darien Street. Furthermore, the casino operator could consider routing all exiting traffic to the S. 10th Street exit if vehicle queuing becomes an issue within the parking structure (see **Section 5.1.3**).
- Delay and queuing along the eastbound shared through-right movement at the intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts driveway would improve by approximately 127 seconds per vehicle and 200 feet, respectively. However, the V/C ratio would remain greater than 1.0, resulting in a LOS F for that

movement. It should also be noted that overall intersection delay improves over the No Build Condition. Overall intersection delay decreases from 55 seconds per vehicle (LOS E) in the No Build Condition to 33 seconds per vehicle (LOS C) in the Build with Improvements Condition.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 95th percentile queue would exceed the right-turn storage by 6 feet (less than 1 vehicle), a negligible queue spillback.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 332 feet (approximately 11 vehicles). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a significant improvement to queuing along this movement when compared to the No Build and Build Conditions. The 50th percentile queue would no longer exceed the storage length, and the 95th percentile queue would be lower than in the No Build and Build Conditions.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 74 feet (approximately 3 vehicles). However, as previously stated, any queue spillback would likely be contained within the adjacent two-way left-turn lane and would not negatively affect the northbound through lanes. The left-turn lane striping could also be extended an additional 130 feet without affecting access to driveways along S. 10th Street.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 170 feet (approximately 6 vehicles). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a significant improvement to queuing along this movement when compared to the Existing, No Build, and Build Conditions. The 50th percentile queue would no longer exceed the storage length, and the 95th percentile queue would be lower than in the Existing, No Build, and Build Conditions.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 33 feet (approximately 1 vehicle). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a lower 95th percentile queue length than in the Existing, No Build, and Build Conditions.

5.3 2021 BUILD CONDITION WITH IMPROVEMENTS CAPACITY ANALYSIS RESULTS

The results of the 2021 Build Condition with Improvements capacity analysis for the Friday Commuter, Friday Pre-Event, Friday Casino, and Saturday Casino peak hours are shown in **EXHIBITS 7, 8, 9, and 10**, respectively. The exhibits contain V/C ratio, delay, LOS, and queuing. An analysis of queuing within storage bays was also conducted (**EXHIBIT 11**).

5.3.1 Non-Event Peak Hours

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2021 No Build Condition during the Friday Commuter, Friday Casino, and Saturday Casino peak hours, with the exception of the following movements/intersections:

- The intersection of Packer Avenue and S. Darien Street/I-76 Eastbound Ramps would operate with an overall intersection delay that is greater than 10 seconds over the No Build Condition. However, the proposed improvements at this intersection result in a significant decrease in intersection delay when compared to the Build Condition. Delay would decrease by approximately 42, 16, and 78 seconds per vehicle in the Friday Commuter, Friday Casino, and Saturday Casino peak hours, respectively.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The eastbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 9 feet (less than 1 vehicle) in the Friday Commuter peak hour. This equates to a negligible queue spillback that would not affect the eastbound through lanes.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 21 feet (less than 1 vehicle) in the Saturday Casino peak hour. This equates to a negligible queue spillback that would not noticeably affect the eastbound through lanes.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 30 feet, 39 feet, and 101 feet in the Friday Commuter, Friday Casino, and Saturday Casino peak hours, respectively. However, as previously stated, any queue spillback would likely be contained within the adjacent two-way left-turn lane and would not negatively affect the northbound through lanes. The left-turn lane striping could also be extended an additional 130 feet without affecting access to driveways along S. 10th Street.

- S. Front Street and I-95 Northbound Ramps/Dunkin Donuts Driveway: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 150 feet (approximately 5 vehicles) during the Friday Commuter peak hour. However, it should be noted that, despite the queue spillback, the signal timing adjustments proposed for this movement would result in significant improvement over the Build Condition. Most notably, the 50th percentile queue would no longer exceed the storage bay length. Furthermore, the results of the Synchro capacity analysis, which considers queue spillback when determining approach delay and LOS, show that the northbound through movement would continue to operate at LOS A.

5.3.2 Pre-Event Peak Hour

Based on the results of the capacity analysis, all lane groups would operate at LOS D or better, and all intersections would operate within 10 seconds of delay of the 2021 No Build Condition during the Friday Pre-Event peak hour, with the exception of the following movements/intersections:

- The northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would continue to operate at LOS F, but would operate within 10 seconds of the No Build Condition delay.
- The eastbound left-turn movement from the garage driveway to S. Darien Street would continue to operate at LOS F. However, all queued vehicles would be contained on-site, and would not affect traffic flow on S. Darien Street. Furthermore, the casino operator could consider routing all exiting traffic to the S. 10th Street exit if vehicle queuing becomes an issue within the parking structure (see **Section 5.1.3**).
- The I-95 Northbound Off-Ramp movement to Packer Avenue would continue to operate at LOS E. However, this condition is considered borderline and no mitigation measures are recommended (see **Section 5.1.4**).
- Delay and queuing along the eastbound shared through-right movement at the intersection of S. Front Street and the I-95 Northbound Ramps/Dunkin Donuts driveway would improve by approximately 144 seconds per vehicle and 200 feet, respectively. However, the V/C ratio would remain greater than 1.0, resulting in a LOS F for that movement. It should also be noted that overall intersection delay improves over the No Build Condition. Overall intersection delay decreases from 68 seconds per vehicle (LOS E) in the No Build Condition to 40 seconds per vehicle (LOS C) in the Build with Improvements Condition.

The results of the queue analysis show that all 50th and 95th percentile queues would be contained within the existing storage bays, with the exception of the following movements:

- S. Broad Street and Packer Avenue: The southbound right-turn movement's 50th and 95th percentile queues would exceed the right-turn storage by 24 feet (less than 1 vehicle), a negligible queue spillback.
- Packer Avenue and S. 10th Street: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 378 feet (approximately 13 vehicles). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a significant improvement to queuing along this movement when compared to the No Build and Build Conditions. The 50th percentile queue would no longer exceed the storage length, and the 95th percentile queue would be lower than in the No Build and Build Conditions.
- Packer Avenue and S. 10th Street: The northbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 81 feet (approximately 3 vehicles). However, as previously stated, any queue spillback would likely be contained within the adjacent two-way left-turn lane and would not negatively affect the northbound through lanes. The left-turn lane striping could also be extended an additional 130 feet without affecting access to driveways along S. 10th Street.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The westbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 181 feet (approximately 6 vehicles). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a significant improvement to queuing along this movement when compared to the Existing, No Build, and Build Conditions. The 50th percentile queue would no longer exceed the storage length, and the 95th percentile queue would be lower than in the Existing, No Build, and Build Conditions.
- Packer Avenue and S. Darien Street/I-76 Eastbound Ramps: The southbound left-turn movement's 95th percentile queue would exceed the left-turn storage by 46 feet (approximately 2 vehicles). Despite the continuation of the occasional queue spillback, the enhancement proposed for this intersection would result in a lower 95th percentile queue length than in the Existing, No Build, and Build Conditions.

5.4 PEDESTRIAN/BICYCLE MITIGATION MEASURES

Based on the information provided in **Section 4.3.2**, it was determined that the majority of pedestrian trips during non-event periods would originate from the SEPTA Broad Street Subway Line, with smaller percentages originating from bus stops near the site, as well as neighborhoods to the north and west. It is also anticipated that additional pedestrian trips to and from the stadiums would be generated before and after stadium events. Anticipated pedestrian travel paths are shown in **EXHIBIT 33**.

The existing pedestrian facilities, with the exception of S. Darien Street, would likely be adequate to support the low (2%) anticipated pedestrian trip generation during non-event periods. However, an increase in pedestrian activity to/from the site before and after stadium events is anticipated. Improvements to the existing sidewalks along the site frontage would be required in order to accommodate pedestrian flow between the stadium complex and the casino. In addition, there is no sidewalk along the S. Darien Street site frontage. It is anticipated that a portion of pre- and post-event pedestrian trips would utilize S. Darien Street if a sidewalk were provided.

In order to mitigate the pedestrian deficiencies along the site frontage, the following six recommendations should be considered:

1. Provide a sidewalk along the S. Darien Street frontage.
2. Improve the existing sidewalks along the S 10th Street and Packer Avenue frontages.
3. Provide ADA-compliant curb ramps at the intersections of S. 10th Street and Packer Avenue, and S. Darien Street and Packer Avenue.
4. Upgrade the crosswalk at the intersection of S. Darien Street and Packer Avenue to be consistent with the adjacent intersections.
5. Install walk/don't walk pedestrian signal heads at the intersections of S. 10th Street and Packer Avenue, S. Darien Street and Packer Avenue, and S. 7th Street and Packer Avenue.
6. Install bike racks or lockers on site.

6.0 Conclusion

This traffic impact study summarizes the analysis that was conducted to evaluate the potential impacts of the proposed Live! Casino and Hotel in South Philadelphia. An analysis of the potential impacts of the proposed casino facility was conducted by evaluating existing, future no build, and future build condition traffic operations during a Friday Commuter peak hour, Friday Pre-Event peak hour, Friday Casino peak hour, and Saturday Casino peak hour. In addition, an assessment of pedestrian facilities was also conducted to evaluate pedestrian circulation to and from the proposed development.

The capacity analysis shows that the proposed development would result in site-specific impacts at the intersections of S. Broad Street and Packer Avenue, Packer Avenue and S. Darien Street/I-76 Eastbound Ramps, Packer Avenue and S. 7th Street, S. Front Street and I-95 Northbound ramps/Dunkin Donuts Driveway, S. Broad Street and Pattison Avenue, and the I-95 Northbound Off-Ramp movement to Packer Avenue. These intersections would experience an overall increase in delay of greater than ten seconds, or contain movements that would experience an increase in delay, volume to capacity (V/C) ratio, and/or queuing, resulting in a LOS E or F during the 2016 and 2021 Build Conditions. Mitigation measures such as adjustments to signal timing and phasing and additional left-turn treatments were evaluated and recommended. **TABLE 4** indicates the operational deficiency identified in the Build Condition analysis and the recommended mitigation measure.

In addition to vehicular operations, pedestrian and bicycle facilities to and from the proposed site were evaluated. Sidewalks are currently provided along the S. 10th Street and Packer Avenue site frontages; however, no sidewalk exists along the S. Darien Street frontage. In addition, ADA-compliant curb ramps and pedestrian signal heads are not provided at the intersections of Packer Avenue and S. 10th Street, and Packer Avenue and S. Darien Street. Therefore, it is recommended that a new sidewalk be provided along S. Darien Street, and that the existing sidewalks along the S. 10th Street and Packer Avenue frontages be improved to accommodate pedestrian flow between the site and the stadiums. In addition, pedestrian signal heads and ADA compliant curb ramps are recommended for the intersections of Packer Avenue and S. 10th Street, and Packer Avenue and S. Darien Street.

In summary, the proposed development would be located in an area of Philadelphia that has upgraded local roadway facilities, as well as ample freeway connections, that were designed to accommodate large traffic volumes for events within the stadium complex. Because of the ample capacity provided within the study area, the results of the analysis presented above show that the proposed development would result in minor intersection-specific impacts. The recommended vehicular and pedestrian mitigation measures would be capable of addressing these impacts, and in some locations, the proposed mitigation measures would result in improved operations over the Existing and/or No Build Conditions.

**LIVE! CASINO AND HOTEL
TRAFFIC IMPACT STUDY
PHILADELPHIA, PA**

Conclusion
November 2013

TABLE 4: Summary of Deficiencies and Recommended Mitigation Measures

Operational Deficiency	Recommended Mitigation Measure
1. Additional right-turn volume from westbound Packer Avenue to northbound S. Broad Street would increase delay and queuing on the westbound Packer Avenue approach, resulting in a V/C ratio greater than 1.0 (LOS F).	Reallocate green time from S. Broad Street to eastbound/westbound Packer Avenue.
2. Delay for the westbound left-turn movement from Packer Avenue to S. 10 th Street would increase by 31 seconds during the Friday Pre-Event peak hour (LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide additional green time for the eastbound/westbound Packer Avenue approaches at the S. 10 th Street intersection.
3. Delay for the westbound left-turn movement from Packer Avenue to S. Darien Street would increase by over 200 seconds per vehicle during the non-event peak hours. Furthermore, event and non-event peak hour queues would extend to the intersection of Packer Avenue and S. 7 th Street.	Provide an additional westbound left-turn lane and extend the storage length. The dual left-turn would operate in a protected phase. The opposing eastbound left-turn would also be modified to operate in a protected phase. The additional lane could be added by restriping the existing pavement to reduce the width of the existing shoulders. The bike lanes would be maintained.
4. The increase in traffic on northbound S. Darien Street would result in an increase in delay and queuing for the southbound left-turn from the I-76 EB off-ramp to eastbound Packer Avenue during the Friday Commuter peak hour (LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide a protected-permissive left-turn phase for the southbound left-turn movement.
5. The left-turn from the proposed garage to northbound S. Darien Street would operate at LOS E and F during the 2016 and 2021 Friday Pre-Event peak hour, respectively.	Consider routing all departing traffic to the S. 10 th Street exit if field operations determine this is needed.
6. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result in an increase in delay for the eastbound left-turn movement from Packer Avenue to northbound S. 7 th Street (LOS D to LOS F).	Install an actuated signal system at the S. 10 th Street, S. Darien Street, and S. 7 th Street intersections. Provide a protected-permissive phase for the eastbound/westbound left-turn movement.
7. Additional site-generated traffic volume on Packer Avenue during the Pre-Event peak hour would result in an increase in delay I-95 Northbound Off-Ramp (LOS C to LOS E).	This is a borderline condition that only occurs for the one hour prior to an event, and does not justify additional mitigation measures.
8. Additional site-generated traffic volume on the northbound left-turn movement from S. Front Street to the I-95 northbound on-ramp would result in an increase in delay during the Friday Commuter peak hour (LOS D to LOS F)	Reallocate green time from southbound S. Front Street to the northbound left-turn phase.

Operational Deficiency	Recommended Mitigation Measure
<p>9. Additional site-generated traffic volume on the eastbound right-turn movement at the intersection of S. Front Street and I-95 Northbound Ramps/Dunkin Donuts would result in an increase in delay of 60 seconds (LOS F) during the Friday Pre-Event peak hour.</p>	<p>Reallocate green time from northbound/southbound S. Front Street to the eastbound approach phase.</p>
<p>10. Additional site-generated traffic volume on the northbound right-turn movement at the intersection of S. Broad Street and Pattison Avenue would result in an increase in delay of 23 seconds (LOS F).</p>	<p>Consider reallocating green time from eastbound/westbound Pattison Avenue to the northbound/southbound phase.</p>
<p>11. Provide pedestrian and bicycle facilities.</p>	<p>Upgrade sidewalk along S. Darien Street and S. 10th Street. Install ADA-compliant curb ramps and pedestrian countdown signals at the Packer Avenue intersections with S. 10th Street, S. Darien Street, and S. 7th Street. Provide bicycle racks or lockers on site.</p>