



TRANSPORTATION IMPACT STUDY (TIS)

Project Name: 3000 Grays Ferry Parking Facility

Multi-Level Parking Garage at 3000 Grays Ferry Avenue
City of Philadelphia, Pennsylvania

Prepared for:

Children's Hospital of Philadelphia
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1 EXECUTIVE SUMMARY

The Children's Hospital of Philadelphia (CHOP) proposes to construct a parking garage located at 3000 Grays Ferry Avenue in Philadelphia, PA. The parcel is bounded by Grays Ferry Avenue to the north, South 30th Street to the east, Titan Street to the south, and South 31st Street to the west. The development block includes a one-story retail store (used by Go-Puff) on the west side of the parcel and a vacant grass field is located on the east side of the parcel.

The parking garage will provide 1,012 parking spots for employees only. Construction of the parking garage is anticipated to begin in 2025 and end in 2026. For this analysis, the Opening Year is 2026 and the Design Year is 2031 (five years after the opening year). Shuttles will be used to transport employees to and from the CHOP campuses located in University City.

The study area for this analysis includes the following twelve (12) intersections (as instructed by Philadelphia Streets Department correspondence dated December 13, 2023):

1. Grays Ferry Avenue and South 29th Street (Signalized)
2. Grays Ferry Avenue and South 30th Street (Signalized)
3. Grays Ferry Avenue and South 31st Street (Signalized)
4. Grays Ferry Avenue and South 32nd Street (Unsignalized)
5. Grays Ferry Avenue and South 33rd Street (Unsignalized)
6. Grays Ferry Avenue and South 34th Street (Signalized)
7. Oakford Street and South 30th Street (Unsignalized)
8. Titan Street and South 30th Street (Unsignalized)
9. Titan Street and South 31st Street (Unsignalized)
10. Wharton Street and South 30th Street (Unsignalized)
11. Wharton Street and South 31st Street (Unsignalized)
12. Wharton Street and South 34th Street (Signalized)

Study intersection turning movement counts were obtained using Miovision cameras, which recorded traffic on December 20, 2023, and January 3, 2024, from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM.

As a result of the analysis, the following improvements are proposed:

- Grays Ferry Ave (SR 3021) and South 34th St (SR 3003)
 - Extend the southbound left turn lane from 270 feet to 300 feet to accommodate the AM and PM peak queues.

In addition to the improvements proposed as a result of the analysis, the City of Philadelphia Streets Department, Traffic Division indicated the following improvements would be required at Grays Ferry Avenue and South 30th Street:

- Install pedestrian signals and a crosswalk for the west side of the intersection.
- Install accessible pedestrian signals for all crossings.

2 INTRODUCTION/PROJECT SUMMARY

The Children's Hospital of Philadelphia (CHOP) proposes construction of a parking garage located at 3000 Grays Ferry Avenue in Philadelphia, PA. The parcel is bounded by Grays Ferry Avenue to the north, South

30th Street to the east, Titan Street to the south, and South 31st Street to the west and includes a one-story retail store on the west side. The development block includes a one-story retail store on the west side of the parcel and a vacant grass field on the east side of the parcel. The tenant occupying the retail store (Go-Puff) has a lease expiring in 2030.

The garage will provide 1,012 employee-only parking spaces to replace 513 employee-only parking spaces at the nearby Warfield Street surface parking lot. CHOP's lease for the Warfield Street lot expires in October 2026 and it cannot be renewed. Construction of the parking garage is anticipated to begin in 2025 and end in 2026. For this analysis, the Opening Year is 2026 and the Design Horizon Year is five years afterwards in 2031. Shuttle Buses will be used to transport employees to and from the CHOP campus in University City.

2.1 Study Area

The study area for this analysis includes the following twelve (12) intersections:

1. Grays Ferry Avenue and South 29th Street – Signalized
2. Grays Ferry Avenue and South 30th Street – Signalized
3. Grays Ferry Avenue and South 31st Street – Signalized
4. Grays Ferry Avenue and South 32nd Street – Unsignalized
5. Grays Ferry Avenue and South 33rd Street – Unsignalized
6. Grays Ferry Avenue (SR 3021) and South 34th Street (SR 3003) – Signalized
 - Note that Grays Ferry Avenue is a State Route west of the intersection with South 34th Street.
7. Oakford Street and South 30th Street – Unsignalized
8. Titan Street and South 30th Street – Unsignalized
9. Titan Street and South 31st Street – Unsignalized
10. Wharton Street and South 30th Street – Unsignalized
11. Wharton Street and South 31st Street – Unsignalized
12. Wharton Street and South 34th Street (SR 3003) – Signalized

The study area locations are shown in Figure 1.

Figure 1. Study Area Locations



Image Source: Google Earth

3 DATA COLLECTION

Study intersection turning movement counts were obtained using Miovision cameras, which recorded traffic on December 20, 2023, and January 3, 2024, from 6:00 AM to 9:00 AM and 3:00 PM to 6:00 PM. The raw, unbalanced traffic data is shown in Appendix A.

Based on the collected traffic data, the AM and PM system peak hours for the study area occur from 7:45 AM to 8:45 AM and 3:30 PM to 4:30 PM. The existing condition peak hour traffic, pedestrian, and bicycle volumes are shown in Figure 3 to Figure 8. The figures illustrating the peak hour traffic volumes include the existing driveway volumes to/from the site that will house the proposed parking garage.

4 CAPACITY ANALYSIS METHODOLOGY

Synchro 11 software was used to analyze level of service (LOS) for the study intersections. LOS is based on the delay and control type (signalized, all-way stop control, two-way stop control, etc.) at the intersection. There are six categories of LOS, defined alphabetically from A to F. In most instances, the delay and level of service were calculated using *Highway Capacity Manual (HCM), 6th Edition* methodologies. *HCM, 6th Edition* methodologies could not be used to calculate delay and level of service for the intersection of Grays Ferry Avenue and 30th Street, so results based on Synchro methodologies were reported.

In accordance with *PennDOT Publication 46: Traffic Engineering Manual (March 2014)*, Pennsylvania default values were applied to calibrate the Synchro models. Per Exhibit 10-9, the base saturation flow rate (2,100 passenger cars per hour per lane) for urban core was applied to the signalized intersections. Per Exhibit 10-10, the start-up lost time (2.5 seconds) and extension of effective green time (3.0 seconds for yellow and all red time less than 6.0 seconds; otherwise, 4.0 seconds) for urban core were also applied

to the signalized intersections. When analyzing future conditions, all signalized intersections were optimized per the guidance in *PennDOT Publication 282: Highway Occupancy Permit Operations Manual*.

5 EXISTING STUDY AREA CONDITIONS

5.1 Existing Roadway Network

Eight roadways are within the study area, and Table 1 summarizes the characteristics of each. The classification, Average Daily Traffic (ADT), and truck percentage were obtained from PennDOT's Traffic Information Repository (TIRe).

Table 1. Existing Roadway Characteristics

Roadway	Classification	Speed Limit (mph)	Travel Lanes	ADT (Year)	Truck %
Grays Ferry Avenue	Urban Other Principal Arterial	30	EB – Two + Bike Lane WB – Two + Bike Lane	12,692 (2019)	7
Wharton Street	Urban Local	25	EB – One	N/A	N/A
29 th Street	Urban Local	25	SB – One	1,773 (2023)	10
30 th Street	Urban Local	Not posted within study area	NB – One	300 (2000)	10
31 st Street	Urban Local	25	SB – One	356 (2000)	10
34 th Street	Urban Other Principal Arterial	25	NB – Two SB – Two	North of Grays Ferry Ave: NB: 15,676 (2023) SB: 10,951 (2023) South of Grays Ferry Ave: NB: 20,126 (2022) SB: 14,621 (2022)	North of Grays Ferry Ave: 3 South of Grays Ferry Ave: 4
Oakford Street	Urban Local	Not posted within study area	WB – One	300 (2000)	10
Titan Street	Urban Local	Not posted within study area	WB – One	300 (2000)	10

5.2 Existing Study Intersections

Table 2 summarizes each study intersection approach configuration and traffic control.

Table 2. Existing Study Intersection Configuration and Traffic Control

Intersection	Approach Configuration	Control
1 – Grays Ferry Avenue and South 29 th Street	<ul style="list-style-type: none"> • SB – Shared left/thru/right lane • EB – 80-foot left turn lane, thru lane, shared thru/right turn lane • WB – 85-foot left turn lane, thru lane, share thru/right turn lane • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • Actuated signal • Permitted phasing on all approaches
2 – Grays Ferry Avenue and South 30 th Street	<ul style="list-style-type: none"> • NB – Shared left/thru/right lane • SB – Left turn lane, right turn lane • EB – 95-foot left turn lane, thru lane, shared thru/right turn lane • WB – Thru lane, shared thru/right turn lane – • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • Actuated signal • Protected/permitted EB left turn phasing
3 – Grays Ferry Avenue and South 31 st Street	<ul style="list-style-type: none"> • SB – Shared left/thru/right lane • EB – 90-foot left turn lane, thru lane, shared thru/right turn lane • WB – 85-foot left turn lane, thru lane, shared thru/right turn lane • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • Actuated signal • Permitted phasing on all approaches • Part of coordinated signal system along Grays Ferry Ave
4 – Grays Ferry Avenue and South 32 nd Street	<ul style="list-style-type: none"> • EB – Thru lane, shared thru/right turn lane – • WB – Two thru lanes • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • No control
5 – Grays Ferry Avenue and South 33 rd Street	<ul style="list-style-type: none"> • NB – Right turn lane • EB – Two thru lanes • WB – Two thru lanes • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • Stop-controlled NB approach
6 – Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)*	<ul style="list-style-type: none"> • NB – 175-foot left turn lane, two thru lanes, 190-foot channelized right turn lane • SB – 270-foot left turn lane, thru lane, shared thru/channelized right turn lane • EB – 205-foot left turn lane, thru lane, shared thru/right turn lane • WB – 200-foot left turn lane, thru lane, shared thru/channelized right turn lane • Bike lane for EB and WB directions 	<ul style="list-style-type: none"> • Actuated signal • Protected-only NB, SB, EB, and WB left turn phasing • Part of coordinated signal system along Grays Ferry Ave
7 – Oakford Street and South 30 th Street	<ul style="list-style-type: none"> • NB – Thru lane • WB – Right turn lane 	<ul style="list-style-type: none"> • All-way stop-controlled
8 – Titan Street and South 30 th Street	<ul style="list-style-type: none"> • NB – Shared left turn/thru lane 	<ul style="list-style-type: none"> • No control

Intersection	Approach Configuration	Control
9 – Titan Street and South 31 st Street	<ul style="list-style-type: none"> • SB – Thru lane • WB – Left turn lane 	<ul style="list-style-type: none"> • All-way stop-controlled
10 – Wharton Street and South 30 th Street	<ul style="list-style-type: none"> • NB – Shared thru/right turn lane • EB – Shared left turn/thru lane 	<ul style="list-style-type: none"> • All-way stop-controlled
11 – Wharton Street and South 31 st Street	<ul style="list-style-type: none"> • SB – Shared left turn/thru lane • EB – Shared thru/right turn lane 	<ul style="list-style-type: none"> • All-way stop-controlled
12 – Wharton Street and South 34 th Street (SR 3003)	<ul style="list-style-type: none"> • NB – 200-foot left turn lane, two thru lanes, 100-foot right turn lane • SB – 100-foot left turn lane, thru lane, shared thru/right turn lane • EB – Shared left turn/thru lane, 75-foot right turn lane • WB – Shared left turn/thru/right turn lane 	<ul style="list-style-type: none"> • Pre-timed signal • Protected/permitted SB left turn phasing • Protected-only NB left turn phasing • Part of coordinated signal system along Grays Ferry Ave

Existing traffic signal plans and timing work orders that were provided for this TIS are included in Appendix B.

5.3 Public Transportation

There are several public transportation routes within the study area, which are summarized in the following list:

- SEPTA Bus Route 12 services Grays Ferry Avenue throughout the study area.
- SEPTA Bus Route 49 services Grays Ferry Avenue, 29th Street, 30th Street, and 34th Street throughout the study area.
- SEPTA Bus Route 64 services Grays Ferry Avenue, Wharton Street, 29th Street, 30th Street, 33rd Street, and 34th Street throughout the study area.

SEPTA bus route maps are included in Appendix C.

5.4 Pedestrian and Bicycle Facilities

Sidewalks are present throughout the entire study area. Unprotected bicycle lanes are provided on Grays Ferry Avenue for both directions within the study area.

5.5 Crash Data

Crash data for each study intersection was obtained using PennDOT's Pennsylvania Crash Information Tool (PCIT), which provides reportable crash information. Table 3 shows the crash data for the five-year period from January 1, 2018, to December 31, 2022, within a 100' radius of each intersection.

Table 3. Crash Data Summary

Intersection	2019	2020	2021	2022	2023	Total
1 – Grays Ferry Avenue and South 29 th Street*	0	0	0	1	2	1
2 – Grays Ferry Avenue and South 30 th Street*	0	0	0	0	1	0
3 – Grays Ferry Avenue and South 31 st Street*	0	0	0	1	0	1
4 – Grays Ferry Avenue and South 32 nd Street	1	1	0	0	0	3
5 – Grays Ferry Avenue and South 33 rd Street	1	0	0	1	1	2
6 – Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)	7	1	2	3	4	17
7 – Oakford Street and South 30 th Street	0	0	0	0	0	0
8 – Titan Street and South 30 th Street	0	0	0	0	0	0
9 – Titan Street and South 31 st Street	0	0	0	0	0	0
10 – Wharton Street and South 30 th Street	0	0	0	1	1	1
11 – Wharton Street and South 31 st Street	1	0	0	0	0	1
12 – Wharton Street and South 34 th Street (SR 3003)*	0	1	0	1	1	2
Total	10	3	2	8	10	28

* The analysis area included two, 100' radius circles since Grays Ferry Avenue was represented as a divided highway in PCIT.

5.6 Land Use Context

According to *PennDOT Design Manual, Part 1X, Appendix B*, the land use context within the study area is town/village neighborhood.

5.7 Existing Traffic Conditions

During existing conditions, all study intersections operate at an overall LOS D or better, except for the intersection at Grays Ferry Avenue and 34th Street which operates at an overall LOS E for the PM peak period. Movements at most intersections operate at LOS D or better and have sufficient available storage capacity to accommodate the 95th percentile queues except for the intersection at Grays Ferry Avenue and 34th Street and the intersection at Wharton Street and 34th Street. The 95th percentile queues at these two intersections are summarized in Table 4 below:

Table 4. Summary of Queues Exceeding Storage Capacity under Existing Conditions

Intersection	Approach / Movement	Queueing Notes
Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)	EB approach	Queues extend back to the intersection with 35 th Street during the PM peak hour.
	WB left turns	Queues extend beyond the turn bay length during both peak hours.
	NB left turns	Queues extend beyond the turn bay length during the PM peak hour.
	SB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Wharton Street and South 34 th Street (SR 3003)	EB right turns	Queues extend beyond the turn bay length during the PM peak hour.
	WB approach	Queues extend back to the intersection with 33 rd Street during the PM peak hour.
	NB left turns	Queues extend beyond the turn bay length during both peak hours.
	SB approach	Queues extend back to the intersection with Grays Ferry Avenue during the PM peak hour.

The LOS and delay results from the AM and PM peak hour capacity analyses are shown in Table 19. The estimated 95th percentile queues are shown in Table 20. The Synchro output for the capacity and 95th percentile queue analysis is included as Appendix D.

6 TRAFFIC CONDITIONS WITHOUT DEVELOPMENT

6.1 Background Growth

The PennDOT Bureau of Planning and Research derived growth factors for September 2023 to July 2024. However, for urban non-interstate roadways in Philadelphia County, a growth rate was not provided. In absence of the PennDOT growth factor, the Philadelphia Streets Department instructed the study team to use a yearly growth rate of 0.05%. For the Opening Year in 2026 and Design Year in 2031, the resulting growth factors are 1.001 and 1.004 respectively. These growth factors were applied to all volumes captured at the study intersections.

6.2 Nearby Developments

CHOP is currently constructing an expansion to their University City campus via the University City Impatient Expansion (UCIE) project. The project includes the addition of patient facilities, reconfiguration or logistic services and circulation changes to the University City campus. The study area and impact of the development is primarily contained within the University City campus. Some traffic destined for expanded facility will travel through the study area of this project, specifically the intersections of 34th Street & Grays Ferry Avenue as well as 34th Street and Wharton Street. The UCIE trips from the intersection of University Avenue/I-76 Ramps and 34th Street were routed through the study area of this project as background development.

Philadelphia Streets recommended that no other nearby developments contribute to the study area, as the projects had either not been formally submitted to the City, were put on hold, or had been previously completed so their traffic is included within these traffic counts conducted.

6.3 Planned Improvements

The study team reviewed PennDOT's 12-Year Program and the Delaware Valley Regional Planning Commission (DVRPC) four-year Transportation Improvement Program (TIP). According to DVRPC's FY2023 TIP for PA, roadway resurfacing is planned for Grays Ferry Avenue between 34th Street and South Street as part of the Citywide 3R project. Typical components include base repair, milling & overlay, drainage improvements, signal modernization, and guiderail improvements. The construction completion date is estimated to be end of year 2025. According to the construction plans provided to the study team, there are no improvements to the traffic signals or roadway geometry that would affect the traffic analysis for this TIS. The improvements are limited to pavement marking restriping and bike lane modifications. The plans are included as Appendix E.

6.4 Future Traffic Conditions without Development

The background growth was applied to the existing traffic volumes to project traffic volumes during the Opening Year (2026) without development and Design Horizon Year (2031) without development. Figure 9, Figure 10, Figure 11, and Figure 12 show the volumes for Opening Year (2026) without development and Design Horizon Year (2031) without development, respectively.

For the future scenarios, traffic signal timings were optimized. Most notably, the cycle lengths for the intersection of Grays Ferry Avenue (SR 3021) and South 34th Street (SR 3003) and the intersection of Wharton Street and South 34th Street (SR 3003) were reduced from 120 seconds to 100 seconds to reduce queue lengths.

During Opening Year (2026) without development and Design Horizon Year (2031) without development, all study intersections operate at an overall LOS of D or better. The following intersections have some movements that operate at LOS E or worse:

- Grays Ferry Avenue (SR 3021) and South 34th Street (SR 3003)
- Wharton Street and South 34th Street (SR 3003)

Refer to Table 19 for the resulting LOS by movement. All movements have available storage capacity to accommodate the 95th percentile queues, except for those shown in Table 5.

Table 5. Summary of Queues Exceeding Storage Capacity during Opening and Design Horizon Years

Intersection	Approach / Movement	Queueing Notes
Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)	EB approach	Queues extend back to the intersection with 35 th Street during the PM peak hour.
	WB left turns	Queues extend beyond the turn bay length during both peak hours.
	NB left turns	Queues extend beyond the turn bay length during the PM peak hour.
	SB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Wharton Street and South 34 th Street (SR 3003)	EB right turns	Queues extend beyond the turn bay length during the PM peak hour.
	WB approach	Queues extend back to the intersection with 33 rd Street during the PM peak hour.

Intersection	Approach / Movement	Queueing Notes
	NB left turns	Queues extend beyond the turn bay length during both peak hours.

The LOS and delay results from the AM and PM peak hour capacity analyses are shown in Table 19. The estimated 95th percentile queues are shown in Table 20. The Synchro output for the capacity and 95th percentile queue analysis is included as Appendices F and G.

7 DEVELOPMENT DESCRIPTION

The proposed parking garage at 3000 Grays Ferry Avenue in Philadelphia will be constructed in one phase and open in the year 2026. Since the proposed parking garage will offset the loss of the nearby Warfield Street surface parking lot, the study team deemed it most appropriate to capture volumes at the Warfield Street lot and utilize those volumes to generate the parking garage trips.

7.1 Trip Generation

The table below summarizes the traffic volumes of employee vehicles and CHOP shuttles entering and exiting the existing Warfield Street parking lot. The volumes for the system peak hours (7:45AM – 8:45AM and 3:30PM – 4:30PM) and the peak hour of the parking lot (6:00AM – 7:00AM and 3:30PM – 4:30PM) are shown in Table 6.

Table 6. Warfield Street Parking Lot Trips

Peak Hour	Employee Vehicles In	CHOP Shuttles In	Employee Vehicles Out	CHOP Shuttles Out
Parking Lot AM Peak (6:00AM – 7:00AM)	280	10	0	12
System AM Peak (7:45AM – 8:45AM)	27	7	0	8
Parking Lot and System PM Peak (3:30PM – 4:30PM)	0	6	98	7

Given that the existing capacity of the Warfield Lot is approximately 513 vehicles and the capacity of the proposed garage on Grays Ferry Avenue is 1,012 vehicles, the Warfield Lot employee vehicle volumes were multiplied by 1.97 (1012 / 513) to generate the number of trips entering and exiting the proposed garage. It was assumed that the number of shuttles entering and exiting would scale using the same factor and that all employees using the lot would travel to and from the CHOP campuses via a shuttle. The resulting trips are shown in Table 7. Note that the City of Philadelphia Streets Department, Traffic Division directed the study team to generate new parking garage trips for the analysis using the system peak hour.

Table 7. Proposed Grays Ferry Parking Garage Trip Generation

Peak Hour	Employee Vehicles In	CHOP Shuttles In	Total In	Employee Vehicles Out	CHOP Shuttles Out	Total Out
System AM Peak (7:45AM – 8:45AM)	53	14	67	0	16	16
Parking Lot and System PM Peak (3:30PM – 4:30PM)	0	12	12	193	14	207

Given that the proposed development is a parking garage, the development will not generate trips for any other mode of transportation. The Warfield Street parking lot traffic volume counts are included as Appendix H.

7.2 Site Design and Driveways

After construction of the proposed garage is completed, there will be a total of five (5) driveways providing access to the lot bounded by Grays Ferry Avenue, Titan Street, South 30th Street, and South 31st Street. The driveways are listed below.

- 31st St & Driveway A (Unused by CHOP)
- Grays Ferry Ave & Driveway B
- 31st St & Driveway C (Unused by CHOP)
- 30th St & Driveway D
- 30th St & Oakford St (Driveway E) – Study Intersection #7

Employees would enter the garage via Driveways B and E and exit via Driveways B, and D. The shuttles would enter via Driveway E and exit via Driveway D. Driveway C would not be used to access the garage due to the one-way configurations. The conceptual design for the ground level section of the parking garage and the site driveways are shown in Figure 2. The raw driveway counts are included in Appendix A.

Figure 2. Parking Garage Conceptual Design (Ground Level) with Driveways



7.3 Trip Distribution and Trip Assignment

The existing traffic data, roadway network, and proposed development driveway locations were considered in determining where new vehicle trips would enter and exit the study area roadway network. The assumed percentages for each peak hour and associated trip distribution are shown in Table 8 and Table 9. Note that there would be no exiting trips during the AM peak nor entering trips during the PM peak, except for the shuttle trips.

Table 8. Trip Distribution (AM Peak)

Entry/Exit Links	AM Entering %	AM Entering Employee Vehicles	AM Entering Shuttles	AM Entering Total Trips	AM Exiting Shuttles
A - Grays Ferry Ave West of 34th St	31%	16		16	
B - 34th St North of Grays Ferry Ave	12%	6	14	20	16
C - 34th St South of Grays Ferry Ave	8%	4		4	
D - 33rd St South of Grays Ferry Ave	5%	3		3	
E - 30th St South of Wharton St	9%	5		5	
F - Grays Ferry Ave East of 29th St	35%	19		19	

Table 9. Trip Distribution (PM Peak)

Entry/Exit Links	PM Exiting %	PM Exiting Employee Vehicles	PM Exiting Shuttles	PM Exiting Total Trips	PM Entering Shuttles
A - Grays Ferry Ave West of 34th St	21%	40		40	
B - 34th St North of Grays Ferry Ave	21%	40	14	54	12
C - 34th St South of Grays Ferry Ave	17%	32		32	
F - Grays Ferry Ave East of 29th St	34%	65		65	
G - 31st St South of Wharton St	8%	16		16	

The trip percentages were initially calculated using the existing balanced volumes. The percentages were then checked by analyzing county to county trips from the Delaware Regional Planning Commission's (DVRPC's) 2012 Household Travel Survey Data¹. It was assumed that entry/exit links A, F and G accounted for trips within Philadelphia County, entry/exit link B accounted for trips to/from Burlington, Camden, Mercer, Bucks, and Montgomery Counties, and entry/exit links C, D, and E accounted for trips to/from Gloucester, Chester, and Delaware Counties. The origin/destination data confirmed that the initial percentages for the AM trips generally matched the DVRCP trip data. However, the initial percentages for trips within Philadelphia County were significantly higher than the percentages estimated from the DVRPC data (i.e., 78% vs. 53%). To more closely match the DVRPC data, entry/exit links A and F were reduced by 12 percentage points each and redistributed to entry/exit links B and C by 16 and 8 percentage points respectively. Note that entry/exit link G remained unchanged since it partially accounts for trips outside of Philadelphia as well.

¹ <https://www.dvrpc.org/transportation/modeling/data/>

The new trips were then assigned to the study area roadway network and associated intersections and driveways using the routes with the lowest travel time. Refer to Figure 13 and Figure 14 for diagrams illustrating the trip assignment.

7.4 Trip Reduction Due to Warfield Lot Closure

Stakeholders indicated that the Warfield Lot would close and the personnel using the lot would then utilize the proposed garage. Thus, in addition to adding the total trips to the network, these existing trips must be removed. It was assumed that the trips to be removed were distributed with the same percentages shown in Table 8 and Table 9. The trips that were removed are shown in Table 10 and Table 11.

Table 10. Trip Reduction Distribution (AM Peak)

Entry/Exit Links	AM Entering %	AM Entering Employee Vehicles	AM Entering Shuttles	AM Entering Total Trips	AM Exiting Shuttles
A - Grays Ferry Ave West of 34th St	31%	-8		-8	
B - 34th St North of Grays Ferry Ave	12%	-3	-7	-10	-8
C - 34th St South of Grays Ferry Ave	8%	-2		-2	
D - 33rd St South of Grays Ferry Ave	5%	-1		-1	
E - 30th St South of Wharton St	9%	-2		-2	
F - Grays Ferry Ave East of 29th St	35%	-9		-9	

Table 11. Trip Reduction Distribution (PM Peak)

Entry/Exit Links	PM Exiting%	PM Exiting Employee Vehicles	PM Exiting Shuttles	PM Exiting Total Trips	PM Entering Shuttles
A - Grays Ferry Ave West of 34th St	21%	-20		-20	
B - 34th St North of Grays Ferry Ave	21%	-20	-7	-27	-6
C - 34th St South of Grays Ferry Ave	17%	-16		-16	
F - Grays Ferry Ave East of 29th St	34%	-33		-33	
G - 31st St South of Wharton St	8%	-8		-8	

The trip reductions were then assigned to the study area roadway network and associated intersections and driveways using the routes with the lowest travel time. Refer to Figure 13 and Figure 14 for diagrams illustrating the trip assignment. Note that the trips removed from the model are shown in red in the diagrams.

8 TRAFFIC CONDITIONS WITH DEVELOPMENT

Optimized traffic signal timings from the future scenarios without development were used for the future scenarios with development. Only minor adjustments were made to the splits and offsets to accommodate the trips generated by the parking garage.

8.1 Opening Year Traffic Conditions

The vehicle trips were added to the Opening Year (2026) without development volumes to obtain the Opening Year (2026) with development volumes, which are shown in Figure 15 and Figure 16. During the

Opening Year (2026) with development, all study intersections operate at an overall LOS of D or better. The following intersections have some movements that operate at LOS E or worse:

- Grays Ferry Avenue (SR 3021) and South 34th Street (SR 3003)
- Wharton Street and South 34th Street (SR 3003)
- Grays Ferry Avenue and South 33rd Street

Refer to Table 21 for the resulting LOS by movement. Note that the movements with LOS E or higher remain unchanged from the scenario without development. All movements have available storage capacity to accommodate the 95th percentile queues, except for those shown in Table 12. Note that, with the exception of the WB left turn movement at Grays Ferry Avenue and South 31st Street, the movements with queues that exceed storage remain unchanged from the scenario without development.

Table 12. Summary of Queues Exceeding Storage Capacity during Opening Year

Intersection	Approach / Movement	Queueing Notes
Grays Ferry Avenue and South 31st Street	WB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)	EB approach	Queues extend back to the intersection with 35 th Street during the PM peak hour.
	WB left turns	Queues extend beyond the turn bay length during both peak hours.
	NB left turns	Queues extend beyond the turn bay length during the PM peak hour.
	SB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Wharton Street and South 34 th Street (SR 3003)	EB right turns	Queues extend beyond the turn bay length during the PM peak hour.
	WB approach	Queues extend back to the intersection with 33 rd Street during the PM peak hour.
	NB left turns	Queues extend beyond the turn bay length during both peak hours.

The estimated 95th percentile queues are shown in Table 22. The Synchro output for the capacity and 95th percentile queue analysis is included as Appendix I.

8.2 Design Horizon Year Traffic Conditions

The vehicle trips were added to the Design Horizon Year (2031) without development volumes to obtain the Design Horizon Year (2031) with development volumes, which are shown in Figure 17 and Figure 18.

During the Design Horizon Year (2031) with development, all study intersections operate at an overall LOS of D or better. The following intersections have some movements that operate at LOS E and higher:

- Grays Ferry Avenue (SR 3021) and South 34th Street (SR 3003)
- Wharton Street and South 34th Street (SR 3003)
- Grays Ferry Avenue and South 33rd Street

Refer to Table 21 for the resulting LOS by movement. Note that the movements with LOS E or higher remain unchanged from the scenario without development. All movements have available storage capacity to accommodate the 95th percentile queues, except for those shown in Table 13. Note that, with the exception of the WB left turn movement at Grays Ferry Avenue and South 31st Street, the movements with queues that exceed storage remain unchanged from the scenario without development.

Table 13. Summary of Queues Exceeding Storage Capacity during Design Horizon Year

Intersection	Approach / Movement	Queueing Notes
Grays Ferry Avenue and South 31st Street	WB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Grays Ferry Avenue (SR 3021) and South 34 th Street (SR 3003)	EB approach	Queues extend back to the intersection with 35 th Street during the PM peak hour.
	WB left turns	Queues extend beyond the turn bay length during both peak hours.
	NB left turns	Queues extend beyond the turn bay length during the PM peak hour.
	SB left turns	Queues extend beyond the turn bay length during the PM peak hour.
Wharton Street and South 34 th Street (SR 3003)	EB right turns	Queues extend beyond the turn bay length during the PM peak hour.
	WB approach	Queues extend back to the intersection with 33 rd Street during the PM peak hour.
	NB left turns	Queues extend beyond the turn bay length during both peak hours.

The Synchro output for the capacity and 95th percentile queue analysis is included as Appendix J.

9 MITIGATION ANALYSIS

The study intersections and intersections with the site driveways were analyzed to determine if mitigation measures were needed. The Philadelphia Street Department *Traffic Engineering Standards* do not include specific requirements for implementing mitigation measures, so the study team used engineering judgement in combination with the requirements outlined in Appendix A of *PennDOT Publication 282: Highway Occupancy Permit Operations Manual* to determine if mitigation should be implemented. The analysis considered LOS, delay, and queues during the Design Horizon Year (2031) with and without development.

9.1 Level of Service and Delay Comparison

Table 14 compares the overall delay and LOS for each intersection between the future scenarios without development and with development. According to Appendix A of *Publication 282*, mitigation strategies are required for an intersection if the overall LOS drops at least one letter and delay increases by more than 10 seconds. For intersections that already have an LOS F without development, mitigation is required if there is an increase of more than 10 seconds of delay.

Table 14. LOS and Delay Comparison and Mitigation Requirements

Intersection	AM Peak LOS & Delay Design Horizon Year (2031)			PM Peak LOS & Delay Design Horizon Year (2031)		
	Without Development	With Development	Mitigation Required? (Yes/No)	Without Development	With Development	Mitigation Required? (Yes/No)
1 - Grays Ferry Ave and South 29 th St	A (4.8 sec)	A (4.7 sec)	No	A (8.8 sec)	A (8.9 sec)	No
2 - Grays Ferry Ave and South 30 th St	B (19.9 sec)	B (20.0 sec)	No	B (18.8 sec)	C (20.6 sec)	No
3 - Grays Ferry Ave and South 31 st St	B (15.2 sec)	B (15.0 sec)	No	B (14.5 sec)	B (14.3 sec)	No
4 - Grays Ferry Ave and South 32 nd St	No results since there are no conflicting movements.					
5 - Grays Ferry Ave and South 33 rd St	A (3.5 sec)	A (3.9 sec)	No	A (1.7 sec)	A (1.4 sec)	No
6 - Grays Ferry Ave (SR 3021) and South 34 th St (SR 3003)	D (36.6 sec)	D (36.6 sec)	No	D (46.8 sec)	D (50.1 sec)	No
7 - Oakford St and South 30 th St	A (8.8 sec)	A (9.1 sec)	No	A (8.3 sec)	A (10 sec)	No
8 - Titan St and South 30 th St	No results since there are no conflicting movements.					
9 - Titan St and South 31 st St	A (0.2 sec)	A (0.2 sec)	No	A (0.5 sec)	A (0.4 sec)	No
10 - Wharton St and South 30 th St	A (9.3 sec)	A (9.4 sec)	No	A (9.4 sec)	A (9.4 sec)	No
11 - Wharton St and South 31 st St	A (8.4 sec)	A (8.4 sec)	No	A (9.2 sec)	A (9.3 sec)	No
12 - Wharton St and South 34 th St (SR 3003)	C (29.6 sec)	C (29.4 sec)	No	D (41.6 sec)	D (39.9 sec)	No
31st St & Driveway A	A (0.8 sec)	A (0.8 sec)	No	A (1.0 sec)	A (1.8 sec)	No
Grays Ferry Ave & Driveway B	A (0.1 sec)	A (0.1 sec)	No	A (0.4 sec)	A (0.3 sec)	No
31st St & Driveway C	A (0.1 sec)	A (0.1 sec)	No	A (0.2 sec)	A (0.2 sec)	No
30th St & Driveway D	A (0.2 sec)	A (0.7 sec)	No	A (0.3 sec)	A (5.5 sec)	No

The results shown in Table 14 indicate that mitigation is not required for any of the intersections based on changes in delay. Note that some intersections perform better under the scenario with development due to the redistribution of trips associated with the closure of the Warfield Lot.

9.2 Queueing Comparison

Publication 282 does not provide mitigation requirements for queues that exceed available storage. Thus, the study team only provided discussion and/or recommendations for queue lengths that exceeded available storage and significantly increased with development (i.e., at least a 10% increase in queue length). Table 15 compares the queue lengths between the scenarios without development and with development. Note that queues are only shown for movements where available storage is exceeded for a peak hour.

Table 15. Queue Length Comparison

Intersection	Approach / Movement	AM Peak Queue Length Design Horizon Year (2031)			PM Peak Queue Length Design Horizon Year (2031)		
		Without Development	With Development	Percent Increase/Decrease	Without Development	With Development	Percent Increase/Decrease
Grays Ferry Avenue and South 31st Street	WB left turns	55*	60*	9%	81*	95	17%
Grays Ferry Ave (SR 3021) and South 34 th St (SR 3003)	EB approach	233*	241*	3%	349	348	0%
	WB left turns	227	211	-7%	231	285	23%
	NB left turns	183*	181	-1%	419	418	0%
	SB left turns	198*	237*	20%	281	300	7%
Wharton St and South 34 th St (SR 3003)	EB right turns	61*	60*	-2%	114	80	-32%
	WB approach	201	197	-2%	224	220	-2%
	NB left turns	235	233	-1%	289	281	-3%

* Does not exceed available storage.

Queue lengths increased 10% or more while also exceeding available storage for the following movements and time periods discussed below.

- Grays Ferry Avenue and South 31st Street WB left turns during the PM peak.
 - Implementing protected/permitted phasing or extending the left turn lane is not recommended since the overall LOS is acceptable and mitigation is not required according to Table 14. Additionally, the storage is exceeded by less than the average car length (25 feet) and the 5' buffer between the left turn lane and through lane would likely allow a vehicle to enter the turn lane without blocking through traffic.
- Grays Ferry Ave (SR 3021) and South 34th St (SR 3003) WB left turns during the PM peak.
 - Extending the left turn lane would not be feasible since doing so would block left turning vehicles from South 33rd Street. Refer to the scenario discussed later in this report that

involves reversing the one-way roadway pairs on South 33rd Street and South 32nd Street to divert some WB left turning traffic at this intersection.

- Grays Ferry Ave (SR 3021) and South 34th St (SR 3003) SB left turns during the AM peak.
 - The study team recommends extending the left turn lane to 300 feet to accommodate the AM and PM peak queues. The approximate roadway width is 55 feet which would be sufficient for 5 total travel lanes that are 11 feet in width. Only pavement markings modifications would be needed.

10 SIGNAL WARRANT ANALYSES

Signal warrants analyses were not conducted for this study since all uncontrolled intersections operated at an overall LOS A under future conditions with development.

11 TURN LANE WARRANT ANALYSES

Turn lane warrant analyses were conducted for the Driveway B on Grays Ferry Avenue used to enter the proposed parking garage, and the results are shown in Table 16. Other intersections were not analyzed for the following reasons:

- The northbound and westbound approaches of Grays Ferry Avenue & Driveway B were not analyzed since the driveway would have a right-in/right-out configuration.
- The intersection of 30th St & Oakford St (Driveway E) was not analyzed since there is no opposing traffic for the northbound left turn movement.
- The intersections at Driveways A and C were not analyzed. South 31st Street is one-way southbound, so there is no traffic opposing southbound left turns.
- The intersection at Driveway D was not analyzed since it is outbound only and northbound vehicles on South 30th Street cannot turn left into the driveway.

Table 16. Proposed Driveway Turn Lane Warrant Analyses Results

Intersection and Approach	Scenario	AM Peak Hour		PM Peak Hour	
		Right Turn Lane Warranted?	Left Turn Lane Warranted?	Right Turn Lane Warranted?	Left Turn Lane Warranted?
Grays Ferry Avenue & Driveway B Eastbound Approach	Opening Year (2024)	No	N/A	No	N/A
	Design Horizon Year (2032)	No	N/A	No	N/A

The analyses worksheets are included as Appendix K.

12 POTENTIAL RECOMMENDED TRANSPORTATION IMPROVEMENTS

Section 9 discusses the mitigation recommended to accommodate the additional traffic generated by the Grays Ferry Parking Facility. Although other improvements may not be necessary to mitigate new traffic, the Streets Department is requiring CHOP to improve the infrastructure of the surrounding network. These improvements were noted during scoping for the TIS, the Streets Department, Traffic Division indicated the following improvements would be required at Grays Ferry Avenue and South 30th Street:

- Install pedestrian signals and a crosswalk for the west side of the intersection.
- Install touchless Accessible Pedestrian Signals (APS) for all crossings.

13 ONE-WAY PAIR REVERSAL

The Philadelphia Streets Department instructed the study team to conduct an analysis of a future scenario where the one-way roadway pairs at South 32nd Street and South 33rd Street between Grays Ferry Avenue and Wharton Street are reversed. The intent of the reversal would be to reduce delay and queueing for the westbound left turn movement at the intersection of Grays Ferry Avenue and South 34th Street. The Synchro model links were revised to reflect the one-way pair reversal, and volumes were redistributed accordingly.

Left turn volumes were subtracted from the westbound left turn movement at the intersection of Grays Ferry Avenue and South 34th Street and transferred to the left turn movement at the intersection with 33rd Street. Vehicles would then turn right onto Wharton Street and turn left onto South 34th Street. For the AM peak, the westbound left turn volume was reduced by 22 vehicles or 15%. This percentage reduction was enough to change the movement LOS from E to D. For the PM peak, the left turn volume was reduced by 50 vehicles or 31%. This percentage reduction was enough to change the movement LOS from F to E, with a delay reduction of 68.1 seconds. Note that for both peak periods, the reduction in volume would allow for the entire queue to be accommodated by the left turn lane according to the model. The LOS and delay results between the Design Horizon Year (2031) with development and with the development and one-way pair reversal are compared in Table 17. Similarly, the queues for the movements at the intersections are compared in Table 18. Note that movements without queues for the one-way pair reversal scenario were excluded.

Table 17. LOS and Delay Comparison with One-Way Pair Reversal

Intersection	AM Peak LOS & Delay Design Horizon Year (2031)			PM Peak LOS & Delay Design Horizon Year (2031)		
	With Development	With Development and Reversal	Delay Increase/Reduction	With Development	With Development and Reversal	Delay Increase/Reduction
4 - Grays Ferry Ave and South 32 nd St	N/A	A (2.9 sec)	N/A	N/A	A (1.1 sec)	N/A
5 - Grays Ferry Ave and South 33 rd St*	A (3.9 sec)	A (0.3 sec)	-3.6 sec	A (1.7 sec)	A (0.4 sec)	-1.3 sec
6 - Grays Ferry Ave (SR 3021) and South 34 th St (SR 3003)	D (36.6 sec)	D (37.1 sec)	0.5 sec**	D (50.1 sec)	D (46.3 sec)	-3.8 sec
12 - Wharton St and South 34 th St (SR 3003)	C (29.4 sec)	C (29.6 sec)	0.2 sec	D (39.9 sec)	D (39.4 sec)	-0.5 sec

* Note that the northbound approach was left in the Synchro model so that HCM 6th Edition results could be reported.

** Overall delay increases since HCM accounts for the effects the upstream arrivals heading NB from the intersection at Wharton St and South 34th St where volume and timing changes were made.

Table 18. Queue Comparison with One-Way Pair Reversal

Intersection	Approach / Movement	Storage Length (ft)	AM Peak Queue Length Design Horizon Year (2031)			PM Peak Queue Length Design Horizon Year (2031)		
			With Development	With Development and Reversal	Percent Increase/Decrease	With Development	With Development and Reversal	Percent Increase/Decrease
4 - Grays Ferry Ave and South 32 nd St	WB Left	180	N/A	2	N/A	N/A	10	N/A
5 - Grays Ferry Ave and South 33 rd St*	NB Left/Right	460*	N/A	75	N/A	N/A	38	N/A
6 - Grays Ferry Ave (SR 3021) and South 34 th St (SR 3003)	EB Left	205	56	56	0%	66	66	0%
	EB Thru/Right	340*	241	245	2%	348	348	0%
	WB U-turn/Left	200	211	171	-19%	285	199	-30%
	WB Thru/Right	850*	249	249	0%	351	351	0%
	NB Left	250	181	180	0%	418	418	0%
	NB Thru	420*	242	194	-20%	163	161	-1%
	SB Left	270	237	243	3%	300	300	0%
	SB Thru/Right	1000*	179	185	1%	471	474	1%
12 - Wharton St and South 34 th St (SR 3003)	EB Left/Thru	370*	117	116	-1%	72	70	-3%
	EB Right	75	60	59	-2%	80	80	0%
	WB Left/Thru/Right	180*	197	216	10%	220	266	21%
	NB U-turn/Left	200	233	233	0%	281	285	0%
	NB Thru	940*	279	281	1%	294	297	0%
	NB Right	100	0	0	0%	7	7	0%
	SB U-turn/Left	100	58	67	16%	6	5	-17%

Intersection	Approach / Movement	Storage Length (ft)	AM Peak Queue Length Design Horizon Year (2031)			PM Peak Queue Length Design Horizon Year (2031)		
			With Development	With Development and Reversal	Percent Increase/Decrease	With Development	With Development and Reversal	Percent Increase/Decrease
	SB Thru/Right	430*	211	211	0%	141	117	-17%

*Available storage is the distance to upstream intersection.

The results indicate no significant changes in LOS and delay. While westbound left turn queues would be reduced at the intersection of Grays Ferry Avenue and South 34th Street, westbound approach queues would increase at the intersection of Wharton Street and South 34th Street, extending past the intersection with South 33rd Street.

To mitigate the westbound queues, left turn lane and signal phasing warrants were evaluated. A left turn lane and protected/permitted phasing are warranted for the westbound approach during the AM and PM peaks under the scenario with the one-way pair reversal. The Synchro analysis results show that the left turn lane would need to be 150 feet to accommodate the PM queues. While adding a left turn lane and protected/permitted left turn phasing would reduce queues and improve operations for the westbound approach, it is likely infeasible to acquire additional right of way given the presence of the adjacent houses, overhead utilities and poles, and business driveway along Wharton Street.

The left turn analyses worksheets are included as Appendix K. The Synchro output for the capacity and 95th percentile queue analysis is included as Appendix L.

14 CONCLUSIONS

This Transportation Impact Study examined the traffic-related impacts of the proposed parking garage at 3000 Grays Ferry Avenue in Philadelphia, PA. As a result of the analysis the following improvements are proposed:

- Grays Ferry Ave (SR 3021) and South 34th St (SR 3003)
 - Extend the southbound left turn lane from 270 feet to 300 feet to accommodate the AM and PM peak queues.

In addition to the improvements proposed as a result of the analysis, the City of Philadelphia Streets Department, Traffic Division indicated the following improvements would be required at Grays Ferry Avenue and South 30th Street:

- Install pedestrian signals and a crosswalk for the west side of the intersection.
- Install accessible pedestrian signals for all crossings.