ARD ENGINEERING
21370 SW Langer Farms Pkwy
Suite 142, Sherwood, OR 97140

Technical Memorandum

To: AJ Michaud, RA Gray Construction

From: Michael Ard, PE

Date: February 17, 2023

Re: SW 126th Place Industrial Building – Trip Generation and Distribution Description

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This memorandum is written to provide information and analysis related to a proposed industrial building at 18350 SW 126th Place in Tualatin, Oregon. The subject property is on the east side of SW 126th Avenue between Oregon Highway 99W and SW Leveton Drive. It has an area of approximately 1.82 acres and is proposed for development with a 18,000 square foot industrial building.

In order to assess the potential transportation impacts of the proposed development, this memorandum provides an estimate of the number of trip ends projected for each mode of travel, a description of the distribution of the projected trips, and an assessment of the surrounding transportation facilities which provide access for motor vehicles, pedestrians, and cyclists.

TRIP GENERATION

Although the proposed facility will have space for multiple tenants and will act as an Industrial Park facility, in accordance with City of Tualatin requirements a trip generation analysis was also conducted using the higher trip rates associated with general light industrial development. This analysis approach reflects the fact that industrial buildings can typically be utilized for light industrial businesses without seeking additional land use approvals. Accordingly, assuming a general light industrial tenant ensures that potential future traffic volumes associated with the site are not underestimated.

Specific tenants for the proposed building have not yet been identified. In accordance with City of Tualatin requirements, the trip estimates were prepared based on data from the current *Trip Generation Manual, 11th Edition*, published by the Institute of Transportation Engineers. The trip estimates were prepared for land use codes 110, *General Light Industrial*, and 130, *Industrial Park*. Both estimates are based on the gross floor area of the proposed facility.

Industrial Park Analysis

The daily and peak-hour motor vehicle trip volumes projected based on usage of the proposed facility as an industrial park are detailed in Table 1on the following page. A detailed trip generation worksheet is also included in the attached technical appendix.

Table 1 - Projected Vehicle Trip Ends - Industrial Park

	AM Peak Hour			PM Peak Hour			Daily
	In	Out	Total	In	Out	Total	Total
18,000 sf Industrial Park	5	1	6	1	5	6	60

Based on ITE data, an 18,000 square foot Industrial Park is projected to generate 10 daily truck trips, representing 20 percent of the daily motor vehicle trips. The truck trips would typically be projected to occur between 7:00 AM and 6:00 PM, with zero to two truck trips during any particular hour of the day. The precise type of trucks that will access the site is currently unknown since the tenants are not known; however, since the area largely serves existing industrial uses and accommodates trucks of all sizes, the site can reasonably accommodate a typical mix of truck types including both single-unit and tractor-trailer truck types.

General Light Industrial Analysis

The daily and peak-hour motor vehicle trip volumes projected based on usage of the proposed facility as a general light industrial facility are detailed in Table 2 below. A detailed trip generation worksheet is also included in the attached technical appendix.

Table 1 - Projected Vehicle Trip Ends - General Light Industrial

	AM Peak Hour			PM Peak Hour			Daily
	In	Out	Total	In	Out	Total	Total
18,000 sf Light Industrial	11	2	13	2	10	12	88

Based on ITE data, an 18,000 square foot Light Industrial building is projected to generate 5 daily truck trips, representing 6 percent of the daily motor vehicle trips. Again, the truck trips would typically be projected to occur between 7:00 AM and 6:00 PM, with zero to two truck trips during any particular hour of the day. The precise type of trucks that will access the site is currently unknown since the tenants are not known; however, since the area largely serves existing industrial uses and accommodates trucks of all sizes, the site can reasonably accommodate a typical mix of truck types including both single-unit and tractor-trailer truck types.

Based on the analysis, development of the site with a General Light Industrial use will result in the highest overall trip volumes; however, development with an Industrial Park will result in the highest truck volumes.

Pedestrian, Bicycle and Transit Trips

In addition to considering motor vehicle trips, the City of Tualatin requests information regarding pedestrian, bicycle, and transit trip ends. For industrial-related uses, the number of pedestrian, bicycle and transit trips is generally low. It is anticipated that the proposed building may generate approximately two to four daily trip ends using these three alternative travel modes. The transportation demands associated with these travel modes are minimal and would not be projected to meaningfully impact the available capacity for these facilities.

TRIP DISTRIBUTION

Under either development scenario, the distribution of motor vehicle trips is projected to be similar. Based on existing travel patterns in the site vicinity, the locations of major destinations and transportation facilities, and prior studies prepared for industrial development within the immediate site vicinity, it is projected that 20 percent of site trips will travel to and from the southwest on Oregon Highway 99W, 30 percent of site trips will travel to and from the northeast on Oregon Highway 99W, 35 percent of site trips will travel to and from the south on SW 124th Avenue, and 15 percent of site trips will travel to and from the east on SW Tualatin Road and SW Leveton Drive.

Typically, walking trips are relatively limited in range, since travel times for longer distances make walking impractical. Accordingly, most walking trips would be projected to travel to and from the nearest residential areas where employees may reside. These are located on the north side of SW Tualatin Road east of SW 124th Avenue and along the north side of Highway 99W.

In conjunction with the proposed development, new sidewalks will be constructed along the site frontage on SW 126th Place. Existing sidewalks are in place along the east side of SW 126th Place extending from the south side of the subject property to SW Leveton Drive, so completion of the new sidewalk along the site frontage will result in a continuous connection to the south. Sidewalks are not provided along SW 126th Place north of the subject property; however, the roadway north of the subject property has speed humps in place and functions more as a parking lot access aisle for G.H. McCulloch than a public roadway. Traffic volumes and speeds are very low along this connection. It is anticipated that if and when the G.H. McCulloch site redevelops, continuous sidewalks will be connected along SW 126th Avenue between Highway 99W and SW Leveton Drive.

SW 124th Avenue and SW Tualatin Road would both be expected to serve pedestrian trips in the site vicinity and have existing sidewalks in place on both sides of the roadway. Oregon Highway 99W also has sidewalks in place on both sides of the roadway east of SW 124th Avenue; however, sidewalks are generally not provided west of SW 124th Avenue.

Bicycle trips have a larger travel range than walking trips. Cycling trips are generally expected to utilize low-volume roadways in combination with roadways where dedicated bicycle lanes are provided and maintained. SW 126th Place and SW Leveton Road west of SW 124th Avenue carry low volumes of traffic at relatively low speeds, and cyclists can safely share the road on these facilities. Other roadways in the site vicinity with dedicated bicycle lanes provided include SW 124th Avenue, SW Leveton Road east of SW 124th Avenue, SW Tualatin Road, SW Herman Road, SW Tualatin-Sherwood Road, and Oregon Highway 99W. These facilities provide good connectivity to the greater bicycle transportation network, with connections to Tigard, Tualatin, Sherwood, and beyond.

Transit trips are projected to travel primarily to and from the nearest stops along Highway 99W north of the subject property. Tri-Met Route 94, *Pacific Highway/Sherwood* provides service between Sherwood and the downtown Portland transit mall from 4:40 AM to 11:50 PM on weekdays, with headways between buses of as little as 10 minutes during peak commute hours. The nearest stops are located near the intersection of Highway 99W at SW 124th Avenue, approximately one quarter mile northeast of the subject property.

SITE ACCESS AND CIRCULATION

The proposed site plan utilizes an access at the north end of the subject property for all motor vehicle trips. Drive aisles providing access to passenger vehicle parking areas are provided along the west and south sides of the proposed building. Truck access will be primarily via a drive aisle on the east side of the building, which provides access to the loading bays at the rear of the building.

The primary drive aisle at the north end of the site lies within an existing 30-foot easement for public utilities, emergency vehicle access and private access to the property located northeast of the project site. The lot on the west side of SW 124th Avenue north of Columbia River Knife and Tool is expected to use the north drive aisle as the primary motor vehicle access for any future development on the lot, since access to SW 124th Avenue is constrained by the proximity to the intersections of SW 124th Avenue at Oregon Highway 99W and SW 124th Avenue at SW Tualatin Road.

Turning movement diagrams showing the travel paths of trucks circulating through the project site were prepared using AutoTurn simulation software. The resulting swept path diagrams are provided in the attached technical appendix.

Based on the analysis, passenger vehicles and large single-unit trucks (AASHTO Type SU-40) can safely and efficiently enter, circulate through the site, and exit the site in the forward direction. The loading bays at the rear of the building are also easily accessible for single-unit trucks, and it is also feasible for them to circulate around the building using the parking lot aisles for access.

Combination tractor/trailer trucks with 33-foot trailers (AASHTO Type WB-40) can also maneuver efficiently through the site and access the loading bays and can circulate around the building using the parking lot drive aisles.

Large combination trucks with 48-foot trailers (AASHTO Type WB-62) and 55-foot trailers (AASHTO Type WB-67) can also access the site, although maneuvering is very constrained due to the limited distance of 73 feet between the rear of the building and the curb at the east side of the maneuvering space since the overall length of these vehicles. These larger trucks also cannot circulate around the building without intruding into space allocated for parking of passenger vehicles (see Figure 5 showing slight intrusion by WB-62 vehicle over sidewalk at the southwest corner of the site and Figure 7 showing somewhat more intrusion over the sidewalk for the WB-67 vehicle). They will therefore generally need to utilize the primary north drive aisle and the truck loading and maneuvering space at the east side of the building for access, circulation, and egress. Loading for these vehicles will likely need to occur by parking parallel to the building within the east side rather than direct access to loading bays. Diagrams showing the entry and exit of the largest of these vehicles (WB-67) as well as how they can turn around within the site are provided in the attached technical appendix. It may be appropriate to consider modifying the site plan slightly to widen the driveway entrance from SW 126th Place in order to accommodate these vehicles without trailering over the sidewalk on the south side of the entrance.

Based on the analysis, the proposed site plan comfortably accommodates the entry, circulation, and egress of passenger vehicles, single-unit trucks, and smaller tractor-trailer vehicles. The site can also accommodate large tractor-trailer vehicles, albeit with some limitations on how these vehicles access the site and how they are loaded and unloaded.

CONCLUSIONS

Based on the analysis, the proposed development is projected to generate traffic volumes well below the threshold at which a full transportation impact analysis is required by the City of Tualatin. The added impacts on area transportation facilities will be nominal, and the proposed site plan in conjunction with the existing transportation infrastructure in the site vicinity is capable of safely supporting the proposed development.

If you have any questions regarding this analysis, please feel free to contact me via email at mike.ard@gmail.com or via phone at 503-862-6960.

Appendix

Trip Generation Calculation Worksheet

Land Use Description: Industrial Park
ITE Land Use Code: 130
Independent Variable: Gross Floor Area
Quantity: 18.0 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.34 trips per ksf
Directional Distribution: 81% Entering 19% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.34 trips per ksf
Directional Distribution: 22% Entering 78% Exiting

Total Weekday Traffic
Trip Rate: 3.37 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

18.0 ksf Industrial Park

	Entering	Exiting	Total
AM Peak Hour	5	1	6
PM Peak Hour	1	5	6
Weekday	30	30	60

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

Industrial Park
(130)

Truck Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

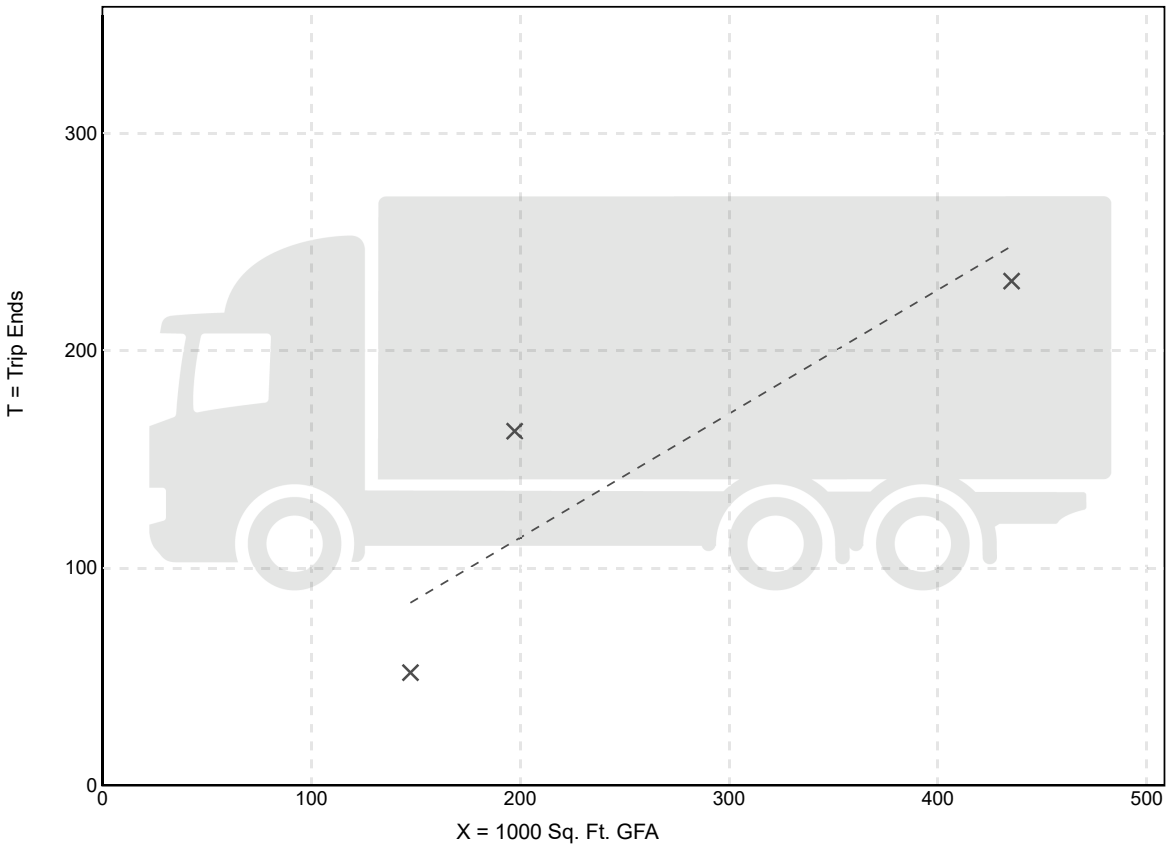
Setting/Location: General Urban/Suburban
Number of Studies: 3
Avg. 1000 Sq. Ft. GFA: 260
Directional Distribution: 50% entering, 50% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.57	0.35 - 0.83	0.20

Data Plot and Equation

Caution – Small Sample Size



Fitted Curve Equation: Not Given

R^2= **

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Industrial Park
(130)

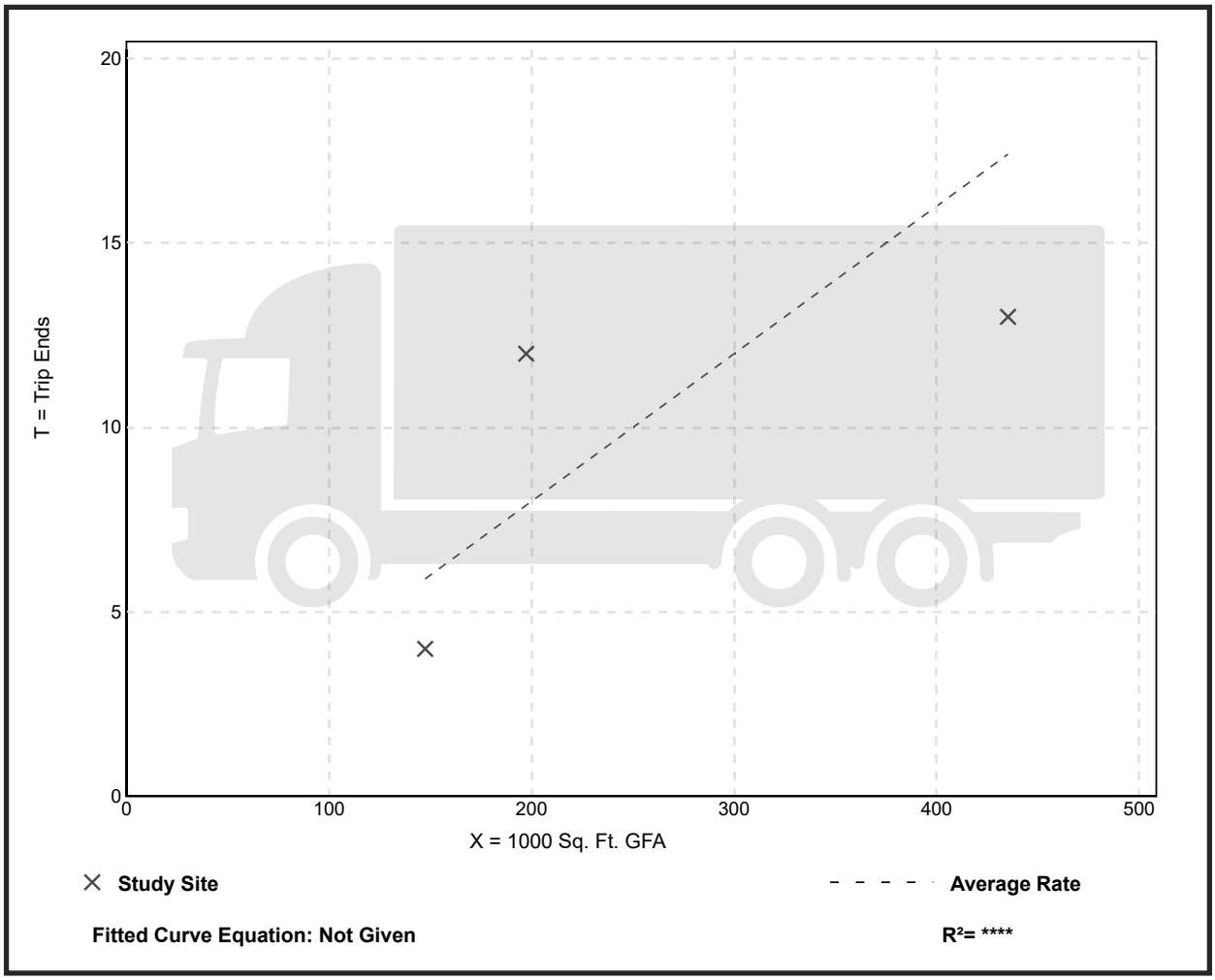
Truck Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 3
Avg. 1000 Sq. Ft. GFA: 260
Directional Distribution: 45% entering, 55% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.04	0.03 - 0.06	0.02

Data Plot and Equation

Caution – Small Sample Size



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Industrial Park
(130)

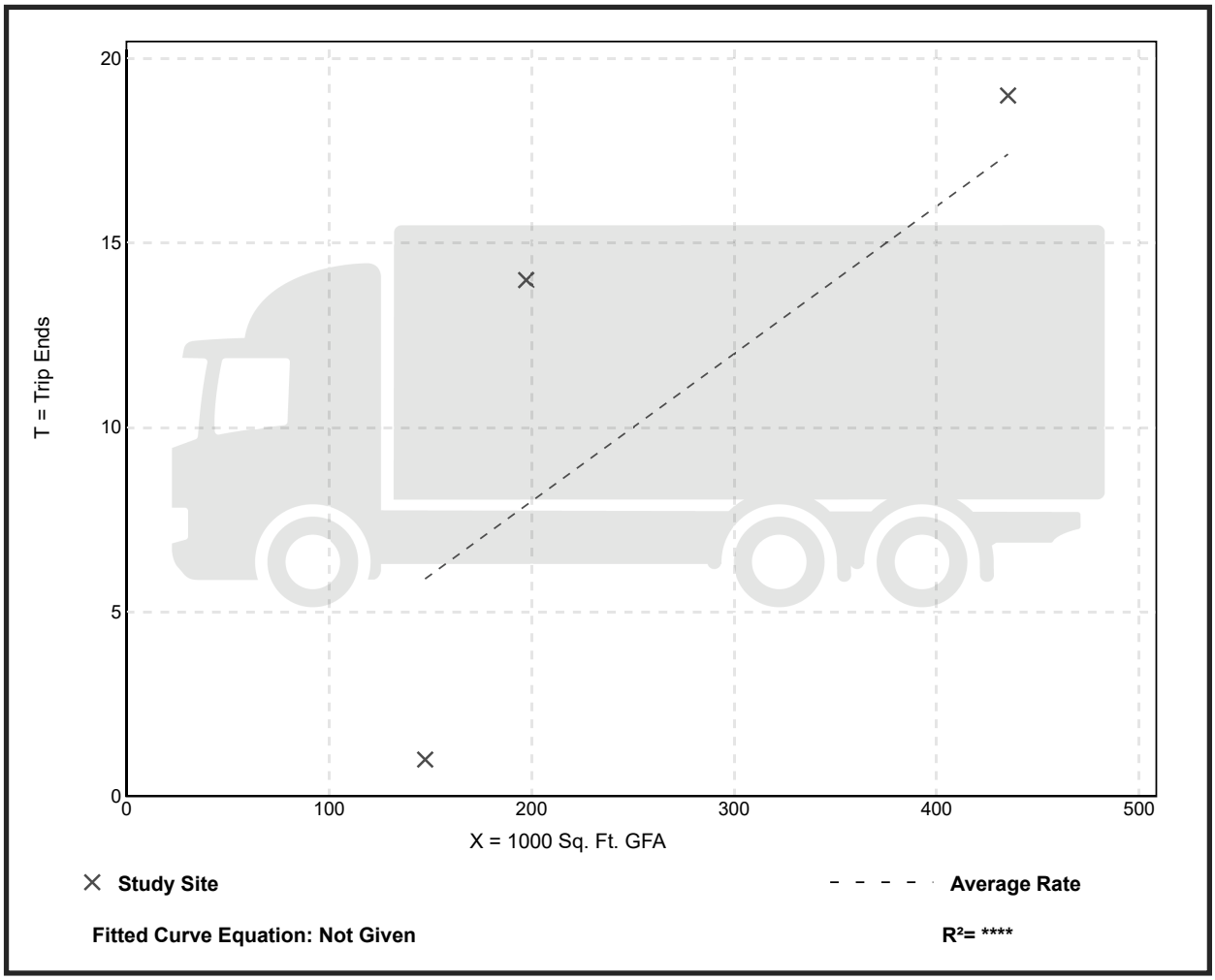
Truck Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 3
Avg. 1000 Sq. Ft. GFA: 260
Directional Distribution: 38% entering, 62% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.04	0.01 - 0.07	0.03

Data Plot and Equation

Caution – Small Sample Size



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Trip Generation Calculation Worksheet

Land Use Description: General Light Industrial
ITE Land Use Code: 110
Independent Variable: Gross Floor Area
Quantity: 18.000 Thousand Square Feet

Summary of ITE Trip Generation Data

AM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.74 trips per ksf
Directional Distribution: 88% Entering 12% Exiting

PM Peak Hour of Adjacent Street Traffic
Trip Rate: 0.65 trips per ksf
Directional Distribution: 14% Entering 86% Exiting

Total Weekday Traffic
Trip Rate: 4.87 trips per ksf
Directional Distribution: 50% Entering 50% Exiting

Site Trip Generation Calculations

18.0 ksf General Light Industrial

	Entering	Exiting	Total
AM Peak Hour	11	2	13
PM Peak Hour	2	10	12
Weekday	44	44	88

Data Source: *Trip Generation Manual, 11th Edition* , Institute of Transportation Engineers, 2021

General Light Industrial
(110)

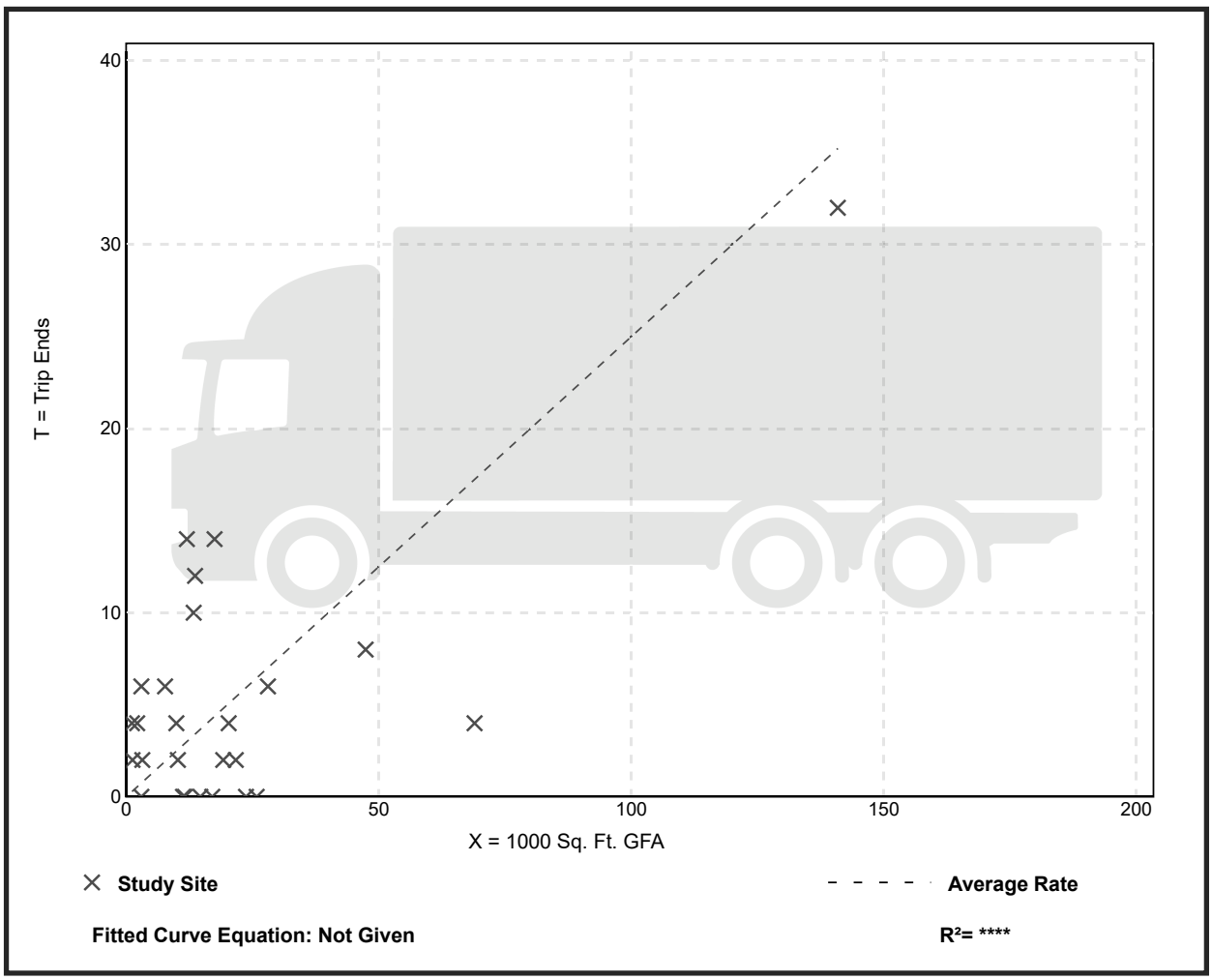
Truck Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

Setting/Location: General Urban/Suburban
Number of Studies: 26
Avg. 1000 Sq. Ft. GFA: 21
Directional Distribution: 50% entering, 50% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.25	0.00 - 3.51	0.36

Data Plot and Equation



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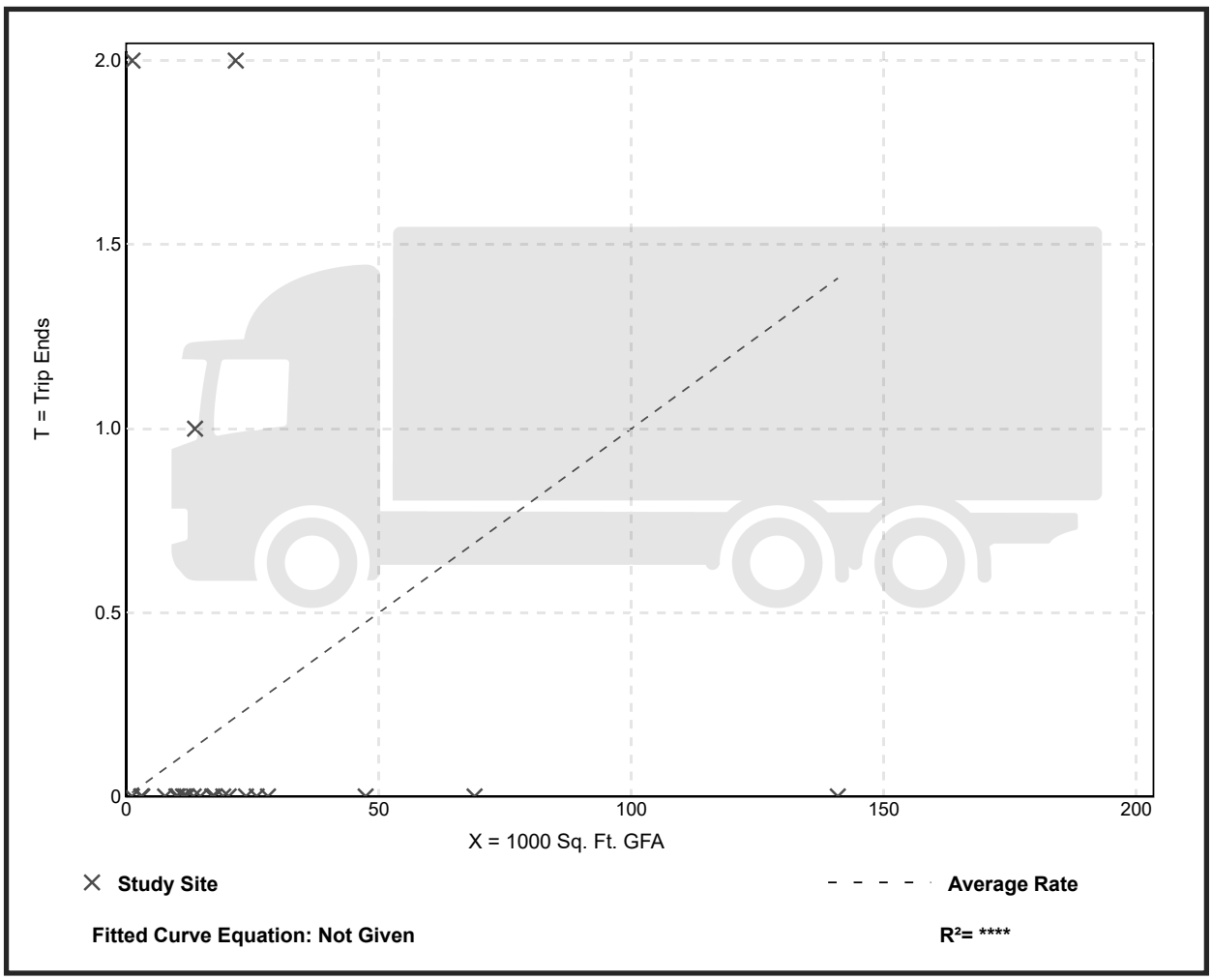
General Light Industrial
(110)

Truck Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 7 and 9 a.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 25
Avg. 1000 Sq. Ft. GFA: 22
Directional Distribution: 60% entering, 40% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.01	0.00 - 1.59	0.08

Data Plot and Equation



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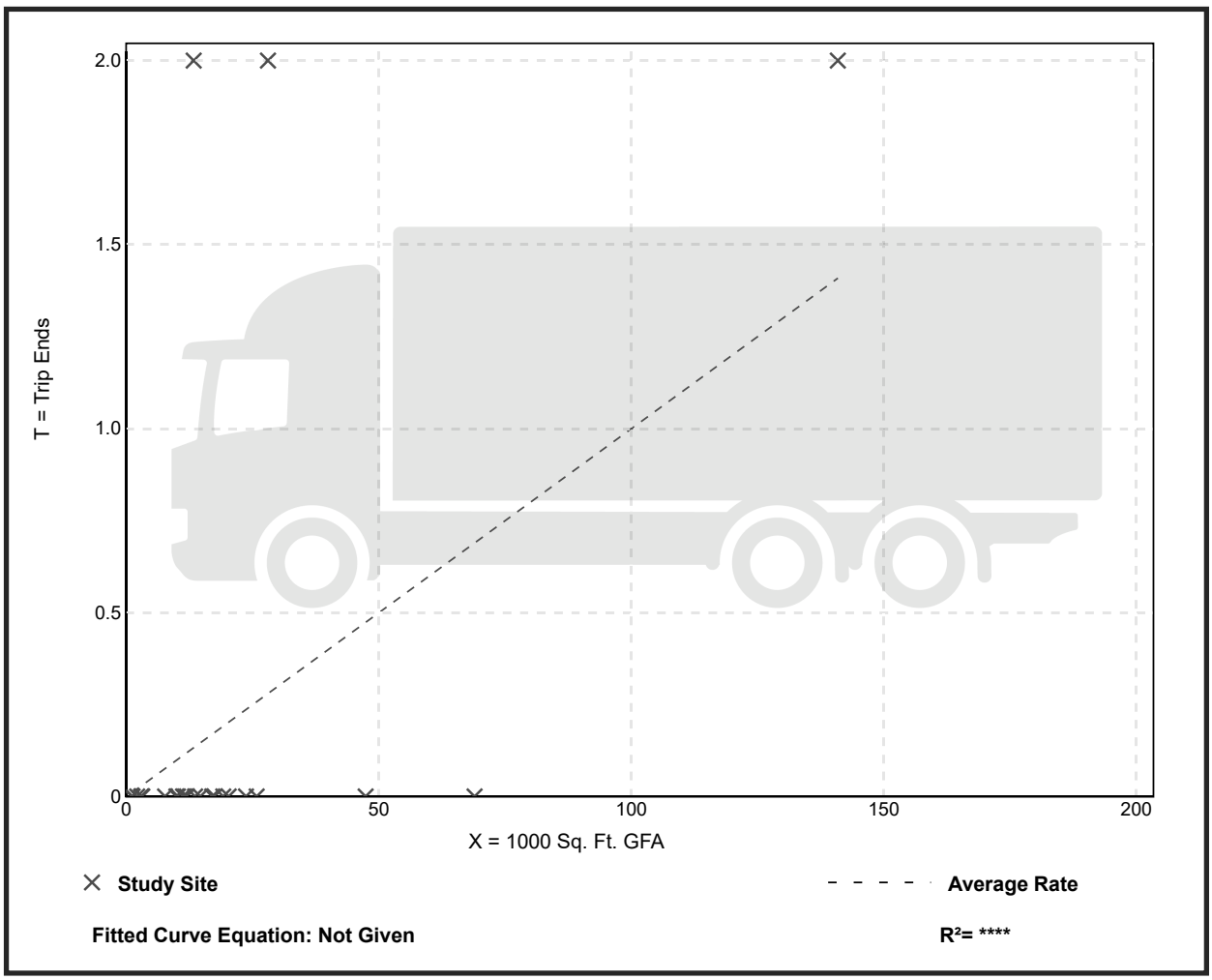
General Light Industrial
(110)

Truck Trip Ends vs: **1000 Sq. Ft. GFA**
On a: **Weekday,**
Peak Hour of Adjacent Street Traffic,
One Hour Between 4 and 6 p.m.
Setting/Location: **General Urban/Suburban**
Number of Studies: 25
Avg. 1000 Sq. Ft. GFA: 21
Directional Distribution: 50% entering, 50% exiting

Truck Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.01	0.00 - 0.15	0.03

Data Plot and Equation



Trip Gen Manual, 11th Edition ● Institute of Transportation Engineers

Hourly Distribution of Entering and Exiting Truck Trips by Land Use			
Source: ITE *Trip Generation Manual* , 11th Edition			
Land Use Code	110		
Land Use	General Light Industrial		
Setting	General Urban/Suburban		
Time Period	Weekday		
# Data Sites	27		
	% of 24-Hour Truck Trips		
Time	Total	Entering	Exiting
12:00 - 1:00 AM	0.0%	0.0%	0.0%
1:00 - 2:00 AM	0.0%	0.0%	0.0%
2:00 - 3:00 AM	0.4%	0.0%	0.8%
3:00 - 4:00 AM	0.0%	0.0%	0.0%
4:00 - 5:00 AM	0.0%	0.0%	0.0%
5:00 - 6:00 AM	0.0%	0.0%	0.0%
6:00 - 7:00 AM	0.0%	0.0%	0.0%
7:00 - 8:00 AM	7.6%	9.8%	5.3%
8:00 - 9:00 AM	9.5%	9.1%	9.8%
9:00 - 10:00 AM	15.5%	15.2%	15.9%
10:00 - 11:00 AM	14.8%	12.1%	17.4%
11:00 - 12:00 PM	6.1%	7.6%	4.5%
12:00 - 1:00 PM	8.7%	9.1%	8.3%
1:00 - 2:00 PM	12.9%	12.9%	12.9%
2:00 - 3:00 PM	10.6%	10.6%	10.6%
3:00 - 4:00 PM	9.1%	9.8%	8.3%
4:00 - 5:00 PM	3.4%	3.0%	3.8%
5:00 - 6:00 PM	1.5%	0.8%	2.3%
6:00 - 7:00 PM	0.0%	0.0%	0.0%
7:00 - 8:00 PM	0.0%	0.0%	0.0%
8:00 - 9:00 PM	0.0%	0.0%	0.0%
9:00 - 10:00 PM	0.0%	0.0%	0.0%
10:00 - 11:00 PM	0.0%	0.0%	0.0%
11:00 - 12:00 AM	0.0%	0.0%	0.0%

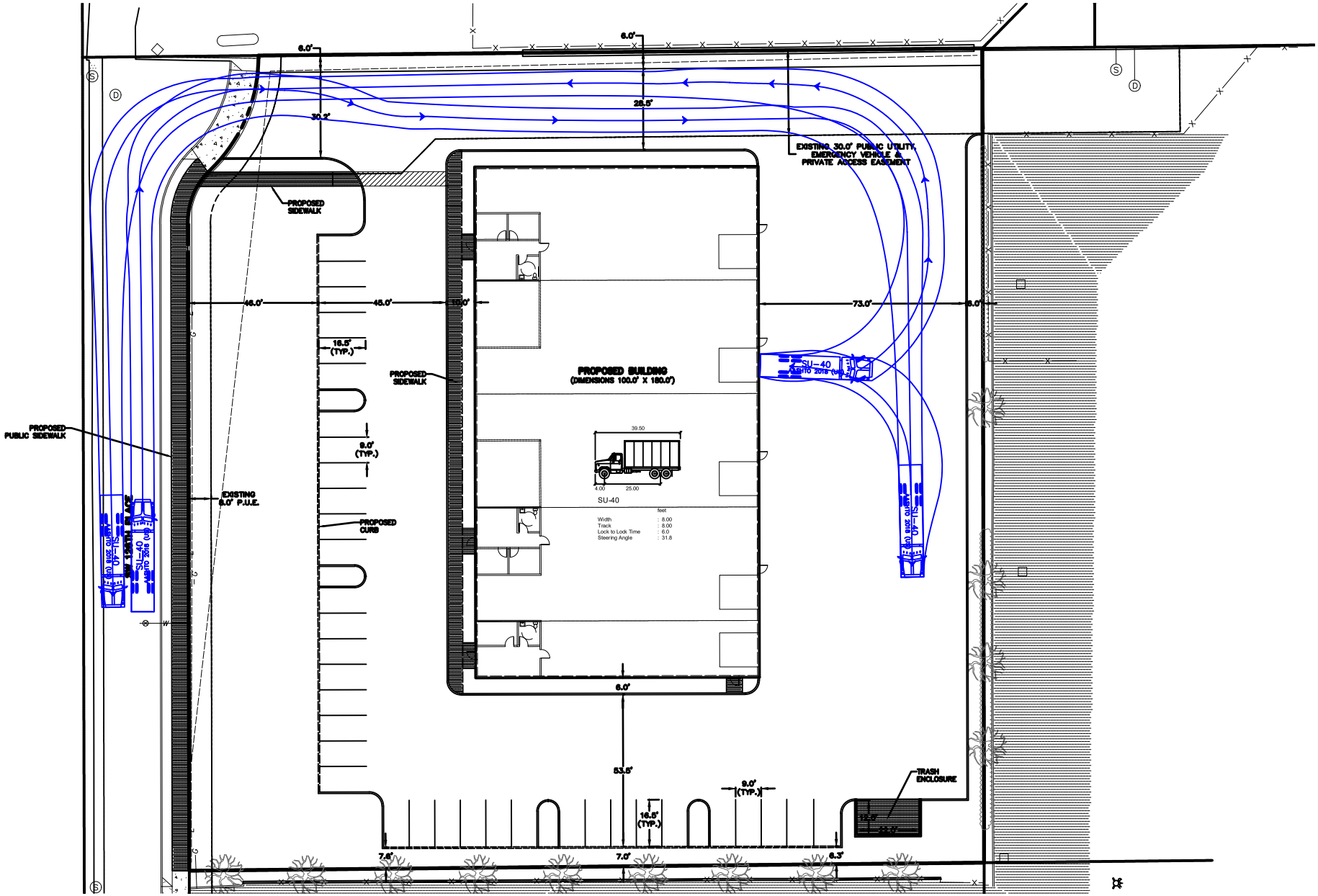


Figure 1: SU-40 Entry, Loading and Exit

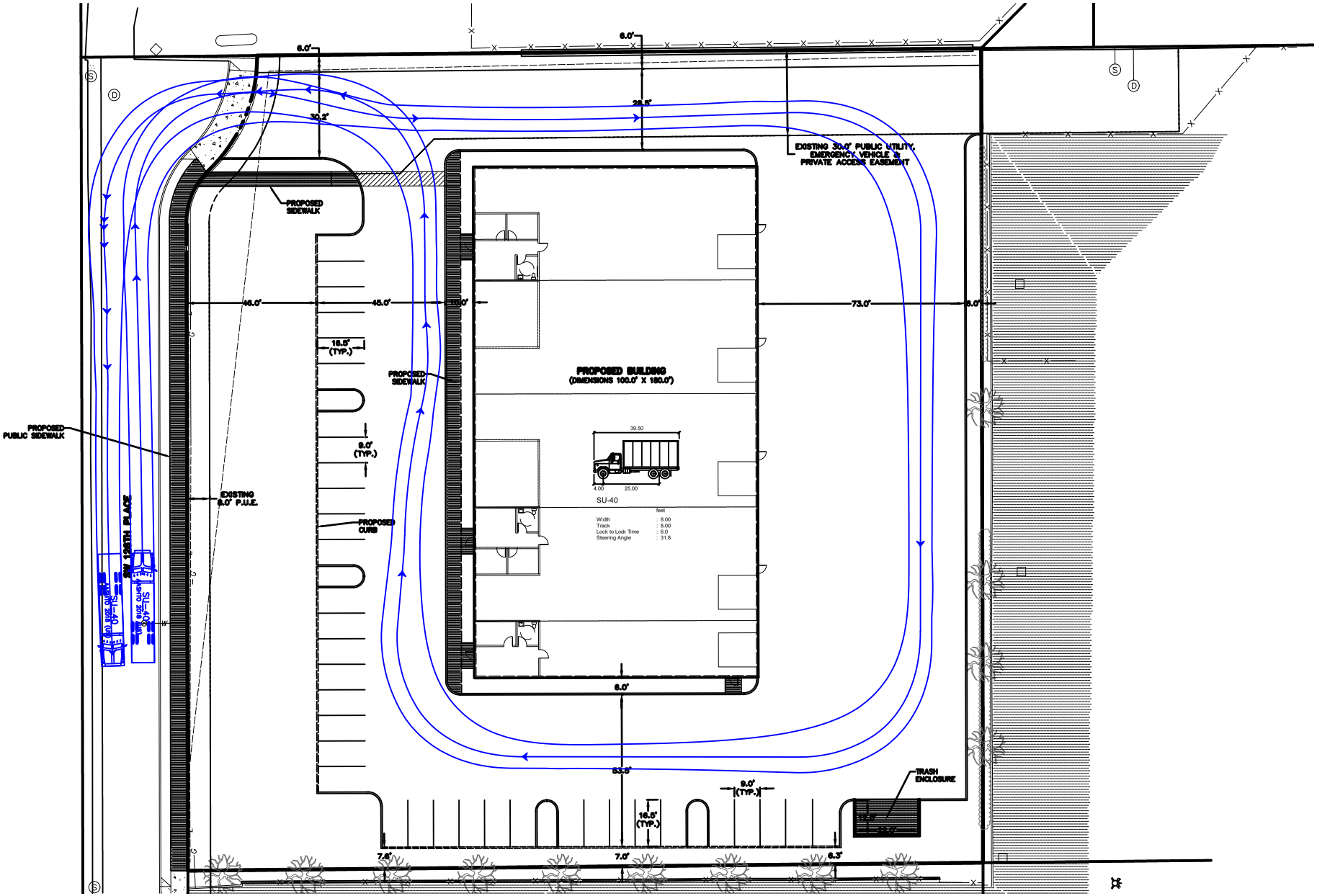


Figure 2: SU-40 Circulation Through Parking Lot

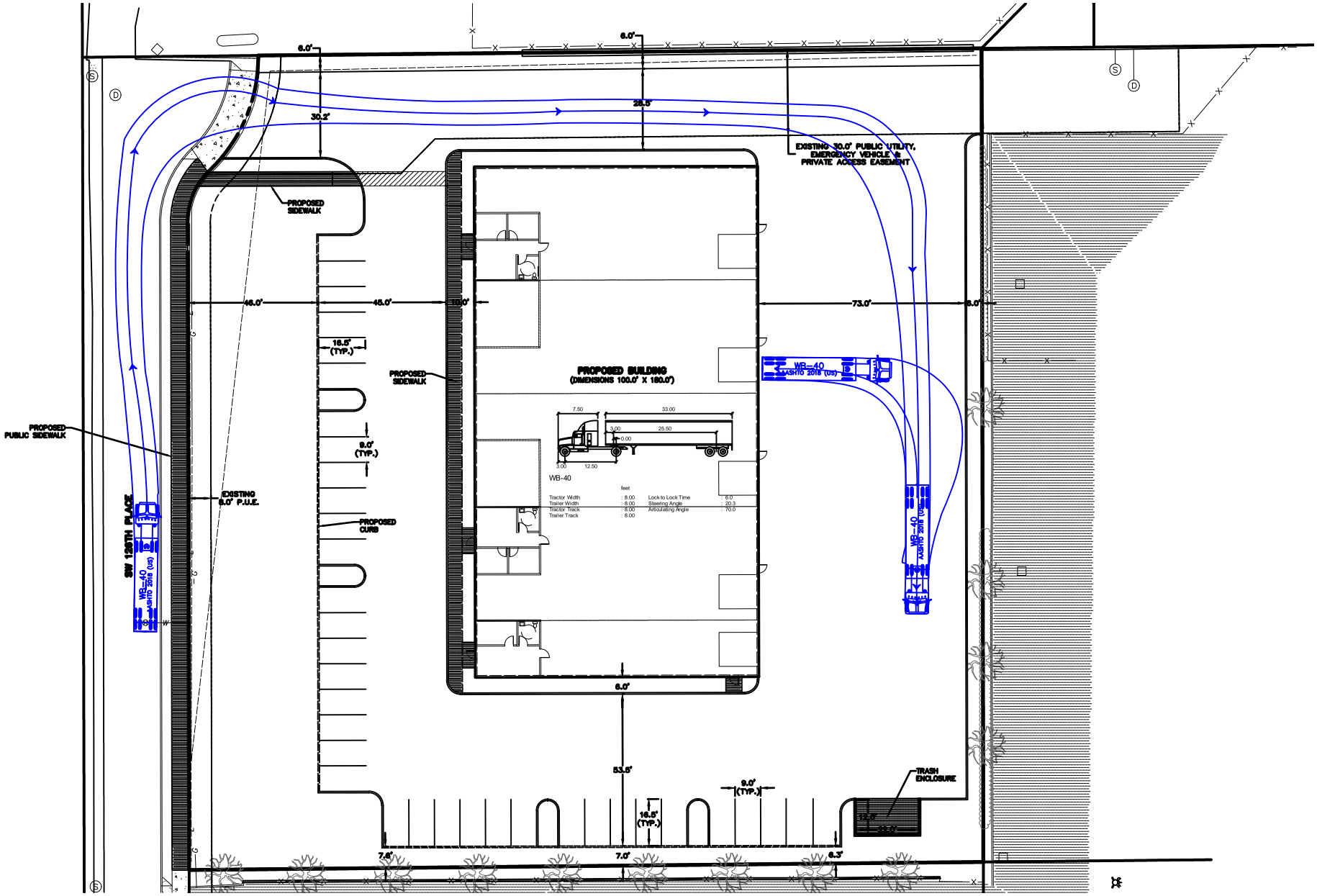


Figure 3: EB-40 Entry and Loading

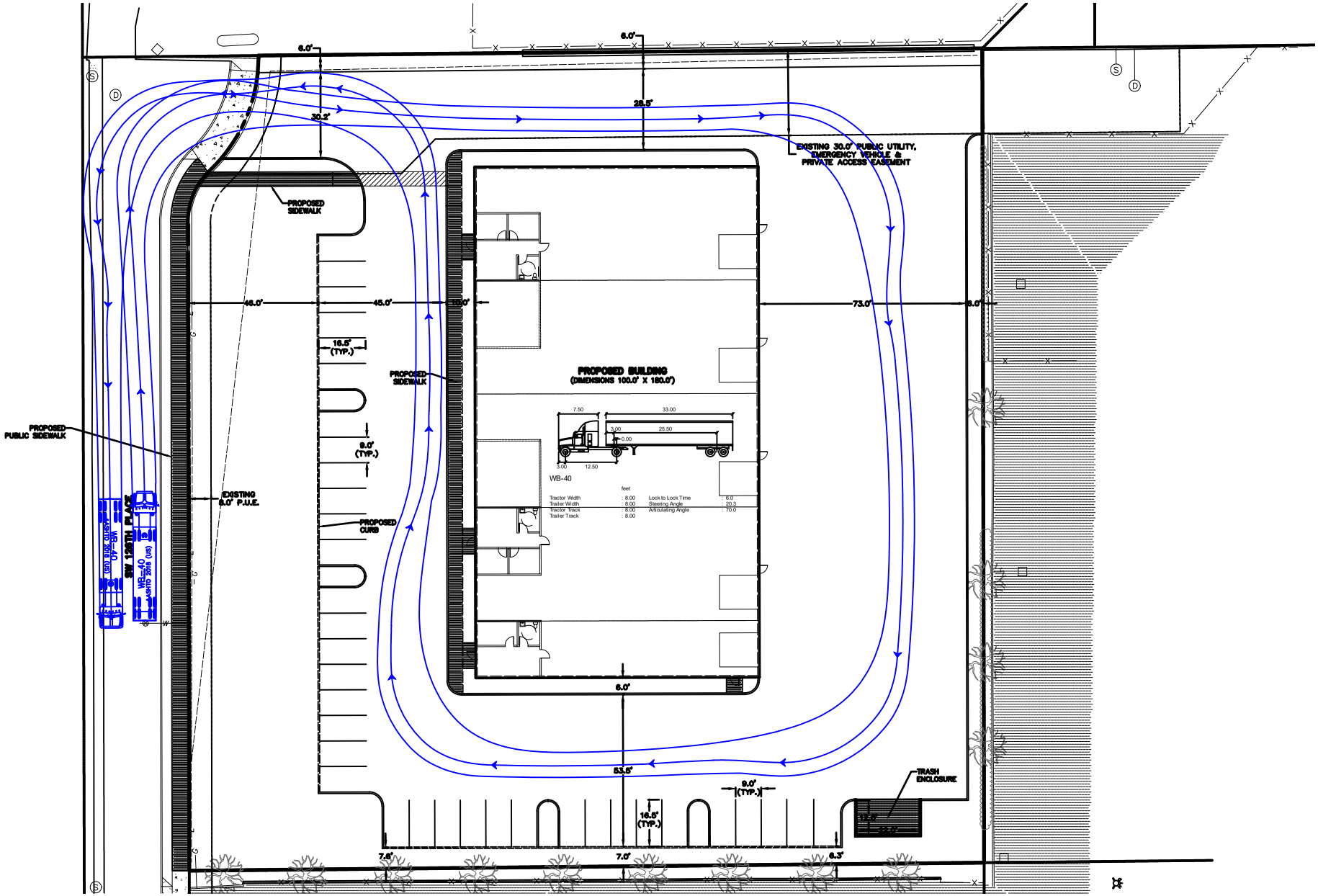


Figure 4: WB-40 Circulation Through Parking Lot

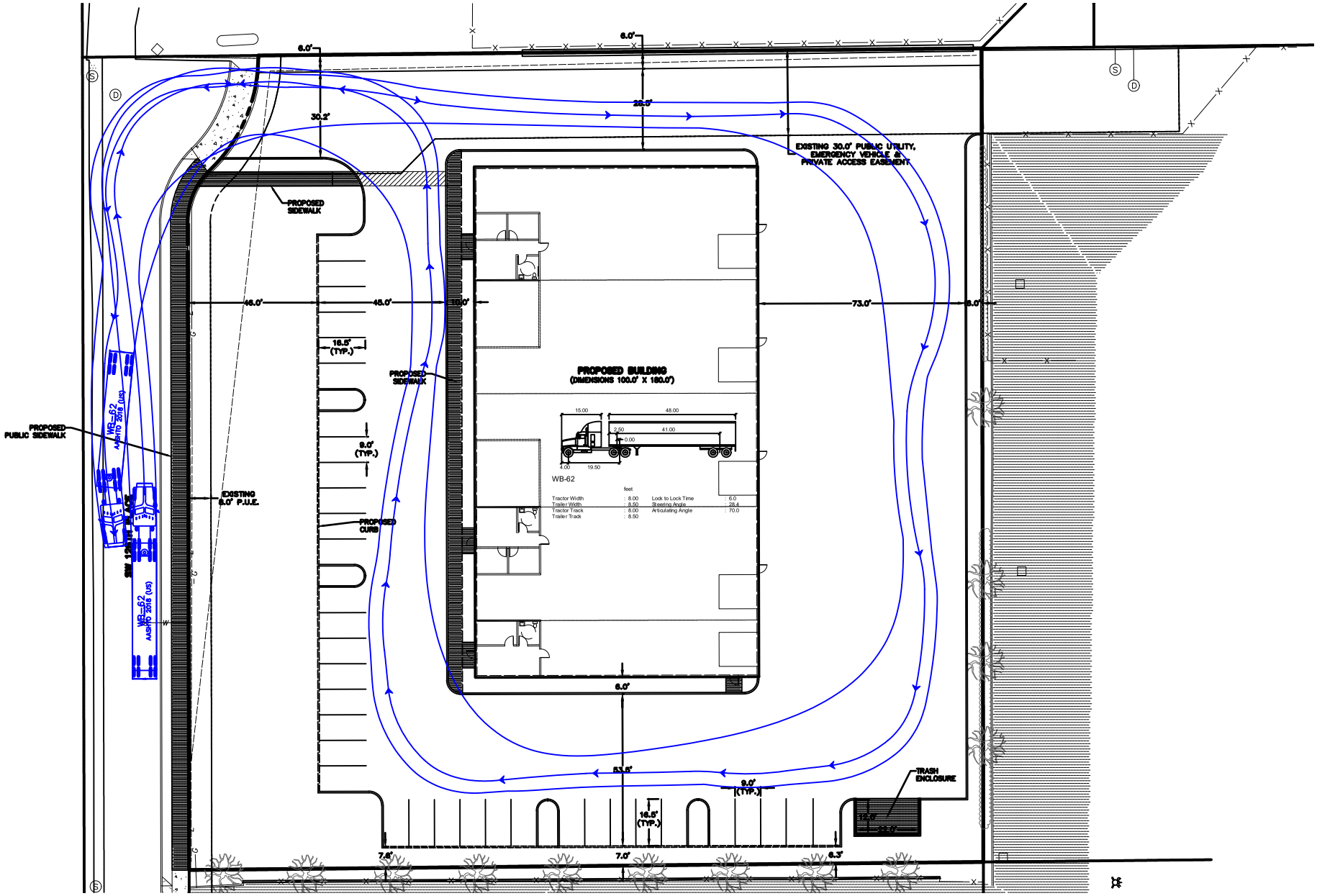


Figure 5: WB-62 Circulation Through Parking Lot (Trailers Over Sidewalk)

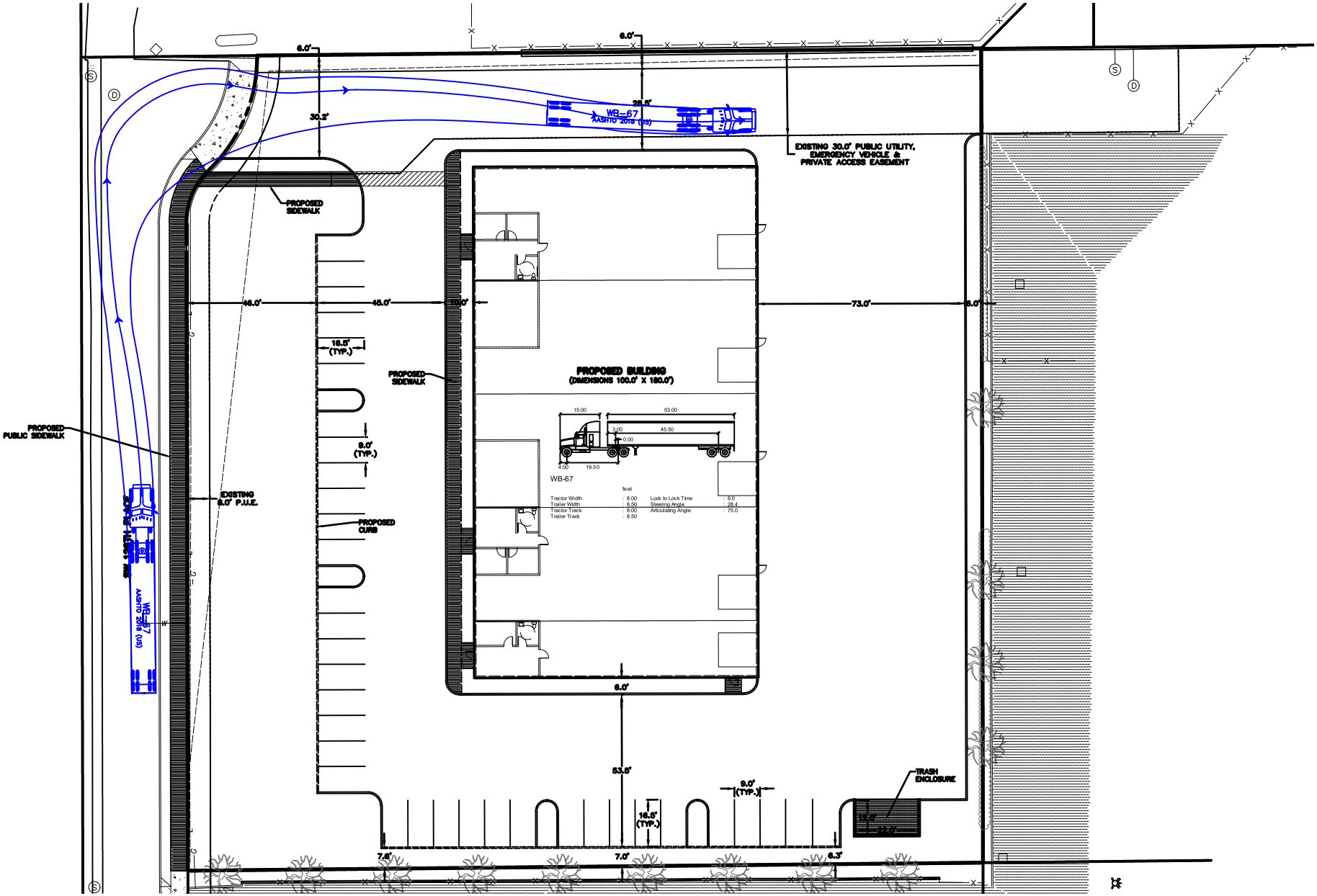


Figure 6: WB-67 Truck Entry Into Site

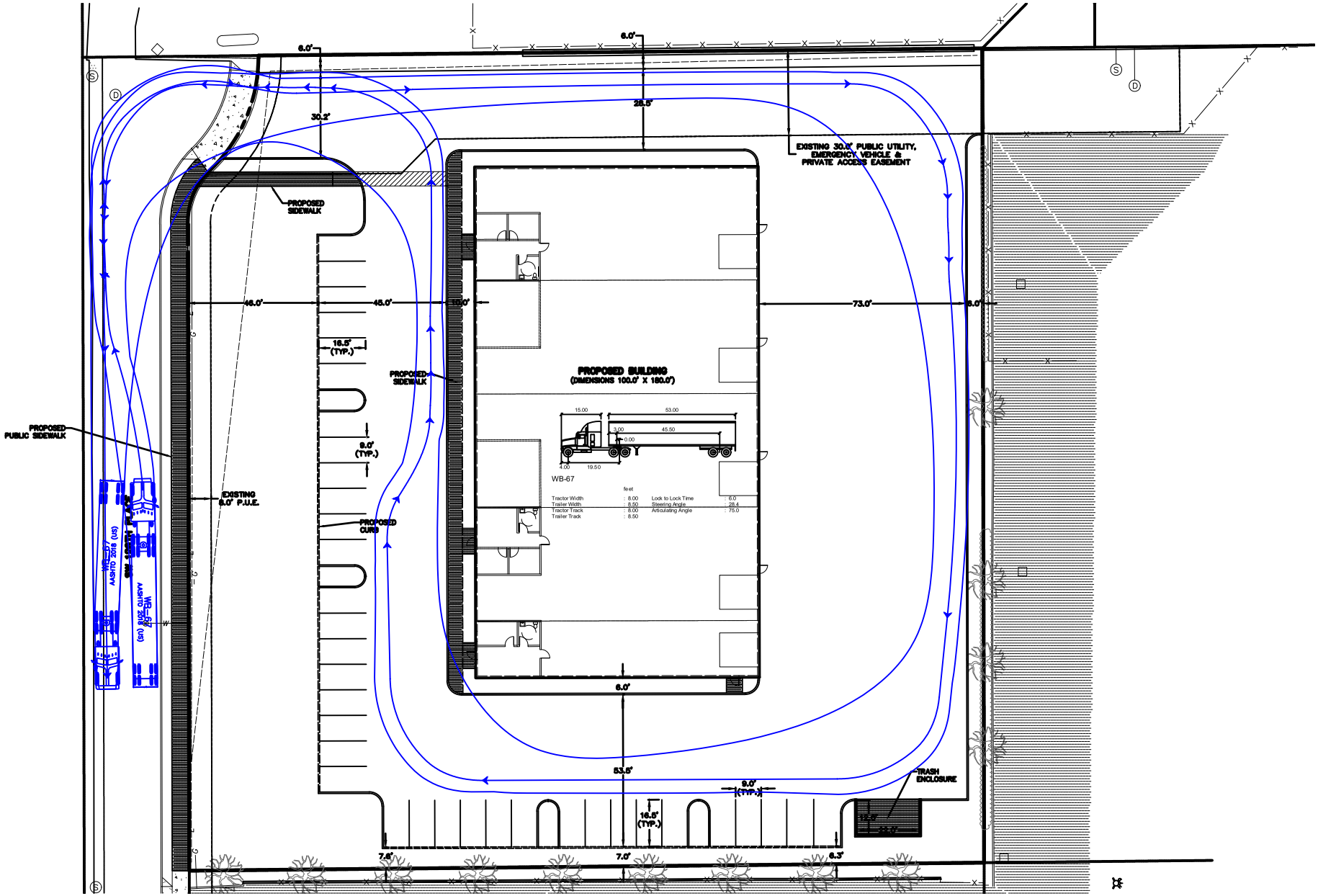


Figure 7: WB-67 Circulation Through Parking Lot (Trailers Over Sidewalk)

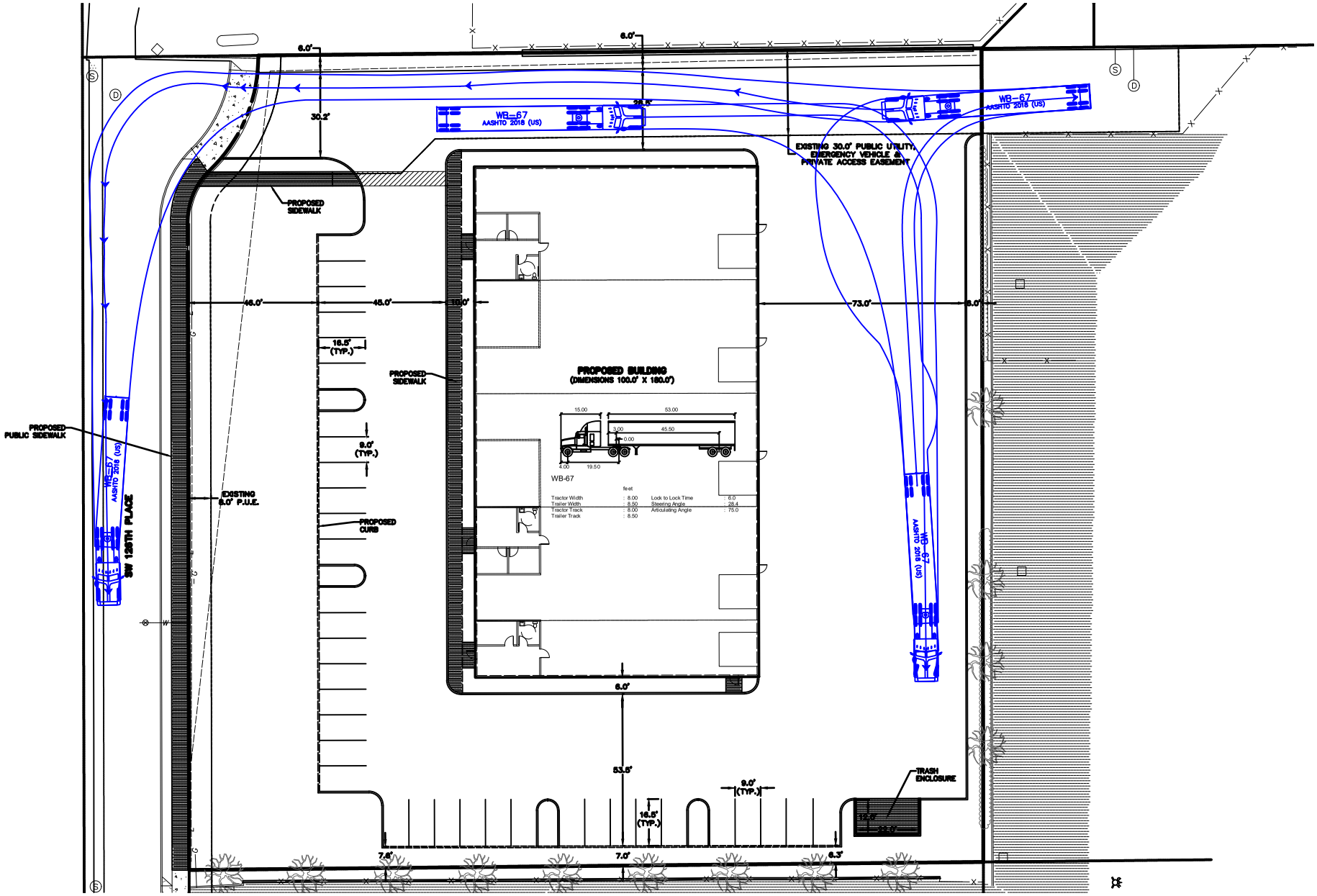


Figure 8: WB-67 Turn Around Maneuver and Exit