



The Standard Hotel

40 Island Avenue
Miami Beach, Florida 33139

prepared for:
INTEGRA

traffic study



July 30, 2024

July 30, 2024

Mr. Jaime Valdivia
INTEGRA
150 SE 2nd Avenue, Suite 800
Miami, Florida 33131

Re: The Standard Hotel – Traffic Engineering Evaluation

Dear Jaime:

Traf Tech Engineering, Inc. is pleased to provide you with the results of the traffic evaluation undertaken for the proposed upgrade associated with The Standard Hotel located on Island Avenue off of Venetian Causeway in the City of Miami Beach in Miami-Dade County, Florida. The 105-room hotel will be re-developed with a 105-room hotel, six apartments, and on-site parking. The on-site parking is to better accommodate the hotel guests of the subject lodging facility.

It has been a pleasure working with you on this project.

TRAF TECH ENGINEERING, INC.

Joaquin E. Vargas, P.E.
Senior Transportation Engineer

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INTRODUCTION

The Standard Hotel is an existing hotel located on Belle Isle in the City of Miami Beach in Miami-Dade County, Florida, as depicted in Figure 1. The site is currently developed with a 105-room hotel and supporting facilities such as restaurants, a pool deck, a spa, a gym, banquet/conference rooms, etc. The hotel provides valet service to all patrons via a drop-off/pickup circular driveway off of Island Avenue. All vehicles are parked at an existing valet-only parking lot located on the east side of West Avenue just north of 18th Street (approximately one-half mile from the hotel).

Traf Tech Engineering, Inc. was retained by INTEGRA to conduct a traffic evaluation in connection with the subject lodging facility. The study addresses the traffic generated by the existing hotel and proposed hotel/apartment project, and existing and proposed parking/valet operations as a result of a new on-site parking proposed at the hotel site.

This study is divided into three (3) sections, as listed below:

1. Inventory and Analysis
2. Trip Generation
3. Conclusions



INVENTORY AND ANALYSIS

Existing Land Uses and Parking/Valet Operation

The project site currently consists of a 105-room hotel and supporting facilities. A circular valet driveway is located on the south side of the hotel building. Valet service is provided at the hotel. The parking lot for the valet service is located at a surface parking lot located on the east side of West Avenue just north of 18th Street (approximately one-half mile from the hotel premises). After a vehicle is dropped off at the valet station located in front of the hotel's entrance off of Island Avenue, valet drivers proceed east on Venetian Causeway/Dade Boulevard and turn left (north) on West Avenue.

The valet vehicle retrieval route consists of exiting the parking lot to proceed south on West Avenue heading toward Dade Boulevard. At Dade Boulevard, valet drivers proceed west toward Venetian Causeway in order to access the hotel site off of Island Avenue.

A shuttle vehicle picks-up and drops-off the valet runners between the valet parking lot and the hotel site. Therefore, for every inbound trip associated with a hotel guest, up to two additional outbound trips (hotel guest's vehicle with valet driver and the shuttle vehicle) head towards the valet parking lot plus one additional inbound trip (shuttle vehicle returning with the valet runner) are generated. Similarly, for every outbound trip associated with a departing hotel guest, one additional outbound trip (shuttle vehicle with valet runner heading towards the valet parking lot) plus two additional inbound trips (returning shuttle vehicle and hotel's guest vehicle with valet driver) are generated.

Based on the above, for every peak hour trip generated by a hotel guest, up to three additional trips are produced by the valet service for not having on-site parking. The existing valet parking routes are graphically depicted in Figures 2 and 3.

Proposed Land Uses and Parking/Valet Operation

The hotel will be re-developed and will maintain the same number of rooms (105) and supporting facilities. Additionally, six (6) apartments will be included at the fourth and fifth levels plus 66 on-site parking spaces (64 regular parking spaces + two handicap parking stalls). With the new parking facility provided on site, the valet service between the hotel and the off-site parking lot will not be required. The proposed site plan is contained in Appendix A. The buildout year is anticipated to be 2028.

Up to three (3) trips will be eliminated from Venetian Causeway/Dade Boulevard for every peak hour trip generated by a hotel guest due to the proposed on-site parking. The future valet parking route (with the proposed on-site parking) is illustrated in Figures 4 and 5. Figure 4 shows the parking route required with the on-site parking. Figure 5 presents the exit route with the valet pick-up area located inside the parking lot.

Parking and Entry Gate

The project requires 62 parking spaces, and 66 parking stalls are proposed on site. The existing hotel currently has no parking spaces on site.

The future driveway into the future parking garage will be controlled with a gate. However, the gate is located near the entrance to the parking area. Hence, no queueing is anticipated near Island Way since the gate is to be located inside the property and will be controlled by the valet operator. The future driveway will eliminate two adjacent single-family homes.

Multimodal Alternatives

The Standard Hotel can be accessed via private automobile, taxi/uber services, public transportation (buses), bicycle, and walking trips. Bus service is provided along Venetian Way with bus stops provided on both sides of the street near Island Avenue for eastbound and westbound traveling passengers. Miami-Dade Transit Route 15 travels along Venetian Way with 30-minute headways on weekdays between 6:00 AM and 7:00 PM and 60-minute headways at nighttime. Saturday and Sunday service is also provided by Miami-Dade Transit Route 15. Miami Beach's South Beach Loop B also provides public transportation to Belle Island.

Bicycle lanes are provided along Venetian Way along the frontage of The Standard Hotel. The proposed re-development project will provide nine (9) short-term bicycle parking spaces and 32 long-term bicycle parking spaces within the hotel site.

Sidewalks are provided along the north and south sides of Venetian Way and on the south side of Island Way, adjacent to the hotel site. Safe pedestrian features (crosswalks, pedestrian signals with push buttons, ramps, etc.) are provided at the signalized intersection of Venetian Way and Island Way/Century Lane. A new pedestrian path is proposed along the east property line linking Island Avenue with the hotel premises.



THE STANDARD HOTEL

Century Lane

Island Avenue

Vehicle Arrival

Venetian Way

To off-site parking lot (1/2 mile away)

Valet Driver to off-site parking

LEGEND	
	Parking Route

Existing Valet Parking Routes

FIGURE 2
The Standard Hotel
Miami Beach, Florida





THE STANDARD HOTEL

Century Lane


Island Avenue

Valet Driver from off-site parking lot

Venetian Way

Vehicle Departure

Vehicle Departure

LEGEND	
	Vehicle Departure Route

Existing Valet Parking Routes

FIGURE 3
The Standard Hotel
Miami Beach, Florida





THE STANDARD HOTEL

Century Lane

Valet Driver to on-site parking

Island Avenue

Vehicle Arrival

Vehicle Arrival

Venetian Way

LEGEND	
	Parking Route

Future Valet Parking Routes

FIGURE 4
The Standard Hotel
Miami Beach, Florida





THE STANDARD HOTEL

Valet Pick-up Occurs Inside Future On-Site Parking Lot

Century Lane

Island Avenue

Venetian Way

Vehicle Departure

Vehicle Departure

LEGEND	
	Vehicle Departure Route

Future Valet Parking Routes

FIGURE 5
The Standard Hotel
Miami Beach, Florida



Roadway System and Analysis

One major roadway (Venetian Causeway/Dade Boulevard) is located adjacent to the project site. Venetian Causeway is a two-lane east-west roadway linking Miami Beach with the City of Miami across Biscayne Bay.

According to FDOT's 2012 Quality/Level of Service Handbook, Venetian Causeway/Dade Boulevard has a maximum level-of-service "D" capacity of approximately 1,197 vehicles per hour. Recent traffic counts recorded by the FDOT (refer to Appendix B) on Venetian Causeway/Dade Boulevard between Belle Isle and Alton Road show daily traffic volumes of approximately 11,179 vehicles and a maximum peak hour volume of approximately 844 vehicles. Hence, Venetian Causeway/Dade Boulevard near The Standard Hotel is operating at level of service "D" with approximately 353 peak hour trips of excess/reserved capacity.

Taxi/Uber Drop-off/Pick-up Operation

Taxi and Uber services for hotel guests are required to use the porte-cochere adjacent to the hotel entrance door. During peak accumulation periods due to the off-site parking associated with the valet service, taxi/Uber drivers oftentimes prefer to park on Island Avenue in order to avoid joining the traffic queues associated with the valet operation. However, with the proposed on-site parking facility, the traffic queues are anticipated to be reduced and therefore, taxi/Uber drivers should be able to use the porte-cochere for drop-off and pick-up of hotel patrons.

Delivery Trucks

Delivery trucks (linen, food service, etc.) use Island Avenue for drop-off and pick-up operation. These trucks usually arrive/depart early in the morning (starting at 6:30 AM) and during the late afternoon period (around 6:30 PM). These trucks currently park on Island Avenue and mix with the queues associated with the current valet operation (with the parking off site). The proposed on-site parking facility will reduce the queues associated with the valet operation and consequently will minimize conflicts with parked delivery trucks. Truck maneuverability analyses using the AutoTURN software are presented in Appendix C.

TRIP GENERATION

A trip generation analysis was conducted for The Standard Hotel. The analysis was performed using the trip generation rates published in the Institute of Transportation Engineer's *ITE Trip Generation Manual* (11th Edition). The trip generation analysis was undertaken for daily, AM peak hour, and PM peak hour conditions. According to ITE's *Trip Generation Manual* (11th Edition), the most appropriate "land use" category for the existing hotel and proposed hotel/apartment project are:

SINGLE-FAMILY ATTACHED HOUSING (ITE Land Use 215)

Daily Trips

$$T = 7.20 (X)$$

Where T = average daily vehicle trip ends, X = number of units

AM Peak Hour

$$T = 0.48 (X) \text{ (31\% inbound and 69\% outbound)}$$

Where T = average AM peak hour vehicle trip ends, X = units

PM Peak Hour

$$T = 0.57 X \text{ (57\% inbound and 43\% outbound)}$$

Where T = average PM peak hour vehicle trip ends, X = units

MULTIFAMILY (MID RISE) (ITE Land Use 221)

Daily Trips

$$T = 4.54 (X)$$

Where T = average daily vehicle trip ends, X = number of units

AM Peak Hour

$$T = 0.37 (X) \text{ (23\% inbound and 77\% outbound)}$$

Where T = average AM peak hour vehicle trip ends, X = units

PM Peak Hour

$$T = 0.39 X \text{ (61\% inbound and 39\% outbound)}$$

Where T = average PM peak hour vehicle trip ends, X = units

HOTEL (ITE Land Use 310)

Daily Trips

$$T = 7.99 (X)$$

Where T = average daily vehicle trip ends, X = number of rooms

AM Peak Hour

$$T = 0.46 (X) \text{ (56\% inbound and 44\% outbound)}$$

Where T = average AM peak hour vehicle trip ends, X = rooms

PM Peak Hour

$$T = 0.59 X \text{ (51\% inbound and 49\% outbound)}$$

Where T = average PM peak hour vehicle trip ends, X = rooms

Using the above-listed trip generation rates from the ITE document, a trip generation analysis was undertaken for the existing and proposed land uses. The results of this effort are documented in Table 1 on the following page. Excerpts from the ITE document are presented in Appendix D.

TABLE 1				
Trip Generation Summary				
The Standard Hotel – Miami Beach, Florida				
		Number of Trips		
Land Use	Size	Daily	AM Peak	PM Peak
EXISTING USE (With Off-Site Valet Operation ¹)				
Based on ITE and Off-Site Valet				
Hotel	105 rooms	1,613	92	119
SF Homes ²	2 units	24	1	1
Total Trips		1,637	93	120
PROPOSED USE (Without Off-Site Valet Operation) – Based on ITE				
Hotel	105 rooms	840	48	62
Apartments	6 units	27	2	2
Total Trips		867	50	64
Difference		-770 (-47%)	-43 (-46%)	-56 (-47%)

Source: ITE Trip Generation Manual (11th Edition)

¹ Trips based on ITE rates multiplied by 1.92 to account for the additional trips generated by the current valet operation (refer to Tables E-1 through E-3 in Appendix E based on 3-day on-site traffic counts).

² Two attached single-family homes adjacent to the hotel will be eliminated to create the entrance to the future on-site parking lot.

As indicated in Table 1 on the previous page, the existing hotel and 2 homes with valet service generates approximately 1,637 daily trips, approximately 93 AM peak hour trips and approximately 120 trips during the typical afternoon peak hour. The proposed on-site parking facility (without the valet service between the hotel and the off-site parking lot and the elimination of two single family homes) is projected to generate approximately 770 less daily trips, approximately 43 less AM peak hour trips, and approximately 56 less trips during the afternoon peak hour.

Based on the above analysis, the proposed on-site parking facility will significantly reduce (-47%) the amount of traffic traveling east and west along the Venetian Causeway/Dade Boulevard between the hotel site and West Avenue. The level of service on the subject segment of this east-west roadway will improve with the proposed The Standard Hotel re-development project.

VALET OPERATION

For the valet analysis, the following assumptions were used:

Vehicle Drop Off (Parking)

- The valet station for the drop-off of vehicles is located at its current location (within the entrance door of the hotel at the circular porte-cochere).
- A valet ticket processing time of 60 seconds was assumed, consistent with other studies in the City of Miami Beach
- The driving distance between the valet station and the farthest on-site parking space is approximately 730 feet. The vehicle travel speed is assumed to be 15 mph (consistent with other Miami Beach studies).
- The walking distance (within the hotel premises) between the farthest on-site parking space and the drop-off valet station is approximately 450 feet. The walking/running speed of a valet personnel is 10 ft/sec (consistent with other Miami Beach studies).
- The inbound control gate is planned as a swing-arm activated with a transponder (3-6 seconds opening time).
- The tandem parking spaces located on the west side of the future on-site parking lot do not add time for parking purposes.

Vehicle Pick-up (Retrieval)

- The valet station for the pick-up of vehicles is located inside the future on-site parking lot (near the south end of the parking area).
- A processing time of 30 seconds was assumed for the valet driver to exit the vehicle and the vehicle owner to get into the existing vehicle.
- The driving distance between the farthest on-site parking space and the pick-up valet station is approximately 260 feet. The vehicle travel speed is assumed to be 15 mph (consistent with other Miami Beach studies).

-
- The walking distance between the farthest on-site parking space and the pick-up valet station is approximately 260 feet. The walking/running speed of a valet personnel is 10 ft/sec (consistent with other Miami Beach studies).
 - The exit control gate does not affect the queueing analysis since it occurs after the vehicle owner picks up his/her car.
 - A 60 second delay was assumed to un-park a vehicle that is blocked by another vehicle at the tandem parking spaces. Only 24 parked vehicles of 66 will experience delay caused by another vehicle parked behind. The remaining 42 parking spaces (64%) will not experience any delay. Hence, the 60 seconds of delay assumed for every vehicle is considered conservative for analysis purposes.

Queueing Analysis

A queueing analysis was conducted for the valet drop-off/pick-up locations. The length of queue anticipated was determined using information contained in ITE's *Transportation and Land Development*, Chapter 8 – Drive-In Facilities³. For this analysis, the following input variables were used:

- Service Rate: As documented in Appendix F, the service rate for parking valet vehicles is approximately 25 vehicles per hour and for retrieval of parked vehicles approximately 28 vehicles per hour.
- Demand Rate: The 105 hotel rooms have a peak hour rate of 0.79 trips per occupied room (refer to last sheet in Appendix D). This results in 83 peak hour trips (37 inbound and 46 outbound). Adding one (1) inbound and one (1) outbound trip for the residential use, a maximum of 38 inbound / 47 outbound valet vehicles were estimated to arrive/depart during the highest hour.

³ By Vergil G. Stover and Frank J. Koepke.

Using equation 8-9b and Table 8-11 of ITE's Transportation and Land Development, the maximum length of queue anticipated at the drop-off valet at the porte-cochere, at the 95% confidence level, is three (3) vehicles with three (3) valet runners. Similarly, the maximum length of queue anticipated at the pick-up valet at the future on-site parking lot, at the 95% confidence level, is four (4) vehicles with three (3) valet runners. Therefore, up to six (6) valet runners and two valet stations should be provided at the re-developed The Standard during peak periods.

The results of the ITE queuing procedure are included in Appendix F.

CONCLUSIONS

The Standard Hotel is an existing hotel located on Belle Isle in the City of Miami Beach in Miami-Dade County, Florida. The site is currently developed with a 105-room hotel and supporting facilities such as restaurants, a pool deck, a spa, a gym, banquet/conference rooms, etc. The hotel provides valet service to all patrons via a drop-off/pickup circular driveway off of Island Avenue. All vehicles are parked at an existing valet-only parking lot located on the east side of West Avenue just north of 18th Street (approximately one-half mile from the hotel).

Traf Tech Engineering, Inc. was retained by INTEGRA to conduct a traffic evaluation in connection with the subject lodging facility. The study addresses the traffic generated by the existing hotel and proposed hotel/apartment re-development project, traffic conditions along Venetian Causeway/Dade Boulevard, and existing and proposed parking/valet operations as a result of a new on-site parking proposed at the existing hotel site.

The existing hotel and 2 homes with valet service generates approximately 1,637 daily trips, approximately 93 AM peak hour trips and approximately 120 trips during the typical afternoon peak hour. The proposed on-site parking facility (without the valet service between the hotel and the off-site parking lot and the elimination of two single family homes) is projected to generate approximately 770 less daily trips, approximately 43 less AM peak hour trips, and approximately 56 less trips during the afternoon peak hour.

The proposed on-site parking facility will significantly (-47%) reduce the amount of traffic traveling east and west along the Venetian Causeway/Dade Boulevard between the hotel site and West Avenue. The level of service on the subject segment of this east-west roadway will improve as a result of the proposed The Standard Hotel re-development project.

Taxi and Uber services for hotel guests are required to use the porte-cochere adjacent to the hotel entrance door. During peak accumulation periods due to the off-site parking associated with the valet service, taxi/Uber drivers oftentimes prefer to park on Island Avenue in order to avoid joining the traffic queues associated with the valet operation. However, with the proposed on-site parking facility, the traffic queues are anticipated to be reduced and therefore, taxi/Uber drivers should be able to use the porte-cochere for drop-off and pick-up of hotel patrons.

Up to six (6) valet runners and two valet stations should be provided at the re-developed The Standard during peak periods. All queueing is anticipated to occur within the front porte-cochere or inside the future on-site parking garage (no traffic spillage onto Island Way is anticipated).

Finally, the City of Miami Beach is considering creating a cul-de-sac on Island Avenue at its western termini (at Century Lane). This will improve safety at the intersection of Venetian Way and Century Lane/Island Avenue. If implemented, the proposed cul-de-sac does not affect the conclusions documented on the previous page. Even though the proposed cul-de-sac will increase traffic conflicts at the east intersection of Island Way/Venetian Way, the proposed hotel re-development project will decrease conflicts at this intersection making the subject intersection safer.

APPENDIX A

Site Plan for on-site Parking Garage

APPENDIX B

**2023 Traffic Counts for Venetian
Causeway/Dade Boulevard
(Source: FDOT)**

COUNTY: 87
 STATION: 8350
 DESCRIPTION: VENETIAN CSWY, 200' EAST OF WEST AVENUE
 START DATE: 08/09/2023
 START TIME: 0000

TIME	DIRECTION: E					DIRECTION: W					COMBINED TOTAL	
	1ST	2ND	3RD	4TH	TOTAL	1ST	2ND	3RD	4TH	TOTAL		
0000	24	11	8	6	49	9	11	13	11	44	93	
0100	9	5	12	4	30	8	5	5	3	21	51	
0200	3	9	9	0	21	3	2	2	5	12	33	
0300	0	5	2	2	9	6	4	5	4	19	28	
0400	2	2	6	3	13	5	2	3	8	18	31	
0500	4	4	12	19	39	3	12	8	22	45	84	
0600	18	23	32	41	114	23	35	47	51	156	270	
0700	73	67	47	74	261	76	53	83	82	294	555	
0800	89	68	74	96	327	101	92	75	100	368	695	
0900	87	69	89	77	322	95	107	99	87	388	710	
1000	128	113	101	132	474	86	78	98	86	348	822	
1100	93	122	117	102	434	107	100	87	102	396	830	
1200	74	112	80	83	349	102	107	91	99	399	748	
1300	90	89	86	89	354	108	102	74	98	382	736	
1400	81	97	96	89	363	104	105	49	87	345	708	
1500	106	92	99	100	397	99	104	93	88	384	781	
1600	88	80	117	84	369	103	80	95	83	361	730	
1700	90	73	98	80	341	105	87	90	79	361	702	
1800	102	80	75	89	346	108	93	91	98	390	736	
1900	71	52	75	65	263	76	72	56	75	279	542	
2000	61	68	76	45	250	69	57	51	46	223	473	
2100	44	41	47	41	173	57	34	50	30	171	344	
2200	33	31	25	27	116	33	47	29	27	136	252	
2300	36	34	35	22	127	32	26	21	19	98	225	
24-HOUR TOTALS:					5541						5638	11179

PEAK VOLUME INFORMATION

	DIRECTION: E		DIRECTION: W		COMBINED DIRECTIONS	
	HOUR	VOLUME	HOUR	VOLUME	HOUR	VOLUME
A.M.	845	341	845	401	845	742
P.M.	1500	397	1215	405	1500	781
DAILY	1000	474	1215	405	1045	844

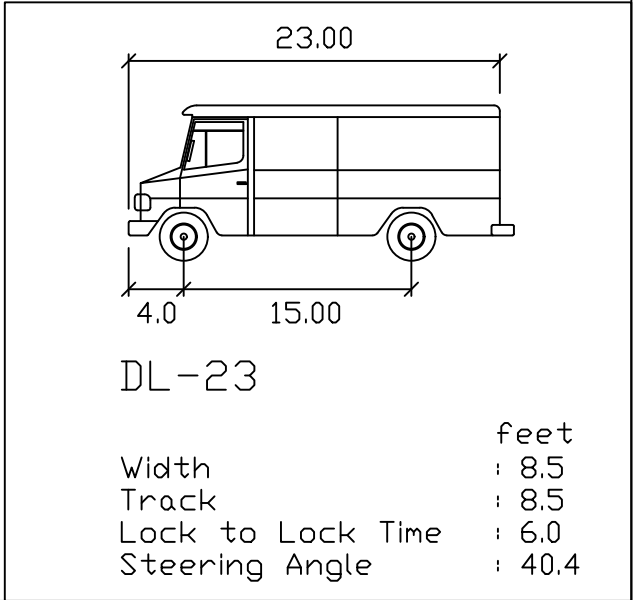
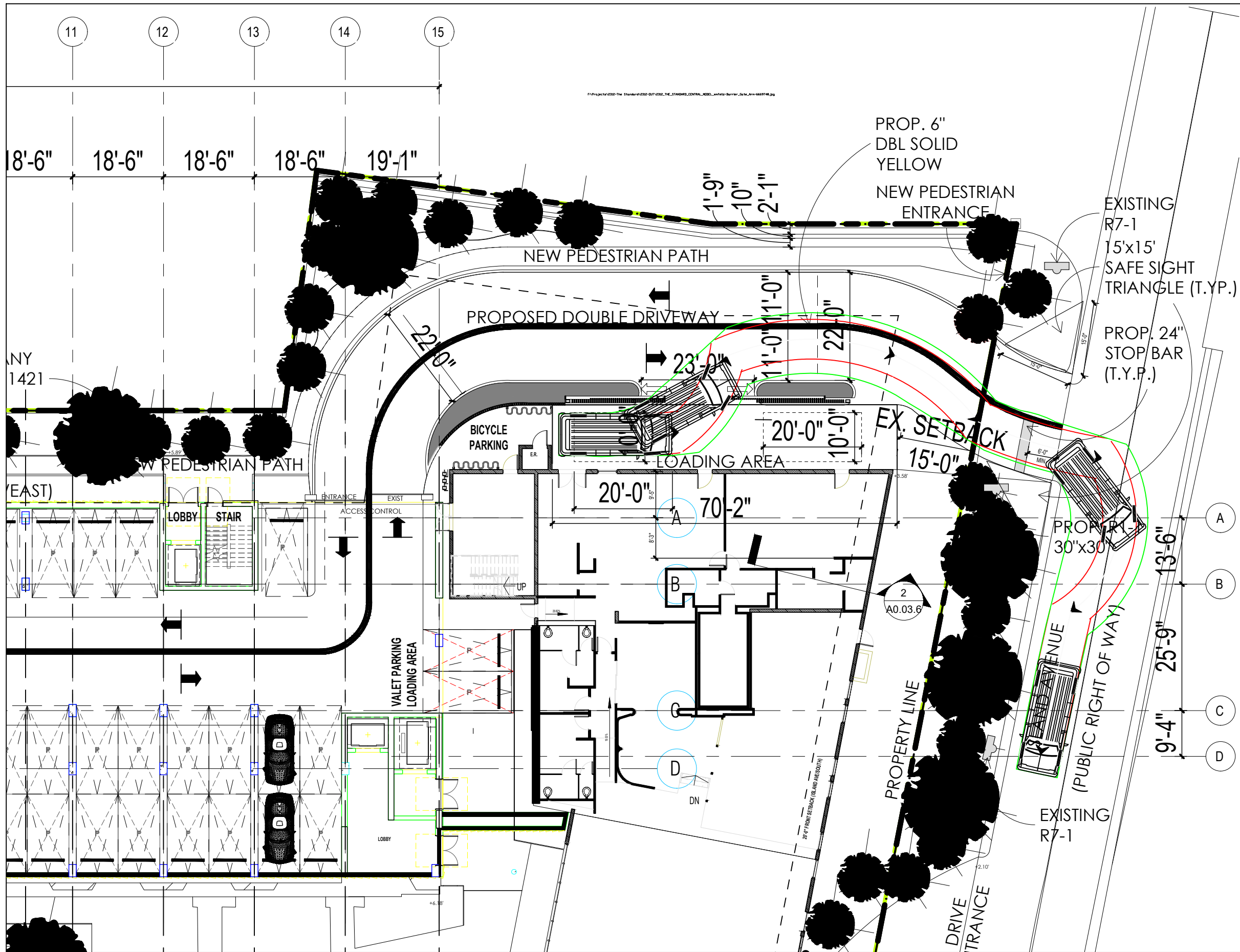
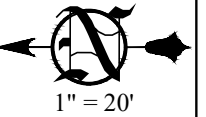
TRUCK PERCENTAGE 2.40 2.64 2.52

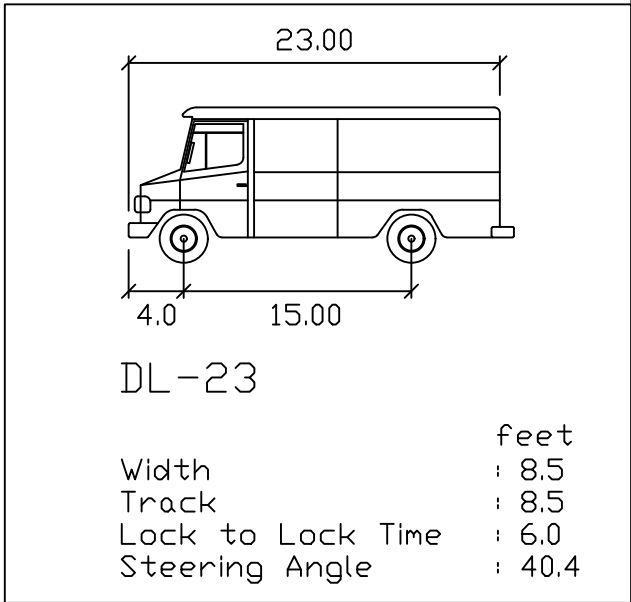
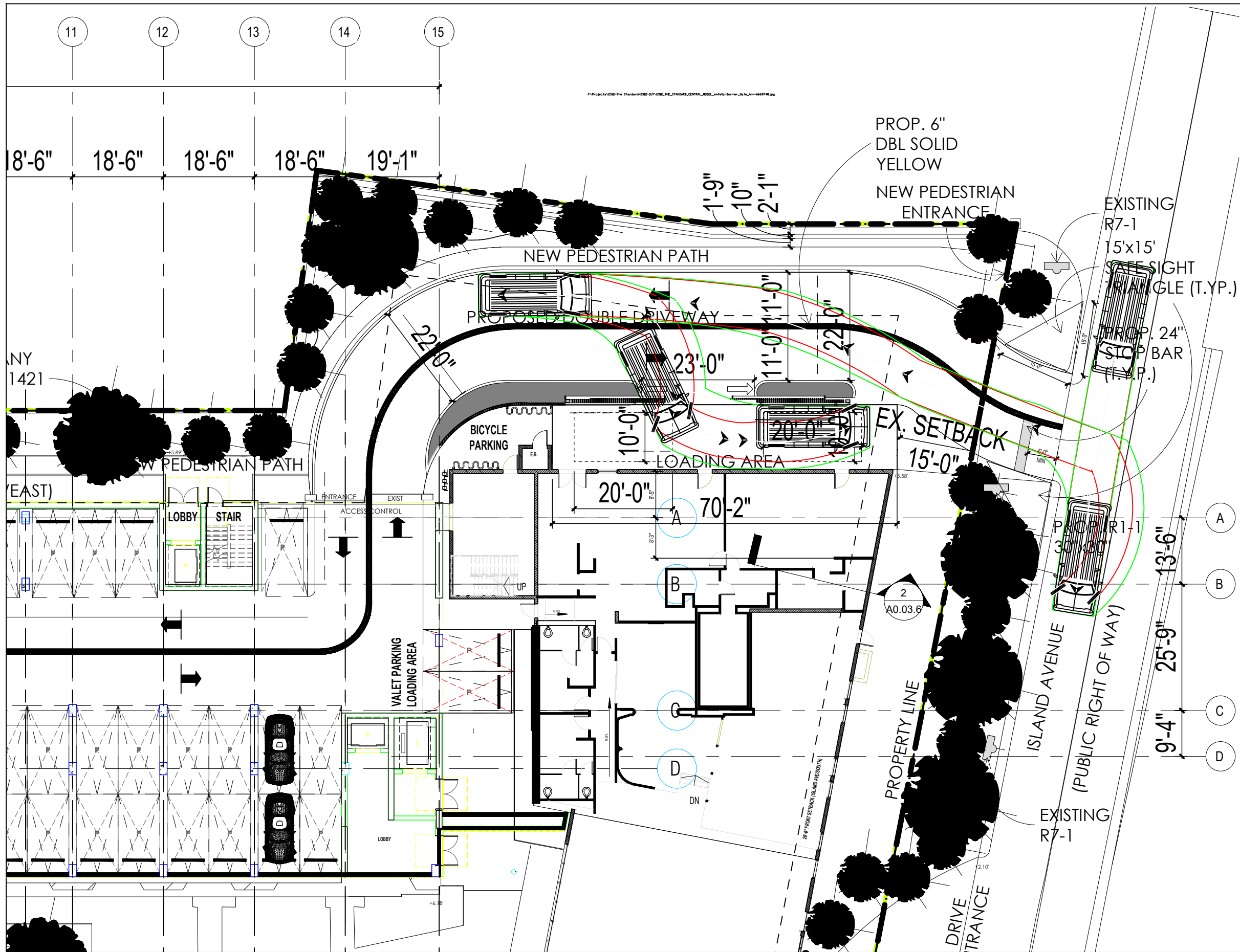
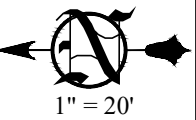
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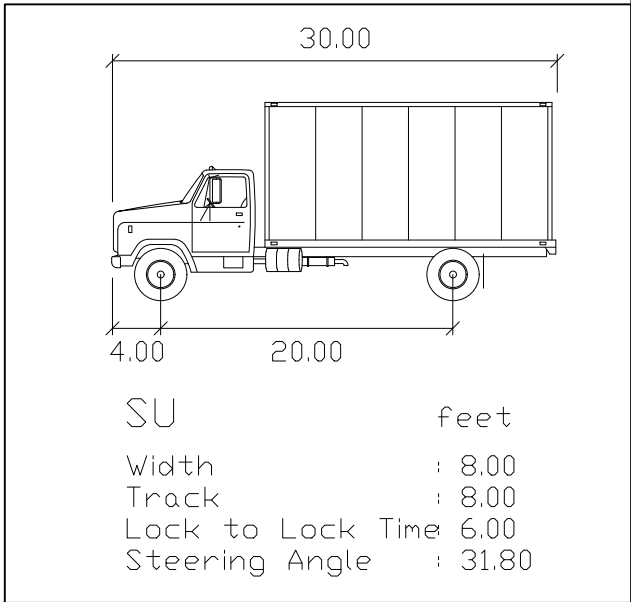
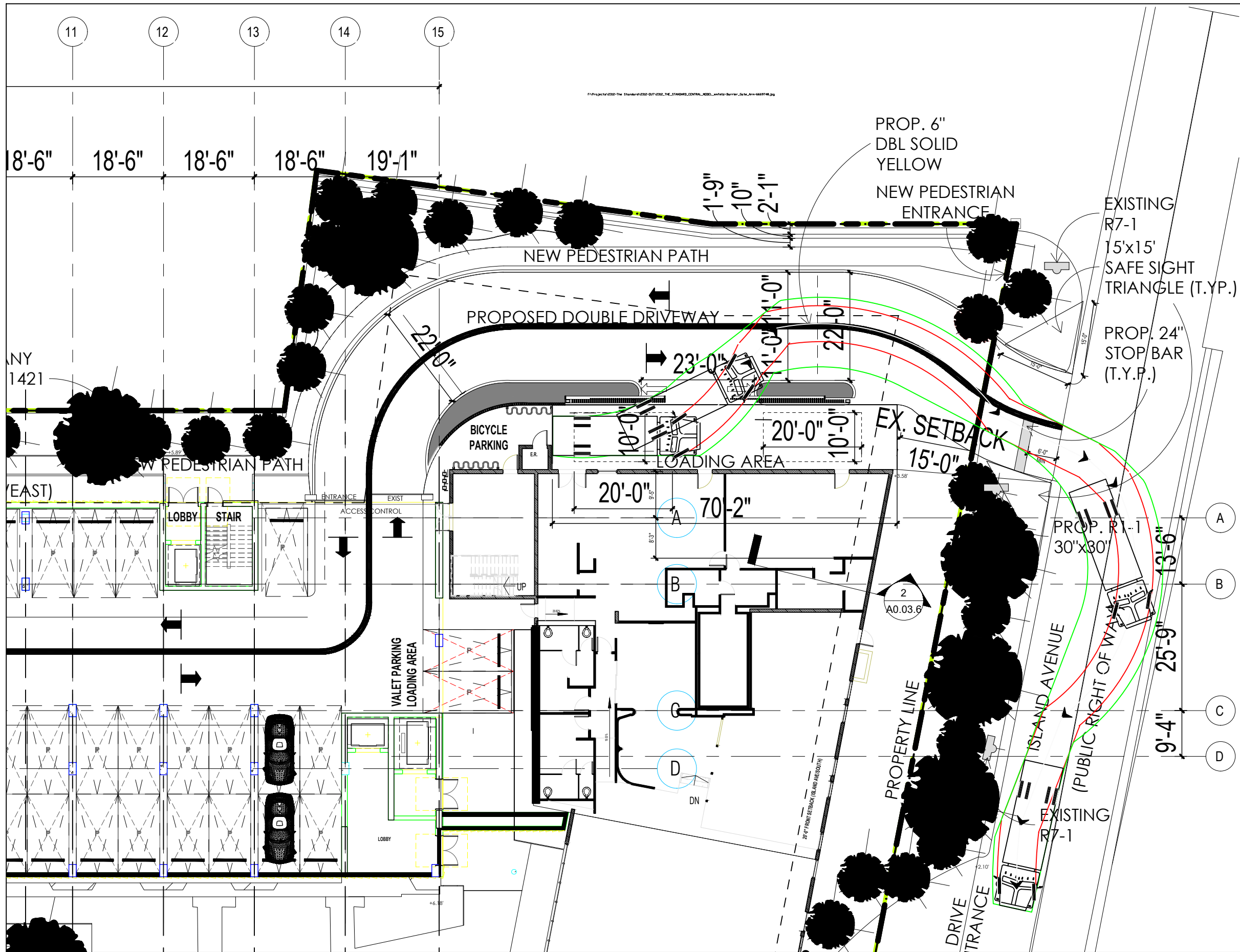
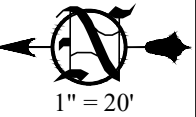
DIR	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	TOTTRK	TOTVOL
E	288	4436	684	18	80	15	3	14	2	1	0	0	0	0	0	133	5541
W	337	4545	607	21	105	7	5	10	1	0	0	0	0	0	0	149	5638

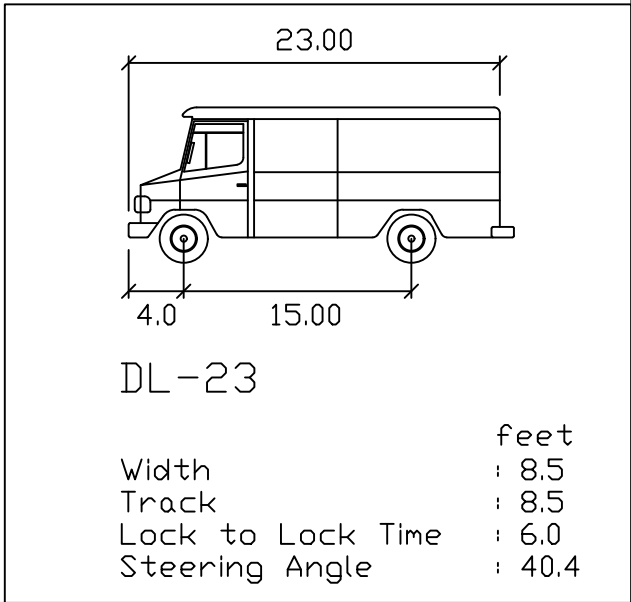
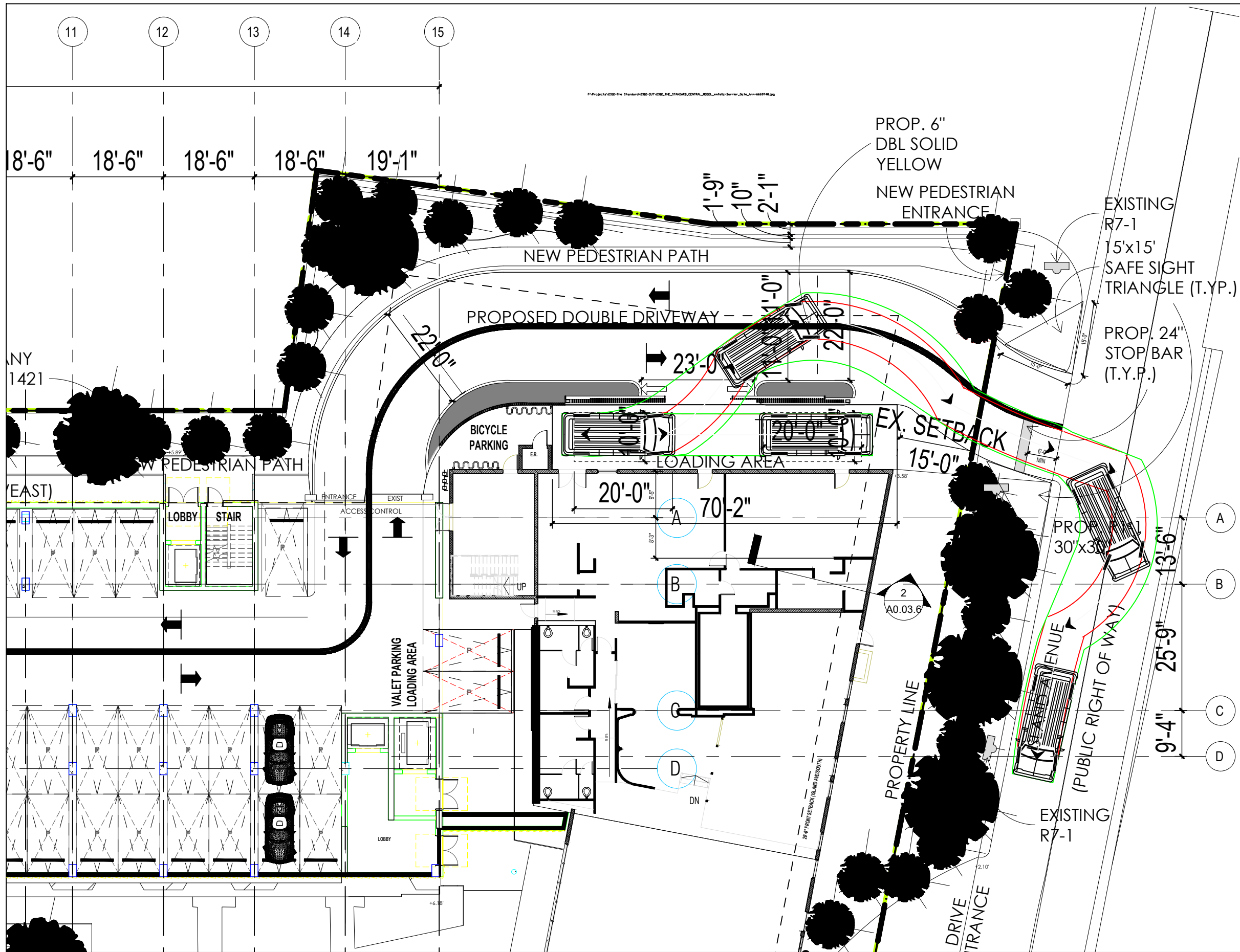
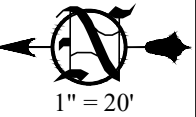
APPENDIX C

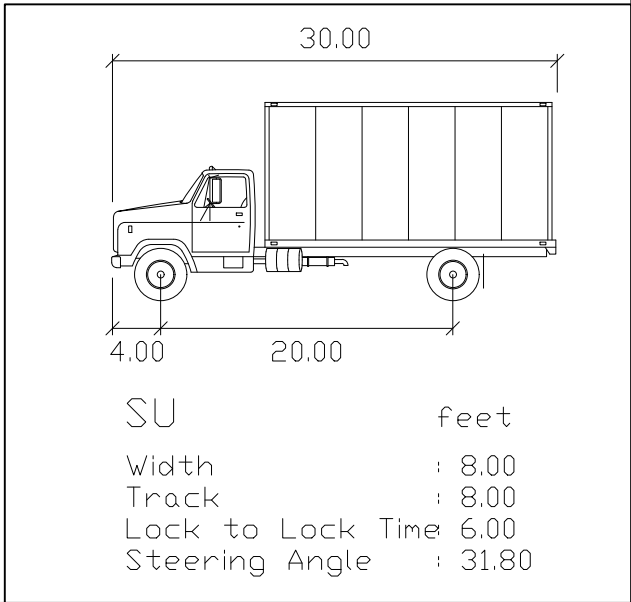
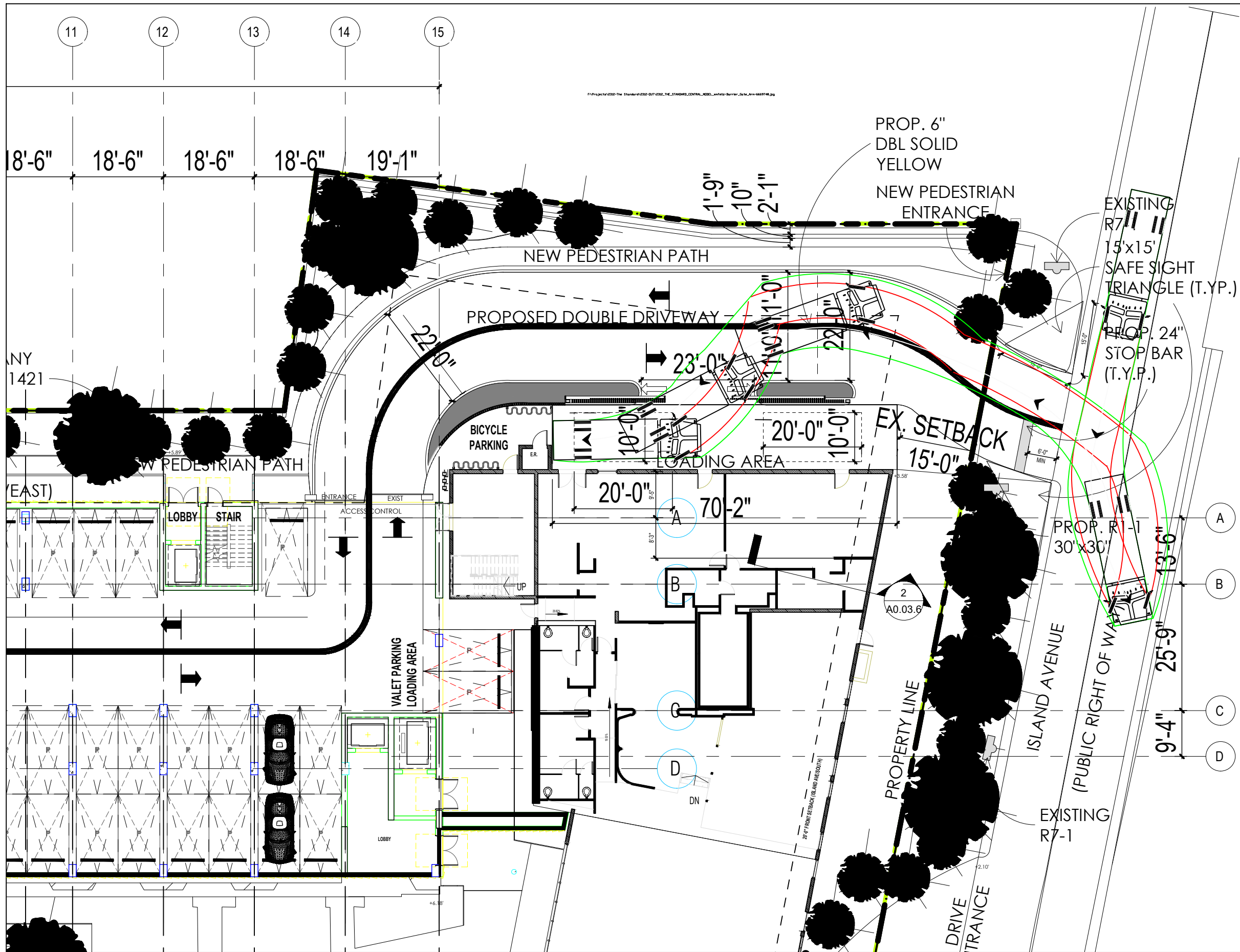
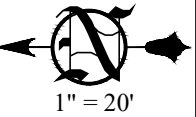
AutoTURN Analyses for Trucks

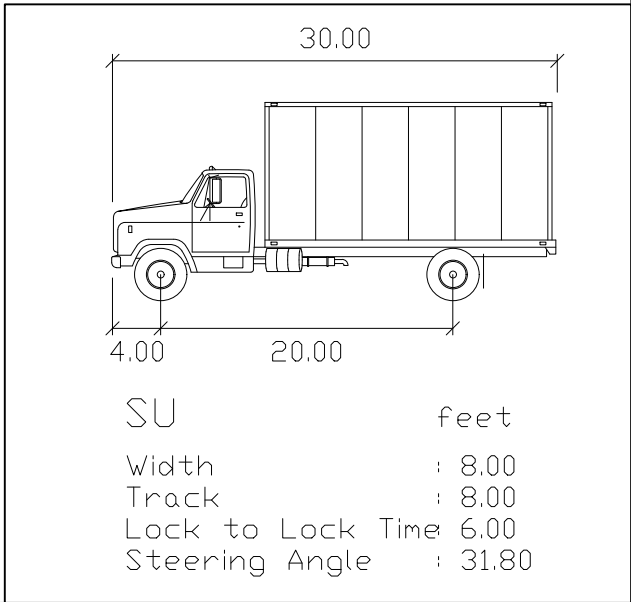
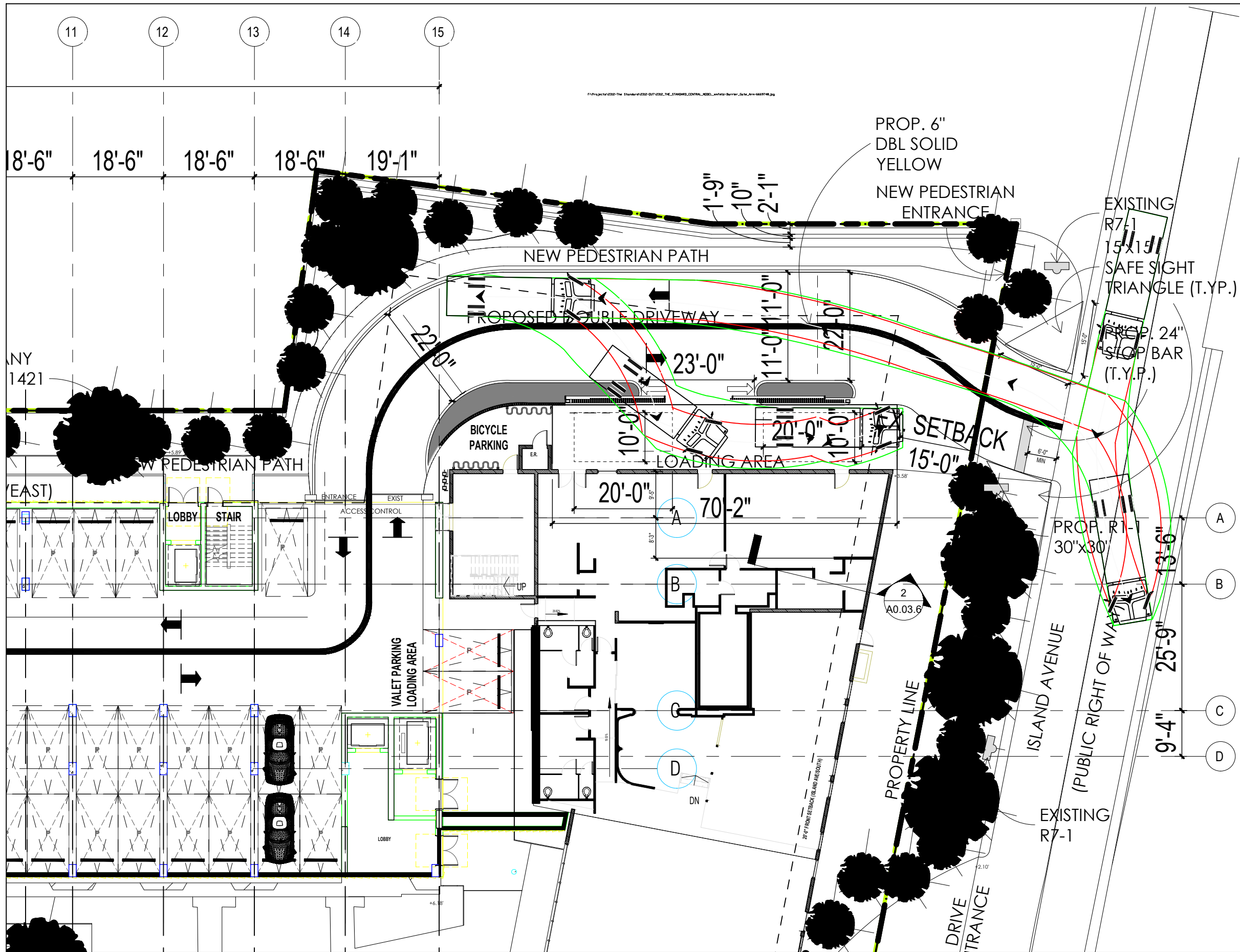
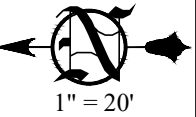












APPENDIX D

**Excerpts from
ITE Trip Generation Manual**

Land Use: 215

Single-Family Attached Housing

Description

Single-family attached housing includes any single-family housing unit that shares a wall with an adjoining dwelling unit, whether the walls are for living space, a vehicle garage, or storage space.

Additional Data

The database for this land use includes duplexes (defined as a single structure with two distinct dwelling units, typically joined side-by-side and each with at least one outside entrance) and townhouses/rowhouses (defined as a single structure with three or more distinct dwelling units, joined side-by-side in a row and each with an outside entrance).

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (<https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>).

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in British Columbia (CAN), California, Georgia, Illinois, Maryland, Massachusetts, Minnesota, New Jersey, Ontario (CAN), Oregon, Pennsylvania, South Dakota, Utah, Virginia, and Wisconsin.

Source Numbers

168, 204, 211, 237, 305, 306, 319, 321, 357, 390, 418, 525, 571, 583, 638, 735, 868, 869, 870, 896, 912, 959, 1009, 1046, 1056, 1058, 1077

Single-Family Attached Housing (215)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 22

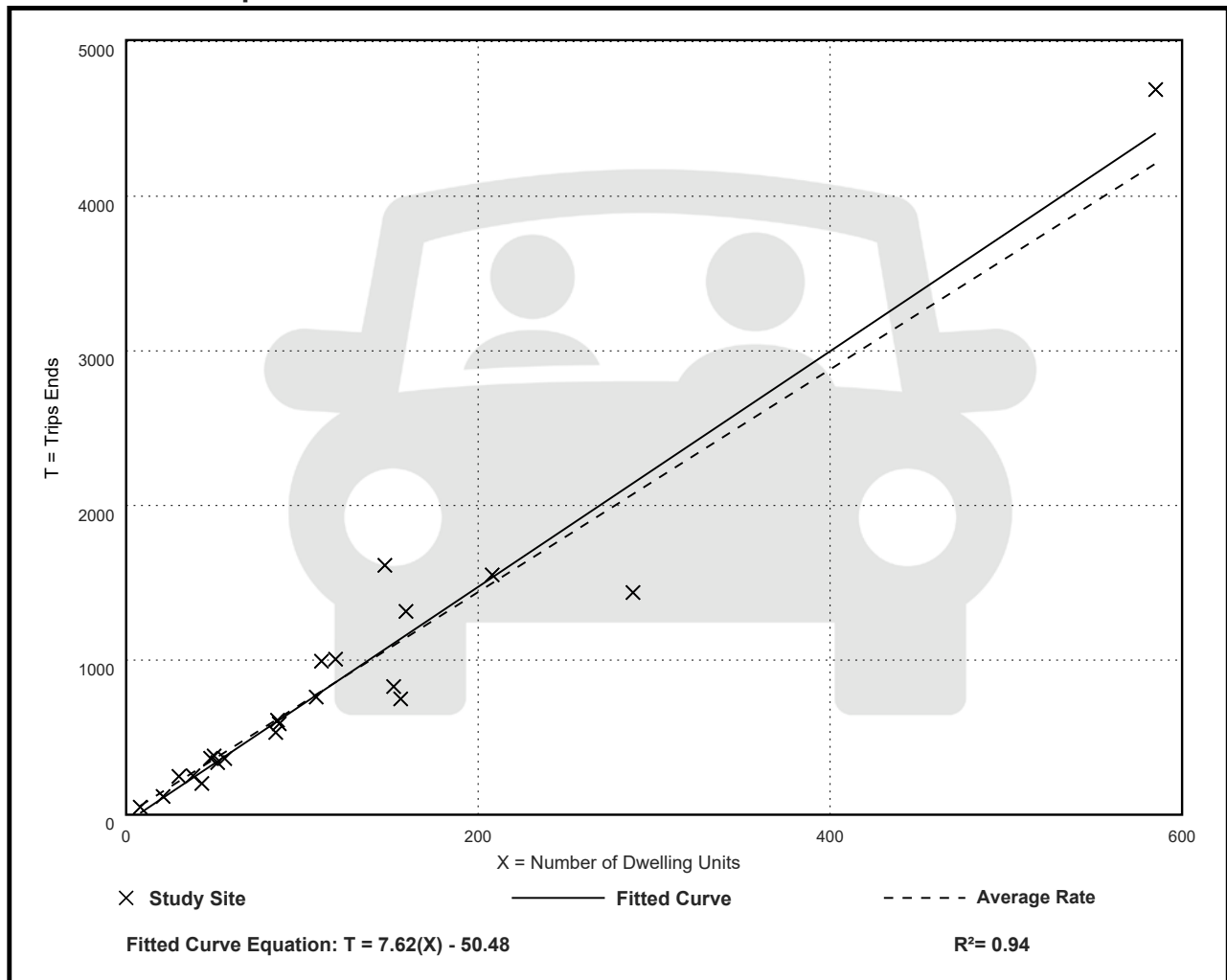
Avg. Num. of Dwelling Units: 120

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
7.20	4.70 - 10.97	1.61

Data Plot and Equation



Single-Family Attached Housing (215)

Vehicle Trip Ends vs: Dwelling Units

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: 46

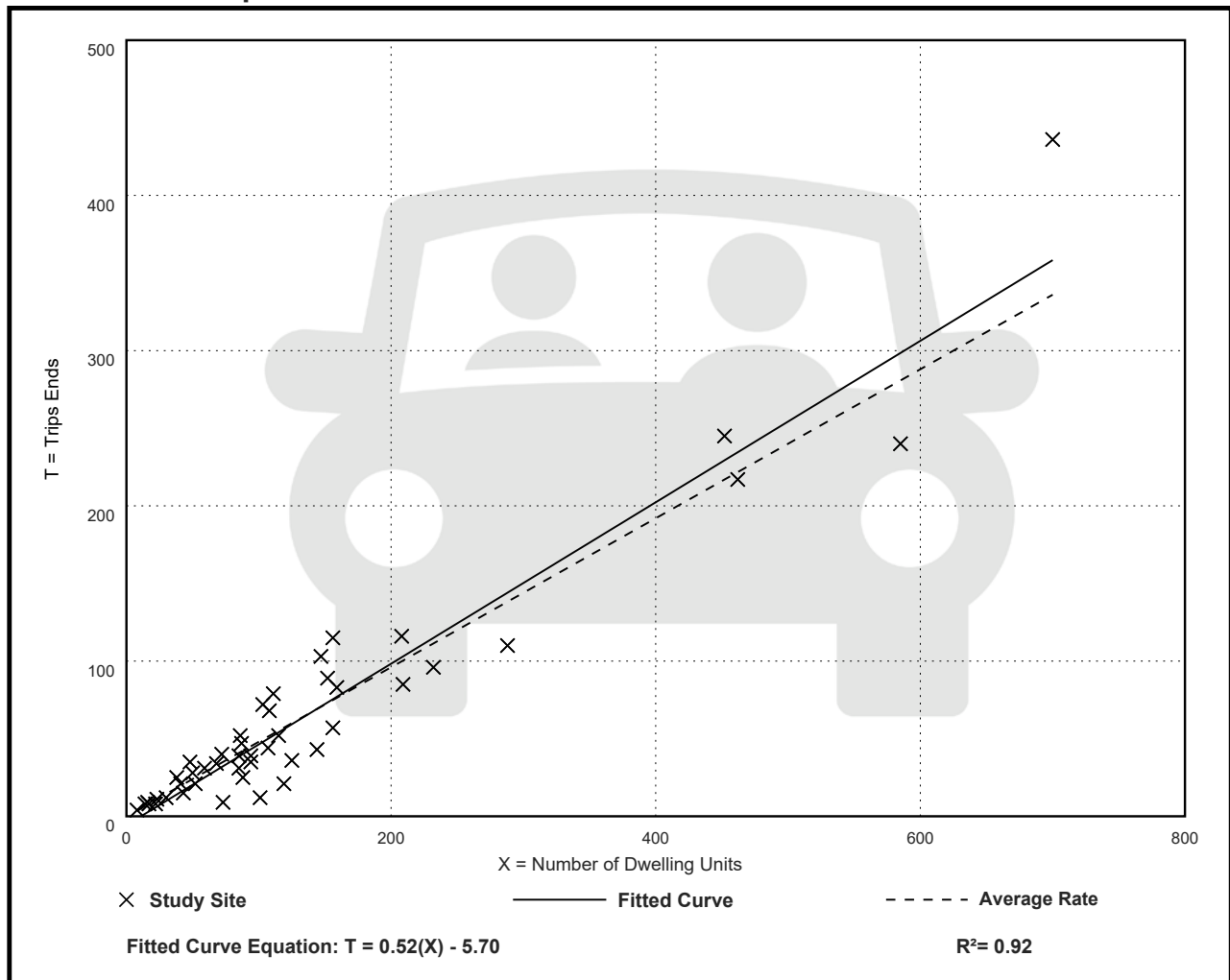
Avg. Num. of Dwelling Units: 135

Directional Distribution: 31% entering, 69% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.48	0.12 - 0.74	0.14

Data Plot and Equation



Single-Family Attached Housing (215)

Vehicle Trip Ends vs: Dwelling Units

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: 51

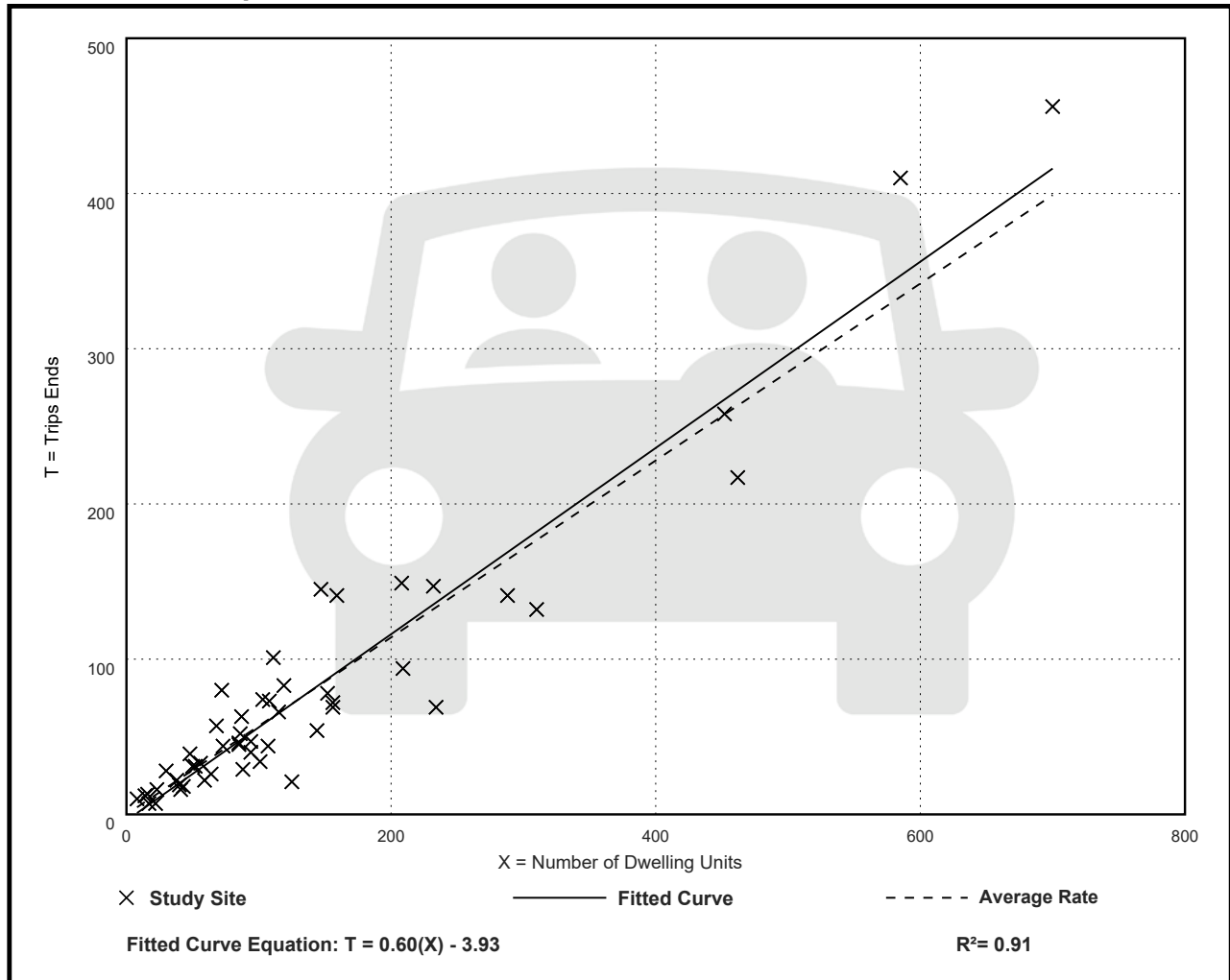
Avg. Num. of Dwelling Units: 136

Directional Distribution: 57% entering, 43% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.57	0.17 - 1.25	0.18

Data Plot and Equation



Land Use: 221

Multifamily Housing (Mid-Rise)

Description

Mid-rise multifamily housing includes apartments and condominiums located in a building that has between four and 10 floors of living space. Access to individual dwelling units is through an outside building entrance, a lobby, elevator, and a set of hallways.

Multifamily housing (low-rise) (Land Use 220), multifamily housing (high-rise) (Land Use 222), off-campus student apartment (mid-rise) (Land Use 226), and mid-rise residential with ground-floor commercial (Land Use 231) are related land uses.

Land Use Subcategory

Data are presented for two subcategories for this land use: (1) not close to rail transit and (2) close to rail transit. A site is considered close to rail transit if the walking distance between the residential site entrance and the closest rail transit station entrance is ½ mile or less.

Additional Data

For the six sites for which both the number of residents and the number of occupied dwelling units were available, there were an average of 2.5 residents per occupied dwelling unit.

For the five sites for which the numbers of both total dwelling units and occupied dwelling units were available, an average of 96 percent of the total dwelling units were occupied.

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (<https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>).

It is expected that the number of bedrooms and number of residents are likely correlated to the trips generated by a residential site. To assist in future analysis, trip generation studies of all multifamily housing should attempt to obtain information on occupancy rate and on the mix of residential unit sizes (i.e., number of units by number of bedrooms at the site complex).

The sites were surveyed in the 1990s, the 2000s, the 2010s, and the 2020s in Alberta (CAN), California, District of Columbia, Florida, Georgia, Illinois, Maryland, Massachusetts, Minnesota, Montana, New Jersey, New York, Ontario (CAN), Oregon, Utah, and Virginia.

Source Numbers

168, 188, 204, 305, 306, 321, 818, 857, 862, 866, 901, 904, 910, 949, 951, 959, 963, 964, 966, 967, 969, 970, 1004, 1014, 1022, 1023, 1025, 1031, 1032, 1035, 1047, 1056, 1057, 1058, 1071, 1076

Multifamily Housing (Mid-Rise) Not Close to Rail Transit (221)

Vehicle Trip Ends vs: Dwelling Units
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 11

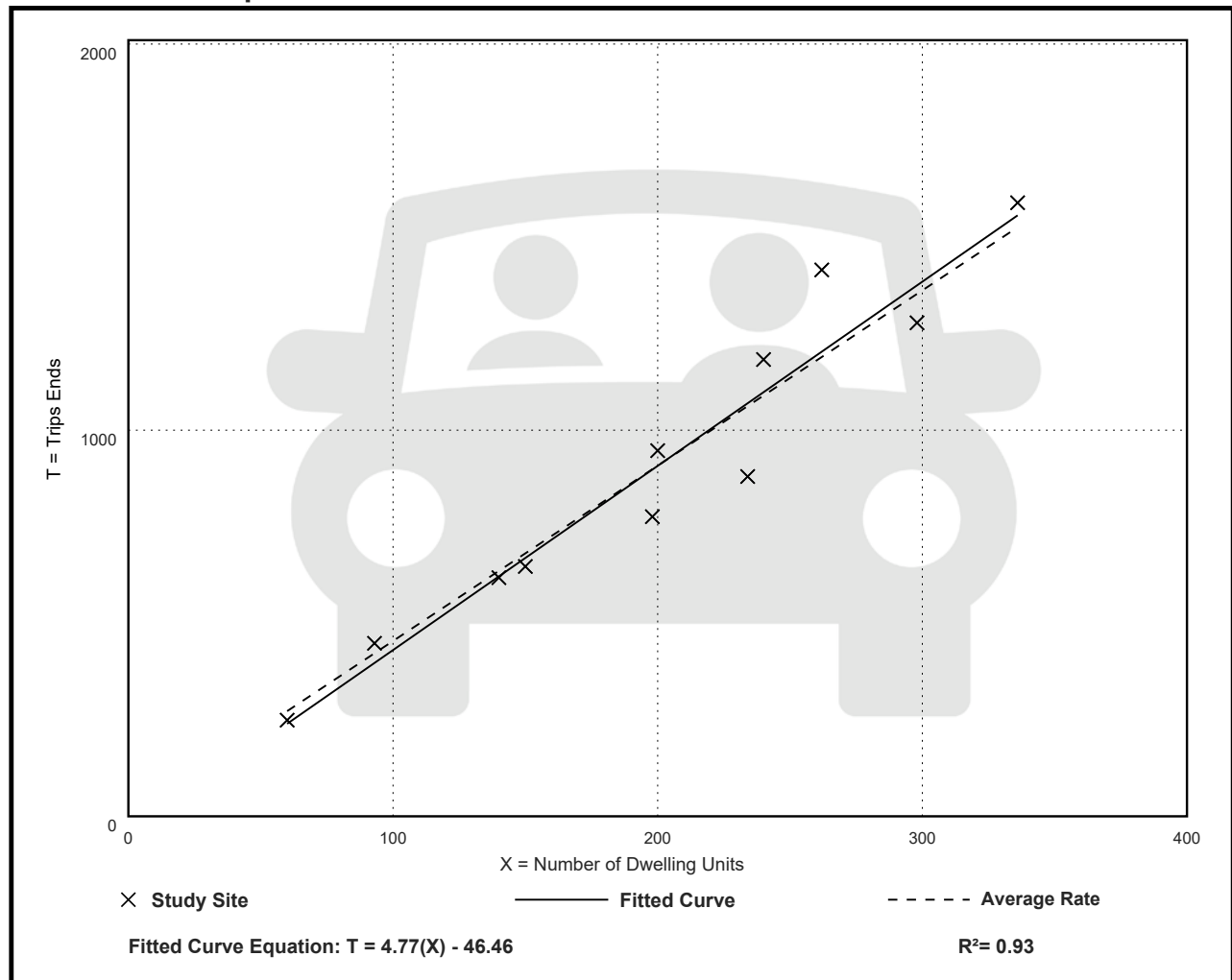
Avg. Num. of Dwelling Units: 201

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
4.54	3.76 - 5.40	0.51

Data Plot and Equation



Multifamily Housing (Mid-Rise) Not Close to Rail Transit (221)

Vehicle Trip Ends vs: Dwelling Units

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: 30

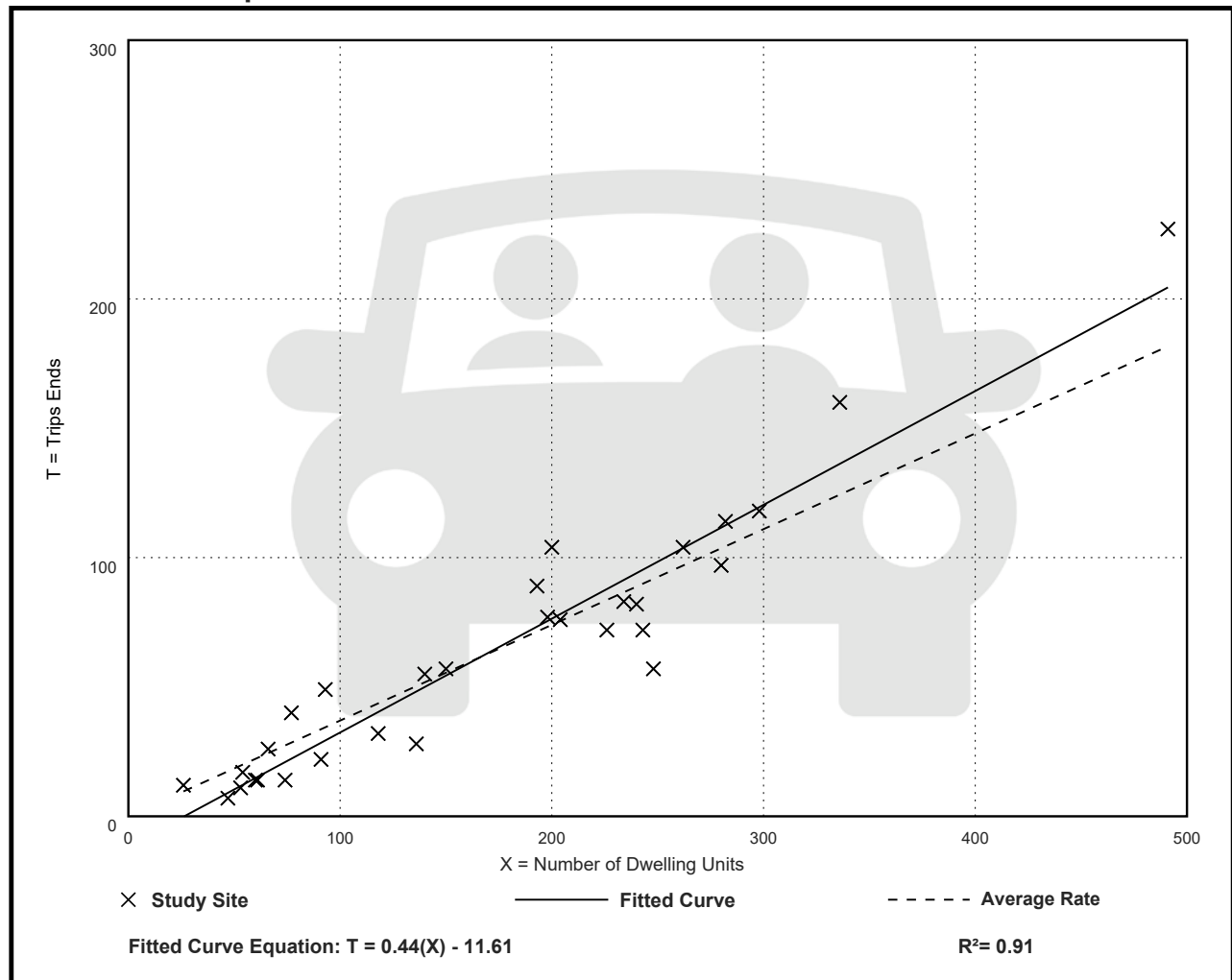
Avg. Num. of Dwelling Units: 173

Directional Distribution: 23% entering, 77% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.37	0.15 - 0.53	0.09

Data Plot and Equation



Multifamily Housing (Mid-Rise) Not Close to Rail Transit (221)

Vehicle Trip Ends vs: Dwelling Units

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: 31

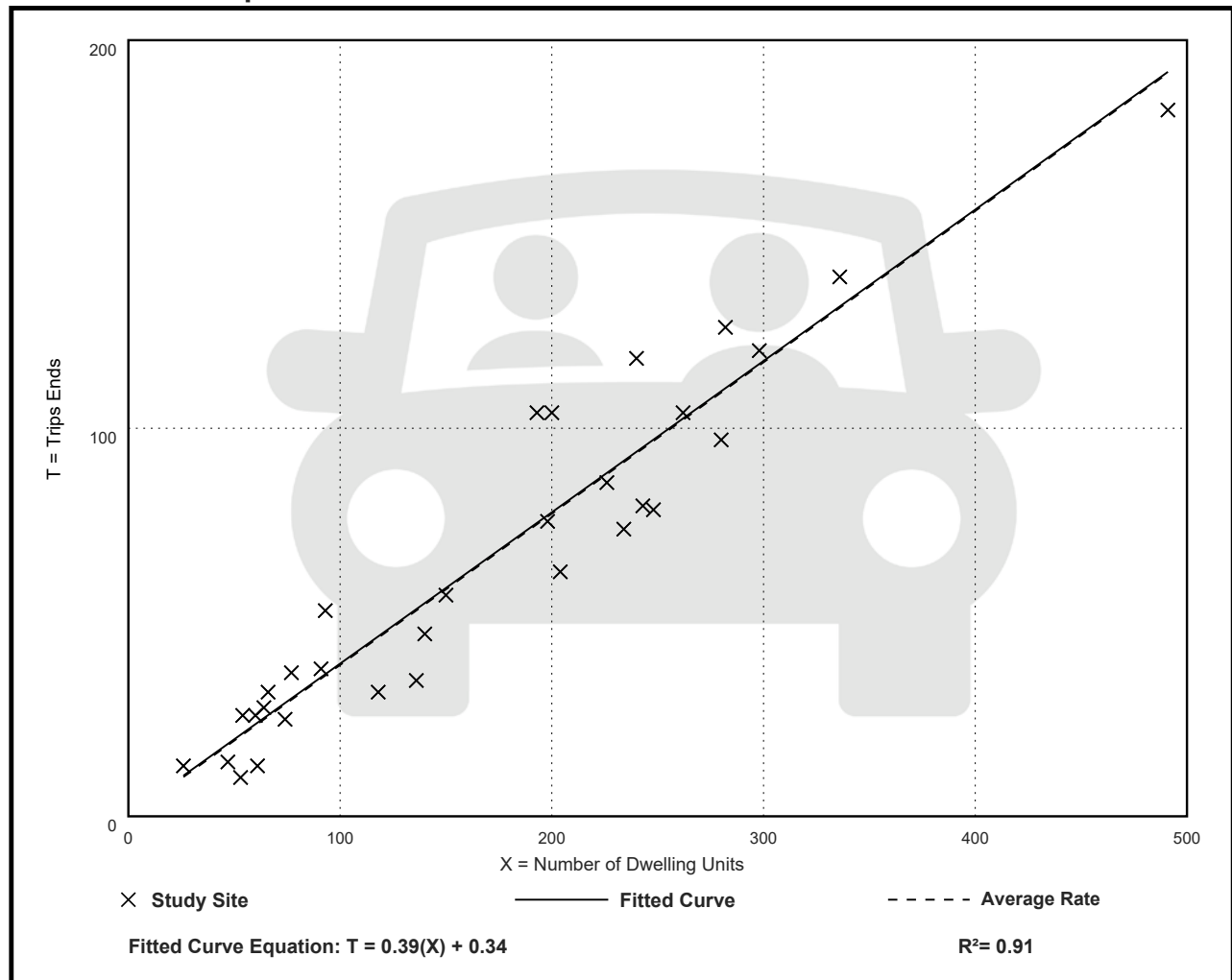
Avg. Num. of Dwelling Units: 169

Directional Distribution: 61% entering, 39% exiting

Vehicle Trip Generation per Dwelling Unit

Average Rate	Range of Rates	Standard Deviation
0.39	0.19 - 0.57	0.08

Data Plot and Equation



Land Use: 310

Hotel

Description

A hotel is a place of lodging that provides sleeping accommodations and supporting facilities such as a full-service restaurant, cocktail lounge, meeting rooms, banquet room, and convention facilities. A hotel typically provides a swimming pool or another recreational facility such as a fitness room. All suites hotel (Land Use 311), business hotel (Land Use 312), motel (Land Use 320), and resort hotel (Land Use 330) are related uses.

Additional Data

Twenty-five studies provided information on occupancy rates at the time the studies were conducted. The average occupancy rate for these studies was approximately 82 percent.

Some properties in this land use provide guest transportation services (e.g., airport shuttle, limousine service, golf course shuttle service) which may have an impact on the overall trip generation rates.

The technical appendices provide supporting information on time-of-day distributions for this land use. The appendices can be accessed through either the ITETripGen web app or the trip generation resource page on the ITE website (<https://www.ite.org/technical-resources/topics/trip-and-parking-generation/>).

The sites were surveyed in the 1980s, the 1990s, the 2000s, and the 2010s in California, District of Columbia, Florida, Georgia, Indiana, Minnesota, New York, Ontario (CAN), Pennsylvania, South Dakota, Texas, Vermont, Virginia, and Washington.

For all lodging uses, it is important to collect data on occupied rooms as well as total rooms in order to accurately predict trip generation characteristics for the site.

Trip generation at a hotel may be related to the presence of supporting facilities such as convention facilities, restaurants, meeting/banquet space, and retail facilities. Future data submissions should specify the presence of these amenities. Reporting the level of activity at the supporting facilities such as full, empty, partially active, number of people attending a meeting/banquet during observation may also be useful in further analysis of this land use.

Source Numbers

170, 260, 262, 277, 280, 301, 306, 357, 422, 507, 577, 728, 867, 872, 925, 951, 1009, 1021, 1026, 1046

Hotel (310)

Vehicle Trip Ends vs: Rooms
On a: Weekday

Setting/Location: General Urban/Suburban

Number of Studies: 7

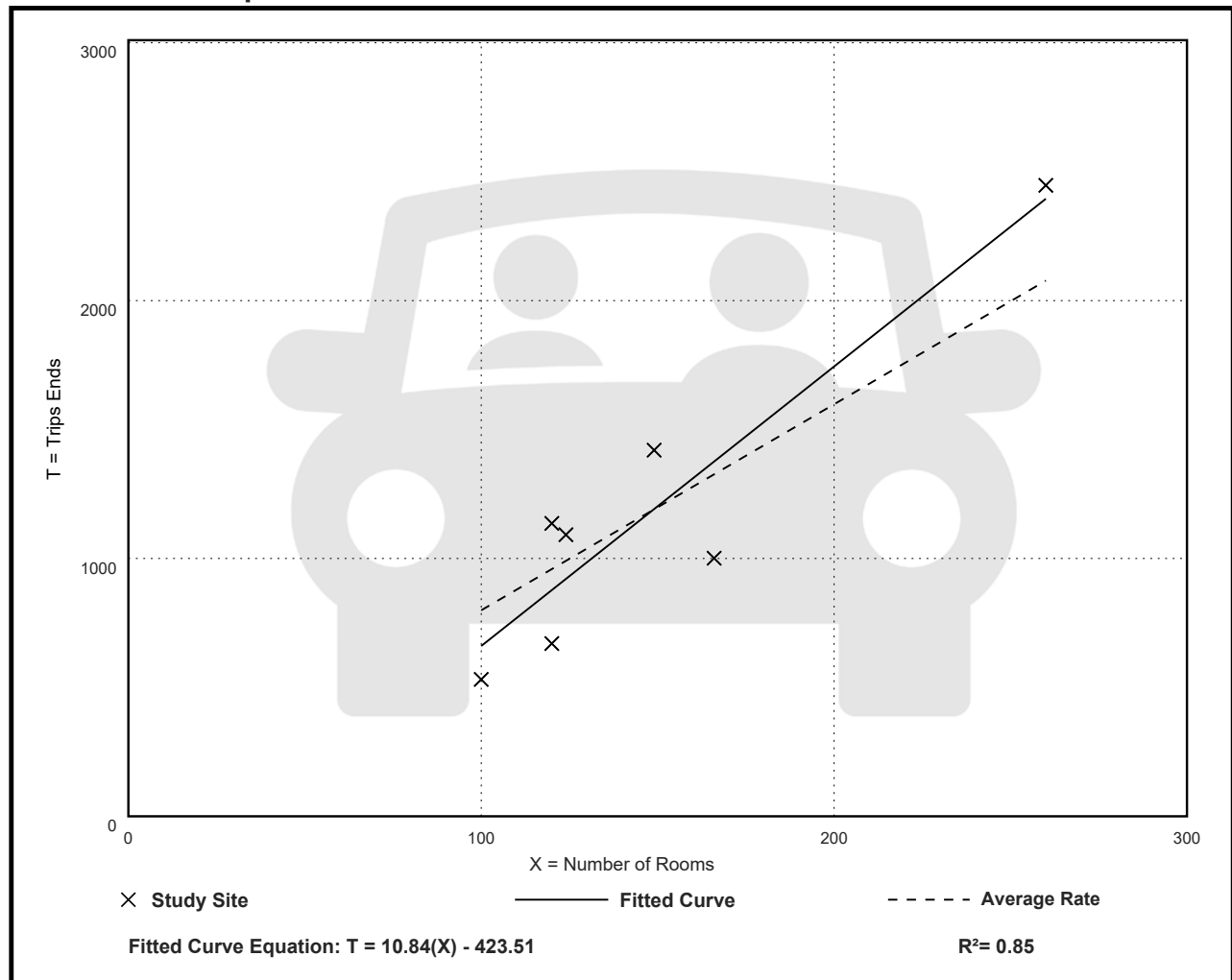
Avg. Num. of Rooms: 148

Directional Distribution: 50% entering, 50% exiting

Vehicle Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
7.99	5.31 - 9.53	1.92

Data Plot and Equation



Hotel (310)

Vehicle Trip Ends vs: Rooms

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: 28

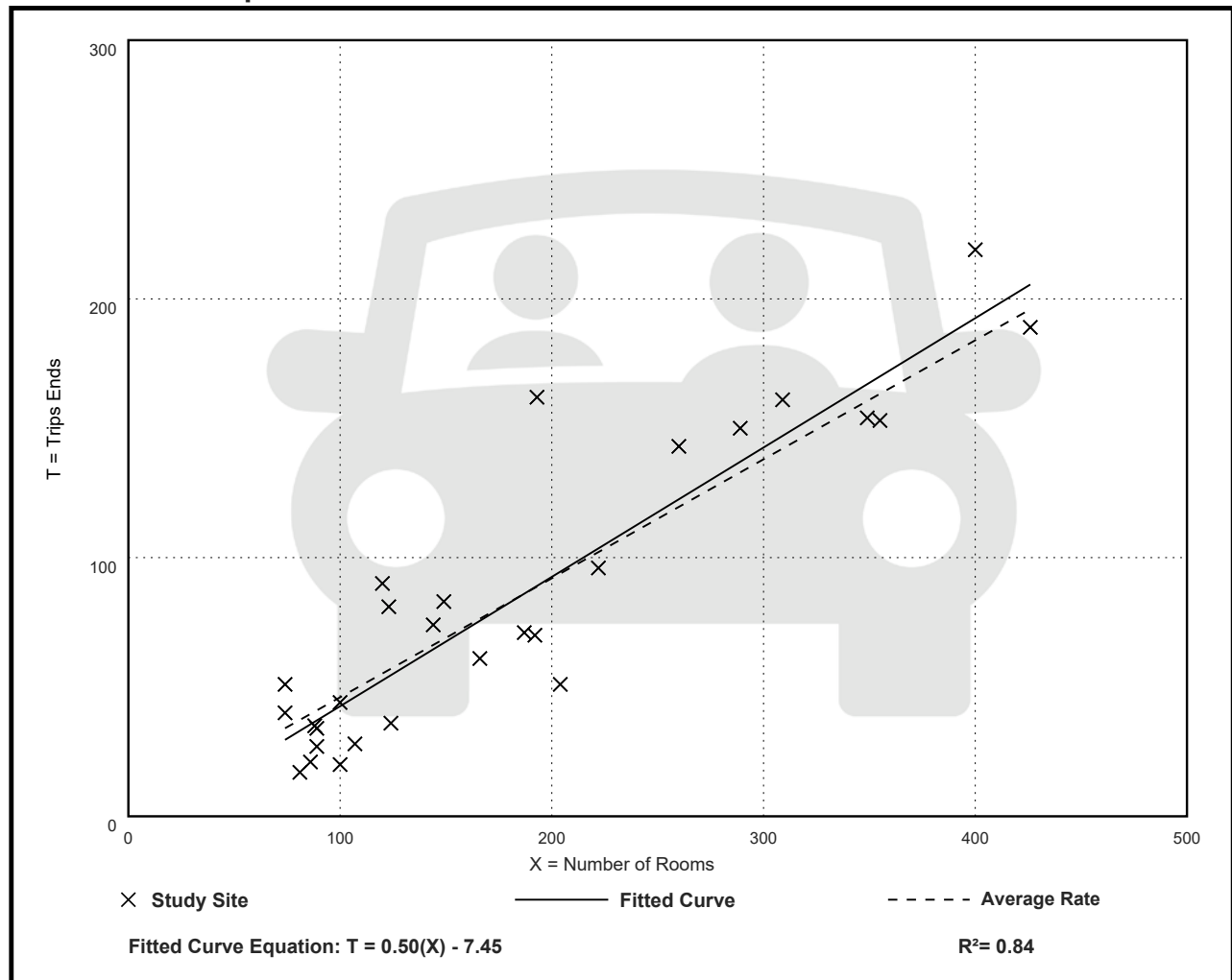
Avg. Num. of Rooms: 182

Directional Distribution: 56% entering, 44% exiting

Vehicle Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
0.46	0.20 - 0.84	0.14

Data Plot and Equation



Hotel (310)

Vehicle Trip Ends vs: Rooms

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: 31

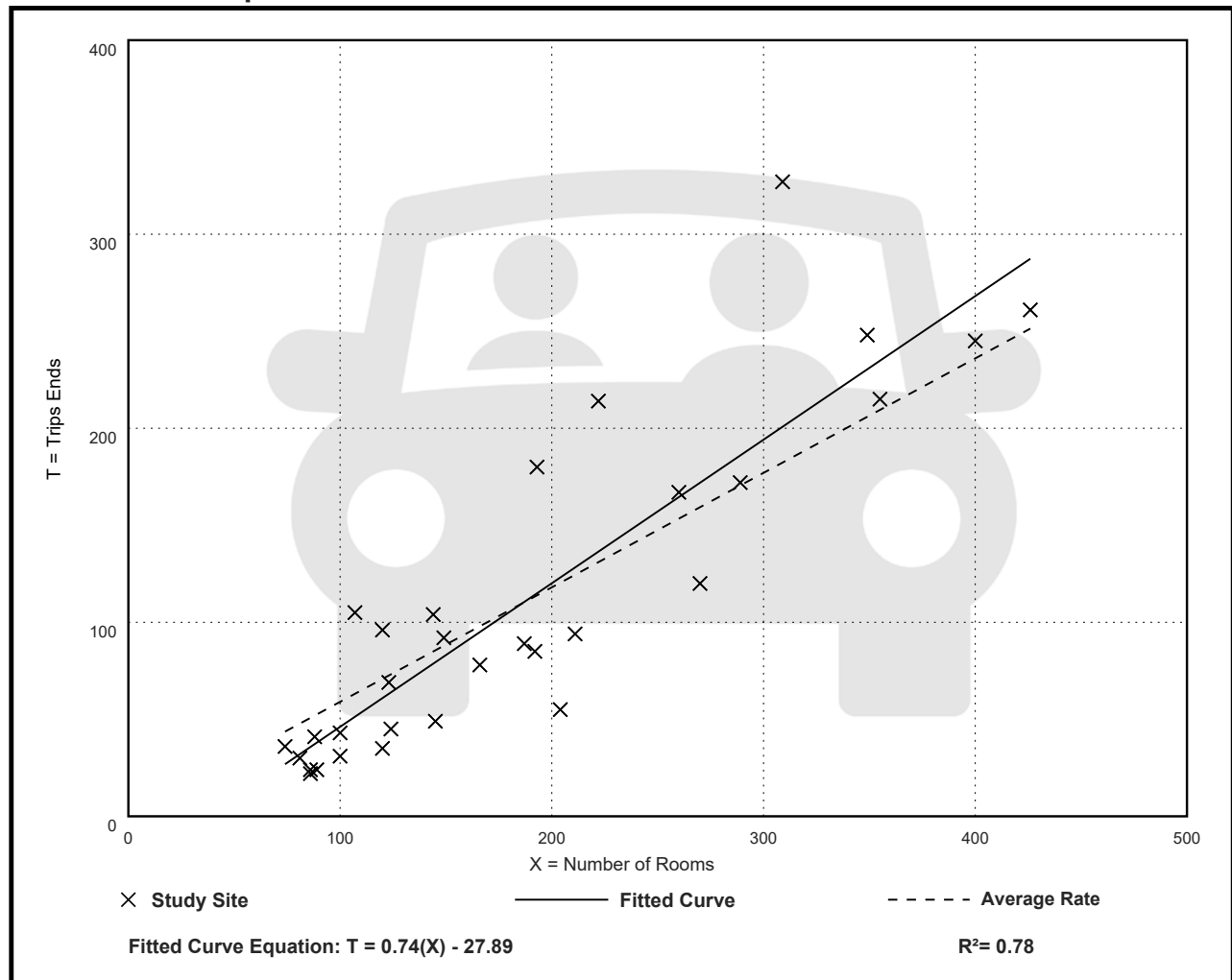
Avg. Num. of Rooms: 186

Directional Distribution: 51% entering, 49% exiting

Vehicle Trip Generation per Room

Average Rate	Range of Rates	Standard Deviation
0.59	0.26 - 1.06	0.22

Data Plot and Equation



Hotel (310)

Vehicle Trip Ends vs: Occupied Rooms

On a: Saturday, Peak Hour of Generator

Setting/Location: General Urban/Suburban

Number of Studies: 4

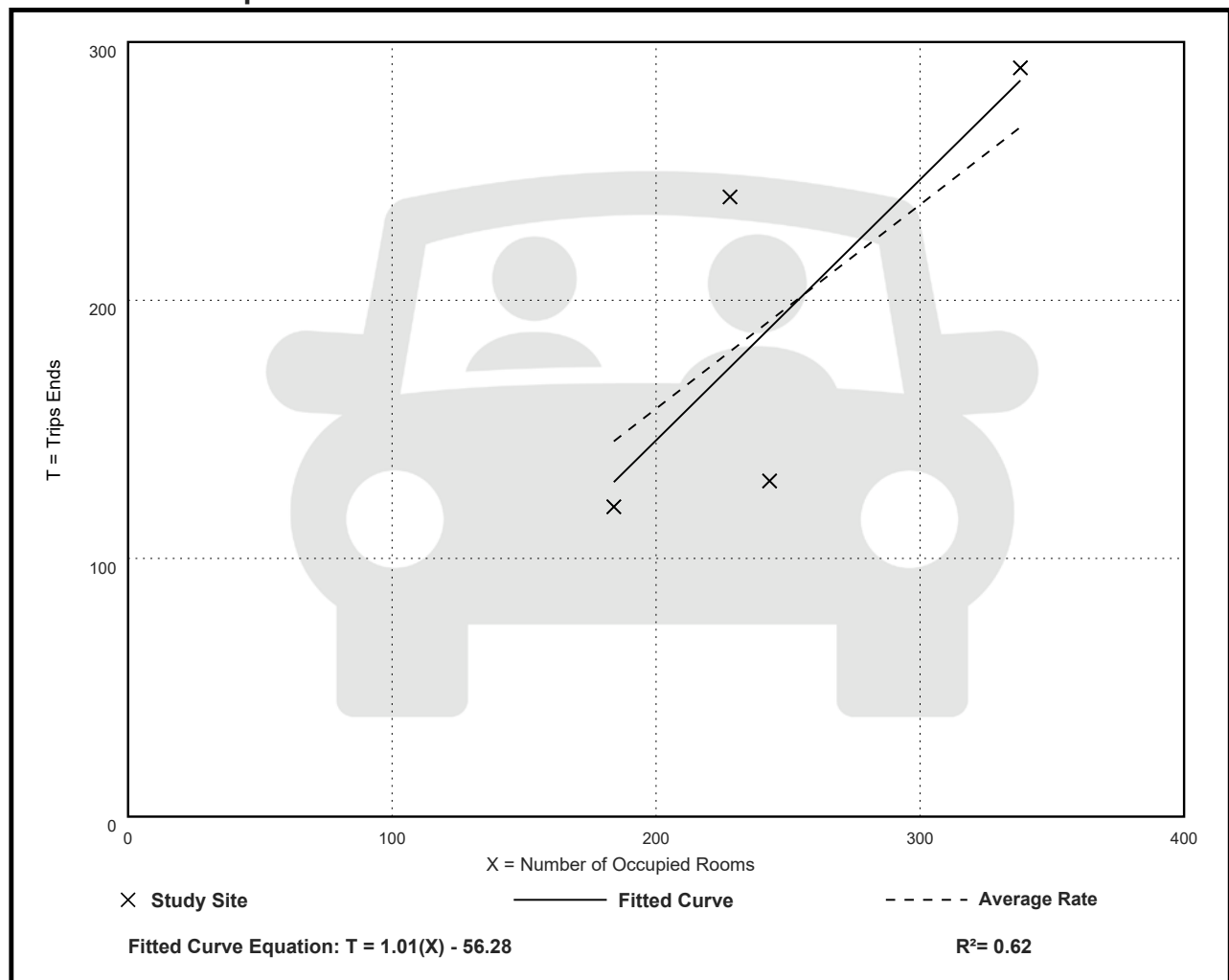
Avg. Num. of Occupied Rooms: 248

Directional Distribution: 45% entering, 55% exiting

Vehicle Trip Generation per Occupied Room

Average Rate	Range of Rates	Standard Deviation
0.79	0.53 - 1.05	0.22

Data Plot and Equation



APPENDIX E

Traffic Classification Counts The Standard

TABLE E-1
Traffic Counts on Saturday, March 2, 2024 (10:00 AM to 8:00 PM)
The Standard Hotel, Miami Beach, Florida

Inbound Vehicles Driven by Owner arriving at Hotel =	139
Outbound Vehicles Driven by Valet to off-site Valet Parking Lot =	139
Inbound Vehicles Driven by Valet from off-site Valet Parking Lot =	86
Outbound Vehicles Driven by Owner leaving hotel =	86
Outbound Hotel SUV/Golf Carts to off-site Valet Parking Lot =	62
Inbound Hotel SUV/Golf Carts from off-site Valet Parking Lot =	100
Hotel Patrons arriving/departing by Uber (Trips)	212
Hotel Patrons arriving/departing by Taxi (Trips)	2
Truck Trips	12
Total Vehicle-Trips Recorded with off-site Valet Parking Lot =	838
Vehicle-Trips created by off-site Valet Parking Lot =	387
Vehicle-Trips without off-site Valet Parking Lot =	451
Total Vehicle-Trips Recorded (838) divided by Total Vehicle Trips without off-site Valet Lot (451) =	1.86

Source: Video Data Solutions (Saturday, March 2, 2024)

The average of the 3-day counts (1.86, 1.86 and 2.03) is 1.92.

TABLE E-2
Traffic Counts on Saturday, May 11, 2024 (10:00 AM to 8:00 PM)
The Standard Hotel, Miami Beach, Florida

Inbound Vehicles Driven by Owner arriving at Hotel =	138
Outbound Vehicles Driven by Valet to off-site Valet Parking Lot =	138
Inbound Vehicles Driven by Valet from off-site Valet Parking Lot =	87
Outbound Vehicles Driven by Owner leaving hotel =	87
Outbound Hotel SUV/Golf Carts to off-site Valet Parking Lot =	39
Inbound Hotel SUV/Golf Carts from off-site Valet Parking Lot =	62
Hotel Patrons arriving/departing by Uber (Trips)	132
Hotel Patrons arriving/departing by Taxi (Trips)	8
Truck Trips	16
Total Vehicle-Trips Recorded with off-site Valet Parking Lot =	707
Vehicle-Trips created by off-site Valet Parking Lot =	326
Vehicle-Trips without off-site Valet Parking Lot =	381
Total Vehicle-Trips Recorded (707) divided by Total Vehicle Trips without off-site Valet Lot (381) =	1.86

Source: Video Data Solutions (Saturday, May 11, 2024)

TABLE E-3
Traffic Counts on Saturday, May 18, 2024 (10:00 AM to 8:00 PM)
The Standard Hotel, Miami Beach, Florida

Inbound Vehicles Driven by Owner arriving at Hotel =	122
Outbound Vehicles Driven by Valet to off-site Valet Parking Lot =	122
Inbound Vehicles Driven by Valet from off-site Valet Parking Lot =	85
Outbound Vehicles Driven by Owner leaving hotel =	85
Outbound Hotel SUV/Golf Carts to off-site Valet Parking Lot =	49
Inbound Hotel SUV/Golf Carts from off-site Valet Parking Lot =	71
Hotel Patrons arriving/departing by Uber (Trips)	96
Hotel Patrons arriving/departing by Taxi (Trips)	2
Truck Trips	12
Total Vehicle-Trips Recorded with off-site Valet Parking Lot =	644
Vehicle-Trips created by off-site Valet Parking Lot =	327
Vehicle-Trips without off-site Valet Parking Lot =	317
Total Vehicle-Trips Recorded (644) divided by Total Vehicle Trips without off-site Valet Lot (317) =	2.03

Source: Video Data Solutions (Saturday, May 18, 2024)

APPENDIX F

Valet Analysis

Queuing Analysis based on ITE Procedures The Standard (Parking Valet Vehicles)

$$q = 38 \text{ veh/hr (demand rate)}$$

$$Q = 25 \text{ veh/hr (service rate*)}$$

$$p = \frac{q}{NQ} = 0.5067 \text{ (N = 3 valet runners)}$$

$$Q_M = 0.5067$$

Using Acceptable Probability of 5% (95% Confidence Level)

$$M = \left(\frac{\text{Ln}(x > M) - \text{Ln}(Q_M)}{\text{Ln}(p)} \right) - 1$$

$$M = \left(\frac{\text{Ln}(0.05) - \text{Ln}(0.5067)}{\text{Ln}(0.5067)} \right) - 1$$

$$M = \left(\frac{-2.9957 - (-0.6798)}{-0.6798} \right) - 1$$

$$M = 3.4 - 1 = 2.4, \text{ say 3 vehicles}$$

- Ticket processing time = **60 sec.** + vehicle travel time at 15 mph (730 feet) = **33 sec.**
+ walking/running time at 10 ft/sec for 450 feet = **45 sec.** + gate delay = **6 sec**
= 144 seconds (25.0 vehicles per hour), **say 25 veh/hr.**

Queuing Analysis based on ITE Procedures The Standard (Retrieval Valet Vehicles)

$$q = 47 \text{ veh/hr (demand rate)}$$

$$Q = 28 \text{ veh/hr (service rate*)}$$

$$p = \frac{q}{NQ} = 0.5595 \text{ (N = 3 valet runners)}$$

$$Q_M = 0.5595$$

Using Acceptable Probability of 5% (95% Confidence Level)

$$M = \left(\frac{\text{Ln}(x > M) - \text{Ln}(Q_M)}{\text{Ln}(p)} \right) - 1$$

$$M = \left(\frac{\text{Ln}(0.05) - \text{Ln}(0.5595)}{\text{Ln}(0.5595)} \right) - 1$$

$$M = \left(\frac{-2.9957 - (-0.5807)}{-0.5807} \right) - 1$$

$$M = 4.2 - 1 = 3.2, \text{ say 4 vehicles}$$

- Walking/Running time at 10 ft/sec for 260 feet = **26 sec.** + Tandem Parking = **60 sec.**
+ vehicle travel time at 15 mph (260 feet) = **12 sec.** + exchange drivers = **30 sec.**
= 128 seconds (28.1 vehicles per hour), **say 28 veh/hr.**

location, a 5% probability of back-up onto the adjacent street is judged to be acceptable. Demand on the system for design is expected to be 110 vehicles in a 45-minute period. Average service time was expected to be 2.2 minutes. Is the queue storage adequate?

Such problems can be quickly solved using Equation (8-9b) given in Table 8-10 and repeated below for convenience.

$$M = \left[\frac{\ln P(x > M) - \ln Q_M}{\ln \rho} \right] - 1$$

where:

M = queue length which is exceeded p percent of the time

N = number of service channels (drive-in positions)

Q = service rate per channel (vehicles per hour)

$\rho = \frac{\text{demand rate}}{\text{service rate}} = \frac{q}{NQ} = \text{utilization factor}$

q = demand rate on the system (vehicles per hour)

Q_M = tabled values of the relationship between queue length, number of channels, and utilization factor (see Table 8.11)

TABLE 8-11
Table of Q_M Values

	$N = 1$	2	3	4	6	8	10
0.0	0.0000	0.0000	0.0000	0.0000			
0.1	.1000	.0182	.0037	.0008	.0000	0.0000	0.0000
.2	.2000	.0666	.0247	.0096	.0015	.0002	.0000
.3	.3000	.1385	.0700	.0370	.0111	.0036	.0011
.4	.4000	.2286	.1411	.0907	.0400	.0185	.0088
.5	.5000	.3333	.2368	.1739	.0991	.0591	.0360
.6	.6000	.4501	.3548	.2870	.1965	.1395	.1013
.7	.7000	.5766	.4923	.4286	.3359	.2706	.2218
.8	.8000	.7111	.6472	.5964	.5178	.4576	.4093
.9	.9000	.8526	.8172	.7878	.7401	.7014	.6687
1.0	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000	1.0000

$$\rho = \frac{q}{NQ} = \frac{\text{arrival rate, total}}{(\text{number of channels})(\text{service rate per channel})}$$

N = number of channels (service positions)

Solution

Step 1: $Q = \frac{60 \text{ min/hr}}{2.2 \text{ min/service}} = 27.3 \text{ services per hour}$

Step 2: $q = (110 \text{ veh/45 min}) \times (60 \text{ min/hr}) = 146.7 \text{ vehicles per hour}$

Step 3: $\rho = \frac{q}{NQ} = \frac{146.7}{(6)(27.3)} = 0.8956$

Step 4: $Q_M = 0.7303$ by interpolation between 0.8 and 0.9 for $N = 6$ from the table of Q_M values (see Table 8-11).

Step 5: The acceptable probability of the queue, M , being longer than the storage, 18 spaces in this example, was stated to be 5%. $P(x > M) = 0.05$, and:

$$M = \left[\frac{\ln 0.05 - \ln 0.7303}{\ln 0.8956} \right] - 1 = \left[\frac{-2.996 - (-0.314)}{-0.110} \right] - 1$$

$$= 24.38 - 1 = 23.38, \text{ say } 23 \text{ vehicles.}$$