

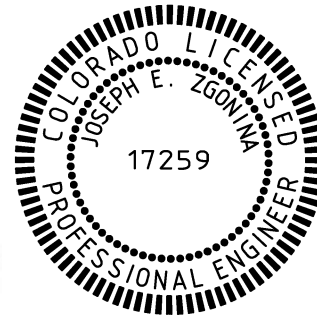
## TRAFFIC ANALYSIS

To: Ashley Zinger  
Aurora Cross Docking

From: Joseph E. Zgonina, P.E.

Date: October 15, 2021  
Revised December 21, 2021  
Revised February 16, 2022

RE: Aurora Cross Docking at Jasper Park  
Aurora, Colorado  
Haeger File No.: 21-150



EXPIRES 10-31-23

A handwritten signature in blue ink that reads "Joseph E. Zgonina".

### 1 – INTRODUCTION

Haeger Engineering LLC has prepared a Traffic Analysis for the proposed Aurora Cross Docking at Jasper Park development located at 15655 East 33<sup>rd</sup> Avenue in the City of Aurora, Colorado. This study was conducted to assess the impact the proposed development would have on traffic conditions and to evaluate traffic circulation through the development. The subject property is in Section 29, Township 3S, Range 66W. The project area is 3.64 acres, is zoned M-1, Light Industrial District, and is in the Industrial Hub placetype. The location map and aerial photograph of the site vicinity are illustrated on *Exhibit 1* in *Appendix A*.

The project consists of a 15,000 sq.ft. industrial building with 5 truck docks, 13 car parking spaces, and 72 truck parking spaces. Access to the site will consist of one full access drive connecting to 33<sup>rd</sup> Place and one full access drive connecting to Jasper Street. The site plan is illustrated on *Exhibit 2* in *Appendix A*. The previously approved plan for the property was a 52,290 sq.ft. industrial building with 16 truck docks and 95 car parking spaces.

### 2 – LAND USE

The subject property was a farm. Major land uses in the vicinity of the development include 32<sup>nd</sup> Avenue Distribution Center to the east and industrial developments to the north, south, and west.

### 3 – EXISTING ROADWAY NETWORK

A field investigation was conducted along the adjacent roadways. The following information was obtained about the existing roadway network.



### **E. 33<sup>rd</sup> PLACE**

- An east-west local roadway providing one lane in each direction that is under the jurisdiction of the City of Aurora.
- At its unsignalized T-intersection with Jasper Street, E. 33<sup>rd</sup> Place provides a single general-purpose lane at the west approach, operating under Stop sign control.
- At its unsignalized intersection with Helena Street, E. 33<sup>rd</sup> Place provides a single general-purpose lane at the east and west approaches.

### **JASPER STREET**

- A north-south local roadway providing one lane in each direction that is under the jurisdiction of the City of Aurora.
- At its unsignalized T-intersection with E. 33<sup>rd</sup> Place, Jasper Street provides a single general-purpose lane at the north and south approaches.
- At its unsignalized T-intersection with E. 33<sup>rd</sup> Avenue, Jasper Street provides a single general-purpose lane at the north and south approaches.
- The posted speed limit on Jasper Street is 25 MPH.

### **E. 33<sup>rd</sup> AVENUE**

- An east-west local roadway providing one lane in each direction that is under the jurisdiction of the City of Aurora.
- At its unsignalized T-intersection with Jasper Street, E. 33<sup>rd</sup> Avenue provides a single general-purpose lane at the west approach.
- At its unsignalized intersection with Helena Street, E. 33<sup>rd</sup> Avenue provides a single general-purpose lane at the east and west approaches.

### **HELENA STREET**

- A north-south local roadway providing one lane in each direction that is under the jurisdiction of the City of Aurora.
- At its unsignalized intersection with E. 33<sup>rd</sup> Place, Helena Street provides a single general-purpose lane at the north and south approaches, operating under Yield sign control.
- At its unsignalized T-intersection with E. 33<sup>rd</sup> Avenue, Helena Street provides a single general-purpose lane at the north approach, operating under Yield sign control.

## **4 – PEAK HOUR TRIP GENERATION**

In order to accurately estimate the traffic that will be generated by the proposed development, data compiled by the Institute of Transportation Engineers (ITE) in the 10<sup>th</sup> Edition of the *Trip Generation Manual* was utilized. Trip generation for a proposed development depends on the size and characteristics of the anticipated land use. The volume of traffic generated by the number of units of the proposed facility was used to determine anticipated traffic volume. The ITE land use code that was consulted for this analysis is indicated in **Table 1** along with the estimated weekday AM peak hour, weekday PM peak hour, and weekday daily traffic volumes. The previously approved industrial development trip generation is also included in **Table 1** for comparison.



Table 1 – ITE Land Use Code and Peak Hour Trip Generation

Land Use	ITE Code	Units	Peak Hour Traffic Volumes				Weekday Daily Trips	
			AM Peak		PM Peak			
			In	Out	In	Out	In	Out
Previously Approved Industrial Development	150	52,290 sf	23	13	7	23	64	64
Proposed Industrial Development	150	15,000 sf	21	11	6	19	34	35
Difference			-2	-2	-1	-4	-30	-29

As indicated in **Table 1**, there will be a reduction in trips from the previously approved industrial development to the proposed industrial development. Total daily trips will be reduced by roughly 46%, while AM peak hour traffic volume will decrease 11% and PM peak hour traffic volume will decrease 17%. The proposed hourly trips are well below the 75 trips / hour requiring a complete traffic impact study.

## 5 – INTERNAL CIRCULATION

The proposed site plan is designed for efficient traffic flow. The on-site drive aisles (24-ft for cars and 88-ft for trucks) allow sufficient room for vehicles to back out of / back in to parking spaces safely and efficiently. Access to the site will consist of two full access drives: one connecting to 33<sup>rd</sup> Place to the north and one connecting to Jasper Street to the east. Vehicles will enter the site at the 33<sup>rd</sup> Place driveway and exit at the Jasper Street driveway.

An AutoTurn analysis was performed to ensure that trucks can safely and efficiently access and circulate the site. The AutoTurn exhibit is included in **Appendix B**.

## 6 – QUEUING ANALYSIS

The hours of operation of the proposed use will be Monday to Friday from 8:00 AM to 6:00 PM and Saturday from 8:00 AM to 1:00 PM. Trucks entering the site will enter a code which will open the gate to allow entry into the site. The gate will close after the truck passes through the gate. It is assumed that the entire process takes 45 seconds from the time the truck arrives at the gate to the time the gate closes after entry. At a rate of 45 seconds, approximately 80 trucks can enter the site per hour. In order to determine the distribution of entering trucks, the *ITE Trip Generation Manual* Hourly Distribution of Entering and Exiting Vehicle Trips by Lane Use chart was used with a conservative assumption that 72 trucks will enter the site per day. Based on the chart, the highest percentage of trucks will enter the site between 1:00 PM and 2:00 PM with 24% or 17 trucks entering. The average number of trucks waiting to enter the site is 0.06 trucks. The 95<sup>th</sup> percentile queue is conservatively one truck length or 73.5 ft, and the queue length is provided on the site plan. The distance from the gate to the 33<sup>rd</sup> Place curb line is 73.5 ft. A Poisson Distribution was used to calculate the probability of two or more trucks arriving at the site per minute. It was determined that there is a 4.34% probability that two or more trucks will arrive at the site per minute, therefore queuing at the gate is anticipated to be low.



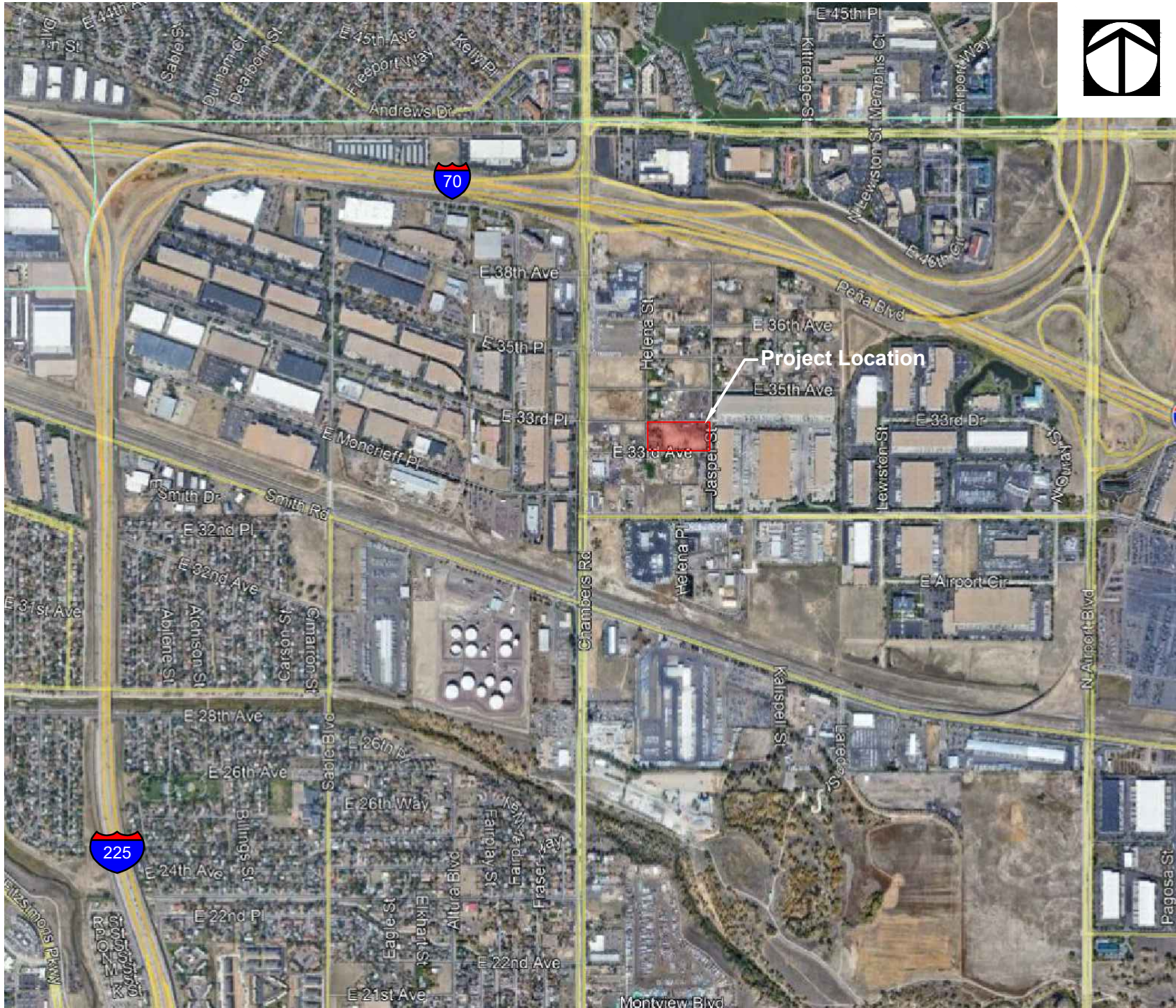
## **7 – RECOMMENDATIONS AND CONCLUSION**

Based on the traffic analysis for the industrial development, the recommendations and conclusions are summarized below:

- The proposed industrial development will generate a much lower traffic volume when compared with the previously approved industrial development.
- The site plan allows adequate site access and on-site circulation for passenger vehicles and trucks.
- Vehicles exiting the site should be under stop sign control.

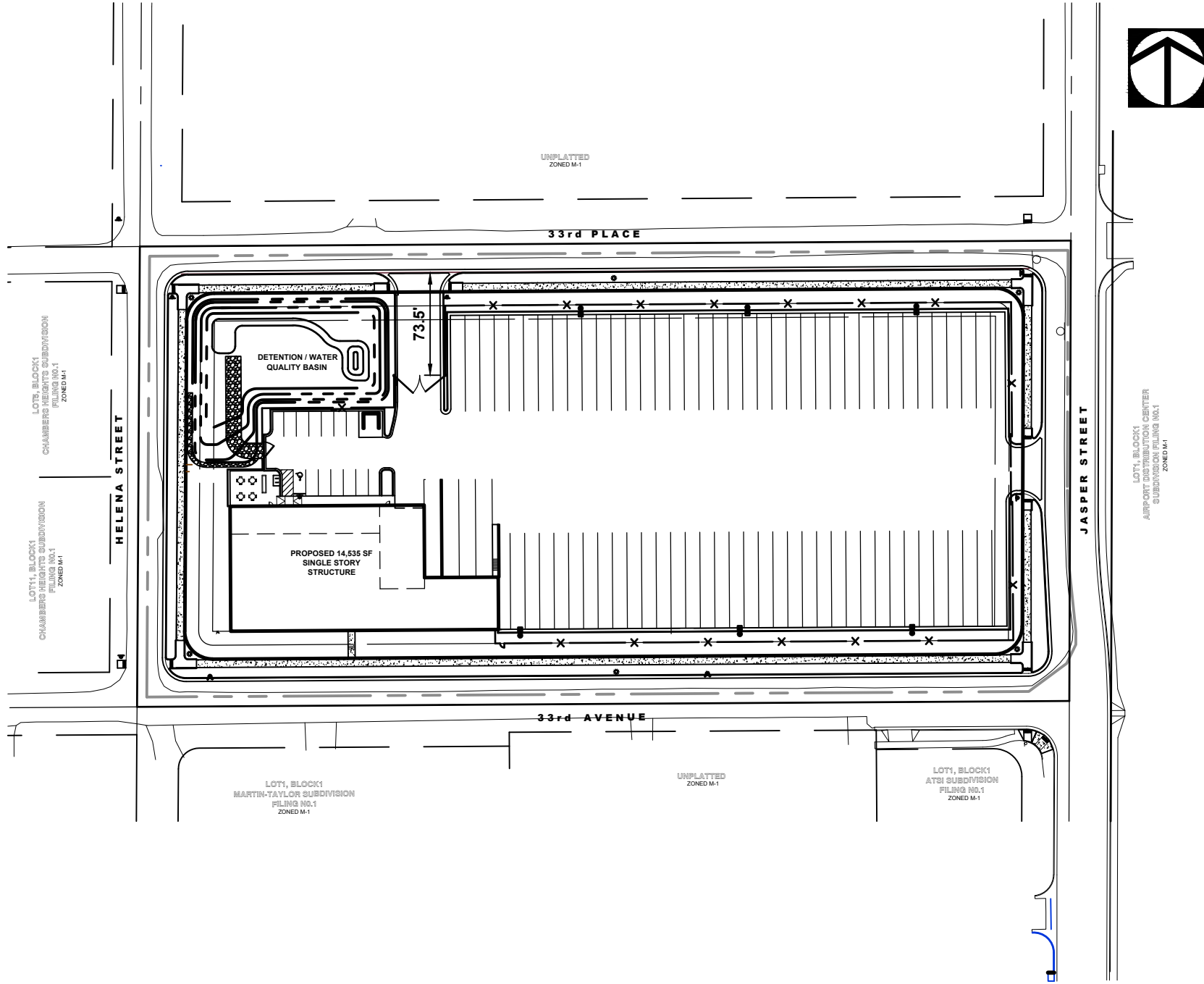


## **APPENDIX A - Exhibits**



**EXHIBIT 1**  
**LOCATION MAP**  
**AURORA CROSS DOCKING**  
**AT JASPER PARK**  
CITY OF AURORA, COLORADO

Project Manager: P L  
Engineer: J E Z  
Date: 10-15-2021  
Project No. 21150  
Sheet 1 / 1



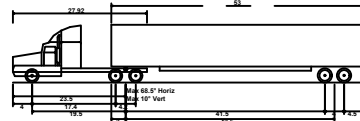
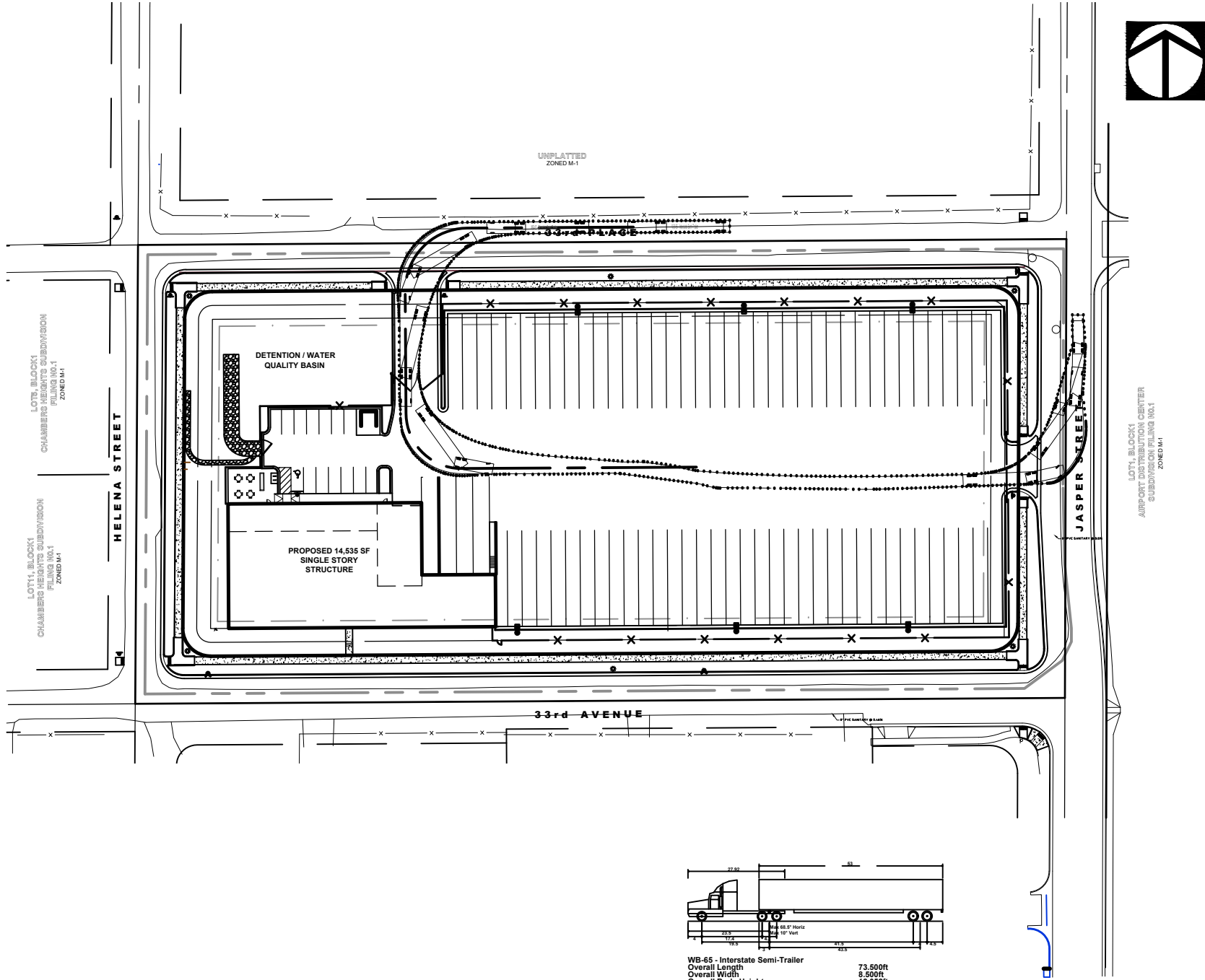
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**EXHIBIT 2  
 SITE PLAN**  
**AURORA CROSS DOCKING  
 AT JASPER PARK  
 CITY OF AURORA, COLORADO**

Project Manager: P L  
 Engineer: J E Z  
 Date: 02-16-2022  
 Project No. 21150  
 Sheet 1 / 1



## **APPENDIX B – AutoTurn Movement Analysis**



WB-65 - Interstate Semi-Trailer  
 Overall Length 73.500ft  
 Overall Width 8.500ft  
 Overall Body Height 12.052ft  
 Min Body Ground Clearance 1.334ft  
 Max Track Width 8.500ft  
 Lock-to-lock time 6.00s  
 Curb to Curb Turning Radius 45.000ft

**EXHIBIT 3**  
**AUTOTURN ANALYSIS**  
**AURORA CROSS DOCKING**  
**AT JASPER PARK**  
 CITY OF AURORA, COLORADO

Project Manager: P L  
 Engineer: J E Z  
 Date: 02-16-2022  
 Project No. 21150  
 Sheet 1 / 1



## **APPENDIX C – ITE Trip Generation Graphs**

# Warehousing (150)

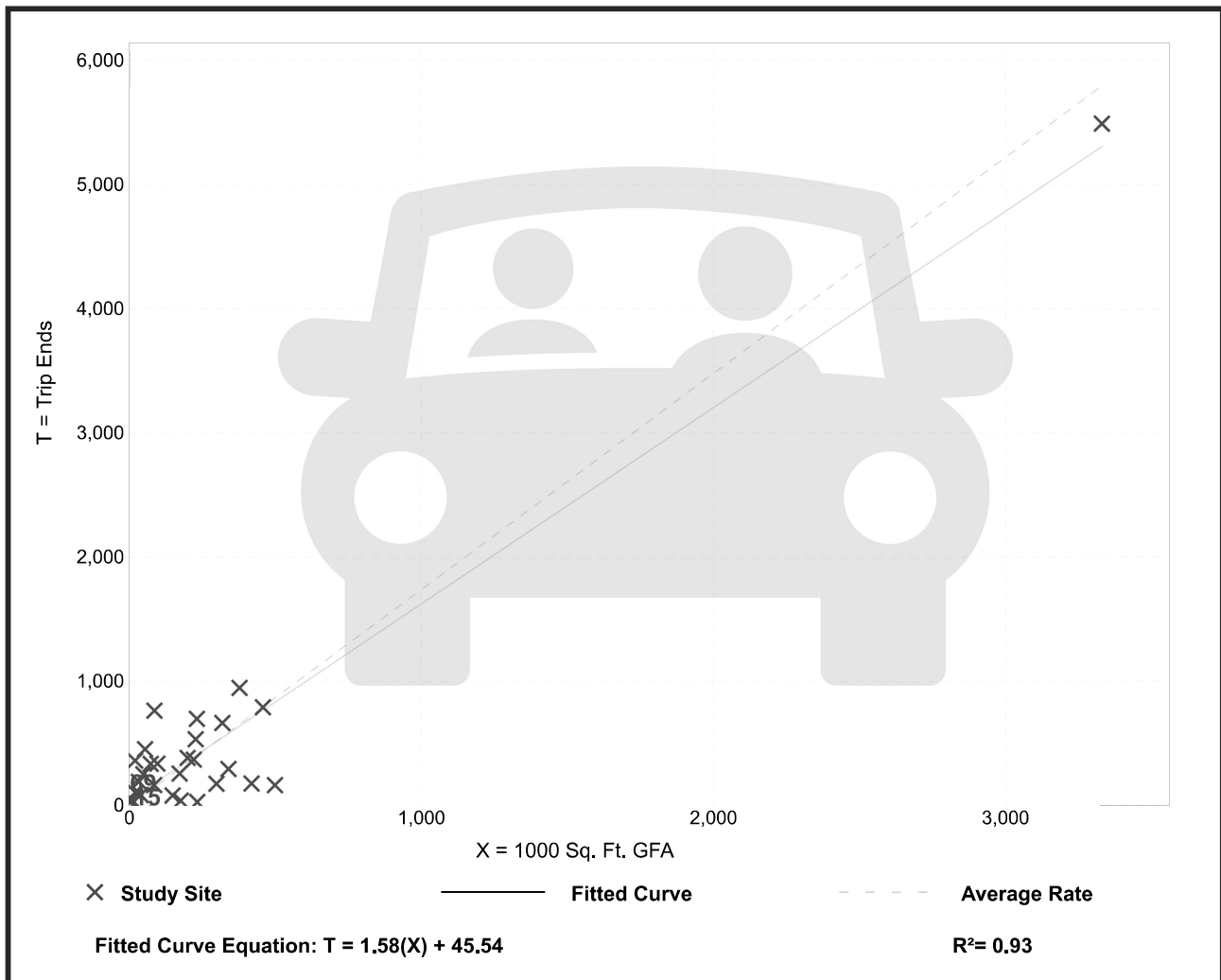
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA  
On a: Weekday

Setting/Location: General Urban/Suburban  
Number of Studies: 29  
Avg. 1000 Sq. Ft. GFA: 285  
Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
1.74	0.15 - 16.93	1.55

## Data Plot and Equation



# Warehousing (150)

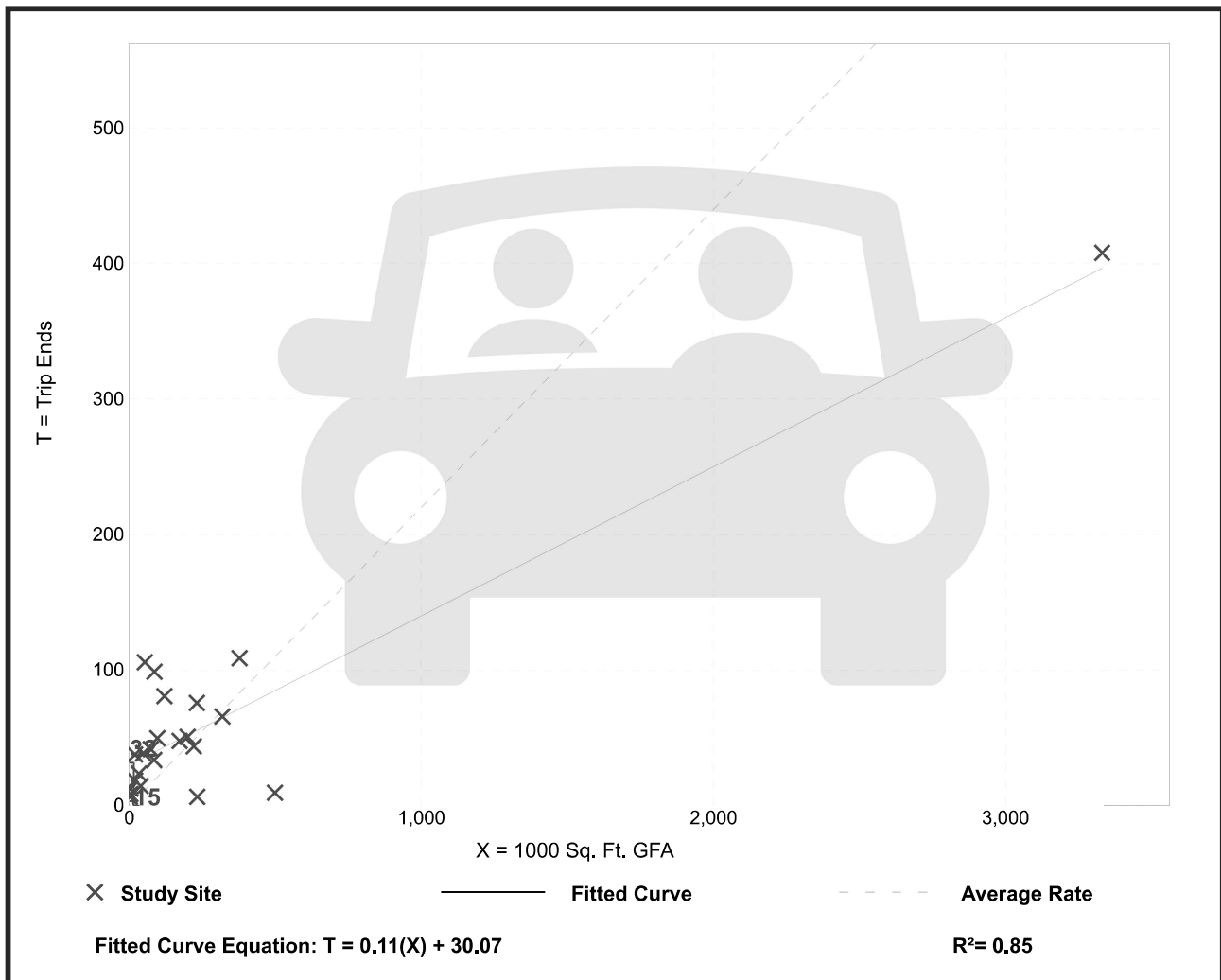
**Vehicle Trip Ends vs: 1000 Sq. Ft. GFA**  
**On a: Weekday,**  
**AM Peak Hour of Generator**

**Setting/Location: General Urban/Suburban**  
 Number of Studies: 23  
 Avg. 1000 Sq. Ft. GFA: 274  
 Directional Distribution: 65% entering, 35% exiting

## Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.22	0.02 - 2.08	0.28

## Data Plot and Equation



# Warehousing (150)

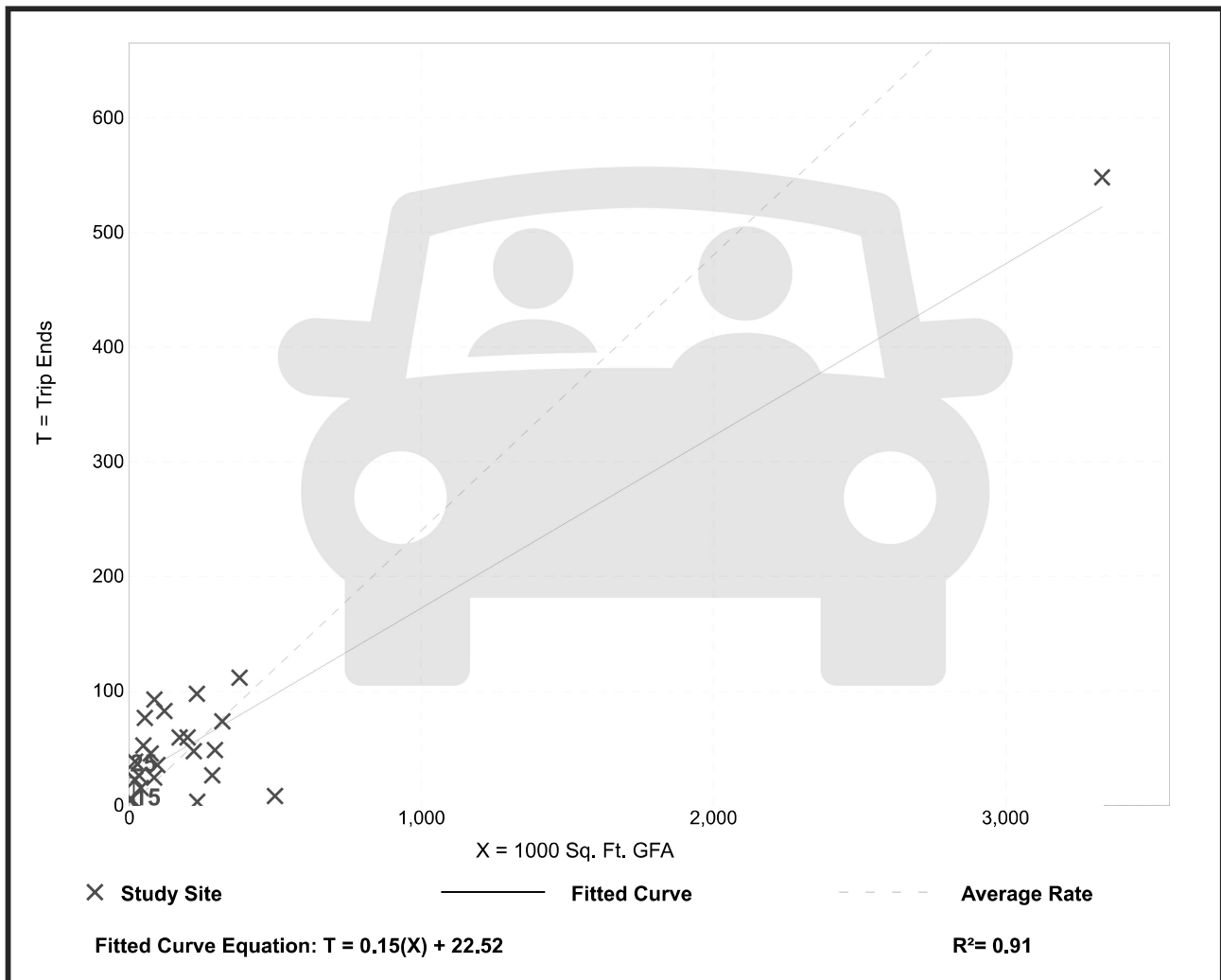
**Vehicle Trip Ends vs: 1000 Sq. Ft. GFA**  
**On a: Weekday,**  
**PM Peak Hour of Generator**

**Setting/Location: General Urban/Suburban**  
 Number of Studies: 25  
 Avg. 1000 Sq. Ft. GFA: 275  
 Directional Distribution: 24% entering, 76% exiting

## Vehicle Trip Generation per 1000 Sq. Ft. GFA

Average Rate	Range of Rates	Standard Deviation
0.24	0.02 - 1.80	0.24

## Data Plot and Equation





## **APPENDIX D – Queuing Analysis**



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## QUEUING ANALYSIS

Project: Aurora Cross Docking at Jasper Park  
Project #: 21-150

Prepared: KML  
Date: 12/21/2021

Hourly Distribution of Entering and Exiting Vehicle Trips by Land Use						
Source: ITE Trip Generation Manual , 11th Edition						
Land Use Code	180					
Land Use	Specialty Trade Contractor					
Setting	General Urban/Suburban					
Time Period	Weekday					
# Data Sites	20					
% of 24-Hour Truck Trips				Total Trucks per day = 72		
Time	Total	Entering	Exiting	Truck Trips Generated		
12:00 - 1:00 AM	0.0%	0.0%	0.0%	Total	Entering	Exiting
1:00 - 2:00 AM	0.0%	0.0%	0.0%	0	0	0
2:00 - 3:00 AM	0.0%	0.0%	0.0%	0	0	0
3:00 - 4:00 AM	0.0%	0.0%	0.0%	0	0	0
4:00 - 5:00 AM	0.0%	0.0%	0.0%	0	0	0
5:00 - 6:00 AM	0.0%	0.0%	0.0%	0	0	0
6:00 - 7:00 AM	0.0%	0.0%	0.0%	0	0	0
7:00 - 8:00 AM	1.5%	3.0%	0.0%	1	2	0
8:00 - 9:00 AM	4.5%	6.1%	3.0%	3	4	2
9:00 - 10:00 AM	13.6%	12.1%	15.2%	10	9	11
10:00 - 11:00 AM	18.2%	18.2%	18.2%	13	13	13
11:00 - 12:00 PM	10.6%	9.1%	12.1%	8	7	9
12:00 - 1:00 PM	15.2%	15.2%	15.2%	11	11	11
1:00 - 2:00 PM	22.7%	24.2%	21.2%	16	17	15
2:00 - 3:00 PM	4.5%	3.0%	6.1%	3	2	4
3:00 - 4:00 PM	6.1%	6.1%	6.1%	4	4	4
4:00 - 5:00 PM	3.0%	3.0%	3.0%	2	2	2
5:00 - 6:00 PM	0.0%	0.0%	0.0%	0	0	0
6:00 - 7:00 PM	0.0%	0.0%	0.0%	0	0	0
7:00 - 8:00 PM	0.0%	0.0%	0.0%	0	0	0
8:00 - 9:00 PM	0.0%	0.0%	0.0%	0	0	0
9:00 - 10:00 PM	0.0%	0.0%	0.0%	0	0	0
10:00 - 11:00 PM	0.0%	0.0%	0.0%	0	0	0
11:00 - 12:00 AM	0.0%	0.0%	0.0%	0	0	0



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## QUEUEING ANALYSIS

Project: Aurora Cross Docking at Jasper Park  
Project #: 21-150

Prepared: KML  
Date: 12/21/2021

Max. Truck Arrival per hour, $\lambda$	17	trucks per hour (1:00 to 2:00)
Average Trucks per minute	0.28	trucks per min.
Gate Operation Rate	45	sec. (total time from open to close)
No. of Trucks that can enter per minute	1.33	trucks per minute
No. of Trucks that can enter per hour, $\mu$	80	trucks per hour

Average no. of trucks waiting to enter the site 0.06

$$L_q = \frac{\lambda^2}{\mu(\mu - \lambda)}$$

Probability of 0 trucks waiting to enter 78.75%

$$P_0 = 1 - \frac{\lambda}{\mu}$$

Probability of more than 1 truck arriving at the same time 4.52%

$$P_{N>k} = \left(\frac{\lambda}{\mu}\right)^{k+1}$$

Poisson Distribution Probability of 2 or more trucks arriving at the same time 4.34%

$$P(x) = \frac{e^{-\lambda} \lambda^x}{x!}$$

Truck Arrivals per Minute	Probability
0	6.05%
1	6.05%
2	3.02%
3	1.01%
4	0.25%
5	0.05%
6	0.01%
7	0.00%
8	0.00%
9	0.00%
10	0.00%

