

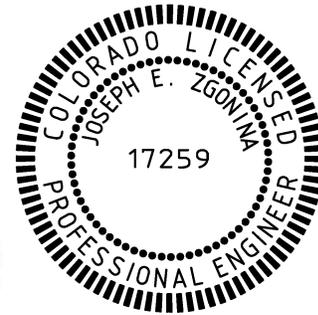
TRAFFIC ANALYSIS

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

1 - INTRODUCTION

Haeger Engineering LLC has prepared a Traffic Analysis for the proposed Aurora Cross Docking at Jasper Park development located at 15655 East 33rd 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 33rd 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 32nd 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. 33rd 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. 33rd Place provides a single general-purpose lane at the west approach, operating under Stop sign control.
- At its unsignalized intersection with Helena Street, E. 33rd 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. 33rd Place, Jasper Street provides a single general-purpose lane at the north and south approaches.
- At its unsignalized T-intersection with E. 33rd 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. 33rd 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. 33rd Avenue provides a single general-purpose lane at the west approach.
- At its unsignalized intersection with Helena Street, E. 33rd 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. 33rd 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. 33rd 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 10th 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 33rd Place to the north and one connecting to Jasper Street to the east. Vehicles will enter the site at the 33rd 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 95th 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 33rd 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.



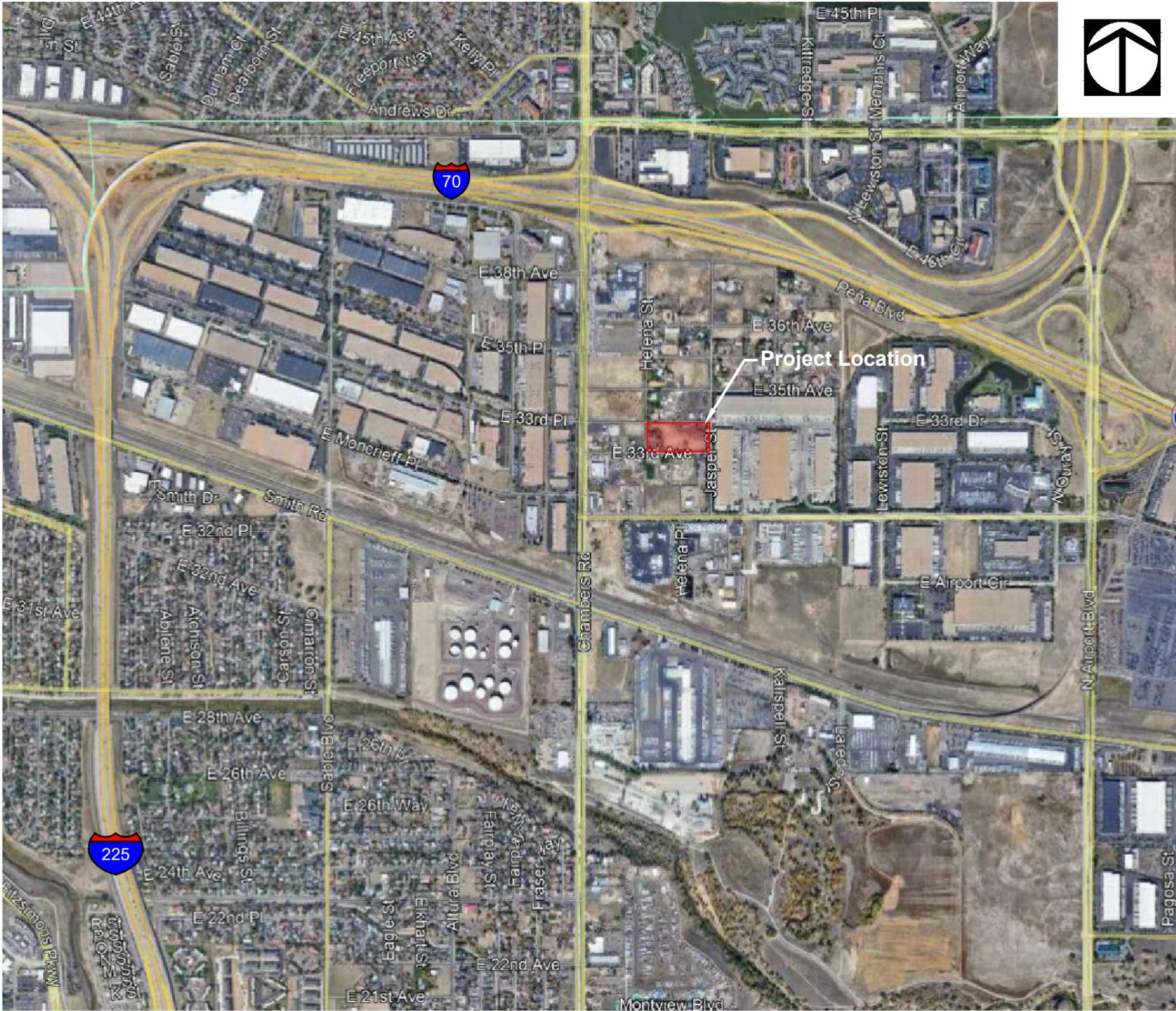
7 – RECOMMENDATIONS AND CONCLUSION

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.



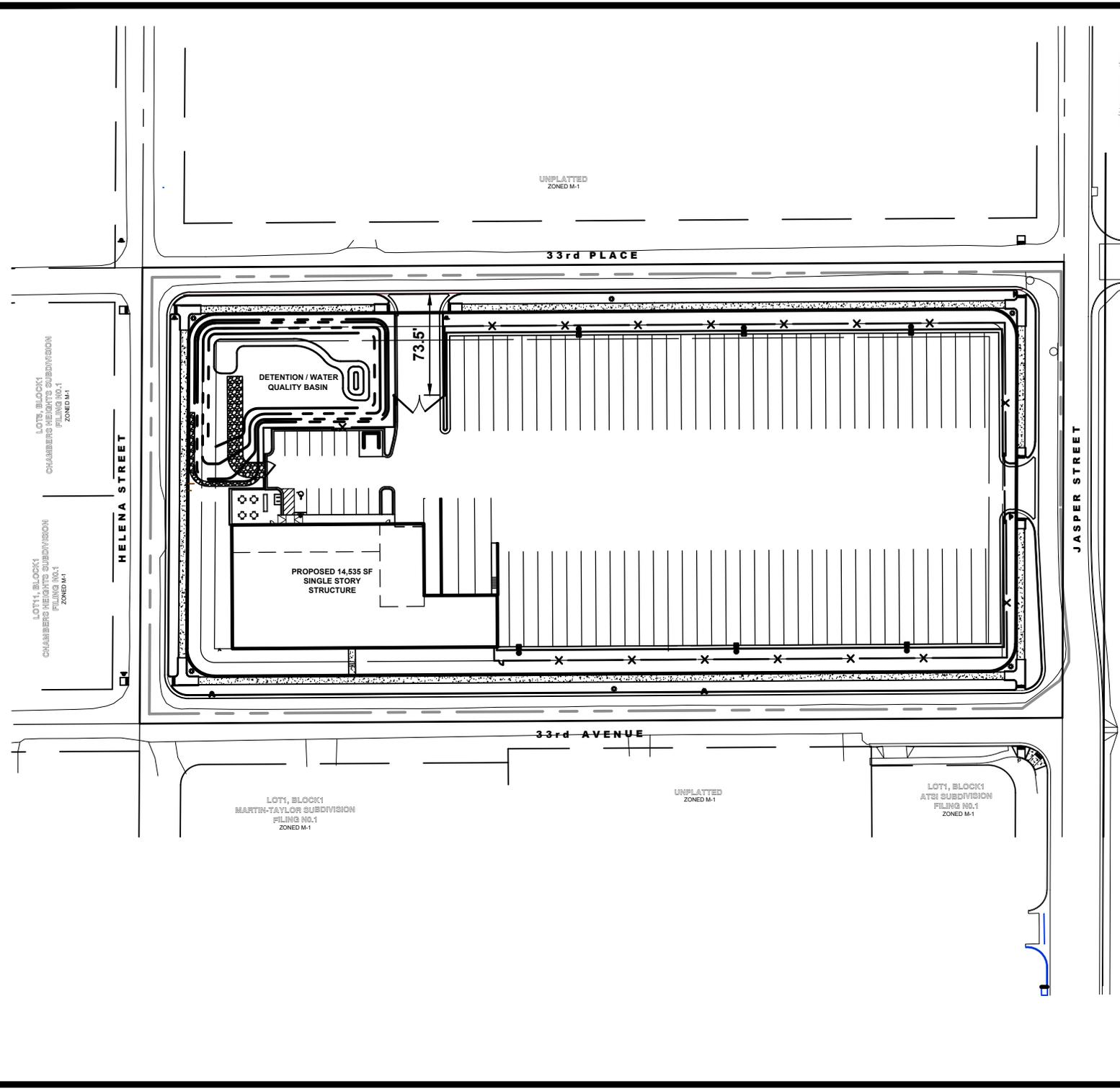
APPENDIX A - Exhibits



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 Illinois Professional Design Firm License No. 184-003152
 www.haegerengineering.com

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



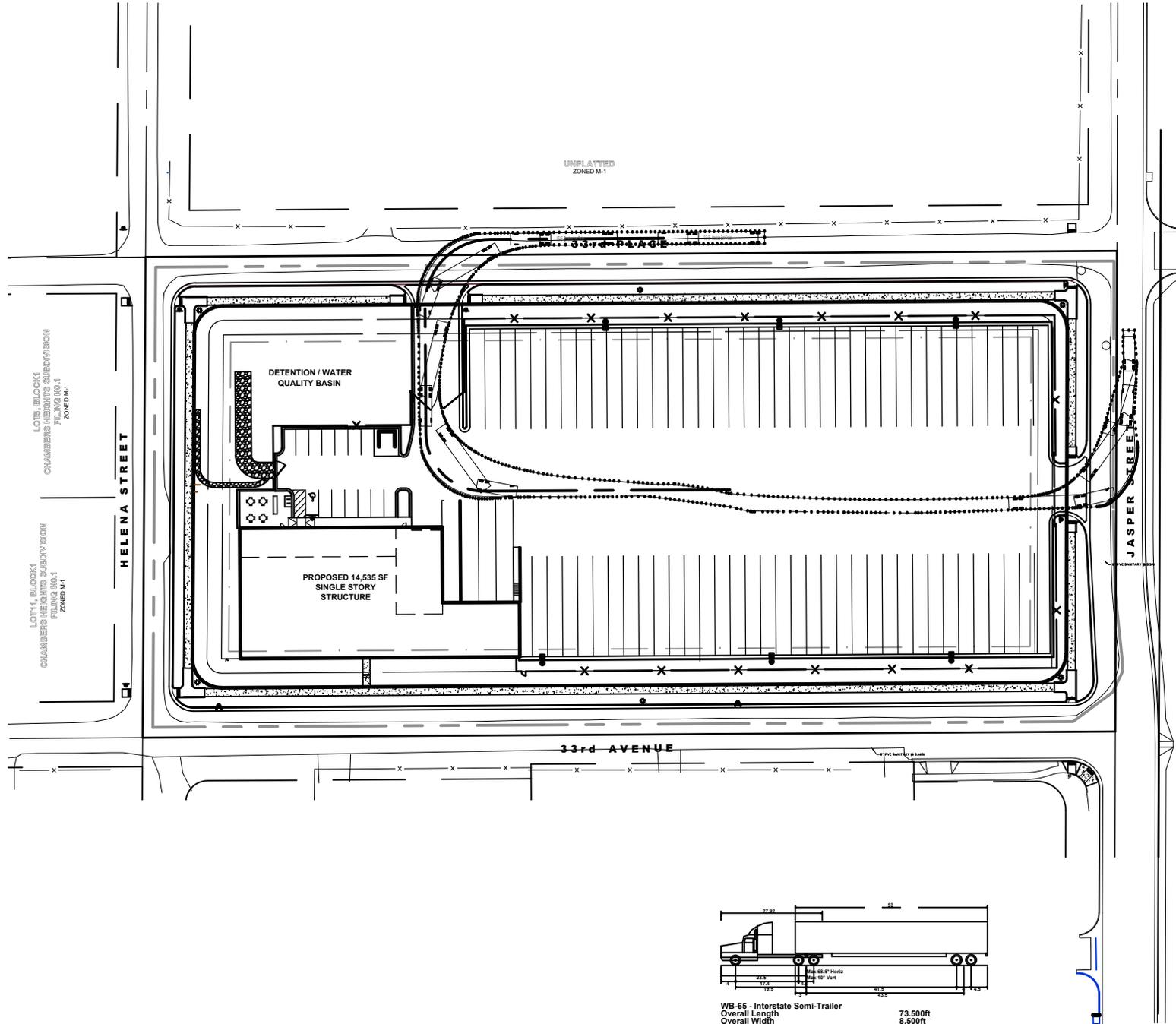
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**EXHIBIT 2
 SITE PLAN**
**AURORA CROSS DOCKING
 AT JASPER PARK**
 CITY OF AURORA, COLORADO

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



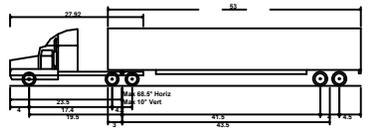
APPENDIX B – AutoTurn Movement Analysis



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



| | |
|---------------------------------|----------|
| 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 |

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)

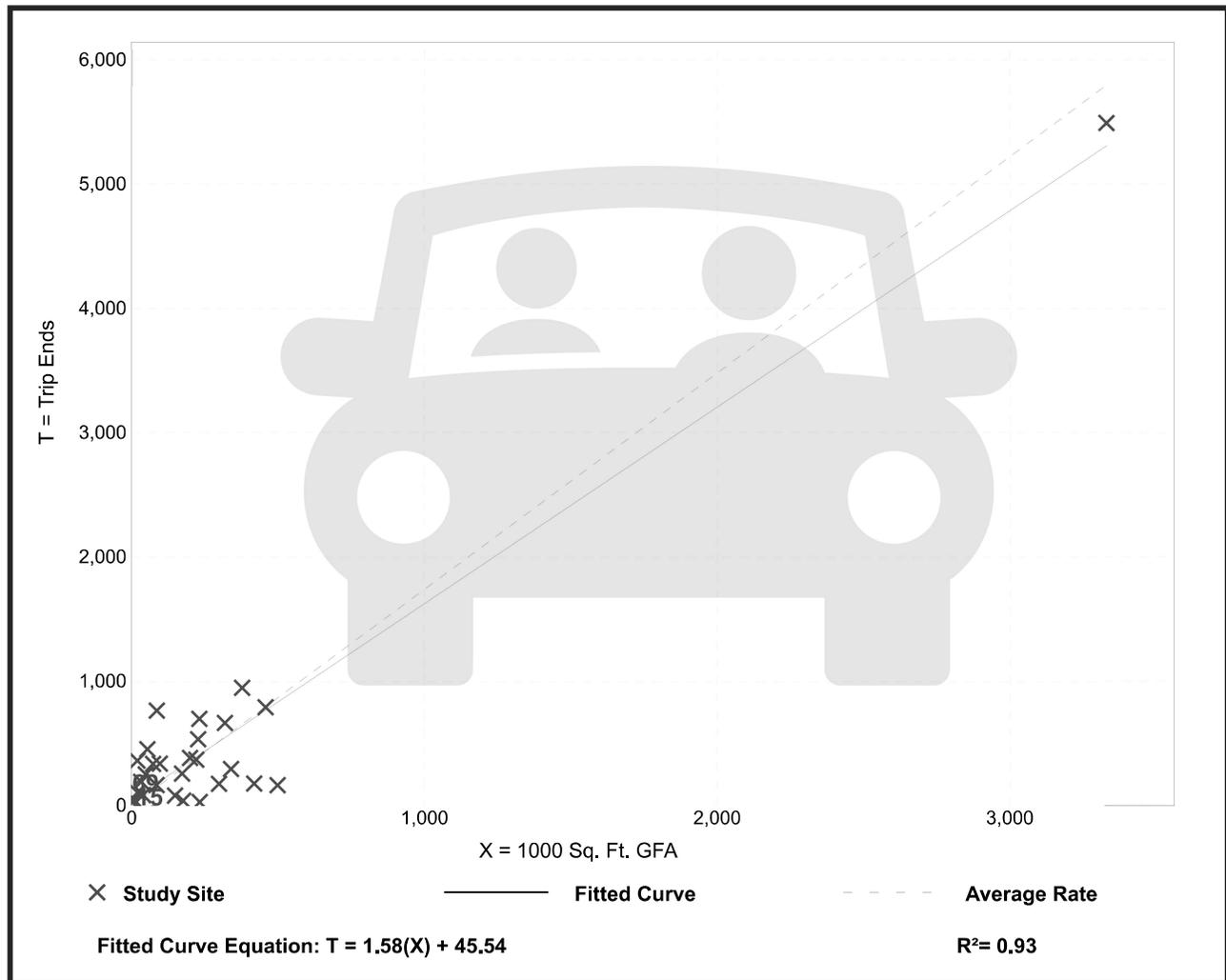
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday

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)

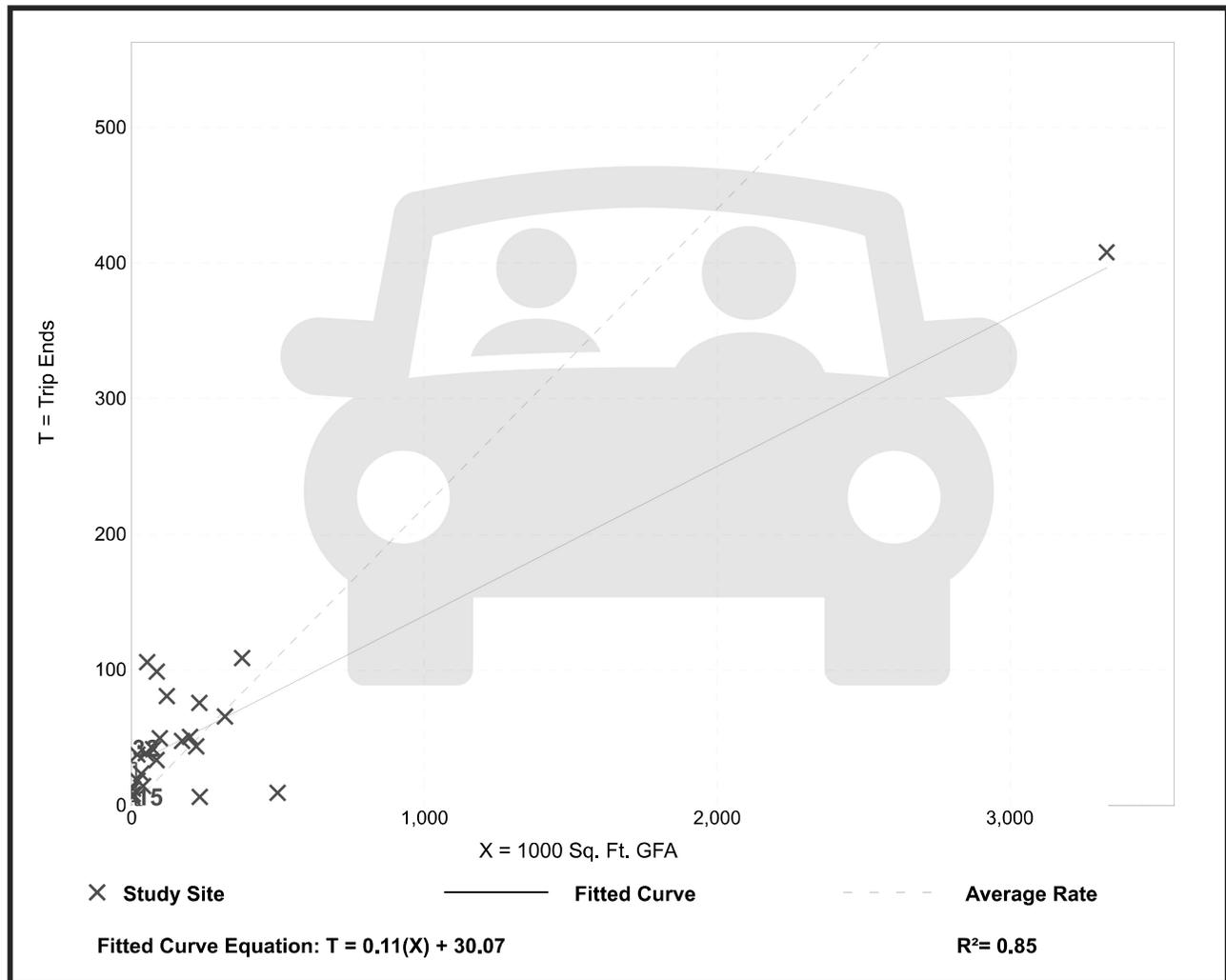
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
AM Peak Hour of Generator

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)

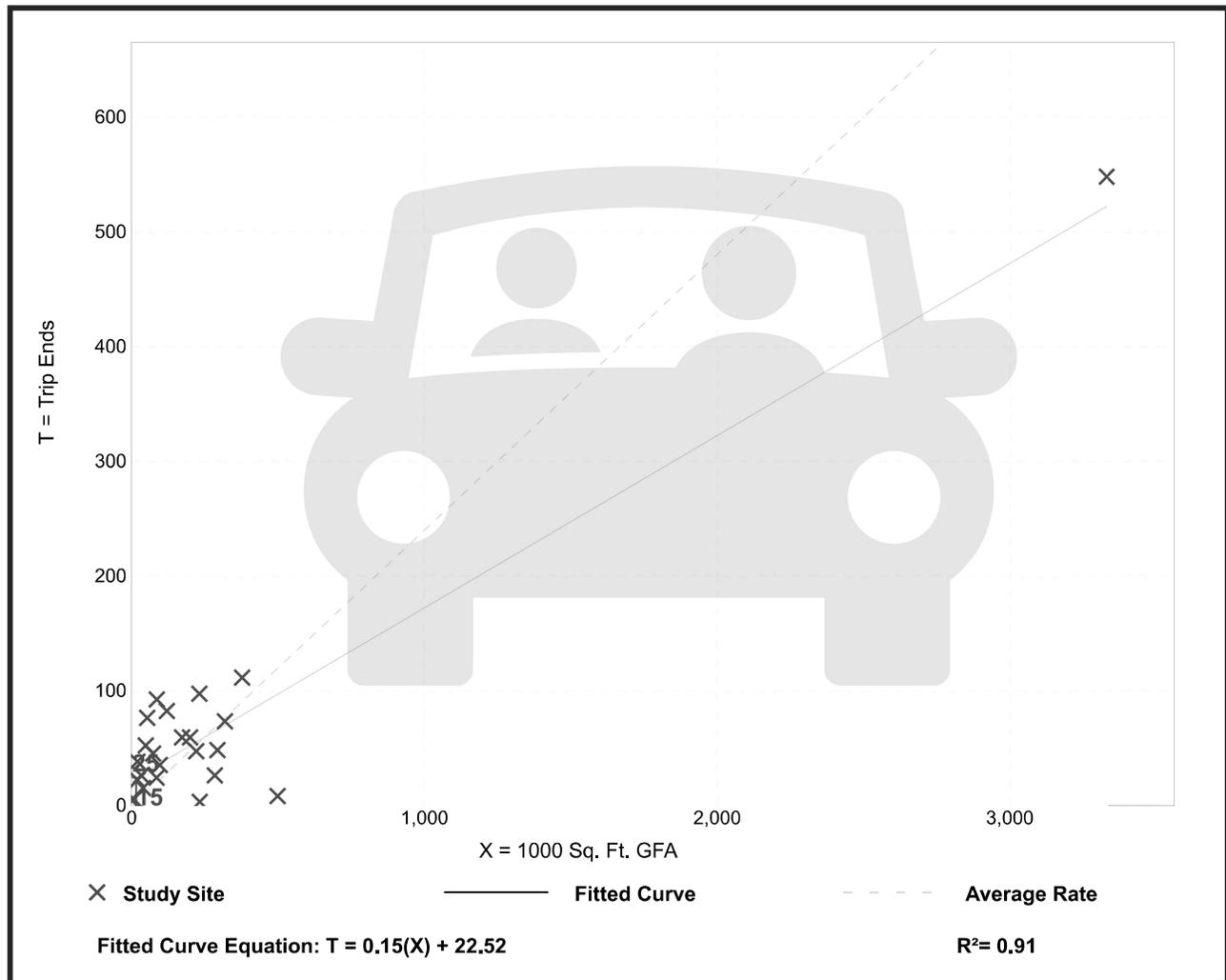
Vehicle Trip Ends vs: 1000 Sq. Ft. GFA
On a: Weekday,
PM Peak Hour of Generator

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



consulting engineers · land surveyors

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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 | | | Total Trucks per day = 72 | | |
| | % of 24-Hour Truck Trips | | | Truck Trips Generated | | |
| Time | Total | Entering | Exiting | Total | Entering | Exiting |
| 12:00 - 1:00 AM | 0.0% | 0.0% | 0.0% | 0 | 0 | 0 |
| 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 |

QUEUING ANALYSIS

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

Prepared: KML
Date: 12/21/2021

| | | |
|--|------|--------------------------------------|
| Max. Truck Arrival per hour, λ | 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, μ | 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% |

