

# Queuing Analysis

For

# CHRIST



# LUTHERAN SCHOOL

Prepared By: Steven Frink, E.I.

**Engineering Design & Construction, Inc.**

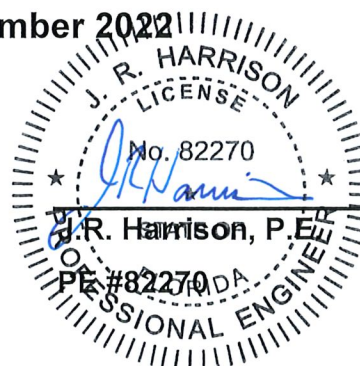
10250 SW Village Parkway, Suite 201

Port St. Lucie, FL 34987

Board of Professional Engineers Certificate of Authorization Number 9935

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12/2/22

Date

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## **Project Description**

Christ Lutheran Church and School is located 1592 SE Floresta Dr in Port St Lucie, Florida, approximately 1.5 miles north of SE Port St Lucie Blvd. The Church not only operates as a place of worship, but as a school as well. Christ Lutheran Church and School is proposing to expand its current enrollment of school-aged children from 108 students to 159 students.

For the development of the queuing analysis is assumed that all parents/guardians will need to remain in their vehicle to pick-up and drop-off the child(ren) at a designated staging area each day. The schools operating hours are from 8:45 AM to 3:00 PM during the school year. Approximately 20 students use before school care and after school care., Before care is provided is provided from 7:00 AM to 8:10 AM and after care is provided 3:00 PM to 6:00 PM, 10 students either ride or walk from school, 15 – 30 students depart via a van. The proposed access for the site will take advantage of the existing ingress and egress driveways along SE Damask Ave.

## **Vehicle Accumulation**

To determine the existing vehicle accumulation for Christ Lutheran, a queuing study was performed at the school on Wednesday, November 2, 2022, and Monday, November 7, 2022, from 2:30 PM to 4:30 PM. 35 vehicles were observed entering the property with the highest concentration arriving between 3:15 PM and 3:30 PM. Each vehicle that arrived, parked in a parking space when picking-up the child(ren) and then departed the site. Table 1 illustrates the number of vehicles that arrived within a fifteen-minute time frame.

Table 1: Queuing Study Results

Time	Nov 02, 2022	Nov 07, 2022
2:30 PM - 2:45 PM	-	1
2:45 PM - 3:00 PM	6	5
3:00 PM - 3:15 PM	8	6
3:15 PM - 3:30 PM	9	14
3:30 PM - 3:45 PM	4	5
3:45 PM - 4:00 PM	4	-
4:00 PM - 4:15 PM	2	1
4:15 PM - 4:30 PM	2	3
<b>Total</b>	<b>35</b>	<b>35</b>

### On-Site Queuing

Christ Lutheran wants to ensure that drop-off and pick-up will run smoothly to minimize unloading and loading times and reduce impacts to adjacent roads. To accomplish this goal, parents are instructed to park to drop-off and pick-up students. Based on the results of the dismissal process and the arrival rate of parents, no impacts to adjacent roadways are anticipated.

The school utilizes a staggered pick-up for each grade level beginning with the high school at 3:00 PM, followed by Kindergarten at 3:15 PM, 1<sup>st</sup> and 2<sup>nd</sup> grade at 3:20 PM, 5<sup>th</sup> – 7<sup>th</sup> grade at 3:30 PM and finally 3<sup>rd</sup> and 4<sup>th</sup> grade at 3:35 PM. A letter indicating the pick-up and drop-off was prepared by the Principle of Christ Lutheran and is included in Appendix D: Supporting Documents.

## **On-Site queuing Contingency Plan**

While the proposed ingress/egress can serve the anticipated increase in traffic volume during drop-off and pick-up, it is important to have a contingency plan in place for any unforeseen issue. The contingency plan, as shown in Appendix B consists of using the drive aisles as storage for additional stacking. This will allow an additional 33 vehicles to wait on-site should the need arise. This plan is not anticipated to be utilized and is provided to demonstrate the flexibility that the existing site has to increase the queuing length in the unlikely event that it is needed. Christ Lutheran will assign staff to critical areas for traffic management and safety. Appendix B depicts the location of each member with each of the members area of responsibility as follows:

- 1) Drop-off/Pick-up Release Director – A trained staff member will release vehicles following the loading and unloading of the students. The staff member will also assist students and parents during the drop-off and pick-up process as needed.
  
- 2) Unloading and Loading of Personnel at Drop-Off/Pick-Up Area – Staff will be positioned within the designated drop-off and pick-up area and at key locations on the site. Depending on the initial process and observed operations, up to 3 teachers and/or administrators will be directly involved in the process of directing students, cars, and traffic.

## **Trip Generation**

The 11<sup>th</sup> edition of the Trip Generation Manual, produced by the Institute of Transportation Engineers, was used to estimate the number of trips that the additional classrooms would contribute to the roadway network. The category for a K-12 private school, with ITE code 532, was used to determine the weekday trips produced for the peak A.M. and P.M. trips generated with the students as the variable factor. Table 2 depicts the existing impacts to the roadway network while Table 3 shows the potential impacts. The new classrooms will add a total of 124 weekday trips, while the peak hour AM and PM impacts are 41 trips and 9 trips, respectively.

Table 2: ITE 532 - Existing Average Trips for K-12 Private School (108 Students)

Time Period	Total	In	Out
Weekday	T=2.48(X)	50%	50%
Weekday, AM Peak Hour	T=0.80(X)	63%	37%
Weekday, PM Peak Hour	T=0.53(X)	42%	58%

Time Period	Total	Entry	Exit
Weekday	268	134	134
Weekday, AM Peak Hour	86	54	32
Weekday, PM Peak Hour	57	24	33

Table 3: ITE 532 - Proposed Average Trips for K-12 Private School (159 Students)

Time Period	Total	In	Out
Weekday	T=2.48(X)	50%	50%
Weekday, AM Peak Hour	T=0.80(X)	63%	37%
Weekday, PM Peak Hour	T=0.53(X)	42%	58%

Time Period	Total	Entry	Exit
Weekday	394	197	197
Weekday, AM Peak Hour	127	80	47
Weekday, PM Peak Hour	154	65	89

## Summary

Christ Lutheran Church and School is projecting a student body of 159 school aged children. Of these 159 students, 10 students will either ride a bike or walk and 15 – 30 students departing the site via a van. A vehicle accumulation evaluation was completed based on an on-site study completed on Wednesday, November 2, 2022, and Monday, November 7, 2022. Based on the study impacts to SE Damask Avenue are not anticipated.

The projected trip generation for Christ Lutheran was completed using the ITE Trip Generation Manual, 11<sup>th</sup> edition. The project is estimated to contribute an extra 126 trips to the local road, resulting in a total trip generation of 394 trips.


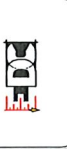
## Appendix A: Vehicle Queue

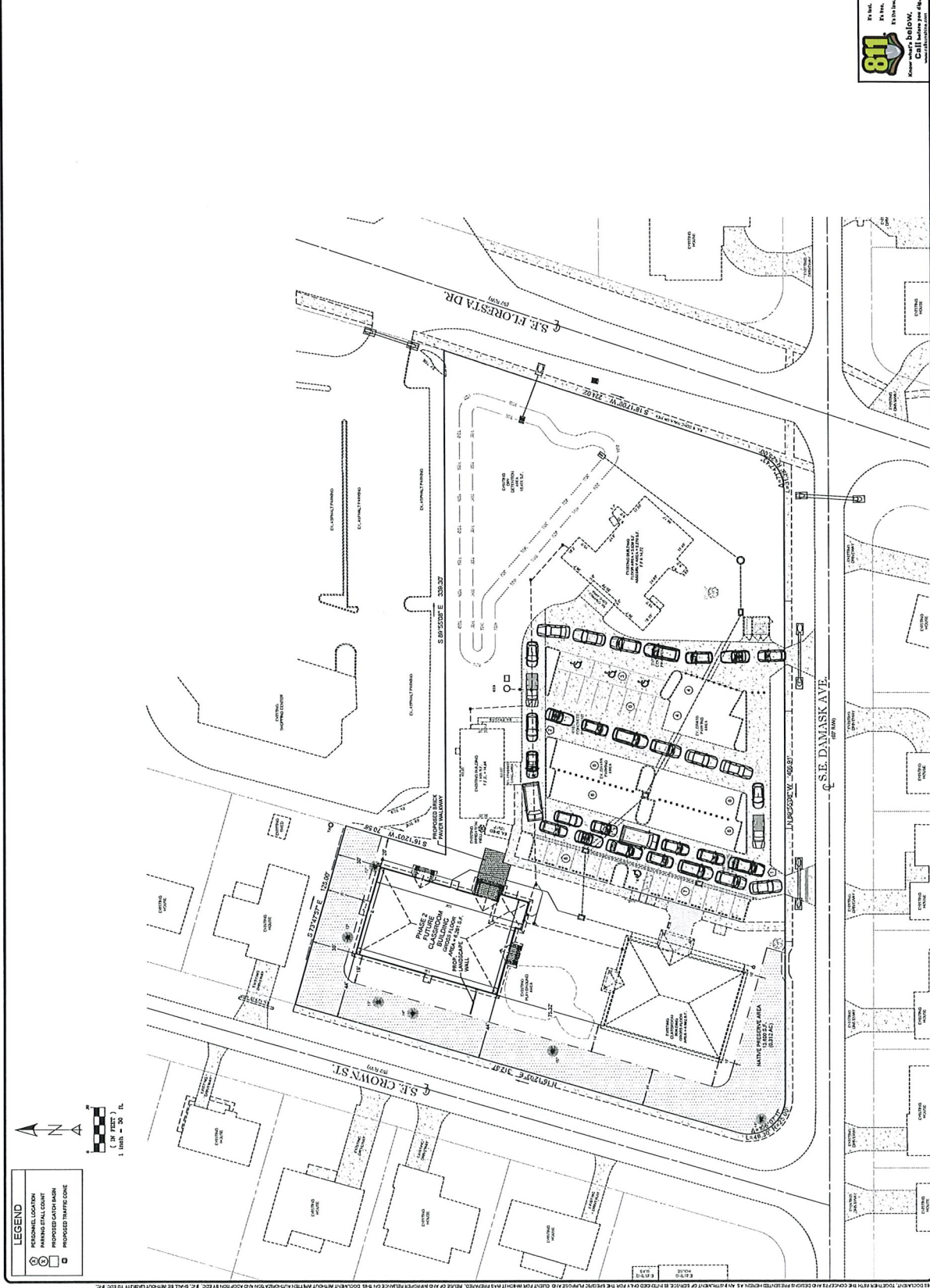








## **Appendix B: Vehicle Queue Contingency Plan**

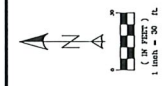


 <p><b>FED</b> ENGINEERS &amp; SURVEYORS ENVIRONMENTAL</p> <p>10355 SW VILLAGE PARKWAY SUITE 301 PORT CHARLOTTE, FL 34687 TEL: 772-462-2445</p> <p>www.fed.com U.S. DEPARTMENT OF AGRICULTURE</p>	<p>DATE: _____</p> <p>SECTION: _____</p> <p>SCALE: _____</p> <p>PROJECT: _____</p> <p>DATE: _____</p>	<p>FLORIDA</p> <p>PORT ST. LUCIE</p> <p><b>CHRIST LUTHERAN SCHOOL</b> PHASE 2 CLASSROOMS QUEUING CONTINGENCY EXHIBIT</p>		<p>22-246</p>	<p>1 OF 1</p>
	<p>DATE: _____</p> <p>SECTION: _____</p> <p>SCALE: _____</p> <p>PROJECT: _____</p> <p>DATE: _____</p>				



**LEGEND**

-  PERSONNEL LOCATION
-  PARKING STALL COUNT
-  PROPOSED CATCH BASIN
-  PROPOSED TRAFFIC CONE



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## **Appendix C: ITE Trip Generation**

Existing

# Private School (K-12) (532)

Vehicle Trip Ends vs: Students  
On a: Weekday

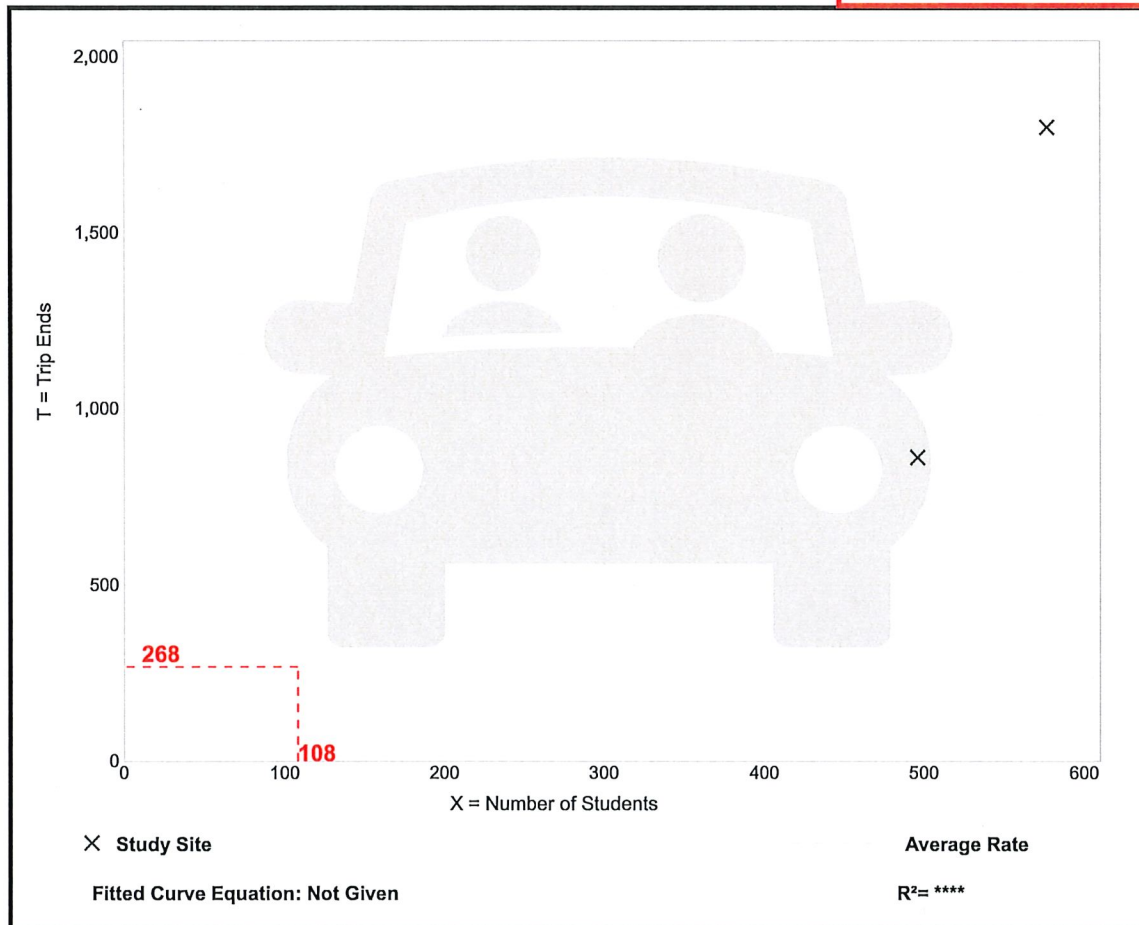
Setting/Location: General Urban/Suburban  
Number of Studies: 2  
Avg. Num. of Students: 537  
Directional Distribution: 50% entering, 50% exiting

## Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
2.48	1.74 - 3.12	*

## Data Plot and Equation

Caution – Small Sample Size



Existing

## Private School (K-12) (532)

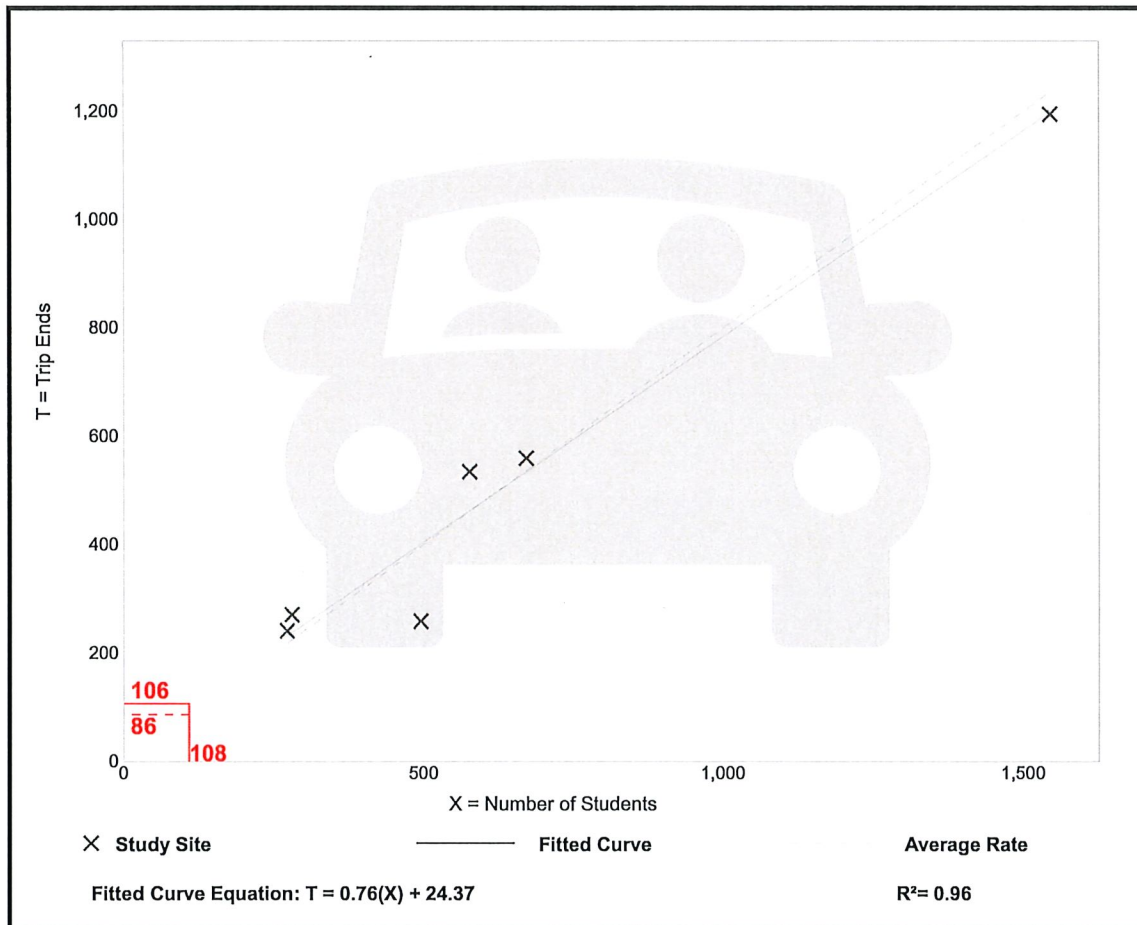
Vehicle Trip Ends vs: Students  
On a: Weekday,  
AM Peak Hour of Generator

Setting/Location: General Urban/Suburban  
Number of Studies: 6  
Avg. Num. of Students: 641  
Directional Distribution: 63% entering, 37% exiting

### Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.80	0.52 - 0.96	0.14

### Data Plot and Equation



Existing

# Private School (K-12) (532)

Vehicle Trip Ends vs: **Students**  
On a: **Weekday,**  
**PM Peak Hour of Generator**

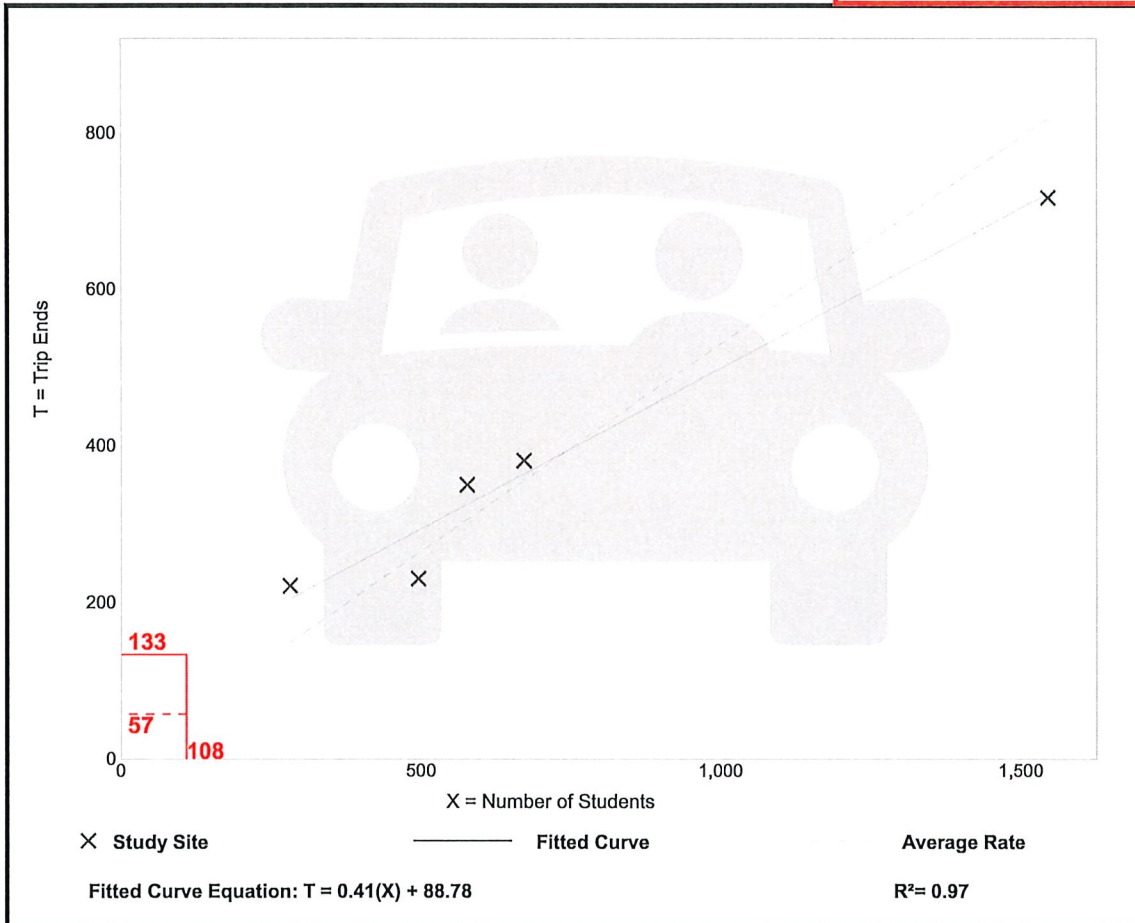
Setting/Location: **General Urban/Suburban**  
Number of Studies: 5  
Avg. Num. of Students: 714  
Directional Distribution: 42% entering, 58% exiting

## Vehicle Trip Generation per Student

Average Rate	Range of Rates	Standard Deviation
0.53	0.46 - 0.79	0.11

## Data Plot and Equation

Caution – Small Sample Size



**Proposed**  
**Private School (K-12)**  
**(532)**

**Vehicle Trip Ends vs: Students**  
**On a: Weekday**

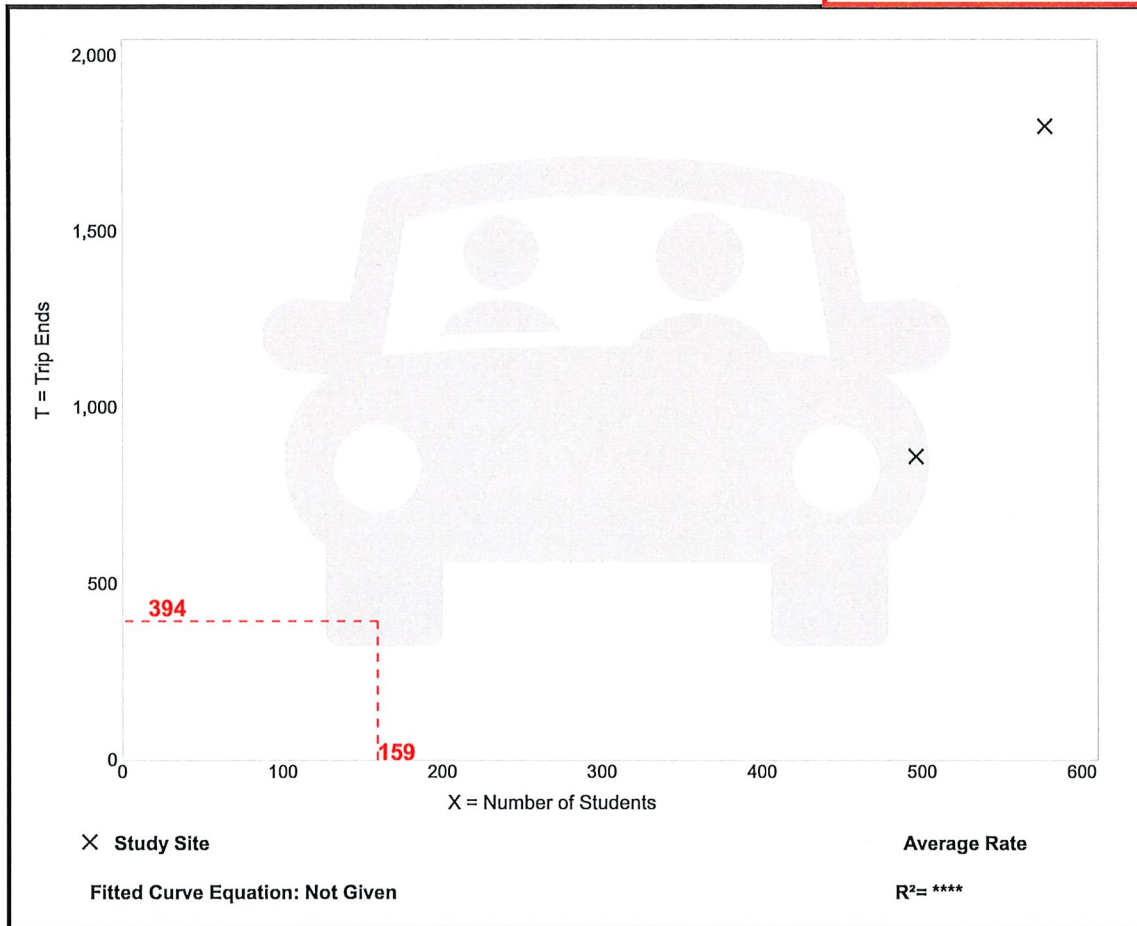
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**Private School (K-12)**  
**(532)**

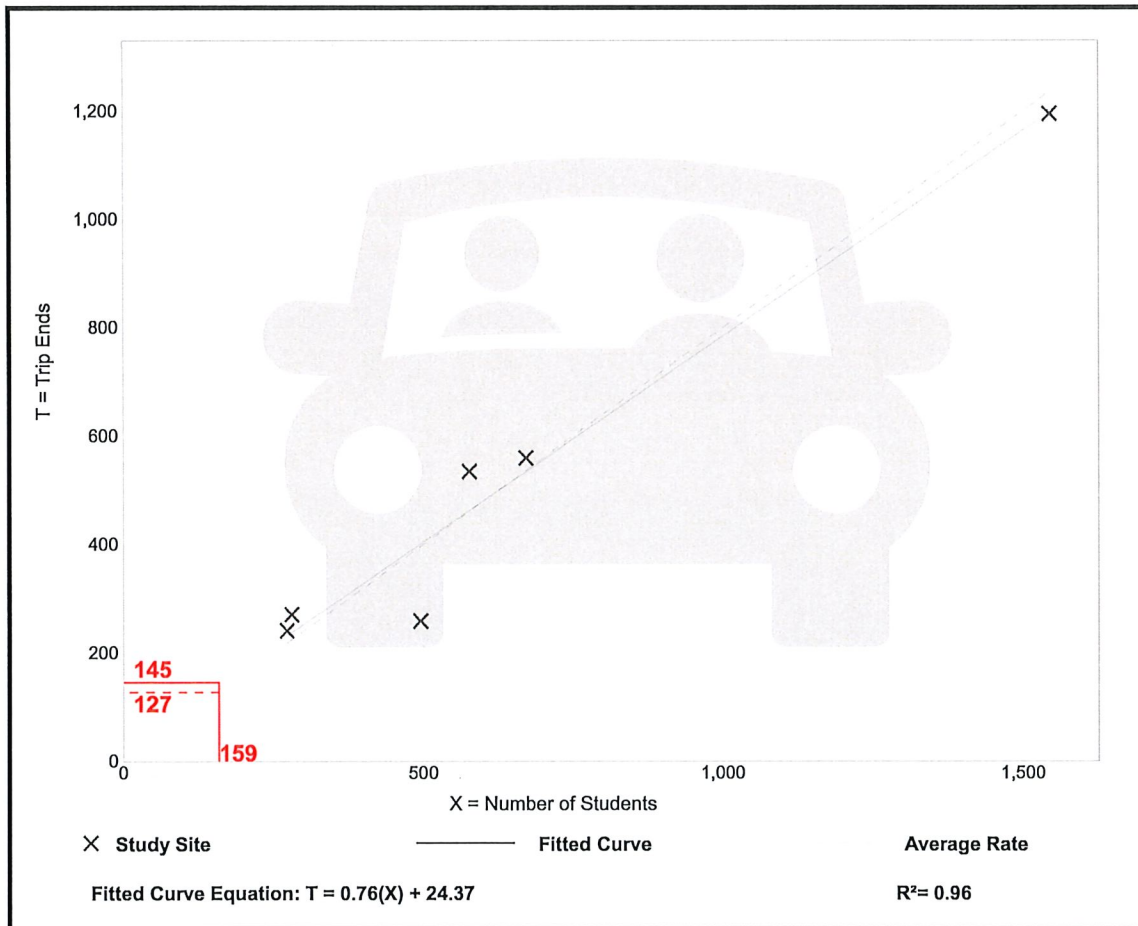
**Vehicle Trip Ends vs: Students**  
**On a: Weekday,**  
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**Data Plot and Equation**



**Proposed**  
**Private School (K-12)**  
**(532)**

**Vehicle Trip Ends vs: Students**  
**On a: Weekday,**  
**PM Peak Hour of Generator**

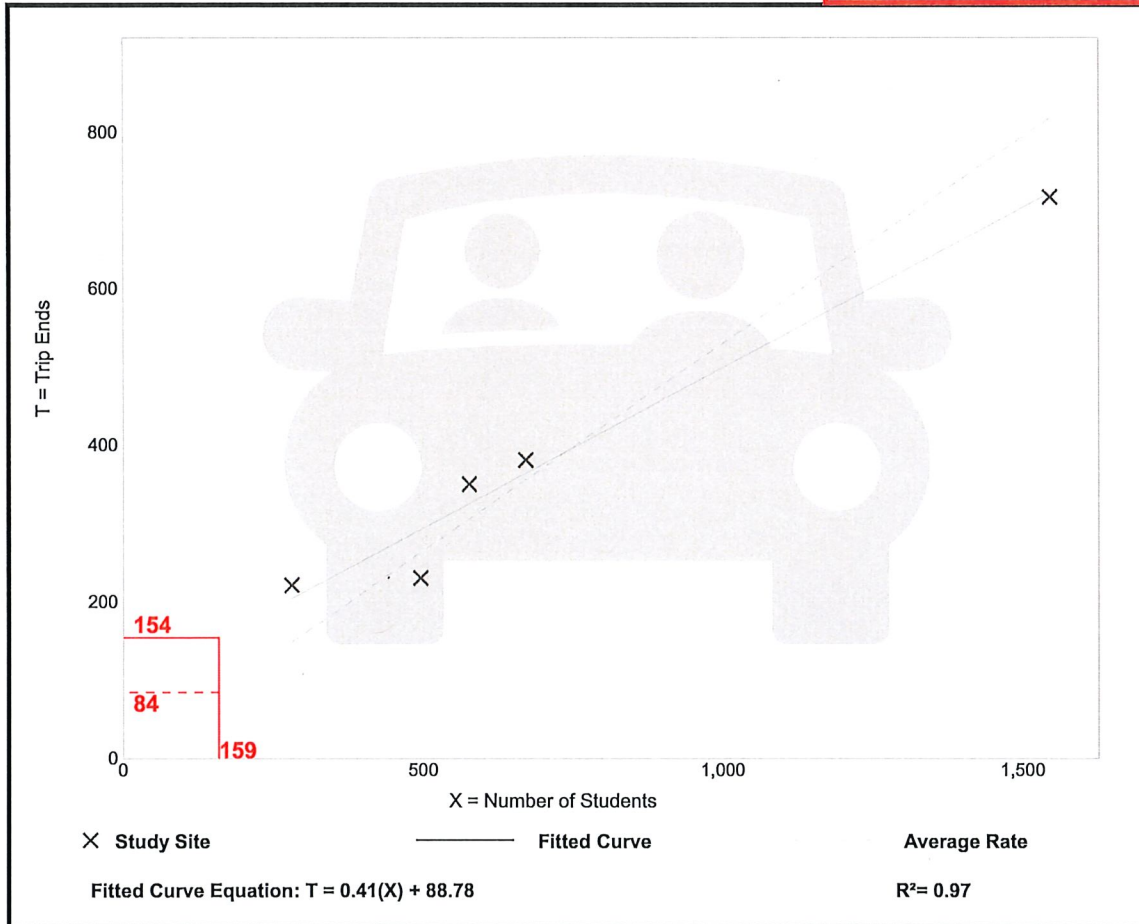
**Setting/Location: General Urban/Suburban**  
 Number of Studies: 5  
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Average Rate	Range of Rates	Standard Deviation
0.53	0.46 - 0.79	0.11

**Data Plot and Equation**

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## **Appendix D: Supporting Documents**



*Figure 1: November 2, 2022, at 3:00 PM*



*Figure 2: November 2, 2022, at 3:15 PM*



*Figure 3: November 2, 2022, at 3:30 PM*



*Figure 4: November 2, 2022, at 3:45 PM*



*Figure 5: November 2, 2022, at 4:00 PM*



*Figure 6: November 2, 2022, at 4:15 PM*



*Figure 7: November 2, 2022, at 4:30 PM*



*Figure 8: November 7, 2022, at 3:00 PM*



*Figure 9: November 7, 2022, at 3:15 PM*



*Figure 10: November 7, 2022, at 3:30 PM*





*Figure 11: November 7, 2022, at 3:45 PM*



*Figure 12: November 7, 2022, at 4:00 PM*



*Figure 13: November 7, 2022, at 4:15 PM*



*Figure 14: November 7, 2022, at 4:30 PM*



10/28/2022

**Please Consider the Following Preliminary Items:**

- Christ Lutheran School **currently** serves 108 students in grades Kindergarten – 12<sup>th</sup> Grade.
- Our drop off and pick up procedure is different from many other schools because there is no vehicle stacking in the parking lot or from our parking lot onto Damask Avenue.
- All vehicles are instructed to park in designated parking areas and let students out.
- This procedure intentionally creates a sporadic flow of traffic that neither overwhelms our campus internally nor causes traffic flow problems onto Damask Ave. and Floresta Blvd.

**Overview of Current Morning Traffic:**

7:00 – 8:10 AM: Extended Care Open

- On an average day **20 students arrive at extended care** before 8:10 AM.
- 108–20 = 88 Remaining Students

8:10 – 8:35 AM: Scheduled School Drop Off Time

- During this 25-minute period, between 40-45 vehicles, carrying the remaining 88 students, enter, park, and exit the parking lot sporadically. Some stay less than 2 minutes, while others stay 10-15 minutes socializing with other parents or staff members.
- Students exit vehicles while parked and enter the school building either independently or within parental supervision.

**Overview of Current Afternoon Traffic:**

Students are dismissed between 3:00 – 3:40 PM.

3:00 PM: High School (14 Students) dismisses.

3:15 PM: Kindergarten (14 Students) dismisses on SW side of school building.

3:20 PM: 1<sup>st</sup> and 2<sup>nd</sup> Grade (16 Students) dismisses on NW side of school play yard.

3:30 PM: 5<sup>th</sup> thru 7<sup>th</sup> Grade (41 Students) dismisses from two separate locations.

3:35 PM: 3<sup>rd</sup> and 4<sup>th</sup> grade (23 Students) dismisses from front door.

**Note:** Each afternoon, approximately **20 students** are sent directly from their classrooms to **extended care**. These students are picked up sporadically between 4:00 – 6:00 PM.

**Note:** Each afternoon, 30 students who arrive in 13 vehicles each morning, are transported in 5 vehicles, eliminating 8 vehicles from the afternoon routine.

**Future Plans:**

- The chart below demonstrates future growth from 108 to 159 students.
- Primary area of future growth will be in grades 9-12.
- Once the new building is occupiable, these students will be dismissed between 2:45 – 3:00 PM
- Our projected growth from 108 to 159 students represents a 47% increase in student census.
- Applying that 47% increase to the maximum number of vehicles currently visiting the campus (40-45) during high traffic times, projects that the maximum number of vehicles we would expect to enter the parking lot during those times once our future goal is realized would be 59-66 vehicles each morning and afternoon.
- To keep future traffic from stacking onto Damask Avenue, we will continue to stagger our drop off and pick up times by grade level, causing traffic to enter and exit the parking lot sporadically, rather than all at once.

<b>Current Enrollment</b>		<b>Future Maximum Enrollment</b>	
<b>Current</b>	<b>Census</b>	<b>Future</b>	<b>Census</b>
Kindergarten	14	Kindergarten	15
Grade 1	8	Grade 1	12
Grade 2	8	Grade 2	12
Grade 3	12	Grade 3	12
Grade 4	11	Grade 4	12
Grade 5	11	Grade 5	12
Grade 6	11	Grade 6	12
Grade 7	10	Grade 7	12
Grade 8	9	Grade 8	12
Grade 9	5	Grade 9	12
Grade 10	4	Grade 10	12
Grade 11	3	Grade 11	12
Grade 12	2	Grade 12	12
<b>Total</b>	<b>108</b>	<b>Total</b>	<b>159</b>