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Casa Esperanza Charter School **Traffic Impact Analysis** **Wake Forest, North Carolina**

TRAFFIC IMPACT ANALYSIS

FOR

CASA ESPERANZA

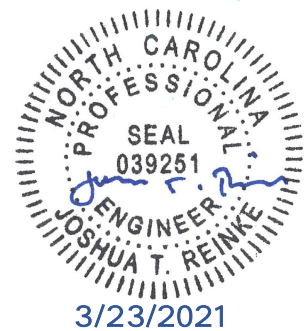
LOCATED

IN

WAKE FOREST, NORTH CAROLINA

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March 2021

RKA Project No. 20476

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TRAFFIC IMPACT ANALYSIS
CASA ESPERANZA
WAKE FOREST, NORTH CAROLINA

EXECUTIVE SUMMARY

1. Development Overview

A Traffic Impact Analysis (TIA) was conducted for the proposed Casa Esperanza school in accordance with the Wake Forest (Town) Unified Development Ordinance (UDO) and North Carolina Department of Transportation (NCDOT) capacity analysis guidelines. The proposed development is to be located north of Height Lane and east of Star Road in Wake Forest, North Carolina.

The subject development is proposed to be an urban charter school with a maximum of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of five (5) grade levels and are anticipated to be even in size.

Access to the charter school site will be provided via one (1) ingress only driveway (southern) and one (1) egress only driveway (northern) along Star Road. Parents will enter the site via the southern driveway and navigate through the campus in a counterclockwise direction. Based on the young age of students (grades pre-K through 8) and due to the counterclockwise flow of vehicles, students should be seated in the backseat on the drivers' side of the vehicle for (un)loading operations. Based on the current site plan, there will be two (2) (un)loading zones located side by side. Based on NCDOT MSTA guidelines and to provide conservative results, only one (1) (un)loading zone was considered for the analysis. This analysis should reflect the worst-case scenario should staff choose to not pursue the two (2) (un)loading zone scenarios at build-out.

The study analyzes traffic conditions during the weekday AM and PM peak hours for the following scenarios:

- Existing (2021) Traffic Conditions

- No-Build (2022) Traffic Conditions
- Build (2022) Traffic Conditions

2. Existing Traffic Conditions

The study area for the TIA was determined through coordination with the Town and NCDOT and consists of the following existing intersections:

- US 1 and Height Lane / Ponderosa Service Road
- Height Lane and Star Road

Peak hour turning movement counts were conducted at the study intersection of US 1 and Height Lane / Ponderosa Service Road in May of 2019, during weekday AM (7:00 to 9:00 AM) and weekday PM (4:00 to 6:00 PM) peak hours. This data was grown up to 2020 by a 3% growth rate and balanced with adjacent intersections as part of the Hawthorne (previously Evolve) TIA. Counts were grown for one additional year, 2021, via a 3% growth rate for the proposed existing (2021) volumes to be utilized for the purposes of this study. Utilizing the weekday PM (4:00 to 6:00 PM) peak hour is expected to provide conservative results for the school PM peak period (typically 2:00 – 4:00 PM); however, data was not available for the school PM peak period. Additionally, it should be noted that these counts are assumed to be 15-minute interval data, although the raw data was not available.

No data was available for the intersection of Height Lane and Star Road; however, based on the traffic data at the intersection of US and Height Lane / Ponderosa Service Road, minimal vehicles are anticipated to travel through this intersection. Due to the limited development to the south and east at this intersection a traffic volume of four (4) vehicles per hour was included on all movements to/from the south (Star Road) and east (Height Lane), per Congestion Management Guidelines. Volumes were then balanced between intersections by adjusting the southbound right-turn movement and eastbound left-turn movement volumes, with a minimum turning movement volume of four (4) vehicles per hour. It should be noted that this methodology does create a slight imbalance in the westbound direction, due to low westbound volumes at the intersection of US and Height Lane / Ponderosa Service Road (less than 12 vehicles per hour); however, is anticipated to be conservative.

3. Site Trip Generation

The school is anticipated to consist of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of 5 grade levels and are anticipated to be even in size at approximately 377 students. Utilizing 100% of one grade grouping (approximately 377 students) plus 25% of the other grade grouping (approximately 94 students) gives 471 students that may arrive under one bell schedule. The additional 25% is expected to account for any overlap. For an urban charter school with 471 students in one grade grouping between grades pre-K through 8, the Traffic Calculator estimates 59 staff members, 263 parent drivers during the school AM peak hour, 185 parent drivers during the school PM peak hour. No buses are anticipated to be provided. Based on the limited data within the study area, weekday PM (4:00 – 6:00 PM) peak hour traffic volumes were utilized. Applying school PM peak hour trips to the weekday PM peak hour traffic volumes is anticipated to provide conservative results for this peak period, particularly along US 1, where there is anticipated to be heavy commuter traffic volumes. Table E-1 provides a summary of the peak trip generation potential for the site.

Table E-1: Site Trip Generation

LAND USE	TRIP GENERATOR	DAILY TRIPS	AM PEAK HOUR (VPH)		PM PEAK HOUR (VPH)	
			Entering	Exiting	Entering	Exiting
Urban Charter School (471 Students)	59 Staff	118	59	0	0	59
	Parents	896	263	263	185	185
Total Site Trips		1,014	322	263	185	244

*The school is anticipated to consist of 754 total students with a staggered bell schedule of a minimum of thirty (30) minutes. Each grade grouping is anticipated to consist of 377 students. Assuming 100% of one grade grouping plus a 25% overlap of the other grade grouping gives 471 students that may arrive under one peak period.

4. Future Traffic Conditions

Through coordination with the Town and NCDOT, it was determined that an annual growth rate of 3% would be used to generate 2022 projected weekday AM and PM peak hour traffic volumes. This ambient growth rate is consistent with the Hawthorne (previously Evolve) TIA. Based on average annually daily traffic (AADT) volumes within the vicinity of the site in recent years, this area has historically been growing by approximately 1%. Utilizing a 3% annually compounded

growth rate is expected to provide conservative future traffic volumes. Additionally, Hawthorne (previously Evolve) was considered as an adjacent development in this study. The weekday PM peak period for residential developments (4:00 – 6:00 PM) differs from the school PM peak period (2:00 – 4:00 PM); however, because the weekday PM (4:00 – 6:00 PM) peak hour was utilized for analysis purposes, no reduction in adjacent development trips was considered to provide conservative future analysis results. Additionally, there is expected to be interaction between the adjacent development and the proposed development based on their respective land uses; however, no reduction in adjacent development trips was applied to provide a conservative estimation of future traffic volumes.

5. Capacity and Queuing Analysis Summary

The analysis considered weekday AM and PM peak hour traffic for existing (2021), no-build (2022), and build (2022) conditions. Refer to Section 7 of the TIA for the capacity analysis summary performed at each study intersection.

The school is anticipated to consist of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of 5 grade levels and are anticipated to be even in size at approximately 377 students. Utilizing 100% of one grade grouping (approximately 377 students) plus 25% of the other grade grouping (approximately 94 students) gives 471 students that may arrive under one bell schedule. The additional 25% is expected to account for any overlap. For a 471-student capacity charter school, the MSTA School Traffic Calculator indicates a maximum high demand internal stacking need of 2,625 feet for student pick-up and drop-off. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The current site plan shows that the maximum high demand internal stacking length is exceeded and approximately 2,730 feet of internal stacking distance is provided. Based on SimTraffic simulations, with signalization at the intersection of US 1 and Height Lane / Ponderosa Service Road or an additional on-site circulating lane, stacking is anticipated to be contained on-site. Refer to Section 7.5 of the report for more information.

6. Recommendations

Based on the findings of this study, specific geometric and traffic control improvements have been identified at study intersections. The improvements are summarized below and are illustrated in Figure E-1.

Developer Improvements:

US 1 and Height Lane / Ponderosa Service Road

- Extend the existing southbound left-turn lane to a minimum of 500 feet of storage and appropriate deceleration and taper length.

Star Road and Site Drive 1

- Construct a westbound approach with one egress lanes.
- Provide stop control for the westbound approach.

Star Road and Site Drive 2

- Construct the eastern leg of the intersection with two (2) ingress lanes.

LEGEND

○ Unsignalized Intersection

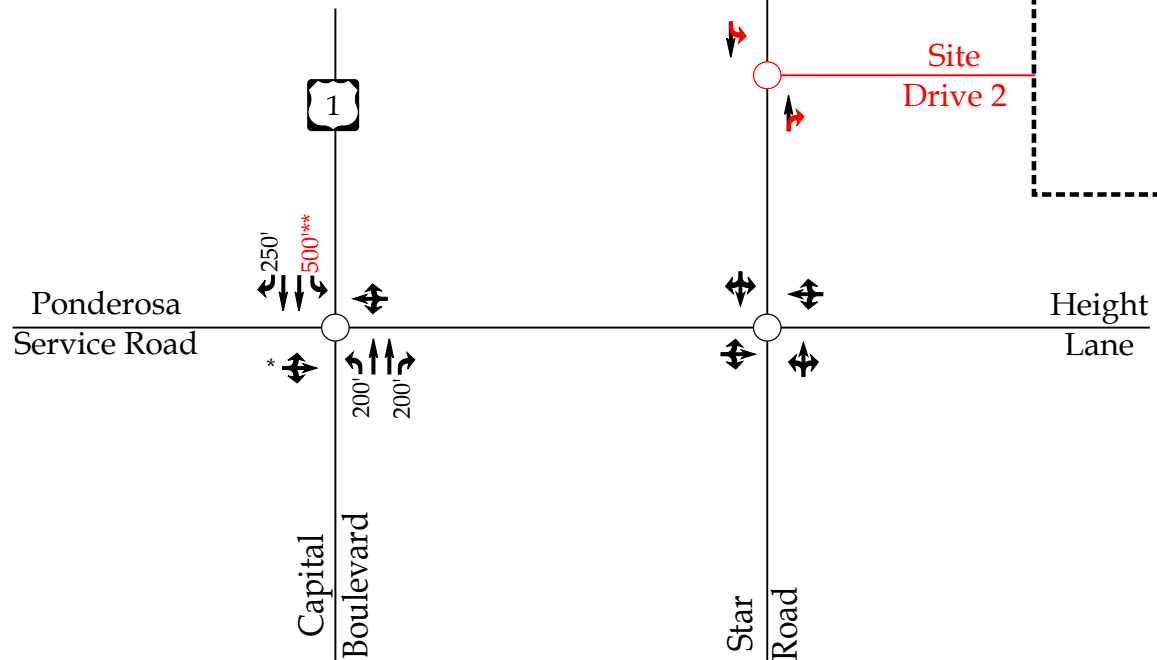
➔ Existing Lane

➔ Improvement by Developer

x' Storage (In Feet)

*Pavement width exists for an exclusive eastbound right-turn turn lane with 75' of storage.

**Extend the existing 250' full width turn lane to a minimum of 500'.



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Casa Esperanza
Charter School
Wake Forest, NC

Recommended Lane
Configurations

Scale: Not to Scale Figure E1

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Appendix A:	Memorandum of Understanding
Appendix B:	Traffic Count Data
Appendix C:	Adjacent Development Information
Appendix D:	Future Roadway Improvements Information
Appendix E:	MSTA Traffic Calculations
Appendix F:	Capacity Calculations – US 1 and Height Lane / Ponderosa Service Road
Appendix G:	Capacity Calculations – Height Lane and Star Road
Appendix H:	Capacity Calculations – Star Road and Site Drive 1
Appendix I:	Capacity Calculations – Star Road and Site Drive 2
Appendix J:	Capacity Calculations – Internal Circulation Results
Appendix K:	Traffic Management Plan

TRAFFIC IMPACT ANALYSIS
CASA ESPERANZA
WAKE FOREST, NORTH CAROLINA

1. INTRODUCTION

The contents of this report present the findings of the Traffic Impact Analysis (TIA) conducted for the proposed Casa Esperanza to be located north of Height Lane and east of Star Road in Wake Forest, North Carolina. The purpose of this study is to determine the potential impacts to the surrounding transportation system created by traffic generated by the proposed development, as well as recommend improvements to mitigate the impacts.

The scope of work for this study was developed based on coordination with the North Carolina Department of Transportation (NCDOT) and the Town of Wake Forest (Town). A copy of the approved Memorandum of Understanding (MOU) has been provided in Appendix A.

The study analyzes traffic conditions during the weekday AM and PM school peak hours for the following scenarios:

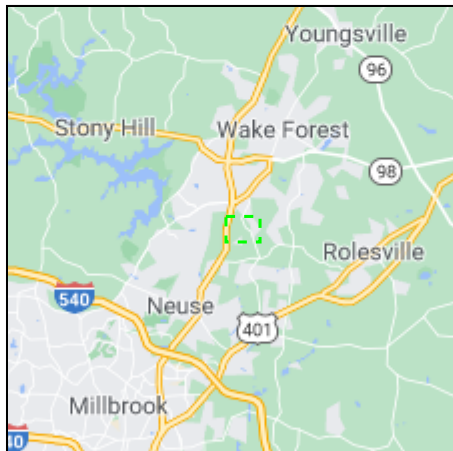
- Existing (2021) Traffic Conditions
- No-Build (2022) Traffic Conditions
- Build (2022) Traffic Conditions

1.1. Site Location and Study Area

The charter school is proposed to be located north of Height Lane and east of Star Road in Wake Forest, North Carolina. The study area for the TIA was determined through coordination with the NCDOT and the Town and consists of the following existing intersections:

- US 1 and Height Lane / Ponderosa Service Road
- Height Lane and Star Road

Refer to Figure 1 for the site location map.



LEGEND

- Proposed Site Location
- Study Intersection
- Study Area

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Casa Esperanza
Charter School
Wake Forest, NC

Site Location Map

Scale: Not to Scale

Figure 1

1.2. Proposed Land Use and Site Access

The subject development is proposed to be an urban charter school with a maximum of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of five (5) grade levels and are anticipated to be even in size. Access to the charter school site will be provided via one (1) ingress only driveway (southern) and one (1) egress only driveway (northern) along Star Road. Parents are anticipated to enter the site via the southern driveway and navigate through the campus in a counterclockwise direction. Based on the young age of students (grades pre-K through 8) and due to the counterclockwise flow of vehicles, students should be seated in the backseat on the drivers' side of the vehicle for (un)loading operations. This counterclockwise pattern was recommended by NCDOT based on any conflict with entering and exiting vehicles. This configuration minimizes conflict and allows for better on- and off-site flow. Based on the current site plan, there will be two (2) (un)loading zones located side by side. Based on NCDOT MSTA guidelines and to provide conservative results, only one (1) (un)loading zone will be considered for the purposes of the analysis. This analysis should reflect the worst-case scenario should staff choose to not pursue the two (2) (un)loading zone scenarios on a given day. Refer to the Traffic Management Plan (TMP) in Appendix K for more information.

For the purpose of this TIA, the charter school is assumed to be fully built and operational to students in 2022. As shown on the site plan, approximately 2,730 linear feet of vehicle stacking for student drop-off and pick-up may be accommodated on site. Refer to Figure 2 for a copy of the preliminary site plan.

1.3. Adjacent Land Uses

The proposed charter school is expected to be constructed within an area consisting primarily of industrial and residential development.

1.4. Existing Roadways

Existing lane configurations (number of traffic lanes on each intersection approach), speed limits, storage capacities, and other intersection and roadway information was collected by

Ramey Kemp & Associates, Inc. (RKA). It should be noted that US 1 is anticipated to be upgraded based on NCDOT STIP Project U-5307C; however, 2040 analysis was determined to not be considered at this time, because U-5307C is anticipated to improve the study area and there would not be anticipated improvements that would be necessary of the school associated with this project, as this study is not a rezoning project. This methodology was discussed during scoping and was approved as part of the Memorandum of Understanding (MOU). Refer to Appendix A for a copy of the approved MOU. Table 1 provides a summary of the existing roadways. Refer to Figure 3 for an illustration of the existing lane configurations within the study area.

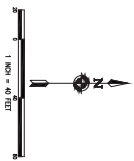
Table 1: Existing Roadway Inventory

Road Name	Route Number	Typical Cross Section	Speed Limit	Maintained By	AADT (vpd)
Capital Boulevard	US 1	4-lane divided	55 mph	NCDOT	47,000 ¹
Height Lane / Ponderosa Service Road	SR 2181	2-lane undivided	35 mph*	Town / NCDOT	1,670 ²
Star Road	SR 2183	2-lane undivided	35 mph*	NCDOT	240 ²


* Assumed based on North Carolina Speed Limits Map published by NCDOT.

1. 2019 NCDOT AADT Information utilized.

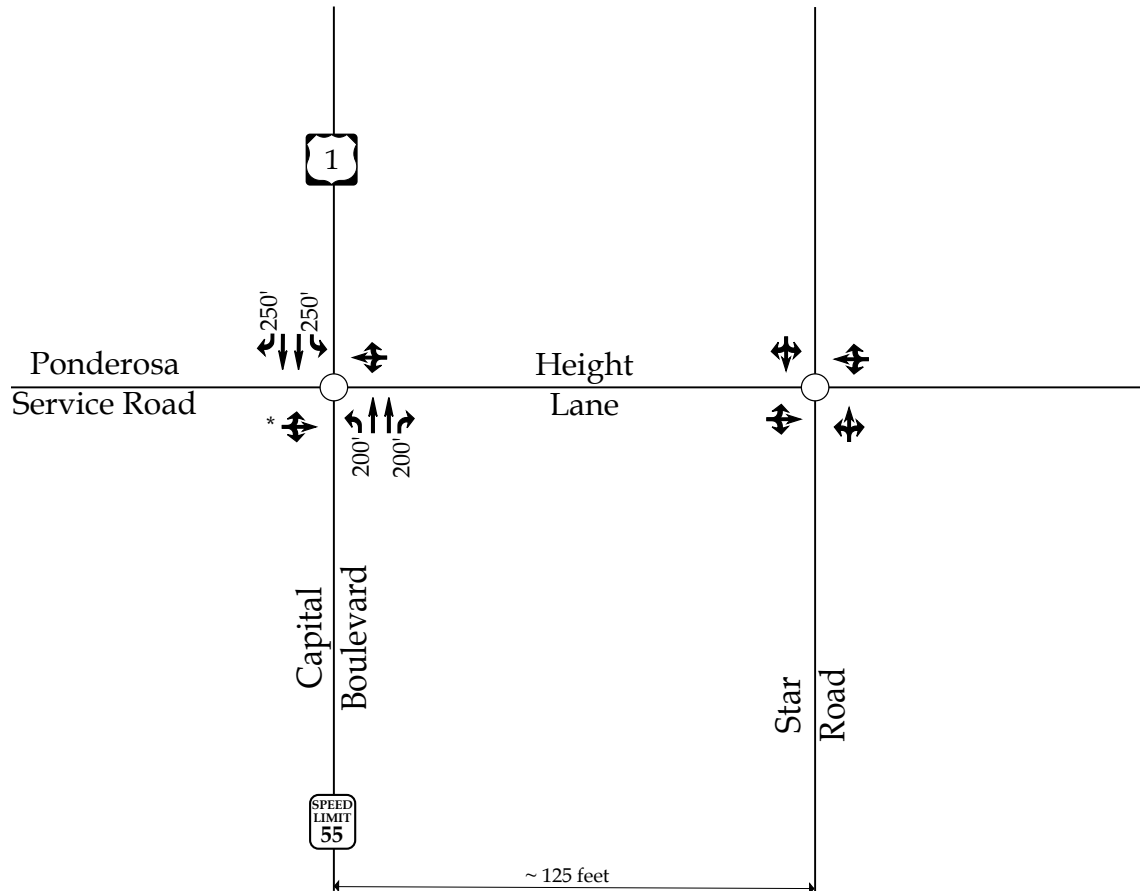
2. AADT based on the traffic counts from 2020, grown to 2021, and assuming the weekday PM peak hour volume is 10% of the average daily traffic.



LEGEND

- Unsignalized Intersection
- ➔ Existing Lane
- X' Storage (In Feet)
-  Posted Speed Limit

*Pavement width exists for an exclusive eastbound right-turn turn lane with 75' of storage.



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Casa Esperanza
Charter School
Wake Forest, NC

Existing (2021)
Lane Configurations

Scale: Not to Scale

Figure 3

2. EXISTING (2021) PEAK HOUR CONDITIONS

2.1. Existing (2021) Peak Hour Traffic

Peak hour turning movement counts were conducted at the study intersection of US 1 and Height Lane / Ponderosa Service Road in May of 2019, during weekday AM (7:00 to 9:00 AM) and weekday PM (4:00 to 6:00 PM) peak hours. This data was grown up to 2020 by a 3% growth rate and balanced with adjacent intersections as part of the Hawthorne (previously Evolve) TIA. Counts were grown for one additional year, 2021, via a 3% growth rate for the proposed existing (2021) volumes to be utilized for the purposes of this study. Utilizing the weekday PM (4:00 to 6:00 PM) peak hour is expected to provide conservative results for the school PM peak period (typically 2:00 – 4:00 PM); however, data was not available for the school PM peak period. Additionally, it should be noted that these counts are assumed to be 15-minute interval data, although the raw data was not available.

No data was available for the intersection of Height Lane and Star Road; however, based on the traffic data at the intersection of US and Height Lane / Ponderosa Service Road, minimal vehicles are anticipated to travel through this intersection. Due to the limited development to the south and east at this intersection a traffic volume of four (4) vehicles per hour was included on all movements to/from the south (Star Road) and east (Height Lane), per Congestion Management Guidelines. Volumes were then balanced between intersections by adjusting the southbound right-turn movement and eastbound left-turn movement volumes, with a minimum turning movement volume of four (4) vehicles per hour. It should be noted that this methodology does create a slight imbalance in the westbound direction, due to low westbound volumes at the intersection of US and Height Lane / Ponderosa Service Road (less than 12 vehicles per hour); however, is anticipated to be conservative.

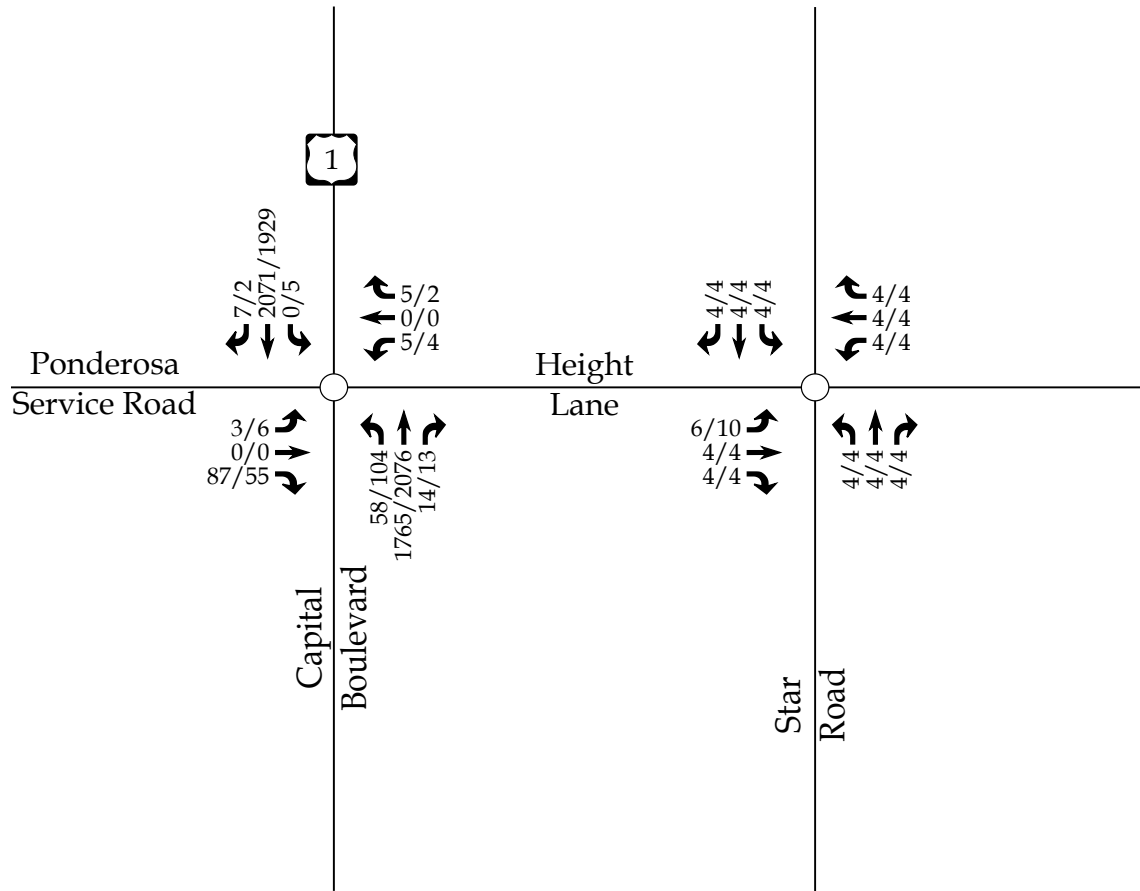
This methodology was reviewed and approved as part of the MOU. Refer to Appendix A for a copy of the approved MOU. Refer to Figure 4 for existing (2021) weekday AM and PM peak hour traffic volumes. A copy of the traffic count data is in Appendix B of this report.

2.2. Analysis of Existing (2021) Peak Hour Traffic

The existing (2021) weekday AM and PM peak hour traffic volumes were analyzed to determine the current levels of service at the study intersections under existing roadway conditions. The results of the analysis are presented in Section 7 of this report.

LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic



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Casa Esperanza
Charter School
Wake Forest, NC

Existing (2021)
Peak Hour Traffic

Scale: Not to Scale

Figure 4

3. NO-BUILD (2022) PEAK HOUR CONDITIONS

In order to account for growth of traffic and subsequent traffic conditions at a future year, no-build traffic projections are needed. No-build traffic is the component of traffic due to the growth of the community and surrounding area that is anticipated to occur regardless of whether the proposed development is constructed. No-build traffic is comprised of existing traffic growth within the study area and additional traffic created as a result of adjacent approved developments.

3.1. Ambient Traffic Growth

Through coordination with the Town and NCDOT, it was determined that an annual growth rate of 3% would be used to generate projected (2022) weekday AM and PM school peak hour traffic volumes. This ambient growth rate is consistent with the Hawthorne (previously Evolve) TIA. Based on average annually daily traffic (AADT) volumes within the vicinity of the site in recent years, this area has historically been growing by approximately 1%. Utilizing a 3% annually compounded growth rate is expected to provide conservative future traffic volumes. This methodology was reviewed and approved as part of the MOU. Refer to Figure 5 for projected (2022) peak hour traffic. Refer to Appendix A for a copy of the approved MOU.

3.2. Adjacent Development Traffic

Per coordination with NCDOT and the Town, Hawthorne (previously Evolve) was considered as an adjacent development in this study. The development did not have any recommended improvements at any intersections in the Casa Esperanza study area. Hawthorne consists of a 23-acre site located east of Star Road and north of Star Road Connector / Ponderosa Service Road Connector. The development will consist of 248 mid-rise multi-family housing units based on its TIA.

It should be noted that the weekday PM peak period for residential developments (4:00 – 6:00 PM) differs from the school PM peak period (2:00 – 4:00 PM); however, because the weekday PM (4:00 – 6:00 PM) peak hour was utilized for analysis purposes, no reduction in adjacent development trips was considered to provide conservative future analysis results.

Additionally, there is expected to be interaction between the adjacent development and the proposed development based on their respective land uses; however, no reduction in adjacent development trips was applied to provide a conservative estimation of future traffic volumes.

Ponderosa Service Road Townhomes was also identified within the study area; however, due to the conservative nature of the study (utilizing the weekday PM peak hour, as opposed to the school PM peak hour, the anticipated interaction between residential adjacent developments and school development, and the high growth rate compared to historical growth within the vicinity of the site), the 3% annually compounded growth rate is anticipated to capture trips by Ponderosa Service Road Townhomes. Therefore, trips by Ponderosa Service Townhomes were not included in future traffic growth. This methodology was reviewed and approved as part of the MOU. Refer to Appendix A for a copy of the approved MOU and Appendix C for additional adjacent development information. Refer to Figure 6 for an illustration of the peak hour adjacent development trips.

3.3. Future Roadway Improvements

US 1 is anticipated to be upgraded based on NCDOT STIP Project U-5307C; however, 2040 analysis was determined to not be considered at this time, because U-5307C is anticipated to improve the study area and there would not be anticipated improvements that would be necessary of the school associated with this project. This methodology was discussed during scoping and approved as part of the MOU. It should be noted that at the build-out of NCDOT STIP Project U-5307C, the school will no longer have immediate access to US 1 (via Height Lane). Navigating to/from the school will require vehicles to utilize the Main Street connection to Star Road. This requires vehicles to travel approximately one (1) mile along Star Road each direction to access the site. Based on coordination with the site team, the school is aware of this future impact. Refer to Appendix A for a copy of the approved MOU and Appendix D for additional future roadway information and coordination.

3.4. No-Build (2022) Peak Hour Traffic Volumes

The no-build (2022) traffic volumes were determined by projecting the existing (2021) peak hour traffic to the year 2022 and adding the adjacent development trips. Refer to Figure 7 for an illustration of the no-build (2022) peak hour traffic volumes at the study intersections.

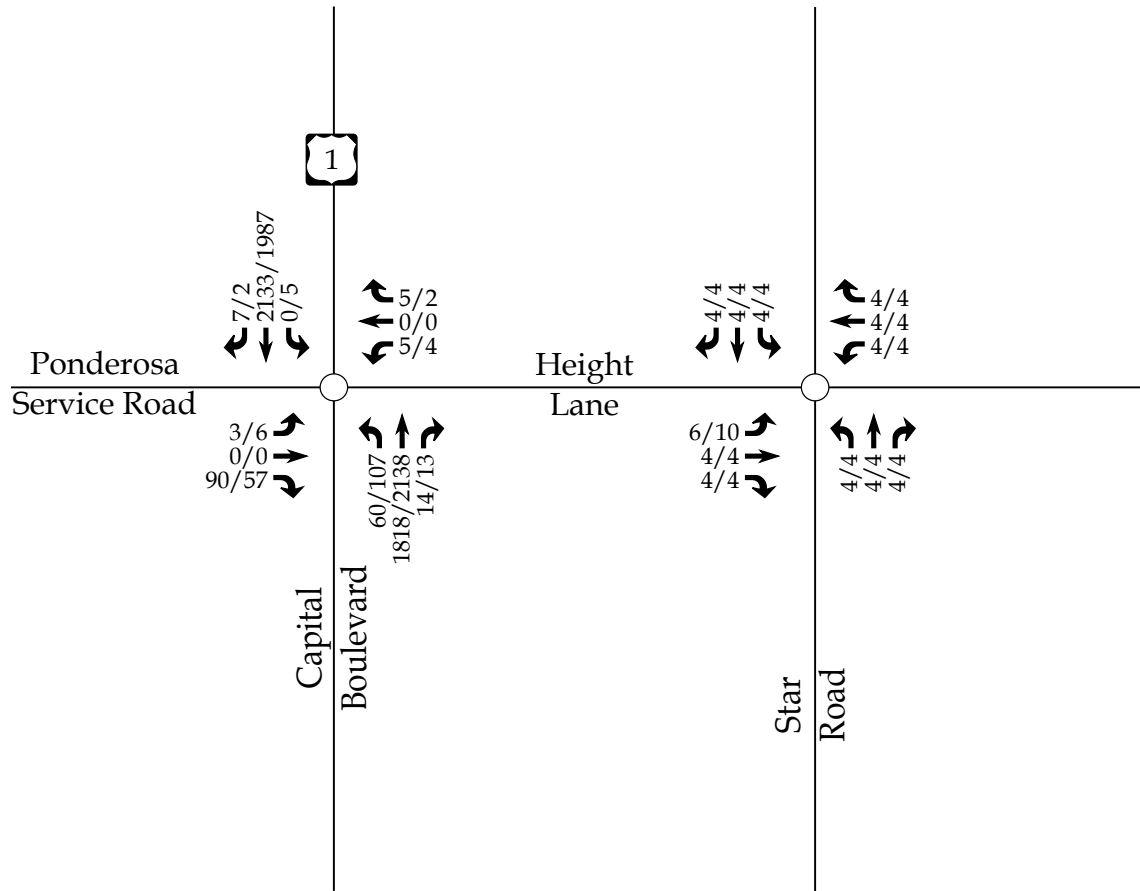
3.5. Analysis of No-Build (2022) Peak Hour Traffic Conditions

The no-build (2022) AM and PM peak hour traffic volumes at the study intersections were analyzed with future geometric roadway conditions and traffic control. The analysis results are presented in Section 7 of this report.



LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic



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Charter School
Wake Forest, NC

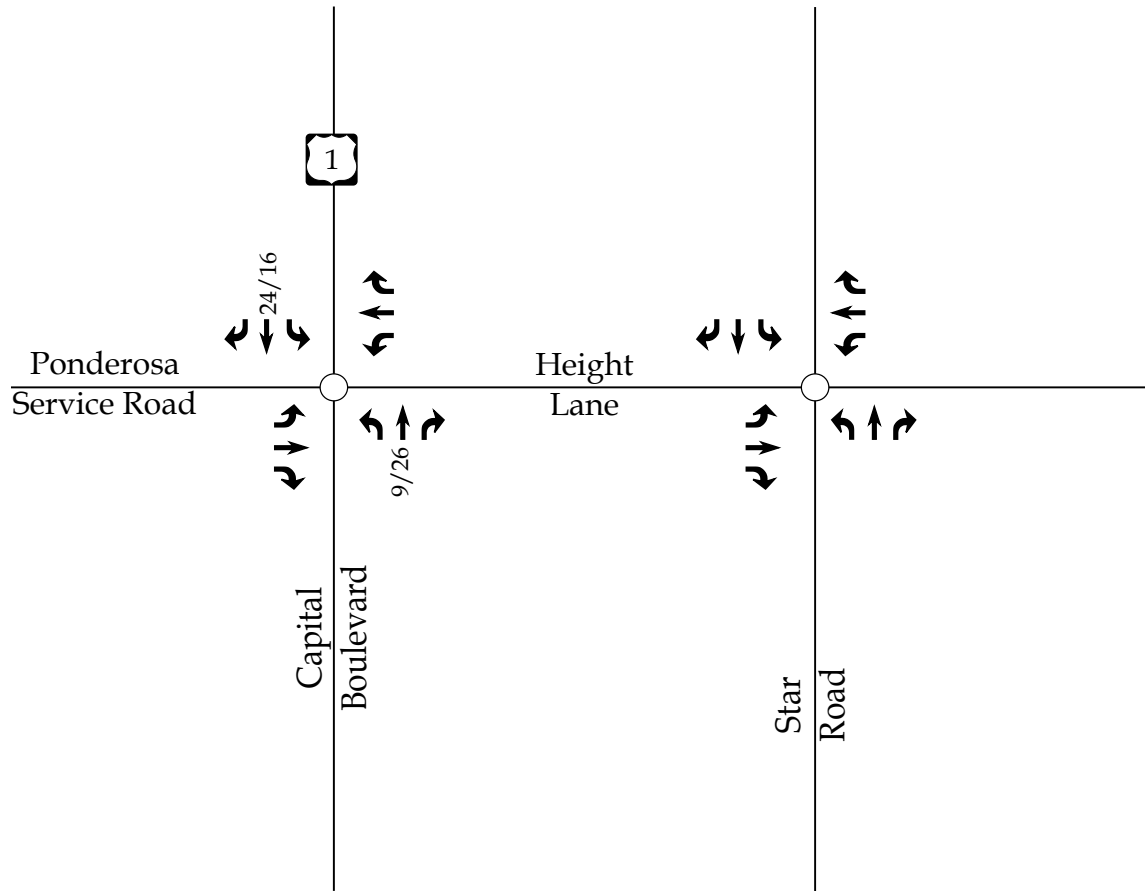
Projected (2022)
Peak Hour Traffic

Scale: Not to Scale

Figure 5

LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic



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Casa Esperanza
Charter School
Wake Forest, NC

Peak Hour Adjacent
Development Trips

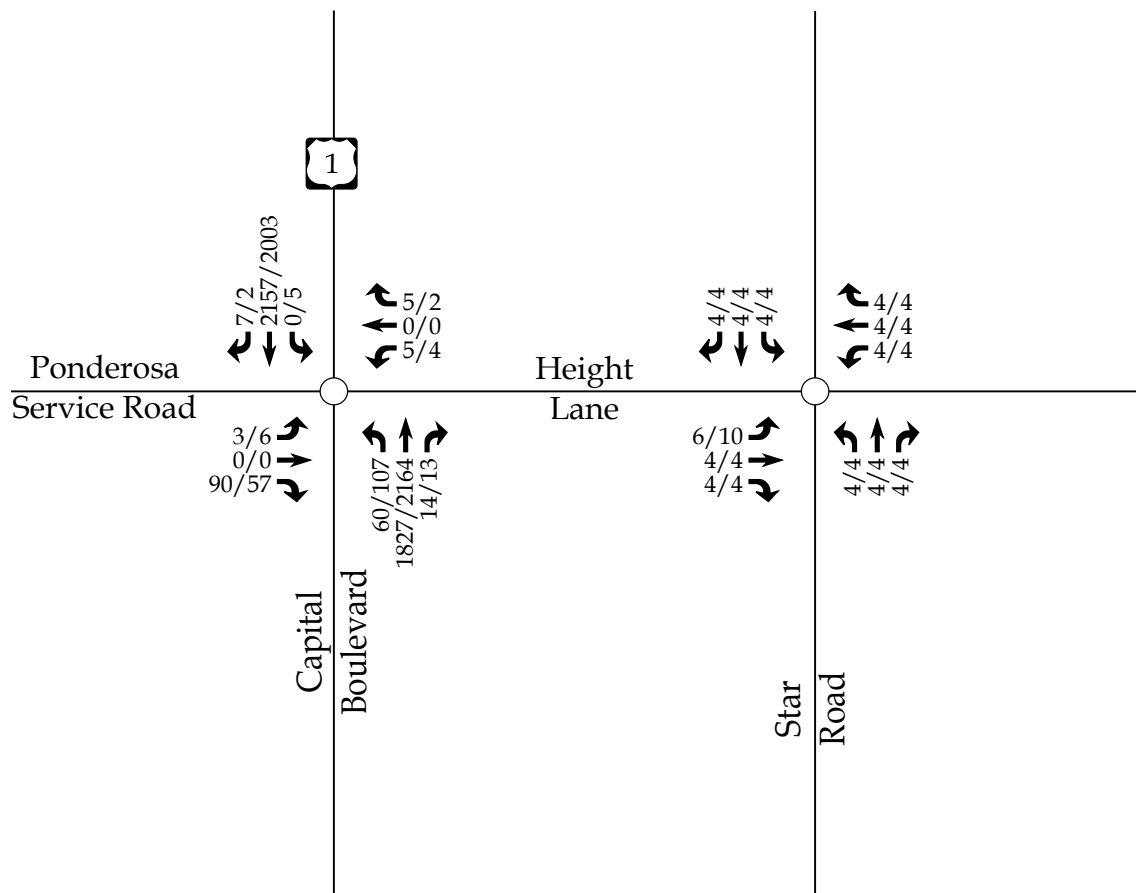
Scale: Not to Scale

Figure 6



LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic



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Casa Esperanza
Charter School
Wake Forest, NC

No-Build (2022)
Peak Hour Traffic

Scale: Not to Scale

Figure 7

4. SITE TRIP GENERATION AND DISTRIBUTION

4.1. Trip Generation

The daily and peak hour traffic expected to be generated by the proposed school was estimated utilizing the Municipal and School Transportation Assistance (MSTA) Traffic Calculator provided by the Traffic Engineering and Safety Systems Branch of the NCDOT. These calculations are based on the average traffic volumes and vehicle queue data on a typical school day obtained at schools across the State of North Carolina. The trip estimates do not consider high traffic demand days or special events.

The school is anticipated to consist of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of 5 grade levels and are anticipated to be even in size at approximately 377 students. Utilizing 100% of one grade grouping (approximately 377 students) plus 25% of the other grade grouping (approximately 94 students) gives 471 students that may arrive under one bell schedule. The additional 25% is expected to account for any overlap. For an urban charter school with 471 students in one grade grouping between grades pre-K through 8, the Traffic Calculator estimates 59 staff members, 263 parent drivers during the school AM peak hour, 185 parent drivers during the school PM peak hour. No buses are anticipated to be provided. Refer to Table 2 for the trip generation summary of the school during the AM and PM peak hour. A copy of the MSTA results is shown in Appendix E.

Table 2: Trip Generation Summary

LAND USE	TRIP GENERATOR	DAILY TRIPS	AM PEAK HOUR (VPH)		PM PEAK HOUR (VPH)	
			Entering	Exiting	Entering	Exiting
Urban Charter School (471 Students)	59 Staff	118	59	0	0	59
	Parents	896	263	263	185	185
Total Site Trips		1,014	322	263	185	244

*The school is anticipated to consist of 754 total students with a staggered bell schedule of a minimum of thirty (30) minutes. Each grade grouping is anticipated to consist of 377 students. Assuming 100% of one grade grouping plus a 25% overlap of the other grade grouping gives 471 students that may arrive under one peak period.

It is anticipated that the proposed school will generate 585 trips (322 entering and 263 exiting) during the weekday AM peak hour and 429 trips (185 entering and 244 exiting) during the school PM peak hour based on the larger school bell schedule. Based on the limited data within the study area, weekday PM (4:00 – 6:00 PM) peak hour traffic volumes were utilized. Applying school PM peak hour trips to the weekday PM peak hour traffic volumes is anticipated to provide conservative results for this peak period, particularly along US 1, where there is anticipated to be heavy commuter traffic volumes.

The MSTA calculator also calculates average and high demand queue lengths. The average queue length noted from the MSTA calculator based on the larger school bell schedule is 2,019 feet and the high demand length is 2,625 feet. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The latest site plan shows that the high demand length is met and approximately 2,730 feet of internal stacking distance is provided.

It should be noted that the school intends to operate with pre-K and Kindergarten students. Based on coordination with NCDOT during scoping, if these students were walked into and out of the school, a reduction in required stacking length may be considered; however, based on coordination after scoping (February 23, 2021), the latest site plan does not adequately accommodate kindergarten park and walk-in area on the site plan. Therefore, MSTA noted that no queue credit would be provided for walk ins. Walking pre-K and Kindergarten students may still be considered should there be stacking concerns at build-out; however, will not be calculated as a decrease in the queue length.

Additionally, MSTA noted on February 23, 2021, that the latest site plan shows vehicle to vehicle conflicts with the parking area and bypassing traffic, which may cause delays and additional queuing. It has been recommended as part of the TMP for staff to arrive a minimum of fifteen (15) minutes prior to the first bell and leave a minimum of thirty (30) minutes after the last bell to minimize these conflicts. Additional recommendations may be included in the TMP dependent upon capacity and internal analysis results. Refer to Section 7 of the report for capacity and internal analysis results. Refer to Appendix K for the TMP.

4.2. Site Trip Distribution and Assignment

Trip distribution percentages used in assigning site traffic for this development were estimated based on a combination of existing traffic patterns, population centers adjacent to the study area, and engineering judgment. It is estimated that trips for students and staff will be distributed as follows:

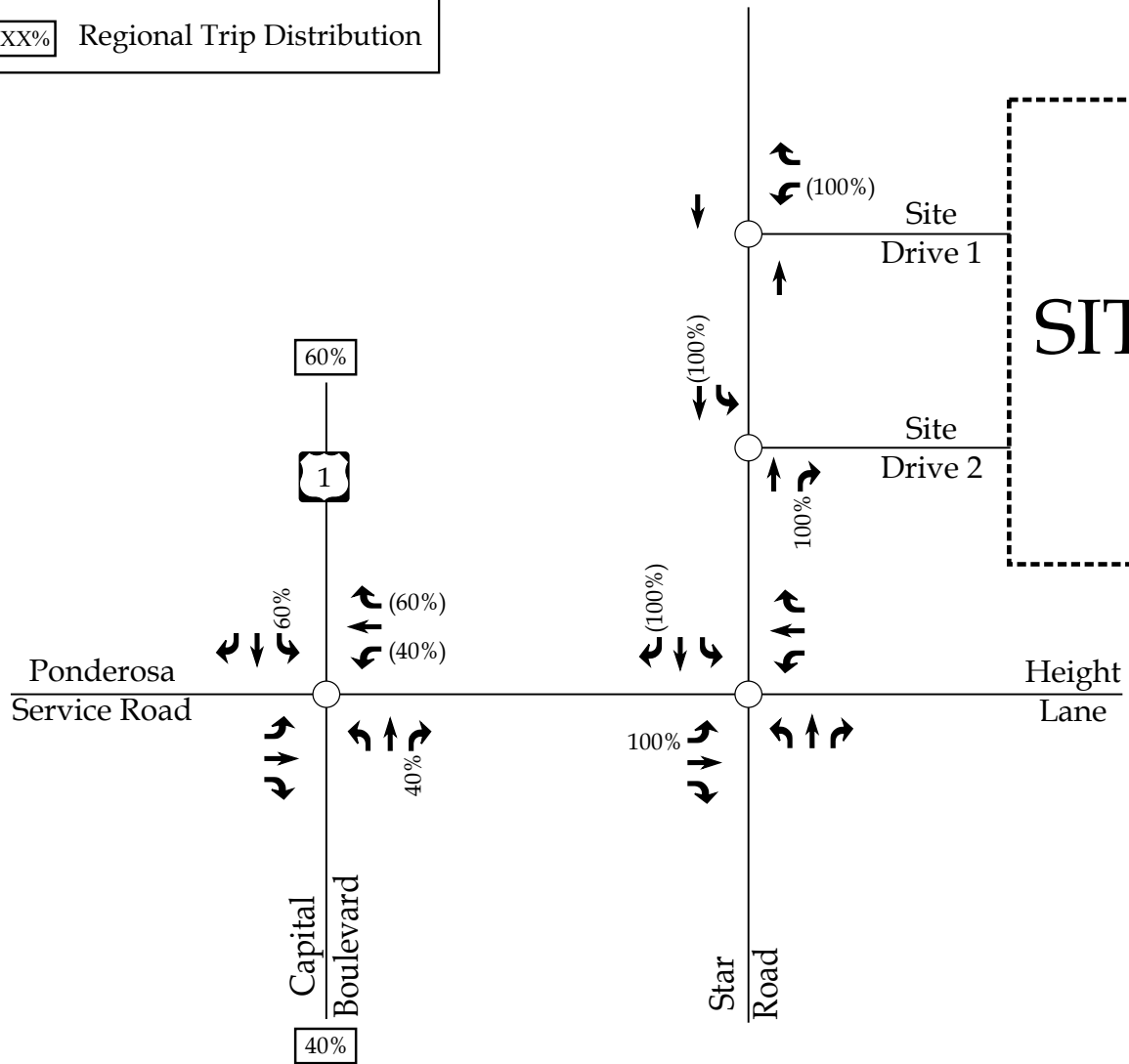
- 60% to/from the north via US 1
- 40% to/from the south via US 1

The distributions have been reviewed and approved by the NCDOT and Town as part of the MOU. It should be noted that the distribution is anticipated to provide conservative analysis results, because it assumes all site traffic will utilize Height Lane when traveling between Star Road and US 1. It is anticipated that if there are delays at the intersection of US 1 and Height Lane / Ponderosa Service Road, site trips may utilize other connectors to/from US 1 along the Star Road corridor. Refer to Appendix A for a copy of the MOU.

Refer to Figure 8 for an illustration of the staff and parent site trip distribution percentages. The trips shown in Table 1 were assigned to the study intersections based on the distribution percentages shown in Figure 8. Because the school is an urban charter school, parents and staff are expected to travel to/from the school in similar distribution patterns based on residential development within the vicinity of the site. It should be noted that after the construction of NCDOT STIP Project U-5307C, all parents/staff are anticipated to enter/exit the TIA roadway network to/from the north along Star Road (connecting to S Main Street). Based on coordination with NCDOT, this analysis was not considered as part of this TIA. Figure 9a and Figure 9b show the anticipated site trips for staff and parents, respectively. The total school site trips are shown in Figure 9c.

LEGEND

- Unsignalized Intersection
- X% → Entering Trip Distribution
- (Y%) → Exiting Trip Distribution
- XX% Regional Trip Distribution



Moving forward.



Casa Esperanza
Charter School
Wake Forest, NC

Site Trip Distribution

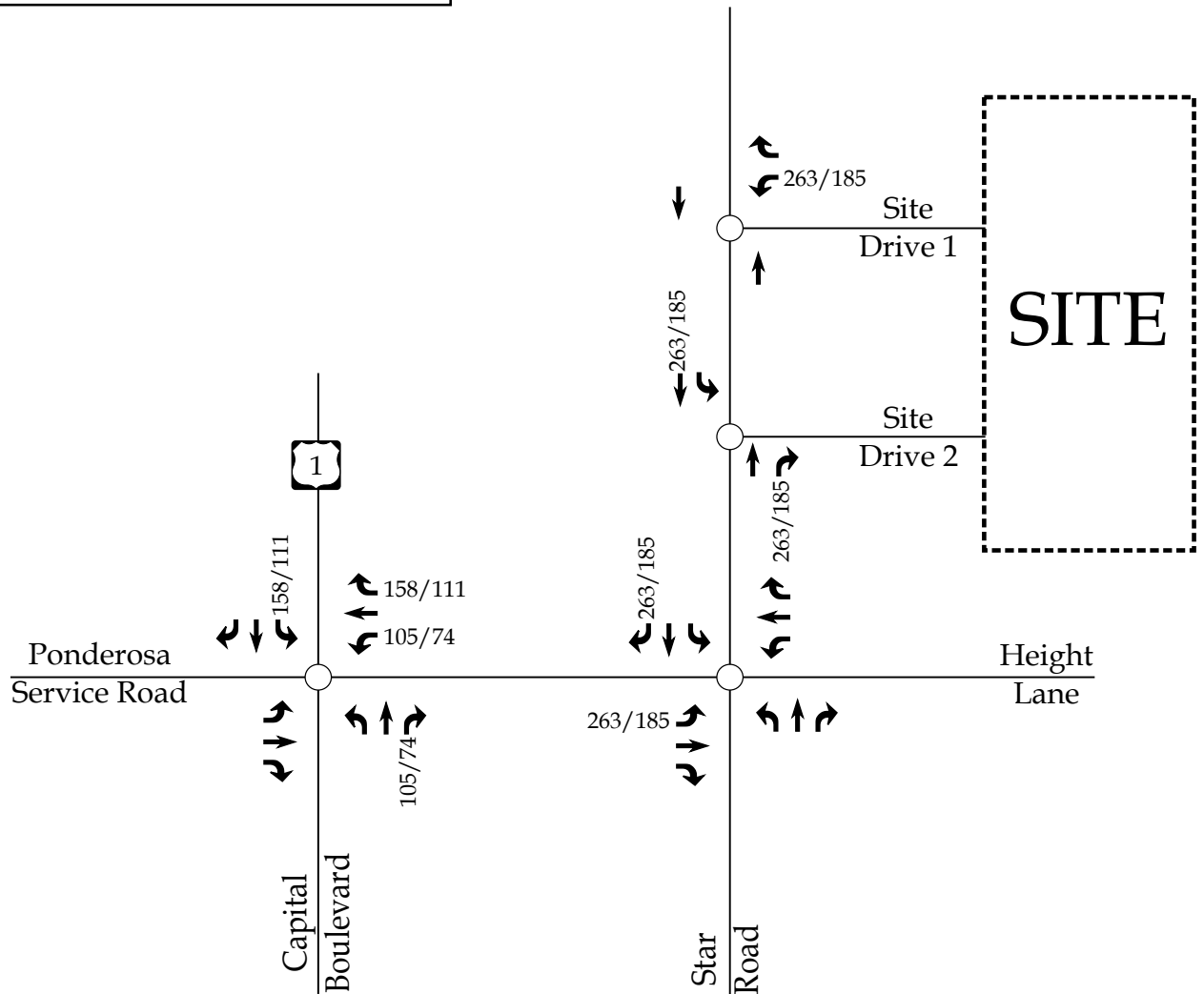
Scale: Not to Scale

Figure 8

LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / School PM Peak Hour Site Trips*

*School PM peak hour trips were applied to the weekday PM peak hour traffic volumes to provide conservative results.



Moving forward.



Casa Esperanza
Charter School
Wake Forest, NC

Site Trip Assignment -
Parent

Scale: Not to Scale Figure 9a

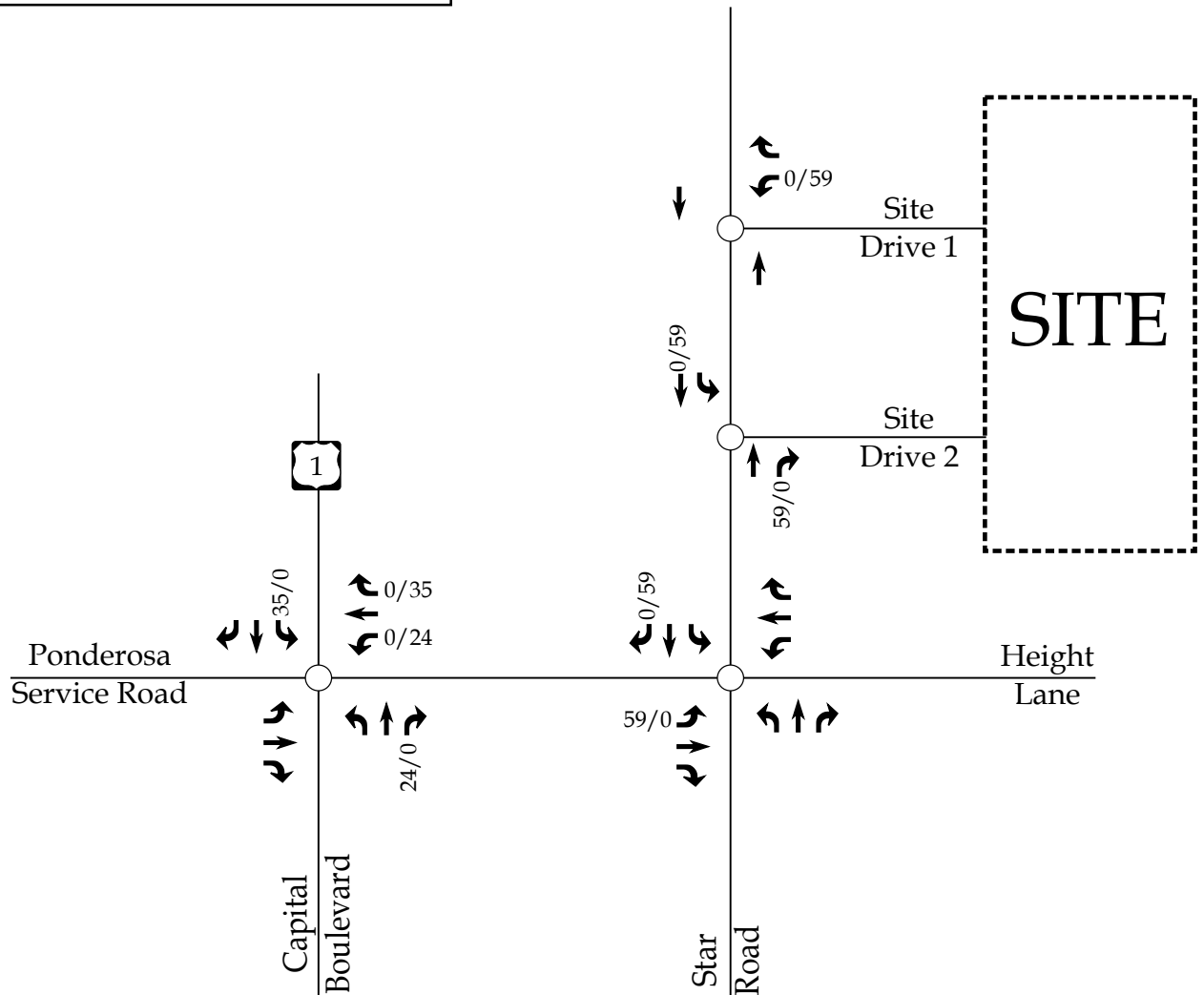
LEGEND



Unsignalized Intersection

X / Y → Weekday AM / School PM
Peak Hour Site Trips*

*School PM peak hour trips were applied to the weekday PM peak hour traffic volumes to provide conservative results.



Moving forward.



Casa Esperanza
Charter School
Wake Forest, NC

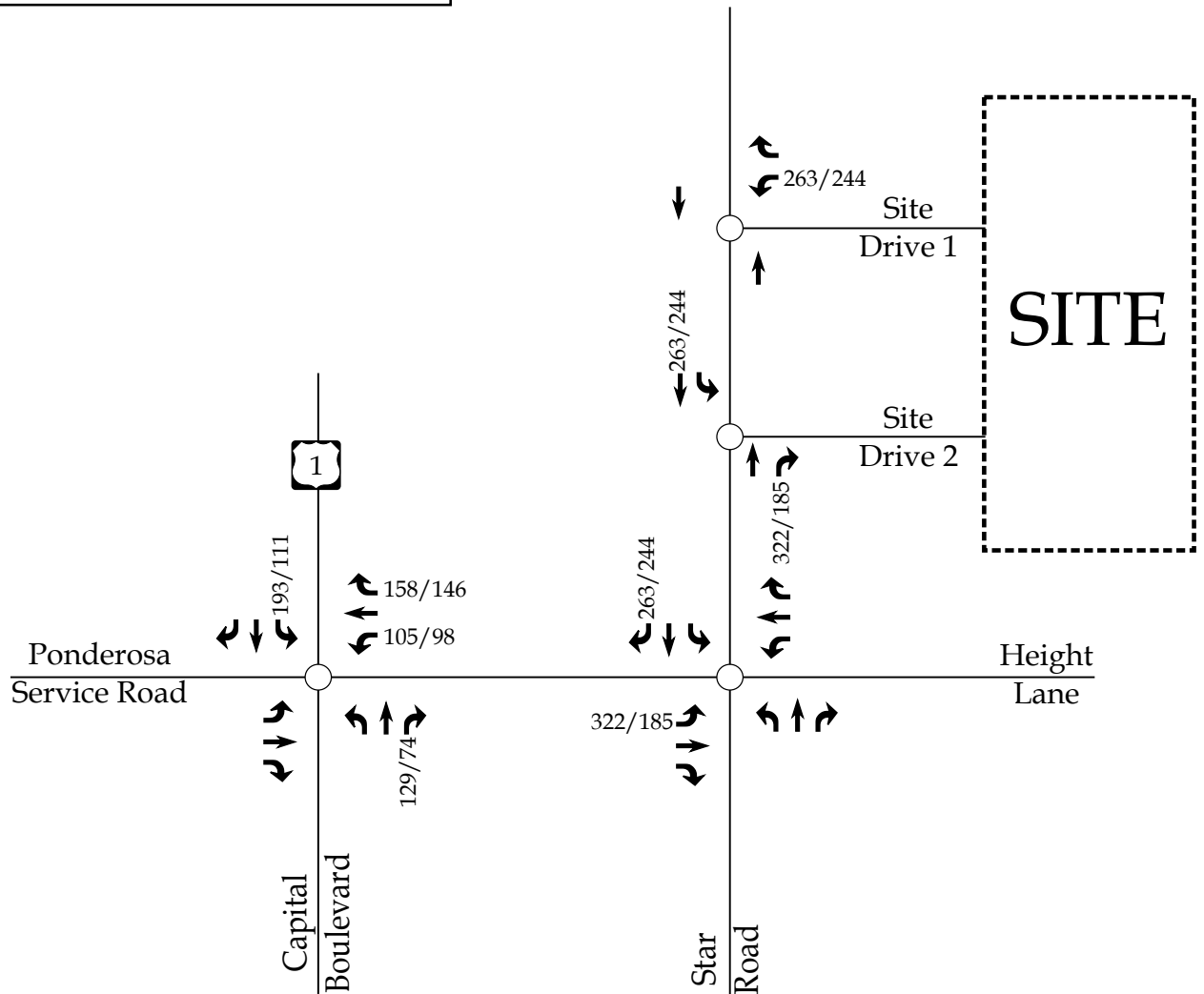
Site Trip Assignment -
Staff

Scale: Not to Scale Figure 9b

LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / School PM Peak Hour Site Trips*

*School PM peak hour trips were applied to the weekday PM peak hour traffic volumes to provide conservative results.



Moving forward.



Casa Esperanza
Charter School
Wake Forest, NC

Site Trip Assignment -
Total

Scale: Not to Scale Figure 9c

5. Build (2022) TRAFFIC CONDITIONS

5.1. Build (2022) Peak Hour Traffic Volumes

In order to estimate traffic conditions with the site fully developed, the total site trips (Figure 9c) were added to the no-build (2022) traffic volumes (Figure 7) to determine build (2022) traffic conditions. Refer to Figure 10 for an illustration of the build (2022) peak hour traffic volumes with the school in place.

5.2. Analysis of Build (2022) Peak Hour Traffic

Study intersections were analyzed with the build (2022) traffic volumes using the same methodology previously discussed for existing and no-build traffic conditions. Peak hour factors for each movement were adjusted in the analysis of build conditions since school trips occur during a short time period. A peak hour factor of 0.50 was used for all school trips and a peak hour factor of 0.90 was used for all other traffic. A weighted average was used to determine the peak hour factor for movements that included both school and non-school traffic.

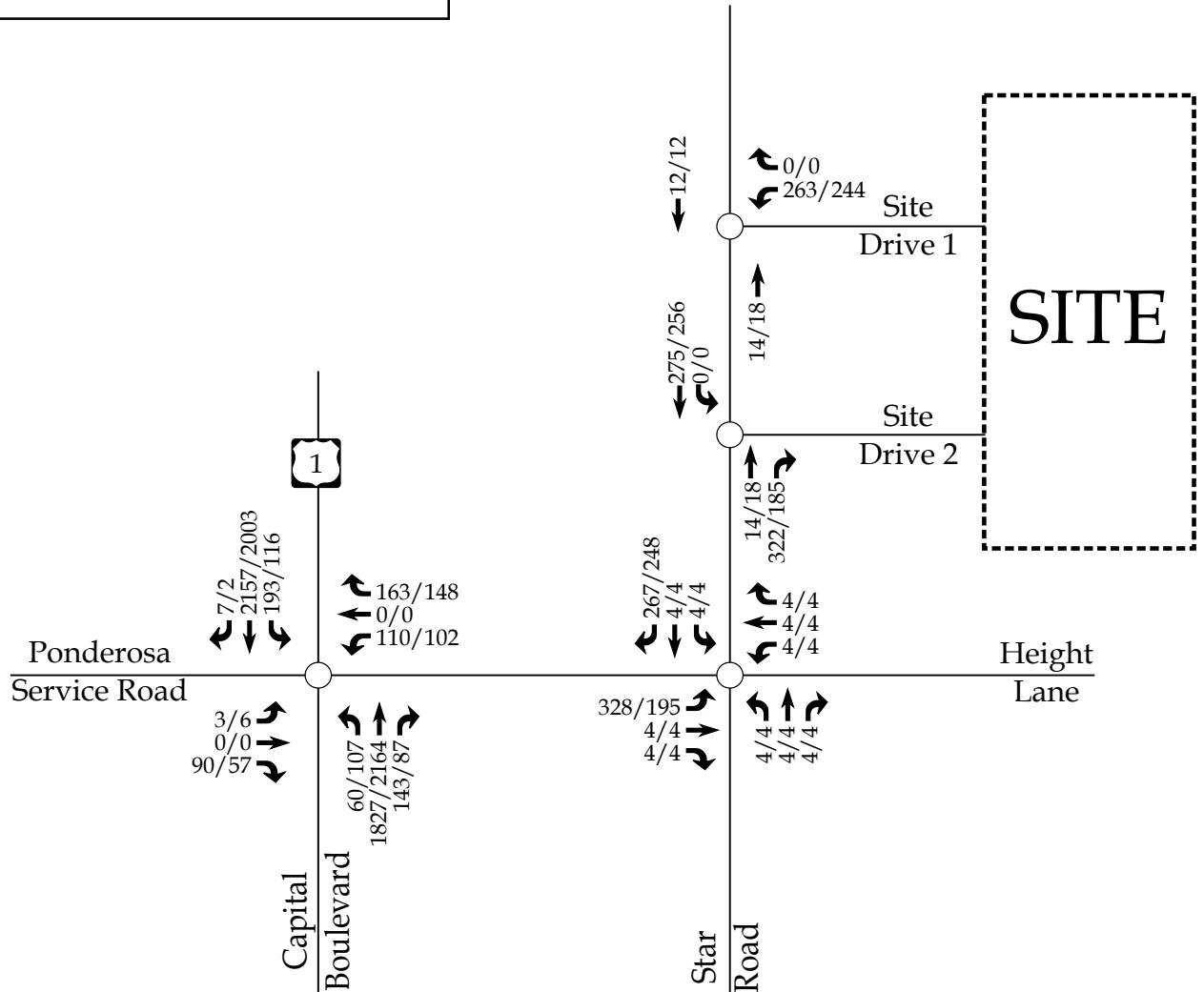
Based on the current site plan, there will be two (2) (un)loading zones located side by side. Based on NCDOT MSTA guidelines and to provide conservative results, only one (1) (un)loading zone will be considered for the purposes of the analysis. This analysis should reflect the worst-case scenario should staff choose to not pursue the two (2) (un)loading zone scenarios.

The study intersections were analyzed with improvements that could reasonably be made by the school to mitigate the school's impact to traffic conditions in the study area. The analysis results are presented in Section 7 of the report. Specific improvements at each study intersection are identified in Section 9.



LEGEND

- Unsignalized Intersection
- X / Y → Weekday AM / PM Peak Hour Traffic



Moving forward.



Casa Esperanza
Charter School
Wake Forest, NC

Build (2022)
Peak Hour Traffic

Scale: Not to Scale Figure 10

6. TRAFFIC ANALYSIS PROCEDURE

Study intersections were analyzed using the methodology outlined in the *Highway Capacity Manual, 6th Edition* (HCM) published by the Transportation Research Board. Capacity and level of service are the design criteria for this traffic study. A computer software package, Synchro (Version 10.3), was used to complete the analyses for all study area intersections. Please note that the unsignalized capacity analysis does not provide an overall level of service for an intersection; only delay for an approach with a conflicting movement.

The HCM defines capacity as “the maximum hourly rate at which persons or vehicles can reasonably be expected to traverse a point or uniform section of a lane or roadway during a given time period under prevailing roadway, traffic, and control conditions.” Level of service (LOS) is a term used to represent different driving conditions and is defined as a “qualitative measure describing operational conditions within a traffic stream, and their perception by motorists and/or passengers.” Level of service varies from Level “A” representing free flow, to Level “F” where breakdown conditions are evident. Refer to Table 3 for HCM levels of service and related average control delay per vehicle for both signalized and unsignalized intersections. Control delay as defined by the HCM includes “initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay”. An average control delay of 50 seconds at a signalized intersection results in LOS “D” operation at the intersection.

Table 3: Highway Capacity Manual – Levels-of-Service and Delay

UNSIGNALIZED INTERSECTION		SIGNALIZED INTERSECTION	
LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)	LEVEL OF SERVICE	AVERAGE CONTROL DELAY PER VEHICLE (SECONDS)
A	0-10	A	0-10
B	10-15	B	10-20
C	15-25	C	20-35
D	25-35	D	35-55
E	35-50	E	55-80
F	>50	F	>80

6.1. Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to NCDOT Congestion Management Guidelines and NCDOT MSTA Guidelines, except that weekday PM (4:00 – 6:00 PM) peak hours were utilized, as opposed to school PM (2:00 – 4:00 PM) peak hours. This is expected to provide a conservative estimate of future traffic conditions within the vicinity of the site, as the study considers school trips overlapping with the weekday PM (4:00 – 6:00 PM) peak hour.

7. CAPACITY ANALYSIS

7.1. US 1 and Height Lane / Ponderosa Service Road

The unsignalized intersection of US 1 and Height Lane / Ponderosa Service Road was analyzed under existing (2021), no-build (2022), and build (2022) conditions with the lane configurations and traffic control shown in Table 4 on the following page.

Based on NCDOT STIP Project U-5307C, this intersection is not anticipated to exist under ultimate conditions at the build-out of NCDOT STIP Project U-5307C and the school will no longer have immediate access to US 1 (via Height Lane). Navigating to/from the school will require vehicles to utilize the Main Street connection to Star Road. This requires vehicles to travel approximately one (1) mile along Star Road each direction to access the site. Based on coordination with the site team, the school is aware of this future impact.

Refer to Table 4 on the following page for a summary of the analysis results. Refer to Appendix F for the Synchro capacity analysis reports.

Table 4: Analysis Summary of US 1 and Height Lane / Ponderosa Service Road

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE*	
			Approach	Overall (sec)	Approach	Overall (sec)
Existing (2021) Conditions	EB	1 LT-TH-RT	--**	N/A	--**	N/A
	WB	1 LT-TH-RT	--**		--**	
	NB	1 LT, 2 TH, 1 RT	D ¹		D ¹	
	SB	1 LT, 2 TH, 1 RT	C ¹		C ¹	
No-Build (2022) Conditions	EB	1 LT-TH-RT	--**	N/A	--**	N/A
	WB	1 LT-TH-RT	--**		--***	
	NB	1 LT, 2 TH, 1 RT	D ¹		E ¹	
	SB	1 LT, 2 TH, 1 RT	C ¹		C ¹	
Build (2022) Conditions	EB	1 LT-TH-RT	--**	N/A	--**	N/A
	WB	1 LT-TH-RT	--**		--**	
	NB	1 LT, 2 TH, 1 RT	D ¹		E ¹	
	SB	1 LT****, 2 TH, 1 RT	F ¹		F ¹	
Build (2022) Conditions with Signalization	EB	1 LT-TH-RT	F	F (235)	E	F (237)
	WB	1 LT-TH-RT	F		F	
	NB	1 LT, 2 TH, 1 RT	F		F	
	SB	1 LT, 2 TH, 1 RT	F		F	

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

*School trips typically occur prior to the weekday PM peak hour; therefore, utilizing the weekday PM peak hour is anticipated to provide conservative results at the study area intersection.

**Based on limitations with the Synchro software, no delay could be reported. LOS F was assumed based on the heavy, opposing mainline volumes.

***LOS D was shown in the Synchro report for this approach. Because no delay was shown in other conditions, no LOS was reported and a failing LOS was assumed based on the heavy, opposing mainline volumes.

****Extend the existing southbound left-turn lane storage.

Improvements by the developer are shown in bold.

Capacity analysis at the intersection of US 1 and Height Lane / Ponderosa Service Road indicates that the minor-street approaches are expected to operate at LOS F during the AM and PM peak hours under all scenarios analyzed. Capacity analysis indicates that the major-street left-turn movements currently operate at LOS D or better. Under no-build (2022) conditions, the northbound major-street left-turn movement is expected to degrade to LOS E during the weekday PM peak hour. Under build (2022) conditions, the southbound left-turn movement is expected to degrade to LOS F during the weekday AM and PM peak hours. It should be noted that the weekday PM peak hour results are expected to be conservative, as the study considered school trips overlapping with the weekday PM peak hour.

Based on SimTraffic results under build (2022) conditions without improvements, heavy queuing is anticipated on the minor-street approaches at this study intersection. Queuing on the westbound approach is anticipated to extend back on-site of the proposed school and lock up the roadway network during the weekday AM peak hour. Additionally, there is anticipated to be heavy queuing during the weekday AM and PM peak hours on the southbound left-turn movement that is anticipated to extend beyond the existing turn lane storage. It should be noted that based on NCDOT STIP Project U-5307C, this intersection is not anticipated to exist under ultimate conditions at the build-out of NCDOT STIP Project U-5307C and the school will no longer have immediate access to US 1 (via Height Lane). Additionally, it should be noted that if heavy stacking and delays persist under build (2022) conditions, it is likely that parents will utilize other connector driveways between US 1 and Star Road to enter and exit the site.

Based on the heavy delays and queuing, the following improvements were considered:

- Restrict the minor-street approaches to right-in / right-out only (not recommended)
 - Restricting these driveways would be expected to shift delays and queuing to adjacent intersections; therefore, this improvement was ultimately not recommended.
- Signalization (not recommended)
 - Peak hour warrants were considered based on the *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the warrants, the traffic at this intersection is anticipated to meet the peak hour warrant for the weekday AM and PM peak hours. It is unlikely, however, that this intersection would satisfy the MUTCD 8-hour and 4-hour warrants (which NCDOT favors for the installation of a traffic signal) based on the nature of school development, which typically generates traffic during two distinct peak periods.
 - Although a traffic signal is not anticipated to be warranted and NCDOT STOP Project U-5307C is anticipated to remove the minor-street approaches at this intersection, a traffic signal was considered based on the poor levels-of-service and significant queuing that is anticipated under build (2022) conditions.

- With a traffic signal, the intersection is anticipated to operate at an overall LOS F; however, queuing along the minor-street approaches and major-street left-turning movements are anticipated to be significantly improved.
- Per NCDOT Congestion Management Guidelines, protected-only phasing was considered on the northbound and southbound left-turn lane and split phasing was considered on the minor-street approaches. With permitted phasing on the minor-street approach, the intersection would be expected to operate with less delay.
- Exclusive turn lanes on the minor-street approaches (not recommended)
 - Based on the pavement width on the eastbound approach, an exclusive eastbound right-turn lane was considered; however, based on Synchro capacity results, there is not anticipated to be a significant decrease in delay as a result of the turn lane. Additionally, turn lanes were considered on the westbound approach, but is also not anticipated to provide a significant decrease in delay.
- Additional on-site storage (per the current site plan)
 - The current site plan includes one parent stacking lane and one bypass lane. The bypass lane was analyzed as an additional circulating lane to contain on-site parent vehicles in order to provide additional stacking to store heavy queues.
 - With the second stacking lane, queuing is anticipated to be contained on-site.
 - The following measures are recommended if the second circulating lane (bypass lane) is dedicated to stacking:
 - All staff should arrive a minimum of thirty (30) minutes prior to the first bell and leave a minimum of thirty (30) minutes after the last bell.
 - Follow guidelines provided in the TMP.

It is recommended that the proposed site utilize the bypass lane as a stacking lane under high-demand days to prevent spill back onto US 1 from the school. Additionally, it is

recommended that the southbound left-turn lane be extended to a minimum of 500 feet (based on the weekday AM peak hour) with appropriate deceleration and taper length per the NCDOT *Policy on Street and Driveway Access to North Carolina Highways* Warrant for Left-Turn Lanes Graph. No additional improvements are recommended for the following reasons:

- Parents and staff are likely to utilize alternative ways to enter and exit the site should heavy delays and queuing persist.
- 4- and 8- hour warrants are unlikely to be met based on the nature of school development, which typically generates traffic during two distinct peak hours.
- The weekday PM peak hour provides a conservative analysis of future PM operations, as the study assumes the school PM (typically 2:00 – 4:00 PM) peak hour occurs with the weekday PM (4:00 – 6:00 PM) peak hour.
- NCDOT STIP Project U-5307C is anticipated to eliminate this intersection.

7.2. Height Lane and Star Road

The unsignalized intersection of Height Lane and Star Road was analyzed under existing (2021), no-build (2022), and build (2022) conditions with the lane configurations and traffic control shown in Table 5. Refer to Table 5 for a summary of the analysis results. Refer to Appendix G for the Synchro capacity analysis reports.

Table 5: Analysis Summary of Height Lane and Star Road

ANALYSIS SCENARIO	APPROACH	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE *	
			Approach	Overall (sec)	Approach	Overall (sec)
Existing (2021) Conditions	EB	1 LT-TH-RT	A ¹	N/A	A ¹	N/A
	WB	1 LT-TH-RT	A ¹		A ¹	
	NB	1 LT-TH-RT	A ²		A ²	
	SB	1 LT-TH-RT	A ²		A ²	
No-Build (2022) Conditions	EB	1 LT-TH-RT	A ¹	N/A	A ¹	N/A
	WB	1 LT-TH-RT	A ¹		A ¹	
	NB	1 LT-TH-RT	A ²		A ²	
	SB	1 LT-TH-RT	A ²		A ²	
Build (2022) Conditions	EB	1 LT-TH-RT	A ¹	N/A	A ¹	N/A
	WB	1 LT-TH-RT	A ¹		A ¹	
	NB	1 LT-TH-RT	F ²		C ²	
	SB	1 LT-TH-RT	B ²		B ²	

1. Level of service for major-street left-turn movement.

2. Level of service for minor-street approach.

*School trips typically occur prior to the weekday PM peak hour; therefore, utilizing the weekday PM peak hour is anticipated to provide conservative results at the study area intersection.

Capacity analysis indicates that the minor-street approaches and major-street left-turn movements at the intersection of Height Lane and Star Road are expected to operate at LOS A during the weekday AM and PM peak hours under existing (2021) and no-build (2022) conditions. Under build (2022) conditions, the northbound minor-street approach is anticipated to operate at LOS F during the weekday AM peak hour and LOS C during the weekday PM peak hour. The southbound minor-street approach and the major-street left-turn movements are anticipated to operate at LOS B or better during the weekday AM and PM peak hours. These levels-of-service are not uncommon for minor-street approaches at an unsignalized intersection.

A traffic signal was considered based on the MUTCD; however, peak hour warrants are not anticipated to be met. Additionally, 4- and 8- hour warrants are not anticipated to be met based on the nature of school development, which typically generates traffic during two distinct peak periods. Additional stop-control was considered; however, is not recommended to prevent spill back onto US 1. If a traffic signal were to be installed at the adjacent intersection of US 1 and Height Lane / Ponderosa Service Road, additional gaps in traffic would be anticipated to be provided for the minor-street approach vehicles at the intersection of Height Lane and Star Road. Overall, no improvements are recommended at this study intersection.

7.3. Star Road and Site Drive 1

The proposed, egress only intersection of Star Road and Site Drive 1 was analyzed under build (2022) conditions with existing lane configurations and traffic control. Refer to Table 6 for a summary of the analysis results. Refer to Appendix H for the Synchro capacity analysis reports.

Table 6: Analysis Summary of Star Road and Site Drive 1

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE*	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2022) Conditions	WB NB SB	1 LT-RT 1 TH 1 TH	B ² -- --	N/A	B ² -- --	N/A

2. Level of service for minor-street approach.

Improvements by the developer are shown in bold.

*School trips typically occur prior to the weekday PM peak hour; therefore, utilizing the weekday PM peak hour is anticipated to provide conservative results at the study area intersection.

Capacity analysis indicates that the minor-street approach at the intersection of Star Road and Site Drive 1 is expected to operate at LOS B during the weekday AM and PM peak hours under build (2022) conditions.

Based on SimTraffic simulations, heavy queuing along the westbound approach at the intersection of US 1 and Height Lane / Ponderosa Service Road spilled back beyond this study intersection during the weekday AM peak hour. These queuing deficiencies are anticipated to be due to off-site concerns and are not anticipated to be due to insufficient stacking length. Due to the heavy queuing off-site, trips were unable to exit the site and therefore spilled back on-site, locking up the internal and external roadway network.

With an additional circulating lane on-site, school trips are anticipated to be contained on the campus. The current site plan includes one parent stacking lane and one bypass lane. The bypass lane was analyzed as an additional circulating lane to contain on-site parent vehicles

in order to provide additional stacking to store heavy queues. With the second stacking lane, queuing is anticipated to be contained on-site. The following measures are recommended if the second circulating lane (bypass lane) is dedicated to stacking:

- All staff should arrive a minimum of thirty (30) minutes prior to the first bell and leave a minimum of thirty (30) minutes after the last bell.
- Follow guidelines provided in the TMP.

Alternatively, additional improvements should be considered at the intersection of US 1 and Height Lane / Ponderosa Service Road to minimize queuing.

7.4. Star Road and Site Drive 2

The proposed, ingress only intersection of Star Road and Site Drive 2 was analyzed under build (2022) conditions with the lane configurations and traffic control shown in Table 7. Refer to Table 7 for a summary of the analysis results. Refer to Appendix I for the Synchro capacity analysis reports.

Table 7: Analysis Summary of Star Road and Site Drive 2

ANALYSIS SCENARIO	A P P R O A C H	LANE CONFIGURATIONS	WEEKDAY AM PEAK HOUR LEVEL OF SERVICE		WEEKDAY PM PEAK HOUR LEVEL OF SERVICE	
			Approach	Overall (sec)	Approach	Overall (sec)
Build (2022) Conditions	NB SB	1 TH-RT 1 LT-TH	--** --**	N/A	--** --**	N/A

Improvements by the developer are shown in bold.

*School trips typically occur prior to the weekday PM peak hour; therefore, utilizing the weekday PM peak hour is anticipated to provide conservative results at the study area intersection.

**Due to deficiencies with the Synchro software for intersections without control, no level of service could be defined. Based on the proposed lane configuration, the turning movements are not anticipated to experience minimal delays entering the site, as there is minimal opposing volume at the study intersection. It should be noted that queuing at adjacent intersections may spill back on-site and may cause delays.

Based on the proposed lane configurations, minimal delay is anticipated at this study intersection during the weekday AM and PM peak hours under build (2022) conditions. It should be noted that under ultimate conditions, after the construction of NCDOT STIP Project U-5307C, all site related trips will navigate to/from the school via the Main Street connection to Star Road to the north. This requires vehicles to travel approximately one (1) mile along Star Road in each direction to access the site. Based on coordination with the site team, the school is aware of this future impact. Under these conditions, exiting vehicles will utilize the westbound right-turn movement at the intersection of Star Road and Site Drive 1 and will have minimal conflict when exiting the site. Queuing is anticipated to be significantly improved with this ultimate configuration, as vehicles will be able to exit the site with minimal delay.

Left and right-turn lanes were considered based on the NCDOT *Policy on Street and Driveway Access to North Carolina Highways*. Based on the low anticipated AADT along Star Road and low mainline through volumes at the study area intersection (less than 20 vehicles during the weekday AM and PM peak hours in both the northbound and southbound directions, excluding school related trips), no turn lanes are recommended.

7.5. Internal Stacking

The school is anticipated to consist of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of 5 grade levels and are anticipated to be even in size at approximately 377 students. Utilizing 100% of one grade grouping (approximately 377 students) plus 25% of the other grade grouping (approximately 94 students) gives 471 students that may arrive under one bell schedule. The additional 25% is expected to account for any overlap.

For a 471-student capacity charter school, the MSTA School Traffic Calculator indicates a maximum high demand internal stacking need of 2,625 feet for student pick-up and drop-off. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The current site plan shows that the maximum high demand internal stacking length is exceeded and approximately 2,730 feet of internal stacking distance is provided.

MSTA noted on February 23, 2021, that the latest site plan shows vehicle to vehicle conflicts with the parking area and bypassing traffic, which may cause delays and additional queuing. It has been recommended as part of the TMP for staff to arrive a minimum of thirty (30) minutes prior to the first bell and leave a minimum of thirty (30) minutes after the last bell to minimize these conflicts.

Additionally, the school intends to operate with pre-K and Kindergarten students. Based on coordination with NCDOT during scoping, if these students were walked into and out of the school, a reduction in required stacking length may be considered; however, based on coordination after scoping (February 23, 2021), the latest site plan does not adequately accommodate kindergarten park and walk-in area on the site plan. Therefore, MSTA noted that no queue credit would be provided. Walking pre-K and Kindergarten students was still recommended as part of the TMP to additionally accommodate any stacking concerns at build-out. It should be noted that with off-site improvements, or an additional circulating lane (per the current site plan), stacking is anticipated to be contained on-site.

Based on SimTraffic queuing results of build (2022) conditions without improvements, heavy stacking is expected on the westbound minor-street approach at the intersection of US 1 and Height Lane / Ponderosa Service Road that is expected to extend through the site and back onto US 1 during the weekday AM peak hour. With signalization at the intersection of US 1 and Height Lane / Ponderosa Service Road or an additional on-site circulating lane, stacking is anticipated to be contained on-site. Based on future roadway improvements, signalization is not recommended. Additional explanation can be found in Section 7.1 of the report. The following measures are recommended if the second circulating lane (bypass lane) is dedicated to stacking:

- All staff should arrive prior to the first bell and leave a minimum of thirty (30) minutes after the last bell.
- Follow guidelines provided in the TMP.

Refer to Appendix J for the Synchro and SimTraffic internal stacking analysis reports. Refer to Appendix K for a copy of the TMP.

8. CONCLUSIONS

This Traffic Impact Analysis (TIA) was conducted to determine the potential traffic impacts of the proposed Casa Esperanza, which is expected to have a student capacity of 754 students in grades pre-K through 8. The school is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. For the purpose of the TIA, the charter school is assumed to be fully built and at core capacity by August of 2022. Access to the charter school site will be provided via one (1) ingress only driveway and one (1) egress only driveway along Star Road. It should be noted that since the scoping meeting for this proposed site, access has been flipped.

Per coordination with NCDOT and the Town, Hawthorne (previously Evolve) was considered as an adjacent development in this study. The development does not have any recommended improvements at any intersections in the proposed Casa Esperanza study area. It should be noted that the PM peak period for Hawthorne (4:00 – 6:00pm) differs from the proposed school PM peak period (2:00 – 4:00); however, because the weekday PM (4:00 – 6:00 PM) peak hour was utilized for analysis purposes, no reduction in adjacent development trips was considered to provide conservative future analysis results. Additionally, there is expected to be interaction between the adjacent development and the proposed development based on their respective land uses; however, no reduction in adjacent development trips is proposed to provide a conservative estimation of future traffic volumes.

Trip Generation

It is estimated that the proposed development will generate approximately 585 site trips (322 entering and 263 exiting) during the AM peak hour, while approximately 429 site trips (185 entering and 244 exiting) during the PM peak hour of the school.

Internal Stacking

The school is anticipated to consist of 754 students, serving grades pre-K through 8, and is anticipated to have a staggered bell of a minimum of thirty (30) minutes between grades pre-K through 3 and grades 4 through 8. These grade groupings each consist of 5 grade levels and are anticipated to be even in size at approximately 377 students. Utilizing 100% of one grade

grouping (approximately 377 students) plus 25% of the other grade grouping (approximately 94 students) gives 471 students that may arrive under one bell schedule. The additional 25% is expected to account for any overlap.

For a 471-student capacity charter school, the MSTA School Traffic Calculator indicates a maximum high demand internal stacking need of 2,625 feet for student pick-up and drop-off. This maximum high demand internal stacking length accounts for an additional 30% of extra stacking length in the MSTA School Traffic Calculator. The current site plan shows that the maximum high demand internal stacking length is exceeded and approximately 2,730 feet of internal stacking distance is provided.

Adjustments to Analysis Guidelines

Capacity analysis at all study intersections was completed according to the Town's UDO, NCDOT Congestion Management Guidelines, and NCDOT Municipal and School Transportation Assistance (MSTA) Guidelines. Refer to section 6.1 of this report for a detailed description of any adjustments to these guidelines made throughout the analysis.

Intersection Capacity Analysis Summary

The proposed site driveways are expected to operate at acceptable levels-of-service under future year conditions. A summary of the study area intersection that is expected to need improvements is as follows:

US 1 and Height Lane / Ponderosa Service Road

Capacity analysis indicates that the minor-street approaches are expected to operate at LOS F during the AM and PM peak hours under all scenarios analyzed. Based on SimTraffic results under build (2022) conditions without improvements, heavy queuing is anticipated on the minor-street approaches at this study intersection. Queuing on the westbound approach is anticipated to extend back on-site of the proposed school and lock up the roadway network during the weekday AM peak hour. Additionally, there is anticipated to be heavy queuing during the weekday AM and PM peak hours on the southbound left-turn movement that is anticipated to extend beyond the existing turn lane storage. It should be noted that based on

NCDOT STIP Project U-5307C, this intersection is not anticipated to exist under ultimate conditions at the build-out of NCDOT STIP Project U-5307C and the school will no longer have immediate access to US 1 (via Height Lane). Additionally, it should be noted that if heavy stacking and delays persist under build (2022) conditions, it is likely that parents will utilize other connector driveways between US 1 and Star Road to enter and exit the site.

Based on the heavy delays and queuing, the following improvements were considered:

- Restrict the minor-street approaches to right-in / right-out only (not recommended)
 - Restricting these driveways would be expected to shift delays and queuing to adjacent intersections; therefore, this improvement was ultimately not recommended.
- Signalization (not recommended)
 - Peak hour warrants were considered based on the *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the warrants, the traffic at this intersection is anticipated to meet the peak hour warrant for the weekday AM and PM peak hours. It is unlikely, however, that this intersection would satisfy the MUTCD 8-hour and 4-hour warrants (which NCDOT favors for the installation of a traffic signal) based on the nature of school development, which typically generates traffic during two distinct peak periods.
 - Although a traffic signal is not anticipated to be warranted and NCDOT STOP Project U-5307C is anticipated to remove the minor-street approaches at this intersection, a traffic signal was considered based on the poor levels-of-service and significant queuing that is anticipated under build (2022) conditions.
 - With a traffic signal, the intersection is anticipated to operate at an overall LOS F; however, queuing along the minor-street approaches and major-street left-turning movements are anticipated to be significantly improved.
 - Per NCDOT Congestion Management Guidelines, protected-only phasing was considered on the northbound and southbound left-turn lane and split phasing was considered on the minor-street approaches. With permitted phasing on

the minor-street approach, the intersection would be expected to operate with less delay.

- Exclusive turn lanes on the minor-street approaches (not recommended)
 - Based on the pavement width on the eastbound approach, an exclusive eastbound right-turn lane was considered; however, based on Synchro capacity results, there is not anticipated to be a significant decrease in delay as a result of the turn lane. Additionally, turn lanes were considered on the westbound approach, but is also not anticipated to provide a significant decrease in delay.
- Additional on-site storage (per the current site plan)
 - The current site plan includes one parent stacking lane and one bypass lane. The bypass lane was analyzed as an additional circulating lane to contain on-site parent vehicles in order to provide additional stacking to store heavy queues.
 - With the second stacking lane, queuing is anticipated to be contained on-site.
 - The following measures are recommended if the second circulating lane (bypass lane) is dedicated to stacking:
 - All staff should arrive a minimum of thirty (30) minutes prior to the first bell and leave a minimum of thirty (30) minutes after the last bell.
 - Follow guidelines provided in the TMP.

It is recommended that the proposed site utilize the bypass lane as a stacking lane under high-demand days to prevent spill back onto US 1 from the school. Additionally, it is recommended that the southbound left-turn lane be extended to a minimum of 500 feet (based on the weekday AM peak hour) with appropriate deceleration and taper length per the NCDOT *Policy on Street and Driveway Access to North Carolina Highways* Warrant for Left-Turn Lanes Graph.

9. RECOMMENDATIONS

Based on the findings of this study, specific geometric and traffic control improvements have been identified at study intersections. The improvements are summarized below and are illustrated in Figure 11.

Developer Improvements:

US 1 and Height Lane / Ponderosa Service Road

- Extend the existing southbound left-turn lane to a minimum of 500 feet of storage and appropriate deceleration and taper length.

Star Road and Site Drive 1

- Construct a westbound approach with one egress lanes.
- Provide stop control for the westbound approach.

Star Road and Site Drive 2

- Construct the eastern leg of the intersection with two (2) ingress lanes.

LEGEND

○ Unsignalized Intersection

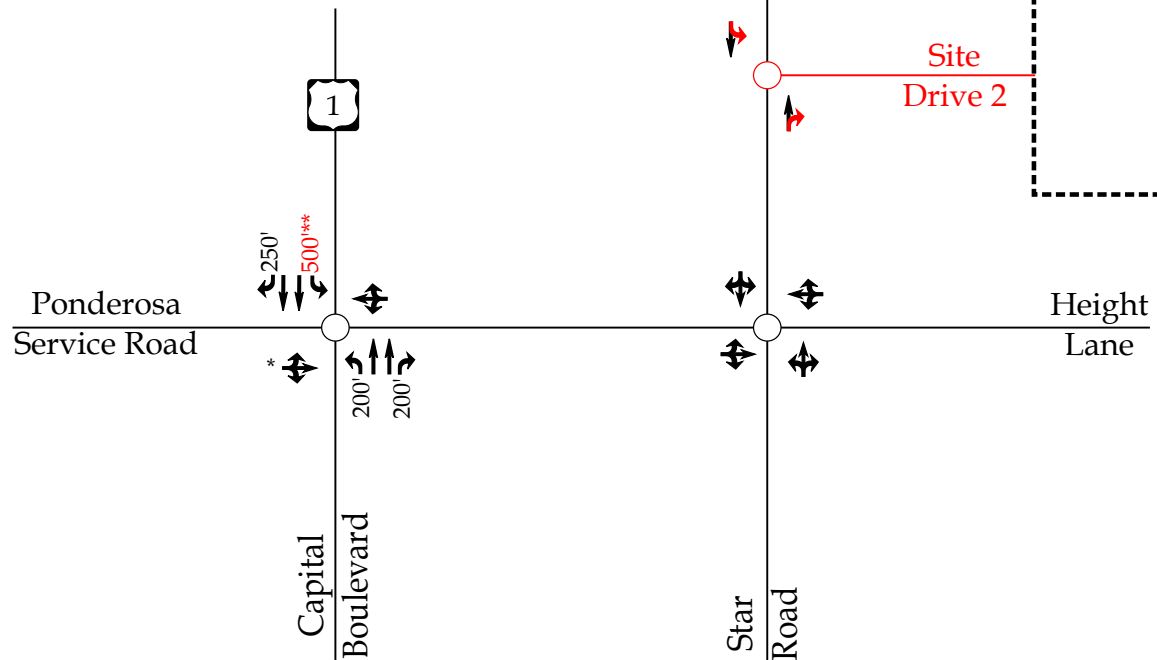
➔ Existing Lane

➔ Improvement by Developer

x' Storage (In Feet)

*Pavement width exists for an exclusive eastbound right-turn turn lane with 75' of storage.

**Extend the existing 250' full width turn lane to a minimum of 500'.



Moving forward.

RKA
RAMEY KEMP ASSOCIATES

Casa Esperanza
Charter School
Wake Forest, NC

Recommended Lane
Configurations

Scale: Not to Scale Figure 11