



CITY OF DURHAM | NORTH CAROLINA

Date: August 29, 2011

To: Danny Cultra, Durham City County Planning Department
From: Bill Judge P.E., City of Durham Department of Transportation
Subject: Voyager Academy Elementary School (D1100049) Traffic Impact Analysis

The City-County Unified Development Ordinance requires that a Traffic Impact Analysis (TIA) be prepared for site plan submittals estimated to generate 150 or more vehicle trips during the peak hour. The proposed development, Voyager Academy Elementary School, is a new charter elementary school that will accommodate 400 students and 53 staff members. The proposed school will generate an estimated 665 daily trips, of which 399 trips would occur during the AM peak hour and 212 trips during the school PM peak hour. The traffic impacts of the proposed school site have been documented in the TIA report prepared by Martin Alexiou Bryson on March 2, 2011 with supplemental analysis on July 13, 2011, August 8, 2011, and August 10, 2011.

The proposed Voyager Academy Elementary School is located in Durham at the southwest corner of Ben Franklin Boulevard and Medical Park Drive. The school is proposed to be accessed via an existing access on Ben Franklin Boulevard at Hock Park Lane (this would be a shared access with the existing Voyager Academy Middle School) and a new access to the west side of Medical Park Drive, south of Ben Franklin Boulevard (this portion of Medical Park Drive is an existing private street that provides access to the proposed Voyager Academy High School). Bus service will not be provided for the proposed charter school.

Per UDO Sections 3.3.3 and 3.3.8, a Transportation Special Use Permit (TSUP) is also required for this site plan, as the proposed elementary school will share access with the middle and high schools and the cumulative trip generation of all three school sites is in excess of 600 peak hour trips. The expected completion year of the school is 2012, and the TIA analysis year is 2013.

Study Area

The TIA analyzed nine (9) intersections in the vicinity of the proposed site. These intersections are:

- N. Roxboro Street and Pacific Avenue
- N. Roxboro Street and Frasier Street/William Penn Plaza
- William Penn Plaza & Ben Franklin Boulevard
- Ben Franklin Boulevard and Pacific Avenue
- Ben Franklin Boulevard and Hock Parc/Freedom Lake Drive
- Ben Franklin Boulevard and Medical Park Drive
- Ben Franklin Boulevard and Technology Drive/Presidents Drive
- Ben Franklin Boulevard and Danube Lane
- Medical Park Drive and Site Access

Traffic Data Collection

The AM and PM (school) peak hour turning movement counts for the intersections in the study area were collected between March 24, 2010 and February 22, 2011, during the hours of 7:00-9:00 AM and 2:00-6:00 PM.

Trip Generation

Trip generation estimates are based on the North Carolina Department of Transportation's (NCDOT) Municipal and School Transportation Assistance (MSTA) School Calculator spreadsheet. Per the MSTA calculator, the school is anticipated to generate 399 trips in the AM peak hour (226 entering, 173 exiting) and 212 trips in the PM school peak hour (106 entering, 106 exiting). The NCDOT trip generation rates are generally higher compared to the ITE Trip Generation Manual. The trip generation is based on 400 students, 53 staff, and no school buses. No adjustments were made to the gross traffic generation volumes.

Trip Distribution and Assignment

The assignment of school traffic on the study area roadway network was based on the following trip distribution percentages:

- To/From the North on N. Roxboro Street: 35% of school trips
- To/From the South on N. Roxboro Street: 10% of school trips
- To/From the North on Danube Lane: 25% of school trips
- To/From the South on Danube Lane: 5% of school trips
- To/From the West on Frasier Street: 10% of school trips
- To/From the South on Ben Franklin Boulevard: 15% of school trips

Approved Development

Approved developments are defined as approved or pending, but not yet constructed, projects within the vicinity of the subject project. The following recently constructed development was included in the TIA:

- Voyager Academy High School: 400 student charter high school on the south side of Ben Franklin Boulevard, east of Medical Park Drive.

In addition to the traffic from this proposed development, a uniform annual compounded growth rate of 3% was utilized to determine the background traffic projections.

TIP Roadway Improvements

There are no NCDOT TIP projects in the study area. However, there is a City of Durham Capital Improvement Project to extend Carver Street east to Old Oxford Road. This project is currently in the design phase.

Capacity Analysis

Capacity analyses were performed using the capacity analysis software Synchro 7. The following scenarios were analyzed for AM and PM school peak hours:

- Existing (2011) conditions
- No-Build (2013) conditions (2011 Existing + 3% Background Growth)
- Build (2013) conditions (2013 No-Build + Site Traffic)
- Build (2013) with Improvements conditions (2013 No-Build + Site Traffic+ Improvements)

This development is located within the suburban tier where the adopted LOS standard is LOS D. The following table summarizes the average delay for the various Levels of Service (LOS) for unsignalized and signalized intersections:

	Signalized Intersections	Unsignalized Intersections
Level of Service	Average Vehicle Delay (Seconds)	Average Vehicle Delay (Seconds)
A	0-10	0-10
B	10-20	10-15
C	20-35	15-25
D	35-55	25-35
E	55-80	35-50
F	>80	>50

N. Roxboro Street and Pacific Avenue (signalized)

The following table summarizes the Level of Service (LOS) for this signalized intersection with existing lane geometry.

Scenario	AM LOS	PM LOS
Existing (2011)	A	C
No-Build (2013)	B	D
Build (2013)	B	D

This signalized intersection currently operates at a LOS C or better during the AM peak hour and school PM peak hour. In No-Build conditions, the intersection will decrease to a LOS B during AM peak hour and a LOS D for the school PM peak hour. With school traffic added, the intersection is projected to operate at an acceptable LOS D or better during both the AM peak hour and the school PM peak hour. No roadway improvements are required to address school traffic impacts.

N. Roxboro Street and Frasier Street/William Penn Plaza (signalized)

The following table summarizes the Level of Service (LOS) for this signalized intersection with existing lane geometry.

Scenario	AM LOS	PM LOS
Existing (2011)	B	C
No-Build (2013)	C	C
Build (2013)	C	C

This signalized intersection currently operates at a LOS C or better during the AM and school PM peak hours. The intersection can accommodate No-Build traffic volumes with a slight increase in peak hour delay. With school traffic added, the intersection is projected to operate at an acceptable LOS C during both the AM peak hour and the school PM peak hour. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and William Penn Plaza (signalized)

The following table summarizes the LOS for this signalized intersection.

Scenario	AM LOS	PM LOS
Existing (2011)	B	B
No-Build (2013)	B	B
Build (2013)	C	B

The intersection currently operates at a LOS B during both the AM and school PM peak hours. The intersection will remain at a LOS B during both the AM and school PM peak hours for the No-Build Condition. With school traffic added, the delays will increase slightly, but an acceptable LOS C or better will be provided for both peak hours. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and Pacific Avenue (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with existing lane geometry.

Scenario	AM LOS	PM LOS
Existing (2011)	B*	B*
No-Build (2013)	D*	C*
Build (2013)	F*	C*

* Unsignalized operation, with LOS reported for the worst (EB) approach on Pacific Avenue

The eastbound approach on Pacific Avenue currently operates at a LOS B during both the AM and school PM peak hours. In No-Build conditions, this eastbound approach will decrease to a LOS D for the AM peak hour and a LOS C for the school PM peak hour. With school traffic added, the intersection will degrade to a LOS F in the AM peak hour. Although undesirable at a signalized intersection, a LOS F is typical and acceptable at an unsignalized intersection for the peak hour until such time as a traffic signal is warranted. Based on a review of the peak hour traffic volumes and the accident data along Ben Franklin Boulevard, a traffic signal is not warranted at this intersection. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and Hock Parc/Freedom Lake Drive (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with existing lane geometry.

Scenario	AM LOS*	PM LOS*
Existing (2011)	E*	B*
No-Build (2013)	F*	C*
Build (2013)	F*	C*

* Unsignalized operation, with LOS reported for the worst (SB) approach on Freedom Lake Drive

Hock Park is an existing two-lane divided roadway providing access to Voyager Academy Middle School. The northbound approach on Hock Parc is restricted to right-turns only due to the heavy school peak hour operations with the existing school. Under this existing condition, the intersection operates at a LOS E in the AM peak hour and a LOS B in the school PM peak hour. In the No-Build condition, the intersection will to decrease to a LOS F in the AM, and a LOS C in the school PM peak hour. With school traffic added, the delays will increase slightly, but the LOS will remain at a LOS F in the AM peak hour and a LOS C in the school PM peak hour. Although undesirable at a signalized intersection, a LOS F is typical and acceptable at an unsignalized intersection for the peak hour until such time as a traffic signal is warranted. Given the low through and left-turn movement traffic volumes on the stop controlled approaches (Hock Park and Freedom Lake Drive), a traffic signal is not appropriate at this intersection. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and Medical Park Drive (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with existing and proposed lane geometry.

Scenario	AM LOS*	PM LOS*
Existing (2011)	B*	A*
No-Build with Improvements (2013) [volume/capacity ratio]	B [WB- 0.891]	A [NB- 0.615]
Build with No-Build Improvements (2013) [volume/capacity ratio]	C [WB- 1.027]	A [NB- 0.638]

* Unsignalized operation, with LOS reported for the worst (NB) approach on Medical Park Drive

The northbound approach on Medical Park Drive currently operates at a LOS B during the AM peak hour and a LOS A during the school PM peak hour. The southern leg of Medical Park Drive will provide access to the proposed Voyager Academy High School. To mitigate the additional site traffic for the Voyager Academy High School the following recently constructed improvement is proposed for the No-Build (2013) Condition:

- Construction of a single-lane roundabout with an eastbound right-turn bypass lane under yield control. This proposed improvement will also require the westbound approach of Ben Franklin Boulevard to be reconstructed to a single approach lane.

With the proposed improvement, the intersection will operate at an acceptable LOS B in the AM peak hour and a LOS A in the school PM peak hour. With elementary school traffic added and the proposed roundabout, the intersection will operate at an acceptable LOS C in the AM peak hour and a LOS B in the school PM peak hour.

The proposed v/c ratio of 1.027 for the westbound movement on Ben Franklin Boulevard in the Build (2013) AM peak hour exceeds the desirable design maximum v/c ratio of 0.850 for roundabouts. Although this v/c ratio exceeds the desirable maximum v/c ratio, no additional improvements are required as the high v/c ratio is caused by the high 15-minute peak hour volumes associated with AM drop-off operations from the three Voyager Academy Schools. The implementation of traffic management plans for all three schools to stagger the pick-up/drop-off times will reduce the v/c ration to an acceptable 0.638. Additionally, there is adequate storage on the westbound approach of

Ben Franklin Boulevard to accommodate the expected queuing for this movement. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and Technology Drive/Presidents Drive (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with existing lane geometry.

Scenario	AM LOS	PM LOS
Existing (2011)	B*	B*
No-Build (2013)	B*	B*
Build (2013)	B*	B*

* Unsignalized operation, with LOS reported for the worst (NB) approach on Presidents Drive

The northbound approach on Presidents Drive currently operates at a LOS B during both the AM and school PM peak hours. In No-Build conditions, this northbound approach would remain at a LOS B during both the AM and school PM peak hour. With school traffic added, the delays will increase slightly, but the LOS will remain at an acceptable LOS B for both peak hours. No roadway improvements are required to address school traffic impacts.

Ben Franklin Boulevard and Danube Lane (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with existing lane geometry.

Scenario	AM LOS	PM LOS
Existing (2011)	B*	B*
No-Build (2013)	C*	B*
Build (2013)	C*	C*

* Unsignalized operation, with LOS reported for the worst (EB) approach on Ben Franklin Boulevard

The eastbound approach on Ben Franklin Boulevard currently operates at a LOS B during both the AM and school PM peak hours. In No-Build conditions, this northbound approach will decrease to a LOS C during the school PM peak hour. With school traffic added, the delays will increase slightly, but the LOS will remain at an acceptable LOS C for both peak hours. No roadway improvements are required to address school traffic impacts.

Medical Park Drive and Site Access #1 (unsignalized)

The following table summarizes the LOS for the worst approach for this unsignalized intersection with the proposed lane geometry.

Scenario	AM LOS	PM LOS
Build with Improvements (2013)	F*	C*

* Unsignalized operation, with LOS reported for the worst (EB) approach on Site Access #1

The eastbound approach on Site Access #1 would operate at a LOS F in the AM peak hour and a LOS C in the school PM peak hour with site traffic and the following recommended improvements:

- Construction of Site Access #1 with one ingress lane, two egress lanes with an appropriate internal tangent throat distance to accommodate a minimum of 754 feet of internal queuing.

Although a LOS F is undesirable at signalized intersections, it is common at unsignalized intersections during a peak hour as the delays are limited to the side street. To accommodate the expected queuing and delays the site plan must be designed to provide a minimum of 754 feet of internal stacking for the eastbound movement.

Summary of TIA Required Improvements

Transportation Management Plan

1. Implementation and adherence to Transportation Management Plans (TMP) for the overall Voyager Academy campus and all three proposed school buildings. Future adjustments to any TMP, requires advance concurrence from the Durham Department of Transportation prior to implementation.