# RHAM Middle and High School Campus Traffic Assessment Supplemental Materials 85 Wall Street, Hebron, CT

Submitted by:

BETA
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In association with Bubaris Traffic Associates

November 20, 2014

# Table of Contents

## 1. INTRODUCTION

This study was authorized by the Region 8 School Board and Town of Hebron following an unfortunate and serious accident, which occurred in the vicinity of the Middle School building during the morning student arrival period. This accident resulted in a fatality. Following the accident, several measures were implemented with varying degrees of success and it was decided to retain professional traffic engineering firm(s) to undertake a study of the school property.

RHAM High and RHAM Middle Schools occupy a consolidated campus with driveways on Wall Street (State Route 316) and Rham Road (which connects to Gilead Street {State Route 85}). The campus in general is oriented in a circular traffic pattern with a two-way roadway adjacent to the school buildings. Parking lots are provided outside this ring road, for the most part, and provide for staff and student parking. The areas beyond parking are occupied by athletic fields, tennis courts, a running track and other sport related facilities. The aerial photo in *Figure 1* shows this arrangement.

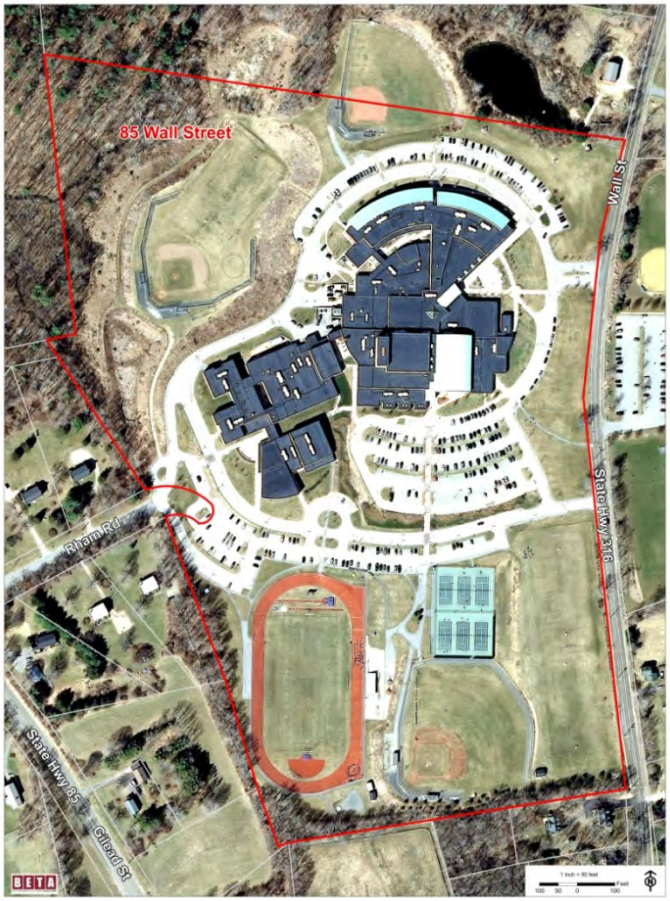


**Figure 1 Region 8 RHAM Schools**

Initial discussions with school staff indicated the primary goal of our work was to focus on pedestrian and vehicle safety with a result that could be implemented prior to the start of the school year in August.

BETA and Bubaris Traffic Associates were retained in late May 2014 and commenced a work plan that addressed both on-campus and off-campus traffic operations.

## 2. WORK PROGRAM

The limited time available and impending summer closing of the schools required and compressed the data collection program. BETA engaged RHS Associates to place automatic traffic recorders and conduct Manual Traffic Turning Movement counts at key locations off and on the RHAM Campus. These counts were performed the week of May 28, 2014.

Concurrently, BETA and Bubaris staff visited the school campus in the morning and afternoon periods to observe traffic operations. At the same time observations of traffic operations on Rham Road, Gilead Street, Main Street and Wall Street were performed.

To assess the safety aspects of roadways approaching the school, it is customary to review the crash history of these routes. BETA obtained the latest three years of accident history from the Connecticut Department of Transportation for Wall Street, Gilead Street and Main Street.

Following the initial data collection, BETA commenced meetings with various stakeholders who could provide input to our work. These meeting included:

- Administrative staff
- Teachers
- Hebron town officials
- Superintendents of School in Marlboro and Andover
- Bus operators
- Police

These were productive discussions and helped focus the project, making us aware of concerns that needed to be considered during the study.

See the *Appendix* of this study for collected data.

## 3. ANALYSIS

Essentially the study was conducted in two phases: 1. External to the campus and 2. Internal to the campus. During the stakeholder interviews the Town Manager of Hebron expressed concerns about traffic operations on Route 66 caused by changes in the school arrival pattern. At one point, we were informed access to the school from Rham Road was limited and this resulted in severe congestion along Main Street from Wall Street to Gilead Street. Similarly, our observations in the afternoon discharge period indicated significant vehicle queuing on Wall Street.

### External Traffic Assessment

Traffic operations were assessed at each of the main offsite intersections that are impacted by RHAM traffic. The results of the external assessment confirmed observations in the field that the intersection of Wall Street and Route 66 was suffering from significant congestion, particularly in the afternoon discharge period and commuter peak. The details of the findings of the external traffic assessment are shown in *Figure 2* following this page.

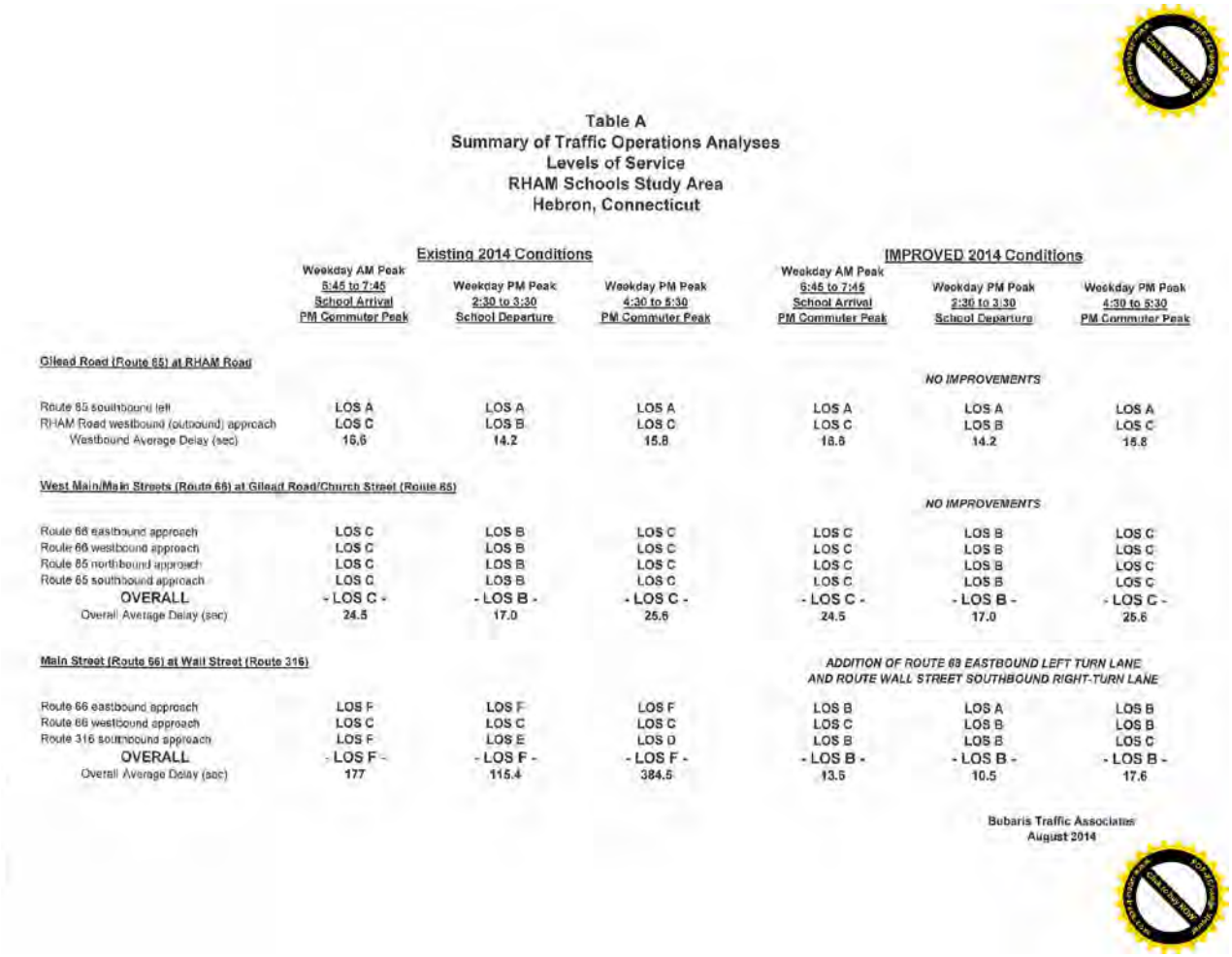


Table A
Summary of Traffic Operations Analyses
Levels of Service
RHAM Schools Study Area
Hebron, Connecticut

| | Existing 2014 Conditions | | | IMPROVED 2014 Conditions | | |
|---|---|---|---|---|---|---|
| | Weekday AM Peak 6:45 to 7:45 School Arrival PM Commuter Peak | Weekday PM Peak 2:30 to 3:30 School Departure | Weekday PM Peak 4:30 to 5:30 PM Commuter Peak | Weekday AM Peak 6:45 to 7:45 School Arrival PM Commuter Peak | Weekday PM Peak 2:30 to 3:30 School Departure | Weekday PM Peak 4:30 to 5:30 PM Commuter Peak |
| **Gilead Road (Route 85) at RHAM Road** | | | | *NO IMPROVEMENTS* | | |
| Route 85 southbound left | LOS A | LOS A | LOS A | LOS A | LOS A | LOS A |
| RHAM Road westbound (outbound) approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Westbound Average Delay (sec) | 16.6 | 14.2 | 15.8 | 16.6 | 14.2 | 15.8 |
| **West Main/Main Streets (Route 66) at Gilead Road/Church Street (Route 85)** | | | | *NO IMPROVEMENTS* | | |
| Route 66 eastbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 66 westbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 85 northbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 85 southbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| OVERALL | - LOS C - | - LOS B - | - LOS C - | - LOS C - | - LOS B - | - LOS C - |
| Overall Average Delay (sec) | 24.5 | 17.0 | 25.6 | 24.5 | 17.0 | 25.6 |
| **Main Street (Route 66) at Wall Street (Route 316)** | | | | *ADDITION OF ROUTE 66 EASTBOUND LEFT TURN LANE AND ROUTE WALL STREET SOUTHBOUND RIGHT-TURN LANE* | | |
| Route 66 eastbound approach | LOS F | LOS F | LOS F | LOS B | LOS A | LOS B |
| Route 66 westbound approach | LOS C | LOS C | LOS C | LOS C | LOS B | LOS B |
| Route 316 southbound approach | LOS F | LOS E | LOS D | LOS B | LOS B | LOS C |
| OVERALL | - LOS F - | - LOS F - | - LOS F - | - LOS B - | - LOS B - | - LOS B - |
| Overall Average Delay (sec) | 177 | 115.4 | 384.5 | 13.5 | 10.5 | 17.6 |

Bubaris Traffic Associates
August 2014

**Figure 2 External Traffic Assessment**

The results above indicated that physical improvements to the intersection of Wall Street and Main Street would be necessary to resolve congestion at this location. This improvement would require the widening of the Wall Street and is discussed later in this report.

## Internal Traffic Assessment

A compilation of the results of stakeholder interviews, on-site observations and discussion of school operations identified several key areas for concern. It should be noted that we did not observe what we would deem a significant safety-related issue. While input indicated close calls and similar concerns, the documented crash history did not reveal material issues. In general, the concerns expressed involved reducing on-site traffic speeds, enhancing pedestrian safety and reducing traffic congestion on the campus.

It must be recognized that RHAM High and Middle Schools are much like any school nationally. They exhibit a high degree of passenger vehicle travel to bring students to the school each day as well as a significant busing activity. In addition, a significant number

of students at the high school level are permitted to drive to school. Parking is regulated by the school administration and assigned areas are provided for staff, visitor and student parking.

RHAM is a regional facility providing services to Hebron, Andover and Marlboro. The bussing program for the school involves 31 buses, of which 15 serve Hebron, 6 Andover, and 10 Marlboro. Discussion with the communities and bus operator indicated that there were only very limited opportunities to shift the current drop-off and pickup schedule for bus transportation. In the morning, bus arrival and discharge are random in nature. For the afternoon pickup period, buses arrive in two phases. Phase 1 includes buses from Andover and Marlboro, while Phase 2 is limited to buses serving Hebron. This plan is established to allow accommodation for the longer travel times to remote communities.

The campus is situated in a circular context with three access points. Rham Road and two drives on Wall Street.

Following the unfortunate incident earlier this year, the concept of bus operations was adjusted to provide for all student bus drop-off to occur on the north side of the high school with all buses entering from Rham Road. Conversely in the afternoon all buses enter the site from the south drive on Wall Street and pick up at the middle and high schools exiting from the North Drive on Wall Street.

Parent pickup and drop-off is provided for the high school on the east side fronting Wall Street. Parent pickup for the middle school is provided in parking areas to the south of the circulating roadway. There appeared to be significant conflict with passenger vehicles and buses in this area.

A significant number of “speed bumps” had been installed in the parking area isles and, while effective in slowing traffic, are not usually able to survive New England winters.

The school uses of a portion of the parking area at the recreation area across Wall Street and a crosswalk has been developed entering this lot at its southerly border. Observations indicate that students who park here do not always use the crossing and instead walk across the grass area across from parent drop-off lanes to cross Wall Street.

Review of the signing installed on the campus indicated instances where compliance with Manual on Uniform Traffic Control Devices would provide clearer guidance to motorists.

Observation of traffic operation during the peak arrival and discharge periods did not indicate issues that were out of those customarily expected at schools. The current trend for parents to drive students to school is present at RHAM. Buses, while numerous, are not completely filled. Due to the need to meet other pupil transportation schedules in each community, both middle and high school students are transported on the same bus. In the morning, student bus arrivals are random and congestion levels are less. In the afternoon the concurrent departure time results in the establishment of significant queuing and temporary parking and standing in areas throughout the campus. In

particular, the south access roadway becomes congested with mixed bus and parent traffic extending its length to the middle school.

In the afternoon, queuing traffic on Wall Street extends from Route 66 back to the South Rham Driveway.

Concern was expressed by Town of Hebron officials that measures concentrating traffic only to Wall and Main Streets would probably increase congestion and queuing on Main Street. This had happened previously and any such changes would be of concern to the Town and require approval by the Town Planning and Zoning Commission or Legal Traffic Authority.

Access from Rham Road was of concern to the middle school staff as it directed traffic thorough the staff parking lot to and from that road. In our meeting with them, specific suggestions were made to mitigate this concern. This will be discussed in the next section of this report.

## 4. RECOMMENDATIONS

When BETA undertook this project, it was our understanding that the primary goal was to develop a plan that could be implemented for the coming school year. These short-term suggestions were to be implementable and not require significant construction. This was the initial focus of the project. We were also asked to identify longer-term recommendations that the board could consider and would need to be implemented over time. This report will explore those opportunities following discussion of short-term recommendations.

**Short-Term Recommendations**

1. Consolidate school bus operations to the north side of the campus with all buses arriving by Rham Road and leaving by the north driveway to Wall Street.
    a. Current afternoon pickup at the middle school is congested at best with queuing traffic extending the length of the southern driveway.
    b. This will allow separation of bus and car traffic, which is considered customary practice in current school site planning.
    c. Limit circulating traffic on the north side of the high school to bus traffic only for the morning and afternoon periods.

2. To maintain reduced speeds on circulating roadways and the parking area it is recommended that permanent traffic calming devices be installed.
    a. Raised crosswalks at key location on the site.
    b. “Speed hump” devices.
    c. These devices will be located along the radial sidewalks and crosswalks that exist on the campus and are spaced to provide a goal speed of between 15 and 17 mph in the parking areas and roads.

3. To implement signing and parking restrictions with will improve traffic flow in the area of the easterly side of the high school parking lot.
    a. Post “No Parking” or “Standing” signs.
    b. During the afternoon discharge period this segment of road becomes congested by parents waiting to access the high school pickup and discharge area.
    c. Until alternate parking capacity is provided, short-term aisle parking will need to be allowed. As the first few bays of the adjacent parking area are reserved for staff, it is probable that conflicts with parked vehicles will not be encountered.

4. During the morning and afternoon arrival and discharge periods establish one-way traffic through the high school drop-off area in the southerly direction.
    a. Will simplify congestion in this area.
    b. Existing parked vehicles would be permitted to move but no new through traffic in the northerly direction would be allowed for the discharge period.
    c. Feasible in concert with 3 above.

5. Relocate crosswalk on Wall Street to the north at a point more in keeping with the desired path of users. Install “School Crossing” signs with rapid rectangular flashing beacons (RRFB).
    a. Wall Street crossing justifies more intense pedestrian warning devices.
    b. The path suggested is more in line with the travel path of students and thus compliance will be better.
    c. The recommended RRFB has been shown to have up to 80 percent compliance from motorists.
    d. Device will be solar powered, avoiding significant construction.

6. During morning and afternoon arrival and discharge, adopt pickup and discharge locations that do not compete with busing.
    a. High school area remains as it exists currently.
    b. Middle school area will be along curb at middle school formerly used for bus pickup.

7. Consider closing one of the two closely spaced openings at the circle on the southerly driveway and, upon development of proper raised sidewalks, remove existing concrete barriers from the student/ staff lot at the southerly side of the middle school.
    a. Becomes a significant area of congestion in the morning and afternoon.
    b. Majority of parents would use pickup and drop-off area adjacent to school and exit to Rham Road.
    c. Traffic destined for other school business could proceed to the easterly driveway to access other areas of the property.

   d. Students or staff leaving would not conflict with the parent pickup operation.
   e. Traffic calming devices would ensure the maintenance of slow speeds in the lot.

8. Campus wide sign upgrade.
   a. Install MUTCD sign upgrades where warranted.
   b. Establish time of day directional regulations.
9. Request review of timing setting on traffic signal at Wall Street and Route 66.
   a. This location has exhibited significant congestion and, while the long term improvement will require construction, a review of the time settings in the current signal may provide some improvement.

The above recommendations are those which we believe can be implemented by or shortly after school opening.

It should be noted that in similar situations, traffic volumes may be spread out by varying dismissal sequence. This matter was discussed at Stakeholder Meetings and the Board of Education expressed interest in the concept. Unfortunately our examination of opportunities for such a recommendation revealed that little opportunity exists at RHAM for implementation of this measure.

- Bus schedules are not flexible due to additional commitments in member communities.
- Student dismissal is varied at the end of the day and is sensitive to class schedule.
- As arrival in the morning is random and thus staggered already, no shift is required at that time.
- Discussion with the administration has indicated this recommendation would be difficult to achieve. The easiest component of traffic to control is busing and external demands limit the ability to shift time in that area. Student drivers and parent pickup would be similarly problematic due to class schedules, early departures and student work schedules.

**Results of Recommended Actions Following the Opening of School**

Upon school opening, the suggested plan was adopted with the exception of removing barriers in the south parking lot. Speed bump locations were adjusted and instructional plans distributed to parents. School operations were observed and slight changes were made to enhance operations.

More permanent speed humps have been ordered to replace temporary units installed last spring.

School bus loading and discharge has been consolidated to the north side of the high school and operates well. No passenger vehicles are allowed in this area

from 6:30 to 7:30 AM and from 1:30 to 2:30 PM. In one observation the bus queue extended past the student pickup drive entry. This was investigated and found to be the result of a delay in the departure of Marlboro, Andover buses.

Parent pickup and drop-off for the High School is maintained in its prior location. Operation is intended to be one way proceeding from North to South. This plan is difficult to achieve in the Afternoon pickup as there is not sufficient storage for vehicles.

The Middle School pickup area works as anticipated and results in much less congestion. Vehicle speeds are slow and parents appear to understand the intended operation.

Items that have not yet been installed are the raised crosswalks and Wall Street Crossing relocation. These actions require more substantial construction, which will be considered in the future.

The current plan in place on the Rham Campus efficiently accommodates arrival and discharge periods. Observation indicates that the plan is working as intended.

**Long Term Improvements**

In several instances, more substantial construction is seen as beneficial to the overall school transportation system. The following recommendations provide for permanent enhancements, which have been demonstrated to be beneficial.

The following improvements are those that would require significant construction and further design.

1. Install additional parking to serve both visitors and parent pickup in the high school area. As noted in the studies above, there is not sufficient capacity to accommodate high school parent pickup demand in the afternoon.
    a. The intention is to provide an area for parents or visitors to park temporarily while not impacting the high school drop-off area. This recommendation would accommodate parents who were displaced from the driveway recommended for parking restrictions and remove the need to consider aisle standing by these parents.

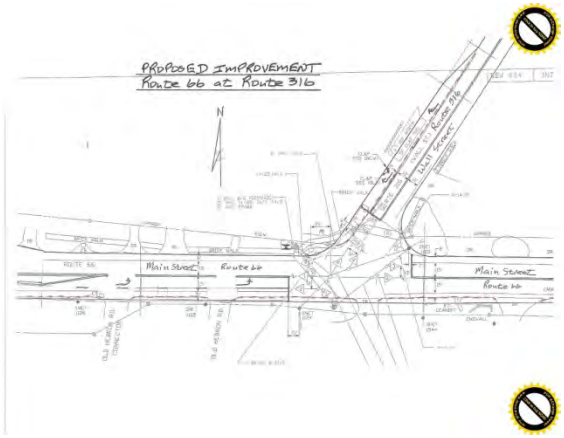
Figure 3 High School Visitor and Student Pickup

b. This improvement would allow resumption of two-way traffic from the north to the south driveway. It would also allow for parents to enter from either Wall Street drive, reducing conflicts with exiting bus traffic at the north drive.

c. This improvement would make visitor parking more convenient and allow clearer implementation of the bus consolidation by requiring all traffic entering at the North Drive from Wall Street to turn left.

2. Relocate the crosswalk on Wall Street and construct sidewalks to move connection to parking lot on the east side of Wall Street.
   a. While mentioned earlier in the short-term recommendations, more significant construction is necessary depending on the location selected for the new crossing.

3. Wall Street at Route 66 Intersection changes.




   a. Add left turn lane on Route 66 eastbound.
   b. Widen Wall Street for two-lane approach to Route 66.
   c. Modify traffic signal.

Figure 4 Intersection Improvement

4. Install permanent raised crosswalks at locations noted on *Figure 5*. Raised crosswalks are limited to areas of parent pickup and drop-off, and are intended to formalize the temporary devices deployed currently. Raised crosswalks are not recommended for the bus operations area, as school buses do not operate well over such devices.
5. To reduce traffic through middle school staff parking areas, the reconstruction of the parking area and development of a circulating driveway is possible and may be achieved with negligible loss of parking. The concept for this improvement is shown in *Figure 5* on the following page.

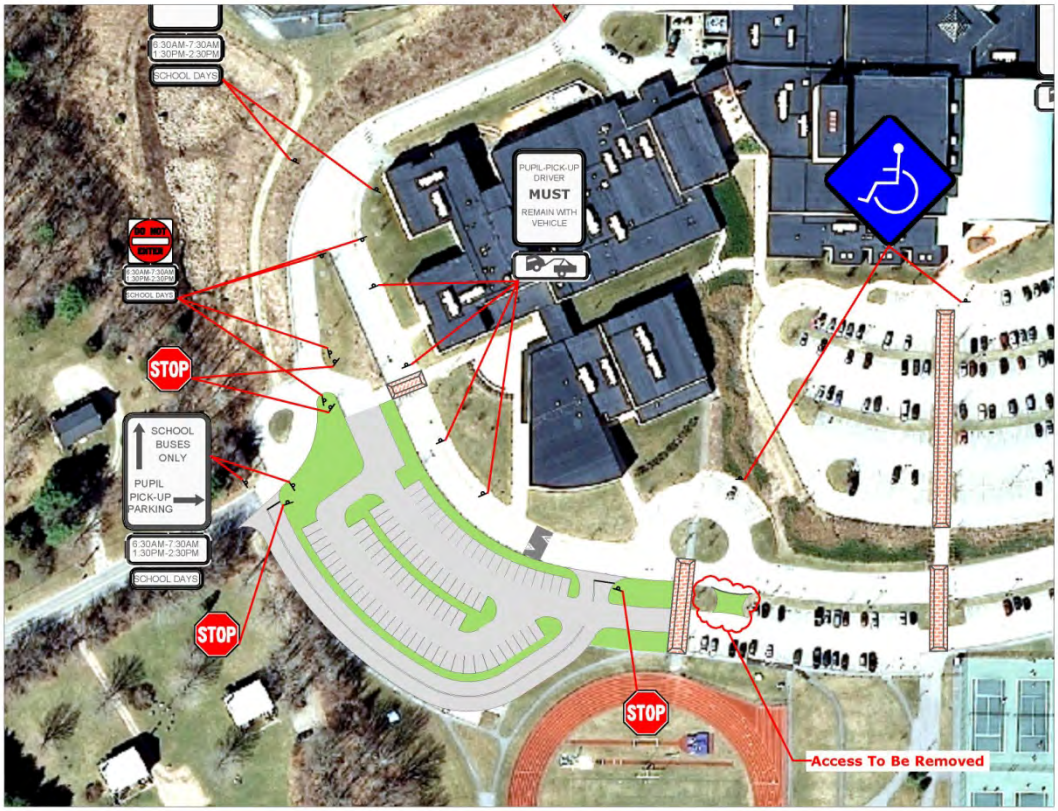



**Figure 5 Raised Crosswalks and Middle School Parking Lot**

In general, these actions will require additional design and construction efforts. In the case of additional parking at the high school pickup area, this action would require approval of the Hebron Planning and Zoning Commission. Improvements to the Wall Street Intersection with Route 66 will require significant funding and approval of the Connecticut Department of Transportation.

## 5. POTENTIAL PROJECT COSTS

While the level of effort for this study has not allowed detailed estimating of the dollar costs for the various recommendations, we have provided following a budgetary estimate

| **Short-Term Recommendations** | **Description** | **Estimate** |
|---|---|---|
| 1 | Consolidate Bus Operations | $1000 |
| 2 | Install Traffic Calming | $25,000 |
| 3 | Parking Restrictions | $500 |
| 4 | High School Drop-off | $500 |
| 5 | Wall Street Crosswalk | $7500 |
| 6 | Parent Pickup Areas | $1500 |
| 7 | Alter School Dismissal | NA |
| 8 | Restrict Openings at Circle near MS | None |
| 9 | Campus Sign Upgrade | $15,000 |

**Long-Term Improvements**

| | | |
|---|---|---|
| 1 | Additional Parking for Drop-off and Visitor Parking | $100,000 |
| 2 | Closure of access to Student Lot at Circle at the Middle School. | |
| 3 | Wall Street Sidewalks and Crossing | $10,000 |
| 4 | Wall Street Intersection | $550,000 |
| 5 | Circulation Roadway and Parking Lot reconstruction – Middle School | $350,000 |

## 6. Next Steps

Continued observation of the school traffic plan should be made by staff. Tweaking or adjusting specific areas would be a natural outcome of any similar plan.

Recognizing the external traffic conditions, noted in our report, are beyond the authority of the Board of Education, we recommend the noted congestion at Wall Street and Route 66 be referred to the Town of Hebron. This project would be best discussed by the Town with the Connecticut Department of Transportation.

## 7. Appendix

1. External Traffic Assessment
2. Consolidated Site Plan with Signing Recommendations
3. Consolidated Site Plan with Long-Term Improvements

# External Traffic Assessment

# Consolidated Site Plan
# with Signing Recommendations

# Consolidated Site Plan
# with Long-Term Improvements

# External Traffic Assessment

# External Traffic Assessment
# RHAM SCHOOL
# Gilead Street (Route 85) and Wall Street (Route 316)
# Hebron, Connecticut

## Introduction

The RHAM School Site, which houses the middle school and high school for the regional school district for the towns of Hebron, Andover and Marlborough, is located between Gilead Road (Route 85) to the west and Wall Street (Route 316) to the east, north of West Main and Main Streets (Route 68) in the Town of Hebron, Connecticut.

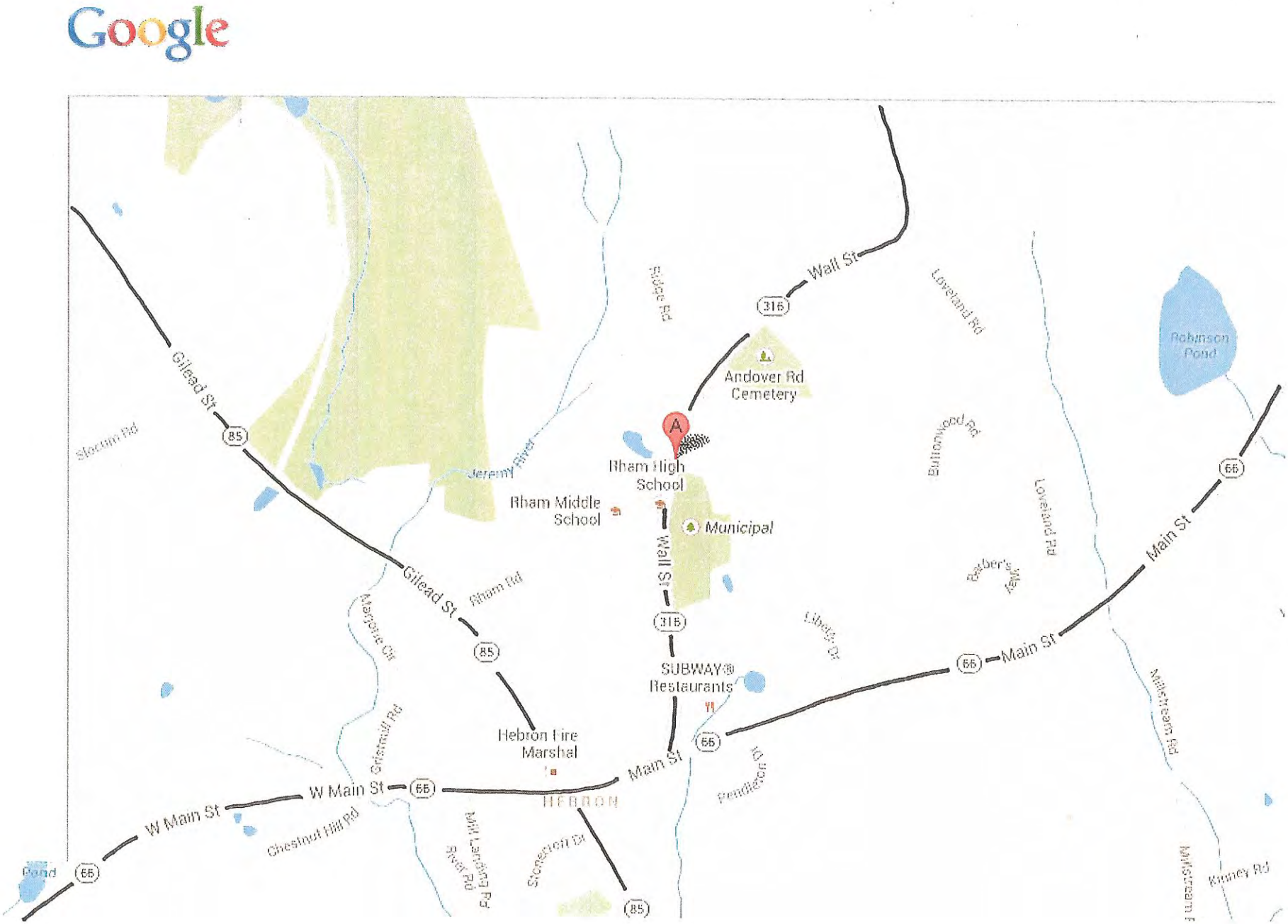
Please refer to the two reprints of maps on the next two pages which locate this site with respect to the surrounding roadway network.

The site is served by three site drives:

1. The unsignalized T-intersection of Gilead Road (Route 85) at RHAM Road, at the west side of the site: Gilead Road is a state highway, Route 85, running north-south, with RHAM Road, a town road, as the east leg of the intersection. All approaches to this intersection are one-lane wide, and the RHAM Road westbound (outbound) approach is controlled by a Stop sign.

2. The unsignalized T-intersection of Wall Street (Route 316) at the North Site Drive at the east side, north end, of the site: Wall Street is a state highway, Route 316, running north-south, with the North Site Drive serving the schools, as the west leg of the intersection. The two Wall Street approaches to this intersection are one lane wide, and the school's site drive eastbound (outbound) approach to this intersection is two lanes wide, with one dedicated left-turn lane and one dedicated right-turn lane, controlled by a Stop sign.

3. The unsignalized T-intersection of Wall Street (Route 316) at the South Site Drive at the east side, south end of the site: Wall Street is a state highway, Route 316, running north-south, with the South Site Drive serving the schools, as the west leg of the intersection. All approaches to this intersection are one-lane wide, and the school's site drive eastbound (outbound) approach is controlled by a Stop sign.


Google
Wall St
316
Andover Rd Cemetery
A
Rham High School
Rham Middle School
Municipal
Wall St
316
Gilead St
85
Gilead St
85
Rham Rd
Jeremy River
Sloan Rd
Sloan Rd
Loveland Rd
Buttonwood Rd
Loveland Rd
Robinson Pond
Barber's Way
Libby Dr
Main St
66
Main St
66
SUBWAY® Restaurants
Hebron Fire Marshal
Main St
55
Pendleton Dr
Antietam Rd
Kinney Rd
W Main St
66
W Main St
66
HEBRON
Chestnut Hill Rd
Mill Landing Rd
Stonecrop Dr
85
Pond
Margate Dr
Cricketmill Rd
River Rd

Google


Wall St
316
Robinson
Pond
Gilead St
85
A
Jeremy River
Municipal
Wall St
316
Main St
66
Gilead St
85
Main St
66
Main St
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W Main St
66
W Main St
HEBRON
Pond
66
85

**Traffic Volumes**

From information obtained from the Connecticut Department of Transportation (CTDOT), 2011 average daily traffic volumes for the immediate roads surrounding and serving the RHAM school site, were estimated as follows:

- Route 66, west of Route 85: 10,100
- Route 66, between Routes 85 and 316: 15,100
- Route 66, east of Route 316: 14,000
- Route 85, south of Route 66: 10,600
- Route 85, north of Route 66: 8,000
- Route 85, north of RHAM Road: 8,900
- Route 316, north of Route 66: 4,500
- Route 316, north of RHAM schools: 2,600

For purposes of the traffic operations analyses that follow, automatic traffic recorder measurements (ATRs) and manual turning movement counts ((TMCs) were conducted on the surrounding roadway network and at one of the three site drives prior to the end of school in June 2014.

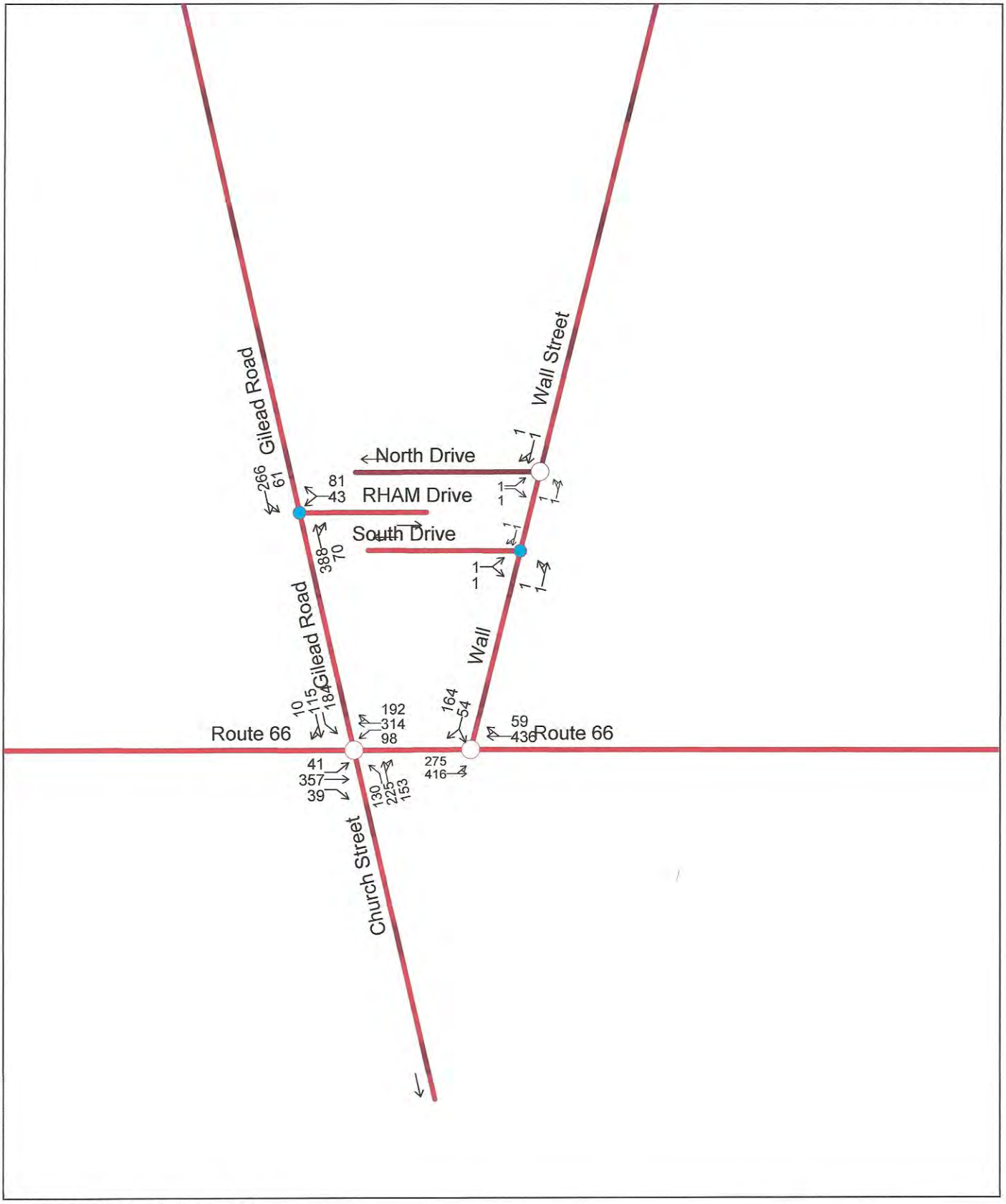
These turning movement count summaries were specifically evaluated to determine the associated peak hour traffic volumes for the following three key periods related to operations to and from the schools, as summarized in the following three schematics:

A. The period from 6:45 to 7:45 am which is both the morning peak hour for the schools (arrivals) as well as the morning commuter peak hour for the surrounding roadway network.

B. The period from2:30 to 3:30 pm which is the afternoon peak hour for the schools (departures).

C. The period from 4:30 to 5:30 pm which is the evening commuter peak hour for the surrounding roadway network.

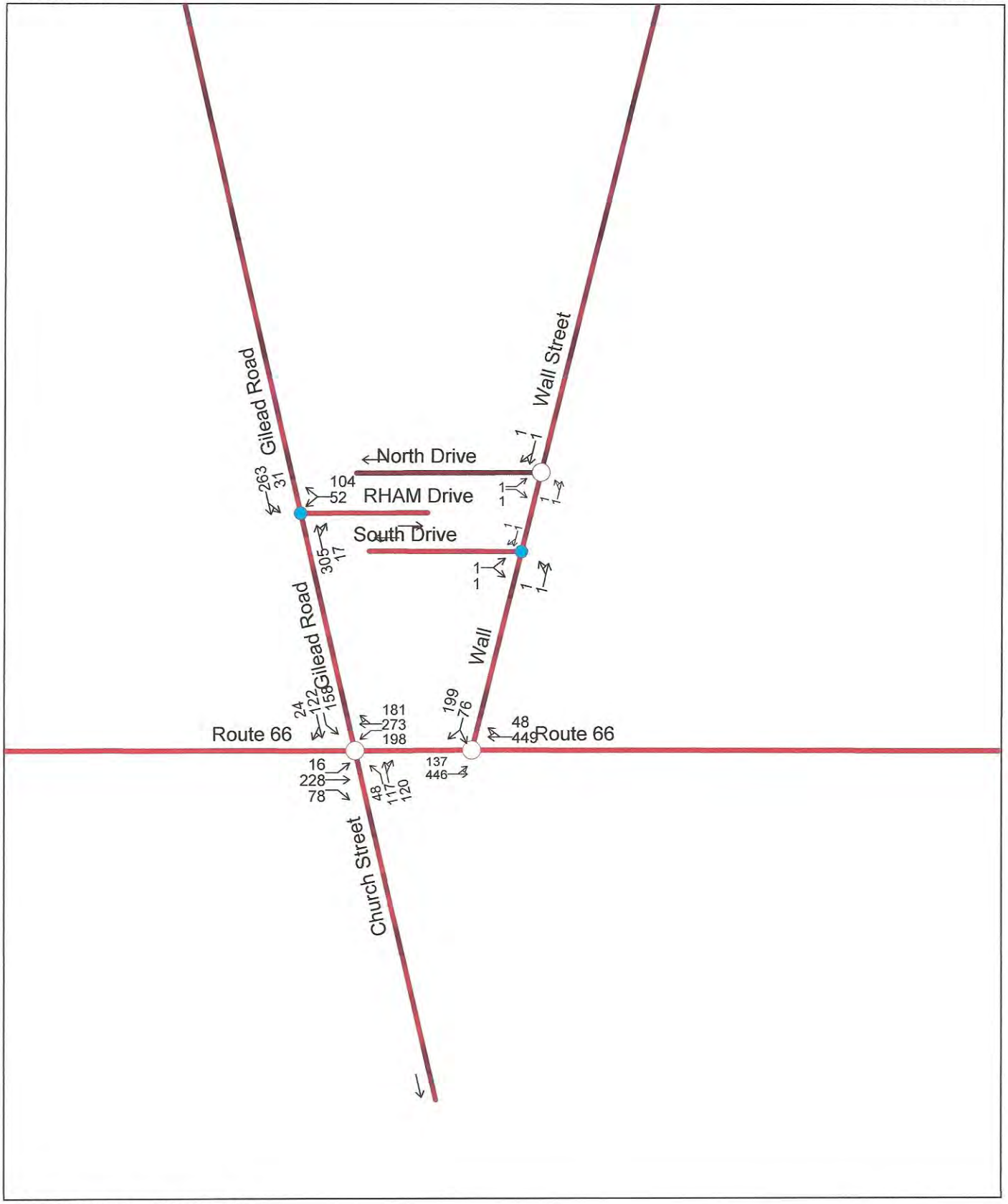
**Map - RHAM Schools, Hebron, CT**
**Volumes** **6/26/2014**




**RHAM Schools, Hebron, CT**
**Bubaris Traffic Associates**

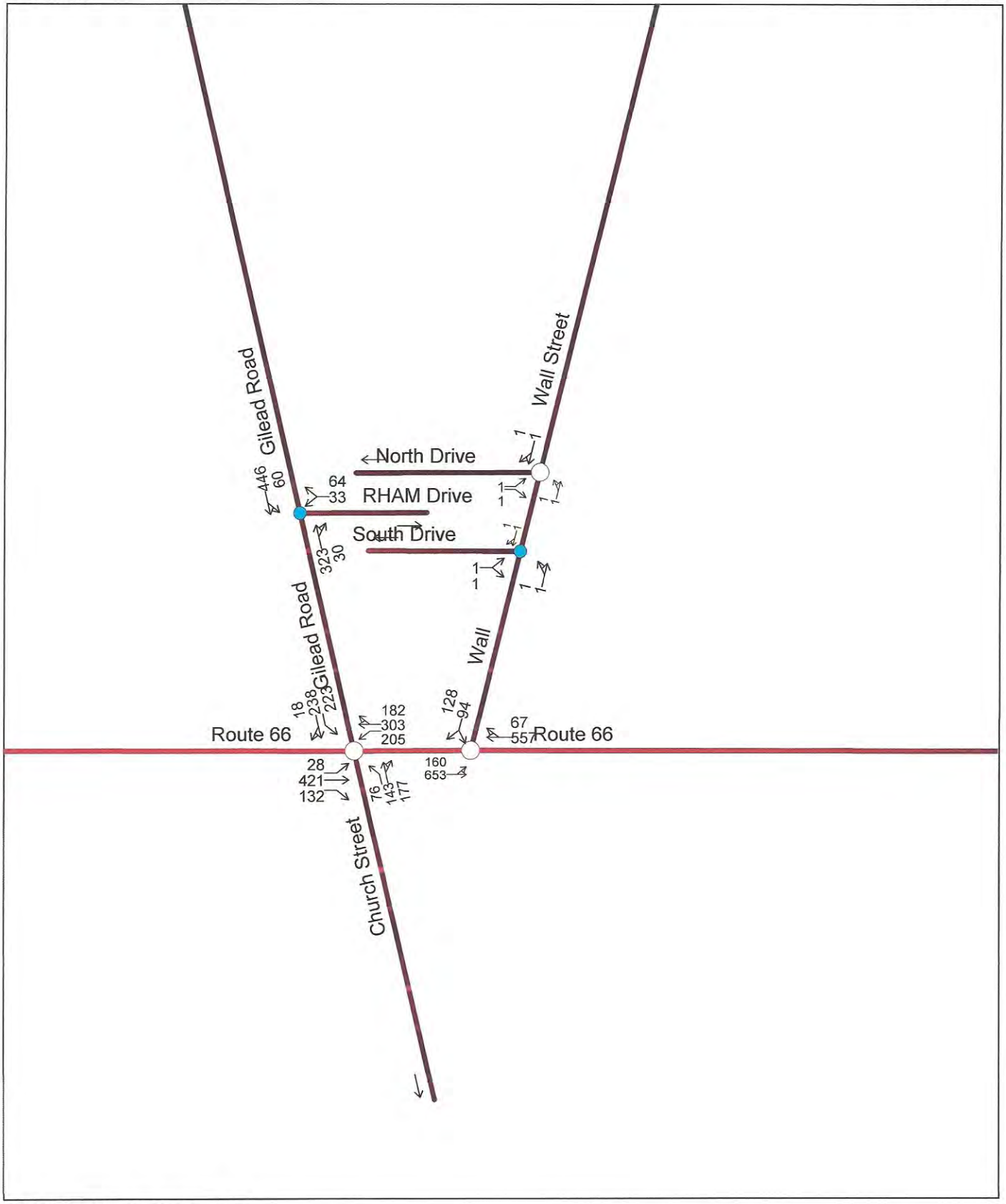
**Existing AM Peak (6:45 to 7:45 am)**

**Map - RHAM Schools, Hebron, CT**
**Volumes** **6/26/2014**




**RHAM Schools, Hebron, CT**
**Bubaris Traffic Associates** **Existing PM Peak (2:30 to 3:30 pm)**

**Map - RHAM Schools, Hebron, CT**
**Volumes** **6/26/2014**




**RHAM Schools, Hebron, CT**
**Bubaris Traffic Associates** **Existing PM Peak (4:30 to 5:30 pm)**

**Background Conditions**

Given the nature of this development and the manner in which it interfaces with the surrounding roadway network, the selected study area for the proposed development consists of the following three (3) external intersections:

- Gilead Road (Route 85) at RHAM Road: This is a 3-way, unsignalized intersection with Gilead Road running north-south and RHAM Road, a town road, as the east leg of the intersection. All approaches to this intersection are one-lane wide and the RHAM Road westbound (outbound) approach is controlled by a Stop sign.

- West Main Street/Main Street (Route 66) at Gilead Road/Church Street (Route 85): This is a 4-way, signalized intersection with Route 66 running east-west and Route 85 running north-south. The east leg of this intersection is known as West Main Street (Route 66). The east leg of this intersection is known as Main Street (Route 66). The north leg of this intersection is known as Gilead Road (Route 85). The south leg of this intersection is known as Church Street (Route 85). The Route 66 eastbound approach is three lanes wide, with one left-turn lane, one through lane, and one right-turn lane. The Route 66 westbound approach is two lanes wide, with one left-turn lane and one combination through/right lane. The Route 85 northbound approach is two lanes wide, with one left-turn lane and one combination through/right lane. The Rout 85 southbound approach is two lanes wide, with one left-turn lane and one combination through/right-turn lane. The traffic signal at this intersection provides four vehicular phases and one exclusive pedestrian phase. The first phase is an advance eastbound/westbound phase to move left turns from Route 66. The second phase moves all the eastbound and westbound movements on Route 66. The third phase is an exclusive actuated phase to move pedestrians across all four legs. The fourth phase is an advance northbound/southbound phase to move left turns from Route 85. The fifth phase is to move all northbound and southbound movements from Route 85.

- Main Street (Route 66) at Wall Street (Route 316): This is a 3-way, signalized intersection with Route 66 running east-west and Route 316 as the north leg of this intersection intersecting Route 66 at a skew. The east and west legs of this intersection are known as Main Street. The north leg of this intersection is known as Wall Street. All approaches to this intersection are currently one-lane wide. The traffic signal at this intersection provides three vehicular phases. The first phase is an advance eastbound phase to move left turns and through movements from Route 66. The second phase moves all the eastbound and westbound movements on Route 66. The third phase moves the movements from Route 316.

**Operations Analysis**

Intersection capacity analyses were performed for the three study intersections defined above utilizing the methodology described in the latest edition of Highway Capacity Manual, Special Report 209, Transportation Research Board. Application of this methodology was facilitated by use of Synchro Analysis Software, developed by the Trafficware Corporation.

Capacity analyses are utilized to determine a Level of Service (LOS) for a given intersection operating under either signalized or unsignalized control.

In the case of signalized intersections similar to the two intersections on Route 66, Level of Service (LOS) is defined in terms of control delay, which is a measure of driver discomfort, frustration, increased fuel consumption, and lost travel time. The delay experienced by a motorist is comprised of a number of factors that relate to control, geometric, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the volume-to-capacity (v/c) ratio for the lane group. In the case of signalized intersections, the Level of Service for each approach is computed, and an overall Level of Service for the entire intersection is determined. In today's environment, Levels of Service C to D are considered acceptable, and Levels of Service A to B are seldom achieved at signalized intersections. Please refer to Exhibit A on the following page which provides details on the definitions of Levels of Service for signalized intersections.

In the case of unsignalized intersections similar to the site drive intersection on Route 85 at RHAM Road, Level of Service (LOS) is defined in terms of the average control delay for the approach or movement evaluated. Control delay involves movements at slower speeds and stops on intersection approaches as vehicles move up in the queue or slow down upstream of an intersection. The delay experienced by a motorist is comprised of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference time that would result during base conditions in the absence of incident, control, traffic, or geometric delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay. At two-way stop-controlled and all-way stop-controlled intersections, control delay is the total elapsed time from a vehicle joining the queue until its departure from the stopped position at the head of the queue. The control delay also includes the time required to decelerate to a stop and to accelerate to the free-flow speed. Level of Service for a one-way or two-

# EXHIBIT A
## LEVEL OF SERVICE CRITERIA
## SIGNALIZED INTERSECTIONS

**SOURCE: HIGHWAY CAPACITY MANUAL (HCM), 2010**
**TRANSPORTATION RESEARCH BOARD (1)**

Level of Service for **signalized intersections** is defined in terms of control delay, which is a measure of driver discomfort, frustration, increased fuel consumption, and lost travel time. The delay experienced by a motorist is comprised of a number of factors that relate to control, geometric, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference travel time that would result during base conditions in the absence of traffic control, geometric delay, any incidents, and any other vehicles. Specifically, LOS criteria for traffic signals are stated in terms of the average control delay per vehicle, typically for a 15-minute analysis period. Delay is a complex measure and depends on a number of variables, including the quality of progression, the cycle length, the green ratio, and the volume-to-capacity (v/c) ratio for the lane group.

In the case of **signalized intersections**, the Level of Service for each approach is computed, and an overall Level of Service for the entire intersection is determined.

Levels of Service (LOS) for **signalized intersections** are defined as follows:

| LEVEL OF SERVICE | CONTROL DELAY PER VEHICLE (SECONDS) | CONDITION |
|---|---|---|
| LOS A | ≤ 10 | LOW DELAY |
| LOS B | > 10 TO 20 | SHORT DELAY |
| LOS C | > 20 TO 35 | AVERAGE DELAY |
| LOS D | > 35 TO 55 | CONGESTION NOTICEABLE |
| LOS E | > 55 TO 80 | LIMIT OF ACCEPTABLE DELAY |
| LOS F | > 80 | UNACCEPTABLE |

In today's environment, Levels of Service C to D are considered acceptable, and Levels of Service A to B are seldomly achieved at signalized intersections.

(1) **HCM**, Exhibit 16-2.

# EXHIBIT B
## LEVEL OF SERVICE CRITERIA
## UNSIGNALIZED INTERSECTIONS

### SOURCE: HIGHWAY CAPACITY MANUAL (HCM), 2010
### TRANSPORTATION RESEARCH BOARD (1)

Level of Service for **unsignalized intersections** similar to the study intersections is defined in terms of the average control delay for the approach or movement evaluated. Control delay involves movements at slower speeds and stops on intersection approaches as vehicles move up in the queue or slow down upstream of an intersection.

The delay experienced by a motorist is comprised of factors that relate to control, geometrics, traffic, and incidents. Total delay is the difference between the travel time actually experienced and the reference time that would result during base conditions in the absence of incident, control, traffic, or geometric delay. Control delay includes initial deceleration delay, queue move-up time, stopped delay, and final acceleration delay.

At two-way stop-controlled and all-way stop-controlled intersections, control delay is the total elapsed time from a vehicle joining the queue until its departure from the stopped position at the head of the queue. The control delay also includes the time required to decelerate to a stop and to accelerate to the free-flow speed.

Level of Service (LOS) for a two-way stop-controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. LOS is **not defined** for the intersection as a whole.

Level of Service (LOS) for an all-way stop-controlled intersection is determined by the computed or measured control delay and is defined for all movements. A LOS **is then defined** for the intersection as a whole.

Levels of Service (LOS) for **unsignalized intersections** are defined as follows:

| LEVEL OF SERVICE | AVERAGE CONTROL DELAY PER VEHICLE (SECONDS) | CONDITION |
|---|---|---|
| LOS A | 0 TO 10 | LITTLE OR NO DELAY |
| LOS B | > 10 TO 15 | SHORT DELAY |
| LOS C | > 15 TO 25 | AVERAGE DELAY |
| LOS D | > 25 TO 35 | LONG DELAY |
| LOS E | > 35 TO 50 | VERY LONG DELAY |
| LOS F | > 50 | EXTREME DELAY |

In today's environment, Levels of Service D to F are common and are often experienced on minor street approaches to major streets carrying relatively high traffic volumes.

(1) **HCM**, Exhibits 17-2 and 17-22.

way stop-controlled intersection is determined by the computed or measured control delay and is defined for each minor movement. LOS for a one-way or two-way stop-controlled intersection is **not defined** for the intersection as a whole. In today's environment, Levels of Service D to F are common and are often experienced on minor street approaches to major streets carrying relatively high traffic volumes. Please refer to Exhibit B on the previous page which provides details on the definitions of Levels of Service for unsignalized intersections.

The results of the capacity analyses of existing 2014 conditions are summarized in Table A on the next page.

A review of Table A shows that levels of service for the unsignalized intersection of Route 85 at RHAM Road are satisfactory showing a level of service A (considered excellent) for the entering left turn from Route 85, and a level of service B to C (considered very good to good) for the exiting maneuvers from RHAM Road, for all three evaluation peaks. Therefore, no geometric and/or traffic control improvements are deemed necessary or recommended.

A review of Table A shows that levels of service for the signalized intersection of Route 66 at Route 85 are satisfactory showing an individual approach and overall intersection level of B to C (considered very good to good) for all three evaluation peaks. Therefore, no geometric and/or traffic control improvements are deemed necessary or recommended.

A review of Table A shows that levels of service for the signalized intersection of Route 66 at Route 316 are NOT satisfactory, with overall intersection level of service F (considered poor) for all three evaluation peaks, and specific problems with both the Route 66 eastbound and the Route 316 southbound approaches suggesting the need for dedicated turn-lanes on both the Route 66 eastbound and Route 316 southbound approaches. Therefore, geometric and/or traffic control improvements are deemed necessary and recommended for this intersection as described in the following section.

**Recommended Improvements**

A review of the right side of Table A shows that significant improvements in traffic operations can be realized at the intersection of Main Street (Route 66) at Wall Street (Route 316) by installing a dedicated eastbound left-turn lane on Route 66 and a dedicated southbound right-turn lane on Route 316.

These two improvements would yield overall level of service B (considered very good) for the intersection during all three of the evaluated study periods, which is a significant improvement over the current overall level of service F during these three study periods.

# Table A
## Summary of Traffic Operations Analyses
## Levels of Service
## RHAM Schools Study Area
## Hebron, Connecticut

| | Existing 2014 Conditions | | | IMPROVED 2014 Conditions | | |
|---|---|---|---|---|---|---|
| | Weekday AM Peak 6:45 to 7:45 School Arrival PM Commuter Peak | Weekday PM Peak 2:30 to 3:30 School Departure | Weekday PM Peak 4:30 to 5:30 PM Commuter Peak | Weekday AM Peak 6:45 to 7:45 School Arrival PM Commuter Peak | Weekday PM Peak 2:30 to 3:30 School Departure | Weekday PM Peak 4:30 to 5:30 PM Commuter Peak |
| **Gilead Road (Route 85) at RHAM Road** | | | | | | |
| | | | | | *NO IMPROVEMENTS* | |
| Route 85 southbound left | LOS A | LOS A | LOS A | LOS A | LOS A | LOS A |
| RHAM Road westbound (outbound) approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Westbound Average Delay (sec) | 16.6 | 14.2 | 15.8 | 16.6 | 14.2 | 15.8 |
| **West Main/Main Streets (Route 66) at Gilead Road/Church Street (Route 85)** | | | | | | |
| | | | | | *NO IMPROVEMENTS* | |
| Route 66 eastbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 66 westbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 85 northbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| Route 85 southbound approach | LOS C | LOS B | LOS C | LOS C | LOS B | LOS C |
| OVERALL | - LOS C - | - LOS B - | - LOS C - | - LOS C - | - LOS B - | - LOS C - |
| Overall Average Delay (sec) | 24.5 | 17.0 | 25.6 | 24.5 | 17.0 | 25.6 |
| **Main Street (Route 66) at Wall Street (Route 316)** | | | | | | |
| | | | | *ADDITION OF ROUTE 68 EASTBOUND LEFT TURN LANE AND ROUTE WALL STREET SOUTHBOUND RIGHT-TURN LANE* | | |
| Route 66 eastbound approach | LOS F | LOS F | LOS F | LOS B | LOS A | LOS B |
| Route 66 westbound approach | LOS C | LOS C | LOS C | LOS C | LOS B | LOS B |
| Route 316 southbound approach | LOS F | LOS E | LOS D | LOS B | LOS B | LOS C |
| OVERALL | - LOS F - | - LOS F - | - LOS F - | - LOS B - | - LOS B - | - LOS B - |
| Overall Average Delay (sec) | 177 | 115.4 | 384.5 | 13.6 | 10.5 | 17.6 |

**Bubaris Traffic Associates**
**August 2014**

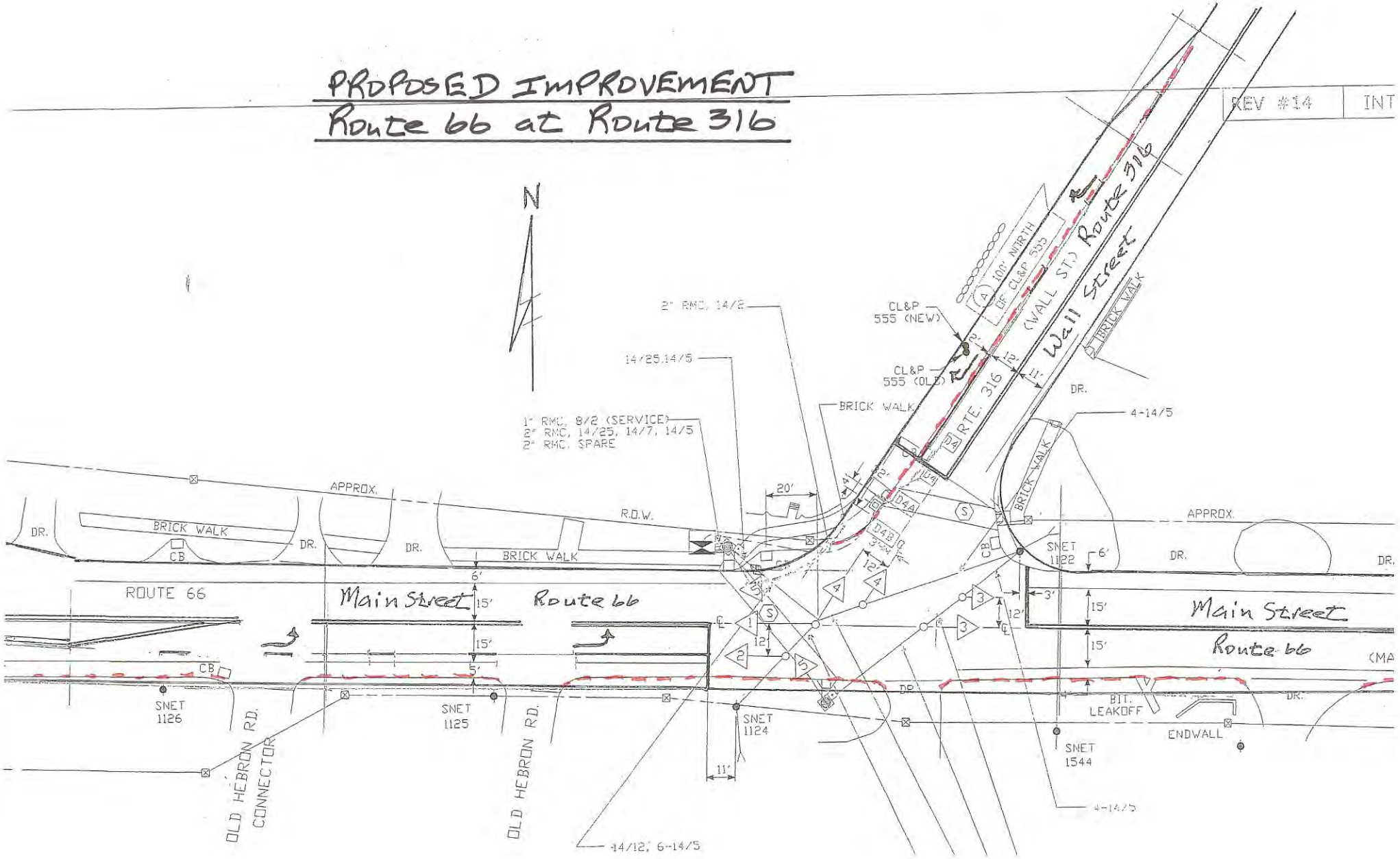
Please refer to the Proposed Improvement sketch on the following page showing the provision of 150-foot long dedicated turn lanes on the eastbound and southbound approaches, with appropriate taper and transition lengths.

The Route 66 eastbound approach can apparently accommodate the additional turn lane within existing rights-of-way with no need to move existing utility poles.

The Route 316 southbound approach cannot accommodate the additional turn lane without the acquisition of additional rights-of-way and the need to relocate at least one utility pole.

# PROPOSED IMPROVEMENT
# Route 66 at Route 316

REV #14 | INT



# Consolidated Site Plan
# with Signing Recommendations

STOP

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

DO NOT
ENTER

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

STOP

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

NOTICE

SCHOOL
BUSES
ONLY
BEYOND
THIS SIGN

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

Crosswalk To Be
Removed

PUPIL-PICK-UP
DRIVER
MUST
REMAIN WITH
VEHICLE

DO NOT
ENTER

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

STOP

SCHOOL
BUSES
ONLY

PUPIL
PICK-UP
PARKING

6:30AM-7:30AM
1:30PM-2:30PM
SHOOL DAYS

Sidewalk and Crosswalk
To Be Removed

NO
PARKING
OR
STOPPING
ANYTIME

Access To Be Removed

New Raised Crosswalk

Speed Hump

# Consolidated Site Plan
# with Long-Term Improvements