

TECHNICAL MEMORANDUM

**POPHAM ROAD/VILLAGE CENTER
PEDESTRIAN SAFETY ANALYSIS
SCARSDALE, NEW YORK**

Prepared for

VILLAGE OF SCARSDALE
Scarsdale, New York

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July 19, 2005
TRC Project No. 48248

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APPENDIX A

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A. **INTRODUCTION**

TRC Raymond Keyes Associates (TRC) has performed a detailed Pedestrian Safety Analysis for the area along Popham Road from Chase Road to East Parkway, within the Village Center of the Village of Scarsdale (see Figure No. 1). In preparation of this Study, TRC performed several field observations at different times of the day and different days of the week. In addition, TRC held various discussions with Village representatives, a representative from the Village Police Department, the Village's Traffic Signal Consultant, and the Westchester County Traffic Engineer, as well as some residents in the area.

Field observations were completed and the intersections along Popham Road in the Village Center were analyzed to determine current conditions and to make recommendations for future improvements. In preparation of this Technical Memorandum, a proposed exclusive pedestrian phase along the Popham Road Corridor was reviewed as one of the possible modifications to improve safety. An exclusive pedestrian phase would be push button activated and stop vehicular traffic at all intersections in each direction.

The following three intersections along Popham Road are considered in this Study:

1. Popham Road @ Chase Road/Overhill Road
2. Popham Road @ East Parkway/Scarsdale Avenue
3. Popham Road @ Garth Road/Depot Place

Currently, these three intersections have pedestrian phases running concurrently with the non-conflicting traffic volume phases. There are no active pedestrian push buttons. Due to the pedestrian volumes along this corridor, as well as the occurrence of some vehicular/pedestrian accidents, including one fatality, and in an effort to improve the safety of the pedestrians, an exclusive pedestrian phase was one modification proposed at all three intersections. Based upon discussions with Village and Police officials, it was determined that glare/shadows at the intersection of Popham Road and Chase Road was the main factor in the fatal accident, as the driver traveled from the light into the shadow area and thus had difficulty seeing the pedestrian. This condition tends to occur more frequently in the winter.

Field observations indicated pedestrian compliance was poor as several pedestrians were observed jaywalking and several others were observed walking during the “Don’t Walk” period. In addition, many motorists were also observed violating traffic signs and road markings.

TRC has prepared this Technical Memorandum to review the pedestrian safety at the three intersections and determine potential safety improvements to be introduced along the Popham Road Corridor.

B. TRAFFIC VOLUMES/EXISTING CONDITIONS

The base traffic and pedestrian volumes utilized in this Technical Memorandum are from the combination of traffic/pedestrian counts performed by Westchester County in April 2005 and traffic/pedestrian volumes collected by TRC in May 2005. These traffic/pedestrian volumes were for the weekday AM, Midday and PM Peak Hours.

The Peak Hours at the three key times of the day were determined to be:

Peak AM Hour: 8:00 AM – 9:00 AM

Peak Midday Hour: 12:00 Noon – 1:00 PM

Peak PM Hour: 5:00 PM – 6:00 PM

The Existing 2005 Peak Hour Traffic/Pedestrian Volumes are illustrated on Figure No. 2.

The traffic volumes, particularly along Popham Road, are generally consistent with those utilized in the Popham Road Bridge Design Report, dated April 2003.

The existing roadway geometry and infrastructure is limited due to the presence of the various buildings and the natural features. Thus, the intersections are not completely standard and there are various offsets and angles at the intersections. In addition, the intersections are relatively close to each other, limiting the distance for storage/queuing of vehicles. The sidewalks and crosswalks are of appropriate widths to support the number

of pedestrians. Field observations revealed that the walk times provided are sufficient based upon standards, however this is after accounting for the median on East Parkway which was interpreted as a pedestrian refuge. Also, as there is multi-family housing with many seniors residing in the Village Center, consideration could be given to extending the pedestrian walk time. After analyzing this modification, however, it would result in further vehicular delays experienced by motorists at the Popham Road intersections in the Village Center. Over the past few years, the Village had adjusted traffic signal times to attempt to improve traffic flow and coordination.

Several field observations were performed by representatives of TRC. Some of these were performed with Village representatives, as well as with a representative of the Village Police Department and the Village's Traffic Signal Consultant. During the field observations, it was noticed that a significant number of drivers as well as pedestrians ignore the signage and striping that is currently present.

In regard to automobiles, the most frequent of the illegal movements by the drivers is for vehicles traveling westbound on Popham Road, approaching Chase Road. These vehicles enter the "right turn only" lane, which is signed for vehicles to turn right from Popham Road onto Chase Road. However, many of these vehicles continue straight along Popham Road, crossing Chase Road. While some then perform the right turn at East Parkway, many are using it as a way to cut ahead of the through vehicles that are queued up in the proper lane, and then continue across the Popham Road Bridge.

The field observations also noted that many pedestrians are ignoring the signage and pedestrian controls. This is occurring in various ways. Some are just plain jay walking, crossing in between the intersections as opposed to at the intersections. A percentage of these individuals were observed utilizing cell phones and generally not paying attention. Several others were observed crossing at the intersections but not following the pedestrian signal indications, including walking when the “Don’t Walk” signal is illuminated. This occurred during different phases, including before the “Walk” phase began, after the “Walk” phase had ended, and when the “Walk” phase was for a different direction, thus the pedestrian was crossing against traffic. It appeared that some pedestrians did not understand the pedestrian crossing, including the pedestrian countdown signals which indicate how much time is left to cross the street.

Some senior citizens were observed crossing the intersections, particularly at the intersection of Popham Road and Chase Road.

C. TRAFFIC SIGNAL PHASING ALTERNATIVES

The traffic signals at the three intersections are currently pre-timed and are coordinated based upon previous studies performed to determine the appropriate timings. The time base coordination means that the three traffic signals are timed to work with each other to improve traffic flow.

TRC performed traffic capacity and progression analyses to identify the impacts associated with the proposed exclusive pedestrian phase utilizing Synchro/SimTraffic software. These analyses incorporate the traffic volumes, roadway geometry, and traffic signal timing to determine operating conditions.

Two different options were analyzed in this study in addition to the existing conditions. The geometry of the intersections is not changed in both the options. The signal timings (amount of green/red time, etc.) and phasings (the approaches to the intersection that have a green light of any particular time) were changed to optimize the network offsets (the timing coordination between the various intersections) and cycle lengths (the amount of time required for a traffic signal to provide green time to each phase). The two options are explained below:

Option 1 – Existing Signal Timings with Added Exclusive Pedestrian Phase (135-second cycle):

An exclusive pedestrian phase is added to the existing vehicular volume phases. Signal timings and phasings were not changed at any of the three intersections for the vehicular traffic, except for the addition of the exclusive pedestrian phase. The signal cycle length is increased from the existing 110-second cycle length to 135 seconds at all of the intersections due to the addition of exclusive pedestrian phase. Considering the geometry and approach widths of all the intersections, the pedestrian phase is given 25 seconds which includes 7 seconds of “Walk” time and 18 seconds of “Flashing Don’t Walk” time, based upon the longest crosswalk without a median, utilizing the standard walking speed of 4.0 feet per second. When significant numbers of children or senior citizens are present, 3.5 feet per second is sometimes used, which would result in a longer pedestrian phase and greater impacts. The seven seconds of walk time would meet standards but is less than what pedestrians currently have to cross at certain roadways in the Village Center.

Option 2 – Optimized Signal Timings with Added Exclusive Pedestrian Phase (150-second cycle):

The signal cycle length is increased to 150 seconds which includes 25 seconds of pedestrian phasing. The signal timings and the phases for the vehicular volume is altered

to achieve proper progression and a balanced Level of Service at all the approaches of each intersection. While performing the progression analysis, the intersection of Popham Road and East Parkway is made the master intersection. The remaining two intersections were coordinated with this master intersection using time based coordination.

D. FINDINGS OF SIGNAL PHASING ANALYSESCapacity Analysis

Capacity analyses were conducted for the study locations to identify the impacts associated with the proposed phasing. The following is a brief description of the procedures utilized in preparation of this analysis:

- Capacity analysis is a method by which traffic volumes are compared to the calculated roadway and intersection capacities to evaluate future traffic conditions. The Highway Research Board describes the methodology used in the 2000 Highway Capacity Manual. In general, the terminology "Level of Service" is used to provide a "qualitative" evaluation based on certain "quantitative" calculations related to empirical values.
- Levels of Service range from A to F. In general, Level of Service A represents the best traffic operating condition. Level of Service for unsignalized and signalized intersections is defined in terms of average delay. Delay is used as a measure of driver discomfort, frustration, efficiency, etc.

A more complete description of the above is contained in Appendix A.

Capacity analyses were performed for the study locations as described below. The capacity analysis worksheets for the study locations are contained in Appendix B.

Location No. 1 – Popham Road and Chase Road/Overhill Road

Existing Conditions

Popham Road forms the east/west direction approaches of this intersection. The eastbound approach has a left-turn lane and a shared through/right-turn lane. The westbound approach has a shared left/through lane and a right only lane. It was observed in the field that the right only lane on the westbound approach is utilized by many vehicles as a shared through/right-turn lane instead. Some of the drivers using the right only lane at the next intersection (Popham Road @ East Parkway) are observed proceeding straight through this intersection and turning right onto East Parkway. Others were observed performing this maneuver to cut ahead of vehicles in the proper lane. The northbound approach is formed by Overhill Road which has one left only lane and a shared through/right-turn lane. The southbound approach is formed by Chase Road which has one left only lane and a shared through/right-turn lane. The intersection is signalized and there is an advanced phase for Popham Road eastbound traffic (which permits Popham Road eastbound traffic to begin moving prior to the westbound traffic).

Capacity Analysis

Capacity analyses were conducted for this intersection using the existing traffic volumes as well as the options described in the previous section for the three different Peak Hours on a weekday. The results of the analysis are shown in the tables below:

| TABLE NO: 1-A EXISTING CONDITIONS | | | | | | | |
|---|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--|
| POPHAM ROAD @ CHASE ROAD/OVERHILL ROAD | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | A | 6.2 | A | 6.8 | A | 5.5 | |
| Eastbound TR | A | 7.8 | A | 7.8 | A | 6.9 | |
| Eastbound Overall | A | 7.5 | A | 7.6 | A | 6.8 | |
| Chase Road/Overhill Road | | | | | | | |
| Westbound LT | B | 18.9 | C | 23.9 | B | 18.8 | |
| Westbound R | B | 13.3 | B | 15.8 | B | 13.2 | |
| Westbound Overall | B | 18.2 | C | 21.6 | B | 18.1 | |
| Chase Road/Overhill Road | | | | | | | |
| Northbound L | D | 36.1 | D | 38.0 | D | 37.4 | |
| Northbound TR | D | 35.4 | D | 38.7 | D | 36.4 | |
| Northbound Overall | D | 35.7 | D | 38.5 | D | 36.8 | |
| Chase Road/Overhill Road | | | | | | | |
| Southbound L | D | 36.3 | D | 41.6 | D | 40.1 | |
| Southbound TR | D | 38.1 | D | 40.1 | D | 39.8 | |
| Southbound Overall | D | 37.6 | D | 40.7 | D | 39.9 | |
| OVERALL | | | | | | | |
| | B | 16.1 | C | 20.4 | B | 17.6 | |

| TABLE NO: 1-B EXISTING SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 135 SECONDS | | | | | | | |
|--|---------------------|--------------|--------------------------|--------------|---------------------|--------------|------|
| POPHAM ROAD @ CHASE ROAD/OVERHILL ROAD | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | B | 16.1 | C | 21.5 | B | 16.9 |
| Eastbound TR | | C | 21.9 | C | 25.4 | C | 23.7 |
| Eastbound Overall | | C | 20.9 | C | 24.5 | C | 22.8 |
| Chase Road/Overhill Road | | | | | | | |
| Westbound LT | | D | 35.2 | E | 71.8 | D | 35.2 |
| Westbound R | | C | 23.6 | C | 27.9 | C | 23.5 |
| Westbound Overall | | C | 33.7 | E | 59.3 | C | 33.8 |
| Chase Road/Overhill Road | | | | | | | |
| Northbound L | | D | 49.5 | D | 53.0 | D | 51.8 |
| Northbound TR | | D | 48.1 | D | 53.0 | D | 49.5 |
| Northbound Overall | | D | 48.8 | D | 53.0 | D | 50.6 |
| Chase Road/Overhill Road | | | | | | | |
| Southbound L | | D | 49.4 | E | 59.5 | E | 55.5 |
| Southbound TR | | D | 52.2 | E | 55.5 | E | 55.1 |
| Southbound Overall | | D | 51.4 | E | 57.2 | E | 55.2 |
| OVERALL | | | | | | | |
| | | C | 30.3 | D | 47.0 | C | 33.3 |

| TABLE NO: 1-C OPTIMIZED SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 150 SECONDS | | | | | | | |
|---|---------------------|--------------|--------------------------|--------------|---------------------|--------------|------|
| POPHAM ROAD @ CHASE ROAD/OVERHILL ROAD | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | B | 12.8 | B | 15.7 | A | 7.2 |
| Eastbound TR | | B | 16.8 | A | 9.9 | B | 10.0 |
| Eastbound Overall | | B | 16.1 | B | 11.2 | A | 9.7 |
| Chase Road/Overhill Road | | | | | | | |
| Westbound LT | | D | 41.9 | D | 44.0 | D | 39.6 |
| Westbound R | | C | 29.0 | C | 28.3 | C | 27.5 |
| Westbound Overall | | D | 40.1 | D | 39.5 | D | 38.0 |
| Chase Road/Overhill Road | | | | | | | |
| Northbound L | | D | 42.0 | D | 50.1 | D | 46.6 |
| Northbound TR | | D | 41.3 | D | 50.4 | D | 45.4 |
| Northbound Overall | | D | 41.6 | D | 50.3 | D | 45.9 |
| Chase Road/Overhill Road | | | | | | | |
| Southbound L | | D | 42.0 | D | 53.9 | D | 48.7 |
| Southbound TR | | D | 43.7 | D | 52.2 | D | 49.0 |
| Southbound Overall | | D | 43.2 | D | 52.9 | D | 48.9 |
| OVERALL | | | | | | | |
| | | C | 29.5 | C | 32.4 | C | 28.1 |

Intersection Summary

As can be seen from the above table, the Option 1 of adding exclusive pedestrian phase to the existing signal timings and phasing would deteriorate Levels of Service in each peak hour. By increasing the cycle length to 150 seconds and optimizing the network offsets, the negative impacts on Levels of Service in Option 2 were not as severe. Levels of Service D

or better would occur during the Peak AM, Mid-day and PM Hours in Option 2, while Levels of Service E would occur on some approaches in Option 1. Queue lengths would be extended as a result of either option.

Location No. 2 – Popham Road and East Parkway/Scarsdale Avenue

Existing Conditions

Popham Road forms the east/west direction approaches to this intersection. East Parkway forms the southbound approach and Scarsdale Avenue forms the northbound approach. The eastbound approach has a left only lane and a shared through/right-turn lane. The westbound approach has a left only, through and a right only lane. The northbound and southbound approaches each have left only lane and a shared through/right-turn lane. The intersection is signalized. The mis-alignment of the Scarsdale Avenue northbound lanes at the intersection creates various problems for other movements, particularly the lefthand turn from Popham Road eastbound onto East Parkway northbound, as well as the turning movements from East Parkway and Scarsdale Avenue.

Capacity Analysis

Capacity analyses were performed for this intersection using the existing volumes. The two options described in Section C were compared with the existing conditions. The tables below summarize the Levels of Service of all the options:

| TABLE NO: 2-A EXISTING CONDITIONS | | | | | | | |
|--|---------------------|--------------|--------------------------|--------------|---------------------|--------------|-------------|
| POPHAM ROAD @ EAST PARKWAY/SCARSDALE AVENUE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | A | 5.6 | A | 4.5 | A | 4.6 |
| Eastbound TR | | A | 6.3 | A | 5.1 | A | 5.1 |
| Eastbound Overall | | A | 6.1 | A | 5.0 | A | 5.0 |
| Westbound | | | | | | | |
| Westbound L | | A | 9.3 | A | 9.8 | B | 12.2 |
| Westbound T | | B | 15.1 | B | 19.6 | C | 21.8 |
| Westbound R | | A | 9.1 | A | 9.4 | B | 11.9 |
| Westbound Overall | | B | 14.1 | B | 17.7 | C | 20.9 |
| East Parkway/Scarsdale Avenue | | | | | | | |
| Northbound L | | E | 56.1 | D | 54.7 | F | 118.4 |
| Northbound TR | | D | 47.6 | D | 42.5 | D | 44.6 |
| Northbound Overall | | D | 50.0 | D | 47.0 | E | 70.4 |
| Southbound | | | | | | | |
| Southbound L | | D | 41.0 | D | 40.0 | D | 40.9 |
| Southbound TR | | D | 51.9 | D | 49.8 | E | 71.8 |
| Southbound Overall | | D | 50.0 | D | 47.8 | E | 66.8 |
| OVERALL | | C | 20.8 | C | 21.2 | C | 29.6 |

| TABLE NO: 2-B EXISTING SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 135 SECONDS | | | | | | | |
|--|---------------------|--------------|--------------------------|--------------|---------------------|--------------|-------|
| POPHAM ROAD @ EAST PARKWAY/SCARSDALE AVENUE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | B | 18.9 | C | 21.2 | C | 20.8 |
| Eastbound TR | | B | 16.4 | B | 11.8 | B | 11.6 |
| Eastbound Overall | | B | 17.3 | B | 13.8 | B | 14.1 |
| | | | | | | | |
| Westbound L | | C | 23.5 | C | 21.8 | C | 26.5 |
| Westbound T | | F | 168.2 | F | 379.6 | F | 249.5 |
| Westbound R | | C | 22.8 | C | 24.9 | C | 26.0 |
| Westbound Overall | | F | 144.9 | F | 312.0 | F | 229.0 |
| East Parkway/Scarsdale Avenue | | | | | | | |
| Northbound L | | F | 127.1 | F | 120.4 | F | 492.9 |
| Northbound TR | | E | 75.2 | E | 61.6 | E | 65.7 |
| Northbound Overall | | F | 89.9 | F | 83.2 | F | 215.3 |
| | | | | | | | |
| Southbound L | | E | 62.7 | E | 58.5 | E | 61.2 |
| Southbound TR | | F | 83.6 | E | 76.5 | F | 140.3 |
| Southbound Overall | | E | 79.8 | E | 72.8 | F | 127.5 |
| | | | | | | | |
| OVERALL | | E | 70.4 | F | 142.9 | F | 124.1 |

| TABLE NO: 2-C OPTIMIZED SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 150 SECONDS | | | | | | | |
|---|---------------------|--------------|--------------------------|--------------|---------------------|--------------|-------------|
| POPHAM ROAD @ EAST PARKWAY/SCARSDALE AVENUE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | C | 28.1 | C | 21.3 | C | 27.1 |
| Eastbound TR | | C | 26.7 | B | 14.9 | B | 17.5 |
| Eastbound Overall | | C | 27.1 | B | 16.3 | C | 20.1 |
| Westbound | | | | | | | |
| Westbound L | | B | 18.3 | B | 13.5 | B | 15.9 |
| Westbound T | | C | 22.7 | D | 46.2 | D | 36.7 |
| Westbound R | | B | 14.2 | B | 13.1 | B | 15.5 |
| Westbound Overall | | C | 21.6 | D | 39.9 | C | 34.8 |
| East Parkway/Scarsdale Avenue | | | | | | | |
| Northbound L | | D | 52.3 | E | 57.4 | E | 67.3 |
| Northbound TR | | D | 50.1 | D | 50.0 | D | 48.1 |
| Northbound Overall | | D | 50.7 | D | 52.7 | D | 54.9 |
| Southbound | | | | | | | |
| Southbound L | | D | 45.0 | D | 47.7 | D | 45.1 |
| Southbound TR | | D | 52.3 | E | 55.3 | E | 59.6 |
| Southbound Overall | | D | 51.0 | D | 53.8 | E | 57.3 |
| OVERALL | | C | 32.5 | D | 35.1 | D | 35.8 |

Intersection Summary

As can be seen from the above tables, existing delays occur on the East Parkway and Scarsdale Road approaches. The Levels of Service become much worse by adding an exclusive pedestrian phase to the existing phasing. By optimizing the network timing

offsets in Option 2, the Levels of Service can be brought back close to the existing conditions, but delays will still occur and queues will be significantly increased.

Location No. 3 – Popham Road and Garth Road/Depot Place

Existing Conditions

Popham Road forms the east/west approaches and Garth Road/Depot Place form the north/south approach. The eastbound approach has a left only lane and a shared through/right-turn lane. The westbound approach has a left only lane, through and a right only lane. The northbound approach formed by Garth Road has a left only lane and a shared through/right-turn lane. The southbound approach formed by Depot Place has a similar lane configuration. The intersection is signalized. The intersection is mis-aligned in both the north/south and east/west directions.

Capacity Analysis

Capacity analyses were performed for this intersection using the existing volumes and the existing geometry. Option 1 and 2 described in Section C are compared to the existing conditions. The Levels of Service for all the conditions are tabulated below:

| TABLE NO: 3-A EXISTING CONDITIONS | | | | | | | |
|---|---------------------|--------------|--------------------------|--------------|---------------------|--------------|-------------|
| POPHAM ROAD @ GARTH ROAD/DEPOT PLACE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | B | 16.0 | B | 13.9 | B | 15.2 |
| Eastbound TR | | C | 30.3 | C | 24.1 | C | 24.7 |
| Eastbound Overall | | C | 28.3 | C | 23.7 | C | 23.8 |
| Westbound | | | | | | | |
| Westbound L | | B | 12.0 | A | 7.0 | A | 6.3 |
| Westbound T | | A | 7.0 | A | 9.4 | A | 9.5 |
| Westbound R | | A | 3.1 | A | 1.9 | A | 2.1 |
| Westbound Overall | | A | 8.2 | A | 8.7 | A | 8.6 |
| Garth Road/Depot Place | | | | | | | |
| Northbound L | | D | 46.8 | D | 44.8 | D | 52.4 |
| Northbound TR | | F | 221.1 | D | 49.8 | F | 83.9 |
| Northbound Overall | | F | 169.9 | D | 47.8 | E | 71.7 |
| Southbound | | | | | | | |
| Southbound L | | E | 79.0 | D | 40.2 | D | 45.1 |
| Southbound TR | | D | 44.8 | D | 37.1 | D | 39.5 |
| Southbound Overall | | E | 58.3 | D | 39.2 | D | 41.8 |
| OVERALL | | D | 46.8 | C | 20.4 | C | 27.4 |

| TABLE NO: 3-B EXISTING SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 135 SECONDS | | | | | | | |
|--|---------------------|--------------|--------------------------|--------------|---------------------|--------------|--------------|
| POPHAM ROAD @ GARTH ROAD/DEPOT PLACE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | C | 28.5 | C | 24.7 | C | 28.3 |
| Eastbound TR | | E | 63.2 | D | 44.1 | D | 45.4 |
| Eastbound Overall | | E | 58.4 | D | 43.4 | D | 43.8 |
| Westbound | | | | | | | |
| Westbound L | | F | 455.9 | D | 43.9 | D | 47.2 |
| Westbound T | | E | 55.6 | F | 221.4 | F | 221.7 |
| Westbound R | | C | 23.6 | B | 19.5 | C | 23.2 |
| Westbound Overall | | F | 170.3 | F | 174.7 | F | 177.4 |
| Garth Road/Depot Place | | | | | | | |
| Northbound L | | E | 69.0 | E | 61.7 | E | 77.0 |
| Northbound TR | | F | 322.4 | E | 71.2 | F | 146.9 |
| Northbound Overall | | F | 248.0 | E | 67.3 | F | 119.8 |
| Southbound | | | | | | | |
| Southbound L | | F | 204.6 | E | 55.6 | E | 76.0 |
| Southbound TR | | E | 61.6 | D | 49.7 | D | 53.0 |
| Southbound Overall | | F | 118.2 | D | 53.8 | E | 62.4 |
| OVERALL | | F | 131.2 | F | 109.7 | F | 115.5 |

| TABLE NO: 3-C OPTIMIZED SIGNAL TIMINGS WITH ADDED EXCLUSIVE PEDESTRIAN PHASE – TOTAL SIGNAL CYCLE LENGTH – 150 SECONDS | | | | | | | |
|---|---------------------|--------------|--------------------------|--------------|---------------------|--------------|-------------|
| POPHAM ROAD @ GARTH ROAD/DEPOT PLACE | | | | | | | |
| Approach | Peak AM Hour | | Peak Mid-Day Hour | | Peak PM Hour | | |
| | LOS | Delay | LOS | Delay | LOS | Delay | |
| Popham Road | | | | | | | |
| Eastbound L | | D | 35.0 | B | 13.7 | C | 33.6 |
| Eastbound TR | | F | 92.7 | D | 45.3 | D | 54.0 |
| Eastbound Overall | | F | 84.7 | D | 44.2 | D | 52.1 |
| Westbound | | | | | | | |
| Westbound L | | E | 66.7 | C | 21.2 | C | 32.7 |
| Westbound T | | B | 13.2 | B | 15.2 | D | 36.8 |
| Westbound R | | A | 8.2 | A | 4.9 | B | 14.5 |
| Westbound Overall | | C | 28.5 | B | 16.4 | D | 35.1 |
| Garth Road/Depot Place | | | | | | | |
| Northbound L | | D | 54.2 | E | 59.9 | E | 56.4 |
| Northbound TR | | F | 91.2 | E | 65.1 | E | 66.6 |
| Northbound Overall | | F | 80.3 | E | 62.9 | E | 62.7 |
| Southbound | | | | | | | |
| Southbound L | | E | 65.4 | D | 54.9 | D | 50.3 |
| Southbound TR | | D | 52.5 | D | 50.9 | D | 47.2 |
| Southbound Overall | | E | 57.6 | D | 53.7 | D | 48.5 |
| OVERALL | | E | 62.8 | C | 33.9 | D | 46.9 |

Intersection Summary

It is observed that existing delays occur at this intersection, particularly on Garth Road and Depot Place. Levels of Service become significantly worse by adding the exclusive pedestrian phase to the existing timings as described in Option 1. By optimizing the

network timings and offsets, overall delays are still increased a significant amount, but to a lesser extent than during Option 1. However, longer queues will occur than currently exist.

E. POTENTIAL MODIFICATIONS

After several field observations, discussions with various Village and Police representatives as well as the Village's Traffic Signal Consultant and the Westchester County Traffic Engineer, and a review of the traffic/pedestrian volumes and analysis, TRC performed a review of the various potential modification options that could be performed at the study locations. Some of the potential modifications reviewed by TRC included the provision of an exclusive four-way pedestrian phase at each of the traffic signals (as described in detail previously), an advance pedestrian phase, and the elimination of a crosswalk, among others. The following is a summary of these options:

1. Provision of an Exclusive Pedestrian Phase

One option that was seriously considered was the provision of an exclusive pedestrian phase. An exclusive pedestrian phase is where traffic on all approaches at the intersection is stopped and pedestrians are provided an exclusive period to cross the streets. This provides a period for all pedestrians to cross with no conflicting vehicle movements. This provides the safest condition for pedestrians.

However, to provide this phase would result in a significant loss of green time at each of the respective intersections, thus causing significant queuing and back-ups, worse than currently exist (see Figures 3 through 5 which illustrate the 95th percentile queue). (It is generally desirable to have greater distance between

intersections, particularly signalized intersections, to provide sufficient storage.) This would cause the intersections to break down and could cause further driver frustration and result in vehicles running red lights. Since the three intersections are coordinated, if the exclusive pedestrian phase is activated at one intersection, it then would be activated at all three locations at the same time, otherwise the coordination of the traffic signals would be lost. Thus, if one pedestrian pushes a pedestrian button at Chase Road, there would be significant lost time at the other two intersections. Another disadvantage with this type of phasing is that some pedestrians are accustomed to walking when the parallel approach of traffic is also moving. Some pedestrians would then cross while traffic is moving and not wait for the exclusive pedestrian phase. Pedestrian buttons would be required on each pole at each of the intersections.

2. An Advance Pedestrian Phase

An Advance Pedestrian Phase is when the pedestrian “Walk” sign is illustrated to permit pedestrians to walk a few seconds ahead of when the vehicular green light occurs, and thus pedestrians have a few second advantage and are thus in the crosswalk prior to the vehicles traveling. The advantage of this is when there are significant numbers of pedestrians as well as a high number of vehicles turning right or left, the pedestrians are able to start crossing before the vehicles turning cut them off. The disadvantage to this is that pedestrians would be in the

crosswalk when vehicles are moving and due to the glare/shadow situation in the instance of the Popham Road/Chase Road intersection, may still not be able to be properly seen by motorists that are turning. Also, green time is lost and further back-ups result. In addition, based upon discussions with the Village's Traffic Signal Consultant, implementation of the advance pedestrian phase requires purchase of new computer software to support this type of traffic signal phasing.

3. Elimination of Crosswalk

Based upon discussions with the Police Department, a major factor in the fatal pedestrian accident was the glare from the sun and shadows from the 2 Overhill Road building located at the southeast quadrant of the intersection of Popham Road and Chase Road/Overhill Road. The combination of this glare and the shadows created results in drivers turning from Chase Road onto Popham Road eastbound having a difficult time seeing pedestrians in the crosswalk. Thus, elimination of this crosswalk would essentially eliminate this interaction.

However, some pedestrians will still continue to cross at this location, particularly those who would then have to make multiple crossing maneuvers as opposed to crossing at just the one crosswalk.

4. Reflectors in Crosswalk

Providing reflectors or blinking lights in the crosswalks would provide some benefits in highlighting the crosswalk during parts of the day but would not have a significant impact on the glare/shadow situation.

5. Raised Crosswalks

Providing raised crosswalks would provide some benefits in highlighting the crosswalk during parts of the day but would not have a significant impact on the glare/shadow situation. Also, these are not designed to be installed on main roadways or emergency roadways.

6. Modifications to Speed Limit

Based upon discussions with Village and Police officials, the speed limit was not necessarily a factor in the pedestrian accidents, including the fatal accident. In that case, the pedestrian was in the crosswalk between Chase Road and Overhill Road and the driver of a vehicle turning left from Chase Road onto Popham Road did not see the pedestrian. The vehicle had been stopped at the intersection and was not driving fast. Field observations did indicate that some vehicles accelerate

quickly to make some left turns to avoid oncoming traffic and the roadway configuration but this is not a result of the speed limit.

7. Relocation of Pedestrian Signal Head

The pedestrian signal head in the northeast corner of the intersection of Popham Road and East Parkway should be relocated if possible to be closer to the intersection and thus be seen easier by pedestrians crossing East Parkway.

8. Educational Campaign

The Village should consider the provision of an Education Campaign through various media outlets and dissemination of literature, as significant numbers of pedestrians were observed jaywalking or not following the pedestrian signals. Some pedestrians did not seem to understand the pedestrian countdown signals. Also, the Educational Campaign could help alert motorists to improve their awareness of the situation in the Village Center and their responsibility to drive safely and lawfully.

9. Police Enforcement of Traffic Regulations

In conjunction with the Educational Campaign, the Village should consider diligent enforcement of vehicular and pedestrian traffic regulations to further reinforce the necessity of adhering to proper traffic safety practices.

10. Stop Bar on Chase Road

Relocation of the stop bar on Chase Road was considered to bring it further back from the Popham Road intersection but this would provide minimal benefits.

Many vehicles would pull up past the stop bar and thus the visibility of pedestrians would not be any different than the current situation. Also, pulling the stop bar back would shorten the storage prior to Harwood Court.

11. Left-Turn Advance from Chase Road to Popham Road

An advance left-turn phase for vehicles turning left from Chase Road onto Popham Road was considered. However, this is not recommended because although pedestrians cannot cross during the advance phase, there will still be “permitted” left turns from Chase Road after the advance phase and the glare/shadow condition would still occur (allowing the left turns to only move during the protected phase would result in longer queues). Additional green time would be required, which would offset the signal coordination and result in longer

delays on the other approaches. Pedestrians would be entering the intersection after vehicles from Chase Road are already moving.

F. ADDITIONAL IMPROVEMENTS

In addition to the potential modifications discussed above, there are other possible improvements that could be considered along Popham Road to help improve safety. The following is a summary of some of these improvements:

1. Popham Road Bridge – The proposed widening of the Popham Road bridge and the resulting additional turning lanes will help improve traffic flow in the area and will help to provide improved pedestrian crossings. In conjunction with the bridge widening, there will be modifications in the area of the 7-Eleven parking lot at the Garth/Popham intersection, resulting in the elimination of the curb cut and parking lot. This will also help with vehicular and pedestrian flow in that area. An extension of the inbound train platform under the bridge to the Freightway open lot will provide further pedestrian safety enhancements for commuters. With these improvements, the traffic signal timing and the pedestrian crossing times will need to be modified.
2. Right Turn from Popham Road onto Chase Road – As described earlier, a number of vehicles traveling westbound on Popham Road enter the right turn only lane at Chase Road even though they are not turning onto Chase Road. Some of these vehicles are proceeding through the intersection and turning right onto East Parkway. However, many are trying to bypass the vehicles that are

stopped/queued in the proper left/through lane and then cut in front of them to proceed through the East Parkway intersection. To eliminate this maneuver, flexible bollards or delineators could be added to force the vehicles in that lane to turn right. A disadvantage of this is that they must be placed to permit trucks to turn and they are an issue sometimes with snow plowing.

3. Relocation of Stop Bar on Popham Road at East Parkway – The location of the original stop bar along Popham Road westbound at East Parkway makes it difficult to see some of the traffic signal heads. The stop bar was relocated which helps this situation, but many drivers have a tendency to move ahead of the new stop bar and thus are not able to see the signal heads. The striping from the original stop bar has re-appeared and should be removed. Moving the stop bar back did shorten the available storage between the intersections. The installation of an additional signal head could be considered.

G. CONCLUSIONS

The provision of an exclusive pedestrian phase at the three intersections would increase safety for pedestrians. However, when added to the existing traffic signal phasing, vehicular delays would increase significantly for motorists in the Village Center and result in long queues and gridlock at times. Optimizing the signal timing would help reduce some of the Level of Service impacts but will also result in significant queuing/congestion. It is the opinion of TRC that the provision of an exclusive pedestrian phase would cause significant congestion in the Village Center area which would result in additional problems including impatient/aggravated drivers which could pose further risks to pedestrians. It is also questionable whether pedestrians would wait for the exclusive pedestrian phase. Also, pedestrian push buttons and signal system modifications would be required. Exclusive pedestrian phases work best when there is significant distance/storage between intersections and tend to be implemented where there are higher numbers of pedestrians.

Eliminating the crosswalk crossing Popham Road east of Chase Road should be considered because of the limited visibility resulting from the glare/shadows from the building. However, some pedestrians will still cross at this location, even without the crosswalk. The elimination of this crosswalk could cause some inconvenience for some pedestrians as they may now have to cross an additional approach.

Raised crosswalks will not provide much benefit, as the glare/shadow situation will still occur. In addition, these type measures are not supposed to be installed on major roads/emergency routes.

Reflectors/flashing lights in the crosswalks would provide some benefits during certain times of the day, but also would not help with the glare/shadow situation. The provision of an advance pedestrian phase also would help in some cases, but would not have an effect with the glare/shadow situation.

An Education Campaign to alert the pedestrians and drivers of the situation including the use of the pedestrian countdown signals should be performed. This could be performed through the newspaper, in-house educational pamphlets, local cable channel and other media outlets. In addition, signs could be added to the signal poles to provide information to the pedestrians.

Having increased police presence will help improve the pedestrian safety at the intersection to a point and enforcement will help reinforce the importance to adhering to proper traffic safety practice. However even with the police presence during the field observations, vehicular and pedestrian violations still occurred. Also, the police cannot be present at all three intersections twenty-four hours a day, seven days a week.