

November 4, 2016

Mr. Kevin Kothe, PE
City Engineer
City of Bloomington – Public Works Department
P.O. Box 3157
Bloomington, IL 61702-3157

Attention: Mr. Luke Thoele, PE

Subject: Hershey Road Speed Studies and Sight Distance Review

Dear Mr. Thoele:

As requested, Farnsworth Group has completed speed studies based upon IDOT Guidelines presented in the document *Policy on Establishing and Posting Speed Limits on the State Highway System* at three locations along Hershey Road between Rainbow Avenue and College Avenue. In addition, the existing intersection sight distance at the entrance to the Village of Spring Ridge subdivision on the west side of Hershey Road between GE Road and Jumer Drive was analyzed based on the IDOT *Bureau of Local Roads and Streets Manual* criteria for intersection sight distance. Below, please find a summary of the results of these studies and analysis.

Speed Studies

Speed measurements were taken at the following three locations on October 13 and 14, 2016 (See Location Map in Exhibit 1):

- 1) Southern segment: approximately 500' north of Rainbow Avenue (650' south of GE Road)
- 2) Middle segment: approximately 450' south of the entrance to the Village of Spring Ridge subdivision (1,000' north of GE Road)
- 3) Northern segment: approximately 400' north of Jumer Drive (650' south of College Avenue)

The above locations were chosen to minimize the effects of the traffic signals at the GE Road and College Avenue intersections on the free flowing traffic speeds. During the measurements, the weather was sunny with temperatures ranging between 45 and 60 degrees. The pavement was completely dry. A radar gun in a concealed location was used to measure the traffic speed. Per IDOT guidelines, the speeds of at least 100 vehicles per lane were obtained. While there is a traffic signal at GE Road to split the study area into distinct southern and middle segments, there is no traffic control device on Hershey Road at Jumer Drive preventing the middle and northern segments from functioning as a single segment. Therefore, a fourth evaluation was

completed for the entire segment between GE Road and College Avenue. Please see Exhibit 2 for data tables and calculations for these four segment analyses. Below is a summary of the results:

| Segment | Current Posted Speed | Posted Speed to North/South | 85 th Percentile Speed | Upper Limit 10 MPH Pace | Adjusted Prevailing Speed |
|--|----------------------|-----------------------------|-----------------------------------|-------------------------|---------------------------|
| 1. Rainbow to GE (Southern) | 30/35 mph* | 30 mph to south | 39 mph | 41 mph | 36 mph |
| 2. GE to Jumer (Middle) | 40 mph | -- | 44 mph | 44 mph | 44 mph |
| 3. Jumer to College (Northern) | 40 mph | 40 mph to north | 42 mph | 42 mph | 38 mph |
| 4. GE to College (Middle and Northern) | 40 mph | 40 mph to north | 43 mph | 43 mph | 41 mph |

* Posted at 35 mph for the north half of the segment and 30 mph for the south half of the segment (change is located immediately south of the entrance to La Petite Academy and north of the entrance to County Companies)

The southern section has an Adjusted Prevailing Speed of 36 mph. This is consistent with the 35 mph posted speed of the northern half of this segment. However, a posted speed of 35 mph would result in an Anticipated Violation Rate of 56%, which is slightly above the 50% maximum threshold and would suggest an alteration upward to 40 mph. A 40 mph Posted Speed would result in an acceptable Anticipated Violation Rate of 9%. It should be noted that the current Posted Speed south of this segment (and even for a portion of the segment itself) is only 30 mph. This segment currently functions as a transition segment between the 40 mph Posted Speed to the north and the 30 mph Posted Speed to the south. According to State guidelines, Posted Speeds are allowed to be transitioned in 10 mph increments, allowing this segment to be posted at 40 mph adjacent to the Posted 30 mph section to the south. Given the “transitional” nature of this segment, and since the Anticipated Violation Rate is only slightly above the 50% maximum threshold, it could be feasible to post this segment at 35 mph. Since there is not currently a traffic device stopping traffic along Hershey Road at Rainbow Avenue, it is possible that the Prevailing Speeds south of Rainbow Court are noticeably in excess of the Posted 30 mph speed. It may be beneficial to further evaluate speeds on Hershey Road to the south and look at this segment as part of a larger section.

The middle segment has an Adjusted Prevailing Speed of 44 mph. This would typically correspond to posting this segment at 45 mph. However, there are several reasons based on engineering judgment to keep this section posted at 40 mph. First, Hershey Road to the north has a prevailing speed consistent with a posted speed of 40 mph and to the south has a prevailing speed consistent with a posted speed of 35 mph. Increasing the posted speed for this relatively short intermittent section could raise the likelihood for higher travel speeds inconsistent with the segments to the north and south since it would be higher than either of these other segments. In addition, since Hershey Road is a north-south corridor through

Bloomington-Normal, having varying speed limits posted throughout the corridor could lead to confusion regarding the legal speed limit as drivers travel through the corridor. Finally, this segment of Hershey Road consists of four lanes with no median and two back to back curves in opposite directions creating a winding alignment throughout the segment that is more suited for lower rather than higher speeds. Posting the speed limit at 40 mph would result in an Anticipated Violation Rate of 43%, which is below the threshold of 50% that would suggest an alteration upward.

The northern segment has an Adjusted Prevailing Speed of 38 mph. This is consistent with the speed to the north and south of this segment and suggests a Posted Speed of 40 mph based on the data gathered.

When the middle and northern segments are analyzed as a single segment stretching between GE Road and College Avenue, the Adjusted Prevailing Speed is 41 mph. This is consistent with the speed to the north of this segment and suggests a Posted Speed of 40 mph based on the data gathered.

In summary, based on the speed data gathered, Hershey Road between Jumer Drive and College Avenue should have a Posted Speed of 40 mph. Similarly, when taking engineering judgment into account as well as analyzing it together with the section to the north, Hershey Road between GE Road and Jumer Drive, Avenue should have a Posted Speed of 40 mph. Based solely on Adjusted Prevailing Speed modified for an acceptable Anticipated Violation Rate, Hershey Road between GE Road and Rainbow Avenue should have a Posted Speed of 40 mph; however, this may be reduced to 35 mph if desired. It is suggested that additional data gathering may be beneficial to the south of Rainbow Avenue and this segment re-evaluated in the context of a larger study area.

Sight Distance Evaluation

Intersection Sight Distance (ISD) was reviewed at the entrance to the Village of Spring Ridge subdivision on the west side of Hershey Road between GE Road and Jumer Drive on October 17, 2016 (See Location Map in Exhibit 1). Criteria from the Illinois Department of Transportation *Bureau of Local Roads and Streets Manual (BLRS)*, Chapter 28 was initially used in evaluating the Intersection Sight Distance. However, due to Hershey Road having four total lanes, the BLRS Manual indicated the *Bureau of Design and Environment Manual (BDE)* should be used and this is the Manual referenced below. Sight distances were reviewed by visual line of sight checks in the field documented via photograph.

The posted speed at this location is currently 40 mph. To account for vehicles traveling over or under the posted speed limit, Intersection Sight Distance was evaluated for speeds ranging from 20 to 55 mph. The primary focus was on Passenger Cars (PC) as the design vehicle per Figure 36-6.C (see Exhibit 3) since the number of trucks per day at the entrance is likely well below 40 per day. However, for reference, sight distance for Single-Unit Trucks (SU) and Multiple-Unit Truck (MU) was also calculated. The height of eye and height of object were both taken to be 3.5 feet. The eye height was not adjusted for SU or MU vehicles since the lower 3.5-foot height is more conservative. The Eye Location was located 14.4 feet from the Hershey Road edge of traveled way. Gap times from Figure 36-6.D were used to calculate the distance along Hershey Road as shown in Exhibit 3. Note that the Gap times were increased as indicated in Note 1

since Hershey Road is a multilane road without a median. Since the entrance approach is flatter than 3%, the gap times in Figure 36-6.D were not further modified.

The required ISD for the PC design vehicle ranged from 221 feet (20 mph) to 551 feet (50 mph) looking to the left (north) and from 235 feet (20 mph) to 588 feet (50 mph) looking to the right (south). Required ISD ranged from 338 feet (20 mph) to 845 feet (50 mph) looking to the left (north) and from 359 feet (20 mph) to 897 feet (50 mph) looking to the right (south) for the MU vehicle.

See Exhibit 4 for photos taken showing the intersection line of sight for the various speeds. As all of the distances corresponding to the lower speeds are also met for the higher speeds, photos are only presented starting with the PC @ 40 mph distances. In each photo, the person in the yellow vest (highlighted with a bright blue circle) is standing at the specified distance. The 3.5-foot object height is approximately at the stomach of the person. Due to the relatively flat terrain through the area of study along Hershey Road, ISD was never limited vertically; it was always restricted due to horizontal obstructions such as trees.

Intersection Sight Distance to the left (north) is critical for vehicles making a right turn onto Hershey Road. As illustrated in Photos 1 through 4, there is adequate ISD for PC (551 feet) and MU (845 feet) vehicles for speeds under 50 mph, which should cover the 99% of the traffic on Hershey Road per the above speed study. In addition, the maximum ISD was observed in the field to be 856 feet as seen in Photo 5. This equates to the ISD required for a PC with speeds on Hershey Road of approximately 75 mph and an MU with speeds of approximately 50 mph on Hershey Road. It should be noted that due to the curvature of Hershey Road, there may be periods during which northbound traffic will block the view of southbound traffic for several seconds, effectively reducing the ISD to around 450 feet, which is still adequate for 40 mph speeds. This can be best illustrated in Photo 1. However, this temporary reduction in ISD will be very brief as the northbound traffic clears the area and at worse, should only cause a small additional number of seconds of delay for vehicles attempting to turn onto Hershey Road.

Intersection Sight Distance to the right (south) is critical for vehicles making a left turn onto Hershey Road. As illustrated in Photos 6 through 8 there is adequate ISD for PC (588 feet) vehicles for speeds under 50 mph, which should cover the 99% of the traffic on Hershey Road per the above speed study. In addition, the maximum ISD was observed in the field to be 870 feet as seen in Photo 10. This equates to the ISD required for a PC with speeds on Hershey Road of approximately 74 mph and an MU with speeds of approximately 48 mph on Hershey Road. In this direction, the ISD for an MU vehicle does not quite reach the 50 mph speeds for Hershey Road due to the presence of a large utility box located along the west edge of Hershey Road. There is a small gap between the utility box and the start of the tree line as seen in Photos 11 and 12 large enough to allow an advance vehicle to be seen. This gap allows an ISD of 897, which is sufficient for an MU vehicle when traffic speeds on Hershey Road are 50 mph. While relying on this gap is not ideal, given that the number of MU vehicles expected to be exiting from the residential development is expected to be very low, and that speeds of 48 mph (for which there is adequate ISD) are likely to cover 98% of the traffic on Hershey (per the above speed study), this should be acceptable.

In summary, intersection sight distances were reviewed by visual line of sight checks in the field at the entrance to the Village of Spring Ridge subdivision on the west side of Hershey Road. Sight distance is available for approximately 856 feet to the left (north)

along Hershey Road and for approximately 870 feet to the right (south). This is adequate ISD for both PC and MU vehicles for traffic coming from the left at speeds under 50 mph (99% of vehicles per above speed study) and from the right at speeds under 48 mph (98% of vehicles per the above speed study). For PC vehicles turning onto Hershey (the vast majority of vehicles exiting the residential subdivision), there is sufficient distance to the left for Hersey Road travel speeds up to approximately 75 mph and to the right for speeds up to 74 mph.

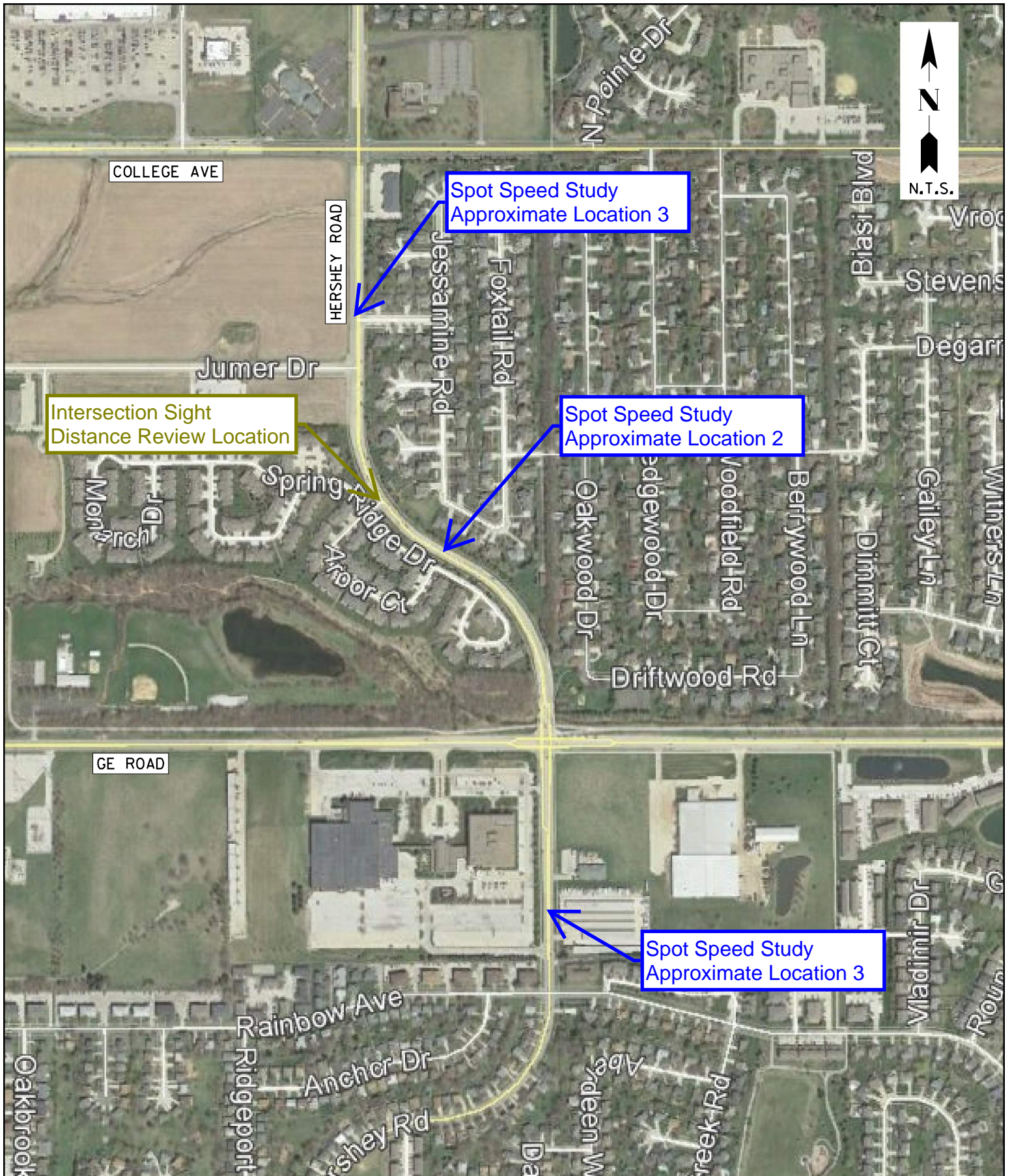
We appreciate the opportunity to complete this study for the City. Please feel free to contact me should you have any questions or comments.

Sincerely,

FARNSWORTH GROUP, INC.

A handwritten signature in black ink, appearing to read "P. Allyn", followed by a horizontal line extending to the right.

Philip S. Allyn, PE, PTOE



2709 McGRAW DRIVE
 BLOOMINGTON, ILLINOIS 61704
 (309) 663-8435 / info@f-w.com

EXHIBIT 1: STUDY LOCATION MAP
 BLOOMINGTON, ILLINOIS
 HERSHEY ROAD SPEED STUDY

Drawn by: DRR
 Reviewed by: PSA
 Date: 10/25/16

EXHIBIT 2a

ESTABLISHMENT OF SPEED ZONE DISTRICT FIVE

ROUTE: Hershey Road **FROM:** Rainbow Avenue

TO: GE Road **LENGTH:** 0.218 miles

CITY: Bloomington **COUNTY:** McLean

I SPOT SPEED STUDIES (Attached)

| CHECK NO. | 85 TH % | UPPER LIMIT 10 MPH PACE |
|-----------|--------------------|----------------------------|
| 1 | 39 mph | 41 mph |
| | | |
| | | |
| | | |

V ACCESS CONFLICTS

| | | | |
|---------------------------------------|-----------|------------|------------------|
| RESIDENTIAL DRIVES: | <u>0</u> | X 1 = | <u>0</u> |
| SMALL BUSINESS DRIVES: | <u>3</u> | X 5 = | <u>15</u> |
| LARGE BUSINESS DRIVES: | <u>2</u> | X10 = | <u>20</u> |
| ACCESS CONFLICT NO. TOTAL: | <u>35</u> | | |
| STUDY LENGTH: <u>0.218</u> (MILES) | = | <u>161</u> | CONFLICTS / MILE |

II TEST RUNS

| RUN NO. | AVG. SPEED | DIRECTION |
|---------|------------|-----------------|
| 1 | N.A. | (Short Segment) |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

VI MISC. FACTORS

| | | |
|----------------------|-----------------------------------|--|
| PEDESTRIAN VOLUME: | <u> </u> | Negligible observed during data gathering |
| HIGH-CRASH LOCATION: | <u> </u> YES <u> X </u> NO | |
| PARKING PERMITTED: | <u> </u> YES <u> X </u> NO | |

III PREVAILING SPEED

| | | |
|--------------------------------|-------------|-----|
| 85 TH % AVG. : | <u>39</u> | MPH |
| UPPER LIMIT OF 10 MPH PACE: | <u>41</u> | MPH |
| TEST RUN AVE. : | <u>N.A.</u> | MPH |
| PREVAILING SPEED: | <u>40</u> | MPH |

VII PREVAILING SPEED ADJUSTMENT

| | | |
|--|---------------|---|
| DRIVEWAY ADJUSTMENT: | <u>10</u> | % |
| PEDESTRIAN ADJUSTMENT: | <u>0</u> | % |
| CRASH ADJUSTMENT: | <u>0</u> | % |
| TOTAL (MAX 20%): | <u>10</u> | % |
| <u>40</u> MPH X <u>10</u> % = <u>4</u> mph | | |
| (Prevailing Speed) (adjust.) | (Max. 9 MPH) | |
| ADJUSTED PREVAILING SPEED: | <u>36</u> mph | |

IV EXISTING SPEED LIMIT

| | | |
|-----------------------|---------------------|-------|
| ZONE BEING STUDIED: | <u>35/30*</u> | MPH |
| VIOLATION RATE: | 96% (30) 56% (35) % | |
| ADJACENT ZONE N or W: | <u>40</u> | MPH |
| LENGTH: | <u>1.120</u> | MILES |
| ADJACENT ZONE S or E: | <u>30</u> | MPH |
| LENGTH: | <u>0.893</u> | MILES |

VIII REVISED SPEED LIMIT

| | | |
|-----------------------------|------------------------------|-----|
| RECOMMENDED SPEED LIMIT: | <u>35 / 40 **</u> | MPH |
| ANTICIPATED VIOLATION RATE: | <u>56 / 9</u> % | |
| | ** See report for discussion | |
| RECOMMENDED BY: | _____ | |
| DATE: | _____ | |
| APPROVED BY: | _____ | |
| DATE: | _____ | |

* Posted at 35 mph for the north half of the segment and 30 mph for the south half of the segment (change is located immediately south of the entrance to La Petite Academy and north of the entrance to County Companies)

Exhibit 2a: Hershey Spot Speed Study Data and Calculations

Rainbow to GE

| Posted Speed Limit (MPH): | | | | | 35/30 |
|------------------------------------|--------------------|---------|----------|---------|--------------|
| Speed (MPH) | Number of Vehicles | | | | |
| | NB Right | NB Left | SB Right | SB Left | Total |
| 25 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 1 | 1 | 0 | 2 |
| 28 | 2 | 0 | 1 | 0 | 3 |
| 29 | 3 | 1 | 2 | 0 | 6 |
| 30 | 4 | 1 | 5 | 0 | 10 |
| 31 | 3 | 6 | 8 | 2 | 19 |
| 32 | 4 | 4 | 5 | 2 | 15 |
| 33 | 8 | 11 | 8 | 5 | 32 |
| 34 | 11 | 13 | 16 | 9 | 49 |
| 35 | 19 | 18 | 25 | 14 | 76 |
| 36 | 14 | 12 | 13 | 20 | 59 |
| 37 | 13 | 9 | 10 | 17 | 49 |
| 38 | 15 | 11 | 13 | 19 | 58 |
| 39 | 6 | 12 | 12 | 8 | 38 |
| 40 | 3 | 10 | 5 | 8 | 26 |
| 41 | 3 | 5 | 6 | 7 | 21 |
| 42 | 0 | 1 | 3 | 3 | 7 |
| 43 | 1 | 0 | 0 | 2 | 3 |
| 44 | 0 | 4 | 0 | 0 | 4 |
| 45 | 1 | 1 | 0 | 0 | 2 |
| 46 | 1 | 0 | 0 | 0 | 1 |
| 47 | 1 | 1 | 0 | 2 | 4 |
| 48 | 1 | 0 | 0 | 0 | 1 |
| 49 | 0 | 0 | 0 | 0 | 0 |
| 50 | 0 | 0 | 0 | 0 | 0 |
| 51 | 0 | 0 | 0 | 0 | 0 |
| 52 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 0 | 0 | 0 | 0 |
| 54 | 0 | 1 | 0 | 0 | 1 |
| 55 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 0 | 0 | 0 | 0 |
| Total Cars | 113 | 122 | 133 | 118 | 486 |
| 85th Percentile Speed (MPH) | | | | | 39 |
| <i>Upper Limit 10 MPH Pace</i> | | | | | <i>41</i> |

EXHIBIT 2b

ESTABLISHMENT OF SPEED ZONE DISTRICT FIVE

ROUTE: Hershey Road FROM: GE Road

TO: Jumer Drive LENGTH: 0.402 miles

CITY: Bloomington COUNTY: McLean

I SPOT SPEED STUDIES (Attached)

| CHECK NO. | 85 TH % | UPPER LIMIT 10 MPH PACE |
|-----------|--------------------|----------------------------|
| 1 | 44 mph | 44 mph |
| | | |
| | | |
| | | |
| | | |

V ACCESS CONFLICTS

| | | | |
|----------------------------|--------------|-------|-------------------------------|
| RESIDENTIAL DRIVES: | <u>0</u> | X 1 = | <u>0</u> |
| SMALL BUSINESS DRIVES: | <u>0</u> | X 5 = | <u>0</u> |
| LARGE BUSINESS DRIVES: | <u>1</u> | X10 = | <u>10</u> |
| ACCESS CONFLICT NO. TOTAL: | <u>10</u> | | |
| STUDY LENGTH: (MILES) | <u>0.402</u> | = | <u>25</u> CONFLICTS / MILE |

II TEST RUNS

| RUN NO. | AVG. SPEED | DIRECTION |
|---------|------------|-----------------|
| 1 | N.A. | (Short Segment) |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

VI MISC. FACTORS

| | | | |
|----------------------|---|-------------|--|
| PEDESTRIAN VOLUME: | Negligible observed during data gathering | | |
| HIGH-CRASH LOCATION: | <u> </u> YES | <u>X</u> NO | |
| PARKING PERMITTED: | <u> </u> YES | <u>X</u> NO | |

III PREVAILING SPEED

| | | |
|--------------------------------|-------------|-----|
| 85 TH % AVG. : | <u>44</u> | MPH |
| UPPER LIMIT OF 10 MPH PACE: | <u>44</u> | MPH |
| TEST RUN AVE. : | <u>N.A.</u> | MPH |
| PREVAILING SPEED: | <u>44</u> | MPH |

VII PREVAILING SPEED ADJUSTMENT

| | | |
|------------------------------|---------------|---|
| DRIVEWAY ADJUSTMENT: | <u>0</u> | % |
| PEDESTRIAN ADJUSTMENT: | <u>0</u> | % |
| CRASH ADJUSTMENT: | <u>0</u> | % |
| TOTAL (MAX 20%): | <u>0</u> | % |
| <u>44</u> MPH X <u>0</u> % = | <u>0</u> mph | |
| (Prevailing Speed) (adjust.) | (Max. 9 MPH) | |
| ADJUSTED PREVAILING SPEED: | <u>44</u> mph | |

IV EXISTING SPEED LIMIT

| | | |
|-----------------------|--------------|-------|
| ZONE BEING STUDIED: | <u>40</u> | MPH |
| VIOLATION RATE: | <u>43</u> | % |
| ADJACENT ZONE N or W: | <u>40</u> | MPH |
| LENGTH: | <u>0.717</u> | MILES |
| ADJACENT ZONE S or E: | <u>35</u> | MPH |
| LENGTH: | <u>0.129</u> | MILES |

VIII REVISED SPEED LIMIT

| | |
|------------------------------|-----------------------|
| RECOMMENDED SPEED LIMIT: | <u>40 / 45</u> ** MPH |
| ANTICIPATED VIOLATION RATE: | <u>43 / 7</u> % |
| ** See report for discussion | |
| RECOMMENDED BY: | _____ |
| DATE: | _____ |
| APPROVED BY: | _____ |
| DATE: | _____ |

Exhibit 2b: Hershey Spot Speed Study Data and Calculations

GE to Jumer

| Posted Speed Limit (MPH): | | | | | 40 |
|------------------------------------|--------------------|---------|----------|---------|-----------|
| Speed (MPH) | Number of Vehicles | | | | |
| | NB Right | NB Left | SB Right | SB Left | Total |
| 25 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 |
| 28 | 1 | 0 | 0 | 0 | 1 |
| 29 | 0 | 0 | 0 | 0 | 0 |
| 30 | 0 | 0 | 1 | 0 | 1 |
| 31 | 0 | 1 | 1 | 0 | 2 |
| 32 | 1 | 1 | 1 | 1 | 4 |
| 33 | 3 | 2 | 1 | 1 | 7 |
| 34 | 1 | 4 | 2 | 2 | 9 |
| 35 | 6 | 10 | 3 | 7 | 26 |
| 36 | 6 | 7 | 3 | 5 | 21 |
| 37 | 11 | 6 | 12 | 6 | 35 |
| 38 | 10 | 15 | 13 | 13 | 51 |
| 39 | 15 | 14 | 10 | 12 | 51 |
| 40 | 15 | 20 | 14 | 14 | 63 |
| 41 | 12 | 14 | 15 | 19 | 60 |
| 42 | 9 | 11 | 10 | 8 | 38 |
| 43 | 8 | 5 | 6 | 10 | 29 |
| 44 | 7 | 6 | 9 | 10 | 32 |
| 45 | 3 | 2 | 3 | 7 | 15 |
| 46 | 4 | 3 | 2 | 1 | 10 |
| 47 | 5 | 2 | 1 | 3 | 11 |
| 48 | 0 | 0 | 0 | 3 | 3 |
| 49 | 1 | 0 | 1 | 1 | 3 |
| 50 | 1 | 0 | 1 | 0 | 2 |
| 51 | 0 | 0 | 0 | 0 | 0 |
| 52 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 2 | 0 | 0 | 2 |
| 54 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 0 | 0 | 1 | 1 |
| Total Cars | 119 | 125 | 109 | 124 | 477 |
| 85th Percentile Speed (MPH) | | | | | 44 |
| <i>Upper Limit 10 MPH Pace</i> | | | | | <i>44</i> |

EXHIBIT 2c

ESTABLISHMENT OF SPEED ZONE DISTRICT FIVE

ROUTE: Hershey Road FROM: Jumer Drive

TO: College Avenue LENGTH: 0.195 miles

CITY: Bloomington COUNTY: McLean

I SPOT SPEED STUDIES (Attached)

| CHECK NO. | 85 TH % | UPPER LIMIT 10 MPH PACE |
|-----------|--------------------|----------------------------|
| 1 | 42 mph | 42 mph |
| | | |
| | | |
| | | |
| | | |

V ACCESS CONFLICTS

| | | | |
|----------------------------|--------------|-------|-------------------------------|
| RESIDENTIAL DRIVES: | <u>0</u> | X 1 = | <u>0</u> |
| SMALL BUSINESS DRIVES: | <u>1</u> | X 5 = | <u>5</u> |
| LARGE BUSINESS DRIVES: | <u>1</u> | X10 = | <u>10</u> |
| ACCESS CONFLICT NO. TOTAL: | <u>15</u> | | |
| STUDY LENGTH: (MILES) | <u>0.195</u> | = | <u>77</u> CONFLICTS / MILE |

II TEST RUNS

| RUN NO. | AVG. SPEED | DIRECTION |
|---------|------------|-----------------|
| 1 | N.A. | (Short Segment) |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

VI MISC. FACTORS

| | | | |
|----------------------|--|-------------|--|
| PEDESTRIAN VOLUME: | <u>Negligible observed during data gathering</u> | | |
| HIGH-CRASH LOCATION: | <u> </u> YES | <u>X</u> NO | |
| PARKING PERMITTED: | <u> </u> YES | <u>X</u> NO | |

III PREVAILING SPEED

| | | |
|--------------------------------|-------------|-----|
| 85 TH % AVG. : | <u>42</u> | MPH |
| UPPER LIMIT OF 10 MPH PACE: | <u>42</u> | MPH |
| TEST RUN AVE. : | <u>N.A.</u> | MPH |
| PREVAILING SPEED: | <u>42</u> | MPH |

VII PREVAILING SPEED ADJUSTMENT

| | | |
|-------------------------------|--------------|-----|
| DRIVEWAY ADJUSTMENT: | <u>10</u> | % |
| PEDESTRIAN ADJUSTMENT: | <u>0</u> | % |
| CRASH ADJUSTMENT: | <u>0</u> | % |
| TOTAL (MAX 20%): | <u>10</u> | % |
| <u>42</u> MPH X <u>10</u> % = | <u>4</u> mph | |
| (Prevailing Speed) (adjust.) | (Max. 9 MPH) | |
| ADJUSTED PREVAILING SPEED: | <u>38</u> | mph |

IV EXISTING SPEED LIMIT

| | | |
|-----------------------|--------------|-------|
| ZONE BEING STUDIED: | <u>40</u> | MPH |
| VIOLATION RATE: | <u>26</u> | % |
| ADJACENT ZONE N or W: | <u>40</u> | MPH |
| LENGTH: | <u>1.120</u> | MILES |
| ADJACENT ZONE S or E: | <u>40</u> | MPH |
| LENGTH: | <u>0.402</u> | MILES |

VIII REVISED SPEED LIMIT

| | | |
|-----------------------------|-----------|-----|
| RECOMMENDED SPEED LIMIT: | <u>40</u> | MPH |
| ANTICIPATED VIOLATION RATE: | <u>26</u> | % |
| RECOMMENDED BY: | _____ | |
| DATE: | _____ | |
| APPROVED BY: | _____ | |
| DATE: | _____ | |

Exhibit 2c: Hershey Spot Speed Study Data and Calculations

Jumer to College

| Posted Speed Limit (MPH): | | | | | 40 |
|------------------------------------|--------------------|---------|----------|---------|-----------|
| Speed (MPH) | Number of Vehicles | | | | |
| | NB Right | NB Left | SB Right | SB Left | Total |
| 25 | 0 | 0 | 0 | 0 | 0 |
| 26 | 0 | 0 | 0 | 0 | 0 |
| 27 | 0 | 0 | 0 | 0 | 0 |
| 28 | 1 | 0 | 0 | 0 | 1 |
| 29 | 0 | 0 | 0 | 0 | 0 |
| 30 | 2 | 0 | 1 | 2 | 5 |
| 31 | 3 | 0 | 3 | 2 | 8 |
| 32 | 4 | 1 | 3 | 4 | 12 |
| 33 | 3 | 1 | 6 | 4 | 14 |
| 34 | 2 | 4 | 5 | 3 | 14 |
| 35 | 8 | 4 | 8 | 7 | 27 |
| 36 | 12 | 5 | 5 | 4 | 26 |
| 37 | 10 | 16 | 10 | 7 | 43 |
| 38 | 15 | 15 | 14 | 11 | 55 |
| 39 | 13 | 12 | 16 | 9 | 50 |
| 40 | 12 | 16 | 17 | 15 | 60 |
| 41 | 12 | 8 | 6 | 15 | 41 |
| 42 | 3 | 7 | 7 | 9 | 26 |
| 43 | 1 | 4 | 4 | 4 | 13 |
| 44 | 1 | 7 | 3 | 3 | 14 |
| 45 | 0 | 1 | 0 | 1 | 2 |
| 46 | 3 | 1 | 0 | 1 | 5 |
| 47 | 1 | 4 | 0 | 0 | 5 |
| 48 | 0 | 1 | 0 | 0 | 1 |
| 49 | 0 | 0 | 0 | 1 | 1 |
| 50 | 0 | 0 | 0 | 0 | 0 |
| 51 | 0 | 1 | 0 | 0 | 1 |
| 52 | 0 | 0 | 0 | 0 | 0 |
| 53 | 0 | 0 | 0 | 0 | 0 |
| 54 | 0 | 0 | 0 | 0 | 0 |
| 55 | 0 | 0 | 0 | 0 | 0 |
| 56 | 0 | 0 | 0 | 0 | 0 |
| 57 | 0 | 0 | 0 | 0 | 0 |
| 58 | 0 | 0 | 0 | 0 | 0 |
| 59 | 0 | 0 | 0 | 0 | 0 |
| Total Cars | 106 | 108 | 108 | 102 | 424 |
| 85th Percentile Speed (MPH) | | | | | 42 |
| <i>Upper Limit 10 MPH Pace</i> | | | | | 42 |

EXHIBIT 2d

ESTABLISHMENT OF SPEED ZONE DISTRICT FIVE

ROUTE: Hershey Road FROM: Jumer Drive

TO: College Avenue LENGTH: 0.597 miles

CITY: Bloomington COUNTY: McLean

I SPOT SPEED STUDIES (Attached)

| CHECK NO. | 85 TH % | UPPER LIMIT 10 MPH PACE |
|------------|--------------------|----------------------------|
| 1 (middle) | 44 mph | 44 mph |
| 2 (north) | 42 mph | 42 mph |
| | | |
| | | |
| | | |

V ACCESS CONFLICTS

| | | | |
|---------------------------------------|-----------|-----------|------------------|
| RESIDENTIAL DRIVES: | <u>0</u> | X 1 = | <u>0</u> |
| SMALL BUSINESS DRIVES: | <u>1</u> | X 5 = | <u>5</u> |
| LARGE BUSINESS DRIVES: | <u>2</u> | X10 = | <u>20</u> |
| ACCESS CONFLICT NO. TOTAL: | <u>25</u> | | |
| STUDY LENGTH: <u>0.597</u> (MILES) | = | <u>42</u> | CONFLICTS / MILE |

II TEST RUNS

| RUN NO. | AVG. SPEED | DIRECTION |
|---------|------------|-----------------|
| 1 | N.A. | (Short Segment) |
| 2 | | |
| 3 | | |
| 4 | | |
| 5 | | |

VI MISC. FACTORS

| | | | |
|----------------------|---|-------------|--|
| PEDESTRIAN VOLUME: | Negligible observed during data gathering | | |
| HIGH-CRASH LOCATION: | <u> </u> YES | <u>X</u> NO | |
| PARKING PERMITTED: | <u> </u> YES | <u>X</u> NO | |

III PREVAILING SPEED

| | | |
|--------------------------------|-------------|-----|
| 85 TH % AVG. : | <u>43</u> | MPH |
| UPPER LIMIT OF 10 MPH PACE: | <u>43</u> | MPH |
| TEST RUN AVE. : | <u>N.A.</u> | MPH |
| PREVAILING SPEED: | <u>43</u> | MPH |

VII PREVAILING SPEED ADJUSTMENT

| | | |
|---|---------------|--------------|
| DRIVEWAY ADJUSTMENT: | <u>5</u> | % |
| PEDESTRIAN ADJUSTMENT: | <u>0</u> | % |
| CRASH ADJUSTMENT: | <u>0</u> | % |
| TOTAL (MAX 20%): | <u>5</u> | % |
| <u>43</u> MPH X <u>5</u> % = <u>2</u> mph | | |
| (Prevailing Speed) | (adjust.) | (Max. 9 MPH) |
| ADJUSTED PREVAILING SPEED: | <u>41</u> mph | |

IV EXISTING SPEED LIMIT

| | | |
|-----------------------|--------------|-------|
| ZONE BEING STUDIED: | <u>40</u> | MPH |
| VIOLATION RATE: | <u>35</u> | % |
| ADJACENT ZONE N or W: | <u>40</u> | MPH |
| LENGTH: | <u>1.120</u> | MILES |
| ADJACENT ZONE S or E: | <u>35</u> | MPH |
| LENGTH: | <u>0.129</u> | MILES |

VIII REVISED SPEED LIMIT

| | | |
|-----------------------------|-----------|-----|
| RECOMMENDED SPEED LIMIT: | <u>40</u> | MPH |
| ANTICIPATED VIOLATION RATE: | <u>35</u> | % |
| RECOMMENDED BY: | _____ | |
| DATE: | _____ | |
| APPROVED BY: | _____ | |
| DATE: | _____ | |

Exhibit 3 Intersection Sight Distance Values

| Design Vehicle | Design Speed | Gap Acceptance Time (seconds) | | Sight Distance (feet) | |
|----------------|--------------|-------------------------------|--------------|-----------------------|--------------|
| | | Looking Right | Looking Left | Looking Right | Looking Left |
| PC | 20 | 8 | 7.5 | 235 | 221 |
| SU | 20 | 10.2 | 9.5 | 300 | 279 |
| MU | 20 | 12.2 | 11.5 | 359 | 338 |
| PC | 25 | 8 | 7.5 | 294 | 276 |
| SU | 25 | 10.2 | 9.5 | 375 | 349 |
| MU | 25 | 12.2 | 11.5 | 448 | 423 |
| PC | 30 | 8 | 7.5 | 353 | 331 |
| SU | 30 | 10.2 | 9.5 | 450 | 419 |
| MU | 30 | 12.2 | 11.5 | 538 | 507 |
| PC | 35 | 8 | 7.5 | 412 | 386 |
| SU | 35 | 10.2 | 9.5 | 525 | 489 |
| MU | 35 | 12.2 | 11.5 | 628 | 592 |
| PC | 40 | 8 | 7.5 | 470 | 441 |
| SU | 40 | 10.2 | 9.5 | 600 | 559 |
| MU | 40 | 12.2 | 11.5 | 717 | 676 |
| PC | 45 | 8 | 7.5 | 529 | 496 |
| SU | 45 | 10.2 | 9.5 | 675 | 628 |
| MU | 45 | 12.2 | 11.5 | 807 | 761 |
| PC | 50 | 8 | 7.5 | 588 | 551 |
| SU | 50 | 10.2 | 9.5 | 750 | 698 |
| MU | 50 | 12.2 | 11.5 | 897 | 845 |

EXHIBIT 3

| 20-Year ADT of Tractor/ Semitrailers on Exit Ramp or Crossroad | Approaching Vehicle on Mainline ⁽²⁾ | Stopped Design Vehicle on Crossroad ⁽¹⁾ |
|--|--|--|
| ADT ≤ 40 | Passenger Car h ₂ = 3.5 ft (h ₂ = 1080 mm) | Passenger Car h ₂ = 3.5 ft (h ₁ = 1080 mm) |
| 40 < ADT ≤ 100 | Passenger Car h ₂ = 3.5 ft (h ₂ = 1080 mm) | Single Unit (SU) or Bus h ₁ = 6 ft (h ₁ = 1.8 m) |
| ADT > 100 | Passenger Car h ₂ = 3.5 ft (h ₂ = 1080 mm) | Tractor/Semitrailers (MU) h ₁ = 8 ft (h ₁ = 2.5 m) |

Notes:

1. *h₁ - Assumed height of eye for stopped motorist.*
2. *h₂ - Assumes 9 in (225 mm) of top of approaching vehicle can readily be seen by stopped motorist.*
3. *Where a mainline crest vertical curve lies close to an intersection of a crossroad or ramp, it may be necessary to increase the length of the vertical curve (designed for either existing or proposed stopping sight distance) or to reduce the grades in order to obtain the proper ISD in the vertical plane.*

**DESIGN VEHICLES USED TO DETERMINE AVAILABLE ISD
ALONG A CROSSROAD**

Figure 36-6.C

EXHIBIT 3

| Design Vehicle | Gap Acceptance Time (t_c) (sec) |
|---------------------|-------------------------------------|
| Passenger Car | 7.5 |
| Single-Unit Truck | 9.5 |
| Tractor/Semitrailer | 11.5 |

Note: Times are for turns onto a two-lane highway without a median and may require adjustments to the base time gaps.

Adjustments:

- Multilane Highways. The following will apply:
 - For left turns onto two-way multilane highways without a median, add 0.5 seconds for passenger cars or 0.7 seconds for trucks for each additional lane from the left, in excess of one, to be crossed by the turning vehicle. See discussion in Section 36-6.03(a) for additional guidance.
 - For right turns, no adjustment is necessary.
- Minor Road Approach Grades. If the approach grade on the minor road exceeds +3%, the following will apply:
 - For right turns, multiply 0.1 seconds times the actual percent grade on the minor road approach and add this number to the base time gap.
 - For left turns, multiple 0.2 seconds times the actual percent grade on the minor approach and add this number to the base time gap.
- Major Road Approach Grade. Major road grade does not affect calculations.

**GAP ACCEPTANCE TIMES
(Left and Right Turns From Minor Road)**

Figure 36-6.D

Exhibit 4: Sight Distance Photos



Photo 1: Looking Left to 441 feet (PC @ 40 mph)

Exhibit 4: Sight Distance Photos



Photo 2: Looking Left to 496 feet (PC @ 45 mph)

Exhibit 4: Sight Distance Photos



Photo 3: Looking Left to 551 feet (PC @ 50 mph)

Exhibit 4: Sight Distance Photos



Photo 4: Looking Left to 845 feet (MU @ 50 mph)

Exhibit 4: Sight Distance Photos



**Photo 5: Looking Left to 856 feet
(MAX visible distance = PC @ ~75 mph, MU @ ~50 mph)**

Exhibit 4: Sight Distance Photos



Photo 6: Looking Right to 470 feet (PC @ 40 mph)

Exhibit 4: Sight Distance Photos



Photo 7: Looking Right to 529 feet (PC @ 45 mph)

Exhibit 4: Sight Distance Photos



Photo 8: Looking Right to 588 feet (PC @ 50 mph)

Exhibit 4: Sight Distance Photos



**Photo 9: Looking Right to 870 feet
(MAX distance of continuous sight = PC @ ~74 mph, MU @ ~48 mph)**

Exhibit 4: Sight Distance Photos



**Photo 10: Looking Right to 897 feet (MU @ 50 mph)
Visible Gap Between Utility Cabinet and Trees**

Exhibit 4: Sight Distance Photos



**Photo 11: Looking Right to 897 feet (MU @ 50 mph)
Visible Gap Between Utility Cabinet and Trees Illustrated by Vehicle**