Appendix E

Traffic Signal Warrants

MD 99 Investigation

Summary of Traffic Signal Warrant Analysis

Intersection: **MD 99 (Old Frederick Road) and Taylor Farm Road**
Location: **Howard County**
Study Year: **2018 Existing Condition**
Study Date: **n/a**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). In place of a count, trip generation estimates were used based on the ITE Trip Generation 10th Edition methodology. Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at Taylor Farm Road under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: Taylor Farm Road**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

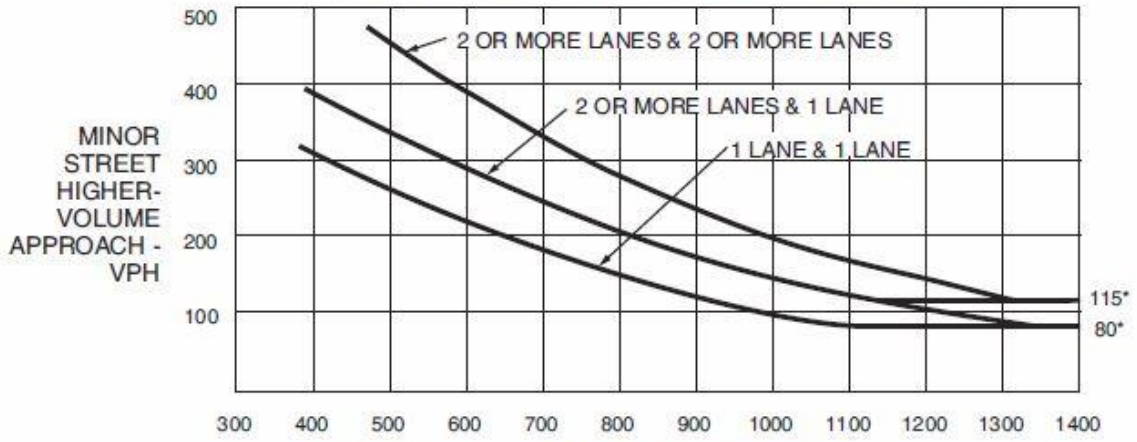
Warrant 7, Crash Experience **WARRANT SATISFIED:** **yes** ☐ **no** ☒

Review of the three year accident report shows 1 crash, which may not be susceptible to improvements under signalized conditions.

This warrant is satisfied when the following apply:

		Condition satisfied:
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐ no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐ no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐ no ☒

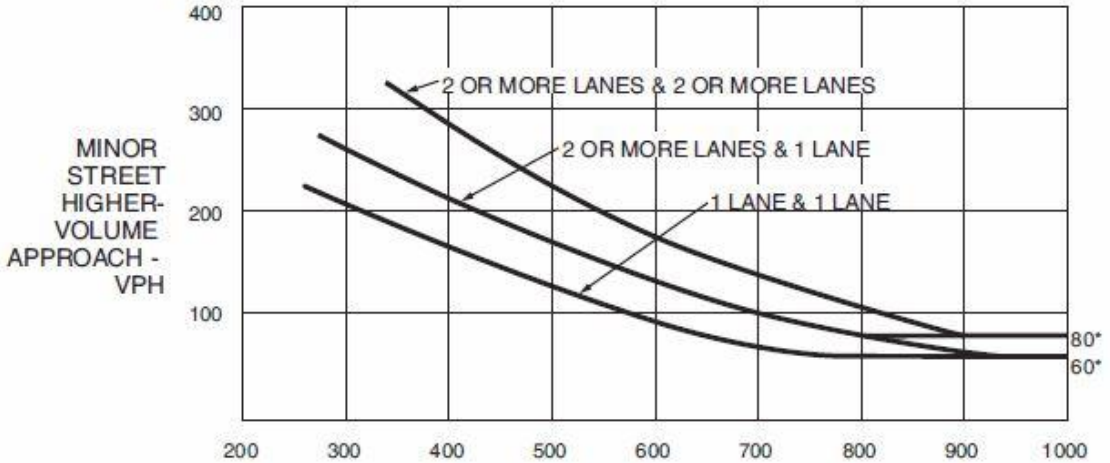
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

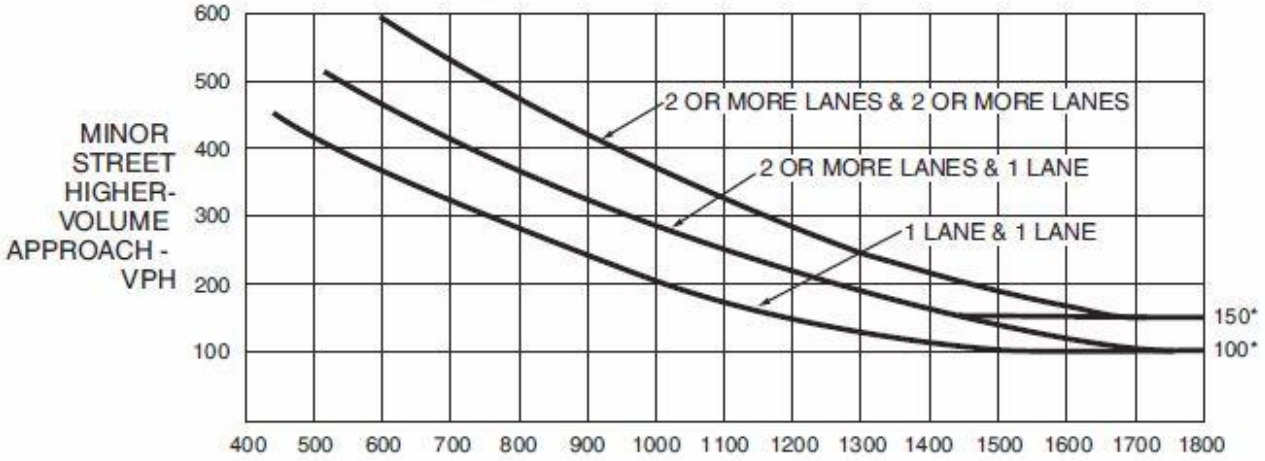
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

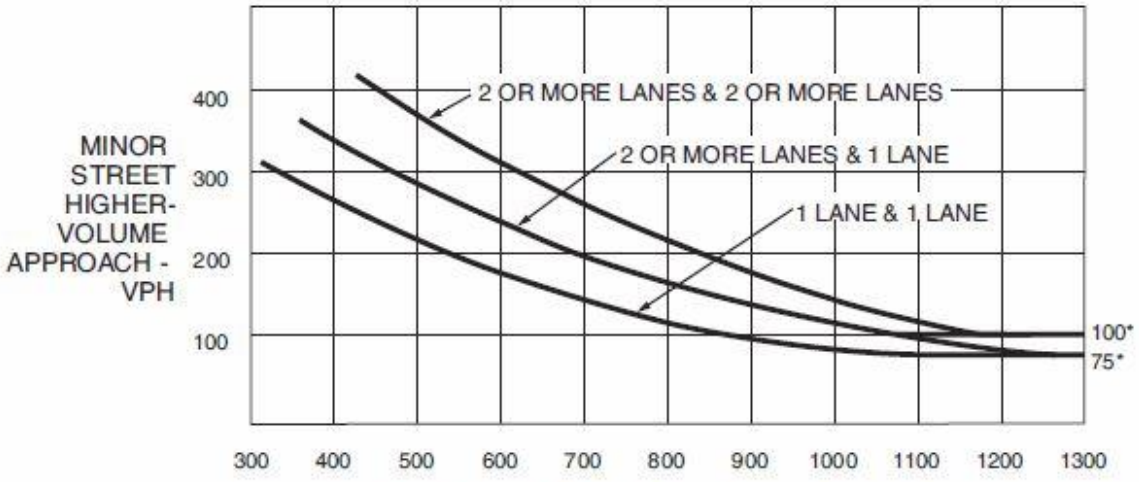
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

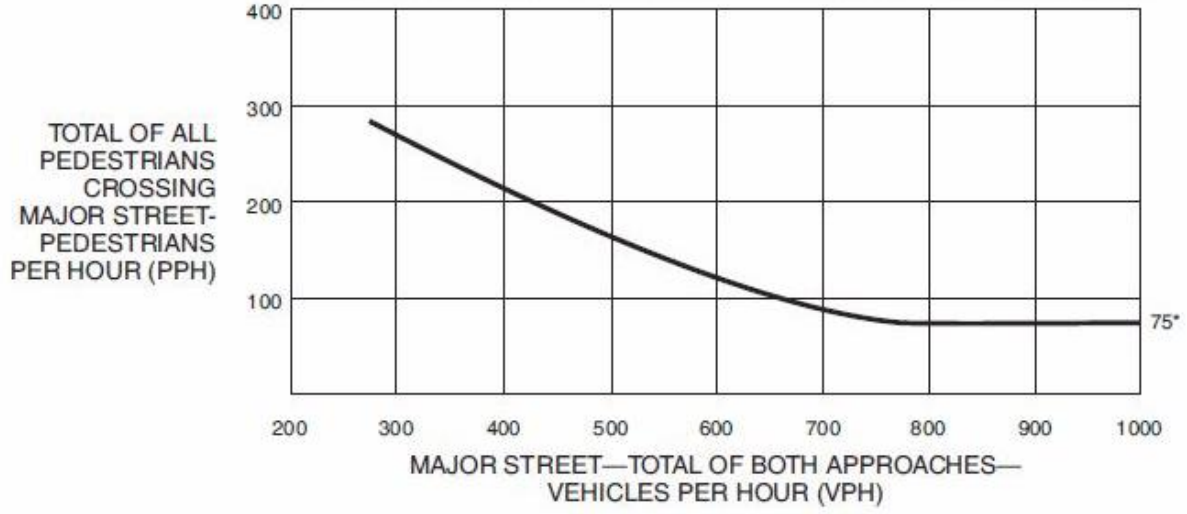
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



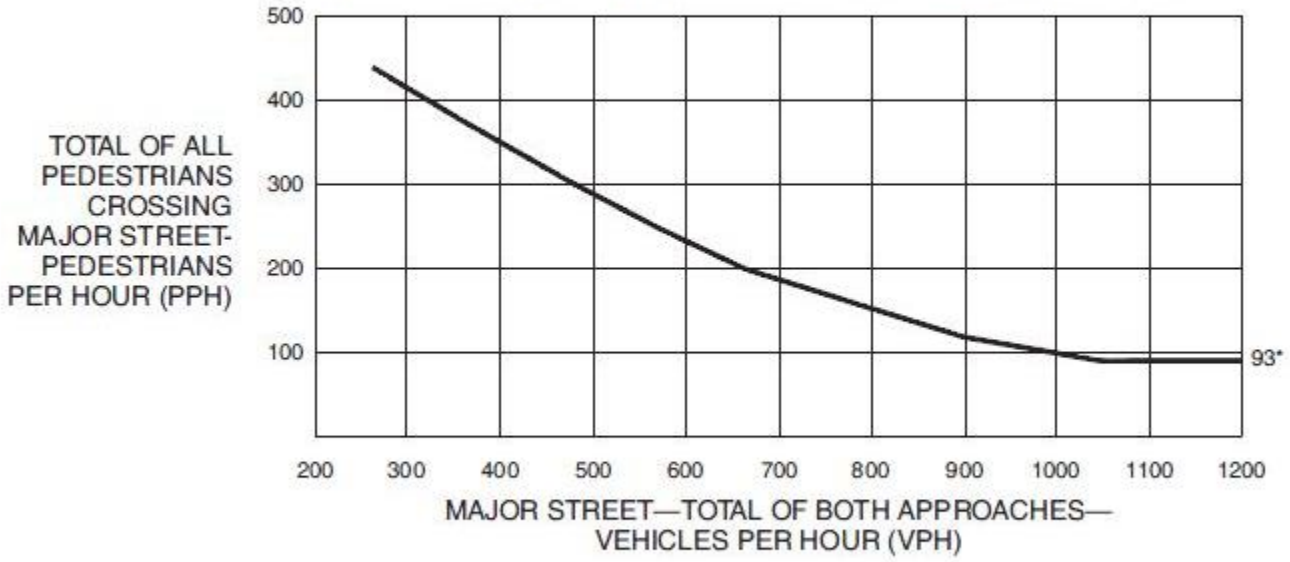
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection: **MD 99 (Old Frederick Road) and Waverly Woods Drive/ Green Clover Road**
Location: **Howard County**
Study Year: **2018 Existing Condition**
Study Date: **n/a**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). In place of a count, trip generation estimates were used based on the ITE Trip Generation 10th Edition methodology. Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at Waverly Woods Drive/Green Clover Road under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

It should be noted that the study intersection is within a school zone.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: Waverly Woods Drive/Green Clover Road**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

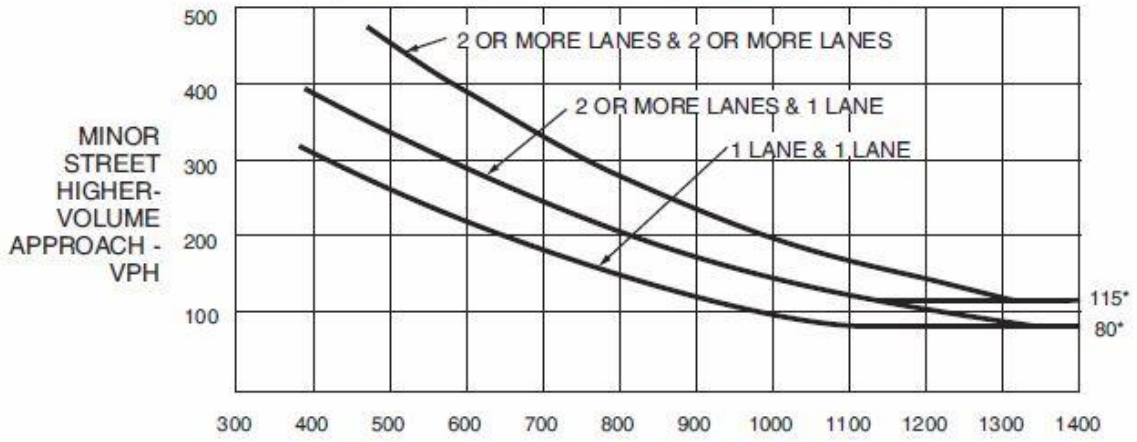
Warrant 7, Crash Experience **WARRANT SATISFIED:** **yes** ☐ **no** ☒

Review of the three year accident report shows 2 crashes, which would not be susceptible to improvements under signalized conditions.

This warrant is satisfied when the following apply:

		Condition satisfied:
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐ no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐ no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐ no ☒

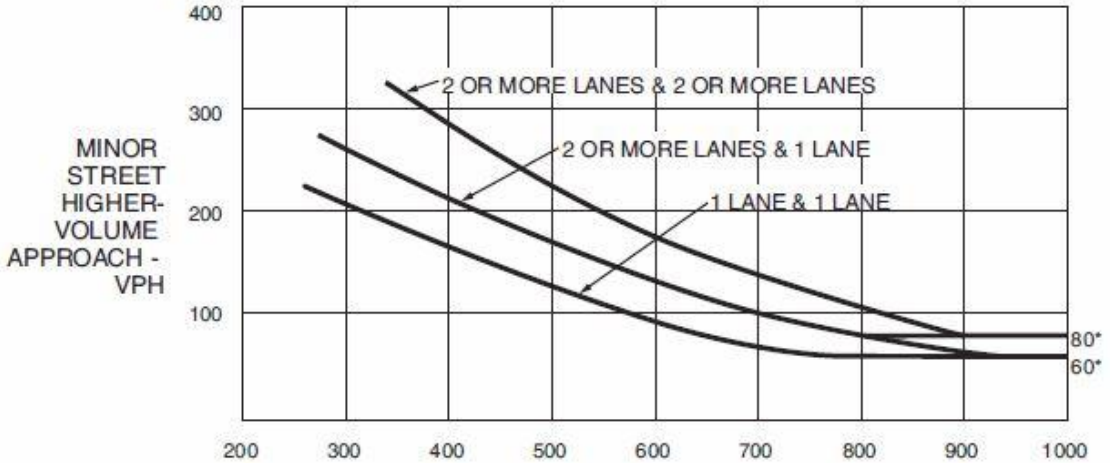
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

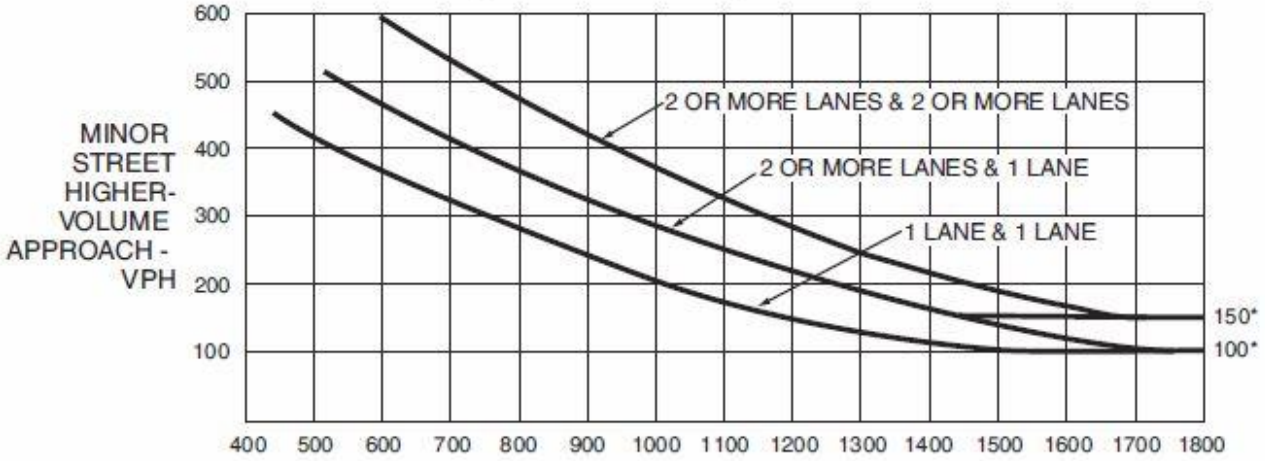
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

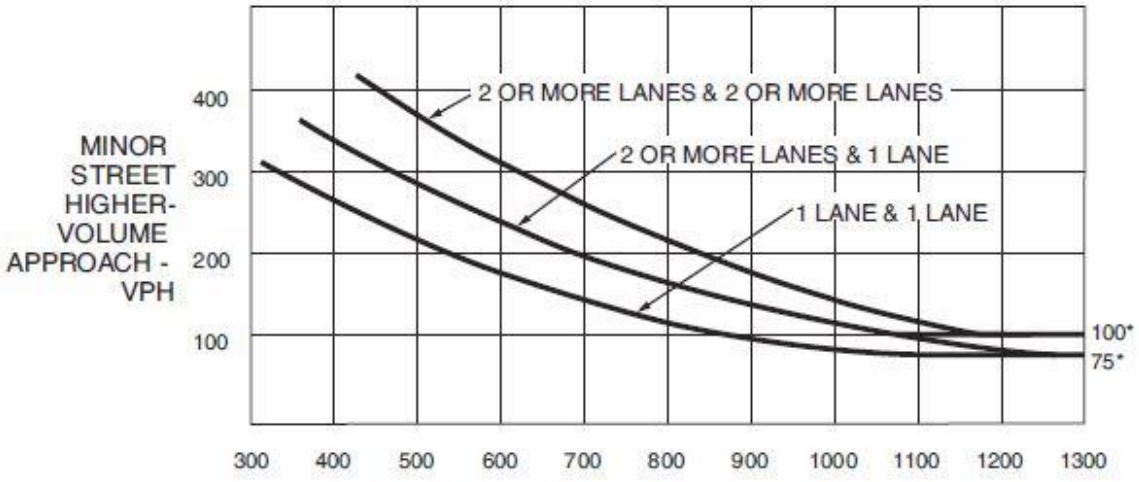
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

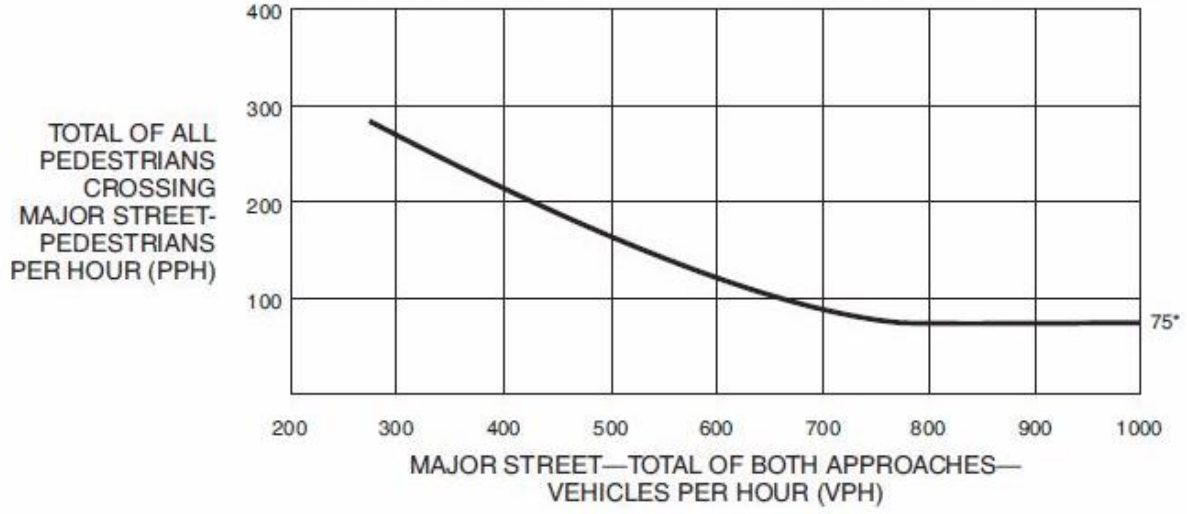
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



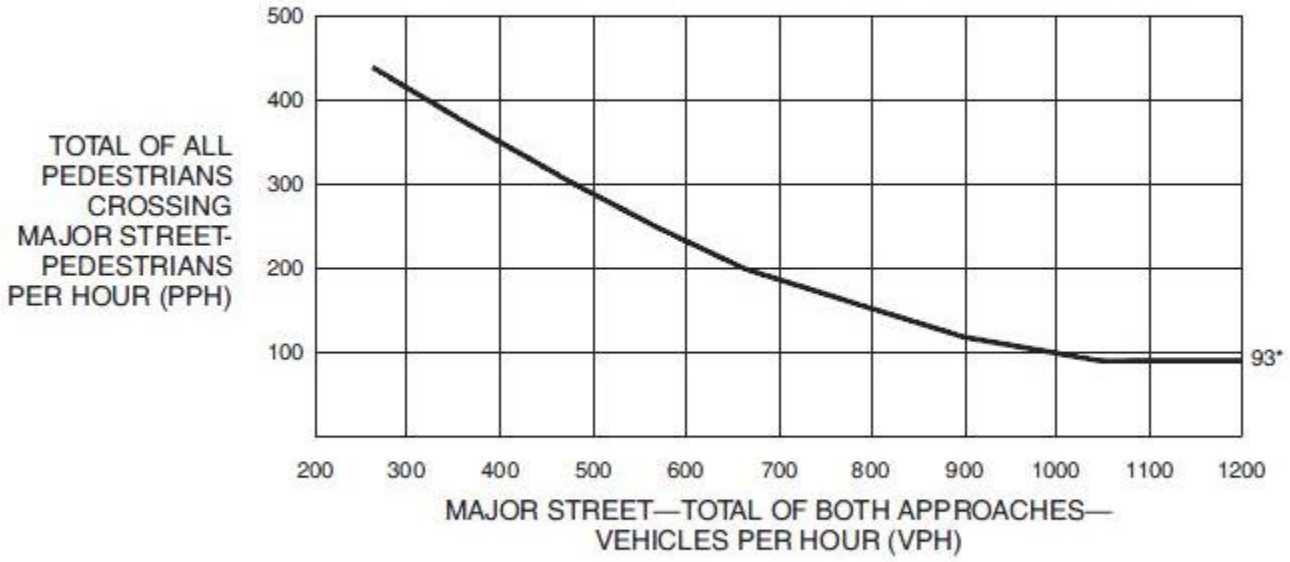
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**Bethany Lane and Postwick Road**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Study Date:	**05/22/2018**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of Bethany Lane at Postwick Road under 2018 Existing Conditions. The intersection meets one of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **Bethany Lane**
Number of lanes of moving traffic on each major street approach: **1 NB, 1 SB**
Minor Street**: Postwick Road**
Number of lanes of moving traffic on each minor street approach: **1 EB, 1 WB**
Posted speed limit along MD 99: **30 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 1, Eight-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when one of the following apply

Condition satisfied:

A. **Minimum Vehicular Volume** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **400 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **120 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	Bethany Lane	15	Postwick Road	42	yes ☐	no ☒
07:00 AM – 08:00 AM	Bethany Lane	687	Postwick Road	77	yes ☐	no ☒
08:00 AM – 09:00 AM	Bethany Lane	635	Postwick Road	62	yes ☐	no ☒
09:00 AM – 10:00 AM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
10:00 AM – 11:00 AM	Bethany Lane	10	Postwick Road	11	yes ☐	no ☒
11:00 AM – 12:00 PM	Bethany Lane	15	Postwick Road	8	yes ☐	no ☒
12:00 PM – 01:00 PM	Bethany Lane	13	Postwick Road	9	yes ☐	no ☒
01:00 PM – 02:00 PM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
02:00 PM – 03:00 PM	Bethany Lane	13	Postwick Road	10	yes ☐	no ☒
03:00 PM – 04:00 PM	Bethany Lane	15	Postwick Road	14	yes ☐	no ☒
04:00 PM – 05:00 PM	Bethany Lane	179	Postwick Road	62	yes ☐	no ☒
05:00 PM – 06:00 PM	Bethany Lane	910	Postwick Road	83	yes ☐	no ☒
06:00 PM – 07:00 PM	Bethany Lane	549	Postwick Road	44	yes ☐	no ☒

B. **<u>The Interruption of Continuous Traffic</u>** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **600 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **60 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	Bethany Lane	15	Postwick Road	42	yes ☐	no ☒
07:00 AM – 08:00 AM	Bethany Lane	687	Postwick Road	77	yes ☐	no ☒
08:00 AM – 09:00 AM	Bethany Lane	635	Postwick Road	62	yes ☐	no ☒
09:00 AM – 10:00 AM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
10:00 AM – 11:00 AM	Bethany Lane	10	Postwick Road	11	yes ☐	no ☒
11:00 AM – 12:00 PM	Bethany Lane	15	Postwick Road	8	yes ☐	no ☒
12:00 PM – 01:00 PM	Bethany Lane	13	Postwick Road	9	yes ☐	no ☒
01:00 PM – 02:00 PM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
02:00 PM – 03:00 PM	Bethany Lane	13	Postwick Road	10	yes ☐	no ☒
03:00 PM – 04:00 PM	Bethany Lane	15	Postwick Road	14	yes ☐	no ☒
04:00 PM – 05:00 PM	Bethany Lane	179	Postwick Road	62	yes ☐	no ☒
05:00 PM – 06:00 PM	Bethany Lane	910	Postwick Road	83	yes ☒	no ☐
06:00 PM – 07:00 PM	Bethany Lane	549	Postwick Road	44	yes ☐	no ☒

Warrant 2, Four-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

The Four-Hour Volume Warrant is satisfied when for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major-street and the corresponding vehicles per hour on the higher volume minor-street all fall above the curve in Figure A since the major street 85th Percentile Speed ≤ 40 MPH. The lower threshold volume for minor street is 80 vph.

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	Bethany Lane	15	Postwick Road	42	yes ☐	no ☒
07:00 AM – 08:00 AM	Bethany Lane	687	Postwick Road	77	yes ☐	no ☒
08:00 AM – 09:00 AM	Bethany Lane	635	Postwick Road	62	yes ☐	no ☒
09:00 AM – 10:00 AM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
10:00 AM – 11:00 AM	Bethany Lane	10	Postwick Road	11	yes ☐	no ☒
11:00 AM – 12:00 PM	Bethany Lane	15	Postwick Road	8	yes ☐	no ☒
12:00 PM – 01:00 PM	Bethany Lane	13	Postwick Road	9	yes ☐	no ☒
01:00 PM – 02:00 PM	Bethany Lane	15	Postwick Road	11	yes ☐	no ☒
02:00 PM – 03:00 PM	Bethany Lane	13	Postwick Road	10	yes ☐	no ☒
03:00 PM – 04:00 PM	Bethany Lane	15	Postwick Road	14	yes ☐	no ☒
04:00 PM – 05:00 PM	Bethany Lane	179	Postwick Road	62	yes ☐	no ☒

05:00 PM – 06:00 PM	Bethany Lane	910	Postwick Road	83	yes ☐	no ☒
06:00 PM – 07:00 PM	Bethany Lane	549	Postwick Road	44	yes ☐	no ☒

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

Warrant 5, School Crossing **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when the study of the frequency and adequacy of gaps in vehicular traffic stream as related to number and size of groups of school children at an established school crossing across a major street shows that the number of adequate gaps in the traffic stream during the period when children are using the crossing is less than the number of minutes in the same period and that there are a minimum of twenty (20) students during the highest crossing hour.

Warrant 7, Crash Experience **WARRANT SATISFIED:** **yes ☐ no ☒**

Review of the three year accident report shows 0 crashes.

This warrant is satisfied when the following apply:

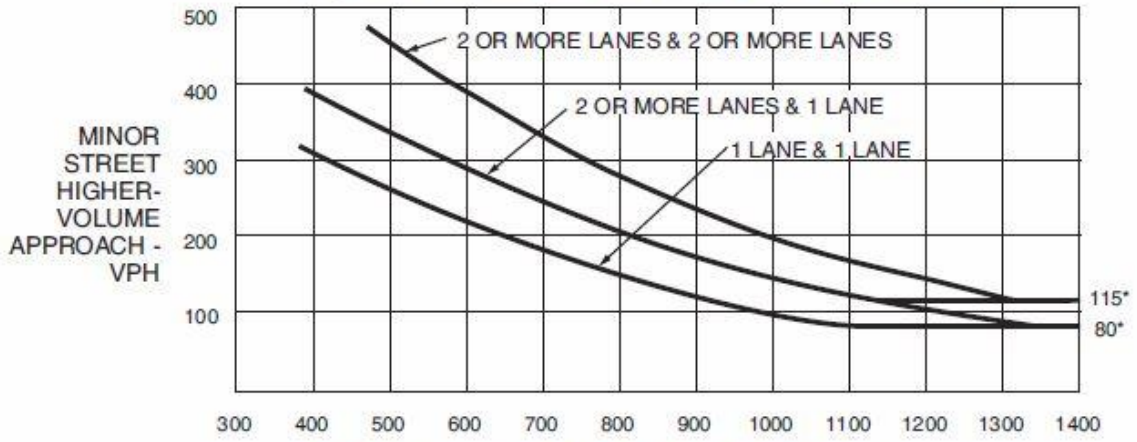
Condition satisfied:

1. Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and yes ☐ no ☒

2. Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and — yes ☐ no ☒

3. There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively. — yes ☐ no ☒

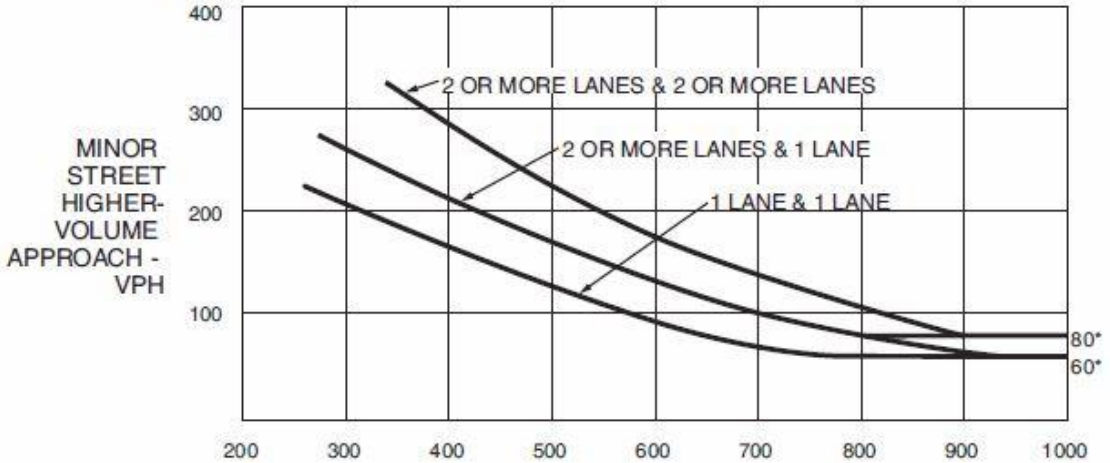
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

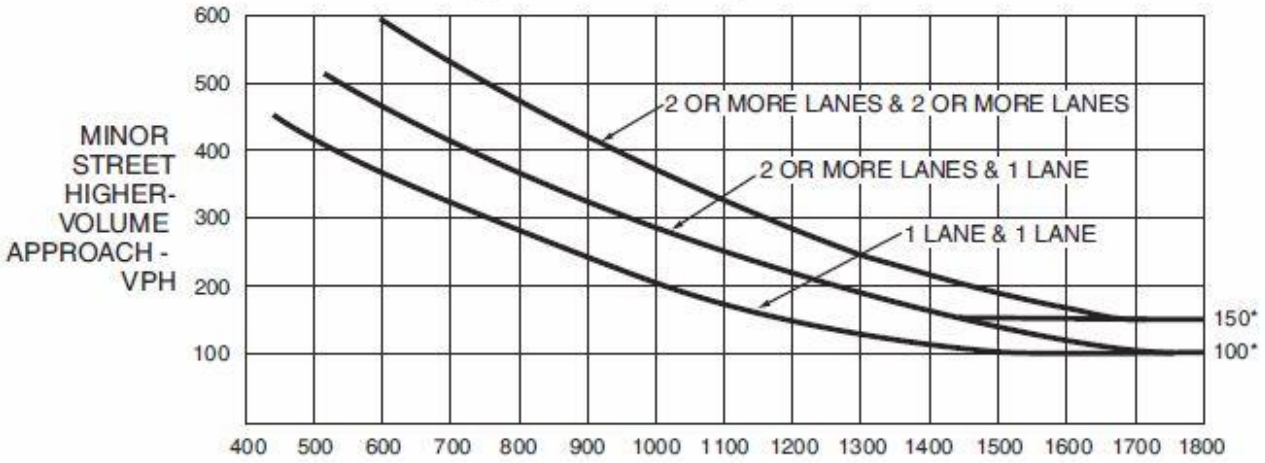
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

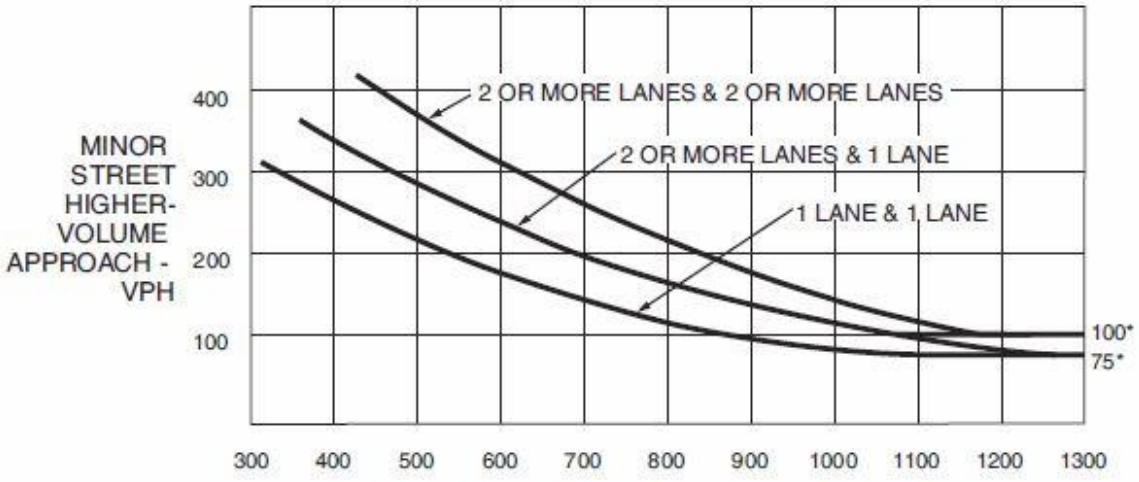
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

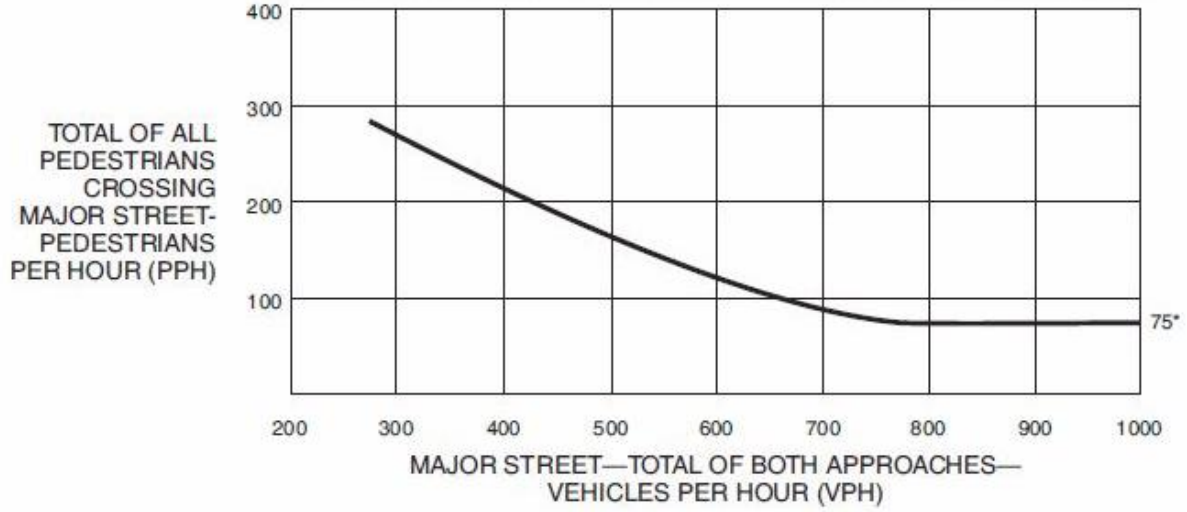
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



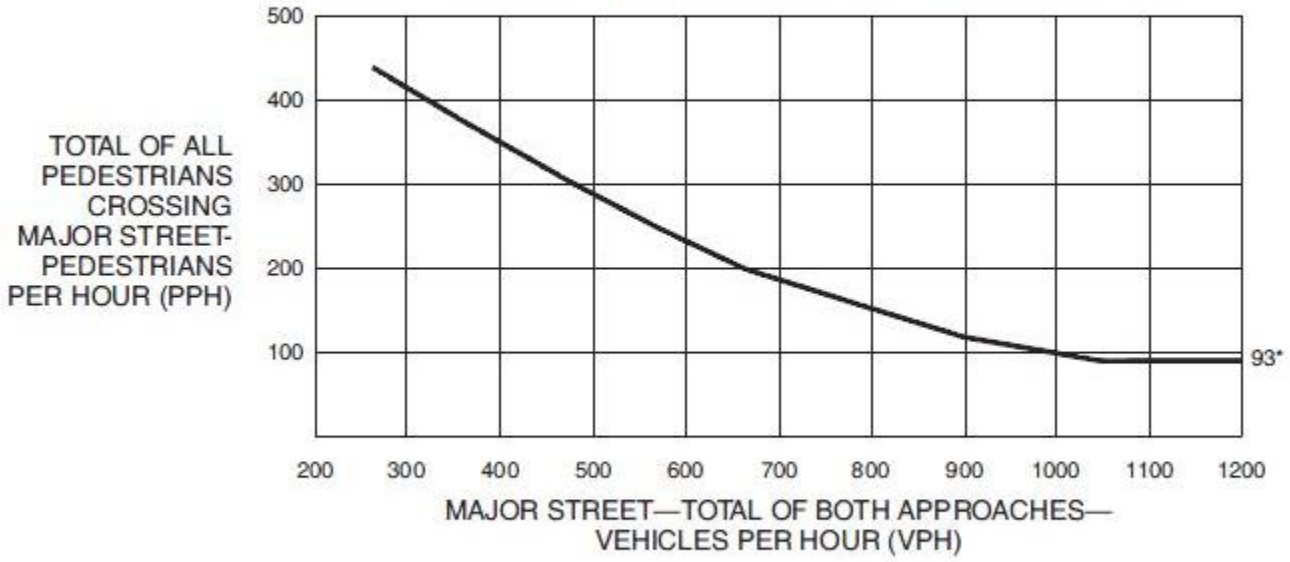
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**MD 99 and Liter Drive**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Study Date:	**n/a**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). In place of a count, trip generation estimates were used based on the ITE Trip Generation 10th Edition methodology. Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at Liter Drive under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: Liter Drive**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

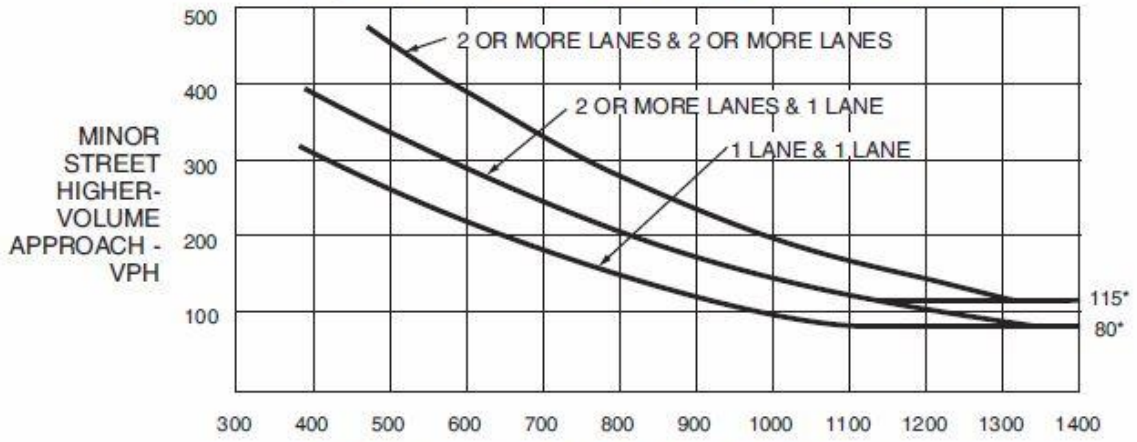
Warrant 7, Crash Experience **WARRANT SATISFIED:** **yes** ☐ **no** ☒

Review of the three year accident report shows 1 crash, which would not be susceptible to improvements under signalized conditions.

This warrant is satisfied when the following apply:

		Condition satisfied:
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐ no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐ no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐ no ☒

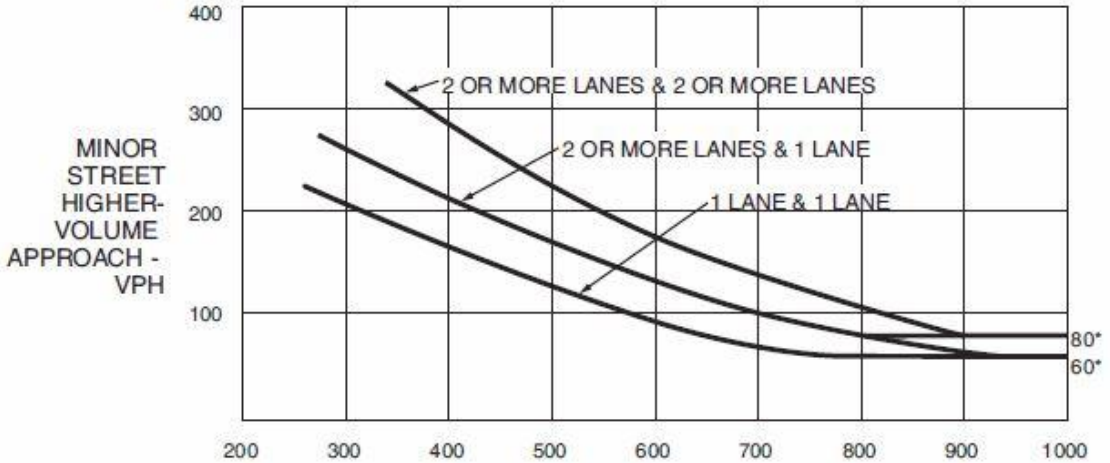
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

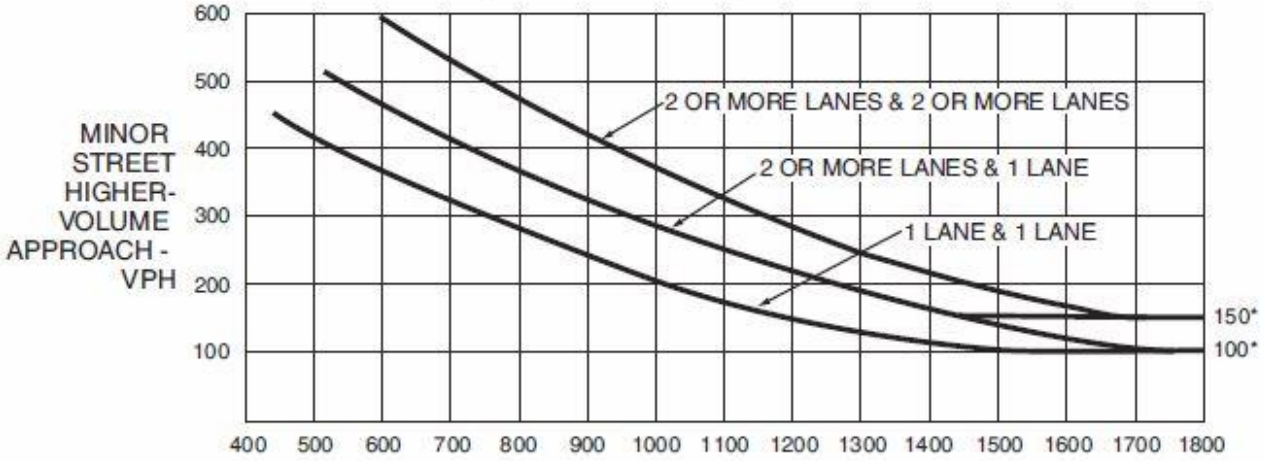
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

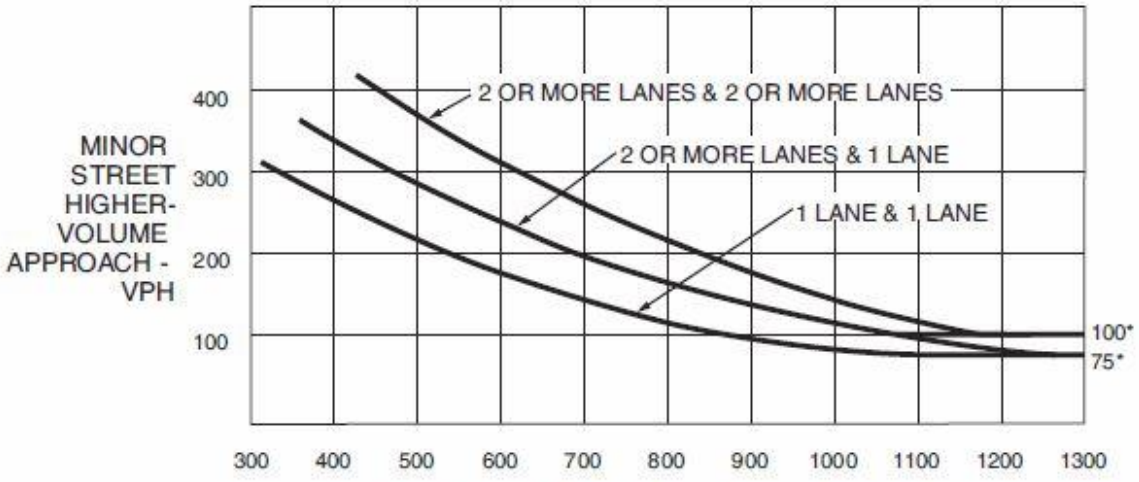
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

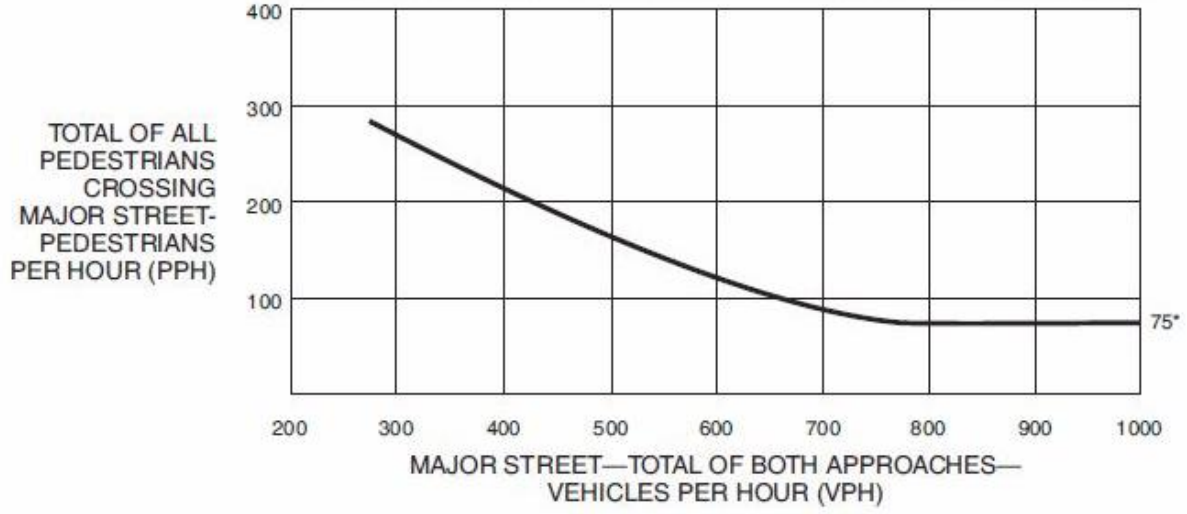
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



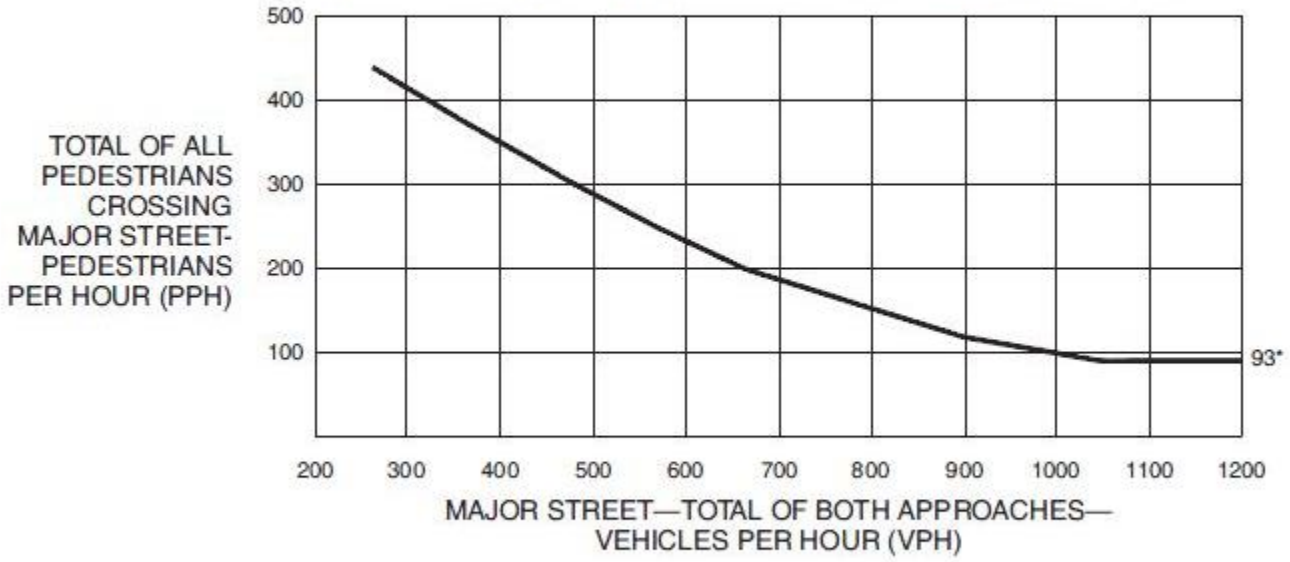
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**MD 99 and Weatherstone Drive**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Study Date:	**n/a**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). In place of a count, trip generation estimates were used based on the ITE Trip Generation 10th Edition methodology. Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at Weatherstone Drive under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☐ **NO**	☒ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: Weatherstone Drive**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

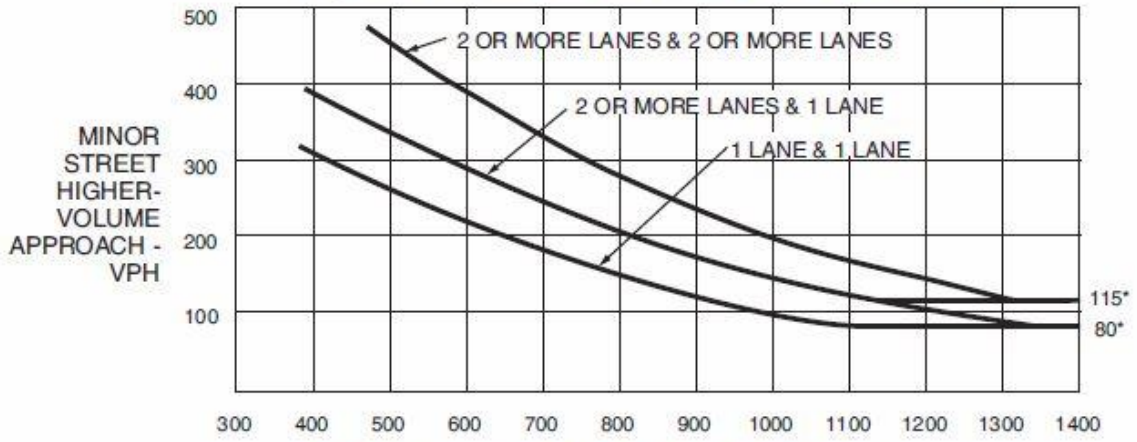
Warrant 7, Crash Experience **WARRANT SATISFIED:** **yes** ☐ **no** ☒

Review of the three year accident report shows 0 crashes.

This warrant is satisfied when the following apply:

		Condition satisfied:	
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐	no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐	no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐	no ☒

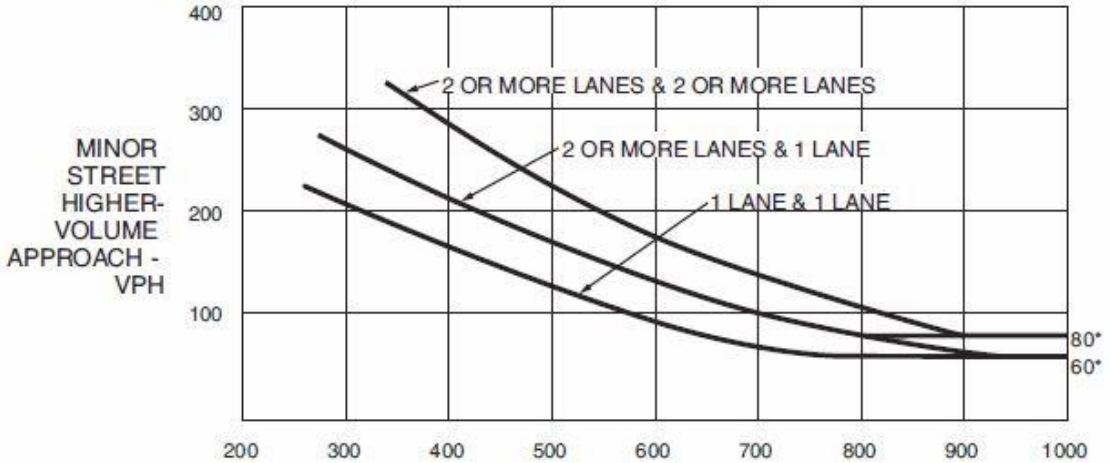
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

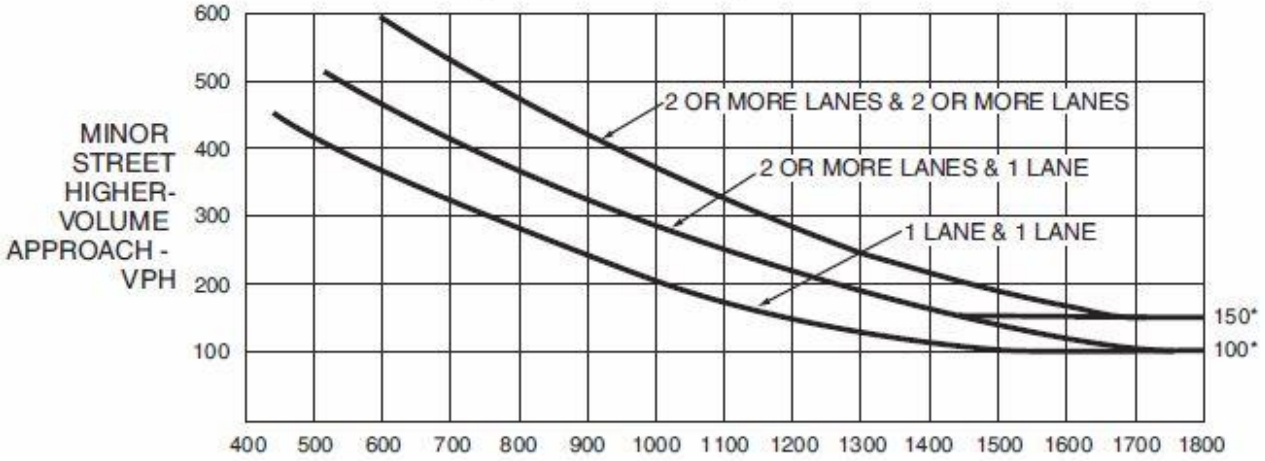
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

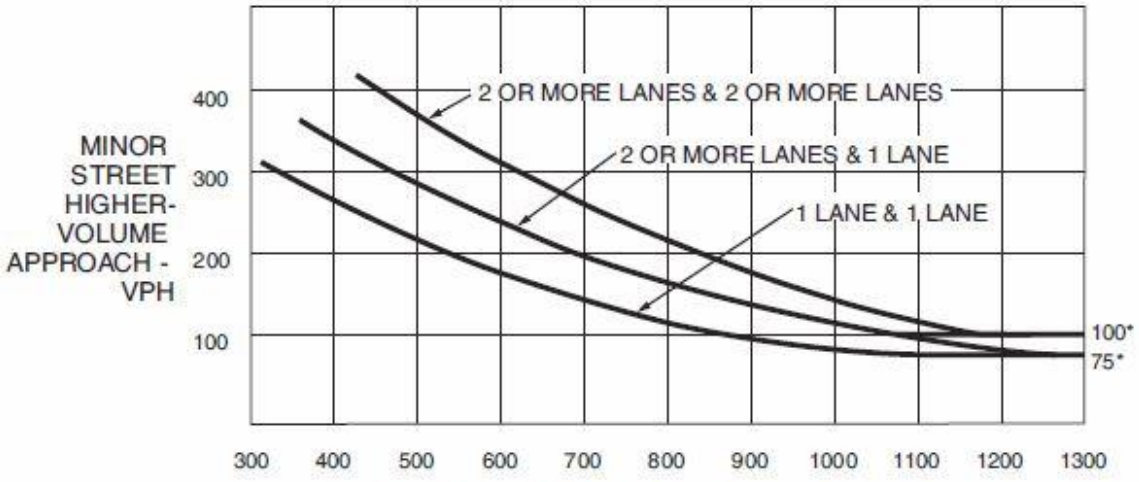
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

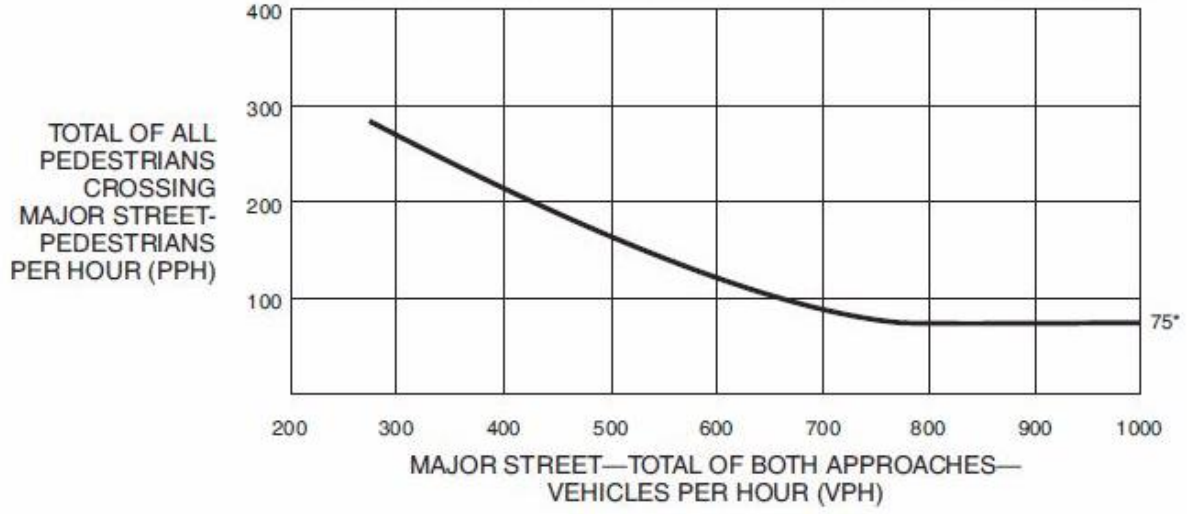
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



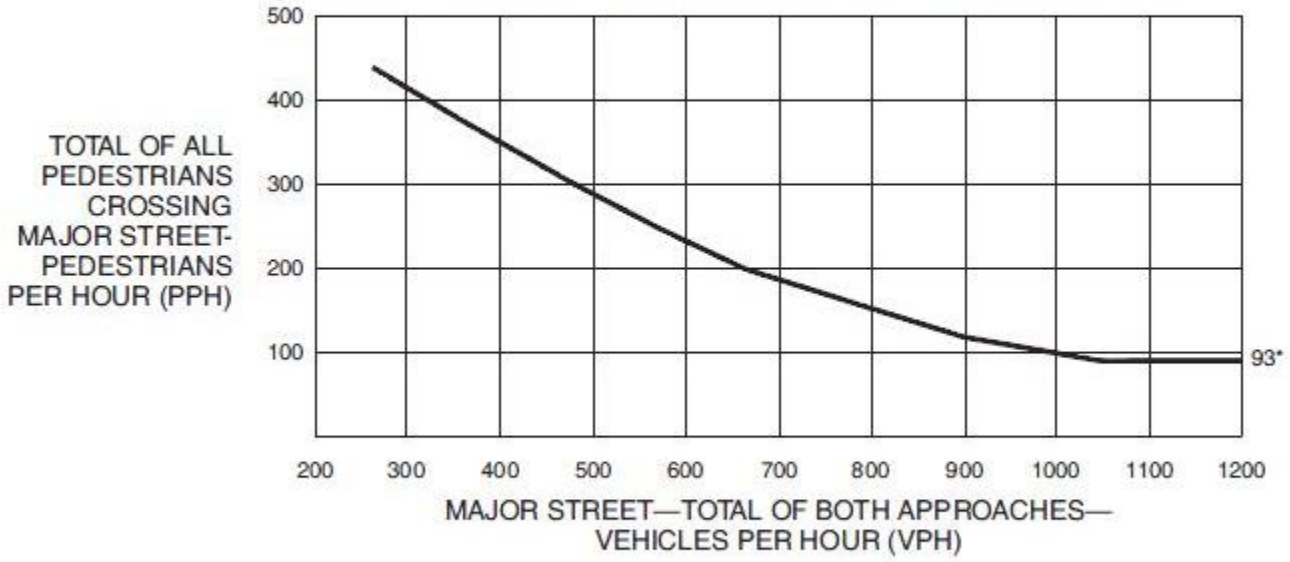
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**MD 99 and McKenzie Road**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Count Date:	**04/05/2016**

Warrant Analysis:

SAI performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the results of the evaluation, the installation of a traffic signal is not recommend at the intersection of MD 99 (Old Frederick Road) at McKenzie Road under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2016

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: McKenzie Road**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 1, Eight-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when one of the following apply

Condition satisfied:

A. Minimum Vehicular Volume yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **400 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **120 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	MD 99	407	McKenzie Road	28	yes ☐	no ☒
07:00 AM – 08:00 AM	MD 99	1064	McKenzie Road	67	yes ☐	no ☒
08:00 AM – 09:00 AM	MD 99	1280	McKenzie Road	69	yes ☐	no ☒
09:00 AM – 10:00 AM	MD 99	826	McKenzie Road	39	yes ☐	no ☒
10:00 AM – 11:00 AM	MD 99	561	McKenzie Road	34	yes ☐	no ☒
11:00 AM – 12:00 PM	MD 99	540	McKenzie Road	33	yes ☐	no ☒
12:00 PM – 01:00 PM	MD 99	547	McKenzie Road	47	yes ☐	no ☒
01:00 PM – 02:00 PM	MD 99	635	McKenzie Road	42	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	737	McKenzie Road	48	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	854	McKenzie Road	27	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1309	McKenzie Road	55	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1290	McKenzie Road	43	yes ☐	no ☒
06:00 PM – 07:00 PM	MD 99	1175	McKenzie Road	52	yes ☐	no ☒

B. **The Interruption of Continuous Traffic** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **600 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **60 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	MD 99	407	McKenzie Road	28	yes ☐	no ☒
07:30 AM – 08:30 AM	MD 99	1253	McKenzie Road	72	yes ☒	no ☐
08:30 AM – 09:30 AM	MD 99	1077	McKenzie Road	59	yes ☐	no ☒
09:30 AM – 10:30 AM	MD 99	650	McKenzie Road	30	yes ☐	no ☒
10:30 AM – 11:30 AM	MD 99	531	McKenzie Road	33	yes ☐	no ☒
11:30 AM – 12:30 PM	MD 99	535	McKenzie Road	42	yes ☐	no ☒
12:30 PM – 01:30 PM	MD 99	589	McKenzie Road	49	yes ☐	no ☒
01:30 PM – 02:30 PM	MD 99	648	McKenzie Road	38	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	737	McKenzie Road	48	yes ☐	no ☒
02:30 PM – 03:30 PM	MD 99	808	McKenzie Road	38	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	854	McKenzie Road	27	yes ☐	no ☒
03:30 PM – 04:30 PM	MD 99	1098	McKenzie Road	50	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1309	McKenzie Road	55	yes ☐	no ☒
04:30 PM – 05:30 PM	MD 99	1334	McKenzie Road	43	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1290	McKenzie Road	43	yes ☐	no ☒
06:00 PM – 07:00 PM	MD 99	1175	McKenzie Road	52	yes ☐	no ☒

Warrant 2, Four-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

The Four-Hour Volume Warrant is satisfied when for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major-street and the corresponding vehicles per hour on the higher volume minor-street all fall above the curve in Figure A since the major street 85th Percentile Speed ≤ 40 MPH. The lower threshold volume for minor street is 80 vph.

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	MD 99	407	McKenzie Road	28	yes ☐	no ☒
07:30 AM – 08:30 AM	MD 99	1253	McKenzie Road	72	yes ☐	no ☒
08:30 AM – 09:30 AM	MD 99	1077	McKenzie Road	59	yes ☐	no ☒
09:30 AM – 10:30 AM	MD 99	650	McKenzie Road	30	yes ☐	no ☒
10:30 AM – 11:30 AM	MD 99	531	McKenzie Road	33	yes ☐	no ☒
11:30 AM – 12:30 PM	MD 99	535	McKenzie Road	42	yes ☐	no ☒
12:30 PM – 01:30 PM	MD 99	589	McKenzie Road	49	yes ☐	no ☒

01:30 PM – 02:30 PM	MD 99	648	McKenzie Road	38	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	737	McKenzie Road	48	yes ☐	no ☒
02:30 PM – 03:30 PM	MD 99	808	McKenzie Road	38	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	854	McKenzie Road	27	yes ☐	no ☒
03:30 PM – 04:30 PM	MD 99	1098	McKenzie Road	50	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1309	McKenzie Road	55	yes ☐	no ☒

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

Warrant 5, School Crossing **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when the study of the frequency and adequacy of gaps in vehicular traffic stream as related to number and size of groups of school children at an established school crossing across a major street shows that the number of adequate gaps in the traffic stream during the period when children are using the crossing is less than the number of minutes in the same period and that there are a minimum of twenty (20) students during the highest crossing hour.

Though Warrant 5 is not satisfied, it should be noted that the intersection is in the walkshed of Mount Hebron High School.

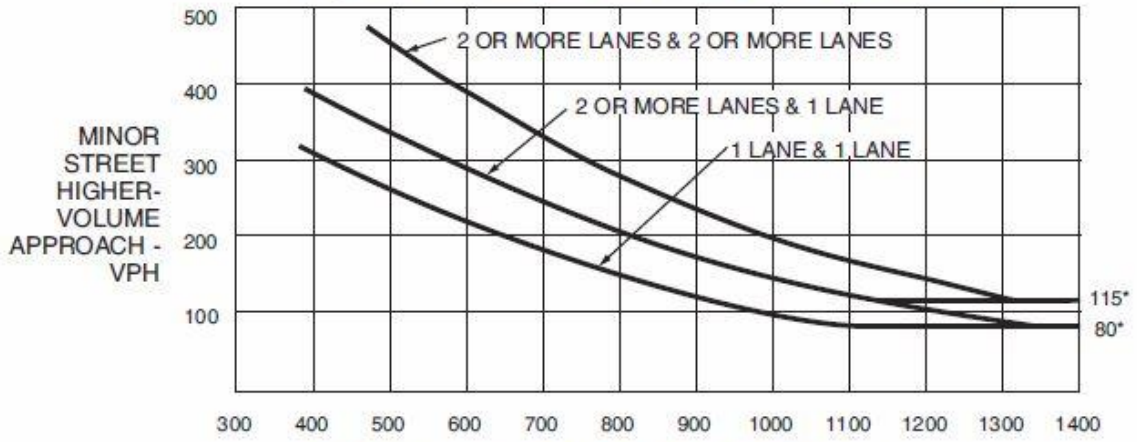
Warrant 7, Crash Experience	**WARRANT SATISFIED:**	**yes** ☐	**no** ☒

Review of the three year accident report shows 3 crashes, though none of them are likely susceptible to improvement with a traffic signal.

This warrant is satisfied when the following apply:

		Condition satisfied:	
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐	no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐	no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐	no ☒

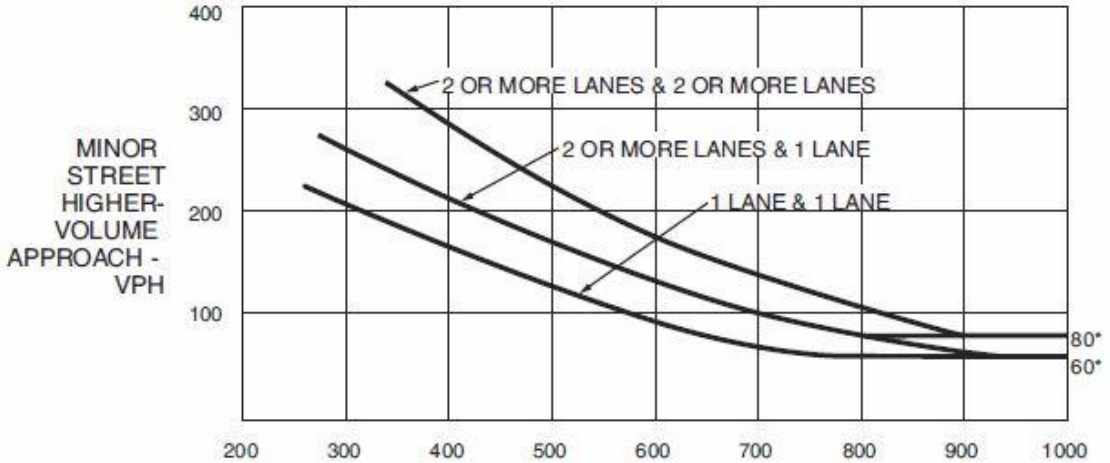
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

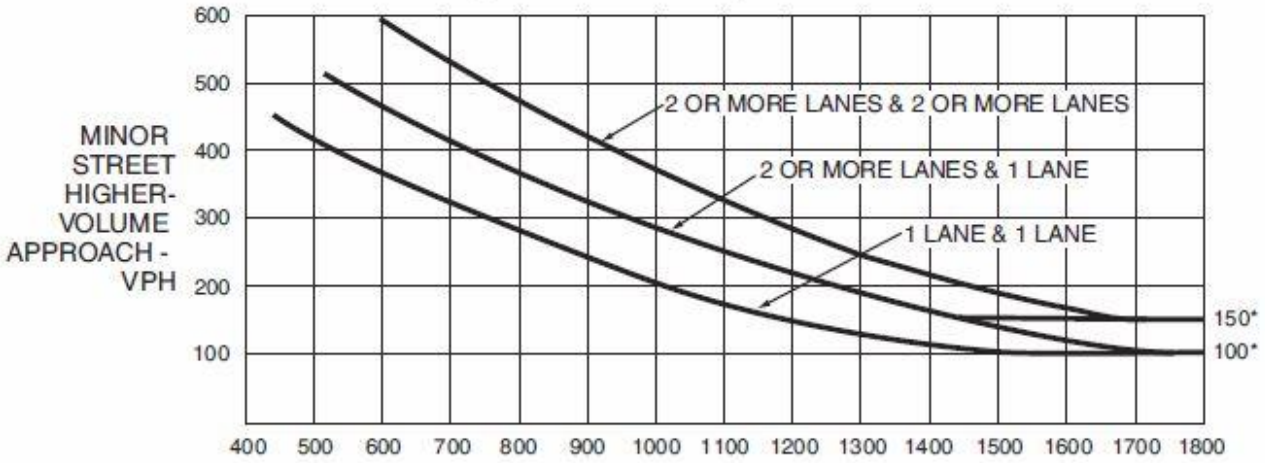
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

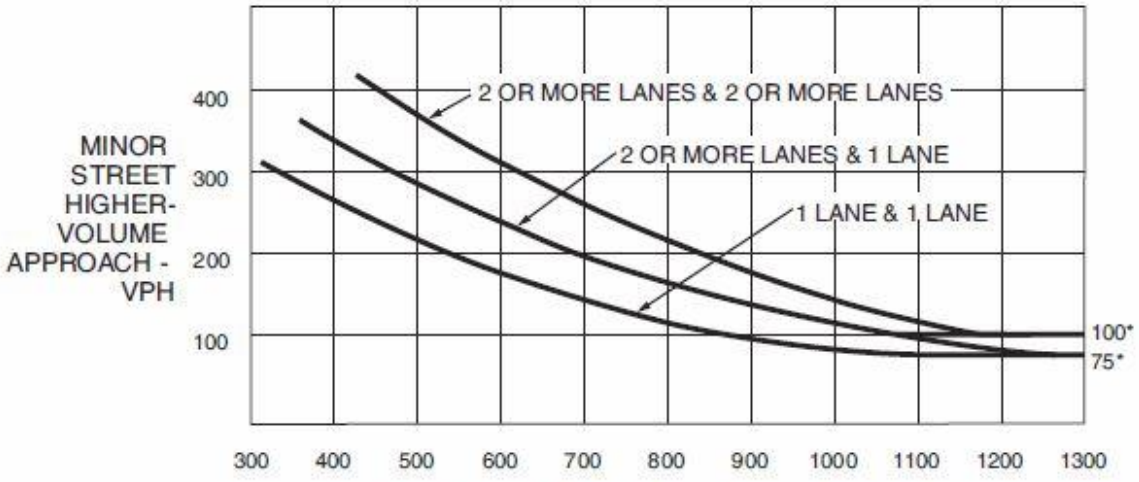
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

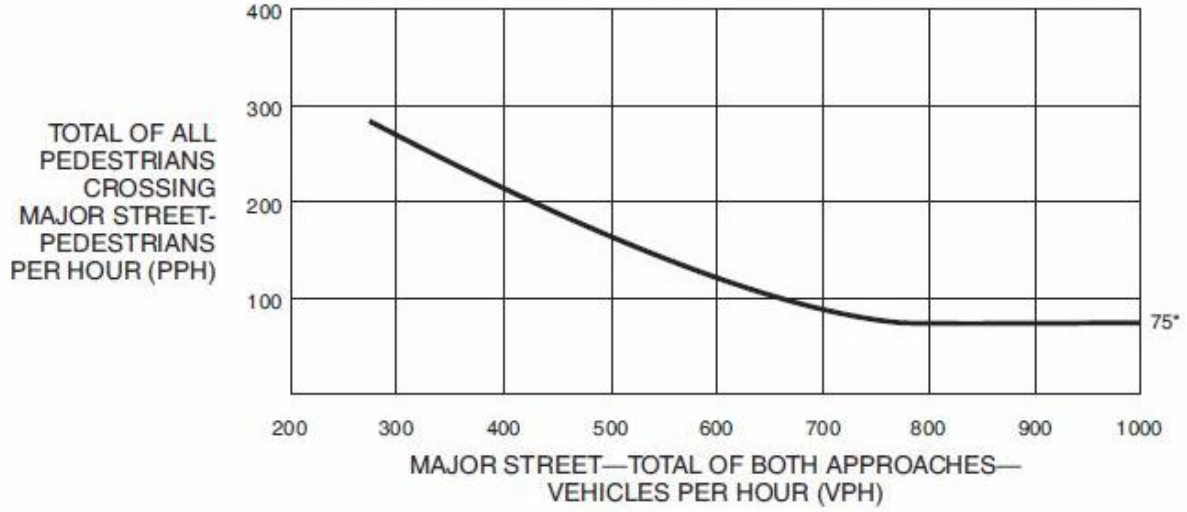
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



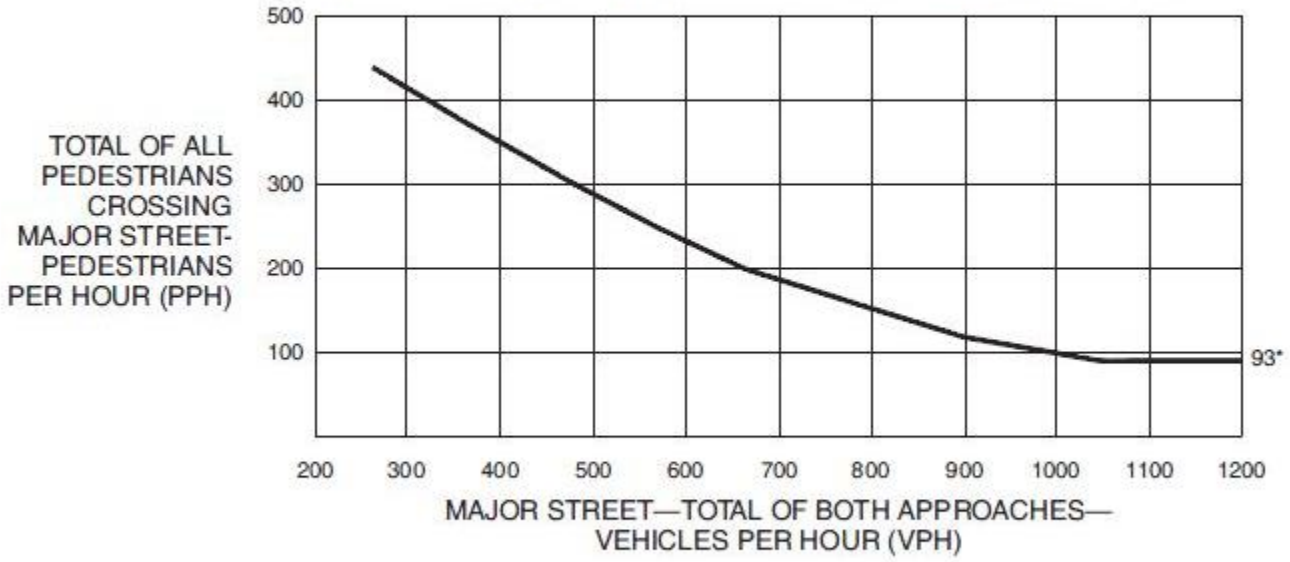
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**MD 99 and West Mount Hebron High School Entrance**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Study Date:	**05/15/2018**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at the west Mount Hebron High School entrance under 2018 Existing Conditions. The intersection meets one of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2018

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: West Mount Hebron High School Entrance**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 1, Eight-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when one of the following apply

Condition satisfied:

A. **Minimum Vehicular Volume** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **400 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **120 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	MD 99	675	West Mount Hebron High School Entrance	15	yes ☐	no ☒
07:00 AM – 08:00 AM	MD 99	1268	West Mount Hebron High School Entrance	120	yes ☒	no ☐
08:00 AM – 09:00 AM	MD 99	505	West Mount Hebron High School Entrance	17	yes ☐	no ☒
09:00 AM – 10:00 AM	MD 99	17	West Mount Hebron High School Entrance	15	yes ☐	no ☒
10:00 AM – 11:00 AM	MD 99	16	West Mount Hebron High School Entrance	10	yes ☐	no ☒
11:00 AM – 12:00 PM	MD 99	11	West Mount Hebron High School Entrance	15	yes ☐	no ☒
12:00 PM –	MD 99	14	West Mount Hebron High School	13	yes ☐	no ☒

01:00 PM			Entrance			
01:00 PM – 02:00 PM	MD 99	554	West Mount Hebron High School Entrance	52	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	354	West Mount Hebron High School Entrance	57	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	18	West Mount Hebron High School Entrance	15	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1064	West Mount Hebron High School Entrance	20	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1588	West Mount Hebron High School Entrance	22	yes ☐	no ☒
06:00 PM – 07:00 PM	MD 99	574	West Mount Hebron High School Entrance	36	yes ☐	no ☒

B. **The Interruption of Continuous Traffic** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **600 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Minor Street: **60 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:15 AM – 07:15 AM	MD 99	999	West Mount Hebron High School Entrance	81	yes ☒	no ☐
07:15 AM – 08:15 AM	MD 99	1190	West Mount Hebron High School Entrance	49	yes ☐	no ☒
08:15 AM – 09:15 AM	MD 99	274	West Mount Hebron High School Entrance	17	yes ☐	no ☒
09:15 AM – 10:15 AM	MD 99	14	West Mount Hebron High School Entrance	15	yes ☐	no ☒
10:15 AM – 11:15 AM	MD 99	16	West Mount Hebron High School Entrance	13	yes ☐	no ☒
11:15 AM – 12:15 PM	MD 99	11	West Mount Hebron High School Entrance	12	yes ☐	no ☒
12:15 PM – 01:15 PM	MD 99	135	West Mount Hebron High School Entrance	12	yes ☐	no ☒
01:15 PM – 02:15 PM	MD 99	511	West Mount Hebron High School Entrance	103	yes ☒	no ☐
02:00 PM – 03:00 PM	MD 99	354	West Mount Hebron High School Entrance	57	yes ☐	no ☒
02:15 PM – 03:15 PM	MD 99	276	West Mount Hebron High School Entrance	14	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	18	West Mount Hebron High School Entrance	15	yes ☐	no ☒

04:15 PM – 05:15 PM	MD 99	288	West Mount Hebron High School Entrance	17	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1064	West Mount Hebron High School Entrance	22	yes ☐	no ☒

Warrant 2, Four-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

The Four-Hour Volume Warrant is satisfied when for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major-street and the corresponding vehicles per hour on the higher volume minor-street all fall above the curve in Figure A since the major street 85th Percentile Speed ≤ 40 MPH. The lower threshold volume for minor street is 80 vph.

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:15 AM – 07:15 AM	MD 99	999	West Mount Hebron High School Entrance	81	yes ☒	no ☐
07:15 AM – 08:15 AM	MD 99	1190	West Mount Hebron High School Entrance	49	yes ☐	no ☒
08:15 AM – 09:15 AM	MD 99	274	West Mount Hebron High School Entrance	17	yes ☐	no ☒
09:15 AM – 10:15 AM	MD 99	14	West Mount Hebron High School Entrance	15	yes ☐	no ☒
10:15 AM – 11:15 AM	MD 99	16	West Mount Hebron High School Entrance	13	yes ☐	no ☒
11:15 AM – 12:15 PM	MD 99	11	West Mount Hebron High School Entrance	12	yes ☐	no ☒
12:15 PM – 01:15 PM	MD 99	135	West Mount Hebron High School Entrance	12	yes ☐	no ☒
01:15 PM – 02:15 PM	MD 99	511	West Mount Hebron High School Entrance	103	yes ☒	no ☐
02:15 PM – 03:15 PM	MD 99	276	West Mount Hebron High School Entrance	14	yes ☐	no ☒
03:15 PM – 04:15 PM	MD 99	288	West Mount Hebron High School Entrance	17	yes ☐	no ☒
04:15 PM – 05:15 PM	MD 99	1178	West Mount Hebron High School Entrance	17	yes ☐	no ☒
05:15 PM – 06:15 PM	MD 99	1491	West Mount Hebron High School Entrance	37	yes ☐	no ☒
06:15 PM – 07:15 PM	MD 99	380	West Mount Hebron High School Entrance	25	yes ☐	no ☒

Warrant 3, Peak Hour	**WARRANT SATISFIED:**	**yes ☐**	**no ☒**

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and — yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and — yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. — yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. — yes ☐ no ☒

Warrant 5, School Crossing	**WARRANT SATISFIED:**	**yes ☐**	**no ☒**

This warrant is satisfied when the study of the frequency and adequacy of gaps in vehicular traffic stream as related to number and size of groups of school children at an established school crossing across a major street shows that the number of adequate gaps in the traffic stream during the period when children are using the crossing is less than the number of minutes in the same period and that there are a minimum of twenty (20) students during the highest crossing hour.

Though Warrant 5 is not met, it should be noted that this intersection is within a school zone.

Warrant 7, Crash Experience	**WARRANT SATISFIED:**	**yes ☐**	**no ☒**

Review of the three year accident report shows 1 crash, which is not susceptible to correction by a traffic signal.

This warrant is satisfied when the following apply:

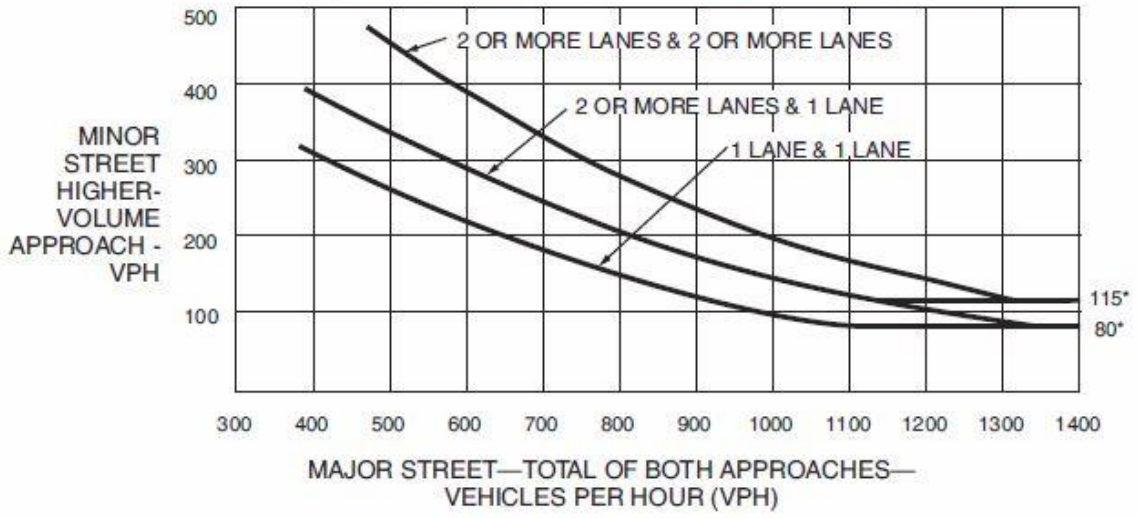
Condition satisfied:

1. Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and — yes ☐ no ☒

2. Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and — yes ☐ no ☒

3. There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively. yes ☐ no ☒

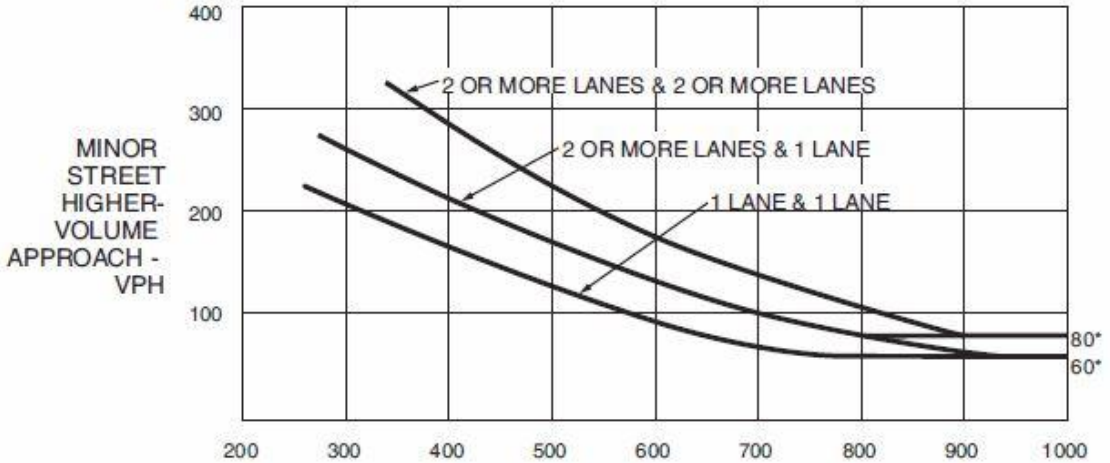
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

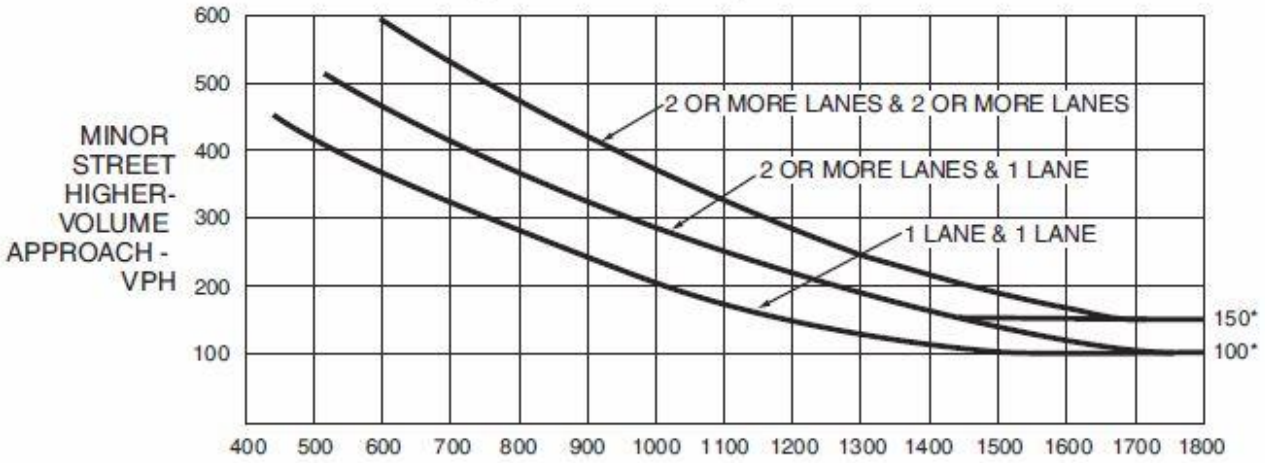
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

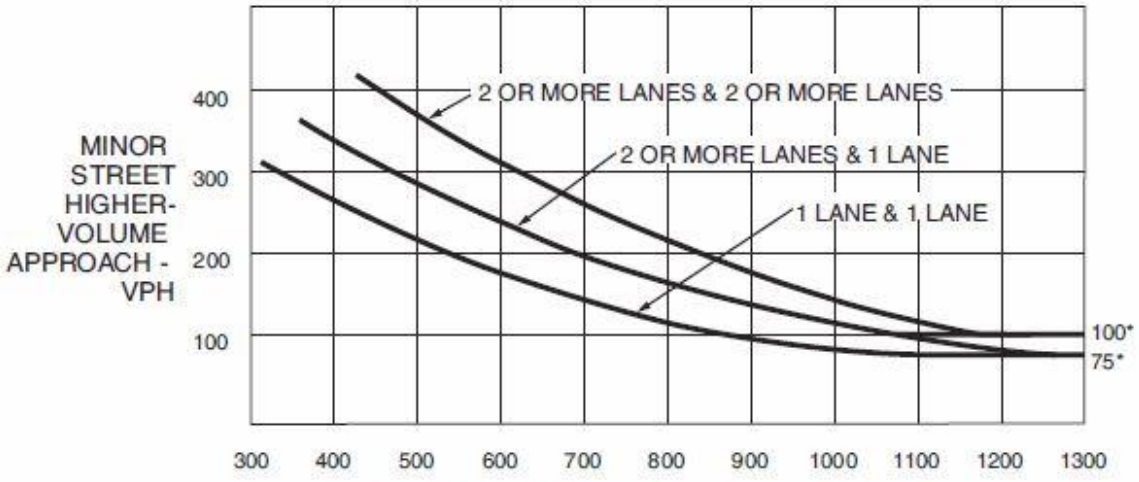
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

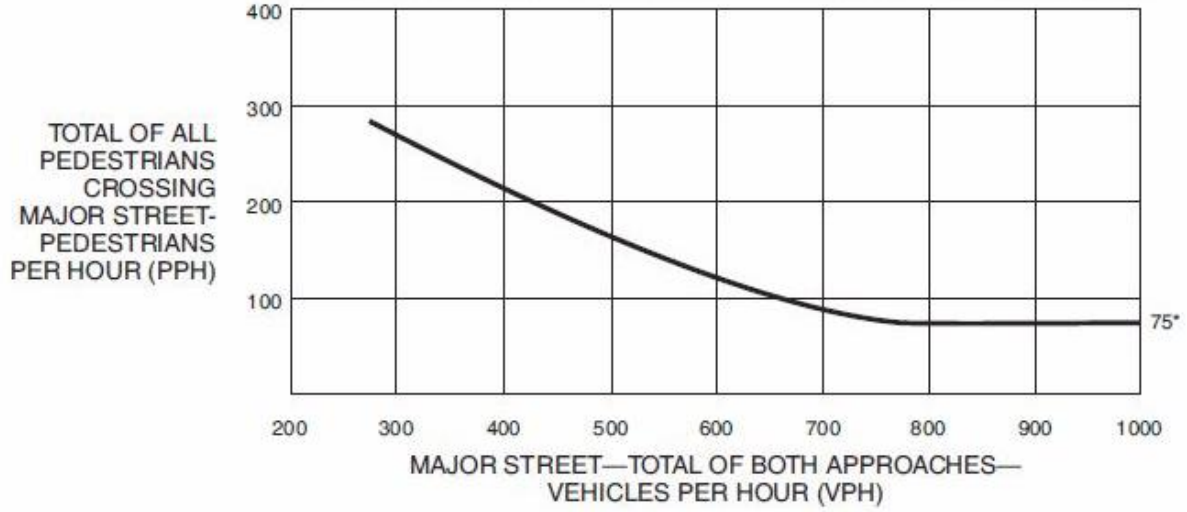
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



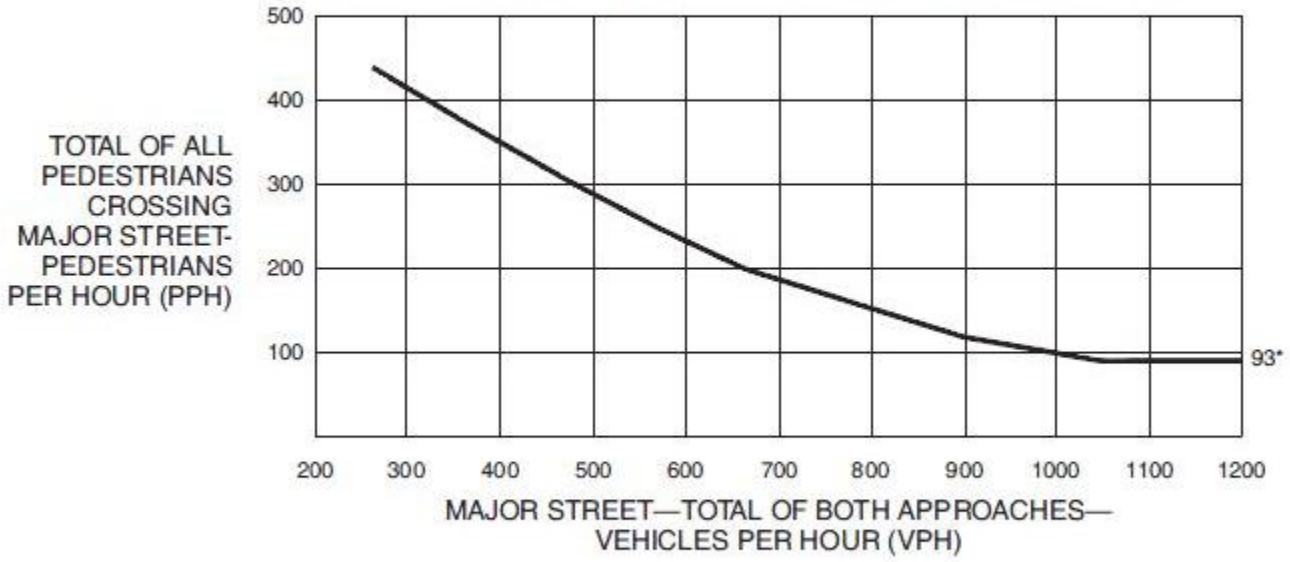
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.

Summary of Traffic Signal Warrant Analysis

Intersection	**MD 99 and Tiller Drive**
Location:	**Howard County**
Study Year:	**2018 Existing Condition**
Study Date:	**04/17/2016**

Warrant Analysis:

The SHA's DSED performed a traffic signal warrant analysis in May of 2018 based on the nationally accepted *Manual on Uniform Traffic Control Devices* (MUTCD). Based on the results of the evaluation, the Data Services Engineering Division (DSED) – Travel Forecasting and Analysis office does not recommend the installation of a traffic signal at the intersection of MD 99 (Old Frederick Road) at Tiller Drive under 2018 Existing Conditions. The intersection meets none of the traffic signal warrants.

☐ 1	Eight-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 2	Four-Hour vehicular volume	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 3	Peak Hour	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 5	School Crossing	☐ **YES**	☒ **NO**	☐ **N/A**
☐ 7	Crash Experience	☐ **YES**	☒ **NO**	☐ **N/A**

☐ **Location warrants signalization under warrant(s)**

☒ Location does not warrant signalization based on data collected.

Traffic Signal Warrant Analysis

Source: Federal Highway Administration, Manual on Uniform Traffic Control Devices, 2011.

YEAR ANALYZED 2016

Does the intersection lie within the built-up area of an isolated community having a population of less than 10,000? yes ☐ no ☒

Major Street: **MD 99 (Old Frederick Road)**
Number of lanes of moving traffic on each major street approach: **1 EB, 1 WB**
Minor Street**: Tiller Drive**
Number of lanes of moving traffic on each minor street approach: **1 NB, 1 SB**
Posted speed limit along MD 99: **40 MPH**

Warrants for Traffic Signal Installation

Traffic control signal may be justified at an intersection, driveway or mid-block pedestrian crossing, if one or more of the following warrants are satisfied:

Warrant 1, Eight-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

This warrant is satisfied when one of the following apply

Condition satisfied:

A. Minimum Vehicular Volume yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **400 vph for 70% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**
Minor Street: **120 vph for 70% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:00 AM – 07:00 AM	MD 99	447	Tiller Drive	33	yes ☐	no ☒
07:00 AM – 08:00 AM	MD 99	1485	Tiller Drive	111	yes ☐	no ☒
08:00 AM – 09:00 AM	MD 99	1196	Tiller Drive	95	yes ☐	no ☒
09:00 AM – 10:00 AM	MD 99	892	Tiller Drive	72	yes ☐	no ☒
10:00 AM – 11:00 AM	MD 99	552	Tiller Drive	40	yes ☐	no ☒
11:00 AM – 12:00 PM	MD 99	511	Tiller Drive	39	yes ☐	no ☒
12:00 PM – 01:00 PM	MD 99	579	Tiller Drive	32	yes ☐	no ☒
01:00 PM – 02:00 PM	MD 99	666	Tiller Drive	31	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	835	Tiller Drive	42	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	1115	Tiller Drive	29	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1501	Tiller Drive	35	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1466	Tiller Drive	34	yes ☐	no ☒
06:00 PM – 07:00 PM	MD 99	1430	Tiller Drive	44	yes ☐	no ☒

B. **The Interruption of Continuous Traffic** yes ☐ no ☒

For each of any 8 hours of an average day, the vehicles per hour on the major street and on the higher-volume minor street or driveway approach to the intersection equal or exceed the following:

Major Street: **600 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Minor Street: **60 vph for 80% since the major street 85th percentile speed ≤ 40 MPH, = 1 lanes on major and = 1 minor lane**

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:30 AM – 07:30 AM	MD 99	1215	Tiller Drive	83	yes ☒	no ☐
07:30 AM – 08:30 AM	MD 99	1323	Tiller Drive	107	yes ☒	no ☐
08:30 AM – 09:30 AM	MD 99	1028	Tiller Drive	85	yes ☒	no ☐
09:30 AM – 10:30 AM	MD 99	668	Tiller Drive	63	yes ☒	no ☐
10:30 AM – 11:30 AM	MD 99	538	Tiller Drive	29	yes ☐	no ☒
11:30 AM – 12:30 PM	MD 99	598	Tiller Drive	44	yes ☐	no ☒
12:30 PM – 01:30 PM	MD 99	735	Tiller Drive	25	yes ☐	no ☒
01:30 PM – 02:30 PM	MD 99	865	Tiller Drive	44	yes ☐	no ☒
02:00 PM – 03:00 PM	MD 99	835	Tiller Drive	42	yes ☐	no ☒
02:30 PM – 03:30 PM	MD 99	1316	Tiller Drive	25	yes ☐	no ☒
03:00 PM – 04:00 PM	MD 99	1115	Tiller Drive	29	yes ☐	no ☒
03:30 PM – 04:30 PM	MD 99	1511	Tiller Drive	35	yes ☐	no ☒
04:00 PM – 05:00 PM	MD 99	1501	Tiller Drive	35	yes ☐	no ☒
04:30 PM – 05:30 PM	MD 99	1497	Tiller Drive	34	yes ☐	no ☒
05:00 PM – 06:00 PM	MD 99	1466	Tiller Drive	34	yes ☐	no ☒
05:30 PM – 06:30 PM	MD 99	1193	Tiller Drive	44	yes ☐	no ☒

Warrant 2, Four-Hour Vehicular Volume **WARRANT SATISFIED:** **yes** ☐ **no** ☒

The Four-Hour Volume Warrant is satisfied when for each of any four hours of an average day, the plotted points representing the vehicles per hour on the major-street and the corresponding vehicles per hour on the higher volume minor-street all fall above the curve in Figure A since the major street 85th Percentile Speed ≤ 40 MPH. The lower threshold volume for minor street is 80 vph.

Time	Major Street	Volume	Minor Street	Volume	Requirement Satisfied	
06:30 AM – 07:30 AM	MD 99	1215	Tiller Drive	83	yes ☒	no ☐
07:30 AM – 08:30 AM	MD 99	1323	Tiller Drive	107	yes ☒	no ☐
08:30 AM – 09:30 AM	MD 99	1028	Tiller Drive	85	yes ☒	no ☐
09:30 AM – 10:30 AM	MD 99	668	Tiller Drive	63	yes ☐	no ☒
10:30 AM – 11:30 AM	MD 99	538	Tiller Drive	29	yes ☐	no ☒
11:30 AM – 12:30 PM	MD 99	598	Tiller Drive	44	yes ☐	no ☒
12:30 PM – 01:30 PM	MD 99	735	Tiller Drive	25	yes ☐	no ☒
01:30 PM – 02:30 PM	MD 99	865	Tiller Drive	44	yes ☐	no ☒
02:30 PM – 03:30 PM	MD 99	1316	Tiller Drive	25	yes ☐	no ☒

03:30 PM – 04:30 PM	MD 99	1511	Tiller Drive	35	yes ☐	no ☒
04:30 PM – 05:30 PM	MD 99	1497	Tiller Drive	34	yes ☐	no ☒
05:30 PM – 06:30 PM	MD 99	1193	Tiller Drive	44	yes ☐	no ☒
06:30 PM – 07:30 PM	MD 99	273	Tiller Drive	22	yes ☐	no ☒

Warrant 3, Peak Hour **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when either of the following two categories apply:

A. If all of the following conditions exist for the same 1 hour of an average day: yes ☐ no ☒

Condition satisfied

1. The total delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equal or exceeds: four vehicle-hours for one lane approach; and five vehicle –hours for two--lane approach, and yes ☐ no ☒

2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vph for one moving lane of traffic or 150 vph for two moving lanes of traffic, and yes ☐ no ☒

3. The total entering volume serviced during the hour equals or exceeds 650 vph for intersections with three approaches or 800 vph for intersections with four or more approaches. yes ☐ no ☒

B. The plot of vehicles per hour on the major street and the corresponding vehicles per hour on the higher-volume minor-street approach for 1 hour of average day falls above the applicable curve in Figure C (major street 85th percentile speed ≤ 40 mph) for the combination of approach lanes. yes ☐ no ☒

Warrant 5, School Crossing **WARRANT SATISFIED:** **yes ☐ no ☒**

This warrant is satisfied when the study of the frequency and adequacy of gaps in vehicular traffic stream as related to number and size of groups of school children at an established school crossing across a major street shows that the number of adequate gaps in the traffic stream during the period when children are using the crossing is less than the number of minutes in the same period and that there are a minimum of twenty (20) students during the highest crossing hour.

Though Warrant 5 is not satisfied, it should be noted that the intersection is in the walkshed of Mount Hebron High School.

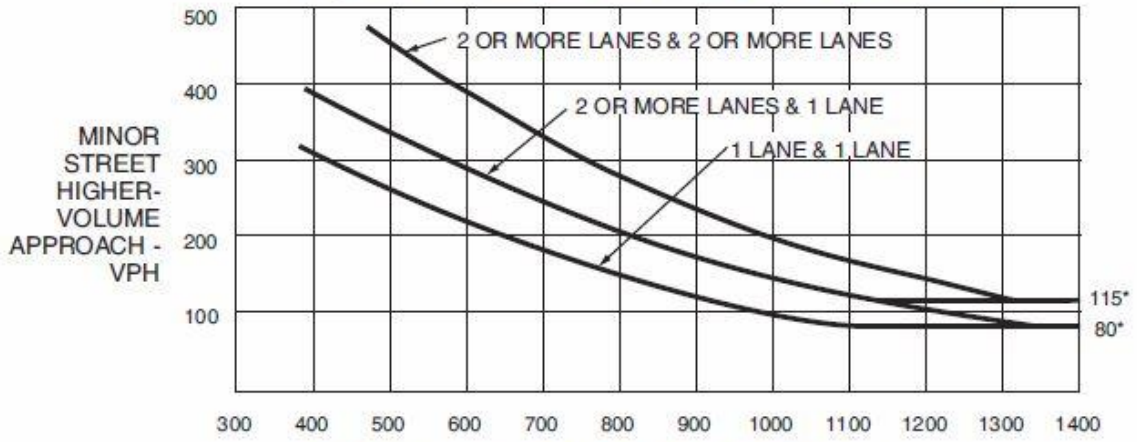
Warrant 7, Crash Experience	**WARRANT SATISFIED:**	**yes** ☐	**no** ☒

Review of the three year accident report shows 5 crashes. At least two of the crashes could have been prevented by a signalized intersection.

This warrant is satisfied when the following apply:

		Condition satisfied:
1.	Adequate trial of alternatives, with satisfactory observance and enforcement has failed to reduce the crash frequency and	yes ☐ no ☒
2.	Five or more reported crashes, of types susceptible to correction by traffic control signal; have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for reportable crashes and	yes ☐ no ☒
3.	There exists a volume of vehicle and pedestrian traffic not less than 56% (major street 85th percentile speed > 40 mph) or 80% of the requirements Specified in Warrant 1 or Warrant 5, respectively.	yes ☐ no ☒

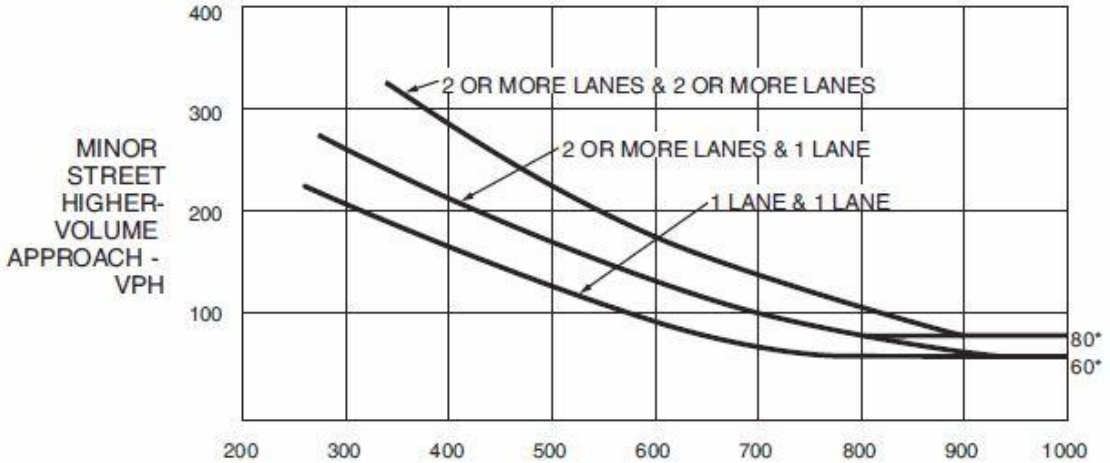
Figure A. Warrant 2, Four-Hour Vehicular Volume



*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

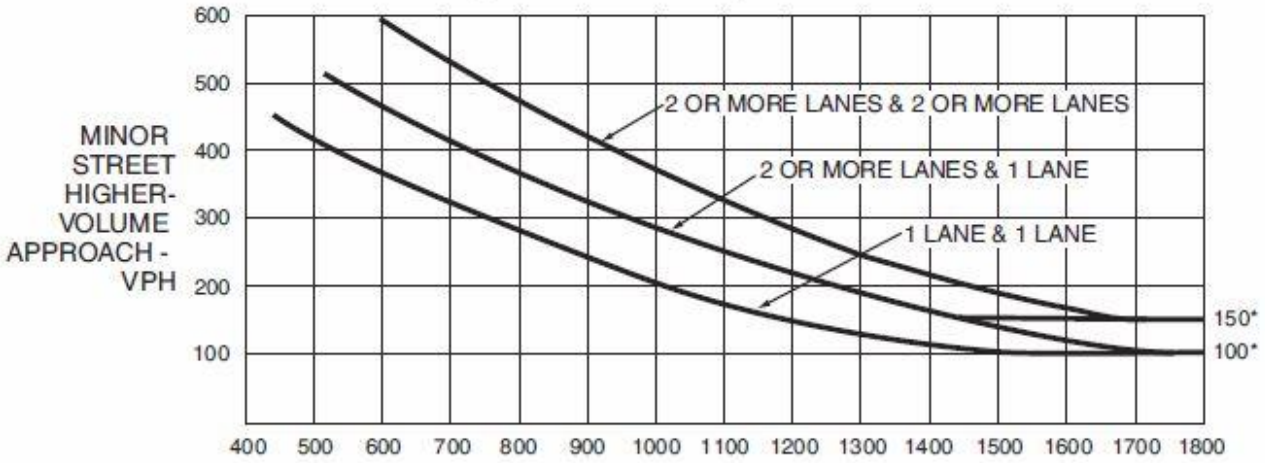
Figure B. Warrant 2, Four-Hour Vehicular Volume (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

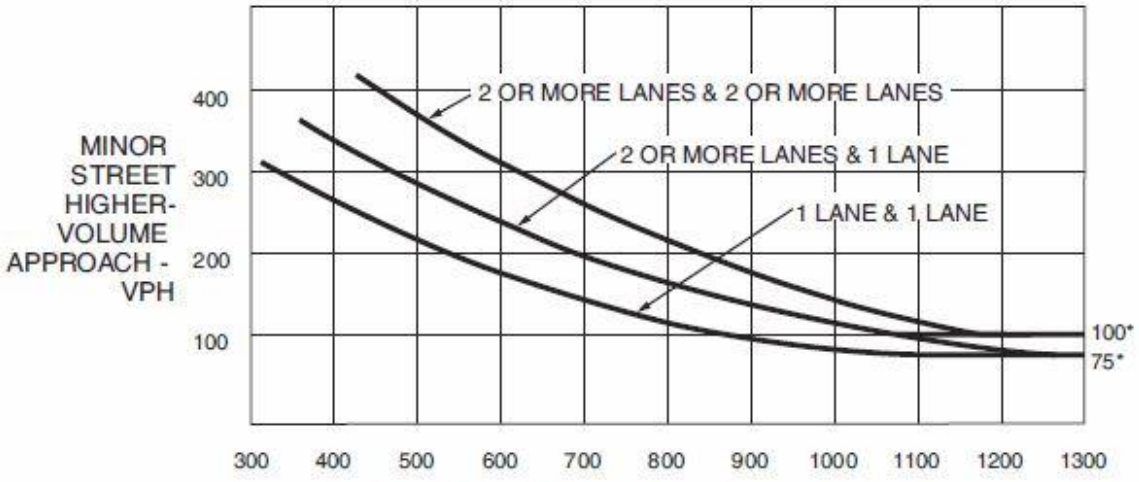
Figure C. Warrant 3, Peak Hour



*Note: 150 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 100 vph applies as the lower threshold volume for a minor-street approach with one lane.

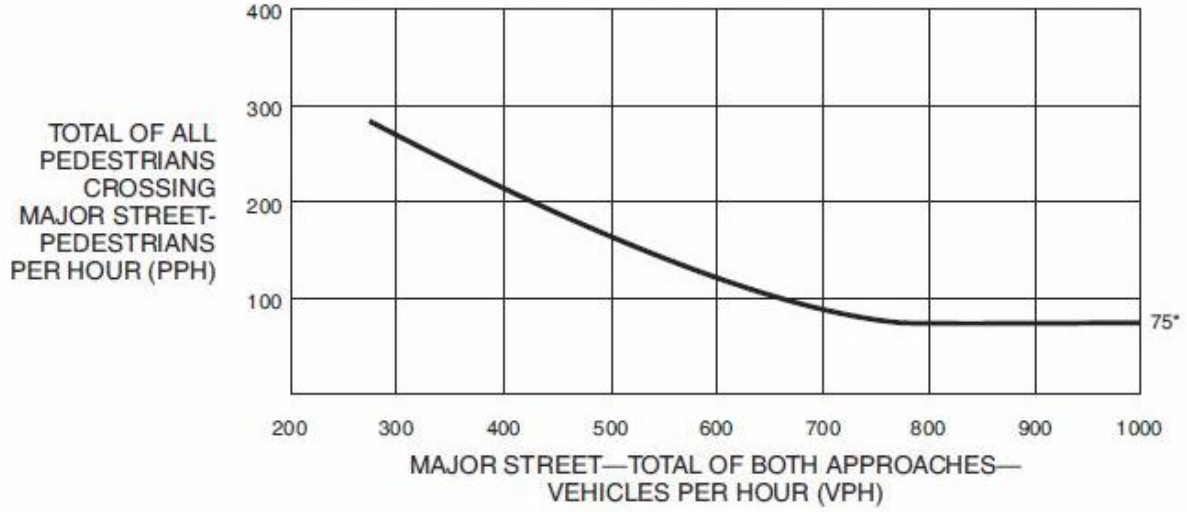
Figure D. Warrant 3, Peak Hour (70% Factor)

(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 40 MPH ON MAJOR STREET)



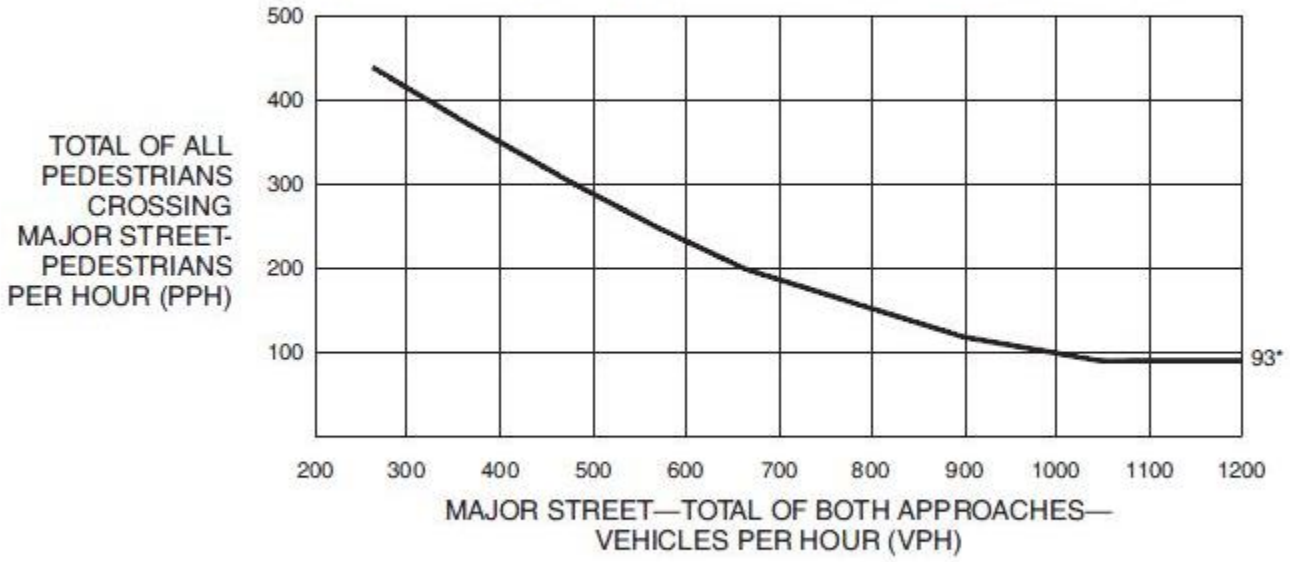
*Note: 100 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 75 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure E. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



*Note: 75 pph applies as the lower threshold volume.

Figure F. Warrant 4, Pedestrian Peak Hour (70% Factor)



*Note: 93 pph applies as the lower threshold volume.