Traffic Signal Warrants
(MUTCD 2009, 2nd Update)

CIVL 4162/6162
Traffic Signals

- **Warrants**
  - Warrant 1, Eight-Hour Vehicular Volume.
  - Warrant 2, Four-Hour Vehicular Volume.
  - Warrant 3, Peak Hour.
  - Warrant 4, Pedestrian Volume.
  - Warrant 5, School Crossing.
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  - Warrant 9, Highway-Rail Crossings
Note

• 70% factors are not shown in this presentation
  - 85th percentile speed exceeds 45 mph
  - An intersection is located in the built up area of an isolated community Population less than 10,000
Warrant-1: 8-Hour Vehicular Volume

The need for a traffic control signal shall be considered if an engineering study finds that one of the following conditions exist for each of any 8 hours of an average day:

- **A.** The vehicles per hour given in both of the 100 percent columns of Condition A in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection; or

- **B.** The vehicles per hour given in both of the 100 percent columns of Condition B in Table 4C-1 exist on the major-street and the higher-volume minor-street approaches, respectively, to the intersection.
Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

**Condition A—Minimum Vehicular Volume**

<table>
<thead>
<tr>
<th>Number of lanes for moving traffic on each approach</th>
<th>Vehicles per hour on major street (total of both approaches)</th>
<th>Vehicles per hour on higher-volume minor-street approach (one direction only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Street</td>
<td>Minor Street</td>
<td>100%&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>500</td>
</tr>
<tr>
<td>2 or more</td>
<td>1</td>
<td>600</td>
</tr>
<tr>
<td>2 or more</td>
<td>2 or more</td>
<td>600</td>
</tr>
<tr>
<td>1</td>
<td>2 or more</td>
<td>500</td>
</tr>
</tbody>
</table>

**Condition B—Interruption of Continuous Traffic**

<table>
<thead>
<tr>
<th>Number of lanes for moving traffic on each approach</th>
<th>Vehicles per hour on major street (total of both approaches)</th>
<th>Vehicles per hour on higher-volume minor-street approach (one direction only)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Major Street</td>
<td>Minor Street</td>
<td>100%&lt;sup&gt;a&lt;/sup&gt;</td>
</tr>
<tr>
<td>1</td>
<td>1</td>
<td>750</td>
</tr>
<tr>
<td>2 or more</td>
<td>1</td>
<td>900</td>
</tr>
<tr>
<td>2 or more</td>
<td>2 or more</td>
<td>900</td>
</tr>
<tr>
<td>1</td>
<td>2 or more</td>
<td>750</td>
</tr>
</tbody>
</table>

<sup>a</sup> Basic minimum hourly volume
<sup>b</sup> Used for combination of Conditions A and B after adequate trial of other remedial measures
<sup>c</sup> May be used when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000
<sup>d</sup> May be used for combination of Conditions A and B after adequate trial of other remedial measures when the major-street speed exceeds 40 mph or in an isolated community with a population of less than 10,000
Warrant-2: Four Hour Vehicular Volume

- The need for a traffic control signal shall be considered if an engineering study finds that, for each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) all fall above the applicable curve in Figure 4C-1 for the existing combination of approach lanes. On the minor street, the higher volume shall not be required to be on the same approach during each of these 4 hours.
Figure 4C-1. 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.
Warrant-3: Peak Hour

The need for a traffic control signal shall be considered if an engineering study finds that the criteria in *either of the following two categories are met*:

- **A.** If all three of the following conditions exist for the same 1 hour (any four consecutive 15-minute periods) of an average day:
  - 1. The total stopped time delay experienced by the traffic on one minor-street approach (one direction only) controlled by a STOP sign equals or exceeds: 4 vehicle-hours for a one-lane approach or 5 vehicle-hours for a two-lane approach; and
  - 2. The volume on the same minor-street approach (one direction only) equals or exceeds 100 vehicles per hour for one moving lane of traffic or 150 vehicles per hour for two moving lanes; and
  - 3. The total entering volume serviced during the hour equals or exceeds 650 vehicles per hour for intersections with three approaches or 800 vehicles per hour for intersections with four or more approaches.

- **B.** The plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the higher-volume minor-street approach (one direction only) for 1 hour (any four consecutive 15-minute periods) of an average day falls above the applicable curve in Figure 4C-3 for the existing combination of approach lanes.
Figure 4C-3. Warrant 3, Peak Hour

MINOR STREET HIGHER-VOLUME APPROACH - VPH

MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*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.
Warrant-4: Pedestrian Volume

The need for a traffic control signal at an intersection or midblock crossing shall be considered if an engineering study finds that one of the following criteria is met:

- A. For each of any 4 hours of an average day, the plotted points representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) all fall above the curve in Figure 4C-5; or

- B. For 1 hour (any four consecutive 15-minute periods) of an average day, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding pedestrians per hour crossing the major street (total of all crossings) falls above the curve in Figure 4C-7.
Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

TOTAL OF ALL PEDESTRIANS CROSSING MAJOR STREET—PEDESTRIANS PER HOUR (PPH)

MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 107 pph applies as the lower threshold volume.
Figure 4C-7. Warrant 4, Pedestrian Peak Hour

TOTAL OF ALL PEDESTRIANS CROSSING MAJOR STREET—PEDESTRIANS PER HOUR (PPH)

MAJOR STREET—TOTAL OF BOTH APPROACHES—VEHICLES PER HOUR (VPH)

*Note: 133 pph applies as the lower threshold volume.
Warrant-5: School Crossing

- The need for a traffic control signal shall be considered when an engineering study of the frequency and adequacy of gaps in the vehicular traffic stream as related to the number and size of groups of schoolchildren at an established school crossing across the major street shows that the number of adequate gaps in the traffic stream during the period when the schoolchildren are using the crossing is less than the number of minutes in the same period (see Section 7A.03) and there are a minimum of 20 schoolchildren during the highest crossing hour.
Warrant-6: Coordinated Signal System

- The need for a traffic control signal shall be considered if an engineering study finds that one of the following criteria is met:
  - A. On a one-way street or a street that has traffic predominantly in one direction, the adjacent traffic control signals are so far apart that they do not provide the necessary degree of vehicular platooning.
  - B. On a two-way street, adjacent traffic control signals do not provide the necessary degree of platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.
Warrant-7: Crash Experience

• The need for a traffic control signal shall be considered if an engineering study finds that all of the following criteria are met:
  - A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and
  - B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period, each crash involving personal injury or property damage apparently exceeding the applicable requirements for a reportable crash; and
  - C. For each of any 8 hours of an average day, the vehicles per hour (vph) given in both of the 80 percent columns of Condition A in Table 4C-1 (see Section 4C.02), or the vph in both of the 80 percent columns of Condition B in Table 4C-1 exists on the major-street and the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80 percent of the requirements specified in the Pedestrian Volume warrant. These major-street and minor-street volumes shall be for the same 8 hours. On the minor street, the higher volume shall not be required to be on the same approach during each of the 8 hours.
Warrant-8: Roadway Network

- The need for a traffic control signal shall be considered if an engineering study finds that the common intersection of two or more major routes meets one or both of the following criteria:
- A. The intersection has a total existing, or immediately projected, entering volume of at least 1,000 vehicles per hour during the peak hour of a typical weekday and has 5-year projected traffic volumes, based on an engineering study, that meet one or more of Warrants 1, 2, and 3 during an average weekday; or
- B. The intersection has a total existing or immediately projected entering volume of at least 1,000 vehicles per hour for each of any 5 hours of a non-normal business day (Saturday or Sunday). A major route as used in this signal warrant shall have at least one of the following characteristics:
  - A. It is part of the street or highway system that serves as the principal roadway network for through traffic flow.
  - B. It includes rural or suburban highways outside, entering, or traversing a city.
  - C. It appears as a major route on an official plan, such as a major street plan in an urban area traffic and transportation study.
Warrant-9: Intersection Near a Grade Crossing

• The need for a traffic control signal shall be considered if an engineering study finds that both of the following criteria are met:
  - A. A grade crossing exists on an approach controlled by a STOP or YIELD sign and the center of the track nearest to the intersection is within 140 feet of the stop line or yield line on the approach; and
  - B. During the highest traffic volume hour during which rail traffic uses the crossing, the plotted point representing the vehicles per hour on the major street (total of both approaches) and the corresponding vehicles per hour on the minor-street approach that crosses the track (one direction only, approaching the intersection) falls above the applicable curve in Figure 4C-9 or 4C-10 for the existing combination of approach lanes over the track and the distance D, which is the clear storage distance as defined in Section 1A.13.
Figure 4C-9. Warrant 9, Intersection Near a Grade Crossing
(One Approach Lane at the Track Crossing)

* 25 vph applies as the lower threshold volume
** VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate
Figure 4C-10. Warrant 9, Intersection Near a Grade Crossing (Two or More Approach Lanes at the Track Crossing)

* 25 vph applies as the lower threshold volume
** VPH after applying the adjustment factors in Tables 4C-2, 4C-3, and/or 4C-4, if appropriate