MUTCD Warrants for Traffic Signals

Participant Learning Guide
A Companion to the On-Demand Learning Module

https://vimeo.com/ctt2center/review/458681482/868fa09cfd
Description
This course provides an overview of Part 4C of the Manual of Uniform Traffic Control Devices (MUTCD) which outlines the warrants for installing traffic signals. Participants will learn about the alternatives to installing a traffic signal, the requirements of each of the nine warrants, and the Connecticut Department of Transportation (CT DOT) process for approving traffic signals. No prior knowledge required.

Target Audience
Entry-level municipal traffic signal technicians, engineers, and decision-makers involved in the planning, design, operation, or maintenance of traffic signals

Alternatives to Traffic Signals
- Improve sight distance
  - Relocate stop bar closer to the intersection so the driver may view approaching traffic more easily
- Install signs
  - Intersection Conflict Warning System may reduce failure to yield
  - LED Stop Sign (MUTCD Section 2A.08) may reduce failure to stop
  - Supplement signs with flashing beacon may reduce failure to stop
  - Convert 2-way stop to all-way stop (MUTCD Section 2B.05-2B.07)
- Lower approach speeds
  - Traffic calming may reduce crashes related to speed (right angle, rear-end, turning)
- Roundabout
  - Reduces speeds and number of conflict points
- Lighting
  - Illuminating areas of stop signs and crosswalks may reduce nighttime crashes
- Geometric Treatments
  - Left-turn bypass lane may reduce rear-end collisions
  - Pedestrian refuge islands improve pedestrian safety

Engineering Study
- Data:
  - Vehicles entering in each hour during 12 hours of an average day
  - Turning movement volumes for peak hours (2 hours in the morning, 2 hours in the afternoon)
  - Pedestrian volumes during counts in (b) and peak ped period.
  - Nearby Activity Centers that serve young, elderly, those with disabilities
    - Senior Centers
    - Schools
    - Requests for accommodation
  - Speed limit or 85th percentile speed
    - Radar ATR (Automatic Traffic Recorder) equipment is available to borrow through the T2 Center’s Equipment Loan Program
- Diagram of intersection
  - Geometrics
  - Channelization
  - Grades
  - ISD restrictions
  - Transit stops and routes
  - Parking
  - Pavement markings
  - Lighting
  - Driveways
  - Railroad crossings
  - Distance to nearest signals
  - Utilities
  - Adjacent land uses
- Collision Diagram
  - UConn Crash Data Repository

**Warrant Analysis**
- A signal should not be installed unless one or more warrants are met.
- The satisfaction of a warrant shall not in itself require the installation of a signal.
- Site-specific characteristics should dictate whether an approach is considered as one lane or two lanes for a warrant.
- Volume estimates from a traffic study should be used for new developments.
- While a summary of each warrant is provided below, refer to MUTCD Part 4C for more detail.

**Warrant 1 - Eight-Hour Vehicular Volume**
- Volumes must meet the requirements in Table 4C-1 for each of any eight hours during a typical day (not required to be consecutive).
- Must meet Condition A or Condition B for each of the eight hours.
  - Condition A
    - A large volume of intersecting traffic
  - Condition B
    - Traffic on minor street suffers from excessive delay
- Combined A and B
  - Only after other alternatives considered
  - Use 80 percent column
- Volumes not required to be on the same minor street approach during each of the 8 hours.
- For an 85th percentile speed greater than 40 mph or an isolated community with a population less than 10,000, lower volume thresholds may be used. See MUTCD for details.

**Warrant 2 - Four Hour Vehicular Volume**
Plotted volumes fall above the curve in Figure 4C-1 for each of any 4 hours during a typical day (don’t need to be consecutive).

Volumes not required to be on the same minor street approach during all four hours.

For an 85th percentile speed greater than 40 mph or an isolated community with a population less than 10,000, Figure 4C-2 may be used.

### Warrant 3 – Peak Hour

- For use where minor street suffers undue delay for at least an hour.
- Typically used for what we call Major Traffic Generators in CT:
  - Office complexes
  - Manufacturing Plants
  - Industrial complexes
  - High-Occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time
- Must meet either Condition A or B.
- **Condition A** (meet all three)
  - Total stopped delay on one minor-street approach at stop sign equals or exceeds 4 veh-hrs for one lane or 5 veh-hrs for two lanes.
  - Same minor street approach equals or exceeds 100 veh/hr for one lane or 150 vph for two lanes.
  - Total entering volume equals or exceeds 650 veh/hr for 3 approaches or 800 veh/hr for 4 or more approaches.
- **Condition B**
  - Plotted volumes fall above the curve in Figure 4C-3 for existing approach lanes.
  - For an 85th percentile speed greater than 40 mph or an isolated community with a population less than 10,000, use Figure 4C-4.
  - If this is the only warrant met, the signal should be actuated.

### Warrant 4 – Pedestrian Volume

- Must meet Condition A or B
- **Condition A**
  - For any 4 hours, the plotted volumes fall above the curve in Figure 4C-5.
  - For an 85th percentile speed greater than 35 mph or an isolated community with a population less than 10,000, use Figure 4C-6
- **Condition B**
  - For 1 hour (any 4 consecutive 15-min. periods), plotted point falls above 4C-7.
- Shall not be applied at locations where the distance to the nearest signal or stop sign is less than 300 feet unless the signal will not restrict progression.
- If this warrant is met, the signal shall be equipped with ped heads.
- Additional guidance is provided based on location:
• Intersection
• Non-intersection crossing
• May not be needed if a coordinated system provides adequate gaps
• Required ped volume may be less for lower crossing speeds (elderly pop.)

Warrant 5 – School Crossing
 • Appropriate where school children cross the major street.
   • Number of adequate gaps in the traffic stream during the period when the school children are using the crossing is less than the number of minutes in the same period and
   • Minimum of 20 school children during the highest crossing hour
 • Consideration should be given to other remedial measures.
   • Warning signs and flashers
   • School speed zones
   • Crossing Guards
   • Grade-separated crossing
 • Shall not be applied at locations where the distance to the nearest signal or stop sign is less than 300 feet unless the signal will not restrict progression.
 • Additional guidance is provided based on location.

Warrant 6 – Coordinated Signal System
 • For use when either Condition A or Condition B is met.
   • Condition A: One-way street or predominantly one direction of travel and signals are too far apart for platooning
   • Condition B: Two-way travel does not provide adequate platooning and proposed and adjacent signals will collectively provide progressive platooning.
 • Should not be applied where spacing would be less than 1,000 feet

Warrant 7 – Crash Experience
 • For use when all of the following conditions are met:
   • Other alternatives have failed to reduce crash frequency
   • Five or more crashes of types susceptible to correction by a signal in 12 month period, each with personal injury or property damage
   • For each of any 8 hours, volumes in both of the 80 percent columns of Condition A in Figure 4C-1 or both of the 80 percent columns of condition B in Figure 4C-1 or ped traffic not less than 80 percent of ped warrant.
 • For an 85th percentile speed greater than 40 mph or an isolated community with a population less than 10,000, the 56 percent columns in Figure 4C-1 may be used.

Warrant 8 – Roadway Network
For use when volumes at an intersection of two or more major routes meet both Condition A and Condition B.

**Condition A**
- Entering vol of at least 1,000 vehicles per hour during peak hour and 5 yr projected volumes that meet one or more of warrants 1, 2 and 3

**Condition B**
- Entering volume of at least 1,000 vehicles per hour for each of any 5 hours during a non-normal business day (Sat or Sun)

The major route should have at least one of the following characteristics:
- Part of a system that serves a principal network for through flow.
- Includes rural or suburban highways outside, entering or traversing a city.
- Appears as a major route on an official plan.

### Warrant 9 – Intersection near a grade crossing

For use where no other warrants are met but the location is proximate to railroad tracks.

Should be applied only after considering other alternatives
- Additional pavement to provide for an evasive maneuver
- Make approach across the track a non-stopping approach

For use when both Condition A and Condition B are met.

**Condition A**
- Approach controlled by stop or yield and center of track nearest intersection is within 140 feet of stop or yield line

**Condition B**
- During the highest volume hour of rail traffic, the plotted point is above the curve in Figure 4C-9 or Figure 4C-10.

If warranted, the minor street shall have actuation

Pre-emption control shall be provided.

Grade crossing shall have flashing-light signals.

### Traffic Signal Application

If a traffic signal warrant is met and the agency decides to install a traffic signal, a traffic signal application must be submitted to the Office of the State Traffic Administration (OSTA).

### Resources

**MUTCD**
https://mutcd.fhwa.dot.gov/

**Intersection Safety Strategies (FHWA)**
Office of the State Traffic Administration
Approved Speed Limits, Traffic Signal Application

University of Connecticut Crash Data Repository
Search for crashes by intersection location
https://www.ctcrash.uconn.edu/

Contact Information
Traffic Signal Circuit Rider
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860 486 4532
https://t2center.uconn.edu/TechnicalAssistance/TrafficSignalCircuitRider/

Don’t forget to take the Participant Evaluation to receive one hour of Signal Academy credit!

https://www.surveymonkey.com/r/2LYFWBV