

October, 2014

Traffic Signal Warrant Assessment Washington Avenue/Fox Street/Walnut Street Intersection Portland, Maine

TRAFFIC SIGNAL WARRANT ASSESSMENT

The traffic signal warrant analysis follows the guidelines presented in the 2009 edition of the Manual on Uniform Traffic Control Devices (MUTCD) in Chapter 4C. The MUTCD provides nine separate traffic signal warrants, whereby, prevailing conditions at an intersection can be evaluated to determine if sequenced traffic signals are warranted. Each of the nine warrants is listed as follows:

- Warrant 1 – Eight Hour Vehicular Volume
- Warrant 2 – Four Hour Vehicular Volume
- Warrant 3 – Peak Hour
- Warrant 4 – Pedestrian Volume
- Warrant 5 – School Crossing
- Warrant 6 – Coordinated Signal System
- Warrant 7 – Crash Experience
- Warrant 8 – Roadway Network
- Warrant 9 – Intersection near a Grade Crossing

The federal publication clearly states that, “*the satisfaction of a traffic signal warrant or warrants shall not in itself require the installation of a traffic control signal*”. Guidance is specifically provided in the MUTCD on the conduct of the required engineering study and the judgment required in completing the signal warrant assessment. The direction provided, specific to prevailing conditions found at the study intersection, is summarized as follows:

A traffic signal should not be installed unless an engineering study indicates that the signal will improve the overall safety and/or operation of the intersection.

A signal should not be installed if it will seriously disrupt traffic flow.

Estimated 2014 “Average” Hourly Traffic Data: The federal MUTCD publication specifically states that the determination of traffic signal justification must be based upon “*average*” travel conditions. MaineDOT provides weekly group mean factors for multiple roadway classifications for the full state highway system based upon their extensive annual traffic count program. MaineDOT has established that the section of Washington Avenue and both Walnut and Fox Streets at the noted intersection are Group I roadways, which are defined as urban roadways or those roads that typically see commuter traffic and experience little fluctuation from week to week throughout the year. MaineDOT’s annual count program suggests that the last week in October, during a typical year is generally representative of “*average*” travel conditions (MaineDOT’s weekly mean factor for the week of October 27 is 0.97).

Accordingly, a manual traffic turning movement count was conducted at the subject intersection on Tuesday, October 28, 2014. The traffic data survey recorded all vehicular and pedestrian traffic entering the intersection in 15-minute intervals between the hours of 6:00AM and 6:00PM consistent with the MaineDOT’s policy in the performance of a traffic signal warrant study (A copy of the data summary is

attached for reference). Table 1 below presents the collected data in a summary format for the traffic signal warrant assessment:

Table 1
Traffic Signal Warrant Study
“Average” Conditions - Vehicular and Pedestrian Volumes
(Washington Avenue/Fox Street/Walnut Street Intersection)

<u>Time of Day</u>	<u>Major Street Volume⁽¹⁾</u> <u>(Both Approaches</u> <u>Washington Avenue)</u>	<u>Minor Street</u> <u>Volume⁽²⁾</u> <u>Fox Street</u>	<u>Minor Street</u> <u>Volume⁽²⁾</u> <u>Walnut Street</u>	<u>Pedestrian Volumes</u> <u>Crossing Washington</u> <u>Avenue</u>
6:00 - 7:00AM	359	59	59	0
7:00 - 8:00AM	698	91	87	7
8:00 - 9:00AM	921	95	116	6
9:00 - 10:00AM	551	73	69	5
10:00 - 11:00AM	539	97	48	11
11:00 - 12:00PM	509	97	55	8
12:00 - 1:00PM	601	109	61	22
1:00 - 2:00PM	608	133	55	25
2:00 - 3:00PM	587	118	75	11
3:00 - 4:00PM	680	131	61	6
4:00 - 5:00PM	801	125	47	13
5:00 - 6:00PM	674	96	54	12

Notes:

⁽¹⁾ Washington Avenue has been defined as the “major” street.

⁽²⁾ Minor Street approaches are both Fox Street and Walnut Street. All right-turn movements were included in hourly Minor Street volumes.

Traffic Safety Data: The Washington Avenue/Walnut Street/Fox Street intersection meets MaineDOT’s criteria for a high crash location. A total of 9 crashes and a Critical Rate Factor (CRF) of 1.98 were reported for the intersection. A more in-depth review (preparation of detailed vehicle collision diagrams) was prepared for the intersection to determine if a clear pattern of accident is occurring (Copies of the Collision Diagrams are attached as an appendix to the report).

The detailed review of the vehicle crash reports for the intersection would suggest two clear patterns of concern: 1) four of the nine accidents involved vehicles on the Fox Street approach turning left onto Washington Avenue being struck by thru vehicles traveling eastbound on Washington Avenue; 2) the second pattern, with a total of three collisions, involved vehicles approaching Washington Avenue from Walnut Street sliding through the intersection striking a thru vehicle on Washington Avenue.

Traffic Signal Warrant Analyses: The assessment was conducted for Warrants 1, 2, 3, 4 and 7; the remaining warrants were considered not applicable for conditions found at the subject intersection. Each of the five traffic signal warrants used in the analyses are briefly described below followed by a determination of whether forecast conditions meet or fail required conditions.

Warrant 1: Eight Hour Vehicular Volume

Condition A - Warrant requires 500 vehicles per hour on major roadway (combination of both directions) and a total of 150 vehicles per hour on the highest minor street approach.

Condition B - Warrant requires 750 vehicles per hour on major roadway (combination of both directions) and a total of 75 vehicles per hour on the highest minor street approach.

Condition A+B - Warrant requires 80% of values stated for both Conditions A & B.

Warrant Not Satisfied Condition A: Hourly volumes on either side street below minimum value of 150 vehicles for eight hour time period.

Warrant Not Satisfied Condition B: Hourly volumes on major street below minimum value of 775 vehicles for eight hour time period.

Warrant Not Satisfied Condition A+B: Hourly volumes on both major and minor streets below minimum values for eight hour time period.

Warrant 2: Four Hour Vehicular Volume

If travel conditions for any four hours of an average day representing the volume per hour on the major street and the corresponding vehicles per hour on the higher volume minor street approach all fall above the applicable curve in Figure 4C-1 (Refer to attached Figure 4C-1 with plotted points).

Warrant Not Satisfied: All points on Figure 4C-1 fall below applicable curve.

Warrant 3: Peak Hour

If travel conditions for one hour of an average day representing the volume per hour on the major street and the corresponding vehicles per hour on the higher volume minor street approach fall above the applicable curve in Figure 4C-3. (Refer to attached Figure 4C-3 with plotted points).

Warrant Not Satisfied: All points on Figure 4C-3 fall below applicable curve.

Warrant 4: Pedestrian Volume

The need for a traffic signal shall be considered if study finds that one of the following criteria is met:

A. For each of any 4 hours of an “average” day the volume of vehicles on major street and the volume of pedestrians crossing street all fall above curve in Figure 4C-5 or,

B. For 1 hour (any four consecutive 15-minute periods) of an “average” day the volume of vehicles on major street and the volume of pedestrians crossing major street falls above curve in Figure 4C-7.

Warrant Not Satisfied Condition A: All points on Figure 4C-5 fall below applicable curve.

Warrant Not Satisfied Condition B: All points on Figure 4C-7 fall below applicable curve.

Warrant 7: Crash Experience

Each of the following criteria must be met to consider the need for a traffic control signal:

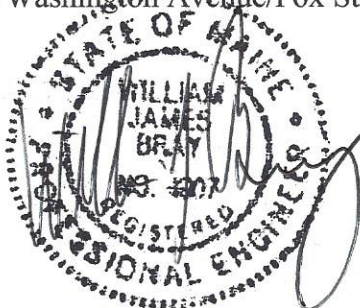
A. Adequate trial of alternatives with satisfactory observance and enforcement has failed to reduce the crash frequency; and

B. Five or more reported crashes, of types susceptible to correction by a traffic control signal, have occurred within a 12-month period; and

C. For each of any 8 hours of an average day, the vehicles per hour given in the 80% column for Condition A in Table 4C-1, or the vph in both of the columns of Condition B in Table 4C-1 exists on both the major and minor street approaches.

Warrant Not Satisfied: Criteria B isn't met, only four crashes reported by MaineDOT meet standard. Criteria C traffic volume requirement of 80% of values for Condition A and B stated in Warrant 1 above are not met for eight hours of an average day.

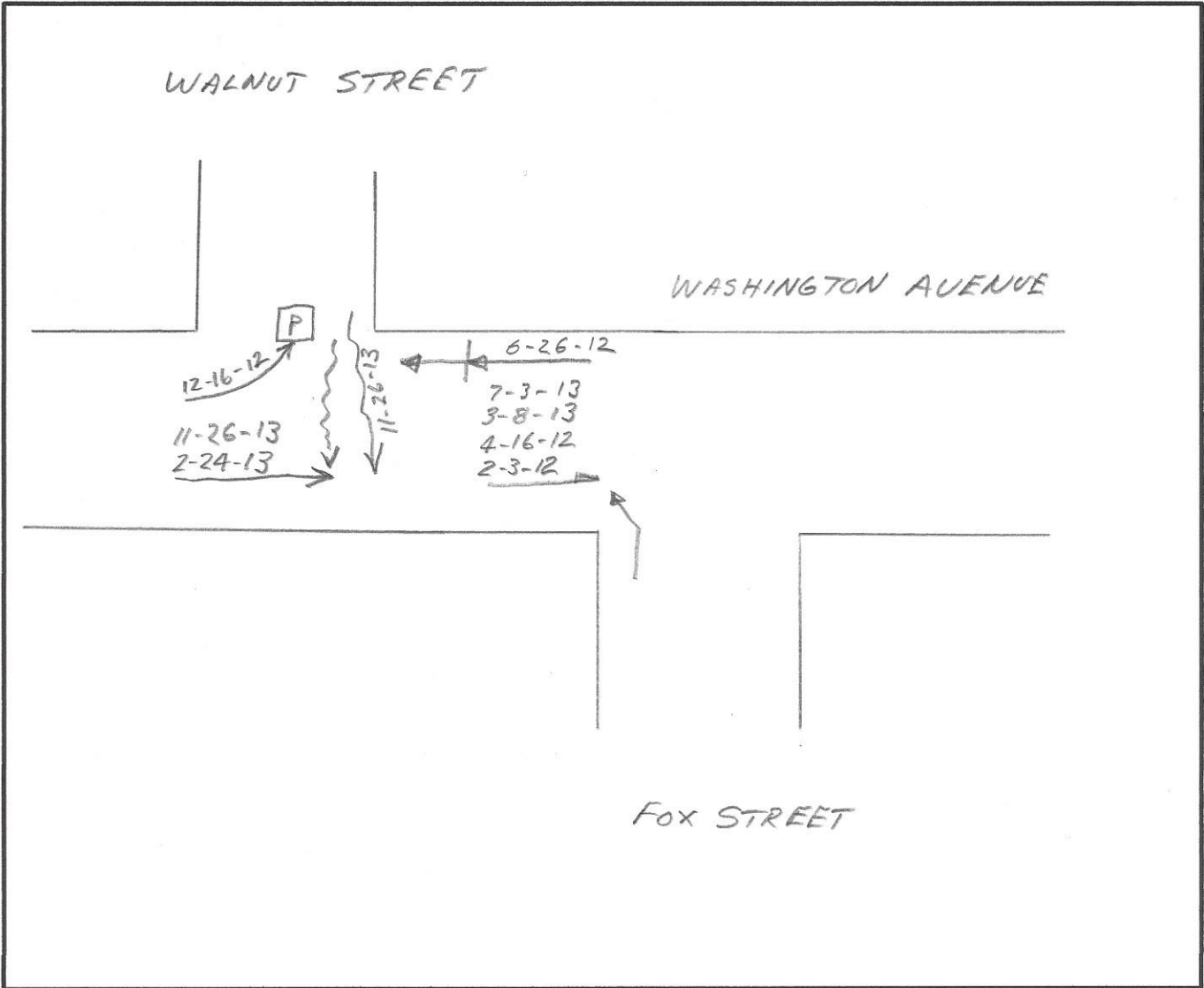
In summary, based upon the presentation of facts stated above, sequenced traffic control signals are not warranted at the Washington Avenue/Fox Street/Walnut Street intersections.



COLLISION DIAGRAM

SHEET 1 OF 2

LOCATION WASHINGTON AVE./WALNUT ST./FOX ST.
 TOWN PORTLAND NODE NO(S) P18879
 YEARS REVIEWED 2011-2014 DATE PREPARED 8-23-2014



CRITICAL RATE FACTOR _____ EQUIV. PROP. DAMAGE ACC/YEAR _____ ACC/MEV _____

LIGHT

- | | | |
|-------------------------|-------------------------|--------------------------|
| 1. DAWN (MORNING) | 2. DAYLIGHT | 3. DUSK (EVENING) |
| 4. DARK (ST. LIGHTS ON) | 5. DARK (NO ST. LIGHTS) | 6. DARK (ST. LIGHTS OFF) |
| 7. OTHER | | |

ROAD SURFACE

- | | | |
|---------------------------|--------------------------|-----------------------------|
| 1. DRY | 2. WET | 3. SNOW/SLUSH-SANDED |
| 4. ICE/PACKED SNOW-SANDED | 5. MUDDY | 6. DEBRIS |
| 7. OILY | 8. SNOW/SLUSH-NOT SANDED | 9. ICE-PKD. SNOW-NOT SANDED |
| 10. OTHER | | |

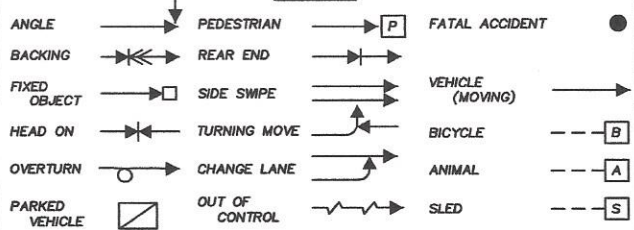
APPARENT CONTRIBUTING FACTORS - HUMAN

- | | | |
|--------------------------------------|-------------------------------------|--------------------------------------|
| 1. NO IMPROPER ACTION | 2. FAIL TO YLD. RIGHT OF WAY | 3. ILLEGAL UNSAFE SPEED |
| 4. FOLLOW TOO CLOSE | 5. DISREGARD TRAFFIC CONTROL DEVICE | |
| 6. DRIVING LEFT OF CENTER-NO PASSING | 7. IMPROPER PASS-OVERTAKING | |
| 8. IMP. UNSAFE LANE CHANGE | 9. IMP. PARKING START/STOP | 10. IMPROPER TURN |
| 11. UNSAFE BACKING | 12. NO SIGNAL OR IMP. SIGNAL | 13. IMPEDING TRAFFIC |
| 14. DRIVER INATTENTION-DISTRACTION | 15. DRIVER INEXPERIENCE | |
| 16. PEDEST. VIOLATION ERROR | 17. PHYSICAL IMPAIRMENT | 18. VISION OBSCURED-WINDSHIELD GLASS |
| 19. VISION OBSCURED-SUN/HEADLIGHTS | | |
| 20. OTHER VISION OBSCUREMENT | 30. OTHER HUMAN VIOLATION FACTOR | |
| 31. HIT AND RUN | 51. UNKNOWN | |

- VEHICULAR

- | | | |
|------------------------------------|----------------------------|--------------------------|
| 41. DEFECTIVE BRAKES | 42. DEFECTIVE TIRE/FAILURE | 43. DEFECTIVE LIGHTS |
| 44. DEFECTIVE SUSPENSION OR FACTOR | 45. DEFECTIVE STEERING | 50. OTHER VEHICLE DEFECT |
| | 51. UNKNOWN | |

SYMBOLS



C = CLEAR
SL = SLEET

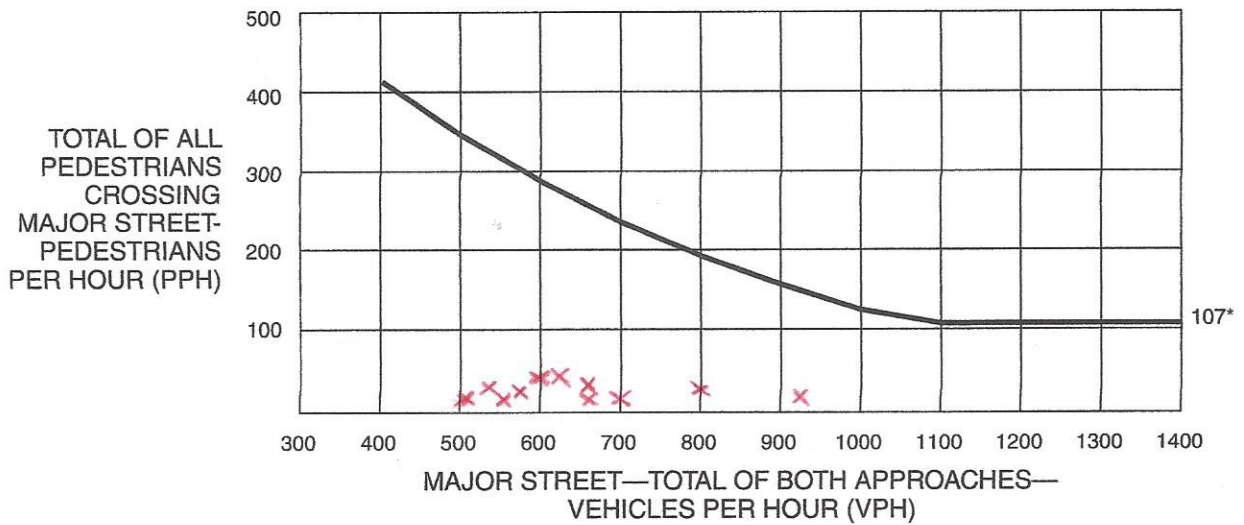
WEATHER

F = FOG
S = SNOW
R = RAIN
CL = CLOUDY
XW = CROSS WINDS

INJURIES

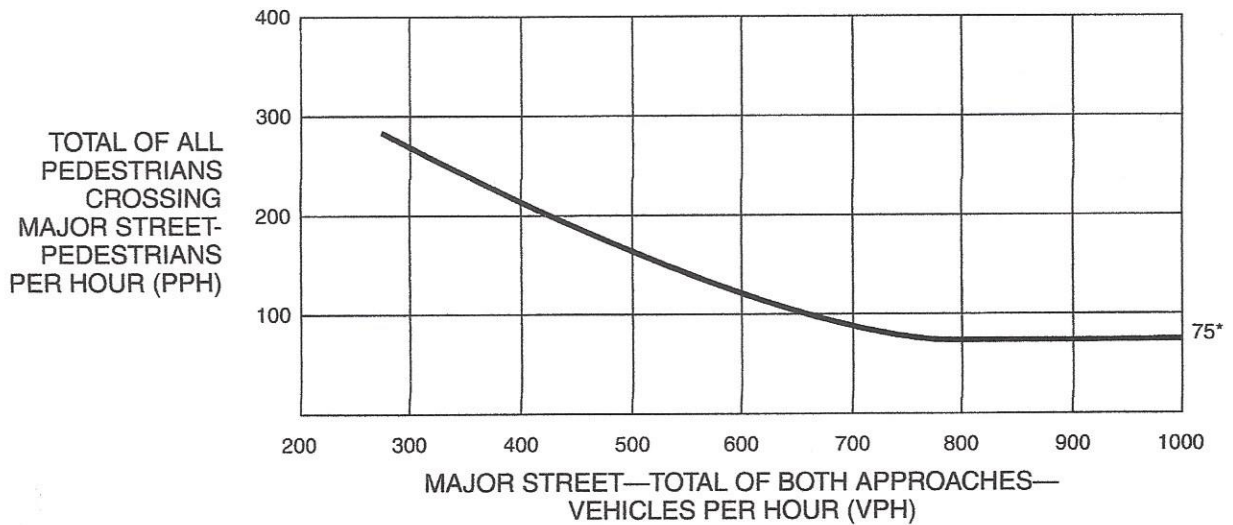
K = FATAL
A = INCAPACITATING
B = NON-INCAPACITATING
C = POSSIBLE INJURY

Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume



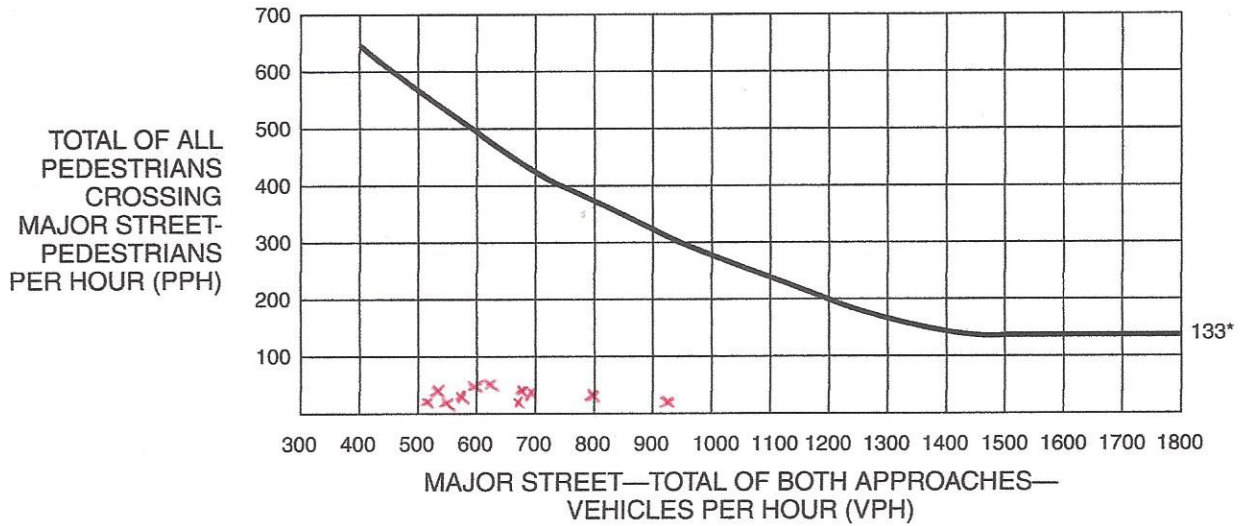
*Note: 107 pph applies as the lower threshold volume.

Figure 4C-6. Warrant 4, Pedestrian Four-Hour Volume (70% Factor)



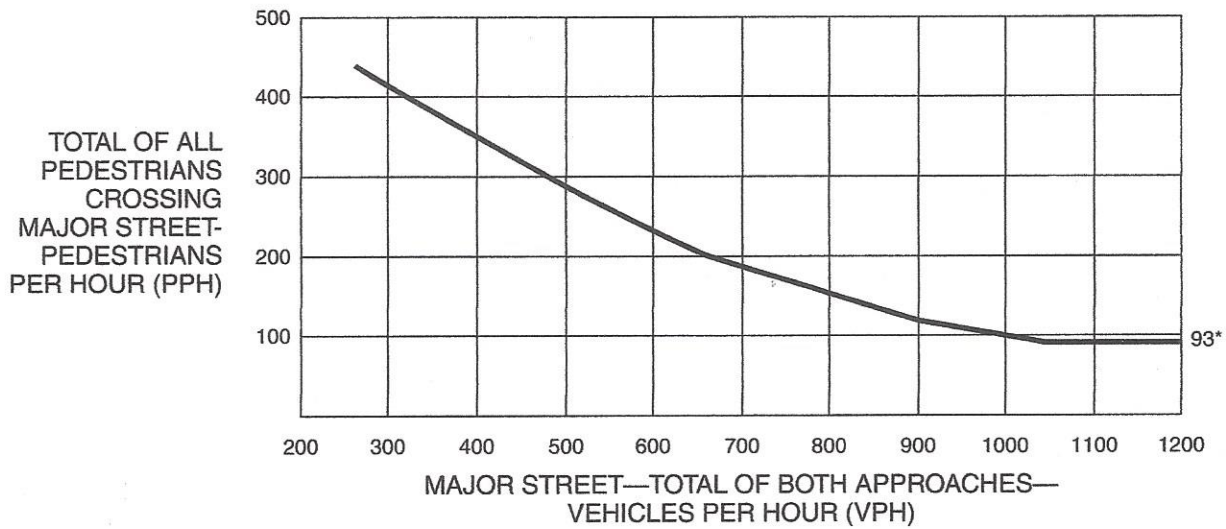
*Note: 75 pph applies as the lower threshold volume.

Figure 4C-7. Warrant 4, Pedestrian Peak Hour



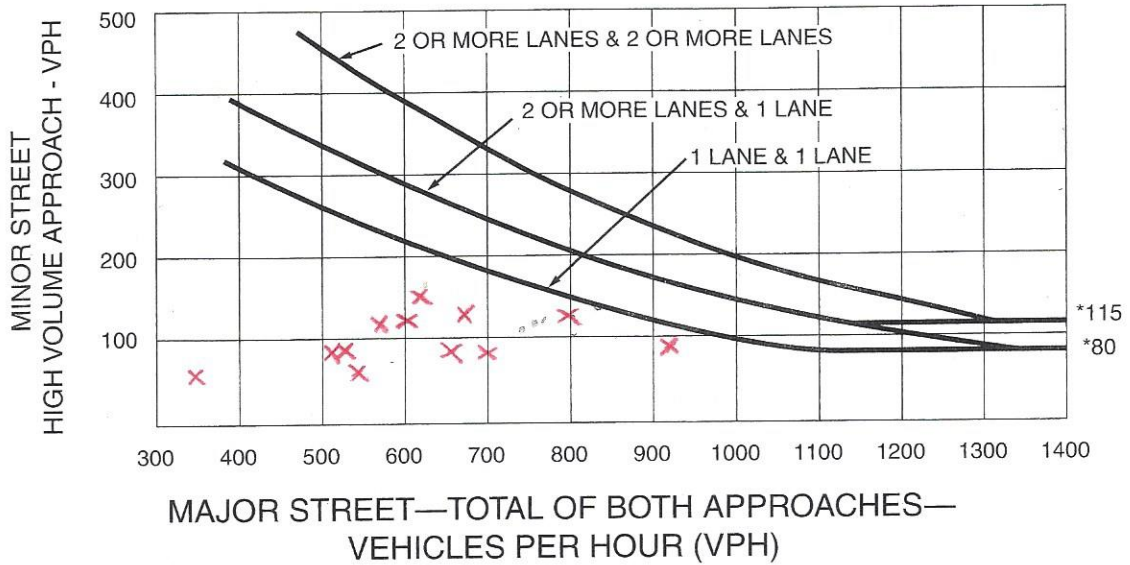
*Note: 133 pph applies as the lower threshold volume.

Figure 4C-8. Warrant 4, Pedestrian Peak Hour (70% Factor)



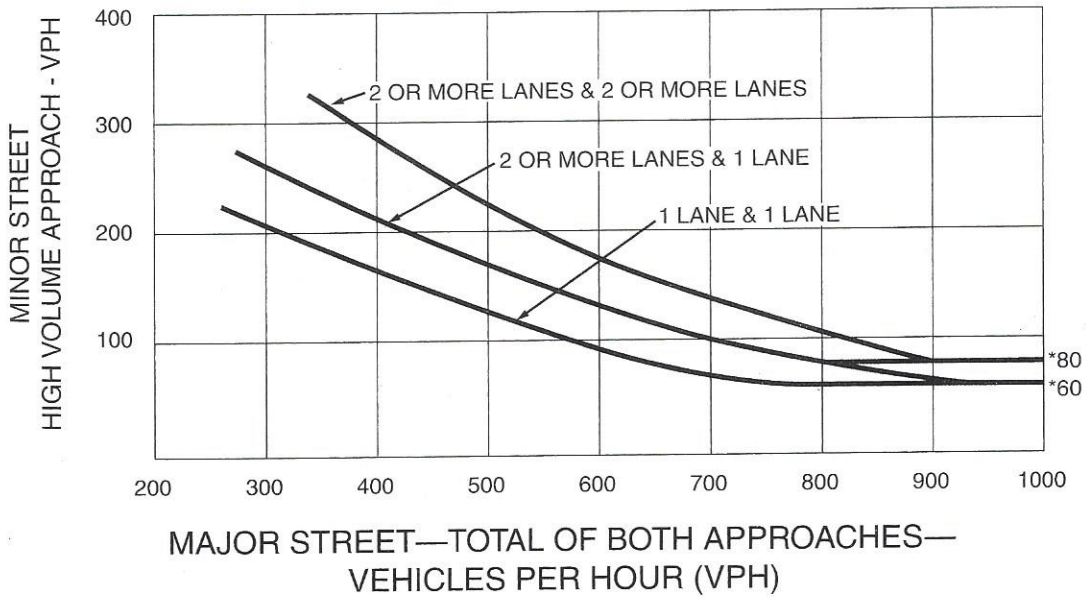
*Note: 93 pph applies as the lower threshold volume.

Figure 4C-1. Warrant 2, Four-Hour Vehicular Volume



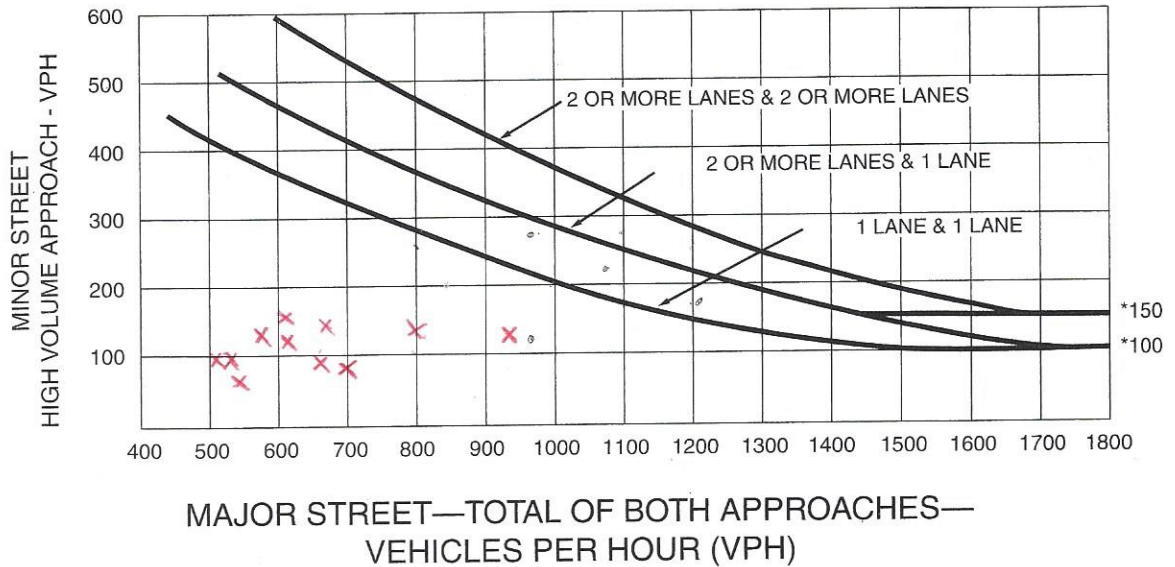
*Note: 115 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 80 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-2. Warrant 2, Four-Hour Vehicular Volume (70% Factor)
 (COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (40 mph) ON MAJOR STREET)



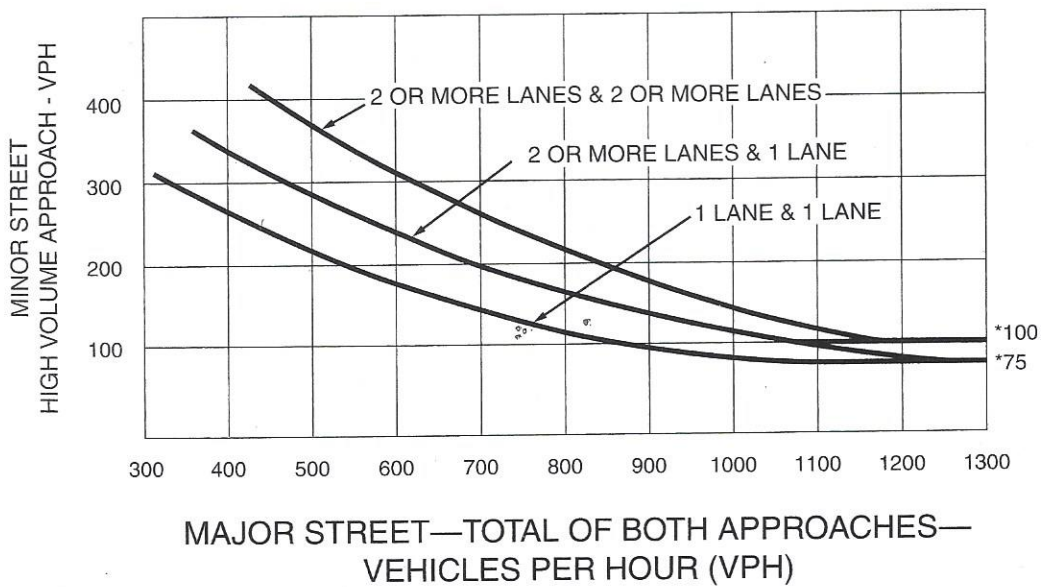
*Note: 80 vph applies as the lower threshold volume for a minor-street approach with two or more lanes and 60 vph applies as the lower threshold volume for a minor-street approach with one lane.

Figure 4C-3. 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 4C-4. Warrant 3, Peak Hour (70% Factor)
(COMMUNITY LESS THAN 10,000 POPULATION OR ABOVE 70 km/h (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.