



Traffic Control Signal for Front St and Hall St  
City Engineering Department  
October 2014

### Referenced Reports and Memorandums

1. October 21, 1993 Memorandum Kurt L. Kunde to Bruce Conradson
2. July 9, 2003 Memorandum Timothy J. Lodge to Richard Lewis
3. 2009 Edition Chapter 4C. Traffic Control Signal Needs Studies

### Warrant for All-Way Stop Installation

#### Warrant 1: 8-hour Vehicular Volume

This warrant is **satisfied** because the traffic volume on Front Street exceeds 750 vehicles per hour for any eight hours of an average day and the traffic volume for Hall Street exceeds 75 vehicles per hour for any eight hours of an average day.

#### Warrant 2: 4-hour Vehicular Volume

This warrant is **satisfied** because the volumes per hour for Hall Street and Front Street fall above the appropriate curve in Figure 4C-1 for each of any four hours of an average day.

#### Warrant 3: Peak Hour

This warrant is **not applicable** because the proposed signal placement would not be for the control of traffic exiting or entering a facility that attracts or discharges large numbers of vehicles over a short time. However, the volumes per hour through the intersection do fall above the appropriate curve in Figure 4C-3 during the peak travel hour of an average day.

#### Warrant 4: Pedestrian Volume

This warrant is **not satisfied** because the pedestrian volume crossing Front Street is falls below the appropriate curve in Figure 4C-5 for each of any four hours of an average day as well as the appropriate curve in Figure 4C-7 for the peak pedestrian hour. However, it should be noted that there are less than 60 gaps per hour during the peak travel hour.



**Warrant 5: School Crossing**

This warrant is **not applicable** to this intersection.

**Warrant 6: Coordinated Signal System**

This warrant is **not satisfied** because a Traffic Control Signal is not needed to maintain proper platooning of vehicles.

**Warrant 7: Crash Experience**

This warrant is **not satisfied** because there have been less than five accidents at this intersection in the past 12 months that could have been prevented by the installation of an All-Way Stop.

**Warrant 8: Roadway Network**

This warrant is **not applicable** because the intersection of Front St and Hall St is not the intersection of two major roads. However, the total entering volume of vehicles at the intersection of Front Street and Hall Street is more than 1000 vehicles per hour during the peak hour of an average day. Also, the five-year projected traffic volumes meet Warrants 1, 2, and 3.

**Additional Notes**

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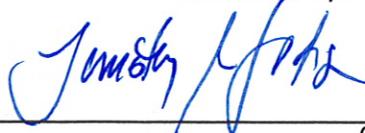
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Prepared By:



Reviewed By:



October 2014

City Engineering Department

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**2014 Multi-Way Stop Sign Warrant--Front and Hall  
Intersection Data**

<b>KEY</b>	
= Area of Concern	
**Estimates and Projected Data are found by using a 2% per year growth rate	

Main Road	Minor Road	Peak Hour Total Control Delay (sec)	Average Control Delay (sec/vehicle)	Peak Hour Level of Service	Peak Hour Total Pedestrians	Peak Hour School Children	Peak Hour Gaps	Peak Hour Bicycles	Main Road Speed Limit
W. Front	Hall/Wadsworth	2741	18.90	C	44	4	1	34	25

**Warrant 1: 8-hour Vehicular Volume**

Main Road	Minor Road	Vehicles per Hour on Major Street	Vehicles per Hour on Minor Street	Meets Condition A	Meets Condition B	Meets Condition A and B Combination	Major/Minor Street Volume Estimated** from:
W. Front	Hall/Wadsworth	1097	229	Yes	Yes	Yes	Current (2014)

Table 4C-1. Warrant 1, Eight-Hour Vehicular Volume

Number of lanes for moving traffic on each approach	Major Street	Minor Street	Condition A—Minimum Vehicular Volume				Condition B—Interruption of Continuous Traffic			
			Vehicles per hour on major street (total of both approaches)		Vehicles per hour on higher-volume minor-street approach (one direction only)		Vehicles per hour on major street (total of both approaches)		Vehicles per hour on higher-volume minor-street approach (one direction only)	
1	100% <sup>a</sup>	1	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
2 or more	500	1	400	350	280	150	120	105	84	
2 or more	600	1	480	420	336	150	120	105	84	
2 or more	600	1	480	420	336	200	160	140	112	
1	500	1	400	350	280	200	160	140	112	
<b>Condition B—Interruption of Continuous Traffic</b>										
<b>Number of lanes for moving traffic on each approach</b>			<b>Vehicles per hour on major street (total of both approaches)</b>				<b>Vehicles per hour on higher-volume minor-street approach (one direction only)</b>			
Major Street	Minor Street	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	100% <sup>a</sup>	80% <sup>b</sup>	70% <sup>c</sup>	56% <sup>d</sup>	
1	1	750	600	525	420	75	60	53	42	
2 or more	1	900	720	630	504	75	60	53	42	
2 or more	1	900	720	630	504	100	80	70	56	
1	1	750	600	525	420	100	80	70	56	

<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

Warrant 2: 4-hour Vehicular Volume

Main Road	Minor Road	Falls Above Curve
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Front

Hall/Wadsworth

Yes

\*2 and 1 lane

Table for Figure 4C-1

One lane and one lane		Two or more lanes and one lane		Two or more lanes and two or more lanes	
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1400	80	1400	80 or 115*	1400	115
1300	80	1300	90 or 115*	1300	115
1200	80	1200	100 or 115*	1200	145
1100	80	1100	120	1100	165
1000	100	1000	150	1000	200
900	120	900	175	900	240
800	150	800	200	800	275
700	180	700	250	700	340
600	220	600	290	600	390
500	260	500	340	500	460
400	310	400	390	400	Not available

Warrant 3: Peak Hour

Main Road	Minor Road	Total Current Entering Volume of Peak Hour	Peak Hour Falls Above 4C-3 Curve	Applicable	Meets Criteria

Front Hall/Wadsworth

1234 Yes

no

n/a

\*1 lane and 2 lanes

Table for Figure 4C-3

One lane and one lane	Two or more lanes and one lane	Two or more lanes and one lane	Two or more lanes and two or more lanes
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1800	100	1800	1800
1700	100	1700	1700
1600	100	1600	1600
1500	100	1500	1500
1400	120	1400	1400
1300	130	1300	1300
1200	150	1200	1200
1100	175	1100	1100
1000	200	1000	1000
900	245	900	900
800	285	800	800
700	325	700	700
600	360	600	600
500	420	500	500
		Not available	Not available

\* 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**

Main Road	Minor Road	Pedestrians Per Hour Falls Above 4C-5 Curve	Pedestrians Per Hour Falls Above 4C-7 Curve	Fewer than 60 Gaps per Hour
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Front Hall/Wadsworth no no Yes

Table for Figure 4C-5

Table for Figure 4C-7

Pedestrian Four-Hour Volume	Pedestrian Peak-Hour Volume		
VPH on the major street (Total of both approaches)	PPH for the total of all pedestrians crossing the major street	VPH on the major street (Total of both approaches)	PPH for the total of all pedestrians crossing the major street
1400	107*	1800	133*
1300	107*	1700	133*
1200	107*	1600	133*
1100	107*	1500	133*
1000	125	1400	150
900	150	1300	175
800	200	1200	200
700	225	1100	225
600	300	1000	280
500	350	900	325
400	400	800	375
* Note: 107 pph applies as the lower threshold volume.		700	420
		600	500
		500	575
		400	650
		*Note: 133 pph applies as the lower threshold volume	

**Warrant 5: School Crossing**

Main Road	Minor Road	Applicable	Meets Criteria
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Front Hall/Wadsworth no n/a

**Warrant 6: Coordinated Signal System**

Main Road	Minor Road	Traffic Control Signals Needed for a Progressive Operation
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Front Hall/Wadsworth no

**Warrant 7: Crash Experience**

Main Road	Minor Road	Correctable Crashes in Past 12 Months	Meets Conditions A, B, & C
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Front Hall/Wadsworth 2 no

**Warrant 8: Roadway Network**

Main Road	Minor Road	5-Year Projected** Major Street Volume	5-Year Projected** Minor Street Volume	5-Year Projected** Total Entering Volume of Peak Hour	Projected Volumes Meet Warrant 1	Projected Volumes Meet Warrant 2	Projected Volumes Meet Warrant 3	Applicable
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Front Hall/Wadsworth 1211 253 1362 Yes Yes Yes no

**Warrant 9: Intersection Near a Grade Crossing**

Main Road	Minor Road	Applicable	Meets Criteria
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Front Hall/Wadsworth no n/a

**W. Front St.  
(400 Block, between Hall St. and Gillis St.)  
Count #7**

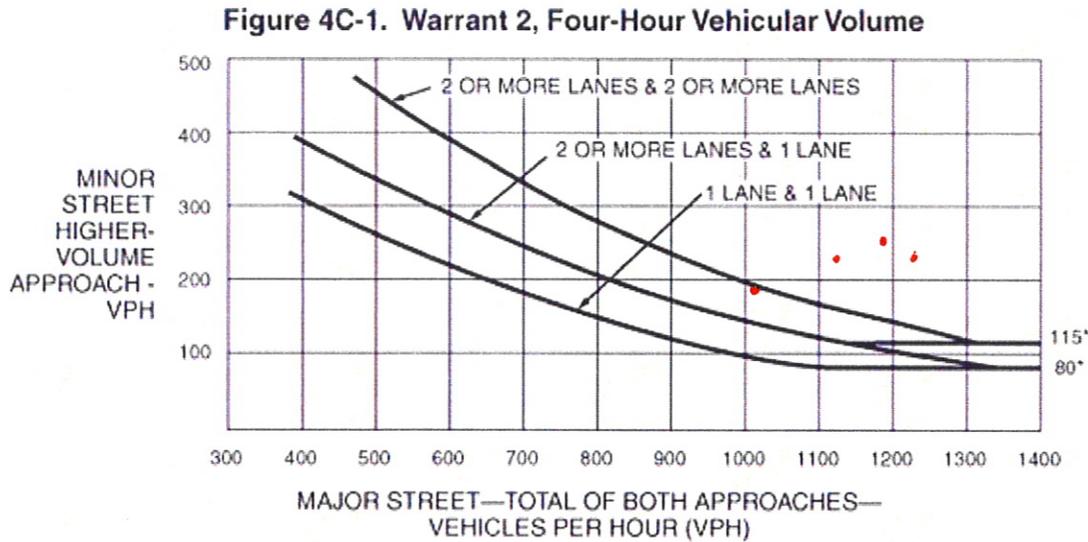
Start Time	Mon 21-Jul-14	Tue 22-Jul-14	Wed 23-Jul-14	Thu 24-Jul-14	Fri 25-Jul-14	Average Day	Sat 26-Jul-14	Sun 27-Jul-14	Week Average
12:00 AM	*	*	88	*	*	88	*	*	88
01:00	*	*	48	*	*	48	*	*	48
02:00	*	*	23	*	*	23	*	*	23
03:00	*	*	12	*	*	12	*	*	12
04:00	*	*	21	*	*	21	*	*	21
05:00	*	*	89	*	*	89	*	*	89
06:00	*	*	<b>272</b>	*	*	272	*	*	272
07:00	*	728	*	*	*	728	*	*	728
08:00	*	864	*	*	*	864	*	*	864
09:00	*	927	*	*	*	927	*	*	927
10:00	*	1010	*	*	*	1010	*	*	1010
11:00	*	<b>1136</b>	*	*	*	<b>1136</b>	*	*	<b>1136</b>
12:00 PM	*	<b>1234</b>	*	*	*	<b>1234</b>	*	*	<b>1234</b>
01:00	*	1196	*	*	*	1196	*	*	1196
02:00	*	1159	*	*	*	1159	*	*	1159
03:00	*	1181	*	*	*	1181	*	*	1181
04:00	*	1153	*	*	*	1153	*	*	1153
05:00	*	1118	*	*	*	1118	*	*	1118
06:00	*	789	*	*	*	789	*	*	789
07:00	*	618	*	*	*	618	*	*	618
08:00	*	458	*	*	*	458	*	*	458
09:00	*	350	*	*	*	350	*	*	350
10:00	*	262	*	*	*	262	*	*	262
11:00	*	176	*	*	*	176	*	*	176
Day Total	0	14359	553	0	0	14912	0	0	14912
% Avg. WKDay	0.0%	96.3%	3.7%	0.0%	0.0%	100.0%	0.0%	0.0%	
% Avg. Week	0.0%	96.3%	3.7%	0.0%	0.0%	100.0%	0.0%	0.0%	
AM Peak Vol.	-	11:00 1136	06:00 272	-	-	11:00 1136	-	-	11:00 1136
PM Peak Vol.	-	12:00 1234	-	-	-	12:00 1234	-	-	12:00 1234
Grand Total	0	14359	553	0	0	14912	0	0	14912
ADT		ADT 14,548	AADT 14,548						

**Hall St.**  
 (100 Block, between Garland St. and Front St.)  
 Count #90

Start Time	Mon 18-Aug-14	Tue 19-Aug-14	Wed 20-Aug-14	Thu 21-Aug-14	Fri 22-Aug-14	Sat 23-Aug-14	Sun 24-Aug-14	Average Day	Week Average
12:00 AM	*	*	23	*	*	*	*	23	
01:00	*	*	8	*	*	*	*	8	
02:00	*	*	7	*	*	*	*	7	
03:00	*	*	3	*	*	*	*	3	
04:00	*	*	20	*	*	*	*	20	
05:00	*	*	24	*	*	*	*	24	
06:00	*	*	94	*	*	*	*	94	
07:00	*	*	193	*	*	*	*	193	
08:00	*	*	222	*	*	*	*	222	
09:00	*	*	201	*	*	*	*	201	
10:00	*	*	192	*	*	*	*	192	
11:00	*	*	<b>228</b>	*	*	*	*	<b>228</b>	
12:00 PM	*	*	231	*	*	*	*	231	
01:00	*	*	<b>258</b>	*	*	*	*	<b>258</b>	
02:00	*	*	232	*	*	*	*	232	
03:00	*	*	245	*	*	*	*	245	
04:00	*	*	206	*	*	*	*	206	
05:00	*	*	<b>251</b>	*	*	*	*	<b>251</b>	
06:00	*	*	184	*	*	*	*	184	
07:00	*	*	116	*	*	*	*	116	
08:00	*	*	96	*	*	*	*	96	
09:00	*	*	82	*	*	*	*	82	
10:00	*	*	30	*	*	*	*	30	
11:00	*	*	36	*	*	*	*	36	
Day Total	0	1246	2151	0	0	0	0	3167	3167
% Avg. WKDay	0.0%	39.3%	67.9%	0.0%	0.0%	0.0%	0.0%	100.0%	11:00
% Avg. Week	0.0%	39.3%	67.9%	0.0%	0.0%	0.0%	0.0%	100.0%	228
AM Peak Vol.	-	-	11:00	-	-	-	-	11:00	-
	-	-	228	-	-	-	-	228	-
PM Peak Vol.	-	17:00	13:00	-	-	-	-	13:00	-
	-	251	258	-	-	-	-	258	-
Grand Total	0	1246	2151	0	0	0	0	3167	3167
ADT		ADT 3,064	ADT 3,064						



## 2009 Edition Part 4 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-1. Warrant 2, Four-Hour Vehicular Volume

This figure shows a graph depicting numerical values for Warrant 2, Four-Hour Vehicular Volume (see Section 4C.03 for further details). The figure displays three curves—one for each existing combination of approach lanes: one lane and one lane, two or more lanes and one lane, and two or more lanes and two or more lanes.

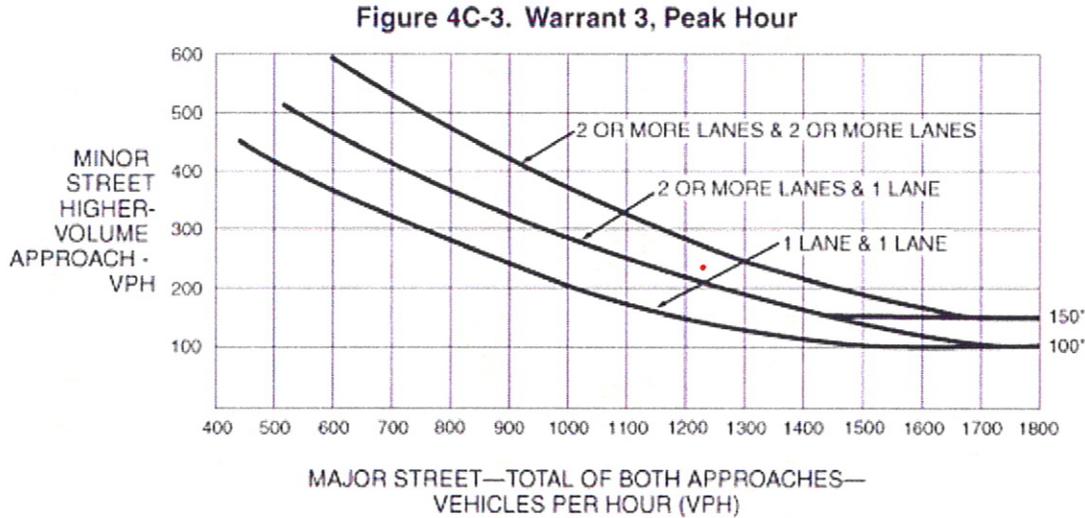
The table below shows the approximate vehicles per hour (VPH) on the major street and corresponding VPH on the minor street for each combination of approach lanes.

**Table for Figure 4C-1**

One lane and one lane		Two or more lanes and one lane		Two or more lanes and two or more lanes	
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1400	80	1400	80 or 115*	1400	115
1300	80	1300	90 or 115*	1300	115
1200	80	1200	100 or 115*	1200	145
1100	80	1100	120	1100	165
1000	100	1000	150	1000	200
900	120	900	175	900	240
800	150	800	200	800	275
700	180	700	250	700	340
600	220	600	290	600	390
500	260	500	340	500	460
400	310	400	390	400	Not available

\* 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.

## 2009 Edition Part 4 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-3. Warrant 3, Peak Hour

This figure shows a graph depicting numerical values for Warrant 3, Peak Hour (see Section 4C.04 for further details). The figure displays three curves—one for each existing combination of approach lanes: one lane and one lane, two or more lanes and one lane, and two or more lanes and two or more lanes.

The table below shows the approximate VPH on the major street and corresponding VPH on the minor street for each combination of approach lanes.

**Table for Figure 4C-3**

One lane and one lane		Two or more lanes and one lane		Two or more lanes and two or more lanes	
VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)	VPH on the major street (Total of both approaches)	VPH on the minor street (Higher volume approach)
1800	100	1800	100 or 150*	1800	150
1700	100	1700	100 or 150*	1700	150
1600	100	1600	120 or 150*	1600	170
1500	100	1500	145 or 150*	1500	180
1400	120	1400	155	1400	220
1300	130	1300	190	1300	250
1200	150	1200	220	1200	285
1100	175	1100	250	1100	340
1000	200	1000	285	1000	370
900	245	900	325	900	425
800	285	800	360	800	475
700	325	700	420	700	540
600	360	600	460	600	590
500	420	500	Not available	500	Not available

## 2009 Edition Part 4 Figure 4C-5. Warrant 4, Pedestrian Four-Hour Volume

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



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

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

This figure shows a graph depicting numerical values for Warrant 4, Pedestrian Four-Hour Volume. The figure displays one curve.

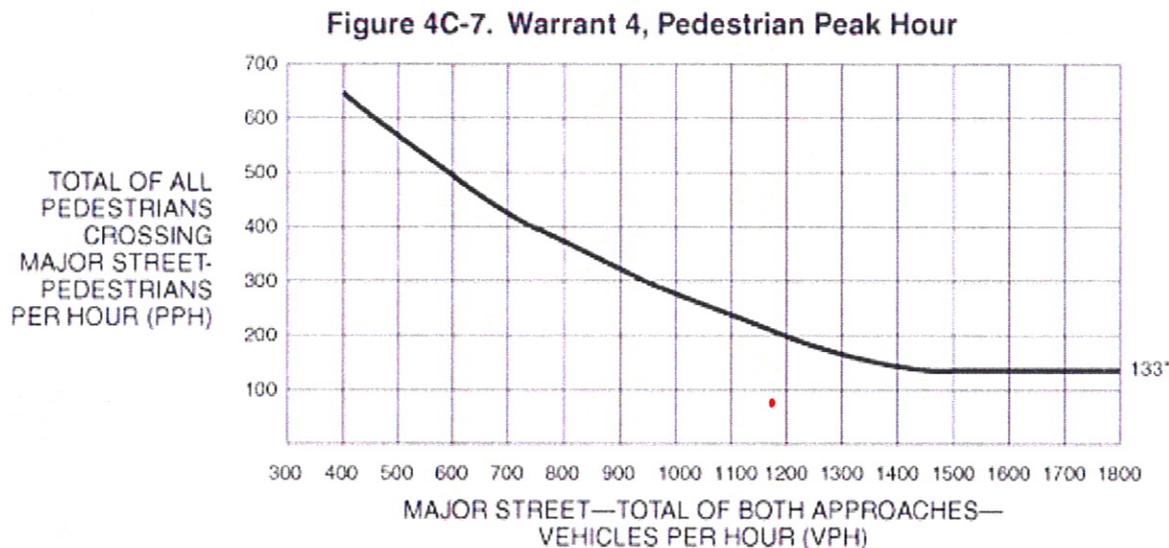
The table below shows the approximate vehicles per hour (VPH) on the major street and corresponding pedestrians per hour (PPH) for the total of all pedestrians crossing the major street.

Table for Figure 4C-5

Pedestrian Four-Hour Volume	
VPH on the major street (Total of both approaches)	PPH for the total of all pedestrians crossing the major street
1400	107*
1300	107*
1200	107*
1100	107*
1000	125
900	150
800	200
700	225
600	300
500	350
400	400

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

## 2009 Edition Part 4 Figure 4C-7. Warrant 4, Pedestrian Peak Hour



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

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

This figure shows a graph depicting numerical values for Warrant 4, Pedestrian Peak Hour. The figure displays one curve.

The table below shows the approximate vehicles per hour (VPH) on the major street and corresponding pedestrians per hour (PPH) for the total of all pedestrians crossing the major street.

**Table for Figure 4C-7**

<b>Pedestrian Four-Hour Volume</b>	
<b>VPH on the major street (Total of both approaches)</b>	<b>PPH for the total of all pedestrians crossing the major street</b>
1800	133*
1700	133*
1600	133*
1500	133*
1400	150
1300	175
1200	200
1100	225
1000	280
900	325
800	375
700	420
600	500
500	575
400	650



## Traffic Crash Reporting System - Crash Detail Report

You searched for **County** = Grand Traverse **City/Township** = Traverse City **Street** = W Front St @ Hall St **Date Range** = 10/27/2013 To 10/26/2014 **Time Range** = 00:00 To 23:59 **Distance** = 200 **Impaired Driving** = Neither Alcohol or Drugs Involved **Crash Type** = Head On-Left Turn, Angle, Rear End, Rear End-Left Turn, Rear End-Right Turn, Sideswipe-Same

<i>Applicable</i>	Time	Date	Type	Area	Alcohol Related	Commercial Vehicles	Pedestrian	Bicycle		
<i>Yes</i>	12:41	09/30/2014	Angle	Intersection	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 5 feet Direction = East									
<i>No</i>	13:15	12/17/2013	Sideswipe-Same	Other	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 50 feet Direction = West									
<i>No</i>	13:16	02/03/2014	Rear End	Intersection	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 20 feet Direction = West									
<i>No</i>	13:20	10/03/2014	Angle	Intersection	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ HALL ST Distance = 75 feet Direction = East									
<i>Yes</i>	13:26	07/16/2014	Rear End	Other	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 100 feet Direction = East									
<i>No</i>	13:49	09/29/2014	Rear End	Intersection	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ HALL ST Distance = 30 feet Direction = East									
<i>No</i>	16:30	12/26/2013	Angle	Intersection	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 100 feet Direction = West									
<i>No</i>	20:30	02/14/2014	Angle	Other	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	HALL ST @ WADSWORTH ST Distance = 50 feet Direction = North									
<i>No</i>	23:49	07/04/2014	Rear End	Other	No	No	No	No	<a href="#">More</a>	<a href="#">UD-10</a>
	W FRONT ST @ WADSWORTH ST Distance = 150 feet Direction = West									

Records 1 to 9 of 9

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