

## Department of Transportation

### Rapid City Region Office

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Mr. Dirk Jablonski, P.E.  
Public Works Director  
City of Rapid City  
300 Sixth Street  
Rapid City, SD 57701

RE: Range/Soo San Signal Issue

Dear Mr. Jablonski,

You have asked for my review of traffic congestion issues at the intersection of Range Rd & Soo San Drive. This intersection is directly adjacent to the West Middle School. Further to the west along Range Rd. are the following traffic generators; Black Hills Workshop, National Guard, Stevens High School, and numerous multi family dwelling units. Presently the intersection in question is free flow on Soo San Dr. with Stop sign for Range Rd.

There has been considerable local discussion regarding perceived need for traffic signals at the Range/Soo San intersection. Traffic counts have been conducted over the recent years (08-29-02, 09-16-04, 01-21-05, and 02-14-05). The Manual on Uniform Traffic Control Devices sets forth eight separate threshold measures of intersection activity that form the basis of our review. The eight separate threshold measures are labeled **WARRANTS**. Prior to any continued consideration for installation of a signal system, there must be at least one of the eight **WARRANTS** satisfied, thereby validating that there is a true level of congestion that **MAY** be improved by installation of a traffic signal system. Prior to the decision prompting installation of a Traffic Signal, one should thoroughly assess all other potential changes that could show improvement, as Traffic Signal installation is rather expensive and may not be the true solution to the problem at hand. Good Engineering judgment dictates that other less costly solutions should be examined first and possibly implemented prior to installation of a Traffic Signal system.

There are numerous suggestions for improvements resulting from earlier review by cities PATH Committee. Some of the suggestions have been implemented, however many have not. In an on-site review in recent days, it is quite apparent to me that there is one main significant detriment to continued movement of traffic at the subject intersection. That single most significant detriment is the near constant congestion directly in front of the school building resulting from morning arrival and end of day pickup of students. As it is presently allowed/encouraged to offload & pickup

students directly in front of school building, this very slow often stoppage of traffic flow results in a queue of traffic backed up both south and north, typically all the way thru Range Rd intersection and well beyond. Unfortunately there are frequent occasions when drivers make U-Turns getting into or out of the offload point in front of the school building. This further aggravates the backup of traffic. Without significant change with this offload/pickup area, there is no improvement anticipated with traffics signals at Range Rd intersection. The intersection area is frequently plugged with idle vehicles waiting in the traffic queue, resulting in everyone being unable to move thru the intersection. All of this stems from the traffic disruptions occurring directly in front of the school building. Thorough review of this issue is now underway by School District folks. The intent is to disallow any drop-off or pickup of students directly in front of the school building, but rather transfer all of that activity to the new parking lot south edge of school building. This change should also include forcing all students to enter thru far south building doors. The large plus for pedestrian traffic is that all students would then be dropped off on west side of Soo San Dr. within the parking lot – thereby none of the students are obligated to cross Soo San Dr. thru traffic as is now the case with many. To make this change effective, the curbside passenger drop off area must be eliminated. A directly related issue is the increased need for a third traffic lane (left turn lane) to ease the considerable movement in & out of subject south-side parking lot in addition to an additional lot access point on northern end of lot. I believe the thought would be to create one way in/ one way out typical of many parking areas. These changes, accomplished jointly by City & School District will yield considerable benefit.

We have prepared a Traffic Analysis Report utilizing the data noted above. A Traffic Analysis Report depicts what if any **WARRANT** is met for traffic signal consideration. As noted earlier, just because a signal **WARRANT** is met, one must use good engineering judgment in determining if it is appropriate to move ahead with signal installation. The Traffic Analysis is attached and you will note that there is a **WARRANT** met. This location is a perfect example of one where it would be very inappropriate to quickly jump to the conclusion of Traffic Signal install prior to trying other suitable means of improving traffic flow characteristics. Prior to my recommendation to move ahead with signal install, I strongly encourage implementation of the various other changes that have been offered. As noted above, the School District is gathering detailed information & costs estimates to change student drop-off pickup areas as detailed. At some future time, after these other measure have been implemented, it would be very appropriate to review again and see what improvement has resulted. I predict that the subject intersection will function much better, resulting in performance that is acceptable to the users, without the need to spend \$100,000 – \$125,000.00 that now is common for traffic signal installation.

Sincerely Yours,

  
Daniel W. Staton

Region Traffic Engineer

# Traffic Analysis Report

## Traffic Control Signal Needs

Rapid City South Dakota

Pennington County

March 2, 2005

Major Street: **Soo San Dr.**

Minor Street: **Range Rd.**

### Summary

The attached traffic analysis report is compiled from a traffic study which was completed on 2/15/2005. As per the Manual of Uniform Traffic Control Devices, 2003 Edition, this intersection was analyzed with regard to the following warrants and was found to comply or not comply with the minimum criteria set forth for each warrant:

	Complies or Does not Comply with minimum criteria
Warrant 1, Eight-Hour Vehicular Volume	Does not Comply
Warrant 2, Four-Hour Vehicular Volume	Complies
Warrant 3, Peak Hour	Does not Comply
Warrant 4, Pedestrian Volume	Does not Comply
Warrant 5, School Crossing	Does not Comply
Warrant 6, Coordinated Signal System	Does not Comply
Warrant 7, Crash Experience	Does not Comply
Warrant 8, Roadway Network	Does not Comply

**At this time, we are not recommending a traffic signal at this location.**

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Dan Staton, Rapid City Region Traffic Engineer

# Warrant 1, Eight-Hour Vehicular Volume

Sheet 1 of 2

## Support:

The Minimum Vehicular Volume, Condition A, is intended for application where a large volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

The Interruption of Continuous Traffic, Condition B, is intended for application where the traffic volume on a major street is so heavy that traffic on a minor intersecting street suffers excessive delay or conflict in entering or crossing the major street.

## Standard:

**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% columns of Condition A in the following table exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection, or**
- B. The vehicles per hour given in both of the 100% columns of Condition B in the following table exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.**

**In applying each condition the 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 these 8 hours.**

## Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in 100% columns may be adjusted to show 70% of the standard values.

**The 70% option was not used for this warrant.**

## Standard:

**The need for a traffic control signal shall be considered if an engineering study finds that both 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 80% columns of Condition A in the following table exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection and**
- B. The vehicles per hour given in both of the 80% columns of Condition B in the following table exist on the major street and on the higher volume minor-street approaches, respectively, to the intersection.**

**These major street and minor-street volumes shall be for the same 8 hours for each condition; however, the 8 hours satisfied in Condition A shall not be required to be the same 8 hours satisfied in Condition B. On the minor street, the higher volume shall not be required to be on the same approach during each of these 8 hours.**

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in 80% columns may be adjusted to show 56% of the standard values.

**The 56% option was not used for this warrant.**

## Warrant 1, Eight-Hour Vehicular Volume

Sheet 2 of 2

Hour Starting	Actual Counts		Condition A (100%)			Condition A (80%)			Condition B (100%)			Condition B (80%)											
	Major	Minor	Major	Minor	Complies	Major	Minor	Complies Yes(1), No(0)	Major	Minor	Complies	Major	Minor	Complies Yes(1), No(0)									
6:00 AM	221	68	500	150	0	400	120	0	750	75	0	600	60	0									
7:00 AM	859	136	500	150	0	400	120	1	750	75	0	600	60	1									
8:00 AM	527	143	500	150	0	400	120	1	750	75	0	600	60	0									
9:00 AM	351	81	500	150	0	400	120	0	750	75	0	600	60	0									
10:00 AM	314	86	500	150	0	400	120	0	750	75	0	600	60	0									
11:00 AM	443	163	500	150	0	400	120	1	750	75	0	600	60	0									
12:00 PM	521	104	500	150	0	400	120	0	750	75	0	600	60	0									
1:00 PM	446	116	500	150	0	400	120	0	750	75	0	600	60	0									
2:00 PM	564	175	500	150	0	400	120	1	750	75	0	600	60	0									
3:00 PM	826	365	500	150	0	400	120	1	750	75	0	600	60	1									
4:00 PM	671	142	500	150	0	400	120	1	750	75	0	600	60	1									
5:00 PM	682	147	500	150	0	400	120	1	750	75	0	600	60	1									
No. of Hours Complying to Condition					2						7						2						4

Guidance:

The combination of Conditions A and B should be applied only after an adequate trial of other alternatives that could cause less delay and inconvenience to traffic has failed to solve the traffic problems.

Conclusion:

**This location does not meet the minimum requirement of 8 hours for Condition A (100%).**

**This location does not meet the minimum requirement of 8 hours for Condition B (100%).**

**This location does not meet the minimum requirement of 8 hours for Condition A (80%).**

**This location does not meet the minimum requirement of 8 hours for Condition B (80%).**

**This location does not comply with this warrant.**

# Warrant 2, Four-Hour Vehicular Volume

Sheet 1 of 1

Support:

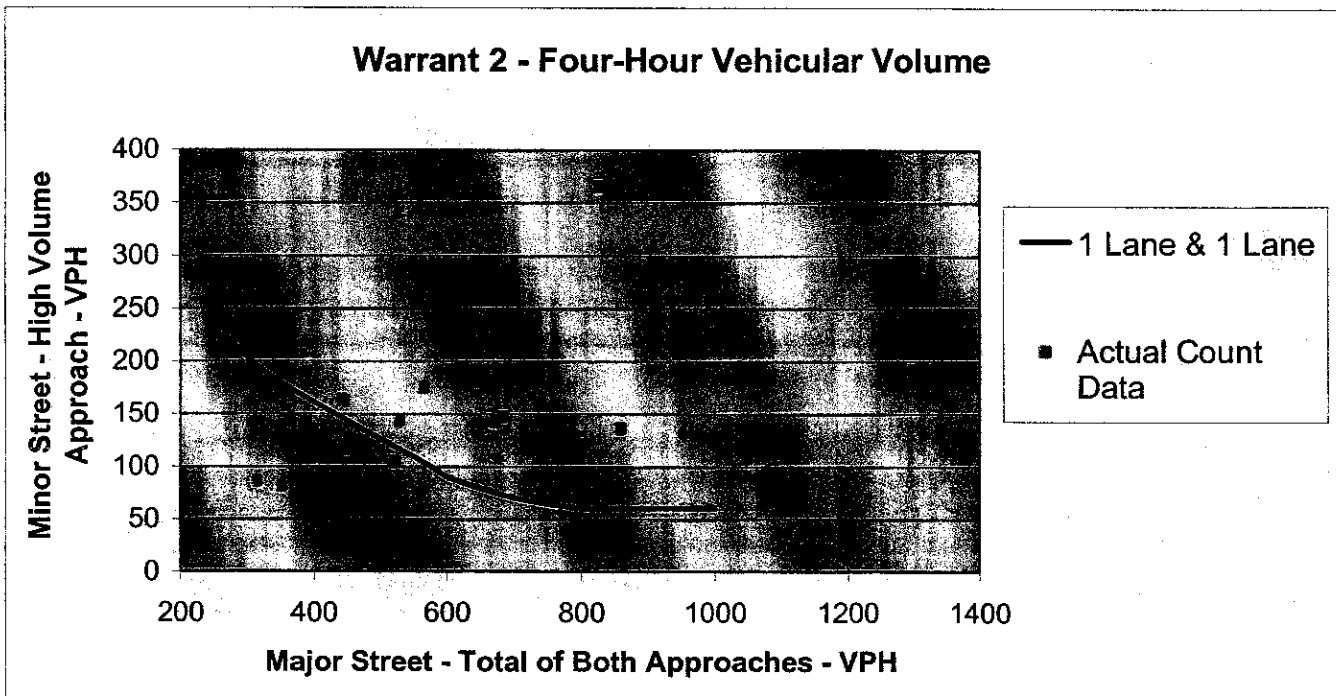
The Four-Hour Vehicular Volume signal warrant conditions are intended to be applied where the volume of intersecting traffic is the principal reason to consider installing a traffic control signal.

Standard:

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 following curve 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.

Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the curve may be adjust as per the M.U.T.C.D. Figure 4C-2.



Conclusion:

If 4 or more red dots fall above the blue line then this intersection complies with this warrant.

This intersection meets the minimum criteria set forth for this warrant.

# Warrant 3, Peak Hour

Sheet 1 of 2

## Support:

The Peak Hour signal warrant is intended for use at a location where traffic conditions are such that for a minimum of 1 hour of an average day, the minor-street traffic suffers undue delay when entering or crossing the major street.

## Standard:

**This signal warrant shall be applied only in unusual cases. Such cases include, but are not limited to, office complexes, manufacturing plants, industrial complexes, or high-occupancy vehicle facilities that attract or discharge large numbers of vehicles over a short time.**

**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 curve in the following figure for the existing combination of approach lanes.**

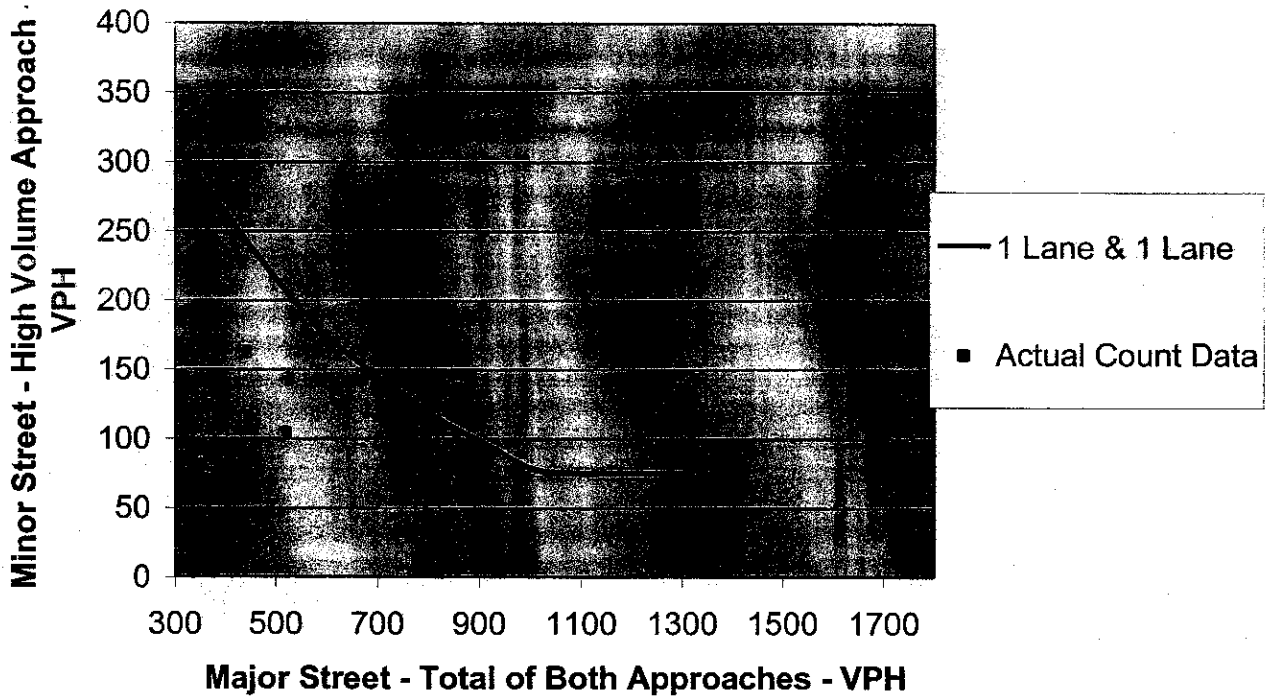
## Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the curve may be adjust as per the M.U.T.C.D. Figure 4C-4.

# Warrant 3, Peak Hour

Sheet 2 of 2

## Warrant 3 - Peak Hour



### Conclusion:

This intersection does not comply with Part A of this warrant.

If 1 or more red dots fall above the blue line then this intersection complies with Part B of this warrant.

This intersection does comply with Part B of this warrant.

This location does not comply with this warrant.



# Warrant 4, Pedestrian Volume

Sheet 1 of 1

## Support:

The Pedestrian Volume signal warrant is intended for application where the traffic volume on a major street is so heavy that pedestrians experience excessive delay in crossing the major street.

## Standard:

**The need for a traffic control signal at an intersection or mid-block crossing shall be considered if an engineering study finds that both of the following criteria are met:**

- A. The pedestrian volume crossing the major street at an intersection or mid-block location during an average day is 100 or more for each of any 4 hours or 190 or more during any 1 hour, and**
- B. There are fewer than 60 gaps per hour in the traffic stream of adequate length to allow pedestrians to cross during the same period when the pedestrian volume criterion is satisfied. Where there is a divided street having a median of sufficient width for pedestrians to wait, the requirement applies separately to each direction of vehicular traffic.**

**The Pedestrian Volume signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

**If a traffic control signal is justified by both this signal warrant and a traffic engineering study, the traffic control signal shall be equipped with pedestrian signal heads conforming to requirements set forth in Chapter 4E of the M.U.T.C.D.**

## Guidance:

If a traffic control signal is justified by both this signal warrant and a traffic engineering study:

- A. If installed within a signal system, the traffic control signal should be coordinated.
- B. At an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors. As a minimum, it should have semi-actuated operation, but full-actuated operation with detectors on all approaches might also be appropriate.
- C. At non-intersection crossings, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.

## Option:

The criterion for the pedestrian volume crossing the major roadway may be reduced as much as 50 percent if the average crossing speed of pedestrians is less than 4 feet per second.

A traffic control signal may not be needed at the study location if adjacent coordinated traffic control signals consistently provide gaps of adequate length for pedestrians to cross the street, even if the rate of gap

## Conclusion:

**A value of 4 ft/sec was assumed to perform calculations for this warrant.**

**This intersection does not comply with this warrant.**

# Warrant 5, School Crossing

Sheet 1 of 1

## Support:

The School Crossing signal warrant is intended for application where the fact that school children cross the major street is the principal reason to consider installing a traffic control signal.

## Standard:

**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 school children 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 children are using the crossing is less than the number of minutes in the same period and there are a minimum of 20 students during the highest crossing hour.**

**Before a decision is made to install a traffic control signal, consideration shall be given to the implementation of other remedial measures, such as warning signs and flashers, school speed zones, school crossing guards, or a grade-separated crossing.**

**The School Crossing signal warrant shall not be applied at locations where the distance to the nearest traffic control signal along the major street is less than 300 feet, unless the proposed traffic control signal will not restrict the progressive movement of traffic.**

## Guidance:

If a traffic control signal is justified by both this signal warrant and a traffic engineering study:

- A. If installed within a signal system, the traffic control signal should be coordinated.
- B. At an intersection, the traffic control signal should be traffic-actuated and should include pedestrian detectors. As a minimum, it should have semi-actuated operation, but full-actuated operation with detectors on all approaches might also be appropriate.
- C. At non-intersection crossings, the traffic control signal should be pedestrian-actuated, parking and other sight obstructions should be prohibited for at least 100 feet in advance of and at least 20 feet beyond the crosswalk, and the installation should include suitable standard signs and pavement markings.

## Conclusion:

**The following remedial actions were considered prior to applying this warrant:**

**Warning signs with flashers have not been tried at this intersection.**

**School speed zones have been tried or are now in use.**

**A school crossing guard has been tried or are now in use.**

**This warrant does not apply due to the fact that not all remedial actions have been attempted.**

# Warrant 6, Coordinated Signal System

Sheet 1 of 1

## Support:

Progressive movement in a coordinated signal system sometimes necessitates installing traffic control signals at intersections where they would not otherwise be needed in order to maintain proper platooning of vehicles.

## Standard:

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, the adjacent traffic control signals do not provide the necessary degree of vehicular platooning and the proposed and adjacent traffic control signals will collectively provide a progressive operation.

## Guidance:

The Coordinated Signal System signal warrant should not be applied where the resultant spacing of traffic control signals would be less than 1000 feet.

## Conclusion:

**This warrant does not apply as there appears to be no problem with platooning at this intersection.**

# Warrant 7, Crash Experience

Sheet 1 of 1

## Support:

The Crash Experience signal warrant conditions are intended for application where the severity and frequency of crashes are the principal reasons to consider installing a traffic control signal.

## Standard:

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% columns of Condition A of Warrant 1, or the VPH in both of the 80% columns of Condition B exists on the major street and on the higher-volume minor-street approach, respectively, to the intersection, or the volume of pedestrian traffic is not less than 80% 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.

## Option:

If the posted or statutory speed limit or the 85th-percentile speed on the major street exceeds 40mph, or if the intersection lies within the built-up area of an isolated community having a population of less than 10,000, the traffic volumes in 80% columns may be adjusted to show 56% of the standard values.

**The 56% option was not used for this warrant.**

## Conclusion:

**This intersection does not comply with this warrant as no alternatives have been attempted to reduce the crash frequency.**

**2 accidents have occurred during a 12 month period that meet the criteria set forth. (Accident**

# Warrant 8, Roadway Network

Sheet 1 of 1

## Support:

Installing a traffic control signal at some intersections might be justified to encourage concentration and organization of traffic flow on a roadway network.

## Standard:

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 VPH during the peak hour of a typical weekday and has a 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 VPH 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 one or more of the following characteristics:

- A. It is a part of the street or highway system that serves as the principal roadway network for through traffic flow, or
- B. It includes rural or suburban highways outside, entering, or traversing a city, or
- 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.

## Conclusion:

This warrant does not apply as this location is not an intersection of two or more major routes.