Minnesota Township Rural Traffic Forecasting

PREPARED FOR: MnDOT

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Introduction

The 2009 update to the Minnesota Manual on Uniform Traffic Control Devices (MnMUTCD) includes guidance in Chapter 5 for "traffic control devices for low volume roads". The MnMUTCD defines low volume roads as:

STANDARD:

A low-volume road shall be defined for this Part of the Manual as follows:

A. A low-volume road shall be a facility lying outside of built-up areas of cities, towns, and communities, and it shall have a traffic volume of less than 400 AADT.
B. A low-volume road shall not be a freeway, expressway, interchange ramp, freeway service road, or a road on a designated State highway system. In terms of highway classification, it shall be a variation of a conventional road or a special purpose road as defined in Section 2A.1.
C. A low-volume road shall be classified as either paved or unpaved.

SUPPORT:

Low-volume roads typically include farm-to-market, recreational, resource management and development, and local roads.

GUIDANCE:

The needs of unfamiliar road users for occasional, recreational, and commercial transportation purposes should be considered.

Given the makeup of the Minnesota township roadway system, it appears much of this guidance would apply to township roads; however, townships typically do not have the funding or resources to obtain roadway counts on their systems to determine annual average daily traffic (AADT) volumes.

In order to provide townships with an easy to use method to estimate the volumes on their roadways, an approach based on trip generation is being investigated.

The Institute of Transportation Engineers (ITE) publishes a report (Trip Generation, 8th Edition: An ITE Informational Report) to predict trip generation based on adjacent land use. This manual, however, does not address low volume, rural roadways. Using this concept, it was suggested that the number of farmsteads or dwellings along these low volume roadways could be used to determine a best fit equation that would predict trip generation and AADT along these roads.

Approach

In order to determine if a correlation could be made between number of dwellings along a township road and AADT to better forecast traffic volumes on low (less than 400 AADT, MNMUTCD) and ultra-low volume (less than 150 daily entering vehicles from Guidelines for the Removal of Traffic Control Devices in Rural Areas, Iowa Highway Research Board Project TR-527) roadways, traffic counts were taken at six different locations (three urban, three rural) within Wright County, Minnesota (Attachment 1).

Wright County engineers identified six locations within the county that would provide reasonable representation of other township roads located within Minnesota. Three roadways selected were considered urban and three considered rural. Traffic counts using tubes were then taken at these six locations in August, 2011 and ADT for each roadway was determined (Attachment 2).

Numbers of dwellings at each location (including those with direct access along the roadway and also nearby dwellings that were not directly on the roadway, but were predicted to access the roadway regularly) were counted using aerial maps (Attachment 3). Length of the roadway was also determined.

Table 1 documents the segment length, number of dwellings and recorded ADT for the selected segments.

WRIGHT COUNTY TOWNSHIOP ROADS ANALYSIS

	Streets	Dwellings on Road	Dwellings use Road to Access	# of Dwellings	Miles	Dwellings/ Mile	ADT	Comments
Rural	10th St SW/Peyton Ave SW/12th St SW	14.0	6.0	20	2.3	8.7	128	
	110th Street SW	19.0	4.0	23	3.3	7.0	119	
	105th Ave	1.0	2.0	3	1.0	3.0	38	
Urban	108th St SW/Knowles Ave NW	33.0	92.0	125	2.0	62.5	591	Lake/camp/ ranches
	Baker Ave NW	14.0	66.0	80	1.1	72.7	477	
	30th St SE	49.0	35.0	84	2.7	31.1	293	

TABLE 1 – WRIGHT COUNTY TOWNSHIP ROADS ANALYSIS

Analysis

The traffic volume and number of dwelling units for the six locations were plotted on a graph to determine a best fit linear equation that could be applied under the rural and urban scenarios. Figures 1 and 2 show the plots and best fit equations.

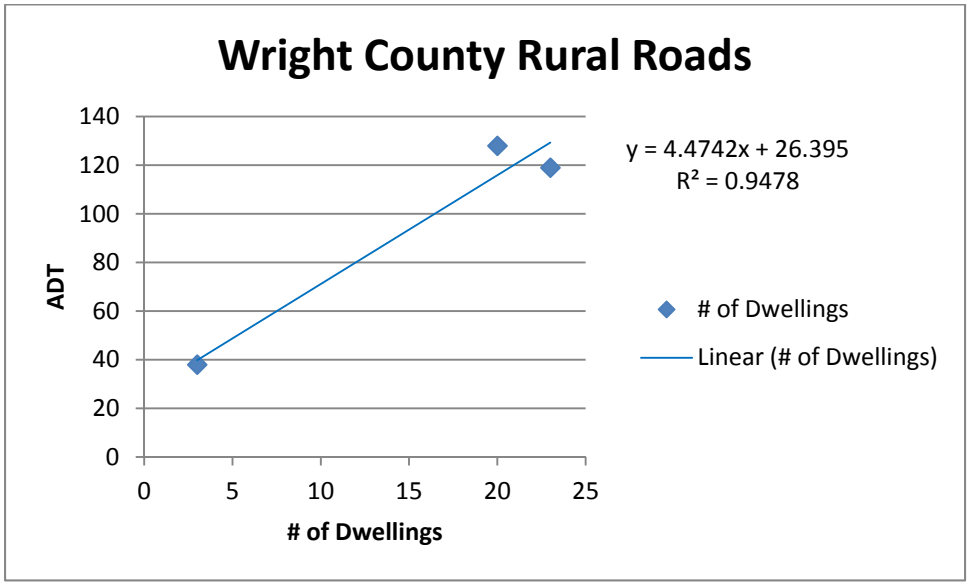


FIGURE 1

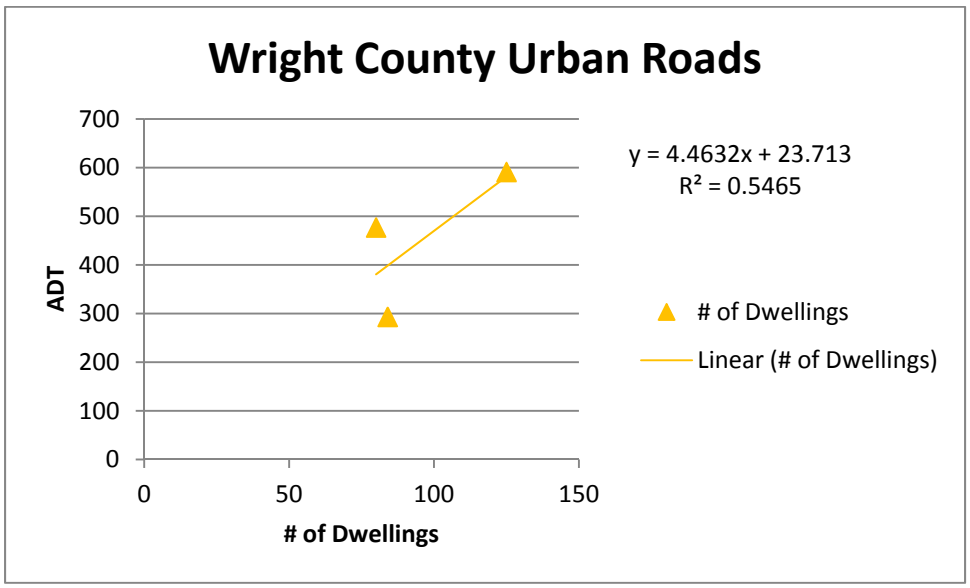


FIGURE 2

Figure 1 shows a strong correlation ($R^2 = 0.9$) between the number of dwellings assumed to use a particular rural roadway and ADT, whereas the correlation is not nearly as strong on the urban roads in Figure 2 ($R^2 = 0.5$). However, given the small sample size, there is a concern that the correlation may not be as strong as demonstrated in the figures.

In order to provide an initial check on the ability to predict traffic on low volume roads, the rural equation was then applied to unpaved county roads in Stevens County. No township

road traffic volumes were available for Stevens County, so low volume unpaved county roads with traffic data were used as a comparable surrogate. Six unpaved Stevens County roads were chosen at random that had AADT traffic counts recorded in 2009(Attachment 4, from 2009 Traffic Volumes General Highway Map by MnDOT). These roads with their documented counts were used in the following analysis.

Table 2 documents the results of the analysis that was used for the Wright County roadway locations completed for the Stevens County unpaved roads.

STEVENS COUNTY ROADS ANALYSIS

Streets	Dwellings on Road	Dwellings use Road to Access	# of Dwellings	Miles	Dwellings/ Mile	Forecast ADT from Count Data Equation	ADT - Actual (From 2009 Traffic Volumes General Highway Map by MnDOT)	ADT - Difference	% Difference
CSAH 7 (CNTY 58 TO CSAH 8)	2.0	4.0	6	3.0	2.0	53	70	-17	-24%
CSAH 14 (CSAH 13 TO LOCAL ROAD)	5.0	3.0	8	4.0	2.0	62	60	2	4%
CSAH 15 (CSAH 8 TO MNTH-28)	10.0	0.0	10	8.0	1.3	71	45	26	58%
CNTY 63 (CSAH 8 TO MNTH 28)	6.0	0.0	6	5.0	1.2	53	80	-27	-33%
CNTY 73 (CNTY 56 TO CSAH 18)	4.0	0.0	4	3.1	1.3	44	25	19	77%
CNTY 76 (US-59 TO CSAH 3)	4.0	3.0	7	2.0	3.5	58	60	-2	-4%

TABLE 2 – STEVENS COUNTY ROADS ANALYSIS

The use of the regression equation, based on Wright County data, generally produced forecasts that came near the actual counts. Three of the forecasts were within 25% of the actual count and another forecast was within 33%. The other two forecasts were more than 50% greater than the actual counts. However, none of these roadways had traffic volumes

near 400 ADT so it is difficult to tell whether or not the equation would accurately predict a low volume road with volumes at or near 400 ADT in order to be consistent with the guidance in Part 5 of the MnMUTCD.

Figure 3 demonstrates the best fit equation of the actual Stevens County road data compared to what the results would have been using the best fit linear equation from the rural count locations in Wright County.

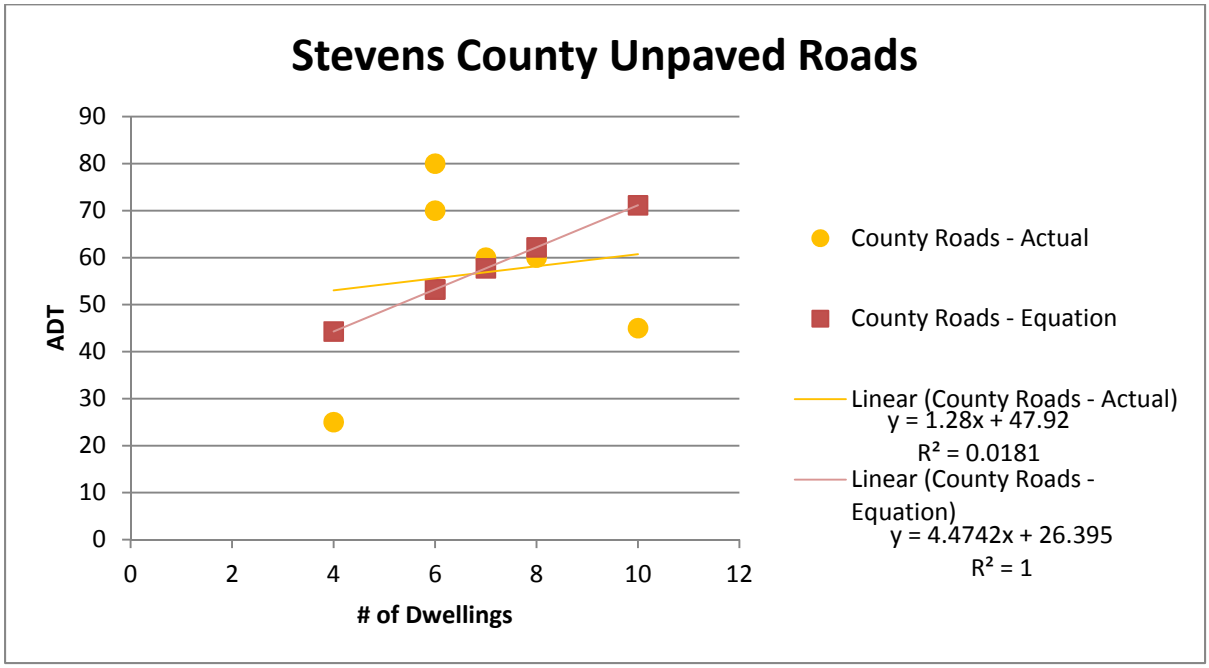


FIGURE 3

The rural road regression equation accurately predicted that the roadways would be under the 400 vehicle ADT threshold for application of the traffic sign guidance in Part 5 of the MnMUTCD.

Another important factor when considering benefits and needs for the application of stop signs at low-volume roadway intersections is entering intersection volumes. The most current research (Guidelines for the Removal of Traffic Control Devices in Rural Areas, Iowa Highway Research Board Project TR-527) found that STOP signs produced no safety benefits at intersections with less than 150 entering daily vehicles.. The equation was used to determine whether or not the intersection entering volume of Stevens County roadways could be accurately predicted.

The same analysis was performed on intersecting roadways of the six randomly selected unpaved Stevens County roadways and the results are documented in Table 3.

STEVENS COUNTY INTERSECTING ROADS ANALYSIS

Streets	Dwellings on Road	Dwellings use Road to Access	# of Dwellings	Miles	Dwellings/ Mile	Forecast ADT from Count Data Equation	ADT - Actual (From 2009 Traffic Volumes General Highway Map by MnDOT)	ADT - Difference	Comments
CNTY 58 (CSAH 7 TO US-59)	4	3	7	3	2.3	58	40	18	
CSAH 13 (CSAH 12 TO CNTY 56)	5	4	9	4	2.3	67	420	-353	NORTH OF CHOKIO
CNTY 66 (BIG STONE CO TO CNTY 54)	3	10	13	7	1.9	85	20	65	
CSAH 8 (CSAH 9 TO US-59)	8	10	18	7	2.6	107	410	-303	2 INDUSTRIAL AREAS
CSAH 18 (CSAH 13 TO CNTY 72)	7	3	10	5	2.0	71	180	-109	
CSAH 3 (GRANT CO TO CNTY 20)	2	4	6	3	2.0	53	25	28	

TABLE 3 – STEVENS COUNTY INTERSECTING ROADS ANALYSIS

These roadway volumes were then assumed to be split 50/50 between each roadway direction and the intersection entering volume was calculated for the Stevens County intersections. Table 4 shows the intersection entering volumes using the rural best fit equation compared to the actual volumes.

STEVENS COUNTY ESTIMATED VS. ACTUAL INTERSECTIONG ENTERING TRAFFIC

Intersections	Equation	Actual	Difference	% Difference
CSAH 7 AND CR 58	55	55	0	0%
CSAH 14 AND CSAH 13	64	240	-176	-272.5%
CSAH 15 AND CR 66	78	33	45	58.3%
CNTY 63 AND CSAH 8	80	245	-165	-205.9%
CNTY 73 AND CSAH 18	58	103	-45	-77.6%
CNTY 76 AND CSAH 3	55	43	13	23.4%

TABLE 4 – STEVENS COUNTY ESTIMATED VS. ACTUAL INTERSECTION ENTERING TRAFFIC

The equation accurately predicted that the four intersections with less than 150 entering daily vehicles would be under the threshold. However, the equation did not identify the two intersections that had volumes greater than the 150 daily volume threshold.

The intersection entering volume was reviewed further to determine possible trends or factors that could be used to better predict the intersection entering volumes. It was determined that the connectivity of the road network and the level of through roadway traffic appear to influence the traffic volumes in addition to just the number of dwellings.

In order to gain a better understanding of the effect of network connectivity on traffic volume, the local roadway system in Stevens County was reviewed and the influence on intersection volume was noted. The network review suggested three levels of intersection adjustments to be applied after the entering intersection volume is calculated.

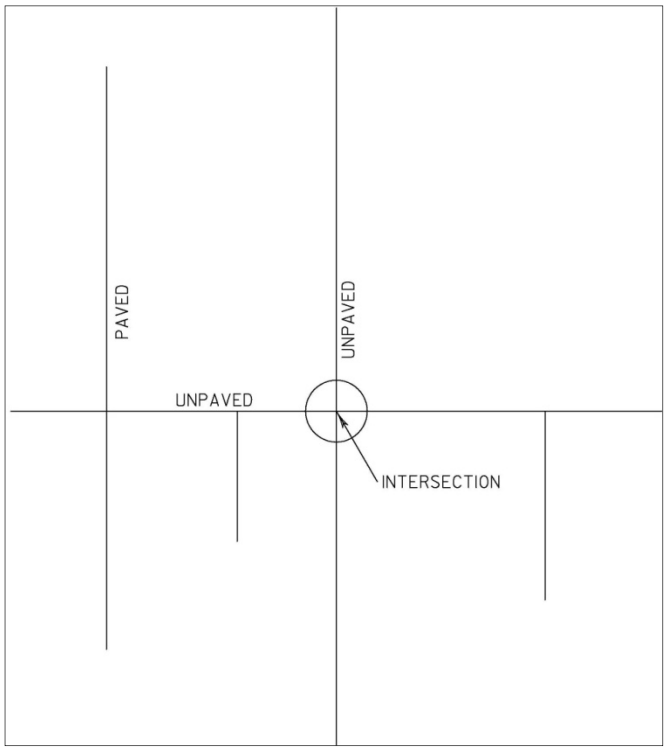


FIGURE 4 – LOW LEVEL OF NETWORK CONNECTIVITY

The first category of intersections has a low level of network connectivity with the following features:

- Intersection of 2 unpaved roads
- Some or multiple connecting routes accessing roadway
- May have paved roadway nearby acting as alternate route to unpaved road

For these simple intersections the adjustment factor would be 1

Sample locations include: CSAH 7 and CR 58, CSAH 15 and CR 66, CNTY 76 and CSAH 3

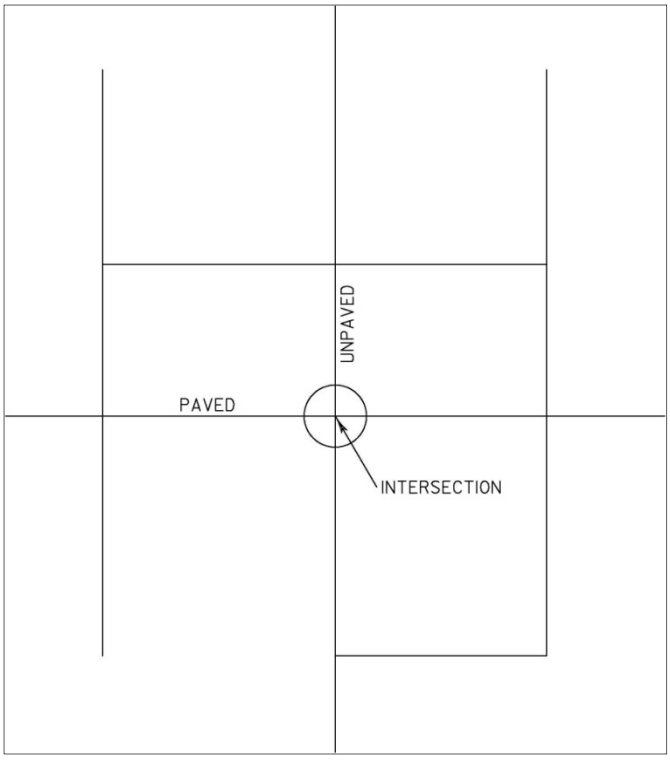


FIGURE 5 – MODERATE LEVEL OF NETWORK CONNECTIVITY

The second category of intersections has a <u>moderate</u> level of network connectivity with the following features:

- Intersection of paved and unpaved roads
- Multiple connecting routes accessing roadway

For these intersections, the adjustment factor would be 2.

A sample location includes: CNTY 73 and CSAH 18

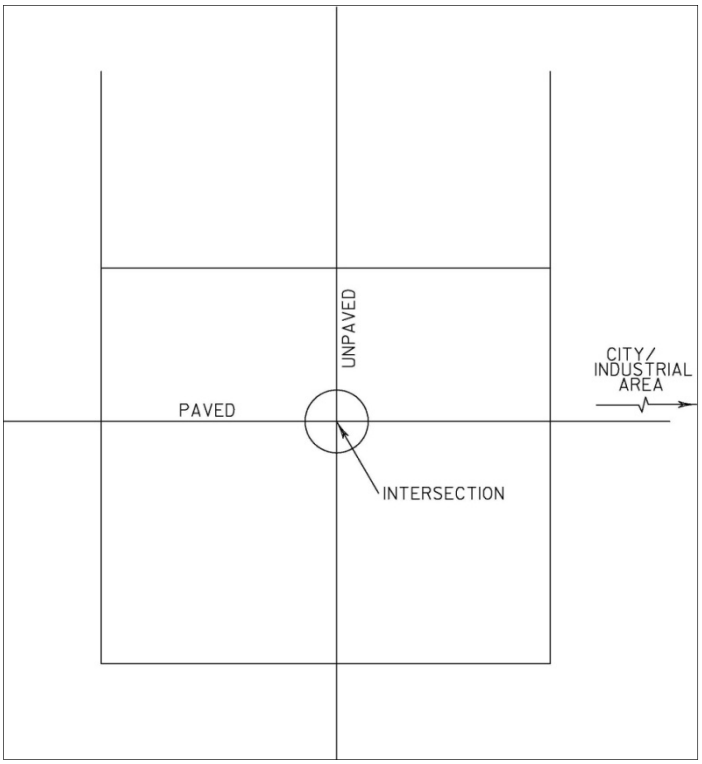


FIGURE 6 – HIGH LEVEL OF NETWORK CONNECTIVITY

The third category of intersections has a <u>high</u> level of network connectivity with the following features:

- Intersection of paved and unpaved roads
- Multiple connecting routes accessing roadway
- City or industrial area nearby

For these intersections the adjustment factor would be 3.

Sample locations include: CSAH 14 and CSAH 13, CNTY 63 and CSAH 8

These adjusted factors were applied to the Stevens County intersections, and the results compared to the actual intersection entering volume and unfactored calculated entering volume are documented in Table 5.

ESTIMATED VS. ACTUAL INTERSECTION ENTERING TRAFFIC AFTER APPLIED FACTORS

Intersections	Equation Before Factor	Factor Applied	Equation After Factor	Actual	Difference	% Difference
CSAH 7 AND CR 58	55	1	55	55	0	0%
CSAH 14 AND CSAH 13	64	3	193	240	-47	-24%
CSAH 15 AND CR 66	78	1	78	33	45	58%
CNTY 63 AND CSAH 8	80	3	240	245	-5	-2%
CNTY 73 AND CSAH 18	58	2	115	103	13	11%
CNTY 76 AND CSAH 3	55	1	55	43	13	23%

TABLE 5 - ESTIMATED VS. ACTUAL INTERSECTION ENTERING TRAFFIC AFTER APPLIED FACTORS

The application of the network connectivity adjustment factors did improve the forecasts of intersection entering volumes. The methodology produced forecasts within ± 25% of the actual counts in 5 out of the 6 samples and was 100% accurate in predicting volumes below or above the ultra-low volume threshold of 150 daily entering vehicles.

Overall Results

Looking at the accuracy of the best fit linear equations from the traffic counts within Wright County, there is a strong fit for the rural locations, but not nearly as strong for the urban. The fit line, however, is based on an extremely small sample size and it cannot be confirmed that it reflects all township roads.

The best fit equation for rural roadways accurately determined roadway volumes to be under 400 AADT when compared to Stevens County gravel roads and resulted in mixed results (above and below) when compared to the actual traffic count data.

When intersection entering volume was calculated at intersections along Stevens County gravel roads, 2 out of 3 intersections were correctly predicted to be below or above 150 daily entering vehicles.

Network connectivity appears to play a large factor in the AADT. It appears adjacent roadways affect the traffic volumes on low-volume rural roadways reflecting the fact that people use a network of roads to get to their destination. Depending on the roadways surrounding their homes, they may be more likely to take one route over another to get where they need to. Using this theory, there appear to be adjustment factors that can be applied to the entering intersection volume equation based on the network of roadways adjacent to the intersection being analyzed.

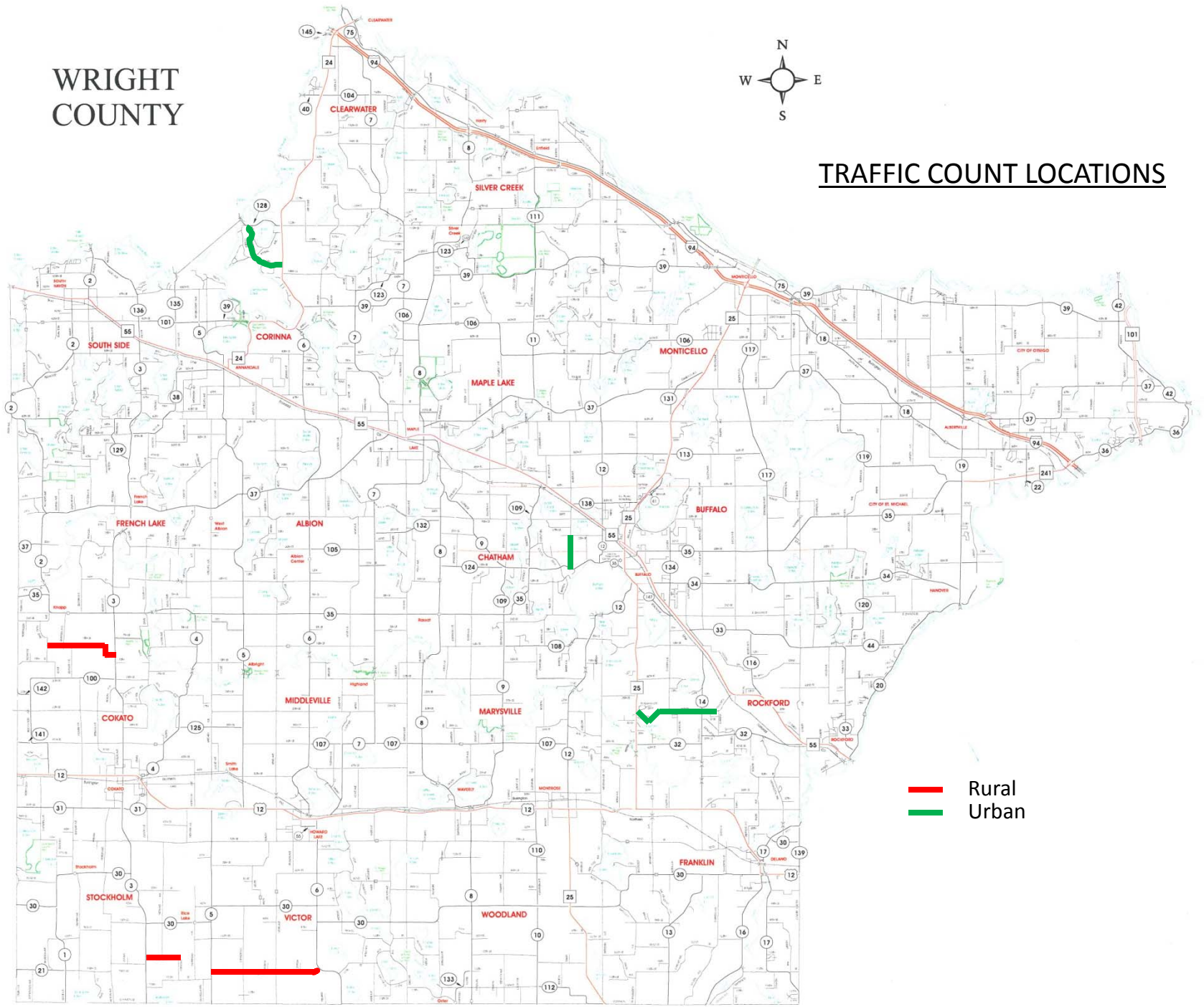
Recommendations

As a first attempt to understand the correlation between land use (number of dwellings) and traffic volumes on low volume, township roads, it appears there is a link between the two based on the chosen sample locations. The correlation is stronger on ultra-low volume (less than 150 daily entering vehicles), rural roads; however, there also appears to be a need to adjust the equations by some factor to account for differences in surrounding roadway densities and systems.

The land use correlation cannot be confirmed in this analysis due to the small sample size. Before encouraging townships to use this method of determining traffic volumes on their systems, it is recommended to invest more work and analysis of other traffic counts and locations to establish a better correlation between the land use and predicted traffic volumes.

Attachment 1

Wright County Township Road Count Locations


WRIGHT
COUNTY
N
W
E
S
TRAFFIC COUNT LOCATIONS
CLEARWATER
SILVER CREEK
CORINNA
SOUTH SIDE
MONTICELLO
MAPLE LAKE
FRENCH LAKE
ALBION
CHATHAM
BUFFALO
MIDDLEVILLE
COKATO
MARYSVILLE
ROCKFORD
FRANKLIN
STOCKHOLM
VICTOR
WOODLAND
Rural
Urban

Attachment 2

Wright County Tubular Traffic Count Data

Traffic Data Inc.

www.trafficdatainc.com
952.926.0916

Site Code: 4

12th St SW west of CR 3
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
12:00 AM	*	*	0	0	0	0	*	*	0
01:00	*	*	1	1	0	1	*	*	1
02:00	*	*	0	0	0	0	*	*	0
03:00	*	*	1	1	1	1	*	*	1
04:00	*	*	0	0	0	0	*	*	0
05:00	*	*	3	2	1	2	*	*	2
06:00	*	*	9	5	**13**	**9**	*	*	**9**
07:00	*	*	8	4	4	5	*	*	5
08:00	*	*	**12**	**10**	3	8	*	*	8
09:00	*	*	9	8	11	9	*	*	9
10:00	*	*	6	4	6	5	*	*	5
11:00	*	*	5	5	1	4	*	*	4
12:00 PM	*	*	8	11	*	10	*	*	10
01:00	*	*	3	2	*	2	*	*	2
02:00	*	**12**	**13**	5	*	10	*	*	10
03:00	*	8	13	9	*	10	*	*	10
04:00	*	7	8	13	*	9	*	*	9
05:00	*	11	12	**14**	*	**12**	*	*	**12**
06:00	*	12	6	6	*	8	*	*	8
07:00	*	9	7	4	*	7	*	*	7
08:00	*	9	8	5	*	7	*	*	7
09:00	*	4	3	2	*	3	*	*	3
10:00	*	4	1	7	*	4	*	*	4
11:00	*	4	1	2	*	2	*	*	2
Day Total	0	80	137	120	40	128	0	0	128
% Avg. WkDay	0.0%	62.5%	107.0%	93.8%	31.3%				
% Avg. Week	0.0%	62.5%	107.0%	93.8%	31.3%	100.0%	0.0%	0.0%	
AM Peak			08:00	08:00	06:00	06:00			06:00
Vol.			12	10	13	9			9
PM Peak		14:00	14:00	17:00		17:00			17:00
Vol.		12	13	14		12			12
Grand Total	0	80	137	120	40	128	0	0	128

ADT ADT 128 AADT 128

Traffic Data Inc.

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952.926.0916

Site Code: 6

110th St SW west of CR 6
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
12:00 AM	*	*	2	1	7	3	*	*	3
01:00	*	*	0	0	0	0	*	*	0
02:00	*	*	0	0	1	0	*	*	0
03:00	*	*	1	2	1	1	*	*	1
04:00	*	*	2	0	1	1	*	*	1
05:00	*	*	5	2	5	4	*	*	4
06:00	*	*	2	4	4	3	*	*	3
07:00	*	*	6	**7**	7	**7**	*	*	**7**
08:00	*	*	2	3	5	3	*	*	3
09:00	*	*	6	4	5	5	*	*	5
10:00	*	*	3	1	**9**	4	*	*	4
11:00	*	*	**8**	6	4	6	*	*	6
12:00 PM	*	*	4	1	*	2	*	*	2
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07:00	*	7	9	11	*	9	*	*	9
08:00	*	12	8	7	*	9	*	*	9
09:00	*	2	5	7	*	5	*	*	5
10:00	*	5	4	3	*	4	*	*	4
11:00	*	0	2	4	*	2	*	*	2
Day Total	0	53	119	119	49	121	0	0	121
% Avg. WkDay	0.0%	43.8%	98.3%	98.3%	40.5%				
% Avg. Week	0.0%	43.8%	98.3%	98.3%	40.5%	100.0%	0.0%	0.0%	
AM Peak			11:00	07:00	10:00	07:00			07:00
Vol.			8	7	9	7			7
PM Peak		20:00	15:00	16:00		14:00			14:00
Vol.		12	11	13		10			10
Grand Total	0	53	119	119	49	121	0	0	121

ADT ADT 119 AADT 119

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952.926.0916

Site Code: 5

105th St SW east of CR 3
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
12:00 AM	*	*	0	0	0	0	*	*	0
01:00	*	*	0	0	0	0	*	*	0
02:00	*	*	0	0	0	0	*	*	0
03:00	*	*	0	0	0	0	*	*	0
04:00	*	*	0	0	0	0	*	*	0
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07:00	*	*	1	1	1	1	*	*	1
08:00	*	*	2	0	2	1	*	*	1
09:00	*	*	3	2	3	3	*	*	3
10:00	*	*	**4**	3	2	3	*	*	3
11:00	*	*	2	**5**	**5**	**4**	*	*	**4**
12:00 PM	*	*	0	3	*	2	*	*	2
01:00	*	*	2	5	*	4	*	*	4
02:00	*	*	**6**	5	*	**6**	*	*	**6**
03:00	*	1	3	2	*	2	*	*	2
04:00	*	**3**	1	3	*	2	*	*	2
05:00	*	1	4	2	*	2	*	*	2
06:00	*	3	2	**7**	*	4	*	*	4
07:00	*	1	2	1	*	1	*	*	1
08:00	*	1	3	0	*	1	*	*	1
09:00	*	1	0	1	*	1	*	*	1
10:00	*	0	0	0	*	0	*	*	0
11:00	*	0	0	0	*	0	*	*	0
Day Total	0	11	36	41	14	38	0	0	38
% Avg. WkDay	0.0%	28.9%	94.7%	107.9%	36.8%				
% Avg. Week	0.0%	28.9%	94.7%	107.9%	36.8%	100.0%	0.0%	0.0%	
AM Peak			10:00	11:00	11:00	11:00			11:00
Vol.			4	5	5	4			4
PM Peak		16:00	14:00	18:00		14:00			14:00
Vol.		3	6	7		6			6
Grand Total	0	11	36	41	14	38	0	0	38

ADT ADT 38 AADT 38

Traffic Data Inc.

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952.926.0916

Site Code: 3

108th St NW west of MN-24
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
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01:00	*	*	0	4	1	2	*	*	2
02:00	*	*	0	0	0	0	*	*	0
03:00	*	*	0	0	1	0	*	*	0
04:00	*	*	6	4	2	4	*	*	4
05:00	*	*	9	10	8	9	*	*	9
06:00	*	*	8	15	16	13	*	*	13
07:00	*	*	32	26	29	29	*	*	29
08:00	*	*	23	37	**40**	33	*	*	33
09:00	*	*	43	**39**	39	**40**	*	*	**40**
10:00	*	*	41	37	36	38	*	*	38
11:00	*	*	**44**	36	*	40	*	*	40
12:00 PM	*	25	35	42	*	34	*	*	34
01:00	*	48	35	52	*	45	*	*	45
02:00	*	34	**47**	55	*	45	*	*	45
03:00	*	30	27	**64**	*	40	*	*	40
04:00	*	**56**	41	50	*	**49**	*	*	**49**
05:00	*	43	43	56	*	47	*	*	47
06:00	*	31	24	37	*	31	*	*	31
07:00	*	21	23	34	*	26	*	*	26
08:00	*	24	23	24	*	24	*	*	24
09:00	*	6	15	20	*	14	*	*	14
10:00	*	1	6	9	*	5	*	*	5
11:00	*	4	1	3	*	3	*	*	3
Day Total	0	323	528	654	174	572	0	0	572
% Avg. WkDay	0.0%	56.5%	92.3%	114.3%	30.4%				
% Avg. Week	0.0%	56.5%	92.3%	114.3%	30.4%	100.0%	0.0%	0.0%	
AM Peak			11:00	09:00	08:00	09:00			09:00
Vol.			44	39	40	40			40
PM Peak		16:00	14:00	15:00		16:00			16:00
Vol.		56	47	64		49			49
Grand Total	0	323	528	654	174	572	0	0	572

ADT

ADT 591

AADT 591

Traffic Data Inc.

www.trafficdatainc.com
952.926.0916

Site Code: 2

Baker Ave NW north of CR 35
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
12:00 AM	*	*	3	0	3	2	*	*	2
01:00	*	*	0	0	1	0	*	*	0
02:00	*	*	1	0	1	1	*	*	1
03:00	*	*	1	0	1	1	*	*	1
04:00	*	*	5	3	1	3	*	*	3
05:00	*	*	8	12	9	10	*	*	10
06:00	*	*	17	20	18	18	*	*	18
07:00	*	*	33	**30**	**31**	**31**	*	*	**31**
08:00	*	*	**34**	18	21	24	*	*	24
09:00	*	*	27	10	30	22	*	*	22
10:00	*	*	28	21	*	24	*	*	24
11:00	*	*	22	18	*	20	*	*	20
12:00 PM	*	20	26	17	*	21	*	*	21
01:00	*	31	30	29	*	30	*	*	30
02:00	*	29	30	26	*	28	*	*	28
03:00	*	24	36	28	*	29	*	*	29
04:00	*	45	**44**	47	*	45	*	*	45
05:00	*	**49**	36	**53**	*	**46**	*	*	**46**
06:00	*	37	37	29	*	34	*	*	34
07:00	*	22	26	26	*	25	*	*	25
08:00	*	16	33	21	*	23	*	*	23
09:00	*	15	19	15	*	16	*	*	16
10:00	*	13	12	10	*	12	*	*	12
11:00	*	5	6	7	*	6	*	*	6
Day Total	0	306	514	440	116	471	0	0	471
% Avg. WkDay	0.0%	65.0%	109.1%	93.4%	24.6%				
% Avg. Week	0.0%	65.0%	109.1%	93.4%	24.6%	100.0%	0.0%	0.0%	
AM Peak			08:00	07:00	07:00	07:00			07:00
Vol.			34	30	31	31			31
PM Peak		17:00	16:00	17:00		17:00			17:00
Vol.		49	44	53		46			46
Grand Total	0	306	514	440	116	471	0	0	471

ADT ADT 477 AADT 477

Traffic Data Inc.

www.trafficdatainc.com
952.926.0916

Site Code: 1

30th St SE west of Deadrick Ave SE
Wright County, MN

Start Time	Mon 22-Aug-11	Tue 23-Aug-11	Wed 24-Aug-11	Thu 25-Aug-11	Fri 26-Aug-11	Average Day	Sat 27-Aug-11	Sun 28-Aug-11	Week Average
12:00 AM	*	*	0	0	1	0	*	*	0
01:00	*	*	1	3	1	2	*	*	2
02:00	*	*	0	0	0	0	*	*	0
03:00	*	*	2	1	0	1	*	*	1
04:00	*	*	2	4	2	3	*	*	3
05:00	*	*	25	28	18	24	*	*	24
06:00	*	*	23	**33**	35	30	*	*	30
07:00	*	*	**30**	28	**36**	**31**	*	*	**31**
08:00	*	*	16	10	21	16	*	*	16
09:00	*	*	13	22	19	18	*	*	18
10:00	*	*	12	14	*	13	*	*	13
11:00	*	**14**	8	15	*	12	*	*	12
12:00 PM	*	10	16	6	*	11	*	*	11
01:00	*	13	6	16	*	12	*	*	12
02:00	*	17	9	14	*	13	*	*	13
03:00	*	19	16	15	*	17	*	*	17
04:00	*	**31**	27	**43**	*	**34**	*	*	**34**
05:00	*	22	**30**	21	*	24	*	*	24
06:00	*	17	19	11	*	16	*	*	16
07:00	*	12	12	6	*	10	*	*	10
08:00	*	10	10	5	*	8	*	*	8
09:00	*	4	2	4	*	3	*	*	3
10:00	*	2	2	3	*	2	*	*	2
11:00	*	2	0	3	*	2	*	*	2
Day Total	0	173	281	305	133	302	0	0	302
% Avg. WkDay	0.0%	57.3%	93.0%	101.0%	44.0%				
% Avg. Week	0.0%	57.3%	93.0%	101.0%	44.0%	100.0%	0.0%	0.0%	
AM Peak		11:00	07:00	06:00	07:00	07:00			07:00
Vol.		14	30	33	36	31			31
PM Peak		16:00	17:00	16:00		16:00			16:00
Vol.		31	30	43		34			34
Grand Total	0	173	281	305	133	302	0	0	302

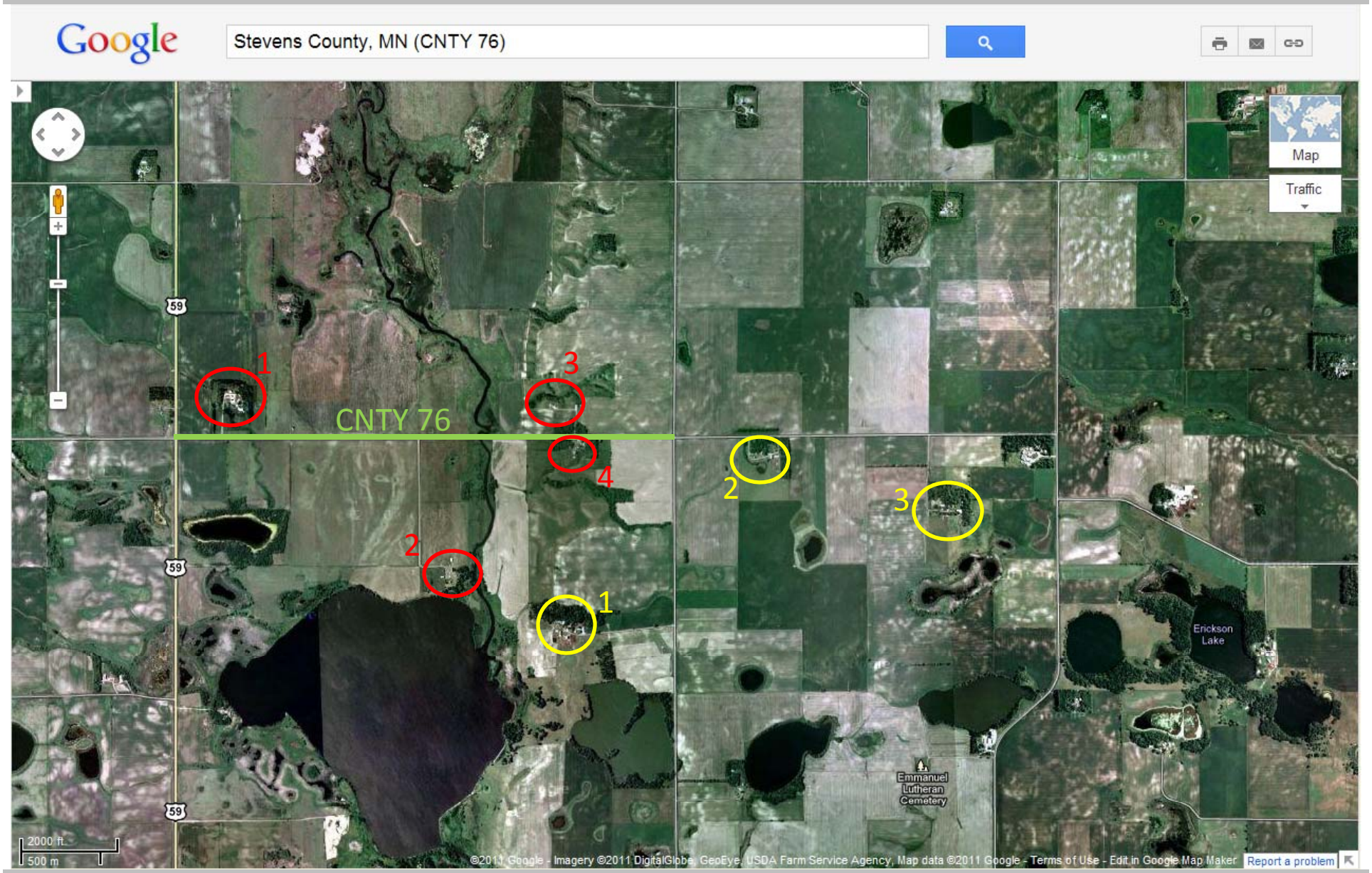
ADT ADT 293 AADT 293

Attachment 3

Example of # of Dwellings Count

Dwellings on Road

Dwellings use road to access



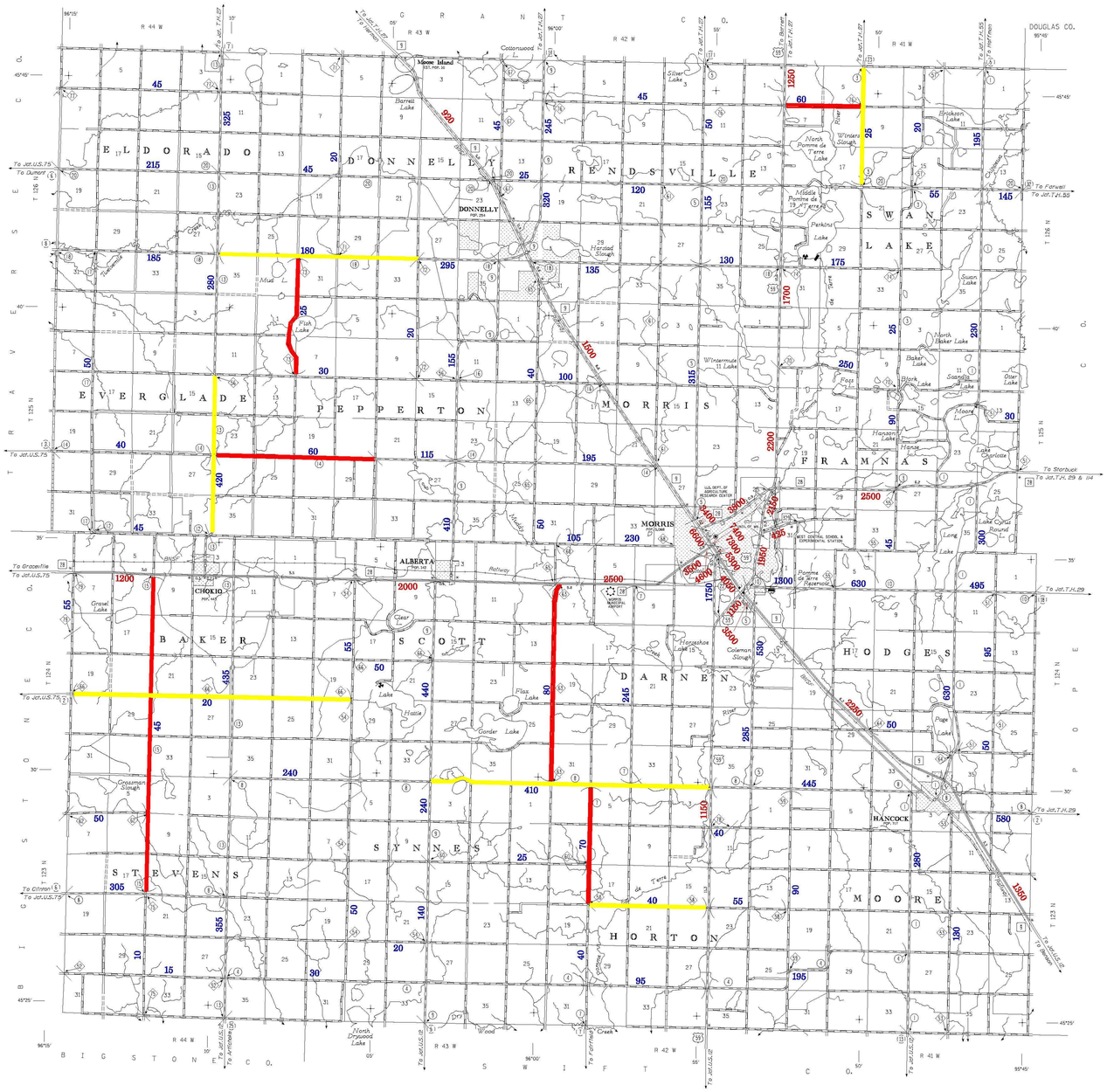
Attachment 4

Stevens County AADT Volume Map and Analysis Locations

2009 TRAFFIC VOLUMES
GENERAL HIGHWAY MAP
STEVENS COUNTY
MINNESOTA

PREPARED BY THE

MINNESOTA DEPARTMENT OF TRANSPORTATION
OFFICE OF TRANSPORTATION DATA & ANALYSIS
IN COOPERATION WITH
U.S. DEPARTMENT OF TRANSPORTATION
FEDERAL HIGHWAY ADMINISTRATION



VOLUMES PREPARED BY
THE OFFICE OF
TRANSPORTATION DATA & ANALYSIS

NUMERALS INDICATE AVERAGE DAILY
TRAFFIC VOLUMES ON DESIGNATED ROADS.

TRUNK HIGHWAY ROUTES ARE 2009 A.A.D.T. VOLUMES
COUNTY SYSTEM ROADS ARE 2009 A.A.D.T. VOLUMES

FOR DESIGNATED ROADS :
/ = SEGMENT ENDPOINT FOR ALL
ROADS INTERSECTED BY HATCH
(= SEGMENT ENDPOINT ONLY FOR
ROAD SEPARATED FROM INTERSECTING
ROAD BY ARC

TRAFFIC VOLUMES ARE SUBJECT TO VARIABILITY AND CONSTRUCTION EFFECTS

FOR MORE INFO VISIT: http://www.dot.state.mn.us/traffic/data/html/aadt.html

SCALE

1 0 1 2 3 4 MILES
1 0 1 2 3 4 5 6 KILOMETERS

2009
BASIC DATA - 1977*

Projections
Minnesota Coordinate System
Central Zone
Lambert Conformal Conic

North American Datum of 1983

N W E S

LEGEND

ROAD AND ROADWAY FEATURES
PROJECTED ROAD
PRIMITIVE ROAD
UNIMPROVED ROAD
GRADED AND DRAINED ROAD
SOIL SURFACE ROAD
GRAVEL OR STONE ROAD
BITUMINOUS SURFACE
PAVED ROAD
DIVIDED ROAD
TRUNK HIGHWAY UNDER CONSTRUCTION
ROADS IN UNINCORPORATED COMPACTS, EXTENSIONS OF LOCAL ROADS NOT FULLY WITHIN MUNICIPALITIES AND FRONTAGE ROADS
POINTS BETWEEN WHICH DISTANCES ARE MEASURED INDICATED THUS
GRADE SEPARATION
FULL TRAFFIC INTERCHANGE
PARTIAL TRAFFIC INTERCHANGE INDICATING TRAFFIC MOVEMENT

ROAD SYSTEM DESIGNATIONS
INTERSTATE TRUNK HIGHWAY
U.S. NUMBERED TRUNK HIGHWAY
STATE NUMBERED TRUNK HIGHWAY
COUNTY STATE AID HIGHWAY
COUNTY ROAD
COUNTY STATE AID IN ADJOINING COUNTY
TERMINATION OF DESIGNATED ROUTE
INTERSTATE EXIT
GREAT RIVER ROAD
FEDERAL AID INTERSTATE SYSTEM
NATIONAL FOREST HIGHWAY
NATIONAL FOREST DEVELOPMENT
INDIAN SERVICE ROAD
STATE FOREST ROAD
STATE PARK ROAD

RAILROADS
RAILROAD (ANY NUMBER OF TRACKS) USED BY A SINGLE OPERATING COMPANY OR BY TRACKS OF ANOTHER CARRIER UNDER TRACKAGE RIGHTS
RAILROADS IN JUXTAPOSITION (TWO OR MORE TRACKS OF SEPARATELY OPERATED COMPANIES) ON ADJACENT RIGHTS OF WAY
RAILROAD STATION
GRADE CROSSING
UNDERPASS HIGHWAY BELOW
OVERPASS HIGHWAY ABOVE

AIRWAYS
RUNWAY
MILITARY FIELD
COMMERCIAL OR MUNICIPAL FIELD
COMPLETE FACILITIES
LIMITED FACILITIES
LANDING AREA OR STRIP
SEAPLANE BASE
AIRWAY LIGHT BEACON, GENERAL
RADIO RANGE STATION

STRUCTURES
General Symbols (over 20' span)
HIGHWAY BRIDGE
SMALL BRIDGES CLOSELY SPACED
DRAWBRIDGE
General Symbols (300' span and over)
GENERAL
DRAWBRIDGE
ARCH
TRUSS
THE WORD TOLL IS ADDED WHERE APPLICABLE
Other Structures
PEDESTRIAN BRIDGE
DAM WITH ROAD (LARGE SCALE)
DAM WITH ROAD (SMALL SCALE)
DAM WITHOUT ROAD (LARGE SCALE)
DAM WITHOUT ROAD (SMALL SCALE)
LEVEE OR DIKE
LEVEE OR DIKE WITH ROAD
MINOR STRUCTURES UP TO 20' SPAN
CONCRETE FORD OR DIP
FORD - ROAD ESTABLISHED

BOUNDARIES
NATIONAL OR STATE
COUNTY
CIVIL TOWNSHIP
CONGRESSIONAL TOWNSHIP SUBLAND
CORPORATE LINE
SECTION LINE
CONGESTED AREA
NATIONAL OR STATE PARK
NATIONAL OR STATE FOREST
INDIAN RESERVATION
GAME REFUGE
AIRPORT
BOUNDARY AREA STATION OR WATERSHED AREA FEDERAL
WATER LINE BETWEEN ADJOINING SHEETS OF THE SAME COUNTY

DRAINAGE
INTERMITTENT STREAM
NARROW STREAM
WIDE STREAMS
MARSH OR SWAMP LAND
DRAINAGE DITCH
LAKE OR POND

NAVIGATION
BANK LINES IN NATURAL STREAMS
SHIP LINES ON INLAND LAKES
DOCK, PIER OR LANDING
NAVIGABLE STREAM
DAM WITH LOCK
LANDMARK LIGHT BEACON
LIGHTHOUSE

CONSERVATION
FOREST RANGER STATION
GUARD OR RANGER STATION
HOT PERMANENT, ELEVATED
FISH HATCHERY
GAME PRESERVE
OBSERVATION OR LOOKOUT TOWER
PERMANENT ELEVATION
SMALL PARK, SP = STATE, CP = COUNTY, MP = MUNICIPAL, WP = WAYSIDE
PUBLIC ACCESS POINT

RECREATION
GOLF COURSE OR COUNTRY CLUB
GUN CLUB
RIFLE RANGE
AMUSEMENT PARK
PICNIC GROUND
PLAYGROUNDS, BALLFIELDS, ETC.
BATHING BEACH OR SWIMMING POOL
SCENIC SITE
CAMP SITE
CAMP OR LODGE

FARM AND DWELLING UNITS
FARM UNIT
DWELLING OTHER THAN FARM
BARRACKS OR DORMITORIES FOR STUDENTS, WORKERS, MIGRANTS, ETC.
SEASONAL DWELLING
ROWS OR GROUPS OF DWELLINGS CLOSELY SPACED
NUMBER ADJACENT TO SYMBOL INDICATES NUMBER OF EACH UNIT
DOT AND ARROW ARE USED TO INDICATE LOCATION OF ANY CULTURAL FEATURE SHOWN OUT OF PORTION

INDUSTRIAL
FACTORY OR INDUSTRIAL PLANT
SAWMILL
STORAGE TANKS, OIL OR GAS
GRAIN ELEVATOR
BEET DUMP
STOCKYARD, FEEDLOT
QUARRY
MILK DEPOT, CREAMERY OR CHEESE FACTORY
WAREHOUSE

COMMERCIAL
STORE OR SMALL BUSINESS ESTABLISHMENT
HOTEL
MOTEL
TOURIST COURT
DRIVE-IN THEATRE
NURSERY
GREENHOUSE

PUBLIC SERVICE FACILITIES
POST OFFICE
FIRE STATION
NURSE'S
PUBLIC LIBRARY
SCHOOL
U.S. BORDER PORT OF ENTRY
RADIO STATION
SEWAGE DISPOSAL PLANT
NURSING HOME
HOSPITAL
TOWN HALL
CORRECTIONAL INSTITUTION

CITY CENTERS
STATE CAPITAL
COUNTY SEAT
CITY CENTER
INCORPORATED CITY GENERALIZED
UNINCORPORATED COMMUNITY

MISCELLANEOUS MAP FEATURES
CHURCH, OTHER RELIGIOUS INSTITUTIONS
CEMETERY
CHURCH WITH CEMETERY ADJACENT
FAIRGROUNDS, RACE COURSES, SPEEDWAYS
MONUMENT (SMALL)
FORT, ARMY CAMP, OR MILITARY POST
GRAVEL PIT
SANITARY LANDFILL
AUTO JUNKYARD
SCRAP METAL JUNKYARD
WATER TREATMENT
STATE PATROL SUBSTATION
DEPARTMENT OF TRANSPORTATION DISTRICT OFFICE
TOLL HOUSE, STATE PORT OF ENTRY OR WEIGH STATION
VALVE HOUSE
NATURAL GAS, PETROLEUM PRODUCTS, CRUDE OIL OR WATER
NATURAL GAS, PETROLEUM PRODUCTS, CRUDE OIL OR WATER
PIPELINE, NATURAL GAS
PIPELINE, PETROLEUM PRODUCTS
PIPELINE, CRUDE OIL
PIPELINE, WATER
TRANSMISSION LINE (ONLY ON OVERLAY)
RADIO TOWER
TRANSONDER STATION
TRIANGULATION STATION
LOOKOUT TOWER AND TRIANGULATION STATION
LATITUDE AND LONGITUDE INTERSECTION
HISTORIC SITES, STATE OR NATIONAL, OPEN TO THE PUBLIC

Outline Map of Minnesota showing location of the County within the State.

Outline Map of the County.

Area of this County 575 Sq.Miles
Land Area 560 Sq.Miles
2000 Total County Population 10,053

*NOTE: ALL FEATURES EXCEPT TOWNSHIP ROADS AND CULTURE ARE CURRENT AS OF JANUARY 1, 2009.

NOTE: FOR DETAIL OF COUNTY STATE AID HIGHWAYS AND COUNTY ROADS IN INCORPORATED PLACES, SEE MAPS OF MUNICIPALITIES.

SHEET 1 OF 1