Determination of the Amount of Historical Traffic Volume Data to be Used to Forecast Future Volumes

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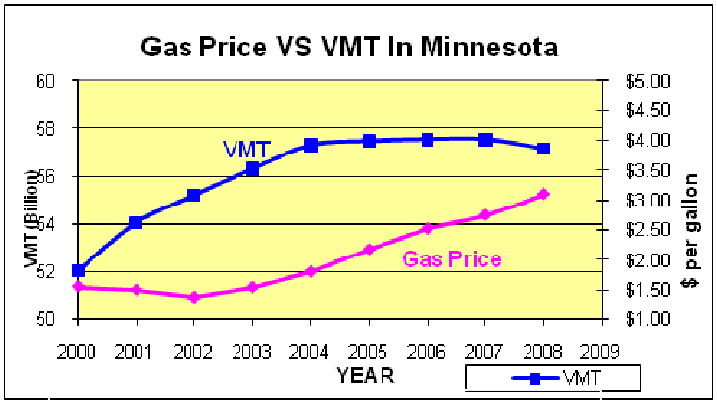
BACKGROUND

"Colombian truckers call strike over gas prices", Marker news reported the Colombian truck drivers will stage a nation-wide strike to protest over the high cost of gasoline. The Herald Tribune, the global edition of the New York Times, published a report that said more than 11,000 truck drivers in Korea went on strike to protest the rising gas prices. Gas prices have been increasing globally.

Gas prices have been increasing rapidly in the last decade. All grades of gas were $1.10 per gallon in1998, but increased to $4.00 per gallon in 2008. The increase of gas prices and the change in the economy appear to have significantly impacted motorists driving behavior. People started taking fewer trips, carpooling, and using more public transportation. The vehicle miles traveled (VMT) graph from Transportation Data Analysis shows the VMT has been flat or declining for the last four years, after many years of steady growth. The changes in driving behavior are major challenges for traffic forecasters, transportation planners, and transportation engineers when estimating future traffic volumes.



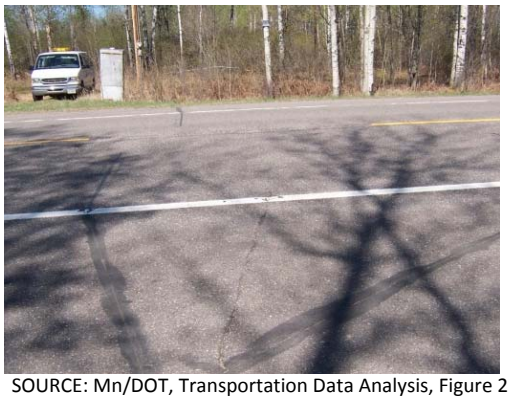
SOURCE: Mn/DOT, Transportation Data Analysis, Figure 1

Accuracy of traffic forecasting is very important. It is important to build a highway infrastructure that is neither too large nor too small to meet the travel demand of the driving public. In this study, different periods of historical traffic data from Automatic Traffic Recorders (ATRs) were used to project the 2006 Annual average daily traffic (AADT) and compare with existing 2006 AADT. This will determine how using different time periods of historical data affect the accuracy of traffic forecasting.

INTRODUCTION

The purpose of this study is to examine the impact on the accuracy of estimating future traffic volumes when using varying amounts of historical traffic volume data in regression analysis. The target data in this analysis were the known traffic volumes of 2006. Historical traffic data from 1966 to 1996 at ATRs were used in different groupings, (ie, 1966-1986, 1966-1976, 1976-1986, 1976-1996, 1986-1996) to estimate the 2006 volumes. The 2006 estimates were then compared to the actual 2006 volumes from the ATRs to determine which historical time data set was most accurate in predicting the future volume.

ATRs are inductive loops placed in the pavement surface that continuously and automatically collect traffic volume data. Weight-In-Motions (WIMs) have sensors to collect weight data along with volume, axle spacing, length, speed, and vehicle type data. As of March 2010, MN/DOT has 14 WIM sites. MN/DOT also has 87 ATRs of which 71 are located on the trunk highway system throughout the state. The other 16 are located on the local roads such as county roads, county state aid roads and municipal state aid roads. Traffic volumes are retrieved from these devices by the Traffic Forecasting and Analysis Section staff every other day.



SOURCE: Mn/DOT, Transportation Data Analysis, Figure 2

The traffic volume data derived from ATRs is used to create annual average daily traffic (AADT) volumes that are mapped and prepared for the annual ATR report. The ATR reports contain more than 20 years of AADT, so AADT in the 1960s can be found in the ATR reports published in the 1980s.

Methods

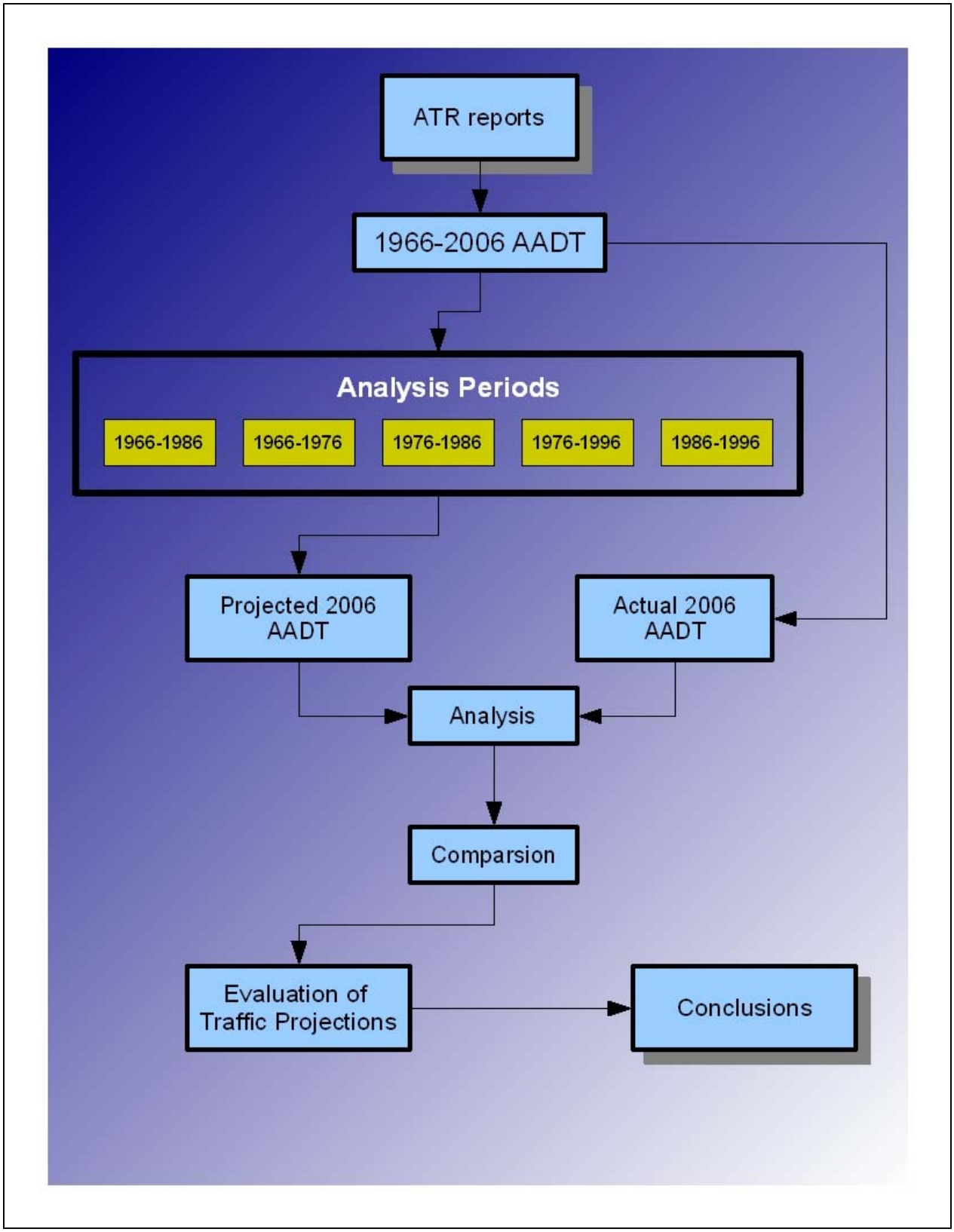
To achieve the objectives of this study, several sequential tasks had to be accomplished. The order used in conducting these tasks is outlined in detail below:

1. **The data needed was indentified**
   The forecast year was 2006. Two base years were being used in this study (1986 and 1996). The year 1986 was the base year for the time periods of 1966-1986, 1966-1976, and 1976-1986 to project AADT. The base year 1996 was the base year for the analysis periods of 1976-1996 and 1986-1996. All the historical AADTs can be found in the ATR reports published by Transportation Data and Analysis. Of the 87 ATRs 46 were selected for this study.

2. **All the data was recorded**
   Next the data was entered in an Excel spreadsheet. The data entered was ATR site number, route, location description, county, district, area type, functional classification, and AADT from 1966 to 2006.

3. **The results were computed**
   The projected AADT's were calculated in Excel using lease squares linear regression analysis for all the various data groups.

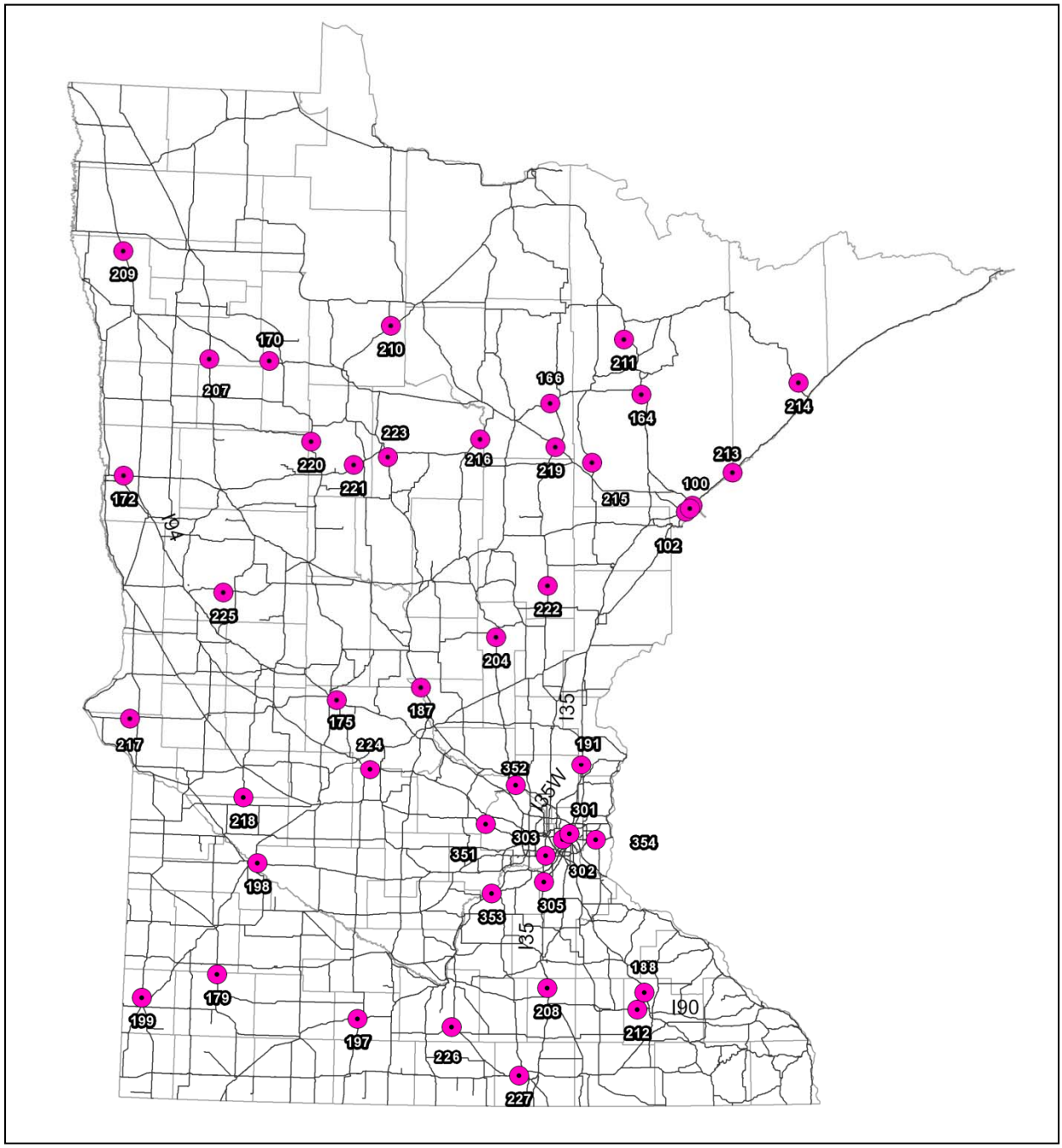
4. **The results were compared and evaluated**
   The following schematic drawing illustrates the process of comparison and evaluation.



SOURCE: Mn/DOT, Transportation Data Analysis, Figure 3

RESULTS

The following map shows the ATRs used in this study. As can be seen, most of the ATRs used are located in Greater Minnesota.

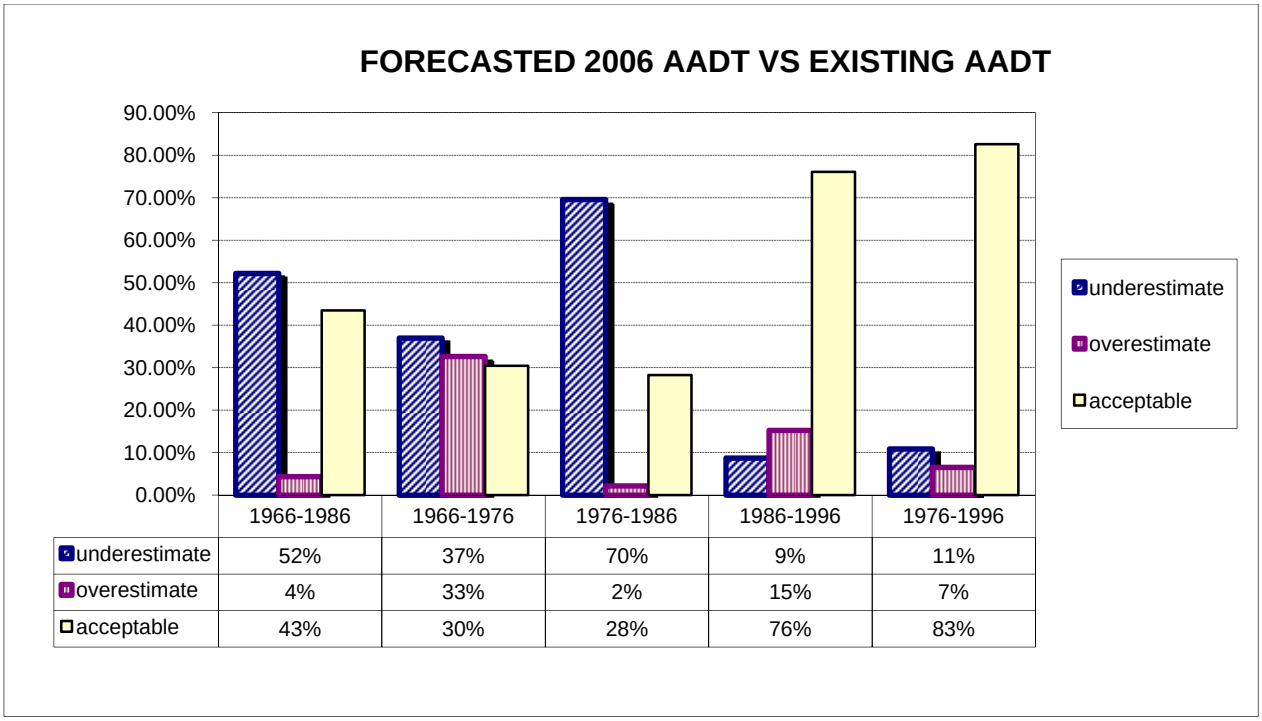


SOURCE: Mn/DOT, Transportation Data Analysis, Figure 4

ATR	CATEGORY	ROUTE	DESCRIPTION	COUNTY
100	OUTSTATE MUN INT	35	N OF 27TH AVE W IN DULUTH	ST. LOUIS
102	OUTSTATE MUN INT	35	N OF GARFIELD AVE IN DULUTH	ST. LOUIS
104	OUTSTATE MUN INT	35	W OF 63RD AVE W IN DULUTH	ST. LOUIS
164	OUTSTATE RURAL TH	53	1.3 MI S OF S JCT TH37 S OF VIRGINIA	ST. LOUIS
166	OUTSTATE RURAL TH	169	W OF CSAH83 E OF CALUMET	ITASCA
170	OUTSTATE RURAL TH	2	W OF CSAH20, W OF BAGLEY	CLEARWATER
172	OUTSTATE RURAL TH	10	1.7 MI E OF CSAH11 E OF DILWORTH	CLAY
175	OUTSTATE RURAL INT	94	SE OF CR1896 SE OF SAUK CENTRE	STEARNS
179	OUTSTATE RURAL TH	59	S OF S JCT CSAH14 S OF GARVIN	LYON
187	OUTSTATE RURAL TH	10	.8 MI NW OF NCL RICE	BENTON
188	OUTSTATE RURAL TH	52	.2 MI N OF CSAH14 (75TH ST NW) N OF ROCHESTER	OLMSTED
191	OUTSTATE RURAL INT	35	1.4 MI N OF CSAH22 (E VIKING BLVD) N OF WYOMING	CHISAGO
197	OUTSTATE RURAL TH	60	.7 MI W OF W JCT TH4 SW OF ST JAMES	Watonwan
198	OUTSTATE RURAL TH	212	E OF TH23 W OF SACRED HEART	RENVILLE
199	OUTSTATE RURAL TH	75	.5 MI N OF CR69 N OF PIIPESTONE	PIPESTONE
204	OUTSTATE RURAL TH	169	.3 MI N OF CASAH22 S OF ONAMIA	MILLE LACS
207	OUTSTATE RURAL TH	59	.8 MI N OF CR204 S OF WINGER	POLK
208	OUTSTATE RURAL INT	35	.6 MI N OF CSAH9 N OF OWATONNA	STEELE
209	OUTSTATE RURAL TH	75	1.7 MI N OF CSAH23 N OF ANGUS	POLK
210	OUTSTATE RURAL TH	71	.2 MI S OF CR302 NE OF BLACKDUCK	BELTRAMI
211	OUTSTATE RURAL TH	53	N OF CR240 N OF VIRGINIA	ST. LOUIS
212	OUTSTATE RURAL TH	14	AT CR104 W OF ROCHESTER	OLMSTED
213	OUTSTATE RURAL TH	61	.5 MI SW OF CR103 SW OF TWO HARBORS	LAKE
214	OUTSTATE RURAL TH	1	NW OF CSAH7 N OF FINLAND	LAKE
215	OUTSTATE RURAL TH	73	S OF CR733 N OF FLOODWOOD	ST. LOUIS
216	OUTSTATE RURAL TH	6	9.7 MI NE OF REMER	CASS
217	OUTSTATE RURAL TH	28	3 MI W OF TH75 W OF GRACEVILLE	BIG STONE
218	OUTSTATE RURAL TH	29	S OF SWIFT/CHIPPEWA	CHIPPEWA
219	OUTSTATE RURAL TH	2	1 OF NW OF TH 65 S OF WARBA	ITASCA
220	OUTSTATE RURAL TH	71	S OF CR89 N OF PARK RAPIDS	HUBBARD
221	OUTSTATE RURAL TH	34	1.5 MI NE OF CSAH2 NE OF NEVIS	HUBBARD
222	OUTSTATE RURAL TH	65	.6 MI N OF CSAH2 N OF MCGRATH	AITKIN
223	OUTSTATE RURAL TH	371	1 MI S OF S JCT TH200 SE OF WALKER	CASS
224	OUTSTATE RURAL TH	55	1 MI W OF CSAH30 W OF EDEN VALY	MEEKER
225	OUTSTATE RURAL TH	210	2 MI W OF CSAH47 W OF BATTLE LK	OTTER TAIL
226	OUTSTATE RURAL TH	30	E OF CSAH14 E OF MAPLETON	BLUE EARTH
227	OUTSTATE RURAL INT	90	1.5 MI W OF TH13 NW OF ALBERT LEA	FREEBORN
301	METRO AREA INT	94	W OF VICTORIA ST IN ST PAUL	RAMSEY
302	METRO AREA INT	494	E OF TH 77 (CEDAR AVE) IN BLOOMINGTON	HENNEPIN
303	METRO AREA INT	35E	S OF ARLINGTON AVE N ST PAUL	RAMSEY
305	METRO AREA INT	35	S OF I-35E & I-35W SPLIT IN BURNSVILLE	DAKOTA
350	METRO AREA TH	3	S OF CR58 (170TH ST) IN ROSEMOUNT	DAKOTA
351	METRO AREA TH	12	W OF W JCT CSAH92 IN INDEPENDENCE	HENNEPIN
352	METRO AREA TH	10	AT DAYTONPORT SCALE IN RAMSEY	ANOKA
353	METRO AREA TH	169	SW PF C559 SW OF JORDAN	SCOTT
354	METRO AREA INT	94	E OF CSAH19 (WODBURY DR) IN WOODBURY	WASHINGTON

Tabulation of ATR locations in the study, Table 1

The accuracy of traffic forecast results are reported in figure 5. The acceptable range was established as +/-20%. Each set of 3 bars represents a different time period of historical AADT that was used to project the 2006 AADT. As the results demonstrate, using 1966-1986 AADT to do the forecasts (that TDA currently uses) is more underestimated than overestimated. The 1976-1986 bars have the highest underestimated percentage in the study. Using the 1976-1986 historical AADT to forecast 2006 AADT is not very accurate. The 1986-1996 and 1976-1996 forecasting time periods have a high percentage of acceptable forecasts. Analysis of the graphs below show that, in these cases, using more recent AADT projected more accurate AADT.



	1966-1986	1966-1976	1976-1986	1986-1996	1976-1996
underestimate	52%	37%	70%	9%	11%
overestimate	4%	33%	2%	15%	7%
acceptable	43%	30%	28%	76%	83%

SOURCE: Mn/DOT, Transportation Data Analysis, Figure 5

The following table outlines the performance measure of using different historical periods of AADT to project 2006 AADT.

The Historical Periods	Base Year	Forecast Year	Years	Rating
1966-1986	1986	2006	20	Fair
1966-1976	1986	2006	10	Fair
1976-1986	1986	2006	10	Poor
1986-1996	1996	2006	10	Good
1976-1996	1996	2006	20	Good

Tabulation of Results, Table 2

On the other hand, using the 1966-1986, 1966-1976, and 1976-1986 traffic volumes yields the highest underestimated percentage in projecting the 2006 AADT. These results indicate that the

traffic growth rate between 1986 and 2006 is higher than the traffic growth rate between 1966 and 1986.

Conclusions

The overall results of this study indicate that using 1976-1996 and 1986-1996 historical AADT for 2006 traffic projection would improve accuracy. Based on the past trends, future AADT projected for the next 10 years is more accurate than AADT projected in the next 20 years. Using the more recent historical AADT produces more accurate estimates of future AADT.

Driving behaviors in the state of Minnesota have been changing with the increase in gas prices and the change in the economy. Traffic volumes are not growing as fast as they had in the 1960s and 1970s. Areas experiencing faster growth in population and employment have the highest increase in AADT. To improve the accuracy of traffic forecasting, forecasters should understand the socioeconomics for surrounding area that include: population, employment growth, and land use changes near the forecasting location.

The office of Transportation Data and Analysis has recently added an enhancement to the "Least Squares Worksheet" (part of the MNESAL traffic forecasting program). Because of recent leveling off and in some cases decline in traffic volume over the last few years, the county factors were developed based on population, labor force, employment and number of households. A final report for developing of county factors will be published on the web soon.

Reference

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