



# Mn/DOT's Office of Transportation Data and Analysis

## TRAFFIC DATA AND MNESALS

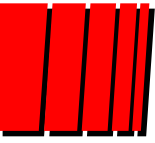


*Traffic Forecasts and Analysis  
Section  
MnPAVE Training  
Spring, 2002*

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# *Traffic Data and ESALs Presentation Outline*

- **Traffic Terminology**
- **Traffic Data Collection**
- **Definition of an ESAL**
- **The MNESAL Program**
- **Producing an ESAL Forecast**
- **MnPAVE Data Requirements**
  - **Present**
  - **Future**



# *Traffic Terminology*

- **Annual Average Daily Traffic (AADT)**
- **Heavy Commercial Annual Average Daily Traffic (HCAADT)**
- **Design Lane**
- **Design Hour Volume (DHV)**
- **Directional Distributional (DD)**
- **Axle Load**
  - **Single axle**
  - **Tandem**
  - **Tridem and more**
- **ESAL factor**
  - **An average effect of one vehicle**
  - **Varies with location and commodities**



# *Data Collection*

- **WEIGH IN MOTION (WIM)**
  - MnRoad
  - Statewide - 26
- **AUTOMATIC TRAFFIC RECORDER**
  - 160 statewide
  - 22 speed sites
- **PNEUMATIC TUBES**
  - AADT (1 tube)
  - Vehicle Classification (2 tubes)



# ESALS

- ESAL - equivalent single axle load
- ESAL - one 18-kip single axle load
- Relative decrease in ride quality
- ESAL depends on
  - Structure
  - Terminal serviceability
- ESAL and R value determine structural design
- ESAL used in MnPAVE



# *MNESALS Program*

- Excel spreadsheet
- Designed to calculate ESALs
- Standardization of methods
- Documentation



# *MNESAL Inputs / Outputs*

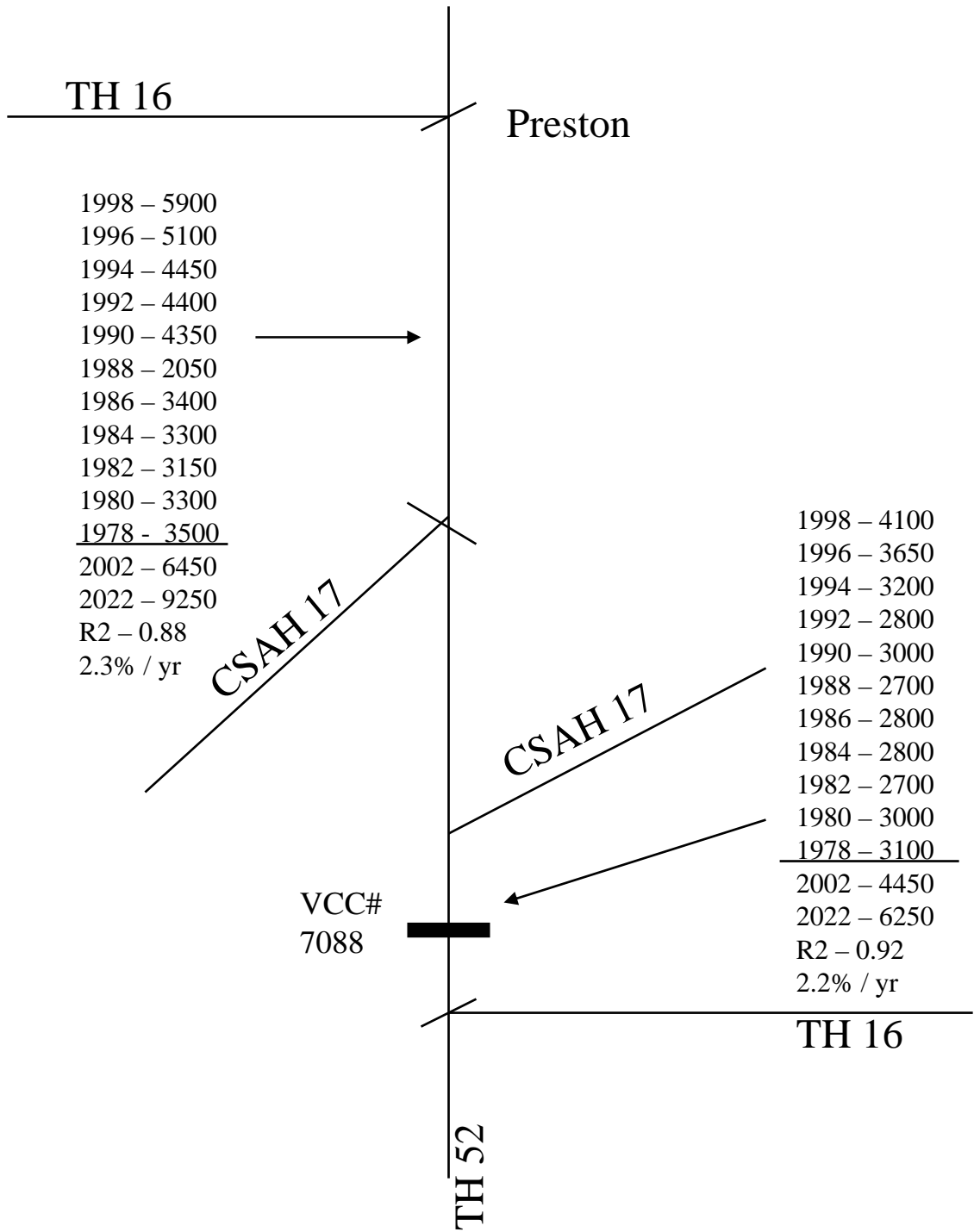
## ● **Inputs**

- **Historic traffic volumes (20 years)**
- **Historic vehicle classification distributions (20 years)**
- **Axle load equivalency factors**
- **Design lane factor**

## ● **Outputs**

- **Projected AADT**
- **Projected HCAADT**
- **20 and 35 year design lane ESALS**
- **Documentation of work performed**

# TH 52 Historic Traffic Volumes





# Hourly Vehicle Class Count

Site 7088 Route TH 16

Description & TH52 W OF E JCT TH52

County FILLMORE

DIST 6

DATE	TIME	M-CYCLE	CAR	PICKUP	BUS	2AXSU	3AXSU	4+AXSU	3+4SEMI	5AXSEMI	HTWT	TWINS	TWINS	TWINS	OTHER	
9/18/95	19:00	2	149	30	3	3	0	0	1	7	0	0	0	0	0	
9/18/95	20:00	0	89	14	0	2	0	0	1	3	0	0	0	0	1	
9/18/95	21:00	0	56	13	0	2	0	0	0	3	0	0	0	0	0	
9/18/95	22:00	0	26	3	0	0	0	0	0	1	0	0	0	0	0	
9/18/95	23:00	0	29	8	0	0	0	0	1	0	1	0	0	0	0	
9/19/95	0:00	0	18	2	0	1	0	0	0	5	0	0	0	0	0	
9/19/95	1:00	0	13	2	0	0	0	0	0	2	0	0	0	0	0	
9/19/95	2:00	0	10	5	1	0	0	0	1	2	0	0	0	0	0	
9/19/95	3:00	0	3	2	0	0	0	0	1	1	0	0	0	0	0	
9/19/95	4:00	0	4	1	0	0	0	0	0	5	0	0	0	0	0	
9/19/95	5:00	0	1	2	0	0	0	0	1	3	0	0	0	0	0	
9/19/95	6:00	0	5	8	1	1	0	0	0	1	0	0	0	0	0	
9/19/95	7:00	0	20	13	0	2	1	0	0	5	2	0	0	0	0	
9/19/95	8:00	0	70	22	1	2	1	0	1	6	0	0	0	0	0	
9/19/95	9:00	0	68	27	3	2	4	2	1	8	0	0	0	0	0	
9/19/95	10:00	1	60	25	2	2	2	0	3	3	0	0	0	0	0	
9/19/95	11:00	0	73	38	0	2	4	0	3	8	0	0	0	0	0	
9/19/95	12:00	0	57	37	0	6	1	0	1	10	0	0	0	0	0	
9/19/95	13:00	0	60	28	1	2	2	0	1	5	0	0	0	0	0	
9/19/95	14:00	0	86	28	0	4	2	0	2	13	1	0	0	0	0	
9/19/95	15:00	0	116	35	0	1	2	0	5	7	1	0	0	0	0	
9/19/95	16:00	0	98	39	1	6	1	0	3	7	0	0	0	0	0	
9/19/95	17:00	0	177	32	2	3	3	0	3	7	0	0	0	0	0	
9/19/95	18:00	1	140	26	3	3	0	0	1	6	0	0	0	0	0	
9/19/95	19:00	0	134	16	0	3	2	0	1	2	0	0	0	0	0	
9/19/95	20:00	0	55	10	0	0	0	0	2	3	0	0	0	0	1	
9/19/95	21:00	0	35	7	0	2	0	0	0	4	0	0	0	0	0	
9/19/95	22:00	0	28	11	0	0	0	0	1	2	0	0	0	0	0	
9/19/95	23:00	0	46	10	0	1	0	0	2	1	0	0	0	0	0	
9/20/95	0:00	0	18	2	0	1	0	0	0	5	0	0	0	0	0	
9/20/95	1:00	0	12	0	1	0	0	0	0	1	0	0	0	0	0	
9/20/95	2:00	0	5	1	0	0	0	0	0	3	0	0	0	0	0	
9/20/95	3:00	0	4	1	0	0	0	0	0	3	0	0	0	0	0	
9/20/95	4:00	0	1	1	0	0	0	0	0	1	0	0	0	0	0	
9/20/95	5:00	0	1	3	1	0	0	0	0	0	0	0	0	0	0	
9/20/95	6:00	0	6	8	0	1	0	0	0	2	0	0	0	0	0	
9/20/95	7:00	0	21	14	1	3	2	0	0	4	2	0	0	0	0	
9/20/95	8:00	0	78	21	1	3	5	0	0	3	0	0	0	0	0	
9/20/95	9:00	0	54	26	1	6	4	0	1	6	0	0	0	0	0	
9/20/95	10:00	0	58	22	1	3	3	1	4	7	0	0	0	0	0	
9/20/95	11:00	0	62	25	0	3	2	0	4	4	1	0	0	0	0	
9/20/95	12:00	0	91	34	0	4	0	0	3	6	0	0	0	0	0	
9/20/95	13:00	0	83	23	1	4	1	0	4	6	0	0	0	0	0	
9/20/95	14:00	0	88	29	1	6	2	1	1	9	1	0	0	0	0	
9/20/95	15:00	1	100	32	0	4	1	1	1	9	0	0	0	0	0	
9/20/95	16:00	0	122	28	1	6	1	0	3	9	0	0	0	0	0	
9/20/95	17:00	0	118	31	1	1	1	0	1	2	0	0	0	0	0	
9/20/95	18:00	1	105	26	1	4	1	0	1	9	0	0	0	0	0	
<b>DIRECTION TOTALS</b>			6	2753	821	29	99	48	5	59	219	9	0	0	2	
<b>SITE TOTALS</b>			11	5491	1642	53	194	99	10	107	403	33	1	0	4	

**Vehicle Type Breakdown for ESAL Calculations**

PASS VEH	2 AX SU	3+ AX SU	3 AX SEMI	4 AX SEMI	5+ AX SEMI	TRKTRLR/BUS	TWINS	TOTAL
3,559	97	55	19	35	210	30	3	4008



# Vehicle Class Count Averages Worksheet

## Vehicle Class Count Averages Worksheet

VCC Site Num. 7088  
 TH TH 52  
 Description W of E Jct of TH 16 (at VCC 7088)

Type	16-24 Vehicle C.C.1		16-24 Vehicle C.C.2		16-24 Vehicle C.C.3		16-24 Vehicle C.C.4		Avg Truck Volumes	Avg Vehicle Pctages
	Year	Pct	Year	Pct	Year	Pct	Year	Pct		
	1995		1990							
Man/Tube	tube		Manual							
1	Cars	3118	91.04%	2728	90.93%					90.98%
2	ASU	63	1.84%	85	2.83%				74	2.34%
3	3+ASU	34	0.99%	19	0.63%				27	0.81%
4	3ASemi	14	0.41%	4	0.13%				9	0.27%
5	4ASemi	27	0.79%	4	0.13%				16	0.46%
6	5+ASemi	147	4.29%	143	4.77%				145	4.53%
7	TT/BUS	20	0.58%	17	0.57%				19	0.58%
8	Twins	2	0.06%	0	0.00%				1	0.03%
Total		3425	8.96%	3000	9.07%					9.02%
Total Heavy Comm		307		272					290	100.00%
Heavy 5 Ax Semi*					27.1					27.10%
Axle Corr Factor			0.92		0.92					0.92

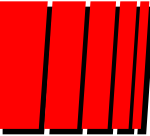
\* Heavy 5 Ax Semi = Tank, Dump, Grain (and Stake if on Timber route-Dist 1,2, or 3)  
 When the Tank, Dumps, & Grains and sometimes stakes are 30% or more of the 5 axle semis, then split into max and other categories (AUTOMATICALLY DONE) ----->  
 Check out tube counts prior to 1996 carefully, body types are N/A prior to 1982, don't use tube collected previous to 1990.

Heavy 5 Ax Semi Split	
1.23%	Max
3.30%	Others
<b>DON'T SPLIT</b>	

NOTE: IF LESS THAN 4 ENTRIES, BE SURE TO DELETE YEAR AND PCT COLUMN  
 DO NOT USE 0, LEAVE BLANK.  
 USER MUST THEN COPY THE FORMULA IN THE PCT COLUMNS BACK TO THE APPROPRIATE COLUMN  
 FOR HELP CALL MARK LEVENSON - 651 -296-8535 OR TOM NELSON - 651-297-1197.



# Least Squares Worksheet



## LEAST SQUARES WORKSHEET

ROUTE: TH 52

SP#: 2310-22

DATE 02/19/02

LOCATION: From N Jct.of CSAH17 to S. Jct of TH16

BASE YEAR: 2002

FORECAST YEAR: 2022

YEAR	FLOW MAP AADT (SEG A)	SEG A HCADT	SEG A 5AX TST	FLOW MAP AADT (SEG B)	SEG A AXLE COOR. FACT. USED	SEG B AXLE COOR. FACT. USED	CORRECTED AADT-A	CORRECTED AADT-A
1978					1.00	1	0	0
1980					1.00	1	0	0
1982	2700				1.00	1	2700	0
1984	2800				1.00	1	2800	0
1986	2800				0.92	1	3042	0
1988					0.92	1	0	0
1990	3000				0.92	1	3259	0
1992					0.92	1	0	0
1994	3200				0.92	1	3477	0
1996	3650				0.92	1	3966	0
1998	4100				0.92	1	4455	0
							0	0
							0	0
							0	0
							0	0
							0	0

### LEAST SQUARES BASED FORECASTS:

### PROJECTED

Year	AADT (Seg. A)	HCADT	5AX TXT	AADT (Seg. B)	Axle Corr. Factors - A	Axle Corr. Factors - B	Calc	ADT Calc
1998	3840	#N/A	#N/A	#DIV/0!	0.92041135	1	260	4100
2002	4200	#N/A	#N/A	0	0.92041135	1		4460
2022	6010	#N/A	#N/A	0	0.92041135	1		6270

Statistics	AADT (Seg. A)	HCADT	5AX TST	AADT (Seg. B)
R 2	0.92	#N/A	#N/A	#DIV/0!
SLOPE	90.36	#N/A	#N/A	#DIV/0!
INTERCEPT	-176698	#N/A	#N/A	#DIV/0!
N	7	0	0	0

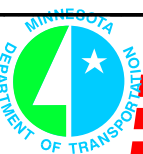
### USE THIS

YEAR	AADT
1998	4100
2002	4450
2022	6250

(AADT'S AND STATISTICS INCLUDE AXLE-CORRECTION.)

PER YEAR GROWTH RATE OVER BASE YR - 2002

2.2% #N/A #N/A #DIV/0!



# Cumulative ESALS Worksheet A

## CUMULATIVE ESALS WORKSHEET

## SEGMENT A

**SP#:** 2310-22  
**ROUTE:** TH 52      **# LANES:** 2      **DATE:** 02/19/02  
**LOCATION:** From N. Jct. of CSAH17 to S. Jct. of TH16  
**VCL SITE #:** 7088

	YEAR	AADT	INIT CALC HCADT	CONSTRN HCADT	INIT CALC 5AX TST	CONSTRAIN 5AX TST
VEH.CLASS YR.:	1995	3425	310	0.0%	---	---
BASE YEAR:	2002	4450	400		200	
FORECAST YEAR:	2022	6250	560		282	

BASE YEAR PROPORTIONS		BASE YR. VOLUME	% TREND	FUTURE %	FUTURE VOL.
2AX-6TIRE SU	2.3%	104	1	2.3%	146
3AX+ SU	0.8%	36	1	0.8%	51
3AX TST	0.3%	12	1	0.3%	17
4AX TST	0.5%	21	1	0.5%	29
5AX+ TST	4.5%	200	1	4.5%	281
(5AX+ TST MAX)	0	0	1	0.0%	0
(5AX+ TST OTH)	0	0	1	0.0%	0
TR TR, BUSES	0.6%	26	1	0.6%	36
TWIN TRAILERS	0.0%	1	1	0.0%	2

SUMMARIES:		AADT	HCADT	HCADT %	20 LANE CUMULATIVE ESAL	YR DESIGN
1995	COUNT:	3425	310	9.1%	***** FLEXIBLE 1,595,000 *****	***** RIGID 2,449,000 *****
2002	FORECAST:	4450	400	9.0%		
2022	FORECAST:	6250	560	9.0%		
DESIGN LANE FACTOR:		0.5				

	ADDITIONAL OUTPUTS:		ESAL FACTORS	
	BASE %	FORECAST %	FLEXIBLE	RIGID
2AX-6TIRE SU	2.3%	2.3%	0.25	0.24
3AX+ SU	0.8%	0.8%	0.58	0.85
3AX TST	0.3%	0.3%	0.39	0.37
4AX TST	0.5%	0.5%	0.51	0.53
5AX+ TST	4.5%	4.5%	1.13	1.89
(5AX+ TST MAX)	0.0%	0.0%	2.40	4.07
(5AX+ TST OTH)	0.0%	0.0%	0.87	1.44
TR TR, BUSES	0.6%	0.6%	0.57	0.74
TWIN TRAILERS	0.0%	0.0%	2.40	2.33

Notes:



# Cumulative ESALS Report A

## CUMULATIVE ESAL REPORT - A

DATE: 02/19/02

ROUTE #: TH 52 DISTRICT: 6 SP#: 2310-22  
 FORECAST #: F-6-0012 COUNTY: Fillmore MILES: \_\_\_\_\_  
 DESCRIPTION: From N. Jct. of CSAH17 to S. Jct. of TH16  
 AUTHOR'S DISTRICT: ---> \_\_\_\_\_ AUTHOR: \_\_\_\_\_

### TRAFFIC SUMMARY

BASE YEAR NUMBER OF LANES (two way): \_\_\_\_\_ 2 \_\_\_\_\_

BASE YEAR --->	2002	DESIGN YEAR ---->	2022	GROWTH / YR (SIMPLE %)
AADT: two-way	4450		6250	2.0%
design-lane	2230		3,130	2.0%
HCADT: two-way	400		560	2.0%
SINGLE UNITS:two-way	140		200	2.1%
TST'S: two-way	233		327	2.0%

### ESAL SUMMARY

#### ANNUAL DESIGN LANE ESAL

FLEXIBLE: 56,308 79,320 +  
 RIGID: 86,502 121,737 +

#### CUMULATIVE DESIGN-LANE ESALS (10 TON)

Design-lane factor: 0.5

DESIGN YEAR	DESIGN-LANE TST'S	ESALS	
		FLEXIBLE	RIGID
2012	140	765,000	1,174,000
2017	152	1,164,000	1,787,000
2022	164	<b>1,595,000</b>	<b>2,449,000</b>
** OR ** DESIGN YEAR		~~~~~	~~~~~
2023	166	1,622,000	2,490,000
2024	168	1,649,000	2,532,000
2025	171	1,676,000	2,573,000
2026	173	1,703,000	2,615,000
2027	175	1,730,000	2,656,000

35 YEAR CUMULATIVE ESAL USING-->  
 2037

2002

AS THE BASE YEAR

3,082,000 4,731,000  
 ~~~~~ ~~~~~

APPROVED BY: \_\_\_\_\_

DATE: \_\_\_\_\_

(FOR PROJECT AADTS AND DESIGN HOUR VOLUMES PLEASE REFER TO PREVIOUSLY APPROVED FORECASTS OR ATTACHED TRAFFIC FLOW DIAGRAMS.)

