

# STARS

## NATMEC 2000

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By

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# Acronym

**S** t a t e

**T** r u c k

**A** c t i v i t y

**R** e p o r t i n g

**S** y s t e m

# What about STARS?

- ❧ MDT (Montana Department of Transportation ) Initiative
- ❧ Funding (80/20 Federal/State Split)
  - ITS Funds (Congressional Earmark)
- ❧ Pilot Project
- ❧ Possible performance-based alternative to the Federal commercial vehicle enforcement plan, and required certification of accomplishment report

# System Goals

- ❧ More and better traffic data collection
- ❧ Improved highway pavement designs
- ❧ Enforcement performance evaluation and scheduling Tool

# STARS Components

- ❧ System of 20 piezo-based WIM recorders
- ❧ Portable WIM Program (63 Sites)
- ❧ Comprehensive Calibration Program
- ❧ MEARS (Measurement of Enforcement Activity Reporting Software)

Note: all sites were selected in compliance with TMG and HMPS field manual

# Benefits

## • Highway Engineering

- Improved ESAL's for pavement design
- Cost savings resulting from the ability to reduce over-building or under-building of Montana's State and Federal highways
- Provides WIM information for LTPP sites

# Benefits cont.

## ✿ Transportation Planning

- Expands MDT's data collection capability
- Improved traffic forecasting
- Better weigh data to calculate ESAL's

# Benefits

cont.

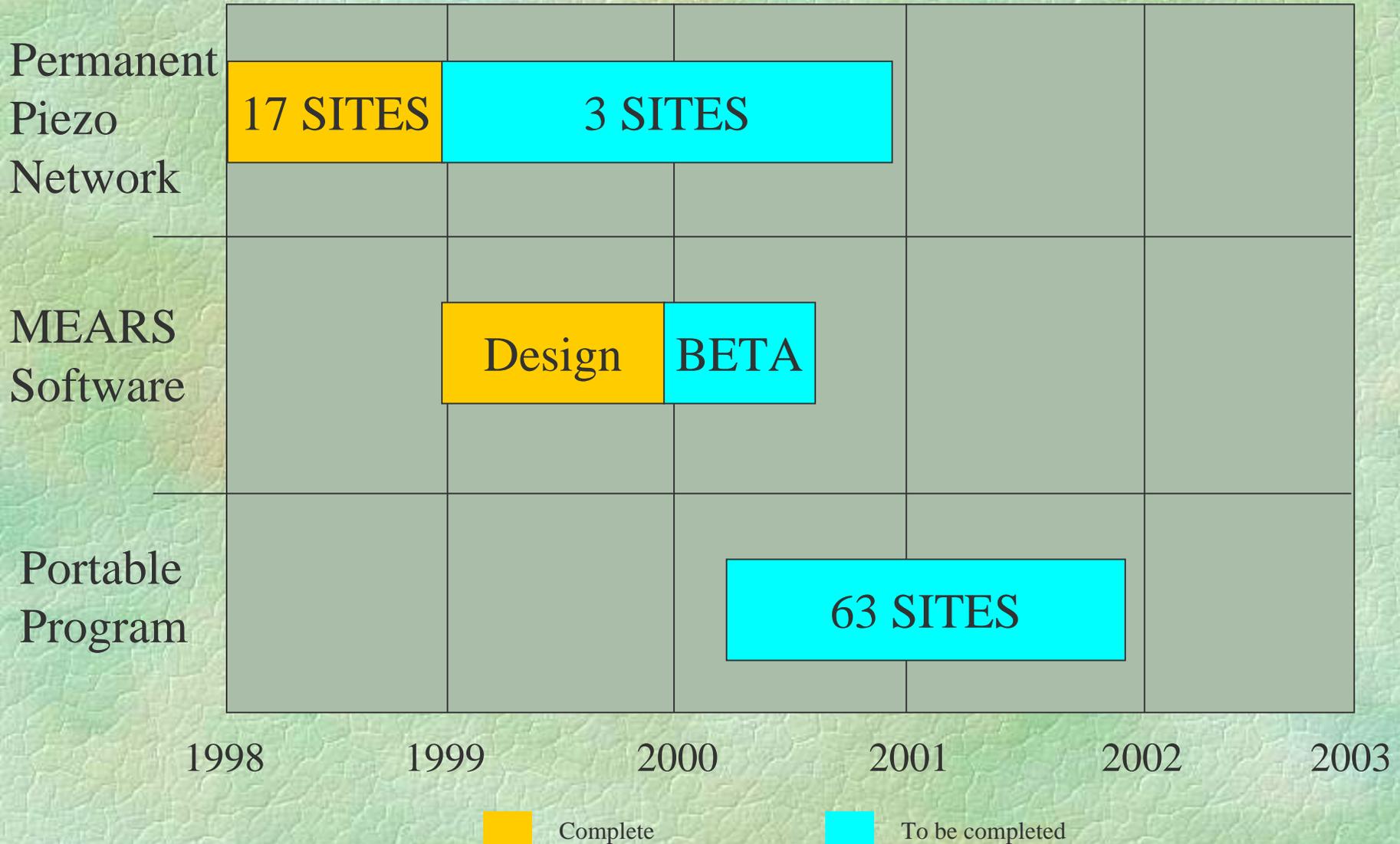
## • Commercial Vehicle Enforcement

- Ability to focus size and weight enforcement resources to specific areas and time periods, targeting incidents of non-compliance
- Document the effectiveness of Montana's enforcement program

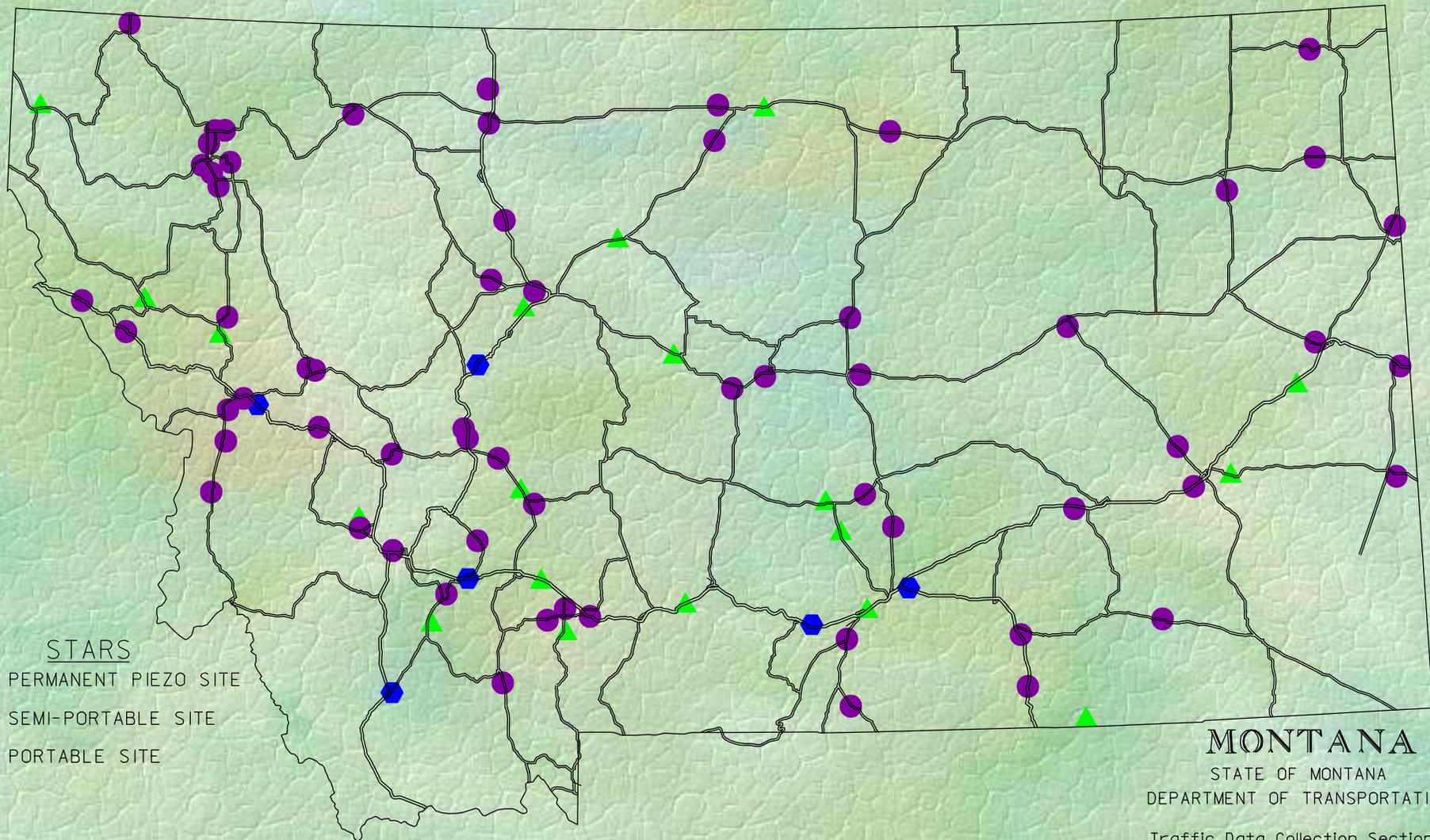
# STARS Deployment Plan

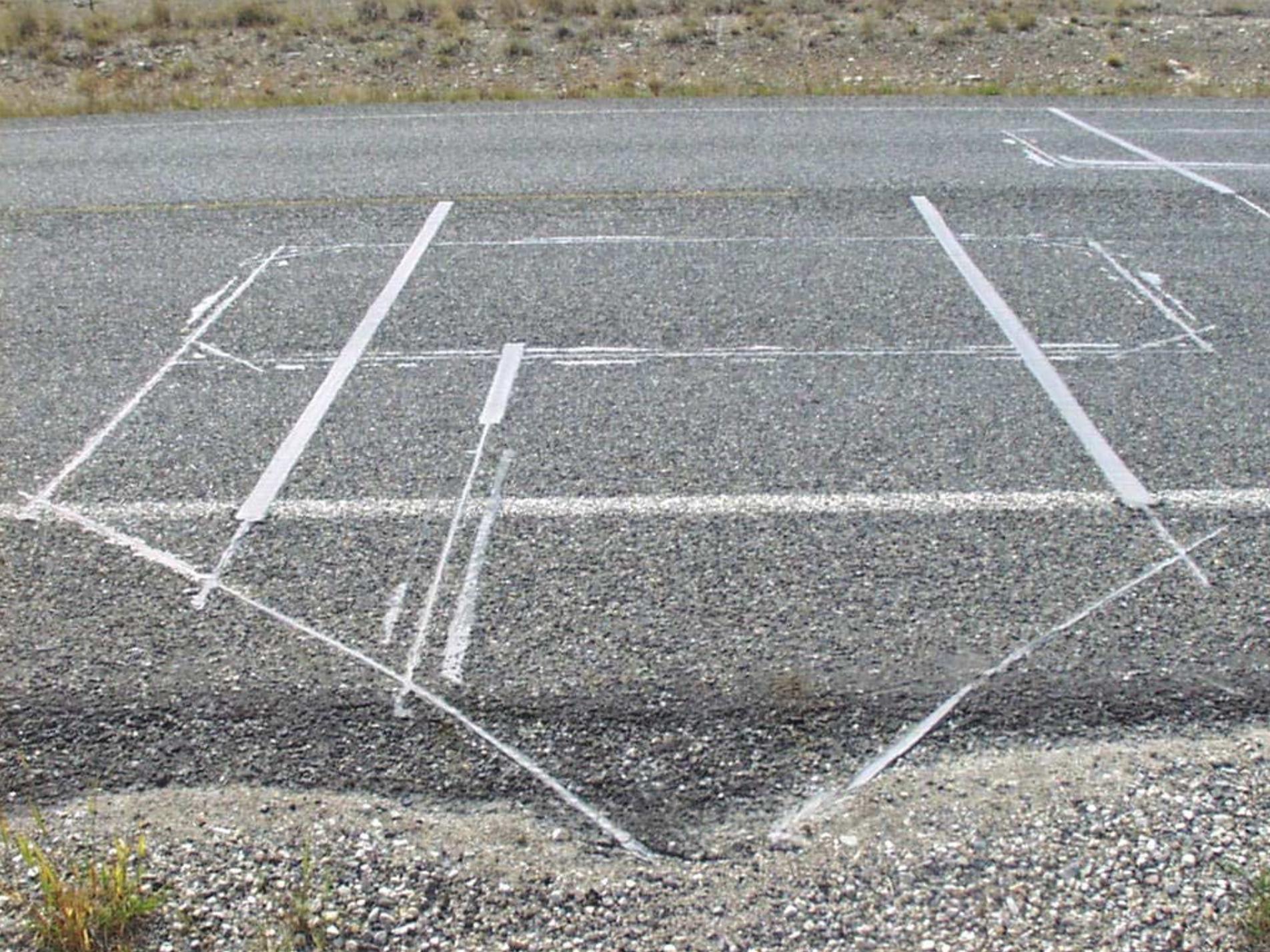
- ❧ Install system of piezo WIM sites
- ❧ Develop MEARS Software
- ❧ Implement the portable WIM program and incorporate it into STARS
- ❧ Rollout Approach
  - Year 1 - Establish a baseline of overweight truck data
  - Year 2 - Utilize STARS reports to assign enforcement officers
  - Year 3 - Evaluate the system's effectiveness

# Implementation Schedule



# STARS Statewide WIM Program







# STARS Evaluation

## ❧ MSU Civil Engineering Department

- Dr. Jodi Carson
- Dr. Jerry Stephens

## ❧ Research Objectives

- Quantify the improvements of the truck weight enforcement activities
- Estimate changes in highway deterioration rate and economic impacts
- Predict the impact of improved vehicle weight and class on pavement design, engineering and long-term planning efforts

# STARS Evaluation

## ❧ Evaluate Pavement Performance and Design Effects

- Slow the pavement deterioration rates by reducing the frequency and weight magnitude of truck using before and after data
  - AASHTO ESAL Model
  - NAPCOM Model
- Improve the truck weight and classification data
  - Evaluate the current data collection and project-level pavement design practices
  - Compare with STARS data

# STARS Evaluation

## ❧ Research methodology

- ID the required data sources and elements
- Establish a baseline for existing commercial vehicle activities
- Develop an enforcement approach
- Deploy targeted enforcement based-on wide-area observation
- Collect after commercial vehicle data
- Analyze and interpret the before/after data
- Document the study results

# STARS WIM Calibration

- ✿ Twice annually
- ✿ Type 9 Test Truck
  - 5-10 passes per lane
- ✿ Track WIM calibration by analyzing vehicle records

# MEARS Facts

## ❧ Oracle Developer 2000 Ver 5.0

- PL/SQL Code
- Windows NT
- Public Domain

## ❧ Input

- Pre-processed, validated and screened data (TRADAS<sup>©</sup>)
- FHWA “C” and “W” records

## ❧ Output

- Enforcement reports
- WIM performance reports
- Annual statewide CV activity reports (rollup)

# Expanded Scheme "F" 4-7

Scheme F Class - Subclass	Vehicle Description	GVW Limit/ KIPS
Class 4 – 1	2 axle single unit – Passenger Bus	32k
Class 4 – 2	3 axle single unit – Passenger Bus	46k
Class 5 – 1	2 axle single unit – 10' to 15' between steering and drive axles	32k
Class 5 – 1	2 axle single unit – 15' to 20' between steering and drive axles	32k
Class 5 – 2	2 axle truck w single axle full trailer or single axle trailer	52k
Class 5 – 3	2 axle truck w tandem axle full or semi trailer	66k
Class 5 – 3	2 axle truck, 10' to 15' between steering and drive axles, w 2 axle full trailer	66k
Class 5 – 3	2 axle truck, 15' to 20' between steering and drive axles, w 2 axle full trailer	66k
Class 5 – 4	2 axle truck, 10' to 15' between steering and drive axles, w 3 axle full trailer	74k
Class 5 – 4	2 axle truck, 15' to 20' between steering and drive axles, w 3 axle full trailer	74k
Class 6 – 1	3 axle single unit truck	46k
Class 7 – 1	4 axle single unit truck	54k
Class 7 – 2	5 axle single unit truck	62k

# Expanded Scheme "F" 8-13

Scheme F Class - Subclass	Vehicle Description	GVW Limit/ KIPS
Class 8 – 1	3 axle tractor/ semi-trailer - 2 axle tractor w single axle trailer	52k
Class 8 – 2	4 axle tractor/ semi-trailer - 3 axle tractor w single axle trailer	66k
Class 8 – 3	4 axle tractor/ semi-trailer - 2 axle tractor w tandem axle trailer	66k
Class 9 – 1	5 axle tractor/ semi-trailer - 3 axle tractor w tandem axle trailer	80k
Class 9 – 2	5 axle tractor/ semi-trailer - 3 axle tractor w split tandem ( $\geq 8'$ ) trailer	86k
Class 9 – 3	5 axle tractor/ semi-trailer - 2 axle tractor w tridem axle trailer	74k
Class 10 – 1	6 axle tractor/ semi-trailer - 3 axle tractor w tridem axle trailer	88k
Class 10 – 2	7 axle tractor/ semi-trailer - 3 axle tractor w quadem axle trailer	96k
Class 11 – 1	5 axle tractor/semi-trailer/full trailer - 2 axle tractor w single axle semi-trailer and 2 axle full trailer	92k
Class 12 – 1	6 axle tractor/semi-trailer/full trailer - 3 axle tractor w single axle semi-trailer and 2 axle full trailer	106k
Class 13 – 1	7 axle tractor/semi-trailer/full trailer - 3 axle tractor w single axle semi-trailer and full trailer w single lead axle and tandem axle	120k
Class 13 – 2	9 axle tractor/semi-trailer/full trailer - 3 axle tractor w tandem axle semi-trailer and full trailer w 2 tandem axle set	131k

# Site Activity Report

16-AUG-2000

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MEASUREMENT OF ENFORCEMENT ACTIVITIES REPORTING SYSTEM  
CLASS WEIGHT INFORMATION

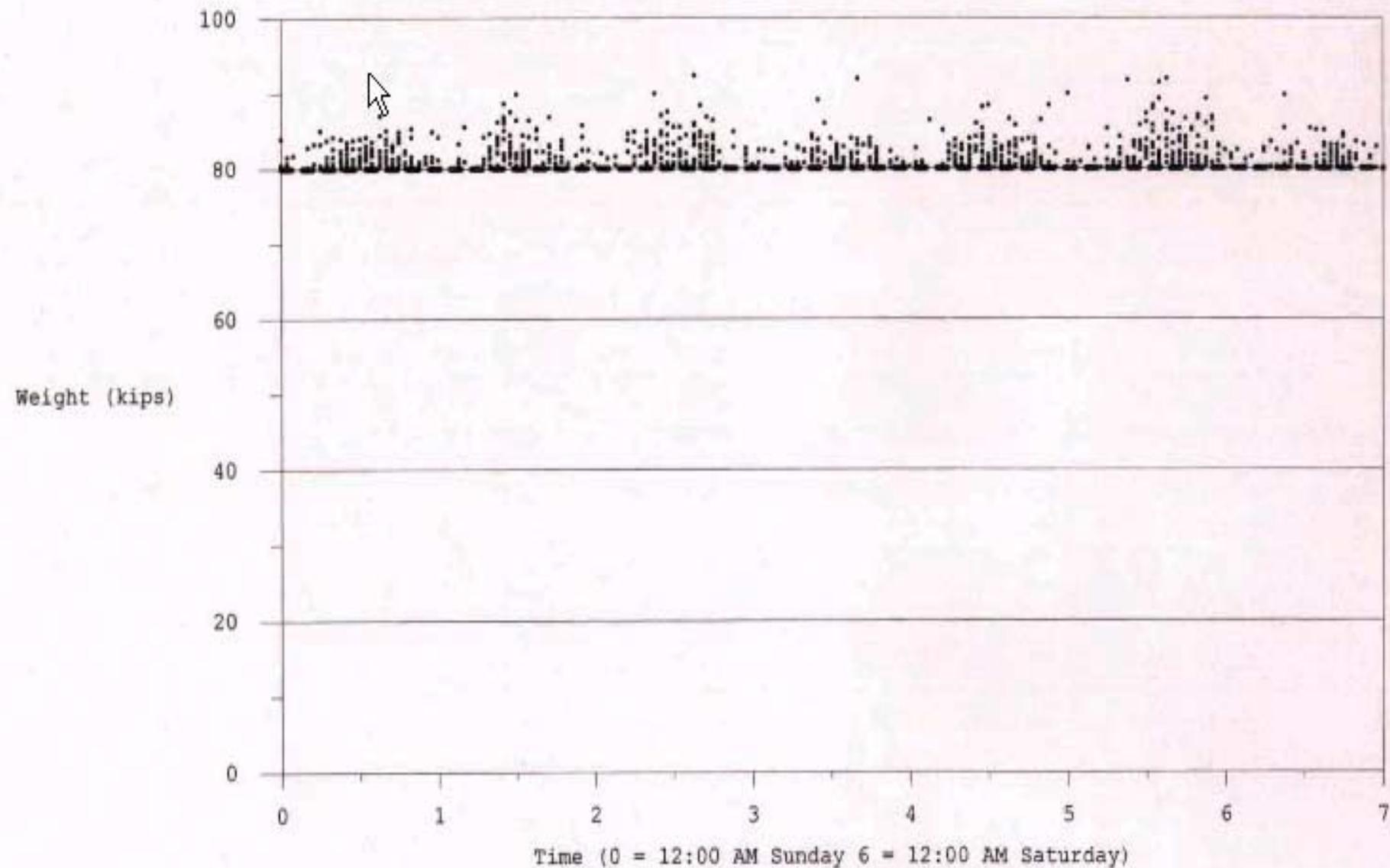
MRSR0035

FROM DATE 01-JUN-2000 TO DATE 30-JUN-2000

Site: MANHATTAN

Class: 9	Population	40474	( 100.00% of current wim data population )	
			Avg Operating Weight (klps):	60.14
			% Overweight:	2.45
			Average Weight exceeding legal limit (klps):	2.04

# Overweight vs. Time Report



# Overweight Vehicle Report

Report Period 01-JUN-2000 To 30-JUN-2000

Site MANHATTAN

Class-Sub Class	GVW Limits	Total # CV in Sample	Total # OW CV in Sample	Cumulative total of OW values	% OW CV	Avg. OW KIPS/ OWC
Class 4 - 1	32 k	1215	44	115.86	3.62	2.63
Class 4 - 2	46 k	779	51	151.63	6.55	2.97
Class 5 - 1	32 k	5761	70	190.80	1.22	2.73
Class 5 - 2	52 k	221	0	0.00	0.00	0.00
Class 5 - 3	66 k	5161	0	0.00	0.00	0.00
Class 5 - 4	74 k	424	0	0.00	0.00	0.00
Class 6 - 1	46 k	2255	193	715.96	8.56	3.71
Class 7 - 1	54 k	176	63	263.89	35.80	4.19
Class 7 - 2	62 k	19	13	63.27	68.42	4.87
Class 7 - 3	62 k	0	0	0.00	0.00	0.00
Class 8 - 1	52 k	628	0	0.00	0.00	0.00
Class 8 - 2	66 k	686	1	3.67	0.15	3.67
Class 9 - 1	80 k	32263	936	1920.64	2.90	2.05
Class 9 - 2	86 k	8163	57	101.53	0.70	1.78
Class 9 - 3	74 k	48	0	0.00	0.00	0.00
Class 10 - 1	88 k	2053	121	569.55	5.89	4.71
Class 10 - 2	96 k	222	10	38.92	4.50	3.89
Class 10 - 3	96 k	217	139	1010.70	64.06	7.27
Class 11 - 1	92 k	495	0	0.00	0.00	0.00
Class 12 - 1	106 k	577	0	0.00	0.00	0.00
Class 13 - 1	120 k	2057	12	62.46	0.58	5.21
Class 13 - 2	131 k	678	11	50.64	1.62	4.60
Class 13 - 3	120 k	1159	3	3.32	0.26	1.11
Class 13 - 4	131 k	0	0	0.00	0.00	0.00
<b>Totals</b>		65257	1724	5262.84	2.64	3.05

# Violation Report (7-day periods)

## CV Violating by Day-of-Week and Direction

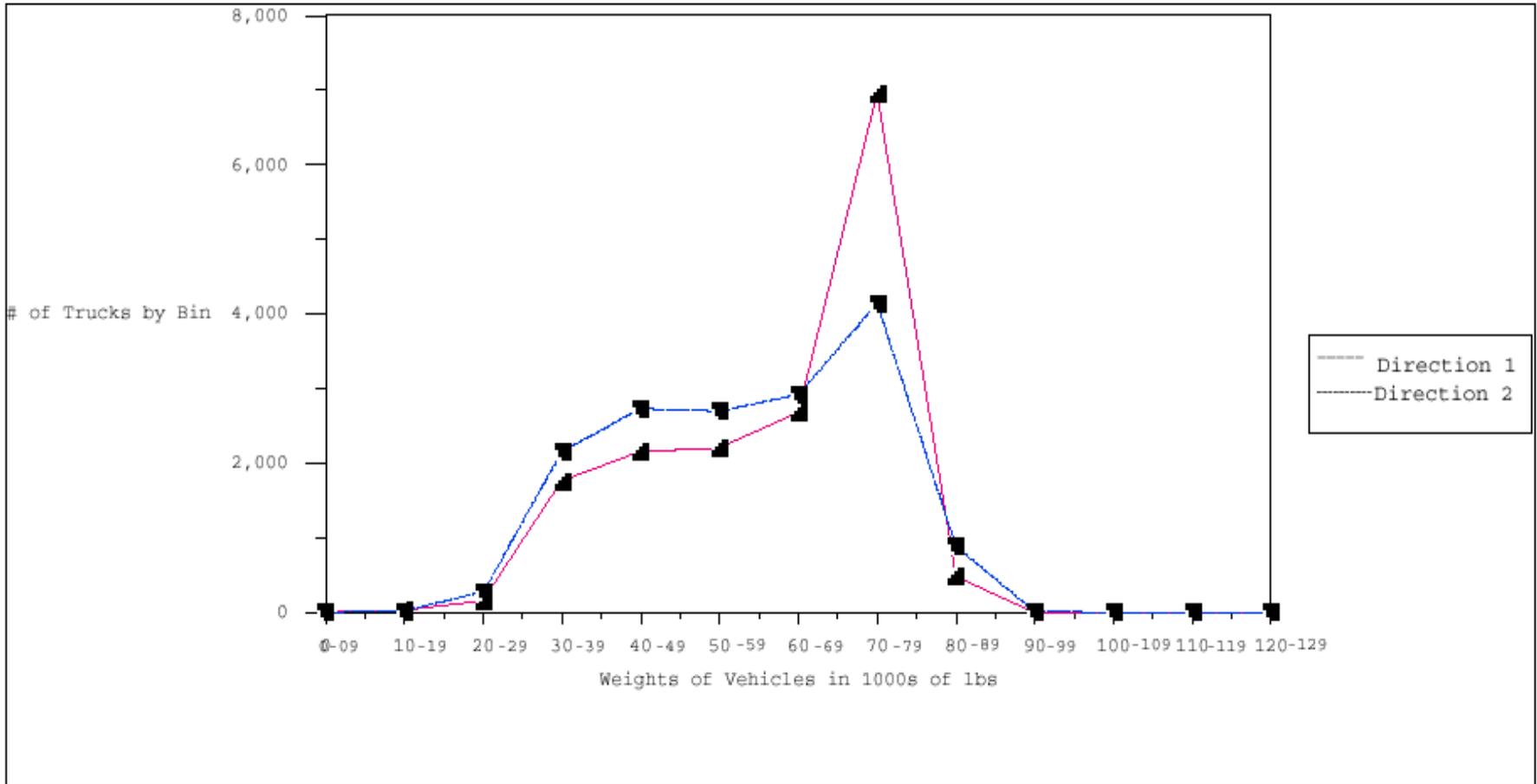
Day-of-Week	% OW CV		# CV Violating	
	East	West	East	West
Sunday	20.21	79.79	38	150
Monday	33.82	66.18	92	180
Tuesday	32.35	67.65	88	184
Wednesday	37.60	62.40	91	151
Thursday	36.95	63.05	109	186
Friday	36.09	63.91	109	193
Saturday	33.99	66.01	52	101

# Calibration Tracking Chart

## Class 9 Truck Weights - MANHATTAN

Site 00104

From 01-JUN-2000 To 30-JUN-2000



Weights 1000s of lbs	00-09	10-19	20-29	30-39	40-49	50-59	60-69	70-79	80-89	90-99	100-109	110-119	120
East Bound Lane(Direction 1)	0	28	154	1761	2156	2203	2678	6957	483	2	0	0	0
West Bound Lane(Direction 2)	0	21	275	2159	2732	2696	2920	4141	885	12	0	0	0

% Class - 14 (errors) - 6.02

# Rollup Report

22-AUG-2000

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MEASUREMENT OF ENFORCEMENT ACTIVITIES REPORTING SYSTEM

MRSR0050

STATEWIDE ACTIVITIES ROLLUP

Year	Total # Vehicles	Total # of CV (Commercial Vehicles)	% CV	# OW Comm. Vehicles	% OW Comm. Vehicles (GVWP)	Annual % of Change in %OWCV	Average OW value/OWCV (GVWS) in kips	% Change of Average OW value/OWCV
2000	4326304	649151	15.0	53147	8.19	0.0	21.52	0.0
Funct. Class 1								
Vol. Grp. 1	1096401	249761	22.78	13456	5.39	0.0	5.05	0.0
Vol. Grp. 2	747984	127060	16.99	3387	2.67	0.0	3.05	0.0
Funct. Class 2								
Vol. Grp. 1	1232187	153054	12.42	20138	13.16	0.0	39.86	0.0
Vol. Grp. 2	471503	48416	10.27	1928	3.98	0.0	7.06	0.0
Vol. Grp. 4	506031	46487	9.19	12201	26.25	0.0	19.37	0.0
Funct. Class 3								
Vol. Grp. 1	163015	19193	11.77	1407	7.33	0.0	5.73	0.0
Funct. Class 4								
Vol. Grp. 1	109183	5180	4.74	630	12.16	0.0	7.26	0.0

# In Summary

- ❖ STARS benefits transportation planning, highway engineering, and commercial vehicle enforcement
- ❖ STARS utilizes pre-existing data in a format required by FHWA
- ❖ STARS could save tax-payers big \$\$\$\$\$\$ through improved enforcement efforts