APPENDIX A: DESCRIPTION OF VEHICLE CLASSES

Class 4-1
2 Axle Single Unit
Passenger Bus

Class 4-2
3 Axle Single Unit
Passenger Bus

Class 5-1
2 Axle Single Unit

Class 5-2
2 Axle Single Unit w/
Single Axle Trailer

Class 5-3
2 Axle Single Unit w/
2 Axle Trailer

Class 5-4
2 Axle Single Unit w/
3 Axle Trailer

Class 6-1
3 Axle Single Unit

Class 7-1
4 Axle Single Unit

Class 7-2
5 Axle Single Unit

Class 7-3
6 Axle Single Unit

Class 8-1
2 Axle Tractor w/
Single Axle Trailer

Class 8-2
3 Axle Tractor w/
Single Axle Trailer

2 Axle Tractor w/
2 Axle Trailer

Class 9-1
3 Axle Tractor w/
Tandem Trailer

Class 9-2
3 Axle Tractor w/
Split Tandem Trailer

Class 9-3
2 Axle Tractor w/
Tridem Trailer

Class 10-1
3 Axle Tractor w/
Tridem Trailer

4 Axle Single Unit w/
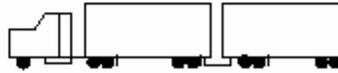2 Axle Trailer

Class 10-2
3 Axle Tractor w/
Quadem Trailer

Class 10-3
4 Single Unit w/
Quadem Trailer

Class 11-1
2 Axle Tractor w/
Single Axle Trailer w/
2 Axle Trailer

Class 12-1
3 Axle Tractor w/
Single Axle Trailer w/
2 Axle Trailer

Class 13-1
3 Axle Tractor w/
Single Axle Trailer w/
Single/Tandem Axle Trailer

Class 13-2
3 Axle Tractor w/
Tandem Axle Trailer w/
Tandem/Tandem Axle Trailer

3 Axle Tractor w/
Tridem Axle Trailer w/
Single/Tandem Axle Trailer

Class 13-3
3 Axle Tractor w/
Tandem Axle Trailer w/
Single/Tandem Axle Trailer
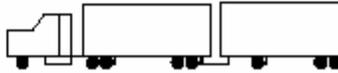
Class 13-4
4 Axle Tractor w/
Tandem Axle Trailer w/
Tandem/Tandem Axle Trailer
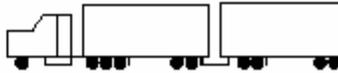
Figure B-1.   Percent Overweight Commercial Vehicles by Month at the **Four Corners/ Gallatin** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-2.   Percent Overweight Commercial Vehicles by Month at the **Ryegate** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-3.   Percent Overweight Commercial Vehicles by Month at the **Stanford** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-4.   Percent Overweight Commercial Vehicles by Month at the **Townsend** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-5. Percent Overweight Commercial Vehicles by Month at the **Arlee** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-6. Percent Overweight Commercial Vehicles by Month at the **Decker** *STARS* Site, Baseline and Focused Enforcement Year
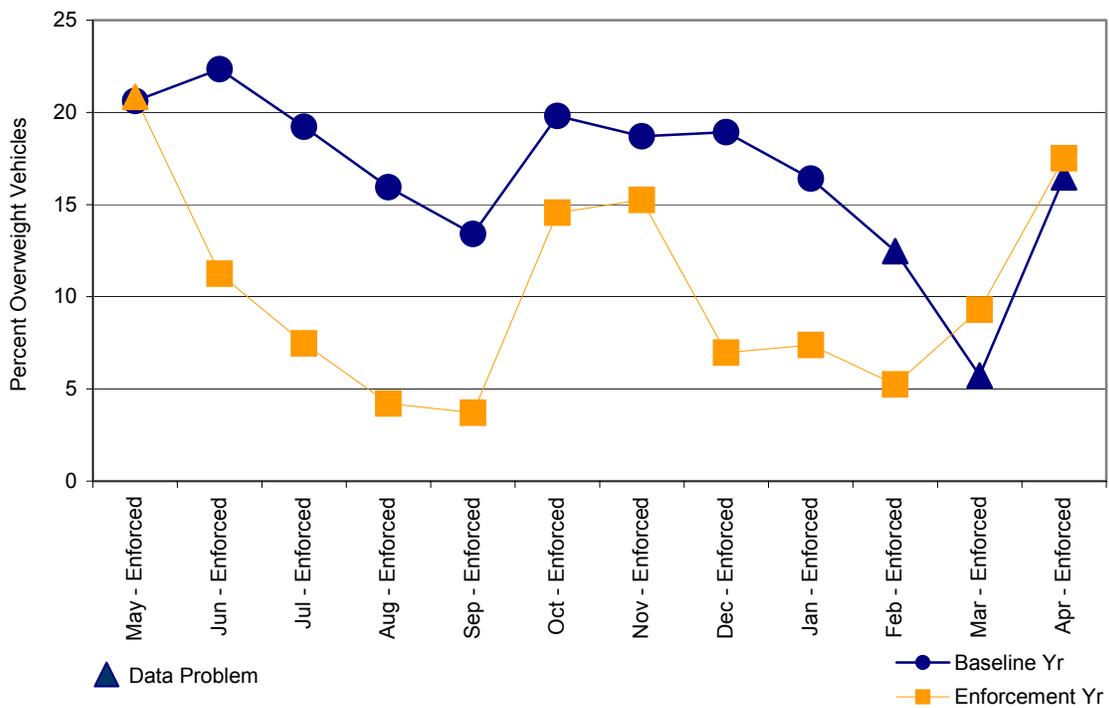
Figure B-7. Percent Overweight Commercial Vehicles by Month at the **Manhattan** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-8. Percent Overweight Commercial Vehicles by Month at the **Miles City East** *STARS* Site, Baseline and Focused Enforcement Year
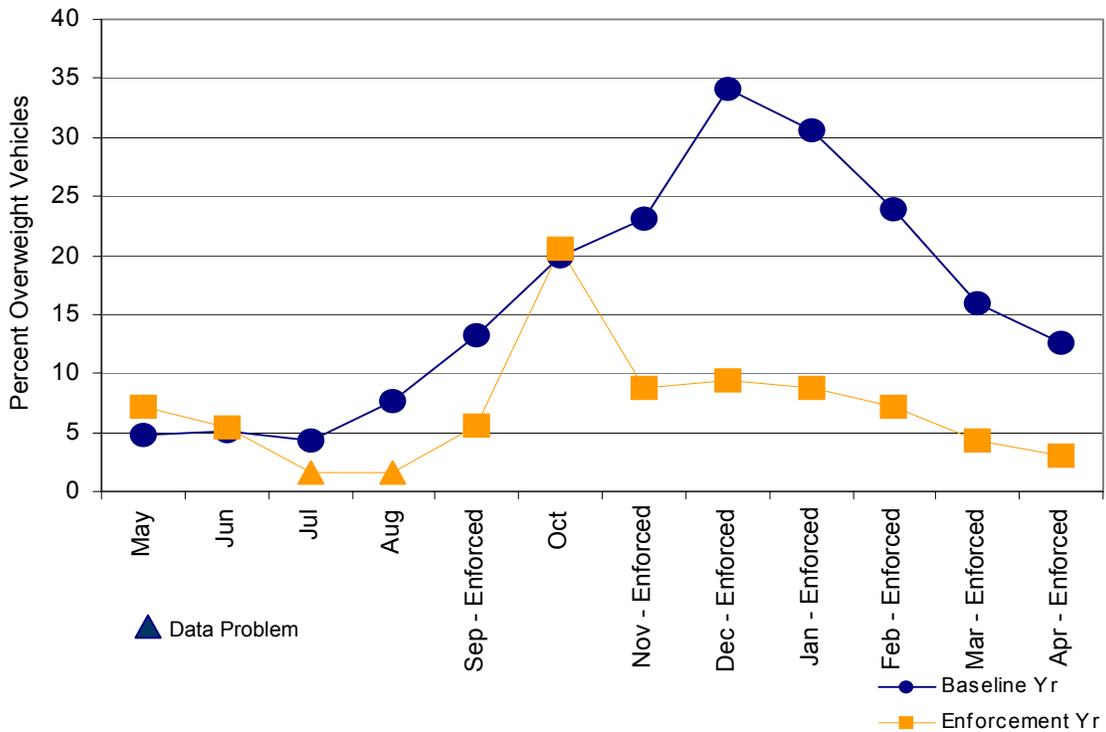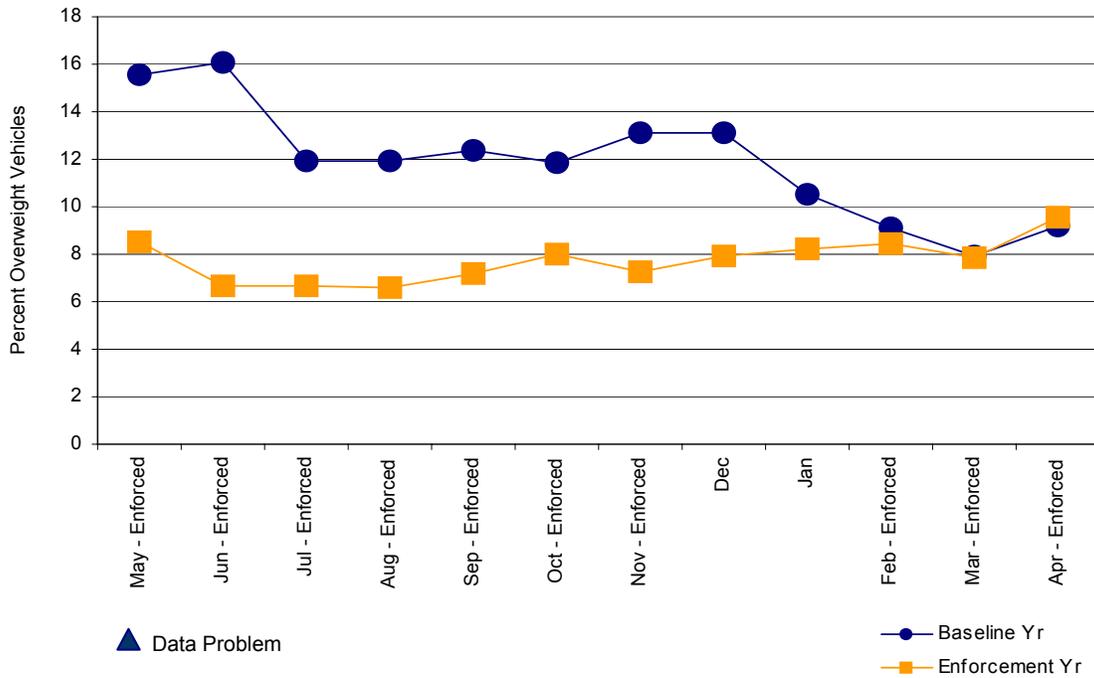
Figure B-9. Percent Overweight Commercial Vehicles by Month at the **Ulm** *STARS* Site, Baseline and Focused Enforcement Year

Figure B-10. Percent Overweight Commercial Vehicles by Month at the **Broadview** *STARS* Site, Baseline and Focused Enforcement Year
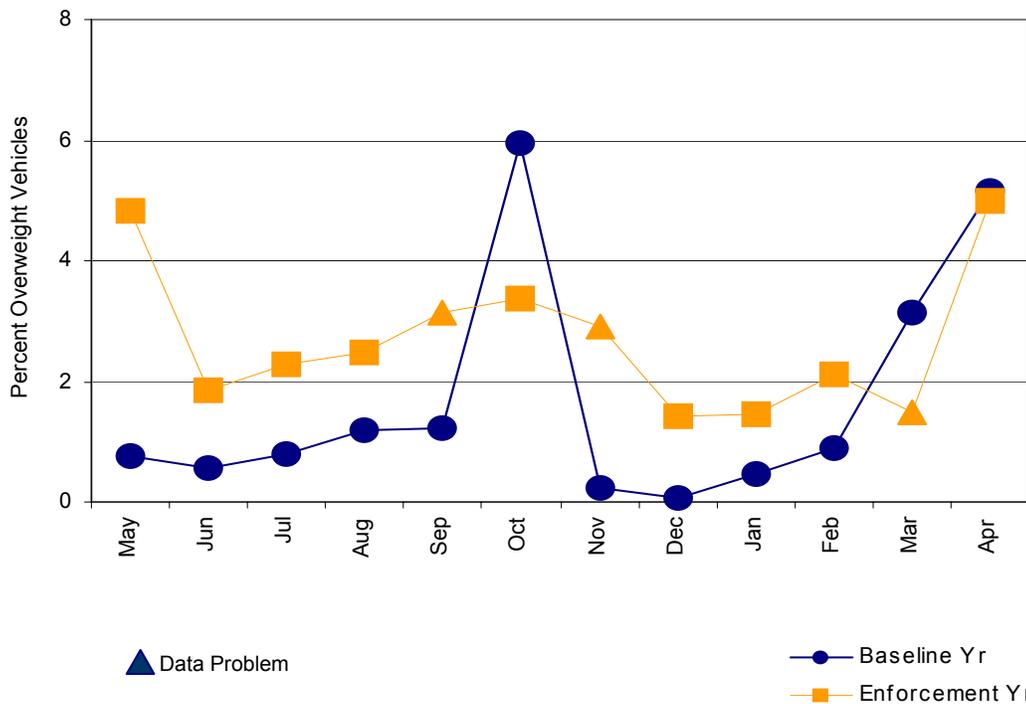
Figure B-11. Percent Overweight Commercial Vehicles by Month at the **Culbertson** *STARS* Site, Baseline and Focused Enforcement Year
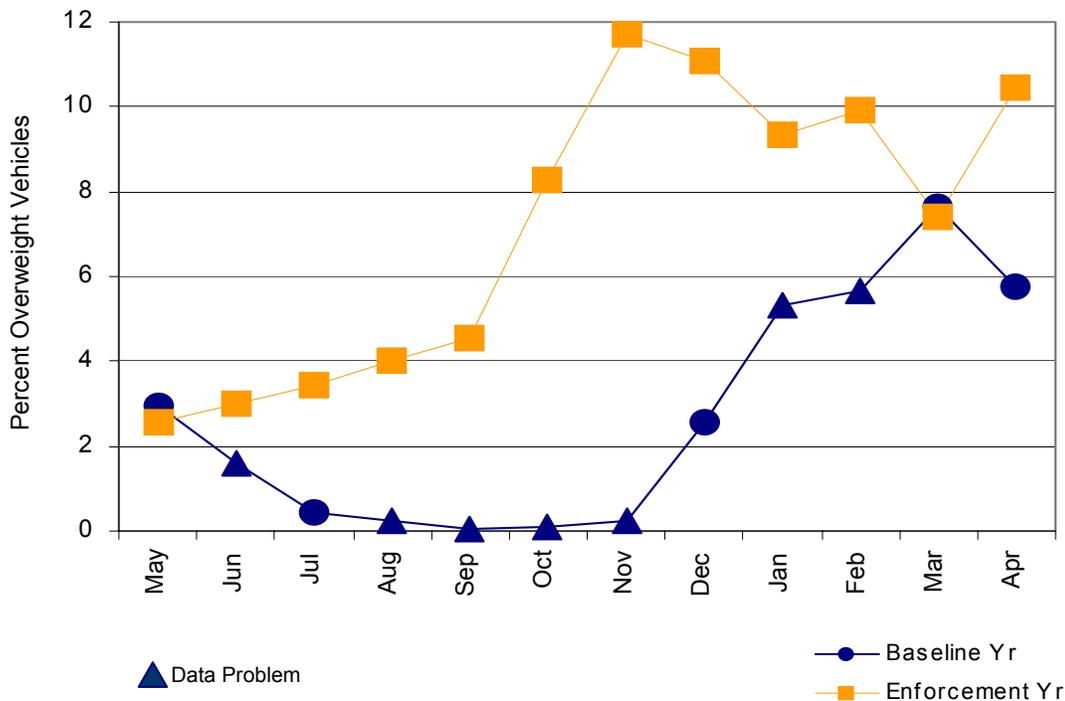
Figure B-12. Percent Overweight Commercial Vehicles by Month at the **Fort Benton** *STARS* Site, Baseline and Focused Enforcement Year
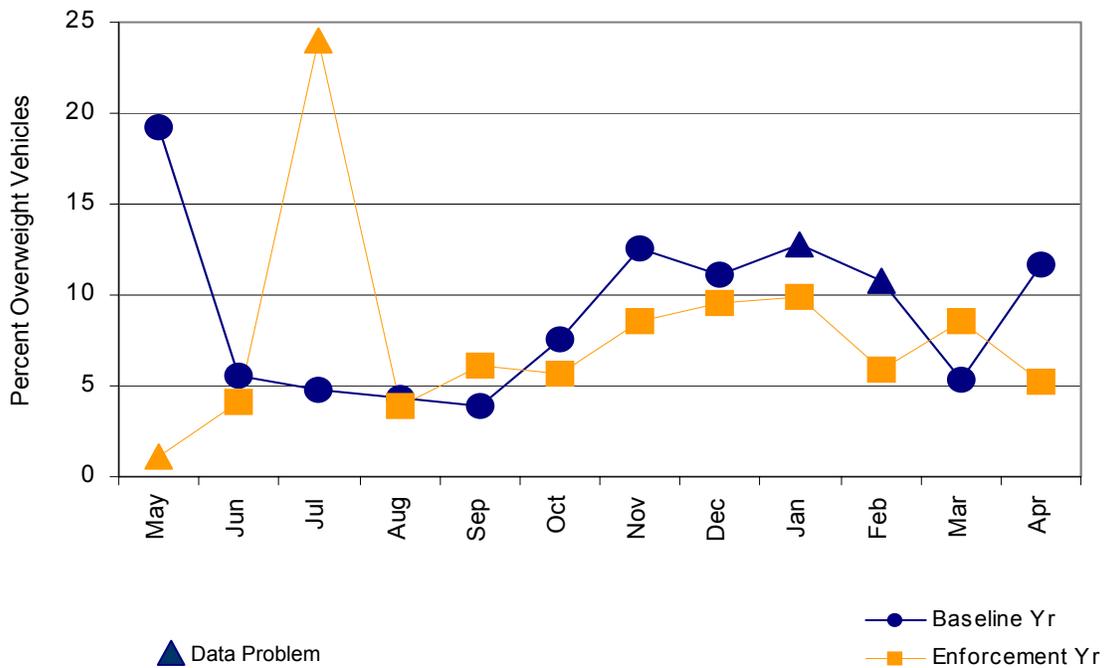
Figure B-13. Percent Overweight Commercial Vehicles by Month at the **Galen** *STARS* Site, Baseline and Focused Enforcement Year
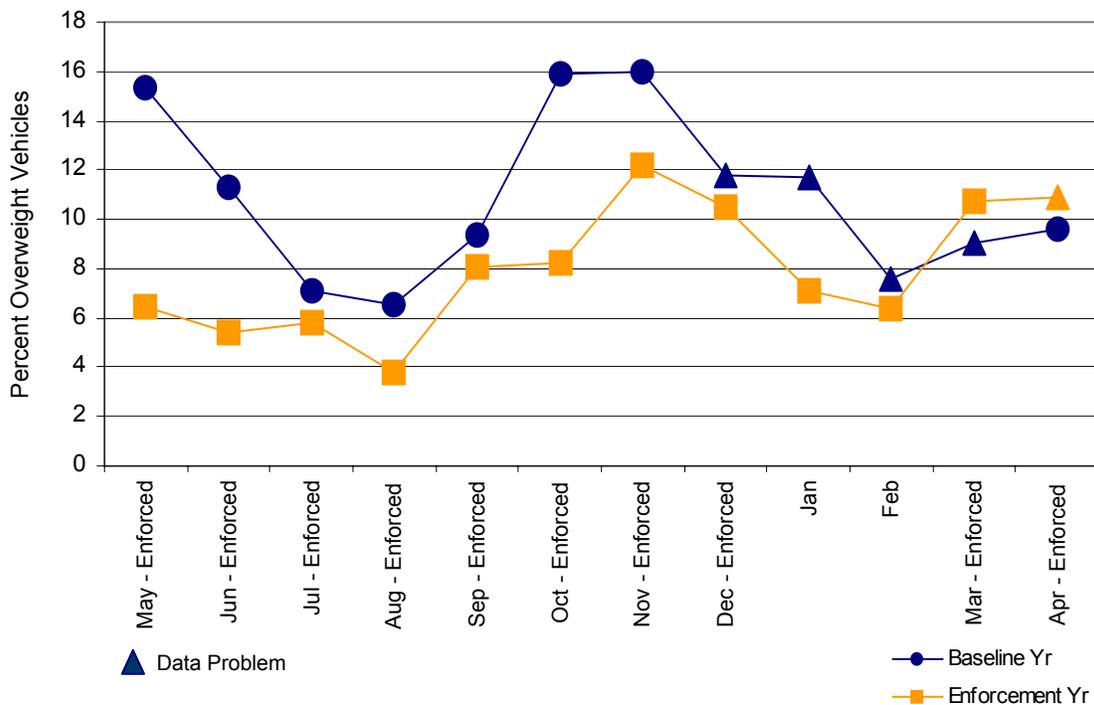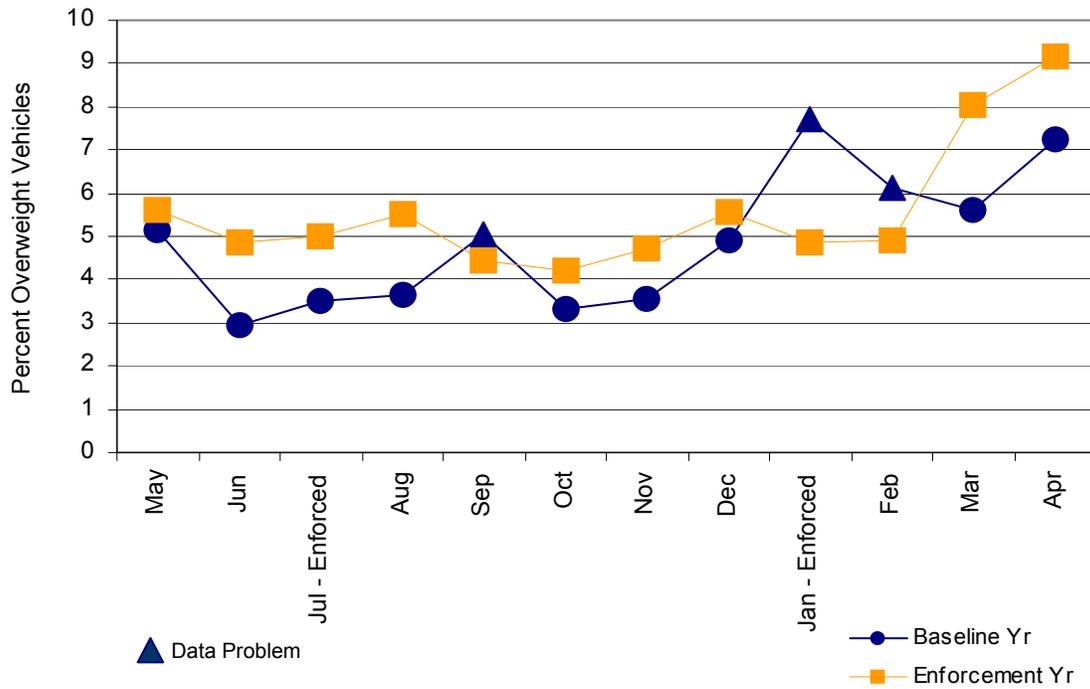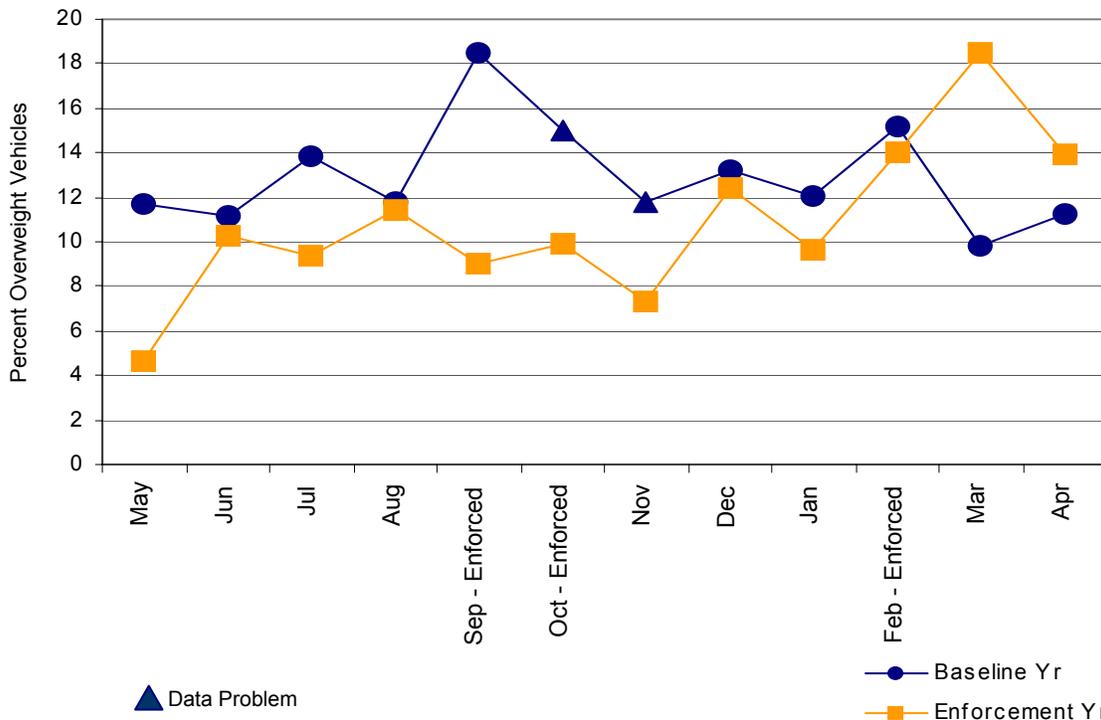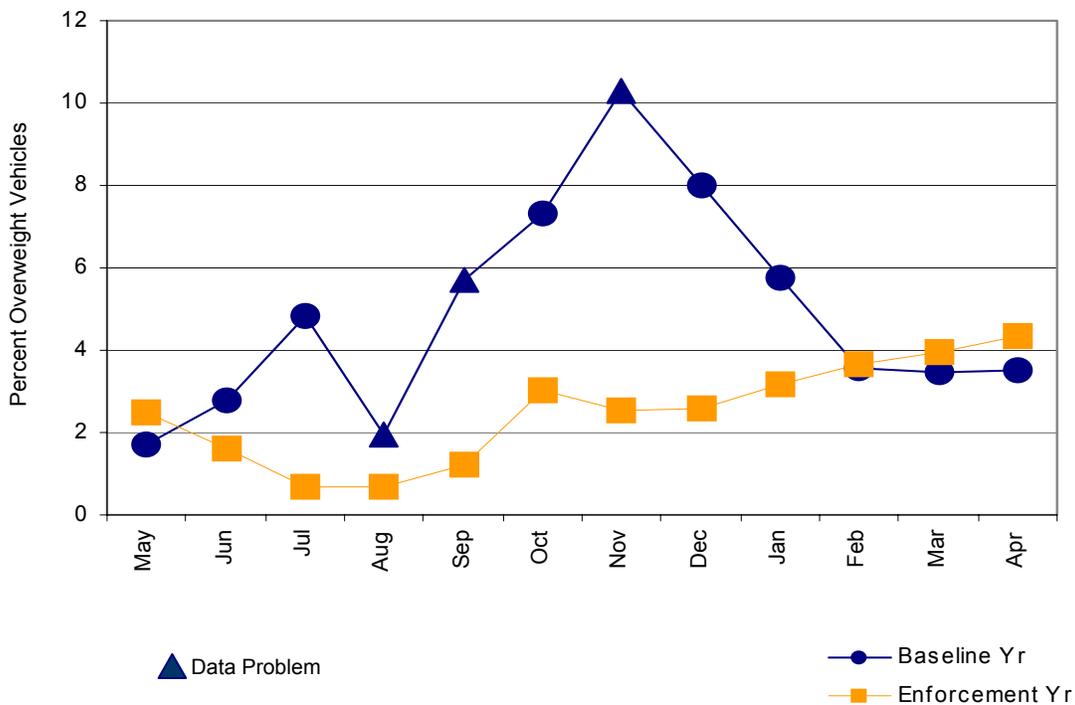

Figure B-14. Percent Overweight Commercial Vehicles by Month at the **Havre East** *STARS* Site, Baseline and Focused Enforcement Year
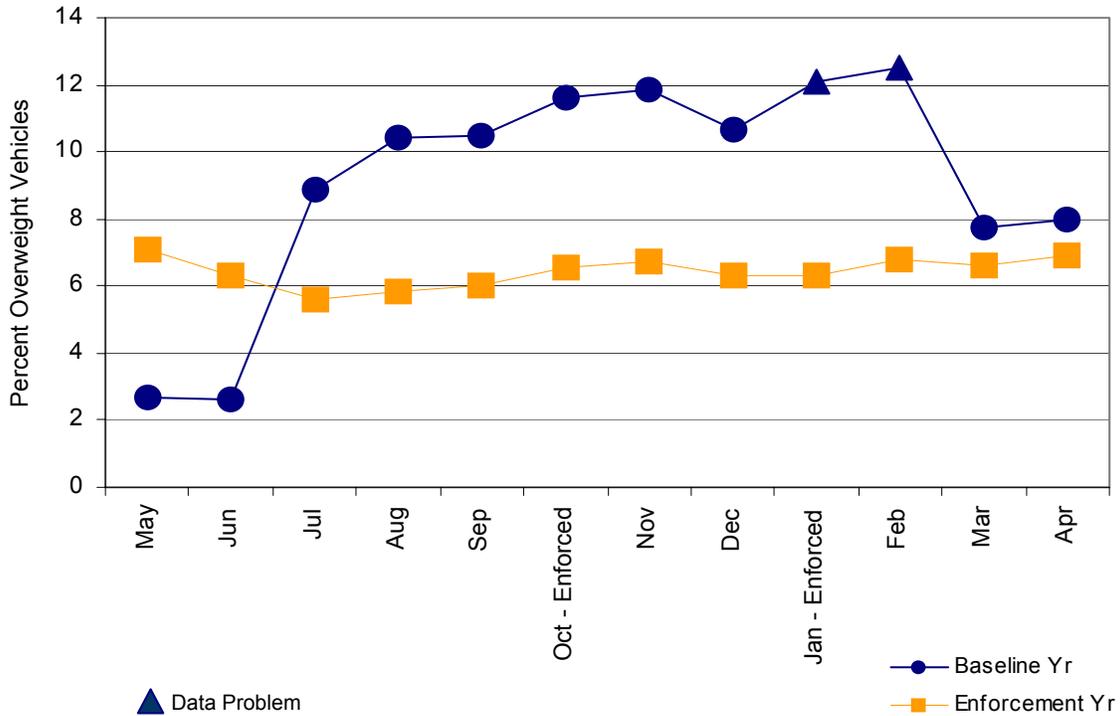
115
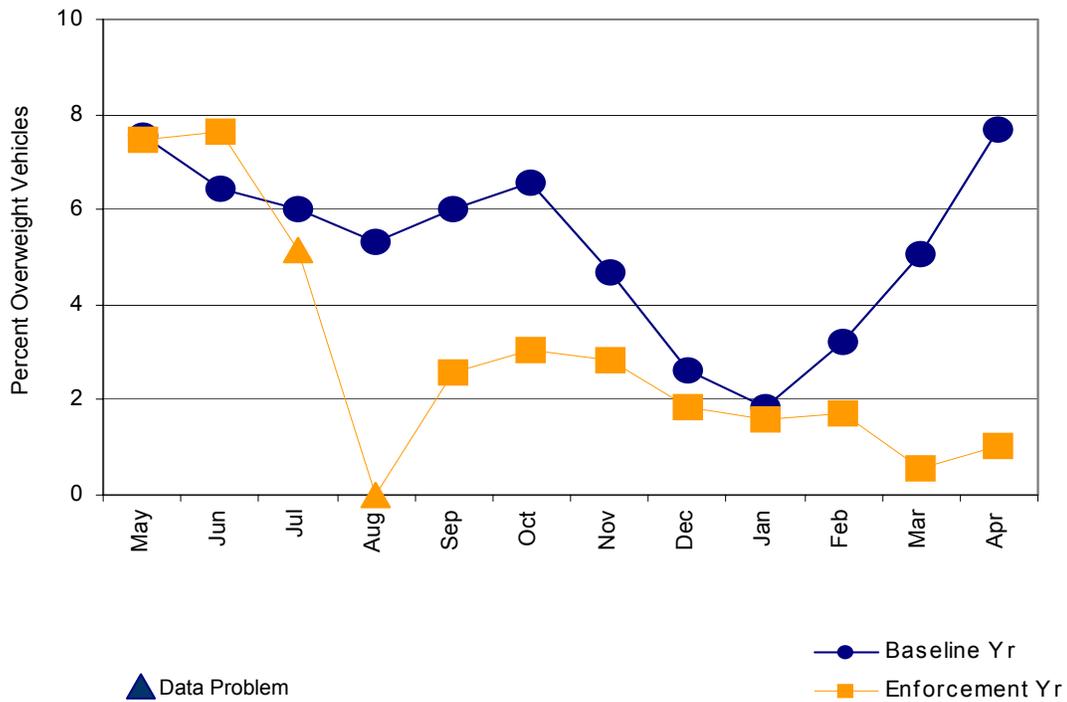
Figure B-15. Percent Overweight Commercial Vehicles by Month at the **Lima** *STARS* Site, Baseline and Focused Enforcement Year
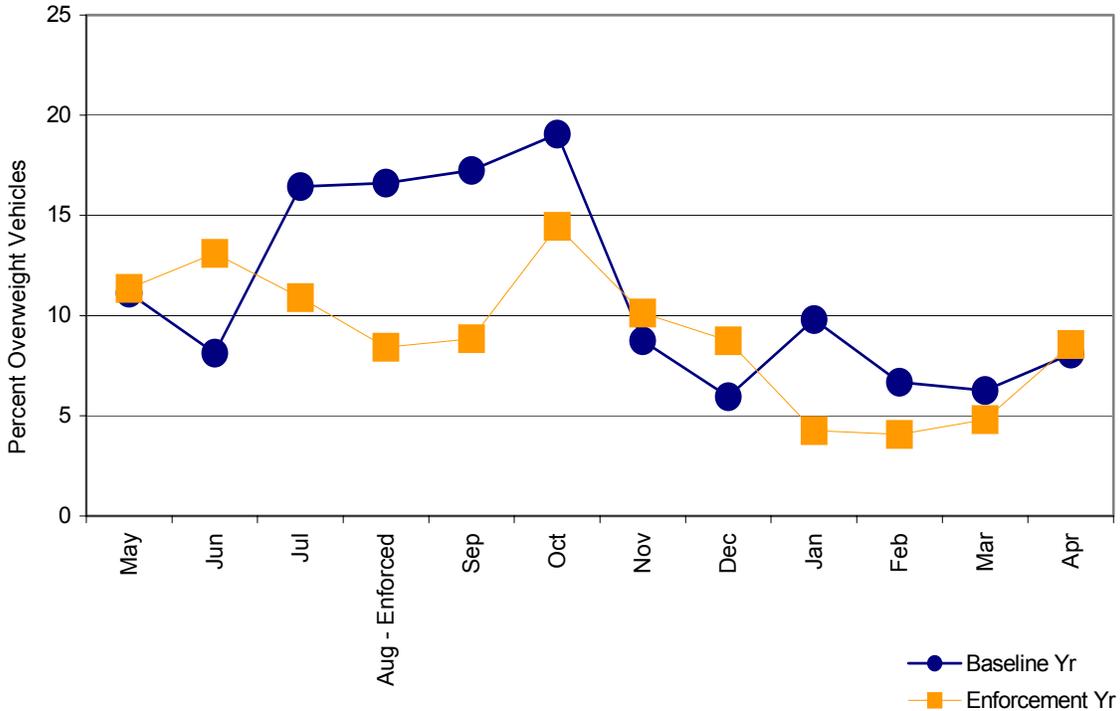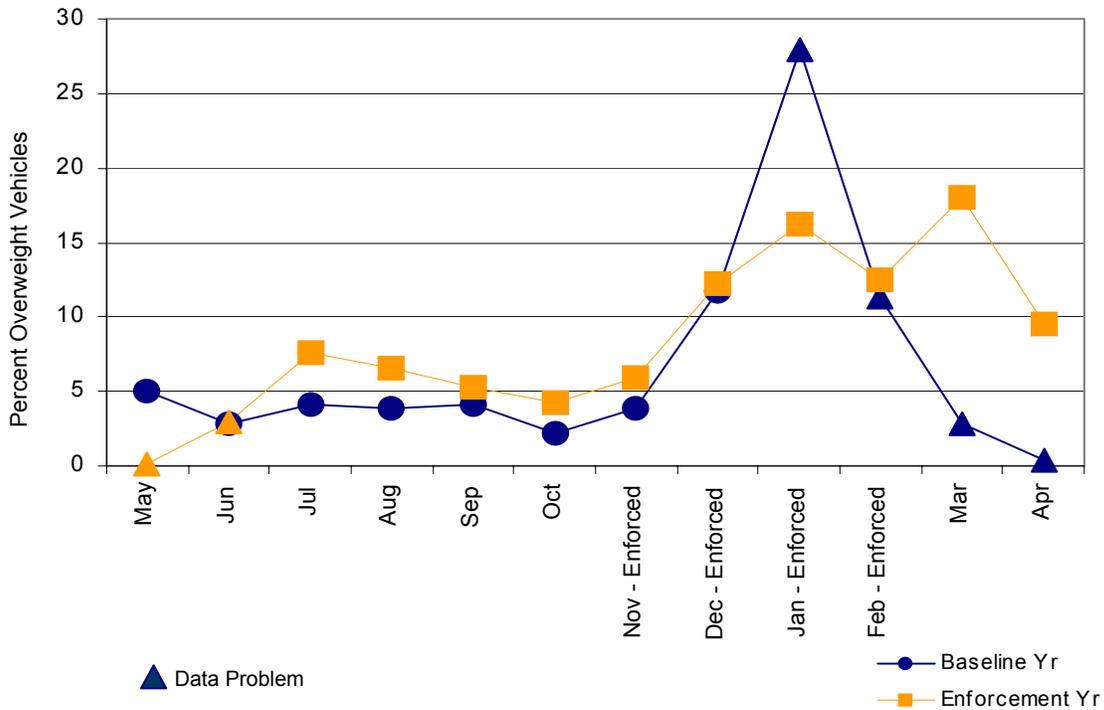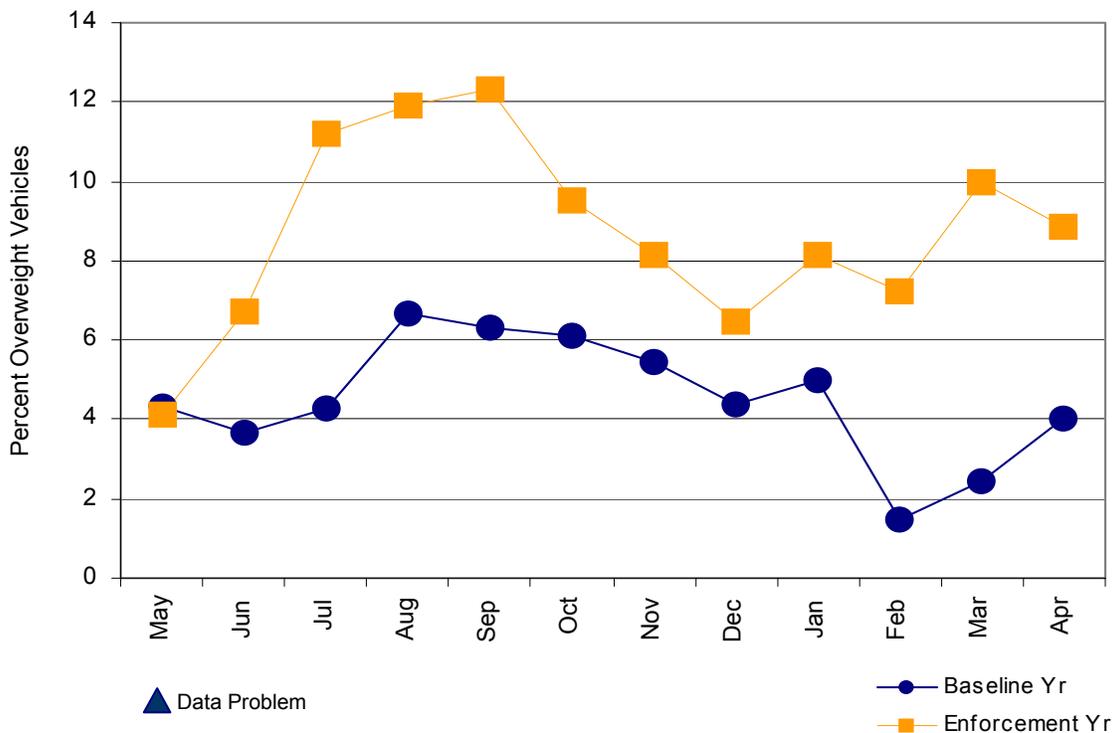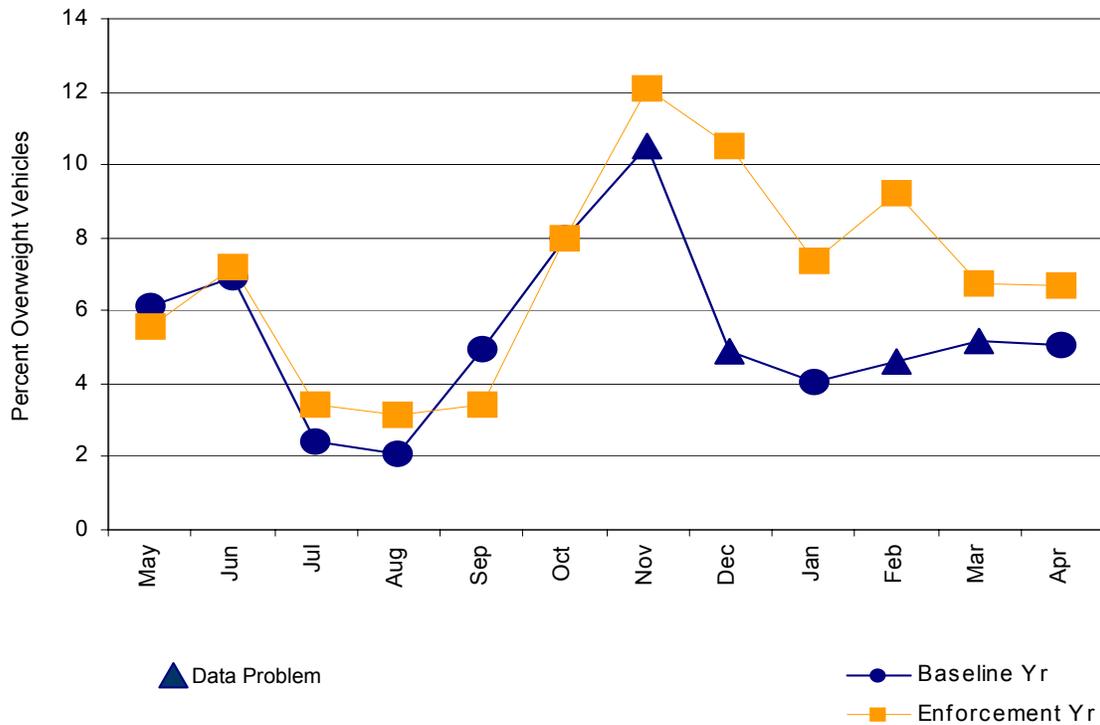

Figure B-16. Percent Overweight Commercial Vehicles by Month at the **Paradise** *STARS* Site, Baseline and Focused Enforcement Year

116

APPENDIX C: GROSS VEHICLE WEIGHT DISTRIBUTIONS

Figure C-1.   Class 6 Gross Vehicle Weight Distributions at **All *STARS* Sites with More than Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year
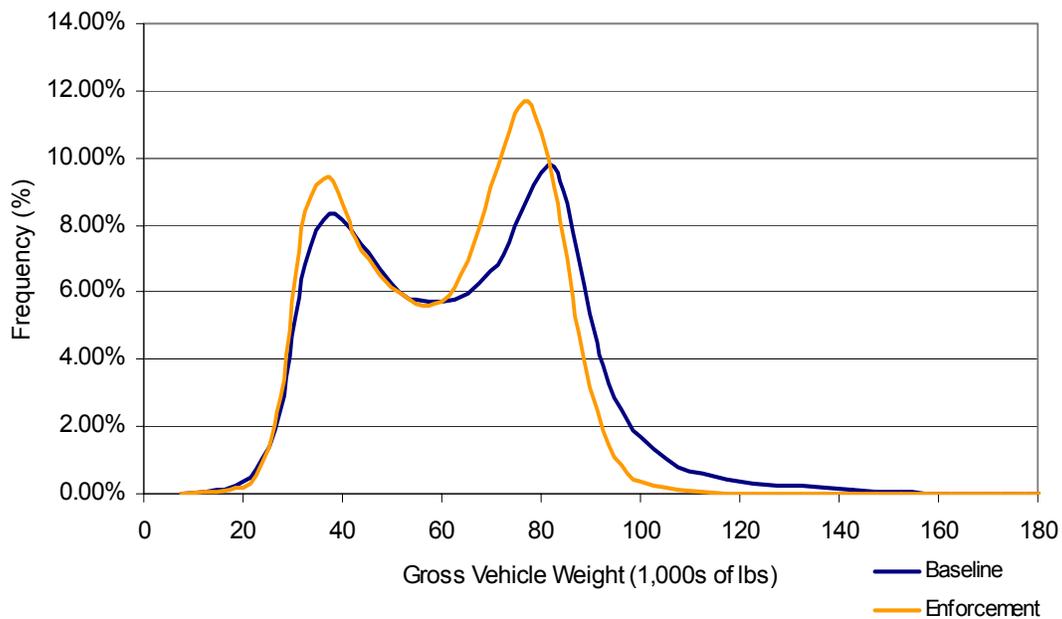
Figure C-2.   Class 9 Gross Vehicle Weight Distributions at **All *STARS* Sites with More than Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year

APPENDIX C: GROSS VEHICLE WEIGHT DISTRIBUTIONS
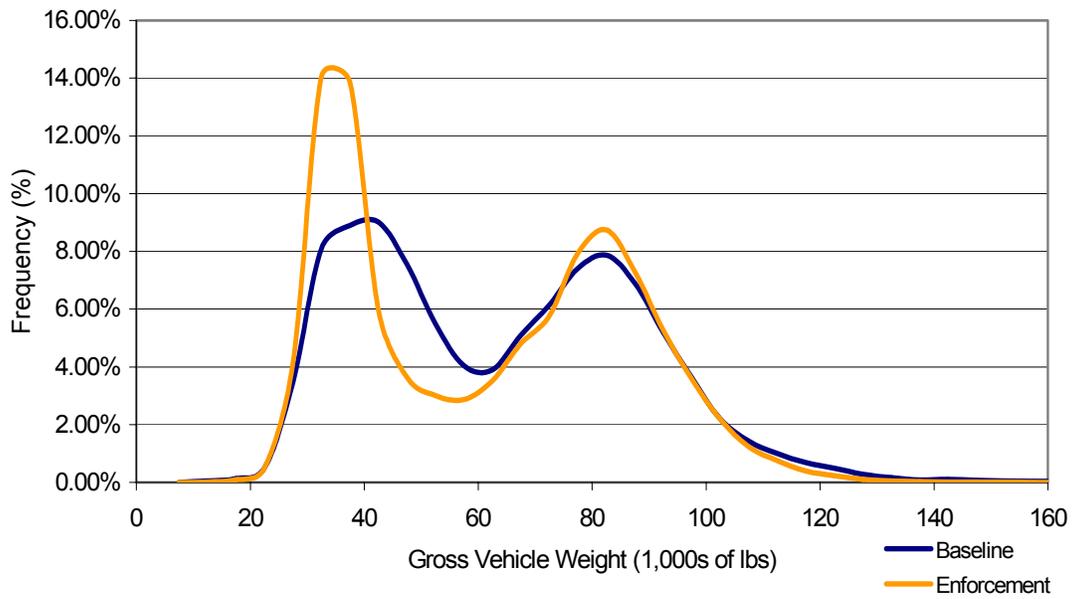
Figure C-3.   Class 10 Gross Vehicle Weight Distributions at **All *STARS* Sites with More than Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year
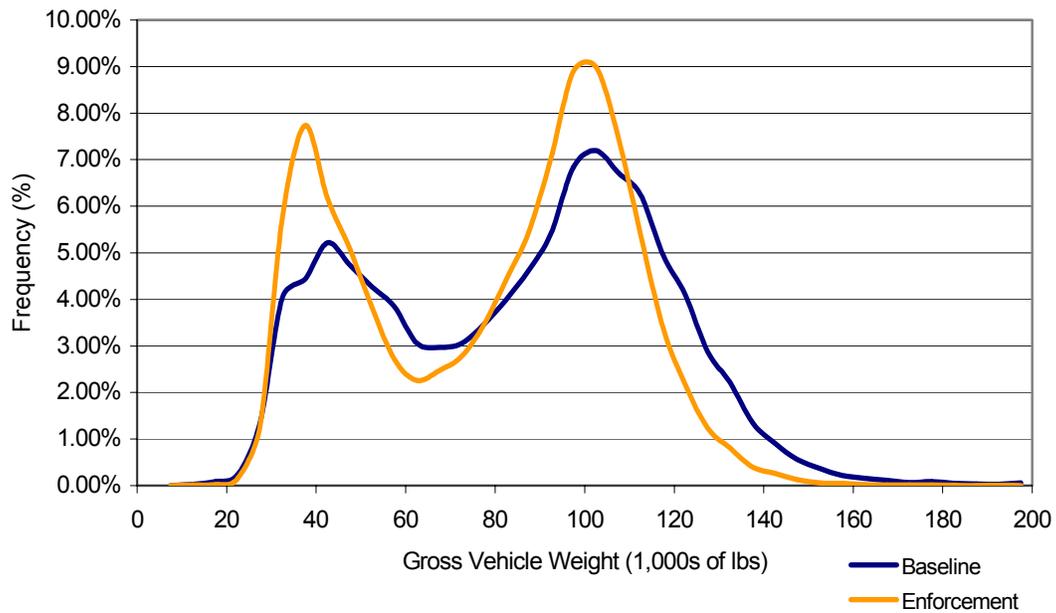
Figure C-4.   Class 13 Gross Vehicle Weight Distributions at **All *STARS* Sites with More than Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year
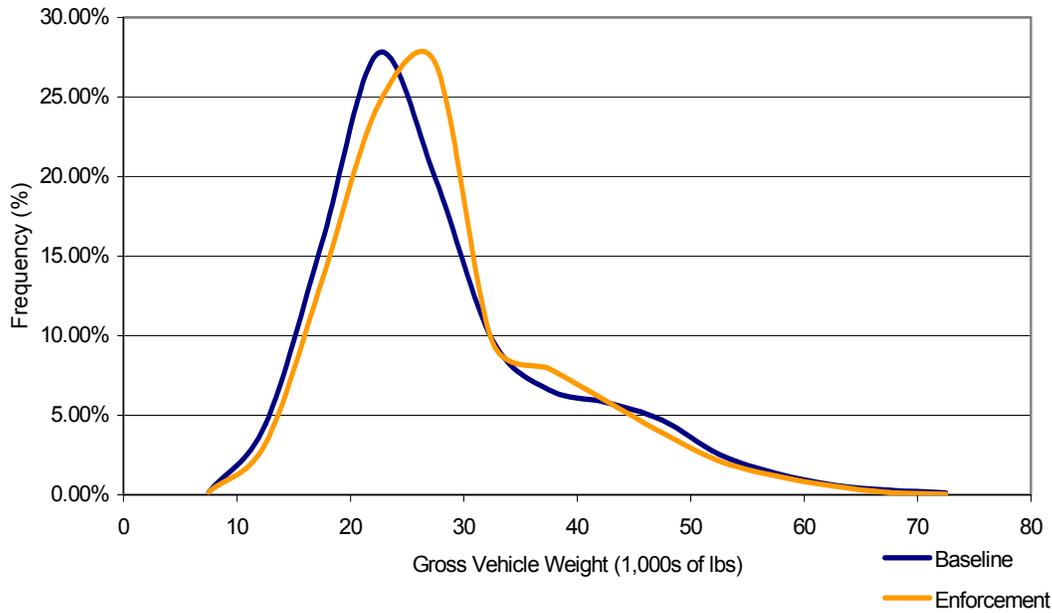
Figure C-5   Class 6 Gross Vehicle Weight Distributions at **All *STARS* Sites with One to Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year
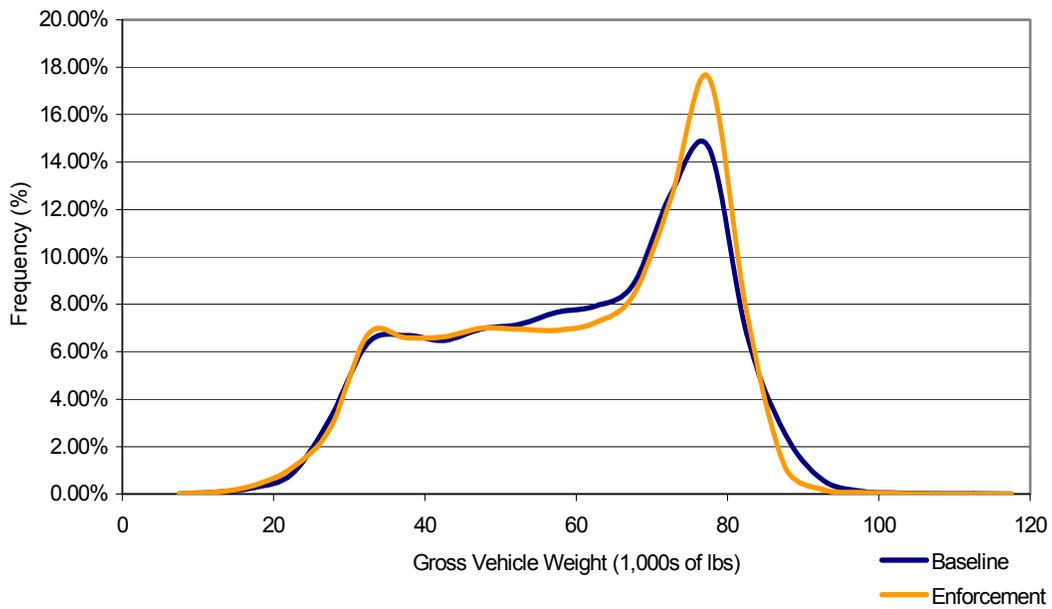
Figure C-6   Class 9 Gross Vehicle Weight Distributions at **All *STARS* Sites with One to Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year

APPENDIX C: GROSS VEHICLE WEIGHT DISTRIBUTIONS
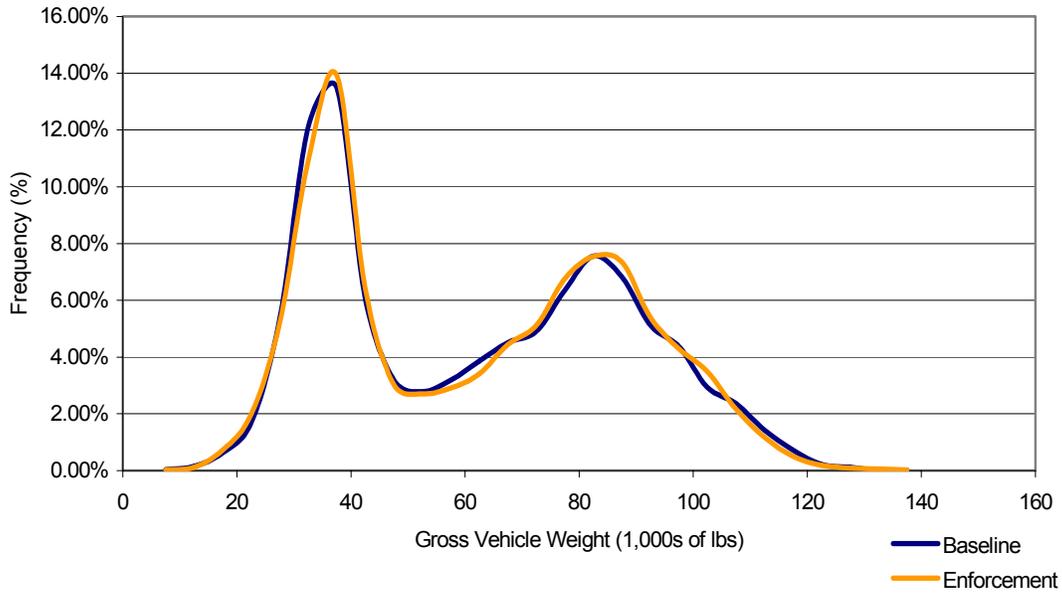
Figure C-7   Class 10 Gross Vehicle Weight Distributions at **All *STARS* Sites with One to Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year
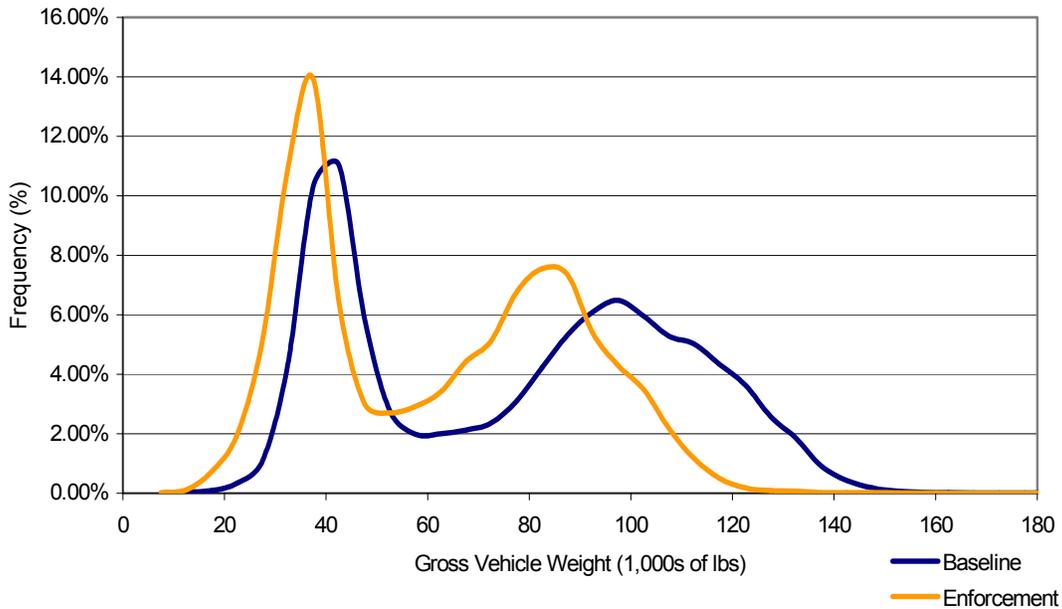
Figure C-8   Class 13 Gross Vehicle Weight Distributions at **All *STARS* Sites with One to Six Months of Focused Enforcement**, Baseline and Focused Enforcement Year

APPENDIX C: GROSS VEHICLE WEIGHT DISTRIBUTIONS
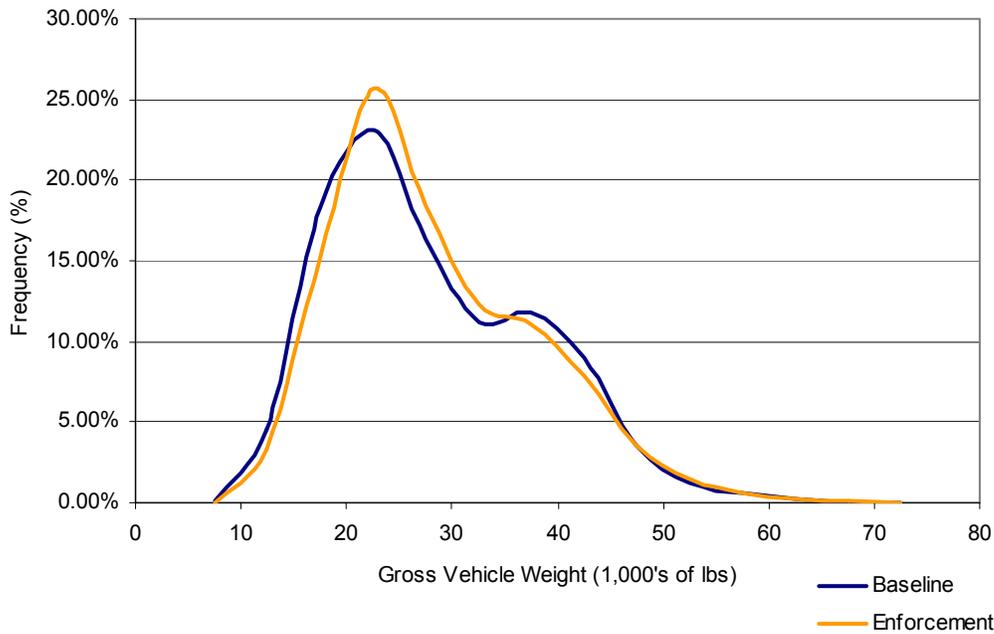
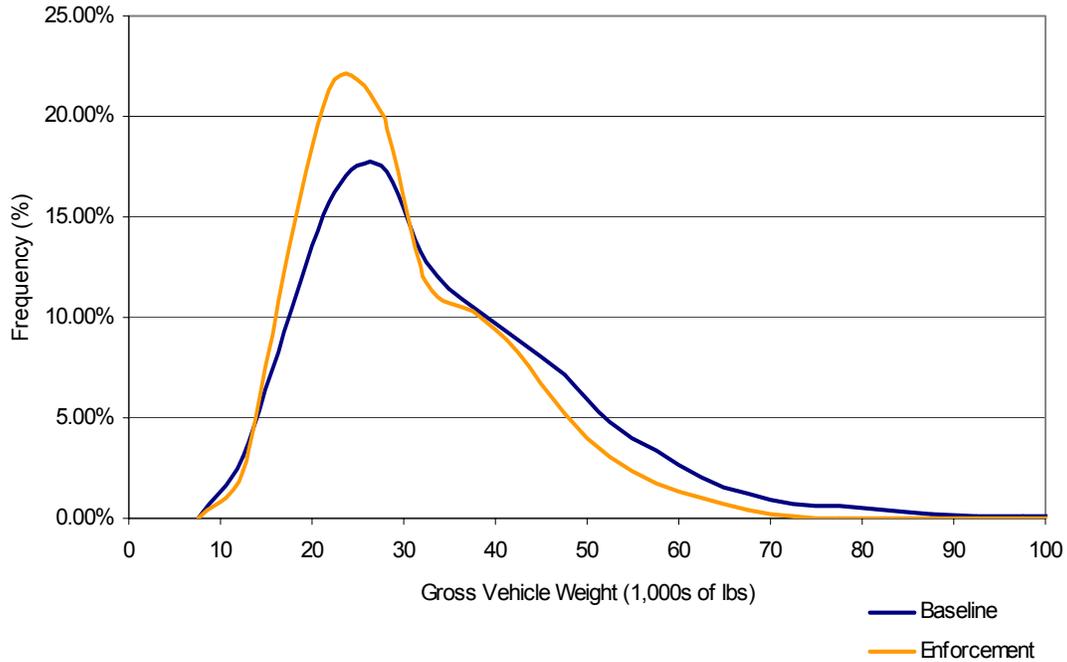Figure C-9   Class 6 Gross Vehicle Weight Distributions at **All *STARS* Sites not Selected for Focused Enforcement**, Baseline and Focused Enforcement Year
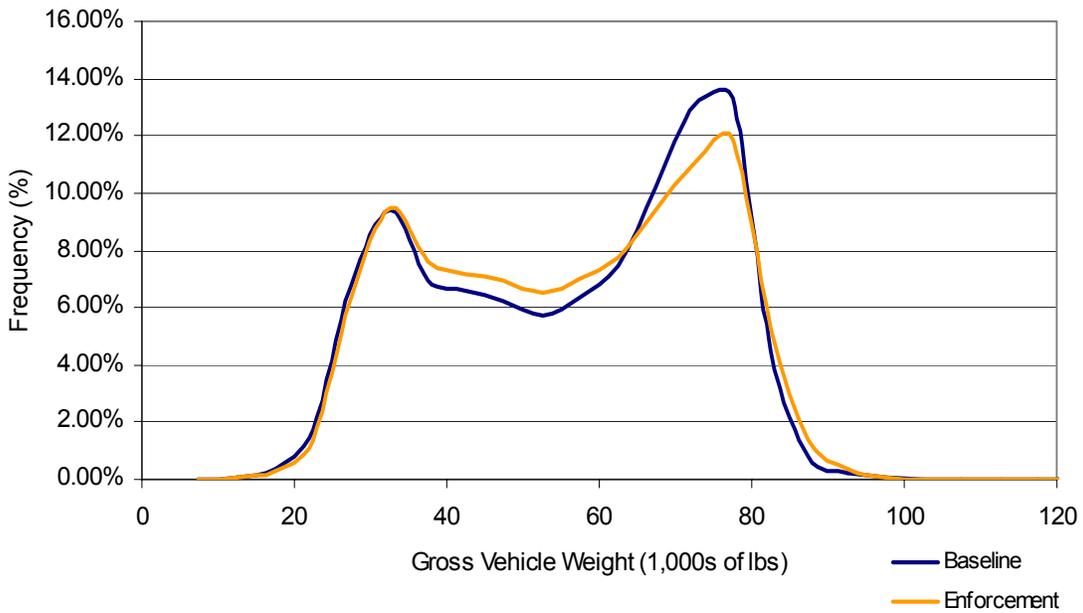
Figure C-10 Class 9 Gross Vehicle Weight Distributions at **All *STARS* Sites not Selected for Focused Enforcement**, Baseline and Focused Enforcement Year

APPENDIX C: GROSS VEHICLE WEIGHT DISTRIBUTIONS
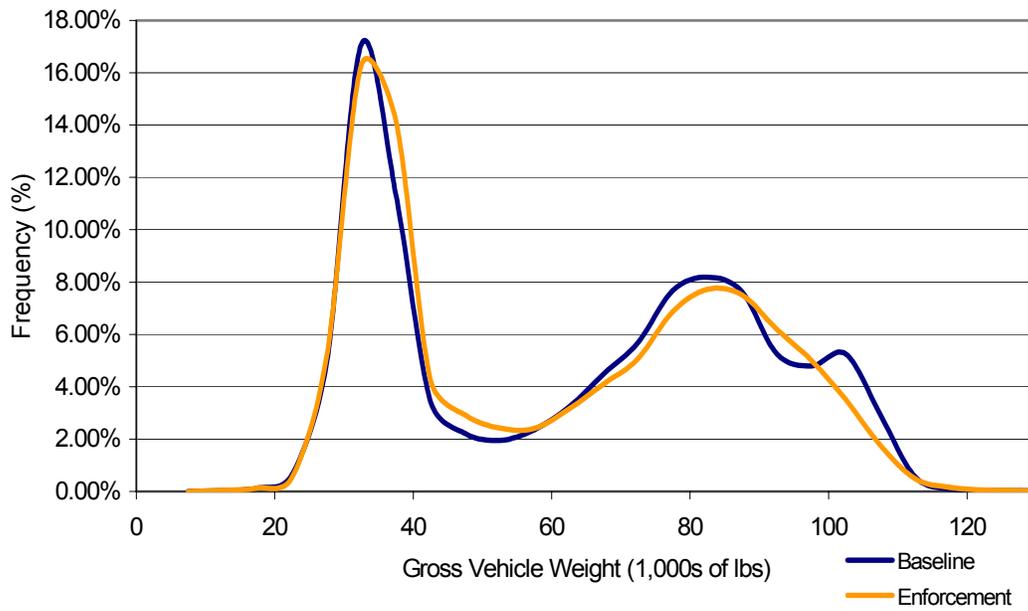
Figure C-11 Class 10 Gross Vehicle Weight Distributions at **All *STARS* Sites not Selected for Focused Enforcement**, Baseline and Focused Enforcement Year
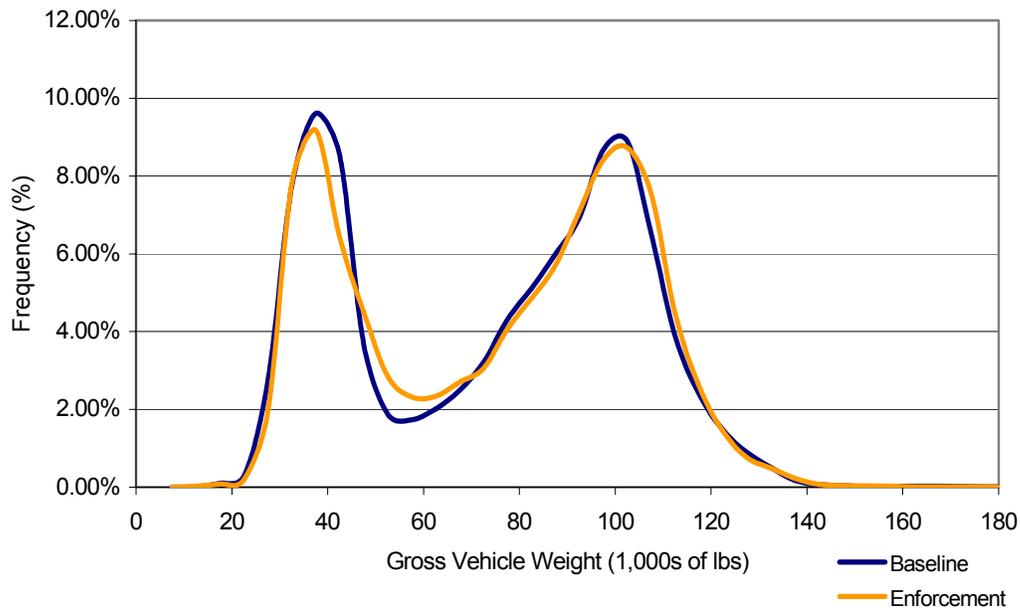
Figure C-12 Class 13 Gross Vehicle Weight Distributions at **All *STARS* Sites not Selected for Focused Enforcement**, Baseline and Focused Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

* Data Problem
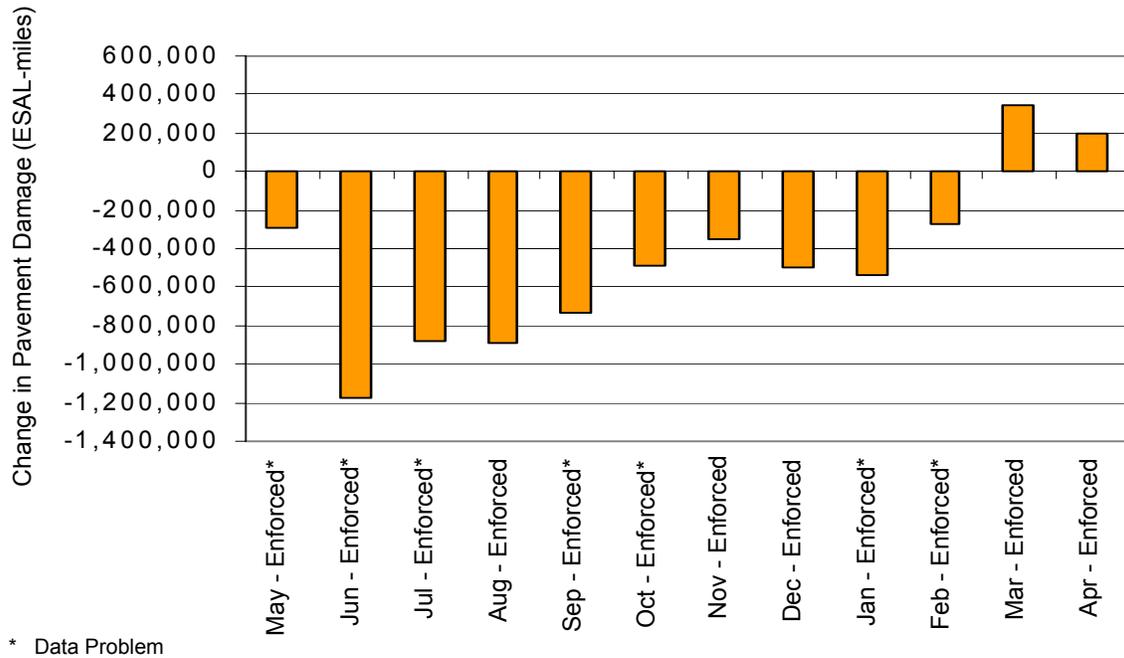
Figure D-1.   Change in Pavement Damage for the **Four Corners/Gallatin** *STARS* Site, Baseline to Focused Enforcement Year

* Data Problem

Figure D-2.   Change in Pavement Damage for the **Ryegat**e *STARS* Site, Baseline to Focused Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

Figure D-3.   Change in Pavement Damage for the **Stanford** *STARS* Site, Baseline to Focused
Enforcement Year

Figure D-4.   Change in Pavement Damage for the **Townsend** *STARS* Site, Baseline to Focused
Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

*   Data Problem

Figure D-5.   Change in Pavement Damage for the **Arlee** *STARS* Site, Baseline to Focused
Enforcement Year

*   Data Problem

Figure D-6.   Change in Pavement Damage for the **Decker** *STARS* Site, Baseline to Focused
Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

* Data Problem

Figure D-7.   Change in Pavement Damage for the **Manhattan** *STARS* Site, Baseline to Focused
Enforcement Year

* Data Problem

Figure D-8.   Change in Pavement Damage for the **Miles City East** *STARS* Site, Baseline to
Focused Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

* Data Problem

Figure D-9. Change in Pavement Damage for the **Ulm** *STARS* Site, Baseline to Focused
Enforcement Year

* Data Problem

Figure D-10. Change in Pavement Damage for the **Broadview** *STARS* Site, Baseline to Focused
Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

* Data Problem

Figure D-11. Change in Pavement Damage for the **Culbertson** *STARS* Site, Baseline to Focused
Enforcement Year

* Data Problem

Figure D-12. Change in Pavement Damage for the **Fort Benton** *STARS* Site, Baseline to Focused
Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE

*   Data Problem

Figure D-13. Change in Pavement Damage for the **Galen** *STARS* Site, Baseline to Focused
        Enforcement Year

*   Data Problem

Figure D-14. Change in Pavement Damage for the **Havre East** *STARS* Site, Baseline to Focused
        Enforcement Year

APPENDIX D: CHANGE IN PAVEMENT DAMAGE
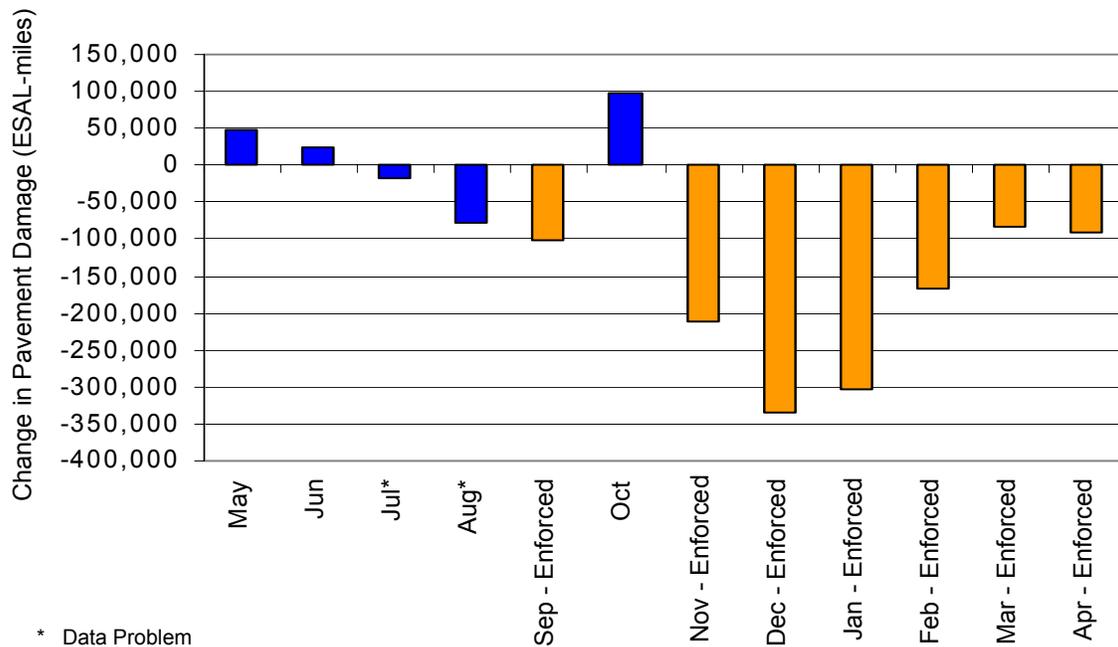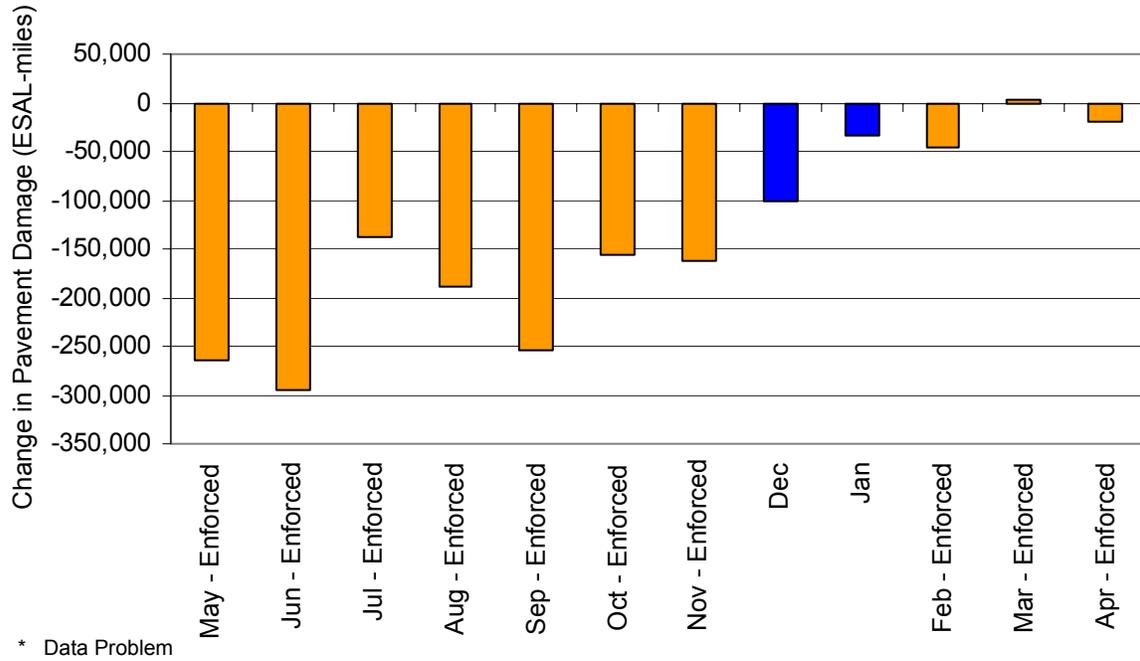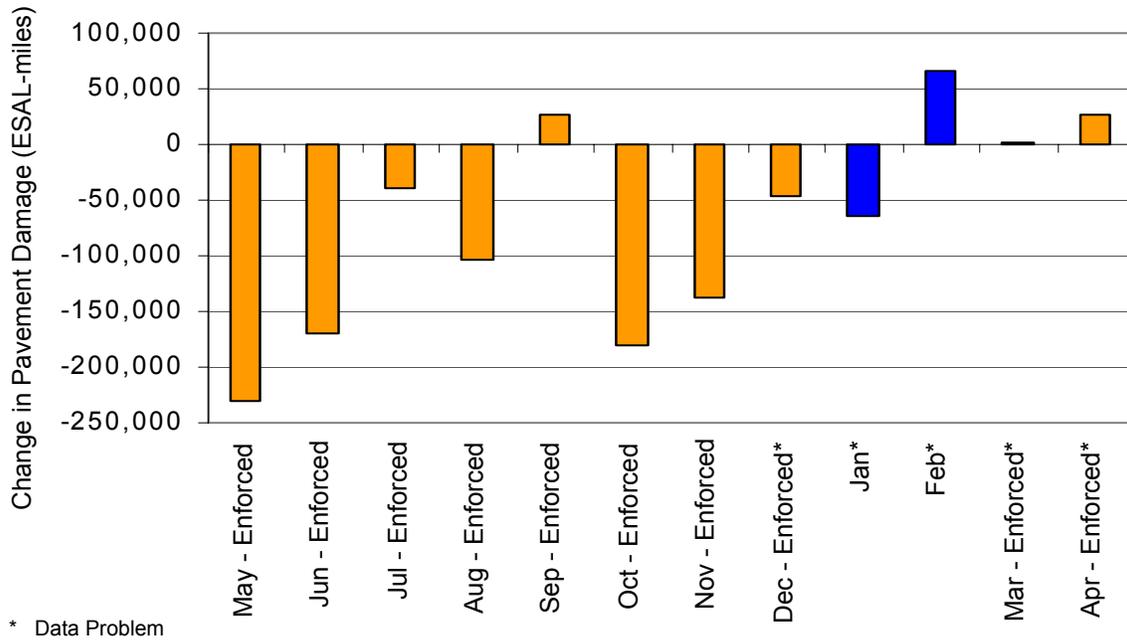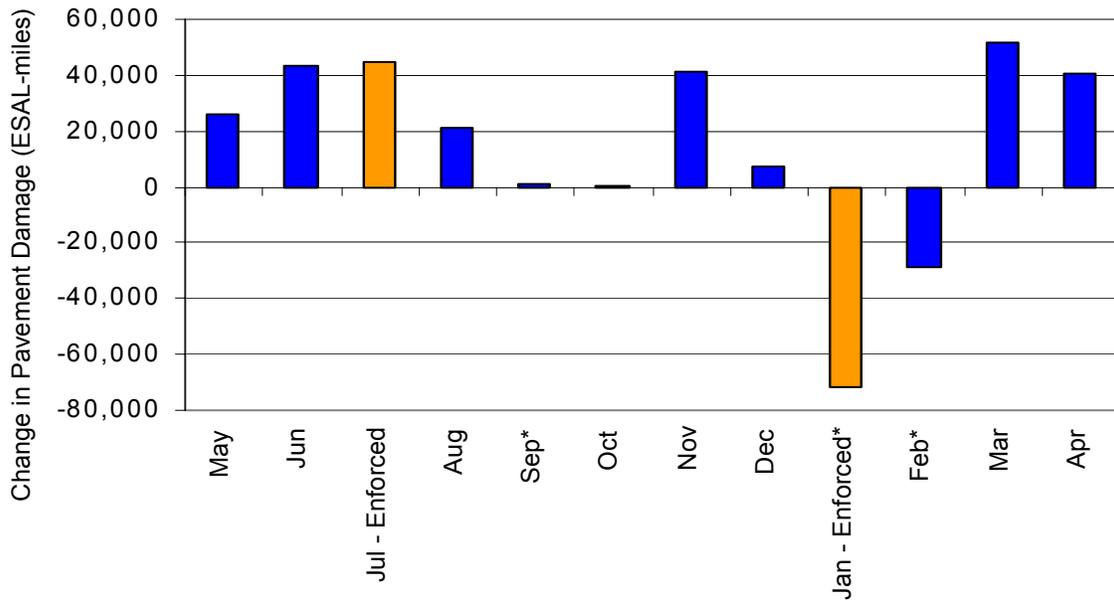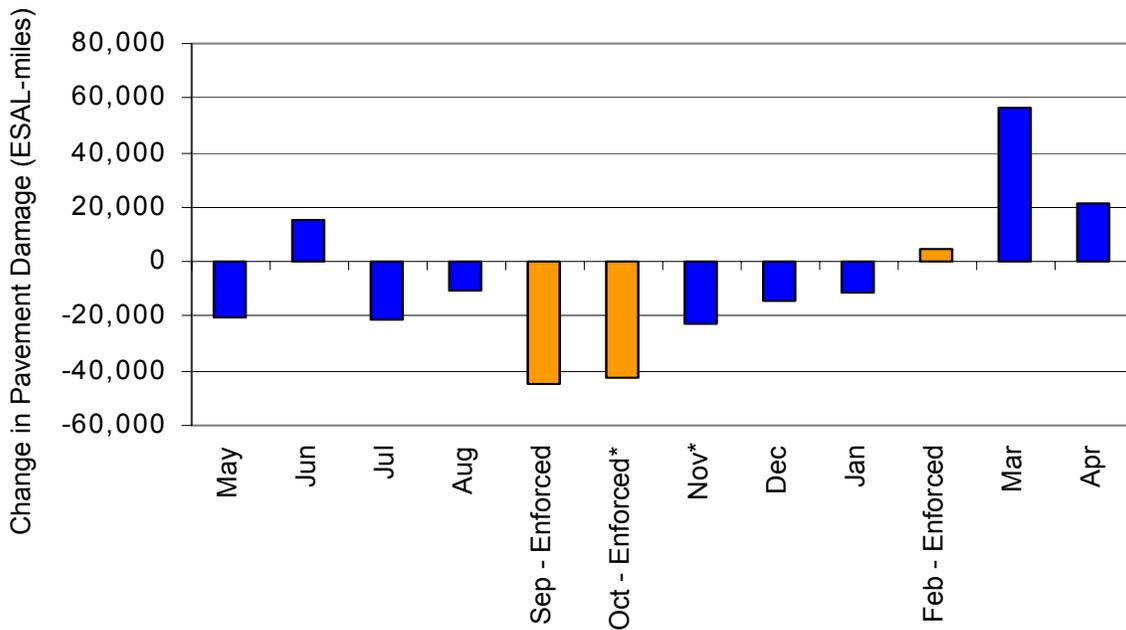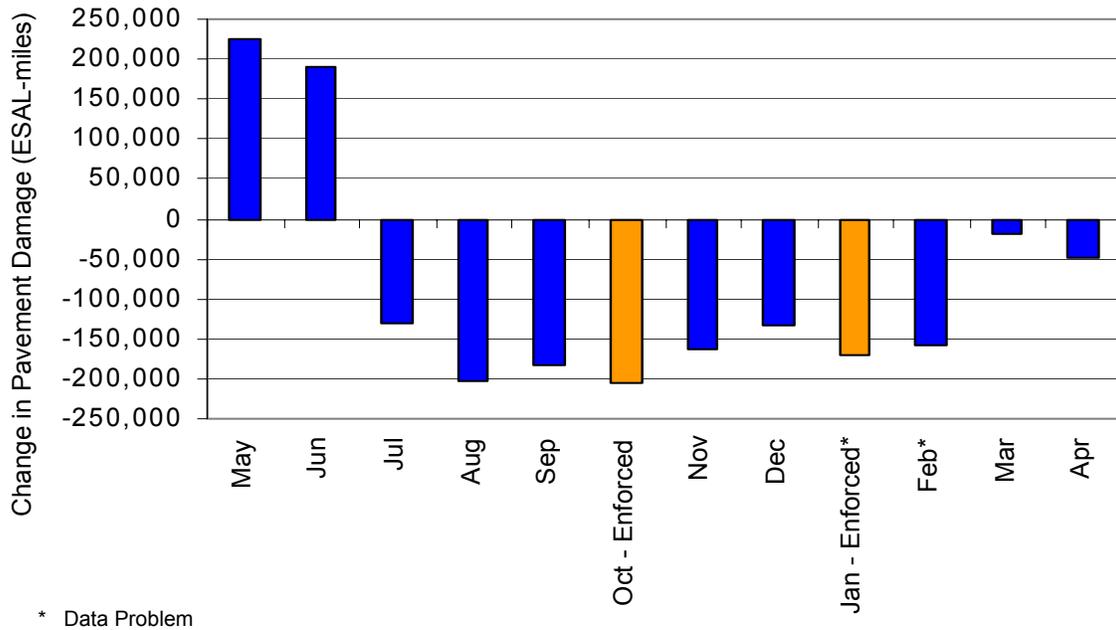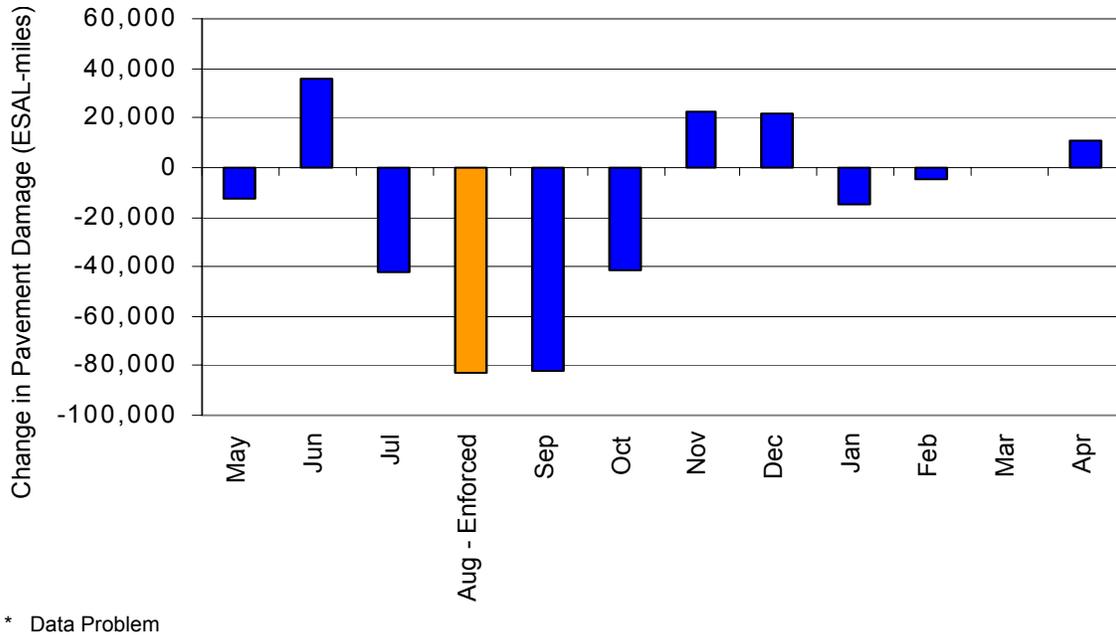

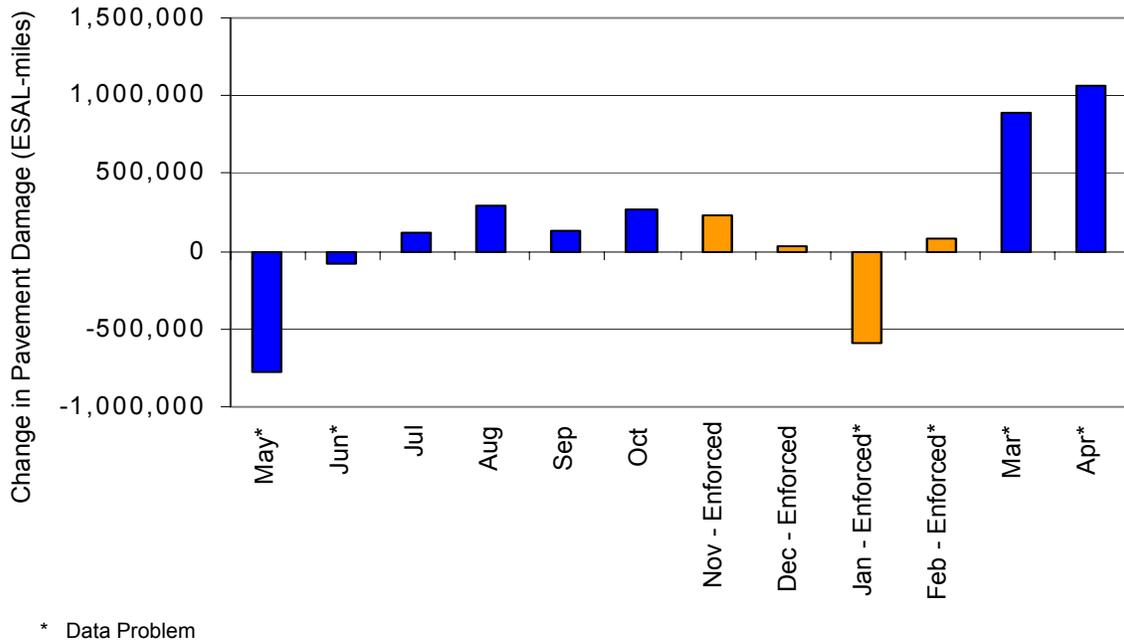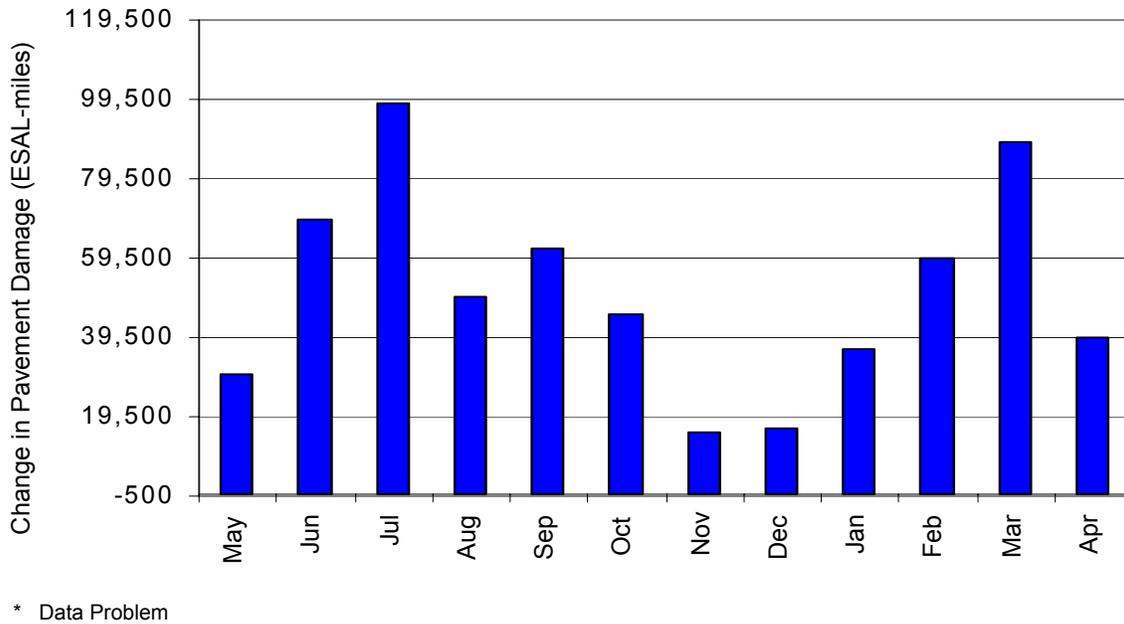* Data Problem

Figure D-15. Change in Pavement Damage for the **Lima** *STARS* Site, Baseline to Focused
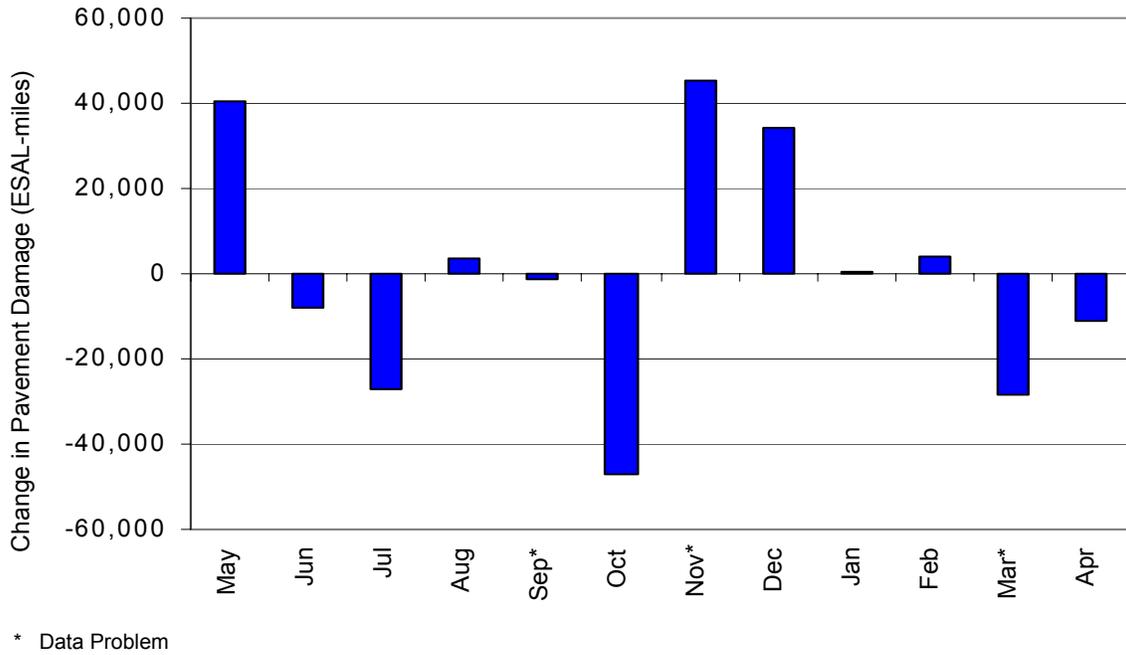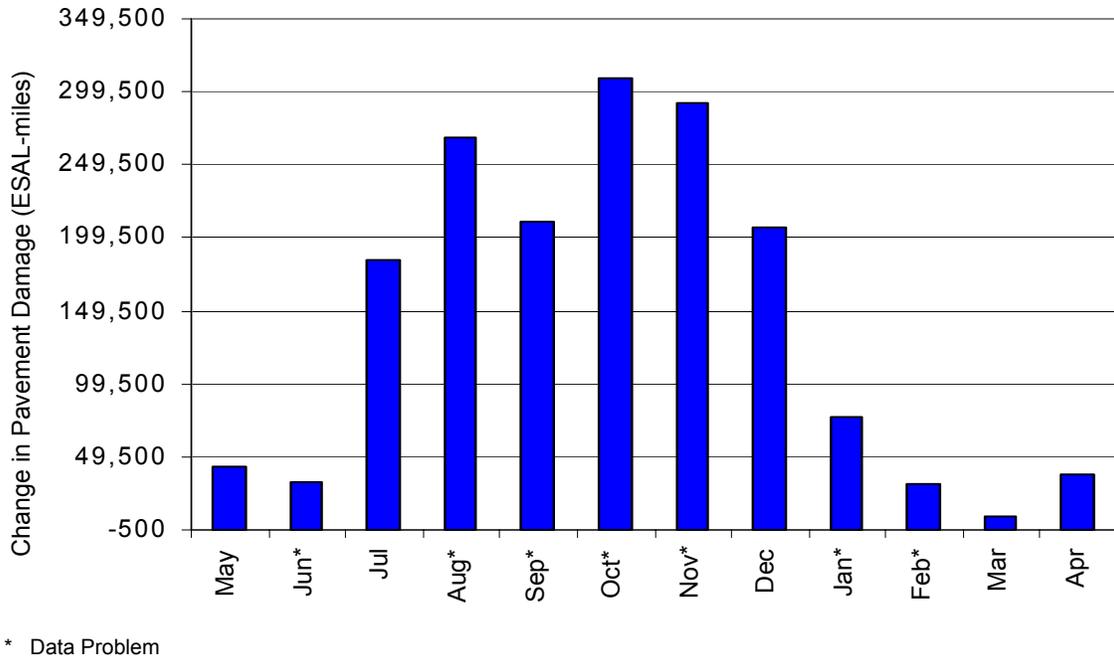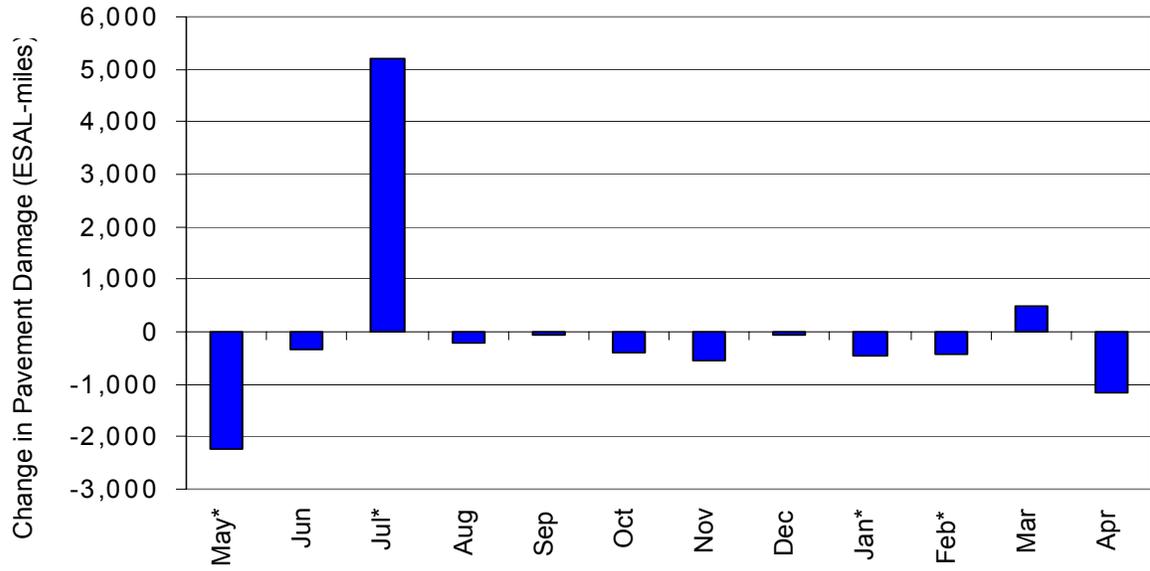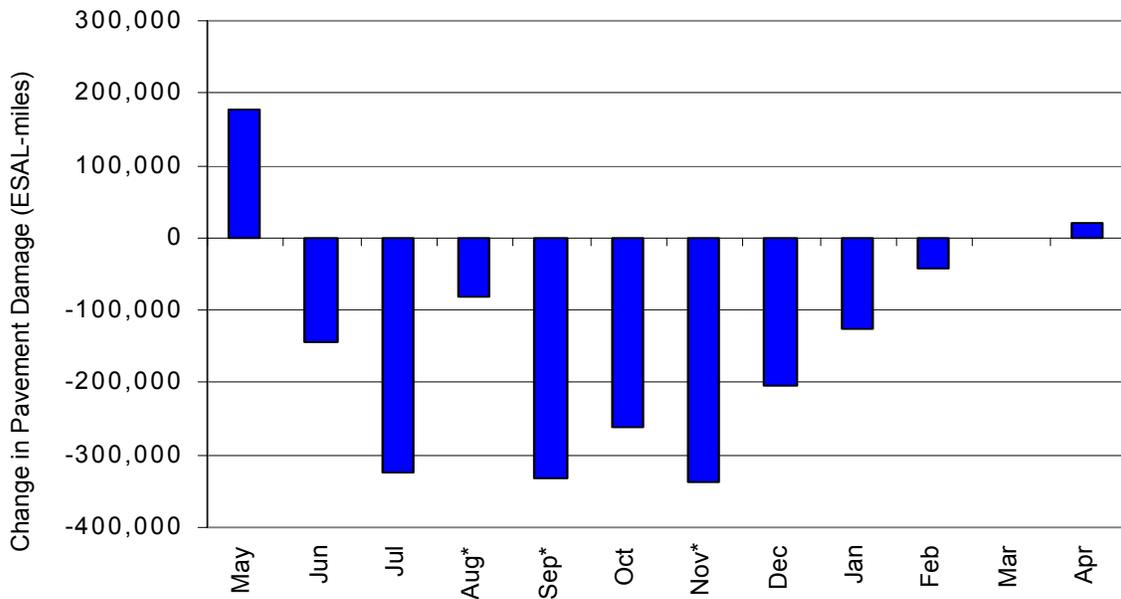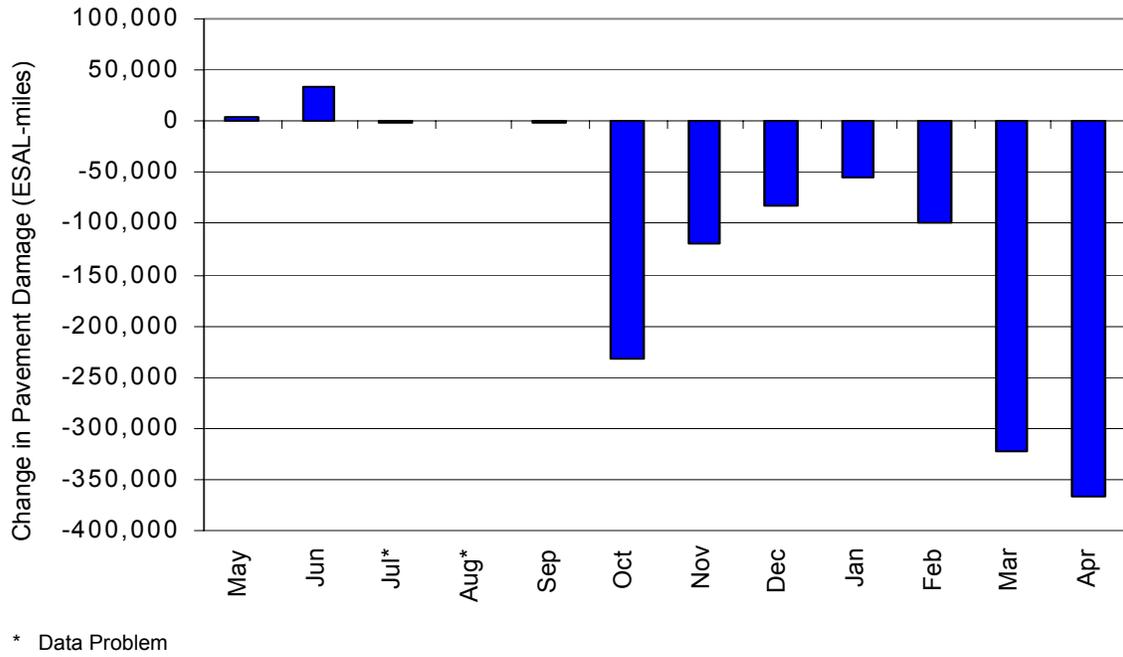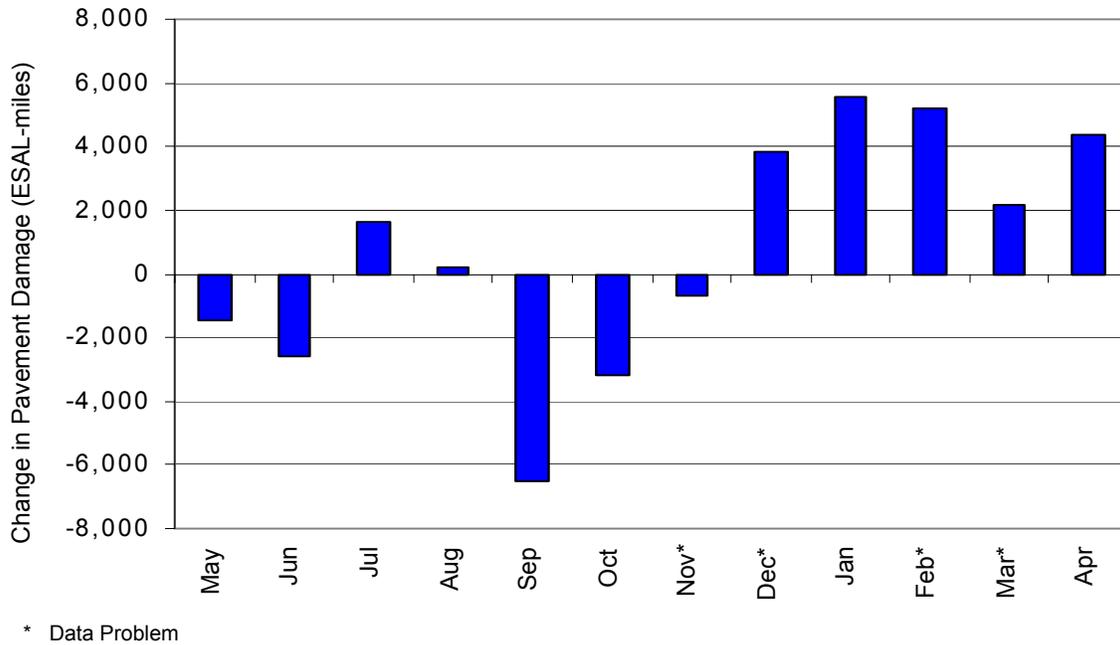Enforcement Year

* Data Problem

Figure D-16. Change in Pavement Damage for the **Paradise** *STARS* Site, Baseline to Focused
Enforcement Year

Western Transportation Institute
Montana State University-Bozeman

MONTANA
STATE UNIVERSITY
B O Z E M A N

MDT

STATE TRUCK ACTIVITIES REPORTING SYSTEM (STARS)

Survey Questionnaire

With the advent of weigh-in-motion (WIM) technologies, the ability to collect and monitor commercial vehicle data has seen great success. Still lacking however, are means to effectively and efficiently utilize this data to achieve long-term infrastructure improvements. The Montana Department of Transportation (MDT) has recently developed a new system that focuses on just that. The **State Truck Activities Reporting System**, or STARS, consists of an extensive array of WIM sensors deployed across the Montana highway system that feed data to customized software programs. The software can subsequently be used to characterize commercial vehicle operations by classification and weight, and to further perform extensive analyses specifically addressing overweight commercial vehicle operations.

In cooperation with Montana State University, a pilot project is currently underway to evaluate the effectiveness of STARS in focusing weight enforcement resources on those locations around the state experiencing the greatest pavement-related infrastructure deterioration from overweight vehicle operations. Secondary benefits include expanded and improved quality of truck weight and classification data collected by MDT. STARS sites include a cross-section of rural, interstate and non-interstate facilities where prevailing truck enforcement activities range from constant to intermittent. Pavement design, engineering and planning efforts all may benefit from this improvement in truck-related data.

The intent of this *Survey Questionnaire* is to solicit information that details the extent of benefits that may result from expanded and improved truck-related data. In particular, representative responses are sought from the areas of:

☑ Planning   ☑ Geometric Design

☑ Engineering   ☑ Safety

☑ Motor Carrier Services   ☑ Bridges

☑ Pavements and Materials

Please assist us in this endeavor by either completing this survey yourself or passing it along to someone appropriate. Return your completed *Survey Questionnaire* no later than **July 10, 2002** by:

1. Email to: JodiC@ce.montana.edu

2. Fax to: (406) 994-6105, ATTN: Jodi Carson

3. Mail, along with any attachments, to: Dr. Jodi Carson
                                           Department of Civil Engineering
                                           214 Cobleigh Hall
                                           Montana State University
                                           Bozeman, Montana 59717

If you have any questions or comments about this *Survey Questionnaire* or the STARS Project itself, please feel free to contact Dr. Jodi Carson at (406) 994-7998 or JodiC@ce.montana.edu. Thank you very much for your assistance.

APPENDIX E: DATA ENHANCEMENT SURVEY

CONTACT INFORMATION

Name: _____   Telephone: _____

Title: _____   Fax: _____

MDT Area/
Division: _____   Email: _____

DATA USE

1. **How do you currently use truck-related data in your day-to-day activities?**

_____

_____

_____

Example applications may include:

   Planning: truck volume data by route for modeling goods movements throughout the state or monitoring truck traffic growth

   Engineering: traffic simulation model applications to test various operational strategies

   Motor Carrier Service: truck weight data for setting equitable vehicle license fees or locating and scheduling enforcement resources

   Pavements and Materials: truck weight and volume data for projecting the number of equivalent single axle loads applied to a pavement structure

   Geometric Design: truck dimensional data for turning radii or lane widths, truck volume and route data for locating climbing lanes

   Safety: truck miles traveled to determine crash exposure rates, various truck characteristics as they affect safety

   Bridges: truck weight data for developing loading standards for bridge design and maintenance

DATA ELEMENTS

2. **What specific types of data do you currently collect or access to support your day-to-day activities? Are there data that you would like to see collected? If yes, what are they?**

   Current: _____

   _____

   Desired: _____

   _____

Example data elements may include:

- *truck volumes by route*
- *truck volumes seasonally*
- *truck origin and destination*
- *percent of overweight trucks in the traffic stream*
- *equivalent single axle loads*
- *truck dimensions*

- *truck weights*   - *truck-involved crashes*

DATA SOURCES

3. What are your current sources for this data?

_____

_____

Example data sources may include:
- *another division within MDT*
- *periodic field studies*
- *another agency such as Montana Highway Patrol*

- *assumed values from professional reference manuals such as the Highway Capacity Manual or Trip Generation Guide*

DATA QUALITY

4. What are the shortcomings with the data that you currently access or collect and utilize?

_____

_____

Example shortcomings may include:
- *not accurate or detailed enough*
- *not timely*

- *difficult to access and requires significant manipulation*

DATA IMPROVEMENTS

STARS will ultimately result in the implementation of 90 truck weight and classification data reporting sites, of which 26 will be permanent and will be operated on a continuous basis. The remaining 64 will be operated intermittently on a three-year cycle using fully portable weigh-in-motion (WIM) equipment. WIM systems provide continuous electronic capture of site identifiers, times and dates of vehicle passage, lane of travel, vehicle speeds and classifications, weights of all axles or axle groups and equivalent single axle load values.

5. How do you think this improvement in truck-related data quantity and quality will affect your day-to-day activities?

_____

_____

Example effects may include:
- *easier access to data*
- *improved accuracy in projected equivalent single axle loads*

- *improved efficiency in data collection and analysis*

6. The new data available through STARS will
(Please check one.)

- ☐ substantially benefit
- ☐ benefit
- ☐ not effect
- ☐ detrimentally effect what I do.

Thank you again for your time and assistance with this effort.