Report No. FHWA-RD-76-138

TRUCK TRAFFIC VOLUME AND WEIGHT DATA FOR 1971 AND THEIR EVALUATION

December 1976

Final Report

FEDERAL HIGHWAY ADMINISTRATION
Offices of Research & Development
Washington, D. C. 20590

NOTICE

This document is disseminated under the sponsorship of the Department of Transportation in the interest of information exchange. The United States Government assumes no liability for its contents or use thereof.

The contents of this report reflect the views of the Office of Research of the Federal Highway Administration, which is responsible for the facts and the accuracy of the data presented herein. The contents do not necessarily reflect the official views or policy of the Department of Transportation.

This report does not constitute a standard, specification, or regulation.

Technical Report Documentation Page

1. Report No.	2. Government Accession No.	3. Recipient's Catalog No.
FHWA-RD-76-138		

4. Title and Subtitle	5. Report Date
TRUCK TRAFFIC VOLUME AND WEIGHT DATA FOR 1971 AND THEIR EVALUATION	December 1976
	6. Performing Organization Code: HRS-41
	8. Performing Organization Report No.
7. Author(s): R. Winfrey, P.D. Howell, and P. M. Kent	
9. Performing Organization Name and Address: Environmental Design and Control Division, Offices of Research and Development, Federal Highway Administration	10. Work Unit No. (TRAIS): FCP 33A1042
	11. Contract or Grant No.: 3-1-1489
	13. Type of Report and Period Covered: Final Report
12. Sponsoring Agency Name and Address: Federal Highway Administration, U. S. Department of Transportation, Washington, D.C. 20590	14. Sponsoring Agency Code

15. Supplementary Notes

Staff Report (HRS-41)

16. Abstract

This report presents an analysis and evaluation of the results of the 1971 annual traffic classification count and weighing of trucks at roadside stations as conducted by the State highway departments in cooperation with the Federal Highway Administration.

This study serves two objectives: (1) a wide range of data are provided on truck use of the highways and (2) the annual truck weighing operation is evaluated from the viewpoint of the quality and extent of the truck count and weight information. For the Other FA primary rural highway system, 2-axle, panel and pickup trucks account for 51 percent of the truck traffic, 2-axle, 6-tire trucks 14 percent and 5-axle tractor semitrailer combinations 20 percent. On the Interstate rural highway system, the heavier trucks have a higher percentage than 2-axle trucks. A trend analysis, 1966 to 1972, indicates that with little exception there was no marked change in truck percentage of total traffic nor in the average gross or axle weights. The 5-axle tractor semitrailer combination increased in use and in loading. There is a marked trend to diesel fuel for combinations and 3-axle single unit trucks. Between 64 and 98 percent of the combination vehicles use diesel fuel.

Recommendations are included for improving truck weighing procedures and application of the truck volume and weight data.

17. Key Words	18. Distribution Statement
Truck weights, truck traffic volume, motor vehicle axle and gross weights, highway planning surveys, annual truck weighing studies, legal weights and dimensions of trucks	No restrictions. This document is available to the public through the National Technical Information Service, Springfield, Virginia 22161.

19. Security Classif. (of this report)	20. Security Classif. (of this page)	21. No. of Pages	22. Price
Unclassified	Unclassified	159	

PREFACE

The contents of this report were the results of a staff study, "Truck Classification and Weight Analysis," undertaken by the Office of Research to determine and evaluate truck characteristics -- usage and trends for various truck types and highway systems.

The basic data were supplied by FHWA's Office of Planning as reported in the 1971 annual traffic classification count and weighing of trucks at roadside stations. The statistical analysis was performed by Mrs. Phebe D. Howell and Mr. Perry M. Kent. Through his familiarity with the study and his expertise in the subject area, Mr. Robley Winfrey provided an objective evaluation of this analysis, described the assembly of information included in the report, detailed the uses which the information will serve, and recommendations for improving truck weighing procedures and application of the truck volume and weight data.

TABLE OF CONTENTS

Introduction 1

Objectives of this Report 2
Objectives of the Counting and Weighing Operation 3

Highway Planning Survey--Weighing of Vehicles 4

State Legal Limits of Vehicle Weight 15

The Total Process of Counting and Weighing Traffic Vehicles 15

Geographical Locations of Weighing Stations 19
Traffic Volume and Classification Count 22
Selection of the Hours Per Day for Weighing 23

Representativeness and Criteria for Statistical Quality 25

Criteria for Quality of Field-collected Weight Data 26
Representativeness of Traffic Volume Classification and of Vehicle Weighings 29
Analysis and Testing of Field Data for Representativeness and Acceptability 30

Collection of Information Other Than Truck Weight, Traffic Volume, and Vehicle Classification 34

Roadside Stations at Which Traffic Was Classified in 1971 36

Traffic Count and Vehicle Classification for 1971 39

Results of the Iowa Vehicle Classification for 1971 39
Hourly Distribution of Truck Traffic by Vehicle Type Code 41

Average Weights, Payloads, and Weight Distributions for 1971 49

Number of Vehicles Weighed in 1971 50
Empty and Loaded, Axle and Vehicle Gross Weights 50
Gross Weight of Empty Trucks 51
Percentage of Empty Trucks and Payload Per Vehicle 53
Analysis of Individual Roadside Stations 59
Gross Weight Distribution 65
Axle Weight Distribution 69

Practical Maximum Gross Weight (PMGW) 75

Trend Over Years of Truck Weights and Traffic Counts 81

Trends in Daily Traffic Counts 83
Trends in Vehicle Weights 83
Trend in Percentage Empty and Payload 88
Fuel Type Trend 88

Discussion for Further Analyses 100

Yearly Schedules of Weighing 103
Difficulty in Comparing Results 103
Uniformity Between States 104
Desirable Standard of Statistical Quality 104
Weakness in Weight and Traffic Classification Data 108

Uses and Users of Truck Weights and Vehicle Classification Counts .. 110

Organizations and Agencies Most Likely to Use the Results of the Annual Truck Weight Studies 116

Description of Uses of Annual Collections of Truck Weight and Other Information 117

Recommendations 122

References 127

Appendix 134

LIST OF TABLES

1. Code numbers and identification of vehicles weighed in 1971.....8

2. Vehicle type coding chart.....12

3. Subcodes to Table 2.....13

4. Codes for Census Divisions and States.....14

5. Maximum legal limits of vehicle length, axle weight, and gross weight of States grouped by census division - limits as of December 31, 1972.....16

6. Number of roadside stations at which traffic was classified in 1971.....37

7. Number of States and number of counting roadside stations for 1971.....40

8. Number of vehicles counted by vehicle code and percentage of total for Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971.....42

9. Number of trucks counted at all stations and percentage of total trucks counted for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971...43

10. Hour by hour percentage distribution of traffic for vehicle codes 200, 220, and 230 for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971.....44

11. Hour by hour percentage distributions of traffic for vehicle codes 321, 322, and 332 for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971.....45

12. Percentage of weighed vehicles that were empty and their average gross weight on the Interstate rural highway system.....54

13. Percentage of weighed vehicles that were empty and their average gross weight on the Other FA primary rural highway system....55

14. Percentage of weighed vehicles that were empty and their average gross weight on the Other FA primary urban systems.....56

15. Number of vehicles weighed, average empty weight and average payload per loaded vehicle for vehicle type codes 220 and 332 for 1966, 1967 and 1971 on the Other FA primary rural highway system by census division.....58

16. U.S. average empty, loaded, and payload weights for three highway systems and nine vehicle type codes 1971.....60

17. Percentage of vehicles weighed empty and gross weights for individual stations in Wisconsin on the Interstate rural highway system in 1971.....62

18. Percentage of vehicles weighed empty and gross weights for 15 roadside stations in Wisconsin on the Other FA primary rural highway system for 1971.....63

19. Practical maximum gross weight of seven vehicle codes at legal axle weights of 18/32 and 22/36 kips, single/tandem axles.....80

20. Ratio of average payload weight per loaded vehicle to average empty weight by vehicle code number.....82

21. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Interstate rural highway system.....84

22. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Other FA primary rural highway system....85

23. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Other FA primary urban highway system....86

24. Trend of average daily counts of main truck type codes, U.S. average for the Other FA primary rural system for 1966, 1969 and 1972.....87

25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system.....89

26. Percentage of total vehicles weighed that were empty and pounds of payload per loaded vehicles, 1966 to 1972, U.S. average for the Other FA primary rural system.....98

27. Type of fuel used by trucks on the Other FA primary rural system--U.S. total for 1966 to 1972.....99

28. Fuel type percentage by truck type for 1972 on the Interstate rural and Other FA primary rural and urban highway systems.....101

29. Vehicles counted and vehicles weighed on the Other FA primary rural system for States in the West North Central census division, 1971.....106

Appendix A Tables

30. Number of vehicles weighed by vehicle code by census division by States--1971, Interstate rural.....135

31. Number of vehicles weighed by vehicle code by census division by States--1971, Interstate urban.....136

32. Number of vehicles weighed by vehicle code by census division by States--1971, Primary rural.....137

33. Number of vehicles weighed by vehicle code by census division by States--1971, Primary urban.....138

34. Number of vehicles weighed by vehicle code by census division by States--1971, Secondary rural.....139

35. Number of vehicles weighed by vehicle code by census division by States--1971, Secondary urban.....140

36. Number of vehicles weighed and number of States weighing National totals by highway system and vehicle code.....141

Appendix B Tables

37. Comparison of the number of vehicles weighed and the average axle and gross weights by States in census division groups, highway system and vehicle type for empty, loaded and combined vehicles.....142

Appendix C Tables

38. Average weight of vehicles weighed by vehicle type, census division and highway systems.....151

39. Number of vehicles tallied.....152

Appendix D Tables

40. Accumulative percentage for gross weight distribution.....153

41. Accumulative percentage for single and tandem axle weight distributions.....156

Appendix E Tables

42. Hourly classification count summary for 1971.....158

LIST OF FIGURES

1. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 200 for selected highway systems 46

2. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 230 for selected highway systems 47

3. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 332 for selected highway systems 48

4. Acculated percentage of gross weight frequencies for vehicles weighed on the Interstate, rural highway system. Vehicle type code 220 is for combined empty and loaded vehicles in Iowa, Minnesota, and Nebraska. Vehicle type code 332 is for empty, loaded, and combined vehicles in North Dakota. Roughness of the curves is a result of inadequate sample size 66

5. Accumulated percentage of gross weight frequencies for vehicle type code 332 weighed empty, loaded, and combined for the Iowa Interstate, rural highway system for 1971 68

6. Accumulated gross weight percentage distribution of combined empty and loaded gross weight for vehicle type codes 210, 220, 230, 321, 322, and 332 for the Other FA Primary, rural highway rural highway system in Iowa for 1971 70

7. Accumulated percentage of gross weight frequencies for vehicle type code 332 loaded vehicles weighed in the West North Central census division on the Interstate rural and Other FA primary rural and urban highway systems for 1971 71

8. Accumulated percentage of axle weight for vehicle type codes 220 and 332, combined empty and loaded, on the Interstate, rural highway system in Iowa 73

9. Tandem pair DE axle weight accumulated percentage by weight intervals for vehicle type code 332, combined empty and loaded, for New England and West North Central Census Divisions for selected Highway Systems..... 74

10. Front axle weight related to gross weight of loaded vehicles for vehicle type codes 200, 210, and 220 for U.S. total of all hgihway systems for 1971 77

11. Front axle weight related to gross weight of loaded vehicles for codes 230, 321, 322, and 332 for U.S. total of all highway systems for 1971 78

12. Front axle weight related to gross weight of loaded vehicles for vehicle type codes 432 and 5212 for U.S. total of all highway systems for 1971 79

INTRODUCTION

Officials in charge of public highway systems are responsible to design, maintain, and operate their highway systems such that highway transportation is safe, economical (consistent with the degree of quality of transportation desired), direct, and convenient. In striving to reach these objectives, the authorities concerned must be fully informed about the characteristics of the vehicles that use their highways. These characteristics include such items as performance on the highway (frequency of trips and speed and rate of change in speed), maximum and minimum capabilities, dimensions (length, width, and height), weights (axle and gross), and the trends in these characteristics. Rates of fuel consumption, empty weight, and total gross weight capacity are factors important to setting tax rates and license fees. These characteristics of vehicles are obtained by observing traffic, weighing vehicles at roadside stations, reviewing manufacturer's specifications, and conducting laboratory and field tests.

Highway authorities, as such, usually have no control over the characteristics of vehicles that use public highways. But such control is accomplished by legislation by the appropriate authorities. Highway authorities may or may not be assigned the responsibility to enforce the legal provisions affecting the use of highways and the characteristics of the vehicles that use public highways. This enforcement is most frequently assigned to police departments at the several levels of government or to a motor vehicle department.

The legal restrictions affecting the use of vehicles on public highways are generally in the areas of vehicle weight, vehicle dimensions, vehicle speed, and vehicle design and equipment related to traffic safety and performance on the highway. Noise generation and air pollution are also covered in legal provisions.

Starting in 1935, the State highway departments began a yearly systematic procedure of weighing commercial vehicles at roadside stations, movable or permanent, as a part of the then inaugurated State-wide highway planning surveys. In addition to axle weights and gross weights, these operations include traffic and vehicle classification counting and, in certain years or circumstances, the measuring of specified dimensions of the vehicles, particularly the length and spacing between axles. The commodity carried and origin and destination of trip may be obtained at the time of certain weighings. Another item sometimes obtained is whether the vehicle was operating under provisions of law for common carrier, contract carrier, agricultural exempt carrier, or as a private carrier.

Thus, in a single year, the individual State, and collectively the nation, has available a collection of information on trucking practice and truck use of the highway systems. This information is used by State and federal authorities in different ways and to different extents, from but little use to near maximum application.

A hoped-for result of this publication is a wider and more intense use of the truck data. Further, there should result improvements in the technique of weighing, in the quality of information recorded, and in presentation of the information.

A highway department cannot control the number, type and performance of vehicles using a highway system, but the vehicle itself and its use on the highway are controlled to some extent by law with reference to dimensions, axle weight and gross weight, and safety items with respect to tires, brakes, mechanical condition, lighting, and hauling of dangerous chemicals and explosives. However, the highway department must design highways that are suitable for use by those vehicles that are legal in design and performance characteristics and that are used legally. For this basic reason, highway departments need to have full knowledge about the vehicles using the highway systems. Full information includes the many specific facts gathered in the annual truck weighings at the roadside.

Highways, including pavements and structures, are long-lasting in use. Therefore, long-range forecasting of the trends in vehicle characteristics and their use of the highways is an important device used by highway managements. The annual weighing of vehicles at the roadside is one of the several activities of highway departments to amass information needed by managements that has to do with traffic forecasting and their responsibilities to provide the public with efficient, economical, and safe highway systems.

OBJECTIVES OF THIS REPORT

From about 1935 when the roadside weighing of motor vehicles was started as a phase of the State-wide highway planning studies, there has not been published one single overall source of general data on motor vehicle weights (gross and axle), and the frequency that each class of vehicle is found in the traffic streams on different highway systems. Among others, one of the objectives of this publication is to make a wide range of data on vehicle weight and traffic classification available for general reference.

Other objectives of this report include the following:

1. To evaluate the results obtained by the several States as to their adequacy, coverage, and suitability for different uses;

2. To suggest changes in the overall weighing and counting process that should improve the quality of the results. However, the actual operation procedure used at the roadside and the choice of instruments and equipment are not discussed;

3. To indicate several applications of the truck weight data and the accompanying traffic classification counts; and

4. To provide a limited analysis of the results and of the time trends, mainly to illustrate how the field results may be used to support adequacy of the roadside weighings, engineering, legislative, administrative, motor vehicle taxation, and other management functions.

OBJECTIVES OF THE COUNTING AND WEIGHING OPERATION

The roadside classification and weighing of the traffic should achieve the following objectives in accordance with the criteria for control of quality of results:

1. Vehicle weights by highway system;

2. Vehicle weights by type of vehicle;

3. Percentage of vehicles over maximum legal weight and amount of overweight in pounds;

4. Percentage of vehicles in each class that are "empty" of payload;

5. Tons of commodity hauled; and

6. Vehicle traffic counts by type of vehicle at all weighing stations.

In this tabulation of objectives at the roadside stations, the word "weight" refers to both gross vehicle weight, empty and with payload, and to individual axle weight. Average weights and the percentage distribution of the individual vehicle weights are included in the objectives.

An important requirement of the truck weighing and traffic classification is that the results should be of such extent and statistical quality that fully acceptable comparisons of the following types can be made (A) of vehicle weights by vehicle type and (B) classification of vehicle types in the traffic flow:

1. Comparisons within each State by highway systems;

2. Comparisons between States by vehicle type and highway systems; and

3. Trends of all main factors over the years.

If each State produces the quality of results that provide for adequate comparisons within a State, the data will be acceptable for comparing census divisions or other regional areas and for compiling national statistics on vehicle weights and traffic composition by highway systems.

HIGHWAY PLANNING SURVEY--WEIGHING OF VEHICLES

The weights of vehicles on the highway--gross weight and axle, or wheel weight--have been of concern to highway engineers and structural engineers, perhaps since the beginning of the wheeled vehicle. Certainly, since the coming of the motor vehicle, say about 1900, dimensions and weights of vehicles on the roads, streets, and highways have been an ever present subject connected with highway and bridge design. The American highway officials were concerned with the maximum legal limits of vehicle dimensions and weights as early as 1920(37).

The systematic study and data collection of motor vehicle dimensions and weights began in 1935 with the State-Wide Highway Planning Surveys conducted by the States in cooperation with the Federal Highway Administration (formerly the U.S. Bureau of Public Roads). The weighing of vehicles at the roadside, particularly trucks and truck combinations, and the measuring of certain dimensions of the vehicles, started in 1935, have continued as an annual summer season activity each year since.

The general overall weighings are carried out by each State under provisions for using Federal-aid highway funds for planning and research activities. For the annual roadside weighing of vehicles, the Federal Highway Administration issues a manual (59) for the routine weighing and for any special information that is to be collected at the same time.

In order that the weight and other information collected by each State during the scheduled truck weighing can be summarized on a national basis, as well as compared State to State and region to region, the Federal Highway Administration has prepared Instructional Memorandums over the years to be followed by each State. Special studies are prescribed for certain years. These special studies include such items as origin and destination, distance of trip, horsepower rating of the engine, etc.

Prior to 1970, each State summarized its field data in accordance with instructions in the Federal Manual (59), and prepared a standard set of tables, available to all desiring copies. But in 1970, the procedure was changed to require that the States submit to the Federal Highway Administration at Washington, D.C., computer cards or tapes. The FHWA then prepares the State summaries and national summaries.

There is no attempt in this report to explain the details of weighing vehicles at the roadside or how the general plan is laid out.

In brief, the State highway departments follow a specific schedule each summer of weighing and enumerating vehicles in the traffic stream. Weighing is usually conducted on the rural and urban portion of the Interstate, other FA primary and FA secondary systems, though not to the same extent on all systems. Essentially, every State weighs each year, but not every State has stations on every system. Weighing is done in two general ways. Permanently installed full-size weighing equipment constructed on turnouts from the main roadway are often used on main highways. These installations have scales that will weigh one axle at a time or weigh the full vehicle with all wheels on the scale platform. In addition to the permanent weighing stations and scales, the States use portable scales.* These scales are used to weigh one wheel at a time. By using two scales simultaneously, both wheels (ends) of an axle can be weighed at the same time. When an axle carries dual tires at each end, both wheels on an end are weighed together as one wheel. With attention to the usual requirements of safety, access, and levelness, these portable scales may be used at most any location. In actual installations, they are set down into the wheel tracks so that the scale platform is level with the roadway surface, or ramps are used to elevate the wheels to the height of the scale platform.

The permanent scale-weighing installations are also used for weight-enforcement weighing at times not used for the planning-survey weighing. During the planning survey weighings the legal limits are not enforced in most States, because of the objectives of getting representative weights of the full traffic stream under normal flow. Enforcement weighing is seldom performed at a station on a 24-hour basis because, when continued more than 2 to 3 hours at a station, the trucks exceeding legal limits tend to reroute to avoid being weighed.

---

* The name LOADOMETER is often used to refer to portable scales for use on wayside weighings of vehicles, but such name is a trade name, not a common name.

A third scheme for weighing motor vehicles on the roadway is "weighing in motion." This scheme uses electronic devices and special weight detecting instruments that weigh the truck axles as they pass over the detector. Weighing vehicles in motion (29, 30) has many advantages over stopping the vehicles for weighing, but the desired level of accuracy has not been fully reached. However, the process is still in the testing and development stage. The equipment can be installed in the pavement surface on any highway in the normal traffic lanes, and for short time periods a surface detector may be used. Obviously, weighing in motion does not give opportunity to collect dimension, origin, destination, type of cargo, and so forth.

The distribution and average weight of vehicles and axles in the Appendix tables and as discussed in this report on truck weights are based upon the number of vehicles weighed, regardless of the number of hours or days that the weighing took place. Further, some weighings may include only part of the number of vehicles passing the weighing station in a given hour for reason that there were so many vehicles in the traffic that 100 percent weighing was not practical. The number of vehicles weighed by type and by hour varies from a low percentage to 100 percent of the total. But because the visual counting and classification of the whole traffic stream is conducted on an hourly basis for a 24-hour day, the number of vehicles weighed and their weights can be expanded to a full day. The actual number of vehicles counted and classified are illustrated in the Appendix tables for different classes of vehicles and highway systems.

Throughout this report, and in other publications of the truck weight data, standard notation schemes are used. Of particular application in this report is the use of names to refer to specific highway systems and vehicle code numbers to refer to types of vehicles. The listing and description of the highway system as taken from the Manual (59) follow:

Code No.	System Name
01	Interstate, rural, final location
02	Interstate, urban final location
03	Other FA primary, rural
04	Other FA primary, urban
05	FA secondary rural, State jurisdiction
06	FA secondary urban, State jurisdiction
07	FA secondary rural, local jurisdiction
08	FA secondary urban, local jurisdiction

Code No.	System Name
09	Other State highways, rural (Non-FA)
10	Other State highways, urban (Non-FA)
11	Local rural roads
12	Local city streets
21	Toll road on Interstate, rural
22	Toll road on Interstate, urban
29	Other State highways, rural, toll (Non-FA)
31	Interstate, rural, present location
32	Interstate, urban, present location
41	Interstate, rural, former traveled-way
42	Interstate, urban, former traveled-way
69	State highways, rural (Non-FA), parkway prohibiting trucks
70	State highways, urban (Non-FA), parkway prohibiting trucks

With the expection of people-carrying vehicles designated as passenger cars and buses, the goods-carrying vehicles are designated in accordance with their axle configuration and number of vehicle units making up a combination vehicle. These designations are listed in Table 1 and explained in Tables 2 and 3. The codes for States and census divisions are given in Table 4.

Table 1: Code numbers and identification of vehicles weighed in 1971

Code No.	Symbol	Number of Axles and Vehicle Units
061000		Small automobiles, in-State
062000		Small automobiles, out-of-State
071000		Standard and compact automobiles, in-State
072000		Standard and compact automobiles, out-of-State
030000	--	Motorcycles and motorscooters
150000	--	Commercial buses
180000	--	Non-revenue buses
200000	2P	Two-axle, four-tire, panel and pickup trucks
210000	2S	Other two-axle, four-tire trucks
220000	2D	Two-axle, six-tire truck
230000	3A	Three-axle truck (usually 10-tire)
240000	4A	Four-axle truck
250000	5A	Five-axle truck
320000	2S0	Two-axle tractor, no trailer
321000	2S1	Two-axle tractor, one-axle semitrailer
322000	2S2	Two-axle tractor, two-axle semitrailer
323000	2S3	Two-axle tractor, three-axle semitrailer
324000	2S4	Two-axle tractor, four-axle semitrailer
327000	2S2(S)	Two-axle tractor, two-axle semitrailer with one spread tandem
328000	2S3(S)	Two-axle tractor, three-axle semitrailer with one spread tandem
330000	3S0	Three-axle tractor, no trailer
331000	3S1	Three-axle tractor, one-axle semitrailer
332000	3S2	Three-axle tractor, two-axle semitrailer
333000	3S3	Three-axle tractor, three-axle semitrailer
334000	3S4	Three-axle tractor, four-axle semitrailer
335000	3S5	Three-axle tractor, five-axle semitrailer
336000	3S6	Three-axle tractor, six-axle semitrailer
337000	3S2(S)	Three-axle tractor, two-axle semitrailer with one spread tandem
338000	3S3(S)	Three-axle tractor, three-axle semitrailer with one spread tandem
339000	3S4(S)	Three-axle tractor, four-axle semitrailer with one spread tandem
342000	4S2	Four-axle tractor, two-axle semitrailer

Table 1: Code numbers and identification of vehicles weighed in 1971 (continued)

Code No.	Symbol	Number of Axles and Vehicle Units
343000	4S3	Four-axle tractor, three-axle semitrailer
344000	4S4	Four-axle tractor, four-axle semitrailer
353000	5S3	Five-axle tractor, three-axle semitrailer
354000	5S4	Five-axle tractor, four-axle semitrailer
421000	2-1	Two-axle truck, one-axle trailer
422000	2-2	Two-axle truck, two-axle trailer
423000	2-3	Two-axle truck, three-axle trailer
424000	2-4	Two-axle truck, four-axle trailer
427000	2-2(S)	Two-axle truck, two-axle trailer with one spread tandem
431000	3-1	Three-axle truck, one-axle trailer
432000	3-2	Three-axle truck, two-axle trailer
433000	3-3	Three-axle truck, three-axle trailer
434000	3-4	Three-axle truck, four-axle trailer
437000	3-2(S)	Three-axle truck, two-axle trailer with one spread tandem
442000	4-2	Four-axle truck, two-axle trailer
443000	4-3	Four-axle truck, three-axle trailer
444000	4-4	Four-axle truck, four-axle trailer
445000	4-5	Four-axle truck, five-axle trailer
447000	4-2(S)	Four-axle truck, two-axle trailer with one spread tandem
452000	5-2	Five-axle truck, two-axle trailer
521100	2S1-1	Two-axle tractor, one-axle semitrailer, one-axle trailer
521200	2S1-2	Two-axle tractor, one-axle semitrailer, two-axle trailer
521300	2S1-3	Two-axle tractor, one-axle semitrailer, three-axle trailer
522100	2S2-1	Two-axle tractor, two-axle semitrailer, one-axle trailer
522200	2S2-2	Two-axle tractor, two-axle semitrailer, two-axle trailer
522300	2S2-3	Two-axle tractor, two-axle semitrailer, three-axle trailer
522400	2S2-4	Two-axle tractor, two-axle semitrailer, four-axle trailer
523200	2S3-2	Two-axle tractor, three-axle semitrailer, two-axle trailer

Table 1: Code numbers and identification of vehicles weighed in 1971 (continued)

Code No.	Symbol	Number of Axles and Vehicle Units
523400	2S3-4	Two-axle tractor, three-axle semitrailer, four-axle trailer
531100	3S1-1	Three-axle tractor, one-axle semitrailer, one-axle trailer
531200	3S1-2	Three-axle tractor, one-axle semitrailer, two-axle trailer
532100	3S2-1	Three-axle tractor, two-axle semitrailer, one-axle trailer
532200	3S2-2	Three-axle tractor, two-axle semitrailer, two-axle trailer
532300	3S2-3	Three-axle tractor, two-axle semitrailer, three-axle trailer
532400	3S2-4	Three-axle tractor, two-axle semitrailer, four-axle trailer
532800	3S2-3(S)	Three-axle tractor, two-axle semitrailer, three-axle trailer with one spread tandem
533200	3S3-2	Three-axle tractor, three-axle semitrailer, two-axle trailer
533300	3S3-3	Three-axle tractor, three-axle semitrailer, three-axle trailer
533400	3S3-4	Three-axle tractor, three-axle semitrailer, four-axle trailer
533500	3S3-5	Three-axle tractor, three-axle semitrailer, five-axle trailer
534200	3S4-2	Three-axle tractor, four-axle semitrailer, two-axle trailer
534300	3S4-3	Three-axle tractor, four-axle semitrailer, three-axle trailer
534400	3S4-4	Three-axle tractor, four-axle semitrailer, four-axle trailer
622200	2-2-2	Two-axle truck, two-axle trailer, two-axle trailer
622300	2-2-3	Two-axle truck, two-axle trailer, three-axle trailer
631200	3-1-2	Three-axle truck, one-axle trailer, two-axle trailer

Table 1: Code numbers and identification of vehicles weighed in 1971 (continued)

Code No.	Symbol	Number of Axles and Vehicle Units
632200	3-2-2	Three-axle truck, two-axle trailer, two-axle trailer
721220	2S1-2-2	Two-axle tractor, one-axle semitrailer, two-axle trailer, two-axle trailer
731220	3S1-2-2	Three-axle tractor, one-axle semitrailer, two-axle trailer, two-axle trailer
831110	3-1-1-1	Three-axle truck, one-axle trailer, one-axle trailer, one-axle trailer

Table 2: Vehicle type coding chart

Vehicle Class or Type	1st Character	2nd Character	3rd Character	4th Character	5th Character	6th Character
Passenger vehicles	basic vehicle type = 0	(C) vehicle type	(A) registration modifier	(B) light trailer modifier	State of registration	
Buses	basic vehicle type = 1	(D) vehicle type	(A) registration modifier	(E) axle & tire modifier	State of registration	
Single-unit trucks	basic vehicle type = 2	(F) vehicle type	(A) registration modifier	(B) light trailer modifier	State of registration	
Tractor + semitrailer	basic vehicle type = 3	total axles on power unit	(G) total axles on first trailer	code = 0	code = 0	(H) special modifier
Truck + full trailer	basic vehicle type = 4	total axles on power unit	(G) total axles on first trailer	code = 0	code = 0	(H) special modifier
Tractor + semitrailer + full trailer	basic vehicle type = 5	total axles on power unit	(G) total axles on first trailer	(G) total axles on second trailer	code = 0	(H) special modifier
Truck + full trailer + full trailer	basic vehicle type = 6	total axles on power unit	(G) total axles on first trailer	(G) total axles on second trailer	code = 0	(H) special modifier
Tractor - semitrailer + 2 full trailers	basic vehicle type = 7	total axles on power unit	(G) total axles on first trailer	(G) total axles on second trailer	(G) total axles on third trailer	(H) special modifier
Truck + 3 full trailers	basic vehicle type = 8	total axles on power unit	(G) total axles on first trailer	(G) total axles on second trailer	(G) total axles on third trailer	(H) special modifier

Source: FHWA Manual, Page 39-C, Reference 59.

Note: Letter in block refers to Table 3 on the following page.

Table 3: Subcodes to table 2

Table A
0 State registration not recorded
1 In-State, all
2 Out-of-State, all
3 In-State, nongovernment owned
4 In-State, government owned
5 Out-of-State, nongovernment owned
6 Out-of-State, government owned
7 Federal government owned

Table B
0 No trailer
1 Camp trailer
2 Mobile home
3 Cargo trailer
4 Boat trailer
5 Towed equipment
6 Towed auto
7 Towed truck
8 "Slantback"
9 Any or all types trailed vehicles

Table C
1 Motorcycle
2 Motorscooter
3 Motorcycle or motorscooter
4 Standard auto
5 Compact auto
6 Small auto
7 Standard and compact auto
8 Compact and small auto

Table D
1 Bus, intercity, commercial
2 Bus, transit, commercial
3 Bus, sightseeing, commercial
4 Bus, commercial, other
5 Bus, commercial, any type
6 Bus, school and nonrevenue
7 Bus, camper
8 Bus, all nonrevenue types

Table E
0 Axle arrangement not recorded
1 Two-axle, four-tire
2 Two-axle, six-tire
3 Three-axle
4 Four-axles or more

Table F
0 Panel and pickup
1 Heavy two-axle, four-tire
2 Two-axle, six-tire
3 Three-axle
4 Four-axle
5 Five-axle
6 Six-axle
7 Seven-axle
8 Eight-axles or more

Table G
1 Single-axle trailer
2 Two-axle trailer
3 Three-axle trailer
4 Four-axle trailer
5 Five-axle trailer
6 Six-axle trailer
7 Two-axle trailer with one spread tandem
8 Three-axle trailer with one spread tandem
9 Four-axle trailer with one spread tandem

Table H
0 No special modification
1 One spread tandem on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
2 Two spread tandems on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
3 Three spread tandems on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
4 One trailer piggyback and no spread tandems except those indicated by 7, 8, 9 in C3, C4, C5.
5 One trailer piggyback and one spread tandem on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
6 One trailer piggyback and two sets of spread tandems on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
7 Two trailers piggyback and no spread tandems except those indicated by 7, 8, 9 in C3, C4, C5.
8 Two trailers piggyback and one spread tandem on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.
9 Two trailers piggyback and two sets of spread tandems on pavement in addition to any indicated by 7, 8, 9 in C3, C4, C5.

Table 4: Codes for census divisions and States

Code	New England (01)
01	Connecticut
02	Maine
03	Massachusetts
04	New Hampshire
05	Rhode Island
06	Vermont
	Middle Atlantic (02)
07	New Jersey
08	New York
09	Pennsylvania
	South Atlantic (North) (03)
11	Delaware
12	District of Columbia
13	Maryland
14	Virginia
15	West Virginia
	South Atlantic (South) (04)
16	Florida
17	Georgia
18	North Carolina
19	South Carolina
	East North Central (05)
21	Illinois
22	Indiana
23	Michigan
24	Ohio
25	Wisconsin
	East South Central (06) (East of Mississippi River)
26	Alabama
27	Kentucky
28	Mississippi
29	Tennessee

Code	West North Central (07) (West of Mississippi River)
31	Iowa
32	Kansas
33	Minnesota
34	Missouri
35	Nebraska
36	North Dakota
37	South Dakota
	West South Central (08)
41	Arkansas
42	Louisiana
43	Oklahoma
44	Texas
	Mountain (09)
51	Arizona
52	Colorado
53	Idaho
54	Montana
55	Nevada
56	New Mexico
57	Utah
58	Wyoming
	Pacific (10)
61	California
62	Oregon
63	Washington
	(11)
64	Alaska
65	Hawaii
66	Puerto Rico

STATE LEGAL LIMITS OF VEHICLE WEIGHT

Each of the 50 States through legislation and regulation controls the maximum weights, dimensions, and combinations of vehicles that may be legally used on its public highways. Perhaps no two State have identical laws and regulations. Differences between States in the axle and gross weights as found in the annual truck-weighing operation may result from the basic differences in legal maximum weight limits. But often, because of differences in sample quality, it is difficult to identify whether the weight differences as found in the truck-weighing operations result from different legal limits or differences in trucking practices, State to State.

Table 5 sets forth the basic axle legal maximum weights, and the basic gross weight legal maximum. A study of this table discloses the variations in legal limits State to State. As indicated in the headnote to the table, there are many other differences too detailed to include herein. Attention is directed to the fact that some of the legal maximums in Table 5 are not legal on the Interstate system. For instance, in Nebraska the limit of 20,000-pound single axle and the limit of 34,000-pound tandem axle are not applicable to the Interstate system.

In any comparison State to State or on highway systems of the axle and gross weights found in the truck weight studies as given in this report, such comparison should be referenced to the applicable limits. For this purpose, the original tabulation by the American Association of State Highway Officials should be used, rather than this abbreviated Table 5.

THE TOTAL PROCESS OF COUNTING AND WEIGHING TRAFFIC VEHICLES

The annual truck weighings conducted by the States may be viewed as a field operation. But, first, the overall operation and guidelines are prepared by the Federal Highway Administration in Washington, D.C. The resulting manual (59) represents many years of experience and many suggestions from the States.

For the field operations in each State, the roadside locations for the traffic counting and weighing of vehicles must be selected. Normally, however, the roadside stations remain the same year to year, with such changes as are desirable because of improvements in the highway systems and their character of traffic.

At each roadside station the traffic is counted for full 24-hour days, and, at the same time, the vehicles are manually identified by classes and types, including automobiles, motorcycles, buses and trucks.

Table 5. Maximum legal limits of vehicle length, axle weight, and gross weight of States grouped by census division—limits as of December 31, 1972

Note: These limits are from the detailed table prepared by the American Association of State Highway Officials, "State Legal Maximum Dimensions and Weights of Motor Vehicles Compared with AASHO Standards." The AASHO prepared a similar table as of December 31, 1970, which was printed in the journal "Public Roads," Vol. 36, No. 8, June 1971.

The reader is warned that this table gives only the general, or basic, limit. See the original source for the many limitations, special provisions, and exceptions: For instance, some of the limits apply only to "designated highways" while others may not apply to the interstate system.

Census Division	State	Maximum length, feet	Permits two cargo units	Axle Weight, Pounds				Gross Weight Limit, Pounds	
				Single Axle		Tandem Axle			
				Statutory limit	With enforcement tolerance	Statutory limit	With enforcement tolerance	Code 332, 5-axle, tractor semi-trailer	Other combinations
New England	Connecticut	55	No	22,400	22,848	36,000	36,720	73,000	NP
	Maine	56-1/2	No	22,000	—	36,000	—	73,280	73,280
	Massachusetts	55	No	22,400	—	36,000	—	73,000	NP
	New Hampshire	55	No	22,400	—	36,000	—	73,280	73,280
	Rhode Island	55	No	22,400	—	none	—	73,280	88,000
	Vermont	55	No	22,400	23,520	36,000	—	73,280	73,280
Middle Atlantic	New Jersey	55	No	22,400	23,520	32,000	33,600	Axle-tire	Axle-tire
	New York	55	No	22,400	—	36,000	—	71,000	71,000
	Pennsylvania	55	No	22,400	23,072	36,000	37,080	73,280	73,280

Table 5. Maximum legal limits of vehicle length, axle weight, and gross weight of States grouped by census division—limits as of December 31, 1972 (continued)

Census Division	State	Maximum length, feet	Permits two cargo units	Axle Weight, Pounds				Gross Weight Limit, Pounds	
				Single Axle		Tandem Axle			
				Statutory limit	With enforcement tolerance	Statutory limit	With enforcement tolerance	Code 332, 5-axle, tractor semi-trailer	Other combinations
South Atlantic North	Delaware	65	Yes	20,000	—	36,000	—	73,280	73,280
	D.C.	50	No	22,000	—	38,000	—	70,000	70,000
	Maryland	65	Yes	22,400	—	40,000	—	73,280	73,280
	Virginia	55	No	18,000	—	32,000	—	70,000	70,000
	West Virginia	55	No	18,000	18,900	32,000	33,600	70,000	70,000
South Atlantic South	Florida	55	No	20,000	22,000	40,000	44,000	Table	Table
	Georgia	55	Yes	18,000	20,340	36,000	40,680	73,280	73,280
	North Carolina	55	No	18,000	19,000	36,000	38,000	73,280	73,280
	South Carolina	55	No	20,000	—	36,000	—	73,280	73,280
East North Central	Illinois	60	Yes	18,000	—	32,000	—	73,280	73,280
	Indiana	65	Yes	18,000	19,000	32,000	33,000		73,280
	Michigan	65	Yes	18,000	—	32,000	—	73,280	Axle-tire
	Ohio	65	Yes	19,000	19,570	32,000	32,960	Formula	Formula
	Wisconsin	55	No	18,000	19,500	30,400	32,000	Table	Table
West North Central	Iowa	60	Yes	18,000	18,540	32,000	32,960		Table
	Kansas	65	Yes	18,000	—	32,000	—	73,280	73,280
	Minnesota	55	No	18,000	—	32,000	—	73,280	73,280
	Missouri	65	Yes	18,000	—	32,000	—	Table	Table
	Nebraska	65	Yes	20,000	—	34,000	—	85,500	95,000
	North Dakota	65	Yes	18,000	—	32,000	—		Formula-tire
	South Dakota	65	Yes	18,000	—	32,000	—		Table
East South Central	Alabama	55	No	18,000	19,800	36,000	—	73,280	Table
	Kentucky	65	Yes	18,000	18,900	32,000	33,600	73,280	73,280
	Mississippi	55	No	18,000	—	28,650	32,000		Table-tire
	Tennessee	55	No	18,000	—	32,000	—	73,280	Special limit

Table 5. Maximum legal limits of vehicle length, axle weight, and gross weight of States grouped by census division—limits as of December 31, 1972 (continued)

Census Division	State	Maximum length, feet	Permits two cargo units	Axle Weight, Pounds				Gross Weight Limit, Pounds	
				Single Axle		Tandem Axle			
				Statutory limit	With enforcement tolerance	Statutory limit	With enforcement tolerance	Code 332, 5-axle, tractor semi-trailer	Other combinations
West South Central	Arkansas	65	Yes	18,000	—	32,000	—	73,280	73,280
	Louisiana	65	Yes	18,000	—	32,000	—	73,280	Axle-tire
	Oklahoma	65	Yes	20,000	—	34,000	—	85,500	90,000
	Texas	65	Yes	18,000	—	32,000	—		Table
Mountain	Arizona	65	Yes	18,000	—	32,000	—	73,280	73,280
	Colorado	65	Yes	18,000	—	36,000	—		Formula
	Idaho	65	Yes	20,000	—	34,000	—		Table-Formula
	Montana	60	Yes	18,000	—	32,000	—	85,500	105,000
	Nevada	70	Yes	18,000	18,900	32,000	33,600		Table
	New Mexico	65	Yes	21,600	—	34,320	—		Table
	Utah	60	Yes	18,000	—	33,000	—	79,900	79,900
	Wyoming	65	Yes	20,000	—	36,000	—		73,450
Pacific	California	75	Yes	18,000	—	32,000	—		Table
	Oregon	75	Yes	20,000	—	34,000	—	76,000	76,000
	Washington	65	Yes	18,000	—	32,000	—	68,000	72,000
	Alaska	70	Yes	20,000	—	34,000	—	88,000	NS
	Hawaii	65	Yes	24,000	—	32,000	—		Formula

Notes: NP—Not Permitted; NS—Not Specified; Axle-tire—gross limit based on axle limits and tire capacity; Table—gross limit set forth in table of specific limits; Formula—gross limit based on formula involving vehicle length and axle spacing; Special limit—limit as specified for the vehicle.

The field operations are scheduled by the States as to months, days, and hours. The quality of final data is dependent upon the number of and location of the roadside stations utilized, the extent of the counting and classifying of the traffic, and the size and quality of the weighing sample, all as affected by the station location, the days of operation, and the hours of the day of weighing.

GEOGRAPHICAL LOCATIONS OF WEIGHING STATIONS

Because of the work time and total cost of weighing trucks at the roadside by the highway department and the cost to the trucking industry in stopping vehicles to be weighed, it is desirable to hold the number of weighings to the minimum that will give an acceptable sample. The work "sample" can be interpreted in several ways. What is wanted in the end is a sample of the traffic composition and vehicle weights (and other information that may be collected), considering the particular weighing station. But there is also the necessity of selecting a sufficient number of stations that will produce, when combined, an acceptable sample of the trucking characteristics on the whole of the system of highways under study, such as Interstate urban, Other FA primary rural, or FA secondary rural. Or perhaps the objective may be to get data on trucking on all highway systems within a given geographical area.

Consider first the selection of geographical locations for weighing stations (both temporary and permanent) on a given highway system. The criteria to consider include the following*:

1. Average daily traffic volume;
2. Percentage of trucks;
3. Percentage of trucks of each type (by axle and wheel arrangement);
4. Variations in the percentage of trucks carrying different types of commodities;

---

*For requirements of a station as related to the weighing operations see: U.S. Department of Transportation, Federal Highway Administration "Guide for Truck Weight Studies." Highway Planning Program Manual, Transmittal 107, Appendix 51, April 1971. Page 6 of reference 59.

5. Whether there is a seasonable variation in the number of trucks in the ADT and whether within the season there is a variation in the type of commodities carried;

6. Relative amount of interstate trips and intrastate trips;

7. Lane use characteristics, adjacent to the station site and at origin and destination of the truck traffic;

8. Ease-difficulty of trucks bypassing the station to avoid being weighed; and

9. Nearby alternative routes, including toll facilities.

In selecting roadside stations, their location and number should be related to their accessibility from headquarters and from each other and by the budget. But consideration must be weighted heavily on getting acceptable samples. Inadequate samples resulting from inadequate financial support of the operation is not good economy. The Manual (59, page 3) reads:

> "The success and value of all uses of the truck weight data depend on the reliability and accuracy of the data collected in the field. The field procedures must be directed toward reliability of data, while at the same time giving full consideration to efficiency of operation and the safety of the traveling public and the field staff. There must be a continuing effort to develop citizen understanding and appreciation for the State and Federal governments' efforts to provide more efficient and convenient transportation. Each of these considerations must be weighed in selecting each station location, scheduling the work and assigning personnel to each task, sampling from the traffic stream, interviewing, and obtaining weights and dimensions."

The following nine paragraphs present some of the considerations associated with the prior listed nine items affecting choice of location of weighing stations:

1. The total traffic volume at a weighing station is important because, in addition to weighing trucks, the total traffic is counted and classified by vehicle type. It is important that the stations on each given highway system when combined give an acceptable average of the traffic counts on the system as a whole for total vehicles and each type of truck, as well as for truck weights and dimensions. Low ADT and high ADT stations can be selected, however, as long as the total data are representative of the highway system for all stations. See page 8 of the Manual (59) for suggestions on the number of weighing stations to operate.

2. It is presumed that traffic counts and vehicle-type classifications are made on each of the highway systems at times and places other than for the truck weight operation. Such data furnish guides as to the range of the percentage of traffic that is trucks, useful in selecting locations for roadside weighing of trucks.

3. The percentage of trucks that falls into each truck type is a factor that is to be observed in selecting locations for weighing vehicles. Highway routes carrying long-haul truck traffic are apt to have different distributions by truck types as compared to routes carrying mostly local traffic, or short-haul trips. The weights and the percentage of empty trucks may also vary with truck percentage.

4. The types of commodities carried by trucks are a function of the local land use, the land use at cities that may be the origin and destination of the trucks to be weighed, and the land use between the weighing station and the origins and destinations of the trucks. These factors are most likely to affect the type of truck and type of body, and, therefore, vehicle weight on the road.

5. Truck traffic, as well as passenger vehicle traffic, is often affected by the four seasons to the extent that the number of trucks will vary, the type of trucks will vary, and the weights of the trucks will vary with the season. Much of the argricultural produce, generally seasonal commodities, is hauled by truck. Also, construction and manufacturing plant operations are often seasonal in character.

6. Interstate trips as compared to intrastate trips by trucks in many localities can vary greatly in traffic volume, type of vehicle, and commodity. A weighing station on the Other FA primary rural highway in Iowa near the Illinois border could carry trucking differing widely from trucks on the Other FA primary rural highway attracting traffic that is mostly intrastate within Iowa.

7. A weighing station on a highway near a textile manufacturing plant probably will have truck traffic of a different character than will a similar weighing station near a television and radio cabinet manufacturing plant. Further, looking all four directions from a weighing station at likely origins and destinations of the traffic may indicate features that are special to that location and not typical of other parts of the highway system.

8. Truck drivers prefer to avoid weighing stations regardless of whether they are being operated for enforcement or for research only. Should an acceptable alternative route be available, drivers are likely to divert away from the weighing station soon after word of its operation is passed along. Preferred locations for weighing are those that cannot easily be bypassed by using other nearby routes.

9. A weighing station should be selected only after determining that nearby highway routes will not be attracting the greater share of the truck traffic. This caution is in addition to the one above on deliberate bypassing and pertains to the preferred choice of route by the trucking industry. Generally, an Interstate route will be chosen in preference to a nonaccess-controlled route, even at some extra distance of travel. Toll highways may be chosen, also, in spite of the cost if they offer an advantage in time and convenience.

The importance of selecting locations on a highway route or highway system is illustrated by the fact that it is a rare instance when truck weight data will be applied by management or by the engineering staff to the highway at the exact place of the weighing station. All weighing stations should be chosen for the purpose of collecting data such that in their whole they reflect the highway system universe from which they were taken.

There should be interdependence in selecting roadside stations for the weighing of trucks and the schedule of weighing and number of vehicles weighed. At a given station, the weighing operation could produce a wholly acceptable set of data for that station, but the station could be so special that its results could unwantingly distort the total data for the highway system when all stations are combined. The final test of the acceptability of the total counting and weighing on a given highway system is the grand total set of data, rather than station by station factors.

The above discussion is not intended to be all inclusive of the factors to consider in locating truck weighing stations on a given highway system, but is sufficient to support the later discussion about truck weight data and why the data collected needs to be examined for its representativeness.

TRAFFIC VOLUME AND CLASSIFICATION COUNT

In order that the sample of the trucks weighed at the several roadside stations can be expanded to a full day, week, or year, and, in order that the sample of individual classes of trucks can be

expanded to full hours (for those instances when the hourly flow was too heavy to count 100 percent of the vehicles) at all weighing stations, 24-hour traffic volume and vehicle classification counts are taken. These manual counts (59, pages 10,14-15) are taken for the full 24-hour day, and include the hours that the weighing operation is conducted, whether for 4-hours, 8-hours or the full 24-hours. Additional counts may be taken on other days.

Expansion of the weights of the vehicles weighed during periods less than a day is directly based upon the total 24-hour count and classification on the assumption that the weight distribution, including the empty/loaded ratio, is the same for the hours weighed as it is for the hours not weighed. On an overall wide range of application, this assumption may introduce no significant errors, but in many specific applications the error may be significant. To test the validity of the assumption, 24-hour weighing operations are made and compared to the results from weighings for less than a 24-hour day. No general conclusion can be drawn without extensive field data. Whether 24-hour weight distributions will differ from the weight distributions for less than a 24-hour period depends solely upon the characteristics of the traffic. As seen from the previous discussion and the factors that cause traffic classifications to differ location to location, and the factors that cause weights to differ day to day and hour to hour, it must be concluded that for every specific counting and weighing operation the results may vary from the result for a full day or full week by a considerable percentage.

SELECTION OF THE HOURS PER DAY FOR WEIGHING

Selection of locations of weighing stations is for the purpose of getting data representative of each highway system, but of equal importance is the selection of the days of the week and hours of the day during which weighing is to be done. A further important factor is the sampling of the traffic stream during the hours of weighing. Sampling the traffic flow is necessitated by reason that when flow is heavy, not all trucks can be weighed, so the excess is passed through without weighing. But since all types of trucks do not flow in the traffic stream at equal percentages, or equal numbers, the general practice is to pass through without weighing part of those types that flow in high numbers, and weigh all or at least a higher percentage of the types that flow in the lower volumes. This sampling technique applies to all days and all hours of weighing, and is supported by taking a full classification count of the entire traffic by vehicle type for full 24-hour periods as discussed.

It has long been known that the flow of vehicular traffic is a variable hour to hour, day to day, and season to season. But acceptable estimates of total volume can be obtained for planning, design,

and administrative uses, by controlled sampling of hours of the day, days of the week, and seasons of the year. The best controls for design of the traffic counting schedule are obtained from permanent recorder stations that record the traffic for each hour of the year, supplemented by visual classifications by vehicle type.

For truck counting, weighing, and classification, however, additional variables are introduced--different types of trucks and their weight vary with volume of traffic over the hours, days, and seasons.

The Manual (59, page 10) says but little about selecting the hours of weighing and days of weighing. The complete statement is:

> "...minimum needs require that weight stations be operated one 8-hour weekday period each year, between late spring and early fall. Where this minimum coverage is used, the 8-hour period selected should include the morning peak at some stations and the afternoon peak at others. Hours of operation (but not necessarily days of the week) should correspond with the hours of operation for the same station on previous surveys to the extent feasible. When a new station is to replace an existing station, it is desirable to operate both the new and old station during the year of transition to maintain continuity of the trend."

The emphasis here is on the continuity of the time trend rather than on getting a good count for the system as a whole. Considering the variability of the truck classification counts, number of classes of vehicles and their weights, it is doubtful that any time trend could be reliably indicated with such few and short time weighings. Some stations, however, are operated for longer than the 8-hour minimum.

The factors of truck traffic that are important in setting the weighing schedule include the following:

1. Traffic volume;
2. Daily and hourly variations in volume flow;
3. Daily and hourly variation in flow of each type of vehicle;
4. Land use at the origins and destinations of the truck traffic, considering both local anf faraway areas;
5. Hours of the day that business and industry operate with respect to those that are served by trucks passing the weighing stations;

6. Seasonal effects on trucking--type of vehicle, types of commodities, and loading practices; and

7. Ratio of empty vehicles to loaded vehicles.

The truck volume is an important factor in selecting the weighing schedule by days and hours of the day. With heavy truck flow per hour, not all trucks can be weighed, but with light hours of flow, perhaps all trucks can be weighed. The heavier volumes of trucks as a whole will carry greater numbers of the local vehicles, particularly of the light commercial delivery trucks of two axles. These classes of vehicles are also largely controlled by the business hours of local retail, wholesale, and service companies. On the other hand, the tractor semitrailer combination vehicles may flow at about the same number per hour for the full 24-hour day. Many full 24-hour classification counts disclose this pattern. The construction trucks, those hauling construction materials and earth excavations, will normally operate only during the construction day. In large urban areas, however, the hauling to the construction site may take place at night to avoid the daytime heavy traffic.

A characteristic of intercity line-haul operations is that loaded vehicles may move out from the industrial areas in the evening to reach destinations before business hours the next morning. They may return during the day, but empty of load. Truck weight data are often weak on the number of empty vehicles and their weight, because empty trucks can be determined to be empty only when they are stopped. Traffic volume counts can determine the number of vehicles of each class and type that flow each hour, but cannot determine the number of empty and loaded trucks. Therefore, unless the hours of weighing cover proportionally equal use of empty and loaded vehicles, the data will be incorrect in this respect. At many weighing stations the ratio of empty trucks to trucks with loads varies hour to hour, even for the same type of vehicle, so that the selection of the hour periods of operation of the weighing station is important from this factor, as well as from others.

REPRESENTATIVENESS AND CRITERIA FOR STATISTICAL QUALITY

An examination of the overall plan of and the operation of the phases of the truck weighing process discloses that, statistically, the results are not a random sample from the universe. Therefore, the resulting traffic volume counts, number of empty and loaded vehicles, average axle and gross weights, and weight distributions do not fit nicely into statistical analyses procedures designed for random sampling and normal distributions. The next three sections discuss the overall truck weighing process from the viewpoint of the quality of results desired and as obtained.

CRITERIA FOR QUALITY OF FIELD-COLLECTED WEIGHT DATA

Even if there were adequate financing to support roadside weighing of motor vehicles on a year-round basis for every route section of a highway system, such operation should not be carried out, for the reason that it would be unreasonable and unnecessary interference with the traffic. Acceptable results can be obtained by applying statistical science to sampling. It is appropriate then to list some of the criteria that could be used in setting scope and quality limits to the truck-weighing studies.

The variability over time of the traffic volume flow, its mix of the several classes and types of vehicles including truck body types, the classes of commodity hauled and their amounts (cubic feet and weight) together with the uses to which the weight data will be put, all point to the fact that such data cannot be precise without totally unreasonable high expense in gathering the data. Even if preciseness were achieved, it would have to be for a specific place, a specific set of conditions, and for a specific time. These characteristics of the traffic, then, indicate that the roadside weighing results are acceptable if they meet that statistical quality wherein the mean gross vehicle weight and axle weight meet the standards of confidence levels and variance acceptable for the main use of the weight data.

The distribution of the gross vehicle weight and axle weights is also an important factor to control. For an analysis of the frequency percentages in 1,000-pound weight intervals the two ends of the frequency curves should be specifically located to within the acceptable range. These frequency curves are usually nonsymmetrical and gross weight curves of empty and loaded vehicles combined may be bimodal.

The truck weight data collected by each State should be of such quality that it could be used internally with the same confidence that might be attached to it on a regional or national basis when data were combined for many States. In other words, the uses of the truck weight data cover four geographical applications: (A) highway route within a State; (B) a highway system within a State; (C) a regional area such as a national census division; and (D) the nation as a whole.

For those vehicle types of low count in the traffic stream, a decision needs to be made in each case whether to prolong the operation of a weighing station in order to weigh a sufficient number to meet the quality standard. When the type of vehicle is well established in the industry (for instance, the 230), then an adequate number should be weighed. The unusual or infrequent types (two front axles or four close-coupled rear axles) should be weighed only as encounted in the

normal weighing schedule. But newer types that are growing in uses (double cargo units or triple cargo units) should be weighed sufficiently to meet the general standards for sample quality.

Because of the complex factors involved in planning and conducting a truck-weighing operation, perhaps there is not a wholly satisfactory process of getting the work accomplished with a high statistical quality. Compromise then is the rule. The following factors are the main ones that enter into the compromise:

1. Direct financial cost to the State highway department;

2. Delay, and resulting expense, to the trucking industry;

3. Organizing and training a field crew;

4. Traffic hazards and police supervision;

5. Quality of results--range of probable errors acceptable;

6. Unevenness of flow during the day of each type of vehicle;

7. Bypassing part of the flow of the vehicle types easily over-sampled in number and weighing longer hours to get an adequate sample of the vehicle types of low volume flow; and

8. Limitations on selecting a random or scientifically designed sample of the weighing stations and of the vehicle types at the station.

Considering each State as its own population universe, there are four factors that must be studied in the planning of a weighing operation designed to produce the minimum acceptable quality of results. These four factors are (A) selecting locations for weighing operations on each highway system, (B) selecting the hours of the day, days of the week, and months of the year for operations, (C) setting the schedule in number of times the weighing should take place at each station, and (D) selecting the minimum number of vehicles to be weighed of each type in the traffic.

Making the decisions indicated in the above listing requires attention to the following characteristics of truck traffic flow that affects the quality of the weight data by type of vehicle.

A. Variables in the highway system and its roadsides:

1. Mix of traffic between interstate, intrastate, and local trips;

2. Location of industrial and commercial plants that affect traffic at weighing stations;

3. Hours and days of operation affecting industrial and commercial plants;

4. Seasonal activities, and their types, that affect traffic at their roadsides;

Note: The industrial and seasonal factors in influence may not all be near to the station, on the same route, or on the same system; some effects can come from 300 miles away.

5. Local activity, such as construction and harvesting of crops;

6. The existing and relatively stable culture and its activities in the area of the weighing station; and

7. The degree that the results when merged with results from other weighing systems will produce overall results within the criteria adopted for control of quality.

B. Clock and day of week timing of the weighing:

1. Work shifts of industry and trucking policy--out fully loaded in the evening and back empty in the morning;

2. Local delivery hauling and service trips--out loaded in the morning and back late afternoon empty, or nearly so;

3. Pickup and delivery services;

4. Hauling of liquids, live stock, construction materials, agricultural products; and

5. Local and long-distance hauling.

The above two sets of itemizations disclose the probability that both the geographical location of the weighing stations on a given highway system and the days and hours that the weighing operation is conducted may affect the quality of the results. Unfortunately, not enough research and analysis of available data have been conducted to determine the specific variations in vehicle weights that could be expected with a variation in the factors listed. The ratio of empty vehicles to those with payload as a variable over the 24-hour day as well as the variation in the weights of the vehicles, both gross and axle, have not been sufficiently determined by actual roadside weighings.

When the results of weighings and payload determinations obtained from any 8-hours of weighings are expanded to the full traffic count for 24 hours, the errors introduced in the expansion remain unknown because of the lack of prior weighing over the full 24-hour day to use as a base for the expansion.

Another problem that arises in the operation of a given station is caused by wide range number of vehicles by type. For instance, for the five-axle tractor semitrailer (code 332), a total of 200 vehicles could be weighed, but for the three-axle single unit truck (code 230), only 15 could be weighed. Both vehicles were weighed 100 percent of their flow. The 332 combination could flow the whole 24-hours a day at about the same rate, but the 230 would most likely have no flow between 7 p.m. and 7 a.m. In this situation one vehicle could be over-sampled and the other under-sampled.

REPRESENTATIVENESS OF TRAFFIC VOLUME CLASSIFICATION AND OF VEHICLE WEIGHINGS

In order to achieve the objectives of the classification and weighing of trucks as stated in the introduction, the field work should be controlled by three factors. First, sufficient volume of data (vehicles counted and vehicles weighed) should be obtained in order that the results will have a level of statistical quality acceptable to their uses--the size of the sample must be adequate; second, the data for a highway system or for a specific code type of vehicle should be an acceptable representation of its own universe--the classification count and the weight data for a specific highway system should be representative of that system; and third, for comparisons of highway systems and for comparisons of States, the data being compared should be representative of the universes being compared--for instance, in comparing census divisions, all States in each division should be included in proportion to the actual flow of vehicles in each State. The following discussions relate to this overall objective of the classification and weighing processes with respect to getting data truly representative of the populations from which they were taken.

Two factors (other than safety, efficiency, and physical requirements) of prime importance in conducting a truck weighing operation at the roadside are representativeness of the (1) traffic volume and composition and (2) of the weight and other technical information recorded.

The objective is to gather traffic flow, vehicle weight, dimension, and other facts that are a good representation of the universe of which they are a part. Obviously, the ultimate would be to count and to weigh every vehicle passing hundreds of stations on the entire system mileage

and cover every minute of time for a year. But such extensive operations are not necessary because under well chosen and controlled counting and weighing of vehicles a representative sample set of data can be assembled. Representativeness applies to the highway system, a highway route, a route section, and a weighing station. Further, representativeness applies to the time identification such as a year, a season, a month, a week, a day, and an hour. Selecting weighing stations, therefore, is dependent upon determining what is wanted.

Counting of traffic and classifying by vehicle type, as well as the weighing of vehicles, is accomplished on a sampling basis. Sampling is applied to locations (stations) on highway systems and to time. Thus, on a State primary rural system of 8,000 miles, perhaps at only five to ten spot locations will traffic be counted and weighed. In a given hour of weighing not all of the 332 tractor semitrailers (and other high volume types) in the traffic stream may be weighed. And further, the hours of the day may have been sampled by weighing only four morning hours and four afternoon hours in a given day. Then, both counting and weighing may have been done on only Monday and Thursday of one week. Should the traffic be counted, classified, and weighed in total for a full 24-hour day, the results would be 100 percent accurate for that day. But such complete data for the day may not produce data that are representative for that station over a longer time period, and may not be representative for the entire route or total highway system on which the station is located.

Sampling is a useful device, but must be used with discretion and known statistical probabilities of its probable errors. Just visual observation of the recordings of counts of traffic and weights of vehicles at a few roadside stations will disclose that the samples may not be an acceptable representation of the traffic at stations or of the route.

A discussion of some of the factors to consider in selecting locations for weighing at the roadside and the sampling of hours and days will afford a foundation for understanding the variability of the data recorded.

ANALYSIS AND TESTING OF FIELD DATA FOR REPRESENTATIVENESS AND ACCEPTABILITY

From the 1971 weighings by State highway departments, a few selections of the data are analyzed to show the wide variation in number of vehicles counted and weighed and the comparative representativeness of these samples.

It is important to assemble adequate data on both counts and weights of vehicles. The end result of their application can be no better than the quality of the original field data.

An important factor to keep in mind, though often overlooked in practice, is that the distribution of the gross weight and of the axle weight is perhaps more important than the average of the weights. This is true because the equivalency factors (75, 76) for conversion of the axle weight data to equivalent 18-kip axle loadings on pavements are exponentials, and must be applied to the weight data by a series of weight intervals, say the axle weight distribution by 1-kip weight intervals. For instance, under certain conditions of design, the equivalence factors for a single axle are as follows: 18-kip axle, 1.00; 20-kip axle, 1.58; 22-kip axle, 2.40; and for a 24-kip axle, 3.51. Likewise, it is the heavy axle loadings that may produce overstress in bridges, so the axle weight distribution is highly important in both pavement and bridge structure design. The running cost for trucks also is an exponential to truck gross weight increase. For a tractor semitrailer the operating costs in cents per mile are about as follows in terms of gross weight: 40-kips, 56.11; 60-kips, 63.30; 80-kips, 71.20; and for 100-kips, 80.18.

Although a set of weighings may produce an acceptable average gross weight, or average axle weight, the distribution of the individual weights, by weight intervals, could be unacceptable.

Another important factor is the weight and ratio of empty vehicles (vehicles without any payload cargo*) to those vehicles with payload (fully or partially loaded). To determine the pounds of payload carried by a given class of vehicle, it is necessary to subtract the average empty gross weight of that vehicle type from the average gross weight of the vehicles with load. No way has yet been developed to weigh the empty weight of a loaded vehicle. Average payload per vehicle type is determined by weighing separately vehicles empty of load and vehicles with load and assuming that all vehicles with load will have the average weight empty equal to that of the weighed empty vehicles of their type. Then, in determining the total tons of payload transported, the average gross weight of the vehicles weighed empty is subtracted from the average gross weight of the vehicles weighed with load. Therefore, it is important to get both an accurate count of the number of empty and of loaded vehicles, as well as a reliable gross weight of both empty vehicles and vehicles with payload.

---

* Payload is defined as the removable content, goods, in the vehicle that is being hauled to a destination. Presumably someone is paying for its haulage. Payload does not include dunnage, packing, tools, or other material customarily carried in the truck.

But the number of vehicles empty (their count) is determined from all vehicles weighed, not the classification 24-hour counts. In the weighing operation, then, it is important to stop and weigh a sufficient number of every type of truck to reliably determine the percentage of total vehicles by type that are empty and their gross weight distribution.

Perhaps the most common deficiency in the vehicle weight data at a given station or for a given highway system is failure to weigh sufficient numbers of vehicles in each category (axle configuration, empty, and loaded). About one-third of combination vehicles on the highway are empty of payload. Therefore, the vehicles with load are two-thirds of total vehicles. Weighing a total of 300 tractor semitrailers, code 322, would produce weight data on 200 loaded vehicles, but only 100 empty vehicles, which could be too few to produce acceptable results. Many of the examples in the Appendix tables disclose this deficiency. And such conclusion was reached by Buffington, et al., as indicated by the following quotation (9, page 50):

> "The analysis of individual station's average vehicle and axle weights according to vehicle types, load characteristics and highway system indicated that such averages vary significantly between stations. Much of the station to station variation between these averages is due to the nonrepresentativeness of the data on an individual station basis.
>
> "There are other station to station differences not caused directly by the weighing schedule. For instance, there are those due to change, which becomes quite large in the area of very small samples. This is indicated by the fact that, in most cases, the number of vehicles (by type) weighed at different stations in 1967 is too small compared to the number of vehicles required by the station's own statistics in order to overcome chance sampling errors of a given magnitude and stated probability level."

The smallness of the sample can be overcome by combining the data for more than one station, or by combining two or three consecutive years of data. But such procedure may not overcome the lack of representativeness of the data at a given station or for the highway system. Statistically, it is one thing to design a total roadside weighing and counting effort for a given year on the basis that each station sample is to produce results that are representative for each station, and quite another operation to produce a highway system sample consolidated from several weighing station samples that is representative for the total highway system on which the individual stations are located.

In the editing of the data and in the analysis of the results, it is often difficult to determine whether departures from the expected values are the result of:

1. poor sampling at the roadside station;

2. arithemetical errors in processing the field data;

3. just an unusual behavior of trucking during the hour or day that the weighing was done; or

4. a real difference in the normal characteristics at that station or that highway system as related to other stations and systems.

For these reasons, variations from prior results obtained elsewhere and relationships between the classes of vehicles from year to year should be carefully investigated before assumed to be correct or incorrect. For instance, reported results of weighing the 230 truck which show that 72 percent of the trucks were empty should immediately sound a warning. This truck, used heavily in construction to haul bulk materials, concrete mix, and construction materials operates closely to 50 percent empty. Further, its use is more predominant in urban areas than on rural highways. It is not a line-haul vehicle.

There are differences in the trucking on highways with respect to relative numbers of the types of vehicles, weights of trucks with and without load, percentage empty, average weight empty, and average payload per vehicle. These differences arise from differences in legal limits of gross and axle weights, State to State, character of the activities within States or regions with respect to types of industry and manufacturer, and whether agricultural in character and whether industry is centralized or dispersed. It is such factors as these that result in specific differences in the characteristics of trucking as detected from analyses of the truck weight data and associated information. Unfortunately, so often the sampling of the truck weighing, the choice of location of weighing stations, and the number of trucks weighed does not produce a representative sample adequate in all respects to positively isolate the real differences in trucking practices and in traffic usage, highway system to highway system, State to State, and census division to census division.

Several States have special provisions for trucks hauling agricultural or manufactured products produced within the State that accords such trucks higher limits of weights or dimensions than is generally applicable. When it is considered that the single axle weight with enforcement tolerance varies State to State from 18,000 to 24,000 pounds, and that the tandem axle limits vary from 32,000 to 44,000 pounds, and that legal gross vehicle weights vary from 70,000 to 105,500 pounds, it is readily seen that State to State there will be differences in the results of truck weighings. Another significant

difference is that only about 30 States permit double cargo units--truck and full trailer, or tractor, semitrailer, and full trailer, as combination vehicles.

Plotting curves of the distribution of empty and loaded gross weights and axle weights is a good device to test the adequacy of a sample of roadside weighings. The usual statistical procedures and checks should also be applied to evaluating truck weights and other data for representativeness and acceptability. Once samples of large numbers known to be adequate in size have been thoroughly examined statistically, future samples could be compared statistically and graphically to the characteristics of these samples proven to be adequate in number and in distribution of weight by weight intervals.

COLLECTION OF INFORMATION OTHER THAN TRUCK WEIGHT, TRAFFIC VOLUME, AND VEHICLE CLASSIFICATION

From year to year the general provisions for conducting the annual truck weighing operations include provisions for collecting data on aspects of trucking and highway use, other than the vehicle and axle weights and traffic classification of vehicles. These provisions include certain specific information that is collected yearly and special operations that vary year to year, as noted in the following listing:

A. INFORMATION THAT IS COLLECTED YEARLY

1. Identification of automobiles as in-State or out-of-State registration;
2. Size of automobile--classified either as standard or small;
3. Enumeration of motorcycles and scooters (regular item since 1965);
4. Commodities carried as payload;
5. Maximum weight for which vehicle is licensed;
6. Cargo body type;
7. Class of operation: common carrier, contract carrier, agricultural exempt carrier, private carrier;
8. Distance between axles; and
9. Engine fuel type.

B. INFORMATION THAT IS COLLECTED ONLY IN YEARS SPECIFIED

1. Occupancy by number of persons in automobiles;

2. Whether front axle tires were recapped;

3. Horsepower of engine;

4. Distance of total trip;

5. Origin and destination of truck by State, county, and city;

6. Type of operation--terminal to terminal or pick-up and delivery;

7. Dimensions of vehicle, particularly width and length (see item A-8 for axle spacing);

8. Specific information on vehicles that exceed the State legal limits of axle and gross weight, such as axle spacing, vehicle width, type of body, commodity carried; and

9. Trip characteristics with reference to chain of production and distribution of commodities--raw materials going to plant, partially finished goods going for further processing, manufactured items going to factories and assemblies, manufacturer to warehouse or wholesaler, wholesaler to retailer, or retailer to consumer.

The field information on the above items is available in the several States and Federal Highway Administration. No analysis of these subjects is included in this report, however.

Anomg the subjects that could be considered for special studies in connection with the annual weighing of the vehicles are:

1. Horsepower of engine. For use in determining the weight/horsepower ratio used in calculating the performance of vehicles and other purposes.

2. Licensed gross weight in those States that license vehicles on the basis of the declared maximum load weight. Licensed gross weight can be compared with actual load gross weight and practical maximum gross weight.

3. Record at time of weighing whether any oversize or overweight vehicle is moving on a special permit.

4. Empty weight posted on vehicle; also, manufacturers' recommended gross weight if posted.

5. State or States in which vehicle is licensed.

6. Class of ownership of vehicle: driver, trucking company, manufacturer, distributor, small private business, farm operator.

7. City in which vehicle is based, or garaged.

8. Persons aboard not counting driver: extra driver, trucker or company employee, relative, friend, stranger.

ROADSIDE STATIONS AT WHICH TRAFFIC WAS CLASSIFIED IN 1971

The number of roadside stations at which the traffic was counted and classified and, with rare exception, weighed, offers some explanation of why State to State there are unexplained differences in the average weight, distribution of weight, and empty/loaded ratio. The characteristics of trucks and their use on the highway vary over a considerable range on any given highway system, depending upon just what location on the highway system (or route) the observations are made. In Table 6, the number of stations per State on the Interstate rural system varies from 0 to 9, and on the Other FA primary rural system the range is from 0 to 16, not counting the 52 in Minnesota. The zero on the Other FA primary rural system is for District of Columbia, which has no rural system.

The number of stations at which to classify and weigh trucks in order to get results that are representative of the traffic by vehicle type and representative of the average weights and their distribution can be determined only by more extensive studies than have been made. The information in Table 6 does suggest that the variations in highway system to highway system and State to State are the result of either one of two factors that cannot be identified separately. Because of the limited number of stations observed and inadequate sampling at some stations, the variances in systems and States cannot be attributed to actual differences in vehicles and trucking practices, as distinguished from sampling deficiencies.

An analysis of the number of roadside stations per 1,000 miles of highway would be worthwhile. Such an index might explain some of the large and small numbers in Table 6.

Table 6. Number of roadside stations at which traffic was classified in 1971

Census Division and State	Interstate Rural	Interstate Urban	Other FA Primary Rural	Other FA Primary Urban	FA Secondary Rural	FA Secondary Urban
New England	10	4	34	14	3	0
01 Connecticut	2	1	3	3	0	0
02 Maine	3	0	12	3	1	0
03 Massachusetts	2	1	6	4	1	0
04 New Hampshire	1	1	5	2	1	0
05 Rhode Island	0	1	1	2	0	0
06 Vermont	2	0	7	0	0	0
Middle Atlantic	10	4	32	12	1	1
07 New Jersey	3	2	6	7	1	1
08 New York	6	1	10	3	0	0
09 Pennsylvania	1	1	16	2	0	0
South Atlantic North	13	3	34	11	0	3
11 Delaware	0	0	4	4	0	0
12 District of Columbia	0	0	0	2	0	0
13 Maryland	3	0	5	2	0	2
14 Virginia	7	2	12	2	0	1
15 West Virginia	3	1	13	1	0	0
South Atlantic South	12	0	43	13	3	2
16 Florida	4	0	11	3	2	0
17 Georgia	1	0	11	4	1	0
18 North Carolina	5	0	16	1	0	2
19 South Carolina	2	0	5	5	0	0
East North Central	32	2	44	11	9	6
21 Illinois	6	0	10	3	0	1
22 Indiana	3	0	7	0	0	1
23 Michigan	6	1	4	2	2	0
24 Ohio	9	1	8	1	0	2
25 Wisconsin	8	0	15	5	7	2
East South Central	18	0	24	9	1	1
26 Alabama	0	0	11	2	1	0
27 Kentucky	6	0	3	1	0	1
28 Mississippi	6	0	5	4	0	0
29 Tennessee	6	0	5	2	0	0

Table 6. Number of roadside stations at which traffic was classified in 1971 (continued)

Census Division	Interstate Rural	Interstate Urban	Other FA Primary Rural	Other FA Primary Urban	FA Secondary Rural	FA Secondary Urban
West North Central	39	4	107	10	34	5
31 Iowa	6	0	7	1	0	0
32 Kansas	5	0	7	0	0	3
33 Minnesota	6	4	52	3	34	1
34 Missouri	8	0	10	2	0	0
35 Nebraska	2	0	14	2	0	0
36 North Dakota	4	0	7	0	0	1
37 South Dakota	8	0	10	2	0	0
West South Central	13	0	38	7	2	3
41 Arkansas	5	0	7	4	0	0
42 Louisiana	2	0	7	2	2	0
43 Oklahoma	2	0	10	1	0	1
44 Texas	4	0	14	0	0	2
Mountain	32	0	49	7	13	3
51 Arizona	6	0	6	1	3	0
52 Colorado	5	0	6	0	1	0
53 Idaho	2	0	10	2	0	0
54 Montana	7	0	4	1	8	0
55 Nevada	3	0	7	0	0	0
56 New Mexico	4	0	7	0	1	1
57 Utah	1	0	4	1	0	2
58 Wyoming	4	0	5	2	0	0
Pacific	11	1	13	4	1	1
61 California	5	1	4	1	1	1
62 Oregon	2	0	6	0	0	0
63 Washington	4	0	3	3	0	0
Noncontinguous						
64 Alaska	--	--	6	0	0	0
65 Hawaii	0	1	6	3	0	0
66 Puerto Rico	--	--	5	0	0	0
U.S. Total	190	19	435	101	67	25

A cursory examination of the vehicle classification and weight data by roadside stations within one State and on the same highway system, indicates that there are significant differences in the results of vehicle count, classification, and weight data. The number of stations required for the collection of representative data could be indicated by analysis of several States where more than two stations were operated on each highway system.

Table 7 gives the number of States in order of increasing number of stations. Both Tables 6 and 7 indicate that State to State there is no consistent procedure followed in selecting the number of roadside stations.

On the Other FA primary rural systems there were 435 stations with 5 to 9 States counting at 4 to 10 stations each. The number of States counting on the Interstate urban and on both FA secondary systems is so small, 17 or fewer, and the number of stations counted so few as to invalidate the results, so far as being representative of these three highway systems. Even the Other FA primary urban data are weak for the reason that of the 41 States counting on the Other FA primary urban system, only eight States counted at more than three stations.

TRAFFIC COUNT AND VEHICLE CLASSIFICATION FOR 1971

The basic tables on file in the FHWA Office of Planning give for each State and for the six Federal-aid highway systems (Interstate, Other FA primary and FA secondary) the number of stations that counted, number of vehicles counted by vehicle type code, percentage of each vehicle type based upon the total count, and the percentage of each vehicle type for each hour of the 24-hour day. (See illustrative tables in the appendix).

RESULTS OF THE IOWA VEHICLE CLASSIFICATION FOR 1971

For illustrative purposes, Table 8 gives for Iowa the traffic count for all types of vehicles for 1971 on the Interstate rural, Other FA primary rural and Other FA primary urban systems. The distribution for the Other FA primary urban system is somewhat rough, because only one roadside station was counted.

For all three systems, the people-carrying vehicles account for close to 77 percent of all vehicles. The 2-axle trucks increase in number and in percentage of total vehicles from the Interstate rural (9.28 percent), through the primary rural aystem (14.45 percent) to the primary urban system (17.80 percent).

Table 7. Number of States[a] and number of counting roadside stations for 1971

Number of Stations	Interstate Rural	Interstate Urban	Other FA Primary Rural	Other FA Primary Urban	FA Secondary Rural	FA Secondary Urban
0	7	38	1	11	36	35
1	4	11	1	10	9	10
2	9	2	0	15	3	6
3	6	0	3	8	1	1
4	6	1	5	5	0	0
5	5	0	7	2	0	0
6	9	0	7	0	0	0
7	2	0	9	1	1	0
8	3	0	1	0	1	0
9	1	0	0	0	0	0
10			6		0	
11			3		0	
12			2		0	
13			1		0	
14			2		0	
15			1		0	
16			2		0	
34			0		1	
52			1		0	
States counting	45	14	51	41	16	17[b]
Total stations	190	19	435	101	67	25

[a]District of Columbia and Puerto Rico included as States for a total of 52.

[b]Includes New Mexico which did not weigh vehicles and excludes Wyoming and Puerto Rico which did weigh vehicles but did not count at roadside stations.

The percentages for the tractor semitrailer combinations decrease over the sequence of these three systems. The increase in the percentage of 2-axle trucks would be expected because all vehicle trips become more local as the highway system becomes more of a local service function. The tractor semitrailer combinations, as line-haul vehicles, have their largest percentage on the Interstate rural system.

The count of 8,595 vehicle type code 332 trucks, or 1,432 per station per day, on the Interstate rural system is the highest volume of any truck type. On the Other FA primary urban system, however, the vehicle type code 200 panal and pickup vehicles have the largest count, 1,473 per station per day.

The trucks are lifted out of Table 8 and placed separately in Table 9 to show the relative percentage each type of truck is of the total truck count. The 2-axle trucks range from 40 percent of all trucks of the Interstate rural system to 76 percent on the primary urban system. Of significance is that the 332 tractor semitrailer on the Interstate rural is 46.1 percent of the total truck count. On the primary urban system, the code 200 panel and pickup is 47.8 percent of all trucks, but only 24.9 on the Interstate rural system.

HOURLY DISTRIBUTION OF TRUCK TRAFFIC BY VEHICLE TYPE CODE

Tables 10 and 11 give the percentage of traffic count for each hour of the day for codes 200, 220, 230, 321, 322 on the thres systems--Interstate rural, Other FA primary rural, and Other FA primary urban for Iowa.

These distributions illustrate characteristics of the use of different types of vehicles as well as their adaptation to the three highway systems. Figures 1, 2 and 3 illustrate these characteristics in graphic form. The code 200 truck on the Other FA primary urban system has the customary two peaks a day, the same as found for passenger cars. These peaks are less pronounced on the Other FA primary rural system, and on the Interstate rural only the afternoon peak prevails. The code 230, the construction bulk hauler, has only one peak and that at midday. Note, however, that this count is for only one station and may not be representative of the Other FA primary urban system as a whole.

Of special significance are the distributions for the three tractor semitrailers, 321, 322 and 332. The 321 has minor peaks morning and afternoon on the Interstate rural, with a fair percentage of trips in the night hours. The 321, however, has more pronounced peaks on the Other FA primary rural system, and the 321 code on the Other FA primary urban has an hourly distribution confined almost entirely to the working day from 7:00 a.m. to 7:00 p.m.

Table 8. Number of vehicles counted by vehicle code and percentage of total for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971

Vehicle Type	Interstate Rural Count	Interstate Rural Percent	Other FA Primary Rural Count	Other FA Primary Rural Percent	Other FA Primary Urban Count	Other FA Primary Urban Percent
061-2 Small cars	2,941	3.66	631	2.15	370	2.81
071-2 Std.& compact	58,320	72.56	21,817	74.38	9,613	73.04
030 Motorcycles	256	0.32	159	0.54	82	0.62
150 Coml. bus	189	0.24	51	0.17	12	0.09
180 Non-coml. bus	27	0.03	36	0.12	1	0.01
Subtotal	61,733	76.81	22,694	77.36	10,078	76.57
200	4,638	5.77	2,604	8.88	1,473	11.19
210	516	0.64	366	1.25	195	1.48
220	1,685	2.09	900	3.07	494	3.76
230	623	0.78	366	1.25	180	1.37
Subtotal	7,462	9.28	4,236	14.45	2,342	17.80
321	372	0.46	100	0.34	42	0.32
322	1,239	1.54	273	0.93	69	0.52
332	8,595	10.70	1,766	6.02	580	4.41
333	22	0.03	19	0.07	5	0.04
Subtotal	10,228	12.73	2,158	7.36	696	5.29
421	257	0.32	101	0.34	20	0.15
422	339	0.42	95	0.32	20	0.15
432	76	0.10	31	0.11	3	0.02
Subtotal	672	0.84	227	0.77	43	0.32
5212	252	0.31	15	0.05	2	0.02
5312	25	0.03	0	--	0	--
Subtotal	277	0.34	15	0.05	2	0.02
Others	4	0	3	0.01	0	--
Grand total	80,376	100.00	29,333	100.00	13,161	100.00
No. of Stations	6	--	7	--	1	--
Average Daily Count per Station	13,396	--	4,190	--	13,161	--

Table 9. Number of trucks counted at all stations and percentage of total trucks counted for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971

Vehicle Type Code	Interstate Rural Count	Interstate Rural Percent	Other FA Primary Rural Count	Other FA Primary Rural Percent	Other FA Primary Urban Count	Other FA Primary Urban Percent
200	4,638	24.9	2,604	39.3	1,473	47.8
210	516	2.8	366	5.5	195	6.3
220	1,685	9.0	900	13.6	494	16.0
230	623	3.3	366	5.5	180	5.9
Subtotal	7,462	40.0	4,236	63.9	2,342	76.0
321	372	2.0	100	1.5	42	1.4
322	1,239	6.7	273	4.1	69	2.2
332	8,595	46.1	1,766	26.6	580	18.8
333	22	0.1	19	0.3	5	0.2
Subtotal	10,228	54.9	2,158	32.5	696	22.6
421	257	1.4	101	1.5	20	0.6
422	339	1.8	95	1.4	20	0.6
432	76	0.4	31	0.5	3	0.1
Subtotal	672	3.6	227	3.4	43	1.3
5212	252	1.4	15	0.2	2	0.1
5312	25	0.1	0	0.0	0	0.0
Subtotal	277	1.5	15	0.2	2	0.1
Total	18,639	100.0	6,636	100.0	3,083	100.0
Average Daily Count per station	3,106	--	948	--	3,083	--

Table 10. Hour by hour percentage distribution of traffic for vehicle codes 200, 220, and 230 for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971

Clock Hour	Vehicle Code 200			Vehicle Code 220			Vehicle Code 230		
	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban
00-01	1.38	1.27	0.54	1.25	1.11	0.40	1.28	0.27	0.00
01-02	0.95	0.42	0.48	0.59	0.22	1.21	0.80	0.27	0.00
02-03	0.88	0.54	0.48	0.83	0.22	0.00	1.77	0.27	0.00
03-04	0.78	0.42	0.75	0.83	0.11	0.00	1.12	0.82	0.56
04-05	0.88	0.54	0.34	0.95	0.22	0.61	0.64	1.37	1.67
05-06	1.55	2.00	3.19	1.36	2.44	2.02	2.57	2.19	0.56
06-07	4.27	3.23	8.28	3.44	3.11	2.43	4.33	4.92	1.67
07-08	5.45	6.57	11.81	5.04	6.11	8.50	7.70	6.83	5.00
08-09	5.43	7.21	5.02	5.93	7.67	7.69	7.38	6.28	8.33
09-10	6.66	7.40	5.09	6.59	8.78	7.09	4.98	4.92	8.89
10-11	6.34	6.99	4.82	5.82	8.78	8.33	7.06	7.38	12.22
11-12	6.43	6.11	6.38	7.13	8.78	8.70	6.42	5.19	13.33
12-13	6.34	4.88	5.43	6.95	5.78	7.89	4.33	9.01	10.00
13-14	6.55	6.30	4.34	6.23	6.33	9.51	5.62	10.10	12.78
14-15	6.49	5.26	5.84	6.88	8.22	7.69	6.90	8.74	2.78
15-16	6.30	7.10	6.99	8.78	6.78	10.12	8.99	9.01	3.33
16-17	8.37	7.64	11.27	8.43	7.44	7.49	7.54	7.38	6.11
17-18	7.03	7.57	4.68	6.05	5.89	3.85	5.30	3.55	4.44
18-19	5.00	5.61	3.53	4.33	4.00	3.85	5.62	5.19	2.22
19-20	3.71	4.15	2.10	3.68	3.22	1.62	2.57	2.19	2.78
20-21	3.21	2.92	2.38	3.09	1.89	0.40	1.93	0.55	0.56
21-22	2.67	2.34	2.31	2.14	1.00	0.20	1.93	0.55	2.22
22-23	1.77	2.11	2.51	2.26	0.67	0.00	1.44	1.91	0.00
23-24	1.56	1.42	1.44	1.42	1.23	0.40	1.78	1.11	0.55
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Average Daily Count	773	372	1,473	281	129	494	104	52	180
Stations	6	7	1	6	7	1	6	7	1

Table 11. Hour by hour percentage distribution of traffic for vehicle codes 321,322, and 332 for the Interstate rural, Other FA primary rural, and Other FA primary urban systems in Iowa for 1971

Clock Hour	Vehicle Code 321			Vehicle Code 322			Vehicle Code 332		
	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban	Interstate Rural	Other FA Primary Rural	Other FA Primary Urban
00-01	3.49	1.00	0.00	2.99	1.47	2.90	3.63	4.19	1.03
01-02	1.61	3.00	0.00	3.23	3.30	1.45	3.42	2.27	2.24
02-03	0.81	1.00	0.00	1.78	3.66	0.00	3.01	2.66	2.07
03-04	0.81	3.00	0.00	2.99	4.40	5.80	2.92	2.38	2.07
04-05	1.61	4.00	0.00	1.94	4.03	2.90	2.91	2.77	3.79
05-06	3.76	2.00	0.00	1.78	4.40	2.90	3.20	3.00	2.76
06-07	3.76	3.00	0.00	3.07	3.66	2.90	3.57	3.96	4.83
07-08	4.30	3.00	2.38	4.76	4.76	4.35	3.84	3.68	4.66
08-09	5.91	6.00	7.14	4.20	8.06	7.24	4.20	4.47	5.00
09-10	4.57	9.00	7.14	5.49	6.23	2.90	3.86	4.42	5.52
10-11	5.38	9.00	11.91	3.55	5.86	10.13	4.62	5.21	5.69
11-12	6.18	6.00	4.76	5.40	3.30	1.45	4.48	6.51	8.45
12-13	7.26	1.00	14.29	4.50	5.49	5.80	4.65	5.83	8.28
13-14	4.30	5.00	9.52	3.55	3.66	7.25	4.46	5.61	6.55
14-15	4.30	5.00	11.91	4.36	5.86	7.25	4.87	5.44	3.62
15-16	5.65	6.00	7.14	5.97	4.03	5.80	4.32	4.70	5.86
16-17	8.06	5.00	11.91	6.38	4.03	7.24	4.68	5.32	5.52
17-18	6.72	8.00	7.14	5.97	6.59	4.35	5.08	4.47	3.45
18-19	5.65	4.00	0.00	5.73	2.93	5.80	5.13	4.64	4.66
19-20	2.96	2.00	2.38	6.38	1.47	1.45	5.12	3.28	4.14
20-21	5.38	1.00	0.00	5.08	4.03	1.45	5.27	3.91	4.66
21-22	3.76	0.00	2.38	4.04	1.10	1.45	5.44	3.79	3.28
22-23	2.15	5.00	0.00	3.47	2.93	5.80	3.60	3.96	0.86
23-24	1.62	8.00	0.00	3.39	4.75	1.44	3.72	3.53	1.01
Total	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00	100.00
Average Daily Count	62	14	42	206	39	69	1,432	252	580
Stations	6	7	1	6	7	1	6	7	1

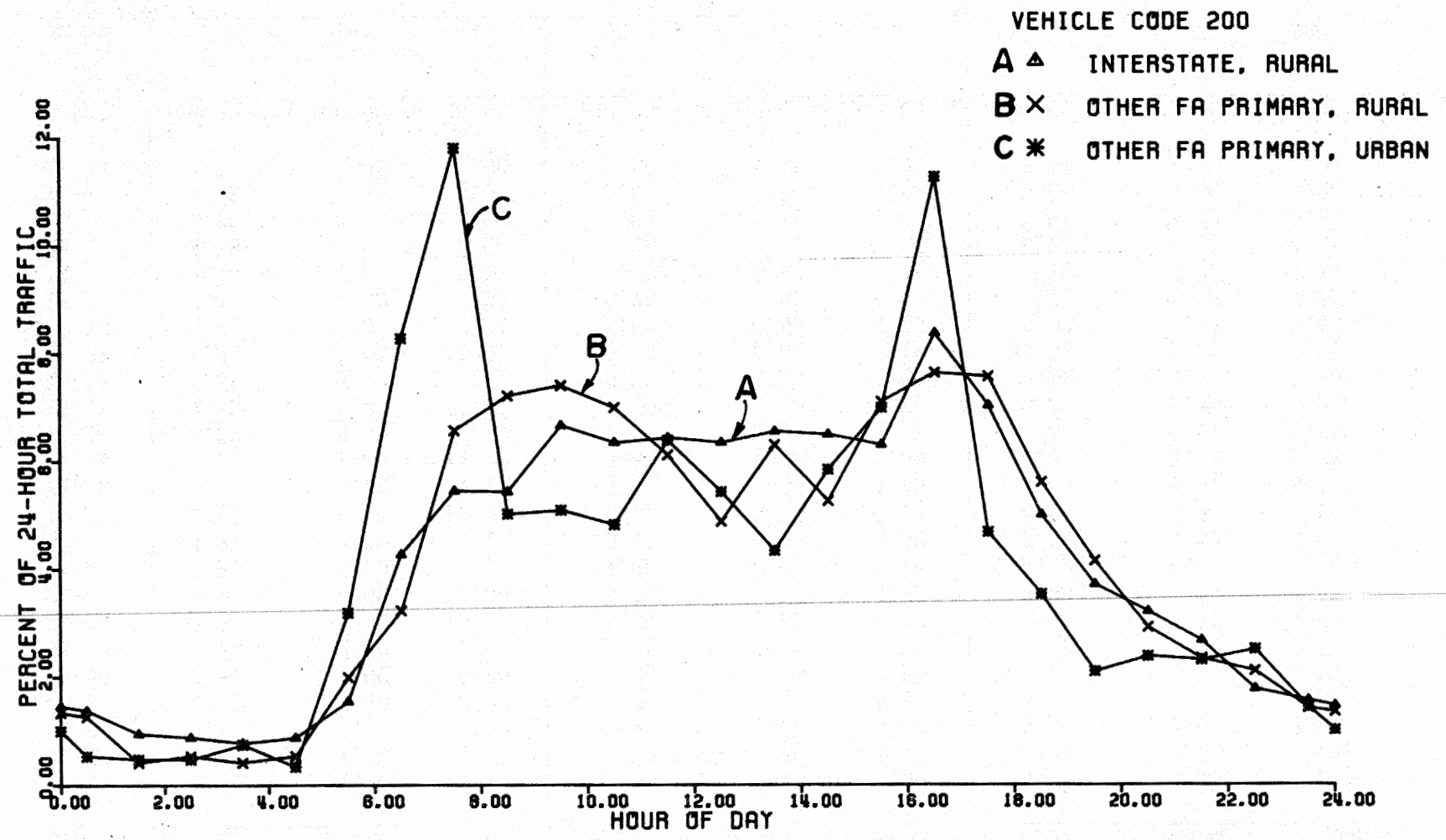


Figure 1. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 200 for selected highway systems.

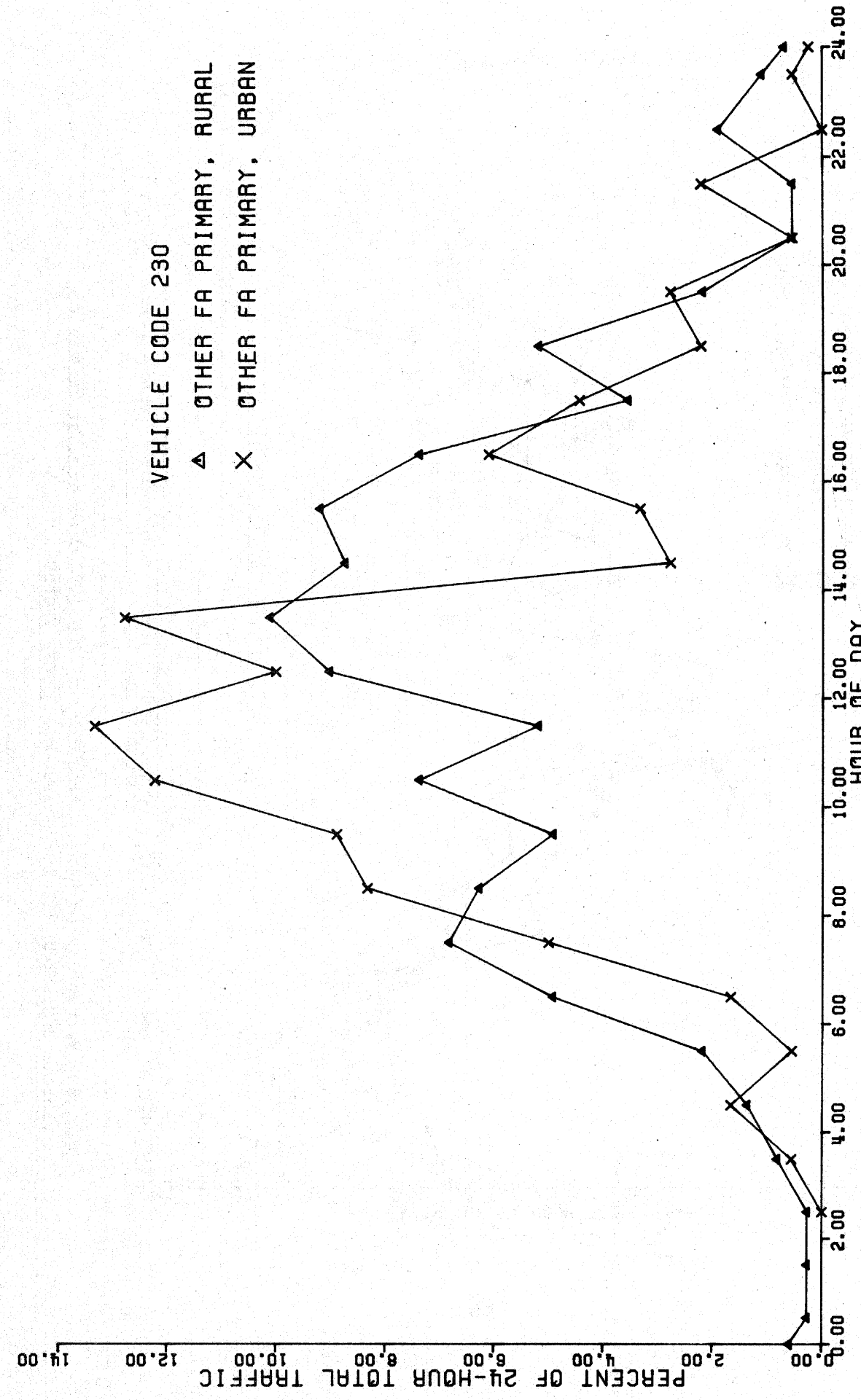


Figure 2. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 230 for selected highway systems.

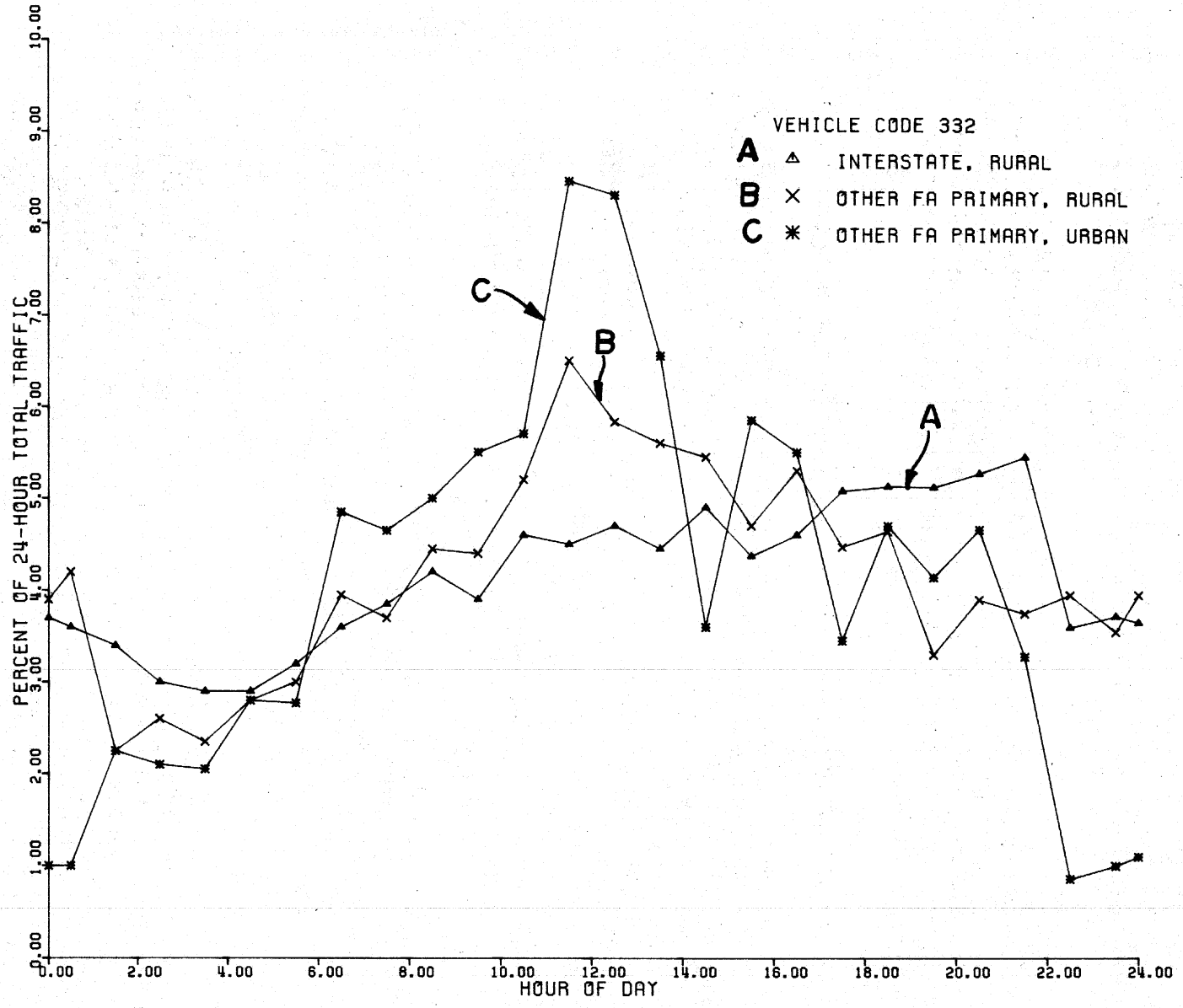


Figure 3. Percentage of hourly frequency of the 1971 Iowa traffic count for vehicle type code 332 for selected highway systems.

The popular 332 tractor semitrailer on the Interstate rural system runs the 24-hour day right through with the small variation of 2.91 percent to 5.45 percent per hour. This same characteristic, though with slighly a wider range of percentage, is found for the 322 on the Other FA primary rural system. On the Other FA primary urban system the 332 has still a higher range with the midday reaching 8.45 percent and the night having a low or 0.86 percent.

These hourly distributions of traffic flow by vehicle type illustrate the importance of giving attention to the distribution in selecting hours of the day for the weighing of trucks. Further, there is need to made analyses of the empty/loaded ratio and of the axle and gross weights over the 24-hour period, particularly so for the line-haul vehicles.

AVERAGE WEIGHTS, PAYLOADS, AND WEIGHT DISTRIBUTION FOR 1971

The field procedure for weighing trucks identifies the weight on each axle and whether the vehicle is empty of payload or with payload. These two basic sets of data are usually summarized by vehicle code number and highway system to produce the following information:

Number of vehicles weighed empty, loaded, and combined;
Average weight on each axle, empty, loaded, and combined;
Average gross weight, empty, loaded, and combined;
Average payload per vehicle;
Percentage of vehicles weighed empty (or weighed loaded); and
Percentage distribution of axle weights and gross weights by weight intervals.

These six sets of data provide for a wide range of application of the weight information, including comparisons by vehicle type, by highway system, by State, by census divisions, and years for trend analyses. The general procedure does not tabulate the data by individual roadside stations, but such information is available from each State highway department and the FHWA Office of Planning at Washington, D.C.

The basic weight data as collected by the States in 1971 (on file in the Office of Planning) are summarized in four series of tables as illustrated in the Appendix. These tables cover average axle weights and average gross weights for empty, loaded, and combined empty and loaded vehicles, and the distribution of these weights by weight intervals. The average payload per loaded vehicle is also given in connection with gross empty and gross loaded weights. In the next seven sections of this text these subjects are discussed and typical results are illustrated in tables and figures.

NUMBER OF VEHICLES WEIGHED IN 1971

An examination of the Appendix A tables that summarize for each State and highway system the total number of vehicles weighed by vehicle code, indicates the wide range in number of trucks weighed by any chosen factor. For instance, table 30 for the Interstate rural system for vehicle type code 200, Colorado weighed 280 and Idaho 3; for vehicle type code 220, Montana weighed 381 and Idaho 92; and for vehicle type code 322, New Jersey weighed 514 and Pennsylvania 62. Also on the Interstate rural system, in the West North Central census division, Iowa weighed 7,437 of the vehicle type code 332 and Minnesota weighed only 197. If there is any real difference in the weights of vehicles and other characteristics of trucking between Iowa and Minnesota, a census division composite would be highly weighted toward Iowa as compared to Minnesota. This range in size of samples weighed, along with those differences in the other five States of the West North Central census division gives rise to questions as to the acceptance of the census division composite.

These tables account for every vehicle weighed in 1971 on all highway systems by each State. It is to be noted that many of the vehicles weighed in several of the vehicle codes were less than 10 and even as low as one. It is probable that some of the instances of weighing only one vehicle could be an error in recording, though the infrequent vehicle type may be found on any highway system in any State. Some of the rare cases may be for a vehicle moving under a special permit. A study of these tables will reveal that many of the vehicle types common in certain States are not to be found at all in other States, because of being prohibited by State law. For instance, in the eastern States the truck with trailer is not generally found, but it is common in the western States.

EMPTY AND LOADED, AXLE AND VEHICLE GROSS WEIGHTS

Table 37 in Appendix B is a sample table showing for nine of the more popular vehicle types, the number of vehicles weighed, average axle weight of each axle and the average gross weight (sum of the axle weights) by empty, loaded, and combined. These data are for the Other FA primary rural highway system by census division. On a State basis this information is highly usable in many local applications of the truck weight data. True, the distributions of weights are not given, but often the average axle weights and average gross weights serve the purpose.

With few exceptions, the census division data show consistency. The exceptions are usually the result of inadequate sample size. The average gross weights for both empty and loaded vehicles, State to State, and by census divisions, would show wide scatter, more so for

the heavier vehicles than for the 2-axle classes. The variations, among other causes, result from the differences in the maximum legal axle and gross weights, State to State. Perhaps also, there are absolute differences within a State on its different highway systems and absolute differences State to State because of the character of the trucking industry and its types of cargo. To determine the real factors that cause the differences in average axle weights and gross weights, as indicated in the basic tables, requires much more detailed analysis than has been attempted herein.

The Appendix tables on average axle weight and average gross weight would be most helpful if they were presented on a State basis. The number of pages required, however, are beyond the limits of this publication. An examination of the State by State tables, as would be expected, shows a wider range of average axle and average gross vehicle weights than is shown by the census divisions.

The average weight of the empty vehicles is of specific question because of two factors. First, the heavy line-haul vehicles, tractor semitrailer and truck trailer combinations, the number of empty trucks is about one-half of the number of trucks with load. Therefore, to get an adequate number of empty vehicles weighed, it may be required to stop (and presumably weigh) twice the number of trucks with load. Second, there is a wide variation in the empty weights of trucks in accordance with their body types. These variations in body type give rise to a wide spread in ratio of empty weight to payload weight. It is true, of course, that the same spread of tare weights is found with load, but the overall gross weight of loaded vehicles masks somewhat the differences in average gross weight empty.

GROSS WEIGHT OF EMPTY TRUCKS

The weight of trucks empty, that is, without any payload or cargo, other than truck equipment, dunnage, and regular items that are not being delivered to a specific destination, is a highly important product of roadside weighings. The gross weight empty of a truck needs to be established, because the gross weight empty enters into the procedure for determining the weight of live load, or payload, that is being carried. The normal procedure is to weigh trucks on the roadside and classify them as empty or with payload. The phrase "with payload" means carrying any amount of cargo to be delivered somewhere. It matters not whether the payload weighs 100 pounds or several tons. From the field data collected on empty vehicles and loaded vehicles, their average gross weights are calculated on the basis of the vehicles weighed.

The assumption is made that the average gross weight of the vehicles weighed empty will also be the average gross weight empty (tare weight) of the loaded vehicles. Thus, by subtracting the average gross weight of the empty vehicles from the average gross weight of the loaded vehicles, the average weight of the payload cargo per loaded vehicle is obtained. From the numbers of empty vehicles and loaded vehicles weighed, the average payload weight carried per vehicle by all vehicles (empty and loaded combined) in a given type can be calculated. The total tonnage of cargo transported over a given highway is then equal to the average weight of cargo per vehicle times the traffic count of that vehicle type.

In the weighing of vehicles at the roadside, there usually is no way to determine whether a vehicle is with load or without load until the vehicle is stopped. The loading condition of open body types can be observed as the vehicle approaches the weighing station, but the closed body types cannot be so observed.

In effect, the empty vehicles and the loaded vehicles become two separate classes of vehicles from the viewpoint of their weights. The weighing crew may weigh a sufficient number of vehicles of a given axle arrangement type to determine the distribution of gross weight of empty and loaded vehicles combined, but not have a sufficient number of empty and loaded vehicles separately to determine their respective average gross weights.

As a general concept, there are three categories of vehicles with reference to the empty/loaded relationship. First, some vehicles, for instance the three-axle single unit dump truck or transit concrete mixer, normally haul cargo (substantially fully loaded) in only the outgoing direction and return empty. A second category of truck use is that where the vehicle starts out with either a full or partial load of cargo to deliver at various stops, and does not normally pick up any return load. Vehicles in this category may be with load at the weighing station, but not often with full load. Delivery vehicles of all types in both rural and urban areas are in this category; tanker trucks and retail goods delivery vehicles are examples. The third category is composed of those trucks that deliver and pick up in route and are usually never without payload and may not often be fully loaded. Common carrier vehicles on certificated routes are common vehicles in this category.

In the truck weighing data, fully loaded vehicles are detected by being up to full legal limit on gross weight or on axle weight. In the industry, however, a truck can be fully loaded from the standpoint of cargo volume (cubage) and not be loaded to maximum weight, either gross or axle weight. Furniture, household goods, seat springs, and automobile carriers usually "load out" on a cubage basis rather than on a weight basis.

In addition to weighing at the roadside a sufficient number of vehicles to establish the average empty gross weight, it is important to establish the ratio of the number of empty vehicles to the total number of that class of vehicle in the traffic stream. Having determined the weight of cargo per vehicle carrying cargo, the next step is to determine the average weight of cargo per vehicle type including the empty vehicles. Should the ratio of empty vehicles to total vehicles weighed be larger than the true ratio, even though the average weights are correct, the computed total tons of cargo hauled will be underestimated.

Tables 12, 13 and 14 for the Interstate rural, and Other FA primary rural, and urban systems give the percentages of the vehicles for nine codes that were empty of payload when weighed as assembled for the ten census divisions and the national total. The percentages empty and average gross weights for the national total are probably a good average. For the census divisions, the low and high percentages and weights in some instances are definitely due to a small-sized sample; other departures from the national average may be the result of actual difference in trucking practices division to division, the roadside station locations, or to the sample of vehicles weighed. A State by State analysis would shed much light on the range of percentages and empty weights that could be expected.

The type code 200 vehicle on the Other FA primary rural nationally averages 66 percent empty. This high percentage is to be expected for this vehicle because it is more of a people carrier than a goods carrier. The tractor semitrailer group of three codes (321, 322, and 332) averages close to 33 percent empty with a census division range from 20 to 69 percent on the Other FA primary rural system. In general, the percentage empty reduces with an increase in average gross empty weight. Such increase is to be expected because the heavier vehicles are mostly line-haul (intercity) vehicles. The exception, of course, is the code 230, construction material carrier (earth excavations, gravel, and mixed concrete). This vehicle averages about 50 percent empty, which is to be expected for the reason that it hauls bulk materials one way and returns empty. It is a shorthaul, nonline-haul, construction type of vehicle, with a few exceptions.

PERCENTAGE OF EMPTY TRUCKS AND PAYLOAD PER VEHICLE

The number of vehicles weighed empty is wholly a matter of chance since there can be no selection as between empty and loaded vehicles until the vehicle is in the weighing position and the driver interviewed.

Table 12. Percentage of weighed vehicles that were empty and their average gross weight on the Interstate rural highway system

Census Division	Vehicle Type Code Number															
	200		210		220		230		321		322		332		432		5212	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New England	177	48	24	26	423	36	111	54	64	33	349	36	476	41	0	-	0	-
Middle Atlantic	182	59	39	37	254	34	46	36	61	30	281	30	614	29	0	-	0	-
South Atlantic North	666	65	49	44	515	35	173	54	104	38	206	25	684	26	0	-	0	-
South Atlantic South	386	66	17	41	518	37	118	52	104	36	562	38	899	35	0	-	0	-
East North Central	851	63	198	56	663	38	183	52	298	42	460	31	1,333	25	8	35	18	14
East South Central	126	56	83	46	452	38	134	48	108	36	301	26	1,147	25	0	-	2	22
West North Central	1,026	51	144	41	934	33	466	48	192	30	532	28	3,235	25	73	42	93	12
West South Central	169	71	8	40	268	35	83	55	114	32	224	32	1,208	30	1	14	13	11
Mountain	295	52	29	31	310	32	104	50	57	29	81	17	798	21	193	43	123	18
Pacific	30	26	6	10	266	32	91	49	74	32	63	23	459	22	179	32	136	16
National	3,908	58	597	42	4,603	35	1,509	50	1,176	35	3,059	30	10,853	26	454	37	385	15
	Average Gross Weight Empty, Pounds															
New England	4,723		5,646		11,180		19,603		22,420		26,367		31,635		-		-	
Middle Atlantic	5,246		5,944		11,811		22,841		22,957		26,523		30,215		-		-	
South Atlantic North	5,022		5,563		10,891		19,089		24,840		27,007		31,003		-		-	
South Atlantic South	4,429		5,124		10,505		18,372		22,829		25,351		29,296		-		-	
East North Central	4,803		6,596		10,883		18,632		22,272		25,340		29,893		29,588		30,239	
East South Central	5,148		5,058		10,494		17,565		22,488		25,680		29,287		-		31,650	
West North Central	4,739		5,573		10,477		16,664		21,571		24,767		29,371		28,186		30,935	
West South Central	4,605		8,200		10,714		16,288		21,071		24,563		28,537		64,800		32,008	
Mountain	5,102		9,190		10,369		19,237		21,986		26,469		30,566		28,808		31,376	
Pacific	4,700		8,183		10,455		19,449		20,449		25,719		29,075		27,185		29,183	
National	4,828		6,091		10,730		18,123		22,252		25,595		29,653		28,161		30,465	

Table 13. Percentage of weighed vehicles that were empty and their average gross weight on the Other FA primary rural highway system

Census Division	Vehicle Type Code Number															
	200		210		220		230		321		322		332		432		5212	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New England	745	52	87	35	757	35	275	49	80	32	385	35	550	41	0	-	0	-
Middle Atlantic	1,262	59	148	35	566	35	114	47	76	33	284	28	628	30	0	-	0	-
South Atlantic North	1,513	74	95	39	780	37	251	49	61	37	252	35	806	37	0	-	0	-
South Atlantic South	3,557	77	70	31	1,176	39	388	51	98	36	838	39	1,151	38	0	-	0	-
East North Central	1,686	63	163	41	661	34	253	47	114	31	234	30	936	32	8	42	7	11
East South Central	1,314	63	121	52	716	43	174	48	68	35	329	43	972	42	0	-	0	-
West North Central	3,077	60	938	55	1,417	36	630	45	128	28	345	34	2,467	37	59	32	16	9
West South Central	986	76	26	31	622	37	225	46	140	33	319	33	1,814	32	7	33	17	7
Mountain	1,064	60	141	44	503	36	209	47	50	26	68	23	754	28	183	43	46	15
Pacific	41	44	20	32	208	38	59	39	14	31	12	21	120	13	67	28	30	27
Noncontiguous	823	67	188	52	558	49	138	46	11	38	85	43	113	41	8	14	45	43
National	16,068	67	1,997	46	7,964	37	2,716	47	840	32	3,151	35	10,311	34	332	35	161	16

Average Gross Weight Empty, Pounds

New England	4,246	5,817	10,768	21,994	22,053	27,398	32,289	-	-
Middle Atlantic	4,739	5,559	10,430	19,821	23,396	26,393	31,128	-	-
South Atlantic North	4,776	6,004	10,662	20,794	24,089	27,280	31,966	-	-
South Atlantic South	4,286	5,804	10,090	18,961	22,520	25,259	31,268	-	-
East North Central	4,644	5,989	10,533	18,083	21,770	25,238	28,974	28,588	32,614
East South Central	4,477	4,800	9,226	17,170	19,799	22,853	27,550	-	-
West North Central	4,566	4,769	10,025	16,568	20,918	24,590	28,659	28,471	31,031
West South Central	4,677	6,354	10,196	17,098	20,891	22,973	29,258	26,614	35,594
Mountain	4,995	7,177	10,306	20,534	22,828	28,156	32,542	30,501	31,035
Pacific	4,522	6,715	10,175	18,720	19,893	24,317	28,441	27,613	28,527
Noncontiguous	4,565	5,948	10,668	24,136	22,509	36,854	39,465	32,763	35,038
National	4,558	5,391	10,247	18,946	21,805	25,598	29,982	29,484	32,236

Table 14. Percentage of weighed vehicles that were empty and their average gross weight on the Other FA primary urban highway system

Census Division	Vehicle Type Code Number																	
	200		210		220		230		321		322		332		432		5212	
	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%	No.	%
New England	383	58	59	29	423	34	83	50	19	21	134	32	96	38	0	-	0	-
Middle Atlantic	711	48	99	23	711	31	170	53	117	30	334	28	449	30	0	-	0	-
South Atlantic North	476	64	157	37	313	38	124	51	38	34	127	35	262	37	0	-	0	-
South Atlantic South	1,680	73	43	38	496	38	76	50	43	37	229	37	258	45	0	-	0	-
East North Central	509	64	39	46	154	33	37	44	12	24	24	30	84	34	2	67	0	-
East South Central	164	58	85	54	322	38	94	53	36	34	134	38	373	40	0	-	0	-
West North Central	1,214	66	254	61	374	36	155	57	41	30	55	34	329	38	3	17	2	25
West South Central	586	80	32	56	141	34	72	46	18	26	51	33	151	26	1	33	2	4
Mountain	181	60	57	40	176	33	58	42	15	31	12	27	47	38	9	47	5	17
Pacific	21	36	0	-	102	32	26	58	29	30	23	41	54	33	16	35	20	33
Noncontiguous	131	60	73	37	149	29	73	45	2	20	39	45	30	42	10	38	17	39
National	6,056	64	898	40	3,361	34	968	51	370	30	1,162	33	2,133	35	41	35	46	23
	Average Gross Weight Empty, Pounds																	
New England	4,311		5,573		10,433		22,486		22,889		29,101		32,758		-		-	
Middle Atlantic	5,485		6,676		12,398		27,563		25,235		29,660		34,448		-		-	
South Atlantic North	5,230		10,858		11,980		25,360		26,458		29,063		34,958		-		-	
South Atlantic South	4,402		5,702		10,116		19,646		23,358		26,191		31,682		-		-	
East North Central	4,683		5,497		10,151		18,792		22,492		26,721		31,182		33,900		-	
East South Central	4,778		4,865		10,034		18,849		19,981		23,984		28,216		-		-	
West North Central	4,544		4,727		9,327		17,699		20,488		26,058		30,964		32,133		30,350	
West South Central	4,631		7,078		10,016		17,092		21,811		23,053		28,314		36,300		38,250	
Mountain	4,550		6,558		9,235		20,028		16,753		23,867		30,232		24,511		28,060	
Pacific	4,410		-		10,051		17,788		18,593		24,091		28,557		26,344		28,430	
Noncontiguous	4,240		5,667		10,972		24,322		22,950		29,103		36,080		32,620		36,806	
National	4,674		6,439		10,704		21,726		22,852		27,482		31,691		28,507		31,996	

To repeat, the two objectives of weighing vehicles empty of payload are to determine their average gross empty weight and to determine the percentage of the total traffic flow of each vehicle type that is empty of payload. If a sample of 200 empty vehicles is necessary to establish the percentage of vehicles that are empty and one-third of that type of vehicle is expected (from prior analyses) to be empty, then the total sample of the traffic stream would need to be 600 vehicles. This analysis was not carried far enough to establish whether the total sample of traffic to be weighed (loaded and empty) to achieve an acceptable average gross empty weight, would also produce an acceptable percentage of empty vehicles. There is some indication that percentage empty may require a larger sample than to determine the average gross weight empty.

The tables on file in the FHWA Office of Planning give the average payload per vehicle of loaded vehicles for six highway systems by vehicle types. The payloads given in these tables are calculated by subtracting the average gross empty weight from the average gross weight of those vehicles with payload. All three averages are given in the tables for each of the ten census divisions and the national total. These tables also give the number of empty, loaded, and combined empty and loaded vehicles weighed. The number of vehicles weighed may be useful in judging the relative sample adequacy in comparisons between highway systems, vehicle codes, and census divisions.

Table 15 compares the empty weights and average payload per vehicle for the Other FA primary rural highway system by census divisions for the year 1966, 1967, and 1971 for vehicle type codes 220 and 332. For each of these two vehicle types on a national basis 1966 to 1971, there are some increases in average empty weight and some decreases in average payload per vehicle. By census division, there are both increases and decreases in the average empty weight and average payload per vehicle.

In Appendix C, table 38 gives the payload per vehicle for nine vehicle types by census division for the Other FA primary rural highway system. An examination of this table shows a wide range in the payload per vehicle for 1971. How much of this range is due to sampling inadequacy and what to basic difference in trucking within the States cannot be determined. However, some of the extreme differences can be accounted for by observation of the small number of vehicles weighed in total of a given class on a given highway system. But when it is remembered that the calculation of the average payload per vehicle is dependent upon the average gross weight of the empty vehicles as well as the average gross weight of the vehicles weighed with payload, it is seen that an adequate number of representative vehicles weighed empty is a requisite to reliably calculating the payload per loaded vehicle.

Table 15. Number of vehicles weighed, average empty weight and average payload per loaded vehicle for vehicle type codes 220 and 332, for 1966, 1967 and 1971 on the Other FA primary rural highway system by census division

Census Division	Year 1966			Year 1967			Year 1971		
	Number Vehicles Weighed	Average Empty Weight,lb.	Average Payload, Pounds	Number Vehicles Weighed	Average Empty Weight,lb.	Average Payload, Pounds	Number Vehicles Weighed	Average Empty Weight,lb.	Average Payload, Pounds
	Vehicle Type Code: 220								
New England	1,696	10,072	5,066	1,472	10,610	5,013	2,156	10,768	4,868
Middle Atlantic	2,387	10,421	4,350	2,564	10,153	4,686	1,616	10,430	4,679
South Atlantic North	2,796	9,998	6,406	3,126	10,094	6,628	2,090	10,662	5,328
South Atlantic South	4,344	9,542	6,209	4,160	9,851	5,963	3,021	10,090	5,764
East North Central	2,254	9,599	6,213	2,028	9,956	5,819	1,948	10,533	4,876
West North Central	5,033	9,060	6,373	3,844	8,800	6,531	1,669	9,226	6,373
East South Central	4,680	9,344	5,749	3,220	9,946	5,386	3,975	10,025	5,789
West South Central	2,319	9,544	5,888	2,467	9,993	5,345	1,687	10,196	5,949
Mountain	1,471	9,292	5,152	1,400	9,413	4,470	1,382	10,306	5,316
Pacific	823	9,401	5,042	739	9,925	4,794	554	10,175	4,341
Noncontiguous	301	11,612	2,176	222	11,664	2,285	1,148	10,668	6,652
National	28,104	9,569	5,764	25,242	9,810	5,620	21,246	10,247	5,508
	Vehicle Type Code: 332								
New England	472	29,544	34,835	525	29,248	31,961	1,348	32,289	32,265
Middle Atlantic	1,266	29,497	29,307	1,965	29,537	28,793	2,108	31,128	27,538
South Atlantic North	2,041	29,353	34,297	2,587	30,659	33,829	2,158	31,966	32,575
South Atlantic South	2,760	31,059	28,962	3,079	31,291	30,299	3,026	31,268	29,751
East North Central	3,131	29,062	33,322	3,138	28,959	30,940	2,905	28,974	30,891
West North Central	4,415	28,015	29,700	4,116	28,362	28,491	2,314	27,550	33,162
East South Central	6,048	29,749	36,080	5,197	29,561	36,664	6,698	28,659	34,239
West South Central	4,664	27,839	30,965	5,123	28,103	31,285	5,738	29,258	31,241
Mountain	1,667	29,317	31,636	2,057	29,139	31,152	2,650	32,542	34,420
Pacific	1,167	28,463	38,639	1,208	28,168	39,120	938	28,441	41,235
Noncontiguous	42	48,533	13,167	29	36,108	27,533	276	39,465	30,794
National	27,673	29,186	32,492	29,024	29,332	32,046	30,159	29,982	32,406

An examination of Table 16 does not disclose any general pattern of empty gross weight and of loaded gross weight as between the three highway systems. Such differences as may be disclosed for a specific vehicle type code, probably could be explained by an analysis of body types and commodities carried. It is probable that the code 230 on the Interstate rural system has a higher percentage of line-haul types of bodies on the three-axle chassis than it does have on either the Other FA primary rural or urban systems. In the urban area, the code 230 traffic may have a high percentage of concrete transit trucks and other construction industry types for hauling bulk materials.

Of interest is the fact that code 432, truck and full trailer, has a lighter empty weight and a heavier loaded weight than either the code 332 or 5212 combinations. In the lower section of Table 16, the average payload per loaded vehicle is given for all of the nine vehicle types on the three highway systems. The ratio of payload weight to empty weight given for each type code and highway system is an index of operating efficiency. Truck operators try for low gross empty weight and high payload per vehicle trip. This index is not so meaningful for the 200, 210, and 220 codes for the reason that they are not line-haul vehicles. The code 230 with some exceptions, is not a line-haul vehicle either, but is definitely weight limited in its operations, being fully weight loaded on a high percentage of trips.

The high ratio for the code 432 combination (1.52, 1.37, and 1.57 for the three systems) is far superior to the other line-haul combinations. The explanation of this high efficiency is not obvious, but an analysis of body types and commodities carried in comparison with the other vehicle type codes, would, no doubt, provide an explanation. The code 432 is primarily a western vehicle, not being legal in eastern States.

The relatively low ratios for the code 321 semitrailer (0.44, 0.41, and 0.31) are partially explained by its frequent use in hauling light density commodities (household goods) and thus is often volume limited as contrasted to being weight limited. In urban areas, the 321 combination is often used as a pickup and delivery vehicle; therefore, it is often not loaded to its weight limit.

ANALYSIS OF INDIVIDUAL ROADSIDE STATIONS

The fact that the several States count and weigh vehicles at a variable number of roadside stations (Table 6) gives rise to questions about whether the vehicle volume counts, the empty/loaded truck ratio, and the axle and gross weights recorded are representative of the highway systems on which the data were taken. An attempt to analyze the

Table 16. U.S. average empty, loaded and payload weights for three highway systems and nine vehicle type codes for 1971

Vehicle Type Code	Interstate Rural		Other FA Primary Rural		Other FA Primary Urban	
	Empty Vehicles Pounds	Loaded Vehicles Pounds	Empty Vehicles Pounds	Loaded Vehicles Pounds	Empty Vehicles Pounds	Loaded Vehicles Pounds
200	4,828	5,955	4,558	5,581	4,674	5,697
210	6,091	7,957	5,391	6,951	6,439	8,340
220	10,730	15,910	10,247	15,755	10,704	15,094
230	18,123	34,786	18,946	38,351	21,726	39,492
321	22,252	32,028	21,805	30,763	22,852	29,907
322	25,595	42,981	25,598	45,291	27,482	45,511
332	29,653	61,207	29,982	62,388	31,691	62,739
432	28,161	70,852	29,484	69,779	28,507	73,124
5212	30,465	62,013	32,236	63,822	31,996	60,585

Vehicle Type Code	Payload per Vehicle Pounds	Ratio: Payload/ Empty Weight	Payload per Vehicle Pounds	Ratio: Payload/ Empty Weight	Payload per Vehicle Pounds	Ratio: Payload/ Empty Weight
200	1,127	0.23	1,023	0.22	1,023	0.22
210	1,866	0.31	1,560	0.29	1,901	0.30
220	5,180	0.48	5,508	0.54	4,390	0.41
230	16,663	0.92	19,405	1.02	17,766	0.82
321	9,776	0.44	8,958	0.41	7,055	0.31
322	17,386	0.68	19,693	0.77	18,029	0.66
332	31,554	1.06	32,406	1.08	31,048	0.98
432	42,691	1.52	40,295	1.37	44,617	1.57
5212	31,548	1.04	31,586	0.98	28,589	0.89

data to answer these questions was applied to Wisconsin on the Interstate rural and Other FA primary rural systems. The study was dropped because of the time required and because of scarcity of data. A brief presentation of some results, however, is given.

Tables 17 and 18 for the vehicle codes 200, 210, 220, 230, and 332 give the daily count, number of vehicles empty and loaded, the empty and loaded gross weights, and the total count for eight Interstate rural stations and 15 Other FA primary rural stations. Because of the short count at each station (usually only one day) sample size is so deficient that variations between roadside locations may be overshadowed by the variations in sample qualities. These two tables do show, nevertheless, that there is a significant range in percentage distribution by vehicle code among the counting stations, that the percentage of empty vehicles varies, and that the average gross weights are affected accordingly. For instance, on the Interstate rural system (Table 17) the eight stations give a range of the percentage of all code 332 vehicles weighed empty from 10 to 30 percent, with an average of 20 percent. It should be noted that these weighing stations are each one-way traffic, but selected in pairs to include traffic in both directions.

The percentage of empty vehicles for the other type codes also shows wide ranges, but for many of the stations the variation is obviously the result of low sample numbers. The same conclusion is reached by examining the average gross weights, which have wide ranges from low to high. The sample number of vehicles per station is too small to disclose whether the difference in average gross weights is the result of sample size or a real difference in the character of trucking practice at several stations.

Similar data are presented in Table 18 for 15 stations on the Wisconsin Other FA primary rural system. For the code 200 vehicle, the percentage empty ranges from a low of 39 percent to a high of 82 percent. Obviously, the high 82 percent is from a sampling deficiency, because only two loaded vehicles were weighed. The average 32 percent empty vehicles for the code 332 is compared to the 20 percent obtained on the Interstate system. The difference between 32 percent and 20 percent could represent a real difference attributed to trucking practices at the stations, or it could be a result of sampling the traffic. But whether the 32 percent and the 20 percent are true differences in truck loading practices between the Interstate rural system and Other FA primary rural system is not answered.

About the only conclusion that can be drawn from this single and brief analysis of individual roadside traffic-counting and vehicle-weighing stations, is that the sample size at a given station is too small to warrant a positive statement that trucking characteristics do vary significantly with location. But a valid conclusion is that the results are representative of the highway system as a whole.

Table 17. Percentage of vehicles weighed empty and gross weights for individual stations in Wisconsin on the Interstate rural highway system in 1971

Station	Daily Count of Code	Number Weighed			Percent Empty	Average Gross Weight			Total Daily Count
		Empty	Loaded	Empty & Loaded		Empty	Loaded	Empty & Loaded	
				Vehicle Type Code:		200			
070	324	16	19	35	46	5,575	6,579	6,120	6,090
071	260	10	17	27	37	4,720	5,241	5,048	5,768
074	392	33	30	63	52	4,639	5,883	5,232	7,599
075	336	20	42	62	32	4,455	5,995	5,498	7,272
076	262	33	35	68	49	4,685	5,994	5,359	5,623
077	219	2	7	9	22	7,600	6,486	6,733	6,599
078	272	15	9	24	63	5,193	5,767	5,408	6,166
079	242	8	14	22	36	4,350	6,436	5,677	5,956
Total	2,307	137	173	310	44	4,826	6,009	5,486	51,073
				Vehicle Type Code:		210			
070	7	0	2	2	-	-	8,700	-	6,090
071	6	1	2	3	33	5,700	19,150	14,667	5,768
074	10	1	4	5	20	4,500	6,175	5,840	7,599
075	6	2	0	2	100	9,150	-	-	7,272
076	11	2	0	2	100	11,000	-	-	5,623
077	47	0	1	1	-	-	7,800	-	6,599
078	33	2	3	5	40	5,900	7,200	6,680	6,166
079	15	1	1	2	50	6,100	9,200	7,650	5,956
Total	135	9	13	22	41	7,600	9,154	8,518	51,073
				Vehicle Type Code:		220			
070	154	12	38	50	24	10,433	15,711	14,444	6,090
071	172	15	42	57	26	10,860	17,162	15,504	5,768
074	147	26	49	75	35	10,400	16,329	14,273	7,599
075	132	17	39	56	30	9,259	14,603	12,980	7,272
076	156	46	35	81	57	10,739	14,823	12,504	5,623
077	132	3	20	23	13	12,133	18,000	17,235	6,599
078	139	10	38	48	21	12,010	15,129	14,479	6,166
079	135	14	17	31	45	11,464	13,647	12,661	5,956
Total	1,167	143	278	421	34	10,678	15,731	14,014	51,073
				Vehicle Type Code:		230			
070	29	4	5	9	44	25,250	36,560	31,533	6,090
071	26	7	9	16	44	19,029	29,856	25,119	5,768
074	21	8	6	14	57	18,825	33,300	25,029	7,599
075	26	4	6	10	40	18,725	32,267	26,850	7,272
076	19	7	4	11	64	18,229	34,150	24,018	5,623
077	31	1	4	5	20	16,200	35,600	31,720	6,599
078	29	6	4	10	60	16,733	40,475	26,230	6,166
079	26	1	7	8	13	15,300	31,043	29,075	5,956
Total	207	38	45	83	46	18,926	33,402	26,775	51,073
				Vehicle Type Code:		332			
070	726	6	54	60	10	34,500	76,722	72,500	6,090
071	797	16	64	80	20	29,081	57,936	52,165	5,768
074	792	61	175	236	26	29,090	61,112	52,835	7,599
075	947	35	184	219	16	29,274	60,367	55,398	7,272
076	553	70	166	236	30	28,974	59,655	50,555	5,623
077	686	19	89	108	18	34,589	67,665	61,846	6,599
078	985	22	140	162	14	32,359	60,974	57,088	6,166
079	961	23	115	138	17	30,009	58,983	54,154	5,956
Total	6,447	252	987	1,239	20	29,996	61,699	55,251	51,073

Table 18. Percentage of vehicles weighed empty and gross weights for 15 roadside stations in Wisconsin on the Other FA primary rural highway system for 1971

Station	Daily Count of Code	Number Weighed			Percent Empty	Average Gross Weight			Total Daily Count
		Empty	Loaded	Empty & Loaded		Empty	Loaded	Empty & Loaded	
				Vehicle Type Code:	200				
004	175	23	22	45	51	4,861	6,255	5,542	5,747
006	165	11	9	20	55	4,982	6,867	5,830	2,054
007	325	9	2	11	82	5,156	6,100	5,327	4,204
008	472	19	11	30	63	4,574	5,309	4,843	6,215
009	391	10	12	22	45	6,980	5,983	6,436	4,258
019	144	21	10	31	68	4,333	4,700	4,452	1,529
022	311	35	18	53	66	4,634	5,822	5,038	2,283
024	368	32	19	51	63	4,675	5,616	5,025	6,504
026	404	7	6	13	54	5,971	7,933	6,877	3,709
028	249	8	7	15	53	5,175	5,943	5,533	2,389
031	341	20	26	46	43	4,510	6,842	5,828	6,777
035	207	17	27	44	39	4,665	5,693	5,295	4,408
036	219	18	21	39	46	4,867	5,243	5,069	4,217
045	182	7	10	17	41	4,943	5,600	5,329	3,152
055	246	53	47	100	53	4,538	5,987	5,219	2,897
Total	4,199	290	247	537	54	4,786	5,946	5,319	60,343
				Vehicle Type Code:	210				
004	42	4	8	12	33	9,550	13,038	11,875	5,747
006	6	0	0	0	-	-	-	-	2,054
007	22	0	1	1	-	-	10,800	-	4,204
008	36	0	0	0	-	-	-	-	6,215
009	11	0	0	0	-	-	-	-	4,258
019	14	0	0	0	-	-	-	-	1,529
022	21	0	0	0	-	-	-	-	2,283
024	18	2	1	3	67	12,750	30,600	18,700	6,504
026	0	-	-	-	-	-	-	-	3,709
028	6	1	2	3	33	7,200	17,000	13,733	2,389
031	18	1	3	4	25	7,300	7,367	7,350	6,777
035	14	1	5	6	17	6,000	6,900	6,750	4,408
036	21	2	6	8	25	6,350	7.117	6,925	4,217
045	24	1	3	4	25	4,800	9.733	8,500	3,152
055	14	1	2	3	33	6,000	8,500	7,667	2,897
Total	267	13	31	44	30	8,285	10,490	9,839	60,343
				Vehicle Type Code:	220				
004	158	14	56	70	20	10,293	15,713	14,629	5,747
006	144	17	21	38	45	11,553	14,781	13,337	2,054
007	210	6	13	19	32	11,367	15,015	13,863	4,204
008	207	8	25	33	24	11,500	16,580	15,348	6,215
009	247	7	12	19	37	11,086	15,267	13,726	4,258
019	85	5	18	23	22	10,560	15,733	14,609	1,529
022	104	6	14	20	30	9,400	18,271	15,610	2,283
024	153	15	29	44	34	11,127	17,293	15,191	6,504
026	157	9	14	23	39	13,511	15,671	14,826	3,709
028	108	4	13	17	24	12,950	15,000	14,518	2,389
031	198	18	54	72	25	11,883	17,165	15,844	6,777
035	142	17	49	66	26	10,535	15,482	14,208	4,408
036	144	23	35	58	40	10,330	15,591	13,505	4,217
045	150	3	15	18	17	11,800	13,920	13,567	3,152
055	95	12	48	60	20	11,708	14,713	14,112	2,897
Total	2,302	164	416	580	28	11,185	15,828	14,515	60,343

Table 18. Percentage of vehicles weighed empty and gross weights for 15 roadside stations in Wisconsin on the Other FA primary rural highway system for 1971 (continued)

Station	Daily Count of Code	Number Weighed			Percent Empty	Average Gross Weight			Total Daily Count
		Empty	Loaded	Empty & Loaded		Empty	Loaded	Empty & Loaded	
				Vehicle Type Code:	230				
004	128	9	5	14	64	21,400	41,780	28,679	5,747
006	15	3	1	4	75	19,333	42,200	25,050	2,054
007	35	1	3	4	25	20,400	33,400	30,150	4,204
008	103	7	1	8	88	23,386	14,900	22,325	6,215
009	25	0	1	1	-	-	49,600	-	4,258
019	25	1	8	9	11	11,000	37,650	34,698	1,529
022	22	1	3	4	25	20,200	40,067	35,100	2,283
024	42	9	4	13	69	18,489	34,475	23,408	6,504
026	37	3	5	8	38	24,267	39,520	33,800	3,709
028	36	3	0	3	100	16,600	-	-	2,389
031	28	5	11	16	31	18,600	37,527	31,613	6,777
035	43	12	6	18	67	16,317	39,183	23,939	4,408
036	37	12	7	19	63	18,958	32,800	24,058	4,217
045	25	0	2	2	-	-	33,100	-	3,152
055	18	3	5	8	38	19,000	36,680	30,050	2,897
Total	619	69	62	131	53	19,249	37,094	27,695	60,343
				Vehicle Type Code:	332				
004	259	25	60	85	29	28,856	59,382	50,404	5,747
006	296	11	32	43	26	33,436	68,500	59,530	2,054
007	442	10	24	34	29	32,360	59,375	51,429	4,204
008	209	16	33	49	33	29,681	63,027	52,139	6,215
009	430	10	20	30	33	29,640	68,280	55,400	4,258
019	96	3	7	10	30	37,000	67,429	58,300	1,529
022	49	3	5	8	38	33,800	67,560	54,900	2,283
024	501	42	72	114	37	28,940	59,707	48,372	6,504
026	104	2	17	19	11	34,900	69,071	65,474	3,709
028	78	2	9	11	18	42,500	71,911	66,564	2,389
031	176	10	41	51	20	27,520	60,588	54,104	6,777
035	353	25	61	86	29	28,316	59,451	50,400	4,408
036	385	37	56	93	40	27,519	58,541	46,199	4,217
045	247	9	20	29	31	31,644	60,280	51,393	3,152
055	76	17	25	42	40	27,741	65,228	50,055	2,897
Total	3,701	222	482	704	32	29,390	61,786	51,570	60,343

GROSS WEIGHT DISTRIBUTION

As is true of many technical and scientific observations, the average of a population group gives useful information, but does not tell the whole of what is often needed, or at least is of significant interest. Reference here is made to the distribution of axle weights on a vehicle to vehicle basis. In the weighing of trucks at the roadside, it is usual practice to weigh each axle separately, then compute the vehicle gross weight, or total vehicle weight, by summing the weights of the axles. Where permanent platform scales are installed with sufficient length and scale capacity, the whole vehicle can be weighed at one time. Gross weights, as with axle weights, are determined separately for vehicles empty of payload and with payload.

Because the number of vehicles weighed in any one axle configuration type, at any station, and on any road system is variable and an uncontrolled number quantitatively, it is common practice to express the weight distribution in terms of a percentage frequency for each weight interval of 1, 2, or 5 kips. The 100 percent base is the total number of vehicles weighed (or axles weighed) in the particular category being studied. These interval percentages may be summed from the lightest weight interval to the heaviest interval to produce an accumulative distribution in percentage of the total number of vehicles weighed that weighed a given number of pounds or less than that given poundage. Figure 4 gives plotted curves of the gross weight for vehicle type codes 220 and 332.

The curves of Figure 4 show undesirable irregularities resulting from an inadequate number of vehicles weighed. In the use of such curves, it is good practice to smooth them to the more probable regression, so that the computed frequencies and the computed average gross weight can be freed somewhat of sample errors. Such procedure is important to the subsequent calculation of the average empty gross weight and the average loaded gross weight, on which two averages the average payload per loaded vehicle depends.

To smooth the distribution curve for gross weight (or axle weight) the procedure may be about as follows (68):

1. Plot the accumulative percentage as shown in Figure 4. The accumulative percentage curve is used rather than the plot of the frequencies for the reason that the frequencies have a wider scatter, plus and minus, making it hard to locate the more probable trend.

2. By judgment, based upon experience with similar gross weight distributions of vehicles computed from adequate numbers of weighings, sketch through the plotted points a curve as shown by the dotted lines of vehicle type code 332 on Figure 4.

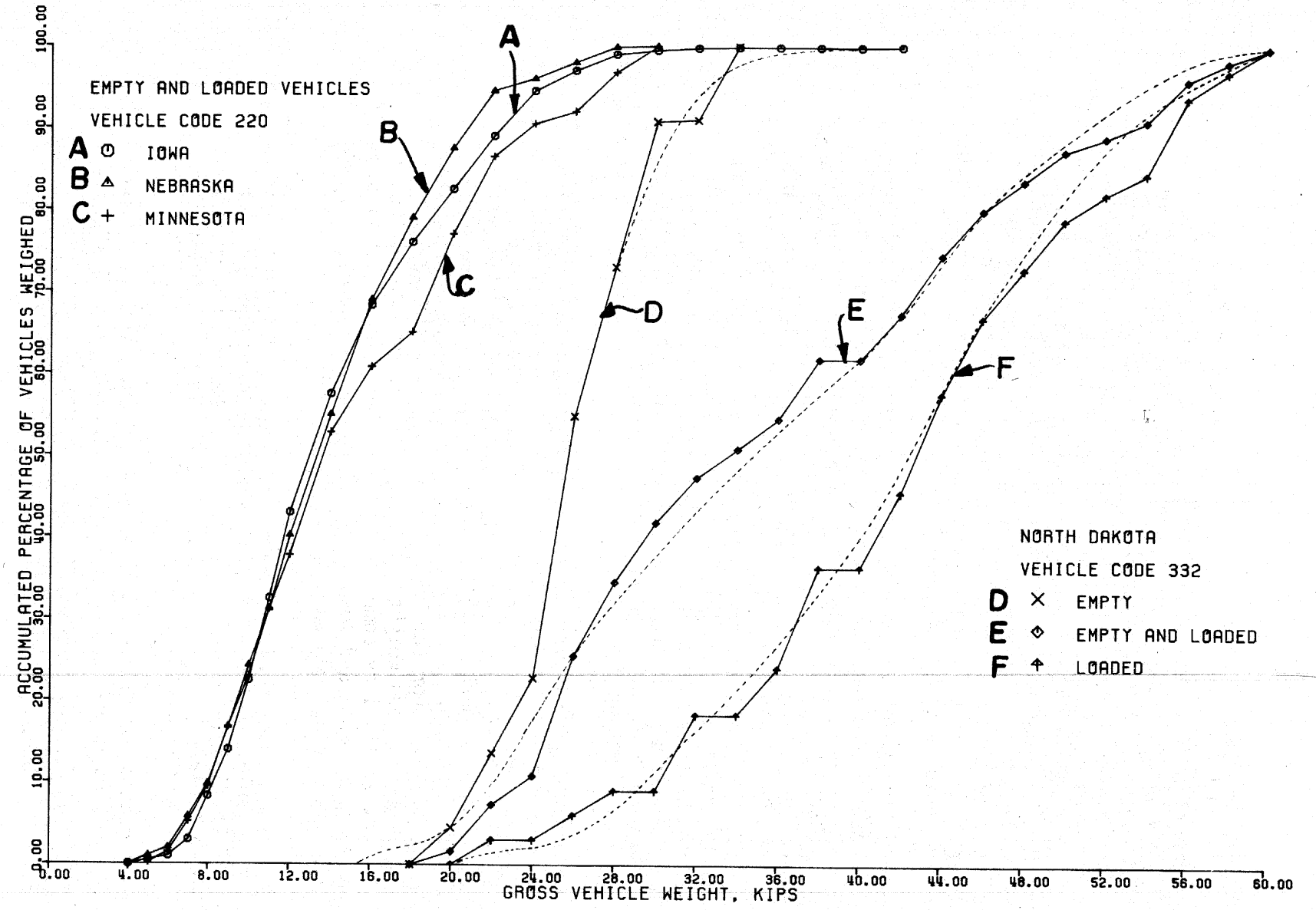


Figure 4. Accumulated percentage of gross weight frequencies for vehicles weighed on the Interstate, rural highway system. Vehicle type code 220 is for combined empty and loaded vehicles in Iowa, Minnesota, and Nebraska. Vehicle type code 332 is for empty, loaded, and combined vehicles in North Dakota. Roughness of the curves is a result of inadequate sample size.

This hand drawn smooth curve is located to represent by judgment the probable trend of the distribution if the data were total for the universe of which they are only a sample. There is no attempt to balance the plus and minus areas.

3. From the sketched in smooth curve, read back and record the percentages of the end of each 1-kip weight interval.

4. To further smooth the curve and to produce well-graduated frequencies, it is well to make successive subtractions from the accumulated percentages read, and then plot and smooth the frequencies in order to eliminate the inaccuracies resulting from reading the plotted summation curve to tenths or hundredths of a percent.

A statistically-minded person may object to the above eye and hand procedure, preferring instead to use some sophisticated mathematical process of curve fitting for which he has a computer program available. There is no objection to the use of mathematical curve fitting procedures when the basic raw data will define the regression. However, many raw observations are so rough that the mathematical procedure cannot be relied upon to produce the most probable distribution. In such cases, the hand judgment graduation is recommended. The hand smoothing may be then followed with mathematical graduation if desired. It should be noted that the traffic count data and the truck weight data are not from random sampling and the distributions are not statistically normal.

In Figure 4 the code 220 curves for combined empty and loaded gross weights show no marked difference between the States of Iowa, Nebraska, and Minnesota. The Iowa curve is the more stable because of the larger sample. For the North Dakota code 332 vehicle, the curve for the empty gross weight shows the usual steepness because the range of weight is small as compared to loaded vehicles. The middle curve for combined empty and loaded vehicles shows the characteristic bimodal distribution introduced when the short-range empty vehicle curve is combined with the long-range loaded curve.

The Iowa curves in Figure 5 for gross weights of the code 332 vehicle on the Interstate rural system are typical of the characteristics for the code 332 vehicle. These curves were computed from an adequate sample of weighings and are thus quite smooth in trend. Of special interest is the steepness of the curve for empty weight plus its long stretched-out ending, 40 kips to 62 kips. The right-hand curve for vehicles with load has a steep rise from about 68 kips to the end at 77 kips. This steepness is a characteristic of loadings that results from trucking practices to load to the legal limit, without much overloading. The middle curve for combined empty and

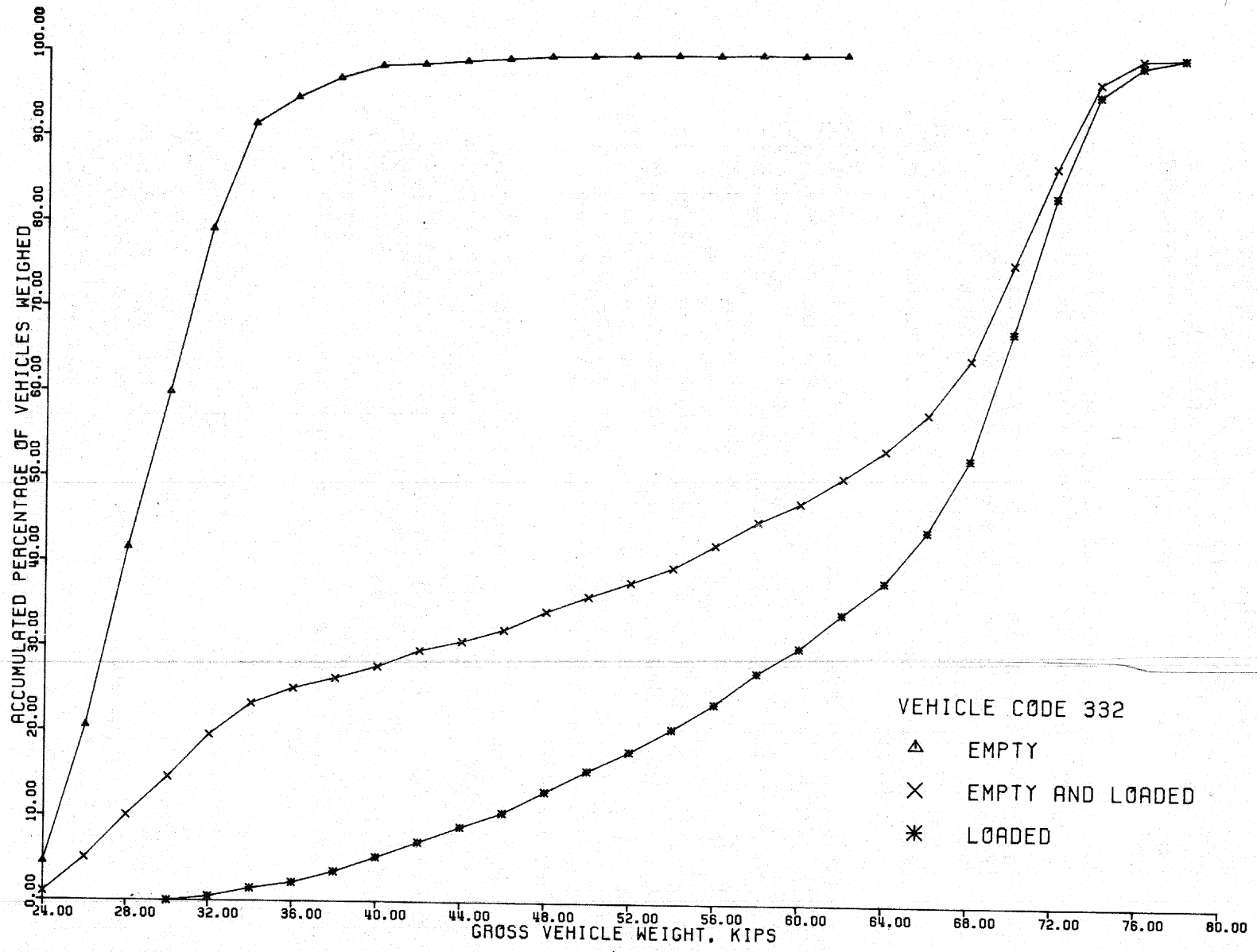


Figure 5. Accumulated percentage of gross weight frequencies for vehicle type code 332 weighed empty, loaded, and combined for the Iowa Interstate, rural highway system for 1971.

loaded vehicles has a distinct break in slope at 34 kips, the weight at which the empty vehicles cease their influence on the combined curve and the influence of the loaded vehicles takes over. It is noted that none of these curves has a normal, or symmetrical, distribution.

Figure 6 compares the gross weight distributions for six vehicle codes on the basis of combined empty and loaded gross weight for the Other FA primary rural system in Iowa for 1971. Each type code has its own characteristic shape of curve, partially, of course, attributed to the effect of the range of gross weight as the gross weight increases.

In Figure 7 there is a comparison of the gross weight distribution for code 332 loaded vehicles in the West North Central census division for the Interstate rural, Other FA primary rural, and Other FA primary urban systems. On the Interstate system, code 332 vehicles have fewer vehicles at the light loads and more vehicles at the heavy loads than is found on the Other FA primary urban system. The Other FA primary rural system falls in between these two loadings. All three systems have the steepness of curves from about 66 kips to 74 kips. The maximum legal gross vehicle weight in the States in the West North Central census division is variable above 73,280 pounds. The percentage of vehicles having gross weights above 74,000 pounds is: Interstate, 2.5 percent; Other FA primary rural, 10.5 percent; and Other FA primary urban, 16.5 percent.

AXLE WEIGHT DISTRIBUTION

Axle weight distribution is a more critical determination than is gross weight distribution because its uses in engineering and in enforcement of legal limits are more specific. Of special concern is the use of the equivalent axles of 18,000 pounds load application to the pavement, the equivalency factors increase exponentially as the axle weight increases. Further, the equivalent number of 18-kip axles must be determined from distribution curves of axle weight for both single and tandem axles. Likewise, in structural design, it is axle weight and axle spacing that are critical, more so than the gross vehicle weight.

The basic tables give for the U.S. total the accumulated percentages of axle weights for empty, loaded, and combined empty and loaded vehicles in weight increments of 1,000 and 2,000 pounds. From the accumulated percentages, the interval frequency may be determined. In pavement design, when using the equivalent 18-kip axle concept, it is required to have the axle weight distribution such as is available in these tables. The distribution by State is more applicable to pavement design, than these distributions by U.S. totals.

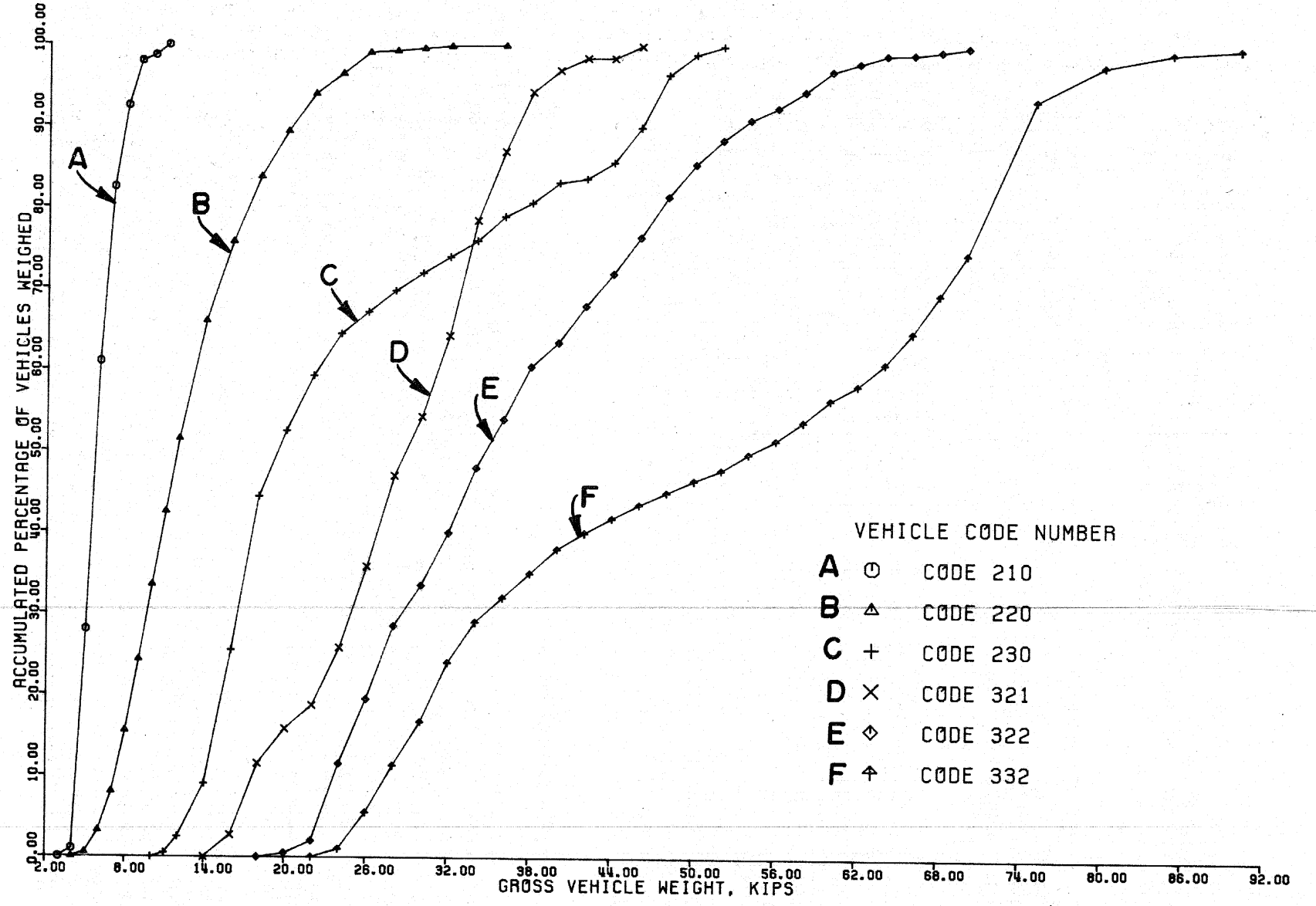


Figure 6. Accumulated gross weight percentage distribution of combined empty and loaded gross weight for vehicle type codes 210, 220, 230, 321, 322, and 332 for the Other FA primary, rural highway system in Iowa for 1971.

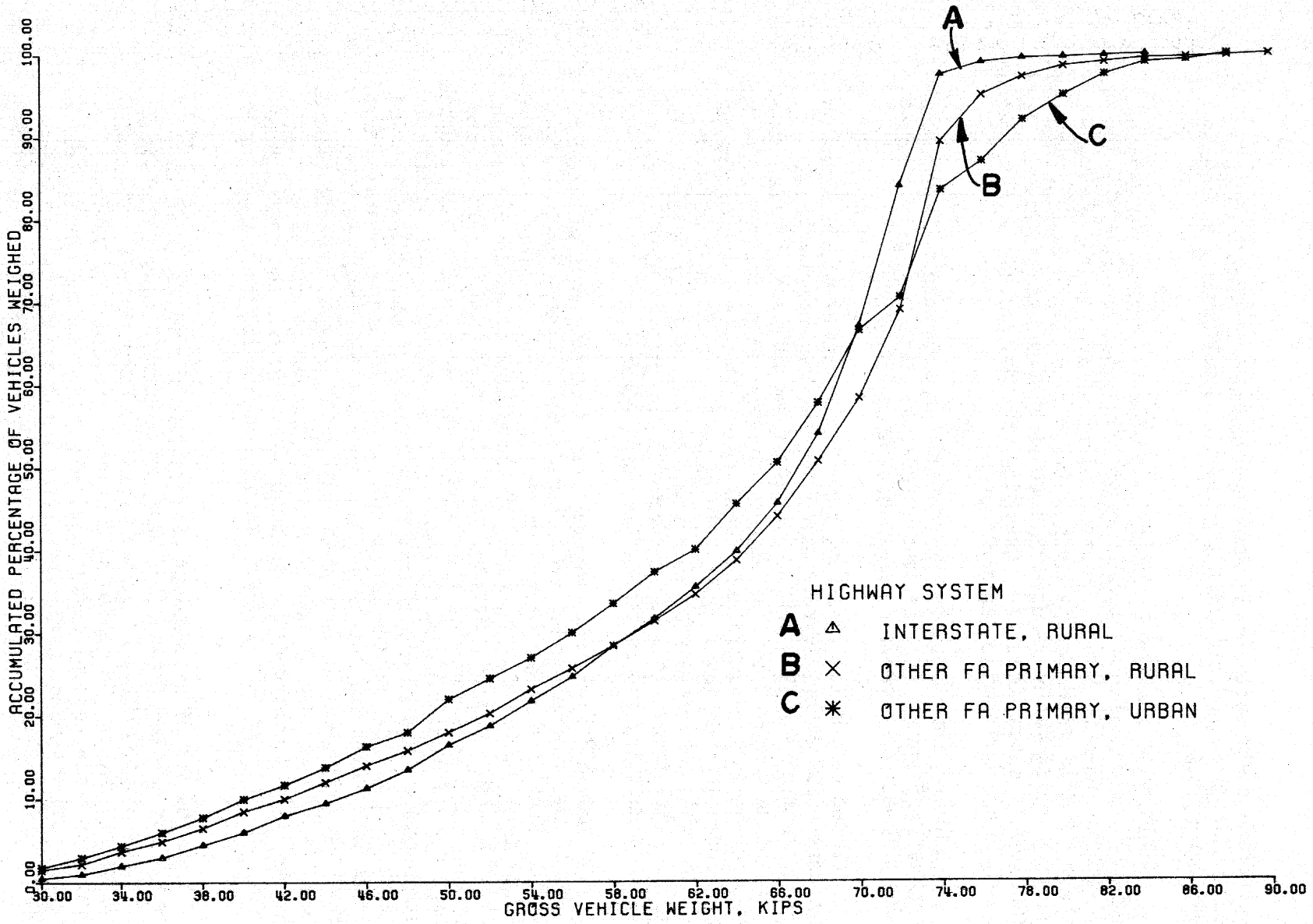


Figure 7. Accumulated percentage of gross weight frequencies for vehicle type code 332 loaded vehicles weighed in the West North Central census division on the Interstate rural and Other FA primary rural and urban highway systems for 1971.

Such State distribution by highway system by each vehicle type is available, of course, at the State highway departments and FHWA at Washington, D.C.

Seldom will the field data on axle weights produce the desired degree of smoothness of the axle weight distribution, even for 300 to 500 axles. When the spread from the lightest axle to the heaviest axle for loaded vehicles may range over 40 to 60 1-kip weight intervals, the frequencies may be reduced to 9 to 15 vehicles per interval. Some smoothing is often necessary, depending upon how precise a distribution is needed for any particular application.

A plot of the cumulative percentages of axle weight frequencies is given in Figure 8 for the Iowa Interstate rural system for vehicle codes 220 and 332, combined empty and loaded vehicles.

The two curves for code 220, curve A for the front, or steering axle, and curve B for the rear axle, or main load-bearing axle, illustrate that for this vehicle the steering axle has a narrow range of weight as compared to the range of the rear axle. This vehicle in Iowa with an 18-kip single axle legal limit, shows only 2 percent of axles exceeding the legal limit. In some States the rear axle overload for this vehicle may be 20 percent of the vehicles weighed. The 220, six-tire truck, is a popular vehicle for general hauling in local communities, but is also a line-haul vehicle.

The code 332 vehicle in Figure 8 has a narrow limit of range of weight of the steering axle, from about 5 to 12 kips. The steering axle for this five-axle tractor semitrailer is not regarded as a load-bearing axle, but it does receive some live load transmitted through the fifth wheel (coupling device) above the rear tandem axles of the tractor. Of significance is the shape of the axle weight distribution curves for the two pairs of tandem axles, BC and DE. This bimodal distribution is the result of combining the empty and loaded vehicles. From about 4 to 12 kips the curves are mostly for empty vehicles, but from 12 to 36 kips the curves are for vehicles with payload. The steep rise in the curves from 28 to 32 kips is a result of the efforts of the haulers to load as nearly to the legal maximum of 32 kips as they can without overloading. As might be expected, the tandem axle pair on the trailer, DE, is more heavily loaded that the tandem pair on the tractor, BC.

A second set of axle weight distribution curves is given in Figure 9 for the New England and West North Central census divisions and Interstate and Other FA primary rural highway systems. The comparisons are for the DE tandem axle pair on the code 332 vehicle. In the West North Central census division, this tractor semitrailer is more heavily loaded on the Interstate rural system than on the Other FA primary rural system. This tandem is overloaded on 6 percent

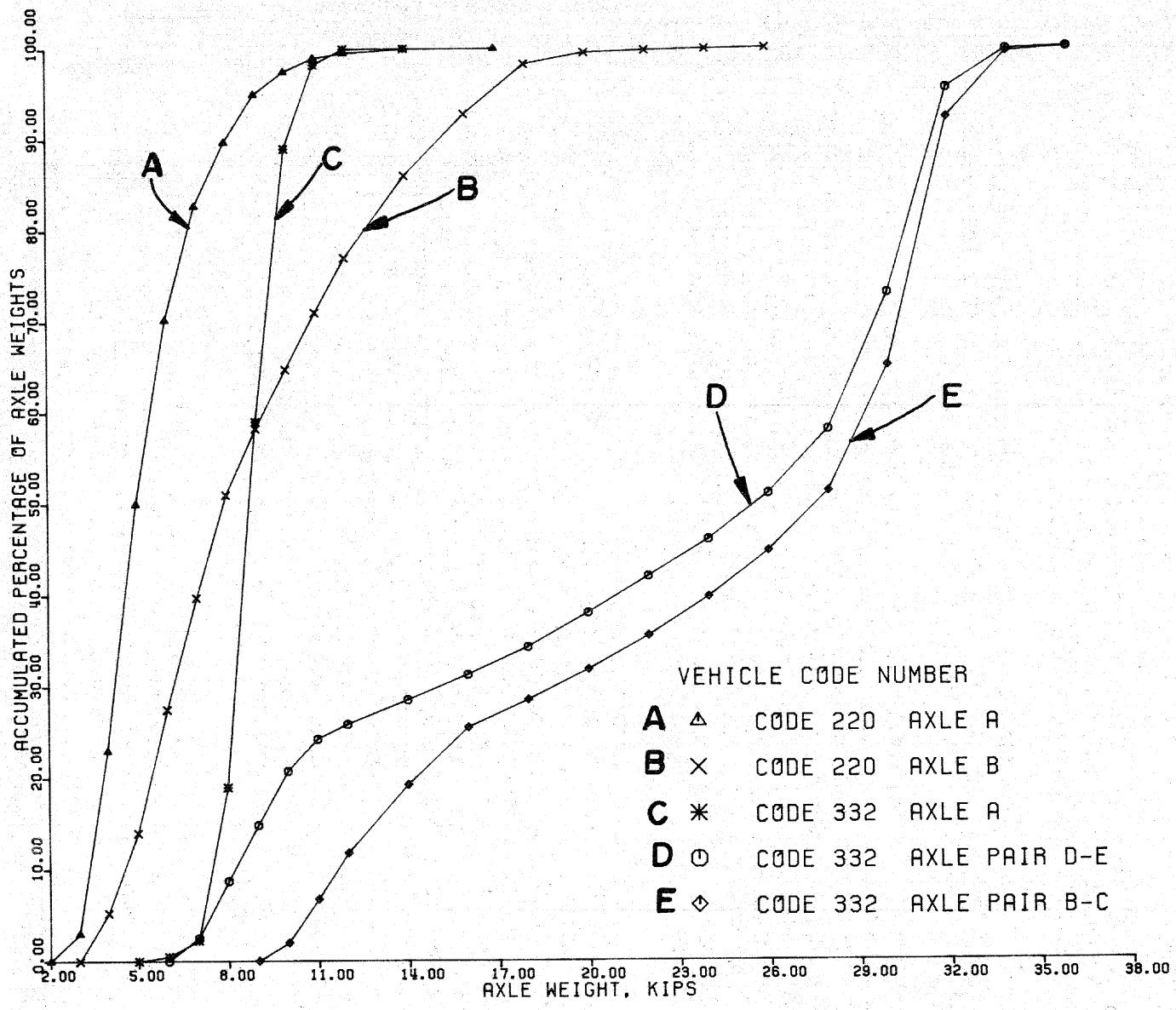


Figure 8. Accumulated percentage of axle weight for vehicle type codes 220 and 332, combined empty and loaded, on the Interstate, rural highway system in Iowa.

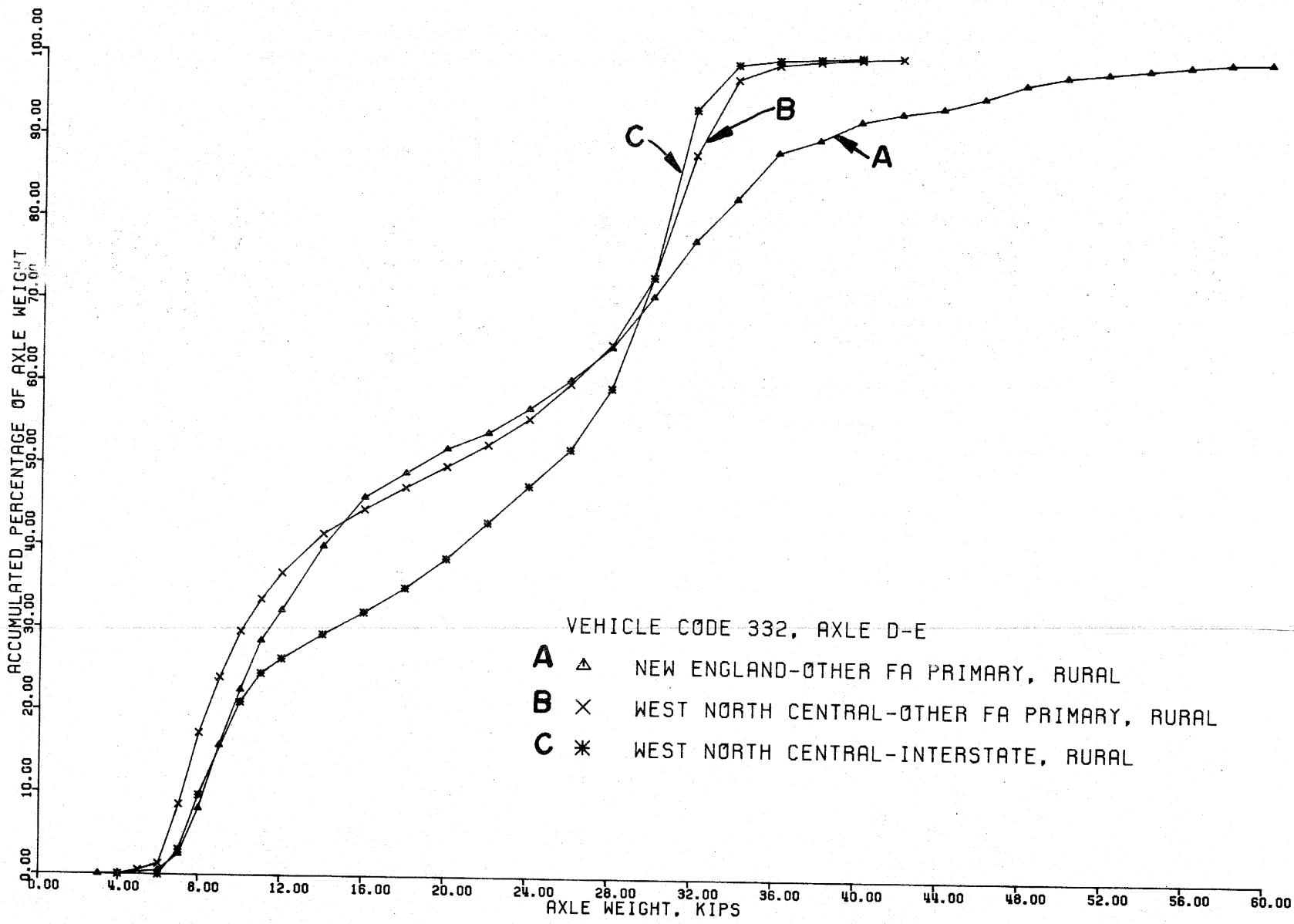


Figure 9. Tandem pair D-E axle weight accumulated percentage by weight intervals for vehicle type code 332, combined empty and loaded, for New England and West North Central census divisions for selected highway systems.

of the vehicles on the Interstate rural system and 12 percent overloaded on the Other FA primary rural system in the West North Central census division.

In the New England census division the distribution of the weights of the DE tandem pair are about the same as in the West North Central census division up to a weight of 30 kips. Upwards of 30 kips, the New England vehicles continue upward to a maximum of 60 kips. The States in the New England census division have a legal maximum limit for weight on a tandem pair of 36 kips, with Connecticut having an enforcement tolerance of 720 pounds. On the basis of 36 kips maximum limit, 12 percent of the DE axles on the code 332 vehicles were overloaded in the New England census division on the Other FA primary rural system.

PRACTICAL MAXIMUM GROSS WEIGHT (PMGW)

The legal maximum gross-weight weight limits in the several States usually apply to overall limits regardless of vehicle design or axle configuration and to the weight on both wheels (ends) of an axle. Exceptions include limits set on the basis of the so-called bridge formula, in which the axle spacing is involved. Axles closer than about eight feet center to center, called tandem axles, usually have a legal maximum limit of less than twice the legal limit on a single axle, as, for example, a limit on a tandem pair of axles of 36,000 pounds when the single axle limit is 22,400 pounds.

The single front or steering axle, in practice is seldem loaded up to legal limit and usually carries less weight than any single axle elsewhere on a loaded vehicle. The legal limit on the steering axle is practically always the same as for any load-bearing single axle, though for reasons of safety in driving, the steering axle has been considered for a limitation, say of about 10,000 pounds. Arkansas has a legal limit of 12,000 pounds on the steering axle.

Since it is not practical to load the steering axle to the full legal limit as done with other single axles, the practical gross and legal limit of capacity of a vehicle is not obtained by adding up the legal limits of all axles. Therefore, the expression "practical maximum gross weight" (PMGW) has come into use as a means of expressing the maximum gross vehicle weight of vehicles considering both the legal axle weight limits and a practical limit for the steering axle. This PMGW is always less than the sum of the individual axle legal limits. For instance, the PMGW of the 332 tractor semitrailer combination could be the sum of 10,000 pounds for the steering axle, and 32,000 pounds for each of the two pairs of tandem axles, assuming the legal limit of 32,000 pounds for a tandem pair. This sum is 74,000 pounds.

For the 322 combination the PMGW might be (assuming 18,000 and 32,000 pounds as the legal limits) 9,000, plus 18,000, plus 32,000 or a total of 59,000 pounds.

This system of arriving at a practical maximum gross vehicle weight calls for some system of determining a practical limit for the steering axle. In the beginning of the use of the PMGW, the front axle weight was often chosen on the basis of what was found to be the average front axle weight for each type of truck, or what manufacturers of trucks and tractors recommended as a normal maximum. Using the average steering axle weight found in the truck weight studies fails to recognize that the front axle will absorb some of the total weight as the vehicle payload increases from being empty to being loaded to legal limit on all load-carrying axles. Under this condition of maximum loading the front axle will be carrying a greater weight than the average of all front axles on the highway. It is logical then to set the practical maximum weight on the front axle at that weight normally carried by it when the vehicle is loaded to legal limit on all other axles.

From the 1971 truck weight data for the U.S. total, the curves in Figures 10, 11, and 12 were plotted to show the weight of the front axle in relation to the overall gross weight of vehicles with load. In Figure 10 there is essentially a linear increase in the weight on the front axle with an increase in total gross weight. This linearity comes from the fact that the codes 200, 210, and 220 are vehicles each having two single axles, so at all loadings the front axle carries about the same proportion of weight.

In Figure 11, the code 230 truck with a single (front) axle and a pair of tandem axles, also produces linear relationship of front axle weight to total vehicle gross weight of loaded vehicles. The 321, tractor semitrailer vehicle produce curved relationship that tends toward flatness between 34 and 72 kips. At a total gross laden weight of 60 kips, each of these two vehicle types would have a front axle weight of 9 kips.

In Figure 12, the two vehicle types that are composed of two cargo-carrying units, codes 432 and 5212, produce curves similar to those for the tractor semitrailer class of only one cargo unit. The 5212 code has a flat section between a gross weight of 52 and 72 kips. Both of these curves in Figure 12 exhibit increasing front axle weights from about 72 kips gross and upward.

Table 19 gives the PMGW for seven vehicle code numbers at two sets of legal maximum axle weights, 18/32 kips and 22/36 kips, single/tandem axles. In constructing the table, the legal axle weights were written into the respective axle cells of Table 19, and then trail readings were made from Figures 10, 11, and 12, until that front axle weight

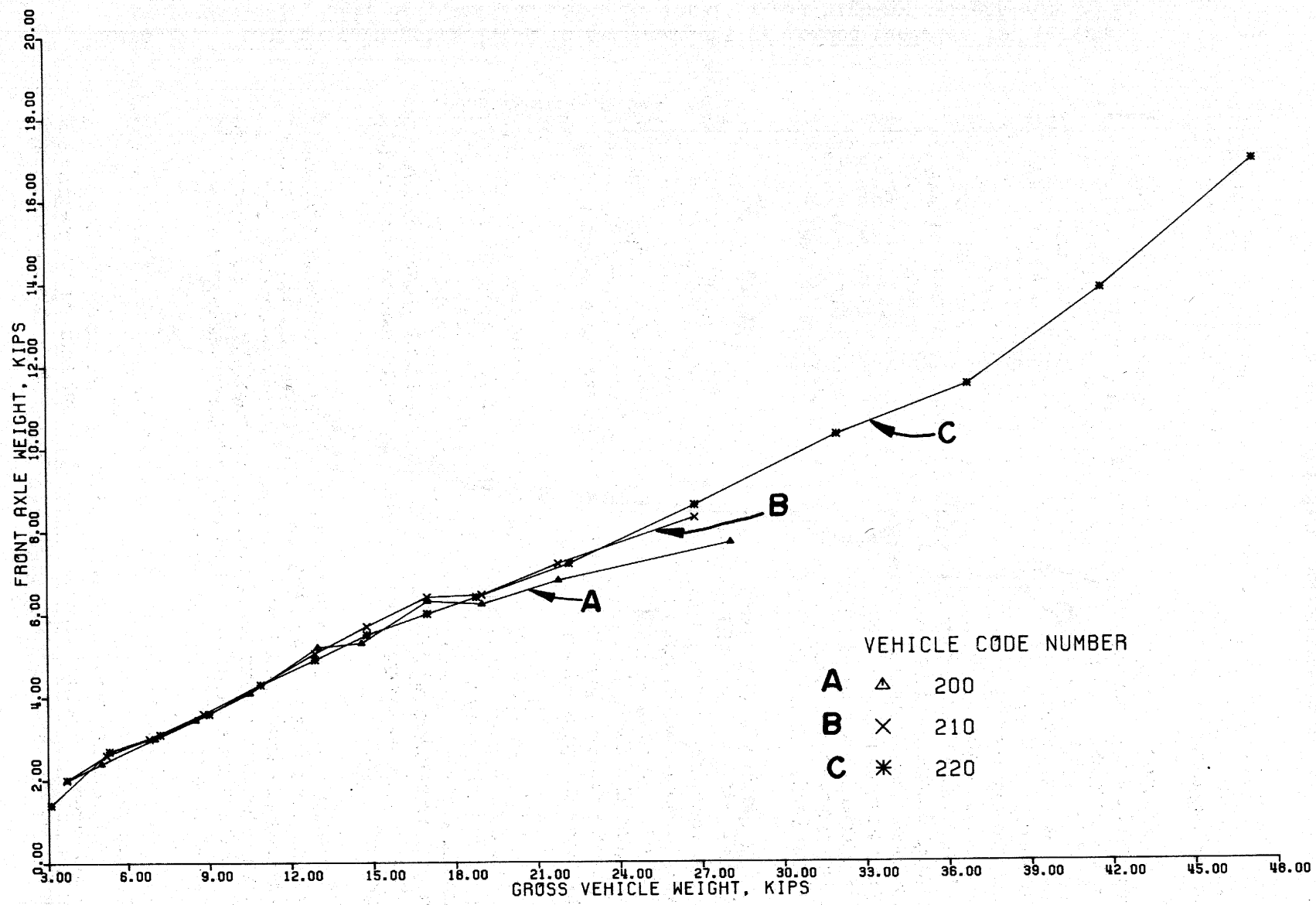


Figure 10. Front axle weight related to gross weight of loaded vehicles for vehicle type codes 200, 210, and 220 for U.S. total of all highway systems for 1971.

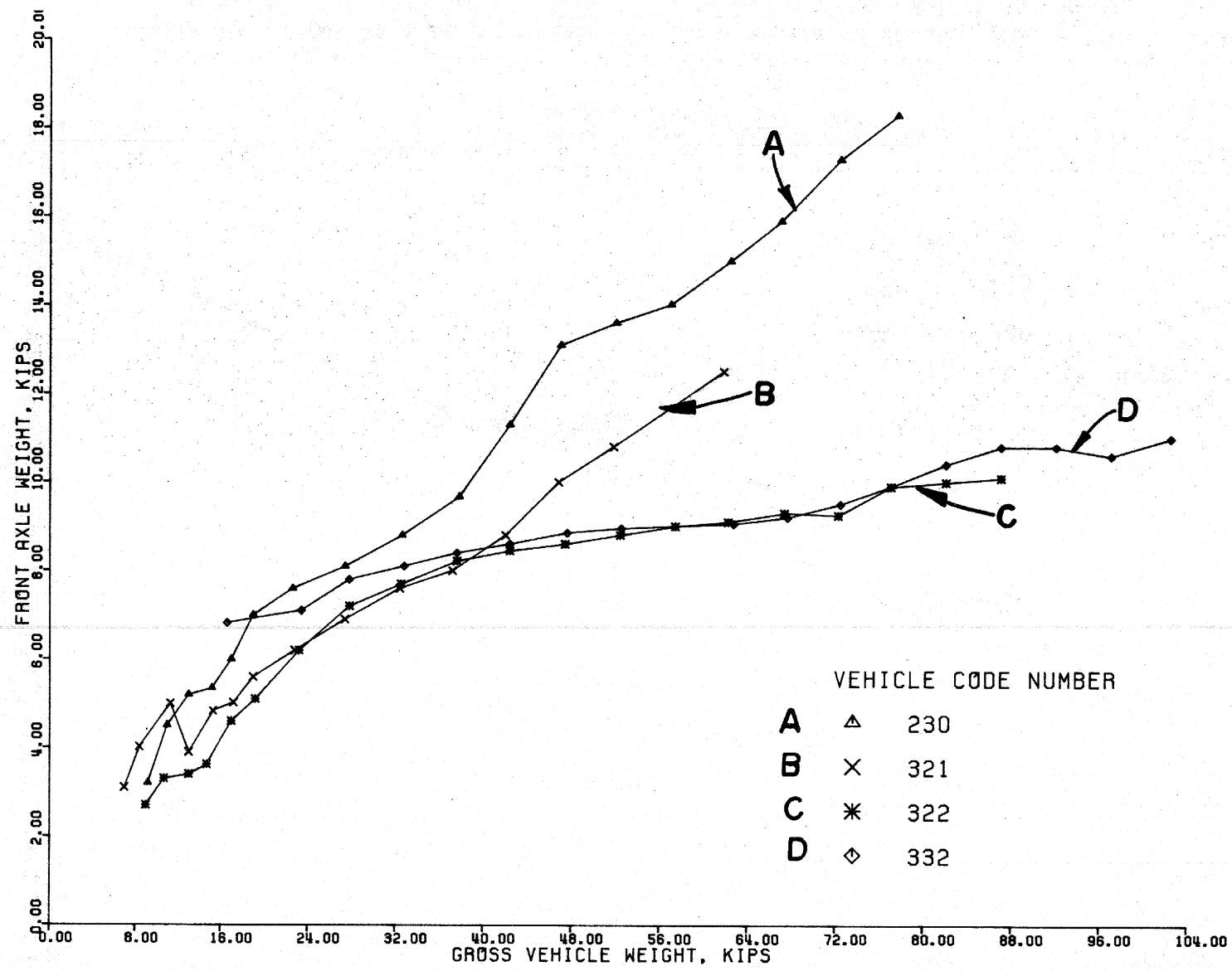


Figure 11. Front axle weight related to gross weight of loaded vehicles for vehicle type codes 230, 321, 322, and 332 for U.S. total of all highway systems for 1971.

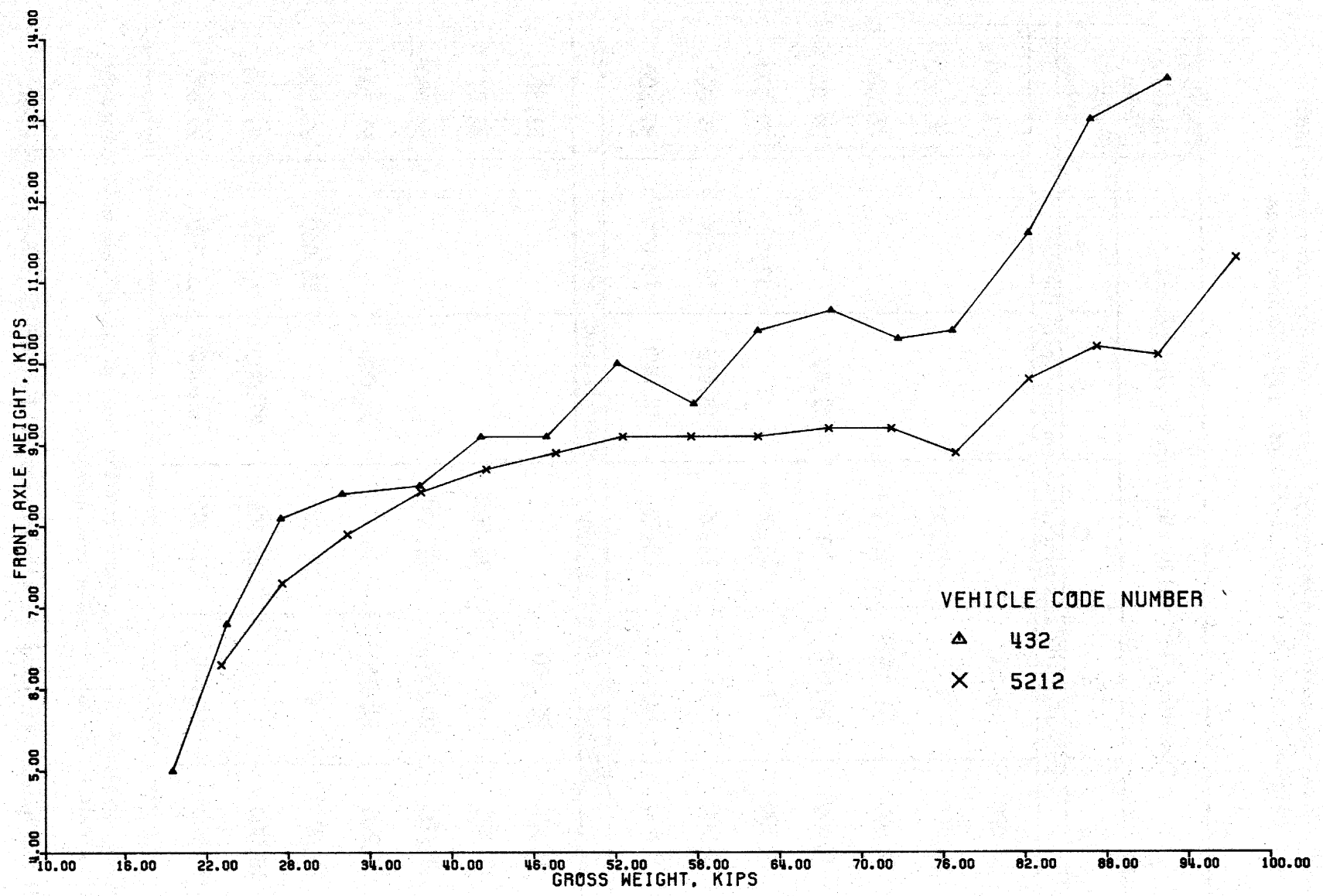


Figure 12. Front axle weight related to gross weight of loaded vehicles for vehicle type codes 432 and 5212 for U.S. total of all highway systems for 1971.

Table 19. Practical maximum gross weight of seven vehicle code types at legal axle weights of 18/32 and 22/36 kips, single/tandem axles

Vehicle Code Number	Specific Axle[a] and Its Maximum Weight, Pounds					Practical Maximum Gross Weight, Pounds
	A	B	C	D	E	
Basis of 18/32 kips single/tandem axle legal limits						
220	8,500	18,000				26,500
230	11,000	T	32,000			43,000
321	9,600	18,000	18,000			45,600
322	9,000	18,000	T	32,000		59,000
332	9,500	T	32,000	T	32,000	73,500
432	11,000	T	32,000	18,000	18,000	79,000
5212	9,500	18,000	18,000	18,000	18,000	81,500
Basis of 22/36 kips single/tandem axle legal limits						
220	10,500	22,000				32,500
230	12,000	T	36,000			48,000
321	11,500	22,000	22,000			55,500
322	9,200	22,000	T	36,000		67,200
332	10,500	T	36,000	T	36,000	82,500
432	13,000	T	36,000	22,000	22,000	93,000
5212	11,000	22,000	22,000	22,000	22,000	99,000

[a]Axles are lettered A, B, C, D, and E from the front (steering) axle as A toward the rear to the last axle in the total truck or combination.

T is for first axle of a tandem pair of which the total weight is in the next column.

was found that subtracted from the corresponding total gross weight gave a difference equal to the sum of the legal axle weights for axles B, C, D, and E.

The PMGW of the 200 and the 210 light trucks would have to be determined on the basis of manufacturers specifications and tire size and quality, because these two classes of trucks are never (never should be, at least) loaded heavily enough to approach the legal single axle legal weight limit. The 220 truck, with its dual rear tires, is capable of and does carry the single axle weight limit on its rear axle, so its PMGW could be determined as illustrated.

Table 20 relates the empty weight, average payload weight for the 1971 Other FA primary rural system, and the PMGW for legal limits of 18/32 kips. The maximum payload, of course, is higher for the 18/32 kip limits than the payload found from the field data for the reason that vehicles on the highway do not all carry maximum legal gross weights. The ratios of the payload weight to the empty weight ranks the vehicle types in the following order from high to low potential efficiency: 432, 220, 5312, 332, 230, 322, and 321. As shown in Table 20, their on-the-road operating efficiency is in the following order, high to low: 432, 332, 230, 5212, 220 and 321. As pointed out in the prior section on payload, the three-axle, tractor semi-trailer code 321, does not operate totally on a weight basis because of hauling light density commodities. It is often on the highway fully loaded on cubage space, but under loaded on axle weight.

TREND OVER YEARS OF TRUCK WEIGHTS AND TRAFFIC COUNTS

One of the objectives of the truck weighing has been to collect the annual vehicle weights and counts in such a manner that a good indication of yearly trends in truck weights and their numbers by class would be obtained. To accomplish this, it has been the practice generally to count at the same stations, same hours, same weeks, and same months, year to year. This plan has had merits, but with the extensive construction of new highways on the Interstate system and major improvement of the other systems, the traffic flow on many routes and sections of routes has undergone material change in both volume and classification of vehicles. These changes include both increases and decreases not attributable to normal changes in economic factors and technological changes in the transportation industry. Some changes in trucking year to year on these particular routes and at specific truck-weighing stations are the result of rerouting of the traffic to take advantage of benefits of the newer highway designs and improved traffic capacities.

Table 20. Ratio of average payload weight per loaded vehicle to average empty weight by vehicle code number

Vehicle Code Number	Basis: 1971 Road Weight data, U.S. Total for the Other FA Primary Rural Highway System			Basis: 18/32 Kip Axle Weight Limits		
	Average Empty Weight, Pounds	Average Payload, Pounds	Ratio: Payload/ Empty Weight	Practical Maximum Gross Weight, Pounds	Maximum Payload, Pounds	Ratio: Payload Empty Weight
220	10,247	5,508	0.54	26,500	16,201	1.57
230	18,946	19,405	1.02	43,000	23,996	1.26
321	21,805	8,958	0.41	45,600	23,795	1.09
322	25,598	19,693	0.77	59,000	33,404	1.31
332	29,982	32,406	1.08	73,500	43,579	1.46
432	29,484	40,295	1.37	79,000	49,613	1.69
5212	32,236	31,586	0.98	81,500	49,306	1.53

One intent of the traffic weighing operations since about 1956, the beginning of the intense program to complete the Interstate system, has been to account for the shifting of traffic, route to route, as distinguished from changes year to year in traffic volume and in vehicle classification for reasons other than the improvement of highway facilities. But how successfully this intent has been achieved is not disclosed by analysis of the data. Emphasis in the selection of truck-weighing stations should be placed on getting a good representation of the truck count and weights on each functional highway system as a whole, and not be concerned as to showing the year to year trends at specific weighing stations. The trend could still be determined, year to year, with good total counts and weights on each system as a whole.

TREND IN DAILY TRAFFIC COUNTS

Tables 21, 22, and 23 for the U.S. total give the average daily count and percentage of total count of vehicles by type codes for the years 1966 to 1972 for the Interstate rural, Other FA primary rural, and Other FA primary urban systems.

The variations in the average daily traffic count year to year may be due to poor sampling of stations with respect to total highway system and the day to day differences in traffic flow. Also, a few States (say three to six) may not have counted for a full 24-hour day in some years. Of the 50 States, the District of Columbia, Puerto Rico, and perhaps a State or two did not count, or may have counted trucks, but not automobiles and buses. Many States did not count on the Interstate urban and Other FA primary urban systems. There is a variation year to year in the number of State station locations on the Interstate system because of continuous highway construction. Further, during the years 1966 to 1972, traffic as a whole was shifting its routing year to year as new sections were opened on the Interstate system and improvements to the Other FA primary rural and urban systems were completed. The counts also differ State to State because not all code types found in the tables are legal in every State.

With the exception of the trends for the codes 220, 321, and 322, Table 24 does not show any significant trends between 1966, 1969, and 1972 for the U.S. average for the Other FA primary rural system.

TREND IN VEHICLE WEIGHTS

For each year 1966 to 1972 Table 25 gives the U.S. total average axle weight and average gross weight for empty, loaded, and combined for nine vehicle type codes on the Other FA primary rural system.

Table 21. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Interstate rural highway system

Vehicle code number	1966		1967		1968		1969		1970		1971		1972	
	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent
071	4,072	42.77	4,387	44.22	4,785	42.57	7,949	44.89	9,179	45.48	8,455	42.82	8,940	42.01
061	242	2.54	252	2.54	491	4.36	545	3.08	633	3.13	659	3.34	1,110	5.21
072	3,056	32.10	3,003	30.27	3,054	27.17	4,640	26.21	5,139	25.46	5,099	25.82	5,014	23.56
062	171	1.80	164	1.66	522	4.65	263	1.49	334	1.66	391	1.98	768	3.61
Subtotal	7,541	79.21	7,806	78.69	8,852	78.76	13,398	75.67	15,285	75.73	14,603	73.96	15,832	74.40
030	10	0.11	10	0.10	13	0.12	20	0.11	38	0.19	47	0.24	58	0.27
150	39	0.41	39	0.40	38	0.34	104	0.59	89	0.44	58	0.29	67	0.32
180	5	0.05	6	0.06	6	0.06	12	0.07	15	0.07	14	0.07	14	0.07
Subtotal	54	0.57	55	0.56	58	0.51	136	0.77	141	0.70	119	0.60	139	0.66
200	471	4.95	533	5.37	660	5.87	1,150	6.50	1,442	7.14	1,582	8.01	1,765	8.29
210	56	0.59	57	0.58	76	0.68	73	0.41	78	0.39	96	0.49	92	0.43
220	257	2.70	263	2.65	274	2.43	467	2.64	546	2.70	555	2.81	569	2.67
230	45	0.47	48	0.48	52	0.47	110	0.62	92	0.46	101	0.51	101	0.47
240	x	0.00	x	0.00	x	0.00	3	0.02	4	0.02	5	0.02	5	0.02
Subtotal	829	8.71	901	9.08	1,062	9.45	1,804	10.19	2,162	10.71	2,338	11.84	2,531	11.89
321	103	1.08	95	0.96	93	0.82	159	0.90	155	0.77	145	0.73	135	0.64
322	343	3.60	324	3.27	305	2.72	520	2.94	503	2.49	450	2.28	431	2.03
323	x	0.00	x	0.00	x	0.00	17	0.10	16	0.08	13	0.06	14	0.07
331	x	0.00	x	0.00	x	0.00	4	0.02	5	0.02	5	0.03	5	0.02
332	586	6.16	672	6.77	758	6.74	1,490	8.41	1,726	8.55	1,874	9.49	1,983	9.32
333	3	0.03	4	0.04	17	0.17	21	0.12	22	0.11	26	0.13	35	0.17
5211	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00
5212	27	0.29	28	0.28	49	0.43	87	0.49	94	0.47	84	0.42	92	0.43
5222	1	0.01	1	0.01	x	0.00	5	0.03	4	0.02	3	0.02	2	0.01
5312	1	0.01	1	0.01	8	0.07	6	0.03	6	0.03	8	0.04	8	0.04
5322	x	0.00	x	0.00	3	0.03	x	0.00	x	0.00	x	0.00	x	0.00
Others	7	0.07	5	0.05	2	0.01	17	0.10	17	0.08	17	0.08	24	0.11
Subtotal	1,071	11.25	1,130	11.39	1,235	10.99	2,327	13.14	2,547	12.62	2,625	13.29	2,730	12.83
421	1	0.01	2	0.02	1	0.01	2	0.01	4	0.02	4	0.02	4	0.02
422	6	0.06	5	0.05	7	0.06	6	0.03	5	0.03	7	0.03	8	0.04
423	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	1	0.00	1	0.00
431	x	0.00	1	0.01	x	0.00	1	0.01	1	0.01	2	0.01	1	0.00
432	13	0.14	12	0.12	22	0.20	31	0.18	34	0.17	34	0.17	33	0.15
433	1	0.01	1	0.01	1	0.01	1	0.00	1	0.00	10	0.05	1	0.01
Others	4	0.04	7	0.07	0	0.00	1	0.00	1	0.00	1	0.00	1	0.00
Subtotal	25	0.26	28	0.28	32	0.29	42	0.24	46	0.23	59	0.30	48	0.22
Average Total	9,520	100.00	9,920	100.00	11,240	100.00	17,706	100.00	20,182	100.00	19,744	100.00	21,280	100.00
Number of Stations	118		132		164		187		190		191		192	

Totals may not add to correct figure because of rounding.
x = Average of less than one vehicle per station.

Table 22. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Other FA primary rural highway system

Vehicle code number	1966		1967		1968		1969		1970		1971		1972	
	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent
071	4,062	53.06	4,613	54.33	4,430	55.63	5,990	54.53	6,537	56.56	5,634	56.15	6,364	54.46
061	219	2.86	290	3.42	231	2.91	320	2.91	474	4.10	430	4.29	755	6.46
072	1,428	18.65	1,440	16.96	1,517	19.05	1,839	16.74	1,617	13.99	1,276	12.72	1,586	13.57
062	68	0.88	94	1.10	75	0.95	100	0.91	357	3.09	115	1.15	152	1.30
Subtotal	5,777	75.45	6,437	75.82	6,253	78.53	8,249	75.10	8,986	77.75	7,456	74.30	8,857	75.79
030	19	0.25	20	0.24	15	0.18	23	0.21	31	0.27	33	0.33	44	0.38
150	27	0.35	25	0.29	21	0.27	61	0.56	32	0.28	26	0.26	25	0.22
180	6	0.08	7	0.09	7	0.08	19	0.17	20	0.17	17	0.17	16	0.14
Subtotal	52	0.68	53	0.62	43	0.54	103	0.94	83	0.72	75	0.75	85	0.73
200	696	9.08	822	9.69	702	8.81	1,069	9.73	1,137	9.84	1,172	11.68	1,391	11.90
210	51	0.67	58	0.68	59	0.74	218	1.98	80	0.70	87	0.87	70	0.60
220	284	3.71	296	3.48	253	3.18	374	3.40	348	3.01	347	3.46	389	3.32
230	59	0.76	60	0.71	63	0.79	81	0.74	80	0.69	79	0.79	89	0.76
240	1	0.01	1	0.01	1	0.01	3	0.03	3	0.03	5	0.05	6	0.05
Subtotal	1,090	14.24	1,237	14.57	1,078	13.54	1,745	15.89	1,649	14.27	1,690	16.84	1,945	16.64
321	63	0.82	57	0.67	48	0.60	62	0.56	56	0.48	49	0.49	43	0.37
322	199	2.61	174	2.04	169	2.13	230	2.09	202	1.74	177	1.76	150	1.28
323	x	0.00	x	0.00	x	0.00	5	0.05	5	0.04	5	0.05	6	0.05
331	2	0.03	1	0.02	x	0.00	2	0.02	4	0.03	1	0.01	1	0.01
332	336	4.39	374	4.41	339	4.26	543	4.94	533	4.61	547	5.45	554	4.74
333	x	0.00	1	0.01	4	0.05	3	0.03	4	0.33	4	0.04	5	0.04
5211	x	0.00	0	0.00	0	0.00	x	0.00	x	0.00	x	0.00	x	0.00
5212	86	1.12	101	1.19	11	0.13	22	0.20	18	0.16	12	0.12	14	0.12
5222	1	0.01	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00
5312	1	0.01	2	0.02	2	0.02	2	0.02	1	0.01	2	0.02	2	0.02
5322	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00
Others	1	0.01	2	0.02	2	0.02	1	0.01	1	0.01	1	0.01	1	0.01
Subtotal	690	9.01	713	8.39	574	7.21	870	7.92	824	7.13	799	7.96	777	6.65
421	1	0.01	1	0.01	2	0.03	2	0.02	2	0.02	2	0.02	3	0.02
422	5	0.06	5	0.06	4	0.05	3	0.03	2	0.02	2	0.02	4	0.03
423	x	0.00	x	0.00	x	0.00	1	0.01	x	0.00	x	0.00	x	0.00
431	x	0.00	x	0.00	x	0.00	1	0.01	1	0.01	1	0.01	1	0.01
432	40	0.52	41	0.49	8	0.10	11	0.09	11	0.09	9	0.09	12	0.10
433	1	0.02	1	0.02	x	0.00	0	0.00	x	0.00	1	0.01	2	0.02
Others	1	0.02	2	0.02	0	0.00	0	0.00	x	0.00	x	0.00	x	0.00
Subtotal	48	0.63	51	0.60	15	0.18	17	0.15	16	0.14	14	0.14	22	0.19
Average Total	7,657	100.00	8,491	100.00	7,963	100.00	10,984	100.00	11,558	100.00	10,034	100.00	11,686	100.00
Number of Stations	426		442		462		465		474		440		368	

Totals may not add to correct figure because of rounding.
x = Average of less than one vehicle per station.

Table 23. U.S. average daily count of vehicles per station, 1966 to 1972 by code type, for the Other FA primary urban highway system

Vehicle code number	1966		1967		1968		1969		1970		1971		1972	
	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent	Average daily count	Percent
071	24,382	70.27	22,330	69.25	12,694	67.92	18,403	66.57	17,591	65.42	16,570	62.99	16,761	59.80
061	2,403	6.93	2,293	7.11	1,106	5.92	1,502	5.43	1,704	6.34	1,744	6.63	2,369	8.45
072	2,198	6.33	2,108	6.54	1,618	8.66	2,203	7.97	2.396	8.91	2,530	9.62	2,742	9.78
062	207	0.60	236	0.73	143	0.77	530	1.92	571	2.12	658	2.50	1,015	3.62
Subtotal	29,190	84.13	26,967	83.63	15,562	83.26	22,638	81.88	22,262	82.79	21,502	81.74	22,888	81.66
030	114	0.33	101	0.31	53	0.29	79	0.29	105	0.39	120	0.46	121	0.43
150	186	0.54	145	0.45	64	0.34	98	0.35	103	0.38	92	0.35	134	0.48
180	23	0.07	18	0.06	10	0.05	22	0.08	20	0.08	24	0.09	26	0.09
Subtotal	323	0.93	263	0.82	127	0.68	198	0.72	228	0.85	236	0.90	282	1.01
200	2,647	7.63	2,501	7.76	1,474	7.89	2,381	8.61	2,489	9.26	2,606	9.91	2,811	10.03
210	309	0.89	294	0.91	235	1.26	151	0.55	193	0.72	142	0.54	173	0.62
220	1,029	2.97	932	2.89	567	3.03	763	2.76	756	2.81	757	2.88	756	2.70
230	137	0.40	130	0.40	96	0.51	124	0.45	126	0.47	135	0.51	139	0.50
240	1	0.00	x	0.00	1	0.00	2	0.01	4	0.02	8	0.03	5	0.02
Subtotal	4,122	11.88	3,857	11.96	2,372	12.69	3,420	12.37	3,568	13.27	3,647	13.87	3,884	13.86
321	178	0.51	155	0.48	78	0.42	94	0.34	88	0.33	83	0.31	88	0.31
322	270	0.78	257	0.80	223	1.19	271	0.98	257	0.95	257	0.98	255	0.91
323	x	0.00	x	0.00	x	0.00	4	0.02	4	0.02	5	0.02	4	0.01
331	7	0.02	6	0.02	x	0.00	1	0.00	2	0.01	2	0.01	2	0.01
332	348	1.00	397	1.23	283	1.52	964	3.49	409	1.52	467	1.78	508	1.81
333	1	0.00	1	0.00	3	0.01	2	0.00	2	0.01	4	0.02	14	0.05
5211	1	0.00	x	0.00	0	0.00	0	0.00	x	0.00	0	0.00	0	0.00
5212	171	0.49	233	0.72	18	0.10	29	0.11	26	0.10	89	0.34	85	0.30
5222	2	0.01	3	0.01	0	0.00	3	0.01	3	0.01	2	0.01	1	0.00
5312	x	0.00	1	0.00	2	0.01	1	0.00	x	0.00	1	0.00	1	0.00
5322	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00
Others	1	0.00	1	0.00	x	0.00	2	0.01	2	0.01	2	0.01	3	0.01
Subtotal	979	2.82	1,055	3.27	608	3.25	1,372	4.96	794	2.95	911	3.46	961	3.43
421	2	0.00	2	0.01	2	0.01	1	0.01	1	0.00	1	0.00	3	0.01
422	7	0.02	8	0.02	7	0.04	2	0.01	23	0.08	2	0.01	3	0.01
423	x	0.00	x	0.00	1	0.00	1	0.00	x	0.00	x	0.00	1	0.00
431	0	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00	x	0.00
432	70	0.20	89	0.28	11	0.06	13	0.05	12	0.05	6	0.02	8	0.03
433	1	0.00	2	0.01	1	0.01	x	0.00	x	0.00	x	0.00	x	0.00
Others	x	0.00	x	0.00	0	0.00	x	0.00	x	0.00	x	0.00	x	0.00
Subtotal	81	0.23	101	0.31	21	0.11	18	0.06	36	0.14	10	0.04	14	0.05
Average Total	34,695	100.00	32,244	100.00	18,690	100.00	27,646	100.00	26,889	100.00	26,306	100.00	28,028	100.00
Number of Stations	98		101		111		107		108		101		104	

Totals may not add to correct figure because of rounding.
x = Average of less than one vehicle per station.

Table 24. Trend of average daily counts of main truck type codes, U.S. average for the Other FA primary rural system for 1966, 1969 and 1972

Vehicle type code	1966			1969			1972		
	Average daily count of code	Percent of total count	Percent of truck count	Average daily count of code	Percent of total count	Percent of truck count	Average daily count of code	Percent of total count	Percent of truck count
200	696	9.09	38.07	1,069	9.73	40.62	1,391	11.90	50.71
210	51	0.67	2.79	218	1.99	8.28	70	0.60	2.55
220	284	3.71	15.54	374	3.41	14.21	389	3.33	14.18
230	59	0.77	3.23	81	0.74	3.08	89	0.76	3.24
321	63	0.82	3.45	62	0.56	2.36	43	0.37	1.57
322	199	2.60	10.89	230	2.09	8.74	150	1.28	5.47
332	336	4.39	18.38	543	4.94	20.63	554	4.74	20.20
432	40	0.52	2.19	11	0.10	0.42	12	0.10	0.44
5212	86	1.12	4.70	22	0.20	0.83	14	0.12	0.51
Others	14	0.18	0.76	22	0.20	0.83	31	0.27	1.13
Average daily count of total trucks	1,828	23.87	100.00	2,632	23.96	100.00	2,743	23.47	100.00
Average daily count of total traffic	7,657	-	-	10,984	-	-	11,686	-	-

An examination of Table 25 indicates that there is some slight increase in axle and gross loadings 1966 to 1972, especially for the years 1971 and 1972. The exception to this general increase is found in the code 321 tractor semitrailer, which vehicle shows about a six percent increase in empty weight (20,661 to 22,013 pounds), but a decrease in weight of loaded trucks of about five percent (32,309 to 30,776 pounds). Because of the rise in the popularity of the code 332 tractor semitrailer since 1966, the code 321 has been shifted to more local hauling and less line-haul usage.

TREND IN PERCENTAGE EMPTY AND PAYLOAD

The percentage of empty and the pounds of payload for the years 1966 to 1972 are given in Table 26 for the nine vehicle codes. There is no pronounced trend in the percentage of empty vehicles. The up and down changes year to year in the pounds of payload per loaded vehicle preclude any conclusion of a positive trend in payload, except for the code 321, which has a distinct downward trend from 11,648 pounds to 8,721 pounds. The code 322 shows the same trend, but less distinctly.

All of the tables presented for the U.S. total, 1966 to 1972, for the Other FA primary rural system are subject to the uncertainty of how representative the sample weighings are and how the sample quality may vary year to year, which subject is discussed at the beginning of this section on trends, with reference to the vehicle classification counts.

FUEL TYPE TREND

The type of fuel used by trucks weighed 1966 to 1972 is given in Table 27 for the U.S. total on the Other FA primary rural system. Propane fuel seems to show some increase in use in the panel and pickup class 1966 to 1972. Propane shows no significant use in any other vehicle type. The turbine engine is used so infrequently that no trend can be detected.

The use of diesel fuel is not significant in the two light truck classes, but does show a marked increase for the two-axle, six-tire truck from 1966 with 1.99 percent of such trucks with diesel engines to 5.50 percent in 1972. Of the three-axle and more single unit truck, 16.25 percent were diesel in 1966, increasing to 45.16 percent in 1972.

The tractor semitrailer class is highly dieselized. The three-axle code 321 increased from 26.38 percent in 1966 to 64.40 in 1972. Because this three-axle semitrailer is also used heavily in urban areas and on short rural hauls, it is not so fully dieselized as the

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system

Vehicle Type Code: 200

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
			Empty				
1966	19,744	2,330	1,970				4,300
1967	18,328	2,349	1,999				4,348
1968	21,432	2,398	2,024				4,422
1969	24,492	2,435	2,089				4,524
1970	17,744	2,368	1,993				4,361
1971	16,068	2,450	2,108				4,558
1972	15,371	2,484	2,124				4,608
			Loaded				
1966	13,566	2,508	2,793				5,301
1967	12,874	2,527	2,819				5,346
1968	15,253	2,577	2,853				5,430
1969	10,767	2,607	2,929				5,536
1970	9,465	2,497	2,727				5,224
1971	8,089	2,663	2,918				5,581
1972	9,270	2,719	2,962				5,681
			Combined Empty and Loaded				
1966	33,310	2,402	2,305				4,707
1967	31,202	2,423	2,337				4,760
1968	36,685	2,472	2,369				4,841
1969	35,259	2,488	2,345				4,833
1970	27,209	2,412	2,248				4,660
1971	24,157	2,522	2,379				4,901
1972	24,641	2,572	2,439				5,011

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 210

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
			Empty				
1966	1,104	2,725	2,683				5,408
1967	1,421	2,679	2,633				5,312
1968	1,402	2,698	2,648				5,346
1969	1,562	2,810	2,847				5,657
1970	1,427	2,678	2,587				5,265
1971	1,997	2,814	2,576				5,390
1972	1,288	2,979	2,887				5,866
			Loaded				
1966	2,265	2,974	3,803				6,777
1967	2,148	2,981	3,837				6,818
1968	2,581	3,020	3,883				6,903
1969	2,115	2,967	3,841				6,808
1970	1,926	2,984	3,789				6,773
1971	2,308	3,058	3,893				6,951
1972	1,912	3,274	4,250				7,524
			Combined Empty and Loaded				
1966	3,369	2,892	3,436				6,328
1967	3,569	2,861	3,357				6,218
1968	3,983	2,906	3,448				6,354
1969	3,677	2,900	3,419				6,319
1970	3,353	2,854	3,278				6,132
1971	4,305	2,945	3,283				6,228
1972	3,200	3,156	3,702				6,858

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 220

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
			Empty				
1966	10,999	4,206	5,363				9,569
1967	10,057	4,310	5,500				9,810
1968	10,680	4,356	5,599				9,955
1969	10,074	4,367	5,669				10,036
1970	8,808	4,424	5,570				9,994
1971	7,964	4,515	5,732				10,247
1972	7,824	4,596	5,831				10,427
			Loaded				
1966	17,105	5,032	10,302				15,334
1967	15,185	5,146	10,284				15,430
1968	18,551	5,188	10,223				15,411
1969	15,652	5,220	10,291				15,511
1970	15,010	5,220	9,916				15,136
1971	13,282	5,409	10,346				15,755
1972	13,402	5,536	10,282				15,818
			Combined Empty and Loaded				
1966	28,104	4,709	8,369				13,078
1967	25,242	4,813	8,378				13,191
1968	29,231	4,884	8,533				13,417
1969	25,726	4,886	8,481				13,367
1970	23,818	4,925	8,309				13,234
1971	21,246	5,074	8,617				13,691
1972	21,226	5,190	8,642				13,832

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 230

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	3,002	6,657	5,862	5,567			18,086
1967	2,969	6,928	6,084	5,701			18,713
1968	3,687	6,886	5,847	5,535			18,268
1969	3,024	6,975	5,799	5,348			18,122
1970	2,869	6,969	5,662	5,284			17,915
1971	2,716	7,431	5,914	5,602			18,947
1972	2,681	7,674	6,007	5,530			19,211
				Loaded			
1966	2,986	8,975	13,844	13,329			36,148
1967	2,960	9,231	14,179	13,656			37,066
1968	3,973	9,291	13,703	13,330			36,324
1969	3,155	9,427	13,708	13,215			36,350
1970	3,121	9,463	13,524	12,919			35,906
1971	3,073	10,241	14,256	13,854			38,351
1972	2,932	10,725	14,307	13,856			38,888
				Combined Empty and Loaded			
1966	5,988	7,813	9,842	9,437			27,092
1967	5,929	8,078	10,126	9,672			27,876
1968	7,660	8,133	9,922	9,578			27,633
1969	6,179	8,227	9,837	9,365			27,429
1970	5,990	8,268	9,758	9,262			27,288
1971	5,789	8,923	10,342	9,982			29,247
1972	5,613	9,268	10,343	9,879			29,490

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 321

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	1,962	5,994	7,861	6,806			20,661
1967	1,625	6,141	7,882	6,733			20,756
1968	1,724	6,304	8,074	6,900			21,278
1969	1,369	6,318	7,975	6,814			21,107
1970	1,095	6,484	7,971	6,696			21,151
1971	840	6,625	8,266	6,915			21,806
1972	822	6,829	8,282	6,945			22,056
				Loaded			
1966	3,757	6,691	13,245	12,373			32,309
1967	3,241	6,794	12,906	12,049			31,749
1968	3,396	7,050	12,793	11,846			31,689
1969	2,795	6,975	12,572	11,475			31,022
1970	2,243	7,022	12,236	11,192			30,450
1971	1,787	7,161	12,456	11,146			30,763
1972	1,566	7,330	12,418	11,029			30,777
				Combined Empty and Loaded			
1966	5,719	6,452	11,398	10,463			28,313
1967	4,866	6,576	11,228	10,274			28,078
1968	5,120	6,799	11,204	10,180			28,183
1969	4,164	6,759	11,060	9,943			27,762
1970	3,338	6,845	10,837	9,717			27,399
1971	2,627	6,989	11,117	9,793			27,899
1972	2,388	7,157	10,994	9,623			27,774

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 322

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	6,994	6,821	7,831	4,766	4,991		24,409
1967	5,660	6,947	7,877	4,756	5,025		24,605
1968	5,752	6,945	8,003	4,789	4,975		24,712
1969	4,722	7,026	8,091	4,905	5,131		25,153
1970	3,971	7,050	8,149	5,047	5,216		25,462
1971	3,151	7,227	8,236	5,012	5,125		25,600
1972	2,892	7,335	8,378	5,139	5,233		26,085
				Loaded			
1966	11,936	7,811	15,633	11,657	11,941		47,042
1967	10,526	7,835	15,314	11,413	11,660		46,222
1968	11,147	7,892	15,111	10,911	11,079		44,993
1969	9,008	7,907	15,043	10,921	11,125		44,996
1970	7,734	7,954	14,763	10,695	10,892		44,304
1971	5,910	8,115	14,976	11,074	11,125		45,290
1972	5,647	8,251	15,080	10,988	11,055		45,374
				Combined Empty and Loaded			
1966	18,930	7,445	12,750	9,111	9,373		38,679
1967	16,186	7,525	12,714	9,085	9,340		38,664
1968	16,899	7,570	12,691	8,827	9,001		38,089
1969	13,730	7,604	12,653	8,852	9,063		38,172
1970	11,705	7,647	12,519	8,779	8,966		37,911
1971	9,061	7,806	12,632	8,966	9,039		38,443
1972	8,539	7,941	12,810	9,007	9,083		38,841

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 332

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	8,711	7,762	6,268	5,778	4,580	4,798	29,186
1967	9,380	7,896	6,293	5,785	4,543	4,815	29,332
1968	11,515	7,896	6,268	5,743	4,445	4,686	29,038
1969	10,928	7,929	6,265	5,770	4,453	4,705	29,122
1970	10,482	7,837	6,185	5,695	4,436	4,632	28,785
1971	10,311	8,142	6,470	5,919	4,616	4,835	29,982
1972	9,948	8,239	6,496	5,992	4,649	4,856	30,232
				Loaded			
1966	18,962	8,855	13,393	13,159	12,961	13,311	61,679
1967	19,644	8,982	13,434	13,102	12,717	13,142	61,377
1968	23,807	8,892	13,354	12,986	12,562	12,933	60,727
1969	22,737	8,898	13,329	12,925	12,393	12,769	60,314
1970	21,699	8,789	13,157	12,712	12,357	12,619	59,634
1971	19,848	9,112	13,782	13,310	12,998	13,186	62,388
1972	19,396	9,243	13,668	13,238	12,954	13,228	62,331
				Combined Empty and Loaded			
1966	27,673	8,511	11,150	10,835	10,323	10,631	51,450
1967	29,024	8,631	11,126	10,737	10,076	10,451	51,021
1968	35,322	8,567	11,044	10,625	9,916	10,244	50,396
1969	33,665	8,583	11,036	10,603	9,816	10,151	50,189
1970	32,181	84,79	10,886	10,427	9,777	10,018	49,587
1971	30,159	8,780	11,282	10,783	10,133	10,331	51,309
1972	29,344	8,903	11,237	10,782	10,138	10,390	51,450

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 432

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	320	7,824	5,473	5,087	4,283	3,997	26,664
1967	398	7,983	5,404	5,150	4,337	4,014	26,888
1968	406	8,037	5,572	5,340	4,393	4,116	27,458
1969	356	8,080	5,741	5,296	4,597	4,258	27,972
1970	345	8,146	5,826	5,388	4,573	4,257	28,190
1971	332	8,310	6,126	5,627	4,886	4,536	29,485
1972	366	8,312	5,812	5,509	4,490	4,162	28,285
				Loaded			
1966	561	9,635	14,077	13,838	15,400	15,474	68,424
1967	652	9,903	14,446	14,241	15,726	15,758	70,074
1968	630	10,168	14,833	14,689	16,020	15,969	71,679
1969	606	10,095	14,655	14,333	15,684	15,728	70,495
1970	678	10,146	14,407	14,176	15,563	15,424	69,716
1971	629	10,315	14,586	14,319	15,403	15,157	69,780
1972	605	10,336	14,831	14,436	15,436	15,255	70,294
				Combined Empty and Loaded			
1966	881	8,977	10,952	10,659	11,362	11,305	53,255
1967	1,050	9,175	11,019	10,795	11,409	11,306	53,704
1968	1,036	9,333	11,204	11,025	11,463	11,324	54,349
1969	962	9,349	11,356	10,988	11,581	11,483	54,757
1970	1,023	9,471	11,513	11,212	11,857	11,658	55,711
1971	961	9,622	11,663	11,316	11,769	11,488	55,858
1972	971	9,573	11,431	11,071	11,310	11,074	54,459

Table 25. U.S. total average axle weight and average gross weight, 1966 to 1972, for the Other FA primary rural highway system (continued)

Vehicle Type Code: 5212

Year	Number of Trucks Weighed	Average Axle Weight, Pounds					Gross Weight, Pounds
		A	B	C	D	E	
				Empty			
1966	233	7,677	7,486	4,968	5,008	4,648	29,787
1967	234	7,609	7,272	4,836	4,876	4,505	29,098
1968	200	7,624	7,325	4,860	4,822	4,535	29,166
1969	246	7,970	7,856	5,280	5,240	4,796	31,142
1970	231	8,012	7,350	5,135	5,136	4,803	30,436
1971	161	8,234	7,878	5,676	5,224	5,225	32,237
1972	125	8,185	7,712	5,534	5,297	4,954	31,682
				Loaded			
1966	698	8,657	15,051	13,938	13,107	12,684	63,437
1967	871	8,795	15,068	13,914	13,011	12,654	63,442
1968	1,013	8,963	15,094	13,993	12,561	12,240	62,851
1969	1,255	8,966	15,220	14,157	12,847	12,603	63,793
1970	1,033	8,883	15,003	13,910	12,517	12,357	62,670
1971	852	9,097	15,440	14,431	12,517	12,337	63,822
1972	584	9,235	15,386	14,256	12,625	12,389	63,891
				Combined Empty and Loaded			
1966	931	8,412	13,158	11,693	11,080	10,673	55,016
1967	1,105	8,544	13,417	11,992	11,289	10,928	56,170
1968	1,213	8,742	13,813	12,487	11,285	10,970	57,297
1969	1,501	8,803	14,013	12,702	11,600	11,323	58,441
1970	1,264	8,724	13,605	12,306	11,168	10,976	56,779
1971	1,013	8,960	14,238	13,039	11,358	11,207	58,802
1972	709	9,050	14,033	12,718	11,333	11,078	58,212

Table 26. Percentage of total vehicles weighed that were empty and pounds of payload per loaded vehicles, 1966 to 1972, U.S. average for the Other FA primary rural system

Year	Vehicle Code Number								
	200	210	220	230	321	322	332	432	5212
	Vehicles Weighed Empty as Percentage of Total Number Weighed								
1966	59.3	32.8	39.1	50.1	34.3	37.0	31.5	36.3	25.0
1967	58.7	39.8	39.8	50.1	33.4	35.0	32.3	37.9	21.2
1968	58.4	35.2	36.5	48.1	33.7	34.0	32.6	39.2	16.5
1969	69.5	42.5	39.2	48.9	32.9	34.4	32.5	37.0	16.4
1970	65.2	42.6	37.0	47.9	32.8	33.9	32.6	33.7	18.3
1971	66.5	46.4	37.5	46.9	32.0	34.8	34.2	34.6	15.9
1972	62.4	40.3	36.9	47.8	34.4	33.9	33.9	37.7	17.6
	Average Pounds of Payload per Loaded Vehicle								
1966	1,002	1,369	5,764	18,061	11,648	22,632	32,492	41,761	33,649
1967	999	1,506	5,620	18,354	10,992	21,617	32,046	43,187	34,345
1968	1,009	1,557	5,457	18,054	10,410	20,281	31,687	44,221	33,685
1969	1,011	1,152	5,475	18,228	9,915	19,843	31,193	42,523	32,651
1970	864	1,508	5,142	17,991	9,299	18,843	30,849	41,527	32,235
1971	1,023	1,560	5,508	19,405	8,958	19,693	32,406	40,295	31,586
1972	1,073	1,659	5,392	19,678	8,721	19,289	32,101	42,008	32,209

Table 27. Type of fuel used by trucks on the Other FA primary rural system - U.S. total for 1966 to 1972

Truck Type	1966		1967		1968		1969		1970		1971		1972	
	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent	Number	Percent
Single Unit Truck														
Panel & pickup														
Counted	284,916	—	342,686	—	319,385	—	501,751	—	542,940	—	519,263	—	532,650	—
Weighed	32,579	—	30,481	—	36,782	—	38,592	—	29,880	—	26,517	—	27,371	—
Known fuel	6,524	100.00	7,537	100.00	10,078	100.00	34,355	100.00	26,723	100.00	23,898	100.00	25,506	100.00
Gasoline	6,478	99.29	7,478	99.21	9,986	99.08	34,216	99.59	26,613	99.58	23,789	99.54	25,338	99.34
Diesel	10	0.15	10	0.13	15	0.14	58	0.16	57	0.21	49	0.20	57	0.22
Propane	21	0.32	39	0.51	37	0.36	77	0.22	52	0.19	59	0.24	108	0.42
Turbine	15	0.22	10	0.13	40	0.39	4	0.01	1	0.00	1	0.00	3	0.01
Other 4-tire														
Counted	20,844	—	24,657	—	27,272	—	101,912	—	38,699	—	38,716	—	27,661	—
Weighed	3,221	—	3,469	—	3,990	—	4,098	—	3,823	—	4,994	—	3,462	—
Known fuel	936	100.00	833	100.00	1,173	100.00	3,016	100.00	3,482	100.00	4,813	100.00	3,298	100.00
Gasoline	928	99.14	824	98.91	1,163	99.14	2,973	98.57	3,441	98.82	4,757	98.83	3,254	98.66
Diesel	4	0.42	6	0.72	4	0.34	38	1.25	29	0.83	34	0.70	33	1.00
Propane	0	0.00	2	0.24	2	0.17	5	0.16	12	0.34	21	0.43	11	0.33
Turbine	4	0.42	1	0.12	4	0.34	0	0.00	0	0.00	1	0.02	0	0.00
2-axle, 6-tire														
Counted	116,898	—	121,370	—	116,101	—	177,084	—	168,030	—	154,531	—	149,542	—
Weighed	27,168	—	24,742	—	29,246	—	26,727	—	24,405	—	22,194	—	22,117	—
Known fuel	6,427	100.00	6,351	100.00	6,909	100.00	23,431	100.00	22,251	100.00	20,346	100.00	20,121	100.00
Gasoline	6,227	96.88	6,132	96.55	6,516	94.31	22,202	94.75	20,926	94.04	18,938	93.07	18,844	93.65
Diesel	128	1.99	142	2.23	295	4.26	1,090	4.65	1,175	5.28	1,269	6.23	1,108	5.50
Propane	57	0.88	66	1.03	80	1.15	133	0.56	144	0.64	135	0.66	164	0.81
Turbine	15	0.23	11	0.17	18	0.26	6	0.02	6	0.02	4	0.01	5	0.02
3-axle, and more														
Counted	23,984	—	24,480	—	29,428	—	39,457	—	39,930	—	37,367	—	38,092	—
Weighed	5,802	—	5,858	—	7,860	—	6,373	—	6,285	—	6,255	—	6,049	—
Known fuel	1,495	100.00	1,676	100.00	2,212	100.00	5,516	100.00	5,781	100.00	5,713	100.00	5,484	100.00
Gasoline	1,233	82.47	1,358	81.02	1,627	73.55	3,677	66.66	3,824	66.14	3,441	60.23	3,001	54.72
Diesel	243	16.25	311	18.55	575	25.99	1,816	32.92	1,945	33.64	2,255	39.47	2,477	45.16
Propane	13	0.86	6	0.35	6	0.27	22	0.39	12	0.20	15	0.26	6	0.10
Turbine	6	0.40	1	0.05	4	0.18	1	0.01	0	0.00	2	0.03	0	0.00
Tractor semitrailer														
3 axles														
Counted	25,954	—	23,894	—	21,913	—	29,687	—	27,070	—	22,026	—	16,689	—
Weighed	5,607	—	4,816	—	5,120	—	4,182	—	3,329	—	2,640	—	2,414	—
Known fuel	1,588	100.00	1,394	100.00	1,366	100.00	3,801	100.00	3,101	100.00	2,500	100.00	2,256	100.00
Gasoline	1,154	72.67	966	69.29	731	53.51	1,737	45.69	1,266	40.82	1,007	40.28	801	35.50
Diesel	419	26.38	420	30.12	623	45.60	2,054	54.03	1,827	58.91	1,492	59.68	1,453	64.40
Propane	11	0.69	6	0.43	10	0.73	10	0.26	7	0.22	1	0.04	2	0.08
Turbine	4	0.25	2	0.14	2	0.14	0	0.00	1	0.03	0	0.00	0	0.00
4 axles														
Counted	83,618	—	73,402	—	78,033	—	110,040	—	99,469	—	79,807	—	58,482	—
Weighed	18,839	—	16,198	—	17,122	—	14,091	—	11,812	—	9,416	—	8,796	—
Known fuel	3,853	100.00	3,569	100.00	4,304	100.00	12,601	100.00	10,731	100.00	8,602	100.00	8,017	100.00
Gasoline	1,835	47.62	1,639	45.92	1,202	27.92	2,813	22.32	2,260	21.06	1,725	20.05	1,368	17.06
Diesel	1,982	51.44	1,909	53.48	3,080	71.56	9,745	77.34	8,448	78.72	6,861	79.76	6,640	82.82
Propane	32	0.83	15	0.42	16	0.37	38	0.30	23	0.21	16	0.18	8	0.09
Turbine	4	0.10	6	0.16	6	0.13	4	0.03	0	0.00	0	0.00	1	0.01
5 axles and more														
Counted	177,853	—	204,254	—	161,637	—	271,323	—	269,832	—	254,271	—	225,031	—
Weighed	28,653	—	30,460	—	37,281	—	36,700	—	34,864	—	32,512	—	31,417	—
Known fuel	8,460	100.00	9,739	100.00	10,149	100.00	33,536	100.00	32,916	100.00	30,773	100.00	29,269	100.00
Gasoline	868	10.26	949	9.74	802	7.90	1,322	3.94	1,088	3.30	751	2.44	657	2.24
Diesel	7,537	89.08	8,745	89.79	9,327	91.90	32,132	95.81	31,764	96.50	29,987	97.44	28,583	97.65
Propane	42	0.49	35	0.35	17	0.16	75	0.22	61	0.18	30	0.09	28	0.09
Turbine	13	0.15	10	0.10	3	0.02	7	0.02	3	0.00	5	0.01	1	0.00
Truck and full trailer														
4 axles and less														
Counted	2,399	—	2,646	—	2,934	—	2,397	—	2,112	—	2,125	—	2,819	—
Weighed	363	—	374	—	459	—	407	—	327	—	331	—	352	—
Known fuel	122	100.00	178	100.00	136	100.00	261	100.00	307	100.00	313	100.00	332	100.00
Gasoline	112	88.27	171	96.06	118	86.76	224	85.82	271	88.27	282	90.09	301	90.66
Diesel	8	11.40	7	3.93	17	12.50	36	13.79	35	11.40	29	9.26	30	9.03
Propane	2	0.32	0	0.00	1	0.73	1	0.38	1	0.32	2	0.63	1	0.30
Turbine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
5 axles														
Counted	17,449	—	18,708	—	3,359	—	5,404	—	5,244	—	3,860	—	4,844	—
Weighed	813	—	1,058	—	1,065	—	1,012	—	1,074	—	1,001	—	1,034	—
Known fuel	282	100.00	420	100.00	473	100.00	982	100.00	1,057	100.00	996	100.00	1,015	100.00
Gasoline	21	7.44	40	9.52	25	5.28	76	7.73	83	7.85	74	7.42	65	6.40
Diesel	261	92.55	379	90.23	445	94.08	903	91.95	971	91.86	921	92.46	949	93.49
Propane	0	0.00	1	0.23	3	0.63	3	0.30	3	0.28	1	0.10	0	0.00
Turbine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	0.09
6 axles and more														
Counted	584	—	801	—	152	—	217	—	278	—	286	—	777	—
Weighed	22	—	20	—	20	—	42	—	65	—	81	—	85	—
Known fuel	1	100.00	10	100.00	3	100.00	42	100.00	65	100.00	80	100.00	84	100.00
Gasoline	0	0.00	0	0.00	0	0.00	2	4.76	1	1.53	6	7.50	3	3.57
Diesel	1	100.00	10	100.00	3	100.00	40	95.23	64	98.46	73	91.25	81	96.42
Propane	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	1	1.25	0	0.00
Turbine	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00	0	0.00
Total, all trucks														
Counted	754,499	—	836,898	—	760,214	—	1,239,272	—	1,193,604	—	1,112,252	—	1,056,587	—
Weighed	123,067	—	117,476	—	138,945	—	132,224	—	115,864	—	105,941	—	103,097	—
Known fuel	29,688	100.00	31,707	100.00	36,803	100.00	117,540	100.00	106,414	100.00	98,034	100.00	95,382	100.00
Gasoline	18,856	63.51	19,557	61.68	22,170	60.23	69,242	58.90	59,773	56.17	54,770	55.86	53,632	56.22
Diesel	10,593	35.68	11,939	37.65	14,384	39.08	47,912	40.76	46,315	43.52	42,970	43.83	41,411	43.41
Propane	178	0.59	170	0.53	172	0.46	364	0.30	315	0.29	281	0.28	328	0.34
Turbine	61	0.20	41	0.12	77	0.20	22	0.01	11	0.01	13	0.01	11	0.01

four-axle and five-axle tractor semitrailers. From 1966 to 1972 the four-axle semitrailer increased from a diesel percentage of 51.44 to 82.82 percent, and the five-axle and more class (practically all are five-axles) increased from 89.08 percent to 97.65 percent.

In the truck with full trailer class, the four-axle combinations are about 10 percent diesel powered, but the number weighed is so small that there is no indication of a trend up or down. In contrast, the five-axle truck and full trailer combination from 1966 to 1972 held to a percentage of diesels of about 92 percent. The six-axle and more truck and full trailer shows some increase in diesel usage 1966 to 1972 in both number weighed and percentage with diesel engines.

All trucks together, 1966 to 1972, increased in percentage of diesel from 35.68 to 43.41 percent. The two-axle light classes of trucks are mainly of gasoline fuel and the three-axle and more vehicles are of diesel fuel with the percentage increasing in all code numbers.

For 1972 in Table 28 the percentage of trucks with diesel fuel is given by three highway systems--Interstate rural, Other FA primary rural, and Other FA primary urban. The trends are somewhat mixed, but with the exception of the three-axle single unit truck and the six-tire, two-axle single unit, the diesel percentage is highest on the Interstate rural system. Of all trucks, the percentage of diesel trucks is highest on the Interstate system (70.23 percent) and lowest on the Other FA primary urban system (34.19 percent).

DISCUSSION FOR FURTHER ANALYSES

The study and analysis of the 1971 vehicle classification count and truck weight data required to produce this publication brought to attention several aspects worthy of special attention. Overall observations and deductions are here reported as are discussions for improving future weighing operations.

With reference to the objectives of the classification count and weighing of vehicles as stated in the introduction, the 1971 results fall short of producing the full data desired, and further, because of limited number of roadside stations and small samples of vehicles counted and weighed, the results do not have the statistical quality necessary for acceptance of the results. Perhaps the outstanding weakness of the overall operation is the variance in quantity and statistical quality of the results as compared State to State and highway system to highway system. Some States collect more information than is necessary to achieve the desired statistical quality and other States produce far less information than the minimum desired to assure representativeness of the data.

Table 28. Fuel type percentage by truck type for 1972 on the Interstate Rural and Other FA primary rural and urban highway systems

Truck Type	Interstate Rural		Other FA Primary Rural		Other FA Primary Urban	
	Number	Percent	Number	Percent	Number	Percent
	Single Unit Truck					
Panel & pickup						
Counted	344,066	-	532,650	-	308,970	-
Weighed	8,118	-	27,371	-	10,585	-
Known fuel	7,749	100.00	25,506	100.00	10,200	100.00
Gasoline	7,705	99.43	25,338	99.34	10,170	99.70
Diesel	39	0.50	57	0.22	13	0.12
Propane	5	0.06	108	0.42	17	0.16
Turbine	0	-	3	0.01	0	-
Other 4-tire						
Counted	18,591	-	27,661	-	20,618	-
Weighed	1,593	-	3,462	-	2,083	-
Known fuel	1,538	100.00	3,298	100.00	2,054	100.00
Gasoline	1,508	98.04	3,254	98.66	1,999	97.32
Diesel	27	1.75	33	1.00	50	2.43
Propane	3	0.19	11	0.33	5	0.24
Turbine	0	-	0	-	0	-
2-axle, 6 tire						
Counted	111,709	-	149,542	-	88,931	-
Weighed	14,370	-	22,117	-	10,910	-
Known fuel	13,241	100.00	20,121	100.00	10,740	100.00
Gasoline	12,205	92.17	18,844	93.65	9,854	91.75
Diesel	1,011	7.63	1,108	5.50	844	7.85
Propane	24	0.18	164	0.81	41	0.38
Turbine	1	0.00	5	0.02	1	0.00
3-axle & more						
Counted	20,782	-	38,092	-	17,041	-
Weighed	3,389	-	6,049	-	2,254	-
Known fuel	3,190	100.00	5,484	100.00	2,235	100.00
Gasoline	1,782	55.86	3,001	54.72	949	42.46
Diesel	1,404	44.01	2,477	45.16	1,283	57.40
Propane	2	0.06	6	0.10	3	0.13
Turbine	2	0.06	0	-	0	-
	Tractor semitrailer					
3 axles						
Counted	26,664	-	16,689	-	10,937	-
Weighed	3,182	-	2,414	-	1,308	-
Known fuel	2,974	100.00	2,256	100.00	1,301	100.00
Gasoline	799	26.86	801	35.50	491	37.74
Diesel	2,172	73.03	1,453	64.40	809	62.18
Propane	1	0.03	2	0.08	1	0.07
Turbine	2	0.06	0	-	0	-

Table 28. Fuel type percentage by truck type for 1972 on the Interstate Rural and Other FA primary rural and urban highway systems (continued)

Truck Type	Interstate Rural		Other FA Primary Rural		Other FA Primary Urban	
	Numner	Percent	Number	Percent	Number	Percent
Tractor semitrailer (continued)						
4 axles						
Counted	86,054	-	58,482	-	31,971	-
Weighed	10,786	-	8,796	-	3,564	-
Known fuel	9,933	100.00	8,017	100.00	3,531	100.00
Gasoline	1,053	10.60	1,368	17.06	522	14.78
Diesel	8,876	89.35	6,640	82.82	3,008	85.18
Propane	1	0.01	8	0.09	1	0.02
Turbine	3	0.03	1	0.01	0	-
5-axles & more						
Counted	423,921	-	225,031	-	72,281	-
Weighed	50,411	-	31,417	-	6,866	-
Known fuel	47,796	100.00	29,269	100.00	6,778	100.00
Gasoline	540	1.12	657	2.24	228	3.36
Diesel	47,217	98.78	28,583	97.65	6,547	96.59
Propane	29	0.06	28	0.09	3	0.04
Turbine	10	0.02	1	0.00	0	-
Truck & full trailer						
4 axles & less						
Counted	2,405	-	2,819	-	568	-
Weighed	588	-	352	-	90	-
Known fuel	572	100.00	332	100.00	88	100.00
Gasoline	467	81.64	301	90.66	71	80.68
Diesel	104	18.18	30	9.03	16	18.18
Propane	1	0.17	1	0.30	1	1.13
Turbine	0	-	0	-	0	-
5 axles						
Counted	6,425	-	4,844	-	921	-
Weighed	1,044	-	1,034	-	133	-
Known fuel	1,030	100.00	1,015	100.00	129	100.00
Gasoline	56	5.43	65	6.40	31	24.03
Diesel	966	93.78	949	93.49	98	75.96
Propane	1	0.09	0	-	0	-
Turbine	7	0.67	1	0.09	0	-
6-axles & more						
Counted	352	-	777	-	38	-
Weighed	23	-	85	-	4	-
Known fuel	19	100.00	84	100.00	4	100.00
Gasoline	3	15.78	3	3.57	0	-
Diesel	16	84.21	81	96.42	4	100.00
Propane	0	-	0	-	0	-
Turbine	0	-	0	-	0	-
Total, all trucks						
Counted	1,040,969	-	1,056,587	-	552,276	-
Weighed	93,504	-	103,097	-	37,797	-
Known fuel	88,042	100.00	95,382	100.00	37,060	100.00
Gasoline	26,118	29.66	53,632	56.22	24,315	65.60
Diesel	61,832	70.23	41,411	43.41	12,672	34.19
Propane	67	0.07	328	0.34	72	0.19
Turbine	25	0.02	11	0.01	1	0.00

The overall analysis suggests the need to establish additional guides and criteria for control of the total operation of data gathering, and to establish some means of getting all States to comply with these guides, standards, and criteria. One of the purposes of this discussion is to illustrate the variable nature of the data gathered in 1971 and to indicate the need to change the total operation to achieve representative data by States and by highway system, yet do so within available funds.

It is timely that the State authorities and FHWA reevaluate the entire truck-weighing program in order to make best use of the available funds and to insure that the weighing operation produces data sufficient for their uses, including system and State comparisons.

YEARLY SCHEDULES OF WEIGHING

This presentation of the 1971 counting and weighing of vehicles brings to light the wide range of number of vehicles weighed, the wide range of the number of stations at which weighing was conducted, and the wide variance of the data as between highway systems. The information collected on the rural and urban FA secondary systems is so sparse that practically nothing usable was obtained in 1971. The Interstate urban system is similarly weak. Because the characteristics of traffic and trucking do not change much one year to the next, it is in order to ask whether it is necessary to weigh vehicles each year on each system. For each system would not weighing on alternate years, or even every three years be sufficient? This subject leads into considering the worth of changing the overall policy on weighing to one that would continue weighing each year, but to concentrate on getting adequate coverage of a highway system to render sound statistical data. For instance, of the three basic highway systems, Interstate, Other FA primary, and FA secondary, a three-year rotation plan would give adequate data for trend studies on all important factors. For control purposes, approximately 20 percent of the stations on a national basis could be counted and weighed each year on each system.

DIFFICULTY IN COMPARING RESULTS

A comparison of truck-weight results State to State and census division to census division for a speficic year produces questionable results by vehicle type and highway system when the number of vehicles weighed is not sufficient to produce stable averages and distributions.

When the sample is inadequate, differences found in any one comparison may be the result of an inadequate sample, rather than due to basic differences in trucking practice or to a known difference in the legal limits of gross and axle weights. The same weaknesses are

illustrated in the weighings by highway systems. The results of weighing on the Interstate urban system, and on both FA secondary systems, are weak. There are instances where a State may weigh a goodly number of vehicles when other States in the census division do not, which renders a census division comparison questionable. Because of individual differences in the trucking practice in the States within a given census division, a census division combined set of data is hardly acceptable when one or more States are excluded, or weigh insufficient numbers of vehicles.

Combining three years of data is a way to improve weight averages and distributions and percentage empty when single year results are inadequate. Combining three years of the data would increase materially the number of vehicles in every sample in which increased sample size is often needed. However, such process may not produce representativeness for a highway system when the data from all three years comes from the same weighing stations, for the same hours and same days of the week, unless those stations combined are representative of the trucking on that system. It is essential to determine that the weighing stations chosen on a given highway system collectively produce results that are representative of all the traffic on that highway system.

UNIFORMITY BETWEEN STATES

For comparisons between States and, therefore, between the different legal and regulatory factors, it is highly desirable that the States adhere to a uniform procedure of counting and weighing vehicles. This statement applies to such factors as weighing the same hours of the day, days of the week (in which there may be significant differences), and to counting and classifying traffic the full 24-hours of each day counted.

One of the causes for variations in the results of traffic classifications and vehicle weights is attributable to the different hours of the day and days of the week that vehicles are counted and weighed. Supposedly, all States count traffic for the full 24-hours, but this standard is not always adhered to. There are also variations in the number of hours a day and what hours are used for the weighing of vehicles.

DESIRABLE STANDARD OF STATISTICAL QUALITY

Fortunately, for the most of the uses of the results of traffic classification and vehicle weights, precise results are not needed. The maximum probable errors that are acceptable will vary with the particular use and with the judgment of the user. Most applications of

the classification volumes and of the vehicle weight data are for a given year and, in forecast studies, for a series of future years. What needs to be known, then, is the probable variance of the data from the truck-weighing operations as related to their universe for a full year. Certain statistical procedure may be used for this purpose, but the results will have uncertainties because the samples from which the data are obtained are not always acceptable samples for the day and hours of observation, and are of unknown quality when related to a full year of traffic covering 8,760 hours. The sampling is not random on any factor observed. When the lack of randomness is combined with the factor of hourly changes in the universe of one year and one mile of highway, the resulting numerical averages and distributions will be possessed with uncertainties.

A desired undertaking is to thoroughly study trucking practice in all of its aspects so that traffic classifications and weight factors can be better related to a whole year of traffic. The design of the truck-weighing operation can then be determined so that the results can be within acceptable statistical limits of averages and distributions.

A traffic stream is composed of a flow of several types of vehicles whose range in number is illustrated by Table 29 for the Other FA primary rural system. In the normal weighing procedure, the weighing crew may weigh all or only part of those vehicle types having high volume flow, such as the 200 and 332, and weigh all of the types having low volume flow, such as 210 and 321. This practice often results in overweighing the large-volume flows and underweighing (statistically speaking) the low-volume flows as shown by Table 29.

Not all of the low-volume types are important in technical and management uses of truck-weight data, but some are, such as code 230, the three-axle, single unit truck.

Of these important truck types flowing in low volume (230, 321, and 432 are examples) it is desirable to adopt some operative procedure to insure that a stable sample will be weighed. One procedure would be to weigh for longer hours, more days, or at more stations. It would be unnecessary to weigh during these extended hours or days the types of vehicles that were adequately sampled in the initial normal time-length weighings. Weighing at more stations is highly desirable when at present only one, two, or three stations on a highway system are operated.

Large or small numbers of vehicles weighed on a given highway system and State can affect the statistical quality of the average weights, percentage distributions by intervals of weight, and the ratio of empty vehicles to total vehicles weighed. But, when weight data from States are to be combined to get census division or other regional comparisons, the relative number of vehicles weighed becomes an important factor. For instance, in Table 29, Iowa weighed the code 200 truck 5.34 times the average

Table 29. Vehicles counted and vehicles weighed on the Other FA primary rural system for States in the West North Cental census division, 1971

State	Vehicle Type Code 200	210	220	230	321	322	332
Daily Traffic Count per Roadside Station							
Iowa	372	52	129	52	14	39	252
Kansas	840	8	158	33	14	30	170
Minnesota	420	13	98	37	13	24	192
Missouri	947	20	220	109	25	64	325
Nebraska	1,115	83	410	113	51	111	622
North Dakota	638	11	189	45	16	25	270
South Dakota	311	31	84	20	4	9	70
Average	588	26	161	53	19	39	257
Total	4,643	218	1,288	409	137	302	1,901
Number of Vehicles Weighed							
Iowa	1,987	342	748	321	70	200	1,360
Kansas	516	12	364	68	22	60	336
Minnesota	158	29	232	113	43	86	625
Missouri	458	28	780	365	97	275	1,146
Nebraska	734	1,445	853	244	101	187	1,021
North Dakota	706	30	631	214	99	162	1,787
South Dakota	1,057	125	510	113	23	58	435
Total	5,616	2,011	4,118	1,438	455	1,028	6,710
Ratio of Number Weighed to Daily Traffic Count							
Iowa	5.34	6.58	5.80	6.17	5.00	5.13	5.40
Kansas	.61	1.50	2.30	2.06	1.57	2.00	1.98
Minnesota	.38	2.23	2.37	3.05	3.31	3.58	3.26
Missouri	.48	1.40	3.55	3.35	3.88	4.30	3.53
Nebraska	.66	17.41	2.08	2.16	1.98	1.68	1.64
North Dakota	1.11	2.73	3.34	4.76	6.19	6.48	6.62
South Dakota	3.40	4.03	6.07	5.65	5.75	6.44	6.21
Average	1.21	9.22	3.20	3.52	3.32	3.40	3.53
Ratio of Average Number Weighed to Daily Traffic Count							
Iowa	0.76	0.94	0.83	0.88	0.71	0.74	0.77
Kansas	0.09	0.25	0.33	0.30	0.21	0.30	0.28
Minnesota	0.02	0.15	0.15	0.19	0.23	0.21	0.20
Missouri	0.03	0.10	0.22	0.21	0.24	0.27	0.22
Nebraska	0.05	1.34	0.16	0.17	0.16	0.13	0.13
North Dakota	0.16	0.36	0.48	0.69	0.88	0.92	0.94
South Dakota	0.38	0.45	0.68	0.65	0.75	0.67	0.69
Average	0.14	0.84	0.34	0.36	0.34	0.34	0.39

	Iowa	Kan.	Minn.	Mo.	Nebr.	N.D.	S.D.	Total
No. of stations weighing	7	7	16	16	13	7	9	75
No. of stations counting	7	7	52	9	14	7	9	105

daily volume flow and Minnesota weighed only 0.38 of the daily volume flow. The ideal, of course, is to weigh each State and system in proportion to the daily flow of each type of vehicle. All of the census division totals in this publication are put together using the number of vehicles weighed, regardless of the proportionality of the respective vehicle traffic in the States or highway systems.

On the Interstate rural system for the code 200, panel and pickup, Maryland weighed 100 vehicles total at three stations and Virginia weighed 751 vehicles at seven stations. The daily count of the type 200 vehicle was 1,236 for Maryland and 1,313 for Virginia. On the basis of traffic flow the proper number weighed for getting the average of the census division should be the ratio of 1313/1236 or 1.06, but the actual number weighed gives a ratio or 751/100 or 7.51. Thus, the census division totals as between Maryland and Virginia are overweighed by Virginia factors in the ratio of 7.51/1.06 or 7.08. This analysis assumes that the weighing and counting stations in Maryland and in Virginia are fully representative of the Interstate rural highway system, which, of course, they may not be.

For comparing two or more States, or for calculating averages, such as for a census division, it is important to have traffic classification counts and numbers of vehicles weighed that produce individual State data having high sample reliability. The number of vehicles counted in such comparisons should be the average count for a 24-hour day. For calculating average weights, the number of vehicles weighed in each State should be in the same proportion to the 24-hour traffic flow.

From an analysis of the results of the annual truck weighing, it is evident that many of the States weigh the truck traffic 100 percent, or nearly so, during the hours the station operates. This weighing is done without regard to the number of vehicles required to be weighed to produce acceptable samples. The results often show large numbers weighed in the 200 and 332 classes and but few vehicles weighed in classes 230 and 321. Assuming that all of the 230 and 321 vehicles passing the station are weighed, it would require additional hours of weighing to increase the sample size. On the other hand, there is little accomplished in weighing numbers of codes 200 and 332 vehicles greatly in excess of the number required to produce an adequate sample. For instance, here are the number of vehicles weighed by specific States in 1971 on the Interstate rural system:

State	Vehicle Type Code 200	210	220	230	321	322	332
Maryland	100	13	287	49	69	128	463
Virginia	751	101	882	219	149	501	1,406
Missouri	326	20	604	156	142	400	2,206
Nebraska	12	20	141	27	29	79	706
California	9	51	359	41	113	153	626
Washington	86	0	293	41	69	71	821

The above listing of six States includes two from each of three census divisions. From the range of number of vehicles weighed in each class, State to State comparisons would not be significant, the averages for census division would be questionable, and even a national average might not be acceptable. Thus, it seems in order to endeaver to get all States up to nearly the same level of statistical sampling for statistical comparisons between States and census divisions.

WEAKNESS IN WEIGHT AND TRAFFIC CLASSIFICATION DATA

Although discussed elsewhere, it may be helpful to list some of the main deficiencies in the truck weight and traffic classification data of which the following may be noted:

1. Within a State

   a. Overweighing and underweighing in sample size by vehicle type;

   b. Lack of adequate samples by type of vehicles and by highway systems to permit determining the differences in trucking by highway systems;

   c. Lack of statistical quality criteria for purpose of determining desirable sample size;

   d. Lack of knowledge of the characteristics of trucking and traffic for a 24-hour day, 7-day week, and 52-week year as needed to establish the desirable hours and days of weighing and of traffic classification; and

   e. Lack of knowledge of trucking and traffic on a highway system as a whole as a basis of judging the representativeness of a given sample to the highway system in total.

2. Between States

   a. Number of vehicles weighed with respect to daily traffic count of each vehicle type often not comparable;

   b. Inadequate sample size;

   c. Wide range in number of stations per highway system, or per 1,000 miles per system; and

   d. Traffic classification and vehicle weighing not comparable as between days and hours of the day.

3. In General

   a. Lack of sufficient stations for classifying traffic and weighing vehicles to establish true averages, distributions, and empty/loaded ratio by highway systems and by States;

   b. Roadside stations on a highway system, days of counting and weighing, and days and hours of weighing are not selected on the basis of random sampling so the normal statistical analyses may not disclose the true variances, probabilities, and distributions;

   c. Lack of sufficient number of loaded and empty vehicles weighed to establish firm ratio of empty/loaded vehicles;

   d. Lack of 24-hour weighings to disclose variations in vehicle weights and empty/loaded ratio. Error in short-time weighing not disclosed because of lack of 24-hour results with which to compare. Truck weights, gross and axle, and empty/loaded ratio not known for 24-hour period; and

   e. Sampling is made difficult because of local operating factors and also because the nature of the distributions of gross and axle weight, empty/loaded ratio, traffic by hours of the day, and trucking characteristics by hours of the day, do not follow symmetrical distributions. Statistical analyses, therefore, may end with considerable uncertainties.

USES AND USERS OF TRUCK WEIGHTS AND VEHICLE CLASSIFICATION COUNTS

The information obtained annually by the States in their roadside weighing and counting of vehicles and the supplemental information collected at the time, has many potential applications in connection with highway systems, transportation, engineering, transportation planning, legislation, the motor vehicle industry, and many applications by a variety of organizations and for a variety of purposes. The evident applications are listed in the following ten groups with subdivision by specific applications:

GROUP 1. ENGINEERING--DESIGN, OPERATIONS, STANDARDS, SAFETY

1. Formulation of overall design policies and standards;
2. Highway geometric design--grades, curves, roadway width, lanes;
3. Structural design--pavements, bridges;
4. Bridge fatigue analysis;
5. Safety analysis of existing bridges and posting of maximum permissible gross vehicle weights;
6. Pavement type selection; bridge type selection;
7. Calculation of number of equivalent 18-kip load applications;
8. Pavement life studies related to equivalent 18-kip load applications and present serviceability index;
9. Selection of representative or critical vehicle for use in:
   a. Structural design;
   b. Development of tables for motor vehicle running costs for representative classes of vehicles;
   c. Road testing and research;
   d. Traffic speed limits; uphill truck performance;
   e. Safety studies;
   f. Truck equivalents in terms of automobiles;
10. Writing specifications for construction; and

11. Guide to Closing routes to trucks during spring thaw.

GROUP 2. ENGINEERING ECONOMY ANALYSES

1. Proposed specific highway improvement projects--design and location;

2. Highway system development such as for a freeway system or an urban arterial system;

3. Multimodal analysis for economy of total transportation;

4. Specific programs of improvements such as spot safety improvements, TOPICS program, highway-railway crossing safety;

5. Economy of truck lanes on plus grades; and

6. Transportation economy of legal limits of dimensions and weights of motor vehicles; desirable legal limits.

GROUP 3. FINANCE AND TAXATION

1. Highway cost allocation analyses;

2. Effect of road-user tax rates and taxed items on highway use and tax revenue; estimates of fuel consumption;

3. Relative user and vehicle tax rates by type of motor fuel;

4. Third structure taxes--weight-distance tax, or any scheme other than full tax and license fees;

5. Reciprocal license agreements between States;

6. Estimating road-user revenue by vehicle class and highway system; and

7. Financial budgeting, especially of incomes.

GROUP 4. LEGISLATION AND PUBLIC POLICY

1. Legislation on maximum legal limits of vehicle dimensions and weights;

2. Legislation on legal minimum and maximum speeds, hill climbing ability, and safety devices;

3. Special exemptions or added restrictions of law related to vehicle dimensions and weights, or to classes of goods carried;

4. Special provisions for legal limits of vehicle dimension and weight for the haulage of local products;

5. Special limitation of vehicle dimensions and weights for intraurban haulage;

6. Transportation policy relative to restrictions on vehicle design, highway use (dimension and weight of vehicle), minimum speed, carriage of dangerous materials;

7. Overall regulation of common carriers, contract carriers, agricultural exempt carriers, and private carriers;

8. Tariff schedules for common carriers for all transportation modes;

9. Comparison of highway use and vehicle design with law and regulation;

10. Guide information for enforcement of motor carrier safety regulations;

11. Effectiveness of enforcement of highway use with respect to oversize and overweight vehicles and planning of enforcement activities; and

12. Guides for policy on issuance of special permits for oversize and overweight vehicles.

GROUP 5. PLANNING--TRANSPORTATION

1. Forecast of highway use by vehicle type and vehicle weights;

2. Possible shift in highway use by vehicle type that would be expected as a result of a change in legal limits, tax rates, or other changes in law, regulation, restriction, or liberation of current restrictions;

3. Project planning and priorities;

4. Overall location and design of highway systems including capacity and level of service;

5. Studies of highway routes for exclusive use of trucks and buses;

6. Transportation economy studies in connection with area proposals for transportation improvements and system development;

7. Location and design of urban freight terminals;

8. Intermodal comparisons and alternative transportation systems; and

9. Estimate of a pavement replacement or resurfacing forecast with and without any specific change in laws or regulations affecting the trucking industry.

GROUP 6. RESEARCH AND DEVELOPMENT

1. Design procedures and factors for pavements and structures;

2. Transportation economy and economic effects of the legal limits on dimensions and weights of motor vehicles, including multicargo body combinations;

3. Design and operation of test roads and laboratory test tracks;

4. Application of new proposals in automotive technology and in trucking technology;

5. Financing and tax policies and schemes;

6. Proposals for new taxes or changes in present tax policy;

7. Intermodal freight exchange of commodities;

8. Freight movement technology--containerization, piggyback, centralized terminals;

9. Intermodal effects of trends in freight hauling by all modes, proposed legislation, and regulation;

10. Correlation of highway trucking with the gross national product and other economic indicators; and

11. Resource information for graduate theses and dissertations.

GROUP 7. SAFETY AND TRAFFIC

1. Traffic simulation studies that involve vehicle class and performance;
2. Traffic safety analyses with respect to vehicle performance as related to highway geometric requirements;
3. Estimation of stopping distance, speed on grades, accelerations, and top speed ability of trucks;
4. Safety inspection of vehicles;
5. Posting of bridges for maximum gross vehicle weight; and
6. Design of traffic control systems and metering of lane occupancy.

GROUP 8. TRANSPORTATION ECONOMICS

1. Computation of the overall cost of transportation--highway cost plus the cost of motor vehicle operation;
2. Economic development of areas and regions affected by motor trucking;
3. Input-output economic analysis;
4. Intermodal freight exchange, practice of and effects of;
5. Intermodal system transportation analyses of costs and effectiveness; and
6. Vehicle operation comparison by vehicle type and economical loading.

GROUP 9. STATISTICS AND TRENDS

1. Annual statistics:
   - A. Vehicle-miles of travel by vehicle types;
   - B. Ton-miles of freight carried by highway;
   - C. Ton-miles of haulage by commodity classifications;
   - D. Average daily traffic volume by highway system by vehicle type;

E. Length of trip, or average distance different commodities are hauled;

F. Average gross weights and average payload weight per vehicle by vehicle type by highway system; and

G. Relative highway use and cargo tonnage of common, contract, agricultural exempt, and private carriers;

2. Body types of commercial vehicles, relative numbers on highways; and

3. Technological developments of vehicles--empty weights, horsepower, types of fuel, hauling distance.

GROUP 10. TRUCKING INDUSTRY, VEHICLE MANUFACTURING, COMMERCE

1. Studies of improvement of equipment (trucks);

2. Analysis of trend in freight movement;

3. Chassis design and power design as affected by truck loading and use;

4. Structural requirements of automotive parts and systems;

5. Regional and highway system differences in trucking volumes, classes of vehicles, and loading practices;

6. Manufacturing planning and produce design;

7. Trends in productivity (efficiency) of highway trucking; and

8. Operations management and locations of service areas, exchange locations, warehousing, and terminal facilities.

Because highways are the full responsibility of public agencies, and transportation, in general, is partly a public responsibility through regulation, it is to be expected that the many agencies and departments of city, county, State and federal governments are the more frequent and regular users of truck weight and traffic information as collected in the annual State weighing operations at the roadside. Industry, commerce, and private transportation companies, however, also find many applications of the results of these information-gathering activities.

The tabulation to follow lists several of the types of agencies and organizations that can be expected to make use of the information gathered in the truck weight studies. It is probably true that should the information collected annually be given a wider notice of being available, its use would be more widespread and more frequent than it is at present.

ORGANIZATIONS AND AGENCIES MOST LIKELY TO USE THE RESULTS OF THE ANNUAL TRUCK WEIGHT STUDIES

A. Agencies of city, county, State, and federal governments

1. Economic analysis agencies

   Agricultural
   Commerce
   Labor
   Transportation

2. Enforcement agencies

   Motor vehicle
   Police and patrol

3. Highway departments

4. Legislative bodies

5. Motor vehicle registration

6. Planning agencies

   Lane use zoning
   Rural and urban
   Regional
   Transportation

7. Regulatory agencies

   Transportation
   Commerce
   Utility commissions

8. Safety departments

   Industrial
   Transportation

9. Transportation departments

B. Nongovernmental organizations

1. Economic forecasters
2. Lane developers
3. Automotive manufacturing industry
4. Tire manufacturing industry
5. Trucking industry
6. Other transportation modes
7. Engineering and business consultants
8. Educational institutions
9. Research institutes

DESCRIPTION OF USES OF ANNUAL COLLECTIONS OF TRUCK WEIGHT AND OTHER INFORMATION

GROUP 1. ENGINEERING--DESIGN, OPERATIONS, STANDARDS

Highway departments, being highly engineering oriented, and being responsible for conducting the annual truck weighing studies, have perhaps been the major users of the truck weight study data, and in their applications, engineering has been a major field of application. In geometric design of highways, vertical gradients, horizontal curves, roadway and lane widths, shoulder widths, sight distance, and ramps must be related to the number, length, width, and height of vehicles expected to use the facility. Knowing the frequency volume of each type of vehicle using a given highway, plus the axle spacing and weight of the trucks, designers are in a position to lay out the geometrics of the highway to accommodate that particular traffic and its expected future changes. An analysis and summary of the truck weight study data afford the basic information for many of the factors of the geometric design of highways.

Highway pavements, bridges, and other roadway structures and culverts must be structurally designed to accommodate the weight loadings imposed by the traffic. Of particular importance to structural design is the frequency of axle load application and the distribution of these load applications, say by 1-kip intervals. The axle weights, combined empty and loaded vehicles, of the full range of

traffic vehicles from passenger cars to the multiunit combinations should be used to calculate the equivalent 18-kip axle applications to the pavements and the actual weights applied to bridge structural systems. The frequency of the load applications to bridges is highly important to calculations of fatigue stress in bridges. Calculation of the structural safety of existing highway bridges is another application to bridges of the truck weight information.

Pavement type and bridge type selections are usually based upon economic cost of the structural systems and their adaptions to the traffic. The ADT by vehicle class and the dimensions and weights of the vehicles are factors that enter into the calculations and considerations of basic types of highway design alternatives and choice of construction materials.

In engineering and management of engineering functions, often special attention must be paid to critical factors or critical items involved, as well as to the whole. For instance, in bridge structural design, a critical vehicle with respect to numbers of axles, weight of axle loading, and spacing between axles is chosen. A good approach to this selection is a thorough examination of the vehicle classifications and their respective axle weights and axle spacings as given in the truck weight studies. Also, in developing the running cost of vehicles for use in economic analyses, it is the usual practice to select typical vehicles on which to base all laboratory, field, and theoretical observations and calculations. Vehicle weights and frequency of each class of vehicle in the traffic stream are the sources of information on which the selection of a representative vehicle is made.

The American Association of State Highway and Transportation Officials and the individual highway departments have design policies and standards that serve as their basic guides in all phases of highway and structural design. The information collected in the annual truck weight studies is a most useful source of information considered in arriving at these policies and standards.

GROUP 2. ENGINEERING ECONOMY ANALYSES

When the analysis for engineering economy includes proposals that involve highway motor vehicles, the running costs of those vehicles usually have been determined by reference to information from the truck weight studies. Essential to the analysis for economy of highway location and design is classification of the traffic by weight and axle configuration. Motor vehicle running cost tables that have been prepared usually have used truck weight and truck enumeration information in selecting typical vehicles for which the running costs were calculated (70).

Practically every analysis of the economy of a proposed improvement project, a system planning study, or a special program (TOPICS) uses in several ways the traffic enumeration and classification, truck characteristics, and motor trucking information available from the annual truck weighing studies.

GROUP 3. FINANCE AND TAXATION

Road user taxes and fees often relate directly to class, type, and weight of vehicle. Within the classes of vehicles, two further factors are generally connected with road user tax policy and law. Whether to tax on the basis of monetary value or cost, size, weight, horsepower, loading capacity, or number of axles are items considered. The second factor is the rate of tax on the factors chosen. It is readily seen that the truck weight studies furnish key information for use in motor vehicle tax proposals, including those related to the so-called "third structure" taxes.

Trucks and buses are singled out for special consideration in tax studies because of their large size and heavy weight as compared to automobiles. Further, because a specific vehicle may be used in several States, trucks and buses are subject to consideration for reciprocal agreements on such items as license fees, fuel tax, and third structure taxes. Mileage driven in specific States by specific vehicles is a factor that may enter into agreements between States relative to road user taxes and fees.

On the assumption that vehicles may be taxed somewhat on the basis of benefits they receive from highway improvements and on the basis of the highway cost they incur, the truck weight studies are a primary source of data for cost allocation studies in connection with legislative proposals for changes in the road user tax structure.

GROUP 4. LEGISLATION AND PUBLIC POLICY

With respect to motor vehicles, legislation and public policy are under almost continuous discussion. In the annual truck weighings there is information that is related to legislation and public policies on the following general subjects: legal limits of dimensions and weights of vehicles (52, 58, 60, 68, 71, 72), minimum speed of trucks, truck safety, special exemptions for haulage of local products, special limits or exemptions for intraurban vehicle trips, overall transportation policies with respect to vehicles and their use, licensing of common and other classes of carriers, and enforcement and effectiveness of legal restrictions. Most States have provisions for permitting vehicles with oversize or overweight loadings to move over public highways under special permits. The trips of vehicles under special

permits have not become such a voluminous movement that further legislation is desirable (22). Recent annual truck weight studies are pertinent to this problem, and future collection of information on special features, such as width of vehicles, could supply much more desirable information.

In connection with legislation and public policy, the factual information collected at the roadside on traffic characteristics is accorded much weight in legislative hearings and analyses because of its authenticity.

GROUP 5. PLANNING--TRANSPORTATION

One of the magic words of today is "planning." Whether short range or long range, today's planning of these things to do in the future usually starts with first looking at today and then looking backwards in time. Much of the value to planning of looking backward is to find criteria, events, trends--up and down--that can be used in forecasting the future. The annual truck weight studies in their collective total are a highly valuable source of information on which to base forecasts of highway trucking on such items as numbers of vehicles by axle and wheel configurations, gross and axle weights, tonnage and kinds of cargo hauled, length of trips, and other items. The same inputs may be used to forecast the changes in the several aspects of trucking should existing laws be considered for changes in any way.

Project and system planning is sighted to supplying the transportation facilities for the amount and character of traffic that is forecasted to use such facilities. Therefore, the truck weight studies are prime sources of getting the details about highway use whether for planning of projects, routes, highway systems, or full transportation intermodal systems.

For intercity and some intraurban freight movements, highways exclusively for trucks are being discussed. Nowhere is there a more valuable collection of information to be applied to studies of special trucking highways than in the annual truck weight studies, particularly the classification counts, and each year of additional data adds to this value.

Intermodal exchange of freight is a popular subject to planners and transportation economists and is becoming increasingly a practice in the freight movement. Associated with this movement is consideration of intermodal freight terminals to which the annual truck studies can contribute much helpful information.

GROUP 6. RESEARCH AND DEVELOPMENT

There is a broad area of research and development with respect to highway transportation in all of its aspects to which the annual truck weight studies can contribute useful information. In fact, any research and development activity that involves motor trucks and total traffic classification will lead to the use of the truck weight study data. In any classification of the uses of the annual truck weight data, research and development will overlap other classes of uses such as planning, engineering, finance and taxation, and transportation.

GROUP 7. SAFETY AND TRAFFIC

The number and types of trucks in the traffic stream and their ability to accelerate and decelerate are factors that are considered by traffic engineers in the design of control systems as elements of traffic safety and traffic movement. Although the truck weight studies are not designed to give full coverage of the information needed by traffic and safety engineers, much of the basic information is there to be used. Even in the planning for roadside collection of additional information, the existing information on classes of trucks, and their size and weight, is a helpful beginning to the design of the survey operation.

GROUP 8. TRANSPORTATION ECONOMICS

In these days of discussing intermodal coordination of transportation, establishing departments of transportation, and arguing about what modes are better, less costly, and to be preferred for any reasons, information about the overall trucking industry becomes important. Without the information that is collected in the annual truck weight studies, it would be somewhat hopeless to estimate the total cost or unit cost of motor trucking to compare with freight-carrying modes.

In the economic development of geographic areas, regardless of how advanced they are, transportation is a critical economic factor. Certainly, the movement of goods as freight is a key factor to the economic health of any area or any industry. The annual truck weight studies furnish much valuable support information to the economists' role in forecasting economic development and identifying methods of bettering the economic conditions in particular areas.

GROUP 9. STATISTICS AND TRENDS

One of the objectives of the annual truck weight studies is to collect information on highway trucking that may be used to indicate

trends over the years of several of the factors observed. The numbers of vehicles recorded by vehicle class and the weight data are the principal factors that may be analyzed to establish trends. These trends are highly useful to various forecasts of trucking and highway use. These are used in highway geometric design, pavement design and bridge design, as well as for ADT and lane capacity.

GROUP 10. TRUCKING INDUSTRY, VEHICLE MANUFACTURING, COMMERCE

Many of the factors within the annual truck weight studies are helpful to the overall motor vehicle industry as well as to the many agencies of governments that use them regularly. Industry, though, is more concerned with the vehicles and their role in transportation than in the aspects of the highway, its design and use.

The truck weight data are helpful to the trucking and manufacturing industry in indicating trends of the relative uses of different classes of vehicles, and of the loads (weights) that the vehicles are carrying, whether less than or more than the manufacturer's recommendations.

Study of the truck weight information may be used by industry in depicting needs for new vehicle designs, engine designs, and loading capacity. For instance, the shift from three- and four-axle tractor semitrailers to the five-axle 332 is apparent in the truck classification data. And now, the increasing popularity of the multiunit combination is showing up. The truck weight data affords industry, as well as highway departments, useful inputs for long range planning.

The relative use of trucking on the several highway systems by geometric locations is useful to the commercial side of trucking in establishing transfer locations, service areas, warehousing, and trucking terminals.

RECOMMENDATIONS

1. Conduct pilot studies and observations as guides to selecting roadside stations for traffic classification and weighing of trucks. The importance of the number of roadside stations and their location for traffic classification and weighing is high with respect to getting data representative of each highway system and in comparisons between States. Therefore, there is reason to select the locations only after each highway system has been examined with respect to the characteristics of truck travel. As one phase of this examination, pilot studies could be conducted at all candidate locations to assemble such information as needed to assure that the stations selected are sufficient in number and in character to produce fully representative data for the

system as a whole. In these pilot studies, traffic would not need to be weighed, but brief interviews with drivers and inspection of the trucks would supply appropriate information.

2. Conduct supplementary analyses and observations to determine the preferred days of week, and hours of the day to weigh trucks; also determine the seasonal effects on truck weights and loading characteristics. Supplementary studies are desirable to bring to light seasonal factors in the weight and traffic count of trucks as well as the variation in days of the week and within the 24-hour period. Of recent years there has been conducted a few 24-hour weighings. A systematic study is in order to bring to light the variances in truck traffic weight and empty/loaded vehicle ratios over the 24-hour day. Use of truck weight data normally is applicable to the full 24-hour day, seven-day week, and the 12-month year. Although these longer counts would be costly, they need not be made frequently. The important need now is to make a sufficient number of the long-time weighings in order to determine what months, what days, and what hours are best for the weighings and what adjusting factors to use to expand short period data to the full period--day, week, or year.

3. Continue to conduct the traffic classification and weighing operations in the summer season. Because of the favorable weather and availability of personnel, the summer season is preferred to other seasons for the truck-weighing operation. Summer operations will cost less, also, than if done in other seasons. In some States, other seasons may be preferable.

4. Establish procedure and criteria for selecting the roadside stations for classifying and weighing vehicles such that the stations selected, when combined, will produce traffic classifications and vehicle weights representative of their respective highway systems.

5. Establish the minimum number of roadside stations for each highway system and the minimum number of vehicles to be weighed of each type, including number of empty vehicles required to produce the desired statistical quality. In making these determinations, available data and probable uses of the data obtained in the truck-weighing studies should be fully analyzed for average weights, weight distributions, empty/loaded ratio, and traffic vehicle type distributions.

6. Encourage the States to meet the full standards of statistical quality adopted to get representative samples in each State so that comparisons between States will be meaningful, as well as comparisons between vehicle types and highway systems.

7. Instead of the policy of counting and weighing in same location, similar days, and same clock times in successive years in

order to better detect trends in traffic volume and truck weights, adopt a policy that sets up the objective of getting representative samples of each highway system, and for counting and weighing at such locations that will assure representative results. Trends over time can still be established, and perhaps with better results than under present practices because of the variance in year to year results caused by inadequate samples.

8. Direct special attention to developing roadside procedures to determine the ratio of empty vehicles to total vehicles weighed. Local research is desirable to determine how to weigh the required number of empty vehicles and the number with load that will yield empty/loaded ratio within the desired limits of the probable true ratio. This ratio is more sensitive to sampling than is the average gross weight or average distribution of gross weight, empty or loaded. Further the data cannot be studied through regression analysis to correct deficiencies. There is just one numerical ratio arrived at for each vehicle type for each highway system; a vehicle is either empty or it is with load, there is no range of answer.

9. Consider recording the empty weight of trucks from the postings on the vehicle as required in some States or as given on manufacturer's plate data. Empty weights from these sources could then be compared with the empty weights as weighed. Also, the empty weights posted on loaded vehicles could be compared to both the weighed empty weight and the posted empty weight. See Reference 34 by Liston and Bielck, HRR No. 26.

10. Weigh at the roadside a limited sample number of automobiles and buses. For policy reasons, passenger cars and buses have not been weighed in the recent past. Because of the light weights of passenger cars and the few numbers of buses in the traffic, these two classes of vehicles do not affect pavement design and bridge design to an appreciable extent. On the other hand, the sizes and weights of both passenger cars and buses are changing over time. Motor vehicle operating cost tables have to be prepared for both types of vehicles and for different weights. The operating cost of these people-carrying vehicles is important in economic studies of transportation between modes for economic analyses of specific projects, and for taxation studies. Unlike the truck class of vehicles, the range in weights and types of passenger cars and buses is not great, and varies but little between highway systems. The needs for the weights of passenger cars and buses would seem to support weighing a reasonable sample every two years. At the same time occupancy per vehicle could be obtained along with origin and destination.

11. Measure the distance between axles less frequently than once a year. Changes in the axle spacing of vehicles come about slowly, so measuring every two or three years will produce the data needed for design and regulatory purposes.

12. Include in the weighing operation one-time studies of special interest than has been the practice. As long as the trucks are stopped for weighing, this opportunity should be used to collect other information helpful to the highway transportation agencies. A three-year rotation plan by highway system could be maintained.

13. Make analyses in depth of available data and that to be collected. Such analyses will achieve two desirable goals: First, the information can be used in establishing policy and procedure for the roadside counting and weighing to improve the results, and second, the results of additional analyses will afford the users of the truck-weighing results not now readily available. These analyses should include the normal statistical evaluation of the data, to better determine their strengths and weaknesses.

14. If not every year, at least every three years, the Federal Highway Administration should publish a summary and analysis of the results of the annual truck-weight study, including trend analyses. The truck-weight study information would have much more usefulness if made available for wide distribution.

15. At the time of roadside weighing, record whether oversize and overweight vehicles are moving under a special permit. To identify such vehicles in the traffic stream would provide useful information for those authorities concerned. Further, often in examining data on weight, attention is given to extra heavy gross or axle weights in the belief that such weights may be in error, but such large weights could be of a vehicle moving under special permit. (Reference 22).

16. Give more attention to editing and correcting errors and discrepancies at the State level before the computer cards or tapes are sent to the FHWA at Washington for processing. Likewise, at the Washington office still further checking for errors is in order. Computer procedures have been recently developed by which a high percentage of serious errors are identified and corrected.

17. Continue annual traffic classifications and weighing of vehicles, but vary the emphasis yearly between highway systems, so that adequate data will be obtained by vehicle type and highway system when counted and weighed intensely every second or third year. As now conducted, the information that is collected on the Interstate urban, FA secondary rural, and FA secondary urban systems has but little practical application for the reason that many States do not weigh at all. The data collected by the few States are so weak in sample size that they have no statistical usefulness, and the one to three stations per State per highway system do not produce countings and weighings representative of the highway system as a whole. A three-year rotation plan of traffic classification and weighing would permit getting

statistically sound results on two systems each year. Vehicle weights and classification counts are not likely to change significantly in a three-year period. But a few key stations on the remaining four systems could be operated each year to detect any significant yearly changes.

REFERENCES

1. ALBERTA DEPARTMENT OF HIGHWAYS AND TRANSPORTATION. Report on the Testing of Triple Trailer Combinations in Alberta, April 1970.

2. ALEXANDER, M. M. JR. and BOWLING, ROBERT E. The Collection and Use of Truck Weight Data. State Highway Department of Georgia, Departmental Research Project No. 6902. Atlanta, Georgia, December 1970.

3. AMERICAN TRUCKING ASSOCIATION. Twin-Trailers--A Key to Modern Transportation, American Trucking Association, Inc., Washington, D.C. Revised November 1968.

4. AMERICAN TRUCKING ASSOCIATION. Incremental Approach to Pavement Structure, Bridges, and Maintenance. Comments submitted to the U.S. Bureau of Public Roads, Washington, D.C., 1959.

5. ARMSTRONG, M. D., JUNG, F. W., and PHANG, W. A. A Proposed Method of Regulating Vehicle Weights in Ontario, Department of Highways, Ontario, Canada.

6. AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Supporting Material for Policy on Maximum Dimensions and Weights of Motor Vehicles to Be Operated Over the Highways of the U.S., November 1962.

7. AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS. Policy on Maximum Dimensions and Weights of Motor Vehicles to be Operated Over the Highways of the U.S. Washington, D.C., December 7, 1964. Revised January 15, 1968.

8. BACKGROUND. Truck Sizes and WEights - of the Future, American Trucking Association, September 25, 1969.

9. BUFFINGTON, JESSE L., ET AL. Procedures for Estimating the Total Load Experience of a Highway as Contributed by Cargo Vehicles. Texas Transportation Institute, Research Report 131-2F, College Station, Texas. September 1970.

10. CALIFORNIA DIVISION OF HIGHWAYS. A Report on the Development of a Truck Calssification Counter, Research Report No. M&R263058, Sacramento, California. State of California Division of Highways, 1965.

11. CHURCH, DONALD E. Highway Share of Intercity Shipments by Manufacturers in the United States, Traffic Quarterly, January 1971.

12. CHURCH, DONALD E. Impact of Size and Distance on Intercity Highway Share of Industrial Products, Highway Research Board, Highway Research Record No. 175, pp. 1-8, 1967.

13. DEACON, J. A. and LYNCH, R. L. Determination of Traffic Parameters for the Prediction, Projection, and Computation of EWL's, Final Report KYHPR-64-21: HPR-1(4), Frankfort, Kentucky: Division of Research, Department of Highways, Commonwealth of Kentucky, August 1968.

14. DESROSIERS, R. D. The Development of a Technique for Determining the Magnitude and Frequency of Truck Loadings on Bridges. Civil Engineering Department, University of Maryland, College Park, Maryland, April 1969.

15. EDHOLM, S. Methods of Traffic Measurement--Determination of Number and Weight of Vehicles, Electronics in Traffic Operations, Highway Research Board, Bulletin No. 338, Washington, D.C., 1962.

16. GLAZE, C. K. Vehicle Weight Phase of the Section 210 Study, Journal of the Highway Division, American Society of Civil Engineers, Vol. 85, No. HY1, Proc. Paper 1928, pp. 65-68, January 1959.

17. HEATHINGTON, K. W. and TUTT, P. R. Estimating the Distribution of Axle Weights for Selected Parameters, Design, Performance, and Surface Properties of Pavement. Highway Research Board, Highway Research Record 189, pp. 44-78, Washington, D.C., 1967.

18. HEIBL, J. J. Analysis of Sample Means at Loadometer Stations. Unpublished Report by Wisconsin Department of Transportation, Madison, Wisconsin, March 1969.

19. HERENDEEN, J. H. Theoretical Development and Preliminary Testing of A Mathematical Model for Predicting Freight Modal Split, Pennsylvania State University, Transportation and Traffic Safety Center, 1969.

20. HERRICK, R. CLYDE. Analytical Study of Weighing Methods for Highway Vehicles in Motion. Highway Research Board, National Cooperative Highway Research Program, Report 71, 1969.

21. HUFF, T. S. and SCRIVNER, F. H. Simplified Climbing-Lane Design Theory and Road Test Results, Highway Research Board, Bulletin 104, Washington, D.C., 1955.

22. JORGENSEN, ROY, AND ASSOCIATES. Oversize-Overweight Permit Operation on State Highways. National Cooperative Highway Research Program, Report 80. Highway Research Board, 1969.

23. JUNG, JR., C. R. The Economics of Twin Trailers, University of Richmond for Virginia Highway Users Association, June 1969.

24. A. T. KEARNEY & COMPANY FOR BUREAU OF PUBLIC ROADS. A Study of the Effect on Truck Transport Practices of Liberalizing Weight & Dimensional Limitations of Vehicles, Contract CPR-11-9811, July 17, 1964.

25. KENT, M. F. The Freight's the Weight, Highway Research Board Proceedings, pp. 21-44, Washington, D. C., 1958.

26. KENT, MALCOLM F. and STEVENS, HOY. Dimensions and Weights of Highway Trailer Combinations and Trucks--1959, National Academy of Sciences, Highway Research Board, Highway Research Record 26, pp. 24-65, Washington, D.C., 1963.

27. LARSON, R. H. Procedural Guide for Estimating Axle Loadings on a Statwide Basis, Purdue University, Lafayette, Indiana, June 1965.

28. LARSON, R. H. and GRECCO, W. L. Estimating Axle Loadings on State Highways in Indiana, Proceedings of the 51st Annual Road School, Lafayette, Indiana, Purdue University, 1965.

29. LEE, CLYDE E. A Portable Electronic Scale in Motion, Highway Research Record 127, Highway Research Board, pp. 22-23, 1966. (See this reference for 16 additional references.)

30. LEE, CLYDE E. and AL-RASHID, NASSER I. A Portable Electronic Scale for Weighing Vehicles in Motion, Research Report 54-1F, Center for Highway Research, University of Texas at Austin, April 1968.

31. LeFEVRE, D. M. Analysis of Traffic Load Characteristics Applicable to Pavement Design, Utah State Highway Department, Salt Lake City, 1969.

32. LIEDER, NATHAN. Wisconsin Truck Weight Data 1963. Washington, D. C., U. S. Bureau of Public Roads.

33. LILL, RICHARD A. Supplemental Comments to AASHTO Committee on Commercial Vehicle Size and Weight, American Trucking Association, Washington, D.C.

34. LISTON, L. L. and BIELAK, S. F. Comparisons of Empty and Gross Weights of Commercial Vehicles: Motor Vehicle Use Characteristics. Highway Research Board, Highway Research Record No. 26, pp. 1-23, Washington, D. C., 1963.

35. MICHICAN DEPARTMENT OF STATE HIGHWAYS. Automatic Weighing of Vehicles in Motion and Collection of Traffic Data by Electronic Methods. Research Project 52 F-26 part B, Michigan Department of State Highways, Lansing, 1966.

36. MIDWEST RESEARCH INSTITUTE. Optimum Enforcement Level for Traffic Weight Operations. Final Report, MRI Project No. 3158-P, Midwest Research Institute, Kansas City, Missouri, October 1968.

37. MOTOR VEHICLE CONFERENCE COMMITTEE. State Restrictions on the Size and Weights of Motor Vehicles. 366 Madison Avenue, New York City, July 1, 1920.

38. NEW JERSEY STATE HIGHWAY DEPARTMENT. Comparisons of Weights Obtained Using Loadometers and Platform Scales in Weighing Tri-Tandems and Split-Tandems, New Jersey State Highway Department, Trenton, 1965.

39. NEW JERSEY DEPARTMENT OF TRANSPORTATION. Different Methods of Weighing Single Unit Trucks Using Loadometers, New Jersey Department of Transportation, Tenton, 1967.

40. NORTH DAKOTA STATE HIGHWAY DEPARTMENT. North Dakota Truck Weight Study, in cooperation with the U. S. Department of Transportation, Federal Highway Administration, Bureau of Public Roads, 1967.

41. DEPARTMENT OF TRANSPORT, ONTARIO. Axle Weight Legislation Made Under the Highway Traffic Act and Regulations, March 1971.

42. PANT, S. K. and WEGMANN, F. J. Multivariate Statistical Techniques for Grouping Loadometer Stations and Development of a Computer Algorithm for Routing Trucks in West Virginia. Department of Civil Engineering, West Virginia University, 1969,

43. PANT, SHIVA K. and WEGMANN, FREDERICK J. Grouping Algorithm for Statewide Loadometer Surveys, Transportation Engineering Journal, Proc. American Society of Civil Engineers, Vol. 97, No. TE3, Paper 8288, pp. 421-439, August 1971.

44. PENNSYLVANIA DEPARTMENT OF HIGHWAYS. Trucking Characteristics Study 1968. Pennsylvania Department of Highways, Harrisburg, 1968.

45. PETROFF, B. B. and SUMNERS, J. H. Some Statistical Evaluations of Truck Weight Characteristics in Mississippi, Motor Vehicle Speed, Volume, Weight, and Travel Times. Highway Research Board, Highway Research Bulletin 303, Washington, D.C., 1961.

46. PHANG, W. A. The Effects of Increased Loads on Flexible and Rigid Pavements, Ontario Department of Highways, August 1969.

47. PHILCO-FORD CORPORATION. Dynamic Vehicular Weighing System, Final Report, Philco Project H-4410, Blue Bell, Pennsylvania. Philco-Ford Corporation, June 1967.

48. PRYOR, C. A., JR. HEINS, C. P. JR., and LOONEY, C. T. G. Statistical Analysis of Heavy Truck Traffic for the State of Maryland, Civil Engineering Department, University of Maryland, College Park, Maryland, June 1967.

49. SHOOK, J. F. PAINES, L. J., and LEPP, T. Y. Use of Loadometer Data in Designing Pavements for Mixed Traffic, Extension of AASHTO Road Test Concepts. Highway Research Board, Highway Research Record No. 42, Washington, D.C., 1963.

50. SKOK, EUGENE L. JR., and ROOT, RICHARD E. Use of Traffic Data for Calculating Equivalent 18000-lb Single Axle Loads, Civil Engineering Department, University of Minnesota and Minnesota Department of Highways, Investigation No. 183, Interim Report, 1970.

51. SKOK, EUGENE L., KOBAYASHI, TAKASHI, and HALS, THOMAS M. Planning Project for Development of Procedures for the Analysis of Weight Distribution Data to Calculate Equivalent Loads (Pavement Design), Civil Engineering Department, University of Minnesota and Minnesota Department of Highways, Investigation No. 231, Final Report, September 1971.

52. SOLOMON, DAVID and OTHERS. SUMMARY AND ASSESSMENT OF SIZES AND WEIGHTS REPORTS (see reports by Winfrey and others), Federal Highway Administration, Report No. FHWA-RD-73-67, Offices of Research and Development, August 1972.

53. STEPHENSON, HENSON K., NOIL, JAMES S., and MAYFIELD, A. DWAIN. Truck Weight Trends Related to Highway Structures. Texas Transportation Institute, Bulletin No.19, College Station, Texas, July 1962.

54. STEVENS, HOY. Line-Haul Trucking Costs in Relation to Vehicle Gross Weight. Highway Research Board Bulletin 301, Washington, D.C., 1962.

55. STEVENS, HOY. Line-Haul Trucking Costs Upgraded, 1964. Highway Research Record 127, pp. 1-21, Highway Research Board, 1966.

56. TURTON, R. A., FURBER, C. P., and GREENWOOD, G. W. State-Wide Truck Weight Research, Cooperative Highway Research Project, M. H. R. 1, University of Maine, Orono, July 1966.

57. U. S. DEPARTMENT OF AGRICULTURE, MARKETING ECONOMICS DIVISION, ECONOMIC RESEARCH SERVICE. For Hire Motor Carriers Hauling Exempt Agricultural Commodities, Nature and Extent of Operations, Jaunary 1963.

58. U. S. HOUSE OF REPRESENTATIVES. Maximum Desirable Dimensions and Weights of Vehicles Operated on the Federal-Aid System, House Document No. 354, Government Printing Office, Washington, D. C., 1964.

59. U. S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION. Highway Planning Program Manual, Transmittal 107, Appendix 51, Guide for Truck Weight Study Manual, Washington, D.C., April 1971.

60. U. S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION. Review of Safety and Economic Aspects of Increased Vehicle Sizes and Weights, Washington, D.C., September 1969.

61. U. S. DEPARTMENT OF TRANSPORTATION, FEDERAL HIGHWAY ADMINISTRATION. Economics of the Maximum Limits of Motor Vehicle Dimensions and Weights, Volumes 1, 2, 3 and 4, June 30, 1968 (unpublished). See No. 52 by Solomon and No. 71 by Winfrey for printed short reports.

62. UNIVERSITY OF KENTUCKY, DEPARTMENT OF CIVIL ENGINEERING. Weighing Vehicles in Motion, A Progress Report, KYHPR-61-27; HPS-HPR-1(26), Lexington, Ky., University of Kentucky, 1965.

63. UTAH STATE DEPARTMENT OF HIGHWAYS. Comparing Pit Scale and Portable Scale Weights, Unpublished Report by Utah Department of Highways, Salt Lake City, 1962.

64. VIRGINIA HIGHWAY SAFETY DIVISION, VIRGINIA DEPARTMENT OF HIGHWAYS AND VIRGINIA DEPARTMENT OF STATE POLICE. The Operational and Safety Characteristics of Twin Trailer Combinations, A report to the Twin Trailer Study Commission, 1969.

65. WESTERN HIGHWAY INSTITUTE. Traction Characteristics of Trucks and Truck Combinations, Research Committee Report No. 1, San Francisco, January 1969.

66. WESTERN HIGHWAY INSTITUTE. Horsepower Considerations for Trucks and Truck Combinations, Research Committee Report No. 2, San Francisco, October 1969.

67. WEINBURG, M. I. and THARP, K. J. Application of Vehicle Operating Characteristics to Geometric Design and Traffic Conditions, Highway Research Board, Washington, D.C., NCHRP Program Report 68, 1969.

68. WHITESIDE, ROBERT E., ET AL. Changes in Legal Vehicle Weights and Dimensions--Some Economic Effects on Highways. Highway Research Board, National Cooperative Research Program, Report 141, 1973.

69. WHITTEMORE, ALLAN P. and WILEY, JOHN R. Dynamic Pavement Loads of Heavy Highway Vehicles. Highway Research Board, NCHRP Report No. 105, Washington, D.C., 1970. Note: A good reference for additional literature and abstracts.

70. WINFREY, ROBLEY. Economic Analysis of Highways. International Textbook Company, Scranton, Pennsylvania, 1969.

71. WINFREY, ROBLEY and OTHERS. Economics of the Maximum Limits of Motor Vehicle Dimensions and Weights, Federal Highway Administration, Offices of Research and Development, Report No. FHWA-RD-73-69 and 70, Vols. 1 and 2, September 1968.

72. WINFREY, ROBLEY and OTHERS. Manual of Procedures for Conducting Studies of the Desirable Limits of Dimensions and Weights of Motor Vehicles, Federal Highway Administration, Offices of Research and Development, Report No. FHWA-RD-73-68, July 1970.

73. WRIGHT, J. M. and TIGNOR, S. C. Relationship Between Gross Weights and Horsepowers of Commercial Vehicles Operating on Public Highways, SAE Paper 937B, 1964.

74. ZUELSDORF, R. J. Collection of Motor Carrier Commodity Flow Data, University of Wisconsin, Madison, 1968.

75. HIGHWAY RESEARCH BOARD. An Introduction to Guidelines for Satellite Studies of Pavement Performance, NCHRP Report No. 2, Washington, D.C.

76. HIGHWAY RESEARCH BOARD. Guidelines for Satellite Studies of Pavement Performance, NCHRP Report 2A, Washington, D.C.

APPENDIX

In this appendix is presented a selection of typical tables of vehicle counts at the weighing stations and of vehicle axle and gross weights. The purpose of these tables is twofold: First, to make available to the reader a more extended set of results than is to be found in the main text, and second, to illustrate some of the types of information that is available from the State truck weight data. As stated in the main text, additional tables of vehicle classification and of both axle and gross weight are available from the Federal Highway Administration's computer bank of basic data.* Arrangements of the data, other than illustrated in the text or in this appendix, are available when so requested and specifically described.

Normally the data may be supplied by year of field collection, State, census division, national totals and averages, highway system, vehicle class or type, hourly counts, empty, with load, and combined, and by axle and gross weights. Data for individual roadside stations can be supplied on receipt of a specific request, but are not generally available. Specially collected information on axle spacing, commodity hauled, trip length, etc., can be supplied if the request is not too extensive and when ample time can be allowed for processing the request.

---

* To obtain specific tables, please write to: U.S. Department of Transportation, Federal Highway Administration, Office of Planning, HHP-40, Washington, D.C. 20590.

APPENDIX A -- TABLE 30. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 01. INTERSTATE RURAL

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	371	96	1196	207	8	192	976	6	16	1157	0	5	0	0	0	0	0	5	4235
01 CONNECTICUT	26	35	219	28	2	47	232	5	1	288	0	4	0	0	0	0	0	0	887
02 MAINE	137	23	549	116	6	97	468	0	13	576	0	0	0	0	0	0	0	1	1986
03 MASSACHUSETTS	74	13	141	3	0	15	92	0	1	93	0	0	0	0	0	0	0	0	432
04 NEW HAMPSHIRE	11	0	103	10	0	22	99	1	1	92	0	0	0	0	0	0	0	0	339
05 RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06 VERMONT	123	25	184	50	0	11	85	0	0	108	0	1	0	0	0	0	0	4	591
MIDDLE ATLANTIC	311	108	767	131	4	205	927	56	4	2124	4	38	3	1	0	0	0	12	4695
07 NEW JERSEY	238	33	383	70	2	95	514	29	3	1181	1	0	1	0	0	0	0	0	2550
08 NEW YORK	62	74	343	54	0	106	351	20	1	710	3	22	2	1	0	0	0	11	1760
09 PENNSYLVANIA	11	1	41	7	2	4	62	7	0	233	0	16	0	0	0	0	0	1	385
S. ATLANTIC NORTH	1141	128	1510	326	3	273	817	3	18	2598	6	28	0	0	0	1	0	11	6863
11 DELAWARE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 DIST. OF COL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 MARYLAND	100	13	287	49	1	69	128	0	5	463	2	12	0	0	0	1	0	4	1134
14 VIRGINIA	751	101	882	219	0	149	501	0	11	1406	0	0	0	0	0	0	0	0	4020
15 WEST VIRGINIA	290	14	341	58	2	55	188	3	2	729	4	16	0	0	0	0	0	7	1709
S. ATLANTIC SOUTH	809	68	1548	244	25	291	1487	4	24	2552	4	2	1	8	3	0	0	9	7079
16 FLORIDA	357	19	455	67	17	111	735	1	7	651	2	0	0	0	0	0	0	1	2423
17 GEORGIA	28	3	33	5	0	4	43	0	1	57	0	0	0	0	0	0	0	0	174
18 NO. CAROLINA	273	42	934	159	8	154	615	3	14	1649	2	2	1	8	3	0	0	8	3875
19 SO. CAROLINA	151	4	126	13	0	22	94	0	2	195	0	0	0	0	0	0	0	0	607
EAST NORTH CENTRAL	1605	425	1828	354	32	719	1497	70	60	5270	169	504	8	44	23	127	10	359	13104
21 ILLINOIS	183	108	138	49	0	89	190	0	9	971	7	10	2	3	1	45	4	3	1812
22 INDIANA	34	6	127	27	6	50	140	7	1	612	4	32	0	0	0	14	2	4	1066
23 MICHIGAN	326	10	287	77	4	146	236	9	6	485	114	0	0	4	2	26	0	224	1956
24 OHIO	732	275	832	117	14	301	628	48	17	1944	36	462	0	12	8	42	4	114	5586
25 WISCONSIN	330	26	444	84	8	133	303	6	27	1258	8	0	6	25	12	0	0	14	2684
EAST SOUTH CENTRAL	235	179	1181	279	13	302	1141	9	18	4543	28	0	0	1	0	9	0	2	7940
26 ALABAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 KENTUCKY	162	12	621	151	0	174	661	9	6	2757	23	0	0	0	0	9	0	0	4585
28 MISSISSIPPI	42	1	157	60	0	63	207	0	4	774	0	0	0	1	0	0	0	2	1311
29 TENNESSEE	31	166	403	68	13	65	273	0	8	1012	5	0	0	0	0	0	0	0	2044
WEST NORTH CENTRAL	2229	361	2924	982	0	641	1882	10	43	13081	45	1	111	174	174	782	107	61	23608
31 IOWA	1133	278	1162	524	0	340	1058	5	16	7437	17	0	106	171	40	236	24	40	12567
32 KANSAS	269	6	304	57	0	53	139	0	1	681	4	1	3	0	12	65	16	4	1615
33 MINNESOTA	34	5	74	36	0	14	39	0	2	197	2	0	1	1	0	0	0	1	406
34 MISSOURI	326	20	604	156	0	142	400	1	7	2206	1	0	0	0	8	279	47	3	4200
35 NEBRASKA	12	20	141	27	0	29	79	0	5	706	2	0	0	1	1	74	14	2	1113
36 NORTH DAKOTA	273	9	256	53	0	22	55	1	9	987	11	0	0	1	106	58	2	11	1854
37 SOUTH DAKOTA	182	23	383	129	0	41	112	3	3	867	8	0	1	0	7	70	4	0	1833
WEST SOUTH CENTRAL	251	22	784	154	0	351	694	0	18	3998	19	6	2	3	7	122	32	6	6469
41 ARKANSAS	146	12	215	50	0	82	175	0	8	1044	7	0	0	0	0	8	2	5	1754
42 LOUISIANA	57	1	37	7	0	16	29	0	0	150	1	6	0	0	0	0	0	0	304
43 OKLAHOMA	40	1	196	38	0	95	207	0	3	1070	3	0	1	2	2	38	16	0	1712
44 TEXAS	8	8	336	59	0	158	283	0	7	1734	8	0	1	1	5	76	14	1	2699
MOUNTAIN	684	137	1035	219	0	199	471	1	46	3849	32	35	4	10	455	701	104	42	8024
51 ARIZONA	52	0	71	13	0	11	38	0	1	150	0	0	0	0	17	40	7	1	401
52 COLORADO	280	10	182	39	0	29	33	0	5	343	9	0	0	0	17	18	9	11	985
53 IDAHO	3	5	92	33	0	25	33	0	7	349	3	0	4	6	56	43	8	3	670
54 MONTANA	5	0	381	72	0	47	86	1	13	1104	7	35	0	1	168	125	3	17	2065
55 NEVADA	98	3	125	19	0	34	88	0	8	731	2	0	0	2	127	276	29	9	1551
56 NEW MEXICO	89	54	163	30	0	45	141	0	6	835	7	0	0	1	48	132	28	0	1579
57 UTAH	9	0	21	6	0	0	13	0	0	94	0	0	0	0	9	21	6	0	179
58 WYOMING	148	65	0	7	0	8	39	0	6	243	4	0	0	0	13	46	14	1	594
PACIFIC	119	66	869	193	0	232	278	4	10	2147	2	20	42	26	571	848	30	22	5479
61 CALIFORNIA	9	51	359	41	0	113	153	4	8	626	2	7	4	6	231	440	16	13	2083
62 OREGON	24	15	217	111	0	50	54	0	2	700	0	13	38	17	151	231	14	9	1646
63 WASHINGTON	86	0	293	41	0	69	71	0	0	821	0	0	0	3	189	177	0	0	1750
NONCONTIGUOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64 ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66 PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	7755	1590	13642	3089	85	3405	10170	163	257	41319	309	639	171	267	1233	2590	283	529	87496

APPENDIX A -- TABLE 31. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 02. INTERSTATE URBAN

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	246	30	264	35	1	44	241	2	2	292	0	1	0	0	0	0	0	0	1158
01 CONNECTICUT	7	0	83	8	1	17	92	0	0	128	0	1	0	0	0	0	0	0	337
02 MAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03 MASSACHUSETTS	16	3	49	5	0	5	35	2	0	38	0	0	0	0	0	0	0	0	153
04 NEW HAMPSHIRE	195	23	104	20	0	19	60	0	2	68	0	0	0	0	0	0	0	0	491
05 RHODE ISLAND	28	4	28	2	0	3	54	0	0	58	0	0	0	0	0	0	0	0	177
06 VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC	374	96	948	123	0	160	639	24	3	708	1	1	0	0	0	0	0	3	3080
07 NEW JERSEY	354	85	767	99	0	136	491	20	2	540	0	0	0	0	0	0	0	0	2494
08 NEW YORK	5	8	144	14	0	20	103	1	0	85	1	1	0	0	0	0	0	3	385
09 PENNSYLVANIA	15	3	37	10	0	4	45	3	1	83	0	0	0	0	0	0	0	0	201
S. ATLANTIC NORTH	90	15	184	22	1	21	97	1	0	328	1	24	0	0	0	0	0	0	784
11 DELAWARE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 DIST. OF COL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 MARYLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 VIRGINIA	44	8	96	10	0	7	48	0	0	102	0	0	0	0	0	0	0	0	315
15 WEST VIRGINIA	46	7	88	12	1	14	49	1	0	226	1	24	0	0	0	0	0	0	469
S. ATLANTIC SOUTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
16 FLORIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 GEORGIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 NO. CAROLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 SO. CAROLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAST NORTH CENTRAL	144	34	142	32	0	41	96	14	4	243	18	29	0	6	0	10	2	51	866
21 ILLINOIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 INDIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 MICHIGAN	27	0	31	14	0	16	57	4	3	94	15	0	0	0	0	8	1	39	289
24 OHIO	117	34	111	18	0	25	39	10	1	149	3	29	0	6	0	2	1	12	577
25 WISCONSIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAST SOUTH CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
26 ALABAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 KENTUCKY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 MISSISSIPPI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 TENNESSEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST NORTH CENTRAL	10	0	32	14	0	3	15	0	0	110	1	0	0	0	2	0	0	1	188
31 IOWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32 KANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33 MINNESOTA	10	0	32	14	0	3	15	0	0	110	1	0	0	0	2	0	0	1	188
34 MISSOURI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35 NEBRASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37 SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST SOUTH CENTRAL	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
41 ARKANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42 LOUISIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43 OKLAHOMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44 TEXAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOUNTAIN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
51 ARIZONA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52 COLORADO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 IDAHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54 MONTANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55 NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 UTAH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
58 WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACIFIC	0	4	114	7	0	22	25	0	1	37	0	0	0	0	19	28	0	3	260
61 CALIFORNIA	0	4	114	7	0	22	25	0	1	37	0	0	0	0	19	28	0	3	260
62 OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63 WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NONCONTIGUOUS	4	21	245	58	0	13	47	0	1	58	1	0	0	0	29	36	0	0	513
64 ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 HAWAII	4	21	245	58	0	13	47	0	1	58	1	0	0	0	29	36	0	0	513
66 PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	868	200	1929	291	2	304	1160	41	11	1776	22	55	0	6	50	74	2	58	6849

APPENDIX A -- TABLE 32. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 03. PRIMARY RURAL

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	1434	255	2203	576	51	255	1111	11	13	1350	4	6	1	0	0	0	0	1	7271
01 CONNECTICUT	58	64	178	10	0	30	208	2	1	219	2	5	0	0	0	0	0	1	778
02 MAINE	540	41	912	326	47	86	415	5	12	595	0	0	0	0	0	0	0	0	2977
03 MASSACHUSETTS	200	76	326	52	0	44	128	0	0	155	1	0	1	0	0	0	0	0	983
04 NEW HAMPSHIRE	41	3	339	129	0	56	147	3	0	153	1	0	0	0	0	0	0	0	872
05 RHODE ISLAND	32	2	28	0	0	2	38	0	0	16	0	0	0	0	0	0	0	0	118
06 VERMONT	563	69	420	59	4	37	175	3	0	212	0	1	0	0	0	0	0	0	1543
MIDDLE ATLANTIC	2154	441	1654	246	16	232	1000	65	2	2110	2	55	4	3	4	0	0	33	8021
07 NEW JERSEY	478	33	329	51	0	85	313	12	1	545	0	0	0	0	0	0	0	0	1847
08 NEW YORK	431	304	553	108	2	62	197	12	0	253	2	4	4	2	0	0	0	17	1951
09 PENNSYLVANIA	1245	104	772	87	14	85	490	41	1	1312	0	51	0	1	4	0	0	16	4223
S. ATLANTIC NORTH	2139	261	2134	526	5	164	719	1	9	2158	3	21	2	3	1	0	0	2	8148
11 DELAWARE	315	13	179	32	0	18	88	1	0	231	0	0	0	0	1	0	0	0	878
12 DIST. OF COL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 MARYLAND	252	19	468	160	0	61	267	0	1	810	0	2	2	3	0	0	0	0	2065
14 VIRGINIA	1054	108	874	214	0	68	259	0	6	802	0	0	0	0	0	0	0	0	3365
15 WEST VIRGINIA	518	121	613	120	5	17	85	0	2	315	3	19	0	0	0	0	0	2	1820
S. ATLANTIC SOUTH	5635	323	3389	792	98	275	2149	9	44	3043	18	2	3	13	1	0	0	11	15805
16 FLORIDA	1935	95	867	170	16	76	1016	0	3	584	8	0	0	0	0	0	0	0	4772
17 GEORGIA	510	29	438	112	25	46	239	3	7	553	7	0	0	0	0	0	0	1	1970
18 NO. CAROLINA	2599	174	1802	477	57	134	765	6	31	1686	3	2	3	13	1	0	0	10	7763
19 SC. CAROLINA	591	25	282	33	0	19	127	0	3	220	0	0	0	0	0	0	0	0	1300
EAST NORTH CENTRAL	2975	470	2021	540	135	367	777	61	32	2906	58	251	18	24	19	63	8	66	10791
21 ILLINOIS	451	57	264	83	0	59	166	1	5	931	3	13	1	6	4	36	5	5	2090
22 INDIANA	637	77	377	111	53	83	118	3	7	578	4	41	1	0	0	7	0	8	2105
23 MICHIGAN	161	10	169	29	4	38	59	0	8	134	17	0	0	1	0	3	2	15	670
24 OHIO	1127	280	619	186	51	92	229	55	0	559	30	197	3	2	5	17	1	30	3483
25 WISCONSIN	579	46	592	131	27	95	205	2	12	704	4	0	13	15	10	0	0	8	2443
EAST SOUTH CENTRAL	1902	237	1718	362	50	199	781	4	18	2331	3	4	0	0	0	0	0	2	7611
26 ALABAMA	1620	25	1193	203	3	137	532	3	11	1472	0	4	0	0	0	0	0	2	5165
27 KENTUCKY	157	9	150	21	0	15	17	1	1	138	1	0	0	0	0	0	0	0	510
28 MISSISSIPPI	78	0	171	58	0	28	144	0	1	384	1	0	0	0	0	0	0	0	865
29 TENNESSEE	47	203	244	80	47	19	88	0	5	337	1	0	0	0	0	0	0	0	1071
WEST NORTH CENTRAL	5616	2011	4118	1438	12	455	1028	9	46	6710	65	4	87	84	186	172	45	59	22145
31 IOWA	1987	342	748	321	0	70	200	0	0	1360	14	0	77	71	23	11	0	7	5237
32 KANSAS	516	12	364	68	0	22	60	0	0	336	4	0	0	0	15	32	9	1	1439
33 MINNESOTA	158	29	232	113	2	43	86	0	0	625	2	0	2	4	19	0	0	6	1327
34 MISSOURI	458	28	780	365	0	97	275	0	10	1146	1	0	2	2	8	88	20	3	3283
35 NEBRASKA	734	1445	853	244	10	101	187	2	5	1021	8	0	2	6	46	19	8	28	4719
36 NORTH DAKOTA	706	30	631	214	0	99	162	2	15	1787	27	4	3	1	72	10	6	13	3782
37 SOUTH DAKOTA	1057	125	510	113	0	23	58	5	4	435	9	0	1	0	3	12	2	1	2358
WEST SOUTH CENTRAL	1331	93	1743	488	0	429	986	5	31	5741	22	2	10	9	21	252	74	4	11241
41 ARKANSAS	207	2	217	96	0	47	88	0	7	587	2	0	0	0	0	10	2	1	1266
42 LOUISIANA	522	28	150	38	0	27	105	3	7	346	4	2	0	0	3	0	0	0	1233
43 OKLAHOMA	310	18	526	152	0	135	328	1	6	2232	5	0	3	1	11	160	26	1	3915
44 TEXAS	292	45	850	202	0	220	467	1	11	2576	11	0	7	8	7	82	46	2	4827
MOUNTAIN	1985	471	1489	458	1	190	307	2	37	2714	34	3	5	18	434	309	73	45	8575
51 ARIZONA	78	4	104	11	0	9	21	0	2	83	0	0	0	2	36	59	8	4	421
52 COLORADO	384	19	170	64	0	11	24	0	4	285	8	0	0	0	21	8	9	5	1012
53 IDAHO	263	45	288	151	0	50	73	2	13	886	9	0	4	14	121	101	11	12	2043
54 MONTANA	69	0	159	42	1	14	22	0	1	299	0	3	0	0	36	0	5	10	661
55 NEVADA	143	15	164	26	0	20	31	0	2	247	0	0	0	0	68	53	13	6	788
56 NEW MEXICO	738	248	456	105	0	48	78	0	11	397	7	0	0	1	47	28	18	2	2184
57 UTAH	171	40	148	40	0	18	41	0	3	356	3	0	1	1	92	50	5	4	973
58 WYOMING	139	100	0	19	0	20	17	0	1	161	7	0	0	0	13	10	4	2	493
PACIFIC	112	66	576	152	0	45	58	0	5	1018	1	127	20	13	250	113	5	16	2577
61 CALIFORNIA	41	10	74	2	0	5	18	0	0	322	0	30	0	0	77	59	3	9	650
62 OREGON	35	56	408	129	0	33	29	0	5	601	1	97	20	13	128	45	2	7	1609
63 WASHINGTON	36	0	94	21	0	7	11	0	0	95	0	0	0	0	45	9	0	0	318
NONCONTIGUOUS	1235	366	1148	303	3	29	199	0	20	276	6	0	0	0	59	105	1	20	3770
64 ALASKA	100	0	73	24	3	9	3	0	3	83	5	0	0	0	55	0	0	17	375
65 HAWAII	646	315	478	184	0	12	59	0	16	109	1	0	0	0	4	105	1	2	1932
66 PUERTO RICO	489	51	597	95	0	8	137	0	1	84	0	0	0	0	0	0	0	1	1463
UNITED STATES	26518	4994	22193	5881	371	2640	9115	167	257	30357	216	475	150	167	975	1014	206	259	105955

APPENDIX A -- TABLE 33. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 04. PRIMARY URBAN

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	665	213	1276	167	19	90	427	2	1	256	2	0	0	0	1	0	0	0	3119
01 CONNECTICUT	26	90	170	25	19	24	76	0	0	53	1	0	0	0	1	0	0	0	485
02 MAINE	326	49	539	66	0	12	109	1	0	62	0	0	0	0	0	0	0	0	1164
03 MASSACHUSETTS	159	57	152	20	0	8	60	0	0	49	0	0	0	0	0	0	0	0	505
04 NEW HAMPSHIRE	22	2	301	49	0	28	128	1	1	45	1	0	0	0	0	0	0	0	578
05 RHODE ISLAND	132	15	114	7	0	18	54	0	0	47	0	0	0	0	0	0	0	0	387
06 VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC	1502	432	2310	327	2	392	1208	54	7	1521	3	22	1	1	0	0	0	4	7786
07 NEW JERSEY	1046	228	1444	232	1	312	978	50	5	1287	0	0	0	0	0	0	0	0	5583
08 NEW YORK	209	175	679	86	0	63	156	1	2	131	3	2	1	1	0	0	0	1	1510
09 PENNSYLVANIA	247	29	187	9	1	17	74	3	0	103	0	20	0	0	0	0	0	3	693
S. ATLANTIC NORTH	787	432	911	180	2	111	366	0	0	707	0	5	1	1	0	0	0	0	3503
11 DELAWARE	373	13	188	35	1	12	87	0	0	229	0	0	0	0	0	0	0	0	938
12 DIST. OF COL.	37	333	68	0	0	32	90	0	0	82	0	0	0	1	0	0	0	0	643
13 MARYLAND	126	33	299	103	0	35	121	0	0	169	0	0	1	0	0	0	0	0	887
14 VIRGINIA	157	30	211	9	0	9	20	0	0	23	0	0	0	0	0	0	0	0	459
15 WEST VIRGINIA	94	23	145	33	1	23	48	0	0	204	0	5	0	0	0	0	0	0	576
S. ATLANTIC SOUTH	2692	139	1462	163	26	116	617	2	7	579	7	1	0	0	0	0	0	0	5811
16 FLORIDA	1095	68	612	67	11	59	339	0	5	169	4	0	0	0	0	0	0	0	2429
17 GEORGIA	274	31	344	51	15	32	166	1	1	231	3	0	0	0	0	0	0	0	1149
18 NO. CAROLINA	440	27	147	19	0	7	26	1	0	41	0	1	0	0	0	0	0	0	709
19 SO. CAROLINA	883	13	359	26	0	18	86	0	1	138	0	0	0	0	0	0	0	0	1524
EAST NORTH CENTRAL	866	94	480	86	10	49	81	1	3	247	8	3	1	2	3	0	0	13	1947
21 ILLINOIS	348	43	154	36	0	15	27	0	0	88	0	1	0	0	0	0	0	4	716
22 INDIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 MICHIGAN	198	7	128	14	6	20	27	0	2	60	7	0	0	0	1	0	0	5	475
24 OHIO	24	17	14	1	0	1	4	0	0	10	0	2	0	0	0	0	0	2	75
25 WISCONSIN	296	27	184	35	4	13	23	1	1	89	1	0	1	2	2	0	0	2	681
EAST SOUTH CENTRAL	317	157	864	178	0	107	354	0	5	924	8	1	0	0	0	0	0	0	2915
26 ALABAMA	112	9	354	65	0	38	169	0	0	477	0	1	0	0	0	0	0	0	1225
27 KENTUCKY	31	11	119	14	0	11	30	0	1	46	1	0	0	0	0	0	0	0	264
28 MISSISSIPPI	107	0	154	74	0	43	117	0	1	298	7	0	0	0	0	0	0	0	801
29 TENNESSEE	67	137	237	25	0	15	38	0	3	103	0	0	0	0	0	0	0	0	625
WEST NORTH CENTRAL	1895	473	1084	274	1	136	163	0	5	872	7	0	13	15	18	8	4	3	4971
31 IOWA	756	155	332	121	0	36	52	0	1	416	4	0	12	14	2	2	0	1	1904
32 KANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33 MINNESOTA	111	13	69	35	1	23	9	0	0	45	0	0	0	0	0	0	0	0	306
34 MISSOURI	111	21	279	73	0	19	43	0	1	235	0	0	1	0	16	4	1	1	805
35 NEBRASKA	319	223	241	26	0	51	54	0	3	153	3	0	0	1	0	1	3	1	1079
36 NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37 SOUTH DAKOTA	598	61	163	19	0	7	5	0	0	23	0	0	0	0	0	1	0	0	877
WEST SOUTH CENTRAL	730	67	420	158	0	70	155	1	5	588	2	1	0	0	3	56	13	3	2272
41 ARKANSAS	217	8	270	131	0	27	62	1	4	255	0	0	0	0	0	4	0	3	982
42 LOUISIANA	504	59	95	15	0	8	28	0	0	36	2	1	0	0	3	0	0	0	751
43 OKLAHOMA	9	0	55	12	0	35	65	0	1	297	0	0	0	0	0	52	13	0	539
44 TEXAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOUNTAIN	303	145	536	139	0	48	44	0	10	125	1	1	2	1	19	30	2	1	1407
51 ARIZONA	6	0	15	0	0	2	0	0	0	3	0	0	0	0	1	3	1	0	31
52 COLORADO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 IDAHO	124	19	124	77	0	11	13	0	2	35	1	0	1	1	10	5	0	0	423
54 MONTANA	0	0	51	9	0	3	4	0	0	26	0	1	0	0	3	4	0	0	101
55 NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 UTAH	58	65	346	42	0	31	25	0	7	29	0	0	1	0	4	3	0	1	612
58 WYOMING	115	61	0	11	0	1	2	0	1	32	0	0	0	0	1	15	1	0	240
PACIFIC	60	0	319	48	0	97	56	0	4	163	0	0	1	4	46	60	0	2	860
61 CALIFORNIA	1	0	176	30	0	83	32	0	4	87	0	0	1	1	23	55	0	2	495
62 OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63 WASHINGTON	59	0	143	18	0	14	24	0	0	76	0	0	0	3	23	5	0	0	365
NONCONTIGUOUS	218	196	510	163	0	10	86	0	2	71	1	0	0	1	26	44	2	27	1357
64 ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 HAWAII	218	196	510	163	0	10	86	0	2	71	1	0	0	1	26	44	2	27	1357
66 PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	10035	2348	10172	1883	60	1226	3557	60	49	6053	39	34	19	25	116	198	21	53	35948

APPENDIX A -- TABLE 34. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 05. SECONDARY RURAL

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	48	7	80	32	0	12	27	0	0	23	0	0	0	0	0	0	0	0	229
01 CONNECTICUT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02 MAINE	19	1	21	10	0	2	11	0	0	13	0	0	0	0	0	0	0	0	77
03 MASSACHUSETTS	25	6	15	1	0	2	13	0	0	1	0	0	0	0	0	0	0	0	63
04 NEW HAMPSHIRE	4	0	44	21	0	8	3	0	0	9	0	0	0	0	0	0	0	0	89
05 RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06 VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC	121	8	274	48	0	118	368	10	6	834	0	0	0	0	0	0	0	0	1787
07 NEW JERSEY	121	8	274	48	0	118	368	10	6	834	0	0	0	0	0	0	0	0	1787
08 NEW YORK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09 PENNSYLVANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. ATLANTIC NORTH	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
11 DELAWARE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 DIST. OF COL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 MARYLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
14 VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
15 WEST VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. ATLANTIC SOUTH	358	14	204	38	4	34	171	1	0	232	4	0	0	0	1	0	0	0	1061
16 FLORIDA	237	5	104	21	2	26	119	1	0	149	3	0	0	0	1	0	0	0	668
17 GEORGIA	121	9	100	17	2	8	52	0	0	83	1	0	0	0	0	0	0	0	393
18 NO. CAROLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
19 SO. CAROLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAST NORTH CENTRAL	365	9	192	33	3	9	19	1	1	32	2	0	1	1	4	1	0	5	678
21 ILLINOIS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
22 INDIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
23 MICHIGAN	174	7	98	14	1	6	13	1	1	20	2	0	0	0	0	1	0	4	342
24 OHIO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
25 WISCONSIN	191	2	94	19	2	3	6	0	0	12	0	0	1	1	4	0	0	1	336
EAST SOUTH CENTRAL	33	2	45	10	0	1	25	0	1	122	0	0	0	0	0	0	0	0	239
26 ALABAMA	33	2	45	10	0	1	25	0	1	122	0	0	0	0	0	0	0	0	239
27 KENTUCKY	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
28 MISSISSIPPI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 TENNESSEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST NORTH CENTRAL	123	6	67	14	0	10	4	0	0	14	0	0	1	1	1	0	0	0	241
31 IOWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32 KANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
33 MINNESOTA	123	6	67	14	0	10	4	0	0	14	0	0	1	1	1	0	0	0	241
34 MISSOURI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35 NEBRASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 NORTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
37 SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST SOUTH CENTRAL	184	7	48	11	0	10	46	1	3	83	0	3	0	0	0	0	0	0	396
41 ARKANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42 LOUISIANA	184	7	48	11	0	10	46	1	3	83	0	3	0	0	0	0	0	0	396
43 OKLAHOMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
44 TEXAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MOUNTAIN	433	36	273	32	1	12	47	0	1	155	1	4	0	0	13	13	2	7	1030
51 ARIZONA	31	0	45	5	0	3	0	0	1	7	0	0	0	0	5	13	0	0	110
52 COLORADO	101	2	30	3	0	0	4	0	0	10	0	0	0	0	0	0	0	0	150
53 IDAHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54 MONTANA	207	1	98	12	1	3	5	0	0	75	0	4	0	0	8	0	1	7	422
55 NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 UTAH	94	33	100	12	0	6	38	0	0	63	1	0	0	0	0	0	1	0	348
58 WYOMING	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
PACIFIC	142	5	56	21	0	7	1	0	0	37	0	0	10	4	6	6	2	8	305
61 CALIFORNIA	142	5	56	21	0	7	1	0	0	37	0	0	10	4	6	6	2	8	305
62 OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63 WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NONCONTIGUOUS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
64 ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66 PUERTO RICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
UNITED STATES	1807	94	1239	239	8	213	708	13	12	1532	7	7	12	6	25	20	4	20	5966

APPENDIX A -- TABLE 35. NUMBER OF VEHICLES WEIGHED BY VEHICLE CODE BY CENSUS DIVISION BY STATES - 1971

HIGHWAY SYSTEM: 06. SECONDARY URBAN

CENSUS DIVISION AND STATE	VEHICLE TYPE CODE 200	210	220	230	240	321	322	323	331	332	333	337	421	422	432	5212	5312	OTHERS	TOTAL
NEW ENGLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
01 CONNECTICUT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
02 MAINE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
03 MASSACHUSETTS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
04 NEW HAMPSHIRE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
05 RHODE ISLAND	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
06 VERMONT	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
MIDDLE ATLANTIC	197	29	103	24	0	10	39	5	0	71	0	0	0	0	0	0	0	0	478
07 NEW JERSEY	197	29	103	24	0	10	39	5	0	71	0	0	0	0	0	0	0	0	478
08 NEW YORK	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
09 PENNSYLVANIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. ATLANTIC NORTH	299	41	370	82	0	31	135	0	2	162	0	0	0	0	0	0	0	0	1122
11 DELAWARE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
12 DIST. OF COL.	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
13 MARYLAND	145	27	287	71	0	31	131	0	2	159	0	0	0	0	0	0	0	0	853
14 VIRGINIA	154	14	83	11	0	0	4	0	0	3	0	0	0	0	0	0	0	0	269
15 WEST VIRGINIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
S. ATLANTIC SOUTH	570	81	263	12	0	4	22	0	0	12	0	0	0	0	0	0	0	0	964
16 FLORIDA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
17 GEORGIA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
18 NO. CAROLINA	570	81	263	12	0	4	22	0	0	12	0	0	0	0	0	0	0	0	964
19 SO. CAROLINA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
EAST NORTH CENTRAL	581	102	209	15	2	18	26	2	0	51	0	6	0	1	0	0	0	3	1016
21 ILLINOIS	78	23	28	2	0	1	3	0	0	3	0	0	0	0	0	0	0	0	138
22 INDIANA	138	8	30	4	1	6	8	0	0	24	0	1	0	0	0	0	0	0	220
23 MICHIGAN	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
24 OHIO	224	51	77	5	1	7	5	2	0	8	0	5	0	1	0	0	0	2	388
25 WISCONSIN	141	20	74	4	0	4	10	0	0	16	0	0	0	0	0	0	0	1	270
EAST SOUTH CENTRAL	238	14	167	33	0	28	49	0	0	69	1	0	0	0	0	0	0	0	599
26 ALABAMA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
27 KENTUCKY	238	14	167	33	0	28	49	0	0	69	1	0	0	0	0	0	0	0	599
28 MISSISSIPPI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
29 TENNESSEE	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST NORTH CENTRAL	649	23	254	34	0	14	18	0	0	19	0	0	0	0	2	0	0	0	1013
31 IOWA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
32 KANSAS	375	15	132	21	0	3	11	0	0	7	0	0	0	0	2	0	0	0	566
33 MINNESOTA	56	3	87	12	0	11	6	0	0	6	0	0	0	0	0	0	0	0	181
34 MISSOURI	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
35 NEBRASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
36 NORTH DAKOTA	218	5	35	1	0	0	1	0	0	6	0	0	0	0	0	0	0	0	266
37 SOUTH DAKOTA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
WEST SOUTH CENTRAL	439	33	271	51	0	24	30	0	0	69	0	0	0	1	0	2	3	1	924
41 ARKANSAS	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
42 LOUISIANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
43 OKLAHOMA	276	2	51	9	0	2	6	0	0	14	0	0	0	0	0	0	1	0	361
44 TEXAS	163	31	220	42	0	22	24	0	0	55	0	0	0	1	0	2	2	1	563
MOUNTAIN	441	140	545	61	0	44	25	0	9	110	0	0	3	1	4	0	0	0	1383
51 ARIZONA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
52 COLORADO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
53 IDAHO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
54 MONTANA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
55 NEVADA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
56 NEW MEXICO	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
57 UTAH	292	46	221	24	0	19	7	0	2	15	0	0	0	0	0	0	0	0	626
58 WYOMING	149	94	324	37	0	25	18	0	7	95	0	0	3	1	4	0	0	0	757
PACIFIC	58	17	89	10	0	8	3	0	1	12	0	0	0	0	1	7	0	2	208
61 CALIFORNIA	58	17	89	10	0	8	3	0	1	12	0	0	0	0	1	7	0	2	208
62 OREGON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
63 WASHINGTON	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
NONCONTIGUOUS	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
64 ALASKA	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
65 HAWAII	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
66 PUERTO RICO	0	0	30	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	30
UNITED STATES	3472	480	2301	322	2	181	347	7	12	575	1	6	3	3	7	9	3	6	7737

APPENDIX A --TABLE 36: NUMBER OF VEHICLES WEIGHED AND NUMBER OF STATES WEIGHING
NATIONAL TOTALS BY HIGHWAY SYSTEM AND VEHICLE CODE

VEHICLE CODE	INTERSTATE RURAL		INTERSTATE URBAN		PRIMARY RURAL		PRIMARY URBAN		SECONDARY RURAL		SECONDARY URBAN	
	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED	STATES WEIGHING	NUMBER OF VEHICLES WEIGHED
HIGH COUNT CODES:												
200000	45	7755	13	868	51	26518	40	10035	16	1807	17	3472
210000	43	1590	11	200	48	4994	25	2348	14	94	17	480
220000	44	13642	14	1929	51	22193	40	10172	16	1239	18	2301
230000	45	3089	14	291	50	5881	39	1883	16	239	17	322
240000	13	85	2	2	18	371	10	60	5	8	2	2
321000	44	3405	14	304	51	2640	41	1226	15	213	15	181
322000	45	10170	14	1160	51	9115	40	3557	15	708	17	347
323000	19	163	7	41	23	167	9	60	4	13	2	7
327000	9	53	2	12	9	44	4	6	0	0	1	1
331000	41	257	7	11	41	257	21	49	5	12	4	12
332000	45	41319	14	1776	51	30357	41	6053	16	1532	17	575
333000	21	309	6	22	35	216	14	39	4	7	1	1
337000	15	639	4	55	16	475	9	34	2	7	2	6
421000	14	171	0	0	19	150	8	19	3	12	1	3
422000	20	267	1	6	20	167	9	25	3	6	3	3
432000	24	1233	3	50	29	975	14	116	6	25	3	7
521200	26	2590	4	74	24	1014	14	198	3	20	2	9
531200	23	283	2	2	22	206	7	21	3	4	2	3
OTHERS*	19	476	3	46	26	215	8	47	4	20	3	5
TOTAL	45	87496	14	6849	51	105955	41	35948	16	5966	18	7737

* 'OTHERS' CATEGORY INCLUDES 65 VARIOUS VEHICLE TYPES WHOSE OCCURANCES WERE CONSIDERED INSIGNIFICANT

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 200000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	745	2,348	1,898	0	0	0	0	4,246
MIDDLE ATLANTIC	1,262	2,543	2,192	0	0	4	0	4,739
SOUTH ATLANTIC NORTH	1,513	2,529	2,247	0	0	0	0	4,776
SOUTH ATLANTIC SOUTH	3,557	2,309	1,977	0	0	0	0	4,286
EAST NORTH CENTRAL	1,686	2,529	2,115	0	0	0	0	4,644
EAST SOUTH CENTRAL	1,314	2,436	2,041	0	0	0	0	4,477
WEST NORTH CENTRAL	3,077	2,441	2,125	0	0	0	0	4,566
WEST SOUTH CENTRAL	986	2,491	2,187	0	0	0	0	4,677
MOUNTAIN	1,064	2,633	2,361	0	0	0	0	4,995
PACIFIC	41	2,456	2,066	0	0	0	0	4,522
NONCONTIGUOUS	823	2,476	2,089	0	0	0	0	4,565
UNITED STATES	16,068	2,450	2,108	0	0	0	0	4,558

TABLE A56

LOADED VEHICLES

NEW ENGLAND	685	2,512	2,567	0	0	0	0	5,079
MIDDLE ATLANTIC	862	2,791	2,964	0	0	0	0	5,756
SOUTH ATLANTIC NORTH	520	2,705	3,038	0	0	0	0	5,743
SOUTH ATLANTIC SOUTH	1,043	2,573	2,804	0	0	0	0	5,377
EAST NORTH CENTRAL	1,011	2,646	2,792	0	0	0	0	5,438
EAST SOUTH CENTRAL	403	2,672	2,915	0	0	0	0	5,587
WEST NORTH CENTRAL	2,078	2,650	2,991	0	0	0	0	5,641
WEST SOUTH CENTRAL	319	2,684	2,960	0	0	0	0	5,644
MOUNTAIN	706	2,810	3,027	0	0	0	0	5,836
PACIFIC	52	2,644	3,358	0	0	0	0	6,002
NONCONTIGUOUS	410	2,662	3,218	0	0	0	0	5,880
UNITED STATES	8,089	2,663	2,918	0	0	0	0	5,581

TABLE A57

LOADED AND EMPTY VEHICLES

NEW ENGLAND	1,430	2,426	2,219	0	0	0	0	4,645
MIDDLE ATLANTIC	2,124	2,644	2,506	0	0	2	0	5,152
SOUTH ATLANTIC NORTH	2,033	2,574	2,450	0	0	0	0	5,023
SOUTH ATLANTIC SOUTH	4,600	2,369	2,164	0	0	0	0	4,533
EAST NORTH CENTRAL	2,697	2,573	2,369	0	0	0	0	4,942
EAST SOUTH CENTRAL	1,717	2,492	2,246	0	0	0	0	4,738
WEST NORTH CENTRAL	5,155	2,525	2,474	0	0	0	0	4,999
WEST SOUTH CENTRAL	1,305	2,538	2,376	0	0	0	0	4,914
MOUNTAIN	1,770	2,704	2,627	0	0	0	0	5,330
PACIFIC	93	2,561	2,788	0	0	0	0	5,349
NONCONTIGUOUS	1,233	2,538	2,464	0	0	0	0	5,002
UNITED STATES	24,157	2,522	2,379	0	0	0	0	4,901

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 210000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	87	2,986	2,831	0	0	0	0	5,817
MIDDLE ATLANTIC	148	2,874	2,685	0	0	0	0	5,559
SOUTH ATLANTIC NORTH	95	2,967	3,037	0	0	0	0	6,004
SOUTH ATLANTIC SOUTH	70	2,883	2,921	0	0	0	0	5,804
EAST NORTH CENTRAL	163	3,030	2,959	0	0	0	0	5,989
EAST SOUTH CENTRAL	121	2,607	2,193	0	0	0	0	4,800
WEST NORTH CENTRAL	938	2,592	2,177	0	0	0	0	4,769
WEST SOUTH CENTRAL	26	3,031	3,323	0	0	0	0	6,354
MOUNTAIN	141	3,491	3,686	0	0	0	0	7,177
PACIFIC	20	3,130	3,585	0	0	0	0	6,715
NONCONTIGUOUS	188	3,069	2,879	0	0	0	0	5,948
UNITED STATES	1,997	2,814	2,576	0	0	0	0	5,391

TABLE A59 — LOADED VEHICLES

NEW ENGLAND	160	2,994	3,586	0	0	0	0	6,580
MIDDLE ATLANTIC	269	3,143	3,928	0	0	0	0	7,071
SOUTH ATLANTIC NORTH	148	3,291	4,492	0	0	0	0	7,782
SOUTH ATLANTIC SOUTH	159	3,018	3,875	0	0	0	0	6,894
EAST NORTH CENTRAL	230	3,167	3,949	0	0	0	0	7,116
EAST SOUTH CENTRAL	113	2,758	3,288	0	0	0	0	6,046
WEST NORTH CENTRAL	771	2,723	3,241	0	0	0	0	5,964
WEST SOUTH CENTRAL	59	3,408	5,239	0	0	0	0	8,647
MOUNTAIN	179	4,131	6,328	0	0	0	0	10,459
PACIFIC	43	3,307	4,349	0	0	0	0	7,656
NONCONTIGUOUS	177	3,071	3,769	0	0	0	0	6,841
UNITED STATES	2,308	3,058	3,893	0	0	0	0	6,951

TABLE A60 — LOADED AND EMPTY VEHICLES

NEW ENGLAND	247	2,991	3,320	0	0	0	0	6,311
MIDDLE ATLANTIC	417	3,048	3,487	0	0	0	0	6,535
SOUTH ATLANTIC NORTH	243	3,164	3,923	0	0	0	0	7,087
SOUTH ATLANTIC SOUTH	229	2,977	3,584	0	0	0	0	6,561
EAST NORTH CENTRAL	393	3,110	3,538	0	0	0	0	6,649
EAST SOUTH CENTRAL	234	2,679	2,722	0	0	0	0	5,402
WEST NORTH CENTRAL	1,709	2,651	2,657	0	0	0	0	5,308
WEST SOUTH CENTRAL	85	3,293	4,653	0	0	0	0	7,946
MOUNTAIN	320	3,849	5,164	0	0	0	0	9,013
PACIFIC	63	3,251	4,106	0	0	0	0	7,357
NONCONTIGUOUS	365	3,070	3,311	0	0	0	0	6,381
UNITED STATES	4,305	2,945	3,233	0	0	0	0	6,227

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 220000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	757	4,615	6,153	0	0	0	0	10,768
MIDDLE ATLANTIC	566	4,731	5,698	0	0	0	0	10,430
SOUTH ATLANTIC NORTH	780	4,631	6,030	0	0	0	0	10,662
SOUTH ATLANTIC SOUTH	1,176	4,577	5,513	0	0	0	0	10,090
EAST NORTH CENTRAL	661	4,665	5,868	0	0	0	0	10,533
EAST SOUTH CENTRAL	716	4,033	5,193	0	0	0	0	9,226
WEST NORTH CENTRAL	1,417	4,299	5,726	0	0	0	0	10,025
WEST SOUTH CENTRAL	622	4,449	5,747	0	0	0	0	10,196
MOUNTAIN	503	4,647	5,659	0	0	0	0	10,306
PACIFIC	208	4,579	5,596	0	0	0	0	10,175
NONCONTIGUOUS	558	4,782	5,887	0	0	0	0	10,668
UNITED STATES	7,964	4,515	5,732	0	0	0	0	10,247

TABLE A62

LOADED VEHICLES

NEW ENGLAND	1,399	5,440	10,195	0	0	0	0	15,636
MIDDLE ATLANTIC	1,050	5,582	9,527	0	0	0	0	15,109
SOUTH ATLANTIC NORTH	1,310	5,621	10,370	0	0	0	0	15,990
SOUTH ATLANTIC SOUTH	1,845	5,578	10,275	0	0	0	0	15,854
EAST NORTH CENTRAL	1,287	5,507	9,902	0	0	0	0	15,409
EAST SOUTH CENTRAL	953	4,912	10,687	0	0	0	0	15,599
WEST NORTH CENTRAL	2,558	5,260	10,554	0	0	0	0	15,814
WEST SOUTH CENTRAL	1,065	5,281	10,864	0	0	0	0	16,145
MOUNTAIN	879	5,324	10,298	0	0	0	0	15,622
PACIFIC	346	5,118	9,399	0	0	0	0	14,516
NONCONTIGUOUS	590	5,780	11,540	0	0	0	0	17,320
UNITED STATES	13,282	5,409	10,346	0	0	0	0	15,755

TABLE A63

LOADED AND EMPTY VEHICLES

NEW ENGLAND	2,156	5,151	8,776	0	0	0	0	13,927
MIDDLE ATLANTIC	1,616	5,284	8,186	0	0	0	0	13,470
SOUTH ATLANTIC NORTH	2,090	5,251	8,750	0	0	0	0	14,001
SOUTH ATLANTIC SOUTH	3,021	5,189	8,421	0	0	0	0	13,610
EAST NORTH CENTRAL	1,948	5,222	8,533	0	0	0	0	13,754
EAST SOUTH CENTRAL	1,669	4,535	8,330	0	0	0	0	12,865
WEST NORTH CENTRAL	3,975	4,917	8,833	0	0	0	0	13,750
WEST SOUTH CENTRAL	1,687	4,974	8,977	0	0	0	0	13,952
MOUNTAIN	1,382	5,077	8,610	0	0	0	0	13,687
PACIFIC	554	4,915	7,971	0	0	0	0	12,886
NONCONTIGUOUS	1,148	5,295	8,792	0	0	0	0	14,087
UNITED STATES	21,246	5,074	8,617	0	0	0	0	13,690

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 230000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	275	7,705	7,512	6,777	0	0	0	21,994
MIDDLE ATLANTIC	114	8,128	6,060	5,633	0	0	0	19,821
SOUTH ATLANTIC NORTH	251	8,359	6,373	6,062	0	0	0	20,794
SOUTH ATLANTIC SOUTH	388	7,497	5,774	5,689	0	0	0	18,961
EAST NORTH CENTRAL	253	7,239	5,546	5,298	0	0	0	18,083
EAST SOUTH CENTRAL	174	6,737	5,327	5,106	0	0	0	17,170
WEST NORTH CENTRAL	630	6,645	5,145	4,778	0	0	0	16,568
WEST SOUTH CENTRAL	225	6,752	5,345	5,001	0	0	0	17,098
MOUNTAIN	209	8,287	6,275	5,973	0	0	0	20,534
PACIFIC	59	7,185	5,781	5,754	0	0	0	18,720
NONCONTIGUOUS	138	9,163	7,524	7,449	0	0	0	24,136
UNITED STATES	2,716	7,431	5,914	5,602	0	0	0	18,946

TABLE A65 — LOADED VEHICLES

NEW ENGLAND	292	9,563	17,939	16,777	0	0	0	44,279
MIDDLE ATLANTIC	129	11,463	13,867	13,488	0	0	0	38,817
SOUTH ATLANTIC NORTH	265	11,402	15,249	15,131	0	0	0	41,781
SOUTH ATLANTIC SOUTH	380	10,462	14,957	14,999	0	0	0	40,418
EAST NORTH CENTRAL	283	10,499	12,859	12,734	0	0	0	36,092
EAST SOUTH CENTRAL	187	8,692	15,111	15,353	0	0	0	39,156
WEST NORTH CENTRAL	783	10,034	12,780	12,472	0	0	0	35,287
WEST SOUTH CENTRAL	260	8,559	13,160	11,660	0	0	0	33,379
MOUNTAIN	236	10,402	13,186	12,714	0	0	0	36,303
PACIFIC	93	10,404	14,472	14,174	0	0	0	39,051
NONCONTIGUOUS	165	12,744	16,395	15,962	0	0	0	45,101
UNITED STATES	3,073	10,241	14,256	13,854	0	0	0	38,351

TABLE A66 — LOADED AND EMPTY VEHICLES

NEW ENGLAND	567	8,662	12,882	11,927	0	0	0	33,471
MIDDLE ATLANTIC	243	9,898	10,204	9,803	0	0	0	29,905
SOUTH ATLANTIC NORTH	516	9,922	10,931	10,719	0	0	0	31,572
SOUTH ATLANTIC SOUTH	768	8,964	10,318	10,296	0	0	0	29,578
EAST NORTH CENTRAL	536	8,960	9,407	9,224	0	0	0	27,592
EAST SOUTH CENTRAL	361	7,750	10,395	10,414	0	0	0	28,559
WEST NORTH CENTRAL	1,413	8,523	9,376	9,042	0	0	0	26,941
WEST SOUTH CENTRAL	485	7,721	9,535	8,571	0	0	0	25,826
MOUNTAIN	445	9,409	9,940	9,548	0	0	0	28,897
PACIFIC	152	9,155	11,099	10,906	0	0	0	31,159
NONCONTIGUOUS	303	11,113	12,355	12,085	0	0	0	35,552
UNITED STATES	5,789	8,923	10,342	9,982	0	0	0	29,247

APPENDIX B

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 321000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	80	6,666	8,668	6,719	0	0	0	22,053
MIDDLE ATLANTIC	76	7,634	8,458	7,304	0	0	0	23,396
SOUTH ATLANTIC NORTH	61	7,438	8,966	7,685	0	0	0	24,089
SOUTH ATLANTIC SOUTH	98	7,058	8,350	7,112	0	0	0	22,520
EAST NORTH CENTRAL	114	6,565	8,225	6,980	0	0	0	21,770
EAST SOUTH CENTRAL	68	6,094	7,510	6,194	0	0	0	19,799
WEST NORTH CENTRAL	128	6,045	8,107	6,766	0	0	0	20,918
WEST SOUTH CENTRAL	140	6,060	7,965	6,866	0	0	0	20,891
MOUNTAIN	50	7,208	8,780	6,840	0	0	0	22,828
PACIFIC	14	6,200	7,800	5,893	0	0	0	19,893
NONCONTIGUOUS	11	6,700	8,445	7,364	0	0	0	22,509
UNITED STATES	840	6,625	8,266	6,915	0	0	0	21,805

TABLE A68

LOADED VEHICLES

NEW ENGLAND	173	7,368	13,058	10,940	0	0	0	31,366
MIDDLE ATLANTIC	153	7,631	11,493	10,782	0	0	0	29,906
SOUTH ATLANTIC NORTH	103	7,668	13,081	12,053	0	0	0	32,802
SOUTH ATLANTIC SOUTH	176	7,499	12,082	11,611	0	0	0	31,192
EAST NORTH CENTRAL	251	6,995	11,951	10,504	0	0	0	29,450
EAST SOUTH CENTRAL	129	6,519	12,133	11,084	0	0	0	29,737
WEST NORTH CENTRAL	325	7,101	12,526	10,939	0	0	0	30,566
WEST SOUTH CENTRAL	289	6,798	12,384	11,301	0	0	0	30,482
MOUNTAIN	139	7,533	13,888	11,906	0	0	0	33,328
PACIFIC	31	6,403	12,477	10,471	0	0	0	29,352
NONCONTIGUOUS	18	7,228	13,117	12,439	0	0	0	32,783
UNITED STATES	1,787	7,161	12,456	11,146	0	0	0	30,763

TABLE A69

LOADED AND EMPTY VEHICLES

NEW ENGLAND	253	7,146	11,670	9,605	0	0	0	28,421
MIDDLE ATLANTIC	229	7,632	10,486	9,628	0	0	0	27,745
SOUTH ATLANTIC NORTH	164	7,582	11,550	10,429	0	0	0	29,561
SOUTH ATLANTIC SOUTH	274	7,341	10,747	10,002	0	0	0	28,091
EAST NORTH CENTRAL	365	6,861	10,787	9,404	0	0	0	27,052
EAST SOUTH CENTRAL	197	6,373	10,538	9,396	0	0	0	26,307
WEST NORTH CENTRAL	453	6,802	11,278	9,760	0	0	0	27,840
WEST SOUTH CENTRAL	429	6,557	10,942	9,854	0	0	0	27,352
MOUNTAIN	189	7,447	12,537	10,566	0	0	0	30,550
PACIFIC	45	6,340	11,022	9,047	0	0	0	26,409
NONCONTIGUOUS	29	7,028	11,345	10,514	0	0	0	28,886
UNITED STATES	2,627	6,989	11,117	9,793	0	0	0	27,899

APPENDIX B

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM VEHICLE TYPE : 322000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	385	7,341	8,941	5,635	5,482	0	0	27,398
MIDDLE ATLANTIC	284	7,816	8,349	5,070	5,158	0	0	26,393
SOUTH ATLANTIC NORTH	252	7,558	9,263	5,307	5,151	0	0	27,280
SOUTH ATLANTIC SOUTH	838	7,413	7,827	4,943	5,076	0	0	25,259
EAST NORTH CENTRAL	234	7,347	8,336	4,617	4,938	0	0	25,238
EAST SOUTH CENTRAL	329	6,466	7,354	4,365	4,668	0	0	22,853
WEST NORTH CENTRAL	345	6,755	8,017	4,809	5,009	0	0	24,590
WEST SOUTH CENTRAL	319	6,642	7,534	4,423	4,375	0	0	22,973
MOUNTAIN	68	7,600	9,053	5,550	5,953	0	0	28,156
PACIFIC	12	6,725	8,400	4,208	4,983	0	0	24,317
NONCONTIGUOUS	85	8,414	11,626	8,095	8,719	0	0	36,854
UNITED STATES	3,151	7,227	8,236	5,012	5,125	0	0	25,598

TABLE A71 LOADED VEHICLES

NEW ENGLAND	726	8,109	16,624	12,033	11,660	0	0	48,426
MIDDLE ATLANTIC	713	8,427	13,790	9,669	9,532	0	0	41,418
SOUTH ATLANTIC NORTH	465	8,429	15,473	11,344	11,362	0	0	46,608
SOUTH ATLANTIC SOUTH	1,288	8,497	15,753	13,462	13,707	0	0	51,420
EAST NORTH CENTRAL	543	7,993	13,548	8,953	9,048	0	0	39,541
EAST SOUTH CENTRAL	442	7,386	14,775	10,578	10,842	0	0	43,580
WEST NORTH CENTRAL	678	7,792	13,695	9,471	9,757	0	0	40,715
WEST SOUTH CENTRAL	662	7,540	14,200	9,941	9,818	0	0	41,499
MOUNTAIN	233	8,303	15,169	10,589	10,709	0	0	44,770
PACIFIC	46	7,691	13,374	8,300	8,748	0	0	38,113
NONCONTIGUOUS	114	9,069	21,041	15,925	16,094	0	0	62,130
UNITED STATES	5,910	8,115	14,976	11,074	11,125	0	0	45,291

TABLE A72 LOADED AND EMPTY VEHICLES

NEW ENGLAND	1,111	7,843	13,961	9,816	9,519	0	0	41,139
MIDDLE ATLANTIC	997	8,253	12,240	8,359	8,286	0	0	37,138
SOUTH ATLANTIC NORTH	717	8,123	13,291	9,222	9,179	0	0	39,815
SOUTH ATLANTIC SOUTH	2,126	8,070	12,629	10,104	10,305	0	0	41,108
EAST NORTH CENTRAL	777	7,798	11,978	7,647	7,810	0	0	35,234
EAST SOUTH CENTRAL	771	6,993	11,608	7,927	8,207	0	0	34,735
WEST NORTH CENTRAL	1,023	7,443	11,780	7,899	8,156	0	0	35,277
WEST SOUTH CENTRAL	981	7,248	12,032	8,146	8,048	0	0	35,475
MOUNTAIN	301	8,144	13,787	9,450	9,635	0	0	41,017
PACIFIC	58	7,491	12,345	7,453	7,969	0	0	35,259
NONCONTIGUOUS	199	8,789	17,020	12,581	12,944	0	0	51,334
UNITED STATES	9,061	7,806	12,632	8,966	9,039	0	0	38,443

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 332000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND	550	8,056	6,968	6,282	5,568	5,417	0	32,289
MIDDLE ATLANTIC	628	8,246	6,601	6,069	4,952	5,260	0	31,128
SOUTH ATLANTIC NORTH	806	8,447	7,086	6,222	4,926	5,285	0	31,966
SOUTH ATLANTIC SOUTH	1,151	8,342	6,550	6,277	4,914	5,186	0	31,268
EAST NORTH CENTRAL	936	8,004	6,295	5,696	4,340	4,640	0	28,974
EAST SOUTH CENTRAL	972	7,502	5,928	5,464	4,178	4,478	0	27,550
WEST NORTH CENTRAL	2,467	8,010	6,188	5,670	4,295	4,496	0	28,659
WEST SOUTH CENTRAL	1,814	8,024	6,420	5,796	4,488	4,530	0	29,258
MOUNTAIN	754	8,945	6,985	6,366	4,896	5,350	0	32,542
PACIFIC	120	8,330	6,168	5,754	4,003	4,186	0	28,441
NONCONTIGUOUS	113	9,648	8,070	7,881	6,772	7,095	0	39,465
UNITED STATES	10,311	8,142	6,470	5,919	4,616	4,835	0	29,982

TABLE A74

LOADED VEHICLES

NEW ENGLAND	798	8,716	13,738	13,011	14,527	14,560	0	64,554
MIDDLE ATLANTIC	1,480	8,988	12,667	12,333	12,054	12,623	0	58,666
SOUTH ATLANTIC NORTH	1,352	9,405	14,003	13,379	13,643	14,112	0	64,541
SOUTH ATLANTIC SOUTH	1,875	9,284	12,931	12,866	12,795	13,143	0	61,019
EAST NORTH CENTRAL	1,969	9,205	13,208	12,822	12,065	12,564	0	59,865
EAST SOUTH CENTRAL	1,342	8,476	13,402	12,890	12,682	13,262	0	60,712
WEST NORTH CENTRAL	4,231	9,209	13,985	13,562	12,880	13,263	0	62,898
WEST SOUTH CENTRAL	3,924	8,881	13,723	13,035	12,921	11,939	0	60,499
MOUNTAIN	1,896	9,506	15,043	14,500	13,477	14,435	0	66,962
PACIFIC	818	9,213	15,532	15,246	14,798	14,886	0	69,676
NONCONTIGUOUS	163	9,839	14,771	14,076	15,309	16,264	0	70,259
UNITED STATES	19,848	9,112	13,782	13,310	12,998	13,186	0	62,388

TABLE A75

LOADED AND EMPTY VEHICLES

NEW ENGLAND	1,348	8,447	10,976	10,266	10,872	10,829	0	51,389
MIDDLE ATLANTIC	2,108	8,767	10,860	10,467	9,938	10,430	0	50,462
SOUTH ATLANTIC NORTH	2,158	9,047	11,419	10,706	10,387	10,815	0	52,374
SOUTH ATLANTIC SOUTH	3,026	8,925	10,504	10,360	9,797	10,116	0	49,702
EAST NORTH CENTRAL	2,905	8,818	10,981	10,526	9,576	10,011	0	49,912
EAST SOUTH CENTRAL	2,314	8,067	10,263	9,771	9,110	9,572	0	46,782
WEST NORTH CENTRAL	6,698	8,767	11,113	10,655	9,718	10,034	0	50,287
WEST SOUTH CENTRAL	5,738	8,610	11,414	10,747	10,255	9,596	0	50,623
MOUNTAIN	2,650	9,346	12,750	12,186	11,036	11,850	0	57,168
PACIFIC	938	9,100	14,334	14,032	13,417	13,517	0	64,401
NONCONTIGUOUS	276	9,761	12,028	11,540	11,814	12,510	0	57,651
UNITED STATES	30,159	8,780	11,282	10,793	10,133	10,331	0	51,309

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM — VEHICLE TYPE : 432000

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND								
MIDDLE ATLANTIC*								
SOUTH ATLANTIC NORTH								
SOUTH ATLANTIC SOUTH								
EAST NORTH CENTRAL	8	7,150	5,838	6,100	4,863	4,638	0	28,588
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	59	7,924	6,227	5,769	4,458	4,093	0	28,471
WEST SOUTH CENTRAL	7	7,443	5,814	5,086	4,486	3,786	0	26,614
MOUNTAIN	183	8,631	6,209	5,715	5,143	4,804	0	30,501
PACIFIC	67	7,933	5,827	5,196	4,530	4,128	0	27,613
NONCONTIGUOUS	8	8,913	6,550	6,150	5,513	5,638	0	32,763
UNITED STATES	332	8,310	6,126	5,627	4,886	4,536	0	29,484

TABLE 477

LOADED VEHICLES

NEW ENGLAND								
MIDDLE ATLANTIC	4	9,950	14,250	9,450	13,000	12,200	0	58,850
SOUTH ATLANTIC NORTH	1	11,200	12,200	8,000	18,000	17,600	0	67,000
SOUTH ATLANTIC SOUTH	1	12,400	14,200	12,400	9,800	9,600	0	58,400
EAST NORTH CENTRAL	11	11,145	14,445	14,218	13,664	13,664	0	67,136
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	125	10,921	14,138	14,263	14,135	13,512	0	66,970
WEST SOUTH CENTRAL	14	10,571	14,157	13,407	12,193	13,407	0	63,736
MOUNTAIN	247	10,387	14,939	14,481	16,054	15,955	0	71,817
PACIFIC	175	10,005	14,664	14,510	16,126	16,007	0	71,313
NONCONTIGUOUS	51	9,265	13,935	13,825	14,376	13,500	0	64,902
UNITED STATES	629	10,315	14,586	14,319	15,403	15,157	0	69,779

TABLE 478

LOADED AND EMPTY VEHICLES

NEW ENGLAND								
MIDDLE ATLANTIC	4	9,950	14,250	9,450	13,000	12,200	0	58,850
SOUTH ATLANTIC NORTH	1	11,200	12,200	8,000	18,000	17,600	0	67,000
SOUTH ATLANTIC SOUTH	1	12,400	14,200	12,400	9,800	9,600	0	58,400
EAST NORTH CENTRAL	19	9,463	10,821	10,800	9,958	9,863	0	50,905
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	184	9,960	11,602	11,540	11,032	10,492	0	54,625
WEST SOUTH CENTRAL	21	9,529	11,376	10,633	9,624	10,200	0	51,362
MOUNTAIN	430	9,640	11,224	10,751	11,410	11,209	0	54,234
PACIFIC	242	9,431	12,217	11,931	12,916	12,719	0	59,214
NONCONTIGUOUS	59	9,217	12,934	12,785	13,175	12,434	0	60,544
UNITED STATES	961	9,622	11,663	11,316	11,769	11,488	0	55,858

TABLE 37. COMPARISON OF THE NUMBER OF VEHICLES WEIGHED AND THE AVERAGE AXLE AND GROSS WEIGHTS BY STATES IN CENSUS DIVISION GROUPS, HIGHWAY SYSTEM AND VEHICLE TYPE FOR EMPTY, LOADED AND COMBINED VEHICLES (CONTINUED)

PRIMARY RURAL SYSTEM

VEHICLE TYPE : 521200

EMPTY VEHICLES

	NUMBER OF VEHICLES WEIGHED	AVERAGE AXLE A	AXLE B	AXLE C	AXLE D	AXLE E	AXLE F	AVERAGE GROSS WEIGHT
NEW ENGLAND								
MIDDLE ATLANTIC								
SOUTH ATLANTIC NORTH								
SOUTH ATLANTIC SOUTH								
EAST NORTH CENTRAL	7	7,671	7,957	5,814	5,714	5,457	0	32,614
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	16	8,400	7,644	5,275	5,125	4,588	0	31,031
WEST SOUTH CENTRAL	17	8,418	7,894	7,335	5,747	6,200	0	35,594
MOUNTAIN	46	8,520	7,650	5,072	5,015	4,778	0	31,035
PACIFIC	30	7,617	7,287	4,927	4,543	4,153	0	28,527
NONCONTIGUOUS	45	8,311	8,569	6,287	5,653	6,218	0	35,038
UNITED STATES	161	8,234	7,878	5,676	5,224	5,225	0	32,236

TABLE A80

LOADED VEHICLES

NEW ENGLAND								
MIDDLE ATLANTIC								
SOUTH ATLANTIC NORTH								
SOUTH ATLANTIC SOUTH								
EAST NORTH CENTRAL	56	8,704	14,655	14,098	11,605	11,779	0	60,841
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	156	8,988	15,052	13,540	11,389	10,933	0	59,903
WEST SOUTH CENTRAL	235	8,858	14,550	13,897	11,675	11,383	0	60,363
MOUNTAIN	263	9,386	15,564	14,230	12,376	12,455	0	64,012
PACIFIC	82	8,884	15,657	14,365	13,504	13,109	0	65,518
NONCONTIGUOUS	60	9,708	19,820	20,118	18,863	18,677	0	87,187
UNITED STATES	852	9,097	15,440	14,431	12,517	12,337	0	63,822

TABLE A81

LOADED AND EMPTY VEHICLES

NEW ENGLAND								
MIDDLE ATLANTIC								
SOUTH ATLANTIC NORTH								
SOUTH ATLANTIC SOUTH								
EAST NORTH CENTRAL	63	8,589	13,911	13,178	10,951	11,076	0	57,705
EAST SOUTH CENTRAL								
WEST NORTH CENTRAL	172	8,934	14,363	12,772	10,806	10,343	0	57,217
WEST SOUTH CENTRAL	252	8,828	14,101	13,454	11,275	11,033	0	58,692
MOUNTAIN	309	9,257	14,386	12,867	11,280	11,312	0	59,103
PACIFIC	112	8,545	13,415	11,837	11,104	10,710	0	55,610
NONCONTIGUOUS	105	9,110	14,998	14,190	13,202	13,337	0	64,837
UNITED STATES	1,013	8,960	14,238	13,039	11,358	11,207	0	58,802

APPENDIX C -- TABLE 38. AVERAGE WEIGHT OF VEHICLES WEIGHED BY VEHICLE TYPE, CENSUS DIVISION AND HIGHWAY SYSTEM

PRIMARY RURAL SYSTEM

CENSUS DIVISION	VEHICLE TYPE: 200000,210000			VEHICLE TYPE: 220000			VEHICLE TYPE: 230000			VEHICLE TYPE: 432000		
	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD
NEW ENGLAND	5,363	4,410	953	15,636	10,768	4,868	44,279	21,994	22,285	0	0	0
MIDDLE ATLANTIC	6,069	4,826	1,243	15,109	10,430	4,679	38,817	19,821	18,996	58,850	0	0
SOUTH ATLANTIC NORTH	6,195	4,849	1,346	15,990	10,662	5,328	41,781	20,794	20,987	67,000	0	0
SOUTH ATLANTIC SOUTH	5,577	4,315	1,262	15,854	10,090	5,764	40,418	18,961	21,457	58,400	0	0
EAST NORTH CENTRAL	5,749	4,763	986	15,409	10,533	4,876	36,092	18,083	18,009	67,136	28,588	38,548
EAST SOUTH CENTRAL	5,687	4,505	1,182	15,599	9,226	6,373	39,156	17,170	21,986	0	0	0
WEST NORTH CENTRAL	5,728	4,613	1,115	15,814	10,025	5,789	35,287	16,568	18,719	66,970	28,471	38,499
WEST SOUTH CENTRAL	6,113	4,720	1,393	16,145	10,196	5,949	33,379	17,098	16,281	63,736	26,614	37,122
MOUNTAIN	6,771	5,250	1,521	15,622	10,306	5,316	36,303	20,534	15,769	71,817	30,501	41,316
PACIFIC	6,751	5,241	1,510	14,516	10,175	4,341	39,051	18,720	20,331	71,313	27,613	43,700
NONCONTIGUOUS	6,170	4,822	1,348	17,320	10,668	6,652	45,101	24,136	20,965	64,902	32,763	32,139
NATIONAL AVERAGE	5,886	4,650	1,236	15,755	10,247	5,508	38,351	18,946	19,405	69,779	29,484	40,295

CENSUS DIVISION	VEHICLE TYPE: 321000			VEHICLE TYPE: 322000			VEHICLE TYPE: 332000			VEHICLE TYPE: 521200		
	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD	AVERAGE GROSS LOADED	AVERAGE EMPTY WEIGHT	AVERAGE PAYLOAD
NEW ENGLAND	31,366	22,053	9,313	48,426	27,398	21,028	64,554	32,289	32,265	0	0	0
MIDDLE ATLANTIC	29,906	23,396	6,510	41,418	26,393	15,025	58,666	31,128	27,538	0	0	0
SOUTH ATLANTIC NORTH	32,802	24,089	8,713	46,608	27,280	19,328	64,541	31,966	32,575	0	0	0
SOUTH ATLANTIC SOUTH	31,192	22,520	8,672	51,420	25,259	26,161	61,019	31,268	29,751	0	0	0
EAST NORTH CENTRAL	29,450	21,770	7,680	39,541	25,238	14,303	59,865	28,974	30,891	60,841	32,614	28,227
EAST SOUTH CENTRAL	29,737	19,799	9,938	43,580	22,853	20,727	60,712	27,550	33,162	0	0	0
WEST NORTH CENTRAL	30,566	20,918	9,648	40,715	24,590	16,125	62,898	28,659	34,239	59,903	31,031	28,872
WEST SOUTH CENTRAL	30,482	20,891	9,591	41,499	22,973	18,526	60,499	29,258	31,241	60,363	35,594	24,769
MOUNTAIN	33,328	22,828	10,500	44,770	28,156	16,614	66,962	32,542	34,420	64,012	31,035	32,977
PACIFIC	29,352	19,893	9,459	38,113	24,317	13,796	69,676	28,441	41,235	65,518	28,527	36,991
NONCONTIGUOUS	32,783	22,509	10,274	62,130	36,854	25,276	70,259	39,465	30,794	87,187	35,038	52,149
NATIONAL AVERAGE	30,763	21,805	8,958	45,291	25,598	19,693	62,388	29,982	32,406	63,822	32,236	31,586

APPENDIX C -- TABLE 39. NUMBER OF VEHICLES TALLIED

PRIMARY RURAL SYSTEM

	VEHICLE TYPE: 200000,210000		VEHICLE TYPE: 220000		VEHICLE TYPE: 230000		VEHICLE TYPE: 432000	
	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES
NEW ENGLAND	845	832	1,399	757	292	275	0	0
MIDDLE ATLANTIC	1,131	1,410	1,050	566	129	114	4	0
SOUTH ATLANTIC NORTH	668	1,608	1,310	780	265	251	1	0
SOUTH ATLANTIC SOUTH	1,202	3,627	1,845	1,176	380	388	1	0
EAST NORTH CENTRAL	1,241	1,849	1,287	661	283	253	11	8
EAST SOUTH CENTRAL	516	1,435	953	716	187	174	0	0
WEST NORTH CENTRAL	2,849	4,015	2,558	1,417	783	630	125	59
WEST SOUTH CENTRAL	378	1,012	1,065	622	260	225	14	7
MOUNTAIN	885	1,205	879	503	236	209	247	183
PACIFIC	95	61	346	208	93	59	175	67
NONCONTIGUOUS	587	1,011	590	558	165	138	51	8
NATIONAL AVERAGE	10,397	18,065	13,282	7,964	3,073	2,716	629	332

	VEHICLE TYPE: 321000		VEHICLE TYPE: 322000		VEHICLE TYPE: 332000		VEHICLE TYPE: 521200	
	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	EMPTY VEHICLES
NEW ENGLAND	173	80	726	385	798	550	0	0
MIDDLE ATLANTIC	153	76	713	284	1,480	628	0	0
SOUTH ATLANTIC NORTH	103	61	465	252	1,352	806	0	0
SOUTH ATLANTIC SOUTH	176	98	1,288	838	1,875	1,151	0	0
EAST NORTH CENTRAL	251	114	543	234	1,969	936	56	7
EAST SOUTH CENTRAL	129	68	442	329	1,342	972	0	0
WEST NORTH CENTRAL	325	128	678	345	4,231	2,467	156	16
WEST SOUTH CENTRAL	289	140	662	319	3,924	1,814	235	17
MOUNTAIN	139	50	233	68	1,896	754	263	46
PACIFIC	31	14	46	12	818	120	82	30
NONCONTIGUOUS	18	11	114	85	163	113	60	45
NATIONAL AVERAGE	1,787	840	5,910	3,151	19,848	10,311	852	161

APPENDIX D -- TABLE 40. ACCUMULATIVE PERCENTAGES FOR GROSS WEIGHT DISTRIBUTION

WEST NORTH CENTRAL
PRIMARY RURAL SYSTEM

WEIGHT INTERVAL	VEHICLE TYPE: 200000			VEHICLE TYPE: 210000			VEHICLE TYPE: 220000		
	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES
UNDER 1,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 2,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 3,000	0.6	0.0	0.4	0.9	0.1	0.5	0.0	0.0	0.0
UNDER 4,000	11.9	2.6	8.1	14.7	2.5	9.2	0.0	0.0	0.0
UNDER 5,000	77.2	32.6	59.2	70.9	29.4	52.2	0.7	0.1	0.3
UNDER 6,000	97.1	66.2	84.6	91.8	58.4	76.7	4.4	0.4	1.8
UNDER 7,000	99.2	86.2	93.9	96.8	79.1	88.8	11.8	1.9	5.4
UNDER 8,000	99.5	95.6	97.9	98.4	91.6	95.3	21.2	5.9	11.3
UNDER 9,000	99.6	98.3	99.1	98.6	96.2	97.7	36.1	10.9	19.9
UNDER 10,000	99.8	99.2	99.6	98.9	97.4	98.2	54.1	17.0	30.2
UNDER 11,000	99.8	99.5	99.7	99.0	98.4	98.8	68.9	22.3	38.9
UNDER 12,000	99.8	99.6	99.7	99.1	98.6	98.9	80.4	28.5	47.0
UNDER 14,000	99.8	99.7	99.7	99.3	98.8	99.1	92.6	40.5	59.0
UNDER 16,000	99.8	99.8	99.8	99.5	99.1	99.3	97.2	52.2	68.2
UNDER 18,000	99.9	99.8	99.8	99.5	99.4	99.4	98.4	63.5	75.9
UNDER 20,000	99.9	99.9	99.9	99.7	99.4	99.5	98.9	74.9	83.5
UNDER 22,000	100.0	100.0	100.0	99.7	99.9	99.8	99.2	84.9	90.0
UNDER 24,000				99.7	99.9	99.8	99.5	92.7	95.1
UNDER 26,000				99.8	99.9	99.8	99.7	97.6	98.4
UNDER 28,000				99.9	99.9	99.9	99.9	99.2	99.5
UNDER 30,000				99.9	99.9	99.9	99.9	99.7	99.8
UNDER 32,000				100.0	100.0	100.0	99.9	99.8	99.8
UNDER 34,000							99.9	99.8	99.9
UNDER 36,000							100.0	99.9	99.9
UNDER 38,000								99.9	99.9
UNDER 40,000								99.9	99.9
UNDER 42,000								99.9	99.9
UNDER 44,000								100.0	100.0

APPENDIX D -- TABLE 40. ACCUMULATIVE PERCENTAGES FOR GROSS WEIGHT DISTRIBUTION (CONTINUED)

WEST NORTH CENTRAL
PRIMARY RURAL SYSTEM

WEIGHT INTERVAL	VEHICLE TYPE: 230000			VEHICLE TYPE: 321000			VEHICLE TYPE: 322000		
	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES
UNDER 1,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 2,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 3,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 4,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 5,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 6,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 7,000	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0
UNDER 8,000	0.0	0.0	0.0	0.0	0.3	0.2	0.0	0.0	0.0
UNDER 9,000	0.2	0.0	0.1	0.0	0.3	0.2	0.3	0.0	0.1
UNDER 10,000	0.6	0.0	0.3	0.0	0.3	0.2	0.3	0.0	0.1
UNDER 11,000	2.1	0.0	0.9	0.0	0.3	0.2	0.3	0.3	0.3
UNDER 12,000	6.3	0.1	2.9	0.0	0.3	0.2	0.6	0.3	0.4
UNDER 14,000	23.7	0.4	10.8	0.0	0.3	0.2	2.0	0.3	0.9
UNDER 16,000	49.0	1.5	22.7	7.8	1.5	3.3	2.6	0.4	1.2
UNDER 18,000	73.0	3.4	34.5	23.4	3.7	9.3	4.3	0.6	1.9
UNDER 20,000	84.6	5.2	40.6	43.0	6.5	16.8	10.4	1.3	4.4
UNDER 22,000	92.1	8.9	46.0	60.9	10.5	24.7	21.4	1.8	8.4
UNDER 24,000	97.0	13.4	50.7	77.3	18.5	35.1	47.8	3.5	18.5
UNDER 26,000	97.9	17.9	53.6	92.2	24.9	43.9	66.7	6.9	27.1
UNDER 28,000	98.6	23.0	56.7	96.9	34.5	52.1	82.9	10.5	34.9
UNDER 30,000	99.0	29.6	60.6	99.2	44.0	59.6	90.4	16.1	41.2
UNDER 32,000	99.0	36.4	64.3	100.0	56.0	68.4	94.8	21.1	45.9
UNDER 34,000	99.4	42.4	67.8		67.7	76.8	96.8	27.3	50.7
UNDER 36,000	99.5	49.0	71.5		78.2	84.3	98.0	35.0	56.2
UNDER 38,000	99.5	53.8	74.2		85.5	89.6	98.8	43.4	62.1
UNDER 40,000	99.8	61.6	78.6		90.5	93.2	99.1	48.5	65.6
UNDER 42,000	99.8	69.3	82.9		95.7	96.9	99.7	55.0	70.1
UNDER 44,000	100.0	79.2	88.5		98.8	99.1	99.7	61.2	74.2
UNDER 46,000		90.9	95.0		99.7	99.8	99.7	67.1	78.1
UNDER 48,000		97.6	98.7		100.0	100.0	99.7	74.6	83.1
UNDER 50,000		99.4	99.6				99.7	79.2	86.1
UNDER 52,000		99.9	99.9				99.7	82.6	88.4
UNDER 54,000		99.9	99.9				99.7	86.7	91.1
UNDER 56,000		99.9	99.9				100.0	91.7	94.5
UNDER 58,000		99.9	99.9					96.5	97.7
UNDER 60,000		99.9	99.9					98.4	98.9
UNDER 62,000		99.9	99.9					99.3	99.5
UNDER 64,000		99.9	99.9					99.7	99.8
UNDER 66,000		99.9	99.9					99.7	99.8
UNDER 68,000		99.9	99.9					99.9	99.9
UNDER 70,000		100.0	100.0					100.0	100.0

APPENDIX D -- TABLE 40. ACCUMULATIVE PERCENTAGES FOR GROSS WEIGHT DISTRIBUTION (CONTINUED)

WEST NORTH CENTRAL
PRIMARY RURAL SYSTEM

WEIGHT INTERVAL	VEHICLE TYPE: 332000			VEHICLE TYPE: 432000			VEHICLE TYPE: 521200		
	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES	EMPTY VEHICLES	LOADED VEHICLES	TOTAL VEHICLES
UNDER 1,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 2,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 3,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 4,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 5,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 6,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 7,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 8,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 9,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 10,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 11,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 12,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 14,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 16,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 18,000	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0	0.0
UNDER 20,000	0.1	0.0	0.0	1.7	0.0	0.5	0.0	0.0	0.0
UNDER 22,000	1.1	0.0	0.4	6.8	0.0	2.2	0.0	0.0	0.0
UNDER 24,000	11.6	0.1	4.4	10.2	0.8	3.8	0.0	0.0	0.0
UNDER 26,000	35.4	0.4	13.3	50.8	0.8	16.8	12.5	0.0	1.2
UNDER 28,000	54.0	0.9	20.4	72.9	1.6	24.5	18.8	0.0	1.7
UNDER 30,000	67.5	1.4	25.7	84.7	1.6	28.3	56.3	1.3	6.4
UNDER 32,000	78.9	2.2	30.5	88.1	2.4	29.9	62.5	2.6	8.1
UNDER 34,000	86.2	3.7	34.1	88.1	2.4	29.9	68.8	4.5	10.5
UNDER 36,000	91.9	4.9	36.9	91.5	3.2	31.5	81.3	4.5	11.6
UNDER 38,000	95.2	6.5	39.2	91.5	4.0	32.1	93.8	7.1	15.1
UNDER 40,000	97.5	8.4	41.2	93.2	4.8	33.2	100.0	7.7	16.3
UNDER 42,000	98.5	10.1	42.6	96.6	5.6	34.8		9.6	18.0
UNDER 44,000	98.9	12.1	44.1	96.6	5.6	34.8		11.5	19.8
UNDER 46,000	99.3	14.0	45.4	96.6	6.4	35.3		15.4	23.3
UNDER 48,000	99.5	15.9	46.7	96.6	7.2	35.9		16.0	23.8
UNDER 50,000	99.6	17.9	48.0	96.6	8.0	36.4		19.2	26.7
UNDER 52,000	99.6	20.3	49.5	96.6	8.0	36.4		23.7	30.8
UNDER 54,000	99.7	23.2	51.4	96.6	8.0	36.4		26.9	33.7
UNDER 56,000	99.7	25.7	53.0	96.6	8.8	37.0		30.8	37.2
UNDER 58,000	99.8	28.5	54.7	96.6	9.6	37.5		35.9	41.9
UNDER 60,000	99.8	31.6	56.7	96.6	12.8	39.7		39.1	44.8
UNDER 62,000	99.8	34.7	58.7	96.6	14.4	40.8		46.2	51.2
UNDER 64,000	99.9	38.9	61.3	96.6	18.4	43.5		51.9	56.4
UNDER 66,000	99.9	44.0	64.6	96.6	24.8	47.8		60.3	64.0
UNDER 68,000	100.0	50.8	68.9	96.6	33.6	53.8		67.3	70.3
UNDER 70,000		58.4	73.7	96.6	45.6	62.0		81.4	83.1
UNDER 75,000		92.9	95.5	100.0	96.0	97.3		98.7	98.8
UNDER 80,000		98.6	99.1		100.0	100.0		99.4	99.4
UNDER 85,000		99.7	99.8					100.0	100.0
UNDER 90,000		100.0	100.0						

APPENDIX D

TABLE 41. ACCUMULATIVE PERCENTAGES FOR SINGLE AND TANDEM AXLE WEIGHT DISTRIBUTIONS

NATIONAL — VEHICLE TYPE: 230000 — PRIMARY RURAL SYSTEM

LOADED AND EMPTY VEHICLES

WEIGHT INTERVAL	AXLE A	AXLE B	AXLE C	AXLE B-C	AXLE D	AXLE C-D	AXLE E	AXLE D-E	AXLE F	AXLE E-F
UNDER 1,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UNDER 2,000	0.1%			0.0%						
UNDER 3,000	0.4%			0.1%						
UNDER 4,000	2.1%			0.1%						
UNDER 5,000	7.5%			0.3%						
UNDER 6,000	17.2%			0.9%						
UNDER 7,000	30.2%			3.5%						
UNDER 8,000	44.0%			8.1%						
UNDER 9,000	57.1%			13.6%						
UNDER 10,000	67.5%			19.3%						
UNDER 11,000	75.9%			26.3%						
UNDER 12,000	82.7%			32.2%						
UNDER 14,000	91.1%			41.4%						
UNDER 16,000	96.3%			48.1%						
UNDER 18,000	98.9%			53.2%						
UNDER 20,000	99.5%			56.6%						
UNDER 22,000	99.8%			59.8%						
UNDER 24,000	100.0%			62.9%						
UNDER 26,000				66.5%						
UNDER 28,000				70.1%						
UNDER 30,000				75.4%						
UNDER 32,000				83.3%						
UNDER 34,000				88.0%						
UNDER 36,000				91.1%						
UNDER 38,000				93.2%						
UNDER 40,000				94.7%						
UNDER 42,000				95.9%						
UNDER 44,000				96.9%						
UNDER 46,000				97.6%						
UNDER 48,000				98.1%						
UNDER 50,000				98.6%						
UNDER 52,000				99.1%						
UNDER 54,000				99.4%						
UNDER 56,000				99.7%						
UNDER 58,000				99.8%						
UNDER 60,000				99.8%						
UNDER 62,000				99.9%						
UNDER 64,000				99.9%						
UNDER 66,000				100.0%						

TABLE 41. ACCUMULATIVE PERCENTAGES FOR SINGLE AND TANDEM AXLE WEIGHT DISTRIBUTIONS (CONTINUED)

NATIONAL — VEHICLE TYPE: 332000 — LOADED AND EMPTY VEHICLES — PRIMARY RURAL SYSTEM

WEIGHT INTERVAL	AXLE A	AXLE B	AXLE C	AXLE B-C	AXLE D	AXLE C-D	AXLE E	AXLE D-E	AXLE F	AXLE E-F
UNDER 1,000	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%	0.0%
UNDER 2,000	0.1%			0.0%				0.0%		
UNDER 3,000	0.1%			0.0%				0.0%		
UNDER 4,000	0.2%			0.0%				0.0%		
UNDER 5,000	0.8%			0.0%				0.4%		
UNDER 6,000	2.4%			0.1%				1.4%		
UNDER 7,000	7.0%			0.1%				5.7%		
UNDER 8,000	24.7%			0.5%				12.4%		
UNDER 9,000	56.4%			1.7%				19.6%		
UNDER 10,000	82.8%			5.4%				25.5%		
UNDER 11,000	93.9%			12.3%				29.8%		
UNDER 12,000	97.6%			19.1%				33.0%		
UNDER 14,000	99.6%			29.0%				37.9%		
UNDER 16,000	99.9%			35.3%				41.4%		
UNDER 18,000	99.9%			39.8%				44.7%		
UNDER 20,000	100.0%			43.6%				47.9%		
UNDER 22,000				47.6%				51.6%		
UNDER 24,000				52.2%				55.8%		
UNDER 26,000				57.8%				61.1%		
UNDER 28,000				64.6%				67.2%		
UNDER 30,000				73.5%				75.3%		
UNDER 32,000				85.9%				86.0%		
UNDER 34,000				94.1%				92.8%		
UNDER 36,000				97.3%				95.9%		
UNDER 38,000				98.7%				97.6%		
UNDER 40,000				99.3%				98.4%		
UNDER 42,000				99.6%				98.9%		
UNDER 44,000				99.8%				99.2%		
UNDER 46,000				99.9%				99.4%		
UNDER 48,000				99.9%				99.6%		
UNDER 50,000				99.9%				99.8%		
UNDER 52,000				100.0%				99.8%		
UNDER 54,000								99.9%		
UNDER 56,000								99.9%		
UNDER 58,000								100.0%		

APPENDIX E

TABLE 42. HOURLY CLASSIFICATION COUNT SUMMARY FOR 1971

NATIONAL

		VEHICLE TYPES									
		071000	061000	072000	062000	SB-TOT	030000	150000	180000	SB-TOT	SB-TOT
TOTAL P / R SYSTEM COUNT FOR 440 STATIONS		2516852	189014	562554	50821	3319241	14599	11179	7314	33092	3352333
DISTRIBUTION BY PCT.		56.52	4.24	12.63	1.14	74.54	.33	.25	.16	.74	75.29
PCT. OF TOTAL BY HOUR	00	1.03	1.12	.91	1.14	1.02	1.20	1.83	.16	1.18	1.02
	01	.66	.67	.64	.73	.66	.66	1.64	.36	.92	.66
	02	.58	.70	.97	1.42	.66	.59	1.58	.48	.90	.66
	03	.31	.30	.41	.47	.33	.27	1.58	.14	.69	.33
	04	.37	.37	.46	.52	.39	.18	1.57	.14	.64	.39
	05	.88	.94	.75	.96	.86	.57	1.39	.30	.79	.86
	06	3.64	4.77	2.11	2.88	3.43	2.45	3.77	3.16	3.06	3.43
	07	5.25	7.04	2.94	3.58	4.93	3.48	4.18	11.18	5.42	4.94
	08	4.79	5.15	4.26	3.93	4.71	2.84	13.69	14.83	9.15	4.75
	09	4.97	4.43	6.06	4.75	5.12	3.21	5.19	5.80	4.45	5.12
	10	5.37	4.52	7.82	6.16	5.75	4.39	6.17	3.83	4.87	5.74
	11	5.50	4.82	7.79	6.30	5.87	5.50	4.73	5.24	5.18	5.86
	12	5.65	5.23	7.43	6.14	5.93	6.31	4.56	4.31	5.28	5.92
	13	5.82	5.32	7.48	7.67	6.10	6.38	4.69	4.33	5.35	6.09
	14	6.16	5.61	7.83	6.51	6.42	7.45	5.47	8.20	6.95	6.43
	15	6.99	6.68	7.87	6.86	7.12	8.03	5.39	15.35	8.76	7.13
	16	8.29	8.58	7.82	7.59	8.21	8.77	5.58	9.54	7.86	8.21
	17	8.23	9.02	6.92	6.88	8.03	8.31	5.12	3.68	6.21	8.02
	18	6.67	6.72	5.56	6.41	6.48	7.39	6.05	2.87	5.94	6.48
	19	5.58	5.52	4.54	7.35	5.43	6.66	4.13	1.70	4.71	5.42
	20	4.60	4.27	3.53	4.15	4.39	6.56	3.60	1.50	4.44	4.39
	21	3.99	3.86	2.66	3.31	3.75	4.27	3.52	1.22	3.35	3.74
	22	2.71	2.55	1.89	2.45	2.56	2.80	2.29	.96	2.22	2.56
	23	1.95	1.81	1.37	1.85	1.84	1.73	2.26	.72	1.69	1.84

		VEHICLE TYPES									
		200000	210000	220000	230000	240000	SB-TOT	321000	322000	323000	331000
TOTAL P / R SYSTEM COUNT FOR 440 STATIONS		514932	38837	152399	34778	2276	742722	21646	77856	2001	650
DISTRIBUTION BY PCT.		11.56	.86	3.42	.78	.05	16.68	.49	1.75	.04	.01
PCT. OF TOTAL BY HOUR	00	.80	.34	.53	.54	.04	.71	1.42	1.97	1.05	1.69
	01	.49	.29	.56	.55	.22	.50	2.20	2.76	1.60	2.31
	02	.57	.46	.75	.76	.31	.61	2.13	2.91	.75	1.23
	03	.33	.24	.56	.59	.48	.39	2.45	2.92	2.15	1.38
	04	.48	.33	.75	.68	.70	.54	2.56	3.23	2.30	.92
	05	1.71	.89	1.32	1.42	1.14	1.57	2.67	3.30	3.50	1.85
	06	5.53	3.25	3.46	3.88	10.46	4.92	3.67	4.39	5.40	6.00
	07	6.72	3.97	5.48	5.90	6.24	6.28	4.28	4.56	4.90	4.46
	08	5.79	4.46	7.69	8.04	7.73	6.22	5.43	5.39	5.65	6.15
	09	5.87	4.77	7.77	8.04	8.83	6.31	6.01	5.55	8.05	4.77
	10	6.00	4.58	7.98	8.19	8.35	6.44	6.44	5.74	8.85	7.54
	11	5.86	4.47	7.61	7.75	8.39	6.24	5.91	5.66	8.10	6.00
	12	5.76	4.49	7.02	7.68	8.13	6.05	5.60	5.28	6.95	10.00
	13	5.98	4.56	7.54	8.39	9.01	6.35	5.80	5.20	6.90	8.00
	14	6.38	4.80	7.57	8.27	8.96	6.64	6.43	5.23	6.70	6.31
	15	7.22	4.94	7.53	7.32	6.90	7.17	5.50	5.15	5.10	6.77
	16	8.86	18.77	8.91	7.52	4.88	9.30	7.13	5.05	5.15	3.54
	17	7.85	4.25	5.37	4.73	3.30	6.99	5.75	4.76	3.65	6.62
	18	5.58	3.21	3.91	3.31	2.33	5.00	4.47	4.34	3.15	3.38
	19	3.97	2.09	2.70	2.01	1.05	3.51	3.50	3.85	2.05	1.38
	20	3.01	1.55	1.86	1.67	.83	2.63	3.23	3.52	2.05	3.08
	21	2.41	1.05	1.40	1.19	.70	2.07	2.55	3.14	2.25	3.08
	22	1.60	21.59	.98	.83	.62	2.46	2.56	3.03	2.45	2.00
	23	1.23	.62	.74	.73	.40	1.07	2.29	3.08	1.35	1.54

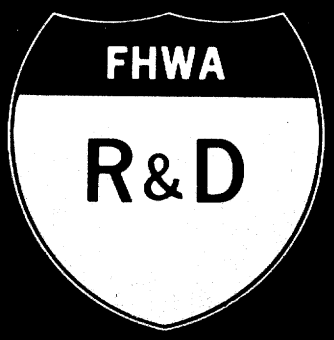
TABLE 42. HOURLY CLASSIFICATION COUNT SUMMARY FOR 1971 (CONTINUED)

NATIONAL

		VEHICLE TYPES									
		332000	333000	521100	521200	522200	531200	532200	OTHERS	SB-TOT	421000
TOTAL P / R SYSTEM COUNT FOR 440 STATIONS		239300	1950	12	5092	136	810	8	1892	351353	727
DISTRIBUTION BY PCT.		5.37	.04	.00	.11	.00	.02	.00	.04	7.89	.02
PCT. OF TOTAL BY HOUR	00	2.58	1.90	8.33	3.97	2.94	5.43	.00	.32	2.37	.69
	01	3.28	1.38	8.33	4.08	6.62	3.58	.00	.37	3.08	.83
	02	3.33	1.23	.00	4.22	.74	3.83	.00	.53	3.13	.96
	03	3.26	.72	8.33	4.08	2.21	2.84	.00	1.59	3.11	.41
	04	3.41	1.28	.00	4.36	5.15	2.96	12.50	4.07	3.31	.55
	05	3.45	3.03	.00	4.26	6.62	3.58	.00	8.14	3.40	.96
	06	4.47	5.44	.00	5.07	2.94	4.81	.00	8.46	4.45	7.57
	07	4.46	5.33	.00	4.67	7.35	5.19	.00	3.81	4.48	1.79
	08	4.64	5.38	8.33	4.36	8.09	4.69	.00	7.66	4.88	5.09
	09	5.00	5.54	33.33	4.05	5.15	5.80	.00	7.45	5.21	4.81
	10	5.27	8.92	16.67	3.87	5.15	5.68	12.50	6.98	5.48	4.40
	11	5.20	6.36	.00	4.01	3.68	3.70	.00	8.09	5.36	7.02
	12	5.11	8.31	8.33	4.14	2.21	4.69	12.50	7.77	5.21	4.26
	13	4.93	6.51	.00	4.46	1.47	2.84	.00	6.92	5.07	4.68
	14	4.86	7.64	.00	4.08	6.62	5.68	12.50	5.87	5.06	9.49
	15	4.66	5.64	.00	4.32	5.88	3.58	12.50	5.07	4.83	11.83
	16	4.61	5.18	.00	3.71	2.21	3.70	12.50	3.70	4.85	10.04
	17	4.41	5.08	.00	3.57	3.68	3.58	.00	4.65	4.56	9.22
	18	4.32	3.95	8.33	4.24	5.88	4.81	12.50	3.33	4.32	5.23
	19	4.00	3.54	.00	3.77	1.47	3.21	.00	2.06	3.90	2.06
	20	3.93	2.31	.00	4.01	5.15	5.31	.00	1.22	3.76	2.89
	21	3.84	1.54	.00	4.75	4.41	5.31	12.50	.79	3.58	1.65
	22	3.49	2.10	.00	3.97	2.21	2.72	.00	.42	3.30	1.65
	23	3.50	1.69	.00	3.95	2.21	2.47	.00	.74	3.29	1.93

		VEHICLE TYPES									
		422000	423000	431000	432000	433000	OTHERS	SB-TOT	SB-TOT	SB-TOT	GR-TOT
TOTAL P / R SYSTEM COUNT FOR 440 STATIONS		836	66	506	3741	221	174	6271	357624	1100346	4452679
DISTRIBUTION BY PCT.		.02	.00	.01	.08	.00	.00	.14	8.03	24.71	100.00
PCT. OF TOTAL BY HOUR	00	.96	.00	.00	2.91	.45	.00	1.96	2.37	1.25	1.08
	01	1.32	1.52	.40	2.75	3.17	2.87	2.15	3.06	1.33	.83
	02	1.67	1.52	.00	2.46	1.36	5.75	2.03	3.11	1.42	.85
	03	1.20	3.03	.59	2.33	1.36	4.02	1.83	3.09	1.27	.56
	04	.84	.00	.20	2.65	.45	6.32	1.96	3.29	1.43	.65
	05	1.20	4.55	.00	3.45	.00	6.32	2.55	3.39	2.16	1.18
	06	7.06	16.67	.99	4.41	3.17	6.32	4.99	4.46	4.77	3.76
	07	3.47	3.03	2.57	4.46	3.17	8.62	3.92	4.47	5.69	5.12
	08	6.22	1.52	6.92	5.93	4.98	4.60	5.84	4.90	5.79	5.01
	09	6.94	4.55	5.53	4.97	9.05	4.02	5.37	5.21	5.96	5.32
	10	4.67	3.03	6.52	6.79	7.24	6.32	6.17	5.49	6.13	5.84
	11	5.62	6.06	7.11	6.71	4.07	2.30	6.41	5.38	5.96	5.88
	12	4.90	3.03	7.91	6.17	10.86	4.02	6.00	5.23	5.78	5.89
	13	6.10	7.58	7.11	6.01	8.14	7.47	6.09	5.09	5.94	6.05
	14	5.81	6.06	11.46	6.01	9.50	7.47	7.53	5.11	6.14	6.36
	15	8.13	9.09	8.70	5.61	7.69	4.60	7.00	4.86	6.42	6.96
	16	8.13	7.58	8.30	5.21	3.17	5.17	6.36	4.87	7.86	8.13
	17	5.14	6.06	10.28	4.97	9.05	5.75	6.09	4.58	6.21	7.57
	18	5.38	3.03	5.34	3.53	1.36	2.30	4.00	4.32	4.78	6.06
	19	4.43	3.03	5.73	2.83	3.17	1.72	3.17	3.89	3.63	4.98
	20	2.51	4.55	1.58	3.10	.90	.00	2.73	3.74	2.99	4.05
	21	1.20	.00	1.38	2.51	6.33	.57	2.20	3.56	2.55	3.45
	22	1.79	1.52	1.19	2.35	1.36	1.72	2.04	3.28	2.73	2.60
	23	1.32	3.03	.20	1.84	.00	1.72	1.59	3.26	1.78	1.83

☆U.S. GOVERNMENT PRINTING OFFICE: 1977-240-897/111


FHWA
R&D