Standard Practice for
Classifying Highway Vehicles from Known Axle Count and Spacing[1]

This standard is issued under the fixed designation E 1572; the number immediately following the designation indicates the year of original adoption or, in the case of revision, the year of last revision. A number in parentheses indicates the year of last reapproval. A superscript epsilon (ε) indicates an editorial change since the last revision or reapproval.

1. Scope

1.1 This practice covers the classification of highway vehicles into categories relating to axle or unit configuration.

1.2 Traditionally, observers have classified vehicles visually. Because of cost, safety considerations, and the need for nighttime classifications, visual classification has become impractical. This practice classifies vehicles by methods other than visual observation, on the basis of axle count and spacing.

1.3 This practice defines a method that, when applied to a vehicle's known axle count and spacings, generates an axle configuration code and a modifier code. The axle configuration code describes the arrangement of axles, axle groups, and body units on the vehicle. The modifier code defines the vehicle's approximate load-carrying capacity.

1.4 This practice also defines procedures for optionally computing two- and six-digit codes that the Federal Highway Administration (FHWA) and states have used to classify vehicles from the axle configuration code and modifier code.

1.5 This practice does not address specific methods for measuring axle count and spacing, but rather the interpretation of such measurements obtained by unspecified automated equipment.

1.6 The degree of agreement between vehicle classifications determined by this practice and visual classifications depends on the accuracy of measured axle count and spacings and on interactions between selected classification parameters and the vehicle mix to which the classification is applied. These effects are complex and have not yet been quantified.

1.7 This practice applies only to vehicles that travel public highways.

1.8 The values stated in SI units are to be regarded as the standard. The values given in parentheses are for information only. The values stated in each system are not exact equivalents; therefore, each system must be used independently of the other. Combining values from the two systems may result in nonconformance with this practice.

1.9 *This standard does not purport to address all of the safety problems, if any, associated with its use. It is the responsibility of the user of this standard to establish appropriate safety and health practices and determine the applicability of regulatory limitations prior to use.*

2. Referenced Documents

2.1 *Miscellaneous Documents:*
Traffic Monitoring Guide, October 1992, FHWA-PL92-017[2]
A Vehicle Data Acquisition System, 1988, Idaho Transportation Department[3]
Vehicle Identification Algorithm, 1990, Idaho Transportation Department[3]

3. Terminology

3.1 *Definitions of Terms Specific to This Standard:*

3.1.1 *axle configuration code, n*—alphanumeric code, up to nine characters long, defining the number and type of units in a vehicle, number of axle groups in each unit, and number of axles in each axle group.

3.1.2 *axle count, n*—the total number of a vehicle's axles in contact with the pavement.

3.1.3 *axle group, n*—one or more adjacent axles, usually sharing a common connection to the body of a vehicle, which jointly support a portion of the vehicle's weight.

3.1.4 *axle spacing, n*—for each axle, the horizontal distance between the center of that axle and that of the preceding axle; the axle spacing for the vehicle's front axle is assumed to be zero.

3.1.5 *classification, n*—see *vehicle classification.*

3.1.6 *commercial vehicle, n*—a vehicle with heavy-duty chassis and suspension designed for commercial freight haulage.

3.1.7 *dolly, n*—an assembly equipped with a hitch and one or more axles, typically used to support the forward end of a semitrailer.

3.1.8 *full trailer, n*—a freight trailer supported at both ends by attached axles.

3.1.9 *group delta, n*—the maximum allowable difference between axle spacings within an axle group and the average axle spacing within the group.

3.1.10 *group limit, n*—the maximum axle spacing permitted for axles within an axle group.

3.1.11 *group spacing, n*—for each axle group, the horizontal distance between the midpoint of that axle group and the preceding axle group; the group spacing of the vehicle's front axle group is assumed to be zero.

3.1.12 *modifier code, n*—a one-character code appended to the axle configuration code to define the approximate load-carrying capacity of the vehicle.

3.1.13 *recreational vehicle, n*—a vehicle with light- or medium-duty chassis and suspension designed for recreational living or hauling.

3.1.14 *semitrailer, n*—a freight trailer supported at its forward end by a truck tractor or another trailer and at its rearward end by attached axles.

3.1.15 *tractor, n*—a powered unit capable of propelling itself and towing other (unpowered) units on a highway.

3.1.16 *unit, n*—an individual, detachable assembly of chassis, body, and axles comprising part of a complete vehicle; units include tractors, full trailers, and semitrailers.

3.1.17 *utility trailer, n*—a full trailer, typically used for light-duty hauling and towed by passenger vehicles or light trucks.

3.1.18 *vehicle, n*—an assembly of one or more units coupled together for travel on a highway; vehicles include one powered unit and may include one or more unpowered full trailer or semitrailer units.

3.1.19 *vehicle classification, n*—the process of characterizing vehicles by axle or unit configuration.

4. Summary of Practices

4.1 This practice classifies individual vehicles with known axle counts and spacings, via the seven-step process given in Table 1.

4.1.1 The vehicle's axle count and spacings are obtained by unspecified means.

4.1.2 Axles are aggregated into axle groups on the basis of axle spacing rules. Group spacing and the number of axles in each group are determined.

4.1.3 Axle groups are aggregated into units on the basis of group spacing rules. The type of each unit—tractor, full trailer, or semitrailer—is also determined.

4.1.4 An axle configuration code is assigned on the basis of the number and type of units, number of axle groups, and number and spacing of axles in each axle group. Letters in the code designate the number of axles in the units' forward axle group. Numbers designate the number of axles in other axle groups. Asterisks designate a semitrailer's forward end, which is not supported by an axle group.

4.1.5 A one-digit modifier code is assigned to distinguish between passenger vehicles and trucks with similar axle configuration codes.

4.1.6 Optionally, a two-digit, thirteen-category vehicle classification code required by the FHWA may be computed from the axle configuration code and modifier.

4.1.7 Optionally, a six-digit vehicle classification code formerly required by the FHWA may be computed from the axle configuration code and modifier.

5. Significance and Use

5.1 Classification is typically used to characterize the composition of vehicular traffic streams and to monitor trends in vehicle configuration. Classification information may be used to estimate fuel consumption and pavement loading, to design highway pavements, geometrics and signals, and to apportion highway user costs.

5.2 The procedure described in this practice produces an axle configuration code and modifier code that are applicable to both existing and new vehicle types. The codes do not depend on fixed definitions of vehicle categories.

TABLE 1 Seven-Step Classification Practice

Step	Quantity Determined	Vehicle 1	Vehicle 2	Vehicle 3	Vehicle 4
1	Axle number	1 2	1 2 3	1 2 3	1 2 3 4
	Axle spacing (m)	0.0 2.8	0.0 2.8 3.0	0.0 5.4 1.3	0.0 4.1 1.3 1.3
2	Group number	1 2	1 2 3	1 2	1 2
	Group spacing (m)	0.0 2.8	0.0 2.8 3.0	0.0 6.0	0.0 5.4
	Group axle count	1 1	1 1 1	1 2	1 3
3	Unit number	1	1 2	1	1
	Unit type	T	T S	T	T
4	Axle configuration code	A 1	A 1 * 1	A 2	A 3
5	Modifier code	3	3	7	7
6	FHWA 2-digit code	02	02	06	07
7	FHWA 6-digit code	040000	040900	230000	240000

Step	Quantity Determined	Vehicle 5	Vehicle 6
1	Axle number	1 2 3 4 5	1 2 3 4 5 6 7 8 9
	Axle spacing (m)	0.0 5.1 1.2 8.2 1.2	0.0 5.1 1.2 8.2 1.2 4.5 1.3 6.0 1.2
2	Group number	1 2 3	1 2 3 4 5
	Group spacing (m)	0.0 5.7 9.4	0.0 5.7 9.4 5.7 7.2
	Group axle count	1 2 2	1 2 2 2 2
3	Unit number	1 2	1 2 3
	Unit type	T S	T S F
4	Axle configuration code	A 2 * 2	A 2 * 2 B 2
5	Modifier code	9	9
6	FHWA 2-digit code	9	13
7	FHWA 6-digit code	332000	532400

5.3 The axle configuration code defined in this practice contains sufficient information on the vehicle to permit reclassification into other common classification methods.

5.4 This practice may be used in conjunction with other traffic data collection procedures, including in-motion vehicle weighing.

6. Procedure

6.1 *Obtain Axle Count and Spacings*—Obtain the axle count and axle spacings for one complete vehicle. Spacing shall be accurate to ±150 mm (±0.5 ft).

6.2 *Aggregate Axles Into Axle Groups*—Identify groups of adjacent, uniformly spaced axles on the basis of defined values for group limit and group delta (Table 2) and the vehicle's axle spacings.

6.2.1 *First Axle*—Assign the vehicle's front axle to the first axle group.

6.2.2 *Subsequent Axles*—Sequentially assign each of the vehicle's remaining axles to existing or new axle groups.

6.2.2.1 *Add to Previous Axle Group*—Add the axle to the previous axle group if its axle spacing does not exceed the group limit and if (*1*) its axle spacing does not differ from the average axle spacing within the previous axle group by more than the group delta, or (*2*) the previous axle group contains only one other axle.

6.2.2.2 *Begin New Axle Group*—Assign the axle to a new axle group if its axle spacing (*1*) exceeds the group limit or (*2*) exceeds the average axle spacing within the previous axle group by more than the group delta.

6.2.2.3 *Split Previous Axle Group*—Group the axle with the last axle of the previous axle group if (*1*) its axle spacing does not exceed the group limit and (*2*) the average axle spacing within the previous group exceeds its axle spacing by more than the group delta. Remove the previous axle from the previous axle group.

6.2.2.4 Repeat the steps given in 6.2.2.1-6.2.2.3 until all axles are assigned to a group.

6.2.3 *Incorrectly Grouped Front Axles*—Separate the first axle group if it is composed of two axles, unless the second axle group is composed of similarly spaced axles. This will separate the first two axles of small vehicles such as automobiles and motorcycles but maintain the grouping of dual steering axles on heavy vehicles.

6.2.4 *Group Spacings and Axle Counts*—As groups are developed, compute and retain the group spacings and number of axles in each group.

6.3 *Assign Axle Groups to Units*:

6.3.1 *Tractor Unit*—Combine the first two axle groups into the first unit, which is assumed to be a tractor.

6.3.2 *Trailer Units*—Combine the remaining axle groups, if any exist, into trailer units. Distinguish semitrailers and full trailers according to the following rules:

6.3.2.1 *Full Trailers*—If two or more axle groups remain to be assigned to a unit, assign the next two groups to a full trailer

if either of the following is true: (*1*) the group spacing of the first remaining axle group does not exceed the group spacing of the second remaining axle group; or (*2*) exactly two groups remain and the group spacing of the second remaining group is too great to represent a dolly or two single-axle groups on a semitrailer.

6.3.2.2 *Semitrailers*—If only one axle group remains to be assigned to a unit, assign that axle group to a semitrailer. Assign the next two axle groups to a semitrailer if more than one axle group remains, the group spacing of the first remaining axle group exceeds the group spacing of the second, and both axle groups are single axles spaced too closely to represent a dolly or full trailer (Table 3). Assign the next axle group to a semitrailer unit if more than one axle group remains, the group spacing of the first remaining axle group exceeds the group spacing of the second, and the groups do not represent a full trailer or a two-axle semitrailer.

6.3.2.3 Repeat the steps given in 6.3.2.1 and 6.3.2.2 until all axle groups are assigned to a unit.

6.3.3 *Unit Type and Group Count*—As units are developed, compute and retain the total number of units, number of axle groups belonging to each unit, and each unit's type (tractor, semitrailer, or full trailer).

6.4 *Assign Axle Configuration Code*—Assign the axle configuration code designating the number and type of units as well as the number of groups and axles in each group.

6.4.1 *First Group in Each Unit*—If the unit is a tractor or full trailer, add a character representing the number of axles in the unit's first axle group (A = 1, B = 2, and so on). If the unit is a semitrailer, add an asterisk (*), indicating the beginning of another unit, but no axles at the point of connection.

6.4.2 *Subsequent Groups in Each Unit*—For each subsequent axle group in the unit, add the numerical character representing the number of axles in the axle group (1 = 1, 2 = 2, and so on).

6.4.3 Repeat the steps given in 6.4.1 and 6.4.2 until characters have been assigned for all units in the vehicle.

6.5 *Assign Modifier Code*—To refine the vehicle's classification, assign a numerical code (Table 4) distinguishing the major categories of passenger vehicles and trucks.

6.5.1 *Characteristic Axle Spacings*—Use the criteria of axle count, axle spacings within axle groups, and spacings between certain axle groups to identify various commercial and noncommercial vehicle types.

6.5.1.1 *Commercial and Recreational Vehicle Axle Spacings*—Determine the number of axle spacings typical of commercial vehicles and the number of axle spacings typical of recreational vehicles for each unit in the vehicle and for the entire vehicle. Consider only axle spacings within axle groups, not spacings between axles in different axle groups. Typically, grouped axles on recreational vehicles are spaced less than 1.1-m (3.5-ft) apart.

6.5.1.2 *Typical Axle Spacings*—Also, base assignment of the modifier code on known axle spacings typical of certain vehicle types (Table 5).

TABLE 2 Group Limit and Group Delta

Parameter	Value, (m)	Value, (ft)
Group limit	2.4	8.0
Group delta	0.6	2.0

TABLE 3 Dolly Length Limit

Parameter	Value, (m)	Value, (ft)
Maximum dolly length	3.6	11.9

TABLE 4 Modifier Codes

Code	Vehicle Resembles
1	motorcycles
2	compact cars
3	standard cars and small pickups
4	pickups and large cars
5	recreational and other large 2-axle vehicles
6	buses
7	3-axle commercial vehicles
8	reserved for future use
9	tractor-trailer combinations

TABLE 5 Axle Spacings for Certain Vehicle Types

Parameter	Value, (m)	Value, (ft)
Maximum motorcycle axle spacing	1.8	6.0
Maximum compact car axle spacing	2.6	8.5
Maximum standard car axle spacing	2.9	9.4
Maximum large car and pickup axle spacing	4.3	14.0
Maximum large two-axle, 6-tire vehicle axle spacing	6.1	20.0
Maximum axle spacing between tractor rear axle and utility trailer front axle	6.1	20.0
Maximum spacing for axles in recreational vehicle axle groups	1.1	3.5

6.5.2 *Two-Axle Tractors*—If the tractor unit of the vehicle has two axles, determine the modifier code on the basis of the number of units and number of groups on trailer units:

6.5.2.1 *Single-Unit Vehicles*—If only one unit exists, determine a noncommercial code according to 6.5.4.

6.5.2.2 *Two-Unit Vehicles*—If any of the trailer unit's axle groups are characteristic of recreational vehicles or the trailer's first two axles are spaced closely, determine a noncommercial code according to 6.5.4. For all other two-unit vehicles, assign a code of 9.

6.5.2.3 *Three-or-More-Unit Vehicles*—If any unit has any axle spacing typical of recreational vehicles but none typical of commercial vehicles, determine a noncommercial code according to 6.5.4. Assign a code of 9 to all other vehicles with three or more units.

6.5.3 *Three-or-More-Axle Tractors*—If the tractor unit of the vehicle has more than two axles, determine the code on the basis of the number of units and number of groups on trailer units:

6.5.3.1 *Single-Unit Vehicles*—If the vehicle has no axle spacings typical of commercial vehicles but some typical of recreational vehicles, assign a code of 5. If the vehicle has any axle spacings typical of commercial vehicles, assign a code of 7 unless the first axle group contains one axle, the second group contains two axles, and the spacing between the first and second axles exceeds the maximum for two-axle truck; in that case, assign a code of 6 to designate a bus.

6.5.3.2 *Two-Unit Vehicles*—If the trailer has only one axle group and the tractor has any axle spacings typical of commercial vehicles, assign a code of 7 if the trailer has axle spacings typical of recreational vehicles or a utility trailer; otherwise, assign a code of 9. If the trailer has one axle group but the tractor has axle spacings typical of recreational vehicles, assign a code of 5 if there are no axle spacings typical of commercial vehicles anywhere on the vehicle; otherwise, assign a code of 9. If the trailer has more than one group and the tractor has any axle spacings typical of commercial vehicles, assign a code of 9. If the trailer has more than one

group and the tractor has axle spacings typical of recreational vehicles, assign a code of 5.

6.5.3.3 *Three-or-More-Unit Vehicles*—If the vehicle has no axle spacings typical of commercial vehicles, but has some axle spacings typical of recreational vehicles, assign a noncommercial code according to 6.5.4. Otherwise, assign a code of 9.

6.5.4 *Noncommercial Vehicles*—Assign a modifier code on the basis of the spacing between the first and second axles.

6.5.4.1 *Motorcycles*—If the spacing does not exceed the defined maximum length for motorcycles, assign a code of 1.

6.5.4.2 *Compact Cars*—Otherwise, if the spacing does not exceed the maximum length for the compact cars, assign a code of 2.

6.5.4.3 *Standard Cars*—Otherwise, if the spacing does not exceed the maximum length for standard automobiles, assign a code of 3.

6.5.4.4 *Large Cars or Pickups*—Otherwise, if the spacing does not exceed the maximum length for large cars and pickups, assign a code of 4.

6.5.4.5 *Two-Axle, Six-Tire Vehicles*—Otherwise, if the spacing does not exceed the maximum length for two-axle, six-tire vehicles, assign a code of 5.

6.5.4.6 *Buses*—Otherwise, assign a code of 6.

6.6 *Assign a Two-Digit Classification Code*—Optionally, compute the two-digit code used by the FHWA for vehicle classification purposes. The thirteen codes and their meanings are given in Table 6. For generality, derive the two-digit code from the axle configuration code and modifier code. This method permits the two-digit code to be computed from previously recorded axle configuration and modifier codes.

6.6.1 *Number of Units*—Compute the total number of units for the vehicle as the total number of non-numeric characters in the axle configuration code.

6.6.2 *Total Number of Axles*—Compute the total number of axles for the vehicle as the sum of the values of numeric characters (1 = 1, 2 = 2, and so on) and non-numeric characters (A = 1, B = 2, and so on).

6.6.3 *Two-Digit Code*—On the basis of the number of units and the vehicle description given by the modifier code, assign the two-digit code:

6.6.3.1 *Category 1*—If the modifier code is 1, designating a motorcycle, assign a two-digit code of 01.

6.6.3.2 *Category 2*—If the modifier code is 2 or 3, designating a compact or standard automobile, assign a two-digit code of 02.

TABLE 6 Two-Digit FHWA Vehicle Classification Codes

Code	Vehicle Description
01	motorcycles
02	passenger cars
03	other 2-axle, 4-tire, single-unit vehicles
04	buses
05	2-axle, 6-tire, single-unit trucks
06	3-axle, single-unit trucks
07	4-or-more-axle, single-unit trucks
08	4-or-less-axle, single-trailer trucks
09	5-axle, single-trailer trucks
10	6-or-more-axle, single-trailer trucks
11	5-or-less axle, multi-trailer trucks
12	6-axle, multi-trailer trucks
13	7-or more axle, multi-trailer trucks

6.6.3.3 *Category 3*—If the modifier code is 4, designating a large car or pickup, assign a two-digit code of 03.

6.6.3.4 *Category 4*—If the modifier code is 6, designating a bus, assign a two-digit code of 04.

6.6.3.5 *Category 5*—If the modifier code does not equal 1, 2, 3, 4, or 6, and the total number of axles is two, assign a two-digit code of 05 to designate a two-axle, six-tire, single-unit truck.

6.6.3.6 *Category 6*—If the total number of axles is three and the modifier code is 7, assign a two-digit code of 06 to designate a single unit truck with three axles.

6.6.3.7 *Category 7*—If the total number of axles exceeds three and the total number of units is one, assign a two-digit code of 07 to designate a single-unit truck with four-or-more axles.

6.6.3.8 *Category 8*—If the number of axles is four or less, and the number of units equals two, assign a two-digit code of 08 to designate a truck with a single trailer and four axles or less.

6.6.3.9 *Category 9*—If the number of axles is five and the number of units equals two, assign a two-digit code of 09 to designate a truck with a single trailer and exactly five axles.

6.6.3.10 *Category 10*—If the number of axles is six or more, and the number of units equals two, assign a two-digit code of 10 to designate a truck with a single trailer and six axles or more.

6.6.3.11 *Category 11*—If the number of axles does not exceed five and the number of units exceeds two, assign a two-digit code of 11 to designate a truck with multiple trailers and five axles or less.

6.6.3.12 *Category 12*, If the number of axles is six and the number of units exceeds two, assign a two-digit code of 12 to designate a truck with multiple trailers and exactly six axles.

6.6.3.13 *Category 13*—If the number of axles is seven or more and the number of units exceeds two, assign a two-digit code of 13 to designate a truck with multiple trailers and seven axles or more.

6.6.3.14 *Unclassified*—Assign a two digit code of 00 to any vehicle not classified in 6.6.3.1 through 6.6.3.13.

6.7 *Assign a Six-Digit Classification Code*—Optionally, compute the six-digit code formerly used by the FHWA for vehicle classification purposes. For generality, derive the six-digit code from the axle configuration code and modifier code. This method permits the six-digit code to be computed from previously recorded axle configuration and modifier codes.

6.7.1 *Number of Units*—Compute the total number of units for the vehicle as the total number of non-numeric characters in the axle configuration code.

6.7.2 *Total Number of Axles*—Compute the total number of axles for the vehicle as the sum of the values of numeric characters (1 = 1, 2 = 2, and so on) and non-numeric characters (A = 1, B = 2, and so on).

6.7.3 *Number of Axles in Each Unit*—For each unit in the vehicle, compute the unit's number of axles as the sum of the values of numeric characters (1 = 1, 2 = 2, and so on) and non-numeric characters (A = 1, B = 2, and so on). Include only those characters that correspond to each individual unit.

6.7.4 *Commercial Vehicles*—If the modifier code is 5, 7, or 9, indicating that the vehicle is a commercial vehicle, construct the six-digit code as follows:

6.7.4.1 *First Digit*—If the second unit—that is, the unit immediately following the tractor—is a full trailer (represented in the axle configuration code by a letter), compute the first digit of the six-digit code as two times the total number of units in the vehicle. If the second unit is a semitrailer (represented in the axle configuration code by an asterisk), compute the first digit as one less than two times the total number of units.

6.7.4.2 *Second Through Sixth Digits*—Set the remaining digits of the six-digit code equal to the number of axles in each unit. Use only as many digits as there are units; set remaining digits equal to zero.

6.7.5 *Noncommercial Vehicles*—If the vehicle is not a commercial vehicle, assign six-digit codes as defined in Table 7. If more than one unit exists, set the fourth digit in the six-digit code to 9, indicating the presence of a trailer.

7. Keywords

7.1 axles; classification; vehicles

TABLE 7 Six-Digit FHWA Vehicle Classification Codes for Non-Commercial Vehicles[A]

Modifier Code	Six-Digit Code
1	030000
2	050000
3	040000
4	200000
6	190000

[A]Add 900 to code if trailer present.

APPENDIX

(Nonmandatory Information)

X1. FORTRAN 77 SOURCE CODE FOR CLASSIFYING HIGHWAY VEHICLES FROM KNOWN AXLE COUNT AND SPACING

X1.1 Explanation

X1.1.1 *Purpose*—The source code given in Figs. X1.1-X1.14 is presented to illustrate application of the procedure described in this practice. It includes subroutines that apply the practice and an interactive main program that allows users to supply axle count and spacings and test the practice. The subroutines, or their equivalent in other computer languages, could be used in traffic data collection equipment or analysis software.

X1.1.2 *Language*—The code is written in ANSI Fortran 77

```
 1   C----------------------------------------------------------------
 2   C Main program E1742881 accepts the operator's definition of vehicles'
 3   C axle count and spacing, then calls a subroutine (VCLASS) to determine
 4   C the axle configuration code and modifier code defined in the procedure
 5   C described by this practice. Finally, E1742881 calls function subprograms
 6   C to generate 2- and 6-digit vehicle classification codes historically
 7   C used by the Federal Highway Administration.
 8   C
 9         PROGRAM E1742881
10   C
11   C     Allocate number of axles and up to 16 axle spacings
12         INTEGER NAXLE
13         REAL ASPACE(16)
14   C
15   C     Allocate classification codes
16         CHARACTER ACODE*9,MCODE*1,FHWA06*6,FHWA13*2
17   C
18   C     Display program title
19         WRITE(*,1)
20   1     FORMAT(23(/),' New Standard for Classification of',
21        *' Highway Vehicles by Axle Count and Spacing'/
22        *' ASTM E17.42.88.1     Revised 01/30/92')
23   C
24   C     Loop on vehicles
25         DO 9 IVHCL=1,10000
26   C
27   C        Read # of axles, blank means quit
28            WRITE(*,2)
29   2        FORMAT('0# of axles? '\)
30            READ(*,3)NAXLE
31   3        FORMAT(I2)
32            IF(NAXLE.LE.0)GO TO 10
33   C
34   C        Read axle spacings
35            ASPACE(1)=0.
36            DO 6 IAXLE=2,NAXLE
37               WRITE(*,4)IAXLE-1,IAXLE
38   4           FORMAT(' Axle'I2'-'I2' spacing (ft)? '\)
39               READ(*,5)ASPACE(IAXLE)
40   5           FORMAT(F5.0)
41   6           CONTINUE
42   C
43   C        Classify vehicle by axle configuration code and modifier)
44            CALL VCLASS(NAXLE,ASPACE,ACODE,MCODE)
45            WRITE(*,7)ACODE,MCODE
46   7        FORMAT(' Axle Configuration Code-Modifier='A9'-'A1)
47   C
48   C        Get and display FHWA 13-category and 6-character codes
49            WRITE(*,8)FHWA13(ACODE,MCODE),FHWA06(ACODE,MCODE)
50   8        FORMAT(' FHWA Codes='A2','A6)
51   C
52   C        Next vehicle
53   9        CONTINUE
54   C
55   C     Done
56   10      STOP
57         END
58
59   C----------------------------------------------------------------
60   C Subroutine VCLASS calls subroutine GROUPS to combine axles into axle
61   C groups, then calls subroutine UNITS to combine groups into vehicle
62   C units. VCLASS also calls subroutines ACCODE and MODIFY to compute the
63   C axle configuration code and modifier code.
```

FIG. X1.1 Source Code Listing

and has been tested using Microsoft Fortran Version 5.1 on IBM PC-compatible personal computers. The code should function for other Fortran 77 compilers and computer systems with slight or no modification.

X1.2 Source Code Listing

X1.2.1 See Fig. X1.1 for the source code listing.

```
64  C
65        SUBROUTINE VCLASS(NAXLE,ASPACE,ACODE,MCODE)
66        INTEGER NAXLE
67        REAL ASPACE(NAXLE)
68        CHARACTER ACODE*9,MCODE*1
69  C
70  C     Allocate group and unit variables. Allow
71  C     up to 16 axle groups and up to four units
72        REAL GSPACE(16)
73        INTEGER NGROUP,GAXLES(16),NUNIT,UAXLES(4),UGROUP(4)
74        CHARACTER*1 UTYPE(4)
75  C
76  C     Determine grouping of axles; display them
77        CALL GROUPS(NAXLE,ASPACE,NGROUP,GAXLES,GSPACE)
78        WRITE(*,1)(IGROUP,GAXLES(IGROUP),GSPACE(IGROUP),IGROUP=1,NGROUP)
79  1     FORMAT(' Group'I2' axles='I1', spacing='F5.1)
80  C
81  C     Combine groups into units; display them
82        CALL UNITS(NGROUP,GAXLES,GSPACE,NUNIT,UAXLES,UGROUP,UTYPE)
83        WRITE(*,2)(IUNIT,UAXLES(IUNIT),UGROUP(IUNIT),
84      *   UTYPE(IUNIT),IUNIT=1,NUNIT)
85  2     FORMAT(' Unit'I2' axles='I1', groups='I1', type='A1)
86  C
87  C     Get axle configuration code and modifier
88        CALL ACCODE(GAXLES,NUNIT,UGROUP,UTYPE,ACODE)
89        CALL MODIFY(ASPACE,GAXLES,NUNIT,UAXLES,UGROUP,MCODE)
90  C
91  C     Done
92        RETURN
93        END
94
95  C-------------------------------------------------------------------
96  C Block data subprogram CLPARM defines all length parameters used to
97  C classify vehicles. Both English and Standard International units are
98  C included. One set of statements must be commented out.
99  C
100       BLOCK DATA CLPARM
101 C
102 C     Allocate important classification control parameters
103       COMMON /PARAMS/ GLIMIT,GDELTA,UTLMAX,TWOMAX,PIKMAX,
104     *   STDMAX,COMMAX,MOTMAX,RECMAX,DOLMAX
105 C
106 C     Define parameters (English units: feet)
107 C     DATA GDELTA / 2.0/ !Maximum axle spacing variation within group
108 C     DATA GLIMIT / 8.0/ !Maximum spacing between axles in group
109 C     DATA UTLMAX /20.0/ !Maximum utility trailer length
110 C     DATA TWOMAX /20.0/ !Maximum two-axle, 6-tired axle spacing
111 C     DATA PIKMAX /14.0/ !Maximum large car/pickup axle spacing
112 C     DATA STDMAX / 9.4/ !Maximum standard car axle spacing
113 C     DATA COMMAX / 8.5/ !Maximum compact car axle spacing
114 C     DATA MOTMAX / 6.0/ !Maximum motorcycle axle spacing
115 C     DATA RECMAX / 3.5/ !Maximum recreational trailer axle spacing
116 C     DATA DOLMAX /11.9/ !Maximum dolly length
117 C
118 C     Define parameters (Standard International units: metres)
119       DATA GDELTA / 0.6/ !Maximum axle spacing variation within group
120       DATA GLIMIT / 2.4/ !Maximum spacing between axles in group
121       DATA UTLMAX / 6.1/ !Maximum utility trailer length
122       DATA TWOMAX / 6.1/ !Maximum two-axle, 6-tired axle spacing
123       DATA PIKMAX / 4.3/ !Maximum large car/pickup axle spacing
124       DATA STDMAX / 2.9/ !Maximum standard car axle spacing
125       DATA COMMAX / 2.6/ !Maximum compact car axle spacing
126       DATA MOTMAX / 1.8/ !Maximum motorcycle axle spacing
127       DATA RECMAX / 1.1/ !Maximum recreational trailer axle spacing
128       DATA DOLMAX / 3.6/ !Maximum dolly length
```

FIG. X1.2 Source Code Listing—Continued

```
129  C
130  C     Done
131        END
132
133  C------------------------------------------------------------------
134  C Subroutine GROUPS accepts a vehicle's axle count and spacings, and
135  C determines the number of axle groups, the number of axles in each
136  C group, and the center-to-center spacings between groups.
137  C
138        SUBROUTINE GROUPS(NAXLE,ASPACE,NGROUP,GAXLES,GSPACE)
139        INTEGER NAXLE,NGROUP,GAXLES(*)
140        REAL ASPACE(*),GSPACE(*)
141  C
142  C     Allocate important classification control parameters
143        COMMON /PARAMS/ GLIMIT,GDELTA,UTLMAX,TWOMAX,PIKMAX,
144       *  STDMAX,COMMAX,MOTMAX,RECMAX,DOLMAX
145  C
146  C     Allocate temporary group axle count and length
147        INTEGER GCOUNT
148        REAL GLENTH
149  C
150  C     Define 1st axle as beginning of 1st group
151        NGROUP=1
152        GCOUNT=1
153        GLENTH=0.
154  C
155  C     Group remaining axles
156        DO 1 IAXLE=2,NAXLE
157  C
158  C        If axle is close to last group...
159         IF(ASPACE(IAXLE).LE.GLIMIT)THEN
160  C
161  C           If last group has more than one axle already,
162  C           see if a new axle will fit into the group
163            IF(GCOUNT.GT.1)THEN
164  C
165  C              Compute average spacing of last group
166               GAVESP=GLENTH/(GCOUNT-1)
167  C
168  C              If axle spacing is significantly greater than the
169  C              last group's average spacing, start a new group
170               IF(ASPACE(IAXLE).GT.GAVESP+GDELTA)THEN
171               CALL NEWGRP
172       *          (IAXLE,ASPACE,NGROUP,GAXLES,GSPACE,GCOUNT,GLENTH)
173  C
174  C              If axle spacing is significantly less than the last
175  C              group's average spacing, remove the group's last axle
176  C              and start a new group with the removed axle and this axle
177               ELSE IF(ASPACE(IAXLE).LT.GAVESP-GDELTA)THEN
178  C
179  C                 Remove axle from last group and correct group spacing
180                  GCOUNT=GCOUNT-1
181                  GLENTH=GLENTH-ASPACE(IAXLE-1)
182  C
183  C                 Begin a new group with removed axle
184                  CALL NEWGRP
185       *             (IAXLE-1,ASPACE,NGROUP,GAXLES,GSPACE,GCOUNT,GLENTH)
186  C
187  C                 Add new axle into new group
188                  GCOUNT=GCOUNT+1
189                  GLENTH=GLENTH+ASPACE(IAXLE)
190  C
191  C              If axle spacing approximately equals last group's
192  C              average spacing, simply add this axle into the group
193               ELSE
194                  GCOUNT=GCOUNT+1
```

FIG. X1.3 Source Code Listing—Continued

```
195                  GLENTH=GLENTH+ASPACE(IAXLE)
196                  ENDIF
197       C
198       C          If only one axle in group, simply add this axle into group
199                  ELSE
200                  GCOUNT=GCOUNT+1
201                  GLENTH=GLENTH+ASPACE(IAXLE)
202       C
203       C          Done with close axle
204                  ENDIF
205       C
206       C          If axle is far from last group, form a new group
207                  ELSE
208                  CALL NEWGRP
209          *          (IAXLE,ASPACE,NGROUP,GAXLES,GSPACE,GCOUNT,GLENTH)
210       C
211       C          Next axle
212                  ENDIF
213       1          CONTINUE
214       C
215       C      Save last group's count and spacing
216              GAXLES(NGROUP)=GCOUNT
217              GSPACE(NGROUP)=GSPACE(NGROUP)+GLENTH/2.
218       C
219       C      Split (misidentified) first group if it has more than one axle
220       C      and its average axle spacing does not approximate second group's
221              IF(GAXLES(1).GT.1.AND.
222          *      (GAXLES(2).NE.2.OR.ABS(ASPACE(2)-ASPACE(4)).GT.GDELTA))THEN
223       C
224       C          Insert the group into the group arrays
225                  NGROUP=NGROUP+1
226                  DO 2 IGROUP=NGROUP,2,-1
227                     GAXLES(IGROUP)=GAXLES(IGROUP-1)
228                     GSPACE(IGROUP)=GSPACE(IGROUP-1)
229       2          CONTINUE
230       C
231       C          Then split front axle group
232                  DO 3 IGROUP=1,2
233                     GSPACE(IGROUP)=ASPACE(IGROUP)
234                     GAXLES(IGROUP)=1
235       3          CONTINUE
236       C
237       C          Correction done
238                  ENDIF
239       C
240       C      Done
241              RETURN
242              END
243
244       C----------------------------------------------------------------
245       C Subroutine NEWGRP performs common operations necessary to add a group
246       C to a vehicle.
247       C
248              SUBROUTINE NEWGRP(IAXLE,ASPACE,NGROUP,GAXLES,GSPACE,GCOUNT,GLENTH
249              INTEGER IAXLE,NGROUP,GAXLES(*),GCOUNT
250              REAL ASPACE(*),GSPACE(*),GLENTH
251       C
252       C      Save number of axles in last group
253              GAXLES(NGROUP)=GCOUNT
254       C
255       C      Recompute last group's spacing
256              GSPACE(NGROUP)=GSPACE(NGROUP)+GLENTH/2.
257       C
258       C      Start a new group
259              NGROUP=NGROUP+1
260              GSPACE(NGROUP)=GLENTH/2.+ASPACE(IAXLE)
```

FIG. X1.4 Source Code Listing—Continued

```
261   C
262   C       Initialize new group axle count and length
263           GCOUNT=1
264           GLENTH=0.
265   C
266   C       Done
267           RETURN
268           END
269
270   C------------------------------------------------------------------------
271   C Subroutine UNITS accepts a vehicle's axle group count, the number of
272   C axles in each group, and the group spacings, then determines the
273   C number of units in the vehicle, the number of axles and axle groups
274   C in each unit, and each unit's type: tractor, semitrailer, or trailer.
275   C
276           SUBROUTINE UNITS(NGROUP,GAXLES,GSPACE,NUNIT,UAXLES,UGROUP,UTYPE)
277           INTEGER NGROUP,GAXLES(*),NUNIT,UAXLES(*),UGROUP(*)
278           REAL GSPACE(*)
279           CHARACTER*1 UTYPE(*)
280   C
281   C       Allocate important classification control parameters
282           COMMON /PARAMS/ GLIMIT,GDELTA,UTLMAX,TWOMAX,PIKMAX,
283         *   STDMAX,COMMAX,MOTMAX,RECMAX,DOLMAX
284   C
285   C       Make 1st (tractor) unit out of first two groups
286           NUNIT=1
287           UTYPE(1)='T'
288           UAXLES(1)=GAXLES(1)+GAXLES(2)
289           UGROUP(1)=2
290           NLEFT=NGROUP-2
291   C
292   C       Initially set tongue and body indexes to next two groups
293           ITONG=3
294           IBODY=4
295   C
296   C       Add units until all axle groups are included
297   1       IF(NLEFT.GT.0)THEN
298   C
299   C         If only one group left, next unit must be a semi-trailer
300             IF(NLEFT.EQ.1)THEN
301             CALL ADUNIT
302         *     ('S',1,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT)
303   C
304   C         If more than one group left, next unit could be full or semi
305             ELSE
306   C
307   C           If body spacing exceeds tongue spacing, assume two-group trailer
308             IF(GSPACE(IBODY).GE.GSPACE(ITONG))THEN
309             CALL ADUNIT
310         *     ('F',2,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT)
311   C
312   C           If tongue spacing exceeds body spacing, could be either one..
313             ELSE
314   C
315   C             If there are exactly two groups left and body length is
316   C             too great for fifth-wheel dolly or spread tandems on a
317   C             semitrailer, assume this unit is a two-group trailer
318             IF(NLEFT.EQ.2.AND.GSPACE(IBODY).GT.DOLMAX)THEN
319             CALL ADUNIT
320         *     ('F',2,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT
321   C
322   C             If body length is short and both remaining groups are
323   C             single axles, assume this is a two-group semitrailer
324             ELSE IF(GAXLES(ITONG).EQ.1.AND.GAXLES(IBODY).EQ.1)THEN
325             CALL ADUNIT
326         *     ('S',2,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT
```

FIG. X1.5 Source Code Listing—Continued

```
327  C
328  C              Otherwise, assume it is a one-group semitrailer
329                 ELSE
330                 CALL ADUNIT
331        *          ('S',1,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT
332                 ENDIF
333  C
334  C            Done with case of more than one group left
335                 ENDIF
336  C
337  C          Done
338                ENDIF
339  C
340  C          Do next group if there is one
341                GO TO 1
342                ENDIF
343  C
344  C        Done
345                RETURN
346                END
347
348  C--------------------------------------------------------------------------
349  C Subroutine ADUNIT is called by UNITS to perform common operations
350  C needed to add a unit to a vehicle. ADUNIT can add semitrailer or full
351  C trailer units with one or more axle groups.
352  C
353                SUBROUTINE ADUNIT
354        *        (TYPE,NUSED,NUNIT,UAXLES,UGROUP,UTYPE,GAXLES,ITONG,IBODY,NLEFT)
355                INTEGER NUNIT,NUSED,UAXLES(*),UGROUP(*),GAXLES(*)
356                INTEGER ITONG,IBODY,NLEFT
357                CHARACTER*1 TYPE,UTYPE(*)
358  C
359  C        Add a unit
360                NUNIT=NUNIT+1
361  C
362  C        Save vehicle type and number of axles and groups
363                UTYPE(NUNIT)=TYPE
364                UAXLES(NUNIT)=GAXLES(ITONG)
365                IF(NUSED.EQ.2)UAXLES(NUNIT)=UAXLES(NUNIT)+GAXLES(IBODY)
366                UGROUP(NUNIT)=NUSED
367  C
368  C        Advance indices for tongue and body groups
369                ITONG=ITONG+NUSED
370                IBODY=IBODY+NUSED
371  C
372  C        Recalculate number of groups left
373                NLEFT=NLEFT-NUSED
374  C
375  C        Done
376                RETURN
377                END
378
379  C--------------------------------------------------------------------------
380  C Subroutine ACCODE computes a vehicle's axle configuration code from
381  C the of units, the number of axle groups in each unit, the unit types,
382  C and the number of axles in each axle group.
383  C
384                SUBROUTINE ACCODE(GAXLES,NUNIT,UGROUP,UTYPE,ACODE)
385                INTEGER GAXLES(*),NUNIT,UGROUP(*)
386                CHARACTER*1 UTYPE(*),ACODE*9
387  C
388  C        Blank axle configuration code
389                ACODE='          '
390  C
391  C        Initialize code character count and axle group count
392                ICODE=0
```

FIG. X1.6 Source Code Listing—Continued

```
393         JGROUP=0
394   C
395   C     Work through units of vehicle
396         DO 2 IUNIT=1,NUNIT
397   C
398   C        If semitrailer, append asterisk to code
399            IF(UTYPE(IUNIT).EQ.'S')THEN
400            ICODE=ICODE+1
401            ACODE(ICODE:ICODE)='*'
402            ENDIF
403   C
404   C        Add characters for other groups in unit
405            DO 1 IGROUP=1,UGROUP(IUNIT)
406   C
407   C           Point to next axle group and next code character
408            JGROUP=JGROUP+1
409            ICODE=ICODE+1
410   C
411   C           Give alpha code to tractor or full trailer's first group
412            IF(IGROUP.EQ.1.AND.UTYPE(IUNIT).NE.'S')THEN
413            ACODE(ICODE:ICODE)=CHAR(GAXLES(JGROUP)+64)
414   C
415   C           Give numeric codes to all other groups
416            ELSE
417            ACODE(ICODE:ICODE)=CHAR(GAXLES(JGROUP)+48)
418            ENDIF
419   C
420   C           Next group
421   1         CONTINUE
422   C
423   C        Next unit
424   2      CONTINUE
425   C
426   C     Done
427         RETURN
428         END
429
430   C-------------------------------------------------------------------
431   C Subroutine MODIFY computes the one-character modifier code, using the
432   C axle spacings, number of axles in each group, number of units, number
433   C of axles in each unit, and number of groups in each unit. MODIFY uses
434   C the parameters defined in CLPARM.
435   C
436         SUBROUTINE MODIFY(ASPACE,GAXLES,NUNIT,UAXLES,UGROUP,MCODE)
437         INTEGER GAXLES(*),NUNIT,UAXLES(*),UGROUP(*)
438         REAL ASPACE(*)
439         CHARACTER*1 MCODE
440   C
441   C     Allocate important classification control parameters
442         COMMON /PARAMS/ GLIMIT,GDELTA,UTLMAX,TWOMAX,PIKMAX,
443        *   STDMAX,COMMAX,MOTMAX,RECMAX,DOLMAX
444   C
445   C     Allocate counts of commercial and recreational vehicle axle group
446         INTEGER NRECVL(8),NCMRCL(8),TRECVL,TCMRCL
447   C
448   C     Initialize vehicle group and axle indexes
449         IGROUP=1
450         KAXLE=0
451   C
452   C     Determine number of commercial and recreational axle
453   C     groups on whole vehicle and on each unit of the vehicle
454         TRECVL=0
455         TCMRCL=0
456         DO 3 IUNIT=1,NUNIT
```

FIG. X1.7 Source Code Listing—Continued

```
457  C
458  C          Zero number of commercial and recreational axle groups for unit
459             NRECVL(IUNIT)=0
460             NCMRCL(IUNIT)=0
461  C
462  C          Add in unit's groups
463             DO 2 IGROUP=IGROUP,IGROUP+UGROUP(IUNIT)-1
464  C
465  C             Compute first and last axles in group
466                JAXLE=KAXLE+2
467                KAXLE=KAXLE+GAXLES(IGROUP)
468  C
469  C             Check spacings of multi-axle groups only
470                IF(GAXLES(IGROUP).GT.1)THEN
471  C
472  C                Check spacings within group
473                   DO 1 IAXLE=JAXLE,KAXLE
474  C
475  C                   If short axle spacing, group is recreational
476                      IF(ASPACE(IAXLE).LE.RECMAX)THEN
477                      TRECVL=TRECVL+1
478                      NRECVL(IUNIT)=NRECVL(IUNIT)+1
479  C
480  C                   If long axle spacing, group is commercial
481                      ELSE
482                      TCMRCL=TCMRCL+1
483                      NCMRCL(IUNIT)=NCMRCL(IUNIT)+1
484                      END IF
485  C
486  C                   Do next axle
487  1                   CONTINUE
488  C
489  C                Multi-axle group done
490                   END IF
491  C
492  C             Next group
493  2             CONTINUE
494  C
495  C          Next unit
496  3          CONTINUE
497  C
498  C       Get modifier for 2 axle tractor vehicles
499          IF(UAXLES(1).EQ.2)THEN
500  C
501  C          1 unit vehicles
502             IF(NUNIT.EQ.1)THEN
503             CALL NONCOM(ASPACE(2),MCODE)
504  C
505  C          2 unit vehicles
506             ELSE IF(NUNIT.EQ.2)THEN
507  C
508  C             2 unit, single group trailer
509                IF(UGROUP(2).EQ.1)THEN
510  C
511  C                If commercial axle spacing on trailer, it's commercial
512                   IF(NCMRCL(2).GT.0)THEN
513                   MCODE='9'
514  C
515  C                If trailer has recreational axle spacing or trailer
516  C                spacing is less than utility trailer, it's non-commercial
517                   ELSE IF(NRECVL(2).GT.0.OR.ASPACE(3).LT.UTLMAX)THEN
518                   CALL NONCOM(ASPACE(2),MCODE)
519  C
520  C                Any other 2 unit, single group trailer: call it commercial
521                   ELSE
522                   MCODE='9'
```

FIG. X1.8 Source Code Listing—Continued

```
523                  END IF
524   C
525   C          2 unit, multi-group trailer
526                  ELSE
527   C
528   C              If commercial axle spacing on trailer, it's commercial
529                  IF(NCMRCL(2).GT.0)THEN
530                  MCODE='9'
531   C
532   C              If recreational axle spacing on trailer or trailer is
533   C              short enough to be a car or pickup, it's non-commercial
534                  ELSE IF(NRECVL(2).GT.0.OR.ASPACE(3).LE.PIKMAX)THEN
535                  CALL NONCOM(ASPACE(2),MCODE)
536                  END IF
537   C
538   C          2 unit vehicles done
539                  END IF
540   C
541   C      3 or more unit vehicles
542              ELSE
543   C
544   C          If any unit has recreational spacing but none
545   C          has commercial axle spacing, it's non-commercial
546              IF(TCMRCL.EQ.0.AND.TRECVL.GT.0)THEN
547              CALL NONCOM(ASPACE(2),MCODE)
548   C
549   C          Call any other 3 or more unit vehicle commercial
550              ELSE
551              MCODE='9'
552              END IF
553   C
554   C      All 2 axle tractor vehicles done
555              END IF
556   C
557   C  Get modifier for 3 or more axle tractor vehicles
558      ELSE IF(UAXLES(1).GE.3)THEN
559   C
560   C      1 unit vehicles
561          IF(NUNIT.EQ.1)THEN
562   C
563   C          If any commercial axle spacings...
564          IF(TCMRCL.GT.0)THEN
565   C
566   C              If first group is single axle and second group
567   C              is two axle and axle spacing is long, it's a bus
568              IF(GAXLES(1).EQ.1.AND.GAXLES(2).EQ.2.AND.
569      *          ASPACE(2).GT.TWOMAX)THEN
570              MCODE='6'
571   C
572   C              Otherwise, it's commercial
573              ELSE
574              MCODE='7'
575              END IF
576   C
577   C          If no commercial axle spacings, but some recreational
578   C          axle spacings, assume it's recreational
579          ELSE IF(TRECVL.GT.0)THEN
580          MCODE='5'
581          END IF
582   C
583   C      Two unit vehicles
584          ELSE IF(NUNIT.EQ.2)THEN
585   C
586   C          Single group trailer
587          IF(UGROUP(2).EQ.1)THEN
```

FIG. X1.9 Source Code Listing—Continued

14

```
588    C
589    C              If tractor has commercial axle spacing...
590                   IF(NCMRCL(1).GT.0)THEN
591    C
592    C                 If trailer also has commercial axle spacing, it's commercial
593                      IF(NCMRCL(2).GT.0)THEN
594                      MCODE='9'
595    C
596    C                 If trailer has recreational axle spacing or
597    C                 utility trailer spacing, it's small commercial
598                      ELSE IF(NRECVL(2).GT.0.OR.ASPACE(3).LT.UTLMAX)THEN
599                      MCODE='7'
600    C
601    C                 Assume anything else to be commercial
602                      ELSE
603                      MCODE='9'
604                      END IF
605    C
606    C              If tractor has recreational axle spacing...
607                   ELSE IF(NRECVL(1).GT.0)THEN
608    C
609    C                 If no commercial axles on vehicle, it's recreational
610                      IF(TCMRCL.EQ.0)THEN
611                      MCODE='5'
612    C
613    C                 If there are commercial axles anywhere, it's commercial
614                      ELSE
615                      MCODE='9'
616                      END IF
617    C
618    C              Single group trailer done
619                   END IF
620    C
621    C           Multi-group trailer
622                ELSE
623    C
624    C              If tractor has commercial axle spacing, it's commercial
625                   IF(NCMRCL(1).GT.0)THEN
626                   MCODE='9'
627    C
628    C              If tractor has recreational axle spacing, it's recreational
629                   ELSE IF(NRECVL(1).GT.0)THEN
630                   MCODE='5'
631                   END IF
632    C
633    C           All two-unit vehicles done
634                END IF
635    C
636    C        Three-or-more unit vehicles
637             ELSE
638    C
639    C           If no commercial axles, but some recreational, it's non-commercial
640                IF(TCMRCL.EQ.0.AND.TRECVL.GT.0)THEN
641                CALL NONCOM(ASPACE(2),MCODE)
642    C
643    C           Otherwise, it's commercial
644                ELSE
645                MCODE='9'
646                END IF
647    C
648    C        All three-or-more axle tractor vehicles done
649             END IF
650    C
651    C     All vehicles done
652          END IF
```

FIG. X1.10 Source Code Listing—Continued

```
653   C
654   C     Done
655         RETURN
656         END
657
658   C------------------------------------------------------------------------
659   C Subroutine NONCOM is called by MODIFY to select the proper modifier
660   C code for non-commercial vehicles.
661   C
662         SUBROUTINE NONCOM(SPACE,MCODE)
663         REAL SPACE
664         CHARACTER*1 MCODE
665   C
666   C     Allocate important classification control parameters
667         COMMON /PARAMS/ GLIMIT,GDELTA,UTLMAX,TWOMAX,PIKMAX,
668        *   STDMAX,COMMAX,MOTMAX,RECMAX,DOLMAX
669   C
670   C     Find vehicle type consistent with axle spacing
671         IF(SPACE.LE.MOTMAX)THEN
672         MCODE='1'                  !Motorcycle
673         ELSE IF(SPACE.LE.COMMAX)THEN
674         MCODE='2'                  !Compact car
675         ELSE IF(SPACE.LE.STDMAX)THEN
676         MCODE='3'                  !Standard car
677         ELSE IF(SPACE.LE.PIKMAX)THEN
678         MCODE='4'                  !Large car or pickup
679         ELSE IF(SPACE.LE.TWOMAX)THEN
680         MCODE='5'                  !2-axle, dual-tired
681         ELSE
682         MCODE='6'                  !Large bus-like
683         END IF
684   C
685   C     Done
686         RETURN
687         END
688
689   C------------------------------------------------------------------------
690   C Function subprogram FHWA06 computes the six-digit classificat code
691   C formerly used by the Federal Highway Administration. The code is
692   C determined from the axle configuration code and the modifier code.
693   C
694         CHARACTER*6 FUNCTION FHWA06(ACODE,MCODE)
695         CHARACTER ACODE*9,MCODE*1
696   C
697   C     Allocate number of axles in units
698         INTEGER UAXLES(4)
699   C
700   C     Default code to all zeros
701         FHWA06='000000'
702   C
703   C     Get number of units and axles from axle classification code
704         CALL UNPACK(ACODE,NAXLE,NUNIT,UAXLES)
705   C
706   C     Commercial vehicles
707         IF(MCODE.EQ.'5'.OR.MCODE.EQ.'7'.OR.MCODE.EQ.'9')THEN
708   C
709   C       1st character depends on whether 1st trailer is semi or full
710           I=NUNIT*2
711           IF(ACODE(3:3).EQ.'*')I=I-1
712           FHWA06(1:1)=CHAR(I+48)
713   C
714   C       Characters 2 through NUNIT+1 designate # of axles in each unit
715           DO 1 ICHAR=2,NUNIT+1
716             IUNIT=ICHAR-1
717             FHWA06(ICHAR:ICHAR)=CHAR(UAXLES(IUNIT)+48)
718   1         CONTINUE
```

FIG. X1.11 Source Code Listing—Continued

```
719   C
720   C      Buses
721          ELSE IF(MCODE.EQ.'6')THEN
722          FHWA06='190000'
723   C
724   C      Small vehicles
725          ELSE
726   C
727   C         Motorcycles
728            IF(MCODE.EQ.'1')THEN
729            FHWA06='030000'
730   C
731   C         Compact cars
732            ELSE IF(MCODE.EQ.'2')THEN
733            FHWA06='050000'
734   C
735   C         Standard cars, small pickups
736            ELSE IF(MCODE.EQ.'3')THEN
737            FHWA06='040000'
738   C
739   C         Large cars, vans, pickups
740            ELSE IF(MCODE.EQ.'4')THEN
741            FHWA06='200000'
742            END IF
743   C
744   C         If there is a trailer, add "900" to code
745            IF(NUNIT.GT.1)FHWA06(4:4)='9'
746   C
747   C      All vehicles done
748          END IF
749   C
750   C      Done
751          RETURN
752          END
753
754   C-------------------------------------------------------------------
755   C Function subprogram FHWA13 computes the two-digit, thirteen-category
756   C classification code used by the Federal Highway Administration. The
757   C code is determined from the axle configuration code and modifier code.
758   C
759          CHARACTER*2 FUNCTION FHWA13(ACODE,MCODE)
760          CHARACTER ACODE*9,MCODE*1
761   C
762   C      Allocate number of axles in units
763          INTEGER UAXLES(4)
764   C
765   C      Get number of units and axles from axle classification code
766          CALL UNPACK(ACODE,NAXLE,NUNIT,UAXLES)
767   C
768   C      Motorcycles
769          IF(MCODE.EQ.'1')THEN
770          FHWA13='01'
771   C
772   C      Compact and standard cars
773          ELSE IF(MCODE.EQ.'2'.OR.MCODE.EQ.'3')THEN
774          FHWA13='02'
775   C
776   C      Large cars and pickups
777          ELSE IF(MCODE.EQ.'4')THEN
778          FHWA13='03'
779   C
780   C      Buses
781          ELSE IF(MCODE.EQ.'6')THEN
782          FHWA13='04'
```

FIG. X1.12 Source Code Listing—Continued

```
783  C
784  C        Large two-axle vehicles
785           ELSE IF(NAXLE.EQ.2)THEN
786           FHWA13='05'
787  C
788  C        Three-axle, single-unit trucks
789           ELSE IF(NAXLE.EQ.3.AND.MCODE.LE.'7')THEN
790           FHWA13='06'
791  C
792  C        Four-or-more axle, single unit trucks
793           ELSE IF(NAXLE.GE.4.AND.NUNIT.EQ.1)THEN
794           FHWA13='07'
795  C
796  C        Four-or-less axle, two-unit combinations
797           ELSE IF(NAXLE.LE.4.AND.NUNIT.EQ.2)THEN
798           FHWA13='08'
799  C
800  C        Five axle, two-unit combinations
801           ELSE IF(NAXLE.EQ.5.AND.NUNIT.EQ.2)THEN
802           FHWA13='09'
803  C
804  C        Six-or-more axle, two-unit combinations
805           ELSE IF(NAXLE.GE.6.AND.NUNIT.EQ.2)THEN
806           FHWA13='10'
807  C
808  C        Five-or-less axle, three-or-more unit combinations
809           ELSE IF(NAXLE.LE.5.AND.NUNIT.GE.3)THEN
810           FHWA13='11'
811  C
812  C        Six axle, three-or-more unit combinations
813           ELSE IF(NAXLE.EQ.6.AND.NUNIT.GE.3)THEN
814           FHWA13='12'
815  C
816  C        Seven-or-more axle, three-or-more unit combinations
817           ELSE IF(NAXLE.GE.7.AND.NUNIT.GE.3)THEN
818           FHWA13='13'
819  C
820  C        All others are unclassified
821           ELSE
822           FHWA13='00'
823           END IF
824  C
825  C        Done
826           RETURN
827           END
828
829  C----------------------------------------------------------------------
830  C Subroutine UNPACK is used by FHWA06 and FHWA13 to recalculate the
831  C number of axles, number of units, and number of axles in each unit
832  C from the axle configuration code.
833  C
834           SUBROUTINE UNPACK(ACODE,NAXLE,NUNIT,UAXLES)
835           CHARACTER ACODE*9
836           INTEGER NAXLE,NUNIT,UAXLES(*)
837  C
838  C        Count units and axles from all characters of configuration code
839           NUNIT=0
840           NAXLE=0
841           DO 1 ICODE=1,9
842  C
843  C           Get ASCII code for character (ICHAR is a utility function
844  C           subprogram which gets the ASCII code for a single character)
845           IASCII=ICHAR(ACODE(ICODE:ICODE))
846  C
847  C           Letters and asterisk designate new units
848           IF((IASCII.GT.64.AND.IASCII.LE.90).OR.IASCII.EQ.42)THEN
```

FIG. X1.13 Source Code Listing—Continued

```
849          NUNIT=NUNIT+1
850          UAXLES(NUNIT)=0
851          END IF
852   C
853   C     Numeric codes 1-9 represent # of axles in group
854          IF(IASCII.GT.48.AND.IASCII.LE.57)THEN
855          N=IASCII-48
856          NAXLE=NAXLE+N
857          UAXLES(NUNIT)=UAXLES(NUNIT)+N
858          END IF
859   C
860   C     Alpha codes A-I represent # of axles in group
861          IF(IASCII.GT.64.AND.IASCII.LE.77)THEN
862          N=IASCII-64
863          NAXLE=NAXLE+N
864          UAXLES(NUNIT)=UAXLES(NUNIT)+N
865          END IF
866   C
867   C     Next character
868   1      CONTINUE
869   C
870   C  Done
871          RETURN
872          END
```

FIG. X1.14 Source Code Listing—Continued