SOCIETY OF AUTOMOTIVE ENGINEERS, INC. • TWO PENNSYLVANIA PLAZA • NEW YORK, NEW YORK 10001

LAND SEA AIR SPACE

TECHNICAL REPORT J224a

COLLISION DEFORMATION CLASSIFICATION — SAE J224a

SAE Recommended Practice

Report of Automotive Safety Committee approved January 1971 and revised February 1972.

1. Purpose and Scope—The purpose and scope of this SAE Recommended Practice is to provide a basis for classification of the extent of deformation caused by vehicle accidents on the highway. It is necessary to classify collision contact deformation (opposed to induced deformation) so that the accident deformation may be segregated into rather narrow limits. Studies of collision deformation can then be performed on one or many data banks with assurance that the data under study are of essentially the same type.[1]

It also is an expression, useful to persons engaged in automobile safety, to appropriately describe a field-damaged vehicle with conciseness in their oral and written communications. Although this classification system was established primarily for use by professional teams investigating accidents in depth, other groups may also find it useful.

The classification system consists of seven characters, three numeric and four alphameric, arranged in a specific order. Each character describes specific deformation detail concerning the direction, location, the size of the area, and extent, which combined together form a descriptive composite of the damaged vehicle. The individual character positions are referred to by column number for identification and compatibility with conventional computer system data storage. Fig. 1 illustrates the format and the general description for each character.

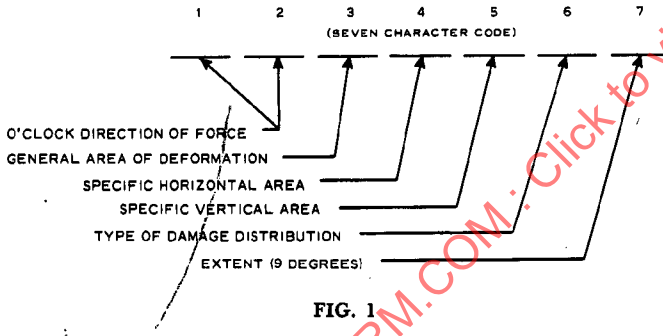


FIG. 1

2. Classification of Collision Damage—Vehicle collision damage is classified in the following respects:

2.1 Direction of Principal Force at Impact—Columns 1 and 2 are used.

The principal force is the force that caused the crush and sheet metal displacement on the damaged vehicle. The direction of the principal force is determined by the resultant of forces acting on the vehicle at the point of application. The direction of the principal force is designated by reference to hour sectors on a conventional clock face positioned over the point of application.

The clock face is assumed to be in a plane referenced to the horizontal plane of the car. "Twelve o'clock" characterizes a frontal directed force applied at the area of vehicle deformation. Other examples of clock positions, such as 3, 6, and 9 o'clock, refer to forces directed from the right, rear, and left respectively. The code classifications are the hour numerals from 01 to 12. Columns 1 and 2 of the classification system are used for direction of principal force. (See Fig. 2.) The entry of 00 indicates that the impact is not horizontal, as in a rollover.

[1]K. A. Stonex, W. D. Nelson, J. W. Garrett, C. S. Michalski, and A. W. Siegel, "Collision Damage Severity Scale." Paper 700136 presented at SAE Automotive Engineering Congress, Detroit, January 1970.

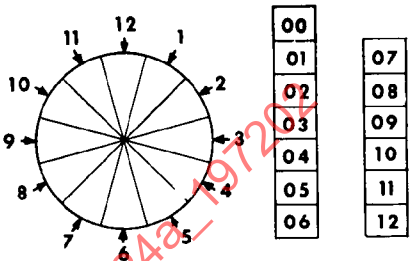
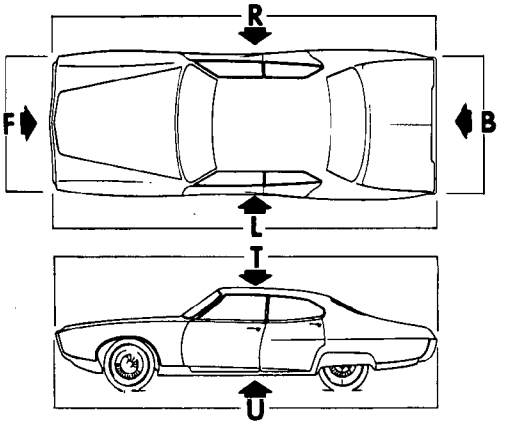


FIG. 2

2.2 Deformation Location and Classification Code—Column 3 is used.

This character of a classification expression broadly defines which projected area of the vehicle contains the deformation. (See Fig. 3.) Angle impacts at 45 deg to the front or rear corner may be difficult to classify. These impacts should be classified as "F" or "B" if the deformation area at the front or rear of the vehicle exceeds the deformation area at the side; "L" (or "R") should be used if the deformation area at the side is larger. Similar consideration should be given to top versus side deformation in rollover; if the deformation area on the top is greater than on the side, use "T." If the side deformation is greater, use "L" (or "R").



Location	Classification
Front	F
Right side	R
Back (rear)	B
Left side	L
Top	T
Undercarriage	U
Unclassifiable	X

FIG. 3

2.3 Specific Horizontal Location of Deformation and Classification Code—Column 4 is used.

The plan view of the vehicle (Fig. 4) illustrates the horizontal areas to be used in locating the deformation. Variations in vehicles require that some special definitions be given as guidelines for the classification code "P." P is defined as follows:

(a) Passenger cars—from the windshield to the rear of the rear-most seat.

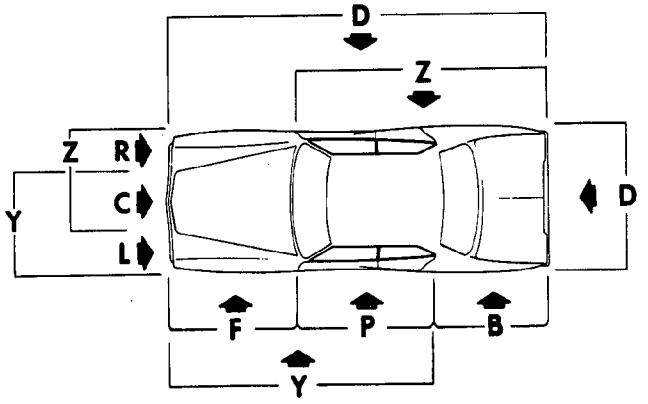
(b) Station wagons—from the windshield to the rear of the second seat.

(c) Vans—from the front-seat backrest to the center of the rear wheel.

(d) Pickups—from the windshield to the rear of the cab.

"F" and "B" are side deformation areas forward and rearward of "P," respectively. Column 4 has meaning only in connection with column 3; that is, it is a suffix of column 3 rather than being independent of it.

The classifications "R," "C," and "L" should not be used for vehicles with top deformation ("T" in column 3).

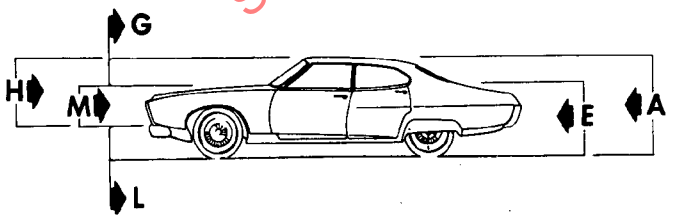


Location	Classification
Distributed—side or end	D
Left—front or rear	L
Center—front or rear	C
Right—front or rear	R
Side front—left or right	F
Side center section—left or right	P
Side rear—left or right	B
Side or end—F+P or L+C	Y
Side or end—B+P or R+C	Z

FIG. 4

2.4 Specific Vertical Location of Deformation and Classification Code—Column 5 is used.

Fig. 5 illustrates general locations of the classifications to be used for denoting the vertical location of all deformations.



Location (Front, Rear, or Either Side)	Classification
All	A
Top of frame to top	H
Everything below belt line	E
Belt line and above	G
Middle—top of frame to belt line or hood	M
Low—top of frame, frame, and below	L
Undercarriage in column 3	X

FIG. 5

2.5 General Type of Damage Distribution and Classification Code—Column 6 is used. Definitions of the classifications are shown in Table 1.

TABLE 1

Type	Classification
Wide impact area	W
Narrow impact area	N
Side swipe	S
Rollover (includes rolling onto side)	O
Overhanging structure	A
Corner	E

These codes are illustrated by the following additional guidelines. To differentiate deformation which includes the corner of the vehicle in the longitudinal and lateral impacts, use the S, E or W classifications. The examples in Table 2 describe impacts at the front right corner.

TABLE 2

Classification	Max. Depth of Deformation from Side Surface
FRES	0 to 4 in (100 mm) (principally sheet metal)
FREE	5 to 16 in (130–410 mm) (wheel and suspension)
FREW	17 in (430 mm) and over (wide area)

Columns 3-6 are used for clarification. Fig. 6 shows these three types and similar damage to the right front side. The classification is appropriate for deformation at any corner of the vehicle for directions of principal force from front, rear, or side directions.

"A" is used to classify impacts where part of the vehicle deformation resulted from an overhanging structure. An example of this is underriding the rear of some large trucks.

The use of "S," "O," "E," and "A" take precedence over "N" or "W." "W" and "N" are used to distinguish between large and small areas of deformation which do not fall into one of the other four categories. If an area is less than 16 in (410 mm) wide or less than 6 in (150 mm) high, "N" is the appropriate classification. For small rectangular or circular areas of deformation, if the perimeter is less than the perimeter of a 16 in (410 mm) square, use the "N"; otherwise, use "W."

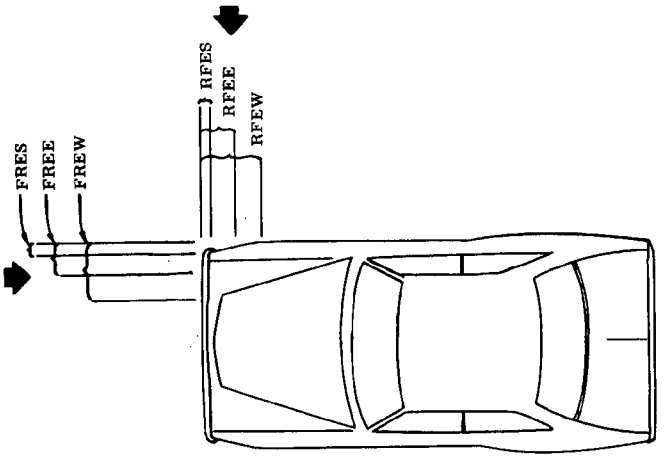


FIG. 6

2.6 Deformation Extent Guide—Column 7 is used.

The extent of residual deformation is classified using a nine-zone extent system as shown in Figs. 7-10. Figs. 7-10 are illustrative for passenger cars, station wagons, vans, and pickups, respectively. Extent zones are applied to front, rear, side, top, or undercarriage deformation and should be selected so that they are compatible with the principal damage selection in column three.

In order to achieve uniformity, the deformation extent guide has been established in relation to specific points on the vehicle.

If the passenger compartment is involved in "top" damage, then the extent number should reflect the extent of damage to the passenger compartment. This is true even if the hood or deck lid are involved.

If the distance from the rearmost point of the vehicle to the top of the rear window is greater than the distance from the top of the rear window to the front door latch pillar (start of zone 9), then use the "passenger car" deformation rear extent zone guide for classifying rear deformation. Other vehicles are classified using the rear extent guide for station wagons and vans.

THE EXTENT NUMBER SHOULD NOT BE USED AS A TOOL FOR DETERMINING THE COLLISION SEVERITY OR ENERGY REQUIRED TO DUPLICATE THE DAMAGE. FOR VEHICLES OF THE SAME BASIC TYPE, IT DOES SERVE AS A TOOL FOR GATHERING TOGETHER VEHICLES WHICH HAVE SIMILAR DAMAGE CHARACTERISTICS.

2.7 Summary of the Classification System—A summary of the classification system and the assignment of codes in columns is shown in Fig. 11. This array shows *most* of the *more likely* classifications that can be made. This display may be of value in auditing reports.

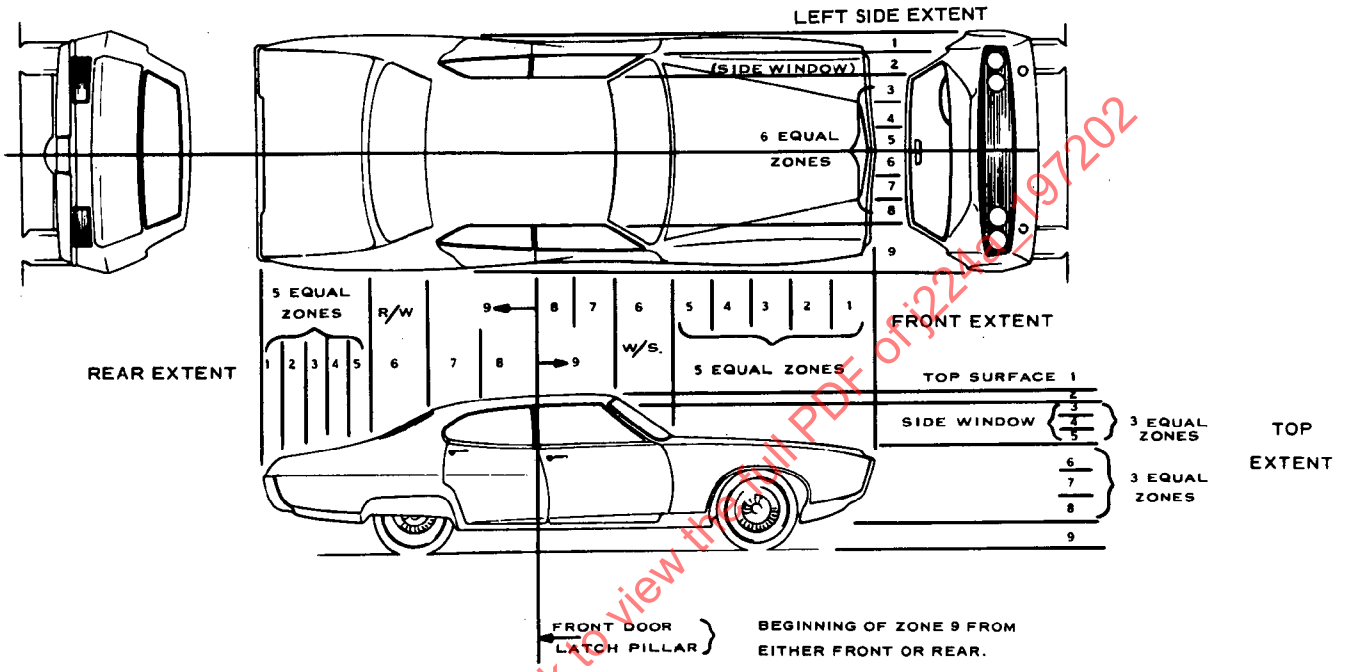


FIG. 7—DEFORMATION EXTENT ZONES (FOR PASSENGER CARS)

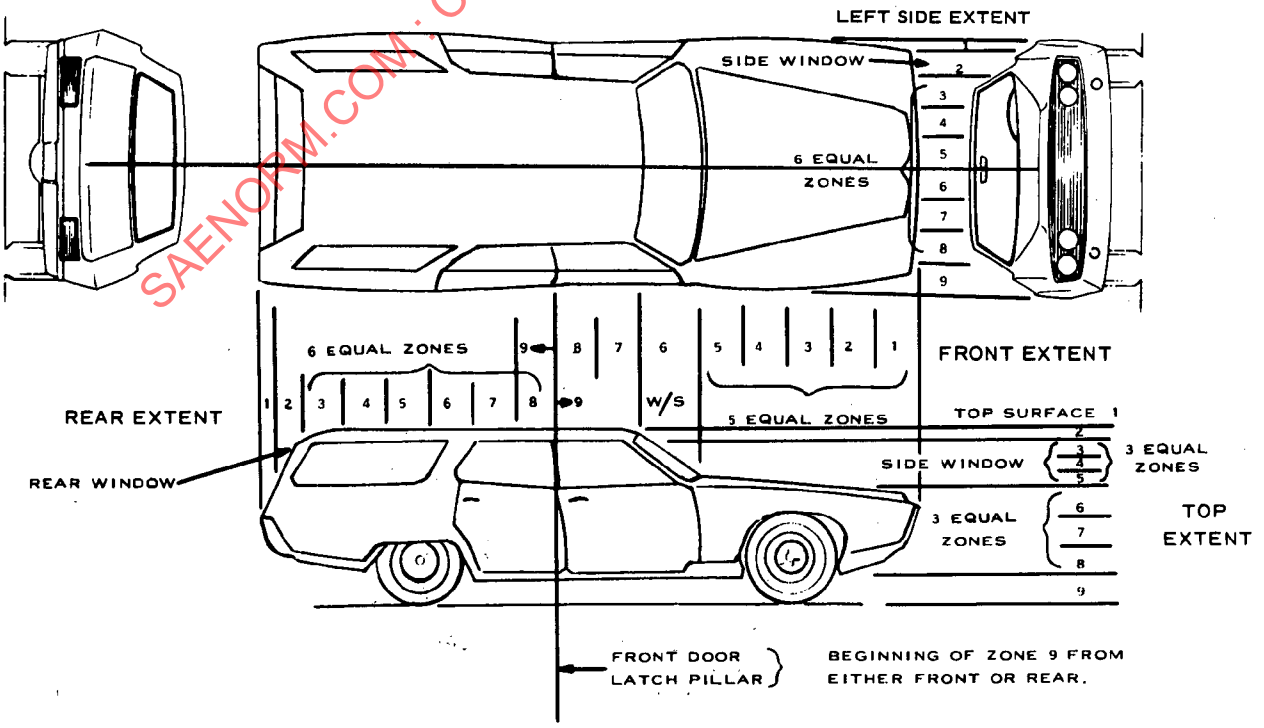


FIG. 8—DEFORMATION EXTENT ZONES (FOR STATION WAGONS)

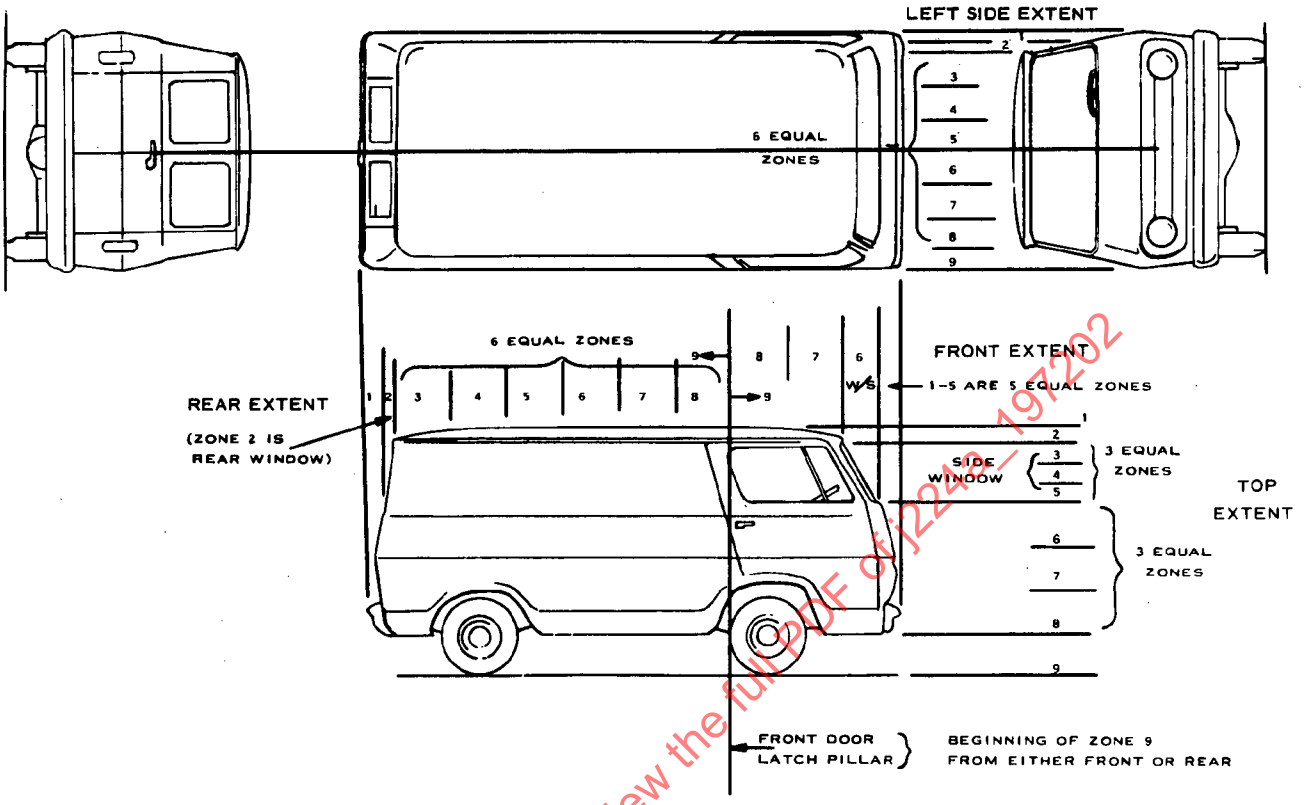


FIG. 9—DEFORMATION EXTENT ZONES (FOR VANS)

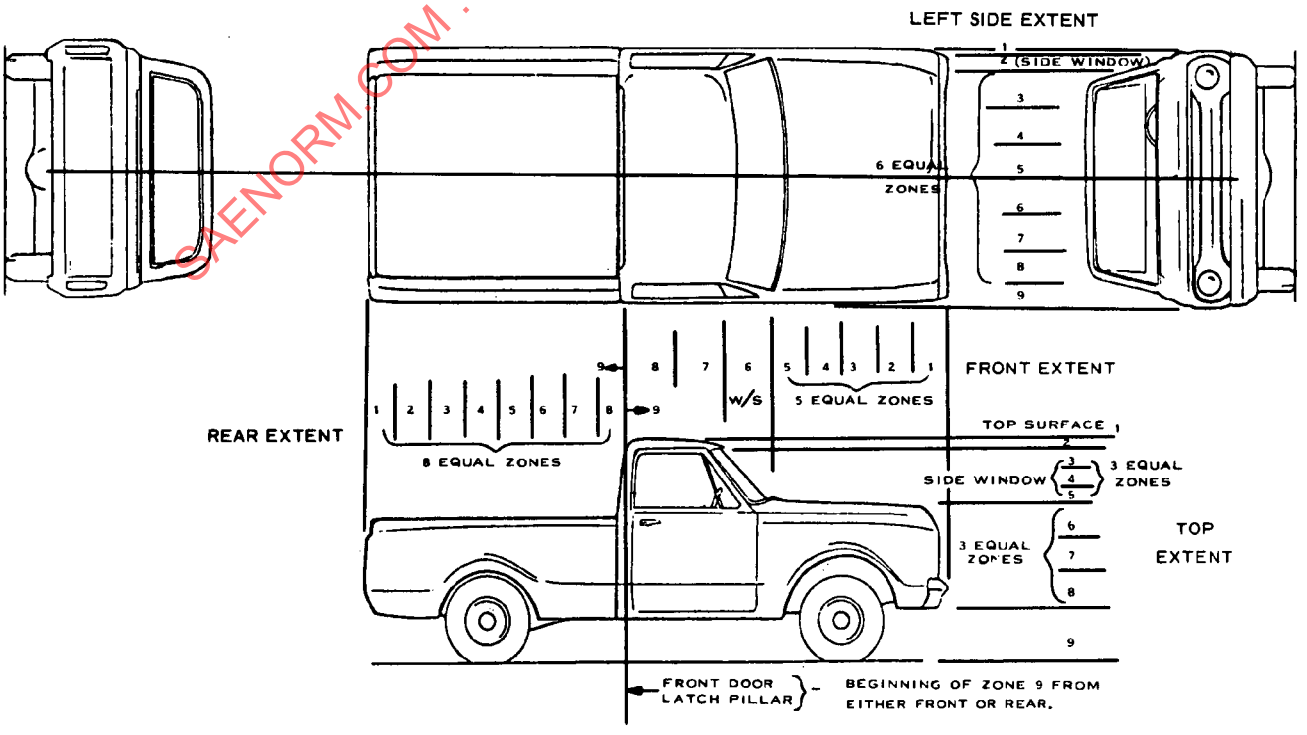


FIG. 10—DEFORMATION EXTENT ZONES (FOR PICKUP TRUCKS)