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USERS MANUAL FOR MEASUREMENT OF INTRUSION IN MOTOR VEHICLE ACCIDENTS

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16. Abstract

This document, along with the companion "Coding Manual for Measurement of Intrusion in Motor Vehicle Accidents," provides the necessary information and instructions to measure, record, and encode data necessary to quantitatively describe vehicle interior intrusion.

This "Users Manual" defines intrusion, describes the measurement philosophy and procedures, and documents the methodology for recording intrusion on the various intrusion data forms as currently used in the April 1978 revision of the National Crash Severity Study (NCSS) project.

Types of intrusion to be documented include: the Catastrophic Crash; Internal Surfaces; Door Intrusion; Seat Intrusion; and Occupant Contact with Intruded Surfaces.

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Crash, Intrusion, Measurement, Data Form, Data Recording, Coding, Accident Investigation Reference Information	

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		49	

CONTENTS

1.0 INTRODUCTION

For some time it has been known that there is a relationship between intrusion of the passenger compartment of a vehicle in an accident and the degree of severity of injuries of the vehicle occupants. Several researchers have noted that it is not necessarily a causal relationship, that is, injuries may be a result of the same factors producing intrusion but only indirectly related to intrusion. Such primary factors may be velocity change (ΔV), mean deceleration, direction and location of impact and resultant vehicle motion. Hence, to date, it has not been established whether, and to what extent, intrusion is of importance as a source of occupant injury.

The intrusion report types and the associated methodology described in this manual have been designed to determine the importance of intrusion as an injury source (both "potential" and actual) and also to investigate a number of specific forms of intrusion, particularly side intrusion and the performance of side structures complying with FMVSS 214. The data shall also be useful in determining the importance of intrusion in vehicles of different size and seating configuration.

Four types of intrusion are considered here. They are:

1. Intrusion associated with the Catastrophic Crash
2. Intrusion of the Internal Surfaces of the Passenger Compartment
3. Door Intrusion
4. Seat Intrusion

While these latter two categories are subsets of Internal Intrusion, separate data forms permit greater detail in describing door and seat intrusion. While not fully documented, penetration by exterior objects is also considered. Special consideration is also given to occupant contacts and resulting injuries associated with intrusion.

2.0 DEFINITIONS

2.1 Intrusion

Intrusion occurs:

a. When the internal boundary of the passenger compartment is moved inward due to direct or indirect damage (i.e., the result of a crushing force applied to the exterior surfaces of the vehicle);

b. When a foreign object exterior to the vehicle penetrates the internal boundary of the passenger compartment;

c. When there is a reduction, or compromise of occupant interior space, including a displacement of the steering wheel, so as to reduce occupant space;

d. Where there is seat distortion and/or movement.

2.2 Catastrophic Crash

A catastrophic crash is a crash in which the passenger compartment integrity has failed completely (such as gross ruptures, tears, openings, avulsions, and/or excessive passenger compartment compression or separation) such that the intrusion is practically beyond measurement. (The shearing off of the greenhouse is not a catastrophic crash.) Figure 2-1 shows a vehicle with catastrophic intrusion.

2.3 Seat Intrusion

Seat intrusion exists when the seat(s) have moved relative to their initial position so as to reduce the space available in a given occupant space. This may be the result of inertia forces on the seat, movement caused by crush of the passenger compartment, or by loading by other occupants or cargo. Note that forward movement of seat backs on older vehicles not equipped with seat back latches is not to be considered an intrusion.

FIGURE 2-1. EXAMPLE OF CATASTROPHIC INTRUSION

2.4 External Object Intrusion

An external object is an object external to the passenger compartment (trees, poles, etc.) and includes components of the case vehicle, such as the hood, which penetrate the interior boundary of the vehicle.

2.5 Occupant Space

2.5.1 An individual occupant space is that space (volume) defined by the manufacturer for the seating of an adult occupant and normally available to the occupant. The boundary surfaces are the six planes (Figure 2-2) defined by the appropriate combinations of the following undeformed surfaces: (1) the interior side(s) of the vehicle; (2) a plane extending upwards at the boundary between manufacturer designated seating positions; (3) the headliner (or interior roof surface); (4) the seat-back surface and cushion surface (including cushion edges); (5) the seat-back back surface (extended to the headliner); (6) the instrument-panel surface, windwhield, cowl surface and toe pan surface; (7) the floor-pan surface; (8) the rear surface (back panels/back door surface).

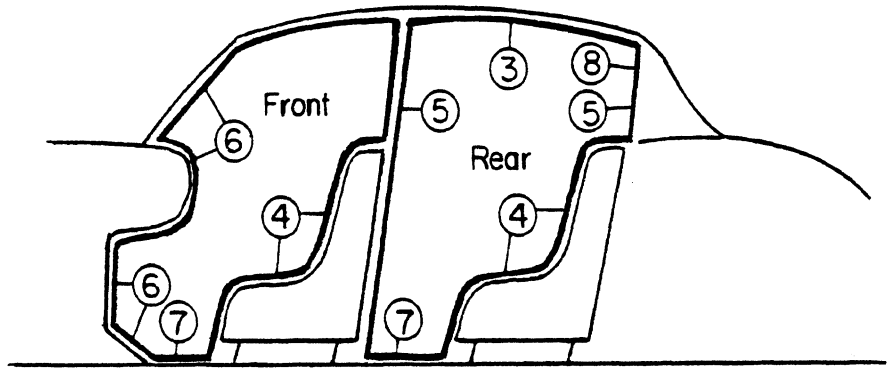


FIGURE 2-2. OCCUPANT SPACE BOUNDARIES IN A PASSENGER VEHICLE

2.5.2 The cargo area is: (1) that seat row which is vacant because the seats have been removed; or (2) the area behind the last row of seats which is normally designated and/or designed by the manufacturer for cargo.

2.6 Occupant Space Number

The occupant space number defines the location of the occupant space for which intrusion is being described. As all intrusions of the passenger compartment are to be documented, there need not be a passenger within the occupant space. The occupant space numbering system is as follows.

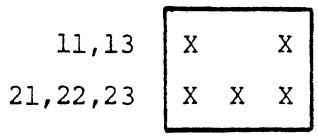
CODES for Occupant Space Number. The correct occupant space number is determined by the vehicle seat configuration at the time of the crash. Occupant space number is a 2 digit code. The first digit (left digit) denotes the seat row (code values from 1-5). The second digit (right digit) denotes the position on the seat and (in some instances) the width of the seat.

Second Digit Codes:

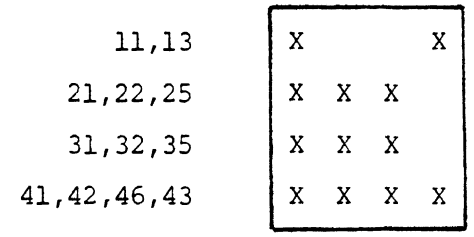
Seat Type	Code Value
Individual Seat (Bucket)	1=Left, 3=Right
Bench:	
Full Width 3 Passenger	1=Left, 2=Center, 3=Right
Full Width 4 Passenger	1=Left, 2=Left Center, 6=Right Center, 3=Right
Partial Width--Left	1=Left, 2=Center, 5=Right + Aisle Space
Partial Width--Center	0=Left + Space, 2=Center, 5=Right + Space
Cargo Area	4=Entire Vehicle Width

Examples:

PASSENGER CAR
(5 Passenger)



VAN
(12 Passenger Capacity)



2.7 Individual Intrusion

An individual intrusion is defined as a single component intruding into a single occupant space. The number of such intrusions to be documented is the number of intruding components crossed with the number of occupant spaces into which they intruded. That is, the numbers of components intruding each occupant space are summed across all occupant spaces.

Examples:

1. The roof is crushed down across the entire width of the front seat. If the seat contains three passenger positions then three occupant spaces were intruded, each by a single component. In this instance, the same component intruded in all three spaces. Thus, the number of intrusions is three.

2. The left-front occupant (driver) space is intruded by both the left front door and the A-pillar. The two components intruding into a single occupant space comprise two intrusions.

Individual intrusions of one inch or less will not be documented. An exception to the documenting of individual intrusions is discussed in Section 6.3 (Combined Components).

2.8 Applicable Vehicle Types

The following are the classes of vehicles to be included in the intrusion data collection.

Vehicle Classes	Seat Capacity Minimum	Seat Capacity Maximum
Passenger Cars	2	6
Station Wagons	3	9
Multi-Purpose Passenger Vehicle	3	9
Utility Vehicles	2	6
Pick-Up Cars	2	3
Pick-Up Trucks	2	6
Passenger Vans	2	12

2.9 Door Intrusion

Door intrusion occurs when the interior surface of a side structure meeting the definition of FMVSS 214 intrudes into an occupant space. Door intrusion is possible on all two and four door vehicles. It is not applicable to the rear (right) side door on passenger vans. A door must be physically present to be included in door intrusion. Door intrusion is also not applicable to the back doors on vans, station wagons, etc.

UPDATE	TEAM	YEAR	MONTH	DAY	SEQUENCE
—	—	—	— —	— —	— — —
1					10

CC

NATIONAL CRASH SEVERITY STUDY

INTRUSION: CATASTROPHIC CRASH

Complete this form *ONLY* if the intrusion satisfies the definition of a CATASTROPHIC CRASH (see User's Manual, Section 2.2).

[11-13] Vehicle No. ___ 0 0

1. Complete the General Intrusion Diagram so as to depict the approximate intrusions (supplemental sketches may be required).

2. Type(s) of catastrophic vehicle damage (code not more than three):

[14] ___

[15] ___

[16] ___

CODES FOR CATASTROPHIC VEHICLE DAMAGE

Passenger compartment opened or separated:*
1 At firewall
2 At B pillar
3 At roof
9 Other--Describe at Code 9 BELOW

Vertical Compression--Extreme:
4 Roof

Longitudinal Compression--Extreme:
5 From front
6 From rear

Lateral Compression--Extreme:
7 From right hand side
8 From left hand side

9 Describe briefly: _____

_____

_____

_____

*Separation or opening need not be complete, but should be of major proportions.

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3. Occupant Space Volume Reduction

	Occupant Space Number*	Approximate Volume Reduction
[17]	11 (front, left [driver])	____
[18]	12 (front, center)	____
[19]	13 (front, right)	____
[20]	21 (rear, left)	____
[21]	22 (rear, center)	____
[22]	23 (rear, right)	____
[23]	34 (third, fourth, or fifth seat/cargo area)	____

CODES FOR VOLUME REDUCTION

1 No Reduction
2 < 20%
3 20% - 40%
4 40% - 60%
5 60% - 80%
6 > 80%
7 Total (100%)
8 Not Applicable
9 Unknown

*See User's Manual, Table 6.2-1: Vehicle Configuration at Time of Crash as an aid to determining appropriate OCCUPANT SPACE NUMBERS to code.

GENERAL RULE:

A. *For a vehicle with more than two seats and with a cargo area behind the seat, code spaces 11, 12, 13, 21, 22, 23, and 34 (to denote area behind the second seat).*

B. *For a vehicle with one seat and a cargo area behind the seat, code spaces 11, 12, 13, and 34 (to denote the area behind the seat), and use Code 8 for 21 through 23.*

[80] I.D. 3

* END OF CATASTROPHIC INTRUSION DATA FORM *

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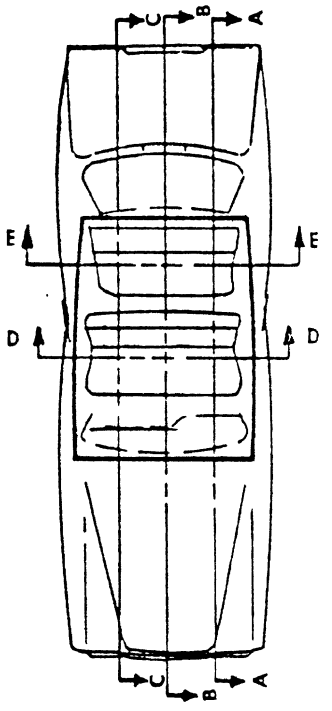
NATIONAL CRASH SEVERITY STUDY

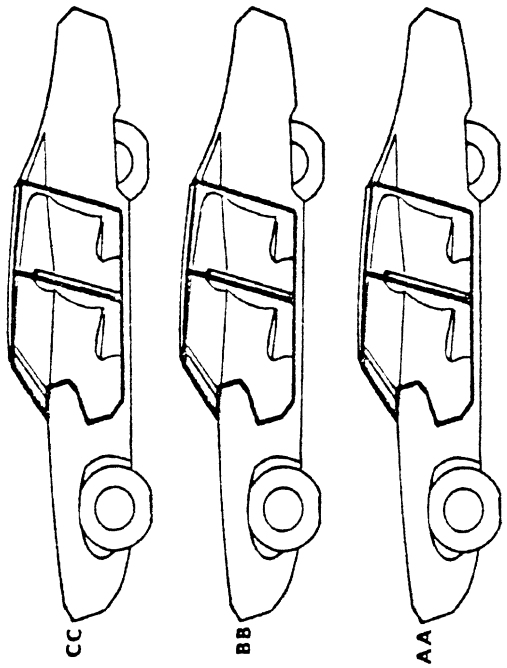
ID-1

General Intrusion Diagram

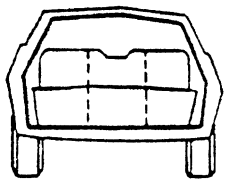
PASSENGER CAR

Sketch intrusion as accurately as possible onto plan view and applicable cross sections. Also sketch the penetrating object where appropriate.

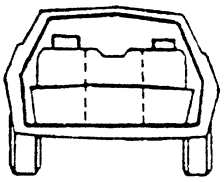




Sections AA, BB, CC are taken through the center of occupant spaces 11, 21; 12, 22; and 13, 23 respectively.



EE
Rear Seat



DD
Front Seat

Sketch of Penetrating Object

Note: Lateral sections are taken through the torso regions of the seats.

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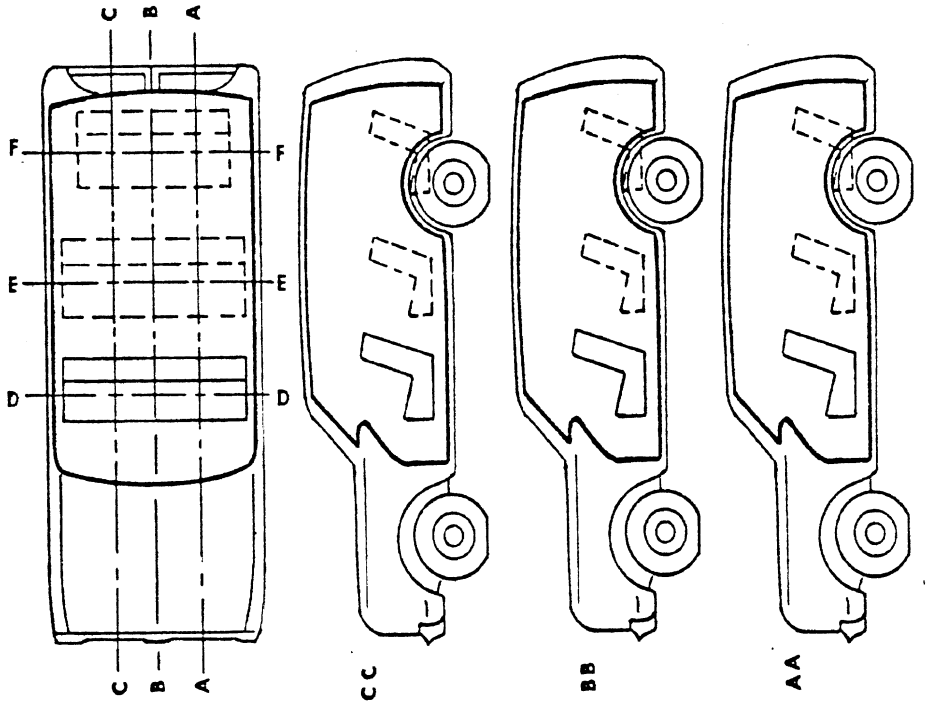
NATIONAL CRASH SEVERITY STUDY

ID-2

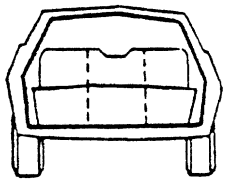
General Intrusion Diagram

STATION WAGON, MULTIPLE PURPOSE PASSENGER VEHICLE

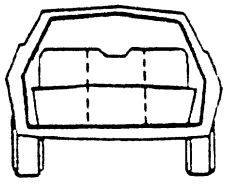
Sketch intrusion as accurately as possible onto plan view and applicable cross sections. Also sketch the penetrating object where appropriate.



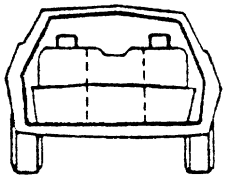
Sections AA, BB, CC are taken through the center of occupant spaces 11, 21; 12, 22; and 13, 23 respectively.



FF
Third
Seat



EE
Second
Seat



DD
Front
Seat

Sketch of Penetrating Object

Note: Lateral sections are taken through the torso regions of the seats.

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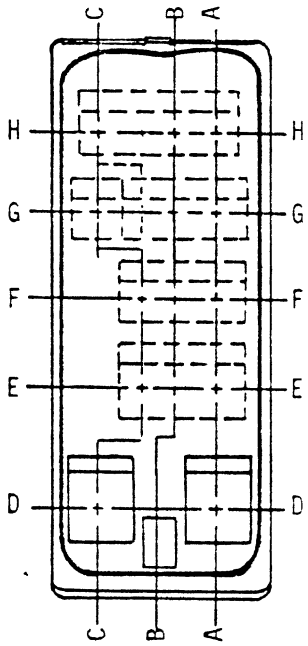
NATIONAL CRASH SEVERITY STUDY

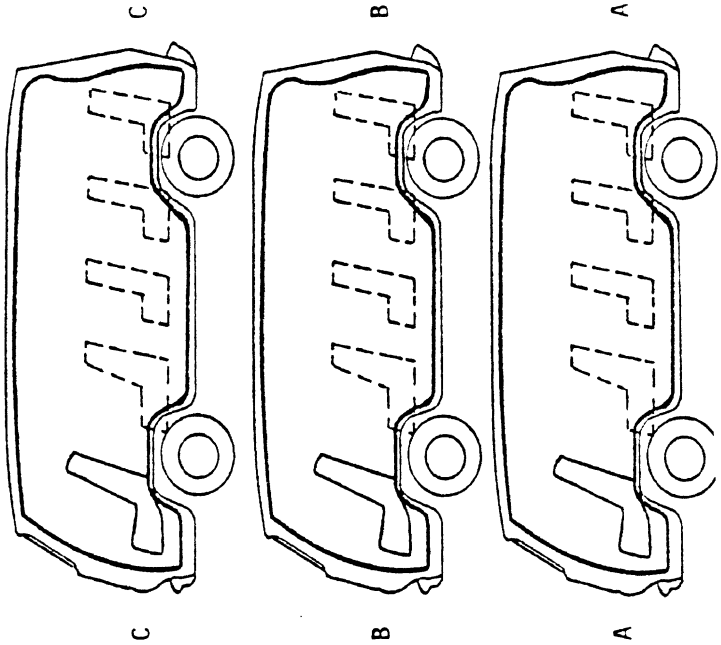
General Intrusion Diagram

PASSENGER VAN

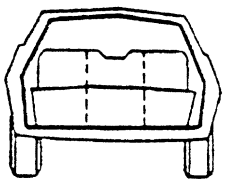
ID-3

Sketch intrusion as accurately as possible onto plan view and applicable cross sections. Also sketch the penetrating object where appropriate.

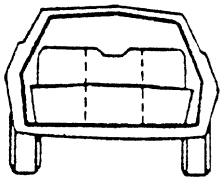




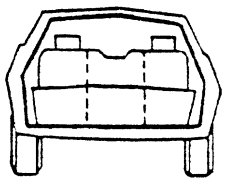
Sections AA, BB, CC are taken through the center of occupant spaces 11, 21; 12, 22; and 13, 23 respectively.



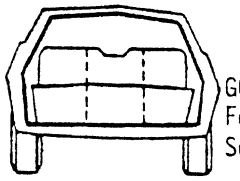
EE
Second
Seat



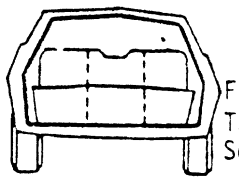
HH
Fifth
Seat



DD
Front
Seat



GG
Fourth
Seat



FF
Third
Seat

Sketch of Penetrating Object

Note: Lateral sections are taken through the torso regions of the seats.

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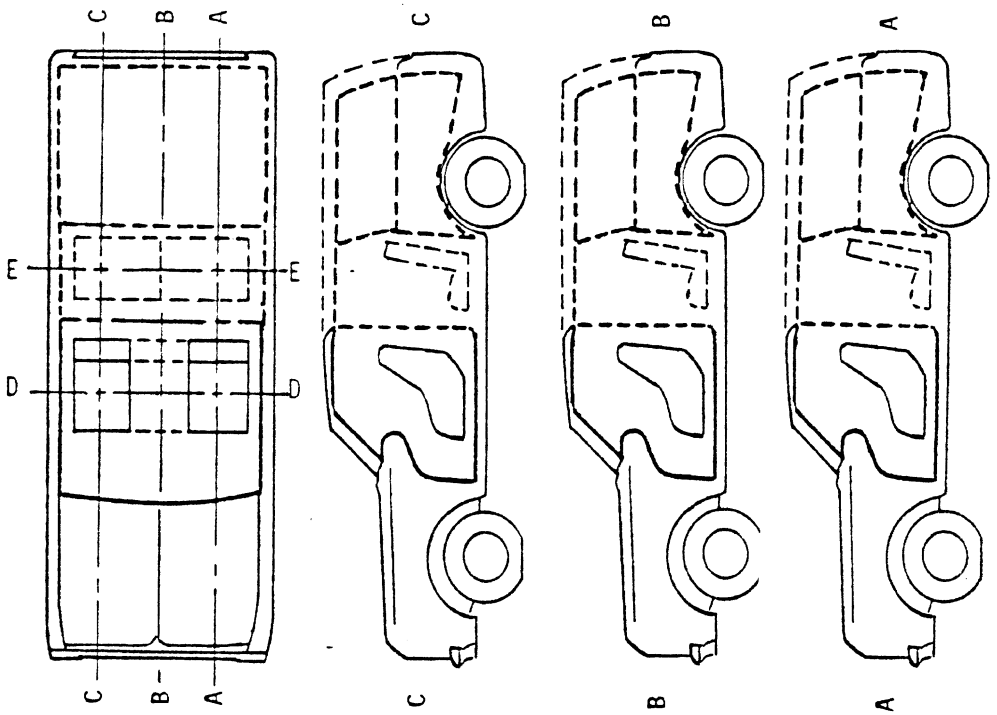
NATIONAL CRASH SEVERITY STUDY

General Intrusion Diagram

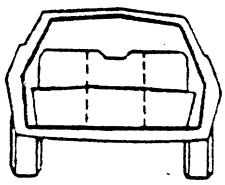
UTILITY & PICK-UP VEHICLES

ID-4

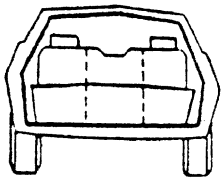
Sketch intrusion as accurately as possible onto plan view and applicable cross sections. Also sketch the penetrating object where appropriate.



Sections AA, BB, CC are taken through the center of occupant spaces 11, 21; 12, 22; and 13, 23 respectively.



EE
Rear
Seat



DD
Front
Seat

Sketch of Penetrating Object

Note: Lateral sections are taken through the torso regions of the seats.

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UPDATE	TEAM	YEAR	MONTH	DAY	SEQUENCE
1					10

IS

NATIONAL CRASH SEVERITY STUDY

INTRUSION: INTERNAL SURFACES OF THE PASSENGER COMPARTMENT

Complete this form *ONLY* when there is intrusion of the internal surfaces of the passenger compartment. Supplemental sketches may be required.

[11-13] Vehicle No. ___ 0 0

1. Complete the General Intrusion Diagram so as to depict the intrusion(s) of the passenger compartment internal surface(s).

   A. For a 2 occupant space vehicle, sketch intrusion on the passenger car diagram and cut-away sections A, C, D.
   B. For a 4 occupant space vehicle, sketch intrusion on the passenger car diagram and cut-away sections A, C, D, E.
   C. For a 5 or 6 occupant space vehicle, complete the passenger car diagram and all cut-away sections.
   D. For a station wagon, complete the station wagon diagram and all cut-away sections. If it is a 3 seat vehicle, ink in the 3rd seat.
   E. For a passenger van, complete the van diagram and all cut-away sections. If it is a 4 or 5 seat van, ink in the 4th and 5th seat.
   F. For a pickup vehicle, complete the pickup diagram and appropriate cut-away sections depending upon the seating arrangements.

[14-15] 2. Total Number of Occupant Spaces in the Vehicle: ___ ___
99= Unknown

[16-17] 3. Total Number of Intrusions ___ ___

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4. Areas of intrusion, associated impacts and resulting maximum intrusion.

Code intrusions in this order: Occupant Space 11, then 13, 23, 21, 12, 22, seat 3 (left to right), seat 4 (left to right), and seat 5 (left to right). See User's Manual, Section 6.3 for further information.

						Intrusion		Occupant Contact**	
	Intrusion Number	Intruded Area or Exterior Object	Occupant Space No.	Associated Impact No.*	Measurement Axis	Intrusion Maximum Extent	Occupant Space Dimension	Intrusion Extent at Contact†	Occupant Space Dimension†
	A	B	C	D	DD	E	F	G	H
[18-27]	01	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[28-37]	02	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[38-47]	03	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[48-57]	04	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[58-67]	05	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[68-77]	06	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[80]	(I.D. 4)								
[01-13]	(Duplicate for Case I.D.)								
[14-23]	07	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[24-33]	08	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[34-43]	09	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[44-53]	10	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[54-63]	11	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[64-73]	12	__ __	__ __	__	__	__ __	__ __	__ __	__ __
	13	__ __	__ __	__	__	__ __	__ __	__ __	__ __
	14	__ __	__ __	__	__	__ __	__ __	__ __	__ __
[80]	(I.D. 5)								

Add additional Intrusion Numbers as needed

*From Impact Number on page 1 of VEHICLE DATA FORM (V), column 54, etc.
CODES: 1, 2, 3, or 4, 6=Occupant Contact/Inertial Forces, 7=Other Impact, 8=Not Applicable, 9=Unknown.

**Noted here for convenience of measurement. Also record as needed in columns G and H of OCCUPANT CONTACT FORM (OC) as appropriate. If no occupant contact occurred for a particular intrusion, leave blank.

†At Point of Occupant Contact.

NOTE: ALL MEASUREMENTS ARE IN INCHES.

Column B: Codes for Intruded Area or Exterior Object

Individual Component

INDIVIDUAL COMPONENT:

Internal	CODE
Instrument Panel	01
Dash Panel--Cowl	02
Toe Pan	03
Steering Column	04
Windshield Header	05
A Pillar	06
Door Panel or Side Panel	07
Window Frame	08
B Pillar	09
C Pillar	10
D Pillar	11
Roof Side Rails	12
Roof or Convertible Top	13
Floor Pan	14
Backlight Header	15
Front Seat-Back Surface/ Seat-Back Back Surface	16
Second Seat-Back Surface/ Seat-Back Back Surface	17
Third Seat-Back Surface/ Seat-Back Back Surface	18
Fourth Seat-Back Surface Seat-Back Back Surface	19
Fifth Seat-Back Surface Seat-Back Back Surface	20
Windshield	21
Back Panel/Back Door Surface	22
Seat Cushion Surface/Edge	23
Console	24
Other: _____	28
Unknown Internal Surfaces	29
Exterior	
Hood	43
Objects Exterior to Car	44
Outside Surface of Car	45
Other: _____	46
Unknown Exterior Object	49
Not Applicable	98
Unknown	99

Grouped for Massive Intrusion into an Occupant Space

	CODE
Instrument Panel-01 A Pillar-06 Door Panel-07	31
Instrument Panel-01 A Pillar-06 W/S Header-05	32
Door Panel-07 B Pillar-09 Roof Rail-12	33
Instrument Panel-01 Floor Pan-14 A Pillar-06 Door Frame-07	34
Roof Rail-12 A Pillar-06 B Pillar-09 Window Frame-08	35
Roof Rail-12 A Pillar-06 B Pillar-09 C Pillar-10 Door Panel-07	36
Roof-13 Roof Rail-12 Window Frame-08 Door Panel-07	37
Backlight Header-15 Roof-13 C Pillar-10 3rd Seat Back-17	38
Roof-13 Roof Rail-12 A Pillar-06 B Pillar-09 C Pillar-10 Window Frame-08 Door Panel-07 Floor Pan-14	39
Instrument Panel-01 Toe Pan-03 W/S Header-05 A Pillar-06 Roof Rail-12 Window Frame-08 Door Panel-07 Roof-13	40
Roof-13 Roof Rail-12 C Pillar-10 Window Frame-08 Floor Panel-14 2nd Seat-17 Door Panel-07	41
Roof Rail-12 Roof-13 B Pillar-09 Window Frame-08 Floor Pan-14 Door Panel-07 2nd Seat-17 Front Seat-16	42

*Use only if all these components components intruded into a single occupant space.

Column C: Codes for Occupant Space Number

Occupant Space Number is a 2-digit code. The use of the code is determined by the vehicle seat configuration at the time of the crash.

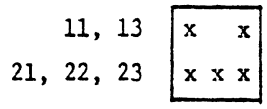
The first digit (left digit) denotes the seat row, with code values from 1-5. The second digit (right digit) denotes the position on the seat and (in some instances) the width of the seat.

Second Digit Codes:

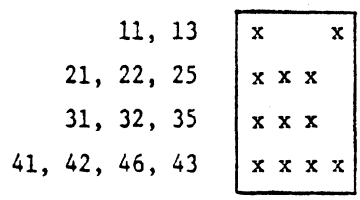
Seat Type	Code Value
Individual seat (bucket)	1=left, 3=right
Bench: Full width 3 passenger	1=left, 2=center, 3=right
Full width 4 passenger	1=left, 2=left center, 6=right center, 3=right
Partial width - left	1=left, 2=center, 5=right+ aisle space
Partial width - centered	0=left + space, 2=center, 5=right + space
Cargo area	4=entire vehicle width

EXAMPLES

Passenger Car
5 passengers



Van
12 passenger capacity



Column DD: Codes for Measurement Axis

X X Axis (fore and aft)
Y Y Axis (lateral)
Z Z Axis (vertical)

If door intrusion occurred, complete DOOR INTRUSION Form (DR).

If seat intrusion occurred, complete SEAT INTRUSION Form (ST).

If occupant contact resulted, complete the appropriate OCCUPANT CONTACT with INTRUDED SURFACES Form (OC).

END OF INTERNAL SURFACES INTRUSION DATA FORM

UPDATE	TEAM	YEAR	MONTH	DAY	SEQUENCE
—	—	—	— —	— —	— — —
1					10

DR

NATIONAL CRASH SEVERITY STUDY

INTRUSION: DOOR

Complete this form as a continuation of the INTERNAL SURFACES FORM when door intrusion is present.

[11-13] Vehicle No. ___ 0 0

[14] 1. Was door intrusion increased by component damage? ____

2 No (Skip to Item 3, Column 31)
1 Yes (Answer Item 2, Column 15)

2. Damaged component causing increased door intrusion:

		Intrusion Number*	Damaged Component #1	Damaged Component #2
[15-18]	A	___ ___	___	___
[19-22]	B	___ ___	___	___
[23-26]	C	___ ___	___	___
[27-30]	D	___ ___	___	___

CODES FOR DAMAGED COMPONENT

1 A Pillar
2 B Pillar
3 Door Latch/Striker
4 Door Hinges
7 Other (Specify) _____
8 Not Applicable
9 Unknown

*From Column A, Item 4--INTERNAL SURFACES INTRUSION FORM.

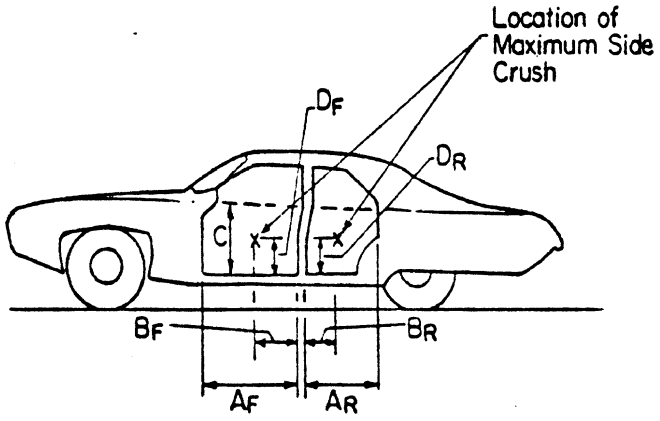
3. By using the following diagram locate the point(s) of maximum *EXTERIOR* inward crush which is directly responsible for the intrusion.

If the vehicle has 2 doors, use only dimensions subscripted F.

If the vehicle has 4 doors, use: dimensions subscripted F for front door crush; dimensions subscripted R for rear door crush; and F and R to describe either a distributed crush to both doors or two separate points of crush.

DO NOT code rear (side) door on VANS.

NOTE: Dimension C should be the same for both front and rear doors.



Dimension		Description	Left Side (Inches)	Right Side (Inches)	
Front Door	A_F*	Width of front door sheet metal.**	__ __	__ __	[31-34]
	B_F	Horizontal location of center of front door crush from B pillar door edge.	__ __	__ __	[35-38]
	D_F	Vertical location of center of front door crush from lower door edge.	__ __	__ __	[39-42]
	C*	Height of door sheet metal from lower edge to edge of window (beltline).	__ __	__ __	[43-46]
Rear Door	A_R*	Maximum width of rear door sheet metal.	__ __	__ __	[47-50]
	B_R	Horizontal location of center of rear door crush from B pillar door edge.	__ __	__ __	[51-54]
	D_R	Vertical location of center of rear door crush from lower door edge.	__ __	__ __	[55-58]

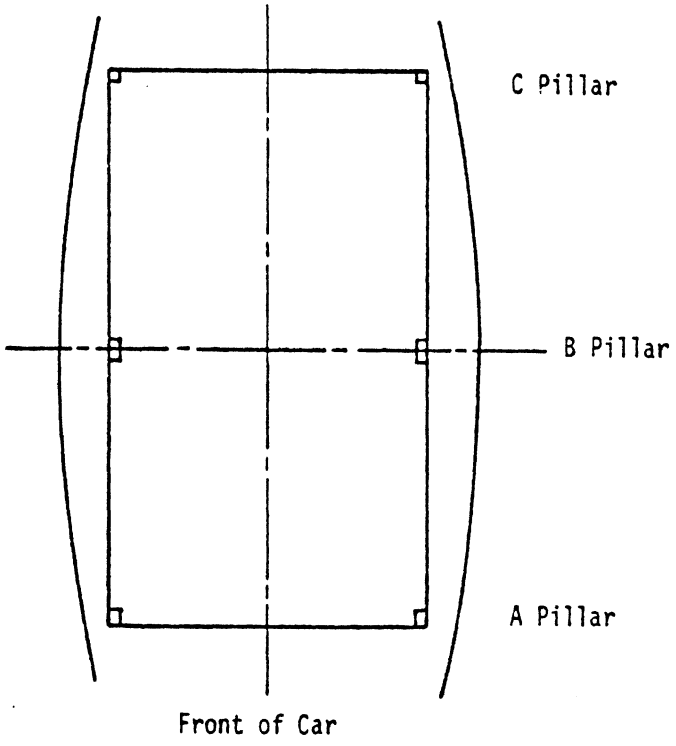
*Should be identical for right and left sides of an undamaged vehicle.

**See User's Manual, Section 5.3 for measurement procedure.

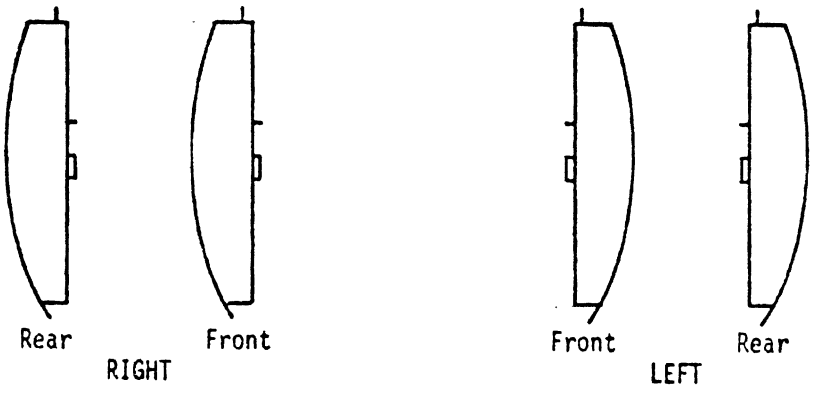
CODE:
77 Distributed Damage
78 Non-direct Impact
97 Undamaged
98 NA (2 door car)
99 Unknown

I.D. 6 [80]

4. Sketch the door(s) area internal surface intruded contour at the horizontal plane showing the maximum intrusion (internal) and crush (external). This plane must lie between the bottom of the door and the beltline.



5. Sketch the door(s) internal surface intruded contour at the vertical plane showing the maximum intrusion and crush.



* END OF DOOR INTRUSION FORM *

3/78 DR-3
HSRI

UPDATE	TEAM	YEAR	MONTH	DAY	SEQUENCE
1					10

ST

NATIONAL CRASH SEVERITY STUDY

INTRUSION: SEAT

Complete this form *ONLY* if seat intrusion has occurred. (If occupant contact occurred as a part of seat intrusion, also refer to FORM OC to note injuries, if any.)

[11-13] Vehicle No. ___ 0 0

1. Sketch the seat intrusion on the attached seat intrusion diagram. Include all necessary dimensions to quantify the final seat position and seat back angles (if these are considered to be intrusion sources).

2. SEAT TYPE

[14] A. Front ___
7 Other: _____

[15] B. Second (Rear) ___
7 Other: _____
8 No Rear Seat

[16] C. Third ___
7 Other: _____
8 No Third Seat

[17] D. Fourth ___
7 Other: _____
8 No Fourth Seat

[18] E. Fifth ___
7 Other: _____
8 No Fifth Seat

CODES FOR SEAT TYPE
(May or may not have arm rests)

Bench	1
Split Bench with or without Folding Back	2
Bench with Separate Back Cushions Front or Rear	3
Bench with Folding Backs	4
Bench with one folding back (may be right or left) or 60/40 split bench	5
Bucket Type Front or Rear	6
Unknown Type	9

3. SEAT INTRUSION

		Intrusion No.*	Cause	Direction
[19-22]	A.	___ ___	___	___
[23-26]	B.	___ ___	___	___
[27-30]	C.	___ ___	___	___
[31-34]	D.	___ ___	___	___
[35-42]	E.	___ ___	___	___
	F.	___ ___	___	___

*From Column A, Item 4--INTERNAL SURFACES INTRUSION FORM.

CODES FOR CAUSE

1 Failure of seat adjusters
2 Failure of seat tracks
3 Failure of seat back folding locks
4 Deformed by impact of passenger from rear
5 Deformed by impact of passenger from front
6 Deformed by inertial forces due to own mass
7 Deformed by intrusion of passenger compartment
8 Other (Specify) _____
9 Unknown

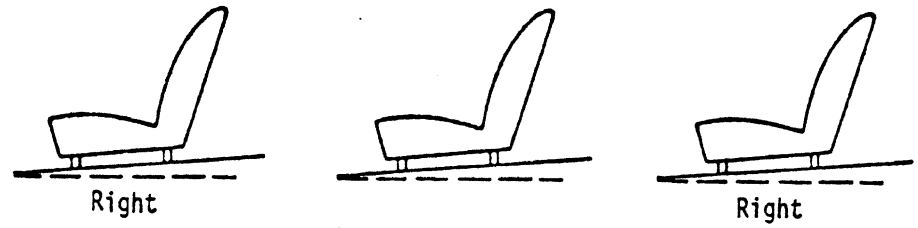
CODES FOR DIRECTION

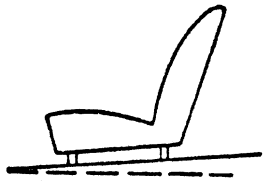
1 Forward
2 Rearward
3 Left
4 Right
9 Unknown

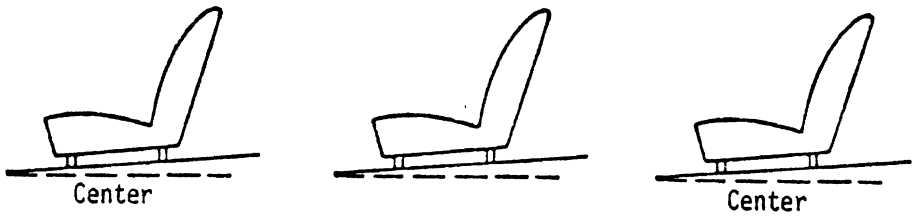
[80] I.D. 7

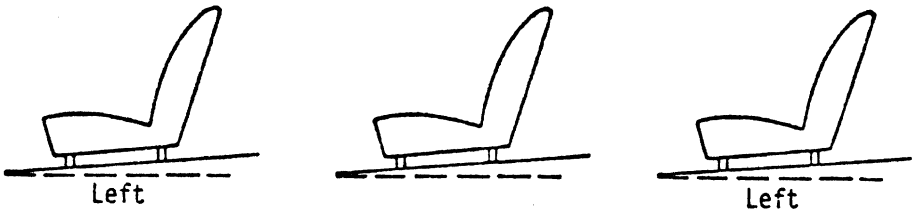
3/78 ST-1
HSRI

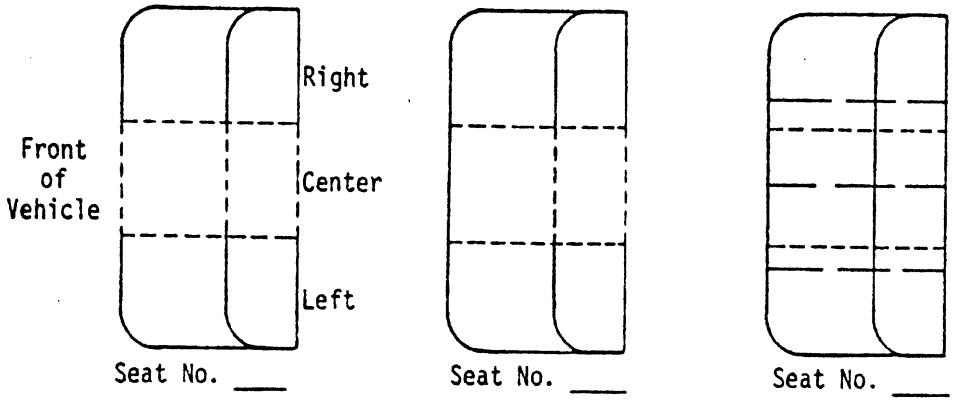
SEAT INTRUSION DIAGRAM











(ADD SEAT ROW DIAGRAMS AS NEEDED.)

* END OF SEAT INTRUSION FORM *

3/78 ST-2
HSRI

UPDATE	TEAM	YEAR	MONTH	DAY	SEQUENCE
__	__	__	__ __	__ __	__ __ __
1					10

OC

NATIONAL CRASH SEVERITY STUDY

INTRUSION: OCCUPANT CONTACT WITH INTRUDED SURFACES

[11-13] Occupant No. __ __ __

Complete this section *ONLY* if there is evidence that an occupant(s) contacted an intruded internal surface (including seats) of the passenger compartment. An injury need not have resulted from the contact.

		Intrusion Number*	Associated Injury Numbers** 1	2	Intrusion Extent at Point of Contact (Inches)† (G)	Occupant Space Dimension†† (Inches) (H)
[14-21]	A	__ __	__	__	__ __	__ __
[22-29]	B	__ __	__	__	__ __	__ __
[30-37]	C	__ __	__	__	__ __	__ __
[38-45]	D	__ __	__	__	__ __	__ __
[46-53]	E	__ __	__	__	__ __	__ __
[54-61]	F	__ __	__	__	__ __	__ __

*From INTERNAL SURFACES INTRUSION FORM, item 4, column A.

**From OCCUPANT DATA PAGE(S), CASE SUMMARY REPORT.
Code 0 if no injury was received from the contact.

†From INTERNAL SURFACES INTRUSION FORM, item 4, column G.

††From INTERNAL SURFACES INTRUSION FORM, item 4, column H.

[80] I.D. 2

* END OF OCCUPANT CONTACT FORM *

HSRI
3/78 OC

4.0 WHEN TO COMPLETE INTRUSION FORMS

This accident study requires that the intrusion supplementary forms be completed whenever there is any intrusion of the passenger compartment as defined in DEFINITION 2.1. The data forms and types of intrusion considered here are: a Catastrophic Crash; Internal Surface Intrusion; Seat Intrusion; Door Intrusion; Occupant Contact with Intruded Surfaces. These forms are to be completely ONLY if that particular form of intrusion has occurred. If there was no intrusion of the passenger compartment, then do not complete any intrusion forms.

A decision flow chart for completion of the intrusion supplementary forms is shown in Figure 4-1.

Note that data on intrusions must be recorded whether or not a passenger is seated within the particular occupant space, except that if intrusions of the internal surfaces of the passenger compartment are one inch or less in maximum extent, do not complete the Internal Surfaces Intrusion form.

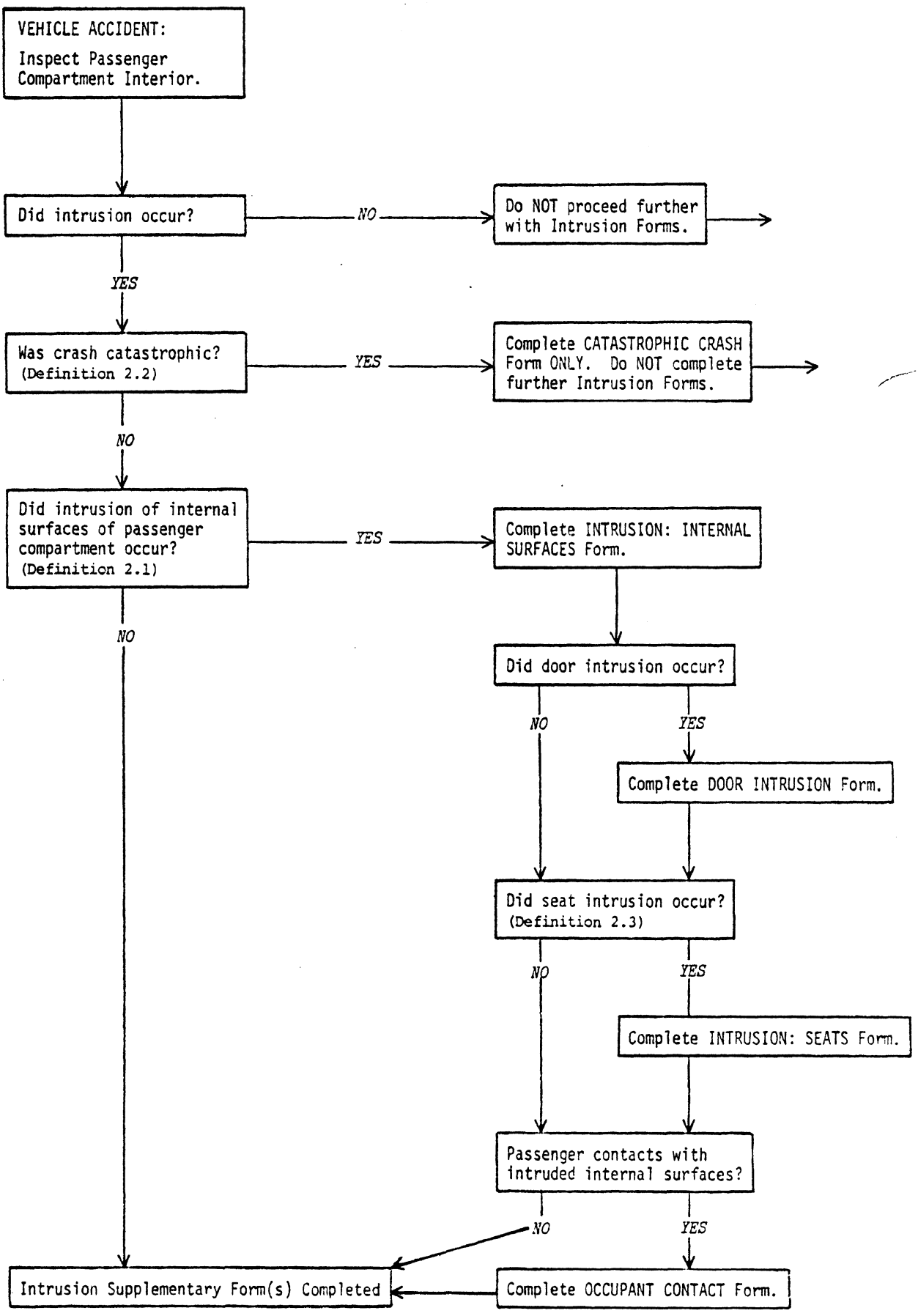


FIGURE 4-1. DECISION TREE FOR USE OF INTRUSION SUPPLEMENTARY FORMS.

5.0 MEASUREMENT METHODOLOGY

In order to measure intrusion of any portion of the passenger compartment, whether it be from the internal surfaces, seats, or door surface, it is necessary to have available original vehicle dimensions so that the change (intrusion) may be determined. These original dimensions are generally not available in a convenient form from motor vehicle manufacturers. Thus it is best for the investigator to obtain this data from measurement of a "reference" vehicle--either an equivalent vehicle or undamaged portions of the case vehicle.

5.1 Passenger Compartment Internal Surfaces Intrusion

5.1.1 Types of Intrusion

Two types of intrusion most often occur in accidents. They are:

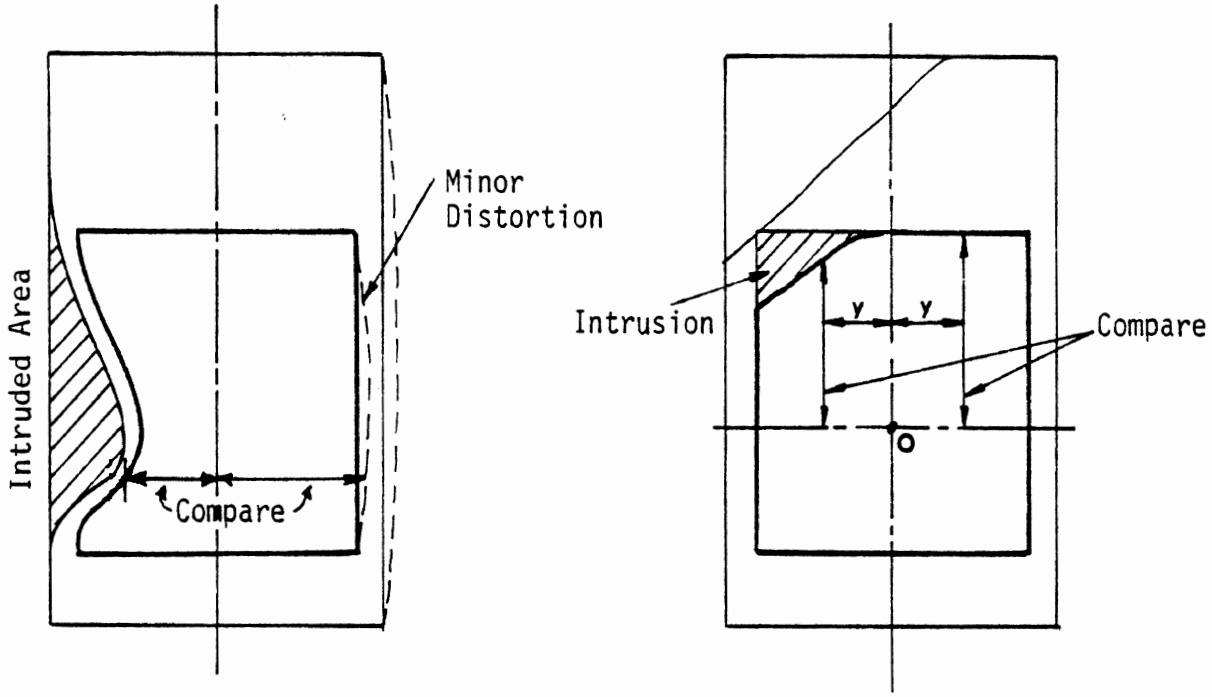
Type A: Intrusion which is limited to one part of the passenger compartment and where the other side of the vehicle remains relatively free of distrotion. This is likely to be the case in the majority of accidents. In many cases it will be possible to obtain a measure of the "original" vehicle dimension by using the fact that the vehicle is symmetrical about a longitudinal center-line.

Type B: Intrusion which occurs in many sections of the passenger compartment with little of the vehicle remaining free of distortion. In this case, it will be necessary to obtain "original" dimensions by comparison with a second (unintruded) vehicle of the same type.

Examples of Types A and B intrusions are shown in Figure 5-1.

5.1.2 Frame of Reference. In order to compare one side of a vehicle with the other or compare two vehicles, a coordinate system within the vehicle needs to be defined.

Type A Intrusion:



Type B Intrusion:

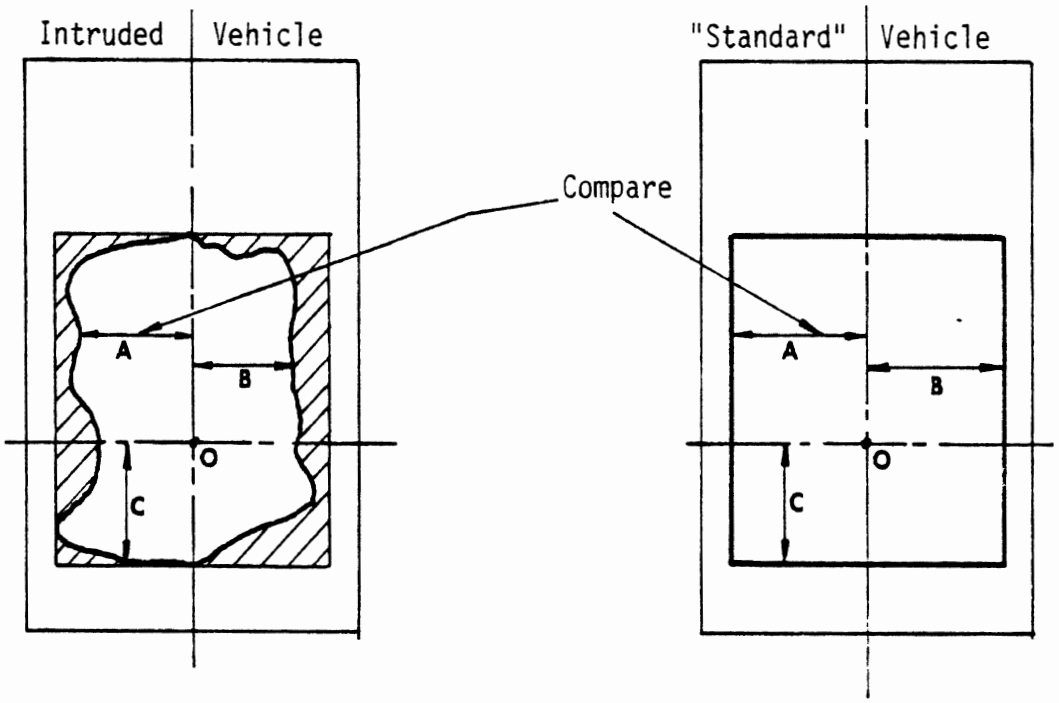


FIGURE 5-1. Examples of Two Basic Types of Intrusion Presenting Different Problems of Measurement.

This system is defined by an orthogonal set of axis (x-y-z) and an origin O as shown in Figure 5-2. The position of the origin is typically on the longitudinal center-line of the vehicle and has an arbitrary location both vertically and longitudinally. *The important feature is that its location be identical for the intruded and "reference" vehicle.*

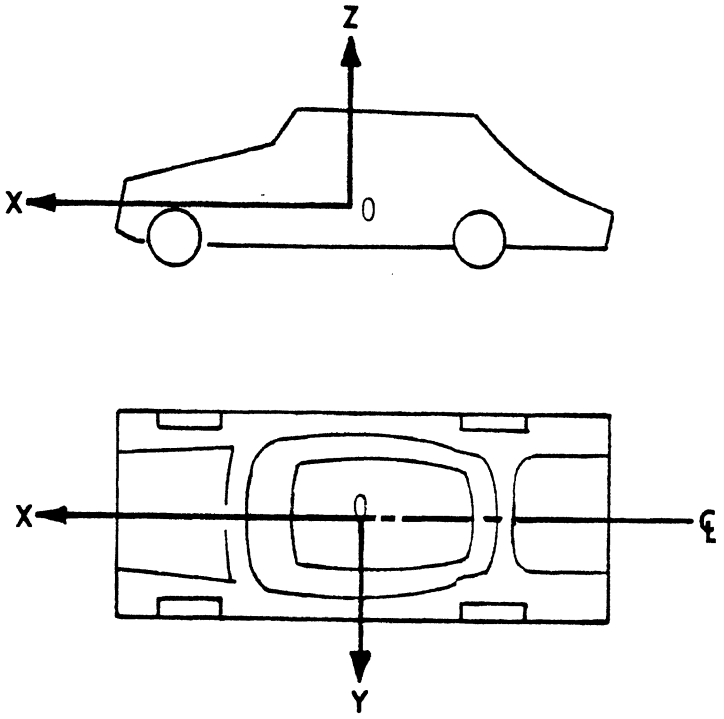


FIGURE 5-2. ORTHOGONAL AXIS IN A VEHICLE

The x-axis (defining a vertical* plane) is on the longitudinal center-line of the vehicle. This could be set up along the transmission drive shaft tunnel for a rear wheel drive vehicle or along a center-line which is equidistant from the sides of the vehicle in a front wheel drive vehicle.

The y-axis (defining another vertical plane)is in a transverse direction. This plane may be set up in any convenient longitudinal location which can be readily established in the "reference" vehicle,

---

*Although stated as vertical here, when the vehicle is inclined the plane rotates and retains its reference to the floor plane of the vehicle.

The y-axis (defining another vertical plane) is in a transverse direction. This plane may be set up in any convenient longitudinal location which can be readily established in the "reference" vehicle, i.e., through the centers of the B-pillars, instrument panel surface, C-pillar, etc.

The z-axis, defining a horizontal plane, is orthogonal to x and y axes. A location at the top of the transmission drive shaft tunnel may be convenient in many cases. The point established by these intersecting planes defines the origin O.

The problem of establishing a frame of reference and measuring intrusion is simplified to some extent since:

*In a frontal collision, there is rarely intrusion at the rear, and vice-versa for a rear collision.

*Side impacts generally damage only one side of the vehicle (except in the case of multiple rollover).

*Roof impacts leave the floor pan undistorted.

Not all intrusions require the establishment of all three axes (planes).

5.1.3 Setting Up the Frame of Reference Within a Vehicle - Use of a Measurement Aid

In many cases intrusion is relatively minor and measurement is simple. However, when vehicle intrusion is large in magnitude and/or severe distortion of the internal surfaces has occurred, it is likely that it will be necessary to have to set up a frame of reference from which to take measurements. A simple extending-tube device (to which is attached an inclinometer) has been designed to aid in these measurements (Figure 5-3).

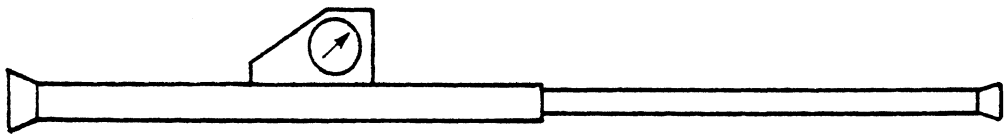


FIGURE 5-3: MEASURING TUBE

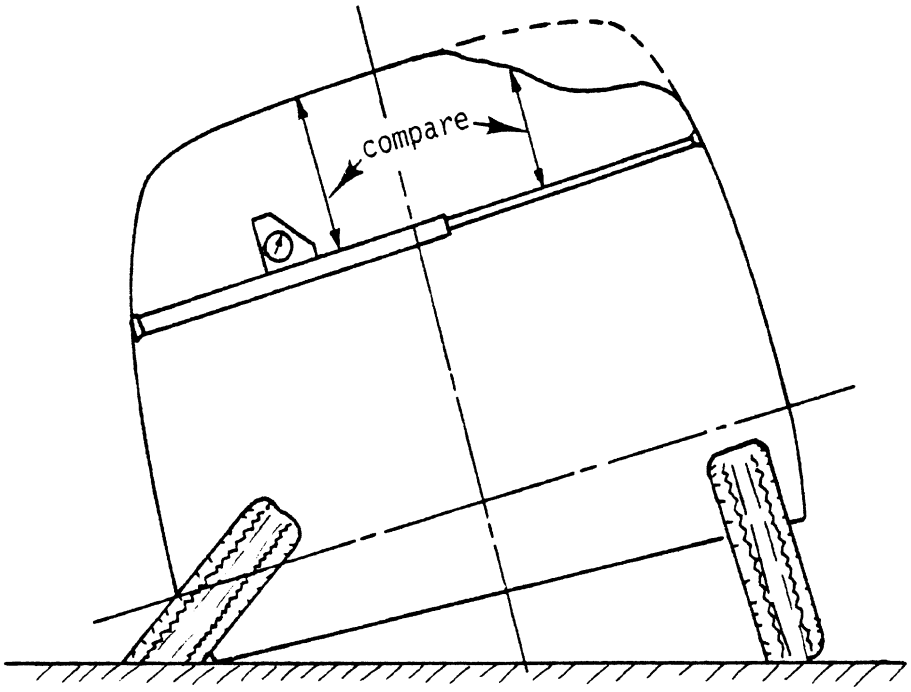
The procedure for establishing the reference planes is as follows:

(1) A "z-axis (vertical)" can be found, for example, by scribing a line on the headliner from the rear-view mirror through the dome light to the center of rear window and locating a second point on the center-line of the transmission drive shaft tunnel. Placing the measuring tube between these two lines will establish a z (vertical) axis. If the tube is then erected anywhere within the vehicle at the same inclination angle a "vertical" or z-axis is obtained.

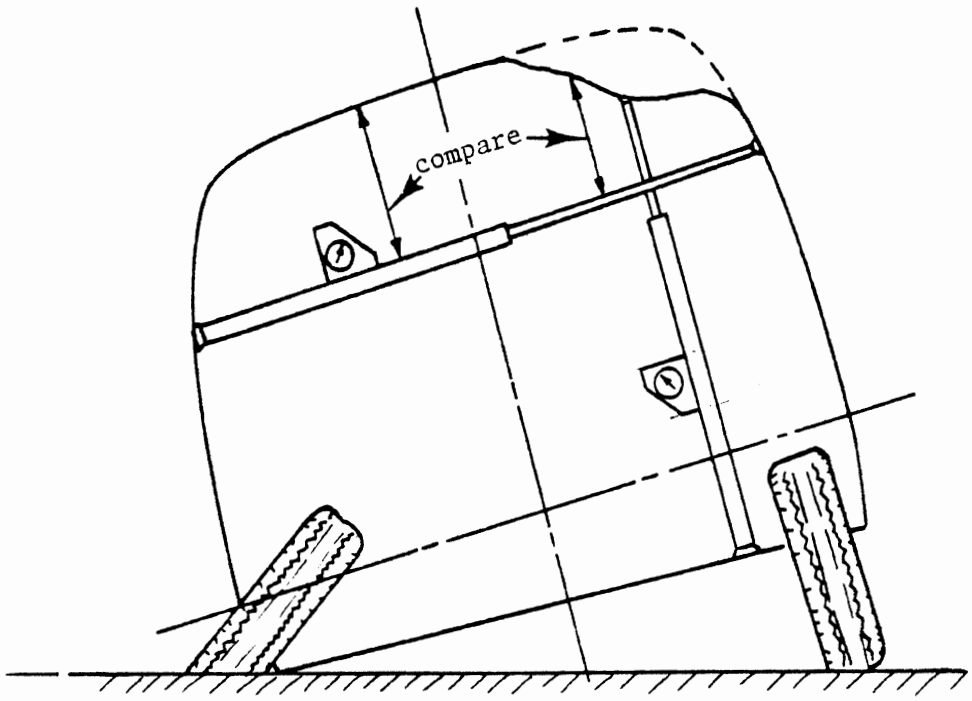
(2) A "y-axis" reference (in lateral or horizontal direction) is obtained by laying the tube between two points, or opposite sides of the vehicle: i.e., the door sills.

(3) The "x-axis" reference (for the longitudinal direction) may be obtained by laying the tube along the door sill and reading the inclinometer.

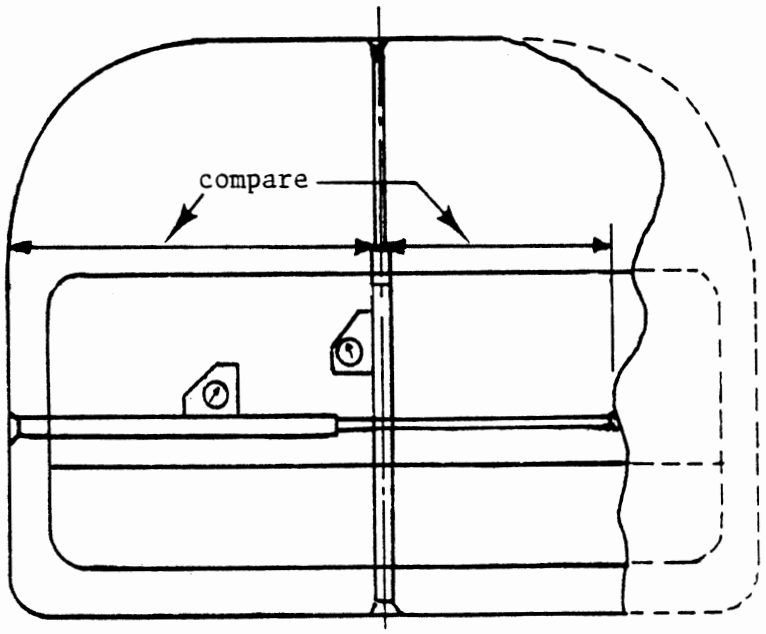
Examples: 1. To measure a roof intrusion.

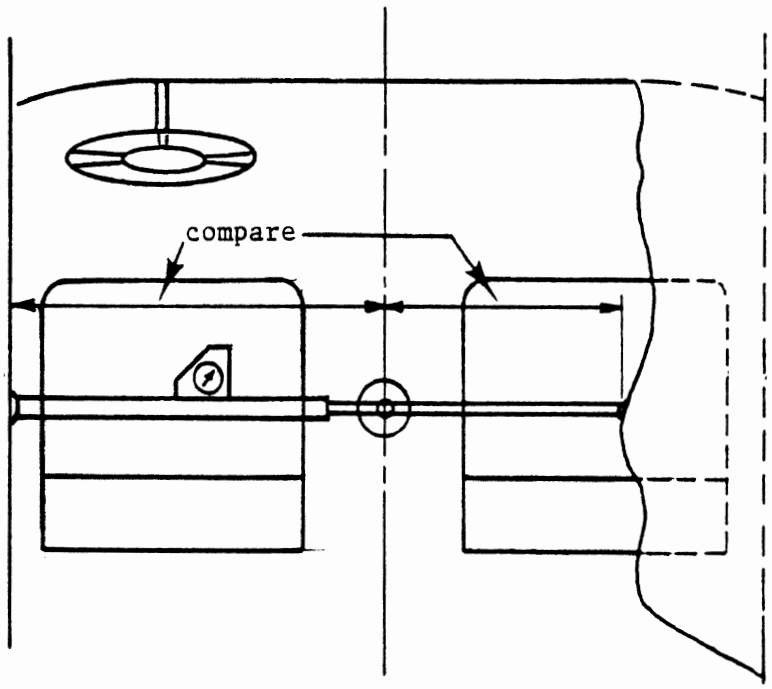


If necessary, the z-axis may also be erected to aid the measurement (see below).



2. To obtain side intrusion measurements relative to a vertical plane.





From experience gained in measuring several "simple" intrusions, the measuring tube (or similar device) may only be necessary for more complex patterns of deformation.

5.1.4 Possible Benchmarks for Use in Measurement. As intrusion is a measurement to be made relative to the original (unintruded) dimension, it is not necessary to make all measurements relative to some standard reference or benchmark position within the vehicle. Each vehicle (and/or measurement) will possibly require a different origin for measurement. This will be determined largely by the pattern of intrusion. The location of the reference frame is, to an extent, decided by the investigator. There are however a number of useful locations within the vehicle which will allow ready comparison for Types (a) and (b) intrusions (see Section 5.1).

(1) Side Intrusion: In this case a "vertical", established along the centerline of the vehicle is required. Suggested locations are:

(a) Along the centerline of the vehicle.

(b) At the center of the inboard seat tracks of bucket seats--if there is floor pan distortion.

(c) At center of inboard seatbelt floor anchorages.

(2) Roof Intrusion: A "horizontal" is required for measurement. This may be established by:

(a) By establishing a y axis as previously described.

(b) By resting the telescoping tube across the arm rests, (providing there is little side distortion), and measuring vertically from this tube (see Figure 5-4).

(c) From the lower edge of the windows.

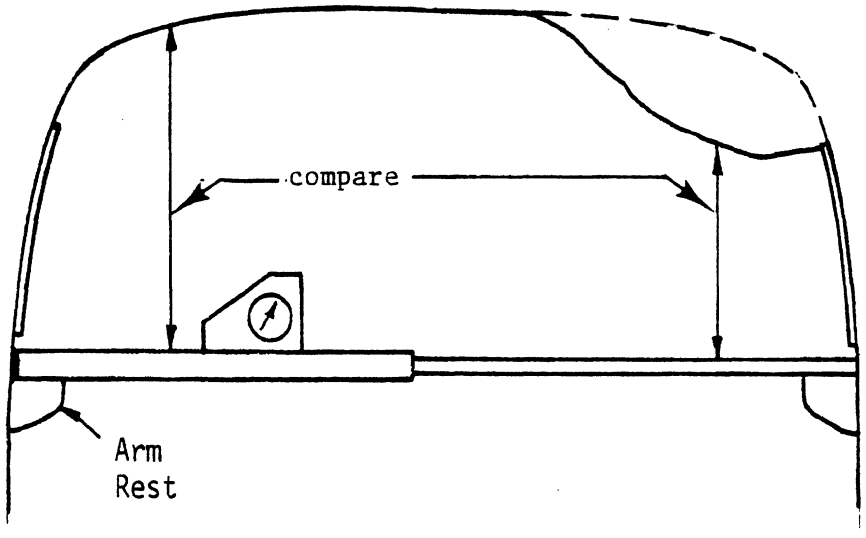


FIGURE 5-4: MEASURING ROOF INTRUSION BY RESTING THE MEASURING TOOL ON THE ARMRESTS

(3) Front or Rear End Intrusion: Measurement here is usually simplified by the fact that an accident in which frontal intrusion occurs is very unlikely to have rear intrusion, and vice versa. Hence there is generally available a horizontal (lateral) axis from which longitudinal measurements can be made. Examples are:

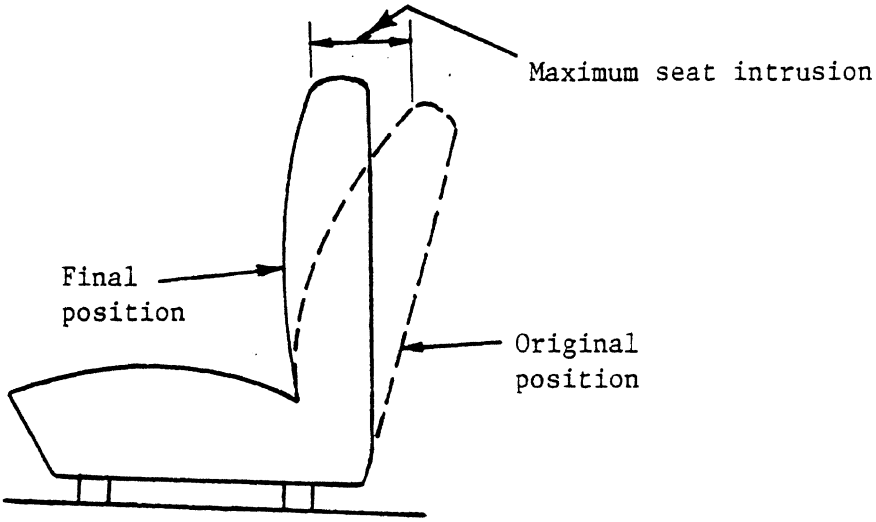
(a) Rear window header.
(b) Front edge of rear seat.
(c) Line joining centers of B-pillars.
(d) Line joining similar points on A-pillars.

(4) Documentation of Measurements: When type (b) intrusions are measured in the accident vehicle, it is important for the investigator to sketch, and/or note the benchmarks or references used. In general, the "reference" vehicle will be measured later, or may be measured by another investigator. Therefore, the method of measurement must be explicitly and thoroughly documented. Also, the values of the measurement--original dimension and intruded dimension--must be recorded so that the Intrusion Maximun extent may be calculated.

5.1.5 Accuracy of Measurement. From the foregoing sections, it is apparent that certain inaccuracies will arise in the process of measurement, particularly when it is necessary to find "original" vehicle dimensions as in Type (b) intrusions. It is suggested that investigator's make their measurements to the nearest ¼ inch for both the intruded and original dimensions.

5.1.6 Calculating Intrusion Maximum Extent. The Intrusion Maximum Extent is found by subtracting the intruded dimension from the original dimension. After finding the magnitude of the intrusion, it should be recorded to the nearest inch. For example, in the roof intrusion shown below, if A = 25½" and B = 15¼" then intrusion = 25½" - 15¼" = 10¼". This should be recorded on the data form as 10".

(a) Seat remains attached to tracks and floor pan.



(b) Seat detached from floor pan.

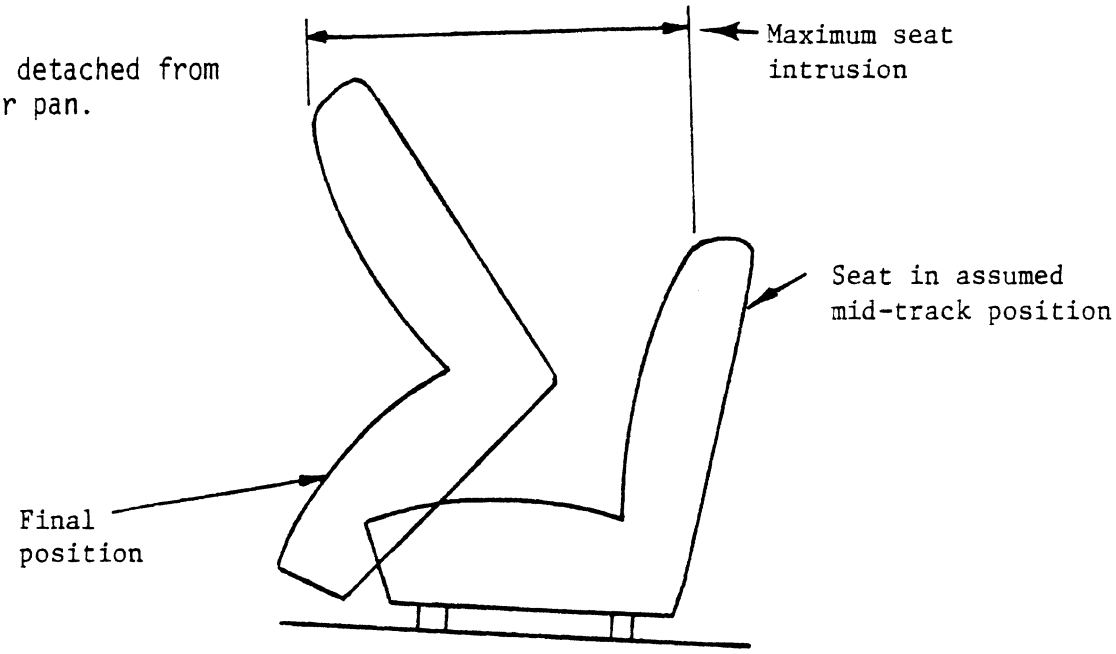


FIGURE 5-5: MEASUREMENT OF MAXIMUM SEAT INTRUSION

5.2 Measurement of Seat Intrusion

Measurement of seat intrusion involves a number of measurement difficulties due to the fact that, after the accident, the original seat position may not be accurately known due to (1) movement of the seat during extrication and (2) failure of the seat track, seat itself, or failure of the various adjusting mechanisms. This problem exists for both the original longitudinal position and original seat-back angle (in cases where it is adjustable). To overcome this problem it may be necessary to make a number of assumptions in the measurement procedure.

The seat intrusion form requires completion of the sketches of seat intrusions. On each of these diagrams place measurements of longitudinal displacements of the seat (where these are apparent) and measure the seat back displacements (angles). In order to determine intrusion when failure of the seat tracks or seat back has occurred it will be necessary to measure the final position of the seat relative to some fixed location within the vehicle, such as a point on the B-pillar, and compare this dimension with that in an unintruded seat. In situations where it is not possible to determine the location of the seat before the crash, assume that it was placed midway along the seat track. Figure 5-5 gives an example of seat intrusion.

5.3 Measurement of Location of Maximum External Door Crush

Door intrusion is caused by a crushing force applied to the outside sheet metal of the door. The purpose of these following measurements are to locate the center of the resulting exterior damage in reference to the door edges. The location of door crush is the only exterior measurement required in all of the intrusion forms.

Dimensions A and C are used to describe the overall size of the door. They are generally made so as to give the maximum dimensions of the door when measured through the center of the crush.

Dimensions A presents some measurement problems as the door edges are not necessarily straight lines. Generally this dimension should be made at a point approximately through the center of the impact using the B-pillar edge of the door as the reference line.

Dimension C (height) is measured from the lower-outside edge of the door to the belt-line.

For the convenience of measuring, dimension B, front and rear should have their origin at the B-pillar edge of the door, and dimension D should have its origin at the bottom door edge.

This procedure covers doors with concentrated impacts. If the damage is distributed, a modified procedure must be used. If the crush is vertical of approximately uniform depth as occurs if a vertical pole is struck in the door, a vertical measurement for D would not be defined. In this case, code D with 77 (distributed damage.) If the line of crush is horizontal,as might result from a high bumper, then the B measurement is undefined and B should be coded with 77 (distributed damage). If the line of crush is at an angle of less than 45 degrees from the vertical, code D with 77, and measure B to the mid-height of the damaged area. Conversely, for lines of crush of more than 45 degrees from the vertical code B with 77 and D with the mid-height.

If the crushing force is indirect, hence leaving no contact mark, then measurements cannot be made to locate its center. Thus code B_F, D_F, B_R, D_R = 78 as needed to indicate non-direct (to the door surface) impact force.

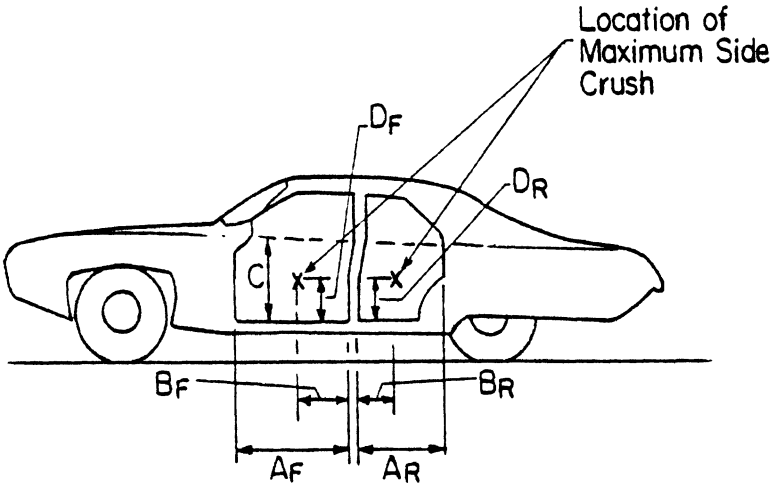
By using the following diagram, locate the point(s) of maximum <u>exterior</u> inward crush which is directly responsible for the intrusion.

If the vehicle has 2 doors, use only dimensions subscripted F.

If the vehicle has 4 doors, use: dimensions subscripted F for front door crush; dimensions subscripted R for rear door crush; and F and R to describe either a distributed crush to both doors or two separate points of crush.

DO NOT code rear (side) door on VANS.

NOTE: Dimension C should be the same for both front and rear doors.



Dimension		Description
Front Door	A_F*	Width of front door sheet metal.**
	B_F	Horizontal location of center of front door crush from B pillar door edge.
	D_F	Vertical location of center of front door crush from lower door edge.
	C*	Height of door sheet metal from lower edge to edge of window (beltline).
Rear Door	A_R*	Maximum width of rear door sheet metal.
	B_R	Horizontal location of center of rear door crush from B pillar door edge.
	D_R	Vertical location of center of rear door crush from lower door edge.

*Should be identical for right and left sides of an undamaged vehicle.

**See User's Manual, Section 5.3 for measurement procedure.

5.4 Penetration by External Objects

No measurement is required in this case. Sketches of the penetrating object are however required; this should show clearly the size of the object relative to the vehicle, the point of entry into the passenger compartment and the final resting position.

6.0 NOTES ON THE INTRUSION SUPPLEMENTARY FORMS

6.1 Intrusion (Columns, 73-78, NCSS Form V)

These entries denote which SUPPLEMENTARY FORMS have been COMPLETED, and *must be answered for all crashes investigated.*

If column 73, CATASTROPHIC CRASH,is marked yes, classifying the intrusion as catastrophic (according to the definition in Section 2.2) then complete the INTRUSION: CATASTROPHIC CRASH form only -- but do not proceed beyond that form.

If the intrusion is non-catastrophic then the response to column 73 is no, and the INTRUSION: INTERNAL SURFACES form must be completed along with whatever additional supplementary intrusion forms are appropriate.

6.2 Intrusion: Catastrophic Crash

Crashes which are extremely severe and which involve extreme magnitudes of intrusion are of little research value as far as a study of intrusion-related injuries are concerned. However, as such cases will arise in this study, it is necessary to record a few details of the type of structural failure which has occurred,and some approximate measure of the intrusion of each passenger space. These minimal data will allow the determination of the significance of this type of accident. Figure 2-1 illustrates intrusion which could be described as catastrophic.

Note the specifications for occupant spaces as used throughout the intrusion supplementary forms. The coding system to handle all types of occupant space configurations is discussed earlier in Section 2.6. Note that because of space limitations and the nature of catastrophic crashes, only certain seat positions will be coded here. This coding is limited to the first two seats (rows), with the remainder being coded 34 (whether seat position or cargo area are available). This special coding is given in Table 6.2-1.

Table 6.2-1. Vehicle Configuration at Time of Crash.
Catastrophic Crash Only.

Type of Vehicle*	Vehicle Passenger Capacity or Number of Seats	Applicable Occupant Spaces to Code	Occupant Spaces Coded not Applicable (P)
1,6,11	2 passenger-not internal cargo	11,13	12,21,22,23,34
1,31,41,6,12	2 passenger w/cargo area behind seat	11,13,34	12,21,22,23
2,32	4 passenger	11,13,21,23	12,22,34
2	5 passenger	11,13,21,22,23	12,34
5,11	1 seat	11,12,13	21,22,23,34
2,13	2 seat	11,12,13,21,22, 23	34
43	3 seat	11,12,13,21,22, 23,34	
45,46	4 seat w/ or w/o cargo area	11,12,13,21,23, 34	
5,12,21,6,33	1 seat w/ internal cargo area	11,12,13,34	21,22,23
3,22,42	2 seat w/ internal cargo area	11,12,13,21,22, 23,34	
4,23,44	3 seat w/ internal cargo area	11,12,13,21,22, 23,34	

*Vehicle Types (used only in this table)

1. sports car
2. passenger car
3. station wagon-2 seat
4. station wage-3 seat
5. station wagon-1 seat with other seats folded
6. pickup car

11. pickup truck
12. pickup truck w/internal cargo area
13. pickup truck w/crew cab

21. carryall-1 seat w/cargo area
22. carryall-2 seat w/cargo area
23. carryall-3 seat

31. utility-2 passenger
32. utility-2 seat
33. utility-3 passenger

41. van-2 passenger
42. van-2 seat
43. van-3 seat
44. van-3 seat w/cargo area
45. van-4 seat
46. van-4 seat w/cargo area
47. van-5 seat w/o cargo area
48. van-5 seat w/cargo area

Definitions: Passenger refers to maximum vehicle occupancy (manufacturer rating). Seat refers to a seating row capable of holding 2 or more passengers.

6.3 Intrusion: Internal Surfaces

If intrusion of any of the internal surfaces (as described in Section 2.1) has occurred, this form must be completed.

Prior to recording the data on the form, sketches of the intruded areas should be made. A diagram of various sections of the occupant compartment is provided in the General Intrusion Diagrams for this purpose. Sketches should be completed through each occupant space. For example, a 6-seat vehicle will require completion of longitudinal sections (through center-line of occupant spaces) A, B, C and lateral sections D, E (through torso region). A 4-seat vehicle will require completion of sections A, C, D, E only.

The number of occupant spaces is the normal manufacturer designated seating capacity of the case vehicle at the time of the crash--not the number of occupants in the vehicle at the time of the crash. Note that some seats may be removed prior to the crash, thus the limitation "at the time of the crash."

The occupant space coding system is described in Section 2.6. Do not confuse this section with Table 6.2-1, as Table 6.2-1 is intended for a specific purpose, i.e., catastrophic crashes only.

Data are required for each intrusion of the internal surfaces of the passenger compartment. If there are more than fourteen intrusions, continue the matrix (on the back of the forms if necessary), starting with intrusion number 15.

It should be noted that a single impact may produce more than one intrusion and also that an intrusion may be the result of more than one impact. The intrusion numbers are reference codes only and are not impact numbers.

The intrusions are listed in the following order, irrespective of severity or of occupant injury. Intrusions occurring to occupant space 11 (if any) are listed first. Intrusions are then listed for space 13, 23, 21, 12 and finally space 22. Intrusions for seats 3, 4, and 5 are listed from left to right and from seat 3 to seat 4 and

seat 5. Occupant spaces where no intrusion has occurred are not recorded. Thus a left side hit may produce intrusion only for space 21. Space 21's intrusions should be listed as intrusions 1, 2, etc., depending on how many components intruded.

The "intruded area" (Column B) is obtained from codes shown on the table accompanying the data forms. Each intruding component is treated as a separate intrusion. However, if several components are intruded into an occupant space as a result of a single crushing force (impact) and it is apparent that the association of injuries with individual intruding components would be highly improbable, then all those intruding components are to be coded as a unit using the appropriate combined component code as given on the data form. *NOTE: Assignment of a group code implies that all components listed for the group code intrude concurrently. To qualify, there must be at least three components in the group. Where a group component is used to aggregate several intruding components (resulting from a single impact) special measurement rules must be used. All measurements are taken orthogonally to the reference plane. Therefore, the investigator must: (1) choose the single component of the group which accounts for the most significant reduction in occupant space; (2) measure and record the intrusion from this component so as to best depict the change in space available to an occupant of that space; (3) note on the margin of the data form the single component to which the measurement was made and the direction of the measurement.*

The "Associated Impact Number" (Column D) is obtained from page 1 of the Vehicle Data Field Form (V). It is essential that this column be completed so as to provide linking between the various forms in the investigation. Code 6 is used to denote inertial or occupant loading of seats, resulting in intrusion of the seat--intrusion which cannot be ascribed to a particular CDC.

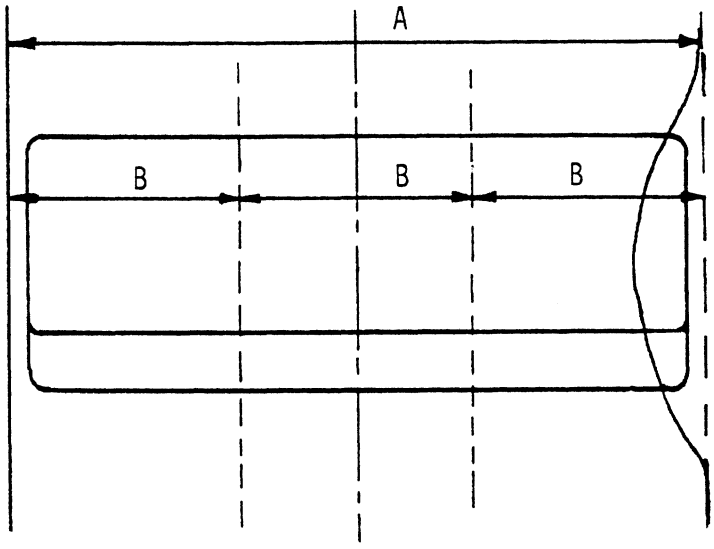
The "Measurement Axis" (column DD) is used to document the axis along which the measurement was taken; i.e., x, y or z. The correct codes here are x, y or z. This is the only place alpha codes are used on the data form.

The "Intrusion Maximum Extent" (Column E) is calculated by subtracting the intruded dimension from the original dimension (see Section 5.1.6). The measurement reference points and dimensions used to calculate this value should be noted marginally for each intrusion and measurement.

If a component has intruded into multiple spaces, the intrusion measurements must be made along the same axis for each occupant space.

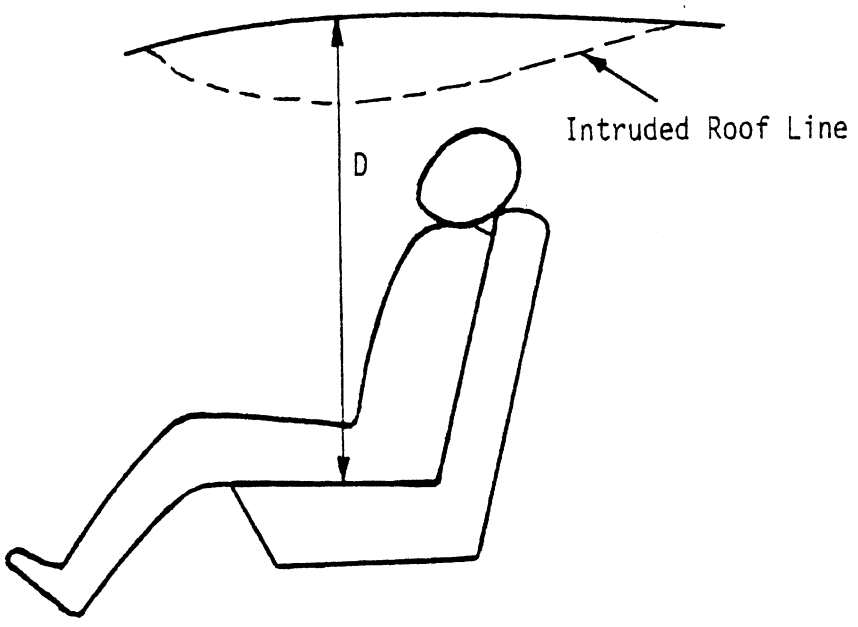
The "Occupant Space Dimension" (Column F) is that dimension of occupant space which is normally available to an occupant in an undamaged vehicle. The value of this dimension is obtained by measuring--in the same direction as the original vehicle dimension--between the boundary surfaces of the occupant space. These boundary surfaces are described in Section 2.5. In certain instances and dependent upon the choice of location of the reference plane, the original vehicle dimension and the occupant space dimension may be the same.

If occupant contact with the intruded surface has occurred (or is suspected) measurements and dimensions G and H similar to E and F above must be made. Provisions are made for recording these on this data form for later transfer to the Occupant Contact Data Form. The major difference between dimensions E and F, and dimension G (Intrusion Extent at (Point of) Contact--and dimension H--Occupant Space Dimension), is that they are to be made at the point on the intruded surface where the contact occurred as opposed to the maximums references in E and F.



EXAMPLE OF OCCUPANT SPACE DIMENSION

The occupant space dimension B, available for each front seat occupant, may be taken as A/3 where A=distance between the intruded internal panels of the door at the armrest level. For a seat capable of holding two or four persons (manufacturer's rating) R=A/2 or R=A/4, respectively. Thus in a two seat vehicle, for example, an occupant volume boundary lies on the center line of the vehicle.



The relevant original dimension is the space available between the seat surface and the internal surface of the roof (headline) before the intrusion occurred (Dimension D).

6.4 Intrusion: Door

The intrusion study is particularly interested in the performance of FMVSS 214. If side intrusion in a door has occurred, the Door Intrusion form must be completed irrespective of whether the door is equipped with a side door beam or not. The exception to this is the right hand rear door on passenger vans.

To compare side-intrusion of vehicles with, and without side guard beams it is necessary to have numerical data on the location of the external crush. Sketch the intrusion at the level on each door showing maximum intrusion of the internal surface. (This should be within the region from the bottom of the door to the belt-line.) Further, it is necessary to locate the center of the

crushing force which caused the door intrusion. The specifics of measuring and recording of these dimensions are given in Section 5.3.

6.5 Occupant Contact

Completion of this form will require careful observation by the investigator to determine whether an occupant has contacted an intruded internal surface of the passenger compartment. A line entry (on this form) should be completed for each occupant contact regardless of whether an injury resulted. It may be necessary to obtain information from vehicle occupants for completion of this section.

Although this form may be difficult to complete in the field, it is essential that it be done where relevant. Only through these data can any relationship be established between intrusions and associated injuries. The measurements (Columns G and H) are to be transferred from the same columns on the Internal Surfaces Form.

The data here are linked to other forms via the intrusion number and the occupant number (from Columns 11-13 of Occupant Data on page 5 of the Case Summary). The injury numbers are those listed for the individual occupants on forms OCC and OI of the Occupant Data Section.

6.6 Intrusion: Seats

Complete this form only if seat intrusion has occurred (according to the definition in Section 2.3).

If major movement of the seats has occurred, make measurements relative to some fixed location within the vehicle. Measurement methodology is discussed in Section 5.2. Include the location of this reference position on the sketch so that comparison data may be found from another vehicle. The seat numbering on this diagram refers to the occupant spaces as previously defined.

Note that this section also requires the direction of seat movement. For example, a rearward movement of the front seat back would be an intrusion of the rear seat occupant space, whereas a

forward movement would be an intrusion of the front occupant space. The intruding component would be, in the case of rearward movement, the seat back back surfaces. Forward movement would cause the seat back cushion surface to intrude. Lateral motion of seats is also possible.

6.7 External Object Penetration

Complete a sketch of the intruding object(s) on the appropriate General Intrusion Diagram form provided.

7.0 PHOTOGRAPHIC DOCUMENTATION

The following photographic requirements will assist the user in the documentation and interpretation of intrusion.

In addition to the normal set of interior photographs, supplementary photographs should be taken which document the nature and extent of the intrusion. Two views of each intrusion depicting the magnitude of the intrusion and overall perspective will be most useful.

Also, each point of occupant contact associated with an intrusion must be marked so as to be identifiable in the photographs. This is most readily accomplished by placing an X, consisting of two crossed pieces of tape, at the point of contact.