



Unit IV

Comfort, Convenience and Crash Testing

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❖ Syllabus:

Seats: types of seats, driving controls accessibility, and driver seat anthropometry. Steering: steering column angle, collapsible steering, and power steering. Adaptive cruise control, navigation system, adaptive noise control, driver information system.

Safety: Motor vehicle safety standards, active safety, passive safety, bio-mechanics Structural safety, energy absorption, ergonomic consideration in safety.



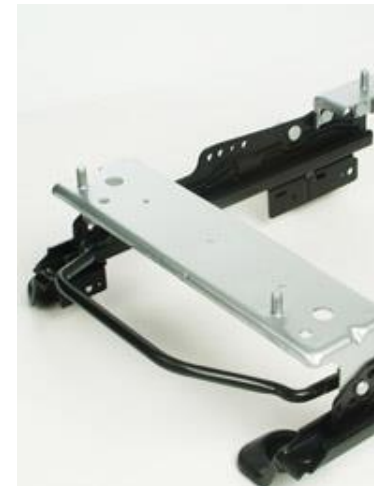
❖ Seats: Design Objectives

➤ Safety

- To ensure that the occupant is properly restrained and coupled to the vehicle deceleration to avoid fatal injuries to the occupant in case of automotive crashes/accidents

➤ Durability and Reliability

- To build a product which meets the stringent durability tests for various components and provide a safe and reliable ride



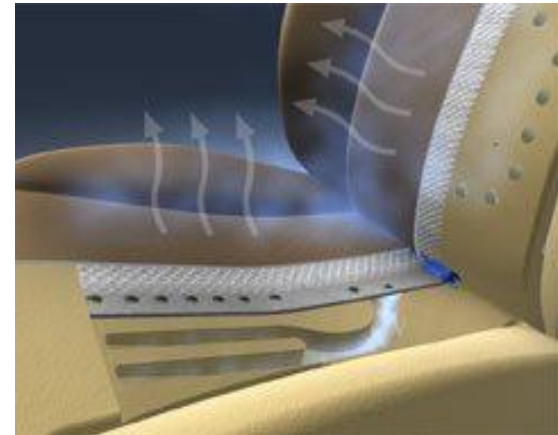
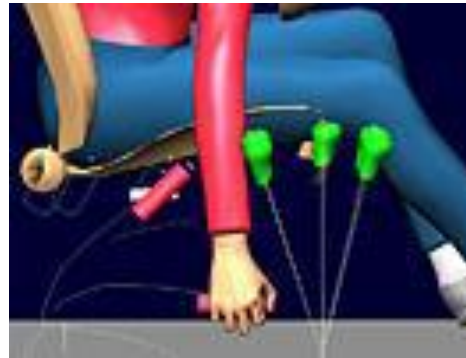


➤ Comfort

- To achieve good occupant/driver ergonomics and insulate him from road vibrations, provide adjustment features to provide a comfortable and effortless ride

➤ Luxury

- To provide aesthetic and high quality design with variety of features to improve occupant comfort/ergonomics



➤ Optimum Design Cycle

- To ensure optimum cost, quality and delivery of the final product for use in mass assembly structure of automobiles

➤ Optimum Utilization of Vehicle Space

- To use the available space inside the vehicle in the most efficient way by packaging and layout study





❖ Types

- **Bucket Seats - Front Driver and Co-Driver Seats**
 - Forward/Rearward movement
 - Adjustable Head-Restraint
 - Adjustable Back-Angle
 - Anti-Submarine
 - Lumbar Support
 - Thigh Support
 - Arm-Rest
- **Bench Seats - Second / Third Row Seating**
 - 60/40 Split Seats
 - Fold and Tumble
 - ISO-FIX attachments
- **Child Restraint Seats** - Specially designed to
 - carry children into adult seats





Typical Seat Configurations





❖ Structure of Car Seat

Back and Cushion Assembly



Recliner Mechanism



Typical Seat without Trim Cover



Cushion Pan



Head Restraint



Seat Back and Lumbar Support



Climate-controlled seat made by Amerigon for several auto makers

MTM SEAT TECHNOLOGY™
MICRO-THERMAL MODULE

AMERIGON
Advanced Automotive Thermal Solutions

HEAT EXCHANGER

PELTIER
CIRCUIT

COOLED OR
HEATED AIR
EXITS TO SEAT
CUSHION

WASTE AIR
EXITS SEAT

AIR DISTRIBUTION DETAIL

PERFORATED LEATHER

DISTRIBUTION LAYER

SCRIM MATERIAL

CHANNEL MOLDED
IN FOAM

ECU-ELECTRONIC
CONTROL MODULE

CONTROL
SWITCH



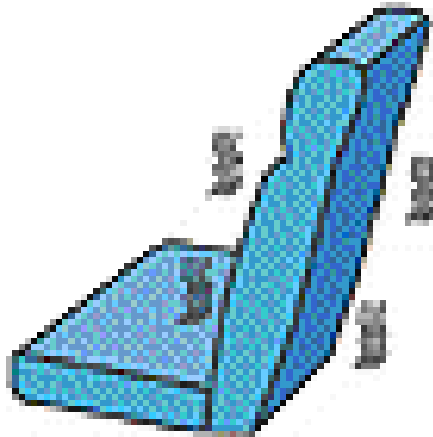






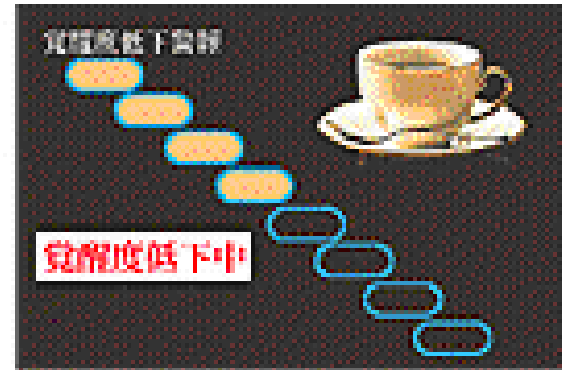
❑ Drowsiness Warning

by seat vibrations, voice controlled by central white line

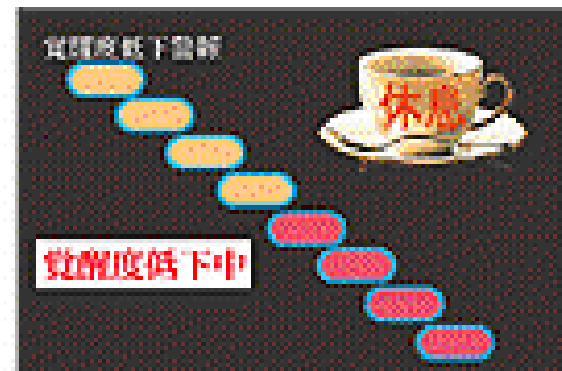


On the second warning, the warning display appears again and the seat begins to vibrate.

First warning
"Please pay attention!"



Second warning
"Please take a rest!"

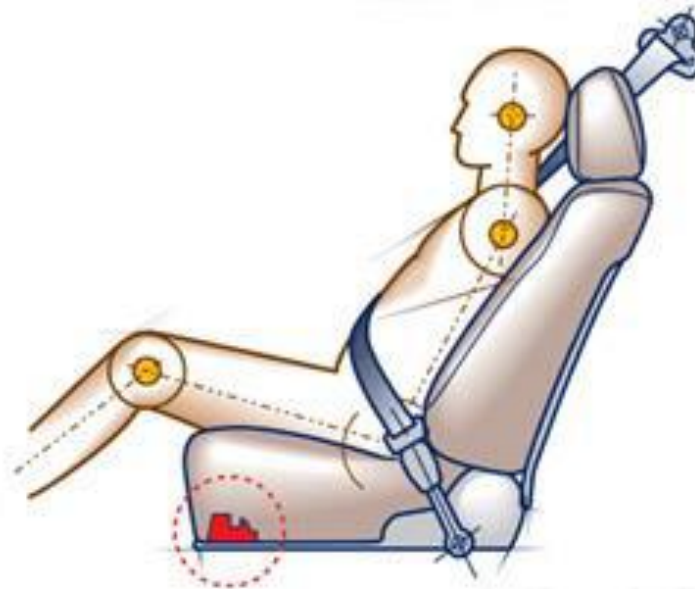


❖ Various Types of Seats used in BUS





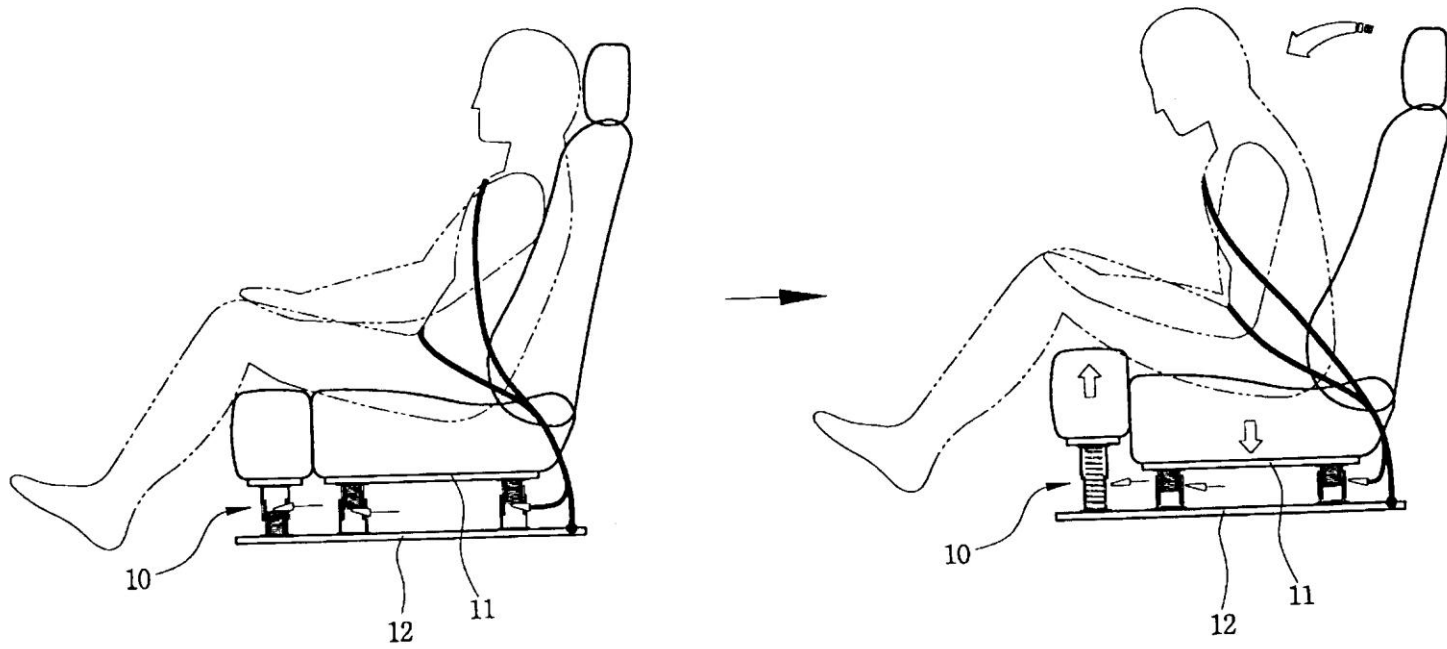
Anti Submarine Seats



Specially designed to protect the passengers in the event of panic braking, these seats prevent the occupants from sliding forward and hurting themselves.

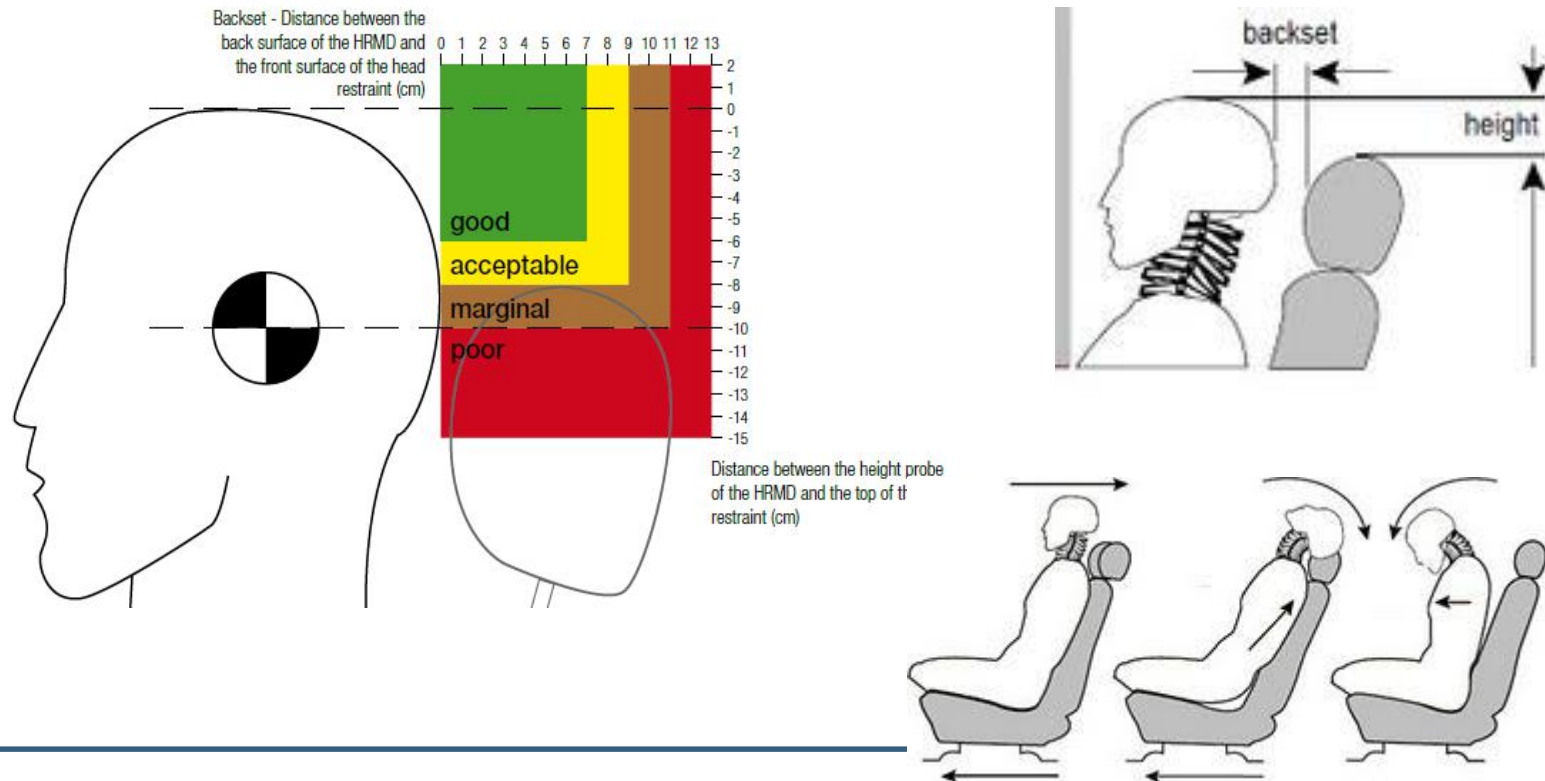


FIG. 4



❖ Head Restraint

"Head restraint" means, at any designated seating position, a device that limits rearward displacement of a seated occupant's head relative to the occupant's torso.





❖ Anatomy

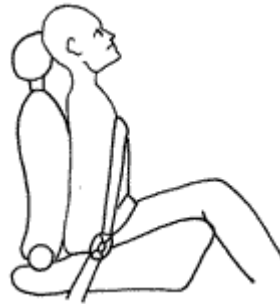
These are the basic motions of the human body during a rear end crash:

Phase 1



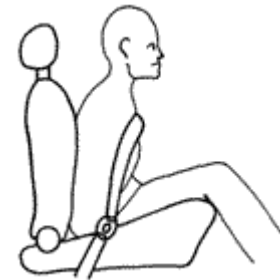
Occupant in vehicle
– head erect.

Phase 2



Car is hit, pushing seat
forward. Head strikes
restraint.

Phase 3

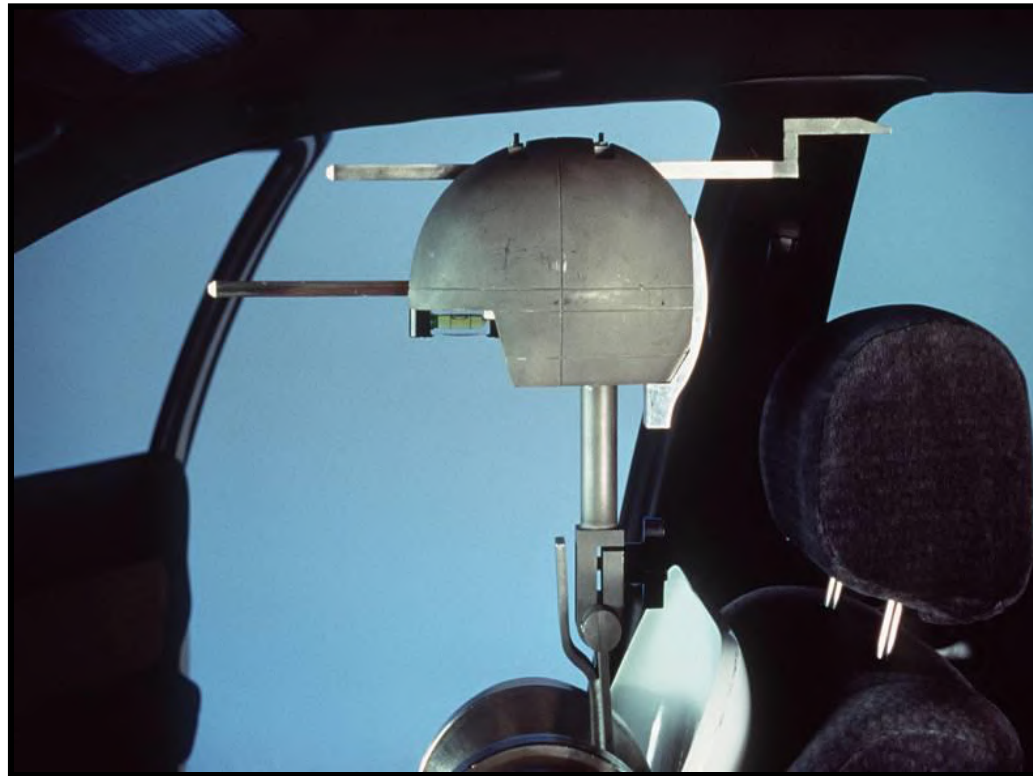


Occupant rebounds – head
moves beyond body.

At first, researchers assumed injury was due to extension of the spine beyond its normal range. However, injury also occurred at low speed crashes with only small extensions of the spinal column.



❖ Head Restraint Measuring Device





❖ **Driver Controls Accessibility:**

- One of the important ways of improving safety is to design equipment in terms of human capabilities and limitations.
- Vehicle design should be initially related to the Biological and Psychological characteristics of the drivers.
- This implies that the vehicle and working area must be built around the driver rather than placing them in a setting without due regard for the individual's requirements and capabilities.
- To give an example, some of the lacunae noticed in regard to human body size and capabilities are as follows:



- The vehicle cab where it is impossible for a tall driver to put his foot on the brake pedal.
- The distance between the brake pedal and the bottom of the steering wheel too short to permit the leg to be raised high enough to place the foot on the pedal, and the gear shifts too close to the wheel to allow the leg to be angled to the right at the knee.
- In some cases, Driver's inability to operate clutch and brake without hitting the knee against the steering wheel. In some vehicles the drivers could not reach the hand brake control without twisting the body out of a normal driving position.



- The vehicle design defects influence the driver's job performance. The physical variables such as design and arrangements of the displays, controls, seats, windows and overall dimensions of the cab area influence driver's comfort.





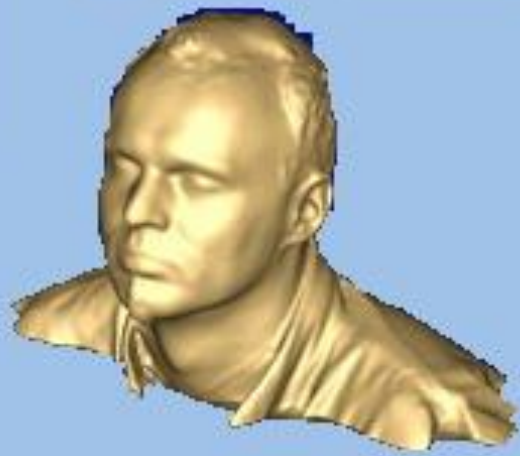
- Is there sufficient **horizontal adjustment** in the seat so that the short man can reach the pedal and still give the tall man enough space so that his legs won't get cramped up under the steering wheel?
- Is there sufficient **vertical adjustment** in the seat to allow the short man to have his eye level several centimeters above the top of the steering wheel, and still permit the tall man to bring his eye level within the frame of the windshield (vision)?
- Are all controls within easy reach of the driver, once the seat has been adjusted by him.?
- Is the cab high enough so that the driver can avoid striking his head on the roof when he hits a bump on the road?
- Is there sufficient space to accommodate boots, gloves, or other personal equipments while the vehicle is being operated?



Driver Seat Anthropometry

❑ TYPES OF ANTHROPOMETRY

- Static anthropometry refers to dimensional measurements taken when the body is in fixed (Static) position.
- Dynamic anthropometry refers to dimensions taken under conditions in which the body is engaged in some physical activity.



SIZE INDIA

