



Business-friendly Solutions

**THE RIGHT
ERGONOMICS
FOR THE RIGHT
AUTOMOTIVE
DESIGN**



Executive Summary

Advances in automotive technology, a highly competitive industry, combined with financial limitations, are continuously setting new challenges for the ergonomic design of cars. With increasing customer expectations and emphasis on user satisfaction by the automotive industry, ergonomics has become a key vehicle attribute and products need to be designed with a combination of features that provide increased functionality, comfort, convenience, safety, and craftsmanship.

However, ergonomics, the science of designing products based on user experience, is not entirely about design; it also takes into account how products are used by people. With respect to a particular vehicle, ergonomics encompasses everything--from the positioning of a switch to a person's seating mode. Packaging based on occupant seating positions inside the vehicle and in relation to various vehicle components such as controls, displays, window openings etc. is also of equal importance.

The key to a successful product is thus defined by how well it scores on performance and usability for the user over a long period of time. Generally speaking, products which are ergonomically superior meet most of the ergonomic design guidelines. Experience suggests that usability scores of products can be directly related to the number of ergonomic design guidelines they meet.

This document highlights some of the various ergonomic considerations, design guidelines and principles and their implementation in automotive design.



The role of ergonomics

Ergonomics (or human factors) is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system. It is a field that applies theory, principles, data and methods to design in order to optimize both human comfort levels and the overall system performance. Also known as comfort design, it is the practice of designing products, systems, or processes, while taking proper account of the interaction between users, equipment and their environments in order to achieve the best fit. It also considers the user's capabilities and limitations to achieve compatibility between tasks, functions, information and the environment.

Human factors engineering

Some of the human characteristics & capabilities influencing performance and design are:

- Anthropometric (physical dimensions)
- Biomechanical (ability to produce and withstand internal forces)
- Information processing (related information acquisition, use or manipulation of memory, and decision making)
- Sensory capabilities
- Multi-tasking
- Motor skills

Key benefits of the application of ergonomics include reduction in human error, fatigue and the risk of accidents, along with improved user satisfaction, productivity & safety.

Challenges

With respect to car design, the main challenge lies in catering to individual comfort levels regardless of size. The needs of other segments such as the physically challenged, pregnant women and senior citizens also need to be taken into consideration while designing the vehicle. Another aspect which impacts automotive ergonomic design is the constantly changing food habits of people. With increase in size & weight, customers continue to expect compact and efficient vehicles with plenty of interior space. Women customers on average are smaller than men and would like more variety in seating positions. Each gender's size and strengths also need to be considered while designing certain levers or features.

Based on all of the above, some key aspects of automotive ergonomics may be listed as:

- Ingress & egress
- Spatial accommodation
- Reachability
- Strength Capability
- Visual field
- Seat design

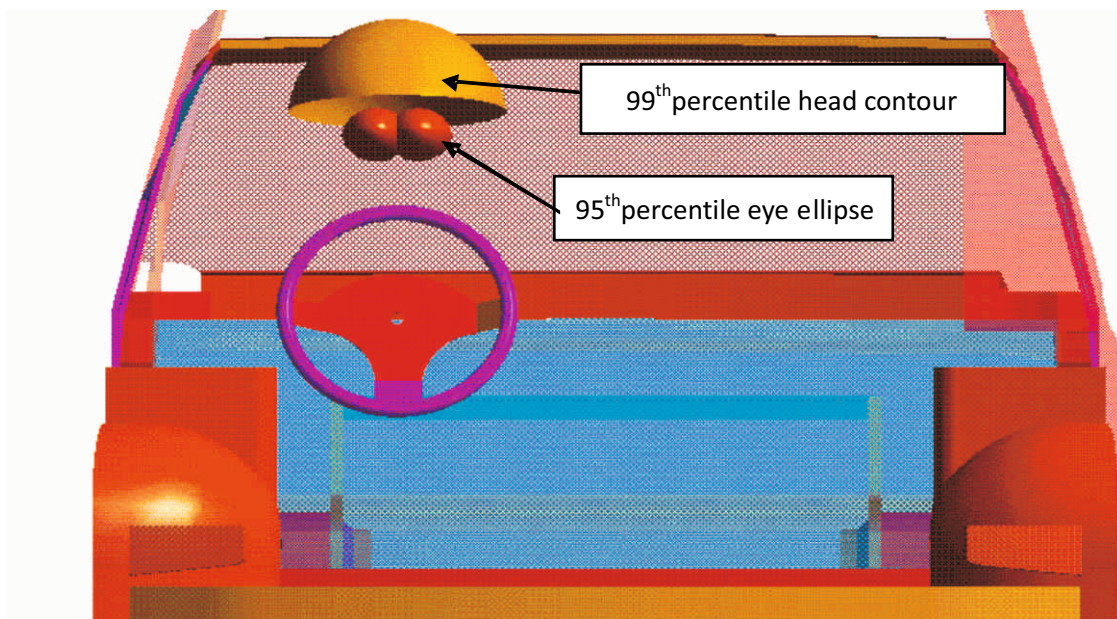


Fig.1 Head contours are used to make sure that there is enough clearance between the occupants head and the roof. Eye ellipses are the locations of the eyes of a range of population with different body sizes to check for the range of visibility levels.



ITC Infotech Value Proposition

We focus on design and development of interior trim parts and their related systems as per vehicle target and system requirements, so that all key ergonomic criteria are successfully met.

The ergonomic design Plan

When solving a problem associated with human factors, one must first understand the user population and their characteristics and usage conditions. The approach should be towards fitting the equipment to the people instead of the other way round. This would mean:

- Designing to satisfy the highest percentage of users from the intended population
- Maximizing both performance and preference for the benefit of most users
- Understanding the designs of competitors (benchmarking) and anticipating their future product design

Some of the major ergonomic checkpoints in key areas have been highlighted below:

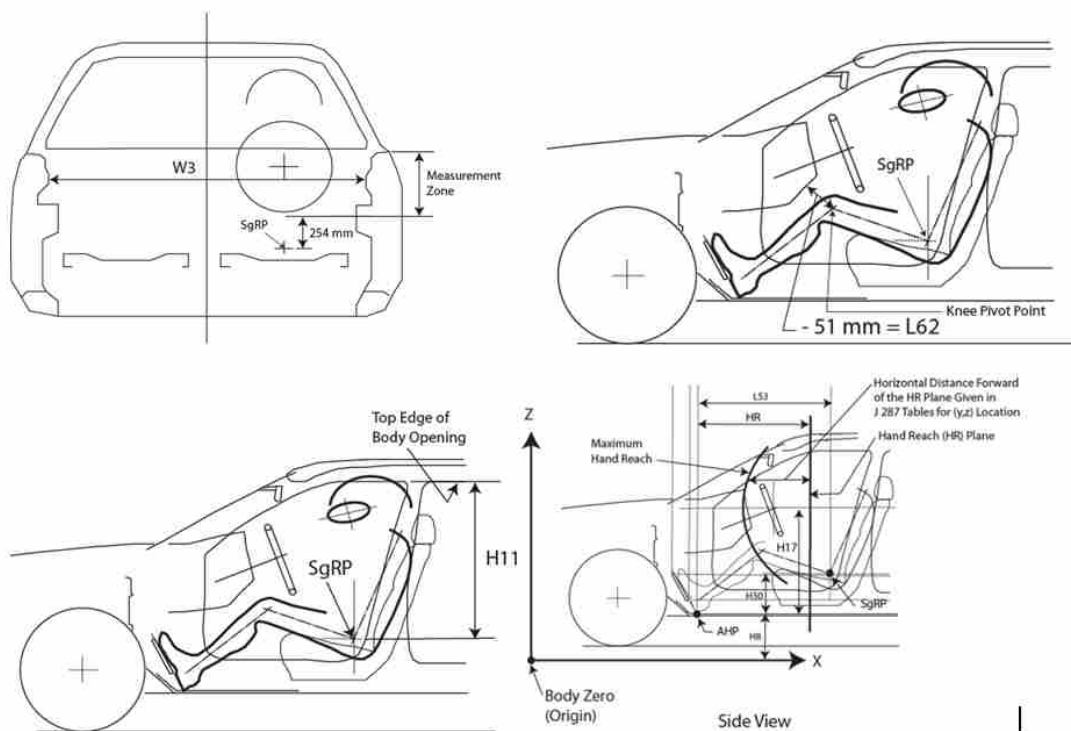


Fig.2 Images indicating various ergonomic check points. Clockwise from top left – Shoulder room, Knee room, Maximum hand reach and Door opening height

FR & RR Seat Roominess

- Head room
- Sunlight exposure amount
- Clearance from components (Assist grip, Sun visor etc.)
- Leg & foot room
- Knee room
- Shoulder & Elbow room
- Steering operation space

CPM

- Switch hand reach
- Usability of Vents
- Usability of Glove box
- Usability of Centre Console box/cup holder
- Usability of tilt lever
- User friendliness of HVAC system
- User friendliness of navigation

Driving position

- Pedal operability
- Clearance around pedals
- Steering operability
- Shift lever operability
- Parking brake operability

- Usability of sun visor
- Usability of light switches
- Usability of assist grip
- Usability of rear view mirror
- Usability of sunglass holder (roof console)
- Ease of opening/closing trunk

Visibility

- FR up angle & down angle field
- RR view mirror field
- ORVM field

Seat

- Lever angle
- Ease of seat arrangement
- Ease of finding lever
- Ease of moving seat
- Seat slide and folding lever

Door & Roof trim

- Operability of regulator handle
- Operability of power window switch
- Usability of door grip
- Usability of inside handle, lock knob
- Usability of outside handle
- Usability of fuel lid opener, trunk lid opener

Trunk utility

- Luggage room capacity & storage performance (SAE, VDA, other capacity requirements)
- Ease of loading/unloading
- Head contact and hand reach

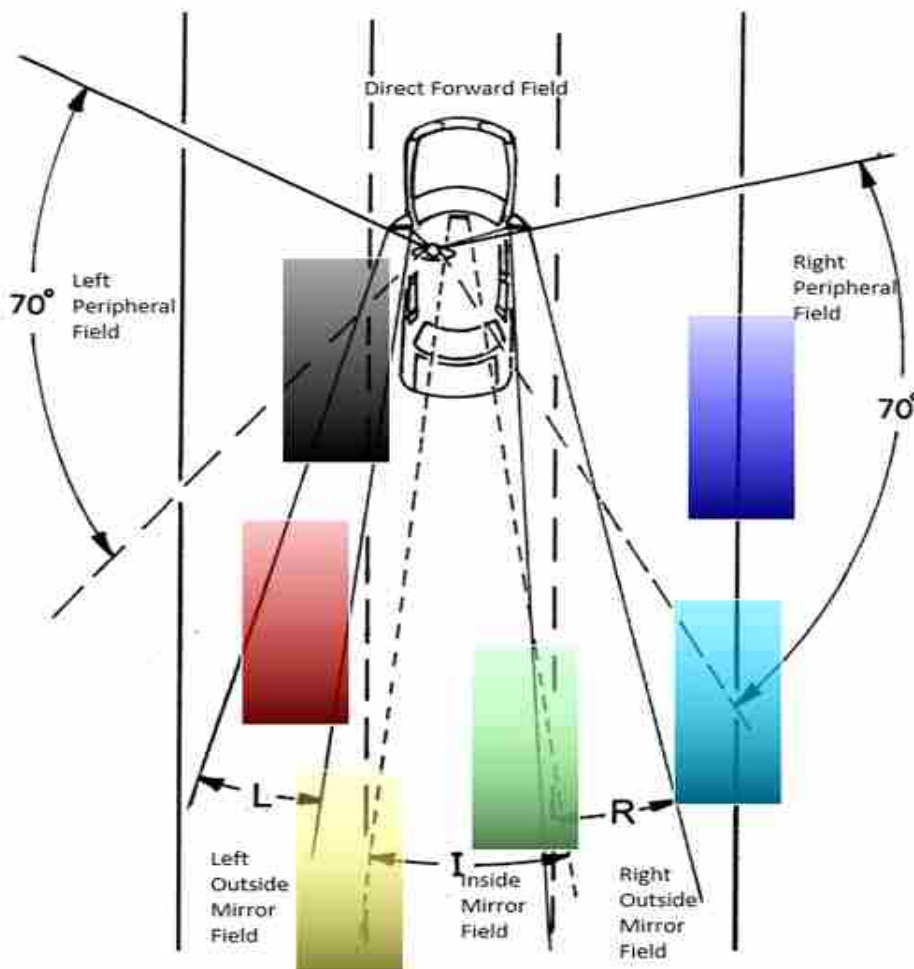


Fig.3 Image depicting various fields of view



Fig.4 Indication of Luggage capacity

Summing up

The right ergonomic structure is an indispensable part of a successful automotive design and making this happen is the right combination of individual parts and systems so that, as a whole, they are all in sync with the vehicle and the user, offering best user experience.

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