

A Literature Review on Ergonomics of Indian Small Auto-Vehicles Seat Design for Passenger Comfort and Safety

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Abstract

The study of ergonomics for auto-vehicles, mainly consider that how an auto vehicle can be designed better for human use. Study of ergonomics deals with comfort, safety and some health problems for drivers and also for passengers. Auto vehicle needs proper designing to overcome from these basic but crucial problems. In this paper, we study about the overall design and contour of the vehicle seat design into the consideration of comfort-discomfort, safety not only for drivers but also for passengers. Pain, shoulder pain, by the continuously driving there is so many chances of lower back pain, injury from lifting increased due to improper design and unbalanced pressure distribution. Overall contour and proper designing directly or indirectly affects human's life.

Keywords

Small auto vehicle seat, ergonomics, comfort, safety, recent research.

Introduction

Comfort is an attribute that today's consumers demand more and more. The seat has an important role to play in fulfilling these comfort expectations. Comfort is a feature that today's clients demand more and more. The seat has a vital role to play in rewarding these comfort prospects. For the drivers and passengers relieves regarding seat of the vehicle is a main role to enhance productivity of drivers and sitting time period concern. [Fai, 2007], [Rauterberg, 2010], [Kittusamy, 2004]. Because it related the side effect of seat discomfort Factors those are affecting the comfort of occupants regarding the seating that are seat interface pressure allotment, improper whole-body pulsation and variation in pressure rate. [Peter, 2014], [Bridger, 1995], [C Fai, 2004].

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Seats are one of the most important components of vehicles and they are the place where professional driver spends most of their time. For the drivers and also for the passenger who drive daily or those spend more time in the travelling by auto vehicle comfort and safety is a main issue. Seats of auto vehicle is major part which is always in contact with the drivers and passengers has a very important significant and it plays important role for improvising the comfort level and work surrounding mainly during the driving a vehicle.[Mike, 2003], [Park 2000], [Salim 2013],[Dian, 2011].Auto vehicle seating system needs improvement for all the occupants but mainly for the drivers because a driver feels more stress and fatigue comparison to the other occupants during the driving. This change mainly in the seat of driver has been subject of keen interest for many years. [Fair 2007],[Bridger, 1995]. Comfort is main attribute for the occupants so without considering the comfort expectations of people we cannot judge actual need and cannot establish proper design of auto vehicle seat. [Mike, 2002].Auto vehicle ergonomics is how we make our Vehicles seat ease to use, how our auto vehicle seat designed superior for the use for the occupants. Overall interior designing of auto vehicle seat considered under the vehicle packaging .vehicle packaging deals with the designing of auto vehicle seat regarding the human factor aspect. During the new model study in the starting stage of study vehicle packaging comes to use. Vehicle packaging is design of auto vehicle. Vehicle packaging is the method to uphold which protect space for the occupant user and compulsory machinery that build up the vehicle being designed.[Mohamed, 2007],[Nishith, 2014]. To improve the factors of automobile seat cushion comfort which all are deals with vibration.[Griffin 2001]. Comfort is considered to be one of the most important aspects of seat design. In the family of auto industry engineers workers are trying to create well-designed seat for providing adequate and proper driving condition which give proper physiological condition regarding the comfort, safety and which is friendly according the occupants body.[Lucas, 2013].Many type of forces and vibration during the driving influence to the human body and affects to the whole body order through the car seat which indicates a distinguishing importance. Because it affect to the driver who makes a further more efforts in comparison the other passengers in the form of tiredness, pain which reduces the overall productivity of the occupants.[Lucas, 2013],[Raul, 2013]. It is essential to have an impression of 'comfort'.[Griffin 2001]. Literature is available on physical site characteristics: the optimal backrest width and seat cushion width based on anthropometrics [Kamp, 2011].The main aim of this paper is a study of small Indian passenger vehicle seat design which has a concern with the small vehicle seat design that affects the occupants soothes safety and musculoskeletal disorder.[Lucas, 2013]

Vehicle Ergonomics

Ergonomics satisfies the condition of occupational health and safety, productivity, comfort and discomfort. Ergonomics is the application of methodical philosophy, method, and statistics careworn from a range of discipline for the maturity of engineering system in which individuals play a noteworthy responsibility.[Bridger,1995],[Grujicic 2010],[Kroemer,1994]. The Institute for Occupational ergonomics (IOE) (1999) defines ergonomics as an research or work philosophy to understand the requirements, restrictions, and abilities of people in the consideration of safety and comfort, and the use of this understanding for the design of products and environments in which people live.[IOE,1999]. Japan ergonomics society defines that Ergonomics Association between "Labors" and "health", in other words, the kinds of "health issues" caused by "working"

was frequently reported even in the time of earliest Egypt and the Greek and Roman period [JES], [SAE standards J1100, 2001]. Ergonomics study of wily equipment and devices that make fit for the human body, and that gives you more comfort and desirable seat. The Ergonomics is the study of the dealings between people and apparatus and the factor that has an effect on the interface for the seat. Its purpose is to improve the performance of systems by improving human machine interaction. This can be done by designing-in a better interface. Consumer expectation for automobile seat comfort continues to rise. Main aim to improve the interface between occupant and vehicle. [Kulkarni, 2011]. It can be happened by designing-in a superior interface. It is very important to enhance the user probability for auto vehicle seat comfort continues to get higher. In a present scenario in the industrialized the human race, sitting is the largely common working posture and perchance the generally frequent leisure posture. [Looze, 2013] For the driving comfort, it is well-known that inhibited sitting postures be capable of lead to discomfort and health disorders regarding to whole body posture like Back pain, neck-shoulder complaint. [Rakesh, 2013]. According to (The International Ergonomics Association Ergonomics) in the account for human factors, is the scientific discipline concerned with the understanding of interactions among humans and other elements of a system, and the profession that applies theory, principles, data and methods to design in order to optimize human well-being and overall system performance. The International Society of Automotive Engineers (1998) is a professional organization for mobility engineering professionals in the aerospace, automotive, and commercial vehicle industries. The Society is a standards development organization for the engineering of powered vehicles of all kinds, including cars, trucks, boats, aircraft, and others. A scientific loom, for the benefit of ourselves and others in the consideration of minimum effort and maximum fulfilment. [Looze, 2003], [Jastrzebowski, 1857].

Vehicle Seat Body-"Seating Comfort and Discomfort"

Seat cushion or seat pan, seat back rest, head restraint seat length and seat height established a overall seat model or when we talks about the seat then its study indulge with the seat cushion seat back and seat head restraint. These are the body parts of the seat The joint, which have been showed the links between these bodies are having connection between seat pillow and its atmosphere, one for the link between seat cushion and seat back, and one for the bond between seat back and head restraint modification in the seat back angle and head restraint angle allows by these joint according to the need, but, in adding up, correspond to the hardness of the associates between seat cushion-seat back and seat back-head restraint. [Rakesh, 2013]. Various studies have investigated the relationship between seat characteristics and seat comfort. Foam thickness and foam hardness were important parameters for seat comfort. Physical characteristics of seats to subjective seat comfort. The seat comfort obtained from cushion occupant feelings and body pressure distribution, and a linear spring characteristic was recommended. [Griffin, 2001]. During the proper design of vehicle seat we concentrated on some important factors that are mainly Backrest angle, cushion edge, Fore-and-aft position, Headrest angle, Headrest level, lumbar position, seat depth, seat depth, seat height, cushion tilt, turning seat.

Driving Postural Problem & Driving Risk

It consist many problem during the continuously driving passenger and driver face the different problem. Sometimes driving would not seem that sitting in a moving vehicle would be dangerous, irrelevant and hazardous to your health .Man factor of driving risk are improper design of seat, long time driving and whole body vibration. During the driving for long time, stress and lower back support ache are numerous complaints reported by means of drivers. Over and over again, it's a all about the term "tedious driving damage" (TDD) which has been used as a major problem. These damaged in our body take account of foot cramps, lower back pain, inflexible neck, and uncomfortable shoulders from pitiable posture, fatigue, stress, strain, and staying in one position for an comprehensive span of time period. Several epidemiological researches illustrate that specialized drivers of a variety of earth moving auto vehicles, have increased risks for whole body skeleton vibration and disorders in the lower back, neck and shoulders, see review by Griffin (1990). It is however close to guess exposure to WBV as a risk feature in the negative manner among drivers since several researches have indicated an association between revelation to WBV and musculoskeletal symptoms and disorders, first in the lower back in the form of injury [Nishith, 2014].

Anthropometric Accommodation

Ergonomics criteria stand for two those are physiological and anthropometric. Ergonomics associated to anthropometry data which have been measured input phase of restful seating position. Through adjustability Comfortable adjustment in the lumbar area is best achieved. A few examples of these dimensions take account of the height of seat over the floor, the height of seat cushion over the floor etc. Anthropometry data deals with the measurement which is best suitable for the individual's body through which occupants will get more and more comfort. Anthropometry basically human eccentric which has an account of design of seat according to the occupant need regarding safety and comfort. An angle according to the vehicle seat is main factor to enhance the comfort level. [Nishith, 2014].

Literature Review Related to Auto Vehicle Seat

References	Study paper name	Study measurement	Conclusion according to their study
Nishith,.(2014)	Framework to Analyse Automotive Interiors with a Focus on Ergonomics	comfort and ease of use	improvement in the vehicle ergonomics
Zamri Mohamed (2007)	Automotive Ergonomics: Passenger Cars Interior Dimension Parameters and Comfort	automotive can be designed better for human	Vehicle packaging, driver seat and steering adjustability
T.C. Fai (2007)	Vehicle seat design: state of art and recent development	Improving the r vehicle seats use comfort and work environment	

K. Mike (2002)	Automobile seat comfort: occupant preferences vs. anthropometric accommodation	Automobile seat drawing	height of the head of lumbar line, seatback width, cushion length and width
S.Rakesh et.al.(2013)	Designing of High Comfort, Reliable and Economical Driver Car Seat	safety of the occupants during impact conditions	improving occupant's-machine interaction
K. Irene (2011)	The influence of car-seat design on its character experience	safety, cars comfort and driving pleasure	comfort experience
A.Giuseppe (2002)	analysis of posture and interface pressure of car drivers	car driver posture	cushion and the backrest
M.Makhsous (2005)	Reducing whole-body vibration and musculoskeletal injury	musculoskeletal disorders in automobile drivers	Reducing whole-body vibration
M.Kolich (2004)	Automobile seat comfort prediction: statistical model vs. artificial neural network	Study of seat model in account of comparison	comfort observation, of seats
P.R.Matthew (2000)	Methods for Measuring and Representing Automobile Occupant Posture	Driver's and passenger's posture and position.	vehicle occupant's posture as a kinematic linkage
K.M.Raul et.al.(2013)	Car seats ergonomics evaluation	ergonomic advantages of different car seats	importance of the car seat
E.B. Lucas and A.S. Onawumi (2013)	Ergonomic Evaluation of In-Vehicle Interface Design of Taxicabs	forces and vibrations through the car seat during the drive	Back soreness
P.D.Michael et.al. (2003)	Sitting comfort and discomfort and the relationships with objective measures	comfort /discomfort in sitting, posture pressure measurements	posture, movement, muscle activity, spinal load

Automotive ergonomics study deals with the how an auto vehicle seat can be designed better for human use .vehicle packaging, driver seat and steering adjustability is the important part for better design of auto vehicle for use. [Mohamed, 2007].vehicle packaging actually stands for vehicle design .vehicle packaging is deals with the design of vehicle seat which include the stages like vehicle seat height ,seat width ,lumbar support ,position of steering ,cushion angle ,back rest angle etc..In designing the automobile, there has to be certain dimension that has been agreed for by the management design and manufacturing department. As ergonomics study stands for easy use of vehicles in the consideration of comfort and safety. The spot light of a make risk providing purchaser satisfaction which is determined by relieve, comfort and ease of use. By

providing comfort and safety parameter that much customer wants; we cannot fulfil the satisfaction. So upgrading in the vehicle ergonomics requires a basic perceptiveness of the problems that arise due to the conformist automotive interior design. [Nishith, 2014]. Which are in make contact with vehicle occupants, take part in to play a significant function in recovering the comfort without compromising safety, producing higher efficiency car comfort and driving pleasure [Park 2000], [Kamp, 2002]. It creates the ladder like data compilation, data confirmation and arithmetical review for such an inspection [Katsuraki 1995] The manuscript brings out the distinctive trends and grades of key for anthropometric process and measure variables like posture, movement, muscle activity, spinal load; it is premature to state that measuring these variables would be useful in seat design. A small number of the body injuries related or physical condition hazards between operators of manufacture equipment are: whole-body vibration, awkward postural requirements, dust, noise, temperature extremes.

Conclusion

Now a day's people are shifting from normal vehicle to luxury vehicle changing with the time because they also need more comfort, not only for comfort or discomfort, but also reducing the health related problem and getting more safety. In India Auto vehicle has being playing very important role in everyone's life .In India everyone using an auto vehicle for their use, it may be car, auto rickshaw, bike, van .An average, person travels minimum 20 km with max. 150 km daily due to this they suffer with the whole body disorder problem. People who travel daily they suffer with having a problem of spinal pain, neck pain, shoulder pain, by the continuously driving there is so many chances of lower back pain injury from lifting increased due to improper design and unbalanced pressure distribution. Overall contour and proper designing directly or indirectly affects human's life. So for overcoming by these problem people do not hesitate to spend more money for getting more comfortable. So it is must provide proper design for reducing this problem.

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