Appendices
AN ERGONOMIC STUDY ON THE TRAFFIC ACCIDENTS IN CALCUTTA

Strategies for accident and injury prevention on the local, regional, national and international level.

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Analysis of about 24000 records of road accidents (from 1983 to 1986) collected from the Statistics Department of Calcutta Traffic Police Head Quarter were done to find out different factors or plausible causes of these accidents and suggest ways and means to minimise the same. The factors considered were, day, month and year of accident, types of vehicles involved, age group of persons, traffic rules as followed by road users, vehicle-road, vehicle-pedestrian, vehicle-passerenger interactions, driving conditions, traffic signaling characteristics, driver's training and selection procedures, etc. Data and information available from State Transport Authorities, various Government agencies and sources were analysed. Moreover, a questionnaire survey on involvement of different factors was also undertaken.

Monthwise distribution of serious and simple injury cases shows that the number of accidents on an average, in the month of October, was about 40% more than that on any other month. The number of fatal accidents remained at a lower level during May, August, October and November which had a tendency to rise (about 35%) in June and December. Daywise distribution of accidents showed that highest number of accidents occurred on Mondays and the number was about 50% more than the number on an average on any other day. Involvement of vehicles in accidents shows that trucks and private cars are responsible for causing the maximum number of fatal and serious injuries respectively. Males aged 18-30 years and females of more than 50 years of age were most susceptible to any kind of accidents. Other important physical factors observed to influence the causation of accidents were found to be as follows:

i) Inadequate width and lack of maintenance of roads and footpaths,
ii) Unauthorized occupation of footpaths by shops and vendors,
iii) Roaduser's lack of awareness towards traffic rules and regulations,
iv) Wrong design and/or faulty installation of traffic signs and signals on the roads.

The causation of highest number of accidents in certain months of the year may be due to overcrowding for festivals, 'Pujas', etc. and in some cases the extreme hot and cold climates of the year, for increase in traffic flow and alteration of alertness respectively were seen observable.

Conclusions were done by way of making following recommendations:

i) Prohibition of overtaking near bus-stops and accident prone areas,
ii) Complete ban on overtaking by buses for competition to get more passengers on the same route,
iii) Compulsory incorporation of 'stop' and 'turn' signal lights in the front as well as at the back of every vehicle,
iv) Ban on parking of vehicles by the sides of congested roads,
v) Inclusion of the nature of accidents in the driver's licence book should be made for evaluation during its next renewal,
vi) Wearing of crash helmets by the pillion riders also should be made compulsory,
vii) Strict enforcement should be done to prevent glare of headlights of passing vehicles especially on highways.
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Designing a Road Accident Surveillance System for India: an Ergonomic Approach

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Abstract. India, like most of the other developing countries, experiences a lack of statistical collection and maintenance of road accident data, scientific method of evaluation and assessment of traffic safety methods. This problem is further aggravated by the large size of the country, in which, data collation and decision making need more closer cooperation. Accurate standardized statistics and information pertaining to the kind of injuries (including fatalities) caused by traffic accidents are a prerequisite for an ergonomically designed programme for preventing and minimising the number and intensity of road accidents.

In the present study an attempt was made to standardize the road accident data collection system (including the methods of reporting and analysing) in operation in the cities of Calcutta, Delhi and Ahmedabad with an aim at utilising afterwards the experience at a national level. The investigation procedures, methods of application and the contents of questionnaire by various agencies like police, insurance agencies and hospitals, etc., were analysed and reviewed to find out the differences. For the implementation of a safety strategy, it required identification of certain information parameters which were found absent in the current procedures. It was also not possible to keep track of the age or road worthiness of the vehicles in traffic as there was no definite system for check-up or maintenance.

Key Words: Ergonomics; Road Accidents in India; Surveillance System; Design

INTRODUCTION

India, having just one percent of the total number of vehicles in the world, accounts for nearly six percent of the total number of road accidents. The accident rate of 35 accidents per 10,000 vehicles in India is very high when compared to the rate of about 10 accidents per 10,000 vehicles in other developing countries. The rate of annual increase of fatalities (21.6%) is again of a great concern. It is feared that by the end of this century, the number of fatalities and injuries from traffic accidents would be about four times and three times respectively of the existing figure (National Transportation Planning and Research Centre, 1983). With the increasing number of vehicles, constant improvisation are also taking place in the traffic scenario. Associated with this, there is the increasing rate of population of both men and vehicles. With a restricted and inadequate motorable road area and continuous change in the traffic situation (changes of the road signs and symbols, road lifting, changing designs of road side features and furnitures), the whole problem of road accidents is becoming more acute day by day. In the present study an attempt was made to interpret, analyse and find out the possibilities of improving the existing surveillance system in an ergonomic manner.

Accident research can be categorised in terms of general types of data sources employed. Strict care must be exercised in the collection and analyses of data, and conclusions must be based on

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the careful and unbiased weighing of the best available evidence (Haddon et al., 1964). Looking at some of the police reports, eye witness testimonies and their interpretation by the police reveals that there is a tendency to "follow a common or national stereotype" while attributing any "cause" to the occurrence of the accident. Absence of any scientific method of investigation makes the analyses poor. In a large proportion of fatal accidents there are no adequate investigation, no careful searches for mechanical or human failures and witnesses too (if at all present) sometimes do not cooperate because in that case they will have to appear before the court, which is somehow unwanted by them.

Humphreys has pointed out the collection and analyses of in-depth road crash data can be considered from three perspectives. 1) the problem of sampling, 2) the techniques of collecting statements from witnesses and 3) the training and support system required for personnel working on the in-depth investigations (Humphreys, 1981).

Under these circumstances, there remains a great importance of comparing the characteristics of accident cases with the characteristics of the corresponding populations and situations from which they are derived. A basic step in the application of the epidemiological approach is determining the fundamental physical, physiological and psychological characteristics of the host. As a matter of fact, a lot of considerations are also to be thought of regarding the anthropometric and physiological characteristics amongst the population in the tropical climates like in India (Sen et al., 1969; Sen and Nag, 1973; Sen, 1979). When these data are correlated with the characteristics of the agent like vehicles and equipment under specific environmental conditions, the resulting information will shed light on the causes of accidents and aid in developing preventive measures. To obtain these kinds of information, experimental and clinical studies, epidemiological surveys, and careful statistical analyses are required (McFarland, 1964).

Aims and Objectives

The preliminary investigation in Calcutta (Sen and Ghosal, 1984; 1985) has shown that the lorries and trucks, private and public buses and cars are involved in most of the accident cases. An attempt was made to find out the process of analysing the equality of risk index. This was aimed to find out whether any particular type of motor vehicle, class of road users, months of the year, day of the week and time of the day could be considered more important than the rest. This ergonomic study also aimed at finding out possibilities of answering some questions like i) possibilities of interpreting accident situations and their pre- and post-events through Haddon's matrix, and ii) those relating to the accident proneness like the following:

a) The largest category of traffic accident death cases within the city.

b) What are the most common physical components of the environment where most number of accidents occurred?

c) What is the age-group of persons involved in serious and fatal accident cases?

d) What is the age-group and experience of the drivers mostly involved in accidents?

e) Is there anything common amongst the ill-fated group of persons?

Materials and Methods

As a pilot study, collection and collation of primary and secondary raw data on road accidents were made from three sources namely the police departments, the hospitals and the insurance agencies in Calcutta, Delhi and Ahmedabad. An in-depth examination of accident records were made
to pick up the kind of information available with an aim to form a matrix of data and information so that the methodology for the construction of a surveillance system becomes uniform and purposeful for research investigations afterwards (Gordon, 1964). The process of reporting, collection and analyses of accidents were investigated. Information were also collected from the Regional Transport Authorities and the Directorate of Transport.

RESULTS AND DISCUSSION

This probing into the matter of the surveillance system was essentially designed to find out preventive strategies to reduce the number of road accidents at least at the local level with a motto to use it afterwards at the national level with feedbacks from the current exercise.

Number and Types of Vehicles

The information on the number of different types of vehicles registered in Calcutta in three years (1981, 1982 and 1983) as obtained from the State Transport Authority, Calcutta is presented in Table 1. It would be seen that the vehicle population in Calcutta was increasing every year. The vehicle population as shown, however, excludes those which were registered in and coming from other states but plying in Calcutta.

Table 1. Number and types of vehicles registered in Calcutta in 3 years.

<table>
<thead>
<tr>
<th>Types of Vehicle</th>
<th>1981</th>
<th>1982</th>
<th>1983</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Private and public trucks, carriers, etc.</td>
<td>19,353</td>
<td>20,381</td>
<td>21,206</td>
<td>60,940</td>
</tr>
<tr>
<td>2. Delivery vans</td>
<td>6,355</td>
<td>6,245</td>
<td>6,313</td>
<td>18,913</td>
</tr>
<tr>
<td>3. Motor cars and jeeps</td>
<td>85,289</td>
<td>88,912</td>
<td>90,727</td>
<td>2,64,928</td>
</tr>
<tr>
<td>4. Motor cycles and scooters</td>
<td>44,479</td>
<td>51,739</td>
<td>57,690</td>
<td>1,53,908</td>
</tr>
<tr>
<td>5. Taxies</td>
<td>8,851</td>
<td>7,538</td>
<td>7,538</td>
<td>23,927</td>
</tr>
<tr>
<td>6. Contracted carriages</td>
<td>1,454</td>
<td>1,893</td>
<td>2,191</td>
<td>5,538</td>
</tr>
<tr>
<td>7. Mini buses</td>
<td>507</td>
<td>553</td>
<td>643</td>
<td>1,703</td>
</tr>
<tr>
<td>8. State and private buses</td>
<td>3,172</td>
<td>3,199</td>
<td>3,252</td>
<td>9,623</td>
</tr>
<tr>
<td>9. Tractors and trailers</td>
<td>2,863</td>
<td>2,894</td>
<td>2,934</td>
<td>8,691</td>
</tr>
<tr>
<td>Grand Total</td>
<td>1,72,323</td>
<td>1,83,354</td>
<td>1,92,494</td>
<td>5,48,171</td>
</tr>
</tbody>
</table>

The Accident Reporting Procedure

In the event of any road accident in the city, the information is conveyed to the control room of the Police Head Quarter or to the Local Police Station. This is done by the common people in the locality or by the nearest traffic constable. If there is no police station in the vicinity of the accident spot, the information is conveyed to the Police Head Quarters which direct the local police station to go to the spot and carry out the follow-ups. Depending upon the position of the vehicle and/or the injured, the immediate physical environment, the nature of injury, the intensity of the fault of the accused is judged, a first information and report (FIR) is made and the matter is sent
to the court for appropriate legal decision.

Implications

Surprisingly, most of the accidents are categorised under "rash" and/or "negligent" driving. This was found to be most unscientific from the viewpoint of investigation because other possible influencing agencies causing the accident are often forgotten or not considered at all. For example, if a scooterist or a motorcyclist falls down while negotiating a road cross section or a curve or a pot hole and injures himself, according to the police reporting the interpretation and the cause of accident will be 'negligent' driving. As far as the investigation procedure is concerned, it should have been more worthwhile to note down the physical parameters of the environment in a systematic manner and interpret the system fault in a scientific manner. If the road is poorly lit, a road crossing or a road poorly designed and if the road is full of pot-holes, it is not the fault of the driver only as interpreted. The driver has to attend many other things on the road and essentially his spare capacity to control the vehicle will go down depending upon the number of factors he has to consider.

The yearwise fatal road accidents in Delhi with causes as found by the Accident Research Cell, Deputy Commissioner of Police Traffic, Delhi, are presented in Table 2.

Table 2. Yearwise fatal accidents in Delhi with causes.

<table>
<thead>
<tr>
<th></th>
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</tr>
</thead>
<tbody>
<tr>
<td>Drivers’ negligence</td>
<td>292</td>
<td>523</td>
<td>662</td>
<td>894</td>
<td>941</td>
</tr>
<tr>
<td>Overspeeding</td>
<td>640</td>
<td>372</td>
<td>209</td>
<td>162</td>
<td>214</td>
</tr>
<tr>
<td>Boarding and deboarding</td>
<td>54</td>
<td>41</td>
<td>71</td>
<td>49</td>
<td>29</td>
</tr>
<tr>
<td>Victim’s fault</td>
<td>14</td>
<td>8</td>
<td>31</td>
<td>20</td>
<td>18</td>
</tr>
<tr>
<td>Hit and run</td>
<td>185</td>
<td>230</td>
<td>225</td>
<td>278</td>
<td>258</td>
</tr>
<tr>
<td>Total</td>
<td>1185</td>
<td>1180</td>
<td>1198</td>
<td>1403</td>
<td>1460</td>
</tr>
</tbody>
</table>

The yearwise (from 1981 to 1983) fatal road accidents with causes as interpreted by the police in Calcutta, mentioned in the previous study undertaken in Calcutta (Sen and Ghosal, 1984), are presented in Table 3.

Table 3. The yearwise fatal road accidents with causes as interpreted by the police in Calcutta.

<table>
<thead>
<tr>
<th>Causes</th>
<th>1981</th>
<th>1982</th>
<th>1983</th>
</tr>
</thead>
<tbody>
<tr>
<td>Knocked down</td>
<td>317</td>
<td>302</td>
<td>295</td>
</tr>
<tr>
<td>Boarding and alighting</td>
<td>66</td>
<td>88</td>
<td>64</td>
</tr>
<tr>
<td>Others</td>
<td>23</td>
<td>28</td>
<td>43</td>
</tr>
<tr>
<td>Total</td>
<td>406</td>
<td>418</td>
<td>402</td>
</tr>
</tbody>
</table>

Now, leaving apart the number of accidents, it may be noticed that the indicated 'causes' were simplified judgements only and did not transpire "what exactly went wrong" and also lacked a clearcut reasoning. For example, there was not a distinct difference between drivers' negligence and
overspeeding, because, in any case, overspeeding is itself an act of negligence.

If one makes an attempt to 'control' these 'causes' an apparent measure that comes in mind is 'education', in case of drivers' negligence or any 'physical control like a speed breaker' in case of overspeeding. If sound and effective preventive measures are to be developed, it may be more important to highlight and focus the "reasons" for negligence or for overspeeding. Similarly, it is difficult to develop any off-hand solution or preventive methodology or control to curb the accidents while 'boarding or alighting'. With these references, it may be stated that unless and until a definite and formatted reporting system is developed and since the FIR becomes a verbose text from which it is difficult to scoop out the salient and indicative features associated in an accident, it will be difficult to develop a compatible and effective preventive or control methodology.

Reporting and collation of data on road accidents with particular reference to their investigation take a worse turn because of two other important factors : i) Lack of eyewitness testimony and ii) Lack of coordination among the acting agencies. In the first case, the eyewitnesses have got a negative attitude towards giving a testimony or a statement regarding the events leading to an accident for the common unwillingness to go to the court. In the second case, the kind of data collection system by the police department does not bear any relationship with that borne by the hospital or by the insurance agencies. No investigation is carried out where all the reports are consulted in an interactive manner.

Among the human variables studied in accident research, much emphasis has been given to age as a factor in the causation of traffic accidents. Although it is commonly noted that experience has a modifying effect in this respect, difficulties often arise in implementing the latter factor in the research design because of the confounding influence of age. In some literature this problem is recognized and different solutions have been tried (Haddon et al., 1964).

Under these circumstances, there is a need to design a coding system with reference to Haddon's work. Traditional approaches to accident analysis emphasise the need for understanding all the factors contributing to the accident sequence resulting from the 'human error'. He pointed out the distinction between the agent (physical energy) and the vehicles or vectors of agent and expanded on a temporal axis - the triad of agent, host and environment. This approach made clear the distinction between injury prevention and accident prevention and emphasised the fact that the former one was not necessarily dependent on the latter. According to Haddon's concept, by thinking backward in time from the injury itself rather than forward in time from the initiating event in the accident sequence, inquiry was expanded to include injury prevention as well as accident prevention. Modular coding of the injury, the agent or the mechanism of injury event with relevant details provided a system with sufficient flexibility to code diverse and complex injury events and their circumstances (Clemmer, 1989).

To make the surveillance system effective, systematic and scientific, the following categories should be incorporated while reporting and analysing the accidents:

i) The demographic criteria, ii) The geographic information, iii) The weather conditions, iv) Time of the day, v) The place of the accident including the physical and environmental characteristics are to be delineated, vi) The job of the victim/injured, vii) The activity in which the victim was engaged at the onset of the injury event has to be identified, viii) The nature of energy exchange which resulted in the causation of the injury has to be identified, ix) The proneness to the energy exchange has to be derived from the victims (or injured persons) with reference to past histories regarding physiological, psychological and socio-economic background and x) The event which just preceded the energy exchange is to be identified.
The concept of "failure" either of human or of machine is to be substantiated by appropriate validity. This concept of interpreting failure was absent in most of the accident reports or data studied.

The last important parameter studied was that of reporting of other contributory 'causes'. It has already been mentioned that 'causes' have always to be substantiated by analysing the system functions or malfunctions, and not just depending upon assumptions. In this regard, it has also been proposed that the inclusion of 'other contributory factors', as also been prescribed by Humphreys (1981) would give much better idea and approach to evaluate the 'event' than mentioning 'possible contributory causes'.

CONCLUSION

The tendency of blaming a victim or the other person, or assigning an assumed cause bears a bias towards accident investigation procedures. It was concluded from the present study that the data base, reporting and the surveillance system can be designed much better if certain emphasis is given on the pre-accident events and on the unsafe parameters possibly linked with the causation of accidents. The inclusion of risk factors encountered and the other possible contributory factors associated with hospital investigation could give more insight and guide the future evaluation and investigation of road accidents in a much better way.

Major recommendations were i) Collection of surveillance data by a centralized agency, ii) Better integration amongst agencies already engaged in data collection, iii) More informative survey on physiological and socio-psychological status of the persons involved in the accidents, iv) Incorporation of environmental factors during collection of data, v) Inclusion of accident data and remarks in the license book of the drivers and vi) Medical programme of the drivers to check their health and fitness.

REFERENCES

International Conference on Traffic Safety
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Proceedings

The Vulnerable Road User

Association for the Advancement of Automotive Medicine
Indian Institute of Technology, Delhi
International Association for Accident and Traffic Medicine
International Committee on Alcohol, Drugs and Traffic Safety
International Federation of Pedestrians
International Research Council on Biokinetics of Impacts
World Health Organisation
INTRODUCTION

With the increasing number of vehicles, constant improvement are also taking place in the traffic scenario. Associated with this there is the fact of increasing rate of population - both human and vehicular. With a restricted and inadequate motorable road area and continuous change in the traffic situation (changes of the road signs and symbols, road lighting, changing designs of road side features and furniture) the whole problem of road accidents is becoming more acute day by day.

Accident research can be categorised in terms of general types of data sources employed, regardless of the purposes for which they are used. Aside from its subject matter, there is very little unique about accident research as a form of scientific activity. The same principles and methods do apply in other research areas. Strict care must be exercised in the collection and analyses of data and conclusions must be based on the careful and unbiased weighing of the best available evidence (1). Looking at some of the police reports, eye witness testimonies and their interpretation by the police reveals that there is a tendency to "follow a common or notional stereotype" while attributing any "cause" to the occurrence of the accident. Absence of any scientific investigation methods makes the analyses much worse. In a large proportion of fatal accidents there are no adequate investigation, no careful searches for mechanical or human failures and witnesses (if at all present) too sometimes do not cooperate because in that case they will have to appear before the court, - which is naturally unwanted by them.

Sometimes in non fatal accidents, involving cerebral concussions the resulting unconsciousness sometimes produces retrograde amnesia for at least the moment of the accident. Many accident victims who experiences such an instance of memory loss, interpret that, probably they had fallen asleep or feeling drowsy - many a times, a conclusion reached by injured drivers and passengers alike. Some interpret this experience as having involved a "blackout" despite the lack of any evidence that this was actually the case (2). Some times, a number of statistical inferences also does not bear the actual causal characteristics. Some statements contribute very little unless it is also known whether the cited characteristics of accident involved drivers are present to a different extent among those who are not so involved. For example, it may well be that an equal fraction of the non-involved drivers operating at the times and places of fatal accidents were also having the same characteristics and these characteristics therefore did not discriminate between those involved and those not involved. Such data are also frequently biased because of the inclination of those investigating accidents to conclude that the occurrence of the accident is sufficient evidence that such violations and characteristics were present. Such conclusions are then used circularly to support preexisting biases.

Under these circumstances, there remains a great importance of comparing the characteristics of accident cases with the characteristics of the corresponding populations and situations from which they are derived. A basic step in the application of the epidemiological approach is determining the fundamental physical, physiological and psychological characteristics of the host. When these data
are correlated with the characteristics of the agent like vehicles and equipment under specific environmental conditions, the resulting information will shed light on the causes of accidents and aid in developing preventive measures. To obtain these kinds of information experimental and clinical studies, epidemiological surveys, and careful statistical analyses are required (3). It is a common shortcoming of accident research that the effort expended and the conclusions reached are not justified by the quality of the data employed. The availability of modern methods also has caused many investigators to lose sight of the fact that no amount of efficient or refined processing can improve the quality of the raw material. Unless a clearcut distinction is borne in mind between the collection of data and their use, analyses are liable to be based on such poor material that the results are of unknown validity. Both this situation and its opposite - the poor use of good data - emphasise the principle that the quality of research cannot be superior to that of its weakest element.

A very interesting observation was that there are certain distinctions between the data used for research and administrative purposes and there are hardly useful distinctions between accidents in which the person injured played an active role and those in which he was merely an innocent victim. For example, in an accident involving the collision of two vehicles, the person injured might have contributed only to the extent of being present at a particular location crossed by a vehicle out of control. On the other hand, the person injured might have been the incompetent driver. Unless these two types of situations and those in which none of the victims contributed directly - for example, in the case of accidents due to mechanical failure resulting from metal fatigue - are distinguished in research studies, the contamination of case series with nonresponsible individuals can substantially dilute the differences between cases and controls that might otherwise be found to exist.

METHODS AND MATERIAL
Where the preliminary investigation in Calcutta (4) has shown that the lorries and trucks, private and public buses, cars are involved in most of the accident cases an attempt was made to find out the equality of risk index in the city of Ahmedabad. This was aimed to find out whether any particular type of motor vehicle, class of road users, months of the year, day of the week and time of the day could be considered more important than the rest. Collection and collation of primary and secondary raw data on road accidents were made from three sources namely the police departments, the hospitals and the insurance agencies. A in-depth examination of accident records were made to pick up he kind of information available with an aim to form a matrix of data and information so that the methodology for the construction of a surveillance system becomes uniform and purposeful, - for research investigations afterwards. The process of reporting, collection and analyses were investigated. Information were also collected from the Regional Transport Authorities and the Directorate of Transport.

AIMS AND OBJECTIVES
This ergonomic study also aimed at finding out possibilities of answering some questions relating to the accident proneness like the following:

a) The largest category of traffic accident death cases within the city.
b) What are the most common physical components of the environment where most number of accidents occurred.
c) What is the age group of persons in involved in serious and fatal accident cases.
d) As far as the socio economic status is concerned is there any commonality amongst the ill fated group of persons.
e) What is the age group and experience of the drivers mostly involved in accidents.

RESULTS AND DISCUSSION
This probing into the matter of the surveillance system was essentially designed to find out preventive strategies to reduce the number of road accidents at least at the local level with a motto to use it afterwards at the national level with feedbacks from the current exercise.
The accident reporting procedure: In the event of any road accident in the city, the information is conveyed to the control room of the Police Headquarters or to the local police station. This is done by the common people in the locality or by the nearest traffic constable. In the event that there is no police station in the near vicinity of the accident spot, the information is conveyed to the Police Headquarters which directs the local police station to go to the spot and carry out the follow-ups. Depending upon the position of the vehicle and/or the injured and upon the immediate physical environment, and the nature of injury, the intensity of the fault of the accused is judged and the matter is sent to the court for appropriate legal decision.

The implications: Surprisingly, most of the accidents are categorized under "rash" and/or "negligent" driving. This was found to be absolutely unscientific from the viewpoint of investigation because unfortunately other possible influencing agencies for causing the accident are often forgotten or not considered at all. For example, if a scooterist or a motorcyclist falls down while negotiating a road cross-section or a curb or a pot-hole and injures himself, according to the police reporting the interpretation and the cause of accident will be the victim's rash and negligent driving. As far as the investigation procedure is concerned, it should have been more worthwhile to note down the physical parameters of the environment in a systematic manner and interpret the system fault in a scientific manner. If the road is poorly lit, a road crossing or a road curb poorly designed, and if the road is full of pot-holes it is not only the fault of a driver as interpreted. The driver has to attend many other things on road and essentially his spare capacity to control the vehicle will go down depending upon the number of factors he has to attend to.

Reporting and collation of data on road accidents with particular reference to their investigation take a worse turn because of two other important factors: i) Lack of eyewitness testimony and, ii) Lack of coordination among the acting agencies. In the first case, the eyewitnesses have got a negative attitude towards giving a testimony or a statement regarding the events leading to an accident. The common fear is going to the court and stand in the witness box. In the second case, the kind of data collection system by the police departments does not bear any relationship with that borne by the hospital or by the insurance agencies. Apart from that, least number of investigations is carried out where all the reports are consulted in an interactive manner.

Among the human variables studied in accident research much emphasis has been given to age as a factor in the causation of traffic accidents. Although it is commonly noted that experience has a modifying effect in this respect, difficulties often arise in implementing the latter factor in the research design because of the confounding influence of age. In some literature this problem is recognized and different solutions have been tried (1). Under these circumstances, there is a need to design a coding system with references to Haddon's work. Traditional approaches to accident analysis emphasize the need for understanding all factors contributing to the accident sequence with emphasis on the "human error". He pointed out the distinction between the agent (physical energy) and the vehicles or vectors of agent and expanded on a temporal axis - the triad of agent, host and environment. This approach made clear the distinction between injury prevention and accident prevention and emphasized the fact that the former one was not necessarily dependent on the latter. According to Haddon's concept, by thinking backward in time from the injury itself rather than forward in time from the initiating event in the accident sequence, inquiry was expanded to include injury prevention as well as accident prevention. Modular coding of the injury, the agent or the mechanism of injury event with relevant details provided a system with sufficient flexibility to code diverse and complex injury events and their circumstances (5).

To make the existing surveillance system more effective, systematic and scientific the following categories were thought to be must to be incorporated while reporting and analyzing the accidents.

1) The demographic criteria.
2) The job of the victim/injured.
3) Time of the day.
4) The weather.
5) The geographic information.
6) The nature of energy exchange which resulted in the causation of the injury has to be identified.
7) The proneness to the energy exchange has to be derived from the victim (or injured persons) with reference to past histories regarding physiological, psychological and socio-economic background.
8) The event which just preceded the energy exchange is to be identified.
9) The activity in which the victim was engaged at the onset of the injury event has to be identified.
10) The place of the accident including the physical and environmental characteristics are to be delineated.

The concept of "failure" either human or machine are to be substantiated by appropriate validity - this concept of interpreting failure was absent in most of the accident reports or data studied.

The last important parameter studied was that of reporting of other contributory 'causes'. It has already been mentioned that 'causes' have always to be substantiated by analysing system functions or malfunctions, and not just depending upon assumptions. In this regard, it has also been proposed that the inclusion of 'other contributory factors' will give much better idea and approach to evaluate the event than mentioning 'possible contributory causes'. The whole study is in the process of evaluation for the possibilities of its application.

CONCLUSION
The tendency of blaming a victim or the other person, or assigning an assumed cause, bears a bias towards accident investigation procedures. It was concluded from this study that the data base reporting and the surveillance system can be designed much better if certain emphasis is given on the pre-accident events and on the unsafe parameters possibly linked with the causation of accidents. The inclusion of risk factors encountered and the other possible contributory factors associated with hospital investigation could give more insight and guide the future evaluation and investigation of road accidents in a much better way.

REFERENCES
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Perception of Risk in the Traffic System and Selection of Control Measures: An Ergonomic Approach

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Objectives
The aim and objectives of this study was to identify certain factors that are perceived as risks by the drivers and development of compatible control measures. The first part was to make a tentative estimation of i) risks (and their seriousness) perceived by the road user, and ii) the characteristics of risky behaviours demonstrated by the drivers and other road users.

Methods
Data was collected through i) administration of questionnaire on the drivers of auto rickshaws and cars ii) noting down observation of ’wrong’ traffic behaviours, iii) tallying the traffic violation data with the observed characteristics iv) speaking to Road Transport Officials, Police officials, pedestrians and drivers through unstructured interviews.

Results and Discussion
Major risk factors were found to be ’overtaking dangerously from the left side’ and excessive speed by auto drivers (72%) and car drivers (74%). 68% of the drivers showed a tendency of ’leaving others behind’. Psycho-physiological interpretations derived from a questionnaire study indicated monotony, irritation and persistent acidity amongst the drivers. It was observed that attention demand to the traffic scenario, was to a great extent responsible for producing psycho-physiological fatigue. Almost 40% of all drivers demonstrated similar risk negotiation patterns. Drivers’ risk taking tendency (observed through negotiation of near accident events and interview) in the age group of 25-35 years are more subjective, whereas drivers aged over 40 years are more objective.

With reference to the findings of this part, it was felt that while attitude building towards maintenance of road safety is a long term proposition, behaviour modification can be achieved through ergonomically compatible system design and can be applied as an immediate measure to control accidents. Possible directions of implementing risk control measures were hypothesised, a portion of the traffic scenario was physically modelled in the laboratory and traffic behaviour were analysed to project the degree and nature of design developments of the roadway components necessary to reduce the occurrence of a risk factor (including its seriousness) and to control the risk taking behaviours of the road users.

Conclusions
Improved designs of the signage and information system, the road dividers, road markings, positioning of traffic signals and zebra crossings etc., if implemented, would markedly reduce the probability of the generation of a risky situation and control the behaviour of the road users in a traffic environment.

Keywords: Traffic systems, Road accidents, Ergonomic approach, Behaviour
Appendices
(abstract and sample questionnaires)
Late Abstracts

W. J. R. Maltese which were significantly lower than the normal
subjects (p<0.001). On the other hand, these values did not
differ significantly from the normal in the alcoholic subjects
(p>0.05). Thus the diabetics showed a decreased and the
alcoholics a normal autonomic functioning. E.E.G.
analyses showed that the alcoholics had A. A. of A. A. which
were significantly lower than the normal subjects (p<0.04). This
trend is probably due to some degree of cerebral attenuation in
the alcoholics. Diabetes showed an increase in A. A.
(p<0.001) which indicates possible cortical depression or
synchronisation of cerebral cortical activity.

A correlation was sought between the autonomic nervous
system parameter VPR and the A. A. of the diabetic and non-
diabetic control subjects. A significant correlation was found

8. An Ergonomic Study on the Road Accidents in Calcutta.

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In the present study, about 24,000 accident reports, from
1981 to 1983 collected from the statistics wing of the Calcutta
Police F. Q. were analysed. The vehicular faults, the human
errors, the month, the day, types of vehicles, age group of
persons involved and the nature of accidents were studied in
detail for the feasibility of implementing ergonomic mays and
means to minimise the number of road accidents in Calcutta.

Main recommendations were: i) Demerits for each accident
should be entered in the license book, ii) Blockade of traffic flow,
overturning near water-spgs, road crossings should be legally
prohibited, iii) "Stop" and "turn" lights should be at the rear
as well as in front and head lights should be switched on in
such cases, iv) Killing of animals at the scene of the accident
should be prohibited, v) wearing of crash helmets by scooter
riders and safety belts for car drivers should be made compulsory.

7. Effect of Stippling, Alcoholic Mice with \( \beta \)-Glycerophosphate on Threonine and Serine Dehydratase Activities in Liver

S. P. Sekera and K. P. Misra
Department of Biochemistry
B. R. D. Medical College,
Gorakhpur

A single dose of \( \beta \)-glycerophosphate elevated the levels of
Threonine dehydratase activity of mouse liver at the end of
24 hours. This increase was found to be more enhanced
at the end of 48 hours. Elevated level returned to normal
level at the end of 168 hours. Similar effects of \( \beta \)-glycerophosphate
were observed with serine dehydratase. The simultaneous
administration of cycloheximide prevented the rise in enzyme
activities indicating de novo synthesis of appropriate enzymes.
It was also confirmed that both the enzymes are single protein in mouse liver as the ratio found was
apparently constant.

92. P. C. Road, Calcutta-700009
Sample Questionnaire

Observations on the driving behaviour

The following seven-point scale was used to assess the intensity or frequency of the occurrences - where, the extreme left and extreme right of the scale stands for "least" and "highest" respectively.

Explanations/Application methodology: The following are the investigator's observations and categorizations of the kinds of driving behaviour demonstrated generally by the drivers in the driving situation. Derived from initial and random observations made on the general driving patterns of car, bus and truck drivers, these were noted down, an attempt is made to tentatively assess their frequency and intensity against a 7-point scale.

1. Inattentive driving:
   a. Does not give attention to the front traffic scene
      Least | | | | | | | | Highest
   b. Does not look at the rear-view mirror
      Least | | | | | | | | Highest
   c. Does not attend to the display panel of the vehicle
      Least | | | | | | | | Highest
   d. Does not attend to road signals/signages
      Least | | | | | | | | Highest
   e. Does not attend to machinery malfunction:
      Least | | | | | | | | Highest

2. Excessive speed on the straight road:
   Least | | | | | | | | Highest

3. Driving at excessive speed around the corner of a road junction:
   Least | | | | | | | | Highest

4. Does not observe traffic signals:
   Least | | | | | | | | Highest

5. Do not adhere to the traffic signals:
   Least | | | | | | | | Highest

6. Overtaking dangerously:
   Least | | | | | | | | Highest

7. Overtaking from the wrong side:
   Least | | | | | | | | Highest

8. Overtaking at the corner or near the islands:
   Least | | | | | | | | Highest

9. Driving on the wrong side of the road:
   Least | | | | | | | | Highest
11. Not giving way to the traffic on the right:
   Least | | | | | | Higher

12. Not maintaining correct side of the road while taking turn:
   Least | | | | | | Higher

14. Not keeping safe distance from the preceding vehicle:
   Least | | | | | | Higher

15. Not slowing down at the pedestrian crossing or road junctions:
   Least | | | | | | Higher

16. Starting the vehicle too quickly / abruptly as soon as the green signal is shown:
   Least | | | | | | Higher

17. Starting from the stop position without giving signals or without observing the traffic:
   Least | | | | | | Higher

18. Does not pay attention to the bad conditions or obstructions on the road:
   Least | | | | | | Higher

19. Cutting in front of another vehicle in a dangerous manner:
   Least | | | | | | Higher

20. High frequency of the brake application:
   Least | | | | | | Higher

22. Driving under influence:
   Least | | | | | | Higher
**Observations on pedestrians' behaviour**

The following seven-point scale was used to assess the intensity of the occurrences - where, the extreme left and extreme right of the scale stands for "least" and "highest" respectively.

**Explanations / Application methodology:** The following are the investigator's observations and categorizations of the kinds of pedestrian behaviour generally demonstrated. Derived from initial and random observations an attempt is made to tentatively assess their frequency and intensity against a 7 - point scale.

1. Pedestrian suddenly running across the road from the front of another vehicle:
   
   | | | | | | | Least | Highest |

2. Joy walking by the pedestrians:
   
   | | | | | | | Least | Highest |

3. Pedestrian running across from behind another vehicle:
   
   | | | | | | | Least | Highest |

4. Pedestrian suddenly stepping out of footpath without paying attention to the traffic:
   
   | | | | | | | Least | Highest |

5. Pedestrian after running across in front of the vehicle turns back:
   
   | | | | | | | Least | Highest |

6. Pedestrian running straight onto the vehicle and dashing against it:
   
   | | | | | | | Least | Highest |

7. Persons / commuters boarding and alighting from the other vehicle without paying attention to the traffic flow:
   
   | | | | | | | Least | Highest |

8. Pedestrian walking on the road under influence:
   
   | | | | | | | Least | Highest |

9. Pedestrians / driver getting confused with the traffic:
   
   | | | | | | | Least | Highest |
Observations on other factors of the environment which may give rise to a risky situation:

The following seven-point scale was used to assess the intensity of the occurrences - where, the extreme left and extreme right of the scale stands for "least" and "highest" respectively.

Explanations / Application methodology: The following are the investigator's observations and categorizations of the kinds of situational factors that has the potential for generating a risky situation. Derived from initial and random observations, an attempt is made to tentatively assess their frequency and intensity against a 7-point scale.

1. Driver or the other road user being blinded by dazzling lights:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

2. Defective condition of the vehicle:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

3. Too many types of vehicles plying on the road:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

4. Passenger (s) or portion of the passenger's body parts leaning out of the vehicle:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

5. The proceeding vehicle does give any turn signal:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

6. The vehicle of the other lane does not give turn signal for lane changing:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

7. Noise, outside the vehicle is so high that the driver is annoyed and confused as well:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest

8. The driver is driving under compulsion:

   | | | | | | | 1 2 3 4 5 6 7

   Least Highest
A single questionnaire administered to each of the drivers.

Explanations/Application methodology: The following are the investigator’s observations and categorizations of the kinds of risks negotiated and demonstrated in the driving situation. Derived from initial and random observations, an attempt is made to tentatively assess their frequency and intensity against a 7-point scale.

The following seven-point scale was used to assess the intensity of the occurrences - where, the extreme left and extreme right of the scale stand for “least” and “highest” respectively.

| Risk                                           | Least | | | | | | Highest |
|------------------------------------------------|------|---|---|---|---|---|---|-------|
| Excessive speed                                |      | | | | | |                  |
| Overtaking dangerously                         |      | | | | | |                  |
| Not observing traffic signals                  |      | | | | | |                  |
| Not paying attention to road conditions         |      | | | | | |                  |
| Cutting in front of another vehicle dangerously |      | | | | | |                  |
| Overtaking from the left side                  |      | | | | | |                  |
| Not keeping safe distance from the preceding vehicle | | | | | | |                  |
Drivers of autorickshaws, Government buses, private cars and trucks. Location: Ahmedabad

Explanations/application methodology: Extensive interview with around 150 drivers of different kinds of vehicles and a probe into probable causative factors that may give rise to a degree of physiological fatigue, yielded the following parameters. These were then categorised as follows and an attempt is made to administer the questionnaire on about 250 drivers to obtain their reactions to be weighed against a 5-point scale to estimate the intensity of each of the parameters.

A single questionnaire administered to each of drivers.

### Parameters

1. What is the level of alertness necessary towards the driving scene?
   - Very high
   - Not too much

2. What is the perceived impact of pollutants like dust, exhaust fumes etc. on health?
   - Very high
   - Not too much

3. What is the perceived level of physical uneasiness caused by heat and humidity?
   - Very high
   - Not too much

4. To what extent do you drive with intrinsic anxieties and worries?
   - Very high
   - Not too much

5. How do you think the time of the day influences driving?
   - Very high
   - Not too much

6. To what extent do you think the duration of driving affects the performance of driving?
   - Very high
   - Not too much

7. What is your opinion about the negative impact of noise while driving on urban roads?
   - Very high
   - Not too much
**Opinion Survey on Near-Accident Experiences**

A single questionnaire administered to each of drivers.

*Explanations/application methodology*: The following parameters were obtained through an unstructured interview with some randomly selected drivers and then the same is to be presented to a larger sample of drivers in order to assess their perception about the extent of involvement of the factors at the individual level.

<table>
<thead>
<tr>
<th>Probable Contributory Factors</th>
<th>Extent of perceived association/ involvement</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Do you think that the other driver was at fault which contributed to developing a near-accident situation?</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>2. Do you think that a combination of unpredicted circumstances develops a chance factor?</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>3. Preoccupied with other thoughts</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>4. Driving with anger/anxiety originated in the immediate past</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>5. To what extent do you think pedestrian's faults influences the driving judgments and decisions - thus generating a near-accident situation?</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>6. To what extent do you think 'fate' is attributed to the development of a near-accident event?</td>
<td>![Very high] ![Not too much]</td>
</tr>
<tr>
<td>7. Do you think that driving with physiological discomforts such as head ache, fatigue, pains in certain body portions etc., can be a cause to generating loss of attention or of any maneuvering capacity - which may eventually generate a near-accident situation?</td>
<td>![Very high] ![Not too much]</td>
</tr>
</tbody>
</table>
Guided questions to assess the nature of psycho-physiological problems observed by the "Accident-free" group and the "Accident-repeater group"

Explanations / application methodology: The following parameters were obtained through an unstructured interview with some randomly selected drivers and then the same is to be presented to a larger sample of drivers in order to assess their perception about the extent of involvement of the factors at the individual level.

The same set of questionnaires to be administered on both the groups.

Guided questions to assess psycho-physiological problems perceived by the "Accident-free" group of drivers:

1. Do you encounter some or other kinds of worries and anxieties during the entire length of the daily routine?  
   - Quite frequently  
   - Never

2. Do you think you maintain a sense of irritation?  
   - Quite frequently  
   - Never

3. Do you think that you possess a feeling of tiredness?  
   - Quite frequently  
   - Never

4. What is the frequency of acidity or any gastric trouble for which either you take self medication or consult local doctor?  
   - Quite frequently  
   - Never

5. Do you think you get angry, have a burst of rage quite frequently or a higher heart rate - which are some of the characteristics of hypertension?  
   - YES  
   - NO  
   - If Yes, please indicate

6. Do you have any specified diseases such as asthma, piles, ulceration of the alimentary canal, liver cirrhosis or any sexually transmitted diseases?  
   - YES  
   - NO  
   - If Yes, please indicate

7. At what rate do you feel giddiness?  
   - Quite frequently  
   - Never

8. At what frequency do you experience headache compelling you to take medicine?  
   - Quite frequently  
   - Never
### Distribution of observed risks as negotiated by the auto-rickshaw drivers at Ahmedabad

Explanations/Application methodology: The following are the investigator’s observations and categorizations of the kinds of risks negotiated and demonstrated in the driving situation. Derived from initial and random observations, an attempt is made to tentatively assess their frequency and intensity against a 7-point scale.

| Risk Type                                      | Almost Always | | | | | | Never |
|------------------------------------------------|---------------|---|---|---|---|---|---|---|---|
| Overtaking from the right side                 |               |   |   |   |   |   |   |   |   |
| Overtaking from the wrong side                 |               |   |   |   |   |   |   |   |   |
| Following the vehicle in front too closely     |               |   |   |   |   |   |   |   |   |
| Overspeeding                                   |               |   |   |   |   |   |   |   |   |
| Careless driving (repetitive application of brake) |               |   |   |   |   |   |   |   |   |

### Findings on perceived and attitudinal factors for risk taking:

Explanations/Application methodology: The following parameters were obtained through an unstructured interview with some randomly selected drivers and then the same is to be presented to a larger sample of drivers in order to assess the drivers’ perception about the extent of involvement of the factors at the individual level.

A seven-point scale was used to assess the intensity of the occurrences where, the extreme left and extreme right of the scale stands for "least" and "highest" respectively.

| Factor                                      | Almost Always | | | | | | Never |
|---------------------------------------------|---------------|---|---|---|---|---|---|---|---|
| Nothing happens                             |               |   |   |   |   |   |   |   |   |
| Mental unrest                               |               |   |   |   |   |   |   |   |   |
| Countering any past event                   |               |   |   |   |   |   |   |   |   |
| I am sure I can do it                       |               |   |   |   |   |   |   |   |   |
| Leave the others behind                     |               |   |   |   |   |   |   |   |   |
| Cross, before it comes in my way            |               |   |   |   |   |   |   |   |   |
| Reach to the destination fast               |               |   |   |   |   |   |   |   |   |
**Psycho-Physiological Observations of Risk Takers:**

*(N = 230) Study location: Ahmedabad (1990)*

Explanations/application methodology: Unstructured interviews with around 150 drivers having risk-taking tendency (arose from the interviews) and having risk records (obtained from accident data sheets), yielded the following health effects or characteristics. These were then categorized under certain plausible psycho-physiological terminology and an attempt is made to administer the questionnaires on the same group of drivers to obtain their reactions to be indicated and weighed against a 5-point scale to estimate the intensity of each of the parameters.

<table>
<thead>
<tr>
<th>Psycho-Physiological Observations</th>
<th>Intensity rating</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Cardio-respiratory changes</strong></td>
<td></td>
</tr>
<tr>
<td>To what extent you feel palpitation?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td><strong>Effects on alimentary system</strong></td>
<td></td>
</tr>
<tr>
<td>Do you have the problem of ulceration of any kind?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what extent do you feel persistent acidity?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td><strong>Effects on the neuro-muscular system</strong></td>
<td></td>
</tr>
<tr>
<td>Do you think your fine movements (such as writing, manipulating small screw drivers etc.) are hindered?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td><strong>Hypertension</strong></td>
<td></td>
</tr>
<tr>
<td>To what frequency do you experience high B.P.?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you find yourself irritated?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you experience headache?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td><strong>Induction of psychological fatigue</strong></td>
<td></td>
</tr>
<tr>
<td>To what frequency do you feel feel tired?</td>
<td>Quite frequently</td>
</tr>
<tr>
<td><strong>Other psychological factors</strong></td>
<td></td>
</tr>
<tr>
<td>To what frequency do you experience monotony / boredom</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you experience lack of interest</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you experience frustration</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you experience insecurity / anxiety</td>
<td>Quite frequently</td>
</tr>
<tr>
<td>To what frequency do you experience over-involvement</td>
<td>Quite frequently</td>
</tr>
</tbody>
</table>
Factors affecting visual cueing of the environment and decision making:

Explanations/application methodology: The following are the Investigator's own observations and categorizations. This also takes the reference of extensive interviews with around 150 randomly selected drivers of different kinds of vehicles and a probe into probable causative factors that may affect visual cueing from the environment while driving. This yielded the following categories of factors or reasons. These, coupled with investigators' own interpretations, were weighed against a 5-point scale to indicate and estimate the intensity of each of the parameters.

1. Traffic signs, symbols, other information systems are embedded in other confusing signs etc., or acts which are called background-noise which hinder the detection of the signals for their perception and recognition:

   Almost always | | | | | Never

2. Compatibility in understanding messages or comprehending signs are difficult:

   Almost always | | | | | Never

3. The speed at which the traffic signs and information messages are to be attended to and load (that is the comprehensibility of the message contained therein) is quite high:

   Almost always | | | | | Never

4. The modality (of displaying awareness messages, warning information, cautionary messages or directional information etc.,) of display or presentation is ergonomically wrong in terms of the choice of the modality vis-a-vis the message content or the gravity and importance of the message:

   Almost always | | | | | Never

5. Though the selection of the modality (indicated in the above point) may be correct, the stereotypes regarding feedback as perceived by the road users is bad:

   Almost always | | | | | Never