Assessment of Driving Behaviour and Safe Driving Skills of Goods Vehicle Drivers in India

Jointly Conducted By:

Central Road Research Institute (CRRI)

and

PCTI Educational Society
(Road Safety Division)

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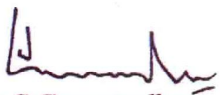
CONTENTS

FOREWORD

I am pleased to provide a foreword for this study carried out jointly by the Traffic Engineering and Safety Division of CSIR-CRRI and PCTI Education Society (Road Safety Division). Inappropriate driving behaviour is considered to be one of the major causes of road crashes in India as compared to defective geometric design of pavement or mechanical defects in the vehicles. More than 65 % of road crashes on Indian roads are caused due to the fault of the road users apart from the other factors such as faulty road design, poor road maintenance and vehicle conditions account for the remaining share of road fatalities.

Considering the increasing trend of road crash scenario occurring due to road users fault, as a starting point, it was felt prudent to assess the psychophysical abilities of the goods vehicle drivers. This category of drivers has been specifically covered in this study due to the extended time span spent by them on the wheels which is invariably beyond 8 hours of working and extending up to 12 hours of driving and moreover, majority of the drivers does not fall under the literate segment of the population in the country. In this study, psycho-physical traits focussing primarily on the visual functional capabilities of the goods vehicle drivers have been assessed. Based on the findings of this limited study it is emphasized that it is worthwhile to carry out special screening and training of the goods vehicle drivers. This envisaged practice is expected to be useful in keeping vigil over the driving capability of the drivers coupled with possible enhancement of their psychomotor skills if corrective measures are taken by them after undergoing training.

I hope that this project will work as a catalyst in coordinating and bringing together concerned agencies for encouraging and promoting the sharing of information, knowledge and specific expertise in traffic psychology area. Further, it is expected that the results would be of immense use to the policy makers and decision makers towards initiating appropriate measures to study the psycho-physical traits of large sample of goods vehicle drivers and drivers of other vehicle types like passenger cars, buses and two wheelers spread across the length and breadth of the country which is expected aid directly in the enhancement of overall road safety.



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1. PREAMBLE

Today, road crashes are one of the leading causes for deaths, disabilities and hospitalization, with severe socioeconomic costs across the world. Road safety is a major issue of national concern. During the last two decades, developing economies like India is experiencing rapid increase in human population and vehicles coupled with increase in road accidents. In the year 2012, approximately 5 lakh road crashes are recorded in India, which had resulted in 1.45 lakh road deaths coupled with the occurrence of more than 5.2 lakh Road Traffic Injuries (RTI). According to the reported statistics of causalities on Indian roads, one road crash is reported every 4 minutes which excludes the unreported road crashes expected to take place at every minute and moreover incidence called as near mistakes take place at every second. The most shocking aspect is that despite India accounting for only about 1 % of the global vehicle population, the total road fatalities on the Indian road network accounted for 10% of the global fatalities. As per the Annual Report by Ministry of Transport & Highways, 2012 (MoRT&H), the loss to the Indian economy due to road fatalities and the severe Road Traffic Injuries / Trauma is estimated to be above 3% of the Gross Domestic Product (GDP).

Need for the Study

Inappropriate driving behaviour is considered to be one of the major causes of road crashes in India as compared to defective geometric design of pavement or mechanical defects in the vehicles. About 65 % of road crashes on Indian roads are caused due to the fault of the road users apart from the other factors such as faulty road design, poor road maintenance and vehicle conditions account for the remaining share of road fatalities. Therefore, as a starting point, it was felt prudent to assess the psychophysical abilities of the goods vehicle drivers considering the fact that this category of drivers in the country are not fully literate coupled with the extended time span spent by them on the wheels which is sometimes beyond 8 hours and extending up to 12 hours of driving. It is expected that the improved driver screening facilities accompanied by availability of good driving aids such as anti glare glasses can be an effective and preventive measure to inhibit crash risks. This research study is jointly conducted by CSIR - Central Road Research Institute and PCTI Education Society (Road Safety Division), Delhi, India to highlight the psycho physical traits of the goods vehicle drivers as a pilot project. This study addresses the assessment of visual functional capabilities of the goods vehicle drivers. It is expected that the results would be of immense use in taking appropriate measures to enhance vision requirements of the subjects and thus directly help in the enhancement of overall road safety.

2. STUDIES CONDUCTED IN INDIA

As per the reported literature, safety consciousness can be imparted amongst the drivers through the assessment of their abilities through an exhaustive driver screening programs, providing free visual aids and modifying present licensing procedures. In a recent study done at Guwahati, India (Chauhan S), an attempt was made to identify the shortcomings in physical attributes of the drivers that may pose road safety hazards such as visual acuity, peripheral vision, depth perception, glare recovery, colour vision, contrast sensitivity, phoria, etc. Based on the analysis of data collected, the following important findings were reported by them:

Three percent of the drivers failed in the phoria test, which checks for proper eye muscles and co-ordination of both eyes to correctly identify the placement of an object ahead. If a particular driver performs, unacceptable in this test, then it indicates that the driver may not be able to identify the position of an object such as, vehicle, pedestrian, etc. in front of him/her on the road correctly.

- Seven per cent of the drivers failed in the glare recovery test, which is an important parameter for safe driving during night, especially on undivided roads, which are predominant in India, and where there is a substantial glare of headlight of the opposing vehicles.
- Five per cent of the drivers were found to have problem of tunnel vision while driving, which shows that such drivers may not be able to identify the side obstructions and correspondingly respond to the stimulus on time.
- Fifteen per cent of the drivers were found to have unacceptable acuity vision in one of the eyes and 4% in both the eyes.
- Five per cent of the drivers had problem with night vision (vision in the presence of headlight).
- Performance of 5% of the drivers was found "unacceptable‟ in colour vision test.

Similarly, based on a study conducted in Hyderabad in India, the following deficiencies were observed:

- About 11% of motorized two wheeler drivers drive the vehicle without possessing driving license. This tendency was higher in the case of drivers aged between 16 and 25 years.
- Also, 0.5% was found to get a driver license before 15 years of age. Out of all license holders who were surveyed in the study, 21.4% had obtained the license without taking the mandatory driving test.
- Thirty per cent of the drivers were found to overtake other vehicles from any side depending on traffic conditions.
- Over 50% were found to drive the vehicle in the direction opposite to the flow of traffic.
- Out of all the drivers who were caught by the traffic police, 56% paid the fine while 26% paid bribe to escape.
- Regarding vehicle conditions, it was observed 49% of drivers had no rear view mirror in their vehicles.

Since the driving task involves performing a number of multi-tasking activities which include driving the vehicle within the road, detecting motorized and non motorized vehicles, pedestrians, judging their speed, position, their possible behaviour and reacting accordingly, Collins, et al (1999) studied several factors that can affect the visibility and conspicuous of the road signs.

Khattak, et al (1998) analyzed the impacts of adverse weather interactions with driver and roadway characteristics on occurrence and injury severity of selected crash types.

Khattak, et al (1993) developed a conceptual framework to assess the visual impact due to adverse weather on travel behaviour. Creating sudden reduction in visibility during simulation exercise showed that road capacity and traffic safety behaviour both decreased. Conditions such as wet pavement, impaired visibility, heavy precipitation, frozen precipitation, flooding, high winds, and extremes of temperature can act in various ways to increase risks to drivers and their vehicles, as well as the infrastructure. The vulnerability of the drivers to weather conditions and climate change on the highways arises from the potential exposure to both unforeseen and anticipated changes in weather or climate patterns and from potential increase in the intensity and frequency of extreme weather events.
A study done by Ashish Verma et al 2011 highlights that driver behaviour through better driver education, driver training and licensing procedures along with good on-road enforcement can be improved. The gamut of these researches helped to create the background of the present study under different Indian conditions.

Thus the above reviewed literature highlights that most of the attitudinal problems of the drivers can be checked through the implementation of the mandatory assessment of the psycho physical traits and imparting training to the drivers in the country as it is expected to have a direct bearing on the reduction of the erratic behaviour of the drivers and road crash proneness. The purpose of this study is not to provide a set of uniform rules that can be implemented unchanged in any jurisdiction. Rather, it is aimed at providing a set of considerations for contemplating the development or refinement of rules in vogue for driving licensing.

3. OBJECTIVE AND SCOPE OF THE STUDY

The objective of this study is to assess the psycho physical traits of the goods vehicle drivers. This study can be considered as a useful tool for objective assessment of the driving performance and safety skills through the assessment of psycho-physical traits of the subjects considered in this study.

The scope of this study is to understand the psychological traits of the sample of goods vehicle drivers operating the vehicles of one of the largest company in the country namely, M/s Agarwal Packers and Movers. The tests conducted as part of this study focused on the assessment of driving performance and safety skills. Eventually, the appropriate tests have been selected with an aim to understand the human elements / aspects which are considered as potential contributors towards the majority of road crashes occurring due to human fault and The tests selected for the present study include the following:

1. Reaction Time (RT)
2. Determination Test (DT)
3. Adaptive Tachistoscopic Traffic Perception Test (ATAVT),
4. Cognitrone (COG)
5. INSSV i.e. Intelligence Test
6. Inventory of Driving related Personality Traits
7. Glare Recovery
8. Eye Test i.e. Vision Screening Test.

These techniques were supplemented with the assessment of the job profile of the subjects through the conduct of an interview with the goods vehicle drivers.

4. METHODOLOGY

4.1 Sample Size and Characteristics of Subjects

The sample size considered in this pilot study was ranging around 535 goods vehicle drivers who are referred as 'subjects' in this study. However, during the conduct of some of the tests, like INSSV, Glare Recovery Test and Vision Screening Test, data was collected on random sampling basis without subjecting all the drivers i.e. selected subjects undergone these tests due to paucity of time and resources. Table-1 presents the profile of the drivers who are engaged either on 'long distance route' or on 'short distance route' i.e. driving within the range of around 300 Kilometres.

Table 1: Number of Subjects considered in the Study

S. No.	Type of Route Driving	Number of Drivers
1.	Long Distance Route	282
2.	Short Distance Route	255
Total Samples		**537**

Table 2: Sample Size of Subjects considered during each Test

Type of Test	Type of Route Driven	
	Long Distance Route	Short Distance City Route
RT	282	255
DT	282	255
ATAVT	282	255
COG	282	255
INSSV	125	125
IVPE	282	255
Glare Recovery	50	50
Eye Test - Vision Screening Test	50	50

Table 2: Presents the list of the tests conducted coupled with sample size chosen for each test.

4.2 A Brief Description of the Tests

4.2.1 Vienna Test System: Vienna Test System has been used to assess the psychological parameters. This is a computerized psychometric assessment tool, which has been developed in Vienna, Austria. This system includes more than 150 psychometric tests in a single system. This system is a portable system used to assess the reaction time, personality, determination, perception, concentration level, the ability to perform multi-tasking coupled with the assessment of intelligence level of the subjects.

4.2.2 Porto Clinic: This is a portable apparatus for testing the visual acuity of the drivers; colour blindness, depth perception, horizontal field test and phoria (refer Figure 1). In this test, the subjects have to read the Snellen chart letters or similar numbers followed by the conduct of Ishihara colour blindness test wherein the subject has to identify the numbers inside the chart without any time limits in place. Based on the understanding capability of the above chart, the comfort levels of the drivers were assessed.

4.2.3 Porto Glare: This apparatus was used for testing the tolerance level exhibited by the drivers towards the oncoming glare from the vehicle headlights which is basically referred as glare test. This test is also a barometer to measure the vision capacity of the drivers during nighttimes.

Figure 1: Instrumentation Deployed for Porto Clinic Test

5. FINDINGS OF THE STUDY

5.1 Reaction Time

Reaction Time Test has been used in the present study**.** This is a test for the assessment of reaction time for audible and visual stimuli. The assessment duration for the conduct of the reaction time assessment is fixed as 5 minutes per subject. The overall reaction level exhibited by all the subjects is depicted in Table-3. As can be noted in Table-3, it presents Percentile rank Mean reaction time and Percentile rank Mean motor time, of the subjects (drivers).

Table 3: Average Reaction Time Exhibited by the Subjects

S.No	Average Percentile Ranking	Mean Score	SD
1	Percentile rank Mean reaction time	16.88	22.13
2	Percentile rank Mean motor time	31.60	25.96

Table 4: Grading of the Reaction Time Exhibited by the Subjects based on the Age Profile

Age (in years)	Number of Drivers	Percentage	Grading
Below 30	284	1.41	Good
		1.76	Above Average
		20.07	Average
		10.21	Below Average
		66.55	**Poor**
Above 30	253	2.77	Good
		0.79	Above Average
		19.37	Average
		9.09	Below Average
		67.98	**Poor**
Overall	537	2.05	Good
		1.30	Above Average
		19.74	Average
		9.68	Below Average
		67.23	**Poor**

From Table 4, it can be inferred that 66.6 % drivers (i.e. out of 284 nos.) who are below the age of 30 are slow in their reaction time whereas 68.0 % of the drivers (i.e. out of 253 nos.) who are above the age of 30 are also equally slow in their reaction time. This implies that there is hardly any difference in the audible, visual stimuli and reaction stimuli between the above age group which is a serious cause of concern amongst the subjects who were tested in this study. Considering the above, it is suggested that the subjects need to hone their reaction skills as it is expected that the persons below 30 years should have exhibited significantly better reaction time compared to the subjects above 30 years of age.

Table 5: Grading of the Reaction Level of the Subjects based on the Distance of Travel

Type of Route Driven	Number of Drivers	%	Grade
Long Distance Route	282	2.84	Good
		1.77	Above Average
		19.50	Average
		10.64	Below Average
		65.25	**Poor**
Short Distance Route	255	1.18	Good
		0.78	Above Average
		20.0	Average
		8.63	Below Average
		69.41	**Poor**
Overall	**537**	2.05	Good
		1.30	Above Average
		19.74	Average
		9.68	Below Average
		67.23	**Poor**

A close look at Table 5 reveals that 65.3 % of the 'Long Distance Route' drivers (i.e. out of 282 nos.) are graded “Poor” towards their ability to exhibit prompt reaction time whereas 67.2 % of the 'short distance route' drivers (i.e. out of 255 nos.) are also equally slow in their reaction time. This implies that there is hardly any difference in the audible and visual stimuli.reaction stimuli between the 'Long Distance Route' and 'Short Distance Route' drivers which is again a serious cause of concern. It is generally expected that ‘Long Distance Route’ drivers should exhibit prompt reaction time as they as they resort to long hours of driving which invariably ranges between 8 - 12 hours.

Based on the results of this limited study (refer Table 4 and 5), It is emphasized that it is worthwhile to carry out special screening and training of the goods vehicle drivers. This envisaged practice is expected to be useful in keeping a strict vigil over the driving capability of the drivers coupled with possible enhancement of their reaction time if corrective measures are taken by them after undergoing training in any of the reputed organisations in the country.

5. 2 Determination Test

Determination Test is a test to understand the performance level of the subjects while performing complex as well as multiple-stimulus, multiple-choice reaction experiments. The assessment duration for the Determination Test was fixed as 4 minutes per subject. Table-6 presents the overall performance results of the determination test conducted amongst the subjects.

Table 6: Overall Performance Results of the Subjects in the Determination Test

S. No.	Average Percentile Ranking	Mean	SD
1	Percentile Rank Correct	17.91	27.15
2	Percentile Rank Incorrect	35.53	30.84
3	Percentile Rank Omitted	13.32	13.87

As mentioned earlier, entire sample of 537 drivers were subjected to the Cognitrone test. The study revealed (refer Table 7) that the 31.7 % of the subjects (out of 284 persons) who are below 30 years are 'Good' in their determination power whereas 42.3 % of the subjects (out of 253 persons) secured 'Average' score. This study shows that 52.6 % subjects who are above age of 30 are ‘Average’ in their determination power and 34.8 % are ‘poor’ in their determination power which again a major cause of concern which need to be immediately addressed.

Table 7: Grading of the Determination Test Results Based on the Age Profile of the Subjects

Age (in years)	Number of Drivers	%	Grading
Below 30	284	31.69	Good
		0.70	Above Average
		42.25	Average
		0.70	Below Average
		31.69	Poor
Above 30	253	3.95	Good
		13.04	Above Average
		52.57	Average
		7.91	Below Average
		34.78	Poor
Overall	537	7.45	Good
		13.97	Above Average
		47.11	Average
		4.10	Below Average
		33.14	Poor

The study revealed that (refer Table-8) 40.8 % of the 'Long Distance Route' goods vehicle drivers (i.e. out of 284 nos.) are average in in their determination power whereas 24.8 % of drivers’ are poor. On the other hand, 35.3 % of the 'Short Distance' goods vehicle drivers are “Average” in their determination power.

Table 8: Grading of the Subjects in the Determination Test Based on the Distance of Travel

Type of Route Driven	Number of Drivers	%	Grade
Long Distance Route	282	3.55	Good
		7.09	Above Average
		40.78	Average
		14.18	Below Average
		24.82	Poor
Short Distance Route	255	23.53	Good
		22.75	Above Average
		35.29	Average
		22.75	Below Average
		23.53	Poor
Overall	537	5.03	Good
		9.31	Above Average
		38.18	Average
		18.25	Below Average
		24.21	Poor

Based on the results of this study (refer Table 7 and 8) it is emphasized that it is worthwhile to carry out special screening and training of the goods vehicle drivers as they resort to long hours of driving ranging between 8 - 16 hours which would help in enhancing determination power of the subjects.

5.3 Adaptive Tachistoscopic Traffic Perception Test (ATAVT)

This is a test for assessing optical perception performance of the subjects and the form S1 has been deployed as India falls under countries following right-hand traffic. The total assessment duration for this ATAVT is 10 minutes per subject. The overall statistical parameters derived for the subjects in the ATAVT is presented in Table-9.

Table 9: Overall Test Results of the ATAVT conducted for the Subjects

S.No	Variables	Mean	SD
1.	Percentile rank Overview	6.10	9.71
2.	Percentile rank Overview, corrected for age	2.72	7.51

In the present study, total sample of 537 drivers were subjected to the Perception test. The study revealed that the 41.90% of the drivers below 30 years age groups and 34.39% drivers of above 30

years age groups performed "Good" whereas 52.46% and 55.73% good vehicle drivers of above 30 years age group performed "Poor" in Perception Test (refer Table 10).

Table 10: Grading of the ATAVT Results Based on the Age Profile of the Subjects

Age (in years)	Number of Drivers	%	Grading
Below 30	284	41.90	Good
		0.35	Above Average
		4.58	Average
		0.70	Below Average
		52.46	Poor
Above 30	253	34.39	Good
		0.40	Above Average
		9.49	Average
		0	Below Average
		55.73	Poor
Overall	537	38.36	Good
		0.37	Above Average
		6.89	Average
		0.37	Below Average
		54	Poor

The study further analysed the performance differences among drivers commuting over "Short distances destination i.e. short route" vs. "Long distances destination i.e. long route" the analysis of the data showed that 54.96% of Long Route truck drivers found "Poor" in Perception Test as against 54% of Short Route drivers in perception test. Thus this study emphasizes the urgent requirement of special screening and training facilities on Perception are required for the drivers of both group (refer Table-11).

Table 11: Grading of the ATAVT Results Based on the Distance of Travel of the Subjects

Type of Route Driven	Number of Drivers	%	Grade
Long Distance Route	282	37.59	Good
		0.35	Above Average
		6.38	Average
		0.71	Below Average
		54.96	Poor
Short Distance Route	255	39.22	Good
		0.39	Above Average
		7.45	Average
		0	Below Average
		52.94	Poor
Overall	537	38.36	Good
		0.37	Above Average
		6.89	Average
		0.37	Below Average
		54	Poor

5.4 Cognitrone

This is a performance parameter, estimated in accordance with the Rasch model, for visual observational ability and skill in obtaining an overview, and also visual orientation ability and speed of perception. This test parameter thus provides the clearest expression of perceptual capacity and speed of perception. A high score indicates well-developed ability to assess situations quickly and accurately, while a low score indicates slower or less accurate visual observational ability and skill. The ability parameter is calculated from the item difficulties and whether the items presented are solved correctly or answered incorrectly. An item is classed as solved only if the answer given includes all the correct object classes and none of the incorrect ones. The subjects considered in the present study had undergone Cognitrone test. This is a test aimed at the general understanding of the attention and concentration levels exhibited by the subjects. For the conduct of this study, form no. S-11 has been used without any fixation of time limit for the subjects. - Short form, no time limit. Average total assessment duration for this Cognitrone Test is around 5 Minutes. Mean ratings of test variables and differentiated results along with SDs are given in Table 12.

Table 12: Mean Rating of Test Variables during the Cognitrone Test

S. No.	Average Percentile Ranking	Mean	SD
1	Percentile rank Mean time "correct rejections"	58.19	39.51
2	Percentile rank Sum "hits"	16.77	24.81
3	Percentile rank Sum "correct rejections"	9.44	19.02
4	Percentile rank Mean time "hits"	59.50	38.08

In the present study total sample of 537 drivers' were subjected to the Cognitrone test. The analyses of the data revealed that majority of the drivers were having "Average or Below Average" performance in Cognitive functionality. This study showed that 54.93% (i.e 284 drivers) of below 30 years performed "Average" and 23.59 % subjects (i.e. 253 drivers) were "Below Average" in their Cognitive Functionality while 53.75% subjects of above 30 years age group performed "Average" and 17.79% "Below Average" in their Cognitive Functionality (refer Table 13).

Table 13: Test of Cognitrone Based on Age Profile

Age	No of Drivers	%	Grading
Below 30	284	0	Good
		0.35	Above Average
		54.93	Average
		23.59	Below Average
		21.13	Poor
Above 30	253	0	Good
		0	Above Average
		53.75	Average
		17.79	Below Average
		28.46	Poor
Overall	537	0	Good
		0.19	Above Average
		54.38	Average
		20.86	Below Average
		24.58	Poor

The data revealed that 54.96% of Long Distance drivers (interstate driving) and 53.73% of Short Distance drivers performed "Average" in the Cognitive Functionality, thus this study emphasizes the urgent requirement of special screening and training facilities on Cognitive Functionality is required among Long Distance Route drivers and Short Distance Route drivers (refer Table 14).

Table 14: Test of Cognitrone Based on Distance of Travel

Route	No of Drivers	%	Grade
Long Distance Route	282	0	Good
		0	Above Average
		54.96	Average
		21.63	Below Average
		23.40	Poor
Short Distance Route	255	0	Good
		0.39	Above Average
		53.73	Average
		20	Below Average
		25.88	Poor
Overall	537	24.58	Good
		20.86	Above Average
		54.38	Average
		0.19	Below Average
		0	Poor

5.4.1 Interpretation of Test Variables:

Mean time "Correct Rejections" (sec):

This variable measures selective attention in the form of the energy needed to maintain a particular level of accuracy. Individuals with a high score on this variable are characterized by a high level of concentration ability. This means that the individual's ability to focus his or her attention on relevant information is well developed. Such individuals have a fast working style during concentrated working.

5.4.2 Sum of "Correct Rejections":

This variable is used to assess the accuracy of concentrated working. Individuals with a high score on this variable display a high level of accuracy in concentrated working. If the respondent's score on this variable is noticeably higher than his/her score on the variable "Mean time correct rejection", this reflects a working style that tends to be slow but exact. If the reverse is the case, the results reflect a style of concentrated working that tends to be inaccurate but fast.

5.5 Intelligence Test

Intelligence Test (INSSV) is one of the tools which have been used in the present study. INSSV is based on the Cattell-Horn-Carroll model. This is a test for assessing general intelligence and Intelligence Quotient. Total assessment duration for this INSSV Test is 10 Minutes per subject (refer Table 15 and Table 16).

Table 15: Results of INSSV Test

Sl. No.	Average Percentile Ranking	Mean	SD
1	Percentile rank Figural inductive reasoning	12.09	17.31

Table 16: Test of General Intelligence (INSSV)

Age	No of Drivers	%	Grading
Below 30	284	1.06	Good
		2.11	Above Average
		50	Average
		0	Below Average
		46.83	Poor
Above 30	253	3.95	Good
		2.77	Above Average
		42.69	Average
		0	Below Average
		50.59	Poor
Overall	537	2.42	Good
		2.42	Above Average
		46.55	Average
		0	Below Average
		48.60	Poor

Table 17: Test of General Intelligence (INSSV)

Route	No of Drivers	%	Grade
Long Distance Route	282	2.13	Good
		2.13	Above Average
		46.45	Average
		0	Below Average
		49.29	Poor
Short Distance Route	255	2.75	Good
		2.75	Above Average
		46.67	Average
		0	Below Average
		47.84	Poor
Overall	537	2.42	Good
		2.42	Above Average
		46.55	Average
		0	Below Average
		48.60	Poor

In the present study total sample population of 537 drivers' were selected for the Intelligence test. The study shows that the 46.83% of drivers (out of 284 nos.) who are 30 years below are "poor" in intelligence whereas 42.69% of drivers (out of 253 nos) who are "above" the age of 30 have been found to be average and 50.59% drivers are found Poor in their Intelligence test (refer table 16).

The study shows that 46. 5 % of Long Distance Route Goods Vehicle drivers (i.e. out of 282 nos.) are "Average" and 48.3 % are "Poor" in Intelligence Test. Similarly, 46.7 % of short distance route drivers (i.e. out of 255 nos.) are "Average" and 48.6 % are "Poor" in Intelligence Test (refer table 17).

Here again, the finding of this study emphasizes the urgent requirement for the setting up of special screening and training facilities to enhance the Intelligence level for both long distance and short distance subjects covered in this study.

5.6 Inventory of Driving related Personality Traits

Inventory of Driving related Personality Traits is one of the tools which have been used in the present study. IVPE is a test for assessing personality test of drivers'. Total assessment duration for this IVPE Test is around 10 Minutes (Table 18).

Table 18: Test of Personality Traits (IVPE)

	No of Driver	Emotional Stability		Sense of Responsibility		Self Control		Adventurousness and need for excitement		Honesty	
Age	s	%	Grading	%	Grading	%	Grading	%	Grading	%	Grading
Below 30	284	22.18	Good	7.75	Good	6.69	Good	8.10	Good	5.99	Good
		0.35	Above Average	4.23	Above Average	4.58	Above Average	2.82	Above Average	4.93	Above Average
		0.35	Average	13.03	Average	14.08	Average	12.32	Average	11.62	Average
		0.70	Below Average	0	Below Average	0.70	Below Average	0.35	Below Average	1.06	Below Average
		76.41	Poor	75	Poor	73.94	Poor	76.41	Poor	76.41	Poor
Above 30	253	18.58	Good	9.49	Good	7.51	Good	7.91	Good	6.32	Good
		0.40	Above Average	3.95	Above Average	4.35	Above Average	3.95	Above Average	5.53	Above Average
		1.58	Average	8.70	Average	10.67	Average	8.30	Average	7.91	Average
		0.40	Below Average	0	Below Average	0.79	Below Average	0.79	Below Average	1.58	Below Average
		79.05	Poor	77.87	Poor	76.68	Poor	79.05	Poor	78.66	Poor
Overall	537	20.48	Good	76.35	Good	7.08	Good	8.01	Good	6.15	Good
		0.37	Above Average	0	Above Average	4.47	Above Average	3.35	Above Average	5.21	Above Average
		0.93	Average	10.99	Average	12.48	Average	10.43	Average	9.87	Average
		0.56	Below Average	4.10	Below Average	0.74	Below Average	0.56	Below Average	1.30	Below Average
		77.65	Poor	8.57	Poor	75.23	Poor	77.65	Poor	77.47	Poor

Table 19: Test of Personality Traits (IVPE)

		Emotional Stability		Sense of Responsibility		Self Control		Adventurousness and need for excitement		Honesty	
Route	No of Drivers	%	Grading	%	Grading	%	Grading	%	Grading	%	Grading
Long Distance Route	284	18.09	Good	7.45	Good	6.74	Good	7.80	Good	4.61	Good
		0	Above Average	4.96	Above Average	3.90	Above Average	2.84	Above Average	6.03	Above Average
		0.71	Average	8.87	Average	10.64	Average	8.87	Average	7.45	Average
		0.35	Below Average	0	Below Average	0.71	Below Average	0.35	Below Average	0.35	Below Average
		80.85	Poor	78.72	Poor	78.01	Poor	80.14	Poor	81.56	Poor
Short Distance City Route	253	23.14	Good	9.80	Good	7.45	Good	8.24	Good	7.84	Good
		0.78	Above Average	3.14	Above Average	5.10	Above Average	3.92	Above Average	4.31	Above Average
		1.18	Average	13.33	Average	14.51	Average	12.16	Average	12.55	Average
		0.78	Below Average	0	Below Average	0.78	Below Average	0.78	Below Average	2.35	Below Average
		74.12	Poor	73.73	Poor	72.16	Poor	74.90	Poor	72.94	Poor
Overall	537	20.48	Good	8.57	Good	7.08	Good	8.01	Good	6.15	Good
		0.37	Above Average	4.10	Above Average	4.47	Above Average	3.35	Above Average	5.21	Above Average
		0.93	Average	10.99	Average	12.48	Average	10.43	Average	9.87	Average
		0.56	Below Average	0	Below Average	0.74	Below Average	0.56	Below Average	1.30	Below Average
		77.65	Poor	76.35	Poor	75.23	Poor	77.65	Poor	77.47	Poor

5.6.1 Summary Findings

In the present study, entire sample of 537 subjects were selected for the Special Personality Test for driving and the following inference were drawn from this analysis:

- The study showed that young drivers had more Emotional Stability as compared to older group of drivers as 76.41% driver's of below 30 years age group vs. 79.05 % drivers of above 30 years age group performed "Poor" while 22.18 % drivers of below 30 years age group vs. 18.58% of above 30 years age group performed "Good" in their Emotional Stability .

- 75% drivers of below 30 years and 77.87 % of above 30 age group performed "Poor" in Sense of Responsibility.

- 73.94% drivers of below 30 years and 76.68 % drivers of above 30 years age group performed "Poor" in their Self Control.

- 76.41% drivers of below 30 years and 79.05 % drivers of above 30 years age group performed "Poor" in their Adventurousness and Need for Excitement.

- 76.41% drivers of below 30 years and 78.66% drivers of above 30 years age group performed "Poor" in the Honesty Scale.

The study emphasizes the urgent requirement of special screening and imparting training facilities on all the personality traits among the Long Distance Route and Short Distance Route Drivers which will include Emotional Stability, Sense of Responsibility, Self Control, Adventurousness and need for excitement, and Honesty using Vienna Test System.

5.7 Vision Requirement for Driving Safety

The preservation of road safety is the prime consideration in addressing vision requirements for driving. Vision is the most important source of information during driving as 90% of the information from the driving environment is taken from the eyes only. The importance of road safety demands that the components of safe driving be understood, the criteria for evaluating candidates be evidence based, and the tests used be valid predictors of driving ability.

The components of safe driving include the following:

1. The motor ability to scan a rapidly changing environment.
2. The sensory ability to perceive information in this rapidly changing environment.
3. The attentiveness to process multiple pieces of information.
4. The cognitive ability to judge this information in a timely fashion and to make appropriate decisions.
5. The motor ability to execute these decisions in a timely fashion.

The interaction of these factors is complex and cannot be inferred from the evaluation of one component alone. For example, an applicant with an excellent visual acuity and fair mobility but impaired cognition may be unsafe, whereas one whose only impairment is moderate visual acuity may be safe. Another applicant with a combination of moderately impaired visual acuity, moderately prolonged reaction time, and moderately impaired motor ability may be unsafe. This is necessary to ensure safety on the roads, to ensure fairness in licensing, and to enable ophthalmologists to provide reasonable guidance for patients for licensing agencies and their medical advisory boards.

5.8 Visual Acuity Test

20% drivers from the sample population were randomly selected for the vision related tests .Visual acuity refers to spatial resolution or the measure of one's vision with respect to clarity, sharpness, or sight ability. This ability results from the coherent focus of light from the region of the cornea on to the retina of the eye (Garcia, et al., 2000, 2002). Spatial resolution allows one to discern objects, read text, and interpret symbols and signage.

In the present study the 57.14% drivers of below 30 age groups were having 6/6 i.e. very good visual acuity, vs. 27.85% drivers of above 30 years age group; from below 30 years only 14.28% required retesting for visual acuity while 27.8% required of above 30 years required "Retesting" and 5.70 % of above 30 years age group failed in the test(refer table 20) .

Table 20: Test of Visual Acuity

Age	No. of Drivers	6/6	%	6/9	%	Re Test	%	Fail	%
Below 30	21	12	57.14	6	28.57	3	14.28571	0	0.00
Above 30	79	22	27.85	26	32.91	22	27.8481	9	11.39
Overall	100	34	42.50	32	30.74	25	21.07	9	5.70

Thus this research study revealed that compulsory vision screening is required for all drivers for getting license renewal or for the new licence applicant who are especially above 30 years.

5.9 Night Vision

Night vision is the ability to see in low light conditions. Whether by biological or technological means, night vision is made possible by a combination of two approaches: sufficient spectral range, and sufficient intensity range. Humans have poor night vision compared to many animals, in part because the human eye lacks a tapetum lucidum (Taeko Chijiiwa, Tatsuro Ishibashi, Hajime Inomata,1990).

- In the present study out of the total sample population approximately 10% drivers were randomly selected for the Night Vision test. The analysis of research data highlighted that Long Distance Route drivers of above 30 years age group were more affected due to low illumination as 34.21% of them performed “Below Average” as against 2.44% of Short Distance City Route drivers of the same group.

- The study further revealed that only 30.26% of Long Distance Route drivers performed “Good” in the test as against 66% of the drivers of Short Routes.

- Thus this study emphasizes the urgent requirement of special screening and training facilities among Long Distance Route HMV drivers (Refer Photo 10.1).

Figure 2: Night Vision Test Being Administered On the Subjects

5.10 Glare Recovery

Glare can be defined as the contrast lowering effect of stray light in a visual scene. Glare forms a veil of luminance which reduces the contrast and thus the visibility of a target is decreased. One cannot see intensity differences efficiently in the presence of a high background of light intensity and the sensitivity to glare is amplified as scattering in cornea or lens increases. High beam of head-light of an on-coming car has blinding effect and decreases the visibility drastically (Table 21).

Table 21: Classification of Subjects based on the Score Obtained during the Glare Test

Score Obtained (Secs.)	Long Distance Route Drivers				Short Distance City Route Drivers				Remarks
	Age (in Years)								
	> 30	%	< 30	%	> 30	%	< 30	%	
> 1.0									Outstanding
1.1 to 1.5							1.00	2.44	Excellent
1.6 to 2.0					1.00	11.11	1.00	2.44	Very Good
2.1 to 2.5					2.00	22.22	10.00	24.39	Good
2.6 to 3.0	3.00	25.00			1.00	11.11	8.00	19.51	Reasonably Good
3.1 to 3.5			4.00	10.53	2.00	22.22	13.00	31.71	Satisfactory
3.6 to 4.0			5.00	13.16	2.00	22.22	2.00	4.88	Above Average
4.1 to 4.5	3.00	25.00	7.00	18.42		0.00	2.00	4.88	Average
4.6 to 8.8	6.00	50.00	18.00	47.37	1.00	11.11	4.00	9.76	Below Average
< 8.0			4.00	10.53					Poor

Similar to the night vision test out of the total sample population approximately 10% drivers were randomly selected for the Glare recovery test. The data revealed that Long Distance Route drivers of above 30 years age group were more affected due to low illumination as 10% of them performed "Poor" as against 0% of Short Distance City Route drivers of same group. The study highlights that only Short Route drivers from the present sample population performed "Good and above " in the test while None of Long Route drivers performed "Good" in the present study, thus this study emphasizes the urgent requirement of special screening and training facilities among Long Distance Route HMV drivers for both of the vision test.

6. CONCLUSION

Based on the findings of this limited study it is emphasized that it is worthwhile to carry out special screening and training of the goods vehicle drivers. This envisaged practice is expected to be useful in keeping skills over the driving capability of the drivers coupled with possible enhancement of their psychomotor skills if corrective measures are taken by them after undergoing training.

The study further analysed the performance differences among drivers commuting over "Short distances destination i.e. short route" vs. "Long distances destination i.e. Long route". Thus this research study revealed that compulsory psychometric assessment and cognitive and behavioural training is required for all goods drivers for getting license renewal or for the new applicant licences especially for above 30 years.

The results obtained through different techniques of study have already been discussed in the respective sections. The road safety factors that emerged from the different techniques are summarised below to get an overall view of the safety increasing road safety for truck drivers in India.

It is not possible to assign any quantitative weightage to any of the attributes to determine their importance while indicating the findings except that the attributes figuring in large number of methods highlight their significance for driving. The study on assessment of driving behaviour and safe driving skills of goods vehicle drivers in India was made using eight tests which are considered one of the most representative ways of assessing the psychomotor skills of the drivers. The main objective of the study is to identify areas that are crucial for driving and thus aid in increasing road safety in the country. The attributes identified in this study are alphabetically listed below:

- Concentration
- Determination
- Depth Perception
- Emotional Stability
- General Intelligence
- Honesty
- Memory
- Observation
- Reaction Time
- Stress Tolerance
- Sense of Responsibility
- Speed of Perception
- Self Control
- Visual Orientation

7. RECOMMENDATION AND DIRECTION FOR FURTHER WORK

For achieving UNO Mission Road Safety Vision - 2020, even one percent of drivers should not be spared for unsafe capabilities. For this there exists an urgent need for automated visual acuity testing for each applicant of refresher course trainee or learner / permanent license. This report also discusses the challenges that countries face when setting or seeking to modify visual standards for drivers. These appear to relate directly to the difficulty of defining statistical thresholds of safe and unsafe drivers. The restricted licenses appear to strengthen visual standards for drivers.

The recommendations emanated out of this study are to improve road safety in India can be reckoned as indicative and there is substantial scope to work further in the following directions.

- ✓ Quantification of the impacts of improved psychophysical traits on road safety and mobility in India.
- ✓ Assessing and giving proper training in cognitive areas which are essential for Road Safety.
- ✓ Developing the complete framework for driver education and licensing in India.
- ✓ Addressing practical issues (differences of language, literacy level of applicants, etc.) in implementation of the proposed framework.

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