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Accidents Analysis of Rail Transportation Industry in Iran

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Abstract: The main idea of this research is to understand and evaluate the working conditions subjected to the rolling stockers of the Islamic republic of Iran railway to reduce the accidents and expenses in order to increase the productivity of the Iranian railway Industry. The problems due to productivity, job satisfaction and work safety have direct relation with the working design. A well-designed working ergonomic circumstance with respect to the physical and mental aspects will increase job satisfaction for the staff and reduce the accidents. It's clear that any accident will impose high values of expenses. It's also realized that many accidents are similar which means that unfortunately the accidents repeat everyday. Therefore, in this research the main parameters such as working circumstances, accessories and equipment which affect the occurrence of the accidents are studied. The design of an ideal workplace can remove or improve those parameters which reduce the working efficiency that could finally prevent the loss of equipment, time, money and human resources.

Key words: Ergonomic · Productivity · Factor · Train

INTRODUCTION

Quantitative evaluation of "degree of comfort" is an important aspect to consider when evaluating the nature of products, or the establishment of design-objective values during vehicle development. ISO2631-1 [1], which defines an acceptable standard of body vibration, is the generally accepted evaluation criteria for evaluating whole-body vibration as part of overall in-vehicle comfort.

According to ISO 2631 which is based on the measurements of body-shaking, the drivers should not work more than 3:45 hours per day.

The incidents due to working circumstances remarkably increased from the beginning of 17th century emerged as a social dilemma [2]. Now a days, the employers understand that the incidents due to working circumstanced will impose serious lost to them and their employees and finally their services and productions.

Transportation industry is one of the main preliminary infrastructures of industry in any country so that, without a safe and efficient transportation system and industry, no development and progress will be achieved. A brief investigation of this industry demonstrates that the quality of transportation network is one of the main distinguished subjects in industrialized and undeveloped countries. In this respect, work conditions for the driver will effectively reduce and eliminate accidents and their related costs.

Research Methodology: The main task of this study is to investigate and identify the main risky circumference factors for the drives in order to control and reduce human factors during driving. The methodology is applied, measurable and conservative which looks into the details of documents and evidences and questionnaires to find out the human mistakes as train drivers and their relation to the accidents. We studied the information took from 130 individuals which, randomly selected from 300 members of train drivers during 2004 to 2006. Following questionnaire was distributed between those mentioned:

During the accident that you were directly interfered on date:……, which of the following elements related to your work circumference condition had major affects. Please complete your answer by ranking its importance using integer numbers from one to four.

- Personal factors (level of education , age, …)
- Organizational factors (payment, benefits , ….)
- Environmental factors (physical matter, work place, tools and equipments, ….)

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Which of the following elements have been more important amongst the physical factors:

- Transferring of extreme vibration of train to the body
- Lack of concentration due to sound pollution in the cabin
- Extreme heat in the cabin
- Extreme cold in the cabin
- Unpleasant light during night time in the cabin
- Unpleasant air conditioning in the cabin
- Existing of gas and dust fumes within the cabin

Which of the following elements associated with the work place, equipments and tools have more affects on the accident:

- Uncomfortable seat within the cabin
- Drive controlling panel
- Control panel equipments (handles, gears, ….)
- Difficulty in using signs and indicators (pressure gage, ….)
- Difficulty in back and forward observation due to unsuitably design of doors and windows and facilities within the cabin
- Difficulty in hearing due to the Lack of headset
- Unpleasant size of the cabin
- Dazzling due to wrong position of doors and windows
- Disruption d or lack of communication systems (wireless systems, ….)
- Lack of supplementary tools necessary for handling of equipments which are difficult to carry by hand
- Extreme exhaustion caused by working condition and using equipments
- Unpleasant conditions caused by improper arrangements of equipments and tools
- Deficient and old equipments and tools
- Depression caused by repetitious activities and working with equipments and tools

Which of the following factors related to the muscular and skeletal complains are much more important to the accident:

- Back exhaustion
- Back pain
- Neck pain
- Extreme pressure caused by work on the body
- Neck rigidity
- Shoulder and arm pain
- Hand and wrist pain

Research Body

Train Rider and the Duty: The train rider has the main key factor. He should first check the train to ensure that it is technically in proper condition. During the trip, he should take care of the signs, speed and limitations to be able to control the train acceleration or its speed. Unlike the past and old train systems, nowadays, train riding is different and take should be given to the control equipments, signs and pressure gauges and etc.

Main Factors of an Accident Caused by Train Rider: A quick look into the conditions of the work circumferences for the train rides, demonstrate the following elements which should be improved to reduce the accident:

- Improper arrangements of equipments and tools
- Lack of systematic activities caused by inexpertly control
- Unpleasant and weak physical condition exists in working place
- Muscular and skeletal complains caused by working conditions or past records
- Breakdown of equipments and tools

Human factors may be caused by physical or mental illnesses and also family problems which may be related to the disproportion of job and the person, Lack of enough training, salary and benefits.

Job Factors: Advancement chances and developments, unpleasant circumferences conditions and etc. may cause job dissatisfaction.

Administrational Factors: The organizational factors will contribute the accidents and are directly related to constitutions, disciplines, rules and style of the system. Amongst them, the cross duties and inadaptability of constitutions and rules with the new conditions may be mentioned.

Circumference Factors: Circumference factors consist of physical, work space, tools, equipments and etc.

Human Factors: Circumferences, equipments and materials are the main factors of a system, which are led by the human factor to manage a system [3]. Disoperation of any of these factors may cause disruption for the system. Accident is a kind of disruption for a system which is caused by any of those factors. Human recourses are the main investments of a system which help to fulfill the tasks of an organization. The safety and validity of a system will mainly be achieved through its human activities in conjunction with the technology and science as tools. Therefore, it is necessary to value and appreciate the human resources and endorse their needs and respect their legal requests.

In this respect, it is realized that usually the human factors in the form of body weakness, ignoring the safety roles, personal and family problems, Lack of experience and skills, abnormal communication with colleagues and extreme daily working time have direct affects on accidents[4].

Prime Aspects in the Study of Train Accidents: Studies of previous train accidents are mainly important as:

- To prevent future similar accidents
- To estimate the human loss of the organization.

As the accidents are frequently happened, thus a systematic and regular investigation to categorize them in the form of the source of phenomenon will lead to remove the main causes such as repairing of equipments, imposing more control system and improving of the working conditions in order to minimize the risks.

Main Ergonomic Factors Due to the Train Rider Mistakes: The main question rises after any accident, is about the causes or the source of train rider imprudence. With respect to the ergonomic factors of accidents, we can mention the following parameters:

Physical Conditions of Work Place

- Lack of enough light
- Noise and extreme sound
- Dazzling condition
- Unsuitable temperature
- Lack of air conditioning system
- Presence of dust
- Lack of vision

Driving Space, Tools and Equipments

- Position and the height of the seat
- Unnecessary activities to access the tools and equipments
- Irregularity of working chairs and boards
- Breakdown of the working tools and equipments
- Difficulty in reading and viewing the monitors and control equipments
- Unsuitable arrangements of equipments and furniture

Skeleton and Muscular Complains

- Physical and job disproportion
- Exhaustion and sickness caused by work condition
- Previous background of the complains
- Extreme pressure on an body organ
- Continuous need to sit, which may cause physical complains
- Similarity and repetitious in working activities

Administration

- Lack of expert director
- Lack of safety disciplines
- Disregarding of working standards

Regarding the above Mentioned Factors, the Following Results Should Be Considered:

- Making suitable the cabin space of GM locomotives based on UIC standard will be effective in reducing the accidents and costs and improving the productivity [5].
- Making suitable the arrangements and design of working circumferences for the train riders will be effective in reducing the accidents and costs and improving the productivity.
- Reaching a normal physiologic and maximum anatomic access will be effective in reducing the accidents and costs and improving the productivity.
- Prepare enough lightening, because of the increased number of accidents at night.
- Ignoring the health and safety aspects will cause the accident to happen by train riders.
- Unsuitable forward and backward observations view will cause the accident to happen.
- Similarity and repetitious in working activities is one of the sources of train accidents.

- Unpleasant noise and sounds is one of the sources of train accidents.
- Transmitting of vibration from the cabin to the body of the train rider will be one of the major sources of train accidents.
- The extend of working time and its related fatigue effects on the body, will increase the accidents.
- Skeleton and muscular complains of train driver itself will increase the accidents.

Ergonomic and its Effects on Productivity: Human factors engineering knowledge follows common aims and has sympathy with the productivity. According to the size of the body and personal necessities, this knowledge helps to set all working requirements in their exact and expected positions to be accessible by the staff.

One of the main aspects in this area is the importance of human health and safety to reduce the risks and incidents caused by mistakes and its role in productivity of organization. Of course, Human health is subjected to dominant working circumference and ergonomic conditions. In brief, ergonomic factor tries to reduce the risk of mistake and to eliminate personal exhaustion and therefore, improve the mental conditions of staff and reduce the accidents and costs, leading to increasing of the productivity.

Ergonomic and its Role on Industrial Developments: Experience shows a direct and close relation between production and working circumferences in any situations such as, transportation industry. Therefore, study of accidents and its high values of cost effects are significant and can lead to achieve valuable developments and growth for transportation industry. In addition, this study can help us to determine the priorities of planning to reduce the incidents and to establish a branch of management as Accident Control Management. This branch can not only help to reduce the cost of incidents, but also should be useful the relevant waste such as, energy waste.

Major Difficulties of Train Riders Based on Their Opinions: Major factors due to working circumferences and ergonomics of train riders which have unpleasant effects on job functioning was investigated through a questionnaire completed by 130 affiliates of a community with 400 members of train riders in Tehran railway. The results can be summarized as follows:

- They believe that compared to their hard and heavy duty, they don't receive enough respects from railway organization.
- They believe that payment system based on mileages is inappropriate and new reasonable methods based on various parameters should be considered.
- They believe that their working circumferences are inappropriate, unpleasant and polluted and usually with deficient air conditioning systems. Dust, pollution and gas fumes in cabins cause serious brief problems.
- They believe that the seats of train riders are usually upset and all together the most horrible conditions within the cabins have serious affects on their efficiency and mental conditions.

Therefore, every train rider faces hazardous, physically polluted and unsuitable conditions which discourage them in their important duties.

Cabin Analysis of Locomotive Riders: Regarding the similar questionnaires distributed among the same 130 individual statistical society, the environmental cabin analysis has done and the following results as tables 1 to 8 are achieved for each part of rail sensitive nodes across the country:

Major Factors of Train Accidents: The following factors are achieved from data analysis of supplied questionnaires, indicating the source of train accidents:

- Cabin temperature
- Effect of cold weather
- Night view
- Air conditioning within the cabin
- Gas Fumes
- Uncomfortable train rider Seat
- Guidance panel
- Control equipments
- Indicators
- Vision problems
- Hearing problems
- Professionalism
- Breakdown of wireless systems
- Extreme exhaustion of train driver
- Breakdown of tools
- Hard Working Conditions
- Back Exhaustion
- Back Pain
- General Pressure

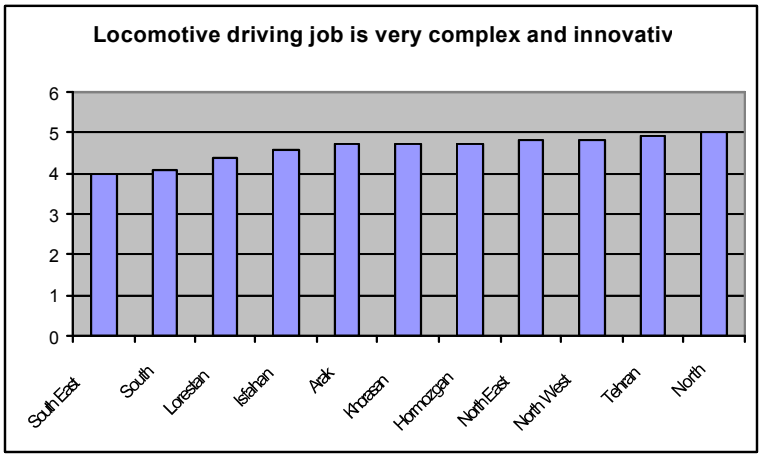

Table 1: Locomotive driving job complexity and innovation

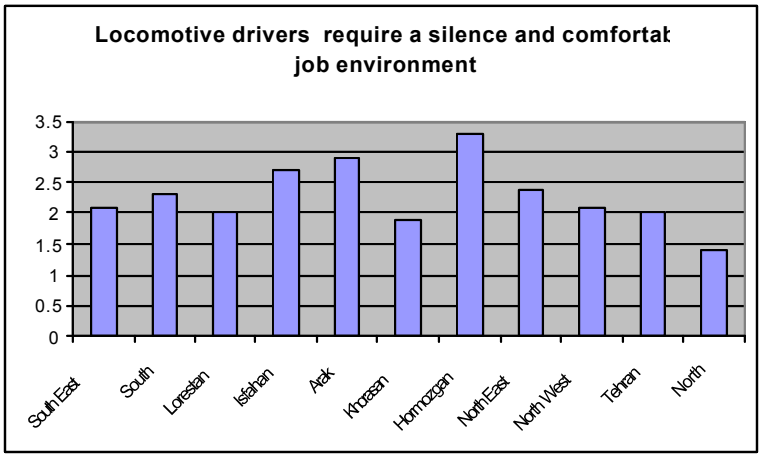

Table 2: Locomotive drivers job environment comfortability

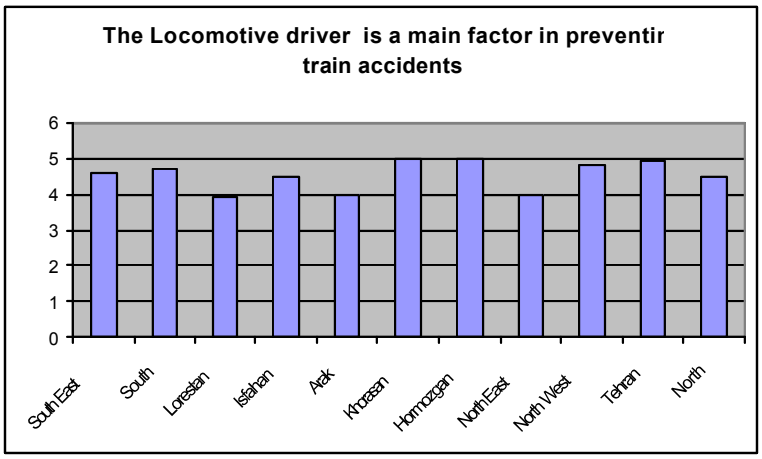

Table 3: Locomotive driver factor in preventing train accidents

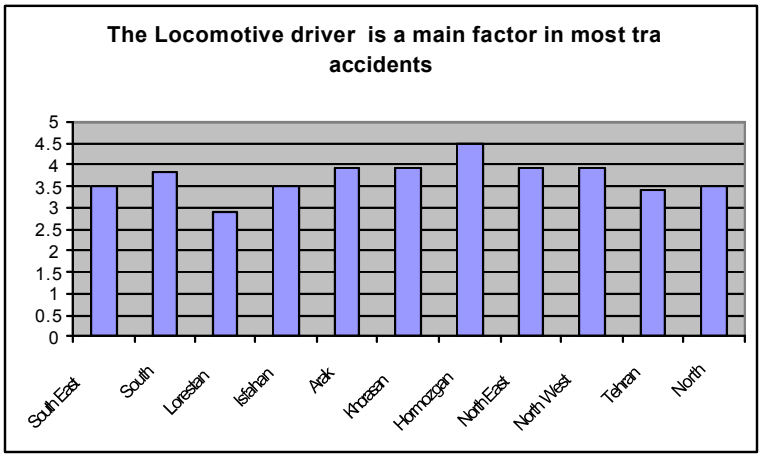

Table 4: Locomotive driver factor in train accidents

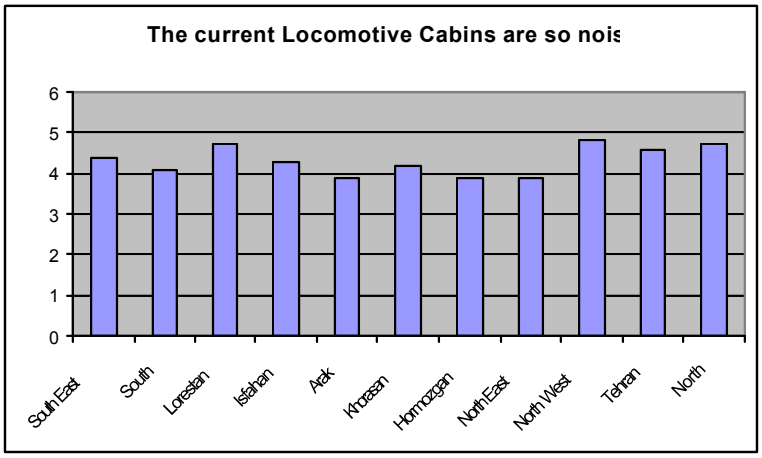

Table 5: Locomotive cabins noise

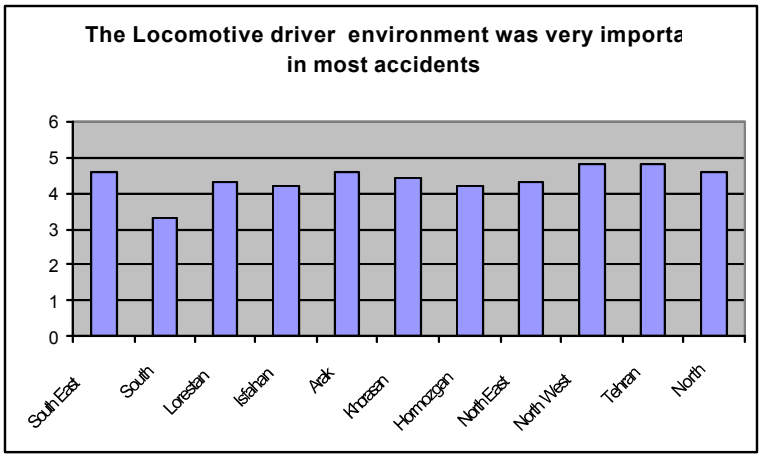

Table 6: Locomotive driver environment

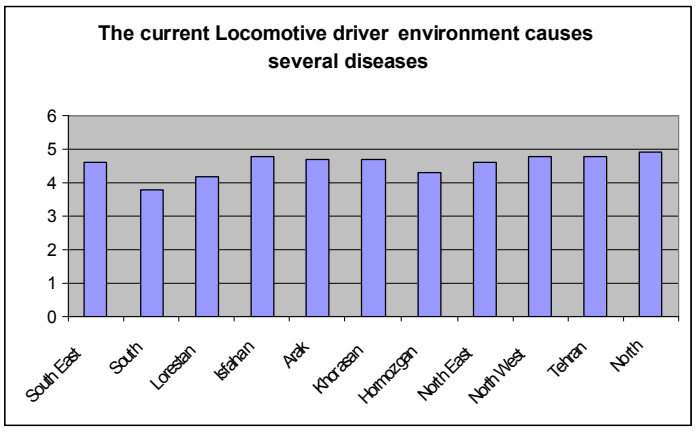

Table 7: Locomotive driver environment diseases

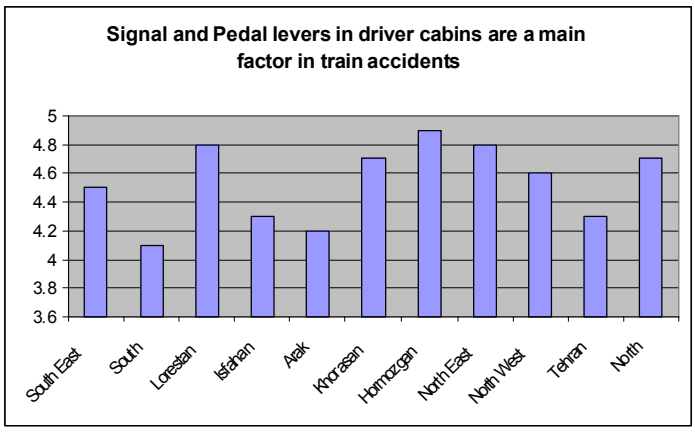

Table 8: Signal and Pedal levers

If the organization can improve these factors, most of the incidents caused by human will be reduced. Study of imposed costs caused by accidents from 2004 to 2006 shows a total value of 4 million US$, which can be reduced remarkably by improving of working conditions that increases the productivity.

DISCUSSION AND CONCLUSION

As mentioned, human is complex of different and influential mechanisms, which may cause a normal person sometimes shows unexpected and unusual behaviors. Thus, understanding the effective conditions on human factors can lead to predict his/her manner which is very important for any administration. On the other hand, improving the working conditions will be valuable and will eliminate those factors which deteriorate the human efficiency.

So, the railway industry consists of various job attractions with respect to human factors engineering projects. Therefore, evaluation of working circumferences for train riders has significant effects on improving the productivity, reducing human mistakes, accidents and thus the costs. This research makes uses of 130 train riders which presented their experiences during 2004 to 2006 in the form of questionnaires. The results were analyzed and led to 19 major factors. With controlling these factors, it is possible to save unexpected costs imposed by accidents and thus, improvement of productivity and efficiency of the whole system could be possible.

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