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Psychological Aspects of Accidents in Area of Road - Railway Grade Crossings

1. Introduction

From history, we remembered the first period of motorization. The famous English law - *The locomotion act*   for many year stopped development of that branch. Cars could only following the man with red flag, which was warnig pedestrians against automobile.In that time, the railway was been victorious after first falls and time of unpopularity. In that first historical period , railways used of traditonal human pathes as valleys of a rivers, sea sides etc.In many cases, tracks crossing old roads but very low frequency of trains was not the special disturbance for people.Therefore railway received the privilege of priority very easy, as the meant of mass transportation. It was a genesis of *rail - road grade crossings.*
Now, we have many such crossings and many problems in every countries.

2.Some Facts and Statistics

In all Europians countries , we have many thousands of poins of probale collisions *train - vehicle.*
Table No 1 shows number of such crossings in Europian Railways Organizations and average density (crossings/ km of railway line). There are various . But from our point of vies, more interesting is a frequency of accidents on rail - road grade crossings in Europian Countries. These data I prezent in the next table No 2. You can see, that I can be proud because in 1990 ,Poland occupied the fourth position in Europe, and had been better than eight position of Deutschland . Unfortunately, since 1990 , situation quickly fall down . We have two probably reasons of that changes:
1. The frequency of trains on Polish State Railways discreased as result of another economic strategy.
2. It leads to limitation of number of R - R crossing, especially crossings watched by staff of railway.

One of results of such situation was increasing of accidents number from 131 in year to about 300 per year (near 2.5 times accidents more). In that time, BundesBahn designed for improvement of traffic safety level on rail - road crossings amount 0.75 mld DM in each year. High intensivity of these efforts significantly influences the number of accidents between trains and vehicles. It was reduced from 445 to 228 at last about 50%.

It is true, that accidents on rail-road crossings there are only small part of general number dangerous situations in traffic (in Poland - 0.53% of all traffic accidents , 1.71% of fatal accidentsw and 0.23% of all accidents. But we m ust point, that from psychological point of view, crash *train - vehicle* is horrible and tied with very tragic consequences. They are especially outrageous for public opinion .In Polish law regulation . the accident on area of rail-road grade crossing belongs to the cathegory of railways accidents (exactly *train accident)* but not registered as normal traffic accidents

We can not forget about *near \accident* problem ,too. In Poland ,each year 320 bareer are broken, on the rail-road crossings. In practice , such situation had been happened everyday. From one hand it shows the real shape of that phenomenon, but from the other hand it could be a picture of lack of discipline of polish drivers.

3.Formal Regulation of Rail - Road Crossings

The Management of Polish State Railway divides Rail - Road Grade Crossing into four basic cathegories. There are following types:

- **the cathegory** *A.* Crossings , protected by full bareers and cotrolled by railway staff.[3360 crossings - 26 accidents in 1995 , *accidental coefficient* - 0.71).
- **the cathegory** *B.* Crossings, protected by half-bareer, eventually supported by red blinking lamps. Moving bareers and switching on lamps realize by automatic system, initiated by coming train.[257 crossings - 10 accidents, *accidental coefficient* - 3.89)
- **the cathegory** *C.* Crossing with only blinking lamp, switch on by coming train from time distance 60-80 sek. [1539 crossings , *accidental coefficient* - 5.59]
- **the cathegory** *D.* Crossing with only typical road and rail signs and nothing more.[11860 crossings]
  176 accidents, *accidental coefficient* - 1.48]

From the psychological points of view, most interesting for us there were two last cathegory of Rail- Road grade crossings. On the two first, drivers had to stop theirs vehicle, because the way is closed by bareers and , practically only breaking of its or errors of railways' staff leads to an accident. In the last cathegories, the way is everytime open, but at last, a driver deceides when and where hist vehicle is be stopped. It is interesting too, the accidental coefficient for cathegory C is relatively higher that for cathegorie C, where the driver receives an information that train is just coming to crossing. In crossings, which belongs to cathegory D, such information is not available, and driver had to be careful. Therefore the accidendal coefficient for that cathegory is relatively low, but in rough accidents statistic, most of them took place in that cathegory of rail-road grade crossings. Traffic safety is tied strongly with decision making proceedure. Therefore our investigation concentrated on these two last cathegories .

4.Methods

We practically used four main methods in our research of psychological problems on R-R crossings:

1. **Analysis of statistical data,** which delivered to us by General Management of Polish State Railway.It contained basic information about all R-R accidents in 1995 year with

the time, day of year, place of collisions , its consequences, list of victims and damages and eventually name of causer.

2. **Questionnaire for drivers** about theirs experiences tied R-R crossings. That questionnaire specially prepared for our research and printed in most popular Polish journal for lovers of motorization - „MOTOR" (80.000 of prints). The questions directed on evaluation technical state of R-R crossings own experiences of road users, their behaviour and observations of other drivers.

3. **Observations of drivers' behaviour in R-R crossings.** We made it with the help of video camera and cordless microphone , which give possibility to record additional information and the comments of the observers. We observed activity many drivers on R-R crossings cathegory C and D in such forms as: speed, stopping vehicles, method of control of space before and in area of the crossing etc.

4. **Deep analysis of accidents in R-R crossings on the base of railway and police reports and other sources.** For that goals we select two fatal accidents ,which happened in district of Cracow.

5. Results

5.1. Main Results of Analysis of Statistics Data

1. Most of accidents in R-R crossings were caused by drivers. Only 12 accidents caused by railway workers (only in cathegory A). We could not find some relations between accidents and such determinants as: hour, day of week , weather conditions and season of year. Probability of accident is tied with the frequency of trains and frequency of passing vehicles. The random factor plays important role in generating of accidental situation, but most of them had the character only *near accidents*. We had to accept the Hepburn theory, that accident happened only, when all accidental factors appeared in exactly this some time.

2. We have in Poland 320 accidents in year, in average 1 accident daily. But we had each year about 300 cases of breaking bareers on the R-R crossings A and B cathegories.. It is evidence of many near-accidents, which happened when a driver avoided the crash his vehicle with a train.

3. The role of alcohol as determinant of accidents in R-R crossings grows and grows.Very often we found in statistics of accidents, the information that vehicle no braked the front of the train but crashed the flank of engine or coaches or vans . We have 2 accidents, when te motorcyclists had collision with train ,which was waiting for green signal just in area of R-R crossing . It is clear that drivers seriously ignored the traffic regulations and self-discipline

5.2. Results of Questionnaire for Road Users

Our questionnaire was printed in the Polish journal „MOTOR" . We got forms, filled by 226 readers from all parts of country. There were in bigger part unprofessional drivers (79%) . They had a possibility to evaluate the quality of surface and quality of road signs in area of R-R crossings. Their opinion shows the figure No 1.
. You can see, that most of our respondents had very bad opinion about the surface in area rail and road crossings. Many drivers said with sarkasm, ,that bad surfase forced them to reduce their speed and this fact is a factor , which guaranted the traffic safety in this area. We have also the answers , that people responsible in Poland for that catastrophic state of surface, ought be trained in the Bundesrepublic
.Our drivers more satisfied for the quality of road sign in area of a crossings. It show fig. No 2. We could not relation between experience of drivers and their ignorance of traffic safety principles. Sometimes in wery well known crossings, they pay attention for timetable of trains. It is very significant, that more about 30% of respondents saw situation ,when a car had been closed on a tracks among a bareers. It supported our hypthesis about great number of near-accidents on the crossings.

5.3 Results of an Observation of Drivers' Behaviour in R-R Crossing Area

.In first part of our analysis we said , that the drivers had tendency for demonstration of dangerous form of behaviour. The General Management of Polish State Railways prezented similar opinion. But our observation supported that opinion only in part. We noticed only 1 situation, when the driver completely ignored red blinking signal .Generally , we recorded four types of drivers' behaviour ,when drivers were crossing the tracks

- *stop ,before tracs;*
- *observation of area of crossing by a driver;*
- *driving in the area R-R crossing , without stopping vehicle;*
- *driving in the area R-R crossing without observation and without reduction of speed.*

But the relation between these types of drivers' behaviour was different for cathegories C and D.It show in fig. No 3 and fig No 4. It is clear, that in R-R crossings cathegory B, the percentage of more dangerous forms of drivers' behaviour had been minimal . But in area of R-R crossings of cathegory D, where probability of collision is greater, drivers demonstrate bigger percentage of evidently dangerous of form of behaviour. What is reasons of such differences? We could give two probable answers.

1. The frequency of trains in R-R crossings both cathegories could be different too, and experienced drivers know the probality , that the train comes , is smaller on crossings cat. C than cath. B. But that explanation is not satisfied for us.
2. According the hypothesis of Lars Aberg , drivers had tendency for avoiding troubles by ignorance of difficult problems on R-R crossings. Undobtely, the situation in the R-R crossings cathegory D is unclear for driver, and therefore, when he has not a full control of s the situation, (for ex. in spite of limitted visibility etc.), he simply ignored the risk of crashing and driving his vehicle quickly and without any observation. Our results supported that hypothesis. It suggest , that efforts of Management of Polish State Railway ought to more intensively changes cathegories of R-R crossings from D to C. It needs reconstruction of these crossings.

5.3. Results of Deep Analysis of Accidents in R-R crossings on the Base of Railway and Police Reports and other Sources

For this goal ,we select two fatal accidents, which happened in 1996 on the South of Poland.

++ In the first accident, two young ladies came into rails with minimal speed of theirs car (about 10 km/h) .It was happened in R-R crossing cathegory D (without blinking lamps). The girl , who was driving, notice the engine ,which was coming in the last moment , she rapidly accelerate her car, and motor stopped in this moment. The visibility of arrounding that crossing, had been very limitted , by bushes, and driver of engine could not to see a crossing car ,earlier. Heavy engine crashed small car and both girls were be killed. In expert's opinion - they had only 2 second for starting motor of their car again or escaping out from the car. From the psychological point of view, we had here typical lack of driver's attention. Our investigation explained of the reason of it. The girl was be a owner and driver of that car, came with the visit to her fiance, who worked as the salesman in a shop near the crossing.In witnesses opinion , she moved her car and driving without control of area in front of her car, which running forward with minimal speed. She did not noticed the engine on the rails. Two photos show the picture of R-R crossing and the point of view from the cabine of engine driver.On first of them ,you can see group of investigators

+ Similar situation we investigated on the R-R crossings cathegory C (with automatic signalization) nearby Zakopane. The fatal accident was caused by young montainer, who lived nearby the crossing. He was the driver of small fiat 126. On the fatal morning ,he ignored red blinking signal and his car did not stopped before a tracks. The consequences of crash were be terrible: killed driver and smashed car. Official report of the investigate comission show as the main reason of the accidents the lack of driver's discipline. But people said that young driver had been hollow drunk and he listened a pop music by earphones of his walkman . These facts were not a true.The victim's family reported, that in the fatal day , the driver waked up very late and he went to his job in hurry. He paid attention at the red signal (which switched on 80 sec before coming the train) but he did not know how long the lamps blinked and deceided to cross the tracks. It was characteristic , that young driver had no any driving licences, but after several attemps, at last he passed through the exam. His first driving licences he wanted to take from the office just in the next day.

These examples show that in most of accidents is very diffcult to precise of the role of human factor , especially quality of processes of decision making. Sometimes, the true is never be discovered

6. Conclusions

1. The system of clasiffication of R-R grade crossings must be changed. New rules of classification had to calculate the frequency of trains and frequency of vehicles but frequency of accidents, which happen in the R-R crossing, too.
2. The psychological aspects of accidents in R-R crossings ought to discuss with a drivers and candidates for driving licences, in the programs of the basic and improvement training.

3. The processes of making decisions by drivers in R-R crossings would be more simplied. It could be realize by changing their structure from cathegory D to C or B, when the driver got clear information that the train is coming or not coming.
4. The surface in R-R crossings had to improve.