How to evaluate the accident situation in India?

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Abstract

The increasing economics in India has an enormous growth of its road traffic. As observed from official Indian accident statistics the number of road fatalities are one of the highest worldwide. In contrast to most industrialized nations they have an rapidly increasing trend. To come along with this trend it becomes more than essential to understand the traffic accident situation. The official Indian accident statistics gives a glimpse of only basic information. Therefore more detailed data is needed. By using In-depth accident data and officially representative statistics the current accident situation can be evaluated in India, if a suitable weighting methodology is considered. Hence in 2009/2010 a pilot study with the collaboration partner JP-Research India pvt. Ldt. was gathered in Tamil Nadu in south of India. In-depth accident investigations were done around the Coimbatore area on four highways. At first, the collected data is evaluated.

Due to consequent and continuous further development based on the first approach a methodology similar to NASS/CDS/GES in the US and GIDAS in Germany was developed. Of course all relevant accident related parameters including pictures and severity information were collected. As a matter of fact based on scaled sketches and reconstruction benefit analyses can be done in order to analyze the accident scenery in India. As a first outcome influence from infrastructure, missing education and vehicle safety were identified as key parameters in order to reduce the number of accidents and casualties.

To compare the accident situation against international standards an accident classification for left hand traffic was developed based on the German Insurance classification system. Looking into detail additional accident types were identified and added to create an Indian accident type catalogue.

The positive results encouraged several OEMs to participate in this investigation and together with BOSCH a consortium was established in 2010/11. Within one year from beginning in May 2011 about 200 highway accidents were collected, reported and reconstructed using the new standard. Hence a first good overview of the accident situation is available for the Coimbatore Tamil Nadu area. The major target for establishing accident investigations is the extension towards other states of India and urban areas to achieve a better overview of the accident scenery. Therefore local and national authorities have to be embedded in order to strengthen the awareness against traffic safety.

Abbreviations

NASS	National Automotive Sampling System
CDS	Crashworthiness Data System
GES	General Estimates System
OEM	Original Equipment Manufacturer
RASSI	Road Accident Sampling System – India
GIDAS	German In-depth Accident Study
GDV	Gesamtverband der Deutschen Versicherungswirtschaft e. V. (German Insurance Association)
ESP®	Electronic Stabitlity Program
ABS	Anti Locking System
CJB	Coimbatore, Tamil Nadu, India

MOTIVATION AND APPROACH

India, a country as large as the whole of Europe is a country with a rapidly growing economy and thus a great need for mobility. The traffic situation (especially the road traffic) is very different from European or North American traffic. A significantly different distribution of the vehicle classes can be recognized.

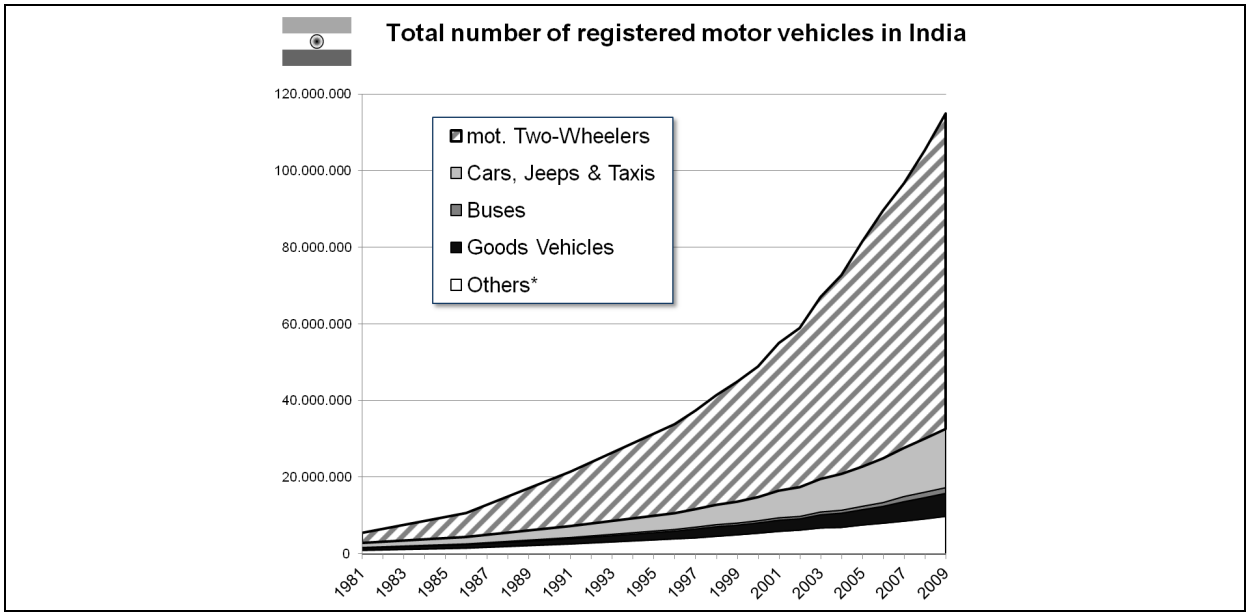

Figure 1. Total number of registered motor vehicles in India (Trend 1981-2009) [1]

The largest share of registered vehicles in India with about 72 percent is the category of motorized two-wheelers. As shown in Figure 1, this vehicle category is the fastest growing vehicle market in India. [1]

In Germany, the share of registered motorized two-wheelers including vehicles with insurance number plate only (e.g. motorcycles up to 50cc), is approximately 11 percent. [2] This and the comparison with India is shown in Figure 2.

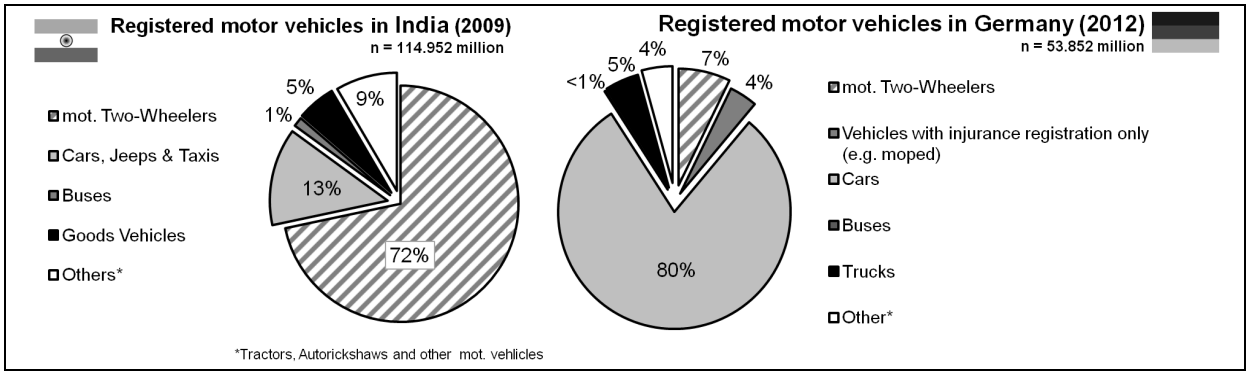

Figure 2. Registered motor vehicles in India 2009 (left) and Germany 2012 (right) categorized by vehicle type. [1] [2]

In Addition to the different distribution in the vehicle classes, totally different trends regarding the number of accidents, number of casualties and fatalities can be seen in India.

The general trend of falling number of annual traffic fatalities and accidents in the western world cannot be seen in India. On the contrary, the number of fatalities, the injured and the number of accidents is rising unabated without a change in trend.

As shown in Figure 3, India has an increase in yearly registered road deaths of about 70 percent over a decade. In Germany, during the same period, a reduction of nearly 50 percent was officially registered (Figure 4). [3] [4]

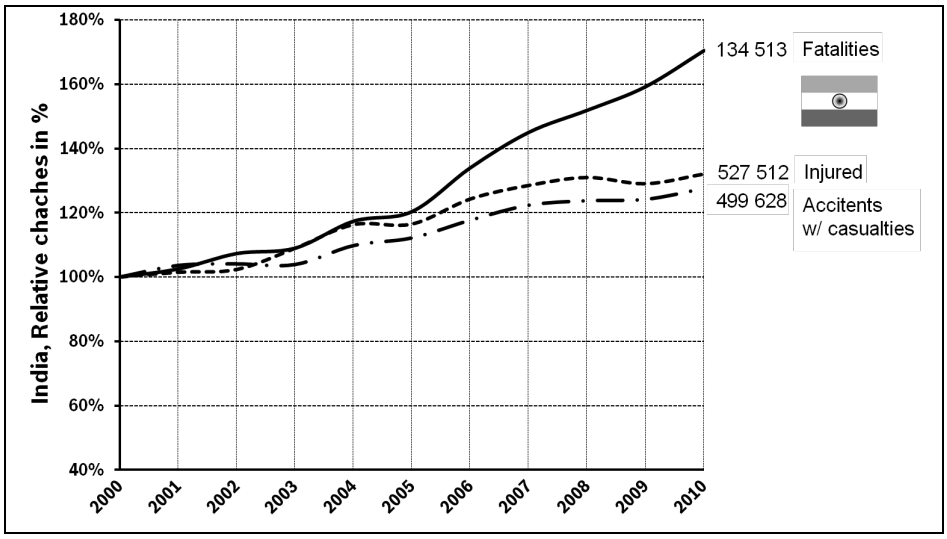

Figure 3. Relative changes for Fatalities, Injured Persons and Accidents with casualties since 2000 in India [3]

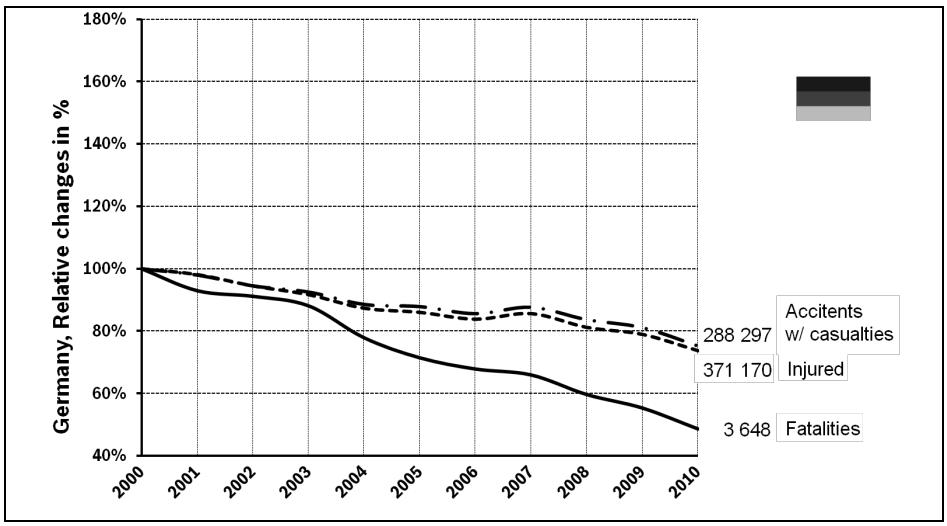

Figure 4. Relative changes for Fatalities, Injured Persons and Accidents with casualties since 2000 in Germany [4]

The alarming trend of accident statistics in India shows clearly that it is very important to investigate the accidents more closely to find possible solutions to prevent accidents, or to reduce the consequences of accidents in the future.

INITIAL CONDITIONS

Official statistics regarding accidents in India are available in national and state wise reports. More detailed information about accident causes, accident conditions and consequences are roughly obtained. There is a lack of engineering data in the reports released by the Officials. This makes the international comparison very difficult, also certain information is not available or is defined differently.

To start an In-depth accident data collection around Coimbatore in south India the Corporate Research of Robert Bosch GmbH assigned in 2010 JP Research India private limited with a pilot study. The used accident database by JP Research is similar to the US accident databases NASS/CDS/GES and was adapted for India.

The In-depth investigation covers an area of national highways with some connecting roads around Coimbatore, Tamil Nadu. After a successful completion of the pilot study, in the beginning of 2011 a Consortium[1] was formed, which aims a long-term continuation of In-depth data collection.

IMPROVEMENT OF RESEARCH METHOD

With the establishment of the Consortium more important additional parameters were included. In addition to important accident reconstruction parameters variables for international comparison and variables for better accident description have been integrated.

Important variables known from GIDAS are the classification of accidents by Accident Type and Accident Kind. In order to have useful accident classification for India, it is developed an Accident Type catalog based on the GDV[2] accident classification. All Accident Types were translated to left-hand traffic and additional special types relevant for India were added in the scheme. With the introduction of these and other variables the international comparisons in future is less complicated.

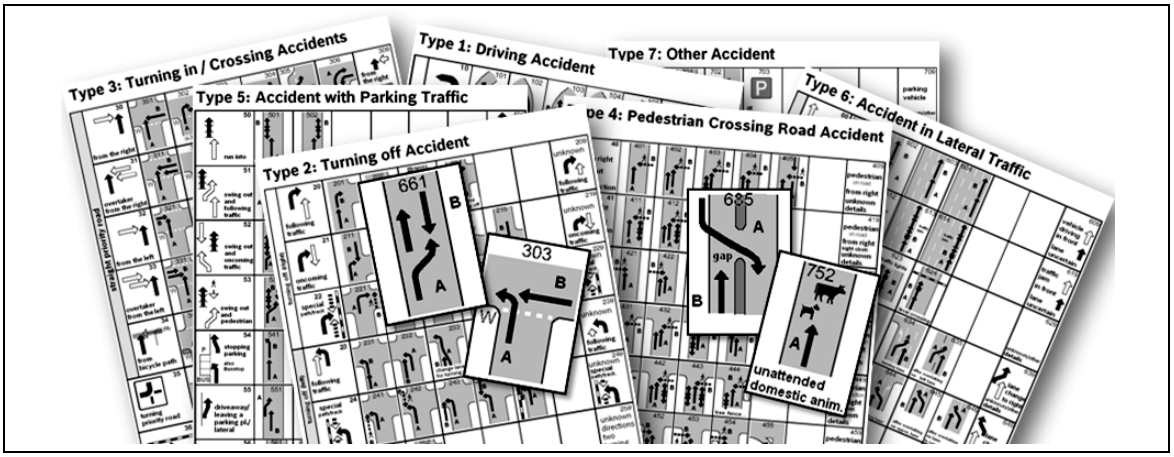

Figure 5. Modified Accident Classification System based on GDV Classification – Accident Type

In addition to the further development of the database, the training of the Indian project partner[3] for data collection was continuously supported during the phase of the pilot study and the current project. So it is ensured that with official start of the project, high-quality data are available.

[1] Daimler, Nissan, Toyota, Bosch
[2] German Insurance Association
[3] JP Research India pvt. ldt.

A focus of support was the preparation of detailed sketches from the accident scene, because this is the main basis for later reconstruction. Methods to interpret the tire marks, scratch marks and other accident details to understand the vehicle movement during the accident, are intensively trained. This includes also different techniques to indentify the final crash position (position before clearing the road.

In spite of the often late arrival of the investigation team at the accident scene, often it is possible to indentify the final crash position from the parking position besides the road. The following Figure 6 and Figure 7 shows, how to find the final crash position by using the towed away position. In this example case, it is determined by the steering angle of wheels, towed away position besides the road and the end of tire marks after collision.

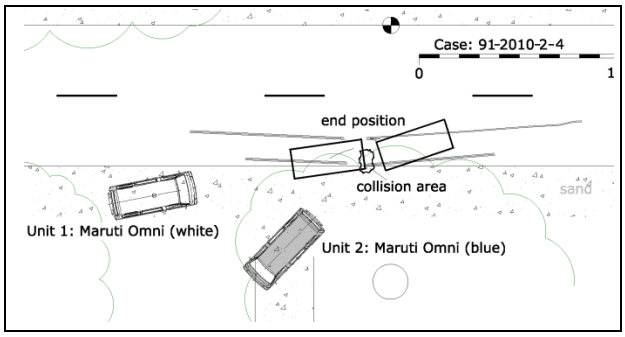

Figure 6. Part of scaled sketch, RASSI case no 91-2010-2-4 [5]

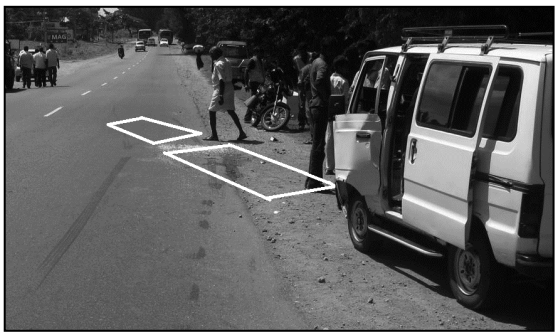
Figure 7. Picture from accident scene. Reconstructed end position is marked [6]

After an accident in India normally the vehicles are moved only a short distance to the side usually by pushing by hand or pulling by another car. This and the fact that you often find blood marks from rescue or first aid on the ground, gives the investigation team the basis to reconstruct the final crash position. Normally, the vehicles remain some time (sometimes several days) at the accident scene and the investigation team can use this method in many cases.

RELEVANCE

After the pilot study and with the ongoing data collection since May 2011 initial research findings are available. These results are not only important from the perspective of the automotive industry. Also the relation to government or public authorities is indentified. As a strategy for better acceptance in India it is suited to show the benefit of accident studies in three important sectors: “Education”, “Infrastructure” and “Vehicle Safety” (see Figure 8).

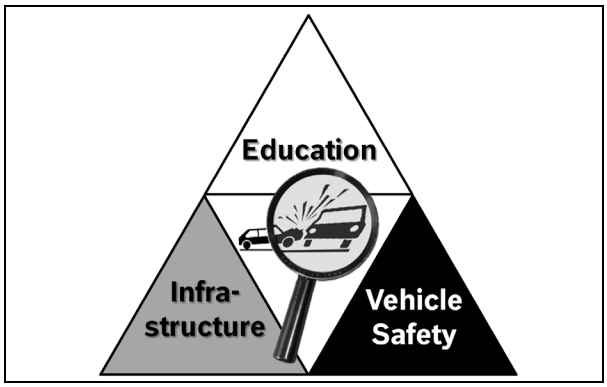

Figure 8. Important sectors of accident research

The sector "Education" includes especially the road safety education itself (better understanding of traffic safety –e.g. using seat belts or helmet usage by two-wheeler riders) and the following of existing traffic rules by the road users (e.g. observe a no overtaking-zone). Important facts regarding characteristics of road or accident relevant installations belong to the sector “Infrastructure”. These two sectors (“Education” and “Infrastructure”) are very interesting for public authorities and government. The sector “Vehicle Safety” mainly concerns to the vehicle manufacture or supplier industry.

Naturally an overlap of contents is possible, but if that explained in these three different sectors the benefit of In-depth accident research is also visible outside the vehicle industry. In almost every accident it is possible to show the problems or find solutions for reducing the accident consequences in the different sectors.

RESULTS

One of the first usable results of the In-depth accident research activity was the identification of example cases for demonstrating the effectiveness of vehicle safety function related to the Indian market. Figure 9 shows the first documented accident in the RASSI database. This was an accident with loss of control after an abrupt avoidance maneuver. An after a hill crest on the road standing two-wheeler was the reason of the avoidance maneuver.

Figure 9. Scene pictures RASSI case no 91-2011-2-1. [7]

Tire marks of the avoidance maneuver and the collision with an in India typical concrete pole is clearly visible. The crashed vehicle with signs of a rollover was found in final position at the accident scene.

Figure 10. Simulation of real RASSI case no 91-2011-2-1 [7] [8]

As shown in Figure 10, the accident reconstruction determined, the accident is related to ESP®, because in front of the collision with the concrete pole, a long skidding event happened. The crashed car (a brand new model – only one week old) was not equipped with the ESP® safety feature.

The detailed analysis of this accident shows the accident could have been avoided if the vehicle would have been equipped with ESP® because after the avoidance maneuver the driver would not have lost control of the car (Visualization in Figure 11).

Figure 11. Simulation of modified RASSI cases no 91-2011-2-1.
Involved car is equipped with ESP® [7] [8]

Besides the importance of this example case to the sector “Vehicle Safety” this case shows also a relevance to the sector of “Infrastructure”. Such concrete poles as a typical Indian boundary of rural roads in case of a collision with a car or rider of motorized two-wheeler results in a very high risk of serious or deadly injury.

In addition to individual case studies, the evaluation of the previously available In-depth data allows a general statement about the accidents situation. Due to the fact the data is collected only in a rural area and a possible underreporting (e.g. single vehicle accidents.) is not considered, at this time the results are not representative for whole India. However, it is possible to identify trends and important points regarding accidents in India.

In the following diagram (Figure 12 left) the distribution of Accident Type (same definition like in Germany) of collected RASSI cases[4] is shown. In parallel, for the period September 2011 to February 2012, the Accident Types of all police reported accidents are collected by the police in the same investigation area (Figure 12 right).

The aim of the parallel request of police data is to develop methods for extrapolation of In-depth data to whole India by using official statistics. Another goal is to improve the quality of RASSI with better notification of new accidents for the investigation team.

[4] Includes cases from BOSCH Pilot Study

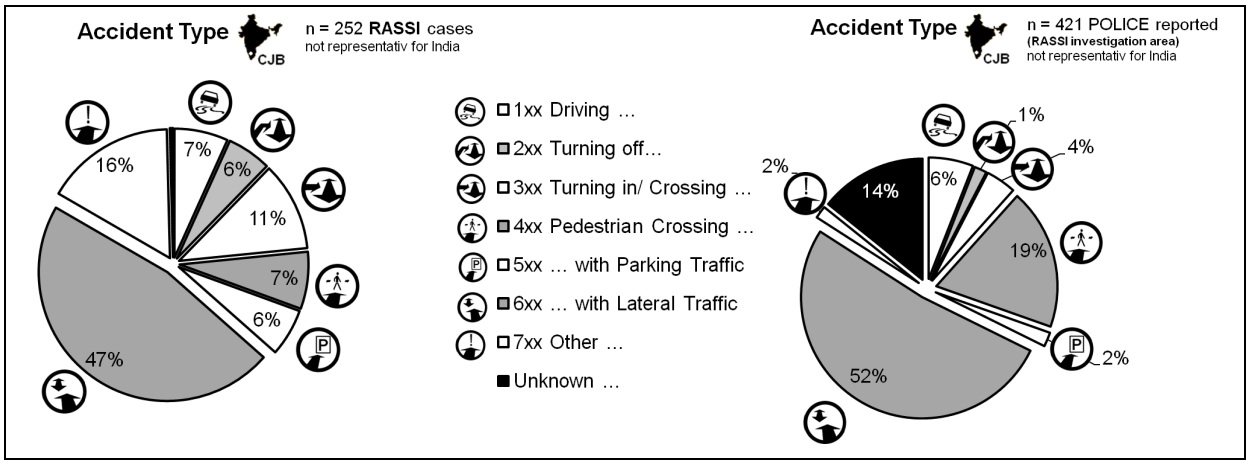

Figure 12. Distribution of Accident Types of RASSI Cases (Status 5/2012) and Police reported cases in the same area of investigation [6] [7] [9]

The analysis shows main problems are accidents in lateral traffic in the investigation area. This is mainly justified due to the fact the investigation area includes only National Highways with a few connecting roads (bypass) in rural area.

The comparison with police data shows in the RASSI database pedestrian accidents are underrepresented. Possible reason is a delayed notification by the police or the accidents are not locatable. This problem can be fixed with an improved accident notification method for example in incorporation with ambulance services.

The following chart (Figure 13) shows the detailed distribution regarding Accident Type of the In-depth cases. By far the largest share is the Accident Type[5] 661. Overtaking maneuver in spite of unclear traffic situation often results in a conflict with oncoming traffic.

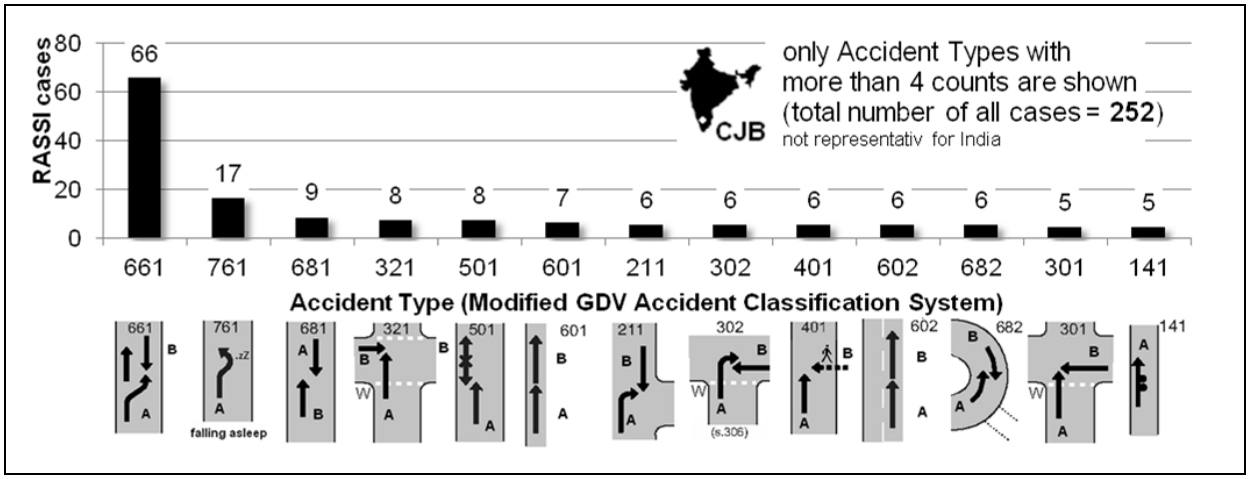

Figure 13. Distribution of Accident Types (modified GDV) of RASSI Cases [6] [7]

The typical consequences of accidents in lateral traffic can be seen with an analysis of Accident Kind (same definition in Germany) (Figure 14). Nearly 35 percents of the documented accidents result in a collision with oncoming vehicles.

[5] Accident Type, modified accident classification system based on GDV

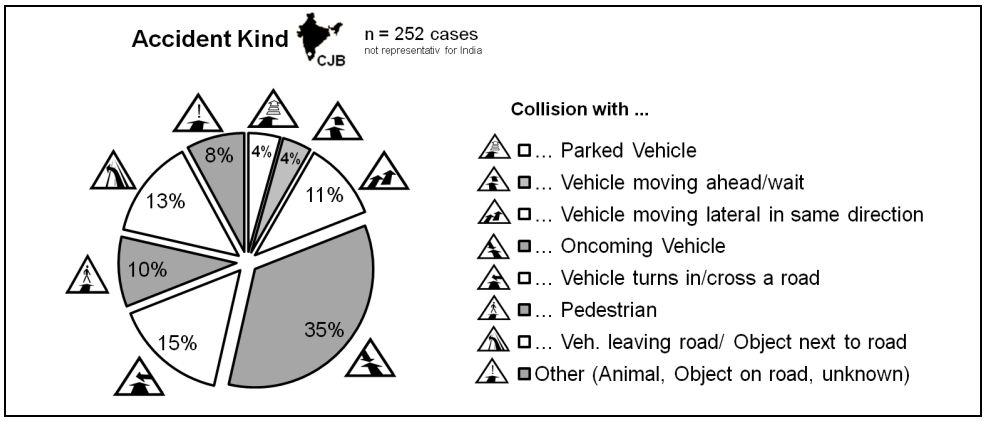

Figure 14. Distribution of Accident Kind of RASSI Cases (Status 5/2012) [6] [7]

An alarming result is visible after an analysis of accident severity. On average, every third accident is an accident with fatal consequences (see Figure 15). In comparison with the police recorded accidents the share of fatal accidents in the In-depth data is only slightly over representative. The police registered in the same investigation area approximately 29% fatal accidents.

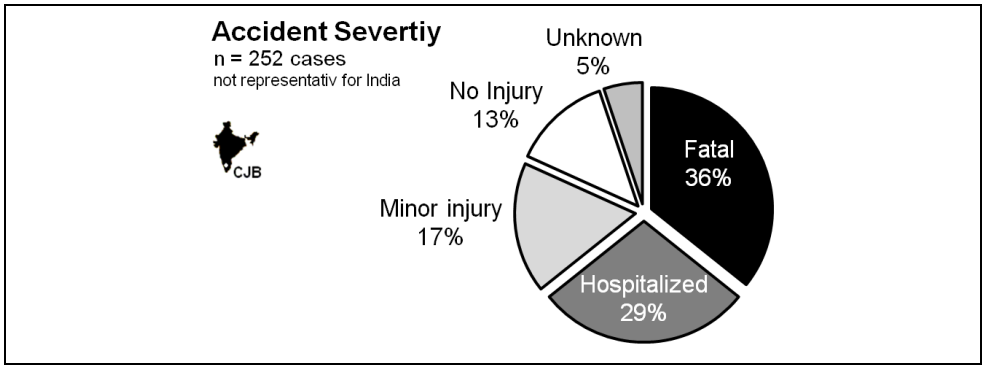

Figure 15. Distribution of Accident Severity of RASSI Cases (Status 5/2012) [6] [7]

For an international comparison of accident severities it is important to note that India has a possible different understanding of categories of uninjured, slightly injured and seriously injured as in Europe. As example, it is possible some accident which counts in Europe to the category of “Slightly Injured” depends in India to the category “Uninjured”. This is due to different understanding of accident parameters.

An important fact is also, nearly 20 percent of the 252 RASSI cases are not reported to the police in the investigation area. It also shows once again the problem of non police reported accidents (official data is underreported) in India. [6] [7] [9] This confirms the assumption that India has a high share of not officially registered accidents. Even the only minor part of category "Uninjured" suggests a high level of unreported cases in the official statistics.

This assumption is based on comparing the number of casualties reported by hospitals with from the police registered number of casualties. The government supported a study in the year 2007 in Bangalore [10], which counts how many patients with traffic accident background are treated in hospitals and how many casualties in traffic accidents are registered by the police at the same time in the same area. In this study are registered 26.191 treated patients and only 6.591casualities recorded by the police. This suggests that approximately only every 4th injured person of traffic accidents is officially registered. Extrapolated to the whole of India, the number of injured persons in traffic accidents is around 2 million every year.

As a possible improvement for the In-depth project, in future the accident notifications should be made not only by police done but also by the ambulance service or the emergency call service.

By using the latest In-depth information it is now possible to make analysis on topics in vehicle safety. The potential and benefit of vehicle safety systems like ABS or ESP® for cars and ABS for powered two-wheeler can be determined with the first results of analysis of In-depth accident data. The results of this are related to roads in rural area of India.

OUTLOOK

With continues data collection and the expansion in 2012, it is possible to consider the urban accidents also. By extending the investigation in other regions of India (e.g. North India), it is also possible to make analysis about the accident situation for whole of India.

The closer involvement of the ambulance system allows a better accident notification and more and better information about injuries and it is possible to consider the official unreported cases also.

In addition to the expansion and improvement of the In-depth accident data collection as a next step a method to extrapolate the collected data to state and national wise results must be found.

As a major result, with help of In-depth accident data, it will be find effective solutions to stop the actual trend of accident situation and to reduce the number of accidents, the number of injured road user and especially to reduce the high number of fatalities in road accidents.

CONCLUSIONS

The official statistics show in addition to a fast-growing vehicle market, the big problem of the high and increasing number of road accidents. To understand the accident causes and find possible solutions, it is necessary to investigate accidents for more detailed information about the key parameters in the sector of “Education”, “Infrastructure” and “Vehicle Safety”. For this purpose, a consortium is established to do a long-term In-depth accident investigation in India.

First analysis based on this In-depth data, show the benefit of vehicle safety systems like ESP® in example cases and describe details, causes and typical scenarios of accidents in rural areas. It also shows that there exists a large group of non-registered accidents with casualties in India. For a better understanding of the accident situation in whole India it is planned for the next level of In-depth accident investigation to expand to other regions and to include also data collection in urban area. The existing consortium is open for new partners from automotive industry or other interested institutions in order to find solutions to make the road traffic saver in India.

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[6] Bosch Pilot Study, data collected by JP Research India pvt ltd.

[7] RASSI Database, data collected by JP Research India pvt ltd.

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