

5. Conclusions

Having considered two European road accident databases in depth we are now in a position to return to the Systems Model of Road Traffic Accidents and the CheckList of Road Safety Systems to evaluate whether the data required by these models is available. Given that the databases are used in the investigation of multiple accidents, it may be unrealistic to expect any project to collect the vast amount of data required by the systems approach for each and every accident. However, we would hope that as a bare minimum, the information at the latent driving conditions level would be available within any database. This would indicate the latent failings that precede the active failure of vehicular, road user or infrastructure factors. This recognition of underlying latent failure would itself be counter to road accident investigation orthodoxy. However, if the research project's methodology allows, an in-depth investigation could then work back to find precise cause of latent failure within the immediate road user, operations management or decision makers levels of responsibility.

5.1 Comparison of OTS and EACS databases

The key differences between the OTS and EACS databases are as follows:

- The OTS database is far more comprehensive than the EACS database, containing over 3000 fields that require completion for each event compared with 822 in the EACS questionnaire. Collecting as much data as is available is a specific research objective of the OTS project, and On The Spot methodology is employed to meet this end.
- Conversely, the research objectives of the EACS project specify a focus on the pre-crash phase, particularly on vehicular factors and safety systems. This reflects ownership of the database by a consortium of car manufacturers.
- In representing nine research groups in six countries, the EACS database has a wider range of accidents than does the OTS database, which is limited to one country only.
- The number of collaborating institutes has however meant that certain data is missing from the EACS database; and that the data collected is prone to other discrepancies resulting from the differing methodologies. The OTS database is maintained by two closely-related institutes and so divergent research methods are not an issue.
- Whilst the EACS questionnaire requires expert and road user judgement as to accident causation, the OTS project does not make comparable judgements as to responsibility.

Comparing the databases, it is clear that the OTS database includes more of the information necessary for the systems approach. Particularly useful features are the amount of data collected, the attention paid to all areas (rather than focusing just on vehicular factors and primary safety), the unified research methodology adopted and the avoidance of interpretation in terms of causation.

While the EACS database includes data from more than one country, at this stage international comparisons are not crucial. We simply need to test the usefulness of the approach in the context of road system.

The SMoRTA model is presented again in Appendix 4, shaded to indicate what aspects of the information needed are currently collected in each of the two accident causation projects. Notes are provided indicating how these judgements have been made. As indicated in Appendix 4A, much, but not all, of the necessary information is collected at the moment by the OTS project. Appendix 4B shows that less information is available to the EACS project, and the number of collaborating research partners makes a change to their investigation methods unlikely. For these reasons, the following discussion will focus solely on the OTS database.

5.2 Safety management in the road system

Having established the more promising of the two databases available, we need to consider how far it would ever be possible to collect all the data required by the systems approach. Issues surrounding the definition of the road 'organisation' and the status of road users as 'employees' of that organisation have been mentioned previously. There are several problems in applying the systems approach to the management of road safety.

Road users choose the trips they make, and there is no one organisation liable when they put themselves and their passengers at risk. On the roads, safety operates at the execution level: i.e. road users themselves are responsible for recognising, avoiding and coping with hazards. Road management in the form of highway codes makes limited provision for road user safety at the higher level of plans and procedures¹¹.

Similarly, near misses are never reported, although in industries such as aviation near miss investigation can provide valuable "free lessons" about organisational safety. The enormous number of road accidents renders the investigation of near misses a logistical impossibility. The structure of the road system also promotes the under-reporting of accidents, in at least two ways: there is no central organisation in charge of overall safety, and there is pressure on the individual drivers to avoid insurance claims¹².

Transport is the overwhelming priority of the road system, with the result that safety is given secondary status for a number of reasons, some of which have been described. This contrasts with the situation in an optimal safety management system, in which the goal of safety would be as important as the goal of production.

¹¹ Thanks to Andrew Hale for the distinction between the "execution" and "plans and procedures" levels.

¹² The exception to this occurs with those occupational drivers who drive within an organisation that is fully concerned with their safety, and that of their vehicles, and so actively discourages underreporting

5.3 The potential for the systems approach to road accident investigation

A number of points must be borne in mind when considering the practicalities of applying the systems approach to the analysis of road traffic accidents. Specifically,

- a systems approach is necessary to identify top-level failure;
- identification of top-level failure depends on the analysis of multiple cases to identify emerging patterns and trends;
- road user behaviour is extremely variable, making the adequate provision of defences in the road system a difficult task;
- road accidents also vary greatly, and so generalisations ought not to be made single cases;
- most road accidents are not investigated in the depth demanded by the systems approach; and
- a database that could support a systems analysis would require the in-depth analysis of multiple cases.

Working through the SMoRTA model systematically can help to determine what information is currently collected, and how far it would be possible or useful to supplement it.

Active failures: local triggers, failed defences, production failures.

Data of this sort is relatively easy to collect, and has long been the focus of accident investigation. The OTS database already includes this data. However, the quality of data collected at these levels varies, depending on the investigating team and their research objectives. While information from the sharp-end is instructive, the quality rather than the quantity of the data is key. For example, the OTS study requires a lot of information on vehicular secondary safety systems, yet the TRL find that this does not really help them to understand why accidents happen.

Active failures: driving conditions

Neither database currently includes information on the error- and/or violation-producing conditions that preceded an individual road accident, except in the form of road user testimony. Information at this level is usually generated by inference, following analysis of multiple cases that feature similar patterns of latent and active failures.

Latent failures: preconditions

Limited information is collected about personal factors in the OTS study, none in the EACS project. While psychological and/or skill factors clearly determine personal propensity to commit errors and violations, the way to address these problems is at a population level, through education and

training. It would be neither effective nor efficient to attempt a psychological profile of accident involved road users.

The single case analyses performed by the TRL can identify inherently unsafe highway design or vehicular performance, and these findings can be passed on to DETR or manufacturers respectively. In this way solutions to the latent failure are sought whilst bypassing the effort required to investigate accidents in terms of failures at the level of operations management. However, there are disadvantages in adopting the single case approach, not least that it is a slow process. Single case analysis does not lend itself to the identification of latent failures of road users. Moreover, strategic change is likely only if standards set at the decision makers level can be identified that are incompatible with system safety. This would require the analysis of multiple cases. Whilst this is possible within both databases scrutinized here, the information they currently collect cannot be used to identify failure at this level. Extension of the TRL's analysis of OTS data may be possible within the current phase; or the methodology might be revised at the phase's conclusion.

Latent failures: road user/vehicular/journey

Inspection of all vehicles and of the physical infrastructure at the crash site is included in the OTS methodology, and in this way failure on behalf of the road user to select safe vehicles or driving infrastructure can be identified. Another possibility, where a company vehicle is involved, would be to refer to company records about trip management. Otherwise, information relating to individual road user factors would have to be gleaned from the free text sections, and other road user testimony.

Latent failures: operations management

Failures at this level would only emerge from multiple case analysis, and would require data to be collected about vehicle service histories, and road maintenance policies and practices in the area of the crash. Recurring evidence of a specific problem with road user behaviour might require changes in training and/or testing policies. Some of this information is already available in the OTS methodology, and further investigations can be carried out if an individual case requires it. However, those who manage the database at TRL consider that it would require a great deal of effort to collect this type of data, and would depend on the co-operation of a number of agencies.

Latent failures: decision makers

Collection of data at the decision makers level would be extremely difficult taking a single case approach. This is partly because of the logistical and conceptual distance between the highest level and sharp-end events, and the mediation of responsibility through the many agencies that make up the operations management level. Furthermore, standards set by the decision makers apply equally to each accident-involved vehicle, road user or area

of infrastructure, so there is no real need to seek this data for each incident. The identification of failure at this levels would require expert inference from the trends revealed by multiple-case analysis.

5.4 Final comments

In the road system as it is now, problems arise because no-one has overall responsibility. Instead, the task of ensuring road user safety is shared among a number of agencies. This lack of co-ordination makes both accident investigation and prevention, i.e., both the reactive and proactive strands of road safety improvement, more difficult.

In the ideal situation, road safety effort would be co-ordinated from the outset. It may be that the approach outlined in this report might be useful in addressing “the serious absence of basic statistical and practical tools for dealing with road casualties” in developing countries noted by the World Health Organisation.

Finally, the utility of any approach to accident analysis, including the systems approach, depends upon the willingness of those who manage the system to learn lessons. Employing the systems approach to road crash analysis would require a great deal of effort, which would only be worthwhile if road management – the decision makers – pay attention to the findings.