



**Economic and Social
Council**

Distr.
GENERAL

TRANS/SC.2/1999/4/Add.1
25 August 1999

ENGLISH ONLY

ECONOMIC COMMISSION FOR EUROPE

INLAND TRANSPORT COMMITTEE

Working Party on Rail Transport
(Fifty-third session, 6-8 October 1999,
agenda item 7)

RAILWAY SAFETY: RISK ASSESSMENT TECHNIQUES

Summary report

Note by the secretariat

Note: the Working Party, at its fifty-first and fifty-second sessions, continued revising information on the application of risk assessment techniques to railway safety (TRANS/SC.2/188, paras. 19-21 and TRANS/SC.2/190, paras. 32-36). Based on the documents previously provided by the Governments of France, Germany, the Netherlands and the United Kingdom and by the International Union of Railways (UIC), the secretariat has produced this note of synthesis.

The Working Party may wish to examine this document and to discuss its role in the future to assist in the implementation of improved risk assessment techniques in railway transport.

Please note that the distribution of documentation for the Working Party on Rail Transport (SC.2) is no longer "restricted". Accordingly, the secretariat has adopted a new numbering system whereby all working documents other than Reports and Agendas will be numbered as follows: TRANS/SC.2/year/serial number. Reports, Agendas, resolutions and major publications will retain their previous numbering system (i.e. TRANS/SC.2/189).

Introduction

Risk assessment is a systematic approach to achieving higher safety levels at the lowest cost. It is a way of effectively managing resources devoted to safety, prioritizing expenditure and ensuring that money spent on safety is used to maximum effect.

Railway undertakings in a number of countries are developing their own approaches to risk assessment. This note of synthesis is based on the information provided by the Governments of France (TRANS/SC2/1998/4/Add.1), Germany (TRANS/SC2/1998/13/Add.1), the Netherlands (TRANS/SC2/1998/4 and TRANS/SC2/1999/4) and the United Kingdom (TRANS/SC2/1998/Add.2), and by the International Union of Railways (UIC)(TRANS/SC.2/1997/3).

Approaches to risk assessment in the railway sector

Risk analysis in the railway sector is being addressed through two different procedures:

- Internal procedures, in which the safety offered by a new system is compared to the safety offered by existing systems operating in the same area, which is taken as a minimum to be reached by the new system.

Internal procedures have been applied and continue to be applied by many railways. They are based on the assumption that the level of safety provided by existing systems is satisfactory and, therefore, any new system intended to provide comparable services must provide a level of safety at least equivalent to the existing one. This is called "proof of identical safety".

- External procedures, in which it is intended to find out whether the risk is negligible, i.e, stays under an "acceptable" level.

External procedures are based in the examination of the consequences of an accident and the calculation of its probability of occurrence. It presents the difficulty to adequately calculate the probability of accident, and to agree upon an "acceptable" level for it.

A particular external approach has begun to be applied in some cases, following the separation of infrastructure and operation activities in the railway sector. It offers the advantage to give more freedom to the railway undertakings to define an efficient safety strategy, while the public authority keeps control of the safety levels offered by the railway system through the definition of an "acceptable" risk level.

This is the case of the so-called "safety-case method", which had been originally developed for risk analysis in industrial sectors dealing with

hazardous materials. It makes a detailed account of the intended business activity with description of all safety principles and rules, and determines the existing risk for individual employees, passengers, and members of the public affected by the railway's activities. On the other hand, upper and lower levels of risk tolerability are established, thus defining a region of risk tolerability known as "ALARP" (As Low As Reasonable Practicable). When risk levels lie in this region (as most of railway risk does) there is an obligation to seek ways to reduce the risk further as long as the cost of doing so is not greatly disproportionate to the benefits gained. Cost-benefit analysis (CBA) used in conjunction with risk assessment can be used to inform the decision making process. Therefore, 3 key stages may be identified:

1. The setting of a target level for the number of accidents, expressed as a ratio of the number of journeys made per death (for passengers), or the number of people employed per death (for staff). This ratio can also be seen as an expression of the risk or probability of an accident occurring.
2. The measurement of accident statistics against the target level to see whether the level of accidents is within acceptable limits or whether action needs to be taken.
3. The assessment of the effectiveness of current or proposed expenditure on safety in terms of cost per life saved (CBA).

Under this scheme, rail operators should submit their safety cases as proof that they have met their responsibility for ensuring the safety of railway operations. This applies to both, the network access conditions which have to be agreed between railway infrastructure managers and train operating companies, and to the proof to be furnished by the railway infrastructure managers that they have ensured the safe condition of their installations.

Working with the ALARP principle means that normally the best practical means are used, but the best technical means are first asked for. It can be therefore defined as a source-oriented policy to reduce risk. In other sectors, an effect-oriented approach has been chosen: in that case, the necessity of taking any measure is related to the possible effects of the activity to the outside population.

This is in particular the approach followed in the Netherlands for some industrial activities, including the transport of hazardous materials. The aim of the risk policy in this particular case is to arrive at a well-considered location of vulnerable functions (residential areas, schools, etc.) and of activities involving the possibility of accidents (e.g. industrial processes involving hazardous materials) that will affect their surrounding area. For this purpose, the risks, as calculated, are checked against the agreed criteria and in the event that a relatively high risk is found, measures are taken into consideration. Two concepts, individual risk (IR) and societal risk

(SR), are central to risk analysis. IR represents the probability of a fatal situation occurring at a particular location with regard to the activity in question. SR gives an indication of the probability of a calamity with a certain number of fatalities occurring. This approach is used for both, stationary installations (railroad yards) and routes (rail lines) used for the transport of hazardous materials, i.e, for external safety purposes. Studies are being initiated to develop such an approach also for internal safety (accidents affecting people that voluntarily use traffic systems).

Three key stages may be considered in deciding on actions to maintain or improve safety:

- (i) the identification of hazards and the means for reducing their likelihood and severity;
- (ii) the creation of a risk control strategy for reducing risks as low as reasonably practicable;
- (iii) the review/modification of the risk control strategy in the light of performance/ experience.

The use of CBA, when sensibly applied, facilitate the prioritisation of schemes to enable resources to be used to the best effect. However, it should not be used to prevent the adoption of measures which are recognised as good practice, or to justify inaction where there are significant uncertainties in costs or benefits. The key is that CBA is used to inform sensible decision making, not to constrain it. It can also help to demonstrate, in quantified terms, that the cost of a particular safety measure may be out of proportion to the benefits, and that less costly measures may be available.

Follow up

Innovative approaches for risk analysis in railway transport are emerging. They seem to respond to a variety of concerns:

- the need to clearly identify the responsibilities of the different actors, following the liberalisation process initiated in the European rail sector, and particularly the constitution of a separated company responsible for railway network and the emergence of different railway undertakings running on it;
- the attempts to improve management of the resources devoted to safety, so that expenditure can be prioritised in an efficient way;
- the concerns about safety linked to activities involving hazardous materials, particularly in densely populated areas.

The Governments are being periodically providing information to the Working Party on their new developments in the field of safety in railway

transport. As a follow up to the issue of the application of risk assessment techniques, the Working Party might consider whether the information to be requested in the future could be focussed on aspects like the following ones:

- accidents; international data gathering could facilitate the development of a more solid basis for the application of quantitative risk analysis techniques in the future;
- description of the priority objectives and policies adopted within national rail safety programmes, and of their performance criteria;
- description of the methodology followed for the definition of the above-mentioned priorities;
- from the above the possibility of establishing a common methodology for risk assessment in rail transport may be explored;
- changes in national rail safety regulations associated to the sector reform process.

The analysis of the risk associated to the transport of hazardous materials by rail may be another area of attention for the Working Party in the future. This activity might start by the identification of rail sections and rail yards more used by this transport in the AGC network, as a first approach to assess the relevance of this question at the European level.
