HEAVY VEHICLE ACCIDENT RISK

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SYNOPSIS

This paper discusses a preliminary attempt to estimate the relative accident risk of some vehicle types commonly used in New Zealand. This type of information should be available to be taken into account with other factors in determining requirements which affect choice of vehicle configurations. A lack of reliable data indicates the need for more research on heavy vehicle safety in New Zealand.

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1. INTRODUCTION

The configuration of heavy vehicles and combinations of heavy vehicles used on New Zealand roads is strongly influenced by the strength of bridges in the roading system. This occurs because bridge design criteria largely define the mass limits permitted on axle groups, irrespective of the loads allowed individual axles. Size limits are designed to take into account manoeuvrability and the ability of roads and streets to safely accommodate vehicles. However, the choice of size limits cannot be made in isolation from weight limits, and in the New Zealand situation weight limits control the choice of internal dimensions within the maximum length and width constraints. This is the underlying reason why truck trailer combinations and A trains predominate over semi trailers.

Bridging must continue to be the limiting determinant for vehicle limits in New Zealand, but it is also desirable to give more consideration to the potential safety performance of the resulting vehicle configurations.

Information is available about the relative design safety advantages of various different configurations, based on analysis of stability, dynamic handling, braking etc. some of which are the subject of other papers at this seminar. This paper investigates available data available from reported accident experience.

2. ANALYSIS OF RELATIVE ACCIDENT RISK

There are 2 main problem areas in obtaining reliable information for this purpose. First is the absence of exposure data, and

second is the quality of the accident information available.

2.1 Exposure Data

A basic requirement of any accident analysis is accident exposure data. This means information about the distances travelled under various conditions by the types of vehicles of interest. Unfortunately no exposure data is available which reliably provides information about the use of different configurations.

Road User Charges statistics provide the total distances travelled for each of more than 45 vehicle types, but does not disclose in what combinations these vehicles are used, or under what condition such as urban or rural.

Registration statistics, and surveys of fleet vehicle numbers and types, suffer from the same disadvantage of providing no information on how vehicle combinations are actually used.

The only useful data is that available from roadside observations. Limited data of this type has been obtained from the comprehensive speed surveys carried out over recent years by Ministry of Transport traffic engineers (1). These surveys provided a record of the number of each vehicle type passing survey points, distributed at about 40 locations on main State Highways in the North and South Islands. This paper attempts to use this data as a proxy for exposure information by assuming that these vehicle type observations are in the same proportions as their rural distance travelled. There is no information about the total rural mileage.

These proportions are shown in the first column of Table 1(appendix 1) The accuracy of this data is assumed to be ±5% approximately; when taken as a representation of the rural State Highway traffic proportions. The reliability of the assumption that this equates with vehicle miles is not known.

Surveys conducted more recently by Ministry of Works and Development suggest that this proportion of heavy vehicles may be increasing (2).

2.2 Accident Data

Accident data has been obtained from Traffic Accident Reports prepared by police and traffic officers. These reports are required for all accidents involving injury or death.

The analysis of this data is in terms of the number of vehicles of each type involved in reported accidents, as distinct from the number of accidents. This is to avoid over rating the risk of vehicle types present in smaller numbers as a result of multi vehicle accidents.

It is not possible to make a reliable estimate of the involvement of the following vehicle types separately: semi-trailers, B-trains, and semi-trailers towing an additional trailer(A-train). This is because the Traffic Accident Reports do not provide for a clear distinction between these vehicle types. However, from a study of a sample of accident reports making an approximate judgement based on an interpretation of various indicative items of information it seems possible that these vehicle types are involved in approximate ratio of 3:1:1.

Table 1 (Appendix 1) shows involvements for the 3 year period 1981-1983.

2.3 Results of Relative Risk Analysis

For each vehicle type an arbitrary risk value has been calculated by taking the ratio of proportion of accidents to proportion of vehicle types. This is shown in the right hand side of Table 1(Appendix 1).

On this basis vehicle types can be ranked according to risk. It is emphasised that due to limitations of the data available these must be regarded as indicative of probable trends, not as definitive results.

Risk Ranking (best to worst)	Arbitrary risk Value*
1. Semi trailers, B trains, A trains	0.4 to 0.6
2. Trucks with trailers	0.5 to 0.7
3. Buses	0.6 to 0.8
4. Trucks(single unit)	0.8 to 1.0
5. Cars and light vehicles	0.8 to 1.0
6. Motorcycles	10.0 to 12.0

* range of values indicates error due to data assumptions.

3. DISCUSSION

3.1 General Conclusions

The most notable result of this risk analysis for vehicle types in rural areas is that motorcycles have clearly the greatest risk having approximately 11 times greater risk than cars,and about 20 times the risk for the safest vehicles.

This result is similar to previously published risk values for motorcycles (3).

Other results are less conclusive, but indicate that larger rigs (i.e. trucks with trailers, semi-trailer, B-trains, A-trains) have a generally lower risk than the other vehicle type. This group has the lowest involvement risk with a value about half that of cars and rigid trucks.

Buses show a risk marginally better than cars and rigid trucks, but not as good as the larger combination vehicles.

These conclusions do not consider the effects of accident severity. This is discussed below.

3.2 Accident Severity

When assessing the significance of relative accident risk it must be noted that the larger vehicle accidents are more likely to involve death. The percentages of rural area involvements of motorcycles and cars with a fatality are 3.2 and 4.9 respectively, while these figures for buses and trucks are 9.43 and 11.14. This clearly indicates that accidents involving heavier vehicles are more severe, in spite of the risk of an accident being lower. Thus in relation to fatalities the risk factors for the heavy vehicle types including buses can be approximately doubled, increasing their risk up to double that for cars.

This greater severity of heavy vehicle accidents can in turn affect their reporting rate - i.e. they may be more

likely to be reported than accidents without heavy vehicle involvement. If so their true accident risk would be lower than the results in Table 1 indicate.

4. CONCLUSIONS

This paper provides some information to help judge the affect of vehicle type on accident involvement. However the data available is generally inadequate for this purpose. As this type of information is of relevance to both operators and government in decision making the need for specific research such as in depth investigation should be addressed. However it is reasonable to conclude, overall, that heavy vehicles experience a lower accident involvement rate than cars or motorcycles but that differences exist between different configurations. For more severe accidents the heavy involvement rate is substantially worse than for cars.

5. REFERENCES

(1) BARNES, J.W., EDGAR J.P., Vehicle Speeds on Rural Roads, Institution of Professional Engineers Conference, Hastings 13-17 February 1984 Proceedings of the Transportation and Traffic Engineering Group.

(2) BENNETT, CHRISTOPHER, R. - The Description of Input Traffic for the Calibration and Validation of TRARR. Ministry of Works and Development Roading Division (Wellington). (Unpublished)

(3) WHITE, W.T. - Survey of Driver Exposure to Risk of Accident - Overview of Findings. Road Traffic Safety Research Council, Seminar on Driving. Proceedings 1979 (Wellington).

APPENDIX 1

Vehicle Type	Proportion of vehicle types on rural State Highways %	Number of reported accident involvement	Proportion of accident involvements %	Proportion involvement divided by proportion vehicles
Motorcycles	1.2(±0.1)	2.208	13.2	11(±1)
Cars and light vehicles	89(±5)	13,296	79.3	0.9(±.05)
Buses	1.2(±0.1)	139	0.8	0.7(±0.1)
Trucks	4.5(±0.2)	661	4.0	0.9(±0.05)
Trucks with trailers	2.2(±0.1)	230	1.4	0.6(±0.1)
Semi trailers Semi trailers with trailer (includes B-trains)	1.8))2.3(±0.1) 0.5)	199	1.2	0.5(±0.1)

TABLE 1

Rural Areas Accident Exposure and Risk