Developing road safety programs for provincial, rural and remote Queensland

Lal C. Wadhwa
Head, Civil and Environmental Engineering
James Cook University, Townsville, Queensland, Australia

Abstract

The commonly held view and some previous research show disproportionably high rates of accidents and fatalities in rural environments. The research presented here is aimed at ascertaining if the rural road accidents are significantly different in severity, frequency and causes of crashes compared to urban road crashes in Queensland. The study would determine the relative risk of driving on rural roads compared to urban roads. It will identify the limitations of the rural road network, and other characteristics of rural travel. It would also ascertain whether levels of enforcement (perceived to be lower in rural and remote areas) are responsible for higher level of risk taking by country drivers. The results of this research would support the development of detailed rural road safety programs.

INTRODUCTION

Definition of Provincial, Rural and Remote Areas

Several definitions of rural and remote areas have been used by different organizations. Australian Bureau of Statistics, Parliamentary Travelsafe Committee (1) and the Australian Traffic Safety Bureau (2) have used different definitions. Two approaches for these definitions have been identified – one based on the distance from a town/city of certain minimum population, and the other based on speed zone. Accidents occurring in speed zones of 100 km or higher are considered as rural while those in less than 100 km speed zone are classified as urban. The following definitions are based on distance from a town or city:

- Urban: Crashes occurring on roads in major population centres which are further divided in to cities and towns of over 50,000 people and under 50,000 people.
- Rural: crashes occurring on the remainder of roads.
- Semi-remote: crashes in locations less than 100 km from a capital city or a city of more than 100,000 population.
- Remote: crashes in locations more than 100 km from a town with a population of at least 5,000. (Parliamentary Travelsafe Committee)

Federal Office of Road Safety (now Australian Transport Safety Bureau) has defined city as a centre of more than 100,000 people.

Open roads outside of town boundaries are considered rural.

An approximation of the distinction between rural and urban areas is also provided by the speed limit at the crash site with limits of 100 km/h or greater deemed to be probably rural, and less than 100 km/h probably urban. This identifies 89% of urban crashes and 83% of rural crashes correctly.

Appropriate classifications for urban, rural and remote areas are required to be defined on the basis of data and literature.

Relevant databases in Queensland

Information contained in Police Reports and Roadcrash database

Police reports and the Queensland Transport database are prepared from form P51. The form provides the following information:

Driver:
Address, age, gender, racial appearance, licence details, BAC result, origin of journey (could be used for fatigue)

Time and location:
Location, Street/highway, intersection, distance from identification marker,

Road features:
Divided, no. of lanes, horizontal features, vertical features, road surface, dry/wet, speed limit.

Unit details:
Rego. No., state of rego., make, model, colour, type, communication device, cruise control, window tint, bullbar fitted. Commercial use, name/sign on vehicle, odometer reading, ownership, damage points, overall damage, no. of occupants

Contributing circumstances:
Lighting, weather, road conditions, violation traffic law, vehicle defects, driver condition, excessive speed, others, statement from victims, description from the reporting officer

Persons killed or injured:
Surname, given names, address, phone, date of birth, gender, seat number, racial appearance, injury, hospital, severity, restraint, helmet, airbag, time and date of death if deceased

ARMIS and TARS databases

Maintained by the Main Roads in Queensland, ARMIS provides information on roads as per Austroads guidelines on rural and urban road classification. It includes number and width of lanes, divided/undivided, shoulder width and surface type.

TARS is a traffic database, also managed by Main Roads. It is linked to the parent ARMIS database, as is the Roadcrash database.

TRACS database

This database is maintained by Queensland Police Service. For the purpose of the CARRS-Q project, information on the level of enforcement in all police stations in the State will be accessed to establish if the level of enforcement is related to driver attitudes and risk-taking behaviour and the occurrence of road crashes.

Comments about accident data

There are no objective criteria for determining if an accident can be attributed to fatigue. Similar driver action at the time of accident could result from fatigue, drink driving, speeding, or undue

care. It is premised that two factors indicating fatigue are the distance of accident location from the origin of the trip (which is collected by the Police) and the driver activity over the past 24 hours before starting the current trip (which is not recorded). It, therefore, becomes difficult to ascertain if an accident has been caused by fatigue of the driver.

Identification of driver's address is adequate to describe if a driver comes from an urban, provincial, rural or remote area. The recording of racial appearance is useful to place the driver in a defined ethnic group to understand if ethnic differences have an influence on driver behaviour and attitude.

Road conditions are listed but some details are missing. The shoulder width and surface type, the sight distance and alignment characteristics (curve radius, grade etc.) are not recorded. Therefore, detailed investigations into the effect of road infrastructure deficiencies on accidents can only be undertaken if the accident data is linked to the road data available from Main Roads.

The study involves the examination of factors that affect accident rates in rural areas

Longer distances
Higher speeds
Relaxed or casual attitudes
Traffic mix
Geometric conditions
Relative low level of police enforcement of traffic regulations
Low level of public education in road safety

It has been observed that

- a higher proportion of country drivers do not wear seat belts (350% higher - 4% for urban drivers vs 14% for country drivers)
- country drivers have more likelihood of having illegal blood alcohol levels (twice compared to city drivers)
- country drivers are more risk-taking, being used to environments with low levels of police enforcement.

Information from the Queensland Police Service database on level of enforcement will be used to relate drivers attitudes to the perceived level of enforcement and the risk involved in violating traffic regulations.

Relative risk

The results of this project are proposed to be presented using the concept of relative risk. It represents the percent increase in the occurrence of an accident due to a deficiency in road.

The study would investigate and develop models which will relate relative risk with the following:

(a) deficiencies in road conditions in rural and remote areas

Are rural environments less safe than urban systems? If so, the rural road conditions may be causing higher fatal crashes. High incidence of loss of control of the vehicle in rural areas could be related to the prevalence of roads with unsealed shoulders in rural areas. These findings would support an urgent need to improve the road systems in the country areas.

(b) driver attitudes, background and ethnicity

It has been shown that the attitudes of country drivers towards seat belt, drink driving, speeding etc. are different than their urban counterparts. What additional risk eventuates from this difference in attitudes?

(c) level of traffic regulations enforcement by police

How much risk can be reduced by increasing police enforcement? Benefits of deployment of additional police resources could be evaluated.

ANALYSIS OF ROAD AND ACCIDENT DATA FOR NORTHERN DISTRICT

To establish the feasibility of data acquisition, data linking and correlating road features and accident frequency, the Main Roads District 9 (Northern) has been selected as the example study area.

The Northern district had a declared road network of 2,218 kilometers. The district covers eight Local Government Areas of which two are predominantly urban. The urban population accounts for over two-thirds of the district's population of 207,000. There are almost 170,000 vehicles registered in the district which represents a very high vehicle ownership level of over 820 vehicles per 1,000 population. During the study period (1995-99), 2,778 accidents were recorded on the declared road network in the district.

Data acquisition

Queensland Transport road crash database has been obtained from Queensland Transport through four main files – injured.txt, crash.txt, circ.txt, and unit.txt. Thirty-two fields for each accident were selected for analysis. These included information relating to the

- time, place and the environment of accident (13 fields),
- details of crash including nature, severity, contributing circumstances, unit types and number (9 fields),
- road characteristics including alignment features, speed zone, traffic control (5 fields0, and
- persons involved (5 fields) .

Accidents are identified by a unique crash number which is used for linking separate files and different databases.

The database containing additional information on the geometric and physical characteristics of roads at accident locations has been provided by the Queensland Main Roads Department. In addition to the unique accident ID (crash number), sixteen fields specified information on road characteristics and traffic volumes. Specific information on speed zone, number of lanes, divided/undivided, total width, surface type and the right and left shoulder width is provided.

Data linking

The data sets from the two databases have been linked using the unique crash numbers. This allows the analysis of crash data and the development of models to relate crash frequency, severity and nature to road characteristics and driver behaviour. Before linking the two data sets, all files were checked to ensure relevance and consistency and to safeguard against obvious errors.

Road characteristics

Accident frequency has been related to varying levels of following road characteristics:

- Surface
- Speed zone
- Number of lanes
- Divided/undivided
- Functional classification
- Horizontal alignment
- Vertical alignment
- Shoulder width

Each of these road features has been classified into two or more categories, as shown in Table 1.

Table 1: Road Characteristics, Queensland Main Roads District 9

Road feature	No. of categories	Description
Surface	2	Sealed, unsealed
Speed zone (km/hr)	5	60, 70, 80, 100, others
Number of lanes	4	1-lane, 2-lane, 3-lane, and 4- or more lanes
Divided/undivided	2	Divided, undivided
Functional classification	4	Arterial, subarterial, collector, local
Horizontal alignment	4	Straight, curved - view open, curved - view obscured, unknown
Vertical alignment	5	Level, grade, dip, crest, unknown
Shoulder width	5	<1 m, 1-2 m, 2-3 m, >3 m, unknown

Frequency and severity of crashes

Crash frequency and severity are examined with respect to all categories and levels of road features described above. For each category within each of the above eight road features, the number of accidents and accident frequency per kilometre of road for each year of the analysis are determined. These descriptors are useful in representing the road features with high accident occurrence but do not consider the traffic volumes using the roads. Thus a higher standard road may show higher accident frequency per kilometre of road compared to a lower standard road carrying much lower volumes of traffic. The conclusion that lower standard roads are safer is, of course, flawed.

Relative risk factors

In this research, the comparative analysis of relative safety of roads with different geometric and physical characteristics is presented in the form of relative risk factors. These factors are based on the accident frequency per million vehicle kilometres travelled (VKT) on each road category. The descriptor of relative risk used in this study is the VKT per accident. Higher the value of this descriptor, safer is the road. The safest type of road is given a risk factor of 1. The risk factors on other road categories are expressed in relation to the safest category. Thus if the VKT per accident for a road of certain category is half of the highest VKT of all categories, then this category has a relative risk factor of 2.

Relative risk factors represent the relative probability of occurrence of an accident as a function of exposure on a particular road category relative to the lowest.

ANALYSIS OF POLICE ENFORCEMENT DATA

The objective of this research is to determine if there is a correlation between the level of enforcement and driver behaviour. Recently, the Queensland Police have provided data on

Crashes by severity, number of major and minor incidents reported

Hours spent on

- speed infringement detections by various modes: laser, mobile, handheld radar, slant radar, and total
- random road watch
- random breath testing – stationary and mobile locations
- education initiatives
- transportation and registration checks

Number of detections of

speed infringement by mode
infringement notices, breach reports, number of arrests
unlicenced breaches, arrests
disqualified breaches, arrests/summons
interruptions, fatigue offences, speed offenses, unregistered, uninsured, and other offences
number of RBTs and positive RBTs both in stationary and mobile locations

etc. etc.

The data has been provided for each police station in Townsville and Mount Isa districts since January 199 on monthly basis. There are 28 stations in Townsville district and 17 in Mount Isa district. This data will be analysed to explore any relationship between enforcement levels and driver attitude towards drinking, speeding and other infringements. This may be useful in explaining, at least partly, the disparity between urban and rural accident frequency, severity and types.

DISCUSSION AND CONCLUSIONS

Tis study has involved the identification and acquisition of crash and road inventory data for Queensland. The two databases for the period 1995 to 1999 have been linked together using the unique crash number and provide an integrated data set which is being used to relate the frequency, severity and nature of accidents to the physical and geometric features of roads characteristics. Models are being developed that would relate relative accident risk to road features. These include surface type, number of lanes, functional class, shoulder width, speed zone, divided/undivided, and horizontal and vertical alignment features. The Queensland Main Roads district 9 based around Townsville has been used as an example study area and the feasibility of this approach has been established.

The study is primarily aimed at establishing the higher risk factors in rural areas due to poorer road standards. Quantitative models would provide insights into why rural areas experience disproportional high rates of accidents and fatalities. Another aspect of this study is aimed at developing relationships between enforcement and driver behaviour and attitude. It has been observed that the incidence of drink driving, violation of seat-belt restraint, and other traffic violations are more common with drivers in rural areas. The thesis that lower levels of enforcement in rural areas may be responsible for this behaviour will be tested quantitatively.

REFERENCES

1. Rural Road Safety in Queensland, Issues Paper No. 4, Parliamentary Travelsafe Committee, Queensland, April 1999, 8pp
2. Henderson, M.J., Towards an Action Plan for Rural Road Safety: A Report of the Wodonga seminar, Federal Office of Road Safety, Canberra, 1995.