HIGHWAY SAFETY ISSUES IN RURAL AND URBAN ENVIRONMENT: VERIFICATION OF COMMUNITY PERCEPTIONS

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ABSTRACT

At a recent workshop on community participation in highway safety involving elected members, local government employees, regional and local transport officials, and others interested in road safety, the participants were asked to identify the most important issues in highway safety. Two independent groups identified issues of particular importance in urban and rural environments.

The regional accident database has been analysed with a view to verifying whether or not the actual cause of accidents are perceived by the community as key issues requiring urgent remedial action. This paper highlights the results of this analysis with a view to establishing a correlation between the community perception versus the key actual causes of road crashes. The implications of such analysis are very important in developing road safety plans and cost-effective strategies for alleviating road crashes.

The paper also outlines the objectives and proposed actions for improving road safety by targeting the issues identified as most significant in the urban and rural highway environments

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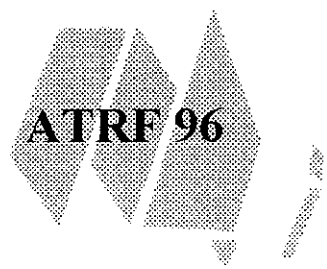

Introduction

At a recent workshop on community participation in highway safety involving elected members, local government employees, regional and local transport officials, and others interested in road safety, the participants were asked to identify the most important issues in highway safety. Two independent groups identified issues of particular importance in urban and rural environments.

It was decided to verify whether or not the actual causes of accidents are perceived by the community as the key issues requiring urgent remedial action. To this end, the regional accident database has been analysed to determine the contribution of the identified deficiencies in transportation system on accidents. This paper highlights the results of this analysis with a view to establishing a correlation between the community perception versus the key actual causes of road crashes. The implications of such analysis are very important in developing road safety plans and cost-effective strategies for alleviating road crashes. The paper also outlines the objectives and proposed actions for improving road safety by targeting the issues identified as most significant in the rural highway environment.

Community perceptions of road accident issues

Community perceptions were discerned at a workshop on road safety conducted in regional centres across Australia in September 1995. In Townsville, the workshop which was attended by elected representatives from councils in urban and rural local government areas and transportation professionals, two groups were formed to represent urban and rural environments.

The rural group identified

- inadequacy in highway environment especially lack of passing lanes, unprotected embankments, lack of adequate shoulder, narrow pavement and bridges, absence of fencing to keep stock restrained etc.
- fatigue for both long-distance (through) travellers as well as for farm drivers working abnormally long hours during the harvest season
- lack of road safety awareness with regard to regulations, signs, and general matters
- conflict in road usage both between through traffic and local traffic as well as between traffic generated by agricultural activity involving heavy vehicles and local passenger traffic, and
- local traffic management problem as a result of grid pattern in most small rural towns.

The urban group identified

- intersections - inadequate capacity
- provision of bikeways - improvement and additions
- speed - especially in residential streets
- lack of 4-lane roads and directional signing
- alcohol-related issues, and

- inconsistency in signal operations - leading right turn at some intersections and trailing at others.

It was felt at the end of the workshop that it would be a useful exercise to examine if the actual causes of road accidents revealed the perceptions held by the two groups at the workshop. The Queensland Department of Transport (called Queensland Transport hereafter) made the regional accident database available to the Department of Civil and Systems Engineering at James Cook University which was analysed with a view to verifying the community perceptions.

Methodology

Data

The database was provided by Queensland Transport and covers the period from 1984 to 1995. The data contains 6893 records with 98 fields for each accident. These included date, time, month and year of accident; street involved; severity; number and type of vehicles; age and sex of drivers and all persons involved; alcohol relevance, RUM (Road User Movement) number; speed limit; weather and light conditions etc. The data is compiled from the Police records of reported accidents. In certain cases, the Police also recorded the factor which was believed to be the cause of accident. This information in conjunction with the actual event description represented by RUM numbers was used to discern the causes of accidents and the likelihood of road, vehicle or human factors which could have contributed to the cause of accident.

Microsoft Excel was used to analyse the accident data. This allowed the tabular as well as graphical outputs for frequency and percentages to be obtained with ease. Such representations were found to assist in comprehending the characteristics of the accidents and investigating the causes to accomplish the objectives of this study.

Study Area

The Study Area is the Northern district of Queensland Department of Transport as shown in Figure 1. It is based in Townsville and extends from 30 km south of Bowen to 30 km north of Tully and west to Pentland. The district's road network of about 2,260 km of declared roads under the jurisdiction of Queensland Transport, comprises of

Highways	720 km.
Developmental Roads	870 km.
Main Roads	250 km.
Secondary Roads	420 km.

This network contains about 450 km section of Bruce Highway (National Highway 1), 270 km of Flinders Highway, another national highway, 430 km. of Gregory Developmental Road and 240 km. of Bowen Developmental road.

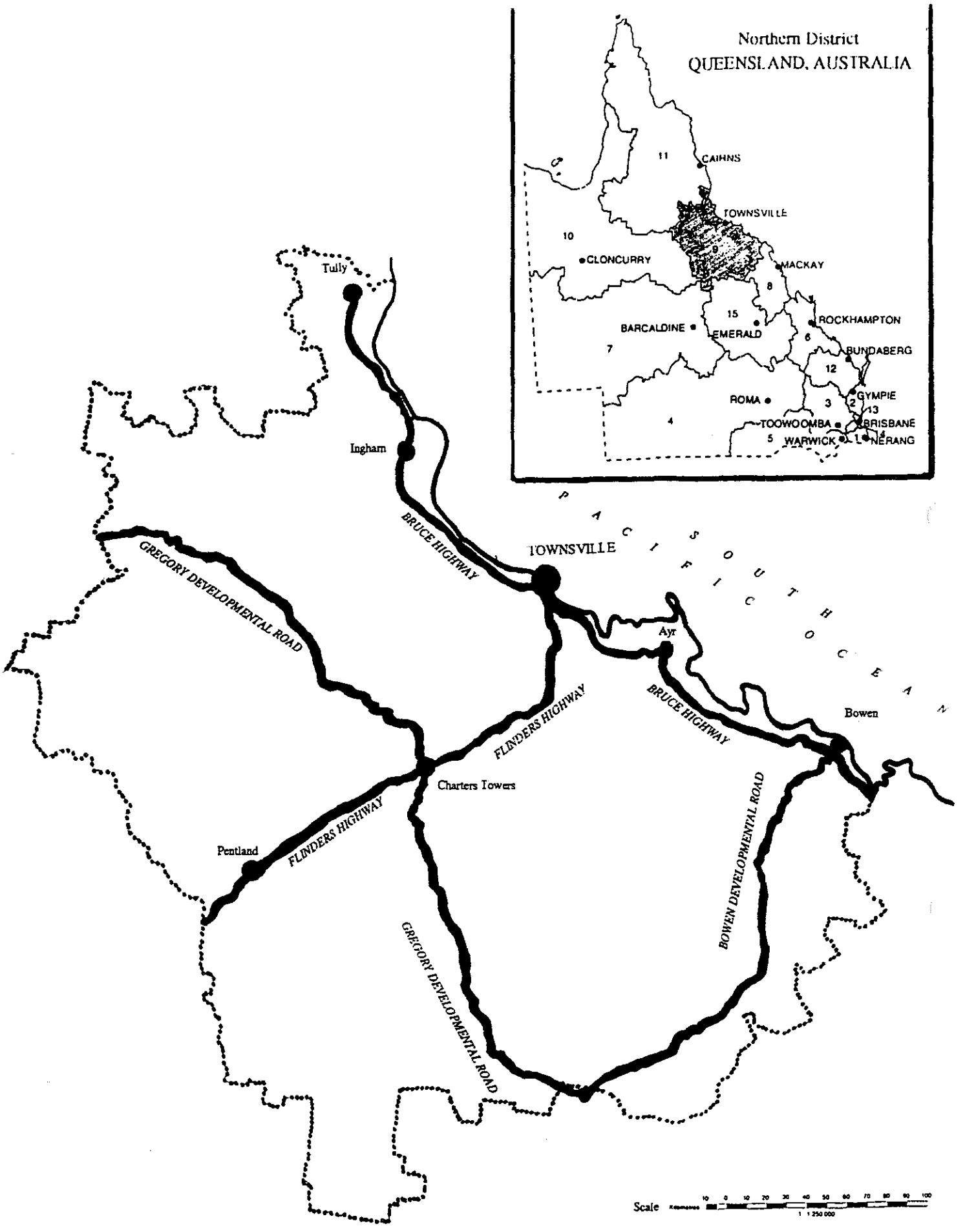

Figure 1: THE STUDY AREA

Source: Queensland Transport

The region encompasses eight local government areas with a population of over 200,000. This is detailed in Table 1.

Table 1: The Study Area

Local Government Area	Population, 1995	% of District Pop.	Growth Rate, 1986-95 (% per annum)
Bowen	13,422	6.57	-0.48
Burdekin	19,254	9.43	-0.09
Cardwell	8,851	4.34	1.38
Charters Towers	9,648	4.73	1.64
Dalrymple	3,456	1.69	-1.55
Hinchinbrook	15,385	7.54	-0.11
Thuringowa	44,417	21.78	5.09
Townsville	89,732	43.95	1.00
Total District	**204,155**	**100**	**1.04**

Source: Australian Bureau of Statistics, 3224.3

Accident analysis

Frequency distribution

There is no pattern or trend in the total number of accidents in the District over the past 10 years. However, 1992-94 experienced a far larger number of accidents than the previous period. If anything, the number of accidents from 1984 to 1995 has not been on a decline. The total number of accidents for each year are shown in Table 2.

Table 2: Accident Frequency

Year	No. of Accidents
1985	594
1986	582
1987	596
1988	626
1989	564
1990	592
1991	567
1992	645
1993	647
1994	709

July and August have higher rates of accidents while February and October had lowest accidents. The highest death rate is in December. Peaks in accident frequency occur in the morning (around 8 am), lunch time (11am - 1 pm) and end of school and work (3 - 5 pm).

Vehicle-kilometers travelled per accident

Vehicle-kilometers travelled (VKT) on any section of the road in the study area have been calculated from data on AADT and length of road section. This has been used to calculate VKT per accident. It has been found that the Bowen - Ayr section of Bruce Highway and Herveys Range Development road are safer with a high VKT/Accident rate while Ayr - Tully sections of Bruce Highway and the Flinders Highway have experienced low VKT/Acc and are, hence, more accident prone. Some key values of VKT per accident are shown in Table 3.

Table 3: VKT/accident for Selected Roads in Study District

Road Section	Length, km	VKT, 1995	VKT/Accident	Remarks
Bruce Highway				
Bowen to Ayr	112	7,252	6.34	Best
Ayr to Townsville	93	12,744	1.95	Worst
All Other Roads				
Ingham - Forrest Beach Road	19	3,823	26.30	Best overall
Ingham - Abergowrie Road	23	4,698	19.72	Second best
Bowen Dev. Road, Bowen - Collinsville	161	1,412	2 26	Worst (exc. Bruce Highway)

Units of VKT/accident are million vehicle kilometers travelled per accident.

Alcohol

Eight per cent of accidents involved drivers who had a blood alcohol content which were above the legal limit of 0.05. It appears that it is not a standard procedure to test for alcohol given an accident has taken place. The "not tested" data is extensive (82%) but most of the drivers who tested positive were at more than twice the legal limit.

Age and Gender

Consistent with other studies, the Townsville regional data showed that young drivers between the age of 17 - 25 years are most vulnerable.

Road User Movement (RUM) Numbers

Road User Movement numbers allow a quick and accurate description of the type of accidents and are depicted in Figure 2. The analysis identified the following ten RUM numbers with the highest number of accidents. In each of these cases, the number of accidents over the study period exceeded 300. Table 4 shows the RUM numbers with over 300 accidents during the study period.

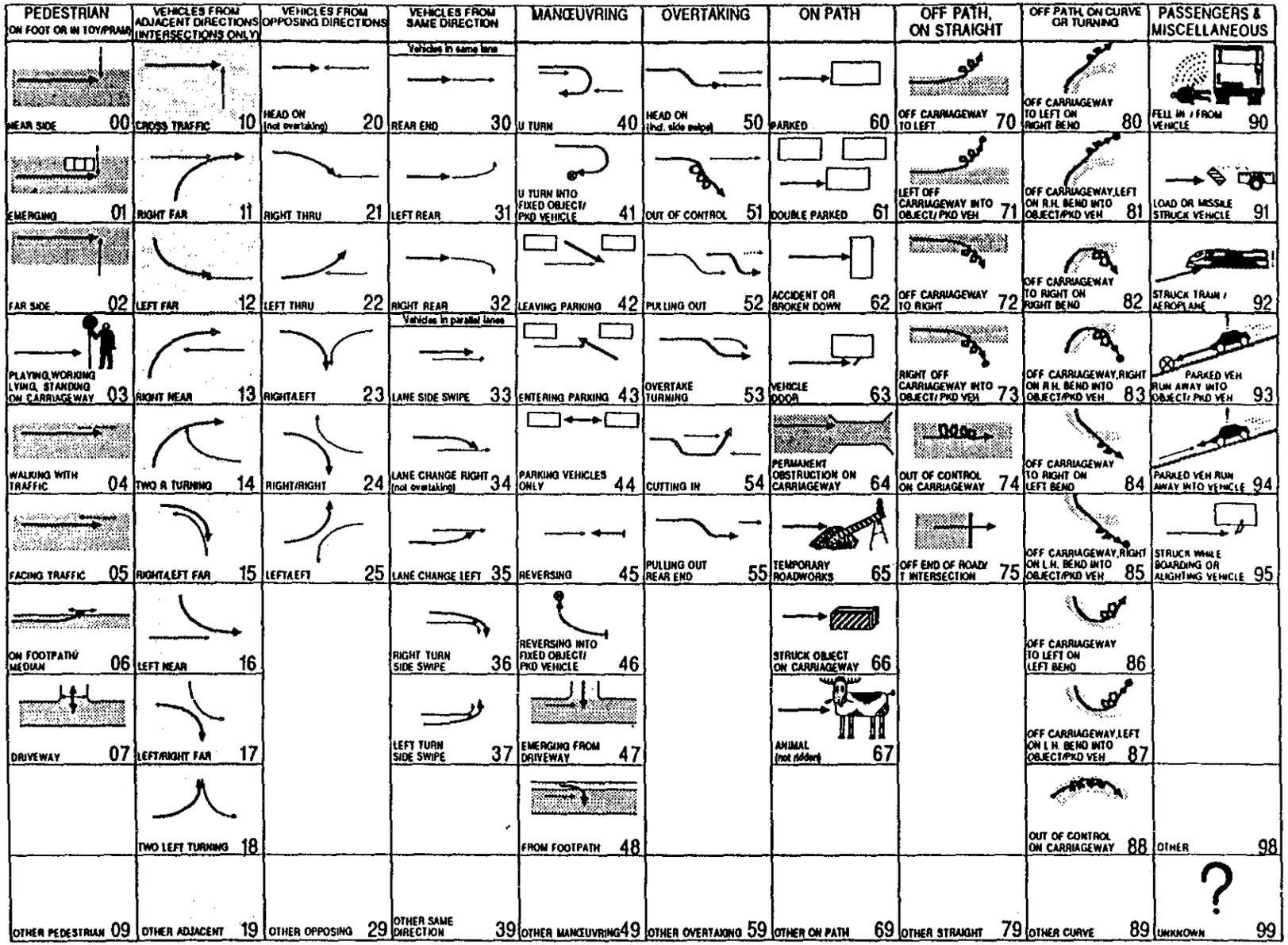

Figure 2 Example of Road User Movement Coding

Table 4: RUM numbers with High Accidents in the Study Area

Rum Number	Description	No. of Accidents
30	rear end, same direction	764
21	right thru, opposite direction	689
10	cross traffic, intersection	458
32	right rear, same direction	422
70	off carriageway to left	382
20	Head-on (not overtaking)	322
72	off carriageway to right	310
13	right rear - intersection	305

Rural and urban comparison

Speed and fatigue are most significant factors in rural locations. Cattle and other animals are exclusively associated with rural accidents. On the other hand, pedestrians and cyclists are more likely to be involved in road accident in urban areas.

The likelihood of a death occurring in rural driving is several times higher than in urban driving. The number of deaths per 1000 accidents was found to be 52.7 in rural areas compared to 13.8 in urban travel.

The proportion of accidents of different severity are shown for urban and rural accidents in Figure 3.

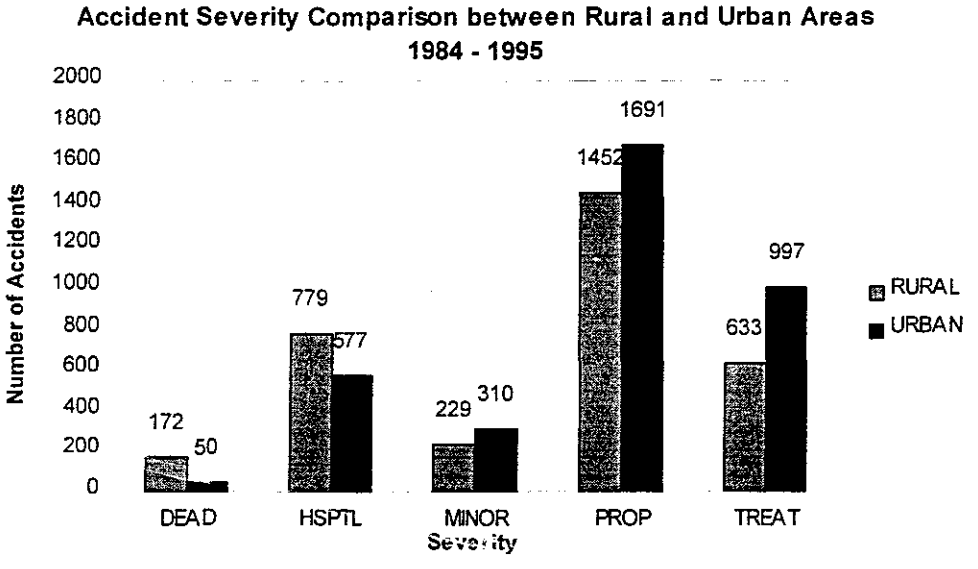

Figure 3: Accident Severity

Rural accident characteristics

Speeds on rural roads are much higher than on urban roads. The majority of rural road sections have 100 km/hr speed limit whereas it is only 60 km/hr for most of urban area. There are some sections with speeds between 60 and 100 km/hr such as 70, 80 or 90 km/hr. The analysis shows that the probability of a fatal accident is four times higher in rural areas compared to urban areas.

The common types of road accidents in the rural environment are shown in Table 4.

Figure 4: Common Accident Rum Numbers, Rural Roads

Rum Number	Description	No. of Accidents
70	off carriageway to left	325
72	off carriageway to right	276
20	Head-on (not overtaking)	220
67	Animal	195
71	Left off carriageway into object/parked vehicle	155
74	Out of control on carriageway	128
30	rear end, same direction	118
53	overtaking, turning	114
73	Right off carriageway into object/parked vehicle	110

RUM number 70 accidents were the most common in rural areas. These accidents are manifested in the vehicle going off straight carriage way to the left. The cause of the accident of the same RUM number can be quite varied. Out of 325 accidents in this category, the causes or contributing factors were recorded by Police for 215 cases.

The two most common causes were recorded as "falling asleep" and "tyres blowing out" Another common cause was the number of animals on the road which forced drivers into taking evasive action that resulted in loss of control. Many roads in the study area are unfenced and cattle wander freely across the roads. Fencing of roads would prevent most of the accident involving cattle. Kangaroos and other natives would continue to wonder on the rural roads nonetheless. Dawn and dusk are very dangerous times as headlights are not yet effective and it is too dark to be seeing properly without artificial light.

Out of 3,267 rural accidents, 284 involved vehicles overtaking. These accidents had RUM numbers from 50 - 55. For example, RUM 53 describes the accident where a vehicle tried to overtake while the one in front is turning right off the carriageway. Passing lanes may reduce this problem. The region has insignificant lengths of passing lanes.

Urban accident characteristics

RUM numbers 21 (right thru collision) and 30 (rear end collision) are most common in urban accidents. Other significant RUM numbers and number of accidents are shown in Table 5.

Table 5: Most Common Rum Numbers, Urban Roads

RUM numbers	Description	No. of accidents
21	right thru collision	609
30	rear end collision	569
10	cross traffic collision at intersection	374
32	right rear end collision	276
13	right near collision	246
31	right rear, same direction	124

RUM 21 accidents occurred at intersections. Most of them occurred at intersections with operating traffic lights (58%) and no control (34%). Other controls such as boom gate, rail crossing, or police control intersections accounted for the remaining 8%. It is likely that operating traffic light controlled intersections where accidents occurred could predominantly be without right-turn arrows.

Disobeying traffic signals, alcohol/drugs, and not giving due care and attention were found to be the most significant contributing factors in urban accidents. These may be due to

(i) poor signing or inconsistencies in traffic controls
(ii) lack of driver education

Cyclists were found to be involved in a large number of accidents.

Verification of Community Perceptions

Rural Environment

1. There is inadequacy in the highway environment, especially lack of passing lanes, unprotected embankments, lack of adequate shoulder, narrow pavement and bridges, absence of fencing to keep stock restrained etc.

This perception places the blame of rural accidents squarely on the roads and road-related features.

The analysis showed that most of the accidents in rural areas were caused by vehicles going off straight carriageway to the left (RUM 70). The results of analysis show that the provision of passing lanes could have saved some of the accidents caused in

overtaking manoeuvre. Furthermore, fencing could have drastically reduced accidents caused by the wandering cattle on the road. Beasts were the third largest contributing factor in rural accidents. Shoulder was a contributing factor in 112 cases which though not in the top ten causes of highway accidents, is not insignificant.

The data does not support the community perception that unprotected embankments, narrow pavement and bridges are significant contributors in rural accidents. However, road inadequacies could have indirectly contributed to human error which caused the largest number of highway accidents in rural areas.

2 Fatigue is a problem for both long-distance (through) travellers as well as for farm drivers working abnormally long hours through the harvest season

Fatigue certainly rated as the leading contributor in rural road accidents. In addition to the accidents for which fatigue has been recorded as the cause of accident, many other accidents where vehicle struck an animal or the driver lost control could have been the result of fatigue.

Therefore, although fatigue is undoubtedly a major contributor of rural road accidents verifying community perception, it is not possible to confirm or deny whether farm drivers working abnormally long hours were involved, and were responsible.

3 Highway safety is compromised due to lack of road safety awareness with regard to regulations, signs, and general matters.

Except for equating lack of due care and attention on the part of the driver to lack of road safety awareness, there is no other clue in the data to verify this perception.

4 There is a conflict in road usage between through traffic and local traffic as well as between traffic generated by agricultural activity involving heavy vehicles and local passenger traffic.

Heavy vehicles do feature in several road accidents. As expected, the most common vehicle involved in accidents with trucks and heavy vehicles is passenger vehicle which may indicate a conflict between traffic generated by agricultural activity and passenger traffic. Twenty five accidents have involved tractors which may be assumed to be associated with agricultural activity. Of these 21 accidents occurred in the rural environment. Therefore the analysis points to the legitimacy of the community concern but the small percentage of such accidents does not validate this perception conclusively.

5 A local traffic management problem exists as a result of the grid pattern in small rural towns.

Unfortunately, the accident data does not include the local urban roads which are not under the jurisdiction of Queensland Transport. Other data sources will have to be obtained and examined to validate this perception. It may be pointed out that 80 per cent of rural accidents occurred within the 100 km/h speed limit zones

Urban Driving Environment

1. Intersection capacity is inadequate

Intersections are certainly the major problem areas since over two-thirds of all urban accidents occurred at intersections. Six intersections in Townsville had more than 50 accidents each during the study period. Most common type of accidents at intersections are with the following RUM numbers.

RUM 21	right thru
RUM 10	cross traffic
RUM 31	left rear

Without detailed capacity analysis, it is only a conjecture that intersections have inadequate capacity. The major cause of accidents could have been poor traffic control or signage at intersections rather than their capacity.

2. Provision of bikeways - improvements and additions

A total of 205 accidents, representing 5.7% of all urban accidents in the region involved bicycles. The analysis shows that the frequency and severity of bicycle accidents involving bicycles has declined over the years. Although the use of bicycles is believed to be increasing, the reduction in accidents can be attributed to improvement in bicycle facilities such as those along the major arterial in Townsville - the Ross River Road.

3. Speeds in residential areas

Speed was found to be a contributing factor in only 26 accidents in urban areas which represents less than one per cent of total urban accidents. The data, however, does not cover most residential streets in the district because they are not under the jurisdiction of Queensland Transport. Local area traffic management has been introduced in many residential areas in response to community concern about speed in residential areas.

4 Lack of 4-lane roads and directional signing

If fewer accidents are found to have occurred on 4-lane highways compared to 2-lane roads per million vehicle km travelled on each of the road classification, the community perception will be verified. However, detailed data on the physical characteristics of roads at the location of accidents has not been analysed so far. This analysis will shortly be undertaken subject to data availability.

5. Alcohol-related issues

Alcohol was found to be the second most common contributing factor. As many as 284 accidents (12.8%) were found to be caused due to this problem. However, the

number of such accidents has been declining since 1986. After a dramatic rise in these accidents in 1992 (cause unknown), there is a decreasing trend again.

6 Inconsistencies in signal operation - leading right turn at some intersections and trailing at others

Due to the inavailability of relevant data, it is difficult to say conclusively whether this perception is founded on the actual causes of road accidents. However, since

- the majority of urban accidents occurred at intersections
- Almost 60 per cent of intersection accidents were caused at signalised intersections, and
- RUM 21 (turning right) is the most common accident description at intersections

the community perceptions about inconsistencies in signal operation appear, prima facia, to be justifiable.

Conclusions

The community perceptions, identified by a group of elected representatives and transport officials, as the leading issues in road safety management have been verified by analysing the road accident data over a period of over ten years for the Northern District of Queensland Transport. The accident data was found to be deficient in certain respects such as the exclusion of local roads, the actual causes of accidents, vehicle type classifications, road and intersection features, etc. However, the available data has verified that many of the community perception about road safety issues are legitimate and justified. The analysis provides support for designing and implementing accident reduction programs which are seen by the community to be pertinent and are also effective in targeting the actual causes of accidents.

Acknowledgments

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